

Wambo Coal Mine and Rail Spur

*Environmental Noise Monitoring
November 2019*

*Prepared for
Wambo Coal Pty Limited*



Noise and Vibration Analysis and Solutions

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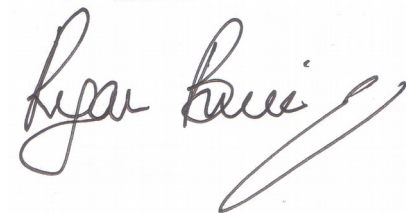
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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Wambo Coal (WC) to conduct a monthly noise survey of operations at Wambo Coal Mine (WCM) and Wambo Coal Rail Spur (WCRS). WCM and WCRS operate under separate development consents and have been monitored separately, while reporting has been combined. The purpose of the survey is to quantify and describe the existing acoustic environment around WCM and WCRS, and compare results with relevant limits.

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 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.

Attended environmental noise monitoring described in this report was undertaken during the night period of 11/12 and 14/15 November 2019 at a total of six monitoring locations for WCM and WCRS.

1.2 Monitoring Locations & Frequency

Monitoring locations, type, and frequency are detailed in Table 1.1 and shown in Figure 1. It should be noted that Figure 1 shows the actual monitoring position, not the location of residences.

Table 1.1: WAMBO COAL MONITORING LOCATIONS AND FREQUENCY¹

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

Site Reference	Residence ²	Monitor Type	Consent Requirements	Frequency
N21	<i>Wambo South</i>	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly
N26	<i>Redmanvale Road South</i>	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

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
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise.
L _{Amax}	The maximum A-weighted noise level over a time period.
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.
L _{Aeq}	The average noise A-weighted energy during a measurement period.
L _{A50}	The noise level which is exceeded for 50 per cent of the time and the median noise level during a measurement period.
L _{A90}	The level exceeded for 90 percent of the time. 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.
L _{Ceq}	The average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
SC	Stability class (or category) is determined from measured wind speed and either sigma-theta or VTG.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible 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 REGULATOR REQUIREMENTS AND NOISE CRITERIA

2.1 WCM Development Consent

The most current development consent for WCM is DA 305-7-2003 (MOD 16, 29 August 2019). Schedule 4 of the WCM consent details specific conditions relating to noise generated by WCM. Relevant sections of the WCM consent are reproduced in Appendix A.

2.2 WCRS Development Consent

The most current development consent for Wambo Rail Loop is WCRS DA 177-8-2004 (MOD 3, 29 August 2019), last modified to include a rail refuelling facility. Schedule 4 of the WCRS consent details specific conditions relating to noise generated by WCRS. Relevant sections of the WCRS consent are reproduced in Appendix A.

2.3 Environment Protection Licence

WCM holds Environment Protection Licence (EPL) No. 529 issued by the Environment Protection Authority (EPA) most recently on 19 July 2019. Relevant sections of the EPL are reproduced in Appendix A.

2.4 Noise Management Plan

Noise monitoring requirements are detailed in the *Wambo Coal Noise Management Plan WA-ENV-MNP-503* (NMP, January 2018), prepared in accordance with the WCM and WCRS consents. The NMP states that monitoring will be conducted to assess noise levels from WCM and WCRS activities. Noise monitoring for rail activities is undertaken at properties numbered N01, N03 and N21 for rail pass-by noise. Relevant sections of the NMP are reproduced in Appendix A.

2.5 Noise Criteria

Environmental noise criteria for WCM and WCRS are consistent between the WCM development consent, NMP, and EPL. Noise criteria detailed in Table 2.1 have been selected as the most appropriate for each monitoring location and are based on the WCM development consent.

Table 2.1: WCM SPECIFIC CRITERIA

Location	Day L _{Aeq,15minute} dB	Evening/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 noise criteria are NA 'not applicable'.

2.6 Meteorological Conditions

In accordance with the WCM consent, noise generated by WCM is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions) of the EPA's 'Industrial Noise Policy' (INP, 2000). In accordance with this requirement, it has been assumed that noise limits apply under all meteorological conditions except during:

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

Condition L4.5 of the EPL uses slightly different terminology and noise limits outlined in the EPL 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 (stability class F) and wind speeds of up to 2m/s at 10 metres above the ground.*

Condition L4.6 of the EPL states that "... temperature inversion conditions must be identified using the sigma-theta method in the EPA's Noise Policy for Industry..." (NPfI, October 2017).

The sigma-theta method outlined in the NPfI allows stability class to be determined from sigma-theta and wind speed data. However, temperature inversion gradient (VTG) cannot be determined by this method.

Consequently, stability class prevailing during each measurement has been assessed against the stability class that corresponds with the EPL VTG to determine whether noise criteria were applicable.

2.7 Modifying Factors

The EPA NPfI 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

Attended environmental noise monitoring was conducted in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise', relevant NSW EPA requirements, and the NMP. Meteorological data was obtained from the WCM automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured noise levels.

3.2 Attended Noise Monitoring

During this survey, monthly attended monitoring was undertaken during the night period at each location. The duration of each measurement was 15 minutes. Atmospheric condition measurement was also undertaken at each monitoring location.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits as it allows an accurate determination of the contribution, if any, to measured noise levels by the source of interest (in this case WCM and/or WCRS).

This survey presents noise levels gathered during attended monitoring that 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 WCM/WCRS's contribution, if any, to measured levels. At each receptor location, WCM/WCRS's $L_{Aeq,15\text{minute}}$ and $L_{A1,1\text{minute}}$ (in the absence of any other noise) was measured directly, where possible, or, determined by frequency analysis.

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 descriptors in accordance with Section 7.1 of the NPfI. 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 (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, nor reasonable to employ 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 $L_{A1,1\text{minute}}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level, or $L_{A\text{max}}$, received from the site 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. 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 $L_{A\text{eq}}$ 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 $L_{A\text{eq}}$ 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 $L_{A\text{eq}}$ 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	701424	14/06/2021
Rion NA-28 sound level analyser	1070590	25/06/2020
Rion NA-28 sound level analyser	30131882	05/02/2021
Rion NA-28 sound level analyser	370304	26/11/2020
Pulsar 106 acoustic calibrator	74813	21/02/2021
Pulsar 105 acoustic calibrator	78226	01/02/2021
Pulsar 106 acoustic calibrator	79631	22/01/2021

4 RESULTS

4.1 Plant Locations

During monitoring undertaken on 11/12 and 14/15 November 2019 between 22:00 and 02:00, equipment in operation was as follows:

11/12 November 2019

- EX211: ME-04-WMAO: ½ hr wait on trucks. Shut down for noise at 01:25am until the end of shift, double benching tight dig, all trucks dumping in pit.
- EX212: ME-S2-WMAO: Walked at start of shift to a conventional bench heading back to north, all trucks dumping RL50
- EX213: HD-S2-WRAO: double benching, daylighting out on south side, all trucks dumping RL100
- EX214: Planned maintenance, not operating.
- EX217: HD-S2-WRAO: Conventional benching all trucks dumping access5 rehab dump.
- EX218: ME-S2-WMBO: double benching large blocky material all trucks dumping RL50, digger walk to new location through stand by period.
- EX219: HD-S1-WMAO: finished tail then walking forward to start drop cut, all trucks dumping RL100, digger walk to new location through stand by period
- LD393: BS Ug coal. All loads to Rom Bin

