Wambo Coal Mine and Rail Spur

Environmental Noise Monitoring

August 2019

Prepared for

Wambo Coal Pty Limited

Global Acoustics

Noise and Vibration Analysis and Solutions

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EXECUTIVE SUMMARY

Global Acoustics was engaged by Wambo Coal (WC) to conduct a noise survey around the Wambo Coal Mine (WCM), and the Wambo Coal Rail Spur (WCRS).

A noise survey around both the WCM and the WCRS is required monthly as a condition of their current development consents (relevant extracts from both are provided in the following report sections).

Environmental noise monitoring described in this report was undertaken during the night of 5/6 August 2019. Attended noise monitoring was conducted at a total of six locations for the WCM and WCRS (see Figure 1).

Attended monitoring was conducted during the night period in accordance with Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirements. The duration of each measurement was 15 minutes.

Noise levels from WCM complied with the $L_{Aeq,15minute}$ and $L_{A1,1minute}$ criteria during attended noise monitoring for August 2019 at all monitoring locations. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

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1 INTRODUCTION

1.1 Background

Global Acoustics were engaged by Wambo Coal (WC) to conduct a noise survey around the Wambo Coal Mine (WCM) and the Wambo Coal Rail Spur (WCRS). The WCM and WCRS operate under separate development consents and have been monitored separately. Reporting, however, has been combined in this document.

WC operates both open cut and underground mining operations from their mine at Warkworth, NSW. The open cut operations include use of heavy mobile equipment in open cut pits, on haul roads and on waste rock emplacements. The underground operations have surface facilities. Both operations utilise a coal handling and preparation plant (CHPP) including conveyors, bins and other material-handling infrastructure.

The WCRS is located between Mt Thorley and Warkworth Village, NSW, (as shown in Figure 1) and includes the following components:

- a product coal stockpile and reclaim area, product coal conveyor, train load-out bin, rail loop and a rail spur from the WCM to Mount Thorley;
- rail transport of product coal to the market, an intermittent activity that can take place at any time; and
- a locomotive refuelling facility.

A noise survey around both the WCM and the WCRS is required monthly as detailed in the WC Noise Management Plan (NMP).

Environmental noise monitoring described in this report was undertaken during the night of 5/6 August 2019.

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

1.2 Monitoring Locations & Frequency

Attended noise monitoring was conducted at a total of six attended locations for WCM and the WCRS. Table 1.1 outlines the monitor type and frequency for the noise monitoring locations shown in Figure 1.

Table 1.1: WAMBO COAL MONITORING LOCATIONS AND FREQUENCY[1]

Site Reference	Residence[2]	Monitor Type	Consent Requirements	Frequency
N01	*Wambo Road Residence*	Attended	Mine & Rail Spur	Monthly
N03	*Kelly Residence*	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly
N16	*Jerrys Plains Road*	Attended	Mine	Monthly
N20A	*Redmanvale Road Central*	Attended	Mine	Monthly
N20	Redmanvale Road Central	Real-Time	Mine	Continuous
N21	*Wambo South*	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly
N26	*Redmanvale Road South*	Attended	Mine	Monthly

Notes:

1. *Sourced from the NMP – WA-ENV-MNP-503, January 2018; and*
2. *Monthly attended monitoring locations are shown in italics.*

Source: Google Maps

Figure 1: WCM Attended Noise Monitoring Locations

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_{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
$L_{A1,1minute}$	The noise level which is exceeded for 1 per cent of the specified time period of 1 minute
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
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 exposure level (SEL), the A-weighted noise energy during a measurement period normalised to one second
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
SC	Stability Class. Estimated from wind speed and sigma theta data
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 STATUTORY REQUIREMENTS & CRITERIA

2.1 Project Approval

WCM was granted consent (DA 305-7-2003) in February 2004, which enables the extension of current open cut and underground mining operations. The latest modification to this consent was approved in December 2017. The relevant sections of this modification are reproduced in Appendix A.

2.2 Environment Protection Licence

Environment Protection Licence number 529 (EPL) applies to the site with the noise section of the current version reproduced in Appendix A.

2.3 Noise Monitoring Program

The *Wambo Coal Noise Management Plan* (WA-ENV-MNP-503, January 2018) was prepared in accordance with Schedule 4 of the consent. The NMP describes monitoring to be conducted for WCM activities, and includes noise criteria. Monitoring is to be undertaken at the properties numbered N01, N03, N16, N20A, N21 and N26 on a monthly basis.

2.4 Project Approval Criteria & Weather Conditions

Criteria detailed in Table 2.1 have been selected as the most appropriate for each monitoring location and are based on the WCM project approval.

It should be noted that properties N01 and N03 are subject to acquisition upon request, as detailed in Schedule 4, Condition 1 of DA 305-7-2003. As such, there are no operational noise goals that apply directly to these properties.

Table 2.1: WCM SPECIFIC CRITERIA

Location	Day $L_{Aeq,15minute}$ dB	Evening and Night $L_{Aeq,15minute}$ dB	Night $L_{A1,1minute}$ dB
N01[1]	NA	NA	NA
N03[1]	NA	NA	NA
N16	35	40	50
N20A	35	40	50
N21	35	40	50
N26	35	40	50

Notes:

1. *N01 and N03 are acquisition upon request and criteria are NA 'not applicable'.*

In accordance with the consent, noise generated by WCM is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.

It has been assumed that in accordance with this requirement, noise limits apply under all conditions except during:

- rain;
- wind speeds (at 10m above ground) greater than 3 m/s; and/or
- atmospheric stability class G.

2.5 EPL Criteria and Weather Conditions

Criteria detailed in Table 2.2 have been selected as the most appropriate for each monitoring location and are based on the EPL associated with WCM.

Table 2.2: WCM SPECIFIC CRITERIA

Location	Day $L_{Aeq,15minute}$ dB	Evening and Night $L_{Aeq,15minute}$ dB	Night $L_{A1,1minute}$ dB
N01[1]	NA	NA	NA
N03[1]	NA	NA	NA
N16[2]	35	40	50
N20A[2]	35	40	50
N21[2]	35	40	50
N26[2]	35	40	50

Notes:

1. *N01 and N03 are acquisition upon request and criteria are NA 'not applicable'; and*
2. *Criteria from the EPL.*

In accordance with Condition L4.5 of the EPL, noise limits identified in Table 2.2 apply under the following meteorological conditions:

- wind speeds of up to 3m/s at 10 metres above the ground level; or
- temperature inversion conditions of up to 3°C/100m and wind speeds of up to 2m/s at 10 metres above the ground.

2.6 WCRS Development Consent

The WCRS Development Application (DA) for the Wambo Rail Loop (DA 177-8-2004), was last modified in February 2012 to include a rail refuelling facility.

The Wambo Coal Noise Management Plan (WA-ENV-MNP-503, January 2018) was prepared in accordance with Schedule 4. The NMP indicates that monitoring will be conducted for WCRS activities, and the noise levels to be used for assessment. The relevant section of the consent is reproduced in Appendix A.

Monitoring for noise from rail activities is undertaken at properties numbered N01, N03 and N21 for rail pass-by noise.

It should be noted that properties at N01 and N03 are subject to acquisition upon request, as detailed in Schedule 4, Condition 1 of DA 305-7-2003. As such, there are no operational noise targets that apply directly to these properties.

2.7 Modifying Factors

The EPA 'Noise Policy for Industry' (NPfI, 2017) was approved for use in NSW in October 2017, and supersedes the EPA's Industrial Noise Policy (INP, 2000). Assessment and reporting of modifying factors is to be carried out in accordance with Fact Sheet C of the NPfI.

NPfI modifying factors, as they are applicable to mining noise, are described in more detail below.

2.7.1 Tonality and Intermittent Noise

As defined in the NPfI:

> *Tonal noise contains a prominent frequency and is characterised by a definite pitch.*
>
> *Intermittent noise is noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB(A); for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.*

2.7.2 Low-Frequency Noise

As defined in the NPfI:

> *Low frequency noise is noise with an unbalanced spectrum and containing major components within the low-frequency range (10 – 160 Hz) of the frequency spectrum.*

The NPfI contains the current method of assessing low-frequency noise, which is a 2 step process as detailed below:

> *Measure/assess source contribution 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 is 15 dB or more and:*
>
> • *where any of the 1/3 octave noise levels in Table C2 are exceeded by **up to and including** 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 and associated notes from the NPfI is reproduced below:

Table C2: One-third octave low-frequency noise thresholds.

Hz/dB(Z)	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (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

Notes:

- dB(Z) = decibel (Z frequency weighted).
- For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from 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, 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 corrections only apply under the standard and/or noise-enhancing meteorological conditions.
- Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.
- 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 licence.

