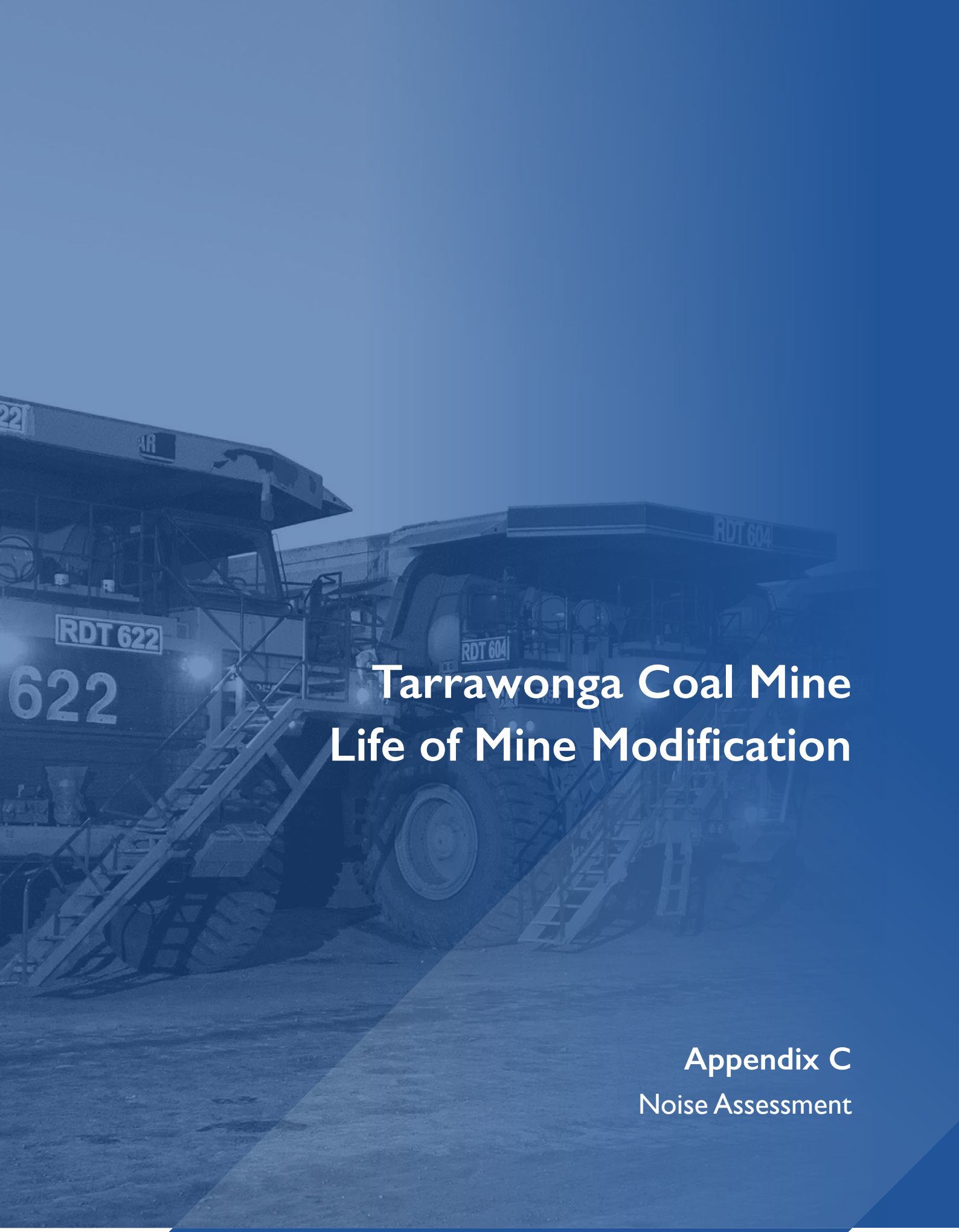

Tarrawonga Coal Mine
Life of Mine Modification

Appendix C
Noise Assessment

WHITEHAVEN COAL

ACOUSTICS AND AIR

TARRAWONGA COAL MINE – LIFE OF MINE MODIFICATION

NOISE ASSESSMENT

REPORT NO. 09341-D
VERSION A

OCTOBER 2019

PREPARED FOR

WHITEHAVEN COAL LIMITED
231 CONADILLY STREET
GUNNEDAH NSW 2380

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	4 October 2019	Roman Haverkamp	John Wassermann

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Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. Today, with offices in Sydney, Newcastle, Wollongong, Orange, Queensland and Hong Kong, Wilkinson Murray services the entire Asia-Pacific region.

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EXECUTIVE SUMMARY

This assessment investigates the operational noise, construction noise and traffic noise impacts associated with a proposed Modification for the Tarrawonga Coal Mine, located in the north-west of New South Wales (NSW). Tarrawonga Coal Pty Limited, a subsidiary of Whitehaven Coal Limited, seeks a modification under section 4.55(2) of the NSW *Environmental Planning and Assessment Act, 1979* (referred to as the Modification).

The main activities associated with the Modification include:

- run-of-mine (ROM) coal production rate increase from 3.0 to 3.5 million tonnes per annum (Mtpa);
- increase in ROM coal transported along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa;
- reduction of the open cut extent to avoid mining:
    - the Upper Namoi alluvium; and
    - Goonbri Creek.
- revision of the post-mining landform and land use;
- relocation of the ROM coal stockpile and associated infrastructure;
- construction of a new site access road and intersection to allow haulage of ROM coal along a section of Goonbri Road; and
- construction and use of a water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project (which is the subject of a separate Development Application for State Significant Development 7480).

Representative scenarios have been considered for the assessment of potential impacts at the surrounding noise-sensitive receivers associated with:

- operational noise, including cumulative noise and maximum noise level events;
- construction activities, including construction noise associated with a new site access road and intersection, a relocation of the ROM coal stockpile and associated infrastructure and a new water transfer pipeline; and
- road traffic noise associated with the Northern Section of the Approved ROM Coal Transport Route.

Operational and road traffic noise associated with the Modification would comply with the Project Approval 11_0047 noise criteria and amenity noise levels.

The operational noise scenarios include representative construction activities that would occur in the vicinity of operational activities and along the proposed water transfer pipeline. Construction noise levels would comply with the relevant noise criteria.

Blasting associated with the Modification is not expected to generate higher overpressure and vibration levels than those associated with the approved operations.

1 INTRODUCTION

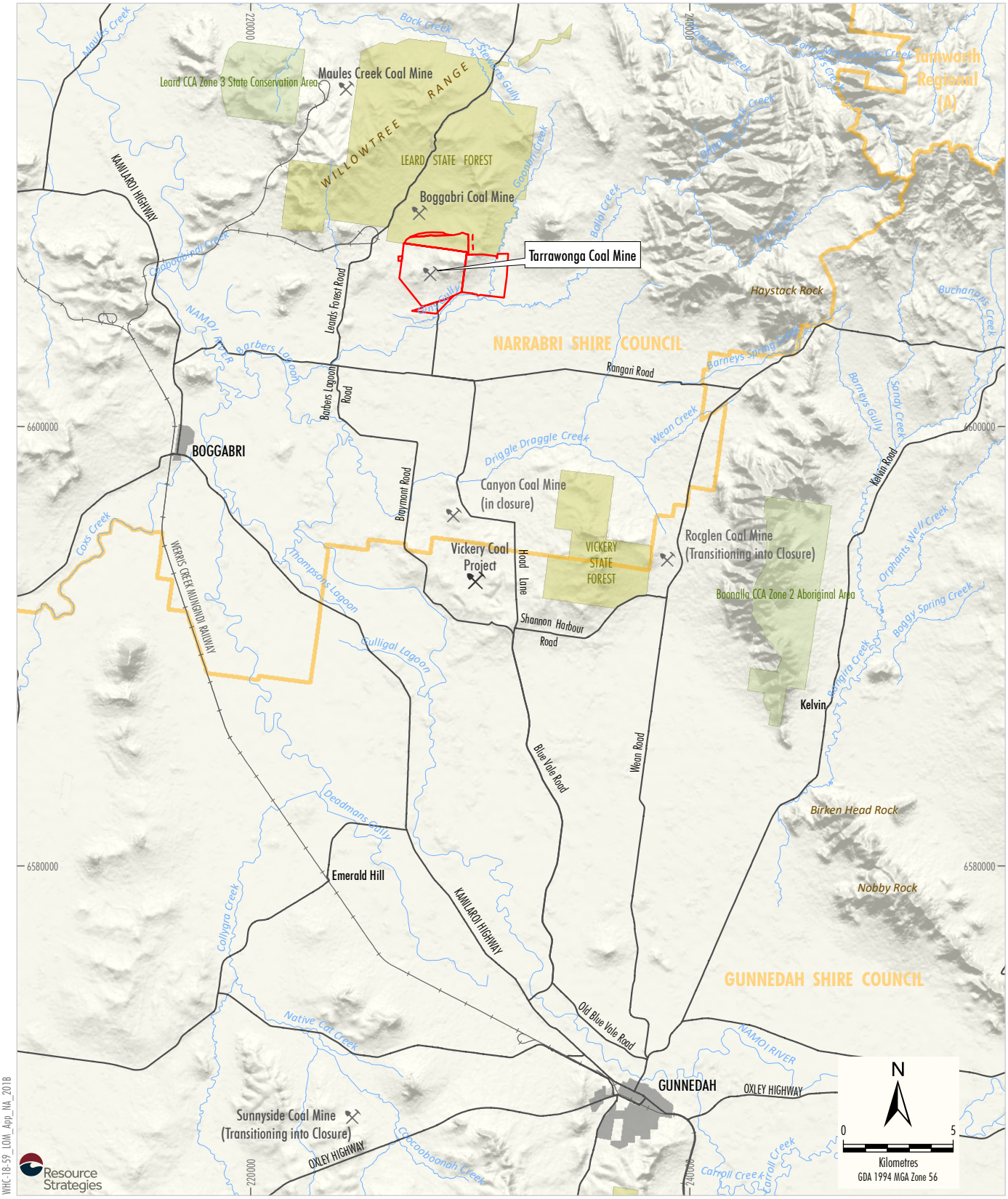
The Tarrawonga Coal Mine is located approximately 42 kilometres (km) north-northwest of Gunnedah in New South Wales (NSW) (Figure 1-1). The Tarrawonga Coal Mine is owned and operated by Tarrawonga Coal Pty Limited (TCPL), a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven).

The Tarrawonga Coal Mine is an open cut coal mine which has been in operation since 2006. Run-of-mine (ROM) coal is crushed and screened on-site, and the sized ROM coal is loaded onto on-highway trucks for transport via the Approved ROM Coal Transport Route to the Whitehaven Coal Handling and Preparation Plant (CHPP).

Mining operations at the Tarrawonga Coal Mine are conducted in accordance with Project Approval (PA) 11_0047, as modified. The approved Tarrawonga Coal Mine operations were assessed in the Tarrawonga Coal Project Environmental Assessment - Noise and Blasting Impact Assessment (Wilkinson Murray, 2011). The approved Tarrawonga Coal Mine general arrangement is shown on Figure 1-2.

The Tarrawonga Coal Mine Life of Mine Modification (the Modification) would be sought under section 4.55(2) of the NSW *Environmental Planning and Assessment Act, 1979*. The Noise Assessment is being prepared in support of the Statement of Environmental Effects for the Modification.

A glossary of terms and definitions is provided as Appendix A of this report.



WHC-18-59_LOM_App_NA_2018

LEGEND

- Mining Tenement Boundary (ML, CL and AUTH)
- Mining Lease Application Boundary (MLA 1)
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Local Government Boundary

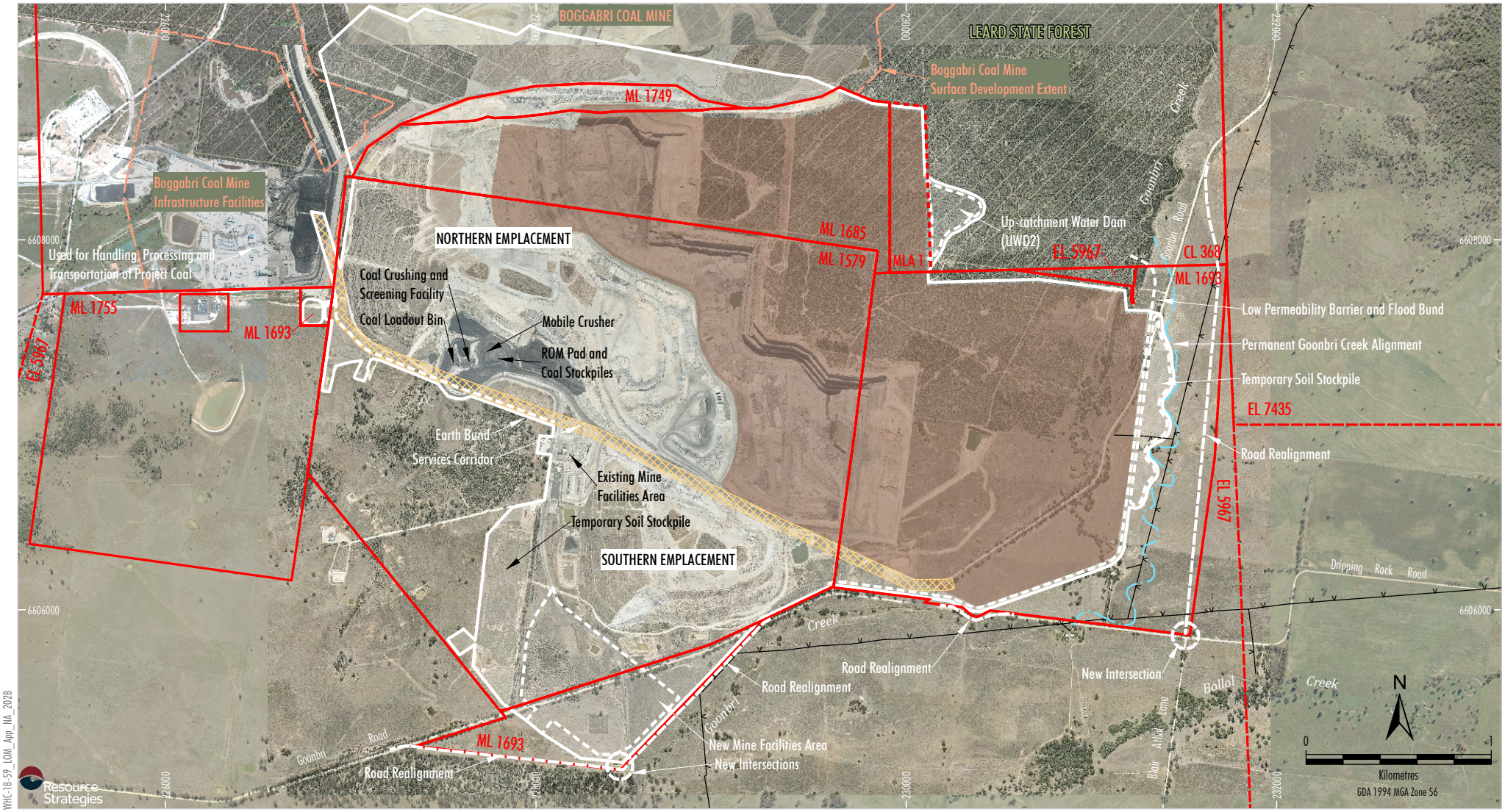
Source: LPMA - Topographic Base (2010); NSW Department of Industry (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Regional Location