14/15 November 2019

- LD392 Sidecasting @ BS UG until 18:30. Operator Manning up Ld393 out of Workshop.
- EX211 ME/04/WMAO Double benching Wambo A waste. Freedig, very hard, tight dig, unshot insitu ground. Raking end wall as we go to ensure safe highwall. All loads to the M/E Inpit dump. On stand until Coal Crew started, due to Manning.
- EX212 ME/S2/WMAO Commenced drop in, ramping down to 4m, conventionally loading Wambo A waste, slow dig, blocky material. All loads to the RL50 dump. Pit inspection delays 16:30-17:15=0.75hrs.
- EX213 MW/S2/RCAO Commenced drop in, ramping down to 4m, opening up area, conventionally loading Redbank A waste. All loads to the RL70 and RL100 dump. ** Digger operator in Training ** Pit inspection delays 16:30-17:15=0.75hrs.
- Ex214 Down for scheduled maintenance.
- EX217 HD/S2/WRAO Conventionally loading Rider A waste. All loads to the RL130 Dump. Pit inspection delays 16:30-17:15=0.75hrs.
- EX218 HD/S1/WTAO Top side loading, digging shallow, unshot insitu partings, slow going, dig rate reduced. All loads to the RL50 dump. Pit inspection delays 16:30-17:15=0.75hrs.

- Ex219 ME/S2/WMAO Double benching Wambo A waste, large blocky material. All loads to the RL50 dump. Pit inspection delays 16:30-17:15=0.75hrs. Last bucket due to walking digger off bench for fuel.

4.2 Total Measured Noise Levels

Overall noise levels measured at each location during attended measurements are provided in Table 4.1. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.1: MEASURED NOISE LEVELS – NOVEMBER 2019¹

Location	Start Date and Time	L _{Amax} dB	L _{A1} dB	L _{A10} dB	L _{Aeq} dB	L _{A50} dB	L _{A90} dB	L _{Amin} dB	L _{Ceq} dB
N01	11/11/19 22:41	51	40	37	35	34	32	30	57
N03	12/11/19 00:54	57	51	49	47	46	44	42	66
N16	12/11/19 00:34	55	46	44	43	42	41	38	58
N16 ²	12/11/19 01:30	49	40	38	36	35	33	31	53
N16 ³	14/11/19 22:21	46	38	28	26	22	21	19	54
N20A	11/11/19 23:24	41	33	30	28	27	24	21	53
N21	11/11/19 22:16	52	40	36	34	33	31	28	54
N26	11/11/19 23:56	46	36	33	30	29	27	24	54

Notes:

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

4.3 Modifying Factors

Measured site-only levels were assessed for the applicability of modifying factors in accordance with the NPfI.

There were no intermittent or tonal noise sources, as defined in the NPfI, audible from site during the survey.

Two 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 – NOVEMBER 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 ³
N16	12/11/19 00:34	42	56	14	NA	NA
N16	12/11/19 01:30	36	50	14	NA	NA

Notes:

1. As per NPfl, if $L_{Ceq} - L_{Aeq} \geq 15$ dB further assessment of low-frequency noise required as detailed in Sections 2.7.2 and 3.4 of this report;
2. As per NPfl, compare measured spectrum against reference spectrum to determine if the low-frequency modifying factor is triggered and application of penalty is required; and
3. Bold results indicate that NPfl low-frequency modifying factor has been triggered and application of correction is required.

4.4 Attended Noise Monitoring

4.4.1 Development Consent Weather Conditions

Table 4.3 to Table 4.4 detail noise levels from WCM in the absence of other noise sources. Noise criteria are applicable if weather conditions during the measurement were within parameters outlined in the WCM development consent.

Table 4.3: $L_{Aeq,15minute}$ GENERATED BY WCM AGAINST PROJECT APPROVAL METEOROLOGICAL CONDITIONS – NOVEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion $L_{Aeq,15min}$ dB ¹	Criterion Applies? ²	WCM $L_{Aeq,15min}$ dB ^{3,4}	Exceedance ^{4,5}
N01	11/11/19 22:41	0.7	D	Nil	NA	34	NA
N03	12/11/19 00:54	0.1	F	Nil	NA	47	NA
N16	12/11/19 00:34	0.2	F	40	Yes	42	2
N16 ⁶	12/11/19 01:30	0.2	E	40	Yes	36	Nil
N16 ⁷	14/11/19 22:21	2.0	F	40	Yes	IA	Nil
N20A	11/11/19 23:24	0.5	D	40	Yes	<30	Nil
N21	11/11/19 22:16	0.7	F	40	Yes	34	Nil
N26	11/11/19 23:56	0.2	F	40	Yes	30	Nil

Notes:

1. NA indicates that criterion is not applicable, as this location is within the Zone of Affection;
2. 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;
3. Site-only $L_{Aeq,15minute}$ attributed to WCM, including modifying factors if applicable;
4. Bold results in red indicate an exceedance of relevant criterion;
5. NA in exceedance column means atmospheric conditions outside conditions specified in approval, therefore criterion was not applicable, or there is no applicable criterion;
6. Re-measure; and
7. Followup measurement.

Table 4.4: $L_{A1,1minute}$ GENERATED BY WCM AGAINST PROJECT APPROVAL METEOROLOGICAL CONDITIONS – NOVEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion $L_{A1,1min}$ dB ¹	Criterion Applies? ²	WCM $L_{A1,1min}$ dB ^{3,4}	Exceedance ^{4,5}
N01	11/11/19 22:41	0.7	D	NA	NA	36	NA
N03	12/11/19 00:54	0.1	F	NA	NA	51	NA
N16	12/11/19 00:34	0.2	F	50	Yes	50	Nil
N16 ⁶	12/11/19 01:30	0.2	E	50	Yes	40	Nil
N16 ⁷	14/11/19 22:21	2.0	F	50	Yes	IA	Nil
N20A	11/11/19 23:24	0.5	D	50	Yes	33	Nil
N21	11/11/19 22:16	0.7	F	50	Yes	42	Nil
N26	11/11/19 23:56	0.2	F	50	Yes	36	Nil

Notes:

1. NA indicates that criterion is not applicable, as this location is within the Zone of Affection;
2. 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;
3. Site-only $L_{A1,1minute}$ attributed to WCM;
4. Bold results in red indicate an exceedance of relevant criterion;
5. NA in exceedance column means atmospheric conditions outside conditions specified in approval, therefore criterion was not applicable, or there is no applicable criterion; and
6. Re-measure; and
7. Followup measurement.

4.4.2 EPL Weather Conditions

Table 4.5 and Table 4.6 detail noise levels from WCM in the absence of other noise sources. Noise criteria are applicable if weather conditions during the measurement were within parameters outlined in the WCM EPL.

