Luddenham Clay/Shale Quarry

Noise Impact Assessment

August 2017

Prepared for

Epic Mining Pty Ltd

Global Acoustics

Noise and Vibration Analysis and Solutions

Global Acoustics Pty Ltd
PO Box 3115 | Thornton NSW 2322
Telephone +61 2 4966 4333
Email global@globalacoustics.com.au
ABN 94 094 985 734

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Prepared for

Epic Mining Pty Limited
PO Box 177
Kemps Creek NSW 2171

Prepared by

Global Acoustics Pty Ltd
PO Box 3115
Thornton NSW 2322

Prepared: Joel Curran
Acoustic Consultant

QA Review: Amanda Borserio
Acoustic Consultant

Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Epic Mining Pty Ltd (the client) to undertake a noise impact assessment for a proposed modification to operations at the Luddenham Shale/Clay Quarry (LQ) on Elizabeth Drive, near Luddenham NSW. Figure 1 shows an aerial photograph of the existing quarry and nearest sensitive receptors.

The proposed modification relates to the creation of a northern stockpile area, composting area and noise bunds associated with both areas as shown in Figure 2. Noise bunds, as advised by the client, are shown as green lines. An additional noise bund show in red has been included to provide additional protection for receptor R2 (as detailed in Table 1.1).

This assessment considers potential noise impacts during construction and operation of the proposed modification. It has been prepared based on information supplied by Epic Mining and National Intergrated Creative Solutions and in accordance with the NSW Industrial Noise Policy (NSW Environment Protection Authority (EPA), 2000) (INP). The road traffic noise assessment was carried out in accordance with the NSW Road Noise Policy (EPA, 2011) (RNP) and the assessment of construction noise was carried out in accordance with the Interim Construction Noise Guideline (EPA, 2009) (ICNG).

1.2 Receptors

Two residential noise sensitive receivers (NSR) were included in the construction and operational noise assessment. Details of NSR included in the assessment are presented in Table 1.1 and their locations shown in Figure 1.

Table 1.1: NOISE SENSITIVE RECEPTORS

Descriptor	Address	Lot	Easting	Northing
R1	2111-2141 Elizabeth Drive, Luddenham	13, DP32026	289137	6250048
R2	225 Adams Road, Luddenham	1, DP623799	289205	6249682

Figure 1: Luddenham Quarry current layout and nearest sensitive receptors

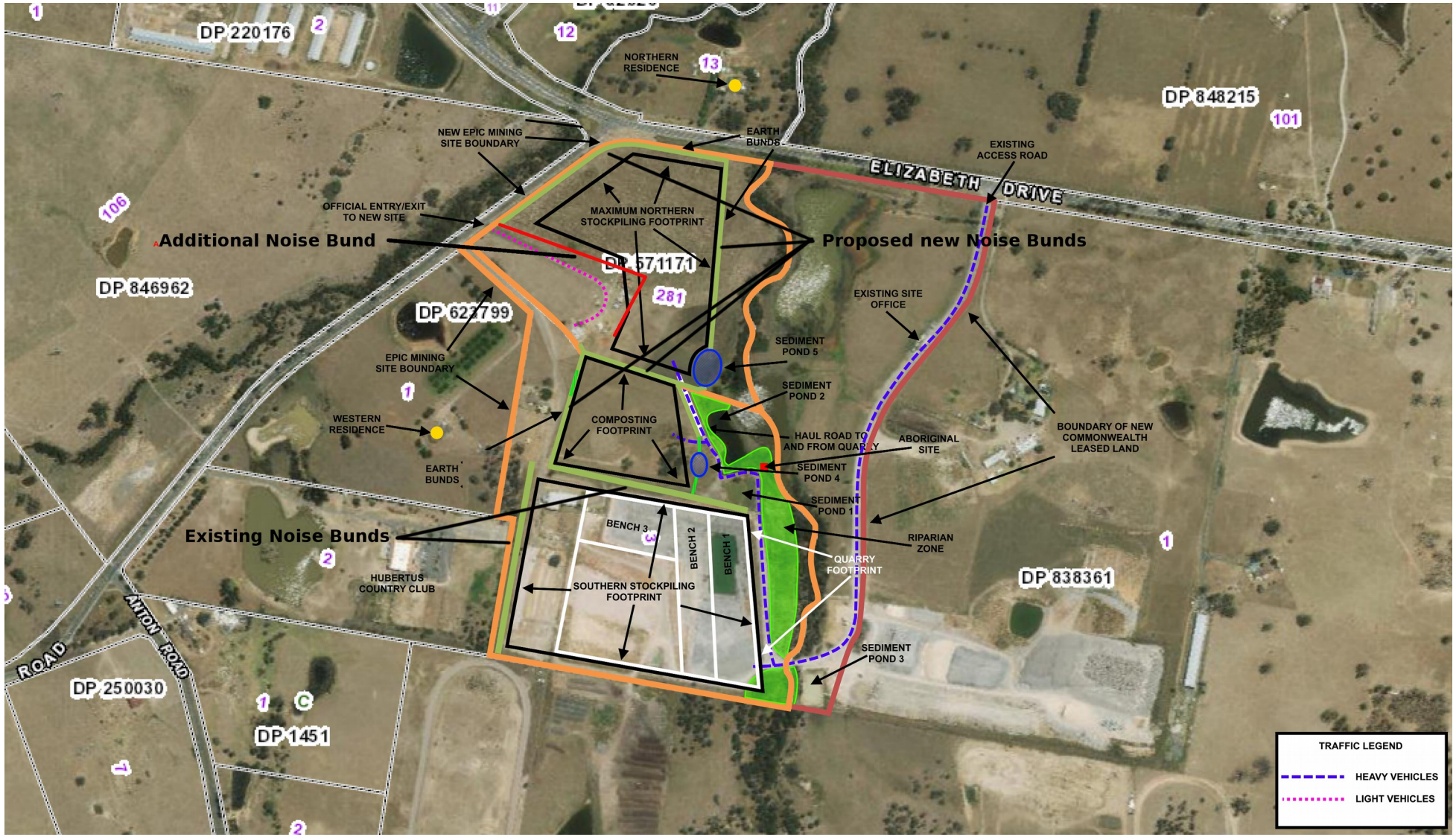

Figure 2: Proposed northern stockpile area, composting area, pit layout, existing, proposed and additional noise bunds

1.3 Terminology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.2.

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels.
L_{A90}	The level exceeded for 90 per cent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes
L_{Aeq}	The average noise energy during a measurement period
L_{pk}	The unweighted peak noise level at any instant
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
SEL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
ABL	Assessment background level (ABL), the 10th percentile background noise level for a single period (day, evening or night) of a 24 hour monitoring period
RBL	Rating background level (RBL), the background noise level for a period (day, evening or night) determined from ABL data
Day	The period 7:00am to 6:00pm
Evening	The period 6:00pm to 10:00pm
Night	The period 10:00pm to 7:00am

2 CRITERIA

Predicted noise impacts from proposed operations were compared to current operational criteria established under existing approvals at LQ and standard noise criteria outlined in relevant government policies and guidelines. These criteria are presented in the following subsections.

2.1 LQ Operational Criteria

Operations at LQ are primarily regulated by NSW Industrial Noise Policy, Environment Protection Licence (EPL) No. 12863 and Development Consent DA 315-7-2003 (with subsequent modifications). Further discussion and relevant excerpts of these documents are provided in this section and in Appendix A.

LQ operates during the day period only, from 7am – 6pm. The day period noise limit for operations at LQ provided by, and consistent between the EPL and DA, is an $L_{Aeq,15minute}$ of 41 dB at any residential or sensitive receptor not associated with LQ activities.

Noise emission criteria apply under all meteorological conditions except during rain and wind speeds (at 10m height) greater than 3m/s, and under "non significant weather conditions".

2.2 NSW Industrial Noise Policy (2000)

The INP was published in 2000 and is currently the primary document governing industrial noise in NSW. The INP states that objectives for environmental noise are '*to account for intrusive noise and … to protect the amenity of particular land uses*'. To achieve these objectives, limits are specified where the '*intrusiveness criterion essentially means that the equivalent continuous (energy-average) noise level of the source should not be more than 5 decibels (dB) above the measured background level*'. Amenity is protected by '*noise criteria specific to land use and associated activities*'.

