Appendix 6

Air Quality Assessment

(SLR Consulting Australia Pty Ltd)

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global environmental solutions

Bogo Quarry

Air Quality Assessment

Report Number 610.15645-R1

18 January 2016

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Bogo Quarry

Air Quality Assessment

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Emissions of particulate matter resulting from site operations at the proposed activity rates have been calculated and dispersion modelling has been conducted using the Ausplume dispersion model and a complete year of site representative meteorological data. Peak hourly emissions have been used to predict the potential maximum 24-hour mean PM_{10}, annual mean PM_{10} and dust deposition in the vicinity of the Quarry.

Background air quality has been considered, using concentrations of PM_{10} as measured at the NSW EPA air quality monitoring station operated in Wagga Wagga.

The total (with background) maximum 24-hour mean, annual mean PM_{10} concentrations and dust deposition rates were predicted to be below the relevant assessment criteria at the nearest residences and consequently, the potential for adverse impacts on the surrounding environment as a result of the proposed expanded operations at the Quarry is considered to be low.

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1 INTRODUCTION

Bogo Operations Pty Ltd (hereafter, "the Applicant") is seeking approval to increase current hard rock production activities from 200,000 tonnes per annum (tpa) to 500,000 tpa and campaign operation of mobile asphalt manufacture and concrete batching plants at the Bogo Quarry (hereafter, "the Quarry"). R.W. Corkery and Co. Pty Limited (hereafter, "RWC"), on behalf of the Applicant, has engaged SLR Consulting Australia Pty Ltd (hereafter, "SLR") to conduct an air quality impact assessment of the proposed activities to determine the potential level of impact on the surrounding environment.

The dispersion modelling assessment contained in this report has used a complete year of site representative meteorological data.

