



# **WONGAWILLI NOISE COMPLIANCE MONITORING Q2 2018**

WCL

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# 1 Introduction

Wollongong Coal Limited (Wollongong Coal) (formerly Gujarat NRE FCGL Pty Ltd) mining operations at NRE Wongawilli Colliery – Nebo Area Project (the Project) are subject to the conditions of the Project Approval, application number 09\_0161 (The Project Approval). Tables 3 and 4 in Schedule 4 of the Project Approval set out the applicable noise limits.

Section 8 of the Project Approval requires a Noise Management Plan to be prepared. This management plan was prepared by Wollongong Coal in July 2016 (reference WWC EC PLN 007).

Section 5.1 of the Noise Management Plan (NMP) states that WCL proposes to undertake quarterly attended monitoring to determine compliance with the criteria. It is noted that two additional monitoring site are identified in the NMP than outlined in the Project Approval, these sites are related to rail noise.

Attended measurements are to be taken over a 15-minute period using Type-1 Sound Level Meters with consideration to the *NSW Industrial Noise Policy* (INP) (EPA 2000) and Australian Standard AS 1055 *Acoustics – Description and Measurement of Environmental Noise*.

This document describes the results of quarterly compliance noise measurements carried out on 11<sup>th</sup> and 12<sup>th</sup> July 2018.

Rail noise monitoring undertaken between on the 11<sup>th</sup> and 12<sup>th</sup> of July 2018 is also described in this document.

## 2 Objectives

The objective of the compliance noise monitoring was to assess compliance of Wongawilli Colliery (the Project) with the relevant noise limit conditions of the Project Approval.

## 3 Reference documents

The following documents have been considered as part of the compliance noise monitoring:

- NRE Wongawilli Colliery Project Approval No. 09\_0161;
- NRE Wongawilli Colliery Environmental Protection Licences No. 1087 and 12442;
- NRE Wongawilli Colliery Nebo Area Environmental Assessment (ERM Report 0097271s);
- NRE Wongawilli Colliery Noise Management Plan (WWC EC PLN 007, July 2016);
- NSW Environmental Protection Agency – Noise Policy for Industry (NPI) (EPA 2017);
- NSW Environmental Protection Agency – Rail Infrastructure Noise Guideline (EPA 2013);
- Australian Standard AS 1055:1997 –Acoustics – Description and Measurement of Environmental Noise; and
- Australian Standard AS 2377:2002 –Acoustics – Methods for the measurement of Railbound Vehicle Noise.

## 4 Noise criteria

### 4.1 Colliery noise

The relevant noise criteria are contained within Tables 3 and 4 of the Project Approval. These tables are reproduced in Table 4.1 and Table 4.2. The locations of the nominated receiver locations are presented in Table 4.3

The Project Approval states both intrusive and amenity criteria, which are respectively assessed over a 15 minute period for the day, evening and night time assessment periods.

It is considered that the intrusive criteria, being both lower and assessed over a shorter time period, are more stringent and therefore the limiting criteria to determine compliance for the Project.

Table 4.1. Noise Criteria dB(A) –Intrusive noise limits as defined in Table 3 of the Project Approval

Receiver Number	Day L <sub>Aeq</sub> (15min)	Evening L <sub>Aeq</sub> (15min)	Night L <sub>Aeq</sub> (15min)	L <sub>A1</sub> (1min)
RA1	43	43	43	59
RA2	44	43	43	60
RA3	40	40	38	48
All other existing residential receivers	40	40	38	48

Note: Day is defined as 7.00am to 6.00pm, evening as 6.00pm to 10.00pm and night as 10.00pm to 7.00am.

Table 4.2. Noise Criteria dB(A) – Amenity Noise Limits as defined in Table 4 of the Project Approval

Receiver Area	Day L <sub>Aeq</sub> (11hr)	Evening L <sub>Aeq</sub> (4hr)	Night L <sub>Aeq</sub> (9hr)
All privately-owned land	60	50	45

Notes to Tables 4.1 and 4.2:

- To interpret the locations, see Appendix 4 of the Project Approval.
- Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions) of the INP.

