Rix's Creek Coal Mine

Environmental Noise Monitoring

December 2017

Prepared for

Rix's Creek Pty Limited

Global Acoustics

Noise and Vibration Analysis and Solutions

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EXECUTIVE SUMMARY

Global Acoustics was engaged by Rix's Creek Mine to conduct a noise survey around their operations, situated less than 10 kilometres north-west of Singleton, NSW. The mine comprises the original Rix's Creek Mine (RCM), now known as Rix's Creek South (RCS), and the former Integra Open Cut Project Mine, now known as Rix's Creek North (RCN).

Attended environmental noise monitoring described in this report was undertaken during the night period of 5/6 December 2017. The duration of each measurement was 15 minutes.

The purpose of the survey was to quantify and describe the acoustic environment around both operations and compare results with noise criteria outlined in the Rix's Creek Noise Management Plan (NMP).

Operational Noise Assessment

Noise levels from RCM complied with relevant criteria at all monitoring locations during the December 2017 monitoring survey.

Wind speed and/or calculated temperature inversion conditions resulted in development consent criteria not being applicable at several locations.

Low Frequency Noise Assessment

A low frequency assessment was carried out in accordance with the EPA 'Noise Policy for Industry' (NPfI). Low frequency modifying factors, where applicable, did not result in any exceedances of RCM noise limits during the December survey.

Global Acoustics Pty Ltd

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Rix's Creek Mine to conduct a noise survey around their operations, situated less than 10 kilometres north-west of Singleton, NSW. The mine comprises the original Rix's Creek Mine (RCM), now known as Rix's Creek South (RCS), and the former Integra Open Cut Project Mine, now known as Rix's Creek North (RCN).

The purpose of the survey was to quantify and describe the acoustic environment around both operations and compare results with noise criteria outlined in the Rix's Creek Noise Management Plan (NMP).

Environmental noise monitoring described in this report was undertaken during the night of 5/6 December 2017.

1.2 Attended Noise Monitoring Locations

In accordance with the NMP, there are a total of ten monitoring locations as detailed in Table 1.1 and shown on Figure 1. It should be noted that this figure shows the actual monitoring position, not the location of residences. Monitoring is not always undertaken at all locations during each month. Further explanation is provided in Section 3.2 of this report.

Table 1.1: ATTENDED NOISE MONITORING LOCATIONS

Location Descriptor ID	EA Reference (RCN/RCS)[1]	Owner or Area	Monitoring Location
NM1	132/171	Bowman	End of Glennie Street, Camberwell
NM2	91/NA	Olofsson	Glennie Creek Road, Camberwell
NM3	47/NA	Cherry	893 Middle Falbrook Road, Middle Falbrook
NM4	19/12	Andrews	997 Bridgman Road, Bridgman
NM5	11/8	Ferraro	788 Bridgman Road, Obanvale
NM6	145/19	Murray	427 Bridgman Road, Obanvale
NM7	NA/61	Gardiner Circuit	McMahon Way, Singleton Heights
NM8	NA/152	Belmadar Way	Cnr Belmadar Way and Maison Dieu Road, Maison Dieu
NM9	NA/121	Llanrian Drive	Llanrian Drive, Gowrie
NM10[2]	NA/135	Long Point	End of Dights Crossing Road, Maison Dieu

Notes:

1. *NA indicates location was not included in the EA for that project; and*
2. *An offset correction has been applied to this measurement as the actual monitoring location is closer to RCM than the area it represents.*

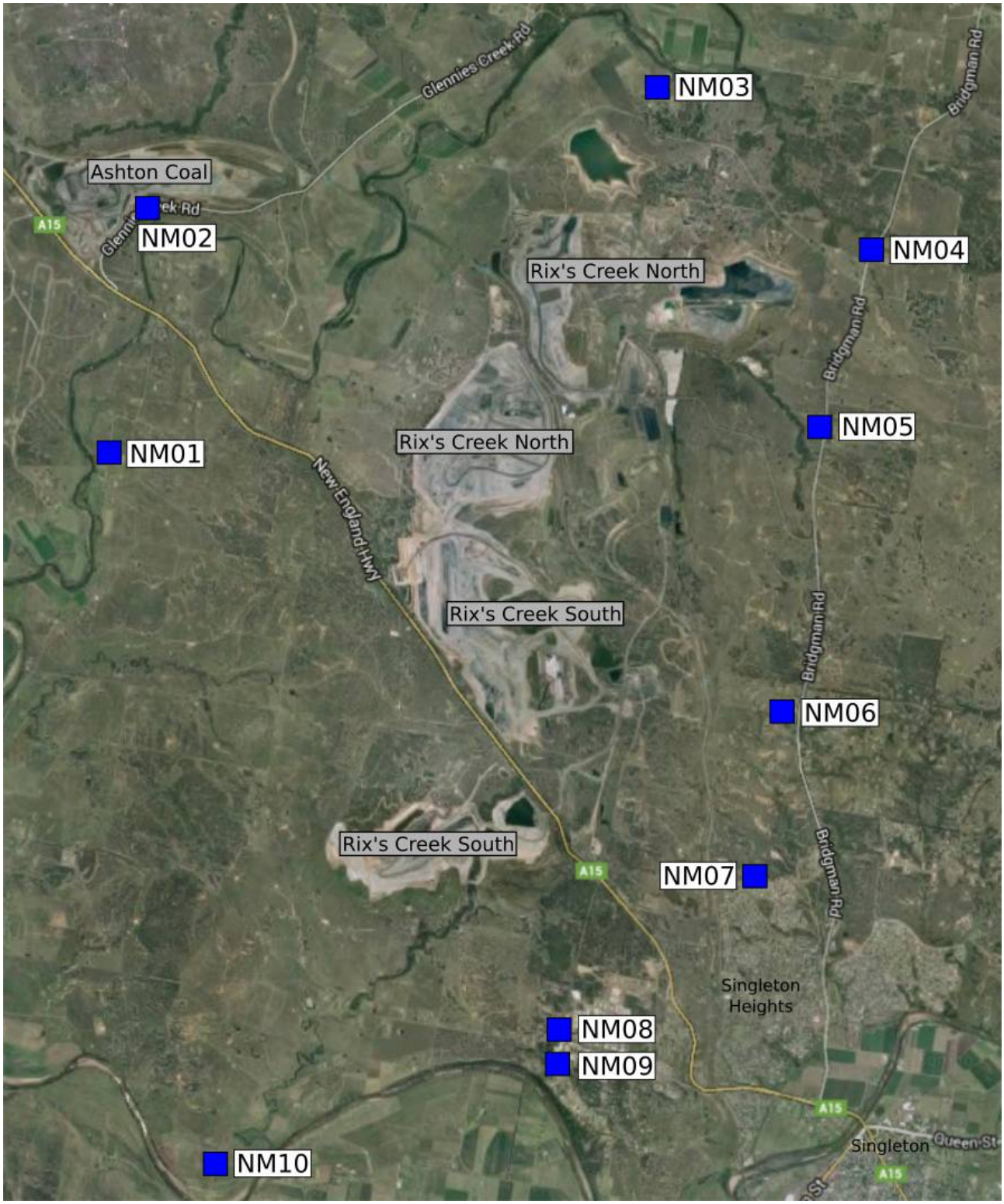


Figure 1: RCM Attended Noise Monitoring Locations

1.3 Terminology and Abbreviations

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

Table 1.2: TERMINOLOGY AND ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{Amax}	The maximum A-weighted noise level over a time period or for an event
L_{A1}	The noise level which is exceeded for 1 per cent of the time
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L_{A50}	The noise level which is exceeded for 50 per cent of the time
L_{A90}	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes.
L_{Amin}	The minimum A-weighted noise level over a time period or for an event
L_{Aeq}	The average noise energy during a measurement period
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude
IA	Inaudible. When site only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

2 PROJECT CONSENT AND CRITERIA

2.1 Project Specific Criteria

Compliance criteria are detailed in Table 2.1 and sourced from Rix's Creek NMP, approved in February 2016. $L_{Aeq,15minute}$ criteria are applicable for the day (0700 to 1800), evening (1800 to 2200) and night (2200 to 0700) periods. $L_{A1,1minute}$ criteria are applicable for the night period only.

As stated in the Rix's Creek NMP, attended monitoring is to be undertaken during the night period only, with monitoring to commence at 9pm and results compared to all criteria.

Table 2.1: RIX'S CREEK IMPACT ASSESSMENT CRITERIA, dB

	Rix's Creek North (RCN) [1,3]		Rix's Creek South (RCS) [1,3]	
Location Descriptor ID	**$L_{Aeq,15minute}$**	**$L_{A1,1minute}$**	**$L_{Aeq,15minute}$**	**$L_{A1,1minute}$**
NM1	38	48	40	48
NM2	40	47	40	47[2]
NM3	39	45	NA	NA
NM4	37	49	42	48
NM5	41	47	42	48
NM6	36	48	42	47
NM7	NA	NA	40	45
NM8	NA	NA	40	47
NM9	NA	NA	40	47
NM10	NA	NA	40	47

Notes:

1. *Criteria applicable for the night period only (10:00pm to 7:00am), however, as stated in the Rix's Creek NMP, attended monitoring undertaken during the night will commence at 9:00pm;*
2. *Criterion set as for Rix's Creek North in absence of data in EIS; and*
3. *NA indicates criteria not applicable at that location, as it was not included in the relevant EA, EIS, or Project Approval.*

2.2 Meteorological Conditions

The RCM NMP and Environment Protection License (EPL 3391, December 2015) outlines required meteorological conditions for criteria to be applicable during attended noise monitoring:

> L3.5 The noise emission limits identified in this licence apply under all meteorological conditions of:
> a) Wind speeds up to 3m/s at 10 metres above the ground level; or
> b) Temperature inversion conditions of up to 3oC/100m and wind speed up to 2m/s at 10 metres above the ground.

