Baal Bone Colliery

Annual Noise Monitoring

July 2017

Prepared for

Baal Bone Colliery

Global Acoustics

Noise and Vibration Analysis and Solutions

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July 2017
Annual Noise Monitoring

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Prepared for

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Cullen Bullen NSW 2790

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EXECUTIVE SUMMARY

Global Acoustics were engaged by Baal Bone Colliery (BBC) to conduct a noise survey around their operations, located near Cullen Bullen, NSW.

A noise survey around BBC is required annually as detailed in their current Noise Management Plan (NMP).

Environmental noise monitoring described in this report was undertaken at two locations during the day, evening, and night periods of 27 July 2017.

Attended monitoring was conducted in accordance with the EPA 'Industrial Noise Policy' (INP) guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'. The duration of each measurement was 15 minutes. The survey purpose is to quantify and describe the existing acoustic environment around BBC and compare results with relevant limits.

Noise levels from BBC complied with the $L_{Aeq,15minute}$ and $L_{A1,1minute}$ development consent criteria at all monitoring locations during the July 2017 survey.

There were no exceedances, complaints or noise related incidents recorded by BBC since the previous monitoring was carried out (August 2016).

Global Acoustics Pty Ltd

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Appendices

1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Baal Bone Colliery (BBC) to conduct a noise survey around its underground coal mining operations near Cullen Bullen, NSW. Historically, operations at BBC included underground extraction of coal using longwall machinery and underground conveyors, as well as surface coal handling and processing infrastructure. However, BBC has been under care and maintenance and used only as a training facility for Glencore employees since 2012.

Environmental noise monitoring described in this report was undertaken during the day, evening and night periods of 27 July 2017. Figure 1 shows the monitoring locations.

The survey purpose is to quantify and describe the existing acoustic environment around the mine and compare results with relevant limits.

1.2 Monitoring Locations

There were two monitoring locations during this survey as detailed in Table 1.1 and shown on Figure 1. It should be noted that this figure shows the actual monitoring position, not the location of residences.

Table 1.1: BBC MONITORING LOCATIONS

Report Descriptor	Monitoring Location
R1	Lot 95 DP 755759, Ben Bullen
R2/R3	Lot 3 and Lot 4 DP 724531, Ben Bullen

1.3 Operations

BBC has advised that during the periods of monitoring on 27 July 2017, the main mine fan was running and there was an Eimco LHD and PJB carrier operating on pit top as part of training exercises.

Figure 1: BBC Attended Noise Monitoring Locations

1.4 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_{Amax}	The maximum A-weighted noise level over a time period or for an event
L_{A1}	The noise level which is exceeded for 1 per cent of the time
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_{A50}	The noise level which is exceeded for 50 per cent of the time
L_{A90}	The level exceeded for 90 percent 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_{Amin}	The minimum A-weighted noise level over a time period or for an event
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
ABL	Assessment background level (ABL), the 10^{th} 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
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude. Estimated from wind speed and sigma theta data
IA	Inaudible. When site only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

2 CONSENT AND CRITERIA

All monitoring has been carried out in accordance with the BBC Environment Protection Licence (EPL) No. 765 and the BBC Noise Monitoring Plan (NMP) which has been approved by the Department of Planning.

2.1 Project Approval and Environment Protection Licence

Project Approval 09_0178 was approved in January 2011, and has since undergone two modifications, the most recent being in December 2015. Table 2 in Schedule 3 of the approval details noise impact assessment criteria. Relevant sections of the modified approval are included in Appendix A.

BBC holds EPL No.765 for Baal Bone Colliery. The latest version of the licence is dated 11 February 2014. Section L4 of the licence outlines noise limits and is reproduced in Appendix A.

2.2 Noise Management Plan

The Baal Bone NMP has been prepared in accordance with Schedule 3, Condition 6 of PA 09_0178.

Section 5 of the NMP details the noise monitoring program, including methodology. Relevant sections have been included in Appendix A.

2.3 Project Specific Criteria

Impact assessment criteria for BBC are detailed in Table 2.1. These criteria have been selected as the most appropriate criteria for each monitoring location and are consistent between the EPL and project approval.

Table 2.1: PROJECT SPECIFIC CRITERIA

Descriptor	Monitoring Location	Day/Evening/Night Assessment Criterion $L_{Aeq,15minute}$ dB	Night Assessment Criterion $L_{A1,1minute}$ dB
R1	Muldoon Residence (Lot 95 DP 755759, Ben Bullen)	46	47
R2	Speirs Residence (Lot 4 DP 734531, Ben Bullen)	41	48
R3	Desch Residence (Lot 3 DP 734531, Ben Bullen)	41	48

2.4 Modifying Factors

Noise monitoring and reporting is carried out generally in accordance with the Environment Protection Authority (EPA) 'Industrial Noise Policy' (INP). Chapter 4 of the INP deals specifically with modifying factors that may apply to industrial noise. The most common modifying factors are addressed in detail below.

2.4.1 Tonality, Intermittent and Impulsive Noise

As defined in the INP:

> *Tonal noise contains a prominent frequency and is characterised by a definite pitch.*
>
> *Impulsive noise has high peaks of short duration or a sequence of such peaks.*
>
> *Intermittent noise is characterised by the level suddenly dropping to the background noise levels several times during a measurement, with a noticeable change in noise level of at least 5 dB. Intermittent noise applies to night-time only.*

2.4.2 Low Frequency Noise

INP Method

As defined in the INP:

> *Low frequency noise contains major components within the low frequency range (20 Hz to 250 Hz) of the frequency spectrum.*

As detailed in Chapter 4 of the INP, low frequency noise should be assessed by measuring the site only C-weighted and site only A-weighted level over the same time period. The correction/penalty of 5 dB is applied *if the difference between the two levels is 15 dB or more*.

Broner Method

Low frequency noise can also be assessed against criteria specified in the paper "A Simple Method for Low Frequency Noise Emission Assessment" (Broner JLFNV vol29-1 pp1-14 2010). If the total predicted site only C-weighted noise level at a receptor exceeds the relevant criterion, a 5 dB penalty (modifying factor) is added to measured levels. This method is included to provide a comparison with the INP method.

dING Method

Whilst the INP is the current document for assessment of industrial noise impact in NSW, the EPA has recently published the Draft Industrial Noise Guideline (dING), which is currently under review after a period of public consultation. The dING contains an alternate method of assessing low frequency noise to

the INP, which is:.

> *Measure/assess C-weighted and A-weighted $L_{eq,T}$ levels over the same time period. The low frequency noise modifying factor correction is to be applied where the C-A level exceeds 15 dB and:*
>
> • *where any of the 1/3 octave noise levels in Table C2 are exceeded by* ***up to*** *5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured A weighted levels applies for the evening/night period; and*
>
> • *where any of the 1/3 octave noise levels in Table C2 are exceeded by* ***more than*** *5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured A weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.*

Table C2 of the dING is reproduced below:

Table C2: One-third octave low frequency noise thresholds

Hz/dB(Z)	One-third octave $L_{Zeq,15minute}$ threshold level												
f,Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

Note: dB(z) = decibel (Z-weighted); f,Hz = frequency in Hertz; Hz/dB(Z) = hertz per decibel (Z-weighted). For the assessment of low frequency noise, care should be taken to select a wind screen that has wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to 5 metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler et.al. 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.

Low frequency noise shall be assessed under the meteorological conditions under which noise limits would apply.

Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or Environment Protection Licence and at locations nominated in the development consent or license.

2.4.3 Low Frequency Assessment Methods

Low frequency assessment methods are summarised in Table 2.2.

Table 2.2: LOW FREQUENCY ASSESSMENT METHODS AND MODIFYING FACTOR TRIGGERS

Assessment Method	Calculation Method
Broner, 2010	Site only L_{Ceq}
INP	Site only L_{Ceq} minus site only L_{Aeq}
dING	1. Site only L_{Ceq} minus site only L_{Aeq} 2. One third octave low frequency noise threshold

Triggers and penalties associated with each method are outlined in Section 2.4.2.

3 METHODOLOGY

3.1 Overview

All noise monitoring was conducted at the nearest residences in accordance with the EPA INP guidelines and Australian Standard AS1055 ' Acoustics, Description and Measurement of Environmental Noise' and the BBC NMP.

Meteorological data was obtained from the BBC weather station. This data allowed correlation of atmospheric parameters and measured noise levels. Atmospheric condition measurement at ground level was also undertaken during attended monitoring.

Monitoring was completed by Jesse Tribby. Details regarding relevant qualifications are provided in Appendix B.

3.2 Attended Noise Monitoring

During this survey, annual attended monitoring was undertaken at two locations during the day, evening, and night period. Two consecutive measurements during each period were carried out. The duration of each measurement was 15 minutes.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits as it allows the most accurate determination of the contribution, if any, to measured noise levels by the source of interest, in this case Baal Bone Colliery.

If the exact contribution of the source of interest cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise levels, for example, L_{A10}, L_{A50} or L_{A90}. This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods as per the Industrial Noise Policy (e.g. measure closer and back calculate) to determine a value for reporting.

All sites noted as NM in this report are due to one or more of the following reasons:

- site noise levels were extremely low and unlikely, in many cases, to be even noticed;
- site noise levels were masked by another relatively loud noise source that is characteristic of the environment (e.g. breeze in foliage or continuous road traffic noise) that cannot be eliminated by moving closer; and/or

- it was not feasible or reasonable to employ INP methods such as move closer and back calculate. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

A measurement of $L_{A1,1minute}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this was quantified by measuring or estimating the highest noise level emitted from a site noise source during the entire measurement period (i.e. the highest level of the worst minute during the 15-minute measurement).

The equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1: MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
Rion NA-28 sound level analyser	30131882	14/03/2019
Pulsar 105 acoustic calibrator	78226	14/03/2019

4 RESULTS

4.1 Attended Noise Monitoring

Noise levels measured at each location during attended surveys are provided in Table 4.1, discussion as to the noise sources responsible for these measured levels is provided in Chapter 5 of this report.

Table 4.1: MEASURED NOISE LEVELS – JULY 2017

Location	Start Date and Time	L_{Amax} dB	L_{A1} dB	L_{A10} dB	L_{A50} dB	L_{Aeq} dB	L_{A90} dB	L_{Amin} dB
Day								
R1	27/07/2017 13:26	53	46	37	27	34	23	20
R1	27/07/2017 13:41	54	45	36	28	34	23	20
R2/R3	27/07/2017 12:44	61	48	36	31	37	27	23
R2/R3	27/07/2017 12:59	65	40	35	29	34	24	20
Evening								
R1	27/07/2017 20:29	53	45	40	33	36	28	25
R1	27/07/2017 20:44	50	43	39	33	35	28	25
R2/R3	27/07/2017 21:10	59	54	42	31	41	19	18
R2/R3	27/07/2017 21:25	52	42	38	31	34	23	19
Night								
R1	27/07/2017 22:39	54	50	44	35	40	27	24
R1	27/07/2017 22:54	55	49	35	27	35	25	23
R2/R3	27/07/2017 22:01	55	50	42	31	39	21	19
R2/R3	27/07/2017 22:16	53	50	45	36	41	27	21

Notes:

1. *Levels in this table are not necessarily the result of activity at BBC.*

Table 4.2 compares measured $L_{Aeq,15minute}$ levels from BBC with impact assessment criteria.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY BBC AGAINST IMPACT ASSESSMENT CRITERIA - JULY 2017

Location	Start Date and Time	Wind Speed m/s[5]	Stability Category[5,6]	Criterion dB	Criterion Applies?[1]	BBC $L_{Aeq,15min}$ dB[2,4]	Exceedance[3]
Day							
R1	27/07/2017 13:26	1.6	A	46	Yes	IA	Nil
R1	27/07/2017 13:41	1.1	A	46	Yes	<20	Nil
R2/R3	27/07/2017 12:44	1.8	A	41	Yes	<30	Nil
R2/R3	27/07/2017 12:59	1.8	A	41	Yes	<30	Nil
Evening							
R1	27/07/2017 20:29	0.7	E	46	Yes	26	Nil
R1	27/07/2017 20:44	0.8	E	46	Yes	26	Nil
R2/R3	27/07/2017 21:10	1.2	F	41	Yes	IA	Nil
R2/R3	27/07/2017 21:25	1.0	F	41	Yes	IA	Nil
Night							
R1	27/07/2017 22:39	0.0	G	46	No	<20	NA
R1	27/07/2017 22:54	0.0	G	46	No	<20	NA
R2/R3	27/07/2017 22:01	0.2	E	41	Yes	<20	Nil
R2/R3	27/07/2017 22:16	0.3	D	41	Yes	<20	Nil

Notes:

1. *Noise emission limits do not apply during the following meteorological conditions: wind speeds greater than 3 metres per second at 10 metres above ground level, stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level, or stability category G temperature inversion conditions;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to BBC;*
3. *NA in exceedance column means atmospheric conditions outside conditions specified in EPL and so criterion is not applicable;*
4. *Bold results in red are possible exceedances of relevant criteria;*
5. *Criterion may or may not apply due to rounding of meteorological data values; and*
6. *Stability category has been determined by the sigma theta method referred to in Part E4 of Appendix E to the NSW INP, in accordance with Section L4.4 of the EPL.*

Table 4.3 compares measured $L_{Aeq,15minute}$ levels from BBC with impact assessment criteria.

Table 4.3: $L_{A1,1minute}$ GENERATED BY BBC AGAINST IMPACT ASSESSMENT CRITERIA - JULY 2017

Location	Start Date and Time	Wind Speed m/s[5]	Stability Category[5,6]	Criterion dB	Criterion Applies?[1]	BBC $L_{A1,1min}$ dB[2,4]	Exceedance[3]
R1	27/07/2017 22:39	0.0	G	47	No	28	NA
R1	27/07/2017 22:54	0.0	G	47	No	29	NA
R2/R3	27/07/2017 22:01	0.2	E	48	Yes	<25	Nil
R2/R3	27/07/2017 22:16	0.3	D	48	Yes	<25	Nil

Notes:

1. *Noise emission limits do not apply during the following meteorological conditions: wind speeds greater than 3 metres per second at 10 metres above ground level, stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level, or stability category G temperature inversion conditions;*
2. *Estimated or measured $L_{A1,1minute}$ attributed to BBC;*
3. *NA in exceedance column means atmospheric conditions outside conditions specified in EPL and so criterion is not applicable;*
4. *Bold results in red are possible exceedances of relevant criteria;*
5. *Criterion may or may not apply due to rounding of meteorological data values; and*
6. *Stability category has been determined by the sigma theta method referred to in Part E4 of Appendix E to the NSW INP, in accordance with Section L4.4 of the EPL.*

4.2 Low Frequency Assessment

Table 4.4 provides statistics for attended noise monitoring undertaken around BBC on 27 July 2017.

Table 4.4: ATTENDED MEASUREMENT STATISTICS FOR BBC – JULY 2017

Conditions	Total for July 2017
Number of measurements	12
Number of measurements where criterion applies	10
Number of measurements where BBC was measurable and where met results in criterion applying	0

None of the 12 measurements occurred during which BBC was directly measurable (not "inaudible", "not measurable" or less than a maximum cut-off value "<30 dB") and where meteorological conditions resulted in criteria applying (in accordance with the consent). No further low frequency assessment was carried out.

4.3 Atmospheric Conditions

Atmospheric condition measurement data, collected with each noise measurement, are shown in Table 4.5. Data from the BBC weather station is included as Appendix D.

Table 4.5: MEASURED ATMOSPHERIC CONDITIONS – JULY 2017

Location	Start Date and Time	Temperature Degrees	Wind Speed m/s [1,2]	Wind Direction Degrees [1,2]	Cloud Cover Eighths
		Day			
R1	27/07/2017 13:26	14	1.1	340	0
R1	27/07/2017 13:41	16	-	-	0
R2/R3	27/07/2017 12:44	14	0.8	275	0
R2/R3	27/07/2017 12:59	15	1.8	330	0
		Evening			
R1	27/07/2017 20:29	1	0.3	190	2
R1	27/07/2017 20:44	0	-	-	2
R2/R3	27/07/2017 21:10	1	0.3	140	2
R2/R3	27/07/2017 21:25	0	0.5	140	2
		Night			
R1	27/07/2017 22:39	0	-	-	2
R1	27/07/2017 22:54	0	0.4	180	3
R2/R3	27/07/2017 22:01	0	0.8	200	2
R2/R3	27/07/2017 22:16	0	-	-	2

Notes:

1. *Wind speed and direction measured at 1.8 metres; and*
2. *"-" indicates calm conditions at 1.8 metres.*

5 DISCUSSION

5.1 Noted Noise Sources

Table 4.1 presents data gathered during attended monitoring. These noise levels are the result of many sounds reaching the sound level meter microphone during monitoring. Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of BBC's contribution, if any, to measured levels. At each receptor location, the BBC only $L_{A1,1min}$ (night period only) and L_{Aeq} (in the absence of any other noise) were, where possible, measured directly, or, determined by frequency analysis.

From these observations summaries have been derived for each location as detailed in the following sections. Statistical 1/3 octave band analysis of environmental noise was undertaken, and Figure 3 to Figure 14 display the frequency ranges for various noise sources at each location for L_{A1}, L_{A10}, L_{A90} and L_{Aeq}. These figures also provide, geographically, statistical information for these noise levels.

An example is provided as Figure 2 where it can be seen that frogs and insects are generating noise at frequencies above 1000 Hz, mining noise is at frequencies less that 1000 Hz (this is typical). Adding levels at frequencies that relate to mining only allows separate statistical results to be calculated. This analysis cannot always be performed if there are significant levels of other noise at the same frequencies as mining, this can be dogs, cows, or most commonly, road traffic.

In should be noted that the method of summing statistical values up to a cutoff frequency can overstate the L_{A1} result by a small margin but is accurate for L_{Aeq}.

