Appendix 8

Air Quality Impact Assessment

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SKM

Cooma Road Quarry Continued Operations Project

AIR QUALITY IMPACT ASSESSMENT

- Final
- 7 August 2012

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1. Introduction

Holcim (Australia) Pty Ltd (Holcim Australia) is proposing to extend both the operational life and annual extraction limit of the Cooma Road Quarry, Googong, near Queanbeyan. This report has been prepared by Sinclair Knight Merz (SKM) for Umwelt (Australia) Pty Limited (Umwelt), who is in turn acting on behalf of Holcim Australia to prepare an Environmental Impact Statement (EIS) for the Project. The purpose of this report is to quantitatively assess the potential worst case air quality impacts of the Project.

1.1. Purpose of Report and Project Scope

The assessment is based on the use of a computer-based dispersion model (AUSPLUME) to predict ground-level dust concentrations and deposition levels in the vicinity of the quarry. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality criteria.

The assessment is based on a conventional approach following the procedures outlined in the NSW Office of Environment and Heritage's (OEH) *Approved Methods for the Modelling and Assessment of Pollutants in NSW* (DEC 2005).

In summary, the report provides information on the following:

- Description of the proposed quarrying activities including; quarrying, processing, handling, storage, transport operations and rehabilitation;
- Identification of relevant air quality criteria;
- Description of existing local meteorological, climatic conditions and existing air quality;
- Description of the methods used to estimate dust emissions from the proposed development
- Assessment of the impact of the proposed development on local and regional ambient air quality;
- Assessment of cumulative impacts and description of the methodology used to determine cumulative impacts;
- Potential impacts during construction;
- Assessment of the potential impacts on air quality other than dust; and
- Description of proposed mitigation and management measures to minimise the generation of dust emissions.

Worst case operational scenarios have been developed to assess the maximum extent of air quality impacts.

1.2. Director General's Requirements

This report also addresses the Director General's Requirements (DGRs) for the Project, which require the preparation of a quantitative air quality impact assessment in accordance with current OEH guidelines. The following table lists the DGRs and requirements also made by relevant state and local government stakeholders.

Table 1-1 Assessment requirements

Requirement	Section of this report
DGRs – DoPI	
Include a quantitative assessment of potential:	
▪ Construction and operational impacts, with particular focus on dust emissions (including PM_{10} emissions, and dust generation from transport of quarry products), as well as diesel and blast fume emissions;	Section 8
▪ Reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed;	Section 6
▪ Monitoring and management measures, in particular air quality monitoring	Section 4.3
Environmental Protection Authority (EPA), NSW Office of Environment and Heritage	
Identify all sources of air emissions from the development, Emissions can be classed as either:	
▪ Point (e.g. emissions from stack or vent) or	Section 5
▪ Fugitive (from wind erosion), leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and years operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works)	Section 5
Provide details of the project that are essential for predicting and assessing air impacts including:	
a) The quantities and physic-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes, etc) of materials to be used, transported, produced or stored;	Section 5
b) An outline of procedures for handling transport, production and storage;	Section 5
c) The management of solid, liquid and gaseous waste streams with potential for significant air impacts	Section 5
Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models;	Section 2
Provide and analyse site representative data on the following meteorological parameters;	
a) Rainfall, evaporation and cloud cover;	Section 4.2
b) Wind speed and direction	Section 4.1
Provide a description of existing air quality and meterology, using existing information and site representitive ambient monitoring data	Section 4.3
Identify all pollutants of concern and estimate emissions by quantity (and size for particles), sorce and discharge point.	Section 5
Describe the effects and significance of pollutant concentration on the environment, human health, amentiy and regional ambient air quality standards or goals.	Section 8
Outline specifications of pollutant control equipment (including manufacture's performance garantees where available) and managment protocols for both point and fugitive emissions. Where possible this should include cleaner production processes.	Section 6
Queanbeyan Council	
The EIS needs to address how the increased operation will impact on dust emissions from the site.	Section 8
Details need to be included on how the concrete recycling and asphalt plant will impact on air quality. Odour and any emissions resulting from the operations including the asphalt manufacturing and concrete crushing need to be addressed.	Section 8[1]
The impact on air quality from the significant increase in the number of vehicle movements transporting material from the site	Section 8

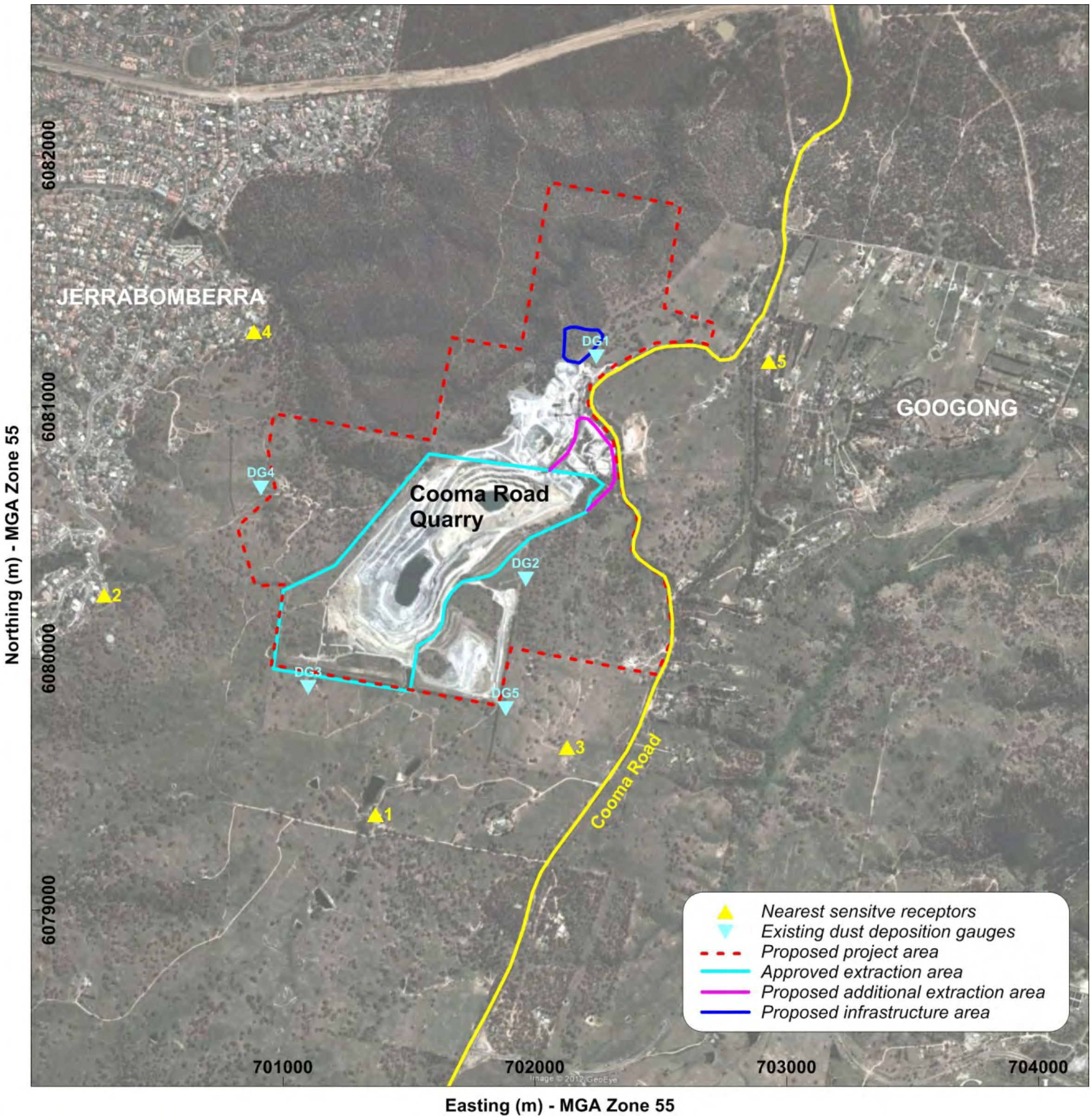
[1] Dust emissions from concrete recycling are addressed in Section 8. Concrete recycling does not generally generate odour emissions. An asphalt manufacturing plant is not part of the Project thus does not require assessment.

Requirement	Section of this report
A complete sampling regime needs to submitted to ensure that the additional extraction will not detract from the air quality in the area	Section 4.3

2. Project Description

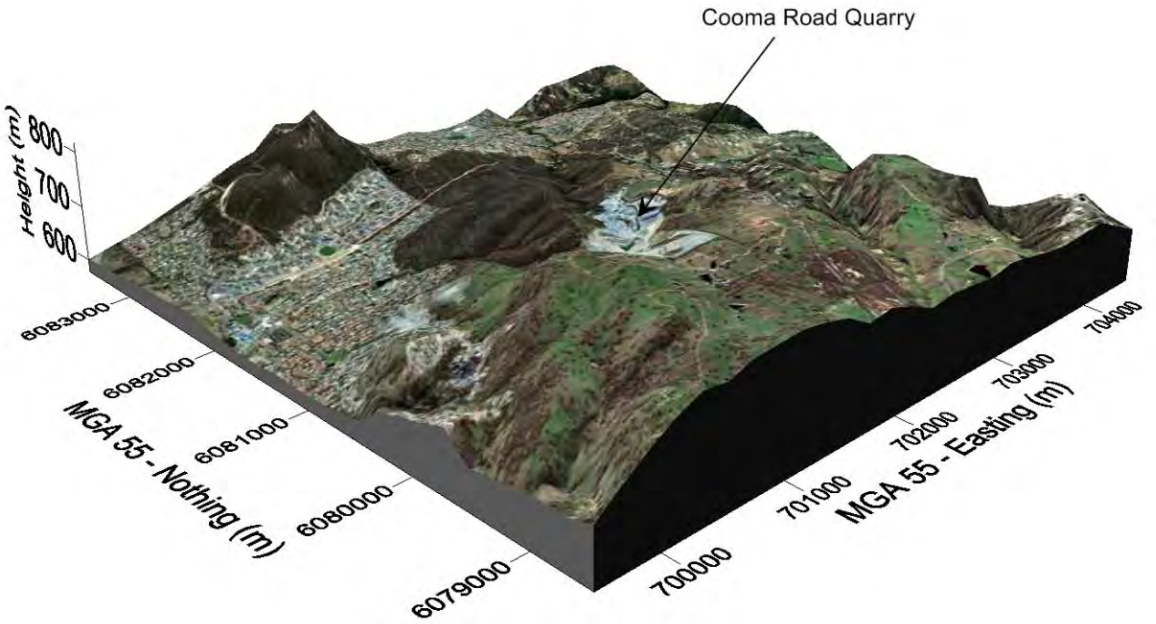
Cooma Road Quarry is a hard rock quarry located approximately six kilometres (km) south of Queanbeyan in Googong, NSW. The quarry is operated by Holcim Australia and has been a local supplier of granite and dacite hard rock since 1959. **Figure 2-1** shows the location of the quarry, the Holcim Australia project boundary and nearest residences.

- **Figure 2-1 Location of Cooma Road Quarry, Googong**



Land use in the area is dominated by quarrying and agriculture with a number of rural residences located in the surrounding area. The quarry is bound by a ridgeline to the north and west of the quarry and by lower rolling hills to the east and south. The terrain of the Project is shown in **Figure 2-2.**

- **Figure 2-2 Terrain in the study region**



Cooma Road Quarry currently produces two principle quarry products; premium quality aggregates produced from granite and elvan material, and roadbase materials and standard quality aggregates produced from dacite material. The production process for all rock types may be summarised as follows (Corkery 2008):

- Blast holes are drilled using a hydraulic drill and are charged with bulk explosives for each blast. Blasts are initiated using non-electric initiation;
- A front-end loader is used to load fragmented material into dump trucks which haul the material via internal quarry roads to the primary crusher;
- Crushed material from the primary crusher is stockpiled and then fed into the secondary crushing house containing three gyratory crushers;
- After crushing, crushed material to be used as aggregates passes through two screening houses where it is washed, sorted into various sizes and stockpiled using tipping trucks. Road base materials pass though only the first screen house and are stockpiled without washing;
- Overburden material is placed in the existing south-eastern overburden emplacement area.

The development consent for the quarry is due to expire in 2015 and approximately 2.1 million tonnes (Mt) of approved reserves will not be extracted before the expiry of the consent. Holcim Australia is seeking approval to extend operations beyond the approved footprint and to also recover approximately 4.5 Mt of additional rock that has been identified under the current infrastructure area.

In summary approval is being sought to:

- Increase the previously approved extraction boundary (see **Figure 2-1)**;
- Relocate the existing workshop, truck parking and temporarily stockpiles to a new infrastructure area to the north of the existing administration offices;
- Increase the annual production limit from 1 million tonnes per annum (Mtpa) to 1.5 Mtpa;
- Allow for receipt of quarry materials from other sites for crushing and screening and then sale (within the total annual production limit proposed of 1.5 Mtpa);
- Extend hours of the operation to 6 am to 10 pm, Monday to Friday, and 6 am to 6 pm on Saturday for certain activities;
- Add a mobile pug mill (Aran 200 or similar) to stabilise road base material with moisture contents not exceeding 10%. The proposed maximum production is 20,000 tpa with an anticipated daily maximum production of about 1,000 tpa;
- Recycle around 10,000 tpa of returned surplus concrete onsite. Surplus concrete would be crushed using the existing crushing plant; and
- Update the provisions for rehabilitation and restoration of the site.

3. Air Quality Criteria

The *National Environmental Protection Measure (Air Quality)* (NEPM) guidelines were developed as a framework for statutory regulation, with the NSW OEH adopting and refining these into the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**DEC, 2005**), hereafter referred to as the Approved Methods. For the purpose of this assessment the criteria outlined in the Approved Methods has been adopted; which provide assessment criteria for additional pollutants (including total suspended particulates and deposited dust) and are generally more stringent then the NEPM. A summary of these criteria are provided in **Table 3-1**.

Of particular relevance to the proposed activities are criteria for particulate matter. There are various classifications of particulate matter, with the OEH providing assessment criteria for the following:

- Total suspended particulates (TSP);
- Particulate matter with equivalent aerodynamic diameter less than or equal to 10 microns (PM_{10}); and
- Deposited dust.

In addition, emissions from vehicles and machinery used during quarrying operations may have the potential to generate air quality impacts. The most significant emissions produced from motor vehicles are oxides of nitrogen (NO_x), carbon monoxide (CO) and PM_{10}.

Table 3-1 summarises the air quality assessment criteria for relevant air pollutants, as noted by the OEH. In general, these criteria relate to the total burden of air pollutants in the air and not just the air pollutants from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts. A discussion of background levels in the study area is provided in **Section 4.3**.

Table 3-1 OEH assessment criteria for particulate matter

Pollutant	Averaging time	Criterion	Application
TSP	Annual average	90 µg/m^3	Cumulative
PM_{10}	Annual average	30 µg/m^3	Cumulative
	Maximum 24-hour average	50 µg/m^3	Cumulative
Deposited dust	Annual average (maximum increase)	2 g/m^2/month	Incremental
	Annual average (maximum total)	4 g/m^2/month	Cumulative
Carbon monoxide (CO)	Maximum 1-hour average	25 ppm	Cumulative
	Maximum 8-hour average	9.00 ppm	Cumulative
Nitrogen dioxide (NO_2)	Maximum 1-hour average	0.12 ppm	Cumulative
	Annual average	0.03 ppm	Cumulative

µg/m^3 = micrograms per cubic metre

ppm = parts per million

The OEH's criteria for TSP and deposited dust have been set to protect against nuisance impacts, while the PM_{10} criteria have been set to protect against adverse health effects.

4. Existing Environment

This section provides a description of the dispersion meteorology, local climatic conditions and existing air quality in the area.

4.1. Dispersion Meteorology

The Gaussian dispersion model used for this assessment, AUSPLUME, requires information about the dispersion characteristics of the area. Suitable meteorological data have been generated for the quarry site using The Air Pollution Model (TAPM), developed by CSIRO. TAPM is a meteorological and air pollution model that uses synoptic weather data to resolve finer-scale meteorological conditions such as hourly wind direction, wind speed, temperature and atmospheric stability. Wind roses were prepared from the TAPM generated data for 2007 to 2009 and all years were simulated to experience similar wind patterns. Data for 2008 have therefore been selected (at random from the three available meteorological years) as a representative dataset. Wind-roses have been created from the 2008 hourly wind speed and wind direction data and are shown in **Figure 4-1**.

It can be seen from **Figure 4-1** that, on an annual basis, the most common wind directions are from the southeast. A similar trend is also present during the summer and autumn months. During winter and spring winds commonly occur from both the south east and northwest. The annual average wind speed from the TAPM generated data was found to be 3.4 metres per second (m/s); a moderate average wind speed.

Meteorological data from the Bureau of Meteorology (BoM) automatic weather station (AWS) at Tuggeranong, approximately 11 km west of the study area, have also been obtained. Records for 2007 to 2011 were processed and hourly records for 2008 showed that average wind speeds were 2.6 m/s. The difference in wind speed between TAPM and observations is likely due to the Tuggeranong AWS located in a built up area, where wind speeds would be affected by the presence of buildings and consequently lower than in a more open location. Annual and seasonal wind roses for Tuggeranong (BoM 2008) are shown in **Appendix A**.

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Figure 4-1 Annual and seasonal wind-roses (Cooma Road Quarry by TAPM, 2008)

To use the wind data to assess dispersion, it is also necessary to have available data on atmospheric stability. In dispersion modelling, atmospheric stability describes the rate at which a plume will disperse, represented by typically six classes; A to F (that is, unstable through to very stable conditions).

For the quarry site, stability class was calculated by TAPM for each hour in the 2008 calendar year. **Table 4-1** shows the frequency of occurrence of the stability categories expected in the area.

Table 4-1 Frequency of occurrence of stability categories in the area

Stability class	Frequency of occurrence (Comma Road Quarry 2008) (%)
A	1
B	7
C	15
D	44
E	13
F	20
Total	**100**

The most common stability class was determined to be D class. This suggests that the dispersion conditions are such that dust emissions will disperse rapidly for a significant proportion of the time.

4.2. Local Climatic Conditions

The BoM collects climatic information at Tuggeranong, approximately 11 km west of the study area, and a range of climatic data collected from this station is presented in **Table 4-2** (BoM, 2012). Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

Cloud cover information is not reported from the Tuggeranong station. Cloud data are often used in conjunction with wind speed data to determine atmospheric stability for air dispersion models, however for this study, the necessary stability data were generated by the prognostic model known as TAPM.

Table 4-2 Climatic information for Tuggeranong

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (C)	30	28	25	21	17	13	12	14	18	21	24	27
Mean minimum temperature (C)	14	14	11	7	3	1	0	1	4	6	10	12
Mean rainfall (mm)	46	69	39	28	22	47	41	50	62	57	77	72
Mean number of days of rain	5	5	4	4	3	6	6	6	7	7	8	6
Mean 9am temperature (C)	20	19	16	13	8	6	5	7	11	14	16	18
Mean 9am relative humidity (%)	61	68	70	69	78	83	82	73	65	60	62	59
Mean 9am wind speed (km/h)	8	8	7	8	7	7	7	9	11	11	10	10
Mean 3pm temperature (C)	28	27	24	20	16	12	11	13	16	19	23	26
Mean 3pm relative humidity (%)	34	39	38	42	50	57	56	50	46	41	39	34
Mean 3pm wind speed (km/h)	16	15	15	14	13	14	14	17	19	19	17	18

Monthly climate statistics for Tuggeranong (Isabella Plains), station number 070339. Commenced: 1996; Last record: January 2012; Latitude (deg S): -35.42; Longitude (deg E): 149.09; Elevation: 587 m; State: NSW. Source: Bureau of Meteorology, 2012.

The data from **Table 4-2** show that the area is characterised by mild to warm summers and cold winters. January is typically the warmest month with a mean daily maximum temperature of 30°C. July is the coolest month with a mean daily minimum temperature of 0°C.

Rainfall data collected at Tuggeranong show that November is usually the wettest month with mean rainfall of 77mm, falling over an average of 8 days in the month. The lowest monthly rainfall on average is May, with a mean monthly rainfall of 22 mm over 3 rain days. The mean annual rainfall is 610 mm with an average of 66 rain days each year.

4.3. Existing Air Quality

Air quality criteria refer to pollutant levels which generally include the project and existing sources. To fully assess impacts against all the relevant air quality criteria (see **Section 3**) it is necessary to have information or estimates on existing air pollutant levels in the area in which the project is likely to contribute to these levels. The following subsections provide a description of the existing air quality.

4.3.1. Dust Concentration

No measurements of TSP or PM_{10} concentrations are available in close proximity to the quarry. However the ACT government operate an air quality monitoring station at Monash, ACT approximately 12 km south west of the site. While the Monash site is not in close proximity to the quarry, the data will however provide a reasonable indication of background air quality for the region. This station records PM_{10}, carbon monoxide, nitrogen dioxide and ozone concentrations. The Monash site is surrounded by rural and residential land uses where the major contributors to TSP and PM_{10} would be local traffic, particularly vehicles travelling along unsealed roads.

Hourly PM_{10} data are recorded by the ACT Environment Protection Authority (EPA) using a Tapered Element Oscillating Microbalance (TEOM) at the Monash monitoring station (EPA, 2011). The maximum 24-hour concentration measured at Monash (in 2010, the most recent year for which data are available) was 48 µg/m^3 on the 19th March, coinciding with a large number of hazard reduction burns occurring in NSW (EPA 2011). There were no recorded exceedances of the 24-hour average 50 µg/m^3 OEH criterion during 2010. It is noted that the 95th percentile[2] 24-hour average concentration measured at Monash during 2010 was 24 µg/m^3. This figure has been adopted as an approximation of the existing maximum 24-hour PM_{10} concentration within the study area.

Annual average PM_{10} results were not published by EPA. The annual average PM_{10} concentration has been estimated at 15 µg/m^3, by reference to the reported 50th percentile result. This is a conservative estimate, given that the 50th percentile result was 10 µg/m^3.

In the absence of existing annual TSP concentration data it has been assumed that the annual TSP concentration would be double the annual PM_{10} concentration. This is a conservative approach as data reported by the NSW Minerals Council (2000) suggested that PM_{10} is generally around 40% of the TSP for similar rural areas. This equates to an annual TSP concentration of 30µg/m^3, which is below the OEH criterion of 90µg/m^3.

4.3.2. Dust Deposition

Holcim Australia monitors monthly dust deposition using dust deposition gauges at five monitoring sites within the study area. The location of these monitoring sites is shown on **Figure 2-1**.

Data collected from the five dust gauges for the period between December 2001 to October 2011 are shown in **Table 4-3**. These measurements include the effects of the existing quarry operations and all other background sources relevant to that location.

[2] 95th percentile is consistent with reporting compliance with air quality criteria http://www.environment.gov.au/soe/2011/report/atmosphere/3-1-current-state-atmosphere.html#ss3-1-2

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Table 4-3 Dust deposition data for Cooma Road Quarry

Month	Monthly result in g/m^2/month				
	Location 1 North Side	Location 2 East Side	Location 3 South Side	Location 4 West Side	Location 5 Southeast
Oct '11	2.4	2.4	0.6	1.3	1.1
Sep '11	2.4	1.7	0.5	1.2	1.0
Aug '11	6.0	3.9	0.6	1.1	0.9
Jul '11	4.6	2.1	0.5	0.4	0.4
Jun '11	3.6	1.9	0.4	0.3	1.1
May '11	7.2	8.1	0.5	0.9	0.4
Apr '11	2.6	3.4	0.1	2.3	1.1
Mar '11	4.2	2.1	0.9	10.0	0.6
Feb '11	1.5	1.2	0.4	15.3	0.9
Jan '11	1.2	1.1	1.8	18.2	1.2
Dec '10	2.2	3.1	1.3	11.8	1.3
Nov '10	1.7	4.8	0.9	2.2	0.8
Oct '10	1.5	6.4	1.4	0.9	1.2
Sep '10	1.4	1.0	0.9	0.4	1.5
Aug '10	2.4	1.1	0.7	0.9	0.5
Jul '10	2.5	1.9	0.4	0.2	0.3
Jun '10	2.3	1.9	0.3	0.4	0.4
May '10	3.6	1.4	0.9	0.7	0.9
Apr '10	2.6	3.6	1.4	0.8	1.4
Mar '10	1.2	1.4	1.0	0.7	1.0
Feb '10	0.7	2.2	1.2	1.4	1.5
Jan '10	No Data	No Data	No Data	No Data	No Data
Dec '09	3.8	7.3	2.7	2.0	4.0
Nov '09	2.5	2.6	2.8	1.4	1.2
Oct '09	3.7	2.6	2.6	4.2	1.6
Sept '09	18.6	16.2	16.2	13.5	18.7
Aug '09	3.1	1.5	0.7	1.0	0.7
Jul '09	2.2	1.4	1.5	0.7	0.7
Jun '09	2.0	0.7	0.5	0.5	0.3
May '09	1.3	0.7	0.4	0.2	0.7
Apr '09	1.6	1.6	1.5	2.2	2.3
Mar '09	1.3	7.3	1.7	0.8	1.0
Feb '09	2.9	1.1	1.1	0.8	1.0
Jan '09	3.6	2.1	4.9	2.7	6.8
Dec '08	2.2	1.5	1.8	1.4	1.4
Nov '08	2.8	1.1	1.7	1.1	0.9
Oct '08	4.6	3.4	2.7	3.2	2.5
Sep '08	6.4	4.0	3.3	3.1	3.6
Aug '08	3.4	1.0	0.3	0.5	0.7
Jul '08	3.2	1.8	0.9	1.5	0.9
Jun '08	3.1	1.6	0.4	1.1	0.4
May '08	3.3	2.2	0.9	0.5	1.0
Apr '08	3.2	2.4	1.4	1.5	2.1
Mar '08	4.4	1.5	1.0	0.8	1.2
Feb '08	1.6	1.2	1.2	1.9	6.6
Jan '08	1.2	0.6	1.1	0.7	1.2

Month	Monthly result in g/m^2/month				
	Location 1 North Side	Location 2 East Side	Location 3 South Side	Location 4 West Side	Location 5 Southeast
Dec '07	3.6	1.1	1.3	1.4	1.3
Nov '07	3.6	2.2	1.7	1.0	3.1
Oct '07	2.0	1.5	1.1	1.6	1.6
Sep '07	2.1	1.2	0.8	4.4	1.9
Aug '07	1.7	1.3	0.6	5.9	0.7
Jul '07	1.8	0.6	0.3	1.3	1.0
Jun '07	3.2	1.1	0.7	1.1	0.9
May '07	2.9	1.3	0.5	0.8	0.6
Apr '07	2.6	1.8	1.0	6.4	1.5
Mar '07	3.2	1.0	1.2	3.9	1.0
Feb '07	0.5	1.8	1.4	5.6	1.4
Jan '07	2.5	1.6	1.7	1.2	1.2
Dec '06	2.0	2.1	1.2	0.8	1.2
Nov '06	3.5	1.9	1.4	1.1	8.5
Oct '06	1.9	2.1	1.2	1.1	0.9
Sep '06	2.4	1.8	0.9	0.7	No Data
Aug '06	2.2	1.5	0.5	0.4	No Data
Jul '06	3.4	1.2	0.7	0.3	No Data
Jun '06	4.6	1.2	1.5	1.0	No Data
May '06	2.0	1.4	0.6	0.6	No Data
Apr '06	1.9	1.3	1.2	0.8	No Data
Mar '06	1.4	1.0	0.8	0.6	No Data
Feb '06	1.6	1.3	2.1	0.7	No Data
Jan '06	2.5	1.6	14.6	1.6	No Data
Dec '05	2.5	1.7	2.4	1.1	No Data
Nov '05	1.9	1.5	3.4	2.2	No Data
Oct '05	2.8	2.4	2.2	0.6	No Data
Sep '05	2.7	1.2	12.1	0.5	No Data
Aug '05	3.3	1.4	1.4	0.5	No Data
Jul '05	0.8	0.4	1.9	0.2	No Data
Jun '05	4.3	1.7	1.9	0.5	No Data
May '05	2.2	0.6	0.3	1.2	No Data
Apr '05	2.4	1.2	2.2	2.8	No Data
Mar '05	2.4	1.7	6.7	5.6	No Data
Feb '05	1.9	1.1	3.4	1.5	No Data
Jan '05	1.8	1.7	6.2	3.3	No Data
Dec '04	2.7	1.9	10.1	1.1	No Data
Nov '04	2.3	1.4	2.7	1.3	No Data
Oct '04	1.9	1.6	1.5	1.0	No Data
Sep '04	3.0	1.3	1.1	0.9	No Data
Aug '04	2.5	1.2	0.6	0.2	No Data
Jul '04	1.0	1.1	1.0	0.5	No Data
Jun '04	0.6	0.8	1.9	0.6	No Data
May '04	2.0	1.3	2.4	0.5	No Data
Apr '04	3.6	1.8	2.3	0.6	No Data
Mar '04	0.8	0.4	3.6	0.1	No Data
Feb '04	3.8	2.0	4.8	2.0	No Data

Month	Monthly result in g/m²/month				
	Location 1 North Side	Location 2 East Side	Location 3 South Side	Location 4 West Side	Location 5 Southeast
Jan '04	2.2	1.2	4.6	6.0	No Data
Dec '03	2.4	1.3	3.9	3.3	No Data
Nov '03	0.9	1.0	2.3	1.9	No Data
Oct '03	1.9	1.9	1.7	1.5	No Data
Sep '03	3.0	2.8	2.5	1.6	No Data
Aug '03	2.4	1.0	2.0	0.5	No Data
Jul '03	2.7	1.5	0.5	0.2	No Data
Jun '03	2.3	1.1	0.7	0.3	No Data
May '03	3.1	0.8	0.7	0.3	No Data
Apr '03	2.9	1.1	1.1	0.9	No Data
Mar '03	2.4	1.6	2.8	1.5	No Data
Feb '03	3.3	2.2	4.1	1.4	No Data
Jan '03	1.3	1.3	3.3	0.8	No Data
Dec '02	6.3	4.1	5.5	4.1	No Data
Nov '02	1.0	0.8	1.4	1.2	No Data
Oct '02	4.4	5.8	6.1	5.5	No Data
Sep '02	2.3	1.7	1.6	1.2	No Data
Aug '02	1.8	1.2	0.8	0.7	No Data
Jul '02	1.2	0.7	0.3	0.2	No Data
Jun '02	2.2	0.8	1.5	0.5	No Data
May '02	2.8	0.9	0.7	0.5	No Data
Apr '02	3.1	1.7	7.8	1.0	No Data
Mar '02	0.2	0.4	0.8	0.1	No Data
Feb '02	1.6	1.3	0.5	2.0	No Data
Jan '02	1.3	1.0	1.0	0.7	No Data
Dec '01	2.4	1.1	1.3	2.6	No Data
Average for last 12 months	**3.3**	**3.0**	**0.7**	**5.4**	**0.9**

Note – For monitoring locations refer to Figure 2-1.

The dust gauges have been located to capture the effects of the quarry operations, around the site boundary. **Table 4-3** shows that all sites have reported an average level below the OEH 4 g/m²/month dust fallout criteria for the most recent 12 months of data, with a maximum of annual average deposition being 3.5g/m²/month recorded at Location 2. A value of 3.3 g/m²/month has been taken as a conservative estimate of annual average deposition at each of the residential receptors shown in **Figure 2-1**. This is a conservative approach as the existing dust deposition monitoring data may already include some dust contribution from the quarry activities, leading to the possible double counting in the assessment.

4.3.3. Carbon Monoxide

No measurements of CO concentration have been made specifically for this project. Eight-hourly CO concentrations are recorded at the Monash air quality monitoring station. Records indicate that the maximum 8-hour CO concentration during 2010 was 1.8 ppm, which is well below the OEH criteria of

9 ppm. No hourly CO concentration data is available, however given the low maximum 8-hourly data (20 percent of the 8-hour given criterion) hourly CO concentrations are also expected to be low.

4.3.4. Nitrogen Dioxide

No measurements of NO_2 concentration have been made specifically for this project however hourly NO_2 concentrations are recorded at the Monash air quality monitoring station. Data from 2010 show that the maximum 1-hour concentration for NO_2 was 0.039 ppm, which is well below the OEH criteria of 0.12 ppm. The annual average concentration of NO_2 for 2010 at Monash was approximately 0.006 ppm which is below the OEH criterion of 0.03 ppm.

4.3.5. Adopted Background Levels

In summary, for this assessment the following background levels have been assumed to apply at the nearest sensitive receptors:

- Annual average TSP of 30 $\mu g/m^3$;
- 24-hour average PM_{10} of 24 $\mu g/m^3$;
- Annual average PM_{10} of 15 $\mu g/m^3$;
- Annual average dust deposition of 3.3 g/m^2/month;
- Maximum 8-hour CO of 1.8 ppm;
- Maximum 1-hour NO_2 of 0.039 ppm; and
- Annual average NO_2 of 0.006 ppm.

5. Estimated Dust Emissions

Dust emissions arise from various activities at quarries. Total dust emissions due to the quarry have been estimated by analysing the activities taking place at the site during both existing and proposed operations. The fraction of fine, inhalable and course particles for each activity has been taken into account for the dispersion modelling.

The operations which apply in each case have been combined with emission factors developed both locally and by the US EPA, to estimate the amount of dust produced by each activity. The emission factors applied are considered to be the most up to date methods for determining dust generation rates.

The assessment has considered both existing and proposed operations and is based conservatively on the assumption of maximum production levels. Emissions for the construction activities have not been estimated as the dust emissions during construction will be much lower than emissions during operations, due to a higher quantity of material handled during operations.

Emission estimates for existing operations have been based on a maximum production of 1 Mtpa, with operating hours between 6 am and 6 pm Monday to Saturday and deliveries between 6 pm and 10 pm. All blasting occurs between the hours of 9 am and 3 pm Monday to Friday.

Emission estimates for the proposed continued operations have been based on a maximum production of 1.5 Mtpa and recycling of 10,000 t of concrete with operating hours increased to 6 am to 10 pm. Primary crushing, delivery and blasting hours will remain unchanged from existing operations.

The most significant dust generating activities from the quarry operations have been identified and the dust emissions estimates during the two operational scenarios are presented below in **Table 5-1**. Details of the calculations of the dust emissions are presented in **Appendix B**. Most of the predicted increases in annual dust emissions are due to the higher volume of overburden handled and higher quantities of rock processed.

- **Table 5-1 Estimated dust emissions due to Cooma Road Quarry operations**

Activity	Calculated TSP emission (kg/y)		Comments on dust control measures
	Existing (Max 1 Mtpa)	Proposed (Max 1.5 Mtpa)	
Drilling rock	10226	10226	Vacuum extraction. No control assumed for modelling.
Blasting rock	1880	1880	None
Loading overburden to trucks	99	497	Water sprays used, but no control assumed for modelling.

Activity	Calculated TSP emission (kg/y)		Comments on dust control measures
	Existing (Max 1 Mtpa)	Proposed (Max 1.5 Mtpa)	
Dumping overburden to emplacement area	99	497	None
Hauling overburden to emplacement area	1515	10247	Watering of haul roads. 75% emission control assumed for modelling.
Dozer shaping overburden dump	17472	17472	None
Loading rocks to trucks	2617	3641	None
Hauling rock to hopper	40000	60000	Watering of haul roads. 75% emission control assumed for modelling.
Dumping rock to hopper	2617	3641	Water sprays used, but no control assumed for modelling.
Primary crushing and screening	1520	2280	Water sprays used. 90% emission control assumed for modelling.
Secondary crushing and screening	15720	23580	Water sprays and dust extraction. 90% emission control assumed for modelling.
Loading to product stockpiles	2617	3641	None
Loading product to road trucks	1438	2156	None
Transport of product offsite (sealed road)	2000	3000	Watering of haul roads. 75% emission control assumed for modelling.
Wind erosion from exposed pit areas and bunds	91354	105408	None
Wind erosion from product stockpiles	7027	10541	None
Wind erosion from overburden emplacement area	17568	21082	None
Grading roads	1418	1418	Watering of haul roads. No control assumed for modelling.
TOTAL DUST (kg)	**217185**	**281207**	**-**

6. Dust Control Measures

The controls that are available for quarry operations can be summarised in three broad categories:

- Engineering controls;
- Operational controls which vary operations when adverse meteorological conditions occur; and
- Planning controls (which increase the separation distance between dust emission sources on the plant and sensitive areas).

Engineering controls involve measures such as shielding and enclosing crushers and screens, conveyors, transfer points and installation of spray systems on stockpiles etc. Planning controls include the maintenance of adequate buffer distances between dust sources and sensitive receptors. Generally these types of controls would be implemented before the project commences.

The following dust control measures are currently implemented onsite:

- Minimisation of the total disturbed/working areas at any one time;
- Dust collection during drilling operations;
- Enclosure of the primary and secondary crushing plants and screening transfer points;
- Watering of unsealed roads, working areas and stockpiles;
- Water sprays on the conveyors;
- Dust extraction system within the secondary crushing plant; and
- Truck wheel wash facility.

Dust control measures that form part of the quarry operations, and which have been taken into account in the modelling, include enclosing the crushing and screening transfer points and using water sprays as required on haul roads and exposed areas. For conservatism, not all dust control measures have been taken into consideration for the modelling. The assumed dust control measures and associated emission reduction for each activity is shown in **Table 5-1**. These measures and emission reductions are consistent with data in the NPI (2011) and suggest that most of the dust sources are subject to some level of dust control.

7. Approach to Assessment

This section describes the assessment methodology for dispersion modelling emissions from the quarry. Specifically this involves a "Level 2" air quality assessment conducted in accordance with the "*Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*" (DEC, 2005). The Level 2 assessment uses site-representative input data, such as detailed meteorological information. The AUSPLUME (version 6.0) model was used to predict dust concentrations within the vicinity of the quarry. AUSPLUME was developed by the Victorian EPA, and is an approved model for conducting site-specific air quality assessments in NSW (DEC, 2005).

Inputs required by the AUSPLUME model include:

- Emission source locations;
- Emission rates;
- Topographical data;
- Locations of sensitive receptors; and
- Meteorological conditions.

The dispersion modelling was based on meteorological information (**Section 4.1**) and the dust emission estimates (**Section 5**) to predict dust concentrations and deposition levels in the vicinity of the site. A conservative approach was taken to estimate dust emissions, using maximum material handling quantities.

As discussed in **Section 5**, two worst case operational scenarios were modelled, one for existing operations and one for proposed operation. Operations for existing and proposed scenarios were represented by a series of volume sources located according to the location of activities for each modelled scenario. **Figure 7-1** shows the location of the modelled volume sources, and identifies where the activities are taking place according to the source location. Information on the allocation of emissions from each activity to source locations is provided in **Appendix B**.

The volume sources were given TSP emission rates and duplicated into three source groups, representing three particle size categories; namely, $PM_{2.5}$ (particles in size range 0 to 2.5 µm), $PM_{2.5\text{-}10}$ (particles in size range 2.5 to 10 µm) and $PM_{10\text{-}30}$ (particles in size range 10 to 30 µm). Each source was assumed to have an aerodynamic particle diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have a particle size of 1 µm.