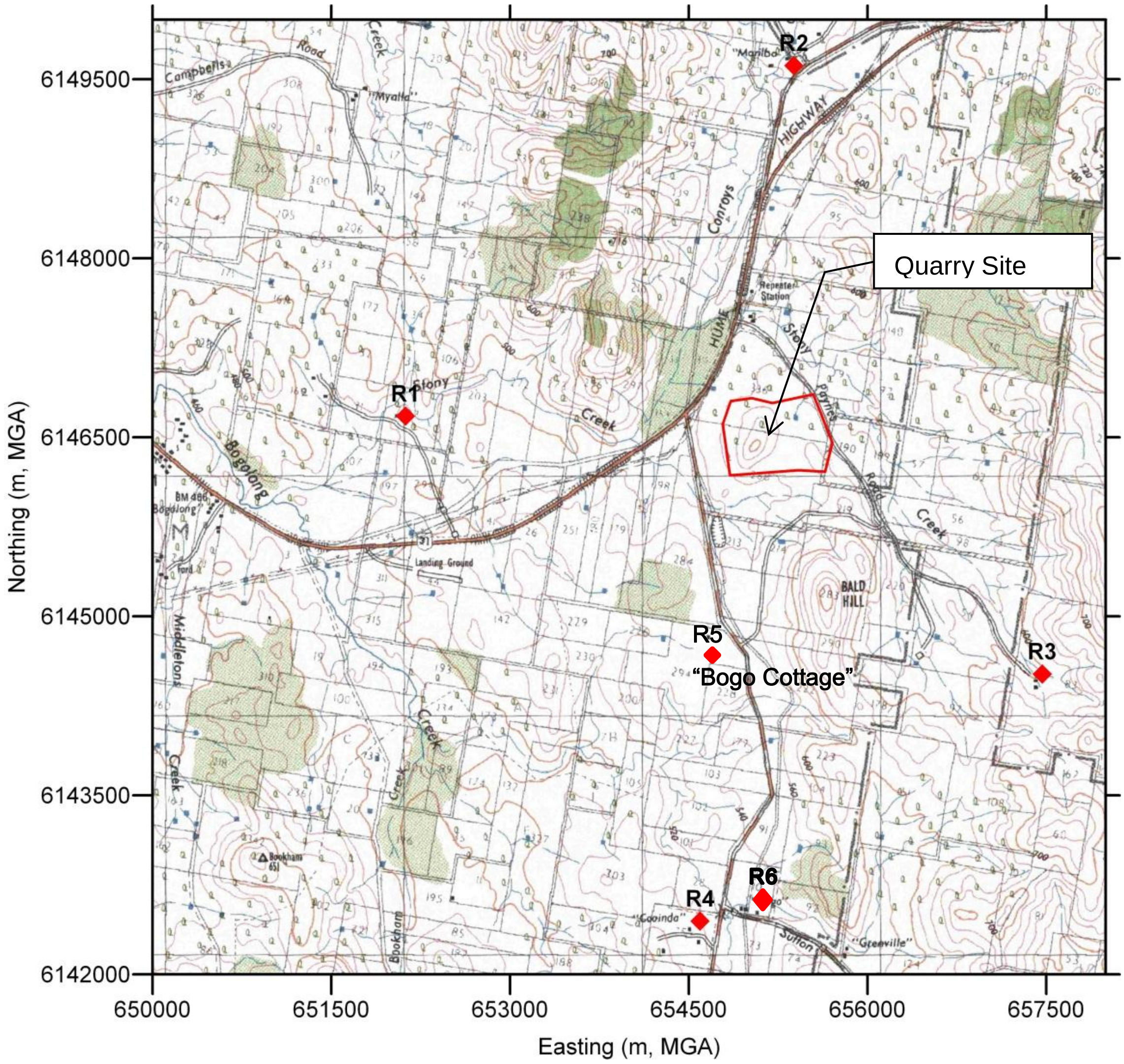
2 QUARRY SETTING

The Quarry is located adjacent to Paynes Road, off the Hume Highway approximately 20 kilometres (km) west of the town of Yass in the Southern Tablelands region of New South Wales. The Quarry is situated amongst undulating terrain in rural land that is primarily agricultural including cattle and sheep grazing. A total of six non-project related residences are located within approximately 4 km of the Quarry. The residence on the "Stoney Creek" property is deemed to be project related. The proximity of the six residences to the Quarry are presented in **Table 1** and their locations illustrated in **Figure 1**.

Table 1 Nearest Non-Project Related Residential Receptors

Receptor ID	Property Name	Location (MGA, m)		Distance (km) / Direction from Limit of Extraction
		Easting	Northing	
R1	"Bogolong Cottage"	652,106	6,146,637	2.9 / W
R2	"Marilba"	655,382	6,149,616	2.9 / N
R3	Linbrook Residence	657,466	6,144,517	2.9 / SE
R4	"Cooinda"	654,594	6,142,447	3.8 / S
R5	"Bogo Cottage"	654,689	6,144,674	1.4 / S
R6	"Bogo"	654,915	6,142,560	3.6 / S

Figure 1 Nearest Non-Project Related Residential Receptors



3 AIR QUALITY CRITERIA

State air quality guidelines adopted by the NSW EPA are published in the *Approved Methods and Guidance For the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DEC, 2005) (hereafter 'The Approved Methods').

The Approved Methods have been consulted during the preparation of this assessment report. The Approved Methods list the statutory methods that are to be used to model and assess emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Project. The criteria listed in the Approved Methods are derived from a range of sources (including the National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC] and World Health Organisation [WHO]). The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting.

3.1 Particulates (as TSP, PM_{10} and $PM_{2.5}$)

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air ($\mu g/m^3$) (NHMRC, 1996).

The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

Emissions of particulate matter less than 10 µm and 2.5 µm in diameter (referred to as PM_{10} and $PM_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are as follows:

- a 24-hour maximum of 50 $\mu g/m^3$; and
- an annual average of 30 $\mu g/m^3$.

The Approved Methods do not set any assessment goals for $PM_{2.5}$. In December 2000, the National Environment Protection Council (NEPC) initiated a review to determine whether a national ambient air quality criterion for $PM_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. The review found that:

- there are health effects associated with these fine particles;
- the health effects observed overseas are supported by Australian studies; and
- fine particle standards have been set in Canada and the USA, and an interim criterion is proposed for New Zealand.