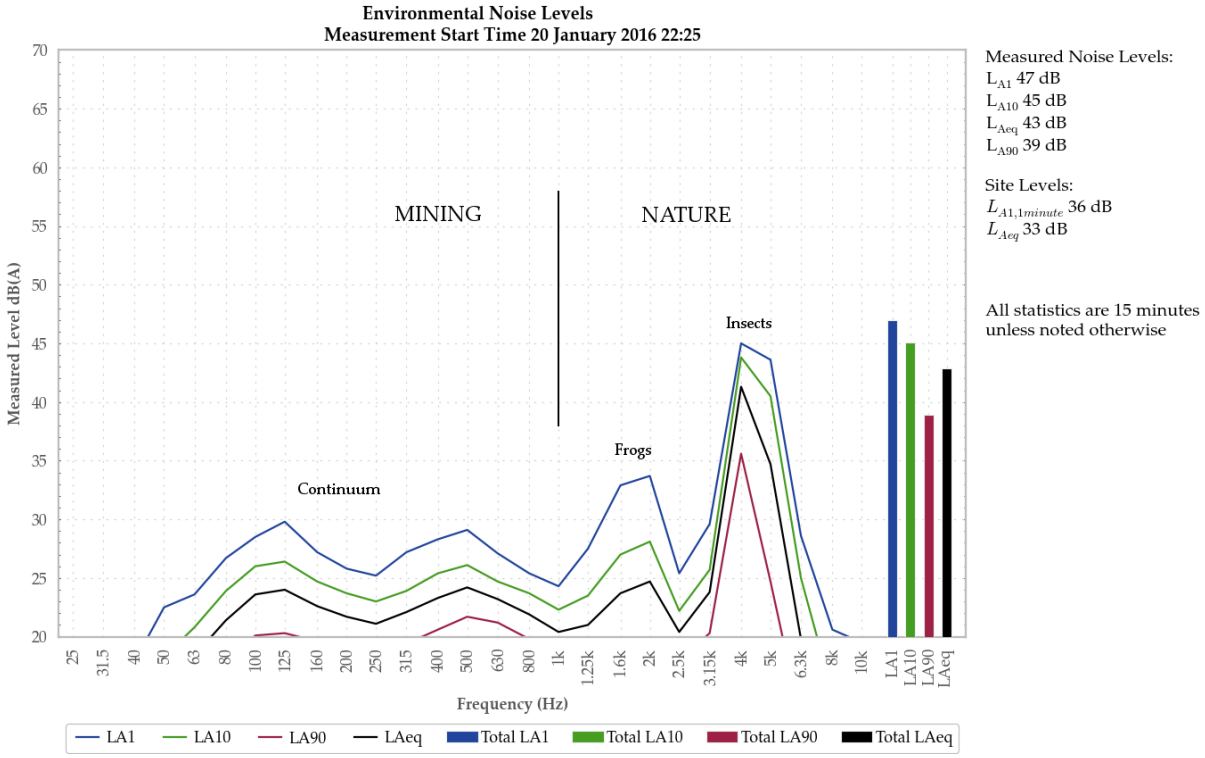

Figure 2: Example Graph (refer to Section 5.1 for explanatory note)

5.1.1 R1 - Day

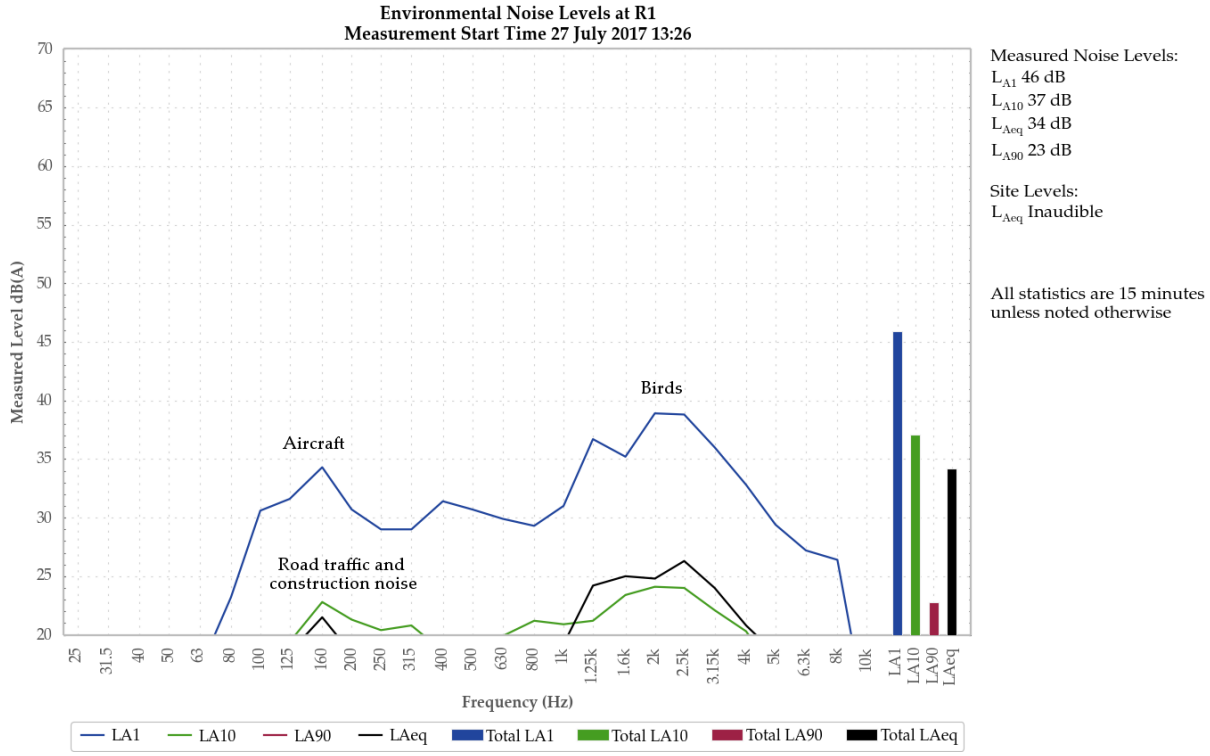

Figure 3: Environmental Noise Levels, R1

BBC was inaudible during the measurement.

Birds, including a rooster, were primarily responsible for generating all measured levels. Noise from road traffic and construction also contributed to the measured L_{Aeq}, L_{A10}, and L_{A90}.

Breeze in the foliage and dogs were also noted.

5.1.2 R1 - Day

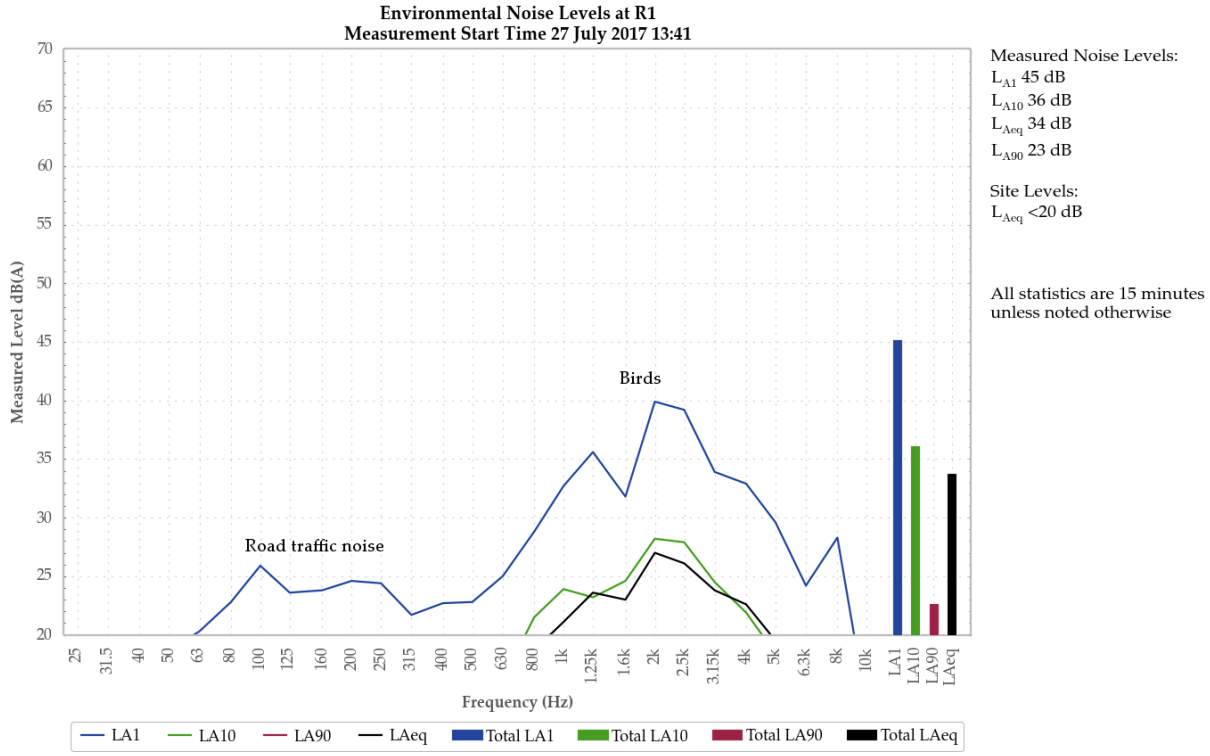

Figure 4: Environmental Noise Levels, R1

A low-level continuum from BBC was audible during the measurement, generating a site only L_{Aeq} of less than 20 dB. Reverse alarm noise was also noted.

Birds generated the measured L_{A1}, L_{A10}, and L_{Aeq}. Breeze in the foliage generated the measured L_{A90}.

Dogs, road traffic noise, and construction noise were also noted.