Further to these conditions, the Project Approval outlines a range of noise goals to be considered with the objective of reducing future noise levels from the Project. These noise goals are presented in Table 4.3.

Table 4.3. *Noise Criteria dB(A) – Intrusive noise goals as defined in Table 5 of the Project Approval*

Receiver Number	Day L <sub>Aeq</sub> (15min)	Evening L <sub>Aeq</sub> (15min)	Night L <sub>Aeq</sub> (15min)	L <sub>A1</sub> (1min)
RA1	40	40	38	51
RA2	40	40	38	51
RA3	40	40	38	48
All other existing residential receivers	40	40	38	48

Notes:

- To interpret the locations, see Appendix 4 of the Project Approval.
- Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the INP.
- The noise goals in Table 5 may be varied by way of direction to the Proponent by the Secretary, following consideration of the results of the noise audit required under condition 7 of the Project Approval.

## 4.2 Rail spur noise

The relevant noise criteria are contained within Table 6 of the Project Approval, and reproduced in Table 4.4.

Table 4.4. *Noise Criteria dB(A) – Rail Noise Limits*

Receiver Area	Day (7am – 10pm) L <sub>Aeq</sub> (15hr)	Night (10pm – 7am) L <sub>Aeq</sub> (period)
All existing residential receivers	65	60

The Project Approval notes that these noise criteria do not apply if the Proponent has an agreement with the relevant owner/s of the residence or land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.

Furthermore, by the end of July 2013, or other timing as may be agreed by the Secretary, the Proponent shall use its best endeavours to ensure that its rail spur is only accessed by:

- Locomotives that are approved to operate on the NSW rail network in accordance with noise limits L6.1 to L6.4 in RailCorp's EPL (No. 12208); and
- Trains comprising no less than 30 wagons.
- In addition, the Proponent shall restrict train speeds on the Wongawilli rail spur to a maximum of 20 km/h.

## 5 Noise monitoring locations

With consideration to the requirements of the Project Approval and the NMP, noise monitoring locations are summarised in Table 5.1 and Figure 5.1.

Table 5.1. *Noise Monitoring Locations*

Receiver Area Number	Description	Coordinates (MGA zone 56H)	
		Easting	Northing
RA1 a	30 Vista Parkway	293868	6183146
RA1 b	111 Smiths Lane	294095	6183327
RA2 a	18 Wongawilli Rd	294622	6182498
RA2 b	1 Wongawilli Rd	294225	6182572
RA3 a	80 Shone Ave	294884	6181794
RA3 b	Jersey Farm	294108	6181565
RA4 a	66 Ritchie Crescent	296299	6182088
RA4 b	61 Huxley Drive	296430	6182008

The rail noise monitoring location utilised during December 2017 monitoring is indicated in Figure 5.2. Monitoring was undertaken at 61 Huxley Drive, Horsley, 2530.



