AIR QUALITY MANAGEMENT PLAN

DOLWENDEE QUARRY

Upper Hunter Holdings

29 August 2023

Job Number 14080359B

Prepared by
Todoroski Air Sciences Pty Ltd
Suite 2B, 14 Glen Street
Eastwood, NSW 2122
Phone: (02) 9874 2123
Fax: (02) 9874 2125
Email: info@airsciences.com.au

Air Quality Management Plan

Dolwendee Quarry

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1 INTRODUCTION

The Dolwendee Quarry (hereafter referred to as the Project) is located in the Upper Hunter Valley region of New South Wales (NSW), approximately 37 kilometres (km) southwest of Scone and 8km northwest of Denman. The immediate land use surrounding the Project is predominantly comprised of rural land used for agriculture and grazing and open cut coal mining at the Mangoola Coal mine located to the northeast.

Activity at the Project includes a quarry operation with on-site processing. The quarry is approved to operate 21 years from the date of commencement, at an allowed extraction of 250,000 tonnes of quarry products per annum (tpa). The resource would be extracted predominantly with ripping methods and blasting using plant including a combination of bulldozer, excavator, front-end-loader, articulated haul truck and road registered semi-trailers to assist with the extraction. The resource would be processed with a mobile in-pit crusher and separating equipment prior to being stockpiled for transport off-site.

An internal haul road approximately 2.5km long would connect the quarry to the Golden Highway for transport of product to customers. The quarry staging would be planned to minimise environmental impacts by limiting quarry-related disturbance to only the approved areas and minimising forward stripping of topsoil and overburden.

Figure 1-1 presents the location of the Project and the receptors. The nearest sensitive receptors are located approximately 1,200m from the quarrying area, and 260m from the site access road. The active quarrying area is nestled into a U-shaped ridge/ escarpment positioned between the quarry and receptors.

Hours of operation are Monday to Friday 7:00am to 6:00pm and Saturday 8:00am to 1:00pm. No operation is permitted on Sunday and Public Holidays. Blasting is only permissible Monday to Friday 9:00am to 5:00pm, except on Public Holidays.

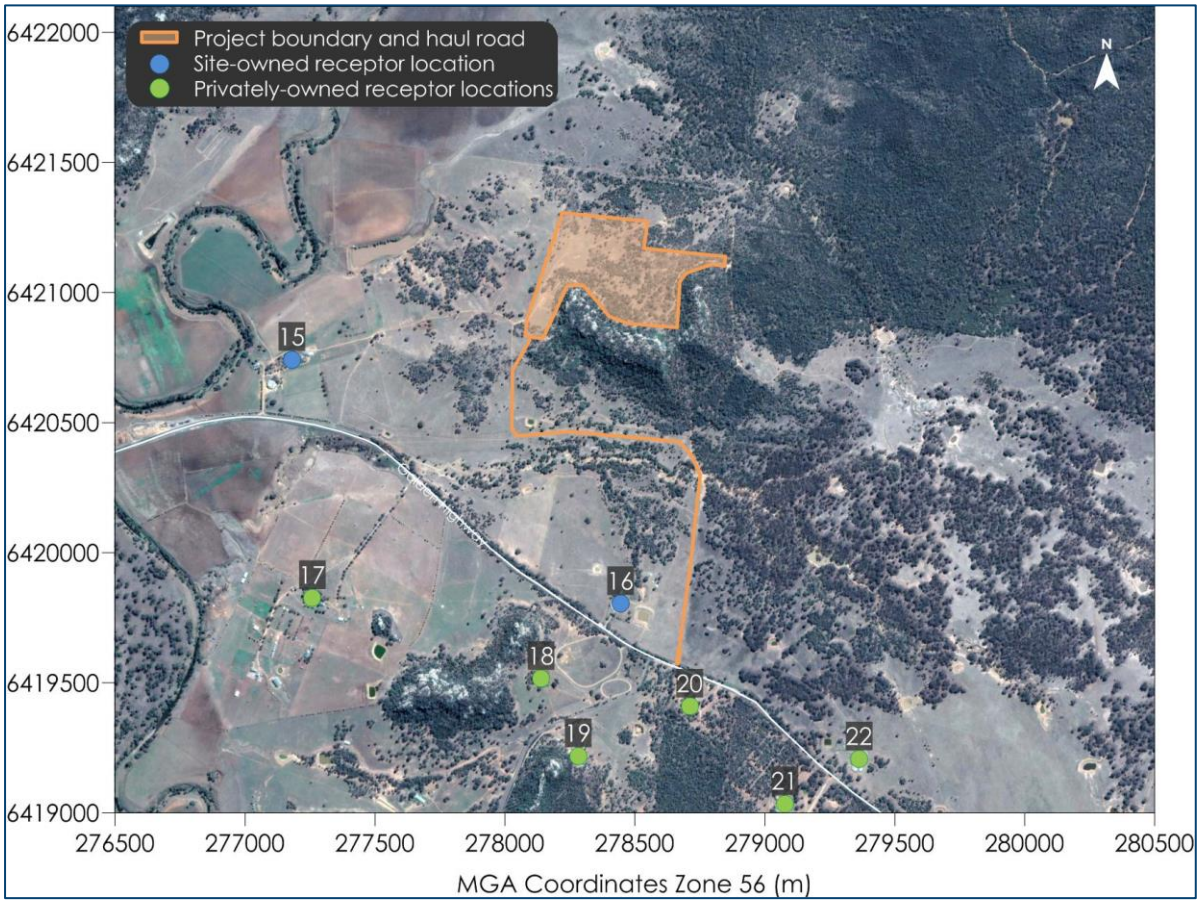

Figure 1-1: Project location

1.1 Aims

This air quality management plan (AQMP) details the management framework and mitigation actions to be taken when operating the Project, and defines the applicable best management practices for the operation.

1.2 Structure of this AQMP

This AQMP is structured as follows:

Section 1: Introduction

Section 2: Outlines the statutory and Project approval requirements applicable to Project.

Section 3: Provides baseline data.

Section 4: Outlines the dust management strategy.

Section 5: Best Practice Assessment

Section 6: Outlines the monitoring network and monitoring methodology for the Project.

Section 7: Outlines the operational management measures for the Project, including roles and responsibilities, key performance indicators and reporting of incidents and non-compliances.

Section 8: Provides details of the complaints management procedures.

Section 9: Provides the references cited in the AQNMP.

2 STATUTORY AND PROJECT APPROVAL REQUIREMENTS

Activity at the Project will be managed in accordance with the air quality related obligations outlined in Development Consent SSD 6519 and per the NSW Environment Protection Authority (EPA) Draft Environmental Protection Licence 21293.