2.3 Modifying Factors

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

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

2.3.1 Tonality and Intermittent Noise

As defined in the Noise Policy for Industry:

> *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.*

There were no intermittent noise sources from site during the survey. In addition, there is no equipment on site that is likely to generate tonal noise as defined in the NPfI.

2.3.2 Low Frequency Noise

As defined in the Noise Policy for Industry:

> *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

Noise monitoring was conducted at the monitoring locations in accordance with the EPA NPfI and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits; it allows an accurate determination of the contribution, if any, to measured noise levels by the source of interest, RCM.

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

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods as per section 7.1 of the NPfI (e.g. measuring at an intermediate location and using relevant calculation) to determine a value for reporting.

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

- site noise levels were extremely low and unlikely, in many cases, to be even noticed;
- site noise levels were masked by another relatively loud noise source that is characteristic of the environment (e.g. breeze in foliage or continuous road traffic noise) that cannot be eliminated by moving closer; and/or
- it was not feasible or reasonable to employ NPfI methods such as using an intermediate location. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

A measurement of $L_{A1,1minute}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level, or L_{Amax}, received from the site during the entire measurement period (i.e. the highest level of the worst minute during the 15-minute measurement).

3.2 Attended Noise Monitoring

Due to the number and distance between monitoring locations in the NMP, it is not possible to determine compliance at each individual residence. As a result a risk-based assessment has been adopted where attended noise monitoring targets locations where operational noise from RCM is likely to be highest. Residences surrounding RCM have been grouped generally according to the locality and local acoustic environment. These groups are referenced in the relevant EAs as Noise Assessment Groups (NAG).

Compliance monitoring is undertaken in accordance with the following procedure outlined in the NMP:

> Compliance monitoring is to be conducted at locations indicated as being in the zone of meteorological enhancement by the predictive noise model. The procedure for determining which locations to monitor is as follows:
>
> 1. The acoustic consultant undertaking the monitoring will access the predictive model website for the site for the upcoming night shift. The model results will indicate graphically the predicted zone of meteorological enhancement;
> 2. A monitoring plan will be developed by the consultant for the upcoming night period. Locations are to include:
>
> a. If a clear zone of meteorological enhancement is indicated, one location in the opposite direction to the zone of predicted enhancement, and, all locations located within the predicted zone of enhancement; and
>
> b. If relatively neutral conditions are predicted with no clear zone of meteorological enhancement, the eight locations nearest the mine will be monitored. NM01, NM03 and NM10 would be excluded, as non-compliance at those locations in the absence of meteorological enhancement is unlikely due to distance from the Mine.
>
> 3. A minimum of six locations are to be monitored per night.
>
> Once monitoring commences, the consultant will apply best judgment to either proceed with the original monitoring plan, or a modified plan if monitoring results justify a change.

Other relevant sections of the NMP regarding attended noise monitoring are provided in Appendix A.

3.3 Meteorological Data

One on-site Automatic Weather Station (AWS) is currently located within each of the RCS and RCN mining lease areas. Each complies with AS2923-1987 'Ambient Air – Guide for measurement of horizontal wind for air quality applications' and the NPfI. These automatic weather stations provide representative weather data for RCM including wind speed and direction, sigma theta, solar radiation, humidity, rainfall and temperature.

Weather data is used to determine the validity of noise monitoring results in accordance with the NPfI. Wind speed and rain data is used for this purpose. Extreme temperature inversions is considered G-class inversions, as determined by use of sigma theta and wind speed to categorise inversion strength, in accordance with the NPfI.

For the purpose of determining valid meteorological conditions for which noise criteria apply:

- The Rix's Creek South AWS will be used for assessment of Rix's Creek South; and
- The Rix's Creek North AWS will be used for assessment of Rix's Creek North.

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 RCM at the monitoring locations are unlikely to be intermittent or tonal.

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

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

The equipment detailed in Table 3.1 was used to measure environmental noise levels. 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	01070590	28/06/2018
Rion NA-28 sound level analyser	00370304	16/11/2018
Rion NC73 acoustic calibrator	11248300	10/10/2019
Pulsar 106 acoustic calibrator	79631	30/03/2019

4 RESULTS

On the night environmental monitoring was conducted, enhancement was predicted to the North and North-West. As a result, check monitoring was conducted at NM08 to the South, followed by monitoring at NM06, NM05, NM04, NM03, NM02 and NM01 (moving from the East through to the North and to the West).

4.1 Overall Noise Levels

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

Table 4.1: MEASURED NOISE LEVELS – DECEMBER 2017[1]

Location	Start Date and Time[2]	L_{Amax} dB	L_{A1} dB	L_{A10} dB	L_{A50} dB	L_{Aeq} dB	L_{A90} dB	L_{Amin} dB	L_{Ceq} dB
NM01	5/12/2017 21:18	51	44	40	38	38	36	34	56
NM02	5/12/2017 21:48	66	57	52	43	48	37	34	58
NM03	5/12/2017 23:40	51	44	41	40	40	38	37	57
NM04	5/12/2017 23:15	48	46	36	31	35	28	26	49
NM05	5/12/2017 22:38	46	44	42	40	41	39	35	52
NM06	5/12/2017 22:07	79	48	45	39	47	36	34	53
NM08	5/12/2017 21:37	51	46	42	39	40	37	35	56

Notes:

1. *Levels in this table are not necessarily the result of activity at RCM; and*
2. *All measurements are 15 minutes duration.*

4.2 Rix's Creek North

Noise levels generated by activity at RCN are shown in Table 4.2 and Table 4.3. Table 4.2 compares measured levels with $L_{Aeq,15minute}$ impact assessment criteria. Criteria are then applied if weather conditions are in accordance with relevant limits. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY RCN AGAINST IMPACT ASSESSMENT CRITERIA – DECEMBER 2017

Location	Start Date and Time	Wind Speed m/s	Wind Direction	VTG °C/100m[1]	$L_{Aeq,15min}$ Criterion dB[6]	Criterion Applies?[2,6]	RCN $L_{Aeq,15min}$ dB [3,4,5]	Exceedance [6]
NM01	5/12/2017 21:18	3.8	169	-1.0	38	No	IA	NA
NM02	5/12/2017 21:48	2.1	175	0.5	40	No	IA	NA
NM03	5/12/2017 23:40	1.4	211	-1.0	39	Yes	<30	Nil
NM04	5/12/2017 23:15	2.5	203	-1.0	37	Yes	<30	Nil
NM05	5/12/2017 22:38	2.0	172	3.0	41	No	<30	NA
NM06	5/12/2017 22:07	1.9	181	0.5	36	Yes	NM	Nil
NM08	5/12/2017 21:37	3.1	164	-1.0	NA	No	IA	NA

Notes:

1. *Sigma theta data used to calculate Vertical Temperature Gradient (VTG) in accordance with procedures outlined in the NPfI;*
2. *Noise emission criteria apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *These are results for RCN in the absence of all other noise sources;*
4. *NM denotes audible but not measurable, IA denotes inaudible;*
5. *Bold results in red are those greater than the relevant criterion (if applicable);*
6. *NA in criterion applies and exceedance columns mean atmospheric conditions outside conditions specified or limits not available for that location and so criterion is not applicable, NA in $L_{Aeq,15minute}$ criterion column means criterion not specified for this location; and*
7. *An offset correction of -1.3dB has been applied to the measurement at NM09 where audible and measurable.*

Table 4.3 compares measured levels with RCN $L_{A1,1minute}$ impact assessment criteria. Criteria are then applied if weather conditions are in accordance with relevant limits.

Table 4.3: $L_{A1,1minute}$ GENERATED BY RCN AGAINST IMPACT ASSESSMENT CRITERIA – DECEMBER 2017

Location	Start Date and Time	Wind Speed m/s	Wind Direction	VTG °C/100m[1]	$L_{A1,1min}$ Criterion dB[6]	Criterion Applies?[2,6]	RCN $L_{A1,1min}$ dB [3,4,5]	Exceedance [6]
NM01	5/12/2017 21:18	3.8	169	-1.0	48	No	IA	NA
NM02	5/12/2017 21:48	2.1	175	0.5	47	No	IA	NA
NM03	5/12/2017 23:40	1.4	211	-1.0	45	Yes	33	Nil
NM04	5/12/2017 23:15	2.5	203	-1.0	49	Yes	30	Nil
NM05	5/12/2017 22:38	2.0	172	3.0	47	No	<30	NA
NM06	5/12/2017 22:07	1.9	181	0.5	48	Yes	NM	Nil
NM08	5/12/2017 21:37	3.1	164	-1.0	NA	No	IA	NA

Notes:

1. *Sigma theta data used to calculate Vertical Temperature Gradient (VTG) in accordance with procedures detailed in the NPfI;*
2. *Noise emission criteria apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *These are results for RCN in the absence of all other noise sources;*
4. *NM denotes audible but not measurable, IA denotes inaudible;*
5. *Bold results in red are those greater than the relevant criterion (if applicable);*
6. *NA in criterion applies and exceedance columns mean atmospheric conditions outside conditions specified or limits not available for that location and so criterion is not applicable, NA in $L_{Aeq,15minute}$ criterion column means criterion not specified for this location; and*
7. *An offset correction of -1.3dB has been applied to the measurement at NM09 where audible and measurable.*

