Section 3
Issue Identification and Prioritisation

This section describes how the environmental issues assessed in the Environmental Assessment were identified and prioritised. In summary:

(i) a comprehensive list of all relevant environmental issues was assembled through consultation with the local community and local and State government agencies, and a review of relevant legislation, planning documents and environmental guidelines;

(ii) a review of the project design and local environmental setting was undertaken to identify risk sources and potential environmental impacts for each environmental issue; and

(iii) through a review of the degree of risk and the expected frequency with which each issue was identified predicted to occur, the relative priority of each issue was determined, with this priority used to provide an order of assessment and breadth of coverage within Section 4.

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3.1 INTRODUCTION

In order to undertake a comprehensive *Environmental Assessment* of the proposed Gunlake Quarry Project, appropriate emphasis needs to be placed on those issues likely to be of greatest significance to the local environment, neighbouring landowners and the wider community. To ensure this has occurred, a program of community and government consultation, preliminary environmental studies and literature review was undertaken to identify relevant environmental issues and potential impacts. This was followed by an assessment of the risk posed by each potential impact in order to prioritise the assessment of the identified environmental issues within the *Environmental Assessment*.

3.2 ISSUE IDENTIFICATION

3.2.1 Introduction

Identification of issues relevant to the Gunlake Quarry Project development and operation involved a combination of consultation and background investigations and research. This included:

- consultation with State and Local government agencies;
- consultation with the local community;
- preliminary environmental studies;
- reviewing existing and proposed operations of related quarrying developments in the region;
- review of environmental assessment documentation of other proposed quarry developments in the district; and
- reference to relevant NSW government policies and guidelines.

Issues identified through this process were then classified according to their impact on the regional, local, or Project Site biophysical and/or social environments. Priority was given to those aspects with a higher potential for impact or an expected high frequency of occurrence.

3.2.2 Consultation

3.2.2.1 Consultation with Surrounding Landowners and the Local Community

The area around the Project Site and the proposed transport route is predominantly rural with increasing rural residential and urban development as Brayton Road approaches Marulan. The By-pass road passes through land characterised by rural development.

Consultation with landholders of properties immediately surrounding the Project Site commenced in 2006. Gunlake provided adequate opportunity for local community members to make contact and find out information about the proposal.

Gunlake representatives have met individually or in family groupings with many of the residents adjacent to the proposed haulage routes. Many non-resident landowners were also contacted and given an opportunity to get more detailed information either by contact or via phone, email or post.

On 27.2.07 Gunlake representatives addressed 10 members of the Big Hill community at a meeting of the Big Hill and Greenwich Park Progress Association.

In February 2007, Gunlake produced and distributed the first Community Newsletter followed by a second newsletter in June 2007. The distribution was undertaken via the local mail service and 400 Newsletters were distributed each time. In addition, the opportunity was taken to hand deliver newsletters to Brayton Road residents.

The Newsletters contained:

- an introduction to the company proposing the Project;
- a brief overview of the proposed quarry and saleable product transport route;
- an explanation of the approval process; and
- contact details for further information.

It is planned to produce further Newsletters as required throughout the approval process and during the operation of the Quarry.

The Community Newsletters were mailed and hand-delivered to landowners in the area and to all potentially affected property owners along the haul route. Company contact details were provided in the Newsletter and Gunlake have received a number of email responses and comments. Gunlake has responded to all of these.

Gunlake have also used advertisements and articles in the local newspaper, the Goulburn Post to advertise activities such as the Community Information Evening and to provide information to the regional community.

In addition, Gunlake have held a Community Information Evening on 9th August 2007. This meeting was advertised on radio and in the Goulburn Post. The meeting was also promoted by 700 leaflets distributed throughout the local community. Approximately 35 people attended the evening and were able to obtain details of the proposal and to convey any comments about the proposal to the Gunlake representatives present.

Community leaders and service group representatives have been contacted and provided with information about the Project and have been given the opportunity to provide feedback to Gunlake to be considered in their Project planning activities. Groups contacted included the Marulan Business and Tourism Association, Marulan Public School and the Big Hill and Greenwich Park Progress Association.

Gunlake representatives met with the proprietor of the school bus that operates on Brayton Road. The group drove along Brayton Road as details were discussed of the Project and particularly the proposed transport routes. Gunlake will continue discussions with the bus proprietor to develop operational plans.

In summary, the matters raised by the local community were as follows:

- transport arrangements, including location of proposed haul routes and safety issues;
- noise and vibration, especially from blasting; and,
- impact on property values.

In addition to these matters, many residents supported the proposal especially in regard to employment opportunities and the suitability of the site for the proposed quarry.

3.2.3 Consultation with Government Agencies

The following State and local Government agencies were consulted by Gunlake, Olsen Environmental Consulting Pty Limited and/or the specialist consultants prior to and/or during the preparation of the *Environmental Assessment*.

- Department of Planning (DoP) (Sydney)*
- Goulburn Mulwaree Council (Goulburn)*
- Sydney Catchment Authority (Penrith)*
- Department of Environment and Conservation (DEC) (South East Region)*
- Department of Water and Energy (Nowra)*
- Department of Primary Industries (Mineral Resources) (DPIMR) (Goulburn)*
- Department of Lands (Goulburn)
- NSW Roads and Traffic Authority (RTA) (Southern Region)

One or more representatives of those agencies identified with an asterisk (*) attended a Planning Focus Meeting held on February 2007 in the Marulan Community Hall and convened and co-ordinated by the Department of Planning. The RTA did not attend, however Gunlake has liased extensively with them subsequent to the Meeting.

The Planning Focus Meeting provided each agency with an opportunity to gain an understanding of the proposal and to inspect the Project Site prior to formally providing their written requirements for the *Environmental Assessment*.

All agencies subsequently forwarded their written requirements to DoP which in turn forwarded them to Gunlake as the Director-General's Requirements. A tabulated summary of the Director General's Requirements and all government agency requirements is included in **Appendix 2**, together with a reference to where each requirement is addressed in the *Environmental Assessment*.

A presentation about the Project has been made to Goulburn Mulwaree Council to keep it informed of the developments and proposals. Gunlake have met Council Officers on a number of occasions to discuss the proposals and to obtain Council's detailed requirements for the assessment.

3.2.4 Review of Planning issues and Environmental Guidelines

3.2.4.1 Introduction

Subject to the specific requirements State Environmental Planning Policy (Major Projects), a number of State and regional planning instruments may apply to the Project. These planning instruments were reviewed to identify any environmental aspects requiring consideration in the *Environmental Assessment*. In addition, the DGRs identified a number of guideline documents to be referenced / reviewed during the preparation of the *Environmental Assessment* (see **Table Appendix II-1**).

A brief summary of each relevant planning instrument is provided in Sections 3.2.5.1 and 3.2.5.2. The application and relevance of planning instruments related to specific environmental issues have been assessed in the relevant specialist consultant assessments. Section 3.2.5.3 briefly outlines the approach taken to referencing and reviewing environmental guideline documents.

3.2.5 State Planning Issues

A total of five State Environmental Planning Policies are relevant to the assessment of the proposed Gunlake Quarry Project.

State Environmental Planning Policy for Mining

The State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Minerals SEPP) was gazetted on 16 February 2007.

The SEPP outlines where various minerals activities are permissible both with and without development consent.

State Environmental Planning Policy (Major Projects)

This SEPP is relevant to the Gunlake Quarry Project in that it identifies development to which the assessment and approval process under Part 3A of the *Environmental Planning and Assessment Act 1979* applies. The Project is being assessed in accordance with Part 3A of the Act.

State Environmental Planning Policy No. 11 (SEPP 11) – Traffic Generating Developments

Clause 7 of SEPP 11 requires that certain applications are referred to the NSW Roads and Traffic Authority (RTA). Extractive Industry is listed under paragraph (m), Schedule 1 of this SEPP and hence this proposal must be referred to the RTA. This SEPP has been included into the Major Project SEPP.

State Environmental Planning Policy No. 33 (SEPP 33) – Hazardous and Offensive Development

The aims and objectives of this development are:

(a) to amend the definitions of hazardous and offensive industries where used in environmental planning instruments;

(b) to render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the grounds that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in this SEPP;

(c) to require development consent for hazardous or offensive development proposed to be carried out in the Western Division;

(d) to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account;

(e) to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact; and

(f) to require the advertising of applications to carry out any such development.

In accordance with the risk screening method contained within the document entitled "Applying SEPP 33", 2nd Edition, (DUAP 1997), all hazardous substances and dangerous goods to be held or used on the Project Site are to be identified and classified, with an assessment undertaken as to whether the proposed development represents a hazardous or offensive, or potentially hazardous or offensive, development The hazardous substances and dangerous goods to be used or stored on the Project Site would be restricted to diesel fuel and the components of the explosives to be used for blasting as part of the mining activities.

State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection

The Goulburn Mulwarree Local Government Area (LGA) is listed in Schedule 1 of this SEPP as an area that could provide habitat for Koalas. The SEPP requires an investigation be carried out to determine if core or potential Koala habitat is present on the areas of the Project Site likely to be disturbed. Core Koala habitat comprises land with a resident population of Koalas, whereas potential Koala habitat comprises land with native vegetation with known Koala feed trees constituting at least 15% of the total number of trees present on a site.

3.2.5.1 Regional Planning Issues

Regional Environmental Plan (REP) No 1 2007. Drinking Water Catchments

This REP applies to the hydrological catchments of Warragamba, Metropolitan, Woronora, Grose River Blue Mountains and Shoalhaven. The proposed quarry is within the Warragamba catchment.

The objectives of the REP are to ensure that developments within Sydney's water catchment area do not have a detrimental impact on the quality of drinking water supply.

The Gunlake Project application will be determined under Part 3A of the Environmental Planning and Assessment Act and consequently, will not be formally subject to the requirements of this REP. However, the REP was used as a basis for criteria for the environmental assessment.

Sydney to Canberra Corridor Strategy

This Department of Planning Strategy outlines the broad strategic future planning direction for the land corridor along the Hume and Federal Highways. The proposed Gunlake Quarry is located within the central sector of the corridor.

The Strategy focuses on providing a development framework for those with planning responsibilities in the corridor. It has a number of key objectives relating to encouraging population in the central sector and developing the central sector as the major regional centre for the corridor. It also has a key objective of fostering local economic development and employment growth and maximising local employment opportunities to decrease reliance on commuting, provided that development is compatible with environmental considerations.

The Strategy also identifies the economic importance of minerals and extractive resources in the corridor and that steps should be taken to ensure that these resources are not sterilised by competing land uses.

The Gunlake Quarry Project is compatible with the aims and objectives of the Strategy. It is economically beneficial and provides employment opportunities in the region and will be managed with due consideration for potential environmental impacts. It will not adversely impact surrounding land uses.

3.2.5.2 Local Planning issues

Mulwaree Shire Local Environmental Plan (LEP) 1995

Under this LEP, the proposed Gunlake Quarry and processing site is zoned 1(a) Rural. The objectives of this zoning include provision for the promotion, enhancement and conservation of valuable deposits of minerals, coal, petroleum, and extractive materials by controlling the location of development for other purposes in order to ensure the efficient extraction of these deposits.

Extractive industries are permissible under the 1(a) zoning with development consent. The Crown Road reserve forming part of the proposed Marulan bypass and Red Hills Road is zoned 1(a) Rural. A new LEP for the LGA is planned to be exhibited soon. Under the new draft LEP, extractive industries remain a permitted use in the rural zone.

Goulburn Mulwaree Strategy

The Goulburn Mulwaree Council has been preparing a strategic plan that will provide a clear direction and guide future change in the area until 2020. The Goulburn Mulwaree Strategy will reflect the directions outlined in the Sydney to Canberra Regional Strategy currently being reviewed. The Council held a workshop on the Strategy in the Marulan Community Hall in December 2005.

The Gunlake Quarry Project is consistent with the aims and objectives of the Strategy as the Project involves the development of the hard rock resource and appropriate management actions to avoid significant effects on adjacent land uses.

3.2.5.3 Environmental Guidelines

The DGRs require that in assessing the identified key assessment requirements, reference be made to one or more guideline documents. In addition, a number of the government agencies consulted in relation to the Project required reference to other environment guideline documents. Each of these guidelines was obtained, reviewed and where appropriate forwarded to the relevant specialist consultant for incorporation into the specialist environmental studies.

3.2.6 Preliminary Environmental Studies

Following the conceptual planning for the proposed Gunlake Quarry Project, environmental investigations were commissioned to broadly investigate the noise, surface water, groundwater, fauna, air quality, transport, flora, soils and cultural heritage of the area being considered as the Project Site and potentially affected surrounding areas. These environmental investigations were initiated to identify any issues that might ultimately prohibit the development of the Project. Information gathered as the assessments progressed enabled environmental issues to be considered in the early planning stages of the Project.

Traffic and Transport

Gunlake commissioned Christopher Hallam & Associates Pty Limited (Hallam) to prepare a Traffic and Transport Assessment of the Project. Initial investigations by Gunlake assessed a

number of transport route options and a two-staged transport route was selected that provided economic transfer of saleable product and minimised the impact on residents.

Hallam worked with Gunlake personnel, Council and RTA engineers to assess likely traffic effects and to prepare recommendations for any necessary upgrading of the transport routes.

Gunlake has consulted with Goulburn Mulwaree Council for a Road Maintenance Agreement.

Surface Water

Gunlake commissioned SEEC Morse McVey and Associates Pty Limited (SEEC) to undertake a Surface Water Assessment for the Project. The Project Site is located adjacent to Chapman's Creek which is a Category 2 stream that flows into Joarimin Creek. Joarimin Creek flows into the Wollondilly River which forms part of the Warragamba Dam catchment area. Consequently, the Project is located within an area administered by the Sydney Catchment Authority (SCA). The Project Site is not affected by flooding of the River and does not have any significant alluvial aquifers.

The Project will source production water from surface runoff, with small amounts of groundwater also available for utilisation. Start up water will come from existing on-site farm dams until purpose built water supply dams and sediment control structures are able to provide adequate water. Bottled potable water will be brought onto site as required and building roof runoff will be harvested in tanks and utilised on the Project Site.

Groundwater

Gunlake commissioned Larry Cook and Associates Pty Limited (Cook) to undertake a Groundwater Assessment for the Project. Quarrying has the potential to intersect groundwater aquifers and affect stock and irrigation supplies. The quarry pit will be maintained in a dewatered state.

The quarry will be located in very hard rock and minor groundwater impacts are expected. There are no substantial aquifers known to be present within the proposed pit area. No alluvial aquifers associated with Thompson's Creek will be excavated as part of the proposal. Only minor groundwater inflows into the quarry are predicted.

Acid Mine Drainage is not expected to result from the Gunlake Quarry activities.

Noise

Gunlake commissioned Heggies Pty Limited (Heggies) to undertake an acoustic assessment for the Project. The Project Site is located in a rural setting with noise typical of a rural environment with natural noise sources and some transportation noise contributions associated with the Hume Highway. Initial monitoring indicated that background noise levels ranged from 30 to 47dB(A). This meant that acoustic issues had to be considered during Project planning.

Air Quality

Gunlake commissioned Heggies Pty Limited (Heggies) to undertake an Air Quality Impact Assessment of the Project. The Project Site is located in a rural setting with air quality

dominated by agricultural activities. Rock quarrying and subsequent transport has the potential to increase air-borne dust levels.

The initial investigations confirmed that existing air quality around the Project Site was generally good. Dust deposition levels and particulate matter data from nearby monitoring stations indicated low levels of air-borne dust and particulates.

Given the rural location of the Project Site, nitrogen dioxide, sulphur dioxide and greenhouse gases were assumed to be at negligible levels.

Flora and Fauna

Gunlake commissioned Ecotone Ecological Consultants Pty Limited (Ecotone) to undertake a Flora and Fauna Survey and to prepare an Ecological Impact Assessment Report of the Project. Apart from the residential and commercial areas in Marulan, land use in the locality is predominantly based on rural and primary industry pursuits, particularly sheep and cattle grazing, agriculture, forestry and quarrying.

Most of the fauna habitat on the Project Site is exotic grassland, with rock outcrops and small areas of remnant woodland scattered over the Project Site. There are no wetlands in the Project Site except for a few small farm dams. Chapman's Creek, the main creek near the Project Site does not run continuously and often consists of isolated small ponds.

Initial investigation indicated that there were a number of flora and fauna species with conservation significance that occur or are likely to occur in and around the Project Site.

Cultural Heritage

Gunlake commissioned Australian Archaeological Survey Consultants Pty Limited (AASC) to undertake a cultural heritage assessment of the lands proposed for development of the Gunlake Quarry.

The Project Site is located in an area that had not been subject to much archaeological investigation. Consequently, there were no known archaeological sites within the Project Site. Some Aboriginal activity and occupation would be expected and an assessment was required to determine any potential impacts on the archaeological record. The field assessment work was undertaken with the assistance of representatives of the Pejar Local Aboriginal Land Council and the D'harawal Knowledge Holders.

Five Indigenous archaeological sites have been identified, consisting of one isolated find and four small artefact scatters containing less than 10 artefacts. AASC recommended that these sites be salvaged and relocated prior to the commencement of works.

Social Impact

Gunlake believes the Project can be implemented with positive impact to the local social environment. There will be 20 full time jobs created at the Quarry and a further 25 jobs associated with saleable product transport.

Aesthetics

The Project is located in a topographic environment that precludes all but isolated long distance views of the activity.

3.2.7 Environmental Issue Prioritisation

The issues identified as requiring assessment within the *Environmental Assessment* have been prioritised based, in decreasing order, of emphasis upon the following.

- Issues raised within the DGRs .
- Issues identified through community consultation.
- Issues expected to have a greater occurrence and with potentially high resultant impact.
- Issues frequently mentioned.

On consideration of the issues identified by the DGR's and through consultation, preliminary investigation, and review of likely impacts specific to the Project, the order of priority was assessed to be as listed below. This order of priority provides the order of assessment in Section 4, namely:

1. Traffic
2. Surface Water
3. Groundwater
4. Noise and Vibration
5. Air Quality
6. Cultural Heritage
7. Flora and Fauna
8. Visual Amenity
9. Bushfire
10. Socio-Economic
11. European Heritage

The sources of risk and potential environmental impacts associated with each issue are discussed within relevant subsections within Section 4.

Section 4A – Environmental Features, Management Measures and Impacts

This section describes the specific environmental features of the Project Site and its surrounds that would or may be affected by Project.

This section is presented in two parts:

Part A:presents background information on a range of environmental features that, while not directly affected by the Project, may have some influence on a number of the subsequent issues; and

Part B:presents information on existing conditions, proposed safeguards and controls and potential impacts the Project may have after implementation of these measures on those environmental issues identified through the issue identification process of Section 3. Where appropriate, proposed monitoring programs are also described.

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Part 4A
Background Information

The descriptions of various assessments of potential environmental impacts throughout Part B of this section are reliant upon a range of background information common to many of the key environmental issues. Background information is provided on the topography, meteorology, land ownership, land uses and surrounding residences.

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4A.1 Topography

4A.1.1 Regional Topography

The regional topography is shown on **Figure 4A.1**. The Project Site lies within the Wollondilly River Catchment in an area representative of the Southern Highlands of NSW. The heavily dissected Shoalhaven River Catchment lies approximately 5km to the south west and the transition to the Western Slopes and Plains occurs approximately 50km to the west.

Natural slopes within the region range from less than 1° along the flood plains of the Wollondilly River to in excess of 25° on the slopes of the many hills that occur in the region. There are slopes in excess of 45° on the sides of the Cookbundoon Range approximately 10km west of the Project Site.

Elevations in the region vary from 821m AHD at Mount Gray adjacent to Goulburn (approximately 23km west southwest of the Project Site), to approximately 636m AHD at the northern end of the Project Site. The Cookbundoon Range rises to 899m AHD west of the Project Site and isolated hills such as Stony Range Hill (762m AHD) occur in the vicinity.

4A.1.2 Local Topography

The local topography within the vicinity of the Project Site is also shown on **Figure 4A.1.**

The Project Site is located on the upper slopes of Thompson's Creek which is a small tributary of Joarimin Creek. Joarimin Creek flows into the Wollondilly River approximately 5km northeast of the Project Site **(Figure 4A.1).**

Elevations range from approximately 636m AHD at the northern end to approximately 700m AHD at the southern end of the Project Site.

4A.2 Meteorology

4A.2.1 Introduction

The Project Site is situated within the Wollondilly River valley on the Southern Tablelands of NSW, and is generally located between the belts of the sub-tropical highs and the zone of mid-latitude westerlies. In summer, synoptic highs dominate the climate. Low pressure systems pass at regular intervals bringing milder temperatures and winds from the southerly quadrant.

4A.2.2 Source of Data

The following summaries of meteorological information for the Project Site have been derived from long term data collected by the Bureau of Meteorology at Station No. 070263 located in Goulburn approximately 30km west southwest of the Project Site. The meteorological data is summarised in **Table 4A.1**.

A meteorological station will be installed on the Project Site in early 2008. Data was not available at the time of writing this report however, it will be collected throughout the life of the Project.

Gunlake Quarry Project
Figure 4A.1 Regional Topography

4A.2.3 Temperature

The data summarised in **Table 4A.1** indicates that the area is characterised by mild to hot summers and cool to cold winters. December, January and February are the warmest months with mean daily maximum temperatures approximating 26 to 28°C. July is the coldest month with a mean daily minimum of 1.3°C. Autumn and Spring are generally mild with occasional erratic temperature fluctuations. Mean diurnal temperature variation is relatively constant throughout the year at about 13°C.

4A.2.4 Rainfall

Rainfall in the local area results from localised convective thunderstorms, or the passage of any of the following major synoptic systems:

- the regular passage of cold fronts across NSW, whenever these fronts extend north into the area; or
- the passage of moist upper atmosphere low cells into the area from Queensland; or the passage of inland tropical cyclones or low pressure systems which have been located over the Pacific Ocean.

Monthly rainfall for Goulburn is presented in **Table 4A.1** and shows that rainfall is relatively consistent throughout the year with a small increase over spring and summer months with November having the highest median rainfall of 66.6mm. On a long term basis the driest month is July with a median rainfall average of 43.4mm. On average, Goulburn experiences 126 rain days per year and an average median rainfall of 641.6mm.

A statistical review of rainfall records has identified that for a dry year (10^{th} percentile rainfall event) the annual rainfall is 385.7mm. For a wet year (90^{th} percentile rainfall event) the annual rainfall is 833.4mm.Of these, the latter two principally occur in the warmer months when convectional storms are also most frequent and result in the majority of the area's total rainfall. Falls during this period are often of high intensity.

4A.2.5 Wind

Wind data obtained from the Goulburn Airport Automatic Weather Station (Station Number 070330) was used by Heggies (2007) to generate annual and seasonal wind roses for the Project Site. The Air Pollution Model (TAPM) software developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) enabled annual and seasonal wind roses to be compiled from this data. These are presented in **Figure 4A.2**.

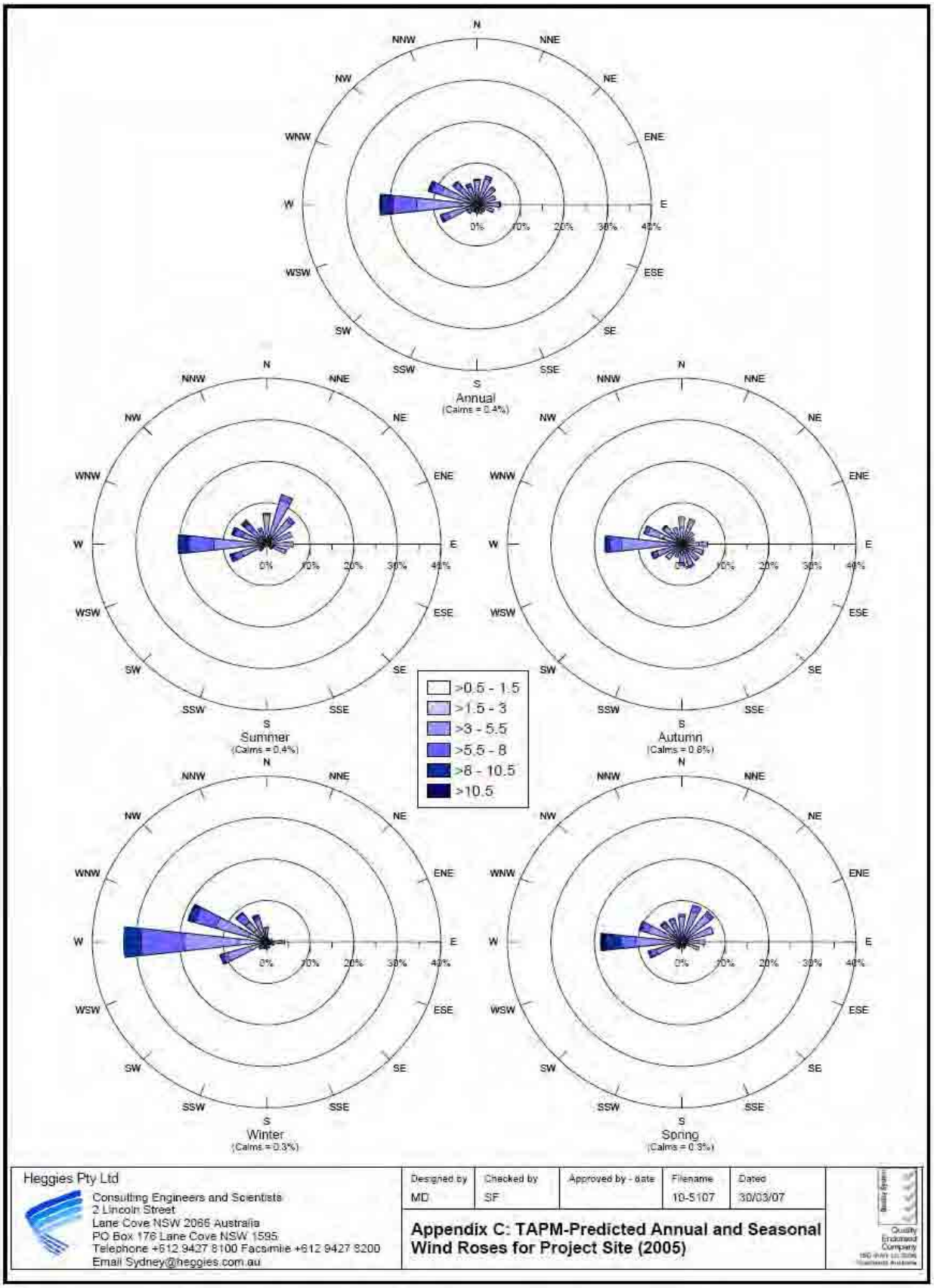
TAPM is a prognostic model used to predict three-dimensional meteorological data. General information on local terrain, vegetation and soil type, and synoptic scale meteorological analyses was incorporated into the model to generate the annual and monthly wind roses.

The annual wind rose for the Project Site indicates that winds are experienced predominantly from the west quadrant and are mild to moderate in nature, having an average wind speed of between 1.5m/s and 8m/s. The strongest winds occur in the winter months. Calm conditions are expected to occur for 7-8% of the time.

Table 4A.1 Mean Monthly Meteorological Data

Climate averages for Station: 070263 GOULBURN (PROGRESS ST) Commenced: 1971; Last record: 2007; Latitude (deg S): -34.7208; Longitude (deg E): 149.7420; State: NSW

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily maximum temperature - deg C	27.5	26.5	24	20.1	16	12.4	11.5	13.1	16.2	19.3	22.2	25.8	19.5
Mean no. of days where Max Temp >= 40.0 deg C	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1
Mean no. of days where Max Temp >= 35.0 deg C	2.9	1.8	0.2	0	0	0	0	0	0	0	0.3	1	6.2
Mean no. of days where Max Temp >= 30.0 deg C	10.2	7.4	3.3	0.2	0	0	0	0	0	0.3	2	6.9	30.4
Highest daily Max Temp - deg C	40.1	39.2	36.9	32.6	25	20	18.6	24	28.2	32.7	40.1	38.4	40.1
Mean daily minimum temperature - deg C	13.4	13.6	11.1	7.8	4.8	2.4	1.3	2	4.6	6.7	9.1	11.6	7.3
Mean no. of days where Min Temp <= 2.0 deg C	0	0	0.3	2.4	8.6	14.3	17.8	15.4	7.8	3.5	1	0.1	71.2
Mean no. of days where Min Temp <= 0.0 deg C	0	0	0.1	0.9	4.4	8.7	12	10	3.4	1.1	0.1	0	40.7
Lowest daily Min Temp - deg C	4.2	3.3	-0.6	-4.4	-5.5	-7.4	-8.5	-6.8	-6	-2	-0.5	0.9	-8.5
Mean 9am air temp - deg C	18.4	17.5	15.8	12.8	9	5.9	5	6.6	10.5	13.8	15	17.7	12.4
Mean 9am wet bulb temp - deg C	15.4	15.5	13.6	11	7.9	5.1	4	5.3	8.3	10.9	12.1	14.1	10.1
Mean 9am dew point - deg C	13.1	13.7	12	9.4	6.9	4	2.8	3.5	5.9	7.9	9.6	11.2	8.2
Mean 9am relative humidity - %	73	79	80	81	86	88	86	81	75	70	72	68	78
Mean 9am wind speed - km/h	7.8	6.9	6.8	6.9	6.3	7	8.2	9.7	11.1	11.4	9.2	9.2	8.4
Mean 3pm air temp - deg C	26	25.1	22.6	18.8	14.7	11.2	10.4	12	15	18	21	24.3	18.3
Mean 3pm wet bulb temp - deg C	17.9	18.2	16.3	13.5	11	8.4	7.5	8.3	10.5	12.8	14.6	16.3	12.8
Mean 3pm dew point - deg C	11.8	12.9	11.4	8.7	7.3	5.1	4	3.7	5.8	7.8	9.1	9.9	8.1
Mean 3pm relative humidity - %	45	50	52	54	62	67	65	59	56	54	51	45	55
Mean 3pm wind speed - km/h	13.5	12.5	11.9	10.8	10.5	11.7	13.4	15.2	14.8	14.6	13.5	14.1	13.1
Mean monthly rainfall - mm	60.7	59.1	55.6	51.1	47.8	45.7	44.6	57.7	50.2	56.6	66	54.4	649.5
Median (5th decile) monthly rainfall - mm	58.3	49.6	52.2	33.5	39.4	35.1	43.4	47.2	46.4	53.2	66.6	45.4	641.6
9th decile of monthly rainfall - mm	136.2	127.6	113.6	136.2	101.8	114.5	84.4	133.2	93.6	102.9	108.3	121.3	833.4
1st decile of monthly rainfall - mm	11.2	13	9.6	4	4.6	12.3	13	11.4	20	17	19	10.5	385.7
Mean no. of raindays	10	9.2	9	9.2	10.6	11.2	12.2	11.9	10.8	11.4	11.5	9.2	126
Highest monthly rainfall - mm	181.1	167	180.8	208.2	124.6	185.2	97.2	215	97.8	148.4	116.6	131.4	
Lowest monthly rainfall - mm	3	2.5	2.4	0.2	2.6	9.4	4	5.2	4.4	5	4.6	0.9	
Highest recorded daily rainfall - mm	63	73.4	93.4	92	61.2	114	40.4	99.2	33.6	51.6	58.6	56.6	114
Mean no. of clear days	7.6	6.1	7.1	7.1	6.2	5.1	6.5	8.5	7.6	7	6.3	8	83.3
Mean no. of cloudy days	10.9	11.8	11.7	11.1	13.3	13.7	12.1	10.9	9.6	10.8	11.5	10.8	138.3
Mean daily evaporation - mm	6.3	5.5	4.1	2.6	1.6	1.1	1.2	1.9	2.8	3.8	5	6.2	3.5



Gunlake Quarry Project
Figure 4A.2 Wind Speed and Direction

The prevailing meteorological conditions are indicative of moderately stable Class "D" conditions (see Part 5 *Specialist Consultant Studies Compendium*). This is indicative of moderately stable conditions, conducive to a moderate level of pollution dispersion due to mechanical mixing.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion of air particles. The Pasquill-Gifford-Turner assignment scheme identifies six Stability Classes, "A" to "F", to categorise the degree of atmospheric stability. Stability Class "A" represents highly unstable conditions that are typically found during summer and categorised by strong winds and convective conditions. Conversely, Stability Class "F" relates to highly stable conditions, typically associated with clear skies, light winds and the presence of a temperature inversion. Classes "B" through to "E" represent conditions intermediate to these extremes.

4A.2.6 Evaporation

Mean daily evaporation data for Goulburn is presented in **Table 4A.1**. Mean daily evaporation is greatest from November to March and corresponds to the months of highest temperatures. During each of these months the mean daily evaporation exceeds 4mm and reaches a peak of 6.3mm per day in January. Mean daily evaporation is least during June and July at 1.1mm and 1.2mm respectively. Average evaporation exceeds rainfall in all months.

4A.2.7 Temperature Inversions

Temperature inversions are often expressed as fogs and/or frosts and invariably occur during calm, clear, cool nights. After sunrise, the inversions normally increase in height before being broken down by solar heating of the land surface.

Table 4A.1 shows that frosts generally occur in the Goulburn area between March and November.

4A.3 Land Ownership, Surrounding Residences and Land Use

4A.3.1 Introduction

In order to assess the impact the establishment and operation of the Gunlake Quarry Project would have on the surrounding environment, an understanding of the number and location of surrounding landholdings and residences along with the land use is required. This sub-section identifies the landholdings and residences in the vicinity of the Project Site and proposed transport route. The sub-section also presents the proximity of surrounding residences to the proposed areas of activity and provides an overview of the land uses both in the local area and surrounding the Project Site.

4A.3.2 Land Ownership and Surrounding Residences

4A.3.2.1 The Project Site and Surrounds

Figure 4A.3 presents the ownership details within and immediately surrounding the Project Site and along the transport route. Gunlake owns the property on which the quarry will be located and owns part of the proposed By-pass road route.

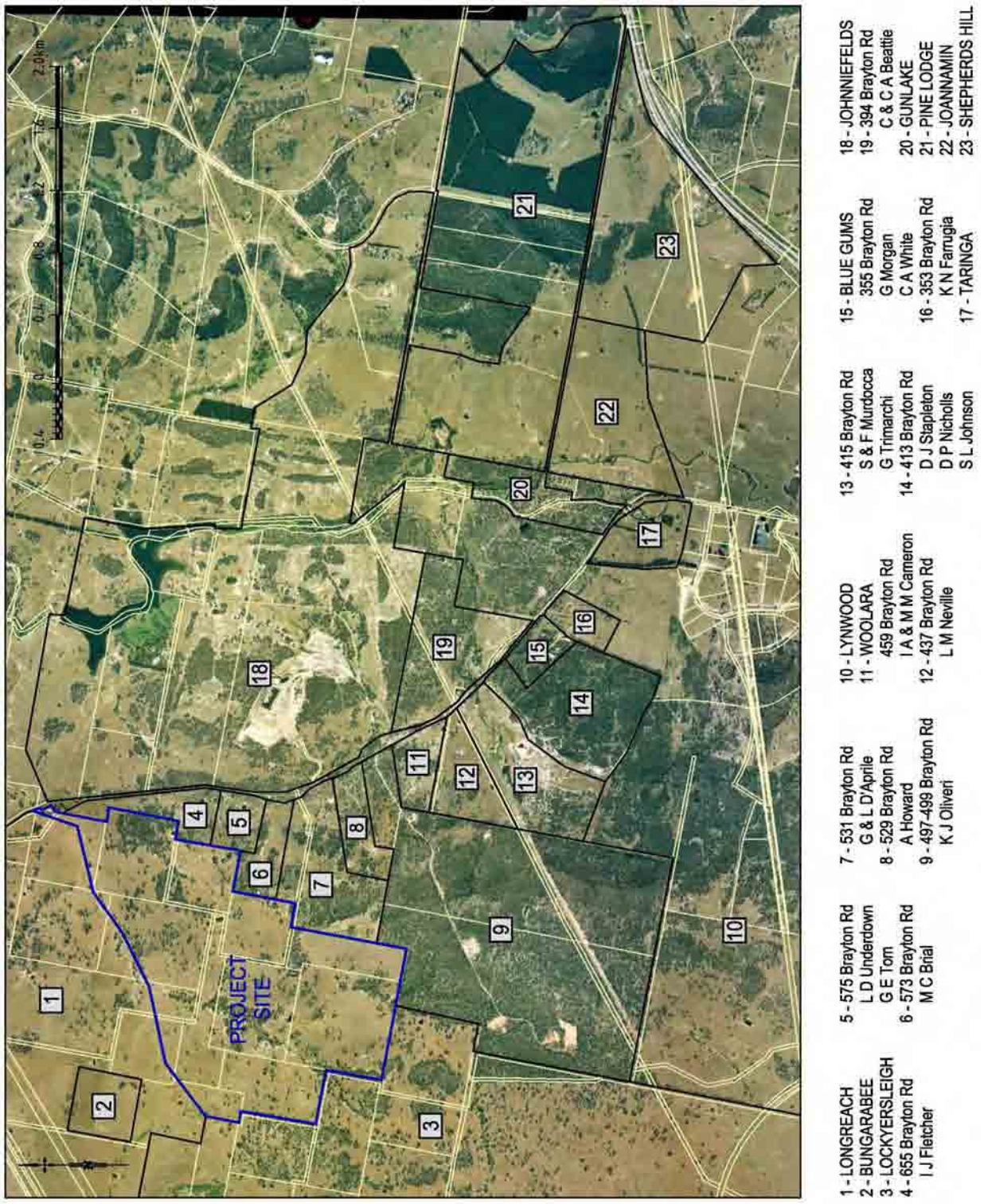
There is a Crown Road Reserve connecting Gunlake property with Red Hills Road. It is proposed to open this Reserve to construct the By-pass road.

Figure 4A.4 shows the locations of DD residences within and immediately surrounding the Project Site that are not owned by Gunlake. The distances from each of the residences to the proposed areas of activity within the Project Site are listed in **Table 4A.2**.

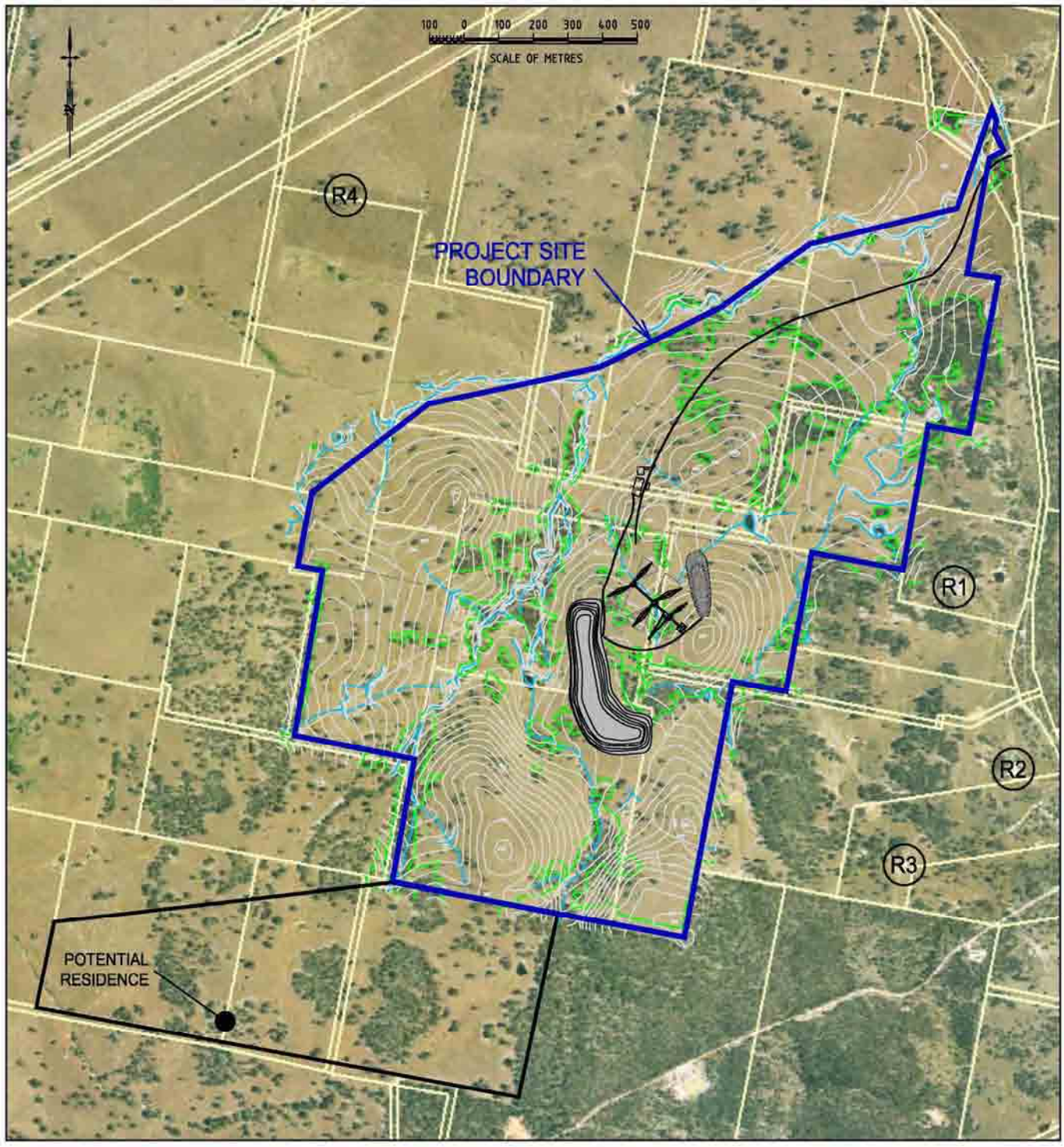
Table 4A.2 Closest Non- Project Related Residences to the Project Site

Residence ID	Approximate Distance (m) from Project Site Boundary	Approximate Distance to Rock Processing Area (m)
R1	0.2	0.7
R2	0.7	1.0
R3	0.5	0.9
R4	0.6	1.4

The type of land use along the transport route is a mix of small rural residential, hobby farm silviculture and agriculture (grazing). Quarrying is a significant existing and future land use locally.



Gunlake Quarry Project
Figure 4A.3 Surrounding Land Ownership



Gunlake Quarry Project
Figure 4A.4 Surrounding Residences

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Section 4B – Potentially Impacted Environmental Features, Management Measures and Impacts

The descriptions of potential environmental impacts throughout Part B are reliant upon a range of background information common to many of the key environmental issues. This background information on topography, meteorology, land ownership, land uses and surrounding residences is presented as Part A.

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4B.1 Traffic

The traffic assessment was undertaken by Christopher Hallam and Associates Pty Limited (Hallam). The full assessment is presented as Part 1 of the Specialist Consultant Studies Compendium (SCSC) with the relevant information from the assessment summarised in the following sections.

4B.1.1 Introduction

The Traffic Assessment was undertaken to assess the traffic and transport implications of the Gunlake Quarry Project as part of the *Environmental Assessment* of the proposal.

In their Assessment Report (SCSC 1), Hallam reviewed the current road network and traffic flows. They reviewed road design standards to provide a basis for assessing any roadwork improvements for the quarry traffic. Their Report sets out their assessment of the traffic implications of the proposal, covering traffic generation, transport route assessment, alternative transport routes and recommended improvement works. They also provide a summary of their recommended roadworks programme, briefly commenting on the environmental implications of the works, and of road pavement issues.

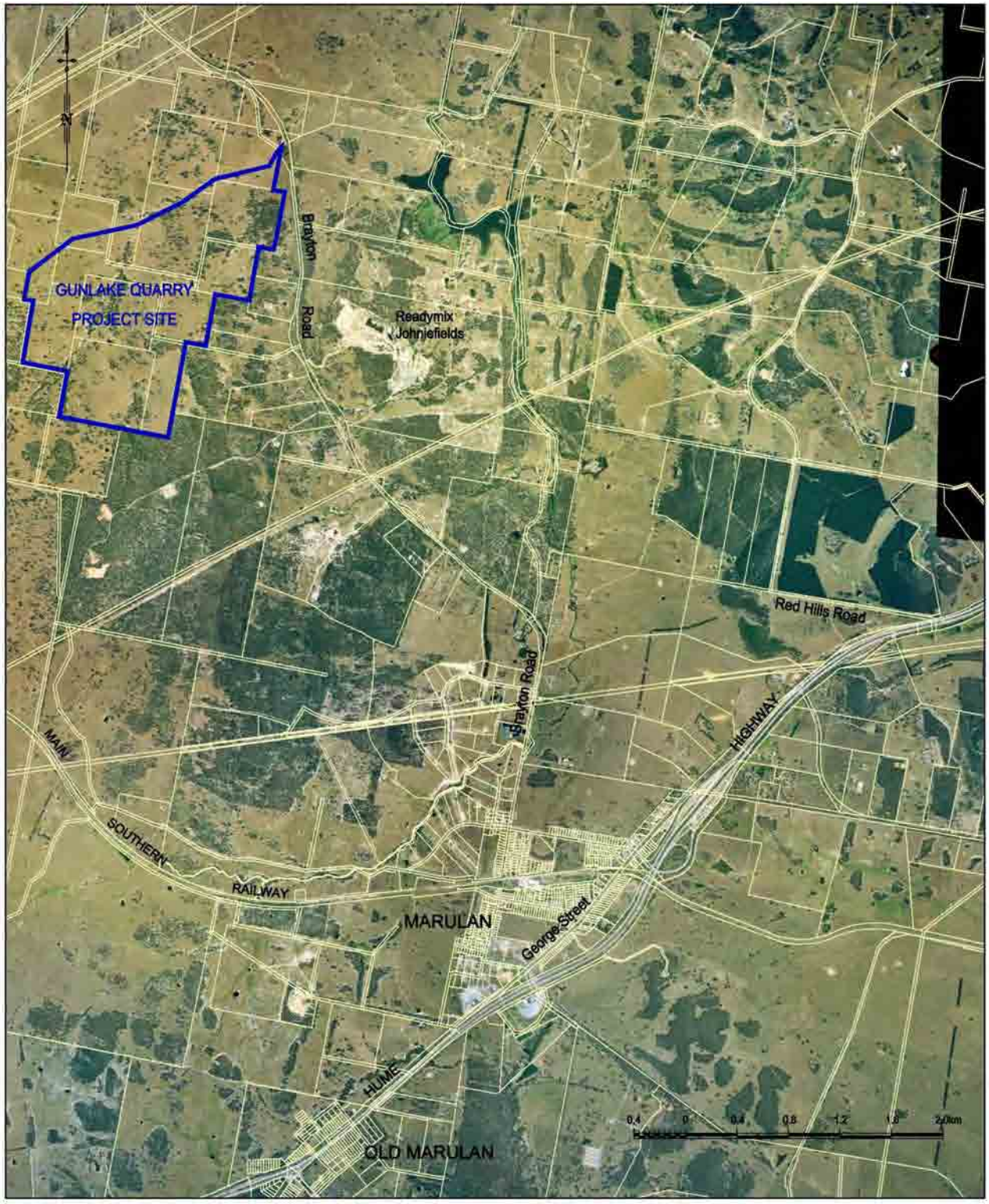
This section summarises the findings of the Traffic Assessment.

4B.1.2 Existing Traffic Environment

4B.1.2.1 Road Network

Figure 4B.1 shows the Project Site and the proposed transport haul routes. The proposed **Stage 1** haul route is along Brayton Road, from the Site to the Marulan Hume Highway interchange to access this Highway. The **Stage 2** haul route will utilise a new By-pass road connecting Brayton Road with Red Hills Road, and then to its junction with the Hume Highway.

Brayton Road, Site to Marulan
At the intersection of the Brayton Road and the quarry access road, Brayton Road has a sealed width of 5.7 m, and with a speed limit of 100 km/hr. The alignment is typical of a relatively lowly used country road, with flat sections interspersed with some rolling hills. Brayton Road generally maintains this width until the access to Johnniefelds Quarry is reached, when the road widens out, maintaining a wider carriageway width until it meets a T-junction on the outskirts of Marulan. At that point, Brayton Road makes a right-angle bend to the East and Stoney Creek Road continues to the South. Stoney Creek Road is relatively short, ending at the Main Southern Railway Line. Stoney Creek Road has residential uses on each side.



Gunlake Quarry Project
Figure 4B.1 District Road Network

Table 4B.1 sets out an inventory of the transport route along Brayton Road from the junction with Stoney Creek Road, Marulan, to the Project Site.

Table 4B.1 Transport Route Inventory, Brayton Road, from Stoney Creek Road, Marulan, to the Quarry Site

Chainage (km)	Nearest Property	Sealed Width (m)	Comments
0.0	78-84	7.2	4 houses on west side, vacant east side
0.1		6.7	Start of 100 km/hr speed zone
0.6		7.1	Concrete bridge, 7.1 m to edges of kerbs on bridge; no centreline
0.9		12.7	Widens on approach to Merino Road, then narrows after junction
1.2		7.2	After Merino Road junction
1.6	#268	7.2	Joarimin Creek Road
1.8		6.9	Driveway on left
2.1		7.3	Culvert
2.2	Near 355	7.5	Minor culvert
2.9	#394	7.7	
3.1	#415	7.5	Bridge/culvert
		7.3	Minor culvert
3.7	#484	9.5	Johnniefelds Quarry access, recently upgraded
4.0		5.7	Older pavement west of Johnniefelds Quarry
4.5		5.7	
4.7	#575		Driveway on northern side of bend
5.0		5.7	
5.6		5.6	Minor crest
6.1	#715	5.7	At site entrance

Brayton Road has a sealed width generally over 7m between Stoney Creek Road and the entrance to the Johnniefelds Quarry. The road pavement in part of this section has been recently upgraded, with the sealed width reducing to 5.7m between Johnniefelds and the Project Site.

Brayton Road through Marulan

Between its junction with Stoney Creek Road and George Street, Brayton Road travels through an urban residential section of Marulan, generally with dwellings on each side. Just east of Stoney Creek Road the carriageway width is 11.8m. Then, for a section approximately 400m long, the carriageway slightly reduces to 10.0m wide, with no kerbs/gutter on the northern side and a roll kerb on the southern side. A gutter is provided on the northern side, just west of Wollondilly Street, with the carriageway reducing slightly to 9.6m. For the 400m west of Wollondilly Street, there is no residential development along the southern side. The road pavement in this section has been recently upgraded.

Between Wollondilly Street and George Street, there are kerbs/gutters on both sides, with a carriageway width of 11.0m.

George Street, Marulan

George Street (the old Hume Highway) extends from the Highway Service Centre south of the town, past the Portland Avenue roundabout, which has access off the current Hume Highway,

through the Marulan town centre to Brayton Road. George Street has kerbside parking on both sides, plus travel lanes. As well as shops, there is a school on George Street. North of Brayton Road, George Street becomes a cul-de-sac, after passing the disused truck checking stations.

Hume Highway Interchange

The eastern extension of Brayton Road passes under the Hume Highway, as part of the Marulan Interchange. The underpass has one travel lane each direction. Southbound traffic on the Highway offloads near the truck checking station and travels under the Highway to access Brayton Road and Marulan. Traffic from Marulan and Brayton Road wishing to travel south uses this underpass to access the southbound load ramp on the eastern side of the Highway. Traffic from Marulan wishing to travel north turns left off Brayton Road onto the load ramp on the western side of the Highway.

Northbound traffic on the Highway cannot offload to Brayton Road. Traffic wishing to make this movement needs to offload at Portland Avenue.

The at-grade interchange of the Highway with Portland Avenue provides left-turn deceleration and acceleration lanes on the Highway to cater for left turns into and out of Portland Avenue. There is also an acceleration lane in the median to assist vehicles turning right out of Portland Avenue. The median strip is wide enough to shelter these right-turning vehicles, prior to acceleration and merging with south bound traffic. Sight distance at this intersection is good.

Just west of this intersection there is a roundabout on Portland Avenue, with George Street and the Old Hume Highway forming a junction with Portland Avenue. This is a large roundabout designed for large heavy vehicles.

Red Hills Road

The existing junction of Red Hills Road with the Hume Highway allows for all movements, at-grade, with a 65m long right turn lane in the Highway median for southbound vehicles wishing to turn right into Red Hills Road. For the 110km/hr design speed on the Highway, this deceleration and right turn lane is substandard in its length. Vehicles can turn right out of Red Hills Road. The median width provides some scope for a driver making this manoeuvre to first cross the northbound traffic before entering the southbound traffic, but it does not constitute seagull chanellisation. There are no left-turn lanes for the movements into or out of Red Hills Road. Sight distance is very good.

There is a Truck Parking Area just south of Red Hills Road, on the Highway. The entrance to this area is approximately 400m south of the junction of Red Hills Road and the Hume Highway.

Red Hills Road approaches the Highway junction via a sharp turn adjacent to a property access. Red Hills Road has a sealed width of 8.1m at this point. **Table 4B.2** provides an inventory of Red Hills Road from its junction with the Highway to the location where the proposed new By-pass road will join it.

The carriageway and alignment of Red Hills Road is designed for local access use.

Table 4B.2 Transport Route Inventory, Red Hills Road west of Hume Highway

Chainage (km)	Sealed Width (m)	Comment
0.0	8.1	At Highway
0.1	5.7	Gate to "Pinelodge"
	5.7	Culvert
	5.7	Bend, 25km/hr advisory speed
0.4	6.9	
0.85	6.6	Crest
1.1	6.6	
1.4	6.5	Bend to North, where proposed By-pass road to join

4B.1.2.2 Traffic Flows

Brayton Road

Table 4B.3 sets out the average current total and heavy vehicle flows on Brayton Road, south of the access to the Johnniefelds Quarry. In Stage 1 this section of road will be the primary haul route from the quarry, and will be used for the entire life of the Project. For Stage 2 a By-pass road will be built to take a large proportion of the traffic at higher transport rates.

However, trucks will continue to use Brayton Road through Marulan at an average of 25 truck movements per day for the life of the Quarry. In Stage 1 trucks will be accessing markets both north and south of Marulan. In later years, there will be trucks accessing markets south of Marulan at an average of 25 per day along this route.

Table 4B.3 Average Daily Traffic Flows on Brayton Road South of Johnniefelds Quarry 25-31 May 2007 (vehicles/day)

Day	Northbound	Southbound	Total	Rigid Class 3-5	Articulated Class 6-13
Average Daily	184	189	373	58	44

Table 4B.3 shows that current average daily traffic flows are relatively low, at 373 vehicles/day. However the proportion of heavy vehicles is high, with 27% overall, including 15% Rigid Trucks (Class 3-5) and 12% Articulated Trucks (Class 6-13). The heavy vehicle numbers reduce on the weekend, particularly on Sunday.

Table 4B.4 sets out the average hourly flows, including a breakdown of Rigid Trucks and Articulated Trucks. The hourly flows are not strongly peaked. The highest morning flows were 36 vehicles/hour in the 8.00-9.00am, with the highest afternoon flows of 30 vehicles/hour in 3.00-4.00pm and 4.00-5.00pm. These flows are of a very low order.

During **Stage 1**, the section of Brayton Road that continues into Marulan will be used by all quarry trucks. In **Stage 2** it will only be used for trucks travelling to the South. The average daily traffic flows on Brayton Road east of Wollondilly Street, Marulan, are shown in **Table 4B.5**.

Table 4B.4 Average Hourly Traffic Flows on Brayton Road South of Johnniefelds Road 25-31 May 2007 (vehicles/hour)

	Northbound			Southbound			Total		
Period	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**
0-1am	0	0	**1**	0	0	**0**	0	0	**1**
1-2	0	0	**1**	0	0	**1**	0	0	**2**
2-3	0	0	**0**	0	0	**0**	0	0	**0**
3-4	0	0	**1**	0	0	**1**	0	0	**2**
4-5	0	0	**1**	0	0	**2**	0	0	**3**
5-6	0	1	**5**	0	0	**2**	0	1	**7**
6-7	1	2	**7**	0	2	**8**	1	4	**15**
7-8	2	2	**15**	4	1	**14**	6	3	**29**
8-9	2	4	**16**	5	3	**20**	7	7	**36**
9-10	1	2	**13**	3	2	**16**	4	4	**29**
10-11	1	2	**13**	4	3	**18**	5	5	**31**
11-12	2	2	**14**	4	3	**15**	6	5	**29**
12-1p	1	2	**12**	3	2	**12**	4	4	**24**
1-2pm	1	1	**12**	2	2	**12**	3	3	**24**
2-3	2	2	**14**	4	2	**14**	6	4	**28**
3-4	1	1	**13**	5	2	**17**	6	3	**30**
4-5	0	0	**12**	4	1	**18**	4	1	**30**
5-6	0	0	**11**	1	0	**9**	1	0	**20**
6-7	0	0	**7**	0	0	**4**	0	0	**11**
7-8	1	0	**6**	1	0	**3**	2	0	**9**
8-9	0	0	**4**	0	0	**1**	0	0	**5**
9-10	0	0	**4**	0	0	**0**	0	0	**4**
10-11	0	0	**3**	0	0	**1**	0	0	**4**
11-12	0	0	**2**	0	0	**1**	0	0	**3**

Table 4B.5 Average Daily Traffic Flows on Brayton Road East of Wollondilly Street, Marulan 25-31 May 2007 (vehicles/day)

Day	**Eastbound**	**Westbound**	**Total**	**Rigid Class 3-5**	**Articulated Class 6-13**
Average Daily	441	423	864	47	53

Within Marulan, the daily traffic flows are still only moderate, well within usual environmental capacity limits for local residential streets. However the numbers of heavy

vehicles are higher than typical in residential streets. The overall percentage of heavy vehicles is 11.6%, of which 6.1% is articulated vehicles.

Table 4B.6 shows the average hourly flows.

Table 4B.6 Average Hourly Traffic Flows on Brayton Road East of Wollondilly Street, Marulan 25-31 May 2007 (vehicles/hour)

	Eastbound			Westbound			Total		
Period	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**
0-1am	0	0	**3**	0	0	**1**	0	0	**4**
1-2	0	0	**2**	0	0	**1**	0	0	**3**
2-3	0	0	**1**	0	0	**1**	0	0	**2**
3-4	0	0	**1**	0	0	**2**	0	0	**3**
4-5	0	0	**1**	0	0	**4**	0	0	**5**
5-6	0	1	**6**	0	1	**11**	0	2	**17**
6-7	0	2	**8**	0	2	**23**	0	4	**31**
7-8	3	2	**21**	2	2	**33**	5	4	**54**
8-9	2	4	**22**	3	4	**41**	5	8	**63**
9-10	1	2	**26**	2	2	**33**	3	4	**59**
10-11	2	3	**31**	1	3	**36**	3	6	**67**
11-12	2	2	**29**	2	4	**30**	4	6	**59**
12-1p	2	3	**34**	1	3	**27**	3	6	**61**
1-2pm	2	1	**28**	2	2	**25**	4	3	**53**
2-3	1	2	**32**	3	2	**26**	4	4	**58**
3-4	3	1	**36**	3	2	**30**	6	3	**66**
4-5	2	0	**42**	2	0	**35**	4	0	**77**
5-6	1	1	**44**	1	0	**24**	2	1	**68**
6-7	0	0	**24**	0	0	**15**	0	0	**39**
7-8	1	0	**16**	0	0	**9**	1	0	**25**
8-9	0	0	**11**	0	0	**6**	0	0	**17**
9-10	0	0	**11**	0	0	**3**	0	0	**14**
10-11	0	0	**6**	0	0	**3**	0	0	**9**
11-12	0	0	**5**	0	0	**2**	0	0	**7**

There is no strong peak hour trend in the flows. The highest flow in the morning was 67 vehicles/hour in the 10.00-11.00am period, while the highest flow in the afternoon was 77 vehicles/hour in the 4.00-5.00pm period. Heavy vehicle movements are concentrated in the daytime period of 7.00am to 5.00pm.

George Street

George Street will be used by quarry trucks arriving from the Highway South during **Stage 1** only. Southbound trucks leaving the quarry will travel directly to the Highway at the Marulan Interchange.

Intersection turning movement counts were undertaken in February 2005 by Transport & Urban Planning, as part of their *Traffic and Transport Impact Assessment* for the proposed

Lynwood Quarry. **Table 4B.7** sets out these peak period flows immediately north of the Portland Avenue roundabout.

The peak hourly flows in **Table 4B.7** are moderate for the main street access into a town centre.

Table 4B.7 Peak Hour Flows on George Street North of Portland Avenue, Friday 11 February 2005

	Northbound		Southbound		Total	
Period	**Heavy**	**Total**	**Heavy**	**Total**	**Heavy**	**Total**
6.30-7.30am	6	36	9	22	**15**	**58**
8-9am	9	34	5	27	**14**	**61**
12-1pm	12	64	4	34	**16**	**98**
5.30-6.30pm	0	37	3	31	**3**	**68**

Hume Highway Interchange
The Hume Highway Interchange will be used by all of the quarry trucks. **Table 4B.8** shows the average current daily traffic flows on the Interchange underpass.

Table 4B.8 Average Daily Traffic Flows on Marulan Interchange Underpass 25-31 May 2007 (vehicles/day)

Day	**Eastbound**	**Westbound**	**Total**	**Rigid Class 3-5**	**Artic Class 6-13**
Average Daily	375	160	535	30	36

The eastbound flows are generally at least double the westbound flows. The total two-way flows of 535 vehicles/day are relatively low for a highway interchange. The overall proportion of heavy vehicles is 12%.

Table 4B.9 shows the average hourly traffic flows on the underpass.

The hourly flows are relatively low for a highway interchange, with two-way flows of less than 50 vehicles/hour. The eastbound flows predominate, following from the daily trends.

Red Hills Road
A new By-pass road is proposed to link Brayton Road with Red Hills Road. Red Hills Road currently carries very low traffic flows, as shown by the average current daily flows in **Table 4B.10.**

Table 4B.9 Average Hourly Traffic Flows on Brayton Road at Marulan Interchange Underpass 25-31 May 2007 (vehicles/hour)

	Eastbound			Westbound			Total		
Period	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**
0-1am	0	0	**2**	0	0	**1**	0	0	**3**
1-2am	0	0	**1**	0	0	**0**	0	0	**1**
2-3	1	0	**1**	0	0	**0**	1	0	**1**
3-4	1	0	**2**	0	0	**1**	1	0	**3**
4-5	0	0	**3**	0	0	**2**	0	0	**5**
5-6	0	0	**2**	0	0	**5**	0	0	**7**
6-7	0	2	**8**	0	1	**9**	0	3	**17**
7-8	2	1	**16**	1	1	**13**	3	2	**29**
8-9	1	1	**28**	1	2	**16**	2	3	**44**
9-10	2	1	**31**	0	2	**14**	2	3	**45**
10-11	3	2	**27**	1	1	**13**	4	3	**40**
11-12	1	2	**28**	0	1	**11**	1	3	**39**
12-1pm	2	2	**26**	0	1	**11**	2	3	**37**
1-2pm	1	1	**23**	0	1	**10**	1	2	**33**
2-3	1	2	**29**	1	1	**10**	2	3	**39**
3-4	2	1	**33**	2	1	**11**	4	2	**44**
4-5	2	1	**37**	0	0	**11**	2	1	**48**
5-6	1	2	**32**	0	0	**6**	1	2	**38**
6-7	0	0	**21**	0	0	**4**	0	0	**25**
7-8	0	1	**12**	0	0	**4**	0	1	**16**
8-9	0	0	**6**	0	1	**3**	0	1	**9**
9-10	0	1	**5**	0	0	**2**	0	1	**7**
10-11	0	0	**2**	0	0	**3**	0	0	**5**
11-12	0	0	**2**	0	0	**1**	0	0	**3**

Table 4B.10 Average Daily Traffic Flows on Red Hills Road West of Hume Highway 25-31 May 2007 (vehicles/day)

Day	**Eastbound**	**Westbound**	**Total**	**Rigid Class 3-5**	**Articulated Class 6-13**
Average Daily	33	32	65	7	2

These daily traffic flows are very low, albeit with some heavy vehicle activity. As would be expected, the average hourly flows are very low, as indicated in **Table 4B.12**.

