MALABAR COAL

MAXWELL PROJECT

APPENDIX I

Noise Impact Assessment

ACOUSTICS AND AIR

MAXWELL PROJECT

NOISE IMPACT ASSESSMENT

REPORT NO. 18226
VERSION A

JUNE 2019

PREPARED FOR

MALABAR COAL LIMITED
LEVEL 26, 259 GEORGE STREET
SYDNEY NSW 2000

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	13 June 2019	Roman Haverkamp	John Wassermann

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

This assessment investigates the operational noise and construction impacts associated with a proposed underground coal mining operation, referred to as the Maxwell Project (the Project), located in the Upper Hunter Valley of New South Wales. Maxwell Ventures (Management) Pty Ltd, a subsidiary of Malabar Coal Limited, seeks to operate the underground mining operation for a period of approximately 26 years.

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

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

The Project is adjacent to two groups of receivers, namely:

- the northern receivers located within the Antiene and East Antiene residential areas near Thomas Mitchell Drive and New England Highway, north and north-east of the Maxwell Infrastructure area; and
- the southern receivers located near the Golden Highway and Hunter River, south and west of the proposed underground mining area within Exploration Licence 5460.

Noise contributions from the Project at all privately-owned southern receivers are predicted to be indistinguishable from background noise.

With the implementation of noise mitigation measures, the Project would result in "marginal" exceedances of the Project noise trigger levels at four northern receivers, which would be afforded mitigation upon request rights. An additional ten northern receivers would experience "negligible" exceedances, which would not be discernible when compared to compliance with the Project noise trigger levels by the average listener.

To put these results in context, if the noise criteria for the former Drayton Mine were assessed under the *Voluntary Land Acquisition and Mitigation Policy* (which did not exist when Project Approval 06_0202 for the Drayton Mine Extension was granted), there would have been 15 receivers with "marginal" exceedances during operation which would have been granted mitigation upon request rights. Of note, the four receivers predicted to have marginal exceedances for the Project would also have had marginal exceedances during operation of the former Drayton Mine. In other words, the predicted noise levels at northern receivers for the Project are generally similar to or less than the noise levels during operation of the former Drayton Mine.

The relatively limited number of exceedances indicates that, with the implementation of proposed mitigation, operational noise from the Project is being managed to the maximum extent possible, and no other measures would be of material benefit.

The operational noise scenarios include representative construction activities that would occur in the vicinity of operational activities.

Elevated noise levels would occur during the daytime at the northern receivers during construction works along the very northernmost section of the transport and services corridor. These noise levels would occur for relatively short durations, are not representative of general noise emissions and would not warrant further noise mitigation or acquisition.

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

1 INTRODUCTION

Maxwell Ventures (Management) Pty Ltd, a wholly owned subsidiary of Malabar Coal Limited (Malabar), is seeking consent to develop an underground coal mining operation, referred to as the Maxwell Project (the Project).

The Project is in the Upper Hunter Valley of New South Wales, east-southeast of Denman and south-southwest of Muswellbrook.

Underground mining is proposed within Exploration Licence (EL) 5460, which was acquired by Malabar in February 2018. Malabar also acquired existing infrastructure within Coal Lease (CL) 229, Mining Lease (ML) 1531 and CL 395, known as the "Maxwell Infrastructure". The Project would include the use of the substantial existing Maxwell Infrastructure, along with the development of some new infrastructure.

This assessment forms part of an Environmental Impact Statement (EIS) which has been prepared to accompany a Development Application for the Project in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979*.

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

1.1 Objectives of this Study

The primary objective of this study is to assess the potential noise impacts associated with the Project by addressing the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DP&E) on 17 January 2019, outlined as follows:

- ***Noise*** *– including a detailed assessment of the likely construction, operational and off- site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Noise Policy for Industry and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy;*

This study also addresses comments made by the NSW Environment Protection Authority (EPA) for input into the SEARs on 23 August 2018:

> *The key issues of interest to the EPA are:*
> - *Potential noise impacts due to construction and operation;*
>
> *…*
>
> *The Noise Policy for Industry 2017 (NPfI) was developed following a review of the NSW Industrial Noise Policy and using input from public consultation on proposed policy amendments, and should be consulted in addition to the Noise Policy reference documents contained within the Indicative Secretary's Environmental Assessments publication.*

2 PROJECT DESCRIPTION

The Project would involve an underground mining operation that would produce high quality coals over a period of approximately 26 years.

At least 75% of coal produced by the Project would be capable of being used in the making of steel (coking coals). The balance would be export thermal coals suitable for the new generation High Efficiency, Low Emissions power generators.

The Project would involve extraction of run-of-mine (ROM) coal from four seams within the Wittingham Coal Measures using the following underground mining methods:

- underground bord and pillar mining with partial pillar extraction in the Whynot Seam; and
- underground longwall extraction in the Woodlands Hill Seam, Arrowfield Seam and Bowfield Seam.

The substantial existing Maxwell Infrastructure would be used for handling, processing and transportation of coal for the life of the Project. The Maxwell Infrastructure includes an existing coal handling and preparation plant (CHPP), train load-out facilities and other infrastructure and services (including water management infrastructure, administration buildings, workshops and services).

A mine entry area (MEA) would be developed for the Project in a natural valley in the north of EL 5460 to support underground mining and coal handling activities and provide personnel and materials access.

ROM coal brought to the surface at the MEA would be transported to the Maxwell Infrastructure area. Early ROM coal would be transported via internal roads during the construction and commissioning of a covered overland conveyor. Subsequently, ROM coal would be transported to the Maxwell Infrastructure area via the covered overland conveyor.

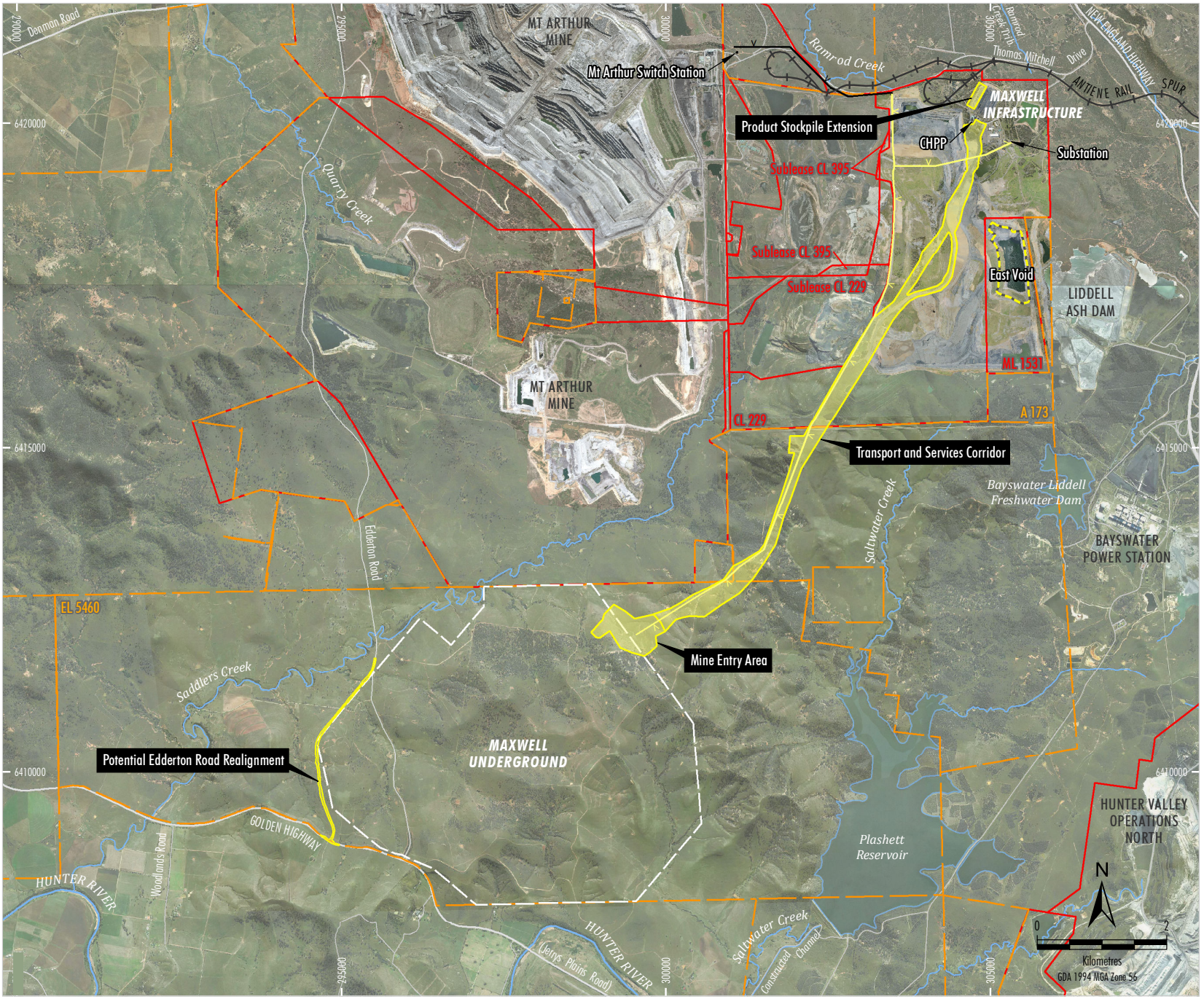
The existing product coal stockpile area at the Maxwell Infrastructure would be extended to allow for better management of different product coal blends. The combined capacity of the product coal stockpiles would increase from approximately 320,000 tonnes (t) to approximately 500,000 t. An additional ROM stockpile would also be developed adjacent to the CHPP to cater for delivery of coal via the covered overland conveyor.

The Project would support continued rehabilitation of previously mined areas and overburden emplacements areas within CL 229, ML 1531 and CL 395. The volume of the East Void would be reduced through the emplacement of reject material generated by Project coal processing activities and would be capped and rehabilitated at the completion of mining.

An indicative Project general arrangement showing the underground mining area and key infrastructure is provided on Figure 2-1. The Project area comprises the following main domains:

- Maxwell Underground – comprising the proposed area of underground mining operations and the MEA within EL 5460.
- Maxwell Infrastructure – the area within existing mining leases comprising the substantial existing infrastructure (including the CHPP) and previous mining areas.
- The transport and services corridor between the Maxwell Underground and Maxwell Infrastructure – this would comprise a site access road, a covered overland conveyor, power supply and other ancillary infrastructure and services.
- A potential realignment of Edderton Road.

A detailed description of the Project is provided in the main document of the EIS.



LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- CHPP Reject Emplacement Area
- Proposed 66 kV Power Supply
- Proposed Ausgrid 66 kV Power Supply Extension#

Subject to separate assessment and approval.

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)
Orthophoto Mosaic: 2018, 2016, 2011

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MAXWELL PROJECT

Project General Arrangement

Figure 2-1

SHM-18-03 Maxwell_EIS_App Noise_201C

3 NOISE RECEIVERS

The Project is adjacent to two groups of receivers, namely the northern receivers potentially impacted by the Maxwell Infrastructure area, and the southern receivers potentially affected by the MEA.

The northern receivers are located within the Antiene and East Antiene residential areas near Thomas Mitchell Drive and New England Highway, north and north-east of the Maxwell Infrastructure area. The identified northern receivers addressed in the assessment include 41 private rural receivers and five mine-owned receivers.

The southern receivers are located near the Golden Highway and Hunter River, south and west of the proposed underground mining area within EL 5460. The southern receivers addressed as part of the assessment include 89 private rural receivers and 11 mine-owned receivers, with a number of the identified private receivers located within the Coolmore Stud, Godolphin Woodlands Stud and Hollydene Estate Wines.

