Invincible Colliery

Environmental Noise Monitoring

Quarter 1 2019

Prepared for

Castlereagh Coal

Global Acoustics

Noise and Vibration Analysis and Solutions

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Invincible Colliery

Environmental Noise Monitoring Quarter 1 2019

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Prepared for

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Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged to conduct a noise survey around Invincible Colliery (the site), an open cut coal mine north-west of Lithgow.

Attended environmental noise monitoring described in this report was conducted at three monitoring locations during the day period of 22 and 28 March 2019. The site is currently under care and maintenance, therefore monitoring was not undertaken during the evening or night periods, as there are no activities occurring on site during these times.

There is unlikely to be noise impact from site, as operations have been significantly reduced. The monitoring program has been modified slightly to take this into account. The duration of each day measurement was 10 minutes if no site noise was audible. If site activities were audible; the measurement duration was increased to 15 minutes.

The purpose of the survey is to quantify and describe the acoustic environment around the site and compare results with specified limits.

1.2 Attended Noise Monitoring Locations

There were three monitoring locations during this survey, as detailed in Table 1.1 and shown in Figure 1.

Table 1.1: ATTENDED NOISE MONITORING LOCATIONS

Descriptor	Owner	Monitoring Location
Cullen Bullen Centre	M. Crane	Mudgee Road
Cullen Bullen West	-	Off Carson Siding Road and Farley Street
Cullen Bullen South	R. Crane	Off Cullen Valley Haul Road

