

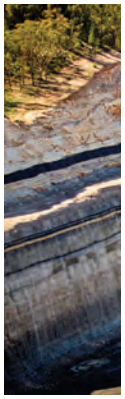



MOOLARBENCOAL

Moolarben Coal Complex
Open Cut Optimisation Modification

Environmental Assessment

APPENDIX A

Noise Assessment

YANCOAL
兖煤澳大利亚有限公司

global environmental solutions

Moolarben Coal Complex

Open Cut Optimisation Modification

Noise Assessment

Report Number 610.13549-R03

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Yancoal Australia Limited

Level 25, 363 George Street

SYDNEY NSW 2000

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Moolarben Coal Complex

Open Cut Optimisation Modification

Noise Assessment

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1 INTRODUCTION

1.1 Background

Moolarben Coal Operations Pty Ltd (MCO), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), operates the Moolarben Coal Complex, which is located approximately 40 kilometres (km) north of Mudgee in the Western Coalfields of New South Wales (NSW).

The Moolarben Coal Complex comprises four approved open cut coal mining areas (OC1 to OC4), three approved underground coal mining areas (UG1, UG2 and UG4) and other mining related infrastructure, including coal processing and transport facilities. Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038, and will continue to be carried out in accordance with Project Approval (05_0117) Moolarben Coal Project Stage 1 (MCP Stage 1) dated 6 September 2007 (as modified) (**Appendix A1**) and Project Approval (08_0135) (Moolarben Coal Project Stage 2) (MCP Stage 2) dated 30 January 2015 (as modified) (**Appendix A2**).

Following a review of mine planning, MCO has identified a number of potential optimisations to enable more efficient operations. With no material change to existing open cut mining fleet, and with changes to the sequencing of open cut mining operations, MCO would be able to optimise operations to achieve an increase in coal production. These optimisations would require MCO to modify Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 (herein referred to as the Open Cut Optimisation Modification [the Modification]).

The Modification would involve:

- Increased run-of-mine (ROM) coal production from the Stage 1 (OC1, OC2 and OC3) and Stage 2 (OC4) open cuts, and an associated increase in product coal and rail movements;
- Changes in previously assessed open cut mining sequence;
- A minor increase in disturbance limits at OC2;
- Changes to the alignment of the haul road from OC2 to OC3 and the location of the OC3 Mine Infrastructure Area;
- Changes to the pit limits of OC3;
- New internal haul road from OC2 to OC4 for the occasional transfer of mining equipment to and from OC4;
- Additional coal handling infrastructure to facilitate the bypass of ROM coal from open cuts; and
- Installation of water treatment facilities.

SLR Consulting Australia Pty Ltd (SLR) has been engaged by MCO to evaluate and assess the potential noise impacts associated with the Modification. In preparing this assessment, SLR has considered several documents including the following:

- Moolarben Coal Project Appendix 4 Noise and Vibration Impact Assessment (MCP Stage 1 NIA) (Spectrum Acoustics, August 2006);
- Moolarben Coal Project Stage 1 Optimisation Modification Appendix C Noise and Vibration Impact Assessment (MCP Stage 1 Mod 9 NIA) (EMM, May 2013);
- Moolarben Coal Project Stage 2 Preferred Project Report Appendix D Environmental Noise Assessment (MCP Stage 2 PPR NIA) (Global Acoustics, January 2012);
- Moolarben Coal Complex OC4 South-West Modification Noise Assessment (OC4 South-West Modification NIA) (SLR, April 2015);
- Moolarben Coal Complex UG1 Optimisation Modification Noise Assessment (UG1 Optimisation Modification NIA) (SLR, May 2015);

- Noise Management Plan (NMP) (MCO, May 2015);
- Blast Management Plan (BMP) (MCO, May 2015);
- Annual Environmental Management Report 2013-2014 (AEMR 2014) (MCO, March 2015);
- Moolarben Coal Complex Annual Review 2015 (MCCAR 2015) (MCO, April 2016);
- Moolarben Coal Complex Annual Review 2016 (MCCAR 2016) (MCO, March 2017);
- Moolarben Coal Project Independent Environmental Audit (MCCIEA 2015) (TB&A, April 2016);
- MCO Independent Noise Review Property 76 Carbone (INRP76 2015) (Bridges Acoustics, 2016);
- MCO Independent Noise Review Property 300 Collins and Marshall (INRP300 2015) (Bridges Acoustics, 2016); and
- Monthly Environmental Noise Monitoring Reports November 2016 to April 2017 (MENMRs) (MCO, 2016/2017).

1.2 Assessment Requirements

The noise impacts for the Modification have been guided by the assessment guidelines as presented in **Table 1**.

Table 1 Noise Impact Assessment Procedure Guidelines

Assessment Guideline	Criteria	Impact
Modification Maximum, Intrusive and Amenity Noise Guided by the requirements of the NSW *Industrial Noise Policy* (INP) (EPA[1], 2000) and associated Application Notes dated 12 June 2013 in relation to setting acceptable project specific noise levels (PSNLs) and assessing any impacts.	**Section 5**	**Section 7**
Cumulative Amenity Noise Guided by the requirements of the INP in relation to existing and successive industrial development by setting acceptable (and maximum) cumulative equivalent continuous noise level ($L_{Aeq\ [period]}$) amenity levels for all industrial (i.e. non-transport related) noise in a receiver area.	**Section 5**	**Section 9**
Blasting Emissions Guided by the requirements of the Australian and New Zealand Environment Council's *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990) in relation to setting acceptable human comfort blast emission levels.	**Section 11**	**Section 11**
Off-site Rail Transport Noise Guided by the requirements of the Rail Infrastructure Noise Guideline (RING) Appendix 2 (EPA, May 2013) in relation to land-use developments (other than rail projects) likely to generate additional rail traffic on an existing rail network.	**Section 10**	**Section 10**
Off-site Road Traffic Noise Guided by the requirements of the EPA's Road Noise Policy (RNP) and associated Application Notes dated 15 February 2013 in relation to setting acceptable LAeq(period) noise levels for sub-arterial, principal haulage route and local roads and assessing any impacts.	Not Applicable - The Modification would not materially change the approved road traffic movements, and no further consideration of the RNP is required.	

Note 1: EPA - Environment Protection Authority.

In addition, the NSW Department of Planning and Environment (DP&E) has released its *Voluntary Land Acquisition and Mitigation Policy (VLAMP): For State Significant Mining, Petroleum and Extractive Industry Developments* (NSW Government, 2014) which must also be considered when assessing operational noise impacts from the Modification.

In September 2015, the EPA released the *Draft Industrial Noise Guideline* (dING) (EPA, 2015) for public comment. Once finalised, the dING is designed to ultimately replace the INP. Changes to the INP of particular relevance to the Modification include:

- Higher daytime noise limits.
- Revised process for determining modifying factor adjustments (including for low frequency noise [**Section 5.2**]).
- Further detail regarding the process for determining applicable noise mitigation measures.

Other approved or proposed projects in the vicinity of Moolarben Coal Complex are presented in **Table 2**. The Wilpinjong Extension Project and the Ulan Continued Operations Project are considered cumulatively for operational noise (**Section 9**) in this assessment.

Table 2 Other Approved or Proposed Projects

Proponent	Project	Status
Wilpinjong Coal Pty Ltd (WCPL)	Wilpinjong Extension Project	Project Approval (SSD-6764) dated 24 April 2017. The Wilpinjong Extension Project is approved to operate up to a maximum coal export capacity (from the site) of 16 million tonnes per annum (Mtpa).
Ulan Coal Mines Ltd (UCML)	Ulan (Mine Complex) Continued Operations Project (Modification 3)	Project Approval (MP 08_0184) dated 15 November 2010 (as modified), which was last modified in March 2016 (Modification 3). The Ulan Mine Complex is approved to operate up to a maximum coal export capacity (from the site) of 20 Mtpa.

2 EXISTING MOOLARBEN COAL COMPLEX

2.1 Overview

The General Arrangement Plan for the existing and approved Stages 1 and 2 of the Moolarben Coal Complex is presented as **Appendix B1**. As shown, the Moolarben Coal Complex comprises four approved open cut coal mining areas (OC1 to OC4), three approved underground coal mining areas (UG1, UG2 and UG4) and other mining related infrastructure including coal processing and transport facilities.

In any calendar year, MCO is approved to extract up to 21 Mtpa of ROM coal from open-cut and underground mining operations; up to 13 Mtpa1 of ROM coal can be washed via the coal handing and preparation plant (CHPP), and up to 18 Mtpa of product coal can be loaded onto trains and exported to the Port of Newcastle up to 24 hours per day, seven days per week.

2.2 Land Ownership

The Land Ownership Plan (**Appendix C1**) identifies the nearest receivers and the Land Ownership Details (**Appendices C2** and **C3**), including a list of property ID numbers, landowners and dwelling co-ordinates.

2.3 Approvals

With respect to noise emissions, MCO operates in accordance with the following project approval and licence conditions:

- Project Approval (05_0117) MCP Stage 1 dated 6 September 2007 (as modified), with the relevant sections attached as **Appendix A1**.
- Project Approval (08_0135) MCP Stage 2 dated 30 January 2015 (as modified), with the relevant sections attached as **Appendix A2**.
- EPA Environment Protection Licence (EPL) No 12932 anniversary date 1 January.

It is noted Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 have identical noise conditions and include conditions relating to acquisition upon request, mitigation upon request and noise assessment criteria (i.e. the Project Approval noise limits).

Note, the Project Approval noise limits are presented as external noise levels, except for the school and church which are nominated as 35 A weighted decibels (dBA) (internal when in use). The internal noise levels can be conservatively transposed to an external noise level by adding 10 dBA. It follows that the Project Approval noise limits in relation to the school and church would have equivalent external noise levels of 45 dBA equivalent continuous noise level (LAeq(1hour)) and 45 dBA LAeq(period), respectively (generally consistent with the INP).

2.4 Noise Management Strategy

MCO has an Environmental Management Strategy (EMS) that establishes the overarching framework for environmental management and monitoring of activities undertaken at the Moolarben Coal Complex.

[1] A maximum of 13.5 Mt of ROM coal can be washed during the 2017 calendar year.

The EMS has been prepared in accordance with Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2, and provides the strategic framework for environmental management at the Moolarben Coal Complex. In addition, Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 set out specific requirements for noise management. MCO has prepared and implemented the Noise Management Plan (NMP) in accordance with the Project Approvals.

2.4.1 Noise Management Plan

In accordance with Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2, the approved NMP approved 23 June 2015 has been prepared to manage noise impacts associated with the Moolarben Coal Complex. The NMP was revised in August 2016 and provided to regulators for approval.

The NMP describes the current noise management regime, which consists of nine off-site operator-attended monitoring sites, five off-site continuous real-time monitors and an Automatic Weather Station (AWS) (**Appendix B2**).

In accordance with the NMP, operator-attended noise monitoring is primarily used for demonstrating compliance with noise criteria, whilst continuous real-time monitoring is used as a noise management tool to assist MCO to take pre-emptive noise management actions to avoid potential non-compliances.

2.4.2 Noise Control and Management Measures

MCO implements a range of noise control and management measures at the Moolarben Coal Complex that includes planning controls, operational controls, engineering controls, a real-time response protocol, meteorological forecasting and continuous improvement, as described in the NMP, to identify and manage noise impacts aimed to achieve compliance with the approved noise criteria (refer **Section 2.3**).

Management Practices - include (but are not limited to) the following**:**

- Monitoring noise using a combination of real-time and attended monitoring of mine-generated noise.
- Operation of AWS to aid noise mitigation measures and the identification of noise enhancing conditions will be continued.
- Reviewing operations to avoid or reduce noise impacts where weather conditions and forecasts identify adverse conditions and/or noise monitoring indicates elevated noise levels are occurring.
- Regularly maintaining all machinery and plant used on site to minimise noise generation.
- Using sound attenuated fleet (eg Dura-Tray fleet) where available.
- Using targeted acoustic bunding around the site (specifically targeting haul roads).
- Adopting multilevel dumping operations where feasible.
- Reducing the volume of reversing sirens and start-up alarms to the minimum practicable level (while still complying with coal mine safety regulations) and using the least intrusive type of reversing alarms.
- Requiring rail providers to use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the Australian Rail Track Corporation EPL.

Source and Transmission Noise Controls - include (but are not limited to) the following:

- Enclosure of high noise emission risk stationary equipment at the CHPP such as conveyors and crushers to an adequate level to maintain compliance with relevant criteria, where noise monitoring and noise modelling indicate attenuation would be required.

- Attenuation of mobile equipment such as haul trucks, shovels and excavators, dozers and drills to an adequate level to maintain compliance with relevant criteria, where noise monitoring and noise modelling indicate attenuation would be required.
- Where applicable, the use of rubber lined truck bodies (Dura-Tray).
- Selective placement of waste rock materials to the west of the OC2 in order to provide an acoustic barrier.

Real-time Response Protocols - are implemented where reasonable and feasible, involving:

- Continuous monitoring of noise levels at real-time monitoring locations during noise sensitive periods;
- Establishment of real-time triggers (set below compliance limits); and
- Investigation and response protocols (**Table 3**) in response to a trigger exceedance.

The real-time response measures evolve over time as a result of greater understanding of the weather patterns and mine operating conditions, and are based on algorithms written within the real-time noise software to post-process noise and meteorological data. The algorithms have been based upon noise modelling conducted for the various project approvals and the actual noise and meteorological results recorded since commencement of operations in 2010.

The Moolarben Coal Complex Production and Environment and Community departments are automatically notified when these triggers have been met through SMS alarming. The suitability and appropriateness of assigned response trigger levels are reviewed on an annual basis with any changes reported in the AEMR/Annual Review.

Table 3 Real-Time Response Management Actions

Colour	Examples of Management/Control Action
Green	• Confirm prevailing weather conditions are acceptable as per approval requirements. • Review the audio to determine noise source and record observations. • Monitor changes in noise levels. • Record management strategies, including details of investigation, type of response (if any required), real-time monitoring results and actions taken.
Amber	• Confirm prevailing weather conditions are acceptable as per approval requirements. • Drive to alarm location to determine noise source and record observations. • Alert the Open Cut Examiner (OCE) of the noise observations. • Review noise generating activities and make preparations for moving into a protected area or shutting down equipment if noise levels remain elevated following valid alarms. • Review predicted weather conditions to identify if noise enhancing conditions are forecast for the rest of the shift. • Monitor changes in noise levels. • Record management strategies, including details of investigation, type of response (if any required), real-time monitoring results and actions taken.
Red	• Confirm prevailing weather conditions are acceptable as per approval requirements. • Drive to alarm location to determine noise source and record observations. • Alert the OCE of the noise observations. • Commence moving equipment into protected areas or shutting down equipment following valid alarms. • Review predicted weather conditions to identify if noise enhancing conditions are forecast for the rest of the shift • Monitor changes in noise levels against operational changes: • Record management strategies, including details of investigation, type of response (if any required), real-time monitoring results and actions taken.

2.4.3 Noise Monitoring Program

A summary of recent noise monitoring locations and associated monitoring frequency are presented in **Table 4** together with a cross reference to the monitoring locations (**Appendix B2**).

Table 4 Noise Monitoring Program Summary

Locality	Receiver ID[1]	Location ID[2]	Frequency	Purpose
Operator-attended noise monitoring				
Ulan	160 School	NA1	Monthly	Compliance
Lower Ridge Road	64 MCO	NA6		
Southern Ridge Road	N/A[3]	NA8[3]		
Winchester Crescent	N/A[3]	NA9[3]		
Winchester Crescent	78 MCO	NA12		
National Park	GRNP	GRNP	Quarterly	Compliance
Nature Reserve	MGNR	MGNR		
Cope Road	258 Elias	NA11		Management
Lagoons Road	21 MCO	NA2	Annually	Validation
Upper Ridge Road	175 MCO	NA3		
Moolarben Road	28 MCO	NA10		
Real-time noise monitoring				
Cope Road	256 Campbell & Frost	ND2	Continuous	Management
Lagoons Road	21 MCO	NR3		
Winchester Crescent	239 MCO	NR4		
Upper Ridge Road	175 MCO	NR5		
Moolarben Road	28 MCO	NR10		
Meteorological monitoring				
Administration Area	MCO	WS1	Continuous	Reference
Ulan Road	MCO	WS3		Compliance
Mobile	Varies	WS5	As required	Supplementary

Source: Table 5 Noise Management Plan (NMP) (MCO, 2015)
Note 1: Receiver ID = Identification, refer **Appendix C1** and **Appendix C2**.
Note 2: Location ID = Identification, refer **Appendix B2**.
Note 3: Ceased noise monitoring following approval of NMP in May 2015.

2.5 Noise Compliance

2.5.1 Independent Environmental Audit Noise Compliance Results

TB&A (2015) assessed the compliance of noise management at the Moolarben Coal Complex with Project Approval and EPL conditions for the period January 2013 to December 2015 as part of the MCCIEA 2015.

TB&A (2015) concluded a noise compliance status of *"Compliant Ongoing"*, stating:

> *The Auditor considers that Moolarben Coal Complex is currently meeting its obligations under all the Project Approval noise conditions, Statement of Commitment and EPL 12932 conditions.*

2.5.2 Operator-attended Noise Compliance Results 2014

Section 3.14.2 of the Annual Environmental Management Report 2013-2014 (AEMR 2014) presents monthly operator-attended noise monitoring at four locations during the period of September 2013 to December 2014, including NA1 Ulan (160 School), NA6 Lower Ridge Road (64 MCO), NA8[2] Southern Ridge Road and NA9[3] Winchester Crescent.

Largely due to the implementation of the proactive noise control and management measures described in **Section 2.4.2**, MCO has maintained a strong record of compliance with the approved noise criteria, with no exceedances at privately owned receivers recorded during the September 2013 to December 2014 reporting period. AEMR 2014 Section 3.14.2 states:

> *MCO complied with the project specific criteria at all monitoring sites during the reporting period.*

2.5.3 Operator-attended Noise Compliance Results 2015

The Moolarben Coal Complex Annual Review 2015 (MCCAR 2015) Section 6.2.2 states:

> *MCO complied with project specific criteria at all monitoring sites during attended noise monitoring undertaken between January and December 2015. In accordance with Condition R4.2 of the EPL, no exceedances were recorded during 2015.*
>
> *…*
>
> *During the reporting period an independent review of noise was conducted at two properties during September and October 2015. The review was conducted by a DP&E approved independent expert and concluded that the operations was achieving sustained compliance and no additional management measures were required.*

2.5.4 Operator-attended Noise Compliance Results 2016

The Moolarben Coal Complex Annual Review 2016 (MCCAR 2016) Section 6.2.2 states:

> *Attended environmental noise monitoring was conducted monthly during reporting period. MCO complied with the project specific criteria at all monitoring sites during attended noise monitoring undertaken between January and December 2016.*

2.6 Blast Management Strategy

As described in **Section 2.4**, the EMS has been prepared in accordance with Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 and provides the strategic framework for environmental management at the Moolarben Coal Complex. In addition, Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 set out specific requirements for blast management. MCO has prepared and implemented the Blast Management Plan (BMP) in accordance with the Project Approvals.

[2] Ceased noise monitoring following approval of NMP in May 2015.

[3] Ceased noise monitoring following approval of NMP in May 2015.

2.6.1 Blast Management Plan

In accordance with Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2, the approved BMP (approved 23 June 2015) has been prepared to ensure that ground vibration and airblast impacts are minimised on the local community, proximal infrastructure (e.g. Ulan-Wollar Road and associated road closures) and cultural heritage sites to the extent required. The BMP describes the current blast management regime, which consists of:

- Blast management strategies used to minimise and manage any impacts;
- Monitoring of ground vibration and airblast at a range of locations;
- Communication with the local community and regulators in relation to blasting activities;
- Measures to be implemented for compliance; and
- Protocols for managing and reporting any blast related exceedances or non-compliances.

2.6.2 Blast Monitoring Program

As presented in **Table 5**, blast emission monitoring consists of two permanent off-site and one on-site blast monitoring locations at sensitive receiver sites and an AWS (**Appendix B2**).

In accordance with the BMP, blast emission monitoring is used for demonstrating compliance with relevant ground vibration and airblast limits.

Table 5 Blast Monitoring Program Summary

Locality	Receiver ID[1]	Location ID[2]	Frequency	Purpose
Permanent blast monitoring at sensitive receivers				
Ulan	160 School	BM1	Every blast	Compliance with human comfort and damage criteria
Lower Ridge Road	64 MCO	BM5		
Moolarben Road	28 MCO	BM6[4]		
Portable blast monitoring at aboriginal rock shelters				
Rock shelter	S1MC55, S1MC56	BM2	Every blast within 500 m	Compliance with the relevant damage risk criteria
Rock shelter	S2MC229[5], S2MC232, S2MC233	Various		
Rock shelter	S1MC343[5], S1MC344[5], S1MC345[5], S1MC352[5]	Various		
Portable blast monitoring at infrastructure sites				
Roadway	-	Various	Every blast within 500 m	Compliance with the relevant damage risk criteria
Railway	-	Various		
ETL[3]	-	Various		
Meteorological monitoring				
Administration Area	MCO	WS1	Continuous	Reference
Ulan Road	MCO	WS3		Compliance
Mobile	Varies	WS5	As required	Supplementary

Source: Table 4 Blast Management Plan (BMP) (MCO, 2015)

Note 1: Receiver ID = Identification, refer **Appendix C1** and **Appendix C2**.

Note 2: Location ID = Identification, refer **Appendix B2**.

Note 3: ETL = Electricity Transmission Line.

Note 4: BM6 to be established prior to commencement of OC3.

Note 5: Rock shelters S2MC229, S1MC343, S1MC344, S1MC345 and S1MC352 have been salvaged and no longer require monitoring, refer **Appendix B2**.

2.6.3 Independent Environmental Audit Blast Compliance Results

TB&A (2015) assessed the compliance of blast management at the Moolarben Coal Complex with Project Approval conditions for the period January 2013 to December 2015 as part of the MCCIEA.

TB&A (2015) concluded a blasting compliance status of *"Compliant"*, stating:

> *The implementation of the Blast Management Plan for the Moolarben Coal Complex describes the management of blasting associated with the open cut operations (including management of overpressure, vibration, and flyrock management) and generally conforms to best practice. The blast monitoring between January 2013 and December 2015 demonstrated compliance with the blast overpressure and vibration criteria at all monitored locations for all blasts.*

2.6.4 Blast Emission Compliance Results 2014

Section 3.13.2 (Table 54) of the AEMR 2014 presents the blast emission monitoring at three locations during the period of September 2013 to December 2014, including BM1 Ulan (160 School), BM5 Lower Ridge Road (64 MCO), and BM2 (Rock shelters). MCO has maintained a strong record of compliance with the approved blast emission criteria, with no exceedances at sensitive receivers recorded during September 2013 to December 2014. AEMR 2014 Section 3.13.2 states:

> *There were no occasions where vibration or overpressure results exceeded the criteria set in the Project Approval and Environment Protection Licence. Two blasts (1.53%) recorded overpressure of between 115dB and 120dB, which is less than the allowable 5%.*

Based on the blast emission monitoring conducted by MCO, a summary of the monitoring results is presented in **Table 6** for the 16-month period September 2013 to December 2014.

Table 6 Blast Emissions Monitoring Results Summary - September 2013 to December 2014

Location ID	Vibration (mm/s)[1]					Airblast (dBLpk)[2]				
	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]
BM1 Ulan (160 School)	0.1	1.2	0.3	0.8	5	82	117	96	108	115
BM5 Lower Ridge Road (64 MCO)	0.01	0.6	0.1	0.4		88	120	98	109	
BM2 (Rock shelters)	0.1	70.0	3.3	39.5	n/a[4]	88	133	117	130	n/a[4]

Source: MCO, 2017

Note 1: Vibration Velocity Peak Vector Sum (PVS) - millimetres per second (mm/s).

Note 2: Airblast Level Linear Peak - decibels linear peak re 20 micropascals (dBLpk re 20 µPa).

Note 3: MCO blast criteria as per the BMP.

Note 4: Vibration and airblast limits not applicable (n/a).

As described in the AEMR 2014, there were no exceedances of the relevant vibration and airblast criteria at the respective blast emission monitoring sites during September 2013 to December 2014.

2.6.5 Blast Emission Compliance Results 2015

The MCCAR 2015 Section 6.3 Table 12 presents the blast emission monitoring compliance summary.

Based on the blast emission monitoring conducted by MCO, a summary of the monitoring results is presented in **Table 7** for the 12-month period January to December 2015.

Table 7 Blast Emissions Monitoring Results Summary - January to December 2015

Location ID	Vibration (mm/s)[1]					Airblast (dBLpk)[2]				
	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]
BM1 Ulan (160 School)	0.1	3.2	0.4	2.2	5	88	115	99	109	115
BM5 Lower Ridge Rd (64 MCO)	0.01	1.8	0.3	0.9		82	115	100	110	
BM2 (Rock shelters)	0.1	38.5	1.3	12.8	n/a[4]	88	127	107	122	n/a[4]

Source: MCO, 2017

Note 1: Vibration Velocity Peak Vector Sum (PVS) - millimetres per second (mm/s).

Note 2: Airblast Level Linear Peak - decibels linear peak re 20 micropascals (dBLpk re 20 µPa).

Note 3: MCO blast criteria as per the BMP.

Note 4: Vibration and airblast limits not applicable (n/a).

As described in the MCCAR 2015, there were no exceedances of the relevant vibration and airblast criteria at the respective blast emission monitoring sites during January to December 2015.

2.6.6 Blast Emission Compliance Results 2016

The MCCAR 2016 Section 6.3 Table 13 presents the blast emission monitoring compliance summary.

Based on the blast emission monitoring conducted by MCO, a summary of the monitoring results is presented in **Table 8** for the 12-month period January to December 2016.

Table 8 Blast Emissions Monitoring Results Summary - January to December 2016

Location ID	Vibration (mm/s)[1]					Airblast (dBLpk)[2]				
	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]
BM1 Ulan (160 School)	0.1	1.6	0.3	1.0	5	82	116	96	107	115
BM5 Lower Ridge Rd (64 MCO)	0.01	1.2	0.3	0.9		88	114	99	108	
BM2 (Rock shelters)	0.3	38.3	1.5	16.4	n/a[4]	88	130	111	128	n/a[4]

Source: MCO, 2017

Note 1: Vibration Velocity Peak Vector Sum (PVS) - millimetres per second (mm/s).

Note 2: Airblast Level Linear Peak - decibels linear peak re 20 micropascals (dBLpk re 20 µPa).

Note 3: MCO blast criteria as per the BMP.

Note 4: Vibration and airblast limits not applicable (n/a).

As described in the MCCAR 2016, there were no exceedances of the relevant vibration and airblast criteria at the respective blast emission monitoring sites during January to December 2016.

2.6.7 Blast Emission Compliance Results 2017

Based on the blast emission monitoring conducted by MCO, a summary of the monitoring results is presented in **Table 9** for the 5-month period January to May 2017. One exceedance of the airblast limit was recorded in February 2017. Details of the exceedances and measures undertaken to prevent further exceedances were reported to DP&E.

Table 9 Blast Emissions Monitoring Results Summary - January to May 2017

Location ID[2]	Vibration (mm/s)[1]					Airblast (dBLpk)[2]				
	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]	Min.	Max.	50% Exceedance	5% Exceedance	Criteria[3]
BM1 Ulan (160 School)	0.1	1.1	0.3	0.7	5	82	112	94	105	115
BM5 Lower Ridge Rd (64 MCO)	0.1	1.1	0.3	0.8		92	126.6	98	107	
BM2 (Rock shelters)	0.3	30.9	3.2	16.5	n/a[4]	96	135	113	125	n/a[4]

Source: MCO, 2017

Note 1: Vibration Velocity Peak Vector Sum (PVS) - millimetres per second (mm/s).

Note 2: Airblast Level Linear Peak - decibels linear peak re 20 micropascals (dBLpk re 20 µPa).

Note 3: MCO blast criteria as per the BMP.

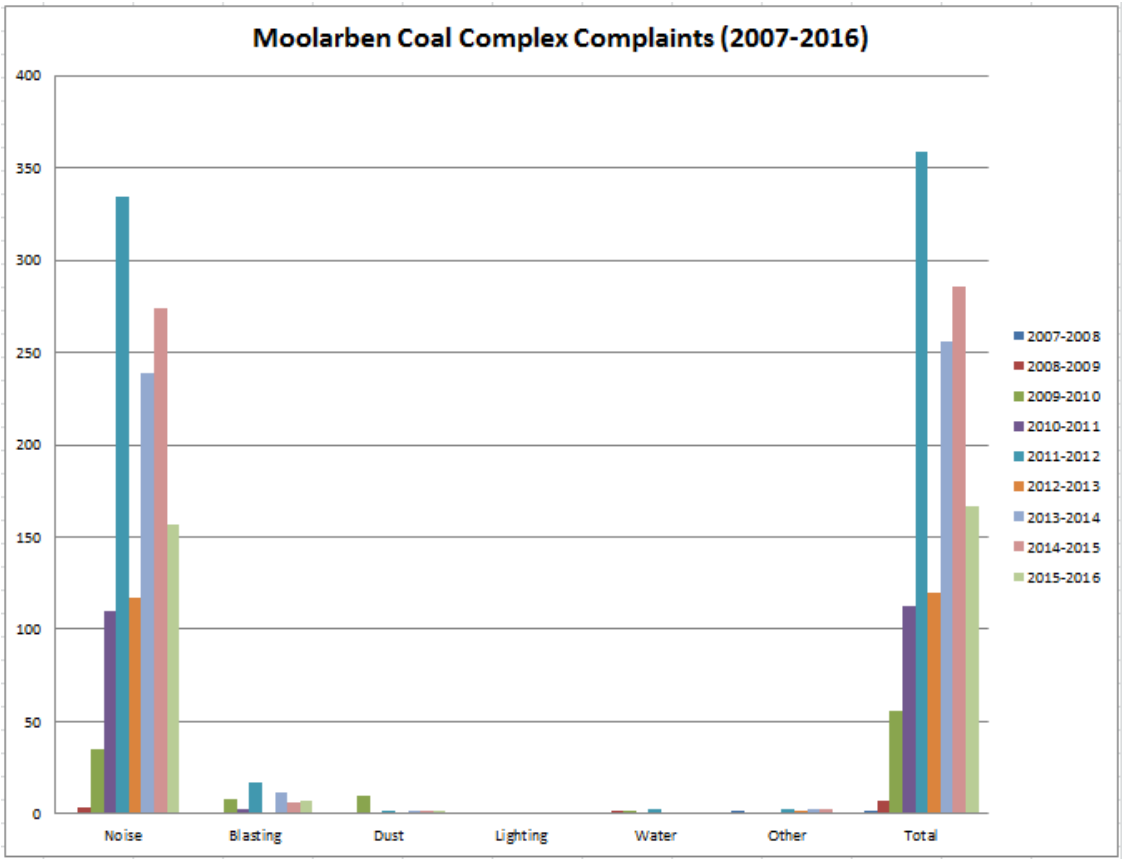
Note 4: Vibration and airblast limits not applicable (n/a).

2.7 Noise Complaints Summary

MCO maintains a complaints register in accordance with approval requirements. A summary of the complaint records from 2007 to 31 December 2016 are presented in **Figure 1**, including operating noise complaints.

Figure 1 shows the number of noise related complaints has diminished from the peak recorded in 2011/2012. The reduction in noise related complaints coincides with the continued implementation of MCO's proactive noise control and management measures described in **Section 2.4.2,** including the introduction of the Dura-Tray haul trucks, on-going noise attenuation to mining fleet, the use of dedicated Mining and Production Environmental Assistants to provide real-time feedback to the mining operations, mine planning to allow for protected work areas to be developed, ongoing community consultation, and land acquisitions.

Figure 1 Complaints Register Summary 2007 to 2017



Source: MCO, 2017

All complaints received by MCO relating to noise were responded to in accordance with the Community Complaints Procedure detailed in the NMP. Following each noise related complaint the source and noise levels were determined or verified. In some instances, mining operations were altered in response to a complaint lodged with MCO during adverse weather conditions. However, there were no reportable environmental incidents (i.e. reportable non-compliances) relating to noise in the 2016 reporting period.

3 PROPOSED MODIFICATION

3.1 Hours of Operation

There would be no change in the approved operating hours of the Moolarben Coal Complex due to the Modification as presented in **Table 10**.

Table 10 Approved Moolarben Coal Complex and Modification Hours of Operation

Operation	Description	Currently Approved[1]	Modification
On-Site	Construction works	Generally daytime (0700 hours to 1800 hours, 7 days per week)	Unchanged
	Maintenance; Operation; Coal handling, processing and stockpiling; and Train loading	24 hours 7 days per week	Unchanged
	Blasting	0900 hours to 1700 hours, Monday to Saturday A maximum of 2 blasts per day and 9 blasts per week on average over any 12 month period	Unchanged
Off-Site	Train Traffic	24 hours, 7 days per week	Unchanged
	Road Traffic	24 hours, 7 days per week	Unchanged

Note 1: As per Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2.

3.2 On-site Construction Works

The Modification would involve construction activities associated with the following:

- Construction of bypass coal conveyor;
- Construction of second rail loadout bin; and
- Construction of water treatment facilities and associated water storages (generally within the Moolarben rail loop).

Construction activities would generally be limited to daytime hours, and noise emissions from construction equipment would be not be significant and indistinguishable to ongoing mining equipment operation. As such, construction activities have not been modelled in this assessment. Attended noise monitoring would continue during daytime construction activities for the Modification to confirm compliance with Project Approval noise limits.

3.3 On-site Open Cut Operations

A summary description of the proposed Modification is provided below.

Pit Disturbance Limits

The Modification would involve minor extensions to the disturbance limits of the OC2 and OC3 open cut pits as follows:

- Minor extension of the OC2 western pit limit.
- Straightening and extensions to the western pit limits of OC3 to facilitate safe and efficient mining.
- Minor extension of the OC3 eastern pit limit to reflect the latest resource definition results.

The extent of additional disturbance would be within the indicative survey area shown on the General Arrangement Plan incorporating the Modification (**Appendix D1**). There would be no change to OC1 or OC4 disturbance limits for the Modification.

Open Cut Production Increase and Mine Sequence

The Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 authorise the following from open cut operations:

- The extraction of up to 8 Mtpa of ROM coal from Stage 1 open cut pits; and
- The extraction of 12 Mtpa of ROM coal from Stage 2 open cut pits.

However, the combined total of ROM coal able to be extracted from the Stage 1 and Stage 2 open cuts is currently limited to 13 Mtpa.

With no material change to the existing open cut mining fleet, and with changes to the sequencing of open cut mining operations, MCO would be able to optimise operations to achieve the following production (**Appendix D2**):

- Up to 10 Mtpa of ROM coal from Stage 1 open cuts (OC1, OC2 and OC3);
- Up to 16 Mtpa of ROM coal from the Stage 2 open cut (OC4); and
- Combined total (Stage 1 and Stage 2) of up to 16 Mtpa of ROM coal.

These changes in open cut production rates would also result in changes to the following:

- Increase in the combined open cut and underground ROM coal limit from 21 to 24 Mtpa (i.e. 16 Mtpa from open cut operations and 8 Mtpa from underground operations);
- Increase in the product coal limit from 18 to 22 Mtpa;
- Increase in product coal rail movements (1 additional train per day on average and 2 additional trains per day at peak);
- Increase in the annual rate of coal rejects production; and
- Increase in the size of ROM coal stockpiles and product coal stockpiles.

The open cut operations would also involve the development of the revised OC2 to OC3 haul road and OC3 mine infrastructure area and the proposed OC2 to OC4 haul road.

3.4 On-site Blasting

The method of overburden and coal material removal at the Moolarben Coal Complex includes drilling and blasting techniques. A mixture of bulk explosive products is used as appropriate to the blast design and environmental conditions. Potential impacts associated with blasting in the Modification extension areas (**Appendix D1**) are assessed in **Section 11**.