Figure 1-1



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Exploration Licence (EL)
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Leard State Forest
- Approximate Extent of Approved Surface Development
- Approximate Extent of Approved Open Cut

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department Finance, Services & Innovation (2017); Whitehaven Coal (2017); Orthophoto: Whitehaven Coal (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Approved General Arrangement

Figure 1-2

2 DESCRIPTION OF MODIFICATION

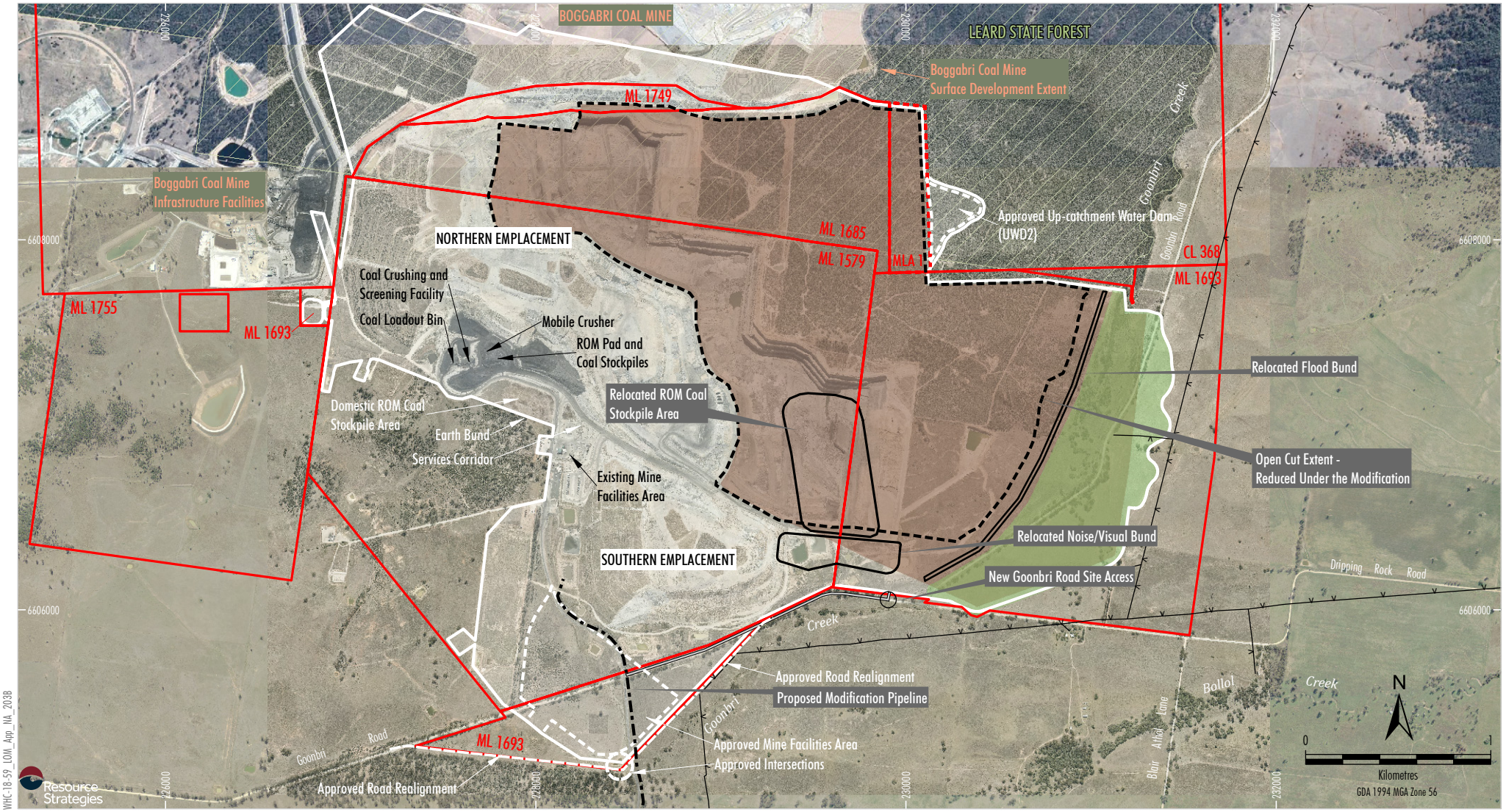
The main activities associated with the Modification include (Figures 2-1 and 2-2):

- ROM coal production rate increase from 3.0 to 3.5 million tonnes per annum (Mtpa);
- increase in ROM coal transported along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa;
- reduction of the open cut extent to avoid mining:
  - the Upper Namoi alluvium; and
  - Goonbri Creek.
- revision of the post-mining landform and land use;
- relocation of the ROM coal stockpile and associated infrastructure;
- construction of a new site access road and intersection to allow haulage of ROM coal along a section of Goonbri Road; and
- construction and use of a water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project (which is the subject of a separate Development Application for State Significant Development 7480).

The Modification would result in no change to the following elements of the Tarrawonga Coal Mine:

- mine life and operating hours;
- mining tenements;
- mining methods;
- employment; and
- domestic coal production.

The Modification would result in a reduction of the open cut extent and does not propose a change to blasting practices or management (e.g. Maximum Instantaneous Charge or pre-blast assessments). Accordingly, blasting associated with the Modification is not expected to generate higher overpressure and vibration levels than those associated with the approved Tarrawonga Coal Mine operations. Therefore, no blasting assessment was undertaken as part of the Modification.



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Leard State Forest
- Approximate Extent of Approved Surface Development
- Approximate Extent of Approved Open Cut
- Modification Open Cut Extent
- Approved Surface Development Area - No Longer Proposed
- Modification ROM Coal Transport Route Along Goonbri Road
- Indicative Location of Modification Pipeline

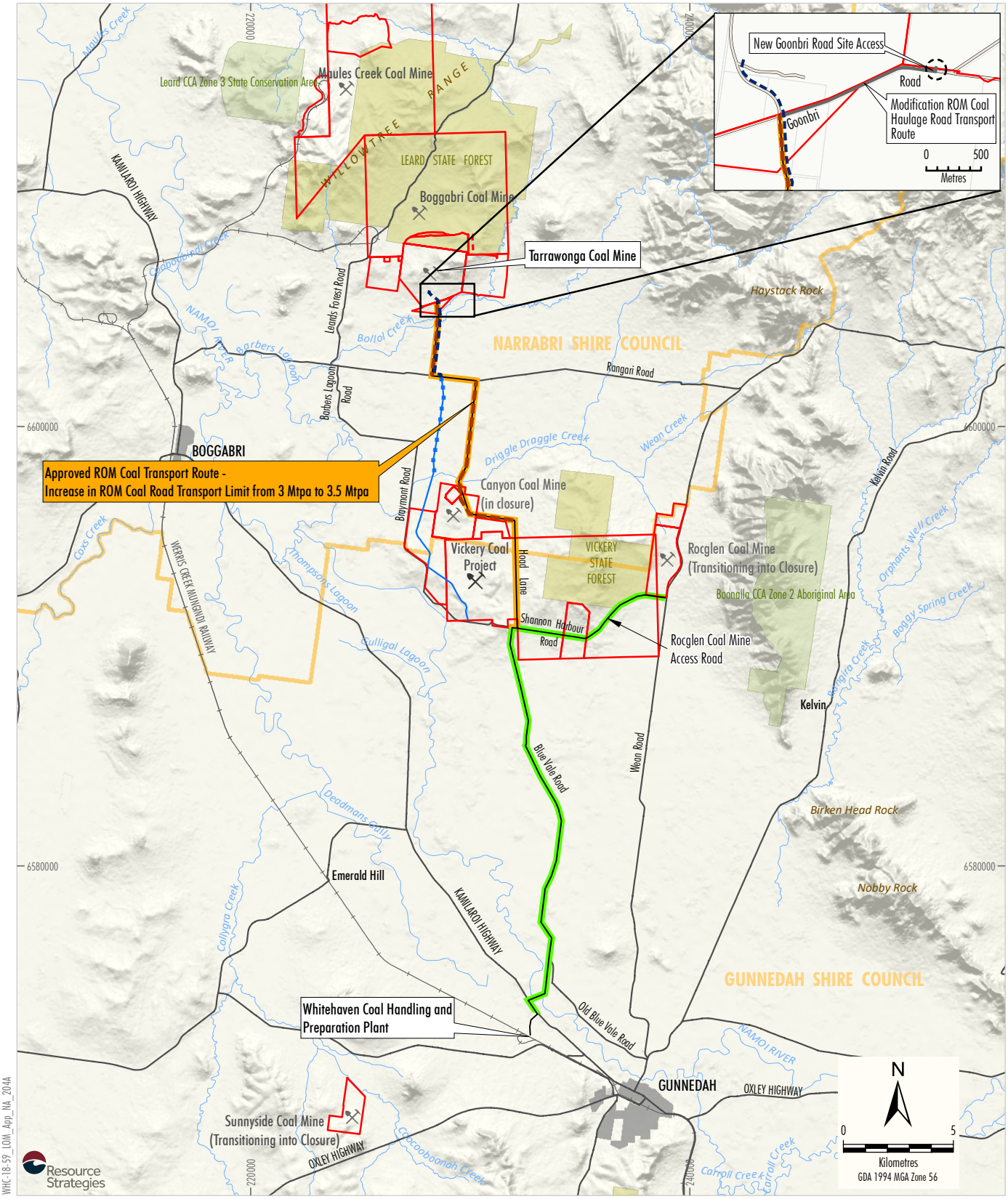
Source: © State of New South Wales and Department of Planning and Environment (2017); © Department Finance, Services & Innovation (2017); Whitehaven Coal (2018); Orthophoto: Whitehaven Coal (2018); Google (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Indicative Modification General Arrangement

Figure 2-1



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Local Government Boundary
- WHC Private Haul Road
- Indicative Location of Modification Pipeline
- Proposed Vickery Extension Project Pipeline Location
- Approved ROM Coal Transport Route - Northern Section
- Approved ROM Coal Transport Route - Southern Section

Source: LPMA - Topographic Base (2010); NSW Department of Industry (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

ROM Coal Road Transport Routes

Figure 2-2

3 REVIEW OF ENVIRONMENTAL NOISE PERFORMANCE

3.1 Operational and Traffic Noise Management

Noise management at the Tarrawonga Coal Mine is currently undertaken in accordance with the Tarrawonga Coal Mine's *Noise Management Plan (NMP)* (Whitehaven, 2014[1]) and the Tarrawonga and Rocglen Coal Mine's *Road Traffic Noise Management Plan* (Whitehaven, 2013[1]). These outline:

- noise mitigation measures and controls;
- the noise monitoring and reporting regimes; and
- the management of exceedances and complaints.

Compliance noise monitoring conducted for the Tarrawonga Coal Mine includes:

- attended compliance noise monitoring undertaken on a quarterly basis by an independent acoustic consultant;
- continuous real time noise monitoring in order to actively manage noise emissions on-site; and
- attended compliance noise monitoring of traffic along the Approved ROM Coal Transport Route.

Environmental noise performance in reference to compliance noise monitoring was reviewed for the last three years of operation (i.e. 2016-2018) and is summarised below.

3.2 Attended Operational Noise Monitoring

Quarterly attended noise monitoring is undertaken by an independent acoustics consultant at three different locations surrounding the Tarrawonga Coal Mine, namely the "Bungalow" (receiver 1aj) and "Barbers Lagoon" (receiver 79a) properties and at the "Matong-Coomalgah" boundary (slightly east of receiver 1ap [shown as receiver 1d in PA 11_0047]).

Attended noise monitoring results demonstrated compliance with the PA 11_0047 noise criteria on all occasions except for one 2 decibel (dB) exceedance of the 35 dBA $L_{Aeq,15min}$ operational noise criterion (Section 5) recorded at the "Barbers Lagoon" property on 9 September 2016.

A 2 dB exceedance is considered negligible and does not represent a non-compliance event in accordance with the NSW *Industrial Noise Policy* which represents the guideline relevant to the *NMP*[2] and PA 11_0047. It should also be noted that a 2 dB increase in noise levels is not discernible by the average listener.

[1] A revised *NMP* and *Road Traffic Noise Management Plan* was submitted to DP&E in August 2018.
[2] Note, the Tarrawonga Coal Mine *NMP* submitted to the DP&E in August 2018 refers to the Noise Policy for Industry.

Notification with regard to this exceedance was made to Department of Planning and Environment (DP&E). An investigation was undertaken following the receipt of results and a combination of unique atmospheric conditions and atypical ground conditions (highly saturated, surface water ponding) appear to be the primary causal factors for the exceedance.

3.3 Real Time Noise Monitoring

In accordance with the requirements of PA 11_0047 and Environmental Protection Licence (EPL) 12365, TCPL has continued to undertake real time noise monitoring and managed noise according to the *NMP* during the review period. In accordance with the *NMP*, TCPL implement the real time monitoring network to ensure site responsiveness to adverse conditions and to support the proactive and reactive noise management system on-site.

