



Appendix H

Noise and Blasting
Assessment

Narrabri Underground Mine Stage 3 Extension Project

Environmental Impact Statement

NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT

NOISE & BLASTING ASSESSMENT

REPORT NO. 17345
VERSION F

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PREPARED FOR

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DOCUMENT CONTROL

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GLOSSARY OF ACOUSTIC TERMS

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

A-weighted – is a frequency dependent curve (or filter) applied to sound pressure levels to mimic the effects of human hearing, especially at lower levels. The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.

C-weighted – is a frequency dependent curve (or filter) applied to sound pressure levels to mimic the effects of human hearing, especially at higher noise levels.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

SWL – Sound Power Level is the total sound energy radiated per second from a noise source. It is quoted in decibels with respect to the reference power level. The reference level is 1pico-watt (pW) or 1×10^{-12} watts.

COMMONLY USED ACRONYMS

AS	Australian Standard
AVTG	<i>"Assessing Vibration: A Technical Guideline"</i>
CoRTN	<i>Calculation of Road Traffic Noise</i>
DP&E	Department of Planning and Environment
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
ENM	Environmental Noise Model
EPA	Environment Protection Authority
EPL	Environment Protection Licence
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ICNG	Interim Construction Noise Guideline
INP	<i>Industrial Noise Policy</i>
LW	Longwall
MIC	Maximum Instantaneous Charge
ML	Mining Lease
MLA	Mining Lease Application
Mtpa	Million tonnes per annum
NCOPL	Narrabri Coal Operations Pty Ltd
NML	noise management level
NMP	Noise Management Plan
NPFI	<i>Noise Policy for Industry</i>
PNTL	Project Noise Trigger Level
PVS	Peak Vector Sum
RNP	<i>Road Noise Policy</i>
RING	Rail Infrastructure Noise Guideline
ROM	Run of Mine
SSD	State Significant Development
VLAMP	<i>Voluntary Land Acquisition and Mitigation Policy</i>

EXECUTIVE SUMMARY

This assessment investigates the operational noise, construction and blasting impacts associated with the Narrabri Underground Mine Stage 3 Extension Project (the Project), located in the New England North West region of New South Wales.

Representative scenarios have been considered for the assessment of potential impacts associated with:

- operational noise, including cumulative noise and maximum noise level events;
- construction activities, including construction noise along with vibration from construction blasting activities associated with shaft construction;
- road transportation noise; and
- rail transportation noise.

The Project is located in a rural setting, with residential receivers being relatively few in number.

With the implementation of noise mitigation measures, noise contributions from the Project at the majority of privately-owned receivers are predicted to be low and indistinguishable from background noise.

The Project would result in “moderate” to “significant” exceedances of the Project noise trigger levels (PNTLs) at two receivers. Given these receivers are predicted to have greater than 5 A-weighted decibel (dBA) exceedances of the PNTLs, they would have the right to acquisition upon request.

The Project would result in a “marginal” exceedance at one receiver whom would be afforded mitigation upon request rights. In this case noise levels may be mitigated through the provision of mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.

An additional receiver would experience a “negligible” exceedance, which would not be discernible when compared to compliance with the PNTLs by the average listener and therefore would not warrant receiver-based treatment or controls.

The relatively limited number of exceedances indicates that reasonable and feasible mitigation measures are being implemented for the Project, and no other measures would be of material benefit.

Cumulative noise levels with the Narrabri Gas Project have been considered, with resulting levels being within the relevant noise criteria designed to protect residential amenity.

The Project would comply with relevant criteria in relation to construction noise, overpressure and ground vibration levels, road transportation noise and rail transportation noise and vibration.

1 INTRODUCTION

The Narrabri Mine is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah within the Narrabri Shire Council Local Government Area of New South Wales (NSW) (Figure 1-1). The Narrabri Mine is operated by Narrabri Coal Operations Pty Limited (NCOPL).

NCOPL is seeking a new Development Consent under the State Significant Development (SSD) provisions of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Narrabri Underground Mine Stage 3 Extension Project (the Project). This Noise and Blasting Assessment forms part of the Environmental Impact Statement (EIS) which has been prepared to accompany the Development Application for the Project. The Secretary's Environmental Assessment Requirements states the following requirements in regard to the Noise and Blasting Assessment:

- **Noise and Vibration** – *an assessment of the likely noise impacts of the development under the NSW Noise Policy for Industry and the Voluntary Land Acquisition and Mitigation Policy (DP&E);*
- *if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline;*
- *an assessment of the likely road noise impacts of the development under the NSW Road Noise Policy;*
- *an assessment of the likely rail noise impacts of the project under the Rail Infrastructure Noise Guidelines;*
- *an assessment of the potential vibration and low frequency noise impacts of the development;*

Additionally, the Environment Protection Authority (EPA) identified the following specific issues to be included within the EIS:

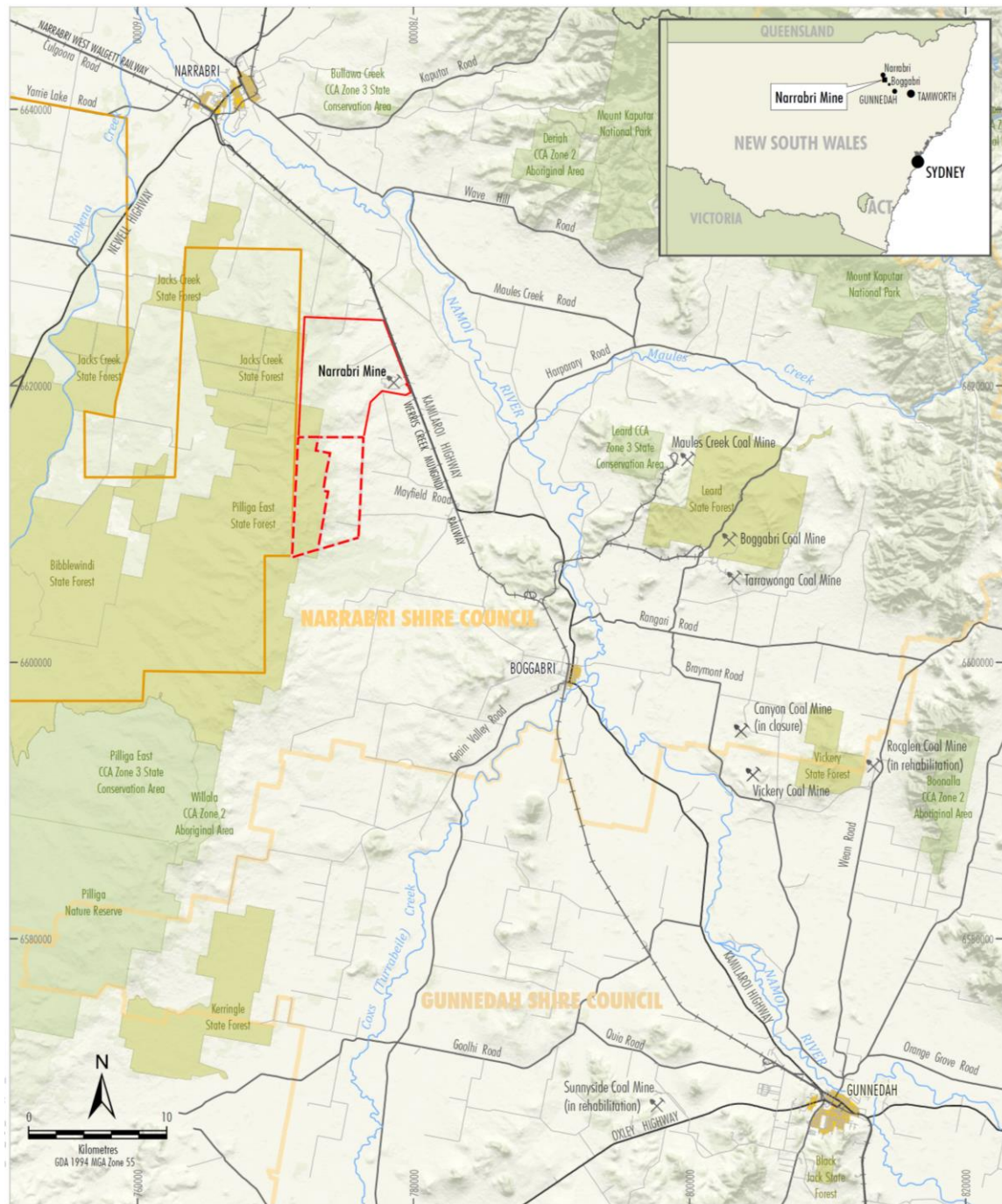
1. *Noise from gas drainage and ventilation: The EIS needs to assess all potentially affected sensitive receivers. With the progression of the long wall, potential impacts on receivers from gas drainage and ventilation infrastructure needs to be assessed, specifically the residence on Lot 5 DP1084395¹ should be assessed in the EIS.*

Finally, NSW Health identified the following specific issues:

- *an assessment of the potential vibration and low frequency noise impacts of the development; figure 2.2 page 8 of Narrabri Underground Mine Stage 3 Extension Project – SIA Scoping Report indicates a number of private in and around the proposed Longwall sites with 1 residence directly above Longwall 120;*
- *potential for cumulative impact in development stage and operating stage for surrounding communities, i.e. Baan Baa, Boggabri.*

¹ This receiver is 653a as per Table 3-1 and Figure 3-1.

Figure 1-1 Regional Location



- LEGEND**
- Mine Site
 - Mining Lease (ML 1609)
 - Provisional Mining Lease Application Area
 - Local Government Boundary
 - State Forest
 - State Conservation Area, Aboriginal Area
 - Narrabri Gas Project (Santos NSW (Eastern) Pty Ltd)

Source: Geoscience Australia (2011); NSW Spatial Services (2019)

WHITEHAVEN COAL
NARRABRI STAGE 3 PROJECT
Regional Location

2 PROJECT DESCRIPTION

2.1 Existing Approval

Stage 1 of the Narrabri Mine was approved under Part 3A of the EP&A Act in 2007 and involved initial site establishment activities and continuous miner mining operations.

Existing mining operations (Stage 2) are undertaken in accordance with Project Approval 08_0144 (as modified), the Approval Decision (EPBC 2009/5003) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the conditions of Mining Lease (ML) 1609.

2.2 Project Overview

The Project involves an extension to the south of the approved underground mining area to gain access to additional coal reserves within Mining Lease Applications (MLAs) 1 and 2 (Figure 2-1), an extension of the mine life to 2044 and development of supporting surface infrastructure. Run-of-mine (ROM) coal production would occur at a rate of up to 11 million tonnes per annum (Mtpa), consistent with the currently approved limit.

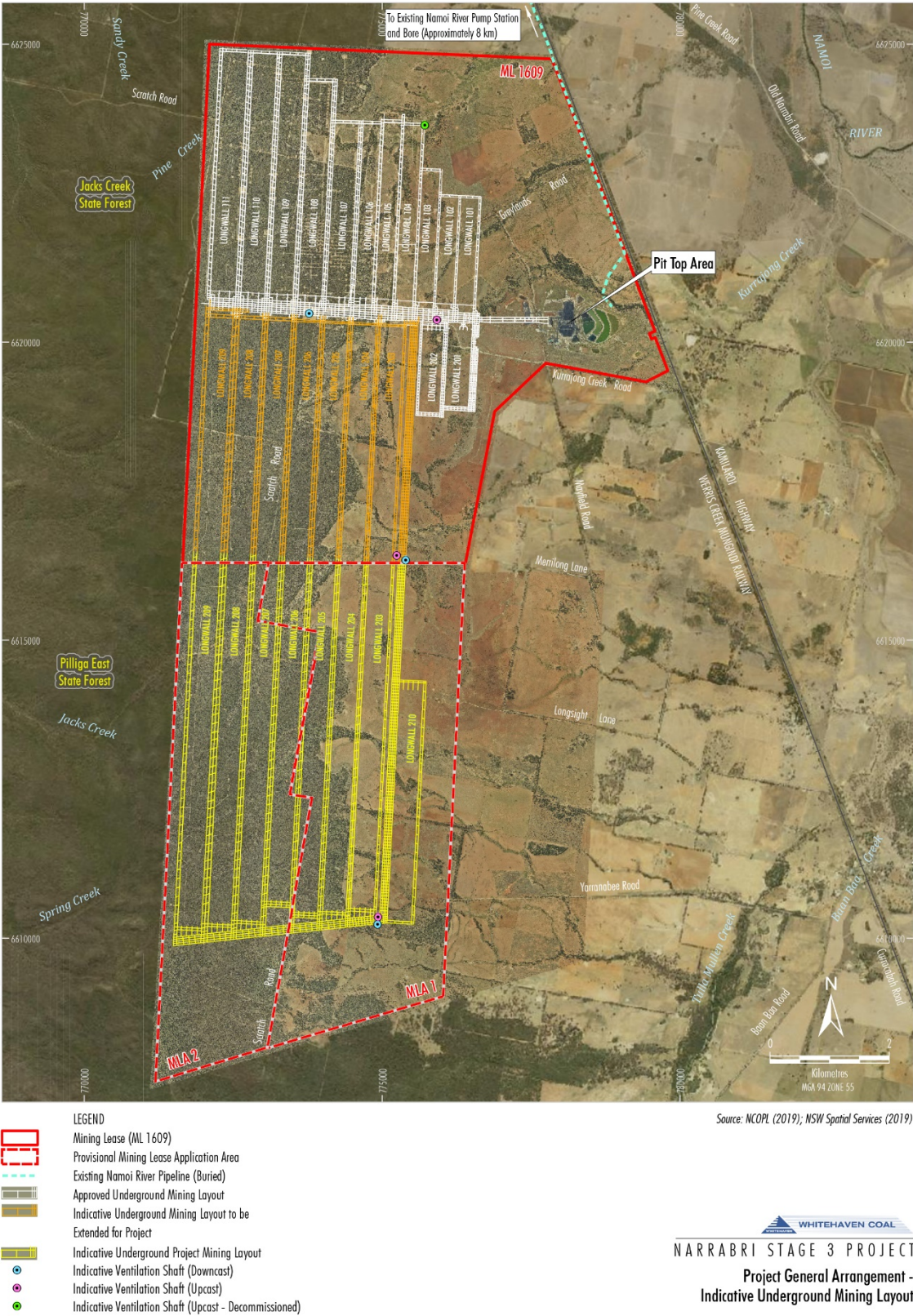
A detailed description of the Project is provided in Section 2 in the Main Report of the EIS.

2.3 Project Activities

Project components with the potential for noise and vibration impacts are:

- Operational noise impacts as a result of the physical extension of mining operations to 2044.
- Construction noise impacts associated with site enabling works, noting that multiple short periods of construction activity would occur throughout the Project life as infrastructure development occurs.
- Blasting noise and vibration impacts associated with potential blasting activities required as part of shaft construction.
- Road noise increases associated with revised traffic volumes associated with the Project.
- No increase in average or peak product rail volumes would be associated with Project, therefore no changes to rail noise is anticipated.

Figure 2-1 Project General Arrangement – Indicative Underground Mining Layout



3 NOISE RECEIVERS

Table 3-1 lists each of the non-project-related receivers within a 5 km radius of the Project together with the name of the property owner and reference number. Figure 3-1 shows the location of each non-Project-related property in relation to the Project.

MLAs 1 and 2 includes land zoned under the Narrabri Local Environmental Plan 2012 as Zone RU1 (Primary Production) and Zone RU3 (Forestry).

All receivers including NCOPL-owned properties and commercial buildings are presented in Appendix A.