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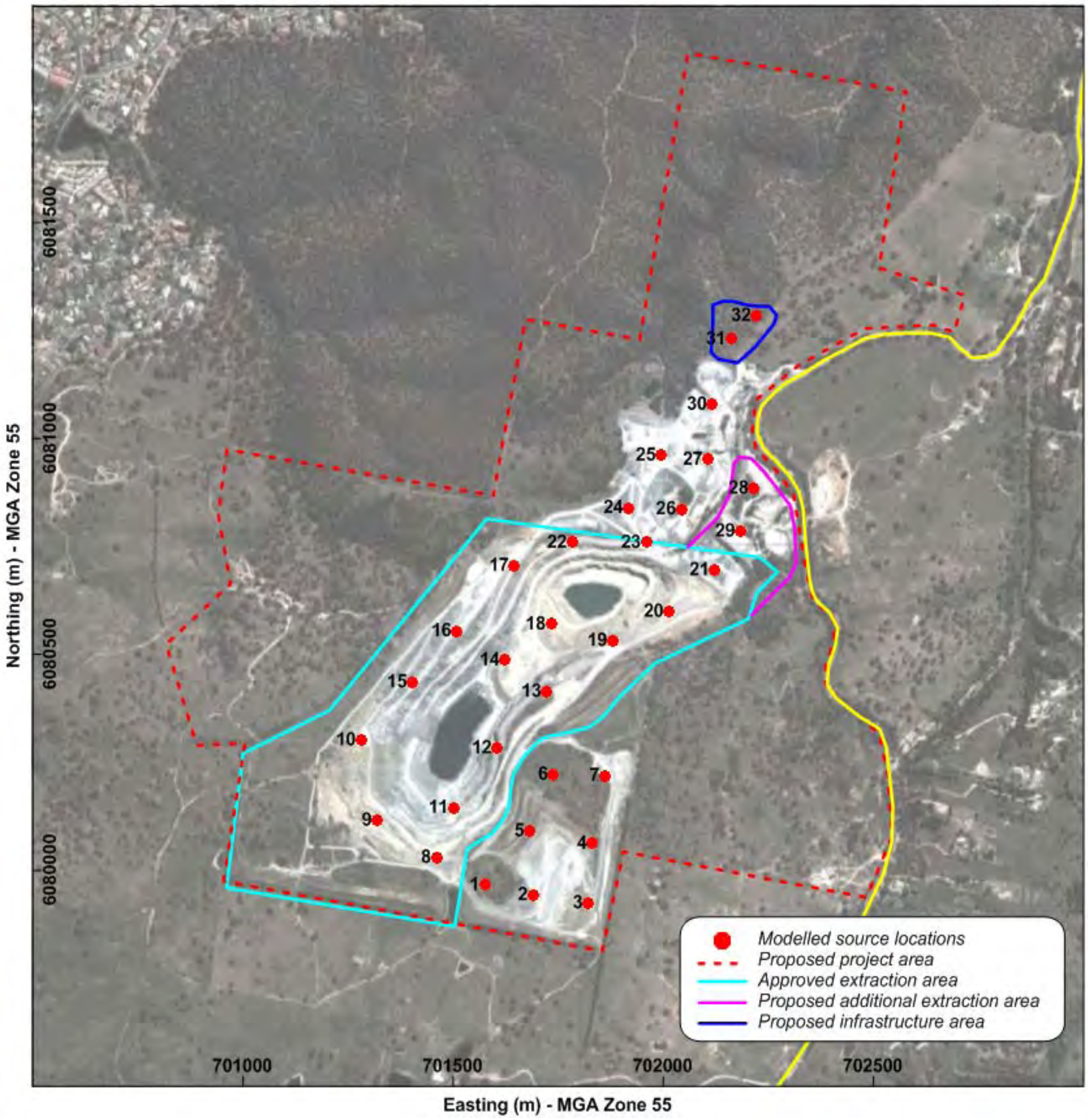
- **Figure 7-1 Location of modelled dust sources**



Sources locations have been selected to cover both existing and proposed operations

Once the model had completed each simulation, the three output files from each source group were combined according to the distribution of particles in each particle size range. The distribution of particles in each size range has been derived from measurements published by the State Pollution Control Commission (**SPCC, 1986**) and is as follows:

- $PM_{2.5}$ is 5% of TSP;
- $PM_{2.5\text{-}10}$ is 34% of TSP; and
- $PM_{10\text{-}30}$ is 61% of TSP.

Emissions from each source were developed on an hourly time step, taking into account the level of activity at that location and the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation, and higher winds with higher dust generation.

Dust concentrations and deposition rates have been predicted in the vicinity of the project area for existing and proposed maximum annual capacity operational scenarios. Local terrain has been included in the modelling (**Figure 2-2**). Dust concentration and deposition levels were predicted at 182 discrete receptors in a 5 km by 5 km model domain, whereby receptors were finely spaced close to the emission sources and coarsely spaced at locations further from the sources.

Under the existing scenario (excluding drilling, blasting and deliveries), an average of 12 working hours per day (6 am to 6 pm) was assumed. Deliveries were modelled over a 16 hour period between 6 am to 10 pm, while blasting and drilling operations were accounted for between 9 am and 3 pm. Dust emissions from wind erosion sources have been modelled for 24 hours per day. Under the proposed scenario, the dust generating activities with extended hours (6 am to 10 pm) included secondary crushing and screening.

As an example of the model setup, the AUSPLUME output file is provided in **Appendix C**.

8. Assessment of Impacts

8.1. Preamble

Dust concentrations and deposition rates for the existing and proposed operational scenarios have been presented as contour plots (**Figure 8-1** and **Figure 8-2**) showing:

1) Predicted maximum 24-hour average PM_{10} concentrations;
2) Predicted annual average PM_{10} concentrations;
3) Predicted annual average TSP concentrations; and
4) Predicted annual average dust deposition.

Model predictions for each assessment scenario have also been presented in tabular form for the nearest sensitive receptors, that is, the nearest residences (**Table 8-1**). ‘Sensitive receptors’ is a term used by the OEH describe such places as existing or future residences, schools and hospitals. **Figure 2-1** shows the identification label given to each of the nearest sensitive receptors. Interpretation and analysis of the model predictions for each assessment scenario is provided below.

8.2. Dust Impacts

Model predictions indicate that the Project will comply with all relevant air quality assessment criteria at the nearest sensitive receptors, specifically:

- Predicted maximum 24-hour average PM_{10} concentrations (due to the incremental increase of the Project plus background levels) are below the 50 µg/m^3 assessment criterion at all sensitive receptors.
- Predicted annual average PM_{10} concentrations (due to the incremental increase of the Project plus background levels) are below the 30 µg/m^3 assessment criterion at all sensitive receptors.
- Predicted annual average TSP concentrations (due to the incremental increase of the Project plus background levels) are below the 90 µg/m^3 criterion at all sensitive receptors.
- Predicted incremental dust deposition levels due to the Project are below the 2 g/m^2/month criterion at all sensitive receptors. Predicted total dust deposition levels (due to the incremental increase of the Project plus background levels) are below the 4 g/m^2/month criterion at all sensitive receptors.

Higher concentrations and deposition levels are generally predicted to the northwest and south east of the site which is consistent with prevailing wind patterns.

Table 8-1 Model predictions at nearest sensitive receptors

ID	Easting	Northing	Due to Project Only		Incremental Increase	Background	Total	Criterion
			1.0 Mtpa	1.5 Mtpa				
Maximum 24-hour PM_{10} (µg/m^3)								
1	701367	6079380	13	17	4	24	27	50
2	700288	6080251	5	8	2	24	26	50
3	702128	6079647	17	23	5	24	29	50
4	700884	6081298	9	11	2	24	26	50
5	702928	6081180	8	12	4	24	28	50
Annual PM_{10} (µg/m^3)								
1	701367	6079380	0.6	0.8	0.2	15	15.2	30
2	700288	6080251	0.5	0.6	0.2	15	15.2	30
3	702128	6079647	1.8	2.4	0.6	15	15.6	30
4	700884	6081298	1.6	2.1	0.5	15	15.5	30
5	702928	6081180	0.5	0.9	0.4	15	15.4	30
Annual TSP (µg/m^3)								
1	701367	6079380	0.8	1.0	0.2	30	30.2	90
2	700288	6080251	0.6	0.8	0.2	30	30.2	90
3	702128	6079647	2.5	3.3	0.8	30	30.8	90
4	700884	6081298	2.3	3.0	0.7	30	30.7	90
5	702928	6081180	0.7	1.2	0.6	30	30.6	90
Annual average dust Deposition (g/m^2/month)								
1	701367	6079380	<0.05	0.1	<0.05	3.3	3.3	4
2	700288	6080251	0.1	0.1	<0.05	3.3	3.3	4
3	702128	6079647	0.4	0.5	0.1	3.3	3.4	4
4	700884	6081298	0.4	0.5	0.1	3.3	3.4	4
5	702928	6081180	0.1	0.2	0.1	3.3	3.4	4

As the model results show compliance with relevant air quality assessment criteria at nearest sensitive receptors, it is concluded that the Project is unlikely to cause adverse air quality impacts.

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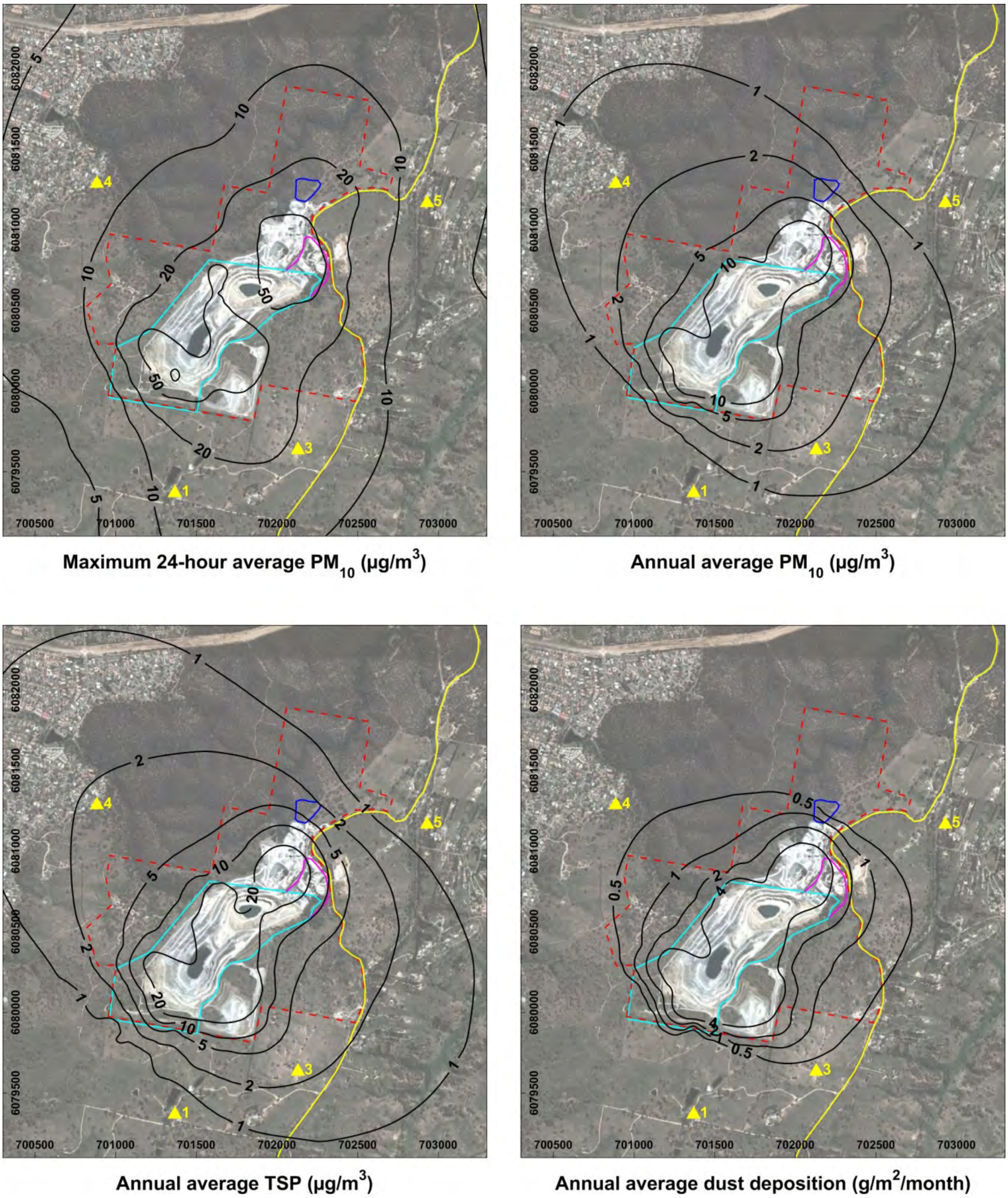
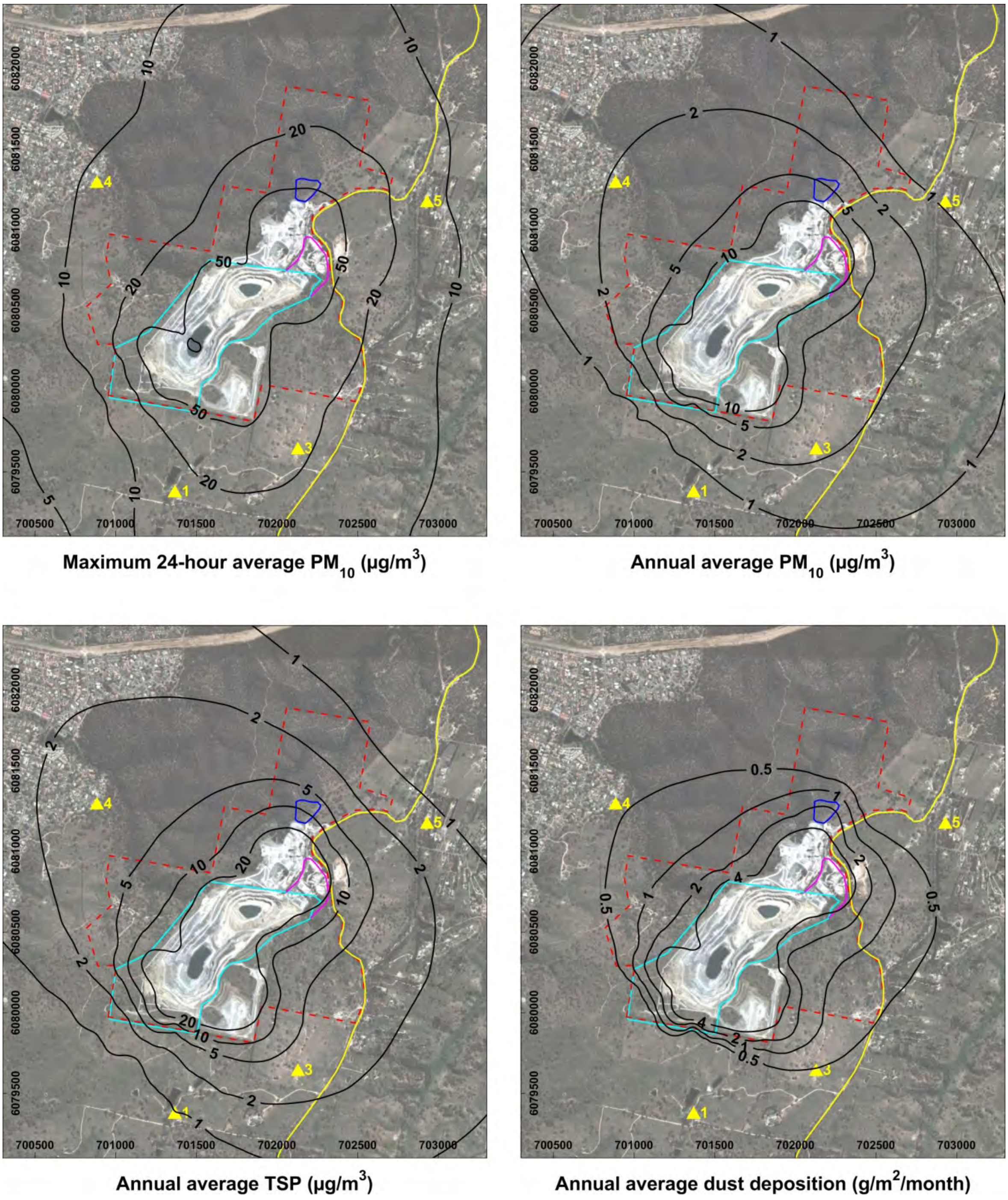
- **Figure 8-1 Dispersion model results for existing quarry (1Mtpa)**



■ **Figure 8-2 Dispersion model results for proposed quarry (1.5Mtpa)**



8.3. Other Air Quality Impacts

Mobile vehicle emissions from additional site activity would result from combustion of petroleum products, such as diesel and gasoline. Emissions generated would include carbon monoxide, carbon dioxide, oxides of nitrogen, sulphides and trace amounts of non-combustible hydrocarbons. Emission rates and potential impacts would depend on the fuel quality, power output, and the condition of the combustion engines. In addition, machinery/equipment would include delivery trucks, loaders, dump trucks, maintenance trucks, water truck, and a pugmill. This impact would likely be minimal provided equipment is appropriately maintained. Given the relatively low existing concentrations of CO and NO_2 in the region, exceedances are highly unlikely to arise from proposed vehicle and machinery activity.

The DGRs also required consideration of blast fume. Dust from blast emissions have been explicitly included in the model and potential impacts are reflected in the model results (**Section 8.2**). Blast fume is characterised by a visible orange/brown cloud, which is the NO_2 emission generated when ammonium nitrate explosive has not detonated ideally. There can be other toxic emissions, such as CO and nitric oxide (NO), but it is the NO_2 which is the more harmful pollutant, in terms of potential health effects.

In practice, NO_2 concentrations in a blast plume can vary significantly. The NO_2 becomes visible at concentrations of around 30 ppm but as these concentrations might only be observed from a blast for a few minutes, the OEH's assessment criteria of 12 pphm for NO_2, which applies to a 1-hour period, is not often compromised. Nevertheless, blast-generated dust and fume will need to be managed and impacts minimised as far as practicable.

The most effective way to manage fume is to aim to eliminate the possibility of fume being generated. Typical blast management includes conducting a pre-blast environmental assessment that considers wind speed, wind direction, and temperature inversions. Blasts should be fired in suitable weather conditions that minimise the potential for dust or fume to be blown towards neighbouring sensitive receptors.

8.4. Cumulative Impacts

A search of the NSW Department of Planning and Infrastructure's project database was undertaken to identify any potential proposed development which may have the potential to impact on local air quality levels in the Queanbeyan Local Government Area. There are currently no proposed projects with the potential to generate significant long term dust impacts within close proximity to the quarry. As such no additional cumulative impact assessment with proposed projects is necessary. It should be noted however that the assessment has considered cumulative impacts with existing sources in the area, as existing air quality has been considered.

8.5. Construction Impacts

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities. The total amount of dust generated would depend on the silt and moisture content of the soil, the types of operations being carried out, exposed area, frequency of water spraying and speed of machinery. The detailed approach to construction would depend on decisions that would be made by the successful contractor and subtle changes to the construction methods and sequences that are expected to take place during the detailed design development.

These activities would not be expected to generate significant quantities of dust, in comparison to the operational stage, and dust emissions would be readily controlled using water sprays and standard dust control measures used on construction sites, such as water trucks, minimising exposed disturbance areas and rehabilitating cleared ground as soon as reasonably practicable.

Dust emissions from construction activities have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts from such activities using dispersion modelling. To do so would require knowledge of weather conditions for the few weeks that work will be taking place in each location. It will be important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum.

9. Conclusions

This report has assessed the potential worst-case air quality impacts associated with existing and proposed operations at Cooma Road Quarry. Dispersion modelling has been used to predict off-site dust concentration and deposition levels due to dust generating activities associated with the quarry.

The dispersion modelling took account of local meteorology and terrain information and used dust emission estimates to predict the air quality impacts for two operational scenarios. The scenarios included existing operations where the quarry operates on average 12 hours per day with a maximum production of 1 Mtpa. The proposed scenario included an extension of the extraction boundary to the north of the current operations, extension of the operating hours to 16 hours per day and a maximum production rate of 1.5 Mtpa. The activities to be undertaken within the extended operation hours are restricted to maintenance, secondary crushing and screening, stockpile management and returning fleet.

A qualitative assessment of air emissions associated with increased vehicle and machinery activity associated with the proposed works was also undertaken. This impact would likely be minimal provided equipment is appropriately maintained.

In summary, the model predictions indicate that the Project will not cause any adverse air quality impacts on the nearby sensitive receptors. Predicted dust concentrations and deposition levels are well below the relevant air quality criteria. The dispersion modelling was based on conservative assumptions about the way in which the quarry will operate. Results are therefore considered to be conservative.

10. References

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BOM (2012) *Climate Statistics for Australia Locations: Monthly climate statistics for* Tuggeranong, Australian Government Bureau of Meteorology. Accessed 27th January 2012 http://www.bom.gov.au/climate/averages/tables/cw_070339.shtml

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EPA (2011) *ACT Air Quality Report 2010*, Environmental Protection Authority, ACT Government, Canberra, Australia

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SPCC (1986) *Particle size distributions in dust from open cut coal mines in the Hunter Valley*, Report Number 10636-002-71, Prepared for the State Pollution Control Commission of NSW (now EPA) by Dames & Moore, 41 McLaren Street, North Sydney, NSW 2060.

US EPA (1985 and updates) *Compilation of Air Pollutant Emission Factors* AP-42 Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

Appendix A Wind Roses Tuggeranong (BoM 2008)

Appendix B Emission Calculations

The dust emission invetories have been formulated from the description of existing and proposed operational quarry activites provided by Umwelt. Estimated emissions are presented for all significant dust generating activites associated with the operations. The relevant emission factors used for the study are described below.

Dozers shaping overburden dump

An emission rate of 14 kg/h has been used for dozers shaping overburden dump in the south east corner of the site (SPCC 1983).

Loading material/dumping material

Each tonne of material loaded will generate a quanitiy of TSP that will depend on the wind speed and the moisture content. Equation 1 shows the relationship between these variables

Equation 1

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right) kg/t$$

Where,

E_{TSP} = TSP emissions

k = 0.74

U = wind speed (m/s)

M = Moisture content (%) [where 0.25<M <4.8]

Hauling material / product on road surfaces

After the application of water the emission factor used for trucks hauling overburden or rock on unsealed surfaces was 1kg per vehicle kilometre travelled (kg/VKT)

Drilling rock

The emission factor used for drilling has been taken to be 0.59 kg/hole (US EPA, 10985 and updates)

Blasting rock and overburden

TSP emissions from blasting were estimated using the US EPA (1985 and updates) emission factor equation given in Equation 2.

Equation 2

$$E_{TSP} \;= 0.00022\ \times\ A^{1.5}\ kg/blast$$

where,

A = area to be blasted in m^2

Primary crushing of material

The emission factor used for primary crushing of material has been taken to be 0.0152 kg/t (US EPA 1985 and updates). It has been assumed that there would be a reduction to TSP emissions from the dust supression methods discussed in Section 5 of this report. The reduction rate uses the same relationship between the controlled and uncontrolled US EPA emission factors (that is 90%).

Secondary crushing of material

The emission factor used for secondary crushing of material is taken to be 0.1526 kg/t (US EPA 1985 and updates). It has been assumed that there would be a reduction to TSP emissions from the use of dust supression methods discussed in Section 5 of this report. The reduction uses the same relationship between the controlled and uncontrolled US EPA emission factors (that is 90%).

Wind erosion

The emission factor for wind erosion of 0.4 kg/ha/h (NPI 2011) has been adopted.

Grading roads

Estimates of TSP emissions from grading roads have been made using the US EPA (1985 and updates) emission factor equation (Equation 4).

Equation 4

$$E_{TSP} = 0.0034\ \times S^{2.5}\ KG/VKT$$

where,

S = speed of the grader in km/h (taken to be 8km/hr)

Appendix C AUSPLUME Model Output File

```
1

        Proposed operations : Dust concentration

 Concentration or deposition                         Concentration
 Emission rate units                                 grams/second
 Concentration units                                 microgram/m3
 Units conversion factor                             1.00E+06
 Constant background concentration                            0.00E+00
 Terrain effects                                     Egan method
 Plume depletion due to dry removal mechanisms included.
 Smooth stability class changes?                     No
 Other stability class adjustments ("urban modes")   None
 Ignore building wake effects?                       Yes
 Decay coefficient (unless overridden by met. file)  0.000
 Anemometer height                                   10 m
 Roughness height at the wind vane site              0.500 m
 Use the convective PDF algorithm?                   No

                   DISPERSION CURVES
 Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
 Horizontal dispersion curves for sources >100m high  Briggs Rural
 Vertical  dispersion  curves for sources >100m high  Briggs Rural
 Enhance horizontal plume spreads for buoyancy?       Yes
 Enhance  vertical  plume spreads for buoyancy?       Yes
 Adjust horizontal P-G formulae for roughness height? Yes
 Adjust  vertical  P-G formulae for roughness height? Yes
 Roughness height                                     0.500m
 Adjustment for wind directional shear                None

                    PLUME RISE OPTIONS
 Gradual plume rise?                                  Yes
 Stack-tip downwash included?                         Yes
 Building downwash algorithm:                        Schulman-Scire method.
 Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
 Partial penetration of elevated inversions?          No
 Disregard temp. gradients in the hourly met. file?   No

 and in the absence of boundary-layer potential temperature gradients
 given by the hourly met. file, a value from the following table
 (in K/m) is used:
```

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

```
 WIND SPEED CATEGORIES
 Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

 WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

 AVERAGING TIMES
 24 hours
  average over all hours

        AUSPLUME Input File : Dust concentration

                     SOURCE GROUPS
```

Group No.	Members						
1	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	32			

```
        2      33     34     35     36     37     38     39
               40     41     42     43     44     45     46

               47     48     49     50     51     52     53

               54     55     56     57     58     59     60

               61     62     63     64
        3      65     66     67     68     69     70     71
               72     73     74     75     76     77     78

               79     80     81     82     83     84     85

               86     87     88     89     90     91     92

               93     94     95     96
```

```
1
                    AUSPLUME Input File : Dust concentration

                             SOURCE CHARACTERISTICS


                    VOLUME SOURCE: 1

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 701576  6079966           754m              2m          10m              2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0       2.30

                    VOLUME SOURCE: 2

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 701691  6079943           760m              2m          10m              2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0       2.30

                    VOLUME SOURCE: 3

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 701822  6079924           764m              2m          10m              2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0       2.30

                    VOLUME SOURCE: 4

   X(m)     Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 701832  6080062           753m              2m          10m              2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
```

```
                  Mass       Size    Density
                fraction  (micron)  (g/cm3)
               -----------------------------
                   1.0000      1.0       2.30

                VOLUME SOURCE: 5

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
701682  6080091          746m              2m        10m            2m

           (Constant) emission rate = 1.00E+00 grams/second

      Hourly multiplicative factors will be used with
      this emission factor.

                Particle  Particle  Particle
                  Mass       Size    Density
                fraction  (micron)  (g/cm3)
               -----------------------------
                   1.0000      1.0       2.30

                VOLUME SOURCE: 6

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
701739  6080222          732m              2m        10m            2m

           (Constant) emission rate = 1.00E+00 grams/second

      Hourly multiplicative factors will be used with
      this emission factor.

                Particle  Particle  Particle
                  Mass       Size    Density
                fraction  (micron)  (g/cm3)
               -----------------------------
                   1.0000      1.0       2.30

                VOLUME SOURCE: 7

  X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
701861  6080219          736m              2m        10m            2m

           (Constant) emission rate = 1.00E+00 grams/second

      Hourly multiplicative factors will be used with
      this emission factor.

                Particle  Particle  Particle
                  Mass       Size    Density
                fraction  (micron)  (g/cm3)
               -----------------------------
                   1.0000      1.0       2.30
```

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Appendix 9

Greenhouse Gas and Energy Assessment

Inspired people | Dedicated team
Quality outcomes

COOMA ROAD QUARRY CONTINUED OPERATIONS PROJECT

Greenhouse Gas and Energy Assessment

August 2012

COOMA ROAD QUARRY CONTINUED OPERATIONS PROJECT

Greenhouse Gas and Energy Assessment

August 2012

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Holcim (Australia) Pty Limited

Project Director: **John Merrell**
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Report No. **2992/R03/Final**
Date: **August 2012**

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Executive Summary

Holcim (Australia) Pty Limited (Holcim Australia) operates the existing Cooma Road Quarry located approximately 6 kilometres south of Queanbeyan.

The current development consent for the Cooma Road Quarry will expire in October 2015. Holcim Australia is seeking approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to extend operations beyond the currently approved footprint and extend the overall life of the quarry to enable the utilisation of remaining resources. This is known as the Cooma Road Quarry Continued Operations Project (the Project).

This report has been prepared as part of the environmental assessment process required under the EP&A Act, and includes greenhouse gas projections, an evaluation of potential climate change impacts and mitigation options.

The greenhouse gas environmental assessment (GHGEA) found that the Project can be attributed with the following greenhouse gas emissions, at the proposed maximum extraction rate of 1.5 Mtpa.

Scope	**Forecast GHG Emissions at a maximum extraction rate of 1.5 Mtpa**	
	(t CO_2-e)	(%)
Scope 1	3,600	49
Scope 2	1,900	26
Scope 3	1,900	25
TOTAL	**7,400**	**100.0**

The Project's annual greenhouse gas emissions are relatively small when compared to the National Greenhouse and Energy Reporting System (NGERS) reporting thresholds and other extractive industries. The majority of the Project's greenhouse gas emissions are generated by the combustion of diesel and are under the direct control of Holcim Australia.

An evaluation of the Project's greenhouse gas emissions found that the Project is unlikely to limit Australia meeting its national and international greenhouse gas targets. In addition, the Project in isolation is unlikely to have an impact on climate change.

All Holcim Australia sites are required to monitor fuel use efficiency and report against efficiency standards. The fuel use assessment process at Cooma Road Quarry will continue to drive improved fuel use efficiency and reduce the greenhouse gas intensity of aggregate products. Furthermore, Holcim Australia is currently preparing energy efficiency opportunity plans, which will generate further site specific energy savings for the Project.

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APPENDICES

1.0 Introduction

Holcim (Australia) Pty Limited (Holcim Australia) owns and operates the Cooma Road Quarry. Cooma Road Quarry is situated in the Southern Tablelands, approximately 6 kilometres south of Queanbeyan, within the Queanbeyan Local Government Area (LGA). Cooma Road Quarry includes an existing quarry, stockpiles, workshop, processing facilities and administrative buildings.

The current development consent (DA371/94), granted in 1995 by Queanbeyan City Council, will expire in 2015, however, there will still be rock resources available for quarrying at the site. Holcim Australia proposes to extend the life of the quarry for an additional 20 years to allow for extraction of these remaining resources and extension of the quarry pit to the north to extract an additional approximately 4.5 Mt of rock. This is known as the Cooma Road Quarry Continued Operations Project (the Project). The Project will also allow an increase to the annual maximum extraction limit from 1 million tonnes per annum (Mtpa) to 1.5 Mtpa.

1.1 The Project

Holcim Australia is planning to seek approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to continue and expand operations of the existing Cooma Road Quarry.

Approval will be sought for the following:

- extraction of the remaining resources within the existing approved quarry pit area;
- extension of the approved extraction boundary to the north covering an area of approximately 3.5 hectares;
- a maximum annual production limit of 1.5 Mtpa;
- allowance to receive quarry materials from other sites for crushing and screening (as required) and then sale. Total product (including from both material quarried from the site and from materials imported to the site) will be maintained within the total production limit of 1.5 Mtpa;
- relocation of the existing workshop, truck parking and temporary stockpiles;
- addition of a mobile pug mill; and
- recycling of clean concrete on site for re-use as product.

The Project is not anticipated to significantly alter other aspects of the existing operations, including:

- overburden emplacement areas;
- extraction method; and
- processing and handling.

The Project will allow quarrying within Cooma Road Quarry to continue within the current approved extraction area and in a north-easterly direction underneath the current infrastructure area.

The following greenhouse gas environmental assessment (GHGEA) evaluates the greenhouse gas and energy use implications of the Project.

2.0 Assessment Framework

2.1 Objectives

The objective of this assessment is to evaluate the greenhouse gas and energy use implications of the Project, in a manner that satisfies the Director-General's stated environmental assessment requirements for the Project. The Director-General has required that the greenhouse gas environmental impact statement includes:

- a quantitative assessment of potential scope 1, 2 and 3 emissions;
- a qualitative assessment of the potential impacts of these emissions on the environment; and
- an assessment of reasonable and feasible measures to minimise the greenhouse gas emissions and ensure energy use efficiency.

Energy consumption is also considered, as energy consumption is strongly associated with greenhouse gas emissions, and is an important component of the *National Greenhouse and Energy Reporting Act 2007*.

2.2 Scope

The scope of the GHGEA includes:

- estimating the total GHG emissions and energy use associated with the Project;
- estimating GHG emissions associated with transporting quarry products from the Project site to domestic clients;
- discussing how the Project may contribute towards climate change;
- estimating the impact of the Project's emissions on state, national and international greenhouse gas emission targets; and
- assessing reasonable and feasible measures to minimise the greenhouse gas emissions and ensure energy use efficiency.

2.3 Definitions and Sources

The GHGEA assessment framework is based on the methodologies and emission factors contained in the *National Greenhouse Accounts (NGA) Factors (2011).* The assessment framework also incorporates the principles of *The Greenhouse Gas Protocol*.

The NGA Factors draw on the National Greenhouse Gas and Energy Reporting System (Measurement) Determination 2008, however, the NGA Factors have a general application to the estimation of a broader range of greenhouse gas inventories (DCCEE 2011a) that are more suited to environmental impact assessment.

The Greenhouse Gas Protocol (World Resources Institute/World Business Council Sustainable Development, 2004) (The Protocol) provides an internationally accepted approach to greenhouse gas accounting. The Protocol provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality. **Table 2.1** contains concepts and definitions from the GHG Protocol relevant to this GHGEA.

Table 2.1 - Glossary of relevant terms from the GHG Protocol (WRI/WBCSD 2004)

Concept	Definition
Greenhouse gases	The greenhouse gases covered by the Kyoto Protocol include: • Carbon dioxide. • Methane • Nitrous oxide. • Hydrofluorocarbons. • Perfluorocarbons. • Sulphur dioxide.
Scope 1 emissions	Direct emissions occur from sources that are owned or controlled by the reporting entity (e.g. fuel use, fugitive emissions). Scope 1 emissions are emissions over which entities have a high level of control.
Scope 2 emissions	Emissions from the generation of purchased electricity consumed by the reporting entity. Scope 2 emissions can be measured easily and can be significantly influenced through energy efficiency measures.
Scope 3 emissions	Indirect emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another reporting entity (e.g. outsourced services). Scope 3 emissions are only estimates and may have a relatively high level of uncertainty, unreliability and variability.

Source: WRI/WBCSD (2004).

2.4 Impact Assessment Methodology

Scope 1, 2 and 3 emissions were calculated based on the methodologies and emission factors contained in the NGA Factors (2011).

Employee commuting emissions were calculated based on the GHG Protocol – Mobile Combustion Tool 2011 (WRI/WBCSD 2011).

A detailed description of GHGEA calculations is provided in **Appendix A**.

2.5 Data Sources

The calculations in this report rely directly on data provided by Holcim Australia. The report has been written with the assumption that the energy consumption and operational data is complete and accurate. Umwelt has not undertaken physical testing and/or auditing to verify the accuracy of the data provided by Holcim Australia.

All methodologies and calculations have been made assuming that all operations will continue as described in **Sections 1.1** and **3.1**.

3.0 Results

A GHGEA will often consider the individual stages of a project as mitigation options can be developed for the construction, operation and closure stages of a project. This GHGEA has not considered construction or closure phases, as construction emissions are likely to be inconsequential and the closure phase is yet to be fully defined and is also unlikely to result in significant emissions based on the current conceptual closure plan presented in the EIS.

3.1 Operation Phase

This GHGEA made the following assumptions:

- energy required to relocate the existing workshop, truck parking and temporary stockpiles to the proposed new infrastructure area is included in operation activity data;
- Holcim Australia owned trucks will deliver 700,000 tonnes of aggregate per annum;
- third party contractors will deliver 800,000 tonnes of aggregate per annum;
- the on-site diesel use estimates include any diesel used in explosives;
- 45 employees drive an average of 40 kilometres (return) to commute between home and work;
- employees will commute in the following vehicle classes; cars 73 per cent, four wheel drives 25 per cent and motorbikes 2 per cent;
- third party contractors will backload recycled concrete to the site;
- the average delivery distance for all products is 28 kilometres;
- the average payload of trucks delivering products is 33 tonnes; and
- average diesel consumption by a heavy, articulated truck is 55l/100 kilometres (VicRoads 2008).

3.1.1 Greenhouse Gas Emissions

The Project's annual operating emissions, at its maximum extraction rate, are summarised in **Table 3.1**. The Project is forecast to contribute 7400 tonnes CO_2-e per annum including direct and indirect emissions. As it is unlikely Cooma Road Quarry will consistently reach the proposed maximum production of 1.5 Mtpa, the greenhouse gas estimates presented in **Table 3.1** are considered likely to be an overestimate of actual greenhouse gas emissions.

The Project is forecast to generate Scope 1 emissions of up to 3600 tonnes CO_2-e per annum from stationary and transport fuel use.

The Project is forecast to generate Scope 2 emissions of up to 1900 tonnes CO_2-e per annum from consuming electricity.

The Project is forecast to be associated with Scope 3 emissions of up to 1900 tonnes CO_2-e per annum. Scope 3 emissions will result from energy extraction/transmission, out-sourced product transport and employee commuting.

Table 3.1 – Annual GHG emissions for the Project at maximum production (refer to Appendix A for details)

			Proposed Maximum Production (based on 1.5 Mtpa)	
Stage	**Scope**	**Source**	**Source totals ($t\ CO_2$-e)**	**Scope totals ($t\ CO_2$-e)**
Operations	Scope 1 (Direct)	Stationary fuel use[1]	2,425.16	3,516.32
		Transport fuel use	1,019.16	
		Fugitive emissions	0	
		Waste	0	
	Scope 2 (Indirect)	Electricity	1,869.00	1,869.00
	Scope 3 (Indirect)	Input products	0	1,852.06
		Energy extraction/transmission	624.68	
		Outsourced transport	1,083.68	
		Employee commuting	143.70	
	Total			**7,237.38**

Table 3.1 demonstrates that the majority of the greenhouse gas emissions associated with the Project are Scope 1 emissions. Approximately 51 per cent of the greenhouse gas emissions associated with the Project are generated by third parties. Holcim Australia is in direct control of approximately 49 per cent of the greenhouse gases associated with the Project.

Scope 2 and 3 emissions have been included in this GHGEA to demonstrate the potential upstream and downstream impacts of the Project. It is important to note that the Project's Scope 2 and Scope 3 emissions should not be attributed directly to Holcim Australia or the Project. All Scope 2 and 3 emissions identified in this GHGEA are attributable to, and may be reported by, other sectors.

The greenhouse gas assessment presented in **Table 3.1** is based on maximum production using primarily on-site resources, which includes the extraction of rock resources on-site, processing small volumes of recycled materials and distributing products to local customers. As outlined in the main text of the Environmental Impact Statement, the extraction of rock resources on-site will be supplemented by importing alternative rock resources from other sites for processing at the site. The greenhouse gas impact of sourcing alternative rock resources has not been estimated, as the on-site extraction scenario is more likely to generate greater direct emissions than third party scenarios.