4.3 Rix's Creek South

Noise levels generated by activity at RCS are shown in Table 4.4 and Table 4.5. Table 4.4 compares measured levels with $L_{Aeq,15minute}$ impact assessment criteria. Criteria are then applied if weather conditions are in accordance with relevant limits. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.4: $L_{Aeq,15minute}$ GENERATED BY RCS AGAINST IMPACT ASSESSMENT CRITERIA – DECEMBER 2017

Location	Start Date and Time	Wind Speed m/s	Wind Direction	VTG °C/100m[1]	$L_{Aeq,15min}$ Criterion dB	Criterion Applies?[2,6]	RCS $L_{Aeq,15min}$ dB [3,4,5]	Exceedance [6]
NM01	5/12/2017 21:18	4.2	137	0.5	40	No	IA	NA
NM02	5/12/2017 21:48	2.8	150	0.5	40	No	IA	NA
NM03	5/12/2017 23:40	4.5	234	-1.0	Nil	No	IA	NA
NM04	5/12/2017 23:15	3.5	219	-1.0	42	No	IA	NA
NM05	5/12/2017 22:38	2.0	198	0.5	42	No	<30	NA
NM06	5/12/2017 22:07	1.5	143	0.5	42	Yes	<30	Nil
NM08	5/12/2017 21:37	3.5	136	0.5	40	No	IA	NA

Notes:

1. *Sigma theta data used to calculate Vertical Temperature Gradient (VTG) in accordance with procedures detailed in the NPfI;*
2. *Noise emission criteria apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *These are results for RCS in the absence of all other noise sources;*
4. *NM denotes audible but not measurable, IA denotes inaudible;*
5. *Bold results in red are those greater than the relevant criterion (if applicable);*
6. *NA in criterion applies and exceedance columns mean atmospheric conditions outside conditions specified or limits not available for that location and so criterion is not applicable, NA in $L_{Aeq,15minute}$ criterion column means criterion not specified for this location; and*
7. *An offset correction of -1.3dB has been applied to the measurement at NM09 where audible and measurable.*

Table 4.5 compares measured levels with RCS $L_{A1,1minute}$ impact assessment criteria. Criteria are then applied if weather conditions are in accordance with relevant limits.

Table 4.5: $L_{A1,1minute}$ GENERATED BY RCS AGAINST IMPACT ASSESSMENT CRITERIA – DECEMBER 2017

Location	Start Date and Time	Wind Speed m/s	Wind Direction	VTG °C/100m[1]	$L_{A1,1min}$ Criterion dB	Criterion Applies?[2,6]	RCS $L_{A1,1min}$ dB [3,4,5]	Exceedance [6]
NM01	5/12/2017 21:18	4.2	137	0.5	48	No	IA	NA
NM02	5/12/2017 21:48	2.8	150	0.5	47	No	IA	NA
NM03	5/12/2017 23:40	4.5	234	-1.0	NA	No	IA	NA
NM04	5/12/2017 23:15	3.5	219	-1.0	48	No	IA	NA
NM05	5/12/2017 22:38	2.0	198	0.5	48	No	39	NA
NM06	5/12/2017 22:07	1.5	143	0.5	47	Yes	<30	Nil
NM08	5/12/2017 21:37	3.5	136	0.5	47	No	IA	NA

Notes:

1. *Sigma theta data used to calculate Vertical Temperature Gradient (VTG) in accordance with procedures detailed in the NPfI;*
2. *Noise emission criteria apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *These are results for RCS in the absence of all other noise sources;*
4. *NM denotes audible but not measurable, IA denotes inaudible;*
5. *Bold results in red are those greater than the relevant criterion (if applicable); and*
6. *NA in criterion applies and exceedance columns mean atmospheric conditions outside conditions specified or limits not available for that location and so criterion is not applicable, NA in $L_{Aeq,15minute}$ criterion column means criterion not specified for this location; and*
7. *An offset correction of -1.3dB has been applied to the measurement at NM09 where audible and measurable.*

4.4 Low Frequency Noise Assessment

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

None of the measurements satisfied the conditions outlined in Section 3.4. Therefore no further assessment was undertaken.

4.5 Measured Atmospheric Conditions

Atmospheric condition data measured by the operator at each location using a Kestrel hand-held weather meter is shown in Table 4.6. Atmospheric condition data is routinely recorded on a site-by-site basis to show conditions during the monitoring period. The wind speed, direction and temperature were measured at 1.8 metres.

Table 4.6: MEASURED ATMOSPHERIC CONDITIONS – DECEMBER 2017[1,2]

Location	Start Date and Time	Temperature degrees C	Wind Speed m/s	Wind Direction Degrees	Cloud Cover 1/8s
NM01	5/12/2017 21:18	16	2.3	180	6
NM02	5/12/2017 21:48	16	1.0	150	6
NM03	5/12/2017 23:40	20	0.0	-	6
NM04	5/12/2017 23:15	17	0.0	-	4
NM05	5/12/2017 22:38	17	0.7	200	4
NM06	5/12/2017 22:07	17	0.0	-	8
NM08	5/12/2017 21:37	20	0.0	-	8

Notes:

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

Weather station data from RCN and RCS is used to determine compliance with specified noise criteria.

5 DISCUSSION

5.1 Noted Noise Sources

Table 4.1 to Table 4.5 present data gathered during attended monitoring. These noise levels are the result of many sounds reaching the sound level meter microphone during monitoring. Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of RCM's contribution, if any, to measured levels. At each receptor location, RCM's $L_{Aeq,15minute}$ and $L_{A1,1minute}$ (in the absence of any other noise) was, where possible, measured directly, or, determined by frequency analysis. Time variations of noise sources in each measurement, their temporal characteristics, are taken into account via statistical descriptors.

Other mines that may be audible at times are Ravensworth Complex, Hunter Valley Operations (HVO), Mount Thorley Warkworth (MTW), Ashton Coal and Wambo Coal mine (WCM).

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

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

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

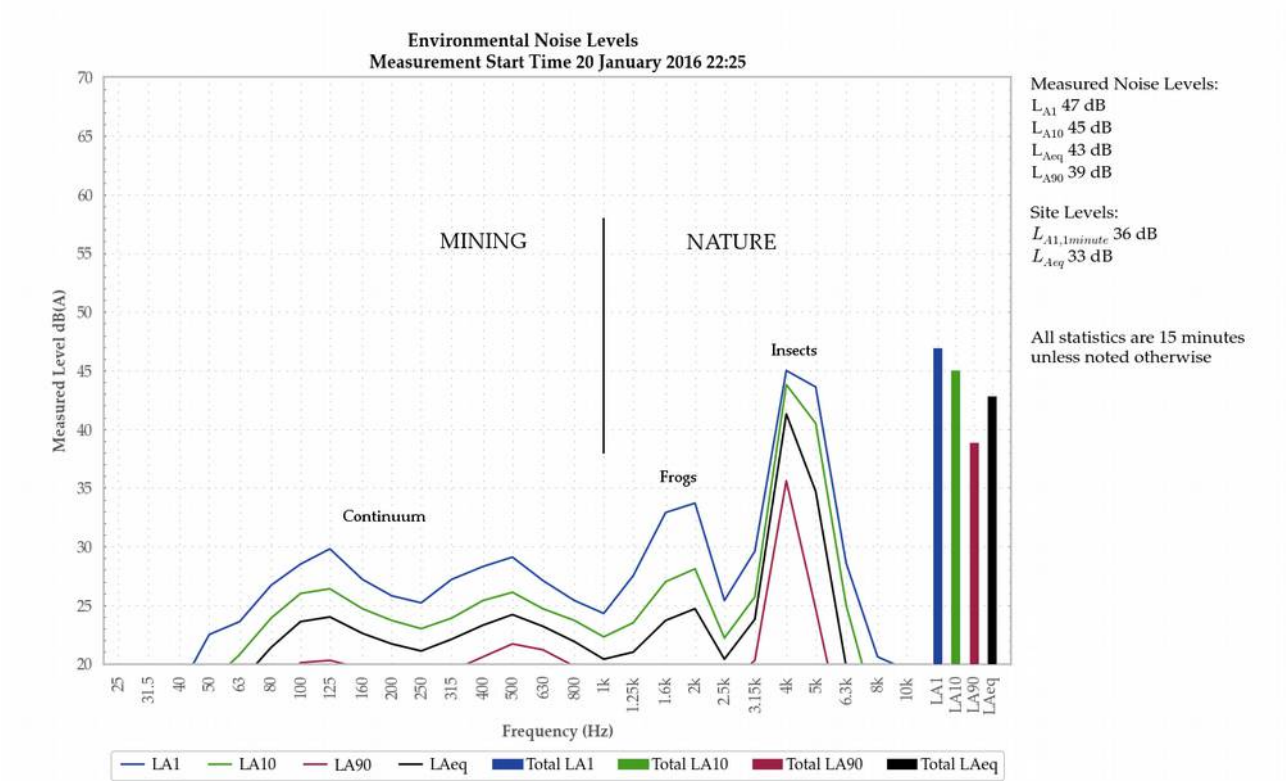


Figure 2: Sample graph (see Section 5.1 for explanation)