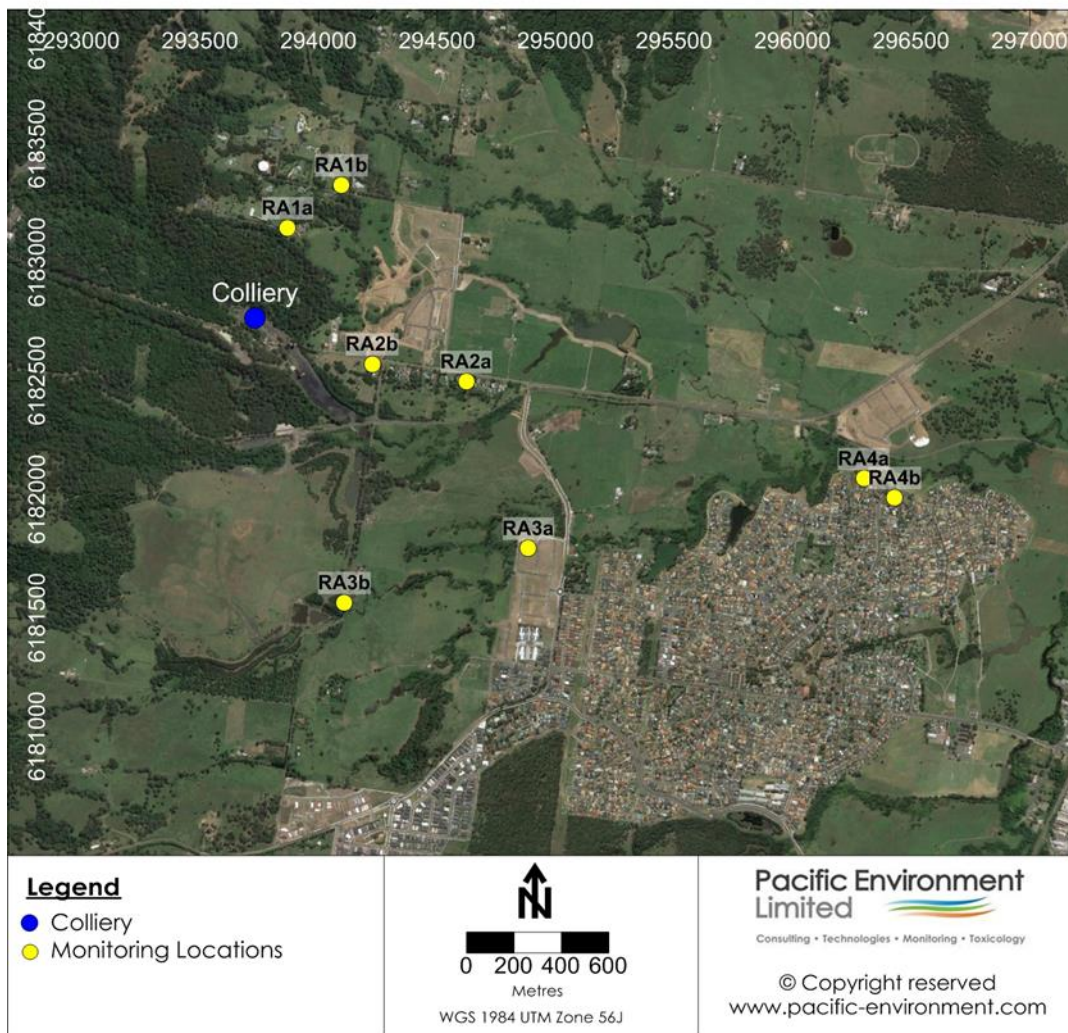


Figure 5.1. NMP Monitoring Locations



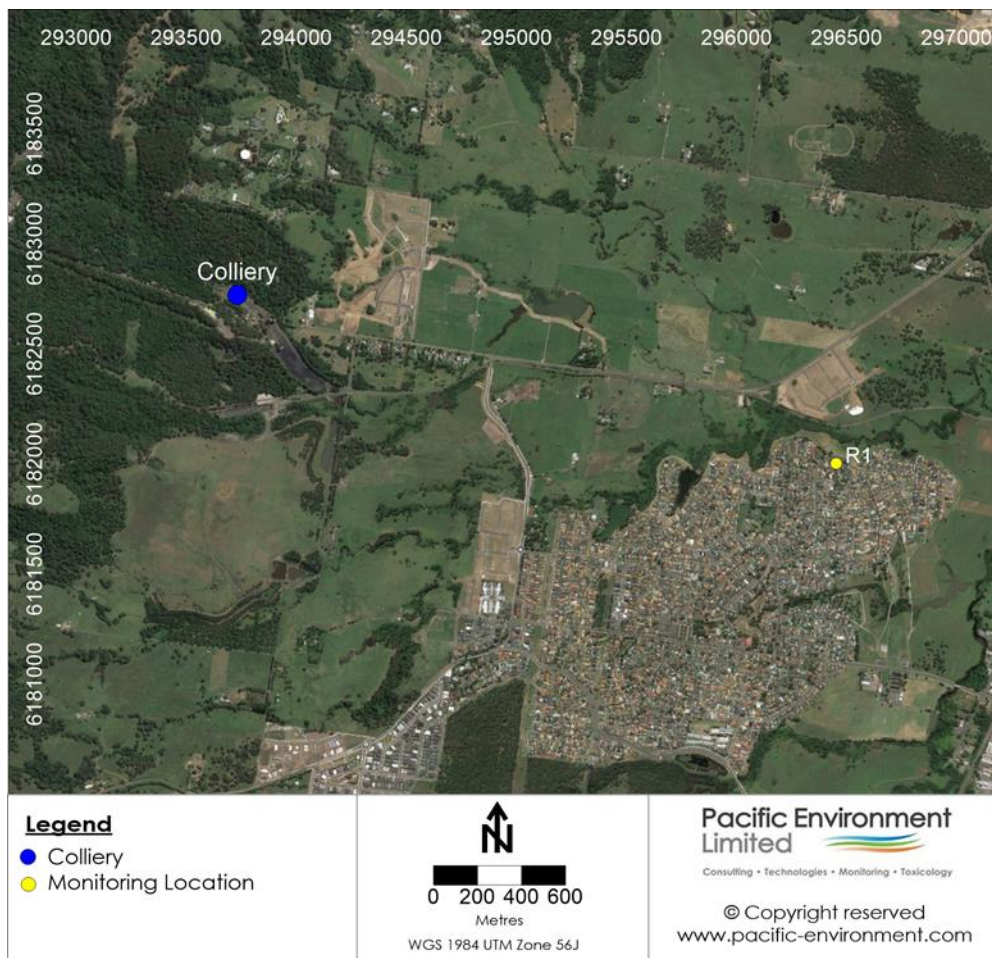


Figure 5.2. Rail Noise Monitoring Location

## 6 Project operations

Project operations were observed during the measurement period to include underground operations and product loadout. Fixed mechanical plant operating included continuous operation of:

- Syntron in the Transfer House at Pit Top;
- Screen and sizer building operation; and
- Conveyor and conveyor drive head operation.

During the day time period loading of coal into trains also occurred. Mobile plant was operating in the stockpile area.

## 7 Measurement Methodology

Attended noise compliance measurements were carried out with reference to the NSW NPI (EPA, 2017) and Australian Standard AS 1055:1997. Rail noise measurements were completed with consideration to Australian Standard AS 2377:2002 and the NSW EPA Rail Infrastructure Noise Guideline (2013).

### 7.1 Operational Noise

15-minute operator attended measurements were carried out at the 6 receiver locations nominated in the Project Approval and shown in Table 4.1, during the day, evening and night periods.

The meteorological conditions were observed during attended noise monitoring. Monitoring data collected at the project's automatic weather station (AWS) was also reviewed to confirm observations. Wind conditions were estimated onsite using an anemometer. The potential for temperature inversions to be present was estimated using the sigma-theta method (Appendix E4 of the INP) using data from the on-site AWS. Stability classes of F or G are considered to be indicative that strong temperature inversions are present.

Measurements were carried out on 11<sup>th</sup> and 12<sup>th</sup> July 2017 utilising two NTi Audio XL2 type 1 Sound Level Meters (serial numbers A2A-06883-E0 and A2A-06981-E0). Calibration was checked before and after measurements using a Pulsar Instruments Model 105 acoustic calibrator (serial number 55095). No significant drift ( $\pm 0.5$  dB) was noted.

The weather conditions were observed to be generally suitable for noise monitoring and in accordance with those specified in the Project Approval.

Operator attended measurements quantified the contribution from the Project using a combination of measured levels, onsite observations and third octave frequency analysis, where appropriate.

For the determination of compliance, Section 11.1.3 of the NSW INP states the following:

*A development will be deemed to be in non-compliance with noise consent or licence condition if the monitored noise level is more than 2 dB above the statutory noise limit specified in the consent or licence condition.*

Therefore non-compliance will be reported where the noise level from the Project is determined to be at least 2 dB above the nominated criteria.