2.1 Development Consent SSD 6519

Schedule 3

Air Quality

Air Quality Impact Assessment Criteria

10. The Applicant must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 3 at any residence on privately-owned land.

Table 3: Air quality criteria

Pollutant	Averaging Period	Criterion	
Particulate matter < 10µm (PM_{10})	Annual	[a, d] 30µg/m³	
Particulate matter < 10µm (PM_{10})	24 hour	[b] 50µg/m³	
Total suspended particulates (TSP)	Annual	[a, d] 90µg/m³	
[c] Deposited dust	Annual	[b] 2g/m²/month	[a, d] 4g/m²/month

Notes to Table 3:
a Cumulative impact (ie increase in concentrations due to the development plus background concentrations due to all other sources).
b Incremental impact (ie increase in concentrations due to the development alone, with zero allowable exceedances of the criteria over the life of the development.
c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.
d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary.
e "Reasonable and feasible avoidance measures" includes, but is not limited to, the operational requirements in conditions 11 and 12 to develop and implement an air quality management system that ensures operational responses to the risks of exceedance of the criteria.

Operating Conditions

11. The Applicant must:

(a) implement all best practice management to minimise dust emissions of the development, including using water carts, water sprays or other suitable controls to minimise dust generation on haul roads, stockpiles and processing areas;

(b) regularly assess meteorological and air quality monitoring data and relocate, modify and/or stop operations on site to ensure compliance with the air quality criteria in this consent;

(c) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see note d under Table 3);

(d) monitor and report on compliance with the relevant air quality conditions in this consent; and

(e) minimise the surface disturbance of the site by the development and undertake progressive rehabilitation;

to the satisfaction of the Secretary.

Air Quality Management Plan

12. The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Secretary. This plan must:

(a) be prepared in consultation with the EPA;

(b) be submitted to the Secretary for approval prior to the commencement of development under this consent, unless otherwise agreed by the Secretary;

(c) describe the measures that would be implemented to ensure:

- *compliance with the relevant conditions of this consent;*
- *best practice management is being employed; and*
- *the air quality impacts of the development are minimised during adverse meteorological conditions and extraordinary events;*

(d) describe the air quality management system in detail;

(e) include an air quality monitoring program that:

- *is capable of evaluating the performance of development;*
- *includes a protocol for determining any exceedances of the relevant conditions of consent;*
- *effectively supports the air quality management system; and,*
- *evaluates and reports on the adequacy of the air quality management system.*

Meteorological Monitoring

13. For the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.

Schedule 5

Annual Review

9. By the end of September each year following the commencement of development under this consent, or other timing as may be agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Secretary. This review must:

(a) describe the development (including any rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year;

(b) include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against the:

- *relevant statutory requirements, limits or performance measures/criteria;*
- *requirements of any plan or program required under this consent;*
- *monitoring results of previous years; and*
- *relevant predictions in the documents listed in condition 2(a) of Schedule 2;*

(c) identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;

(d) identify any trends in the monitoring data over the life of the development;

(e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and

(f) describe what measures will be implemented over the current financial year to improve the environmental performance of the development.

The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of Schedule 5) and any interested person upon request.

INDEPENDENT ENVIRONMENTAL AUDIT

10. Within a year of the date of commencing development under this consent and every 3 years thereafter, unless the Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. This audit must:

(a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;

(b) include consultation with the relevant agencies and (if established) the CCC;

(c) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent and any relevant EPL or necessary water licences for the development (including any assessment, strategy, plan or program required under these approvals);

(d) review the adequacy of strategies, plans or programs required under the abovementioned approvals;

(e) recommend appropriate measures or actions to improve the environmental performance of the development, and/or any assessment, strategy, plan or program required under the abovementioned approvals; and

(f) be conducted and reported to the satisfaction of the Secretary.

Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Secretary.

2.2 NSW EPA Environmental Protection Licence 21293

L.4 Blasting

L4.6 Offensive blast fume must not be emitted from the premises

Note: Offensive blast fume means post-blast gases from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:

a) are harmful to (or likely to be harmful to) a person that is outside the premises from which it is emitted, or

b) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.

L6 Potentially offensive odour

L6.1 No condition in this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997 provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

O3 Dust

O3.1 All unsealed trafficable areas, and stockpiled materials, must be kept sufficiently wet, or be controlled by another appropriate means, so as to prevent or minimise windblown or traffic generated dust.

O5 Other operating conditions

Air Pollutants

O5.1 The premises must be maintained in a condition which prevents or minimises the emission of air pollutants, including dust, from the premises.

O5.2 All activities conducted on the premises must be undertaken by such practical means to avoid or minimise the emission of air pollutants, including dust.

O5.3 All haul roads must be constructed and maintained so that a minimum 80% control efficiency of haul road dust is achieved.

M2 Weather monitoring

M2.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

Point 2

Parameter	***Sampling Method***	***Units of measure***	***Averaging Period***	***Frequency***
Rainfall	*AM-4*	*mm*	*1 hour*	*continuous*
Sigma theta	*AM-2 and AM-4*	*degrees*	*10 minute*	*continuous*
Siting	*AM-1*	*-*	*-*	*-*
Temperature at 2 metres	*AM-4*	*°C*	*10 minute*	*continuous*
Temperature at 10 metres	*AM-4*	*°C*	*10 minute*	*continuous*
Wind Direction at 10 metres	*AM-2 and AM-4*	*degrees*	*15 minute*	*continuous*
Wind Speed at 10 metres	*AM-2 and AM-4*	*metres per second*	*15 minute*	*continuous*

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:

1. *a Statement of Compliance,*
2. *a Monitoring and Complaints Summary,*
3. *a Statement of Compliance - Licence Conditions,*
4. *a Statement of Compliance - Load based Fee,*
5. *a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,*
6. *a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and*
7. *a Statement of Compliance - Environmental Management Systems and Practices.*

At the end of each reporting period, the EPA will provide to the licensee notification that the Annual Return is due.

3 BASELINE DATA

3.1 Local climate

Available long-term climatic data from the Bureau of Meteorology (BoM) weather station at Scone Airport AWS (Site No. 061363) collected over a 14 to 19-year period for the various meteorological parameters are presented in **Table 3-1** and **Figure 3-1**. The Scone Airport AWS is located approximately 37km northeast of the Project.

Table 3-1: Monthly climate statistics summary – Scone Airport AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temp. (°C)	31.6	30.6	28.0	24.6	20.4	17.0	16.6	18.7	22.2	25.2	28.0	30.1	24.4
Mean min. temp. (°C)	16.9	16.6	14.3	10.1	6.6	4.8	3.3	3.6	6.7	9.5	13.0	15.3	10.1
Rainfall													
Rainfall (mm)	61.8	55.9	54.6	34.3	35.8	47.7	37.9	35.8	34.4	47.7	74.5	77.0	616.0
No. of rain days (≥1mm)	6.0	5.2	6.2	4.0	4.3	6.3	4.8	4.3	4.7	5.4	7.0	6.9	65.1
9am conditions													
Mean temp. (°C)	22.3	21.3	19.0	17.0	13.0	10.0	9.4	11.3	15.3	18.3	19.7	21.6	16.5
Mean R.H. (%)	70	77	82	77	81	86	83	73	66	62	66	67	74
Mean W.S. (km/h)	11.3	10.0	8.9	8.2	7.0	7.5	7.0	9.9	11.4	12.7	12.7	11.9	9.9
3pm conditions													
Mean temp. (°C)	29.9	28.9	26.7	23.4	19.4	16.1	15.6	17.7	20.8	23.6	26.0	28.4	23.0
Mean R.H. (%)	41	47	47	49	51	58	55	47	44	42	43	42	47
Mean W.S. (km/h)	19.2	18.7	18.6	18.0	16.1	16.0	16.5	18.7	18.9	19.1	20.6	20.0	18.4