Applicable intrusiveness and amenity limits are derived independently. These are then compared to determine project specific noise levels (PSNL).

The intrusiveness criterion is expressed as:

$$L_{Aeq,15minute} \leq RBL + 5$$

Where $L_{Aeq,15\ minute}$ is the L_{Aeq} noise level from the source, measured over 15 minutes and RBL is the rating background level. Where the RBL is less than L_{A90} 30 dB, a value of L_{A90} 30 dB can be adopted. Therefore, the minimum $L_{Aeq,15minute}$ intrusiveness criterion becomes $L_{Aeq,15minute}$ 35 dB.

An amenity criterion caps industrial noise levels. Amenity criteria are recommended for various land uses. According to the INP, an urban area is an area with an acoustic environment that:

- is dominated by 'urban hum' or industrial source noise;
- has through traffic with characteristically heavy and continuous traffic flows during peak periods;

- is near commercial districts or industrial districts; and
- has any combination of the above.

Where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic related sound sources. This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument, and also includes mixed land use zones such as mixed commercial and residential uses.

The subject site is located in close proximity to Elizabeth Drive. Attended monitoring previously conducted at LQ has noted that road traffic activity along Elizabeth Drive is through traffic with heavy and continuous flows during peak periods and the area is dominated by an 'urban hum' consisting mainly of road traffic noise. On the basis of proximity to Elizabeth Drive and its associated traffic, and the presence of an urban hum, receptors R1 and R2 are considered to be urban for this assessment.

Recommended amenity limits from the INP for residences in urban areas are shown in Table 2.2. Adjustments to these are sometimes required where there is high traffic or existing industrial noise.

Table 2.1: STANDARD AMENITY CRITERIA

Type of Receiver	Period[1]	Acceptable $L_{Aeq,15minute}$ (dB)	Maximum $L_{Aeq,15minute}$ (dB)
Residence – Urban Areas	Day	60	65
	Evening	50	55
	Night	45	50

Notes:

1. *Day: 7:00am to 6:00pm ~ Evening: 6:00pm to 10:00pm ~ Night: 10:00pm to 7:00am.*

2.3 Recommended Project Specific Noise Criteria

Section 3.1 and Section 4.1 of this report detail methodology and results of recent background noise monitoring used to establish RBL's. Recommended project specific noise criteria for LQ are detailed in Table 2.2.

Table 2.2: PROJECT SPECIFIC NOISE CRITERIA, dB

Receptor	Period[1]	RBL	Intrusiveness Criterion $L_{Aeq,15minute}$	Recommended Amenity Criterion $L_{Aeq,period}$	Recommended Project Specific Criterion $L_{Aeq,15minute}$
R1	Day	46	51	60	51[2]
	Evening	46	51	50	50
	Night	42	47	45	45
R2	Day	40	45	60	45[2]
	Evening	44	49	50	49
	Night	42	47	45	45

Notes:

1. *Day: 7:00am to 6:00pm ~ Evening: 6:00pm to 10:00pm ~ Night: 10:00pm to 7:00am; and*
2. *Operations at LQ are contained to the day period.*

2.4 Interim Construction Noise Guideline

The ICNG specifically relates to construction, maintenance and renewal activities.

The guideline specifies standard construction hours as:

- Monday to Friday, 7am to 6pm;
- Saturday, 8am to 1pm; and
- No construction work on Sunday and public holidays.

The guideline suggests that a qualitative assessment only is required where the duration of the works is less than three weeks.

For construction projects where the duration is greater than three weeks, a quantitative assessment is required, with comparison to relevant criteria.

The criteria for work undertaken during standard construction hours are:

- $L_{Aeq,15minute}$ equal to background plus 10 dB (noise affected); or
- $L_{Aeq,15minute}$ 75 dB (highly noise affected).

An L_{Aeq} criterion of background plus 5 dB is specified for work outside the standard construction hours.

The proposed duration of construction for this project is advised to be 2-3 weeks, therefore conservatively, a quantitative assessment and comparison with construction noise criteria has been undertaken. All construction work is scheduled to be undertaken during standard construction hours.

Applicable day period RBL's are detailed in Table 2.2. On this basis, the construction 'noise affected' criterion for R1 becomes $L_{Aeq,15minute}$ 56 dB and for R2 becomes $L_{Aeq,15minute}$ 50 dB during standard construction hours. The 'highly noise affected' criterion remains at $L_{Aeq,15minute}$ 75 dB.

2.5 Sleep Disturbance Criteria

Potential sleep disturbance impact is typically assessed for the INP defined night period, which is 10pm to 7am. As LQ activities are to occur between 7am and 6pm, sleep disturbance has not been evaluated.

2.6 Blast Vibration and Overpressure Criteria

No blasting occurs at LQ and no assessment has been evaluated.

2.7 Cumulative Noise Criteria

Several other commercial enterprises exist to the north and north west of LQ along Luddenham Road and Elizabeth Drive respectively. No cumulative assessment has been made with these enterprises in mind, however, years of Global Acoustics' attended monitoring performed for LQ has noted road traffic and aircraft as the dominant noise sources in the area, with little to no contribution from any other notable industrial noise source other than LQ (when audible).

2.8 Road Traffic Noise Criteria

In 2011 the EPA, then known as the Department of Environment, Climate Change and Water NSW, released the RNP. Criteria outlined in the RNP are applicable to this project and apply different noise limits dependent upon the development category and receptor type. Table 2.3 shows applicable criteria for the proposal.

Table 2.3: ROAD TRAFFIC NOISE ASSESSMENT CRITERIA FOR RESIDENTIAL LAND USES

Road Category	Type of project/land use	Assessment Criteria dB(A)	
		Day	Night
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	L_{Aeq}, (1 hour) 55 (external)	L_{Aeq}, (1 hour) 50 (external)

The client advised that work force numbers and heavy vehicle movements to and from site will not increase as a result of the proposed modification. As such, road traffic noise is not considered further in this assessment.

3 METHODOLOGY

3.1 Background Noise Monitoring

3.1.1 Unattended Noise Monitoring

Unattended noise monitoring was conducted in accordance with the INP at two locations (R1 and R2) from 27 March and 3 April 2017 to establish RBL for urban receptors in the area.

In relation to determination of background noise levels the INP states that *'Noise monitoring should not be conducted or the data should be excluded when average wind speeds (over 15 minute periods or shorter) at microphone height are greater than 5m/s, or when rainfall occurs.'* Meteorological data has been filtered such that only periods with wind speed less than 5 m/s and no rainfall are included in this assessment.

3.1.2 Noise Monitoring Equipment

Table 3.1 lists the equipment used to measure environmental noise levels. Calibration certificates are provided in Appendix B.

Table 3.1: NOISE MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
Rion NL-42EX noise logger	00410151	22/07/2017
Ngara real-time sound acquisition system	87802E	18/09/2017
ARL ND9 acoustic calibrator	N225020	27/10/2018

3.2 Model Parameters

3.2.1 Model

Noise levels were calculated using DataKustik CadnaA noise modelling software to determine the acoustic impact of operational activities at receptor locations. Acoustic modelling allows for the prediction of external noise levels from LQ operations. The following model assumptions were adopted:

- windows are generally the weakest paths in a building façade so results were predicted at a height of 1.5m above ground level to represent ground floor windows (both residences are single story homes);
- noise source heights are as detailed in Table 3.3;
- the quarry excavator and dozer are modelled at the average pit depth of 20m;
- front end loaders are modelled as operating at the base of stockpiles;

- stockpile dozers are modelled as operating for half of any 15 minute period at the bottom of the stockpile, and the other half at the top of the stockpile;
- excavators, front end loaders, dozers are modelled as operating at full noise for the 15 minute period;
- all noise bunds from construction scenarios 9 and 10 are in place before any operational scenarios occur; and
- road trucks and haul trucks are represented as strings of points to distribute the acoustic energy over the length of their operating routes.

3.2.2 Topography

No usable topography could be supplied for the site and surrounding area. Topography was sourced from Google Earth in 1m intervals.