Table B4.11 Average Hourly Traffic Flows on Red Hills Road West of Hume Highway 25-31 May 2007 (vehicles/hour)

	Eastbound			Westbound			Total		
Period	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**	**Rigid**	**Artic**	**Total**
0-1am	0	0	**1**	0	0	**0**	0	0	**1**
1-2am	0	0	**0**	0	0	**0**	0	0	**0**
2-3	0	0	**0**	0	0	**0**	0	0	**0**
3-4	0	0	**0**	0	0	**0**	0	0	**0**
4-5	0	0	**0**	0	0	**0**	0	0	**0**
5-6	0	0	**0**	0	0	**0**	0	0	**0**
6-7	0	0	**2**	0	0	**0**	0	0	**2**
7-8	1	0	**3**	0	0	**1**	1	0	**4**
8-9	0	0	**4**	0	0	**5**	0	0	**9**
9-10	0	0	**3**	0	0	**3**	0	0	**6**
10-11	0	0	**2**	0	0	**3**	0	0	**5**
11-12	0	0	**2**	0	0	**2**	0	0	**4**
12-1	1	0	**2**	0	0	**2**	1	0	**4**
1-2pm	0	0	**2**	1	0	**2**	1	0	**4**
2-3pm	0	0	**2**	1	0	**2**	1	0	**4**
3-4	0	0	**3**	0	0	**2**	0	0	**5**
4-5	0	0	**4**	1	0	**5**	1	0	**9**
5-6	0	0	**1**	0	0	**3**	0	0	**4**
6-7	0	0	**1**	0	0	**1**	0	0	**2**
7-8	0	0	**1**	0	0	**0**	0	0	**1**
8-9	0	0	**1**	0	0	**0**	0	0	**1**
9-10	0	0	**1**	0	0	**0**	0	0	**1**
10-11	0	0	**0**	0	0	**0**	0	0	**0**
11-12	0	0	**0**	0	0	**0**	0	0	**0**

The "peak" hour flows were 9 vehicles/hour in the periods 8.00-9.00am and 4.00-5.00pm.

4B.1.3 Road Design Standards

In reviewing the proposed transport routes, Hallam referenced several guidelines discussed in the following section.

Road Design Guide
The Roads & Traffic Authority's *"Road Design Guide"* is the primary road design reference for NSW roads. **Table 4B.14** and **Table 4B.13** are taken from the Guide and they set out the recommended lane and shoulder widths for different traffic flows.

Table 4B.12 Lane Widths Two Lane Two Way Rural Roads

AADT (vehicles/day)	No. of Lanes	Lane Width (m)
1-150	1	3.5
150-500	2	3.0
500-2000	2	3.0-3.5
> 2000	2	3.5

Where the intended design speed through mountainous terrain will be in excess of 80km/hr, or 100km/hr in undulating terrain, or where there is a predominantly high percentage of heavy vehicles (20% for 500 AADT and 5% for 2000 AADT), a lane width of 3.5m is desirable.

Table 4B.13 Shoulder Widths for Two Lane Two Way Rural Roads

AADT (vehicles/day)	Shoulder Width (m)
1-500	1.0-1.5
500-1000	1.0-2.0
Over 1000	2.0-3.0
Adjacent to barrier lines	3.0

Shoulders should be sealed to a width of 0.5m from the edge of the sealed lane, when the predicted AADT is less than 2000, and 1m when the predicted AADT is greater than 2000.

Table 3.11-2 of the Roads & Traffic Authority's *"Road Design Guide"*, sets out recommended bridge carriageway widths, from kerb to kerb, for non-Highway roads. For daily traffic flows of 100-500 vehicles/day, a 6.0m road plus two 1.0m shoulders is recommended, for a total width of 8.0m. For daily traffic flows of 500-1000 vehicles/day, a 6.5m road plus two 1.0m shoulders is recommended, for a total width of 8.5m.

Section 4.7.4 of the *Road Design Guide* deals with sight distance requirements at intersections. Drivers approaching an intersection need to be able to see intersection geometry and pavement markings. For this, the *approach sight distance* from a driver eye height of 1.15m (in a car) to the pavement level is required. For design speeds of 80km/hr and 100km/hr the approach sight distance on level terrain is 100m and 150m.

The *safe intersection sight distance* (SISD) specifies the distance that an approaching vehicle on the major road can see a vehicle on the side road about to cross or join the major road. This is measured from car driver eye height to car driver eye height. For design speeds of 80, 100 and 110km/hr the SISD is 160m, 225m and 295m respectively. Note that on the measurement of sight distances, while a driver's eye height is taken to be 1.15m, the eye height of the driver of a truck + dog rig, as measured on a quarry truck, is 2.45m, or over double the eye height of a car driver. This gives a truck driver better sight distance where there is a constraint with the vertical alignment, plus an enhanced ability to see over vegetation on the inside of corners.

Route Assessment Guidelines for Restricted Access Vehicles

The Roads & Traffic Authority publication *"Route Assessment Guidelines for Restricted Access Vehicles"* was prepared for assessing proposed transport routes by over-dimension vehicles, including B-doubles. These guidelines provide an insight into road cross-sectional considerations of the RTA when assessing the movement of 25m long articulated vehicles. In summary, for total traffic flows of less than 500 vehicles/day, a total road formation width of 7.0m, including shoulders, is recommended for straight sections. For 500-2000 vehicles/day, lane widths of 3.0m each and shoulder widths of 1.0m each are recommended. For daily flows of up to 6,000 vehicles/day, the lane width remains at 3.0m. This is less than the 3.5m lane widths recommended in the *Road Design Guide* for flows over 2,000 vehicles/day.

These *Guidelines* do not recommend any minimum horizontal or vertical geometry standards. They do not mention any minimum bridge widths, but do comment that the structural capacity of bridges might need to be checked.

Goulburn Mulwaree Council Draft Development Control Plan Provisions for Heavy Vehicle Generating Development

Goulburn Mulwaree Council has recently drafted planning provisions for heavy vehicle generating development, to be incorporated into the consolidated Development Control Plan currently being formulated. In terms of the upgrading of haulage routes, the Draft standards are:

- 7m wide carriageways in rural areas
- 6m wide carriageways in village areas
- 1m wide shoulder with 500mm seal
- 8m wide culverts and bridges (i.e. from barrier to barrier)
- Replacement of road with dense grade asphaltic concrete or stone mastic asphalt in village areas
- Possible intersection upgrades.

Goulburn Mulwaree Council Pavement Design for Brayton Road-Marulan

Goulburn Mulwaree Council has recently reconstructed Brayton Road for a length of 1200m, from the access to the Readymix Johnniefelds Quarry, towards Marulan. The document *Pavement Design, Brayton Road – Marulan, 2006-2007 Pavement Rehabilitation Program*, sets out the specifications for the road standards considered appropriate by Council. These standards and specifications were based on *"an AADT of 550, with a large volume of heavy vehicles using the Readymix Quarry"*. They noted:

> *"The existing **formation width** varies between 8m and 9m and the objective is to widen the formation width to **9.0m.***
>
> *The existing **seal width** also varies between 6m and 7m and the objective is to seal to **7.0m."***
>
> *"Both sections [Chainage 0m to 600m and 600m to 1200m] will be constructed with a 9m wide formation and a 7m wide two coat seal (14mm/7mm) finish."*

The definition of carriageway in the RTA *Road Design Guide*, includes the shoulder used by vehicles. The 7m wide carriageway stated in the Council's Draft DCP Provisions for Heavy Vehicle Generating Development thus includes sealed sections of the road shoulder. Taking these sections to be 0.5m on each side, the sealed width is thus 0.5 + 6.0 + 0.5 = 7.0m. This is the sealed width implemented on Brayton Road, and hence the Draft DCP Provisions and the "as constructed" works are consistent.

Guide to Traffic Generating Developments

The Roads & Traffic Authority's "*Guide to Traffic Generating Developments"* provides general advice on the traffic impact assessment of proposed developments. For assessing the peak period operation of intersections, this *Guide* makes recommendations for varying levels of service. These are reproduced in **Table 4B.14**.

The RTA *Guide* also recommends performance standards for the *environmental capacity* of residential streets. These have been developed for application on any residential streets in the State, and hence are applicable to streets such as Brayton Road, Marulan. They have been developed taking into account issues such as pedestrian safety in crossing the road, traffic noise, road hierarchy design and surveyed perceptions of traffic annoyance. They are based on peak hour flows because these can specifically be correlated with traffic gaps for pedestrians crossing the road. **Table 4B.15** reproduces these standards.

Table 4B.14 Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (seconds /vehicle)	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays; roundabouts require other control mode	At capacity, needs other control mode
F	Over 70	Over capacity	Over capacity

Table 4B.15 Environmental Capacity Performance Standards on Residential Streets

Road Class	Road Type	Maximum Speed (km/hr)	Maximum Peak Hour Flow
Local	Access Way	25	100
	Street	40	200 environmental goal
		40	300 maximum
Collector	Street	50	300environmental goal
		50	500 maximum

4B.1.4 Traffic Impacts

4B.1.4.1 Traffic Generation and Transport Routes

Two stages of operation are proposed:

Stage 1: An average of 25 truck movements per day, with a peak no greater than 50% more than that average.

Stage 2: Over the average 25 truck movements, increasing over time to an estimated 100 truck movements per day.

In addition to the truck movements, there will be staff commuting movements. With 20 staff on the Site, and conservatively assuming every staff member drives, there will be 40 light vehicle movements each day by staff by **Stage 2**. There will also be occasional visitor movements plus deliveries.

For **Stage 1**, material will be transported by articulated semi-trailer and truck-and-dog rigs, with three or four-axle dogs. For **Stage 2**, while the current assessment has been based on the same vehicle types, consideration will be given to the use of B-Doubles. If proposed, a separate application will be made for the haul route to be approved as a B-Double route.

Stage 1
The haulage route for **Stage 1** will utilise existing roads as shown on **Figure 4B.2**

- New access from the Project Site to Brayton Road.
- Brayton Road, through northern edge of Marulan, to the Hume Highway interchange near RTA Checking Station, most trucks will use this interchange.
- Trucks arriving from the Highway South will off-load near Highway Service Centre and travel northbound through Marulan town centre, to access Brayton Road.

The proposed haulage hours for **Stage 1** are 9pm Sunday to 6pm Saturday. (After construction of the By-pass route, being **Stage 2**, there will be no haulage through Marulan outside the hours of 6.00am to 6.00pm Monday to Saturday).

Taking the daily average truck movements of 25, there will be an average of 1.04 truck movements each hour on Brayton Road. The distribution of haulage of material is estimated to be 80% to the Highway North and 20% to the Highway South. For the trucks returning from the Highway South, there will be up to 3 movements each day through the town centre.

The Site access onto Brayton Road will be constructed prior to the haulage of quarry material in **Stage 1**. This access will be near the current site access. To maximise sight distance, some clearing of roadside vegetation is proposed.

Stage 2

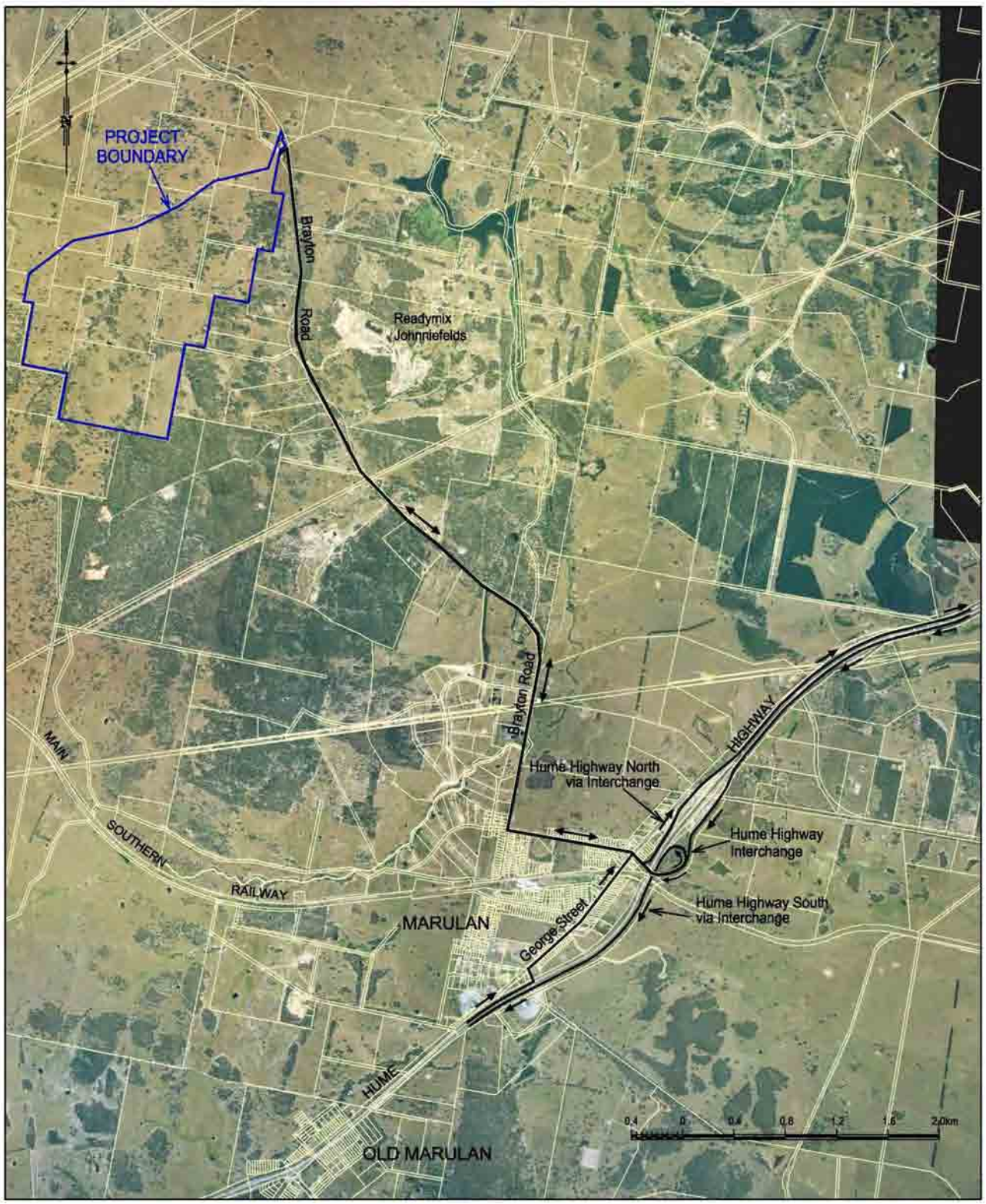
For **Stage 2**, with truck movements exceeding the average of 25/day, a new By-pass road is proposed to be constructed, from Brayton Road to Red Hills Road, along an unformed Crown Road. The starting point on Brayton Road will be through land owned by Gunlake Quarries, at a location to be selected to maximise sight distances to/from Brayton Road. This route will join Red Hills Road at the point where it makes a right-angle turn to the North. Where Red Hills Road joins the Hume Highway, quarry trucks will only make left turns. It is proposed to dedicate this new By-pass road to Council, as a public road.

Unladen quarry trucks arriving from the Highway North will proceed southbound along the Highway and off-load at the Marulan Interchange. They will then proceed through a new roundabout at the interaction of Brayton Road and George Street. They will make a U-turn manoeuvre at the roundabout to return northbound along the Highway prior to making a left-turn into Red Hills Road (**Refer Figure 4B.3**).

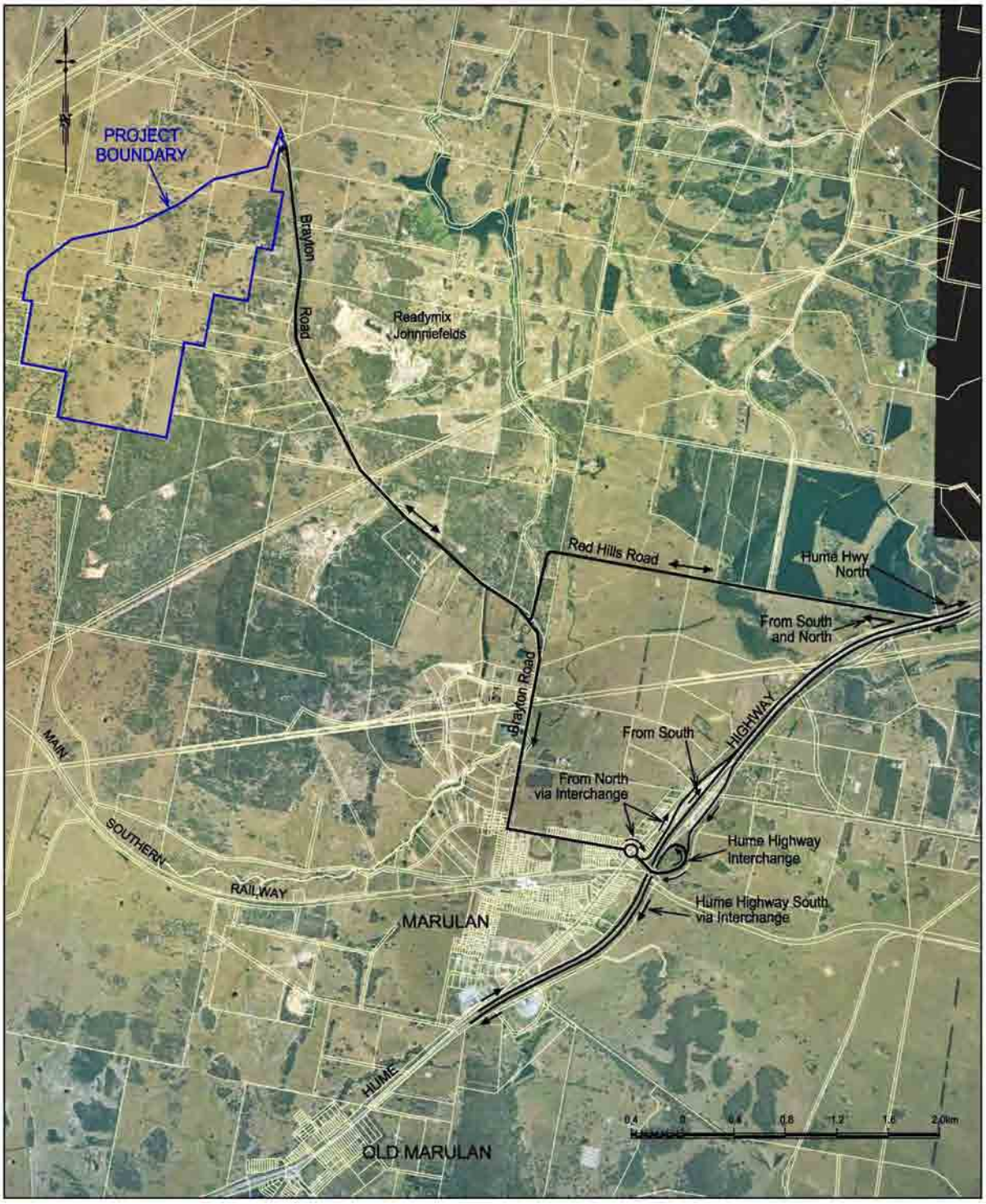
Stage 2 will have an estimated 100 truck movements each day. The hours of haulage will be from 9.00pm Sunday to 6.00pm Saturday. These hours will apply to the main route, via Red Hills Road. For haulage to the Highway South, the hours 6.00am to 6.00pm Monday to Saturday will apply. Trucks from the Highway South will turn left from the Highway into Red Hills Road. **Table 4B.16** shows the daily and average hourly movements based on estimated 100 truck movements each day and a predicted 80% North and 20% South split.

Table 4B.16 Daily and Hourly Truck Movements Stage 2

Location	Trucks per Day	Trucks per Hour
From North, U-turn at Portland Avenue and left turn to Red Hills Road	40	1.7
To North, via left turn from Red Hills Road to Highway	40	1.7
From South, via left turn into Red Hills Road	10	0.4
To South, via Brayton Road	10	0.4



Gunlake Quarry Project
Figure 4B.2 Stage 1 Saleable Products Transport Route



Gunlake Quarry Project
Figure 4B.3 Stage 2 Saleable Products Transport Route

Improvements to Brayton Road are further discussed in Sections 4B.1.4.3. and 4B.1.4.4. New junctions will be constructed where the By-pass road meets Brayton Road and where the quarry access meets Brayton Road. A new roundabout will be constructed at the junction of Brayton Road and George Street in Marulan, just west of the Marulan Interchange. This is further discussed in Section 4B.1.4.6. The intersection of Red Hills Road and the Hume Highway will be upgraded as discussed in Section 4B.1.4.8.

Subject to RTA agreement, all haul roads will be signposted with an 80km/hr speed limit, for trucks and buses. The relative distances of the haul routes are not long, with the distance from the Site to the new By-pass road being approximately 4.0km, with a further 1.5km to the 60km/hr restriction in Marulan. The total distance along the proposed By-pass road and Red Hills Road is approximately 3.0km.

4B.1.4.2 Alternative Transport Routes

The primary transport route, for **Stage 1** operations, is via Brayton Road from the Site through to the existing Hume Highway interchange at Marulan. This utilises existing road infrastructure.

The **Stage 2** operations will generate an estimated 100 truck movements in total each day. The proposed hours are 9pm Sunday to 6pm Saturday . For this level of operation, the amenity implications for dwellings fronting Brayton Road within Marulan could be significantly adverse. Consequently, the new By-pass road to connect Brayton Road with Red Hills Road has been proposed. This **Stage 2** proposal will require an intersection upgrade at the Red Hills Road and Hume Highway intersection.

The approved Lynwood Quarry further to the South will provide a new grade-separated interchange at the junction of the Highway with Marulan South Road and with the proposed Lynwood Quarry haul road. The latter will be a private road. The timing of the construction of this interchange is not known.

Trucks from the proposed Gunlake Quarry do not have access to the Lynwood Quarry private haul road or the new interchange.

The Lynwood Quarry includes a provision for a rail loading balloon loop on the southern side of the Main Southern Railway, west of Marulan. This loop and associated infrastructure will not be able to be accessed off the public road network. At present, Stoney Creek Road ends at the railway lines within Marulan. Stoney Creek Road south of Brayton Road is a local residential street, with dwellings on both sides, and is not suitable as a haul road.

Further road access options on the northern outskirts of Marulan were investigated. However, the relevant land was not available for sale, and hence this option is not available.

An option was developed for a U-turn facility at the Highway interchange adjacent to the RTA truck checking station, east of Brayton Road. A design was developed following initial feedback from the RTA. However, the RTA did not approve the proposed layout.

Another option was for trucks in Stage 2 to turn right into Portland Avenue off the Hume Highway, make a U-turn at the existing roundabout at Portland Avenue/George Street and

then return to the Highway via a left turn, to travel northbound to Red Hills Road, where they would turn left into Red Hills Road and then to the quarry. This movement would average 40/day, or up to 2 trucks/hour.

Approaching Portland Avenue from the Highway North, there is a deceleration lane in the median and a protected right turn bay. There is very good visibility towards approaching northbound vehicles. The driver would take a gap in northbound traffic and cross the two northbound lanes. After making a U-turn, the driver would turn left back onto the Highway and use the existing acceleration lane.

The Roads & Traffic Authority (RTA) and Council expressed concern about the safety of the Highway/Portland Avenue intersection, given its accident history, and have not ruled out closing the median at this intersection. The implications of closing this intersection have not been fully investigated by the RTA or Council

The RTA have provided the accident history at this intersection for the most recent five year period. It showed five accidents as follows:

20/4/2002	Van eastbound from Portland, across Highway, hit northbound car
28/4/2002	Car eastbound from Portland, turning right onto Highway, hit northbound station wagon
18/12/2005	Truck westbound from eastern service road, turning right onto Highway, hit northbound car
18/3/2006	Car eastbound from Portland, hit southbound car
21/7/06	15 m north of Portland, northbound station wagon hit northbound car while merging lanes

There were no accidents involving vehicles making a right turn from the Highway North into Portland Avenue.

If the median were closed, four out of these five accidents would not occur. If the Portland Avenue approach had channelisation to prevent cross and right turn movements, only allowing left turn movements, and if similar channelisation were provided on the service road on the eastern side, the same four accidents would not occur.

In summary, this transport route option is an alternative, or at the least a short term option, with the RTA being able to prevent all of the accidents that have occurred right at the intersection over the last five years.

4B.1.4.3 Brayton Road Junctions

Table 4B.17 shows the average hourly traffic flows on Brayton Road south of Johnniefelds Quarry. This table indicates very low traffic flows, with nominal peaks at 8.00-9.00am and 3.00-4.00pm. The weekday flows are marginally higher than the average weekly flows.

Table 4B.17 Average Weekday Peak Hour Flows on Brayton Road South of Johnniefelds Quarry, 25-31 May 2007

Peak Hour	Northbound	Southbound	Total
8.00-9.00am	18	24	**42**
3.00-4.00pm	15	17	**32**

For **Stage 1**, with an average of 25 truck movements per day, the average hourly truck movement will be one per hour. Clearly with this level of flow overlayed onto the current peak hour flows there will be no traffic capacity issues at the Site access intersection or at the Brayton Road/Stoney Creek Road intersection.

For **Stage 2**, hourly truck movements between the Site and the new By-pass road junction will be 2 truck movements per hour in each direction. Again, overlayed on the current "peak" hour flows, there will be no traffic capacity issues. These are average truck flows. A peak hour might see up to a 50% increase, or 3 truck movements per hour, which again will be insignificant in traffic capacity terms. The despatch of laden trucks will be determined by the loading capacity at the quarry.

The key issue with the Brayton Road junctions is traffic safety. At the Site access intersection, taking the hourly flows in **Table 4B.17** as the starting point, and adding a left turn into the Site of 2 vehicles/hour and a right turn out of the Site of 2 vehicles/hour, Figure 4.5.12 of the RTA's *Road Design Guide* indicates that a Type BAL treatment would be adequate for the left turn. With no right turn truck movements into the quarry, no special treatment is needed for this right turn. Figure 4.5.12 does make the comment that "*Use of Types "AU" and "CH" is preferred on high speed and/or heavy vehicle routes to enhance safety"*. While the threshold for a Type AUL treatment is significantly above the current traffic flow levels, to be conservatively safe, Hallam recommended a Type AUL treatment.

At the request of Council, Hallam adopted the Councils Draft DCP Provisions for Heavy Vehicle Generating Development for a sealed width between the Site and the Johnniefelds quarry of 7.0m. For the auxiliary left turn into the quarry, a lane width of 3.25m will be constructed. A 80km/hr speed limit for trucks (and buses) would be appropriate, to enhance traffic safety. With this speed and left turn lane width, the diverge length (Td) would be 72m. This would be adequate for a vehicle to stop from 80km/hr at a "desirable maximum" deceleration rate of 3.5 m/s^2 (Table 4.8.3 of *Road Design Guide*). As suggested in the *Road Design Guide*, the initial taper will be 20m, with the parallel section of lane then 52m long. The quarry site driveway will have an initial sealed width of 7.0m. **Figure 4B.4** shows the schematic layout of the Brayton Road and Quarry Access Road intersection.

No widening is proposed for the carriageway of Brayton Road west of the Site, because quarry traffic will not use this section of road, with the possible exception of an employee commuting to work. With the level of current traffic and the level of right turn movement out of the quarry site, an auxiliary acceleration lane would not be justified.

With the level of eastbound peak hour flow at the Site access – 24vehicles/hour in morning peak hour and 17 vehicles/hour in afternoon peak hour – and with no traffic likely to be

arriving at the Site from Brayton Road West, no additional treatment is proposed for the eastbound approach.

Should the RTA decide to not improve traffic safety through the imposition of an 80 km/hr speed limit for trucks and buses, the deceleration length would be increased accordingly.

At the Site access, there is currently some vegetation within the road reserve to the west of the Site that will be cut back to maintain sight lines for safety purposes.

At the junction of Brayton Road with the new By-pass road (**Figure 4B.5**), the same traffic conditions will apply as for the Site access junction, with the exception that the through movements along Brayton Road will be reversed. These movements are of a very low order. For the same reasons, a Type AUL treatment, with a 72m long auxiliary left turn lane will be installed. The location of this junction will be designed to maximise sight distances in both directions. Roadside vegetation may be trimmed as required to maintain sight lines. Again, the length of left turn lane would increase if the truck speed limit is not imposed.

With this junction, the westbound peak hour flows on Brayton Road are very low, at 18 vehicles/hour in the morning and 15 vehicles/hour in the afternoon. With the construction of the new By-pass road, there might be a low flow making a right turn into the By-pass road. Since this will be a public road intersection, Hallam recommended that this westbound approach have a BAR treatment, with shoulder widening opposite the By-pass road, to provide better safety for passing through traffic.

4B.1.4.4 Brayton Road Route

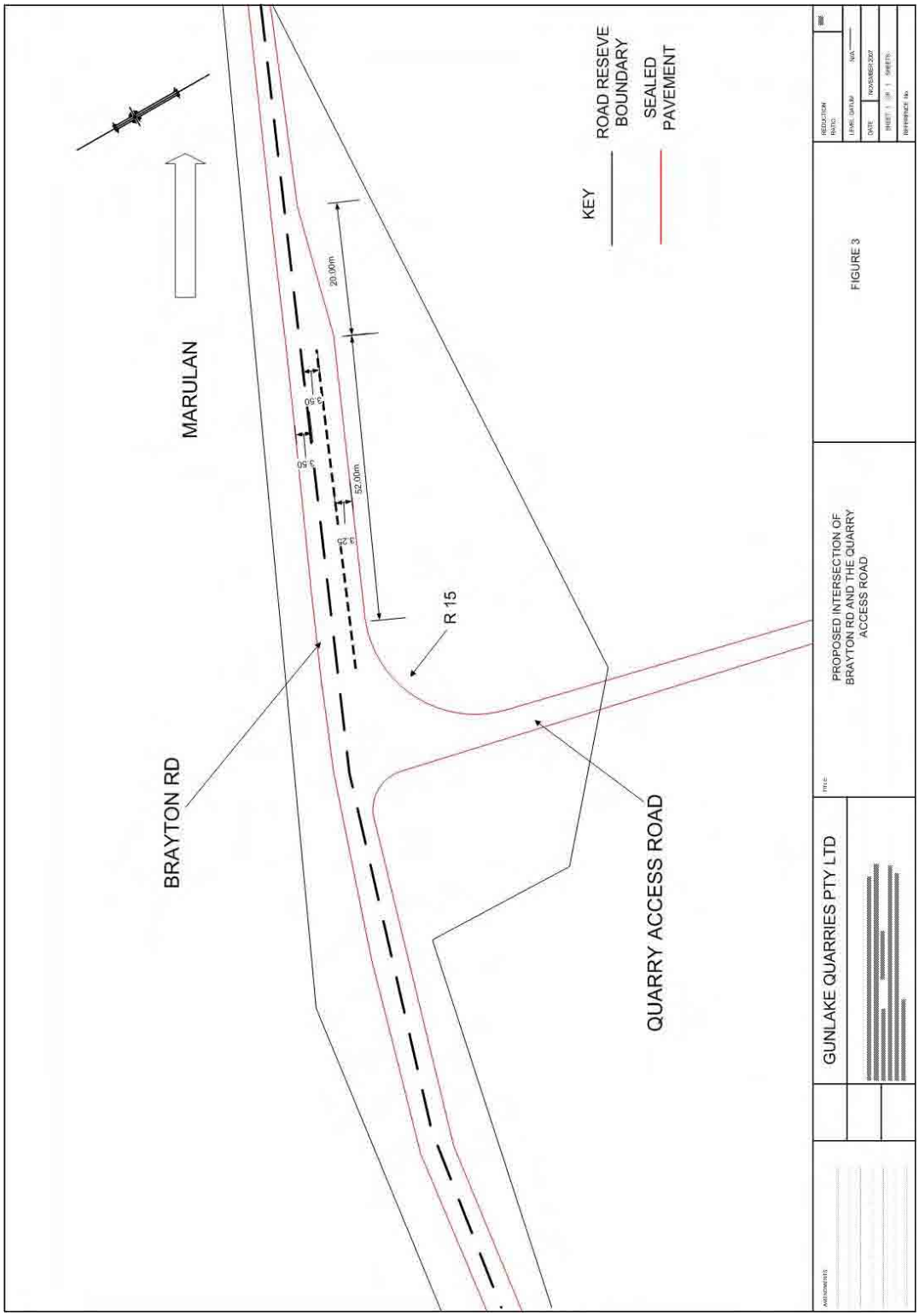
For **Stage 1**, the transport route will be along the length of Brayton Road, from the Site, into Marulan township and onto the Highway interchange, with trucks from the Highway South using George Street to connect with Brayton Road. This will see an average of 25 truck movements each day, with an average of about one truck movement each hour.

For **Stage 2**, the main transport route will be along Brayton Road from the Site to the By-pass road, with 100 truck movements along this section, averaging 4 truck movements each hour over any 24 hour period. Trucks travelling to south will continue to use Brayton Road at an average of 25 movements per day for the life of the quarry but the hours will be between 6am and 6pm Monday to Saturday only.

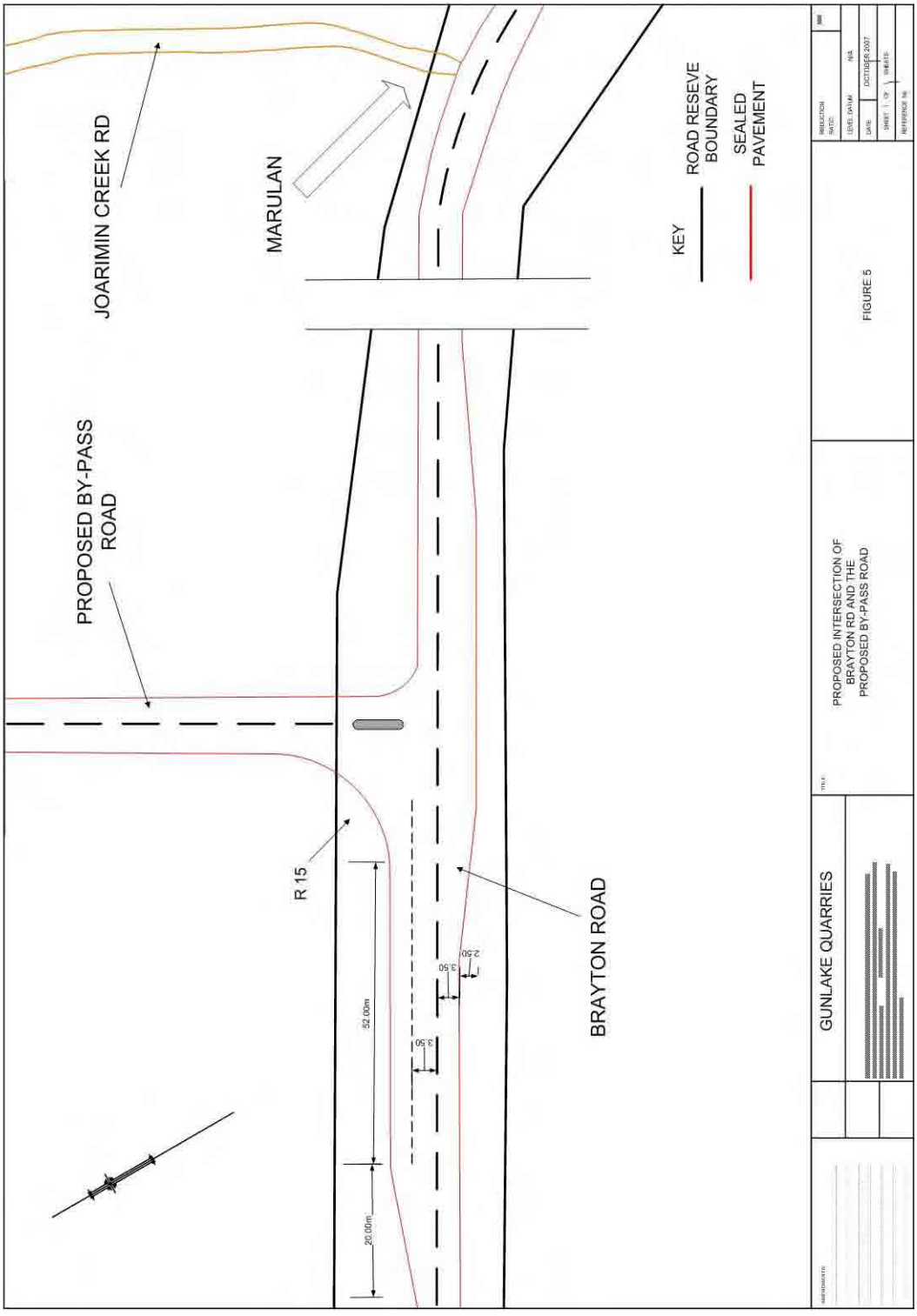
Brayton Road: Site to Stoney Creek Road
Table 4B.18 shows the average daily traffic flows on Brayton Road south of Johnniefelds Quarry plus the **Stage 1** and **Stage 2** additional traffic flows.

Table 4B.18 Average Daily Traffic Flows on Brayton Road South of Johnniefelds Quarry (vehicles/day)

Day	Light	Rigid Truck Class 3-5	Articulated Class 6-13	Total Traffic
Avg Weekly	271	58	44	373
Stage 1	+10	-	+25	408
Stage 2	+40	-	+100	513



Gunlake Quarry Project
Figure 4B.4 Brayton Road and Quarry Access Road Intersection



Gunlake Quarry Project
Figure 4B.5 Brayton Road/Bypass Road Junction

Stage 1 would see about 408 vehicles per day, including 127 trucks (58 rigid and 69 articulated). If assessment is based on the RTA *Road Design Guide,* while the flow is less than 500 vehicles/day, the heavy vehicle numbers would make lane widths of 3.5m "desirable". The criterion of truck numbers in the *Road Design Guide* is 20% heavy for 500 vehicles/day or 5% heavy for 2000 vehicles/day, both of which equate to 100 trucks per day. However this criterion is already reached, with the current average daily traffic of 373 vehicles/day including 102 trucks. With **Stage 2**, the average daily flows would see about 513 vehicles/day, with total trucks numbering 202.

The existing Johnniefelds Quarry is clearly adding to the current heavy vehicle numbers. The proposed Gunlake Quarry will increase these numbers.

The RTA's *Route Assessment Guidelines for Restricted Access Vehicles* only recommends lane widths of 3.0m, for flows of up to 6,000 vehicles/day.

Goulburn Mulwaree Council has developed its own road design guidelines and Brayton Road and Red Hills Road are fully under the control of Council. The Council's Draft DCP Provisions for Heavy Vehicle Generating Development and the specifications for the reconstruction works on Brayton Road south of the Johnniefelds Quarry are consistent – for the observed daily flows over 500 vehicles/day and large numbers of quarry trucks, Council recommend a sealed width of 7.0m. This sealed width includes two 3.0m lanes plus 0.5m of sealed shoulder on each side. Hallam adopted this specification for their assessment of Council roads.

Hallam considered the haul routes in five sections, with the recommended upgrades for each section set out in **Table 4B.19**. The 5 sections are:

- **Section A** Site to Johnniefelds Quarry access
- **Section B** Johnniefelds Quarry access to new By-pass road junction
- **Section C** Brayton Road (New By-pass road junction to Marulan interchange)
- **Section D** New By-pass road, Brayton Road to Red Hills Road
- **Section E** Red Hills Road to the Hume Highway

Table 4B.19 Proposed Roadworks

Stage	Section A	Section B	Section C	Section D	Section E
1	7.0 m total seal	No Change	No change	-	-
2	7.0 m total seal	No Change	No change	7.0 m total seal	7.0m total seal

Much of Section B has recently been reconstructed by Council.

The Roads & Traffic Authority's *Road Design Guide* recommends that auxiliary lanes for overtaking only be considered for lengths greater than 500m, where the grade exceeds 4.5%. Table 3.2-6 of this *Guide* sets out Minimum Volume Warrants for Selected Road

Improvement Options. The lowest category is for *Auxiliary lanes on 10% of length.* For "rolling" terrain (BCR = 1) the minimum AADT is 1400 vehicles/day. The respective lengths of haul route and the maximum daily flows with the quarry in operation are contained in **Table 4B.20**.

Table 4B.20 Maximum Daily Flows on Haulage Routes

Haul Route Section	**Length(km)**	**Future AADT**
Brayton Road Site to By-pass road	4.5	513 vehicles per day
Brayton Road By-pass road to Marulan	1.5	408 vehicles per day
New By-pass road	2.0	80 vehicles per day
Red Hills Road east By-pass road	1.4	145 vehicles per day

Based on these figures, there is no warrant for auxiliary lanes for overtaking.

Brayton Road: Stoney Creek Road to Hume Highway Interchange
The average daily traffic flows would increase as set out in **Table 4B.21**. For the staff commuter movements, these have been assumed to split with other routes, such as Stoney Creek Road and the new By-pass road. In addition, some of these commuter trips are likely to be currently occurring, as workers travel to other job locations.

Table 4B.21 Average Daily Traffic Flows on Brayton Road East of Wollondilly Street (vehicles/day)

Day	**Light**	**Rigid Truck Class 3-5**	**Articulated Class 6-13**	**Total Vehicles**
Average Weekly	764	47	53	864
Stage 1 and 2	+20	-	+25	909

The additional 25 truck movements each day in **Stage 1** would increase the total heavy vehicle movements to approximately 125 movements each day, with the articulated truck movements increasing from 53 to 78 movements each day. The total traffic flows would not increase substantially. **Stage 2** would see no further increase in truck traffic and in total traffic along this route. With the current satisfactory carriageway widths in this section of Brayton Road, with a minimum of 9.6m available, no road upgrading will be required. This width allows for overtaking, but on flat terrain, subject to an urban speed limit, this is not an important issue.

Table 4B.22 sets out the current and projected average hourly flows between 6.00am and 6.00pm, with the additional one truck per hour indicated. The **Table** also shows an additional 20 car movements by staff, as shown in brackets under the Total.

Table 4B.22 Average Hourly Traffic Flows in Brayton Road East of Wollondilly Street (vehicles/hour)

Period	Rigid Truck Class 3-5	Articulated Class 6-13	Total +Truck (+Car)
6-7am	0	4 +1	31 +1 (+3)
7-8am	5	4 +1	54 +1 (+4)
8-9am	5	8 +1	63 +1 (+3)
9-10am	3	4 +1	59 +1
10-11am	3	6 +1	67 +1
11-12noon	4	6 +1	59 +1
12-1pm	3	6 +1	61 +1
1-2pm	4	3 +1	53 +1
2-3pm	4	4 +1	58 +1
3-4pm	6	3 +1	66 +1 (+3)
4-5pm	4	0 +1	77 +1 (+4)
5-6pm	2	1 +1	68 +1 (+3)

Table 4B.22 indicates that the highest peak hourly flow will increase from 77 to 82 vehicles/hour, in the afternoon. The highest morning flow will be 68 vehicles/hour. In terms of the environmental capacity thresholds the environmental goal for a local residential street is 200 vehicles/hour (Refer **Table 4B.15**). The post-development situation will be very satisfactory.

4B.1.4.5 George Street

The **Stage 1** operation will see 2-3 trucks each day travel from the Highway South, left into Portland Avenue, right into George Street and along George Street to Brayton Road. This movement will not occur in **Stage 2**, when any trucks arriving from the Highway South will continue on the Highway, pass the truck checking station and turn left into Red Hills Road. George Street immediately north of Portland Avenue carries 60-100 vehicles/hour in peak periods, with up to 15 truck movements in an hour. The additional truck movements would have an insignificant impact.

4B.1.4.6 Brayton Road / George Street Roundabout

During **Stage 1**, no changes are proposed to the existing Brayton Road and George Street Intersection at Marulan.

For **Stage 2**, when daily truck movements exceed the average of 25 movements per day, trucks from the North will offload the Highway at the Marulan Interchange and proceed along Brayton Road. They will then pass through a new roundabout at the junction of Brayton Road and George Street to make a U-turn and return to the Highway via the onload ramp. The construction of the upgraded junction of Red Hills Road with the Highway will incorporate a closure of the Highway median, as required by the RTA.

The layout of the proposed new roundabout is shown in **Figure 4B.6**. This roundabout will allow southbound vehicles to offload from the Highway, pass under the Highway towards Brayton Road, make a U-turn at the roundabout and return to the Highway via the left-turn onload ramp. The existing priority controls on the Brayton Road/George Street junction would simply be replaced by a roundabout, requiring all vehicles to slow down. This would provide net safety benefits.

Traffic flows through this junction are relatively low. **Table 4B.8** indicates that the average daily traffic flows of 375 vehicles per day eastbound (travelling to the Highway South) and 160 vehicles per day westbound (Travelling from the Highway North). Peak hour flows are 30-40 vehicles per hour eastbound and 10-15 vehicles per hour westbound.

A manual traffic count at the Marulan Interchange undertaken on Monday 6th August 2007 in the period 6:00am – 12:00noon found peak hour flows of 26 vehicles per hour making the left-turn northbound load movement, 18 vehicles per hour travelling eastbound under the Highway to continue to the Highway South and 20 vehicles per hour offloading from the Highway North to travel westbound under the Highway into Marulan.

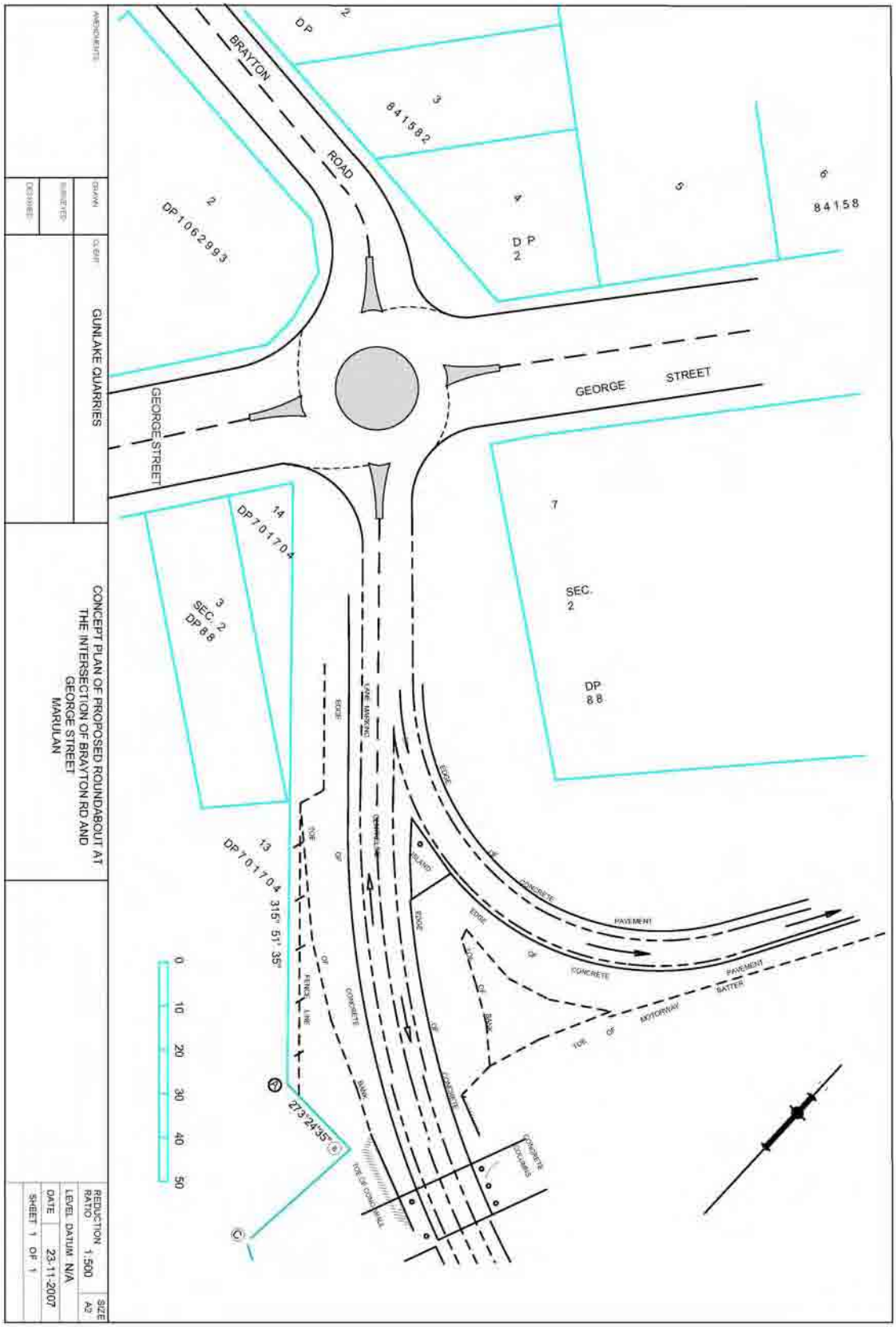
With all peak hour movements either into or out of the Brayton Road/George Street junction less than 50 vehicles per hour, there are no traffic capacity issues, either with the current priority control or with a one-lane roundabout. The roundabout will be designed to provide for large articulated trucks to turns. It will need to be constructed prior to the introduction of Stage 2 traffic movements. The Stage 2 operations will see an additional 2 trucks per hour making the U-turn at the George Street roundabout.

Should any future urban development occur on George Street north of Brayton Road, this roundabout will provide road network benefits.

Gunlake considered a number of options to enable trucks returning to site during Stage 2 of the Project to be able to undertake a U-turn manoeuvre and access the Red Hills Road and new By-pass Road in order to return to the quarry.

Continue to truck through Marulan. This would involve continued use of Brayton Road for all of the Project. Gunlake believed that the transportation levels of Stage 2 would be better handled on the By-pass Road and would avoid noise, traffic safety and visual elements associated with continued use of Brayton Road. This By-pass road has also been favoured by Council and some Residents previously, as mentioned in the Mulwaree Shire Council-Director of Environmental Services' Report-on Building, Planning, Health and General-17Th December 1998 and the Report by Director of Environmental Services dated 24th August 2000

Install a U-turn facility at the Marulan Interchange. This option involved the potential construction of a U-turn facility at the Marulan Interchange that enabled trucks returning from the north to exit at the Interchange, pass beneath the Hume Highway and access the northern on-ramp. Trucks would then proceed north along the Hume Highway to the Red Hills Road intersection. Gunlake prepared a suitable layout for this arrangement in accordance with RTA Guidelines. However, the RTA rejected this option.



Gunlake Quarry Project
Figure 4B.6 Proposed Brayton Road / George Street Roundabout

Utilise existing U-turn facility at Portland Avenue. This option utilised existing road infrastructure and required returning trucks to make a right hand turn to exit the Hume Highway, negotiate the existing U-turn facility at Portland Avenue and re-enter the Hume Highway and travel north to the Red Hills Road intersection. Gunlake supported this proposal. However, both the RTA and Council did not support this option on the basis of the potential closure of tthis intersection. The implications of closing this intersection have not been fully investigated by RTA or Council and has raised some serious concerns from the Marulan Fire Brigade regarding emergency responses. In addition the Goulburn Mulwaree Strategy-Designing the Future Marulan Workshop-December 2005 identified the need to improve this at grade RTA crossing.

George Street Roundabout. This is the proposed option and was discussed with the RTA and Council Officers. The roundabout can be designed to meet RTA Guidelines. It is located within the Commercially zoned area of Marulan. Should the RTA and Council decide to close the Portland Ave intersection this roundabout would be ideally suited to accommodate the increased traffic that would be forced to travel along George Street.

4B.1.4.7 Marulan Interchange

During **Stage 1**, there will be an average of 10 truck movements each day travelling eastbound on Brayton Road and turning left onto the northbound onload ramp, an average of 10 truck movements travelling southbound on the Highway, offloading at the Brayton Road interchange and heading westbound along Brayton Road, and 2-3 truck movements each day heading eastbound under the Highway and joining the southbound load ramp to travel to the Highway South. With these movements of less than one per hour added to the current flows, there clearly will not be any road or interchange capacity issues. This interchange has ample spare capacity for these movements.

During **Stage 2** typically 12 to 13 trucks per day will continue to use the Marulan Interchange to access the Highway South. During the Stage trucks will access the quarry via Red Hills Road and the new By-pass road.

The Brayton Road / George Street roundabout will remove the need for any vehicles to make a right turn from the Highway North into Red Hills Road. Hence, with the option to upgrade the Highway/Red Hills Road junction to allow left turn movements by quarry trucks, the low volume of general traffic making this right turn now could use the roundabout to return to Red Hills Road or continue along Brayton Road and use the new By-Pass road to Red Hills Road.

4B.1.4.8 Red Hills Road Transport Route

Hume Highway/Red Hills Road Junction

Prior to truck movements exceeding the average of 25 movements each day, the **Stage 2** haulage route will be constructed to provide a link between Brayton Road and Red Hills Road, and with the junction of Red Hills Road and the Hume Highway upgraded. This new By-pass road is proposed to be a public road.

The current traffic flows in Red Hills Road just west of its junction with the Hume Highway were discussed in Section 4B.1.2.2. **Table 4B.10** summarises the daily traffic flows.

Current traffic flows on Red Hills Road are very low, with an average daily traffic flow of 65 vehicles/day, relatively evenly split per direction. There are some heavy vehicle movements, mainly rigid vehicles (Class 3-5). There are very low current hourly flows in Red Hills Road.

Table 4B.23 shows the daily traffic flows on the Hume Highway north of South Marulan Road, in February 2005. (Source: *Environmental Impact Statement, Proposed Lynwood Quarry, Marulan,* May 2005.)

Table 4B.23 Daily Traffic Flows on Hume Highway, South Marulan 15-21 February 2005 (vehicles/day)

Day	Northbound	Southbound	Total
Monday	7,911	9,620	17,531
Tuesday	7,862	8,200	16,062
Wednesday	8,414	8,375	16,789
Thursday	9,454	8,966	18,420
Friday	13,051	11,619	24,670
Saturday	9,931	9,467	19,398
Sunday	12,196	12,572	24,768
Average Daily Traffic	**9,831**	**9,831**	**19,662**

In terms of peak hour flows on the Highway, the Lynwood Quarry EIS also provides details of hourly flows. **Table 4B.23** shows that highway traffic flows are highest on the Friday. **Table 4B.24** sets out the peak hourly flows on Friday 18 February 2005.

Table 4B.24 Peak Hour Traffic Flows on Hume Highway, South Marulan Friday 18 February 2005 (vehicles/hour)

Period	Northbound Total (Heavy vehicles)	Southbound Total (Heavy vehicles)
7.00-8.00am	365 (136)	405 (81)
8.00-9.00am	448 (137)	562 (85)
9.00-10.00am	596 (148)	660 (94)
3.00-4.00pm	1,081 (114)	865 (145)
4.00-5.00pm	1,210 (84)	855 (123)
5.00-6.00pm	1,169 (96)	942 (120)

The proposed **Stage 2** access arrangements would see an average of 2 trucks/hour turning left from the Highway into Red Hills Road, and 2 trucks/hour turning left from Red Hills Road onto the Highway. The current peak hour two-way movement on Red Hills Road is about 10 vehicles/hour. These movements are split between left and right turns at the Highway junction. The RTA have advised that if Red Hills Road is to be used as a quarry truck haul route then they would require the Highway median at the junction to be closed to physically prevent right turn movements. At present there is a right-turn bay some 65m long in the median.

The junction of Red Hills Road is perpendicular to the Hume Highway. To the south is part of the disused Old Hume Highway which is currently being used as a Truck Parking Area. The entrance to this area is approximately 400m south of the current Red Hills Road/Hume Highway intersection. The Highway has two travel lanes per direction. Along the western side the constructed road shoulder is about 3.0m wide. The speed limit on the Highway is 110km/hr.

Table 4B.25 shows the level of use of the truck parking area and turning movements at the Red Hills Road/Highway junction.

Table 4B.25 Weekday Hourly Use of Truck Parking Area and Turning Movements at Red Hills Road/Highway Junction – 8 August 2007

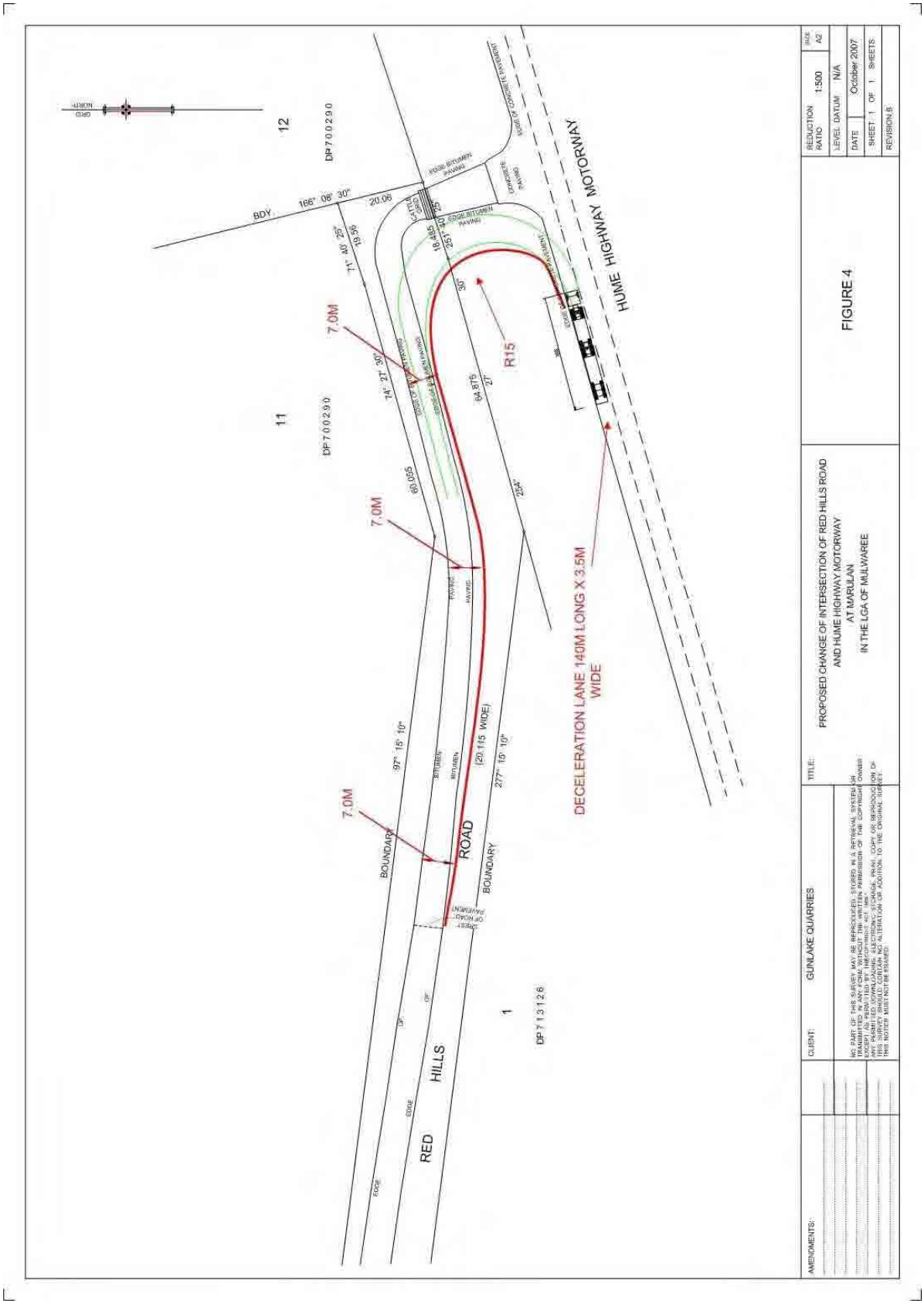
Period	RT to Red Hills	LT to Red Hills	LT from Red Hills	RT from Red Hills	Into Truck Area	Out of Truck Area
6-7am	0	1	0	0	5	6
7-8am	2	1	0	0	4	6
8-9am	5	2	1	1	4	4
9-10am	1	1	0	0	6	4
10-11am	1	0	1	0	4	5
11-12n	1	0	2	2	4	4
Total	**10**	**5**	**4**	**3**	**27**	**29**

RT: Right-turn LT: Left-turn

Table 4B.25 shows that the use of the Truck Area is relatively low in traffic generation terms, with an average of 5 trucks per hour using this area. The average movement of 5 trucks per hour represents an average of one truck every 12 minutes. This Truck Parking Area does not have an acceleration or deceleration lane, drivers either simply slow down in the road shoulder or in the kerbside lane. However, due to the entrance of this area being approximately 400m from the proposed new intersection, there would be no conflict between trucks entering the Truck Parking Area and trucks turning left into Red Hills Road. Trucks wishing to exit the truck parking area could enter the shoulder south of the proposed deceleration lane and merge with northbound traffic. Vehicles making a left turn into Red Hills Road would have priority over trucks pulling out of the Truck Parking Area.

The provision of a deceleration lane for trucks wishing to turn left into Red Hills Road would have a net positive impact on traffic safety by providing a wider area for trucks exiting the Truck Parking Area to accelerate when rejoining northbound traffic.

Figure 4B.7 shows the proposed concept design of the new Red Hills Road/ Hume Highway interchange to be constructed south of the existing intersection. The **Figure 4B.7** design is overlaid on a survey plan of the current junction layout. The location of this intersection is positioned to maximise sight distance as well as being close to a slight crest on the highway to maximise deceleration and acceleration to and from the junction.



Gunlake Quarry Project
Figure 4B.7 Hume Highway / Red Hills Road Intersection

For the left turn entry to Red Hills Road an auxiliary deceleration lane is proposed, some 140m long, and 3.5m wide. This will require minor road widening. This meets the requirements of the RTA's *Road Design Guide* and will provide an adequate length for deceleration. With the relative volume of quarry truck movements, less than 2 trucks per hour, and the Truck Parking Area activity being very low, the proposed works would provide a net positive impact on traffic safety.

In terms of consistency of approach on at-grade intersections along the Hume Highway in the Marulan area, Hallam noted that there had recently been intersection safety upgrades at the Highway junctions with Carrick Road and with Towrang Road. Seagull-channelisation has been provided at these junctions, plus left-turn deceleration lanes into the side streets. Hallam understood that at Carrick Road, there is a left-turn deceleration lane, plus an acceleration lane in the median for traffic turning right out of Carrick Road, this being 300m long. No acceleration lane has been provided for traffic turning left out of Carrick Road. A similar design has been provided at the Towrang Road intersection.