Table 4.5: *L_{Aeq,15minute}* GENERATED BY WCM AGAINST EPL METEOROLOGICAL CONDITIONS – NOVEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion <i>L_{Aeq,15min}</i> dB ¹	Criterion Applies? ²	WCM <i>L_{Aeq,15min}</i> dB ^{3,4}	Exceedance ^{4,5}
N01	11/11/19 22:41	0.7	D	Nil	NA	34	NA
N03	12/11/19 00:54	0.1	F	Nil	NA	47	NA
N16	12/11/19 00:34	0.2	F	40	Yes	42	2
N16 ⁶	12/11/19 01:30	0.2	E	40	Yes	36	Nil
N16 ⁷	14/11/19 22:21	2.0	F	40	No	IA	NA
N20A	11/11/19 23:24	0.5	D	40	Yes	<30	Nil
N21	11/11/19 22:16	0.7	F	40	Yes	34	Nil
N26	11/11/19 23:56	0.2	F	40	Yes	30	Nil

Notes:

1. NA indicates that criterion is not applicable, as this location is within the Zone of Affection;
2. 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 stability category F temperature inversion conditions 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;
3. Site-only *L_{Aeq,15minute}* attributed to WCM, including modifying factors if applicable;
4. Bold results in red indicate an exceedance of relevant criterion; and
5. NA in exceedance column means atmospheric conditions outside conditions specified in EPL, therefore criterion was not applicable, or there is no applicable criterion.

Table 4.6: $L_{A1,1minute}$ GENERATED BY WCM AGAINST EPL METEOROLOGICAL CONDITIONS – NOVEMBER 2019

Location	Start Date and Time	Wind Speed m/s	Stability Class	Criterion $L_{A1,1min}$ dB ¹	Criterion Applies? ²	WCM $L_{A1,1min}$ dB ^{3,4}	Exceedance ^{4,5}
N01	11/11/19 22:41	0.7	D	NA	NA	36	NA
N03	12/11/19 00:54	0.1	F	NA	NA	51	NA
N16	12/11/19 00:34	0.2	F	50	Yes	50	Nil
N16 ⁶	12/11/19 01:30	0.2	E	50	Yes	40	Nil
N16 ⁷	14/11/19 22:21	2.0	F	50	No	IA	NA
N20A	11/11/19 23:24	0.5	D	50	Yes	33	Nil
N21	11/11/19 22:16	0.7	F	50	Yes	42	Nil
N26	11/11/19 23:56	0.2	F	50	Yes	36	Nil

Notes:

1. NA indicates that criterion is not applicable, as this location is within the Zone of Affection;
2. 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 stability category F temperature inversion conditions 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;
3. Site-only $L_{A1,1minute}$ attributed to WCM;
4. Bold results in red indicate an exceedance of relevant criterion;
5. NA in exceedance column means atmospheric conditions outside conditions specified in EPL, therefore criterion was not applicable, or there is no applicable criterion;
6. Re-measure; and
7. Followup measurement.

4.5 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, hail, or wind speeds above 5 m/s at microphone height.

Table 4.7: MEASURED ATMOSPHERIC CONDITIONS – NOVEMBER 2019

Location	Start Date and Time	Temperature °C	Wind Speed m/s	Wind Direction ° Magnetic North ¹	Cloud Cover 1/8s
N01	11/11/19 22:41	18	0.0	-	0
N03	12/11/19 00:54	15	0.0	-	0
N16	12/11/19 00:34	16	0.0	-	0
N16 ²	12/11/19 01:30	15	0.0	-	0
N16 ³	14/11/19 22:21	20	0.0	-	0
N20A	11/11/19 23:24	17	0.0	-	0
N21	11/11/19 22:16	18	0.6	210	0
N26	11/11/19 23:56	17	0.0	-	0

Notes:

1. "-" indicates calm conditions at monitoring location;
2. Re-measure; and
3. Followup measurement.

Meteorological data used for compliance assessment is sourced from the WCM AWS.

5 DISCUSSION

5.1 Noted Noise Sources

During attended monitoring, the time variations (temporal characteristics) of noise sources are taken into account in each measurement via statistical descriptors. From these observations, summaries have been derived for each location and provided in this chapter. Statistical 1/3 octave-band analysis of environmental noise was undertaken and the following figures display frequency ranges of various noise sources at each location for LA1, LA10, LAeq, LA50 and LA90 descriptors. 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 while mining noise is at frequencies less than 1000 Hz, which 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, such as 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 LA1 result by a small margin but is entirely accurate for LAeq.

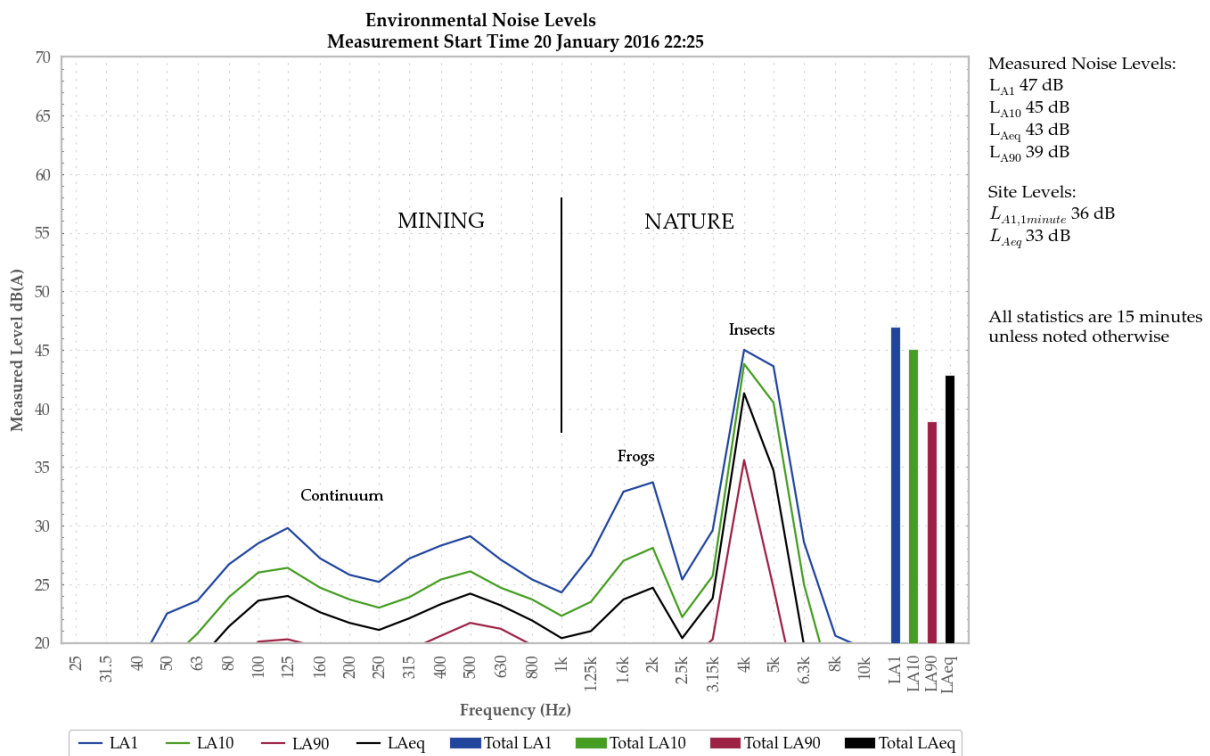


Figure 2: Example Graph (refer to section 5.1 for explanatory note)