If in any year, the balance on product was primarily from alternative rock resources, Scope 1 emissions are expected to decline, as less diesel will be required for extracting rock resources on-site. Sourcing alternative rock resources may increase Scope 3 emissions, as the Project may import rock resources that have embedded emissions, generated by third parties extracting the rock resources on behalf of the Project.

3.1.2 Energy Use

The Project is forecast to consume up to 72,480 GJ per annum from combusting diesel and consuming grid electricity.

[1] Includes any diesel used in explosives

3.2 Data Exclusions

The activities and emission sources listed in **Table 3.2** have been excluded from this GHGEA as they were considered unreliable and/or incidental for the purposes of this report.

Importing alternative rock resources is likely to increase transport diesel use. Additional transport diesel use due to importing rock resources is not included as activity data is unreliable. The Project has not fully quantified demand for alternative rock resources or the location (and therefore transport distances) of alternative rock resources.

Greenhouse gas emissions from gas insulated switch gear and/or commercial air-conditioning systems are unlikely to significantly change the final greenhouse gas inventory.

Greenhouse gas emissions from business travel are often excluded from greenhouse gas inventories. Given the nature of the Project, the expected emissions from business travel (i.e. flights, taxis and hire cars) will be immaterial to the final greenhouse gas inventory.

Greenhouse gas emissions generated by waste transferred to local landfill were excluded from the analysis as the likely emissions were considered to be immaterial. The inclusion of this emission source would not significantly change the final greenhouse gas inventory.

Importing alternative rock resources from third parties will increase demand for purchased products. Purchased products are not included as activity data is unreliable. The Project has not forecast demand for importing alternative rock resources.

Table 3.2 – Data exclusions from the GHGEA

Emissions source	Scope	Description
Combustion of fuel for transport of imported rock	Scope 1	• Additional transport fuel combustion associated with sourcing rock resources from third parties
Industrial processes	Scope 1	• Sulphur hexafluoride (high voltage switch gear) • Hydrofluorcarbon (commercial and industrial refrigeration)
Combustion of fuel for energy	Scope 3	• Business travel
Landfill emissions from waste	Scope 3	• Solid waste to landfill
Purchased products	Scope 3	• Imbedded emissions in rock resources purchased from third parties

4.0 Impact Assessment

The greenhouse gas emissions generated by the Project have the potential to impact the physical environment and the greenhouse gas reduction objectives of state, national and international governing bodies. The following section makes the distinction between environmental impacts and impacts on policy objectives.

4.1 Environmental Impact

The Project's greenhouse gas emissions will have a dispersed impact as they are highly mobile and are generated up and down the supply chain (i.e. it is a non-point source of pollution). Greenhouse gas emissions primarily alter the atmospheric concentration of carbon dioxide and methane. The secondary impacts of greenhouse gas emissions include: global warming, ocean acidification and carbon fertilisation of flora. The secondary impacts of greenhouse gas emissions may have many ramifications for the natural and built environment.

The Project's direct emissions are forecast to be approximately 3600 tonnes CO_2 –e per annum if operating at the proposed maximum capacity of 1.5 Mtpa.

Approximately 40 to 50 per cent of the Project's carbon dioxide (CO_2) emissions will impact the atmosphere and become a 'greenhouse gas' (i.e. causing radiative forcing). The remaining 50 to 60 per cent of the Project's CO_2 emissions will be absorbed by the ocean and cycled through land biota (Knorr 2009, Raupach *et al* 2008). The airborne fraction (i.e. the proportion of CO_2 that remains in the atmosphere) of the CO_2 emitted from the Project is likely to remain in the atmosphere for a long period. The 2007 Intergovernmental Panel on Climate Change (IPCC) policy makers summary report states that 'about half of a CO_2 pulse to the atmosphere is removed over a timescale of 30 years; a further 30 per cent is removed within a few centuries; and the remaining 20 per cent will stay in the atmosphere for many thousands of years' (Archer *et al* 2009).

To put the Project's emissions into perspective, it needs to be noted that global Scope 1 emissions are forecast to be approximately 46,000,000,000 tonnes CO_2-e per year by 2020 (Sheehan *et al* 2008). During operation, the Project will contribute approximately 0.0000078 per cent to global emissions per annum.

4.2 Impact on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and persists for an extended period, typically decades or longer (IPCC 2007).

Climate change is caused by changes in the energy balance of the climate system. The energy balance of the climate system is driven by atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation (IPCC 2007). The impact of greenhouse gases and aerosols on the energy balance of the climate system is measured as radiative forcing, which is defined as the influence a factor has in altering the incoming and outgoing energy in the Earth-atmosphere system (IPCC 2007).

Radiative forcing of the climate system is dominated by long lived greenhouse gases, such as carbon dioxide, methane, nitrous oxide and halocarbons (IPCC 2007). All greenhouse gases have a positive radiative forcing value, which means that the climate system has the potential to retain more energy (or heat) as the concentration of greenhouse gases in the atmosphere increases. There is strong evidence to suggest that observations of global warming are directly correlated to increased concentrations of atmospheric greenhouse gases (IPCC 2007).

The impact of the Project on climate change should not be assessed by simply applying a radiative forcing coefficient to the greenhouse gases generated by the Project. Carbon emitted to the atmosphere is exchanged between carbon reservoirs such as oceans and ecosystems over a wide range of timescales. It is erroneous to assume that the greenhouse gases generated by the Project will shift the atmospheric concentration of greenhouse gases in a linear way (IPCC 2007).

Rather than try and quantify the direct impact project emissions may have on atmospheric concentrations of greenhouse gases, it is more useful to qualify how project emissions may drive global emission scenarios.

The Project's greenhouse gas emissions are highly unlikely to impact the main drivers of future emissions assessed in the global IPCC Special Report on Emission Scenarios, which are used to model climate change. The Project in isolation is unlikely to have an impact on climate change.

4.3 Impact on State Policy Objectives

The Project is located within the jurisdiction of the NSW State Government and therefore the Project should consider the State's greenhouse gas emission objectives. The NSW Government has removed its commitment to a 2025 greenhouse gas reduction target. The recently published NSW State Plan, NSW 2021 – A Plan to Make NSW Number One (NSW 2011), has removed all references to a state based greenhouse gas reduction target.

The NSW government plans to reduce greenhouse gas emissions by (Office of Environment and Heritage 2012):

- working with other governments through the Council of Australian Governments (COAG);
- providing financial support through the Climate Change Fund;
- ensuring all NSW Government agencies become carbon neutral by 2020;
- promoting energy efficiency;
- promoting clean and renewable energy;
- promoting low carbon transport;
- promoting low carbon agriculture and carbon sequestration; and
- encouraging waste avoidance and resource recovery, and the reduction of emissions from waste disposal and landfill.

The energy efficiency and waste objectives are the only objectives relevant to the Project. The concrete recycling component of the Project provides additional resource recovery capacity in NSW and it is consistent with the NSW Government waste objective. Holcim Australia also has processes in place to continuously improve energy use efficiency (refer to **Section 5.2**) and is committed to reduce waste from its operations (refer to **Section 5.1**).

4.4 Impact on National Policy Objectives

The federal government has committed to reduce Australia's greenhouse gas emissions to 25 per cent below 2000 levels by 2020, if the world agrees to an ambitious global deal to stabilise levels of greenhouse gases in the atmosphere at 450 parts per million CO_2-e or lower (DCCEE 2011).

If the world is unable to reach agreement on a 450 parts per million target, Australia will still reduce its emissions by between 5 and 15 per cent below 2000 levels by 2020 (DCCEE 2011).

If Australia is able to meet the 5 per cent reduction target by 2020, the nation will be generating approximately 525 Mt CO_2-e per annum (DCCEE 2011b).

The Project is forecast to generate up to 3600 tonnes CO_2-e Scope 1 emissions per annum by 2020. The Project's annual Scope 1 emissions are forecast to represent approximately 0.00069 per cent of Australia's national emissions by 2020. The Project's Scope 2 and 3 emissions should not be considered against national objectives, as Scope 2 and 3 emissions (which occur in Australia) will be reported by other sectors of the Australian economy.

The Project is unlikely to limit the federal government achieving its national greenhouse gas objectives.

4.5 Impact on International Objectives

International greenhouse gas reduction targets have not yet been agreed and/or formalised. The Copenhagen Accord (the Accord), however, provides some direction for international greenhouse gas objectives. The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE 2011c), states that the Copenhagen Accord is an international agreement under the UNFCCC to:

- hold any increase in global temperature to below 2 degrees Celsius;
- specify, side by side, emissions targets for developed countries and actions to reduce emissions by developing countries;
- develop a framework for national and international monitoring of what developed and developing countries will do; and
- provide considerable financing to support emissions reductions and adaptation in developing countries.

Australia has formally registered its support for the Accord and is encouraging its fast and full implementation (DCCEE 2011c). Under the Accord, Australia has committed to reducing its 2020 national greenhouse gas inventory by 5 per cent (based on the 2000 inventory).

DCCEE 2011 states that the Government will not increase Australia's emissions reduction target above 5 per cent until:

- the level of global ambition becomes sufficiently clear, including both the specific targets of advanced economies and the verifiable emissions reduction actions of China and India;
- the credibility of those commitments and actions is established; and
- there is clarity on the assumptions for emissions accounting and access to markets.

Australia's international objectives align with its national objectives. If the Project is unlikely to limit the federal government achieving its national objectives, then the Project is unlikely to limit the federal government achieving its international objectives.

5.0 Greenhouse Gas and Energy Management Assessment

The GHGEA is required to assess reasonable and feasible measures to minimise the Project's greenhouse gas emissions.

The term reasonable incorporates notions of costs and benefits, whereas the term feasible focuses on the more fundamental practicalities of the mitigation measures, such as engineering considerations and what is practical to build or operate (Hunter Environment Lobby Inc v Minister for Planning 2011).

Holcim Australia will implement greenhouse gas reduction measures that are both technically feasible and financially reasonable.

5.1 Current Management Measures

Holcim Australia's environmental performance is driven by its Environmental Policy (Holcim (Australia) Pty Limited 2010), which states that protecting the environment is integral to sustainable development. The Environmental Policy (Holcim (Australia) Pty Ltd 2010) includes specific commitments which address greenhouse gas emissions. The commitments are:

- ensure energy efficiency, optimum use of raw materials and the reduction of waste in all operations; and
- respond to the challenges presented by climate change by identifying opportunities to reduce its carbon footprint.

Holcim Australia designs and manages its operations to achieve these commitments.

5.2 Proposed Greenhouse Gas Mitigation Measures

The energy efficiency of quarry operations is driven by energy use and productivity. Energy efficiency is maximised when highly efficient equipment is operated at optimal capacity. Holcim Australia's quarry planning process optimises operational productivity through scheduling and equipment selection.

Holcim Australia is currently preparing energy efficiency opportunity plans on a national basis and per business unit. Cooma Road Quarry will be required to review these plans and implement initiatives where applicable.

Holcim Australia will continue to mitigate Scope 1 emissions through diesel use efficiency initiatives. Holcim Australia is unable to directly manage Scope 3 emissions as Holcim Australia does not have operational control of transport contractors and/or facilities that extract and supply energy.

The Project will continue to monitor diesel usage and seek opportunities for further efficiency. All Holcim Australia sites are required to complete an annual self-assessment report against Holcim Australia standards, which include fuel efficiency. The self-assessment process drives sites to review current practices and implement fuel efficiency initiatives.

5.3 Assessment of Proposed Management Measures

The greenhouse gas mitigation measures available to Cooma Road Quarry are limited to diesel use efficiency and switching energy sources. The Project's scope 1 emissions are generated by on-site machinery and trucks combusting diesel. A very small proportion of scope 1 emissions (approximately 0.3 per cent) are generated by light vehicles combustion of petrol.

The potential greenhouse gas management measures for the Project are presented in **Table 5.1**. Cooma Road Quarry can mitigate greenhouse gas emissions by improving diesel use efficacy and/or replacing diesel with a lower carbon intensity fuel, such as biodiesel or compressed natural gas (CNG).

Table 5.1 – Potential Greenhouse Gas Management Measures

Management Principle	**Description**	**Example of Measures**
Reduce emissions intensity	Change activities/processes to reduce the consumption of energy per unit of production	• Upgrading the fuel use efficiency of plant and equipment • Re-designing processes to minimise material handling and transport distances
Switch energy sources	Utilise alternative energy sources which have a lower greenhouse gas intensity in existing processes	• Replace diesel with biodiesel • Replace diesel with CNG

Diesel use efficiency projects have the potential to significantly reduce the greenhouse gas intensity of the Project. An on-going program to review and progressively replace or upgrade equipment to improve diesel use efficiency is both a reasonable and feasible greenhouse gas mitigation measure. Holcim Australia has a process in place for identifying and implementing diesel use efficiency opportunities (refer to **Section 5.2**).

Switching from diesel to biodiesel may provide further opportunity to reduce the greenhouse gas intensity of the Project. Similarly, switching from diesel to a gaseous fuel, such as CNG, may also reduce the greenhouse gas emissions profile of the Project. Alternative fuels are not currently considered feasible on a large scale, as supply can be limited (i.e. required volumes are not always available), and some plant and equipment does not comply with biofuel specifications.

The proposed greenhouse gas mitigation measures are reasonable and feasible for the Project. Additional measures available include:

- monitoring developments in alternative fuel technology; and
- considering biodiesel compatibility in future procurement decisions.

6.0 Conclusion

The Project is forecast to produce a relatively small volume of greenhouse gases over the life of the quarry. Greenhouse gas modelling estimates that the Project will produce Scope 1 and 2 emissions of up to 5400 tonnes CO_2-e of per annum, which is well below the facility based NGERS reporting thresholds.

This GHGEA found that the Project is unlikely to impact on national greenhouse gas policy objectives due to the relatively small contribution the Project will make to national emissions.

The Project in isolation is unlikely to have an impact on climate change.

Approximately 49 per cent of the Project's greenhouse gas emissions are generated under the direct operational control of Holcim Australia. Holcim Australia will continue to manage greenhouse gas emissions through the ongoing implementation of reasonable and feasible initiatives which improve diesel use efficiency.

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APPENDIX A

Project's Operating Emission Calculations

Appendix A - Operation Calculations

Stationary fuel use

Activity Data		Energy Use		Emission Factors		
				CO_2	**CH_4**	**N_20**
Fuel Type	kL	GJ/kL	GJ	kg CO_2-e/GJ	kg CO_2-e/GJ	kg CO_2-e/GJ
Diesel	904	38.6	34,894.40	69.2	0.1	0.2
				t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)				2,414.69	3.49	6.98
Total GHG emissions (t CO_2-e)						**2,425.16**

Transport fuel use

Activity Data		Energy Use		Emission Factors		
				CO_2	**CH_4**	**N_20**
Fuel Type	kL	GJ/kL	GJ	kg CO_2-e/GJ	kg CO_2-e/GJ	kg CO_2-e/GJ
Diesel	400	38.6	15,440	69.2	0.2	0.5
Petrol	5	34.2	171	66.7	0.6	2.3
				t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)				1,079.86	3.19	8.11
Total GHG emissions (t CO_2-e)						**1,091.16**

Electricity

Activity Data	Energy Use	Emission Factors		
		CO_2	**CH_4**	**N_20**
kWh	GJ	kg CO_2-e/kWh	kg CO_2-e/GJ	kg CO_2-e/GJ
2,100,000	7,560	0.89	N/A	N/A
		t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)		1,869	N/A	N/A
Total GHG emissions (t CO_2-e)				**1,869**

Product Transport by 3rd Party Contractors - Trucks

Activity Data				Emission Factors		
				CO_2	**CH_4**	**N_20**
Product	Product (t)	Distance (km)	Diesel Use (GJ)	kg CO_2-e/GJ	kg CO_2-e/GJ	kg CO_2-e/GJ
Aggregate out	800,000	28	14,410.67	75.2[2]	N/A	N/A
				t CO_2-e	t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)				1,083.68	N/A	N/A
Total GHG emissions (t CO_2-e)						**1,083.68**

[2] Note: The emissions factor includes scope1 (69.9 kg CO_2-e/GJ) and scope 3 (5.3 kg CO_2-e/GJ) emissions factors

Extraction, production and distribution of energy purchased

Activity Data			Emission Factors	
			CO_2	CO_2
Purchased energy	GJ	kWh	kg CO_2-e/GJ	kg CO_2-e/GJ
Diesel and Petrol	50,505.40	-	5.3	N/A
Electricity	-	2,100,000	N/A	0.17
			t CO_2-e	t CO_2-e
Breakdown of individual GHG emissions (t CO_2-e)			267.68	357
Total GHG emissions (t CO_2-e)				**624.68**

Employee commuting

Activity Data		Emission Factors	
		CO_2	CO_2
Vehicle class	km/year	kg CO_2-e/km	t CO_2-e
ULP Car < 1.4 L	0	0.173	0
ULP Car 1.5 - 2.0 L	97,200	0.215	20.9
ULP Car > 2.0 L	270,000	0.299	80.8
Diesel Car > 2.0 L	27,000	0.256	6.6
Diesel Light Goods Vehicle < 3.5 t	135,000	0.251	33.9
Motorbike > 500cc	10,800	0.137	1.5
Total GHG emissions (t CO_2-e)			**143.7**

Appendix 10

Noise and Blasting Impact Assessment

Inspired people | Dedicated team
Quality outcomes

COOMA ROAD QUARRY CONTINUED OPERATIONS PROJECT

Noise and Blasting Impact Assessment

October 2012

COOMA ROAD QUARRY CONTINUED OPERATIONS PROJECT

Noise and Blasting Impact Assessment

October 2012

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Holcim (Australia) Pty Limited

Project Director: **John Merrell**
Project Manager: **Kirsty Davies**
Report No. **2992/R04/Final**
Date: **October 2012**

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FIGURES

APPENDICES

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1.0 Introduction

Holcim (Australia) Pty Ltd (Holcim Australia) operates the Cooma Road Quarry, an existing hard rock quarry located approximately 6 kilometres south of Queanbeyan (refer to **Figure 1.1**). Holcim Australia is seeking development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for continued operation of the existing Cooma Road Quarry, referred to herein as the Cooma Road Quarry Continued Operations Project (the Project).

This Noise Impact Assessment (NIA) report has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Holcim Australia, as part of the Environmental Impact Statement (EIS) for the Project.

The computer-based modelling software package Environmental Noise Model (ENM) was used to predict the noise levels produced by the operation of the proposed development in the surrounding environment. The ENM noise model was based on machine and plant sound power level data collected by Umwelt or provided by Holcim. This model was then used to predict future noise levels produced by the proposed development.

This Noise Impact Assessment has been prepared in accordance with the *NSW Industrial Noise Policy* (INP) [Environment Protection Authority (EPA) 2000].

1.1 Project Description

Cooma Road Quarry currently operates under a development consent (DA371/94) granted by Queanbeyan City Council on 26 October 1995. The development consent was granted for a period of 20 years and will expire in October 2015. As there will still be significant hard rock resources available for extraction at the site at this time, it is proposed to extend the life of the Cooma Road Quarry for an additional 15 years. To cater for predicted increases in demand associated with regional growth, it is proposed to increase production capacity from 1 Mtpa to 1.5 Mtpa and extend the hours of operation for certain activities (refer to **Section 1.2.1**). Approval is also sought to receive quarry materials from other sites for crushing and screening (as required) and then sale. Total product (including from both material quarried from the site and from materials imported to the site) will be maintained within the total production limit of 1.5 Mtpa. The Project will provide important construction resources to support the planned future growth and development of the Canberra and Queanbeyan regions.

The Project represents the continuation of the existing quarry operations, which will remain substantially the same. The current on-site processing infrastructure will remain the same, with the addition of a mobile pug mill. The mobile pug mill, or continuous mixing plant, allows materials to be simultaneously ground and mixed with a liquid. The mobile pug mill will be utilised to mix aggregate with cement, and crushed or milled concrete.

Extraction of the additional hard rock resources at the site will be achieved through extending the approved extraction boundary to the north. In order to accommodate the extended extraction boundary, the existing workshop, truck parking area and temporary stockpiles will be relocated to a proposed new infrastructure area situated north of the existing site infrastructure area to an area approved for disturbance by the existing development consent. The proposed infrastructure area will include workshops, laboratory, truck wash, amenities and parking areas.

Source: Holcim (2012), Google Earth (2011) and Queanbeyan City Council (2006)

0 0.5 1.0 1.5km
1:35 000

Legend
Proposed Project Area

FIGURE 1.1

Locality Map

The proposed quarry extension will also require the relocation of two product stockpile areas with a capacity of approximately 6000 tonnes and 15,000 tonnes to be situated within the existing quarry pit between the existing granite and dacite extraction pits.

1.1.1 Hours of Operations

The quarry currently has approval to operate between 6.00 am and 6.00 pm Monday to Saturday, excluding public holidays with general maintenance permitted until 10.00 pm and truck movements associated with delivery vehicles returning to site permitted until 8.00 pm. The Project proposes to extend the hours of operation for certain activities from 6.00 am to 10.00 pm Monday to Friday and 6.00 am to 6.00 pm Saturday.

Activities that are proposed to be undertaken within the extended hours of operation are confined to:

- secondary crushing and screening;
- product stockpile management;
- water cart operations for stockpile area and plant area;
- pumping for dewatering activities;
- maintenance of fixed plant and mobile plant, as currently approved; and
- road trucks returning to the site as currently approved.

The following activities will not be undertaken outside the currently approved hours of operation:

- primary crushing;
- in pit loading and hauling;
- any activity on the overburden areas;
- blasting activities, including blast hole drilling;
- road trucks departing from site and returning to the site (by 8.00 pm); and
- road truck loading.

1.2 Project Area

The Project area has historically been used for quarrying and associated processing activities. The land surrounding the Project area is generally used for conservation, agricultural, rural residential and residential purposes.

Grazing land characterised by gently undulating slopes and plains is located adjacent to the east and the south of the Project area. Further to the east of Cooma Road Quarry are the rural residential areas of Googong and Talpa Heights. Adjoining the northern and western boundary of the Project area are large areas of remnant vegetation. Cuumbuen Nature Reserve is located approximately 3.5 kilometres to the north east and Jerrabomberra Mountain Reserve is 2 kilometres to the north-west. Other land uses within the vicinity of the Project area are the residential areas of Jerrabomberra, located 1 kilometre to the west, and Karabar, located approximately 2 kilometres to the north.

1.2.1 Land Ownership

A large portion of the existing quarry site is located on land owned by Holcim Australia, as shown in **Figure 1.2**. The remainder of the Project area is located on privately owned land leased by Holcim Australia.

Ownership of the land surrounding the Project area is shown on **Figure 1.2**. Holcim Australia owns the land directly to the south-east of the Project area, while land to the south, west and north is privately owned.

The location of private residences surrounding the Project area is shown on **Figure 1.2**. The three nearest privately owned residences are located approximately 500 metres east of the infrastructure area, 800 metres to the south-south-east of the southern portion of the quarry area and 900 metres to the west of the quarry area.

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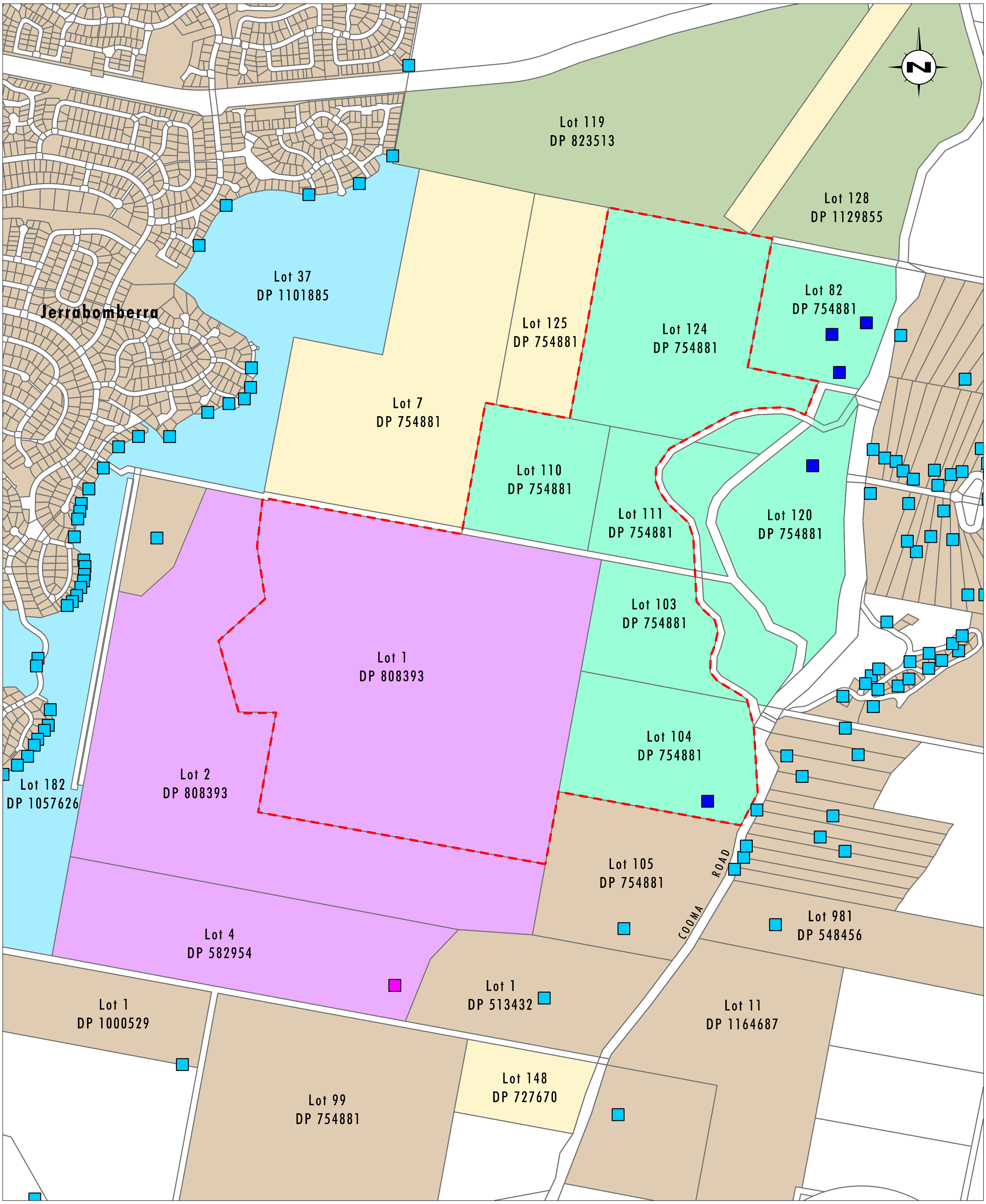

Source: LPMA (2010)

0 100 300 600m
1:17 000

Legend

- Proposed Project Area
- Holcim Owned Land
- Privately Owned Land Leased by Holcim
- Crown Land
- Queanbeyan City Council
- Ngambri Local Aboriginal Land Council
- Private
- Indicative Dwelling Location
- Holcim Leased
- Holcim Owned

FIGURE 1.2

Land Ownership

File Name (A4): R04/2992_045.dgn
20121029 14.57

2.0 Statutory Requirements

2.1 Director General's Requirements

The Department of Planning & Infrastructure (DP&I) issued Director General's Requirements (DGRs) for the Project on 14 February 2012. The DGRs outline the specific requirements to be addressed by this environmental impact statement (EIS). The DGRs for the key issue of noise, vibration and blasting to be addressed in the EIS is outlined below:

> **Noise, Vibration & Blasting** – including a quantitative assessment of potential:
> - construction, operational and off-site transport noise impacts;
> - blasting impacts on people, livestock and property;
> - reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and
> - monitoring and management measures;

The DGRs require the proposal to be assessed in accordance with the following relevant policies and guidelines:

- *NSW Industrial Noise Policy* (INP) [Environment Protection Authority (EPA) 2000];
- *Environmental Noise Management –* Assessing Vibration: a technical guide [Department of Environment and Conservation (DEC) 2006];
- *NSW Road Noise Policy* [Department of Environment, Climate Change and Water *(DECCW)* 2011]*;* and
- *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* [The Australian and New Zealand Environment Conservation Council (ANZECC) 1990].

2.2 Section 10 of the Industrial Noise Policy

Section 10 – Applying the policy to existing industrial premises of the INP (EPA 2000) deals with application of the INP (EPA 2000) to existing industrial noise sources such as the Cooma Road Quarry. The approach established by the EPA was designed to allow established industries to adapt to changes in the noise expectations of the community while remaining economically viable.

The INP (EPA 2000) identifies four triggers for the application of Section 10. These are:

- the site becomes the subject of serious and persistent noise complaints;
- there is a proposal to upgrade and/or expand the site;
- the site has no formal consent or licence conditions and management wish to clarify their position; and
- management chooses to initiate a noise reduction program.

Using theses triggers as a guide, the methodology for the preparation of the NIA has taken into account:

1. Cooma Road Quarry is not the subject of noise complaints from the community or Office of Environment and Heritage (OEH).

2. As discussed in **Section 1**, the preparation of an EIS and supporting studies is to enable the continuation of the existing quarry operations. That is, the operations will remain substantially the same. However, the Project will include some minor 'upgrade and/or expansion' to the site to account for changes/improvements in operating practices, equipment selection and product quality/demand.

3. The existing development consent for Cooma Road Quarry was granted in 1995. As a result, the management of the noise impacts is based around the expectation of the *Environmental Noise Control Manual* (EPA 1994). In support of the development application for the continued operation of the Cooma Road Quarry, Holcim will need to establish contemporary noise criteria for the site in accordance with the INP (EPA 2000).

4. Based on Point 3 above, Holcim recognise that the Cooma Road Quarry may not achieve contemporary project-specific noise levels as defined by the INP (EPA 2000). However, Section 10 of the INP (EPA 2000) notes that:
   - the project-specific noise levels (PSNL) should not be applied as mandatory noise limits;
   - the PSNLs supply the initial target levels and drive the process of assessing all feasible and reasonable control measures;
   - achievable noise limits result from applying all feasible and reasonable noise control measures; and
   - for sites with limited mitigation measures the achievable noise limits may sometimes be above the project-specific noise levels.

As noted in the INP (EPA 2000), the site may need to reduce its noise emissions progressively to achieve target noise limits. Such measures are typically set out in a noise reduction program attached as a licence condition to the sites Environment Protection License.

Section 10 of the INP (EPA 2000) outlines a methodology for the assessment of a project where a company proposes to upgrade or modify its existing operations. This methodology, outlined in **Section 2.3**, is also applicable to a proposal for the continuation of an existing operation where the proponent wishes to clarify its position with respect to the expectation of the INP (EPA 2000).

With respect to the methodology outline in **Section 2.3**, the PSNLs determined from the assessment of the underlying background and amenity noise levels in the receiver areas surrounding the Project are not mandatory noise limits. The PSNLs provide the initial target levels that drive the process for assessing feasible and reasonable control measures. The achievable noise limits result from applying all feasible and reasonable control measures to the operation.

2.3 Methodology

To satisfy the requirements of the relevant policies and guidelines, the NIA has:

- identified noise sensitive locations likely to be affected by activities at the site and determined existing background and amenity noise levels at representative locations in accordance with the INP (EPA 2000) (refer to **Section 3.0**);
- determined the PSNLs for the operation based on the assessment of underlying background and amenity noise levels of the surrounding receiver areas (refer to **Section 3.0**);
- identified all noise sources from the Project (including both construction and operational phases). Determined the expected noise levels and noise characteristics (e.g. tonality, impulsiveness, etc) likely to be generated from the noise sources (refer to **Section 5.0**). This included measuring the noise levels produced by the existing operations, taking into consideration meteorological effects such as wind and temperature inversions;
- identified the times of operation for the construction and operational phases of the Project and for all noise producing activities (refer to **Section 1.0** and **Section 4.0**);
- determined the noise levels likely to be received at the most sensitive locations under neutral meteorological conditions and relevant gradient winds (refer to **Section 5.0**);
- considered the influence of existing meteorological conditions such as wind and temperature inversions in the prediction model so as to provide a true representation of actual noise levels (refer to **Section 4.0** and **Section 5.0**);
- compared the predicted noise levels with the appropriate PSNL determined for the activity/operation being considered (refer to **Section 5.0**). The assessment of the predicted noise levels against PSNL was undertaken in accordance with Section 10 of the INP (EPA 2000) (refer to **Section 2.0**);
- discussed the findings from the predictive modelling and, where predicted noise levels exceeded the relevant PSNL, recommended additional mitigation measures (refer to **Section 5.0**);
- determined the achievable project noise levels and that would form the basis of project-specific noise criteria in accordance with the requirements of Section 10 of the INP (EPA 2000) (refer to **Section 3.0**, **5.0** and **6.0**); and
- provided details of the noise monitoring program with monitoring to be undertaken at noise sensitive locations subject to the agreement of the owners/occupiers of those properties.

The computer-based modelling software package Environmental Noise Model (ENM) was used to predict the noise levels produced by the Project in the surrounding environment. The ENM noise models were based on machine and plant sound power level data obtained from Holcim Australia or collected by Umwelt, digital terrain maps of the region surrounding the Project prepared by Umwelt and the layout of the existing and proposed operations provided by Holcim Australia. The ENM model of the existing operations was validated by comparing the predicted noise levels with the results from the noise monitoring program.

The NIA was based on the noise levels predicted by the ENM model of the existing and proposed operations. The predicted noise levels from the existing operation were compared with the noise monitoring results obtained for the existing operation. This information was used to validate the ENM model of the existing operation and assess the effects of meteorological conditions (primarily wind speed and wind direction).

The assessment of the predicted noise levels against PSNLs was then undertaken in accordance with Section 10 the INP (EPA 2000). Where it was found that the predicted noise levels noise exceeded the respective PSNLs, appropriate mitigation measures were investigated. The results of this investigation are presented in **Section 5.0**.

A glossary of terms and abbreviations used in this report is provided in **Appendix A**.

The noise modelling and assessment process is described in **Sections 3.0** through **5.0**. A detailed summary of the INP (EPA 2000) assessment methodology used for this NIA is provided in **Appendix B**.

3.0 Existing Acoustic Environment and Assessment Criteria

3.1 Existing Noise Environment

The existing noise environment in the area surrounding the Project was assessed in accordance with Section 3 of the INP (EPA 2000) using a combination of Acoustic Research Laboratories environmental noise loggers over a period of one week in January 2012. The results of the noise monitoring program were used to determine the project-specific noise levels (PSNL) for the Project.

Environmental noise loggers were placed at three locations, N1, N2 and N3 shown on **Figure 3.1**, to monitor the ambient noise levels in the regions surrounding the Project. These locations are considered to be representative of the nearest and/or most potentially affected residential receiver areas to the north-east, south and west of the Project.

Details of the monitoring locations and noise monitoring programs are presented in **Table 3.1**.

Table 3.1 – Details of the Noise Monitoring Program

Monitoring Location	Location	Logger Serial No.	Measurement
N1	409 Old Cooma Road, Googong	878079	12:15 pm 20/01/2012 to 8:30 am 27/01/2012
N2	732c Old Cooma Road, Googong	878042	1:45 pm 20/01/2012 to 9:45 am 27/01/2012
N3	15 Copperfield Place, Jerrabonberra	878007	2:30 pm 20/01/2012 to 10:00 am 27/01/2012

The monitoring data from the environmental noise logging program includes:

- date, time and temperature;
- ambient noise levels recorded as $L_{Aeq, 15minute}$ and $L_{A90, 15minute}$;
- maximum and minimum noise levels; and
- statistical noise levels representative of the ambient noise environment recorded as $L_{A1, 15minute}$, $L_{A10, 15minute}$, etc.

The results of the monitoring program, reported as the underlying Rating Background Level (RBL) and the Mean $L_{Aeq, period}$ (where 'period' equals day, evening and night) are presented in **Appendix C** and summarised in **Table 3.2**.

The RBL was determined for each receiver location described in **Table 3.1**, in accordance with the INP (EPA 2000). The assessment of the evening and night-time (6.00 am to 7.00 am) RBL also took into consideration the recommendations of the OEH *Application Note for the Assessment of Intrusiveness Criteria* (DECC July 2006).

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Source: Holcim (2012), Google Earth (2011)

0 0.25 0.5 1km
1:20 000

Legend

Proposed Project Area
Noise Logger Location

FIGURE 3.1

Noise Logger Locations

File Name (A4): R04/2992_043.dgn
20121029 14.53

The RBL used in the derivation of the PSNL at each monitoring location excludes the estimated L_{A90} noise contribution from the noise source under investigation (i.e. Cooma Road Quarry).

Table 3.2 – Monitoring Results, RBL and Mean $L_{Aeq, period}$, dB(A)

Monitoring Location	Time Period[1]	RBL	Mean $L_{Aeq, period}$
N1 - 409 Old Cooma Road, Lot 1, DP 218719, Googong	Day	39.0	57.2
	Evening	33.6	53.4
	Night	30.0	51.5
	Night part-operation 6.00–7.00 am	37.9	57.5
N2 - 732c Old Cooma Road, Lot 4, DP 582954 Googong	Day	32.2	47.5
	Evening	30.0	56.3
	Night	30.0	44.5
	Night part-operation 6.00–7.00 am	34.7	48.9
N3 - 15 Copperfield Place, Lot 2, DP 808393 Jerrabonberra	Day	30.0	44.8
	Evening	30.0	50.4
	Night	30.0	36.7
	Night part-operation 6.00–7.00 am	30.0	54.7

Note 1: Monday to Saturday Day is 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm and Night 10.00 pm to 7.00 am; on Sundays and Public Holidays Day is 8.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm and Night 10.00 pm to 8.00 am.

The noise levels presented in **Table 3.2** represent the underlying level of noise present at the monitoring locations. Based on a review of the audio data collected during the monitoring program, it is considered that the noise contribution from the existing site operations had minimal acoustic influence on the measured noise levels and did not need to be removed from the assessment of the existing ambient noise environment. During the monitoring program, data affected by rain or wind speeds in excess of 5 m/s was excluded in accordance with the Section 3.4 of the INP (EPA 2000). Meteorological data was obtained from the Bureau of Meteorology (BoM) Canberra Airport automatic weather station (AWS) located approximately 10 kilometres to the north-north-west of the Project area.

3.2 Intrusiveness and Amenity Criteria

3.2.1 Application of the Industrial Noise Policy

The INP has two components for the assessment of industrial noise sources, intrusive noise impacts and noise amenity levels. When assessing the noise impact of industrial sources both components are considered for residential receivers.

The PSNL reflects the most stringent noise levels derived from both the intrusive and amenity criteria. Where the intrusive criteria is less than or equal to the amenity criteria, the intrusive criteria is applied as the limiting criterion and forms the PSNL for the industrial source as it is more stringent due to being determined over a much shorter period of time.

Where the predicted amenity noise level is lower than the intrusive level, both the intrusive and amenity noise limits become the limiting criteria and form the PSNL for the industrial source.

PSNL set the benchmark against which noise impacts and the need for noise mitigation are assessed. For existing operations the PSNL are not mandatory but supply the initial target levels that are used to derive the achievable noise limits based on the implementation of feasible and reasonable control measures.

When setting the PSNL the INP recommends the application of the most stringent requirement so that the applicable PSNL both limits intrusive noise and protects noise amenity. The PSNL derived for the Project are provided in **Section 3.3** and the achievable noise limits are discussed in **Section 7.0**.