The review concluded that there is sufficient community concern regarding $PM_{2.5}$ to consider it an entity separate from PM_{10}.

As such, in July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$, setting the following Interim Advisory Reporting Standards for $PM_{2.5}$ (NEPC, 2003):

- a 24-hour average concentration of 25 $\mu g/m^3$; and
- an annual average concentration of 8 $\mu g/m^3$.

It is noted that the NEPM Advisory Reporting Standards relating to $PM_{2.5}$ particles are reporting guidelines only at the present time and not intended to represent air quality criteria. A summary of the particulate guidelines is shown in **Table 2**.

Table 2 EPA Goals for Particulates

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m^3
PM_{10}	24 Hours Annual	50 µg/m^3 30 µg/m^3
$PM_{2.5}$	24 Hours Annual	25 µg/m^3 (interim advisory reporting standard only) 8 µg/m^3 (interim advisory reporting standard only)

Source: (NSW DEC, 2005), (NEPC, 2003)

3.1.1 Potential Changes to the Ambient Air Quality NEPM

On 29 April 2014, Environment Ministers signalled their intent to vary the Ambient Air Quality NEPM based on the latest scientific understanding of the health risks resulting from airborne particulate pollution. On 15 July 2015, Ministers agreed in-principle to adopt reporting standards for annual average and 24-hour $PM_{2.5}$ as outlined in **Table 3** with a move to 7 µg/m^3 and 20 µg/m^3 over the longer term. Ministers agreed to finalise their consideration of the matter by 31 December 2015, including appropriate standards for PM_{10}.

Table 3 Proposed Variation to the Ambient Air Quality NEPM

Metric	Averaging Period	Current Standard	Options for Standard	Allowed Exceedances
PM_{10}	Annual average	None	No standards with consideration of 20 µg/m^3	N/A
	24-hour mean	50 µg/m^3	50 µg/m^3, with consideration of 45 µg/m^3 and 40 µg/m^3	See note below
$PM_{2.5}$	Annual average	8 µg/m^3 (advisory)	8 µg/m^3	N/A
	24-hour mean	25 µg/m^3 (advisory)	25 µg/m^3	See note below

Source: (NEPC, 2014)

The four options for the form of the 24-hour standards, and specifically the treatment of exceedances, for both PM_{10} and $PM_{2.5}$ are as follows:

- Business as usual option; a rule that allows a fixed number of exceedances of a PM standard in a given year, with no exclusion of data for exceptional events.
- A rule that allows a fixed number of exceedances of a PM standard in a given year, but with exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, with no exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, but with exclusion of data for exceptional events.

It has been identified by the NEPC that it is likely that jurisdictions will want to identify local issues that affect the form of the standards and therefore the options for this standard have been left open for the consultation phase which closed in October 2014.

3.2 Particulates (as Deposited Dust)

The preceding section is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts need also to be considered, mainly in relation to deposited dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m^2/month).

Table 4 presents the impact assessment goals set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 4 EPA Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month

Source: (NSW DEC, 2005)

4 EXISTING ENVIRONMENT

There is currently no PM_{10} monitoring data available for the area immediately surrounding the Quarry.

The NSW EPA maintains a network of ambient air quality monitoring stations (AQMS) across the State, the nearest of which is located at Wagga Wagga North, approximately 125 km west-southwest of the Quarry. Concentrations of PM_{10} have been recorded at the Wagga Wagga North AQMS since 2011. Measurements have previously been recorded at the Wagga Wagga AQMS from 2001 to 2011, when the site was moved. Review of all available PM_{10} data (2001-2014) has identified a wide range of recorded 24-hour PM_{10} concentrations, as illustrated in **Figure 2**.