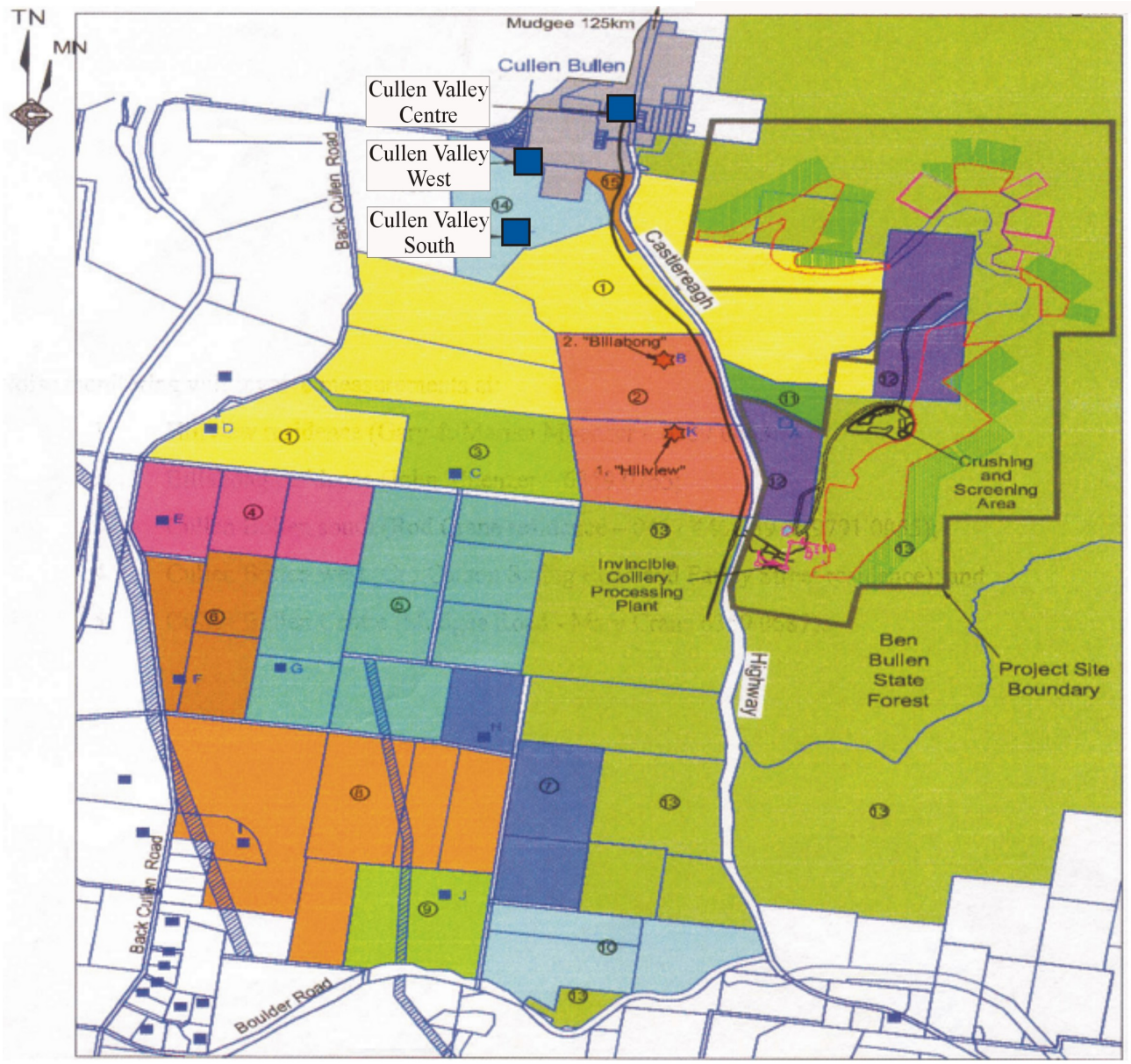

Figure 1: Invincible Colliery Noise Monitoring Locations
Source: Invincible Colliery Open Cut Mine Extension – Noise Impact Assessment (ERM – April 2008).

1.3 Terminology & Abbreviations

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

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
$L_{A1,1minute}$	The noise level which is exceeded for 1 per cent of the specified time period of 1 minute
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L_{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_{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.
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 CONSENTS AND CRITERIA

The relevant conditions relating to noise from the project approval and Environmental Protection Licence (EPL) are reproduced in Appendix A.

2.1 Project Specific Criteria

2.1.1 Project Approval

Castlereagh Coal obtained a modification to the project approval in February 2018 (07-0127) for the continuation of open cut mining activities. Schedule 3, Conditions 1 to 5 of the approval details the noise requirements. Noise impact assessment criteria as described in the project approval are detailed in Table 2.1.

Table 2.1: INVINCIBLE COLLIERY PROJECT APPROVAL NOISE IMPACT ASSESSMENT CRITERIA, dB

Residence / Location	Day $L_{Aeq,15minute}$	Evening $L_{Aeq,15minute}$	Night $L_{Aeq,15minute}$
All Privately owned land	35	35	35

Notes:

1. *An agreement with respect to noise emissions has been negotiated between Invincible Colliery and the owner of "Billabong" and "Hillview" properties. The owner of the two residences has confirmed that predicted noise levels are acceptable, despite the predicted noise levels being greater than the calculated noise criterion. These two residences are also subject to acquisition upon request. As such there is no noise criterion for these two residences and monitoring is no longer undertaken.*

The noise criteria in Table 2.1 do not apply under meteorological conditions of:

- wind speeds greater than 3 m/s at 10 metres above ground level; or
- temperature inversion conditions between 1.5ºC and 3ºC/100m and wind speeds greater than 2 m/s at 10 metres above ground level; or
- temperature inversion conditions greater than 3ºC/100m.

2.1.2 Environment Protection Licence

Invincible Colliery holds EPL 1095 issued by the Environment Protection Authority (EPA) most recently on 14 May 2015. Noise requirements are detailed in L4 of the EPL. Noise impact assessment criteria as described in the EPL are detailed in Table 2.2.

Table 2.2: INVINCIBLE COLLIERY EPL NOISE CRITERIA, dB

Residence / Location	Day $L_{Aeq,15minute}$	Evening $L_{Aeq,15minute}$	Night $L_{Aeq,15minute}$
All Privately owned land	40	35	35

The noise criteria in Table 2.2 apply under all meteorological conditions except:

- during rain and wind speeds (at 10m height) greater than 3m/s; and
- under "non-significant" weather conditions.

The EPA has confirmed with Global Acoustics that non-significant weather conditions are those that occur less than 30% of the time. The most recent noise impact assessment for Invincible Colliery was undertaken by Umwelt as part of the Southern Extension Project in 2016. The wind rose data in Appendix C of that assessment indicates that only NE and ENE winds occur more than 30% of the time at this particular site during the day or evening. Therefore, the EPL noise criteria in Table 2.2 only apply under NE and ENE wind directions (33.75° - 78.75°).

2.2 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.