3.2.2 Intrusiveness Criteria

The monitoring results presented in **Table 3.2** and **Appendix C** show that the RBLs in the region surrounding the Project are generally between 30 to 39 dB(A). The presence of Old Cooma Road road traffic noise at monitoring location N1 as well as frequent aircraft flyover noise (from Canberra Airport), natural ambient noises such as insects and birds and local domestic noise sources has some impact on the background noise environment during the day, evening and night periods at all the noise monitoring locations.

The corresponding Intrusiveness Criteria range from 35 dB(A) – the minimum possible intrusiveness criterion under the INP – during the night to a maximum of 44 dB(A) during the day periods (refer to **Section 3.3** for details).

3.2.3 Amenity Criteria

The ambient noise levels in the region surrounding the Project are affected by birds, transportation noise sources (Canberra Airport aircraft flyover noise) as well as domestic noise source activity. The ambient noise levels can also, depending on proximity, be affected by Old Cooma Road road traffic noise.

Depending on proximity to the site, wind direction and meteorological conditions ambient noise levels at the monitoring locations can contain noise contribution from existing site industrial activities. In accordance with the INP (EPA 2000), the noise monitoring results effected by Cooma Road Quarry were exclude from the analysis of the amenity noise levels.

To limit continuing increases in noise levels due to industrial development, the INP (EPA 2000) has identified maximum ambient noise levels for typical receiver areas and land uses. Receiver locations N1 and N3 are considered to be with a ‘suburban’ noise amenity area as defined by the INP. Receiver N2 is considered to be within a ‘rural’ noise amenity area as defined by the INP.

The recommended acceptable and maximum ambient noise levels for rural and suburban noise amenity areas are provided in **Table 3.3**. The Amenity Criteria is then determined by comparing the existing ambient noise levels resulting from industrial noise sources with the recommended acceptable ambient noise levels (refer to **Table 3.4** for the application of **Table 3.3**).

Table 3.3 – Amenity Criteria – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources, dB(A)

Type of Receiver	Indicative Noise Amenity Area	Time of Day [1] (Period)	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50

Note 1: For Monday to Saturday, Day-time 7.00 am–6.00 pm; Evening 6.00 pm–10.00 pm; Night-time 10.00 pm–7.00 am. On Sundays and Public Holidays, Day-time 8.00 am–6.00 pm; Evening 6.00 pm–10.00 pm; Night-time 10.00 pm–8.00 am.

In accordance with Section 3.2 of the INP (EPA 2000), the Amenity Criteria is based on the measured industrial noise levels, measured as $L_{Aeq, period}$ noise levels, less the contribution from the existing quarry operations. The existing quarry had minimal acoustic influence on the background noise levels and ambient noise levels at the monitoring locations and did not need to be removed from analysis when deriving the site PSNL.

The Project will continue to operate during part of the night period, between 6.00 am to 7.00 am. The existing ambient noise levels at N1 and N3 resulting from transportation-related sources, from road traffic and aircraft traffic respectively, trigger the night Amenity Criteria to be derived using the high-traffic noise criterion. The amenity criterion between 6.00 am to 7.00 am at N1, N2 and N3 becomes 47, 40 and 45 dB(A) respectively.

3.3 Project-specific Noise Levels

The day-time, evening and night-time PSNLs developed for the Project are presented in **Table 3.4**.

Table 3.4 – Determination of the Project-Specific Noise Levels, dB(A)

Receiver	N1	N2	N3
Assessment of Day-time Noise Levels			
Rating Background Noise Level	39.0	32.2	30.0
Intrusiveness Criteria	**44**	**37**	**35**
Acceptable Noise Level	55	50	55
Mean Measured L_{Aeq}	57.2	47.5	44.8
Estimated Industrial L_{Aeq} Noise Contribution	n/a	n/a	n/a
Assessment in areas of high traffic noise[2]	n/a	n/a	n/a
Amenity Criteria	**55**	**50**	**55**
Day-time PSNL [1]	**44 $L_{Aeq, 15minute}$**	**37 $L_{Aeq, 15minute}$**	**35 $L_{Aeq, 15minute}$**
Assessment of Evening Noise Levels			
Rating Background Noise Level	33.6	30.0	30.0
Intrusiveness Criteria	**39**	**35**	**35**
Acceptable Noise Level	45	45	45
Mean Measured L_{Aeq}	53.4	56.3	50.4
Estimated Industrial L_{Aeq} Noise Contribution	n/a	n/a	n/a
Assessment in areas of high traffic noise[2]	n/a	n/a	n/a
Amenity Criteria	**45**	**45**	**45**
Evening PSNL [1]	**39 $L_{Aeq, 15minute}$**	**35 $L_{Aeq, 15minute}$**	**35 $L_{Aeq, 15minute}$**
Assessment of Night-time Noise Levels			
Rating Background Noise Level	30.0	30.0	30.0
Intrusiveness Criteria	**35**	**35**	**35**
Acceptable Noise Level	40	40	40
Mean Measured L_{Aeq}	51.5	44.5	36.7
Estimated Industrial L_{Aeq} Noise Contribution	n/a	n/a	n/a
Assessment in areas of high traffic noise	41.5 [2]	n/a	n/a
Amenity Criteria	**41**	**40**	**40**
Night-time PSNL [1]	**35 $L_{Aeq, 15minute}$**	**35 $L_{Aeq, 15minute}$**	**35 $L_{Aeq, 15minute}$**
Assessment of Night-time part-operation 6.00 am to 7.00 am Noise Levels			
Rating Background Noise Level [4]	37.9	34.7	30.0
Intrusiveness Criteria	**43**	**40**	**35**
Acceptable Noise Level	40	40	40
Mean Measured L_{Aeq}	57.5	48.9	54.7
Estimated Industrial L_{Aeq} Noise Contribution	n/a	n/a	n/a
Assessment in areas of high traffic noise	47.5 [3]	n/a	44.7 [3]
Amenity Criteria	**47**	**40**	**45**
Night-time PSNL (part-operation 6.00 am to 7.00 am)	**43 $L_{Aeq, 15minute}$**	**40 $L_{Aeq, 15minute}$**	**35 $L_{Aeq, 15minute}$**

Note 1: For Monday to Saturday, Day-time 7.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-7.00 am. On Sundays and Public Holidays, Day-time 8.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-8.00 am.

Note 2: As per Section 2.2.3, *Assessment in areas of high traffic noise* of the *NSW Industrial Noise Policy* (EPA 2000). Amenity criterion is '$L_{Aeq,\ period}$ minus 10 dB' where the level of existing transportation noise level is ≥ 10 dB above acceptable noise level (ANL). The ANL used to derive the amenity criterion can be adjusted on the basis of the high existing transportation noise level. If the existing industrial noise is low, then the traffic-modified ANL becomes the amenity criterion.

Note 3: The assessment of high traffic noise also relates transport noise including aircraft noise. The amenity criterion is '$L_{Aeq,\ period}$ minus 10 dB' where the level of existing transportation noise level is ≥ 10 dB above ANL.

Note 4: The OEH Application Note for the Assessment of Intrusiveness Criteria (DECC July 2006) section titled *How to account for operations that only occur for part of the day, evening or night* adopts the basic premise of assessing noise over the period that an activity occurs. If a plant operates for only part of either the day, evening or night, the assessment and applicable criteria are based on the period that the plant operates. Here, as the night operations are proposed to occur only between 6.00 am and 7.00 am the assessment of background noise and existing noise from industry would cover only that 1 hour and the applicable criteria would be derived from this period. The amenity criterion is equally applicable to a development that operates only for a portion of the relevant assessment period.

3.4 Sleep Disturbance Criteria

The sleep disturbance criteria are based on the guideline publication of the OEH *Noise Guide for Local Government* (DECCW 2010), which suggests that to prevent sleep disturbance, the $L_{A1,1minute}$ or L_{Amax} level of a noise source should not exceed the L_{A90} background noise level by more than 15 dB when measured outside the bedroom window. The sleep disturbance criteria for the monitoring locations N1, N2 and N3 are presented in **Table 3.5**.

Table 3.5 – Sleep Disturbance Criteria, dB(A)
Night part-operation 6.00 am–7.00 am

Representative Receiver	ID	Measured RBL $L_{A90,Night}$	Sleep Disturbance Criteria, $L_{A1,1minute}$
409 Old Cooma Road, Googong	N1	38	53
732c Old Cooma Road, Googong	N2	35	50
15 Copperfield Place, Jerrabonberra	N3	30	45

As noted above, and consistent with existing operations, the Project will only operate during part of the night period, between 6.00 am to 7.00 am.

3.5 Construction Noise Criteria

The construction activity associated with the Project includes the construction of the relocated infrastructure area and initial ground preparation works for commencement of pit operations in the proposed quarry extension area. The extension of the quarry pit will be a gradual process as part of the quarries normal operations.

DECCW's (now OEH's) *Interim Construction Noise Guideline* (DECCW 2009) provides criteria for construction activities as presented in **Table 3.6** for residences. The criteria are intended to guide the need for and the selection of feasible and reasonable work practices to minimise construction noise impacts.

Table 3.6 – DECCW Construction Noise Criteria at Residences, dB(A)

Construction Time	Construction Noise Criterion $L_{Aeq, 15 minute}$
Recommended standard hours Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Rating Background Noise Level + 10 dB
Outside recommended standard hours	Rating Background Noise Level + 5 dB

The construction noise criteria for representative receiver locations are presented in **Table 3.7**.

Table 3.7 – Construction Criteria for Representative Receiver Locations

Representative Receiver	ID	Daytime Construction Noise Criteria, dB(A)
409 Old Cooma Road, Googong	N1	49
732c Old Cooma Road, Googong	N2	42
15 Copperfield Place, Jerrabonberra	N3	40

3.6 Road Traffic Noise Criteria

The DECCW's (now OEH's) *NSW Road Noise Policy* (DECCW 2011) sets out criteria for road traffic noise through the provision of a framework that addresses traffic noise issues associated with new developments, new or upgraded road developments or planned building developments.

Table 3.8 outlines the criteria relevant for the predicted increase in two way traffic volumes due to the Project along Old Cooma Road, the primary access route to Cooma Road Quarry.

Table 3.8 – Road Noise Criteria, dB(A)

Road Category	Type of project/land use	Assessment Criteria dB(A)	
		Day (7.00 am – 10.00 pm)	**Night (10.00 pm – 7.00 am)**
Freeway/arterial/sub-arterial roads	Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15 hour)}$ 60 (external)	$L_{Aeq(15 hour)}$ 55 (external)

Source: *NSW Road Noise Policy* (DECCW 2011)

Where the criteria in **Table 3.8** are not achievable through feasible and reasonable mitigation measures, Section 3.41 of the *NSW Road Noise Policy* (DECCW 2011) gives further guidance stating: 'any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

3.7 Blasting Emissions Criteria

3.7.1 Introduction

Explosives are used in extractive and quarry operations for resource extraction which is achieved by drilling holes in a pre-defined pattern considering angle, depth and spacing. These holes are then filled with an emulsion-type explosive charge and the charge initiated with the aid of primers and detonators. Detonation is undertaken using a delayed firing technique to ensure the sequential firing of each hole and to blast efficiency and reduce its environmental impacts.

Blasting can have impacts on surrounding residential receivers and structures (including buildings) with regard to airblast (overpressure) and ground vibration. The locations of surrounding residential receivers are presented in **Figure 3.2**. Other structures with the potential to be affected by blasting include a locally listed heritage site comprising of an earthen/rock lime kiln located approximately 180 metres to the east of the Granite Extraction Pit and south of the proposed quarry extension area (refer to **Figure 3.3**).

Blasting emissions criteria for residential and structural receivers are presented in **Section 3.7.2** to **Section 3.7.3**. The methodology for predicting ground vibration and blasting levels associated with the Project is presented in **Section 4.6**. This methodology typically involves the analysis of site blasting monitoring data. However, due to a lack of detailed information on blast source locations corresponding to the measured Peak Vibration and Peak Overpressure values, generic ground vibration and airblast prediction calculations have been undertaken using industry standards. The results of the blasting assessment are presented in **Section 5.6**.

3.7.2 Residential Receivers

The OEH has established guidelines for blasting based on the impacts on human comfort levels. The guidelines have been adapted from the Australian and New Zealand Environment Conservation Council (ANZECC) guidelines *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC 1990). The guidelines are defined in terms of impact on airblast (pressure), measured in dB(Linear) (dBL), and ground vibration, measured as peak particle velocity (PPV), and are presented in **Table 3.9**.

Table 3.9 – Blasting Emissions Criteria for Residential Receivers

Blasting Impact	Recommended 95th Percentile Maximum Level [1]	Maximum Level
Airblast (dB Linear Peak) [1]	115	120
Ground Vibration (mm/s) [2]	5	10

Source: Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC 1990).

Note 1: This level may be exceeded on up to 5 per cent of the total annual number of blasts.

Note 2: It is recommended by ANZECC that a level of 2 mm/s be considered as a long term regulatory goal.

3.7.3 Lime Kiln

Moses Morley's Lime Kiln is an item of local heritage significant located within the Project area, east of the existing granite pit. No specific blasting criteria have been applied to the kiln to date. The potential impacts of blasting have been assessed as part of the Historic Heritage Assessment for the Project (Umwelt 2012) and, as part of the Project, Holcim has committed to not increase the level of impact on the kiln.

Source: Holcim (2012), Google Earth (2011) and Queanbeyan City Council (2006)

0 0.5 1 1.25km
1:25 000

Legend

- Proposed Project Area
- Indicative Dwelling Location
- Holcim Leased
- Holcim Owned

FIGURE 3.2

Indicative Locations of the Nearest Potential Noise Sensitive Residential Receivers (Dwellings)

File Name (A4): R04/2992_083.dgn
20121003 15.36

Source: Holcim (2012), Google Earth (2011)

0 0.25 0.5 0.75km
1:15 000

Legend

Proposed Project Area
Kiln
Existing Blast Monitoring Location

FIGURE 3.3

Existing and Proposed Blast Monitoring

4.0 Modelling Parameters

4.1 Noise Prediction Model

4.1.1 Construction and Operational Phases

A computer model, incorporating identifiable noise sources and surrounding terrain characteristics, was used to calculate the expected contribution to noise levels at the closest residential areas during the construction and operational phases of the Project. The model used was Environmental Noise Model (ENM), developed by RTA Technology Pty Ltd. ENM is recognised and accepted by the OEH as a computer modelling program suited to predicting noise impacts from industrial noise sources.

ENM calculates noise levels at either specified receiver locations (single point calculation) or generates noise level contours over a defined area (contour calculation). The single point calculation feature of ENM was used to assess noise impacts from the proposed development for calm neutral and prevailing meteorological conditions.

4.1.2 Road Traffic Noise

The road noise impacts associated with traffic movements generated by the Project were modelled using the US Federal Highway Administration (FHWA) Traffic Noise Model (TNM). TNM is a highway traffic noise prediction and analysis model used to analyse highway geometries including vehicle speeds, vehicle type, setback distances and the effectiveness of barriers.

4.2 Operational Noise Sources

Noise source models were prepared to represent the type of equipment currently in use and planned to be used in the ongoing operation of the quarry. Throughout the life of the Project the equipment outlined in **Table 4.1**, or the equivalent, will be in use around the project area.

Table 4.1 – Sound Power Levels of Proposed Equipment, dB(A)

Equipment Description	SWL [dB(A) re: 1 pW]	Modelled [5]		
		N	D	E
Truck Wash Bay Pump	74 [1]	✓	✓	✓
Workshop activities	86 [1]	✓	✓	✓
Truck Washout	98 [1]	✓	✓	✓
Air Conditioning Units	70 [1]	-	✓	-
Aggregate dumping onto stockpile	81 [1]	-	✓	✓
CAT 740 working	108 [2]	✓	✓	✓
Primary Crusher (continuous)	120 [2]	-	✓	-
Secondary Crusher Crusher House (continuous)	103 [2,3]	-	✓	-
Secondary Crusher Dust House Building (continuous)	103 [2,3]	-	✓	-
Secondary Crusher Wash House Building (continuous)	103 [2,3]	-	✓	-
CAT 988 Loader (retrieving material and loading CAT 773 Haul trucks)	111 [4]	✓	✓	✓

Table 4.1 – Sound Power Levels of Proposed Equipment, dB(A) (cont.)

Equipment Description	SWL [dB(A) re: 1 pW]	Modelled [5]		
		N	D	E
CAT 773D Dump Truck (Idling while getting loaded)	111 [4]	-	✓	-
CAT 773D Dump Truck (Travel between pit-face and crusher storage)	114 [4]	-	✓	-
CAT 773D Dumping	109 [4]	-	✓	-
CAT 773D Dump Truck (Travel between crusher storage and pit face)	114 [4]	-	✓	-
CAT 769C Water Cart (Travelling around site)	115 [4]	-	✓	✓
CAT 980 Loader (Working around crushers)	111 [2]	-	✓	-
Komatsu WA500-03 (Working around stockpiles)	108 [2]	-	✓	✓
Public road haul truck (picking up material and at weighbridge)	109 [2]	✓[6]	✓	✓[7]
Mobile pug mill	110 [1]	-	✓	
Agitator truck idling in parking area	96 [1]	✓[6]	✓	✓[7]
Mobile crushing and screening plant - in-pit for peak demand periods	118 [1]	-	✓	-

Note 1: Source - Umwelt sound power level (SWL) library.

Note 2: Source - Cooma road Quarry EIS, CMPS&F Environmental, document no. CPJ/5259 1994.

Note 3: Resultant radiating SWL of crusher house enclosure with building elements components of 10 per cent open area, 80 per cent colourbond sheet-metal cladding and 10 per cent polycarbonate cladding).

Note 4: Source - In-situ measured SWL of mobile plant fleet, 2012.

Note 5: Equipment modelled in the night-time (**N**) period from 6.00 am to 7.00 am, day time period (**D**) from 7.00 am to 6.00 pm and the evening period (**E**) from 6.00 pm to 10.00 pm.

Note 6: Not at full daytime production capability, modelled at 25 per cent usage.

Note 7: Not at full daytime production capability, modelled at 50 per cent usage.

During the daytime period all the equipment listed in **Table 4.2** could reasonably be expected to operate during periods of peak production. As noted in **Section 1.0**, not all the equipment would operate during the early morning and the evening periods. The sources used in the modelling of the evening and night-time period of the operation (6.00 am to 7.00 am) are shown in **Table 4.1**. The modelling included a sensitivity analysis on the impact of running the secondary crushing plant, in addition to the equipment identified in **Table 4.1**, during the evening period.

4.3 Construction Noise Sources

A noise source model was prepared to assess the noise impacts of the construction phase of the Project. A range of typical construction equipment likely to be utilised on the site in the construction of the infrastructure area were included in the model. The sound power levels of this equipment are described in **Table 4.2**. Given the size of the development it would be unusual to have multiple machines on site operating continuously. To account for the variability in the construction noise levels a sound power level of 105 dB(A) was used to represent a combination of machine related construction activities.

Table 4.2 – Sound Power Levels of Construction Equipment, dB(A)

Equipment Description	SWL, [dB(A) re: 1 pW]
Dumping of fill material	96
Front end Loader	102
Truck at idle	84
Bobcat	93
Concrete Truck	106

4.4 Road Traffic Noise

The traffic volumes generated by Cooma Road Quarry will increase as a result of the Project. The traffic impact assessment prepared for the Project by Transport & Urban Planning (2012) outlines the following predicted increases to the existing two way traffic volumes as a result of the Project:

- on Old Cooma Road to the north of the Project, south of the West Avenue where the increase in two way traffic volumes due to the Project will be a total of 90 vehicle trips per day of which 72 trips will be heavy vehicle trips (refer to **Table 4.3**);
- on Old Cooma Road to the north of the Project where the increase in two way traffic volumes due to the Project will be a total of 136 vehicle trips per day of which 106 trips will be heavy vehicle trips (refer to **Table 4.4**); and
- on Old Cooma Road to the south of the Project where the increase in two way traffic volumes due to the Project will be a total of 4 heavy vehicle trips per day (refer to **Table 4.5**).

Table 4.3 – Old Cooma Road North of the Project South of West Avenue
(Weekday Two-way Traffic Volumes with Project)

Vehicle classification	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes (vpd)	Proportion (%)		Volumes (vpd)	Proportion (%)
Light	13,552	93.8%	18	13,570	93.3%
Heavy	894	6.2%	72	966	6.7%
Total	14,446	100.0%	90	14,536	100.0%

Source: Transport & Urban Planning, 11094r, 2012

Table 4.4 – Old Cooma Road North of the Project
(Weekday Two-way Traffic Volumes with Project)

Vehicle classification	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes (vpd)	Proportion (%)		Volumes (vpd)	Proportion (%)
Light	2749	83.0%	30	2779	80.6%
Heavy	564	17.0%	106	670	19.4%
Total	3314	100.0%	136	3450	100.0%

Source: Transport & Urban Planning, 11094r, 2012

Table 4.5 – Old Cooma Road South of the Project
(Weekday Two-way Traffic Volumes with Project)

Vehicle classification	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes (vpd)	Proportion (%)		Volumes (vpd)	Proportion (%)
Light	2628	92.7%	0	2628	92.5%
Heavy	208	7.3%	4	212	7.5%
Total	2836	100.0%	4	2840	100.0%

Source: Transport & Urban Planning, 11094r, 2012

The US FHWA Traffic Noise Model (TNM) was used to model the pre and post noise impacts associated with the movement of traffic generated by the Project on Old Cooma Road south of West Avenue to the north of the Project and Old Cooma Road to the immediate north and south of the Project. As a worst case, it was assumed that all the heavy vehicle traffic movements would occur during week day day-times (7.00 am to 6.00 pm) as defined in the *NSW Road Noise Policy* (DECCW 2011).

4.5 Receivers

The Single Point Calculation module of ENM was used to predict the noise impacts of the Project at 113 residential receiver locations surrounding the Project area, the location of which are shown on **Figure 3.2**.

Five of the residential receiver locations shown on **Figure 3.2** are on Holcim Australia owned land (N02) or land leased by Holcim Australia (N04, N05, N06, N37 and N60). These properties have not been included in this assessment as Holcim Australia has management control of this land. Holcim Australia intends to continue to hold leases over this land for the operational life of the quarry.

The road traffic noise impacts were modelled at set back distances of 25 metres, 50 metres and 100 metres from the centre line of Old Cooma Road.

4.6 Meteorological Conditions

Section 5 of the INP (EPA 2000) requires that noise impacts be assessed under weather conditions that would be expected to occur at a particular site for a significant period of time.

Default INP wind conditions were used in the modelling of the predicted noise levels. This approach assumes that meteorological effects are present for a significant amount of time and avoids the need to quantify these effects in detail. This is a conservative approach that is likely to predict the upper range of potential noise impacts.

The source-to-receiver gradient winds identified from the Canberra Airport weather station with the greatest potential to enhance noise impacts are a prevailing north-easterly wind that would propagate the noise from the Project towards the receivers south-west of the site. Therefore, the meteorological conditions used in the noise impact assessment are:

- calm neutral conditions; and
- a gradient wind from the north east.

4.7 Ground Vibration and Airblast Impact Prediction Methodology

The prediction of ground vibration and airblast impacts typically involves the development of site laws for the Project to assess the impacts of blasting on residential and other sensitive receivers in proximity to the Project. Monitoring data collected during previous blasting activities was analysed and used in conjunction with industry and Australian standards to develop the site laws for the Project.

The development of ground vibration and airblast site laws are subject to the guidance of the OEH and ANZECC which provide for the inherent variability associated with the impacts of blasting emission by allowing the definition of site laws with a five percent exceedance probability. They also provide a definitive maximum criterion above which noise emissions are in breach of the site laws.

Holcim maintain a blast monitor at Lot 105 DP 754881, 509 Cooma Road, Googong, NSW (receiver N67). The monitoring data from this site and the respective size of each blast was used to construct preliminary site laws for the Project. A quantitative record of the location of each blast was not recorded, therefore accurate Project specific site laws were unable to be defined.

4.7.1 Ground Vibration Site Law

The methodology outlined in the *Blasting Guide* (Orica 2012) was used to determine the median Peak Vector sum (PVS) (50%) ground vibration site law.

The PVS (50%) is defined as:

$$\text{PVS (mm/s) (50\%)} = 1140\ (\text{SD})^{-1.6}$$

Where SD (scaled distance) is defined as:

$$SD\ (m.kg^{0.5}) = D/(MIC^{0.5})$$; and

MIC is the maximum explosive charge mass (kilograms) detonated per delay at any 8 millisecond interval and D is the distance between charge and receiver.

The 95th percentile ground vibration site law, which may be exceeded on up to 5 per cent of the total annual blasts, was not determined due to the lack of location-specific blast data.

4.7.2 Airblast Site Law

As with the ground vibration site law, the lack of precise source location data hindered the accuracy of the derived airblast site law. As such, methodology outlined in the *ICI Blasting Guide* (ICI 1995) was used to determine the 95th percentile airblast site law, which may be exceeded on up to 5 per cent of the total annual blasts. The airblast site law is defined by the peak airblast level (SPL) measured in dB(Lin).

The SPL 5 per cent is defined as:

$$\text{SPL, dB(Lin) (5\%)} = -24 \log (\text{SD}) + 165.3$$

Where SD (scaled distance) is defined as:

$$\text{SD (m.kg}^{-0.33}) = \text{D/MIC}^{0.33}$$; and

MIC is the maximum explosive charge mass (kilograms) detonated per delay and D is the distance between charge and receiver.

The median SPL (50%) law has also been determined from methodology outlined in AS 2187.2 – 2006 (ANZECC, 2006):

$$\text{SPL dB(Lin) (50\%)} = 516\ (\text{SD})^{-1.45}$$

5.0 Predicted Impacts

5.1 Operational Noise Impacts

5.1.1 Prediction of Projected Noise Levels

Section 6 of the INP (EPA 2000) requires the prediction of noise levels taking into account all the possible noise sources that may reasonably be expected when the plant or facility in question is fully operational. The schedule of equipment (or their equivalent) that the quarry will normally use is described in **Section 4.2**. The ENM model has been prepared assuming that all the equipment available is operational for durations of time representative of typical operational scenarios. Sources were located in representative locations based on typical quarry operations and in areas as indicated by Holcim.

Two operational scenarios were modelled:

- a 'shallow extraction' scenario where quarry and infrastructure operations were modelled with extraction occurring at a shallow depth within the proposed quarry extension area; and

- a 'deep extraction' scenario where quarry and infrastructure operations were modelled with extraction occurring deeper within the proposed quarry extension area.

As noted in **Section 4.5** the predicted noise impacts have been modelled to 113 residential receiver locations shown on **Figure 3.2**. The residential receiver locations on land owned (N02) or leased (N04, N05, N06, N37 and N60) by Holcim Australia have not been included in this assessment as Holcim Australia has management control of this land.

5.1.2 Predicted Noise Impacts

ENM's Single Point Calculation module was used to determine the night time part-operation (6.00 am–7.00 am), day time and evening noise levels under operation conditions discussed in **Section 4.2** for the meteorological conditions discussed in **Section 4.5**. The results presented in **Table 5.1** are representative of the 'shallow extraction' scenario <u>following</u> the implementation of reasonable and feasible control measures.

Table 5.1 – Predicted Sound Pressure Levels, dB(A)
Shallow Pit Depth Operational Scenario

Modelled Receiver Location	Target PSNL [dB(A) $L_{Aeq,15minute}$ re: 20 µPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) $L_{Aeq,15minute}$ re: 20 µPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N1	43	44	39	Neutral Conditions	25	32	28
				Gradient Wind	22	29	25
N3	35	35	35	Neutral Conditions	18	28	21
				Gradient Wind	21	30	24
N7	43	44	39	Neutral Conditions	27	34	31
				Gradient Wind	25	31	28
N8	43	44	39	Neutral Conditions	30	36	32
				Gradient Wind	27	34	30

Table 5.1 – Predicted Sound Pressure Levels, dB(A)
Shallow Pit Depth Operational Scenario (cont.)

Modelled Receiver Location	Target PSNL [dB(A) $L_{Aeq,15minute}$ re: 20 µPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) $L_{Aeq,15minute}$ re: 20 µPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N9	40	37	35	Neutral Conditions	32	38 [1]	34
				Gradient Wind	30	35	32
N10	40	37	35	Neutral Conditions	29	36	32
				Gradient Wind	27	34	30
N11	40	37	35	Neutral Conditions	29	36	32
				Gradient Wind	28	34	30
N12	40	37	35	Neutral Conditions	33	38 [1]	35
				Gradient Wind	32	37	33
N13	40	37	35	Neutral Conditions	29	35	31
				Gradient Wind	27	33	30
N14	40	37	35	Neutral Conditions	32	37	34
				Gradient Wind	31	36	32
N15	40	37	35	Neutral Conditions	28	35	31
				Gradient Wind	26	33	29
N16	40	37	35	Neutral Conditions	26	34	30
				Gradient Wind	25	32	28
N17	40	37	35	Neutral Conditions	26	33	29
				Gradient Wind	24	31	27
N18	40	37	35	Neutral Conditions	26	33	29
				Gradient Wind	24	31	27
N19	40	37	35	Neutral Conditions	21	31	26
				Gradient Wind	19	29	24
N20	40	37	35	Neutral Conditions	19	30	26
				Gradient Wind	17	29	24
N21	40	37	35	Neutral Conditions	18	29	23
				Gradient Wind	16	26	22
N22	40	37	35	Neutral Conditions	19	30	24
				Gradient Wind	17	28	22
N23	40	37	35	Neutral Conditions	24	31	27
				Gradient Wind	22	30	25
N24	40	37	35	Neutral Conditions	24	31	27
				Gradient Wind	22	30	26
N25	40	37	35	Neutral Conditions	22	31	27
				Gradient Wind	20	29	25
N26	40	37	35	Neutral Conditions	19	29	24
				Gradient Wind	18	28	23
N27	40	37	35	Neutral Conditions	20	30	25
				Gradient Wind	18	29	24

Table 5.1 – Predicted Sound Pressure Levels, dB(A)
Shallow Pit Depth Operational Scenario (cont.)

Modelled Receiver Location	Target PSNL [dB(A) LAeq,15minute re: 20 µPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) LAeq,15minute re: 20 µPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N28	40	37	35	Neutral Conditions	21	30	25
				Gradient Wind	19	28	24
N29	40	37	35	Neutral Conditions	24	32	27
				Gradient Wind	23	31	26
N30	40	37	35	Neutral Conditions	26	34	30
				Gradient Wind	24	32	28
N31	40	37	35	Neutral Conditions	27	35	31
				Gradient Wind	26	34	29
N32	40	37	35	Neutral Conditions	28	35	30
				Gradient Wind	26	33	29
N33	40	37	35	Neutral Conditions	28	35	31
				Gradient Wind	27	34	29
N34	40	37	35	Neutral Conditions	28	36	31
				Gradient Wind	27	34	30
N35	40	37	35	Neutral Conditions	33	38 [1]	35
				Gradient Wind	32	37	33
N36	40	37	35	Neutral Conditions	28	35	31
				Gradient Wind	26	33	29
N38	40	37	35	Neutral Conditions	27	35	30
				Gradient Wind	27	33	29
N39	40	37	35	Neutral Conditions	27	35	29
				Gradient Wind	27	33	29
N40	40	37	35	Neutral Conditions	27	34	29
				Gradient Wind	26	33	28
N41	40	37	35	Neutral Conditions	26	33	28
				Gradient Wind	25	32	28
N42	40	37	35	Neutral Conditions	25	33	28
				Gradient Wind	24	32	27
N43	40	37	35	Neutral Conditions	25	33	28
				Gradient Wind	25	32	27
N44	40	37	35	Neutral Conditions	26	33	28
				Gradient Wind	25	32	28
N45	40	37	35	Neutral Conditions	27	34	29
				Gradient Wind	26	33	28
N46	40	37	35	Neutral Conditions	26	34	29
				Gradient Wind	26	33	28
N47	40	37	35	Neutral Conditions	26	34	29
				Gradient Wind	26	33	28

Table 5.1 – Predicted Sound Pressure Levels, dB(A)
Shallow Pit Depth Operational Scenario (cont.)

Modelled Receiver Location	Target PSNL [dB(A) LAeq,15minute re: 20 µPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) LAeq,15minute re: 20 µPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N48	40	37	35	Neutral Conditions	26	34	29
				Gradient Wind	26	34	29
N49	40	37	35	Neutral Conditions	26	34	29
				Gradient Wind	26	33	29
N50	40	37	35	Neutral Conditions	26	34	29
				Gradient Wind	26	33	28
N51	40	37	35	Neutral Conditions	27	35	29
				Gradient Wind	27	34	29
N52	40	37	35	Neutral Conditions	27	34	29
				Gradient Wind	27	34	30
N53	40	37	35	Neutral Conditions	27	35	29
				Gradient Wind	27	34	30
N54	40	37	35	Neutral Conditions	26	35	29
				Gradient Wind	27	35	30
N55	40	37	35	Neutral Conditions	25	35	28
				Gradient Wind	27	37	29
N56	43	44	39	Neutral Conditions	28	41	32
				Gradient Wind	29	41	32
N57	43	44	39	Neutral Conditions	26	39	29
				Gradient Wind	26	40	30
N58	40	37	35	Neutral Conditions	21	33	24
				Gradient Wind	22	33	25
N59	43	44	39	Neutral Conditions	29	39	31
				Gradient Wind	31	40	33
N61	40	37	35	Neutral Conditions	21	31	24
				Gradient Wind	21	32	24
N62	40	37	35	Neutral Conditions	19	31	21
				Gradient Wind	19	31	22
N63	43	44	39	Neutral Conditions	24	34	26
				Gradient Wind	26	35	28
N64	43	44	39	Neutral Conditions	24	34	26
				Gradient Wind	27	36	29
N65	43	44	39	Neutral Conditions	22	33	25
				Gradient Wind	26	35	28
N66	40	37	35	Neutral Conditions	20	30	22
				Gradient Wind	22	31	24
N67	40	37	35	Neutral Conditions	24	35	28
				Gradient Wind	30	41 [1]	35

**Table 5.1 – Predicted Sound Pressure Levels, dB(A)
Shallow Pit Depth Operational Scenario (cont.)**

Modelled Receiver Location	Target PSNL [dB(A) LAeq,15minute re: 20 µPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) LAeq,15minute re: 20 µPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N68	40	37	35	Neutral Conditions	20	30	24
				Gradient Wind	27	35	30
N69	40	37	35	Neutral Conditions	15	24	17
				Gradient Wind	18	26	20
N70	40	37	35	Neutral Conditions	11	20	14
				Gradient Wind	15	24	18
N71	40	37	35	Neutral Conditions	18	28	21
				Gradient Wind	25	35	30
N72	35	35	35	Neutral Conditions	9	19	11
				Gradient Wind	17	27	22
N73	35	35	35	Neutral Conditions	7	17	11
				Gradient Wind	12	21	15
N74	35	35	35	Neutral Conditions	8	17	11
				Gradient Wind	12	20	15
N75	35	35	35	Neutral Conditions	8	17	11
				Gradient Wind	11	20	14
N76	35	35	35	Neutral Conditions	8	18	11
				Gradient Wind	12	21	15
N77	35	35	35	Neutral Conditions	8	17	11
				Gradient Wind	12	21	15
N78	35	35	35	Neutral Conditions	10	19	13
				Gradient Wind	13	22	16
N79	35	35	35	Neutral Conditions	11	22	15
				Gradient Wind	14	25	18
N80	35	35	35	Neutral Conditions	11	20	14
				Gradient Wind	15	24	19
N81	35	35	35	Neutral Conditions	11	20	14
				Gradient Wind	15	24	19
N82	35	35	35	Neutral Conditions	11	20	15
				Gradient Wind	15	24	18
N83	35	35	35	Neutral Conditions	11	20	15
				Gradient Wind	15	24	18
N84	35	35	35	Neutral Conditions	11	20	15
				Gradient Wind	15	24	18
N85	35	35	35	Neutral Conditions	11	21	15
				Gradient Wind	14	23	18
N86	35	35	35	Neutral Conditions	12	21	15
				Gradient Wind	14	24	19

Table 5.1 – Predicted Sound Pressure Levels, dB(A)
Shallow Pit Depth Operational Scenario (cont.)

Modelled Receiver Location	Target PSNL [dB(A) LAeq,15minute re: 20 μPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) LAeq,15minute re: 20 μPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N87	35	35	35	Neutral Conditions	13	23	16
				Gradient Wind	17	27	21
N88	35	35	35	Neutral Conditions	13	23	17
				Gradient Wind	17	27	21
N89	35	35	35	Neutral Conditions	15	25	18
				Gradient Wind	18	27	21
N90	35	35	35	Neutral Conditions	14	25	17
				Gradient Wind	17	27	20
N91	35	35	35	Neutral Conditions	14	24	18
				Gradient Wind	17	27	21
N92	35	35	35	Neutral Conditions	14	24	18
				Gradient Wind	17	27	20
N93	35	35	35	Neutral Conditions	14	24	17
				Gradient Wind	16	26	20
N94	35	35	35	Neutral Conditions	14	23	17
				Gradient Wind	16	26	20
N95	35	35	35	Neutral Conditions	13	23	17
				Gradient Wind	16	25	19
N96	35	35	35	Neutral Conditions	13	23	17
				Gradient Wind	16	25	19
N97	35	35	35	Neutral Conditions	13	23	17
				Gradient Wind	15	25	19
N98	35	35	35	Neutral Conditions	14	24	17
				Gradient Wind	16	26	20
N99	35	35	35	Neutral Conditions	14	24	17
				Gradient Wind	16	26	20
N100	35	35	35	Neutral Conditions	14	24	17
				Gradient Wind	16	26	20
N101	35	35	35	Neutral Conditions	14	24	18
				Gradient Wind	17	26	21
N102	35	35	35	Neutral Conditions	14	24	18
				Gradient Wind	16	26	20
N103	35	35	35	Neutral Conditions	14	24	19
				Gradient Wind	16	26	21
N104	35	35	35	Neutral Conditions	15	25	19
				Gradient Wind	16	27	21
N105	35	35	35	Neutral Conditions	15	26	20
				Gradient Wind	17	27	22

Table 5.1 – Predicted Sound Pressure Levels, dB(A) Shallow Pit Depth Operational Scenario (cont.)

Modelled Receiver Location	Target PSNL [dB(A) LAeq,15minute re: 20 μPa]			Modelled Weather Conditions	Predicted Noise Level [dB(A) LAeq,15minute re: 20 μPa]		
	Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm		Night 6.00 am to 7.00 am	Day 7.00 am to 6.00 pm	Evening 6.00 pm to 10.00 pm
N106	35	35	35	Neutral Conditions	16	26	21
				Gradient Wind	19	29	24
N107	35	35	35	Neutral Conditions	16	26	21
				Gradient Wind	19	29	24
N108	35	35	35	Neutral Conditions	16	26	21
				Gradient Wind	18	28	23
N109	35	35	35	Neutral Conditions	16	26	20
				Gradient Wind	18	28	22
N110	35	35	35	Neutral Conditions	15	25	19
				Gradient Wind	17	26	21
N111	35	35	35	Neutral Conditions	13	23	16
				Gradient Wind	13	23	17
N112	35	35	35	Neutral Conditions	13	23	17
				Gradient Wind	13	23	17
N113	35	35	35	Neutral Conditions	15	25	19
				Gradient Wind	15	25	19
N114	35	35	35	Neutral Conditions	15	27	20
				Gradient Wind	14	26	20
N115	35	35	35	Neutral Conditions	18	27	22
				Gradient Wind	19	27	22
N116	35	35	35	Neutral Conditions	15	25	19
				Gradient Wind	14	24	18
N117	35	35	35	Neutral Conditions	15	26	20
				Gradient Wind	13	24	18
N118	35	35	35	Neutral Conditions	18	28	23
				Gradient Wind	15	25	20
N119	35	35	35	Neutral Conditions	20	35	32
				Gradient Wind	17	33	30

Note 1: Predicted noise levels exceeding the respective day time criteria.