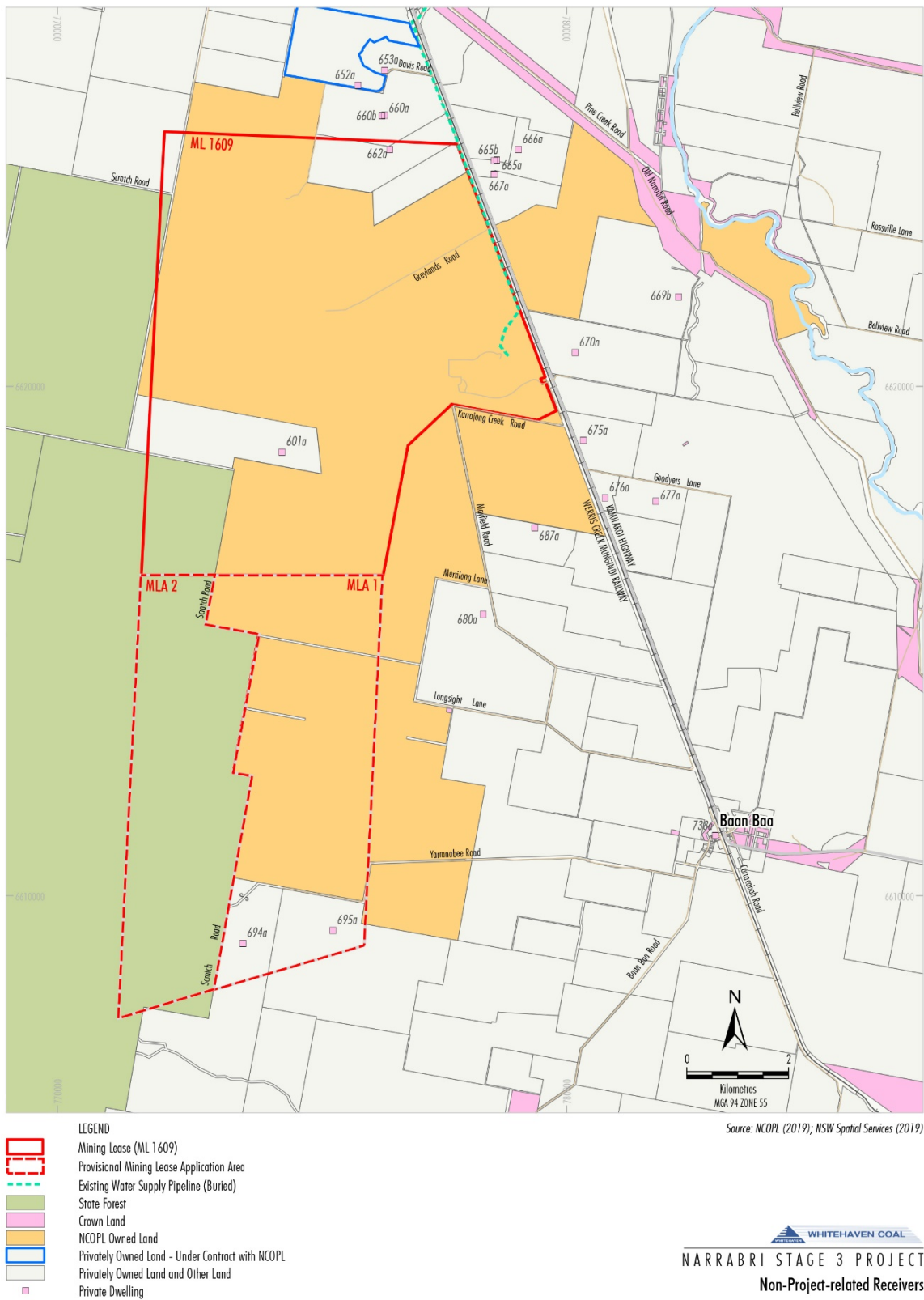
Table 3-1 Non-Project-related Residences

Receiver No.	Property Name	Property Owner
601a	-	B & D & N & P GRNCARSKI
652a ¹	"High Range"	AR & JS COLLINS
653a	"Hillcrest"	KA & PE KIDCAFF
660a	"Darjeeling"	AL & LM GRUMLEY
660b	"Darjeeling"	AL & LM GRUMLEY
662a	"Newhaven"	JF & KL SCOTT
665a	-	BR & MJ O'CONNOR
665b	-	BR & MJ O'CONNOR
666a	-	NE HOBSON and TM WILLEMSE
667a	"Merulana"	PJ SMART
669b	"Greenhills"	CH & RL MELBOURNE
670a	"Bow Hills"	JME & R STIEGER
675a	"Ardmona"	PC WEBB
676a	"Wilga"	RR MCCLUNG & EF WEBSTER
677a	-	AD & IH MOULDS
680a	"Burragurru"	GR & L STUART
687a	"Pineview"	CS & DL KIRKBY
694a	"The Bulga"	RK MARTIN II
695a	"Uambi"	DP & SW MURRAY
738a ¹	-	B & BC STEWART

Note 1: Property 652a is under contract with NCOPL.

Note 2: Receiver 738a is located on the north-west edge of Baan Baa has been retained and is conservatively assumed to be representative of receivers at Baan Baa.

Figure 3-1 Non-Project-related Receivers



4 REVIEW OF EXISTING NOISE MANAGEMENT PERFORMANCE

Project Approval (08_0144) for the Narrabri Mine outlines conditions specific to noise management including impact assessment criteria, acquisition and additional mitigation upon request criteria, noise mitigation measure requirements and monitoring requirements.

The noise conditions from Schedule 4 of the current Project Approval are presented below:

Impact Assessment Criteria

1. The Proponent shall ensure that the noise generated by the project does not exceed the levels set out in Table 1.

Table 1: Impact assessment criteria dB(A)

Location	Day $L_{Aeq}(15 \text{ minute})$	Evening $L_{Aeq}(15 \text{ minute})$	Night	
			$L_{Aeq}(15 \text{ minute})$	$L_{A1}(1 \text{ minute})$
All privately-owned residences	35	35	35	45

Notes:

- To determine compliance with the $L_{Aeq}(15 \text{ minute})$ limit, noise from the project is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.
- These noise limits apply to applicable receivers under all meteorological conditions except for any one of the following:
 - wind speeds greater than 3 metres/second at 10 metres above ground level; or
 - stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
 - stability category G temperature inversion conditions.
- Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological weather station located in the vicinity of the site, or as otherwise agreed by the Secretary.
- To determine compliance with the $L_{A1}(1 \text{ minute})$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).
- These limits do not apply if the Proponent has an agreement with the relevant owner/s of these residences to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.

Noise Acquisition Criteria

2. If the noise generated by the project exceeds the criteria in Table 2 at any residence on privately-owned land then the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 5-7 of schedule 7.

Table 2: Noise acquisition criteria dB(A)

Location	Day $L_{Aeq}(15 \text{ minute})$	Evening $L_{Aeq}(15 \text{ minute})$	Night $L_{Aeq}(15 \text{ minute})$
All privately-owned residences	40	40	40

Note: Noise generated by the project is to be measured in accordance with the notes presented below Table 1. For this condition to apply, the exceedances of the criteria must be systemic.

Additional Noise Mitigation Measures

3. If the noise generated by the project is equal to or exceeds the criteria in Table 3 at any residence on privately-owned land, then the Proponent shall, upon receiving a written request from the landowner, implement reasonable and feasible noise mitigation measures (such as double-glazing, insulation, and/or air conditioning) at the residence in consultation with the landowner. If within 3 months of receiving this request from the landowner, the Proponent and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 3: Additional noise mitigation criteria

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)
All privately-owned residences	38	38	38

Note: Noise generated by the project is to be measured in accordance with the notes presented below Table 1. For this condition to apply, the exceedances of the criteria must be systemic.

Noise Management Plan

4. The Proponent shall revise the Noise Management Plan for the Stage 1 project to encompass all proposed mine activities and potential impacts associated with noise management (Stages 1 and 2) and subsequently implement this revised version of the Noise Management Plan to the satisfaction of the Secretary. This Plan shall:
- be prepared in consultation with EPA by a suitably qualified expert whose appointment has been approved by the Secretary;
 - be submitted to the Secretary for approval by 30 June 2011; (c) include a Noise Monitoring Program incorporating:
 - real-time noise and temperature inversion monitoring; and
 - attended noise monitoring
 to monitor the performance of the project;
 - include reactive noise control measures to manage noise impacts for sensitive receivers; and
 - include a protocol to establish whether the project is complying with the noise impact assessment criteria in Table 1.

4.1 Summary of Impact Assessment Criteria

Condition 1, Schedule 4 of Project Approval (08_0144) and Condition L3 of Environment Protection Licence (EPL) 12789 outline the noise impact assessment criteria for the Narrabri Mine. Noise at the Narrabri Mine must not exceed 35 A-weighted decibels (dBA), $L_{eq}(15mins)$ at a privately owned receiver during the day, evening or night.

The same conditions also include a sleep disturbance noise criteria of 45 dBA, $L_{1(1 min)}$ during the night.

Condition 1, Schedule 4 of Project Approval (08_0144) and Condition L3 of EPL 12789 also includes a sleep disturbance noise criteria of 45 dBA, $L_{1(1 min)}$ during the night.

The impact assessment criteria do not apply during the following meteorological conditions:

- wind speeds greater than 3 metres/second (m/s) at 10 metres (m) above ground level;
- 'F' class temperature inversions (1.5 to 4 degrees Celsius [$^{\circ}C$]/100 m)⁽²⁾ and source to receiver wind speed greater than 2 m/s at 10 m above ground level; or
- 'G' class temperature inversions (greater than 4 $^{\circ}C$ /100 m)⁽³⁾.

² Condition L3.5 of EPL 12789 excludes "Stability category F temperature inversion conditions" rather than "temperature inversions of 1.5 to 4 $^{\circ}C$ /100 m".

³ Condition L3.5 of EPL 12789 excludes "Stability category G temperature inversions" rather than "temperature inversions of greater than 4 $^{\circ}C$ /100 m".

Condition 2, Schedule 4 of Project Approval (08_0144) requires NCOPL to acquire land upon the written request of the relevant landholder, if the noise generated by the Narrabri Mine at the landholders residence exceeds 40 dBA_{Leq(15 mins)} during the day, evening or night. Conditions 5 to 7, Schedule 7 of Project Approval (08_0144) outline additional procedures for potential land acquisitions triggered by Condition 2, Schedule 4 of Project Approval (08_0144).

Condition 3, Schedule 4 of Project Approval (08_0144) requires NCOPL to undertake reasonable and feasible noise mitigation measures at a residence upon the written request of the relevant landholder, if the noise generated by the Narrabri Mine at the landholder's residence is equal to or exceeds 38 dBA_{Leq(15 mins)} during the day, evening or night.

4.2 Noise Management & Mitigation Measures

Noise management at the Narrabri Mine is conducted in accordance with the Noise Management Plan (NMP) (NCOPL, 2018) prepared in accordance with Condition 4, Schedule 4 of Project Approval (08_0144).

NCOPL is required to manage noise levels from the Narrabri Mine in accordance with the noise impact assessment criteria specified in Project Approval (08_0144) using reasonable and feasible mitigation measures. The following reasonable and feasible mitigation measures are implemented at the Narrabri Mine and reflect the actions listed in the Statement of Commitments:

- Activities are conducted within the approved hours (e.g. construction activities are restricted to between 7.00 am and 10.00 pm).
- The rotary breaker is fully enclosed.
- The coal handling and preparation plant (CHPP) is enclosed and 50% of the internal surface is lined with acoustic insulation.
- Ventilation fans are banded when located in the vicinity of a receiver.
- Surface drills operating over LW 1 to LW 3 and LW 24 to LW 26⁴ will be attenuated to achieve a sound power level (SWL) of 109 dBA.
- Dozers are not used on the reject emplacement area during evening and night periods during temperature inversion conditions.
- Truck movements to the reject emplacement area are restricted to one load per 15 minutes during temperature inversion conditions.
- All reversing alarms on equipment are broadband frequency types (i.e. high frequency reversing alarms are not permitted).
- Equipment used on-site is regularly serviced so that SWLs remain the same.
- When selecting new/replacement equipment, equipment with a lower SWL is selected where feasible.

4.3 Noise Monitoring & Compliance

The NMP includes a noise monitoring program in accordance with Condition 4, Schedule 4 of Project Approval (08_0144). The NMP also addresses EPL 12789 noise monitoring requirements. The noise monitoring program includes attended noise monitoring and real time (unattended) noise monitoring.

⁴ 26 longwalls (LWs 1 to 26) were proposed as part of the Stage 2 Environmental Assessment for the Narrabri Mine (R.W. Corkery & Co., 2009). As part of Narrabri Mine Modification 5 (NCOPL, 2015), the Narrabri Mine reduced to 20 longwall panels, with the numbering revised to LWs 101 to 120. LWs 112 to 120 have been renamed to LWs 201 to 209 for the Project.

4.3.1 Attended Monitoring

Attended monitoring is completed by a suitably qualified consultant and is used to assess compliance with licence and approval limits for mine contributed noise. Attended monitoring is undertaken on a quarterly basis over a period of three consecutive days. A summary of the noise monitoring results is outlined in Table 4-1 with additional details provided where results were recorded above the criteria at privately-owned residences where a private agreement is not in place.

Table 4-1 Summary of Operational Noise Monitoring Results (March 2018 – March 2020)

Monitoring Period	Result
2018	
Quarter 1	Exceedance for "Ardmona".
Quarter 2	No exceedances recorded.
Quarter 3	No exceedances recorded.
Quarter 4	Exceedance for "Bow Hills" ¹ .
2019	
Quarter 1	No exceedances recorded.
Quarter 2	No exceedances recorded ² .
Quarter 3	Exceedance for "High Range" ³ .
Quarter 4	No exceedances recorded.
2020	
Quarter 1	No exceedances recorded.

Source: Environmental Resources Management Australia Pty Ltd (ERM) (2020), NCOPL (2020a).

- ¹ NCOPL has entered into an agreement with the landholder which includes the implementation of additional mitigation measures at the "Bow Hills" residence.
- ² Elevated records at "Newhaven" and "High Range" were measured during non-compliant weather conditions. Wind speed >3m/s throughout measurement period.
- ³ 2 dB modifying factor correction for low frequency noise has been applied in accordance with the *Noise Policy for Industry (NPI)* (EPA, 2017).

The results in Table 4-1 show exceedances at "Ardmona", "Bow Hills" and "High Range".

Regarding the exceedance at "Ardmona", dozer track noise and conveyor noise continuum were identified as the dominant noise sources from the Narrabri Mine (NCOPL, 2019). The exceedance was considered an isolated occurrence for the monitoring station (NCOPL, 2019). The following periods of monitoring showed compliance at this location.

"Bow Hills" has entered into an agreement with NCOPL which includes the installation of additional noise mitigation measures consistent with Condition 3, Schedule 4 of Project Approval (08_0144).

Regarding the exceedance at "High Range", the contributing noise source was determined to be the main exhaust vent fan (SLR Consulting, 2019a). It is noted that subsequent attended measurements at this location have shown compliance and that NCOPL is in discussions in regard to noise mitigation options.

4.3.2 Real Time Monitoring

Real time (unattended) noise monitoring is conducted using a mobile SentineX real time continuous noise monitor to assist in the management of Narrabri Mine noise impacts (i.e. is used for real-time management and not for compliance monitoring). The real time noise monitors are positioned at receiver locations that are most likely to be impacted by Narrabri Mine operations or at a receiver location where a noise-related complaint has been received.

As described above, real time noise monitoring is not used for compliance monitoring. Compliance monitoring is conducted using attended monitoring methodology in accordance with Project Approval (08_0144) and EPL 12789.

4.4 Noise Complaints

Complaints in regard to noise received over the auditing period for 2017 to 2019 include (ERM, 2020):

- 2017 – during the reporting period 12 complaints were received and 4 were related to noise.
- 2018 – during the reporting period 6 complaints were received and 5 were related to noise.
- 2019 – during the reporting period 60 complaints were received and 52 were related to noise (NCOPL, 2020b).

Complaints in 2019 were abnormally high for the three-year period. However, out of the 60 complaints NCOPL received in 2019, 52 were made by the same complainant. It is noted that NCOPL is in discussions in regard to noise mitigation options (NCOPL, 2020b).

5 NOISE & VIBRATION CRITERIA

5.1 Noise Policy for Industry

The original noise assessment for the Project was conducted using the NSW *Industrial Noise Policy* (EPA, 2000) (*INP*). The *INP* has been superseded and is replaced by the NSW *Noise Policy for Industry* (*NPI*), however the *INP* continues to be used where it is referred to in licence and consent conditions (except for Section 4 which has been replaced by the provisions in Fact Sheet C of the *NPI*).

5.2 Overview

The *NPI* provides a framework and process for deriving noise criteria for consents and licences that enable the EPA and others to regulate premises that are scheduled under the *Protection of the Environment Operations Act 1997*.

The *NPI* documents a procedure for assessment and management of industrial noise which involves the following steps:

- determining the project noise trigger levels (PNTLs) for a development. The PNTL is a benchmark level above which noise management measures are required to be considered and is not intended as a mandatory requirement. They are derived by considering short-term intrusiveness due to changes in the existing noise environment (applicable to residential receivers only) and maintaining noise level amenity for particular land uses for residents and other sensitive receivers;
- predicting or measuring noise produced by the development (having regard to any associated annoying characteristics and prevailing meteorological effects);
- comparing the predicted or measured noise level with the PNTL and assessing impacts and the need for noise mitigation and management measures;
- considering any residual noise impacts following the application of feasible and reasonable noise mitigation measures;
- setting statutory compliance levels that reflect the best achievable and agreed noise limits for development; and
- monitoring and reporting environmental noise levels from the development.

5.2.1 Intrusiveness Noise Trigger Levels

For assessing intrusiveness, the background noise level (L_{A90}) is typically measured and the Rating Background Level (RBL) determined. Given the operational nature of the Narrabri Mine, it is necessary to review previous studies to determine the RBLs.

Background noise levels were established as part of the Stage 1 Noise Assessment for the Narrabri Mine. A summary of the outcomes of this assessment with regards to background noise levels can be found below (R.W. Corkery & Co. Pty Ltd, 2009):

Given the rural locality, none of the identified residences are currently subjected to significant (i.e. present for a high proportion of time) noise levels from transportation or industrial sources. It is therefore assumed that background noise levels are currently at or below 30 dBA L_{90} at all receivers during day, evening and night periods. Under the NSW Industrial Noise Policy, it is a standard requirement that noise levels below 30dB(A) can be taken as 30 dBA for the purposes of assessing industrial noise, such as noise from a coal mine like that proposed. As such, a 30 dBA, L_{90} background level has been adopted for all residences during the day, evening and night.