3.2.3 Noise Bunds

Figure 2 shows existing LQ noise bunds to the west and north of the main pit as well as the proposed noise bunds around the composting area (an extension of the existing bund to the north of the main pit) and around the proposed northern stockpile area. An additional mitigation noise bund used in the models is also shown running along the southern boundary of the northern stockpile area. The incorporation of this extension to the proposed northern stockpile bund is required to achieve the modelled results in this report.

Existing noise bunds were modelled at current heights in all scenarios.

Proposed composting area noise bunds were modelled at 5.2m for construction and operational scenarios. Proposed northern stockpile area noise bunds were modelled at 5.2m and 6.0m for the operational scenarios.

3.2.4 Meteorological Conditions

Under various wind and temperature gradient conditions, noise may be increased or decreased compared with still-isothermal conditions (i.e. no wind or temperature gradient). Atmospheric conditions that most affect noise propagation are temperature and wind velocity gradients. They can both enhance or reduce noise propagation from source to receiver due to refraction of sound propagating through the atmosphere, brought about by a change in sound speed with height.

Noise levels are increased when the wind blows from source to receiver or under temperature inversion conditions (both of which are sometimes referred to as adverse weather conditions), and are decreased when the wind blows from receiver to the source or under temperature lapse conditions.

Badgery's Creek weather station meteorological data was obtained from the Bureau of Meteorology (BOM) for the entire year of 2015. Data analysis showed no meteorological conditions are considered prevailing in accordance with INP guidelines (that is, no conditions present for more than 30% of the time).

Meteorological effects were calculated using the CONCAWE calculation methodology within the CadnaA software. The option in CadnaA was selected to interpolate meteorological categories for the operational and construction scenarios. This option allows for a finer degree of meteorological variation between categories than the standard CONCAWE method, which provides more realistic meteorological variation.

While not specifically meeting the criteria of a prevailing meteorological condition, north to north-easterly wind directions were noted as being the most prevalent in all seasons during the day period and have been conservatively considered in this assessment. Table 3.2 details all meteorological conditions considered.

As LQ operations fall exclusively in the day period, analysis of temperature inversion frequency was not undertaken and a neutral atmospheric stability class has been conservatively adopted.

Table 3.2: METEOROLOGICAL CONDITIONS USED IN MODELS

ID	Temperature °C	Humidity %	Wind Speed m/s	Wind Direction degrees	Stability Class
Neutral	10	80	-	-	D
Adopted prevailing	10	80	3.0	22.5	D

3.3 Model Scenarios

3.3.1 Operational Scenarios

Figure 3 shows the operational and construction noise model with LQ noise sources from all scenarios present as a blue "+" point source or blue line source, topography in 1m intervals and receptors as two toned black and white circles. All existing noise bunds are modelled at their current height of 5.2m. Stockpiles are modelled at a height of 5.0m.

Eight potential operational scenarios were assessed. Each scenario represents a reasonable and feasible 15-minute operating configuration for that scenario. Note that advice from the client is that scenarios 1 and 2 will not occur at the same time, and that scenarios 7 and 8 are only expected to occur 1-2 days per week for no more than 2 hours at a time and not simultaneously.

All noise bunds are included in all scenarios with the exception of construction scenarios 9 and 10 which entail the creation of the proposed northern stockpile area and composting area noise bunds respectively. Therefore, construction work in scenarios 9 and 10 would need to occur before model results from scenarios 1-8 are valid.

All operational scenarios were modelled with existing bunds, proposed composting area noise bunds at the client advised height of just over 5.0m (modelled at 5.2m) as well as with the northern stockpile area noise bunds at both 5.2m and also at a client advised maximum of 6.0m.

Operational scenarios were:

- Scenario 1 – Extraction from the area of the proposed northern stockpile closest to R1, consisting of a single front end loader loading two road trucks which the haul product material from the northern stockpile to the main entrance and off site;
- Scenario 2 – Extraction from the area of the current southern stockpile to the west of the main pit, closest to the nearest receptor R2, consisting of a single front end loader loading two road trucks which haul product material from the southern stockpile to the main entrance and off site;
- Scenario 3 – Composting, consisting of a single front end loader in the composting area and a medium truck hauling material between the main entrance to the compost area;
- Scenario 4 – Quarrying, consisting of an excavator and dozer in the closest area of the quarry to the nearest receptor R2 (Bench 3 as noted in Figure 2), and a dump truck hauling material to the proposed northern stockpile;
- Scenario 5 – Composting and northern operations, a combination of scenarios 1, 3 and 4;
- Scenario 6 – Composting and southern operations, a combination of scenarios 2 and 3; and
- Scenario 7 – Dozer on proposed northern stockpile (northern extremity), consisting of a single dozer used to form unloaded product material into stockpiles; and
- Scenario 8 – Dozer on proposed northern stockpile (southern extremity), consisting of a single dozer used to form unloaded product material into stockpiles.

3.3.2 Construction Scenarios

Two construction scenarios were assessed to predict noise levels from construction of the northern stockpile area and composting area noise bunds. Each scenario represents a reasonable and feasible 15-minute operating configuration for that scenario. Construction models were run with the inclusion of the 5.2m existing noise bunds during the construction of the 5.2m proposed noise bunds, as detailed in Section 4.3. Construction scenarios were:

- Scenario 9 – Northern stockpile noise bund construction; consisting of an excavator and dozer in the closest area of the quarry to R2 (Bench 3 as noted in Figure 2), a dump truck hauling overburden material from the quarry to the proposed northern noise bund and an excavator forming up the noise bund; and
- Scenario 10 – Composting area noise bund construction, consisting of an excavator and dozer in the closest area of the quarry to R2 (Bench 3 as noted in Figure 2), a dump truck hauling overburden material from the quarry to the proposed composting area noise bund and an excavator forming up the noise bund.