5.1.1 NM01 – 5 December 2017

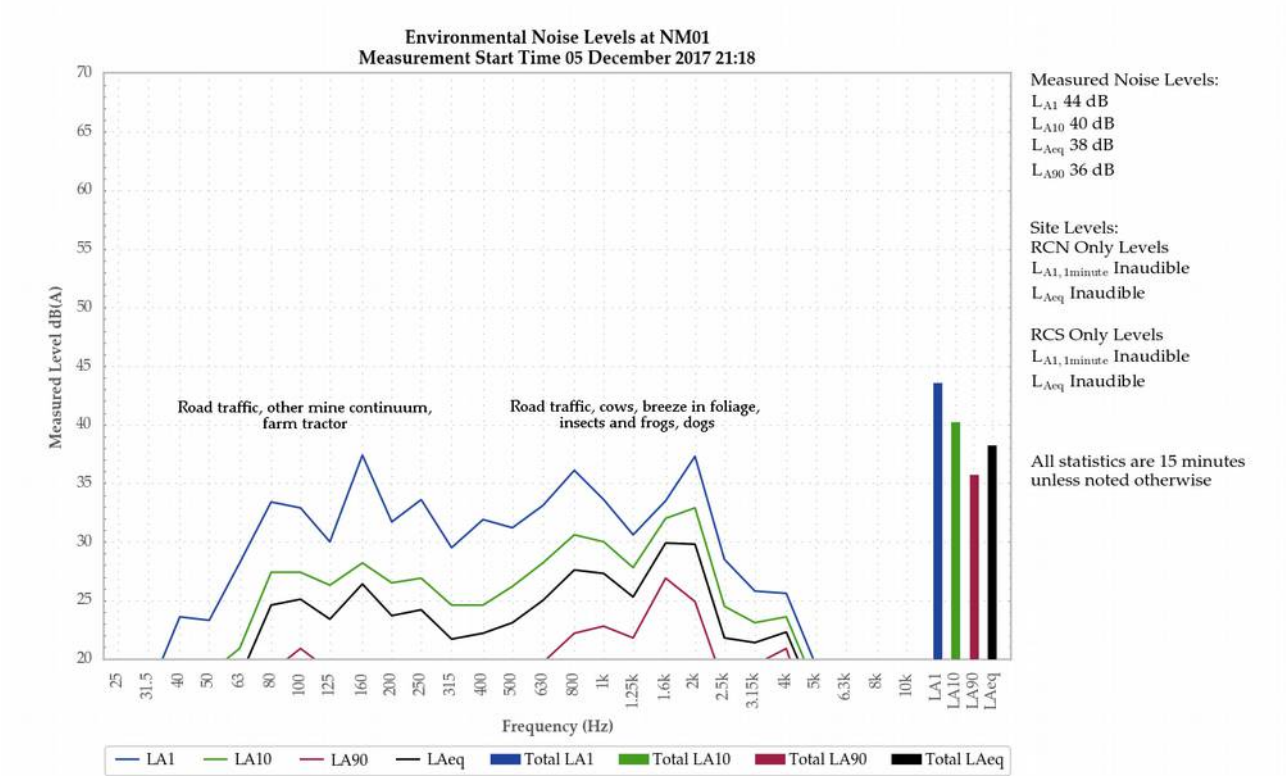


Figure 3: Environmental Noise Levels, NM01 – End of Glennie Street, Camberwell

RCM was inaudible.

Road traffic, another mine continuum, breeze in the foliage, insects and frogs were responsible for all measured levels.

Cows and dogs were also noted.

5.1.2 NM02 – 5 December 2017

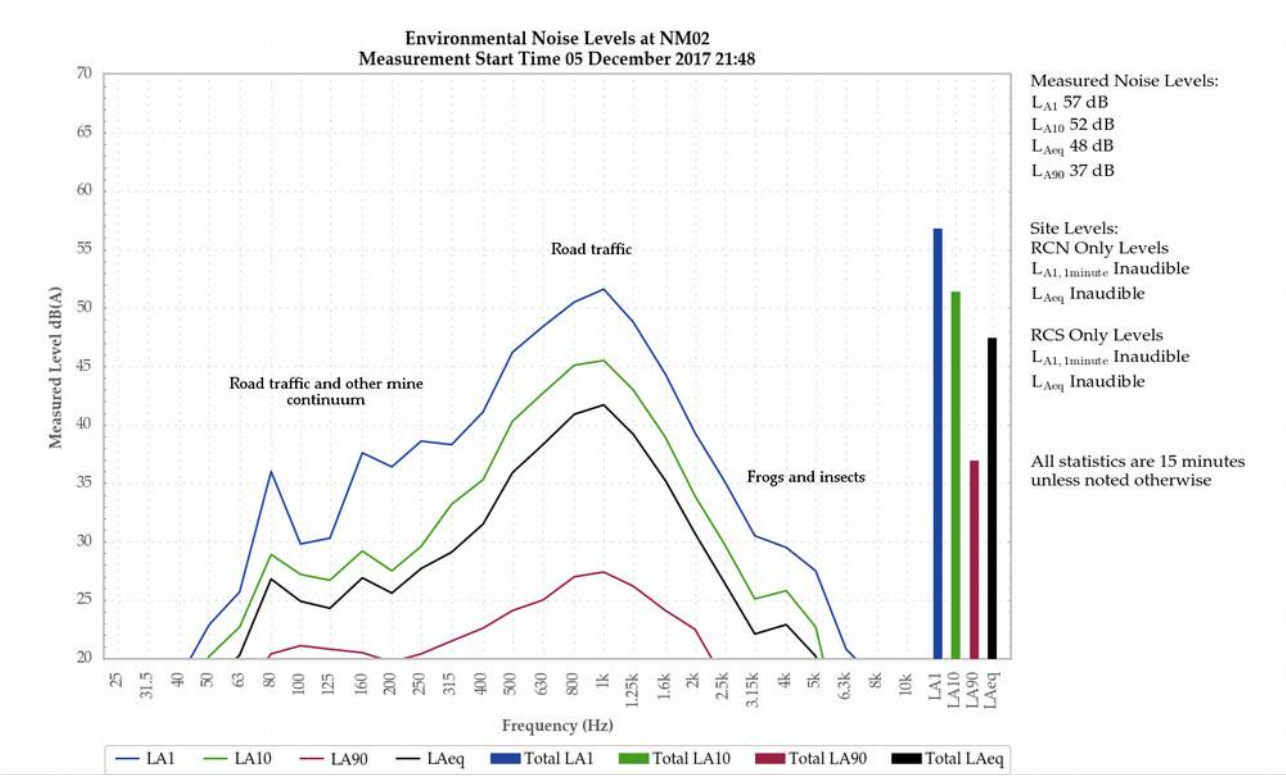


Figure 4: Environmental Noise Levels, NM02 – Glennie Creek Road, Camberwell

RCM was inaudible.

Road traffic primarily generated measured levels.

Frogs, insects and activities at another mine were also noted.

5.1.3 NM03 – 5 December 2017

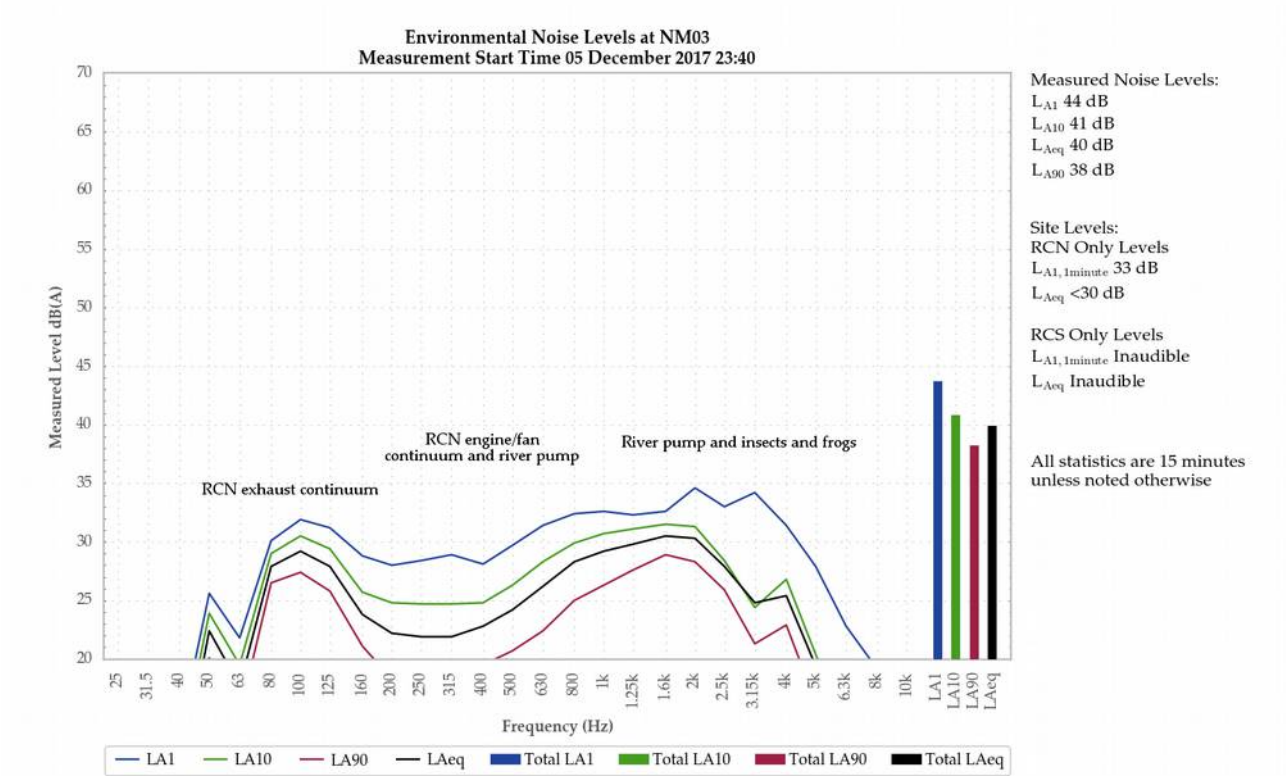


Figure 5: Environmental Noise Levels, NM03 – 893 Middle Falbrook Road, Middle Falbrook

Low-level engine continuum was audible from RCN during most of the measurement. Track noise was also noted. These sources generated the site only L_{Aeq} of less than 30 dB. A surge in the continuum generated the site only $L_{A1,1minute}$ of 33 dB.