5.1.1 N01

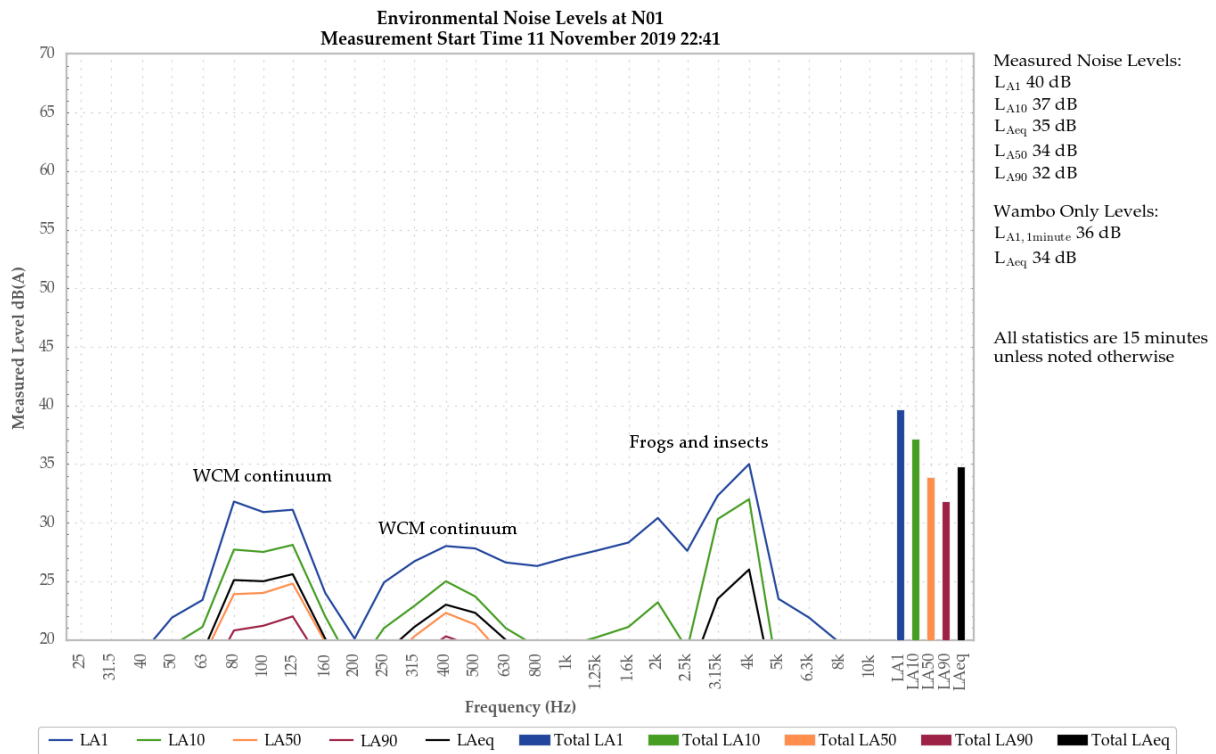


Figure 3: Environmental Noise Levels, N01 – Wambo Road

A continuum was audible from WCM throughout the measurement, generating a site only LAeq of 34 dB and a site only LA1,1minute of 36 dB.

WCM was primarily responsible for the measured LAeq, LA50 and LA90. WCM combined with frogs and insects to generate the measured LA1 and LA10.

Dogs and birds were also noted.

5.1.2 N03

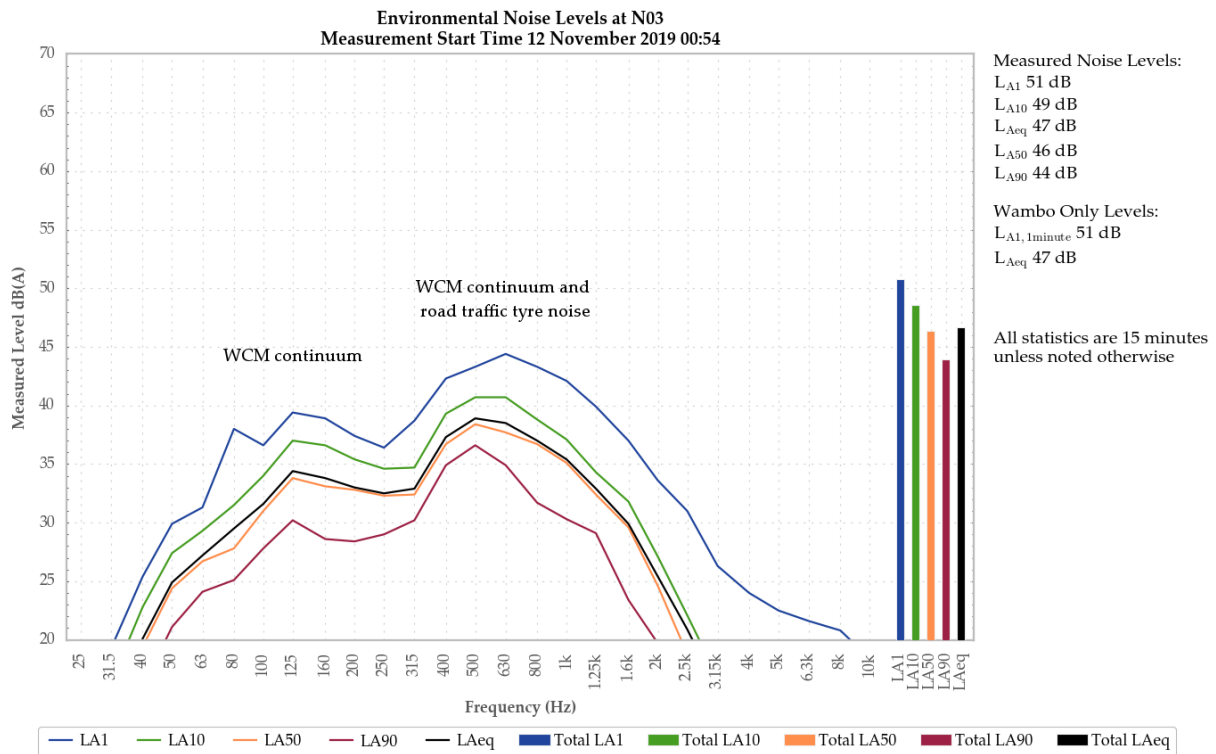


Figure 4: Environmental Noise Levels, N03 - Kelly

A continuum from WCM was audible throughout the measurement, and generated the site-only LAeq,15minute of 47 dB. Conveyor belt alarms generated the site-only LA1,1minute of 51 dB. Dozer tracks were also noted.

Noise sources from WCM were responsible for all measured noise levels.

Road traffic noise was also noted.