5.1.3 R2/R3 - Day

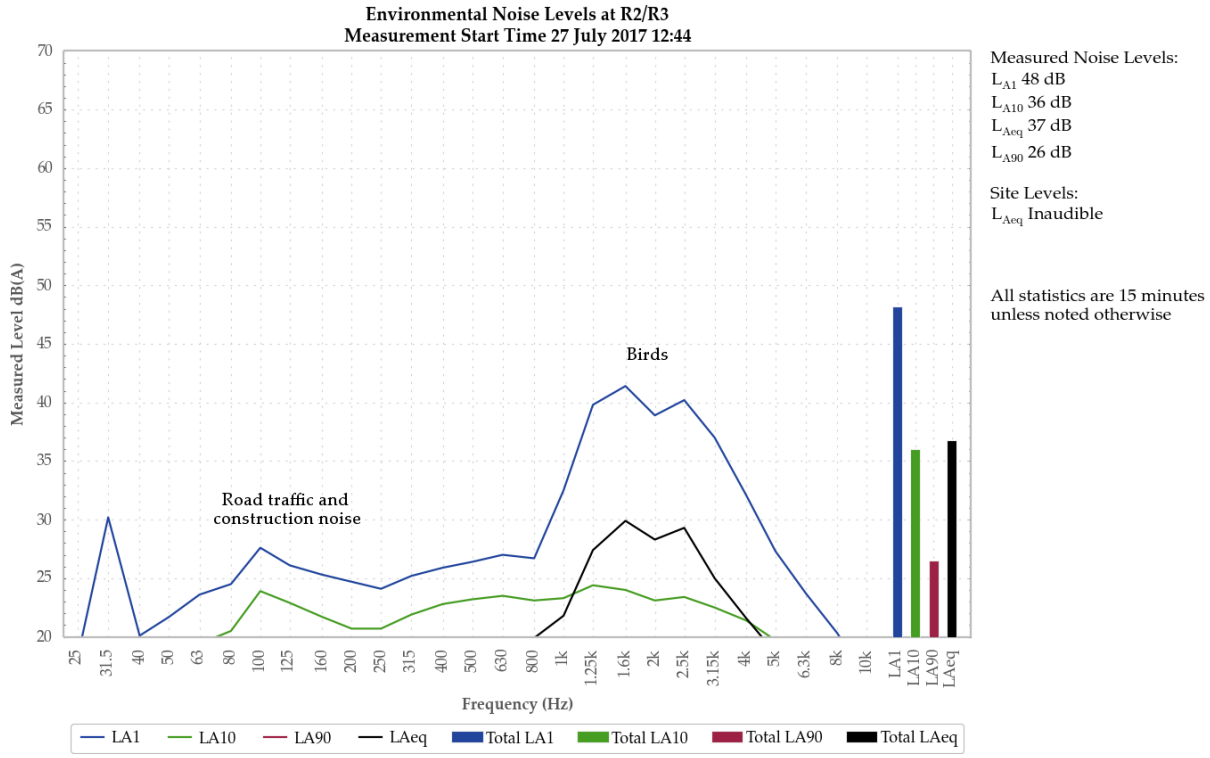

Figure 5: Environmental Noise Levels, R2/R3

BBC was inaudible during the measurement.

Birds generated the measured L_{A1} and L_{Aeq}. Breeze in foliage and on the microphone primarily generated the measured L_{A10}. Birds were also a minor contributor to the L_{A10}. Road traffic and construction noise generated the measured L_{A90} and were also minor contributors to the L_{A10} and L_{Aeq}.

A local impact noise was also noted.

5.1.4 R2/R3 - Day

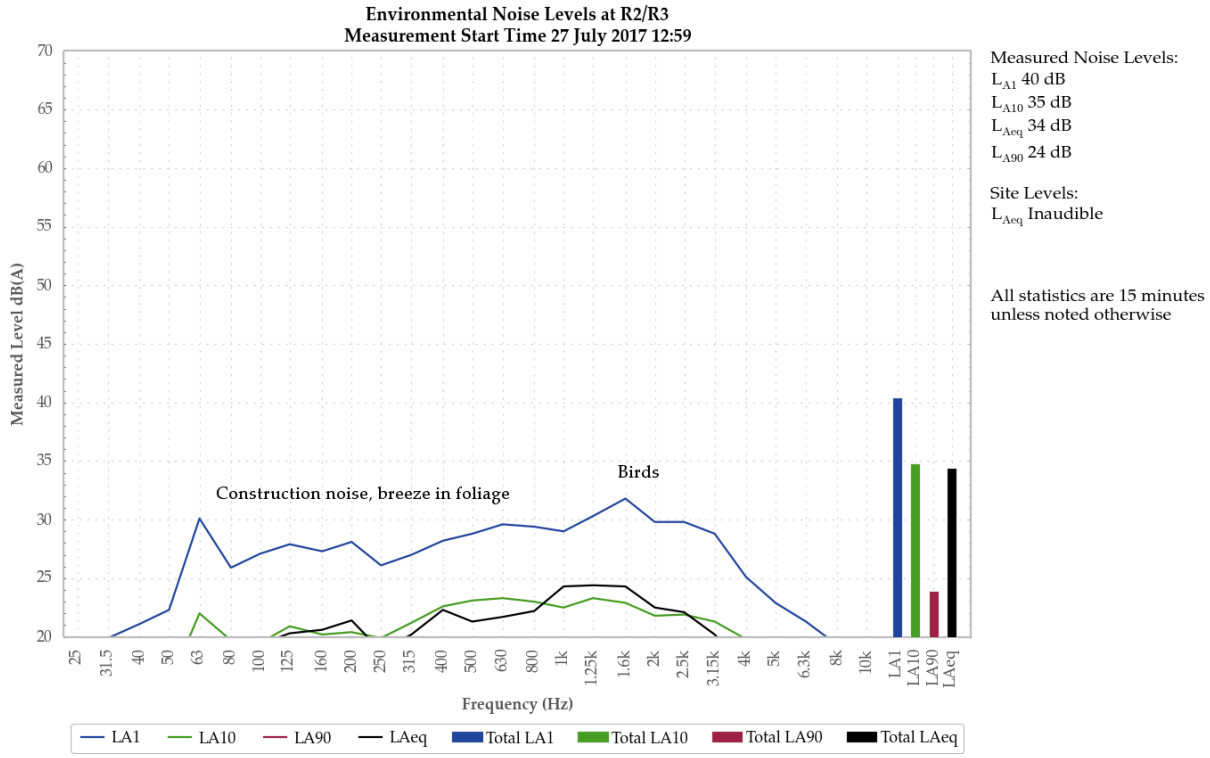

Figure 6: Environmental Noise Levels, R2/R3

BBC was inaudible during the measurement.

Birds and breeze in foliage and on the microphone generated the measured L_{A1}, L_{A10}, and L_{Aeq}. A local impact noise was also a minor contributor to the measured L_{Aeq}. Construction noise generated the measured L_{A90}.

5.1.5 R1 - Evening

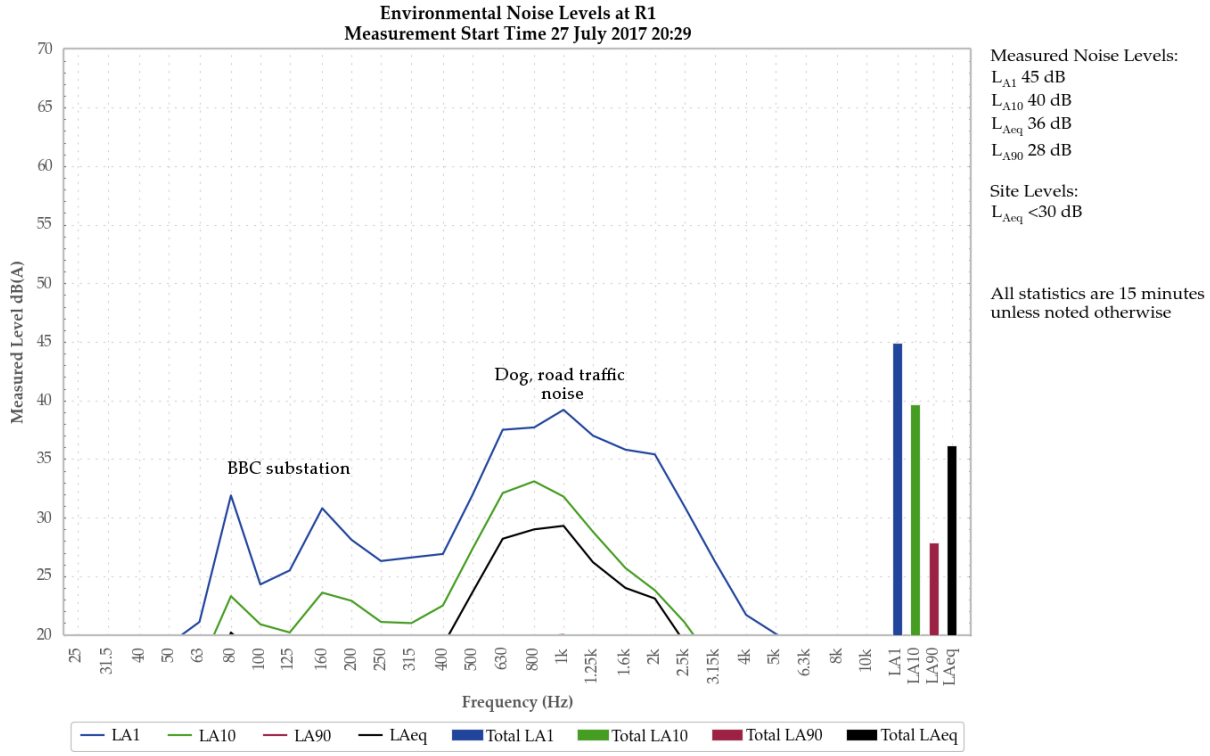

Figure 7: Environmental Noise Levels, R1

Substation continuum from BBC was audible during the measurement, generating a site only L_{Aeq} of less than 30 dB.