Source: **Bureau of Meteorology, 2018**

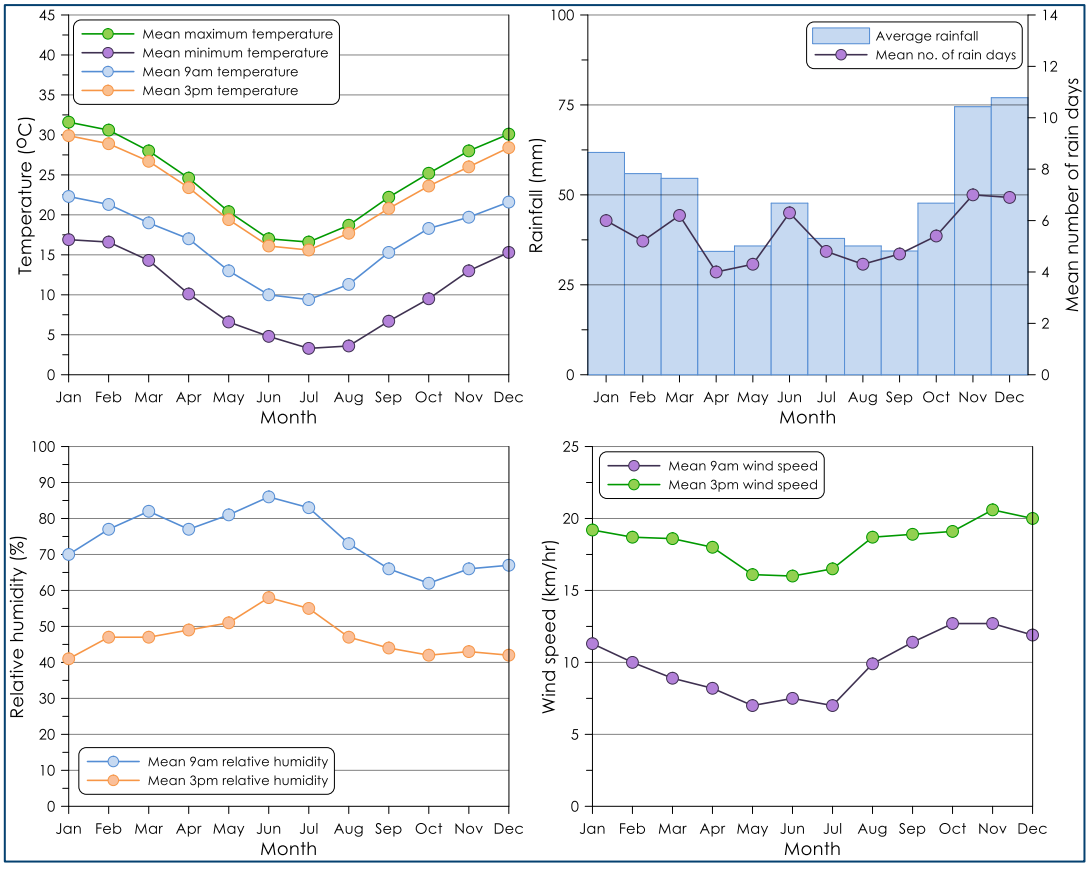

Figure 3-1: Monthly climate statistics summary – Scone Airport AWS

3.2 Local meteorological conditions

Annual and seasonal windroses prepared from data measured by the NSW Office of Environment and Heritage (OEH) at Wybong during 2017 are presented in **Figure 3-2**. Analysis of the windroses indicate that the wind directions typically align along a north/ north-northwest to southeast axis on an annual basis. This pattern is expected for this location considering the wider terrain features. During summer, winds are predominantly from the southeast. The autumn wind distribution is varied, with winds from the north are most frequent. In winter the distribution shows winds predominately from the north. The spring wind distribution is similar to the annual distribution, typically dominated by winds from the north/ northwest and southeast.

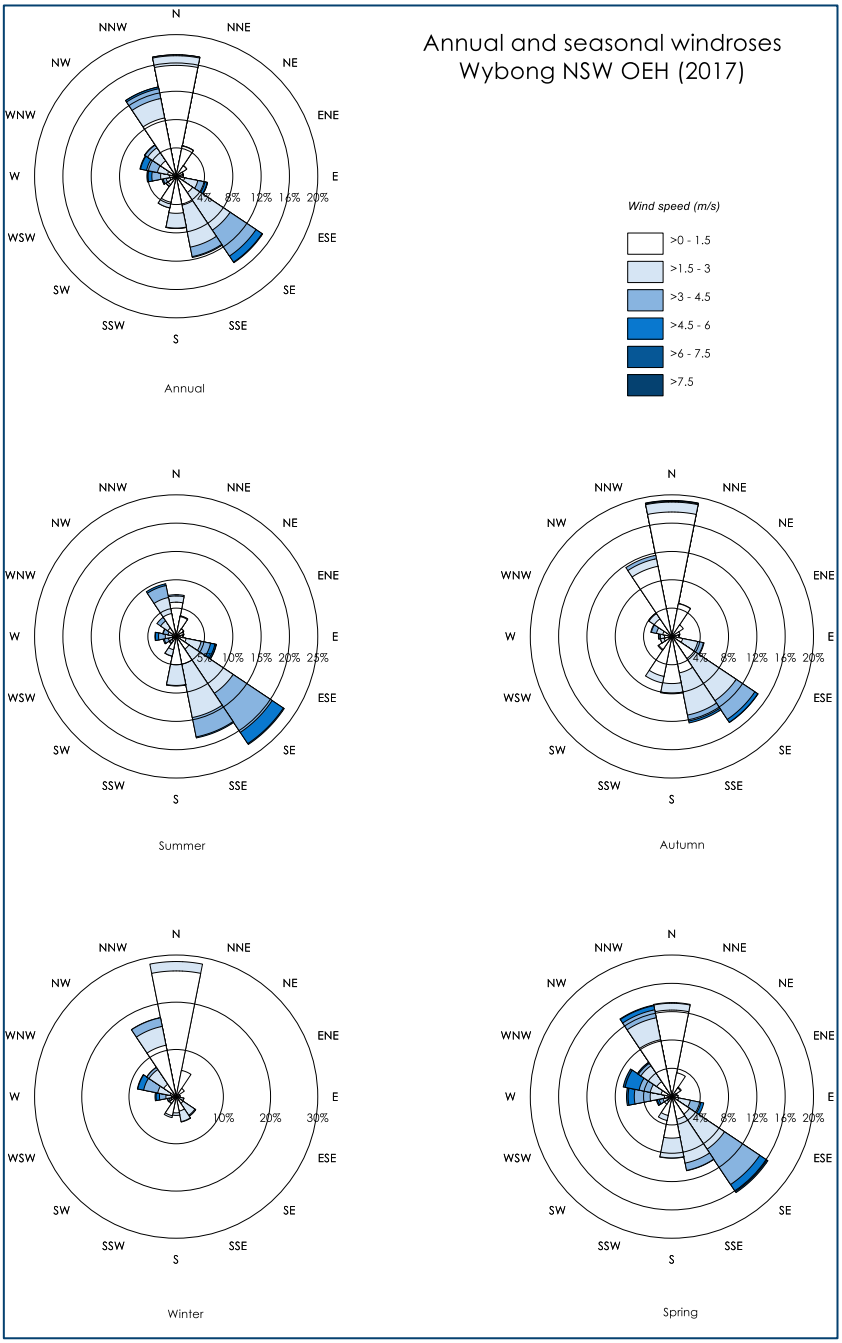

Figure 3-2: Annual and seasonal windrose for Wybong NSW OEH (2017)