RCS was inaudible.

Birds primarily generated the measured L_{A1}. A local continuum (thought to be a pump or equipment associated with bridge works) generated the measured L_{A10}, L_{Aeq} and L_{A90}.

Insects and frogs were also noted.

5.1.4 NM04 – 5 December 2017

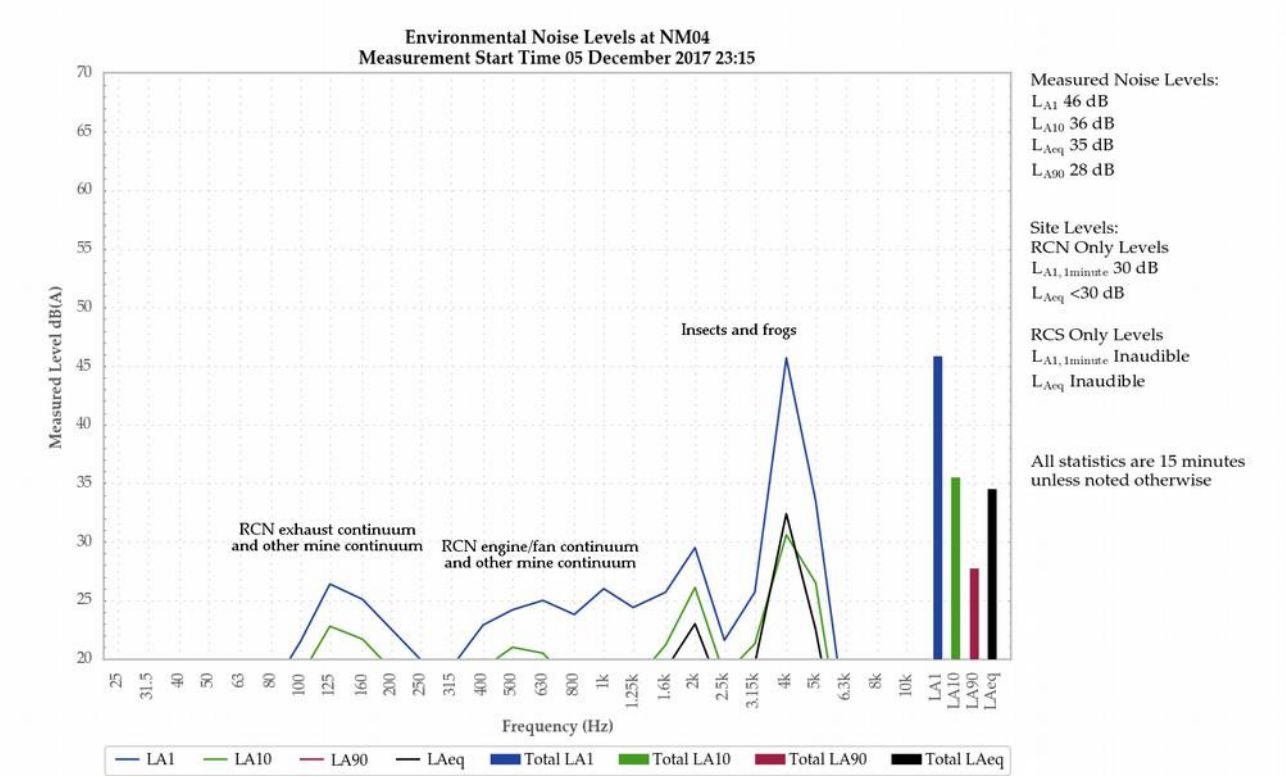


Figure 6: Environmental Noise Levels, NM04 – 997 Bridgman Road, Bridgman

A low level exhaust/engine/fan continuum and dozer track noise from RCN was audible throughout the measurement, generating the site only L_{Aeq} of less than 30 dB and $L_{A1,1minute}$ of 30 dB.

RCS was inaudible.

Insects and frogs were primarily responsible for all measured levels. RCN contributed to the measured L_{A90}.

Dogs were also noted.

5.1.5 NM05 – 5 December 2017

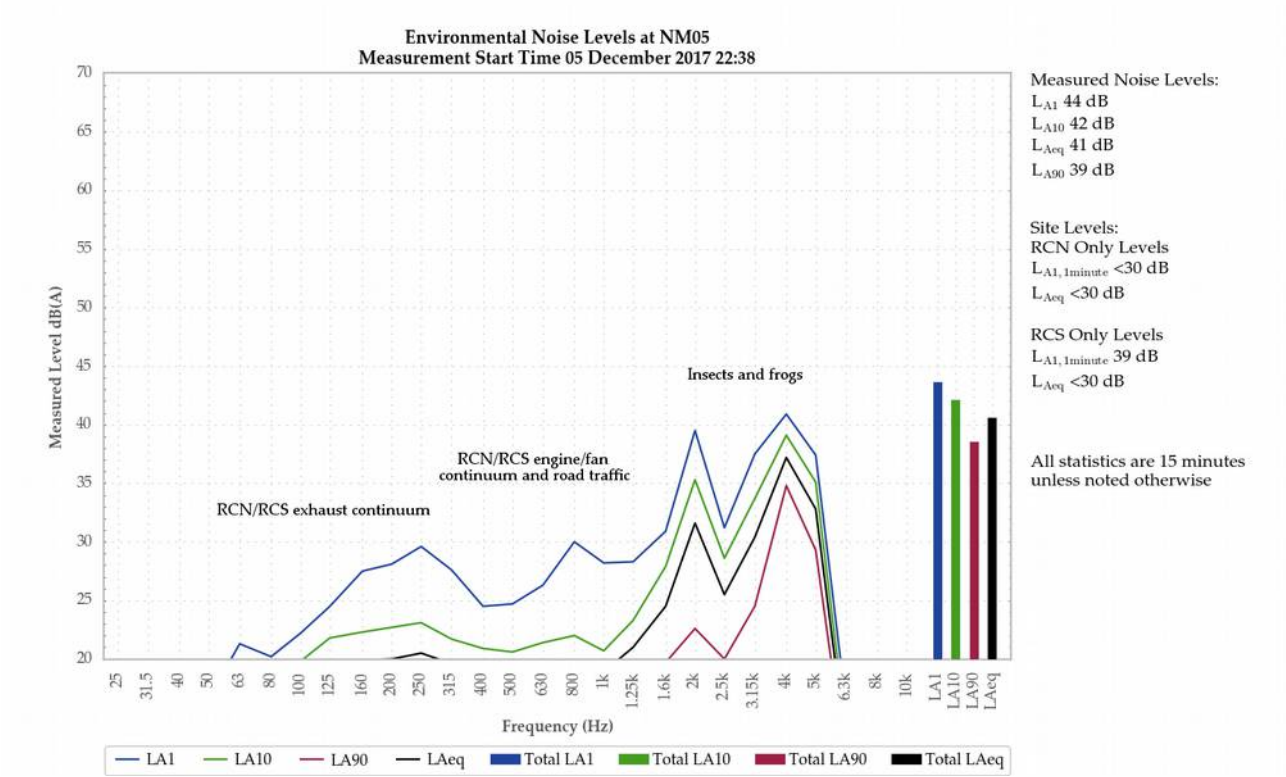


Figure 7: Environmental Noise Levels, NM05 – 788 Bridgman Road, Obanvale

A low level exhaust/engine/fan continuum and dozer track noise from RCN was audible throughout the measurement, generating the site only L_{Aeq} and $L_{A1,1minute}$ of less than 30 dB.

A low level exhaust/engine/fan continuum from RCS was audible throughout the measurement, generating the site only L_{Aeq} of less than 30 dB. A surge in engine/fan noise generated the $L_{A1,1minute}$ of 39 dB.

Insects and frogs were primarily responsible for all measured levels. Road traffic noise contributed to the L_{A1} and L_{A10}.