A 1998 ADT traffic count at Carrick Road showed 98 vehicles per day, a figure greater than the existing figure in Red Hills Road of 65 vehicles per day, with the latter figure projected to increase to about 140 vehicles per day with the quarry traffic. Existing left turn movements out of Carrick Road were 0-3 vehicles per hour in the peak hours in a count undertaken in April 2003, while on Towrang Road the equivalent left turn flows were 2-3 vehicles per hour. The current left turn flows out of Red Hills Road are 0-2 vehicles per hour, which will increase by +2 vehicles per hour with the proposed quarry. At the Towrang Road and Carrick Road junctions, the RTA quite correctly placed greater importance on the acceleration lane to enable vehicles merging with the "fast" lane to get up to speed before the merge.

Impact of Closure of Highway Median

The closure of the Highway median will have a minor impact on local traffic. The current average daily traffic on Red Hills Road is 65 vehicles/day. On the day surveyed, over the 6.00am to 12.00noon period the total two-way movement in Red Hills Road was 22 vehicles/6 hr, with a right-turn into Red Hills Road totalling 10 vehicles and a right-turn out of Red Hills Road totalling 3 vehicles. In proportion with the average daily flow of 65 vehicles/day, approximately 35 vehicles/day would be likely to be disadvantaged by the closure. This closure would achieve a public safety benefit. For vehicles currently turning right into Red Hills Road from the Highway South, they could continue southbound to the Marulan Interchange and travel along Brayton Road to the new By-pass road to connect to Red Hills Road. This facility can easily accommodate this level of diversion. For vehicles turning right from Red Hills Road into the Highway southbound, they could use the new By-pass road to travel to Brayton Road and thence down to Marulan, and to the Highway South if that is their destination. In summary, about 35 vehicle movements each day would be required to make a short diversion. The public safety benefits in removing right turn movements to and from the Highway, clearly out way any impacts associated with these closures.

Construction of the By-pass road to connect Brayton Road and Red Hills Road has historically been recognised by Council and some residents as a worthwhile improvement to the local road network.

The Report dated 24th August 2000 by Mulwaree Shire Council Director of Environmental Services favours a connection to Brayton Road from Red Hills Road as it connects the Uringalla Estate and future 1(b) land north of Marulan to the town and provides better social and commercial connection with the town and can proceed, as the area develops, from Section 94 Contributions. The Mulwaree Shire Council-Director of Environmental Services Report-on Building, Planning, Health and General dated 17th December 1998 describes this as a suitable option as it:

- Reduces highway usage,
- Reduces the potential for accidents at a further highway access;
- Provides easy access to Marulan for Uringalla residents;
- Provides a good road along the north and west of the Urban Investigation Zone; and
- Supports the further development of Marulan to supply the daily needs of local residents.

The reports also refers to letters from neighbours supporting this access to Brayton Road.

Highway Junction
Hallam assessed the proposed junction layout with the addition of 2 truck movements each hour turning left into Red Hills Road and left out of Red Hills Road. The only movement delayed is the left turn out of Red Hills Road. The predicted average delays for this left turn movement are shown in **Table 4B.26**.

Table 4B.26 Level of Service Highway Junction

Period	Delay (seconds per vehicle)	Level of Service
9.00am – 10.00am	14.5	A
4.00pm – 5.00pm	18.5	B

These are satisfactory levels of delay. They are not sensitive to whether it is one truck every 30 minutes or one truck every 20 or 15 minutes, that could occur when truck movements were more peaked than the average.

Red Hills Road Route
The current average daily traffic flows on Red Hills Road are 65 vehicles/day, including 7 rigid truck and 2 articulated truck movement. **Stage 2** would see an estimated 80 truck movements each day, taking the total daily movement to 145 vehicles/day, substantially less than 500 vehicles/day.

The narrow carriageway widths close to the Highway intersection will be resolved with the proposed intersection design. From the chainage point approximately 400m west of the current Highway junction, the sealed width varies between 6.9 and 6.5m, prior to where the

new By-pass road will intersect. Based on the RTA's *Road Design Guide,* for a daily traffic flow of up to 500 vehicles/day, a 6.0m sealed width plus shoulder sealing of 0.5m on each side will be constructed, for a total sealed width of 7.0m. For situations with 500 vehicles/day including 20% trucks (100 trucks) a lane width of 3.5m is "desirable", leading to a total sealed width of 8.0m. The RTA's guidelines for B-double routes recommend a total sealed formation width of 7.0m for flows of up to 500 vehicles/day. More relevant is the Councils Draft DCP Provisions for Heavy Vehicle Generating Development, for Council roads, where a total carriageway width of 7.0m, including sealed shoulders, is recommended for rural roads. Minor carriageway widening will be required to provide 7.0m of seal.

New By-pass Route
For the new By-pass route to connect Brayton Road with Red Hills Road, the projected traffic flow is 80 articulated trucks each day, plus some light traffic movements associated with staff commuting, or traffic diverted due to the median closure of the Highway at the Red Hills Road junction. A sealed width of 7.0m will be installed, including the 0.5m seal on each shoulder.

4B.1.5 Recommended Roadworks Programme

4B.1.5.1 Programme

Stage 1

1.1 Construct site access intersection on Brayton Road. Refer **Figure 4B.4**.

1.2 Brayton Road from the Site to the Johnniefelds Quarry access (2.4km) to provide 2 x 3.0m lanes plus 2 x 1.0m shoulders, each with 0.5m of seal.

Stage 2

2.1 Construct intersection of new By-pass road with Brayton Road. Refer **Table 4B.5**.

2.2 Construct new By-pass road from Brayton Road to Red Hills Road to provide 2 x 3.0m lanes plus 2 x 1.0m shoulders, each shoulder with 0.5m of seal.

2.3 Upgrade Red Hills Road from the By-pass road to the Hume Highway intersection, to provide 2 x 3.0m lanes plus 2 x 1.0m shoulders, each shoulder with 0.5m of seal.

2.4 Construct roundabout at the intersection of Brayton Road and George Street. Refer **Figure 4B.6**.

2.5 Reconstruct intersection of Hume Highway with Red Hills Road. Refer **Figure 4B.7**.

4B.1.5.2 Section 94 Contributions.

The Mulwaree Section 94 Contributions Plan (CP) 2003 makes provision for a levy for road upgrades and maintenance in relation to Extractive Industries. The quarry proposes to transport up to 125,000tpa at **Stage 1**, increasing over time to 500,000tpa at **Stage 2**.

In **Stage 1**, the laden trucks will travel along Brayton Road from the Site to the Hume Highway interchange at Marulan.

In **Stage 2**, the laden trucks will travel along Brayton Road to the new By-pass road and then along Red Hills Road to the Hume Highway. Some trucks will continue to use the Stage 1 route.

The Contribution Plan Section 3.9.6 Extractive Industries provides for the levy to meet *expenditure to maintain, repair and where necessary reconstruct the roads,* and further *is appropriate for new construction, maintenance and rebuilding of any road that is used by quarry traffic.* Gunlake proposes in **Stage 1** to carry out the necessary upgrading of Brayton Road at its cost upfront, and in **Stage 2** to fully construct the new By-pass road and upgrade Red Hills Road where necessary and ultimately construct the new roundabout at the intersection of George Street and Brayton Road, all at its own cost upfront. Accordingly it is proposed that the payment of the levy would be off-set against the costs of the upgrading and the new road construction in each case when completed.

Even though the proposed traffic increase will be noticeable, it should not have a major impact on local traffic, roads and road users. The proposed construction of the new By-pass road, the new roundabout at the George Street and Brayton Road intersection, the upgrading of Red Hills Road, where required, and Brayton Road, between the quarry and the By-pass road, will have beneficial results for local road users.

Construction of the By-pass road to connect Brayton Road and Red Hills Road has historically been recognised by Council and some residents as a worthwhile improvement ot to the local road network.
The Report dated 24th August 2000 by Mulwaree Shire Council Director of Environmental Services dated 24th August 2000 favours a connection to Brayton Road from Red Hills Road as it connects the Uringalla Estate and future 1(b) land north of Marulan to the town and provides better social and commercial connection with the town and can proceed, as the area develops, from Section 94 Contributions. T, and the Mulwaree Shire Council-Director of Environmental Services Report-on Building, Planning, Health and General dated 17th December 1998 describes this as a suitable option as it:

- Reduces highway usage,
- Reduces the potential for accidents at a further highway access;
- Provides easy access to Marulan for Uringalla residents;
- Provides a good road along the north and west of the Urban Investigation Zone; and
- Supports the further development of Marulan to supply the daily needs of local residents.
- Reduces the potential for accidents at a further highway access point

The roundabout proposed for George Street has been made necessary by the intention of the RTA and Goulburn Mulwaree Council to close the existing at grade intersection roundabout at Portland Avenue. The implications of closing this intersection have not been fully investigated by the RTA or Council. The intended closure has raised some serious concerns from the Marulan Fire Brigade regarding emergency responses. In addition, participants in the Goulburn Mulwaree Strategy-Designing the Future Marulan Workshop held in December 2005 identified improvements to the at grade RTA crossing as a key issue for the future development of Marulan village.

The existing Portland Avenue roundabout intersection would utilise existing road infrastructure enabling returning trucks to make a safe right hand turn to exit the Hume Highway, negotiate the existing U-turn facility at Portland Avenue and re-enter the Hume Highway and travel north to the Red Hills Road intersection.

The existing intersection arrangement at Portland Avenue would satisfy the requirement for vehicles returning to the quarry to make a safe right hand turn from the Hume Highway. If the existing intersection is closed, a roundabout would need to be constructed at the intersection of George Street and Brayton Road to accommodate the increase in traffic it would have to be replaced by a new one to enable traffic to exit and access the Hume Highway. The volume of non project-related traffic using the new roundabout would be significantly greater than project-related traffic.

The Mulwaree Shire Council Contribution Plan (Section 3.9.6 Extractive Industries) provides for the Section 94 levy to meet expenditure to maintain, repair and where necessary reconstruct the roads, and further is appropriate for new construction, maintenance and rebuilding of any road that is used by quarry traffic. As shown in Section 5.1 of this Environmental Assessment, Gunlake proposes in Stage 1 to carry out the necessary upgrading of Brayton Road at its cost upfront, and in Stage 2 to fully construct the new By-pass road, upgrade Red Hills Road where necessary and ultimately construct the new roundabout at the intersection of George Street and Brayton Road, all at its own cost upfront. Accordingly it is proposed that the payment of the levy would be off set against the costs of the upgrading of existing roads and the construction of new roads and intersections.

4B.2 Water, Soil and Agriculture

The water, soil and agriculture assessment was undertaken by SEEC Morse McVey and Associates (SEEC). The full assessment is presented in Part 2 of the Specialist Consultant Studies Compendium (SCSC), with the relevant information from the assessment summarised in the following sub-sections.

4B.2.1 Introduction

Community and Government liaison discussions and meetings, together with preliminary environmental assessment identified surface water issues as one of the main environmental concerns about the proposed Gunlake Quarry Project.

Water, soils and agriculture are intimately connected and SEEC addressed these issues together. Their report is presented in three main sections:

- A description of the soils and an assessment of their agricultural value.

- A Conceptual Soil and Water Management Plan for the establishment stage. This Plan describes how soil and water will be managed during the establishment stage to the requirements of the Landcom Blue Book 2004.

- A Conceptual Water Cycle Management Plan for the operational stage. This Plan describes how stormwater will be managed during the operational stage and how a neutral or beneficial effect on water quality will be obtained.

4B.2.2 Soil and Agriculture

The SEEC Report includes the following components and these are summarised in the following sections:

- An assessment of the soil landscapes, including soil sampling and testing to determine constraints and opportunities for the proposed development and the potential for the soils to be used for rehabilitation.

- Identification of agricultural value of the lands.

- Identification of potential impacts on significant agricultural lands and productive soils (if applicable).

- Recommendations for impact mitigation on agriculturally valuable soil landscape areas (if applicable).

4B.2.2.1 Land Use

The present land use at the Project Site is livestock grazing. Mostly it is vegetated with native and improved pasture grasses including some broadleaved weeds. It has been cleared extensively of native vegetation, with some small patches of highly disturbed remnant woodland remaining. A detailed description of the vegetation is included in Section 4.7 and SCSC 7.

4B.2.2.2 Soils

There is one soil landscape across the quarry and its access road and six soil landscapes on the proposed By-pass road. The Bindook Road Soil Landscape occurs at the quarry and its access road. The Soil Landscapes occurring along the By-pass road are:

- Bindook Road
- Paddy's River
- Marulan
- Jaqua
- Gibraltar Rocks
- Larkin (Variant A)

A full description of these Soil Landscapes and representative photographs are included in Section 1.4 of the SEEC Report.

Figure 4B.8 shows the distribution of these Soil Landscapes around the quarry, access road and By-pass road.

Soil testing was undertaken on representative samples to obtain useful information for managing soil impacts during construction and operation of the proposal. The detailed results are included in Section 1.4 of the SEEC Report.

The SEEC assessment determined the following general features of the site soils:

- Dispersible (Sediment Type D) for the most part,
- Moderately to very highly erodible,
- Moderately acidic in the topsoils,
- Non-saline to slightly saline,
- Low to moderate cation exchange capacities,
- Calcium:magnesium ratios that infer soils that are low or even deficient in calcium,
- Very low phosphorus levels,
- Very low to moderate potassium levels,
- Very high variability for use in the walls of sediment basins and site specific testing was recommended.

The phosphorus, potassium and calcium levels of the soils will be improved during rehabilitation in areas sown to permanent pasture. Areas to be planted with native vegetation may not require application of fertilizer, however, this would be determined at the time of planting.

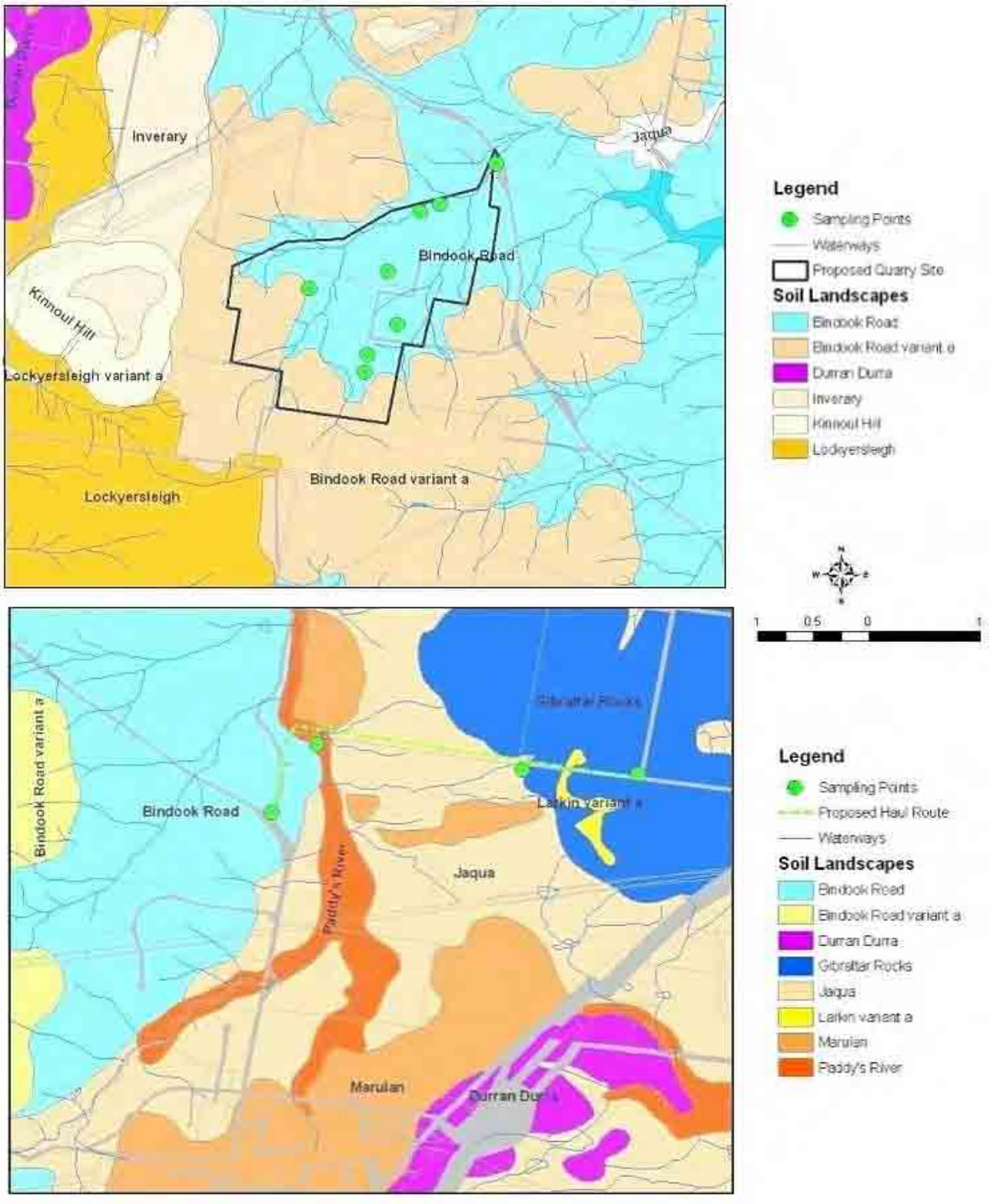
4B.2.2.3 Agricultural Value

SEEC classified the lands affected by the Gunlake Quarry Project to be in Agricultural Suitability Classes 4 and 5.

Class 4 includes land best suited to agriculture. Cultivation of occasional crops is possible in some areas, especially during favourable seasons. However, this can increase the erosion hazard substantially. Production levels are likely to be low.

Class 5 lands are suited to occasional light grazing, but are best retained under natural bushland. Other agricultural pursuits are not recommended.

- SEEC concluded that development of the Gunlake Quarry Project will not affect any lands of significant agricultural value.



Gunlake Quarry Project
Figure 4B.8 Soil Landscape Distribution

4B.2.2.4 Mitigation

SEEC concluded that potential impacts of the Project on soils and agricultural values could be mitigated by:

- Stripping and stockpiling topsoil from areas to be developed, including the quarry, access road and By-pass road.
- Separately stockpiling topsoils and subsoils.
- Ensuring newly vegetated areas are fertilised and watered (if possible) until adequate vegetative cover is established to reduce erosion potential.
- Inspecting newly planted areas regularly and, where failures occur, replanting vegetation as necessary.
- Where areas of localised soil erosion are identified, implementing appropriate measures such as planting additional stabilising vegetation or wind breaks, stabilising soils with mulches or soil binders, and taking steps to minimise any concentrated stormwater flows.

Should areas of localised poor drainage be identified, undertaking appropriate remedial action such as installing formalised drainage channels or pipes, improving soil permeability by cultivating the soil, improving soil permeability by installing infiltration trenches and planting moisture tolerant vegetation in problem areas.

These mitigation measures will be implemented and they have been incorporated into the Conceptual Soil and Water Management Plan discussed in the following Section as well as Sections 2.3 and 2.4.

4B.2.3 Conceptual Soil and Water Management Plan

4B.2.3.1 Introduction

Part 2 of the SEEC Report contains a detailed description of the Conceptual Soil and Water Management Plan (SWMP). This Plan describes how soil and water will be managed during establishment stage to the requirements of the Landcom Blue Book 2004.

Section 2.3.4 of this *Environmental Assessment* summarises the SWMP and provides explanatory figures of the Plan.

The Plan proposed by SEEC is a conceptual one. Following Project Approval a detailed version will be prepared which will consider any conditions imposed by the approval and contain detailed drawings of any engineering structures.

In designing structures for the SWMP, SEEC Morse McVey planned for structures to be stable in at least the 10-year ARI, t_c event. Spillways in sediment basins and WQCP's would

be designed to be stable in the 100-year ARI, t_c event. Design to other events, such as the 100-year ARI, 24-hour event for spillways and the 20-year ARI, 24-hour event for earth banks are lower standards and do not meet the requirements of Landcom (2004).

Figure 4B.9 and Figure 4B.10 detail the Conceptual Soil and Water Management Plan for the Project Site and the area along the By-pass road.

The following sections summarise important components of the SWMP.

4B.2.3.2 Erosion Control

The details of how erosion control will be achieved are included in Section 2.4 of the SEEC Report. In general, erosion control will be achieved by a combination of actions including:

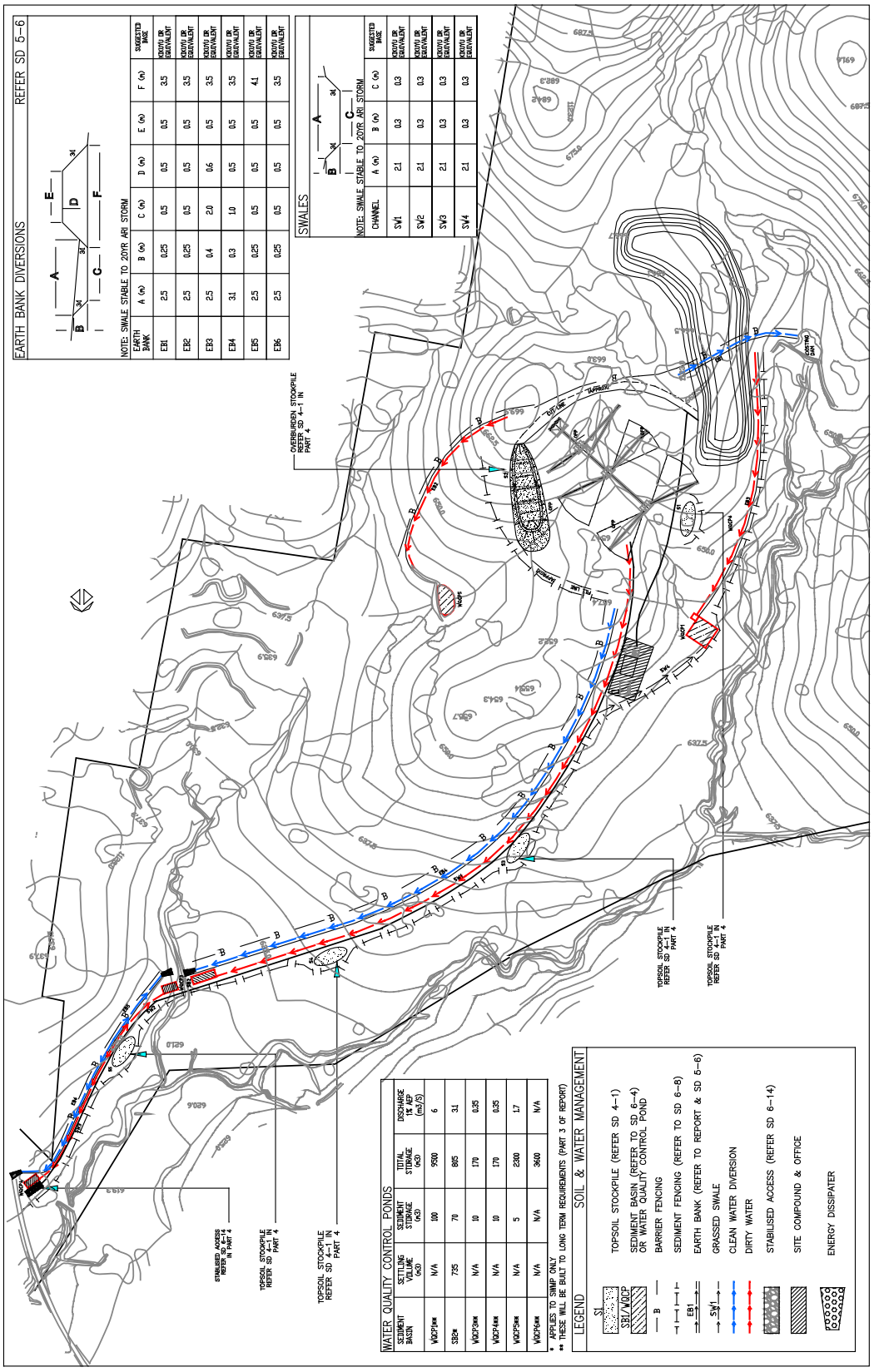
- Limiting site disturbance in extent and nature to that described in the SWMP.
- Undertaking the erosion control works in the stages and timing sequence as described in the SWMP.
- Erecting barriers and sediment fencing to minimise disturbance by preventing vehicular and pedestrian access to restricted areas.
- Cut and fill arrangements will be minimised, however, where they do occur, batters will not exceed gradients of 2.5H:1V on east and south-facing slopes, and 3:1 on north and west-facing slopes.

Vehicular access to disturbed lands will be confined to that essential for construction.

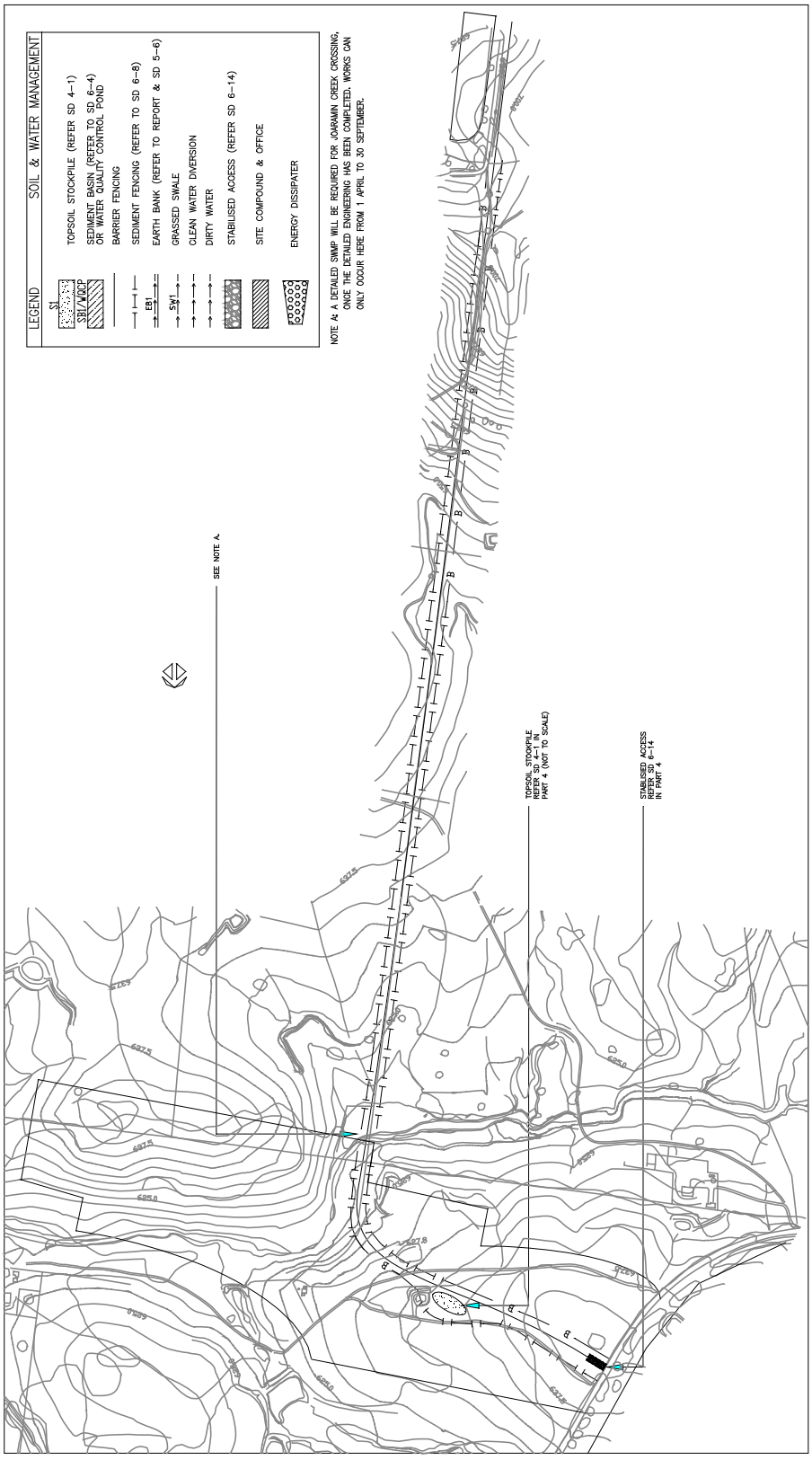
4B.2.3.3 Site Stabilisation

The details of how site stabilisation will be achieved are detailed in Section 2.4 of the SEEC Report. In general, site stabilisation will be achieved by a combination of actions including:

- Progressively stabilising any disturbed areas using appropriate erosion control measures.
- Using temporary vegetative cover or soil binders as appropriate.
- Leaving a loose soil cover on all completed engineering works to encourage water infiltration and to assist soil retention.
- Site landscaping will be undertaken as soon as possible and within 15 working days from completion of construction activities.



Gunlake Quarry Project
Figure 4B.9 Conceptual Soil and Water Management Plan for the Project Site



Gunlake Quarry Project
Figure 4B.10 Conceptual Soil and Water Management Plan for the By-Pass Road

4B.2.3.4 Topsoil Replacement

The details of how topsoil replacement will be achieved are detailed in Section 2.4 of the SEEC Report. In general, it will be achieved by a combination of actions including:

- Wherever possible, topsoil will be replaced to a depth of 75mm. There are sections of the Project Site, especially around the quarry pit, where this may not be possible due to the absence of topsoil material. However, Gunlake will ensure topsoil is retained for rehabilitation purposes. If the stockpiled topsoil is insufficient to permit achieving the 75mm cover other actions will be taken such as incorporating organic material into the soil, or reducing the cover to 50mm and covering with a thick biodegradable matting material.

- Ideally, all topsoil will be handled when it is moist rather then wet or dry. This will avoid a decline in soil structure.

- Compacted construction areas will be deep ripped to greater than 200mm along the contour to assist soil retention and to improve water infiltration and root penetration.

- Topsoil will be left in a scarified or ploughed condition.

- Compaction of recently topsoiled areas by construction equipment will be avoided.

4B.2.3.5 Revegetation

The details of how revegetation will be achieved are detailed in Section 2.4 of the SEEC Report. Suitably qualified persons will be contracted for advice on revegetation establishment.

4B.2.3.6 Pollution Control

The details of how pollution control will be achieved are detailed in Section 2.5 of the SEEC Report. In general, it will be achieved by a combination of actions including:

- Stabilised site access will be installed to all areas that are subject to disturbance and accessed from public sealed roads.

- Sediment fencing will be installed as indicated on the SWMP.

- Water collected in Sediment Basins will be tested for suspended solids concentration and will only be released if the level is <50mg/L. If the level is >50mg/L the basins will be flocculated with gypsum sulphate (Refer Appendix 5 SEEC Report) prior to discharge.

- Following storm events, all basins will be drained to regain design capacity. Flocculation may be required prior to drainage.

- Sediment removed from any trapping device will be disposed in locations where further erosion will not occur.

- Acceptable receptacles will be provided as required for the various wastes generated on site.

- Safe storage will be provided for fuels, oils and all chemicals.

4B.2.3.7 Site Monitoring and Maintenance

In accordance with the requirements of the Blue Book and normal best practice, site monitoring will be undertaken during and after construction and will include the following:

- Waste receptacles will be emptied as necessary. Disposal of waste will be in a manner approved by the Quarry Manager.

- A self-auditing programme will be implemented. The Quarry Manager will inspect the site weekly and maintain a log of inspections paying particular attention to all the elements of the SWMP.

- A rain gauge will be installed at the Project Site as part of the weather station. It will be capable of determining rainfall event severity.

- Revegetated areas will be inspected regularly to determine success. Replanting will occur as necessary.

- An adequate watering and fertilising system will be maintained in revegetation areas.

- Areas of localised soil erosion will be identified and appropriate preventive measures implemented.

- Areas of localised poor drainage will be identified and appropriate remedial action taken.

- Measures will be taken to ensure that water contained in sediment dams and with a suspended solids level >50mg/L will not be discharged from site.

4B.2.4 Water Demand

Gunlake Quarry intends to harvest all production water from surface runoff. This section describes the Project's water requirements and discusses the potential water balance.

The Gunlake Project will require water for:

- Crushing Plant.

- Dust suppression on roads and hardstand areas.

- Pasture Irrigation.
- Truck Washing.
- Domestic Water.

4B.2.4.1 Crushing Plant

Water will be required at the Crushing Plant to operate atomised sprays for dust suppression at all discharge points, the tipping point into the apron feeder and for the primary crusher input and discharge.

The rate of consumption will be approximately 3.2L for every tonne of saleable product. At peak production of 500,000tpa the water requirement for the Crushing Plant will be 1.6MLpa, which is equivalent to approximately 4,500Lpd. This water will be lost from the site water cycle as it evaporates or adheres to the gravel.

4B.2.4.2 Haul Roads and Hardstand Areas

The heavy vehicle haulroad and the hardstand areas around the office complex will require water spraying to achieve dust control. There are approximately 1.5ha of haul road and 1.0ha of hardstand area requiring treatment in this way.

Water for this dust suppression will come from rainfall (less evaporation) and water applied from the water truck. There is an excess of evaporation over rainfall and the modelling exercise has predicted that approximately 7.2MLpa of additional water will be required to meet the rainfall/evaporation deficit. The water truck will apply approximately 2mm of water per non-rainy day and will require approximately 13MLpa. Both sources of water were taken into account in the water balance prepared by SEEC and discussed in Section 4B.2.4.3.

4B.2.4.3 Pasture Irrigation

The Project will increase the amount of impervious surfaces which will increase the volume of runoff from the site. The Crushing Plant and bare area dust suppression will not use all of the projected increase in water runoff. Consequently, Gunlake will establish approximately 10ha of pasture irrigation to use the excess water. SEEC predicted that the pasture irrigation will require approximately 50MLpa of water.

A detailed water balance is included in Table 7 in Section 3.3.7.3 of the SEEC Report. **Table 4B.27** summarises the more detailed SEEC water balance.

Table 4B.27 Summary Water Balance

Consumption Task	Volume (MLpa)
Crushing Plant	1.6
Dust Suppression	13.0
Rainfall Deficit	7.2
Pasture Irrigation	50.0
TOTAL WATER DEMAND	**71.8**

It is possible that groundwater seepage into the quarry pit will be saline. However, this seepage will be shandied with trapped rainwater. Larry Cook and Associates (Specialist Consultant Studies Compendium, Part 3, Volume II Environmental Assessment), predicts groundwater inflow rates of less than 0.3MLpa in Year 1 and up to 3.5MLpa at full quarry extent in Years 20 - 30.

SEEC Morse McVey predict that on average there will be a shandy ratio of 1 part potential saline water with 10 parts rainwater within the quarry pit. They also predict that at such a ration, salinity levels will be low enough to permit direct irrigation from WQCP6. This would be established as part of the site water quality monitoring program and following advice from an agricultural consultant.

Should salinity levels prove to be too high the water could alsombe shandied with water trapped in nearby WQCP1, before being used for irrigation. With this scenario, SEEC Morse McVey predict an ultimate shandy ratio of 1:50 resulting in low saline water suitable for irrigation.

There are six small farm dams on the Project Site and the harvestable right multiplier for the property is 0.08ML/ha. SEEC Morse McVey advise that the harvestable right provisions do not apply to the Project for the following reasons:

- The Project Site is 231ha and consequently, the total harvestable right is 18.4ML, which exceeds the volume of the six existing dams,
- All WQCPs are either off-line or on minor watercourses only (first or second order streams), and,
- All dams will be constructed for environmental purposes only.

There are no wetlands on the Project Site.

4B.2.4.4 Truck Washing

Trucks will be spray washed before leaving the Project Site. Water for this purpose will be sourced from WQCP 1 **(Figure 4B.9).** Water will be conveyed from the truck wash station back to WQCP 1 and water loss from this source is considered to be minor.

4B.2.4.5 Domestic Water

There will be 20 staff at the Project Site. They will each require approximately 50Lpd for toilets, showers and kitchen use. This equates to an approximate daily use of 1000Lpd which will be sourced from rainwater tanks. All this water becomes waste water and leaves the site water cycle.

4B.2.5 Conceptual Water Management Plan

4B.2.5.1 Introduction

Part 3 of the SEEC Report contains a detailed description of the Conceptual Water Management Plan (WMP). This Plan flows logically from the SWMP and describes how stormwater will be managed during the operational stage and how a neutral or beneficial effect on water quality will be obtained.

The Plan proposed by SEEC is a conceptual one. Following Project Approval a detailed version will be prepared which will consider any conditions imposed by the approval and contain detailed drawings of any engineering structures.

The Project is located within an area administered by the Sydney Catchment Authority (SCA) which requires that all developments demonstrate a neutral or beneficial effect (NORBE) on receiving waters.

Figure 4B.11 details the Conceptual Water Management Plan for the Project Site.

The following sections summarise important components of the WMP.

4B.2.5.1 Quarry Site

Section 3.4 of the SEEC Report contains a detailed description of the measures taken to manage the water cycle during operations of the Gunlake Quarry. This *Environmental Assessment* section summarises those measures.

In general terms the measures will include the following:

- Ensuring the earth banks that direct clean water away from the road are functioning.
- Constructing all components in accordance with the specifications detailed in the final WMP.
- Building the quarry access road with in-fall drainage to direct water to stabilised areas.
- Collecting flow in pits upslope of the road and passing that water under the road to be distributed across grassed areas downslope of the road.
- Converting sediment basins required for the SWMP to water control ponds as defined in the WMP.

- Water collected in the quarry pit will be pumped to WQCP6 **(Figure 4B.11)** and will become part of the site water cycle. It will most likely be used for pasture irrigation.

- Managing the components of the WMP in accordance with the recommendations in the SEEC Report as finalised after Project Approval. This will require monitoring and testing to ensure objectives are met.

- Storing fuel in dedicated tanks, under roof cover and on a concrete surface at the end of the maintenance shed. Spill control kits will be available and staff will be trained in their use. Waste oils, greases and fuels will be collected and recycled.

- Storing all chemicals in appropriate dedicated containers.

- Collecting all domestic wastewater and treating it in an aerated wastewater treatment system that will provide secondary treated effluent suitable for disposal by irrigation.

- The disposal of the secondary treated effluent will occur on a dedicated 1000m^2 irrigation field **(Figure 4B.11).** The area will have no less than 500mm of soil cover and be no closer to a watercourse than 100m. The area will be fenced from the public and have signs informing that treated wastewater is being reused for irrigation.

4B.2.5.2 By-pass Road

Long term water control along the By-pass road will be achieved by a combination of actions including the following:

- Swales constructed in accordance with the WMP to provide for road drainage.

- Cut and fill batters will not exceed 2:1 and batter lengths will not exceed 7.5m.

4B.2.5.3 Monitoring and Maintenance

To ensure continued acceptable performance, Gunlake will implement an ongoing programme for maintenance of the various water control measures. This programme will include the following components:

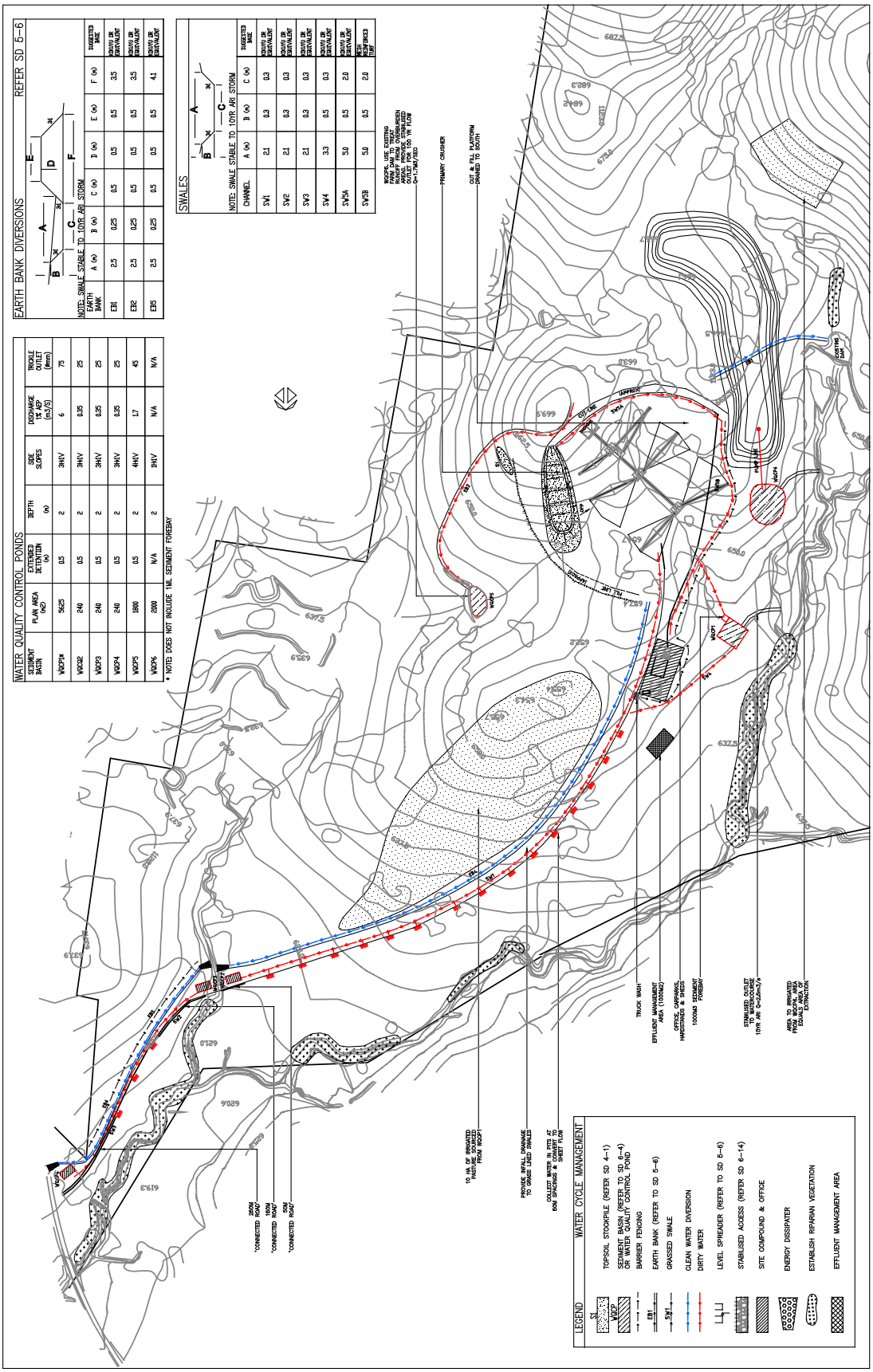
- Inspecting swales every 6 months to confirm 75% ground cover. Replanting/repair will be undertaken as required.

- Inspecting the access road and By-pass road pavement seal and drainage structures.

- Inspecting hardstand areas to ensure subsoils are not exposed.

- Collecting sediments from water quality ponds periodically as required.

- Managing on-site effluent systems according to operating and Council requirements.



Gunlake Quarry Project
Figure 4B.11 Conceptual Water Management Plan for the Project

- Inspecting clean and dirty water diversion drains to confirm ongoing performance.
- Periodically cleaning out the sediment forebay of WQCP1 and placing sediment away from potential eroding areas.
- Inspecting the outlets of all WQCPs after major rainfall events.
- Inspecting all rainwater tanks periodically.
- Regularly inspecting all dust control components.
- Collecting the appropriate monitoring data to manage the irrigated pasture and land correctly.
- Ensuring that the irrigation does not lead to runoff.
- Sampling water quality.

4B.2.6 Water Monitoring

Pre-quarrying water quality monitoring was undertaken between January and July 2007. This programme has recommenced and will continue until the quarrying programme commences in order to provide a sound background database of surface water quality in Chapman's Creek.

The detailed results of the water analysis are included in Appendix 9 of the SEEC Morse McVey report (Specialist Consultant Studies Compendium Part 2, Volume II of the Environmental Assessment).

The data show that the present water quality of Chapman's Creek is good and they provide a baseline description of existing water quality.

Ongoing water quality sampling will be undertaken to replicate the analyses outlined in Section 3.2.8 of SEEC Morse McVey (Specialist Consultant Studies Compendium, Part 2 Volume II of the Environmental Assessment). This will aim to demonstrate whether NORBE continues to be achieved. The sampling methodology will accord with the Australian Guidelines for Water Quality Monitoring and Reporting (2000) and will be established together with a suitably qualified consultant and officers from the Department of Environment and Climate Change (DECC).

In the unlikely event that monitoring indicates that NORBE is unlikely to continue ot be achieved, the soil and water management program will be adjusted to the satisfaction of DECC. After each samopling and analysis set, a report will be prepared and forwarded to DECC to show that the performance of the program.

4B.2.7 Pre and Post Development Pollutant Loads Modelling

4B.2.7.1 Introduction

SEEC modelled pre-development and post-development sediment and pollutant loads using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) developed by the CRC for Catchment Hydrology. The details of this modelling are included in Sections 3.5 and 3.6 of the SEEC Report. Copies of the model output have been forwarded to Sydney Catchment Authority to help them assess the environmental impact of the Project.

This section summarises the outcomes of the MUSIC modelling investigation.

4B.2.7.2 Model Outputs

The MUSIC model enables determination of the principal pollutants before and after development and any changes in export levels as a result of the development.

The model provides output for the following parameters:

- Flow (MLpa)
- TSS - Total Suspended Solids (kgpa)
- TP - Total Phosphorus (kgpa)
- TN - Total Nitrogen (kgpa)
- Gross Pollutants (kgpa).

SEEC modelled expected pollutant levels for an average period and for a wet period under existing conditions. The outcome was compared with pollutants resulting during an average and wet period after the development and assuming all management recommendations had been implemented. **Table 4B.28** summarises the outcomes.

The Sydney Catchment Authority advised SEEC that, in assessing NORBE, they would be looking for a 20% reduction in the mean annual nutrient export from the Project Site post development. **Table 4B.28** shows that significant pollutant load reductions are predicted by MUSIC.

Another NORBE objective is to ensure nutrient concentrations are no greater post-development than pre-development. MUSIC predicted that concentrations of TSS, Total Phosphorus and Total Nitrogen will meet this objective.

Table 4B.28 Pollutant Loads Pre and Post Development

Parameter	Pre-development	Post-development	% Change
		Average Year	
Flow (MLpa)	7.74	9.25	20
TSS (kgpa)	1260.00	389.00	-69
TP (kgpa)	3.45	0.93	-73
TN(kgpa)	24.30	13.00	-47
		Wet Year	
Flow (MLpa)	49.10	64.80	32
TSS(kgpa)	8740.00	3190.00	-64
TP(kgpa)	24.10	6.92	-71
TN(kgpa)	183.00	89.30	-51

In relation to gross water flow, MUSIC predicted that, despite water consumption on the Gunlake Quarry, there would be a 1.5MLpa increase in stormwater flow offsite in an average year. SEEC increased the predicted gross water flow to 19.5MLpa to account for some un-modelled sections of road and internally draining water in the quarry pit.

4B.2.7.3 Water Quality Objectives

A series of water quality objectives have been developed for the Hawkesbury – Nepean River Catchment. These were first outlined in the Independent Inquiry into the Hawkesbury-Nepean River System and have been integrated into Catchment Blueprints. The Warragamba Catchment Blueprint, developed by the Cox's and Wollondilly River Catchment Management Committees incorporates targets for land and water management.

The Healthy River Commission proposes water quality objectives that are incorporated into the Catchment Blueprint. It recommends the following approximate targets for drinking water catchment areas:

- 50ug/L (0.050mg/L) for TP (no percentile given, 50% assumed),
- 700ug/L (0.7mg/L) for TN (no percentile given, 50% assumed).

SEEC developed cumulative frequency graphs of nutrient loads using the MUSIC outputs (Refer Section 3.6.4 SEEC Report). These clearly show that predicted water nutrient levels meet the water quality objectives demonstrating the effectiveness of the proposed treatment measures. The proposed measures significantly reduce annual flows and loads through extensive re-use and treatment. Major gains are made in managing runoff from smaller, more frequent storm events.

4B.3 Groundwater

The hydrological assessment was undertaken by Larry Cook and Associates Pty Limited (Cook). Their assessment is presented in full as Part 3 of the Specialist Consultant Studies Compendium (SCSC 3), with the relevant information summarised in the following subsections.

4B.3.1 Introduction

The objectives of the hydrogeological assessment were to:

- Establish and assess local and district hydrogeological conditions.
- Establish the existing groundwater utilisation in the district.
- Estimate recharge volumes in the area centred on the Project Site.
- Carry out analytical testing to characterise the groundwater.
- Assess any potential impacts of the proposed extraction of rhyodacite (Bindook Porphyry) on district aquifer systems, local and district water tables, groundwater dependant ecosystems, groundwater chemistry and local water users.
- Provide recommendations including operational safeguards, mitigation measures and contingency planning.
- Develop a long-term groundwater monitoring program, and reporting and database management protocols.

4B.3.2 Geology

The Project Site straddles a folded and deformed basement sequence of Devonian age volcanic rocks collectively known as the Bindook Porphyry Complex which includes two important members; the Barralier Ignimbrite and the Joaramin Ignimbrite.

An extensive network of fractures, faults and thrusts dissects the district providing potential fluid pathways and conduits. Several strong sets of complimentary, often orthogonal northeast and northwest trending linear features surround the Project Site that are reflected in linear drainage traces, vegetation anomalies and subtle colour texture contrasts on aerial photos.

4B.3.3 Hydrogeology

Two types of water-bearing zones (aquifers) are recognised in the Project Site:

- **Alluvial aquifers** associated with alluvial deposits developed in the drainages associated with the Chapman's Creek system. This part of Chapman's Creek is a second-order drainage which has deposited varying but relatively small thicknesses of alluvium that has resulted from continuing erosion of the land surface. Potential low-yielding small-scale aquifers are associated with the poorly-developed relatively flat-lying sand/gravel units and lenses.

- **Hardrock aquifers** associated with mainly sub-vertical geological discontinuities (joints, fractures and faults) that have dissected the porphyry. Enhanced hydraulic conductivity may be associated with the occurrence of relatively open joints and fractures or in areas containing a high density of fracturing and/or intersecting fractures/faults. The occurrence of fractures in an impermeable host indicates that anisotropic hydrogeological conditions exist.

4B.3.4 Groundwater Availability and Utilisation

Five registered bores are charted by the DWE within a 5km radius of the Project Site. However two of these have been incorrectly plotted on government maps and do not exist in this area. The neighbouring bores intersect porphyry with recorded variable water quality and low yields which suggests low rock permeability.

The closest neighbouring registered bore is located 1500m east-southeast of the proposed quarry.

4B.3.5 Aquifer Recharge

Aquifer recharge is primarily by way of precipitation (rainfall). Based on a recharge proportion from rainfall of 2% and adopting a 20-square-kilometre fractured basement recharge area, Cook estimated recharge into the ''hardrock'' aquifers to be approximately 252 MLpa.

A proportion of recharge will provide important base flow to the Chapman's Creek and Joarimin Creek systems. During periods of high flow, the structurally controlled creeks in the area and district would likely provide increased recharge into the deeper basement rock aquifers. The mean annual district evaporation markedly exceeds the mean annual district rainfall.

4B.3.6 Aquifer Discharge

A series of nine 'water features' or 'springs' were identified in the Chapman's Creek Catchment within approximately 1400m of the proposed quarry. **Figure 4B.12** shows the location of these springs. The springs occur at the base of changes of slope and on elevated parts of distinct linear drainage traces. The location of the springs reveal a likely elevation

control and in this regard, the springs appear to be clustered into at least two main groups located 1000 to 1400m distant from the proposed quarry on the south side of the Chapman's Creek Catchment and between 450 and 1100m distance on the north side.

The closest water feature to the proposed quarry (Spring 6) has a separation distance of 200m and located on the intersection of three interpreted geological discontinuities (fractures). The dominant geological structure is oriented north-northeast parallel to the western extremity of the proposed quarry. The feature is coincident with an existing small farm dam and general depression in the topography and is an artificial man-made structure. It is considered potentially significant in terms of potential impacts from the proposed development.

4B.3.7 Groundwater Flow Direction

The direction of groundwater flow surrounding the proposed quarry is generally to the north sub-parallel to the topography.

Figure 4B.13 shows the contours of the elevation of the piezometric surface with respect to the Australian Height Datum (AHD). The direction of groundwater flow surrounding the quarry is generally to the north sub-parallel to the topography. The directions of flow are shown on **Figure 4B.13**.

The hydraulic gradient beneath the central and northern parts of the quarry footprint is between approximately 1 in 13 and 1 in 32. The hydraulic gradient beneath the southern part of the footprint is notably less and estimated at approximately 1 in 50.

4B.3.8 Permeability

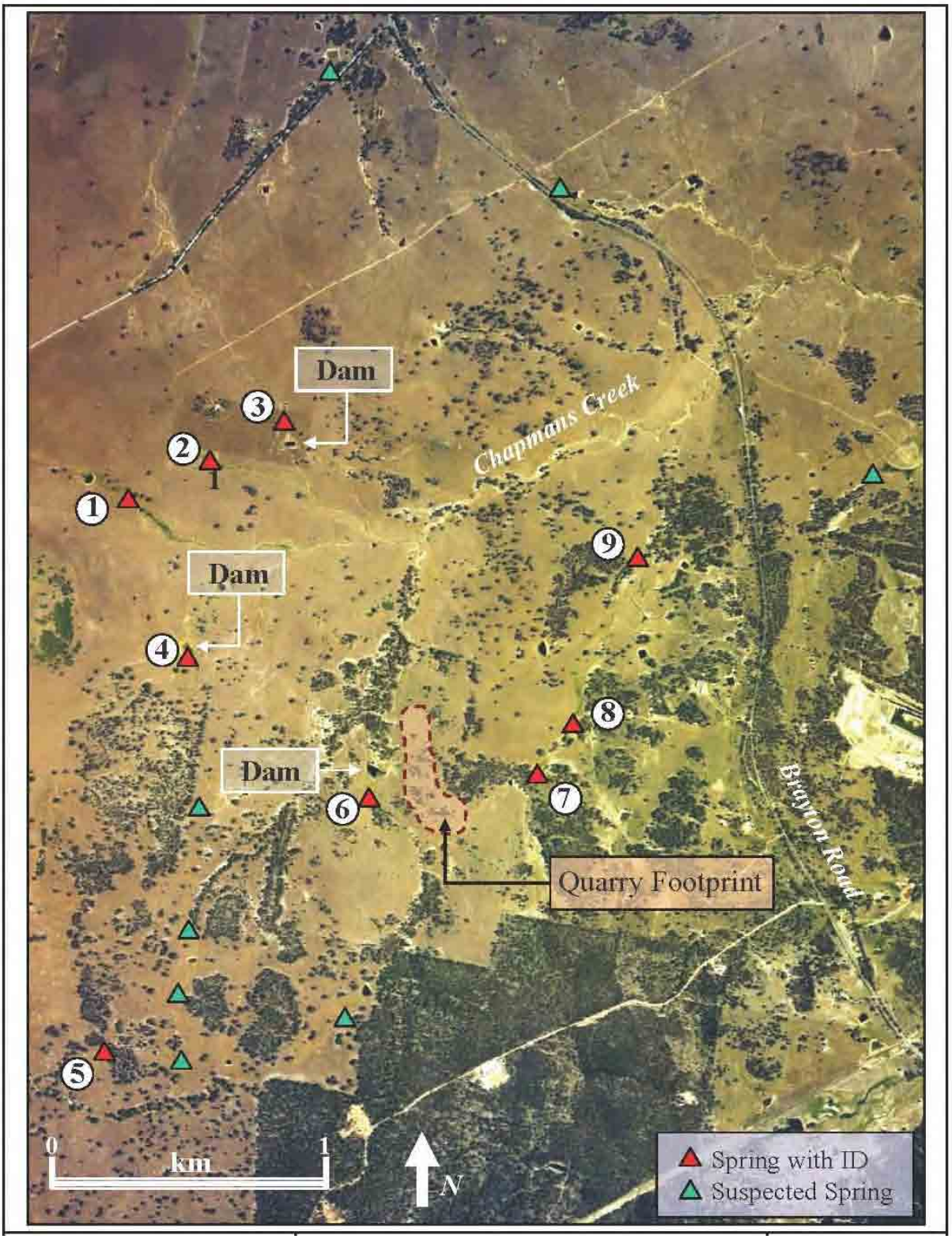
Cook attempted to carry out short-term pumping tests in the 10 selected monitoring bores in order to establish representative aquifer parameters including hydraulic conductivity and transmissivity. However, none of the monitoring bores could sustain pumping beyond between about several seconds and several minutes. The recovery of the water level in the majority of monitoring bores was almost non-existent to very slow due to the very low permeability of the porphyry host rock.

Cook carried out dedicated 'slug' tests in the same 10 monitoring bores. The results confirmed low to very low rock permeabilities with the majority of tests revealing hydraulic conductivities of less than about 0.04m/day and transmissivities of less than approximately $0.6m^2$/day.

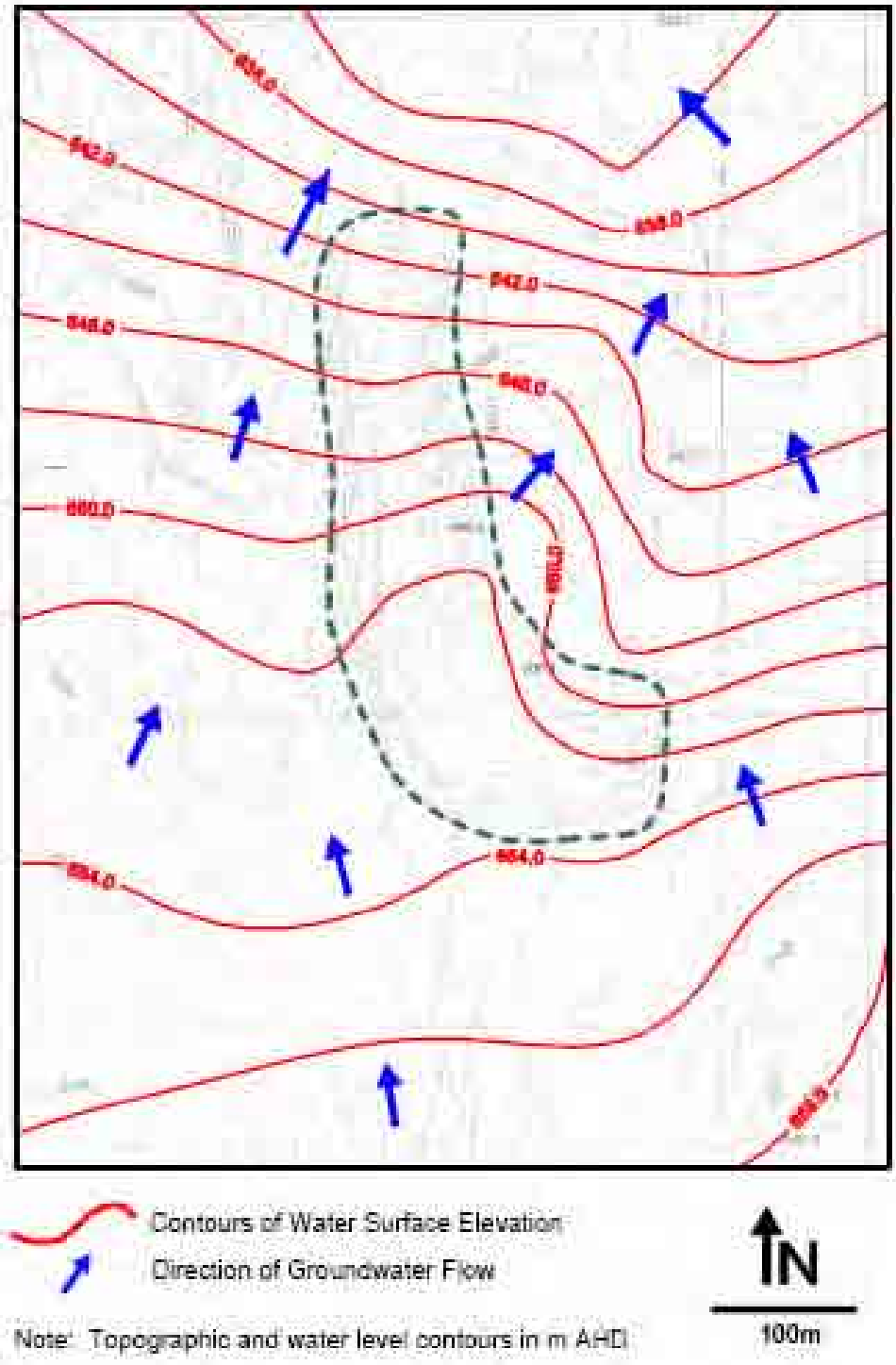
The permeability test results are consistent with:

- The occurrence of 'tight' fractures and joints in outcrop.
- Networks of fine fractures and veins in drill core.
- A compressional regional tectonic regime.
- Paucity of successful water bores in the local area.

High salinity levels in some district 'hardrock' aquifers.



Gunlake Quarry Project
Figure 4B.12 Water Spring Locations



Gunlake Quarry Project
Figure 4B.13 Piezometric Surface

4B.3.9 Ground Water Quality

Baseline groundwater sampling and water quality testing showed that the groundwater is near neutral, 'hard' and moderately to highly saline and likely evolving along joint and fracture-controlled flow paths.

The following points summarise the water quality test results:

- The pH of the groundwater samples measured in the laboratory are all similar. The pH ranges from 6.7 to 7. This indicates that the groundwater is near neutral which reflects the composition of the porphyry host rock.

- The groundwater in all bores is moderately to highly saline with measurements ranging from 720 μS/cm to 7210 μS/c.

- Concentrations of ammonia were detected in all but one sample. The levels were generally low with the highest concentration being 4.5mg/L.

- Concentrations of other cations (Ca, K and Mg) suggest that the groundwater is 'hard'.

- Sulphate concentrations were generally low with the highest level recorded being 44mg/L.

- Elevated levels of bicarbonate were recorded in all bores with the highest concentration recorded being 760mg/L. This is not unexpected in groundwater hosted by igneous rock complexes of this composition.

- Nitrate concentrations were generally low to slightly elevated.

- Nitrite concentrations were generally low to slightly elevated and generally lower than the nitrate levels for the same samples.

- Phosphate was detected at trace levels in 9 of the 10 groundwater samples. The highest concentration recorded was 0.06mg/L. The presence of nutrients such as nitrate and phosphate in groundwater is usually associated with past agricultural activities. These results indicate that there is minor contamination of the groundwater system.

- Total phosphorus was detected in all groundwater samples. The highest concentration recorded was 4.0mg/L.

- Dissolved iron was detected at trace levels in five of the ten samples. There was one exception recorded at 0.69mg/L. This level may cause staining of fixtures and may cause deposits to form in irrigation equipment. Iron (and manganese) can be satisfactorily managed by aeration and other readily available methods if required.

- Trace concentrations of copper and zinc were recorded in all 10 samples. All other metal concentrations with the exception of Total Iron were less than the Method Detection Limit (MDL).

The groundwater can be classified as dominantly Magnesium-Chloride or Sodium-Chloride type with minor Sodium-Bicarbonate type. Some of the groundwater displays geochemistry expected at the discharge end of the hydrogeochemical cycle and some at the recharge end.

Cook determined that the chemical evolution of the groundwater is occurring along flow paths, which is consistent with the interpretation of evolving chemistry along fracture-controlled flow paths.

4B.3.10 Impact Assessment

Four potential groundwater-related impacts are associated with the proposed quarry development.

- Potential impact of the proposed extraction on any groundwater dependant ecosystems (GDEs).
- Potential impact associated with the extraction of porphyry, with any extraction of groundwater from the proposed quarry development on the local and district water table, on underlying ‘‘hardrock’’ aquifer systems and on any groundwater users. This includes the potential for impact on groundwater chemistry.
- Potential cumulative groundwater impact from the proposed quarry and other quarries in the district.
- Potential impact from acid mine leachate, if it is generated.