3 METHODOLOGY

3.1 Overview

All noise monitoring was conducted at the nearest residences in accordance with the NPfI, Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise' and, the WCM NMP.

3.2 Attended Noise Monitoring

Attended noise monitoring was conducted at all locations during the night period. The duration of all measurements 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 WCM.

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 NPfI (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 NPfI 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 is the highest noise level emitted from the WCM noise source during the entire measurement period (i.e. the highest level of the worst minute during the 15 minute measurement).

3.3 Meteorological Data

Meteorological data was obtained from the WCM meteorological station; this was logged at 10-minute intervals. Atmospheric parameters include wind speed, wind direction, rainfall and sigma theta. This data allowed correlation of atmospheric parameters and measured noise levels.

When meteorological data is provided in less than 15 minute intervals, an analysis must be conducted to determine the meteorological conditions present for the majority of each measurement period and whether those conditions result in noise criteria being applicable or not.

3.4 Modifying Factors

Years of monitoring have indicated that noise levels from mining operations, particularly those measured at significant distances from the source are relatively continuous and broad spectrum. Given this, noise levels from WCM at the monitoring locations are unlikely to be intermittent or tonal.

Assessment of low-frequency modifying factors is necessary when application of the maximum correction could potentially result in an exceedance of the relevant site-only L_{Aeq} criterion. Low-frequency analysis is therefore undertaken for measurements in this report where:

- meteorological conditions resulted in criteria being applicable;
- contributions from WCM were audible and directly measurable, such that the site-only L_{Aeq} was not “NM” or less than a maximum cut off value (e.g. “<20 dB” or “<30dB”);
- contributions from WCM were within 5 dB of the relevant L_{Aeq} criterion, as 5 dB is the maximum penalty that can be applied by low-frequency modifying factors; and
- WCM was the only low-frequency noise source.

All measurements meeting these conditions were evaluated for possible low-frequency penalty applicability in accordance with the NPfI.

3.5 Attended Noise Monitoring Equipment

Equipment used to measure environmental noise levels are listed in Table 3.1. Calibration certificates are provided in Appendix B.

Table 3.1: ATTENDED NOISE MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
Rion NA-28 sound level analyser	370304	26/11/2020
Rion NA-28 sound level analyser	701424	14/06/2021
Rion NA-28 sound level analyser	30131882	05/02/2021
Pulsar 106 acoustic calibrator	81334	05/03/2020
Pulsar 106 acoustic calibrator	74813	21/02/2021
Pulsar 105 acoustic calibrator	78226	01/02/2021

4 RESULTS

4.1 Plant Locations

During monitoring undertaken on 5/6 August 2019 between 22:00 and 02:00, equipment in operation was as follows:

- LD393 working on stockpile with 3x trucks feeding the washery
- Ex211 MP-30-WRCO Deckloading out from the west back to the east, all waste RL70 down at start of shift, first bucket 12:24am, early last bucket for fuelling
- Ex212 MP-28-WMAO Conventionally benching Wambo waste back to the east leaving a 5m buffer, raising floor where needed managing overheight, all waste RL70, early last bucket prep
- Ex213 MP-28-WMAO Double Benching into the western ramp Wambo A waste, all waste RL70, early last bucket walk to floor for service
- Ex214 ME-S2-WMAO Double Benching Wambo A waste, leaving catch bench and a wedge on the western side, blocky dig (un shot areas) all waste RL130, had two of the small 789 OB trucks on its cycle, total wait on trucks: 50, late back for crib nop pit licence for the operators, early last bucket walk off bench
- Ex217 HD-03-WRAO Conventional pass Rider A waste, dozer pushing out the coal as it was uncovered, all waste RL130, long bench causing relocates, early last bucket walk off the bench. Operated in swing shift OT, all waste RL130
- Ex218 HS-01-WRAO Conventional bench and double benching Rider A waste though to the west, dozer flat topping shot, tight narrow dig area, all waste INPIT dump, NOISE AFFECTED.30
- Ex219 HD-03-WRAO Conventionally benching Rider A waste towards the south, dig prep clean up . 40, all waste RL130, early last bucket walk off bench, and
- LD393 working on SBU stockpile with 3x trucks feeding the washery, NOISE AFFECTED. 30, started walking to ROM at 12:15, 12:37 first bucket on rom, low ash, Operated in swing shift OT on rom feeding low ash to the washery

4.2 Total Measured Noise Levels

Noise levels measured at each location during attended 15 minute 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 – AUGUST 2019[1]

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	L_{Ceq} dB
N01	05/08/2019 23:18	49	41	34	31	32	29	26	56
N03	06/08/2019 00:44	57	50	43	37	41	35	33	59
N16	06/08/2019 00:08	43	40	37	33	34	31	26	54
N20A	05/08/2019 22:55	43	31	25	22	23	20	18	53
N21	05/08/2019 22:20	47	41	39	37	37	35	32	59
N21[2]	05/08/2019 22:46	46	38	35	31	32	29	27	56
N26	05/08/2019 23:31	39	27	25	22	23	20	18	53

Notes:

1. *Levels in this table are not necessarily the result of activity at WCM or WCRS; and*
2. *Re-measure.*

4.3 Modifying Factors

Measured WCM only levels were assessed for the applicability of modifying factors in accordance with the EPA's NPfI.

There were no intermittent or tonal noise sources, as defined in the NPfI, audible from site during the survey. One of the measurements in this survey satisfied the conditions outlined in Section 3.4 and were assessed for low-frequency modifying factors in Table 4.2.

Table 4.2: LOW-FREQUENCY MODIFYING FACTOR ASSESSMENT – AUGUST 2019

Location	Start Date and Time	Measured WCM Only L_{Aeq} dB	Measured WCM Only L_{Ceq} dB	WCM Only $L_{Ceq} - L_{Aeq}$ dB[1]	Max exceedance of ref spectrum Result[2]	Penalty dB[2]
N21	05/08/2019 22:20	37	54	17	2.7 dB @ 50 Hz	2

Notes:

1. *As per NPfI, if $L_{Ceq} - L_{Aeq} \geq 15$ dB further assessment of low- frequency noise required as detailed in Section Table 4.2 of this report; and*
2. *As per NPfI, compare measured spectrum against reference spectrum to determine if the low-frequency modifying factor is triggered and application of penalty is required.*

4.4 Project Approval & Weather Conditions

Noise levels generated by activity at WCM are shown in Table 4.3 and Table 4.4, where comparison of measured $L_{Aeq,15minute}$ and $L_{A1,1minute}$ levels for WCM is made with relevant noise criteria. Criteria are then applied if weather conditions are in accordance with the mine's approval and modifying factors are applied, if applicable.

Table 4.3: $L_{Aeq,15minute}$ GENERATED BY WCM AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – AUGUST 2019

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m[1]	Stability Class[1]	PA Criterion $L_{Aeq,15min}$ dB[2]	Criterion Applies? [3]	Measured WCM $L_{Aeq,15min}$ dB [4,5]	Exceedance[6]
N01	05/08/2019 23:18	0.2	3.0	F	NA	NA	IA	NA
N03	06/08/2019 00:44	0.6	3.0	F	NA	NA	38	NA
N16	06/08/2019 00:08	0.6	3.0	F	40	Yes	34	Nil
N20A	05/08/2019 22:55	1.0	-1.0	D	40	Yes	<25	Nil
N21	05/08/2019 22:20	0.6	3.0	F	40	Yes	39	Nil
N21[7]	05/08/2019 22:46	0.5	0.5	E	40	Yes	32	Nil
N26	05/08/2019 23:31	0.1	3.0	F	40	Yes	23	Nil

Notes:

1. *Vertical temperature gradient (VTG) and stability class calculated using sigma theta values according to NPfI procedures;*
2. *NA indicates that criterion is not applicable, as this location is within the Zone of Affectation;*
3. *The noise emission limits identified in the above table do not apply during rain and/or wind speeds (at 10m above ground) greater than 3 m/s and/or atmospheric stability class G. Criterion may or may not apply due to rounding of meteorological data values;*
4. *Estimated or measured $L_{Aeq,15minute}$ attributed to WCM. NM denotes WCM audible but not measurable, IA denotes inaudible;*
5. *Bold and red text indicate an exceedance of relevant criterion;*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
7. *Re-measure.*

Table 4.4: $L_{A1,1minute}$ GENERATED BY WCM AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – AUGUST 2019