All 146 identified receivers are listed in Table 3-1 and shown on Figure 3-1 and Figure 3-2. Eastings and Northings are in Map Grid of Australia (MGA) 84 coordinates, Zone 56.

Table 3-1 Receivers Considered in this Assessment

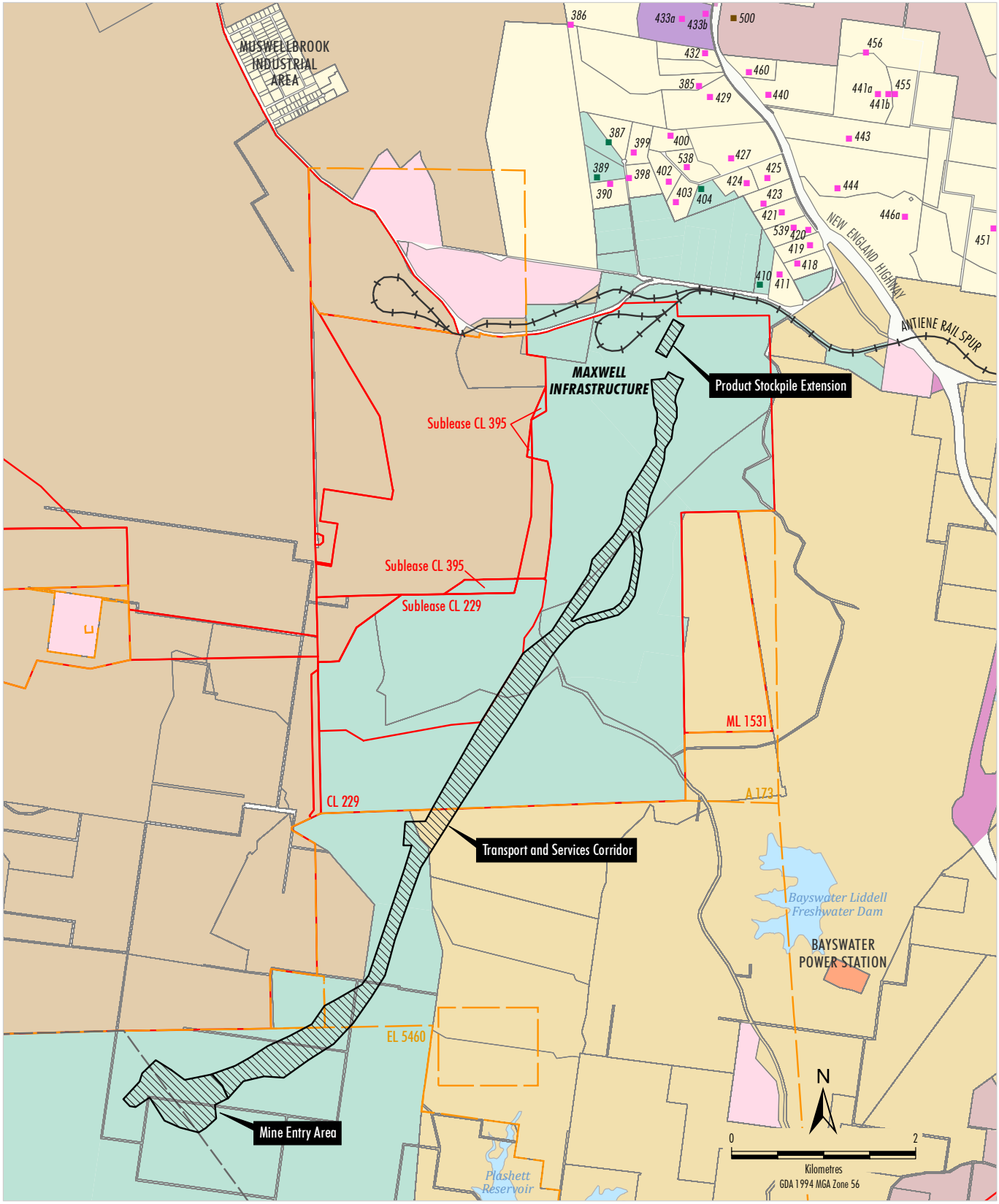
Receiver ID	Ownership	Easting	Northing	Receiver Group
Privately-owned Dwellings				
24a*	PM, BR & DE Wolfgang	289028	6411349	South
24b*	PM, BR & DE Wolfgang	288978	6411330	South
25*	PM, BR & DE Wolfgang	289188	6411398	South
172*	Tomag Holdings Pty Ltd	302770	6404001	South
207*	DG & JC De Somer	302473	6403889	South
209	Tomag Holdings Pty Ltd	302020	6404600	South
211a*	Tomag Holdings Pty Ltd	302157	6404354	South
211b*	Tomag Holdings Pty Ltd	302214	6404446	South
211c*	Tomag Holdings Pty Ltd	302260	6404376	South
217c	Calogo Bloodstock AG (T/A Coolmore Australia)	301522	6404891	South
217d	Calogo Bloodstock AG (T/A Coolmore Australia)	301413	6404794	South
217e	Calogo Bloodstock AG (T/A Coolmore Australia)	301028	6404866	South
217f	Calogo Bloodstock AG (T/A Coolmore Australia)	301100	6404800	South
219a	Calogo Bloodstock AG (T/A Coolmore Australia)	299545	6405806	South
219b	Calogo Bloodstock AG (T/A Coolmore Australia)	299930	6405691	South
219c	Calogo Bloodstock AG (T/A Coolmore Australia)	299603	6405798	South
219d	Calogo Bloodstock AG (T/A Coolmore Australia)	299376	6405871	South
219e	Calogo Bloodstock AG (T/A Coolmore Australia)	298219	6406126	South
226a	Calogo Bloodstock AG (T/A Coolmore Australia)	296124	6408219	South
226b	Calogo Bloodstock AG (T/A Coolmore Australia)	296159	6408251	South
226c	Calogo Bloodstock AG (T/A Coolmore Australia)	296197	6408291	South
226d	Calogo Bloodstock AG (T/A Coolmore Australia)	296167	6407835	South
227a	Calogo Bloodstock AG (T/A Coolmore Australia)	295508	6407554	South
227b	Calogo Bloodstock AG (T/A Coolmore Australia)	295517	6407450	South

Receiver ID	Ownership	Easting	Northing	Receiver Group
227c	Calogo Bloodstock AG (T/A Coolmore Australia)	295599	6407384	South
227d	Calogo Bloodstock AG (T/A Coolmore Australia)	295727	6407254	South
227e	Calogo Bloodstock AG (T/A Coolmore Australia)	295863	6407149	South
227f	Calogo Bloodstock AG (T/A Coolmore Australia)	297732	6407244	South
228a	Calogo Bloodstock AG (T/A Coolmore Australia)	296522	6404625	South
228b	Calogo Bloodstock AG (T/A Coolmore Australia)	296558	6404613	South
228c	Calogo Bloodstock AG (T/A Coolmore Australia)	296601	6404618	South
228e	Calogo Bloodstock AG (T/A Coolmore Australia)	296627	6404676	South
228f	Calogo Bloodstock AG (T/A Coolmore Australia)	296644	6404702	South
228g	Calogo Bloodstock AG (T/A Coolmore Australia)	296628	6404738	South
228h	Calogo Bloodstock AG (T/A Coolmore Australia)	296603	6404759	South
228i	Calogo Bloodstock AG (T/A Coolmore Australia)	296579	6404768	South
228j*	Calogo Bloodstock AG (T/A Coolmore Australia)	296035	6404130	South
228k	Calogo Bloodstock AG (T/A Coolmore Australia)	296550	6404778	South
228l	Calogo Bloodstock AG (T/A Coolmore Australia)	297058	6405418	South
228m	Calogo Bloodstock AG (T/A Coolmore Australia)	297035	6405673	South
228n	Calogo Bloodstock AG (T/A Coolmore Australia)	296756	6406195	South
228o	Calogo Bloodstock AG (T/A Coolmore Australia)	297129	6405571	South
228p	Calogo Bloodstock AG (T/A Coolmore Australia)	296629	6405031	South
228q	Calogo Bloodstock AG (T/A Coolmore Australia)	296472	6405458	South
228r	Calogo Bloodstock AG (T/A Coolmore Australia)	296688	6405768	South
230a*	Calogo Bloodstock AG (T/A Coolmore Australia)	296073	6403370	South
230b*	Calogo Bloodstock AG (T/A Coolmore Australia)	296534	6403370	South
238a	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293690	6404530	South
238b*	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293448	6404472	South
238c	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293477	6404511	South
238d	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293488	6404605	South
238e	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293464	6404652	South
238f	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293412	6404692	South
238g*	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293509	6404396	South
238h*	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	293548	6404428	South
239a	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291713	6405504	South
239b	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291715	6405733	South
239c	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291782	6405691	South
239d	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291838	6405663	South
239e	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291885	6405635	South
239f	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291771	6405520	South
239g	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291601	6405610	South
239h	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291633	6405728	South
239i	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291549	6405924	South
239j	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291456	6406066	South
239k	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	291475	6406037	South
240a	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	292092	6407335	South
240b	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	292457	6407903	South
240c	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	292485	6407928	South

Receiver ID	Ownership	Easting	Northing	Receiver Group
240d	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	292518	6407959	South
240e	Darley Australia Pty Limited (now Godolphin Australia Pty Ltd)	292433	6407832	South
250a*	Hynken Pty Limited	290612	6409153	South
250b*	Hynken Pty Limited	290653	6409203	South
253*	NE Ray	290014	6407156	South
254a*	Hynken Pty Limited	290350	6406976	South
254b*	Hynken Pty Limited	290304	6406976	South
254c*	Hynken Pty Limited	290272	6406974	South
255*	AJ & JM Coster	289934	6406788	South
279*	AJ & LM Davies	288299	6406750	South
284*	PW & CF Brown	289310	6406844	South
285*	TN & WL Goodwin	288709	6406688	South
287*	TN Goodwin	288674	6406836	South
298a*	JN & JE Wolfgang	289756	6408885	South
298b*	JN & JE Wolfgang	289532	6408902	South
299*	WRL Wolfgang	288968	6409056	South
306*	TL Wolfgang	288192	6408863	South
527*	Calogo Bloodstock AG (T/A Coolmore Australia)	300744	6403958	South
528*	Tomag Holdings Pty Ltd	302325	6404276	South
532*	GR & SE EASTLEY	288870	6406915	South
384*	K Casben	304374	6424129	North
385	TTW Keast & RA Sumner	305106	6423174	North
386	K Casben	303708	6423839	North
390	MF & AV Doherty	304139	6422112	North
398	CJ & LE Duck	304342	6422175	North
399	KT Ryan	304396	6422452	North
400	JW Nash	304794	6422633	North
402	RJD & DA Osborn	304779	6422137	North
403	RC & LT Skinner	304854	6421911	North
411	NH Robertson	305984	6421127	North
418	PG Horder	306175	6421247	North
419	EJ & MC Sharman	306310	6421439	North
420	LK Nash	306292	6421610	North
421	B Jones	306007	6421800	North
423	P & K Clifton	305807	6421894	North
424	GEJ & PH De Boer	305624	6422117	North
425	PA & KM Cavanagh	305849	6422167	North
427	RE & ID Baxter	305453	6422388	North
429	RW Kerr	305224	6423053	North
432	J Fox	305171	6423525	North
433a	Muswellbrook Shire Council	304920	6423905	North
433b	Muswellbrook Shire Council	305178	6423954	North
435a*	MT Perram	305059	6424243	North
435b*	MT Perram	304864	6424156	North
438*	WJH & BJ Hopmans	305991	6424365	North