4B.3.10.1 Springs and GDEs

Figure 4B.12 shows the location of the nine springs occurring around the Project Site. Cook considered that eight of the nine springs will not be significantly impacted by the proposed quarry because they are distant from the proposed quarry and either down gradient or side gradient.

However, one of the springs identified as Spring 6 may be at risk of potential impacts. Spring 6 is located approximately 200m west of the proposed quarry. The principle reasons for the risk to Spring 6 are:

- The spring is in relative close proximity to the proposed quarry.
- The spring is interpreted to discharge from a sub-vertical fracture at elevation 650m AHD.

- The spring provides a small but beneficial water supply for the possible GDE that has formed by the construction of a small-scale on-line storage (dam) which appears to be largely perched.

It is apparent that the artificial ponding downstream of Spring 6 may be largely perched and the groundwater discharging from Spring 6 may not be in direct hydraulic connection with the porphyry aquifer that will at least in part be intercepted by the proposed quarry. The likely source of groundwater feeding this spring is a prominent north-easterly oriented sub-vertical fracture parallel to the western boundary of the proposed quarry. This fracture is upgradient, and will, in all probability, not be significantly affected by the operations.

However, it is possible that the water table, groundwater gradient and direction of flow close to the spring may be influenced by the artificial permanent steepening associated with the resulting void. The degree of encroachment is difficult to quantify but the results of the permeability testing indicate very low hydraulic conductivities throughout the porphyry.

Although the geometry of the fracture system is imperfectly understood, Cook concluded that it is unlikely that the proposed quarry will have any significant impact on the local or district water table and therefore on any spring flows. Nevertheless, Cook recommended a long-term program of flow and water quality monitoring of Spring 6 in order to detect and monitor any changes if they occur. Gunlake will implement this program.

Ecotone (Specialist Consultant Studies Compendium Part 7) noted that if drawn-down impacts result in the complete drying out of a spring-fed dam within the study area, this would result in the loss of that groundwater dependent ecosystem. Although these dams have been artificially created, native flora and fauna species have come to be reliant upon the habitat they provide. If the proposal were to result in the loss of one or more of these dams, it is recommended that compensatory habitat be created elsewhere within the study area.

4B.3.10.2 Local and District Groundwater

The very low conductivities measured in the porphyry indicate that the proposed extraction would not adversely impact on the district groundwater system. However, the proposed staged extraction of porphyry has the potential of altering hydrogeological conditions in close proximity to the void at the end of Year 30. The changed hydrogeological conditions are predicted to be peripheral to the void and confined to a zone extending no more than about 100m to 200m from the quarry. The newly established hydraulic gradient surrounding the void may potentially impact on Spring 6.

There is a poorly developed alluvial system associated with the upper reaches of Chapman's Creek. The amount of water stored in the thin alluvium is predicted to be low and highly dependant on rainfall. The quarry operations are not expected to impact on this poorly developed system.

Cook considered the potential for significant impact from the proposed quarrying on any other water users surrounding the Project Site to be very low. This prediction is based on the large separation distance between the nearest bore and the proposed quarry, and the demonstrated low global permeability values recorded for the porphyry mass in the Project Site. This prediction is supported by the occurrence of low yields in the three surrounding registered bores which indicates low rock permeabilities. The paucity of registered bores in the local area may indicate that past groundwater exploration has not been particularly successful; perhaps further confirmation of low rock permeabilities.

4B.3.10.3 Potential Cumulative Impact

The Gunlake Quarry is one of three proposed and operational quarries in the immediate area north of Marulan. The other developments are the existing Johnniefelds Quarry and the proposed Lynwood Quarry.

All three extractive operations are hosted by the Bindook Porphyry. This rock has a very low to low permeability indicating that any impact on the porphyry-hosted groundwater system would appear to be confined to a local scale at Lynwood and Johnniefelds. Cook predicted it to be similarly confined close to the proposed Gunlake Quarry.

Predictions of the drawdown on the northern side of the Lynwood Quarry towards the Gunlake Quarry do not extend more than about 500m beyond the northern boundary. The Lynwood Quarry is proposed to be much larger than either Johnniefelds or Gunlake. The distance between the three quarries are all in excess of 500m and Cook concluded that, based on the available geological and hydrogeological evidence and data, especially the separation distances and the low rock permeabilities, that there are no predicted cumulative impacts.

4B.3.10.4 Acid Mine Drainage

Acid mine leachate relates to the production of low pH water usually associated with the oxidation of metal sulphide minerals, in particular pyrite. Cook predicted that, based on geological investigations the potential for the production of acid leachate from the proposed quarrying operations is very low because the ingredients for acid mine leachate (mainly disseminated pyrite) do not exist.

4B.3.10.5 Groundwater Inflow to Pit

Estimates of groundwater inflow into the quarry were calculated using a simple analytical solution which predicts inflows into an excavation and projects water level declines proximal to the void. Cook elected to not use a three-dimensional computer model as they believed, due to the unknown nature of rock fracture, that it would not provide more accurate results.

Groundwater inflow during Years 1 through 2 is expected to be very low which is consistent with the results of permeability testing. Moderate increases in total inflow volumes are predicted as the quarry expands through Years 2 to 30 with flow estimates of up to possibly 3.5MLpa in Year 30. Accumulated groundwater in the quarry will either evaporate totally or mix with rainfall water and be transferred to WQCP6 and eventually applied to the irrigation area. The small volumes of ground water predicted to enter the quarry pit will not adversely affect irrigation water quantities or quality.

The amount of groundwater inflow into the quarry will be off-set by evaporation. Therefore it is unlikely that significant ponding will occur in the quarry. The exception is quarrying recharge from intense storms which will be handled in the surface water system discussed in Section 4B.2. The demonstrated very low rock permeabilities and relatively high evaporation rates indicate that the water table will remain beneath the void.

Table 4B.29 lists the most likely rates of ground water inflow into the quarry.

Table 4B.29 Predicted Groundwater Inflows into Quarry

Years	Inflow L/s	Inflow MLpa
0-1	<0.02	<0.3
1-2	<0.02	<0.4
2-5	0.02	0.5
5-20	0.08	2.5
20-30	0.11	3.5

4B.3.11 Monitoring

Measurements of water level will be continued in the monitoring network prior to the commencement of any quarry operations in order to build on the existing baseline database.

Water level monitoring and water quality testing to date has provided a set of important water level data.

An ongoing long-term program of regular water level and water quality monitoring will be carried out following commencement of mining operations. Measurements of water level will be collected using the existing installed automated water level data loggers and recorders in the representative monitoring bores. These monitoring data will be statistically analysed in order to establish a set of trigger levels, which will be used to alert any imminent or occurring impact/s from the proposed quarry. Section 14.1 of the Cook Report (Specialist Consultant Studies Compendium, Part 3, Volume II of the Environmental Assessment) includes a detailed description of the establishment of these trigger values.

Sampling and testing of groundwater in the representative monitoring bores will be carried out on a three (3) monthly basis for 12 months following the commencement of quarrying operations then on a six (6) monthly basis. In this way, analysis of the results will establish any trends in water quality. Careful analysis and progressive assessment of the results may lead to the reduction of the number of analytes determined and the frequency of sampling.

The likely analytes and tests for quarterly sampling in the first 12-month period following commencement of quarrying is provided in **Table 4B.30.**

Table 4B.30 Proposed Analytes

Proposed List of Analytes and Tests	
pH	Copper (Cu)
Electrical Conductivity (EC)	Lead (Pb)
Total Dissolved Solids (TDS)	Carbonate Alkalinity (as CaCO3)
Sodium (Na)	Total Alkalinity (as CaCO3)
Calcium (Ca)	Total Phosphorus (Total P)
Potassium (K)	Nitrate (NO3-N)
Magnesium (Mg)	Nitrite (NO2-N)
Ammonia (NH4-N)	Phosphate (PO4)
Chloride (Cl)	Zinc (Zn)
Sulphate (SO4)	Total Iron (Fe)
Bicarbonate Alkalinity (as CaCO3)	Dissolved Iron (Fe)
Oil and Grease	

A representative network of monitoring bores will be maintained at the locations listed in **Table 4B.31**. The monitoring bore network incorporates selected existing 'open' bores some of which can be readily converted to permanent monitoring bores. The network includes a set of control bores that are not within or downslope of the proposed quarry area.

Three new monitoring bores are proposed:

- One bore designed to monitor the fluctuations in water level within the dam at Spring 6.

- A relatively shallow monitoring bore (piezometer) positioned close to the dam associated with Spring 6 and designed to monitor any shallow groundwater in the vicinity of the GDE. The depth of the bore will depend on the progressive results of the drilling.

- One additional ''hardrock'' monitoring bore to fill in the existing network in the northern part of the Project Site.

The recommended design and depth of the monitoring bores are provided in **Table 4B.31**.

Table 4B.31 Location and Depth of Proposed Monitoring Bores.

Monitoring Bore	Coordinates (GPS-AMG)		Depth (m)	Screen Position	
	Easting (m)	Northing (m)		From (m)	To (m)
GM5	771856	6159495	22.50	19.50	22.50
GM6	771916	6159367	25.88	22.80	25.80
GM11	771937	6159186	23.35	20.30	23.30
GM13	771816	6159042	22.36	19.30	22.30
GM18	771743	6159110	24.10	21.40	24.10
GM21	771788	6159255	22.71	19.70	22.70
GM22	771662	6159294	11.70	8.70	11.70
GM24	771676	6158934	21.00	18.00	21.00
GM35	771961	6159027	27.54	24.50	27.50
GM36	771920	6158843	17.12	14.10	17.10
GM100	771628	6159144	Approx. 2.0	0.50	2.00
GM101	771644	6159128	TBA	TBA	TBA
GM102	771764	6159372	Approx. 30.0	27.00	30.00

The recommended monitoring program is summarised in **Table 4B.32**.

4B.3.12 Data Management and Reporting

The protocol for data management is summarised as follows:

- The water level data downloaded from the loggers in the monitoring bores will be imported into an electronic database or spreadsheet and viewed following each round of monitoring. This process will ensure that a progressive record of the data is stored and maintained, and the integrity/quality of the data can be checked on a regular basis.
- A copy of the water level data will be emailed to the hydrogeological consultant for assessment and a backup copy of the water level kept in a database or spreadsheet in a secure off-site place.
- An electronic water quality database or spreadsheet will be developed and maintained.
- An electronic rainfall database or spreadsheet will be developed and maintained.

Table 4B.32 Recommended Water Monitoring Program

Monitoring Type	Activity	Sample Frequency	Comment
Water Level	Automatic water level measurements in *'Odyssey'* data logger in monitoring bores	• *Initial* 4-hourly (1 sample every 4 hours) • *Assess* data after 12 months • *Depending* on results and trends, decrease frequency to 8-hourly (1 sample every 8 hours)	This sample frequency is designed to provide adequate, real time good quality water level data, optimise the logger battery life and optimise logger memory.

Monitoring Type	Activity	Sample Frequency	Comment
Water Quality	Groundwater sampling in representative monitoring bores	• *Initial* 3-monthly (1 sample per bore every 3 months) for 12 months • *Assess* data after 12 months • *Depending* on results and trends decrease frequency to 6-monthly (1 sample every 6 months)	This sample frequency is designed to provide adequate water quality data to assess any significant changes in groundwater chemistry that may be due to the proposed quarry operations.
Rainfall	Automatic rainfall measurements in *tipping bucket rain gauge* data logger on site	• *Continuous* logging at every 0.5mm tip with time/date stamps	This sample frequency is designed to provide adequate, real time good quality rainfall data, optimise the logger battery life and optimise logger memory.

4B.3.13 Mitigation and Compensation

Although the probability of any potential significant adverse impacts of the proposed quarry operations on the district water table and therefore on Spring 6 or indeed on any other springs surrounding the Project Site is low, the assessment is based on the available data and results of field and laboratory studies and investigations.

The conceptual geological and hydrogeological model is not perfectly understood and therefore potential for impact remains. For this reason, if there is a scientifically demonstrated significant impact on any of the springs or registered bores surrounding the Project Site, a set of options has been developed for each.

Springs

Any deterioration in the discharge flow of springs in the local area surrounding the Project Site less than historical low flow rates that can, with the available scientific data, be linked to quarrying activities, the following options are presented for consideration subject to any agreement/s between the owner and Gunlake.

- Compensate the owner of the Property by supplying groundwater supplies to the property/s with a minimum flow equivalent to the measured and documented losses with water quality commensurate with the spring, or better.

- Provide monetary compensation to the property owner for the measured and documented losses.

- Drill a test bore on the Property for the owner in order to replace or improve the flow rate of the spring. The water quality must be similar to the spring water quality or suitable for the intended purpose.

Neighbouring Registered Bores

The results of hydrogeological investigations within and surrounding the Project Site and the large separation distances between the proposed quarry and registered bores in the local area indicate that registered groundwater users will not be significantly affected by the quarry. Although the risk of significant impact on registered water users is considered to be very low, long-term water level monitoring will be required peripheral to the quarry in order to detect any potential distance impacts.

If there is a scientifically demonstrated significant impact on any neighbouring water users surrounding the Project Site, for example, a fall in bore water level that can, with the available scientific data, be linked to quarrying activities, the following options are presented for consideration subject to any agreement/s between the property owners and Gunlake.

- Compensate the owner of the property by supplying groundwater supplies to the property with a minimum flow equivalent to the measured and documented losses with water quality commensurate with the present bore supply, or better.

- Provide monetary compensation to the property owner for the measured and documented losses.

- Drill a test bore on the property for the owner in order to replace or improve the flow rate of the existing registered bore. The water quality must be similar to the existing bore water quality or suitable for the intended purpose.

4B.4 Noise and Vibration

The noise and vibration assessment was undertaken by Heggies Pty Limited (Heggies). The full assessment is presented as Part 4 of the Specialist Consultant Studies Compendium, with the relevant information from the assessment summarised in the following subsections.

4B.4.1 Introduction

The Heggies Report (SCSC 4) identifies the potential construction, operational and traffic noise and blasting impacts associated with the proposed development of Gunlake Quarry on the Marulan community. It recommends various management strategies to minimise the impacts on the community.

The following sub-sections summarise the Heggies Report.

4B.4.2 Receptor Locations

The closest sensitive receptors to the site are four residences located within a distance of approximately 1 km of the processing plant. Noise and blasting emission levels are predicted at these four points. Receptor locations and distances to Project Site boundary and the processing plant are given in **Table 4B.33.** There is a potential residence site located south west of the quarry site. Locations of existing and potential sensitive receptors in relation to the Project Site are shown in **Figure 4B.14**.

Table 4B.33 Closest Sensitive Receptors

Sensitive Receptor	Distance to Project Site boundary (km)	Distance to processing plant (km)
R1	0.2	0.7
R2	0.7	1
R3	0.5	0.9
R4	0.6	1.4

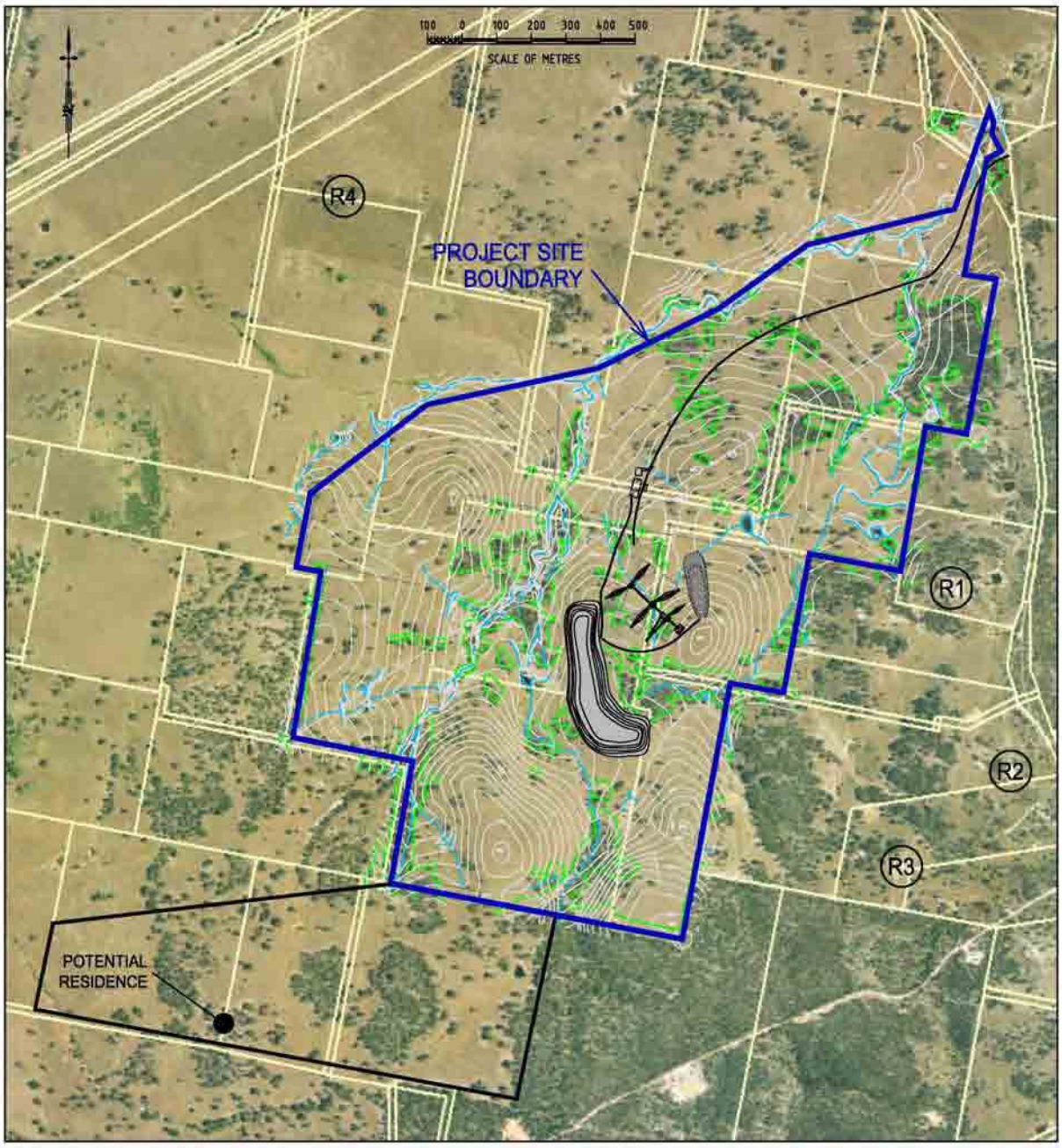
4B.4.3 Noise and Vibration Assessment Procedure

4B.4.3.1 Introduction

Responsibility for the control of noise emission in New South Wales is vested in Local Government and the DECC. The DECC Industrial Noise Policy (INP), provides a framework and process for deriving noise criteria for consents and licences that will enable the DECC to regulate premises that are scheduled under the Protection of the Environment Operations Act 1997.

The specific policy objectives are to:

- Establish noise criteria that would protect the community from excessive intrusive noise and preserve the amenity for specific land uses.
- Use the criteria as the basis for deriving project specific noise levels.
- Promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- Outline a range of mitigation measures that could be used to minimise noise impacts.
- Provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of the industrial development.



Gunlake Quarry Project
Figure 4B.14 Sensitive Receptors

- Carry out functions relating to the prevention, minimisation and control of noise from the premises scheduled under the Act.

4B.4.3.2 Assessing Intrusiveness

The intrusiveness criterion essentially means that the equivalent continuous noise level (LAeq) of the source should not be more than 5 dBA above the measured (or default) Rating Background Level (RBL).

4B.4.3.3 Assessing Amenity

Amenity assessment is based on noise criteria specific to the land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise.

Table 4B.34 details amenity criteria listed in the INP.

4B.4.3.4 INP Assessment of Prevailing Weather Conditions

Wind
Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the noise source. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Where the source to receiver wind component at speeds of up to 3m/s occur for 30% or more of the time in any seasonal period (during the day, evening or night), then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

In order to determine the prevailing conditions for the Project Site, weather data for the period April 2004 to July 2007 were obtained from a weather station at Marulan South operated by Hydrometric Consulting Services Pty Ltd for Blue Circle Southern Cement. The data was analysed in order to determine the frequency of occurrence of winds of speeds up to 3m/s in each season.

The results of the on-site weather station analysis for daytime, evening and night-time winds are presented in **Table 4B.35**, **Table 4B.36** and **Table 4B.37** respectively. In each table, the wind directions and percentage occurrence are those dominant during each season.

Table 4B.34 Amenity Criteria - Recommended LAeq Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50 dBA	55 dBA
		Evening	45 dBA	50 dBA
		Night	40 dBA	45 dBA
	Suburban	Day	55 dBA	60 dBA
		Evening	45 dBA	50 dBA
		Night	40 dBA	45 dBA
	Urban	Day	60 dBA	65 dBA
		Evening	50 dBA	55 dBA
		Night	45 dBA	50 dBA
	Urban/Industrial Interface - for existing situations only	Day	65 dBA	70 dBA
		Evening	55 dBA	60 dBA
		Night	50 dBA	55 dBA
School classrooms - internal	All	Noisiest 1-hour period when in use	35 dBA	40 dBA
Hospital ward - internal - external	 All All	 Noisiest 1-hour period Noisiest 1-hour period	 35 dBA 50 dBA	 40 dBA 55 dBA
Place of worship - internal	All	When in use	40 dBA	45 dBA
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50 dBA	55 dBA
Active recreation area (eg School playground, golf course)	All	When in use	55 dBA	60 dBA
Commercial premises	All	When in use	65 dBA	70 dBA
Industrial premises	All	When in use	70 dBA	75 dBA

Notes: For Monday to Saturday, Daytime 0700 hours - 1800 hours; Evening 1800 hours - 2200 hours; Night-time 2200 hours - 0700 hours.

On Sundays and Public Holidays, Daytime 0800 hours - 1800 hours; Evening 1800 hours - 2200 hours; Night-time 2200 hours - 0800 hours.

The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 4B.35 Seasonal Frequency of Occurrence Wind Speed Intervals – Daytime

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 2.0 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	0.8%	ENE	9.5%	24.2%	33.7%
Autumn	4.7%	E	13.3%	11.8%	25.1%
Winter	5.9%	WSW	9.4%	16.6%	22%
Spring	0.8%	ENE	6.3%	13.8%	19.8%

Table 4B.36 Seasonal Frequency of Occurrence Wind Speed Intervals – Evening

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 2.0 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	3.2%	ENE	23.8%	31.6%	55.4%
Autumn	13.7%	E	20.3%	8.8%	27.6%
Winter	18.4%	W	15%	11.2%	26.3%
Spring	7.4%	NE	18.5%	13.7%	32.1%

The prevailing winds less than (or equal to) 3 m/s with a frequency of occurrence greater than (or equal to) 30% and considered to be relevant to the site in accordance with the INP are presented in **Table 4B.38**, where the dominant conditions are underlined.

Table 4B.37 Seasonal Frequency of Occurrence Wind Speed Intervals - Night-time

Period	Calm (<0.5 m/s)	Wind Direction ±(45°)	Wind Speed		
			0.5 to 2.0 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	15.4%	ENE	29.6%	6.3%	35.9%
Autumn	26.8%	WNW	17.2%	7.6%	24.8%
Winter	22.7%	W	16.8%	10.3%	27.1%
Spring	15.6%	NW	19.2%	9.3%	28.6%

Table 4B.38 Project Prevailing Wind Conditions in Accordance with NSW INP (2000)

Season	Winds ± ≤ 3 m/s with frequency of Occurrence ≥ 30%[1]		
	Daytime	Evening	Night-time
Summer	<u>ENE (34%)</u>, E (32%), NE (31%)	NNE (37%), NE (52%), <u>ENE (55%)</u>, E (50%), ESE (32%)	NNE (30%), NE (35%), <u>ENE (36%)</u>, E (32%)
Autumn	Nil	Nil	Nil
Winter	Nil	Nil	Nil
Spring	Nil	<u>NE (32%)</u>, ENE (31%)	Nil

Note 1: The dominant seasonal wind speeds are underlined

Temperature Inversion
Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for 30% or more of the total night-time during winter or about two nights per week. The INP states that temperature inversions need only be considered for the night-time noise assessment period ie 2200 hours to 0700 hours.

Drainage Flow Winds
The drainage-flow wind does not apply to the Gunlake Quarry Project development as intervening topography exists between sources and receivers.

Additional DECC Noise Assessment Information
The DECC's recommended noise assessment criteria aim to limit potential intrusive noise emissions and preserve noise amenity. In cases where the limiting noise assessment criterion (in this case LAeq(15minute) intrusiveness criterion) cannot be achieved, then practicable and economically feasible noise control measures should be applied. This usually requires demonstration that Best Achievable Technology and Best Environmental Management Practices have been implemented in order to mitigate adverse acoustical impacts.

In the event that the lowest achievable noise emission levels remain above the noise assessment criteria, the potential noise impact needs to be balanced and assessed against any economic and social benefits the project may bring to the community. It then follows that where the consenting authority may consider that the development does offer community benefits, then these may be grounds for permitting achievable noise emission levels as statutory compliance levels.

4B.4.4 Existing Acoustical Environment

Heggies completed both unattended and attended background noise monitoring. The attended monitoring results confirm the results obtained from the unattended noise loggers and support the use of the noise levels in being representative of the background noise environment at all residences, except at the eastern boundary residence. Farming plant was constructing a dam at the time of this attended measurement, therefore the results for this location were considered unrepresentative. In order to obtain a better indication of representative noise levels at this location, Heggies selected a typical weekday fifteen minute monitoring period from the noise logger data. A summary of the results of unattended background noise surveys is presented in **Table 4B.39** for the proposed operational hours of the quarry.

Table 4B.39 Summary of Existing LA90 Rating Background Levels (RBL's) and Existing LAeq Ambient Noise Levels - dBA re 20 µPa

Monitoring Locations	$L_{A90(15minute)}$ Rating Background Noise Level[1,2]			$L_{Aeq(period)}$ Existing Ambient Noise Level[1]		
	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night 2200-0700 Hours	Daytime 0700-1800 Hours	Evening 1800-2200 Hours	Night 2200-0700 Hours
R1 - 575 Brayton Road	34	33	31	47	42	40
R2 - 531 Brayton Road	36	35	32	47	43	42
R3 - 529 Brayton Road	34	33	31	45	49	44
R4 - 1540 Carrick Road	30	31	30	46	39	40
17 Brayton Road	47	47	38	60	57	54

Note 1: The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level.

The L_{Aeq} is the equivalent continuous noise level defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Note 2: In accordance with INP procedures, if the RBL is below 30 dBA, then 30 dBA shall be the assumed RBL.

Table 4B.39 shows that the LA90(15minute) RBL's at the various monitoring locations ranged from 30 dBA to 47 dBA during the daytime, 31 dBA to 47 dBA during the evening and were 30 dBA to 38 dBA during the night-time. The measured background noise levels are typical of those of a rural environment with natural noise sources and some transportation noise contributions associated with the Hume Highway.

4B.4.5 Construction Noise Emission Criteria

The DECC's preferred approach to the control of construction noise involves the application of noise level restrictions, time restrictions and silencing.

Noise Level Restrictions

For a cumulative period of exposure to noise from construction activity of up to four (4) weeks in duration, the LA10(15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90(15minute) RBL by more than 20 dBA.

For a cumulative period of exposure to noise from construction activity of between 4 weeks and 26 weeks duration, the LA10(15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90(15minute) RBL more than 10 dBA.

For a cumulative period of exposure to noise from construction activity in excess of 26 weeks duration, the LA10(15minute) noise level emitted by the works, when measured at a residential receiver, should not exceed the LA90(15minute) RBL by more than 5 dBA.

Time Restrictions

Monday to Friday 0700 hours to 1800 hours
Saturday 0700 hours to 1300 hours if inaudible on residential premises; otherwise 0800 hours to 1300 hours
No work on Sundays or Public Holidays.

Silencing
All practical measures should be used to silence construction equipment, particularly in instances where extended hours of operation are required.

Relevant quarry construction noise assessment criteria, based on a 4 to 26 week construction period, are presented in **Table 4B.40**. These criteria are based on the foregoing construction noise guidelines and the daytime LA90(15minute) RBLs (**Table 4B.34**) calculated from the background noise logging.

Table 4B.40 Daytime Construction Noise Criteria - dBA re 20µPA

Receiver	**LA10(15minute) Construction Criteria**
R1 - 575 Brayton Road	44
R2 - 531 Brayton Road	46
R3 - 529 Brayton Road	44
R4 - 1540 Carrick Road	40

4B.4.6 Operational Noise Criteria

Heggies determined the Gunlake Quarry operational noise emission criteria with reference to the INP including an assessment of the RBLs, the intrusiveness criteria and the amenity criteria.

The intrusiveness criteria have been set for the proposed hours of quarry operation based on the RBLs (**Table 4B.39**) at the surrounding residences.

The existing ambient LAeq in the area surrounding the Project Site was controlled by rural sources and road traffic noise. The residences in the vicinity of the proposed quarry operations are best described by the "rural" receiver type. There being no other industrial noise sources in the area, the amenity criteria have been set using the recommended LAeq(period) contribution from industrial noise as presented in **Table 4B.34.**

The resulting operational intrusive and amenity noise emission criteria are given in **Table 4B.41.**

Table 4B.41 Operational Noise Emission Criteria - dBA 20 µPa[1]

Receiver	Intrusiveness Criterion LAeq(15minutes)			Amenity Criterion LAeq(period)		
	Daytime 0700 -1800 Hours	Evening 1800 -2200 Hours	Night 2200 -0700 Hours	Daytime 0700 -1800 Hours	Evening 1800 -2200 Hours	Night 2200 - 0700 Hours
R1 - 575 Brayton Road	39	38	36	50	45	40
R2 - 531 Brayton Road	41	40	37	50	45	40
R3 - 529 Brayton Road	39	38	36	50	45	40
R4 - 1540 Carrick Road	35	36	35	50	45	40
17 Brayton Road	52	47	38	N/A	N/A	N/A

Note 1: It is considered unduly stringent to assess operations between 0600 hours and 0700 hours weekdays and Saturdays under the "night-time period" criteria as the L_{Aeq} and RBL levels are more representative of the daytime. Therefore, the period between 0600 hours and 0700 hours weekdays and Saturdays has been assessed as part of the daytime period (as a shoulder period) as discussed in the EPA Industrial Noise Policy Section 3.3.

Table 4B.41 shows that the amenity criteria noise levels are significantly higher than the intrusiveness criteria noise levels at all locations. Compliance with the intrusiveness criteria, therefore, will demonstrate compliance with the amenity criteria. Accordingly, Heggies based their assessment on the intrusiveness criteria being the controlling noise criteria.

In relation to potential sleep disturbance the DECC impose a screening criteria of RBL + 15dBA. Consequently, the criterion at the potentially most affected residence (Residence R1) is 46dBA. The worst case predicted noise level from the evening/night-time truck loading and product transportation is 35dBA. Heggies concluded that, given that the L_{Amax} levels are less than 10dBA above the L_{Aeq} levels, compliance with the 46 dBA L_{Amax} criterion will be met.

4B.4.7 Road Transportation Noise Assessment

Whilst operating on the Project Site, road vehicle noise contributions are included in the overall predicted LAeq(15minute) quarry operational noise emissions. On public roads, including the By-pass road, different noise assessment criteria apply to the vehicles, which would be regarded as "traffic", rather than as part of the quarrying operation noise sources.

In June 1999, the DECC issued a document entitled "*Environmental Criteria for Road Traffic Noise*". In terms of the functional categories of roads, the DECC's document states that: "*It is noted that some industries (such as mines and extractive industries) are, by necessity, in locations that are often not served by arterial roads. Heavy vehicles must be able to get to their bases of operation, and this may mean travelling on local roads. Good planning practice recognises that we must acknowledge this type of road use and develop ways of managing any associated adverse impacts. To this end, the concept of 'principal haulage routes' has been endorsed by the Department of Urban Affairs and Planning's North Coast Extractive Industries Standing Committee. Ways of identifying 'principal haulage routes' and managing associated adverse impacts have not yet been fully defined. Where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for*

collector roads, recognising the intent that they carry a different level and mix of traffic to local roads."

Accordingly, the Project related traffic on both Brayton Road and the By-pass road (Red Hills Road) was assessed as a collector road.

Goulburn Mulwaree Council classify Brayton Road as an Arterial Road and the use by Heggies of a Collector Road classification is conservative. Council classifies Red Hills Road as a Local Road.

Based on the above, the relevant assessment criteria for the Gunlake Quarry are presented in **Table 4B.42.**

Table 4B.42 Road Traffic Noise Criteria

Type of Development	Criteria $L_{Aeq(1hour)}$ Daytime	Criteria $L_{Aeq(1hour)}$ Night-time	Where Criteria Are Already Exceeded
8. Land use developments with potential to create additional traffic on collector roads	60 dBA along Brayton Road and 55dBA along Red Hills Road.	55 dBA along Brayton Road and 50dBA along Red Hills Road.	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using "quiet" vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dBA.

Note: Total traffic noise contribution including existing and project related vehicle movements. $L_{Aeq(1hour)}$ represents the highest LAeq noise level for any hour during daytime (0700 hrs to 2200 hrs) and night-time (2200 hrs to 0700 hrs).Blast Emissions Assessment Criteria

4B.4.8 Blast Emissions Assessment Criteria

There are a range of blast emissions assessment criteria covering structural damage as a result of ground vibration and air blast. There are also air blast and ground vibration criteria that assess human comfort and disturbance. The ground vibration and air blast levels which cause concern or discomfort to residents are significantly lower than the damage limits. Humans are far more sensitive to some types of vibration and can detect and possibly even be annoyed at vibration levels which are well below those causing any risk of damage to a building or its contents.

The criteria normally recommended for blasting in NSW, based on human discomfort, are contained in the DECC's Environmental Noise Control Manual (Chapter 154). However, for recent projects the DECC has advocated the use of the Australian and New Zealand Environment Council (ANZEC) guidelines.

The ANZEC criteria for the control of blasting impact at residences are as follows:

- The recommended maximum level for airblast is 115 dB Linear.
- The level of 115 dB Linear may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dB Linear at any time.
- The recommended maximum level for ground vibration is 5 mm/s (peak particle velocity (ppv)).
- The ppv level of 5mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10mm/s at any time.
- Blasting should generally only be permitted during the hours of 0900 hours to 1700 hours Monday to Saturday. Blasting should not take place on Sundays and public holidays.

4B.4.9 Impact Assessment

4B.4.9.1 Construction

The likely duration of construction for the proposed Gunlake Quarry is between 4 weeks and 26 weeks. Therefore, the LA10(15minute) noise level emitted by the works when measured at a residential receiver should not exceed the LA90(15minute) RBL by more than 10 dBA.

Output results from the noise model are presented in Table 4B.43 together with the respective criteria.

Table 4B.43 Predicted Daytime Construction Noise Levels - dBA re 20 µPa

Receiver	Predicted LA10(15minute) Noise Level	LA10(15minute) Construction Criterion
R1 - 575 Brayton Road (R1)	43	44
R2 - 531 Brayton Road (R2)	38	46
R3 - 529 Brayton Road (R3)	39	44
R4 - 1540 Carrick Road (R4)	37	40
R5 - Proposed Residence	25	40

Table 4B.43 shows that the proposed construction activities will comply with the construction noise criteria at all surrounding residential receivers.

4B.4.9.2 Operation

Based on the output from the noise model and on the noise emissions criteria presented in **Table 4B.41**, **Table 4B.44** presents the predicted LAeq(15minute) noise level contributions from the proposed quarry operations together with the respective criteria. These predicted noise levels have been modelled assuming Heggies noise management recommendations are implemented.

Blasthole drilling will occur on average 1 day per week (daytime only) and was therefore not modelled in the scenarios given in **Table 4B.44**. There will be no blasthole drilling during the evening and night-time hours. Modelling with the blasthole drill indicated that the daytime LAeq(15minute) noise levels increase by 0 dBA to 1 dBA at the nominated receivers for the Year 1 scenario. There was no corresponding noise level increase with the addition of the blasthole drill to the Year 10 Scenario.

Table 4B.44 Noise Level Impact Assessment - dBA re 20 µPa

Receiver	Daytime (0600-1800 hours) Calm		Evening (1800-2200 hours) Calm		Night-time (2200-0600 hours) Calm		Night-time (2200-0600 hours) 3°/100m Inversion	
	Predicted LAeq (15minute) Noise Level	LAeq (15minute) Intrusive Criterion	Predicted LAeq (15minute) Noise Level	LAeq (15minute) Intrusive Criterion	Predicted LAeq (15minute) Noise Level	LAeq (15minute) Intrusive Criterion	Predicted LAeq (15minute) Noise Level	LAeq (15minute) Intrusive Criterion
Year 1 Scenario								
R1	38	39	31	38	31	36	36	36
R2	34	41	27	40	27	37	32	37
R3	35	39	24	38	24	36	29	36
R4	32	35	25	36	25	35	30	35
R5	21	35	7	35	7	35	12	35
Year 10 Scenario								
R1	37	39	31	38	31	36	36	36
R2	33	41	27	40	27	37	32	37
R3	33	39	24	38	24	36	29	36
R4	31	35	25	36	25	35	30	35
R5	19	35	7	35	7	35	12	35

Table 4B.44 shows that the proposed operations will comply with the noise criteria during each assessment at all surrounding residential receivers.

4B.4.9.3 Road Traffic

The noise impact of the quarry related road traffic on the Brayton Road and Red Hills Road was conducted via the prediction of future (with the quarry operating) peak hourly traffic noise levels on the subject roads.

The assessment was based on the existing traffic flows and traffic mix presented in the Traffic Count Study of Brayton Road and Red Hills Road, Marulan prepared by CFE Information Technologies (May/June 2007), and on the proposed quarry related traffic volumes presented in the Transport of the Proposed Gunlake Quarry, Brayton Road (Christopher Hallam & Associates Pty Ltd, February 2008).

The traffic noise level predictions at the closest receivers adjacent to the proposed Gunlake Quarry are presented in **Table 4B.45**

Table 4B.45 Predicted Future LAeq(1hour) Traffic Noise Levels Brayton Road - East of Proposed Quarry - 71m from Road Centre

	Maximum Hourly Existing Plus Quarry				**Minimum Hourly Existing Plus Quarry**				**7 Day Average Maximum Hourly Existing Plus Quarry**			
Number of Hourly Quarry Truck Movements	1	2	4	8	1	2	4	8	1	2	4	8
Day (0700-2200 hours)	52.6	52.8	53.0	53.5	42.8	43.9	45.5	47.6	50.9	51.1	51.4	52.1
Maximum Allowable Trucks Movements	170				176				175			
Night (2200-0700 hours)	49.6	49.9	50.3	51.1	42.5	43.7	45.4	47.5	47.6	48.0	48.7	49.9
Maximum Allowable Trucks Movements	55				55				52			

The corresponding daytime and night-time LAeq(1hour) traffic noise level predictions for Brayton Road near Marulan Village and Red Hills Road are presented in **Table 4B.46** and **Table 4B.47** respectively. These noise levels predictions are based on the maximum hourly quarry related traffic and the minimum existing hourly traffic.

Table 4B.46 Predicted Future LAeq(1hour) Traffic Noise Levels Brayton Road - Marulan Village – 21m from Road Centre

	Maximum Hourly Existing Plus Quarry				**Minimum Hourly Existing Plus Quarry**				**7 Day Average Maximum Hourly Existing Plus Quarry**			
Number of Hourly Quarry Truck Movements	1	2	4	8	1	2	4	8	1	2	4	8
Day (0700-2200 hours)	62.7	62.8	63.0	63.4	54.7	55.3	56.4	57.9	61.3	61.5	61.8	62.3
Maximum Allowable Trucks Movements	18[1]				16				13[1]			
Night (2200-0700 hours)	61.7	61.9	62.1	62.6	52.4	53.5	55.0	57.0	58.2	58.5	59.1	60.0
Maximum Allowable Trucks Movements	14[1]				4				4[1]			

Note 1 Based on increasing the existing traffic noise level by 2 dBA

Table 4B.47 Predicted Future LAeq(1hour) Traffic Noise Levels Red Hills Road - 350m from Road Centre

	Maximum Hourly Existing Plus Quarry				**Minimum Hourly Existing Plus Quarry**				**7 Day Average Maximum Hourly Existing Plus Quarry**			
Number of Hourly Quarry Truck Movements	1	2	4	8	1	2	4	8	1	2	4	8
Day (0700-2200 hours)	37.0	37.4	38.2	39.3	32.0	33.2	34.0	37.0	34.7	35.3	36.4	38.0
Maximum Allowable Trucks Movements									2000			
Night (2200-0700 hours)	33.6	34.4	35.7	37.6	32.0	33.2	34.8	37.0	32.5	33.6	35.1	37.2
Maximum Allowable Trucks Movements									650			

The day time and night time traffic noise level predictions at the closest residential receiver adjacent to (southeast of) the proposed roundabout are presented in **Table 4B.48.** This residence is located 52m from the interchange underpass and 30m from George Street.

Table 4B.48 Predicted Future LAeq(1hour) Traffic Noise Levels Brayton Road – Interchange /underpass – 52mm from Road Centre

	Maximum Hourly Existing Plus Quarry				**Minimum Hourly Existing Plus Quarry**				**7 Day Average Maximum Hourly Existing Plus Quarry**			
Number of Hourly Quarry Truck Movements	1	2	4	8	1	2	4	8	1	2	4	8
Day (0700-2200 hours)	57.0	57.2	57.5	58.2	49.7	50.6	52.1	54.1	54.8	55.1	55.7	56.7
Maximum Allowable Trucks Movements	23				40				31			
Night (2200-0700 hours)	53.2	53.6	54.4	55.7	47.9	49.3	51.2	53.5	52.7	53.2	54.1	55.4
Maximum Allowable Trucks Movements	6				42				10			

The corresponding day time and night time traffic noise level predictions are presented in **Table 4B.49** and are based on the maximum allowable hourly quarry related traffic and the existing peak hour traffic.

Table 4B.49 Predicted Existing LAeq(1hour) Traffic Noise Levels – Peak Periods George Street – Marulan Village – 30m from Road Centre

Period	Exisitng Peak LAEq (1 hour) Noise Level	LAEq (1 hour) Criterion[1]	Allowable Vehicle Movements (Passbys)	
			Light	Heavy
0630-0730 hours	60.6dBA	62.6dBA	10	11
0800-0900 hours	60.5dBA	62.5dBA	10	11
1200-1300 hours	61.9dBA	63.9dBA	10	16
1730-1830 hours	58.5dBA	60.5dBA	10	6

Note 1: Based on increasing the existing noise level by 2dBA.

Table 4B.50 shows the predicted existing and future traffic noise levels along Brayton Road and the By-pass road.

Table 4B.50 Predicted Existing and Future $L_{Aeq(1hour)}$ Traffic Noise Levels - Brayton Road - North of Marulan Village

EA Residence Identifier/ Offset Distance	Existing Maximum Hourly - dBA (Day / Night)	Maximum Hourly Existing Plus Quarry (3 movements/hr) - dBA (Day / Night)
5 - 197 m	45.5 / 42.0	46.2 / 43.4
7 - 80 m	51.4 / 47.9	52.1 / 49.3
8 - 530 m	38.9 / 35.4	39.6 / 36.8
12 - 155 m	47.0 / 43.5	47.7 /44.9
15 - 160 m	46.8 /43.3	47.5 / 44.7
16 - 165 m	46.6 / 43.1	47.3 / 44.5
17 - 75 m	51.8 / 48.3	52.5 / 49.7
19 - 75 m	51.8 / 48.3	52.5 / 49.7
21 - 420 m	40.5 / 36.9	41.2 / 38.4
22 - 230 m	44.4 / 40.9	45.1 / 43.3
23 - 640 m	37.7 / 34.9	38.4 / 35.6

Table 4B.51 shows the predicted and future traffic noise level predictions for other residences more distant from Brayton Road with Marulan Village than the residents described in **Table 4B.46**.

Table 4B.51 Predicted Existing and Existing and Future $L_{Aeq(1hour)}$ Traffic Noise Levels - Brayton Road - Marulan Village

Number of Residences/ Range of Offset Distance	Existing Maximum Hourly - dBA (Day / Night)	Maximum Hourly Existing Plus Quarry (3 movements/hr) - dBA (Day / Night)
North/South Road Section		
13 Residences / 21 m to 50 m	56.6 to 62.3 (Day)	57.2 to 62.9 (Day)
	55.5 to 61.2 (Night)	56.3 to 62.0 (Night)
East/West Road Section		
36 Residences / 21 m to 50 m	56.6 to 62.3 (Day)	57.2 to 62.9 (Day)
	55.5 to 61.2 (Night)	56.3 to 62.0 (Night)

Review of the road traffic noise level predictions presented in **Table 4B.45**,**Table 4B.46**, **Table 4B.47** and **Table 4B.48**, the noise level predictions for peak period traffic in **Table 4B.49** and the traffic noise criteria presented in **Table 4B.42** indicates the following:

- The existing daytime and night-time $L_{Aeq(1hour)}$ noise levels are lower than the NSW DEC's recommended assessment criteria at the closest residences on Brayton Road, south of the proposed quarry, and at the closest residence on Red Hills Road but exceed the criteria at the closest residence in Marulan Village (based on the measured maximum hourly traffic flows).

- Based on the controlling traffic flow scenarios of the existing maximum daytime hourly traffic and the existing 7 day average maximum hourly night-time traffic on Brayton Road, south of the quarry, plus quarry traffic, the allowable number of trucks to comply with the 60dBA and 55dBA $L_{Aeq(1hour)}$ criteria for the daytime and night-time are 170 trucks per hour and 52 trucks per hour respectively.

- Based on the controlling traffic flow scenarios of the 7 day average maximum hourly daytime and night-time traffic on Brayton Road, through Marulan Village, the allowable number of trucks to comply with the allowable 2dBA increase in the existing $L_{Aeq(1hour)}$ traffic noise levels are 13 trucks per hour during daytime and 4 trucks per hour during the night.

- Based on the controlling traffic flow scenarios of the 7 day average maximum hourly daytime and night-time traffic on Red Hills Road, the allowable number of trucks to comply with the 55dBA and 50dBA $L_{Aeq(1hour)}$ criteria respectively are 2,000 trucks per hour and 650 trucks per hour respectively.

- The existing daytime and night-time $L_{Aeq(ihour)}$ noise levels from traffic on the Marulan Interchange underpass are lower than the NSW DECC's recommended assessment criteria of 60dBA and 55dBA at the closest residence of the proposed roundabout at George Street.

- Based on the controlling traffic flow scenarios of the existing maximum daytime and night-time hourly traffic on the Marulan Interchange underpass,

plus quarry traffic, the allowable number of truck movements to comply with the 60dBA and 55dBA $L_{Aeq(1hour)}$ criteria for daytime and night-time are 23 truck movements per hour and 6 truck movements per hour respectively.

- The existing peak hour $L_{Aeq(1hour)}$ noise levels from the traffic on George Street are higher than the NSW DECC's recommended assessment criteria at the closest residence to the proposed roundabout.

- Based on the controlling 1730 hours to 1830 hours peak traffic flow scenario on George Street, the allowable number of truck movements to comply with the allowable 2dBA increase in the existing peak $L_{Aeq(1hour)}$ traffic noise level is 6 truck movements per hour.

Heggies concluded that the predicted existing plus worst case quarry traffic noise levels will clearly comply with the NSW DECC's daytime and night-time traffic noise criteria nominated in **Table 4B.42** on Brayton Road, Red Hills Road and at the new roundabout at the Brayton Road and George Street intersection.

4B.4.9.4 Blast Emissions

The Heggies assessment derived the following information from the predicted levels of blast emissions:

- The predicted levels of ground vibration at all nearby residences comply with the ANZEC general human comfort criterion (of 5mm/s) and consequently with the ANZEC maximum human comfort criterion as well as the BS 7385 structural damage criterion of 15mm/s (at 4Hz).

- The maximum predicted ground vibration level of 1.8mm/s occurs at Residence R3 using an MIC of 49kg (corresponding to blasting a full height 13m bench).

- The predicted levels of peak airblast at all residences comply with the ANZEC general human comfort criterion of 115dB Linear and consequently with the ANZEC maximum human comfort criterion.

- The predicted levels of peak airblast are clearly well below the US Bureau of Mines damage limit of 132dB Linear (2Hz cut off) at all residences.

Notwithstanding the above, Heggies recommended that all blasts are monitored at the closest/potentially most affected residence in order to establish compliance with the nominated criteria and to progressively update the blast emissions site laws (ground vibration and airblast) in order to optimise future blast designs, based on actual site conditions. Gunlake will implement these monitoring recommendations. In this way, the site laws can be used to assist with the blast designs in order to ensure compliance with the ANZEC criteria at all nearby residences.

By adopting this approach, in conjunction with the inevitable future introduction of improved blasting products, it is anticipated that the blast emissions criteria can be met without imposing any significant constraints on the blast designs throughout the life of the quarry.

4B.4.9.5 Cumulative Noise Assessment

Cumulative noise emissions are assessed using the INP's first and second environmental noise control objectives as follows.

The INP's first objective, that the intrusive noise emission from any single development does not exceed the background level by more than 5 dBA, relates to individual industrial sites where the intrusive noise limit is generally specified in the Development Consent and/or Pollution Control Licence.

There is no established procedure (or regulatory requirement) to derive intrusive $L_{Aeq(15minute)}$ noise criteria for the cumulative operation of existing and/or approved industrial developments in a locality.

The INP's second objective, that the $L_{Aeq(Period)}$ amenity level (ie non-transport related) does not exceed the specified "acceptable" or "maximum" noise level appropriate for the particular locality and land use, is aimed at restricting the potential cumulative increase in amenity noise levels, otherwise known as "background creep".

Accordingly Heggies asessed the cumulative impact of the project area with existing and proposed noise sources (ie the Johnniefelds Quarry and the Lynwood Quarry respectively) by determination of compliance with the amenity noise levels.

Residence R1 is potentially most affected by noise from the Johnniefelds Quarry and the proposed Residence R5 is potentially most affected by noise from the Lynwood Quarry.

The cumulative noise of these receiver locations (ie R1 and R5) would be higher than at other locations equidistant from all three quarries.

The highest predicted $L_{Aeq(15minute)}$ noise level from the proposed quarry at Residence R1 is 38 dBA during daytime. This noise level is 12 dBA lower than the amenity criterion of 50 dBA $L_{Aeq(day)}$. The estimated noise level contribution at Residence R1 from the Johnniefelds Quarry, based on the attended noise survey data, would be less than 32 dBA. This noise level is 18 dBA lower than the amenity criterion of 50 dBA $L_{Aeq(day)}$.

Given that the $L_{Aeq(day)}$ noise levels would be at least 3 dBA lower than the $L_{Aeq(15minute)}$ intrusive levels, the cumulative impact at Residence R1 would be considerably (approximately 15 dBA) lower than the $L_{Aeq(day)}$ 50 dBA criterion.

Similarly, for the proposed Residence R5, the highest predicted $L_{Aeq(15minute)}$ noise level from the proposed quarry is 23 dBA during daytime. This noise level is 27 dBA lower than the amenity criterion of 50 dBA $L_{Aeq(day)}$.

The estimated worst case $L_{Aeq(15minute)}$ noise level contribution at R5 from the Lynwood Quarry, from a review of the Noise Impact Assessment noise contours, is less than 25 dBA, 25 dBA lower than the 50 dBA $L_{Aeq(day)}$ amenity criterion.

Again, given that the $L_{Aeq(day)}$ noise levels would be at least 3 dBA lower than the $L_{Aeq(15minute)}$ intrusive levels, the cumulative impact at the proposed Residence R5 would be considerably (approximately 23 dBA) lower than the 50 dBA $L_{Aeq(day)}$ criterion.

4B.4.10 Noise Management and Control

Heggies undertook an analysis of background noise measurements conducted in accordance with the INP. The daytime construction and daytime, evening and night-time intrusive noise level criteria at the potentially most affected residences were established.

In relation to the operational noise impact assessment, compliance with operational LAeq(15minute) intrusive noise criteria would also result in compliance with the LAeq(period) amenity criteria. The controlling noise criterion is therefore the intrusive criterion for each respective period.

The predicted daytime construction LA10(15minute) noise emissions comply with the nominated criteria at all nearby residences during the anticipated construction period of between 4 weeks and 26 weeks.

The predicted daytime, evening and night-time noise levels comply with the intrusive (and amenity) noise assessment criteria at all nearby receivers, assuming Heggies noise management recommendations are adopted.

Heggies predicted that there will be no potential for sleep disturbance at any nearby noise sensitive receiver from the proposed Gunlake Quarry.

It is therefore concluded that, based on the predicted noise levels, the operation of the proposed Gunlake Quarry would have a negligible noise impact at the nearest residences.

Notwithstanding the above, Heggies recommended that in accordance with the procedures described in the INP, consultation should be undertaken with the DECC in relation to the setting of achievable noise limits for the Gunlake Quarry Project.

In accordance with the INP, Gunlake will implement the following management procedures where required:

- Noise monitoring on site and within the community.
- Prompt response to any community issues of concern.
- Refinement of on site noise mitigation measures and quarry operating procedures, where practical.

- Discussions with relevant property holders to assess concerns.
- Consideration of acoustical mitigation at the receivers.
- Consideration of negotiated agreements with property holders.

These management procedures are in addition to ensuring that feasible noise controls, as included in the predictive modelling, have been implemented for all stages of this Project including:

- Blasthole drilling operations being restricted to daytime only.
- All fixed and mobile plant being selected to have a sound power level (SWL) not exceeding those outlined in **Table 4B.52.**

Table 4B.52 SWL of Plant for Gunlake Quarry

Plant Items	SWL L_{Aeq} (dBA)
Primary Jaw Crusher	94
Secondary Gyratory Crusher	105
Tertiary Cone Crusher	105
Screen 1	105
Screen 2	88
Excavator	104
Face Loader (FEL)	109
Stock Pile Loader	108
Road Trucks	105
Quarry Truck	100
D10 Dozer	116
12t Roller	109
Grader	110

Gunlake will consult with the DECC in relation to the setting of achievable noise limits for the Project.

4B.5 Air Quality

The air quality assessment was undertaken by Heggies Pty Ltd (Heggies). The full assessment is presented in Part 5 of the Specialist Consultant Studies Compendium (SCSC 5), with the relevant information from the assessment summarised in the following subsections.

4B.5.1 Introduction

The pollutant dispersion modelling carried out in the assessment utilised the Ausplume Gaussian Plume Dispersion Model software developed by EPA Victoria, Version 6.0.

Dispersion meteorology used input data from the nearest Bureau of Meteorology automatic weather station to the Project Site at Goulburn, located approximately 30km to the south-southwest.

The Air Pollution Model (TAPM) was used to supplement this data for indirect parameters not recorded at Goulburn. TAPM under-predicted calm wind speed conditions at the Project Site and a more conservative approach was to use the actual wind recorded at Goulburn.

A scenario was modelled to reflect operations at the proposed quarry for Year 20 operations, selected to represent mining activities in the southern end of the pit, mining at full hourly production with 100 daily product truck movements. This scenario reflected worst case operations at the quarry.

The results of the modelling indicate that annual average dust deposition, annual average PM_{10} concentrations and 24-hour average PM_{10} concentrations associated with the Project Site are predicted to satisfy the air quality goals, provided specific operation controls are adhered to.

A semi-quantitative assessment of $PM_{2.5}$ concentrations attributable to the Project Site was conducted based on modelling of PM_{10} concentrations. Both the 24-hour and annual average air quality goals for $PM_{2.5}$ are easily satisfied.

A semi-quantitative assessment of respirable crystalline silica attributable to the Project Site was conducted based on modelling of PM_{10} concentrations. Both the short-term occupational and longer term exposure levels are easily satisfied.

An assessment of the effects of dust on vegetation and livestock indicates that operations on the Project Site are unlikely to result in significant impacts.

Heggies adopted a worst-case scenario for modelling, in terms of particulate emission rates and operational conditions. As a result, all predictions in their assessment should be viewed as conservatively high, with levels expected to be lower than those modelled during normal operation of the Project Site.

4B.5.2 Existing Air Quality Environment

4B.5.2.1 Introduction

Air quality guidelines and goals refer to levels of "pollutants" in air which include both operational and existing sources. In order to fully assess impacts against all the relevant air quality guidelines and goals, it is therefore necessary to compile information or estimates on existing dust deposition levels and the existing concentrations of airborne particulates.

In the absence of site-specific air quality data, existing background levels are described through reference to monitoring undertaken at nearby locations.

Pollutant concentrations were predicted at the nearest potentially affected sensitive receptors. The closest sensitive receptors to the site are four residences located within a distance of approximately 1km – 2km from the processing plant. Pollutant concentrations are predicted at these four points. Receptor locations and distances to the Site boundary and the processing plant are given in **Table 4B.53.**

Table 4B.53 Closest Sensitive Receptors

Sensitive Receptor	Distance to Site boundary (km)	Distance to processing plant (km)
R1	0.2	0.7
R2	0.7	1.0
R3	0.5	0.9
R4	0.6	1.4

Locations of sensitive receptors in relation to the Site are shown in **Figure 4B.15**.

4B.5.2.2 Dust Deposition

Three dust deposition gauges have been installed at the Project Site to determine the likely background. The data collected has enabled an estimation of the ambient dust deposition rate for assessment purposes. The average deposition rate for insoluble solids from the three sites has been recorded to be of the order of 1.5g/m^2/month expressed as an annual average.

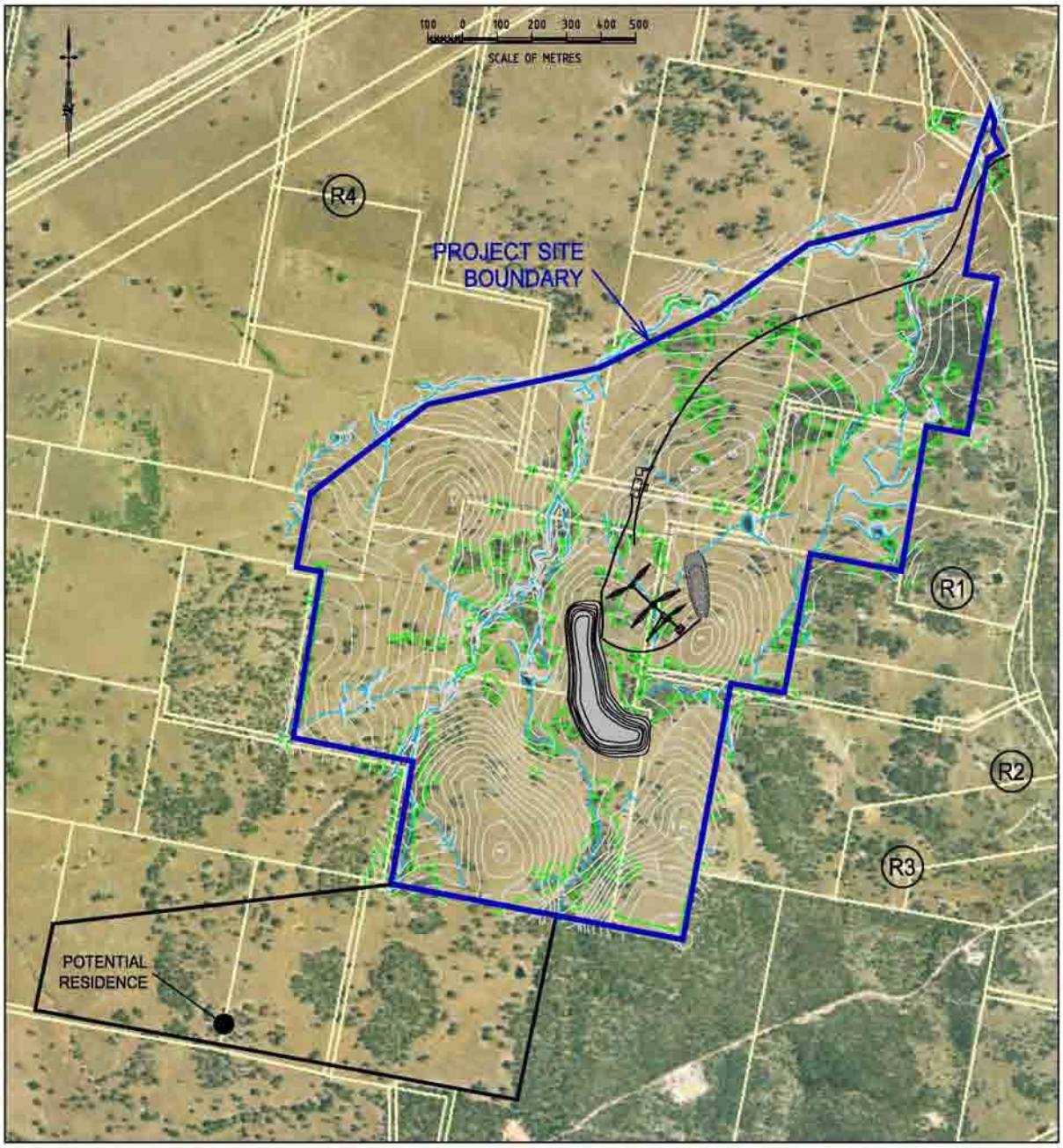
Dust deposition data is also available from the Lynwood Quarry site, located approximately 2km south of the Gunlake Quarry Project Site. At Lynwood, insoluble solids for the period June 2004 to January 2005 indicate a background level of dust deposition of 1.8g/m^2/month.

4B.5.2.3 Particulate Matter

The term particulate matter refers to a category of airborne particles typically less than 50 microns (μm) in aerodynamic diameter and ranging down to 0.1μm in size. Particles less than 10μm and 2.5μm are referred to in this report as PM_{10} and $PM_{2.5}$ respectively.

The closest NSW Department of Environment and Climate Change (DECC) air quality monitoring station to the Project Site is the Oakdale air quality monitoring site, located on a residential property at Ridge Road, Oakdale.

The monitoring site is located in a rural area on the far south-west edge of the Sydney Basin and is at an elevation of 457m. It is situated within the DECC's South-west Sydney region. It is located 95km to the northeast of the Gunlake Project Site and it is considered to be most representative of background conditions.



Gunlake Quarry Project
Figure 4B.15 Sensitive Receptors

The following air quality parameters are recorded at the monitoring station:

- O_3
- NO, NO_2 & NO_x
- Fine particles
- Wind speed, wind direction and sigma theta
- Ambient temperature
- Relative humidity
- Solar radiation.

The 24 hour average PM_{10} concentrations recorded at Oakdale for the year 2005 indicate that the highest 24-hour average PM_{10} concentration recorded was 42.6µg/m^3, recorded on 13 January 2005. The annual average PM_{10} concentration at Oakdale was 13.4µg/m^3. No exceedances of the NSW DECC criterion of 50µg/m^3 were recorded during 2005.

Measurement of background PM_{10} concentrations at Lynwood Quarry, located approximately 2km south of the Gunlake Quarry Project Site. Data for the period 11 June 2004 to 27 February 2005 showed the highest 24-hour average PM_{10} concentration recorded was 61.4µg/m^3 while the second highest was 35.8µg /m^3. The average PM_{10} concentration for the monitoring period was reported as 13.5µg /m^3.