2.2.1 Tonality and Intermittent Noise

As defined in the NPfI:

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

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

2.2.2 Low-Frequency Noise

As defined in the NPfI:

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

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

> *Measure/assess source contribution C-weighted and A-weighted L_{eq},T levels over the same time period. The low frequency noise modifying factor correction is to be applied where the C-A level is 15 dB or more and:*

*• where any of the 1/3 octave noise levels in Table C2 are exceeded by **up to and including** 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured A weighted levels applies for the evening/night period; and*

*• where any of the 1/3 octave noise levels in Table C2 are exceeded by **more than** 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured A weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.*

Table C2 and associated notes from the NPfI is reproduced below:

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

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

Notes:

- dB(Z) = decibel (Z frequency weighted).
- For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to 5 metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler, 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.
- Low-frequency noise corrections only apply under the standard and/or noise-enhancing meteorological conditions.
- Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.
- Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or environment protection licence, and at locations nominated in the development consent or licence.

3 METHODOLOGY

3.1 Overview

Attended monitoring was conducted at three sites in accordance with Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA guidelines. Atmospheric condition measurement was also undertaken.

3.2 Attended Noise Monitoring

Given the site is on care and maintenance, the duration of each day measurement was generally 10 minutes. When site activities were audible; the duration of these measurements was increased to 15 minutes. During this survey attended monitoring was undertaken once at each measurement location during the day period.

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 (in this case Invincible Colliery).

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

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

Therefore, 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 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.

Meteorological data has been sourced from the Invincible Colliery weather station.

3.3 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 Invincible Colliery 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 Invincible Colliery 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 Invincible Colliery 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
- Invincible Colliery was the only low-frequency noise source.

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

3.4 Attended Monitoring Equipment

The equipment detailed in Table 3.1 were 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	00370304	26/11/2020
Rion NA-28 sound level analyser	30131882	05/02/2021
Pulsar 106 acoustic calibrator	81334	22/11/2020
Pulsar 106 acoustic calibrator	78226	01/02/2021

4 RESULTS

4.1 Total Measured Noise Levels

Overall noise levels measured at each location during attended measurement are provided in Table 4.1.

Table 4.1: MEASURED NOISE LEVELS[1] - QUARTER 1 2019

Location	Start Date and Time	L_{Amax} dB	L_{A1} dB	L_{A10} dB	L_{A50} dB	L_{Aeq} dB	L_{A90} dB	L_{Amin} dB	L_{Ceq} dB
Cullen Bullen Centre	22/03/2019 16:02	81	76	69	52	64	46	42	72
Cullen Bullen West	28/03/2019 14:41	64	50	42	37	40	33	29	53
Cullen Bullen South	28/03/2019 14:55	59	49	43	39	41	35	30	53

Notes:

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

4.2 Modifying Factors

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

There were no intermittent or tonal noise sources, as defined in the NPfI, audible from site during the survey. None of the measurements satisfied the conditions outlined in Section 3.3 when assessing low-frequency noise.

Therefore no further assessment of modifying factors was undertaken.

4.3 Attended Noise Monitoring

4.3.1 Project Approval Monitoring

Table 4.2 details $L_{Aeq,15minute}$ noise levels for Invincible Colliery in the absence of other noise sources. Criteria are then applied if weather conditions are in accordance with the project approval.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY INVINCIBLE COLLIERY AGAINST PROJECT APPROVAL CRITERIA – QUARTER 1 2019

Location	Start Date and Time	Wind Speed m/s [1,2]	VTG $^oC/100m^2$	L_{Aeq} Criterion dB	Criterion Applies? [1]	SiteLAeq dB [3,4]	Exceedance[4,5]	Notes
Cullen Bullen Centre	22/03/2019 16:02	3.3	-2.0	35	No	IA	NA	Invincible Colliery was inaudible. Road traffic noise and breeze generated the measured levels. Birds, thunder and residents were also noted.
Cullen Bullen West	28/03/2019 14:41	1.8	-2.0	35	Yes	IA	Nil	Invincible Colliery was inaudible. Road traffic noise, aircraft and birds generated the measured levels. Local impacts were also noted.
Cullen Bullen South	28/03/2019 14:55	1.3	-2.0	35	Yes	IA	Nil	Invincible Colliery was inaudible. Road traffic noise, aircraft and birds generated all measured levels. Insects were also noted.

