

Wambo Coal Mine and Rail Spur

*Environmental Noise Monitoring
September 2020*

*Prepared for
Wambo Coal Pty Limited*



Noise and Vibration Analysis and Solutions

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Environmental Noise Monitoring September 2020

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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 nights of 8/9 and 10/11 September 2020 at a total of five 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	Monitor Type	Consent Requirements	Frequency
N01	Wambo Road Residence	Attended	Mine & Rail Spur	Monthly
N16	Jerrys Plains Road	Attended	Mine	Monthly
N20A	Redmanvale Road Central	Attended	Mine	Monthly
N20 ²	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:

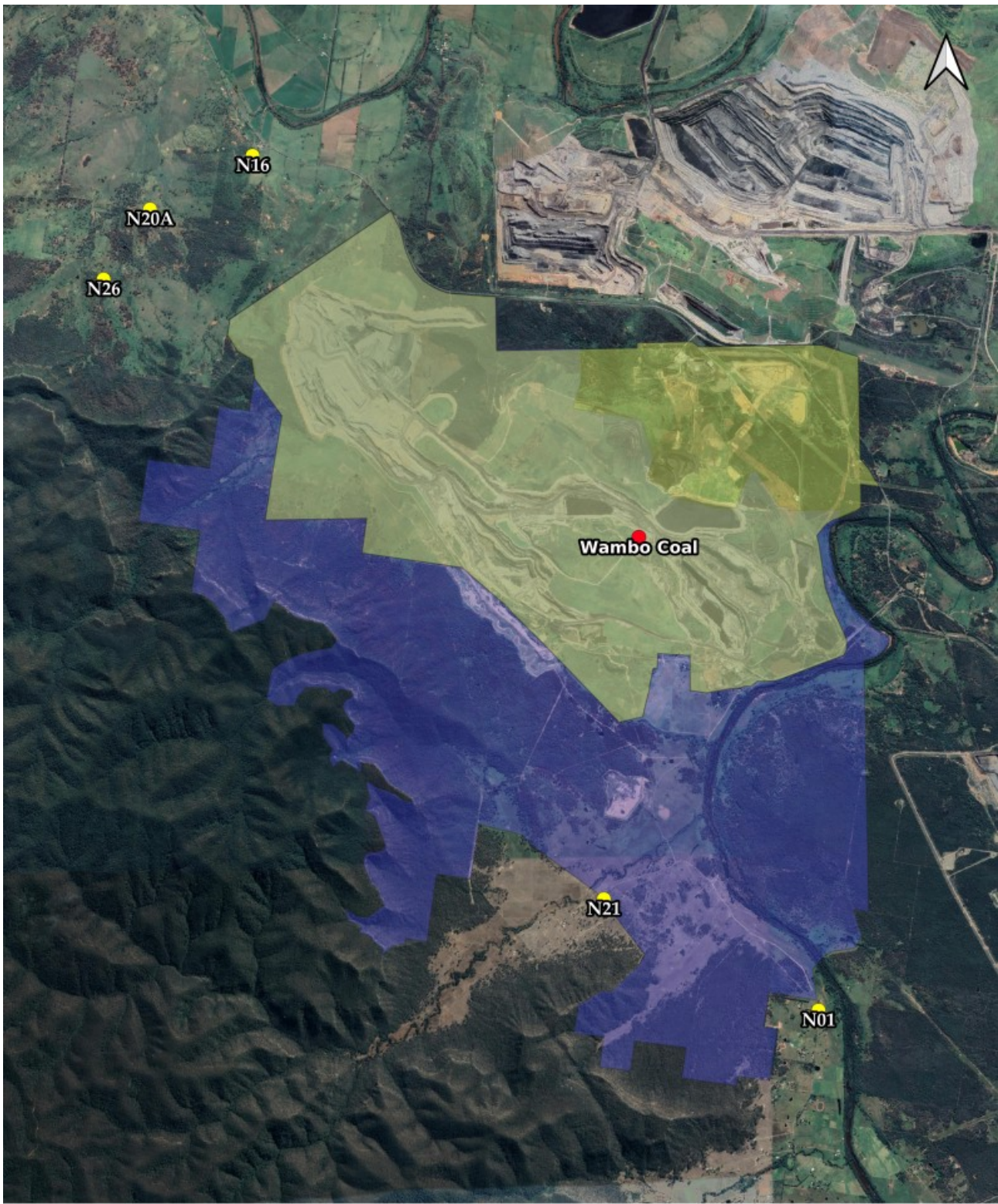
1. Sourced from the NMP – WA-ENV-MNP-503, January 2018; and
2. N20 is not an attended noise monitoring location, but is the location of a real-time continuous noise monitor.

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.



- Legend**
- WCM Features
 - WAMBO Monitoring Locations
 - United Wambo Project Area_SSD7142
 - WAMBO_DA_305_7_2003



CRS: GDA/MGA Zone 56s
Date of map creation: 03/12/2019
Source: Google Satellite Hybrid tile

Figure 1: WCM Attended Noise Monitoring Locations

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 2 Part B 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 2 Part B 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 27 March 2020. 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 2020), prepared in accordance with the WCM and WCRS consents. Relevant sections of the NMP are reproduced in Appendix A.

2.5 Noise Criteria

Noise criteria detailed in Table 2.1 have been adopted based on Condition L5.1 of the EPL.

Table 2.1: WCM NOISE CRITERIA, dB(A)

Location	Day L _{Aeq,15minute}	Evening/Night L _{Aeq,15minute}	Night L _{A1,1minute}
N01 ^{1,2}	40	40	50
N16	40	40	50
N20A	40	40	50
N21	40	40	50
N26	38	38	50

Notes:

1. Noise criteria for the nearest privately-owned property (R003 – Birrell) have been adopted; and
2. Monitoring at this location is not required by the EPL, but is still required by the NMP.

2.6 Meteorological Conditions

Meteorological conditions required for noise criteria to apply are consistent between the consent and EPL.

2.6.1 Development Consent

Appendix 5 of MOD 16 details specific meteorological conditions required for noise criteria to be applicable:

APPENDIX 5 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in condition B12 are to apply under all meteorological conditions except the following:
 - (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
 - (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
 - (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or
 - (iii) temperature inversion conditions greater than 3°C/100m.
 - (b) where Pasquill Stability Classes have been assessed, then:
 - (i) wind speeds greater than 3m/s at 10m above ground level;
 - (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level;
 - (iii) stability category G temperature inversion conditions.

As lapse rates (VTG) were not measured directly, meteorological conditions have been assessed against Pasquill stability classes detailed in 1.(b).

2.6.2 Environment Protection Licence

Condition L5.5 of the EPL details meteorological conditions required for noise limits to apply:

- L5.5 The noise limits set out in condition L5.1 apply under all meteorological conditions except for the following:
- a) Wind speeds greater than 3 metres/second at 10 metres above the ground level;
 - b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
 - c) Stability category G temperature inversion conditions.

Condition L5.5 is consistent with stability category conditions outlined in Appendix 5, 1.(b).

2.7 Modifying Factors

The EPA 'Noise Policy for Industry' (NPfI, 2017) was approved for use in NSW in October 2017. For assessment of modifying factors, the NPfI immediately superseded the 'Industrial Noise Policy' (INP, 2000), as outlined in the EPA document 'Implementation and transitional arrangements for the Noise Policy for Industry' (2017). Assessment and reporting of modifying factors has been undertaken in accordance with Fact Sheet C of the NPfI.

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.

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 (in this case WCM and/or WCRS) 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).

Often extraneous noise events (for example, road traffic pass-bys and dogs) interfere with the measurement of site noise levels in the frequency range of interest. Where required, the sound level meter is paused during these occurrences to aid in quantification of the site only $L_{A\text{eq},15\text{minute}}$ level.