4B.5.2.4 Summary of Air Quality

Based on the data and discussion in Section 4B.5.2.2 and Section 4B.5.2.3, the site-specific background air quality levels presented in **Table 4B.54** have been adopted for the assessment of the proposed Gunlake Quarry Project.

Table 4B.54 Background Air Quality Environment for Assessment Purposes

Air Quality Parameter	Averaging Period	Assumed Background Level
TSP	Annual	26.8µg/m^3
PM_{10}	24-Hour	Daily varying [1]
	Annual	13.4µg/m^3
Dust	Annual	1.5g/m^2/month
Note 1: Daily varying 24-hour average PM_{10} concentrations were used for modelling purposes.		

4B.5.3 Potential Sources of Air Contaminants

The main sources of dust generated during the development and operation of the proposed quarry and use of the proposed transport routes would include:

- quarrying activities (including vegetation clearing, soil stripping, overburden movement, and drilling and blasting activities;

- road and hardstand area construction (on-site);
- road construction and delivery of road construction materials;
- rock processing area activities (crushing / screening plant, front-end loader);
- wind erosion from areas within the quarry pit, emplacements and soil stockpiles;
- general movement of heavy vehicles on unsealed roads within the site (haul truck wheel dust); and
- transportation of product from the Project Site.

4B.5.4 Air Quality Criteria

4B.5.4.1 Particulate Matter Goals

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

The NSW PM_{10} goals as expressed in the DECC Approved Methods are:

- A 24-hour maximum of 50µg/m^3; and
- An annual average of 30µg/m^3.

The 24-hour PM_{10} standard of 50µg/m^3 is numerically identical to the equivalent National Environment Protection Measure (NEPM) reporting standard, except that the NEPM reporting standard allows for 5 exceedances per year. These NEPM goals were developed by the National Environmental Protection Council (NEPC) in 1998 to be achieved within 10 years of commencement.

In July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$. This document references the following goals for $PM_{2.5}$:

- A 24-hour maximum of 25µg/m^3; and
- An annual average of 8µg/m^3.

4B.5.4.2 Total Suspended Particulates Goals

The National Health and Medical Research Council (NHMRC) have recommended an annual average goal for Total Suspended Particulates (TSP) of 90µg/m^3.

The PM_{10} particle size fraction is typically of the order of 50% of the TSP mass in rural areas. Therefore, the NHMRC recommended TSP level of 90µg/m^3 is consistent with an annual average PM_{10} goal of approximately 45µg/m^3. Consequently, the NHMRC goal may be regarded as less stringent than the more recent DECC PM_{10} goal of 30µg/m^3.

Therefore, it was concluded that the annual TSP goal would be achieved for the Gunlake Quarry Project if the annual PM_{10} goal is satisfied.

4B.5.4.3 Dust Emission Goals

Sections 4B.5.4.1 and 4B.5.4.2 addressed goals for health impacts of particulate matter. There is also potential for dust deposition to result in nuisance impacts.

To avoid dust nuisance the DECC has developed assessment goals for dust fallout. These goals specify a maximum increase in deposited dust of $2g/m^2$/month and in any case, not to exceed a maximum total deposited dust level of $4g/m^2$/month.

In Section 4B.5.2.2, the ambient dust deposition level has been assumed to be less than $2g/m^2$/month. Consequently, the maximum increase in deposited dust level ($2g/m^2$/month) would be the governing goal for the Gunlake Quarry Project.

4B.5.4.4 Project Air Quality Goals

In summary, the DECC (EPA) project specific air quality goals are as follows.

PM_{10}: A 24-hour maximum of $50\mu g/m^3$
An annual average of $30\mu g/m^3$

$PM_{2.5}$: A 24-hour maximum of $25\mu g/m^3$
An annual average of $8\mu g/m^3$

Dust: An incremental annual average dust deposition level of $2g/m^2$/month; and a total annual average dust deposition level of $4g/m^2$/month.

4B.5.5 Operational Air Quality Controls

A dust control strategy will be implemented at the Project Site to minimise potential emissions, particularly during adverse weather condition days when excessive amounts of dust could be generated. Adverse weather conditions from an air quality perspective include moderate to strong winds prevailing from the western quadrant. These blow in the direction of the closest non-project related residence.

Specific design and operational safeguards have been planned for implementation at the Project Site, including the following:

- Water spraying in excess of $2L/m^2$/application applied to internal haul roads;
- Temporary partial enclosure of stockpiles and processing area through installation of wind breaks (Hessian screen) along the western side of the processing area (subject to monitoring results);
- Stabilisation and/or revegetation of the overburden emplacement;

- Installation of water sprays at the tipping point to the apron feeder and at the primary crusher input;

- Instigation of water spraying at discharge points to stockpiles when winds in excess of 8m/s are recorded on the on-site weather station; and

- Minimising of exposed surfaces where possible.

4B.5.6 Impact Assessment

4B.5.6.1 Introduction

The assessment of impacts of the proposed Gunlake Quarry Project was primarily undertaken through computer modelling to establish likely concentrations of PM_{10}, deposited dust and respirable crystalline silica around the Project Site. The modelling undertaken by Heggies (2007) at 4 local non-project related residences ("assessment locations") assumes the adoption of operational controls as set out in Section 4B.5.5. and the detailed modelling assumptions included in Section 5.7.1 of the Heggies Report. Specific distances of the assessment locations to Project Site activities are presented in **Table 4B.53**.

In order to assess the level of impact, the predicted concentrations have been compared against the air quality goals established in Section 4B.5.4.

4B.5.6.2 Air Quality Modelling

Computer predictions of fugitive emissions from the Project Site were undertaken using the Ausplume Gaussian Plume Dispersion Model software (Ausplume) developed by EPA (Victoria). Ausplume combines the particulate emission factors for the various Project Site activities, meteorological data and local topography to predict the dispersion of dust and other particulate matter.

Meteorological Data

The Air Pollution Model (TAPM) software, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), was used to simulate the meteorology of the area. Data obtained from the Bureau of Meteorology's Goulburn Airport Automatic Weather Station (AWS) (Station Number 070330), located approximately 30km south southwest of the Project Site. At the time of the assessment, a site weather monitoring station was not available, however one will be installed on the Gunlake Quarry Project Site.

The generated meteorological data set was compared with observed wind data from the Goulburn Airport and a good correlation between the generated and observed wind directions and wind speeds obtained (Heggies, 2007). This good correlation validates the generated data set and therefore increases the level of confidence that can be placed in the predictions from the modelling. However, TAPM under-predicted calm wind speed conditions at the Project Site requiring a more conservative approach and actual wind recorded at Goulburn was used in the modelling.

Local Topography

There are no significant topographic features which would impede atmospheric dispersion between the Project Site and adjacent residences. Consequently, topography was not considered in the Ausplume dispersion model.

Modelled Scenario

The modelling scenario was selected for Year 20 operations. This included quarrying activities in the southern end of the pit, quarrying at full hourly production with an estimated 100 daily truck movements and reflecting worst case operations at the quarry.

4B.5.6.3 Dust Deposition

Table 4B.55 presents the results of the Ausplume predictions for dust deposition.

The results show the mean average monthly dust deposition predicted at the residences surrounding the Site over a one-year time frame.

Table 4B.55 Background and Incremental Dust Deposition at Nearest Non-Site Related Residences

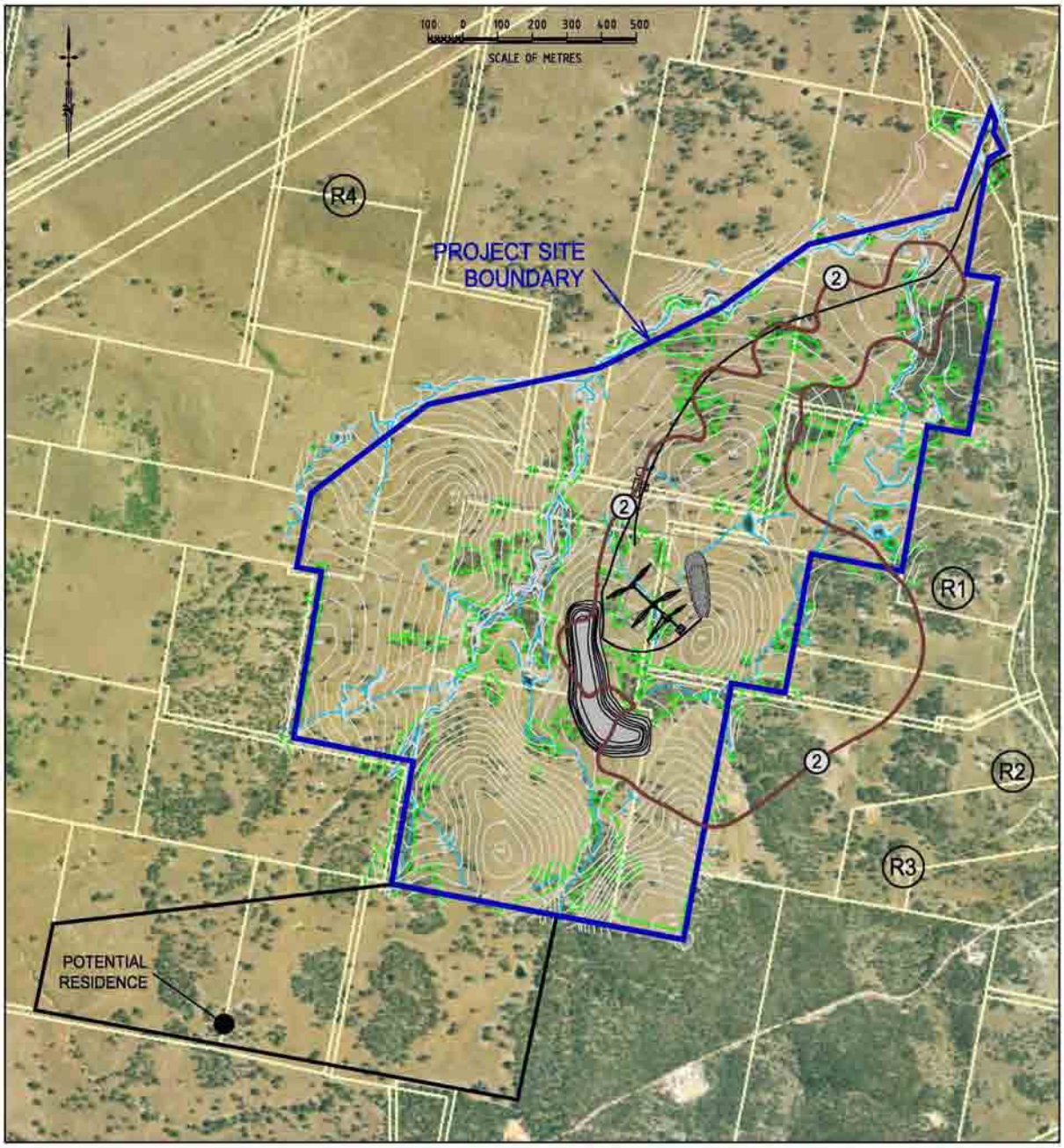
Receptor	Dust – Annual Average (g/m^2/month)			
	Background	Increment	Background + Increment	Air Quality Goal
R1	1.7	1.5	3.2	4.0
R2	1.7	1.2	2.9	4.0
R3	1.7	1.0	2.7	4.0
R4	1.7	0.2	1.9	4.0

The maximum predicted monthly dust deposition (background plus increment) associated with the Project Site is 3.2 g/m^2/month. As such, levels of dust deposition are predicted to satisfy the dust deposition goal.

A contour plot of the modelled incremental increase in dust deposition attributable to the Project Site is presented in **Figure 4B.16**.

4B.5.6.4 PM_{10} (24-hour Average)

Table 4B.56 presents the results of the Ausplume predictions for 24-hour PM_{10} concentrations. It has been assumed that background levels of PM_{10} vary on a daily basis. These background levels have been incorporated into the model.



Gunlake Quarry Project
Figure 4B.16 Average Monthly Dust Deposition

Table 4B.56 Maximum Predicted (Background + Increment) 24-Hour PM_{10} Concentration (µg/m^3)

	PM_{10} – 24-hour Average (µg/m^3)			
Receptor	**Background (Date)**	**Increment**	**Background + Increment**	**Air Quality Goal**
R1	39.1 (24/12/05)	9.3	48.4	50
R2	42.6 (13/01/05)	1.5	44.1	50
R3	42.6 (13/01/05)	3.3	45.9	50
R4	42.6 (13/01/05)	0.1	42.7	50

The maximum 24-hour average PM_{10} concentrations (background plus increment) are predicted to be less than 48.4µg/m^3 at all the nearest non-Site related residences, satisfying the air quality goal of 50µg/m^3

A contour plot of the maximum predicted 24-hour PM_{10} concentration (background plus increment) attributable to the Project Site is presented in **Figure 4B.17**.

4B.5.6.5 PM_{10} Annual Average

Table 4B.57 presents the results of the Ausplume predictions for 24-hour PM_{10} concentrations.

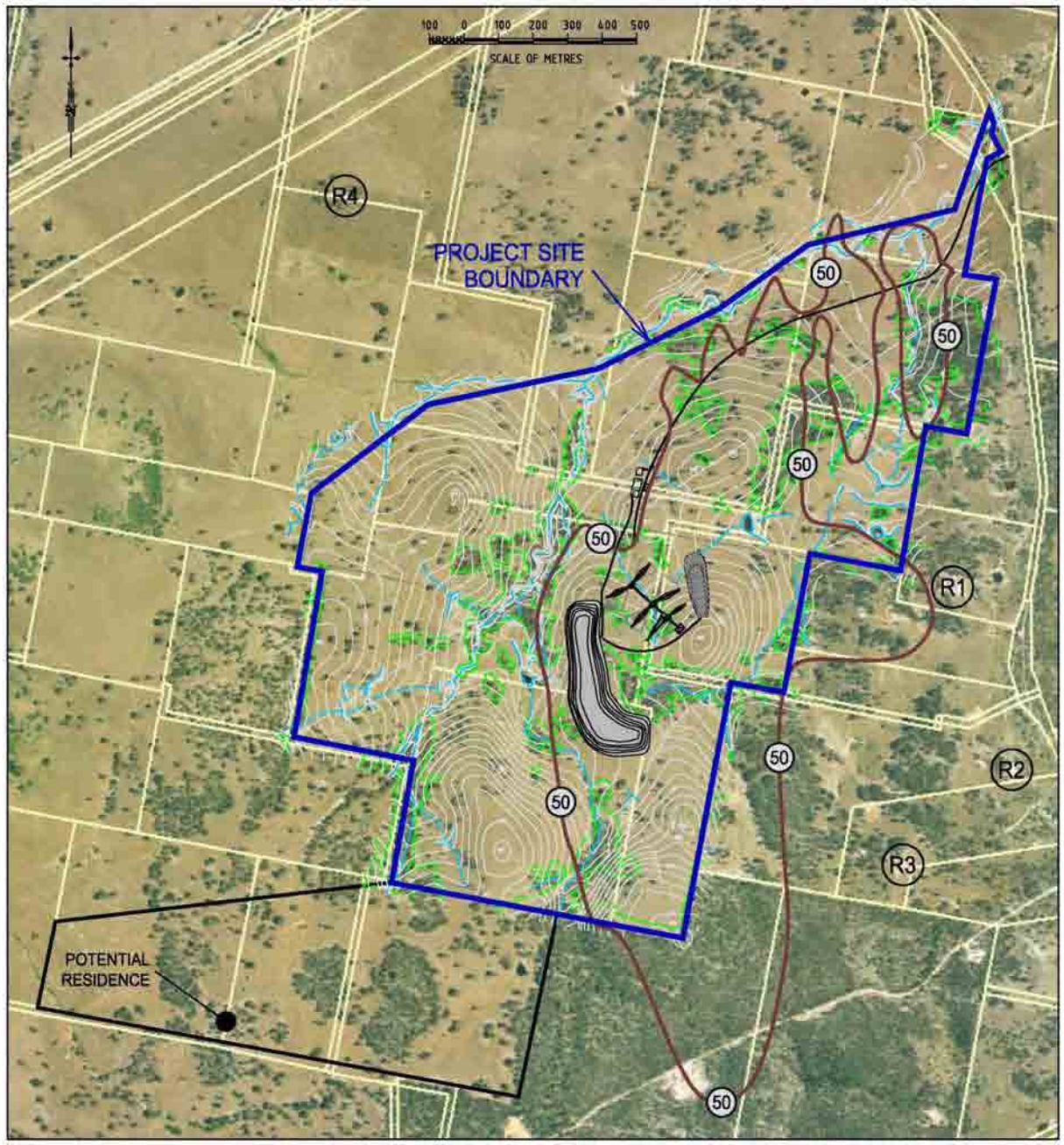
It was assumed that the annual average background concentration of PM_{10} is 13.4µg/m^3 at the nearest residences. This background level was incorporated into the model.

Table 4B.57 Predicted Annual Average (Background + Increment) PM_{10} Concentration (µg/m^3)

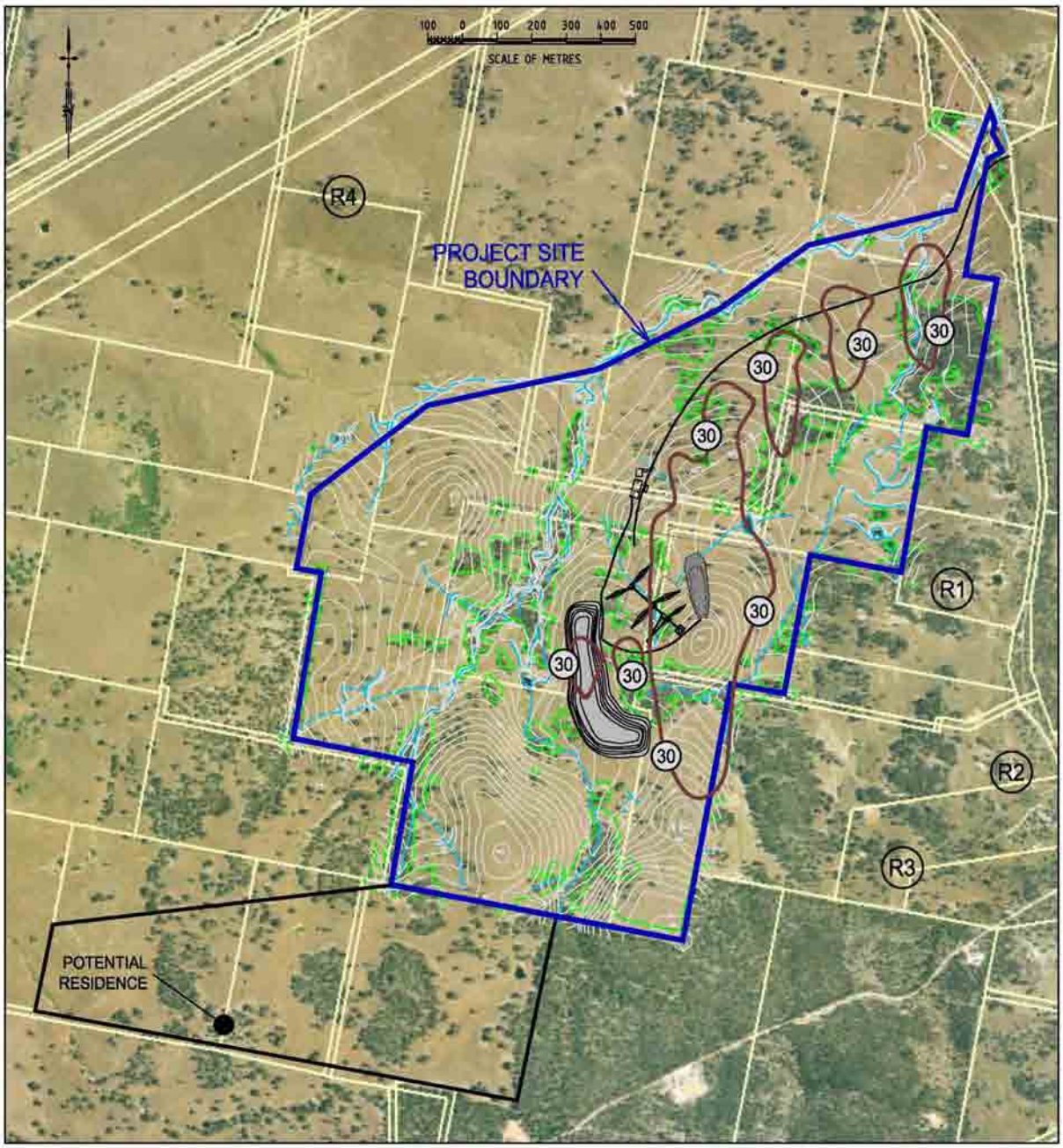
Receptor	PM_{10} – Annual Average (µg/m^3)			
	Background	**Increment**	**Background + Increment**	**Air Quality Goal**
R1	13.4	4.2	17.6	30
R2	13.4	2.1	15.5	30
R3	13.4	3.3	16.7	30
R4	13.4	0.5	13.9	30

The total annual average PM_{10} concentrations (background plus increment) associated with the Project Site are predicted to be less than 17.6µg/m^3 at all nearest non-site related residences. As such, annual concentrations of PM_{10} are predicted to satisfy the air quality goal of 30µg/m^3.

A contour plot of the modelled annual average PM_{10} concentrations (background plus increment) attributable to the Project Site is presented in **Figure 4B.18**.



Gunlake Quarry Project
Figure 4B.17 Maximum Predicted 24 Hour Average PM_{10} Concentration



Gunlake Quarry Project
Figure 4B.18 Annual Average PM_{10} Concentrations

4B.5.6.6 Total Suspended Particulates TSP

Modelling of TSP emissions from the site has been conducted using the emission rates calculated in Appendix E of the Heggies Air Quality Impact Assessment (Specialist Consultant Studies Compendium Part 5, Volume III of the Environmental Assessment). **Table 4B.58** presents the results of the Ausplume predictions for Annual Average TSP concentrations at the closest residential receptors.

Heggies assumed that the annual average background concentration of TSP is 27µg/m^3 for the area (derived by doubling the Lynwood Annual Average PM_{10} concentration of 13.5µg/m^3).

Table 4B.58 Predicted Annual Average TSP Concentration (µg/m^3)

Receptor	Annual Average Incremental TSP	Background	Total TSP	Air Quality Goal
R1	5.6	27	32.6	90
R2	2.9	27	29.9	90
R3	4.9	27	31.9	90
R4	0.8	27	27.8	90
R5	0.5	27	27.5	90

Table 4B.58 shows that the total annual average TSP concentrations (background plus increment) associated with the Site are predicted to be less than 32.6µg/m^3 at all nearest non-site related residences. As such, annual concentrations of TSP are predicted to easily satisfy the air quality goal of 90µg/m^3.

Figure 4B.19 presents a contour plot of the modelled annual average TSP concentrations (background plus increment) attributable to the Site.

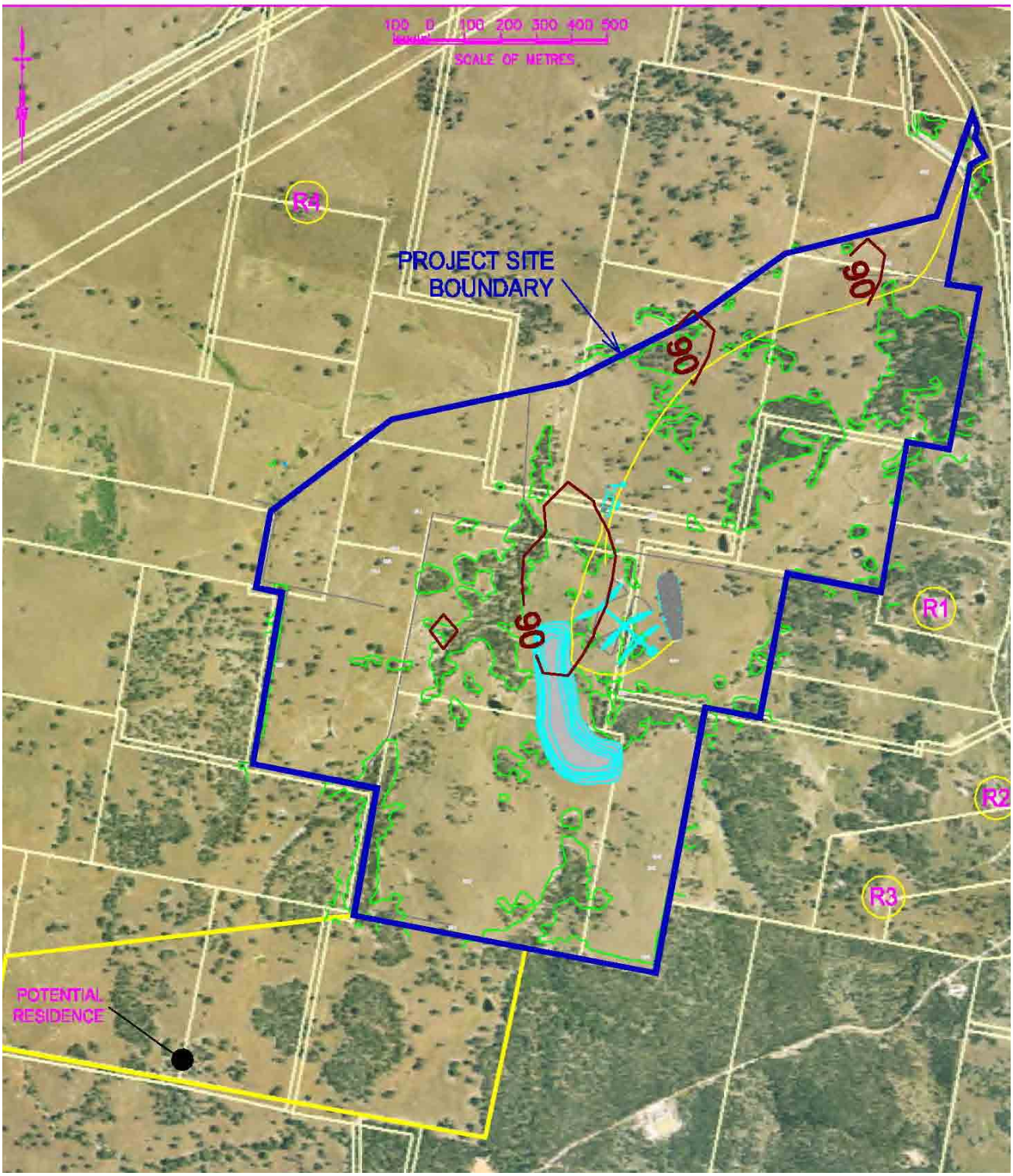
4B.5.6.7 $PM_{2.5}$

There is little data available regarding $PM_{2.5}$ emission factors and it was not quantitatively assessed using the Ausplume model. However, a semi-quantitative assessment of likely $PM_{2.5}$ concentrations attributable to the Project was determined based on the predicted PM_{10} levels derived from the modelling.

Heggies (2007) estimated that, inclusive of Project activities:

- 24-hour average $PM_{2.5}$ are predicted to be of the order of 13µg/m^3, thus satisfying the 24-hour average goal for $PM_{2.5}$ of 25µg/m^3, and,

- Annual average $PM_{2.5}$ levels are predicted to be of the order of 5µg/m^3, thus satisfying the annual average goal for $PM_{2.5}$ of 8µg/m^3.



Gunlake Quarry Project
Figure 4B.19 Predicted Annual Average TSP Concentraction 90 μg/m^3 Contour

4B.5.7 Respirable Crystalline Silica

Silica occurs in a crystalline or non-crystalline form. Epidemiological studies indicate that occupational exposure to high concentrations of respirable crystalline silica has associated adverse health effects. There are no known adverse health effects associated with exposure to respirable crystalline silica in non-occupational settings (IARC, 1997; CICAD, 2000).

As crystalline silica has its fibrogenic effects in the deeper areas of the respiratory system, it is the particles which are able to penetrate to the alveoli which are of prime concern (NIOSH, 2002; US EPA, 1996). It is generally considered that particles less than 3 – 5µm have a greater potential to reach the alveolar region (US EPA, 2004; IARC 1997; CICAD 2000).

The US EPA (1996) concluded that an inferential method to estimate the crystalline silica fraction in ambient PM_{10} is to assess the nearby soil and that an inherent assumption is that the percentage of crystalline silica within the emitted PM_{10} is equivalent to the fraction within the parent source (USEPA, 1996). Gunlake advised that the quartz content of the rock is of the order of 7%.

The National Occupational Health and Safety Commission (NOHSC) in Australia has established an exposure standard of 0.1mg/m^3 for crystalline silica (expressed as Respirable Quartz), effective from 1 January 2005.

While the NOHSC standard can be used as a guide, the California Office of Environmental Health Hazard Assessment (OEHHA) has adopted a chronic Reference Exposure Level (REL) of 3µg/m^3 for respirable crystalline silica. A chronic REL is an airborne level of a substance at or below which no adverse health effects are anticipated in individuals indefinitely exposed to that level. RELs are developed from the best available published scientific data, based solely on health considerations.

The maximum predicted 24 Hour average PM_{10} resulting from the operation of the proposed quarry is not anticipated to exceed 50µg/m^3 at the nearest residences over a 24 hour period. Assuming a 7% quartz content, this would result in a maximum 24 hour respirable crystalline silica concentration of less than 3.5µg/m^3. This would indicate that the National Occupational Health and Safety Commission (NOHSC) exposure standard of 0.1mg/m^3 will be easily satisfied.

The maximum predicted annual average PM_{10} resulting from the operation of the proposed quarry is 17.6µg/m^3. Assuming 7% quartz content, this would result in a maximum annual average respirable crystalline silica concentration of 1.2µg/m^3. This would indicate that the OEHHA REL of 3µg/m^3 will be easily satisfied.

The crystalline silica component of ambient emissions has been observed to be higher within larger size particle size fractions (>10µm) then those fractions less than 10µm. It is suggested that this unequal distribution may be due to quartz, which is harder than most minerals, resisting comminution to finer particle sizes (USEPA, 1996).

The PM_{10} sub-set of TSP is typically 50% in regions where road traffic is not the dominant particulate source. As the maximum annual average PM_{10} is predicted as 17.6μg/m^3, this would indicate that TSP mass concentration would be of the order of 35μg/m^3. Assuming 7% quartz content, this would result in a maximum annual average TSP crystalline silica concentration of 2.5μg/m^3 which would still comply with the OEHHA REL of 3μg/m^3. It is noted that the respirable fraction dust is in the size range of < 7μm, and TSP is generally considered to include particles up to 30μm. As such only a small proportion of TSP is considered respirable.

4B.5.8 Cumulative Impacts

A number of existing quarries are located within the regional context of the proposed site. Readymix operates 1km to the east of the proposed hard rock quarry on the Johnniefelds property and proposes to operate 2km to the south on the Lynwood property. The Readymix Lynwood Quarry is significantly larger that the Marulan Gunlake Quarry with a proposed operating throughput of 5 million tonnes per annum (Holmes, May 2005). The Readymix Johnniefelds Quarry is likely to be similar in scale to the proposed Marulan Gunlake Quarry given that the EPA Licence (EPL 1371) indicates a scale of >100,000t - 500,000t obtained.

Existing Ambient Air Quality. As discussed in Section 3 Heggies Air Quality Impact Assessment (Specialist Consultant Studies Compendium Part 5, Volume III of the Environmental Assessment), three Dust Deposition Gauges have been installed at the Project Site and monitoring has been ongoing since January 2007. Monitoring of background dust during this period at the site, accounts for the cumulative contribution of all existing dust sources in the region, including the existing Johnniefelds Quarry, unsealed roads and natural sources of dust.

Two of the Dust Deposition monitoring locations are located on the eastern site boundary closest to operations at the Readymix Johnniefields site, one of which is located 400m north of residence R1 and approximately 600m northwest of the Readymix Johnniefelds site. Under certain wind conditions, the dust contribution from the Readymix Johnniefelds Quarry at R1, could be higher than levels recorded to date at this monitoring location. Therefore, a conservative approach was adopted using the dust deposition results from monitoring on the Marulan Gunlake Quarry Site as the background concentrations (without the Readymix Johnniefelds site) and assess, on top of this, the cumulative increase from all proposed and existing quarries.

Existing monitoring data exists for the area (High Volume Air Sampling for PM_{10} on the Lynwood property) which can be used as an indication of the background level of PM_{10} and TSP (derived from published PM_{10} / TSP ratios).

Dust Deposition. The highest predicted Dust Deposition level for the proposed Marulan Gunlake Quarry is 1.5g/m^2/month. Working on the assumption that the Readymix Johnniefeld Quarry is similar in scale, the maximum predicted dust deposition from this site could also be 1.5g/m^2/month.

An Air Quality Assessment has been conducted for the Readymix Lynwood Quarry (Holmes, 2005) with revised modelling conducted following a request from the DECC to use site specific weather data. On the basis of this assessment, the predicted dust deposition from the Lynwood Quarry at residences to the north of the site (and closest to the Marulan Gunlake Quarry) would not exceed 0.12g/m^2/month.

The total cumulative predicted impact is presented in **Table 4B.59**. The results indicate a slight exceedance of the Air Quality Goal (4g/m^2/month), however this is based on the conservative assumption that the background concentration does not account for the contribution from the existing Johnniefelds Quarry and a certain amount of double counting will be evident. On the basis of this small increase, the total cumulative impact is not anticipated to be significant.

The DoP and the DECC in their Assessment Report for the Proposed Lynwood Quarry were satisfied that the proposal would not have a significant impact on the air quality of the area, despite slight exceedances of the dust deposition goal.

The predicted increment from the Marulan Gunlake Quarry of 1.5 g/m^2/month satisfies the maximum incremental increase goal of 2 g/m^2/month.

Table 4B.59 Cumulative Dust Deposition Assessment

Predicted Increment from Marulan Gunlake Quarry	1.5 g/m^2/month
Predicted Increment from Johniefeld Quarry	~ 1.5 g/m^2/month
Predicted Increment from Lynwood Quarry	~ 0.12 g/m^2/month
Estimated Background	1.5 g/m^2/month
Total Cumulative Impact	**4.62**

Particulate Matter.

The maximum incremental 24 hour PM_{10} concentration from the Gunlake Quarry is of the order of 11g/m^3. Working on the assumption that the Readymix Johnniefeld Quarry is similar in scale, the maximum incremental 24 hour PM_{10} concentration from this site could also be 11g/m^3.

An Air Quality Assessment has been conducted for the Readymix Lynwood Quarry (Holmes, 2005) with revised modelling conducted following a request from the DECC to use site specific weather data. On the basis of this assessment, the predicted 24-hour PM_{10} concentration from the Lynwood Quarry at residences to the north of the site (and closest to the Marulan Gunlake Quarry) would not exceed 6g/m^3.

The total cumulative predicted impact is presented in **Table 4B.60**. The results indicate a total incremental 24 hour PM_{10} concentration of less than 30g/m^3 from all three sources. Daily varying concentrations of PM_{10} may result in higher background concentrations on given days, however this is difficult to quantify for this semi-quantitative cumulative assessment. The average 24-hour PM_{10} concentration for the area is of the order of 13g/m^3.

The results of the semi-quantitative cumulative assessment of annual average PM_{10} and TSP concentrations indicated air quality goals are unlikely to be compromised.

Table 4B.60 Cumulative PM_{10} Assessment

	24 hr PM_{10}	Annual Average PM_{10}	Annual Average TSP
Predicted Increment from Marulan Gunlake Quarry	**11 μg/m³**	**4.2 μg/m³**	**5.6 μg/m³**
Predicted Increment from Johniefeld Quarry	11 μg/m³	4.2 μg/m³	5.6 μg/m³
Predicted Increment from Lynwood Quarry	6 μg/m³	1.8 μg/m³	2.5 μg/m³
Estimated Background	13 μg/m³ [a]	13 μg/m³	33 μg/m³
Total Cumulative Impact	**41 μg/m³**	**23.2 μg/m³**	**46.7 μg/m³**

Note: [a] This is the average 24-hour PM_{10} recorded at the Lynwood site for the monitoring period. Daily varying concentrations of PM_{10} may result in higher background concentrations, however this is difficult to quantify for this semi-quantitative cumulative assessment.

4B.5.9 Dust Impacts on Vegetation

The area surrounding the Project Site has been mainly cleared of native vegetation with scattered pockets of bush and scrub remaining.

Dust can have both physical and chemical effects on plants. Physical effects include blockage and damage to stomata, shading, abrasion of leaf surface or cuticle. The chemical effects of dust, working either directly on the plant surface or by changing the chemistry of the soil, are likely to be more important than any physical effects. Changes in soil chemistry may have long-term effects on species competition and community structure.

Consequently, the impact of dust on vegetation is dependent on the rate of dust deposition and the chemical composition of the dust. There have been very few recent studies conducted regarding the vegetative health impacts of dust deposition. Farmer (1993) summarised results from studies of vegetation exposed to dust deposition from nearby limestone quarries, cement plants, and other sources such as roads and coal quarries and concluded that dust may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic pollutants. Flow-on effects include reduced productivity and changes in floral and faunal community structure.

Yang (1988) noted that dust deposition levels of 0.75 to 1.5g/m²/day (i.e. 22 to 45g/m²/month) would not result in adverse effects on plant production. Decreased respiration rates were noted to occur for cereals when cement dust deposition rates exceeded 7g/m²/day (Environment Canada, 1998).

However, there is no single minimum dust deposition rate at which impacts were experienced due to the different chemical composition of dusts studied and the variety of plant species studied.

The dust deposition criterion apply to "sensitive receivers" which are defined as locations where people are likely to work or reside, including known or likely future locations. Vegetative communities are not explicitly considered as sensitive receivers, except in relation to impacts of hydrogen fluoride where the sensitivity of grapevines and stone fruit species to this compound is considered relevant. Areas of high ecological value or agricultural resources may be more sensitive to dusts than other areas.

However, documented levels given for potential impacts on vegetation, including sensitive natural vegetation and crops, are orders of magnitude higher than were predicted to occur in the vicinity of the Project Site.

4B.5.10 Dust Impacts on Livestock

The areas surrounding the Project Site are primarily used for sheep grazing, predominantly to the north and west.

There is little published literature regarding the impacts of dust deposition relative to wool yield and quality. Some studies have suggested that a relationship exists between wool value and dust content and that dust can affect wool quality after events such as dust storms and from other natural sources. However, this relationship never been quantified.

A recent study has shown that dust content of wool is in fact a heritable trait (Schlink, 2003) and that sheep may be bred to produce better quality wool that is less susceptible to adverse effects from dust.

Mentor Consulting (1993), as quoted in Hunt (2003), undertook grazing trials in NSW with dairy cattle. The trails were designed to determine the impact of coal mine dust contamination of pasture on pasture intake, grazing behavior and milk production of dairy cattle. Coal dust added to a pasture equivalent to 8g/m²/day had no effect on pasture palatability or cattle production. Hunt (2003) cites a study by Marek and Hais (1970) which investigated dust inhalation and ingestion of contaminated pastures by dairy cattle. According to this study, production levels were reduced by about 10% when deposition levels reached 48 to 96g/m²/month but not detectable at lower dust deposition rates.

The predicted incremental increase in dust deposition from the Site is less than 0.2g/m^2/month to the north and west of the Site which is unlikely to have a noticeable effect on dust levels in wool. The health impacts on livestock are similarly not considered to be an issue as levels given for potential impacts on livestock are orders of magnitude higher than were predicted to occur in the vicinity of the Project Site.

4B.5.11 Construction Phase Emissions

The air quality impacts during the operation of the Gunlake Quarry would be greater than those during construction and site establishment. Therefore the intention of the Heggies Report was to demonstrate that if operational phase activities do not result in exceedances of

relevant air quality criteria, construction phase emissions similarly would not result in adverse air quality.

In addition, localised air quality impacts associated with the construction can largely be controlled through technical means including good site management, vehicle maintenance and applying appropriate dust mitigation measures.

4B.5.12 Vehicle Emissions

Vehicle exhaust emissions of oxides of nitrogen (NO_X), sulphur dioxide (SO_2) and hydrocarbons from construction and vehicles are not expected to be significant given the relatively small scale nature of the quarry and limited equipment inventory. Emissions from these sources are expected to be easily assimilated into the local airshed and unlikely to cause exceedances of air quality goals even at residences close to the transport route. Additionally, the low sulphur content of Australian diesel is expected to ensure air quality goals for sulphur dioxide (SO_2) would not be exceeded.

4B.5.13 Air Quality Monitoring

The fugitive particulate emissions are likely to be acceptable for the operation phases of the quarry and as such air quality is not anticipated to be adversely affected at the nearest residences.

However, to demonstrate compliance with the air quality goals, monitoring will be conducted at appropriate locations and frequencies throughout the life of the quarry with an annual review of the extent of monitoring conducted.

The dust deposition monitoring currently undertaken at the site will be continued.

Monitoring of 24-hour concentrations of PM_{10} will be undertaken at one location for an appropriate period, as agreed with the DECC. It is proposed that the monitoring will be conducted on a one-day-in-six cycle using a High Volume Air Sampler (HVAS). A suitable location would be at resident R1, the closest resident to the Site. Monitoring for PM_{10} will be conducted for a period of at least one year and at maximum quarry throughput. Should no exceedance of the 24-Hour PM_{10} criteria (directly attributable to the Gunlake Quarry) occur during this period, monitoring will be reviewed and discontinued as appropriate.

An on-site Weather Station will be established to monitor wind speed and wind direction. The weather station will be fitted with either an alarm / automatic notification system for when wind speeds exceed 8m/s.

Monitoring will be undertaken according to the DECC document *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* 2005. Specifically, monitoring should be conducted in accordance with the following Australian Standards:

- AS 2922-1987 Ambient Air - Guide for the Siting of Sampling Units (NSW DEC Method AM-1).

- AS 3580.9.6-2003 Particulate Matter - PM_{10} - high volume sampler with size-selective inlet.

- AS 3580.10.1-2003 Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method (NSW DEC Method AM-19).

Responsibilities and Accountabilities. An organisational structure for the management of environmental control and reporting procedures will be implemented. The Quarry Manager will oversee the environmental management of the site, liaise as necessary with other on-site personnel and report directly to the overall Project Manager.

The purpose of this structure is to ensure the following:

- The environmental procedures are effectively implemented and have the intended outcome, that is, no off-site nuisance or other effects due to air pollution are experienced; and
- Non-compliance with any of the desired environmental outcomes will be reported promptly and corrective action will be taken to mitigate any impacts.

Many of the dust-control procedures will be implemented as required and compliance checked by daily visual inspection. All site personnel and subcontractors will undergo appropriate induction training courses and individual responsibilities for ensuring that procedures are adhered to will be clearly defined.

The management and reporting of environmental aspects of activities will be the responsibility of the Quarry Manager, with specific tasks delegated to on-site personnel. Simple daily visual checks will be made by on-site personnel for most parameters and any non-conformances shall be reported immediately to the Project Manager.

Reporting. Monthly dust deposition gauge and HVAS results will be reported to the Project Manager so that dust control and operational procedures can be reviewed and modified, if required.

Results of monitoring will be reported through the Annual Environmental Monitoring Report which would be made available to the DECC and local community groups if relevant.

Non Compliance and Corrective Action. Where the air quality monitoring identifies non-compliance with the relevant criteria, the Quarry Manager will plan and carry out corrective action.

If monitoring indicates that the air quality objectives are being significantly exceeded on multiple occasions the Quarry Manager would:

- Identify the activities that were occurring at the time of the exceedance;

- Determine the activities that were most likely contributing to the exceedance (employing continuous monitoring techniques);
- Review work procedures and environmental controls in place for this activity;
- Implement an agreed alternative to more adequately control dust generation; and
- Inform the DECC and local community groups of the exceedance and planning corrective action.

The corrective action may involve supplementary monitoring to identify the source of the non-conformance, and/or may involve modification of work procedures, techniques or programmes to avoid any recurrence or minimise its adverse effects.

Complaints Handling. A complaints handling procedure shall be drawn up by Gunlake Quarries Management. An effective complaint investigation shall determine the likely cause of the complaint. A review of the air quality monitoring results will be undertaken following a complaint to determine if air quality goals are also being exceeded. A review of work procedures and / or dust control procedures shall be undertaken in response to complaints and supplementary monitoring undertaken if deemed necessary.

4B.6 Cultural Heritage

The cultural heritage assessment was undertaken by Australian Archaeological Survey Consultants Pty Ltd (AASC). The full assessment is presented as Part 6 of the Specialist Consultant Studies Compendium (SCSC 6), with the relevant information from the assessment summarised in the following subsections.

4B.6.1 Introduction

A review was made of the NSW DEC AHIMS database, the Goulburn Mulwaree Shire Council LEP, the NSW State Heritage Register and the Australian Heritage Database to determine if any previously identified Indigenous and non-Indigenous sites were located within, or in close proximity to the Project Site. While no Indigenous sites have been registered within the survey area, several sites have been identified within the region.

The Goulburn Mulwaree Shire Council LEP and State Heritage Register identify two (2) non-Indigenous heritage items within proximity to the survey area, the Marulan Station and Yard Group and Old Marulan Town. None of the above non-Indigenous heritage items are within the bounds of the study area, nor will the items be impacted on by the proposed developments.

The fieldwork component of the cultural heritage assessment for the Project was completed by Dave Johnston (AASC Archaeologist), Peter Falk (representing Gavin Andrews of the D'harawal Knowledge Holders) and Justine Boney (Pejar Local Aboriginal Land Council Representative). The survey was carried out on the 6th and 13th June 2007.

Field investigations were also carried out to identify non-Indigenous sites within the study area and to assess the impact the proposed development may have on previously recorded

non-Indigenous heritage items. The assessment by Robert Paton and Charmain O'Halloran (AASC Archaeologists) was completed on the 11th October 2007.

During the course of the field survey five (5) Indigenous archaeological sites were identified. The sites consisted of one (1) isolated find and four (4) small artefact scatters containing less than 10 artefacts.

4B.6.2 Indigenous Consultation

The NSW DEC also have a policy that Local Aboriginal Land Councils and Native Title Claimants should be consulted and actively involved in the Cultural Heritage Assessment process.

In accordance with the Department of Environment and Conservation (NSW) *Interim Community Consultation Requirements for Applicants* (2004) requests for registration of interest were sought through public notification via an advertisement in the local print media. A record of responses to this notification is included in the Consultation section of the AASC Report.

Respondents to the notification included:

- Pejar Local Aboriginal Land Council
- Peter Falk (representative for Gavin Andrews of the D'harawal Knowledge Holders)

Respondents provided either written or verbal registration of interest. All respondents were contacted by phone to confirm their registration of interest and provided with the proposed methodology for the preliminary phase of field investigations.

Written notification was provided to:

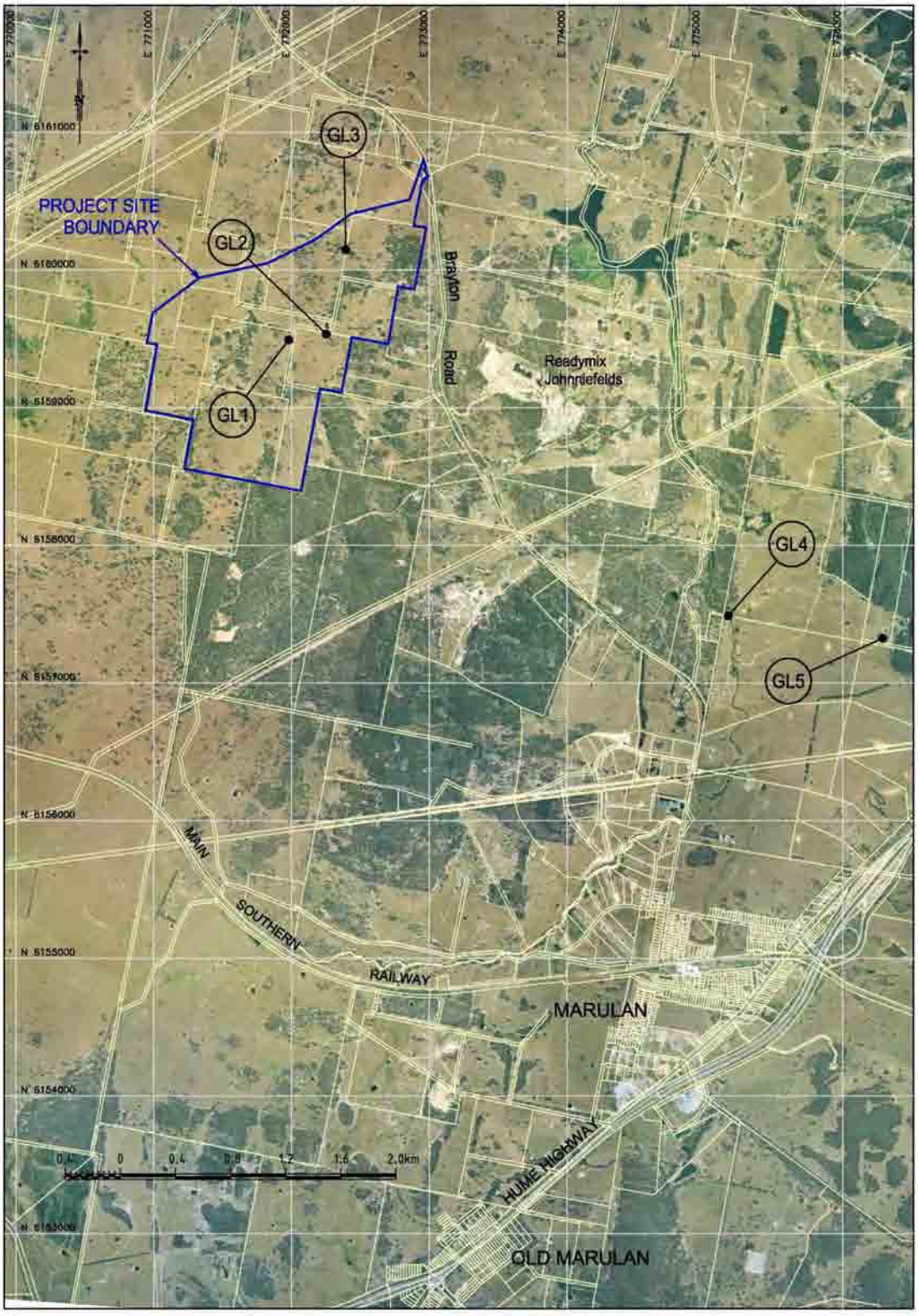
- Local Aboriginal Land Council(s);
- Registrar of Aboriginal Owners;
- Native Title Services;
- Local council(s);
- Department of Environment and Conservation (DEC).

The respondents provided verbal agreement to the proposed field methodology during telephone communications with Charmain O'Halloran (AASC Archaeologist).

Both respondents were invited and participated in the fieldwork and compilation of the recommendations.

4B.6.3 Indigenous Archaeological Sites

During the field survey 5 Indigenous archaeological sites were identified. The sites consisted of 1 isolated find and 4 small artefact scatters containing less than 10 artefacts. The locations of the sites are shown on **Figure 4B.20**. **Table 4B.61** summarises the sites.



Gunlake Quarry Project
Figure 4B.20 Archaeological Sites

Table 4B.61 Survey Results

Site Name	Site Type	Site Details
GL1	Artefact Scatter	6 artefacts on erosion scald on saddle
GL2	Artefact Scatter	6 artefacts on gently sloping dirt track
GL3	Artefact Scatter	4 artefacts on erosion scald on gently sloping flat
GL4	Isolated Find	1 artefact on west bank of creek
GL5	Artefact Scatter	2 artefacts on moderate hill slope

All artefact scatters recorded during the present survey were identified as small, artefact quantities ranging from 2-6 in each site. One isolated find consisting of 1 artefact was also recorded.

4B.6.4 Management Commitments

Heritage management options and recommendations were made on the following bases:

- Consultation with representatives of the Pejar Local Aboriginal Land Council and Peter Falk, representative for Gavin Andrews of the D'harawal Knowledge Holders;
- The legal and procedural requirements of NSW DEC;
- The results of the investigation as documented in the report; and
- Background research into the extant archaeological and historic record for the study area and its surrounding regions.

The following commitments are aimed at minimising the impact of proposed developments on any potential cultural resources present within the surveyed area.

1) Salvage and relocation of all sites (GL1–5) will be completed prior to the commencement of works. The salvage will be completed in accordance with the NPWS Act 1974 (NSW). A Section 90 Application (Consent, Consent with salvage) will be submitted to the NSW DEC. The salvage program will be completed on receipt of the Section 90 permit, by a qualified Archaeologist and with representatives of the relevant Indigenous organisations.

2) Copies of the archaeological report will be or have been supplied to:

   - NSW DEC;
   - Pejar Local Aboriginal Land Council;
   - Peter Falk (representative for Gavin Andrews of the D'harawal Knowledge Holders);

- Goulburn Mulwarree Council.

The following mitigation measures will be implemented in the event that sites or artefacts are identified during the course of monitoring and construction activities.

Discovery of Cultural Heritage Items

Step 1
Any person discovering suspected cultural heritage sites or items will notify machinery operators that are working in the general vicinity of the area that earth disturbance works should stop immediately.

Step 2
A buffer protection zone of 20m x 20m will be established around the suspected cultural heritage site or items. No unauthorised entry or earth disturbance will be allowed within this 'archaeological zone' until such time as the suspected cultural heritage items have been assessed, and appropriate mitigation measures have been carried out.

Step 3
If required, an archaeologist will be contracted and requested to assist the Indigenous stakeholders in carrying out an assessment of the cultural heritage find.

Step 4
Based on the findings of the assessment, appropriate management recommendations will be developed for the cultural heritage find. These recommendations will be submitted to the Parties for endorsement.

Step 5
Once endorsement has been obtained, the prescribed management recommendations will be carried out by the appropriate personnel.

Step 6
On the completion of the prescribed works, the Parties will advise the Quarry Manager (or other Project Personnel) that construction works may recommence in the 'archaeological zone'. If there are further constraints to construction works in the 'archaeological zone', then the Quarry Manager will be informed of these. It is the responsibility of the Quarry Manager to inform construction crews of these constraints.

Discovery of Skeletal Material

Step 1
Under no circumstances should the suspected skeletal remains be touched or disturbed. If these are human remains, then this area potentially is a crime scene. Tampering with a crime scene is a criminal offence.

Step 2
Any person discovering suspected skeletal remains will notify machinery operators that are working in the general vicinity of the area that earth disturbing works should stop immediately.

Step 3
A buffer protection zone of 100m x 100m will be established around the suspected skeletal remains. No unauthorised entry or earth disturbance will be allowed with this buffer zone until such time as the suspected skeletal remains have been assessed.

Step 4
The police, DECC and a qualified archaeologist will be contacted and informed of the discovery. A time will be arranged for these parties to meet on site to carry out an assessment of the suspected skeletal remains.

Step 5
Should the skeletal remains be declared an Indigenous burial site, the following procedures will be implemented.

- A meeting shall be convened between the Parties to review the circumstances of the find.
- The Indigenous representatives in consultation with Gunlake Quarries shall request that identified Aboriginal representatives, a qualified archaeologist and the relevant DECC officer shall undertake a site inspection. The purpose of this inspection will be to develop recommendations for further actions required at this site.
- These recommendations shall be submitted to the Parties for review and endorsement.

4B.7 Flora and Fauna

The flora and fauna survey and ecological impact assessment report was undertaken by Ecotone Ecological Consultants Pty Limited (Ecotone) The full assessment is presented in Part 7 of the Specialist Consultant Studies Compendium (SCSC), with the relevant information from the assessment summarised in the following subsections.

4B.7.1 Introduction

The objectives of the Flora and Fauna and Ecological Impacts Assessment were to:

- describe the existing biological environment of the study area in relation to flora and fauna;
- identify the potential impacts of the proposal for any threatened species, populations or ecological communities that occur or could be likely to occur in the subject site;

- assess the potential impacts of the proposal on the biota of each site by application of the provisions of the relevant NSW and Commonwealth legislation; and

- provide discussion on measures to manage potential impacts and effects of the proposal, using the principles of "avoid, minimise and mitigate" in that order of preference.

The environmental studies were conducted in three stages:

- review of available literature pertaining to the site and surrounding locality and preliminary habitat assessment of the subject site;

- completion of targeted field surveys for threatened species regarded as potential subject species, and surveys to investigate the inherent biological attributes of the site; and

- assessment of impact of the proposal on flora and fauna in accordance with the relevant NSW and Commonwealth legislation and planning instruments.

The subject site for the quarry pit and haul road consists of cleared grazing land with scattered trees, currently stocked with sheep. The By-pass road passes through land of varying land-use including uncleared land with natural or partially cleared and disturbed vegetation, a fruit orchard, cleared grazing land and plantation pine forest. The highway intersection with Red Hills Road consists of disturbed roadside vegetation with remnant trees, planted native species and weeds. At the time of the survey, the vegetation in the pasture areas of the study area was much diminished due to the prevailing drought conditions. Weeds were generally sparse and scattered, with the exception of serrated tussock grass which has invaded pastures and is present at high density.

The Ecotone Assessment was undertaken in accordance with requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); NSW *Threatened Species Conservation Act 1995* (TSC Act); *National Parks and Wildlife Act 1974* (NP&W Act); *Environmental Planning and Assessment Act 1979* (EP&A Act); and subsequent amendments to these. Specific consideration was given to Section 5A of the *EP&A Act*.

4B.7.2 Potential Flora and Fauna Species and Ecological Communities

Ecotone undertook a detailed reviews of existing databases to predict the flora and fauna species and communities likely to occur in the area around the Project Site. The details of their reviews are included in Section 2 of their report.

Ecotone identified the following listed species and ecological communities as having potential to occur around the Project Site and were regarded as potential subject species in their assessment:

Flora

- *Eucalyptus macarthurii* (TSC Act only)
- *Baloskion longipes* (TSC Act only)
- *Genoplesium plumosum*
- *Leucochrysum albicans* var. *tricolor* (EPBC Act only)
- *Pomaderris cotoneaster*

Fauna

- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Brown Treecreeper
- Hooded Robin
- Black-chinned Honeyeater
- Turquoise Parrot
- Barking Owl
- Powerful Owl
- Speckled Warbler
- Diamond Firetail
- Masked Owl
- Regent Honeyeater
- Large-eared Pied Bat
- Eastern False Pipistrelle
- Eastern Bent-wing Bat
- East-coast Freetail-bat
- Squirrel Glider
- Koala

Endangered Ecological Communities

- White Box Yellow Box Blakely's Red Gum Woodland
- Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT (EPBC Act only).

Field survey techniques were designed to adequately target these subject species and ecological communities and the potential impacts on the subject species and communities as a result of the proposed development were assessed.

4B.7.3 Aquatic Fauna Habitat

Ecotone undertook a fish habitat assessment to address NSW Fisheries (1999 & 1998) Guidelines for Aquatic Habitat and Fish Assessment (1998 and 1999). Their findings are as follows:

Geomorphology
The study area forms part of the southern Hawkesbury-Nepean Catchment area. The Project Site and the areas affected by the haulage routes eventually drain to the Wollondilly River, which eventually flows into Lake Burragorang and forms part of Sydney's water supply.

Flow Regime
At the time of survey, no flow was evident in any watercourse or drainage lines within the subject site. Chapman's Creek lies along the northern boundary of the Project Site and contained only occasional small pools of water at the time of survey. Joarimin Creek is associated with the By-pass road and contained some larger pools of water, though no flow was evident at the time of survey. Both of these creeks and drainage lines within the subject site suffer from moderate to severe erosion.

Water Quality
No water quality testing was undertaken. From observations at the time of survey it was noted that while water quality appeared to vary between different pools, in general any standing water appeared highly discoloured.

Water Depth
At the time of the survey**,** the water depth in all observed pools within the study area was no more than 1m and mostly much less.

Land Use
Land use within the study area is predominantly devoted to grazing, with a pine plantation in the vicinity of Red Hills Road. Other land uses nearby include quarrying, some areas of native vegetation and Johnniefelds Dam.

Riparian Vegetation
Due to grazing pressure and erosion, riparian vegetation throughout the subject site is quite degraded, with some areas infested with blackberry. In many places particularly on the Project Site, riparian vegetation has been reduced to canopy trees with a very sparse understorey of native and introduced groundcovers and the occasional low shrub (mostly blackberry).

In-stream Vegetation
Very little instream vegetation occurs in Chapman's Creek and other drainage lines in the Project Site. The larger, permanent pools in Joarimin Creek contain *Typha orientalis* and some sedges and rushes.

Presence of Wetlands
Joarimin Creek flows into Johnniefelds Dam, which constitutes an artificial wetland. No other wetland areas are known to occur within the study area.

Substrate Type
The substrate is predominantly soil with some rocky areas.

Fish Refuge Areas
The Wollondilly River and Johnniefelds Dam are the only known potential fish refuge areas nearby.

Potential Spawning Areas
There were no obvious potential spawning areas at time of survey.

Natural and Artificial Barriers to Fish
The ephemeral nature of both creeks and drainage lines within the subject site results in a natural barrier to passage between the more permanent pools outside of periods of water flow.

Likely Presence of Migratory Fish Species
No records of migratory fish species occur within the subject site. It is not expected that the proposed development or associated construction works would negatively impact any species of migratory fish.

Aquatic Fauna Present
A survey of aquatic fauna was not undertaken, however, it is expected that some aquatic fauna (eg. freshwater crayfish, aquatic insects) occur in dams and some of the larger pools in creeklines within the subject site (particularly Joarimin Creek). A full species list would only be obtained by conducting a detailed capture and release study. Given the ephemeral nature of creeklines within the subject site and the fact that no threatened species are expected to occur, the undertaking of a full aquatic survey was not considered warranted under the survey guidelines.

4B.7.4 Vegetation Communities

Ecotone identified eight broad vegetation community types in the study area, three of which are highly modified or artificial communities:

Natural Communities
1. Cabbage Gum / Yellow Box / Argyle Apple Riparian Floodplain Woodland
2. Yellow Box / Blakeley's Red Gum / Stringybark Open Woodland
3. Argyle Apple / Stringybark Open Forest / Woodland
4. White Gum / Argyle Apple Woodland
5. Stringybark / Wattle Ridgetop Open Forest.

Derived / Artificial Communities
6. Cultivated Pine Plantations and Fruit Orchard
7. Dams with Fringing Vegetation
8. Cleared, open grassland / Derived Pasture with a mix of introduced and native pasture grasses, remnant native flora species and scattered introduced or remnant native trees.

Community 8 occupies the bulk of the Project Area and the transport routes, and a large proportion of the area around the By-pass road between Brayton Road and the Hume Highway. Various communities are dominant in other parts of the study area, as discussed in **Table 7** of the Ecotone Report.

A detailed description of the structure and floristics of the vegetation communities within the site is given in **Table 7** of the Ecotone Report**,** and the distribution of the natural vegetation communities in each of the sites is shown in **Figures 3a – 3c** of the same report**.**

Figure 4B.21 shows the location of these vegetation communities in relation to various components of the Project.

4B.7.5 Species Diversity

Species diversity is a distinguishing parameter of floral communities and can provide a basis for performance monitoring. Ecotone identified a total of 103 flora species from 42 families. The breakdown of species diversity is detailed in **Table 4B.62**.

Table 4B.62 Species Richness and Categories in each Study Site

	Total - all sites
No. of Species	103
Families	42
Ferns	3
Pines	1
Dicotyledons	66
Monocotyledons	32
Exotics	32
% Exotic	31%

A list of all flora species recorded and identified from within the study area is included as **Appendix 1** of the Ecotone Report (SCSC 7).