3.3 Local air quality

The main sources of particulate matter in the wider area around the Project include agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities such as mining. Available data from the NSW OEH monitoring stations at Wybong, Muswellbrook and Muswellbrook NW are used to characterise the existing air quality levels at the Project.

Table 3-2 and **Figure 3-3** present a summary of the particulate concentrations for the Wybong, Muswellbrook and Muswellbrook NW monitoring stations from 2013 to 2017. Annual average PM_{10} concentrations were below the relevant criterion of 25µg/m³.

The existing maximum 24-hour average PM_{10} concentrations recorded occasionally exceed the 24-hour average goal of 50µg/m³ during the period reviewed. Elevated 24-hr average PM_{10} levels occur from time to time at most monitoring locations in NSW.

Table 3-2: Particulate matter levels from NSW OEH monitoring stations

Year	Wybong	Muswellbrook	Muswellbrook NW
	Annual average		
2013	15.5	22.6	18.9
2014	17.0	21.4	19.2
2015	14.8	19.1	16.7
2016	15.3	19.2	16.6
2017	16.6	21.7	18.5
	Maximum 24-hour average		
2013	83.0	55.6	52.4
2014	67.7	53.0	50.8
2015	79.5	72.6	72.9
2016	52.1	43.9	44.8
2017	64.3	56.5	51.0

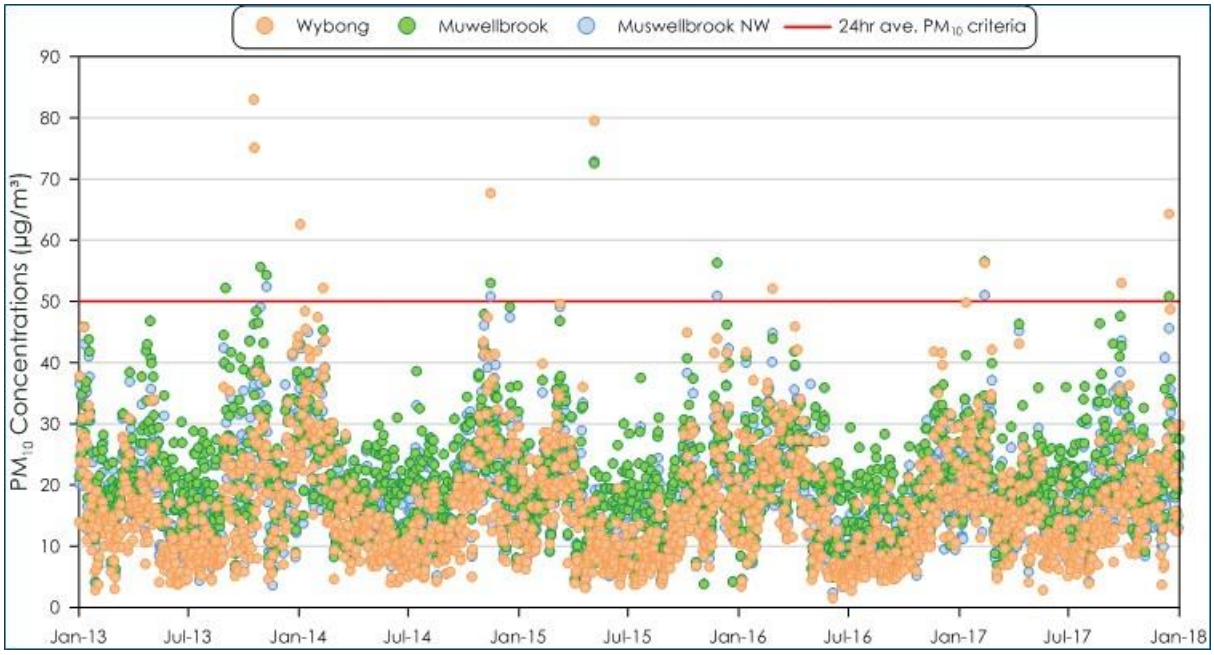

Figure 3-3: 24-hour average PM_{10} concentrations

4 BEST PRACTICE ASSESSMENT

This best practice assessment has generally followed the methodology outlined in the *NSW OEH document Coal Mine Particulate Matter Control Best Practice Site-specific determination guideline* (**NSW OEH, 2011**).

It is important to note that best practice controls relate to those which can be reasonably and practically implemented by the operator, factoring in the nature of the project, environment and receptors. This assessment recommends controls that represent the best approach to ensure significant, actual dust reductions are achieved on an ongoing basis, using measures that in general can readily be confirmed to be in place.

Best practice also extends to the operational monitoring and reactive management of the site when adverse conditions arise. (Detailed in the subsequent section).

4.1 Baseline dust emission estimates

This section presents the baseline dust emission estimates for each of the significant dust generating activities at the Project.

Three size fractions of dust are considered: Total suspended particulates (TSP – all dust that can become, and stay, airborne), inhalable particulate (PM_{10} – dust with aerodynamic diameter less than or equal to 10µm), and respirable particulate ($PM_{2.5}$ – dust with aerodynamic diameter less than or equal to 2.5µm).

USEPA AP-42 emission factors were used to estimate potential dust emissions from each type of activity based on the proposed level of each activity and the available data. As it would appear that the relevant AP42 emission factor for wind erosion is based on data obtained from inactive exposed areas, the State Pollution Control Commission (SPCC) emission factor was used to estimate wind erosion from active exposed areas (such as the active extraction area). The SPCC became the EPA, and the factor is based on NSW data.

When using the equations, various assumptions are required when site specific data were not available but for the most part, the assumptions do not influence the control efficiency analysis in the study as the assumptions only affect parameters that the operator cannot control and which remain unchanged with or without the control in place, for example silt or moisture levels in overburden. The proposed reasonable and practicable best practice dust mitigation measures outlined in Section 10 of the *Air Quality Assessment Dolwendee Quarry* (**Todoroski Air Sciences, 2015**) (AQIA) which are applied to the baseline dust emissions estimates include watering of unpaved haul roads and dust suppression for drilling.

Table 4-1 presents the estimated baseline dust emissions estimates for the Project, with and without the proposed particulate matter controls in place. The activities highlighted in blue shading indicate where control measures have been applied in the *AQIA*.