From previous background noise surveys, it has been established that the RBL of the area is less than 30 dBA (Spectrum Acoustics, 2009). The *NPTI* states that where the daytime RBL was measured at less than 35 dBA, then a minimum daytime RBL of 35 dBA must be used. Additionally, the *NPTI* states that where the evening and night time RBL was measured at less than 30 dBA, then a minimum daytime RBL of 30 dBA must be used. Therefore, the daytime RBL for all sensitive receivers has been assumed to be 35 dBA and the evening and night time RBL for all sensitive receivers has been assumed to be 30 dBA.

The Narrabri Gas Project is an approved development located to the west of the Project. The Noise and Vibration Assessment for the Narrabri Gas Project included background noise monitoring at five locations within the Narrabri Gas Project area (GHD, 2015). Background noise levels in the Narrabri Gas Project area were generally below 30 dBA (GHD, 2015). Further detail regarding the Narrabri Gas Project is provided in Section 7.7.

The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous noise level (L_{Aeq}) of the source (measured over a 15-minute period) does not exceed the background noise level (RBL) by more than 5 dBA. Therefore, the Project Intrusiveness Noise Trigger Levels (PNTL) are calculated by adding 5 dBA to the RBL.

Table 5-1 summarises the minimum assumed RBLs and the intrusiveness noise levels relevant to the Project.

Table 5-1 Project Intrusiveness Noise Trigger Levels, dBA

Receiver	RBL			Intrusiveness Noise Level		
	Daytime	Evening	Night	Daytime	Evening	Night
All privately owned residences	35	30	30	40	35	35

Note 1: Daytime 7.00am–6.00pm; Evening 6.00pm–10.00pm; Night 10.00pm–7.00am.

5.2.2 Amenity Noise Levels

The *NPTI* amenity noise level is specific to the type of land use and associated activities. The amenity noise levels relate only to industrial-type noise and do not include transportation noise (when on public transport corridors), noise from motor sport, construction noise, community noise, blasting, shooting ranges, occupational workplace noise, wind farms and, amplified music/patron noise.

The amenity noise level aims to limit continuing increases in noise levels which may occur if the intrusiveness level alone is applied to successive development within an area.

The recommended amenity noise level represents the objective for total industrial noise at a receiver location. The project amenity noise level represents the objective for noise from a single industrial development at a receiver location, as follows:

Project amenity noise level = Amenity noise level – 5 dB.

To prevent increases in industrial noise due to the cumulative effect of several developments in an area, the project amenity noise level for each new source of industrial noise is set at 5 dBA below the recommended amenity noise level. For comparison with the intrusiveness level (Table 5-1), the project amenity noise trigger level is converted from a period level (day, evening or night time periods) to a 15-minute level by adding 3 dBA in accordance with the *NPTI*.

Amenity noise levels are not used directly as regulatory limits. They are used in combination with the PNTL to assess the potential impact of noise, assess mitigation options and determine achievable noise requirements.

The *NPFI* amenity noise trigger levels for a rural area is presented in Table 5-2.

Table 5-2 Amenity Noise Trigger Levels, dBA

Receiver	Noise Amenity Area	Time of Day ¹	Recommended	Project Amenity
			Amenity Noise Level <i>L</i> _{Aeq,period} (dBA)	Trigger Level <i>L</i> _{Aeq,15min} dBA
Residence	Rural	Day	50	48
		Evening	45	43
		Night	40	38
Commercial	All	When in use	65	63

Note 1: Daytime 7.00am–6.00pm; Evening 6.00pm–10.00pm; Night 10.00pm–7.00am.

5.2.3 Project Noise Trigger Levels

In determining the PNTL, a comparison needs to be made between the amenity and intrusiveness trigger levels, and the lowest noise level (i.e. most stringent) needs to be selected for each period (day, evening and night). As presented in Table 5-3, Project Intrusive Noise Trigger Level is the lowest (as noted by bold text) and therefore will be used as the project trigger levels.

Table 5-3 Project Noise Trigger Levels

Receiver	Time of Day ¹	Project	Project	Resulting PNTL <i>L</i> _{Aeq,15min}
		Intrusiveness Noise	Amenity	
		Trigger Level <i>L</i> _{Aeq,15min} dBA	Trigger Level <i>L</i> _{Aeq,15min} dBA	
All privately owned residences	Day	40	48	40
	Evening	35	43	35
	Night	35	38	35

Note 1: Daytime 7.00am–7.00pm; Evening 7.00pm–10.00pm; Night 10.00pm–7.00am.

5.3 Modifying Factor Adjustments

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, the noise may cause greater annoyance. The *NPFI* refers to these potentially annoying characteristics as “modifying factors”. The *NPFI* recommends correction factors to be applied to the source noise level at the receiver before comparison with the criteria to account for the additional annoyance caused by these modifying factors.

From review of monitoring reporting at the Narrabri Mine, the only potentially relevant characteristic for noise from the mine is the potential for dominant low-frequency content.

The *NPFI* recommends investigating whether a modifying factor for low-frequency noise is applicable based on an analysis of third octave band levels where there is a difference between C- and A- weighting levels of more than 15 dB. The factor to be applied depends on comparison of the third octave spectrum of the noise against the threshold spectrum in Table 5-4 (Table C2 from *NPFI*).

Table 5-4 Low Frequency Noise Thresholds (Table C2 from *NPfI*)

Threshold & Predicted Level	One-Third Octave Centre Frequency, Hz ¹												
	10	12	16	20	25	31	40	50	63	80	100	125	160
L _{Zeq,15min} threshold level	92	89	86	77	69	61	54	50	50	48	48	46	44

Note 1: Hz = Hertz.

The following corrections apply where the measured dBC minus dBA level is 15 dB or more:

- Where any of the one-third octave noise levels in *NPfI* Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.
- Where any of the one-third octave noise levels in *NPfI* Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.

A low-frequency noise assessment for the Project is provided in Section 7.3. This assessment concludes no modifying factor correction for low-frequency noise is warranted for the Project.

5.4 Residual Noise Impacts

The *NPfI* recognises that where all feasible and reasonable noise mitigation measures have been applied, a proposed development might give rise to residual noise impacts.

The *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) (Department of Planning and Environment [DP&E], 2018) describes mitigation for residual noise and air quality impacts from State significant mining, petroleum and extractive industry developments through the application of voluntary mitigation and acquisition rights.

Table 4.1 of the *NPfI*, which interprets the significance of any potential noise exceedances, is reproduced below in Table 5-5. These significance categories (i.e. negligible, marginal, moderate and significant) are generally consistent with Table 1 of the *VLAMP* (DP&E, 2018) which addresses noise and air quality impacts from State significant mining, petroleum and extractive industry developments.

Table 5-5 Significance of Residual Noise Impacts

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Then the significance of residual noise level is:
<=2 dBA	Not applicable	Negligible
	< recommended amenity noise level or	
>= 3 but <=5 dBA	> recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1dB	Marginal
>= 3 but <=5 dBA	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1dB	Moderate
>5 dBA	=< recommended amenity noise level	Moderate
>5 dBA	> recommended amenity noise level	Significant

The *NPFI* also gives examples of noise mitigation measures addressing residual noise impacts in Table 4.2 of the Policy. The measures are also generally consistent with Table 1 of the VLAMP. Table 4.2 of the *NPFI* is reproduced in Table 5-6.

Table 5-6 Examples of Receiver-Based Treatment to Mitigate Residual Noise Impacts

Significance of Residual Noise Level	Example of Potential Treatment
Negligible	The exceedance would not be discernible by the average listener and therefore would not warrant receiver-based treatment or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Significant	May include suitable commercial agreement where considered feasible and reasonable.

Table 5-7 presents the methodology for assessing noise levels which may exceed the *NPFI* PNTLs at privately-owned residences.

Table 5-7 Project Noise Impact Assessment Methodology

Noise Management Zone		Noise Affection Zone
1-2 dB above Project noise trigger levels	3-5 dB above Project noise trigger levels	> 5 dB Project noise trigger levels
No treatment/controls required	<ul style="list-style-type: none"> Voluntary mitigation rights applicable. Architectural treatment required if requested (incl. ventilation & upgraded façade elements). 	<ul style="list-style-type: none"> Voluntary mitigation rights applicable. Architectural treatment required if requested (incl. ventilation & upgraded façade elements). Voluntary land acquisition rights applicable.

5.5 Trigger Levels for Maximum Noise Level Events

Noise sources of short duration and high level may cause disturbance to sleep if occurring during the night time and therefore need to be considered.

The approach recommended by the *NPFI* is to apply the following initial screening noise levels:

- $L_{A_{Fmax}}$ 52 dBA or the prevailing RBL + 15 dB, whichever is the **greater**; and
- $L_{Aeq,15min}$ 40 dBA or the prevailing RBL + 5 dB, whichever is the **greater**.

The sleep disturbance screening noise levels apply outside bedroom windows during the night time period (10.00pm to 7.00am).

Where the screening noise levels cannot be met, a detailed maximum noise level event assessment should be undertaken. The $L_{A_{fmax}}$ screening levels based on $RBL + 15 \text{ dB}$ and $L_{Aeq,15min}$ screening level based on $RBL + 5 \text{ dB}$ are below $L_{A_{fmax}} 52 \text{ dBA}$ and $L_{Aeq,15min} 40 \text{ dBA}$, respectively, when considering the RBL of the area. Therefore, the project specific maximum event screening levels at all receivers are:

- $L_{A_{fmax}} 52 \text{ dBA}$; and
- $L_{Aeq,15min} 40 \text{ dBA}$.

The trigger levels for the maximum noise level event assessment are only applicable to the night time (10.00 pm to 7.00 am) period.

5.6 Construction Noise Goals

The *Interim Construction Noise Guidelines* (ICNG) (NSW Department of Environment and Climate Change, 2009) recommends noise management levels (NMLs) to reduce the likelihood of noise impacts arising from construction activities. The NML recommended for residential receivers are presented in Table 5-8.

Table 5-8 Noise at Receivers using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
Recommended Standard Hours:		
Monday to Friday	Noise affected $RBL + 10\text{dBA}$	<ul style="list-style-type: none"> The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
7am to 6pm		
Saturday		
8am to 1pm		
No work on Sundays or Public Holidays		
Recommended Standard Hours:		
Monday to Friday	Highly noise affected 75dBA	<ul style="list-style-type: none"> The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
7am to 6pm		
Saturday		
8am to 1pm		
No work on Sundays or Public Holidays		

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
Outside standard hours	Noise affected + 5dB	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

The *ICNG* recommended standard construction hours are:

- 7.00am to 6.00pm Monday to Friday;
- 8.00am to 1.00pm Saturday; and
- No work on Sunday or public holidays.

5.7 Blasting Criteria

5.7.1 Annoyance Criteria

The EPA guideline *Assessing Vibration: a technical guideline* (Department of Environment and Conservation, 2006) defers to the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* prepared by the Australian and New Zealand Environment Council (1990). Human annoyance criteria and other recommendations for blasting for any privately-owned receivers or other sensitive locations are:

- The recommended maximum overpressure level (OP) for blasting is 115 dB linear.
- The level of 115 dB linear may be exceeded for up to 5% of the total number of blasts over a 12-month period but should not exceed 120 dB at any time.
- The recommended maximum vibration velocity for blasting is 5 millimetres per second (mm/s) Peak Vector Sum (PVS).
- The PVS level of 5 mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period but should not exceed 10 mm/s at any time.
- Blasting should generally only be permitted during the hours of 9.00am to 5.00pm Monday to Saturday and should not take place on Sundays and Public Holidays.
- Blasting should generally take place no more than once per day.

These criteria are typically adopted by the EPA when issuing EPLs for projects involving blasting.

5.7.2 Building Damage Criteria

Australian Standard (AS) 2187.2-2006 *Explosives – Storage and Use – Part 2 Use of explosives* indicates "From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133dB". For assessment of damage due to ground vibration, AS 2187.2-2006 recommends frequency-dependent criteria for vibration damage, derived from British Standard 7385-2 and United States Bureau of Mines Standard RI 8507 (summarised in Table 5-9). These are less stringent than the human comfort criterion of 5 mm/s noted above, and hence need to be considered only in the case of mine-owned receivers. For the frequencies typical of blast vibration, a value of 10 mm/s peak particle velocity (PPV) represents a conservatively low estimate of the level above which structural damage may possibly occur.

Table 5-9 Recommended Vibration and Airblast Limits

Building Type	Vibration Level (mm/s)	Airblast Level (dB re 20 μ Pa)
Sensitive (and Heritage)	5	133
Residential	10	133
Commercial/Industrial	25	133

The annoyance criteria (Australian and New Zealand Environment Council, 1990) are more stringent than the building damage criteria (Table 5-9) and would be taken as the governing criteria for the Project. Therefore, the annoyance criteria for blasting, presented in Section 5.7, will be used to assess the blasting impacts.

5.8 Road Traffic Noise Criteria

The Department of Environment, Climate Change and Water (DECCW) (2011) *Road Noise Policy* (RNP) provides criteria for "land use developments which generate additional traffic on Highways". The criteria relevant to the Project are reproduced below.

Table 5-10 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project / Land Use	Assessment Criteria – dBA	
		Day (7am-10pm)	Night (10pm-7am)
Freeway / arterial / sub-arterial roads	Existing residences affected by noise from new freeway / arterial / sub-arterial road corridors	L _{Aeq,15hr} 55 (external)	L _{Aeq,9hr} 50 (external)
	Existing residences affected by noise from redevelopment of existing freeway / arterial / sub-arterial roads	L _{Aeq,15hr} 60 (external)	L _{Aeq,9hr} 55 (external)
	Existing residences affected by additional traffic on existing freeways / arterial / sub- arterial roads generated by land use developments	L _{Aeq,15hr} 60 (external)	L _{Aeq,9hr} 55 (external)

In addition to the criteria outlined above, the *RNP* also states that any increase in the total noise level at a location due to a proposed project or traffic-generating development must be considered. The relative increase criteria for residential land uses is reproduced below in Table 5-11.

Table 5-11 Relative Increase Criteria for Residential Land Uses

Road Category	Type of Project / Land Use	Total Traffic Noise Level Increase – dBA	
		Day (7am-10pm)	Night (10pm-7am)
Freeway / arterial / sub-arterial roads	New road corridor / redevelopment of existing road / land use	Existing traffic	Existing traffic
	development with the potential to generate additional traffic on existing road	$L_{Aeq,15hr} + 12 \text{ dB}$ (external)	$L_{Aeq,9hr} + 12 \text{ dB}$ (external)

5.9 Rail Traffic Criteria

The *Rail Infrastructure Noise Guideline (RING)* (EPA, 2013) has requirements for the geographic extent of rail noise assessments for rail traffic generating developments. The requirements are summarised below. Land-use developments other than rail projects that are likely to generate additional rail traffic on an existing rail network should be assessed against the following requirements:

- *Identify the typical offset distance/s of sensitive receivers from the rail line/s that are likely to be affected by increased rail movements.*
- *Quantify the existing level of rail noise at the offset distance/s identified above using the noise descriptors $L_{Aeq,15/9hr}$ and L_{Amax} (95 th percentile) dB(A).*
- *Predict the cumulative rail noise level (ie. from the existing and proposed rail movements) using a calibrated noise model (based on predicted increased rail movements) at the offset distances identified above.*
- *Compare the cumulative noise level with the rail noise assessment trigger levels: $L_{Aeq,15hr}$ 65 dB(A), $L_{Aeq,9hr}$ 60 dB(A), and L_{Amax} (95 th percentile) 85 dB(A).*
- *Implement all feasible and reasonable noise mitigation measures where the cumulative noise level exceeds the noise assessment trigger levels and project-related noise increases are predicted.*
- *Where the L_{Aeq} noise level increases are more than 2 dB(A), which is equivalent to approximately 60 per cent of the total line or corridor rail traffic, and exceeds the relevant noise assessment trigger level, strong justification should be provided as to why it is not feasible or reasonable to reduce the increase.*

Notes:

1. *A project-related noise increase is an increase of more than 0.5 dB over the day or night periods.*
2. *The geographical extent of the rail noise assessment ideally should be where project-related rail noise increases are less than 0.5 dB. This roughly equates to where project-related rail traffic represents less than 10 per cent of the total line or corridor rail traffic.*

Specifically, the assessment is not required to extend to where Project rail traffic represents less than 10% of total line/corridor rail traffic, as in this case the change in noise exposure is equivalent to less than 0.5 dB. Rail noise and vibration from the Project along the Werris Creek Mungindi Railway is considered in Section 6.6.

5.10 Rail Vibration Level Criteria

Various authorities have set maximum limits on allowable ground and building vibration in different situations. In this report, vibration criteria were obtained from the Department of Environment and Conservation (2006) publication "*Assessing Vibration: A Technical Guideline*" (AVTG). Department of Environment and Conservation (2006) limits are for vibration in buildings and relate to personal comfort and not structural integrity of the building.