Where applicable, adjustments have been made for annoying characteristics such as tonality, impulsiveness and low frequency noise as defined in the NPI.

The  $L_{A1,15min}$  represents the level exceeded for 1% of the measurement time. In this case, 1% of the measurement time is 9 seconds. It is considered that the  $L_{A1}$  in addition to the  $L_{Amax}$  of the measurement are taken into account in addition to observed levels to provide an indication of short duration high noise level events that contribute to the potential for sleep disturbance.

## 7.2 Rail Noise

Attended measurements were carried out on 12<sup>th</sup> July 2018, utilising ERM's NTi Audio Sound Level Meter. Continuous sound pressure level data was collected over the monitoring interval.

Due to extraneous noise in the area, attended measurements were taken closer to the railway line than indicated in Figure 5.1. Two measurements were taken simultaneously in the vicinity of RA4A and RA4B, approximately, 55 metres and 130 metres from the rail line respectively.

The logger was located in the back garden of 64 Ritchie Crescent, approximately 100m from the rail line.

Train passby events were identified in the collected data, then post processed to calculate passby sound exposure levels (SEL) for each event. Period noise levels were calculated from the event SELs.

Where identified in the collected audio data, extraneous noise was removed from the passby event.

The meteorological conditions observed during the unattended noise monitoring were generally satisfactory for noise monitoring.

## 8 Monitoring Results

### 8.1 Colliery Operational Noise

The results of the operator attended measurements are presented in Table 8.1. All values are in dB(A)

Receiver	Time	Period	Criteria	Weather	Measured Noise Level			Estimated Contribution from Project	Complies	Notes
			$L_{Aeq,15min}$		$L_{Aeq}$	$L_{A10}$	$L_{A90}^1$	$L_{Aeq,15min}$ dB(A)		
RA1a	11/07/18 17:44	Day	43	Calm, 12°C, Wind: 0 m/s	47	48	44	<43	Yes	Mine noise (constant hum) @ 43 dB(A), Air conditioner nearby @ 48 dB(A), Dogs barking @ 52-58 dB(A)
RA1b	11/07/18 17:42	Day	43	Calm, 10°C, Wind: 0 m/s	50	47	38	<43	Yes	Birds @ 50-58 dB(A), Cars @ 53-74 dB(A).
RA2a	11/07/18 17:11	Day	44	Calm, 10°C, Wind: 0 m/s	62	66	70	<40	Yes	Distant traffic @ 43-47 dB(A), Car passing @ 60-75 dB(A), Traffic on adjacent street @ 45-57 dB(A), Plane overhead @ 51-53 dB(A).
RA2b	11/07/18 17:06	Day	44	Calm, 10°C, Wind: 0 m/s	59	61	47	46-47	Yes	Birds 50-80 dB(A), Cars 50-75 dB(A), Engine noise (constant/distant) from mine @ 46-47 dB(A).
RA3a	11/07/18 16:32	Day	40	Calm, 12°C, Wind: 0 m/s	49	51	45	<40	Yes	Construction noise @ 48-56 dB(A) Birds @ 52-58 dB(A).
RA3b	11/07/18 16:37	Day	40	12°C, Wind: 0 m/s	49	51	46		Yes	Siren/Reversing beepers @ 48 dB(A), Distant traffic c@ 46-48 dB(A), Hammering sounds 44-53 dB(A), Plane overhead @ 50-52 dB(A), Car passing @ 58 dB(A).
RA4a	11/07/18 14:30	Day	40	Calm, 13°C, Wind: 0.7-1.3 m/s	55	55	41	<40	Yes	Distant vehicles @ 55 dB(A), Aeroplane @ 55-63 dB(A), trucks @ 58 dB(A), Dogs @ 55-77 dB(A).
RA4b	11/07/18 14:35	Day	40	13°C, Wind: 0.2-0.5 m/s	53	55	48	<40	Yes	Consistent truck hum @ 48-50 dB(A), Plane overhead @ 59-62 dB(A), Dog barking (consistent) @ 50-57 dB(A).
RA1a	11/07/18 22:21	Eve	43	9°C, Wind: 1-3 m/s	53	50	39	<43	Yes	Constant mine hum @ 40-43 dB(A), Car passing @ 55-62 dB(A)
RA1b	11/07/18 22:04	Eve	43	Breezy, 9°C, Wind: 1-3 m/s	44	40	37	36-38	Yes	Coal mine 36-38 dB(A), Cars 59-66 dB(A), Trees 38-41 dB(A)
RA2a	11/07/18 21:22	Eve	43	Calm, 11°C, Wind: 0 m/s	55	53	37	37-39	Yes	Distant traffic @ 38-42 dB(A), Constant mine hum @ 37-39 dB(A), Traffic passing @ 60-72 dB(A), Plane overhead @ 40-43 dB(A).