From **Table 4-1**, the application of the proposed particulate matter controls results in total dust emissions from the entire site of approximately 40% of the uncontrolled baseline emissions estimates for the Project. For conservatism, a 75%control efficiency for unsealed roads was assumed in the AQIA, whereas control efficiencies of 80% to 90% are achieved by extractive industries in the Hunter Valley through regular watering of well constructed roads in combination with speed restrictions.

Table 4-1: Estimated baseline dust emission estimates for the modelled Project (kg of TSP)

Activity	Controlled			Uncontrolled		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Excavator loading Topsoil to haul truck	3	1	0.2	3	1	0.2
Hauling to Topsoil dump	38	11	1	153	45	5
Emplacing at Topsoil dump	3	1	0.2	3	1	0.2
Excavator loading Overburden to haul truck	53	25	4	53	25	4
Hauling Overburden to emplacement area	926	273	27	3,703	1,093	109
Emplacing at dump	53	25	4	53	25	4
Drilling gravel material	103	54	3	343	178	10
Blasting gravel material	51	27	2	51	27	2
Loading gravel material to crusher	263	124	19	263	124	19
Crushing gravel material	675	300	54	675	300	54
Screening gravel material	3,125	1,075	94	3,125	1,075	94
Unloading processed gravel material to stockpile	263	124	19	263	124	19
Rehandle processed gravel material at stockpiles	263	124	19	263	124	19
Loading processed gravel material to haul truck	263	124	19	263	124	19
Hauling product gravel material offsite	37,478	11,062	1,106	149,913	44,248	4,425
Hauling product gravel material offsite - paved road	395	438	44	395	438	44
Wind erosion - whole site	37,493	18,746	2,812	37,493	18,746	2,812
Total emissions (kg/yr)	**81,446**	**32,536**	**4,226**	**197,013**	**66,701**	**7,637**

4.2 Ranked activities

From **Table 4-1** the top four dust generating activities at the Project are identified as:

- Hauling on unpaved roads;
- Wind erosion from exposed areas;
- Screening gravel material; and,
- Crushing gravel material.

These four activities account for more than 99% of the estimated dust emissions estimates for the Project. Dust controls on other activities would not tangibly change any actual emissions.

4.3 Analysis of potential control measures

The potential dust control measures for the top four sources of dust emissions are examined in order of highest to lowest emissions.

4.3.1 Hauling on unpaved roads

Table 4-2 outlines potential control measures to reduce particulate matter emissions from hauling on unpaved roads.

Table 4-2: Potential control measures to reduce particulate matter emissions from hauling on unpaved roads

Control measure		Effectiveness
Vehicle restrictions	Reduction from 75km/hr to 50km/hr.	40-75%
	Reduction from 65km/hr to 30km/hr.	50-85%
Surface improvements	Pave the surface.	>90%
	Low silt aggregate.	30%
	Oil and double chip surface.	80%
Surface Treatments	Watering (standard procedure).	10-74%
	Watering Level 1 (2L/m²/hr).	50%
	Watering Level 2 (>2L/m²/hr).	75%
	Watering grader routes.	50%
	Watering twice a day for industrial unpaved road.	55%
	Suppressants.	84%
	Hygroscopic salts.	Ave. 45% over 14 days
		82% within 2 weeks
	Lignosulphonates.	66-70% over 23 days
	Polymer emulsions.	70% over 58 days
	Tar and bitumen emulsions.	70% over 20 days
Other	Use larger vehicles rather than smaller vehicles to minimise number of trips.	90t to 220t: 40% 140t to 220t: 20% 140t to 360t: 45%
	Use conveyors in place of haul roads.	>95%

Source: **Katestone (2011)**

4.3.2 Wind erosion

Table 4-3 outlines potential control measures to reduce particulate matter emissions from wind erosion from exposed areas.

Table 4-3: Control measures to reduce particulate matter emissions from wind erosion from exposed areas

Control measure		Effectiveness
Avoidance	Minimise pre-strip. EMP should specify a benchmark for optimal performance and report annually against benchmark.	100% per m² of pre-strip avoided
Surface stabilisation	Watering.	50%
	Chemical suppressants.	70% 84%
	Paving and cleaning.	>95%
	Apply gravel to stabilise disturbed open areas.	84%
	Rehabilitation. EMP should specify a rehabilitation goal and report annually against progress to meeting goal.	99%
Wind speed reduction	Fencing, bunding, shelterbelts or in-pit dump. Height should be greater than the height of the erodible surface.	30% 70-80%
	Vegetative ground cover.	70%

Source: **Katestone (2011)**

4.3.3 Crushing and screening

Table 4-4 outlines potential control measures to reduce particulate matter emissions from wind erosion from exposed areas.

Table 4-4: Control measures to reduce particulate matter emissions from crushing and screening

Control measure		Effectiveness
Dust suppression	Wet suppression systems – Crushing [1]	78%
	Wet suppression systems – Screening [1]	91%
	Foaming agent	>78%
Enclosure [2]	Conduct activity within enclosure	70%
	Conduct activity within enclosure and use of fabric filters	99%

Source: [1] **US EPA (2004)** [2] **NPI (2012)**

4.4 Evaluation of potential additional control measures

A summary of the evaluation of potential additional control measures is presented in **Table 4-5**.

The recommended additional control measures, based on the top four dust generating activities at the Project include:

- Restriction of vehicle speed to 30km/hr at the quarry site, and along the site access road within 500m of the Golden Highway;
- Minimise pre-strip of active area;
- Watering of exposed areas for stabilisation;
- Establish rehabilitation goals and report annually on progress; and,
- Apply wet suppression for crushing and screening.

4.5 Timeframe for implementation

The recommended additional control measures should be implemented at the commencement of operations.

Table 4-5: Summary of application of control measures for the Operational Project

Control measure		Application at Project	Comment
Hauling on unpaved roads			
Vehicle restrictions	Reduction from 75km/hr to 50km/hr.	-	-
	Reduction from 65km/hr to 30km/hr.	Recommended	A speed limit of 30km/hr is recommended for the site and on the site access road within 500m of the Golden Highway. Measure is applied via signage.
Surface improvements	Pave the surface.	-	Applied to first 50m of the road adjacent to the Golden Highway, not practical/ feasible elsewhere.
	Low silt aggregate.	-	Haul road surfaces will be regularly maintained via watering and grading to ensure a smooth compacted surface with reduced loose surface silt. Trials may also be undertaken for effectiveness of dust suppressant sprays/seals
	Oil and double chip surface.	-	Not practical/ feasible.
Surface Treatments	Watering (standard procedure).	-	-
	Watering Level 1 (2L/m^2/hr).	-	-
	Watering Level 2 (>2L/m^2/hr).	Yes	Application via watercart capable to delivering more than 2L/m^2/ hr (multiple passes are preferred to a single drenching pass).
	Watering grader routes.	-	Not a regular control measure, but if significant dust is generated from graders, target watering is recommended at these times.
	Watering twice a day for industrial unpaved road.	-	Not a regular measure, but may be practiced, say on a very hot and windy day
	Suppressants.	-	-
	Hygroscopic salts.	-	-
	Lignosulphonates.	-	-
	Polymer emulsions.	-	-
	Tar and bitumen emulsions.	-	-
Other	Use larger vehicles rather than smaller vehicles to minimise number of trips.	-	Not practical/ feasible. Road going vehicles required.
	Use conveyors in place of haul roads.	-	Not practical/ feasible.
Wind erosion			
Avoidance	Minimise pre-strip. EMP should specify a benchmark for optimal performance and report annually against benchmark.	Recommended	Recommended for this Project.
Surface stabilisation	Watering.	Recommended	Targeted watering of active areas when in use (considered an appropriate control measure for this source.