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m[1]	Stability Class	PA Criterion $L_{A1,1min}$ dB [2]	Criterion Applies? [3]	WCM $L_{A1,1min}$ dB [4,5]	Exceedance[6]
N01	05/08/2019 23:18	0.2	3.0	F	NA	NA	IA	NA
N03	06/08/2019 00:44	0.6	3.0	F	NA	NA	49	NA
N16	06/08/2019 00:08	0.6	3.0	F	50	Yes	41	Nil
N20A	05/08/2019 22:55	1.0	-1.0	D	50	Yes	<25	Nil
N21	05/08/2019 22:20	0.6	3.0	F	50	Yes	47	Nil
N21[7]	05/08/2019 22:46	0.5	0.5	E	50	Yes	38	Nil
N26	05/08/2019 23:31	0.1	3.0	F	50	Yes	27	Nil

Notes:

1. *Vertical temperature gradient (VTG) and stability class calculated using sigma theta values according to NPfI procedures;*
2. *NA indicates that criterion is not applicable, as this location is within the Zone of Affectation;*
3. *The noise emission limits identified in the above table do not apply during rain and/or wind speeds (at 10m above ground) greater than 3 m/s and/or atmospheric stability class G. Criterion may or may not apply due to rounding of meteorological data values;*
4. *Estimated or measured $L_{A1,1minute}$ attributed to WCM. NM denotes WCM audible but not measurable, IA denotes inaudible;*
5. *Bold and red text indicate an exceedance of relevant criterion;*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable, or, there is no applicable criterion; and*
7. *Re-measure.*

4.5 EPL and Weather Conditions

Noise levels generated by activity at WCM are shown in Table 4.5 and Table 4.6, where comparison of measured $L_{Aeq,15minute}$ and $L_{A1,1minute}$ levels for WCM is made with relevant noise criteria. Criteria are then applied if weather conditions are in accordance with the mines EPL and modifying factors are applied, if applicable.

Table 4.5: $L_{Aeq,15minute}$ GENERATED BY WCM AGAINST EPL ASSESSMENT CRITERIA – AUGUST 2019

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m[1]	EPL Criterion $L_{Aeq,15min}$ dB [2]	Criterion Applies? [3]	Measured WCM $L_{Aeq,15min}$ dB [4,5]	Exceedance[6]
N01	05/08/2019 23:18	0.2	3.0	NA	NA	IA	NA
N03	06/08/2019 00:44	0.6	3.0	NA	NA	38	NA
N16	06/08/2019 00:08	0.6	3.0	40	No	34	NA
N20A	05/08/2019 22:55	1.0	-1.0	40	Yes	<25	Nil
N21	05/08/2019 22:20	0.6	3.0	40	No	39	NA
N21[7]	05/08/2019 22:46	0.5	0.5	40	Yes	32	Nil
N26	05/08/2019 23:31	0.1	3.0	40	No	23	NA

Notes:

1. *Vertical temperature gradient (VTG) calculated using sigma theta values according to NPfI procedures;*
2. *NA indicates that criterion is not applicable, as this location is within the Zone of Affectation;*
3. *Noise emission limits identified in the above table apply under meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level, or temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level. Criterion may or may not apply due to rounding of meteorological data values;*
4. *Estimated or measured $L_{Aeq,15minute}$ attributed to WCM. NM denotes WCM audible but not measurable, IA denotes inaudible;*
5. *Bold and red text indicate an exceedance of relevant criterion;*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in EPL and so criterion is not applicable, or, there is no applicable criterion; and*
7. *Re-measure.*

Table 4.6: $L_{A1,1minute}$ GENERATED BY WCM AGAINST EPL ASSESSMENT CRITERIA – AUGUST 2019

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m[1]	EPL Criterion $L_{A1,1min}$ dB [2]	Criterion Applies? [3]	WCM $L_{A1,1min}$ dB [4,5]	Exceedance[6]
N01	05/08/2019 23:18	0.2	3.0	NA	NA	IA	NA
N03	06/08/2019 00:44	0.6	3.0	NA	NA	49	NA
N16	06/08/2019 00:08	0.6	3.0	50	No	41	NA
N20A	05/08/2019 22:55	1.0	-1.0	50	Yes	<25	Nil
N21	05/08/2019 22:20	0.6	3.0	50	No	47	NA
N21[7]	05/08/2019 22:46	0.5	0.5	50	Yes	38	Nil
N26	05/08/2019 23:31	0.1	3.0	50	No	27	NA

Notes:

1. *Vertical temperature gradient (VTG) calculated using sigma theta values according to NPfI procedures;*
2. *NA indicates that criterion is not applicable, as this location is within the Zone of Affectation;*
3. *The noise emission limits identified in the above table apply under meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level; or temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level. Criterion may or may not apply due to rounding of meteorological data values;*
4. *Estimated or measured $L_{A1,1minute}$ attributed to WCM. NM denotes WCM audible but not measurable, IA denotes inaudible;*
5. *Bold and red text indicate an exceedance of relevant criterion;*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in EPL and so criterion is not applicable, or, there is no applicable criterion and*
7. *Re-measure.*

4.6 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.7. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain or hail.

Table 4.7: MEASURED ATMOSPHERIC CONDITIONS – AUGUST 2019

Location	Start Date and Time	Temperature degrees	Wind Speed m/s	Wind Direction Magnetic North[1]	Cloud Cover eighths
N01	05/08/2019 23:18	4	0.0	-	0
N03	06/08/2019 00:44	4	0.0	-	0
N16	06/08/2019 00:08	8	0.0	-	0
N20A	05/08/2019 22:55	6	0.0	-	0
N21	05/08/2019 22:20	6	0.0	-	0
N21[2]	05/08/2019 22:46	7	0.0	-	0
N26	05/08/2019 23:31	6	0.0	-	0

Notes:

1. *'-' indicates calm conditions; and*
2. *Re-measure.*

Data obtained from the WCM meteorological station and used for compliance assessment is provided in Appendix C.

5 DISCUSSION

5.1 Noted Noise Sources

Section 4 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 contribution of WCM, if any, to measured levels. At each receptor location, the $L_{Aeq,15minute}$ and $L_{A1,1minute}$ (night-time only) for the WCM (in the absence of any other noise) was, where possible, measured directly, or, determined by frequency analysis. These levels are summarised in Table 4.3 and Table 4.4. Time variations of noise sources in each measurement, their temporal characteristics, are taken into account via statistical descriptors.

From these observations summaries have been derived for each location. The following chapter sections provide these summaries. Statistical 1/3 octave band analysis of environmental noise was undertaken, and Figure 3 to Figure 8 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, graphically, 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 than 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.

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

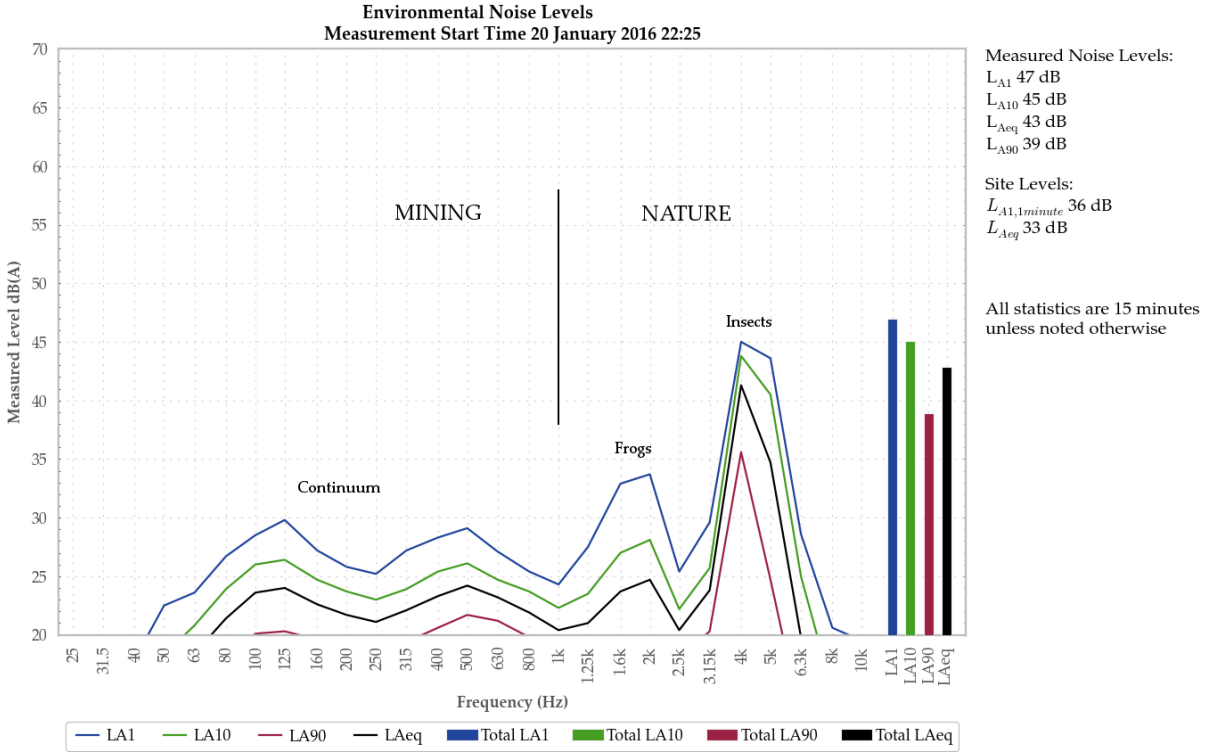

Figure 2: Sample graph (see Section 5.1 for explanatory note)