5.1.3 Control Measures

A range of measures were investigated to control the noise impacts associated with the Project in accordance with **Appendix D**. The reasonable and feasible control measures that have been incorporated into the ENM noise model of the Project include:

- the attenuation of the primary crushing plant from a sound power level of 120 dB(A) to approximately 112 dB(A);
- the management of loaders and road haulage trucks to minimise the number of machines running in exposed locations at any one point in time;
- the management of the layout of the stockpiles and work areas to minimise the number of machines running in exposed locations;
- the management of stockpiles to act as barriers between working machines and potential receiver areas (applicable to potential exposed areas higher within the quarry and product area);
- not running the secondary crushing plant during the evenings if potentially adverse weather conditions aid in the propagation of noise to the receiver areas; and
- the construction of an earth-berm situated along the eastern extent of the proposed infrastructure area.

With these control measures in place the number of potential exceedances of the PSNL in **Table 5.1** and the maximum level of exceedances of the PSNL are summarised in **Table 5.2**.

Table 5.2 – Summary of Predicted Noise Impacts

Meteorological Conditions	Night [1]	Day [1]	Evening	
			No 2ndry [1] Crushing	with 2ndry [2] Crushing
Neutral Conditions				
No. Properties	0	3	0	0
Maximum Exceedance	-	1 dB	-	-
Gradient Wind				
No. Properties	0	1	0	1
Maximum Exceedance	-	4 dB	-	3 dB

Note 1: Summary of results in **Table 5.1**.

Note 2: Summary of modelling results with the secondary crusher running during the evening period.

Section 7 of the INP (EPA 2000) notes that when the predicted noise impacts exceed the project-specific noise levels, additional measures may be required to reduce noise levels to meet the project-specific noise levels. In addition to the control measures outlined above a range of measures, based on the strategies outlined in **Appendix D**, were considered for the Project. These included:

- Controlling noise at the source through the elimination of noisy equipment and relocating equipment or reorienting equipment to reduce the noise impacts. Where practical this has been included in the control measures outlined above and includes the attenuation of the primary crushing plant, maintenance of equipment and limiting extractive activities to the day-time period only. However, other potential changes to the key noise sources that were not feasible included changing the secondary crushing plant as it is an existing fixed installation, or the complete elimination of the primary crushing plant which is not possible as this is an integral component of the quarry operations.

- Controlling the transmission of noise with the orientation and location of the new site infrastructure area. Additionally, a noise barrier will be constructed along the eastern side of the new infrastructure area to further manage noise impacts from this area. While investigated and considered appropriate for the new infrastructure area, it was determined the construction of noise barriers at other locations around the site to minimise noise impacts was not feasible as they would be mostly ineffectual.
- Controlling noise at the receiver has not been investigated as a part of this assessment apart from recognising that Holcim Australia has management control of the land identified as residential receiver locations N02, N04, N05, N06, N37 and N60.

With respect to controlling noise emissions at the source, a sensitivity analysis was conducted on the impact of running the secondary crushing plant during the evening period. The summary of these modelling results, provided in **Table 5.2**, indicate that only two property would potentially be affected during adverse weather conditions, Properties N60 and N67. Property N60 currently has a lease agreement in place with Holcim Australia and therefore Holcim Australia has management control over the property.

ENM's Single Point Calculation module was also used to determine the predicted noise levels for the ‘deep extraction’ scenario. The results for the night time part-operation (6.00 am–7.00 am) and evening time are the same as the results for the 'shallow extraction' scenario as the activities during these times will be essentially the same. During the day time period the predicted noise levels are marginally quieter for the deep scenario. However, as the location of the dominant noise sources will remain unchanged (i.e. crushing and screening plant and product dispatch area) the reduction in the overall predicted noise levels are minimal.

5.1.4 Summary of Findings

The modelling results presented in **Table 5.1** and summarised in **Table 5.2** indicate that for the 'shallow extraction' scenario, with reasonable and feasible controls in place:

- under the modelled meteorological conditions, the predicted $L_{Aeq,15minute}$ noise levels would not exceed the respective night time part-operation (6.00 am–7.00 am) PSNL.
- the predicted $L_{Aeq,15minute}$ noise levels exceeded the respective day time PSNL:
  - at three (3) receiver locations, N09, N12 and N35, by 1 dB under neutral conditions; and
  - at one (1) receiver location, N67, by 4 dB under the worst case gradient winds from the north east.
- under the modelled meteorological conditions without the secondary crushing plant operating the predicted $L_{Aeq,15minute}$ noise levels would not exceed the evening PSNLs.
- with the secondary crushing plant running, the predicted $L_{Aeq,15minute}$ noise level exceeded the evening PSNLs:
  - at one (1) receiver location, N67, by 3 dB under the worst case gradient winds from the north east.

Without the implementation of the controls discussed above the Project could exceed the respective PSNL at a number of additional properties. The number of potential exceedances of the PSNL and the maximum level of exceedances of the PSNL are summarised in **Table 5.3**.

Table 5.3 – Summary of Potential Noise Impacts

Meteorological Conditions	Night	Day	Evening	
			No 2ndry Crushing	with 2ndry Crushing
Neutral Conditions				
No. Properties	0	4	4	4
Maximum Exceedance	-	3 dB	2 dB	2 dB
Gradient Wind				
No. Properties	0	5	1	2
Maximum Exceedance	-	6 dB	2 dB	4 dB

The modelling results summarised in **Table 5.3** indicate that for the 'shallow extraction' scenario without the recommended controls in place:

- under the modelled meteorological conditions the predicted $L_{Aeq,15minute}$ noise levels would not exceed the respective night time part-operation (6.00 am–7.00 am) PSNLs.
- the predicted $L_{Aeq,15minute}$ noise levels would exceed the respective day time PSNLs:
  - at four (4) receiver locations, N09, N12, N14 and N35, by 2 to 3 dB under neutral conditions; and
  - at five (5) receiver locations, N12, N14, N35, N55 and N67, under the worst case gradient winds from the north east. Under the worst case gradient wind conditions, the predicted noise levels at N12, N14 and N35 exceed the PSNL by 1 to 2 dB. At N55 and N67 the predicted noise levels exceed the respective PSNL by 4 dB and 6 dB.
- the predicted $L_{Aeq,15minute}$ noise level without the secondary crushing plant operating exceeded the evening PSNLs:
  - at four (4) receiver locations, N12, N14 and N35, by 1 to 2 dB under neutral conditions; and
  - at one (1) receiver location, N67, by 2 dB under the worst case gradient winds from the north east.

During the day time and evening periods the dominant noise sources at N09, N12, N14 and N35 under neutral meteorological conditions were the modelled road-haul trucks within the new infrastructure area.

Under the worst case gradient winds from the north east during the day time period the dominant noise source at N55 and N67 was the primary crushing plant. During the evening period the dominant noise source at N67 was associated with front end loaders modelled to be working around the secondary crushing plant and product handling area. As shown in **Table 5.2**, the application of appropriate controls and management of site activities would reduce or eliminate these exceedances.

The modelling results summarised in **Table 5.3** also indicate that for the 'shallow extraction' scenario without the suggested controls in place:

- with the secondary crushing plant operating during the evening the predicted $L_{Aeq,15minute}$ noise level exceeded the evening PSNLs:
  - at four (4) receiver locations, N09, N12, N14 and N35, by 1 to 2 dB under neutral conditions (predicted to be 0.2 dB increase in the noise level); and
  - at two (2) receiver location, N35 and N67, by 1 dB and 4 dB respectively under the worst case gradient winds from the north east.

The sensitivity analysis conducted on running the secondary crushing plant during the evening period indicates the plant could run under most meteorological conditions however, due consideration needs to be given to meteorological conditions that could enhance the propagation of noise to the surround receiver areas, specifically a gradient wind from the north east.

5.2 Sleep Disturbance

Noise sources that could lead to sleep disturbance are typically transient noises and often have tonal characteristics. Activities occurring within the night part-operational period (6.00 am–7.00 am) that could lead to sleep disturbance include:

- public road haul truck at site entrance weigh-bridge;
- CAT 980 Loader - Working around crushers stockpile area;
- CAT 773 dumping at material stockpiles;
- Komatsu WA500-03 - Working around stockpiles; and
- reversing beepers.

The predicted received $L_{A1,1minute}$ noise levels associated with these activities are presented in **Table 5.4**.

Table 5.4 – Predicted $L_{A1,1minute}$ Sleep Disturbance Noise Levels, dB(A)

Receiver	N1	N2	N3
Sleep Disturbance Criteria	**53**	**50**	**45**
Public road haul truck at site weighbridge	35	25	19
CAT 980 Loader - Working around crushers stockpile area	17	20	14
CAT 773 dumping at material stockpiles	23	26	20
Komatsu WA500-03 - Working around stockpiles	20	21	14
Potentially worst case reversing beepers	45	36	30

The results in **Table 5.4** indicate that the $L_{A1,1minute}$ noise levels associated with activities proposed to occur within the night period part-operational period (6.00 am–7.00 am) are unlikely to lead to sleep disturbance in the nearby residential areas.

5.3 Construction Noise Impacts

Construction work that is potentially audible at any sensitive receiver location will be undertaken between 7.00 am and 6.00 pm Monday to Friday, 8.00 am to 1.00 pm on Saturdays.

The predicted worst case $L_{Aeq,15minute}$ construction noise levels under neutral weather conditions are given in **Table 5.5** for the nearest residential receivers.

Table 5.5 – Predicted Construction Noise Levels, dB(A)

Receiver	N4 (residence to the NE)	N37 (residence to the east)	N56 (residence to the SE)
Construction Noise Criterion Recommended standard hours	**49**	**49**	**49**
Predicted construction noise levels	45	47	44

Based on the results presented in **Table 5.5**, construction noise levels are predicted to comply with the OEH's construction noise criteria.

5.4 Road Traffic Noise Impacts

5.4.1 Project Contribution to Road Traffic Noise

The predicted increase in road traffic noise impacts due to the Project, based on the projected additional traffic volumes associated with the Project in **Table 4.3** to **4.5**, are presented in **Table 5.6**.

Table 5.6 – Predicted Weekday Day Time $L_{Aeq,1hour}$ Noise Levels, dB(A)

Residence Setback Distance (m)	Old Cooma Road North of the Project, South of West Avenue			Old Cooma Road North of the Project			Old Cooma Road South of the Project		
	Pre	Post	Increase	Pre	Post	Increase	Pre	Post	Increase
25	62.2	62.4	0.2	58.9	59.5	0.6	56.9	57.0	0.1
50	55.3	55.5	0.2	52.4	53.1	0.7	49.6	49.7	0.1
100	50.4	50.7	0.3	47.8	48.5	0.7	44.6	44.7	0.1

In **Table 5.6** it has been assumed that the majority of the additional heavy vehicle movements generated by the Project would occur during the week day day-time period from 7.00 am to 6.00 pm.

The results presented in **Table 5.6** indicate the predicted increase in two way traffic volumes due to the Project along Old Cooma Road would not result in current road traffic noise levels exceeding the *NSW Road Noise Policy* (DECCW 2011) criteria presented in **Table 3.8**.

On Old Cooma Road north of the Project, south of West Avenue the noise levels are predicted to be above the daytime $L_{Aeq(15\ hour)}$ criteria of 60 dB(A) presented in **Table 3.8** at a setback distance of 25 metres. The predicted noise levels are not associated with traffic generated by the Project. From **Table 4.3** it can be seen that the project generated less than 1 per cent of the traffic along the section of Cooma Road north of the Project, south of West Avenue. The predicted increase in traffic noise levels from vehicle movements associated with the Project are predicted to lead to insignificant increases in existing road traffic noise levels along Old Cooma Road. That is, the predicted increase in the road traffic noise level is less than the maximum increase of 2 dB recommended in Section 3.41 of the *NSW Road Noise Policy* (DECCW 2011).

5.4.2 Realignment of Old Cooma Road

Queanbeyan City Council has approval to realign the section of Old Cooma Road adjacent to Cooma Road Quarry. Construction of the realignment commenced in mid 2012. A noise assessment of the proposed Old Cooma Road realignment and duplication was undertaken by the Acoustics and Vibration Unit of the University of New South Wales at Australian Defence Force Academy (ADFA), in 2009. The ADFA report (2009) found that future predicted road traffic noise levels are already predicted to exceed road traffic noise goals for traffic travelling along Old Cooma Road and appropriate noise mitigation works are proposed as part of the realignment and duplication works.

The ADFA report (2009) indicated 2031 represents the year that the predicted road capacity would be achieved. Leading up to this period the additional vehicle movements generated by the Project would only represent a small component of the traffic on Old Cooma Road.

5.5 Predicted Blast Emission Levels

The impacts of blasting associated with the Project have been predicted at the sensitive receivers in proximity to the Project. Ground vibration levels have been predicted using the site law developed using the methodology outlined in the *Blasting Guide* (Orica 2012) and AS 2187.2 – 2006 (ANZECC 2006).

5.5.1 Residential Receivers

The predicted ground vibration and airblast levels at residential receiver locations as a result of the Project's blasting activities are summarised in **Table 5.7**. These predictions reflect the worst case airblast and vibration levels potentially experienced at each residential and commercial receiver location as a result of the Project and are based on the historical maximum MIC values.

Table 5.7 – Predicted Blasting Emissions at Residential

Receiver Location	Distance (m)	MIC (kg)	Predicted Blasting Level		Blasting Emissions Criteria	
			SPL (dBL)	PVS (mm/s)	SPL (dBL)	PVS (mm/s)
N67 - (Lot 105 DP 754881, 509 Cooma Road, Googong)	790	337	116	2.77	115	5

Note 1: Distance measured from edge of Project boundary.

The results presented in **Table 5.7**, indicate that the predicted ground vibration levels from a maximum 337 kilogram MIC would comply with the ANZECC and OEH criteria at the nearest residential receivers, however, at this MIC, a minor exceedance of 1dB of the ANZECC and OEH air blast criteria could be expected.

In accordance with Cooma Road Quarry's existing practice, the permissible MIC for each blast will be calculated based on the specific location in which it will occur and on the blasting site law. Holcim Australia will design all blasts to comply with the ANZECC and OEH ground vibration and air blast criteria.

The blasting site law will be constantly updated using site-specific blast monitoring data. This process will provide the Cooma Road Quarry with flexibility to design blasts to best meet production requirements while complying with relevant criteria for residential receivers.

5.5.2 Lime Kiln Site

Holcim Australia will design all blasts so as to not exceed ground vibration levels currently experienced at the kiln site.

6.0 Conclusion and Recommendations

6.1 Noise Impact Assessment

6.1.1 Conclusion

Umwelt has undertaken a Noise Impact Assessment of the Project in accordance with the INP (EPA 2000). Two operational scenarios were modelled to represent quarry operations with extraction occurring at shallow depths, and with extraction occurring deeper within the proposed quarry extension area.

The results in **Section 5.0** indicate that with appropriate control measures in place the potential maximum exceedance of the target PSNLs would be 4 dB.

When predicted noise levels exceed the target PSNL a range of strategies should be considered to reduce the noise impact on offsite receivers. The three main strategies for noise control (detailed in **Appendix D**) are:

- **controlling noise at the source** - There are three approaches to controlling noise generated by the source: Source elimination; Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA);

- **controlling the transmission of noise** - There are two approaches: the use of barriers and land-use controls which attenuate noise by increasing the distance between source and receiver; and

- **controlling noise at the receiver** - There are two approaches: negotiating an agreement with the landholder or acoustic treatment of dwellings to control noise.

If unacceptable noise impacts from a development persist after noise mitigation action has been undertaken, Section 8 and Section 10 of the INP (EPA 2000) provide a process for negotiating an agreement between the proponent and the affected party(s). One of the outcomes from this process is to set project-specific noise criterion for the Project that allow the Cooma Road Quarry to adapt to changes in the noise expectations of the community while remaining economically viable. The project-specific noise criterion would be based on, but are not necessarily, the target PSNL and would take into consideration the implementation of reasonable and feasible controls suggested in **Section 5.0**.

Holcim Australia is committed to implementing the controls discussed in **Section 5.0**. As discussed above, with these controls in place the results in **Section 5.0** indicates a potential maximum exceedance of the target PSNLs of 4 dB. A sensitivity analysis of the effective of the control measures identified in **Section 5.0** indicated that under worst-case meteorological conditions the Project could potentially exceed the target PSNLs by up to 6 dB during the day time.

Following the installation of any attenuation measures site emitted noise should be assessed against the project-specific noise criteria for each of the receiver locations.

6.1.2 Recommended Management and Monitoring Program

Holcim Australia will implementation the noise attenuation measures discussed in **Section 5.0**. In addition, within six months of the date of consent, Holcim Australia will also prepare and implement a Noise Management Plan for the Project. The Noise Management Plan will be integrated into the Cooma Road Quarry Environmental Management Plan. The Plan will outline the feasible and reasonable noise management measures to be investigated as a part of the proposed Operational Noise and Vibration Review for the Project, and noise and vibration monitoring program that will confirm the operational noise levels and performance of the proposed mitigation measures in accordance with the target project-specific noise criteria for the Project.

Within 24 months of the date of consent, Holcim Australia will undertake an Operational Noise and Vibration Review to confirm the noise and vibration control measures being implemented for the Project. The review will seek to confirm the predicted operational noise levels, evaluate all feasible and reasonable noise and vibration mitigation measures and identify any further specific mitigation measures if necessary.

On an annual basis, Holcim Australia will undertake compliance noise and vibration monitoring to confirm the operational noise levels of the Project that will specifically address:

- compliance with the target project-specific noise criteria for the Project; and
- measurement and assessment of any transient noise levels using the sleep disturbance criteria descriptor of $L_{A1,\ 1\ minute}$.

The noise monitoring should be based around an attended monitoring program that:

- measures $L_{A90,15\ minute}$ and $L_{Aeq,15\ minute}$ ambient noise levels;
- measures and/or calculates the contributed noise level from the operation;
- measures other statistical noise levels representative of the noise environment including the maximum and minimum noise levels measured during the interval; and
- records weather conditions at the monitoring site.

The results of the monitoring program should be reviewed by the Holcim Australia environmental representative to assess compliance with the goals outlined in **Section 5.0** and reported in accordance with any requirements of the development consent or Environment Protection Licence.

6.2 Blasting Assessment

6.2.1 Residential Receivers

The blasting impact assessment indicated that the predicted airblast and ground vibration levels associated with the Project can comply with the relevant criteria at the nearest residential receivers when the limiting MIC is applied. Holcim Australia will design all blasts to comply with the ANZECC and OEH ground vibration and airblast criteria.

The MIC for each blast will vary, and be limited, depending on the location of the area being quarried and its relation to potentially affected receivers (infrastructure or residential). It is recommended that blast emission (PVS) prediction site laws for the Project be developed using the results from each blast so that the blast site law can be continually refined to ensure that the MIC for each individual blast will be based on the constraints at the nearest affected receiver.

6.2.2 Recommendations

It is recommended that ongoing monitoring of ground vibration and airblast levels be undertaken during each blasting event as well as recording the precise location of each blast, to allow further refinement of the ground vibration site law. This will provide a more precise predictive tool for ongoing prediction of blasting impacts on structural receivers as quarrying progresses. It is also recommended that additional monitoring locations be installed, particularly at the north west-side of the earthen/rock kiln.

Until peak overpressure and peak vibration data is recorded in conjunction with blast locations, it is recommended that MIC is limited to 95 per cent of the maximum calculated MIC.

Following the implementation of location recording for all blasting activities, the site laws should be modified to ensure that the MIC for each individual blast is based on the constraints at potentially affected receiver locations.

7.0 References

NSW Environment Protection Authority 1994, *Environmental Noise Control Manual.*

NSW Environment Protection Authority 2000, *New South Wales Industrial Noise Policy.*

NSW Department of Environment, Climate Change 2008 *Application Notes – NSW Industrial Noise Policy.*

NSW Department of Environment, Climate Change and Water 2010, *Noise Guide for Local Government* (DECCW 2010/799).

NSW Department of Environment, Climate Change and Water 2011, *NSW Road Noise Policy.*

ICI 1995, *Blasting Guide*.

Orica Group of Companies 2012, *Orica Blasting Guide.*

APPENDIX A

Glossary of Terms

Appendix A – Glossary and Abbreviations

1/3 Octave	Single octave bands divided into three parts.
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment background level – A single-figure background noise level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24-hr period of the monitoring period). It is determined by taking the lowest 10th percentile of the L_{90} level for each assessment period.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A), dBA	Decibels A-weighted.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
L_{A10}	The percentile sound pressure level exceeded for 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source.
L_{A90}	Background Noise Level. The percentile sound pressure level exceeded for 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis.
L_{Amax}	The maximum of the sound pressure levels recorded over an interval of 1 second.
$L_{A1,1minute}$	The measure of the short duration high-level noises that cause sleep arousal. The noise level is measured as the percentile sound pressure level that is exceeded 1 per cent of measurement period with 'A' frequency weighting calculated by statistical analysis during a measurement time interval of 1 minute.
$L_{Aeq,t}$	Equivalent continuous sound pressure level - The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting.

L_{An} Percentile level - A measure of the fluctuation of the sound pressure level which is exceeded 'n' per cent of the observation time.

RBL Rating background level - The overall single figure background level representing each assessment period over the whole monitoring period determined by taking the median of the ABLs found for each assessment period.

SPL (dBA) Noise: Sound pressure level - The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by:

$$SPL = 10.\log10\ (p/po)^2$$

where p is the rms sound pressure in pascals and po is the sound reference pressure at 20 μPa. decibels.

SWL Sound power level - a measure of the energy emitted from a source as sound and is given by:

$$SWL = 10.\log10\ (W/W_o)$$

where W is the sound power in watts and W_o is the sound reference power at 10^{-12} watts.

APPENDIX B

INP Assessment Methodology

Appendix B – INP Assessment Methodology

Industrial Noise Policy

Responsibility for the control of noise emissions in NSW is vested in Local Government and the Office of Environment and Heritage (OEH). The *NSW EPA Industrial Noise Policy* (INP), 2000, provides a framework and methodology for deriving limit conditions for consent and licence conditions. Using this policy the OEH regulates premises that are scheduled under the *Protection of the Environment Operations Act 1997* (POEO Act).

The specific INP (EPA 2000) objectives are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve the noise amenity for specific land uses;
- to use the criteria as the basis for deriving project-specific noise levels;
- to promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consent or licence conditions that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The INP (EPA 2000) is designed for large and complex industrial sources and outlines processes designed to strike a feasible and reasonable balance between the operation of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

The application of the INP (EPA 2000) involves the following processes:

- determining the project-specific noise levels (PSNL) from intrusiveness and amenity based measurement of the existing background and ambient noise levels. For existing industrial operations, the underlying level of noise present in the ambient noise, should be determined excluding the noise source under investigation;
- predicting or measuring the noise levels produced by the development; and
- comparing the predicted noise levels with the project-specific noise levels and assessing the impacts.

Where the project-specific noise levels are predicted to be exceeded the INP (EPA 2000) provides guidelines on the assessment of feasible and reasonable noise mitigation strategies, including:

- 'weighing up' the benefit of the development against the social and environmental costs resulting from the noise impacts;
- establishment of achievable and agreed noise limits for the development in consultation with the consent authority; and
- undertaking performance monitoring of environmental noise levels to determine compliance with the consent and licence conditions.

INP Assessment Methodology

There are two criteria to consider when establishing project-specific noise levels for the assessment of industrial noise sources. These criteria are:

- **the intrusive noise criterion**, which is based on the background noise level plus 5 dB. The background noise level, or Rating Background Level (RBL), is determined in accordance with Section 3 of the INP (EPA 2000) and is based on the use of noise monitoring data or INP default RBLs (refer to INP (EPA 2000)), to establish the assessable background noise levels; and

- **the noise amenity criterion**, which is based on the recommended noise levels in the INP (EPA 2000) for prescribed land use. The recommended acceptable and maximum ambient noise levels are outlined in Table 2.1 of the INP (EPA 2000). Table 2.2 of the INP (EPA 2000) outlines the requirements for developments where the existing noise level from industrial noise sources is close to the acceptable noise level.

The relevant tables in Section 2 of the INP relating to the amenity criteria relevant to the Project are presented in **Table B.1** and **Table B.2**.

Table B.1 – Amenity Criteria – Recommended L_{Aeq} 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 dB(A)	55 dB(A)
		Evening	45 dB(A)	50 dB(A)
		Night	40 dB(A)	45 dB(A)
	Suburban	Day	55 dB(A)	60 dB(A)
		Evening	45 dB(A)	50 dB(A)
		Night	40 dB(A)	45 dB(A)
	Urban	Day	60 dB(A)	65 dB(A)
		Evening	50 dB(A)	55 dB(A)
		Night	45 dB(A)	50 dB(A)
	Urban/Industrial Interface - for existing situations only	Day	65 dB(A)	70 dB(A)
		Evening	55 dB(A)	60 dB(A)
		Night	50 dB(A)	55 dB(A)
Area specifically reserved for passive recreation	All	When in use	50 dB(A)	55 dB(A)
Active recreation area (School playground, golf course)	All	When in use	55 dB(A)	60 dB(A)
Commercial premises	All	When in use	65 dB(A)	70 dB(A)
Industrial premises	All	When in use	70 dB(A)	75 dB(A)

Source: Table 2.1, INP (EPA 2000)

Note 1: For Monday to Saturday, Daytime 7.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-7.00 am. On Sundays and Public Holidays, Daytime 8.00 am-6.00 pm; Evening 6.00 pm-10.00 pm; Night-time 10.00 pm-8.00 am.

Note 2: The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table B.2 – Modification to Acceptable Noise Level (ANL) to Account for Existing Levels of Industrial Noise

Total Existing LAeq Noise Level from Industrial Noise Sources	Maximum LAeq Noise Level for Noise from New Sources Alone, dB
≥ Acceptable noise level plus 2 dB	If existing noise level is likely to decrease in future acceptable noise level minus 10 dB If existing noise level is unlikely to decrease in future existing noise level minus 10 dB
Acceptable noise level plus 1 dB	Acceptable noise level minus 8 dB
Acceptable noise level	Acceptable noise level minus 8 dB
Acceptable noise level minus 1 dB	Acceptable noise level minus 6 dB
Acceptable noise level minus 2 dB	Acceptable noise level minus 4 dB
Acceptable noise level minus 3 dB	Acceptable noise level minus 3 dB
Acceptable noise level minus 4 dB	Acceptable noise level minus 2 dB
Acceptable noise level minus 5 dB	Acceptable noise level minus 2 dB
Acceptable noise level minus 6 dB	Acceptable noise level minus 1 dB
< Acceptable noise level minus 6 dB	Acceptable noise level

Source: Table 2.2, INP (EPA 2000)

Note 1: ANL = recommended acceptable L_{Aeq} noise level for the specific receiver.

In assessing the noise impacts from industrial sources at residential receivers both the intrusive and amenity criteria are considered. For each period (day, evening and night) the most stringent of either the intrusive or amenity criteria becomes the limiting criterion and forms the project-specific noise level for the industrial source.

If the existing ambient noise level is close to the acceptable noise level, a new source must be controlled to preserve the amenity of the surrounding area. If the overall noise level from the industrial source already exceeds the acceptable noise level for the affected area, the L_{Aeq} noise level from a new source should meet the conditions set out in **Table B.2** above.

INP Project-Specific Criteria

The INP (EPA, 2000) states that the criteria outlined in Tables 2.1 and 2.2 (refer to **Tables B.1** and **B.2** above) have been selected to protect at least 90 per cent of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90 per cent of the time. Provided the criteria in the INP (EPA 2000) are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

Table B.3 presents the methodology for assessing noise levels which may exceed the INP (EPA, 2000) project-specific noise assessment criteria.

Table B.3 – Noise Impact Assessment Methodology

Assessment Criterion	Project-Specific Criteria	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dB	≤ 5 dB above project-specific criteria	≥ 5 dB above project-specific criteria
Amenity	INP based on existing industrial level	≤ 5 dB above project-specific criteria	≥ 5 dB above project-specific criteria

For the purposes of assessing the potential noise impacts the project-specific, management and affectation criteria are further defined in the following sections.

<u>Project-Specific Criteria</u>

Most people in the broader community would generally consider exposure to noise levels that achieve the project-specific criteria to be acceptable.

<u>Noise Management Zone</u>

Depending on the degree of exceedance of the project-specific criteria (1 dB to 5 dB) noise impacts in this zone could range from negligible to moderate. It is recommended that management procedures be implemented including:

- prompt response to any issues of concern raised by community;
- noise monitoring on-site and within the community;
- refinement of on-site noise mitigation measures and plant operating procedures where practical;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with property holders.

<u>Noise Affectation Zone</u>

Exposure to noise levels corresponding to this zone (more than 5 dB above project-specific criteria) may be considered unacceptable by some property holders and implementation of the following measures may be required:

- discussions with relevant property holders to assess concerns and provide solutions;
- implementation of acoustical mitigation at receivers; and
- negotiated agreements with property holders.

Assessing Intrusiveness Criteria

The OEH has provided an application note for the assessment of the intrusiveness criteria such that the level for night time is no greater than the evening and evening is no greater than the daytime level (DECC July 2006). The application note is reproduced below.

When the RBL for Evening or Night is Higher than the RBL for Daytime
http://www.environment.nsw.gov.au/noise/applicnotesindustnoise.htm

The results of long term unattended background noise monitoring can sometimes determine that the calculated Rating Background Level (RBL) for the evening or night period is higher than the RBL for the daytime period. These situations can often arise due to increased noise from for example insects or frogs during the evening and night in the warmer months or due to temperature inversion conditions during winter. The objective of carrying out long-term background noise monitoring is to determine existing background noise levels at a location that are indicative of the entire year.

In determining project-specific noise levels from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific noise levels for a particular development, it is generally recommended that the intrusive noise level for evening be set at no greater than the intrusive noise level for daytime. The intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening. Alternative approaches to these recommendations may be adopted if appropriately justified.

Assessing Sleep Disturbance

The DECC have provided an application note for the assessment of sleep disturbance (DECC July 2006). The application note is reproduced below.

Sleep Disturbance

http://www.environment.nsw.gov.au/noise/applicnotesindustnoise.htm

Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.

DEC reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, DEC recognised that current sleep disturbance criterion of an $L_{A1,\ (1\ minute)}$ not exceeding the $L_{A90,\ (15\ minute)}$ by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DEC will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or $L_{A1,\ (1\ minute)}$, that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;
- time of day (normally between 10.00 pm and 7.00 am); and
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The $L_{A1,\ (1\ minute)}$ descriptor is meant to represent a maximum noise level measured under 'fast' time response. DEC will accept analysis based on either $L_{A1,\ (1\ minute)}$ or $L_{A,\ (Max)}$.

APPENDIX C

Environmental Noise Logger Monitoring Results

Appendix C – Environmental Noise Logger Monitoring Results

20/01/2012 to 27/01/2012 inclusive

The results of the unattended noise monitoring are presented graphically as weekly run charts in **Figure C.1** to **C.3**.

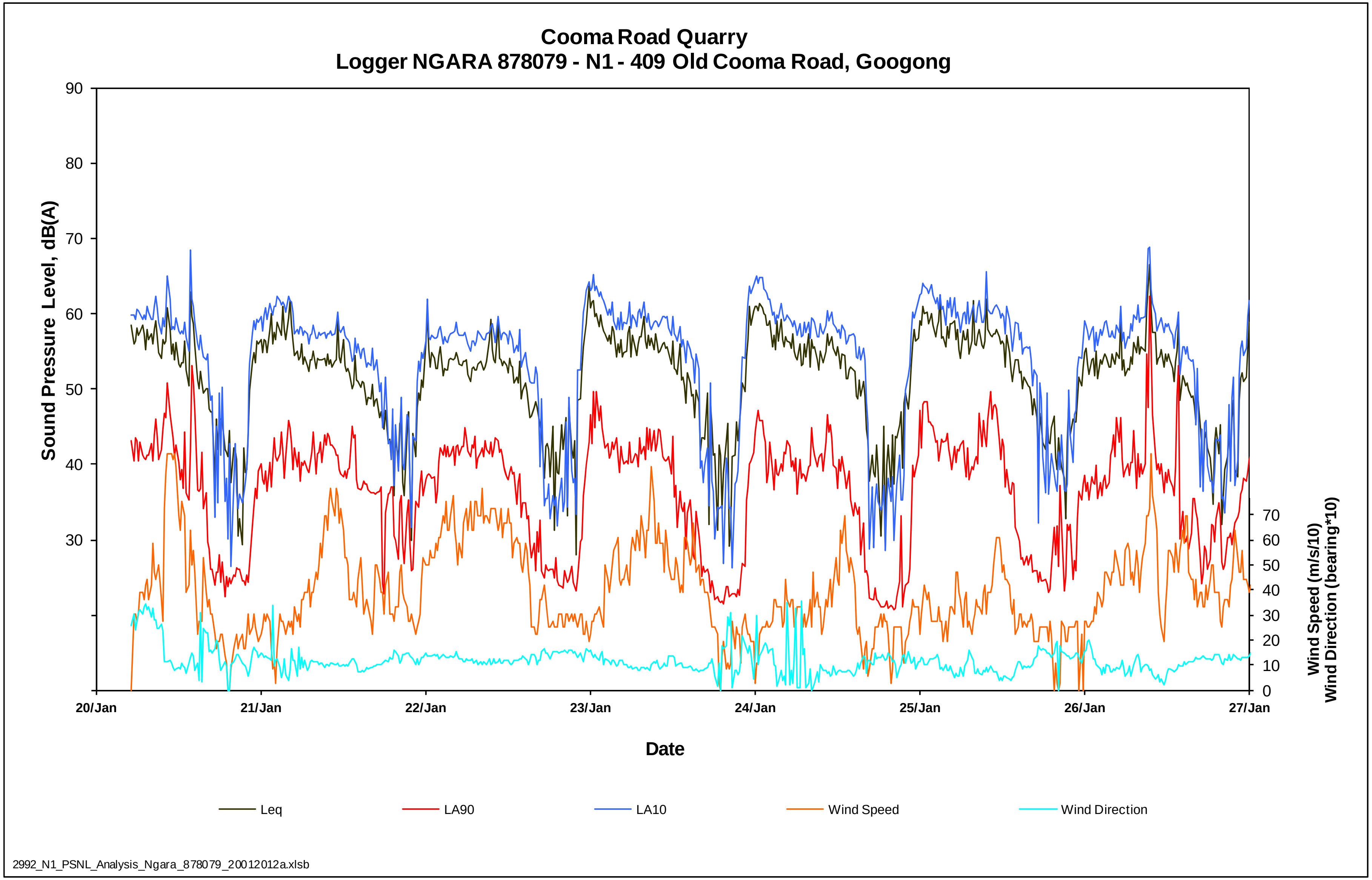

Figure C.1 – Raw Data Charts - N1, 409 Old Cooma Road, Googong

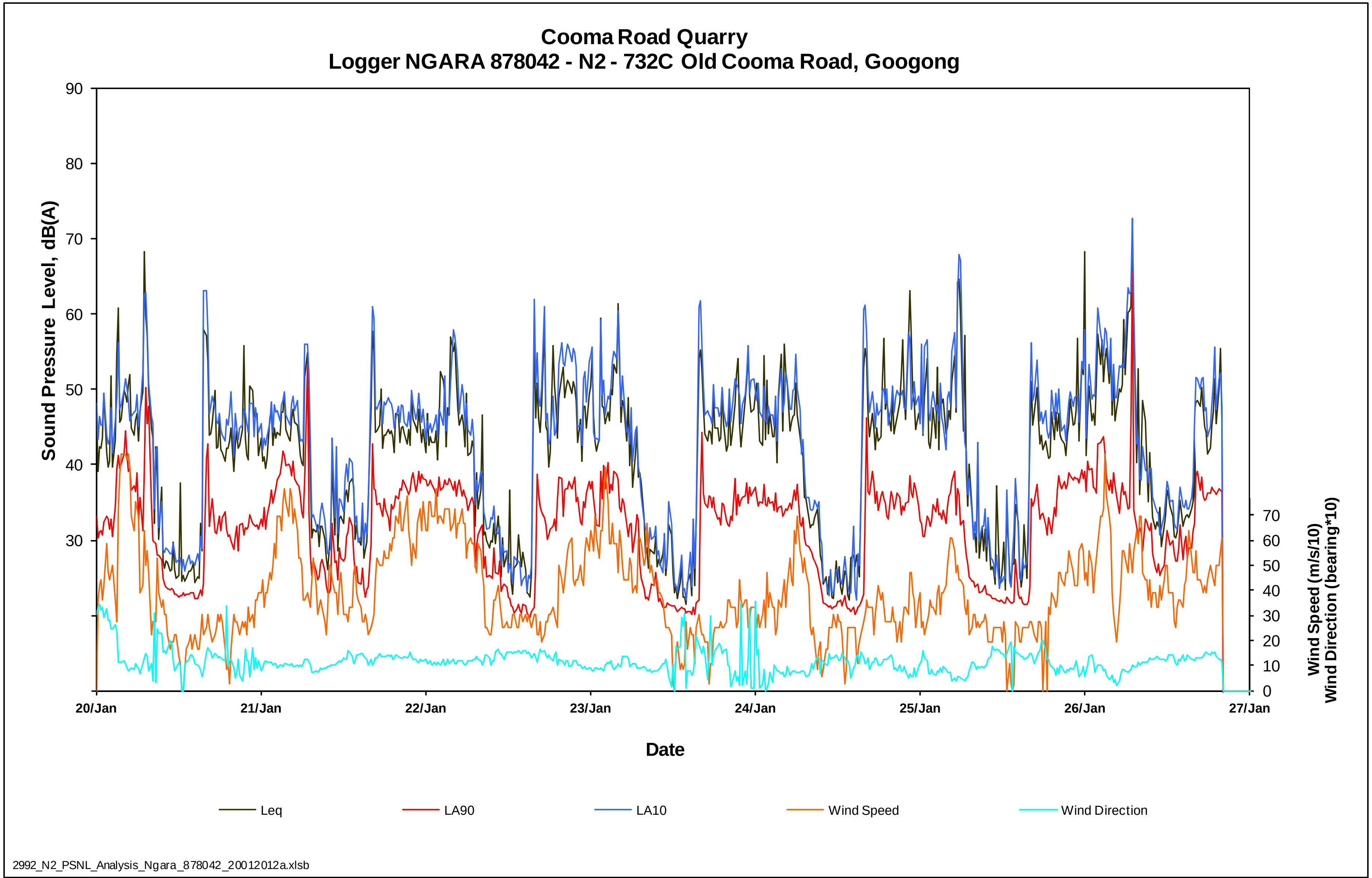

Figure C.2 – Run Chart for N2, 732c Old Cooma Road, Googong

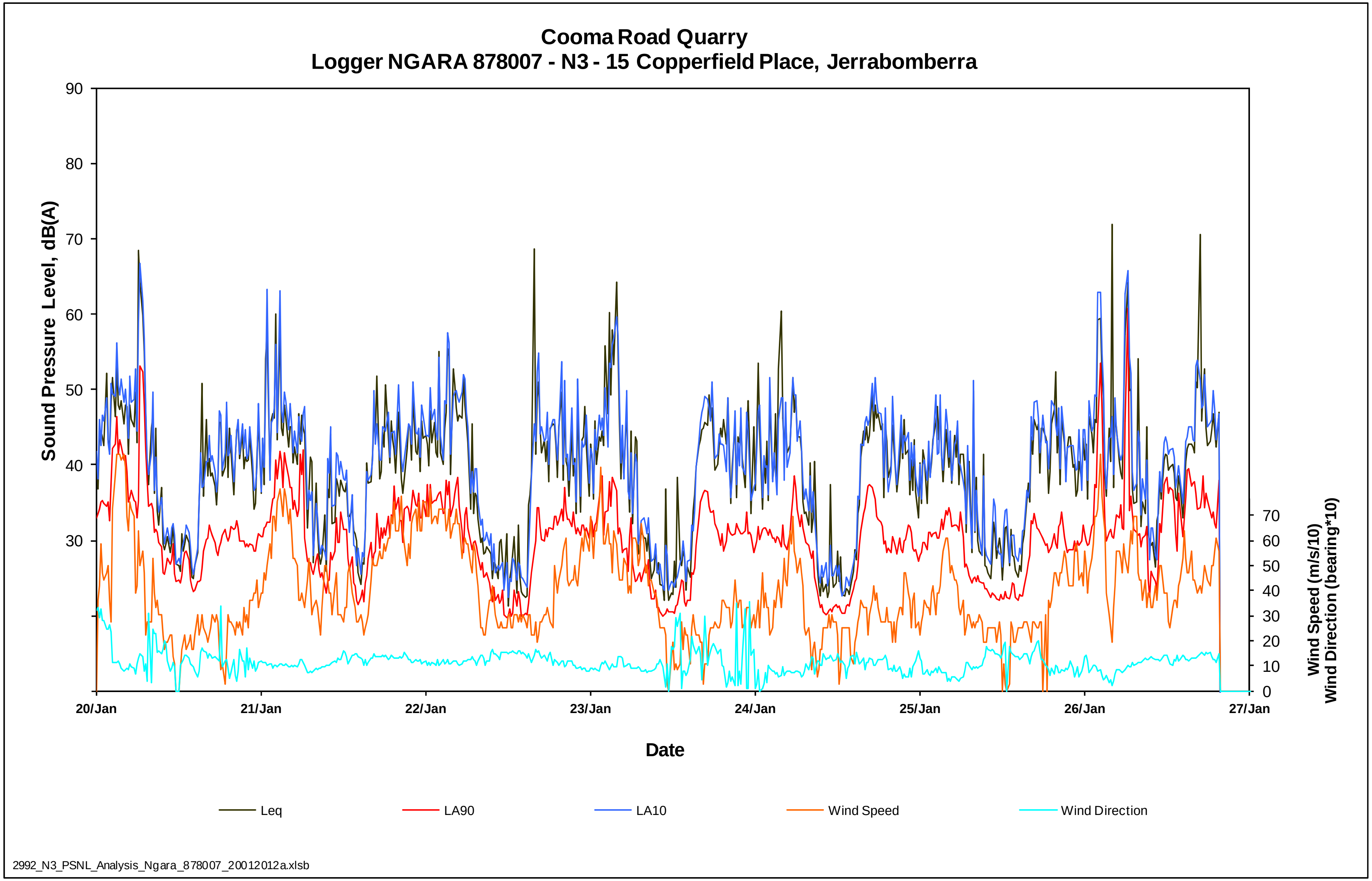

Figure C.3 – Run Chart for N3, 15 Copperfield Place, Jerrabomberra

APPENDIX D

Noise Mitigation Control Strategies

Appendix D – Noise Mitigation and Control Strategies

1.0 Expectation of the *NSW Industrial Noise Policy*, (EPA 2000)

Section 7 of the *NSW Industrial Noise Policy* (INP) (EPA 2000) notes that when the predicted noise impacts exceeds the project-specific noise levels, mitigation measures that will reduce noise levels to meet the project-specific noise levels need to be considered.