5.1.3 N16

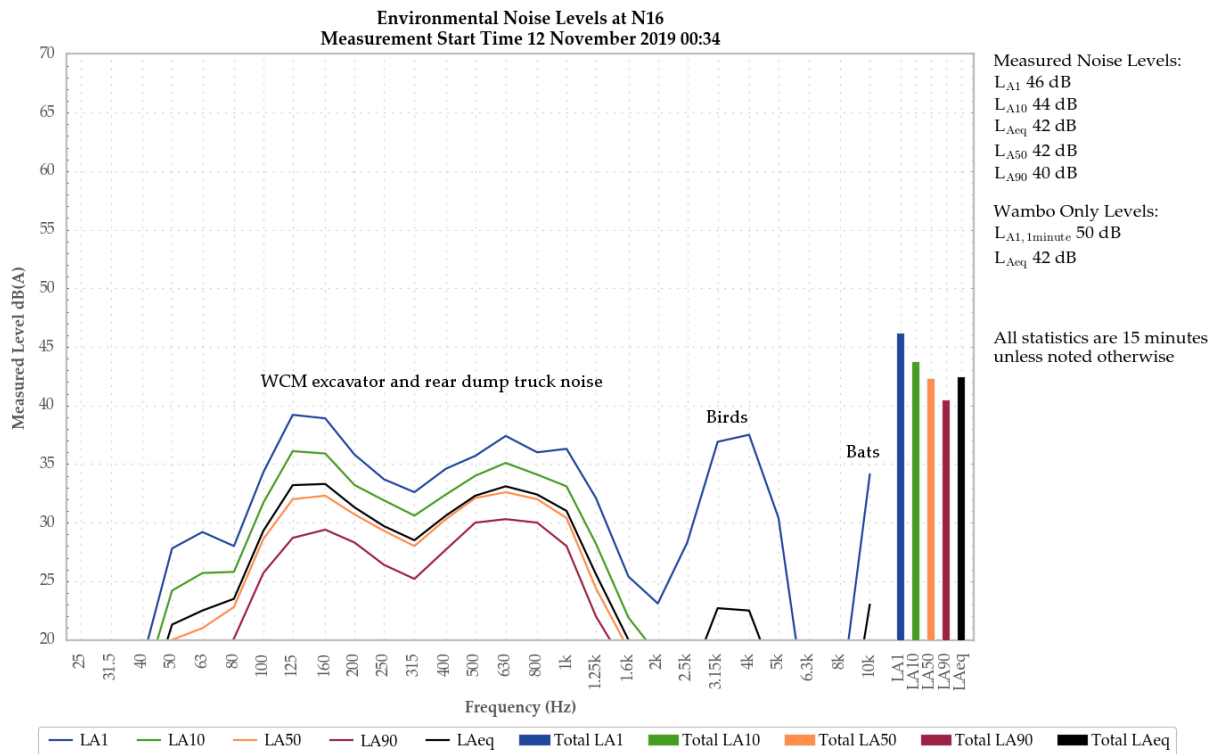


Figure 5: Environmental Noise Levels, N16 – Jerrys Plains Road

Excavator and rear dump truck noise from WCM was audible throughout the measurement, and generated the site-only LAeq,15minute of 42 dB. An impact noise generated the site-only LA1,1minute of 50 dB.

WCM was responsible for the measured LA10, LAeq, LA50 and LA90. Birds and bats contributed to the measured LA1.

Local farm equipment was also noted.

WCM was notified of the exceedance and changes to the operations were made prior to the re-measure. Excavator 211 was shutdown.

5.1.4 N16 - Re-measure

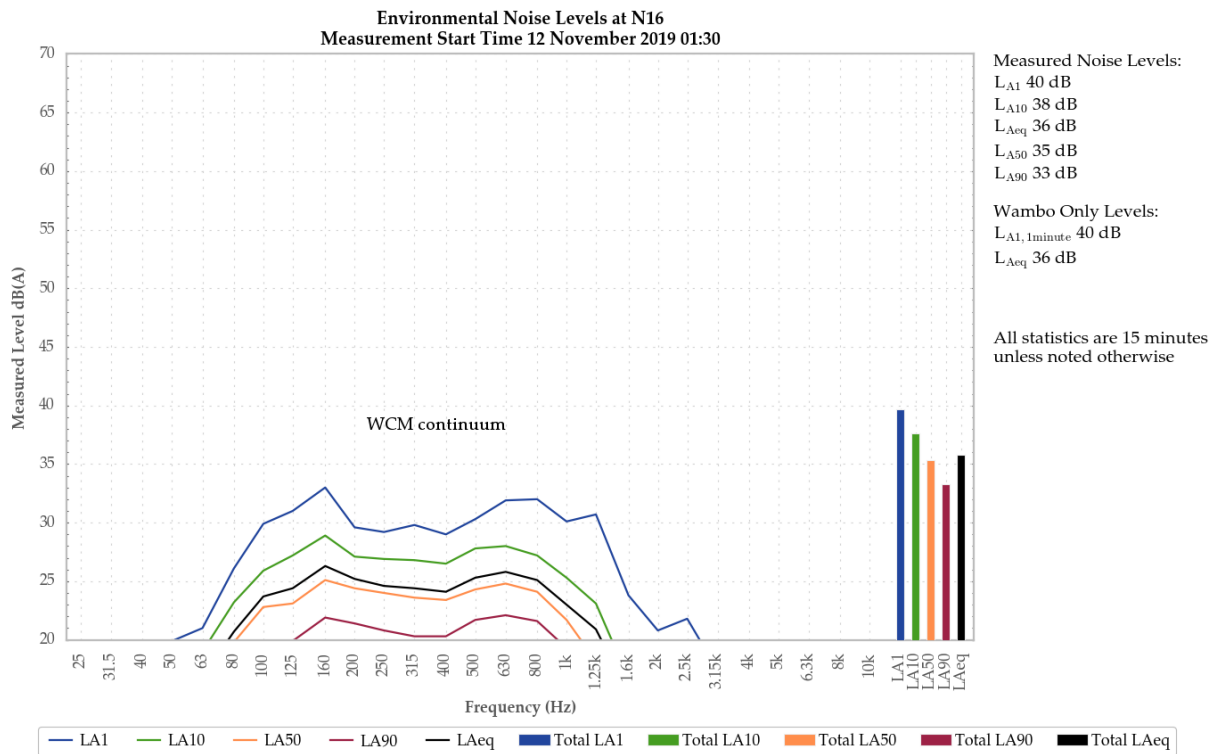


Figure 6: Environmental Noise Levels, N16 – Jerrys Plains Road

A continuum from WCM was audible throughout the measurement, and generated the site-only LAeq,15minute of 36 dB. Surges in the continuum generated the site-only LA1,1minute of 40 dB.

The continuum from WCM was primarily responsible for all measured noise levels.

Frogs and irrigation was also noted.