3.4 Road Noise Monitoring

Compliance noise monitoring of road traffic along public sections of the Approved ROM Coal Transport Route was conducted generally in accordance with the Tarrawonga and Rocglen Coal Mine's *Road Traffic Noise Management Plan*.

Monitoring was undertaken at the privately-owned residences on the "Werona" and "Brooklyn" properties located off Blue Vale Road. Results showed compliance with the Tarrawonga Coal Mine traffic noise criteria (Section 7.2) on all occasions, which is consistent with noise predictions for the Southern Section of the Approved ROM Coal Transport Route.

3.5 Noise Complaints

No complaints were received in relation to noise during the review period.

4 NOISE RECEIVERS AND SURROUNDING LAND USES

Land use in the local area is dominated by agricultural operations and open cut coal mining. The Tarrawonga Coal Mine is bounded to the north by the Leard State Forest and the Boggabri Coal Mine (BCM).

To the west, south and east of the Tarrawonga Coal Mine are a range of mine-owned and privately-owned rural receivers, all of which have been considered in this assessment. These receivers (25 privately-owned receivers and 45 mine-owned receivers) are listed in Table 4-1 and shown on Figure 4-1.

In addition to the receivers listed in Table 4-1, three indicative receiver locations in Leard State Forest have been selected for assessment against the amenity noise levels set in the *Noise Policy for Industry (NPfI)* (NSW Environmental Protection Authority, 2017). The location of these receivers has been selected for their proximity to access tracks within the Leard State Forest.

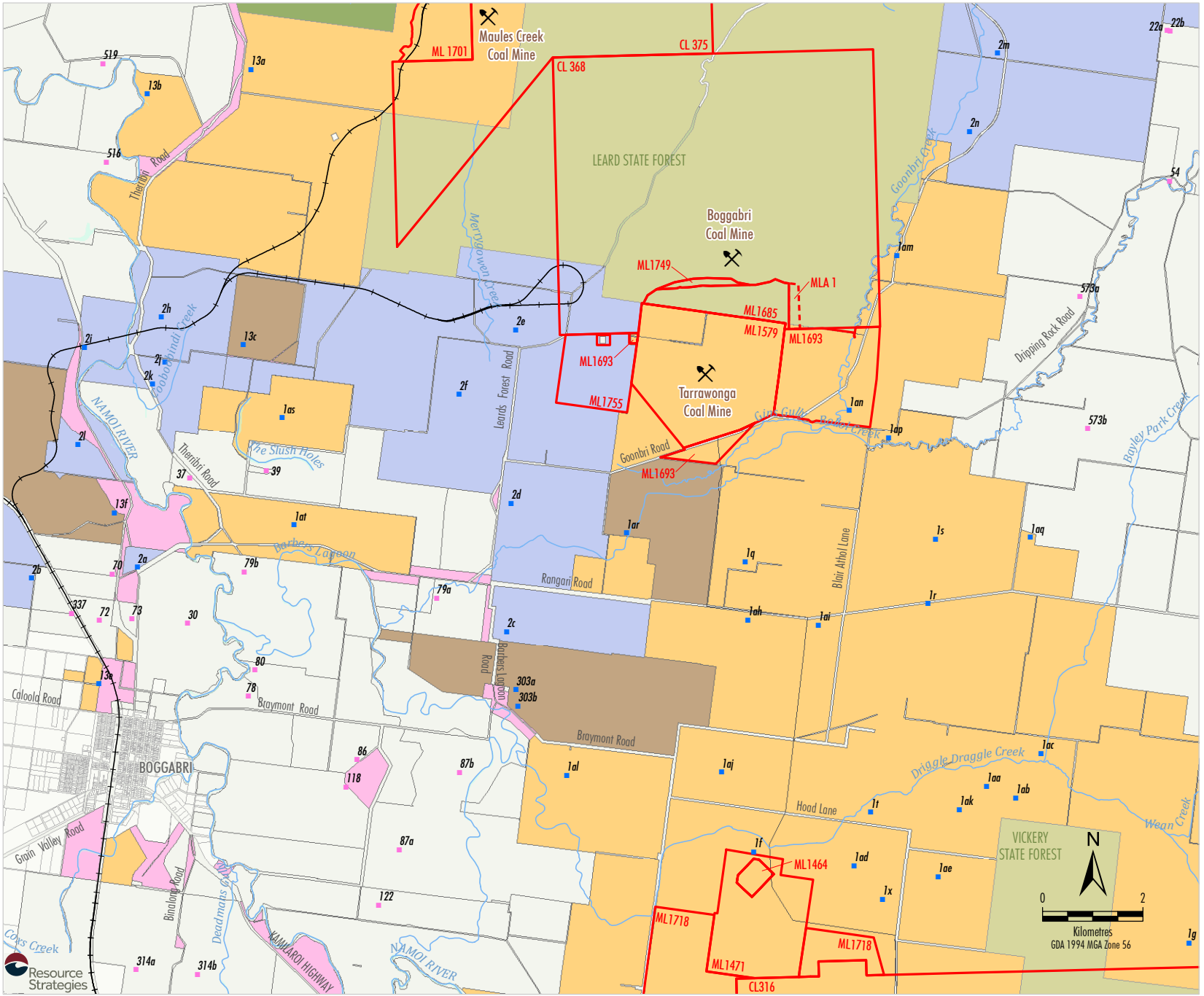
Table 4-1 Receivers Considered in Assessment

Rec ID	Ownership	Easting	Northing
	Privately-owned Dwellings		
22a	CJ Westlake	237464	6613804
22b	CJ Westlake	237526	6613782
30	Marilyn Frances Hart in 6/9 share, Penelope Frances Rice in 1/9 share, Timothy Thompson Hart in 1/9 share, and Sophie Louise Hart in 1/9 share as tenants in common	217911	6601948
37	Richard John Browning and Elaine Joy Browning as tenants in common in equal shares	217952	6604864
39	David Victor Gillham	219481	6604997
54	Peter Andrew Devine	237514	6610781
70	Dennis William Keys and Anne Marie Keys as joint tenants	216407	6602932
72	Richard Walter Kemp and Edward John Kemp as tenants in common in equal shares	216153	6602004
73	Lee Wayne Hunt and Margaret Dianne Hunt as joint tenants	216800	6602036
78	James Michael McKechnie and Nicole Mary McKechnie as joint tenants	219126	6600495
79a	Kenneth David Gillham	222883	6602455
79b	Kenneth David Gillham	219041	6602977
80	A D Watson Holdings Pty Ltd	219253	6601019
86	Peter J Watson Holdings Pty Ltd	221297	6599230
87a	David Sinclair Riley	222139	6597432
87b	David Sinclair Riley	223342	6598974
118	Andrew David Watson	221075	6598682
122	Nandewar Pty Limited	221722	6596321
314a	Global Ag Properties Australia Pty Ltd	216885	6595029
314b	Global Ag Properties Australia Pty Ltd	218109	6594937
337	Paul James Bell	215595	6602145
516	Peter John Watson and Georgia Parkin as joint tenants	216293	6611163
519	Riverway Boggabri Pty Ltd	216220	6613128
573a	MHPF Bellevue Land Pty Ltd	235726	6608475

Rec ID	Ownership	Easting	Northing
573b	MHPF Bellevue Land Pty Ltd	235880	6605843
	Mine-owned Dwellings		
1aa	Whitehaven Coal Mining Pty Limited	233861	6598699
1ab	Whitehaven Coal Mining Pty Limited	234447	6598461
1ac	Whitehaven Coal Mining Pty Limited	234948	6599352
1ad	Whitehaven Coal Mining Pty Limited	231216	6597110
1ae	Whitehaven Coal Mining Pty Limited	232895	6596896
1ah	Whitehaven Coal Mining Pty Limited	229097	6602016
1ai	Whitehaven Coal Mining Pty Limited	230504	6601914
1aj	Whitehaven Coal Mining Pty Limited	228572	6598981
1ak	Whitehaven Coal Mining Pty Limited	233318	6598234
1al	Whitehaven Coal Mining Pty Limited	225481	6598912
1am	Whitehaven Coal Mining Pty Limited	232069	6609299
1an	Whitehaven Coal Mining Pty Limited	231116	6606205
1ao	Whitehaven Coal Mining Pty Limited	230899	6605874
1ap	Whitehaven Coal Mining Pty Limited	231907	6605661
1aq	Whitehaven Coal Mining Pty Limited	234736	6603667
1ar	Whitehaven Coal Mining Pty Limited	226672	6603754
1as	Whitehaven Coal Mining Pty Limited	219798	6606061
1at	Whitehaven Coal Mining Pty Limited	220038	6603915
1f	Whitehaven Coal Mining Pty Limited	229210	6597384
1g	Whitehaven Coal Mining Pty Limited	237902	6595557
1q	Whitehaven Coal Mining Pty Limited	229044	6603178
1r	Whitehaven Coal Mining Pty Limited	232693	6602344
1s	Whitehaven Coal Mining Pty Limited	232841	6603631
1t	Whitehaven Coal Mining Pty Limited	231547	6598184
1x	Whitehaven Coal Mining Pty Limited	231784	6596439
2a	Boggabri Coal Pty Limited	216911	6603076
2b	Boggabri Coal Pty Limited	214795	6602850
2c	Boggabri Coal Pty Limited	224284	6601781
2d	Boggabri Coal Pty Limited	224370	6604351
2e	Boggabri Coal Pty Limited	224464	6607819
2f	Boggabri Coal Pty Limited	223331	6606527
2h	Boggabri Coal Pty Limited	217386	6608068
2i	Boggabri Coal Pty Limited	215854	6607464
2j	Boggabri Coal Pty Limited	217462	6607175
2k	Boggabri Coal Pty Limited	217214	6606728
2l	Boggabri Coal Pty Limited	215721	6605519
2m	Boggabri Coal Pty Limited	234081	6613345
2n	Boggabri Coal Pty Limited	233520	6611771
13a	Estate: perpetual lease Michael John Nott and Maree Louise Nott as joint tenants	219178	6613017
13b	-	217106	6612530
13c	Aston Coal 2 Pty Limited, Boggabri Coal Pty Limited, Icra Mc Pty Limited, and J-Power Australia Pty Limited	219019	6607512

Rec ID	Ownership	Easting	Northing
13e	Aston Coal 2 Pty Ltd	216140	6600745
13f	Estate: perpetual lease Aston Coal 2 Pty Ltd and Idemitsu Boggabri Coal Pty Limited as tenants in common in equal shares	216450	6604160
303a	Whitehaven Coal Mining Limited and Boggabri Coal Pty Limited	224469	6600621
303b	Whitehaven Coal Mining Limited and Boggabri Coal Pty Limited	224507	6600300
Leard State Forest			
LSF1	-	231911	6610467
LSF2	-	232705	6612382
LSF3	-	232947	6614338

Notes:
- Eastings and Northings are in Map Grid of Australia (MGA) 84 coordinates, Zone 56.
- Leard State Forest locations are not included in Figure 4-1.



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Land Ownership

Figure 4-1

WHC-18-59_LOM_App_NA_205B

5 OPERATIONAL NOISE CRITERIA

5.1 Project Approval Noise Criteria

PA 11_0047 has set noise criteria for the Tarrawonga Coal Mine. Conditions discussing operational noise criteria are summarised in this section.

5.1.1 Operational Noise Criteria

Condition 3, Schedule 3 of PA 11_0047 requires TCPL to ensure that the noise generated by the Tarrawonga Coal Mine does not exceed the criteria in Table 5-1 at any residence on privately-owned land. Table 5-1 includes an $L_{Aeq,15min}$ noise criterion for the day, evening and night time periods to address intrusiveness and an $L_{A1,1min}$ noise criterion to address potential for sleep disturbance at night.

Table 5-1 Operational Noise Criteria

Location	Day, Evening & Night	Night
	$L_{Aeq,15min}$ (dBA)	**$L_{A1,1min}$ (dBA)**
All privately-owned receivers	35	45

Source: PA 11_0047
Notes:

- Daytime: the period from 7.00 am to 6.00 pm.
- Evening: the period from 6.00 pm to 10.00 pm.
- Night: the period from 10.00 pm to 7.00 am.
- Operational noise includes noise from the mining operations and the use of private roads (excluding the Kamilaroi Highway overpass) and rail spurs.
- Noise is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the *NSW Industrial Noise Policy*.
- dBA = decibel (A frequency weighted).

Condition 4, Schedule 3 of PA 11_0047 requires TCPL to acquire the residence and land, or provide additional mitigation to the residence, in accordance with the procedures in Conditions 8 and 9 of Schedule 4, if:

- the noise generated by the Tarrawonga Coal Mine exceeds the noise criteria in Table 5-1 at the residence; and
- TCPL receives a written request for acquisition or additional mitigation from the landowner.

5.1.2 Privately-Owned Land Criteria

Condition 5, Schedule 3 of PA 11_0047 requires TCPL to acquire the residence and land in accordance with the procedures in Conditions 8 and 9 of Schedule 4, if:

- the noise generated by the Tarrawonga Coal Mine exceeds an $L_{Aeq,15min}$ level of 40 dBA over more than 25 percent (%) of the privately-owned land; and
- TCPL receives a written request for acquisition from the landowner.

5.1.3 Cumulative Noise Criteria

In accordance with Condition 6, Schedule 3 of PA 11_0047, TCPL must ensure that the noise generated by the Tarrawonga Coal Mine combined with the noise generated by other mines in the area does not exceed the criterion in Table 5-2 at any residence on privately-owned land.

Table 5-2 Cumulative Noise Criteria

Location	Day, Evening & Night
	$L_{Aeq,Period}$ (dBA)
All privately-owned receivers	40

Notes:

- Daytime: the period from 7.00 am to 6.00 pm.
- Evening: the period from 6.00 pm to 10.00 pm.
- Night: the period from 10.00 pm to 7.00 am.
- Operational noise includes noise from the mining operations and the use of private roads (excluding the Kamilaroi Highway overpass) and rail spurs.
- Cumulative noise is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the *NSW Industrial Noise Policy*.