Receiver ID	Ownership	Easting	Northing	Receiver Group
440	MJ & SL Ward	305857	6423073	North
441a	BT & JE Davis	307051	6423083	North
441b	BT & JE Davis	307163	6423084	North
443	JA FISHER & CI Dennis	306736	6422603	North
444	KC & KI Cross	306609	6422064	North
446a	Wild Group Pty Ltd	307345	6421749	North
451	RD & WM Wiekens	308305	6421623	North
455	BJ King	307233	6423085	North
456	TR & KS Zolnikov	306923	6423536	North
460	MJ & EJ Wallman	305647	6423320	North
507*	Merlaust Pty Limited	305078	6424355	North
508*	D Harris	305103	6424569	North
509*	PJ Hogan	305179	6424765	North
537*	RJ Gumb	302472	6424541	North
538	RB Halloran	304973	6422286	North
539	LK Nash	306136	6421635	North
Mine-owned Dwellings				
57	Malabar Coal (Maxwell Management) Pty Ltd	292808	6410941	South
58a	Malabar Coal (Maxwell Management) Pty Ltd	297477	6407717	South
58b	Malabar Coal (Maxwell Management) Pty Ltd	297358	6407729	South
60a	Hunter Valley Energy Coal Pty Ltd (BHP)	295689	6413017	South
60b	Hunter Valley Energy Coal Pty Ltd (BHP)	295883	6413125	South
60c	Hunter Valley Energy Coal Pty Ltd (BHP)	295752	6413191	South
60d	Hunter Valley Energy Coal Pty Ltd (BHP)	295680	6413189	South
145a	Malabar Coal (Maxwell Management) Pty Ltd	300400	6407255	South
145b	Malabar Coal (Maxwell Management) Pty Ltd	300192	6406996	South
145c	Malabar Coal (Maxwell Management) Pty Ltd	300289	6406665	South
536	Malabar Coal (Maxwell Management) Pty Ltd	299404	6408034	South
387	Malabar Coal (Drayton Management) Pty Ltd	304123	6422565	North
389	Malabar Coal (Drayton Management) Pty Ltd	303996	6422182	North
404	Malabar Coal (Drayton Management) Pty Ltd	305128	6422054	North
410	Malabar Coal (Drayton Management) Pty Ltd	305767	6421009	North
500	Coal & Allied Operations and HVO Resources (Yancoal and Glencore Joint Venture)	305481	6423913	North

Note:
* Receiver is outside the extent of Figures 3-1 and 3-2.



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LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

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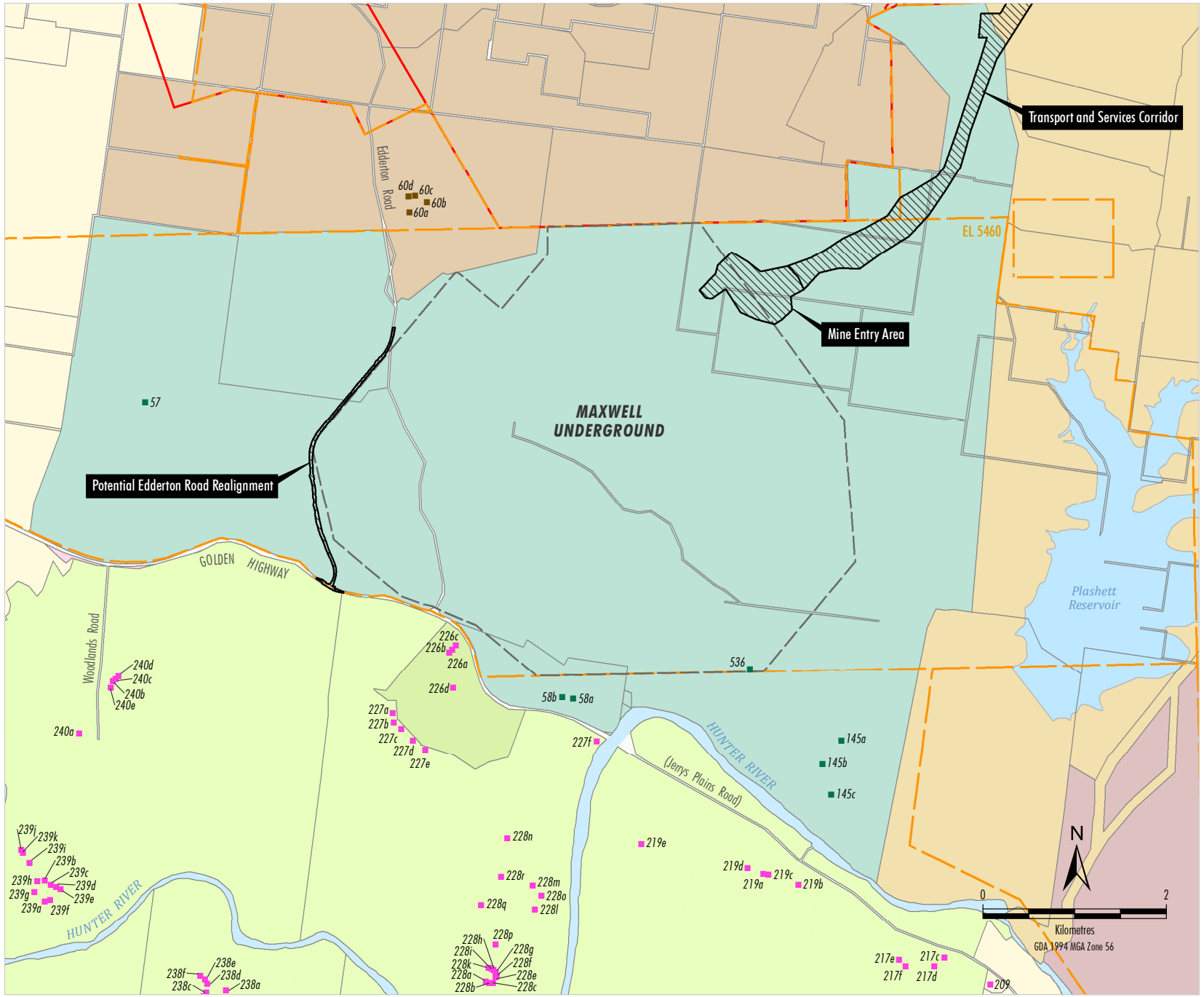
Northern Receiver Locations

Figure 3-1



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

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Southern Receiver Locations

Figure 3-2

SHM-18-03 Maxwell_EIS_App Noise_203C

4 OPERATIONAL NOISE ASSESSMENT CRITERIA

The Project's noise-sensitive receivers are subject to differing acoustic environments:

- The northern receivers located in Antiene and East Antiene are potentially affected by noise generated by the Mt Arthur Mine and the surrounding road network (i.e. New England Highway and Thomas Mitchell Drive).
- The southern receivers are located in a rural environment with minimal industrial noise, with the exception of traffic noise for those receivers located in close proximity to regional roads (e.g. the Golden Highway).

Past background noise surveys were reviewed to establish background noise levels which can be used to define Project noise trigger levels.

4.1 Rating Background Levels – Northern Receivers

A noise assessment conducted by Bridges Acoustics in 2007 included an assessment of background noise levels to the north of the Maxwell Infrastructure. These background noise measurements sought to identify background noise levels in the absence of audible noise from the then mining activities at the Maxwell Infrastructure (former Drayton Mine). This was complicated by the similar noise characteristics from the Mt Arthur Mine, the New England Highway and Thomas Mitchell Drive. Attended noise measurements were collected during wind speeds up to 3m/s from the north-west to north-east quadrants to exclude noise contributions from the Drayton Mine and provide representative background noise levels.

As a result of discussions held with the Department of Environment and Conservation (now EPA), Bridges Acoustics (2007) adopted conservatively lower Rating Background Levels (RBLs) at each monitoring location. These RBLs were assigned to the northern receivers based on proximity to the monitoring locations and exposure to the Mt Arthur Mine, New England Highway and Thomas Mitchell Drive.

Review of the RBLs adopted by Bridges Acoustics (2007) indicates they are comparable to what would be expected in rural areas such as Antiene and East Antiene and are considered appropriate to define noise trigger levels for the northern receivers. The RBLs likely do not fully capture the contribution of traffic noise from the New England Highway and traffic noise may have increased since 2007 and, as such, the Bridges Acoustics (2007) RBLs are considered conservative (that is, lower than actual).

It is noted that the background noise surveys considered as part of the *Mt Arthur Coal Open Cut Modification – Noise and Blasting Assessment* (Wilkinson Murray, 2013) would have included noise contributions from the former Drayton Mine operations and, therefore, could not be used to establish noise trigger levels for the Project in accordance with the *Noise Policy for Industry (NPfI)* (EPA, 2017).

Table 4-1 summarises the adopted RBLs at the privately-owned northern receivers, consistent with Bridges Acoustics (2007). Three identified receivers located further to the north (receivers 507, 508 and 509) were not considered by Bridges Acoustics (2007) and as such do not have RBLs. For those three receivers, the assessment conservatively adopts the minimum assumed RBLs set by the *NPfI* (35 A-weighted decibels [dBA] for daytime, 30 dBA for evening, and 30 dBA for night).

Table 4-1 Adopted RBLs – Northern Receivers

Receiver ID	Adopted RBLs (dBA)		
	Daytime	Evening	Night
385, 390, 398, 399, 411, 418, 419, 420, 421, 423, 424, 425, 427, 429, 432, 433a, 433b, 435a, 435b, 438, 440, 443, 444, 446a, 460 and 539	35	32	32
384, 386, 400, 402, 403, 441a, 441b, 451, 455, 456, 507, 508, 509, 537 and 538	35	30	30

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

4.2 Rating Background Levels – Southern Receivers

A long-term unattended background noise survey was conducted by Bridges Acoustics in 2011 near the southern receivers to determine background noise levels to the south and east of the Maxwell Underground (Bridges Acoustics, 2015). Short-term attended measurements were also carried out in conjunction with the unattended noise survey to understand the nature of the acoustic environment dominating background noise levels.

It was found that the acoustic environment to the south and south-east of the Maxwell Underground was generally driven by distant traffic noise from the Golden Highway. Areas to the south-west, which generally benefit from more shielding from distant traffic due to undulating terrain, were subject to lower RBLs.

Review of the RBLs adopted by Bridges Acoustics (2015) for the southern receivers indicates that they are comparable to what would be expected in remote rural areas. Therefore, they are considered appropriate to define noise trigger levels for the Project. RBLs affected by distant traffic noise (especially to the south and south-east of the Maxwell Underground) may have increased since 2011 and as such, the RBLs determined by Bridges Acoustics (2015) are considered conservative.

Table 4-2 summarises the adopted RBLs at the privately-owned southern receivers. Consistent with Bridges Acoustics (2015), receivers located along the Golden Highway south and south-east of the Maxwell Underground were assigned RBLs of 35 dBA (daytime), 33 dBA (evening) and 33 dBA (night) to account for noise associated with highway traffic. The remaining southern receivers were conservatively assigned the minimum RBLs of 35 dBA (daytime), 30 dBA (evening) and 30 dBA (night) in accordance with the NPfI.