Blasting would continue and only occur between the hours of 0900 hours and 1700 hours, Monday to Saturday (excluding public holidays). There would be no change to the current maximum of 2 blasts per day and the number of blasts in any week would remain limited to 9 blasts per week (averaged over a calendar year) in accordance with Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2.

3.5 Off-site Rail Transport

Product coal produced by the CHPP at the Moolarben Coal Complex would continue to be stockpiled prior to being reclaimed and loaded onto trains for transport to the Port of Newcastle via the Gulgong to Sandy Hollow railway line before connecting to the Main North Line at Muswellbrook (**Appendix M1**).

As described in **Section 3.3**, changes in open cut production rates would also result in an increase in the product coal limit from 18 Mtpa to 22 Mtpa. As a result, there would be an increase in the average product coal train departures from the site by 1 per day (i.e. up from of 7 to 8 train departures per day on average in any calendar year). This requires the peak number of product coal train departures from site to increase by 2 per day (i.e. up from a peak of 9 to 11 departures per day). Train loading and despatch would continue to be conducted 24 hours per day, 7 days per week.

3.6 Off-site Road Transport

There would be no material change to the approved workforce at the Moolarben Coal Complex and related daily road traffic generation due to the Modification, and off-site road traffic noise is not further considered in this report.

4 EXISTING METEOROLOGICAL AND NOISE ENVIRONMENT

4.1 Meteorological Environment

As discussed in **Section 2.4.1**, MCO maintains an EPA-approved AWS as shown in **Appendix B2**. An assessment of prevailing wind conditions was derived from the EPA-approved AWS located at WS3. Consistent with the previous noise assessments for the Moolarben Coal Complex, the dominant seasonal wind speeds and directions recorded for the 42-month period from January 2011 to June 2014 are presented in **Appendix E** for daytime (0700 hours to 1800 hours), evening (1800 hours to 2200 hours) and night-time (2200 hours to 0700 hours), in accordance with a methodology consistent with the requirements of the INP.

An assessment of winter temperature gradients and atmospheric stability has been derived from the on-site Temperature Tower located at the Wilpinjong Coal Mine. Presented in **Appendix E** is the winter Temperature Gradient Exceedance Levels summary, winter Temperature Gradient Exceedance Levels 24-hour profile and winter Temperature Gradient Cumulative Frequency Distribution for the 34-month period (August 2011 to July 2014), in accordance with a methodology consistent with the requirements of the INP Appendix E (E2).

4.1.1 Prevailing Winds

Section 5.3 of the INP, Wind Effects, states:

> *Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season.*

The prevailing winds less than (or equal to) 3 metres per second (m/s) with a frequency of occurrence greater than (or equal to) 30% are presented in **Table 11** and considered to be relevant to the Moolarben Coal Complex in accordance with the INP.

Table 11 Prevailing Seasonal 10 m Wind Velocities In Accordance with the INP

Season	Winds ±45 degrees 3 m/s with Frequency of Occurrence 30%		
	Daytime	Evening	Night-Time
Annual	Nil	SW (33%), WSW (30.8%)	Nil
Summer	Nil	ENE (30.6%)	ENE (37.1%), E (36.3%)
Autumn	Nil	SSW (31.6%), SW (34.7%), WSW (30.3%)	Nil
Winter	WSW (30.8%), W (30%)	SSW (32.3%), SW (40.5%), WSW (40.4%), W (30.5%)	SW (32.7%), WSW (33.1%)
Spring	Nil	SSW (37.3%), SW (44.4%), WSW (42.1%)	SSW (36.1%), SW (37.5%), WSW (30.6%)

4.1.2 Temperature Inversions

Section 5.2 of the INP, Temperature Inversions, states:

> *Assessment of impacts is confined to the night noise assessment period (10.00 pm to 7.00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible.*
>
> *Where inversion conditions are predicted for at least 30% (or approximately two nights per week) of total night-time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment.*

The seasonal combined evening/night-time temperature gradients and atmospheric stability are presented in **Table 12** and considered to be relevant to Moolarben Coal Complex in accordance with the INP.

Table 12 Prevailing Seasonal Temperature Gradients in Accordance with the INP

Stability Class	Frequency of Occurrence - Evening/Night-time					Temperature Gradient °C/100 m[1]	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0.3%	0.7%	0.0%	0.0%	0.3%	<-1.9	Lapse
B	0.5%	1.3%	0.1%	0.0%	0.5%	-1.9 to -1.7	Lapse
C	0.9%	2.3%	0.2%	0.0%	0.9%	-1.7 to -1.5	Lapse
D	34.6%	58.1%	26.9%	17.4%	33.2%	-1.5 to -0.5	Neutral
E	25.0%	24.7%	28.6%	22.6%	23.5%	-0.5 to 1.5	Weak inversion
F	25.1%	9.5%	31.0%	39.1%	22.8%	1.5 to 4	Moderate inversion
G	13.7%	3.4%	13.1%	20.9%	18.7%	>4.0	Strong inversion
F+G	38.8%	12.9%	44.1%	59.9%	41.6%	>1.5	Moderate to Strong

Note 1: °C/100 m = Degrees Celsius per 100 metres.

In accordance with **Table 12**, the combined frequency of occurrence of moderate to strong (i.e. >1.5°C/100 m) winter temperature inversions is greater than 30% (actually 59.9%) during the combined evening/night-time period and therefore requires assessment, in accordance with the INP. The assessment of winter temperature gradients and atmospheric stability derived from the Wilpinjong Coal Mine Temperature Tower data has provided additional data regarding the characterisation of temperature gradients that occur in the area.

Based on analysis of available data (**Appendix E**), it was determined that noise impacts coinciding with temperature gradients up to 5.2°C/100 m were assessable, in accordance with the INP, as these temperature inversions (less than and up to 5.2°C/100 m) occur for up to 90% of the time during the evening/night periods during winter.

In addition, the INP Section 5.2 Temperature Inversions also states:

> *The drainage-flow wind default value should generally be applied where a development is at a higher altitude than a residential receiver, with no intervening higher ground (for example, hills). In these cases, both the specified wind and temperature inversion default values should be used in the noise assessment for receivers at the lower altitude.*

Some of the Cooks Gap privately owned receivers are positioned at lower elevations, relative to the Moolarben Coal Complex, with minimal intervening topography between the site and the nearest receivers. A site-specific 1.0 m/s east-northeast drainage flow has been adopted in this assessment and is consistent with the meteorological analysis undertaken and applied in both the OC4 South-West Modification Noise Impact Assessment (NIA) (SLR, April 2015) and UG1 Optimisation Modification NIA (SLR, May 2015).

4.1.3 Noise Model Meteorological Parameters

The Environmental Noise Model (ENM) noise modelling meteorological parameters are presented in **Table 13** based on foregoing analysis of the Moolarben Coal Complex AWS meteorological data set together with the Wilpinjong Coal Mine winter temperature gradients.

Table 13 Calm (Neutral) and Noise Enhancing Meteorological Modelling Parameters

Period	Meteorological Parameter	Air Temperature	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	18°C	55%	0 m/s	0°C/100 m
	Wind only	19°C	55%	WSW and W 3 m/s	0°C/100 m
Evening	Calm	16°C	66%	0 m/s	0°C/100 m
	Wind only	16°C	65%	ENE, SSW, SW, WSW and W 3 m/s	0°C/100 m
Night-time	Calm	12°C	75%	0 m/s	0°C/100 m
	Wind only	12°C	75%	ENE, E, SSW, SW and WSW 3 m/s	0°C/100 m
	Strong Inversion	6°C	70%	0 m/s	5.2°C/100 m
	Strong Inversion plus Drainage	6°C	70%	ENE 1.0 m/s	5.2°C/100 m

4.2 Noise Environment

Although the Moolarben Coal Complex has approved noise limits for privately owned receivers in Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2, the INP procedures and Application Notes (12 June 2013) require noise impact assessments to review the pre-mining background noise data to determine the relevant Rating Background Levels (RBLs) and noise amenity levels ($L_{Aeq(period)}$). Background noise monitoring results to characterise and quantify the pre-mine noise environment in the area surrounding Moolarben Coal Complex were conducted in July 2005 and presented in the MCP Stage 1 NIA.

The measurement methodology and analysis procedures are described in the MCP Stage 1 NIA. The relevant estimated RBLs and noise amenity levels ($L_{Aeq(period)}$) are presented in **Table 14**, which form the basis of establishing the Project-specific noise assessment criteria (**Section 5**).

Table 14 Background Noise and Amenity Levels for Assessment Purposes

Locality	Estimated RBL[1,2] All Noise Sources			Estimated LAeq(period)[1,2] Industrial Noise Only		
	Daytime	Evening	Night-time	Daytime	Evening	Night-time
Privately Owned Land	30	30	30	<44	<39	<34

Source: Spectrum Acoustics (2006)

Note 1: Estimated RBLs and noise amenity levels in the absence of Moolarben Coal Complex operation.

Note 2: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

5 NOISE ASSESSMENT CRITERIA

The Moolarben Coal Complex operates in accordance with the Project Approval noise limits (**Section 2.3** and **Appendix A1** and **Appendix A2**). The Project Approval noise limit for privately owned receivers is 35 dBA $L_{Aeq(15minute)}$ during the daytime, evening and night-time with the exception of five receivers (30, 31, 63, 70, 75). Notwithstanding, in accordance with the INP Application Notes (12 June 2013), PSNLs and Sleep Disturbance Noise Levels (SDNLs) for the Moolarben Coal Complex incorporating the Modification determined in accordance with the INP are described below.

5.1 Intrusive and Amenity Noise Assessment Criteria

The EPA has regulatory responsibility for the control of noise from "scheduled premises" under the *Protection of the Environment Operations Act, 1997*. In implementing the INP, the EPA has two broad objectives:

- Controlling intrusive noise levels in the short-term; and
- Maintaining noise amenity levels for particular land uses over the medium to long-term.

The INP prescribes detailed calculation routines for establishing PSNLs (i.e. $L_{Aeq[15minute]}$ intrusive criteria and $L_{Aeq[period]}$ amenity criteria) at potentially affected receivers for an industrial development. Ideally, the intrusive noise level should not exceed the background level by more than 5 dBA. Similarly, the noise amenity level should not exceed the specified INP "acceptable" or "maximum" noise level appropriate for the particular land use. The applicable acceptable and maximum noise amenity levels for receivers in the vicinity of the Moolarben Coal Complex are shown in **Table 15**.

Table 15 INP Acceptable and Maximum Noise Amenity Levels (dBA re 20 µPa)

Locality	INP Noise Amenity Zone	Amenity $L_{Aeq(period)}$[1] Acceptable			Amenity $L_{Aeq(period)}$[1] Maximum		
		Day	Evening	Night	Day	Evening	Night
Privately Owned Land	Rural Residential	50	45	40	55	50	45
Any	School[2]	External 45 when in use			External 50 when in use		
Any	Church[2]	External 50 when in use			External 55 when in use		
Any	Passive Recreation	External 50 when in use			External 55 when in use		
Any	Commercial	External 65 when in use			External 70 when in use		

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 2: External criteria equivalent to internal criteria plus 10 dBA.

As the INP acceptable noise amenity level sets the preferred total noise level from all industrial noise sources, cumulative impacts from the Modification are assessed against the amenity $L_{Aeq(period)}$ acceptable noise levels specified in **Table 15**. In addition, DP&E's VLAMP (**Section 1.2**) and the amenity criteria are also used to determine any need for acquisition rights over vacant land as further discussed in **Section 5.4**.

In accordance with the INP's Chapter 2 Industrial Noise Criteria and relevant Application Notes, the PSNLs for the residential and other localities in the vicinity of the Moolarben Coal Complex are presented in **Table 16** for both intrusive noise and amenity.

Table 16 Project-specific Noise Levels and Assessment Criteria (dBA re 20 µPa)

Locality	Land Use	Intrusive $L_{Aeq(15minute)}$[1]			Amenity $L_{Aeq(period)}$[1]		
		Day	Evening	Night	Day	Evening	Night
Privately Owned Land	Rural Residential[2]	35	35	35	50	45	40
Any	School[3]	Intrusive noise criteria not applicable			External 45 when in use (daytime/evening only)		
Any	Church[3]	Intrusive noise criteria not applicable			External 50 when in use (daytime/evening only)		
Any	Passive Recreation	Intrusive noise criteria not applicable			External 50 when in use		
Any	Commercial	Intrusive noise criteria not applicable			External 65 when in use		

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 2: At the most-affected point within 30 m of the residential area.
Note 3: External criteria equivalent to internal criteria plus 10 dBA.

The intrusiveness criterion is met if the $L_{Aeq(15minute)}$ is less than or equal to the RBL plus 5 dBA, where the RBL is described in **Section 4.2**.

The INP states that the PSNLs are based on preserving the amenity of at least 90% of the population living in the vicinity of industrial noise sources by limiting the adverse effects of noise for at least 90% of the time. Provided the PSNLs are achieved, then most people would consider the resultant noise levels acceptable. In those cases where the PSNLs are not achieved, it does not automatically follow that all people exposed to the noise would find the noise "unacceptable". In subjective terms, the VLAMP characterises noise impacts resulting from residual noise exceedances of the PSNLs generally as follows:

- If the residual noise exceedance is 0-2 dBA above the PSNL, then noise impacts are considered to be negligible (i.e. not noticeable by all people).
- If the residual noise exceedance is 3-5 dBA above the PSNL, and the development would contribute less than 1 dB to the total industrial noise level, then noise impacts are considered to be marginal (i.e. not noticeable by most people).
- If the residual noise exceedance is 3-5 dBA above the PSNL, and the development would contribute more than 1 dB to the total industrial noise level, then noise impacts are considered to be moderate (i.e. not noticeable by some people but may be noticeable by others).
- If the residual noise exceedance is >5 dBA above the PSNL in the INP, then noise impacts are considered to be significant (i.e. noticeable by most people).

5.2 Low Frequency Noise Modifying Adjustment Factors

In accordance with the INP's Chapter 4 Modifying factor adjustments, where a noise source contains certain characteristics, such as dominant low frequency content, the INP states that there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level. The modifying factors (if applicable) are to be applied to the measured or predicted noise level at the receiver and then assessed against the PSNLs. In the case of low frequency (20 Hz to 250 Hz) noise, the INP requires a 5 decibel (dB) correction to be applied to the measured or predicted noise levels where the difference between the A and C weighted level is 15 dB (or more) at the receiver.

Noise measurements of the existing Moolarben Coal Complex noise emissions (coinciding with temperature inversions) were conducted by SLR for a duration of one week in August 2014 using a full spectrum noise monitor (i.e. capacity to measure low-frequency noise) located at the receiver 175 (MCO) being generally representative of the nearest Cooks Gap receivers to the Moolarben Coal Complex.

The noise data were then analysed in accordance with the INP requirements to estimate the $L_{eq(15minute)}$ A and C weighted noise levels of the Moolarben Coal Complex operations; this coincided with strong temperature inversions (average approximately 5.6°C/100 m) between 0000 hours to 0500 hours. The measurement results at the receiver 175 (MCO) show a mean difference of 13.3 dB between the estimated (mine-contributed) intrusive $L_{Aeq(15minute)}$ and the $L_{Ceq(15minute)}$ noise levels (i.e. below the INP's low frequency modifying threshold of 15 dB).

On review of this data, together with the operator-attended noise monitoring results presented in the following reports:

- *MCO Independent Noise Review Property 76 Carbone (INRP76 2015) (Bridges Acoustics, 2016);*
- *MCO Independent Noise Review Property 300 Collins and Marshall (INRP300 2015) (Bridges Acoustics, 2016); and*
- *Monthly Environmental Noise Monitoring Reports November 2016 to May 2017 (MENMRs) (MCO, 2016/2017).*

It is concluded that Moolarben Coal Complex noise emissions do not contain "dominant low frequency content" in accordance with the INP's assessment procedures.

5.2.1 Draft Industrial Noise Guideline Low Frequency Noise Assessment

In September 2015, the NSW Government released the dING (EPA, 2015) for public comment. Within this document, a revised method of low frequency noise assessment is proposed based on:

- The measurement of overall C weighted and A weighted level; and
- One-third octave measurements in the range 10 Hz to 160 Hz, with the one-third octave measurements based on the DEFRA curve method.

Two penalties (5 dB and 2 dB) are nominated in the dING, depending on one-third octave measurements. Release of the final dING is currently pending. MCO's monitoring results would be assessed against the INP, or policy that supersedes this policy (e.g. the finalised dING), with respect to modifying factors (including for low frequency noise). If noise generated by the Moolarben Coal Complex incorporating the Modification is found to contain annoying characteristics (such as dominant low frequency content), the appropriate modifying factor would be applied to measured noise levels and assessed against noise criteria.

5.3 Sleep Disturbance Assessment Criteria

When mobile equipment and fixed plant operate simultaneously during the night-time, some noise sources (including the operation of trains on the rail loop) have the potential to emerge audibly above the overall mine noise and potentially disturb the sleep of nearby residents.

The EPA's INP Application Notes dated 12 June 2013 (refer **Appendix F**) recognise that the current $L_{A1(1minute)}$ sleep disturbance criterion of 15 dBA above the prevailing $L_{A90(15minute)}$ level is not ideal. The assessment of potential sleep disturbance is complex and not fully understood; however, the EPA believes that there is insufficient information to determine a suitable alternative criterion.

Appendix B (Technical Background to Road Traffic Noise Criteria) of the *Environmental Criteria for Road Traffic Noise* (EPA, 1999) contains a comprehensive review of research into sleep disturbance and traffic noise. The review has been more recently updated in the NSW RNP (DECCW, 2011) (Section 5.3 Sleep Disturbance); however, the EPA's conclusion remains unchanged as follows:

- Maximum *internal* noise levels below 50 to 55 dBA are unlikely to cause awakening reactions; and
- One or two noise events per night, with maximum *internal* noise level of 65 to 70 dBA, are not likely to affect health and wellbeing significantly.

It is noteworthy that conditions of approval generally include external noise limits. The internal noise levels (presented above) can be conservatively transposed to an external noise level by adding 10 dBA (or 12.5 dBA when measured 1 m from the dwelling facade). It follows that an external $L_{A1(1minute)}$ noise criteria of 60 dBA would appear to be consistent with the current research in relation to this matter.

The EPA continues to review research on sleep disturbance as it becomes available and in the interim, the EPA suggests that the $L_{A1(1minute)}$ level of 15 dBA above the RBL is a suitable screening criterion for sleep disturbance for the night-time period. This approach is generally consistent with Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2. The approved $L_{A1(1minute)}$ noise limit is presented in **Table 17**.

Table 17 Night-time $L_{A1(1minute)}$ Sleep Disturbance Noise Level (dBA re 20 µPa)

Locality	Project Approval $L_{A1(1minute)}$ Limit[1]
Privately Owned Land	45

Note 1: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0800 hours.

The monthly operator-attended noise monitoring results (as presented in the MENMRs) for monitoring locations NA6 and NA12 (refer **Appendix B2**) have been reviewed for the period November 2012 to December 2016 to determine the mean difference between the intrusive $L_{Aeq(15minute)}$ and the corresponding $L_{A1(1minute)}$ noise levels. The results are summarised in **Table 18** including the mean (mine-contributed) intrusive $L_{Aeq(15minute)}$ and $L_{A1(1minute)}$ noise levels.

Table 18 Measured Night-time $L_{Aeq(15minute)}$ and $L_{A1(1minute)}$ Noise Levels (dBA re 20 µPa)

Locality	Receiver ID[1]	Location ID[2]	Mean $L_{Aeq(15minute)}$	Mean $L_{A1(1minute)}$	Mean Difference
Lower Ridge Road	64 MCO	NA6	28.0	33.1	5.1
Winchester Crescent	78 MCO	NA12	27.0	31.8	4.8
		Overall	**27.5 dBA**	**32.4 dBA**	**4.9 dBA**

Note 1: Receiver ID = Identification, refer **Appendix C1** and **Appendix C2**.
Note 2: Location ID = Identification, refer **Appendix B2**.

The measured results at locations NA6 and NA12 show a mean difference of approximately 5 dBA between the (mine-contributed) intrusive $L_{Aeq(15minute)}$ and $L_{A1(1minute)}$ noise levels and are, therefore, consistent with similar mining operations where the difference is typically <10 dBA. Hence, if the intrusive PSNLs (**Section 5.1**) (i.e. RBL plus 5 dBA) are achieved, then the SDNLs (i.e. RBL plus 15 dBA) would also be met. This relationship enables the noise assessment process to focus on the setting and assessment of INP-based intrusive noise and amenity levels, which aim to minimise annoyance at noise sensitive receiver locations.

Notwithstanding the foregoing, the predicted $L_{A1(1minute)}$ night-time noise levels are presented in **Section 7.3** together with an assessment of potential sleep disturbance impacts from Moolarben Coal Complex incorporating the Modification.

5.4 Voluntary Land Acquisition and Mitigation Policy

The recently released VLAMP describes the NSW Government's policy for voluntary mitigation and land acquisition to address noise (and dust) impacts from State Significant Mining, Petroleum and Extractive Industry Developments. The NSW Government has had long-standing processes in place for land acquisition and mitigation associated with mining developments, and these procedures have now been formalised in the VLAMP, including:

- That industry needs to apply all reasonable and feasible measures to minimise noise (and dust) impacts.

- When noise and dust impacts are considered to be significant enough to warrant mitigation at the receiver or acquisition upon request.
- Requirements for negotiated agreements between proponents and landowners.
- The measures that need to be offered to affected landholders when impacts are marginal or moderate (but within approval limits).

An extract from the VLAMP is attached as **Appendix G** that details how the policy applies to noise impacts and the key sections are reproduced as follows:

Table 1 Characterisation of Noise Impacts and Potential Treatments

Residual Noise Exceeds INP Criteria By	*Characterisation of Impacts*	*Potential Treatment*
0-2 dBA above the project specific noise level (PSNL)	*Impacts are considered to be* ***negligible***	*The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls*
3-5 dBA above the PSNL in the INP but the development would contribute less than 1 dB to the total industrial noise level	*Impacts are considered to be* ***marginal***	*Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity*
3-5 dBA above the PSNL in the INP and the development would contribute more than 1 dB to the total industrial noise level	*Impacts are considered to be* ***moderate***	*As for marginal impacts but also upgraded facade elements like windows, doors, roof insulation etc to further increase the ability of the building facade to reduce noise levels*
>5 dBA above the PSNL in the INP	*Impacts are considered to be* ***significant***	*Provide mitigation as for moderate impacts and see voluntary land acquisition provisions below*

Voluntary mitigation rights

A consent authority should only apply voluntary mitigation rights where, even with the implementation of best practice management:

- *The noise generated by the development would be equal to or greater than 3dB(A) above the INP project-specific noise level at any residence on privately owned land; or*
- *The development would increase the total industrial noise level at any residence on privately owned land by more than 1dB(A), and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the INP; or*
- *The development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING (see Appendix B) by greater than or equal to 3dB(A) at any residence on privately owned land.*

All noise levels must be calculated in accordance with the INP or RING (as applicable).

The selection of mitigation measures should be guided by the potential treatments identified in Table 1 above.

Voluntary land acquisition rights

A consent authority should only apply voluntary land acquisition rights where, even with the implementation of best practice management:

- *The noise generated by the development would be more than 5dB(A) above the project specific noise level at any residence on privately owned land; or*
- *The noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the INP on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls2; or*
- *The development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria in Table 6 of Appendix 3 of the RING at any residence on privately owned land.*
- *All noise levels must be calculated in accordance with the INP or RING (as applicable).*

[2] *Voluntary land acquisition rights should not be applied to address noise levels on vacant land other than to vacant land specifically meeting these criteria.*

It is also noteworthy that:

- *A consent authority can apply voluntary mitigation and voluntary land acquisition rights to reduce:*
  - *Operational noise impacts of a development on privately owned land; and*
  - *Rail noise impacts of a development on privately-owned land near non-network rail lines (private rail lines) on or exclusively servicing industrial sites (see Appendix 3 of the RING);*
- *But not:*
  - *Construction noise impacts, as these impacts are shorter term and can be controlled;*
  - *Noise impacts on the public road or rail network; or*
  - *Modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997.*

5.5 Modification and Cumulative Noise Impact Assessment Methodology

Table 19 presents the generalised methodology for assessing the Modification operating noise levels against the intrusive and amenity PSNLs (**Table 16**) and the $L_{A1(1minute)}$ SDNLs (**Table 17**) together with cumulative amenity noise levels (**Table 15**) for assessing operating noise levels from existing, approved and proposed mining developments in the vicinity of the Modification.

Table 19 Modification and Cumulative Noise Impact Assessment Methodology (dBA re 20 µPa)

Affected Land Use	Assessment Parameter	Assessment Criteria	Noise Management Zone[1]		Affectation Zone[2]
			Negligible	Marginal to Moderate	Significant
Residential dwellings	PSNL Intrusive	RBL plus 5 dBA	1 to 2 dBA above assessment criteria	3 to 5 dBA above assessment criteria	> 5 dBA above assessment criteria
	PSNL Amenity	INP acceptable			
	SDNL $L_{A1(1minute)}$	RBL plus 15 dBA			
Vacant land	PSNL Amenity	INP acceptable	Not applicable	Not applicable	> 5 dBA above assessment criteria[3]
Residential dwellings	Cumulative Amenity Level	INP acceptable	1 to 2 dBA above assessment criteria	3 dBA above assessment criteria	> 3 dBA above assessment criteria[4]

Note 1: Noise Management Zone - depending on the range of exceedance of the PSNL and or SDNL assessment parameters, potential project noise impacts range from negligible to moderate in accordance with the VLAMP.

Note 2: Noise Affectation Zone - noise exceedances greater than 5 dBA above the PSNL and or SDNL assessment parameters may result in significant project noise impacts in accordance with the VLAMP.

Note 3: Noise Affectation Zone - equivalent to a noise exceedance of the INP's maximum noise amenity level on more than 25% of any privately owned vacant land, and a dwelling could be built on that vacant land under existing planning controls in accordance with the VLAMP.

Note 4: Exposure to cumulative mine noise levels greater than 3 dBA above the relevant INP acceptable noise level may be considered unacceptable by some landowners.

6 NOISE MODELLING METHODOLOGY

6.1 Moolarben Coal Complex and the Modification Noise Model Validation

The noise model for the Moolarben Coal Complex was prepared using RTA Software's Environmental Noise Model (ENM for Windows, Version 3.06), a commercial software system developed in conjunction with the NSW EPA. The acoustical algorithms utilised by this software have been endorsed by the Australian and New Zealand Environment Council and all State Environmental Authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available. The ENM algorithm has been used for all major noise assessments at the Moolarben Coal Complex, including the UG1 Optimisation Modification NIA, OC4 South-West Modification NIA, MCP Stage 1 Mod 9 NIA and MCP Stage 2 PPR NIA.

SLR conducted a noise investigation survey in July and August 2014 to update and validate the Moolarben Coal Complex noise model and reflect as-built noise emissions, as follows:

- On-site noise measurements to determine fixed plant sound power levels (SWLs) including CHPP, conveyors and drives, ROM bin, sizing station as well as locomotives operating on the rail loop.
- On-site noise measurements to determine and/or verify mobile equipment SWLs including dozers, excavators, haul trucks and drills.
- The digital terrain was updated to include latest high resolution landforms, particularly extensive noise wall bunding on the western extent of OC2.
- Additional noise sources were added into the model to more accurately reflect the noise emissions from significant mobile equipment.
- Far-field operator-attended and unattended noise surveys (3 validation locations) were conducted to determine Moolarben Coal Complex's noise level contribution at each location. For each survey the prevailing weather conditions as well as the number and location of operating plant and equipment were recorded.
- The outcome of the validation exercise resulted in a noise model calibration factor (of negative 2.1 dBA) which has been included in the Modification noise assessment (while noting that the validation outcomes are generally consistent with field measurement and modelling results from similar large scale resource developments).

The three operational noise modelling scenarios (described below) include existing and proposed plant and equipment items operating concurrently to simulate the overall maximum energy equivalent (i.e. $L_{Aeq[15minute]}$) intrusive noise level. A large proportion of the mobile equipment is operated in repeatable routines and a relatively smaller proportion of the emissions emanate from continuous fixed plant items.

Mobile fleet undergo regular maintenance on-site, resulting in a portion of the total mobile fleet (refer **Section 6.3**) being out of service at any given time. This has been reflected in the 2019, 2021 and 2026 operating scenarios noise modelling, which assumes a mobile fleet utilisation of approximately 82%. Generally, 80% to 85% mobile equipment utilisation (and driver availability) is consistent with large scale open-cut mining operations.

6.2 Mobile Equipment and Fixed Plant Sound Power Levels

The potential for machinery to emit noise is quantified as the SWL expressed in dBA re 1 pico watt (pW). At the receptor, the received noise is quantified as the sound pressure level (SPL) expressed in dBA re 20 micro pascals (µPa). In general terms, any variation in the on-site plant and equipment SWLs will produce a similar variation in the off-site SPL at the receiver (i.e. an increase of 5 dBA in the SWL of equipment operating at a site would result in a corresponding 5 dBA increase in SPL of intrusive noise at the receiver, when averaged over the same 15-minute period).

Equipment SWLs at the Moolarben Coal Complex are the subject of ongoing measurements in accordance with the NMP, and MCO has refined the SWLs for individual fleet items. Comparative mobile equipment, fixed plant and total SWLs are presented **Appendix H**, as determined from the UG1 Optimisation Modification NIA and the proposed Modification. Based on the UG1 Optimisation Modification NIA, the total SWL was approximately 135.3 dBA and, for the proposed Modification, the total SWL is approximately 135.2 dBA in Years 2021 and 2026. As shown in **Appendix H**, following the reconfiguration of mobile equipment and fixed plant, the proposed Modification total SWL is approximately 0.1 dBA lower by comparison to the existing and approved Moolarben Coal Complex as modelled in the UG1 Optimisation Modification.

The L_{Aeq} SWLs given for each item of mobile equipment or fixed plant do not include noise emissions which emanate from alarms or communication "horns". It is noted that MCO has installed broadband "quacker" reversing alarms on all of the Moolarben Coal Complex mobile equipment fleet. Further, implementation of "silent horns" which uses radio to communicate between mobile plant is used on-site. External horns are used in emergency situations only.

6.3 Noise Modelling Scenarios

6.3.1 Year 2019, 2021 and 2026 Operating Scenarios

In accordance with INP requirements, the Modification description was reviewed to determine representative operating scenarios to assess potential noise impacts. Scenarios representing typical Modification operations in 2019, 2021 and 2026 were identified and selected to represent the Modification. A summary is presented below and further information on each Modification scenario is presented in **Appendices I1** to **I4**:

- 2019 - representative of open cut operations extracting ROM coal at the maximum proposed rate (i.e. 16 Mtpa of ROM coal). Coal fleets are located in OC3 and OC4 with overburden fleets located in OC2, OC3 and OC4 (**Appendices I1 and I4**).
- 2021 - representative of Stage 1 open cut operations (i.e. mining domains closest to the private receivers to the west of the Moolarben Coal Complex) extracting ROM coal at the maximum proposed rate (i.e. 10 Mtpa). Coal fleets are located in OC3 and OC4, with overburden fleets located in OC1, OC3 and OC4 (**Appendices I2 and I4**).
- 2026 - representative of open cut operations extracting ROM coal at the maximum proposed rate (i.e. 16 Mtpa) from Stage 2 open cut (OC4). All coal and overburden fleets are located in OC4 (**Appendices I3 and I4**).

Note that a fleet as described above includes an excavator as well as associated dozers, haul trucks and drills as required. While each fleet can operate on either coal or overburden, each fleet has been designated as operating either on coal or overburden for the modelling scenarios as described in **Appendix I**. The different fleet types will have varying elevations and configurations (e.g. overburden fleets generally modelled with a shorter haul distance than coal fleets).

6.4 Noise Mitigation and Management Measures

6.4.1 Moolarben Coal Complex Existing Operations

MCO is obligated to manage noise levels from the Moolarben Coal Complex in accordance with the noise limits specified in MCP Stage 1 Project Approval (05_0117) and MCP Stage 2 Project Approval (08_0135), using reasonable and feasible mitigation measures. The obligation to meet the Project Approval noise limits has been achieved through a combination of the following:

- For the majority of private landowners, the implementation of the noise management strategy as per the NMP including the use of real-time noise monitoring to manage noise levels.
- For a minority of private landowners, property acquisitions and private compensation agreements, which has had the effect of reducing the number of privately owned receivers that could potentially be affected by noise impacts from the Moolarben Coal Complex.

An appreciable level of effort has been applied by MCO to identify and implement reasonable and feasible on-site noise controls since the commencement of open cut mining, particularly to minimise the impact of night-time noise emissions from the Moolarben Coal Complex. The noise management strategy and MCO's compliance with the noise limits specified in Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 is provided in **Section 2.4**, including:

- A description of real-time continuous noise monitoring, investigation of triggers and response protocol;
- The continuation of real-time monitoring, and the temporary stand-down of equipment, as required, as part of the response protocol for Real-Time Response Trigger Levels;
- A summary of operator-attended monitoring results showing MCO was in compliance with the Project Approval noise limits in the 2014, 2015 and 2016 reporting periods; and
- A summary of complaints received by MCO showing that the number of noise related complaints has diminished from a peak recorded in 2011/2012.

6.4.2 Moolarben Coal Complex Incorporating the Modification

Given the successful implementation of the noise management strategy for the existing operations, MCO has made allowances for noise attenuated mobile equipment and fixed plant associated with the Modification in order to comply with the Project Approval noise limits. However, further investigation of reasonable and feasible noise mitigation measures for the proposed Modification was necessary and was conducted in consultation with MCO particularly in relation to evening and night-time operations.

Guidelines for determining feasible and reasonable noise mitigation are presented in the INP and the EPA's Rail Infrastructure Noise Guideline (RING) (Appendix 6) which provides further definition of the key terms (refer **Appendix J**). In particular, the INP Section 1.4.5 Applying Noise Mitigation Strategies, states the following:

> *Where noise impacts are predicted, noise-source managers should seek to achieve the criteria by applying feasible and reasonable mitigation measures. In this context feasibility relates to engineering considerations and what can practically be built, and reasonableness relates to the application of judgment in arriving at a decision, taking into account the following factors:*
>
> - *Noise mitigation benefits - amount of noise reduction provided, number of people protected*
> - *Cost of mitigation - cost of mitigation versus benefit provided*
> - *Community views - aesthetic impacts and community wishes*
> - *Noise levels for affected land uses - existing and future levels, and changes in noise levels.*

The INP focuses on achieving the desired environmental noise outcomes without prescribed management or mitigation strategy to achieve PSNLs. In this way, the proponent is given maximum flexibility when designing and implementing a program of noise management and control applicable to its operations.

A number of iterative steps were undertaken to further develop noise mitigation measures for the Modification, including:

- Extensive preliminary noise modelling scenarios representative of the predicted maximum Modification noise emissions to identify any potential noise exceedances, which indicated that under the most noise enhancing conditions (i.e. inversion plus drainage) and without the implementation of additional mitigation measures, negligible to marginal exceedances of Project Approval noise limits may occur in the 2019 and 2021 scenarios (i.e. while Stage 1 open cut operations are coincident with Stage 2 open cut operations).

- Ranking the highest noise contributors and progressively introducing noise mitigation measures to appreciably reduce noise associated with the Modification.
- Evaluating various combinations of noise control and management measures to assess their relative effectiveness including (under inversion plus drainage conditions):
    - Shutting down auxiliary equipment;
    - Relocating fleet items from OC2 to more shielded locations in OC4; and/or
    - Progressively shutting down OC3 overburden or coal fleet items.