4B.7.6 Vegetation Condition and Weeds

The vegetation of most of the study area has been transformed by the high levels of past clearing, grazing, plantations and/or other disturbances. Most of the weed species are herbaceous and not present at particularly high densities, but some species of woody weed are present.

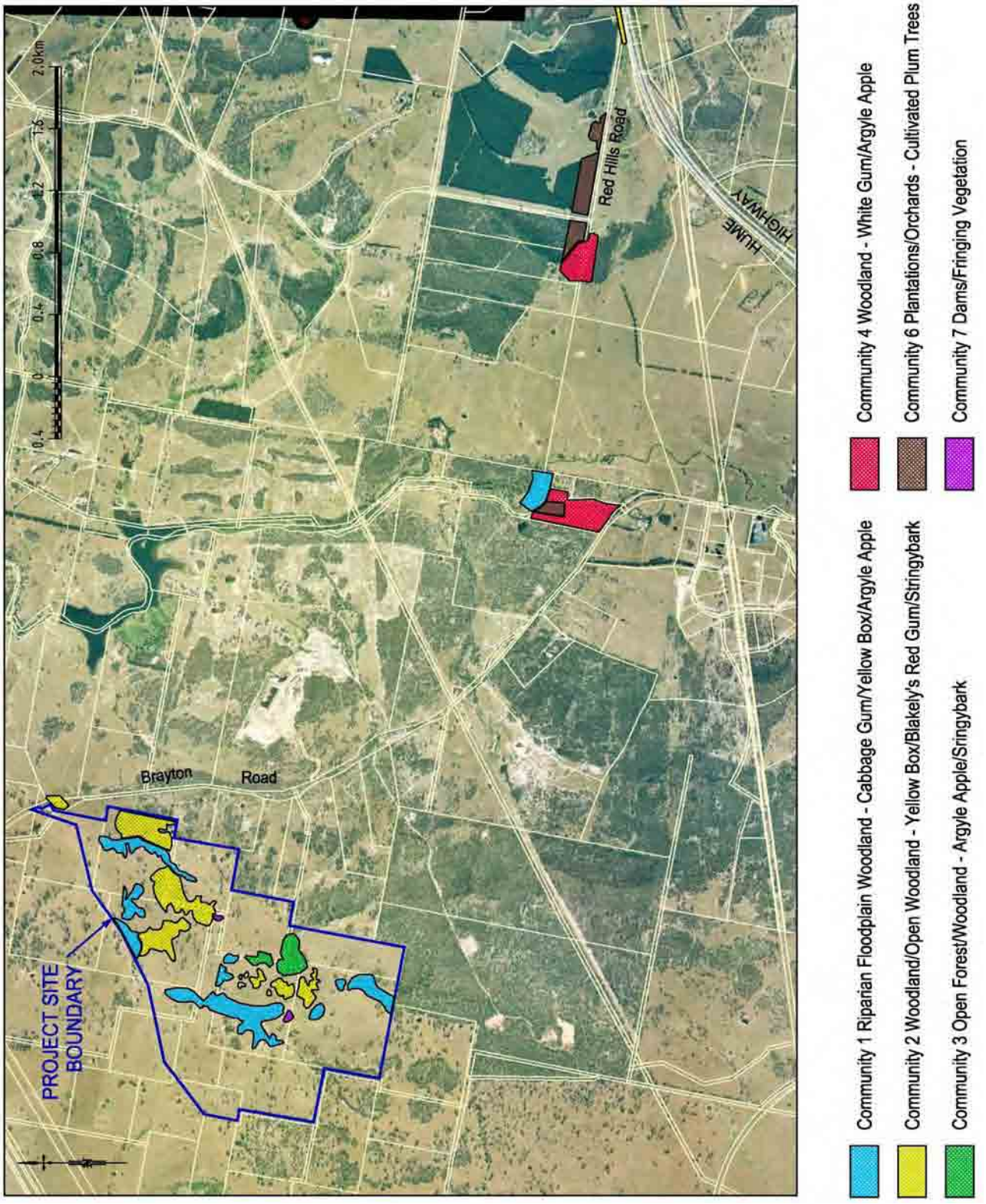
Five of the species recorded in the study area are declared Noxious Weeds in the control area of Goulburn Mulwaree Council. These, together with their relevant control classes, are:

- Blackberry (*Rubus fruticosus*) – Class 4
- Paterson's Curse (*Echium plantagineum*) – Class 4
- Serrated Tussock (*Nassella trichotoma*) – Class 4
- St. Johns Wort (*Hypericum perforatum*) – Class 3
- Sweet Briar (*Rosa rubiginosa*) – Class 4

Explanations of the relevant control categories are as follows:

Class 3: The plant must be fully and continuously suppressed and destroyed.

Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. Additionally for Blackberry and Serrated Tussock: the plant may not be sold, propagated or knowingly distributed.



Gunlake Quarry Project
Figure 4B.21 Vegetation Communities

To address legislative requirements, Council has adopted the following Policies:

- Management Plan for the Enforcement of Class 4 Noxious Weeds
- Noxious Weed Management Program Guidelines

Gunlake will implement weed control in accordance with these policies.

By far the most significant and potentially serious noxious weed present within the study area is Serrated Tussock, which was present at high abundance particularly in the pasture areas (Community 8) in the study area.

Apart from declared noxious species, common environmental weed species within the study area included mainly exotic pasture grass species and minor occurrences of herbaceous pasture and roadside weed species.

4B.7.7 Fauna

Ecotone positively identified 88 fauna species, comprising 84 native and 4 introduced species. In addition, 2 probable identifications and 2 possible identifications of insectivorous bat species were made using ultrasonic call analysis. A list of all species recorded in the study area during this survey is presented in **Appendix 2** of the Ecotone Report (SCSC 7).

Mammals
During the survey period 20 mammal species were positively recorded in the study area, comprising 17 native and three introduced species. In addition to these, 2 insectivorous bats were given a probable identification (*Mormopterus sp. 4 (Adams et al)* Southern Freetail-bat and *Falsistrellus tasmaniensis* Eastern False Pipistrelle) and 2 were given a tentative (possible) identification (*Myotis macropus* Southern Myotis and *Scotorepens greyii* Little Broad-nosed Bat).

Evidence of wombat activity was observed throughout the subject site and Sugar Gliders were seen or heard during most spotlighting and call playback sessions. Other commonly recorded mammals included Grey Kangaroos and Rabbits. Insectivorous bats made up half of the mammal species recorded within the study area.

In terms of threatened mammals species, one threatened insectivorous bat was positively identified, ***Miniopterus schreibersii oceanensis*** **Eastern Bent-wing Bat**, listed as **Vulnerable** on the TSC Act. In addition, ***Falsistrellus tasmaniensis*** **Eastern False Pipistrelle** was given a probable identification and ***Myotis macropus*** **Southern Myotis** was given a tentative (possible) identification based on ultrasonic call analysis. Both of these species are listed as **Vulnerable** on the TSC Act.

Reptiles
Ecotone recorded 6 species of reptile during the survey period. These were *Amphibolurus muricatus* Jacky Lizard, *Egernia cunninghami* Cunningham's Skink, *Hemiergis decresiensis*

Three-toed Skink, *Lampropholis guichenoti* Garden Skink, *Tiliqua scincoides* Eastern Blue-tongued Lizard and *Pseudechis porphyriacus* Red-bellied Black Snake.

Frogs
Ecotone recorded 7 species of frog at dams and pools of water within creeklines in the area. These were *Crinia parinsignifera* Plains Froglet, *Crinia signifera* Common Eastern Froglet, *Limnodynastes peronii* Striped Marsh Frog, *Limnodynastes tasmaniensis* Spotted Grass Frog, *Uperoleia fusca* Dusky Toadlet, *Uperoleia laevigata* Red-groined Toadlet and *Litoria peronii* Peron's Tree Frog.

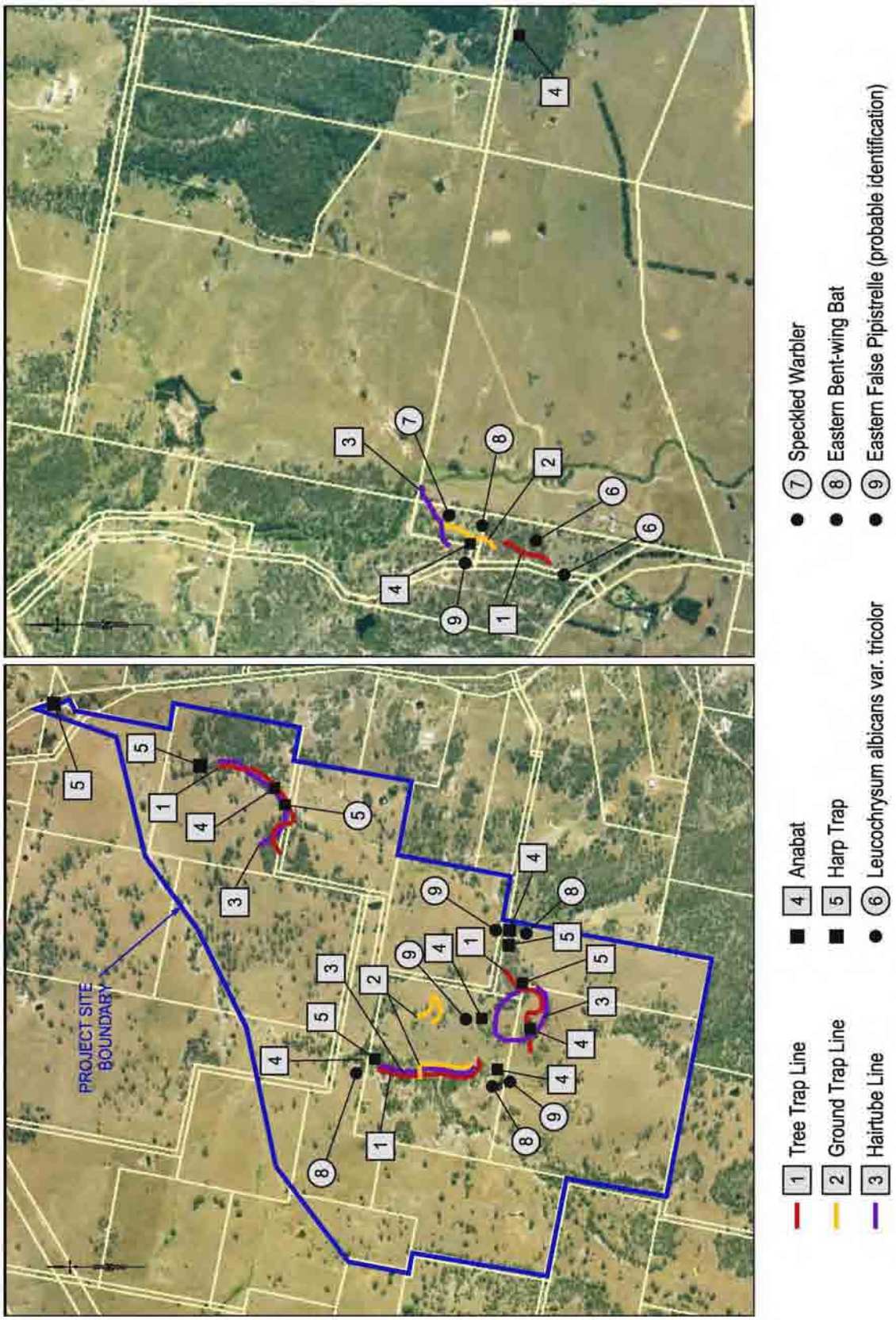
Birds
Ecotone recorded 65 bird species within the study area, comprising 64 native and one introduced species. Many of the bird species were recorded in areas where the trees remain, with the introduced Common Starling tending to dominate open areas within the subject site. One threatened bird species, *Pyrrholaemus sagittatus* Speckled Warbler, was recorded within the subject site. Two individuals of this species were recorded foraging in introduced shrubs (plum trees) in the old tip area at near the proposed crossing of Joarimin Creek. The Speckled Warbler is listed as **Vulnerable** on the TSC Act.

Habitat Trees
A number of habitat trees were recorded within the subject site, most with small hollows. Few of the habitat trees recorded contain medium or large hollows. It is estimated that seven habitat trees from within the Project Site will require removal as a result of the proposed development. Of these, 4 were observed to contain medium or large hollows, with the remaining 3 containing only small or possible hollows.

Fauna Diversity
Fauna diversity within the study area was found to be high despite the level of past clearing, grazing pressure and drought conditions. Ecotone considered that due to the short time frame of the field survey, other common fauna species would be recorded with further survey work. Any regeneration of native vegetation within the site (particularly of the understorey) due to a decrease in grazing pressure and adequate rains in the area would increase the quality of fauna habitat available, particularly for ground dwelling or ground foraging animals.

Significant Fauna Species
Ecotone positively identified 2 threatened fauna species, (*Pyrrholaemus sagittatus* Speckled Warbler and *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat), which were positively recorded within the subject site during the survey period. In addition to these, *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) was given a probable identification and *Myotis macropus* (Southern Myotis) given a tentative (possible) identification based on ultrasonic call analysis. All of these species are listed as **Vulnerable** on the TSC Act. Other threatened species have potential to occur or occasionally visit the subject site, in particular some of the more nomadic bird species such as the Black-chinned Honeyeater, Regent Honeyeater, and Swift Parrot, which may visit during peak flowering periods.

Figure 4B.22 shows where the positively identified threatened species were observed.



Gunlake Quarry Project
Figure 4B.22 Locations of Positively Identified Threatened Specifies

4B.7.8 Flora and Fauna Impacts

The proposed Gunlake Quarry and associated haul and By-pass roads are likely to result in the loss of some woodland vegetation, including the loss of some hollow-bearing trees.

In terms of threatened fauna, the most likely impact is an increased risk of road death or injury from increased vehicle activity within the area. For some hollow-reliant species (eg. threatened microbats, Squirrel Glider), there is the potential for some roosting or breeding hollows to be lost as some hollow-bearing trees will be removed. It is uncertain what impacts may result from increased noise, dust and night-time light from the proposed quarry, though some species may move away from the works and road areas.

Although overall impacts on threatened species are likely to be minimal for most of the identified subject species and ecological communities, an assessment of impact under the provisions of Section 5A of the *Environmental Planning and Assessment Act* 1979 and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 was undertaken. These are known as "seven-part tests". The details of this assessment are included in Section 4.2 of the Ecotone Report (SCSC).

4B.7.8.1 Threatened Species Conservation Act

Flora
No threatened flora species listed by the NSW TSC Act were recorded within the study area, but there is a small chance that one or more of the potential subject species could nevertheless be present, given the large size of the study area and the severe drought conditions at the time of the survey. One or two species (e.g., *Genoplesium plumosum*, the Tallong Midge Orchid which dies back after flowering) may simply not have been detectable, considering the condition of the habitat and diminished nature of the ground layer. As a purely precautionary measure, the seven-part test was applied to these species.

One endangered ecological community (EEC) listed by the TSC Act was identified as occurring within the study area. The proposed quarry and associated roads would remove and/or disturb some habitat for the EEC identified as the *White Box Yellow Box Blakely's Red Gum Woodland* (Box-Gum Woodland) community.

In relation to the seven-part tests for these threatened species and endangered ecological community, Ecotone determined that no threatened flora species are considered likely to be affected by the proposal. In the unlikely event that any are affected, Ecotone concluded that the impact would not be significant. Because of its limited scale in relation to areas of similar or better quality habitat that would be retained, the minor loss of modified and degraded *White Box Yellow Box Blakely's Red Gum Woodland* (Box-Gum Woodland) community vegetation resulting from the proposal is unlikely to have a significant effect on the EEC that currently occurs in the study area or on the conservation of flora in the area in general.

Fauna

In their assessment, Ecotone positively identified 2 threatened fauna species, being *Pyrrholaemus sagittatus* Speckled Warbler and *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat. In addition to these, *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) was given a probable identification and *Myotis macropus* (Southern Myotis) given a tentative (possible) identification based on ultrasonic call analysis. The Southern Myotis was not initially considered a potential subject species based on the available habitat and lack of records within the study locality. However, given that a possible call was recorded during the survey, this species was assessed as a potential subject species. In total, 19 threatened species are known or considered to have potential to occur within the subject site. These subject species were assessed using the 7-part test.

Details of the assessment are included in Section 4.2. of the Ecotone Report (SCSC 7).

In relation to the seven-part tests for these threatened species and endangered ecological community, Ecotone determined that the main impact is likely to be the increased vulnerability of the Speckled Warbler and other fauna to road death or injury due to increased vehicle activity in the study area.

Two speckled warblers were recorded at the By-pass Road site near the proposed intersection with Brayton Road. The proposed road through this area would result in the fragmentation of speckled warbler habitat and increased traffic associated with the road would lead to an increased risk of death due to vehicle strike. The By-pass Road would have a speed limit of 80km/h with an average of 80 vehicle movements in a 24 hour period, increasing in peak times to 120 vehicle movements with the possible addition of 5 vehicles per day from local traffic. In peak periods this would result in an approximate maximum of 60 vehicle movements during daylight hours, or roughly five vehicles per hour. Given the T-intersection with Brayton Road and relatively sharp bend within 500m it is unlikely that traffic will be travelling at the permissible speed along the section of road that passes through speckled warbler habitat.

The speckled warbler is known to be susceptible to local extinction in vegetation remnants of less than 100ha. Based on aerial photography of the region, the vegetation remnant that includes the site where the two speckled warblers were sited covers a minimum of 170ha (excluding vegetation south of Brayton Road). While the proposal would result in some loss of habitat along the road area and lead to increased traffic and risk of road death in the area, it is not expected that the proposed development will have such an impact that the local population of speckled warbler would be placed at risk of extinction. A number of mitigative measures may assist in minimising impacts on the speckled warbler. These are listed below:

- The speckled warbler lays its eggs sometime between August and January in a nest that it builds on the ground amongst fallen branches or litter, or at the base of a low, dense plant. Any works activities within the haul road site (in particular vegetation clearing) should take place out of the breeding season for the Speckled Warbler so as to avoid destroying any nest sites containing eggs or chicks. If a nest containing eggs or chicks is discovered during clearing operations, it and the surrounding vegetation should be left until the young are fully mobile and capable of fending for themselves.

- Excluding grazing from within this section of the By-pass Road would allow natural regeneration of speckled warbler habitat.

- Active regeneration of degraded habitat would assist in improving the quality of speckled warbler habitat, however it is important to retain the existing exotic shrubs and small trees until suitable replacement native habitat is in place as these currently provide important habitat for the speckled warbler.

- Replanting existing cleared areas at the Project Site with suitable vegetation would assist in extending speckled warbler habitat in the general area. This could be linked to the planned riparian vegetation establishment areas and would be most beneficial in the south-eastern corner, or elsewhere within the site where the replanting areas would connect to existing vegetation off-site.

One potential impact that could affect hollow-reliant fauna would be the loss of habitat associated with the removal of hollow-bearing trees. Seven habitat trees within the proposed quarry area are expected to require removal and others elsewhere within the site may also be removed. Ideally all hollow-bearing trees within the subject site should be marked in the field and accurately surveyed. The road routes will be planned so as to avoid all potential hollow-bearing trees wherever possible.

Potential indirect impacts from increased noise, dust and night-time light could result in some species moving further away from the works and road areas.

None of these predicted impacts are expected to place any local population of a threatened fauna species at risk of extinction. The general conclusions indicate that the proposal is unlikely to significantly impact upon any local population of threatened species or any endangered population, ecological community or their habitats.

4B.7.8.2 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

This Act focuses Commonwealth interests on matters of national environmental significance including integrated biodiversity conservation and the management of important protected areas.

The matters of national environmental significance (NES) as identified in the Act which require assessment and approval to be addressed by the Commonwealth include:

- World Heritage properties
- National Heritage places
- Ramsar wetlands
- Nationally threatened species and ecological communities (Part 13, Division 1, Subdivision A of the EPBC Act)
- Migratory species
- Commonwealth Marine areas
- Nuclear actions (including uranium mining).

The assessment and approval process applies to any action that has, will have or is likely to have a significant impact on a matter of NES. An action is defined as a project, development, undertaking or an activity or series of activities.

The only matters of NES that could be relevant in the case of the Gunlake Quarry proposal are nationally threatened species and ecological communities, and migratory species.

Flora

One threatened flora species listed exclusively as Endangered under the EPBC Act (*Leucochrysum albicans* var. *tricolor* - Hoary Sunray) was recorded along parts of the By-pass road route. The species appeared to be restricted to the eastern parts of the site, including alongside the access road to the old tip site (Joarimin Creek Road) not far from the gate into the site and in cleared and disturbed land that once formed part of the tip itself, in the eastern part of the property. The species appeared to be restricted to more open areas and was not recorded within the proposed alignment for the By-pass road. Therefore, provided that the proposed By-pass road follows the alignment currently proposed, the local population of the species is not expected to be adversely affected. It is possible that the proposed road could remove some individuals that were not detected during the survey, or individuals that may become established within the proposed alignment, in the time before the road is constructed. The action proposed is unlikely to have a significant impact upon this species provided that disturbances are confined to the proposed alignment itself and reasonable measures are taken to prevent invasive species becoming established in habitat adjacent to the known occupied habitat for the species.

Fauna - Threatened and Migratory

No threatened or migratory fauna listed in the EPBC Act were recorded during the field survey. With regard to threatened fauna, potential habitat occurs within the subject site for three species listed in the EPBC Act, *Lathamus discolor* (Swift Parrot), *Xanthomyza phrygia* (Regent Honeyeater) and *Chalinolobus dwyeri* (Large-eared Pied Bat). None of these species were recorded during the field survey.

The Endangered Swift Parrot and Regent Honeyeater may forage within the study area on an occasional opportunistic basis, particularly during peak flowering periods. Potential foraging habitat exists for the Vulnerable Large-eared Pied Bat, though no suitable roosting habitat exists as this species roosts in caves, culverts and other similar structures. None of these species will be significantly impacted upon based on the criteria for endangered and vulnerable species.

With regards to migratory species, three have potential to pass through or occasionally forage within the study area. These are *Hirundopus caudacutus* (White-throated Needletail), *Merops ornatus* (Rainbow Bee-eater) and *Xanthomyza phrygia* (Regent Honeyeater). None of these species are expected to breed within the study area. The proposal is not expected to have any impact on the ability of listed migratory species to travel across the landscape or to breed within the locality.

Threatened Ecological Communities

One threatened ecological community listed under the EPBC Act was identified as occurring within the study area. *White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (formerly ‘Grassy White Box Woodlands’) is the equivalent

threatened community to the *White Box Yellow Box Blakely's Red Gum* EEC as listed under the NSW TSC Act 1995. The EEC is listed as Critically Endangered under the EPBC Act 1999. However, the Commonwealth definition only includes remnants that are in relatively good condition to qualify for the EEC. On the basis of the list of criteria given in the listing information for the EEC, Ecotone determined that Community 2 generally corresponds to the EEC but not Community 1. Therefore the EEC as listed by the EPBC Act is more restricted in distribution than the equivalent community listed by the TSC Act. Ecotone concluded that the removal of small, fragmented areas of remnant trees and shrubs constituting the community in the study area would not result in a significant impact on the critically endangered ecological community, Therefore, no further assessment in relation to threatened flora or ecological communities was required pursuant to the EPBC Act.

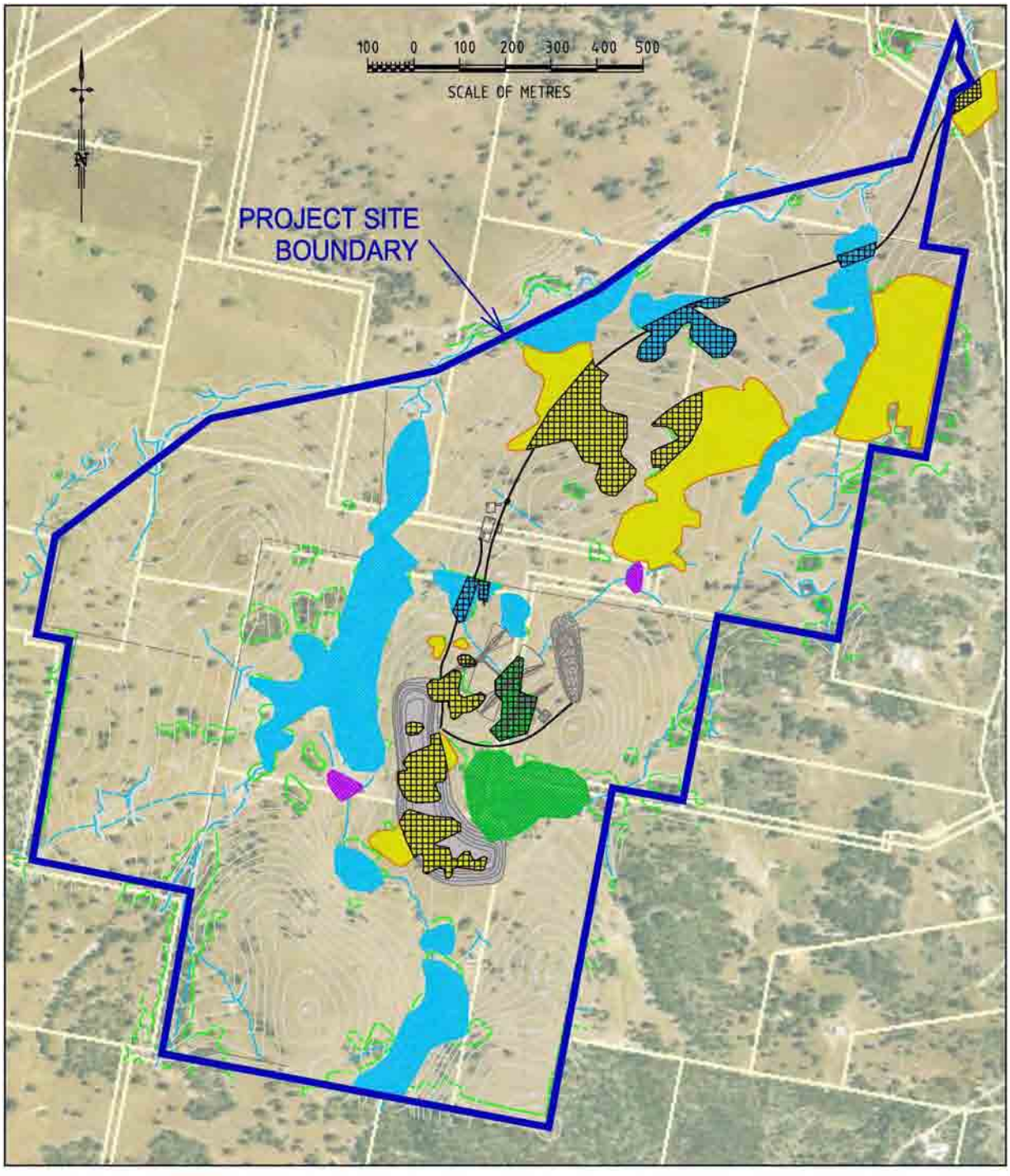
The proposed development in the quarry site will remove or modify up to 7.8ha of Box Gum Woodland EEC, which mostly occurs in highly disturbed and degraded condition within the subject site. **Figure 4B.23** shows the areas of vegetation that would be cleared or modified. Of the vegetation communities identified, Communities 1 and 2 are considered to qualify as the EEC. An area of 1.6ha of Community 1 and an area of 6.2ha of Community 2 would be affected by the proposal.

The proposal will remove up to approximately 0.5ha of the EEC from the By-pass road site, however this figure may vary slightly since the exact alignment of the road has not yet been finalised. Since the proposed haul road will not be required for another five years or so, every effort will be made to select a route that minimises the loss of any vegetation, particularly the EEC which only occurs along the creek bank for a short distance, plus a small area of regrowth EEC in a highly degraded condition alongside the Hume Highway.

The DECC Queanbeyan office advised that local' should be considered to be an area within a 5km radius of the centre of the Project Site. 'Regional' refers to the bioregion in which the subject site occurs according to the national IBRA bioregionalisation system. In this case the region is defined as the entire South Eastern Highlands bioregion.

Most of the area within a 5km radius of the centre of the Project Site is shown as supporting Southern Tableland Grassy Woodlands to a land cover of less than 1%. Therefore, on this basis up to 79ha. of the EEC is predicted to occur within a 5km radius of the site. Since at least 37ha. of the EEC (18 haof Community 1 plus19ha of Community 2) were mapped within the study area alone, the predicted figure of 79ha for the EEC within a 5km radius is likely to be an underestimate. As a result of the proposal, up to 7.8ha of EEC would be affected. On this basis, up to 21% of the EEC would be removed or modified from within the quarry site, and up to 10% within a 5km radius (although this figure is probably an overestimate as discussed).

In terms of regional loss, the northern half of the South Eastern Highlands bioregion contains large areas supporting Box Gum Woodland with land cover of between 1 and 50%. Much of the remainder of the bioregion supports remnants of the EEC with land cover similar to that of the local area. Box Gum Woodland occurs in approximately half the area of the bioregion as a whole. The total area of Box Gum Woodland in the bioregion would probably amount to thousands of hectares. The loss or modification of up to 7.8ha. of the EEC from the quarry site plus up to 0.5ha from the haul road site would be insignificant in the regional context.



Gunlake Quarry Project
Figure 4B.23 Cleared Vegetation Communities

Ecotone emphasised that the EEC is in poor condition throughout the Project Site. The above estimates of areas of the EEC that would be removed or modified include patches in which the tree layer has been substantially thinned and the shrub layer entirely removed. All areas of the EEC are subject to ongoing grazing and include a significant component of weeds and exotic species, notably serrated tussock grass.

Key Threatening Processes
To date, 17 key threatening processes have been listed under the EPBC Act, most of which are equivalent to key threatening processes listed under the NSW TSC Act. Those that may be most relevant to the Gunlake Quarry proposal include:

- Land Clearance
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)
- Competition and land degradation by feral Rabbits
- Predation by feral Cats
- Predation by the European Red Fox (*Vulpes vulpes*)
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.

The equivalent key threatening processes were also assessed as part of the NSW EP&A Act section 5A assessment process, and found to be either insignificant or readily manageable within the context of the quarry proposal.

No other NES Matters or other matters protected by the EPBC Act are directly relevant to the study area. Therefore the specific assessment process under the provisions of the *EPBC Act* 1999 is not required for the Gunlake Quarry development, since it does not constitute an action that is likely to have an impact on any Matter of National Environmental Significance.

4B.7.8.3 Native Vegetation Act 2003

The remnant areas of vegetation within the study area are defined according to the recently-enacted *Native Vegetation Act 2003* as “Remnant Vegetation”.

Normally, approval to clear any quantity of remnant vegetation within a site under the *Native Vegetation Act 2003* on a rural-zoned property would be required from the NSW Department of Natural Resources and managed by the relevant Catchment Management Authority (in this case the Hawkesbury Nepean Catchment Management Authority). The Gunlake Quarry Project is being assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. This means that the proposal will not formally be subject to the requirements of the *Native Vegetation Act*, however Gunlakes proposed vegetation management will be generally consistent with the requirements of this Act.

4B.7.8.4 Rivers and Foreshores Improvement Act 1948

The *Rivers and Foreshores Improvement Act 1948* is gradually being replaced by the *Water Management Act 2000*. However until that happens in full, the *Rivers and Foreshores Improvement Act 1948* still applies. Under the Act, a Part 3A permit would be required for specified activities in protected waters or protected land within the subject site. Protected waters includes all clearly defined drainage lines, and protected land is defined as the bank,

bed and shore of the protected waters, plus adjacent land within 40m of the top of the bank. A Part 3A permit is required for activities involving the excavation or removal of material from protected land or any activity which might obstruct or detrimentally affect the flow of protected waters.

This would normally apply to Chapman's Creek and Joarimin Creek and any major tributaries within the subject site, including all land within 40m of the top of the stream bank. It may also apply to land further than 40m from the water body, if an activity poses a threat to protected waters or protected land.

The Gunlake Quarry Project is being assessed under Part 3A of the *Environmental Planning and Assessment Act 1979.* This means that the proposal will not formally be subject to the requirements of the *Rivers and Foreshores Improvement Act*, however Gunlake's proposed approach to activity within 40m of protected waters and within protected lands will be generally consistent with the requirements of this Act.

SEPP Koala Habitat Protection

Prior to a Development Application for bushland areas being approved, the following considerations need to be assessed:

- identification of "potential Koala Habitats" within the proposed development area; if the total tree cover contains 15% or more of the Koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be "potential" Koala habitat;

- identification of "core Koala habitat" within the development area. "Core Koala habitat" is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;

- identification of "core Koala habitat" will require that a plan of management must accompany the DA application;

- if the rezoning of lands, other than to environmental protection, involves potential of core Koala habitat then the Director of Planning may require a local environmental study be carried out.

The Mulwaree LGA is listed in Schedule 1 of SEPP 44, therefore it applies to the Gunlake Quarry Project.

Only one listed preferred food tree species (*Eucalyptus viminalis* Ribbon Gum) was recorded within the study area. This species is restricted to a few individuals near Joarimin Creek and do not constitute 15% or more of the total tree cover. Therefore the area does not constitute potential Koala habitat as defined in SEPP 44.

While the study area does not constitute "potential" Koala habitat based on the SEPP 44 assessment, the Draft Recovery Plan for the Koala *Phascolarctos cinereus* (NPWS 2003a) lists secondary food tree species and supplementary species used by Koalas in the Central and

Southern Tablelands. Of these, the following species were recorded within the study area during the field survey:

Secondary Food Tree Species

Eucalyptus cinerea (Argyle Apple)
Eucalyptus blakelyi (Blakely's Red Gum)
Eucalyptus bridgesiana (Apple Box)
Eucalyptus melliodora (Yellow Box)

Supplementary Species

Eucalyptus macrorhyncha (Red Stringybark)

Due to the presence of these species, searches were undertaken for any evidence of Koala activity at three different quadrats within the subject site and Koala calls were played as part of the nocturnal call playback surveys. No Koala scats or any other evidence of Koala activity was observed during the call playback surveys, Koala scat searches or opportunistically throughout the survey period. While some records of Koalas occur within a 5km radius of the Project Site, most of the records within the locality come from Morton National Park, Bungonia State Recreation Area and other large tracts of bushland.

The results of the field survey and a review of Koala records within the study locality indicate that no resident population of Koalas occurs within the study area.

4B.7.8.5 Areas Impacted By Quarry Activities

Ecotone estimated that up to 8.8ha of vegetation in total would be impacted by the quarry, associated buildings, irrigation areas and access road. The breakdown of vegetation from each community that would be impacted is given in **Table 4B.63.**

Table 4B.63 Areas of Native Vegetation Affected by Quarry Operations

Vegetation Community	Area Impacted (ha)	EEC?
1 – Riparian Floodplain Woodland	1.6	Yes
2 – Yellow Box / Red Gum Open Woodland / Woodland	6.2	Yes
3 – Argyle Apple / Stringybark Open Forest / Woodland	1.0	No
Total	8.8	-

The exact area of natural vegetation that would be impacted in the By-pass road site cannot be calculated at this stage, since the exact route alignment has not been finalised. However, a 20m strip of land was studied for the entire length of the proposed By-pass road in order to cover any variation in the location of the proposed 8m road formation. When the By-pass road is required at Stage 2, a final route will be designed to minimise the amount of vegetation that would be affected, taking particular care to avoid mature and habitat trees. As with the quarry site, most of the natural vegetation in the haul road site is partly cleared and disturbed. The vast majority of the intended route passes through cleared pasture, pine plantation, an abandoned orchard, an existing road or along an existing vehicle track though remnant vegetation near Brayton Road.

The areas to be impacted by various components of the proposal in the quarry site are shown in **Figure 4B.23**. The areas of anticipated impact shown are generous, and not as much vegetation may actually be affected as shown.

4B.7.8.6 Hollow-bearing Trees

Along the Quarry Access Road and on the Project Site, a total of 23 hollow-bearing trees are considered likely to be removed as they lie within areas expected to be cleared for the quarry and associated infrastructure. Eight hollow-bearing trees are located on the edge of the planned works area and it is uncertain whether these will require removal. Twelve of the surveyed hollow-bearing trees are unlikely to require removal. There may be some scope to reduce the number of hollow-bearing trees removed by slightly modifying the location of site offices, fencing or other elements of the project.

Prior to clearing activities, these identified hollow-bearing trees would be marked and an experienced fauna handler would be present when the trees are removed. As hollow logs and fallen trees provide habitat for a range of fauna species, felled hollow bearing trees would be retained on site and left as fallen timber.

Gunlake will design the By-pass road route that will minimise mature tree loss along the haul road site. At the detailed planning stage the trees that may be affected would be assessed in the field.

The potential impact of the removal of hollow-bearing trees on threatened hollow dependent fauna was assessed for each of the relevant subject species using the seven-part test. In addition to threatened species, a number of other fauna species have potential to utilise hollow-bearing trees within the Project Site, including birds, arboreal mammals, insectivorous bats, reptiles and frogs. Those identified potential impacts on threatened fauna are more thoroughly explored below.

Ten threatened hollow dependent fauna species have been identified as having potential to occur within or occasionally visit the study area and are considered subject species. These are listed below along with the hollow size they require:

- Barking owl (large)
- Brown treecreeper (medium)
- East-coast freetail-bat (small-medium; also roosts under exfoliating bark)
- Eastern false pipistrelle (small-medium; also roosts under exfoliating bark)
- Gang-gang cockatoo (large)
- Glossy black-cockatoo (large)
- Masked owl (large)
- Powerful owl (large)
- Squirrel glider (medium)
- Turquoise parrot (medium – this species will also nest in hollow logs on the ground)

Barking owl, gang-gang cockatoo, glossy black-cockatoo, masked owl and powerful owl:

The barking owl, gang-gang cockatoo, glossy black-cockatoo, masked owl and powerful owl are all reliant on trees containing large hollows for breeding or roosting purposes. None of these species were recorded during the field survey, though individual records of the gang-gang cockatoo and powerful owl exist within five kilometres of the Project Site. Based on the habitat tree survey within the main Project Site, two dead stags containing large hollows are likely to be removed as a result of the proposal, and an additional one may require removal. Very few trees containing large hollows were observed along the By-pass Road route and it is unlikely that any will require removal as a result of the proposed road.

While there was no evidence that any of the trees containing large hollows were being used by nesting birds, they do provide potential habitat for these five threatened fauna species. In the unlikely event that a nest tree for one of these species was to be removed during the breeding season, this could potentially result in the loss of eggs or nestlings and possibly adult birds.

Squirrel glider, brown treecreeper, turquoise parrot:

The squirrel glider, brown treecreeper and turquoise parrot are reliant upon trees containing medium hollows for breeding or roosting purposes, although the turquoise parrot is also known to nest in hollow stumps, fence posts and hollow logs on the ground. None of these species were recorded during the field survey, although individual records of the brown treecreeper and squirrel glider have been recorded within five kilometres of the Project Site. In the case of the brown treecreeper, it is considered unlikely to occur within the Project Site as this species requires large areas of contiguous habitat. Given the lack of records within the locality and lack of a suitable grassy understorey within the site, the turquoise parrot is also considered unlikely to occur at the Project Site. All three species have some potential to occur at the By-pass Road site and in native vegetation west of Red Hills Road.

Up to nine trees or dead stags containing potentially suitable hollows for these three species may be removed from within the Project Site as a result of the proposal. Few trees containing medium-sized hollows were observed along the By-pass Road route and is expected that the road would be able to be designed so as to avoid affecting most of these trees.

With regard to the squirrel glider, while the removal of trees containing medium-sized hollows could potentially result in the loss of a roost tree, the bulk of hollow-bearing trees within the subject site will be retained and it is unlikely that the removal of these trees would place a local population of the species at risk of extinction. At a worst case scenario, individual gliders could potentially be killed during clearing operations. This would be mitigated against by having an experienced fauna handler present during clearing operations and by bringing trees down gently or felling in sections.

Trees containing potential suitable nesting hollows for the brown treecreeper and turquoise parrot are likely to be removed as a result of the proposal. In the unlikely event that a nest tree was to be removed during the breeding season, this could potentially result in the loss of eggs or nestlings and possibly adult birds.

East-coast freetail-bat and eastern false pipistrelle:

The east-coast freetail-bat and eastern false pipistrelle are reliant upon hollow-bearing trees for roosting and breeding purposes and are most likely to use small and medium-sized hollows, although they will also roost behind exfoliating bark. Individual records of both the east-coast freetail-bat and the eastern false pipistrelle occur within five kilometres of the Project Site, however only probable calls of the eastern false pipistrelle were recorded during the field survey. Up to 31 trees containing potentially suitable roosting or breeding habitat for these bats may be removed as a result of the proposal, however the bulk of hollow-bearing trees within the site will be retained.

As both of these bat species exhibit a large home range and are likely to utilise a variety of roosts within that range, it is considered unlikely that the loss of potential roost trees associated with the proposal would result in a local population of either species being placed at risk of extinction. However in the unlikely event that a maternity roost is destroyed during the breeding season, this could have a significant impact on the local population of that species. Individual bats could also be killed if a roost tree is removed during winter when bats are in torpor.

General comments:

The DECC Queanbeyan office was contacted for further advice regarding this issue and according to Allison Treweek, the two hollow-reliant species of most concern were the gang-gang cockatoo and the eastern false pipistrelle. In order to minimise potential impacts on these two species, an experienced fauna handler would be present when hollow-bearing trees are removed and the recommended timing for tree removal is between March and May inclusive or September.

If clearing operations are unable to be timed so as to avoid the main spring/summer breeding period and winter months when bats enter torpor, then a number of mitigative measures would be implemented to assist in reducing impacts on hollow-reliant fauna. These include pre-clearing surveys of those hollow-bearing likely to be removed and the presence of an experienced fauna handler during clearing operations. In addition, felling trees in sections or laying them down gently would minimise the risk fauna being injured. If a nest or maternity roost is discovered during clearing operations, this tree would be left standing until an ecologist has reviewed the situation.

4B.7.8.7 Flora and Fauna Management Commitments

In order to maximise conservation of local flora and fauna and to ameliorate impacts of the proposal on the local natural environment (including potential habitat for threatened or significant species or ecological communities), Gunlake has committed to the following steps:

- As wide a buffer as possible will be maintained between the top of the creek bank and the edge of the proposed quarry pit, haul road or By-pass roads (except where creek crossings are required).

- Habitat trees will be retained if possible. As some habitat trees are likely to require removal, this should be timed so as to avoid the breeding season of hollow-reliant threatened fauna such as the Brown Treecreeper and hollow-roosting bat species. In addition, tree removal should not take place in winter as hollow-roosting bats enter torpor at this time of year. Ideally habitat trees should be removed between January and April.

- For any habitat trees being removed during tree-felling operations, an experienced wildlife handler will be in attendance in order to rescue injured or displaced wildlife.

- As Speckled Warblers were observed foraging in introduced shrubs and small trees near the By-pass road route these will be retained. If any bush regeneration activities are to take place in this area, the reestablishment of Speckled Warbler habitat (ie. suitable native shrubs and small trees) should be a priority. The existing introduced shrub and small trees will not be removed until suitable replacement native habitat is in place.

- The Speckled Warbler lays its eggs sometime between August and January in a nest that it builds on the ground amongst fallen branches or litter, or at the base of a low, dense plant. Ideally any works activities within the haulage route between Brayton Road and Joarimin Creek (in particular vegetation clearing) will take place out of the breeding season for the Speckled Warbler so as to avoid destroying any nest sites containing eggs or chicks.

- Appropriate sediment and erosion control measures will be implemented for the duration of construction and quarrying operations in all affected parts of the study area. In particular, steps will be taken (silt fences, cut-off drains, detention basins etc.) to prevent silt and sediment from the quarry or roads from entering the watercourses.

- At the old tip site near the proposed Joarimin Creek crossing, a number of 'junk' piles of concrete, tin, etc. provide excellent habitat for a range of reptile species and these will be retained.

- Livestock proof fencing will prevent grazing of areas identified for regeneration.

- Offset areas will be set aside for regeneration of riparian corridors on the Project Site.

- A vegetation and weed management strategy will be prepared. Wherever possible, all shrubs, including dead plants, will be left in situ until suitable replacement native shrubs are able to provide important shelter for the Speckled Warbler and other small birds.

- Rehabilitation efforts will incorporate areas identified as forming part of the Endangered Ecological Community (EEC) in the study area. Assisted natural regeneration of the vegetation is the preferred approach wherever practical. However, if artificial plantings are to be used, only native species currently occurring on the subject site or local species listed as occurring within the EEC according to the Final Determination (NSW Scientific Committee 2002a) will be used.

- Prior to clearing for construction of the By-pass road between Brayton Road and Joarimin Creek, targeted seasonal flora surveys will be carried out to determine whether the Endangered species *Leucochrysum albicans* var. *tricolor* occurs within or immediately adjacent to the proposed road alignment. The likelihood of the species occurring in the alignment is considered to be very low but a targeted seasonal survey will allow for a more informed conclusion.

The DECC Queanbeyan office was contacted for further advice regarding additional investigation of the Tallong Midge Orchid. Allison Treweek from the office received advice from John Briggs who is a specialist on this species. John Briggs is of the opinion that unless any potential habitat for the species is on sandstone, then the species is extremely unlikely to occur. If this is the case, then DECC's position according to Allison Treweek is that further surveys for the species are unnecessary. The only potential habitat area for the species was in the far western end of the proposed haul road alignment, where a dense stand of the commonly associated species violet kunzea (*Kunzea parvifolia*) occurs. This area is not on sandstone, therefore the species is considered unlikely to occur. Accordingly, it is not proposed to conduct further survey work for the species.

4B.7.8.8 Flora and Fauna Assessment Conclusions

One threatened flora species listed by the EPBC Act, but not the TSC Act, was positively recorded within the study area. The Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) is listed as Endangered under the EPBC Act, and was recorded near but not within the alignment of the proposed By-pass road. It is not expected to be impacted by the proposal.

Remnants of vegetation of the Endangered Ecological Community (EEC) *White Box Yellow Box Blakeley's Red Gum Woodland* (Box Gum Woodland) as listed under the NSW *TSC Act 1995* were recorded. These areas correspond to vegetation Communities 1 and 2 shown on **Figure 4B.21**. However, given the different listing criteria, a more restricted area of remnants meets the definition of the equivalent *White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* ecological community which is listed as Critically Endangered under the Commonwealth *EPBC Act 1999*. The Commonwealth-listed ecological community generally corresponds to Community 2 only.

The current quarry, transport route and By-pass road proposal would result in the removal of a minor proportion of the total occurrence of the EEC in the study area and entire study locality, and possible indirect ongoing disturbances to the community during the operational phase of the quarry. However, assessment of the likely impacts on the EEC under the NSW and Commonwealth assessment provisions concluded that overall these are not considered to be significant, and recommendations have been made to ameliorate the effects of these impacts in Section 4B.7.8.7.

Two threatened fauna species, the Eastern Bent-wing Bat and Speckled Warbler, were positively identified within the subject site. In addition, a probable identification of the Eastern False Pipistrelle and a possible identification of the Southern Myotis were made using ultrasonic call analysis. A number of other threatened fauna species have potential to occur or occasionally visit the subject site on an opportunistic basis. The main impacts of the proposed

quarry and haul roads are expected to be an increased risk of injury or death from being hit by a vehicle, the loss of some known or potential habitat (in particular the removal of hollow-bearing trees) and the potential for some threatened species to move away from the proposed development area due to increased noise, dust and night-time light.

These potential impacts are not expected to significantly impact any population of threatened fauna species. The overall conclusion from the 'seven-part test' for threatened fauna is that there is unlikely to be any significant impact on any local population of threatened fauna in the area.

Other issues associated with the proposed Gunlake Quarry include minor vegetation removal and potential further degradation of ephemeral creek lines in the area. Vegetation clearing would be required as a result of the proposed development. The bulk of clearing at the Project Site would take place at the proposed quarry site, though some trees along the access road route may also require removal.

In addition, there will be vegetation removed along the proposed haul road route. While no known roost or nest sites for any threatened fauna species are expected to be affected, Gunlake will retain all habitat trees within the site wherever possible as they provide potential shelter and breeding habitat for a wide range of fauna species.

The potential impacts on flora and fauna within the study area will be mitigated by provision of compensatory habitat to offset the vegetation cleared or disturbed. This will include appropriate rehabilitation, regeneration and revegetation of suitable areas within the subject site, mainly involving riparian habitat.

Gunlake will prepare and implement a Site Vegetation Management Plan.

4B.8 Visibility

4B.8.1 Introduction

One of the positive characteristics of the Gunlake Quarry site is that it is not visible from the local road network or from adjacent property homesteads.

Distant glimpses can be had of the Quarry site from one property approximately 2km northwest of the Quarry Office. A topographic ridge isolates the Quarry from residences to the east and traffic on Brayton Road. The out-of-quarry overburden emplacement will provide a vegetated bund wall able to visually screen the quarry and rock processing facilities

The following sub-sections assess the existing visual amenity of the local setting, identify operational safeguards and mitigation measures and provide an assessment of the residual impacts following the implementation of these safeguards and mitigation measures.

4B.8.2 Existing Visual Amenity

4B.8.2.1 Introduction

Existing visual amenity is considered in relation to views of the Project Site. The potential to view the site from local roads was determined. The proposed transport route outside the vicinity of the Project Site would be predominantly along existing roads which have not been assessed for visual impact. The existing roads, Brayton Road and Red Hills Road will be connected by the By-pass road.

4B.8.2.2 Views of the Project Site

The existing topography of the local area, together with patches of trees provide a very effective screening of close views of the Project Site. Clear views of the Project Site cannot be had from the local road network. Long distance views (5km) of the Project components are possible from isolated parts of private properties. Views of the site tend to be obscured by topography or distance effects.

The transport routes will be visible, especially where Red Hills Road joins the Hume Highway. People will notice modified transport arrangements, but it is expected that these will be of general interest only and will not be significantly different from the views already being experienced by people travelling on the Hume Highway. The Highway is the main road route linking Sydney, Melbourne, Canberra and the significant rural populations in south east Australia.

People in vehicles travelling between Brayton and Marulan along Brayton Road would be unable to see the Project Site. They will see vehicles entering and leaving the Quarry on the access road, along Brayton Road and entering and leaving the By-pass road.

4B.8.3 Visual Controls

Topographical features and the remnant vegetation along local road easements offers natural screening of the proposed activities on the Project Site.

The following additional controls would be implemented.

- The Project Site would be progressively rehabilitated such that cleared or non-vegetated areas would be minimised. In particular, non-persistent cover crops would be sown immediately over areas to be rehabilitated prior to the establishment of the designated vegetation type.
- The overburden emplacement has been designed to provide additional visual and acoustic screening of the rock processing area and elements of the Project in that general vicinity. **Figure 2.13** illustrates the final landform of the emplacement.
- The height of the conveyor structures in the rock processing area has been restricted to less than 10m ensuring they are screened by topography and the overburden emplacement bund.

Other more general safeguards and controls to be implemented would include:

- minimising the extent of land disturbance / clearing in advance of quarrying;
- progressive rehabilitation of all disturbed areas within the Project Site;
- implementation of air quality controls as identified in Section 4B.5; and
- maintaining the quarry and associated buildings and areas of disturbance in a clean and tidy condition at all times.

There will not be any late night quarrying or rock processing activity. Lighting will be required to enable safe truck loading and this is planned to occur 24 hours per day apart from a break from Saturday to Sunday evening.

Permanent lighting or floodlights would be positioned and directed to minimise emissions, with lighting not required at any given time not used. Where the use of floodlights is required in the quarry, on the overburden emplacement or within the rock processing area, they would be directed downwards and away from the nearest non-project related residences and public roads.

4B.8.4 Assessment of Impacts

The general public will not have views of activities or disturbance on the Project Site. In addition, the Project Site lies within a rural landscape where areas of land are disturbed seasonally for agriculture-related purposes. Given Gunlakes's proposal to minimise the extent of surface disturbance in advance of quarrying and to implement progressive rehabilitation, together with the design features of the overburden emplacement to blend with the existing landform, the likely visual impact of the Project is assessed to be minimal and acceptable.

Notwithstanding the likely extent of visual impact, Gunlake will maintain regular communications with those residents close to the Project and implement any reasonable additional controls to further reduce the impact on their visual amenity should it be required.

4B.9 Bushfire

4B.9.1 Existing Bushfire Hazard

Table 2.1 in the NSW Rural Fire Service publication *"Planning for Bushfire Protection, 2006"*, identifies the development control process for developments in bushfire prone areas.

Where development is assessed in accordance with Part 3A of the EPA Act, the Department of Planning, in conjunction with the NSW Rural Fire Service, reviews the proposal in relation to bushfire protection measures.

Much of the Project Site has been cleared for agricultural activities and would be expected to exhibit a low bushfire hazard. The vegetation along and adjacent to the proposed transport

route comprises a mixture of cleared areas and small patches of native woodland vegetation. There is a pine plantation close to the alignment of the By-pass road.

Areas like the Project Site and proposed transport route should not be considered in isolation as the bushfire risk of surrounding areas may raise the level of bushfire risk associated with the site. The vegetation of land surrounding the proposed transport route is predominantly cleared for agriculture and is therefore likely, if anything, to decrease bushfire risk.

4B.9.2 Safeguards and Controls

The activities of the Project that may increase the risk of fire on the Project Site and proposed transport route, and the controls proposed to limit the risk posed by these are presented in**Table 4B.64**

4B.9.3 Assessment of Impact

The Project would undoubtedly increase the number and type of ignition sources in the local area. The proposed controls and safeguards, in conjunction with general clearing activities associated with the quarrying activities would, however, ensure that a low bushfire hazard was maintained on the Project Site and along the proposed transport route.

Table 4B.64 Bushfire Hazard – Activities and Controls

Activity	Possible Ignition Source	Safeguards and/or Controls
Blasting	• Ejected Shot	• Blast design to be undertaken by qualified personnel. • Inspection of blast conducted prior to blast. • Blast Management Plan to be prepared and followed. • Water truck available to douse any smouldering vegetation etc.
Refuelling	• Spilt fuel ignited by spark	• Refuelling undertaken within designated fuel bays or within cleared area of the Project Site. • Vehicles to be turned off during refuelling. • No smoking policy to be enforced in designated areas of the Project Site. • Fire extinguishers maintained within site vehicles.
General Activities	• Cigarette • Rubbish, eg. glass, metal.	• No smoking policy to be enforced in designated areas of the Project Site. • Focus on housekeeping to be maintained by mine management. • Water cart available to assist in extinguishing any fire ignited. • Site vehicles to carry a fire extinguisher.

4B.10 Socio Economic

4B.10.1 Background

The proposed Gunlake Quarry Project is located within a regional and rural setting in the Southern Tablelands of NSW. Recent demographic trends in Australia have demonstrated acceleration in the trend to the "move to the coast" phenomenon, or to large community centres, placing considerable stress and change on small centres.

Regional areas are often sensitive to employment loss where the economic support for villages and towns can be relatively single dimensional, ie. dominated by a single industry or even a single employer. Technology change, industry reform and rationalisation have led to closure of many regional businesses including key employers and economic drivers in a region.

In recent times, the increase in proposed hard rock quarries in the Marulan area has provided potential diversification of industry, employment generation and skills provision. In this context, the Project has the potential to maintain and increase the economic drive provided by this industry.

During construction, the Gunlake Quarry Project will require the services of earth moving contractors, structural steel fabricators and erectors, electricians, plumbers and general engineering services. During the operational stage the Quarry will require the services of maintenance workers and truck drivers. It is anticipated that the bulk of these services can be serviced by locally or regionally based companies and individuals. The services will be provided by people that are additional to quarry employees.

4B.10.2 Management Measures

4B.10.2.1 Social

Gunlake expects that of the 20 quarry employees, all but up to 5 would be sourced locally. Those not sourced locally would likely commute from their existing residences. Gunlake do not anticipate any direct increase in population as a result of the Project and do not anticipate any noticeable impact on housing, infrastructure or services in Marulan.

Agricultural Lands

Gunlake has minimised any potential impact through a commitment to return a proportion of the Project Site to agricultural land. The current agricultural potential for the land is low and highly productive agricultural lands will not be affected by the Project.

The areas associated with the out of pit emplacement and the depression remaining after the quarry has been rehabilitated will have reduced agricultural potential post-mining. However, they will be capable of limited production and will be operated in accordance with the agricultural/habitat conservation focus of ongoing property management.

4B.10.2.2 Economic

Apart from the potential contributions to the surrounding local communities, which may be either financial or in-kind contributions, Gunlake would be contributing significantly to the local economy through wages and payment for services. Gunlake will implement a policy that encourages employment of local district personnel, with arrangements for training and certification put in place to ensure suitable applicants can acquire the necessary skills.

Goulburn Mulwaree Council has a Section 94A Contributions Plan which was adopted in January 2004. The Plan was prepared in accordance with the requirements of Section 72 of the *Environmental Planning and Assessment Act, 1979* and the *Environmental Planning and Assessment Regulation, 2000*.

The plan states that among primary purposes include the following:

- To authorise the imposition of a condition on certain development consents requiring the payment of a levy determined in accordance with the plan.

- To assist the Council to provide the appropriate public amenities and services required to maintain and enhance amenity and service delivery within the Mulwaree Shire Local Government Area.

The Plan also details the framework for collection, management and expenditure of the funds collected.

4B.10.3 Impact Assessment

4B.10.3.1 Local Capacity

Impacts on local capacity are likely to be relatively modest considering the Project is unlikely to generate an increase in people migrating into the area to take up employment. It is expected that the bulk of employees will already be living in the immediate district or within commute distances.

It is assessed that any increase in demand on 'soft' infrastructure such as schools and medical services would be negligible or relatively minor and manageable.

The Project will improve the local road infrastructure. Provision of a connection between Brayton Road and Red Hills Road has been supported by Council for a number of years and will enhance the functionality of the area road network.

4B.10.3.2 Social

In addition to the direct and indirect employment opportunities that would arise from the Project, the following positive social impacts may occur:

- Maintenance of employment levels in the quarrying and related industry for the next 30 years, with potential to extend out to in excess of 100 years.
- Training opportunities for local people, in a growth industry (quarrying).
- Stimulus to local businesses, particularly in Marulan, including motel and hotel trade, cafes and restaurants, quarrying-related engineering and surplus spending activity.

With respect to potentially adverse social impacts resulting from the Project, the following assessments are made:

- Noise levels in areas immediately surrounding the Project Site and proposed transport route would increase marginally.

- The number of trucks using the Brayton Road and Red Hills Road saleable products transport route would increase, however, appropriate controls would be put in place, and would be maintained for the Project, to minimise impacts on other road users.
- The Project would require a cessation of agricultural activities on the Project Site for the duration of the Project. This would be partially mitigated through the rehabilitation of a portion of the Project Site to agricultural land of a similar agricultural suitability class. The area is restricted to 230ha and the loss of such a small parcel of low productivity agricultural land is not seen as a significant impact.

4B.10.3.3 Economic

A significant proportion of the capital costs to establish the Project would be related to construction labour, power supply, on site facilities construction and materials. Much of this capital would be spent locally where possible, with labour and materials sourced from the region where possible.

It is anticipated a significant portion of Project wages and salaries money would be retained locally through payment of local contractors and employees.

The Department of Primary Industries Geological Survey Branch has identified the benefit of ensuring multiple sources of course aggregate in the Sydney Planning Region. In 2001, the Survey Branch recommended that, *"….strategies be developed that ensure there is access to multiple sources of aggregate rather than just a few. This would provide a range of product types and would guard against the market becoming dominated by a small number of suppliers. Continued competition in the market will result in lower prices and thus benefit the consumer and the community in general"*.

Additionally, consumables and the purchase of sundry materials would inject a significant amount of money into the local services and suppliers, as well as those based in surrounding larger centres.

4B.10.3.4 Land Values

There are many factors that combine to determine the value of land, including for example, location, soil type, climate, distance from services, schooling opportunities, social interaction opportunities, climatic conditions, and location in relation to markets.

The eventual effect of a development such as the Gunlake Quarry Project on land values would be a balance between positive and negative influences.

The negative influences would include:

- actual and perceived environmental impacts such as water quality and quantity impacts, noise, dust, increased traffic and visibility issues;

- not wanting to live near a quarry; and
- reduced agricultural activity in the local region as land is diverted to quarrying use.

The positive influences would include such factors as:

- increased opportunity for off-farm employment to replace or augment current income opportunities;
- employment opportunities for children;
- improved communication and transport facilities; and
- diversification of the local economy reducing the implication of market and seasonal influences on the economy.

Gunlake will implement management strategies to address predicted environmental issues. This action should address actual environmental impacts and would also help to address any perceived impacts.

The personal preference for living near a quarry is more problematic, however, there are a number of valid reasons for deciding to do so and these are included in the above list of positive factors.

The small size (230ha) of low productivity land temporarily removed from agricultural production is not likely to have a significant impact on local agricultural production.

Consequently, Gunlake believes that there would be both positive and negative influences on property values as a result of the construction and operation of the Gunlake Quarry Project. It is impossible to predict whether there would be more positive or negative influences and it is most likely that the impact would be close to neutral.

Proposed management responses to predicted environmental impacts would help to minimise any negative impacts on property values and would enhance the likelihood of positive influences.

4B.10.3.5 Eventual Quarry Closure

The Gunlake Quarry has a planned potential production life of 100 years at which time the hard rock resource will have been extracted. The current application is for a 30 year approval to operate the quarry.

4B.11 European Heritage

4B.11.1 Desktop Search of Heritage Listed Items

A desktop search of the Goulburn Mulwaree Local Government Area on the following heritage databases was conducted in March 2007.

- Mulwaree Local Environmental Plan – Schedule 1.
- Australian Heritage Database (which includes places listed in the World Heritage List, National Heritage List, Commonwealth Heritage list and Register of the National Estate) .
- State Heritage Register.
- State Heritage Inventory.

No listed heritage sites were identified within the Project Site, or within the vicinity of the Project Site.

4B.11.2 Management Measures

As no sites were identified, no management measures are required.

4B.11.3 Assessment of Impacts

As no sites were identified, there would be no impact on any items or places of European heritage significance.

4B.12 Road Upgrading

4B.12.1 Introduction

Gunlake commissioned Laterals Environmental (Laterals) to undertake a review of the environmental factors that may be impacted by the proposed upgrade of sections of Brayton Road and Red Hills Road. Their review is presented in a Review of Environmental Factors (REF) supported by a Flora and Fauna Assessment. The REF and Flora and Fauna Assessment are included as Part 8A and Part 8B respectively in the Specialist Consultants Studies Compendium.

The REF supports the various assessments undertaken by the Specialist Consultants and focuses on the impacts of modifying existing sections of road.

The review was carried out in accordance with Part 5 of the Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulations 2000. It has been summarised and incorporated into this Environmental Assessment which is being processed under Part 3A of the Environmental Planning and Assessment Act 1979.

Laterals concluded that their REF had assessed to the fullest extent possible all matters affecting or likely to affect the environment by reason of the road upgrading including whether there is likely to be a significant effect on threatened species, populations and ecological communities and their habitats, and heritage and archaeological matters.

They also concluded that there is no significant effect on threatened species, populations and ecological communities and their habitats, and heritage and archaeological matters.

Their assessment made a number of recommendations that have been accepted by Gunlake and will form the basis of environmental management of the road upgrade activities.