Control measure		Application at Project	Comment
	Chemical suppressants.	-	-
	Paving and cleaning.	-	-
	Apply gravel to stabilise disturbed open areas.	-	Could be considered depending on available material.
	Rehabilitation. EMP should specify a rehabilitation goal and report annually against progress to meeting goal.	Recommended	Recommended for this Project.
Wind speed reduction	Fencing, bunding, shelterbelts or in-pit dump. Height should be greater than the height of the erodible surface.	-	-
	Vegetative ground cover.	-	May be considered in the rehabilitation goal.
Crushing and screening			
Dust suppression	Wet suppression systems – Crushing	Recommended	Recommended for this Project.
	Wet suppression systems – Screening	Recommended	Recommended for this Project.
	Foaming agent	-	Not practical/ feasible.
Enclosure	Conduct activity within enclosure	-	Not practical/ feasible.
	Conduct activity within enclosure and use of fabric filters	-	Not practical/ feasible.

With these controls in place, higher control efficiencies that assumed for the purposes of conservatism in the modelling are achievable, For example for the unsealed haul road, the control level would be 75% for Level 2 watering, plus 50% to 85% for speed reduction which will result in control efficiency of at least 80% to 90%, consistent with efficiencies demonstrated by extractive activities in the Hunter Valley.

5 DUST MANAGEMENT STRATEGY

The activities at the site will generate some amount of dust emissions, therefore it is prudent to take reasonable and practicable measures to prevent and minimise excessive generation of dust emissions which may affect the surrounding environment.

To ensure that dust generation during operational activities is managed in a best practice manner and any potential off-site impacts are minimised, appropriate operational and physical mitigation measures would be utilised, as set out below.

5.1 Dust emission sources

Sources of air emissions from operational activities are identified as follows:

- Wind erosion of exposed areas and stockpiles;
- Handling of materials including loading/unloading;
- Material processing (i.e. crushing and screening);
- Vehicle movement and hauling; and,
- Engine exhaust of vehicles and plant.

5.2 Dust mitigation measures

The primary dust mitigation measures that are to be applied to the on-site activities to minimise the generation and hence potential for dust impacts at the nearby sensitive receptors and in the surrounding environment are outlined below.

5.2.1 General

- Site induction for all site staff to include air quality management requirements to ensure awareness of potential air quality impacts;
- Activities are to be assessed during adverse weather conditions and modified as required (e.g. increase watering, or reduce any unnecessary activities). For the purpose of this plan, adverse wind conditions are defined as when there has been no rain in the past 72 hours, with temperatures above 38 degrees Celsius and wind speeds above 8m/s blowing towards the sensitive receptors; and,
- Visual surveillance of dust plumes from all activity, at least daily by Site Manager or supervisors.

5.2.2 Wind erosion of exposed areas and stockpiles

- The area of exposed surfaces will be minimised where practicable, such as by minimising road widths, shaping stockpiles in a manner which reduces the exposed surface area, or by covering exposed surfaces with coarse material (>10mm);
- Exposed active areas and active stockpiles will be watered on a daily basis (or more frequently as required) to keep surface moisture levels sufficient to minimise wind erosion. A final application of water at the end of the day may be needed under hot and windy conditions;

- Dusty material stockpiles will be located as far away from sensitive receptors as possible; and,
- Ancillary vehicles will be kept within active, controlled areas, and off other exposed or inactive areas to avoid potential additional disturbance of these surface in these areas.

5.2.3 Handling of material

- When loading and unloading material, the drop height of the material will be minimised as far as is practical, for example the front end loader will tip the bucket only when it is close to the ground, the bed of the truck or the material pile being added to, or trucks will "block dump" loads partially onto existing piles;
- Minimise spillage from loading/unloading and clean up any spillage of silty/ dusty materials as soon as practicable;
- Where feasible and practical, use of watering to ensure moisture content of material handled is sufficient to minimise dust generation; and,
- During periods of high wind speeds (above 8m/s) and winds blowing towards the sensitive receptors, the material handling activities will be minimised or ceased when excessive visible plumes of dust cannot be abated and a continuous visible plume of dust reaches over the site boundary.

5.2.4 Material processing

- Dusty materials will be sprayed with water prior and if necessary during and after processing; and,
- Overloading of the crushers and screens will be prevented to avoid spillage.

5.2.5 Vehicle movement and hauling materials

- Haul roads will be watered using water carts such that the road surface has sufficient moisture to minimise on-road dust generation but not so much as to cause mud/dirt track out to occur. The key is to aim for frequent, but light watering of the main haul road, or occasional heavy watering of less frequently used roads;
- Regularly inspect haul roads and maintain surfaces to remove potholes or depressions;
- Vehicle traffic will be restricted to designated routes that can be managed by regular watering;
- To minimise mud or dirt track out onto public roads, vehicles are to be cleaned of any excess "parasitic" dirt, sand and other materials adhering to the outside of trucks, hitches, bogies etc. prior to leaving the site. (this is minimised by careful loading to prevent spillage);
- Vehicle loads will be secured and covered when transporting materials on or off-site. The exposed surface of dusty materials in trucks may also be watered if necessary;
- Materials will be loaded onto vehicles in a uniform, level manner and not able to spill from the vehicle; and,
- The number of trips will be minimised by maximising the vehicle load (but not overloading).

5.2.6 Engine exhaust of vehicles and plant

- Where possible, the use of vehicles and plant will be minimised by maximising utilisation of plant load capacity;
- When not in use, engines of on-site vehicles and plant will be switched off; and,
- Vehicles and plant including any fitted pollution reduction devices, will be maintained and serviced according to manufacturer's specifications.

6 MONITORING NETWORK

To assess compliance with the approval requirements and the performance of the mitigation measures, ambient air quality monitoring will be conducted at various locations near the operational activity that can be inferred as representative of the nearest sensitive receptors.

Other monitoring includes meteorological monitoring to record weather conditions representative of the Project site.

A simple, achievable and practical monitoring plan has been recommended in consideration of the nature of the project, available staff/ skills and also the surrounding environment and receptors.

The monitoring network is proposed to be in place prior to the commencement of the operation.

The monitoring network will be reviewed annually with regards to potential improvements and modifications to the monitoring framework. Subject to a record of demonstrated sustained compliance continuation of monitoring would be reviewed. Any proposed changes to monitoring network would be subject to discussion and approval from the NSW EPA.

6.1 Monitoring methods

6.1.1 Real-time PM_{10} monitoring

Two portable PM_{10} monitors would be deployed for at least 24 months, covering a period of activity at a rate near to capacity in order to quantify the dust concentrations on the site. The two temporary PM_{10} monitors are proposed to be installed for monitoring operational dust levels, see **Figure 6-1**.