A dog primarily generated the measured L_{A1}, L_{A10} and L_{Aeq}. Continuum from BBC generated the measured L_{A90}.

Road traffic noise and frogs were also noted.

5.1.6 R1 - Evening

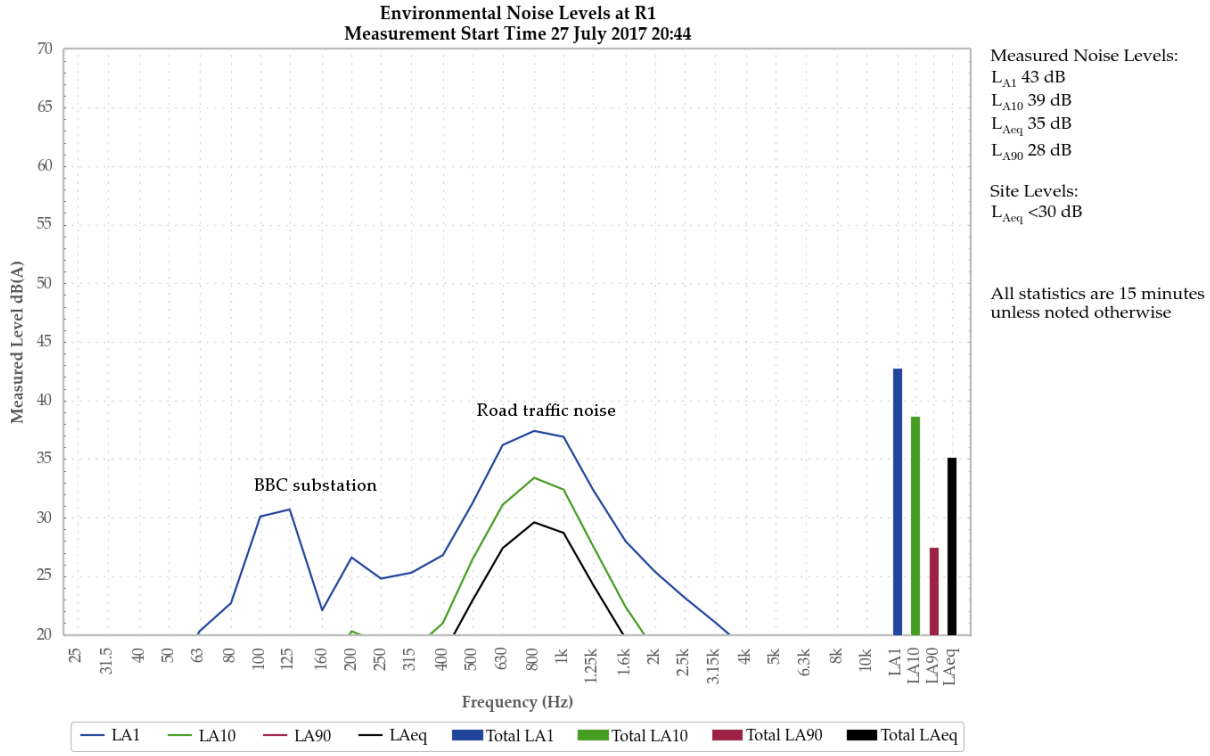

Figure 8: Environmental Noise Levels, R1

Substation continuum from BBC was audible during the measurement, generating a site only L_{Aeq} of less than 30 dB.

Road traffic noise generated the measured L_{A1}, L_{A10} and L_{Aeq}. Continuum from BBC generated the measured L_{A90}.

5.1.7 R2/R3 - Evening

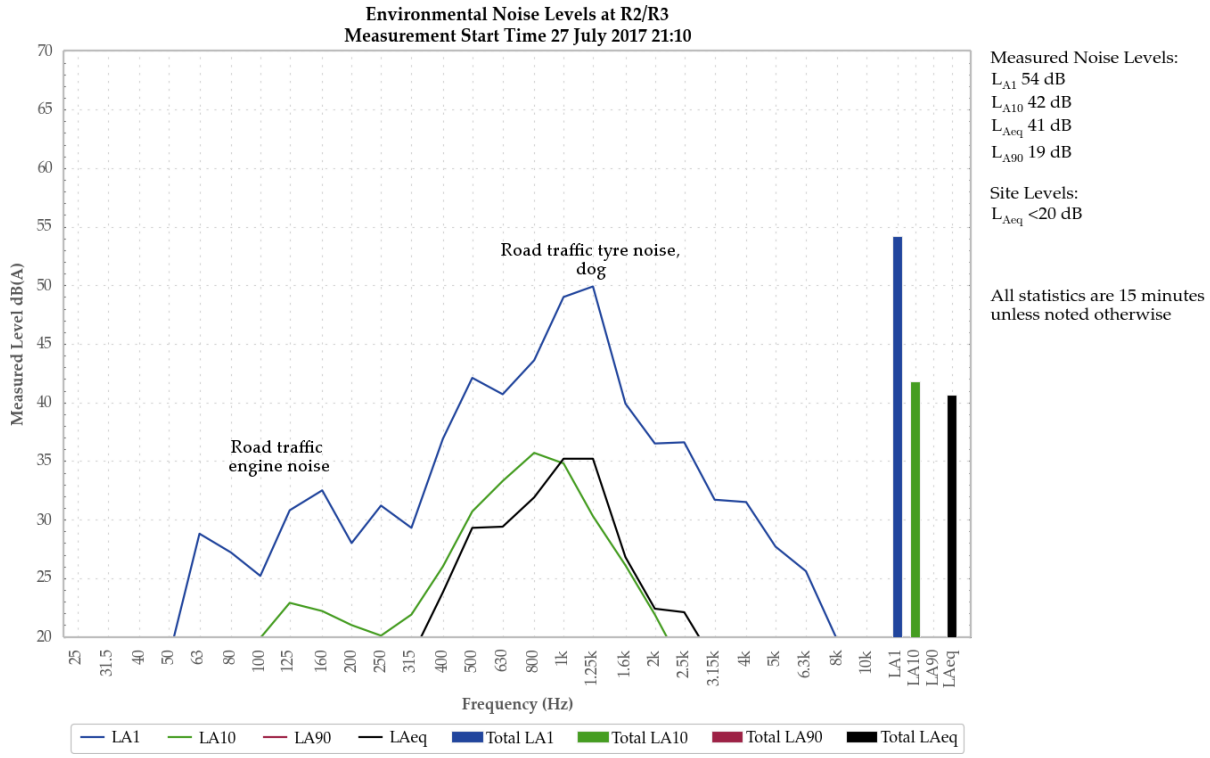

Figure 9: Environmental Noise Levels, R2/R3

Substation continuum from BBC was audible during the measurement, generating a site only L_{Aeq} of less than 20 dB.

Road traffic noise and dogs generated the measured L_{A1}, L_{A10} and L_{Aeq}. Continuum from BBC and the noise floor of the measurement instrument were responsible for the measured L_{A90}.

Frogs were also noted.

5.1.8 R2/R3 - Evening

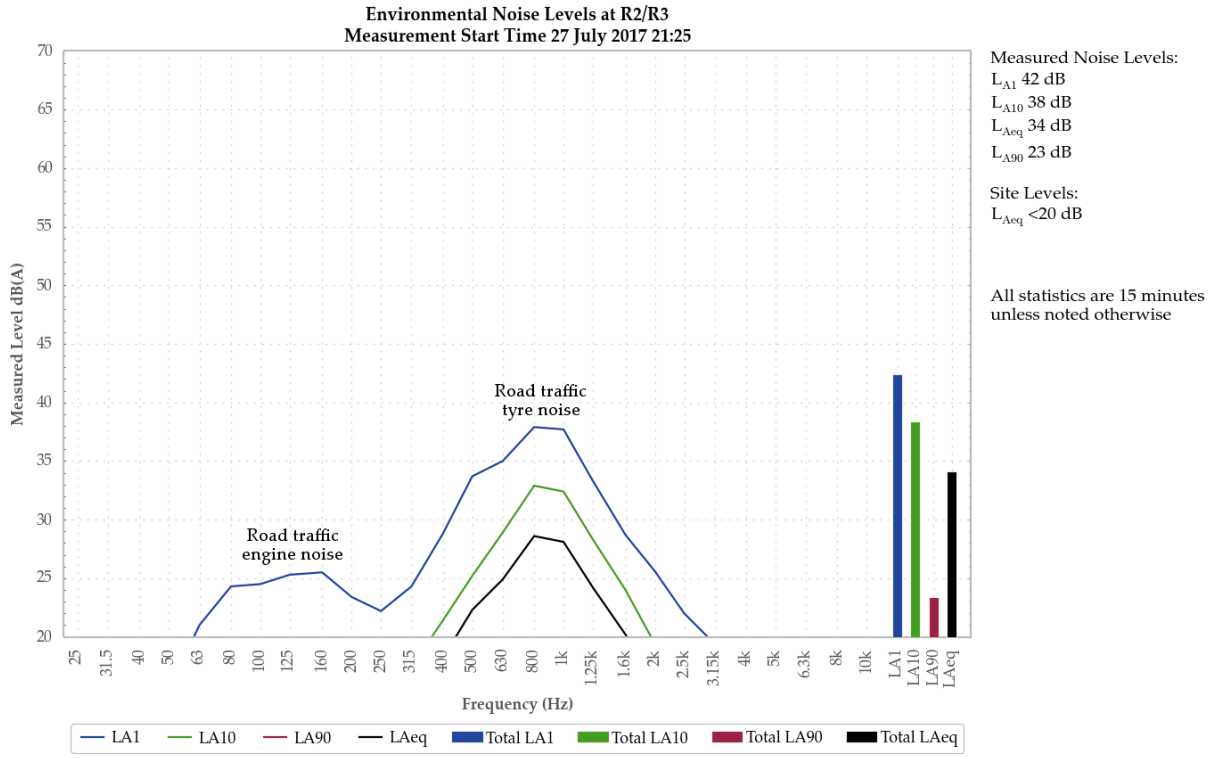

Figure 10: Environmental Noise Levels, R2/R3

Substation continuum from BBC was audible during the measurement, generating a site only L_{Aeq} of less than 20 dB.