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 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	00370304	26/11/2020
Rion NA-28 sound level analyser	30921838	21/04/2021
Rion NA-28 sound level analyser	01070590	11/06/2022
Rion NA-28 sound level analyser	30131882	05/02/2021
Pulsar 105 acoustic calibrator	78226	11/03/2022
Pulsar 106 acoustic calibrator	81334	12/02/2022
ND9 acoustic calibrator	N225020	27/05/2022
Pulsar 106 acoustic calibrator	74813	10/06/2022

3.5 Modifying Factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable, 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”).

If applicable, modifying factors have been reported and added to measured site-only $L_{A\text{eq}}$ noise levels when meteorological conditions satisfied requirements for site noise criteria to be applicable. Low-frequency modifying

factors have only been applied to site-only L_{Aeq} levels if WCM/WCRS was the only contributing low-frequency noise source.

4 RESULTS

4.1 Plant Locations

During monitoring on 8/9 and 10/11 September 2020 between 22:00 and 02:00, equipment in operation was as follows:

8/9 September 2020

- Ex211 Peabody Peak;
- Ex212 HD/S11/WMA Conventionally loading Wambo A Low Ash Coal, slow digging due to shallow bench. All loads to ROM;
- Ex213 HD/S12/WMAO Conventionally loading Wambo A waste. Down with broken seat from 17:30 – 20:00;
- Ex214 HD/EB2/WMAO Double Benching Wambo A waste. All loads to M/E Inpit Dump;
- Ex217 HD/S12/WMAO Double benching Wambo A waste. All loads to RL110 Dump. Trucks running unlocked with Ex218 circuit. Walking to service position at end of NS;
- Ex218 HD/EB1/WMAO Relocating start of shift from service area to dig area. Double Benching Wambo A waste. All loads to RL110 Dump. Trucks running unlocked with Ex217 circuit;
- Ex219 HD/EB2/WMAO Double benching Wambo A waste. All loads to Inpit Ramp. Utilised for the OT in the Standby period; and
- LD393 not utilised on shift.

10/11 September 2020

- Ex211 - HD S12 WMA - Peabody peak;
- Ex212 - HD S11 WMAO - Conventional bench wambo a coal, feeding chpp;
- Ex213 - HD EB2 WMAO - Deck loading removing ramp, leaving wedge on floor, Wambo A waste. All loads to the RL110;
- Ex214 - HD EB2 WMAO - Double benching Wambo A waste, continuing to the north, all loads to the montrose east inpit dump. Bench prep 0.5hrs;
- Ex217 - HD EB2 WMAO - Double benching Wambo A waste, continuing to the east all loads to the rl110 dump;
- Ex218 - HD EB2 WMAO -Double benching Wambo A waste, continuing to the north, all loads the rl 110 dump;
- Ex219 - HD EB1 WMAO - Double benching Wambo A waste, taking full bench, continuing to the south, raising floor to prevent potential over height all loads to the inpit dump;
- LD393 - down for service; and
- LD 392 - feeding the CHPP with 2 trucks, whilst ex 212 trucks cycle. Then to the SBU for side casting.

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 – SEPTEMBER 2020¹

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
N01	8/09/2020 22:00	49	43	41	38	38	36	33
N16	8/09/2020 23:37	56	41	37	34	33	30	27
N20A	8/09/2020 23:09	39	37	32	30	29	27	23
N21	8/09/2020 22:48	55	51	41	40	37	35	32
N26	8/09/2020 22:00	48	45	43	41	40	38	35
N26 ²	8/09/2020 22:37	48	43	40	36	33	28	23
N26 ³	10/09/2020 22:03	50	46	42	40	40	38	36
N26 ⁴	10/09/2020 22:53	49	44	42	39	38	36	33

Notes:

1. Levels in this table are not necessarily the result of activity at WCM or WCRS;
2. Remeasure;
3. Follow-up monitoring; and
4. Follow-up monitoring remeasure.

4.3 Modifying Factors

Measured site-only levels were assessed for the applicability of modifying factors in accordance with the NPfI and methodology described in Section 3.5.

Modifying factors, as defined in the NPfI, were applicable in two measurements during the survey and are detailed in Table 4.2.

Table 4.2: MODIFYING FACTOR ASSESSMENT – SEPTEMBER 2020

Location	Start Date and Time	Measured WCM Only LAeq dB	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality ¹	Low-frequency Modifying Factor?	Maximum Exceedance of NPfI Reference Spectrum _{1,2}	Total Penalty dB ²
N26	8/09/2020 22:00	39	No	No	NA	Yes	3 dB @ 125 Hz	2
N26	10/09/2020 22:03	39	No	No	NA	Yes	2 dB @ 125 Hz	2

Notes:

1. NA denotes 'not applicable'; and
2. Bold results indicate that application of NPfI modifying factor/s is required.

4.4 Attended Noise Monitoring

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 EPL.

Table 4.3: *L_{Aeq,15minute} GENERATED BY WCM AGAINST EPL – SEPTEMBER 2020*

Location	Start Date and Time	Wind Speed m/s	Stability Category ¹	Criterion L _{Aeq,15min} dB	Criterion Applies? ²	WCM L _{Aeq,15min} dB ^{3,4}	Exceedance ^{4,5}
N01	8/09/2020 22:00	0.7	D	40	Yes	30	Nil
N16	8/09/2020 23:37	1.0	E	40	Yes	33	Nil
N20A	8/09/2020 23:09	0.4	F	40	Yes	IA	Nil
N21	8/09/2020 22:48	0.4	F	40	Yes	34	Nil
N26	8/09/2020 22:00	0.7	D	38	Yes	41	3
N26 ⁶	8/09/2020 22:37	0.9	D	38	Yes	27	Nil
N26 ⁷	10/09/2020 22:03	1.5	E	38	Yes	41	3
N26 ⁸	10/09/2020 22:53	1.9	E	38	Yes	38	Nil

Notes:

1. Stability Class calculated using sigma theta method provided by NPfI;
2. Noise emission limits identified in the above table apply under all meteorological conditions except wind speeds greater than 3 m/s at 10 metres above ground level; or stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level, or stability category G temperature inversion conditions;
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 EPL, therefore criterion was not applicable, or there is no applicable criterion;
6. Remeasure;
7. Follow-up monitoring; and
8. Follow-up monitoring remeasure.

Table 4.4: $L_{A1,1minute}$ GENERATED BY WCM AGAINST EPL – SEPTEMBER 2020

Location	Start Date and Time	Wind Speed m/s	Stability Category ¹	Criterion $L_{A1,1min}$ dB	Criterion Applies? ²	WCM $L_{A1,1min}$ dB ^{3,4}	Exceedance ^{4,5}
N01	8/09/2020 22:00	0.7	D	50	Yes	40	Nil
N16	8/09/2020 23:37	1.0	E	50	Yes	36	Nil
N20A	8/09/2020 23:09	0.4	F	50	Yes	IA	Nil
N21	8/09/2020 22:48	0.4	F	50	Yes	38	Nil
N26	8/09/2020 22:00	0.7	D	50	Yes	45	Nil
N26 ⁶	8/09/2020 22:37	0.9	D	50	Yes	29	Nil
N26 ⁷	10/09/2020 22:03	1.5	E	50	Yes	41	Nil
N26 ⁸	10/09/2020 22:53	1.9	E	50	Yes	40	Nil

Notes:

1. Stability Class calculated using sigma theta method provided by NPfI;
2. Noise emission limits identified in the above table apply under all meteorological conditions except wind speeds greater than 3 m/s at 10 metres above ground level; or stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level, or stability category G temperature inversion conditions;
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. Remeasure;
7. Follow-up monitoring; and
8. Follow-up monitoring remeasure.