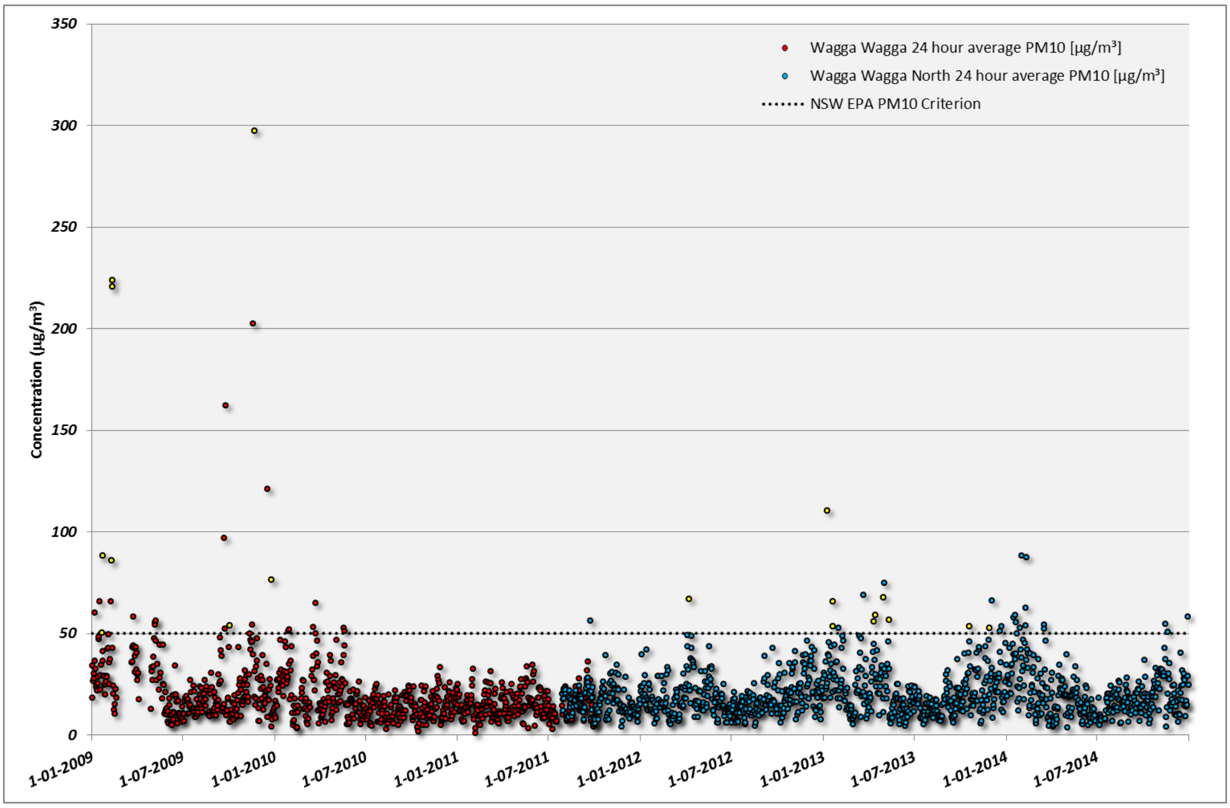
Over the period 2009 to 2014, 58 exceedances of the NSW EPA PM_{10} criterion of 50 µg/m^3 have been recorded at the AQMS' within Wagga Wagga. Eighteen of these elevated concentrations have been attributed (within the annual NEPM compliance report) to natural sources (bushfires, dust storms, grassfires or stubble burning events). The 14 exceedances recorded in 2014 cannot be attributed to natural events at this time as the NEPM compliance report for 2014 is not currently available. Although all exceedances cannot be attributed to natural events, it is likely that these elevated concentrations may be due, at least in part, to natural or agricultural events.

An analysis of PM_{10} data as measured at the Wagga Wagga and Wagga Wagga North AQMS is presented in **Table 5**. Analyses are presented for all recorded data and with the identified exceedances (those attributable through the NEPM compliance reports as being due to natural events) removed. For the purposes of this assessment, the 75th percentile 24 hour average PM_{10} concentrations as measured at the Wagga Wagga North AQMS between July 2011 and December 2013 with all identified 'natural' exceedances removed have been adopted as a 24 hour background concentration (23.7 µg/m^3).