5.1.1 N01 – 5 August 2019

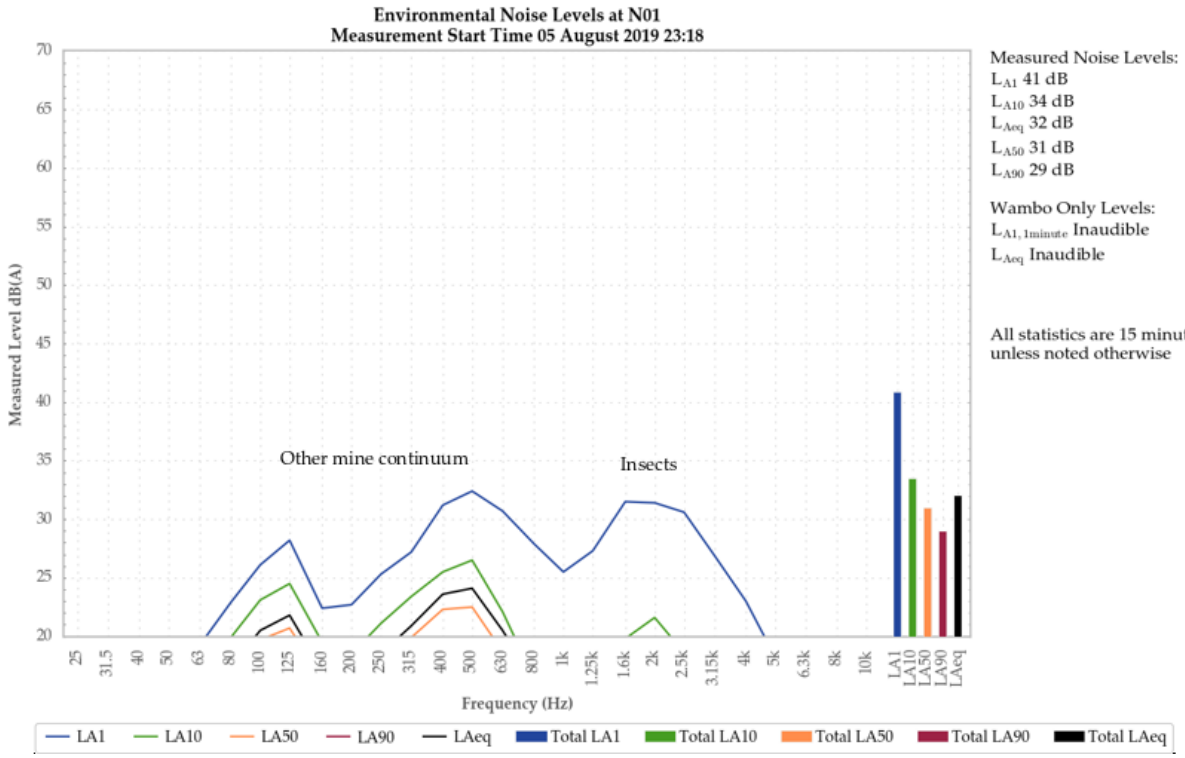

Figure 3: Environmental Noise Levels, N01 – Wambo Road

WCM was inaudible.

Mining noise from multiple mines primarily generated the measured levels. Insects contributed to the measured L_{A1} and L_{A10}.

Road traffic was also noted.

5.1.2 N03 – 6 August 2019

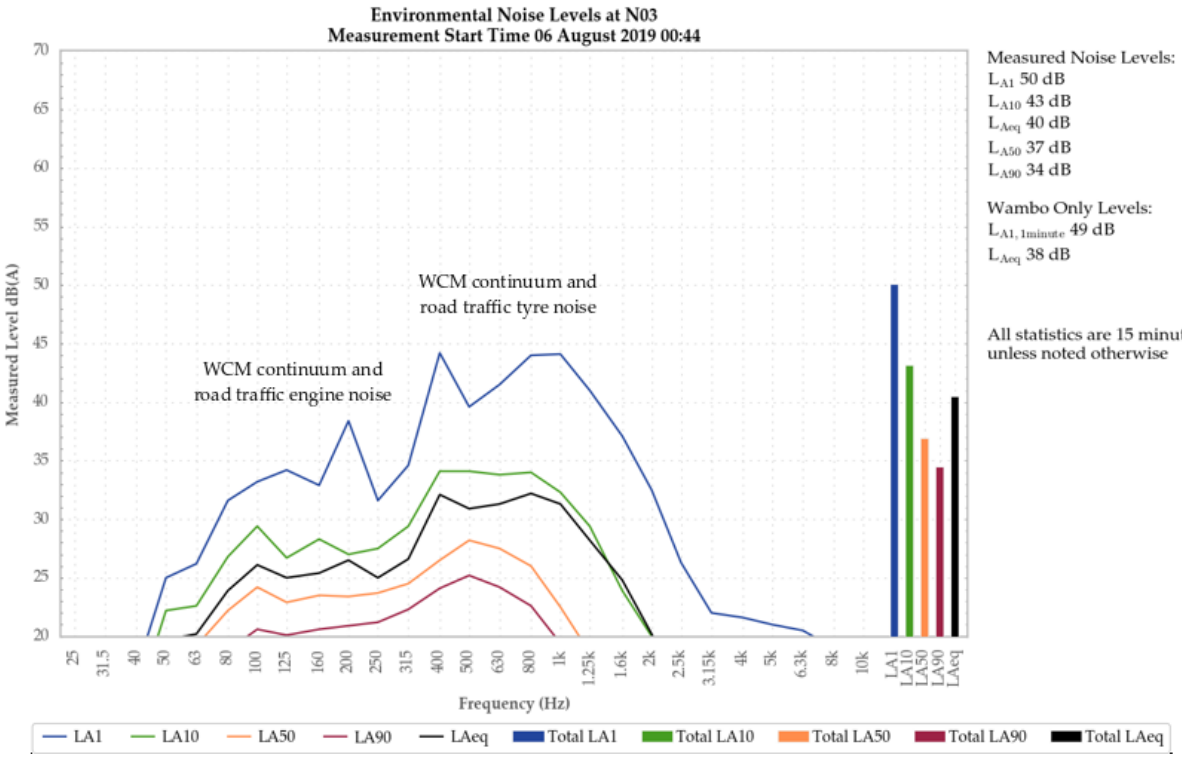

Figure 4: Environmental Noise Levels, N03 - Kelly

WCM was audible throughout the measurement, general mine continuum generated the site-only $L_{Aeq,15minute}$ of 38 dB. Surge in continuum generated the site-only $L_{A1,1minute}$ of 49 dB. Dozer engine and track noise were also noted.

WCM continuum primarily generated the measured levels. Road traffic noise contributed to the measured L_{A1}, L_{A10} and L_{Aeq}.