The INP (EPA 2000) identifies three main mitigation strategies for noise control:

1. Controlling noise at the source;
2. Controlling the transmission of noise; and
3. Controlling noise at the receiver.

The extent of management/mitigation required is determined by the degree of the predicted noise impact and exceedance of the project-specific noise levels.

2.0 Controlling Noise at the Source

2.1 Source Elimination

Where practical, a noise source could be replaced by an alternate process or item of equipment or machinery or even eliminated completely.

2.2 Best Management Practice

Best management practice (BMP) is the adoption of particular operational procedures that minimise noise while retaining productive efficiency. When an appropriate mitigation strategy that incorporates expensive engineering solutions is being considered, the extent to which cheaper, non engineering – oriented BMP can contribute to the required reduction of noise should be taken into account.

Application of BMP includes the following types of practice:

- siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise;
- where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently;
- keeping equipment well maintained;
- employing ‘quiet’ practices when operating equipment—for example, positioning idling trucks in appropriate areas; and/or
- running operator-education programs on the effects of noise and the use of quiet work practices.

2.3 Best Available Technology Economically Achievable

Allied with BMP is the use of the 'best available technology economically achievable' (BATEA). With BATEA, equipment, plant and machinery that produce noise incorporate the most advanced and affordable technology to minimise noise output. Affordability is not necessarily determined by the price of the technology alone. Increased productivity may also result from using more advanced equipment, offsetting the initial outlays (for example, 'quieter' equipment that can be operated over extended hours). Often old or badly designed equipment can be a major source of noise.

Where BMP fails to achieve the required noise reduction by itself, the BATEA approach should then be considered. Examples of uses of BATEA are:

- adjusting reversing alarms on heavy equipment to make them 'smarter', by limiting acoustic range to the immediate danger area;
- using equipment with efficient muffler design;
- using quieter engines, such as electric instead of internal combustion;
- using efficient enclosures for noise sources;
- using high-pressure hydraulic systems to split rock, instead of hydraulic or pneumatic hammers; and/ or
- damping or lining metal trays or bins.

3.0 Controlling Noise in Transmission

Barriers are more effective if they are near the source or the receiver. Their effectiveness is also determined by the height, the materials used (absorptive or reflective) and the density of the material used. The relationship of these design features to attenuation is well documented. Barriers can take a number of forms including free-standing walls along roads, grass or earth mounds or bunds and trenches or cuttings within which noise sources are sited. Barriers are employed when source and receiver control is either impractical or too costly.

4.0 Controlling Noise at the Receiver

Noise controls at the receiver are expensive when many receivers require treatment, but may be attractive and cost-effective where only a few receivers would be affected by noise and the alternatives are even more expensive source controls. Cost effectiveness is also determined by the increase in future potential receivers where residential land is being developed near the noise source.

The two major controls are insulation and double glazing of windows. For these to be effective, the residence needs air conditioning, or a sophisticated ventilation system that does not compromise the effect of the noise insulation.

Negotiations with landholder range from setting up mutually agreeable private agreement to the more extreme option of property acquisition.

5.0 Noise Mitigation Strategies

Selecting an appropriate strategy for a proposed development or alterations to an existing development involves the following steps:

- Determining the noise reduction required to achieve the project-specific noise levels.
- Identifying the specific characteristics of the industry and the site that would indicate a preference for specified measures.
- Examining the mitigation strategy chosen by similar industries on similar sites with similar requirements for noise reduction; and considering that strategy's appropriateness for the subject development.
- Considering the range of noise-control measures available.
- Considering community preferences for particular strategies. This is especially important when the community has particular sensitivities to noise.

The preference ranking (from most preferred to least preferred) for particular strategies is typically:

- **Land-use controls** – When such strategic planning land use decisions are available to the proponent or regulatory authority(s), this long-term strategy is preferable to other measures as it separates noise-producing industries from sensitive areas and avoids more expensive short-term measures.
- **Control at the source (BMP and BATEA)** – Used in conjunction with each other and other strategies, source control strategies are the best after land-use planning, as they serve to reduce the noise output of the source so that the surrounding environment is protected against noise.
- **Control in transmission** – This is the next best strategy to controlling noise at the source as it serves to reduce the noise level at the receiver but not necessarily the environment surrounding the source.
- **Receiver controls** – This is the least-preferred option, as it protects only the internal environment of the receiver and not the external noise environment. Proponents will take into account the cost-effectiveness of strategies in determining how much noise reduction is affordable. A proponent's choice of a particular strategy is likely to have unique features due to the economics of the industry and site specific technical considerations.

The above steps and the range of measures described in the chapter can be used as a guide in assessing the strength of the proponent's mitigation proposals.

Where a proposed mitigation strategy will not achieve the desired noise reduction and leaves a remaining noise impact, the problem needs to be solved by negotiation.

Appendix 11

Traffic Impact Assessment

TRAFFIC IMPACT ASSESSMENT

FOR

COOMA ROAD QUARRY

CONTINUED OPERATIONS

Ref. 11094r

22 August 2012

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EXECUTIVE SUMMARY

This report documents the assessment of the traffic impacts of a proposal for the continued operations of the Cooma Road Quarry for an additional 20 years from 2015.

The quarry is located in Old Cooma Road south of Edwin Land Parkway. Queanbeyan City Council is proposing to upgrade the road network in the area in and around the quarry to cater for future traffic growth associated with the new towns of Googong and Tralee, as well as background traffic growth. As part of these works the Quarry's Access Road with Old Cooma Road will be upgraded (Stage 1 of Old Cooma Road Realignment Works). This is expected to occur in 2012 / 2013.This intersection will be the only intersection that provides access to Cooma Road Quarry from Old Cooma Road.

The existing quarry employs 20 plant employees plus truck drivers and operates from 6am to 6pm Monday to Saturday, with approval for sales and transportation of 1.0 mtpa of quarry product.

The existing quarry operation generates:

- *Some 130 two way vehicle trips per day for light vehicles (employees and visitors) and small trucks up to 4.5 tonnes based on 65 inbound trips and 65 outbound trips; and*

- *224 two way heavy vehicle truck trips per day (on an average day for 1.0 mtpa) based on 112 inbound truck trips and 112 outbound truck trips*

Ninety (90%) of the quarry product travels towards the Canberra area, with the other 10% travelling to Bungendore and the NSW South Coast.

This is not expected to change significantly under the continued operations (the Project).

For the Project, approval is being sought to increase the sales and transportation from the quarry to 1.5 mtpa, as well as extend quarry the hours of operation to 10pm on Monday to Friday (ie. 6am – 10pm Mon – Fri). Saturday will remain at 6am – 6pm. The additional hours on Monday to Friday is being sought to cater for special orders / circumstances where night delivery of the quarry product is required (such as roadworks).

Under the Project, plant employees are expected to increase by 4-6 employees (ie. total of 24 – 26 plant employees), as well as a similar increase in the number of truck drivers.

For 1.5 mtpa the Project is expected to generate

- *160 two way light vehicle and small truck trips per day associated with employees, visitors and some sales transported in light vehicles (ie. 80 in / 80 out)*

- *334 two way heavy vehicle trips per day (on an average day) (ie. 167 in / 167 out)*

The additional traffic generation from project based on 1.5mtpa is estimated to be:

- *30 two way light vehicle trips per day based on 15 inbound trips and 15 outbound trips; and*

- *110 two way heavy vehicle trips per day based on 55 inbound trips and 55 outbound trips.*

During a busy hour at the quarry, the additional traffic from the Project would result in an additional 16 two way heavy vehicle trips (ie. 8 in / 8 out) plus 3 light vehicle trips.

The assessment based on SIDRA traffic modelling has found that the proposed new Quarry Access Road intersection with Old Cooma Road will have a good to very good level of service with the additional traffic from the Project in the immediate future with plenty of spare capacity to cater for future traffic growth in Old Cooma Road.

On the wider road network that are used by the quarry trucks, the additional traffic from the Project will comprise a very small proportion of total traffic and the assessment concludes that the impact of this additional traffic on these roads and principal intersections would be relatively minor.

In the longer term the proposed upgrades to the road network planned by Queanbeyan City Council will cater for future traffic growth including the small proportion of traffic that will be generated by the quarry.

The Project is not expected to have any negative impacts on road safety. The assessment of the most recent three year crash history for the road network used by quarry trucks, does not indicate that heavy (truck) vehicles are overrepresented in crash statistics.

The planned road upgrades will assist in managing / addressing future road safety issues associated with the overall future traffic growth on the road network, including the relatively small increase in traffic volumes, due to the Project.

The construction impacts of the Project are not expected to be significant and in terms of the combined traffic generation for the quarry (ie. construction traffic plus operational traffic) would not exceed the traffic generation of the operational phase of the Project for any day, or, hour of the day.

CONTENTS

ILLUSTRATIONS

APPENDICES

1.0 INTRODUCTION

1.1 Background

Holcim (Australia) Pty Ltd (Holcim Australia) currently operates a hard rock quarry, known as Cooma Road Quarry, located approximately 11 kilometres south-east of Canberra and 6 kilometres south of Queanbeyan in New South Wales (refer to **Figure 1**). The quarry has been in operation since 1959 and is considered a significant local supplier of granite and dacite hard rock aggregates to the region.

The current development consent (DA371/94), granted in 1995 by Queanbeyan City Council, will expire in 2015, however, there will still be rock resources available for quarrying at the site. Holcim Australia proposes to extend the life of the quarry and extend the approved extraction boundary to allow for extraction of the remaining resources at the site. The proposed Project will also aim to increase the annual maximum extraction limit from 1 million tonnes per annum (mtpa) to 1.5 mtpa. The proposed Project will provide important construction resources to support the planned future growth and development of the Canberra and Queanbeyan regions.

The proposed Project is a State significant development as defined under the State *Environmental Planning Policy (State and Regional Development) 2011* and requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 Authority Requirements

As part of the preparation of the Traffic Impact Assessment for the Continued Operations of Cooma Road Quarry (“The Project”) consideration was given to the requirements of the Director General (of the Department of Planning), Roads and Maritime Services (RMS) and Queanbeyan City Council including any key issues identified by these authorities.

<u>Director General’s Requirements</u>

The Director General’s Requirements included:

(i) accurate predictions of the road traffic generated by the project;
(ii) an assessment of potential traffic impacts on the safety and efficiency of the road network; and
(iii) a detailed description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network in the surrounding area over the life of the project.

<u>Roads and Maritime Services (RMS)</u>

The RMS requested that the following matters should be addressed / included in a traffic impact study:

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FIGURE 1

COOMA ROAD QUARRY, QUEANBEYAN

SITE LOCATION

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(i) A description of the increase in traffic generation as a result of the expansion of operations, including the total number of employees and drivers required to operate at the maximum level permitted.

(ii) A description of the traffic impacts associated with the development including a plan showing existing and proposed access arrangements.

(iii) Clarification of the sight distance available at the existing / proposed access / accesses.

(iv) The identification of suitable infrastructure required to ameliorate any traffic impacts and safety impacts associated with the development.

Queanbeyan City Council

Queanbeyan City Council requested the following:

(i) The identification and development of the transport routes including possible new routes;

(ii) Traffic impacts caused by the Project on the Queanbeyan Road network, with regard to traffic volumes and Level of Service;

(iii) The performance of the proposed new intersection of the proposed Old Cooma Road deviation and the Old Road that will be used by Quarry trucks;

(iv) Assessment of the amenity of residents along all haulage routes; and

(v) Undertake pavement condition surveys on the nominated haulage routes to determine a pavement rehabilitation strategy.

Items (iv) and (v) are addressed elsewhere in the EIS.

With regard to the item (ii) Council requested the use of the TRACKS model to examine the impacts of the Project on the road network. The TRACKS model is a strategic network traffic model normally used in studies of large land use changes and or future new road links. It would not normally be used for small land use changes such as the Project, as the impacts of the Project, will be relatively minor away from the immediate area adjacent the quarry and will be dispersed over a large area.

As the existing and future transport routes of the quarry trucks are known, as well as the proportion of trucks using these routes, assigning the traffic generated by the Project is relatively straight forward.

The SIDRA traffic model has been used to examine the impacts of the additional traffic from the Project at the principal intersections, on the road network. SIDRA is the appropriate traffic model to examine these impacts.

2.0 PROPOSED PROJECT

Cooma Road Quarry has been in operation since 1959 and is a significant local supplier of granite and dacite hard rock aggregates to the region. An approval for the current Cooma Road Quarry operations was granted in 1995 by Queanbeyan City Council for a period of 20 years and will expire in 2015. The existing quarry operations are shown on **Figure 2**. The proposed Project will involve extending the life of the quarry to allow for extraction of the remaining resources on site.

In order to extract the remaining resources, Holcim Australia is proposing to extend the currently approved extraction boundary. The proposed extraction area extension includes resources beneath part of the existing quarry infrastructure area (see **Figure 2**). In order to accommodate the proposed extraction boundary increase, the existing workshop, truck parking area and temporary stockpiles will be relocated to the north to an area approved for disturbance by the existing consent (refer to **Figure 2**). The proposed Project will also seek to increase the maximum annual extraction limit to 1.5 mtpa from the presently approved 1 mtpa. Approval is also sought to receive quarry materials from other sites for crushing and screening (as required) and then sale. Total product (including from both material quarried from the site and from materials imported to the site) will be maintained within the total production limit of 1.5 mtpa. Total truck movements will be managed so that truck movements associated with bringing quarry materials to the site do not increase total truck movements beyond those resulting from transport of 1.5 mtpa product.

Access to the site will continue to be via the existing access point off Old Cooma Road (refer to **Figure 2**). Queanbeyan City Council has approval to realign this section of Old Cooma Road further east, resulting in the majority of traffic bypassing the quarry. The existing section of Old Cooma Road will remain as the direct access road to the quarry site and extraction area.

Holcim Australia also propose to introduce a mobile pug mill as part of the proposed Project to assist in meeting customer demands for different types of product and also to undertake recycling of surplus concrete material for reuse as product.

Table 2.1 provides a comparison of the currently approved Cooma Road Quarry to the proposed Project.

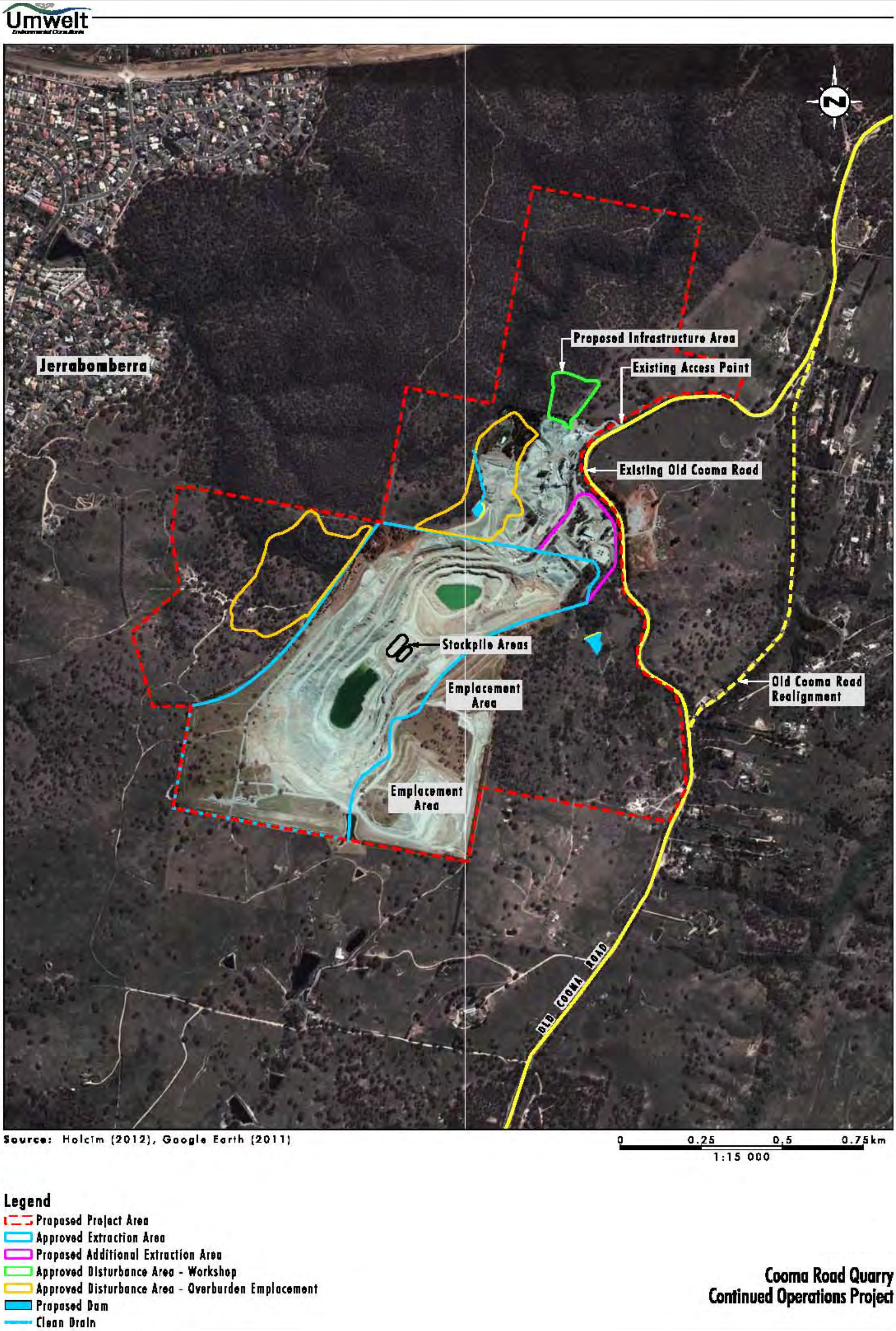

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FIGURE 2

COOMA ROAD QUARRY, QUEANBEYAN

EXISTING AND PROPOSED QUARRY OPERATIONS

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TABLE 2.1

COMPARISON OF CURRENTLY APPROVED COOMA ROAD QUARRY AND THE PROPOSED PROJECT

Major Project Components / Aspects	Currently Approved Cooma Road Quarry	Proposed Project
Quarry Life	Quarry operations to cease October 2015.	Additional 20 years of quarry life until 2035.
Limits on Production	1 mtpa	1.5 mtpa
Quarry Footprint	As shown on **Figure 2**	Extension of quarry pit within the existing disturbed quarry infrastructure area as shown on **Figure 2.**
Overburden Emplacement Areas	As shown on **Figure 2**	No change. Existing overburden emplacement areas contain sufficient capacity for continued operations.
Hours of Operation	Current operating hours are 6am to 6pm Monday to Saturday. General maintenance and returning delivery truck movements permitted until 10pm Monday to Saturday.	Increase the hours of operation to 6am to 10pm Monday to Friday and continue existing hours of 6am to 6pm Saturday. Primary crushing restricted to 6am – 6pm Monday to Saturday. Increased hours are to allow for increased flexibility to supply material for certain projects and to accommodate the increased extraction rate.
Transport	Road transportation of 1 Mtpa. See Section 4.1 for current traffic generation.	Road transportation of 1.5 Mtpa. See Section 4.2 for details.
Employment	Current employment is 20 operational employees plus 13 full time road transport drivers and up to 30 road transport contractors.	Proposed employment is 24-26 operational employees, plus up to 17 full time road transport drivers and up to 45 road transport contractors
Infrastructure	As shown on **Figure 2**	Relocate workshop, truck parking and temporary stockpiles to accommodate extension of extraction boundary (refer to **Figure 2**). Addition of mobile pug mill.

Major Project Components / Aspects	Currently Approved Cooma Road Quarry	Proposed Project
Site Access	Existing access as approved in Old Cooma Road.	No change. Continued use of existing access. After realignment of Old Cooma Road, access to the quarry will be from Council designed southern access road.
Concrete Recycling for re-use as Product	Not currently undertaken	Commence recycling of clean surplus concrete material on site using the existing processing infrastructure for re-use as product.

The existing transport routes include:

- Old Cooma Road, north of the quarry / Cooma Street / Lowe Street (MR 584) and Rutledge Street / Crawford Road to the Kings Highway (MR 51);
- Southbar Road (from Cooma Road) and Lanyon Drive (MR 52); and
- Old Cooma Road (MR 584) south of the quarry (occasional route only).

The proposed transport routes will include the existing transport routes above plus:

- Edwin Land Parkway following its construction and extension to Cooma Street and Tompsitt Drive to Lanyon Drive.
- In the longer term, some quarry trucks may also use the future Ellerton Drive Extension (in lieu of Cooma Street/Lowe Street to Kings Highway) following its construction between Edwin Land Parkway at Cooma Street and Ellerton Drive.

The existing and proposed future transport routes are shown in **Figure 3**.

Currently some 75% of the quarry product from the quarry is transported by Holcim to its concrete batching plants or other customers and the remaining 25% of the quarry product are ex bin sales.

Approximately 90% of product is transported towards the ACT (Canberra) area and the remaining 10% towards Bungendore / NSW south coast area.

This is not expected to change significantly over the 20 years of the proposed quarry extension.

Quarries typically have their highest traffic generation during the AM morning period between opening time normally around 6am and 12 midday. The AM peak hour normally represents the busiest peak hour.

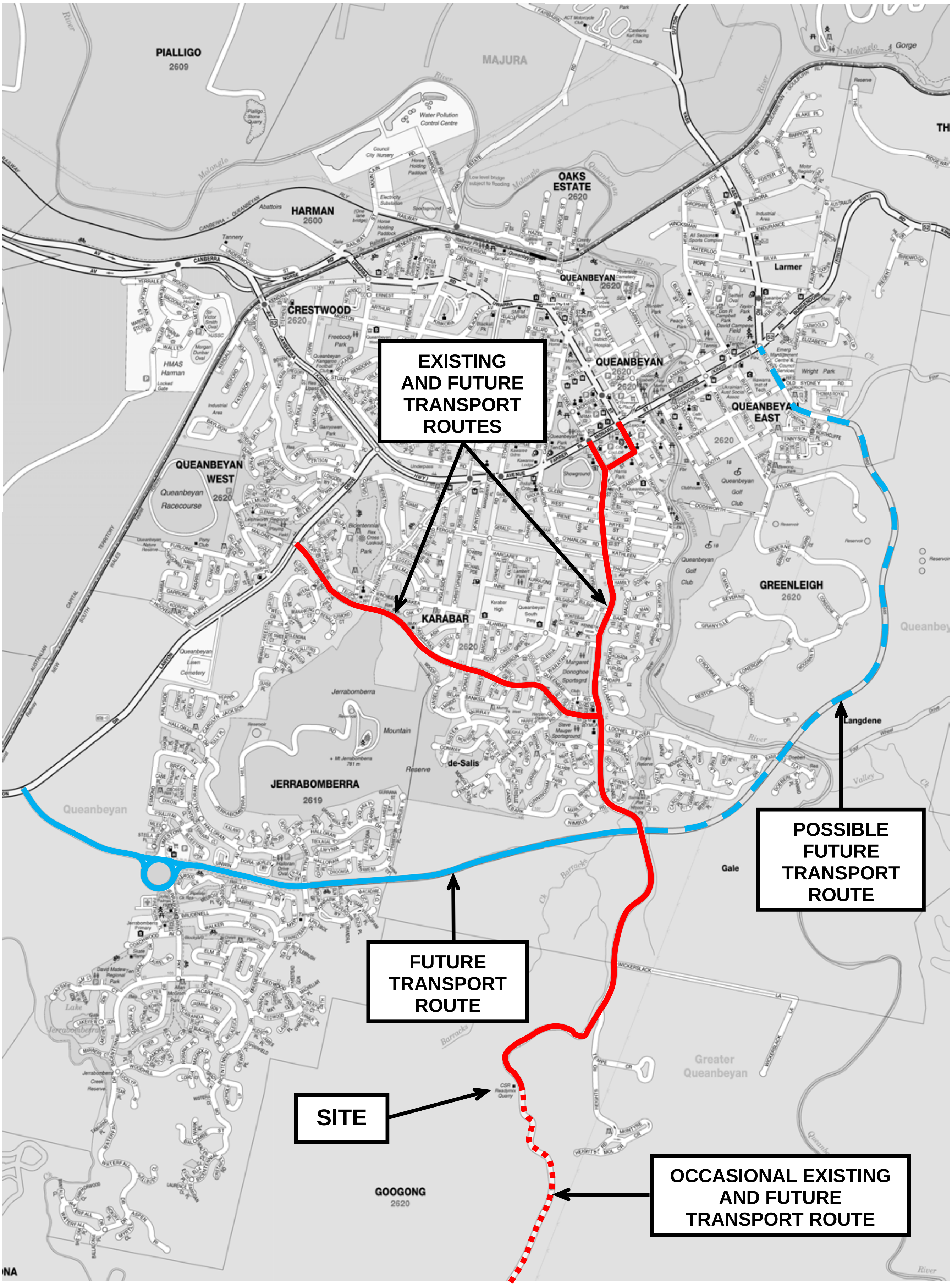

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FIGURE 3

COOMA ROAD QUARRY, QUEANBEYAN

EXISTING AND PROPOSED FUTURE TRANSPORT ROUTES

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3.0 EXISTING AND FUTURE CONDITIONS

3.1 Principal Road Network

The principal road network that services the existing quarry (**Figures 1 and 3**) includes:

- Old Cooma Road/Cooma Street/Lowe Street (MR 584) and Rutledge Street/Crawford Street;
- Southbar Road and Lanyon Drive;
- Old Cooma Road (south of the quarry); and
- Kings Highway.

The above roads form the principal transport routes used by product trucks from the quarry.

3.2 Description of Existing Roads and Intersections

3.2.1 Old Cooma Road/Cooma Street/Lowe Street (MR 584) and Rutledge Street/Crawford Street

These roads are used by quarry product trucks as the main route travelling between the quarry and the Kings Highway to reach the areas of Fishwick, Mitchell, Gungahlin, Bungendore and NSW South Coast.

A portion of this route (Old Cooma Road and the southern section of Cooma Street) is also used to Southbar Road by trucks when travelling to and from the Hume area, as well as for some deliveries to Fishwick.

The first section of the route between the quarry and the Edwin Land Parkway Extension (which is currently under construction) is a two lane winding rural road. This section is to be replaced and upgraded by the Old Cooma Road realignment proposal.

Cooma Street, north of the Proposed Edwin Land Parkway passes through urban areas and generally provides for one travel lane in each direction with a combination of parking lanes in midblock locations, and turning lanes at intersections. Sections of the road are divided with a median. Intersection treatments include traffic signals and seagull treatments at major intersections and priority and sign control at minor intersections.

Cooma Street intersects with Lowe Street and Rutledge Street just south of the Kings Highway at a roundabout intersection.

Lowe Street (part of MR 584) and Rutledge Street and Crawford Street are town roads in Queanbeyan Town Centre that provide access to Kings Highway.

Both Lowe Street and Crawford Street are controlled by traffic signals at their intersections with Kings Highway and the Rutledge Street/Crawford Street intersection is controlled by a roundabout.

The speed limit along the route is 70km/h in Old Cooma Road south of the Proposed Edwin Land Parkway, 60km/h in Cooma Street between the Parkway and West Avenue and 50km/h in Cooma Street north of West Avenue and in Lowe Street, Rutledge Street and Crawford Street.

A school zone is provided in Lowe Street and a section of Cooma Street, just south of Lowe Street.

Formal and informal pedestrian crossing facilities are provided in the urban section of the route between Southbar Road and Kings Highway by way of signalised crossings, pedestrian crossings, pedestrian refuge islands and the median between Southbar Road and Thorpe Street, which allows pedestrians to stage a crossing of the road.

Old Cooma Road/Cooma Street/Lowe Street is an existing bus route. Section 3.6 provides further details.

3.2.2 Southbar Road and Lanyon Drive (MR 52)

Southbar Road and Lanyon Drive (MR 52) is used by a proportion of product trucks travelling to and from the Hume area, and for a portion of deliveries to Fishwick.

Southbar Road between Cooma Street and Kinsella Street is a divided road providing a wide travel lane in each direction, as well as right turn bays at the intersections. The section from Kinsella Street to Lanyon Drive is predominantly a two lane undivided urban road, with sealed shoulders.

The intersection of Southbar Road/Cooma Street is controlled by traffic signals and other major intersections have roundabout control including the intersection of Southbar Road/Lanyon Drive. Minor intersections in Southbar Road are subject to priority or Stop Sign control. The intersection of Donald Road / Southbar Road has three (3) way stop sign control.

The speed limit in Southbar Road is 60km/h.

The median in the divided road section provides informal pedestrian crossing facilities which allow pedestrians to stage their crossings. Several pedestrian/cyclist refuges are provided in the undivided road section between Kinsella Street and Lanyon Drive. Sections of Southbar Road are used by school buses, but no pick up/set down movements occur in Southbar Road.

Lanyon Road (MR 52) is a four lane divided state road that links between Kings Highway in the north and Monaro Highway at Hume in the south.

The speed limit in Lanyon Drive is 60km/h and 70km/h in the northern section and 80km/h between south of Southbar Road and Monaro Highway. There is a high level of traffic management implemented along Lanyon Drive, including intersection treatments, (roundabouts and turning bays at conventional intersections), as well as wide shoulders / breakdown lanes and cyclist facilities.

The use of Southbar Road route is expected to reduce, once Edwin Land Parkway is extended to Old Cooma Road.

3.2.3 Kings Highway (MR 51)

The Kings Highway (MR 51) east and west of Crawford Street and Lowe Street forms part of the existing transport routes for product quarry trucks travelling towards the

Bungendore/South Coast areas (east of Crawford Street) and north to Fishwick and Mitchell/Gungahlin areas.

Kings Highway is a state highway and has a high level of traffic management implemented along its length. In the urban area of Queanbeyan the speed limit in the Kings Highway is 60km/h.

3.2.4 Old Cooma Road (MR 584) South of the Quarry

Old Cooma Road (MR 584) south of the quarry is a two lane rural road which connects to Monaro Highway approximately 15km south of the quarry. Old Cooma Road is also used by school buses.

The section immediately south of the quarry to Googong Road (approximately 3km in length) will be realigned and improved by Queanbeyan Council as part of the Old Cooma Road realignment scheme.

Currently this section of Old Cooma Road is used as a local and relatively infrequent transport route.

The construction of the proposed new Googong township which will be accessed from Googong Dam Road will increase the use of the realigned section of Old Cooma Road between the quarry and Googong Dam Road, by quarry product trucks, once work on the new town begins.

Until this occurs, the use of Old Cooma Road south of Googong Road is expected to remain an infrequent transport route.

3.3 Future Road Network Changes

3.3.1 Proposed Road Changes

The planned road network changes include:

- The realignment of Old Cooma Road;
- The extension of Edwin Land Parkway; and
- Proposed future Ellerton Drive.

A description of the proposed works is outlined below.

3.3.2 Realignment of Old Cooma Road

A new four lane dual carriageway road will be constructed in 2 stages to realign Old Cooma Road. This realignment and upgrade will provide a better link between Queanbeyan and the new township of Googong. The realignment is shown in **Appendix 1**.

The upgraded road will extend from the new Edwin Land Parkway / Old Cooma Road intersection (south of Karabar) through to Googong Dam Road (which is the entrance to the new Googong township).

Stage 1 is a 1.5km long realignment of Old Cooma Road. It will be a three lane road, including a southbound climbing lane between the Quarry Access Road (which is the current Old Cooma Road section) and the southern end of Talpa Heights, and is scheduled to commence in mid 2012 and require approximately 7 months to complete. This new road will include street lighting at the new Heights Road intersection and an upgrade to the entrance to Talpa Road. The new intersection that will provide access to Cooma Road Quarry is described in Section 4.3.3 of the report.

Stage 2 will involve a 4.5km long duplication of Old Cooma Road from Edwin Land Parkway at Karabar to the new Googong township. This will deliver a four lane dual carriageway for the full length of the duplication. This Stage is scheduled for completion by 2031. This new section of road will include street lighting at the Wickerslack Lane intersection.

Additional works are planned in the Stage 2 duplication to provide an off-road cycle and pedestrian path to join the new Googong township with Queanbeyan to provide a safer environment for pedestrians and cyclists.

Associated activities include the construction of noise barriers and landscaping.

3.3.3 Extension of Edwin Land Parkway

This road is currently being constructed and is expected to open in mid 2012.

The new two lane single carriageway road will link Jerrabomberra to Old Cooma Road at Karabar. This road will extend from the existing termination point of Edwin Land Parkway located at the roundabout on Numeralia Drive / Stringybark Drive in Jerrabomberra and connect through to Old Cooma Road just south of Candlebark Road past Barracks Creek Bridge in Karabar.

The road will have a single carriageway to match the existing Edwin Land Parkway, with the exception of an additional slow lane for the climb from Old Cooma Road.

The new section of Edwin Land Parkway will be approximately 2.3km in length and will have street lighting along the entire alignment. There will be an off-road cycle and pedestrian path constructed to join with the existing path on Edwin Land Parkway. Work will also include realignment of Old Cooma Road. This will involve a new crossing over Barracks Creek, straightening the road and raising the road approximately one metre. This will improve the alignment and safety of Old Cooma Road. The roundabout on Numeralia Drive / Stringybark Drive will remain in place. Additional works in relation to existing pedestrian facilities on Edwin Land Parkway will be undertaken to provide a safer environment.

The work on the road will also include the construction of noise barriers and landscaping.

The intersection of Old Cooma Road and Edwin Land Parkway will be a controlled intersection using traffic lights.

When the new road link is open, it will provide a high standard arterial through route between Old Cooma Road and Lanyon Drive. The existing sections of the route include Edwin Land Parkway between Jerrabomberra Parkway / Limestone Drive and Strinkybark Drive which is a 2 lane single carriageway road and Tompsitt Drive between

Lanyon Drive and Jerrabomberra Parkway / Limestone Drive which is a dual lane (2 lanes in each direction) dual carriageway road.

The existing section also provides a shared bicycle and pedestrian path in Edwin Land Parkway and wide sealed shoulders that can be used by cyclists in Tompsitt Drive.

School buses use the existing section of Edwin Land Parkway and Tompsitt Drive, but no set down pick up movements occur in these roads.

3.3.4 Proposed Future Ellerton Drive Extension

The proposed link will commence at the current end of Ellerton Drive and link to the new Edwin Land Parkway intersection at Old Cooma Road. It is envisaged that the road will generally be a two lane road, with provisions for cyclists.

A 2008 traffic study by consultants Gabites Porter found that the proposed Ellerton Drive extension is required to cater for future traffic growth associated with the new towns and subdivisions as well as natural traffic growth in the Queanbeyan area. The new road is expected to reduce the future impact of the additional traffic using Cooma Street.

Council is currently progressing the detail design, but has no date for construction. The traffic study identified that the new road would be required by 2021, but Council has indicated that further analysis of the timing is needed, due to the delay on the start of the Googong and Tralee greenfield developments.

Council, in February 2012, identified that it would be in excess of 5 years before all environment studies, legislative approvals, design matters and land ownership matters would be finalised, regardless of when funding is received for construction.

3.3.5 Future Intersection Upgrades

As part of the above works, a number of principal intersections will be upgraded to cater for the future traffic volumes projected to use the road network. Several other intersections have also been identified for future improvements. It is expected that these intersections will be upgraded as required, before 2031.

3.4 Existing Traffic Conditions on the Road Network

3.4.1 Existing Traffic Volumes

Traffic volumes using the principal road network adjacent to Old Cooma Road Quarry were collected as part of this assessment.