Notes:

1. *Meteorological data has been sourced from the Invincible Colliery weather station;*
2. *Noise emission limits do not apply under the following meteorological conditions:*
   - *Wind speeds greater than 3 m/s at 10 meters above ground level; or temperature inversion conditions between 1.5ºC and 3ºC/100m and wind speeds greater than 2 m/s at 10 metres above ground level; or*
   - *temperature inversion conditions greater than 3ºC/100m.*
3. *These are results for Invincible Colliery in the absence of all other noise sources. NM denotes audible but not measurable, IA denotes inaudible;*
4. *Bold results in red are those greater than the relevant criterion (if applicable); and*
5. *NA in exceedance column means atmospheric conditions outside specified in the project approval and criterion is not applicable.*

4.3.2 EPL Monitoring

Table 4.3 details L_{Aeq} noise levels for Invincible Colliery in the absence of other noise sources. Criteria are then applied if weather conditions are in accordance with the EPL.

Table 4.3: $L_{Aeq,15minute}$ GENERATED BY INVINCIBLE COLLIERY AGAINST EPL CRITERIA – QUARTER 1 2019

Location	Start Date and Time	Wind Speed m/s [1,2]	Wind Direction	L_{Aeq} Criterion dB	Criterion Applies? [1]	Site L_{Aeq} dB [3,4]	Exceedance[4,5]	Notes
Cullen Bullen Centre	22/03/2019 16:02	3.3	209	40	No	IA	NA	Invincible Colliery was inaudible. Road traffic noise and breeze generated the measured levels. Birds, thunder and residents were also noted.
Cullen Bullen West	28/03/2019 14:41	1.8	8	40	No	IA	NA	Invincible Colliery was inaudible. Road traffic noise, aircraft and birds generated the measured levels. Local impacts were also noted.
Cullen Bullen South	28/03/2019 14:55	1.3	11	40	No	IA	NA	Invincible Colliery was inaudible. Road traffic noise, aircraft and birds generated all measured levels. Insects were also noted.

Notes:

1. *Meteorological data has been sourced from the Invincible Colliery weather station;*
2. *Noise emission limits do not apply under following meteorological conditions:*
   - *during rain and wind speeds (at 10m height) greater than 3m/s; and*
   - *under "non-significant" weather conditions (e.g. wind directions outside of the angles 33.75° - 78.75°);*
3. *These are results for Invincible Colliery in the absence of all other noise sources. NM denotes audible but not measurable, IA denotes inaudible;*
4. *Bold results in red are those greater than the relevant criterion (if applicable); and*
5. *NA in exceedance column means atmospheric conditions outside specified in the project approval and criterion is not applicable.*

4.4 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.4. 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 4.4: MEASURED ATMOSPHERIC CONDITIONS – QUARTER 1 2019

Location	Start Date and Time	Temperature °C	Wind Speed m/s	Wind Direction	Cloud Cover 1/8s
Cullen Bullen Centre	22/03/2019 16:02	16	1.1	180	8
Cullen Bullen West	28/03/2019 14:41	25	0.7	50	5
Cullen Bullen South	28/03/2019 14:55	23	0.6	40	5

Meteorological data sourced from the Invincible Colliery weather station is used to determine compliance with criteria.

5 SUMMARY OF COMPLIANCE

Global Acoustics was engaged to conduct a noise survey around Invincible Colliery, an open cut coal mine north-west of Lithgow.

Attended environmental noise monitoring described in this report was undertaken at three monitoring location during the day period of 22 and 28 March 2019. The site is currently under care and maintenance, therefore monitoring was not undertaken during the evening or night periods, as there are no activities occurring on site during those times.

Invincible Colliery complied with noise limits at all locations during Quarter 1 2019 monitoring. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

APPENDIX

A STATUTORY REQUIREMENTS

NSW Department of Planning Project Approval 07-0127 applies to the Invincible Colliery operation. The noise section is reproduced below.

A.1 INVINCIBLE COLLIERY PROJECT APPROVAL

NOISE

Acquisition Upon Request

1. If a written request for acquisition was made by the owner of the land listed in Table 1, before the approval of Modification 5, the Proponent must acquire the land in accordance with the procedures in conditions 5 and 6 of schedule 4.

Table 1: Land subject to acquisition upon request

Residence
Billabong, Hillview

Note: To interpret the locations referred to in Table 1, see the applicable figures in Appendix 3.

Noise Criteria

2. The Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 2 at any residence on privately-owned land.

Table 2: Noise criteria dB(A)

Location	Day	Evening	Night	
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$
393 (Billabong)	40	40	35	45
394 (Hillview)	43	43	35	45
All other privately owned land	35	35	35	45

Note: To interpret the locations referred to in Table 2, see the applicable figures in Appendix 3.