5.1.3 N16 – 6 August 2019

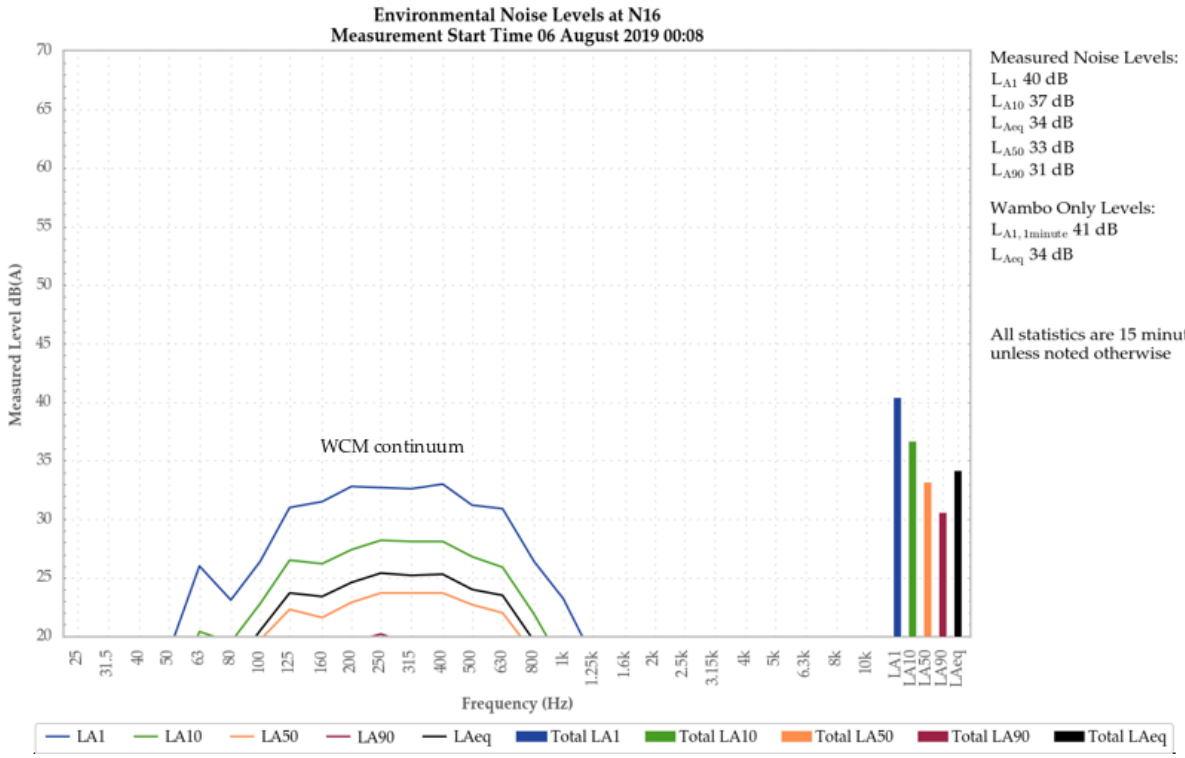

Figure 5: Environmental Noise Levels, N16 – Jerrys Plains Road

WCM was audible throughout the measurement as general mine continuum, generating the site-only $L_{Aeq,15minute}$ of 34 dB. Surge in continuum generated the site-only $L_{A1,1minute}$ of 41 dB. Dozer track noise was also noted.

WCM generated all measured levels.

5.1.4 N20A – 5 August 2019

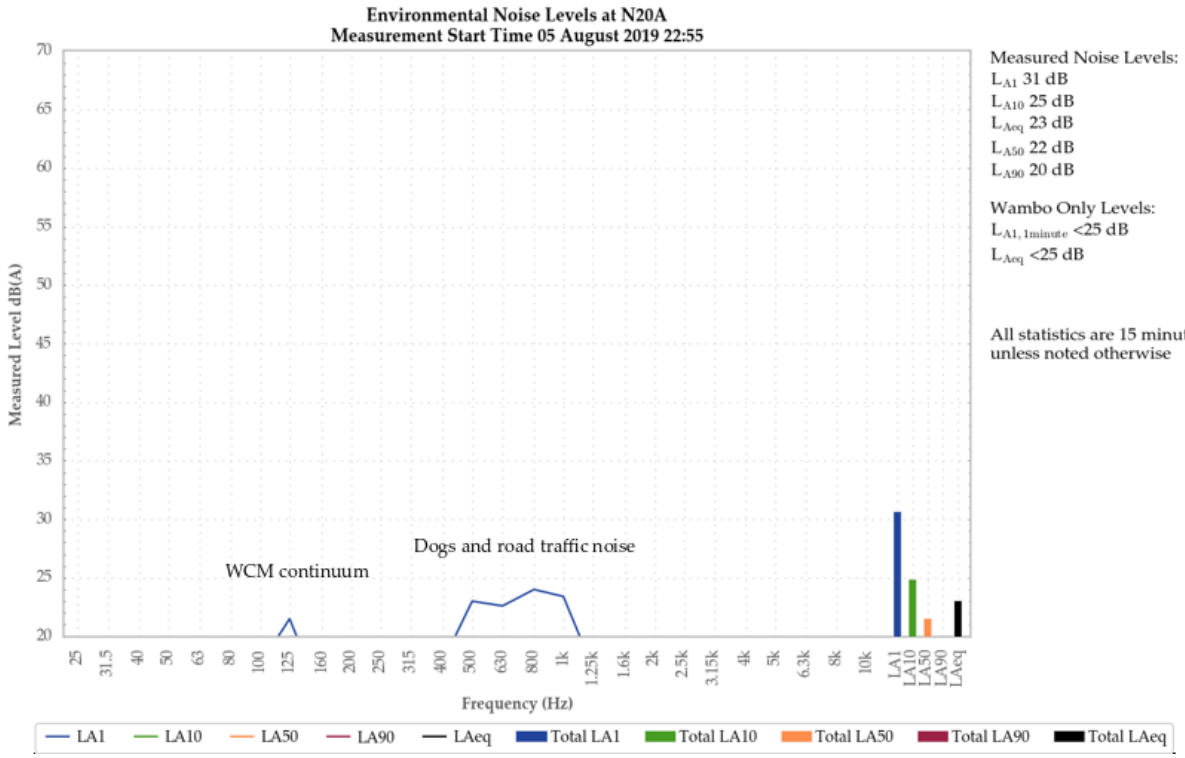

Figure 6: Environmental Noise Levels, N20A – Redmanvale Road Central

WCM was audible at low levels throughout the measurement as a general mine continuum, generating the site-only $L_{Aeq,15minute}$ and $L_{A1,1minute}$ of less than 25 dB

Dogs and road traffic noise primarily generated the measured L_{A1}. WCM was primarily responsible for the other measured levels.

5.1.5 N21 – 5 August 2019

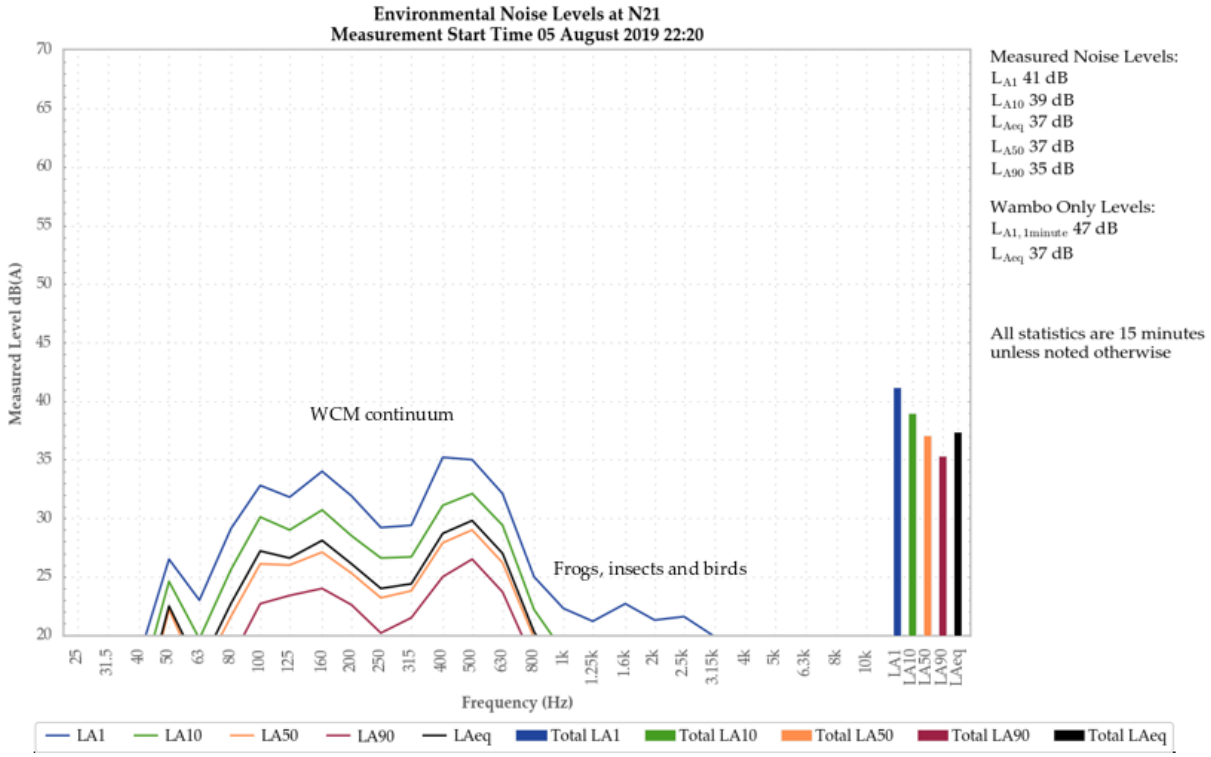

Figure 7: Environmental Noise Levels, N21 – Wambo South

WCM was audible throughout the measurement as a general mine continuum, generating a site-only $L_{Aeq,15minute}$ of 37 dB. Impact noise from loading generated the site-only $L_{A1,1minute}$ of 47 dB. A 2 dB low frequency modifying factor penalty was applicable to this measurement in accordance with the NPfI, resulting in a site-only $L_{Aeq,15minute}$ of 39 dB.