The preliminary modelling indicated that, with the implementation of standard noise controls described in **Section 2.4.2**, and additional mitigation under the most noise enhancing INP-assessable meteorological conditions, predicted noise levels would be consistent with those for the currently approved operations. The requirement to implement additional mitigation to maintain noise levels to within Project Approval noise limits would be determined through the continued use of the real-time monitoring system described in **Section 2.4.2**, which, as evidenced in **Section 2.5**, has been effective in maintaining compliance with noise limits to date.

MCO considers the continued use of real-time mitigation to be reasonable and feasible. On this basis, the predictive noise modelling and associated noise impact assessments for the Modification are presented in **Section 7**.

7 INTRUSIVE NOISE IMPACT ASSESSMENT

7.1 Daytime Operating Intrusive Noise Levels

The predicted daytime $L_{Aeq(15minute)}$ intrusive noise levels for the 2019, 2021 and 2026 operating scenarios are presented in **Table 20** for privately owned receivers in the vicinity of the Moolarben Coal Complex, together with the relevant Project Approval noise limits (**Appendices A1** and **A2**).

Table 20 Daytime Operating Intrusive Noise Years 2019, 2021 and 2026 (dBA re 20 µPa)

ID No and Landholder		Year 2019[1]		Year 2021[1]		Year 2026[1]		Project Approval Noise Limit
		Calm	Wind	Calm	Wind	Calm	Wind	
Cooks Gap								
37	Stewart	14	9	12	8	9	5	35
39	Sprigg	19	15	16	12	10	7	35
40	Devenish	17	12	14	11	10	7	35
41(a)	Libertis	20	15	16	12	10	7	35
41(b)	Libertis	17	12	20	15	15	11	35
60	Rayner & Mundey	14	10	17	13	14	10	35
61	Miller	16	12	19	16	16	13	35
70	Coventry	24	19	26	21	19	14	37
75	Ban	21	16	23	19	17	12	36
79	Nagle	18	13	22	17	16	12	35
80	Sebelic	18	13	21	17	16	12	35
82	Hungerford & Clemens	16	12	19	16	16	12	35
83	Wall	16	12	20	16	16	11	35
84	Sebelic	15	11	18	14	15	11	35
86	Harris	16	11	19	15	15	11	35
87	Howe	15	11	18	14	15	11	35
88	Meyers	14	10	15	11	13	9	35
89	Glover & Tomlinson	16	11	19	14	15	11	35
90	Powell	16	11	19	14	15	11	35
91	Graham	14	9	13	9	11	7	35
94	Mittemayer	18	13	19	15	15	11	35
95	Withington	17	12	18	14	15	11	35
96	Lazicic	17	12	18	13	15	11	35
97	Smith	16	11	17	13	14	10	35
98	Piper	16	12	16	12	14	10	35
99	Jenner & Jensen	16	11	14	10	12	8	35
100	Ellem	15	10	13	9	10	6	35
101	Hull	17	12	14	10	10	6	35
102	Roberts	17	12	14	10	10	6	35
103	Burnett & Grant	17	12	17	12	14	10	35
104	Deeben	17	12	15	11	12	8	35
105	Katsikaris	17	12	15	11	12	9	35
106	Reid	19	14	16	12	10	6	35

ID No and Landholder		Year 2019[1]		Year 2021[1]		Year 2026[1]		Project Approval Noise Limit
		Calm	Wind	Calm	Wind	Calm	Wind	
107	Raso	19	14	15	11	10	6	35
109	Evans	21	16	17	12	10	6	35
110	Thompson & Evans	21	16	16	12	10	6	35
111	McEwan	17	12	15	11	11	7	35
112	Croft	17	13	15	10	10	6	35
113	Ratcliff	18	13	15	11	10	6	35
119	Kearns	17	11	14	10	10	6	35
171	McGregor	15	10	15	11	13	9	35
180	Barrett	23	18	24	19	19	14	35
181	Forster	23	18	24	19	19	14	35
182	Dutoitcook	23	18	24	19	18	14	35
183	Steines	22	17	23	18	19	14	35
184(a)	Stevenson	22	17	23	18	18	13	35
184(b)	Stevenson	22	17	23	18	18	13	35
186	Adamson	20	15	21	16	17	12	35
187	Feeney	21	16	22	17	17	12	35
188	Fielding	17	12	16	12	13	8	35
189	Fay	20	15	21	17	17	12	35
190	Sahyoun	16	11	16	12	13	9	35
191	Lasham	19	15	21	17	17	13	35
192	Williams	18	13	20	16	16	11	35
194	Potts	15	11	16	12	13	8	35
195	Cottam	18	13	20	16	17	12	35
196	Saxberg & Weir	16	11	17	13	14	9	35
200	Grimshaw	15	11	17	12	14	10	35
201(a)	Towerton	15	11	15	11	13	8	35
201(b)	Towerton	15	10	16	12	12	8	35
202	Butler	15	11	17	13	14	10	35
203	Miller	17	13	18	14	14	10	35
204	Donnan	17	12	19	14	15	10	35
206	Marshall & Vella	18	13	19	15	15	11	35
207	Smith	16	12	16	12	13	9	35
208	Hasaart	17	12	17	13	13	9	35
209	Mawson	16	11	16	12	13	9	35
210	Tebutt	16	11	16	12	13	9	35
217	Patterson	20	15	17	13	13	9	35
218	Soady	20	13	17	12	13	9	35
219	Riger	18	13	17	12	13	10	35
220	Rusten & Smith	15	10	16	12	14	10	35
222	Purtell	18	13	17	12	13	9	35
223	Palmer & Stewart	18	13	16	12	13	9	35
224	Dupond	18	13	19	15	15	11	35

ID No and Landholder		Year 2019[1]		Year 2021[1]		Year 2026[1]		Project Approval Noise Limit
		Calm	Wind	Calm	Wind	Calm	Wind	
226	Muscat	17	12	19	15	15	11	35
227	Hughes	17	12	19	15	15	11	35
229	Lowe	17	12	20	16	16	11	35
230	Hoole & Rawlinson	17	12	20	16	16	11	35
231	Morrison & Benny	17	12	20	16	16	11	35
232	Haaring	17	12	20	16	16	11	35
233	Boal	17	12	20	16	16	11	35
234	Gaw	18	13	21	16	16	11	35
235	Wilson	18	14	21	16	16	12	35
236	Donovan	19	14	21	17	16	12	35
237	Stokes	18	14	21	17	16	12	35
238	Powell	19	14	22	17	16	12	35
300	Collins & Marshall	20	16	18	14	11	6	35
303	Ungaro	20	15	23	17	16	11	35
305	Barisic & Aul	20	15	21	17	16	11	35
306	Armstrong	21	16	22	17	18	13	35
307	Chant & Young	20	15	21	17	17	12	35
308	Dower	17	12	18	13	13	8	35
309	Maher	14	10	14	9	9	5	35
310	Death	14	11	14	10	10	5	35
312	Ioannou	13	9	12	8	9	4	35
313	Pracy	12	8	11	6	8	3	35
314	Ford	12	8	11	6	8	3	35
315	Richards & Uzelac	12	10	11	8	8	3	35
316	Vassel & Williams	12	10	11	8	8	3	35
317	Hore & Bingham	13	9	11	7	8	3	35
Ulan								
11(b)	Mullins & Imrie	11	23	11	24	11	18	35
255	Schmitz	17	13	17	13	13	8	35
256	Campbell & Frost	18	14	19	15	15	9	35
258	Elias	19	15	20	16	16	10	35

Note 1: Highest predicted noise level from the INP meteorological conditions (**Table 13**) for each receiver.
Note 2: Predicted noise level complies with the Project Approval noise limit.

7.2 Evening Operating Intrusive Noise Levels

The predicted evening $L_{Aeq(15minute)}$ intrusive noise levels for the 2019, 2021 and 2026 operating scenarios are presented in **Table 21** for privately owned receivers in the vicinity of the Moolarben Coal Complex, together with the relevant Project Approval noise limits (**Appendices A1** and **A2**).

Table 21 Evening Operating Intrusive Noise Levels Years 2019, 2021 and 2026 (dBA re 20 µPa)

ID No and Landholder		Year 2019[1]		Year 2021[1]		Year 2026[1]		Project Approval Noise Limit
		Calm	Wind	Calm	Wind	Calm	Wind	
Cooks Gap								
37	Stewart	15	31	13	29	10	23	35
39	Sprigg	20	31	16	31	10	27	35
40	Devenish	17	32	15	31	11	23	35
41(a)	Libertis	20	32	17	32	10	27	35
41(b)	Libertis	17	31	20	30	16	26	35
60	Rayner & Mundey	15	32	17	31	14	24	35
61	Miller	16	32	20	31	17	24	35
70	Coventry	24	35	26	36	19	32	37
75	Ban	21	34	24	34	18	31	36
79	Nagle	18	34	22	33	17	29	35
80	Sebelic	18	33	22	32	17	28	35
82	Hungerford & Clemens	16	32	20	31	16	24	35
83	Wall	16	32	21	30	16	25	35
84	Sebelic	15	32	18	30	15	24	35
86	Harris	16	31	20	29	16	25	35
87	Howe	15	32	18	30	15	25	35
88	Meyers	14	31	15	30	13	24	35
89	Glover & Tomlinson	16	31	19	30	15	25	35
90	Powell	16	30	19	30	15	25	35
91	Graham	14	31	14	29	11	23	35
94	Mittemayer	18	30	19	30	15	25	35
95	Withington	18	30	19	30	15	24	35
96	Lazicic	17	30	18	30	15	24	35
97	Smith	17	31	17	30	15	24	35
98	Piper	17	31	16	30	14	24	35
99	Jenner & Jensen	16	31	15	30	12	23	35
100	Ellem	16	31	13	31	10	23	35
101	Hull	17	31	15	30	10	26	35
102	Roberts	17	30	14	30	10	26	35
103	Burnett & Grant	17	30	17	30	14	24	35
104	Deeben	17	30	16	29	13	25	35
105	Katsikaris	17	30	16	29	13	25	35
106	Reid	19	31	16	30	10	26	35
107	Raso	19	31	16	31	10	27	35
109	Evans	21	30	17	30	11	26	35
110	Thompson & Evans	21	30	17	30	10	26	35
111	McEwan	18	30	15	29	12	26	35
112	Croft	18	29	15	29	10	26	35
113	Ratcliff	18	30	15	29	10	26	35
119	Kearns	17	31	14	30	10	24	35

ID No and Landholder		Year 2019[1]		Year 2021[1]		Year 2026[1]		Project Approval Noise Limit
		Calm	Wind	Calm	Wind	Calm	Wind	
171	McGregor	15	24	16	23	13	18	35
180	Barrett	24	33	25	33	19	30	35
181	Forster	24	30	24	32	20	26	35
182	Dutoitcook	23	33	24	33	19	30	35
183	Steines	23	32	24	32	19	29	35
184(a)	Stevenson	22	33	23	32	18	30	35
184(b)	Stevenson	22	32	23	32	18	29	35
186	Adamson	20	29	22	30	17	26	35
187	Feeney	21	32	22	32	18	29	35
188	Fielding	17	28	17	28	13	23	35
189	Fay	20	32	22	32	17	29	35
190	Sahyoun	16	28	17	28	14	22	35
191	Lasham	20	29	21	29	18	23	35
192	Williams	19	31	21	31	17	27	35
194	Potts	16	28	17	27	13	22	35
195	Cottam	18	30	21	30	17	26	35
196	Saxberg & Weir	16	28	18	27	14	23	35
200	Grimshaw	16	27	17	26	14	21	35
201(a)	Towerton	16	26	16	25	13	20	35
201(b)	Towerton	15	28	16	27	12	22	35
202	Butler	15	26	17	26	14	21	35
203	Miller	18	28	19	28	15	26	35
204	Donnan	18	30	19	30	15	26	35
206	Marshall & Vella	18	26	19	26	15	21	35
207	Smith	17	28	17	28	13	25	35
208	Hasaart	17	28	17	28	14	25	35
209	Mawson	17	27	17	27	13	25	35
210	Tebutt	16	27	17	27	13	25	35
217	Patterson	20	29	17	29	13	25	35
218	Soady	20	29	17	29	13	25	35
219	Riger	18	28	17	28	14	26	35
220	Rusten & Smith	15	25	16	24	14	20	35
222	Purtell	18	30	17	29	14	26	35
223	Palmer & Stewart	18	30	17	29	14	26	35
224	Dupond	18	30	19	30	15	25	35
226	Muscat	17	30	19	30	15	25	35
227	Hughes	17	31	20	30	16	25	35
229	Lowe	17	31	20	31	16	26	35
230	Hoole & Rawlinson	17	31	21	31	16	26	35
231	Morrison & Benny	17	31	21	30	16	26	35
232	Haaring	18	32	21	30	16	27	35
233	Boal	17	32	21	31	16	27	35

ID No and Landholder		Year 2019[1]		Year 2021[1]		Year 2026[1]		Project Approval Noise Limit
		Calm	Wind	Calm	Wind	Calm	Wind	
234	Gaw	18	32	21	31	16	27	35
235	Wilson	19	32	21	32	17	28	35
236	Donovan	19	32	22	32	17	28	35
237	Stokes	19	33	22	32	17	28	35
238	Powell	19	33	22	32	17	28	35
300	Collins & Marshall	20	30	18	32	11	27	35
303	Ungaro	20	30	23	32	16	26	35
305	Barisic & Aul	20	30	22	31	17	27	35
306	Armstrong	21	30	22	31	18	26	35
307	Chant & Young	21	30	22	31	17	25	35
308	Dower	17	29	18	30	13	25	35
309	Maher	14	28	14	29	10	25	35
310	Death	15	28	14	30	10	25	35
312	Ioannou	14	29	13	30	9	25	35
313	Pracy	13	28	12	29	9	25	35
314	Ford	12	28	11	29	8	25	35
315	Richards & Uzelac	13	28	11	30	8	25	35
316	Vassel & Williams	13	28	11	30	8	25	35
317	Hore & Bingham	14	29	12	30	8	26	35
Ulan								
11(b)	Mullins & Imrie	11	7	11	8	11	8	35
255	Schmitz	19	32	20	33	16	31	35
256	Campbell & Frost	18	32	19	32	15	31	35
258	Elias	19	32	20	33	16	31	35

Note 1: Highest predicted noise level from the INP meteorological conditions (**Table 13**) for each receiver.
Note 2: Predicted noise level complies with the Project Approval noise limit.

7.3 Night-time Operating Intrusive and Sleep Disturbance Noise Levels

The predicted night-time operating $L_{Aeq(15minute)}$ intrusive and sleep disturbance $L_{A1(1minute)}$ noise levels for the 2019, 2021 and 2026 operating scenarios are presented in **Table 22** for privately owned receivers in the vicinity of the Moolarben Coal Complex, together with the relevant Project Approval noise limits (**Appendices A1** and **A2**).

Table 22 Night-time Operating Intrusive and Sleep Disturbance Noise Levels (dBA re 20 µPa)

ID No and Landholder		Year 2019[1]			Year 2021[1]			Year 2026[1]			Project Approval Noise Limit
		Calm	Wind or Inver[2]	$L_{A1(1min)}$	Calm	Wind or Inver[2]	$L_{A1(1min)}$	Calm	Wind or Inver	$L_{A1(1min)}$	
Cooks Gap											
37	Stewart	15	32	37	13	30	35	10	25	30	35/45
39	Sprigg	20	32	37	17	32	37	10	29	34	35/45
40	Devenish	17	33	38	15	32	37	11	24	29	35/45
41(a)	Libertis	21	33	38	17	33	38	11	29	34	35/45
41(b)	Libertis	17	32	37	20	31	36	16	27	32	35/45
60	Rayner & Mundey	15	33	38	17	31	36	15	26	31	35/45
61	Miller	17	34	39	20	32	37	17	27	32	35/45
70	Coventry	24	36	41	27	37	42	20	34	39	37/45
75	Ban	22	36	41	24	36	41	18	34	38	36/45
79	Nagle	19	35	40	23	34	39	17	31	36	35/45
80	Sebelic	18	34	39	22	34	39	17	30	35	35/45
82	Hungerford & Clemens	16	34	38	20	32	37	16	27	32	35/45
83	Wall	17	33	38	21	31	36	16	28	33	35/45
84	Sebelic	15	33	38	19	31	36	16	26	31	35/45
86	Harris	16	32	37	20	30	35	16	27	32	35/45
87	Howe	16	33	38	19	31	36	16	27	32	35/45
88	Meyers	15	33	38	16	30	35	13	26	31	35/45
89	Glover & Tomlinson	16	32	37	19	31	36	16	27	31	35/45
90	Powell	16	32	37	19	31	36	16	27	32	35/45
91	Graham	14	32	37	14	30	35	11	25	30	35/45
94	Mittemayer	18	31	36	19	30	35	15	27	31	35/45
95	Withington	18	31	36	19	31	36	15	26	31	35/45
96	Lazicic	18	31	36	18	31	36	15	26	31	35/45
97	Smith	17	32	36	17	31	36	15	26	31	35/45
98	Piper	17	31	36	17	31	36	14	26	31	35/45
99	Jenner & Jensen	17	32	37	15	31	36	12	25	30	35/45
100	Ellem	16	32	37	13	31	36	10	25	30	35/45
101	Hull	18	32	37	15	31	36	10	28	33	35/45
102	Roberts	17	31	36	15	31	36	10	28	33	35/45
103	Burnett & Grant	17	31	36	17	30	35	15	26	31	35/45
104	Deeben	17	31	35	16	30	35	13	27	32	35/45
105	Katsikaris	18	31	36	16	30	35	13	27	32	35/45
106	Reid	19	32	37	17	31	36	10	28	33	35/45
107	Raso	19	32	37	16	32	37	10	28	33	35/45
109	Evans	22	31	36	17	31	36	11	28	33	35/45
110	Thompson & Evans	22	31	36	17	31	36	10	28	33	35/45
111	McEwan	18	30	35	16	30	35	12	27	32	35/45

ID No and Landholder		Year 2019[1]			Year 2021[1]			Year 2026[1]			Project Approval Noise Limit
		Calm	Wind or Inver[2]	$L_{A1(1min)}$	Calm	Wind or Inver[2]	$L_{A1(1min)}$	Calm	Wind or Inver	$L_{A1(1min)}$	
112	Croft	18	30	35	15	30	35	10	28	33	35/45
113	Ratcliff	19	31	36	16	29	34	10	28	33	35/45
119	Kearns	17	32	37	14	31	36	10	26	31	35/45
171	McGregor	15	24	29	16	23	28	13	19	24	35/45
180	Barrett	24	35	39	25	35	40	20	32	37	35/45
181	Forster	24	31	36	25	32	37	20	28	33	35/45
182	Dutoitcook	24	34	39	24	34	39	19	32	37	35/45
183	Steines	23	33	38	24	33	38	20	31	36	35/45
184(a)	Stevenson	22	34	39	23	33	38	18	32	37	35/45
184(b)	Stevenson	23	34	38	23	33	38	19	31	36	35/45
186	Adamson	21	30	35	22	31	36	17	28	33	35/45
187	Feeney	22	33	38	23	33	38	18	31	36	35/45
188	Fielding	17	29	34	17	29	34	13	24	29	35/45
189	Fay	21	33	38	22	32	37	18	31	36	35/45
190	Sahyoun	17	29	34	17	29	34	14	24	29	35/45
191	Lasham	20	30	35	21	30	35	18	24	29	35/45
192	Williams	19	32	37	21	32	37	17	29	34	35/45
194	Potts	16	29	33	17	28	32	14	24	29	35/45
195	Cottam	18	32	37	21	30	35	17	28	33	35/45
196	Saxberg & Weir	16	29	34	18	27	32	15	24	29	35/45
200	Grimshaw	16	27	32	17	26	31	14	23	27	35/45
201(a)	Towerton	16	27	32	16	26	31	13	22	27	35/45
201(b)	Towerton	15	29	34	16	27	32	12	24	29	35/45
202	Butler	16	27	32	17	26	31	14	23	27	35/45
203	Miller	18	29	34	19	28	33	15	27	32	35/45
204	Donnan	18	30	35	19	30	35	15	28	33	35/45
206	Marshall & Vella	19	27	32	19	26	31	16	22	27	35/45
207	Smith	17	29	34	17	28	33	14	27	31	35/45
208	Hasaart	17	29	34	18	29	34	14	27	32	35/45
209	Mawson	17	28	33	17	27	32	14	26	31	35/45
210	Tebutt	17	28	33	17	27	32	14	26	31	35/45
217	Patterson	21	30	35	18	30	34	14	27	32	35/45
218	Soady	20	30	35	17	29	34	13	27	32	35/45
219	Riger	19	29	34	17	28	33	14	27	32	35/45
220	Rusten & Smith	15	26	31	16	25	30	14	21	26	35/45
222	Purtell	19	30	35	17	30	35	14	28	32	35/45
223	Palmer & Stewart	18	31	36	17	30	35	14	28	32	35/45
224	Dupond	18	31	36	20	31	35	16	27	31	35/45
226	Muscat	18	31	36	20	30	35	16	27	32	35/45
227	Hughes	17	32	37	20	31	36	16	27	32	35/45
229	Lowe	17	32	37	21	32	36	16	28	33	35/45

ID No and Landholder		Year 2019[1]			Year 2021[1]			Year 2026[1]			Project Approval Noise Limit
		Calm	Wind or Inver[2]	$L_{A1(1min)}$	Calm	Wind or Inver[2]	$L_{A1(1min)}$	Calm	Wind or Inver	$L_{A1(1min)}$	
230	Hoole & Rawlinson	17	32	37	21	32	36	16	28	33	35/45
231	Morrison & Benny	17	32	37	21	31	36	16	28	33	35/45
232	Haaring	18	33	38	21	31	36	16	29	34	35/45
233	Boal	18	33	38	21	31	36	16	29	34	35/45
234	Gaw	18	33	38	21	32	37	17	29	34	35/45
235	Wilson	19	33	38	22	33	38	17	30	35	35/45
236	Donovan	19	33	38	22	33	38	17	30	35	35/45
237	Stokes	19	34	39	22	33	38	17	30	35	35/45
238	Powell	19	34	39	22	34	39	17	30	35	35/45
300	Collins & Marshall	21	31	36	19	33	37	12	29	34	35/45
303	Ungaro	21	31	36	23	33	38	16	28	33	35/45
305	Barisic & Aul	20	31	35	22	32	37	17	29	34	35/45
306	Armstrong	22	31	36	23	32	37	19	28	33	35/45
307	Chant & Young	21	30	35	22	32	37	17	27	32	35/45
308	Dower	17	29	34	18	31	36	13	27	32	35/45
309	Maher	14	29	34	14	30	35	10	27	32	35/45
310	Death	15	29	34	14	31	36	10	27	32	35/45
312	Ioannou	14	29	34	13	30	35	9	27	32	35/45
313	Pracy	13	29	34	12	30	35	9	27	32	35/45
314	Ford	12	29	34	11	30	35	9	27	32	35/45
315	Richards & Uzelac	13	29	34	11	31	35	8	28	32	35/45
316	Vassel & Williams	13	30	35	11	31	36	8	28	33	35/45
317	Hore & Bingham	14	30	35	12	31	36	9	28	33	35/45
Ulan											
11(b)	Mullins & Imrie	11	24	29	11	26	31	11	25	30	35/45
255	Schmitz	19	34	37	21	35	38	17	34	38	35/45
256	Campbell & Frost	18	33	38	19	34	39	15	34	39	35/45
258	Elias	19	34	39	21	35	40	17	34	39	35/45

Note 1: Highest predicted noise level from the INP meteorological conditions (**Table 13**) for each receiver.
Note 2: Predicted noise level incorporate the implementation of real-time controls.
Note 3: Predicted noise level complies with the Project Approval noise limit.

7.4 Impact Assessment Summary

In summary, the predicted daytime, evening and night-time intrusive $L_{Aeq(15minute)}$ noise levels and night-time maximum $L_{A1(1minute)}$ noise levels for the 2019, 2021 and 2026 operating scenarios show:

- Compliance is generally determined by evening and night-time noise levels, due to the noise-enhancing meteorological conditions (**Table 13**) that occur during the evening and night-time; and
- No exceedance of the Project Approval noise limits are predicted during the daytime, evening and night-time (**Table 20, Table 21** and **Table 22**) at any privately owned receivers.

7.5 Privately Owned Vacant Land Impact Assessment

The outer envelope night-time $L_{Aeq(15minute)}$ intrusive noise contours for years 2019, 2021 and 2026 are presented in **Appendices K1** to **K3**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2 dBA. This means that, in some cases, the noise contours will differ slightly from the values in **Table 22**, which are calculated at the individual receptor locations and are therefore more accurate predictions.

Based on the noise impact assessment methodology as guided by the VLAMP and presented in **Table 19**, noise impacts on vacant land have been assessed on the basis that any vacant land is permitted to have a dwelling. In the years 2019, 2021 and 2026, the night-time 45 dBA intrusive $L_{Aeq(15minute)}$ noise contour is predicted to fall short of the nearest privately owned vacant land (34 Rheinberger) and therefore, remain below the maximum recommended rural residential night-time ($L_{Aeq(9\ hour)}$) noise amenity level of 45 dBA in accordance with the INP.

8 NOISE AMENITY IMPACT ASSESSMENT

8.1 Modification Operating Noise Amenity Levels

The predicted daytime, evening and night-time $L_{Aeq(period)}$ noise amenity levels for the 2019, 2021 and 2026 operating scenarios are presented in **Table 23** for privately owned receivers as well as schools, churches and commercial receivers in Ulan Village in the vicinity of the Moolarben Coal Complex.

Table 23 Daytime, Evening and Night-time Noise Amenity Years 2019, 2021 and 2026 (dBA re 20 µPa)

ID No and Landholder		Year 2019[1]			Year 2021[1]			Year 2026[1]		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Cooks Gap										
37	Stewart	12	28	31	10	26	28	7	20	23
39	Sprigg	17	28	31	14	28	30	8	24	27
40	Devenish	14	29	32	12	28	31	8	20	22
41(a)	Libertis	17	29	32	14	29	31	8	25	27
41(b)	Libertis	14	28	30	17	28	30	13	23	25
60	Rayner & Mundey	12	29	32	14	28	30	12	21	24
61	Miller	14	29	32	17	28	31	14	22	25
70	Coventry	21	32	35	23	33	36	16	29	32
75	Ban	18	31	34	21	32	34	15	28	31
79	Nagle	15	31	34	19	31	33	14	26	29
80	Sebelic	15	30	33	19	30	32	14	25	28
82	Hungerford & Clemens	13	29	32	17	28	31	13	22	25
83	Wall	13	29	32	18	28	30	13	23	26
84	Sebelic	12	29	32	16	27	29	13	21	24
86	Harris	13	28	31	17	27	29	13	22	25
87	Howe	13	29	31	16	27	29	12	22	25
88	Meyers	12	29	31	13	27	29	10	21	24
89	Glover & Tomlinson	13	28	30	16	27	30	12	22	24
90	Powell	13	28	30	16	28	30	12	22	24
91	Graham	11	28	31	11	26	29	8	21	23
94	Mittemayer	15	27	30	16	27	29	12	22	24
95	Withington	15	28	30	16	27	30	12	22	24
96	Lazicic	14	28	30	15	27	30	12	22	24
97	Smith	13	28	30	14	27	30	12	22	24
98	Piper	14	28	30	13	27	30	11	21	23
99	Jenner & Jensen	13	28	30	12	27	30	9	21	23
100	Ellem	13	28	31	10	28	30	7	20	23
101	Hull	14	28	30	12	27	30	7	23	26
102	Roberts	14	27	30	12	27	29	7	23	26
103	Burnett & Grant	14	27	30	14	27	29	11	22	24
104	Deeben	14	27	29	13	26	29	10	23	25
105	Katsikaris	14	27	29	13	26	29	10	23	25
106	Reid	16	28	30	13	28	30	7	23	26
107	Raso	16	28	30	13	28	30	7	24	26
109	Evans	18	28	30	14	27	30	8	23	26
110	Thompson & Evans	18	28	30	14	27	29	8	23	26

ID No and Landholder		Year 2019[1]			Year 2021[1]			Year 2026[1]		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
111	McEwan	15	27	29	12	27	29	9	23	25
112	Croft	15	27	29	12	27	29	7	23	26
113	Ratcliff	15	27	29	13	26	28	7	23	26
119	Kearns	14	28	31	11	27	30	8	21	24
171	McGregor	12	21	23	13	21	22	10	17	18
180	Barrett	21	31	33	21	31	33	16	27	30
181	Forster	21	28	30	21	29	31	16	24	26
182	Dutoitcook	20	30	33	21	30	33	16	27	30
183	Steines	20	29	32	21	30	32	16	27	29
184(a)	Stevenson	19	30	33	20	30	32	15	27	30
184(b)	Stevenson	19	30	32	20	30	32	15	27	29
186	Adamson	17	27	29	18	27	30	14	23	26
187	Feeney	18	29	32	19	29	32	15	26	29
188	Fielding	14	26	28	14	26	28	10	20	23
189	Fay	17	29	32	19	29	31	14	26	29
190	Sahyoun	13	25	28	14	25	27	11	20	22
191	Lasham	17	26	29	18	27	29	15	21	23
192	Williams	15	28	31	18	28	31	13	24	27
194	Potts	13	25	27	14	24	26	10	20	22
195	Cottam	15	28	30	18	27	29	14	24	26
196	Saxberg & Weir	13	25	27	15	24	26	11	20	22
200	Grimshaw	13	24	26	14	23	25	11	19	21
201(a)	Towerton	13	24	26	13	23	25	10	18	20
201(b)	Towerton	12	25	27	14	24	26	9	20	22
202	Butler	12	24	26	15	23	25	11	19	21
203	Miller	15	26	28	16	25	27	12	23	25
204	Donnan	15	27	29	16	27	29	12	24	26
206	Marshall & Vella	15	24	26	16	24	25	13	19	20
207	Smith	14	26	28	14	25	27	10	22	25
208	Hasaart	14	26	28	14	26	28	11	22	25
209	Mawson	13	25	27	14	24	26	10	22	25
210	Tebutt	13	24	27	14	24	26	10	22	24
217	Patterson	17	27	29	14	26	28	11	23	25
218	Soady	16	27	29	14	26	28	10	23	25
219	Riger	15	26	28	14	25	27	11	23	25
220	Rusten & Smith	12	23	25	13	22	24	11	18	20
222	Purtell	15	27	29	14	27	29	11	23	26
223	Palmer & Stewart	15	27	29	14	26	29	11	23	25
224	Dupond	15	27	30	16	27	29	12	22	24
226	Muscat	14	27	30	16	27	29	12	23	25
227	Hughes	14	28	30	17	28	30	13	23	25
229	Lowe	14	28	30	17	28	30	13	23	26
230	Hoole & Rawlinson	14	28	31	18	28	30	13	23	26
231	Morrison & Benny	14	28	31	17	27	30	13	24	26
232	Haaring	14	29	31	18	28	30	13	24	27

ID No and Landholder		Year 2019[1]			Year 2021[1]			Year 2026[1]		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
233	Boal	14	29	32	18	28	30	13	24	27
234	Gaw	15	29	32	18	28	31	13	24	27
235	Wilson	16	29	32	18	29	31	14	25	28
236	Donovan	16	29	32	19	29	32	14	25	28
237	Stokes	16	30	33	19	30	32	14	25	28
238	Powell	16	30	33	19	30	32	14	26	28
300	Collins & Marshall	17	28	30	16	29	32	9	24	27
303	Ungaro	17	27	30	20	30	32	13	24	26
305	Barisic & Aul	17	27	29	19	29	31	14	24	27
306	Armstrong	18	27	30	19	29	31	15	24	26
307	Chant & Young	18	27	30	19	29	31	14	23	25
308	Dower	14	26	28	15	27	30	10	22	25
309	Maher	12	25	28	11	26	29	7	22	25
310	Death	12	26	28	11	27	29	7	22	25
312	Ioannou	11	26	28	10	27	29	6	22	25
313	Pracy	10	25	28	9	26	29	6	22	25
314	Ford	9	25	28	8	26	29	5	22	25
315	Richards & Uzelac	11	25	28	9	27	29	5	22	25
316	Vassel & Williams	11	26	28	9	27	29	5	23	26
317	Hore & Bingham	11	26	29	9	27	30	5	23	26
Ulan										
11(a)	Mullins & Imrie	23	10	22	24	10	24	23	10	22
11(b)	Mullins & Imrie	19	9	19	21	10	20	20	10	20
11(c)	Mullins & Imrie	21	11	21	22	11	23	22	11	22
255	Schmitz	14	27	31	15	28	31	10	27	31
256	Campbell & Frost	15	29	32	16	30	33	12	28	32
258	Elias	16	30	33	17	30	34	13	28	32
Ulan Village Non-residential										
9	Orica Australia Pty Limited	24	35	38	27	37	40	20	33	36
26	Forty North P/L	23	32	35	24	34	37	21	32	35
46B	North Eastern Wiradjuri Wilpinjong Community Fund Limited	29	39	42	30	40	43	29	39	43
66	Rostherne P/L	28	38	41	29	39	42	28	38	41
149	Mid Western Regional Council	28	38	41	29	39	43	27	39	42
160[5]	Minister for Education and Training (Ulan Public School)	27	38	41	28	39	42	27	38	41
162	Rowmint P/L	28	38	41	29	39	42	28	38	41
168	PJL Constructions Pty Limited (Church)	28	38	41	29	39	42	28	38	42

Note 1: Highest predicted noise level from the INP meteorological conditions (**Table 13**) for each receiver.

Note 2: Predicted noise level complies with the noise amenity levels (Table 16).

8.2 Impact Assessment Summary

In summary, the predicted daytime, evening and night-time $L_{Aeq(period)}$ noise amenity levels for the 2019, 2021, and 2026 operating scenarios show that:

- Compliance is generally determined by evening and night-time noise levels, due to the noise enhancing meteorological conditions (refer **Table 13**) that occur during the evening and night-time;
- No exceedance of the PSNL (**Table 16**) and Project Approval noise limits are predicted during the daytime, evening and night-time (**Table 23**) at any school or church;
- There is no exceedance of the relevant amenity PSNL (**Table 16**) at all privately owned receivers; and
- There is no exceedance of the relevant amenity PSNL (**Table 16**) at all commercial receivers.

Based on the outer envelope night-time $L_{Aeq(15minute)}$ intrusive noise contours for year 2019, 2021 and 2026 presented in **Appendices K1** to **K3**, the noise levels at Goulburn River National Park and Munghorn Gap Nature Reserve are unlikely to exceed the relevant amenity PNSL (and Project Approval noise limit) of $L_{Aeq(period)}$ 50 dBA.

9 CUMULATIVE NOISE AMENITY ASSESSMENT

9.1 $L_{Aeq(Period)}$ Noise Amenity Criteria, Impact Assessment and Summary

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ noise amenity levels for all industrial noise sources only (i.e. non-transport related) for a particular land use. It is noted that the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources, but rather seeks to control cumulative noise via the $L_{Aeq(period)}$ noise amenity criterion (refer **Section 5.1**).

A summary of the major existing, approved and proposed industrial developments in the vicinity of Moolarben Coal Complex are presented in **Table 2**. The Ulan West Modification Environmental Assessment (EA) was prepared by Umwelt on behalf of UCML and includes the repositioning of approved ventilation shafts and dewatering bores as well as the installation of additional ventilation shafts and associated surface infrastructure. The Ulan West Modification Noise Impact Assessment (EA Appendix 7) Section 5.4 concludes that the cumulative noise impact assessment criteria will not be exceeded due to the UCML modification and is therefore not further considered in this report.

The predicted noise amenity levels from the Moolarben Coal Complex incorporating the Modification, Ulan Continued Operations Project and Wilpinjong Extension Project were also conservatively considered. The estimated mine operating evening and night-time $L_{Aeq(period)}$ noise amenity levels from each of these developments have been established by reviewing the relevant EAs (where available). These are then used for the purposes of the cumulative evening and night-time noise amenity assessment.