5.1.5 N16 – Followup Measurement

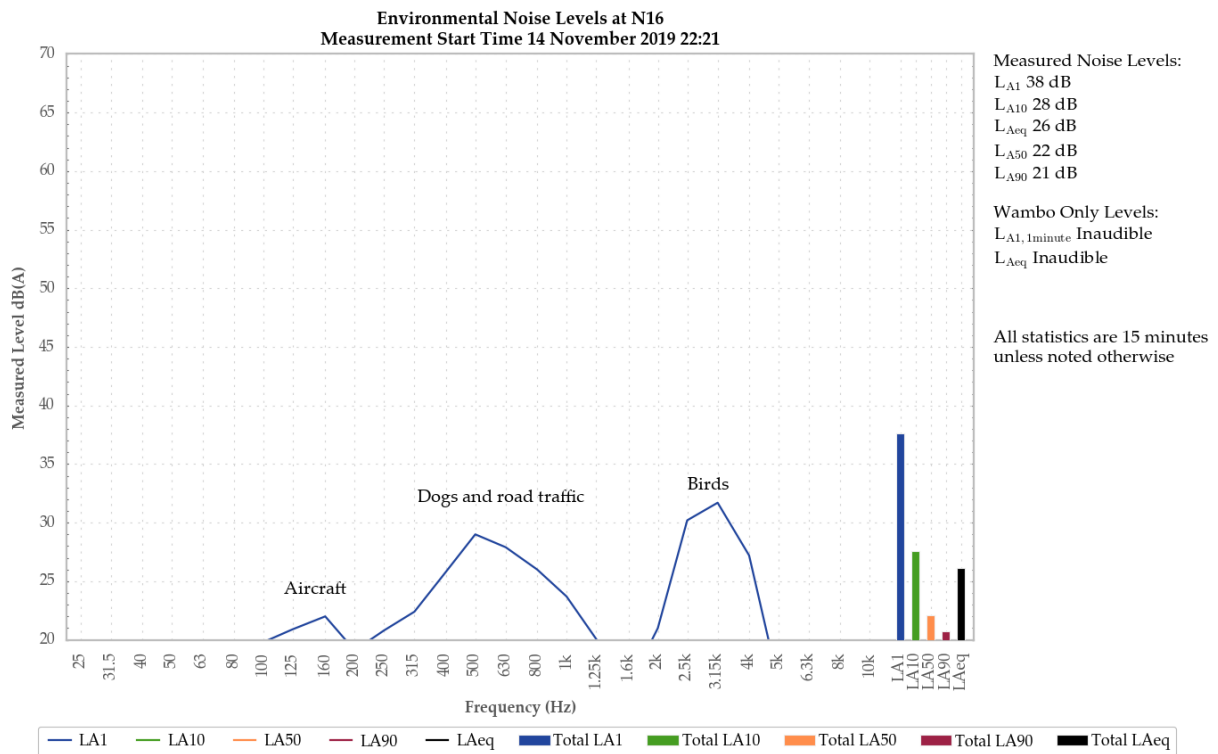


Figure 7: Environmental Noise Levels, N16 – Jerrys Plains Road

WCM was inaudible during the measurement.

Dogs, road traffic and birds generated the LA1, LA10 and LAeq. Insects generated the measured LA90.

Aircraft and local noise were also noted.

5.1.6 N20A

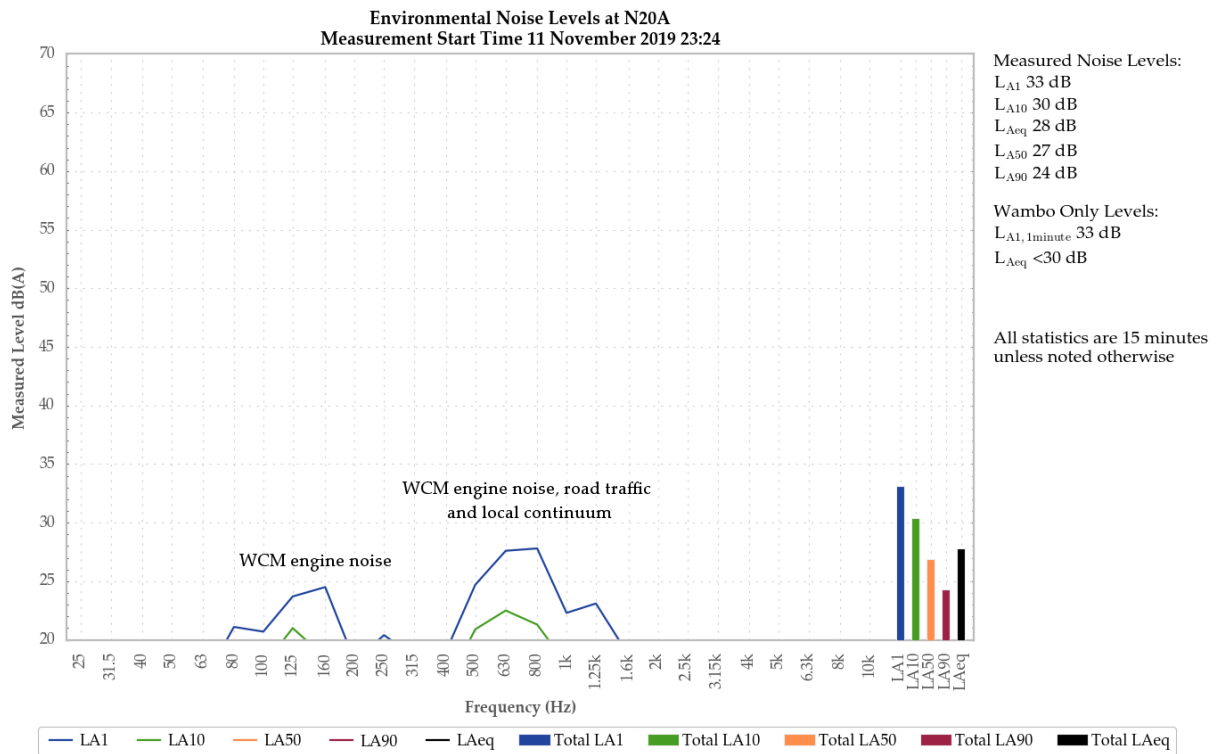


Figure 8: Environmental Noise Levels, N20A – Redmanvale Road Central

Engine noise from WCM was audible at times during the measurement, resulting in a site-only LAeq,15minute of less than 30 dB and a site-only LA1,1minute of 33 dB.

WCM combined with road traffic and a local continuum to generate the measured levels.