WCM mine generated all measured levels.

Frogs, insects and birds were also noted.

5.1.6 N21 – 5 August 2019 (Re-measure)

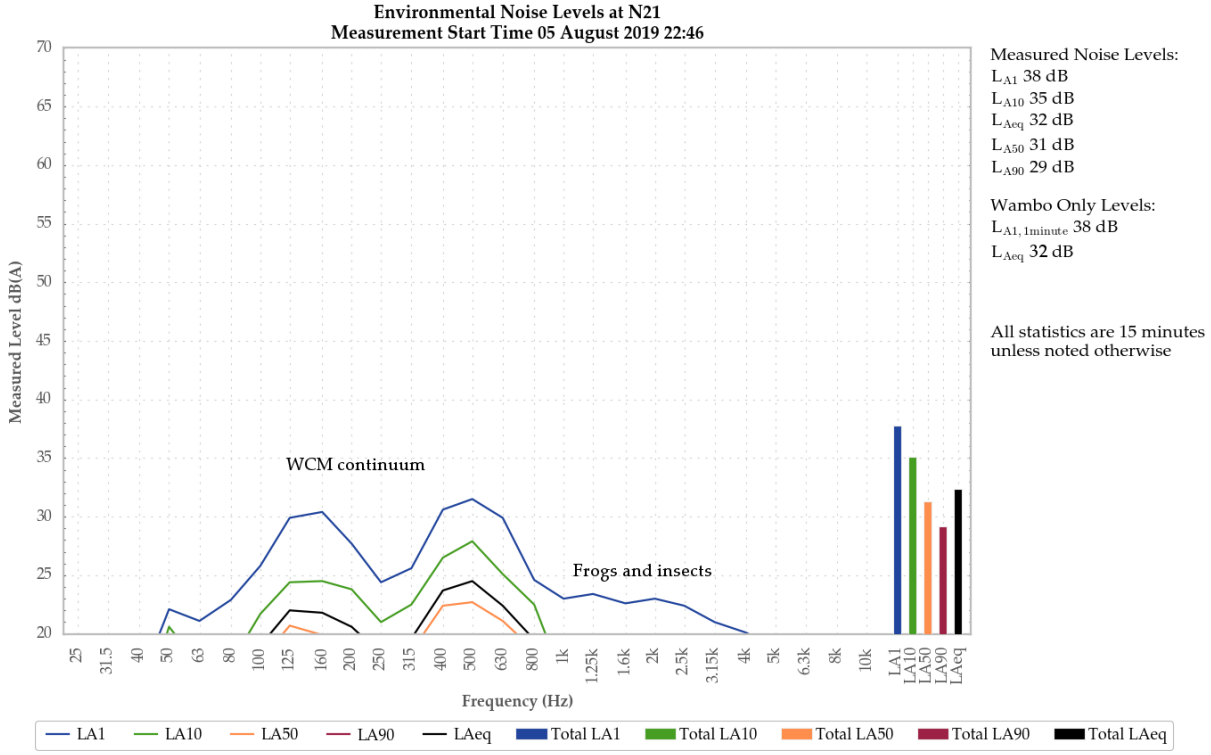

Figure 8: Environmental Noise Levels, N26 – Redmanvale Road South

WCM was audible throughout the measurement as a general mine continuum, generating a site-only $L_{Aeq,15minute}$ of 32 dB. Surge in continuum generated the site-only $L_{A1,1minute}$ of 38 dB.

WCM mine primarily generated all measured levels. Frogs and insects were a minor contributor to the measured L_{A1}.

5.1.7 N216– 5 August 2019

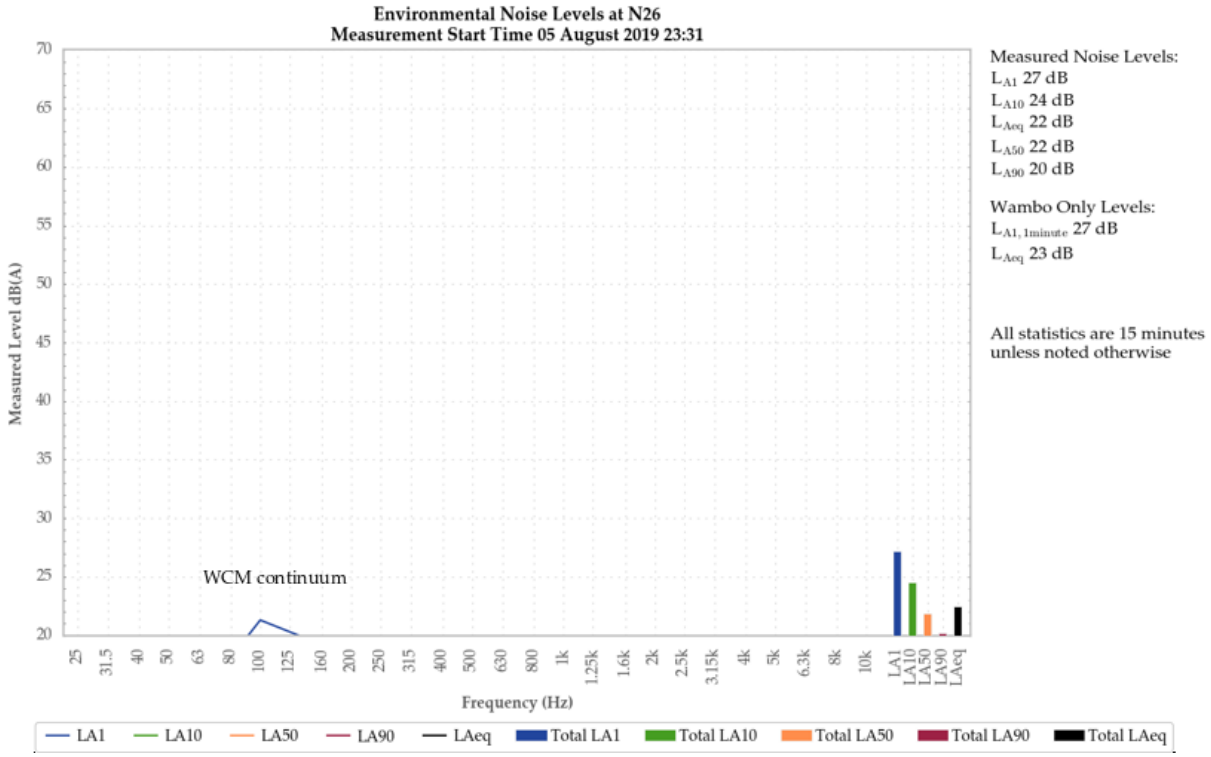

Figure 9: Environmental Noise Levels, N26 – Redmanvale Road South

WCM was audible throughout the measurement as a general mine continuum, generating a site-only $L_{Aeq,15minute}$ of 23 dB. Surge in continuum generated the site-only $L_{A1,1minute}$ of 27 dB.

WCM generated all measured levels.

Dogs were also noted.

6 SUMMARY

Global Acoustics was engaged by Wambo Coal (WC) to conduct a noise survey around the Wambo Coal Mine (WCM), and the Wambo Coal Rail Spur (WCRS).

A noise survey around both the WCM and the WCRS is required monthly as a condition of their current development consents (relevant extracts from both are provided in the following report sections). Environmental noise monitoring described in this report was undertaken during the night of 5/6 August 2019.