Table 4-2 Adopted RBLs – Southern Receivers

Receiver ID	Adopted RBLs (dBA)		
	Daytime	Evening	Night
24a, 24b, 25, 230a, 230b, 238a, 238b, 238c, 238d, 238e, 238f, 238g, 238h, 239a, 239b, 239c, 239d, 239e, 239f, 239g, 239h, 239i, 239j, 239k, 240a, 240b, 240c, 240d, 240e, 250a, 250b, 253, 254a, 254b, 254c, 255, 279, 284, 285, 287, 298a, 298b, 299, 306, 527 and 532	35	30	30
172, 207, 209, 211a, 211b, 211c, 217c, 217d, 217e, 217f, 219a, 219b, 219c, 219d, 219e, 226a, 226b, 226c, 226d, 227a, 227b, 227c, 227d, 227e, 227f, 228a, 228b, 228c, 228e, 228f, 228g, 228h, 228i, 228j, 228k, 228l, 228m, 228n, 228o, 228p, 228q, 228r and 528	35	33	33

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

4.3 Project Noise Trigger Levels

4.3.1 Intrusiveness Noise Levels

The *NPfI* specifies an intrusiveness noise level which requires that the $L_{Aeq,15min}$ from a specific industrial source should not exceed the background noise level by more than 5 dB.

Table 4-3 summarises the intrusiveness noise levels relevant to the Project.

Table 4-3 Project Intrusiveness Noise Levels

Receiver Group	Receiver ID	Project Intrusiveness Noise Levels $L_{Aeq,15min}$ (dBA)		
		Daytime	Evening	Night
North	385, 390, 398, 399, 411, 418, 419, 420, 421, 423, 424, 425, 427, 429, 432, 433a, 433b, 435a, 435b, 438, 440, 443, 444, 446a, 460 and 539	40	37	37
	384, 386, 400, 402, 403, 441a, 441b, 451, 455, 456, 507, 508, 509, 537 and 538	40	35	35
South	24a, 24b, 25, 230a, 230b, 238a, 238b, 238c, 238d, 238e, 238f, 238g, 238h, 239a, 239b, 239c, 239d, 239e, 239f, 239g, 239h, 239i, 239j, 239k, 240a, 240b, 240c, 240d, 240e, 250a, 250b, 253, 254a, 254b, 254c, 255, 279, 284, 285, 287, 298a, 298b, 299, 306, 527, and 532	40	35	35
	172, 207, 209, 211a, 211b, 211c, 226a, 226b, 226c, 226d, 217c, 217d, 217e, 217f, 219a, 219b, 219c, 219d, 219e, 227a, 227b, 227c, 227d, 227e, 227f, 228a, 228b, 228c, 228e, 228f, 228g, 228h, 228i, 228j, 228k, 228l, 228m, 228n, 228o, 228p, 228q, 228r and 528	40	38	38

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

4.3.2 Amenity Noise Levels and Project Amenity Noise Levels

The *NPfI* specifies an amenity noise level where receptors are potentially subjected to cumulative noise from a number of industrial sources. This criterion aims to maintain noise amenity across the different times of day with recommended amenity noise levels to mitigate noise impacts such as speech interference, community annoyance and some sleep disturbance.

For the Project there are other potential sources of industrial noise, such as, the Mt Arthur Mine located directly to the west of the Maxwell Infrastructure (Figure 2-1). The recommended amenity noise level sets upper limits for the total $L_{Aeq,Period}$ noise levels at a given receiver from all industrial sources over the daytime, evening and night periods. For this Project, the surrounding potential receivers are situated in an area which would be classified as "Rural" under the *NPfI*, and the relevant recommended $L_{Aeq,Period}$ amenity noise levels are 50 dBA, 45 dBA and 40 dBA for daytime, evening and night time periods, respectively.

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

Project amenity noise level = Amenity noise level – 5 dB

Table 4-4 summarises the Project amenity noise levels in terms of $L_{Aeq,Period}$ levels.

Table 4-4 Project Amenity Noise Levels ($L_{Aeq,Period}$)

Receiver ID	Project Amenity Noise Levels $L_{Aeq,Period}$ (dBA)		
	Daytime	Evening	Night
All identified receivers (Table 3-1)	45	40	35

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

The *NPfI* stipulates that Project amenity noise levels are expressed as $L_{Aeq,15min}$ values and provides the following conversion for $L_{Aeq,Period}$ levels into $L_{Aeq,15min}$ levels:

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

Table 4-5 summarises the Project amenity noise levels in terms of $L_{Aeq,15min}$ levels.

Table 4-5 Project Amenity Noise Levels ($L_{Aeq,15min}$)

Receiver ID	Project Amenity Noise Levels $L_{Aeq,15min}$ (dBA)		
	Daytime	Evening	Night
All identified receivers (Table 3-1)	48	43	38

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

4.3.3 Project Noise Trigger Levels

The *NPfI* stipulates the 'Project noise trigger levels' as the lower (i.e. more stringent) of the Project intrusiveness noise levels and Project amenity noise levels.

Table 4-6 summarises the Project noise trigger levels used for all identified receivers in this assessment. The Project intrusive noise levels are equal to, or lower (i.e. more stringent) than the Project amenity noise levels and therefore have been adopted as the Project trigger noise levels.

Table 4-6 Project Noise Trigger Levels

Receiver Group	Receiver ID	Project Noise Trigger Levels $L_{Aeq,15min}$ (dBA)		
		Daytime	Evening	Night
North	385, 390, 398, 399, 411, 418, 419, 420, 421, 423, 424, 425, 427, 429, 432, 433a, 433b, 435a, 435b, 438, 440, 443, 444, 446a, 460 and 539	40	37	37
	384, 386, 400, 402, 403, 441a, 441b, 451, 455, 456, 507, 508, 509, 537 and 538	40	35	35
South	24a, 24b, 25, 230a, 230b, 238a, 238b, 238c, 238d, 238e, 238f, 238g, 238h, 239a, 239b, 239c, 239d, 239e, 239f, 239g, 239h, 239i, 239j, 239k, 240a, 240b, 240c, 240d, 240e, 250a, 250b, 253, 254a, 254b, 254c, 255, 279, 284, 285, 287, 298a, 298b, 299, 306, 527 and 532	40	35	35
	172, 207, 209, 211a, 211b, 211c, 226a, 226b, 226c, 226d, 217c, 217d, 217e, 217f, 219a, 219b, 219c, 219d, 219e, 227a, 227b, 227c, 227d, 227e, 227f, 228a, 228b, 228c, 228e, 228f, 228g, 228h, 228i, 228j, 228k, 228l, 228m, 228n, 228o, 228p, 228q, 228r and 528	40	38	38

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

4.4 Modifying Factor Adjustments

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

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

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

Two penalties are nominated in the *NPfI*:

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

Table C2 of the *NPfI* is reproduced below:

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

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

***Note**:*

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

A low-frequency noise assessment for the Project is provided in Section 5.6. This assessment concludes no modifying factor correction for low-frequency noise is warranted for the Project.

4.5 Trigger Levels for Maximum Noise Level Event Assessment

To help protect residents from sleep disturbance (awakening or disturbance to sleep stages), the *NPfI* also includes the following:

> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken.*

On the basis that the existing RBLs for the night period are assumed to range between 30 dBA and 33 dBA depending on the receiver, the Project's trigger levels for the maximum noise level event screening assessment are:

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

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

4.6 Residual Noise Impacts

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

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

Table 4.1 of the *NPfI*, which quantifies the significance of any potential noise exceedances, is reproduced below in Table 4-7. These significance categories (i.e. negligible, marginal, moderate and significant) are generally consistent with the significance categories described in Table 1 of the *VLAMP*.

Table 4-7 Significance of Residual Noise Impacts

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

Table 4.2 of the *NPfI* provides example measures for addressing residual noise impacts. The measures are also generally consistent with Table 1 of the *VLAMP*. Table 4.2 of the *NPfI* is reproduced in Table 4-8.

Table 4-8 Examples of Receiver-Based Treatment to Mitigate Residual Noise Impacts

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

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

For privately-owned residences, Table 4-9 presents the options for addressing noise levels where they may exceed the Project noise trigger levels.

Table 4-9 Project Noise Impact Assessment Methodology

Noise Management Zone		Noise Affectation Zone
1-2 dB above Project noise trigger levels (refer Table 4-6)	**3-5 dB above Project noise trigger levels (refer Table 4-6)**	**> 5 dB Project noise trigger levels (refer Table 4-6)**
No treatment/controls required.	• Voluntary mitigation rights applicable. • Architectural treatment required if requested (incl. ventilation & upgraded façade elements).	• Voluntary mitigation rights applicable. • Architectural treatment required if requested (incl. ventilation & upgraded façade elements). • Voluntary land acquisition rights applicable.

5 OPERATIONAL NOISE ASSESSMENT

5.1 Noise Modelling Methodology

Operational noise levels at nearby receivers have been calculated using the Environmental Noise Model (ENM) (a proprietary computer program from RTA Technology Pty Ltd). This modelling software is compatible with the *NPfI* and has been previously accepted by the EPA and the DP&E for use in environmental noise assessments. The assessment models the total noise at each receiver including the operation of the Project. Total predicted operational noise levels are then compared with the Project noise trigger levels presented in Table 4-6.

5.1.1 Noise Assessment Scenarios

Noise modelling was undertaken for the daytime, evening and night operating scenarios for Project Years 1, 3 and 4. These Project Years were selected to represent operations with the greatest potential for noise impacts on both the southern and northern receivers. They can be described as follows:

- Project Year 1 considers the initial underground mining operations, where trucks are used to transport ROM coal via a new road from the MEA to the existing Maxwell Infrastructure where handling and processing of coal and loading of coal onto trains would occur. Trucking of ROM coal, handling and processing of coal, and loading of coal onto trains would occur during the daytime only. The ROM coal would either be dumped directly into the existing dump hopper at the Maxwell Infrastructure or onto the ROM stockpile area directly to the south-west of the CHPP at the Maxwell Infrastructure. Project Year 1 considers construction works at the MEA (including construction of drifts and ventilation shafts), along the site access road, and ongoing rehabilitation of the previously mined areas at the Maxwell Infrastructure.
- Project Year 3 considers underground bord and pillar mining plus development operations with ROM coal being transported using the same truck numbers as Project Year 1 via the site access road from the MEA to the existing Maxwell Infrastructure where handling and processing of coal and loading of coal onto trains would take place. Trucking of ROM coal, handling and processing of coal, and loading of coal onto trains would occur on a 24-hour basis. Project Year 3 considers daytime construction works associated with the upgrade of Maxwell Infrastructure and the new covered overland conveyor.
- Project Year 4 considers underground mining operations using a secondary sizer at the MEA and a new covered overland conveyor to transport ROM coal from the MEA to the upgraded Maxwell Infrastructure where handling and processing of coal and loading of coal onto trains would occur. All infrastructure would be operating on a 24-hour basis. The upgraded Maxwell Infrastructure would include a new ROM stockpile with a travelling tripper system and an expanded product stockpile area.

Key Project components are shown on Figure 2-1.

5.1.2 Construction Activities

As mentioned in the description of Project Years 1 and 3, construction activities have been included in the assessed operational noise scenarios. As perceived by receivers in the vicinity of the Project, noise associated with construction activities, such as construction of the MEA (including construction of drifts and ventilation shafts) and Maxwell Infrastructure upgrades, would largely be indistinguishable from operational mining and coal processing activities given similar plant would be deployed and construction activities would occur in areas adjacent to operational activities. Therefore, construction noise during operational years was assessed in combination with operational noise against the daytime Project noise trigger level of 40 dBA (Table 4-6).

Construction activities associated with the site access road and covered overland conveyor would by nature move progressively along the transport and services corridor. As perceived by the northern receivers, these construction activities would generate the greatest contributions to operational noise levels when taking place at the northern end of the transport and services corridor. Similarly, they are expected to cause the most impact to the southern receivers when working near the southernmost end of the proposed transport and services corridor.