Condition 7, Schedule 3 of PA 11_0047 requires TCPL to acquire the residence and land, or provide additional mitigation to the residence, in accordance with the procedures in Conditions 8 and 9 of Schedule 4, if:

- the noise generated by the Tarrawonga Coal Mine exceeds the noise criteria in Table 5-2 at the residence; and
- TCPL receives a written request for acquisition or additional mitigation from the landowner.

A Boggabri–Tarrawonga–Maules Creek Complex (BTM Complex) Noise Management Strategy (Whitehaven Coal and Idemitsu Australia Resources, 2017) has been prepared to collectively manage cumulative noise impacts of their operations. The BTM Complex Noise Management Strategy stipulates the same criteria listed in Table 5-2.

5.2 Modifying Factor Adjustments

Where a noise source contains certain annoying characteristics, such as low-frequency noise, the *NPfI* states that a penalty should be applied to measured or predicted noise levels before comparing to the relevant Modification noise trigger levels.

The *NPfI* provides a method of low-frequency noise assessment based on:

- overall 'C' weighted and 'A' weighted predicted or measured levels; and
- one-third octave predicted or measured levels in the range 10–160 Hertz (Hz).

Two penalties are nominated in the *NPfI*:

2 dB (evening and night)	if the C- minus A-weighted noise level over the same period is 15 dB or more, and where any of the third octave noise levels in Table C2 of the *NPfI* are exceeded by up to and including 5 dB and cannot be mitigated.
2 dB (daytime) and 5 dB (evening and night)	if the C- minus A-weighted noise level over the same period is 15 dB or more, and where any of the third octave noise levels in Table C2 of the *NPfI* are exceeded by more than 5 dB and cannot be mitigated.

Table C2 of the *NPfI* is reproduced below:

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

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

***Note**:*

- *dB(Z) = decibel (Z frequency weighted).*

A low-frequency noise assessment for the Modification is provided in Section 6.5. This assessment concludes no modifying factor correction for low-frequency noise is warranted for the Modification.

5.3 Residual Noise Impacts

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

The *Voluntary Land Acquisition and Mitigation Policy (VLAMP)* (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 quantifies the significance of any potential noise exceedances, is reproduced below in Table 5-3. These significance categories (i.e. negligible, marginal, moderate and significant) are generally consistent with the significance categories described in Table 1 of the *VLAMP*.

Table 5-3 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
>= 3 but <=5 dBA	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1 dB	Marginal
>= 3 but <=5 dBA	> recommended amenity noise level and the increase in total	Moderate

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:
	cumulative industrial noise level resulting from the development is more than 1 dB	
>5 dBA	=< recommended amenity noise level	Moderate
>5 dBA	> recommended amenity noise level	Significant

Table 4.2 of the *NPfI* provides example measures for addressing residual noise impacts. The measures are also generally consistent with Table 1 of the *VLAMP*. Table 4.2 of the *NPfI* is reproduced in Table 5-4.

Table 5-4 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.

Note in accordance with the *VLAMP*, mitigation rights are afforded to properties with predicted exceedances that are characterised as marginal, moderate or significant and acquisition rights are afforded to properties with predicted exceedances that are characterised as significant.

For privately-owned residences, Table 5-5 presents the options for addressing noise levels where they may exceed the operational noise criteria.

Table 5-5 Modification Noise Impact Assessment Methodology

Noise Management Zone		Noise Affectation Zone
1-2 dB above operational noise criteria (refer Tables 5-1 and 5-2)	**3-5 dB above operational noise criteria (refer Tables 5-1 and 5-2)**	**> 5 dB above operational noise criteria (refer Tables 5-1 and 5-2)**
No treatment/controls required.	• Voluntary mitigation rights applicable. • Architectural treatment required if requested (incl. ventilation & upgraded façade elements).	• Voluntary mitigation rights applicable. • Architectural treatment required if requested (incl. ventilation & upgraded façade elements). • Voluntary land acquisition rights applicable.

5.4 Noise Criteria for Leard State Forest

5.4.1 Cumulative Noise Criteria for Leard State Forest

Three receiver locations have been chosen within Leard State Forest (LSF1-3) in order to review the potential for noise impacts under the amenity criteria for areas specifically reserved for passive recreation.

The *NPfI* sets an amenity noise level of 50 dBA $L_{Aeq,Period}$ for passive recreation areas when in use (conservatively assumed to include the day and evening assessment periods). This represents the objective for total industrial noise at the Leard State Forest locations and will be used when addressing cumulative noise impacts (Section 6.9).

Note that the Modification amenity noise level refers to the $L_{Aeq,Period}$ noise level, which represents noise over an entire day, evening or night time period (i.e. different to the operational noise criteria which refer to a noise level over 15 minutes).

5.4.2 Operational Noise Criteria for Leard State Forest

The *NPfI* establishes a Project specific amenity noise level so that total industrial noise levels remain within the recommended amenity noise levels as follows:

Project amenity noise level = Amenity noise level – 5 dB

As such, the Modification amenity noise level for the Leard State Forest locations is 45 dBA $L_{Aeq,Period}$.

The *NPfI* stipulates that operational noise criteria should be expressed as $L_{Aeq,15min}$ values and provides the following method to convert $L_{Aeq,Period}$ levels into $L_{Aeq,15min}$ levels:

- $L_{Aeq,15min} = L_{Aeq,Period} + 3$ dB.

Therefore, the resultant operational noise criterion for the Leard State Forest locations is 48 dBA $L_{Aeq,15min}$ for the day and evening periods.

6 OPERATIONAL NOISE ASSESSMENT

6.1 Noise Modelling Methodology

Operational noise levels at nearby receivers have been calculated using the Environmental Noise Model (ENM) (a proprietary computer program from RTA Technology Pty Ltd). This modelling software is compatible with the *NPfI* and has been previously accepted by the Environmental Protection Authority and the DP&E for use in environmental noise assessments. The assessment models the total noise at each receiver from the operation of the Modification. Total predicted operational noise levels are then compared with the relevant operational noise criteria presented in Sections 5.1 and 5.4.

6.1.1 Noise Assessment Scenarios

Noise modelling was undertaken for Modification Years 3 (2022) and 7 (2026). These Modification Years were selected to represent operations with the greatest potential for noise impacts on surrounding receivers and in particular the receivers east of the Tarrawonga Coal Mine. They can be described as follows:

- Modification Year 3 considers the mining operations with relocated ROM coal stockpile and associated infrastructure in place. ROM coal production would be at the proposed maximum rate of 3.5 Mtpa and the volume of displaced waste material is expected to be the highest of the life of the mine. Coal mining and waste material removal activities would be concentrated near the south-east corner and central-northern part of the open cut extent.
- Modification Year 7 considers the mining operations with relocated ROM coal stockpile and associated infrastructure in place. ROM coal production would be at the proposed maximum rate of 3.5 Mtpa, with volumes of displaced waste material still relatively high. Coal mining and waste material removal activities would be concentrated along the eastern end and north-east corner and of the open cut extent.

Key Modification components are shown on Figure 2-1.

6.1.2 Construction Activities

As described in Section 2, the Modification involves construction activities associated with;

a) a new site access road and intersection along a section of Goonbri Road;

b) a new water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project; and

c) the relocation of the ROM coal stockpile and associated infrastructure.

As perceived by receivers in the vicinity of the Modification, noise associated with the above construction activities would largely be indistinguishable from coal transportation, operational mining and coal processing activities given similar plant would be deployed and construction activities would occur in areas adjacent to operational activities. Therefore, construction noise was assessed in combination with operational noise against the operational noise criteria (Section 5.1.1).

Construction noise is discussed in Section 6.10.

6.1.3 Meteorological Environment for Noise Assessment Purposes

Fact Sheet D of the *NPfI* 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 below.

Table D1: Standard and noise-enhancing meteorological conditions.

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

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:

1. Conservatively adopt noise-enhancing meteorological conditions without processing meteorological data local to the site; or
2. Determine the significance of noise-enhancing meteorological conditions based on meteorological data local to the site and adopt significant noise-enhancing conditions for the assessment. Where noise-enhancing meteorological conditions are deemed non-significant, standard meteorological conditions may be adopted.

The second option was adopted for the noise assessment as it would provide a more representative estimate of noise impacts.

The significance of noise-enhancing meteorological conditions is based on approximately six years' worth of meteorological data (January 2013 – early October 2018) obtained from the Tarrawonga Coal Mine automatic weather station. The dataset includes wind speed, wind direction and observations of sigma-theta used to determine Pasquill-Gifford stability categories (in accordance with Fact Sheet D).

Analysis of the meteorological data in accordance with Fact Sheet D of the *NPfI* establishes a number of noise-enhancing meteorological conditions during the day and at night. Appendix B provides a summary of the methodology used to determine the significance of those noise-enhancing meteorological conditions.

Analysis of the Tarrawonga Coal Mine meteorological data established significant wind-related noise-enhancing meteorological conditions during the day from the southern (S), south-southwestern (SSW), southwestern (SW), west-southwestern (WSW) and western (W) directions.

Analysis of the data determined that the percentage of occurrence of moderate-to-strong temperature inversions in winter, averaged over the six years, was 35.4% (see Section B.2 of Appendix B). As such, moderate-to-strong temperature inversions are considered significant to the Modification.

Fact Sheet D of the *NPfI* does not provide guidance regarding the use of winds during temperature inversions (e.g. a frequency of occurrence threshold or the presence of certain topography leading to drainage flows). A pragmatic risk management approach has therefore been adopted, whereby temperature inversions with source-to-receiver winds up to 2 m/s are only considered in the assessment when the frequency of occurrence is greater than 10% in any season. This approach has been adopted for other mining projects and is considered reasonable and acceptable.

Analysis of the meteorological data following the methodology directed in Fact Sheet D determined temperature inversions with winds from the northern (N), north-northeastern (NNE), northeastern (NE), east-northeastern (ENE), eastern (E), and north-northwestern (NNW) directions are found to have frequencies of occurrence ranging from 13.7% to 19.1% in winter. As such, the above drainage flow winds were addressed as part of the noise assessment. Drainage flow winds are considered too infrequent for all other directions.

The resultant noise-enhancing meteorological conditions relevant to the Modification along with the standard meteorological conditions are summarised in Table 6-1. All meteorological conditions presented in Table 6-1 have been considered for the assessment since the noise-enhancing meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* do not necessarily result in higher noise levels when compared with standard meteorological conditions at a particular receiver location.

Table 6-1 Relevant *NPfI* Meteorological Conditions

Assessment Period	*NPfI* Meteorological Condition	Description of Meteorological Parameters
Day	Noise-enhancing meteorological conditions	3 m/s wind in S, SSW, SW, WSW & W directions; stability categories A-D
	Standard meteorological conditions	0.5 m/s wind in source-to-receiver direction; stability categories A-D
Evening	Standard meteorological conditions	0.5 m/s wind in source-to-receiver direction; stability categories A-D
Night	Noise-enhancing meteorological conditions	Stability category F; no drainage flow wind
		Stability category F with 2 m/s drainage flow wind in N, NNE, NE, ENE, E & NNW directions
	Standard meteorological conditions	0.5 m/s wind in source-to-receiver direction; stability categories A-D

Notes:

- Wind in source-to-receiver direction was considered using the closest direction in a 16-direction compass to the source-to-receiver direction.

For each assessment period, only the highest noise predictions under the relevant *NPfI* meteorological conditions presented in Table 6-1 (including both standard and noise-enhancing meteorological conditions as described in Fact Sheet D) are reported.

6.2 Investigation of Feasible & Reasonable Noise Mitigation Measures

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 Modification 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 TCPL.
4. Adoption by TCPL of management and mitigation measures to optimise noise emissions associated with the Modification.

As a result of this preliminary modelling, TCPL has selected mobile plant in consideration of good practice sound power levels (SWLs) in order to improve acoustic performance.

TCPL proposes to install bunds directly south of the relocated ROM coal stockpile area (with Relative Level of 310 metres [m]). The bunds are also expected to provide some level of shielding to noise generated by the Modification.

It is important to note that TCPL currently implements a real time monitoring and weather forecasting system, incorporating noise and meteorological monitoring, with the purpose of anticipating upcoming periods of noise-enhancing meteorological conditions that may generate noise exceedances at receivers surrounding the Modification. Such a system allows TCPL to predict and prepare for modification of operations to reduce noise levels as far as reasonably and feasibly practical in the event that adverse weather conditions are experienced. Details regarding the real time monitoring and forecasting system are provided in the Noise Management Plan.

6.3 Indicative Fleet List

Table 6-2 presents the proposed equipment and their periods of operation (i.e. daytime/evening/night). Mobile fleet would be confirmed during detailed design and procurement for the Modification.

As explained in Section 6.1, construction activities have conservatively been included in the Year 3 and Year 7 operational noise scenarios. A description of the construction fleet is included in Section 6.10 (Construction Activities).

Table 6-2 Indicative Fleet

Fleet/ Infrastructure Item		Location/Function	Number of Equipment		Assessment Period
			Year 3	Year 7	
Open Cut Mining	CAT 789D Rigid Dump Truck	ROM coal transport	5	5	Daytime, evening, night
	Hitachi EH 4000 Rigid Dump Truck	Waste material transport	17	17	Daytime, evening, night
	Volvo A40D Articulated Truck	Waste material transport	4	4	Daytime, evening, night
	Hitachi EX 5600 Excavator	Waste material transport	3	3	Daytime, evening, night
	Terex RH170 Excavator	ROM coal transport	1	1	Daytime, evening, night
	Komatsu PC450 Excavator	Waste material transport and civil works	1	1	Daytime, evening, night
	Hitachi 25-tonne Excavator	Waste material transport and civil works	1	1	Daytime, evening, night
	CAT D11 Dozer	Waste material emplacement	2	2	Daytime, evening, night
	CAT D11 Dozer	Waste material removal	4	4	Daytime, evening, night
	CAT D11 Dozer	Topsoil material removal	1	1	Daytime, evening, night
	CAT D10 Dozer	Coal mining	4	4	Daytime, evening, night
	CAT 657 Scraper	Topsoil material removal	4	4	Daytime, evening, night
	CAT 988 Loader	Chitter	1	1	Daytime, evening, night
	Drill	Waste material blasting	3	3	Daytime, evening, night
	CAT 950 Loader (Stemming)	Waste material blasting	1	1	Daytime, evening, night
	Volvo Semi-Trailer Truck (Blast Product)	Waste material blasting	2	2	Daytime, evening, night
	Isuzu Truck (Stemming)	Waste material blasting	1	1	Daytime, evening, night
Haul Road Maintenance	CAT 16M Grader	Haul road maintenance	2	2	Daytime, evening, night
	CAT 966 Loader	Haul road maintenance	1	1	Daytime, evening, night
	Volvo A40D Articulated Truck	Haul road maintenance	2	2	Daytime, evening, night
	CAT 773 Water Truck	Haul road maintenance	2	2	Daytime, evening, night
Relocated ROM Coal Stockpile Area	Mobile Crusher	Coal processing	2	2	Daytime, evening, night
	CAT 988 Loader	ROM stockpile management	2	2	Daytime, evening, night
	CAT 992 Loader	ROM stockpile management	1	1	Daytime, evening, night
Coal Transport Off-Site	Road registered truck	Coal trucking off-site	-	-	Daytime, evening, night *

* Note: Coal transport off-site restricted between hours of 6.00 am to 9.15 pm by PA 11_0047. As such, it is included in day, evening and night assessment periods.