Based on procedures set out in Appendix B of the AVTG, a maximum allowable vibration velocity of 2.82 mm/s applies to train-induced ground vibration, which is typically at frequencies greater than 10 Hz.

6 ASSESSMENT METHODOLOGY

6.1 Construction Noise Assessment Methodology

Assessment of construction noise was conducted using Environmental Noise Model (ENM) (a proprietary computer program from RTA Technology Pty Ltd) software.

Construction and development activities in the vicinity of the Project are described in detail below:

Construction Phase 1: General access road construction undertaken as required. Central ventilation shaft constructed, and other activities are concentrated in this area.

Construction Phase 2: General access road construction undertaken as required. Southern ventilation shaft being constructed, and other activities are concentrated in this area.

All construction/development activities would generally be undertaken between 7.00 am to 6.00 pm, Monday to Sunday (inclusive), with the exception of drilling operations, which would be undertaken 24 hours a day. Drilling operations have therefore been considered as part of operational noise (refer to Section 6.2). Construction/development activities undertaken outside of these hours (except for drilling operations) would include:

- activities that cause $L_{Aeq(15 \text{ minute})}$ of no more than 35 dBA at any privately-owned residence, or at a higher level that has been agreed with the resident;
- the delivery of materials of which delivery is required, by the NSW Police Department or Roads and Maritime Service, to be undertaken for safety reasons outside the normal construction hours; and
- emergency work to avoid the loss of life, damage to property or to prevent environmental harm.

An indicative equipment schedule for all construction phases, and corresponding sound power levels (SWLs) are summarised in Table 6-1.

Table 6-1 Construction Noise Sources & Sound Power Levels

Construction Component	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item SWL (A) 15min	Total Sound Power Level per Area SWL (A) 15min
Access Road Construction	1	Grader (14G Cat)	112	115
	2	Gravel truck	108	
	1	Water cart	106	
Ventilation Shaft Construction	1	Bulldozer (D8)	116	118
	1	Grader (14G Cat)	112	
	1	Gravel truck	108	
	1	Water cart	106	
Pre-Drainage Site Preparation	1	Bulldozer (D8)	116	117
	1	Gravel truck	108	
	1	Water cart	106	

It is unlikely that all items would operate within the same 15-minute period, however a conservative approach has been used with regard in calculating the total SWL for each construction phase. Additionally, as construction noise is likely to be indistinguishable from operational noise, the predicted operational noise levels have been summed with the construction noise in the assessment.

6.2 Operational Noise Assessment Methodology

Operational noise levels at nearby receivers have been calculated using the ENM, a proprietary computer program from RTA Technology Pty Ltd. This modelling software is recommended by the *NPFI* and has been previously accepted by the EPA for use in environmental noise assessments. The assessment models the total noise at each receiver from the operation of the Project.

The following information was provided by NCOPL in order to facilitate noise modelling:

- Mine plans for relevant modelled phases.
- Topographic information covering the general area and including all relevant noise-sensitive receivers.
- Location of existing and future fixed infrastructure, such as the CHPP, crushers and conveyors.
- Location of existing and future plant.
- Meteorological data for the site obtained from the site weather station.

Total predicted operational noise levels compared with the PNTLs are presented in Section 7.

6.2.1 Modelled Scenarios

Noise modelling was undertaken for the day, evening and night operating scenarios for Project Years 2025, 2041 and 2042. These scenarios are generally described as:

- Scenario 1 (2025): First year of Project peak ROM coal production. Surface drilling and Pre-drainage activity atop of LWs 204 and 205. Operation of ventilation shafts (VSU7 and VSU1). The ventilation shafts include fans and provide outside air supply for the underground longwall mining operation. The ventilation fans operate 24 hours a day, seven days a week. Goaf drainage activities concentrated to north-east of LW 203.
- Scenario 2 (2041): Ventilation activities concentrated to the south and goaf drainage activities concentrated to the south-west of the Project area. Surface drilling and Pre-drainage activity atop of LW 210. Operation of ventilation shafts (VSU7 and VSU1). Goaf drainage activities concentrated to south-west above LW 209.
- Scenario 3 (2042): Ventilation and gas drainage activities concentrated to the south-east of the Project area. Surface drilling atop of LW 201 and Pre-drainage activity concentrated the south-east of the Project area atop LW 210. Operation of ventilation shafts (VSU7 and VSU1). Goaf drainage activities concentrated to south-east above LW 210.

The modelled scenarios presented in this report represent the culmination of multiple iterative noise modelling investigations designed to determine feasible and reasonable noise mitigation measures. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify the potential for noise exceedances.
2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.
3. Review of the effectiveness of these measures and assessment of their feasibility by NCOPL.

4. Adoption by NCOPL of management and mitigation measures to appreciably reduce noise emissions associated with the Project. As a result of this preliminary modelling, modifications to the Project were undertaken in order to improve acoustic performance, including:
 - a. Selection of mobile plant and infrastructure items in consideration of good practice SWLs.
 - b. Use of directional fans to direct noise away from key receivers.

The resulting noise sources (Section 6.2.2) and mitigation measures (Section 6.2.3) reflect this process.

6.2.2 Noise Sources

Table 6-2 presents modelled SWLs and references used in the assessment in accordance with the *NPI*.

The nominated SWLs included in Table 6-2 are generally indicative of leading practice mining equipment (for noise performance). Mobile fleet and acoustic designs for infrastructure items would be selected as part of the detailed mine design, however it is expected SWLs would be generally consistent with those presented in Table 6-2.

NCOPL recognises the importance of input data such as SWLs as a source of variability in noise predictions and understands the importance of consistent SWLs in order to maintain the noise footprint of the Project estimated as part of the assessment. As such, NCOPL has committed to implement and manage proper care and maintenance of the equipment to avoid any deterioration and/or damage of noise attenuation components.

The basis for the SWLs are a combination of real SWL measured and modelling sensitivity analysis. As highlighted in comments on the SWL in the SLR reports, the SWL change in each testing event. For example, the Komatsu 475 was 116 dBA in 2018, but 118 dBA in 2019.

The SWL used in the modelling was based on the Komatsu 475 SWL of 116dBA measured in 2018. This was considered to be the most reasonably achievable SWL (if dozers were attenuated or new dozers purchased/leased) that provided a reduced impact on surrounding landholders.

Table 6-2 Sound Power Levels for Indicative Operational Fleet

ID	Source	Item	SWL (dBA)	Source Ref.
1	Conveyors	n/a	80 dBA/m	Plant Noise Test Results (Spectrum Acoustics, 2015a)
2a	ROM Stockpile Dozer (Komatsu 475 – dynamic)	1	116	Narrabri Coal Mine Sound Power Level Survey (SLR Consulting Pty Ltd, 2018a)
2b	ROM Stockpile Dozer (D11T – dynamic)	1	116	SWL based on Komatsu 475 – dynamic SWL
3a	Product Stockpile Dozer (Komatsu 375A – dynamic)	1	114	Narrabri Coal Mine Sound Power Level Survey (SLR Consulting Pty Ltd, 2018a)
3b	Rejects Dozer (D11T – dynamic)	1	116	SWL based on Komatsu 475 – dynamic SWL
4	Crusher ¹	1	108	Plant Noise Test Results (Spectrum Acoustics, 2015a)
5	Bypass crusher	1	108	Plant Noise Test Results (Spectrum Acoustics, 2015a)
6	CHPP (attenuated)	1	110	Plant Noise Test Results (Spectrum Acoustics, 2015a)

ID	Source	Item	SWL (dBA)	Source Ref.
7	Rail loadout	1	105	Wilkinson Murray internal database
8	Workshop	1	95	Narrabri Coal Mine Stage 2 Longwall Project NVIA (Spectrum Acoustics, 2009)
9	Personnel Carrier	1	110	Wilkinson Murray internal database
10	Locomotives idling on rail loop	1	102	Wilkinson Murray internal database
11	Rejects Truck	1	109	Wilkinson Murray internal database
12	Rejects Dozer (D9R – Dynamic)	1	116	SWL based on Komatsu 475 – dynamic SWL
13	Water Cart	1	109	Wilkinson Murray internal database
14	Howden Goaf blower powered by Cummins genset (GOAF)	3	103	Narrabri Coal Mine Sound Power Level Survey (SLR Consulting Pty Ltd, 2018b)
15	Pre-drainage (Generator, Pumps & Drill Rig)	2	103	Noise Assessment Narrabri Mine Stockpile Extension Modification (Spectrum Acoustics, 2015b) with appropriate adjustments for generators and pumps
16	Schram Drill Rig ²	2	109 (shielded)	Narrabri Coal Mine Surface Drill Operations SWL Survey (SLR Consulting Pty Ltd, 2019b)
17	Upcast fan (VSU) ³	2	116	Ulan Coal Mine Additional Ventilation Shafts - Noise Assessment (Wilkinson Murray, 2015a)
18	Vent Fan (VSU10)	1	117 (total)	Narrabri Mine Modification 5 - Noise Assessment (Wilkinson Murray, 2015b)

Note 1: Assumed same as bypass crusher.

Note 2: Similar shielding described in reference SLR (2019b).

Note 3: Shielding applied for NW directivity simulation.

6.2.3 Noise Mitigation & Management Measures

NCOPL proposes to adopt a range of reasonable and feasible noise control and management measures to reduce noise levels from the Project. The noise mitigation and management methods were developed through an iterative noise modelling approach. The proposed reasonable and feasible noise control and management measures are generally consistent with the existing Narrabri Mine, as follows:

- Upcast ventilation fans are required to meet a specification of 116 dBA SWL.
- Upcast ventilation fans (VSU1 and VSU7) to be installed 'off-axis' to the north-west to limit noise impacts on the south-eastern receivers (694a, 695a). A detailed design process will be followed to ensure appropriate mitigation design of the Upcast fans is achieved which may require a more detailed directivity analysis at a later design.
- All surface drills to be attenuated to achieve a maximum SWL of 109 dBA SWL.
- Dozers SWLs restricted to a maximum SWL of 116 dBA SWL.
- Truck movements to the reject emplacement area are restricted to one load per 15 minutes during temperature inversion conditions.

- All reversing alarms on equipment are broadband frequency types (i.e. high frequency reversing alarms are not permitted).
- Equipment used on-site is regularly serviced so that SWLs remain the same.
- When selecting new/replacement equipment, equipment with equivalent or lower SWL is selected where feasible.

In addition, NCOPL would continue to monitor noise in real-time and undertake temperature inversion monitoring to allow active management of noise impacts in accordance with the *NMP* (NCOPL, 2018) (or its latest approved version).

Noise Management Zone

Receivers exposed to operational noise levels of between 1 to 5 dB above the PNTLs fall within the "Noise Management Zone" (Table 5-7). Depending on the extent of the exceedance, noise impacts within the Noise Management Zone could range from "negligible" to "marginal" to "moderate". Receiver 675a was predicted to experience "marginal" noise impacts. For noise sensitive receivers falling within the Noise Management Zone, it is recommended that management procedures be implemented, including:

- noise monitoring on-site and within the community;
- prompt response to any community issues of concern or complaints including discussions with relevant landowners;
- implementation of mine operating procedures including real-time noise monitoring;
- implementation of other on-site noise mitigation measures; and
- provision of feasible and reasonable architectural treatment at receivers exposed to "marginal" to "moderate" noise impacts, including ventilation and/or air conditioning systems.

Noise Affection Zone

Receivers expected to be exposed to operational noise levels in excess of 5 dB above the PNTLs are said to fall within the Noise Affection Zone (Table 5-7). Exposure to noise levels corresponding to this zone may be of some concern to some landowners, particularly at night-time. For noise receivers located within this zone, it is recommended that NCOPL considers adopting the following management measures:

- discussions with relevant landowners to assess concerns and define responses;
- provision of feasible and reasonable architectural treatment at receivers including ventilation and upgraded façade elements; and/or
- seek to enter into negotiated agreements with landowners (including acquisition).

6.3 Accounting for Different Meteorological Conditions

Fact Sheet D of the *NPI* defines standard meteorological conditions and noise-enhancing meteorological conditions to be considered for the assessment. The definition of those conditions is provided in Table D1 of Fact Sheet D which is reproduced in Table 6-3.

Table 6-3 Standard and noise-enhancing meteorological conditions

<i>Meteorological conditions</i>	<i>Meteorological parameters</i>
<i>Standard meteorological conditions</i>	<i>Day/evening/night: stability categories A-D with wind speed up to 0.5m/s at 10m AGL</i>
<i>Noise-enhancing meteorological conditions</i>	<i>Day/evening: stability categories A-D with light winds (up to 3m/s at 10m AGL) Night: stability categories A-D with light winds (up to 3m/s at 10m AGL) and/or stability category F with winds up to 2m/s at 10m AGL</i>

Notes: m/s = metres per second; m = metres; AGL = above ground level; where a range of conditions is nominated, the meteorological condition delivering the highest predicted noise level should be adopted for assessment purposes. However, feasible and reasonable noise limits in consents and licences derived from this process would apply under the full range of meteorological conditions nominated under standard or noise-enhancing conditions as relevant. All wind speeds are referenced to 10m AGL. Stability categories are based on the Pasquill-Gifford stability classification scheme.

Fact Sheet D provides two options when considering meteorological effects:

- conservatively adopt noise-enhancing meteorological conditions without processing meteorological data local to the site; or
- determine the significance of noise-enhancing meteorological conditions based on meteorological data local to the site and:
 - 1) adopt significant noise-enhancing conditions for the assessment where noise-enhancing meteorological conditions are deemed significant; or
 - 2) adopt non-significant, standard meteorological conditions for the assessment where noise-enhancing meteorological conditions are not deemed significant may be adopted.

As NCOPL maintains a weather station at the mine, an analysis of the meteorological data was undertaken to determine the significance of noise-enhancing meteorological conditions at the site.

6.3.1 Analysis of Meteorology

Approximately six years' worth of meteorological data (January 2013 – early April 2019) obtained from the Narrabri Mine automatic weather station and was processed to determine the significance of local noise-enhancing meteorological conditions according to Fact Sheet D of the *NPFI*.

Temperature Inversions

Table 6-4 presents the results of the analysis of the occurrence of temperature inversions meteorological data and shows that F and G class Pasquill-Gifford stability categories are not considered a feature of the area according to the *NPFI* - that is, temperature inversions occur less than 30% in any season at night.

Table 6-4 Percent Occurrence of Night Time F & G Pasquill-Gifford Stability Categories

All Years	Spring	Summer	Autumn	Winter
Average	14.5%	11.5%	12.2%	15.6%

Based on the dataset, moderate-to-strong temperature inversions are not considered significant to the Project. However, Wilkinson Murray is of the view that they should still be considered as part of the night time noise enhancing conditions. Given the location of the Project, it is expected the percentage of occurrence of moderate-to-strong temperature inversions could be possible with the threshold of greater than 30%.

Winds combined with Temperature Inversions

Fact Sheet D of the *NPFI* does not provide guidance regarding the use of drainage flow winds during temperature inversions. A pragmatic risk management approach may be adopted, whereby temperature inversions with drainage flow winds are only considered in the assessment when the frequency of occurrence is greater than 10% in any season.

A summary of the prevailing winds and temperature inversion analyses is presented in Table 6-5.

Table 6-5 Prevailing wind analysis results

Direction	All light winds up to 2m/s during Stability Cat F and Cat G				
	Spring	Summer	Autumn	Winter	Maximum Season
N	3.4%	2.4%	2.7%	3.5%	3.5%
NNE	3.3%	2.4%	2.6%	3.2%	3.3%
NE	3.5%	2.4%	2.6%	3.1%	3.5%
ENE	3.7%	2.5%	2.7%	3.0%	3.7%
E	4.2%	2.8%	3.0%	3.4%	4.2%
ESE	4.6%	3.1%	3.5%	3.8%	4.6%
SE	4.8%	3.3%	3.8%	4.2%	4.8%
SSE	4.7%	3.5%	4.0%	4.5%	4.7%
S	4.4%	3.7%	3.8%	4.3%	4.4%
SSW	4.0%	3.4%	3.6%	4.1%	4.1%
SW	3.5%	3.2%	3.3%	4.0%	4.0%
WSW	3.6%	3.0%	3.3%	4.4%	4.4%
W	3.6%	2.8%	3.1%	4.4%	4.4%
WNW	3.8%	2.6%	3.1%	4.5%	4.5%
NW	3.7%	2.6%	3.1%	4.5%	4.5%
NNW	3.7%	2.4%	3.0%	4.2%	4.2%

Analyses of the Narrabri Mine meteorological data establishes a frequency of occurrence of night time meteorological conditions involving temperature inversions with drainage flow winds at less than 10% in any season. As such, meteorological conditions involving temperature inversions with drainage flow winds are not considered in the noise assessment.

Winds

The *NPFI* recommends consideration of wind effects if they are a “feature” of the area. The *NPFI* defines “feature” as the presence of source to receiver winds at speeds up to 3 m/s (measured at 10 m above ground level) and occurring for 30% of the time or more in any assessment period and season.