It should be noted that for each of the developments noted above, the likelihood of the existing, approved and proposed developments emitting simultaneous maximum noise emissions is remote, due to the range of development locations and directional and other differences in the noise-enhancing weather effects. This cumulative assessment is therefore considered to be conservative.

In accordance with the INP Chapter 2 Industrial Noise Criteria, the evening cumulative sum of the existing, approved and proposed developments $L_{Aeq(4hour)}$ noise amenity levels have been determined (**Appendix L1**). Similarly, the night-time cumulative sum of the existing, approved and proposed developments $L_{Aeq(9hour)}$ noise amenity levels have been determined (**Appendix L2**). In summary, the predicted daytime, evening and night-time (cumulative) noise amenity levels show that:

- No exceedance of the INP acceptable evening and night-time noise amenity levels (**Table 15**) are predicted at any privately owned receivers due to potential cumulative impacts; and
- No exceedance of the INP acceptable evening and night-time noise amenity levels (**Table 15**) are predicted at any school, church or commercial receivers due to potential cumulative impacts.

10 OFF-SITE RAIL TRANSPORT

10.1 Rail Generating Developments Noise Assessment Criteria

The ARTC operates the Hunter Valley Rail Network in NSW and the extent of the network is shown in the Hunter Valley Corridor Network Diagram attached as **Appendix M1**. Noise emissions from the ARTC's railways are regulated via their EPL No 3142, revision date 22 June 2017 (refer **Appendix M2**).

In addition, the EPA RING (EPA, May 2013) specifies noise and vibration trigger levels for (new and existing) heavy and light rail infrastructure projects. However, land use developments other than rail infrastructure projects (i.e. mining and extractive industries) that are likely to generate additional rail traffic on an existing rail network (i.e. the Modification) with potential noise impacts are assessed against the requirements detailed in the RING Appendix 2 (refer **Appendix M3**).

As a result, the rail noise assessment criteria from the ARTC's EPL and EPA's RING (Appendix 2) are similar and the Modification has been assessed against the requirements of the RING (Appendix 2). The rail noise assessment trigger levels are reproduced in **Table 24**.

Table 24 RING (Appendix 2) Rail Noise Assessment Trigger Levels

Railway	Descriptor	Rail Noise Assessment Trigger Levels
Main North, Merriwa and Gulgong to Sandy Hollow lines	Daytime/evening $L_{Aeq(15hour)}$	65 dBA
	Night-time $L_{Aeq(9hour)}$	60 dBA
	Maximum Pass-by [L_{Amax} (95^{th} percentile)]	85 dBA

Note: 95th percentile equates to the 5% exceedance value.

10.2 Gulgong to Sandy Hollow Railway Traffic

The existing, approved, operating and proposed daytime, night-time and 24-hour train movements are presented in **Table 25** together with the estimated operating conditions whilst travelling on the Gulgong to Sandy Hollow Railway. The train movement analysis assumes that the existing and approved Bylong, Ulan, Moolarben and Wilpinjong mines operate at approved capacities and the cumulative coal train movements are unconstrained by the existing railway capacity.

For the proposed increases in rail movements for the Modification, it has been assumed that the additional 1 train per day on average (equivalent to 2 movements) could occur during the day or during the night. The additional 2 trains per day at peak could both occur during the day (4 movements) or 1 could occur during the night (2 movements).

Table 25 Gulgong to Sandy Hollow Railway Train Movements[1] - Unconstrained

Status	Train Type	Train Movements						Train Length (m)	Train Speed (kph)
		Daytime		Night-time		24 Hours			
		Mean	Peak	Mean	Peak	Mean	Peak		
Existing	Passenger	0	0	0	0	0	0	-	-
	Freight	2	2	0	0	2	2	850	60
Proposed Mine	Bylong Coal Project[2]	4.4	15	0	5	4.4	20	1543	60
Operating Mines	Ulan Continued Operations[3]	9	14	5	6	14	20	1543	60
	Moolarben Coal Complex[4]	10	13	4	5	14	18	1543	60
	Wilpinjong Extension Project[5]	9	14	3	6	12	20	1543	60
The Modification	Moolarben Open Cut Optimisation Modification	2	4	2	2	2	4	1543	60
Cumulative Existing + Proposed/Operating mines		34.4	58	12	22	46.4	80		
Cumulative Existing + Proposed/Operating mines + the Modification		36.4	62	14	24	48.4	84		
Existing + Unconstrained Cumulative Proposed/Operating Mines		34.4	58	12	22	46.4	80		
The Modification		**2**	**4**	**2**	**2**	**2**	**4**		
Existing + Unconstrained Cumulative Proposed/Operating Mines + the Modification		36.4	62	14	24	48.4	84		
% Increase due to the Modification		6%	7%	17%	9%	4%	5%		

Note 1: Two movements equals one arrival and departure of a single train.
Note 2: Bylong Coal Project DP&E Preliminary Environmental Assessment draft Development Consent conditions.
Note 3 Ulan Coal Continued Operations Noise and Vibration Assessment (Wilkinson Murray Pty Ltd, 2009).
Note 4: Moolarben Coal Complex UG1 Optimisation Modification Noise Assessment (SLR, 2015).
Note 5: Wilpinjong Extension Project Noise and Blasting Assessment (SLR, 2015).

As can be seen from **Table 25**, the peak percentage increase due to the Modification would comprise less than 10% of (unconstrained) cumulative train movements along the railway.

In addition, it is noted operating capacities for the Gulgong to Sandy Hollow Railway are described in the ARTC's 2016-2025 Hunter Valley Corridor Capacity Strategy (ARTC, 2016), with the physical capacity of the rail line constraining daily train movements in practice. As such, it is likely actual train movements would be fewer than those presented in **Table 25** for an unconstrained scenario. The assessed unconstrained scenario, therefore, considers a greater potential noise impact than is likely to occur and provides a more conservative assessment. As the unconstrained scenario was assessed not to cause an unacceptable impact on any private receivers, the lower noise impacts that would be associated with a constrained scenario have not been separately assessed.

10.3 Noise Modelling Methodology

The calculation of the daytime and night-time equivalent continuous noise levels and the maximum pass-by levels have been conducted using the Nordic Rail Prediction Method (1994) with corrections for NSW trains (SLR Consulting Australia Pty Ltd, 2007). The noise predictions from the modified method have been previously accepted by proponents, the NSW EPA and NSW DP&E.

The prediction model uses characteristic noise levels for the various sources (locomotive engine and exhaust noise as a function of throttle notch, wheel/rail noise as a function of train speed, and wagon type, etc.) at a fixed reference distance. The model then makes adjustments for the train length, distance from the track (assuming no barriers), angle of view (assuming 180 degrees) and facade reflection. Parameters including the daytime $L_{Aeq(15hour)}$, night-time $L_{Aeq(9hour)}$ and maximum (5% exceedance) pass-by level, can then be determined by summing the effects of the individual noise sources and by incorporating the number of train events.

Note, the model assumes no intervening structures (i.e. existing topography, buildings and the like), therefore, the predicted noise levels are indicative and in some cases likely to be conservative at some receiver distances.

10.4 Gulgong to Sandy Hollow Railway Noise Prediction

10.4.1 Daytime Operations

The daytime $L_{Aeq(15hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and proposed/operating rail traffic are presented in **Table 26** together with the cumulative existing and proposed/operating and the Modification. Train movements are considered on an average and peak basis.

Table 26 Daytime Predicted Rail Traffic Noise (dBA re 20 µPa)

Distance to Receiver	Existing + Unconstrained Cumulative Proposed/Operating Mines			Existing + Unconstrained Cumulative Proposed/Operating Mines + the Modification			Increase in Noise Levels	
	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$	Passby Maximum	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$	Passby Maximum	Average $L_{Aeq(15hour)}$	Peak $L_{Aeq(15hour)}$
30 m	66	68	89	66	69	89	0.2	0.3
60 m	63	65	86	63	66	86	0.2	0.3
90 m	61	64	84	61	64	84	0.2	0.3
120 m	60	62	82	60	63	82	0.2	0.3
150 m	59	61	81	59	62	81	0.2	0.3

Note 1: Train movements are considered on an average and peak basis.

The following assessments are derived from the predicted rail traffic noise levels:

- A comparison of the existing and proposed/operating average $L_{Aeq(15hour)}$ rail noise with the cumulative existing, proposed/operating and the Modification levels indicates that the daytime rail noise would increase by up to 0.2 dBA.
- The existing and proposed/operating average $L_{Aeq(15hour)}$ rail noise meets the 65 dBA criterion at a distance of 34 m (and greater). The cumulative existing, proposed/operating and the Modification average $L_{Aeq(15hour)}$ rail noise level meets the 65 dBA criterion at a distance of 36 m (and greater).
- A comparison of the existing and proposed/operating peak $L_{Aeq(15hour)}$ rail noise with the cumulative existing, proposed/operating and the Modification levels indicates that the daytime rail noise would increase by up to 0.3 dBA.
- The existing and proposed/operating peak $L_{Aeq(15hour)}$ rail noise meets the 65 dBA criterion at a distance of 57 m (and greater). The cumulative existing, proposed/operating and the Modification peak $L_{Aeq(15hour)}$ rail noise meets the 65 dBA criterion at a distance of 61 m (and greater).
- The existing and proposed/operating maximum pass-by noise level would remain unchanged due to the Modification and would continue to meet the criterion of 85 dBA at a distance of 61 m (and greater).

- All privately owned receivers in the vicinity of the Modification (i.e. Ulan, Araluen, Wollar, Mogo and Barigan villages) are located well beyond 61 m from the Gulgong to Sandy Hollow railway line.

10.4.2 Night-time Operations

The night-time $L_{Aeq(9hour)}$ and maximum (5% exceedance) pass-by noise levels for the existing and proposed/operating rail traffic are presented in **Table 27** together with the cumulative existing and proposed/operating and the Modification. Train movements are considered on an average and peak basis.

Table 27 Night-time Predicted Rail Traffic Noise (dBA re 20 µPa)

Distance to Receiver	Existing + Unconstrained Cumulative Proposed/Operating Mines			Existing + Unconstrained Cumulative Proposed/Operating Mines + the Modification			Increase in Noise Levels	
	Average $L_{Aeq(9hour)}$	Peak $L_{Aeq(9hour)}$	Passby Maximum	Average $L_{Aeq(9hour)}$	Peak $L_{Aeq(9hour)}$	Passby Maximum	Average $L_{Aeq(9hour)}$	Peak $L_{Aeq(9hour)}$
30 m	64	66	87	64	66	87	0.7	0.4
60 m	61	63	84	61	63	84	0.7	0.4
90 m	59	61	82	60	62	82	0.7	0.4
120 m	58	60	80	58	60	80	0.7	0.4
150 m	57	59	79	57	59	79	0.7	0.4

Note 1: Train movements are considered on an average and peak basis.

The following assessments are derived from the predicted rail traffic noise levels:

- A comparison of the existing and proposed/operating average $L_{Aeq(9hour)}$ rail noise with the cumulative existing, proposed/operating and the Modification levels indicates that the night-time rail noise would increase by up to 0.7 dBA.
- The existing and proposed/operating average $L_{Aeq(9hour)}$ rail noise meets the 60 dBA criterion at a distance of 63 m (and greater). The cumulative existing, proposed/operating and the Modification average $L_{Aeq(9hour)}$ rail noise level meets the 60 dBA criterion at a distance of 73 m (and greater).
- A comparison of the existing and proposed/operating peak $L_{Aeq(9hour)}$ rail noise with the cumulative existing, proposed/operating and the Modification levels indicates that the night-time rail noise would increase by up to 0.4 dBA.
- The existing and proposed/operating peak $L_{Aeq(9hour)}$ rail noise meets the 60 dBA criterion at a distance of 105 m (and greater). The cumulative existing, proposed/operating and the Modification peak $L_{Aeq(9hour)}$ rail noise meets the 60 dBA criterion at a distance of 115 m (and greater).
- The existing and proposed/operating maximum pass-by noise level would remain unchanged due to the Modification and would continue to meet the criterion of 85 dBA at a distance of 40 m (and greater).
- All privately owned receivers in the vicinity of the Modification (i.e. Ulan, Araluen, Wollar, Mogo and Barigan villages) are located well beyond 115 m from the Gulgong to Sandy Hollow railway line.

10.5 Impact Assessment Summary

For the existing and proposed/operating train movements, rail noise levels exceed both the daytime and night-time RING criteria within:

- 34 m for average daytime, and 57 m for peak daytime rail noise; and
- 63 m for average night-time, and 105 m for peak night-time rail noise.

The predicted increase in cumulative rail noise impacts due to the Modification would result in an increase in the distance at which compliance with RING criteria is predicted from:

- 34 m to 36 m for average daytime, and 57 m to 61 m for peak daytime rail noise; and
- 63 m to 73 m for average night-time, and 105 m to 115 m for peak night-time rail noise.

The predicted increase in cumulative rail noise levels due to the Modification is:

- 0.2 to 0.3 dB for the daytime; and
- 0.4 to 0.7 dB for the night-time.

The predicted increase in noise levels due to the Modification is less than 2 dB for all scenarios, and as such, is unlikely to be perceptible.

It should be noted that noise levels from rail movements is controlled by the ARTC via EPL 3142. Consistent with Schedule 3, Condition 6(d) of Project Approval (05_011) MCP Stage 1, MCO will continue to only use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL to minimise noise emissions from the additional rail movements associated with the Modification.

11 BLASTING IMPACT ASSESSMENT

11.1 Blasting Assessment Criteria

11.1.1 Australian Standard Criteria

Australian Standard (AS) 2187: Part 2-2006 *Explosives - Storage and Use - Part 2: Use of Explosives* provides guidance in assessing blast-induced ground (and structural) vibration and airblast effects on buildings and their occupants; details are presented in Appendix J of AS 2187.

Recommended vibration limits are based on international standards (or studies) as presented in Appendix J Tables J4.5(A) and J4.5(B) of AS 2187, for human comfort and structural building damage, respectively. Similarly, recommended human comfort and structural damage airblast limits are presented in Appendix J Tables J5.4(A) and J5.4(B) AS 2187, respectively.

The guideline *Assessing Vibration: A Technical Guideline* (DEC, 2006) specifically does not consider blasting-induced vibration; therefore, this guideline is not discussed further.

11.1.2 Human Comfort Noise and Vibration Criteria

Ground vibration and airblast levels that cause human discomfort are lower than recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally ensures that the potential to cause structural damage is negligible. The currently adopted limits for assessing potential annoyance from blasting during daytime hours are as per the ANZEC *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* dated September 1990, as follows:

- The recommended maximum level for airblast is 115 dB Linear.
- The level of 115 dB Linear may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dB Linear at any time.
- The recommended maximum for ground vibration is 5 mm/s, Peak Vector Sum (PVS) vibration velocity.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

The ANZEC criteria are generally consistent with AS 2187: Part 2-2006 Appendix J Tables J4.5(A) and J5.4(A) with respect to vibration and airblast human comfort, respectively.

11.1.3 Livestock Comfort Noise and Vibration Criteria

In a study by Casaday and Lehmann (1967) (*Responses of Farm Animals to Sonic Booms*) animal installations were selected for observations on animal behaviour under sonic boom conditions. The number of animals observed in this study included approximately 10,000 commercial feedlot beef cattle, 100 horses, 150 sheep and 320 lactating dairy cattle. Booms during the test period were scheduled at varying intervals during the morning hours on Monday to Friday of each week.

Results of the study showed that the reactions of the sheep and horses to sonic booms were slight. Dairy cattle were little affected by sonic booms (125 dB to 136 dB). Only 19 of 104 booms produced even a mild reaction, as evidenced by a temporary cessation of eating, rising of heads, or slight startle effects in a few of those being milked. Milk production was not affected during the test period, as evidenced by total and individual milk yield. The researchers developed a summary by species and farms, indicating that the few abnormal behavioural changes observed were well within the range of activity variation within a group of animals. They defined these changes as horses jumping up and galloping around the paddock, bellowing of dairy cattle, and increased activity by beef cattle (Casaday and Lehmann, 1967). In order to provide for a conservative assessment, the lowest airblast exposure studied (125 dB) was adopted as a criterion for the purposes of assessment of livestock impacts.

Similarly, an investigation (Heggies Pty Ltd, 2006) was conducted to determine the vibration levels experienced by cattle during typical short-term road transportation, together with any vibration-induced health affects as observed by a registered veterinary surgeon. The study concluded that cattle are commonly exposed to vibration levels in excess of 200 mm/s during road transportation with no adverse effects on the cattle's health, including levels of stress and contentment. It was consequently presumed that there would only be an effect on the cattle's health at vibration levels well in excess of 200 mm/s.

11.1.4 Building Damage Airblast Criteria

In relation to building damage airblast criteria, AS 2187: Part 2-2006 Appendix J J5.4(B) recommends a maximum airblast of 133 dB Linear Peak.

11.1.5 Building Damage Vibration Criteria

The applicable building damage vibration criteria AS 2187: Part 2-2006 Appendix J J4.5(B) is derived from British Standard 7385: Part 2-1993 *Evaluation and Measurement for Vibration in Buildings Part 2. Guideline to damage levels from ground borne vibration*. The standard sets guideline values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels have been established to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration which are considered in the standard include blasting (carried out during mineral extraction or construction excavation), demolition, piling, ground treatments (e.g. compaction), construction equipment, tunneling, road and rail traffic and industrial machinery.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in **Table 28** and graphically in **Figure 2**.

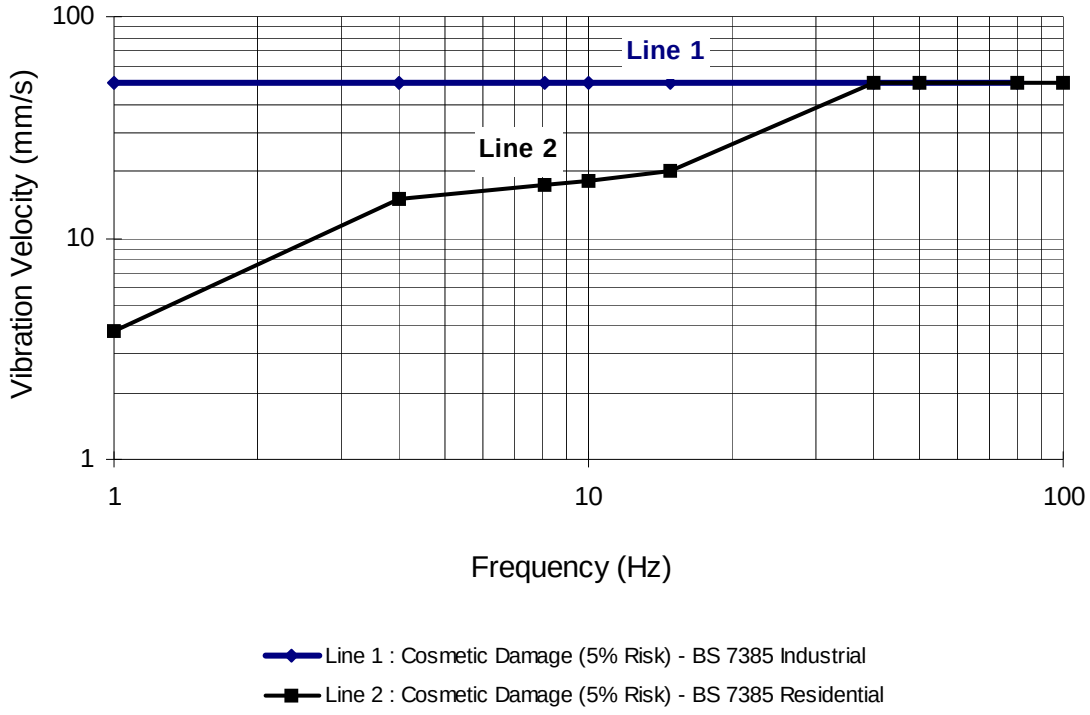
Table 28 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Line	Type of Building	Vibration PCPV in Frequency Range of Predominant Pulse[1]	
		4 to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	-
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: Vibration Peak Component Particle Velocity - PCPV (mm/s).

The standard states that the guide values in **Table 28** relate predominantly to transient vibration which does not give rise to resonant responses in either structures or low-rise buildings.

Figure 2 Graph of Transient Vibration Guide Values for Cosmetic Damage



The standard goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 28,** and major damage to a building structure may occur at values greater than four times the tabulated values. It is noteworthy that in addition to the guide values nominated in **Table 28**, the standard states that:

> *Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.*

Also that:

> *A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.*

Based on the foregoing discussion a conservative vibration (PCPV) damage assessment criterion of 12.5 mm/s would be applicable to all privately owned residential dwellings, as well as unreinforced or light framed structures or light commercial type buildings.

11.1.6 Railway, Roadway and Other Public Infrastructure Vibration Damage Criteria

Infrastructure located outside of existing mining tenements includes the railway (line), roadway (culverts) and electricity transmission lines (ETLs). Accordingly, consideration has been given to potential vibration effects on such infrastructure.

The German Standard DIN 4150-3:1999 *Structural Vibration Part 3: Effects of vibration in structures* provides guideline values for evaluating the effect of vibration on buried pipework. The values are based on the assumption that pipes have been manufactured and laid using current technology. Additional considerations may be required at junctions. The recommended limits for short-term vibration to ensure minimal risk of damage are presented in **Table 29**.

Table 29 Guideline Values for Vibration - Effects of Short-Term Vibration on Buried Pipework

Pipe Material	Vibration PCPV Measured on the Pipe
Steel (including welded pipes)	100 mm/s
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s
Masonry, plastic	50 mm/s

Note: The WCPL BMP dated May 2014 nominates similar infrastructure vibration criteria.

The railway infrastructure comprises mainly steel with concrete and similar materials and based on the foregoing a vibration (PCPV) damage assessment criterion of 100 mm/s would be applicable. Similarly, roadway infrastructure comprises mainly concrete and similar materials, and a vibration (PCPV) damage assessment criterion of 80 mm/s would be applicable. ETLs would also typically attract a damage assessment of criteria of 50 mm/s to 100 mm/s.

As described in **Section 2.6**, the approved BMP has adopted a (PCPV) damage assessment criterion of 50 mm/s for all public infrastructure (unless otherwise agreed with the DP&E).

11.1.7 Aboriginal Heritage Site Vibration Damage Criteria

As described in **Section 2.6.2**, a number of Aboriginal rock shelters have been identified at the Moolarben Coal Complex as shown on **Appendix B2** (i.e. S1MC55, S1MC56, S2MC229, S2MC232, S2MC233, S1MC343, S1MC344, S1MC345 and S1MC352).[4]

There are no regulatory criteria nominated in Australia for the assessment of damage to Aboriginal rock shelter sites from vibration. Research, however, has been undertaken by the United States (US) Army Corps of Engineers into the effects of large surface blasts on the dynamic stability of nearby unlined tunnels of various diameters in sandstone and granite (*Blast Vibration Monitoring and Control* [Dowding, 1985]). The results of the research indicated that intermittent rock fall or observable damage was not observed until vibration levels exceeded 460 mm/s.

This assessment therefore adopts a conservative safe blast design vibration criterion of 250 mm/s (5% exceedance) applicable to Aboriginal rock shelters and other archaeological/geological structures. MCO has developed a management protocol for rock shelters, where if blasting is proposed closer than 230 m to an identified potential rock shelter, MCO will engage suitable specialists to either:

- determine a vibration limit specific to maintaining the integrity of the particular feature; and
- manage and monitor blasting to maintain vibration limits below that limit; or
- advise on and implement (as necessary) an appropriate test excavation and salvage program.

11.2 Proposed Open Pit Blasting Practices

Assessment of the ground vibration and airblast emissions arising from coal and overburden blasting within the Modification area has been based on the indicative Modification blast design parameters presented in **Table 30**, which are generally similar to the current blasting practices in the existing open cut areas. Potential blast impacts associated with the Modification extension areas (**Appendix D1)** have been assessed.

[4] Rock shelters S2MC229, S1MC343, S1MC344, S1MC345 and S1MC352 have been salvaged (refer **Appendix B2**).

Table 30 Modification Coal and Overburden Indicative Blast Design Parameters

Parameter	Coal Ranges	Overburden Ranges
Bench Height	Typically 5m to 12m	Typically 6m to 37m
Burden and Spacing	Typically 7.5m to 8m	Typically 7m to 9m
Stemming	Typically 4.0m (aggregate)	Typically 5.0m (aggregate)
Hole Diameter	Typically 229mm	Typically 229mm & 251mm
Number of Holes	Typically 300 holes	Typically 400 holes (Max 600 in OC4)
Charge Mass per Hole	Typically up to 100 kilograms (kg)	Typically up to 1000 kilograms (kg)
Holes per Delay	Typically 1 to 5 holes	Typically 1 to 5 holes
Maximum Instantaneous Charge (MIC)	Maximum 400 kg	Typically 1,500 kg, Maximum 4,500 kg
Effective Powder Factor	Typically 0.1 to 0.15kg^m^3	Typically 0.5 to 0.75 kg^m^3

Firstly, to determine the blasting emissions levels at the nearest potentially affected receivers, the measured ground vibration and airblast levels from the Moolarben Coal Complex blast monitoring programme were collated (**Section 2.6.2**). The useful blast emission results for the period May 2013 to December 2016 were analysed to determine the 50% and 5% exceedance ground vibration and airblast site laws based on approximately 137 coal blast emission levels from the monitoring location at Ulan School (BM1), Lower Ridge Road (BM5) and Rock Shelters (BM2), as follows:

Coal Blast Site Laws:

$$PVS\ (50\%) = 360*(R/Q^{1/2})^{-1.25}$$
$$PVS\ (5\%) = 885*(R/Q^{1/2})^{-1.25}$$
$$SPL\ (50\%) = 158 - 20*(\log(R) - \tfrac{1}{3}\log(Q))$$
$$SPL\ (5\%) = 169 - 20*(\log(R) - \tfrac{1}{3}\log(Q))$$

where,

PVS = Vibration velocity Peak Vector Sum (PVS) (mm/s)
SPL = Airblast Linear Peak Level (dBLpk re 20 µPa).
R = Distance between charge and receiver (m)
Q = Charge mass per delay (kg)

Similarly, to determine the blasting emissions levels at the nearest potentially affected receivers, the measured ground vibration and airblast levels from the Moolarben Coal Complex blast monitoring programme were collated (**Section 2.6.2**). The useful blast emission results for the period May 2013 to December 2016 were analysed to determine the 50% and 5% exceedance ground vibration and airblast site laws based on approximately 468 overburden blast emission levels from the monitoring locations at Ulan School (BM1), Lower Ridge Road (BM5) and Rock Shelters (BM2), as follows:

Overburden Blast Site Laws:

$$PVS\ (50\%) = 489*(R/Q1/2)-1.48$$
$$PVS\ (5\%) = 1651*(R/Q1/2)-1.48$$
$$SPL\ (50\%) = 146 - 17*(\log(R) - \tfrac{1}{3}\log(Q))$$
$$SPL\ (5\%) = 156 - 17*(\log(R) - \tfrac{1}{3}\log(Q))$$

where,

PVS = Vibration velocity Peak Vector Sum (PVS) (mm/s)
SPL = Airblast Level Linear Peak (dBLpk re 20 µPa)
R = Distance between charge and receiver (m)
Q = Charge mass per delay (kg)

11.3 Privately Owned Receivers and Community Facilities

Using the ground vibration and airblast site laws described above, blast emissions were predicted at the nearest privately owned receivers and community facilities in Ulan for a coal blast design MIC 400 kg and overburden blast design MIC 4,500 kg for blasts within the Modification extension areas (**Appendix D1**). The predicted ground vibration and airblast emissions are presented in **Table 31**.

Table 31 Predicted Vibration and Airblast Levels for Privately Owned Receivers & Community Facilities

ID No	Ownership or Land Use	Vibration (mm/s)[1]		Airblast (dBLpk)[2]		Vibration (mm/s)[1]		Airblast (dBLpk)[2]	
		Coal 400 kg		Coal 400 kg		Overburden 4,500 kg		Overburden 4,500 kg	
		50%	5%	50%	5%	50%	5%	50%	5%
Cooks Gap									
37	Stewart	0.4	1.1	104	115	1.0	3.5	104	114
39	Sprigg	0.4	0.9	103	114	0.9	2.9	103	114
40	Devenish	0.5	1.1	105	115	1.1	3.7	104	115
41(a)	Libertis	0.4	1.0	104	115	1.0	3.3	104	114
41(b)	Libertis	0.3	0.8	102	113	0.7	2.4	102	113
60	Rayner & Mundey	0.5	1.1	104	115	1.1	3.6	104	115
61	Miller	0.4	1.1	104	115	1.0	3.4	104	114
70	Coventry	0.4	1.0	103	114	0.9	3.0	103	114
75	Ban	0.4	1.0	103	114	0.9	3.1	103	114
79	Nagle	0.4	1.0	104	114	0.9	3.1	103	114
80	Sebelic	0.4	0.9	103	114	0.8	2.7	103	113
82	Hungerford & Clemens	0.4	1.0	104	115	1.0	3.3	104	114
83	Wall	0.4	0.9	103	114	0.9	3.0	103	114
84	Sebelic	0.4	1.0	104	115	0.9	3.2	103	114
86	Harris	0.4	0.9	103	114	0.8	2.8	103	113
87	Howe	0.4	1.0	103	114	0.9	3.0	103	114
88	Meyers	0.4	1.0	104	115	1.0	3.3	104	114
89	Glover & Tomlinson	0.4	0.9	103	114	0.8	2.7	103	113
90	Powell	0.4	0.9	103	114	0.8	2.7	103	113
91	Graham	0.4	1.0	104	115	1.0	3.3	104	114
94	Mittemayer	0.3	0.8	102	113	0.7	2.4	102	113
95	Withington	0.3	0.8	102	113	0.7	2.5	102	113
96	Lazicic	0.3	0.8	102	113	0.8	2.6	102	113
97	Smith	0.4	0.9	103	114	0.8	2.7	103	113
98	Piper	0.4	0.9	103	114	0.8	2.8	103	113
99	Jenner & Jensen	0.4	0.9	103	114	0.9	2.9	103	114
100	Ellem	0.4	1.0	104	115	1.0	3.3	104	114
101	Hull	0.4	1.0	103	114	0.9	3.0	103	114
102	Roberts	0.4	0.9	103	114	0.8	2.8	103	113
103	Burnett & Grant	0.3	0.8	102	113	0.7	2.5	102	113
104	Deeben	0.3	0.8	102	113	0.7	2.4	102	113
105	Katsikaris	0.3	0.8	102	113	0.7	2.4	102	113
106	Reid	0.4	0.9	103	114	0.8	2.7	103	113
107	Raso	0.4	0.9	103	114	0.9	2.9	103	114
109	Evans	0.3	0.8	102	113	0.8	2.5	102	113

ID No	Ownership or Land Use	Vibration (mm/s)[1]		Airblast (dBLpk)[2]		Vibration (mm/s)[1]		Airblast (dBLpk)[2]	
		Coal 400 kg		Coal 400 kg		Overburden 4,500 kg		Overburden 4,500 kg	
		50%	5%	50%	5%	50%	5%	50%	5%
110	Thompson & Evans	0.3	0.8	102	113	0.7	2.5	102	113
111	McEwan	0.3	0.8	102	113	0.7	2.4	102	113
112	Croft	0.3	0.8	102	113	0.7	2.4	102	113
113	Ratcliff	0.3	0.8	102	113	0.7	2.5	102	113
119	Kearns	0.4	1.0	104	115	0.9	3.2	103	114
171	McGregor	0.4	0.9	103	114	0.8	2.8	103	113
180	Barrett	0.3	0.8	102	113	0.7	2.5	102	113
181	Forster	0.3	0.8	102	113	0.7	2.4	102	113
182	Dutoitcook	0.3	0.8	102	113	0.7	2.3	102	112
183	Steines	0.3	0.7	102	112	0.6	2.2	101	112
184(a)	Stevenson	0.3	0.8	102	113	0.7	2.4	102	112
184(b)	Stevenson	0.3	0.8	102	113	0.7	2.3	102	112
186	Adamson	0.3	0.7	101	112	0.6	2.1	101	112
187	Feeney	0.3	0.7	102	112	0.6	2.2	101	112
188	Fielding	0.3	0.7	101	112	0.6	2.1	101	112
189	Fay	0.3	0.7	101	112	0.6	2.2	101	112
190	Sahyoun	0.3	0.7	101	112	0.6	2.0	101	112
191	Lasham	0.3	0.7	101	112	0.6	2.1	101	112
192	Williams	0.3	0.7	101	112	0.6	2.2	101	112
194	Potts	0.3	0.7	101	112	0.6	1.9	101	112
195	Cottam	0.3	0.7	101	112	0.6	2.2	101	112
196	Saxberg & Weir	0.3	0.7	101	112	0.6	1.9	101	111
200	Grimshaw	0.3	0.7	101	112	0.6	2.0	101	112
201(a)	Towerton	0.3	0.7	101	112	0.6	2.0	101	112
201(b)	Towerton	0.3	0.7	101	112	0.6	2.0	101	112
202	Butler	0.3	0.7	101	112	0.6	2.0	101	112
203	Miller	0.3	0.7	101	112	0.6	2.1	101	112
204	Donnan	0.3	0.7	101	112	0.6	2.1	101	112
206	Marshall & Vella	0.3	0.7	101	112	0.6	2.0	101	112
207	Smith	0.3	0.7	102	112	0.7	2.2	102	112
208	Hasaart	0.3	0.8	102	113	0.7	2.3	102	112
209	Mawson	0.3	0.8	102	113	0.7	2.4	102	113
210	Tebutt	0.3	0.8	102	113	0.8	2.6	102	113
217	Patterson	0.3	0.8	102	113	0.7	2.4	102	113
218	Soady	0.3	0.8	102	113	0.7	2.5	102	113
219	Riger	0.3	0.8	102	113	0.7	2.2	102	112
220	Rusten & Smith	0.3	0.8	102	113	0.7	2.4	102	113
222	Purtell	0.3	0.7	102	113	0.7	2.2	102	112
223	Palmer & Stewart	0.3	0.8	102	113	0.7	2.3	102	112
224	Dupond	0.3	0.8	102	113	0.7	2.4	102	113
226	Muscat	0.3	0.8	102	113	0.7	2.3	102	112
227	Hughes	0.3	0.8	102	113	0.7	2.4	102	113
229	Lowe	0.3	0.8	102	113	0.7	2.5	102	113

ID No	Ownership or Land Use	Vibration (mm/s)[1]		Airblast (dBLpk)[2]		Vibration (mm/s)[1]		Airblast (dBLpk)[2]	
		Coal 400 kg		Coal 400 kg		Overburden 4,500 kg		Overburden 4,500 kg	
		50%	5%	50%	5%	50%	5%	50%	5%
230	Hoole & Rawlinson	0.3	0.8	102	113	0.8	2.6	102	113
231	Morrison & Benny	0.3	0.8	102	113	0.7	2.5	102	113
232	Haaring	0.3	0.8	102	113	0.7	2.5	102	113
233	Boal	0.3	0.8	102	113	0.7	2.5	102	113
234	Gaw	0.3	0.8	102	113	0.7	2.5	102	113
235	Wilson	0.3	0.8	102	113	0.7	2.4	102	113
236	Donovan	0.3	0.8	102	113	0.7	2.4	102	113
237	Stokes	0.3	0.8	102	113	0.8	2.6	102	113
238	Powell	0.3	0.9	103	113	0.8	2.6	102	113
300	Collins & Marshall	0.3	0.8	102	113	0.7	2.3	102	112
303	Ungaro	0.3	0.8	102	113	0.7	2.4	102	113
305	Barisic & Aul	0.3	0.8	102	113	0.7	2.3	102	112
306	Armstrong	0.3	0.7	102	113	0.7	2.2	102	112
307	Chant & Young	0.3	0.7	101	112	0.6	2.2	101	112
308	Dower	0.3	0.7	101	112	0.6	2.0	101	112
309	Maher	0.3	0.6	101	111	0.5	1.8	101	111
310	Death	0.3	0.7	101	112	0.6	1.9	101	111
312	Ioannou	0.3	0.6	100	111	0.5	1.8	101	111
313	Pracy	0.2	0.6	100	111	0.5	1.7	100	111
314	Ford	0.2	0.6	100	111	0.5	1.7	100	111
315	Richards & Uzelac	0.2	0.6	100	111	0.5	1.7	100	111
316	Vassel & Williams	0.2	0.6	100	111	0.5	1.7	100	111
317	Hore & Bingham	0.3	0.7	101	112	0.6	1.9	101	111
Ulan									
11(a)	Mullins & Imrie	0.1	0.3	95	106	0.2	0.7	96	106
11(b)	Mullins & Imrie	0.1	0.3	95	106	0.2	0.7	95	106
11(c)	Mullins & Imrie	0.1	0.3	95	106	0.2	0.7	96	106
255	Schmitz	0.2	0.5	98	109	0.4	1.3	99	109
256	Campbell & Frost	0.2	0.5	99	110	0.4	1.3	99	110
258	Elias	0.2	0.5	99	110	0.4	1.4	99	110
Ulan Village Non-residential									
9	Orica Australia Pty Limited	0.4	1.0	103	114	0.9	3.0	103	114
26	Forty North P/L	0.3	0.8	102	113	0.7	2.5	102	113
46B	North Eastern Wiradjuri Wilpinjong Community Fund Limited	0.3	0.7	101	112	0.6	1.9	101	112
66	Rostherne P/L	0.3	0.7	101	112	0.6	2.0	101	112
149	Mid Western Regional Council	0.3	0.7	101	112	0.6	2.1	101	112
160	Minister for Education and Training (Ulan Public School)	0.3	0.7	101	112	0.6	2.1	101	112
162	Rowmint P/L	0.3	0.7	101	112	0.6	2.0	101	112
168	PJL Constructions Pty Limited (Church)	0.3	0.7	101	112	0.6	2.1	101	112

Note 1: Vibration Velocity Peak Vector Sum (PVS) - (mm/s).