Road traffic generated all measured noise levels.

Frogs and a local impact noise were also noted.

5.1.9 R1 - Night

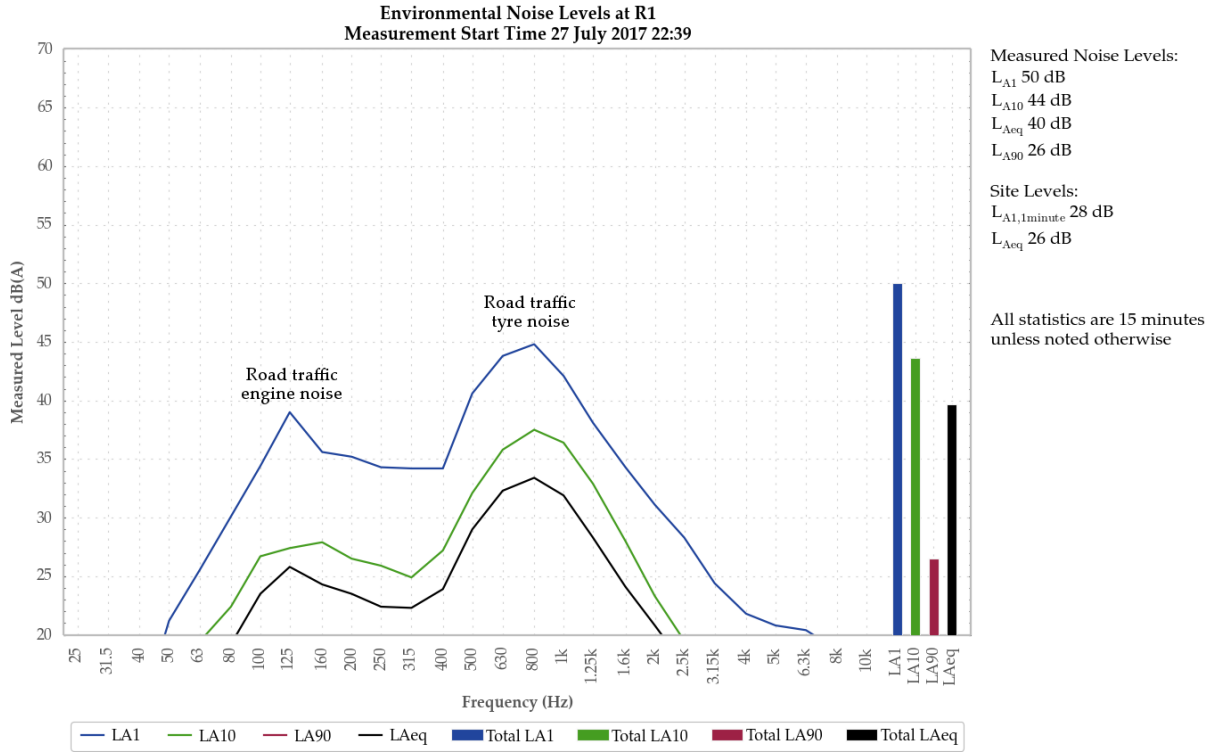

Figure 11: Environmental Noise Levels, R1

A substation and fan continuum from BBC was audible during the measurement, generating a site only L_{Aeq} of 26 dB and an $L_{A1,1minute}$ of 28 dB.

Road traffic noise generated the measured L_{A1}, L_{A10} and L_{Aeq}. The continuum from BBC generated the L_{A90}.

Dogs were also noted.

5.1.10 R1 - Night

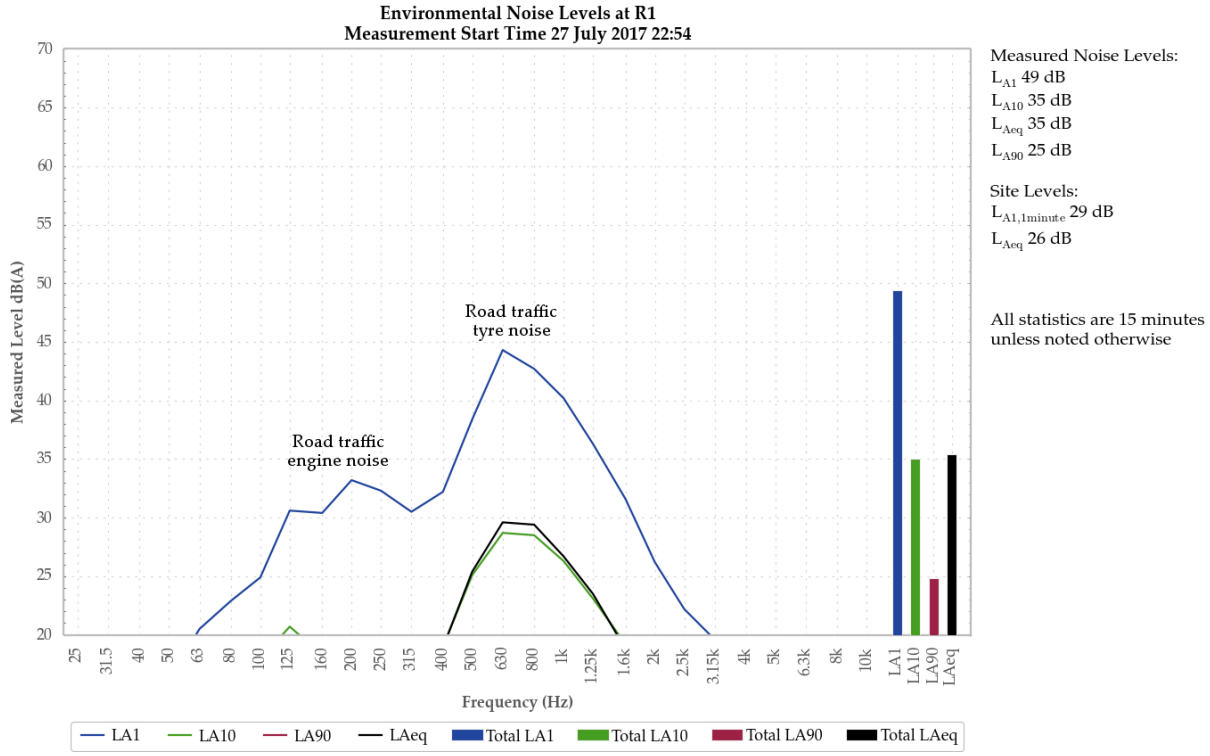

Figure 12: Environmental Noise Levels, R1

A substation and fan continuum from BBC was audible during the measurement, generating the site only L_{Aeq} of 26 dB and $L_{A1,1minute}$ of 29 dB.

Road traffic noise generated the measured L_{A1}, L_{A10} and L_{Aeq}. The continuum from BBC generated the measured L_{A90}.

Frogs were also noted.