5.1.6 NM06 – 5 December 2017

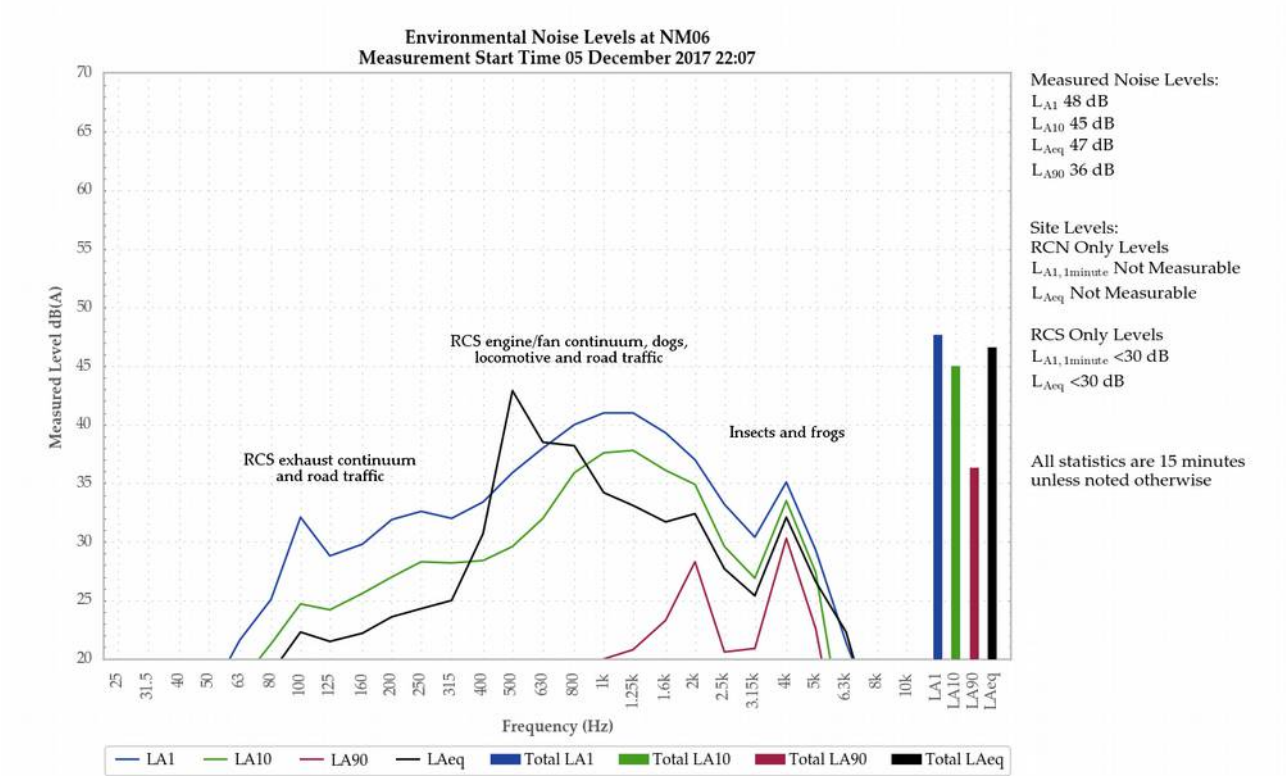


Figure 8: Environmental Noise Levels, NM06 – 427 Bridgman Road, Obanvale

RCN was audible as a low level continuum which was not measurable.

A low level exhaust/engine/fan continuum and dozer track noise from RCN was audible throughout the measurement, generating the site only L_{Aeq} and $L_{A1,1minute}$ of less than 30 dB.

Road traffic generated the L_{A1} and L_{A10}. Dogs and road traffic generated the L_{Aeq}. Insects and frogs generated the L_{A90}.

A locomotive was also noted.

5.1.7 NM08 – 5 December 2017

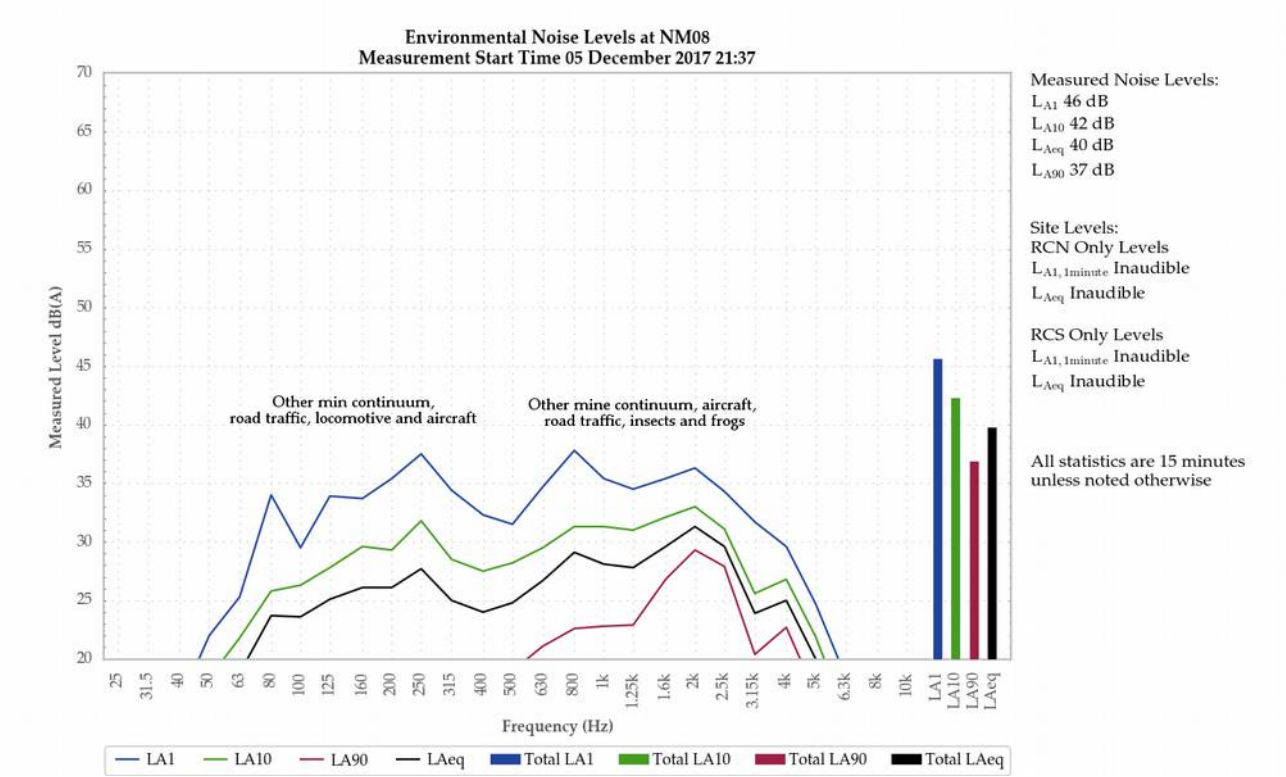


Figure 9: Environmental Noise Levels, NM08 – Cnr Belmadar Way and Maison Dieu Road, Maison Dieu

RCM was inaudible.

Road traffic, noise from another mine, birds, insects and frogs combined to generate the L_{A1}, L_{A10} and L_{Aeq}. Insects and frogs generated the L_{A90}.

Locomotives and aircraft were also noted.

6 SUMMARY OF COMPLIANCE

Global Acoustics were engaged by Rix's Creek Mine to conduct a noise survey around their operations, situated north-west of the town of Singleton, NSW. The mine comprises the original Rix's Creek Mine, now known as Rix's Creek South (RCS), and the former Integra Open Cut Project Mine, now known as Rix's Creek North (RCN).

Environmental noise monitoring described in this report was undertaken during the night of 5/6 December 2017.

The purpose of the survey was to quantify and describe the acoustic environment around both operations and compare results with noise criteria outlined in the Rix's Creek Noise Management Plan (NMP).

6.1 Operational Noise Assessment

Noise levels from RCM complied with relevant criteria at all monitoring locations during the December 2017 monitoring survey.

Wind speed and/or estimated temperature inversion conditions resulted in development consent criteria not being applicable at several locations.

6.2 Low Frequency Noise Assessment

A low frequency assessment was carried out in accordance with the EPA 'Noise Policy for Industry' (NPfI). Low frequency modifying factors, where applicable, did not result in any exceedances of RCM noise limits during the December survey.

Global Acoustics Pty Ltd

APPENDIX

A NOISE MANAGEMENT PLAN

5. Attended Noise Compliance Monitoring

5.1.1 INTRODUCTION

Attended monitoring is required to assess compliance with regulatory limits. Note: As described in this document it does not address the 25% of privately owned land aspect of Schedule 3, Condition 2 of the Rixs Creek North Cut Project Approval. As recommended in the 2011 Independent Environmental Audit, the requirement to assess affectation of 25% of privately owned land should be removed as a requirement (for all criteria); it is not practical to determine and has no relevance to resident amenity.

Attended monitoring at all receptor locations will be at night only commencing from 9pm, with results compared to all criteria (day, evening and night). Atmospheric conditions and noise propagation are usually the same on the evening/night and night/day time boundaries. Note also that receptors near to, or exposed to, the New England Highway have a completely different noise environment in the day due to traffic such that mining noise is unlikely to be a problem. This is consistent with the Independent Review Of Cumulative Noise Impacts -Camberwell Village (WMPL, May 2010), which states:

> *The L_{Aeq} levels near the New England Highway are predominately due to road traffic and associated heavy vehicles, rather than mining or other industrial noise, and is unlikely to decrease in the future.*

5.1.2 FREQUENCY

Attended compliance monitoring is to be undertaken one night per calendar month.

5.1.3 LOCATIONS

Compliance cannot be determined at each individual resident so on the monitoring night monitoring is targeted to locations where operational noise is likely to be the highest. These monitoring locations are selected by the following procedure.

Residences surrounding the Mine have been grouped generally according to the locality and local acoustic environment. These groupings are referenced in the relevant EAs as Noise Assessment Groups (NAG). Monitoring locations, including the receptor reference numbers from the relevant EAs and the NAG each represents, are listed in Table 5-6.

Compliance monitoring is to be conducted at locations indicated as being in the zone of meteorological enhancement by the predictive noise model. The procedure for determining which locations to monitor is as follows:

1. The acoustic consultant undertaking the monitoring will access the predictive model website for the site for the upcoming night shift. The model results will indicate graphically the predicted zone of meteorological enhancement;
2. A monitoring plan will be developed by the consultant for the upcoming night period. Locations are to include:
    a. If a clear zone of meteorological enhancement is indicated, one location in the opposite direction to the zone of predicted enhancement, and, all locations located within the predicted zone of enhancement; and

b. If relatively neutral conditions are predicted with no clear zone of meteorological enhancement, the eight locations nearest the mine will be monitored. NM01, NM03 and NM10 would be excluded, as non-compliance at those locations in the absence of meteorological enhancement is unlikely due to distance from the Mine.