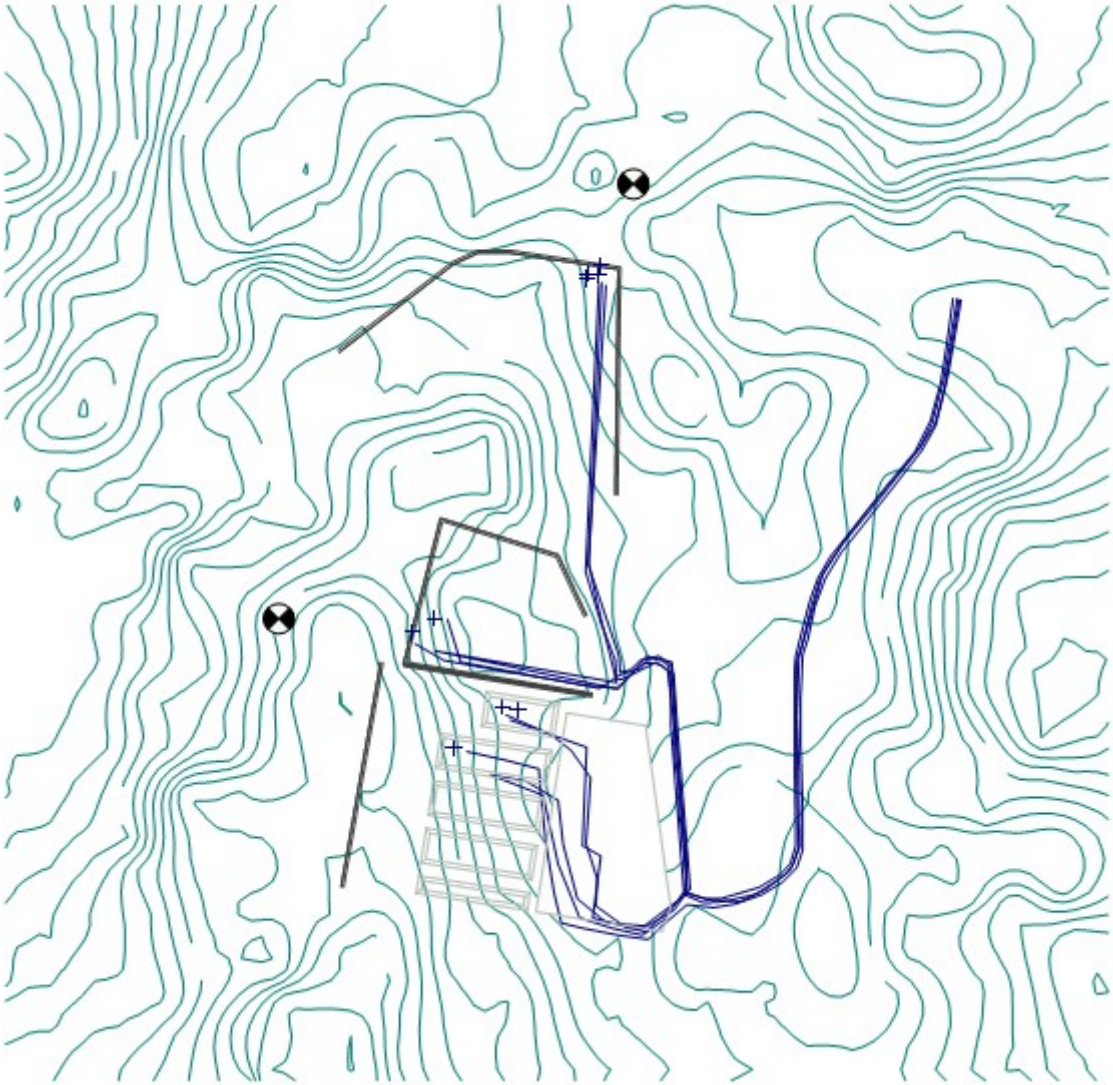

Figure 3 Operational and construction noise model, showing topographic contours (1m interval), all LQ noise sources (point sources as "+" and line sources as dark blue lines) and receptors as two toned circles

3.4 Equipment Sound Power

All sound power data with the exception of the CAT D8T dozer has been supplied by the client. In the case of the dozer, a sound power level was sourced from Global Acoustics' technical database which was based on the measurement of similar equipment. Modelled source heights, sound power spectra and totals used in the noise models are shown in Table 3.3.

Table 3.3: SOURCE SOUND POWER

		Octave Band Sound Power Spectrum, L_{Aeq} dB									
Item Description	**Source height (m)**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Total dB (Lin)**	**Total dB (A)**
Front End Loader	2.5	102	94	92	92	91	88	87	78	128	104
Excavator (30T)	2.5	108	101	100	100	96	94	91	86	134	110
Dump Truck	2.0	76	84	89	104	95	93	88	88	110	105
Road Truck	2.0	97	68	76	81	96	87	85	80	123	100
Tracked Dozer (D8T)	2.0	77	98	101	109	112	108	101	93	119	115

4 RESULTS

4.1 Background Noise Monitoring

Unattended noise monitoring was carried out by Global Acoustics at R1 and R2 between 27 March and 3 April 2017. Logger data has been filtered using meteorological data from Epic Mining's on site weather station. Background noise levels have been removed where wind speeds were greater than 5 m/s and/or rainfall occurred. Noise logger graphs are shown in Appendix C to show the extent of filtered data.

Approximately 5 days of suitable background noise data was collected after filtering for unsuitable weather conditions. According to the INP, '*Typically, one week's worth of valid data covering the days and times of operation of the proposed development is required to meaningfully determine the existing noise environment. However, the duration of monitoring should be determined by taking into account the circumstances of the particular situation. The cyclic or random nature of ambient noise levels can affect the duration required. In areas where the background noise levels are affected significantly by nearby road traffic with regular daily pattern, three days' worth of valid data may be sufficient*'. Years of attended monitoring around LQ have revealed the acoustic environment to be dominated by heavy and continuous road traffic primarily along Elizabeth Drive and aircraft noise with little to no contribution from industry.

Table 4.1 and Table 4.2 provide a summary of logging data for NSR R1 and R2 (filtered for meteorological conditions detailed above) used in this assessment.

Table 4.1: MET FILTERED NOISE LEVELS FOR R1 – MARCH/APRIL 2017

Period	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	RBL (dB)
Day	62	65	51	46
Evening	59	63	49	46
Night	56	59	47	42

Notes:

1. *Day: 7:00am to 6:00pm ~ Evening: 6:00pm to 10:00pm ~ Night: 10:00pm to 7:00am.*

Table 4.2: MET FILTERED NOISE LEVELS FOR R2 – MARCH/APRIL 2017

Period	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)	RBL (dB)
Day	62	58	52	40
Evening	59	60	55	44
Night	53	55	50	42

Notes:

1. *Day: 7:00am to 6:00pm ~ Evening: 6:00pm to 10:00pm ~ Night: 10:00pm to 7:00am.*

4.2 Operational Noise Assessment

4.2.1 5.2m Noise Bunds (all noise bunds)

The client advised that existing and proposed noise bunds would be a height of just over 5.0m. Initially, all existing and proposed noise bunds were modelled at a height of 5.2m.

Table 4.3 provides predicted noise levels at receptors for the eight operational scenarios during neutral atmospheric conditions and 5.2m noise bunds. Predicted results are compared to operational noise criteria.

Table 4.3: PREDICTED NOISE LEVELS AT RECEIVERS – NEUTRAL ATMOSPHERIC CONDITIONS – $L_{Aeq,15minute}$ dB

NSR ID	Project Specific Criteria	Scenario 1 Predicted	Scenario 2 Predicted	Scenario 3 Predicted	Scenario 4 Predicted	Scenario 5 Predicted	Scenario 6 Predicted	Scenario 7 Predicted	Scenario 8 Predicted
R1	51	45	34	35	33	45	37	**58 (7)**	48
R2	45	35	40	40	35	42	43	43	**48 (3)**

Notes

1. *Bold red results indicate and exceedance of the PSNL, and bold red bracketed text indicates the dB exceedance.*

Table 4.4 provides predicted noise levels at receptors for the eight operational scenarios during adopted prevailing atmospheric conditions and 5.2m noise bunds. Predicted results are compared to operational noise criteria.

Table 4.4: PREDICTED NOISE LEVELS AT RECEIVERS – ADOPTED PREVAILING ATMOSPHERIC CONDITIONS – $L_{Aeq,15minute}$ dB

NSR ID	Project Specific Criteria	Scenario 1 Predicted	Scenario 2 Predicted	Scenario 3 Predicted	Scenario 4 Predicted	Scenario 5 Predicted	Scenario 6 Predicted	Scenario 7 Predicted	Scenario 8 Predicted
R1	51	44	30	31	27	44	33	**54 (3)**	41
R2	45	37	40	41	35	43	43	**48 (3)**	**53 (8)**

Notes

1. *Bold red results indicate and exceedance of the PSNL, and bold red bracketed text indicates the dB exceedance.*

Scenarios 1 to 6 did not predict any exceedances of operational criteria, assuming that the proposed northern stockpile area and composting area noise bunds are in place.

Scenario 7 involved a dozer operating on the northern extremity of the proposed northern stockpile. Exceedances were predicted for R1 in neutral conditions, and for R1 and R2 in adopted prevailing conditions.

Scenario 8 involved a dozer operating on the proposed northern stockpile southern extremity. Exceedances were predicted for R2 in both neutral and adopted prevailing conditions.

The client advised that dozer operation on the stockpile will be limited to 1-2 days per week for 1-2 hours at a time, so the predicted noise levels in scenarios 7 and 8 are expected to occur for a small proportion of quarry operating times.

4.2.2 6.0m Noise Bunds (northern stockpile noise bunds)

Due to predicted exceedances of operational noise criteria at R1 and R2, the proposed noise bunds around the northern stockpile area were raised in the model to a height of 6.0m in an attempt to mitigate noise impacts on residences.

Table 4.5 provides predicted noise levels at receptors for the eight operational scenarios with neutral atmospheric conditions with 5.2m heights for all bunds with the exception of the northern stockpile area which was modelled at a height of 6.0m. Predicted results are compared to operational noise criteria.