Note 2: Airblast Level Linear Peak - (dBLpk re 20 µPa).

Note 3: Predicted blast emission level complies with the human comfort criteria of 5 mm/s and 115 dBLpk.

11.3.1 Impact Assessment Summary

In summary, the predicted blast emission levels show no exceedance of the human comfort criteria for vibration or airblast overpressure.

11.4 Public Infrastructure, Aboriginal Rock Shelters and Structures on Private Property

Using the ground vibration site law described above, blast emissions were predicted at public infrastructure and Aboriginal rock shelters for a coal blast design MIC 400 kg and overburden blast design MIC 4,500 kg (from blasts within the Modification extension areas) (**Appendix D1**). The predicted ground vibration emissions are presented in **Table 32**.

Table 32 Predicted Vibration Levels for Public Infrastructure and Aboriginal Rock Shelters

ID No or Land Use	Landowner	Vibration (mm/s)[1]		Vibration (mm/s)[1]	
		Coal 400 kg		Overburden 4,500 kg	
		50%	5%	50%	5%
Public Infrastructure[2]					
Moolarben Road Culvert	Mid-Western Regional Council	2.7	6.6	8.7	29.4
Mayberry Road Culvert		1.9	4.6	5.7	19.3
Ulan Road Culvert		0.4	1.1	1.0	3.5
Off-site Railway Line	ARTC	0.2	0.5	0.4	1.4
Aboriginal Rock Shelter[3]					
S1MC55	MCO	0.9	2.3	2.4	8.3
S1MC56		0.9	2.3	2.4	8.3
S2MC232		0.7	1.7	1.8	6.1
S2MC233		0.7	1.8	1.9	6.3
Structures on Private Property[4]					
Structures on Property 34	Rheinberger	2.1	5.0	3.7[5]	12.5[5]

Note 1: Vibration Velocity Peak Vector Sum (PVS) - (mm/s).
Note 2: Predicted ground vibration level complies with public infrastructure vibration criterion of 50 mm/s.
Note 3: Predicted ground vibration level complies with the Aboriginal rock shelter vibration criterion of 250 mm/s.
Note 4: Predicted ground vibration level complies with the light framed structure vibration criterion of 12.5 mm/s
Note 5: Results for a blast size of 2,160 kg MIC for blasts within 1,820 m of structures on Property 34. Note, 2,160 kg MIC is greater than the typical MIC of 1,500 kg for the Modification area (**Table 30**).

11.4.1 Impact Assessment Summary

In summary, the predicted blast emission levels show:

- No exceedance of the public infrastructure damage vibration criteria of 50 mm/s;
- No exceedance of the Aboriginal rock shelters damage vibration criteria of 250 mm/s; and
- No exceedance of the building damage criteria for structures on private property of 12.5 mm/s.

12 SUMMARY OF FINDINGS

12.1 Noise Assessment Criteria

12.1.1 INP Assessable Meteorological Conditions

An assessment of the on-site wind environment was prepared and is presented in **Appendix E** based on the analysis of the wind velocity from the EPA approved AWS (**Appendix B2**). An assessment of winter temperature gradients and atmospheric stability has been derived from the on-site Temperature Tower located at Wilpinjong Coal Mine. The INP assessable meteorological noise modelling parameters are presented in **Table 13**.

The INP assessable meteorologic noise modelling parameters include noise enhancing conditions such as winds that are generally from the Moolarben Coal Complex to receivers, strong inversion and inversions plus drainage.

12.1.2 Noise Impact Assessment Methodology

Table 33 presents the generalised methodology for assessing the Modification operating noise levels against the intrusive and amenity PSNLs (**Table 16**) and the $L_{A1(1minute)}$ SDNLs (**Table 17**), together with cumulative amenity noise levels (**Table 15**) for assessing operating noise levels from existing, approved and proposed mining developments in the vicinity of the Modification.

Table 33 Modification and Cumulative Noise Impact Assessment Methodology (dBA re 20 µPa)

Affected Land Use	Assessment Parameter	Assessment Criteria	Noise Management Zone[1]		Affectation Zone[2]
			Negligible	Marginal to Moderate	Significant
Residential dwellings	PSNL Intrusive	RBL plus 5 dBA	1 to 2 dBA above assessment criteria	3 to 5 dBA above assessment criteria	> 5 dBA above assessment criteria
	PSNL Amenity	INP acceptable			
	SDNL $L_{A1(1minute)}$	RBL plus 15 dBA			
Vacant land	PSNL Amenity	INP acceptable	Not applicable	Not applicable	> 5 dBA above assessment criteria[3]
Residential dwellings	Cumulative Amenity Level	INP acceptable	1 to 2 dBA above assessment criteria	3 dBA above assessment criteria	> 3 dBA above assessment criteria[4]

Note 1: Noise Management Zone - depending on the range of exceedance of the PSNL and or SDNL assessment parameters, potential project noise impacts range from negligible to moderate in accordance with the VLAMP.

Note 2: Noise Affectation Zone - noise exceedances greater than 5 dBA above the PSNL and or SDNL assessment parameters may result in significant project noise impacts in accordance with the VLAMP.

Note 3: Noise Affectation Zone - equivalent to a noise exceedance of the INP's maximum noise amenity level on more than 25% of any privately owned vacant land, and a dwelling could be built on that vacant land under existing planning controls in accordance with the VLAMP.

Note 4: Exposure to cumulative mine noise levels greater than 3 dBA above the relevant INP acceptable noise level may be considered unacceptable by some landowners.

12.1.3 Noise Control and Management Measures

MCO is required to manage noise levels from the Moolarben Coal Complex in accordance with the Project Approval noise limits using reasonable and feasible mitigation measures. The requirement to meet the Project Approval noise limits has been achieved through a combination of the following:

- For the majority of private landowners, the implementation of the noise management strategy as per the NMP including the use of real-time noise monitoring to manage noise levels during the night.
- For a minority of private landowners, property acquisitions and private compensation agreements, which have had the effect of reducing the number of privately owned receivers that could potentially be affected by noise impacts from the Moolarben Coal Complex.

Further details regarding the Moolarben Coal Complex noise management strategy and MCO's compliance with the noise limits specified in Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 are provided in **Section 2.4**.

MCO would continue to meet its obligation to comply with the noise limits specified in Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 through the continued implementation of the noise management strategy. This would include the continuation of real-time monitoring, and the temporary stand-down of equipment, as required, as part of the response protocol to Real-Time Response Trigger Levels.

12.2 Modification and Cumulative Mine Operating Noise Impact Assessment

12.2.1 Modification Operating Intrusive Noise Levels and Impact Summary

In summary, the predicted daytime, evening and night-time intrusive $L_{Aeq(15minute)}$ noise levels and night-time maximum $L_{A1(1minute)}$ noise levels for the 2019, 2021 and 2026 operating scenarios show:

- Compliance is generally determined by evening and night-time noise levels, due to the noise-enhancing meteorological conditions (**Table 13**) that occur during the evening and night-time; and
- No exceedance of the Project Approval noise limits is predicted during the daytime, evening and night-time (**Table 20, Table 21** and **Table 22**) at any privately owned receivers.

12.2.2 Review of the Noise Management Measures

MCO is committed to maintaining an awareness of best practice noise mitigation technologies and alternative operating methodologies. MCO implements noise control and management measures that are found to be feasible, reasonable and effective in the context of a safe and economic mining operation; and where there is a clear community benefit with their application. Available best practice mitigation technologies and alternative operating methodologies are reviewed on an ongoing basis.

Potential noise impacts would continue to be managed and monitored in accordance with the requirements of Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 and the Moolarben Coal Complex NMP. The NMP would be updated as necessary to incorporate the Modification.

12.3 Rail Traffic Impact Assessment

12.3.1 Change in Rail Traffic

As descried in **Section 3.5**, there would be an increase in the average product coal train departures from the site by 1 per day (i.e. up from of 7 to 8 trains departures per day on average in any calendar year). This requires the peak number of product coal train departures from site to increase by 2 per day (i.e. up from a peak of 9 to 11 departures per day). Train loading and despatch would continue to be conducted 24 hours per day, 7 days per week.

12.3.2 Impact Assessment Summary

The predicted increase in noise levels due to the Modification is less than 2 dB for all scenarios, and as such, is unlikely to be perceptible.

It should be noted that noise levels from rail movements are controlled by the ARTC via EPL 3142. Consistent with Schedule 3, Condition 6(d) of Project Approval (05_011) MCP Stage 1, MCO will continue to only use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL to minimise noise emissions from the additional rail movements associated with the Modification.

12.4 Blasting Impact Assessment

12.4.1 Proposed Open Pit Blasting Practices

Assessment of the ground vibration and airblast emissions arising from coal and overburden blasting has been based on the indicative Modification blast design parameters presented in **Table 30**, which are generally similar to the current blasting practices in the existing open cut areas. Potential blast impacts associated with the Modification extension areas (**Appendix D1)** have been assessed.

12.4.2 Privately Owned Receivers and Community Facilities

The predicted blast emission levels show no exceedance of the human comfort criteria for vibration or airblast overpressure.

12.4.3 Public Infrastructure and Aboriginal Rock Shelters

The predicted blast emission levels show:

- No exceedance of the public infrastructure damage vibration criteria of 50 mm/s;
- No exceedance of the Aboriginal rock shelters damage vibration criteria of 250 mm/s; and
- No exceedance of the building damage criteria for structures on private property of 12.5 mm/s.

Potential blasting impacts would continue to be managed and monitored in accordance with the requirements of Project Approval (05_0117) MCP Stage 1 and Project Approval (08_0135) MCP Stage 2 and the Moolarben Coal Complex BMP. The BMP would be updated as necessary to incorporate the Modification.

SCHEDULE 3
ENVIRONMENTAL CONDITIONS - GENERAL

NOISE

Noise Criteria

Acquisition Upon Request

1A. Upon receiving a written request for acquisition from an owner of the land listed in Table 1A, the Proponent shall acquire the land in accordance with the procedures in conditions 10 and 11 of Schedule 4.

Table 1A: Land subject to acquisition upon request

Receiver ID
32

Note: To interpret the land referred to in Table 1, see the applicable figures in Appendix 5.

Transitional Acquisition and Mitigation Arrangements

1B. (deleted)

1. The Proponent shall ensure that the noise generated by the Moolarben mine complex does not exceed the noise criteria in Table 1 at any residence on privately-owned land or the other specified locations.

Table 1: Noise criteria dB(A)

Land Number	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
30, 63	39	39	39	45
70	37	37	37	45
75	36	36	36	45
31	36	35	35	45
All other privately owned residences	35	35	35	45
Ulan Primary School		35 (internal) when in use		-
Ulan Anglican Church		35 (internal) when in use		-
Goulburn River National Park Munghorn Gap Nature Reserve		50 when in use		-

Note: To interpret the land referred to in Table 1 see the applicable figures in Appendix 5.

Noise generated by the Moolarben mine complex is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

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

Land Acquisition Criteria

2. If the noise generated by the Moolarben mine complex exceeds the criteria in Table 2A, , then upon receiving a written request for acquisition from an owner of the land listed in Table 2A, the Proponent shall acquire the land in accordance with the procedures in conditions 10 and 11 of Schedule 4.

Table 2A: Acquisition criteria dB(A) LAeq (15min)

Receiver ID	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
63	43	43	42
All other privately-owned residences	40	40	40

Note: To interpret the land referred to Table 2A, see the applicable figures in Appendix 5.

3. If the noise generated by the Moolarben mine complex contributes to exceedances of the relevant criteria in Table 2 on more than 25% of any privately-owned land (and a dwelling could be built on that land under existing planning controls), the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 10-11 of Schedule 4.

Table 2: Land acquisition criteria

Day/Evening/Night $L_{Aeq(period)}$	Receiver
55/50/45	All privately-owned land

Note: Noise generated by the complex is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

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

Noise Mitigation Criteria

4. If the noise generated by the Moolarben mine complex exceeds the criteria in Table 3A, then upon receiving a written request the Proponent shall implement additional noise mitigation measures (such as double-glazing, insulation and/or air conditioning) at the residence in consultation with the landowner. These measures must be reasonable and feasible, and directed towards reducing the noise impacts of the project on the residence.

   If within 3 months of receiving this request from the owner, the Proponent and the owner 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 3A: Mitigation criteria dB(A) LAeq 15min)

Receiver ID	Day ($L_{Aeq\ (period)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
63	40	40	39
All privately owned residences other than those in Table 3	37	37	37

Note: To interpret the land referred to Table 3A, see the applicable figures in Appendix 5.

Mitigation Upon Request

5. Upon receiving a written request from the owner of the residence on the land listed in Table 3, the Proponent shall implement additional noise mitigation measures (such as double-glazing, insulation and/or air conditioning) at the residence in consultation with the landowner. These measures must be reasonable and feasible, and directed towards reducing the noise impacts of the Moolarben mine complex on the residence.

   If within 3 months of receiving this request from the owner, the Proponent and the owner 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: Land subject to additional noise mitigation upon request

Receiver ID
30

Note: To interpret the land referred to in Table 3 see the applicable figures in Appendix 5. However, these noise criteria do not apply if the Proponent has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.

Operating Conditions

6. The Proponent shall:
   (a) implement best management practice to minimise the operational, road and rail noise of the project;
   (b) operate a comprehensive noise management system on site that uses a combination of predictive meteorological forecasting and real-time noise monitoring data to guide the day to day planning of mining operations, and the implementation of both proactive and reactive noise mitigation measures to ensure compliance with the relevant conditions of this approval;
   (c) minimise the noise impacts of the project during meteorological conditions when the noise limits in this approval do not apply (see Appendix 6);
   (d) only use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL;

(e) co-ordinate noise management with the noise management at Ulan and Wilpinjong mines to minimise cumulative noise impacts; and
(f) carry out regular monitoring to determine whether the project is complying with the relevant conditions of this approval,

to the satisfaction of the Secretary.

Noise Management Plan

7. The Proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA and be submitted to the Secretary for approval by 31 March 2015;
   (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this approval;
   (c) describe the proposed noise management system in detail;
   (d) include a monitoring program that:
   - uses attended noise monitoring to evaluate compliance of the project against the noise criteria in this approval;
   - includes a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results over time (so the real-time noise monitoring program can be used as a better indicator of compliance with the noise criteria in this approval and trigger for further attended monitoring);
   - evaluates and reports on:
     - the effectiveness of the noise management system; and
     - compliance against the noise operating conditions; and
   - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

BLASTING

Blasting Criteria

8. The Proponent shall ensure that the blasting on the Moolarben mine complex does not cause exceedances of the criteria in Table 4.

Table 4: Blasting criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Residence on privately owned land, churches and schools	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months
All public infrastructure	-	50 (or a limit determined by the structural design methodology in AS 2187 2-2006, or its latest version, or other alternative limit for public infrastructure, to the satisfaction of the Secretary)	0%

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

Blasting Hours

9. The Proponent shall only carry out blasting on the site between 9am and 5pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Secretary.

Blasting Frequency

10. The Proponent may carry out a maximum of:
    (a) 2 blasts a day; and
    (b) 9 blasts a week, averaged over a calendar year,

    at the Moolarben mine complex.

This condition does not apply to blasts that generate ground vibration of 0.5 mm/s or less at any residence on privately-owned land, blasts misfires or blasts required to ensure the safety of the mine or its workers.

Note: For the purposes of this condition, a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the mine.

Property Inspections

11. If the Proponent receives a written request from the owner of any privately-owned land within 2 kilometres of any approved open cut mining pit on site for a property inspection to establish the baseline condition of any buildings and/or structures on his/her land, or to have a previous property inspection updated, then within 2 months of receiving this request the Proponent shall:
    (a) commission a suitably qualified, experience and independent person, whose appointment is acceptable to both parties to:
        - establish the baseline condition of any buildings and other structures on the land, or update the previous property inspection report; and
        - identify measures that should be implemented to minimise the potential blasting impacts of the project on these buildings and/or structures; and
    (b) give the landowner a copy of the new or updated property inspection report.

    If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Proponent or the landowner disagrees with the findings of the property inspection report, either party may refer the matter to the Secretary for resolution.

Property Investigations

12. If the owner of any privately-owned land claims that buildings and/or structures on his/her land have been damaged as a result of blasting on the site, then within 2 months of receiving this claim the Proponent shall:
    (a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties to investigate the claim; and
    (b) give the landowner a copy of the property investigation report.

    If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damage to the satisfaction of the Secretary.

    If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Proponent or the landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Secretary for resolution.

Operating Conditions

13. The Proponent shall:
    (a) implement best practice blasting management to:
        - protect the safety of people and livestock in the surrounding area;
        - protect public or private infrastructure/property in the surrounding area from any damage; and
        - minimise the dust and fume emissions of any blasting;
    (b) operate a suitable system to enable the public to get up-to-date information on the proposed blasting Schedule on site; and
    (c) co-ordinate the timing of blasting on site with the timing of blasting at the Ulan and Wilpinjong mines to minimise cumulative blasting impacts,

    to the satisfaction of the Secretary.

14. The Proponent shall not undertake blasting on site within 500 metres of:
    (a) any public road;
    (b) the Gulgong to Sandy Hollow Railway Line;
    (c) the Wollar-Wellington 330kV Transmission Line; or
    (d) any land outside the site not owned by the Proponent,

    unless the Proponent has:
        - demonstrated to the satisfaction of the Secretary that the blasting can be carried out closer to the infrastructure or land without compromising the safety of people or livestock or damaging the infrastructure and/or other buildings and structures; and
        - updated the Blast Management Plan to include the specific measures that would be implemented while blasting is being carried out within 500 metres of the infrastructure or land; or
        - a written agreement with the relevant infrastructure owner or landowner to allow blasting to be carried out closer to the infrastructure or land, and the Proponent has advised the Department in writing of the terms of this agreement.

Blast Management Plan

15. The Proponent shall prepare and implement a Blast Management Plan for the project prior to undertaking any blasting on site to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with the EPA and be submitted to the Secretary for approval by 31 March 2015;
    (b) describe the measures that would be implemented to ensure compliance with the blast criteria and operating conditions of this approval;
    (c) propose and justify any alternative ground vibration limits for public infrastructure in the vicinity of the site (if relevant); and
    (d) include a monitoring program for evaluating compliance with the blasting criteria and operating conditions of this approval.

METEOROLOGICAL MONITORING

20B. For the life of the project, the Proponent shall ensure that there is a meteorological station in the vicinity of the site that:
    (a) complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline; and
    (b) is capable of continuous real-time measurement of temperature lapse rate in accordance with the NSW Industrial Noise Policy, unless a suitable alternative is approved by the Secretary following consultation with the EPA.

APPENDIX 6:
NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Table 2 of the conditions are to apply under all meteorological conditions except the following:
    (a) wind speeds greater than 3 m/s at 10 metres above ground level; or
    (b) stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level; or
    (c) stability category G temperature inversion conditions.

Determination of Meteorological Conditions

1. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located on the site.

Compliance Monitoring

2. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

3. This monitoring must be carried out at least 12 times a year, unless the Secretary directs otherwise.

4. Unless the Secretary agrees otherwise, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
    (a) monitoring locations for the collection of representative noise data;
    (b) meteorological conditions during which collection of noise data is not appropriate;
    (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
    (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

NOISE

Acquisition Upon Request

1. Upon receiving a written request for acquisition from the owner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 5 and 6 of Schedule 5.

Table 1: Land subject to acquisition upon request

Receiver ID
32

Note: To interpret the land referred to in Table 1, see the applicable figures in Appendix 5.

Mitigation Upon Request

2. Upon receiving a written request from the owner of any residence on the land listed in Table 2, the Proponent shall implement additional noise mitigation measures (such as double-glazing, insulation and/or air conditioning) at the residence in consultation with the landowner. These measures must be reasonable and feasible, and directed towards reducing the noise impacts of the project on the residence.

If within 3 months of receiving this request from the owner, the Proponent and the owner 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 2: Residence subject to additional noise mitigation upon request

Receiver ID
30

Note: To interpret the land referred to in Table 2, see the applicable figures in Appendix 5.

Noise Criteria

3. The Proponent shall ensure that the noise generated by the Moolarben mine complex does not exceed the criteria in Table 3 at any residence on privately-owned land or the other specified locations.

Table 3: Noise criteria dB(A)

Receiver ID	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
30, 63	39	39	39	45
70	37	37	37	45
75	36	36	36	45
31	36	35	35	45
All other privately-owned residences	35	35	35	45
Ulan Primary School	35 (internal) when in use			-
Ulan Anglican Church	35 (internal) when in use			-
Goulburn River National Park Munghorn Gap Nature Reserve	50 when in use			-

Note: To interpret the land referred to in Table 3, see the applicable figures in Appendix 5.

Noise generated by the Moolarben mine complex is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

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

4. If the noise generated by the Moolarben mine complex exceeds the criteria in Table 4 then upon receiving a written request for acquisition from an owner of the land listed in Table 4, the Proponent shall acquire the land in accordance with the procedures in conditions 5 and 6 of Schedule 5.

Table 4: Acquisition criteria dB(A) $L_{Aeq\ (15min)}$

Receiver ID	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
63	43	43	42
All other privately-owned residences	40	40	40

Note: To interpret the land referred to Table 4, see the applicable figures in Appendix 5.

5. If the noise generated by the Moolarben mine complex contributes to exceedances of the relevant criteria in Table 5 on more than 25% of any privately-owned land (and a dwelling could be built on that land under existing planning controls), the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 5 and 6 of Schedule 5.

Table 5: Land acquisition criteria

Day/Evening/Night $L_{Aeq(period)}$	Receiver
55/50/45	All privately-owned land

Note: Noise generated by the project is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

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

Noise Mitigation Criteria

6. If the noise generated by the Moolarben mine complex exceeds the criteria in Table 6 at any privately owned residence, then upon receiving a written request the Proponent shall implement additional noise mitigation measures (such as double-glazing, insulation and/or air conditioning) at the residence in consultation with the landowner. These measures must be reasonable and feasible, and directed towards reducing the noise impacts of the project on the residence.

   If within 3 months of receiving this request from the owner, the Proponent and the owner 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 6: Mitigation criteria dB(A) $L_{Aeq\ (15min)}$

Receiver ID	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
63	40	40	39
All privately owned residences other than those in Table 2	37	37	37

Note: To interpret the land referred to Table 6, see the applicable figures in Appendix 5.

Operating Conditions

7. The Proponent shall:
   (a) implement best management practice to minimise the operational and road noise of the project;
   (b) operate a comprehensive noise management system that uses a combination of predictive meteorological forecasting and real-time noise monitoring data to guide the day to day planning of mining operations, and the implementation of both proactive and reactive noise mitigation measures to ensure compliance with the relevant conditions of this approval;
   (c) minimise the noise impacts of the project during meteorological conditions when the noise limits in this approval do not apply (see Appendix 6);
   (d) only use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL;
   (e) co-ordinate noise management at the Moolarben mine complex with the noise management at Ulan and Wilpinjong mines to minimise cumulative noise impacts; and
   (f) carry out regular monitoring to determine whether the Moolarben mine complex is complying with the relevant conditions of this approval,

   to the satisfaction of the Secretary.

Noise Management Plan

8. The Proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA, and submitted to and approved by the Secretary prior to the commencement of any development on site under this approval;
   (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this approval;
   (c) describe the proposed noise management system in detail; and
   (d) include a monitoring program that:
   - evaluates and reports on:
     - the effectiveness of the noise management system;
     - compliance against the noise criteria in this approval; and
     - compliance against the noise operating conditions;
   - includes a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results over time (so the real-time noise monitoring program can be used as a better indicator of compliance with the noise criteria in this approval and trigger for further attended monitoring); and
   - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

BLASTING

Blasting Criteria

9. The Proponent shall ensure that blasting on the Moolarben mine complex does not cause exceedances of the criteria in Table 7.

Table 7: Blasting criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Residence on privately owned land	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months
All public infrastructure	-	50 *(or a limit determined by the structural design methodology in AS 2187.2-2006, or its latest version, or other alternative limit for public infrastructure, to the satisfaction of the Secretary)*	0%

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

Blasting Hours

10. The Proponent shall only carry out blasting on site between 9 am and 5 pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Secretary.

Blasting Frequency

11. The Proponent may carry out a maximum of:
   (a) 2 blasts a day; and
   (b) 9 blasts a week, averaged over a calendar year,
   at the Moolarben mine complex.

This condition does not apply to blasts that generate ground vibration of 0.5 mm/s or less at any residence on privately-owned land, blast misfires or blasts required to ensure the safety of the mine or its workers.

Note: For the purposes of this condition, a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the mine.

Property Inspections

12. If the Proponent receives a written request from the owner of any privately-owned land within 2 kilometres of any approved open cut mining pit on site for a property inspection to establish the baseline condition of any buildings and/or structures on his/her land, or to have a previous property inspection updated, then within 2 months of receiving this request the Proponent shall:
    (a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties to:
        - establish the baseline condition of any buildings and other structures on the land, or update the previous property inspection report; and
        - identify measures that should be implemented to minimise the potential blasting impacts of the project on these buildings and/or structures; and
    (b) give the landowner a copy of the new or updated property inspection report.

    If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Proponent or the landowner disagrees with the findings of the property inspection report, either party may refer the matter to the Secretary for resolution.

Property Investigations

13. If the owner of any privately-owned land claims that buildings and/or structures on his/her land have been damaged as a result of blasting on the site, then within 2 months of receiving this claim the Proponent shall:
    (a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties to investigate the claim; and
    (b) give the landowner a copy of the property investigation report.

If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damage to the satisfaction of the Secretary.

If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Proponent or the landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Secretary for resolution.

Operating Conditions

14. The Proponent shall:
    (a) implement best management practice to:
        - protect the safety of people and livestock in the surrounding area;
        - protect public or private infrastructure/property in the surrounding area from any damage; and
        - minimise the dust and fume emissions of any blasting;
    (b) ensure that blasting on the site does not damage Aboriginal rock shelter sites S2MC229 (AHIMS No. 36-3-1376), S2MC232 (AHIMS No. 36-3-1379) or S2MC233 (AHIMS No. 36-3-1380);
    (c) operate a suitable system to enable the public to get up-to-date information on the proposed blasting Schedule on site; and
    (d) co-ordinate the timing of blasting on site with the timing of blasting at the Ulan and Wilpinjong mines to minimise cumulative blasting impacts, to the satisfaction of the Secretary.

    Note: To identify the Aboriginal rock shelter sites, see the applicable figure in Appendix 8.

15. The Proponent shall not undertake blasting on site within 500 metres of:
    (e) any public road;
    (f) the Gulgong to Sandy Hollow Railway Line;
    (g) the Wollar-Wellington 330kV Transmission Line; or
    (h) any land outside the site not owned by the Proponent,

    unless the Proponent has:
        - demonstrated to the satisfaction of the Secretary that the blasting can be carried out closer to the infrastructure or land without compromising the safety of people or livestock or damaging the infrastructure and/or other buildings and structures; and
        - updated the Blast Management Plan to include the specific measures that would be implemented while blasting is being carried out within 500 metres of the infrastructure or land; or
        - a written agreement with the relevant infrastructure owner or landowner to allow blasting to be carried out closer to the infrastructure or land, and the Proponent has advised the Department in writing of the terms of this agreement.

Blast Management Plan

16. The Proponent shall prepare and implement a Blast Management Plan for the project to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with the EPA, and submitted to and approved by the Secretary prior to conducting any blasting on site;
    (b) describe the measures that would be implemented to ensure compliance with the blast criteria and operating conditions of this approval;
    (c) propose and justify any alternative ground vibration limits for public infrastructure in the vicinity of the site (if relevant); and
    (d) include a monitoring program for evaluating and reporting on compliance with the blasting criteria and operating conditions of this approval.

METEOROLOGICAL MONITORING

24. For the life of the project, the Proponent shall ensure that there is a meteorological station in the vicinity of the site that:
    (a) complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline; and
    (b) is capable of continuous real-time measurement of temperature lapse rate in accordance with the *NSW Industrial Noise Policy,* unless a suitable alternative is approved by the Secretary following consultation with the EPA.

APPENDIX 6
NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Table 3 of the conditions are to apply under all meteorological conditions except the following:
    (a) wind speeds greater than 3 m/s at 10 metres above ground level; or
    (b) stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level; or
    (c) stability category G temperature inversion conditions.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located on the site.

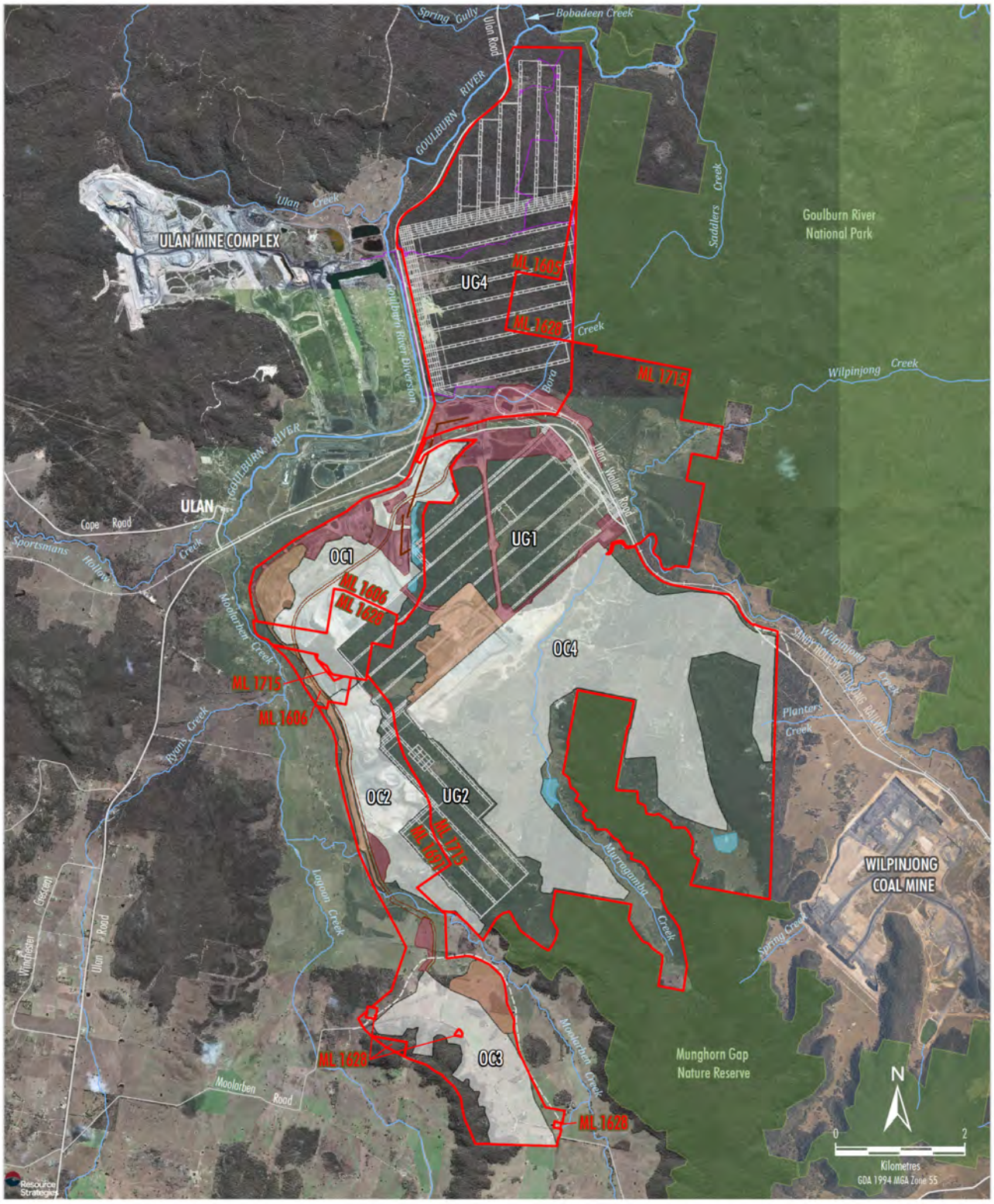
Compliance Monitoring

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.