6.4 Indicative Sound Power Levels

Table 6-3 presents modelled plant SWLs, a description of noise controls implemented, and references for all the SWLs in accordance with the *NPfI*.

Mobile fleet and acoustic designs for infrastructure items would be selected as part of the detailed mine design and procurement for the Modification, however it is expected that SWLs would be generally consistent with those presented in Table 6-3.

TCPL recognises the importance of SWLs in order to minimise noise and has committed to proper care and maintenance of the equipment to avoid deterioration of noise attenuation components.

As explained in Section 6.1, construction activities have conservatively been included in the Year 3 and Year 7 operational noise scenarios. The SWLs assumed for the construction fleet is included in Section 6.10.

6.5 Low-Frequency Noise Assessment Results

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 operational noise criteria.

As stated in Section 5.2, the *NPfI* provides a method for assessing low-frequency noise based on:

- overall 'C' weighted and 'A' weighted predicted or measured levels; and
- one-third octave predicted or measured levels in the range 10–160 Hz.

The C-weighted noise level minus A-weighted noise level assessment was conducted using the ENM for a selection of receivers considered to be representative of various catchment areas surrounding the Modification. The assessment was based on the relevant night time *NPfI* meteorological conditions (Table 6-1) resulting in the highest noise levels.

Table 6-4 sets out the selected receivers in the different catchment areas.

Table 6-3 Indicative Equipment Sound Power Levels

Fleet/Infrastructure Item		Indicative Sound Power Level per Item L_{Aeq} (dBA)	Reference
Haul Trucks	CAT 789D Rigid Dump Truck	120	SLR Consulting Australia (2019)
	Hitachi EH 4000 Rigid Dump Truck	116	Wilkinson Murray (2017)
	Volvo A40D Articulated Truck	116	Global Acoustics (2013)
Excavators	Hitachi EX 5600 Excavator	118	Hansen Bailey (2015)
	Terex RH170 Excavator	116	SLR (2019)
	Komatsu PC450 Excavator	112	SLR (2015)
	Hitachi 25-tonne Excavator	112	SLR (2015)
Dozers	CAT D11 Dozer	120	SLR (2019)
	CAT D10 Dozer	119	SLR (2019)
Loaders	CAT 992 Loader	113	Manufacturer Specifications
	CAT 988 Loader	111	Manufacturer Specifications
	CAT 966 Loader	109	Manufacturer Specifications
	CAT 950 Loader (Stemming)	109	Manufacturer Specifications
Drills	Drill	117	Wilkinson Murray (2011)
Scrapers	CAT 657 Scraper	115	Wilkinson Murray (2009)
Graders	CAT 16M Grader	110	SLR (2019)
Water Trucks	CAT 773 Water Truck	117	Manufacturer Specifications
Other Trucks	Volvo Semi-Trailer Truck (Blast Product)	108	Hansen Bailey (2015)
	Isuzu Truck (Stemming)	108	Hansen Bailey (2015)
Infrastructure	Mobile Crusher	113	Wilkinson Murray (2011)
	Road registered truck	109	Inter-Noise 2011 research paper (2011)

Table 6-4 Low-Frequency Noise Assessment – Catchment Areas

Representative Receiver	Direction	Catchment Area Receivers
Receiver 2n	Northeast	1am, 2m, 2n, LSF1, LSF2 and LSF3
Receiver 54	Northeast	22a, 22b and 54
Receiver 573a	East	573a and 573b
Receiver 1s	Southeast	1ah, 1ai, 1an, 1ao, 1ap, 1aq, 1q, 1r and 1s
Receiver 1t	South-southeast	1aa, 1ab, 1ac, 1ad, 1ae, 1aj, 1ak, 1f, 1g, 1t and 1x
Receiver 87b	Southwest	1al, 2c, 79a, 86, 87a, 87b, 118, 122, 303a and 303b
Receiver 314b	Southwest	314a and 314b
Receiver 2d	West	1ar, 2d, 2e and 2f
Receiver 37	West	1as, 1at, 2a, 2b, 2h, 2i, 2j, 2k, 2l, 13c, 13e, 13f, 30, 37, 39, 70, 72, 73, 78, 79b, 80 and 337
Receiver 516	West-northwest	13a, 13b, 516 and 519

Table 6-5 summarises the difference between the C-weighted noise level and the A-weighted noise level for the two modelled Modification Years.

Table 6-5 C-Weighted Minus A-Weighted Noise Levels

Assessed Receiver	$L_{Ceq,15min}$ Noise Level - $L_{Aeq,15min}$ Noise Level (dB)	
	Year 3	Year 7
Receiver 2n	15.4	15.2
Receiver 54	17.6	17.6
Receiver 573a	15.4	15.5
Receiver 1s	15.3	14.2
Receiver 1t	17.9	16.8
Receiver 87b	19.3	18.4
Receiver 314b	19.1	19.1
Receiver 2d	16.6	16.6
Receiver 37	19.6	19.6
Receiver 516	20	20.5

Note:
Levels highlighted indicate differences of 15 dB or more.

Table 6-5 indicates that all assessed receivers are expected to be subject to an unbalanced spectrum with major components within the low-frequency range of the frequency spectrum. For those receivers, the resultant spectrum was compared with the low-frequency noise threshold curve (Section 5.2).

Reliable data of low-frequency mining noise over long-distances is currently limited and relevant data at the Tarrawonga Coal Mine is unavailable at this stage. The most reliable dataset available to establish a typical low-frequency spectrum shape was captured as part of a noise audit conducted at Bulga Village for an open cut mine (Wilkinson Murray, 2016).

Measurements conducted for the audit were carried out at an approximate distance of 3 to 4 km from the mine, with a propagation path comparable to those surrounding the Tarrawonga Coal Mine. The spectrum shape shown in Table 6-6 corresponds to an average of 37 low-frequency measurements in third octave bands between 10 Hz to 160 Hz.

Table 6-6 Typical Measured Low-Frequency Spectrum – Bulga Village Noise Audit

	Third Octave Band Centre Frequency, Hz												
	10	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Measured level dB(Z)	49	55	57	52	52	52	51	52	49	50	48	45	40

The low-frequency spectrum shape was then normalised to the 63 Hz octave component of the predicted noise levels (i.e. from the ENM) at each of the assessed receivers and compared against the low-frequency noise threshold curve (Section 5.2). The 63 Hz octave component is considered to be the most reliable octave band as source spectra were not always available at lower octave bands.

It was found that normalised low-frequency spectrum shapes are below the low-frequency noise threshold at all assessed receivers except for receivers 1s, 1t and 2d. All receivers contained in the catchment area represented by receivers 1s, 1t and 2d are mine-owned and do not require assessment against the operational noise criteria.

The low-frequency noise assessment indicates it is unlikely that any of the privately-owned receivers surrounding the Modification would be subject to dominant low-frequency noise. Therefore, no modifying factor correction for low-frequency noise is warranted for the Modification.

6.6 Predicted Operational Noise Levels from the Modification

The predicted $L_{Aeq,15min}$ operational noise levels at each receiver are presented in Table 6-7. Results are presented for each of Modification Years 3 and 7 under Fact Sheet D meteorological conditions (Section 6.1.3). The maximum result of applicable Fact Sheet D meteorological conditions (i.e. standard conditions and noise-enhancing conditions) is presented.

Appendix C presents indicative noise contours under the relevant Fact Sheet D meteorological conditions (Table 6-1) for the two modelled Modification Years. Noise contours are provided for daytime, evening and night periods.

The mine-owned receivers are included in Table 6-7 for information only. Noise levels are rounded to the nearest dB.

Table 6-7 Predicted $L_{Aeq,15min}$ Operational Noise Levels

Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)						$L_{Aeq,15min}$ Operational Noise Criteria Day/Eve/Night (dBA)
	Year 3			Year 7			
	Day	Eve	Night	Day	Eve	Night	
Privately-owned Dwellings							
22a	27	19	24	26	18	24	35 / 35 / 35
22b	28	21	25	26	19	24	35 / 35 / 35
30	13	13	18	11	11	17	35 / 35 / 35
37	20	20	29	17	17	28	35 / 35 / 35
39	19	19	30	20	20	29	35 / 35 / 35
54	31	23	29	31	18	29	35 / 35 / 35
70	22	22	28	21	21	28	35 / 35 / 35
72	11	11	23	9	9	22	35 / 35 / 35
73	6	6	14	5	5	14	35 / 35 / 35
78	24	24	29	22	22	29	35 / 35 / 35
79a	26	26	34	24	24	34	35 / 35 / 35
79b	25	25	31	22	22	30	35 / 35 / 35
80	24	24	30	22	22	29	35 / 35 / 35
86	25	25	30	24	24	30	35 / 35 / 35
87a	24	24	29	23	23	29	35 / 35 / 35
87b	26	26	31	24	24	32	35 / 35 / 35
118	16	16	22	14	14	22	35 / 35 / 35
122	23	23	28	22	22	28	35 / 35 / 35
314a	21	21	25	20	20	25	35 / 35 / 35
314b	21	21	25	21	21	25	35 / 35 / 35
337	15	15	24	15	15	23	35 / 35 / 35
516	18	17	26	11	9	22	35 / 35 / 35
519	23	19	26	19	13	24	35 / 35 / 35
573a	35	23	34	34	22	33	35 / 35 / 35
573b	35	30	35	35	29	35	35 / 35 / 35
Mine-owned Dwellings							
1aa	29	25	32	30	27	32	n/a[1]
1ab	29	25	31	30	26	32	n/a[1]
1ac	29	25	30	30	25	31	n/a[1]
1ad	27	27	30	25	25	30	n/a[1]
1ae	27	25	30	27	25	30	n/a[1]
1ah	32	32	41	31	31	41	n/a[1]
1ai	33	32	40	32	32	40	n/a[1]
1aj	30	30	34	27	27	34	n/a[1]
1ak	30	26	32	30	27	32	n/a[1]
1al	27	27	32	26	26	33	n/a[1]
1am	45	33	42	47	36	44	n/a[1]
1an	56	47	57	55	48	58	n/a[1]
1ao	55	48	59	54	48	58	n/a[1]
1ap	50	42	52	49	43	52	n/a[1]
1aq	34	30	35	35	30	36	n/a[1]

Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)						$L_{Aeq,15min}$ Operational Noise Criteria Day/Eve/Night (dBA)
	Year 3			Year 7			
	Day	Eve	Night	Day	Eve	Night	
1ar	32	32	43	30	30	44	n/a[1]
1as	20	20	29	14	14	29	n/a[1]
1at	25	25	32	22	22	31	n/a[1]
1f	27	27	32	26	26	32	n/a[1]
1g	24	21	25	24	22	25	n/a[1]
1q	35	35	45	34	34	46	n/a[1]
1r	35	30	38	35	31	38	n/a[1]
1s	38	33	41	39	34	42	n/a[1]
1t	28	27	32	26	26	32	n/a[1]
1x	26	25	29	24	24	29	n/a[1]
2a	23	23	28	21	21	28	n/a[1]
2b	19	19	26	20	20	26	n/a[1]
2c	28	28	36	26	26	36	n/a[1]
2d	28	28	39	27	27	39	n/a[1]
2e	29	29	43	22	22	39	n/a[1]
2f	27	27	38	23	23	37	n/a[1]
2h	17	17	24	12	12	21	n/a[1]
2i	18	18	26	12	12	24	n/a[1]
2j	25	25	30	22	22	30	n/a[1]
2k	24	24	29	21	21	29	n/a[1]
2l	22	22	27	17	17	26	n/a[1]
2m	34	26	32	34	26	33	n/a[1]
2n	37	27	35	37	26	35	n/a[1]
13a	24	19	28	19	12	25	n/a[1]
13b	23	19	27	19	13	25	n/a[1]
13c	26	26	32	22	22	31	n/a[1]
13e	23	23	27	21	21	27	n/a[1]
13f	21	21	28	20	20	28	n/a[1]
303a	27	27	34	26	26	34	n/a[1]
303b	27	27	34	26	26	34	n/a[1]
Leard State Forest							
LSF1	41	27	-	43	29	-	48 / 48 / n/a[2]
LSF2	37	27	-	38	27	-	48 / 48 / n/a[2]
LSF3	26	16	-	26	16	-	48 / 48 / n/a[2]

Notes:

1. Operational noise criteria do not apply to mine-owned receivers.
2. Noise criteria for the Leard State Forest only apply when it is in use, which has conservatively been assumed to be during the day and evening periods.

Noise contributions from the Modification at all privately-owned receivers and the Leard State Forest receivers are predicted to comply with the operational noise criteria.

6.7 Maximum Noise Level Event Assessment

As described in Section 5.1, the operational noise criteria include an $L_{A1,1min}$ noise criterion of 45 dBA to address the potential for sleep disturbance at night.