Investigative modelling has indicated that due to operational noise, daytime works associated with construction of the site access road in Year 1 would become inaudible to the northern receivers beyond approximately 500 to 1,500 metres (m) from the northernmost end of the transport and services corridor at the Maxwell Infrastructure, depending on the meteorological conditions present at the time (i.e. with construction noise becoming inaudible at larger distances from the northernmost end of the corridor with light winds blowing in the direction of the northern receivers, and inaudibility achieved at 500 m from the northernmost end of the corridor in calm conditions or with winds other than source-to-receiver winds).

Similarly, daytime works associated with the construction activities along the covered overland conveyor in the Year 3 scenario would become inaudible to the northern receivers beyond approximately 350 to 1,000 m from the northernmost end of the transport and services corridor at the Maxwell Infrastructure, depending on the meteorological conditions present at the time.

The length of the proposed site access road is 10.5 kilometres (km), and length of the proposed covered overland conveyor is 9.6 km. Therefore, construction works along the transport and services corridor are only expected to contribute to overall levels for relatively short durations as perceived by the northern receivers: only 5-15 % of the daytime in Year 1 and 3.5-10% of the daytime in Year 3. Given these activities would occur for relatively short durations, noise contributions from construction works at the northernmost end of the transport and services corridor are not deemed representative of general noise emissions throughout the year for the purpose of operational noise assessment and are not included in the assessed operational noise scenarios for the northern receivers in Section 5.7, although are provided in Appendix E for completeness.

Due to the negligible operational noise levels anticipated at the southern receivers, noise contributions from construction works at the southern end of the transport and services corridor have been included in the operational noise predictions for the southern receivers.

In addition to consideration in the operational noise scenarios, noise contributions from construction works, including initial construction activities and the potential Edderton Road realignment, have also been assessed against the *Interim Construction Noise Guideline* (*ICNG*) (Department of Environment and Climate Change, 2009) in Section 6.

5.1.3 Meteorological Environment for Noise Assessment Purposes

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

Table D1: Standard and noise-enhancing meteorological conditions.

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

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

Fact Sheet D provides two options when considering meteorological effects:

1. Conservatively adopt noise-enhancing meteorological conditions without processing meteorological data local to the site; or

2. Determine the significance of noise-enhancing meteorological conditions based on meteorological data local to the site and adopt significant noise-enhancing conditions for the assessment. Where noise-enhancing meteorological conditions are deemed non-significant, standard meteorological conditions may be adopted.

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

The significance of noise-enhancing meteorological conditions is based on five years of meteorological data obtained from the Maxwell Infrastructure CHPP Automatic Weather Station (AWS) and Maxwell Underground MET03 AWS. The Maxwell Infrastructure CHPP AWS data (July 2013 – August 2018) was used to determine the significance of noise-enhancing meteorological conditions for the northern receivers while the Maxwell Underground MET03 AWS data (February 2013 - August 2018) was used to establish noise-enhancing conditions relevant to the southern receivers. Both datasets include wind speed, wind direction and observations of sigma-theta used to determine Pasquill-Gifford stability categories (in accordance with Fact Sheet D).

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

Analysis of data from the Maxwell Infrastructure CHPP AWS and the Maxwell Underground MET03 AWS determined that the percentage of occurrence of moderate-to-strong temperature inversions averaged over the five years was 27.5% and 12.5%, respectively (see Section B.3 of Appendix B). Given the location of the Project in the Hunter Valley, which is known for inversion conditions, moderate-to-strong inversions have conservatively been considered as part of the night time noise enhancing conditions.

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

For the northern receivers, analysis of the meteorological data following the methodology directed in Fact Sheet D determined temperature inversions with winds from the western (W), west-northwestern (WNW), northwestern (NW), and north-northwestern (NNW) directions are found to have frequencies of occurrence ranging from 10.3% to 13.2% in winter. As these winds would generally not be towards any of the northern receivers, they have not been addressed in the assessment.

For the southern receivers, the frequency of occurrence of night time meteorological conditions involving temperature inversions with winds was less than 10% in any direction in all seasons.

Given night time meteorological conditions involving temperature inversions with winds towards the northern receivers would be so infrequent, these noise enhancing conditions would be managed by Malabar using a pro-active noise management system with identification of modified operating scenarios (Section 5.3) to maintain compliance with relevant Project noise trigger levels in the event that adverse weather conditions are experienced.

The resultant noise-enhancing meteorological conditions relevant to the Project along with the standard meteorological conditions are summarised in Tables 5-1 and 5-2 for the northern and southern receivers, respectively. All meteorological conditions presented in Tables 5-1 and 5-2 have been considered for the assessment since the noise-enhancing meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* do not necessarily result in higher noise levels when compared with standard meteorological conditions at a particular receiver location.

Table 5-1 Relevant *NPfI* Meteorological Conditions - Northern Receivers

Assessment Period	*NPfI* Meteorological Condition	Description of Meteorological Parameters
Daytime	Noise-enhancing meteorological conditions	3 m/s wind in ESE, SE, SSE, W, WNW, NW & NNW directions; stability categories A-D
	Standard meteorological conditions	0.5 m/s wind in source-to-receiver direction; stability categories A-D
Evening	Standard meteorological conditions	0.5 m/s wind in source-to-receiver direction; stability categories A-D
Night	Noise-enhancing meteorological conditions	Stability category F; no wind component
	Standard meteorological conditions	0.5 m/s wind in source-to-receiver direction; stability categories A-D

Notes:
ESE = East-southeast.
SE = South-east.
SSE = South-southeast.
W = West.
WNW = West-northwest.
NW = North-west.
NNW = North-northwest.
Wind in source-to-receiver direction was considered using the closest direction in a 16-direction compass to the source-to-receiver direction.

Table 5-2 Relevant *NPfI* Meteorological Conditions - Southern Receivers

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

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

For each assessment period, only the highest noise predictions under the relevant *NPfI* meteorological conditions presented in Tables 5-1 and 5-2 (including both standard and noise-enhancing meteorological conditions as described in Fact Sheet D) are reported.

5.2 Investigation of Feasible & Reasonable Noise Mitigation Measures

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

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify the potential for noise exceedances. These scenarios consider various stacking/reclaiming combinations on different product stockpiles within the Maxwell Infrastructure.
2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.
3. Review of the effectiveness of these measures and assessment of their feasibility by Malabar.
4. Adoption by Malabar of management and mitigation measures to optimise noise emissions associated with the Project.

As a result of this preliminary modelling, modifications to the Project were undertaken in order to improve acoustic performance, including:

a. Selection of mobile plant and infrastructure items in consideration of good practice sound power levels (SWLs).

b. Use of a pro-active noise management system (Section 5.3) with development of modified operating scenarios during noise-enhancing meteorological conditions in the daytime, evening and night time periods. The pro-active noise management system would be described in a Noise Management Plan.

Table 5-3 provides a summary of the specific mitigation measures proposed for the Project in order to reduce potential noise emissions.

Table 5-3 Specific Mitigation Measures

Project Year when Applicable	Specific Mitigation Measures
All Project Life	Noise controls on a selection of mobile plant during fleet procurement (e.g. consideration of extra quiet mobile plant models) to reduce emitted noise levels.
All Project Life	Enclosure/acoustic shrouding and acoustic design for selected infrastructure items including the covered overland conveyor and ventilation fans.
All Project Life	Real-time monitoring and forecasting system, incorporating noise and meteorological monitoring, with the purpose of anticipating upcoming periods of noise-enhancing meteorological conditions that may generate noise exceedances at receivers surrounding the Project. Such a system would allow Malabar to predict and prepare for modification of operations to reduce noise levels as far as reasonably and feasibly practical in the event that adverse weather conditions are experienced. Details regarding the real-time monitoring and forecasting system would be provided in a Noise Management Plan.

5.3 Pro-Active Noise Management during Noise-Enhancing Meteorological Conditions

It is proposed to have a real-time monitoring and meteorological forecasting system in place to assist with managing noise levels during upcoming periods of noise-enhancing meteorological conditions. This system would be used for all stages of the Project life and would involve a combination of:

- noise monitoring, which indicates the trend in actual noise levels at a location; and
- meteorological monitoring and forecasting, which indicates the likelihood that the current trend would continue or intensify over the ensuing period.

In the event that the real-time monitoring and meteorological forecasting system predicts that elevated noise levels at some receivers may occur, Malabar would prepare to adjust operations to minimise noise impacts in the event that predicted adverse weather conditions are experienced.

Details regarding the real-time monitoring and forecasting system would be provided in a Noise Management Plan.

A range of feasible and reasonable mitigation measures would be available to Malabar in addition to the operational controls already incorporated into the preliminary modelling (i.e. use of "low noise" attenuated mobile plant, etc.). These measures would be employed as required throughout the life of the Project to maintain compliance.

This assessment integrates pro-active and reactive noise management measures into the scenarios for Project Years 1, 3 and 4, as some receivers to the north of the Project were predicted to experience exceedances in the absence of these measures (Appendix D).

The mitigation measures adopted to address potential exceedances at the closest privately–owned receivers are described in Table 5-4.

Table 5-4 Mitigation Measures

Applicable Modelling Scenario	Pro-Active/Reactive Mitigation Measures	Approximate Noise Reduction at Key Receivers
Year 1 – Daytime	Suspension of all rehabilitation activities.	1 dB
Year 3 – Daytime	Suspension of operation of front-end loader at the Maxwell Infrastructure.	1 dB
Year 3 – Night	Suspension of operation of front-end loader at the Maxwell Infrastructure.	1 dB
Year 4 – Daytime	Suspension of operation of both dozers at the Maxwell Infrastructure ROM stockpile.	1 dB
Year 4 – Evening	Suspension of operation of both dozers at the Maxwell Infrastructure ROM stockpile.	1 dB
Year 4 – Night	Suspension of operation of both dozers at Maxwell Infrastructure ROM stockpile and cease reclaiming from new product stockpile during train loading process.	2 dB

As shown in Table 5-4, the identified pro-active/reactive mitigation measures adopted in the noise modelling would reduce noise levels by approximately 1-2 dB at key nearby receivers under adverse weather conditions.

5.4 Indicative Fleet List

Table 5-5 presents the proposed equipment and their periods of operation (i.e. daytime/evening/night). Mobile fleet would be confirmed during detailed design and procurement for the Project.

As explained in Section 5.1, construction activities have conservatively been included in the Year 1 and Year 3 operational noise scenarios. A description of the construction fleet is included in Section 6.2 (Description of Construction Activities).