Receiver	Time	Period	Criteria	Weather	Measured Noise Level			Estimated Contribution from Project	Complies	Notes
			$L_{Aeq,15min}$		$L_{Aeq}$	$L_{A10}$	$L_{A90}^1$	$L_{Aeq,15min}$ dB(A)		
RA2b	11/07/18 21:39	Eve	43	Calm, 9°C, Wind: 0 m/s	53	47	42	44-46	Yes	Domestic noises from nearby home 46-47 dB(A), Cars 68-75 dB(A).
RA3a	11/07/18 21:10	Eve	40	Calm, 11°C, Wind: 0 m/s	40	42	33		Yes	Aeroplane @ 48 dB(A), Cars @ 46-61 dB(A), Frogs 32-34 dB(A).
RA3b	11/07/18 21:50	Eve	40	11°C, Wind: 0 m/s	39	41	35	<40	Yes	Crickets, distant traffic, mine hum @ 38 dB(A), Hammering/dumping sounds @ 39-42 dB(A), Dogs barking @ 38 dB(A), Distant traffic @ 35 dB(A), Mine hum @ 38-40 dB(A), Car passing @ 49 dB(A).
RA4a	11/07/18 20:37	Eve	40	Calm, 13°C, Wind: 0 m/s	41	45	32		Yes	Aeroplane @ 45 dB(A), Cars @ 40-55 dB(A).
RA4b	11/07/18 20:30	Eve	40	Calm, 13°C, Wind: 0 m/s	44	46	32		Yes	Dog barking @ 42-48 dB(A), Crickets + background ambient @ 32-35 dB(A), Plane overhead @ 42-44 dB(A), Car passing @ 52-63 dB(A)
RA1a	11/07/18 23:42	Night	43	9°C, Wind: 0 m/s	41	41	39	<40	Yes	Dog bark @ 48 dB(A), Mine hum @ 40-42 dB(A)
RA1b	11/07/18 23:38	Night	43	Calm, 9°C, Wind: 0.5-1 m/s	45	41	37	38-40	Yes	Mine noise @ 38-40 dB(A), Dogs @ 37-45 dB(A), Frogs and trees @ 46 dB(A), Cars @ 64-69 dB(A).
RA2a	11/07/18 23:51	Night	43	Calm, 9°C, Wind: 0.4-0.6 m/s	41	41	39		Yes	Mine hum @ 40-43 dB(A), Distant traffic @ 42 dB(A), Car approaching/passing @ 48-78 dB(A), Plane overhead @ 42-46 dB(A).
RA2b	11/07/18 23:12	Night	43	Calm, 9°C, Wind: 0.4 m/s	46	44	39	38-41	Yes	Mine noise (constant) @ 38-41, Mine noise (5 minute period) @ 40-47 dB(A), Aeroplanes @ 45-57 dB(A), Car @ 73 dB(A).
RA3a	11/07/18 22:39	Night	38	Calm, 9°C, Wind: 0.4 m/s	41	44	37	37-39	Yes	Mine noise @ 37-39 dB(A), Cars @ 40-50 dB(A), Aeroplane @ 53 dB(A), Frogs @ 36-38 dB(A)
RA3b	11/07/18 22:23	Night	38	9°C, Wind: 0-0.6 m/s	40	43	38	<40	Yes	Mine hum @ 38-40 dB(A), Plane @ 40-45 dB(A), Crickets @ 38-42 dB(A), Water trickling (constant) @ 38 dB(A)