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 4.5. 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 4.5: MEASURED ATMOSPHERIC CONDITIONS – SEPTEMBER 2020

Location	Start Date and Time	Temperature °C	Wind Speed m/s	Wind Direction ° Magnetic North ¹	Cloud Cover 1/8s
N01	8/09/2020 22:00	12	0.0	-	0
N16	8/09/2020 23:37	15	0.0	-	0
N20A	8/09/2020 23:09	18	0.0	-	0
N21	8/09/2020 22:48	13	0.0	-	0
N26	8/09/2020 22:00	19	0.0	-	0
N26 ²	8/09/2020 22:37	16	0.0	-	0
N26 ³	10/09/2020 22:03	14	1.4	110	4
N26 ⁴	10/09/2020 22:53	14	2.1	150	5

Notes:

1. "-" indicates calm conditions at monitoring location; and
2. Remeasure;
3. Follow-up monitoring; and
4. Follow-up monitoring remeasure.

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.

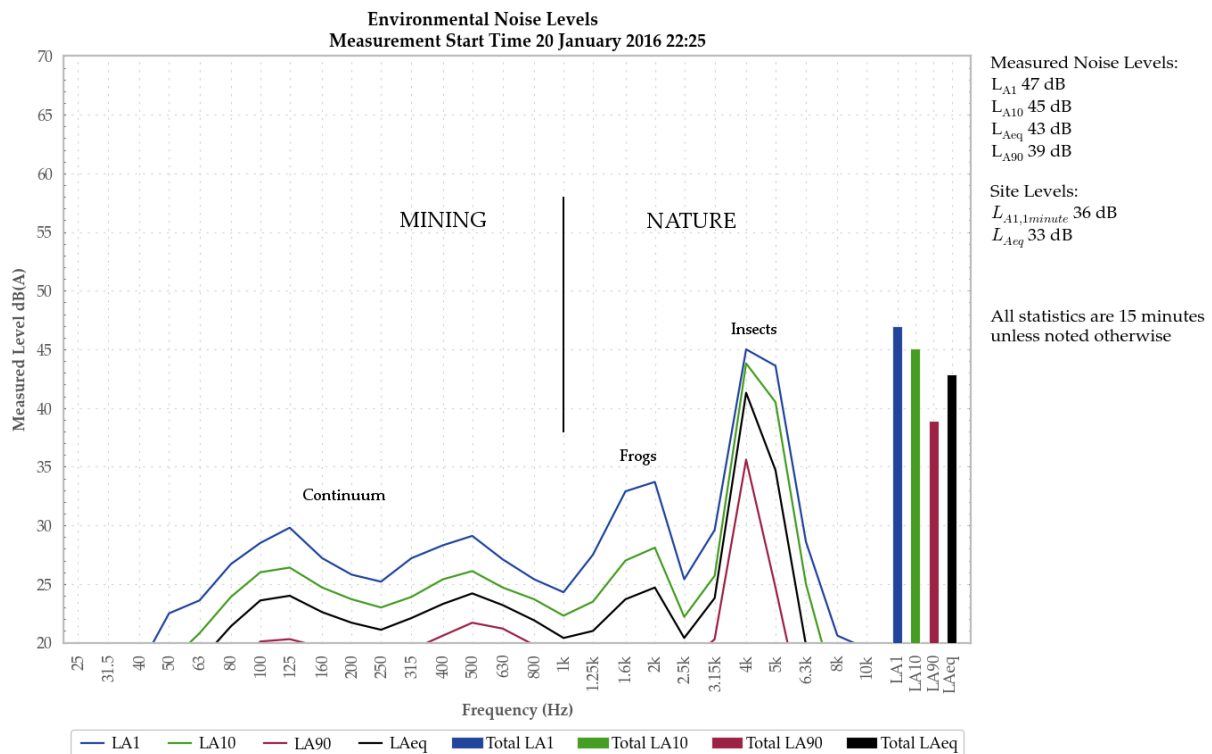


Figure 2: Example Graph (refer to section 5.1 for explanatory note)

5.1.1 N01

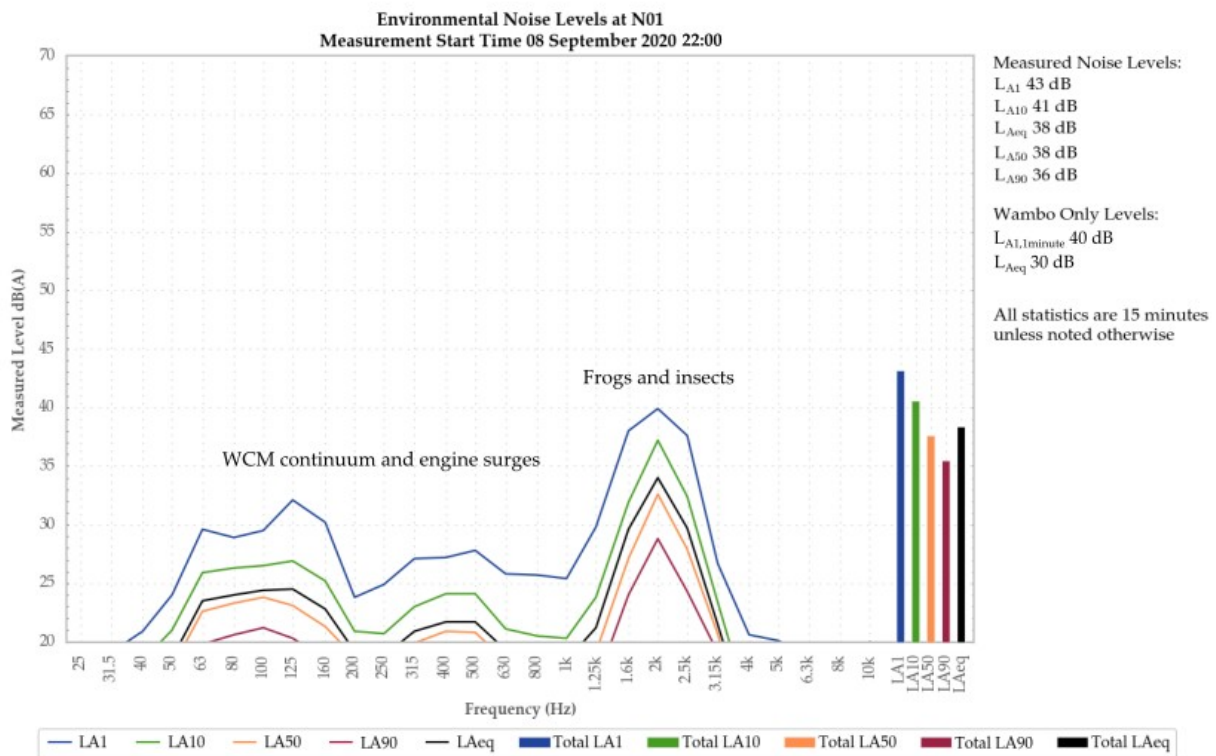


Figure 3: Environmental Noise Levels, N01 – Wambo Road

A mining continuum from WCM was audible throughout the measurement, which generated a site-only L_{Aeq} of 30 dB. Engine surges were responsible for the measured site-only $L_{A1,1minute}$ of 40 dB.

Frogs and insects were responsible for the measured noise levels.