A summary of the prevailing wind analysis is presented in Table 6-6.

Table 6-6 Prevailing wind analysis results

Wind Direction ¹	Assessment Period											
	Summer Day	Summer Evening	Summer Night	Autumn Day	Autumn Evening	Autumn Night	Winter Day	Winter Evening	Winter Night	Spring Day	Spring Evening	Spring Night
N	9.2%	2.4%	1.7%	8.9%	1.9%	1.6%	8.9%	1.8%	2.0%	9.7%	3.0%	1.7%
NNE	7.9%	2.3%	0.9%	7.3%	1.1%	1.0%	7.3%	1.1%	1.0%	8.0%	2.0%	1.2%
NE	8.2%	3.4%	1.3%	7.7%	1.5%	1.0%	7.4%	1.4%	0.9%	7.9%	2.4%	1.4%
ENE	10.8%	5.1%	2.8%	11.6%	3.9%	1.8%	11.0%	2.1%	1.6%	10.8%	3.5%	2.4%
E	14.3%	6.7%	5.7%	21.3%	8.0%	5.9%	21.0%	4.8%	5.1%	17.0%	5.2%	5.8%
ESE	16.2%	7.1%	9.6%	27.0%	11.6%	12.3%	26.1%	8.5%	11.7%	19.9%	6.5%	11.2%
SE	16.2%	6.6%	11.3%	27.9%	13.9%	14.5%	26.2%	10.8%	13.8%	19.9%	7.1%	13.3%
SSE	14.7%	6.3%	11.8%	27.0%	15.7%	15.1%	25.3%	13.1%	14.4%	18.8%	9.4%	14.1%
S	12.1%	6.0%	11.4%	23.7%	15.2%	15.4%	22.6%	15.6%	14.8%	16.2%	11.1%	14.4%
SSW	9.3%	5.6%	9.2%	15.1%	12.4%	12.1%	14.3%	14.6%	12.6%	10.9%	10.8%	12.0%
SW	8.7%	5.9%	6.6%	10.5%	10.0%	6.5%	10.7%	12.8%	7.5%	9.0%	11.0%	7.8%
WSW	10.1%	6.6%	5.9%	10.5%	8.7%	5.1%	11.9%	12.1%	6.8%	10.1%	11.8%	6.7%
W	12.2%	6.7%	6.1%	12.0%	7.3%	5.1%	13.6%	10.4%	7.2%	12.1%	10.3%	6.6%
WNW	13.0%	5.8%	5.2%	12.0%	5.8%	4.3%	13.5%	7.6%	6.4%	12.9%	8.1%	5.6%
NW	12.5%	4.5%	4.4%	11.5%	4.5%	3.5%	12.3%	5.8%	5.1%	12.3%	6.6%	4.5%
NNW	10.9%	3.2%	3.0%	10.0%	3.1%	2.6%	10.4%	3.7%	3.6%	11.2%	4.7%	3.1%

1. Consistent with the *NPFI* each direction is reported plus or minus 45°.

The analysis shows that the frequency of occurrence of winds up to 3 m/s did not trigger the 30% *NPFI* assessment requirement for any assessment periods (i.e. day, evening and night).

6.3.2 Adopted Meteorological Parameters for Noise Assessment Model

Based on analysis of the Narrabri Mine meteorological data, all meteorological conditions summarised in the Table 6-7 have been modelled. The meteorological conditions include both standard and noise-enhancing conditions.

Table 6-7 NPfI Meteorological Conditions addressed in Assessment

Assessment Period	NPfI Meteorological Condition	Description of Meteorological Parameters
Day	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D
Evening	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D
Night	Noise-enhancing meteorological conditions	Stability category F; no drainage flow wind
	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D

6.4 Sleep Disturbance

Previous assessments identified the potential for sleep disturbance occurring during operations within the Pit Top Area due to general impact noise from the rotary breaker, CHPP and coal (train) loading operations. SWLs of modelled L_{Amax} noise sources are summarised as follows:

- Dozer track noise 124 dBA L_{AFmax}
- Infrastructure area impact noise 125 dBA L_{AFmax}

Impact noise was modelled using the ENM program under the noise-enhancing (adverse) atmospheric conditions. The L_{AFmax} values were modelled using the same plant locations used for the modelling of operational noise impacts. Each of the two event items listed above was modelled separately, and the highest predicted L_{AFmax} value from any item is reported.

6.5 Blasting

The following sections provide standard equations for predicting blast overpressure and ground vibration levels, sourced from the United States Bureau of Mines.

Unweighted air blast OP are predicted from Equation 1 below.

$$OP = 165 - 24(\log_{10}(D) - 0.3 \log_{10}(Q)), \quad \text{dB} \quad (1)$$

where D is distance from the blast to the assessment point (m) and
 Q is the weight of explosive per delay (kg).

6.5.1 Blast Overpressure & Vibration

The basic equations for calculation of PPV levels from blasting are as follows:

$$PPV = 1140 \left(\frac{D}{Q^{0.5}} \right)^{-1.6}, \text{ mm/s} \quad (\text{for average ground type}) \quad (2)$$

$$PPV = 500 \left(\frac{D}{Q^{0.5}} \right)^{-1.6}, \text{ mm/s} \quad (\text{for hard rock}) \quad (3)$$

Where D and Q are defined as in Equation 1. A conservative assumption of 'average' ground type (Equation 2) will be applied.

6.6 Rail Noise & Vibration

Product coal is transported from the Narrabri Mine to Newcastle by rail via the Werris Creek Mungindi Railway. The Narrabri Mine is currently approved for up to 8 trains per day. It is understood that these trains could arrive at any time (i.e. daytime/evening [7.00 am to 10.00 pm] or night time [10.00 pm to 7.00 am]), however the arrival/departure of trains is generally split approximately 60% at daytime/evening (7.00 am to 10.00 pm) and 40% at night time (10.00 pm to 7.00 am). The Project would not change the maximum number of trains per day nor would increase the average number of trains per day (4).

The Narrabri Mine Modification 5 Noise Assessment (Wilkinson Murray, 2015b) assessed the potential rail noise impacts of the approved Narrabri Mine and concluded that the rail noise levels of an average of four trains per day would be below the *RING* criteria. Given the Project would not change the average or peak number of trains per day, there would be no project-related rail noise increase on the Werris Creek Mungindi Railway, with reference to the *RING*. In addition, no additional peak vibration levels from rail passbys are anticipated. Therefore, noise and vibration impacts associated with rail operations will not be considered further in this assessment.

7 MINE OPERATIONAL MINE NOISE ASSESSMENT

7.1 Introduction

This section presents predicted noise and vibration levels and provides mitigation recommendations where criterion exceedances are predicted.

7.2 Predicted Noise Levels

The predicted daytime, evening and night noise levels for all non-Project-related receivers are shown below in Table 7-1, Table 7-2 and Table 7-3 for day, evening and night, respectively. Mine-owned receivers are included in Appendix B for the purpose of information only.

Table 7-1 Predictions Noise Levels – Daytime ($L_{Aeq,15min}$ dBA)

Receiver	Year of Operation			PNTL	Complies (Yes/ No)
	2025	2041	2042		
601a	55	34	35	40	No
652a	26	25	26	40	Yes
653a	22	22	22	40	Yes
660a	26	26	26	40	Yes
660b	27	27	26	40	Yes
662a	27	27	27	40	Yes
665a	28	28	28	40	Yes
665b	28	28	28	40	Yes
666a	26	26	26	40	Yes
667a	29	29	30	40	Yes
669b	30	30	30	40	Yes
670a	41	41	41	40	No
675a	37	37	37	40	Yes
676a	32	32	32	40	Yes
677a	27	27	27	40	Yes
680a	27	27	27	40	Yes
687a	33	33	33	40	Yes
694a	28	29	28	40	Yes
695a	21	26	23	40	Yes
738a	11	12	11	40	Yes

Table 7-2 Predictions Noise Levels – Evening ($L_{Aeq,15min}$ dBA)

Receiver	Year of Operation			PNTL	Complies (Yes / No)
	2025	2041	2042		
601a	55	34	35	35	No
652a	26	25	26	35	Yes
653a	22	22	22	35	Yes
660a	26	26	26	35	Yes
660b	27	27	26	35	Yes
662a	27	27	27	35	Yes
665a	28	28	28	35	Yes
665b	28	28	28	35	Yes
666a	26	26	26	35	Yes
667a	29	29	30	35	Yes
669b	30	30	30	35	Yes
670a	41	41	41	35	No
675a	37	37	37	35	No
676a	32	32	32	35	Yes
677a	27	27	27	35	Yes
680a	27	27	27	35	Yes
687a	33	33	33	35	Yes
694a	28	29	28	35	Yes
695a	21	26	23	35	Yes
738a	13	14	13	35	Yes

Table 7-3 Predictions Noise Levels – Night time ($L_{Aeq,15min}$ dBA)

Receiver	Year of Operation			PNTL	Complies (Yes / No)
	2025	2041	2042		
601a	56	40	40	35	No
652a	28	28	28	35	Yes
653a	27	27	27	35	Yes
660a	29	29	29	35	Yes
660b	29	29	29	35	Yes
662a	29	29	29	35	Yes
665a	31	31	31	35	Yes
665b	31	31	31	35	Yes
666a	29	29	29	35	Yes
667a	32	32	32	35	Yes
669b	32	32	32	35	Yes
670a	43	43	43	35	No

Receiver	Year of Operation			PNTL	Complies (Yes / No)
	2025	2041	2042		
675a	39	39	39	35	No
676a	34	34	34	35	Yes
677a	30	29	30	35	Yes
680a	30	30	30	35	Yes
687a	36	36	36	35	No
694a	32	33	32	35	Yes
695a	24	34	28	35	Yes
738a	28	28	28	35	Yes

Operational noise impacts for all other receivers including NCOPL-owned properties, commercial and public buildings are presented in Appendix B.

As shown in Table 7-4, Table 7-5 and Table 7-6, the night time project trigger noise level of 35 dBA $L_{Aeq,15min}$ is exceeded at four receivers, after the implementation of noise mitigation measures. The relatively limited number of exceedances indicates that reasonable and feasible mitigation measures are being implemented for the Project, and no other measures would be of material benefit.

A summary of privately-owned residences with predicted exceedances of the relevant daytime, evening and night time intrusive PNTLs is presented in Table 7-4, Table 7-5 and Table 7-6, respectively. The receivers are grouped according to noise impacts as interpreted by the VLAMP (Section 5.4) for each Project year assessed.

Table 7-4 Non-Project Residence Exceedances (2025)

Exceedance	Daytime (Standard meteorological conditions)	Evening (Standard meteorological conditions)	Night time (Noise-enhancing meteorological conditions)
1 to 2dBA above PNTL	670a	675a	687a
3 to 5dBA above PNTL	None	None	675a
5dBA above PNTL	601a	601a, 670a	601a, 670a

Table 7-5 Non-Project Residence Exceedances (2041)

Exceedance	Daytime (Standard meteorological conditions)	Evening (Standard meteorological conditions)	Night time (Noise-enhancing meteorological conditions)
1 to 2dBA above PNTL	670a	675a	687a
3 to 5dBA above PNTL	None	None	601a, 675a
5dBA above PNTL	None	670a	670a

Table 7-6 Non-Project Residence Exceedances (2042)

Exceedance	Daytime (Standard meteorological conditions)	Evening (Standard meteorological conditions)	Night time (Noise-enhancing meteorological conditions)
1 to 2dBA above PNTL	670a	675a	687a
3 to 5dBA above PNTL	None	None	601a, 675a
5dBA above PNTL	None	670a	670a

In summary, based on the worst-case results for all the scenarios shown in Table 7-4, Table 7-5 and Table 7-6, and with reference to the significance of the residual impacts table (Table 5-5):

- negligible exceedance of less than 2 dBA at one receiver (687a);
- marginal exceedance of between 3 and 5 dBA at one receiver (675a);
- moderate exceedance of more than 5 dBA at one receiver (670a). NCOPL has a current agreement with receiver 670a regarding noise mitigation which is being renegotiated for the Project; and
- significant exceedance of more than 5 dBA at one receiver (601a).

Day, evening and night time noise contours are presented in Appendix D.

7.3 Modifying Correction Factors

A low-frequency noise assessment was conducted to ascertain whether any of the identified receivers should be subject to a modifying factor correction due to dominant low-frequency content. Such correction would be applied to the predicted noise levels before comparing to the relevant PNTL.

The low-frequency noise assessment was carried out in accordance with the methodology described Section 5.3. Spectrum analysis was conducted for the predicted levels for each receiver and compared with the NPfI low frequency noise threshold (Table C2 from NPfI). No exceedances were predicted for the 2025, 2041 or 2042 scenarios.

Additionally, site monitoring reporting considers the one-third octave measured levels (i.e. the low-frequency spectrum shape) in accordance with the NPfI. From a review of all reports within the 2018 to 2019 period, it was found that all low-frequency spectrum shapes are below the low-frequency noise threshold in the NPfI, with the exception of one daytime exceedance in September 2019 (Table 4-1).

As such, the low-frequency noise assessment indicates that it is unlikely that any of the receivers surrounding the Project would be subject to dominant low-frequency noise, except on infrequent occasions. Therefore, no modifying factor correction for low-frequency noise is warranted for the Project.

7.4 Sleep Disturbance Assessment

As described in Section 5.5, the Project's trigger levels for the above maximum noise level event screening assessment are:

- $L_{Aeq,15min}$ 40 dBA; and/or
- L_{AFmax} 52 dBA.

Review of Table 7-4 indicates that night time $L_{Aeq,15min}$ noise predictions are exceeding 40 dBA at receiver 601a and 670a with mitigation. The owner of this receiver is expected to be subject to "significant" and "moderate" exceedances due to operational noise emissions (Table 5-5) and as such, would fall into the noise affectation zone.

The predicted night time L_{AFmax} noise levels at receivers surrounding the Project are summarised in Table 7-7. Noise levels were summed with the operational noise levels presented in Table 7-4, Table 7-5 and Table 7-6 and then compared with the L_{AFmax} screening level of 52 dBA for this assessment.

L_{AFmax} noise predictions are based on the relevant night time meteorological conditions determined in accordance with Fact Sheet D of the *NPFI*. It should be noted that the reported levels are conservative as the highest levels have been assumed and the resultant L_{AFmax} noise predictions were added to the highest $L_{Aeq,15min}$ predicted levels.

Table 7-7 Sleep Disturbance Noise Impacts (L_{AFmax})

Receiver No.	2025	2041	2042	Screening Level	Complies (Yes/ No)
	Adverse	Adverse	Adverse	L_{AFmax}	
601a	56	40	41	52	No
652a	28	28	28		Yes
653a	27	27	27		Yes
660a	32	32	32		Yes
660b	32	32	32		Yes
662a	33	33	33		Yes
665a	35	35	35		Yes
665b	35	35	35		Yes
666a	31	31	31		Yes
667a	37	37	37		Yes
669b	35	35	35		Yes
670a	47	47	47		Yes
675a	42	42	42		Yes
676a	37	37	37		Yes
677a	32	32	32		Yes
680a	32	32	33		Yes
687a	39	39	39		Yes
694a	32	33	32		Yes
695a	24	34	28		Yes

Table 7-7 indicates that night time L_{AFmax} noise levels comply with sleep disturbance criteria, with the exception of one receiver ('601a').

7.5 Blasting Assessment

Blasting may be necessary during the construction of the ventilation shaft locations shown as 'VSU' and 'VSD' in Section 6.2.2.

Based on the formulae presented in Section 6.5 and the minimum distances from the closest ventilation shaft to sensitive receivers, the following summarises the predicted blasting emissions when utilising a Maximum Instantaneous Charge (MIC) of 400 kilograms (kg).

As shown in Table 7-8, no blasting overpressure and vibration levels are predicted to exceed the relevant criteria at the nearest surrounding residences.

Table 7-8 Predicted Blasting Emissions

Receiver	Ventilation Shaft Distance (m)	MIC (kg)	Predicted PVS (mm/s)	Predicted Overpressure Level (dB re 20 μPa)	Criteria	
					Maximum PVS (mm/s)	Maximum Overpressure Level (dB re 20 μPa)
695a	955	400	2	94	5	115
689a	1,138	400	2	92	5	115
689b	1,105	400	2	91	5	115

7.6 Voluntary Land Acquisition Assessment

The Project is subject to voluntary land acquisition when the rural amenity noise levels plus 5 dB in Table 2.2 of the *NPFI* is exceeded on more than 25% of any privately-owned land at night where there is an existing dwelling or where a dwelling could be built under existing planning controls.

The recommended voluntary land acquisition criterion is:

- Night time – 45 $L_{Aeq,period}$.

Wilkinson Murray has reviewed potential impacts on privately-owned land. Review of the noise contours in Appendix D established that the night time 45 dBA $L_{Aeq,period}$ remain within lands owned by NCOPL. The noise contours used for this review are based on $L_{Aeq,15min}$ predictions and therefore should be considered conservative as the minus 3 dB conversion from a 15-minute to period level has not been considered.