3. A minimum of six locations are to be monitored per night.

Once monitoring commences, the consultant will apply best judgment to either proceed with the original monitoring plan, or a modified plan if monitoring results justify a change.

The procedure for monitoring when a clear zone of meteorological enhancement is predicted is:

1. The first monitoring location will be the potentially most affected location in the opposite direction to the zone of predicted enhancement to confirm noise emission in that direction is well below compliance criteria;
2. If the Mine L_{Aeq} is more than 2 dB below the relevant criterion at the first location (L_{Aeq} < criterion minus 2 dB), the consultant will proceed with the original plan and move to the locations within the predicted zone of enhancement;
3. If the Mine L_{Aeq} is within 2 dB of the relevant criterion (L_{Aeq} >= criterion minus 2 dB), the consultant will monitor at the next most potentially affected location in the same general direction from the Mine. This procedure will be repeated until the Mine L_{Aeq} is more than 2 dB below the relevant criterion. Result acceptance procedures in Section 5.1.7 will be applied;
4. The consultant will then proceed with the original plan; and
5. If fatigue management rules result in insufficient time to monitor all locations, the consultant will apply best judgement to determine which locations will provide the best indication of compliance with the time available.

The procedure for monitoring when no clear zone of meteorological enhancement is predicted is:

1. The first monitoring location will be the potentially most affected location based on forecast and prevailing meteorological conditions;
2. If compliance is demonstrated, the consultant will proceed with the original plan;
3. If non-compliance is measured at any location, result acceptance procedures in Section 5.1.7 will be applied. Any locations in the same general direction from the Mine that were omitted in the original plan will be included; and
4. If fatigue management rules result in insufficient time to monitor all locations, the consultant will apply best judgement to determine which locations will provide the best indication of compliance with the time available.

The consultant shall maintain a fatigue management policy, which will be provided to the Mine and/or regulators on request.

Table 5-6 Attended Monitoring Locations

NMP ID	EA Ref. (ICO/RCM) [1]	Owner or Area	NAG [2]
NM01	132/171	Bowman	6 (ICO) / M (RCM)
NM02	91/NA	Olofsson	4 (ICO)
NM03	47/NA	Cherry	B, C, F, 1, 6 and 12 (ICO)
NM04	19/12	Andrews	11 and A (ICO) / A (RCM)
NM05	11/8	Ferraro	10 and 11 (ICO) / A (RCM)
NM06	145/19	Murray	9 (ICO) / B and C (RCM)
NM07	NA/61	Gardiner Circuit	8 (ICO) / D and E (RCM)
NM08	NA/152	Belmadar Way	NA / J, G and F (RCM)
NM09	NA/121	Llanrian Drive	NA / H (RCM)
NM10	NA/135	Long Point	NA / K and I (RCM)

Notes: 1. NA indicates location was not included in the EA for that project; and

2. Indicates the NAG reference the location represents from the relevant EAs.

Figure 5-1 illustrates attended monitoring locations.

5.1.4 METHODS

Attended monitoring is to be conducted in accordance with the *'Industrial Noise Policy' (INP)* guidelines and *Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'*. The duration of each measurement is to be 15 minutes.

As indicated in L3.3, L3.4 & L3.5 of EPL 3391:

L3.3 Noise from the premises is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in this licence unless otherwise stated.

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.

L3.4 Noise from the premises is to be measured at 1 m from the dwelling facade to determine compliance with the LA1(1minute) noise limits in this licence.

L3.5 The noise emission limits identified in this licence apply under all meteorological conditions of: a) Wind speeds up to 3m/s at 10 metres above the ground level; or

b) Temperature inversion conditions of up to 3oC/100m and wind speed up to 2m/s at 10 metres above the ground.

In most cases, monitoring near the residence is impractical due to barking dogs or issues with obtaining access. In all cases, measurements are to be undertaken at a suitable and representative location.

Some measurement results may be inconclusive and reported as "Inaudible" (IA) or "Not Measurable" (NM). When site noise is noted as IA then there was no site noise at the monitoring location. However, if site noise is noted as NM, this means some noise was audible but could not be quantified. This means that noise from the site was either very low, or, being masked by other noise that was relatively loud. In the former case (very low site levels) it is not considered necessary to attempt to accurately quantify site NM noise as it would be significantly less than any criterion and most unlikely to cause annoyance (and in many cases, to be even noticed).

If site noise were NM due to masking then suitable methods must be employed as per the Industrial Noise Policy (e.g. measure closer and back calculate) to determine a value for assessment of compliance.

As indicated in the notes below Table 2 of the Rixs Creek North Project Approval:

Noise generated by the projects is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.

The procedures and exemptions will include the assessment of modifying factors from Section 4 of the INP, where applicable. Years of monitoring have indicated that noise levels from mining operations, particularly those levels measured at significant distances from the source are relatively continuous. Given this, noise levels at the monitoring locations are unlikely to be intermittent or impulsive. However, tonality and low frequency are to be assessed by analysis of the measured L_{Aeq} and/or L_{Ceq} spectrum.

5.1.5 METEOROLOGICAL MONITORING

One on-site Automatic Weather Station (AWS) is currently located within each of the Rixs Creek South and Rixs Creek North mining lease areas. Each complies with AS2923-1987 Ambient Air – Guide for measurement of horizontal wind for air quality applications and the INP. These AWS provide representative weather data for the Mine including wind speed and direction, sigma theta, solar radiation, humidity, rainfall and temperature. Weather data will be used to determine the validity of noise monitoring results in accordance with the INP. Wind speed and rain data will be used for this purpose. Extreme temperature inversions will be considered G-class inversions, as determined by use of sigma theta and wind speed to categorise inversion strength, in accordance with Appendix E of the INP.

For the purpose of determining valid meteorological conditions for which noise criteria apply:

- The Rixs Creek South AWS will be used for assessment of Rixs Creek South; and
- The Rixs Creek North AWS will be used for assessment of Rix's Creek North.

5.1.6 DATA TO BE COLLECTED

Data shall be collected in 15 minute periods and the Mine only L_{Aeq} result recorded. Low pass filtering will be used to remove extraneous noise such as insects when applicable. Other extraneous noise may be paused from the data set or excluded by other means. Statistical data must be one-third octave.

Assessment of impact is to include consideration of mining activity and atmospheric conditions during each measurement. Wind speed and/or estimated temperature inversion conditions may result in regulatory criteria not being applicable in accordance with the INP.

The Mine only L_{Ceq} result should be collected simultaneously. Low pass filtering will be used to remove extraneous high spectrum noise when required

A low frequency noise penalty of 5 dB is to be added to the Mine only L_{Aeq} result when noise from the mine causes:

- The Mine only C weighted reading to exceed L_{Ceq} 65 dB during the day or evening periods; or
- The Mine only C weighted reading to exceed L_{Ceq} 60 dB during the night period.

The following information must be recorded during attended noise monitoring:

- Time and date;
- Location;
- Name of person carrying out the monitoring;
- Serial number of equipment used;
- Noted sources and noise levels, direction and frequency from source of interest;
- Duration of monitoring;
- Measured noise levels including L_{Aeq}, L_{Amax}, L_{Amin}, L_{A1}, L_{A10}, L_{A50} and L_{A90}, and
- Weather conditions including temperature, relative humidity, wind speed average, wind speed maximum, wind direction and estimated cloud cover.

5.1.7 RESULT ACCEPTANCE

A 15 minute measurement shall be taken and assessed against the applicable criterion. If the Mine only L_{Aeq} result is below the criterion, then the consultant will record it, note the site has passed and move on to the next monitoring location.

If the Mine only L_{Aeq} result exceeds the criterion, is attributable to the Mine, and taken in valid meteorological conditions, then the following steps are to be followed:

1. Consultant will record the reading, advise the Mine of the criterion exceedance and proceed to Step 2. The Mine will implement remedial action as required.
2. Within 75 minutes after the first measurement (and no earlier than 10pm) a second 15 minute measurement is to be made. If this second result exceeds the criterion then proceed to Step 3, otherwise proceed to Step 4.
3. If the result is attributable to the Mine and taken in valid meteorological conditions then proceed to Step 5.
4. The consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within 1 week, and move on to the next monitoring location.
5. The consultant will record the result, note the site has failed and is deemed a '*noise affected night*' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within 1 week, and move on to the next monitoring location.

If the Mine only L_{Aeq} result exceeds the criterion, is attributable to the Mine, and taken in invalid meteorological conditions, the consultant will record it, advise the Mine a measurement has exceeded the criterion, and move on to the next monitoring location.

As detailed in Section 6.2.3 of this NMP, the OCE is to be advised of any potential noise exceedance detected during attended monitoring. The flow chart in Figure 6-5 details the attended monitoring exceedance procedure.

5.1.8 COMPLIANCE CRITERIA

Table 5-7 sets out night period noise compliance criteria. Rixs Creek North criteria are sourced from the Project Approval. Rixs Creek South $L_{Aeq,15minute}$ intrusive noise criteria are based on proposed criteria nominated in the EIS. $L_{A1,1minute}$ criteria are based on sleep disturbance criteria for the relevant NAG derived in the EIS.

$L_{Aeq,15minute}$ criteria are applicable for the day (07:00 to 18:00), evening (18:00 to 22:00) and night (22:00 to 07:00) periods. $L_{A1,1minute}$ criteria are applicable for the night period only.