Table 4.5: PREDICTED NOISE LEVELS AT RECEIVERS – NEUTRAL ATMOSPHERIC CONDITIONS – $L_{Aeq,15minute}$ dB

NSR ID	Project Specific Criteria	Scenario 1 Predicted	Scenario 2 Predicted	Scenario 3 Predicted	Scenario 4 Predicted	Scenario 5 Predicted	Scenario 6 Predicted	Scenario 7 Predicted	Scenario 8 Predicted
R1	51	44	33	34	32	44	36	**55 (4)**	48
R2	45	35	40	40	35	42	43	43	**48 (3)**

Notes

1. *Bold red results indicate and exceedance of the PSNL, and bold red bracketed text indicates the dB exceedance.*

Table 4.6 provides predicted noise levels at receptors for the eight operational scenarios with adopted prevailing atmospheric conditions with 5.2m heights for all bunds with the exception of the northern stockpile area which was modelled at a height of 6.0m. Predicted results are compared to operational noise criteria.

Table 4.6: PREDICTED NOISE LEVELS AT RECEIVERS – ADOPTED PREVAILING ATMOSPHERIC CONDITIONS – $L_{Aeq,15minute}$ dB

NSR ID	Project Specific Criteria	Scenario 1 Predicted	Scenario 2 Predicted	Scenario 3 Predicted	Scenario 4 Predicted	Scenario 5 Predicted	Scenario 6 Predicted	Scenario 7 Predicted	Scenario 8 Predicted
R1	51	43	30	31	27	43	33	51	41
R2	45	37	40	41	35	43	43	**48 (3)**	**52 (7)**

Notes

1. *Bold red results indicate and exceedance of the PSNL, and bold red bracketed text indicates the dB exceedance.*

Scenarios 1 to 6 did again not result in any predicted exceedances of operational criteria, assuming that the proposed northern stockpile area and composting area noise bunds are in place.

Exceedances were predicted during scenario 7 for R1 in neutral conditions and R2 in adopted prevailing conditions with bund heights of 5.2m. Noise levels with an increased northern stockpile area bund height to 6.0m were predicted to reduce by 3 dB for R1 during neutral and adopted prevailing conditions, and there was no change predicted for R2.

Exceedances were predicted during scenario 8 for R2 in neutral and adopted prevailing conditions with bund heights of 5.2m. Raising the northern stockpile area noise bund height to 6.0m resulted in no change to levels predicted at R2 for neutral conditions, but a 1 dB decrease was predicted during adopted prevailing conditions.

4.3 Construction Noise Assessment

Construction noise levels were predicted at receptors for two scenarios under both neutral and adopted prevailing atmospheric conditions. Scenarios 9 and 10 represent worst case scenarios for R1 and R2 respectively in terms of proximity of noise sources to receptors. Construction models represent the construction of bunds at heights of both 5.2m and 6.0m as detailed in 3.3.1, however, no change in levels was predicted therefore results shown represent the construction of either bund height.

4.3.1 Neutral Atmospheric Conditions

Predicted results under neutral atmospheric conditions are compared to the ICNG noise affected criterion in Table 4.7 and were compared to the ICNG highly affected criterion in Table 4.8.

Table 4.7: PREDICTED CONSTRUCTION NOISE LEVELS IN NEUTRAL CONDITIONS – NOISE AFFECTED CRITERION, $L_{Aeq,15minute}$ dB

NSR ID	ICNG Noise Affected Criterion	Scenario 9 Predicted	Scenario 10 Predicted
R1	56	**61 (5)**	47
R2	50	40	**51 (1)**

Notes

1. *Bold red results indicate and exceedance of the ICNG criterion, and bold red bracketed text indicates the dB exceedance.*

Table 4.8: PREDICTED CONSTRUCTION NOISE LEVELS IN NEUTRAL CONDITIONS – HIGHLY AFFECTED CRITERION, $L_{Aeq,15minute}$ dB

NSR ID	ICNG Highly Affected Criterion	Scenario 9 Predicted	Scenario 10 Predicted
R1	75	61	47
R2	75	40	51

Notes

1. *Bold red results indicate and exceedance of the ICNG criterion, and bold red bracketed text indicates the dB exceedance.*

Exceedances of the ICNG noise affected criterion are predicted for scenario 9 at R1 and scenario 10 at R2 during neutral atmospheric conditions respectively, however no exceedances are predicted of the ICNG highly affected criterion.

4.3.2 Adopted Prevailing Atmospheric Conditions

Predicted results under adopted prevailing met conditions are compared to the ICNG noise affected criterion in Table 4.9 and were compared to the ICNG highly affected criterion in Table 4.10.

Table 4.9: PREDICTED CONSTRUCTION NOISE LEVELS IN ADOPTED PREVAILING CONDITIONS – NOISE AFFECTED CRITERION, $L_{Aeq,15minute}$ dB

NSR ID	ICNG Noise Affected Criterion	Scenario 9 Predicted	Scenario 10 Predicted
R1	56	**60 (4)**	44
R2	50	43	**51 (1)**

Notes

1. *Bold red results indicate and exceedance of the PSNL, and bold red bracketed text indicates the dB exceedance.*

Table 4.10: PREDICTED CONSTRUCTION NOISE LEVELS IN ADOPTED PREVAILING CONDITIONS – HIGHLY AFFECTED CRITERION, $L_{Aeq,15minute}$ dB

NSR ID	ICNG Highly Affected Criterion	Scenario 9 Predicted	Scenario 10 Predicted
R1	75	60	44
R2	75	43	51

Notes

1. *Bold red results indicate and exceedance of the PSNL, and bold red bracketed text indicates the dB exceedance.*

Exceedances of the ICNG noise affected criterion are predicted for scenario 9 at R1 and scenario 10 at R2 under adopted prevailing atmospheric conditions, however no exceedances are predicted of the ICNG highly affected criterion.

5 DISCUSSION

5.1 Operational Noise

Table 4.3 and Table 4.4 summarise predicted noise levels at NSRs for all operational scenarios, with noise bund height of 5.2m during neutral and adopted prevailing atmospheric conditions respectively.

Table 4.5 and Table 4.6 summarise predicted noise levels at NSRs for all operational scenarios, with noise bund heights of 6.0m during neutral and adopted prevailing atmospheric conditions respectively.

Scenarios 1 to 6 did not result in any predicted exceedance of operational criteria for either noise bund height modelled, assuming that the proposed northern stockpile area and composting area noise bunds constructed in scenarios 9 and 10 are in place.

Scenario 7 involved a dozer operating on the proposed northern stockpile (northern extremity).

For a noise bund height of 5.2m:

- exceedances of PSNL were predicted for R1 (7 dB) in neutral conditions, and for R1 (3 dB) and R2 (3 dB) in prevailing conditions.

For a noise bund height (northern stockpile noise bund height change only) of 6.0m:

- exceedances of PSNL were predicted for R1 (4 dB) in neutral conditions and for R2 (3 dB) in prevailing conditions.

Scenario 8 involved a dozer operating on the proposed northern stockpile (southern extremity).

For a noise bund height of 5.2m:

- exceedances of PSNL were predicted for R2 (3 dB) in neutral conditions and for R2 (8 dB) in adopted prevailing conditions.

For a noise bund height (northern stockpile noise bund height change only) of 6.0m:

- exceedances of PSNL were predicted for R2 (3 dB) in neutral conditions and for R2 (7 dB) in adopted prevailing conditions.

For scenarios 7 and 8 it should be noted that:

- while exceedances of the recommended operational criteria are solely due to the operation of the dozer on the stockpile, the client advised that dozer operation on the stockpile will be limited to 1-2 days per week for 1-2 hours at a time, so the predicted noise levels in scenarios 7 and 8 are expected to occur for a small proportion of quarry operating times.; and
- background logging revealed the L_{Aeq} for the day period for both R1 and R2 was 62 dB, which based on years of monitoring around the LQ site, is likely to be a result of road traffic and aircraft

noise. This measured L_{Aeq} is a minimum of 4 dB above the modelled results for dozer operation in the northern stockpile area.

5.2 Construction Noise

Table 4.7 to Table 4.10 detail predicted noise levels during noise bund construction. Scenarios 9 and 10 represent worst case scenarios for R1 and R2 respectively.