5.1.2 N16

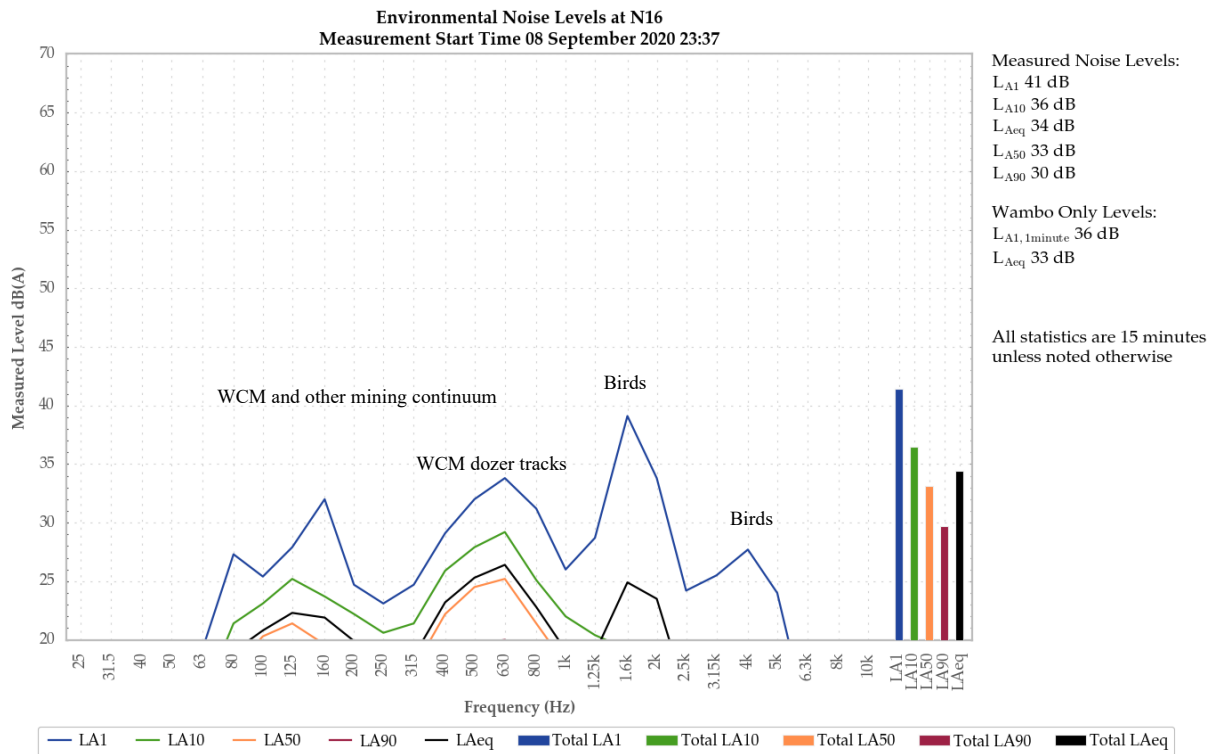


Figure 4: Environmental Noise Levels, N16 – Jerrys Plains Road

A mining continuum and dozer tracks from WCM were audible throughout the measurement, generating a site-only LAeq of 33 dB. Track noise was responsible for the measured site-only LA1,1minute of 36 dB.

Birds and WCM engine surges were responsible for the measured LA1. WCM continuum was primarily responsible for the measured LA10, LAeq, LA50 and LA90. Birds contributed to the measured LAeq and continuum from another mining operation contributed to the measured LA50 and LA90.

Insects and bats were also noted.

5.1.3 N20A

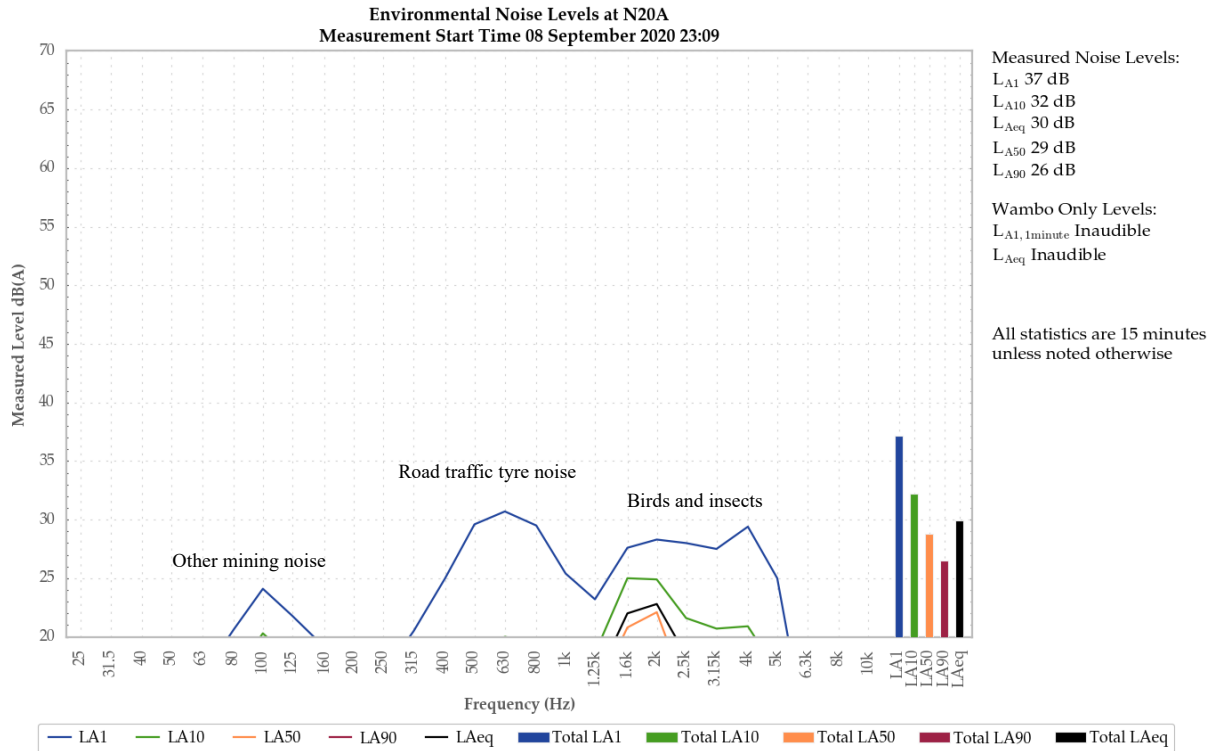


Figure 5: Environmental Noise Levels, N20A – Redmanvale Road Central

WCM was inaudible during the measurement.

Birds, insects and road traffic were responsible for the measured LA1. Insects generated the measured LA10, LAeq and LA50. Continuum from another mining operation combined with insects to generate the measured LA90.