5.1.11 R2/R3 - Night

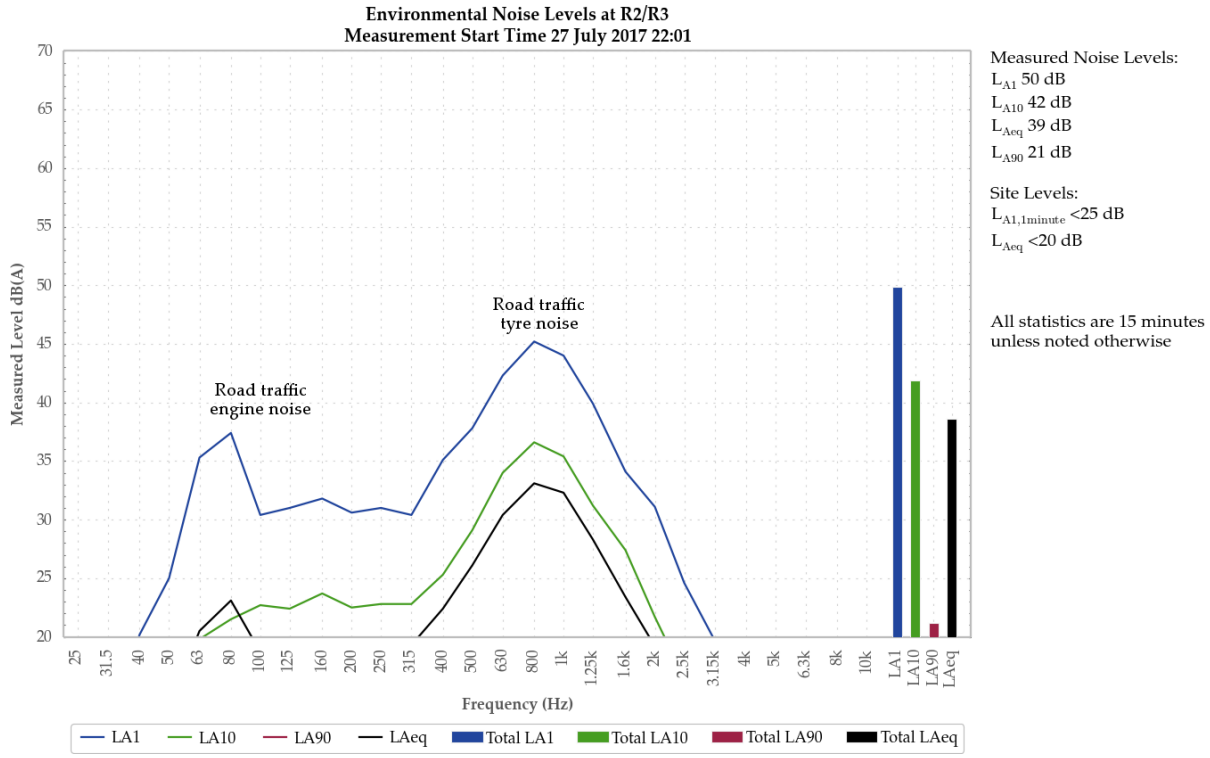

Figure 13: Environmental Noise Levels, R2/R3

Substation continuum from BBC was audible during the measurement, generating the site only L_{Aeq} of less than 20 dB and $L_{A1,1minute}$ of less than 25 dB.

Road traffic noise generated the measured L_{A1}, L_{A10} and L_{Aeq}. Continuum noise from BBC and road traffic noise were responsible for the measured L_{A90}.

Dogs were also noted.

5.1.12 R2/R3 - Night

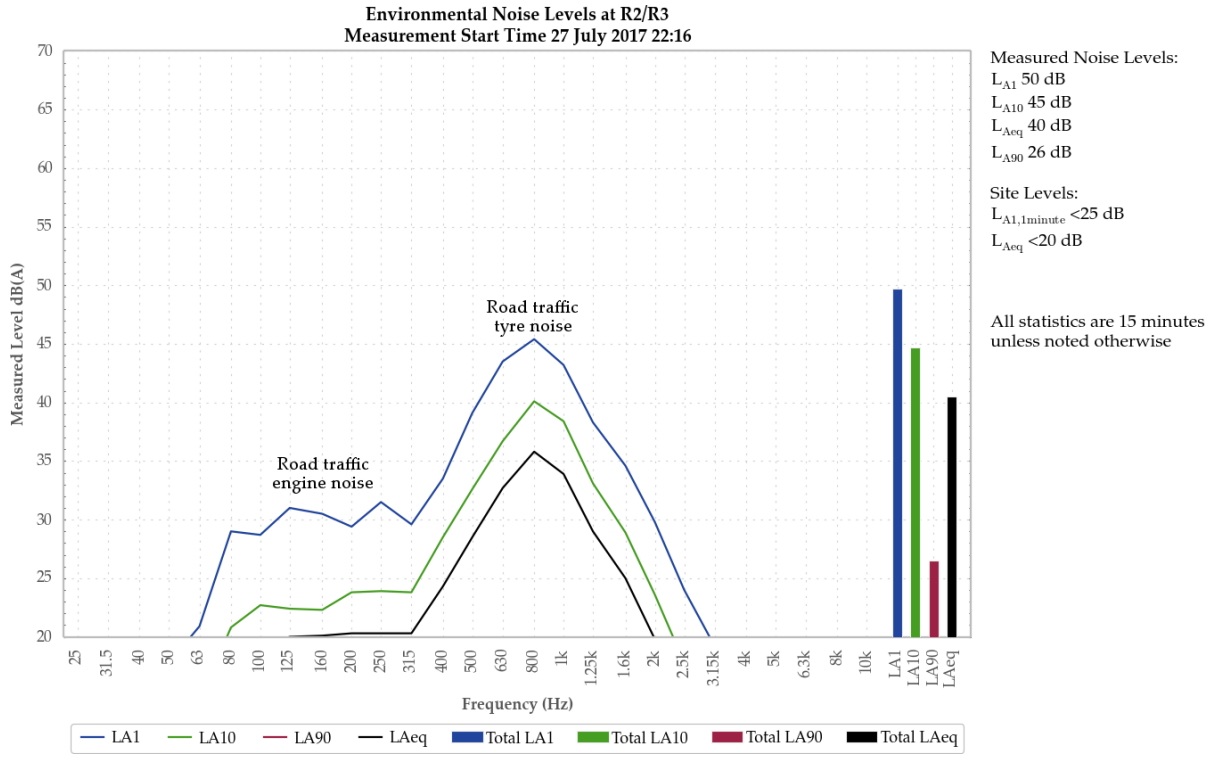

Figure 14: Environmental Noise Levels, R2/R3

Substation continuum from BBC was audible during the measurement, generating the site only L_{Aeq} of less than 20 dB and $L_{A1,1minute}$ of less than 25 dB.

Road traffic noise generated all measured levels.

6 SUMMARY OF COMPLIANCE

The following summaries apply to annual attended noise monitoring conducted for Baal Bone Colliery during the day, evening, and night periods of 27 July 2017.

6.1 Operational Noise Assessment

Activities from BBC complied with the relevant noise limits during attended monitoring on 27 July 2017 at all monitoring locations.

There were no exceedances, complaints or noise related incidents recorded by BBC since the previous monitoring was carried out (August 2016).

6.2 Low Frequency Assessment

No measurements occurred during which BBC mine was directly measurable, was within 5 dB of the relevant limits and where meteorological conditions resulted in criteria applying (in accordance with the EPL).

No further low frequency assessment was required.

Global Acoustics Pty Ltd

APPENDIX

A STATUTORY REQUIREMENTS

Project Approvals

The most recent version of the project approval was approved in December 2015. Sections relating to noise are reproduced below.

NOISE

Noise Impact Assessment Criteria

4. By 31 December 2011, the Proponent shall ensure that the noise generated by the project does not exceed the long term noise impact assessment criteria in Table 2 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.

Table 2: Long Term Noise Impact Assessment Criteria

Location	***All periods***	***Night***
	dB(A) $L_{Aeq\ (15\ min)}$	*dB(A)* $L_{A1\ (1\ min)}$
R1	46	47
R2	41	48
R3	41	48
All other privately-owned land	35	45

5. Until 31 December 2011, the Proponent shall ensure that the noise generated by the project does not exceed the interim noise impact assessment criteria in Table 3 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 3: Interim Noise Impact Assessment Criteria

Location	***All periods***	***Night***
	dB(A) $L_{Aeq\ (15\ min)}$	*dB(A)* $L_{A1\ (1\ min)}$
R1	48	47
R2	43	48
R3	43	48
All other privately-owned land	35	45

Notes to Tables 2 and 3:

- *To interpret the locations referred to in Table 2, see the applicable figure in Appendix 2;*
- *Noise generated by the project is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy; and*
- *These noise impact assessment criteria do not apply if the Proponent has an agreement with the relevant owner/s to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.*

Noise Management Plan

6. The Proponent shall prepare a Noise Management Plan for the project, to the satisfaction of the Secretary. The plan must:
   (a) be prepared in consultation with EPA, and submitted to the Secretary for approval within 6 months of the date of this approval; and
   (b) include a Noise Monitoring Program, that uses a combination of real-time and supplementary attended monitoring measures, and includes a protocol for determining exceedances with the relevant conditions of this approval.

Operating Conditions

7. The Proponent shall:
   (a) implement best practice noise management, including all reasonable and feasible noise mitigation measures to minimise the operational, low frequency, rail, and road traffic noise generated by the project;

   (b) regularly assess the real-time noise monitoring and meteorological forecasting data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this approval,

   to the satisfaction of the Secretary.

Road Haulage Management Plan

8. The Proponent shall prepare and implement a Road Haulage Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be submitted to the Secretary for approval 3 months prior to any proposal to truck more than 5,000 tonnes of coal per month from the mine;
   (b) detail the procedures for the ongoing assessment of noise impacts on residences as a result of road haulage of coal from the project; and
   (c) detail the procedures for the ongoing identification and implementation of reasonable and feasible noise mitigation works at residences adversely impacted by road haulage noise directly attributable to the project.

Environment Protection Licence

BBC holds Environmental Protection Licence (EPL No. 765. The relevant sections are reproduced below.

L4 Noise limits

L4.1 Noise generated from the premises must not exceed the noise limits in the table below. The locations referred to in the table below are indicated on Project Approval 09_0178, Baal Bone Coal Project, Appendix 2, Figure 2 - Noise Receivers.

Location	All Periods	Night
	dB(A) LAeq (15 min)	dB(A) LA1 (1 min)
R1 (Muldoon residence Lot95 DP755759 Ben Bullen)	46	47
R2 (Speirs residence Lot4 DP734531 Ben Bullen)	41	48
R3 (Desch residence Lot3 DP734531 Ben Bullen)	41	48
All other privately-owned land	35	45

Note: The above noise limits do not apply at properties where the licensee has a written agreement with the landowner regarding the applicable noise limit.

L4.2 For the purposes of condition L4.1:

a) All Periods refers to day, evening and night time; and
b) Night is defined as the period between 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

L4.3 Noise limits set out in condition L4.1 apply under all meteorological conditions except for the following:

a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
c) Stability category G temperature inversion conditions.