4. This monitoring must be carried out at least 12 times a year, unless the Secretary directs otherwise.

5. Unless the Secretary agrees otherwise, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
    (d) monitoring locations for the collection of representative noise data;
    (e) meteorological conditions during which collection of noise data is not appropriate;
    (f) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
    (g) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

APPROVED MOOLARBEN COAL PROJECT (STAGE 1 AND STAGE 2) GENERAL ARRANGEMENT

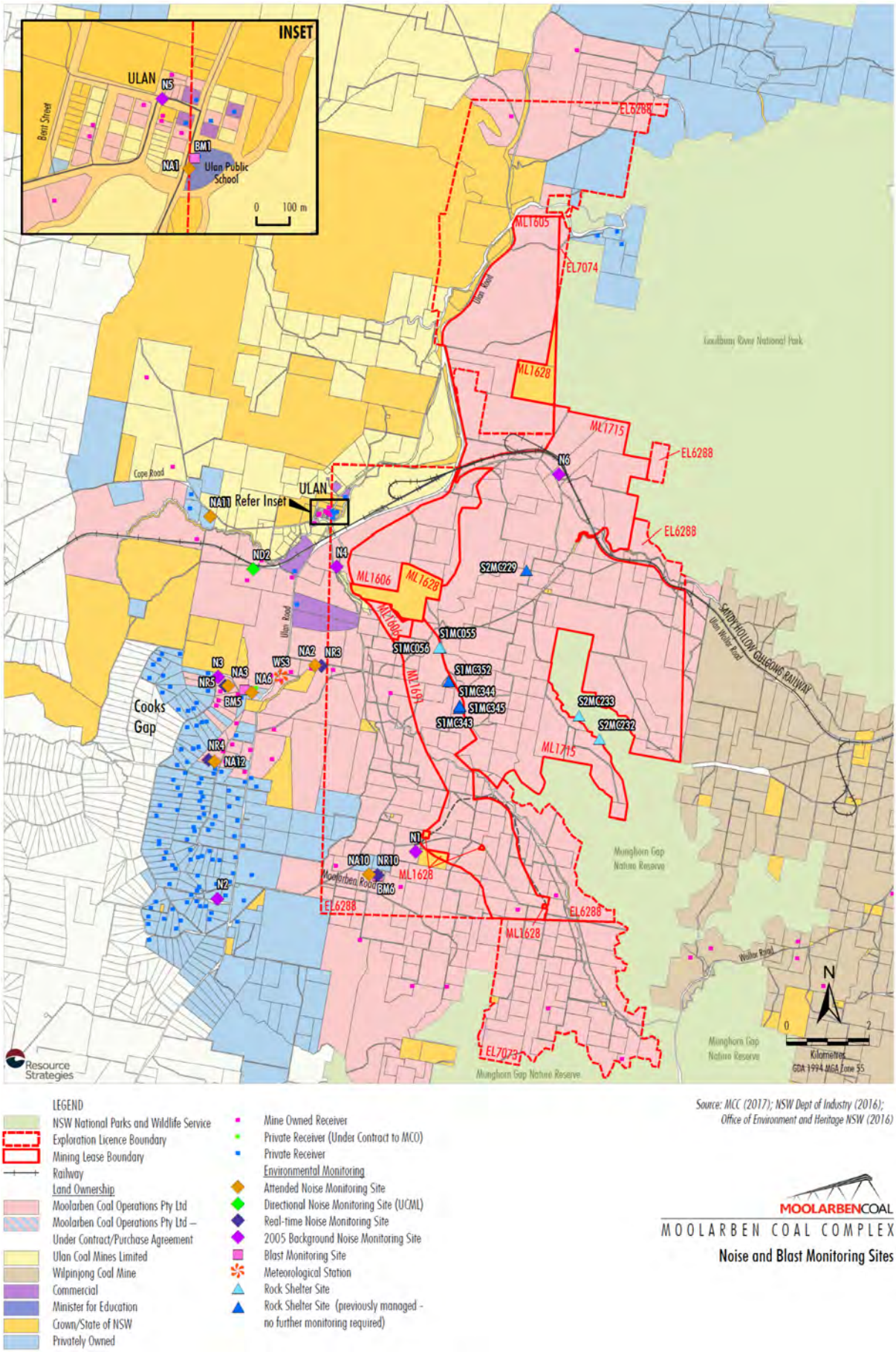


LEGEND
- Mining Lease Boundary
- Existing/Approved Development
- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Pipeline and Borefield Infrastructure
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)

Source: MCO (2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)
Orthophoto Mosaic: MCO (April 2016 - May 2012)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX
Approved Moolarben Coal Complex

MOOLARBEN COAL COMPLEX NOISE AND BLAST MONITORING SITES



LEGEND

- NSW National Parks and Wildlife Service
- Exploration Licence Boundary
- Mining Lease Boundary
- Railway

Land Ownership

- Moolarben Coal Operations Pty Ltd
- Moolarben Coal Operations Pty Ltd – Under Contract/Purchase Agreement
- Ulan Coal Mines Limited
- Wilpinjong Coal Mine
- Commercial
- Minister for Education
- Crown/State of NSW
- Privately Owned

- Mine Owned Receiver
- Private Receiver (Under Contract to MCO)
- Private Receiver

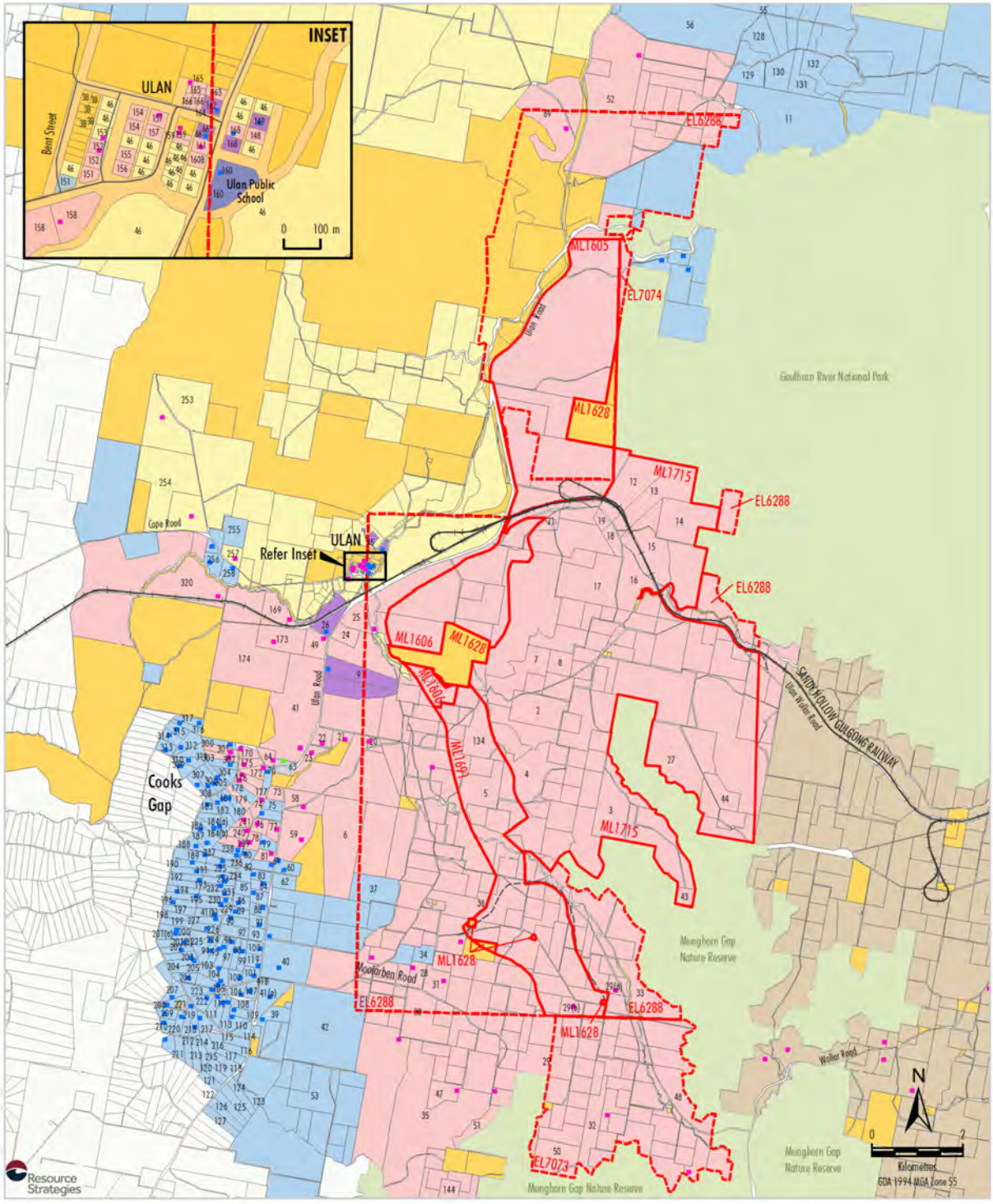
Environmental Monitoring

- Attended Noise Monitoring Site
- Directional Noise Monitoring Site (UCML)
- Real-time Noise Monitoring Site
- 2005 Background Noise Monitoring Site
- Blast Monitoring Site
- Meteorological Station
- Rock Shelter Site
- Rock Shelter Site (previously managed - no further monitoring required)

Source: MCC (2017); NSW Dept of Industry (2016); Office of Environment and Heritage NSW (2016)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX
Noise and Blast Monitoring Sites

LAND OWNERSHIP PLAN



LEGEND

- Exploration Licence Boundary
- Mining Lease Boundary
- Railway
- National Park/Nature Reserve

Land Ownership

- Moolarben Coal Operations Pty Ltd
- Moolarben Coal Operations Pty Ltd – Under Contract/Purchase Agreement
- Ulan Coal Mines Limited
- Wilpinjong Coal Mine
- Commercial
- Minister for Education
- Crown/State of NSW
- Privately Owned

- Mine Owned Receiver
- Private Receiver (Under Contract to MCO)
- Private Receiver

Source: MCC (2017); NSW Dept of Industry (2016); Office of Environment and Heritage NSW (2016)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX
Relevant Land Ownership Plan

RELEVANT LAND OWNERSHIP LIST

Ref No	Landholder
1-8	Moolarben Coal Operations Pty Ltd
9	Orica Australia Pty Limited
10	Moolarben Coal Operations Pty Ltd
11	JE Mullins & CD Imrie
12-25	Moolarben Coal Operations Pty Ltd
26	Forty North Pty Limited
27-33	Moolarben Coal Operations Pty Ltd
34	T Rheinberger
35-36	Moolarben Coal Operations Pty Ltd
37	M Stewart
38	The State of New South Wales
39	RM & DJ Sprigg
40	JM Devenish
41	Moolarben Coal Operations Pty Ltd
41(a&b)	PP Libertis
42	C & L Schmidt
43-44	Moolarben Coal Operations Pty Ltd
45	Advance Energy
46	Moolarben Coal Operations Pty Ltd/ Ulan Coal Mines Limited
46(b)	North-Eastern Wiradjuri Wilpinjong Community Fund Limited
47	SF & MR Andrews - Under MCO Contract/Purchase Agreement
48-52	Moolarben Coal Operations Pty Ltd
53	WD & MS Bryant
54	MA & C Harris
56	MJ & V Cundy
58-59	Moolarben Coal Operations Pty Ltd
59	G & GM Szymkarczuk
60	CL Rayner & DM Mundey
61	MA Miller
62	R Menchin
63	BF & B Whiticker
64	Moolarben Coal Operations Pty Ltd
66	Rostherne Pty Limited
69	Moolarben Coal Operations Pty Ltd
70	DJ & A Coventry
71	Moolarben Coal Operations Pty Ltd
73-74	Moolarben Coal Operations Pty Ltd
75	P Ban
76-78	Moolarben Coal Operations Pty Ltd
79	PTJ & SE Nagle
80	W & D Sebelic
81	Moolarben Coal Operations Pty Ltd
82	SC Hungerford & MC Clemens
83	DS Sebelic
85	J & Z Nikolovski
86	NW Harris
87	BJ & K Howe
88	BC Meyers
89	MV & HM Glover & E & BJ Tomlinson
90	SA Powell
91	HM Graham
92	VA Pullicino & J, S & G Bonnici
93	F & M Fenech
94	LK Mittemayer
95	BJ Withington
96	D Lazicic
97	DJ & MD Smith
98	ME & JJ Piper
99	DE Jenner & WB Jensen
100	W Ellem
101	RD & DMZ Hull
101(a)	PJ Kearns
102	KA Roberts
103	SB Burnett & SL Grant
104	RA & LA Deeben
105	DJ & N Katsikaris
106	TB & JH Reid
107	ZJ & M & AA Raso
108	R Varga
109	DA Evans
110	JT Thompson & HT Evans
111	GJ & NJ McEwan
112	MJ & LM Croft
113	CPG Ratcliff
114	TF & K Holland
115	PR McLean
116	DJ & SM Reid
117	JM Dick
118	A Scott
119	PJ Kearns
120	PS & DR Ord
121	EJ Cullen
122	WF Wirth
123	G Tuck-Lee & Symons
124	WJ & HE Bailey
125	DB McBride
126	MP Julian
127	BKT & SA Bracken
128	AW Sims
129	M Yelds
130	GP McEwen
131	GR & RA King
132	N Atkins
134	Moolarben Coal Operations Pty Ltd
144	Moolarben Coal Operations Pty Ltd
148	Moolarben Coal Operations Pty Ltd
149	Mid-Western Regional Council
151	Roman Catholic Church
152	Moolarben Coal Operations Pty Ltd
153	Ulan Coal Mine Limited
154-159	Moolarben Coal Operations Pty Ltd
160	Minister For Education And Training
160(b)	Moolarben Coal Operations Pty Ltd
161	Moolarben Coal Operations Pty Ltd
162	Rowmint Pty Limited
163-166	Moolarben Coal Operations Pty Ltd
168	PJL Constructions Pty Limited
169-170	Moolarben Coal Operations Pty Ltd
171	AD & SA McGregor
172-177	Moolarben Coal Operations Pty Ltd
178	PR Stone
180	CD & LL Barrett
181	SM Forster
182	J Dutoitcook
183	R & EA Steines
184	(a&b) LA Stevenson
186	RW & IJ Adamson
187	BT & KM Feeney
188	KR & T Fielding
189	GA Fay
190	T & LK Sahyoun
191	BW & TS Lasham
192	D Williams
193	DJ Moloney
194	PM & K Potts
195	R Cottom
196	F Saxberg & M Weir
197	PGG & I Neilsen
198	GR & ME Metcalfe
199	PGG & I Nielsen
200	VK Grimshaw
201	KR & GM Towerton
202	H & VF Butler
203	DJ Miller
204	RB & JE Donnan
205	DW Sparrow & M Tallan
206	CA Marshall & R Vella
207	AA & DM Smith
208	SA & CR Hasaart
209	F Mawson
210	JM & AM Tebutt
211	SA McGregor & WJ Gray
212	E & M Lepik
213	D & J Parsonage
214	RK & EG O'Neil
215	SG & PM Green
216	G Holland & FA Handicott
217	GF & GEL Soady
219	T & S Riger
220	SJ Rusten & NJ Smith
221	The State of New South Wales
222	BJ Purtell
223	EW Palmer & JM Stewart
224	RS & PCC Dupond
225	G & RF Doualetas
226	LAA & FC Muscat
227	WP & JA Hughes
229	JJ & BA Lowe
230	DA Hoole & DT Rawlinson
231	T Morrison & SM Benny
232	L & JA Haaring
233	K & D Boal
234	D & L Gaw
235	LM & RS Wilson
236	RG & CA Donovan
237	B & S Stokes
238	B Powell
239-241	Moolarben Coal Operations Pty Ltd
244	JT & YR Jones
245	MP & KLE Cresham
247	J & K Batshon
248	G Boustani
249	CJ & JI Eldridge
251	NF Potter & CE Selley
253-254	Ulan Coal Limited
255	HJ & H Schmitz
256	RC Campbell
258	PM & CD Elias
300	CM Collins & CY Marshall
301-302	Moolarben Coal Operations Pty Ltd
303	HJ Ungaro
304	G Balajan
305	L Barisic & M Aul
306	E Armstrong
307	M Chant & NK Young
308	NA Bower
309	GS Maher
310	KI Death
311	BJ & LC Williamson
312	MS & JJ Ioannou
313	NJ & BDE Tracy
314	SL Ford
315	WJ Richards & BJ Uzelac
316	CR Vassel & CM Williams
317	RJ Hore & V Bingham
320	Moolarben Coal Operations Pty Ltd
325	S & T Fevale
326	AW & LM Murray
327	CA Tanner
328	Essential Energy
329	G Tuck-Lee

Resource Strategies

Source: MCO (2017)

MOOLARBENCOAL
MOOLARBERN COAL COMPLEX
Relevant Landholder List

LAND OWNERSHIP DETAILS

ID	Owner	Type	Easting (MGA)	Northing (MGA)	Elevation
Cooks Gap					
37	M Stewart	Private	756179	6417107	547
39	RM & DJ Sprigg	Private	756038	6415288	585
40	JM Devenish	Private	756389	6416414	554
41(a)	PP Libertis (Perpetual Lease)	Private	756194	6415791	574
41(b)	PP Libertis (Perpetual Lease)	Private	754978	6417572	586
60	CL Rayner and DM Mundey	Private	756500	6418546	527
61	MA Miller	Private	756375	6418755	524
70[1]	DJ & A Coventry	Private	756132	6420692	510
75[1]	P Ban	Private	756012	6419777	513
79	PTJ & SE Nagle	Private	756034	6419159	519
80	W & D Sebelic	Private	755649	6418908	531
82	SC Hungerford & MC Clemens	Private	756223	6418659	524
83	CF & CR Wall	Private	755832	6418444	533
84	DS Sebelic	Private	756047	6418248	531
86	NW Harris	Private	755506	6417818	558
87	BJ & K Howe	Private	755841	6418051	539
88	BC Meyers	Private	756043	6417724	539
89	MV & HM Glover & E & BJ Tomlinson	Private	755431	6417645	559
90	SA Powell	Private	755337	6417501	565
91	HM Graham	Private	755969	6417348	544
94	LK Mittemayer	Private	754900	6416785	609
95	BJ Withington	Private	755085	6416834	600
96	D Lazicic	Private	755183	6416867	590
97	DJ & MD Smith	Private	755364	6416985	573
98	ME & JJ Piper	Private	755440	6416783	575
99	DE Jenner & WB Jensen	Private	755603	6416770	568
100	W Ellem	Private	755992	6416832	556
101	RD & DMZ Hull	Private	755850	6416237	571
102	KA Roberts	Private	755530	6416189	579
103	SB Burnett & SL Grant	Private	755072	6416399	595
104	RA & LA Deeben	Private	755112	6416116	592
105	DJ & N Katsikaris	Private	755061	6416033	597
106	TB & JH Reid	Private	755558	6415823	601
107	ZJ & M & AA Raso	Private	755752	6415919	587
109	DA Evans	Private	755410	6415494	620
110	JT Thompson & HT Evans	Private	755361	6415339	619
111	GJ & NJ McEwan	Private	755052	6415789	604
112	MJ & LM Croft	Private	755138	6415655	605
113	CPG Ratcliff	Private	755269	6415661	606
119	PJ Kearns	Private	755937	6416447	564
171	AD & SA McGregor	Private	753898	6414840	665
180	CD & LL Barrett	Private	755292	6420111	565

LAND OWNERSHIP DETAILS

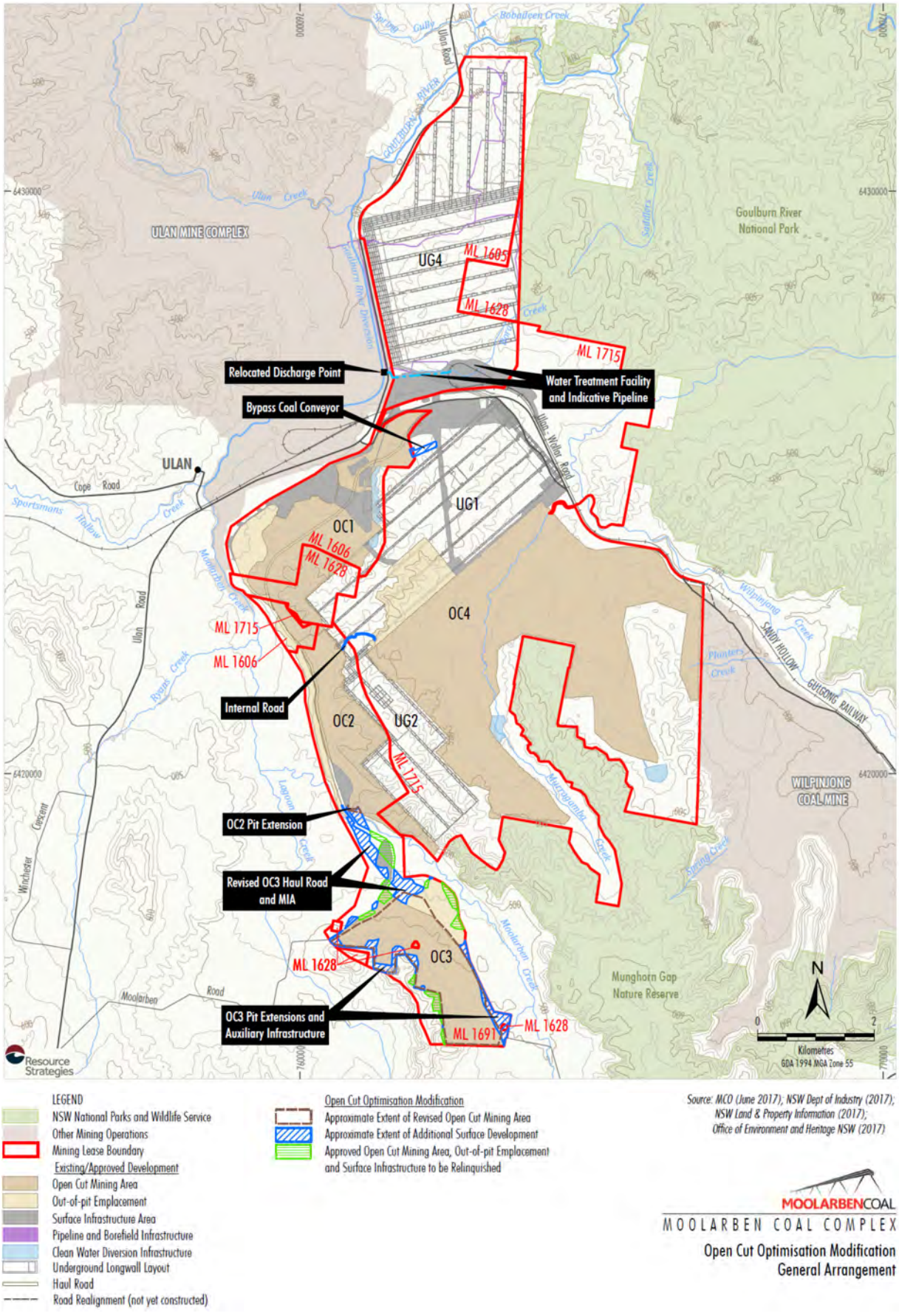
ID	Owner	Type	Easting (MGA)	Northing (MGA)	Elevation
181	SM Forster	Private	755178	6420092	568
182	J Dutoitcook	Private	755049	6420016	580
183	R & EA Steines	Private	754822	6419969	589
184(a)	LA Stevenson	Private	755093	6419504	564
184(b)	LA Stevenson	Private	754967	6419464	581
186	RW & IJ Adamson	Private	754674	6419437	589
187	BT & KM Feeney	Private	754816	6419137	594
188	KR & T Fielding	Private	754577	6419073	584
189	Fay	Private	754772	6418881	593
190	T & LK Sahyoun	Private	754488	6418711	579
191	BW & TS Lasham	Private	754592	6418520	588
192	D Williams	Private	754649	6418328	589
194	PM & K Potts	Private	754160	6418080	578
195	R Cottam	Private	754583	6417973	591
196	F Saxberg & M Weir	Private	754072	6417840	583
200	VK Grimshaw	Private	754141	6417241	604
201 (a)	KR & GM Towerton	Private	754138	6417158	605
201 (b)	KR & GM Towerton	Private	754311	6416962	609
202	H & VF Butler	Private	754258	6416804	609
203	DJ Miller	Private	754462	6416639	627
204	RB & JE Donnan	Private	754537	6416557	635
206	CA Marshall & R Vella	Private	754394	6416192	628
207	AA & DM Smith	Private	754057	6415768	635
208	SA & CR Hasaart	Private	753938	6415612	648
209	F Mawson	Private	753883	6415407	650
210	JM & AM Tebutt	Private	753873	6415226	660
217	RP & JL Patterson	Private	754659	6415319	661
218	GF & GEL Soady	Private	754550	6415117	666
219	T & S Riger	Private	754468	6415587	647
220	SJ Rusten & NJ Smith	Private	754258	6415351	645
222	BJ Purtell	Private	754813	6415761	628
223	EW Palmer & JM Stewart	Private	754921	6415935	612
224	RS & PCC Dupond	Private	754895	6417021	602
226	LAA & FC Muscat	Private	754812	6417270	592
227	WP & JA Hughes	Private	755000	6417482	585
229	JJ & BA Lowe	Private	755115	6417791	579
230	DA Hoole & DT Rawlinson	Private	755229	6417879	573
231	T Morrison & SM Benny	Private	755200	6418034	563
232	L & JA Haaring	Private	755121	6418197	564
233	D & K Boal	Private	755196	6418290	554
234	D & L Gaw	Private	755157	6418405	557
235	LM & RS Wilson	Private	755107	6418631	559
236	RG & CA Donovan	Private	755165	6418738	557

LAND OWNERSHIP DETAILS

ID	Owner	Type	Easting (MGA)	Northing (MGA)	Elevation
237	B & S Stokes	Private	755468	6418862	540
238	B Powell	Private	755497	6418969	537
300	CM Collins & CY Marshall	Private	755327	6421268	542
303	HJ Ungaro	Private	755327	6420850	553
305	L Barisic & M Aul	Private	755052	6420566	559
306	E Armstrong	Private	754978	6420431	564
307	M Chant & NK Young	Private	754843	6420373	563
308	NA Dower	Private	754605	6420402	554
309	GS Maher	Private	754219	6420817	534
310	KI Death	Private	754407	6420948	534
312	MS & JJ Ioannou	Private	754239	6421215	523
313	NJ & BDE Pracy	Private	753906	6421166	518
314	SL Ford	Private	753997	6421486	512
315	WJ Richards & BJ Uzelac	Private	754141	6421605	511
316	CR Vassel & CM Williams	Private	754210	6421744	510
317	RJ Hore & V Bingham	Private	754646	6421744	519
Ulan					
11 (a)	JE Mullins & CD Imrie	Commercial	765376	6431622	388
11 (b)	JE Mullins & CD Imrie	Private	765265	6431931	380
11 (c)	JE Mullins & CD Imrie	Commercial	764784	6431839	393
255	HJ & H Schmitz	Private	754922	6425602	458
256	R Campbell & S Frost	Private	754887	6425251	452
258	PM & CD Elias	Private	755375	6425132	453
Ulan Village Non-residential					
160	Minister for Education and Training (Ulan Public School)	School	758350	6425029	418
168	PJL Constructions Pty Limited (Church)	Church	758386	6425136	419
9	Orica Australia Pty Limited	Commercial	757478	6422930	451
26	Forty North Pty Limited	Commercial	757430	6423741	435
46B	North Eastern Wiradjuri Wilpinjong Community Fund Limited	Commercial	758663	6425526	416
66	Rostherne Pty Limited	Commercial	758310	6425130	420
149	Mid Western Regional Council	Commercial	758457	6425165	417
162	Rowmint Pty Ltd	Commercial	758342	6425199	419

Note 1: Project Approval Noise Limit for this receiver is above the intrusive PSNL (refer Appendices A1 and A2).
Note 2: Mine-owned properties subject to completion of current purchase agreement.
Note 3: Landowner that can request additional noise mitigation measures.

OPEN CUT OPTIMISATION MODIFICATION GENERAL ARRANGEMENT



LEGEND
- NSW National Parks and Wildlife Service
- Other Mining Operations
- Mining Lease Boundary

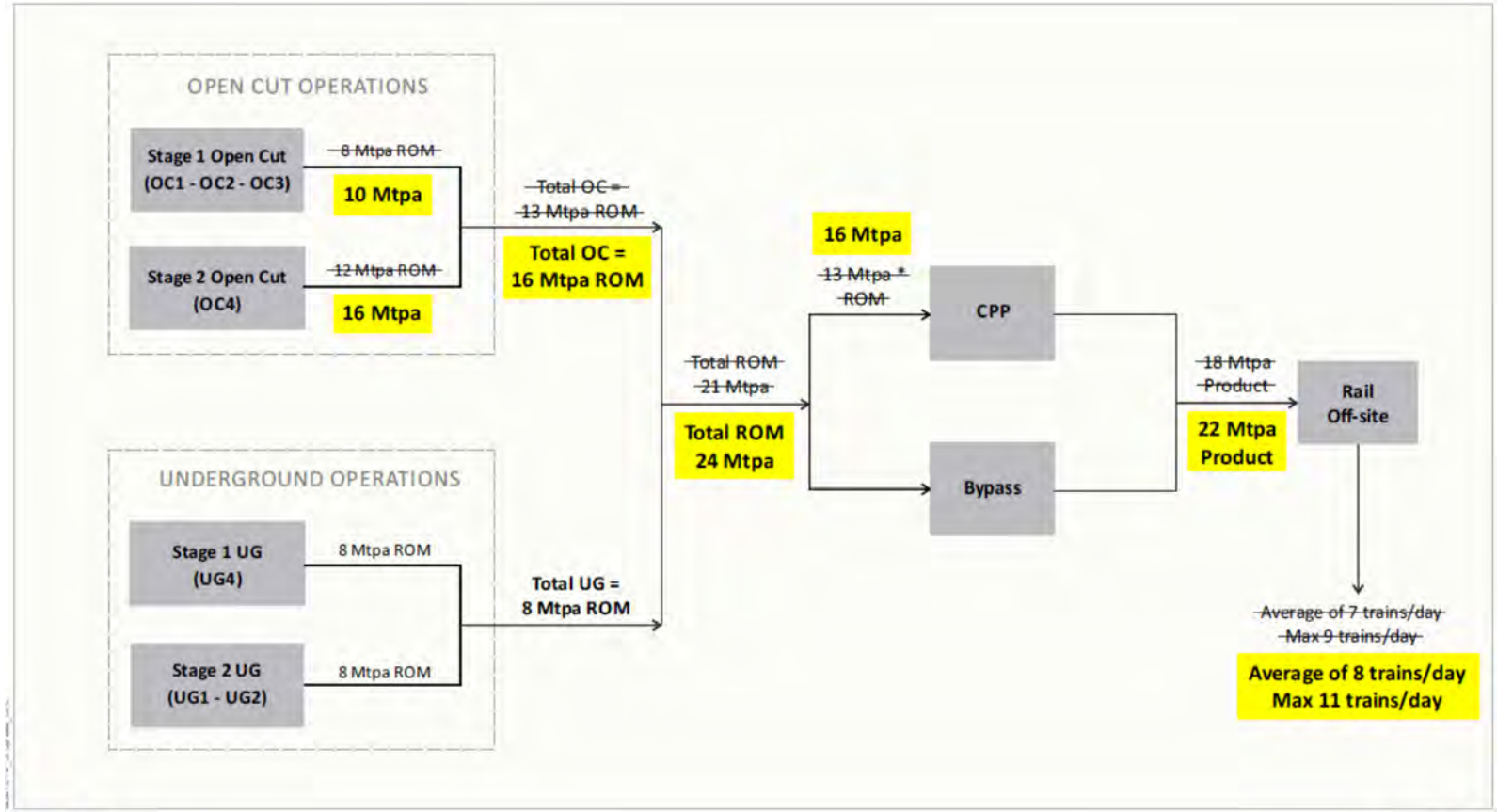
Existing/Approved Development
- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Pipeline and Borefield Infrastructure
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)

Open Cut Optimisation Modification
- Approximate Extent of Revised Open Cut Mining Area
- Approximate Extent of Additional Surface Development
- Approved Open Cut Mining Area, Out-of-pit Emplacement and Surface Infrastructure to be Relinquished

Source: MCO (June 2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX
Open Cut Optimisation Modification General Arrangement

OPEN CUT OPTIMISATION MODIFICATION COAL HANDLING AND PROCESSING SCHEMATIC



On-site Automatic Weather Station (AWS) - August 2011 to July 2014

Table E1 Seasonal Frequency of Occurrence Wind Speed Intervals - Daytime

Period	Calm (< 0.5 m/s)	Wind Direction (± 45°)	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	10.0%	ENE	13.1%	10.4%	23.4%
Summer	4.1%	ENE	12.7%	15.0%	27.7%
Autumn	12.9%	ENE	17.0%	11.8%	28.8%
Winter	16.4%	WSW	17.5%	13.3%	30.8%
		W	16.3%	13.8%	30.0%
Spring	6.1%	WSW	9.9%	12.4%	22.4%

Table E2 Seasonal Frequency of Occurrence Wind Speed Intervals - Evening

Period	Calm (< 0.5 m/s)	Wind Direction (± 45°)	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	19.1%	SW	28.7%	4.4%	33.0%
		WSW	26.1%	4.7%	30.8%
Summer	9.5%	ENE	14.8%	15.8%	30.6%
Autumn	24.7%	SSW	29.8%	1.8%	31.6%
		SW	32.1%	2.6%	34.7%
		WSW	27.6%	2.8%	30.3%
Winter	28.0%	SSW	29.6%	2.8%	32.3%
		SW	35.5%	5.0%	40.5%
		WSW	34.3%	6.1%	40.4%
		W	24.4%	6.1%	30.5%
Spring	13.1%	SSW	32.0%	5.3%	37.3%
		SW	37.1%	7.3%	44.4%
		WSW	34.5%	7.5%	42.1%

Table E3 Seasonal Frequency of Occurrence Wind Speed Intervals - Night-Time

Period	Calm (< 0.5 m/s)	Wind Direction (± 45°)	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	36.1%	SW	25.5%	1.9%	27.4%
Summer	25.7%	ENE	21.2%	15.9%	37.1%
		E	20.3%	16.0%	36.3%
Autumn	43.8%	SW	25.2%	1.3%	26.5%
Winter	44.7%	SW	29.4%	3.3%	32.7%
		WSW	28.4%	4.7%	33.1%
Spring	28.6%	SSW	34.6%	1.6%	36.1%
		SW	35.4%	2.1%	37.5%
		WSW	28.4%	2.3%	30.6%

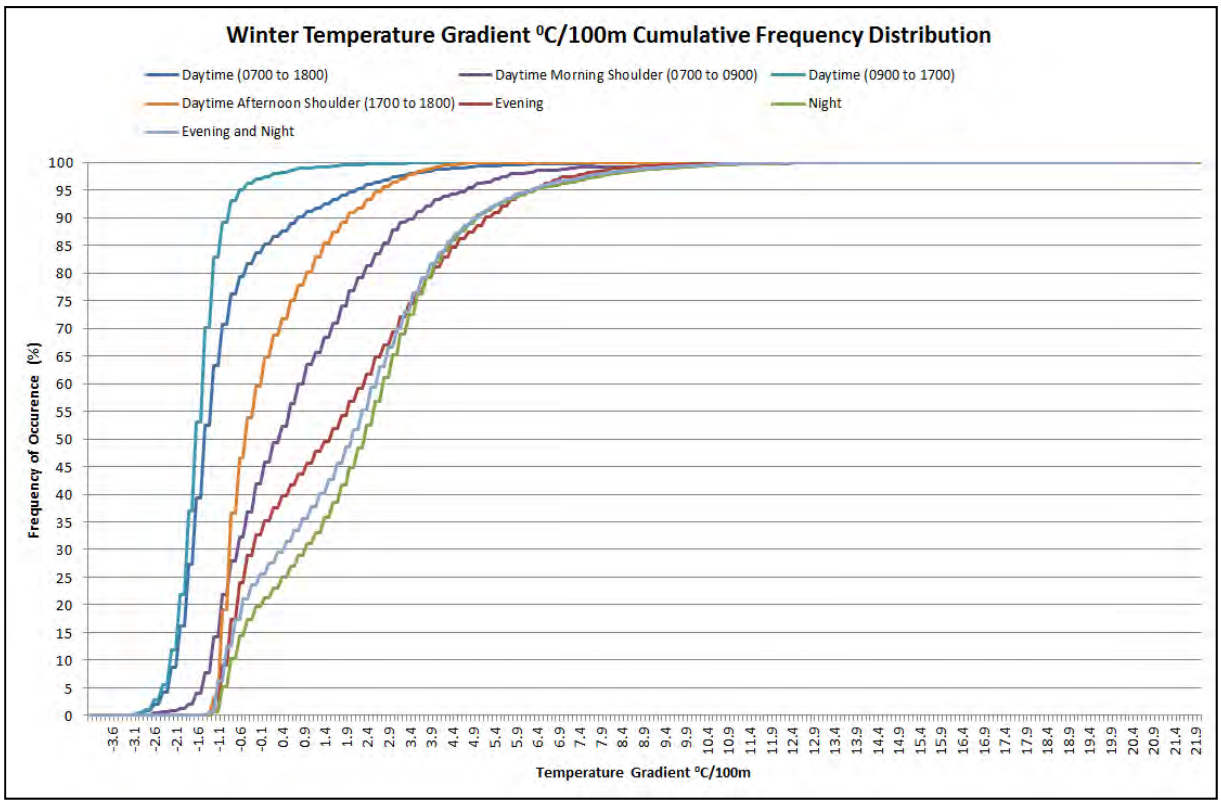
Table E4 Winter Temperature Gradient Exceedance Level (Degrees C per 100 m) Summary

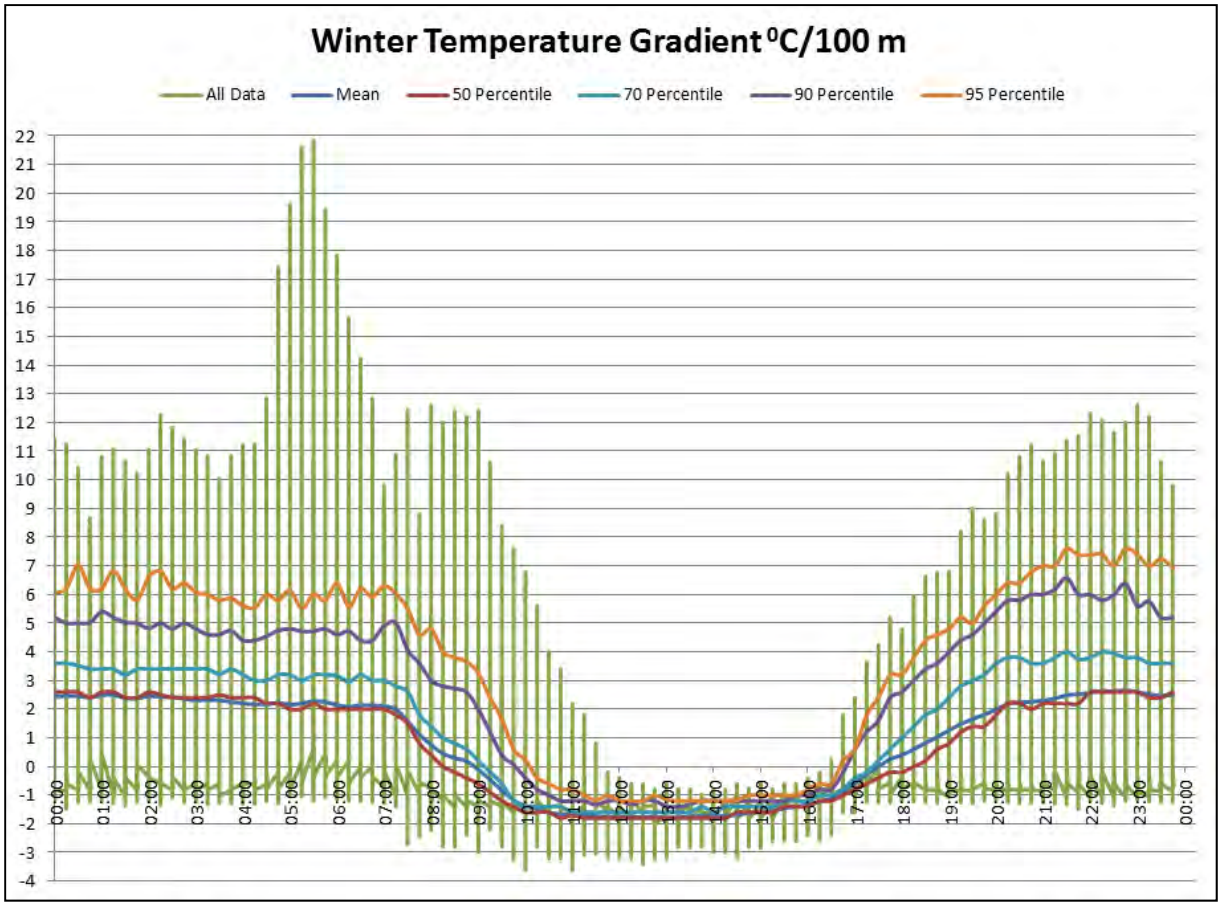
Daytime Exceedance			Evening Exceedance			Night-time Exceedance			Evening/Night-time Exceedance		
0700 to 1800 hours			1800 to 2200 hours			2200 to 0700 hours			1800 to 0700 hours		
50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%
-1.4	-1.0	0.8	1.6	3.2	5.2	2.4	3.4	5.0	2.2	3.4	5.2

Table E5 Morning Shoulder, Daytime and Afternoon Shoulder Winter Temperature Gradient Exceedance Level

0700 to 0900 hours				0900 to 1700 hours				1700 to 1800 hours			
50%	30%	10%	5%	50%	30%	10%	5%	50%	30%	10%	5%
0.4	1.6	3.6	4.8	-1.6	-1.4	-0.8	-0.4	-0.4	0.4	2.0	2.8

On-site Automatic Temperature Tower (ATT) - August 2011 to July 2014





EPA'S INP APPLICATION NOTE - SLEEP DISTURBANCE

Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The NSW Industrial Noise Policy (INP) (New South Wales [NSW] Environmental Protection Agency [EPA], 2000) does not specifically address sleep disturbance from high noise level events.