5.1.7 N21

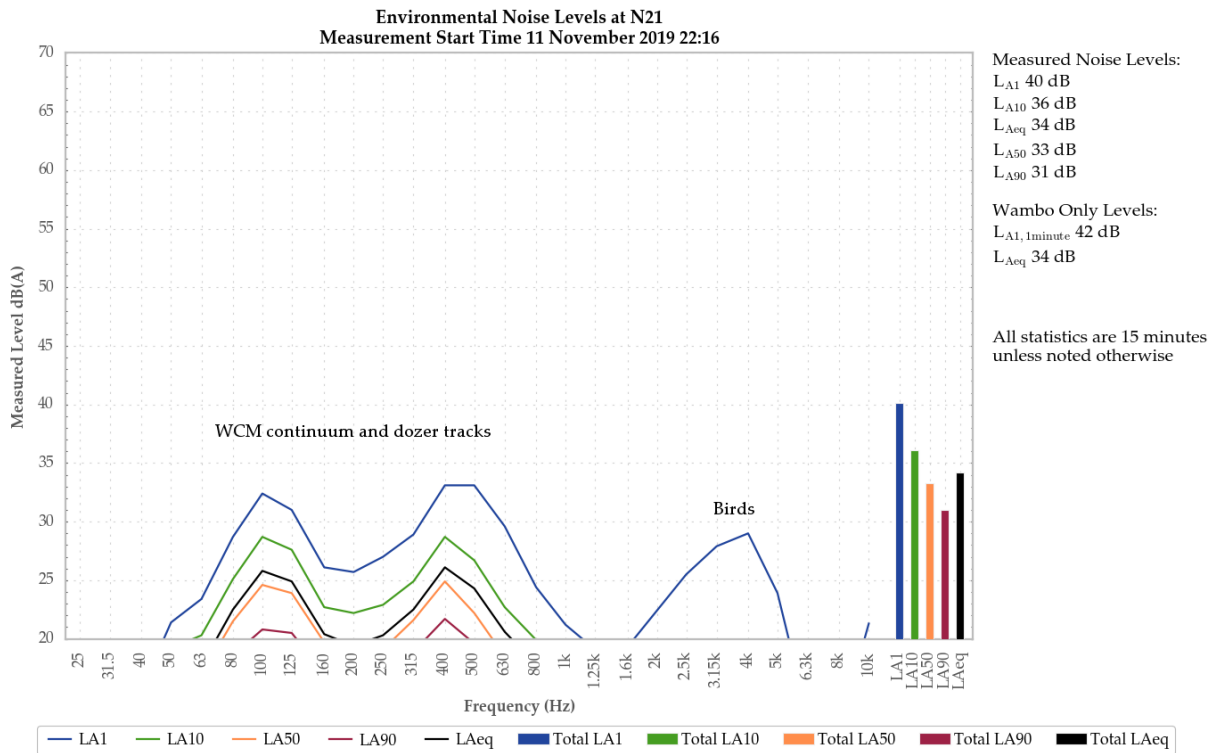


Figure 9: Environmental Noise Levels, N21 – Wambo South

An engine and fan continuum and dozer tracks from WCM were audible throughout the measurement, resulting in a site-only LAeq,15minute of 34 dB. A surge in the continuum generated a site-only LA1,1minute of 42 dB.

WCM mining noise sources generated all measured levels.

Birds, frogs and insects were also noted.

5.1.8 N26

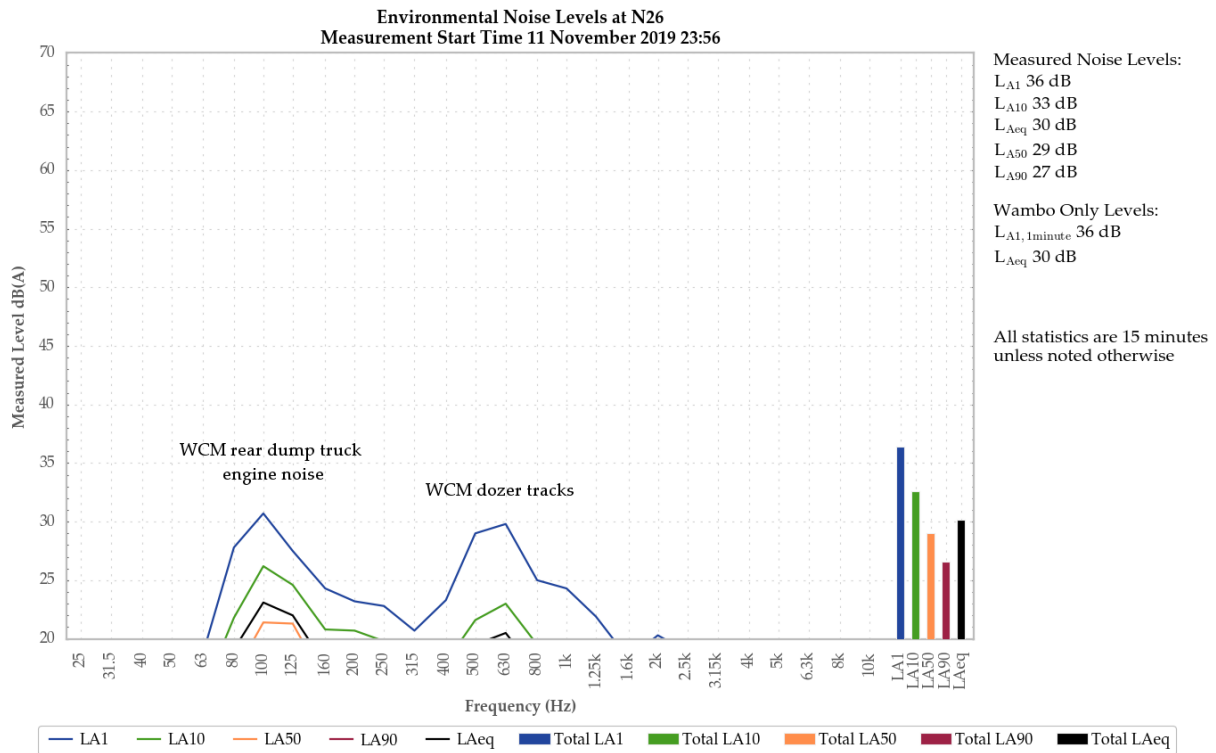


Figure 10: Environmental Noise Levels, N26 – Redmanvale Road South

Rear dump truck engine noise and dozer tracks from WCM were audible throughout the measurement. These sources resulted in a site-only LAeq,15minute of 30 dB. A surge in engine noise generated a site-only LA1,1minute of 36 dB.

WCM mining noise sources generated all measured levels.

Birds and distant dogs were also noted.

6 SUMMARY

Global Acoustics was engaged by WC to conduct a monthly noise survey of operations at WCM and WCRS. The purpose of the survey is to quantify and describe the existing acoustic environment and compare results with relevant limits.

Attended environmental noise monitoring described in this report was undertaken during the night period of 11/12 and 14/15 November 2019 at six monitoring locations.

Noise levels from WCM and WCRS complied with relevant criteria at all monitoring locations during the November 2019 survey, with the exception of N16.

At 00:34 on 12 November 2019, WCM noise levels exceeded the L_{Aeq} criterion by 2 dB. Excavator and rear dump truck noise were responsible for the site only levels. WCM were notified and operations were changed prior to a re-measure within 75 minutes. WCM noise levels complied with the relevant criteria during the re-measure, and the followup measurement, which was undertaken within 7 days on the 14 November 2019.

Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

APPENDIX

A *REGULATOR DOCUMENTS*

A.1 WAMBO COAL MINE DEVELOPMENT CONSENT

NOISE

Operational Noise Criteria

B12. During Phase 1, the Applicant must ensure that the noise generated by the Wambo Mining Complex does not exceed the criteria in Table 3 at any residence^a on privately-owned land.

Table 3: Operational noise criteria dB(A) for Phase 1

Noise Assessment Location	Day L _{Aeq} (15 min)	Evening/Night L _{Aeq} (15 min)	Night L _{A1} (1 min)
R019	59	59	N/A
R003	40	40	50
R016			
R025			
R029			
R033			
R039			
R042			
R320 (previously 15B)			
R345 (previously 15B)			
R006	39	39	50
R007			
R048			
R343 (previously 37)			
R017	38	38	50
R030 (previously 38)			
R035			
R049			
R075			
R346			
R348			
R379 (previously 91)			
R043	37	37	50
R163			
R344 (previously 137)			
R380 (previously 246)			
R381 (previously 178)	36	36	50
All other privately-owned residences	35	35	50

^a The Noise Assessment Locations referred to in Table 3 are shown in Appendix 4.