To assess compliance with the $L_{A1,1min}$ noise criterion, the noise model was also used to analyse potential $L_{A1,1min}$ noise levels likely to arise from the Modification's night time operations. The instantaneous noise sources and their typical $L_{A1,1min}$ SWL (i.e. typical noise level at the point of origin rather than at the receiver location) that may have the potential to generate sleep disturbance can be summarised as follows:

- Excavator dumping in empty truck bodies: 115-125 dBA $L_{A1,1min}$.
- Dozer track noise in 1st gear: 114-124 dBA $L_{A1,1min}$.
- ROM coal stockpile area impact noise: 115-125 dBA $L_{A1,1min}$.
- Bulk haulage truck passbys: <118 dBA $L_{A1,1min}$.
- Road haulage truck passbys: <115 dBA $L_{A1,1min}$.

To be conservative the upper end of the level range has been used for noise predictions. The predicted night time $L_{A1,1min}$ noise levels at receivers surrounding the Modification are summarised in Table 6-8. $L_{A1,1min}$ noise levels were added to the operational noise levels and then compared with the $L_{A1,1min}$ noise criterion of 45 dBA. The Leard State Forest receivers are not included in Table 6-8 as they do not represent residences. Mine-owned receivers are included for information only.

The $L_{A1,1min}$ values were modelled assuming the same plant locations used for the modelling of operational noise impacts. Each of the five event items listed above was modelled separately, and the highest predicted $L_{A1,1min}$ value from any item is presented in Table 6-8.

$L_{A1,1min}$ noise predictions are based on the relevant night time meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Table 6-1). It should be noted that the reported levels in Table 6-8 are conservative as the highest levels have been assumed and the resultant $L_{A1,1min}$ noise predictions were added to the highest $L_{Aeq,15min}$ predicted levels.

Table 6-8 Modification $L_{A1,1min}$ Levels from Night Time Operations

Receiver ID	$L_{A1,1min}$ Noise Level (dBA)		$L_{A1,1min}$ Night Operational Noise Criterion (dBA)
	Year 3	Year 7	
Privately-owned Dwellings			
22a	25	24	45
22b	26	25	45
30	20	18	45
37	29	28	45
39	31	30	45
54	30	29	45
70	28	28	45
72	24	22	45
73	19	15	45
78	29	29	45

Receiver ID	$L_{A1,1min}$ Noise Level (dBA)		$L_{A1,1min}$ Night Operational Noise Criterion (dBA)
	Year 3	Year 7	
79a	35	35	45
79b	31	30	45
80	30	30	45
86	30	31	45
87a	29	30	45
87b	32	32	45
118	25	22	45
122	28	28	45
314a	25	25	45
314b	26	26	45
337	25	24	45
516	27	23	45
519	27	25	45
573a	35	34	45
573b	35	36	45
Mine-owned Dwellings			
1aa	35	33	n/a[1]
1ab	33	32	n/a[1]
1ac	32	32	n/a[1]
1ad	43	31	n/a[1]
1ae	33	30	n/a[1]
1ah	43	42	n/a[1]
1ai	49	41	n/a[1]
1aj	40	35	n/a[1]
1ak	38	33	n/a[1]
1al	33	33	n/a[1]
1am	43	45	n/a[1]
1an	60	60	n/a[1]
1ao	63	60	n/a[1]
1ap	55	54	n/a[1]
1aq	37	38	n/a[1]
1ar	45	45	n/a[1]
1as	30	29	n/a[1]
1at	33	32	n/a[1]
1f	54	32	n/a[1]
1g	28	26	n/a[1]
1q	48	47	n/a[1]
1r	39	40	n/a[1]
1s	42	44	n/a[1]
1t	39	32	n/a[1]
1x	39	29	n/a[1]
2a	29	28	n/a[1]
2b	26	26	n/a[1]
2c	36	36	n/a[1]
2d	41	40	n/a[1]
2e	45	40	n/a[1]

Receiver ID	$L_{A1,1min}$ Noise Level (dBA)		$L_{A1,1min}$ Night Operational Noise Criterion (dBA)
	Year 3	Year 7	
2f	40	38	n/a[1]
2h	25	21	n/a[1]
2i	26	24	n/a[1]
2j	31	30	n/a[1]
2k	30	29	n/a[1]
2l	28	26	n/a[1]
2m	33	34	n/a[1]
2n	36	36	n/a[1]
13a	29	26	n/a[1]
13b	28	25	n/a[1]
13c	32	31	n/a[1]
13e	27	27	n/a[1]
13f	28	28	n/a[1]
303a	35	35	n/a[1]
303b	34	35	n/a[1]

Note:

1. Operational noise criteria do not apply to mine-owned receivers.

Table 6-8 indicates that $L_{A1,1min}$ noise levels due to night time operations from the Modification are predicted to be below the Modification's $L_{A1,1min}$ operational noise criterion of 45 dBA at all privately-owned receivers.

6.8 Privately-Owned Land Noise Assessment

According to PA 11_0047, voluntary land acquisition noise rights apply where the noise generated by the Tarrawonga Coal Mine exceeds an $L_{Aeq,15min}$ level of 40 dBA on more than 25% of any privately-owned land.

Review of noise impacts indicates that three parcels of land within the receiver 573 property would exceed the privately-owned land criterion on more than 25% of the land.

Note the description of land in PA 11_0047 (Condition 4, Schedule 3) states:

> *For the purposes of acquisition under this condition, parcels of land that are in close proximity and operated as a single agricultural enterprise should be included as part of the land to be acquired.*

Because the three parcels of land mentioned above form part of the same agriculture enterprise, the privately-owned land noise assessment should be conducted for the entire receiver 573 property. On this basis, the privately-owned land criterion is not exceeded on more than 25% of the land.

Therefore, the privately-owned land criterion is complied with at all surrounding privately-owned properties.

According to the *VLAMP*, voluntary land acquisition noise rights apply where: "the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5 dB in Table 2.2 of the *NPfI* on more than 25% of any privately-owned land". Review of noise impacts indicates that the vacant land noise criterion (45 dBA $L_{Aeq,Period}$ or 48 dBA $L_{Aeq,15min}$ at night) is complied with at all surrounding privately-owned properties.

6.9 Cumulative Noise

The Modification would operate concurrently with BCM located directly northwest of the Tarrawonga Coal Mine, and Maules Creek Coal Mine (MCCM) approximately 5 km northwest of the Tarrawonga Coal Mine. As such, receivers may potentially be exposed to noise from all three industrial sources simultaneously.

BCM is an open cut coal mine approved to extract up to 8.6 Mtpa of ROM coal from the open cut, process up to 4.2 Mtpa of ROM coal, and transport up to 8.6 Mtpa of ROM coal off-site using a rail loop and private rail spur (PA 09_0182).

MCCM is an open cut mining operation approved to extract up to 13 Mtpa of ROM coal from the open cut and transport it off-site via rail (PA 10_0138).

Cumulative noise levels were calculated considering the relative noise contributions from the Tarrawonga Coal Mine, the BCM and the MCCM. The contribution of noise from the BCM has been taken from predictions of noise emissions included in *Boggabri Coal Pty Limited – Acoustic Impact Assessment – Continuation of Boggabri Coal Mine Environmental Assessment* prepared by Bridges Acoustics (2010). Contribution from the MCCM was based on predictions obtained from *Aston Resources Pty Limited – Acoustics Impact Assessment – Maules Creek Coal Project Environmental Assessment* prepared by Bridges Acoustics (2011).

Due to their locations relative to the Modification, Rocglen Coal Mine and other mining operations further afield (including the Vickery Extension Project) are expected to have a negligible impact on the receivers in the vicinity of the Modification and therefore cumulative noise calculations do not include them.

The methodology adopted to predict cumulative noise was to logarithmically sum the predicted night time noise levels from the Modification, the BCM and the MCCM for receivers potentially impacted by all or a combination of the three sites.

The night time assessment period was selected as it represents the worst-case period in terms of predicted noise levels, and as such there is more potential for the Modification to contribute to cumulative noise issues in this period. Note that the assessment at the Leard State Forest receivers was based on daytime levels as night time noise levels are not considered for those receivers (see Section 5.4).

Although some noise predictions associated with the BCM consist of point source $L_{Aeq,15min}$ levels as calculated using ENM, others had to be estimated from the night time noise contours under adverse meteorological conditions (3 degrees per 100 m temperature inversions combined with 2 m/s drainage flow winds in the source-to-receiver direction), using a conservative methodology. The BCM noise predictions assume transport of ROM coal using the Boggabri train loading facility, rail loop and rail spur line.

Noise contributions from the MCCM are based on point source $L_{Aeq,15min}$ predictions at receiver locations and the night time noise contours under prevailing meteorological conditions (3 degrees per 100 m temperature inversions combined with relevant drainage flow winds). Because of the relative distance separating the Tarrawonga Coal Mine and the MCCM, receivers located outside the 30 dBA noise contour (i.e. subject to noise levels below 30 dBA) were not included in the calculations. The MCCM noise predictions assume transport of ROM coal using the on-site train loading facility, rail loop and rail spur line.

Scenarios undertaken for the BCM Acoustic Impact Assessment (Bridges Acoustics, 2010) included Scenario Years 1, 5, 10 and 21. Scenarios undertaken for the MCCM Acoustic Impact Assessment (Bridges Acoustics, 2011) were undertaken for Scenario Years 1, 5, 10, 15 and 21. For the purposes of cumulative noise predictions, the closest available corresponding noise prediction years at BCM and MCCM to the two Modification scenarios were selected. The summation of the various noise predictions used for cumulative noise predictions is summarised below:

- Cumulative Year 3 = Year 3 Modification + Year 10 BCM + Year 10 MCCM.
- Cumulative Year 7 = Year 7 Modification + Year 10 BCM + Year 15 MCCM.

The predicted cumulative noise levels are presented in Table 6-9 for all identified receivers. The mine-owned receivers are included in Table 6-9 for information only. The cumulative noise levels include operational noise from the three sites, noise associated with both private rail spurs (i.e. BCM and MCCM), and noise from the private sections of the Approved ROM Coal Road Transport Route.

Note that noise levels are expressed as $L_{Aeq,Period}$ levels for assessment against the cumulative noise criterion (Section 5.1.3). $L_{Aeq,15min}$ levels were converted into $L_{Aeq,Period}$ levels using the method provided in the *NPfI* whereby $L_{Aeq,Period}$ is taken to be equal to $L_{Aeq,15min}$ - 3 dB.

Table 6-9 Predicted Night Time Cumulative $L_{Aeq,Period}$ Operational Noise Levels from the Modification, BCM and MCCM

Rec ID	$L_{Aeq,Period}$ Noise Level (dBA)							$L_{Aeq,Period}$ Cumulative Noise Criterion (dBA)
	Modification		BCM	MCCM		Cumulative		
	Year 3	Year 7	Year 10	Year 10	Year 15	Year 3	Year 7	
Privately-owned Dwellings								
22a	21	21	<27	-	-	<28	<28	40
22b	22	21	<27	-	-	<28	<28	40
30	15	14	<27	-	-	<27	<27	40
37	26	25	31	-	-	32	32	40
39	27	26	31	-	-	33	32	40
54	26	26	<32	-	-	<33	<33	40
70	25	25	27	-	-	29	29	40
72	20	19	28	-	-	29	28	40
73	11	11	27	-	-	27	27	40
78	26	26	27	-	-	30	30	40
79a	31	31	31	-	-	34	34	40
79b	28	27	29	-	-	31	31	40
80	27	26	28	-	-	30	30	40

Rec ID	$L_{Aeq,Period}$ Noise Level (dBA)							$L_{Aeq,Period}$ Cumulative Noise Criterion (dBA)
	Modification		BCM	MCCM		Cumulative		
	Year 3	Year 7	Year 10	Year 10	Year 15	Year 3	Year 7	
86	27	27	28	-	-	30	31	40
87a	26	26	27	-	-	30	30	40
87b	28	29	30	-	-	32	32	40
118	19	19	28	-	-	29	28	40
122	25	25	<27	-	-	<29	<29	40
314a	22	22	<27	-	-	<28	<28	40
314b	22	22	<27	-	-	<28	<28	40
337	21	20	30	-	-	30	30	40
516	23	19	30	-	-	31	30	40
519	23	21	<27	-	-	<29	<28	40
573a	31	30	<32	-	-	<35	<34	40
573b	32	32	<32	-	-	<35	<35	40
Mine-owned Dwellings								
1aa	29	29	<27	-	-	<31	<31	n/a[1]
1ab	28	29	<27	-	-	<30	<31	n/a[1]
1ac	27	28	<27	-	-	<30	<31	n/a[1]
1ad	27	27	<27	-	-	<30	<30	n/a[1]
1ae	27	27	<27	-	-	<30	<30	n/a[1]
1ah	38	38	33	-	-	39	39	n/a[1]
1ai	37	37	32	-	-	38	38	n/a[1]
1aj	31	31	<32	-	-	<34	<35	n/a[1]
1ak	29	29	<27	-	-	<31	<31	n/a[1]
1al	29	30	<32	-	-	<34	<34	n/a[1]
1am	39	41	39	-	-	42	43	n/a[1]
1an	54	55	37	-	-	54	55	n/a[1]
1ao	56	55	37	-	-	56	55	n/a[1]
1ap	49	49	35	-	-	49	49	n/a[1]
1aq	32	33	30	-	-	34	35	n/a[1]
1ar	40	41	37	-	-	42	42	n/a[1]
1as	26	26	32	-	-	33	33	n/a[1]
1at	29	28	30	-	-	33	32	n/a[1]
1f	29	29	<32	-	-	<34	<34	n/a[1]
1g	22	22	<27	-	-	<28	<28	n/a[1]
1q	42	43	35	-	-	43	43	n/a[1]
1r	35	35	31	-	-	36	37	n/a[1]
1s	38	39	32	-	-	39	40	n/a[1]
1t	29	29	<27	-	-	<31	<31	n/a[1]
1x	26	26	<27	-	-	<30	<29	n/a[1]
2a	25	25	28	-	-	30	30	n/a[1]
2b	23	23	33	-	-	33	33	n/a[1]
2c	33	33	32	-	-	35	35	n/a[1]
2d	36	36	36	-	-	39	39	n/a[1]
2e	40	36	>42	-	-	>44	>43	n/a[1]
2f	35	34	39	-	-	41	40	n/a[1]
2h	21	18	>42	>42	>42	>45	>45	n/a[1]

Rec ID	$L_{Aeq,Period}$ Noise Level (dBA)							$L_{Aeq,Period}$ Cumulative Noise Criterion (dBA)
	Modification		BCM	MCCM		Cumulative		
	Year 3	Year 7	Year 10	Year 10	Year 15	Year 3	Year 7	
2i	23	21	>42	-	-	>42	>42	n/a[1]
2j	27	27	33	37	37	39	39	n/a[1]
2k	26	26	34	36	36	38	38	n/a[1]
2l	24	23	37	-	-	37	37	n/a[1]
2m	29	30	23	-	-	30	31	n/a[1]
2n	32	32	35	-	-	37	37	n/a[1]
13a	25	22	<27	36	36	<37	36	n/a[1]
13b	24	22	27	33	32	34	34	n/a[1]
13c	29	28	36	40	40	42	42	n/a[1]
13e	24	24	27	-	-	29	29	n/a[1]
13f	25	25	27	-	-	29	29	n/a[1]
303a	31	31	30	-	-	34	34	n/a[1]
303b	31	31	30	-	-	33	33	n/a[1]
Leard State Forest[2]								
LSF1	38	40	27	-	-	38	40	50[3,4]
LSF2	34	35	27	-	-	35	35	50[3,4]
LSF3	23	23	<27	-	-	<28	<29	50[3,4]

Notes:

1. Cumulative noise criteria do not apply to mine-owned receivers.
2. The cumulative noise assessment at the Leard State Forest receivers is based on daytime levels as night time noise levels are not considered for those receivers (Section 5.4).
3. The noise criterion for the Leard State Forest only applies when it is in use, which has conservatively been assumed to be during the day and evening periods (Section 5.4).
4. The noise criterion for the Leard State Forest is expressed as an amenity noise level (i.e. not a Modification amenity noise level) since the cumulative assessment addresses cumulative levels from all nearby mining operations, private roads and private rail spurs.