Receiver	Time	Period	Criteria $L_{Aeq,15min}$	Weather	Measured Noise Level $L_{An,15min}$ dB(A)			Estimated Contribution from Project	Complies	Notes
			dB(A)		$L_{Aeq}$	$L_{A10}$	$L_{A90}^1$	$L_{Aeq,15min}$ dB(A)		
RA4a	12/07/18 00:12	Night	38	9°C, Wind: 0 m/s	37	35	30	<35	Yes	Car @ 52 dB(A)
RA4b	12/07/18 00:15	Night	38	9°C, Wind: 0.5-0.6 m/s	38	38	28	<30	Yes	Mine hum @ 30 dB(A), Distant traffic @ 32-35 dB(A), Traffic passing @ 48-55 dB(A).

Notes: All noise levels are rounded to the nearest whole decibel.  
 1 values exceeding the adopted criteria are indicated in bold font.



Table 8.1. *Attended Measurement Results (Sleep Disturbance)*

Receiver	Criteria $L_{A1,1min}$ dB(A)	Measured Levels $L_{A1,1min}$ dB(A) $L_{A1}$	Estimated Contribution from Project $L_{A1,1min}$	Complies	Notes
RA1a	59	50	<40	Yes	Site source generally steady state mechanical noise, no detectable peak events. Measured peaks not site related.
RA1b	59	47	<40	Yes	Site source generally steady state mechanical noise, no detectable peak events. Measured peaks not site related.
RA2a	60	44	<40	Yes	Site source generally steady state mechanical noise, no detectable peak events.
RA2b	60	41	<40	Yes	Site source generally steady state mechanical noise, no detectable peak events.
RA3a	48	43	<38	Yes	Site source generally steady state mechanical noise, no detectable peak events. Measured peaks not site related.
RA3b	48	47	<41	Yes	Site source generally steady state mechanical noise, no detectable peak events. Measured peaks not site related.
RA4a	48	40	<40	Yes	Site source generally steady state mechanical noise, no detectable peak events. Measured peaks not site related.
RA4b	48	40	<40	Yes	Site source generally steady state mechanical noise, no detectable peak events. Measured peaks not site related.


Notes: All noise levels are rounded to the nearest whole decibel.

## 8.2 Rail spur noise

The results of the rail noise measurements at rail receiver location R1 are presented in Table 8.2 for LAeq, period criteria. All values are in dB(A).

Rail operations during monitoring included 1 locomotive pass by events during attended monitoring on 12<sup>th</sup> July and 1 locomotive pass by during unattended monitoring on 11<sup>th</sup> July.

Table 8.2. Rail Noise events (LAeq Noise Levels)

Location	Date	Time (hh:mm) (AEDST)	Duration (mm:ss)	 LAeq	Rail Noise Level LAeq period	Criteria	Complies
64 Ritchie Crescent, Horsley	11/07/18	15:48	7:33	93	48	65	Yes
RA4A	12/07/18	9:40	6:18	82	36	65	Yes
RA4B	12/07/18	9:39	3:40	85	39	65	Yes

## 9 Discussion

### 9.1 Operational colliery noise

The Project was inaudible during the daytime and barely audible during evening and night time periods at all locations.

Site noise levels during the night time periods were found to be below the relevant sleep disturbance limits for all locations, where identified.

During the night time period, no short duration high noise level events were identified. No annoying characteristics were observed during measures which would trigger the application of modifying factors as defined in Chapter 4 of the INP.

### 9.2 Rail spur

Measured rail noise levels were below the day time noise limit of 65 dB(A) and night time noise limit of 60 dB(A) for monitoring undertaken on 11<sup>th</sup> and 12<sup>th</sup> July 2018.