A review of research on sleep disturbance was conducted for the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, the DECCW recognised that current sleep disturbance criterion of an $L_{A1(1minute)}$ not exceeding the $L_{A90(15minute)}$ by more than 15 A-weighted decibels (dBA) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the DECCW will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or $L_{A1(1minute)}$, that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- Time of day (normally between 2200 hrs and 0700 hrs).
- Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The $L_{A1(1minute)}$ descriptor is meant to represent a maximum noise level measured under "fast" time response. DECC will accept analysis based on either $L_{A1(1minute)}$ or L_{Amax}.

NOISE EXTRACT DP&E VOLUNTARY LAND ACQUISITION AND MITIGATION POLICY

NOISE

This section details how the policy applies to noise impacts.

Assessment criteria

Applicants are required to assess the impacts of the development in accordance with the:

- NSW Industrial Noise Policy (EPA 2000) (INP);
- Rail Infrastructure Noise Guideline (EPA 2013) (RING);
- Road Noise Policy (DECCW 2011) (RNP); and the
- Interim Construction Noise Guideline (DECC 2009) (ICNG).

These policies and guidelines seek to strike an appropriate balance between supporting the economic development of NSW and protecting the amenity and wellbeing of the community. They recommend standards for regulating the construction, operational, road and rail noise impacts of a development, and require applicants to implement all reasonable and feasible avoidance and mitigation measures.

These standards are generally conservative, and it does not automatically follow that exceedances of the relevant criteria will result in unacceptable impacts.

Mitigation and acquisition criteria

A consent authority can apply voluntary mitigation and voluntary land acquisition rights to reduce:

- Operational noise impacts of a development on privately-owned land; and
- Rail noise impacts of a development on privately-owned land near non-network rail lines (private rail lines) on or exclusively servicing industrial sites (see Appendix 3 of the RING);

But not:

- Construction noise impacts, as these impacts are shorter term and can be controlled;
- Noise impacts on the public road or rail network; or
- Modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through site-specific pollution reduction programs under the *Protection of the Environment Operations Act 1997*.

Process for decision-making on noise impacts

The decision-making process which should be applied by a consent authority under this policy is summarised in Figure 4 below.

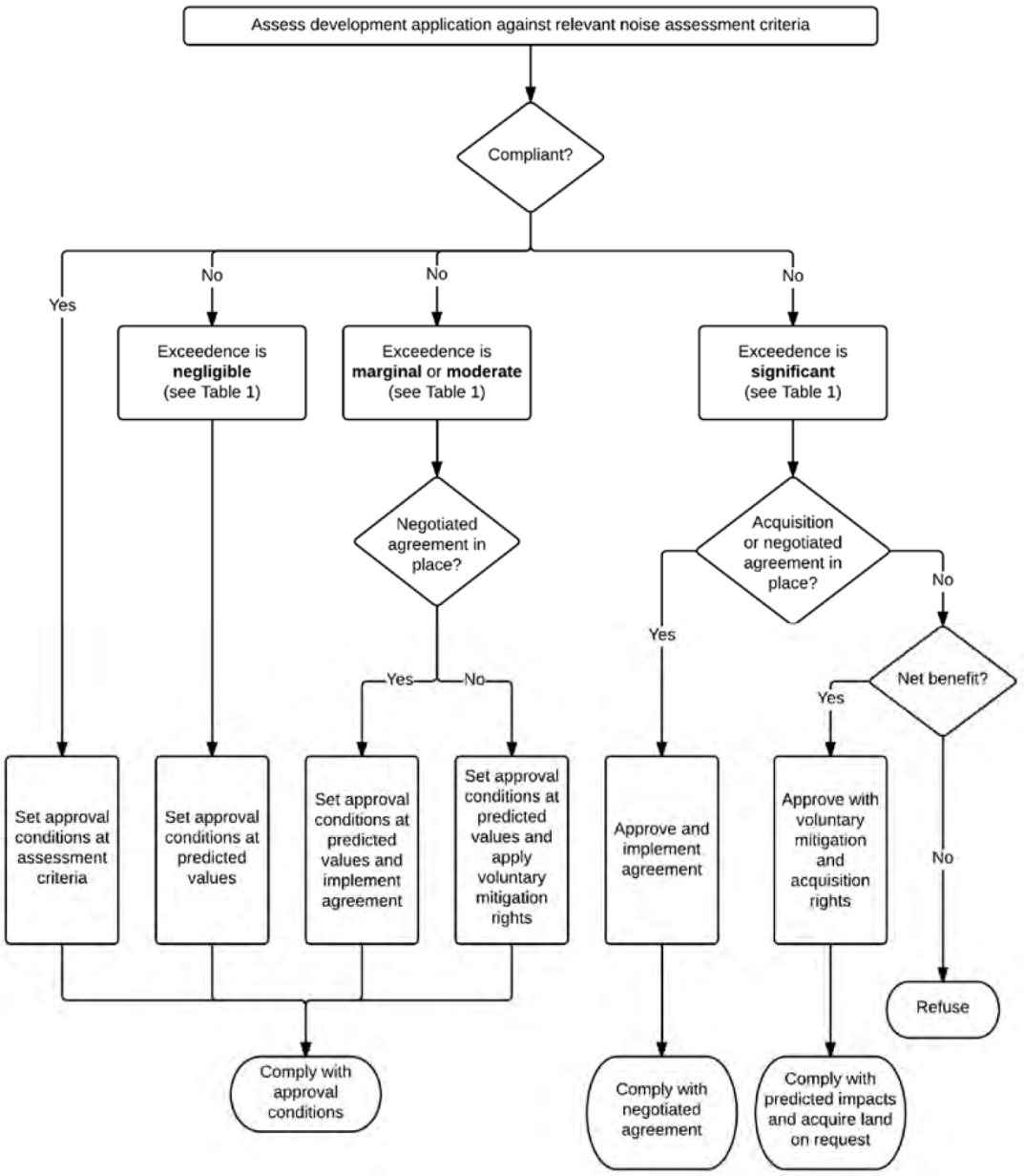


Figure 4 – Decision-making process for noise impacts.

Table 1 below summarises the NSW Government's interpretation of the significance of any potential exceedances of the relevant noise assessment criteria, and identifies potential treatments for these exceedances.

Table 1 - Characterisation of noise impacts & potential treatments

Residual noise exceeds INP criteria by	Characterisation of impacts	Potential treatment
0-2dB(A) above the project specific noise level (PSNL)	Impacts are considered to be **negligible**	The exceedances would not be discernable by the average listener and therefore would not warrant receiver based treatments or controls
3-5dB(A) above the PSNL in the INP but the development would contribute less than 1dB to the total industrial noise level	Impacts are considered to be **marginal**	Provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity.
3-5dB(A) above the PSNL in the INP and the development would contribute more than 1dB to the total industrial noise level	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors, roof insulation etc. to further increase the ability of the building façade to reduce noise levels.
>5dB(A) above the PSNL in the INP	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions below.

Voluntary mitigation rights

A consent authority should only apply voluntary mitigation rights where, even with the implementation of best practice management:

- The noise generated by the development would be equal to or greater than 3dB(A) above the INP project-specific noise level at any residence on privately owned land; or
- The development would increase the total industrial noise level at any residence on privately owned land by more than 1dB(A) and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the INP; or
- The development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING (see Appendix B) by greater than or equal to 3dB(A) at any residence on privately owned land.

All noise levels must be calculated in accordance with the INP or RING (as applicable).

The selection of mitigation measures should be guided by the potential treatments identified in Table 1 above.

Voluntary land acquisition rights

A consent authority should only apply voluntary land acquisition rights where, even with the implementation of best practice management:

- The noise generated by the development would be more than 5dB(A) above the project-specific noise level at any residence on privately owned land; or
- The noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the INP on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls[7]; or
- The development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria in Table 6 of Appendix 3 of the RING at any residence on privately owned land.

All noise levels must be calculated in accordance with the INP or RING (as applicable).

[7] *Voluntary land acquisition rights should not be applied to address noise levels on vacant land other than to vacant land specifically meeting these criteria.*

Comparative Fixed Plant and Mobile Equipment Fleets SWLs (dBA re 1 pW)

Equipment	Type/ Capacity	UG1 Optimisation Modification NIA[1,2]			Year 2019[3]			Year 2021[3]			Year 2026[3]		
		No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL
Drill	Atlas Copco DML60	2	117	120	2	117	120	2	117	120	2	117	120
	Pit Viper 275	2	115	118	2	115	118	2	115	118	2	115	118
Excavator	Liebherr 996	2	117	120	2	117	120	2	117	120	2	117	120
	Liebherr 996B	1	111	111	1	111	111	1	111	111	1	111	111
	Liebherr 9800	1	114	114	1	114	114	1	114	114	1	114	114
	CAT 6050	2	118	121	2	118	121	2	118	121	2	118	121
	Komatsu PC1250	-	111	-	1	111	111	1	111	111	1	111	-
Front-end Loader	Komatsu WA1200	2	121	124	3	121	126	3	121	127	3	121	126
	Komatsu WD900	1	120	120	-	120	-	-	120	-	-	120	-
	CAT 854	1	114	114	1	114	114	1	114	117	1	114	114
Truck	Komatsu 930E	-	111	-	5	113	120	5	113	120	5	113	120
	Komatsu 830E	29	115	130	17	115	127	17	115	127	17	115	127
	Komatsu 730E/CAT 789	9	114	124	11	114	124	11	114	125	11	114	124
Dozer	Komatsu D475	7	113	121	17	113	125	17	113	125	17	113	125
	Komatsu D375	3	113	118	3	113	118	3	113	118	3	113	118
	CAT D11T	8	116	125	2	116	119	2	116	119	2	116	119
	CAT D10T	4	114	120	-	114	-	-	114	-	-	114	-
Water Truck	Komatsu HD785	4	115	121	5	115	122	5	115	122	5	115	122
Grader	Komatsu GD825	2	110	113	-	110	-	-	110	-	-	110	-
	CAT 24M	2	110	113	3	110	115	3	110	115	3	110	115
	CAT 16M	2	108	111	3	108	113	3	108	113	3	108	113
Support Loader	Komatsu WA580-6	1	115	115	1	115	115	1	115	115	1	115	-
Support Excavator	Komatsu PC450	2	105	108	3	105	110	3	105	108	3	105	112
Support Scraper	CAT 657G	1	117	117	-	117	-	-	117	-	-	117	-
Service Truck	Komatsu HD785	1	115	115	1	115	115	1	115	115	1	115	115
Service Truck	CAT 773F	1	114	114	2	114	117	2	114	117	2	114	117

PROJECT DAYTIME PLANT AND EQUIPMENT SOUND POWER LEVELS (SWL)

Equipment	Type/ Capacity	UG1 Optimisation Modification NIA[1,2]			Year 2019[3]			Year 2021[3]			Year 2026[3]		
		No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL
MMU		-	108	-	3	108	113	3	108	113	3	108	113
Stemming truck		-	108	-	1	108	108	1	108	108	1	108	108
Truck	Mack MetroLiner	-	108	-	1	108	108	1	108	108	1	108	108
Mobile Equipment		**90**		**134.6**	**93**		**134.1**	**93**		**134.1**	**93**		**134.1**
CHPP		1	118	118	1	118	118	1	118	118	1	118	118
Reject Bin		1	104	104	1	104	104	1	104	104	1	104	104
Feeder		1	114	114	1	114	114	1	114	114	1	114	114
Crusher		1	114	114	1	114	114	1	114	114	1	114	114
Transfer Station		2	115	118	3	115	120	3	115	120	3	115	120
Sizing Station		1	116	116	1	116	116	1	116	116	1	116	116
Stacker		1	105	105	2	105	108	2	105	108	2	105	108
Conveyor			101 (per 100m)	120		101 (per 100m)	120		101 (per 100m)	120		101 (per 100m)	120
Conveyor Drive		11	98	108	11	98	109	11	98	109	11	98	109
Ventilation Fans		2	112	115	2	112	115	2	112	115	2	112	115
Loadout Bin		1	113	113	2	113	116	2	113	116	2	113	116
Locomotive		3	109	114	3	109	114	3	109	114	3	109	114
CHPP Plant				**125.9**			**126.5**			**126.5**			**126.5**
Dozer		2	114	117	1	114	114	1	114	114	1	114	114
Sizing Station		1	116	116	1	116	116	1	116	116	1	116	116
Conveyor			101 (per 100m)	105		101 (per 100m)	115		101 (per 100m)	115		101 (per 100m)	115
Conveyor Drives		3	95/98/101	103	3	95/98/101	103	3	95/98/101	103	3	95/98/101	103
Rear Air Intake		1	111.6	112	1	111.6	112	1	111.6	112	1	111.6	112
Underground 1				**120.4**			**120.7**			**120.7**			**120.7**
Dozer		-	-	-	-	-	-	2	113	116	2	113	116
Transfer Station		-	-	-	-	-	-	2	115	118	2	115	118

PROJECT DAYTIME PLANT AND EQUIPMENT SOUND POWER LEVELS (SWL)

Equipment	Type/ Capacity	UG1 Optimisation Modification NIA[1,2]			Year 2019[3]			Year 2021[3]			Year 2026[3]		
		No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL	No. Items	SWL per Item	Total SWL
Conveyor		-	-	-	-	-	-	1817	101 (per 100m)	114	1817	101 (per 100m)	114
Conveyor Drive		-	-	-	-	-	-	4	98	104	4	98	104
Discharge		-	-	-	-	-	-	2	96.3	99	2	96.3	99
Sizing Station		-	-	-	-	-	-	1	116	116	1	116	116
Bypass Conveyor				**-**			**-**			**122.3**			**122.3**
Estimated Mine Site				**135.3**			**135.0**			**135.2**			**135.2**

Note 1: Estimated mobile equipment SWLs based on demonstrated noise controls. Estimated fixed plant SWLs based on achievable low noise emission standards and NIA acoustic design requirements.

Note 2: As modelled in the UG1 Optimisation Modification NIA.

Note 3: Estimated mobile equipment SWLs based on existing performance and demonstrated noise controls. Estimated fixed plant SWLs based on achievable low noise emission standards and NIA acoustic design requirements. The number of items stated is the total excluding any utilisation rate.

Year 2019 Scenario Typical Mobile Equipment Fleet Distribution

Open Cut 1 Area	Open Cut 2 Area	Open Cut 3 Area	Open Cut 4 Area	CHPP/ROM Area	Drill/Preparation Area	Underground 1 Area (UG1)	Unutilised
	Overburden Fleet: 1 x Liebherr 996 Excavator 2 x Komatsu D375 Dozers 4 x Komatsu 830E Trucks	**Coal Fleet**: 1 x Komatsu PC450 Excavator (Non-adverse conditions ONLY): 1 x Komatsu WA1200 Loader 1 x CAT 854 Dozer 7 x CAT 789D Haul Trucks	**Coal Fleet**: 1 x Komatsu WA580 Loader (Daytime Only) 1 x Komatsu PC450 Excavator (Operating in OC4 when not coaling from OC3): 1 x CAT 6050 Shovel 1 x CAT 854 Dozer 4 x CAT 789D Haul Trucks 1 x Komatsu WA1200 Loader (Satellite ROM – Turn off when coaling from OC3)	3 x Komatsu D475 Dozers (S/Pile) (ROM) 1 x Komatsu WA1200 Loader (ROM) 2 x CAT 789D Haul Trucks (Reject)	**OC3:** 1 x Atlas Copco DML 60 Drill 1 x MMU 1 x Komatsu D375 Dozer	1 x Komatsu D475 Dozer	2 x CAT 789D Haul Trucks 4 x Komatsu 830E Trucks 1 x Komatsu 930E Trucks 1 x PitViper 275 Drill 4 x Komatsu D475 Dozers 1 x Komatsu WA1200 Loader 1 x CAT 24M Grader 1 x CAT 16M Grader 1 x CAT 6050 Shovel 1 x Mack MetroLiner 1 x Komatsu PC450 Excavator
		Overburden Fleet: 1 x Liebherr 996B Excavator 2 x Komatsu D475 Dozers 4 x Komatsu 830E Trucks	**Overburden Fleet 1**: 1 x Komatsu PC1250 Excavator 4 x Komatsu D475 Dozers (Pushing) 1 x Liebherr 9800 Excavator 1 x Komatsu D475 Dozer 4 x Komatsu 930E Trucks 2 x CAT D11 Dozer		**OC4:** 1 x PitViper 275 Drills 1 x Atlas Copco DML 60 Drill 2 x MMUs 1 x Stemming Truck 2 x Komatsu D475 Dozers		
			Overburden Fleet 2: 1 x Liebherr 996 Excavator 1 x Komatsu D475 Dozer 5 x Komatsu 830E Trucks				
Support Fleet: 1 x Komatsu HD785 Water Truck 1 x Komatsu HD785 Service Truck	**Support Fleet**: 1 x Komatsu HD785 Water Truck 1 x CAT 16M Grader	**Support Fleet**: 1 x Komatsu HD785 Water Truck 1 x CAT 773F Service Truck 1 x CAT 24M Graders	**Support Fleet**: 2 x Komatsu HD785 Water Trucks 1 x CAT 773F Service Truck 1 x CAT 24M Graders 1 x CAT 16M Grader				

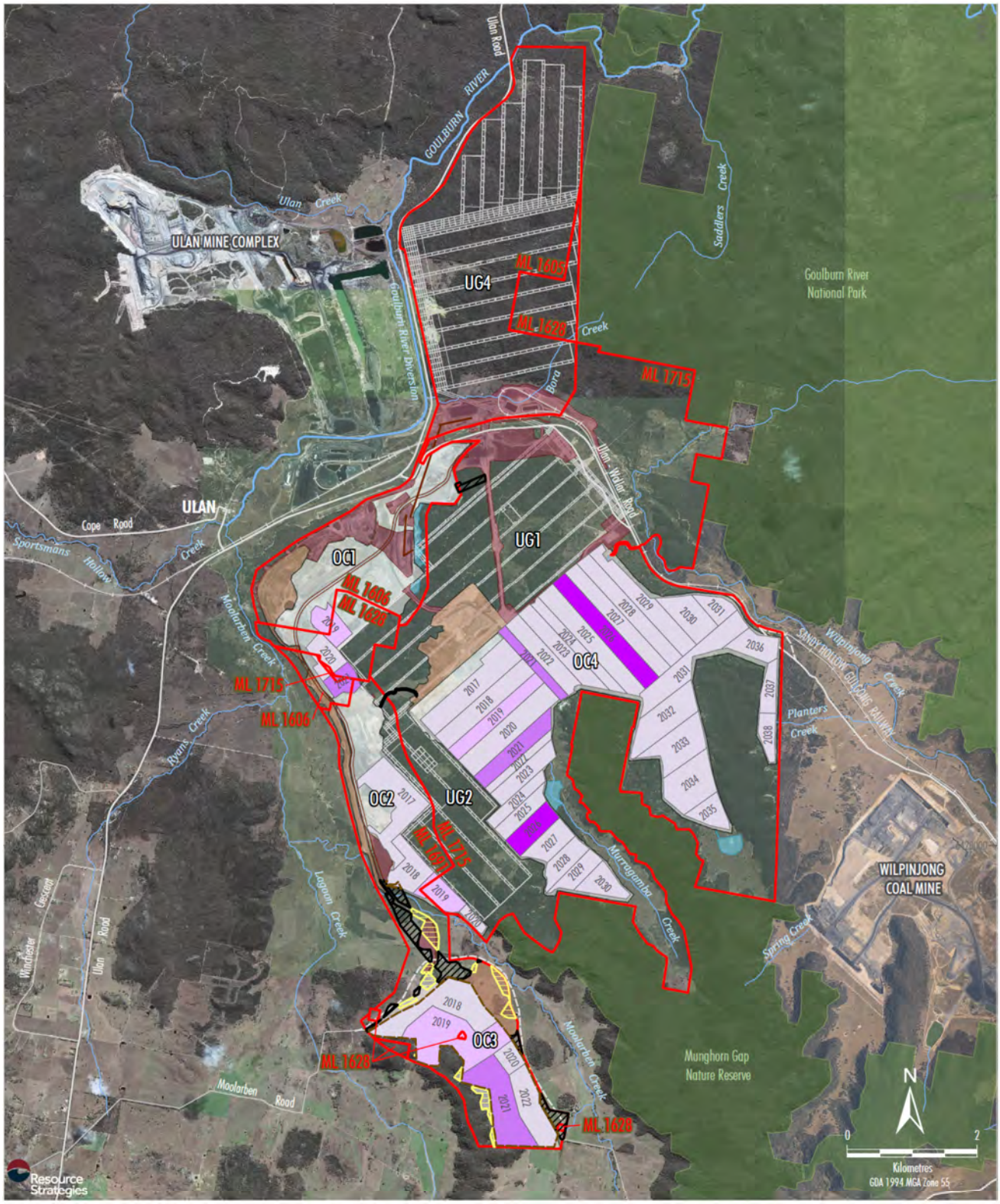
Year 2021 Scenario Typical Mobile Equipment Fleet Distribution

Open Cut 1 Area	Open Cut 3 Area	Open Cut 4 Area	CHPP/ROM Area	Drill/Preparation Area	Underground 1 Area (UG1)	Bypass Conveyor Area	Unutilised
Overburden Fleet: 1 x Liebherr 996 Excavator 2 x Komatsu D375 Dozers 3 x Komatsu 830E Trucks	**Coal Fleet**: 1 x Komatsu PC450 Excavator (Non-adverse conditions ONLY): 1 x Komatsu WA1200 Loader 1 x CAT 854 Dozer 8 x CAT 789D Haul Trucks	**Coal Fleet**: 1 x Komatsu PC450 Excavator (Operating in OC4 when not coaling from OC3): 1 x CAT 6050 Shovel 1 x CAT 854 Dozer 4 x CAT 789D Haul Trucks 1 x Komatsu WA1200 Loader (Satellite ROM – Turn off when coaling from OC3)	3 x Komatsu D475 Dozers (S/Pile) (ROM) 1 x Komatsu WA1200 Loader (ROM) 2 x CAT 789D Haul Trucks (Reject)	**OC1:** 1 x PitViper 275 Drills 1 x Atlas Copco DML 60 Drill 2 x MMUs 1 x Stemming Truck 2 x Komatsu D475 Dozers	1 x Komatsu D475 Dozer	2 x Dozers (e.g. Komatsu 475)	5 x Komatsu 830E Trucks 1 x Komatsu 930E Truck 1 x PitViper 275 Drill 4 x Komatsu D475 Dozers 1 x Komatsu WA1200 Loader 1 x CAT 24M Grader 1 x CAT 16M Grader 1 x CAT 6050 Shovel 1 x Mack MetroLiner Truck 1 x Komatsu PC450 Excavator 1 x 789D
	Overburden Fleet: 1 x Liebherr 996B Excavator 2 x Komatsu D475 Dozers 4 x Komatsu 830E Trucks	**Overburden Fleet 1**: 4 x Komatsu D475 Dozers (Pushing) 1 x Liebherr 9800 Excavator 1 x Komatsu D475 Dozer 4 x Komatsu 930E Trucks 2 x CAT D11 Dozers					
		Overburden Fleet 2: 1 x Liebherr 996 Excavator 1 x Komatsu D475 Dozer 5 x Komatsu 830E Trucks 1 x Komatsu PC1250 Excavator 1 x Komatsu WA580 Loader (Daytime Only)		**OC3:** 1 x Atlas Copco DML 60 Drill 1 x MMU 1 x Komatsu D375 Dozer			
Support Fleet: 1 x Komatsu HD785 Water Truck 1 x Komatsu HD785 Service Truck 1 x CAT 16M Grader	**Support Fleet**: 1 x Komatsu HD785 Water Trucks (Day/Evening ONLY): 1 x Komatsu HD785 Water Trucks 1 x CAT 773F Service Truck 1 x CAT 24M Grader	**Support Fleet**: 2 x Komatsu HD785 Water Trucks 1 x CAT 773F Service Truck 1 x CAT 24M Grader 1 x CAT 16M Grader					

Year 2026 Scenario Typical Mobile Equipment Fleet Distribution

Open Cut 1 Area	Open Cut 4 Area	CHPP/ROM Area	Drill/Preparation Area	Underground 1 Area (UG1)	Bypass Conveyor Area	Unutilised
	Coal Fleet: 1 x CAT 6050 Shovel 1 x CAT 854 Dozer 6 x CAT 789D Haul Trucks 1 x Komatsu WA1200 Loader (Satellite ROM)	3 x Komatsu D475 Dozers (S/Pile) (ROM) 1 x Komatsu WA1200 Loader (ROM) 3 x CAT 789D Haul Trucks (Reject)	**OC4 West:** 1 x PitViper 275 Drill 1 x Atlas Copco DML 60 Drill 2 x MMUs 1 x Stemming Truck 2 x Komatsu D475 Dozers	1 x Komatsu D475 Dozer	2 x Dozers (e.g. Komatsu 475)	2 x CAT 789D Haul Trucks 5 x Komatsu 830E Trucks 1 x Komatsu 930E Truck 1 x Komatsu HD785 Water Truck 4 x Komatsu D475 Dozers 1 x Komatsu WA1200 Loader 1 x CAT 24M Grader 1 x CAT 16M Grader 1 x CAT 6050 Shovel 1 x Mack MetroLiner Truck 1 x Komatsu PC1250 Excavator 1 x Komatsu WA580 Loader 1 x Komatsu PC450 Excavator
	Overburden Fleet 1: 1 x Liebherr 996B Excavator 3 x Komatsu D475 Dozers 4 x Komatsu 830E Trucks 1 x Komatsu PC450 Excavator					
	Overburden Fleet 2: 1 x Liebherr 996 Excavator 1 x Komatsu D475 Dozer 5 x Komatsu 830E Trucks 1 x CAT D11 Dozer 1 x Komatsu PC450 Excavator		**OC4 East:** 1 x PitViper 275 Drill 1 x Atlas Copco DML 60 Drill 1 x MMU 1 x Komatsu D475 Dozer			
	Overburden Fleet 3: 1 x Liebherr 996 Excavator 1 x Komatsu D375 Dozer 3 x Komatsu 830E Trucks					
	Overburden Fleet 4: 2 x Komatsu D475 Dozers (Pushing) 1 x Liebherr 9800 Excavator 1 x Komatsu D475 Dozer 4 x Komatsu 930E Trucks 1 x CAT D11 Dozer					
Support Fleet: 1 x Komatsu HD785 Service Truck 1 x Komatsu HD785 Water Truck	**Support Fleet**: 3 x Komatsu HD785 Water Trucks 2 x CAT 773F Service Trucks 2 x Komatsu D375 Dozers 2 x CAT 24M Graders 2 x CAT 16M Graders					

INDICATIVE MINE PROGRESSION



LEGEND

Mining Lease Boundary

Existing/Approved Development
- Open Cut Mining Area
- Out-of-pit Emplacement
- Surface Infrastructure Area
- Clean Water Diversion Infrastructure
- Underground Longwall Layout
- Haul Road
- Road Realignment (not yet constructed)

Open Cut Optimisation Modication
- Approximate Extent of Revised Open Cut Mining Area
- Approximate Extent of Additional Surface Development
- Approved Open Cut Mining Area, Out-of-pit Emplacement and Surface Infrastructure to be Relinquished

Indicative Mine Progression
- 2019 Noise Modelling Scenario
- 2021 Noise Modelling Scenario
- 2026 Noise Modelling Scenario

Source: MCO (2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017) Orthophoto Mosaic: MCO (April 2016 - May 2012)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX

Open Cut Optimisation Modification
Indicative Mine Progression

Feasible and Reasonable Mitigation

'Feasible' and 'reasonable' mitigation is defined as follows.

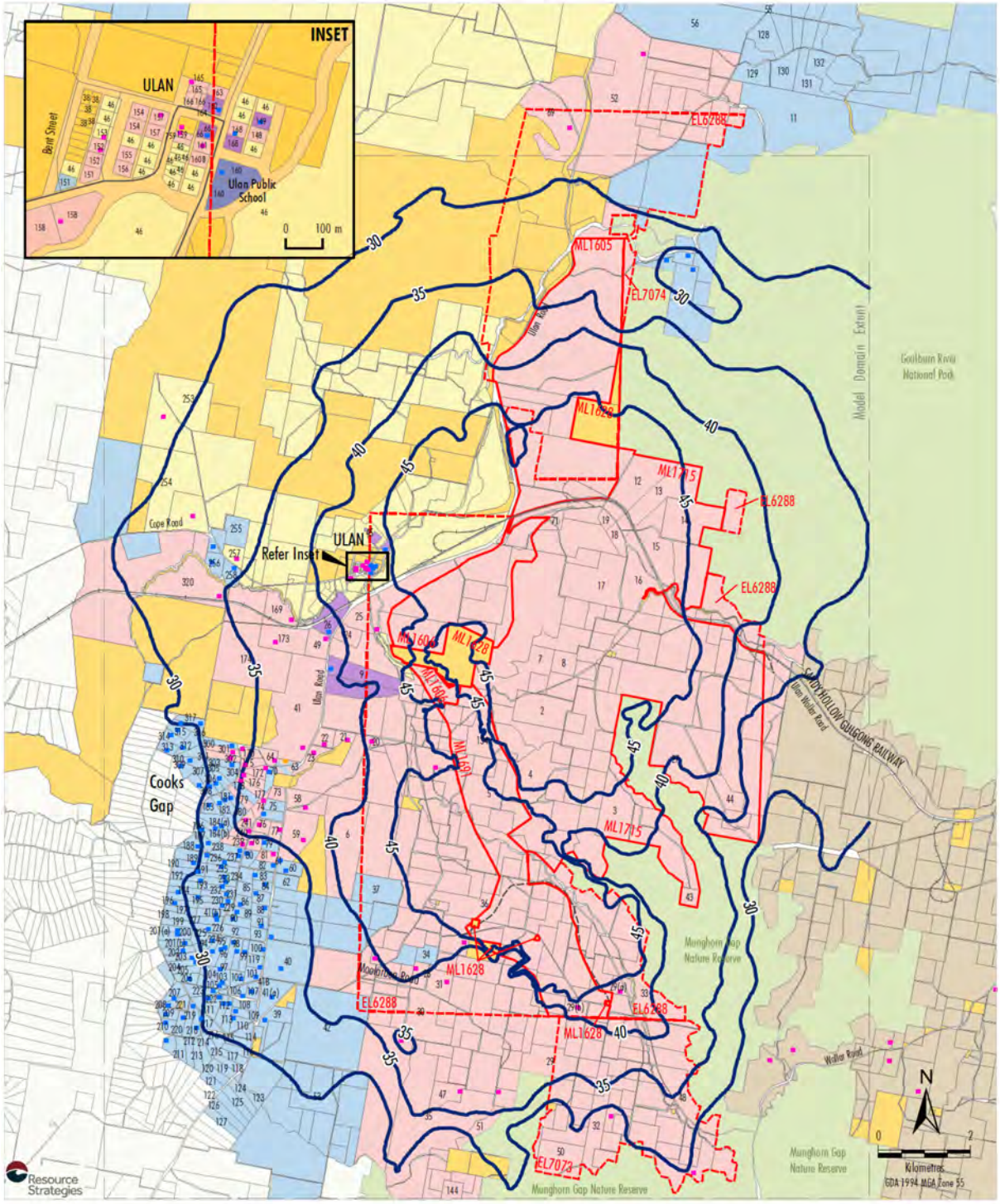
A **feasible** mitigation measure is a noise mitigation measure that can be engineered and is practical to build, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending operational practices (e.g. changing timetable schedules) to achieve noise reduction.