Noise levels from WCM complied with the $L_{Aeq,15minute}$ and $L_{A1,1minute}$ criteria during attended noise monitoring for August 2019 at all monitoring locations. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

APPENDIX

A DEVELOPMENT CONSENT & EPL

A.1 WAMBO COAL MINE DEVELOPMENT CONSENT

A.1.1 Relevant Wambo Coal Mine Development Consent Conditions

The relevant sections of the December 2017 modified conditions are reproduced below:

SCHEDULE 4
SPECIFIC ENVIRONMENTAL CONDITIONS

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Applicant must acquire the land in accordance with the procedures in conditions 9-11 of schedule 5:

Table 1: Land subject to acquisition upon request

2 – Lambkin	23A & B - Kannar
13C - Skinner	31A,B,C & D - Fisher
19A & B – Kelly	51 – Hawkes
22 – Henderson	56 - Haynes

Note: For more information on the numbering and identification of properties used in this consent, see Attachment 1 of the EIS for the Wambo Development Project. Lands titled 23A & B – Kannar, 31A,B,C & D – Fisher, 51 – Hawkes and 56 – Haynes have been acquired and are now mine-owned.

[1]NOISE

Noise Impact Assessment Criteria

6. The Applicant must ensure that the noise generated by the Wambo Mining Complex does not exceed the noise impact assessment criteria presented in Table 9.

Table 9: Noise impact assessment criteria dB(A))

Day $L_{Aeq(15\ minute)}$	***Evening/Night*** $L_{Aeq(15\ minute)}$	***Night*** $L_{A1(1\ minute)}$	***Land Number***
35	*41*	*50*	*94 – Curlewis*
			3 – Birrell

[1] Incorporates EPA GTAs

Day $L_{Aeq(15\ minute)}$	Evening/Night $L_{Aeq(15\ minute)}$	Night $L_{A1(1\ minute)}$	Land Number
35	40	50	4B – Circosta
			15B - McGowen/Caslick
			16 – Cooper
			23C – Kannar
			25 – Fenwick
			28A & B – Garland
			33 -Thelander/O'Neill
			39 – Northcote
			40 – Muller
			254A – Algie
35	39	50	5 – Strachan
			6 - Merrick
			7 - Maizey
			37 - Lawry
			48 - Ponder
35	38	50	1 - Brosi
			17 - Carter
			18 - Denney
			38 - Williams
			49 - Oliver
			63 - Abrocuff
			75 - Barnes
			91 - Bailey
35	37	50	27 - Birralee
			43 - Carmody
			137 - Woodruff
			163 - Rodger/Williams
			246 - Bailey
35	36	50	13B - Skinner
			178 - Smith
			188 - Fuller
			262A, B & C - Moses
35	35	50	All other residential or sensitive receptors, excluding the receptors listed in condition 1 above

Notes:

- *Noise generated by the Wambo Mining Complex is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy*

Land Acquisition Criteria

7. If the noise generated by the Wambo Mining Complex exceeds the criteria in Table 10, the Applicant must, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 9-11 of schedule 5.

Table 10: Land acquisition criteria dB(A)

Day/Evening/Night $L_{Aeq(15\ minute)}$	***Property***
43	*94 - Curlewis*
	23C – Kannar
	254A - Algie
40	*All other residential or sensitive receptor, excluding the receptors listed in condition 1 above*

Note: Noise generated by the Wambo Mining Complex is to be measured in accordance with the notes presented below Table 9 above. Property 23C – Kannar has been acquired and is now mine-owned.

Operating Conditions

8. The Applicant must:
   (a) implement best management practice to minimise the operational, low frequency and traffic noise of the Wambo Mining Complex;
   (b) operate a comprehensive noise management system for the Wambo Mining Complex that uses a combination of predictive meteorological forecasting and real-time noise monitoring data to guide the day to day planning of mining operations and the implementation of both proactive and reactive noise mitigation measures to ensure compliance with the relevant conditions of this consent;
   (c) maintain the effectiveness of noise suppression equipment (if fitted) on plant at all times and ensure defective plant is not used operationally until fully repaired;
   (d) ensure that noise attenuated plant (if used) is deployed preferentially in locations relevant to sensitive receivers;
   (e) minimise the noise impacts of the Wambo Mining Complex during meteorological conditions when the noise limits in this consent do not apply;
   (f) co-ordinate the noise management for the Wambo Mining Complex with the noise management at nearby mines (including HVO South, HVO North and Mt Thorley Warkworth mines) to minimise the cumulative noise impacts of these mines and the Wambo Mining Complex,

   to the satisfaction of the Secretary.

Noise Management Plan

9. The Applicant must prepare a Noise Management Plan for the Wambo Mining Complex to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA, and submitted to the Secretary for approval by the end of June 2013;
   (b) describe the measures that would be implemented to ensure:
      - best management practice is being employed;
      - the noise impacts of the Wambo Mining Complex are minimised during meteorological conditions when the noise limits in this consent do not apply; and
      - compliance with the relevant conditions of this consent;
   (c) describe the proposed noise management system in detail;
   (d) include a monitoring program that:
      - uses a combination of real-time and supplementary attended monitoring measures to evaluate the performance of the Wambo Mining Complex;
      - adequately supports the proactive and reactive noise management system for the Wambo Mining Complex;
      - includes a protocol for determining exceedances of the relevant conditions in this consent;
      - evaluates and reports on the effectiveness of the noise management system for the Wambo Mining Complex;
      - provides for the annual validation of the noise model for the Wambo Mining Complex; and
   (e) include a protocol that has been prepared in consultation with the owners of nearby mines (including HVO South, HVO North and Mount Thorley Warkworth mines) to minimise the cumulative noise impacts of these mines and the Wambo Mining Complex.

   The Applicant must implement the approved management plan as approved from time to time by the Secretary.

A.2 WAMBO RAIL SPUR DEVELOPMENT CONSENT

The relevant sections of the February 2012 modified conditions for the rail spur are reproduced below:

SCHEDULE 4
GENERAL ENVIRONMENTAL CONDITIONS

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 1-3 of schedule 5.

Table 1: Land subject to acquisition upon request

19 - L Kelly	55 - E & C Burley

Note: For more information on the numbering and identification of properties used in this consent, see Attachment 1A and Attachment 1B of the SEE for the Alterations to the Wambo Development Project – Rail and Train Loading Infrastructure.

2. While the land listed in Table 1 is privately owned, the Applicant shall implement all practicable measures to ensure that the impacts of the development comply with the predictions in the SEE, and the relevant conditions in this consent, at any residence on this land, to the satisfaction of the Director-General.

[1]NOISE

Noise Impact Assessment Criteria

3. The Applicant shall ensure that noise generated by the development, combined with noise generated by any development in the Wambo Mining Complex, does not exceed the noise criteria provided in Table 2, unless higher noise criteria are specified in the consent for the Wambo Coal Mine (DA 305-7-2003).

Table 2: Noise impact assessment criteria dB(A)

Day $L_{Aeq(15\ minute)}$	Evening/Night $L_{Aeq(15\ minute)}$	Night $L_{A1(1\ minute)}$	Land Number
35	35	50	All private residential or sensitive receptors, excluding the receptors listed in Table 1

Notes:
- *Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

Construction Hours

4. The Applicant shall ensure that all construction work is carried out from 7 am to 6 pm Monday to Saturday (inclusive) and 8 am to 6 pm Sundays and Public Holidays.

Operating Hours

5. The Applicant shall:
   (a) take all practicable measures to minimise train movements at the development on Friday evening (6 pm-9 pm) and Sunday morning (9 am-12 am);
   (b) report on the implementation and effectiveness of these measures,
   to the satisfaction of the Director-General.

Rail Noise

6. The Applicant shall seek to ensure that its rail spur is only accessed by locomotives that are approved to operate on the NSW rail network in accordance with noise limits L6.1 to L6.4 in RailCorp's EPL (No. 12208) and ARTC's EPL (No. 3142) or a Pollution Control Approval issued under the former *Pollution Control Act 1970*.

Noise Monitoring

7. The Applicant shall monitor the noise generated by the development, and noise generated by the Wambo Mine, in general accordance with the Noise Management Plan for the Wambo Mining Complex and the *NSW Industrial Noise Policy*.

7A. By 31 May 2012, the Applicant shall review and update the Noise Management Plan for the Wambo Mining Complex, including a noise monitoring protocol for evaluating compliance with the criteria in condition 3 above.

7B. During the first 12 months of operation of the Rail Refuelling Facility, the Applicant must conduct attended noise monitoring at the nearest private receptor during refuelling events, no less often than every three months.

A.3 WAMBO RAIL LINE DEVELOPMENT CONSENT

The relevant sections of the 1998 conditions for the rail line are reproduced below:

Operational Noise

8. The Applicant shall ensure noise emissions from the operations of the railway line when measured at any residence along the railway line corridor shall not exceed the following EPA criteria:

   (a) planning level of $L_{Aeq\ 24hr}$ 55dBA; and

   (b) maximum passby level of L_{Amax} 85dBA

   The noise criteria levels shall be measured under prevailing weather conditions in accordance with EPA requirements and to be consistent with EPA's requirements as applied to the New South Wales coal industry, or otherwise agreed to by the EPA.