Table 5-5 Indicative Fleet

	Fleet/ Infrastructure Item	Location/Function	Number of Equipment			Period
			Year 1	Year 3	Year 4	
Mobile Fleet – MEA and Transport and Services Corridor	Road registerable bulk haulage truck	ROM coal transport	5	5	0	Daytime only for Year 1; daytime, evening, night for Year 3
	CAT D11 Dozer	ROM stockpile management at MEA	1	0	1	Daytime only for Year 1; daytime, evening, night for Year 4
	CAT 992 Front-end loader	Loading of trucks at MEA prior to commissioning overland conveyor	1	1	0	Daytime only for Year 1; daytime, evening, night for Year 3
	CAT 14 Grader	Transport and Services Corridor (prior to sealing site access road)	1	0	0	Daytime
	Water truck	Roads (prior to sealing of the site access road)	1	0	0	Daytime
	Personnel transporter (operating at the surface)	MEA	3	3	3	Daytime only for Year 1; daytime, evening, night for Year 3 and Year 4
Mobile Fleet – Maxwell Infrastructure CHPP	CAT 992 Front-end loader	ROM stockpile management at Maxwell Infrastructure	1	1	0	Daytime only for Year 1; daytime, evening, night for Year 3
	CAT D11 Dozer	ROM stockpile management at Maxwell Infrastructure	0	0	2	Daytime, evening, night
		New product stockpile management at Maxwell Infrastructure	0	0	1	Daytime, evening, night
Mobile Fleet – Maxwell Infrastructure Rehabilitation	Dump truck	Rehabilitation (currently operating)	2	0	0	Daytime
	CAT D11 Dozer	Rehabilitation (currently operating)	1	0	0	Daytime
	CAT 980 Front-end loader	Rehabilitation (currently operating)	1	0	0	Daytime

	Fleet/ Infrastructure Item	Location/Function	Number of Equipment			Period
			Year 1	Year 3	Year 4	
MEA	Primary sizer	Coal processing – located inside underground mine	1	1	1	Daytime, evening, night
	Secondary sizer at MEA	Coal processing	0	0	1	Daytime, evening, night
	Water treatment facility	Underground mine support	1	1	1	Daytime only for Year 1; daytime, evening, night for Year 3 and Year 4
	Gas drainage plant	Underground mine support	0	0	1	Daytime, evening, night
	Gas abatement	Underground mine support	0	0	1	Daytime, evening, night
	Portal fan (Whynot Seam)	Underground mine ventilation	2	2	0	Daytime, evening, night
	Portal fan (Woodlands Hill Seam)	Underground mine ventilation	0	2	0	Daytime, evening, night
	Upcast shaft fan	Underground mine ventilation	0	2	3	Daytime, evening, night
Covered Overland Conveyor	Covered overland conveyor	ROM coal transport	0	0	1	Daytime, evening, night
Maxwell Infrastructure	Maxwell Infrastructure	Coal processing and handling	-	-	-	Daytime only for Year 1; daytime, evening, night for Year 3 and Year 4
	Workshop	Maintenance (currently operating)	1	1	1	Daytime only for Year 1; daytime, evening, night for Year 3 and Year 4
Train	Locomotive	Rail loop	3	3	3	Daytime only for Year 1; daytime, evening, night for Year 3 and Year 4

5.5 Indicative Sound Power Levels

Table 5-6 presents modelled plant SWLs, a description of noise controls implemented, and references for all the SWLs in accordance with the *NPfI*.

The nominated SWLs included in Table 5-6 are generally indicative of standard plant except for; (i) the CAT D11 dozer, (ii) the ventilation fans, and, (iii) the covered overland conveyor, for which the SWL reflects leading practice mining equipment for noise performance. SWLs for the existing Maxwell Infrastructure items were obtained from Bridges Acoustics (2015).

Mobile fleet and acoustic designs for infrastructure items would be selected as part of the detailed mine design and procurement for the Project, however it is expected SWLs would be generally consistent with those presented in Table 5-6.

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

As explained in Section 5.1, construction activities have conservatively been included in the Year 1 and Year 3 operational noise scenarios. The SWLs assumed for the construction fleet is included in Section 6.2 (Construction Noise).

Table 5-6 Indicative Equipment Sound Power Levels

Fleet/ Infrastructure Item		Indicative Sound Power Level per Item L_{Aeq} (dBA) [1]	Comments	Reference
Mobile Fleet – MEA and Transport and Services Corridor	Road registerable bulk haulage truck	112	Travelling at 80 kilometres per hour (km/hr)	Inter-Noise 2011 research paper (2011)
		95	Loading and manoeuvring at stockpile area	Inter-Noise 2009 research paper (2009)
	CAT D11 Dozer	113	Full suppression kit; restricted to 1st gear (forward & reverse) during adverse conditions; minimal track slapping	Wilkinson Murray (2013)
	CAT 992 Front-end loader	114	-	Global Acoustics (2013)
	CAT 14 Grader	108	-	Wilkinson Murray (2013)
	Water truck	100	-	Global Acoustics (2013)
	Personnel transporter	110	-	Wilkinson Murray (2015)
Mobile Fleet – Maxwell Infrastructure CHPP	CAT 992 Front-end loader	114	-	Global Acoustics (2013)
	CAT D11 Dozer	113	Full suppression kit; restricted to 1st gear (forward & reverse) during adverse conditions; minimal track slapping	Wilkinson Murray (2013)
Mobile Fleet – Maxwell Infrastructure Rehabilitation	Dump truck	112	Travelling at 80 km/hr	Inter-Noise 2011 research paper (2011)
		95	Loading and manoeuvring at stockpile area	Inter-Noise 2009 research paper (2009)
	CAT D11 Dozer	113	Full suppression kit; restricted to 1st gear (forward & reverse) during adverse conditions; minimal track slapping	Wilkinson Murray (2013)
	CAT 980 Front-end loader	113	-	Direct measurements conducted for Russell Vale Colliery, Wollongong (8 July 2014)
MEA	Primary sizer (all years)	-	Located inside underground mine	N/A
	Secondary sizer (Year 4 onwards)	107	-	Bridges Acoustics (2015)
	Water treatment facility	86	-	Wilkinson Murray (2009a)
	Gas drainage plant	95	Assume similar to Appin West	
	Gas abatement	113	Assume gas treatment consistent with the West Cliff Ventilation Air Methane Project	

Fleet/ Infrastructure Item		Indicative Sound Power Level per Item L_{Aeq} (dBA) [1]	Comments	Reference
	Ventilation fan at portals	105	Slow speed, silenced, sitting approximately 25 m below natural ground level	Wilkinson Murray (2012)
	Ventilation fan at upcast shaft outlet	110	Slow speed, silenced, located at natural ground level	
Covered Overland Conveyor	Conveyors (low noise and/or fully enclosed)	76/m*	Acoustic design - polyethylene idlers, shielded near belt and idler bearings or fully enclosed	Bridges Acoustics (2015)
	Covered overland conveyor drive tower	106	-	Global Acoustics (2013)
Maxwell Infrastructure	Dump hopper (Years 1 and 3)	103	-	Bridges Acoustics (2015)
	Secondary sizer (Years 1 and 3)	107	-	
	Tertiary sizer/screen	111	-	
	Transfer station	101	-	
	Coal preparation plant	105	-	
	Stacker	103	-	
	Reclaimer	106	-	
	Train loading bin	106	-	
	Conveyors (low noise and/or fully enclosed)	76/m*	Acoustic design - polyethylene idlers, shielded near belt and idler bearings or fully enclosed	
	Travelling tripper system	100	Internal lining and vibration isolation of tripper impact plates and hangers as well as internal lining and top covering of trouser leg chutes	Hatch (2014)
	CHPP Conveyor Drive	95	-	Wilkinson Murray (2009b)
	Workshop	80	-	Wilkinson Murray (2009a)
Train	Locomotive during loading process	102	-	Wilkinson Murray (2018)

Note:
1. Indicative sound power levels with noise controls where appropriate. Mobile fleet would be selected during detailed mine design.
* Note decibels are not added linearly. Conveyors are assumed to have a SWL of 76 dBA per metre, which is equivalent to 86 dBA over ten metres.

5.6 Low-Frequency Noise Assessment Results

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

As stated in Section 4.4, the *NPfI* provides a method for assessing low-frequency noise based on:

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

The C-weighted noise level minus A-weighted noise level assessment was conducted for a selection of receivers considered to be representative of various catchment areas surrounding the Project. The assessment was based on the relevant night time *NPfI* meteorological conditions (Tables 5-1 and 5-2) resulting in the highest noise levels.

Table 5-7 sets out the selected receivers in the different catchment areas.

Table 5-7 – Low-Frequency Noise Assessment – Catchment Areas

Representative Receiver	Receiver Group	Direction	Catchment Area Receivers
Receiver 25	South	South-west of the MEA	24a, 24b, 25, 57, 250a, 250b, 298a, 298b, 299 and 306
Receiver 60c	South	North-west of the MEA	60a, 60b, 60c and 60d
Receiver 228r	South	South of MEA	58a, 58b, 145a, 145b, 145c, 219a, 219b, 219c, 219d, 219e, 226a, 226b, 226c, 226d, 227a, 227b, 227c, 227d, 227e, 227f, 228a, 228b, 228c, 228e, 228f, 228g, 228h, 228i, 228j, 228k, 228l, 228m, 228n, 228o, 228p, 228q, 228r, 230a, 230b and 536
Receiver 253	South	South-west of MEA	238a, 238b, 238c, 238d, 238e, 238f, 238g, 238h, 239a, 239b, 239c, 239d, 239e, 239f, 239g, 239h, 239i, 239j, 239k, 240a, 240b, 240c, 240d, 240e, 253, 254a, 254b, 254c, 255, 279, 284, 285, 287 and 532
Receiver 398	North	North of Maxwell Infrastructure	387, 389, 390, 398, 399, 400, 402, 403, 404, 424, 425, 427 and 538
Receiver 419	North	North-east of Maxwell Infrastructure	410, 411, 418, 419, 420, 421, 423, 444 and 539
Receiver 451	North	North-east of Maxwell Infrastructure	446a and 451
Receiver 455	North	North-east of Maxwell Infrastructure	441a, 441b, 443, 455 and 456
Receiver 460	North	North of Maxwell Infrastructure	385, 429, 432, 440 and 460
Receiver 507	North	North of Maxwell Infrastructure	384, 386, 433a, 433b, 435a, 435b, 438, 500, 507, 508, 509 and 537
Receiver 528	South	South-east of MEA	172, 207, 209, 211a, 211b, 211c, 217c, 217d, 217e, 217f, 527 and 528

Table 5-8 summarises the difference between the C-weighted noise level and the A-weighted noise level for the three modelled Project Years.

Table 5-8 – C-Weighted Minus A-Weighted Noise Levels

Assessed Receiver	$L_{Ceq,15min}$ Noise Level - $L_{Aeq,15min}$ Noise Level (dB)		
	Year 1	Year 3	Year 4
Receiver 25	18.1	18.9	18.7
Receiver 60c	15.7	15.4	14.7
Receiver 228r	18.6	18.1	17.5
Receiver 253	19.3	19.4	20.3
Receiver 398	23.1	16.4	9
Receiver 419	19.4	13.2	10.3
Receiver 451	19	17.3	14.6
Receiver 455	18.7	17.2	14.5
Receiver 460	19.4	18	13.4
Receiver 507	21.2	19.3	14.3
Receiver 528	17.7	18.9	19.6

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

Reliable data of low-frequency mining noise over long-distances is currently limited. The most reliable dataset available to establish a typical low-frequency spectrum shape was captured as part of a noise audit conducted at Bulga Village for an open cut mine (Wilkinson Murray, 2016). While the Maxwell Project is not an open cut mine and not directly comparable to the Bulga open cut, measurements conducted for the audit were carried out at an approximate distance of 3 to 4 km from the mine, with a propagation path comparable to those surrounding the Maxwell Project. The spectrum shape shown in Table 5-9 corresponds to an average of 37 low-frequency measurements in third octave bands between 10 Hz to 160 Hz.

Table 5-9 Typical Measured Low-Frequency Spectrum – Bulga Village Noise Audit

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

The low-frequency spectrum shape was then normalised to the 63 Hz octave component of the predicted noise levels at each of the assessed receivers and compared against the low-frequency noise threshold curve (Section 4.4). The 63 Hz octave component is considered to be the most reliable octave band as source spectra were not always available at lower octave bands.

It was found that all normalised low-frequency spectrum shapes are below the low-frequency noise threshold.

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

It should be noted that annual compliance noise assessments conducted for the former Drayton Mine (which operated until October 2016) included low-frequency noise analysis which showed that noise from the mine, when audible, did not contain dominant low-frequency content at the northern receivers. Noise levels captured as part of the compliance noise assessments would have been affected by the former Drayton Mine coal handling and preparation plant area which is generally consistent with the proposed Maxwell Infrastructure.