Table 5 24-hour Average PM_{10} Data at Wagga Wagga and Wagga Wagga North AQMS

Parameter	Wagga Wagga		Wagga Wagga North	
	All Data	Identified Exceedances Removed	All Data	Identified Exceedances Removed
From (month)	January 2009		July 2011	
To (month)	October 2011		December 2013	
# months data	33		29	
10th percentile	7.7 µg/m^3	7.7 µg/m^3	8.9 µg/m^3	8.9 µg/m^3
25th percentile	10.7 µg/m^3	10.7 µg/m^3	12.3 µg/m^3	12.2 µg/m^3
50th percentile	15.9 µg/m^3	15.8 µg/m^3	15.9 µg/m^3	17.3 µg/m^3
75th percentile	23.3 µg/m^3	22.9 µg/m^3	23.8 µg/m^3	23.7 µg/m^3
100th percentile	297.4 µg/m^3	202.6 µg/m^3	110.7 µg/m^3	74.6 µg/m^3

Figure 2 Wagga Wagga and Wagga Wagga North PM_{10} Monitoring Data 2009 to 2014



Note: Yellow dots are those measurements identified within the NEPM compliance reports as being due to 'natural' events

An analysis of annual average PM_{10} data as measured at the Wagga Wagga North AQMS between 2012 and 2014 is presented in **Table 6**. For the purposes of this assessment and in the interests of conservatism, the annual average PM_{10} concentrations as measured at the Wagga Wagga North AQMS during 2013 have been adopted as an annual background concentration (22.1 µg/m^3).

Table 6 Annual Average PM_{10} Data at Wagga Wagga North AQMS

Parameter	Wagga Wagga North
	All Data
Annual Average – 2012	18.8 µg/m^3
Annual Average – 2013	22.1 µg/m^3
Annual Average – 2014	20.6 µg/m^3

5 DISPERSION MODELLING

5.1 Modelling Methodology

Due to the significant separation distance between the surrounding non-Project related receptors (residences) and the Quarry (see **Section 2**) and the relatively low level of operations associated with the proposed ongoing operation within the Quarry, a screening level dispersion modelling assessment has been conducted in an attempt to predict potential worst-case impacts associated with emissions of PM_{10} and dust from the Quarry. Discussions with NSW EPA have confirmed that given the level of operations at the Quarry, the support of the proposed expansion from nearby residents and the level of air quality mitigation implemented at the site (refer to **Section 6**), the level of assessment is appropriate.

Dispersion modelling has been conducted using the Ausplume Gaussian Plume Dispersion Model (Version 6.0) developed by EPA Victoria. Ausplume is an approved dispersion model for use in NSW and is appropriate for the level of assessment performed within this report. Default options specified in the Ausplume Technical Users' Manual have been used, as per the Approved Methods.

The meteorological input file used for the air quality modelling was for Woodlawn, near Tarago, NSW for the calendar year 2005, which is the closest dataset available within the SLR database to the Quarry Site (approximately 50km to the east south-east). This screening approach is in accordance with the air quality assessment guidelines prescribed within the Approved Methods, which requires dispersion modelling to be conducted with a complete year of site representative meteorological conditions.

Given the large separation distance between the Quarry Site and surrounding receptors (**Section 2**), the exact siting of each emissions source is not considered critical for this assessment. However, all components within the extraction area at the Quarry Site have been modelled as separate sources.

Topographic features of the local area, which may assist in the alteration in meteorological conditions and subsequent pollutant dispersion, have not been included in this assessment.

Finally, in order to derive the maximum potential 24-hour emissions from the Quarry Site, all sources are assumed to emit continuously within their respective hours of operation.

Appendix A presents the emissions inventory compiled for this screening assessment. In general, default emission factors have been used as contained in Table 1 of the *Emission Estimation Technique Manual for Mining, Version 3.1*, (hereafter, "EETMM") (Department of the Environment, 2012).