5.1.4 N21

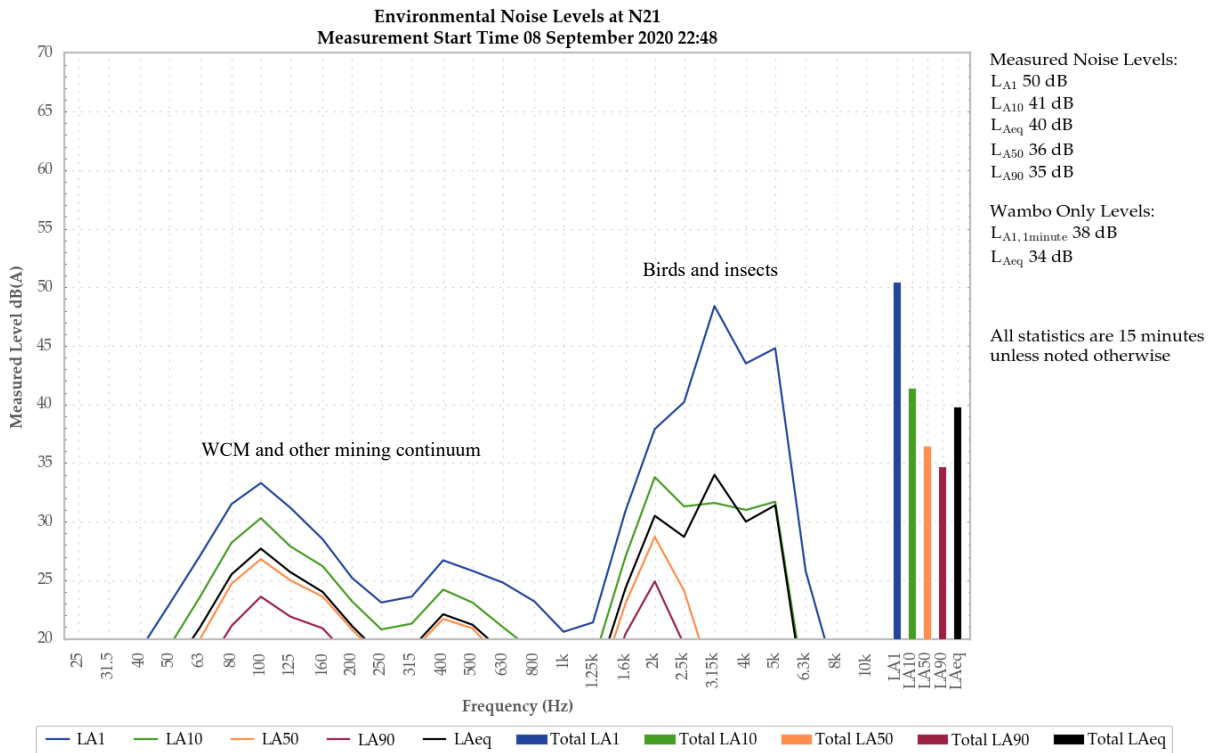
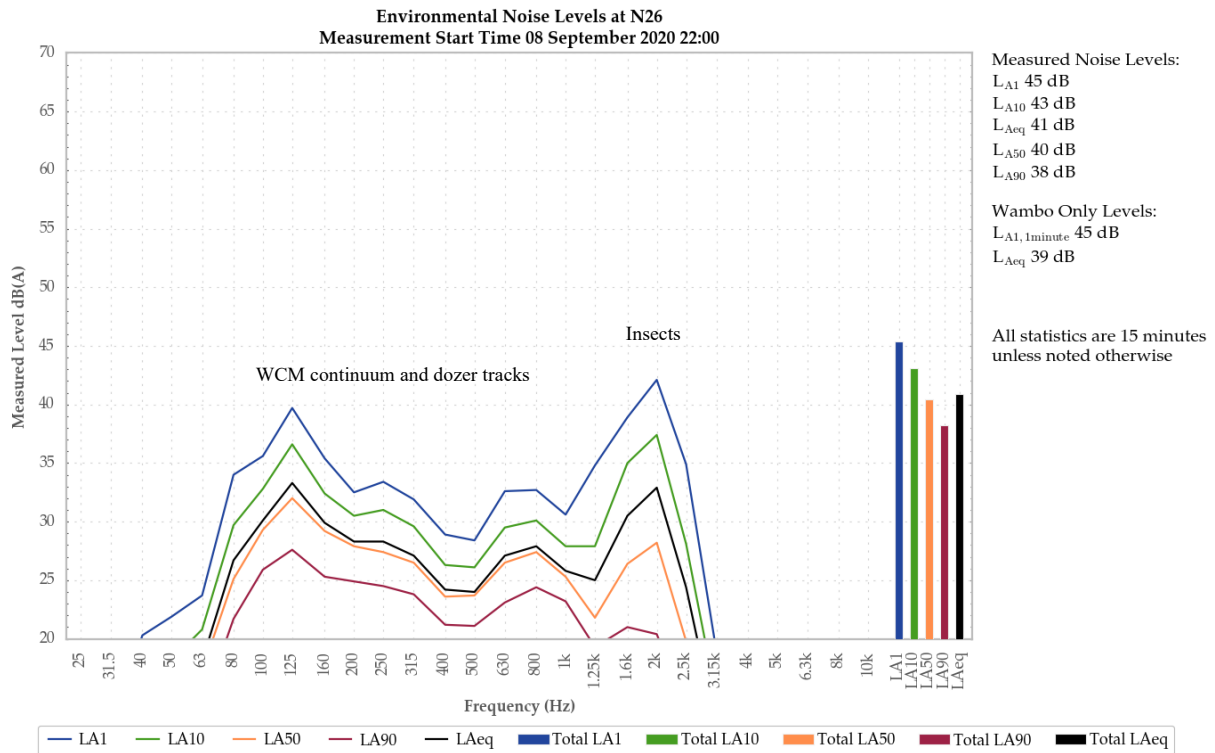


Figure 6: Environmental Noise Levels, N21 – Wambo South

A mining and engine continuum from WCM was audible throughout the measurement, and generated a site-only LAeq,15minute of 34 dB. Engine surges generated the site-only LA1,1minute of 38 dB.

Birds were responsible for the measured LA1, LA10 and LAeq. Continuum from WCM and another mining operation combined with insects to generate the measured LA50 and LA90.

5.1.5 N26



A mining continuum and dozer tracks from WCM were audible throughout the measurement, generating a site-only LAeq of 39 dB. A low-frequency modifying factor of 2 dB was applicable, resulting in a site-only LAeq of 41 dB. Surges in the continuum generated the site-only LA1,1minute of 45 dB.

Due to discrepancies between noise criteria at the monitoring location compared to noise criteria at nearby residences, this measurement represents a 1 dB exceedance of the site-only LAeq criterion at property 345. Site-only noise levels should not have exceeded relevant noise criteria at other properties in the area.

WCM continuum combined with insects to generate the measured noise levels.

Birds were also noted.

Dispatch was called at the conclusion of the measurement. Operations were altered and a second measurement was undertaken within 75 minutes.

5.1.6 N26 – Remeasure

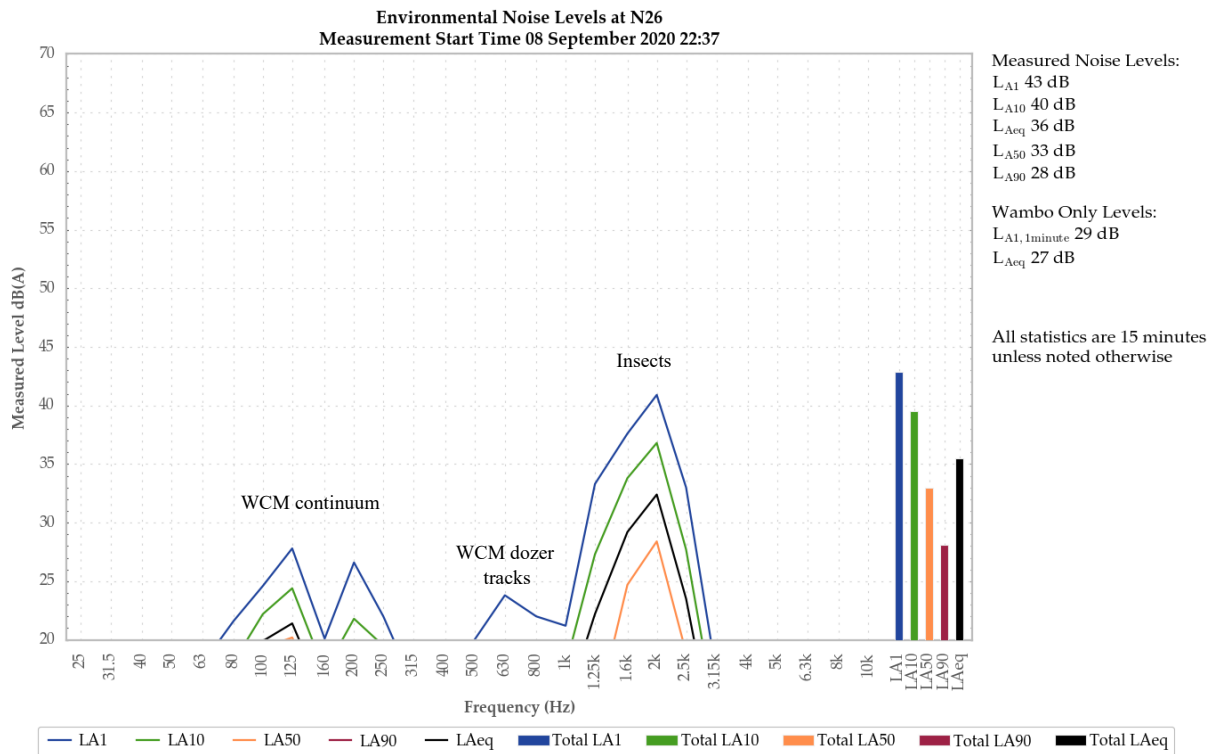


Figure 8: Environmental Noise Levels, N26 – Redmanvale Road South

A mining continuum and dozer tracks from WCM were audible throughout the measurement, generating a site-only LAeq of 27 dB. Surges in the continuum generated the site-only LA1,1minute of 29 dB.