Table 5-7 Compliance Criteria

NMP ID	EA Ref. (ICO/RCM) [1]	Rix's Creek North		Rixs Creek South	
		$L_{Aeq,15minute}$ dB	$L_{A1,1minute}$ dB	$L_{Aeq,15minute}$ dB	$L_{A1,1minute}$ dB
NM01	132/171	38	48	40	48
NM02	91/NA	40	47	40	47 [1]
NM03	47/NA	39	45	NA	NA
NM04	19/12	37	49	42	48
NM05	11/8	41	47	42	48
NM06	145/19	36	48	42	47
NM07	NA/61	NA	NA	40	45
NM08	NA/152	NA	NA	40	47
NM09	NA/121	NA	NA	40	47
NM10	NA/135	NA	NA	40	47

Notes: 1. Criterion set as for Rixs Creek North in the absence of data in the EIS; and

2. NA indicates criteria not applicable at that location, as it was not included in the relevant EA, EIS or Project Approval.

5.1.9 REPORTING

Attended monitoring reports should include a comparison to criteria detailed in the relevant project approval. All attended measurement result analysis should consider criteria applicability (for impact,

mitigation, cumulative and acquisition criteria) with regard to wind speed and vertical temperature gradient.

All results that exceed criteria, including instances where the second measurement indicates compliance with criteria, shall be reported to DP&E the following day along with actions taken to reduce the noise.

All monitoring that results in a night being deemed a '*noise affected night*' in accordance with Section 5.1.7 shall be reported to DP&E and the affected community as per the notification requirements.

5.1.10 EXCEEDANCE PROCEDURE

.Procedures to be followed in the event of a measured noise exceedance are outlined in Section 6.2.3

6.2.3 ATTENDED COMPLIANCE MONITORING EXCEEDANCE MEASURED

Any exceedance of a noise criterion is to be acted upon immediately it is measured. The acoustic consultant undertaking attended monitoring is to contact the Mine to advice of the problem and discuss possible changes to operations that should lead to compliance. A remeasure is required to evaluate the effectiveness of any change implemented as outlined in Section 5.1.7, if the measurement was made in valid meteorological conditions. The Senior Environmental Officer and/or the Environmental Officer should also be advised of the exceedance.

Responsibility: Noise Monitoring Consultant

Timing: Each event

The Department of Planning & Environment (Singleton Compliance Branch) and/or the Environment Protection Authority is to be informed of any noise criterion exceedance.

Responsibility: Senior Environmental Officer or Environmental Officer

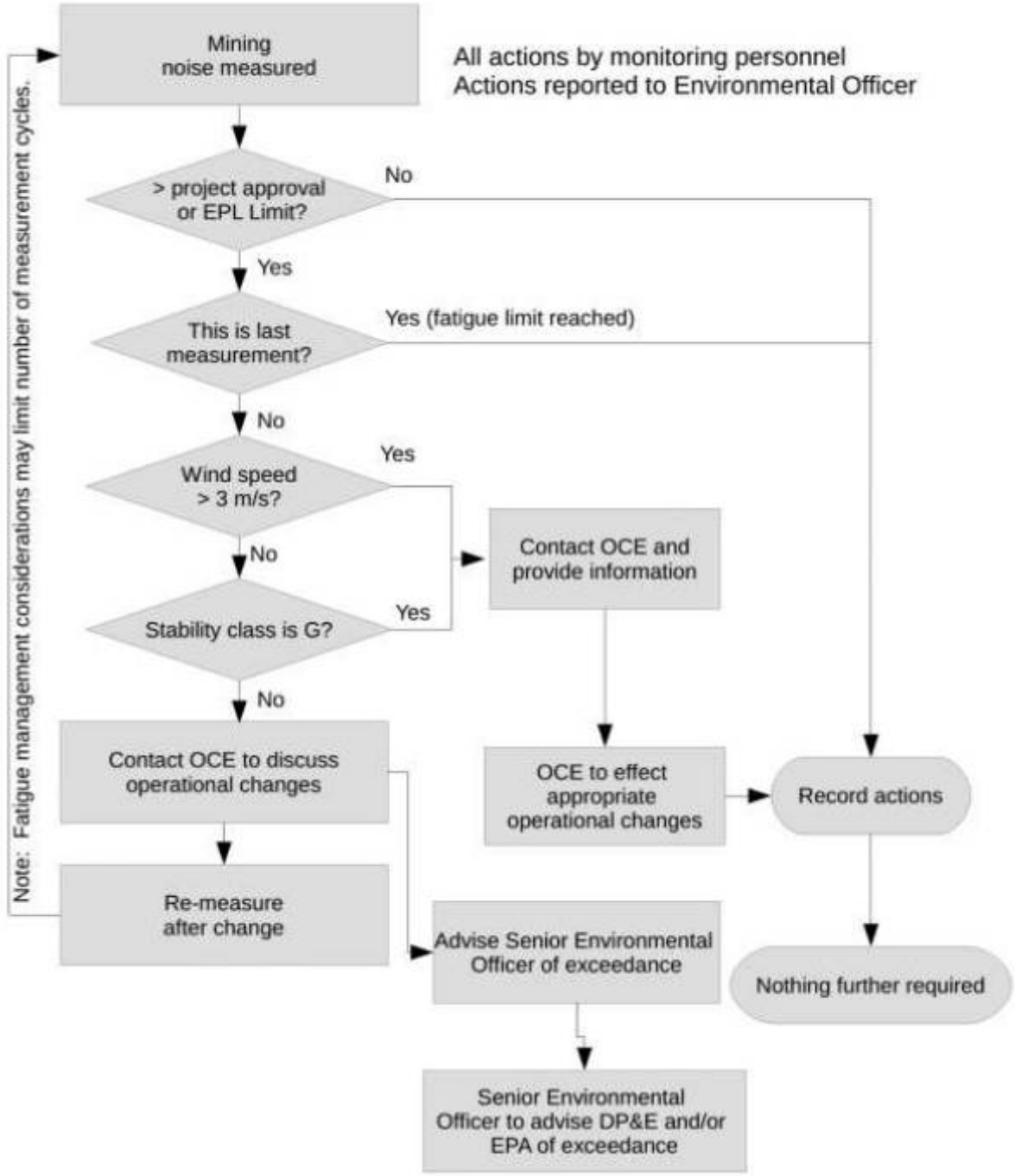
Timing: Each event

This Noise Management Plan is to be issued to any consultant conducting attended noise monitoring for the site so they understand all relevant procedures.

Responsibility: Environmental Officer

Timing: On commencement of contract and every time this document is updated.

Figure 6-5 Attended Monitoring Exceedance Procedure



APPENDIX

B CALIBRATION CERTIFICATES

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

Sound Level Meter
IEC 61672-3.2006

Calibration Certificate

Calibration Number C16323

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thorton 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		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.4°C	**Ambient Temperature :**	21.4°C
Relative Humidity :	37.5%	**Relative Humidity :**	37.5%
Barometric Pressure :	100.19kPa	**Barometric Pressure :**	100.23kPa

Calibration Technician : Calvin Simpfendorfer
Secondary Check: Riley Cooper
Calibration Date : 28/06/2016
Report Issue Date : 30/06/2016
Approved Signatory : Ken Williams

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

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

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

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.12dB*	*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.

NATA
WORLD RECOGNISED ACCREDITATION

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

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

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

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Sound Level Meter
IEC 61672-3.2006
Calibration Certificate

Calibration Number C16643

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 :	22.2°C	**Ambient Temperature :**	22.4°C
Relative Humidity :	46.6%	**Relative Humidity :**	44.5%
Barometric Pressure :	99.95kPa	**Barometric Pressure :**	99.95kPa

Calibration Technician : Vicky Jaiswal
Secondary Check: Sandra Minto
Calibration Date : 16/11/2016
Report Issue Date : 17/11/2016

Approved Signatory : Juan Aguero

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

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

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

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.12dB*	*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.

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 60942-2004
Calibration Certificate

Calibration Number C17511

Client Details	Acoustic Research Labs Pty Ltd Level 7, Bld 2, 423 Pennant Hills Road Pennant Hills NSW 2120
Equipment Tested/ Model Number :	Rion NC-73
Instrument Serial Number :	11248300

Atmospheric Conditions

Ambient Temperature :	22.8°C
Relative Humidity :	49.8%
Barometric Pressure :	99.46kPa

Calibration Technician :	Jason Gomes	**Secondary Check:**	Riley Cooper
Calibration Date :	10/10/2017	**Report Issue Date :**	11/10/2017
Approved Signatory :			Ken Williams

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

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	94.2	1004.10

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Specific Tests	Least Uncertainties of Measurement - Environmental Conditions		
Generated SPL	*±0.11dB*	*Temperature*	*±0.05°C*
Short Term Fluct.	*±0.02dB*	*Relative Humidity*	*±0.46%*
Frequency	*±0.01%*	*Barometric Pressure*	*±0.017kPa*
Distortion	*±0.5%*		

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

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Sound Calibrator
IEC 60942-2004

Calibration Certificate

Calibration Number C17149

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

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

Atmospheric Conditions
Ambient Temperature : 21.9°C
Relative Humidity : 54.6%
Barometric Pressure : 98.84kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 30/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 31/03/2017
Approved Signatory : Juan Aguero

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

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	94.1	1000.38

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

Least Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.11dB*	*Temperature*	*±0.05°C*
Short Term Fluct.	*±0.02dB*	*Relative Humidity*	*±0.46%*
Frequency	*±0.01%*	*Barometric Pressure*	*±0.017kPa*
Distortion	*±0.5%*		

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

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

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