L4.4 For the purposes of condition L4.3:
a) Data recorded by the meteorological station identified as EPA Licence Point 13 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy.

L4.5 To determine compliance:

a) with the Leq(15 minute) noise limits in condition L4.1, the noise measurement equipment must be located:
(i) approximately on the property boundary, where any dwelling is situated 30 metres or less from the property boundary closest to the premises; or
(ii) within 30 metres of a dwelling facade, but not closer than 3 metres where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable
(iii) within approximately 50 metres of the boundary of a National Park or Nature Reserve.
b) with the noise limits in condition L4.1, the noise measurement equipment must be located:
(i) at the most affected point at a location where there is no dwelling at the location; or the property boundary closest to the premises; or
(ii) at the most affected point within an area at a location prescribed by condition L4.5(a).

L4.6 A non-compliance of condition L4.1 will still occur where noise generated from the premises in excess of the appropriate limit is measured:

a) at a location other than an area prescribed by condition L4.5(a); and/or
b) at a point other than the most affected point at a location.

L4.7 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

Noise Management Plan

The relevant sections of the BBC Noise Management Plan related to the noise monitoring program are reproduced below.

5. NOISE MONITORING PROGRAM

The NMP has been developed to address assessment procedures normally required by the EPA and DP&E; noise exposure for three residential receptors (R1, R2 and R3); and, assess compliance status with the noise conditions in PA 09_0178.

5.1 Attended Noise Monitoring

While Baal Bone is not an operating mine (from January 2013), attended monitoring frequency will be annual, provided that no significant changes in noise trends are identified.

Attended monitoring will be undertaken at receptors R1 and R2/R3 annually or as required to address reported noise incidents. As R2 and R3 are within 50 meters proximity of each other, monitoring for these locations will be concurrent and be taken at the midway point between them.

Scheduled operator attended noise monitoring will be undertaken during day, evening and night time assessment periods. Noise measurements at each assessment location will be undertaken over two consecutive 15 minute periods. The measurement results reported will include the L_{Amax}, L_{A1}, L_{Aeq} and L_{A90} levels and measured/calculated L_{Amax} and L_{Aeq} contributions from Baal Bone Colliery.

When direct measurement is not feasible to verify Baal Bone Colliery noise contributions, modelling will be undertaken to confirm the contribution. The measured or calculated contributed noise level will be adopted to assess against the criteria of PA 09_0178.

Attended noise monitoring will be increased in frequency to quarterly prior to the recommencement of mining operations.

5.2 Noise Measurement

Noise measurements will be undertaken in accordance with the Australian Standards AS1055-1997 "Acoustics - Description and Measurement of Environmental Noise' and the EPA's INP.

Noise from Baal Bone Colliery will be measured or predicted as an $L_{Aeq\ 15min}$ level at the most affected point on or within the residential property boundary or if this is more than 30 m from the residence, at the most affected point within 30 m of the residence. L_{Amax} noise from Baal Bone Colliery will be measured or predicted to outside a residential bedroom window during the night-time period between 10.00 pm and 7.00 am.

Noise measurements for the purpose of assessing compliance will be undertaken with instrumentation calibrated by a NATA Certified Laboratory. Instrumentation calibration levels will be checked with a portable calibrator immediately before and after the measurements, with the variation in calibration levels not exceeding ±0.5 dB. Copies of the meter calibration certificates will be attached to the attended noise monitoring report.

5.4 Meteorological Conditions

Meteorological conditions will be determined from the Baal Bone Colliery weather station. The station is programmed to provide mean and maximum parameters at 15 minute intervals. The reported parameters will include wind speed, wind direction, temperature, and humidity data. In the event the Baal Bone Colliery weather station data is not available, data from the Lithgow Meteorological Station located in Birdwood St, Lithgow will be used.

APPENDIX

B QUALIFICATIONS

Global Acoustics Pty Ltd ACN 094 985 734
PO Box 3115
Thornton NSW 2322
Phone: 02 49664333
Fax: 02 49664330
Email: global@globalacoustics.com.au

Curriculum Vitae for Jesse Tribby

ACADEMIC QUALIFICATIONS:	Bachelor of Science, Cum Laude Interdisciplinary Studies, Music and Acoustical Engineering, Boise State University
CAREER AND SPECIALISED COMPETENCE:	Jesse is a graduate engineer with experience in sound power testing, blast and environmental noise monitoring and occupational noise assessments. Jesse also has experience as a sound engineer.

PROFESSIONAL EXPERIENCE

August 2011 to present **GLOBAL ACOUSTICS PTY LTD**

Jesse is an Acoustics Technician responsible for undertaking environmental noise, vibration and blast monitoring, and occupational health and safety assessments. Jesse also undertakes sound power testing and screening of mining equipment, enabling the accurate identification of mining noise sources when conducting off-site environmental noise monitoring.

June 2004 to March 2011 **MORRISON CENTER FOR THE PERFORMING ARTS**

Jesse was a live sound engineer responsible for reinforcement of the acoustical environment and effective sound design. Jesse is also experienced with live mixing in dynamic performance conditions.

APPENDIX

C 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 61672-3.2013

Calibration Certificate

Calibration Number C17126

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thornton NSW 2322

Equipment Tested/ Model Number : Rion NA-28
Instrument Serial Number : 30131882
Microphone Serial Number : 04739
Pre-amplifier Serial Number : 11942

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22.4°C	**Ambient Temperature :**	22.6°C
Relative Humidity :	55.6%	**Relative Humidity :**	58.1%
Barometric Pressure :	99.91kPa	**Barometric Pressure :**	99.85kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 14/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 15/03/2017

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.16dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

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.

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.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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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 C17127

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thornton NSW 2322

Equipment Tested/ Model Number : Pulsar 105
Instrument Serial Number : 78226

Atmospheric Conditions
Ambient Temperature : 22.3°C
Relative Humidity : 55.6%
Barometric Pressure : 99.9kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 14/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 15/03/2017

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	94.1	1000.32

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	*±0.11dB*	*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.

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

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APPENDIX

D METEOROLOGICAL DATA

METEOROLOGICAL DATA FROM BBC WEATHER STATION[1]

End Date and Time	Wind Speed m/s	Wind Direction Degrees	Stability Class [1]	VTG °C/100m [1]	Total Rainfall mm
27/07/2017 13:00	1.8	314	A	-2.0	0
27/07/2017 13:15	1.8	321	A	-2.0	0
27/07/2017 13:30	0.9	330	A	-2.0	0
27/07/2017 13:45	1.6	330	A	-2.0	0
27/07/2017 14:00	1.1	329	A	-2.0	0
27/07/2017 14:15	1.6	309	A	-2.0	0
27/07/2017 14:30	2.2	319	A	-2.0	0
27/07/2017 14:45	1.5	356	A	-2.0	0
27/07/2017 15:00	1.1	9	A	-2.0	0
27/07/2017 15:15	1.4	0	A	-2.0	0
27/07/2017 15:30	1.6	8	A	-2.0	0
27/07/2017 15:45	1.4	20	A	-2.0	0
27/07/2017 16:00	1.7	49	A	-2.0	0
27/07/2017 16:15	1.3	26	A	-2.0	0
27/07/2017 16:30	0.9	32	A	-2.0	0
27/07/2017 16:45	1.0	39	A	-2.0	0
27/07/2017 17:00	0.2	38	F	3.0	0
27/07/2017 17:15	0.8	148	F	3.0	0
27/07/2017 17:30	0.9	161	F	3.0	0
27/07/2017 17:45	1.3	171	E	0.5	0
27/07/2017 18:00	0.6	142	F	3.0	0
27/07/2017 18:00	0.6	142	F	3.0	0
27/07/2017 18:15	1.0	161	D	-1.0	0
27/07/2017 18:30	1.1	164	D	-1.0	0
27/07/2017 18:45	1.2	164	E	0.5	0
27/07/2017 19:00	0.5	144	E	0.5	0
27/07/2017 19:15	0.5	125	F	3.0	0
27/07/2017 19:30	0.8	150	E	0.5	0
27/07/2017 19:45	0.9	147	E	0.5	0
27/07/2017 20:00	1.0	150	D	-1.0	0
27/07/2017 20:15	1.2	157	D	-1.0	0
27/07/2017 20:30	0.8	148	D	-1.0	0
27/07/2017 20:45	0.7	143	E	0.5	0

End Date and Time	Wind Speed m/s	Wind Direction Degrees	Stability Class [1]	VTG °C/100m [1]	Total Rainfall mm
27/07/2017 21:00	0.8	151	E	0.5	0
27/07/2017 21:15	0.8	132	D	-1.0	0
27/07/2017 21:30	1.2	146	F	3.0	0
27/07/2017 21:45	1.0	143	F	3.0	0
27/07/2017 22:00	0.7	147	F	3.0	0
27/07/2017 22:00	0.7	147	F	3.0	0
27/07/2017 22:15	0.2	129	E	0.5	0
27/07/2017 22:30	0.3	142	D	-1.0	0
27/07/2017 22:45	0.6	161	E	0.5	0
27/07/2017 23:00	0.0	NA	G	4.1	0
27/07/2017 23:15	0.0	NA	G	4.1	0
27/07/2017 23:30	0.0	171	E	0.5	0
27/07/2017 23:45	0.1	107	F	3.0	0
28/07/2017 00:00	0.5	156	F	3.0	NA

Notes:

1. *Stability class and VTG estimated from sigma theta data; and*
2. *"NA" indicates data not available.*