Insects were responsible for the measured noise levels.

Distant road traffic was also noted.

5.1.7 N26 – Follow-up Monitoring

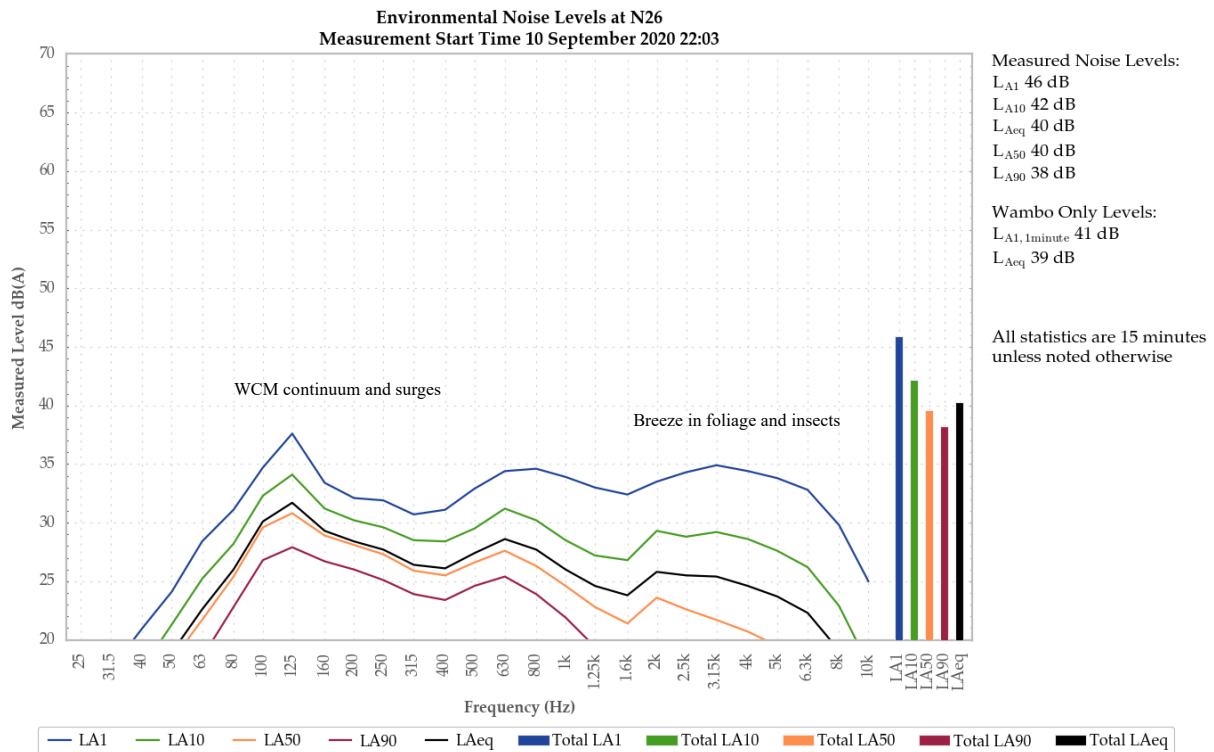


Figure 9: Environmental Noise Levels, N26 – Redmanvale Road South

A mining continuum from WCM was audible throughout the measurement, generating a site-only $L_{Aeq,15\text{minute}}$ of 39 dB. A low-frequency modifying factor of 2 dB was applicable, resulting in a site L_{Aeq} of 41 dB. Surges in the continuum generated the site-only $L_{A1,1\text{minute}}$ of 41 dB. Engine surges were also noted.

Due to discrepancies between noise criteria at the monitoring location compared to noise criteria at nearby residences, this measurement represents a 1 dB exceedance of the site-only L_{Aeq} criterion at property 345. Site-only noise levels should not have exceeded relevant noise criteria at other properties in the area.

WCM continuum combined with breeze in foliage and insects to generate the measured noise levels.

Birds were also noted.

Dispatch was called at the conclusion of the measurement. Operations were altered and a second measurement was undertaken within 75 minutes.

5.1.8 N26 – Follow-up Monitoring Remeasure

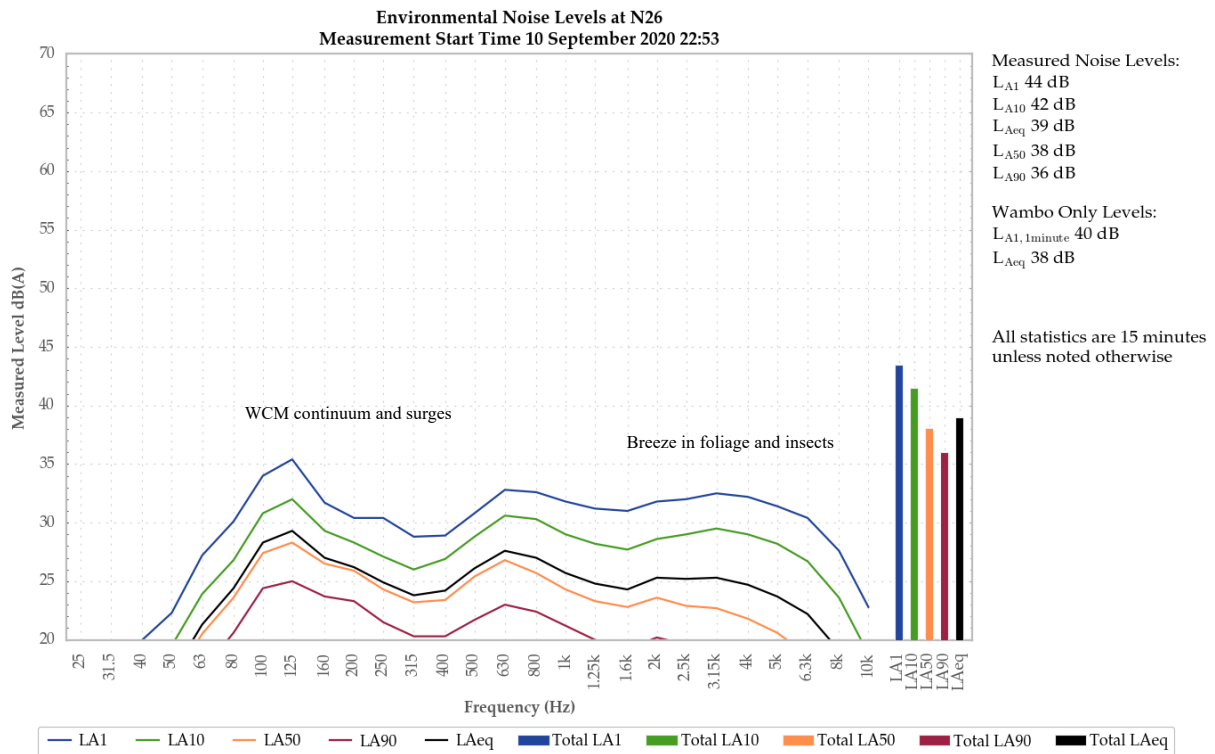


Figure 10: Environmental Noise Levels, N26 – Redmanvale Road South

A mining continuum from WCM was audible throughout the measurement, and generated a site-only LAeq,15minute of 38 dB. Surges in the continuum generated the site-only LA1,1minute of 40 dB.