Noise generated by the project is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy* (as may be revised from time to time). Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner to exceed the noise criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

Operating Conditions

3. The Proponent must:
   (a) implement all reasonable and feasible measures to minimise the operational, low frequency and road noise of the project;
   (b) minimise the noise impacts of the project during meteorological conditions when the noise criteria in this consent do not apply (see Appendix 4);
   (c) co-ordinate noise management at the site with the Cullen Valley and Baal Bone mines, to minimise any cumulative noise impacts; and
   (d) carry out regular monitoring to determine whether the development is complying with the relevant conditions of this approval.

Noise Management Plan

4. Prior to recommencing mining operations, unless the Secretary agrees otherwise, the Proponent must prepare a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA;
   (b) describe the measures that would be implemented to ensure compliance with the relevant noise criteria and operating conditions in this approval;
   (c) describe the proposed noise management system in detail; and

(d) include a noise monitoring program that:
- evaluates and reports on:
  - the effectiveness of the noise management system;
  - compliance against the noise criteria in this approval; and
- compliance against the noise operating conditions; and
- defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

5. The Noise Management Plan approved by the Secretary must be implemented.

A.2 INVINCIBLE COLLIERY EPL

L4 Noise limits

L4.1 Noise from the premises must not exceed:

a) 40 dB(A) LAeq(15 minute) during the day (7 am to 6 pm); and
b) 35 dB(A) LAeq(15 minute) at all other times except as expressly provided by this licence;

at any residence on privately owned land.

Where LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

Note: The licensee may exceed the limits set in L5.1 only if the licensee has a written negotiated noise agreement with the landowner of the premises in question and has provided a copy of this agreement to the EPA.

L4.2 To determine compliance with condition(s) L5.1 noise must be measured at, or computed for, the most affected point or within the residential boundary, or at the most affected point within 30 m of a dwelling (rural situations) where the dwelling is more than 30 m from the boundary. A modifying factor correction must be applied for tonal, impulsive or intermittent noise in accordance with the "Environmental Noise Management - NSW Industrial Noise Policy (January 2000)".

L4.3 The noise emission limits identified in this licence apply under all meteorological conditions except:
a) during rain and wind speeds (at 10m height) greater than 3m/s; and
b) under "non-significant weather conditions".

Note: Field meteorological indicators for non-significant weather conditions are described in the NSW Industrial Noise Policy, Chapter 5 and Appendix E in relation to wind and temperature inversions.

APPENDIX

B CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
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Pennant Hills NSW AUSTRALIA 2120
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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		Post-Test Atmospheric Conditions	
Ambient Temperature :	23.6°C	**Ambient Temperature :**	22.4°C
Relative Humidity :	42.6%	**Relative Humidity :**	42.4%
Barometric Pressure :	98.42kPa	**Barometric Pressure :**	98.45kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 26 Nov 2018
Secondary Check: Lewis Boorman
Report Issue Date : 29 Nov 2018
Approved Signatory : Ken Williams

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

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.12dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.18dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.51dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

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

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

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

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

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

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Sound Level Meter
IEC 61672-3.2013

Calibration Certificate

Calibration Number C19073

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	NA-28
Instrument Serial Number :	30131882
Microphone Serial Number :	04739
Pre-amplifier Serial Number :	11942

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	24.5°C	**Ambient Temperature :**	23.6°C
Relative Humidity :	54.5%	**Relative Humidity :**	51%
Barometric Pressure :	99.39kPa	**Barometric Pressure :**	99.36kPa

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

Approved Signatory : Ken Williams

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

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013

Least Uncertainties of Measurement -

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

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

NATA ACCREDITATION

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

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

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

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

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Sound Calibrator
IEC 60942-2017

Calibration Certificate

Calibration Number C18619

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 : 24.2°C
Relative Humidity : 42.9%
Barometric Pressure : 97.69kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 22 Nov 2018
Secondary Check: Lewis Boorman
Report Issue Date : 29 Nov 2018
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	94.2	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 -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.11dB*	*Temperature*	*±0.2°C*
Frequency	*±0.01%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.48%*	*Barometric Pressure*	*±0.015kPa*

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

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

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

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Sound Calibrator
IEC 60942-2017

Calibration Certificate

Calibration Number C19074

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

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

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

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

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

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

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

Least Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.11dB*	*Temperature*	*±0.2°C*
Frequency	*±0.01%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.48%*	*Barometric Pressure*	*±0.015kPa*

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

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

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

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