Cumulative operational noise predictions are expected to comply with the relevant noise criteria at all identified privately-owned receivers and all three Leard State Forest locations.

6.10 Construction Noise

As described in Section 6.1.2, some construction activities associated with the Modification have been assessed cumulatively with operational noise, with reference to the operational noise criteria. This is because the noise generated by these construction activities would likely be indistinguishable from noise generated by operational activities.

Construction activities in the vicinity of the Modification identified as having potential for intrusive noise are summarised in Table 6-10.

Table 6-10 Construction Activities

Construction Activity	Timeframe
Construction of a new site access road and intersection along a section of Goonbri Road	Two to four weeks
Construction of a water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project	Two to four weeks
Relocation of the ROM coal stockpile and associated infrastructure	Two to four weeks

All construction activities identified in Table 6-10 would take approximately two to four weeks to complete and would occur at the following times:

- Monday to Friday, 7.00 am to 6.00 pm.
- Saturday, 8.00 am to 1.00 pm.
- No work on Sundays or public holidays.

Note that these times correspond to the recommended standard hours according to the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009).

The relocation of the ROM coal stockpile and associated infrastructure would be conducted using primarily the existing mobile equipment (i.e. not equipment additional to the existing operational mobile fleet). Additional craning equipment would also be used but is not expected to make any material difference to the Modification's overall noise levels. As such, the relocation of the ROM coal stockpile and associated infrastructure is not discussed any further in the assessment.

An indicative construction fleet for the other two identified construction activities, and corresponding SWLs, is presented in Table 6-11. The total SWL for each of the identified activities is also included. Note that a correction of -5 dB was applied to the total SWL for the construction of the site access road and intersection to account for time correction, as the entire construction fleet would not always operate concurrently (i.e. not all plant items are expected to be operating all the time).

Table 6-11 Indicative Noise Sources & Sound Power Levels for Construction Equipment

Construction Activity ID	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item (dBA)	Total Sound Power Level per Activity (dBA)
Construction of site access road & intersection	1	Dozer (CAT D8 or equivalent)	116	112.7 *
	1	Grader	108	
	1	Excavator (25 tonne)	103	
	1	Roller (18 tonne)	107	
	1	Water cart	100	
	2	Delivery truck (manoeuvring on-site)	100	
	1	Paving Machine (with asphalt truck)	104	
Construction of a water transfer pipeline	1	Excavator (15 tonne)	97	97

* Note: A correction factor of -5 dB was applied to the total SWL to account for time correction, as the entire construction fleet would not always operate concurrently.

Construction noise was predicted using the ENM considering approximate work locations.

Noise levels associated with the construction of the site access road and intersection have been predicted under the relevant meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (outlined in Table 6-1). The resultant noise levels were then conservatively added to the operational daytime noise levels for Modification Year 3 (Table 6-7). The combined noise levels (rounded) were found to be identical to those without construction. Therefore, noise levels associated with the construction of the site access road and intersection would comply with the operational noise criteria at all identified privately-owned receivers and all three Leard State Forest locations.

The water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project would be located over 5 km from the closest privately-owned receiver. Therefore, it is not expected to generate any impact on any of the privately-owned receivers or the Leard State Forest locations.

7 ROAD TRAFFIC NOISE ASSESSMENT

7.1 Introduction

Project Approvals for the Tarrawonga Coal Mine, the Rocglen Coal Mine and the Vickery Coal Project permit road transport of ROM coal from the mines to the Whitehaven CHPP (approximately 5 km northwest of Gunnedah) using the Approved ROM Coal Road Transport Route (Figure 2-2). The Approvals set a limit to the transport of ROM coal as follows:

- 3.0 Mtpa of ROM coal from the Tarrawonga Coal Mine;
- 1.5 Mtpa of ROM coal from Rocglen Coal Mine;
- 3.5 Mtpa of ROM coal cumulative from Vickery Coal Project, Tarrawonga and Rocglen Coal Mines (prior to commissioning of an overpass over the Kamilaroi Highway near the CHPP); and
- 4.5 Mtpa of ROM coal cumulative from Vickery Coal Project, Tarrawonga and Rocglen Coal Mines (following commissioning of the overpass over the Kamilaroi Highway near the CHPP).

The Modification seeks an increase in ROM coal transported along the Northern Section of the Approved ROM Coal Road Transport Route (between the Tarrawonga Coal Mine and Shannon Harbour Road) from 3.0 to 3.5 Mtpa (i.e. there would be no change to the Southern Section of the Approved ROM Coal Transport Route, south of Shannon Harbour Road).

Because the Modification involves a change to the approved haulage along the Northern Section of the Approved ROM Coal Road Transport Route, the road traffic noise assessment only considers potential traffic noise impacts generated by the Northern Section of the route.

7.2 Road Traffic Noise Criteria

PA 11_0047 sets road noise traffic criteria for the Tarrawonga Coal Mine. Condition 8, Schedule 3 requires TCPL to ensure that traffic noise on public roads generated by the Tarrawonga Coal Mine and other mines does not exceed the criteria in Table 7-1 at any residence on privately-owned land.

The Approved ROM Coal Road Transport Route includes a combination of private roads located within mine-owned land and sections of public road (e.g. Rangari Road and Hoad Lane). The criteria specified in Table 7-1 apply only to public road sections.

Table 7-1 Road Traffic Noise Criteria

Location	Day and Evening (combined)	Night
	$L_{Aeq,15hr}$ (dBA)	$L_{Aeq,9hr}$ (dBA)
All privately-owned receivers	60	55

Source: PA 11_0047 (as modified)
Notes:

- Day and evening combined: the period from 7.00 am to 10.00 pm.
- Night: the period from 10.00 pm to 7.00 am.
- Noise is to be measured in accordance with the relevant procedures in the *NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011).*

7.3 Road Traffic Noise Impacts

The closest privately-owned receivers to the Northern Section of the Approved ROM Coal Road Transport Route are receivers 79a located over 5.3 km to the west of the route and receiver 573b located over 6.8 km to the east.

Preliminary calculations have determined that because of the considerable distance separating both receivers to the Approved Road Transport Route, traffic noise levels generated by the Tarrawonga Coal Mine and other mines on the public road sections of the Northern Section of the Approved ROM Coal Road Transport Route are expected to meet the road traffic noise criteria specified in Table 7-1.

Therefore, the Modification is not expected to generate any road traffic noise impacts on the surrounding privately-owned receivers.

8 CONCLUSION

This assessment has addressed potential operational noise, construction noise and traffic noise impacts associated with the Modification. A summary of the assessment conclusions is provided below.

8.1 Modification Operational Noise

- Operational noise impacts were assessed for two years (Modification Years 3 and 7), for different periods of the day (daytime, evening and night time) and with regard for noise-enhancing meteorological conditions including winds with speeds of up to 3 m/s and temperature inversions of up to 4 degrees Celsius/100 m.
- The significance of noise-enhancing meteorological conditions (in accordance with Fact Sheet D of the *NPfI*) was determined based on local meteorological data 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.
- Operational and road transportation noise associated with the Modification would comply with the PA 11_0047 operational noise criteria and amenity noise levels at all identified privately-owned receivers and the Leard State Forest locations.
- A low-frequency noise assessment was conducted which indicates that it is unlikely that any of the privately-owned receivers surrounding the Modification would be subject to dominant low-frequency noise. Therefore, no modifying factor correction for low-frequency noise is warranted.

8.2 Maximum Noise Level Event Assessment

- Modelling of $L_{A1,1min}$ noise levels at nearby receivers was undertaken for typical instantaneous mine-site noise sources, such as excavator dumping in empty truck bodies, and dozer track noise. This analysis indicates that predicted $L_{A1,1min}$ noise levels would comply with the PA 11_0047 $L_{A1,1min}$ noise criteria of 45 dBA at all identified privately-owned receivers.

8.3 Privately-Owned Land Assessment

- The assessment indicates that the PA 11_0047 privately-owned land criterion is complied with at all surrounding privately-owned properties.

8.4 Cumulative Noise

- Cumulative noise predictions from the operation of the Modification, BCM, and MCCM were conducted.
- The assessment indicates that cumulative noise levels resulting from the concurrent operation of these projects would comply with the PA 11_0047 cumulative noise criteria and amenity noise levels at all identified privately-owned receivers and the Leard State Forest locations.

8.5 Construction Activities

- Construction noise associated with a new site access road and intersection along a section of Goonbri Road, a new water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project, and the relocation of the ROM coal stockpile and associated infrastructure was addressed in the assessment.
- Construction noise would largely be indistinguishable from coal transportation, operational mining and coal processing activities and as such construction noise was assessed in combination with operational noise against the operational noise criteria.
- Construction noise levels combined with operational noise would comply with the operational noise criteria at all identified privately-owned receivers and all three Leard State Forest locations.

8.6 Road Traffic Noise

- A road traffic noise assessment was conducted for the Northern Section of the Approved ROM Coal Road Transport Route and it was determined that compliance with the PA 11_0047 road traffic noise criteria is expected at all privately-owned receivers surrounding the Modification.

9 REFERENCES

Bridges Acoustics (2010) *Boggabri Coal Pty Limited – Acoustic Impact Assessment – Continuation of Boggabri Coal Mine Environmental Assessment.*

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APPENDIX A

GLOSSARY OF TERMS & DEFINITIONS

GLOSSARY OF TERMS & DEFINITIONS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed which involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are defined here.

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.

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.

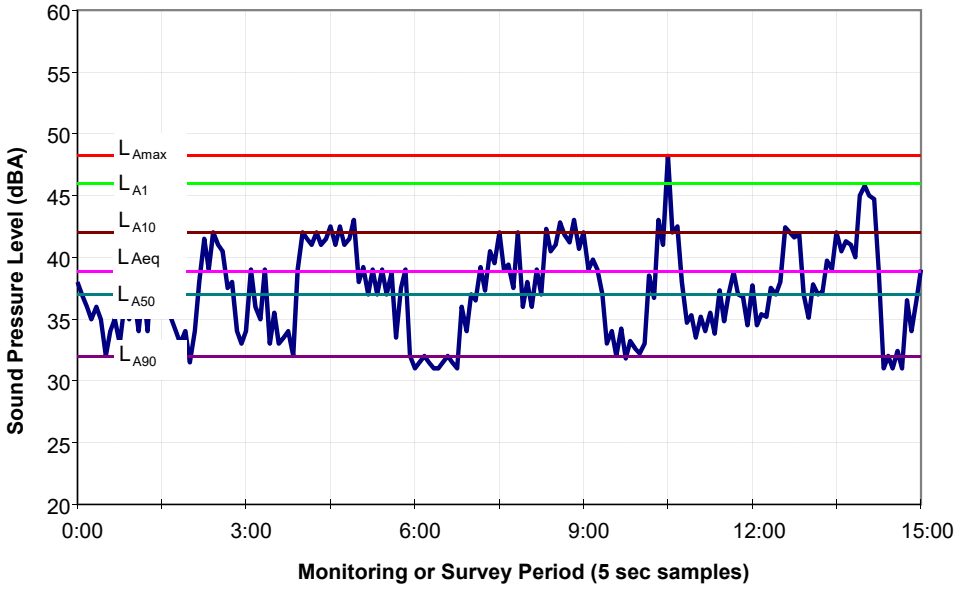
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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.

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.

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.

Typical Graph of Sound Pressure Level vs Time



APPENDIX B

DETERMINATION OF NOISE-ENHANCING METEOROLOGICAL CONDITIONS IN ACCORDANCE WITH FACT SHEET D OF THE *NPfI*

Appendix B sets out the process followed to determine the significance of the noise-enhancing meteorological conditions. As described in Fact Sheet D of the *Noise Policy for Industry* (*NPfI*), the significance of noise-enhancing conditions is based on a threshold of occurrence of 30 per cent.

B.1 Wind-Related Noise-Enhancing Conditions

For each season and assessment period (i.e. day, evening, night), the following process was followed:

1. Convert sigma-theta observations from raw data into Pasquill-Gifford (PG) stability category using the sigma-theta methodology. We assumed a surface roughness of 0.1 metres (m). This is considered a conservative approach as it assumes no trees and/or forest in the general area separating the Modification and surrounding receivers.
2. Cull out any data with PG stability category other than A, B, C or D and winds of 0 metres per second (m/s) or > 3 m/s.
3. Group all wind directions into a 16-direction wind compass (22.5 degree-arc per direction), with North ranging from 348.75 degrees – 11.25 degrees.
4. For each of the above 16 directions, add the four closest directions (2 x 22.5 degree-arcs on either side) to generate 16 totals (112.5 degree-arc per direction).
5. Divide the number of entries in each of the 16 totals over base data.
6. Assess percentage of occurrence against threshold of occurrence of 30 per cent determined in accordance with the provisions in *NPfI*. If percentage of occurrence is 30 per cent or more (rounded to 1 decimal place), light winds in the direction in question are considered significant.