To assess compliance with Condition 10, Schedule 3 of the consent SSD-6519 it will be necessary to extrapolate the measured level to the concentration likely to have occurred further off-site at private residences (unless the readings are already below all criteria). Similarly, to assess compliance with Condition 0.5.3 of the EPL 21293 further analysis of the measured data would be necessary to calculate any control efficiency.

In the event of an observable dust incident, the PM_{10} monitor would be used to measure dust levels up and down wind of operational areas to quantify the amount of dust generated and identify sources requiring remedial action.

In the event of a complaint or following a written direction from the Secretary, the PM_{10} monitor would be positioned near the affected receptor location and used to demonstrate compliance with the air quality criteria. It is important to note that the measured results cannot be used directly for assessing compliance without further analysis.

6.1.2 Dust deposition

Deposited dust is assessed as insoluble solids as defined by Standards Australia *AS/NZS 3580.10.1:2016: Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric Method*. Two permanent dust gauges are proposed to be installed at the same location as the two portable PM10 monitors for monitoring operational dust levels, see **Figure 6-1**.

6.1.3 Meteorological monitoring

Meteorological monitoring will be conducted to continuously monitor wind speed, wind direction, sigma-theta (the standard deviation of horizontal wind directions), temperature, rainfall and solar radiation.

A meteorological station needs to be installed, and as far as possible, be compliant with the requirements of several applicable standards; the NSW EPA *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (2006), which refers to Australian Standard *AS 2923-1987: Guide for measurement of horizontal wind for air quality applications*, (or the standard which supersedes it; *AS/NZS 3580.14-2014 Methods for sampling and analysis of ambient air – Meteorological monitoring for ambient air quality monitoring applications)* or the alternative NSW EPA approved method set out in United States Environmental Protection Agency publication *EPA 454/R-99-005: Meteorological monitoring guidance for regulatory modelling applications*.

6.2 Monitoring network

The monitoring network design is based on consideration of the prevailing weather conditions and areas representative of the surrounding sensitive receptor locations.

The monitoring network is shown in **Figure 6-1**.

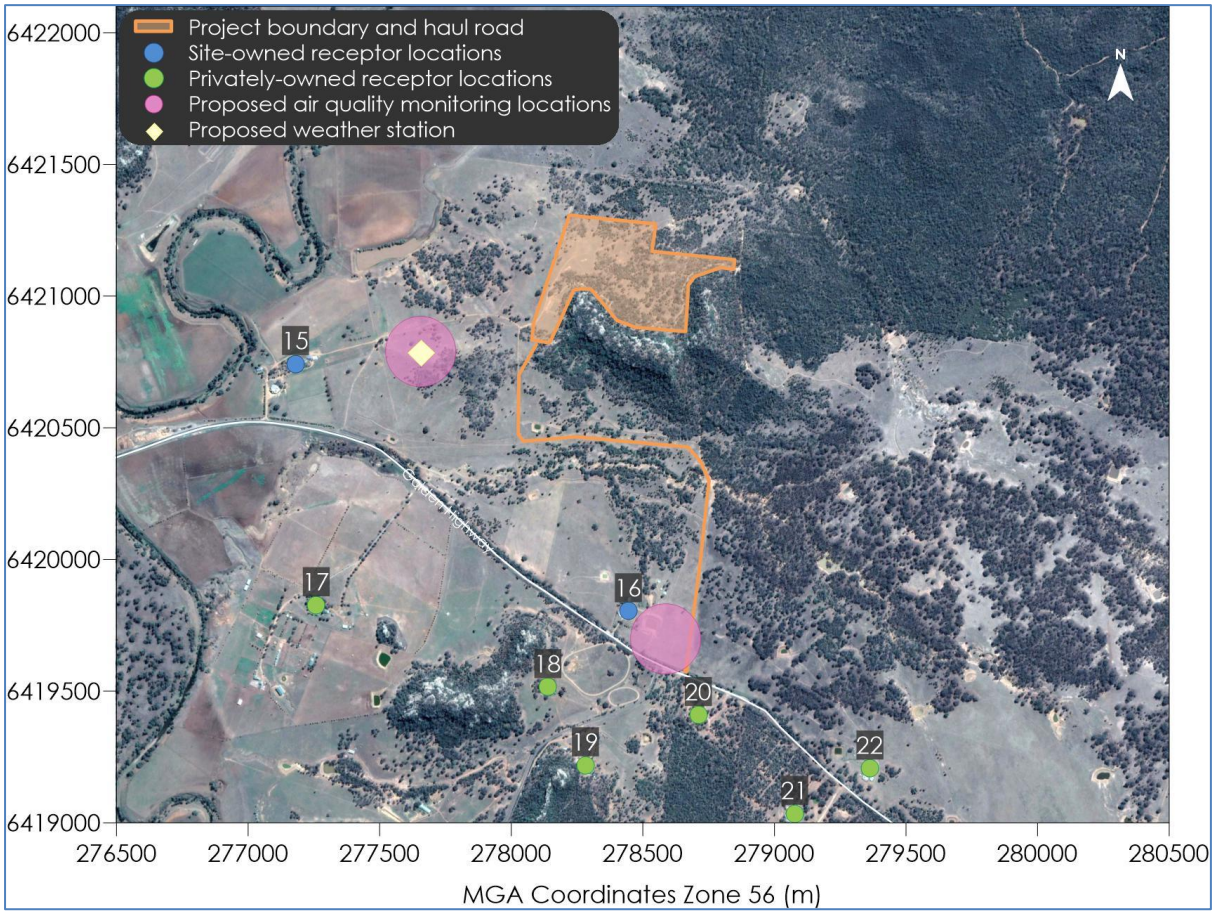

Figure 6-1: Proposed monitoring locations

6.3 Dust deposition monitoring

Dust deposition monitoring is proposed at five locations, with three locations representative of the nearest sensitive receptors or located between the site and the receptors, as shown in **Figure 6-1**. Monitoring samples are analysed in a laboratory on a monthly basis.

It is assumed that where dust deposition levels are within the air quality criteria of 4g/m^2/month as outlined in SSD 6519 for the Project, then all other dust criteria are met.

6.4 Meteorological monitoring

A meteorological weather station should be established in a suitable location on-site and maintained as to be capable of continuously monitoring the parameters in Error! Reference source not found.**Table 6-1.** A suggested location is provided in Figure 6-2.

The weather station is to be sited in accordance with AM-2, *Guide for measurement of horizontal wind for air quality applications* (**AS 2923-1987** or **AS/NZS 3580.14-2014**), and AM-4, *Meteorological monitoring guidance for regulatory modelling applications* EPA 454/R-99-005 (**USEPA (2000)**), as far as is practicable.