Exceedances of the ICNG noise affected criterion were predicted during scenario 9 at R1 (5 dB) during neutral conditions and R1 (4 dB) during adopted prevailing conditions. An exceedance of the ICNG noise affected criterion was predicted during scenario 10 at R2 (1 dB) during both neutral and adopted prevailing conditions.

It should be noted that while significant exceedances (>2 dB as per the INP) of the ICNG noise affected criterion are predicted during scenario 9 at R1, and 1 dB exceedances at R2 are predicted during scenario 10, in both instances the overall levels are well within the ICNG highly noise affected criterion of $L_{Aeq,15minute}$ 75 dB. Additionally, noise bund construction is advised to be of short duration and is estimated to be completed within 2-3 weeks.

6 CONCLUSION AND RECOMMENDATIONS

Global Acoustics was engaged by Epic Mining Pty Ltd (the client) to undertake a noise impact assessment for a proposed modification to operations at the Luddenham Shale/Clay Quarry (LQ) on Elizabeth Drive, near Luddenham NSW. Figure 1 shows an aerial photograph of the existing quarry and nearest sensitive receptors.

The proposed modification relates to the creation of a northern stockpile area, composting area and noise bunds associated with both areas as shown in Figure 2. Noise bunds as advised by the client are shown as green lines. An additional noise bund show in red has been included to provide additional protection for receptor R2 (as detailed in Table 1.1).

This assessment considers potential noise impacts during construction and operation of the proposed modification. It has been prepared based on information supplied by Epic Mining and National Intergrated Creative Solutions.

6.1 Operational Noise

All operational noise models included the proposed extension to the proposed northern stockpile area bund marked on Figure 2 with a red line. The inclusion of this extension is recommended as it is required to achieve the noise levels predicted in this report.

With noise bunds as shown in Figure 2 in place (regardless if the northern stockpile area bund was 5.2m or 6.0m), no exceedances of PSNL were predicted for scenarios 1-6.

For scenarios 7 and 8, raising the northern stockpile area noise bund to a height of 6.0m reduced predicted noise levels at R1 by up to 3 dB (also removing an exceedance predicted during prevailing conditions) and also reduced predicted levels at R2 by up to 1 dB. Exceedances during scenario 7 with 6.0m noise bunds (around the northern stockpile area) are still in the range of 3-4 dB, and during scenario 8 are still in the range of 3-7 dB.

The client advised that the maximum height for bunds would be 6.0m so further increasing the height was not an option in this assessment, but based on these results it is recommended that the northern stockpile area noise bund be raised to 6.0m. It is also recommended to restrict dozer operations to 1st gear as best practice.

While exceedances are still predicted for scenarios 7 and 8 with the increased height to 6.0m of the northern stockpile area noise bund, it should be noted that overall predicted levels in these scenarios are below the L_{Aeq} day period noise level measured during background noise logging (62 dB for both R1 and R2). As noted previously, the existing environment is known to be dominated by road traffic and aircraft noise which will potentially mask noise levels from LQ, particularly if dozer operations occurred during peak traffic periods.

Given that a single dozer will be operating in the stockpile area 1-2 days per week for 1-2 hours at any one

instance, any noise impact at receptors would be intermittent, short term and likely below the level of ambient noise from road traffic and aircraft.

Overall, additional consultation with the community and regulators is recommended to determine what further noise management options may be required or considered reasonable given the existing traffic-noise dominated environment around LQ and that operations are restricted to the day period.

Table 1 of the Department of Planning (DoP) document 'Voluntary Land Acquisition and Mitigation Policy' (VLAMP), although relating specifically to state significant mining, petroleum and extractive industry developments can provide guidance on negotiating with noise affected receivers. The document also summarises the NSW Government's interpretation of the significance of any potential exceedances of the relevant noise assessment criteria and identifies potential treatments for these exceedances.

Guidance regarding the negotiation process can also be found in Section 8 of the INP. This section gives guidance on the evaluation of residual noise level impacts giving consideration to the character of the noise, the existing environment, other (future) industry in the area and the feasibility of further mitigation measures. It also outlines the process to begin a negotiated agreement with the affected residents.

6.2 Construction Noise

Predicted noise levels at R1 and R2 during worst case modelled construction scenarios are predicted to exceed the ICNG noise affected criterion by 1-5 dB, but all predicted levels were well below the ICNG highly affected noise criterion.

Construction noise levels at receptors are expected to reduce as activities move away from the modelled worst case scenario locations. The duration of construction is advised to be 2-3 weeks and while this duration does not warrant a quantitative assessment, one has been conservatively carried out.

Section 5.2 and Section 6 of the ICNG provide guidance on work practices to minimise noise, community notification and complaint handling and should be consulted as best practice. The ICNG suggests work practices that can help to minimise noise levels generated on site and can be applied to both construction and operational noise. Good work practices include:

- scheduling the noisiest work activities to be completed during the least sensitive times of the day;
- train and encourage workers to use equipment in ways that minimise noise;
- maintain equipment and plant in good working order;
- ensure site managers periodically check the site and nearby residences for noise problems so that solutions can be quickly applied. It is good practice for the proponent to consult with noise sensitive land use occupants who may be affected by noise from the construction and operation;

- avoid the use of radios where neighbours can be affected;
- avoid dropping items and metal on metal contact; and
- avoid mobile plant clustering near receivers.

The guideline also outlines the aims of community engagement, suggested means of contact and ways to keep communication lines open.

Global Acoustics Pty Ltd

APPENDIX

A CONSENTS AND GUIDELINES

B.1 Environment Protection Licence No. 12863

Environmental Protection Licence 12863 applies to operations at Luddenham Clay/Shale Quarry. The relevant sections have been included below.

L5 Noise limits

L5.1 Noise from the premises must not exceed an LAeq(15 minute) noise emission criterion of 41 dB(A) at any residential or other sensitive receptors not associated with the activities except as expressly provided by this licence.

Where LAeq means the equivalent continuous noise level - the level of noise equivalent to the energy-average of noise levels occuring over a measurement period.

L5.2 To determine compliance with condition L5.1 noise must be measured at, or computed for, EPA identification Points 7, 8, 9 and 10 as specified in condition P1.4. A modifying factor correction must be applied for tonal, impulsive or intermittent noise in accordance with the Environmental Noise Management - NSW Industrial Noise Policy (January 2000).

L5.3 The noise emission limits identified in this licence apply under all meteorological conditions except:
a) during rain and wind speeds (at 10m height) greater than 3m/s; and
b) under "non-significant weather conditions".

Note: Field meteorological indicators for non-significant weather conditions are described in the NSW Industrial Noise Policy, Chapter 5 and Appendix E in relation to wind and temperature inversions.

M8 Other monitoring and recording conditions

Noise

M8.1 The licensee must monitor noise at points 7, 8, 9 and 10 as defined in condition P1.4. Monitoring must be conducted on a quarterly basis. Based on the results of noise monitoring and a demonstration that activities at the premises have not resulted in any exceedances of noise limits, the frequency of noise monitoring may be altered by the EPA in consultation with the licensee after consideration of the results of monitoring and other relevant matters.

M8.2 The monitoring requirements specified in conditions M2, M4, M7 and M8 may be amended from time to time by the EPA in consultation with the licensee after consideration of the results of monitoring and other relevant matters.

B.1 Luddenham Quarry Development Consent

Approval was granted by the Department of Planning (DoP) in May 2004 with the most recent modification approved in May 2015 (MOD3).

Condition 12 of Schedule 4 of the project approval relate to impact assessment criteria and is reproduced below.

NOISE

Noise Impact Assessment Criterion

12. [5]The Applicant shall ensure that the noise generated by the development does not exceed the noise impact assessment criterion presented in Table 5.

Day $L_{Aeq(15\ minute)}$	Property
41	*All residential or sensitive receptors not associated with the development.*

Table 5: Noise impact assessment criterion dB(A)

Notes:

(a) The noise limits in Table 5 are for the noise contribution of the establishment and operation of the clay/shale quarry on Lot 3, DP 623799 and Lot 1 DP838361, Adams Road, Luddenham.

(b) The criterion in Table 5 does not apply to a six-week period for the construction of a noise attenuation bund adjacent to the quarry excavation area.

(c) Noise from the development is to be measured at the most affected point or within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary.