In some instances, the moisture content of materials at the Quarry Site is not adequately reflected within the default emission factors contained in the EETMM, and the equations given in either Table 1 of the EETMM document or USEPA AP-42 documentation were therefore used to derive representative emission factors. The following emission factors were derived using this method:

Bulldozer

$$EF = k \times \frac{s^{1.2}}{M^{1.3}} \text{ kg/h}$$

where k=2.6 for TSP and 0.34 for PM_{10}, s = silt content and M = moisture content.

Miscellaneous Handling (Front-End Loaders, loading of materials)

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

where k=0.74 for TSP and 0.35 for PM_{10}, U = mean wind speed and M = moisture content.

Blasting

$$EF = 344 \times \frac{A^{0.8}}{M^{1.9} \times D^{1.8}} \text{ kg/blast}$$

where A = Blast area, M = moisture content and D = depth of blast holes. PM_{10} is 52% of TSP.

Haul truck wheel dust (USEPA AP-42)

The emission factor for wheel generated dust is estimated from the USEPA emission equation for Wheel Generated Dust from Unpaved Roads (2003).

$$EF = k \times \left(\frac{s}{12}\right)^{0.7} \times \left(\frac{W}{3}\right)^{0.45} \times \left(\frac{281.9}{1000}\right) \text{ kg/VKT}$$

where k=4.9 for TSP and 1.5 for PM_{10}, s = silt content and W = vehicle gross mass.

A number of broad assumptions have been made in creating this emissions inventory, including the following:

- Average hours of operation for a 17 hour quarry day have been assumed for most of the components (**Appendix A**).
- Some operations have the potential to be performed over a 24 hour period when required. Dispersion modelling has reflected this potential operation (ie. product loading and haulage and from the processing plant)
- Generic silt and moisture contents of 10% and 5% respectively have been assumed for all materials handling operations to provide a conservative estimation of emissions. Silt and moisture contents for unsealed Haul Routes of 1.1% and 6.4% (USEPA, 1998) have been adopted.
- A total throughput of 1,416 tonnes per day has been adopted. This reflects the average hourly throughput multiplied by the daily hours of operation.
- No emission control factors have been applied.
- Default emission factor for crushing at the processing plant incorporates all associated screening and handling, as per the EETMM.
- The entire Quarry footprint, including processing plant, concrete batching and asphalt plant; has been included for a source of wind erosion.

5.2 Dispersion Modelling Results

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

Table 7 presents the maximum 24-hour mean and annual mean PM_{10} concentrations at the nearest residences.

Table 7 Predicted Maximum Incremental 24-hour and Annual Mean PM_{10} Concentrations

Residence	Maximum 24-hour Mean PM_{10} (µg/m^3)	Annual Mean PM_{10} (µg/m^3)
R1	4.4	0.4
R2	4.1	0.1
R3	4.7	0.6
R4	2.0	0.1
R5	6.7	0.3
R6	2.0	0.1

Table 7 indicates that when the predicted maximum 24-hour mean concentrations are combined with the 75th percentile PM_{10} background concentrations obtained from Wagga Wagga North (23.7 µg/m^3), the combined (or total) PM_{10} concentrations are below the 24-hour assessment criterion value of 50 µg/m^3 at each location.

Table 7 also indicates that when the predicted annual mean concentrations are combined with the PM_{10} background concentrations obtained from Wagga Wagga North (22.1 µg/m^3), the combined (or total) PM_{10} concentrations are below the annual mean assessment criterion value of 30 µg/m^3 at each location.

As the predicted maximum 24-hour and annual mean PM_{10} concentrations (with background) are below the relevant assessment criteria at each residence, the potential for adverse impacts on the surrounding environment as a result of the proposed expanded operations at the Quarry is considered to be low.

Table 8 presents the mean dust deposition predicted at the nearest residences.