7.7 Cumulative Noise Amenity Impact Summary

Cumulative noise impacts would potentially be caused by simultaneous operation of the Project and other nearby industrial developments such as the Narrabri Gas Project to the west.

The area around the Narrabri Mine also contains various sources that may contribute to industrial noise emissions. In addition, the Narrabri Gas Project is proposing progressive installation of up to 850 new gas wells on up to 425 new well pads over approximately 20 years, and the construction and operation of gas processing and water treatment facilities. The Narrabri Gas Project (SSD 6456) was approved by the Independent Planning Commission of NSW on 30 September 2020.

The Narrabri Gas Project Noise and Vibration Assessment (GHD, 2015) showed that the most intense operational noise sources (gas processing and compression) would be located approximately 20 km to the west of the Narrabri Mine. Operational noise impacts from other sources would meet the criteria at a distance of approximately 220 m (under adverse meteorological conditions) from the Narrabri Gas Project gas wells (GHD, 2015). In addition, review of noise contours for this project showed that noise levels in the vicinity of the Narrabri Mine would be negligible.

Cumulative noise impacts of industrial noise sources are controlled by the *NPFI* methodology for determining a project's 'amenity' criterion, as described in Section 5.2.2 and within the *NPFI*. The amenity criteria have been set to $L_{Aeq(15min)}$ 38 dBA for sensitive receivers within the study area for the Project which is greater than the *NPFI* intrusiveness criteria. Furthermore, due to the significant distance from Narrabri Gas Project-related noise sources, minimal cumulative impacts on sensitive receivers are anticipated.

Given the above, no cumulative impacts are expected in the localities of Baan Baa and Boggabri. Commercial receivers have also been assessed for all scenarios of the Project (Appendix C). Noise contributions from the Project are predicted to be below the relevant noise criteria (Table 5-2) at all commercial receivers.

8 ROAD NOISE IMPACT ASSESSMENT

8.1 Introduction

The existing road network serving the Project includes the Kamilaroi Highway, Kurrajong Creek Road and the Mine Access Road. The existing workforce at the Narrabri Mine is approximately 520 people, which would be generally unchanged for the Project. Notwithstanding, there would be short periods where there would be approximately 20 additional personnel required for the Project to assist with construction/development activities.

8.2 Existing Traffic Data

The Transport Planning Partnership (TPPP) was engaged by NCOPL to conduct a detailed road transport assessment, including a traffic survey completed in June 2019 (TPPP, 2020). Because of the limited change in mine employment levels associated with the Project, changes in traffic volumes between the "Build" (including the Project) and "no Build" options (in the absence of the Project) are minor.

The results of the traffic survey program, and projected traffic volumes for Years 2025 and 2032 have been used for noise assessment purposes. Years 2025 and 2032 were chosen for the Road Transport Assessment (TPPP, 2020) as short- and long-term Project scenarios, respectively. In addition, 2025 corresponds to the first year of maximum ROM coal production, and 2032 is located in the period where the mine life is proposed to be extended.

8.3 Noise-Sensitive Receivers

In accordance with the DECCW (2011) *NSW Road Noise Policy* all sensitive receivers within 600 m from the centre line of the outermost traffic lane on each side of the subject roads have been identified for the noise assessment and are identified in Table 8-1 and shown in Figure 3-1.

Table 8-1 Road Traffic Receiver Locations

Assessed Receiver	Address	Distance from Kamilaroi Highway
676a	16346 Kamilaroi Highway, Baan Baa	145 m
675a	16462 Kamilaroi Highway, Baan Baa	128 m
667a	17024 Kamilaroi Highway, Turrawan	330 m

8.4 Traffic Modelling Parameters

Traffic data was obtained from traffic surveys conducted by TPPP in June 2019 (TPPP, 2020). A summary of traffic volumes used for noise modelling scenarios are provided in Table 8-2.

Table 8-2 Predicted Road Traffic Volumes

Road Section	Time Period	Vehicle Class	2025		2032	
			'No Build' scenario	'Build' scenario	'No Build' scenario	'Build' scenario
Kamilaroi Highway – North of Kurrajong Creek Road	Daytime 7am-10pm	Light	1,872	1,884	1,651	1,969
		Heavy	445	449	394	426
		Total	2,317	2,333	2,045	2,395
	Night time 10pm-7am	Light	374	386	195	388
		Heavy	68	68	70	72
		Total	442	454	265	460
Kamilaroi Highway – South of Kurrajong Creek Road	Daytime 7am-10pm	Light	1,966	1,974	1,863	2,058
		Heavy	404	408	340	386
		Total	2,370	2,382	2,203	2,444
	Night time 10pm-7am	Light	362	370	254	372
		Heavy	57	59	57	63
		Total	419	429	311	435

8.5 Modelling Methodology

Acoustic modelling has been undertaken in accordance with the NSW *Road Noise Policy* (DECCW, 2011) as well as international best practice. Predictions have been made using the *Calculation of Road Traffic Noise (CoRTN)* model within the *SoundPLAN 7.4* software suite.

This procedure has been modified to permit calculation of 15 hour and nine-hour L_{A10} levels which have then been converted to L_{Aeq} levels using the US Federal Highway Administration procedure.

A summary of the modelling parameters is included below in Table 8-3.

Table 8-3 Operational Traffic Noise Modelling Parameters

Item	Details
Traffic volumes	See Table 8-2
Traffic speeds	100 km/h
Noise modelling algorithms	CoRTN as implemented by SoundPLAN V7.4 ($L_{Aeq} = CoRTN L_{10}, -3 \text{ dB}$)
Split height corrections	Car Exhaust (0.5 m): 0 dB Truck Tyres (0.5 m): -5.4 dB Truck Engines (1.5 m): -2.4 dB Truck Exhaust (3.6 m): -8.6 dB
Road surface corrections	0 dB (Dense Grade Asphalt) + 3 dB (Concrete)
Australian conditions correction (ARRB)	-1.7 dB for façade locations -0.7 dB for free-field locations
Ground absorption	0.75
Receiver locations	1 m from building facades 1.5 m above ground level for ground floor 4.5 m above ground level for 1 st floor
Façade correction	+2.5 dB for assessment location 1 m from building facades

8.6 Predicted Noise Levels

Predicted noise levels for the 2025 and 2032 scenarios are presented below in Table 8-4 and Table 8-5.

Table 8-4 Predicted Noise Level Results (2025)

ID	Address	Use	2025 'No Build' Predicted Noise Level (dBA)		2025 'Build' Predicted Noise Level (dBA)			Triggered for Mitigation?
			Daytime	Night	Daytime	Night	Increase	
			L _{Aeq} (15hr)	L _{Aeq} (9hr)	L _{Aeq} (15hr)	L _{Aeq} (9hr)		
676a	16346 Kamilaroi Hwy	Residential	45.8	40.5	45.8	40.7	0.2	No
675a	16462 Kamilaroi Hwy	Residential	47.8	42.6	47.8	42.7	0.1	No
667a	17024 Kamilaroi Hwy	Residential	40.0	35.1	40.0	35.2	0.1	No

Table 8-5 Predicted Noise Level Results (2032)

ID	Address	Use	2032 'No Build' Predicted Noise Level (dBA)		2032 'Build' Predicted Noise Level (dBA)			Triggered for Mitigation?
			Daytime	Night	Daytime	Night	Increase	
			L _{Aeq} (15hr)	L _{Aeq} (9hr)	L _{Aeq} (15hr)	L _{Aeq} (9hr)		
676a	16346 Kamilaroi Hwy	Residential	45.4	40.1	45.7	40.8	0.7	No
675a	16462 Kamilaroi Hwy	Residential	47.4	42.0	47.7	42.9	0.9	No
667a	17024 Kamilaroi Hwy	Residential	39.5	34.2	40.0	35.3	1.1	No

The above results show that the Project is predicted to result in a negligible change in existing road traffic noise levels in all surrounding sensitive receivers. In all cases, the predicted increase is substantially less than 2 dB at all receivers.

9 CONSTRUCTION NOISE ASSESSMENT

9.1 Construction Noise & Vibration Assessment Methodology

Assessment of construction noise was conducted using ENM software for the daytime period only. The noise sources were modelled as point sources with (1.5 m above ground) with the methodology described in Section 6.1.

9.2 Predicted Noise Levels

Table 9-1 provides the predicted construction noise levels combined with the operational noise levels for all non-Project-related receivers in the vicinity of the Project. The noise predictions are provided as daytime levels under the relevant daytime meteorological conditions determined in accordance with Fact Sheet D of the *NPT* (Table 6-7) resulting in the highest noise predictions. Mine-owned receivers are included in Appendix C for the purpose of information only.

Table 9-1 Predicted Construction Noise Levels

Receiver	L _{Aeq,15min} Noise Level (dBA)	
	Phase 1	Phase 2
601a	55	55
652a	26	26
653a	22	22
660a	26	26
660b	27	27
662a	27	27
665a	28	28
665b	28	28
666a	26	26
667a	29	29
669b	30	30
670a	41	41
675a	37	37
676a	32	32
677a	27	27
680a	27	27
687a	33	33
694a	32	31
695a	37	37

The results of Table 9-1 indicate that construction noise levels would comply with the *ICNG* 'noise affected' management levels at all privately-owned receivers, with the exception of 601a. The exceedance at 601a is a result of operational noise only and is addressed in Section 7.2.

10 CONCLUSION

This assessment has addressed potential noise and blasting impacts associated with the Project.

The Project involves an extension to the south of the approved underground mining area to gain access to additional coal reserves within MLAs 1 and 2 (Figure 2-1), an extension of the mine life to 2044 and development of supporting surface infrastructure. ROM coal production would occur at a rate of up to 11 Mtpa, consistent with the currently approved limit.

10.1 Project Operational Noise

- Operational noise impacts were assessed for three years (Project Years 2025, 2041 and 2042), for different periods of the day (daytime, evening and night time).
- The significance of noise-enhancing meteorological conditions (in accordance with Fact Sheet D of the *NPTI*) was determined based on meteorological data local to the site and noise predictions were conducted for both standard meteorological conditions and significant noise-enhancing conditions. The assessment presents the highest noise predictions under the relevant meteorological conditions, which are considered conservative.
- Initial modelling resulted in key mitigation measures being adopted for the Project, including:
 - Selection of lower sound power equipment (Product Stockpile Dozer and Rejects Dozer) to limit operational noise impacts.
 - Location and directivity of ventilation shaft design optimised to minimise noise impacts.
- With the above controls in place, exceedances of the PNTLs are predicted for privately-owned receivers 601a, 670a, 675a, and 687a for periods of time during the life of the Project. Notwithstanding the conservatism associated with the meteorological conditions modelled, exceedances predicted at receiver 687a is considered to be “negligible” (between 1-2 dB according to the *VLAMP*) and would not be discernible (when compared to compliance with the PNTL) by the average listener, in accordance with the *VLAMP*. “Marginal” exceedance is predicted for receiver 675a and therefore the property owner is eligible (upon request) for reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning). Additionally, receivers 670a and 601a predicted “Moderate” and “Significant” exceedances, respectively. Given these receivers were predicted to have noise levels greater than 5 dBA over the PNTL, the owners of receivers 670a and 601a have the right to acquisition upon request (Table 5-7).
- A low-frequency noise assessment was conducted which indicates that it is unlikely that any of the receivers surrounding the Project would be subject to low-frequency noise. Therefore, no modifying factor correction for low-frequency noise is warranted for the Project.

10.2 Voluntary Land Acquisition Assessment

- No properties would be affected by noise impacts in excess of the voluntary land acquisition criterion of 45 dBA $L_{Aeq,period}$.

10.3 Cumulative Noise Assessment

- The assessment indicates that there are no additional impacts due to cumulative noise sources from the operation of the Narrabri Gas Project; or any other existing or proposed projects within the area.

10.4 Sleep Disturbance Assessment

- Modelling of L_{Amax} noise levels at nearby receivers was undertaken for typical instantaneous mine-site noise sources. This analysis indicates that predicted L_{AFmax} noise levels would comply with the L_{AFmax} noise trigger of 52 dBA at all the identified receivers with the exception of one receiver '601a'. Exceedances of up to 4 dBA are predicted to occur at this receiver during the '2025' scenario only.

10.5 Construction Noise & Vibration Assessment

- The assessment indicates construction noise levels would comply with the *ICMG* 'noise affected' management levels at all privately-owned receivers.

10.6 Road Noise Assessment

- The assessment indicates no road noise impacts are predicted as a result of additional traffic volumes associated with the Project.

10.7 Blasting Noise & Vibration Assessment

- The assessment indicates no blasting overpressure and vibration levels are predicted to exceed the relevant criteria at the nearest surrounding residences.

11 REFERENCES

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- Spectrum Acoustics (2015b) *Noise Assessment Narrabri Mine Stockpile Extension Modification Narrabri, NSW*. Prepared for Whitehaven Coal Limited.
- The Transport Planning Partnership (2020) *Narrabri Underground Mine Stage 3 Extension Project Road Transport Assessment*. Prepared for Narrabri Coal Operations Pty Ltd.

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Wilkinson Murray Pty Ltd (2015a) *Ulan Coal Mine Additional Ventilation Shafts - Noise Assessment*.

Wilkinson Murray Pty Ltd (2015b) *Narrabri Mine Modification 5 – Noise Assessment* (Ref: WCL100715 NG_Narrabri Mod5).

APPENDIX A

ALL RECEIVERS INCLUDING NCOPL-OWNED PROPERTIES,
COMMERCIAL & PUBLIC BUILDINGS

Receiver ID	Property Owner	Property Category
600q	NCOPL OWNED	Dwelling
600w	NCOPL OWNED	Dwelling
501a	DIOCESE OF ARMIDALE	Dwelling
511a	RA MAUNDER	Dwelling
511b	RA MAUNDER	Dwelling
512a	Oakey Point Pty Ltd	Dwelling
512b	Oakey Point Pty Ltd	Dwelling
600r	NCOPL OWNED	Dwelling
600u	NCOPL OWNED	Dwelling
600v	NCOPL OWNED	Dwelling
600a	NCOPL OWNED	Dwelling
600b	NCOPL OWNED	Dwelling
600c	NCOPL OWNED	Dwelling
600d	NCOPL OWNED	Dwelling
600e	NCOPL OWNED	Dwelling
600f	NCOPL OWNED	Dwelling
600g	NCOPL OWNED	Dwelling
600h	NCOPL OWNED	Dwelling
600n	NCOPL OWNED	Dwelling
600p	NCOPL OWNED	Dwelling
601a	B & D & N & P GRNCARSKI	Dwelling
641a	S SMITH	Dwelling
647a	J & T BAUTISTA	Dwelling
647a	J & T BAUTISTA	Dwelling
647b	J & T BAUTISTA	Dwelling
647c	J & T BAUTISTA	Dwelling
652a	AR & JS COLLINS	Dwelling
652b	AR & JS COLLINS	Dwelling
653a	KA & PE KIDCAFF	Dwelling
660a	AL & LM GRUMLEY	Dwelling
660b	AL & LM GRUMLEY	Dwelling
662a	JF & KL SCOTT	Dwelling
664a	JA & SG HOLMAN	Dwelling
665a	BR & MJ O'CONNOR	Dwelling
665b	BR & MJ O'CONNOR	Dwelling
666a	NE HOBSON & TM WILLEMSE	Dwelling
667a	PJ SMART	Dwelling
669a	CH & RL MELBOURNE	Dwelling
669b	CH & RL MELBOURNE	Dwelling
670a	JME & R STIEGER	Dwelling

Receiver ID	Property Owner	Property Category
675a	PC WEBB	Dwelling
676a	RR MCCLUNG & EF WEBSTER	Dwelling
677a	AD & IH MOULDS	Dwelling
677b	AD & IH MOULDS	Dwelling
600z	NCOPL OWNED	Dwelling
680a	GR & L STUART	Dwelling
600x	NCOPL OWNED	Dwelling
600y	NCOPL OWNED	Dwelling
684a	AJ & BA MAINEY	Dwelling
684b	AJ & BA MAINEY	Dwelling
685a	DL & L PETTY	Dwelling
687a	CS & DL KIRKBY	Dwelling
600s	NCOPL OWNED	Dwelling
600t	NCOPL OWNED	Dwelling
690a	BD NICHOLSON	Dwelling
693a	ZMD ENGINEERING PTY LTD	Dwelling
694a	RK MARTIN II	Dwelling
695a	DP & SW MURRAY	Dwelling
699a	SA & T BROADHEAD	Dwelling
701a	RPC & WE WANNAN	Dwelling
702a	RJ DIXON	Dwelling
703a	WL EDDINGTON	Dwelling
705a	H DIXON	Dwelling
707a	DH & GE BARTON	Dwelling
710a	JR WALLACE	Dwelling
711a	RJ MACKLEY	Dwelling
711b	RJ MACKLEY	Dwelling
714a	JC & S ALLAWAY	Dwelling
715a	RE WADDELL	Dwelling
717a	TK JEFFRIES	Dwelling
717b	TK JEFFRIES	Dwelling
718a	E SCOTT	Dwelling
719a	JF & PD & TJ KENNEDY	Dwelling
719b	JF & PD & TJ KENNEDY	Dwelling
719c	JF & PD & TJ KENNEDY	Dwelling
720a	RA EDDINGTON	Dwelling
721a	CJ BAKER	Dwelling
724a	JJ SHIELDS	Dwelling
725a	CF & RG SHIELDS	Dwelling
725b	CF & RG SHIELDS	Dwelling