Tables B-1, B-2 and B-3 summarise the frequencies of occurrence for all seasons for the day, evening and night periods, respectively. Highlighted cells indicate percentages of occurrence exceeding the threshold of occurrence of 30 per cent.

Table B-1 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Day

Direction	Spring	Summer	Autumn	Winter
N	8.8%	10.5%	9.3%	12.0%
NNE	7.3%	9.5%	8.4%	10.2%
NE	7.1%	10.0%	8.7%	9.6%
ENE	7.6%	11.3%	10.6%	9.8%
E	8.8%	13.1%	13.3%	10.4%
ESE	11.1%	15.1%	17.5%	12.1%
SE	14.7%	17.8%	21.9%	15.4%
SSE	19.8%	20.7%	27.5%	22.0%
S	27.1%	23.9%	33.6%	32.2%
SSW	31.2%	25.7%	36.9%	35.7%
SW	33.0%	27.1%	35.7%	36.0%
WSW	32.3%	27.0%	33.1%	34.7%
W	28.4%	24.6%	28.1%	30.3%
WNW	20.5%	19.8%	20.0%	19.8%

Direction	Spring	Summer	Autumn	Winter
NW	15.0%	15.5%	13.2%	14.9%
NNW	11.4%	12.7%	10.7%	13.3%

Notes:

- N = North.
- NNE = North-northeast.
- NE = North-east.
- ENE = East-northeast.
- E = East.
- S = South.
- SSW = South-southwest.
- SW = South-west.
- WSW = West-southwest.
- W = West.
- NNW = North-northwest.

Table B-2 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Evening

Direction	Spring	Summer	Autumn	Winter
N	9.6%	3.7%	10.7%	16.9%
NNE	9.9%	3.6%	11.6%	17.1%
NE	10.4%	4.8%	12.5%	17.5%
ENE	11.6%	6.8%	14.3%	18.0%
E	8.0%	7.7%	10.5%	9.0%
ESE	5.4%	8.1%	9.6%	4.8%
SE	4.7%	8.5%	8.8%	3.1%
SSE	5.0%	8.2%	8.4%	2.6%
S	4.7%	6.7%	6.9%	2.1%
SSW	4.4%	5.1%	5.0%	2.0%
SW	5.1%	4.4%	3.9%	3.3%
WSW	6.0%	4.3%	4.1%	6.0%
W	5.9%	4.3%	4.4%	7.4%
WNW	5.1%	3.7%	3.9%	7.3%
NW	4.2%	3.0%	3.5%	7.1%
NNW	7.7%	3.5%	8.6%	14.9%

Table B-3 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Night

Direction	Spring	Summer	Autumn	Winter
N	9.5%	3.8%	8.1%	13.3%
NNE	10.7%	4.9%	9.5%	13.6%
NE	11.8%	6.9%	10.9%	13.9%

Direction	Spring	Summer	Autumn	Winter
ENE	12.8%	9.8%	12.8%	14.1%
E	8.2%	9.7%	9.4%	7.9%
ESE	5.2%	9.1%	7.0%	3.1%
SE	3.8%	8.2%	5.5%	1.6%
SSE	3.1%	6.7%	4.5%	1.4%
S	3.0%	4.7%	3.3%	1.8%
SSW	3.3%	4.0%	3.6%	2.4%
SW	3.8%	3.9%	3.9%	3.1%
WSW	4.1%	3.8%	4.0%	4.3%
W	4.1%	3.5%	4.0%	5.4%
WNW	3.0%	2.7%	3.0%	4.5%
NW	2.1%	1.6%	2.1%	3.9%
NNW	6.8%	2.7%	5.7%	9.7%

Table B-4 summarises all percentages of occurrence for the worst-case seasons for day, evening and night.

Table B-4 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Worst-Case Season

Direction	Day	Evening	Night
N	12.0%	16.9%	13.3%
NNE	10.2%	17.1%	13.6%
NE	10.0%	17.5%	13.9%
ENE	11.3%	18.0%	14.1%
E	13.3%	10.5%	9.7%
ESE	17.5%	9.6%	9.1%
SE	21.9%	8.8%	8.2%
SSE	27.5%	8.4%	6.7%
S	33.6%	6.9%	4.7%
SSW	36.9%	5.1%	4.0%
SW	36.0%	5.1%	3.9%
WSW	34.7%	6.0%	4.3%
W	30.3%	7.4%	5.4%
WNW	20.5%	7.3%	4.5%
NW	15.5%	7.1%	3.9%
NNW	13.3%	14.9%	9.7%

Based on the percentages of occurrence summarised in Table B-4, the following wind directions were considered significant when addressing wind-related noise-enhancing conditions:

- Day - S; SSW; SW; WSW and W.

B.2 Temperature Inversion Noise-Enhancing Condition

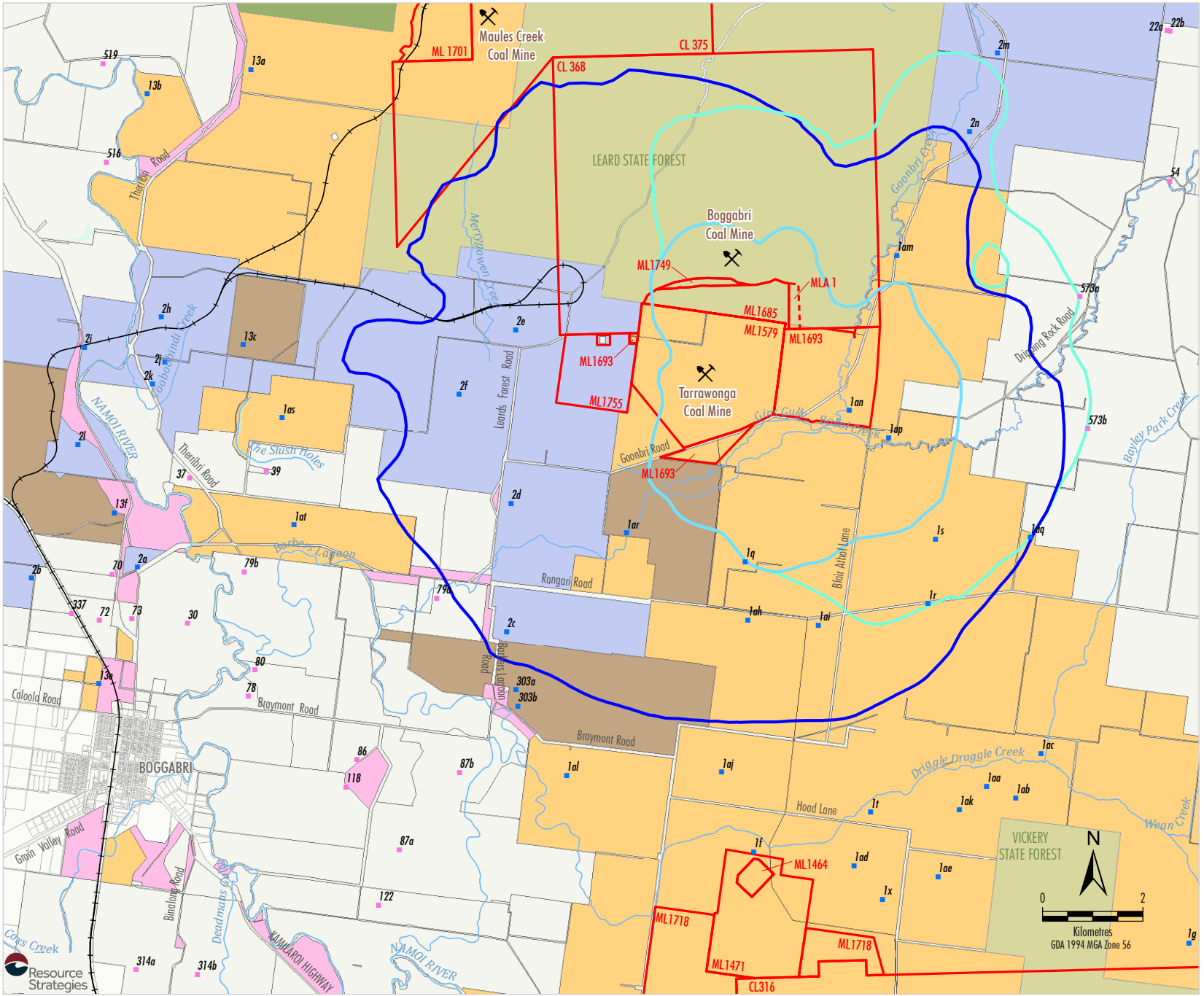
The following process was followed:

1. Convert sigma-theta observations from raw data into PG stability category using the sigma-theta methodology. We assumed a surface roughness of 0.1 m. This is considered a conservative approach as it assumes no trees and/or forest in the general area separating the Modification and surrounding receivers.
2. For the combined evening/night assessment periods (6.00pm-7.00am) and winter season, cull out any data with PG stability category other than F or G.
3. Divide the number of entries over base data including all PG stability categories to establish a percentage of occurrence.
4. Assess percentage of occurrence against threshold of occurrence of 30 per cent determined in accordance with the provisions in the *NPfI*. If percentage of occurrence is 30 per cent or more (rounded to 1 decimal place), moderate-to-strong temperature inversions are considered significant.

The percentage of occurrence was determined to be 35.4 per cent, and as such moderate-to-strong temperature inversions are considered significant to the Modification.

APPENDIX C

NOISE CONTOURS



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Modification Predicted Day Time Noise Contours (35 dB[A])
- Modification Predicted Evening Noise Contours (35 dB[A])
- Modification Predicted Night Time Noise Contours (35 dB[A])

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Modification Predicted Noise Contours - Year 3

Figure C-1

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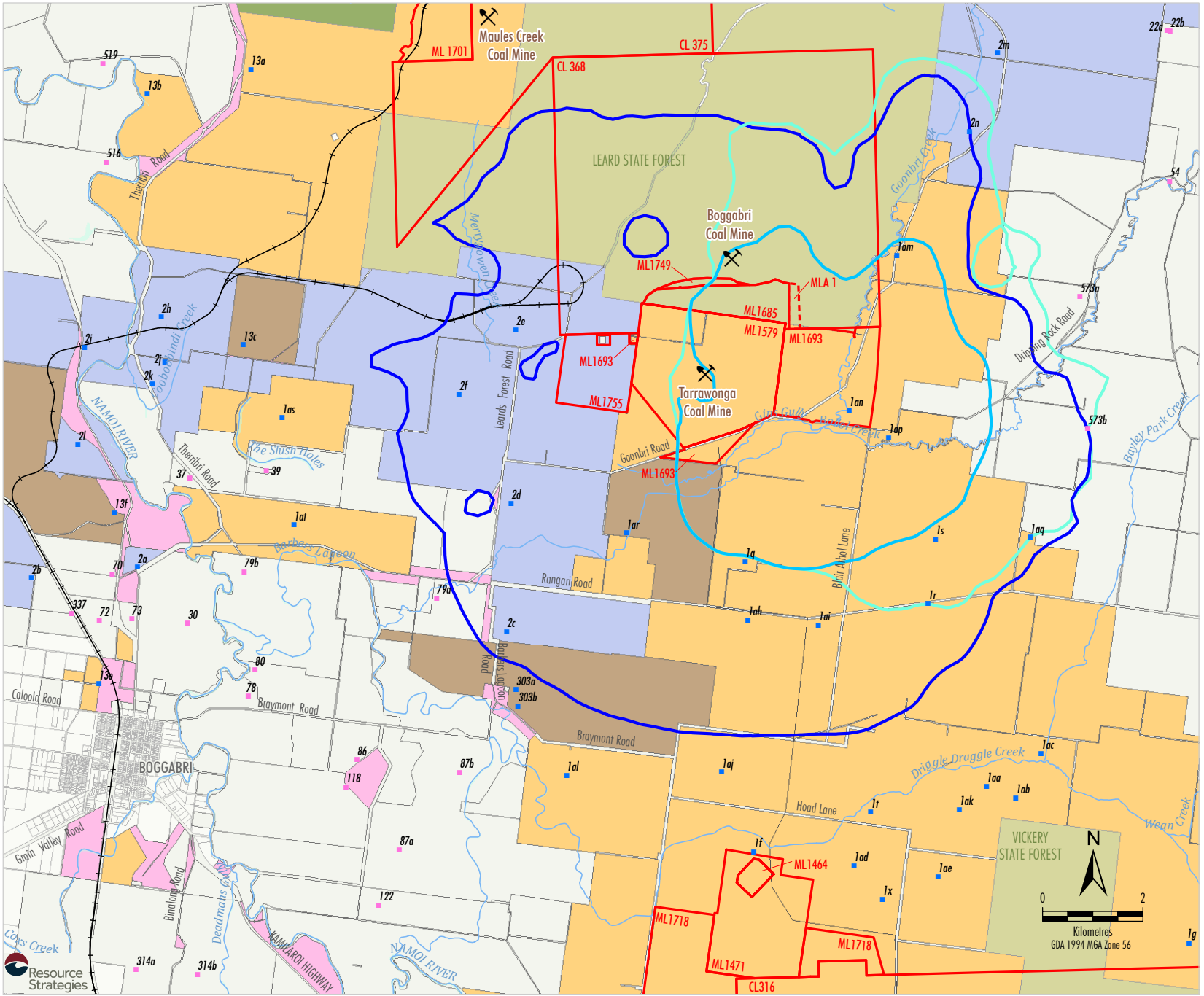

LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Modification Predicted Day Time Noise Contours (35 dB[A])
- Modification Predicted Evening Noise Contours (35 dB[A])
- Modification Predicted Night Time Noise Contours (35 dB[A])

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Modification Predicted Noise Contours - Year 7

Figure C-2

WHC-18-59_LOM_App_NA_207C