WCM continuum combined with breeze in foliage and insects to generate the measured noise levels.

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 of 8/9 and 10/11 September 2020 at five monitoring locations.

Noise levels from WCM and WCRS complied with relevant criteria at all monitoring locations during the September 2020 survey, with the exception of N26.

During the N26 measurement starting at 22:00 on the night of 8/9 September 2020, a mining continuum and dozer tracks from WCM were audible throughout the measurement, generating a site-only L_{Aeq} of 39 dB. Surges in the continuum generated the site-only $L_{A1,1minute}$ of 45 dB.

A low-frequency modifying factor of 2 dB was applicable, resulting in a site-only L_{Aeq} of 41 dB which exceeded the L_{Aeq} criterion by 3 dB. Due to discrepancies between noise criteria at the monitoring location compared to noise criteria at nearby residences, this measurement represents a 1 dB exceedance of the site-only L_{Aeq} criterion at property 345. Site-only noise levels should not have exceeded relevant noise criteria at other properties in the area.

A second measurement was conducted within 75 minutes of the first measurement. Levels during this measurement met the relevant criteria. Follow-up monitoring was conducted within a week of the exceedance measurement.

During N26 follow-up monitoring taken at 22:03 on the night of 10/11 September 2020, a mining continuum from WCM was audible throughout the measurement, generating a site-only $L_{Aeq,15minute}$ of 39 dB. Surges in the continuum generated the site-only $L_{A1,1minute}$ of 41 dB. Engine surges were also noted.

A low-frequency modifying factor of 2 dB was applicable, resulting in a site L_{Aeq} of 41 dB which exceeded the L_{Aeq} criterion by 3 dB. Due to discrepancies between noise criteria at the monitoring location compared to noise criteria at nearby residences, this measurement represents a 1 dB exceedance of the site-only L_{Aeq} criterion at property 345. Site-only noise levels should not have exceeded relevant noise criteria at other properties in the area.

A second measurement was conducted within 75 minutes of the first measurement. Levels during this measurement met the relevant criteria.

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

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

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

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.

ACQUISITION UPON REQUEST

- C1. Upon receiving a written request for acquisition from the owner of the privately-owned land^a listed in Table 3, the Applicant must acquire the land in accordance with the procedures in conditions C3 to C10, inclusive.

Table 3: Land subject to acquisition upon request

R019

^a The location of the land referred to in Table 3 is shown on the figure in Appendix 3.

A.3 ENVIRONMENT PROTECTION LICENCE 529

L5 Noise limits

L5.1 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.

Receiver Land Number	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LA1(1 minute)
EPA Point 20 in NMG1	40	40	40	50
EPA Point 21 in NMG2	40	40	40	50
EPA Point 22 in NMG3	40	40	40	50
EPA Point 23 in NMG4	38	38	38	50
Residence 019	59	59	59	
Residence 003 and 025 in NMG3	40	40	40	50
Residence 016 and 039 in NMG1	40	40	40	50
Residence 029, 042 and 345 in NMG4	40	40	40	50
Residence 033 and 320 in NMG2	40	40	40	50
Residence 006 and 007 in NMG3	39	39	39	50
Residence 048 and 343	39	39	39	50
Residence 017 in NMG1	38	38	38	50
Residence 030, 035, 049, 075 and 379	38	38	38	50
Residence 346 and 348 in NMG4	38	38	38	50
Residence 344 in NMG2	37	37	37	50
Residence 043, 163, 380 and 381	37	37	37	50
All other privately owned residences in Appendix 4 of DA 305-7-2003 29 August 2019	35	35	35	50

- L5.2 Limits and Residences referenced in condition L5.1 are from Appendix 4 and Table 3 - Phase 1 in DA 305-7-2003 dated 29 August 2019 (EPA Reference DOC19/1117963).
- L5.3 Noise monitoring groups (NMG) referenced in Condition 5.1 are from the document titled "*Wambo Coal Mine Noise Monitoring Groups Noise Modelling Evaluation*" Global Acoustics dated 16 August 2019, EPA Reference DOC19/704212.
- L5.4 For the purpose of Condition L5.1:
- 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; and
 - c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.
- L5.5 The noise limits set out in condition L5.1 apply under all meteorological conditions except for the following:
- a) Wind speeds greater than 3 metres/second at 10 metres above the ground level;
 - b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
 - c) Stability category G temperature inversion conditions.
- L5.6 For the purposes of condition L5.5:
- a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 17 must be used to determine meteorological conditions; and
 - b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017).

M10 Noise monitoring

M10.1 To assess compliance with the noise limits specified within this licence, the licensee must undertake operator attended noise monitoring at each specified noise monitoring point in accordance with the table below.

POINT 20,21,22,23

Assessment period	Minimum frequency in a reporting period	Minimum duration within assessment period	Minimum number of assessment period
Night	Monthly	15 minutes	1 operation day

M10.2 To assess compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with Conditions L5.4 to L5.6:

- a) at the EPA points 20,21,23 and 23 identified in P1.3;
- b) occur every calendar month in a reporting period; and
- c) occur during one night time period as defined in the Noise Policy for Industry 2017 for a minimum of 15 minutes at each location from a), and when relevant b) during the night.

M10.3 For the purposes of compliance monitoring and determining the noise generated at the premises the modification factors in the EPA's Fact Sheet C of the Noise Policy for Industry (2017) must be applied, as appropriate, to the noise levels measured by noise monitoring equipment.

Definitions

Noise refers to 'sound pressure levels' for the purpose of conditions L5.1 to L5.6 and condition M10.

A.4 WCM Noise Management Plan

5.0 Noise Monitoring Program

5.1 Noise Monitoring Network

WCPL has established a noise monitoring network to assess the noise performance of the operation against the noise impact assessment criteria provided in **Section 3.1**. The noise monitoring network (refer to **Table 6** and **Figure 5**) consists of:

- Four real time noise monitors (unattended noise monitoring); and
- Six attended noise monitoring locations.

The location and type of monitoring equipment in the noise monitoring network has been strategically chosen and positioned around the operation to provide noise monitoring coverage.

Table 6: Attended and Unattended Noise Monitoring Locations

Site Ref	Residence	Type	Location	Frequency	Approximate Co-ordinates (MGA 94, z56)	
					Northing	Easting
N01	Wambo Road Residence	Attended	Mine & Rail Spur	Monthly	6388696	313352
N03	Kelly Residence	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly	6394362	314207
N16	Jerrys Plains Road	Attended	Mine	Monthly	6399785	306000
N20A	Redmanvale Road Central	Attended	Mine	Monthly	6399100	304666
N20	Redmanvale Road Central	Real-Time	Mine	Continuous	6398504	304518
N21	Wambo South	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly	6390149	310586
N26	Redmanvale Road South	Attended	Mine	Monthly	6398160	304172

5.3 Attended Noise Monitoring

WCPL attended noise monitoring has been carried out monthly since January 2014. The monitoring is conducted by a WCPL appointed acoustic specialist who measures and describes the acoustic environment at each attended monitoring location. The attended noise monitoring results are compared with noise impact assessment criteria (as defined in **Section 3.1**) to assess compliance. Attended noise monitoring is considered the preferred method for determining compliance with prescribed limits because it allows for an accurate determination of the contribution, if any, made by industrial noise sources to measured ambient noise levels.