Table 6-1: Meteorological monitoring parameters

Parameter	Units of measure	Sample frequency	Averaging period	Method
Wind speed at 10m	m/s	Continuous	15 minutes	AM-2 & AM-4
Wind direction at 10m	degrees	Continuous	15 minutes	AM-2 & AM-4
Sigma Theta	Degrees	Continuous	10 minutes	AM-2 & AM-4
Temperature at 2m	Celsius	Continuous	10 minutes	AM-4
Temperature at 10m	Celsius	Continuous	10 minutes	AM-4
Rainfall	mm	Continuous	1 hour	AM-4

7 OPERATIONAL MANAGEMENT

7.1 Roles and responsibilities

Management roles and responsibilities are listed in **Table 7-1**.

Table 7-1: Roles and responsibilities

Role	Responsibility
General Manager	✦ Provide sufficient resources to manage dust related risks and to progress opportunities for improvement. ✦ Identify and allocate sufficient resources to manage dust related risks by supporting AQMP implementation.
Onsite Manager	✦ Oversee the implementation, monitoring and review of the AQMP in accordance with applicable requirements. ✦ Record, investigate and respond to dust related incidents and complaints in accordance with complaint and incident management procedures. ✦ Periodically assess dust management performance (annually and whenever a process change is put in place).

Role	Responsibility
	✦ Provide training to employees and contractors for the implementation of dust management related controls, systems and procedures. ✦ Implement, monitor and review programs, systems and procedures linked to dust management.
Employees and Contractors	✦ Conduct work activities within training and induction parameters. ✦ Immediately reporting incidents and complaints to the Site Supervisor.

7.2 Environmental air quality awareness and training

The Project will provide training commensurate with the roles and responsibilities of personnel outlined in **Table 7-1**.

Staff training implemented at the site with respect to dust, odour and noise management includes the following:

- Site familiarisation inductions provided to all new employees and contractors;
- General environmental awareness provided to all employees and contractors; and,
- Issue specific training sessions provided to employees and contractors as required.

7.3 Key performance indicators

Table 7-2 details specific dust, odour and noise management performance indicators for the Project.

Table 7-2: Specific performance indicators

Objective	Target	Performance indicator
Regulatory compliance.	No excessive visible dust generation from the site (no continuous plume of visible dust beyond activity/ site boundary).	Daily record of site observations for visible dust. Monthly record of measured PM_{10} dust levels.
	Annual average dust deposition levels below 4 g/m²/month.	Record of dust deposition levels below 4 g/m²/month.
Complaints management.	Operate with minimal visible dust (the cause of most complaints).	Any visible dust plumes are less than the size of the operating plant item. All complaints recorded, all reasonable complaints investigated and the outcomes documented, including follow up with complainant.
Ensure all applicable mitigation measures are being taken to minimise dust.	Application of the recommended mitigation measures (as applicable to the specific situation).	Maintaining on-site documentation or a log of mitigating measures taken, and the aspect of the operation to which they are applied.
	Newly developed, improved measures are adopted where applicable.	Development of new measures that are necessary to ensure optimal use of available resources.

7.4 Reporting for compliance

Annual reporting per the requirements of the Consent and EPL will be conducted.

A report will be prepared annually, by the end of September each year following the commencement of development under this consent.

This includes an Annual Review (per Schedule 5 Condition 9) and the EPL Annual Return (per Condition R1.1 of EPL 21293.

The reports will include a review of the monitoring results and complaints records for the operations over the previous calendar year.

The reports will include:

- A comparison of the monitoring results against:
  - Relevant statutory requirements;
  - Performance measures;
  - Monitoring results of previous years; and,
  - Relevant predictions in the air quality and noise assessment.
- Identify any non-compliance over the last year(s), and describe what actions were (or are being) taken to ensure compliance; and,
- Identify any trends in the monitoring data over the life of the Project.

The Secretary (and any other relevant agencies) will be immediately notified of any incident. Within 7 days of the date of the date of the incident, a detailed report on the incident will be provided to the Secretary in accordance with Condition 7 of Schedule 5 of the development consent.

7.5 Corrective actions

Where the compliance evaluation indicates non-compliance with the air (dust deposition) criteria or a valid complaint relating to dust, the following actions will be undertaken:

- Identify activities occurring during non-compliance;
- Determine the most likely source of the emissions;
- Review the process and current dust controls; and,
- Implement an alternative to reduce emissions where feasible.

The corrective action may involve supplementary monitoring to identify the source of the non-compliance, or may involve modification of activities to avoid any recurrence or minimise its adverse effects.

7.6 Review of AQMP

Review of the AQMP will be conducted within three months of the submission of an annual review, incident report, audit report or any modification to the consent, in order to ensure the plan continues to reflect operational processes and procedures.

The review process will consider:

- Inputs or responses from regulatory agencies;
- Monitoring network and ongoing requirements;
- Incident and complaints investigations; and,
- Any changes in organisational structure and/or responsibilities.

Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted for the approval of the Secretary.

7.7 Independent Environmental Audit

An Independent Environmental Audit of the development will be conducted within a year of the date of commencing development under the Consent and every 3 years thereafter, unless the Secretary directs otherwise.

The audit team must be led by a suitably qualified auditor and include any experts specified by the Secretary.

The purpose of the audit is to assess the environmental performance (including for air quality) and compliance will all requirements in the Consent, EPL, etc as appliable. The audit reviews plans, such as this AQMP, and would recommend any areas for improving environmental performance.

8 COMPLAINTS MANAGEMENT

All complaints are to be considered and recorded. Any incident or plausible complaint regarding dust will be investigated to identify wherever possible the specific cause, corrective action will be implemented where necessary and feasible to do so and this including follow up with the complaint will be documents. The following would be conducted where required:

- Review of management practices to systematically identify and implement options to modify site practices, to ensure effective control of dust generating activities so as to achieve compliance with the relevant criteria; and,
- All complaints will be documented by appropriate personnel on the complaints register, including the correction action taken where needed and follow up with the complainant.

The complaints register will document the following information of each complaint:

- Date and time complaint was lodged;
- Method by which the complaint was made;
- Details of complainant (if provided);
- Nature of the complaint;
- Likely cause of the complaint;
- Action taken and reasoning behind action; (if no action was taken, the reasoning behind no action); and
- Follow up with the complainant.

The complainant will be advised of any actions implemented or proposed and their feedback sought in this regard.

The complaint record will be kept for at least five years after the complaint was made, and a summary of complaints, their causes and corrective actions shall be provided annually in the Annual Review.

9 REFERENCES

Bureau of Meteorology (2018)

Climate Averages Australia, Bureau of Meteorology website, accessed July 2018. <http://www.bom.gov.au/climate/averages>

Katestone Environmental Pty Ltd (2011)

"NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining", Katestone Environmental Pty Ltd prepared for DECCW, 2011.

NSW EPA (2017)

"Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales", January 2017

NSW OEH (2011)

"Coal Mine Particulate Matter Control Best Practice Site-specific determination guideline", NSW OEH, November 2011.

Todoroski Air Sciences (2015)

"Air Quality Assessment Dolwendee Quarry", prepared by Todoroski Air Sciences for KMH Environmental, September 2015.

US EPA (2000)

"Meteorological monitoring guidance for regulatory modelling applications EPA 454/R-99-005" US EPA, Research Triangle Park, North Carolina 27711, 2000.