Receiver ID	Property Owner	Property Category
729a	BA BAKER	Dwelling
730a	W CODY	Dwelling
730b	W CODY	Dwelling
734a	DG & JA EVERSON	Dwelling
734b	DG & JA EVERSON	Dwelling
735c	JA & SA SCHMIERER	Dwelling
735c	JA & SA SCHMIERER	Dwelling
736a	AL & DA WILLIS	Dwelling
738a	B & BC STEWART	Dwelling
740a	N TOWNS	Dwelling
740b	N TOWNS	Dwelling
741a	KR AH SHAY & DA BAGSHAW	Dwelling
742a	WK MARTIN	Dwelling
744a	GP DEVINE	Dwelling
745a	JW SMITH	Dwelling
747a	EJ & VL HOSKINSON	Dwelling
747b	EJ & VL HOSKINSON	Dwelling
750a	DA NEWBURY	Dwelling
752a	DA SLADE	Dwelling
754a	CF & KJ SHIELDS	Dwelling
756a	GP NICHOLSON & KL PEARSON	Dwelling
756a	GP NICHOLSON & KL PEARSON	Dwelling
756b	GP NICHOLSON & KL PEARSON	Dwelling
757a	CARLTON PHILLIP PATERSON	Dwelling
757a	CARLTON PHILLIP PATERSON	Dwelling
759a	PL ANDERSON	Dwelling
761a	CD ERVINE & SM KIRBY	Dwelling
761b	CD ERVINE & SM KIRBY	Dwelling
781a	BELLEVUE COTTON PTY LTD	Dwelling
784a	BELLQUIN PTY LTD	Dwelling
784b	BELLQUIN PTY LTD	Dwelling
794a	DE & LD EATHER	Dwelling
800a	DE & JR ZIMMERMAN	Dwelling
H_712_1	CA & KM GUEST	Hotel
H_712_2	CA & KM GUEST	Hotel
H_712_3	CA & KM GUEST	Hotel
H_712_4	CA & KM GUEST	Hotel
H_713_1	BARANBAH PTY LIMITED	Hotel
H_713_2	BARANBAH PTY LIMITED	Hotel
H_713_3	BARANBAH PTY LIMITED	Hotel

Receiver ID	Property Owner	Property Category
H_713_4	BARANBAH PTY LIMITED	Hotel
H_713_5	BARANBAH PTY LIMITED	Hotel
Hall_728_1	TJ FLEMING & LW KELLY & E MAUNDER	Community Hall
RFS_4_1	THE STATE OF NEW SOUTH WALES	Rural Fire Shed
RFS_4_2	THE STATE OF NEW SOUTH WALES	Rural Fire Shed
SH_4	THE STATE OF NEW SOUTH WALES	School House

APPENDIX B

OPERATIONAL NOISE PREDICTIONS

Receiver ID	Property Owner	Property Category	2025		2041		2042	
			Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)
600q	NCOPL OWNED	Dwelling	26	29	31	34	31	34
600w	NCOPL OWNED	Dwelling	23	25	23	24	23	25
501a	DIOCESE OF ARMIDALE	Dwelling	11	13	12	14	11	13
511a	RA MAUNDER	Dwelling	18	19	17	19	18	19
511b	RA MAUNDER	Dwelling	18	19	17	19	18	19
512a	Oakey Point Pty Ltd	Dwelling	25	27	25	27	25	27
512b	Oakey Point Pty Ltd	Dwelling	24	26	24	26	24	26
600r	NCOPL OWNED	Dwelling	24	27	36	38	26	32
600u	NCOPL OWNED	Dwelling	15	18	30	34	23	25
600v	NCOPL OWNED	Dwelling	15	18	31	35	23	26
600a	NCOPL OWNED	Dwelling	40	43	40	43	40	43
600b	NCOPL OWNED	Dwelling	35	37	35	37	35	37
600c	NCOPL OWNED	Dwelling	38	41	38	41	38	41
600d	NCOPL OWNED	Dwelling	29	33	29	33	29	33
600e	NCOPL OWNED	Dwelling	32	36	31	35	31	35
600f	NCOPL OWNED	Dwelling	45	48	44	48	45	48
600g	NCOPL OWNED	Dwelling	46	50	46	50	46	50
600h	NCOPL OWNED	Dwelling	36	42	35	41	36	41
600n	NCOPL OWNED	Dwelling	46	48	46	48	46	48
600p	NCOPL OWNED	Dwelling	35	38	35	38	35	38
601a	B & D & N & P GRNCARSKI	Dwelling	55	56	34	40	35	40
641a	S SMITH	Dwelling	27	28	27	28	27	28
647a	J & T BAUTISTA	Dwelling	16	21	16	20	16	20
647a	J & T BAUTISTA	Dwelling	22	28	22	28	22	28
647b	J & T BAUTISTA	Dwelling	16	21	16	19	16	19
647c	J & T BAUTISTA	Dwelling	13	20	13	19	13	19
652a	AR & JS COLLINS	Dwelling	26	28	25	28	26	28
652b	AR & JS COLLINS	Dwelling	26	28	26	28	26	28
653a	KA & PE KIDCAFF	Dwelling	22	27	22	27	22	27
660a	AL & LM GRUMLEY	Dwelling	26	29	26	29	26	29
660b	AL & LM GRUMLEY	Dwelling	27	29	27	29	26	29
662a	JF & KL SCOTT	Dwelling	27	29	27	29	27	29
664a	JA & SG HOLMAN	Dwelling	21	23	21	23	21	23
665a	BR & MJ O'CONNOR	Dwelling	28	31	28	31	28	31
665b	BR & MJ O'CONNOR	Dwelling	28	31	28	31	28	31
666a	NE HOBSON & TM WILLEMSE	Dwelling	26	29	26	29	26	29
667a	PJ SMART	Dwelling	29	32	29	32	30	32
669a	CH & RL MELBOURNE	Dwelling	23	24	23	24	23	24
669b	CH & RL MELBOURNE	Dwelling	30	32	30	32	30	32

Receiver ID	Property Owner	Property Category	2025		2041		2042	
			Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)
670a	JME & R STIEGER	Dwelling	41	43	41	43	41	43
675a	PC WEBB	Dwelling	37	39	37	39	37	39
676a	RR MCCLUNG & EF WEBSTER	Dwelling	32	34	32	34	32	34
677a	AD & IH MOULDS	Dwelling	27	30	27	29	27	29
677b	AD & IH MOULDS	Dwelling	11	12	12	13	11	13
600z	NCOPL OWNED	Dwelling	35	37	35	37	35	37
680a	GR & L STUART	Dwelling	27	30	27	30	27	30
600x	NCOPL OWNED	Dwelling	31	34	31	34	31	34
600y	NCOPL OWNED	Dwelling	34	38	34	38	34	38
684a	AJ & BA MAINEY	Dwelling	16	17	16	18	16	18
684b	AJ & BA MAINEY	Dwelling	15	16	15	16	14	16
685a	DL & L PETTY	Dwelling	13	15	14	16	13	15
687a	CS & DL KIRKBY	Dwelling	33	36	33	36	33	36
600s	NCOPL OWNED	Dwelling	20	23	39	41	27	33
600t	NCOPL OWNED	Dwelling	20	23	39	41	28	33
690a	BD NICHOLSON	Dwelling	12	13	14	15	12	14
693a	ZMD ENGINEERING PTY LTD	Dwelling	16	18	17	19	16	19
694a	RK MARTIN II	Dwelling	28	32	29	33	28	32
695a	DP & SW MURRAY	Dwelling	21	24	26	34	23	28
699a	SA & T BROADHEAD	Dwelling	9	11	14	15	10	12
701a	RPC & WE WANNAN	Dwelling	10	11	11	12	10	12
702a	RJ DIXON	Dwelling	15	16	14	16	15	16
703a	WL EDDINGTON	Dwelling	12	13	12	14	12	14
705a	H DIXON	Dwelling	12	13	13	14	12	14
707a	DH & GE BARTON	Dwelling	12	13	12	14	12	13
710a	JR WALLACE	Dwelling	12	13	12	14	11	13
711a	RJ MACKLEY	Dwelling	12	13	12	14	12	13
711b	RJ MACKLEY	Dwelling	12	13	12	14	12	13
714a	JC & S ALLAWAY	Dwelling	12	13	12	14	12	13
715a	RE WADDELL	Dwelling	12	13	12	14	12	13
717a	TK JEFFRIES	Dwelling	12	13	12	14	12	13
717b	TK JEFFRIES	Dwelling	12	13	12	14	12	13
718a	E SCOTT	Dwelling	12	13	12	14	12	13
719a	JF & PD & TJ KENNEDY	Dwelling	11	12	12	13	11	13
719b	JF & PD & TJ KENNEDY	Dwelling	12	13	12	13	11	13
719c	JF & PD & TJ KENNEDY	Dwelling	12	13	12	14	11	13
720a	RA EDDINGTON	Dwelling	12	13	12	14	12	13
721a	CJ BAKER	Dwelling	13	14	13	15	13	14
724a	JJ SHIELDS	Dwelling	13	14	13	14	13	14

Receiver ID	Property Owner	Property Category	2025		2041		2042	
			Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)
725a	CF & RG SHIELDS	Dwelling	13	14	14	15	13	15
725b	CF & RG SHIELDS	Dwelling	13	14	14	15	13	15
729a	BA BAKER	Dwelling	11	13	12	13	11	13
730a	W CODY	Dwelling	11	13	12	13	11	13
730b	W CODY	Dwelling	11	13	12	13	11	13
734a	DG & JA EVERSON	Dwelling	11	12	12	14	11	13
734b	DG & JA EVERSON	Dwelling	11	12	12	14	11	13
735c	JA & SA SCHMIERER	Dwelling	11	13	12	14	11	13
735c	JA & SA SCHMIERER	Dwelling	14	16	18	20	15	17
736a	AL & DA WILLIS	Dwelling	11	13	12	14	11	13
738a	B & BC STEWART	Dwelling	11	13	12	14	11	13
740a	N TOWNS	Dwelling	11	13	12	14	11	13
740b	N TOWNS	Dwelling	11	12	12	14	11	13
741a	KR AH SHAY & DA BAGSHAW	Dwelling	11	12	12	14	11	13
742a	WK MARTIN	Dwelling	11	13	12	14	11	13
744a	GP DEVINE	Dwelling	12	13	13	14	12	13
745a	JW SMITH	Dwelling	12	13	13	14	12	14
747a	EJ & VL HOSKINSON	Dwelling	12	13	13	14	12	14
747b	EJ & VL HOSKINSON	Dwelling	12	13	13	14	12	14
750a	DA NEWBURY	Dwelling	11	12	12	14	11	13
752a	DA SLADE	Dwelling	11	12	12	14	11	13
754a	CF & KJ SHIELDS	Dwelling	12	13	13	14	12	13
756a	GP NICHOLSON & KL PEARSON	Dwelling	11	12	12	13	11	13
756a	GP NICHOLSON & KL PEARSON	Dwelling	11	12	12	14	11	13
756b	GP NICHOLSON & KL PEARSON	Dwelling	11	12	12	13	11	13
757a	CARLTON PHILLIP PATERSON	Dwelling	12	13	13	14	12	13
757a	CARLTON PHILLIP PATERSON	Dwelling	12	13	13	14	12	13
759a	PL ANDERSON	Dwelling	10	12	14	16	11	12
761a	CD ERVINE & SM KIRBY	Dwelling	9	11	14	16	10	11
761b	CD ERVINE & SM KIRBY	Dwelling	9	11	14	15	10	11
781a	BELLEVUE COTTON PTY LTD	Dwelling	21	23	21	22	21	22
784a	BELLQUIN PTY LTD	Dwelling	21	22	21	22	21	22
784b	BELLQUIN PTY LTD	Dwelling	21	22	21	22	21	22
794a	DE & LD EATHER	Dwelling	22	22	22	22	22	22
800a	DE & JR ZIMMERMAN	Dwelling	17	19	17	18	17	18
H_712_1	CA & KM GUEST	Hotel	12	13	12	14	12	13
H_712_2	CA & KM GUEST	Hotel	12	13	12	14	12	13
H_712_3	CA & KM GUEST	Hotel	12	13	12	14	12	13
H_712_4	CA & KM GUEST	Hotel	12	13	12	14	12	13

Receiver ID	Property Owner	Property Category	2025		2041		2042	
			Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)	Calm (-1c Temp inv.)	Adverse (4c Temp inv.)
H_713_1	BARANBAH PTY LIMITED	Hotel	12	13	12	14	11	13
H_713_2	BARANBAH PTY LIMITED	Hotel	12	13	12	14	12	13
H_713_3	BARANBAH PTY LIMITED	Hotel	12	13	12	14	12	13
H_713_4	BARANBAH PTY LIMITED	Hotel	12	13	12	14	12	13
H_713_5	BARANBAH PTY LIMITED	Hotel	12	13	12	14	12	13
Hall_728_1	TJ FLEMING & LW KELLY & E MAUNDER	Community Hall	12	13	12	14	12	13
RFS_4_1	THE STATE OF NEW SOUTH WALES	Rural Fire Shed	11	13	12	13	11	13
RFS_4_2	THE STATE OF NEW SOUTH WALES	Rural Fire Shed	11	13	12	13	11	13
SH_4	THE STATE OF NEW SOUTH WALES	School House	11	12	12	13	11	13

APPENDIX C

PREDICTED CONSTRUCTION NOISE LEVELS

Receiver ID	Property Owner	Property Category	Phase 1	Phase 2
600q	NCOPL OWNED	Dwelling	32	32
600w	NCOPL OWNED	Dwelling	23	23
501a	DIOCESE OF ARMIDALE	Dwelling	14	13
511a	RA MAUNDER	Dwelling	18	18
511b	RA MAUNDER	Dwelling	18	18
512a	Oakey Point Pty Ltd	Dwelling	25	25
512b	Oakey Point Pty Ltd	Dwelling	24	24
600r	NCOPL OWNED	Dwelling	36	36
600u	NCOPL OWNED	Dwelling	32	32
600v	NCOPL OWNED	Dwelling	33	32
600a	NCOPL OWNED	Dwelling	40	40
600b	NCOPL OWNED	Dwelling	35	35
600c	NCOPL OWNED	Dwelling	38	38
600d	NCOPL OWNED	Dwelling	32	32
600e	NCOPL OWNED	Dwelling	34	33
600f	NCOPL OWNED	Dwelling	45	45
600g	NCOPL OWNED	Dwelling	46	46
600h	NCOPL OWNED	Dwelling	37	37
600n	NCOPL OWNED	Dwelling	46	46
600p	NCOPL OWNED	Dwelling	35	35
601a	B & D & N & P GRNCARSKI	Dwelling	55	55
641a	S SMITH	Dwelling	27	27
647a	J & T BAUTISTA	Dwelling	16	16
647a	J & T BAUTISTA	Dwelling	22	22
647b	J & T BAUTISTA	Dwelling	16	16
647c	J & T BAUTISTA	Dwelling	14	14
652a	AR & JS COLLINS	Dwelling	26	26
652b	AR & JS COLLINS	Dwelling	26	26
653a	KA & PE KIDCAFF	Dwelling	22	22
660a	AL & LM GRUMLEY	Dwelling	26	26
660b	AL & LM GRUMLEY	Dwelling	27	27
662a	JF & KL SCOTT	Dwelling	27	27
664a	JA & SG HOLMAN	Dwelling	21	21
665a	BR & MJ O'CONNOR	Dwelling	28	28
665b	BR & MJ O'CONNOR	Dwelling	28	28
666a	NE HOBSON & TM WILLEMSE	Dwelling	26	26