This included daily volumes and vehicle classification counts on Old Cooma Road / Cooma Street as well as intersection counts in the AM period between 6am and 11am at a number of intersections. **Figure 4** shows the count locations.

The daily volume and vehicle classification counts were undertaken between 19–26 March 2012. The AM period intersection counts were undertaken on 22 March 2012 and 13 June 2012. **Figures 5 and 6** show a summary of daily volume and vehicle classification counts **(Figure 5)** and the weekday AM peak hour traffic counts **(Figure 6).**

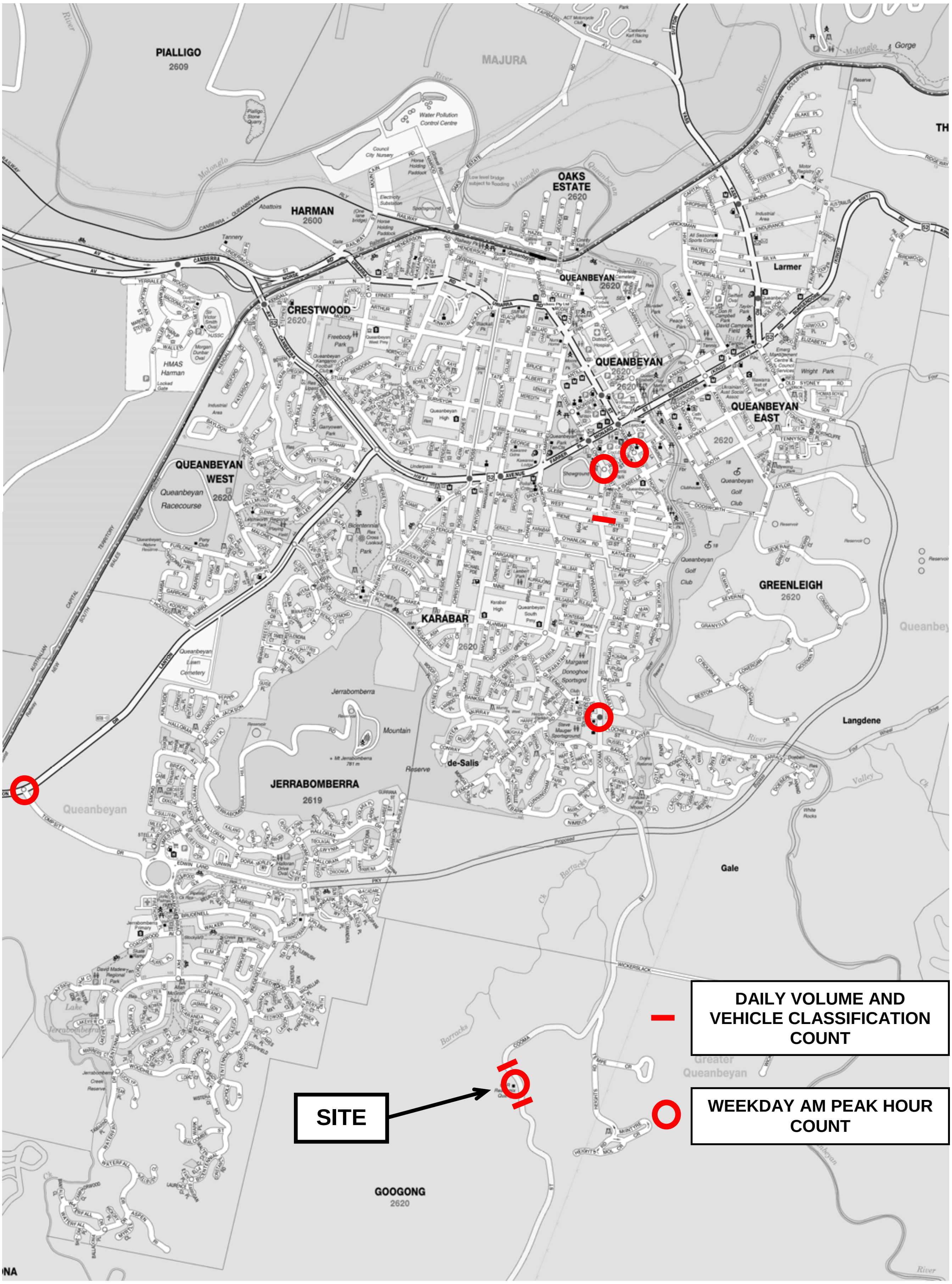

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FIGURE 4

COOMA ROAD QUARRY, QUEANBEYAN

TRAFFIC COUNT LOCATIONS

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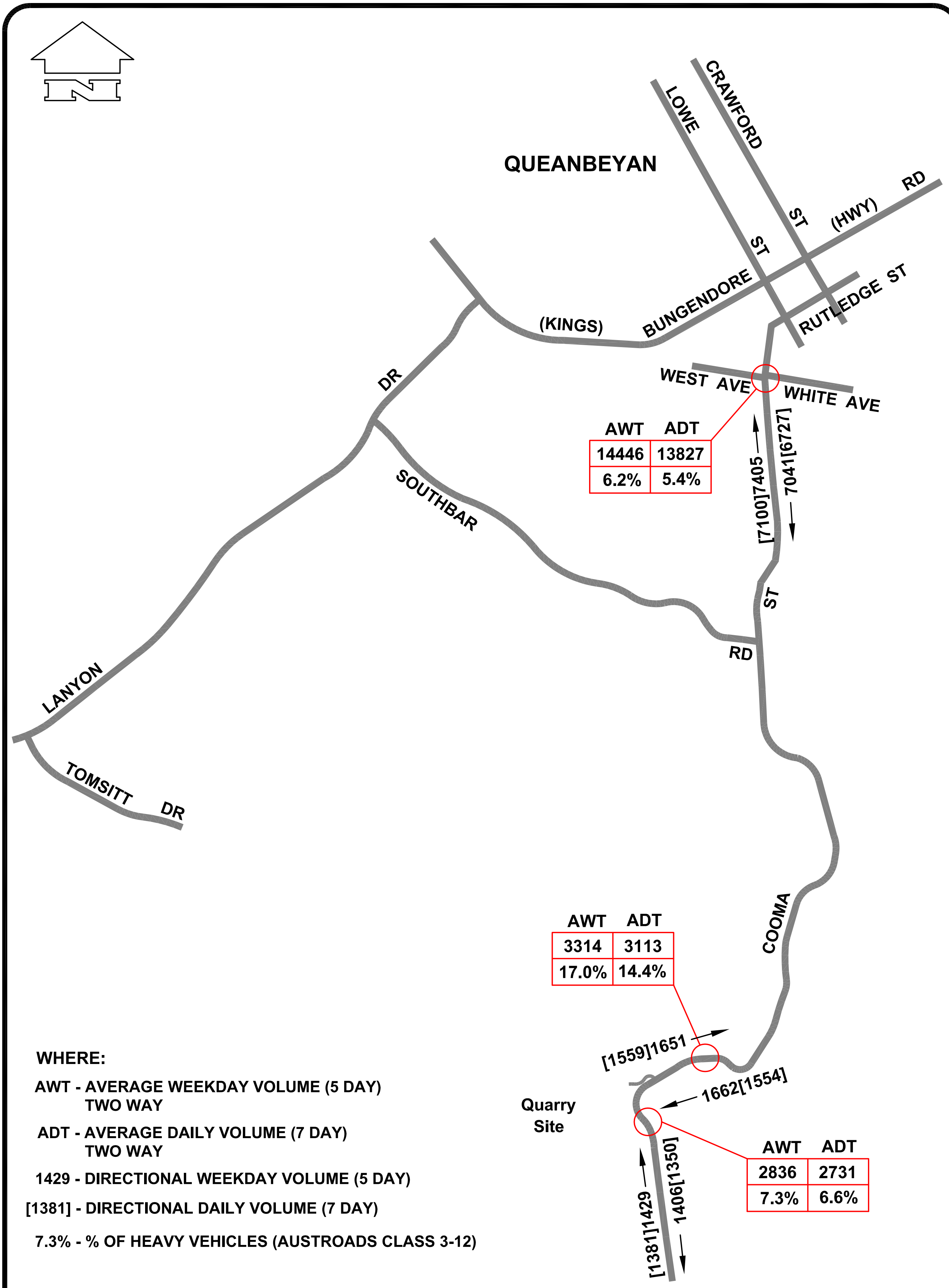

WHERE:

AWT - AVERAGE WEEKDAY VOLUME (5 DAY) TWO WAY

ADT - AVERAGE DAILY VOLUME (7 DAY) TWO WAY

1429 - DIRECTIONAL WEEKDAY VOLUME (5 DAY)

[1381] - DIRECTIONAL DAILY VOLUME (7 DAY)

7.3% - % OF HEAVY VEHICLES (AUSTROADS CLASS 3-12)

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FIGURE 5

COOMA ROAD QUARRY
QUEANBEYAN

EXISTING DAILY VOLUMES AND VEHICLE CLASSIFICATION

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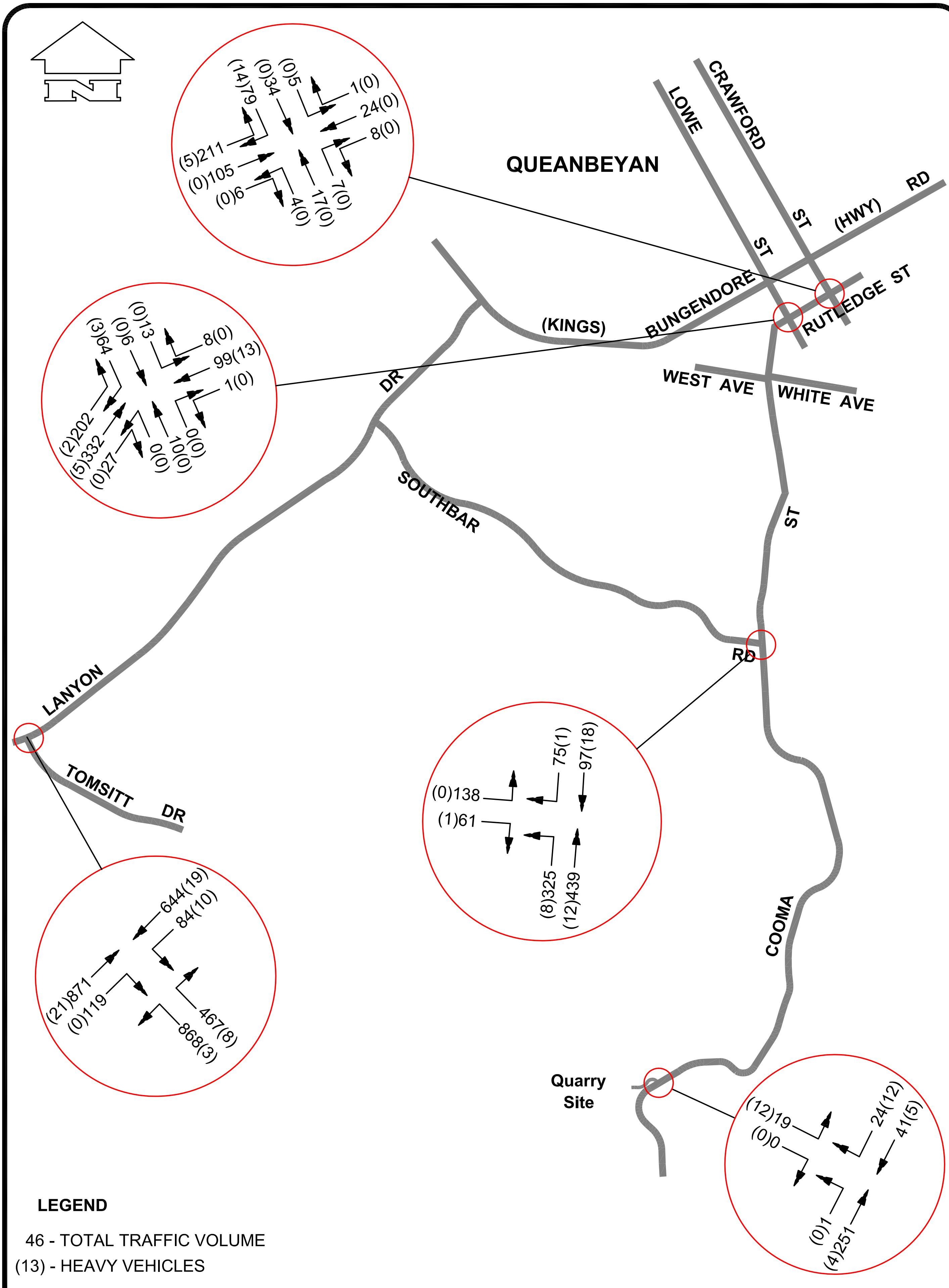

LEGEND

46 - TOTAL TRAFFIC VOLUME

(13) - HEAVY VEHICLES

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FIGURE 6

COOMA ROAD QUARRY
QUEANBEYAN

EXISTING AM PEAK HOUR TRAFFIC VOLUMES 7.45 - 8.45AM

JOB NO. 11094

In addition to the above counts published and unpublished RMS (Roads and Maritime Services) traffic volume data for a number of locations on state roads was obtained from the RMS.

3.4.2 Old Cooma Road / Cooma Street / Lowe Street / Rutledge Street / Crawford Street

Daily Volumes

Tables 3.1 and 3.2 show the daily traffic volumes including heavy vehicles using Old Cooma Road (north of the Quarry) and Cooma Street, south of West Avenue.

Reference to Table 3.1 shows that on a typical weekday (5 day average) Old Cooma Road north of the Holcim's quarry carries two way traffic volumes of 3314 vehicles per day (vpd). Heavy vehicles (Austroad Classes 3 to 12) total 564 vpd. Heavy vehicles represent around 17.0% of the total volumes using this section of Old Cooma Road on an average weekday.

TABLE 3.1

OLD COOMA ROAD NORTH OF HOLCIM QUARRY
5 DAY AVERAGE AND 7 DAY AVERAGE TRAFFIC VOLUMES
AND VEHICLE CLASSIFICATION

Direction of Travel	5 Day Average (Weekday)			7 Day Average (ADT)		
	Light[1]	Heavy[2]	Total	Light[1]	Heavy[2]	Total
North	1366	285	1651	1333	228	1559
South	1383	279	1662	1332	222	1554
Total	2749	564	3314	2665	448	3113
Proportion of Total	83.0%	17.0%	100%	85.6%	14.4%	100%

Source: Traffic Counts 19 to 26 March 2012

[1]Light Vehicles – Austroads 1 and 2 vehicle classification and motorbikes
[2]Heavy Vehicles – Austroads 3-12 vehicle classifications

Reference to Table 3.2 shows that on a typical weekday (5 day average) Cooma Street south of West Avenue in Queanbeyan carries two way traffic volumes of 14,446 vehicles (vpd). Heavy vehicles (Austroad Classes 3 to 12) total 894 vpd. Heavy vehicles represent around 6.2% of the total volumes using this section of Cooma Street on an average weekday.

TABLE 3.2

COOMA STREET SOUTH OF WEST AVENUE
5 DAY AVERAGE AND 7 DAY AVERAGE TRAFFIC VOLUMES
AND VEHICLE CLASSIFICATION

Direction of Travel	5 Day Average (Weekday)			7 Day Average (ADT)		
	Light[1]	Heavy[2]	Total	Light[1]	Heavy[2]	Total
North	6954	451	7405	6727	373	7100
South	6598	443	7041	6356	371	6727
Total	13552	894	14446	13083	744	13827
Proportion of Total	93.8%	6.2%	100%	94.6%	5.4%	100%

Source: Traffic Counts 19 to 26 March 2012

[1]Light Vehicles – Austroads 1 and 2 vehicle classification and motorbikes
[2]Heavy Vehicles – Austroads 3-12 vehicle classifications

<u>Weekday AM Peak Hour Traffic Volumes</u>

Figure 5 shows the AM peak hour traffic volumes at several intersections along the Old Cooma Road / Cooma Street / Lowe Street / Rutledge Street / Crawford Street route.

Reference to **Figure 5** shows the following:

- Old Cooma Road, north of the Holcim's quarry carries two way AM peak hour volumes of 335 vph of which 33 vehicles are heavy vehicles (ie. 9.9% of the total). The northbound traffic movement is the peak direction with 270 vph, of which 16 are heavy vehicles.

- Cooma Street, south of Southbar Road carries two way AM peak hour volumes of 922 vph of which 39 vehicles are heavy vehicles (ie. 4.2% of the total). The northbound movement (ie. the peak direction) accounted for 764 vph including 20 heavy vehicles.

- Cooma Street, north of Southbar Road carries two way AM peak hour volumes of 749 vph of which 31 vehicles are heavy vehicles (ie. 4.1% of the total). The northbound movement accounted for 577 vph including 12 heavy vehicles.

- Cooma Street south of Lowe Street carries two way AM peak hour volumes of 724 vph of which 22 vehicles are heavy vehicles (ie. 3.0% of the total). The northbound movement into Lowe Street and Rutledge Street accounts for 561 vph of including 7 heavy vehicles.

- Lowe Street, north of Rutledge Street carries two way AM peak hour volumes of 303 vph of which 4 vehicles are heavy vehicles (ie 1.3% of total). The northbound movement accounts for 220 vph including 2 heavy vehicles.

- Rutledge Street, east of Lowe Street carries two way AM peak hour volumes of 453 vph of which 18 vehicles are heavy vehicles (ie 4.0% of total). The eastbound movement which is the peak direction accounts for 345 vph including 5 heavy vehicles.

- Crawford Street, north of Rutledge Street carries two way AM peak hour volumes of 347 vph of which 19 vehicles are heavy vehicles (ie 5.5% of total). The northbound direction accounts 229 vehicles including 5 heavy vehicles and is the peak direction.

3.4.3 Southbar Road and Lanyon Drive

Daily Volumes

There are no published daily volumes available for Southbar Road.

The latest available RMS ADT (Annual Daily Traffic) volume for Lanyon Drive, north of Hoover Road (which is south of Southbar Road) for 2008 was 15,338 axle pairs (ie passenger car unit equivalents).

Weekday AM Peak Hour Traffic Volumes

During the weekday AM peak hour Southbar Road, west of Cooma Street **(Figure 6)** carries two way peak hour volumes of 599 vph, of which 10 vehicles are heavy vehicles. (ie 1.7% of the total). The eastbound direction accounts for 400 vehicles including 9 heavy vehicles, and is the peak direction.

During the weekday AM peak hour (7.30am – 8.30am) Lanyon Drive, north of Tompsitt Drive, carries two way peak hour volumes of 2065 vph, of which 58 vehicles are heavy vehicles (ie 2.8% of the total). The peak direction, which is northbound accounts for some 1,337 vph, including 29 heavy vehicles.

3.4.4 Kings Highway

Daily Volumes

The latest available daily ADT volumes for Kings Highway have been obtained from the RMS for the year 2008 and are reproduced below.

- Kings Highway, west of Lanyon Drive – 22,026 axle pairs (ie passenger car equivalents).
- Kings Highway, east of Collett Street – 20,066 axle pairs (ie passenger car equivalents).
- Kings Highway, near Faunce Street (east of Yass Road) – 8,303 vehicles.

Weekday AM Peak Hour Traffic Volumes

There are no weekday AM peak hour volumes available for Kings Highway.

3.4.4 Old Cooma Road, South of Cooma Road Quarry

Daily Volumes

Table 3.3 shows the daily traffic volumes including heavy vehicles using Old Cooma Road, south of the quarry.

Reference to Table 3.3 shows that on a typical weekday (5 day average) Old Cooma Road south of the Holcim quarry carries two way traffic volumes of 2836 vehicles per day (vpd). Heavy vehicles (Austroad Classes 3 to 12) total 208 vpd. Heavy vehicles represent around 7.3% of the total volumes using this section of Old Cooma Road on an average weekday.

TABLE 3.3

**OLD COOMA ROAD SOUTH OF COOMA ROAD QUARRY
5 DAY AVERAGE AND 7 DAY AVERAGE TRAFFIC VOLUMES
AND VEHICLE CLASSIFICATION**

Direction of Travel	5 Day Average (Weekday)			7 Day Average (ADT)		
	Light[1]	Heavy[2]	Total	Light[1]	Heavy[2]	Total
North	1321	108	1429	1287	94	1381
South	1307	100	1407	1263	87	1350
Total	2628	208	2836	2550	181	2731
Proportion of Total	92.7%	7.3%	100%	93.4%	6.6%	100%

Source: Traffic Counts 19 to 26 March 2012

[1]Light Vehicles – Austroads 1 and 2 vehicle classification and motorbikes
[2]Heavy Vehicles – Austroads 3-12 vehicle classifications

<u>Weekday AM Peak Hour Volumes</u>

Old Cooma Road, south of Cooma Road Quarry carries two way AM peak hour volumes of 293 vph of which 10 vehicles are heavy vehicles (ie. 3.1% of the total). The northbound traffic movement is the peak direction with 252 vph, of which 4 are heavy vehicles. **Figure 6** refers.

3.5 Road Safety

Road crash statistics were provided by the RMS for sections of the road network adjacent to the Cooma Road Quarry for the 3 year period from 1 October 2008 to 30 September 2011.

A summary of the analysis of these statistics is outlined below.

3.5.1 Old Cooma Road, North of the Quarry / Cooma Street / Lowe Street / Rutledge Street / Crawford Street Route

There was one (1) crash, which was an injury crash in Lowe Street between Cooma Street and Kings Highway, in this period. The crash involved cars only (ie. no heavy truck vehicles).

In Rutledge Street (between Lowe Street and Crawford Street) and in Crawford Street (between Rutledge Street and Kings Highway) there were 2 cross traffic accidents at the intersection of Crawford Street / Rutledge Street, one (1) of which was an injury accident. Neither of these crashes involved heavy (truck) vehicles. There were no midblock crashes in these two streets.

In Cooma Street and Old Cooma Road between Lowe Street and Edwin Land Parkway there was a total of 21 crashes, including 8 injury crashes. Crash types included rear end, off road / out of control and intersection accidents as well as miscellaneous crashes. There was one (1) crash involving a heavy (truck) vehicle which was a rear end injury crash at the intersection of Southbar Road.

In the section of Old Cooma Road between Edwin Land Parkway and the Quarry Entrance there were a total of 10 crashes, 4 of which were injury crashes. The majority of these were off road / out of control accidents plus several other accident types. None of these crashes involved heavy (truck) vehicles.

There were no crashes at the intersection of Old Cooma Road / Quarry Entrance.

As previously noted, this section of Old Cooma Road is to be realigned and upgraded and it is expected that the new alignment will assist in improving road safety in this section.

3.5.2 Old Cooma Road, South of the Quarry

In the section of Old Cooma Road between the Quarry Entrance and Googong Dam Road there were a total of 9 crashes, 3 of which were injury accidents.

This section of Old Cooma Road will also be upgraded as part of the realignment proposal which should also assist in improving road safety.

There were also 9 crashes including 5 injury accidents in the section of Old Cooma Road between Googong Dam Road and Monaro Highway.

For the total length of Old Cooma Road, south of the Quarry, most of the crashes were run off road / out of control accidents, plus others including hit animal, head on (non overtaking and overtaking) and driveway crashes.

Heavy (truck) vehicles were not involved in any of the accidents and as noted above, no vehicle accidents occurred in Old Cooma Road at the Quarry Entrance.

3.5.3 Southbar Road

There were a total of 15 crashes including 5 injury crashes in Southbar Road between Cooma Road and Lanyon Drive.

Most of these crashes were intersection type accidents which occurred along the length of the route, plus several run off the road / out of control crashes.

None of these crashes involved heavy (truck) vehicles.

3.5.3 Edwin Land Parkway and Tompsitt Drive

There were no reported crashes in Edwin Land Parkway in the 3 year period.

There were 3 crashes including one (1) injury accident in Tompsitt Drive. These crashes were run off road crashes as well as one (1) rear end crash. None of these crashes involved heavy (truck) vehicles.

3.5.4 Principal Intersections on the State Road Network

Crash statistics were also obtained for those intersections used by trucks (or will be used in the future) from Old Cooma Road quarry. The intersections include:

- Kings Highway / Lowe Street
- Kings Highway / Crawford Street
- Kings Highway / Lanyon Road
- Lanyon Road / Southbar Road
- Lanyon Road / Tompsitt Drive

Kings Highway / Lowe Street

There were 7 crashes including 2 injury crashes at this intersection. The majority of crashes were rear end type plus several crashes involving vehicles leaving parking spaces.

There was one (1) crash involving a heavy (truck) vehicle in the Kings Highway, east of the intersection which involved a car leaving a parking space and a truck proceeding east. This was a non injury accident.

Kings Highway / Crawford Street

There were 6 crashes including one (1) injury crash at this intersection. Crash types included several rear end crashes, plus cross traffic, opposing turns and overtaking in the same direction.

None of the crashes involved heavy (truck) vehicles.

Kings Highway / Lanyon Road

There were 7 crashes near this intersection including one (1) injury crash. None of these crashes occurred within 45 metres of the intersection, with all of the crashes occurring between 49 – 100 metres from the intersection.

All of the crashes were rear end crashes, or, off road / out of control crashes. None of the crashes involved heavy (truck) vehicles.

Lanyon Road / Southbar Road

There were no reported crashes at this intersection for the 3 year period.

Lanyon Road / Tompsitt Drive

There were a total of 8 crashes including 3 injury crashes at this intersection in the 3 year period. Crash types included, rear end, off road / out of control, cross traffic, plus crashes with temporary road works equipment.

None of these crashes involved heavy (truck) vehicles.

A number of the crashes occurred during the period when the intersection was being upgraded as part of the upgrade of Lanyon Drive, which was completed and opened to traffic in April 2011.

3.5.5 Summary

In concluding the assessment of the crash statistics for the 3 year period indicates that:

- There were no crashes at the intersection of Cooma Road Quarry Vehicle Access Road / Old Cooma Road.

- The majority (nearly all) of the crashes across the road network involved light vehicles. Heavy (truck) vehicles were only involved in a very small number of crashes.

- The proposed realignment of Old Cooma Road between Edwin Land Parkway and Googong Road should address the adverse crash history in this section of Old Cooma Road.

Other than these works there is no particular pattern to the type of crashes that occurred across the road network that could be easily treated through remedial works in a cost effective way.

3.6 Bus Routes

Deannes Bus Services operates a number of bus routes in Queanbeyan, on roads that are and may be also used in the future by Cooma Road Quarry trucks. This includes:

- 835 bus service which operates along Kings Highway between Crawford Street and Lanyon Drive and Edwin Land Parkway/Tompsitt Drive between Stringybark Drive and Lanyon Drive;

- 836 bus service which operates along Kings Highway between Lowe Street and Crawford Street and Lowe Street/Cooma Street to Fegus Road;

- 839 bus service which operates along Kings Highway between Lowe Street and Crawford Street and Lowe Street/Cooma Street to Candlebark Road; and

- 840 bus service which operates along Crawford Street and Rutledge Street and in the Karabar area, subject to demand.

Deannes Bus Service also operates a number of school bus services along Old Cooma Road/Cooma Street/Lowe Street as well as in sections of Southbar Road, Edwin Land Parkway/Tompsitt Drive.

The latter routes of Southbar Road, Edwin Land Parkway/Tompsitt Drive do not have pick ups or set downs on these roads. Pick up and set downs on the Lowe Street/Cooma Street are at the designated bus stops and along Old Cooma Road at locations approved by Queanbeyan City Council.

4.0 ASSESSMENT OF TRAFFIC IMPACTS OF PROJECT

4.1 Existing Traffic Generation

Based on Holcim's gate records for the busiest days in the week of 19 – 24 March 2012 the existing average traffic generation of the quarry is:

- A total of 130 two way trips per day for cars, light vehicles and some small trucks up to 4.5 tonnes based on 65 inbound trips / 65 outbound trips. This included employee trips (plant plus drivers), visitors and some ex bin sales in small vehicles.

- A total of 217 (say 218) two way product truck trips (truck and dog trailers and semi trailers) based on 109 inbound trips / 109 outbound trips.

The daily traffic generation of product trucks at 1.0 mtpa (million tonnes per annum) based on 300 days of sales and transportation and average loads of 30 tonnes is 112 loads per day ie. 224 truck trips (112 inbound trucks / 112 outbound trucks).

Hourly traffic generation is calculated to be:

- 10 loads ie. 20 truck trips (10 inbound trucks / 10 outbound trucks) during an average hour; and

- 16 loads ie. 32 truck trips (16 inbound trucks / 16 outbound trucks) during a busy hour.

4.2 Traffic Generation of Project

The project seeks approval for production of up to 1.5 mtpa of quarry product.

Additional employees will include 4-6 plant employees plus additional truck drivers, which are likely to be of the same order, resulting in a total of 8-12 additional staff.

Light vehicle trips, assuming that some increase in visitors and ex bin sales in smaller vehicles also occurs, is estimated to be a total of 160 two way trips per day based on 80 trips in / 80 trips out which is an increase of 30 light vehicle trips per day (ie. 15 in / 15 out).

Product truck trips for 1.5 mtpa based on sales and transport for 300 days per year with average load of 30 tonnes, (same as the existing loads) calculates to 167 loads per day or 334 truck movements per day, between 6am and 6pm.

There will be no increase in truck trips due to the mobile pug mill or the concrete recycling operation, as neither of these would result in any separate additional traffic generation. Concrete for recycling will be delivered as part of the back trip from product trucks making deliveries to customers or the concrete batching plants and the pug mill allows variations to quarry product, which has been factored into the overall sales and traffic generation for the project.

Whilst the proposal seeks to increase its hours of operation on Monday to Friday to up to 10pm (ie. 6am – 10pm) the additional 4 hours from 6pm to 10pm will only be for special circumstances, where delivery of product on a particular job / project is required out of normal work hours.

For the purpose of calculating the traffic generation of the product trucks it is assumed this will occur between 6am to 6pm.

The hourly traffic generation of the product trucks due to the project is calculated to be:

- 14 loads ie. 28 truck trips (14 inbound trucks / 14 outbound trucks) during an average hour; and
- 24 loads (48 truck trips) 24 inbound trucks / 24 outbound trucks during a busy hour.

4.3 Assessment of Impacts of Project Associated with Increased Traffic Levels

4.3.1 Traffic Increases

Tables 4.1 and 4.2 show the increase in product truck trips per day and per hour from the project.

TABLE 4.1

INCREASE IN DAILY PRODUCT TRUCK LOADS AND TRIPS WITH PROJECT

Existing Approval 1.0 mtpa		Project Up to 1.5 mtpa		Difference	
Loads	Two Way Trips	Loads	Two Way Trips	Loads	Two Way Trips
112	240	167	334	+55	+110

TABLE 4.2

INCREASE IN HOURLY PRODUCT TRUCK LOADS AND TRIPS WITH PROJECT

	Existing Approval 1.0 mtpa		Project Up to 1.5 mtpa		Difference	
	Loads	Two Way Trips	Loads	Two Way Trips	Loads	Two Way Trips
Average Hour	10	20	14	28	+4	+8
Busy Hour	16	32	24	48	+8	+16

As noted in Section 4.2 the increase in light vehicle trips for the project is 30 trips per day (ie. 15 in / 15 out) most of which will be associated with additional staff.

4.3.2 Road Network

The assessment of the traffic impacts of the project on the road network has been undertaken for the year 2013 when it is assumed that Stage 1 of the Old Cooma Road realignment would be completed and the Edwin Land Parkway Extension will also be operating.

A portion of the existing trips generated by the quarry currently using Southbar Road are expected to transfer to Edwin Land Parkway once this road is opened.

Weekday Volumes

Figure 7 shows the additional weekday traffic volumes from the project on an average day where sales are at 1.5 mtpa assigned to the road network.

Tables 4.3, 4.4 and 4.5 show the changes in the weekday two way traffic volumes using Old Cooma Road/Cooma Street at various locations, due to the additional vehicles generated by the project.

Reference to these tables and **Figure 7** shows that:

- The increase in two way weekday traffic volumes south of the quarry will be 4 heavy vehicles per day, which will have virtually no impact on traffic conditions in this section of Old Cooma Road. See Table 4.3.

- North of the quarry in Old Cooma Road, the increase in two way traffic volumes due to the project will be a total of 136 vehicle trips per day of which 106 trips will be heavy vehicle trips. Table 4.4 refers. This will increase the proportion of heavy vehicles using this section of Old Cooma Road by 2.4% and represents an increase in total volumes of 3.9%. These are considered to be relatively small increases which would result in relatively small traffic impacts.

In Cooma Street, south of West Street the increase in two way volumes on a weekday due to the project would be 90 vehicles, of which 72 vehicle trips would be heavy vehicles. This will increase the proportion of heavy vehicles using this section of Cooma Street by 0.5% and total two way volumes by 0.6%. The change in the number of heavy vehicles and total traffic, on a weekday as a result of the project are considered to be relatively small when compared to the existing volumes and traffic composition using this section of Cooma Street, on weekdays. Table 4.5 refers.

Some 40 vehicles per day including 34 heavy vehicles from the quarry are expected to use Edwin Land Parkway and Tompsitt Drive on a weekday with the project in place. Edwin Land Parkway and Tompsitt Drive have been designed and constructed as a high standard arterial road and as such will easily accommodate the quarry traffic.

No increase in traffic using Southbar Road is expected due to the project.

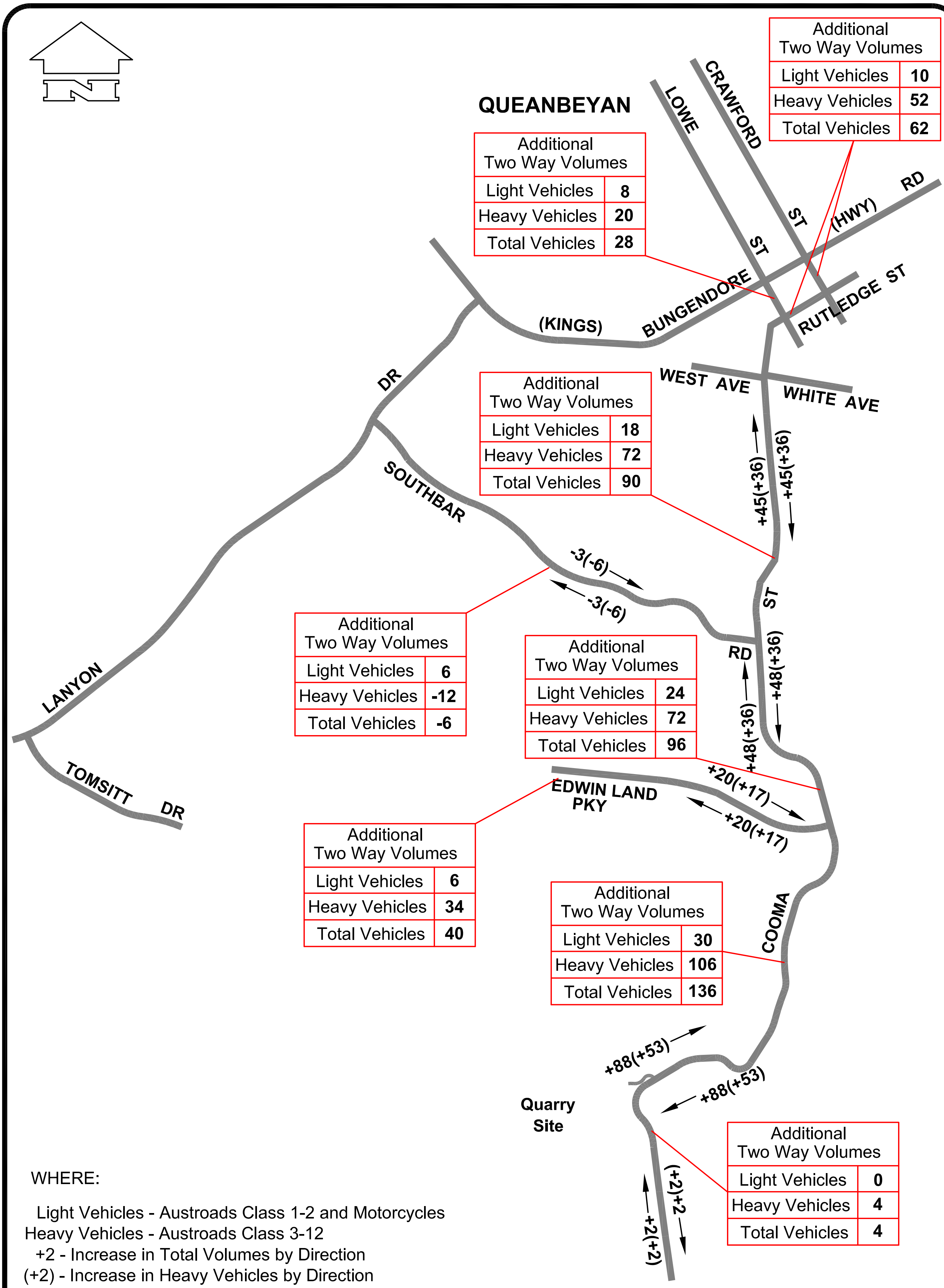

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FIGURE 7

COOMA ROAD QUARRY, QUEANBEYAN

ADDITIONAL WEEKDAY TRAFFIC VOLUMES FROM PROJECT ON AVERAGE DAY

JOB NO. 11094

TABLE 4.3

OLD COOMA ROAD SOUTH OF QUARRY
WEEKDAY TWO WAY VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	2628	92.7%	0	2628	92.5%
Heavy	208	7.3%	4	212	7.5%
Total	2836	100.0%	4	2840	100.0%

TABLE 4.4

OLD COOMA ROAD NORTH OF QUARRY
WEEKDAY TWO WAY VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	2749	83.0%	30	2779	80.6%
Heavy	564	17.0%	106	670	19.4%
Total	3314	100.0%	136	3450	100.0%

TABLE 4.5

COOMA STREET SOUTH OF WEST STREET
WEEKDAY TWO WAY VOLUMES WITH PROJECT

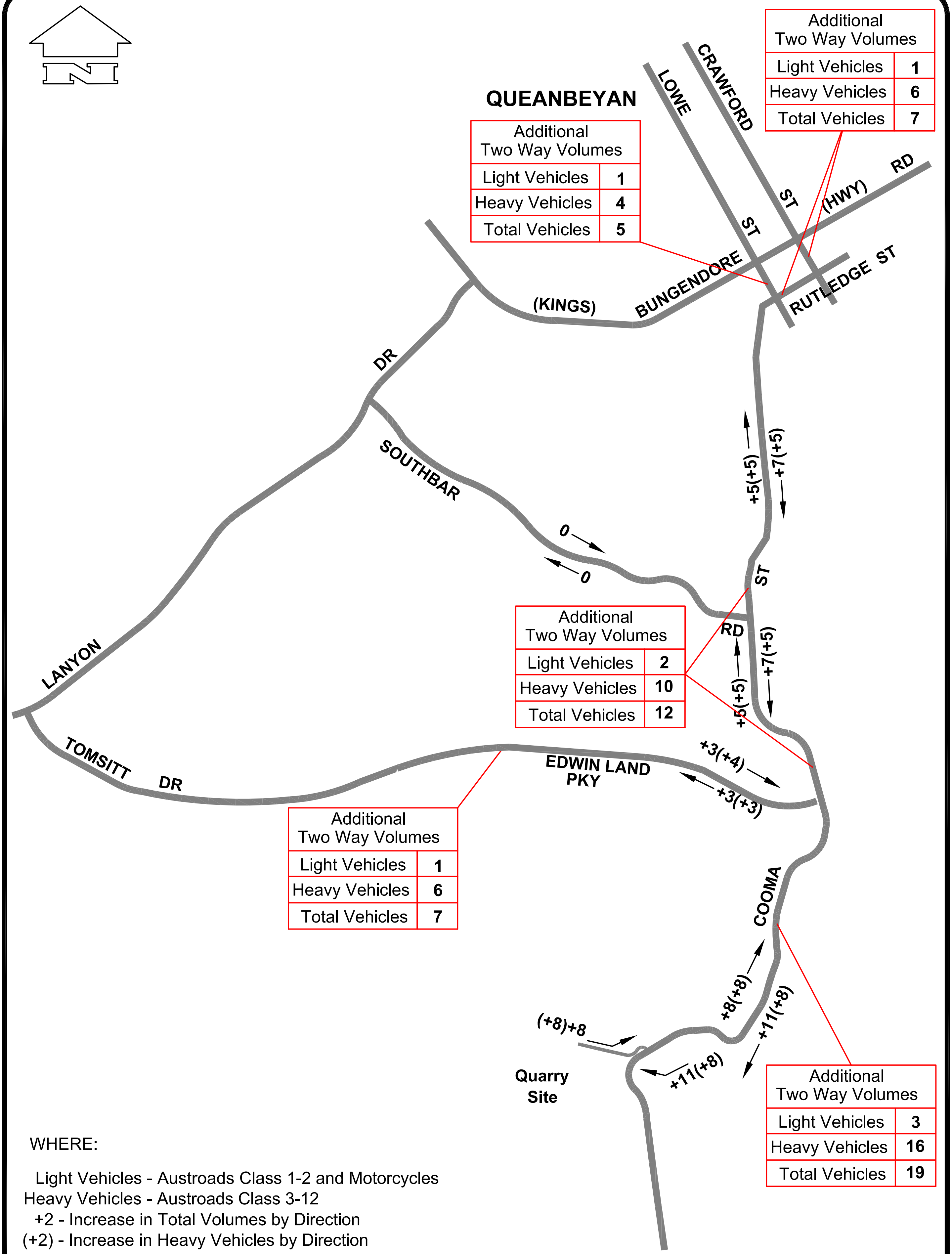
	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	13,552	93.8%	18	13,570	93.3%
Heavy	894	6.2%	72	966	6.7%
Total	14,446	100.0%	90	14,536	100.0%

Weekday AM Peak Hour Traffic Volumes

Figure 8 shows the additional traffic from the project at 1.5 mtpa during a busy hour in the AM peak hour assigned to the road network.