Table 8 Predicted Mean Dust Deposition

Residence	Mean Dust Deposition (g/m^2/month)
R1	<0.1
R2	<0.1
R3	<0.1
R4	<0.1
R5	<0.1
R6	<0.1

Table 8 indicates that the mean dust deposition rates predicted at each location are well below the relevant assessment criterion of 2 g/m^2/month. Therefore, the potential for adverse impacts on the surrounding environment as a result of the proposed expanded operations at the Quarry is considered to be minimal.

As discussed, the results presented do not include the impacts of any control measures which are, and will continue to be implemented as part of the Quarry operation. A discussion of the measures which will act to further reduce impacts of particulate matter is presented in **Section 6**.

6 DUST MITIGATION MEASURES

6.1 Site Specific Mitigation Measures

The mitigation measures adopted by the Applicant for general dust control are summarised below:

- Surface disturbance (and vegetation clearing) would be limited to the area required for at least 12 months of operations. Soil stockpiles retained for periods greater than 3 months would be sown with a sterile cover crop.
- Exposed areas that are not part of active operational areas would be progressively revegetated.
- Wherever possible, soil stripping would continue to be undertaken at a time when there is sufficient soil moisture to prevent significant dust lift-off.
- Whenever possible, the Applicant would avoid stripping soil and overburden, and importing and placing VENM during periods of high winds.
- Dust sprays would continue to be used within the crushing and screening plant at locations that have high potential for dust generation, including at Screens 1 and 2.
- Product stockpiles would be limited to approximately 20,000 tonnes under normal operating conditions.
- The exhausts of all earthmoving equipment would continue to be diverted away from the ground surface so as not to generate dust.
- The front-end loader would continue to be fitted with appropriate exhaust controls. The Applicant would ensure that all plant and equipment is properly maintained to ensure no unacceptable exhaust emissions occur.
- The entrance to the Quarry Site and the entire length of Paynes Road to the Hume Highway is sealed and maintained by the Applicant thereby reducing dust dispersal from quarry-related traffic.
- Internal haul roads and the unsealed areas around the processing plant would continue to be maintained by periodic grading to remove unconsolidated material from the surfaces and regular application of water through the use of a 20,000 L water cart. The frequency of water application would be dependent on climatic factors, in particular wind and temperature, and usage.
- The internal haul roads would be clearly defined and vehicles and equipment restricted to those roads during normal operational activities.
- All product trucks leaving the Quarry would continue to be covered.

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

- The cement/fly ash silos would be filled using an enclosed pneumatic transfer system, i.e. the sealed trucks would be pressurised, and fitted with reverse pulse filters to ensure all air discharged to the atmosphere during the silo filling process would be free of particulate matter. After each delivery, the pneumatic filling line would be blown through and capped.
- The cement/fly ash silos would also be fitted with high level alarms which would be interlocked with the filling line so that, in the event of a silo approaching an overfill condition, an audible alarm would sound and the pneumatic filling line would close.
- The asphalt plant would be fitted with a bag house which would be designed to control solid particles.
- The bitumen and asphalt storage tanks would be thermostatically controlled to prevent overheating and associated odour emissions.
- Water sprays would be installed at the point of discharge of aggregates onto the batching conveyor. These water sprays would be initiated when the material is not sufficiently damp to prevent dust generation.

- A conveyor scraper would be installed to clean the return side of the conveyors.
- The raw materials storage bins would be protected using shields above the storage bin walls.
- Routine clean-up of any spillages resulting from delivery of raw materials and placement within either the appropriate stockpiles or within the wedge pit.

6.2 Daily Site Inspections

Daily site inspections will continue to be carried out during quarrying operations. Daily environmental inspections will include, but not be limited to:

- Visual inspection of airborne dust.
- Ensure mud tracking onto Paynes Road is negligible near the Quarry entrance.
- Inspection of any rehabilitated areas (where relevant).

Any environmental inspection reports should include the above observations, with remedial or corrective actions noted (as appropriate). Any remedial or corrective actions should be reported to the Quarry Manager as soon as is practicable.