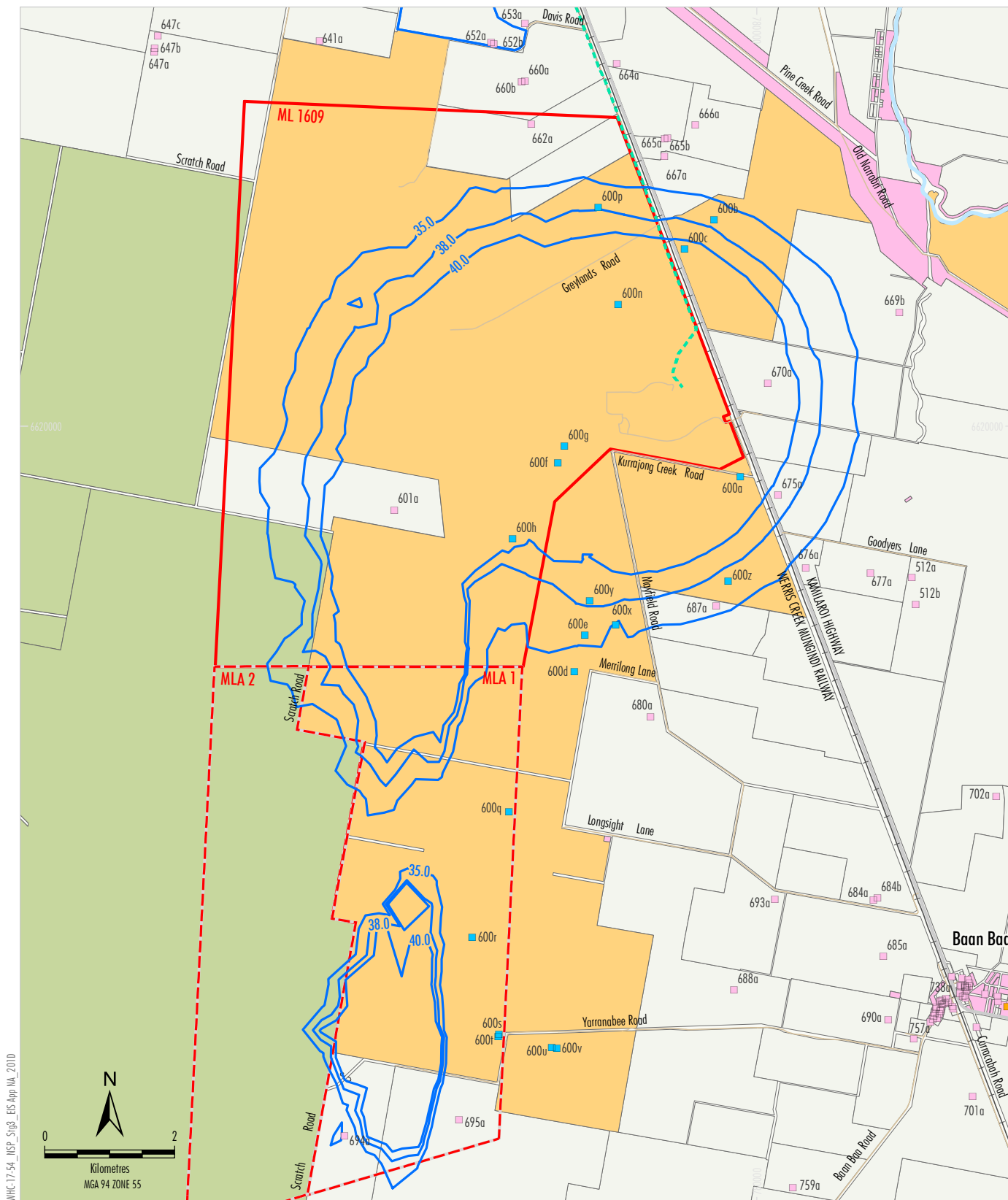
Receiver ID	Property Owner	Property Category	Phase 1	Phase 2
667a	PJ SMART	Dwelling	29	29
669a	CH & RL MELBOURNE	Dwelling	23	23
669b	CH & RL MELBOURNE	Dwelling	30	30
670a	JME & R STIEGER	Dwelling	41	41
675a	PC WEBB	Dwelling	37	37
676a	RR MCCLUNG & EF WEBSTER	Dwelling	32	32
677a	AD & IH MOULDS	Dwelling	27	27
677b	AD & IH MOULDS	Dwelling	13	13
600z	NCOPL OWNED	Dwelling	35	35
680a	GR & L STUART	Dwelling	27	27
600x	NCOPL OWNED	Dwelling	32	32
600y	NCOPL OWNED	Dwelling	35	35
684a	AJ & BA MAINEY	Dwelling	16	16
684b	AJ & BA MAINEY	Dwelling	15	15
685a	DL & L PETTY	Dwelling	15	15
687a	CS & DL KIRKBY	Dwelling	33	33
600s	NCOPL OWNED	Dwelling	41	40
600t	NCOPL OWNED	Dwelling	41	40
690a	BD NICHOLSON	Dwelling	15	15
693a	ZMD ENGINEERING PTY LTD	Dwelling	18	18
694a	RK MARTIN II	Dwelling	32	31
695a	DP & SW MURRAY	Dwelling	37	37
699a	SA & T BROADHEAD	Dwelling	16	16
701a	RPC & WE WANNAN	Dwelling	13	13
702a	RJ DIXON	Dwelling	15	15
703a	WL EDDINGTON	Dwelling	14	13
705a	H DIXON	Dwelling	14	13
707a	DH & GE BARTON	Dwelling	13	13
710a	JR WALLACE	Dwelling	13	13
711a	RJ MACKLEY	Dwelling	14	13
711b	RJ MACKLEY	Dwelling	14	13
714a	JC & S ALLAWAY	Dwelling	14	13
715a	RE WADDELL	Dwelling	13	13
717a	TK JEFFRIES	Dwelling	13	13
717b	TK JEFFRIES	Dwelling	14	13
718a	E SCOTT	Dwelling	14	13

Receiver ID	Property Owner	Property Category	Phase 1	Phase 2
719a	JF & PD & TJ KENNEDY	Dwelling	13	13
719b	JF & PD & TJ KENNEDY	Dwelling	13	13
719c	JF & PD & TJ KENNEDY	Dwelling	13	13
720a	RA EDDINGTON	Dwelling	14	13
721a	CJ BAKER	Dwelling	15	14
724a	JJ SHIELDS	Dwelling	15	14
725a	CF & RG SHIELDS	Dwelling	15	15
725b	CF & RG SHIELDS	Dwelling	16	15
729a	BA BAKER	Dwelling	13	13
730a	W CODY	Dwelling	13	13
730b	W CODY	Dwelling	13	13
734a	DG & JA EVERSON	Dwelling	13	13
734b	DG & JA EVERSON	Dwelling	13	13
735c	JA & SA SCHMIERER	Dwelling	14	13
735c	JA & SA SCHMIERER	Dwelling	19	19
736a	AL & DA WILLIS	Dwelling	14	13
738a	B & BC STEWART	Dwelling	14	13
740a	N TOWNS	Dwelling	14	13
740b	N TOWNS	Dwelling	14	13
741a	KR AH SHAY & DA BAGSHAW	Dwelling	13	13
742a	WK MARTIN	Dwelling	14	13
744a	GP DEVINE	Dwelling	14	14
745a	JW SMITH	Dwelling	14	14
747a	EJ & VL HOSKINSON	Dwelling	14	14
747b	EJ & VL HOSKINSON	Dwelling	14	14
750a	DA NEWBURY	Dwelling	13	13
752a	DA SLADE	Dwelling	14	13
754a	CF & KJ SHIELDS	Dwelling	14	14
756a	GP NICHOLSON & KL PEARSON	Dwelling	13	13
756a	GP NICHOLSON & KL PEARSON	Dwelling	14	13
756b	GP NICHOLSON & KL PEARSON	Dwelling	13	13
757a	CARLTON PHILLIP PATERSON	Dwelling	15	14
757a	CARLTON PHILLIP PATERSON	Dwelling	15	14
759a	PL ANDERSON	Dwelling	17	17
761a	CD ERVINE & SM KIRBY	Dwelling	17	16
761b	CD ERVINE & SM KIRBY	Dwelling	17	16

Receiver ID	Property Owner	Property Category	Phase 1	Phase 2
781a	BELLEVUE COTTON PTY LTD	Dwelling	21	21
784a	BELLQUIN PTY LTD	Dwelling	21	21
784b	BELLQUIN PTY LTD	Dwelling	21	21
794a	DE & LD EATHER	Dwelling	22	22
800a	DE & JR ZIMMERMAN	Dwelling	17	17
H_712_1	CA & KM GUEST	Hotel	14	13
H_712_2	CA & KM GUEST	Hotel	14	13
H_712_3	CA & KM GUEST	Hotel	14	13
H_712_4	CA & KM GUEST	Hotel	13	13
H_713_1	BARANBAH PTY LIMITED	Hotel	13	13
H_713_2	BARANBAH PTY LIMITED	Hotel	14	13
H_713_3	BARANBAH PTY LIMITED	Hotel	14	13
H_713_4	BARANBAH PTY LIMITED	Hotel	14	13
H_713_5	BARANBAH PTY LIMITED	Hotel	14	13
Hall_728_1	TJ FLEMING & LW KELLY & E MAUNDER	Community Hall	14	13
RFS_4_1	THE STATE OF NEW SOUTH WALES	Rural Fire Shed	13	13
RFS_4_2	THE STATE OF NEW SOUTH WALES	Rural Fire Shed	13	13
SH_4	THE STATE OF NEW SOUTH WALES	School House	13	13

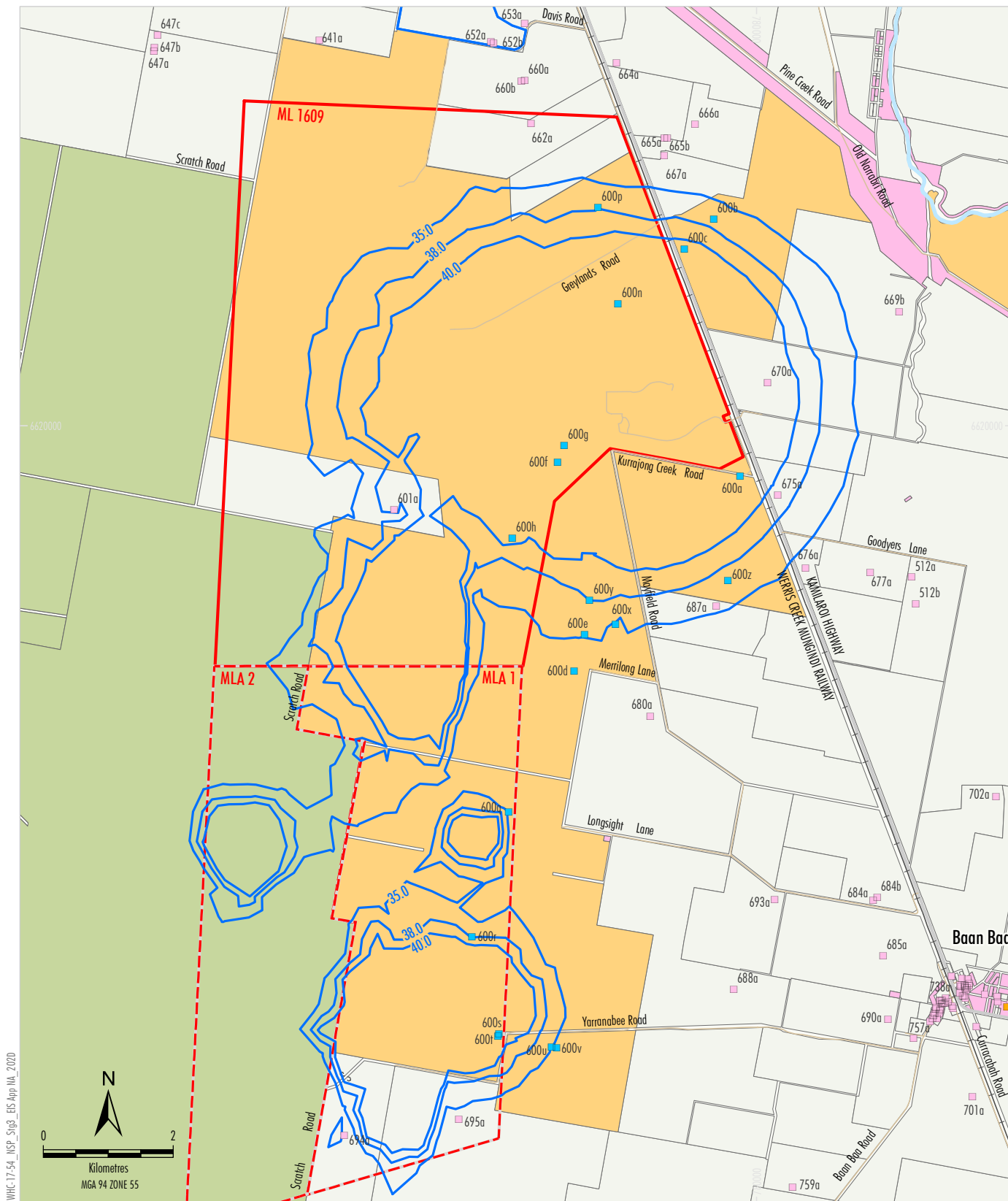
APPENDIX D

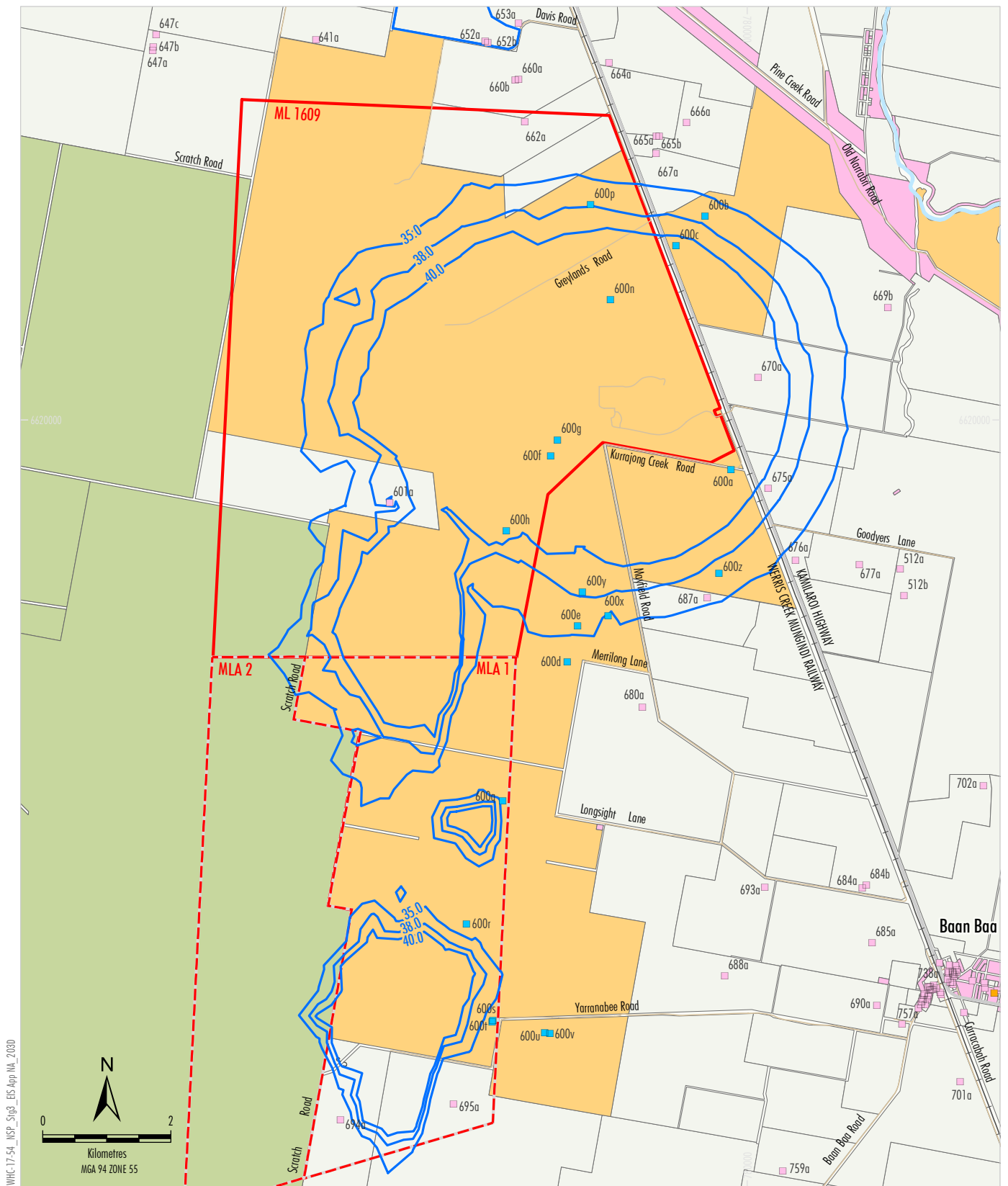
NOISE CONTOURS



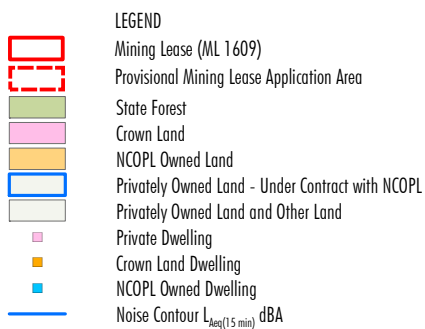
WHITEHAVEN COAL
NARRABRI STAGE 3 PROJECT
Maximum Predicted Noise Level
Year 2025 – Night

Figure D-1





Source: NCOPL (2019) ; NSW Spatial Services (2019)



Note: The night-time Project Noise Trigger Level is 35 dBA


NARRABRI STAGE 3 PROJECT
Maximum Predicted Noise Level
Year 2042 – Night

Figure D-3