Tables 4.6 to 4.12 show the additional project traffic, during a busy hour, as well as changes to the existing AM peak hour volumes at various locations on the road network.

Reference to the tables and **Figure 8** show that the additional traffic from the project during the AM peak will be relatively small ranging from a total of 19 vehicles (two way volume) including 16 heavy vehicles, just north of the quarry to 12 vehicles (two way volume) including 10 heavy vehicles in Cooma Street near West Street. The latter volume of 12 additional vehicles will split between Lowe Street and Rutledge Street / Crawford Street to access the Kings Highway.



WHERE:

Light Vehicles - Austroads Class 1-2 and Motorcycles
Heavy Vehicles - Austroads Class 3-12
+2 - Increase in Total Volumes by Direction
(+2) - Increase in Heavy Vehicles by Direction

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FIGURE 8

COOMA ROAD QUARRY, QUEANBEYAN

ADDITIONAL TRAFFIC VOLUMES FROM PROJECT IN BUSY HOUR

JOB NO. 11094

In terms of impacts, the additional traffic from the project increases the proportion of heavy vehicles using the Old Cooma Road / Cooma Street / Lowe Street and Rutledge Street / Crawford Street route by between 1.0% and 3.9% during the AM peak hour. The proportional increase in total volumes using the route from the project is in the order of 1.3% to 5.4%, during the AM peak hour.

A total of 7 vehicles (two way volume) including 6 heavy vehicles associated with the quarry is expected to use Edwin Land Parkway in the AM peak hour.

No increase in the use of Southbar Road by vehicles generated by the quarry is expected during the AM peak hour.

TABLE 4.6

OLD COOMA ROAD NORTH OF QUARRY
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	302	90.1%	3	305	86.2%
Heavy	33	9.9%	16	49	13.8%
Total	335	100.0%	19	354	100.0%

TABLE 4.7

COOMA ROAD / STREET SOUTH OF SOUTHBAR ROAD
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	883	95.8%	2	885	94.7%
Heavy	39	4.2%	10	49	5.3%
Total	922	100.0%	12	934	100.0%

TABLE 4.8

COOMA ROAD / STREET NORTH OF SOUTHBAR ROAD
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	718	95.9%	2	720	94.6%
Heavy	31	4.1%	10	41	5.4%
Total	749	100.0%	12	761	100.0%

TABLE 4.9

COOMA ROAD / STREET SOUTH OF LOWE STREET
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	702	97.0%	2	704	95.7%
Heavy	22	3.0%	10	32	4.3%
Total	724	100.0%	12	736	100.0%

TABLE 4.10

LOWE STREET SOUTH OF KINGS HIGHWAY
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	299	98.7%	1	300	97.4%
Heavy	4	1.3%	4	8	2.6%
Total	303	100.0%	5	308	100.0%

TABLE 4.11

RUTLEDGE STREET EAST OF LOWE STREET
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	435	96.0%	1	436	94.8%
Heavy	18	4.0%	6	24	5.2%
Total	453	100.0%	7	460	100.0%

TABLE 4.12

CRAWFORD STREET SOUTH OF KINGS HIGHWAY
AM PEAK HOUR TWO WAY TRAFFIC VOLUMES WITH PROJECT

	Existing		Project Additional Volumes	Existing Plus Project	
	Volumes	Proportion		Volumes	Proportion
Light	328	94.5%	1	329	92.9%
Heavy	19	5.5%	6	25	7.1%
Total	347	100.0%	7	354	100.0%

4.3.3 Principal Intersection of Old Cooma Road / Quarry Access Road

This intersection will provide the only access to Cooma Road Quarry from Old Cooma Road.

The weekday AM peak hour will be the critical peak hour for the traffic generation of the quarry.

As part of the Stage 1 works for the realignment of Old Cooma Road, a new intersection will be provided for the quarry access approximately 200 metres south of the existing Tempe Crescent/Old Cooma Road intersection.

The intersection shown on **Figure 9A** (draft plan only) will be a T junction intersection incorporating:

- Left turn deceleration lane into the Quarry Access Road and left turn acceleration lane out of the Quarry Access Road in Old Cooma Road.
- Right turn bay in Old Cooma Road for the right turn.
- One northbound through lane and 2 southbound through lanes in Old Cooma Road.
- A single lane approach and a departure lane in the Quarry Access Road.

The intersection has been designed by consultants on behalf of Queanbeyan City Council. It is expected that the design will be in accordance to current Austroad standards with regard to auxiliary lane lengths and merge distances, as well as the appropriate sight distance for traffic turning into and out of the Quarry Access Road.

To examine the impacts of the additional traffic from the proposal, traffic modelling has been undertaken using the SIDRA software package at this intersection.

SIDRA assesses the operational performance of intersections under traffic signal, roundabout or sign control. The best criteria for assessing intersections controlled by sign control are Level of Service (LS), Degree of Saturation (DS) and Average Vehicle Delay (AVD). Table 4.13 shows the Level of Service Criteria for intersections as reproduced from the RTA's Guide to Traffic Generating Developments. The desirable design criteria for intersections is a Level of Service D or better.

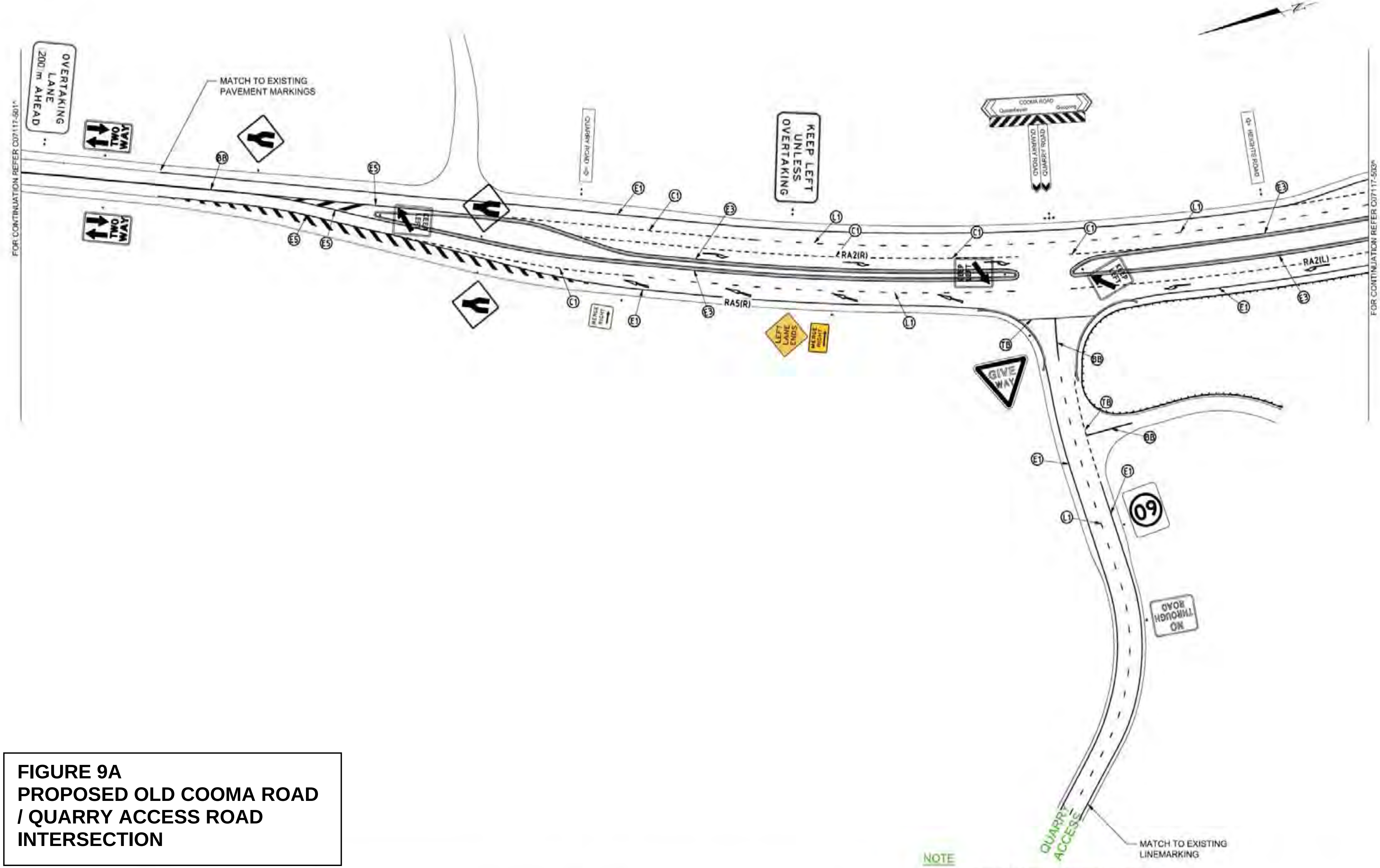

FIGURE 9A
PROPOSED OLD COOMA ROAD / QUARRY ACCESS ROAD INTERSECTION

NOTE

REFER C07117-500^ FOR LINEMARKING TYPES AND LEGEND.

DRAFT

1:1000 1:500

CONSULT AUSTRALIA

Queanbeyan City Council

OLD COOMA ROAD REALIGNMENT

BROWN Smart Consulting

COOMA ROAD REALIGNMENT
PAVEMENT MARKING AND SIGNPOSTING
SHEET 2

C07117#502^

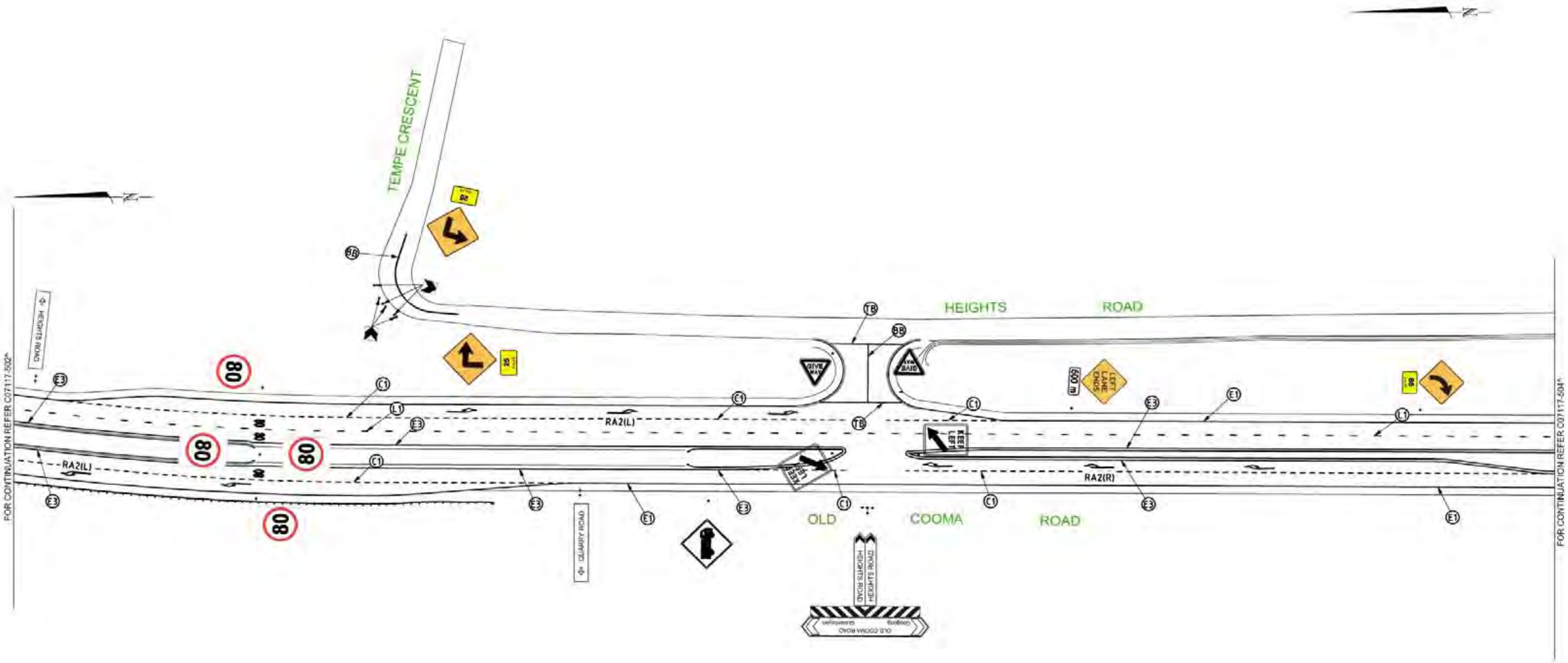

FIGURE 9B
PROPOSED OLD COOMA ROAD / QUARRY ACCESS ROAD INTERSECTION

NOTE

REFER C07117-500^ FOR LINEMARKING TYPES AND LEGEND.

DRAFT

1:1000 1:500

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SHEET 3

C07117#503^

For intersections controlled by Give Way / Stop signs, the Level of Service of the intersection is determined by the movement with the highest average vehicle delay and not the average vehicle delay for all vehicles using the intersection.

TABLE 4.13

LEVEL OF SERVICE CRITERIA FOR INTERSECTIONS

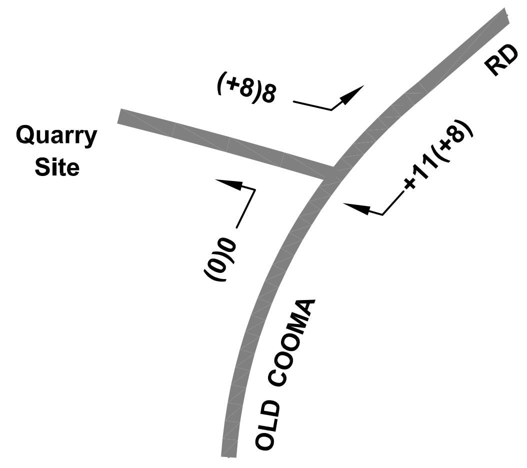
Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
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, requires other control mode

Source: Table 4.1 RTA Guide to Traffic Generating Developments October 2002

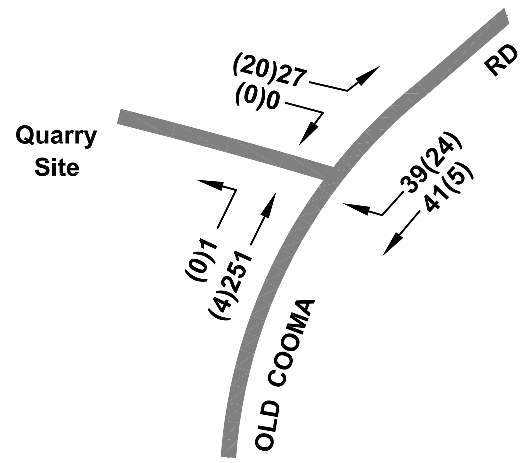
Long Term Traffic Assignment

The modelling has been undertaken for the existing volumes (**Figure 6**) as well with the additional traffic for the project in the AM peak hour as shown on **Figure 10.** This is expected to be the normal Long Term Traffic Assignment from the quarry. Allowance has been made for heavy vehicles using the intersection.

The results of the modelling are shown in Table 4.14 and show that the intersection, with the additional traffic from the project, will have a good operation with a Level of Service A operation with relatively low vehicle delays for the minor movements (10.1 to 14.3 seconds per vehicle), with minimal queuing in each lane.



INCREASE / CHANGE
FROM PROJECT



46 - TOTAL TRAFFIC VOLUME
(4) - HEAVY VEHICLES
+11 - TOTAL TRAFFIC INCREASE
(+8) - HEAVY VEHICLES INCREASE

* INTERSECTION VOLUMES BASED ON NORMAL LONG TERM TRAFFIC ASSIGNMENT

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FIGURE 10
COOMA ROAD QUARRY, QUEANBEYAN
BUSY HOUR TRAFFIC VOLUMES WITH PROJECT IN AM PEAK HOUR AT OLD COOMA RD / QUARRY RD INTERSECTION *
JOB NO. 11094

TABLE 4.14

SIDRA RESULTS FOR OLD COOMA ROAD/QUARRY ACCESS ROAD FOR EXISTING CONDITIONS AND WITH PROJECT* DURING A BUSY HOUR IN AM PEAK.

Movement	Existing				With Project			
	DS	AVD (secs)	LS	95% Queue Length (m)	DS	AVD (secs)	LS	95% Queue Length (m)
West: Quarry Access Road								
Left	0.038	12.9	A	2.5	0.057	13.7	A	4.2
Right	0.038	11.0	A	2.5	0.058	11.4	A	4.2
South: Old Cooma Road								
Left	0.001	10.1	A	0	0.001	10.1	A	0
Through	0.137	0	A	0	0.137	0	A	0
North: Old Cooma Road								
Through	0.012	0	A	0	0.012	0	A	0
Right	0.037	14.0	A	2.1	0.058	14.5	A	3.6
All Vehicles	**0.137**	**1.8**	**A**	**2.4**	**0.137**	**2.5**	**A**	**4.2**

Where:

DS	Degree of Saturation
AVD	Average Vehicle Delay in Seconds
LS	Level of Service
95%tile Queue Length	95%tile Back of Queue Length in metres

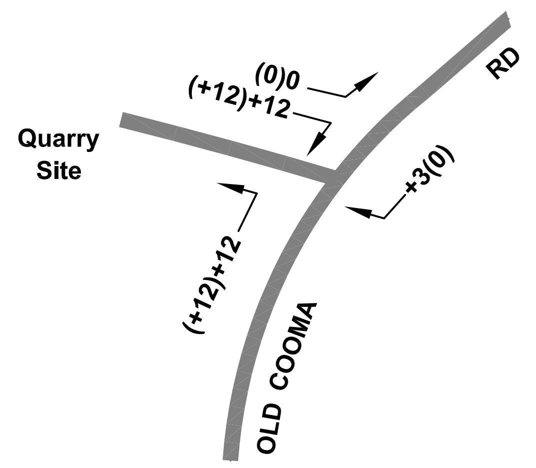
* Based on normal Long Term Traffic Assignment

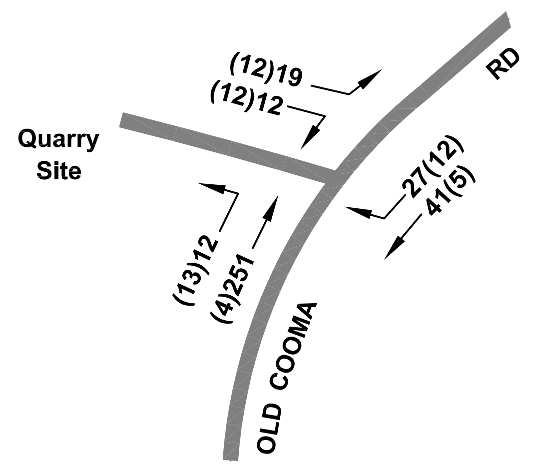
<u>Higher Deliveries South to Future Googong Township</u>

For a period of the proposed quarry life, a higher proportion of truck trips are expected to turn right out of the Quarry Access Road and travel south to deliver aggregate as part of the construction for the new Googong Township.

To examine this scenario during a busy hour at the quarry that occurs in the AM peak hour, it is assumed that some 50% of the trucks out of the quarry, will turn right, in lieu of turning left, with a corresponding change between the left and right turn into Quarry Access Road from Old Cooma Road. **Figure 11** shows the alternative traffic assignment at the intersection. Additional SIDRA modelling has been undertaken to examine the impacts of this traffic assignment on the intersection.

The results of the modelling are shown in Table 4.15 and show that the intersection would continue to have a good operation with a Level of Service B operation and relatively low vehicle delays in the order of 14.3 to 19.0 seconds per vehicle for the minor movements, as well as and minimal queue lengths.





46 - TOTAL TRAFFIC VOLUME
(4) - HEAVY VEHICLES
+11 - TOTAL TRAFFIC INCREASE
(+8) - HEAVY VEHICLES INCREASE

* INTERSECTION VOLUMES BASED ON HIGHER NUMBER OF TRIPS TO AND FROM SOUTH FOR CONSTRUCTION OF GOOLONG TOWN

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FIGURE 11
COOMA ROAD QUARRY, QUEANBEYAN
BUSY HOUR TRAFFIC VOLUMES WITH PROJECT IN AM PEAK HOUR AT OLD COOMA RD / QUARRY RD INTERSECTION BASED ON ALTERNATIVE ASSIGNMENT *
JOB NO. 11094

TABLE 4.15

SIDRA RESULTS FOR OLD COOMA ROAD/QUARRY ACCESS ROAD INTERSECTION WITH PROJECT AND ASSUMING HIGHER RIGHT TURN OUT OF THE QUARRY ACCESS ROAD* DURING A BUSY HOUR IN AM PEAK.

Movement	DS	AVD (secs)	LS	95% Queue Length (m)
West: Quarry Access Road				
Left	0.093	18.8	B	7.8
Right	0.094	19.0	B	7.8
South: Old Cooma Road				
Left	0.012	15.4	A	0
Through	0.137	0	A	0
North: Old Cooma Road				
Through	0.012	0	A	0
Right	0.037	14.3	A	2.2
All Vehicles	**0.137**	**2.9**	**B**	**7.8**

Where:

DS	Degree of Saturation
AVD	Average Vehicle Delay in Seconds
LS	Level of Service
95%tile Queue Length	95%tile Back of Queue Length in metres

* Based on Construction of Googong Township

4.3.4 Other Intersections

SIDRA traffic modelling was also undertaken to assess the impacts of the additional traffic generated by the Project on other major intersections on the road network.

The modelling was undertaken for a busy hour at the quarry coinciding with the AM peak hour at the following intersections;

- Cooma Street/Southbar Road – Traffic Signal Control;
- Cooma Street/Lowe Street/Rutledge Street – Roundabout Control; and
- Rutledge Street/Crawford Street – Roundabout Control.

The modelling for the existing conditions was also incorporated so that comparisons could be drawn on the impacts of the Project.

The results of the SIDRA traffic modelling are shown in Tables 4.16, 4.17 and 4.18.

Reference to Table 4.16, which shows the results for the traffic signal controlled intersection of Cooma Street/Southbar Road shows that this intersection will retain a Level of Service B operation which is a good operation with average vehicle delays of 18.8 seconds per vehicle. When compared to the existing conditions, there will be no measurable change in either the Level of Service, or vehicle delay at the intersection from the additional traffic generated by the Project.

Reference to Tables 4.17 and 4.18 which show the modelling results for the Cooma Street/Lowe Street/Rutledge Street intersection and the Rutledge Street/Crawford Street intersections respectively, also show that there will be very minimal impacts from the Project. Both the roundabout intersections will continue to operate at a very good Level of Service with Level of Service A operation and relatively small vehicle delays.

There is virtually no change in operating conditions with the additional traffic from the Project, as compared to existing conditions.

TABLE 4.16

SIDRA RESULTS FOR OLD COOMA STREET/SOUTHBAR INTERSECTION FOR EXISTING CONDITIONS AND WITH PROJECT DURING A BUSY HOUR IN AM PEAK.

Movement	Existing				With Project			
	DS	AVD (secs)	LS	95% Queue Length (m)	DS	AVD (secs)	LS	95% Queue Length (m)
West: Southbar Road								
Left	0.235	23.8	B	29.5	0.235	23.8	B	29.5
Right	0.333	36.3	C	19.2	0.333	36.3	C	19.2
South: Cooma Street								
Left	0.558	22.0	B	60.6	0.558	22.0	B	60.6
Through	0.530	12.7	A	79.2	0.539	12.7	A	81.0
North: Cooma Street								
Through	0.086	3.3	A	11.8	0.093	3.4	A	12.9
Right	0.350	37.3	C	22.6	0.350	37.3	C	22.6
All Vehicles	**0.559**	**18.8**	**B**	**79.2**	**0.559**	**18.8**	**B**	**81.0**

Where:

DS	Degree of Saturation
AVD	Average Vehicle Delay in Seconds
LS	Level of Service
95%tile Queue Length	95%tile Back of Queue Length in metres

TABLE 4.17

SIDRA RESULTS FOR OLD COOMA STREET/LOWE STREET/RUTLEDGE STREET INTERSECTION FOR EXISTING CONDITIONS AND WITH PROJECT DURING A BUSY HOUR IN AM PEAK.

Movement	Existing				With Project			
	DS	AVD (secs)	LS	95% Queue Length (m)	DS	AVD (secs)	LS	95% Queue Length (m)
South: Cooma Street								
Left	0.370	6.4	A	22.2	0.377	6.5	A	23.1
Through	0.371	5.5	A	22.2	0.377	5.5	A	23.1
Right	0.369	11.2	A	22.2	0.379	11.2	A	23.1
East: Lowe Street								
Left	0.011	7.1	A	0.4	0.011	7.2	A	0.5
Through	0.011	6.2	A	0.4	0.011	6.2	A	0.5
Right	0.011	11.9	A	0.4	0.011	12.0	A	0.5
North: Rutledge Street								
Left	0.105	6.9	A	5.1	0.105	7.0	A	5.6
Through	0.102	6.2	A	5.1	0.110	6.4	A	5.6
Right	0.103	11.7	A	5.1	0.109	11.8	A	5.6
West: Lowe Street								
Left	0.088	8.2	A	4.1	0.094	8.4	A	4.6
Through	0.088	7.3	A	4.1	0.094	7.4	A	4.6
Right	0.088	13.1	A	4.1	0.095	13.3	A	4.6
All Vehicles	**0.371**	**6.8**	**A**	**22.2**	**0.377**	**6.9**	**A**	**23.1**

Where:

DS	Degree of Saturation
AVD	Average Vehicle Delay in Seconds
LS	Level of Service
95%tile Queue Length	95%tile Back of Queue Length in metres

TABLE 4.18

SIDRA RESULTS FOR OLD RUTLEDGE STREET/CRAWFORD STREET INTERSECTION FOR EXISTING CONDITIONS AND WITH PROJECT DURING A BUSY HOUR IN AM PEAK.

Movement	Existing				With Project			
	DS	AVD (secs)	LS	95% Queue Length (m)	DS	AVD (secs)	LS	95% Queue Length (m)
South: Crawford Street								
Left	0.024	7.6	A	1.0	0.025	7.6	A	1.0
Through	0.024	6.9	A	1.0	0.025	6.9	A	1.0
Right	0.024	11.5	A	1.0	0.025	11.5	A	1.0
East: Rutledge Street								
Left	0.029	7.7	A	1.2	0.029	7.7	A	1.3
Through	0.029	6.9	A	1.2	0.029	7.0	A	1.3
Right	0.029	11.6	A	1.2	0.029	11.6	A	1.3
North: Crawford Street								
Left	0.117	7.8	A	6.2	0.122	7.8	A	6.7
Through	0.117	7.1	A	6.2	0.122	7.1	A	6.7
Right	0.117	12.2	A	6.2	0.122	12.3	A	6.7
West: Rutledge Street								
Left	0.228	7.2	A	12.0	0.233	7.3	A	12.7
Through	0.227	6.4	A	12.0	0.233	6.4	A	12.7
Right	0.226	11.1	A	12.0	0.234	11.1	A	12.7
All Vehicles	**0.228**	**7.9**	**A**	**12.0**	**0.233**	**8.0**	**A**	**12.7**

Where:

DS	Degree of Saturation
AVD	Average Vehicle Delay in Seconds
LS	Level of Service
95%tile Queue Length	95%tile Back of Queue Length in metres

At other intersections on the wider arterial road network including;

- Lanyon Drive/Southbar Road; and
- Lanyon Drive/Tompsett Drive

the impacts of the Project will be minimal.

As previously noted, the road changes that incorporate the extension of Edwin Land Parkway to Old Cooma Road, is expected to limit future traffic growth along Southbar Road including vehicles generated from Cooma Road Quarry.

No increased use of Southbar Road by quarry trucks is expected from the Project.

The intersection of Lanyon Drive/Tompsett Drive has only recently been upgraded to its current high standard and will have sufficient capacity to cater for the future traffic flows at the intersection, including the small number of vehicles generated by the quarry.

4.3.5 Summary

The impacts of the increased traffic generated by the Project on the road network are expected to be satisfactory.

The upgraded Old Cooma Road/Quarry Access Road will have a good to very good operation in terms of capacity and vehicle delays with the additional traffic from the Project.

On the wider network the increase in traffic as a result of the Project will be dispersed over a number of routes, resulting in relatively small increase in the overall traffic levels on these roads.

Currently the major intersections on the road network all operate at good to very good Levels of Service and will continue to do so, with the Project in place, in the immediate future.

4.4 Future Traffic Conditions

The Project will extend the existing quarry's life by 20 years. The Gabites Porter Traffic Study has identified future (2031) projected traffic volumes on the Queanbeyan road network associated with estimated background traffic growth, plus the growth associated with the new towns of Googong and Tralee. The study has also identified the required road network improvements (See section 3.3) to cater for the future traffic growth on the road network, which have been adopted by Council.

Some of these works are either currently under construction, or will shortly commence construction, while others are awaiting funding and final approvals and will be undertaken over the next 10-15 years.

These works will cater for the future traffic growth on the road network, including traffic generated by the Project. The latter traffic will make up a very small proportion of the total future traffic using the Queanbeyan Road network.

The extension of Ellerton Drive, when constructed is likely to result in a proportion of quarry trucks which currently use the Cooma Street route to the Kings Highway being diverted onto this new road and reducing the number of quarry trucks using Old Cooma Road/Cooma Street between Edwin Land Parkway and Kings Highway.

4.5 Road Safety

The Project is not expected to have any negative impacts on road safety. The assessment of the most recent three year crash history for the road network used by quarry trucks, does not indicate that heavy (truck) vehicles are overrepresented in crash statistics.

As noted in earlier sections of the report, the Quarry Access Road intersection at Old Cooma Road will be upgraded in the next 12 months. The assessment of the immediate future conditions indicates that the intersection will have plenty of spare capacity to cater for future traffic using Old Cooma Road.

The road upgrades, including the realignment of Old Cooma Road (Stages 1 and 2) and the Extension of Edwin Land Parkway, as well as the future Ellerton Drive Extension and the proposed intersection upgrades will assist in managing/addressing future road safety issues associated with the overall future traffic growth on the road network, including the relatively small increase in traffic volumes, due to the Project.

4.6 Construction Impacts

The construction period for the Project is expected to be about 3-4 months.

The construction impacts are not expected to be significant and in terms of the combined traffic generation for the quarry (i.e. construction traffic plus operational traffic) would not exceed the traffic generation of the operational phase of the Project for any day, or, hour of the day.

It is expected that some co-ordination may be required with Queanbeyan City Council concerning the vehicle access to the Quarry during the construction of the new Quarry Access Road intersection with the realigned Old Cooma Road.

5.0 CONCLUSIONS

This report documents the assessment of the traffic impacts of a proposal for the continued operations of the Cooma Road Quarry for an additional 15 years from 2015.

The quarry is located in Old Cooma Road south of Edwin Land Parkway. Queanbeyan City Council is proposing to upgrade the road network in the area around the quarry to cater for future traffic growth associated with the new towns of Googong and Tralee, as well as background traffic growth. As part of these works the Quarry's Access Road intersection with Old Cooma Road will be upgraded (Stage 1 of Old Cooma Road Realignment Works). This is expected to occur in 2012 / 2013. This intersection will be the only intersection that will provide access to Cooma Road Quarry from Old Cooma Road.

The existing quarry operation generates:

- Some 130 two way vehicle trips per day for light vehicles and small trucks up to 4.5 tonnes based on 65 inbound trips and 65 outbound trips;

- 224 two way heavy vehicle truck trips per day (on an average day for 1.0 mtpa) based on 112 inbound truck trips and 112 outbound truck trips.

The additional traffic generation from the project based on 1.5mtpa is estimated to be:

- 30 two way light vehicle trips per day based on 15 inbound trips and 15 outbound trips; and

- 110 two way heavy vehicle trips per day based on 55 inbound trips and 55 outbound trips.

The assessment based on SIDRA traffic modelling has found that the proposed new Quarry Access Road intersection with Old Cooma Road will have a good to very good level of service, with the additional traffic from the Project in the immediate future with plenty of spare capacity to cater for future traffic growth in Old Cooma Road.

On the wider road network that are used by the quarry trucks, the additional traffic from the Project will comprise a very small proportion of total traffic and the assessment concludes that the impact on these roads and principal intersections would be relatively minor.

In the longer term the proposed upgrades to the road network planned by Queanbeyan City Council will cater for future traffic growth including the small proportion of traffic that will be generated by the quarry.

REFERENCES

1. Austroads Guide to Road Design

2. Austroads Guide to Road Safety – Version 1 Dec 2010

3. Austroads Guide to Traffic Management

4. Roads and Traffic Authority (RTA now RMS) – Traffic Volume Data for Southern Region 2005 / 2006, plus updates supplied by RMS

5. RTA (now RMS) Austroads Guide Supplements – Austroads Guide to Traffic Management – January 2011

6. RTA (now RMS) Supplement to Austroads Guide to Road Design Parts 1-5, 6 and 8

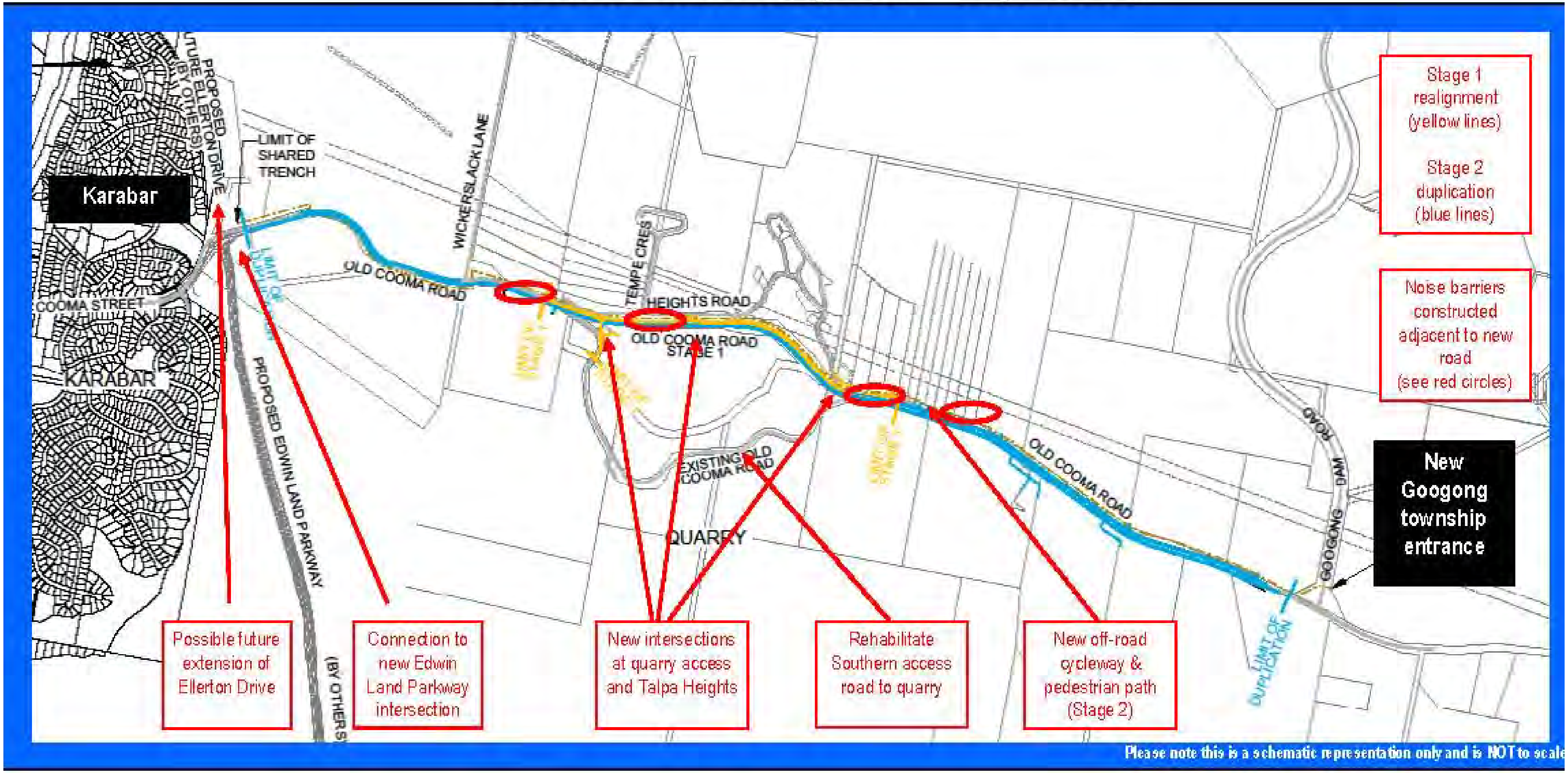
7. RMS Supplements to Austroads Guide to Road Safety

8. RMS Southern Region – Crash Statistics for 1 October 2008 to 30 December 2011

APPENDICES

1. Old Cooma Road Realignment – Key Features

Old Cooma Road Realignment — Key Features



APPENDIX 1

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