Operator attended noise measurements are conducted during night period² operations to quantify noise emissions from WCPL as well as the overall level of ambient noise.

Noise levels (LA_{max} and LA_{eq}) from the Mine are quantified over a 15 minute measurement period. In addition, the overall levels of ambient noise (i.e. LA_{max} , LA_1 , LA_{10} , LA_{50} , LA_{90} , and LA_{eq}) over the 15 minute period will be quantified and characterised.

Attended noise monitoring will be conducted at a representative location in accordance with the NPfl and Australian Standard AS 1055 '*Acoustics, Description and Measurement of Environmental Noise*'.

In accordance with Condition 7B, Schedule 4 of DA 177-8-2004, quarterly attended monitoring at the Kelly residence (N03) was undertaken to coincide with train refuelling, during the first 12 months of operation of the Wambo rail loop³ locomotive provisioning facility. Following a demonstrated history of compliance, the monitoring has ceased. Monitoring will be reactivated if triggered by a resident complaint or a significant change or amendment to the approved operations at the locomotive provisioning facility.

Measurement of rail pass-by noise levels was removed from the monitoring program in Version 5 of the NMP, following a demonstrated history of compliance. Monitoring will be recommenced if triggered by complaint, or change in rolling stock used to transport coal from WCPL.

Meteorological data from the WCPL meteorological station will be utilised to correlate atmospheric parameters and measured noise levels. Ground level atmospheric condition measurement is also undertaken during attended monitoring. Noise criteria only apply in meteorological conditions specified in the conditions (**Section 3.1**).

The modified DEFRA method (as described in Downey and Parnell [2017]) will be used to identify noise from the Mine with dominant low frequency content. Modifying factors will be applied in accordance with the NPfl.

APPENDIX

B CALIBRATION CERTIFICATES



Octave Band Filter AS 4476:1997 Calibration Certificate

Calibration Number C19214A

Client Details Acoustic Research Labs Pty Ltd
36/14 Loyalty Rd
North Rocks NSW 2151

Filter Model Number : Rion NA-28
Filter Serial Number : N/A
Instrument Serial Number : 30921838
Microphone Serial Number : 04128
Pre-amplifier Serial Number : 11893

Atmospheric Conditions

Ambient Temperature : 24°C
Relative Humidity : 40.9%
Barometric Pressure : 101.56kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 12 Apr 2019
Secondary Check: Max Moore
Report Issue Date : 11 Sep 2020

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
4.4 & 5.3: 1/1 Octave relative attenuation	Pass	4.6 & 5.5: Linear operating range	Pass
4.4 & 5.3: 1/3 Octave relative attenuation	Pass	4.8 & 5.7: Anti-alias filters	Pass
		4.10 & 5.9: Flat frequency response	Pass

The fractional octave band meter under test has been shown to conform to the class 1 requirements for periodic testing as described in AS 4476:1997 for the tests stated above.

Electrical Tests		Least Uncertainties of Measurement - Environmental Conditions	
< 16Hz	±0.19dB	Temperature	±0.2°C
16Hz-100Hz	±0.12dB	Relative Humidity	±2.4%
100Hz-1000Hz	±0.1dB	Barometric Pressure	±0.015kPa
1000Hz-10kHz	±0.1dB		
>10kHz	±0.1dB		

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 SI units.

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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Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
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 C20331

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 : 21.1°C
Relative Humidity : 57.8%
Barometric Pressure : 101.27kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 21.8°C
Relative Humidity : 56.5%
Barometric Pressure : 101.17kPa

Calibration Technician : Jeff Yu
Calibration Date : 11 Jun 2020

Secondary Check: Max Moore
Report Issue Date : 15 Jun 2020

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
123Hz	±0.15dB	Relative Humidity	±2.4%
1kHz	±0.15dB	Barometric Pressure	±0.015kPa
8kHz	±0.14dB		
Electrical Tests	±0.10dB		

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 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
11.3 Hz to 8kHz	±0.13dB	Relative Humidity	±2.4%
12.5kHz	±0.2dB	Barometric Pressure	±0.015kPa
16kHz	±0.29dB		
Electrical Tests			
31.3 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 Calibrator

IEC 60942-2017

Calibration Certificate

Calibration Number C20308

Client Details Acoustic Research Labs Pty Ltd
Unit 36, 14 Loyalty Road
North Rocks NSW 2151

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

Atmospheric Conditions

Ambient Temperature : 22°C
Relative Humidity : 52.1%
Barometric Pressure : 101.2kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 27 May 2020
Secondary Check: Max Moore
Report Issue Date : 29 May 2020

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
94	1000	93.98	1000.10
114	1000	114.04	1000.10

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	±0.14dB	Temperature	±0.2°C
Frequency	±0.09%	Relative Humidity	±2.4%
Distortion	±0.09%	Barometric Pressure	±0.015kPa

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

* The tests <1000 kHz are not covered by Acoustic Research Labs Pty Ltd 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.
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Sound Calibrator
IEC 60942-2017
Calibration Certificate

Calibration Number C20332

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 : 21.5°C
Relative Humidity : 56.9%
Barometric Pressure : 101.46kPa

Calibration Technician : Jeff Yu
Calibration Date : 10 Jun 2020
Secondary Check: Max Moore
Report Issue Date : 15 Jun 2020

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
94	1000	93.96	1000.70

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	±0.14dB	Temperature	±0.2°C
Frequency	±0.09%	Relative Humidity	±2.4%
Distortion	±0.09%	Barometric Pressure	±0.015kPa

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

* The tests <1000 kHz are not covered by Acoustic Research Labs Pty Ltd 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

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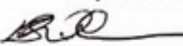
**Acoustic
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Sound Calibrator
IEC 60942-2017

Calibration Certificate

Calibration Number C20155

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Dr Thornton NSW 2322
Equipment Tested/ Model Number : Instrument Serial Number :	Pulsar Model 105 78226
Atmospheric Conditions	
Ambient Temperature :	23.4°C
Relative Humidity :	53.8%
Barometric Pressure :	101.2kPa
Calibration Technician :	Lucky Jaiswal
Calibration Date :	11 Mar 2020
Secondary Check:	Alannah Squires
Report Issue Date :	12 Mar 2020
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
94	1000	94.13	1000.37

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.

Specific Tests	Least Uncertainties of Measurement - Environmental Conditions		
	Generated SPL	Frequency	Distortion
	$\pm 0.14\text{dB}$	$\pm 0.09\%$	$\pm 0.09\%$
	Temperature	Relative Humidity	Barometric Pressure
	$\pm 0.2^\circ\text{C}$	$\pm 2.4\%$	$\pm 0.015\text{kPa}$

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

* The tests <1000 kHz are not covered by Acoustic Research Labs Pty Ltd NATA accreditation.



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 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
Ambient Temperature : 23.6°C
Relative Humidity : 42.6%
Barometric Pressure : 98.42kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 22.4°C
Relative Humidity : 42.4%
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 61672-3:2013, 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	±0.31dB	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.



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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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Sound Calibrator
IEC 60942-2017
Calibration Certificate

Calibration Number C20082

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	Pulsar Model 106
Instrument Serial Number :	81334
Atmospheric Conditions	
Ambient Temperature :	24.6°C
Relative Humidity :	48.9%
Barometric Pressure :	99.8kPa
Calibration Technician :	Lucky Jaiswal
Calibration Date :	12 Feb 2020
Secondary Check:	Max Moore
Report Issue Date :	13 Feb 2020
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	94.1	1000.35

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		Environmental Conditions	
Generated SPL	±0.14dB	Temperature	±0.2°C
Frequency	±0.01%	Relative Humidity	±2.4%
Distortion	±0.5%	Barometric Pressure	±0.015kPa

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

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

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