Selecting **reasonable** measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measure. To make such a judgement, consider the following.

- Noise impacts:
    1. existing and future levels, and projected changes in noise levels
    2. level of amenity before the project, e.g. the number of people affected or annoyed
    3. any noise performance criteria for the development, e.g. internal noise levels for certain rooms
    4. the amount by which the triggers are exceeded.
- Noise mitigation benefits:
    5. the amount of noise reduction expected, including the cumulative effectiveness of proposed mitigation measures - ideally, a noise wall/mound should be able to reduce noise levels by at least 5 decibels
    6. the number of people protected.
- Cost effectiveness of noise mitigation:
    7. the total cost of mitigation measures, taking into account the physical attributes of the site, e.g. topography, geology, and the cost variation to the project given the expected benefit
    8. noise mitigation costs compared with total project costs, taking into account capital and maintenance costs
    9. ongoing operational and maintenance cost borne by the community, e.g. running air conditioners or mechanical ventilation.
- Community views:
    10. engage with affected land users when deciding about aesthetic and other impacts of noise mitigation measures
    11. determine the views of all affected land users, not just those making representations, through early community consultation
    12. consider noise mitigation measures that have majority support from the affected community.

Take into account the above considerations when determining which locations should be mitigated first. In practice, the detail of the mitigation measures applied will largely depend on project-specific factors. The outcome this process aims to achieve is to balance the project's benefits for the wider community against the costs and benefits of mitigation measures. These are the measures that minimise, as far as practicable, the local impacts of the project. Project approval conditions that flow from this process should be achievable. They need to provide clarity and confidence for the proponent, local community, regulators and the ultimate operator that the proposed mitigation measures can achieve the predicted level of environmental protection.

YEAR 2019 NIGHT-TIME OPERATING INTRUSIVE LAEQ(15MINUTE) NOISE CONTOUR



LEGEND

- Exploration Licence Boundary
- Mining Lease Boundary
- Railway
- National Park/Nature Reserve

Land Ownership

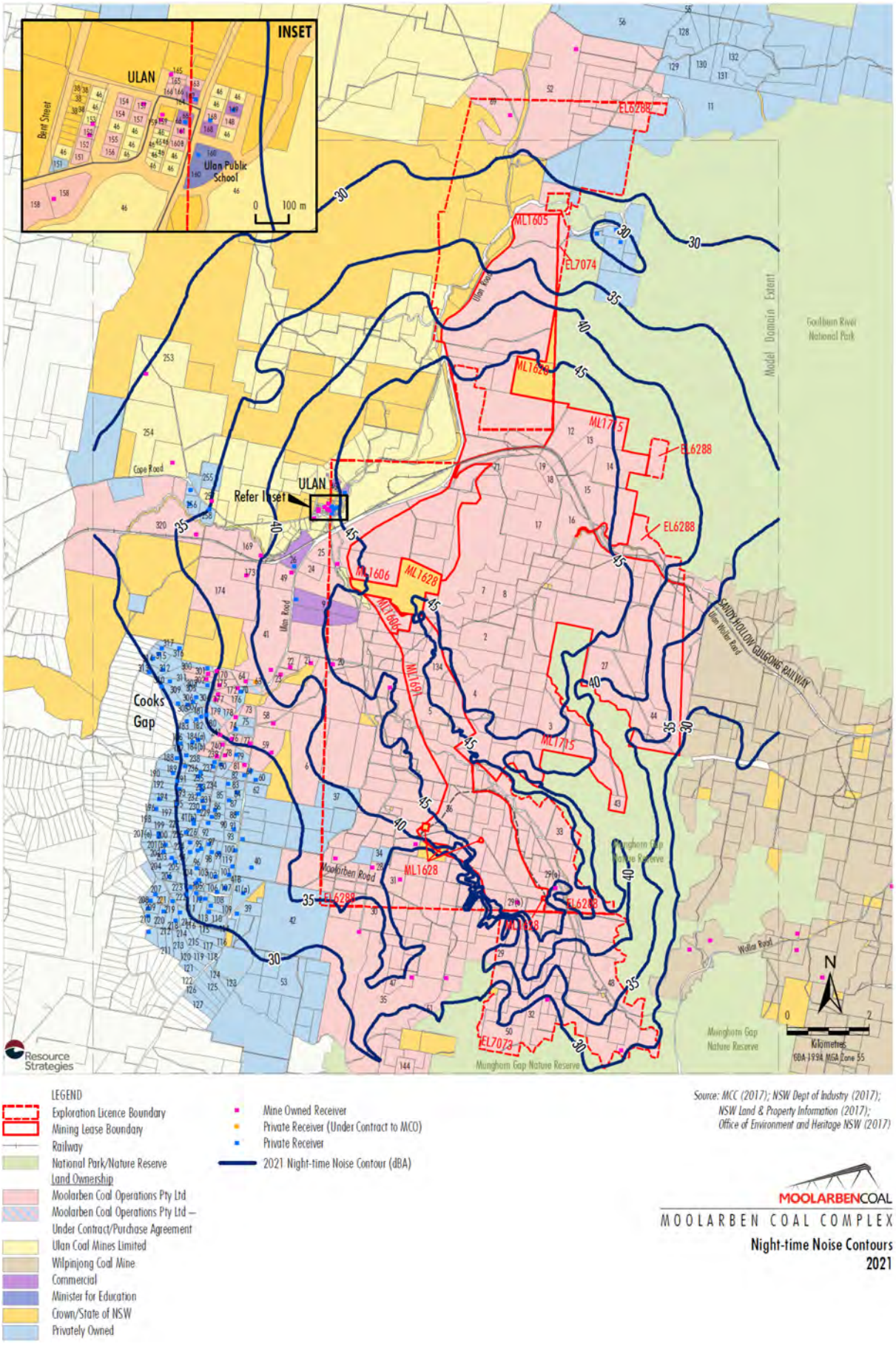
- Moolarben Coal Operations Pty Ltd
- Moolarben Coal Operations Pty Ltd – Under Contract/Purchase Agreement
- Ulan Coal Mines Limited
- Wilpinjong Coal Mine
- Commercial
- Minister for Education
- Crown/State of NSW
- Privately Owned

- Mine Owned Receiver
- Private Receiver (Under Contract to MCO)
- Private Receiver
- 2019 Night-time Noise Contour (dBA)

Source: MCC (2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX
Night-time Noise Contours 2019

YEAR 2021 NIGHT-TIME OPERATING INTRUSIVE LAEQ(15MINUTE) NOISE CONTOUR



LEGEND

- Exploration Licence Boundary
- Mining Lease Boundary
- Railway
- National Park/Nature Reserve

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- Moolarben Coal Operations Pty Ltd – Under Contract/Purchase Agreement
- Ulan Coal Mines Limited
- Wilpinjong Coal Mine
- Commercial
- Minister for Education
- Crown/State of NSW
- Privately Owned

- Mine Owned Receiver
- Private Receiver (Under Contract to MCO)
- Private Receiver
- 2021 Night-time Noise Contour (dBA)

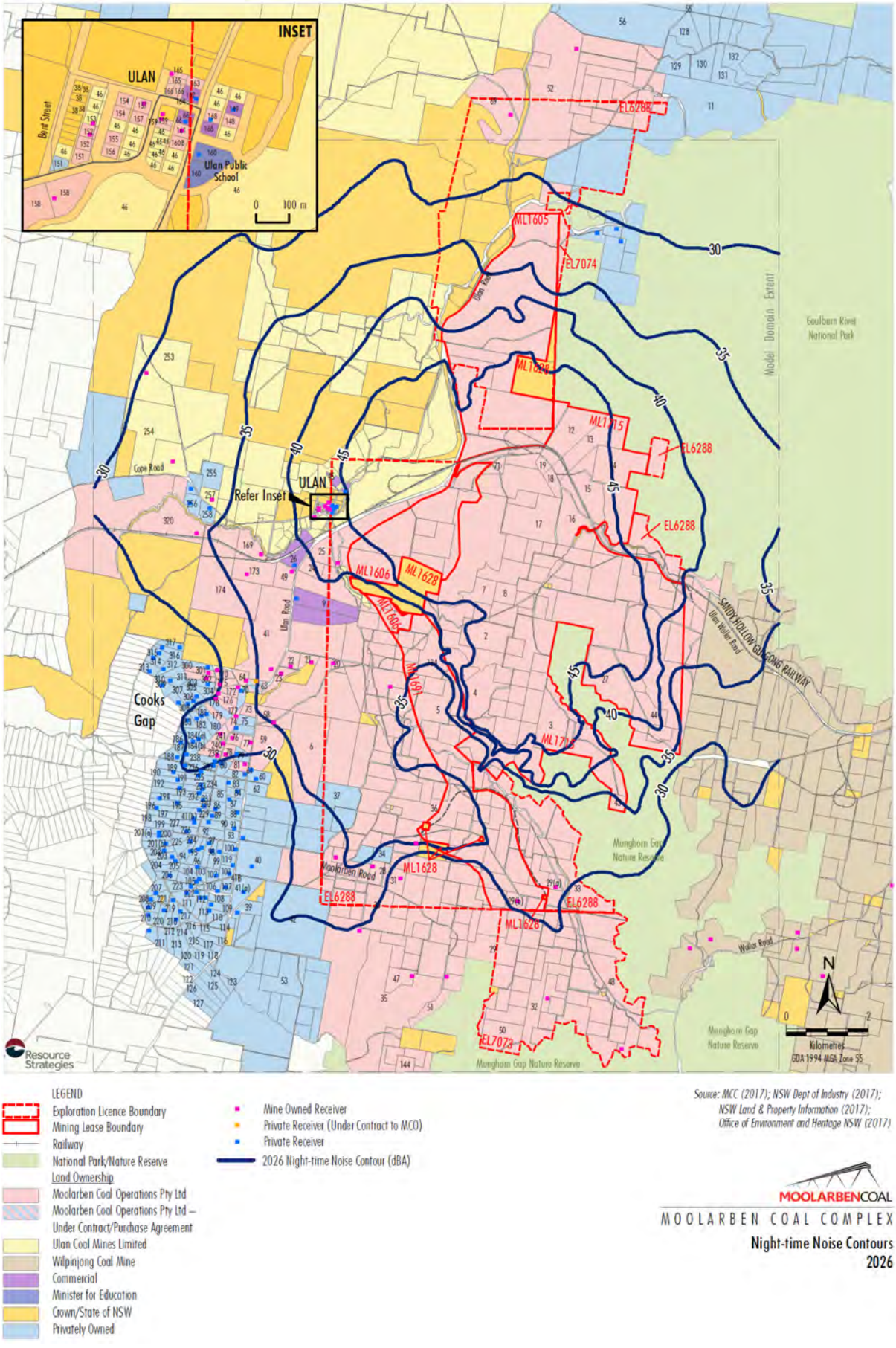
Source: MCC (2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Night-time Noise Contours 2021

YEAR 2026 NIGHT-TIME OPERATING INTRUSIVE LAEQ(15MINUTE) NOISE CONTOUR



LEGEND

- Exploration Licence Boundary
- Mining Lease Boundary
- Railway
- National Park/Nature Reserve

Land Ownership

- Moolarben Coal Operations Pty Ltd
- Moolarben Coal Operations Pty Ltd – Under Contract/Purchase Agreement
- Ulan Coal Mines Limited
- Wilpinjong Coal Mine
- Commercial
- Minister for Education
- Crown/State of NSW
- Privately Owned

- Mine Owned Receiver
- Private Receiver (Under Contract to MCO)
- Private Receiver
- 2026 Night-time Noise Contour (dBA)

Source: MCC (2017); NSW Dept of Industry (2017); NSW Land & Property Information (2017); Office of Environment and Heritage NSW (2017)

MOOLARBENCOAL
MOOLARBEN COAL COMPLEX
Night-time Noise Contours 2026

CUMULATIVE EVENING AMENITY NOISE LEVELS

In accordance with the INP Chapter 2 Industrial Noise Criteria (Section 2.2.4), the evening cumulative sum of the existing, approved and proposed developments $L_{Aeq(4hour)}$ noise amenity levels have been determined as presented below.

Evening Cumulative ($L_{Aeq(4hour)}$) Noise Amenity Levels (dBA re 20 µPa)

ID No and Landholder		Moolarben Coal Complex Open Cut Optimisation Modification[1]	Ulan Coal Continued Operations	Wilpinjong Extension Project	Cumulative Amenity Level	NSW INP Acceptable Amenity
Cooks Gap						
37	Stewart	28	25	21	30	45
39	Sprigg	28	24	20	30	45
40	Devenish	29	25	21	31	45
41(a)	Libertis	29	24	20	31	45
41(b)	Libertis	28	25	20	30	45
60	Rayner & Mundey	29	27	21	31	45
61	Miller	29	27	21	32	45
70	Coventry	33	29	20	35	45
75	Ban	32	28	20	33	45
79	Nagle	31	27	20	33	45
80	Sebelic	30	27	20	32	45
82	Hungerford & Clemens	29	27	21	32	45
83	Wall	29	26	20	31	45
84	Sebelic	29	26	21	31	45
86	Harris	28	26	20	30	45
87	Howe	29	26	20	31	45
88	Meyers	29	26	21	31	45
89	Glover & Tomlinson	28	26	20	30	45
90	Powell	28	25	20	30	45
91	Graham	28	25	20	30	45
94	Mittemayer	27	25	20	30	45
95	Withington	28	25	20	30	45
96	Lazicic	28	25	20	30	45
97	Smith	28	25	20	30	45
98	Piper	28	25	20	30	45
99	Jenner & Jensen	28	25	20	30	45
100	Ellem	28	25	20	31	45
101	Hull	28	24	20	30	45
102	Roberts	27	24	20	30	45
103	Burnett & Grant	27	24	20	29	45
104	Deeben	27	24	20	29	45
105	Katsikaris	27	24	20	29	45
106	Reid	28	24	20	30	45
107	Raso	28	24	20	30	45
109	Evans	28	24	20	30	45
110	Thompson & Evans	28	24	20	30	45
111	McEwan	27	24	20	29	45
112	Croft	27	24	20	29	45

CUMULATIVE EVENING AMENITY NOISE LEVELS

ID No and Landholder		Moolarben Coal Complex Open Cut Optimisation Modification[1]	Ulan Coal Continued Operations	Wilpinjong Extension Project	Cumulative Amenity Level	NSW INP Acceptable Amenity
113	Ratcliff	27	24	20	29	45
119	Kearns	28	25	20	30	45
171	McGregor	21	23	19	26	45
180	Barrett	31	28	20	33	45
181	Forster	29	28	20	32	45
182	Dutoitcook	30	28	20	32	45
183	Steines	30	27	19	32	45
184(a)	Stevenson	30	27	20	32	45
184(b)	Stevenson	30	27	20	32	45
186	Adamson	27	27	19	30	45
187	Feeney	29	27	20	31	45
188	Fielding	26	26	19	29	45
189	Fay	29	26	20	31	45
190	Sahyoun	25	26	19	29	45
191	Lasham	27	26	19	30	45
192	Williams	28	26	19	31	45
194	Potts	25	25	19	29	45
195	Cottam	28	25	19	30	45
196	Saxberg & Weir	25	25	19	29	45
200	Grimshaw	24	25	19	28	45
201(a)	Towerton	24	25	19	28	45
201(b)	Towerton	25	25	19	28	45
202	Butler	24	24	19	28	45
203	Miller	26	24	19	29	45
204	Donnan	27	24	19	29	45
206	Marshall & Vella	24	24	19	28	45
207	Smith	26	24	19	28	45
208	Hasaart	26	23	19	28	45
209	Mawson	25	23	19	28	45
210	Tebutt	24	23	19	27	45
217	Patterson	27	23	19	29	45
218	Soady	27	23	19	29	45
219	Riger	26	24	19	28	45
220	Rusten & Smith	23	23	19	27	45
222	Purtell	27	24	19	29	45
223	Palmer & Stewart	27	24	19	29	45
224	Dupond	27	25	20	30	45
226	Muscat	27	25	20	30	45
227	Hughes	28	25	20	30	45
229	Lowe	28	26	20	30	45
230	Hoole & Rawlinson	28	26	20	30	45
231	Morrison & Benny	28	26	20	31	45
232	Haaring	29	26	20	31	45

CUMULATIVE EVENING AMENITY NOISE LEVELS

ID No and Landholder		Moolarben Coal Complex Open Cut Optimisation Modification[1]	Ulan Coal Continued Operations	Wilpinjong Extension Project	Cumulative Amenity Level	NSW INP Acceptable Amenity
233	Boal	29	26	20	31	45
234	Gaw	29	26	20	31	45
235	Wilson	29	26	20	31	45
236	Donovan	29	26	20	31	45
237	Stokes	30	27	20	32	45
238	Powell	30	27	20	32	45
300	Collins & Marshall	29	29	20	32	45
303	Ungaro	30	29	20	32	45
305	Barisic & Aul	29	28	20	32	45
306	Armstrong	29	28	20	32	45
307	Chant & Young	29	28	19	31	45
308	Dower	27	28	19	31	45
309	Maher	26	28	19	30	45
310	Death	27	28	19	31	45
312	Ioannou	27	28	19	31	45
313	Pracy	26	28	19	30	45
314	Ford	26	28	19	31	45
315	Richards & Uzelac	27	28	19	31	45
316	Vassel & Williams	27	28	19	31	45
317	Hore & Bingham	27	29	19	31	45
Ulan						
11(a)	Mullins & Imrie	10	25	23	27	65
11(b)	Mullins & Imrie	10	25	23	27	45
11(c)	Mullins & Imrie	11	25	23	27	65
255	Schmitz	28	30	20	32	45
256	Campbell & Frost	30	28	20	32	45
258	Elias	30	28	20	33	45
Ulan Village Non-residential						
9	Orica Australia Pty Limited	37	34	22	39	65
26	Forty North P/L	34	36	21	38	65
46B	North Eastern Wiradjuri Wilpinjong Community Fund Limited	40	48	23	49	65
66	Rostherne P/L	39	43	23	44	65
149	Mid Western Regional Council	39	44	23	45	65
160[2]	Minister for Education and Training (Ulan Public School)	39	42	23	44	45/45[3]
162	Rowmint P/L	39	43	23	45	65
168[2]	PJL Constructions Pty Limited (church)	39	43	23	45	50/45[3]

Note 1: Highest predicted noise level from the INP meteorological conditions (**Table 13**) for each receiver
Note 2: In use daytime and evening only.
Note 3: INP Acceptable amenity noise level criteria/Project Approval noise limit.
Note 4: Predicted evening noise level complies with the INP Acceptable noise amenity level.

In accordance with the INP Chapter 2 Industrial Noise Criteria (Section 2.2.4), the night-time cumulative sum of the existing, approved and proposed developments $L_{Aeq(9hour)}$ noise amenity levels have been determined as presented below.

Night-time Cumulative ($L_{Aeq(9hour)}$) Noise Amenity Levels (dBA re 20 µPa)

ID No and Landholder		Moolarben Coal Complex Open Cut Optimisation Modification[1]	Ulan Coal Continued Operations	Wilpinjong Extension Project	Cumulative Amenity Level	NSW INP Acceptable Amenity
Cooks Gap						
37	Stewart	31	26	23	33	40
39	Sprigg	31	25	23	32	40
40	Devenish	32	26	23	33	40
41(a)	Libertis	32	25	23	33	40
41(b)	Libertis	30	26	22	32	40
60	Rayner & Mundey	32	28	24	34	40
61	Miller	32	28	23	34	40
70	Coventry	36	30	23	37	40
75	Ban	34	29	23	36	40
79	Nagle	34	28	23	35	40
80	Sebelic	33	28	23	34	40
82	Hungerford & Clemens	32	28	23	34	40
83	Wall	32	27	23	33	40
84	Sebelic	32	27	23	33	40
86	Harris	31	27	23	33	40
87	Howe	31	27	23	33	40
88	Meyers	31	27	23	33	40
89	Glover & Tomlinson	30	27	23	32	40
90	Powell	30	26	23	32	40
91	Graham	31	26	23	33	40
94	Mittemayer	30	26	22	32	40
95	Withington	30	26	22	32	40
96	Lazicic	30	26	22	32	40
97	Smith	30	26	23	32	40
98	Piper	30	26	23	32	40
99	Jenner & Jensen	30	26	23	32	40
100	Ellem	31	26	23	33	40
101	Hull	30	25	23	32	40
102	Roberts	30	25	23	32	40
103	Burnett & Grant	30	25	22	32	40
104	Deeben	29	25	22	31	40
105	Katsikaris	29	25	22	31	40
106	Reid	30	25	23	32	40
107	Raso	30	25	23	32	40
109	Evans	30	25	22	32	40
110	Thompson & Evans	30	25	22	32	40
111	McEwan	29	25	22	31	40
112	Croft	29	25	22	31	40

CUMULATIVE NIGHT-TIME AMENITY NOISE LEVELS

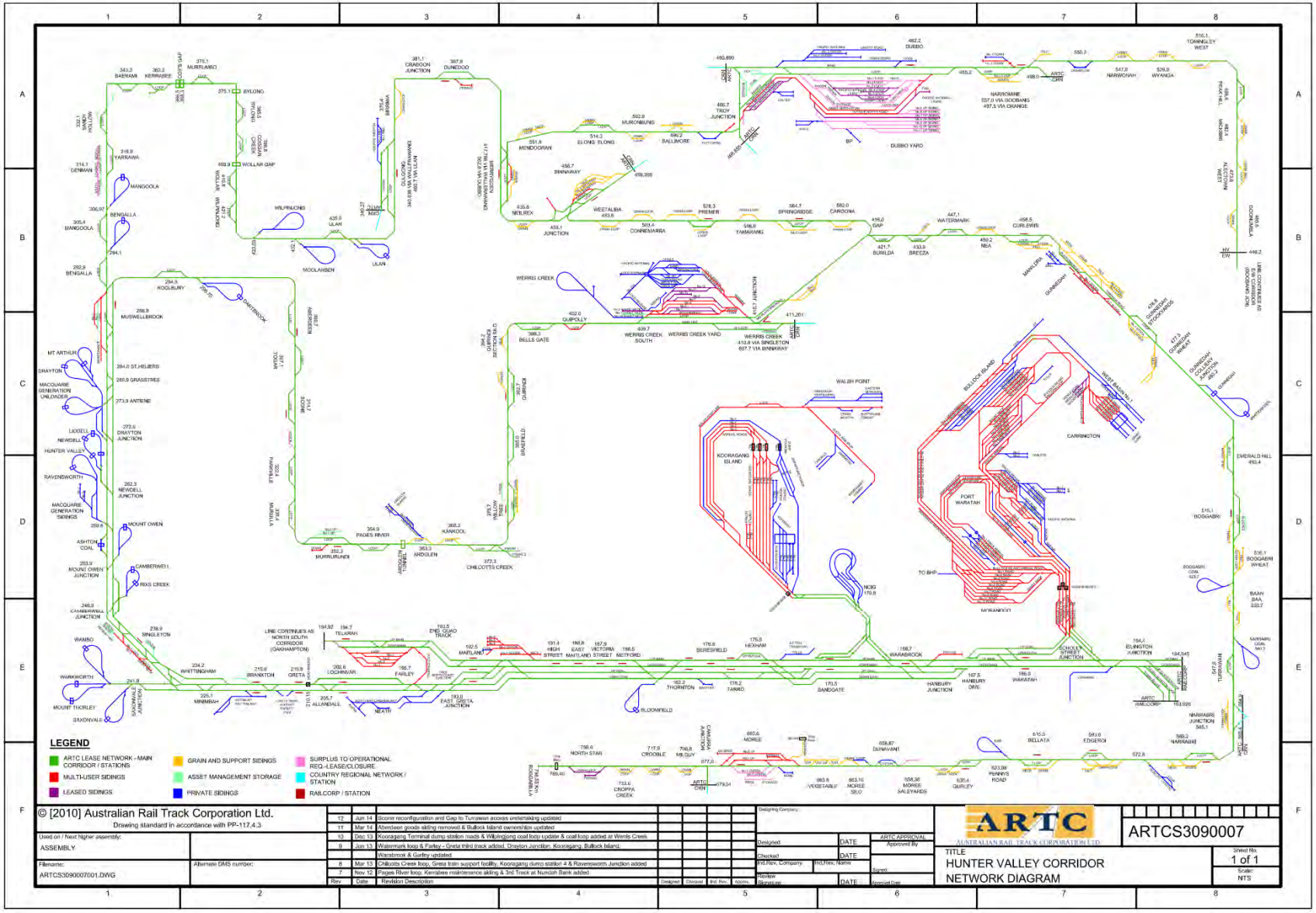
ID No and Landholder		Moolarben Coal Complex Open Cut Optimisation Modification[1]	Ulan Coal Continued Operations	Wilpinjong Extension Project	Cumulative Amenity Level	NSW INP Acceptable Amenity
113	Ratcliff	29	25	22	31	40
119	Kearns	31	26	23	33	40
171	McGregor	23	24	21	28	40
180	Barrett	33	29	22	35	40
181	Forster	31	29	22	34	40
182	Dutoitcook	33	29	22	35	40
183	Steines	32	28	22	34	40
184(a)	Stevenson	33	28	22	34	40
184(b)	Stevenson	32	28	22	34	40
186	Adamson	30	28	22	32	40
187	Feeney	32	28	22	34	40
188	Fielding	28	27	22	31	40
189	Fay	32	27	22	33	40
190	Sahyoun	28	27	22	31	40
191	Lasham	29	27	22	32	40
192	Williams	31	27	22	33	40
194	Potts	27	26	22	30	40
195	Cottam	30	26	22	32	40
196	Saxberg & Weir	27	26	22	30	40
200	Grimshaw	26	26	22	30	40
201(a)	Towerton	26	26	22	30	40
201(b)	Towerton	27	26	22	30	40
202	Butler	26	25	22	29	40
203	Miller	28	25	22	30	40
204	Donnan	29	25	22	31	40
206	Marshall & Vella	26	25	22	29	40
207	Smith	28	25	21	30	40
208	Hasaart	28	24	21	30	40
209	Mawson	27	24	21	29	40
210	Tebutt	27	24	21	29	40
217	Patterson	29	24	22	31	40
218	Soady	29	24	22	31	40
219	Riger	28	25	22	30	40
220	Rusten & Smith	25	24	22	28	40
222	Purtell	29	25	22	31	40
223	Palmer & Stewart	29	25	22	31	40
224	Dupond	30	26	22	32	40
226	Muscat	30	26	22	32	40
227	Hughes	30	26	22	32	40
229	Lowe	30	27	22	32	40
230	Hoole & Rawlinson	31	27	22	33	40
231	Morrison & Benny	31	27	22	33	40
232	Haaring	31	27	22	33	40

CUMULATIVE NIGHT-TIME AMENITY NOISE LEVELS

ID No and Landholder		Moolarben Coal Complex Open Cut Optimisation Modification[1]	Ulan Coal Continued Operations	Wilpinjong Extension Project	Cumulative Amenity Level	NSW INP Acceptable Amenity
233	Boal	32	27	22	33	40
234	Gaw	32	27	22	33	40
235	Wilson	32	27	22	33	40
236	Donovan	32	27	22	34	40
237	Stokes	33	28	23	34	40
238	Powell	33	28	23	34	40
300	Collins & Marshall	32	30	22	34	40
303	Ungaro	32	30	22	34	40
305	Barisic & Aul	31	29	22	34	40
306	Armstrong	31	29	22	33	40
307	Chant & Young	31	29	22	33	40
308	Dower	30	29	22	33	40
309	Maher	29	29	22	32	40
310	Death	29	29	22	33	40
312	Ioannou	29	29	22	33	40
313	Pracy	29	29	21	32	40
314	Ford	29	29	21	32	40
315	Richards & Uzelac	29	29	22	33	40
316	Vassel & Williams	29	29	22	33	40
317	Hore & Bingham	30	30	22	33	40
Ulan						
11(a)	Mullins & Imrie	24	27	26	31	65
11(b)	Mullins & Imrie	20	27	26	30	40
11(c)	Mullins & Imrie	23	27	26	30	65
255	Schmitz	31	32	23	35	40
256	Campbell & Frost	33	31	23	35	40
258	Elias	34	31	23	36	40
Ulan Village Non-residential						
9	Orica Australia Pty Limited	40	35	24	41	65
26	Forty North P/L	37	37	24	40	65
46B	North Eastern Wiradjuri Wilpinjong Community Fund Limited	43	50	26	51	65
66	Rostherne P/L	42	45	26	47	65
149	Mid Western Regional Council	43	46	26	47	65
160[2]	Minister for Education and Training (Ulan Public School)	-	-	-	-	45/45[3]
162	Rowmint P/L	42	45	26	47	65
168[2]	PJL Constructions Pty Limited (Church)	-	-	-	-	50/45[3]

Note 1: Highest predicted noise level from the INP meteorological conditions (**Table 13**) for each receiver
Note 2: In use daytime and evening only.
Note 3: INP Acceptable amenity noise level criteria/Project Approval noise limit.
Note 4: Predicted night-time noise level complies with the INP Acceptable noise amenity level.

HUNTER VALLEY CORRIDOR NETWORK DIAGRAM



L2 Noise limits

L2.1 Approvals for Locomotives

The licensee must obtain approval from the EPA prior to permitting operation on the "premises" of:
1. a class or type of locomotive, whether new or existing, that has not been operated on the NSW rail network; or
2. a locomotive that has been substantially modified since it was last used on the NSW rail network

EPA approval will be on the basis of compliance with the locomotive noise limits in Condition L2.3.

This condition L2 does not apply to the operation of a locomotive solely for the purposes of conducting noise or other tests that are required for the locomotive's acceptance by the EPA, the licensee or any person concerned with the design, manufacture, supply or acquisition of the locomotive, provided that multiple pass bys do not occur adjacent to residential premises in the course of the testing.

Note: EPA approval for a class or type or model of locomotive will require noise test results from a representative number of locomotives from that class or type.

L2.2 General Noise Limits

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am – 10pm), 60 dB(A)Leq, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.

L2.3 EPA Locomotive Noise Limits

Operating Condition	Speed and Location of Measurement	Noise Limit - Microphone height: 1.5 metres above
Idle with compressor radiator fans and air conditioning operating at maximum load occurring at idle	Stationary 15 metre contour	70 dB(A) Max
All other throttle settings under self load with compressor radiator fans and air conditioning operating	Stationary 15 metre contour	87 dB(A) Max 95 dB Linear Max
All service conditions	As per Australian Standard AS2377-2002 (Acoustics - Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA	87 dB(A) Max 95 dB Linear Max

L2.4 Limits for Tonality

All external noise must be non-tonal. For the purpose of this condition, external noise is non-tonal if the sound pressure level in each unweighted (linear) one-third octave band does not exceed the level of the adjacent bands on both sides by:

a) 5 dB if the centre frequency of the band containing the tone is above 400 Hz; and
b) 8 dB if the centre frequency of the band containing the tone is between 160 and 400 Hz, inclusively; and
c) 15 dB if the centre frequency of the band containing the tone is below 160 Hz.

L2.5 Limits for Low-Frequency Noise

All external noise must not exhibit an undue low-frequency component. To comply with this requirement, linear noise levels must not exceed the A-weighted noise levels by more than 15dB.

L2.6 **Locomotive Noise Emission Test Methods**

Application for approval as required by L2.1 must be supported by type testing of the locomotive using procedures that are consistent with the requirements of Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA. The type testing must provide all necessary measurement parameters for demonstrating compliance with the locomotive noise limits in L2.3.

Information supplied to the EPA as part of the application for approval must fulfil the requirements of Section 11 of AS2377-2002 for reporting.

Note: The measurement parameters required in L2.3 differ in some cases from those identified in AS2377-2002. The test procedures, measurement equipment and environmental conditions applied in supporting the application to the EPA for approval are to yield all parameters identified in L2.3 but are otherwise to be applied in a manner that is consistent with the requirements of AS2377-2002. The 15 metre contour specified in L2.3 is to be represented by the 12 measurement points shown in AS2377-2002, Figure 1.

L2.7 **Approval of Locomotives Not Meeting All EPA Limits**

The EPA may approve locomotives that do not comply with all limits prescribed by L2.3, provided that the application for approval demonstrates that:

a) the noise emission performance of the locomotive is consistent with current best practice; and

b) all measures for minimising the extent of any non-compliance have been investigated and those that are identified as reasonable and feasible have been implemented; and

c) none of the non-compliances will result in unacceptable environmental impacts.

U1 PRP 3.1 Audit of the Noise Performance of Locomotives on the ARTC Network

U1.1 Almost a third of all rail noise complaints received by the Environment Protection Authority (EPA) between 2007 and 2011 were generated by pass by noise from locomotives. For this reason the EPA considers the ongoing monitoring and management of locomotive noise to be a critical component of environmental regulation of the NSW rail network.

The purpose of PRP 3.1 is for the licensee to:

1. obtain accurate measurements of the noise performance of locomotives operating on the NSW rail network by conducting wayside noise monitoring and to provide that data to relevant locomotive operators and the EPA; and

2. obtain accurate information on the actions of locomotive operators to rectify locomotives identified by the wayside monitoring as poorly performing in order to determine whether locomotive operators are implementing all reasonable and feasible noise mitigation measures.

The licensee is required to comply with PRP3.1 outlined in U1.2 below by completing each described action in the program within the set timeframe.

U1.2 **Action 3.1A**

The licensee will implement and maintain a monitoring program which will:
- Monitor noise emissions from locomotives and rolling stock accessing ARTC's network and passing the Metford wayside measurement location; and
- Record and store data from wayside noise monitoring.

The noise monitoring program must be consistent with the *Australian Rail track Corporation Wayside Noise Monitoring Program Work Plan* submitted to the EPA by ARTC on 17 April 2009 and with the previous noise ARTC Wayside Noise Pilot Monitoring Program conducted between January – July 2010.

Timeframe – Commencement of the program will be within 16 weeks of inclusion of the PRP on the licence. The program will be conducted for a period of 12 months.

Action 3.1B

The licensee will submit to the EPA for approval a comprehensive reporting procedure that, as a minimum, includes:
1. providing quarterly reports to relevant locomotive operators on noise data collected which identify those locomotives with noise levels in the top 5% of locomotives measured in that quarter;
2. obtaining quarterly reports from locomotive operators on actions taken to reduce noise levels from identified locomotives; and
3. providing the EPA with quarterly reports which include:
   - noise monitoring data showing all noise monitoring results, and
   - the information received (from the preceding quarter) from locomotive operators on measures taken to reduce noise levels from identified locomotives.

Timeframe – Within 12 weeks of inclusion of the PRP on the licence.

Action 3.1C

The licensee will implement the EPA approved reporting procedure from Action 3.1B.

Timeframe – Within three weeks of the EPA approving the procedure.

Appendix 2 Environmental assessment requirements for rail traffic-generating developments

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} (95th percentile) dB(A).
- Predict the cumulative rail noise level (i.e. 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} (95th 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.
3. Guidance on the concept of 'feasible and reasonable' is outlined in Appendix 6.

Mitigating noise from rail traffic-generating developments

For a traffic-generating development like a coal mine, the proponent would not have control over the public rail infrastructure. Consequently they would have limited opportunities to implement mitigation, such as noise barriers. In such cases, control of noise and vibration at the source is the most effective means of mitigation. However, the land-use developer responsible for the additional rail traffic (such as a mine, quarry or industrial site) could contract to a rail service provider who would use best practice rolling stock, including locomotives approved to operate on the NSW rail network in accordance with environment protection licences issued by the EPA. At property (architectural) treatments should be considered for affected receivers, if reasonable.