4B.12.2 Proposed Activities

It is proposed to upgrade the travel and width of sections of Brayton and Red Hills Roads between the Project Site and Red Hills Road.

Road upgrade activities will include:

- Site preparation, including works compounds and temporary erosion and sediment controls.

- Tree clearance and earthworks, including excavation of cuttings and fill placement for embankments and stockpiling of soils, gravel and road surface metal.

- Drainage, including the installation of under road drainage pipes, the extension of existing under road drainage pipes, and the construction of longitudinal drains along the roadside with appropriate mitre drains.

- Pavement construction, including preparing and placing base and sub-base courses and the placing of the bitumen seal surface.

- Post construction works, including soil stabilisation, maintenance of erosion and sediment controls, rehabilitation of erosion and sediment controls in the event of failure, placement of reserved topsoils and revegetation with grasses, tree planting in areas for rehabilitation, pavement marking and advisory signs as necessary for a local road, rehabilitation of the works compound and removal of any oil or other accidental chemical spills and the general clean up of the activity area.

A works compound will be required to store construction materials, machinery and oils and other chemicals that are typically used during road construction. Temporary soil stockpile sites will also be required.

Vacant land is most likely to be used for the works compound and stockpile sites. Suitable sites will be selected by the preferred contractor at the time of construction. There are many suitable locations. However, care will be taken to ensure that site selection takes into consideration environmental impact potential, including vegetation (especially hollow trees), power and telephone services, dams and existing drainage, and proximity to residences. Controls will be designed to prevent contamination of any dam or drainage line by runoff from the compounds, and dust and noise controls.

The following general criteria will be complied with when selecting the location of the works compound. The sites will:

- Be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They will be established where native vegetation disturbance is minimal or weeds dominate, and requiring minimal or no clearing of native vegetation.

No trees or large shrubs will be removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.

- Not be located in areas subject to floods.
- Not be established on highly erodible soils unless it is unavoidable. In these circumstances, appropriate soil-specific erosion control measures need to be developed and implemented.
- Be provided with erosion and sediment controls prior to occupation.
- Have drainage controls including diversion drains and perimeter banks, and the bunding of liquid storage areas installed prior to the compounds being occupied and will be maintained and renewed as necessary during the construction period to ensure their effectiveness.
- Be located as far away from any natural watercourse as practicable.
- Not unduly interfere with the agricultural or other economic activities in the area.
- Be as far away from nearby residences so as to cause the least interference from dust and noise impact on the residence.
- Be restored at the completion of the occupation.
- Selected with preference given to re-occupying previously established works compound sites, stockpile sites or other highly disturbed areas.
- Controlled to ensure that concrete trucks will not be allowed to wash out concrete residue at the site.
- In the case of the works compound, be securely fenced against theft and vandalism if considered necessary by the Quarry Manager.
- Secured against theft and unauthorised use of plant and machinery when not in use.
- Provide for storage of all chemicals in a lockable storage shed/ temporary building with a floor. The shed would be surrounded by an earth bund that is able to contain at least 110% of the volume of the largest container stored in it.
- In the case of the works compound, contain materials for the cleaning up of any chemical spills such as hydrocarbon absorbent booms (for use in waterways) and loose absorbent material. Fire extinguishers of a type appropriate to the materials stored at the compound would also be kept on site.
- Not have any fuels stored at the works compound. Plant and equipment will be refuelled from refuelling trucks on-site, or at the Contractor's main depot off-site. Refuelling and other machinery maintenance would be undertaken in specially designated bunded areas designed to enable any spilled fuels and oils to be contained on-site and cleaned up.

Typical equipment to be used for road construction activities include, medium-heavy tractor dozers, compactors and rollers, excavators, front-end loaders, trucks, graders, water carts

and backhoes. The methods to be employed in the project would follow standard road construction practices. No need for any non-standard construction methods have been identified.

There is no identified need for on-site concrete batching plants or mobile bitumen plants. Base and sub base construction materials will be sourced from the road site and existing suppliers.

The working hours for road modifications will be 7am to 6pm Monday to Friday (excluding Public holidays) and 8am to 1pm Saturdays. No work is proposed to be carried out on a Sunday or on Public holidays. Any extension of these working hours for extenuating circumstances may only be approved by the Quarry Manager and potentially affected landowners and residents will be advised by a letter box drop or site visit at least 2 days prior to the work occurring.

Contractors will employ their specific construction techniques but will comply with the design requirements for the road and the need to employ environmental mitigation measures as identified in the REF and other laws normally applying within the state. This will include an assurance that landowners adjoining the road works are not inconvenienced and works do not cause unreasonable interruption to farm management practices or other existing operations.

4B.12.3 Environmental Assessments, Impacts and Management

4B.12.3.1 Air

The proposed road improvements will result in better traffic movement reducing exhaust emissions and allowing for small localised improvements to air quality.

During construction the movement of vehicles and plant would create potential for additional dust impacts.

The movements of plant and vehicles between work sites and the site of the works compound will produce additional potential dust impacts on nearby residences. Dust suppression measures such as providing a temporary blue metal overlay or temporary sealing of the access track into the compound, or damping with water will be implemented as required to minimise or eliminate the potential additional dust impacts. Impacts will be assessed during the construction and appropriate dust suppression measures implemented if and when required.

Air quality may also be temporarily affected by the use of un-maintained machinery and equipment that can result in high levels of diesel particulate matter being produced. The proper maintenance of vehicles will assist in minimising this potential impact.

The generation of most potential airborne dust will be easily prevented or suppressed by keeping haul roads damp and soil stockpiles covered. Exhaust fumes will be minimised by ensuring all plant and machinery are fitted with properly functioning and maintained exhaust systems.

To minimise or eliminate potential adverse impacts on air quality, the following controls and measures will be implemented:

- Areas of exposed soil will be limited to those areas being worked at any one time.
- All areas of exposed soil will be stabilised as soon as possible, and progressively stabilised as work areas are completed.
- All loads of soil or other potential dust generating materials transported by vehicles will be covered during transportation.
- The tailgates of all vehicles will be kept securely closed during transportation.
- Dust will be suppressed as necessary during construction by spraying exposed soil with water from a water cart which would be maintained on-site.
- Specific dust suppression measures will be implemented around the works compound site as necessary if it is located close to any residence.
- Dust producing activities will be avoided on high wind days.
- Soil stockpiles will be kept covered or planted with cover crops until used.
- Haul roads and site compounds will be topped with gravel or kept moist.
- Cleared timber or other materials will not be burned.
- Mud spilt or tracked by construction equipment onto the sealed section of road or other sealed roads will be cleaned up regularly.
- All plant and equipment will be maintained in accordance with the manufacturers' specifications to ensure they operate efficiently and do not produce excessive exhaust emissions.

4B.12.3.2 Water

The road works occur wholly within the Sydney Catchment Authority Area. The Red Hills Road area drains into the Shoalhaven Catchment and the Brayton Road area to the Wollondilly Catchment. The Drinking Water Catchments REP No. 1 requires that activities in the Sydney Catchment Authority Area do not negatively impact the quality of receiving waters.

Road works will occur within 40m of the top bank of first and second order streams along Brayton and Red Hills Roads and a third order stream near the entrance to the proposed Gunlake Quarry. Normally, a permit issued under Part 3A of the Rivers and Foreshores Improvement Act 1948 would be required. However, the Project is being assessed in

accordance with Part 3A of the Environmental Planning and Assessment Act 1979, and a 3A permit is not required. The Project will be assessed with due consideration of matters relevant to a Part 3A Permit. Work is required near streams but no temporary or permanent blockages to the channel would be needed. Where scour is currently occurring at pipe or culvert outlets, the need for scour protection will be investigated and installed if required.

Water to be used on the site would be brought in by water cart or drawn from farm dams or bores where available.

Quantitative water quality data is not available for the creeks associated with the site. The most significant pollutants entering the watercourses emanating from the road is sediment from the gravel road surface and localised runoff of hydrocarbons and heavy metals from road transport.

The widening of the road is not expected to have any long-term impact on water quality in the area if the recommendations of the Laterals REF are implemented.

During the construction phase, the greatest potential for water pollution would be due to sediment laden runoff entering the waterways. There is also a risk of oil spillage from broken hydraulic lines on plant and equipment. However, given the ephemeral nature of the creeks, and the erosion and sediment controls and measures to be implemented, as well as best work practices, the likelihood of water pollutants moving far from the worksite is low.

An Environmental Management Plan incorporating erosion and sediment controls will be developed for the road upgrading works. The Environmental Management Plans will address and comply with Roads and Traffic Authority requirements.

In order to minimise potential impacts on water, the following controls and measures will be implemented:

- The erosion and sediment control measures adopted in the Environmental Management Plan be implemented to ensure a neutral impact on surface and ground water quality.

- Where stream bed scour is currently occurring at culvert outlets, the need for scour protection will be investigated and installed if required.

- Plant and equipment will be inspected regularly to ensure there are no leakages of fuel, oil or hydraulic fluid.

- An environmental emergency plan for pollutant spillages will form part of the erosion and sediment controls in the Environmental Management Plan.

- An appropriate spill containment kit will be kept on site at all times.

4B.12.3.3 Noise and Vibration

4.12.3.3.1 Operational Traffic Noise

The site is located in a rural area where background noise levels are generally low and the greatest noise and vibration source is likely to be from local traffic.

No noise measurements were undertaken for the assessment of the road modifications since the road alignment is generally contained within the existing road alignment. The Environmental Management Plan for the road upgrading activity will identify the location of the nearest residences and ensure that noise criteria are not exceeded in accordance with Department of Conservation and Climate Change (DECC) guidelines included in **Table 4B.65**.

4.12.3.3.2 Road Traffic Noise Criteria

The DECC publication "Environmental Criteria for Road Traffic Noise" (May 1999) provides the assessment criteria for road traffic noise in NSW. Tables 1 and 2 of the *Criteria* contain classifications and noise goals for various road developments.

Brayton Road and Red Hills Roads are considered to be "Local Roads" as defined by the Criteria. The applicable road traffic noise criteria for the road upgrade component of the Project are therefore as shown in **Table 4B.65**.

Table 4B.65 DECC Road Traffic Noise Criteria for Redevelopment of an Existing Local Road.

Type of Development	Criteria
Redevelopment of an existing local road	DAY (7 am – 10 pm) LAeq (1 hour) 60dB(A) NIGHT(10 pm – 7 am) LAeq (1 hour) 55dB(A)
	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through medium-term and long-term strategies, such as regulation of exhaust noise from in-service vehicles; limitations on exhaust brake use; restricted access for sensitive areas or during sensitive times to low-noise vehicles; improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards; and alternative methods of freight haulage.

Laterals concluded that it is unlikely that the existing noise levels at any existing dwelling exceeds the noise levels of LAeq(1 hour) 60dB(A) day and LAeq(1 hour) 55 dB(A) night, given the redevelopment of the road, the better road travel, alignment and width.

Generally, the realignment of the road does not move the road significantly closer to any existing dwelling. The future traffic noise levels should therefore not exceed the DECC noise level criteria which allows for an increase over existing noise levels of no more than 2dB(A).

4.12.3.3.3 Construction Noise

The construction period for the road upgrade is anticipated to be up to 8 weeks. However, this may not be continuous, depending on contractor and proponent scheduling. Construction noise has the potential to affect residents close to the alignment.

The Roads and Traffic Authority adopts the construction noise control criteria of the DECC. The DECC noise criteria recognise that high construction noise levels are likely to be accepted by local residents due to the usually short term duration of construction activities.

The construction noise level restrictions set by the DECC are:

- For a cumulative construction noise exposure period of up to four weeks, the $L_{A10\ (15\ minutes)}$, emitted by the works to specific residences should not exceed the LAM background level by more than 20dB(A). (That is, the construction noise level occurring for 10% of the time (L_{A10}), measured for 15 minutes, should not exceed the background noise level that occurs during 90% of the day (L_{A90}) by more than 20dB(A).

- For a cumulative construction noise exposure period of between four weeks and twenty-six weeks, the emitted L_{A10} noise level should not exceed the L_{A90} level by more than 10 dB(A).

- For a cumulative construction noise exposure period greater than twenty-six weeks, the emitted L_{A10} noise level should not exceed the L_{A90} level by more than 5 dB(A).

The applicable construction noise criteria for this proposal would therefore be an L_{A10} noise level of no more than 10dB(A) above the background L_{A90} level.

To minimise noise potential, noisy plant will be parked overnight at work sites that are not located in close proximity of the close dwelling houses. This will avoid the noise associated with movements, and with starting up in the morning. Plant will be parked off the road in areas cleared for the work, and work in close proximity to dwelling houses will be carried out in the shortest possible time.

Best practice work methods will be adopted to ensure that potential impacts are minimised. The local residents potentially affected by construction noise will be advised of any expected short-term high noise levels, and a Noise Management Plan will be developed in consultation with any concerned residents. A complaints procedure will also be developed and specified in the Environmental Management Plan for the road upgrade works.

The types of actions that could be used for controlling construction noise and vibration include:

Source controls

- **Scheduling**
  Perform noisy work during less sensitive time periods where possible when working near residences.

- **Equipment restrictions**
  Ensure equipment has quality mufflers installed and is regularly maintained to manufacturer's specifications.

- **Substitution**
  Use quieter and less vibration emitting construction methods where possible.

- **Site access**
  Vehicle movements outside construction hours, including loading and unloading operations, will be minimised and avoided where possible.

- **Reversing alarms**
  Alternatives, such as manually adjustable or ambient noise sensitive types ("smart" reversing alarms) will be considered.

Path controls

- **Noise barriers**
  Locate equipment to take advantage of the noise barriers provided by existing site features and structures, such as embankments and storage sheds.

- **Increased distance**
  Locate noisy plant as far away as possible from noise-sensitive receptors.

- **Site access**
  Select and locate site access roads as far away as possible from noise-sensitive areas.

Receptor controls

- **Consultation**
  Community consultation, information, participation and complaint responses are essential aspects of all construction noise management programs.

4.12.3.3.4 Construction Vibration

The proposal has the potential to generate high vibration levels through the use of vibratory rollers for compacting fill and pavement base materials.

In terms of vibration from construction machinery, the general principles applied to determining safe vibration levels stipulate that residences located 20m from road construction work may experience vibration levels up to 3mm/sec when vibratory rollers are being used. While this is below the level considered to be potentially damaging to architectural structures, it is likely to be above a level that may cause adverse comment from residents.

Given that the nearest residence is located about 100m from the closest part of the work, vibrations from vibratory rollers are unlikely to cause discomfort to the residents. However, if a complaint regarding noise or vibration is received, adjustments to work practices will be undertaken as required to try to eliminate the source of the excessive noise or vibration.

The following controls and measures will be implemented to ensure that construction noise and vibration are kept to the minimum.

- Work compounds, parking areas, equipment and material stockpiles will be located as far away from dwellings as possible.

- If the works compound is located near a residence, strategies will be implemented in consultation with the residents to minimise construction noise and vibration.

- The residents of the nearby dwellings will be advised of any potential high noise or vibration producing activities at least one week prior to that activity occurring, and a noise and vibration management plan should be devised in consultation with them if they are concerned.

- The residents will be notified in advance of any proposed work outside of normal working hours that is likely to be noisy or to produce high vibration levels.

- A procedure for dealing with complaints will be developed and specified in the Environmental Management Plan for the road upgrade works.

- Vibration from construction will be kept to the minimum practically achievable.

- If a complaint is received, adjustments to work practices will be undertaken as required to try to eliminate the source of the excessive noise or vibration.

4.12.3.3.5 Flora and Fauna

As part of their environmental assessment of the road upgrade work, Laterals completed a Flora and Fauna Assessment and this is included as Part 8B of the Specialist Consultant Studies Compendium.

The Flora and Fauna Assessment included a habitat assessment to ascertain the range of species that are likely to use the area affected by the road upgrade. It also includes a threatened species assessment for the affected area.

The area around the existing road supports scattered low open forest with frequent cleared areas. A variety of locally common plants occur as well as frequent exotic species. Several other habitat components occur and terrestrial habitat is generally good. While the road corridors support several useful habitat components, the wider landscape is similarly vegetated and supports better arboreal habitat. Coarse woody debris, simple rock habitats and understorey plants occur in the road corridors.

While removal of small patches of native vegetation is an essential part of the proposed road upgrading, the design is able to retain the most important pockets of remnant habitat along the road route and the works will result in a minimal impact on flora and fauna.

It is highly unlikely that this proposal will have a significant impact in any way on any identified threatened or migratory species identified under either the NSW Threatened Species Conservation Act 1995 or the commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

Any potential impacts on flora and fauna of the road upgrade works will be mitigated to a satisfactory level of impact by implementing the safeguards provided by the Flora and Fauna Assessment and summarised in the following paragraphs.

To minimise or eliminate potential adverse impacts on flora and fauna and to ensure that the road upgrading project does not have a negative impact on biodiversity the following controls and measures will be implemented:

- Soil disturbance shall not be more than is required to undertake the work. Vehicle, plant and stockpile impacts will be restricted to areas already devoid of vegetation.

- An Environmental Management Plan (EMP) that incorporates erosion and sediment control measures for the site will be prepared prior to soil being disturbed.

- Disturbed banks and batters will be rehabilitated by the addition of topsoil and sowing and maintenance of suitable species as soon as is practical to avoid the establishment of weed species in accordance with an Erosion and Sediment Control Plan.

- Vegetation removal will be undertaken in a way that minimises impact to retained vegetation.

- Where possible dead hollow wood will be retained or added as terrestrial habitat to the road reserve at a density no greater than one to two logs per ten metres.

- Works and stockpile compounds will be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They will be established where native vegetation disturbance is minimal or weeds dominate, and requiring no clearing of native vegetation. No trees or large shrubs will be removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.

- Topsoil that is stripped from the construction areas will be stockpiled and spread over disturbed areas prior to seeding or planting of rehabilitation grasses and trees.

- Weeds will be removed and taken to an approved waste management facility.

- The area to be disturbed for construction will be kept to the minimum required for safe and efficient activity.

- Tree felling will be undertaken so that minimal damage occurs to trees intended for retention.

- Excess timber logs may be made available to local residents for fire wood, while the rest of the vegetation (including stumps) will either be chipped on site using a mobile chipper or fractured and left for fauna use.

- Chipped native vegetation will be used where available to protect exposed areas and excess sold as landscape supplies.

- Cleared vegetation or other materials will not be burned on site.

- Areas of the road reserve disturbed by works will be rehabilitated using locally occurring native plants.

4.12.3.3.6 Waste Minimisation and Management

Few materials are likely to be able to be reused as the road upgrade activity is limited to road widening. Removed topsoil will be stockpiled and respread over areas to be revegetated. The largest component of recyclable material would be cleared timber much of which can remain on the site as habitat or chipped and left on disturbed soil to aid soil conservation and plant regeneration.

Other waste reduction measures, such as the recycling of packaging, will be included as part of a Waste Management Plan incorporated into the Environmental Management Plan. The Waste Management Plan will, if necessary, address transportation and disposal arrangements for waste produced from the site.

Appropriate receptacles will be provided for un-recyclable waste material at the works compound, and their contents disposed of off-site at a suitably licensed waste management facility on a regular basis and secured against vandalism. The disposal of chemical, fuel and lubricant containers, solid and liquid wastes should be in accordance with the requirements of the Department of Environment and Climate Change and the Goulburn Mulwaree Council.

If contaminated waste is generated, the appropriate Department of Environment & Climate Change licences and approvals should be obtained for its disposal. The operators of the proposed disposal site will be notified in advance regarding any contaminated waste.

The following controls and measures will be implemented:

- A Resource and Waste Management Plan (RWMP) would be prepared in accordance with the Resource Management Hierarchy established under the *Waste Avoidance & Resource Recovery Act 2001*.

- Waste produced on the road upgrade works will be minimised, reused or recycled wherever possible.

- Unavoidable wastes would be disposed of in an appropriate manner at a licensed waste disposal facility, as addressed in the Waste Management Plan.

- Waste material would be classified in accordance with the Department of Conservation and Climate Change's Environmental Guidelines: Assessment. Classification and Management of Liquid and Non-Liquid Wastes.

- Waste oil will be sent to approved recyclers.

- Topsoil will be stockpiled and used in the stabilisation and rehabilitation of the works site.

- Removed vegetation (including stumps) will be either chipped on site using a mobile chipper or left for fauna use. Any chipped material will be used on site for stabilisation and rehabilitation works, or if too great a volume is produced, sold to landscape suppliers or made available to local residents for garden use.

- Portable, self-contained toilet and washroom facilities will be provided at the work site and should be regularly emptied and serviced by the contractor providing them.

- Putrescible and other waste not able to be recycled will be collected regularly and disposed of at a licensed landfill or other disposal site in the area.

- Cleared vegetation or other materials will not be burned on site.

- Secure rubbish bins with heavy lids will be provided within the site compound. These will be regularly emptied.

- The work site will be left in a tidy and rubbish free state at the end of each working shift and upon completion of the works.

- Contaminated materials will be disposed of at a licensed disposal site in accordance with the appropriate DECC licences and approvals.

4.12.3.3.7 Archaeology and Heritage

A preliminary Archaeological Assessment for the Gunlake Quarry Project has been undertaken by Australian Archaeological Survey Consultants Pty Limited (AASC). A copy of the AASC report is included as Part 6 in the Specialist Consultant Study Compendium. This report presents the findings of research into archaeological and historic heritage on the proposed quarry site and most of the associated haul roads including Red Hills Road.

In order to supplement the AASC assessment, Laterals invited the Local Aboriginal Land Council (Pejar LALC) to survey the areas adjacent to the sections of road proposed to be upgraded. Their findings were not available at the time of producing the Laterals Report. Subject to finalisation of the LASLC Report, its recommendations will be implemented together with those contained in the AASC Report.

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Section 5
Draft Statement of Commitments

This section has been prepared in accordance with the requirements of Part 3A of the Environmental Planning and Assessment Act 1979, and presents a compilation of the actions and initiatives that Gunlake Quarriescommits to implement if the Gunlake Quarry Project is approved. These commitments are designed to effectively manage, mitigate, guide and monitor the Project from initial construction through to full production and eventually rehabilitation of the Project Site.

The Environmental Assessment of the Project has identified a range of environmental, social and management outcomes and measures, all required to avoid or reduce the environmental and social impacts of the Project.

All parties involved in the design, establishment and operational phases of the Project will be required to undertake their work in accordance with these commitments.

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5.1 GENERAL PROJECT COMMITMENTS

- Gunlake will develop an Environmental Management Plan (EMP) for the Gunlake Quarry. The EMP will also detail the monitoring regime that will provide the data necessary to determine compliance with environmental performance criteria.

- All available reclaimable topsoil will be used for preparing disturbed surface areas for revegetation.

- The proposed hard rock quarry would be operated with comprehensive systems to manage and monitor groundwater, surface water, noise, blasting, air quality, Aboriginal heritage, flora, fauna, traffic, visual and socio-economic aspects.

- Gunlake would seek approval from the Council for the installation on the Project Site of an aerated wastewater treatment system (AWTS) that will provide secondary treatment effluent suitable for disposal by irrigation. All domestic waste water will be collected and treated in the waste water management system.

- Clearing of the vegetation within the quarry area would be undertaken using a progressive campaign basis with the extent of clearing undertaken in each campaign being just sufficient for the subsequent year of quarry development.

- The size and location of water and soil erosion control structures would vary depending on the surface area and location of disturbance but would be based on the structure designs and construction notes identified in the Landcom publication, "Soils and Construction Volume 1" 4th Edition March 2004.

- Wherever practicable, stripped topsoil and subsoil would be directly replaced on completed sections of the final landform.

- Explosives and detonators would not be stored on site.

- The rock processing plant will feature atomised water dust suppression systems at all discharge points. There will also be atomised water sprays for dust control at the tipping point into the apron feeder and at the primary crusher input and discharge. The product conveyors will be covered. All screens will be enclosed to provide dust and noise attenuation.

- Potable water, ie. water for drinking purposes, and water for toilets and showering would be transported from Marulan to supplement rainwater collected off buildings and stored in tanks.

- Water required for operational purposes would be obtained from the various sedimentation and fresh water dams that form part of the site surface water and quarry pit management system.

- The Project will be powered by electricity from the State Supply Grid. Mobile plant will be powered by diesel fuel.

- A dedicated 1000m^2 irrigation field will be established to accommodate the predicted wastewater generated on site.

- Fuel storage and refuelling facilities for the mobile quarry fleet, comprising storage for 50kL diesel in a WorkCover-approved self-bunded fuel tank and a refuelling bay would be located adjacent to the Maintenance Workshop.

- The bulk of transport activities associated with the Project would revolve around the road transportation of saleable products from the Project Site to widely distributed markets.

- Gunlake will develop a mechanism to record and resolve complaints. This will support the Company's ongoing Community Liaison Programme.

- A Road Construction Management Plan would be prepared to ensure appropriate procedures are in place for the management of both quarry-related and public traffic during road construction activities.

- Gunlake has commenced consultation with Goulburn Mulwaree Council to develop a road maintenance and capital improvement agreement to cover transport route impacts associated with the movement of finished product.

- An Occupational Health and Safety Management System and a Major Hazard Management System would be developed.

- On cessation of quarrying and processing activities, a number of structures and facilities would be decommissioned and removed as part of the rehabilitation of the Project Site.

- At the completion of the Project a thorough inspection of the soil directly below and surrounding fuel storage and refuelling areas would be conducted to ensure any contaminated soil is identified. Gunlake will conduct a Phase 1 Hydrocarbon Contamination assessment and undertake appropriate action as determined by that review.

- All demountable buildings and structures erected on the Project Site would be transported off site at the completion of the Project.

- Gunlake would undertake an ongoing rehabilitation. Gunlake would take the necessary precautions to prevent excessive development of weeds within the rehabilitated areas. monitoring and maintenance program throughout and beyond the operation of the proposed Gunlake Quarry.

- Gunlake propose to undertake some replanting of riparian corridor habitat in the major creek lines on the Project Site.

- It is planned to produce further Community Newsletters as required throughout the approval process and during the operation of the Quarry.

- A meteorological station will be installed on the Project Site in early 2008.

5.2 TRAFFIC

- New road intersections will be constructed at the intersection of Brayton Road with the mine access road, Brayton Road and the By-pass road connecting to Red Hills Road, at the Brayton Road and George Street intersection (new roundabout) and the Red Hills Road intersection with the Hume Highway.

- Brayton Road between the Quarry Access road and the entry to Johnniefelds will be upgraded to a 7m wide total seal.

- Gunlake will construct a new By-pass road to connect Brayton Road to Red Hills Road.

- During Stage 2 of the Project Gunlake will improve the section of Red Hills Road to the Hume Highway including a total 7m seal.

5.3 WATER, SOIL AND AGRICULTURE

- Topsoil will be stripped and stockpiled from areas to be developed, including the quarry access road and By-pass road.

- Topsoils and subsoils will be stockpiled separately.

- A Conceptual Soil and Water Management Plan (SWMP) has been prepared. This Plan describes how soil and water will be managed during the establishment stage to the requirements of the Landcom Blue Book 2004. Following Project Approval a detailed version will be prepared which will consider any conditions imposed by the approval and contain detailed drawings of any engineering structures. Gunlake commits to implementing the finally agreed SWMP. Maintenance and monitoring programmes are included in the SWMP.

- A Conceptual Water Management Plan (WMP) has been proposed. This Plan flows logically from the SWMP and describes how stormwater will be managed during the operational stage and how a neutral or beneficial effect on water quality will be obtained. Following Project Approval a detailed version will be prepared which will consider any conditions imposed by the approval and contain detailed drawings of any engineering structures. Gunlake commits to implementing the finally agreed WMP. Maintenance and monitoring programmes are included in the WMP.

- Except as may be expressly provided by an Environment Protection Licence, the proponent would not discharge any dirty water from the quarry or ancillary operations.

5.4 GROUNDWATER

- Measurements of water level will be continued in the monitoring network prior to the commencement of any quarry operations in order to build on the existing baseline database.

- An ongoing long-term program of regular water level and water quality monitoring will be carried out following commencement of mining operations. Measurements of water level will be collected using the existing installed automated water level data loggers and recorders in the representative monitoring bores.

- Sampling and testing of groundwater in the representative monitoring bores will be carried out on a three (3) monthly basis for 12 months following the commencement of mining operations then on a six (6) monthly basis. In this way, analysis of the results will establish any trends in water quality. Careful analysis and progressive assessment of the results may lead to the reduction of the number of analytes determined and the frequency of sampling.

- A representative network of monitoring bores will be maintained. Three new monitoring bores are proposed.

- If there is a scientifically demonstrated significant impact on any of the springs or registered bores surrounding the Project Site, a set of mitigation options has been developed for each.

5.5 NOISE AND VIBRATION

- All blasts will be monitored at the closest/potentially most affected residence (subject to the owners approval) in order to establish compliance with the nominated criteria and to progressively update the blast emissions site laws (ground vibration and airblast) in order to optimise future blast designs, based on actual site conditions.

- Gunlake will consult with the DECC in relation to the setting of achievable noise limits for the Project.

- In accordance with the INP, Gunlake will implement the following management procedures where required:

    - Noise monitoring on site and within the community.

    - Prompt response to any community issues of concern.

    - Refinement of on site noise mitigation measures and quarry operating procedures, where practical.

    - Discussions with relevant property holders to assess concerns.

    - Consideration of acoustical mitigation at the receivers.

- Consideration of negotiated agreements with property holders.
- Blasthole drilling operations being restricted to daytime only.
- All fixed and mobile plant being selected to have a sound power level (SWL) not exceeding those outlined in **Table 4B.51** of Section 4B.4.

5.6 AIR QUALITY

- Specific design and operational safeguards have been planned for implementation at the Project Site, including the following:
  - Water spraying in excess of 2L/m^2/application applied to internal haul roads;
  - Temporary partial enclosure of stockpiles and processing area through installation of wind breaks (Hessian screen) along the western side of the processing area (subject to monitoring results);
  - Stabilisation and/or revegetation of the overburden emplacement;
  - Installation of water sprays at the tipping point to the apron feeder and at the primary crusher input;
  - Instigation of water spraying at discharge points to stockpiles when winds in excess of 8m/s are recorded on the on-site weather station; and
  - Minimising of exposed surfaces where possible.
- The dust deposition monitoring currently undertaken at the site will be continued.
- Monitoring of 24-hour concentrations of PM_{10} will be undertaken at one location for an appropriate period, as agreed with the DECC. Monitoring will be conducted on a one-day-in-six cycle using a High Volume Air Sampler (HVAS). A suitable location would be at resident R1, the closest resident to the Site. Monitoring for PM_{10} will be conducted for a period of at least one year and at maximum quarry throughput. Should no exceedance of the 24-Hour PM_{10} criteria (directly attributable to the Gunlake Quarry) occur during this period, monitoring will be reviewed and discontinued as appropriate.
- An on-site Weather Station will be established to monitor wind speed and wind direction. The weather station will be fitted with an alarm / automatic notification system for when wind speeds exceed 8m/s.
- Monitoring will be undertaken according to the DECC document *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* 2005.

5.7 CULTURAL HERITAGE

- Salvage and relocation of all sites (GL1–5) will be completed prior to the commencement of works. The salvage will be completed in accordance with the NPWS Act 1974 (NSW).

- There are commitments detailed in Section 4B.6.3 about discovery of cultural heritage items not identified prior to works commencing. These will be implemented by Gunlake.

- There are commitments detailed in Section 4B.6.3 about discovery of skeletal remains not identified prior to works commencing. These will be implemented by Gunlake.

5.8 FLORA AND FAUNA

- Gunlake will implement weed control in accordance with the Goulburn Mulwaree Council policy publications *"Management Plan for the Enforcement of Class 4 Noxious Weeds" and "Noxious Weed Management Program Guidelines"*.

- As wide a buffer as possible will be maintained between the top of the creek bank and the edge of the proposed quarry pit, haul road or By-pass roads (except where creek crossings are required).

- Habitat trees will be retained if possible. As some habitat trees are likely to require removal, this should be timed so as to avoid the breeding season of hollow-reliant threatened fauna.

- For any habitat trees being removed during tree-felling operations, an experienced wildlife handler will be in attendance in order to rescue injured or displaced wildlife.

- The introduced shrubs and small trees near the By-pass road route will be retained to maintain Speckled Warbler habitat.

- Appropriate sediment and erosion control measures will be implemented for the duration of construction and quarrying operations in all affected parts of the study area. In particular, steps will be taken (silt fences, cut-off drains, detention basins etc.) to prevent silt and sediment from the quarry or roads from entering the watercourses.

- At the old tip site near the proposed Jaoramin Creek crossing, a number of 'junk' piles of concrete, tin, etc. provide excellent habitat for a range of reptile species and these will be retained.

- Livestock proof fencing will prevent grazing of areas undergoing regeneration.

- Offset areas will be set aside for regeneration of riparian corridors on the Project Site.

- A vegetation and weed management strategy will be prepared. Wherever possible, all shrubs, including dead plants, will be left in situ until suitable replacement native shrubs are able to provide important shelter for the Speckled Warbler and other small birds.

- Rehabilitation efforts will incorporate areas identified as forming part of the Endangered Ecological Community (EEC) in the study area. Assisted natural regeneration of the vegetation is the preferred approach wherever practical. However, if artificial plantings are to be used, only native species currently occurring on the subject site or local species listed as occurring within the EEC according to the Final Determination (NSW Scientific Committee 2002a) will be used.

- Prior to clearing for construction of the By-pass road between Brayton Road and Jaoramin Creek, targeted seasonal flora surveys will be carried out to determine whether the Endangered species *Genoplesium plumosum* and *Leucochrysum albicans* var. *tricolor* occur within or immediately adjacent to the proposed road alignment. The likelihood of either species occurring in the alignment is considered to be very low (particularly for *Genoplesium plumosum*) but a targeted seasonal survey will allow for a more informed conclusion.

5.9 BUSHFIRE

- **Table 4B.59** identifies the series of commitments Gunlake has made to reduce likelihood of bushfire.

5.10 SOCIO-ECONOMIC

- Gunlake will return a proportion of the Project Site to agricultural land.

- Gunlake will implement a policy that encourages employment of local district personnel, with arrangements for training and certification put in place to ensure suitable applicants can acquire the necessary skills.

- During the operational stage the Quarry will require the services of maintenance workers and truck drivers. It is anticipated that the bulk of these requirements can be serviced by locally or regionally based companies and individuals.

5.11 ROAD UPGRADING

- The Laterals Review of Environmental Factors of the road upgrading component of the Gunlake Quarry Project made a number of recommendations that have been accepted by Gunlake and will form the basis of environmental management of the road upgrade activities.

- Vacant land is most likely to be used for the works compound and stockpile sites. Suitable sites will be selected by the preferred contractor at the time of construction. Site selection criteria are included in the Laterals REF and these will be applied at the appropriate time.

- The working hours for road modifications will be 7am to 6pm Monday to Friday (excluding Public holidays) and 8am to 1pm Saturdays. No work is proposed to be carried out on a Sunday or on Public holidays. Any extension of these working hours for extenuating circumstances may only be approved by the Quarry Manager and potentially affected landowners and residents will be advised by a letter box drop or site visit at least 2 days prior to the work occurring.

- Contractors will employ their specific construction techniques but will comply with the design requirements for the road and the need to employ environmental mitigation measures as identified in the REF and other laws normally applying within the state.

- To minimise or eliminate potential adverse impacts on air quality, the following controls and measures will be implemented:

    - Areas of exposed soil will be limited to those areas being worked at any one time.

    - All areas of exposed soil will be stabilised as soon as possible, and progressively stabilised as work areas are completed.

    - All loads of soil or other potential dust generating materials transported by vehicles will be covered during transportation.

    - The tailgates of all vehicles will be kept securely closed during transportation.

    - Dust will be suppressed as necessary during construction by spraying exposed soil with water from a water cart which would be maintained on-site.

    - Specific dust suppression measures will be implemented around the works compound site as necessary if it is located close to any residence.

    - Dust producing activities will be avoided on high wind days.

    - Soil stockpiles will be kept covered or planted with cover crops until used.

- Haul roads and site compounds will be topped with gravel or kept moist.
- Cleared timber or other materials will not be burned.
- Mud spilt or tracked by construction equipment onto the sealed section of road or other sealed roads will be cleaned up regularly.
- All plant and equipment will be maintained in accordance with the manufacturers' specifications to ensure they operate efficiently and do not produce excessive exhaust emissions.

- In order to minimise potential impacts on water, the following controls and measures will be implemented:
  - The erosion and sediment control measures adopted in the Environmental Management Plan be implemented to ensure a neutral impact on surface and ground water quality.
  - Where stream bed scour is currently occurring at culvert outlets, the need for scour protection will be investigated and installed if required.
  - Plant and equipment will be inspected regularly to ensure there are no leakages of fuel, oil or hydraulic fluid.
  - An environmental emergency plan for pollutant spillages will form part of the erosion and sediment controls in the Environmental Management Plan.
  - An appropriate spill containment kit will be kept on site at all times.

- The following controls and measures will be implemented to ensure that construction noise and vibration are kept to the minimum:
  - Work compounds, parking areas, equipment and material stockpiles will be located as far away from dwellings as possible.
  - If the works compound is located near a residence, strategies will be implemented in consultation with the residents to minimise construction noise and vibration.
  - The residents of the nearby dwellings will be advised of any potential high noise or vibration producing activities at least one week prior to that activity occurring, and a noise and vibration management plan should be devised in consultation with them if they are concerned.
  - The residents will be notified in advance of any proposed work outside of normal working hours that is likely to be noisy or to produce high vibration levels.
  - A procedure for dealing with complaints will be developed and specified in the Environmental Management Plan for the road upgrade works.

- Vibration from construction will be kept to the minimum practically achievable.

- If a complaint is received, adjustments to work practices will be undertaken as required to try to eliminate the source of the excessive noise or vibration.

- To minimise or eliminate potential adverse impacts on flora and fauna and to ensure that the road upgrading project does not have a negative impact on biodiversity the following controls and measures will be implemented:

  - Soil disturbance shall not be more than is required to undertake the work. Vehicle, plant and stockpile impacts will be restricted to areas already devoid of vegetation.

  - An Environmental Management Plan (EMP) that incorporates erosion and sediment control measures for the site will be prepared prior to soil being disturbed.

  - Disturbed banks and batters will be rehabilitated by the addition of topsoil and sowing and maintenance of suitable species as soon as is practical to avoid the establishment of weed species in accordance with an Erosion and Sediment Control Plan.

  - Vegetation removal will be undertaken in a way that minimises impact to retained vegetation.

  - Where possible dead hollow wood will be retained or added as terrestrial habitat to the road reserve at a density no greater than one to two logs per ten metres.

  - Works and stockpile compounds will be in areas already cleared of native vegetation, such as the construction zone or agricultural paddocks. They will be established where native vegetation disturbance is minimal or weeds dominate, and requiring no clearing of native vegetation. No trees or large shrubs will be removed for the establishment of the works compound or stockpile sites if they are located outside the construction zone.

  - Topsoil that is stripped from the construction areas will be stockpiled and spread over disturbed areas prior to seeding or planting of rehabilitation grasses and trees.

  - Weeds will be removed and taken to an approved waste management facility.

  - The area to be disturbed for construction will be kept to the minimum required for safe and efficient activity.

  - Tree felling will be undertaken so that minimal damage occurs to trees intended for retention.

  - Excess timber logs may be made available to local residents for fire wood, while the rest of the vegetation (including stumps) will either be chipped on site using a mobile chipper or fractured and left for fauna use.

- Chipped native vegetation will be used where available to protect exposed areas and excess sold as landscape supplies.

- Cleared vegetation or other materials will not be burned on site.

- Areas of the road reserve disturbed by works will be rehabilitated using locally occurring native plants.

- A Waste Management Plan will be incorporated into the road upgrading Environmental Management Plan. The Waste Management Plan will, if necessary, address transportation and disposal arrangements for waste produced from the site.

- The following waste controls and measures will be implemented:

  - A Resource and Waste Management Plan (RWMP) would be prepared in accordance with the Resource Management Hierarchy established under the *Waste Avoidance & Resource Recovery Act 2001*.

  - Waste produced on the road upgrade works will be minimised, reused or recycled wherever possible.

  - Unavoidable wastes would be disposed of in an appropriate manner at a licensed waste disposal facility, as addressed in the Waste Management Plan.

  - Waste material would be classified in accordance with the Department of Conservation and Climate Change's Environmental Guidelines: "*Assessment. Classification and Management of Liquid and Non-Liquid Wastes"*.

  - Waste oil will be sent to approved recyclers.

  - Topsoil will be stockpiled and used in the stabilisation and rehabilitation of the works site.

  - Removed vegetation (including stumps) will be either chipped on site using a mobile chipper or left for fauna use. Any chipped material will be used on site for stabilisation and rehabilitation works, or if too great a volume is produced, sold to landscape suppliers or made available to local residents for garden use.

  - Portable, self-contained toilet and washroom facilities will be provided at the work site and should be regularly emptied and serviced by the contractor providing them.

  - Putrescible and other waste not able to be recycled will be collected regularly and disposed of at a licensed landfill or other disposal site in the area.

  - Cleared vegetation or other materials will not be burned on site.

- Secure rubbish bins with heavy lids will be provided within the site compound. These will be regularly emptied.

- The work site will be left in a tidy and rubbish free state at the end of each working shift and upon completion of the works.

- Contaminated materials will be disposed of at a licensed disposal site in accordance with the appropriate DECC licences and approvals.

Section 6 Evaluation / Justification of Project

This section concludes the assessment of the proposed Gunlake Quarry Project. The key assessment requirements identified by the Director-General's Requirements and other issues identified as having environmental impact are reassessed based on the implementation of the proposed safeguards, controls and mitigation measures. The Project is then evaluated based on the predicted residual impact and with consideration of ecologically sustainable development (ESD) principles.

A justification for the Project is then provided based on the residual impacts of the likely economic and social benefits that would be generated and the consequences locally, regionally and nationally of the Project not going ahead.

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6.1 INTRODUCTION

As a conclusion to the Environmental Assessment, the development and operation of the Gunlake Quarry Project is evaluated and justified through consideration of its potential impacts on the environment and potential benefits to the local and wider community.

Project evaluation has been undertaken by firstly reassessing the risks posed to the local environment by Project activities, following consideration of the Proponent's proposed controls, safeguards and/or mitigation measures summarised in Section 5. The Project has also been evaluated against the principles of Ecologically Sustainable Development (ESD) in order to provide further guidance as to the acceptability of the Project, as presented in the Environmental Assessment.

Section 6.3, which presents the justification of the Project, revisits the predicted residual impacts on the biophysical environment, considers the socio-economic benefits which would be provided and assesses the consequences of not proceeding with the Project.

6.2 EVALUATION OF THE PROJECT

6.2.1 Residual Environmental Risk and Impacts

Following consideration of the proposed operational safeguards, controls and mitigation that would be implemented by the Proponent as part of the Project design, **Table 6.1** identifies the residual environmental impact for each of the potential environmental impacts identified in Section 3.2.7.

The impacts associated with the majority of possible environmental impacts are considered moderate or less and therefore, while these may result in impacts deemed unacceptable to some stakeholders, the development and operation of the Project, with the implementation of appropriate management plans, are generally considered acceptable.

Table 6.1 Residual Environmental Risk and Impacts

Environmental Issue	Environmental Assessment Conclusion
Traffic	The Traffic Impacts are fully discussed in Section 4B.1. The Project transport task will be achieved in two distinct Stages. In order to minimise potential traffic impacts, Gunlake, in a co-ordinated manner, propose to build a new By-pass road, upgrade existing roads, construct new and modify existing intersections. These proposals will accommodate the impacts resulting from the Gunlake Quarry Project in a safe and acceptable manner in accordance with RTA and Council Standards. The local road network will be improved.
Surface Water	Gunlake will implement a Soil and Water Management Plan (SWMP) for the establishment stage of the Project and a Water Cycle Management Plan (WMP) for the operational stage. The SWMP will meet the requirements of the Landcom Blue Book. The WMP describes the management of stormwater and demonstrates

	how a neutral or beneficial effect on water quality will be achieved. Both Plans will be implemented by Gunlake and incorporate commitments to best practice soil and water management. Detailed Plans will be developed to incorporate any Project Approval conditions. The operational water supply will be obtained from surface runoff water and a pasture irrigation activity can be managed to ensure a site water balance that does not result in an increase in water discharged from the Project Site. Modeling predicts an improvement in the water quality flowing from the Project Site. Monitoring will confirm achievement of compliance.
Groundwater	Groundwater inflow into the quarry pit is predicted to be minimal and peak at 3.5MLpa. A large component of this inflow is expected to evaporate and significant ponding of pit inflow is not expected. A small component of the groundwater inflow will mix with rainfall water and be incorporated into the Surface Water Management Plan. Monitoring will confirm achievement of compliance.
Noise and Vibration	Monitoring defined the existing noise environment. Gunlake will implement a range of management strategies to minimize noise emissions from the Project. Modeling has determined that the proposed operations will comply with all noise criteria at all surrounding residences. Even during worst case quarry traffic scenarios, the proposal will comply with the DECC's daytime and night-time traffic noise criteria. Blasting noise and vibration criteria will be achieved. Monitoring will confirm achievement of compliance.
Air Quality	Existing air quality was determined using on-site monitoring and regional databases. Modeling predicted compliance with air quality criteria. Gunlake will implement a range of management strategies to minimize air quality impacts. Monitoring will confirm achievement of compliance.
Cultural Heritage	No items of non-Indigenous heritage will be affected by the Project. Five Indigenous archaeological sites were identified and Gunlake has proposed a number of management options to control adverse effects on these.
Flora and Fauna	There is one threatened flora species (Hoary Sunray) recorded in the vicinity of the Project Site. There is also some remnant vegetation of the White Box, Yellow Box Blakeley's Red Gum woodland occurring on the Site. Neither are expected to be significantly

	impacted by the Project. Two threatened fauna species (Eastern Bent-wing Bat and the Speckled Warbler) were recorded in the vicinity of the Project, however, there is unlikely to be any significant impact on any local population of threatened fauna. Gunlake will implement a number of management strategies aimed at reducing any potential flora and fauna impacts. They will prepare and implement a Site Vegetation Management Plan.
Visual Amenity	The Project will have minimal visual impact. Topographic features and remnant vegetation effectively screens the Project from public view. Project related traffic will be visible on local roads, however, it will be a very small component of the overall traffic flow.
Bushfire	The Project should not significantly affect bushfire hazard. Gunlake will implement management activities to minimize the risk and will participate in local bushfire control activities.
Socio-Economic	The Project is not expected to create adverse socioeconomic impact. It will create positive impacts through the creation of long term employment and provision of essential quarried rock saleable products to support the development of urban and industrial developments and related transport infrastructure.
European Heritage	The Project will not have any impact on European Heritage.

6.2.2 Ecologically Sustainable Development

6.2.2.1 Introduction

Sustainable practices by industry, all levels of government and the community are recognised to be important for the future prosperity and well-being of the world. The principles of Ecologically Sustainable Development (ESD) that have been recognised for over a decade were based upon meeting the needs of the current generation while conserving our ecosystems for the benefit of future generations. In order to achieve sustainable development, recognition needs to be placed upon the integration of both short-term and long-term environmental, economic, social and equitable objectives.

Throughout the design of the Project, the Proponent has endeavoured to address each of the sustainable development principles. The following sub-sections draw together the features of the Project that reflect the four principles of sustainable development, namely:

- the precautionary principle;
- the principle of social equity;
- the principle of the conservation of biodiversity and ecological integrity; and
- the principle for the improved valuation and pricing of environmental resources.

6.2.2.2 The Precautionary Principle

To satisfy this principle of ESD, emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it. During the planning phase for the Project and throughout the preparation of the Environmental Assessment, the Proponent engaged specialist consultants to examine the existing environment, predict possible impacts and recommend controls, safeguards and/or mitigation measures in order to ensure that the level of impact satisfies statutory requirements or reasonable community expectations. Throughout the development of the Project, the Proponent and its consultants have adopted an anticipatory approach to impacts, particularly that of irreversible ecological damage, by undertaking an analysis of the risks posed by activities of the Project, an appropriate level of research and baseline investigations and environmental evaluation. The controls, safeguards and/or mitigation measures have therefore been planned with a comprehensive knowledge of the existing environment and the potential risk of environmental degradation posed by Project activities.

The implementation of the environmental safeguards, controls and mitigation measures has been formalised by the Proponent as the draft Statement of Commitments presented as Section 5.

Examples of matters relating to the precautionary principle that were considered during the various stages of the Project are listed below.

Objectives of the Project
The Project has been designed with the principal objective being to develop and operate the quarry in a safe and environmentally responsible manner which meets the requirements of local and State government agencies, accepted industry standards and wherever possible, reasonable community expectations. The Proponent recognises that only through comprehensive environmental assessment and an environmentally responsible approach to the design and operation of the proposed development can the risk of harm to the environment be minimised.

Design of Project Components
Several design aspects of the Project were modified during the planning stage in order to ensure the requirements of local and State government agencies, accepted industry standards and wherever possible, reasonable community expectations were met. These included the following.

- The location of the quarry offices and facilities was chosen to reduce visibility of these components of the Project.
- Project activity has been located well clear of Chapman's Creek.
- Rehabilitation of the site incorporates replanting of a riparian corridor along Chapman's Creek and one of its tributaries.
- An amenity bund around the rock processing area was designed to maximise the use of overburden from the rock processing area and the initial sector of the quarry pit while providing visual and acoustic benefits.

Integration of Safeguards and Procedures
The framework for ongoing environmental management, operational performance and rehabilitation of the Project Site would be provided through the Project approval and be managed in accordance with the approval conditions, Gunlake's environmental management objectives and existing legislation. In addition:

- all on-site procedures would be regularly reviewed, particularly in light of monitoring results;
- surface water, groundwater, noise, and deposited dust levels would be monitored at locations potentially most affected by the Project in order to ensure the continued compliance with the goals outlined in this document;
- the principles outlined in the surface water management section of the Environmental Assessment (Section 4B.2) would be adopted to minimise any impact on water quality or quantity at areas affected by the Project;
- wherever possible, areas not required for quarry-related activities would remain grassed to assist in minimising erosion and reducing the suspended sediment load in surface water flowing through the Project Site; and
- topsoil and subsoil would be stripped, stockpiled and re-spread on the basis of the quality of the soil and planned final land use of different areas of the final landform.

Rehabilitation and Subsequent Land Use

Long term adverse impacts on the local environment would be avoided through the design and rehabilitation of a landform suitable for future use for agriculture and the establishment / maintenance of areas of native vegetation for the riparian corridor along Chapman's Creek.

Conclusion

The precautionary principle has been considered during all stages of the design and assessment of the Gunlake Quarry Project. The approach adopted, ie. risk review, initial assessment, consultation, specialist investigations and safeguard design, provides a high degree of certainty that the Project would not result in any major unforeseen impacts.

6.2.2.3 Social Equity

Social equity embraces value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to the community. Social equity includes for both inter-generational (between generations) and intra-generational (within generations) equity considerations.

Equity within generations requires that the economic and social benefits of the development be distributed appropriately among all members of the community. Equity between generations requires that the non-material well-being or "quality of life" of existing and future residents of the local community would be maintained throughout and beyond the life of the Project.

Both elements of social equity are addressed through the design of the Project itself, the implementation of operational safeguards to mitigate any short-term or long-term environmental impacts, and the proposed rehabilitation of the areas directly disturbed. Examples of matters relating to social equity that are relevant to the various stages of the proposed development are listed below.

Identification of Project Objectives

The Project has been designed with the objective of providing significant employment opportunities to residents of the Goulburn Mulwaree Local Government Area. This objective would require a commitment to employee training.

The Project has been designed with the objective to ensure the continued viability of surrounding land uses throughout and beyond the life of the Project.

Design of Project Components

The Project has been designed to maintain inter-generational equity, ie. in recognition that quarrying is a relatively short-term land use, and to ensure components of the existing biological, social and economic environment available to existing generations would also be available to future generations.

- The location and orientation of the quarry and associated activity has been designed to minimise visual impact for local residents.
- Quarrying operations will be subject to the requirements of an Environmental Management Plan.
- The availability of groundwater to surrounding landholders, although not predicted to be noticeably affected by the Project, would be monitored throughout the life of the Project and compensatory measures taken should a short-term reduction in the availability of groundwater to local landholders occur.
- The rehabilitation of the Project Site has been designed to integrate the re-establishment of agricultural land with the conservation of native vegetation and the creation of a riparian habitat corridor.

Integration of Safeguards and Procedures

The Proponent recognises that all members of the local Marulan community should benefit appropriately from the Project either directly or indirectly. In order to ensure a realistic distribution of benefits, the Proponent would continue to consult with the local community and maintain a pro-active approach to issues of interest. This dialogue would also include a system to record, manage and respond to any complaints relating to the operation.

Rehabilitation and Subsequent Land Use

The final landform would be constructed and rehabilitated in a manner that would generally retain land with an agricultural potential similar to that prior to mining, thereby providing support for continuing economic activity within the local community. The quarry pit will remain as a depression in the landscape.

Conclusion

The principle of social equity has been addressed throughout the design of the Project. The Gunlake Quarry Project would contribute significantly to the economic activity of Marulan and the communities of the Goulburn Mulwaree Local Government Area through the generation of employment and increased demand for local goods and services and flow-on effects. As such, the benefits of the Project would be distributed throughout the local community. The Project was also designed such that elements of the existing environment available to this generation, including agricultural land, water and local biodiversity would continue to be available to future generations. The Proponent would adopt a pro-active approach in identifying and addressing any concerns identified by the local community.

6.2.2.4 Conservation of Biological Diversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological processes and systems are central goals of sustainability. It is important that developments do not threaten the integrity of the ecological system as a whole or the conservation of threatened species in the short- or long-term. Details of how the Project has been designed to achieve compliance with these principles are set out below.

Identification of Project Objectives
The Proponent is committed to undertake all activities in an environmentally responsible manner, and recognises the need to ensure that changes to natural components of the environment do not adversely affect biological diversity or ecological integrity. As such, the Project has been designed with an objective to minimise impacts on the flora and fauna of the Project Site, whilst allowing the extraction of an economically viable resource.

Design of Project Components
- Water management structures have been designed and would be constructed to ensure that only water within DEC specified criteria leaves the area disturbed around the quarry.

Integration of Safeguards and Procedures
- Post-quarrying rehabilitation of the Project Site would include the establishment of a riparian corridor along Chapman's Creek.
- Weed eradication programs would be developed and implemented, as required.

Rehabilitation and Subsequent Land Use
The final landform has been designed primarily to provide for some agricultural activity but with the establishment of some native vegetation and fauna habitat included.

Conclusion
The Project would have little impact on local or regional biodiversity. Disturbance to areas of native vegetation would be minimised wherever possible. Weed eradication programs would be implemented as appropriate and would further assist in addressing the principle of sustainable development.

6.2.2.5 Improved Valuation and Pricing of Environmental Resources

The issues that form the basis of this principle relate to the acceptance that the polluter pays, all resources are appropriately valued, cost-effective environmental stewardship is adopted and the adoption of user-pays principle based upon the full life cycle of the costs. A reflection of these issues on the proposed Gunlake Quarry Project is set out below.

Identification of Project Objectives
The Proponent's principal objective is to operate the quarry in a profitable, safe and environmentally responsible manner, which demonstrates that an appropriate value has been placed on elements of the existing environment.

Design of Project Components and Integration of Safeguards and Procedures
The extent of research, planning and design of environmental safeguards, mitigation measures and offset strategies to prevent irreversible damage to environmental resources, other than the rock to be quarried, is evidence of the value placed by the Proponent on these resources.

Rehabilitation and Subsequent Land Use
The design of the final landform to integrate ongoing agricultural activities with the re-establishment of native vegetation illustrates the value placed by the Proponent on both the agricultural and ecological elements of the Project Site.

Conclusion
The value placed by the Proponent on environmental resources is evident in the identification of Project objectives, extent of site-specific research, planning and environmental safeguards and measures to be implemented to prevent irreversible damage to the environment on and surrounding the Project Site. It is planned that the income received from the sale of the quarried rock products would be sufficient to enable the Proponent to achieve an acceptable profit level whilst undertaking all environmentally-related tasks and meeting all commitments in all consents, leases, licences and approvals and those made to the local community.

6.2.2.6 Conclusion

The approach taken in planning the Project has been multi-disciplinary, involved consultation with potentially affected local residents and various government agencies and emphasis on the application of safeguards to minimise potential environmental, social and economic impacts. The design of the Project has addressed each of the sustainable development principles, and on balance, it is concluded that the Gunlake Quarry Project achieves a sustainable outcome for the local and wider environment.

6.3 JUSTIFICATION OF THE PROJECT

6.3.1 Introduction

In assessing whether the development and operation of the Project is justified, consideration has been given both to the predicted residual impacts on the local and wider environment and the potential benefits the Project would have for the Proponent, Marulan, Goulburn Mulwaree Local Government Area, NSW and Australia. When considering the predicted residual impacts, a review of the proposed controls, safeguards and mitigation measures of the Proponent was also undertaken to determine the emphasis placed on impact minimisation and the incorporation of the principles of ESD.

This section also considers the consequences of the Project not proceeding.

6.3.2 Biophysical Considerations

Section 4B presents the range of residual impacts on the biophysical environment predicted should the Project proceed, after the adoption of a number of design and operational procedures, mitigation measures and/or offset strategies. The Project would have a range of impacts on the biophysical

environment. The residual impacts considered of greatest significance, and the proposed management of these, are summarised as follows.

Water Resources

A proportion of the surface water currently flowing through the Project Site would be retained on site for use in dust suppression. The "clean" water component captured would be within the maximum harvestable right for the Project Site, with additional clean water diverted to natural watercourses. Sediment-laden or "dirty" water originating from disturbed areas would be collected and preferentially used for dust suppression. Any excess dirty water would be retained to allow sufficient time for suspended solids to settle out and enable it to be discharged within DEC criteria.

During the life of the Project, the local groundwater level in the immediate vicinity of the quarry pit will be lowered. However, as the water in these layers is not generally accessed by local groundwater users, a significant impact on non-Project related registered bores in the vicinity of the Project Site is not expected.

Soils and Land Capability

Impacts on the soils of the Project Site would be temporary and manageable given the procedures intended to stockpile and revegetate all soils.

Flora and Fauna

Disturbance to native vegetation and fauna habitats would be limited given the largely cleared nature of the Project Site and avoidance of disturbance to the more sensitive remnant communities. Rehabilitation would include establishment of a riparian habitat corridor along Chapman's Creek

Aboriginal Heritage

The small scatters of artefacts identified near the Project will be salvaged and relocated prior to any site activity. The Proponent is committed to ensuring that any artefacts or sites of Aboriginal heritage significance that may be identified in the future are appropriately protected and/or managed.

Noise

The Project would generate noise levels over and above those currently experienced throughout the existing environment. These noise levels, assuming the implementation of the operational commitments identified in Section 5, would not exceed the DECC nominated criteria. The Proponent will develop and implement measures to mitigate or minimise noise levels.

Air Quality

Air pollutant levels are predicted to be below DECC criteria for deposited dust, PM_{10} and $PM_{2.5}$ at all non-Project related residences, ie. assuming the adoption of a range of standard dust control measures.

Visibility

Activities on the Project Site are not visible from local roads. Limited long views can be had from neighbouring properties. The Project will have minor visual impact and create a very minor change to the existing visual amenity although the construction and vegetation of the overburden emplacement around the Rock Processing area would help to mitigate this change.

Traffic

Traffic would increase along the saleable products transport route between the Project Site and the Hume Highway. Intersection and road upgrades and construction will help to accommodate this increase. The Proponent will enter a road maintenance contribution agreement with Goulburn Mulwaree Council in order to provide assurance of appropriate response to any road deterioration resulting from the increased traffic.

When considering the implementation of the controls, safeguards and mitigation measures proposed by the Proponent and summarised in Section 5, the level of impact on the biophysical environment is relatively minor.

6.3.3 Socio-economic Considerations

The impacts of the Project on the socio-economic environment would be largely positive given the positive increase in employment opportunities, the Proponent's commitment to employing local residents, the diversification of industry within the Marulan area and the flow-on effects to subsidiary and associated industries and businesses of the Project.

Marulan and Goulburn Mulwaree Local Government Area are also considered to have sufficient existing facilities and services to cater for the very minor predicted population growth.

The Project would also have significant economic benefits to NSW and Australia through the payment of taxes. The saleable products are an essential resource for future urban, industrial and transport developments.

6.3.4 Consequences of not Proceeding with the Project

The consequences of not proceeding with the Project include the following:

- The hard rock resource would not be quarried by the Proponent. Such an outcome would be contrary to the State's and the Proponent's objective to maximise rock resource utilisation in the Marulan area.
- The opportunity to create up to 20 full-time jobs would be foregone. The additional 25 people employed driving trucks delivering saleable product to diverse market locations would have to find an alternative employment opportunity.
- The quarried rock industry would have reduced competition.
- The disposable wages for the full-time and part-time workforce would be foregone, a substantial proportion of which would be spent in the Marulan area.
- The opportunity to diversify industry within the Marulan area would be foregone along with the training opportunities proposed by the Proponent. This loss of training opportunities would also reduce the ability of the local communities to retain younger people who are generally leaving to pursue greater opportunities elsewhere.
- Foregoing PAYE taxes for the 30 year life of the quarry.
- The minor impacts on the local biophysical environment would not eventuate.

It is considered that the benefits of proceeding with the Project therefore far outweigh the minor impacts on the environment that would result. The consequences of not proceeding with the Project also weigh heavily in favour of proceeding with the Gunlake Quarry Project.

6.4 CONCLUSION

The Gunlake Quarry Project has, to the extent feasible, been designed to address the issues of concern to the community and all levels of government. The Project provides for the quarrying, processing and despatch of a high quality rock product which would be significant in generating employment opportunities and boosting the local economies of Marulan and other surrounding communities. The development and operation of the Project would be a positive change to the local area economic base. The post-quarrying landform would integrate the re-establishment of agricultural land with areas designated for the conservation and extension of native vegetation and fauna habitat.

This document and the range of specialist consultant studies undertaken have identified that the Gunlake Quarry Project should proceed because it would:

(i) contribute towards satisfying the demand for crushed rock products;
(ii) reduce risk levels associated with possible incidents and impacts on the environment to an acceptable level;
(iii) have a minimal and manageable impact on the biophysical environment;
(iv) satisfy sustainable development principles;
(v) provide for continuing and future use of the Project Site for agriculture;
(vi) provide significant training and employment opportunities for residents of Marulan and surrounding communities; and
(vii) contribute to the diversification of industry within the Goulburn Mulwaree Local Government Area and promote a continued growth in economic activity in the LGA.