9. Prior to the commencement of operations, the Applicant shall prepare in consultation with the EPA and Singleton Shire Council an Operational Noise Management Plan. The Operation Noise Management Plan shall demonstrate that all practical design and noise mitigation methods have been undertaken to achieve the noise levels specified in Condition 8.

A.4 WAMBO ENVIRONMENT PROTECTION LICENCE NUMBER 529

The relevant sections of the EPL are reproduced below:

L4.1 Noise generated at the premises must not exceed the noise limits presented in the table below. The noise limits in the table below represent the noise contribution from the premises.

Noise Limits dB(A)

Receiver Land Number	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LA1(1 minute)
94 - Curlewis	35	41	41	50
3 - Birrell 4B - Circosta 15 - McGowen/ Caslick 16 - Cooper 25 - Fenwick 28 - Garland 33 - Thelander/ O'Neill 39 - Northcote 40 - Muller 254 - Algie	35	40	40	50
5 - Strachan 6 - Merrick 7 - Maizey 37 - Lawry 48 - Ponder	35	39	39	50
1 - Brosi 17 - Carter 18 - Denney 30 - Williams 49 - Oliver 63 - Abrocuff 75 - Barnes 91 - Bailey	35	38	38	50
27 - Birralee 43 - Carmody 137 - Woodruff 163 - Rodger/ Williams 246 - Bailey	35	37	37	50
13B - Skinner 178 - Smith 188 - Fuller 262 - Moses	35	36	36	50

All other residential or sensitive receptors excluding the receptors listed above and also excluding those listed in Table 1 of Schedule 4 of the Wambo Coal Mine Development Consent (DA 305-7-2003).	35	35	35	50

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays
d) The Receiver Land Owner locations are as detailed in the Environmental Impact Statement titled "*Wambo Development Project*", Volumes 1-5 dated July 2003 and prepared by Resource Strategies Pty Ltd.

L4.3 Noise from the premises is to be measured at the most affected point or within the residential boundary or at the most affected point within 30m of the dwelling (rural situations) where the dwelling is more than 30m from the boundary to determine compliance with the LAeq(15 minute) noise limits in condition L4.1.

Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy.

The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.

L4.4 Noise from the premises is to be measured at 1m from the dwelling façade to determine compliance with the LA1(1minute) noise limit in condition L4.1.

L4.5 The noise emission limits identified in condition L4.1 apply under meteorological conditions of:

a) Wind speeds of up to 3m/s at 10 metres above the ground level; or
b) Temperature inversion conditions of up to 3°C/100m and wind speeds of up to 2m/s at 10 metres above the ground.

L4.6 In regard to condition 4.5(b) of the Licence, temperature inversion conditions must be identified using the sigma-theta method in the EPA's Noise Policy for Industry, October 2017, from data obtained from the premises weather station at EPA monitoring point 17.

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 61672-3:2013
Calibration Certificate

Calibration Number C18618

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	00370304
Microphone Serial Number :	10421
Pre-amplifier Serial Number :	60313

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	23.6°C	**Ambient Temperature :**	22.4°C
Relative Humidity :	42.6%	**Relative Humidity :**	42.4%
Barometric Pressure :	98.42kPa	**Barometric Pressure :**	98.45kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 26 Nov 2018
Secondary Check: Lewis Boorman
Report Issue Date : 29 Nov 2018
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 61672-3:2013, 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 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.12dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.18dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.51dB*	*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.

NATA
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 - calibration.

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.

PAGE 1 OF 1

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Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C19342

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thorton NSW 2322
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	00701424
Microphone Serial Number :	01916
Pre-amplifier Serial Number :	01463

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	26°C	**Ambient Temperature :**	26°C
Relative Humidity :	40.2%	**Relative Humidity :**	40.7%
Barometric Pressure :	100.96kPa	**Barometric Pressure :**	100.32kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 14 Jun 2019
Secondary Check: Eloise Burrows
Report Issue Date : 18 Jun 2019
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 61672-3:2013, 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 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.11dB*		

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 - calibration.

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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Sound Level Meter
IEC 61672-3.2013

Calibration Certificate

Calibration Number C19073

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	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 :	24.5°C	**Ambient Temperature :**	23.6°C
Relative Humidity :	54.5%	**Relative Humidity :**	51%
Barometric Pressure :	99.39kPa	**Barometric Pressure :**	99.36kPa

Calibration Technician : Charlie Neil
Calibration Date : 5 Feb 2019
Secondary Check: Lewis Boorman
Report Issue Date : 6 Feb 2019

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 61672-3:2013, 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 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013

Least Uncertainties of Measurement -

Acoustic Tests	
31.5 Hz to 8kHz	*±0.15dB*
12.5kHz	*±0.2dB*
16kHz	*±0.29dB*
Electrical Tests	
31.5 Hz to 20 kHz	*±0.11dB*

Environmental Conditions	
Temperature	*±0.2°C*
Relative Humidity	*±2.4%*
Barometric Pressure	*±0.015kPa*

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.

Accredited for compliance with ISO/IEC 17025 - calibration.

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Sound Calibrator
IEC 60942-2004

Calibration Certificate

Calibration Number C18114_Reissued

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

Equipment Tested/ Model Number : Pulsar 106
Instrument Serial Number : 81333

Atmospheric Conditions
Ambient Temperature : 22°C
Relative Humidity : 53.1%
Barometric Pressure : 99.41kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 5 Mar 2018
Secondary Check: Riley Cooper
Report Issue Date : 20 Jun 2018

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	94.2	1000.40

The sound calibrator has been shown to conform to the class 2 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*	*±0.3°C*
Short Term Fluct.	*±0.06dB*	*Relative Humidity*	*±2.5%*
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 - calibration.

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Sound Calibrator

IEC 60942-2017

Calibration Certificate

Calibration Number C19124

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

Equipment Tested/ Model Number : Pulsar Model 106
Instrument Serial Number : 74813

Atmospheric Conditions

Ambient Temperature : 24°C
Relative Humidity : 50.4%
Barometric Pressure : 99.54kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 21 Feb 2019
Secondary Check: Lewis Boorman
Report Issue Date : 22 Feb 2019

Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	94.0	1000.33

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2017 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*	*±0.2°C*
Frequency	*±0.01%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.48%*	*Barometric Pressure*	*±0.015kPa*

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 - calibration.

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Sound Calibrator
IEC 60942-2017

Calibration Certificate

Calibration Number C19074

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

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

Atmospheric Conditions
Ambient Temperature : 23.8°C
Relative Humidity : 53.7%
Barometric Pressure : 100.09kPa

Calibration Technician : Charlie Neil
Calibration Date : 1 Feb 2019
Secondary Check: Lewis Boorman
Report Issue Date : 6 Feb 2019
Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Pre Adjustment	94.0	1000.0	94.4	1000.38
Post Adjustment	94.0	1000.0	94.1	1000.39

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 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*	*±0.2°C*
Frequency	*±0.01%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.45%*	*Barometric Pressure*	*±0.015kPa*

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.

NATA

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
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APPENDIX

C METEOROLOGICAL DATA

METEOROLOGICAL DATA FROM WCM WEATHER STATION

End Date and Time	Wind Speed Average m/s	Wind Direction Average Degrees	Sigma Theta
05/08/2019 22:10	0.7	197	9.7
05/08/2019 22:20	0.8	186	7.4
05/08/2019 22:30	0.6	183	32.3
05/08/2019 22:40	0.5	219	40.1
05/08/2019 22:50	0.5	241	18.5
05/08/2019 23:00	0.5	224	12.8
05/08/2019 23:10	1.0	228	10.8
05/08/2019 23:20	0.6	207	16.8
05/08/2019 23:30	0.2	24	86.3
05/08/2019 23:40	0.1	146	90.0
05/08/2019 23:50	0.5	257	30.0
06/08/2019 00:00	0.8	277	18.8
06/08/2019 00:10	0.8	268	17.1
06/08/2019 00:20	0.6	230	26.5
06/08/2019 00:30	0.3	142	40.4
06/08/2019 00:40	0.6	201	13.9
06/08/2019 00:50	0.8	198	11.1
06/08/2019 01:00	0.6	198	34.3
06/08/2019 01:10	0.5	182	44.3
06/08/2019 01:20	0.7	186	18.9
06/08/2019 01:30	0.8	168	32.4
06/08/2019 01:40	0.3	180	70.5
06/08/2019 01:50	0.4	204	58.1
06/08/2019 02:00	0.3	239	58.5
06/08/2019 02:10	0.5	204	55.1