5.7 Predicted Operational Noise Levels from the Project

The predicted $L_{Aeq,15min}$ operational noise levels at each receiver are presented in Table 5-10. Results are presented for each of Project Years 1, 3 and 4 under Fact Sheet D meteorological conditions (Section 5.1.3). The maximum result of applicable Fact Sheet D meteorological conditions (i.e. standard conditions and noise-enhancing conditions) is presented.

Appendix C presents indicative noise contours under the relevant Fact Sheet D meteorological conditions (Tables 5-1 and 5-2) for the three modelled Project Years. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2 dB in the vicinity of the Maxwell Infrastructure. This means that in some cases the noise contours would differ slightly from the values in Table 5-10, which are calculated at the individual receptor locations and are therefore more accurate predictions. Noise contours are provided for daytime and night periods and incorporate the mitigation measures described in Section 5.3.

Within Table 5-10, operational noise predictions at privately-owned receivers in excess of the Project noise trigger levels are highlighted. The mine-owned receivers are included in Table 5-10 for information only. Noise levels are rounded to the nearest dB, and incorporate the mitigation measures (Section 5.3), where there would be an exceedance in the absence of these mitigation measures.

For completeness, the noise levels at the key receivers in the absence of mitigation measures are included in Appendix D.

Treatment of noise from construction works at the northernmost end of the transport and services corridor are discussed in Section 5.1.2.

Table 5-10 - Predicted $L_{Aeq,15min}$ Operational Noise Levels

Receiver Group	Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)[1]									Noise Trigger Level Day/Eve/ Night (dBA)
		Year 1			Year 3			Year 4			
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night	
Privately-owned Dwellings											
South	24a	<20	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	24b	<20	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	25	<20	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	172	<20	<20	23	<20	<20	20	<20	<20	<20	40 / 38 / 38
South	207	22	<20	23	<20	<20	20	<20	<20	<20	40 / 38 / 38
South	209	21	<20	24	<20	<20	21	<20	<20	<20	40 / 38 / 38
South	211a	22	<20	24	<20	<20	21	<20	<20	<20	40 / 38 / 38
South	211b	20	<20	24	<20	<20	20	<20	<20	<20	40 / 38 / 38

Receiver Group	Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)[1]									Noise Trigger Level Day/Eve/ Night (dBA)
		Year 1			Year 3			Year 4			
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night	
South	211c	<20	<20	24	<20	<20	21	<20	<20	<20	40 / 38 / 38
South	217c	22	<20	25	<20	<20	22	<20	<20	22	40 / 38 / 38
South	217d	22	<20	25	<20	<20	22	<20	<20	22	40 / 38 / 38
South	217e	22	<20	26	<20	<20	22	<20	<20	22	40 / 38 / 38
South	217f	22	<20	25	<20	<20	22	<20	<20	22	40 / 38 / 38
South	219a	21	<20	27	<20	<20	23	<20	<20	24	40 / 38 / 38
South	219b	22	<20	23	<20	<20	23	<20	<20	24	40 / 38 / 38
South	219c	21	<20	26	<20	<20	23	<20	<20	24	40 / 38 / 38
South	219d	21	<20	27	<20	<20	23	<20	<20	24	40 / 38 / 38
South	219e	21	<20	20	<20	<20	24	<20	<20	24	40 / 38 / 38
South	226a	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	226b	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	226c	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	226d	20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	227a	23	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	227b	22	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	227c	21	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	227d	22	<20	<20	<20	<20	23	<20	<20	23	40 / 38 / 38
South	227e	22	<20	<20	<20	<20	22	<20	<20	23	40 / 38 / 38
South	227f	20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	228a	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228b	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228c	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228e	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228f	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228g	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228h	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228i	25	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228j	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 38 / 38
South	228k	26	<20	24	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228l	23	<20	26	<20	<20	23	<20	<20	23	40 / 38 / 38
South	228m	23	<20	<20	<20	<20	23	<20	<20	23	40 / 38 / 38
South	228n	20	<20	<20	<20	<20	22	<20	<20	22	40 / 38 / 38
South	228o	23	<20	26	<20	<20	24	<20	<20	23	40 / 38 / 38
South	228p	25	<20	25	20	<20	23	<20	<20	22	40 / 38 / 38
South	228q	25	<20	26	20	<20	23	<20	<20	23	40 / 38 / 38
South	228r	23	<20	<20	<20	<20	23	<20	<20	24	40 / 38 / 38
South	230a	25	<20	23	<20	<20	21	<20	<20	20	40 / 35 / 35
South	230b	23	<20	21	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238a	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238b	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238c	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238d	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238e	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238f	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238g	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	238h	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239a	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239b	22	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239c	22	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35

Receiver Group	Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)[1]									Noise Trigger Level Day/Eve/ Night (dBA)
		Year 1			Year 3			Year 4			
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night	
South	239d	22	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239e	22	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239f	22	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239g	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239h	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239i	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239j	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	239k	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	240a	<20	<20	<20	<20	<20	21	<20	<20	20	40 / 35 / 35
South	240b	<20	<20	20	<20	<20	21	<20	<20	21	40 / 35 / 35
South	240c	<20	<20	20	<20	<20	21	<20	<20	21	40 / 35 / 35
South	240d	<20	<20	20	<20	<20	21	<20	<20	21	40 / 35 / 35
South	240e	<20	<20	20	<20	<20	21	<20	<20	21	40 / 35 / 35
South	250a	24	<20	22	<20	<20	20	<20	<20	<20	40 / 35 / 35
South	250b	24	<20	22	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	253	21	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	254a	20	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	254b	20	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	254c	20	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	255	21	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	279	24	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	284	23	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	285	23	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	287	23	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	298a	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	298b	<20	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	299	23	<20	<20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	306	26	20	21	<20	<20	<20	<20	<20	<20	40 / 35 / 35
South	527	23	<20	24	<20	<20	21	<20	<20	21	40 / 35 / 35
South	528	20	<20	23	<20	<20	20	<20	<20	<20	40 / 38 / 38
South	532	23	<20	20	<20	<20	<20	<20	<20	<20	40 / 35 / 35
North	384	33	<20	<20	32	23	29	30	22	28	40 / 35 / 35
North	385	36	<20	<20	36	29	34	37	30	35	40 / 37 / 37
North	386	34	<20	<20	33	28	31	33	27	31	40 / 35 / 35
North	390	42[2]	<20	<20	42[2]	35	39[2]	42[2]	36	39[2]	40 / 37 / 37
North	398	41[2]	<20	<20	42[2]	34	39[2]	42[2]	36	39[2]	40 / 37 / 37
North	399	40[2]	<20	<20	40[2]	33	37[2]	40[2]	34	37[2]	40 / 37 / 37
North	400	40	<20	<20	39	31	36[2]	40	33	36[2]	40 / 35 / 35
North	402	42[2]	<20	<20	42[2]	32	39[2]	42[2]	35	39[2]	40 / 35 / 35
North	403	43[2]	<20	<20	43[2]	32	40[2]	43[2]	35[2]	40[2]	40 / 35 / 35
North	411	43[2]	<20	<20	43[2]	35	41[2]	42[2]	34	40[2]	40 / 37 / 37
North	418	42[2]	<20	<20	42[2]	35	39[2]	40	33	38[2]	40 / 37 / 37
North	419	40[2]	<20	<20	40[2]	34	38[2]	39	32	37[2]	40 / 37 / 37
North	420	40	<20	<20	40	34	38[2]	38	32	37	40 / 37 / 37
North	421	40	<20	<20	39	33	38[2]	38	33	38[2]	40 / 37 / 37
North	423	40	<20	<20	40	32	39[2]	40	32	39[2]	40 / 37 / 37
North	424	40	<20	<20	40	31	38[2]	39	31	38[2]	40 / 37 / 37
North	425	39	<20	<20	39	31	37[2]	37	31	37[2]	40 / 37 / 37
North	427	39	<20	<20	39	30	37	38	30	37	40 / 37 / 37
North	429	37	<20	<20	36	29	34	37	31	35	40 / 37 / 37

Receiver Group	Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)[1]									Noise Trigger Level Day/Eve/ Night (dBA)
		Year 1			Year 3			Year 4			
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night	
North	432	35	<20	<20	34	28	32	35	29	33	40 / 37 / 37
North	433a	34	<20	<20	33	27	31	33	28	32	40 / 37 / 37
North	433b	33	<20	<20	32	26	30	33	27	31	40 / 37 / 37
North	435a	32	<20	<20	31	25	29	32	26	30	40 / 37 / 37
North	435b	32	<20	<20	32	26	29	32	26	30	40 / 37 / 37
North	438	31	<20	<20	30	25	28	28	24	27	40 / 37 / 37
North	440	36	<20	<20	35	30	34	33	30	33	40 / 37 / 37
North	441a	33	<20	<20	32	29	31	30	27	30	40 / 35 / 35
North	441b	33	<20	<20	32	28	31	29	27	29	40 / 35 / 35
North	443	35	<20	<20	34	30	34	32	29	32	40 / 37 / 37
North	444	37	<20	<20	37	32	35	34	29	34	40 / 37 / 37
North	446a	36	<20	<20	36	29	33	33	26	31	40 / 37 / 37
North	451	32	<20	<20	32	<20	29	28	<20	26	40 / 35 / 35
North	455	33	<20	<20	32	28	31	29	26	29	40 / 35 / 35
North	456	32	<20	<20	32	28	30	28	26	29	40 / 35 / 35
North	460	35	<20	<20	35	29	33	34	28	33	40 / 37 / 37
North	507	32	<20	<20	31	25	29	31	26	30	40 / 35 / 35
North	508	31	<20	<20	30	25	28	30	25	29	40 / 35 / 35
North	509	30	<20	<20	29	24	27	30	24	28	40 / 35 / 35
North	537	30	<20	<20	28	23	25	28	24	27	40 / 35 / 35
North	538	40[2]	<20	<20	40[2]	31	38[2]	41[2]	34	38[2]	40 / 35 / 35
North	539	40[2]	<20	<20	40	32	38[2]	38	31	38[2]	40 / 37 / 37
Mine-owned Dwellings											
South	57	26	20	26	20	<20	21	20	20	22	n/a[3]
South	58a	<20	<20	<20	<20	<20	<20	<20	<20	<20	n/a[3]
South	58b	<20	<20	<20	<20	<20	<20	<20	<20	<20	n/a[3]
South	60a	38	30	33	31	29	30	31	31	32	n/a[3]
South	60b	37	31	34	30	28	31	31	31	33	n/a[3]
South	60c	34	27	33	26	24	30	26	26	33	n/a[3]
South	60d	37	31	32	28	27	30	29	29	32	n/a[3]
South	145a	22	<20	29	<20	<20	25	<20	<20	27	n/a[3]
South	145b	<20	<20	<20	<20	<20	<20	<20	<20	<20	n/a[3]
South	145c	<20	<20	<20	<20	<20	20	<20	<20	23	n/a[3]
South	536	23	<20	25	<20	<20	25	<20	<20	28	n/a[3]
North	387	38	<20	<20	37	28	34	38	29	35	n/a[3]
North	389	42	<20	<20	42	35	39	43	37	40	n/a[3]
North	404	42	<20	<20	41	30	39	43	33	42	n/a[3]
North	410	45	<20	<20	45	36	42	43	35	41	n/a[3]
North	500	33	<20	<20	32	26	30	32	27	31	n/a[3]

Notes:

1. Levels highlighted indicate predictions under the relevant Fact Sheet D meteorological conditions in excess of the Project noise trigger levels at privately-owned receivers.
2. Noise prediction with mitigation measures in place. Note that a mitigated level is only presented for receivers where exceedances were predicted in the absence of mitigation measures. That is, all other data shown in this table excludes mitigation, therefore mitigation measures would also reduce noise levels at other receivers.
3. Project noise trigger levels do not apply to mine-owned receivers.