B13. During Phase 2 and Phase 3, the Applicant must ensure that the noise generated by the Wambo Mining Complex does not exceed the criteria in Table 4 at any residence^a on privately-owned land.

Table 4: Operational noise criteria dB(A) for Phase 2 and Phase 3

Noise Assessment Area	Noise Assessment Location	Day L _{Aeq} (15 min)	Evening L _{Aeq} (15 min)	Night L _{Aeq} (15 min)	Night L _{A1} (1 min)
Area 1 - North Bulga	R003	38	38	38	48
	R007 R379	37	37	37	47
	All other privately-owned residences	35	35	35	45
Area 2 - South Wambo	R025	39	39	39	49
	R035a	37	37	37	47
Noise Assessment Area	Noise Assessment Location	Day L _{Aeq} (15 min)	Evening L _{Aeq} (15 min)	Night L _{Aeq} (15 min)	Night L _{A1} (1 min)
	All other privately-owned residences	35	35	35	45
Area 3 - Warkworth Village	R019	59	59	59	69
	All other privately-owned residences	44	44	43	53
All other areas	All privately-owned residences	35	35	35	45

^a The Noise Assessment Areas referred to in Table 4 are shown in Appendix 4.

B14. Noise generated by the Wambo Mining Complex must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the *NSW Industrial Noise Policy* (EPA, 2000). Appendix 5 of this consent sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

B15. The noise criteria in Table 3 and Table 4 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Noise Operating Conditions

B16. The Applicant must:

- (a) take all reasonable steps to minimise all noise from construction and operational activities, including low frequency and other audible characteristics, as well as road noise associated with the development;
- (b) monitor and record all major equipment use and make this data readily available at the request of the Department or the EPA;
- (c) operate a noise management system commensurate with the risk of impact to ensure compliance with the relevant conditions of this consent;
- (d) take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions when the noise criteria in this consent do not apply (see Appendix 5); and
- (e) carry out regular attended noise monitoring (at least once a month, unless otherwise agreed by the Planning Secretary) to determine whether the development is complying with the relevant conditions of this consent.

Noise Management Plan

- B17. The Applicant must prepare a Noise Management Plan for the Wambo Mining Complex to the satisfaction of the Planning Secretary. This plan must:
- (a) be prepared by a suitably qualified and experienced person/s;
 - (b) be prepared in consultation with the EPA;
 - (c) describe the measures to be implemented to ensure:
 - (i) compliance with the noise criteria and operating conditions in this consent;
 - (ii) best practice management is being employed; and
 - (iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions under which the noise criteria in this consent do not apply (see Appendix 5);
 - (d) seek to minimise road traffic noise generated by employee commuter vehicles on public roads;
 - (e) describe the noise management system in detail; and
 - (f) include a monitoring program that:
 - (i) uses a combination of real-time and supplementary attended monitoring to evaluate the performance of the development;
 - (ii) includes a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results over time;
 - (iii) adequately supports the noise management system; and
 - (iv) includes a protocol for distinguishing noise emissions between the Wambo Mining Complex and United Wambo open cut coal mine; and
 - (v) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of any such event.
- B18. The Applicant must not commence Phase 2 until the Noise Management Plan is approved by the Planning Secretary.
- B19. The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

A.2 WAMBO RAIL SPUR DEVELOPMENT CONSENT

PART B SPECIFIC ENVIRONMENTAL CONDITIONS

NOISE

Noise Operating Conditions

B1. The Applicant must:

- (a) take all reasonable steps to minimise all noise associated with the development, including during noise-enhancing meteorological conditions;
- (b) operate a noise management system commensurate with the risk of impact to ensure compliance with the relevant conditions of this consent;
- (c) only use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL and use reasonable endeavours to ensure that rolling stock is selected to minimise noise;
- (d) use all reasonable efforts to co-ordinate noise management on the site with the noise management at Wambo mine; and
- (e) carry out regular attended noise monitoring to determine whether the development is complying with the relevant conditions of this consent.

A.3 WAMBO RAIL LINE DEVELOPMENT CONSENT

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 ENVIRONMENT PROTECTION LICENCE 529

- 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 - Birralea 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
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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



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 C18363

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

Equipment Tested/ Model Number : Rion NA-28
Instrument Serial Number : 01070590
Microphone Serial Number : 08184
Pre-amplifier Serial Number : 52329

Pre-Test Atmospheric Conditions
Ambient Temperature : 21.3°C
Relative Humidity : 41.7%
Barometric Pressure : 100.95kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 22.7°C
Relative Humidity : 39.2%
Barometric Pressure : 100.89kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 25 Jun 2018

Secondary Check: Lewis Boorman
Report Issue Date : 25 Jun 2018

Approved Signatory :

Juan Aguero

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	
51.5 Hz to 9kHz	±0.12dB	Temperature	±0.05°C
12.5kHz	±0.18dB	Relative Humidity	±0.16%
16kHz	±0.31dB	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 - 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



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	Secondary Check: Lewis Boorman
Calibration Date : 26 Nov 2018	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			
31.5 Hz to 8kHz	±0.12dB	Environmental Conditions	
12.5kHz	±0.18dB	Temperature	±0.05°C
16kHz	±0.51dB	Relative Humidity	±0.46%
Electrical Tests		Barometric Pressure	±0.017kPa
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 - calibration.

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

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www.acousticresearch.com.au

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
Ambient Temperature : 24.5°C
Relative Humidity : 54.5%
Barometric Pressure : 99.39kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 23.6°C
Relative Humidity : 51%
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 - Environmental Conditions			
Acoustic Tests		Temperature	±0.2°C
31.5 Hz to 8kHz	±0.15dB	Relative Humidity	±2.4%
12.5kHz	±0.2dB	Barometric Pressure	±0.015kPa
16kHz	±0.29dB		
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.



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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
Thornton 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
Ambient Temperature : 26°C
Relative Humidity : 40.2%
Barometric Pressure : 100.96kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 26°C
Relative Humidity : 40.7%
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 organization 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.

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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 C19029

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

Equipment Tested/ Model Number : Pulsar Model 106
Instrument Serial Number : 79631

Atmospheric Conditions

Ambient Temperature : 23.1°C
Relative Humidity : 58.2%
Barometric Pressure : 99.49kPa

Calibration Technician : Charlie Neil
Calibration Date : 22 Jan 2019

Secondary Check: Lewis Boorman
Report Issue Date : 24 Jan 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	94.3	1000.38

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 - Environmental Conditions

Specific Tests	Uncertainty	Environmental Conditions	Uncertainty
Generated SPL	±0.11dB	Temperature	±0.2°C
Frequency	±0.01%	Relative Humidity	±2.4%
Distortion	±0.5%	Barometric Pressure	±0.013kPa

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 Australia's national standards.

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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
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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	Secondary Check:	Lewis Boorman
Calibration Date :	1 Feb 2019	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	±0.48%	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.

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