## 10 Statement of compliance

ERM has completed operational noise compliance monitoring for Wongawilli Colliery. Measurements were completed at eight (8) locations representative of residential areas (RA1 to RA4), and demonstrated that measured noise levels are below relevant noise limits for all periods.

Project operations were inaudible at all locations during the day and barely audible during evening and night time periods.

Maximum site noise levels during the night time periods were not identifiable, therefore remaining below the relevant sleep disturbance limits for all locations.

No annoying impulsive, low frequency or tonal characteristics were observed from the Project at locations.

Rail noise levels Park were within the day time rail noise limit of  $L_{Aeq}$  65 dB(A) (7am to 10pm) and night time rail noise limit of  $L_{Aeq}$  60 dB(A) (10pm to 7am).

## 11 Conclusion

ERM conducted operational compliance noise monitoring at Wongawilli Colliery on 11<sup>th</sup> and 12<sup>th</sup> July 2018 during typical operations. This involved the completion of attended noise measurements at eight (8) locations during the day, evening and night periods as required by the Project Approval.

The assessment was conducted according to current guidelines, standards and assessment methods.

The compliance monitoring found that the Project is operating within its required noise limits. Project operations were inaudible at all locations during the day, evening and night time periods.

No annoying impulsive, low frequency or tonal characteristics were observed from the Project at locations.

Maximum site noise levels during the night time periods were found to be below the relevant sleep disturbance limits for all locations, where identified.

Attended rail noise measurements were carried out on 12<sup>th</sup> July at RA4A and RA4B and an additional pass by was captured by unattended monitoring on 11<sup>th</sup> July at 64 Ritchie Crescent.

Measured rail noise levels were below the day time noise limit of 65 dB(A) and night time noise limit of 60 dB(A).

Therefore compliance has been demonstrated at all monitoring locations for all periods.

# Appendix A

## Glossary of Terms

Term	Description
Adverse weather	Weather conditions that affect noise measurements (wind, rain and temperature inversions) that occur at a particular site for a significant period of time. The maximum wind speed allowed during acoustics measurements are in process is 5m/s. No rain is allowed.
Ambient noise	The all-encompassing noise environment at a given location, made up of many sources in the near and far field.
Assessment period	The period in a day over which assessments are made.
A-weighting	Adjustment made to a noise level based on international standards. Approximates a human's hearing response to frequency at lower sound levels.
Background noise	Background noise is the term used to describe the underlying level of noise present in an area, measured in the absence of any extraneous noise. Typically when measured with a sound level meter is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period ( $L_{A90,T}$ ).
dB	Decibel, the logarithmic ratio of a given sound pressure to a reference pressure.
dB(A)	A-weighted decibels.
Free-field	A sound field where the effects of reflection are negligible throughout the region of interest.
Frequency	The number of cycles per unit of time. It is measured with cycles per second (cps) or the interchangeable Hertz (Hz). Frequency can be associated as a synonymous to pitch.
Intermittent noise	Level that drops to the background noise level several times during the period of observation.
Heavy vehicle	A truck or other vehicle with either two or three axles, two groups or three or more axles, more than two groups.
Light vehicle	Passenger vehicles (cars, vans, utilities, motorcycles etc.).
$L_{A1,T}$	The noise level exceeded for 1% of the time period, T.
$L_{A10,T}$	The noise level exceeded for 10% of the time period, T.
$L_{A90,T}$	The noise level exceeded for 90% of the time period, T. Commonly referred to as the background noise level.
$L_{Aeq,T}$	The equivalent average noise level of the time period, T. It represents in a single number, the energy of the actual fluctuating noise level over the period.
$L_{Amax,T}$	The maximum noise level measured during the period, T.
RBL	Rating Background Level. The background noise level as defined by the NSW Industrial Noise Policy (EPA, 2000). It is calculated by the taking the median value of the lowest 10th percentile LA90 measurements in any day, evening or night period.
Sound Pressure Level (SPL)	Is the difference between the pressure produced by a sound wave and the barometric (ambient) pressure at the same point in space. Typically expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Levels (Lw)	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power. Typically associated with noise sources.