7 CONCLUSIONS

In order to assess the potential for impact of the proposed increased production level and other operations at the Quarry Site on the surrounding environment, SLR has conducted a dispersion modelling assessment.

Modelling has been conducted using the Ausplume dispersion model and a complete year of site representative meteorological data. Peak hourly emissions have been used to predict the potential maximum 24-hour mean PM_{10}, annual mean PM_{10} and dust deposition in the vicinity of the Quarry.

The total (with background) maximum 24-hour mean, annual mean PM_{10} concentrations and dust deposition rates were predicted to be below the relevant assessment criteria at the nearest residences and, consequently, the potential for adverse impacts on the surrounding environment as a result of the proposed expanded operations at the Quarry Site is considered to be low.

Table 9 Emissions Inventory – Source Details

PP = Processing Plant, AP = Asphalt Plant, CP = Concrete Plant

Source	Silt Content (%)	Moisture Content (%)	Hours of Operation	Hourly Throughput (t)	Haul Route Distance (m)	Load in Truck (t)	Truck Weight (t)	VKT/hr	Blast Area (m^2)	Depth Blast (m)	No of Holes / hour	Total Area (m^2)
Pit Dozer	10	5	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pit FEL	10	5	17	83.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pit Drill	10	5	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5	N/A
Pit Blast	10	5	1	N/A	N/A	N/A	N/A	N/A	300	15	N/A	N/A
Pit Haulage	6.4	1.1	17	83.3	220	55	100	0.7	N/A	N/A	N/A	N/A
PP Crushing	10	5	17	83.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PP SP Loading	10	5	17	83.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PP FEL product	10	5	24	59.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PP product Haulage	6.4	1.1	24	59.0	510	30	40	2.0	N/A	N/A	N/A	N/A
PP FEL pre-coat	10	5	17	83.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AP FEL hopper	10	5	17	58.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AP product haulage	6.4	1.1	17	58.8	270	30	40	1.1	N/A	N/A	N/A	N/A
CP FEL hopper	10	5	17	3.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CP product haulage	6.4	1.1	17	3.5	340	30	40	0.1	N/A	N/A	N/A	N/A
Wind Erosion (WE) - Pit	10	5	24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	198575
WE – Top soil	10	5	24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	198575

Table 10 Emissions Inventory – Emission Rates

Source	Dust Emission Factor	PM_{10} Emission Factor	Unit	Dust Emission Rate	PM_{10} Emission Rate	Unit
Pit Dozer	5.0853	1.1296	kg/hr	1.413	0.314	g/s
Pit FEL	0.0010	0.0003	kg/t	0.023	0.006	g/s
Pit Drill	0.5900	0.3100	kg/hole	0.819	0.431	g/s
Pit Blast	1.1432	0.5944	kg/blast	0.318	0.165	g/s
Pit Haulage	4.3100	1.1635	kg/VKT	0.798	0.215	g/s
PP Crushing	0.0100	0.0040	kg/t	0.231	0.093	g/s
PP SP Loading	0.0006	0.0003	kg/t	0.013	0.006	g/s
PP FEL product	0.0006	0.0003	kg/t	0.009	0.004	g/s
PP product Haulage	2.8537	0.7703	kg/VKT	1.591	0.429	g/s
PP FEL pre-coat	0.0006	0.0003	kg/t	0.013	0.006	g/s
AP FEL hopper	0.0006	0.0003	kg/t	0.009	0.004	g/s
AP product haulage	2.8537	0.7703	kg/VKT	0.839	0.227	g/s
CP FEL hopper	0.0006	0.0003	kg/t	0.0005	0.00026	g/s
CP product haulage	2.8537	0.7703	kg/VKT	0.063	0.017	g/s
Wind Erosion (WE) - Pit	0.4000	0.2000	kg/ha/hr	1.11E-05	5.56E-06	$g/m^2/s$
WE – Top soil	0.4000	0.2000	kg/ha/hr	1.11E-05	5.56E-06	$g/m^2/s$