(d) To determine compliance with the $L_{Aeq(15\ minute)}$ noise limits in the above table where it can be demonstrated that direct measurement of noise from the development is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.

12A. When extraction operations are taking place in Bench 3, as indicated on Figure 1 in Appendix 1, operations are restricted to the use of 1 truck and 1 excavator, until the quarry floor is at least 1.5m below the existing ground level.

Operating Conditions

13. The Applicant shall ensure that all vehicles travelling on internal roads do not exceed 20 kilometres per hour.

14. The Applicant shall design operations to minimise the need for reversing of trucks and machinery where reversing beepers may contribute to noise impacts exceeding the criterion in condition 12.

Monitoring

15. The Applicant shall prepare noise compliance assessments of the operations at the site, within 3 months of the commencement of operations, and at intervals of 3 months thereafter, unless otherwise agreed by the Secretary and the EPA. The assessment shall be carried out by a suitably qualified and experienced acoustical consultant, approved by the Secretary, and submitted to the EPA and the Department.

B.2 NSW Industrial Noise Policy (2000)

2 Industrial Noise Criteria

The assessment procedure for industrial noise sources has two components:

- controlling intrusive noise impacts in the short term for residences
- maintaining noise level amenity for particular land uses for residences and other land uses.

In assessing the noise impact of industrial sources, both components must be taken into account for residential receivers, but, in most cases, only one will become the limiting criterion and form the project-specific noise levels for the industrial source. The worked case studies in *Appendix A* show how both components work together.

The procedures specified in the policy differentiate between low- and high-noise-risk developments, with simpler procedures available for developments with low noise risk. Differentiation between these two types of developments is on the basis of magnitude (for example, level of noise expected) and extent of impact (for example, expected area of affectation). Hence, a development that is likely to make excessive noise affecting a large area can be considered to be a high-risk development, and vice versa for low risk.

2.1 Intrusive noise impacts

The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB.

To account for the temporal variation of background noise levels, the method outlined in *Section 3.1* is recommended for determining the background noise level (rating background level—RBL) to be used in the assessment. This approach aims to result in the intrusive noise criterion being met for at least 90% of the time periods over which annoyance reactions can occur (taken to be periods of 15 minutes).

Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point before comparison with this criterion. Where the noise source contains annoying characteristics—such as prominent tonal components, impulsiveness, intermittency, irregularity and dominant low-frequency content—adjustments as outlined in *Section 4* apply.

Procedures for considering meteorological effects such as temperature inversions and wind are outlined in *Section 5* to account for characteristic weather conditions under which the intrusiveness criterion applies.

The intrusiveness criterion is summarised as follows:

$$L_{Aeq,\ 15\ minute} \leq \text{rating background level plus 5}$$

where:

$L_{Aeq,\ 15\ minute}$ represents the equivalent continuous (energy average) A-weighted sound pressure level **of the source** over 15 minutes. **Other descriptors may be used as appropriate provided they can be justified on the basis of being characteristic of the source (see *Section* 2.3).** This is to be assessed at the most-affected point on or within the **residential** property boundary—or, if that is more than 30 m from the residence, at the most-affected point within 30 m of the residence.

Rating background level is the background level to be used for assessment purposes as deter-mined by the method outlined in *Section 3.1*.

A 15-minute sampling period is used when measuring the level of intrusive noise. There has been no definitive research to quantify the time period over which annoyance to intrusive noise varies. Clearly, annoyance reactions are likely to occur over periods of less than a day, and there will be variations depending on individual tolerance and characteristics of the noise. The 15-minute period has been selected as a reasonable estimate of the period over which annoyance may occur. This time period has been used by the EPA for some time, and experience

has shown that it is a reasonable approach to assessing intrusive noise impacts.

In some rural situations, the rating background level may be the same for the day and night. In these cases, it is recognised that excursions of noise above the intrusiveness criterion during the day would not usually have the same impact as they would at night. This is due to the more sensitive nature of activities likely to be disturbed at night (for example, sleep and relaxation).

2.2 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in *Table 2.1*. Meeting the acceptable noise levels in *Table 2.1* will protect against noise impacts such as speech interference, community annoyance and, to some extent, sleep disturbance. These levels represent current best practice for assessing industrial noise sources, based on research and a review of assessment practices used overseas and within Australia.

Table 2.1 also includes recommended maximum noise levels for different land uses. These recommended maximum values provide guidance on an upper limit to the level of noise from industry. In all cases it is expected that all feasible and reasonable mitigation measures would be applied before the recommended maximum noise levels are referenced.

In some instances it may not be possible to achieve even the recommended maximum noise level, even after all feasible and reasonable noise mitigation has been applied. Such cases are expected to have a large adverse noise impact. Where a proposed development exceeds the recommended maximum noise levels in *Table 2.1*, substantial benefits in other areas, including a high degree of social worth, would need to be demonstrated.

Where the existing noise level from industrial noise sources is close to the acceptable noise level, the noise level from any new source(s) must be controlled to preserve the amenity of an area. If the total noise level from industrial sources already exceeds the acceptable noise level for the area in question, the L_{Aeq} noise level from any new source should not be greater than:

- 10 dB below the acceptable noise level if there is a reasonable expectation that existing levels may be reduced in the future; or
- 10 dB below the existing level if there is no such reasonable expectation that existing levels will fall (for example, in cases where surrounding areas are fully developed) and no significant changes to land use are expected.

Table 2.2 sets out the implications of this requirement for noise from industrial sources.

Adjustments are to be applied to the source noise level received at the assessment point, before comparison with this criterion, where the noise source contains annoying characteristics such as prominent tonal components, impulsiveness, intermittency, irregularity and dominant low-frequency content, as outlined in *Section 4*.

Procedures for considering meteorological effects such as temperature inversions and wind are outlined in *Section 5* to account for characteristic weather conditions under which the amenity criteria apply.

In determining the existing L_{Aeq} noise level from industry, noise from transportation-related sources (road traffic, rail traffic and aircraft) may be excluded. Criteria for noise from these sources are defined separately. Research and experience indicates that residents distinguish and respond separately to noise from road traffic, rail traffic, aircraft and industrial sources, rather than registering an overall noise annoyance related to the total L_{Aeq} noise level. *Section 3.2* gives guidance on how to determine existing noise levels. Practical means by which transportation noise (road traffic in particular) may be excluded from a measurement of existing noise levels are presented in *Section 3.2.1*.

Where existing traffic noise levels are continuously high, the existing level of the traffic noise (determined by using the method outlined in *Section 3.2*) can be 10 dB or more above the recommended acceptable noise level shown in *Table 2.1*. In these situations the industrial source may be inaudible, even where it produces noise levels higher than the acceptable noise level. The criterion to be applied in this case is set out in *Section 2.2.3*.

Global Acoustics Pty Ltd | PO Box 3115 | Thornton NSW 2322
Telephone +61 2 4966 4333 | Email global@globalacoustics.com.au
ABN 94 094 985 734

Table 2.1. 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, dB(A) *(see Note 8 in Section 2.2.1)*	
(see Notes in Section 2.2.1)			**Acceptable** *(See Note 11)*	**Recommended Maximum** *(See Note 11)*
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
	Urban/Industrial Interface – for existing situations only	Day	65	70
		Evening	55	60
		Night	50	55
School classroom—internal	All	Noisiest 1-hour period when in use	35 *(See Note 10)*	40
Hospital ward —internal —external	 All All	 Noisiest 1-hour period Noisiest 1-hour period	 35 50	 40 55
Place of worship—internal	All	When in use	40	45
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55
Active recreation area (e.g. school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Where there is a reasonable expectation that the cumulative noise level from industrial sources could increase in future (for example, through the development of further new sources), this should be considered in setting noise levels, as outlined in *Section 2.2.4*.