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Section 7
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Section 8
Glossary of Technical Terms, Acronyms, Symbols and Units

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GLOSSARY OF TERMS

A horizon – part of soil profile immediately below the topsoil.

acid – substance with a pH less than 7.0; the lower the pH, the higher the corrosive ability of the substance.

acid formation – the process whereby acid is formed by the oxidation of minerals (particularly sulfides) exposed to air and water.

acid mine drainage (AMD) – runoff of acidic water, typically from mine waste rock, following acid formation within the rock.

acoustic bund – a natural or artificial structure (e.g. a hill or a bund) that inhibits the transmission of sound.

adverse weather conditions (in respect of noise and dust) – conditions, such as high wind, that assist the movement of dust or propagation of noise away from the mine towards receptors.

aerial photographs – photographs of landscape taken from a plane (typically areas several kilometres across) used for the surveying and interpretation of vegetation type, geology, land use, etc.

aerial survey – survey of a landscape from an aeroplane, typically involving aerial photography, to determine specific characteristics (e.g. mineral potential or land use).

airblast overpressure – a shock wave from the blast transmitted through the air, normally measured in dB(Linear).

air pollutant – a substance in ambient atmosphere, resulting from the activity of man or from natural processes, causing adverse effects to man and the environment (also called "air contaminant").

air pollution emissions inventory – all information, collection and processing system containing data on emissions of, and sources of, air pollution from both man-made and natural causes.

air quality criteria – quantitative relationship between a pollutant's dose, concentration, deposition rate or any other air quality-related factors, and the related effects on receptors, e.g. humans, animals, plants, or materials. Air quality criteria serve as the scientific basis for formulating ambient air quality standards or objectives.

alkaline – having a pH greater than 7.0.

alkalinity – in water analysis a measure of the carbonates, bicarbonates, hydroxides and occasionally the borates, silicates and phosphates in the water.

alluvial – pertaining to material, such as sand or silt, deposited by running water (e.g. a creek or river).

ambient level – existing level of a phenomenon without the influence of the proposal.

amenity – the desirability of an area.

amphibians – animals (such as frogs) adapted to live both on land and in water.

anecdotal evidence – informal, oral or written evidence of an event.

ANFO – mixture of ammonium nitrate and fuel oil (diesel) used as an explosive.

anticline – a fold in the form of an up-turned basin.

aquifer – rock or sediment capable of holding and transmitting groundwater.

arboreal – pertaining to tree habitats.

archaeology – the scientific study of human history, particularly the relics and cultural remains of the distant past.

artefact – anything made by human workmanship, particularly by previous cultures (such as chipped and modified stones used as tools).

atmospheric stability – a measure of turbulence which determines the rate at which the effluent is dispersed as it is transported by the wind.

average annual rainfall – the average amount of rain to fall at a specific location over the period of 1 year (measured in millimetres).

B horizon – subsoil material located below the A horizon material and above the parent rock.

backfill – material used to fill created void.

background dust level – dust level in the absence of mining and processing activities.

background noise levels – the level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (eg sound from a particular noise source; or sound generated for test purposes).

bank cubic metre – a volume of 1m3 in the ground prior to disturbance.

baseline monitoring – monitoring performed prior to site development.

basin – the drainage area of a river and its tributaries or of a groundwater system.

batter – An engineered slope of soil or rock fill on either side upslope or downslope of a road, embankment or mine waste storage.

bench – a step in the face of a quarry or mine which could be up to 25 m high.

blasthole – hole drilled into rock to position explosive for blasting.

blasting – the operation of breaking rock by means of explosives.

blast rock – rock that is propelled into the air by the force of an explosion. Usually comes from pre-broken material on the surface or upper open face.

bore – a well, usually of less than 20 cm diameter, sunk into the ground and from which water is pumped.

bulldozer – an item of tracked mobile earth moving equipment fitted with a front blade and with rear rippers used for pushing and ripping soil and rock.

bund – embankment of clay or weathered rock emplaced for visual or acoustic screening.

catch drains – drains used to intercept and redirect runoff.

catchment area – the area determined by topographic features within which rainfall will contribute to runoff at a particular point.

cation – an ion having a positive charge and characteristically moving toward a negative electrode.

channel – river or irrigation channel, includes bed and bank.

clay – a size term denoting particles, regardless of mineral composition, with diameter less than 0.004 mm.

community – a combination of plants that are dependant on their environment and influence one another and modify their own environment. They form together, with their common habitat and other associated organisms, an ecosystem, which is also related to neighbouring ecosystems and to the macroclimate of the region.

concentration – the amount of a substance, expressed as mass or volume, in a unit volume of air.

conductivity – the measurement of the ability of a substance (either a measure of solid, liquid or gas) to transmit electricity; a measure of the salt content.

conglomerate – sedimentary rock consisting of poorly sorted grains (typically pebbles surrounded by finer material, such as sand or silt).

conservation – the management of resources in a way that will benefit both present and future generations.

contour bank – an earth bank constructed across a slope parallel to contours.

contractor – specialist brought in to perform a specific task, such as the construction of mine infrastructure or the excavation (mining) of the open pit.

core – (archaeology) a piece of stone from which flakes have been removed; cores often show distinctive flake scars indicative of certain production techniques, such as blade or adze production.

cross-section – a two-dimensional diagram of an object presented as if the object had been cut along its length.

crusher – that part of an ore-processing plant where the ore is mechanically crushed into smaller pieces.

crushing – the mechanical process of reducing rock size usually by pressure or impact.

culvert – large pipe or channel carrying water underneath a structure (e.g. a road or railway track) or underneath the ground.

cumulative – increasing by successive additions.

deceleration lane – a lane used for decreasing speed before leaving the road.

decibel – unit expressing difference in power between acoustic signals.

density – 1. The mass of a substance (e.g. sediment) divided by its volume; water has a density of exactly 1 kilogram per litre; gold has a density of 19.3 kilograms per cubic metre. 2. The coverage of vegetation (e.g. trees) per unit of distance (along a linear transect) or unit of area (in an area transect).

deposition – laying down of particulate material (e.g. sediment in a lake or tailings solids in a tailings storage).

detonator – a device that triggers an explosive.

diamond core – cylindrical-shaped drilling samples obtained by use of a diamond surfaced drilling bit.

diamond drill hole – drill hole constructed by equipment using rotary fluid flushing and a diamond faced bit to obtain core from the rock being drilled.

dip – the angle that rock strata make with a horizontal surface measured at right angles to the strike.

dispersibility – a characteristic of soils relating to their structural breakdown in water into individual particles.

diversion bank – an earth bank constructed to divert water away from disturbed areas.

drainage line – a passage along which water concentrates and flows towards a stream, drainage plain or swamp intermittently during or following rain.

drawdown – the difference between the water level observed during pumping and the non-pumping water level (static water level or static head).

drill core – the cylindrical sample of rock recovered by means of diamond drilling.

drilling – the action of boring holes (usually less than 30 centimetres in diameter and up to several kilometres deep) into the ground, typically to establish a water bore or to investigate the geology found at depth.

dust concentration – the amount of a substance, expressed as mass or volume, in a unit volume of air.

dust – particles of mostly mineral origin generated by erosion of surfaces and the mining and handling of materials

electrical conductivity (EC) – the ability of a substance (either solid, liquid or gas) to transmit electricity.

ecology – the relationship between living things and their environment.

ecologically sustainable development (ESD) – using, conserving and enhancing the community's resources so that ecological processes on which life depends are maintained and the total quality of life, now and in the future can be increased.

ecosystem – the totality of biological processes and interactions within a specified physical environment.

Emerson Class No. – ranking given to a soil or clay according to the Emerson crumb test.

emission – a discharge of a substance (e.g. dust) into the environment.

emission factor – an expression for the rate at which a pollutant is generated as a result of some activity, divided by the level of that activity.

environment – a general term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms (including human beings) exists.

environmental constraints – limitations on a project by components of the environment.

Environmental Assessment (EA) – a formal description of a project and an assessment of its likely impact on the physical, social and economic environment. The EA is used as a vehicle to facilitate public comment and as the basis for analysing the project with respect to granting approval under relevant legislation.

ephemeral – not permanent, e.g. a stream that flows only seasonally or after rainfall or a lake that periodically dries out.

erodibility – the tendency of soil, earth or rock to erode.

erosion – the wearing away of the land surface (whether natural or artificial) by the action of water, wind and ice.

erosion potential – the susceptibility of a parcel of land to the prevailing agents of erosion. It is dependent on a combination of climate, landform, soil, land use and land management factors.

evaporation – the loss of water as vapour from the surface of a liquid that has a temperature lower than its boiling point.

excavate – to dig into natural material or fill using an excavator or other machinery.

excavator – item of earth moving equipment fitted with a bucket on an articulated boom and used for digging material from a face in front of, or below the machine. An excavator would be used around the perimeter of the lakes.

existing air quality – the quality of the ambient air near ground level, expressed as concentrations or deposition rates or air pollutants – also expressed as ambient air quality.

exotic – introduced or foreign, not native.

fault – a fracture in rock along which there has been observable displacement.

fauna – a general term for animals (birds, reptiles, marsupials, fish etc.) particularly in a defined area or over a defined time period.

feasibility study – a preliminary technical and economic study to assess the viability of a project.

fill – material imported and emplaced to raise the general surface level of a site.

front-end loader – machine used to lift and place soil, earth, rocks, etc. on a construction site.

fugitive emissions – emissions not entering the atmosphere from a stationary vent (stack). Examples of fugitive dust sources include vehicular traffic on unpaved roads, handling of raw materials, wind erosion of dusty surfaces, etc.

geotechnical – technical or engineering aspects relating to soil, rock and other materials.

grader – an item of earthmoving equipment, rubber tyred and fitted with a centrally mounted blade and rippers used to shape and trim the ground surface.

gradient – rate of change of a given variable (such as temperature or elevation) with distance.

grassland – an extensive area of largely treeless land covered mainly by natural grasses.

ground vibration – oscillatory motion of the ground caused by the passage of seismic waves originating from a blast.

groundcover – vegetation that grows close to the ground (such as grasses and herbs) providing protection from erosion.

groundwater – all waters occurring below the land surface; the upper surface of the soils saturated by groundwater in any particular area is called the water table.

groundwater depression – localised lowering of the regional water table.

groundwater surface – the upper surface of the water table.

habitat – the place where an organism normally lives; habitats can be described by their floristic and physical characteristics.

haul road – road used in a quarry for haulage of rock from the active face to the crusher and for general site access.

haul truck – a truck specifically designed for hauling and tipping soil or rock within the quarry or similar situation.

head (hydraulic head) – energy contained in a water mass, produced by elevation, pressure or velocity.

heavy metals – normally trace metals of high density which occur in ore deposits and may be environmentally hazardous.

heritage – the things of value which are inherited.

heritage significance – of aesthetic, historic, scientific, cultural, social, archaeological, natural or aesthetic value for past, present or future generations.

hydraulic conductivity (k) – the rate of flow of water in an aquifer through a cross section of unit area under a unit hydraulic gradient, at the prevailing temperature. Usually expressed in units of metres per second or metres per day.

hydraulic gradient – the direction of flow of groundwaters.

hydrogeology (geohydrology) – the study of groundwater and the related geologic aspects of surface waters.

in-situ – a term sued to distinguish material (e.g. rocks, minerals, fossils, etc.) found in its original position of formation, deposition, or growth, as opposed to transported material.

indigenous – belonging to, or found naturally in, a particular environment (see also exotic).

infiltration – the process of surface water soaking into the soil.

inflow – flow directed into a particular feature, such as a lake or a mine pit.

infrastructure – the supporting installations and services that supply the needs of a project.

inter-generational equity – the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

interburden – rock strata in between coal seams.

intermittent – flows periodically, irregularly.

inversion - generally used in meteorology with respect to an increase of temperature with height in contrast with the usual decrease of temperature with height in the troposphere. An inversion layer is distinguished by its large stability, which limits the turbulence and therefore the dispersion of pollutants.

invertebrates – commonly, animals without a backbone (jellyfish, worms, molluscs, etc.).

ion – an atom or compound that has gained or lost an electron, so that it is no longer electrically neutral but carries a positive or negative charge.

jointing - planes of discontinuity in rockmass which exhibit no evidence of relative movement.

landform – a specific feature of a landscape (such as a hill) or the general shape of the land.

lapse weather conditions – weather conditions that neither particularly exacerbate nor mitigate the dispersal of pollutant emissions (dust, noise etc.) from the project area.

loam – loose soil composed of clay and sand, especially a kind containing organic matter and of great fertility.

Local Environmental Plan (LEP) – a plan developed by a council to control development in part or all of their shire or municipality.

long-term – a period of time associated with annual air quality standards. Long-term models usually address pollutant concentrations over several seasons to one year.

low loader – is a trailer which has a relatively low carrying deck and used to transport large items of equipment such as bulldozers or scrapers.

low-yielding – an aquifer which yields water at a low rate.

mammal – animal of the class mammalia, distinguished by the presence of hair and mammary glands.

management strategy – a policy or direction that assists in actions required to address issues.

migratory – passing, usually predictably (based on aquatic species), from one region or climate to another, for purposes of feeding, breeding, or other biological purposes.

mitigation measures – measures employed to reduce (mitigate) an impact (such as the construction of a perimeter bund to reduce sound emissions).

mobile equipment – wheeled or tracked self propelled equipment such as trucks and front-end loaders.

monitoring – systematic sampling and, if appropriate, sample analysis to record changes over time caused by impacts such as mining.

mudstone – sedimentary rock formed from the consolidation of silt and clay.

National Park – an area set aside for the protection of flora and fauna and for public recreation.

natural – existing in, or formed by, nature (generally excludes anything obviously modified by human beings).

neutral – neither acidic nor basic (e.g. a pH equal to 7.0).

noxious – introduced species considered to be harmful to native species or to the habitat of native species.

nutrients – generally refers to nitrogen and phosphorus, which are essential for biological growth.

offset strategy – a method of providing for disturbance attributable to the proposal through additional or compensatory measures.

open cut – large hole excavated in an open-cut mining operation to remove the ore.

operations phase – that period of the mining project, after construction and prior to decommissioning, during which pit excavation and metal extraction takes place.

overburden (waste rock) – in the mining context refers to non-economic material to be removed to allow access to the resource.

particle size distribution – the relative proportions of particles (e.g. in a sediment) that fall within specific size categories.

particulate matter – small solid or liquid particles suspended in or falling through the atmosphere - sometimes expressed by the term particulates.

peak particle velocity (ppv) – a measure of ground vibration reported in millimetres per second (mm/sec).

perennial – refers to stream which has flow throughout the year.

permeability – a material property relating to the ability of the material to transmit water.

Permian – the geological period of time from 280 to 225 million years.

pH – a measure of the degree of acidity or alkalinity of a solution; expressed numerically (logarithmically) on a scale of 1 to 14, on which 1 is most acid, 7 is neutral acid, and 14 is most basic (alkaline).

piezometer – a core drilled specifically for the monitoring of groundwater levels and water quality.

pollution – the alteration of air, soil, or water as a result of human activities such that it is less suitable for any purpose for which it could be used in its natural state.

population – a group of organisms all of the same species occupying a particular area.

potable – water suitable for human consumption.

precautionary principle – a principle of ESD which states that decisions about any proposed development should be guided by careful management to avoid serious and irreversible damage to the environment.

progressive rehabilitation – rehabilitation of mine or disturbed areas as soon as practicable after they are released during the life of the mine.

Project Site – the total area covered by the project, including pit, processing plant, overburden dumps, stockpiles, bunds, ponds, etc.

pump test – the systematic pumping of water from a bore to test the response of an aquifer.

quadrat – a square survey area.

quantify – to determine the quantity or amount of a component in a substance.

Quaternary – geological period of time from 2 million years before present to present.

recharge – the addition of water to an aquifer, directly from the surface, indirectly from the unsaturated zone, or by discharge from overlying or underlying aquifer systems.

Regional Environmental Plan (REP) – a plan prepared by the State Government Department responsible for planning where controls on development are considered on a regional and/or statewide basis.

rehabilitation – the preparation of a final landform after quarrying and its stabilisation with grasses, trees and shrubs.

reject material – comprises a mixture of high ash coal and non-coal materials such as sedimentary rock and clay.

relative humidity – the ratio of actual moisture in the air to the amount the air could hold if saturated, at a given temperature.

relief – the variation in landscape elevation over a region.

remnant vegetation – native vegetation remaining after widespread clearing has taken place.

reptiles – cold-blooded vertebrates, including lizards, snakes, turtles, and crocodiles.

reserves – in the mining context refers to those parts of a resource where sufficient information is available to undertake mine planning.

resource – an estimate of potentially usable coal in a defined area based on preliminary information.

revegetation – replacement of vegetation, principally grasses and legumes on areas disturbed by mining activities.

runoff – that portion of the rainfall falling on a catchment area that flows from the catchment past a specified point.

saline – water with high salt concentration.

salinity – the dissolved content of water expressed in terms of milligrams per litre.

scarred tree – tree with cuts in its bark or wood made by Aborigines.

scraper – irregularly shaped artefact that has been modified in a manner that suggests use in scraping activities, notably woodworking.

screening – a process which separates crushed rock into various size fractions – this usually involves a mechanical vibration of the rock over a series of decks fitted with steel mesh, steel plate or polyurethane or rubber mats with fixed sized apertures.

sediment basin – a small excavation designed to trap the coarse material washed from disturbed areas.

sequence (geological) – layers of (predominantly) sedimentary rocks sourced from a common geological environment or period.

short-term – a period of time associated with air quality standards for pollutant exposures ranging between one hour and twenty four hours.

silt – a classic sediment, most of the particles of which are between 0.063mm and 0.004mm in diameter.

silt-stop fencing – fine mesh fencing normally installed downslope of a sediment source, designed to trap silt and sediment and allow the water to pass through.

soil erosion hazard – the susceptibility of an area of land to erosion and includes rainfall erosivity, slope, soil erodibility and cover.

solubility – the ability of a substance (such as copper) to dissolve in a solvent (such as water); solubility depends on such factors as temperature and pH.

source – the place where pollutants are emitted into the atmosphere. Sources may be point, area or line sources. Often the term "source" is used for a whole plant or an installation. In air pollution modelling, the terms "continuous source" and "instantaneous source" are used:

continuous source: source which emits pollution continuously over a time period much larger than the travel time to a point where the concentration is considered. Usually it is assumed that during this time period the emission is constant.

instantaneous source: source which emits pollution over a time period much short than the travel time of the emission to a point where its concentration is considered.

species – a taxonomic grouping of organisms that are able to interbreed with each other but not with members of other species.

species diversity – a measure of the number of different species in a given area.

specific energy – heat liberated by combustion of a fuel, ie. energy available per unit of mass.

stable – used with respect to the atmospheric boundary layer, when the vertical temperature gradient is greater than the adiabatic lapse rate. Vertical air motions are suppressed. The turbulence intensity is low resulting in poor dispersion conditions.

stemming – the fine material placed in a blast drill hole after the explosive to ensure blast force is directed laterally.

stockpile – a pile used to store material (such as low-grade ore) for future use.

storage capacity – the maximum volume of liquid able to be retained in a container (e.g. a reservoir or lake).

stripping – removal of vegetation and topsoil.

structure (soil) – the physical texture of the soil arising from the interrelationship between the grain size, composition, and organic nature of a soil.

subsoil – the layer of soil lying below the topsoil; usually contains less organic matter and is less fertile.

surface waters – all water flowing over, or contained on, a landscape (e.g. runoff, streams, lakes etc).

Surface Water Management Plan (SWMP) – a plan to manage the capture, storage and use of Project Site surface water.

suspended solids – analytical term applicable to water samples referring to material recoverable from the sample by filtration.

temperature inversion – an increase in air temperature with height.

terrestrial – of or relating to the land, as distinct from air or water.

texture (of soil) – variations in composition, grain size distribution, and structure.

topography – the physical relief and contour of a region.

topsoil – the upper layer of soil, usually containing more organic material and nutrients than the subsoil beneath it.

total suspended particulates (TSP) – the mass of all particulate matter suspended in a solution.

total suspended solids – a common measure used to determine suspended solids concentrations in a waterbody and expressed in terms of mass per unit of volume (e.g. milligrams per litre).

tributary – a stream or river that flows into a larger river or lake.

weathered rock – rock affected to any degree by the processes of chemical or physical weathering.

weed – any plant (in particular an herbaceous one) that survives in an area where it is harmful or troublesome to the desired land use.

wildlife – non-domesticated fauna.

wildlife corridor – a strip of vegetation that has a design purpose of allowing animals to pass from one area to another and acting as an undisturbed area for wildlife preservation.

wind direction – the direction from which the wind, averaged over a certain period of time, is blowing.

wind erosion – wearing away of exposed soil, earth, or rock surfaces by the abrasive action of wind-blown particles (e.g. grains of sand).

wind rose – diagrammatic representation of wind direction, strength, and frequency of occurrence over a specified period.

woodland – plant communities dominated by trees whose crowns shade less than 30% of the ground.

yield – (of a water bore) 1) the capacity of the bore to produce water. 2) the amount of water actually withdrawn.

GLOSSARY OF ACRONYMS

AADT Annual Average Daily Traffic.

Adb air dried basis.

AEMR Annual Environmental Management Review.

AHD Australian height datum (in metres).

AHIMS Australian Heritage Information Management System.

ALS Australian Laboratory Services.

AMD Acid Mine Drainage.

ANC Acid Neutralising Capacity.

ANFO Ammonium Nitrate and Fuel Oil.

ANZECC Australian and New Zealand Environment and Conservation Council.

AS Australian Standard.

CEC Cation Exchange Capacity.

CL Coal Lease.

CHPP Coal Handling and Preparation Plant.

DA Development Application.

dB(A) decibels, A-weighted scale.

DEC Department of Environment and Conservation (NSW).

DECC Department of Environment and Climate Change (NSW).

DEH Department of Environment and Heritage (Commonwealth).

DNR Department of Natural Resources (NSW).

DoH Department of Housing (NSW).

DoL Department of Lands (NSW).

DoP Department of Planning(NSW).

DP Deposited Plan.

DPI Department of Primary Industries (NSW).

DPI (MR) Department of Primary Industries (Mineral Resources) (NSW).

DUAP Department of Urban Affairs and Planning (NSW). (now DoP)

DWE Department of Water and Energy (NSW).

EAT Emersons Aggregate Test.

EC electrical conductivity.

ECRTN Environmental Criteria for Road Traffic Noise.

EIS Environmental Impact Statement.

EL Exploration Licence.

EPBC Act Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).

EP&A Act Environmental Planning and Assessment Act 1979 (NSW).

ESD Ecologically Sustainable Development.

GSC Gunnedah Shire Council.

GWP Global Warming Potential.

HVAS High Volume Air Sampling.

INP Industrial Noise Policy.

LALC Local Aboriginal Land Council.

LEP Local Environmental Plan.

LGA Local Government Area.

MIC Maximum Instantaneous Charge.

MLA Mining lease application.

MOP Mining Operations Plan.

MR Main Road.

MREMP Mining, Rehabilitation and Environmental Management Process.

NAG Net Acid Generation.

NAPP Net Acid Producing Potential.

NATA National Association of Testing Authorities.

NEPC National Environment Protection Council.

NEPM National Environment Protection Measure.

NHMRC National Health and Medical Research Council.

NPWS National Parks and Wildlife Service (NSW).

PHA Preliminary Hazard Analysis

PSA Particle Size Analysis

PVS Peak Vector Sum

POEO Act Protection of the Environment Operations Act 1997 (NSW).

REP Regional Environmental Plan.

ROM Run-of-Mine.

RTA Roads and Traffic Authority (NSW).

RBL Rating Background Level

SEPP State Environmental Planning Policy.

SMU Soil Mapping Unit.

SR Shire Road

SWMP Surface Water Management Plan.

TAPM The Air Pollution Model.

TSC Act Threatened Species Conservation Act 1995 (NSW).

TSP Total Suspended Particulate

USBM United States Bureau of Meteorology.

VBMP Vegetation and Biodiversity Management Plan.

WCL Whitehaven Coal Limited.

WHO World Health Organisation

GLOSSARY OF SYMBOLS AND UNITS

^{o} degrees.

^{o}C degrees Celsius.

% percentage.

$M million dollars.

< less than.

≤ less than or equal to.

> greater than.

≥ greater than or equal to.

bcm bank cubic metre – a volume of 1m^3 in the ground prior to disturbance.

cm centimetre (= 10mm).

D% dispersion percentage.

dB decibel, unit used to express sound intensity.

dB(A) the unit of measurement of sound pressure level heard by the human ear, expressed in "A" scale.

deg degrees.

g gram (= 0.001 kilogram).

g/m^2/month grams per square metre per month – unit for deposited dust.

ha hectare (100m x 100m).

kcal/kg kilocalories per kilogram.

kg kilogram (= 1 000 grams).

kL kilolitre (= 1 000 litres).

km kilometre (= 1 000 metres).

km^2 square kilometre (= 1 million m^2).

km/hr kilometres per hour.

kVA kilovolt – amperes.

L litre.

lcm loose cubic metre – a volume of 1m^3 after excavation.

L/s litres per second.

L/t litres per tonne.

L/hr litres per hour.

L_{A10} sound level exceeded 10% of the sampling time.

L_{A90} sound level exceeded 90% of the sampling time.

L_{Aeq} the L_{Aeq} is the "equal energy" average noise levels, and is used in some instances for the assessment of traffic noise effects or the risk of hearing impairment due to noise exposures.

$L_{Aeq\ 1\ hour}$ the "equal energy" average noise level over 60 minutes – used for assessing impacts of noise from motor vehicles.

$L_{Aeq\ T}$ sound level of continuous noise which emits the same energy as the fluctuation sound over a given time period (T).

L_{Amax} the absolute maximum noise level measured in a given time interval.

L_{AN} the A-weighted sound pressure level exceeded by N% of a given measured period.

m metre (= 100cm).

m AHD metres Australian Height Datum.

M million.

m^2 square metre.

m^3 cubic metre.

m/s metres per second.

Mbcm million bank cubic metres.

mg milligram (weight unit = 0.001 gram).

mg/L milligrams per litre (parts per million).

ML megalitre.
MLpa megalitres per annum.

mm millimetre (= 0.001 metres).

mm/s millimetres per second

Mt million tonnes (metric tonne = 1 000kg).

Mtpa million tonnes per annum.

PM_{10} particulate matter <10μm in diameter.

SWL standing water level.

t tonne (= 1 000kg).

tpa tonnes per annum.

V:H vertical to horizontal ratio

μS/cm microsiemens per centimetre

μm micrometres (= 0.001mm)

$\mu g/m^3$ micrograms (1 x 10^{-6} grams) per cubic metre

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APPENDIX I

Major Projects Application

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Major Projects application

NSW GOVERNMENT
Department of Planning

Date received: 1/6/07

Project Application No. _____

1. Before you lodge

This form is required to apply for the approval of the Minister to carry out a Project to which Part 3A of the *Environmental Planning and Assessment Act, 1979* (the Act) applies.

Before lodging this application, it is recommended that you first consult with the Department of Planning (the Department) concerning your Project.

Please be aware that you may need to conduct a Planning Focus Meeting before lodging this application involving the Department, relevant agencies, Council or other groups identified by the Department. If you are required to conduct a Planning Focus Meeting, you will need to provide details and outcomes arising from the meeting.

To ensure that your application is accepted as being duly made, you must

- complete ALL parts of this form, **and**
- submit all relevant information required by this form.

All applications must be lodged with the Director-General, by courier or mail.

Ground floor, 23-33 Bridge Street, SYDNEY NSW 2000
GPO Box 39 SYDNEY NSW 2001
DX 10181 Sydney Stock Exchange
t: 02 9228 6111
f: 02 9228 6455

2. Details of the proponent

Company/organisation/agency: Gunlake Quarries

ABN: 50 087 309 391

First name: Edward

Family name: O'Neil

STREET ADDRESS

Unit/street no.: 2/53

Street name: Cross St

Suburb or town: Double Bay

State: NSW

Postcode: 2028

POSTAL ADDRESS (or mark 'as above')2

PO Box 1665

Suburb or town: Double Bay

State: NSW

Postcode: 1360

Daytime telephone: 02 9363 1744

Fax: 02 9363 1277

Mobile: 0411 652 658

Email: ed@gunlake.com.au

3. Identify the land you propose to develop

STREET ADDRESS

Unit/street no.: 715

Street or property name: Brayton Rd

Suburb, town or locality: Marulan

Postcode: 2579

Local government area: Goulburn Mulwaree

REAL PROPERTY DESCRIPTION

See attached

OR: detailed description of land attached: ☒

The real property description is found on a map of the land or on the title documents for the land. If you are unsure of the real property description, you should contact the Department of Lands.

Please ensure that you place a slash (/) to distinguish between the lot, section, DP and strata numbers. If the Major Project applies to more than one piece of land, please use a comma to distinguish between each real property description.

Where the Major Project is subject to Clause 8F of the *Environmental Planning and Assessment Regulation 2000* and in lieu of completing the above, a description or detailed plan of the land affected must be included with the documents required with Part 4 below.

4. Proposed Major Project – Description and other Requirements

Provide a brief title for your Project that includes all significant components. If the application relates to only part of a Project, include a clear title that describes the relevant part.

Develop a Hard Rock Quarry with associated processing plant and by-pass road, producing 500 000 tpa at full production

Is the application related only to a part of a Project? ☐ Yes ☒ No

You are also required to provide a Project Description Report and address any matters required by the Director-General in accordance with 75E of the Act. Failure to do so may lead to your application being rejected.

Is a Project Description attached:

Hard copy: ☒ Yes ☐ No

Electronic version: ☒ Yes ☐ No

(NB: An electronic copy is required as all applications must be provided on the Department's website. You should contact the Department on the correct electronic format).

Is the Project Description Report consistent with the requirements of any Guideline produced by the Department (including any draft)? ☒ Yes ☐ No

Does the Project Description Report include additional matters required by the Director-General, such as evidence of a Planning Focus Meeting and consultation? ☒ Yes ☐ No

CONCEPT APPROVAL

If you are applying for a **concept approval**, the Department's *Concept Approval Guideline* should be consulted and the matters identified therein must be addressed as part of your application.

Does the Project Description Report submitted address the relevant guidelines for Concept Approvals? ☐ Yes ☒ No

FULL TIME EQUIVALENT JOBS

Please indicate the number of jobs created by the proposed Major Project. This should be expressed as a proportion of full time jobs over a full year.

Construction jobs (full-time equivalent): 10

Operational jobs (full-time equivalent): 45

SCHEDULE OF LAND

715 Brayton Rd

Lot	Deposited Plan
48	750003
111	750053
52	750003
50	750003
149	750053
73	750003
74	750003
260	750053
53	750003
148	750053
10	254024
42	750003
76	750003
54	750003
1	750003
1	328725

268 Brayton Rd

Lot	Deposited Plan
1	868065

Crown Rd Reserve bounding lots

Lot	Deposited Plan
1	**834993**
1	**713126**
5	**713126**
22	**750053**
23	**750053**
24	**750053**

5. Approvals from state agencies

Does the proposed Major Project require any of the following: (tick all appropriate)

- ☐ an aquaculture permit under section 144 of the *Fisheries Management Act 1994*
- ☐ an approval under section 15 of the *Mine Subsidence Compensation Act 1961*
- ☐ a mining lease under the *Mining Act 1992*
- ☐ a production lease under the *Petroleum (Onshore) Act 1991*
- ☒ an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act)
- ☒ a consent under section 138 of the *Roads Act 1993*

6. Application fee

You are required to pay a fee for the assessment of a Major Project. This fee is based on the estimated cost of the Major Project.

The Department requires that you pay a proportion of the total fee with this application and you should consult with the Department before lodging this application to determine the proportion to be paid.

Estimated Project Cost

$15M

7. Owner's Consent

As the owner(s) of the above property, I/we consent to this application being made on our behalf by the Proponent:

Signature

See attached

Name

Date

Signature

See attached

Name

Date

Note: The Department will not accept an application for a Major Project without having the signature of the owner of the land, **unless** the Major Project is subject to Clause 8F of the *Environmental Planning and Assessment Regulation 2000.*

8. Proponent's Signatures

As the proponent(s) of the proposed Major Project and in signing below, I/we hereby:

- provide a description of the proposed Project and address all matters required by the Director-General pursuant to Section 75E of the Act, and
- apply, subject to satisfying Clause 8D of the *Environmental Planning and Assessment Regulation 2000*, for the Director-General Environmental Assessment Requirements pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979*, and
- declare that all information contained within this application is accurate at the time of signing.

Signature

Name

Edward O'Neil

Date

15/5/07

In what capacity are you signing if you are not the proponent

Name, if you are not the proponent

268 Brayton Rd

Lot	Deposited Plan
1	868065

As the owners of the above property, we consent to this application being made on our behalf by the Proponent:

Signature

Peter Lockwood

Name

Peter Lockwood

Date

10-5-07

Signature

Carla Lockwood

Name

Carla Lockwood

Date

10-5-07

715 Brayton Rd

Lot	Deposited Plan
48	750003
111	750053
52	750003
50	750003
149	750053
73	750003
74	750003
260	750053
53	750003
148	750053
10	254024
42	750003
76	750003
54	750003
1	750003
1	328725

As the owner of the above property, I consent to this application being made on our behalf by the Proponent:

Signature

William L. Tooth

Name

William Laurence Tooth

Date

7.5.07

Department of Lands

Land Administration & Management
Property & Spatial Information
Goulburn Office: 159 Auburn Street Goulburn NSW
Postal address: PO Box 748, Goulburn NSW 2580
Phone: (02) 4824 3704
Fax: (02) 4822 4287
Contact Person: **Mandy Franklin**

8 May 2007

PROPOSAL AFFECTING CROWN ROAD
CONSENT OF OWNER FOR LODGEMENT OF DEVELOPMENT APPLICATION

PROPERTY DETAILS:	Crown public road South of Lots 22, 23 & 24, D.P. 750053 & Lot 1 DP 834993 Parish of Uringalla, County of Argyle
DESCRIPTION OF PROPOSED DEVELOPMENT: Affecting the Crown road illustrated by red colour on the attached diagram.	Proposed construction of a Crown public road to serve as access to a proposed hard rock quarry.
CONSENT AUTHORITY:	Goulburn Mulwaree Shire Council, Department of Lands and relevant consent authorities

CONSENT STATEMENT

So far as the interests of the Department of Lands are concerned, consent is hereby given to the lodgement of the Development Application subject to the Crown and the Minister for Lands being indemnified and kept indemnified against all claims arising out of the use and occupation of the road in relation to any development or activity undertaken in terms of Development Consent which may subsequently be granted.

TIME LIMIT: This consent remains current for a period of 12 months from the date of issue.

CONSENT STIPULATIONS: This consent is subject to the following stipulations:

1. This consent is given without prejudice so that full investigation of the development proposal may proceed under environmental planning law. The giving of consent to lodgement of the development application does not imply or allow presumption of the concurrence of the Minister for Lands for the development proposal and does not prevent the Department of Lands or the Minister from lodging an objection at a later date when the full implications of the proposal are evident.
2. The proposal may also require separate application, investigation and determination by the Department of Lands and/or other public authorities. It is the responsibility of the development proponent to ascertain the requirements of all public authorities involved.
3. Irrespective of any development consent granted or any approval given by other public authorities, **the development proponent shall not commence development or construction works on the Crown roads described in this letter without the prior approval of the Department of Lands, or until the roads are transferred to the control of Goulburn Mulwaree Council.** If prior transfer to the said Council transpires then construction and development is one for negotiation by the development proponent direct with that Council.
4. The right is reserved to revoke or modify the consent at any time prior to determination of the development application.

Mandy Franklin
Senior Property Officer
CROWN LANDS NSW, Goulburn
For and on behalf of the Minister for Lands

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APPENDIX II

Summary of Director Generals Requirements

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Appendix II

Addressing Director-General's Requirements.

The Following Table (**Table Appendix II – 1**) provides an itemised and tabulated summary of the Director-General's Requirements, including the requirements provided by the various government agencies consulted, and reference to the section within the Environmental Assessment or Specialist Consultant Studies Compendium where they are addressed.

Table Appendix II – 1. Director-General's Requirements.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
1. Department of Planning	1.1 The Environmental Assessment (EA) must include an Executive Summary.	Front of EA.
	1.2 The EA must include a detailed description of all components of the project including the need for the project, alternatives considered and various components and stages of the project.	EA Section 2.
	1.3 The EA must include consideration of any relevant statutory provisions.	EA Section 3.2.3.
	1.4 The EA must include a general overview of the environmental impacts of the project, identifying the key issues for further assessment, and taking into consideration the issues raised during consultation.	EA Section 3.
	1.5 The EA must include a detailed assessment of the key issues identified in items 1.12 to 1.21 below and any other significant issues identified in the general overview of the project (See Item 1.4 above).	See below.
	1.6 The EA must include a description of the existing environment.	EA Section 4A.
	1.7 The EA must include an assessment of the potential impacts of the project including potential cumulative impacts.	EA Section 4B.
	1.8 The EA must include a description of measures that would be implemented to avoid, minimise, mitigate, offset, manage, and/or monitor the impacts of the project.	EA Section 4B.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	1.9 The EA must include a Draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures.	EA Section 5.
	1.10 The EA must include a conclusion justifying the Project, taking into consideration the environmental impacts of the project, the suitability of the site, and the benefits of the Project.	EA Section 6.4.
	1.11 The EA must include a signed statement from the author of the EA report certifying that the information contained in the report is neither false nor misleading.	Front of EA.
	1.12 **Key Issue. Surface and Groundwater.** Including details of surface and ground water impacts and a site water balance; details of the proposed water management system including any creek diversions and sediment/water supply dams (both for quarry site and haul road: consideration of the relevant provisions of *Drinking Water Catchments Regional Environmental Plan No 1);* and a surface and ground water contingency strategy setting out appropriate measures to ensure continued water supplies for surrounding landowners and the environment.	EA Section 4B2 and SCSC Part 2 for Surface Water. EA Section 4B.3 and SCSC Part 3 for Groundwater.
	1.13 **Key Issue. Noise.** Including construction and operational noise (both for the quarry site and haul road) and off-site road noise impacts.	EA Section 4B.4 and SCSC Part 4.
	1.14 **Key Issue. Blasting and Vibration**	EA Section 4B.4 and SCSC Part 4.
	1.15 **Key Issue. Air Quality.** Including an assessment for both the quarry site and haul road.	EA Section 4B.5 and SCSC Part 5.
	1.16 **Key Issue. Traffic and Transport.** Including details of traffic volumes generated by the project and assessment of the capacity and safety of the proposed haul road and transport routes, including all intersections between the site and the Hume Highway.	EA Section 4B.1 and SCSC Part 1.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	1.17 **Key Issue. Flora and Fauna.** Including impacts on threatened species, populations or endangered ecological communities or their habitats; and details of vegetation offsets to ensure that there is no net loss to the flora and fauna values of the area in the medium to long term (both for the quarry site and haul road).	EA Section 4B.7 and SCSC Part 7.
	1.18 **Key Issue. Visual**	EA Section 4B.8.
	1.19 **Key Issue. Heritage.** Including Aboriginal and non-Aboriginal heritage.	EA Section 4B.10. EA Section 4B.6 and SCSC Part 6.
	1.20 **Key Issue. Rehabilitation and Final Land Form.** Including a justification for the proposed final land form and use in relation to any strategic land use objectives for the area; a detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape; the measures that would be put in place to ensure sufficient financial resources are available to implement the proposed rehabilitation measures, and the ongoing management of the site following the cessation of extraction activities.	EA Section 2.11. SCSC Part 2.
	1.21 The EA must take into account relevant State government technical and policy guidelines.	All SCSC identify relevant guidelines.
	1.23 During the preparation of the EA, the Proponent should consult with the relevant local and State or Commonwealth government authorities, service providers, community groups and affected landowners. In particular, the Proponent should consult with, the Department of Environment and Climate Change, Department of Lands, Department of Primary Industries, Department of Water and Energy, Roads and Traffic Authority, Sydney Water Catchment Authority and Goulburn Mulwaree Council. The consultation process and the issues raised must be described in the EA.	EA Sections 3.2.2 and 3.2.23.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
2. NSW Roads and Traffic Authority	2.1 A traffic study should be prepared in accordance with Table 2.1 of the RTA's Guide to Traffic Generating Developments.	SCSC Part 1.
	2.2 The applicant should identify suitable treatments required to ameliorate any traffic and safety impacts associated with the development.	EA Sections 4B.1.3, 4B.1.4 and 4B.1.5.
	2.3 Concept design plans MUST be submitted of all proposed changes to the classified road network to demonstrate that treatments can be achieved in accordance with RTA standards.	SCSC Part 1 Figures 3, 4 and 5.
	2.4 The applicant should identify all heavy vehicle routes and assess the suitability of those routes to cater for large vehicles.	EA Sections 2.1.3. and 4B.1. SCSC Part 1.
	2.5 The RTA strongly recommends that the developer consider the environmental impacts of any proposed roadworks including closure of existing median breaks as part of the Statement of Environmental Effects. If these impacts are not considered, then the RTA would require the applicant to provide a separate environmental impact assessment prior to commencing any works that were conditioned as requirements of the development.	EA Part 4B.1.4.7. and SCSC Parts 8A and 8B. EA Section 4B.1.4 and SCSC Part 1.
3. Department of Environment and Conservation (Now Department of Environment and Climate Change (DECC).	3.1 The DECC requires an assessment on the actions that will be taken to avoid, mitigate or compensate for impacts of the proposal on the following: 1. Air – dust is the primary air quality concern for this project. Particular attention must be paid in the assessment to the cumulative impacts from this and surrounding activities on sensitive receivers. 2. Noise – noise impacts from the project are also a major concern, also requiring cumulative impact assessment with respect to sensitive receivers. 3. Water. 4. Waste. 5. Threatened species and their habitat. 6. Aboriginal cultural heritage values. 7. Contaminated sites.	All. SCSC Parts 5, 4, 6,7. Air. EA Sections 4B.5.5 to 4B.5.11. Noise. EA Section 4B.10. Water. EA 4B.3.13. Waste. EA Section 2.9. Threatened Species. EA Section 4B.7. Cultural. EA Section 4B.6. Contaminated Sites EA Section 2.11.4.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.2 The proposal is scheduled under the Protection of the Environment Operations Act 1997 and will require an Environmental Protection Licence under that Act.	Gunlake will make application for Licence. EA Section 2.1.5.2.
	3.3 The environmental assessment must include a comprehensive description of the production processes, all discharges and emissions to the environment, an assessment of likely environmental impacts, and a comprehensive description of any control measures.	EA Sections 2 and 4B. SCSC Parts 1, 2, 3,4 and 5.
	3.4 **Air Issues.**	SCSC Part 5. EA Section 4B.5.
	3.4.1 Identify all potential emission sources including open exposed areas, drilling and blasting, material processing and handling, conveyors, transfer points, loading and unloading, stockpile and haulage activities.	
	3.4.2 Provide details of proposed dust management strategies for all potential sources of dust.	
	3.4.3 Environmental assessment must be conducted in accordance with the DEC publication "Approved Methods for Modelling of Pollutants in NSW".	
	3.4.4 Environmental assessment must assess the PM10 24hour and annual average, total suspended particulates and deposited dust impacts.	
	3.4.5 Environmental assessment must include a cumulative assessment that examines the impacts of the proposal combined with all existing and approved dust generating activities in the area.	
	3.5 **Noise and Vibration Issues.**	

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.5.1 Environmental assessment should identify all potential noise sources and describe the extent to which noise emissions are likely to impact on any residential and/or other sensitive receivers in the vicinity of the site.	SCSC Part 4. EA Section 4B.4.
	3.5.2 Environmental assessment should include a noise impact assessment undertaken in accordance with the EPA publication "NSW Industrial Noise Policy".	SCSC Part 4. EA Section 4B.4.
	3.5.3 The noise impact assessment should take into account both the construction and operational phases of the development, clearly specifying the proposed hours of operation for both phases and take into account adverse weather conditions including temperature inversions.	SCSC Part 4. EA Section 4B.4.
	3.5.4 Sound power levels (measured or estimated) for all plant and equipment should be clearly stated and justified.	SCSC Part 4. EA Section 4B.4.
	3.5.5 There should be an assessment of cumulative noise impacts, having regard to any other developments existing and/or approved for the locality.	SCSC Part 4. EA Section 4B.4.
	3.5.6 Where adverse noise impacts are predicted, the impact assessment should provide details on proposed noise control measures.	SCSC Part 4. EA Section 4B.4.
	3.5.7 The noise impact assessment should identify the transport routes to be used, the hours of operation, anticipated traffic movements, and expected increase in noise levels. The assessment should be generally undertaken in accordance with the EPA publication "Environmental Criteria for Road Traffic Noise".	SCSC Part 4. EA Section 4B.4.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.5.8 The method, data and assumptions used to assess the impact of road haulage on residential properties must be fully documented and justified. Where disturbance due to road transport is likely to exceed the recommended criteria, the environmental assessment must describe the measures proposed to mitigate the impacts and the extent to which the measures are likely to be effective in Achieving the relevant criteria.	SCSC Part 4. EA Section 4B.4.
	3.5.9 Blast induced vibration effects from the project must also be considered and a thorough assessment must take into account the ANZECC publication "Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration".	SCSC Part 4. EA Section 4B.4.
	3.6 **Water Issues**	
	3.6.1 Clearly demonstrate where the water will be sourced from and the quantities required for dust control and other activities.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.6.2 Address other water related issues including erosion and sediment control during construction activities including pipelines, stormwater runoff control and chemical storage during operation, and on-site sewage management.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.6.3 If an off-site discharge is proposed for any or all wastewater streams, then the environmental assessment must address potential impacts and demonstrate that discharges will not prejudice attainment of water quality objectives for the receiving watercourse.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.6.4 The proponent will need to demonstrate that acid mine leachate will not occur from the site.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.6.5 DECC expect that this activity can be managed without discharging to waters and it is therefore unlikely that any discharge will be licensed.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.6.6 Environmental assessment should describe the sewage treatment and effluent management system, estimate the quantity and quality of the effluent, and describe the proposed method of disposal.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.6.7 As on-site land irrigation is proposed, the environmental assessment should demonstrate by way of water balance and land capability assessment that the effluent management system is sustainable and will not result in pollution of watercourses or groundwater.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.6.8 In addition to process wastewaters and to discharges from the on-site sewerage system, the environmental assessment should describe measures for dealing with the following • Measures to control erosion and sedimentation during construction activities including construction of the gas supply and water supply/discharge pipelines. • Measures to capture and treat stormwater runoff from site during the operational phase • Sealing areas of the site to prevent soil erosion. • Spillage controls and bunding for materials used on site.	EA Sections 4B.2 and 4B.3.SCSC Parts 2 and 3.
	3.7 **Waste Issues**	

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.7.1 Environmental assessment should describe all wastes that will be generated by the proposal including for each of the main waste streams, the process from which it will be generated; its quantity and composition; its classification under the Protection of the Environment Operations Act 1979; and the proposed arrangements for dealing with the waste.	EA Section 2.9.
	3.7.2 Environmental assessment should clearly identify methods of reducing waste volumes and recycling and reusing wherever possible.	EA Section 2.9.
	3.7.3 Detail the likelihood of generation of industrial/hazardous wastes and any anticipated storage/disposal methods.	Appendix 3.
	3.7.4 Environmental assessment must identify any fuel or chemical storage areas to be established on the site and describe the measures proposed to minimise the potential for leakage or migration of pollutants into the soil, groundwater or surface water systems.	EA Section 2.5.
	3.8 **Other Construction Phase Issues**	
	3.8.1 Details of appropriate erosion and sediment controls, and dust and noise controls should be included in the environmental assessment.	SCSC Part 2. EA Section 4B.2.
	3.8.2 All areas disturbed during construction which are not included in the working area of the plant must be revegetated to a high standard.	SCSC Part 2. EA Section 4B.2.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.8.3 The likelihood of disturbing acid sulphate soils and/or pre-existing site contamination during the construction phase must be detailed in the environmental assessment and, where applicable, contingency plans must be proposed for the management of acid sulphate or contaminated soils.	SCSC Part 2. EA Section 4B.2.
	3.8.4 Environmental assessment should specify and assess all monitoring programs for measuring noise, air quality and water quality monitoring during the construction phase an on-going operation of the facility. The evaluation should include a detailed description of the monitoring strategies, sample analysis methods and the level of reporting proposed.	SCSC Parts 1 to 7 and EA Section 4B.
	3.8.5 Environmental assessment should outline procedures for responding to breaches of environmental conditions and for reporting these incidents both to the regulatory agencies and to the community. These include complaints handling mechanisms and emergency response procedures.	EA Section 3.2.
	3.8.6 Environmental assessment must outline the ongoing rehabilitation of the site over the 30 year approval period, as well as final rehabilitation plan after the 30 year period has lapsed.	EA Section 2.11.
	3.8.7 Environmental assessment must document the management of any land contamination.	No existing contamination expected.
	3.9 **Impacts on Threatened Species and Their Habitat**	
	3.9.1 A field survey of the site should be conducted and documented in accordance with the draft guidelines "Guidelines for Threatened Species Assessment".	SCSC Parts 7 and 8B. EA Sections 4B.7 and 4B.12.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	3.9.2 Likely impacts on regionally significant protected and threatened species and their habitat need to be assessed, evaluated and reported on.	SCSC Parts 7 and 8B. EA Sections 4B.7 and 4B.12.
	3.9.3 Attachment 2 of the DECC submission includes a list of relevant threatened species that have to be assessed.	SCSC Parts 7 and 8B. EA Sections 4B.7 and 4B.12.
	3.10 **Impacts on Aboriginal Cultural heritage Values**	
	3.10.1 Environmental assessment should address and document the information requirements set out in the draft "Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation".	SCSC Part 6. EA Section 4B.6.
	3.10.2 Environmental assessment must identify the nature and extent of impacts on Aboriginal cultural heritage values across the project area. Accordingly, the environmental assessment must describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on Aboriginal cultural heritage values. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	SCSC Part 6. EA Section 4B.6.
	3.10.3 Environmental assessment needs to clearly demonstrate the effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations.	SCSC Part 6. EA Section 4B.6.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
4. Department of Primary Industries.	4.1 The proponent must be able to demonstrate that the size and quality of the resource have been adequately assessed and provide details of methods used to assess the resource.	EA Section 2.2.
	4.2 A commitment to provide annual production data to the Department of Primary Industries be included in the proponents Statement of Commitments.	EA Section 5
	4.3 **Environmental Assessment Requirements**	
	4.3.1 In relation to fisheries, the Department advised that the environmental assessment should include consideration of the following:	SCSC Part 4. EA Section 4B.7.3.
	• Description of any aquatic environments located on or adjacent to the site and their regional significance.	
	• Predictions of temporary and permanent impacts on aquatic environments both on the site and downstream.	
	• Safeguards to mitigate any impacts upon aquatic environments and riparian habitats (eg full details of proposed riparian buffer zones and any riparian rehabilitation and revegetation plans).	
	• Predictions of any temporary and permanent impacts upon water quality and aquatic threatened species, populations and ecological communities listed under the Fisheries Management Act 1994	

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	• Safeguards to mitigate any impacts upon water quality, including impacts downstream into Chapman's Creek, Joarimin Creek and the Wollondilly River (eg details of proposed water quality monitoring downstream of the site).	
	• Details of any proposed waterway crossings or possible obstruction of fish passage.	
	• Assessment of any potential impacts of the quarry construction works and future operation of the quarry on recreational fishing in the vicinity.	
	4.4 **Agricultural Issues.**	
	4.4.1 The impacts of the quarry on surrounding properties will need to be investigated ie the impacts of noise dust and vibration on any sensitive agricultural operations (potential turkey/chicken farms) in the area.	SCSC Parts 2, 3, 4 and 5. EA Sections 4B.4 and 4B.5.
	4.4.2 The impacts of the quarry on the quality and quantity of surface and ground water will need to be considered.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	4.4.3 The use of the site when extraction is complete will need to be identified, including how the quarry will be rehabilitated to a landscape of value to the community. A plan of progressive rehabilitation is desirable.	EA Section 2.11.
	4.4.4 A plan for effective storage and management of topsoil held for rehabilitation of the quarry should be included.	SCSC Part 2. EA Section 4B.
	4.4.5 A weed management plan should be developed to address weed infestation and control to prevent the spread to surrounding properties.	EA Section 2.11.8.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	4.4.6 If livestock are proposed to be run in the vicinity of the proposed developments, the Environmental Assessment should indicate how livestock are to be excluded from the quarry, waste water control dams, transport routes and other facilities.	EA Section 2.10.2.
	4.5 A thorough geological assessment should be undertaken to determine the nature, quality and extent of the resource. The following issues need to be addressed in the environmental assessment.	EA Section 2.2.
	4.5.1 A summary of the regional and local geology including information on the stratigraphic unit or units subject of the proposal.	EA Section 2.2.
	4.5.2 The amount of material available for extraction and the method or methods used to determine this amount. Plans and cross sections summarising this data, at a standard scale, showing the location of drillholes and/or trenches and the area proposed for extraction, should be included in the environmental assessment.	EA Section 2.2.
	4.5.3 Information such as grainsize and mineralogy, nature and extent of weathering or alteration and amount and type of deleterious minerals, if any, should be indicated. Details of tests carried out to determine the characteristics of the material should be appended.	EA Section 2.2.
	4.5.4 An assessment of the quality of the material and its suitability for the anticipated range of applications should be given.	EA Section 2.2
	4.5.5 The amount of material anticipated to be produced annually should be indicated. The intended life of the operation should be indicated.	EA Section 2.3.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	4.5.6 An assessment of alternative sources to the proposal and the availability of these sources. The impact of not proceeding with the proposal should be addressed.	EA Sections 2.1.1 and 6.3.4.
	4.5.7 Justification for the proposal in terms of the local and, if appropriate, the regional context. Identification of the subject site in relevant planning instruments such as regional environmental plans, should be noted.	EA Sections 2.1.5 and 3.2.
	4.5.8 Information on the location and size of markets to be supplied from the site.	EA Section 2.1.1.
	4.5.9 Transport routes for the material to the market.	EA Section 2.1.3.
	4.5.10 Disposal of waste products and the location and size of stockpiles.	EA Sections 2.9 and 2.3.4.
	4.5.11 Assessment of noise, vibration, dust and visual impacts, and proposed measures to minimise these impacts.	SCSC Parts 4 and 5. EA Sections 4B.4 and 4B.5.
	4.5.12 Proposed rehabilitation procedures during, and after completion of extraction operations and proposed final land use of site.	EA Section 2.11.
	4.5.13 Assessment of the ecological sustainability of the proposal.	EA Section 6.2.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
5. NSW Department of Water and Energy	5.1 Details of the quarry proposal should be identified in the Environmental Assessment as well as a description of the existing environment and the impacts of the quarry on natural resources. There should be a full and open assessment of proposals made as well as of alternatives. Information should address but not be limited to the following issues: • The development proposal, description with detailed maps, plans and diagrams of the site and the proposed development and infrastructure. • Quarrying method, sequencing, site preparation, any pre-quarrying operations. • Stockpile locations and topsoil stockpile management. • Internal access tracks and their stabilisation and erosion control works. • On-going site rehabilitation. • Decommissioning at end of quarry life, remaining features and land use proposals.	EA Section 2.
	5.2 The environmental assessment should include detailed biophysical description of site and immediate locality including but not limited to topography, drainage patterns, geology, vegetation, soils, rural land capability, agricultural land suitability, water resources, both surface and groundwater and its usage, existing land uses etc.	EA Sections 4A and 4B.
	5.3 Water sources, water usage and water management details of the proposal are required, including design, layout, pumping and storage capacities, volumes of water to be used, all associated earthworks and infrastructure works etc.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	5.4 Include environmental impact management reports demonstrating how the proposed water demand and usage will impact on the surrounding water users including the water-dependent environment, for example geotechnical reports for salinity or acid sulfate soils.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	5.5 Environmental assessment will need to demonstrate the proposal's sustainability and its commercial and environmental merit.	EA Part 6.
	5.6 The location and estimated capacity of every dam must be shown.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	5.7 The proponent will need to demonstrate how the proposal meets the principles of the NSW Groundwater Policy Framework.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	5.8 The environmental assessment should include details on the soil and water management works planned for the site in order to mitigate any contamination of downstream waterways and lands and to rehabilitate and stabilise disturbed areas. A Soil and Water Management Plan should include, but not be limited to, the following:	SCSC Part 2. EA Section 4B.2.
	• In relation to soil management: description of the soil types present on the site, topsoil and subsoil stripping program, including locations and their management and topsoil and subsoil re-use proposals.	SCSC Part 2 EA Section 4B.2
	• In relation to surface water management; management of clean and dirty runoff from adjacent lands and the quarry. Potentially polluting waters should be contained and managed on site.	SCSC Part 2 EA Section 4B.2

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	• In relation to erosion and sedimentation control; management and control of erosion and sediment movement at all stages of the project and the specifications and management of temporary and permanent structures.	SCSC Part 2 EA Section 4B.2
	• In relation to rehabilitation; conceptual end-use landforms, soil management, decommissioning of various components of the project as they become redundant, ongoing rehabilitation of all disturbed areas, revegetation techniques and proposals, including species and rates (both for the stability of disturbed areas during the operation and final end-use and a maintenance program for rehabilitation and plantings.	SCSC Part 2 EA Section 4B.2
6. Sydney Catchment Authority	6.1 The project has been classified as a Major project to be assessed and determined under Part 3A of the EP&A Act and it is not formally subject to the requirements of the Drinking Water Catchments Regional Environmental Plan No 1. However SCA consider water quality issues should be comprehensively considered in the assessment process and that this planning instrument establishes appropriate assessment criteria.	SCSC Part 2. EA Section 4B.2.6.
	6.2 SCA considers that the environmental assessment must include an assessment of whether the proposal will have a neutral or beneficial effect on water quality based on the following:	SCSC Part 2. EA Section 4B.2.6.
	• Consider the Drinking Water Catchments Regional Environmental Plan No 1 and have regards to the water quality objectives detailed in the plan.	SCSC Part 2. EA Section 4B.2.6.
	• Contain relevant studies that address the following:	SCSC Part 2. EA Section 4B.2.6.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	1. Details of the site characteristics and identification of the likely pollutants of concern during construction, operation and decommissioning stages of the quarry.	SCSC Part 2. EA Section 4B.2.6.
	2. Identification of potential impacts of these pollutants on water quality (surface and groundwater) during construction, operation and decommissioning stages of the quarry.	SCSC Part 2. EA Section 4B.2.6.
	3. Detail the on-ground water quality protection measures during construction, operation and decommissioning stages of the quarry along with the performance criteria for each measure and assess whether the water quality measures are sustainable for the periods for which they are expected to be in place.	SCSC Part 2. EA Section 4B.2.6.
	4. For each identified pollutant of concern assess the post-activity condition in relation to the pre-activity condition in terms of load and concentration for both wet and dry weather conditions (this will require modelling to be undertaken).	SCSC Part 2. EA Section 4B.2.6.
	5. Determine and state whether a neutral or beneficial effect on water quality of receiving waters (surface and groundwater) will occur during construction, operation and decommissioning stages of the quarry.	SCSC Part 2. EA Section 4B.2.6.
	6.3 The environmental assessment needs to provide details of the proposals to manage waste waters associated with processing quarry materials, general stormwater runoff, and site office and buildings.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	6.4 The environmental assessment needs to provide details of and assess the impacts associated with development of water supply dams, use of groundwater and relocation of water courses and drainage depressions.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	The environmental assessment needs to provide details of the practices proposed to ensure materials transported from the site by road do not spill.	EA Section 2.4

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	The environmental assessment needs to provide details of measures to minimise impacts on watercourses by use of suitable water sensitive urban design elements at proposed bypass route creek crossings that maintain existing geomorphology of watercourses with minimal disturbance.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
	6.7 The environmental assessment needs to provide details of measures proposed to be adopted to offset impacts associated with construction activities eg earthworks, vegetation clearing, track construction etc. These measures could include remediation of existing gully erosion and improved management of watercourses and related riparian areas.	SCSC Parts 2 and 3. EA Sections 4B.2 and 4B.3.
7. Goulburn Mulwaree Council	7.1 How is the proposal consistent with the Sydney-Canberra Corridor Review and Council's 2020 Plan.	EA Section 3.2.5.
	7.2 Estimated vehicle movements and haulage times should be confirmed. Traffic impacts for both transport routes should be assessed in depth and the arrangements for the new Hume Highway intersection formalised.	SCSC Part 1. EA Sections 2.6, 2.7 and 4B.1.
	7.3 It is essential that adequate buffers separating the subject site from adjoining properties are contained within the Gunlake property and actively managed by the operation to maintain protection for adjoining landowners.	EA Section 2.1
	7.4 Assess the noise emanating from the development site and along transport routes. Particular attention should be given to neighbouring dwellings and dwellings along the Marulan village section of Brayton Road. The cumulative impacts of the proposed Gunlake Quarry operating concurrently with the nearby Johnniefields quarry should be investigated.	SCSC Part 4. EA Section 4B.4.
	7.5 How will dust generation be minimised?	SCSCV Part 5. EA Section 4B.5.

ORGANISATION	ISSUE	SECTION WHERE ADDRESSED.
	7.6 How will the amenity and established rural character of the locality be affected by the development?	EA Section 6 and SCSC Parts 1, 2, 3, 4, 5, 6 and 7.
	7.7 Mechanisms should be designed to record and resolve complaints relating to operations at the site.	EA Section 5.1
	7.8 The site should be self sufficient in terms of water consumption. How will an adequate supply be secured?	SCSC Part 2. EA Section 4B.2.
	7.9 Details regarding the location of proposed structures, such as employee amenities should be provided.	EA Section 2.5.
	7.10 Rehabilitation of the site should be a continual process over the life of the quarry, rather than simply taking place after the extraction is completed. Appropriate mechanisms including performance securities should be included to ensure this is achieved.	EA Section 2.11.
	7.11 Developer contributions or other proposed assistance with community development in Goulburn Mulwaree.	EA Section 2.2.

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APPENDIX III

SEPP 33 Assessment

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SEPP No 33 Hazardous and Offensive Development

The Department of Urban Affairs and Planning (now Department of Planning) have published a set of Guidelines to be used for Projects that may be affected by State Environmental Planning Policy No 33, Hazardous and Offensive Development (SEPP 33).

These Guidelines were reviewed to determine whether SEPP 33 applied to the Gunlake Quarry Project.

Figure 1 in the Guidelines enables the proponent of a Project to determine whether SEPP 33 applies. There are two basic questions that need to be addressed. These are whether the Project is potentially hazardous and whether it has pollution potential.

Addressing the potentially hazardous issue first. The Gunlake Quarry Project will have diesel and oil stored on the site. The diesel and oil will primarily be for quarry operational vehicles.

Diesel and oil are classified Class 3, C1 material in the Summary of Dangerous Goods Code of Classification reproduced at Appendix 6 in the Guidelines.

Class 3 means that it is a flammable liquid which is capable of being ignited and of burning. The C1 classification derives from it having a flashpoint above 61 ^{o}C but not exceeding 150 ^{o}C. Table 1 in the Guidelines, which outlines the screening method to be used includes the following comment. “If Class C1 and/or C2 are present on site and are stored in a separate bund or within a storage area where they are the only flammable liquid present they are not considered to be potentially hazardous”.

The diesel at Gunlake will be stored in a 50,000L tank separately bunded area with no other flammable liquid present. The oil will be stored in a 5,000L tank also separately bunded. Consequently, the Gunlake Quarry Project is not potentially hazardous with respect to diesel and oil storage and SEPP 33 is not triggered for these materials.

Blasting materials will not be stored on site.

Now turning to the issue of whether the Project is potentially polluting. Operation of the Gunlake Quarry Project will be subject to a Pollution Control Licence issued by the DECC. The DECC have commented on their requirements to be addressed in this Environmental Assessment. It is likely that, providing certain issues are addressed, they will issue a licence to enable the Project to operate. Consequently, in accordance with the Guidelines, it is likely that a Pollution Control Licence can be obtained and that the development is permissible and can proceed to detailed assessment.

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