NSW industrial noise policy

APPENDIX

B CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2006
Calibration Certificate

Calibration Number C15339

Client Details	Acoustic Research Labs Pty Ltd - Hire Level 7, Building 2, 423 Pennant Hills Road PENNANT HILLS NSW 2120
Equipment Tested/ Model Number :	Rion NL-42EX
Instrument Serial Number :	00410151
Microphone Serial Number :	135411
Pre-amplifier Serial Number :	10145

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	21.7°C	**Ambient Temperature :**	21.7°C
Relative Humidity :	48%	**Relative Humidity :**	48.6%
Barometric Pressure :	100.47kPa	**Barometric Pressure :**	100.42kPa

Calibration Technician : Dennis Kim
Calibration Date : 22/07/2015
Secondary Check: Sandra Minto
Report Issue Date : 23/07/2015
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10: Self-generated noise	*Pass*	14: Level linearity on the reference level range	*Pass*
11: Acoustical tests of a frequency weighting	*Pass*	15: Level linearity incl. the level range control	*Pass*
12: Electrical tests of frequency weightings	*Pass*	16: Toneburst response	*Pass*
13: Frequency and time weightings at 1 kHz	*Pass*	17: Peak C sound level	*Pass*
		18: Overload Indication	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.120dB*	*Temperature*	*±0.3°C*
12.5kHz	*±0.165dB*	*Relative Humidity*	*±4.1%*
16kHz	*±0.245dB*	*Barometric Pressure*	*±0.1kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.121dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

NATA
WORLD RECOGNISED ACCREDITATION

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

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Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990

Calibration Certificate

Calibration Number C15445

Client Details Acoustic Research Labs Pty Ltd
Level 7, Building 2, 423 Pennant Hills Road
PENNANT HILLS NSW 2120

Equipment Tested/ Model Number : ARL Ngara
Instrument Serial Number : 87802E
Microphone Serial Number : 315009
Pre-amplifier Serial Number : 27880

Atmospheric Conditions
Ambient Temperature : 23°C
Relative Humidity : 43%
Barometric Pressure : 100.45kPa

Calibration Technician : Dennis Kim
Calibration Date : 18/09/2015
Secondary Check: Sandra Minto
Report Issue Date : 21/09/2015
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10.2.2: Absolute sensitivity	*Pass*	10.3.4: Inherent system noise level	*Pass*
10.2.3: Frequency weighting	*Pass*	10.4.2: Time weighting characteristic F and S	*Pass*
10.3.2: Overload indications	*Pass*	10.4.3: Time weighting characteristic I	*Pass*
10.3.3: Accuracy of level range control	*Pass*	10.4.5: R.M.S performance	*Pass*
8.9: Detector-indicator linearity	*Pass*	9.3.2: Time averaging	*Pass*
8.10: Differential level linearity	*Pass*	9.3.5: Overload indication	*Pass*

Least Uncertainties of Measurement -

Acoustic Tests
31.5 Hz to 8kHz *±0.120dB*
12.5kHz *±0.165dB*
16kHz *±0.245dB*
Electrical Tests
31.5 Hz to 20 kHz *±0.098dB*

Environmental Conditions
Temperature *±0.3°C*
Relative Humidity *±4.1%*
Barometric Pressure *±0.1kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

NATA
WORLD RECOGNISED ACCREDITATION

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

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Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Calibrator
IEC 60942-2004

Calibration Certificate

Calibration Number C16608

Client Details ARL Hire
423 Pennant Hills Rd
PENNANT HILLS NSW 2120

Equipment Tested/ Model Number : ARL ND9
Instrument Serial Number : N225020

Atmospheric Conditions
Ambient Temperature : 22.1°C
Relative Humidity : 46%
Barometric Pressure : 99.51kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 27/10/2016
Secondary Check: Aarons Skeates-Udy
Report Issue Date : 27/10/2016
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
5.2.2: Generated Sound Pressure Level	*Pass*	5.3.2: Frequency Generated	*Pass*
5.2.3: Short Term Fluctuation	*Pass*	5.5: Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	93.9	1000.16
Measured Output	114.0	1000.0	113.9	1000.15

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

Least Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.09dB*	*Temperature*	*±0.05°C*
Short Term Fluct.	*±0.02dB*	*Relative Humidity*	*±0.46%*
Frequency	*±0.01%*	*Barometric Pressure*	*±0.017kPa*
Distortion	*±0.5%*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

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Accredited for compliance with ISO/IEC 17025.

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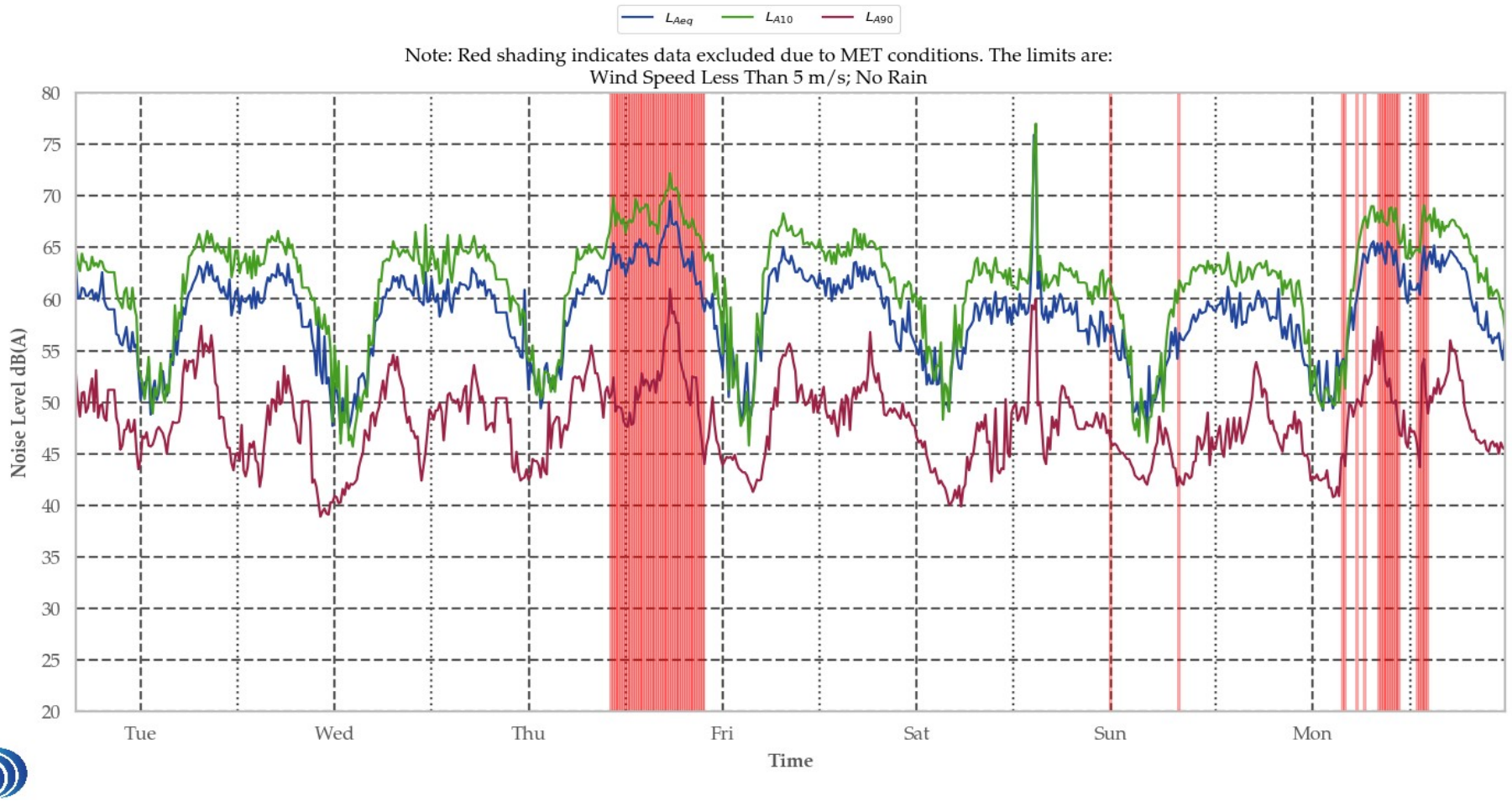
APPENDIX

C NOISE LOGGER GRAPHS

Environmental Noise Levels at R1
For 27 March 2017 to 03 April 2017



Environmental Noise Levels at R2
For 27 March 2017 to 03 April 2017