Noise contributions from the Project at all privately-owned southern receivers are predicted to be less than or equal to 27 dBA in the daytime, evening and night time (Table 5-10). In consideration of the $L_{A90,\ 15\ min}$ and $L_{Aeq,\ 15\ min}$ noise levels measured by Bridges Acoustics (2015), these noise contributions would be indistinguishable from background noise.

With the mitigation measures in place, "marginal" exceedances (between 3-5 dB according to the *VLAMP*) are predicted at receivers 403 and 411 during the daytime and night periods and at receivers 402 and 538 during the night period in Years 3 and 4.

"Negligible" exceedances (between 1-2 dB according to the *VLAMP*) are predicted at receivers 390, 398, 400, 402, 411, 418, 419, 420, 421, 423, 424, 538 and 539. As described in the *VLAMP*, such "negligible" exceedances would not be discernible by the average listener.

A summary of the privately-owned receivers predicted to exceed the Project noise trigger levels under the relevant meteorological conditions is provided in Table 5-11. The receivers are segregated according to noise impacts as interpreted by the *VLAMP* (Section 4.6) for the Project Year/assessment period with potentially the most impact.

Table 5-11 Summary of Potential Exceedances at Privately-owned Receivers

Zone	Exceedance Level	Receivers exceeding under relevant meteorological conditions								
		Year 1			Years 2-3			Years 4-26		
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Noise Management Zone	1 to 2 dB	• 390 • 398 • 402 • 418	-	-	• 390 • 398 • 402 • 418	-	• 390 • 398 • 400 • 418 • 419 • 420 • 421 • 423 • 424 • 539	• 390 • 398 • 402 • 411 • 538	-	• 390 • 398 • 400 • 418 • 421 • 423 • 424 • 539
	3 to 5 dB	• 403 • 411	-	-	• 403 • 411	-	• 402 • 403 • 411 • 538	• 403	-	• 402 • 403 • 411 • 538
Noise Affectation Zone	>5 dB	-	-	-	-	-	-	-	-	-

Section 5.11 provides a description of Malabar's obligations with respect to these zones of management and affectation. As shown in Table 5-11, noise levels after the implementation of noise mitigation measures are predicted to generate "marginal" exceedances at a total of four receivers, with an additional ten receivers experiencing "negligible" exceedances. This relatively limited number of exceedances indicates that, with the implementation of proposed mitigation, noise from the Project would be managed to the maximum extent possible, and no other measures would be of material benefit.

To put these results in context, if the noise criteria for the former Drayton Mine were assessed under the *VLAMP* (which did not exist when Project Approval 06_0202 for the Drayton Mine Extension was granted), there would have been 15 receivers with marginal exceedances during operation which would have been granted mitigation upon request rights. Of note, the four receivers predicted to have marginal exceedances for the Project would also have had marginal exceedances during operation of the former Drayton Mine. In other words, the predicted noise levels at northern receivers for the Project are generally similar to or less than the noise levels during operation of the former Drayton Mine. This is a logical conclusion given the cessation of a significant open cut mining operation.

5.8 Vacant Land Noise Assessment

According to the *VLAMP*, voluntary land acquisition noise rights apply where: "the noise generated by the development could contribute to exceedances of the acceptable noise levels plus 5 dB in Table 2.2 of the *NPfI* on more than 25% of any privately-owned land".

Review of noise impacts indicates that the vacant land noise criterion (45 dBA $L_{Aeq,Period}$ or 48 dBA $L_{Aeq,15min}$ at night) is complied with at all surrounding privately-owned properties.

5.9 Cumulative Noise

If approved, the Project would operate concurrently with the Mt Arthur Mine. As such, receivers may potentially be exposed to noise from both industrial sources simultaneously.

Cumulative noise levels were calculated considering the relative noise contributions from the Project and the Mt Arthur Mine. The Mt Arthur Mine, is an open cut and underground coal mine approved to extract up to 32 Mtpa of ROM coal from the open cut and up to 36 Mtpa of ROM coal from the complex (Project Approval 09_0062).

The contribution of noise from the Mt Arthur Mine has been taken from predictions of noise emissions included in *Mt Arthur Coal Open Cut Modification – Noise and Blasting Assessment* prepared by Wilkinson Murray (2013).

Due to their locations relative to the Project, Liddell Power Station, Bayswater Power Station, the Bengalla Mine, Hunter Valley Operations, Greater Ravensworth Area Operations and other mining operations further afield are expected to have a negligible impact on the receivers in the vicinity of the Project and therefore cumulative noise calculations do not include them.

The methodology adopted to predict cumulative noise was to logarithmically sum the predicted night time noise levels from the Project and the Mt Arthur Mine for receivers potentially impacted by both sites, namely the northern receivers.

The night time assessment period was selected as it represents the worst-case period in terms of the predicted Project noise levels and the amenity noise trigger levels, and as such there is more potential for the Project to contribute to cumulative noise issues in this period.

Although some noise predictions associated with the Mt Arthur Mine consist of point source $L_{Aeq,15min}$ levels as calculated using ENM, others had to be estimated from the "worst case all years" night time noise contours or predictions at nearby receivers.

According to the *Rail Infrastructure Noise Guideline* (*RING*) (EPA, 2013), noise generated by trains using non-network rail lines exclusively servicing one or more industrial sites and extending beyond the boundary of the industrial premises - such as the Antiene Rail Spur - should be assessed separately to industrial noise. However, the Mt Arthur Mine noise assessment predated the *RING* and considered transport noise on the Antiene Rail Spur as operational noise and as such, its operational noise predictions and noise contours included rail noise associated with the spur. Therefore, noise predictions deemed to be affected by rail spur transport noise were estimated in the absence of rail noise, using a conservative methodology.

For the purposes of cumulative noise predictions, the closest available corresponding noise prediction years to the three Project scenarios were selected. The summation of the various noise predictions used for cumulative noise predictions is summarised below:

- Cumulative Year 1 = Year 1 Project + Year 2022 Mt Arthur Mine.
- Cumulative Year 3 = Year 3 Project + Year 2022 Mt Arthur Mine.
- Cumulative Year 4 = Year 4 Project + Year 2026 Mt Arthur Mine.

The predicted cumulative noise levels are presented in Table 5-12 for all identified northern receivers. The mine-owned receivers are included in Table 5-12 for information only.

Noise predictions incorporate the mitigation measures described in Section 5.3. Note that only the key receivers with predicted exceedances of the Project noise trigger levels in the absence of mitigation measures (Table 5-10) are presented as mitigated in Table 5-12.

Table 5-12 Predicted Night Time Cumulative $L_{Aeq,15min}$ Operational Noise Levels from Project and Mt Arthur Mine

Rec Group	Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)								Recommended $L_{Aeq,15min}$ Night Time Amenity Noise Level (dBA)
		Project			Mt Arthur Mine		Cumulative			
		Year 1	Year 3	Year 4	2022	2026	Year 1	Year 3	Year 4	
Privately-owned Dwellings										
North	384	<20	29	28	37	37	37	38	38	43
North	385	<20	34	35	34	34	34	37	38	43
North	386	<20	31	31	35	35	35	36	36	43
North	390	<20	39[1]	39[1]	35	35	35	40[1]	40[1]	43
North	398	<20	39[1]	39[1]	35	35	35	40[1]	40[1]	43
North	399	<20	37[1]	37[1]	35	35	35	39[1]	39[1]	43
North	400	<20	36[1]	36[1]	35	35	35	39[1]	39[1]	43
North	402	<20	39[1]	39[1]	35	35	35	40[1]	40[1]	43
North	403	<20	40[1]	40[1]	35	35	35	41[1]	41[1]	43
North	411	<20	41[1]	40[1]	34	34	34	42[1]	41[1]	43
North	418	<20	39[1]	38[1]	34	34	34	40[1]	39[1]	43
North	419	<20	38[1]	37[1]	34	34	34	39[1]	39[1]	43
North	420	<20	38[1]	37	34	34	34	39[1]	39	43
North	421	<20	38[1]	38[1]	34	34	34	39[1]	39[1]	43
North	423	<20	39[1]	39[1]	34	34	34	40[1]	40[1]	43
North	424	<20	38[1]	38[1]	34	34	34	39[1]	39[1]	43

Rec Group	Rec ID	$L_{Aeq,15min}$ Noise Level (dBA)								Recommended $L_{Aeq,15min}$ Night Time Amenity Noise Level (dBA)
		Project			Mt Arthur Mine		Cumulative			
		Year 1	Year 3	Year 4	2022	2026	Year 1	Year 3	Year 4	
North	425	<20	37[1]	37[1]	34	34	34	39[1]	39[1]	43
North	427	<20	37	37	34	34	34	39	39	43
North	429	<20	34	35	34	34	34	37	38	43
North	432	<20	32	33	32	32	32	35	36	43
North	433a	<20	31	32	29	29	29	33	34	43
North	433b	<20	30	31	29	29	29	33	33	43
North	435a	<20	29	30	28	28	28	32	32	43
North	435b	<20	29	30	29	29	29	32	33	43
North	438	<20	28	27	33	33	33	34	34	43
North	440	<20	34	33	33	33	33	37	36	43
North	441a	<20	31	30	33	33	33	35	35	43
North	441b	<20	31	29	33	33	33	35	34	43
North	443	<20	34	32	33	33	33	37	36	43
North	444	<20	35	34	33	33	33	37	37	43
North	446a	<20	33	31	33	33	33	36	35	43
North	451	<20	29	26	33	33	33	34	34	43
North	455	<20	31	29	33	33	33	35	34	43
North	456	<20	30	29	33	33	33	35	34	43
North	460	<20	33	33	33	33	33	36	36	43
North	507	<20	29	30	28	29	28	32	33	43
North	508	<20	28	29	29	30	29	32	33	43
North	509	<20	27	28	28	30	28	31	32	43
North	537	<20	25	27	30	30	30	31	32	43
North	538	<20	38[1]	38[1]	36	36	35	40[1]	40[1]	43
North	539	<20	38[1]	38[1]	34	34	34	39[1]	39[1]	43
Mine-owned Dwellings										
North	387	<20	34	35	33	34	33	37	38	n/a[2]
North	389	<20	39	40	37	37	37	41	42	n/a[2]
North	404	<20	39	42	36	36	35	41	43	n/a[2]
North	410	<20	42	41	35	35	35	43	42	n/a[2]
North	500	<20	30	31	30	30	30	33	34	n/a[2]

Notes:

1. Noise prediction with integrated pro-active and reactive management measures in place. Note that a mitigated level is only presented for receivers where exceedances of the Project noise trigger levels were predicted in the absence of mitigation measures (Table 5-10). The implementation of mitigation measures would also benefit other receivers surrounding the Project.
2. Project amenity noise levels do not apply to mine-owned receivers.

With the mitigation measures in place, cumulative operational noise predictions are expected to comply with the relevant noise criteria at all identified receivers.

5.10 Maximum Noise Level Event Assessment

As described in Section 4.5, the Project's trigger levels for the maximum noise level event screening assessment are:

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

Review of Table 5-10 indicates that night time $L_{Aeq,15min}$ noise predictions are exceeding 40 dBA at receiver 411 by 1 dB with mitigation. The owner of this receiver is expected to be subject to "marginal" exceedances due to operational noise emissions (Table 5-10) and as such, would fall into the noise management zone.

To assess compliance with the L_{AFmax} noise trigger of 52 dBA, the noise model was also used to analyse potential L_{AFmax} noise levels likely to arise from the Project's night time operations. The instantaneous noise sources and their typical L_{AFmax} SWL (i.e. typical noise level at the point of origin rather than at the receiver location) that may have the potential to generate sleep disturbance can be summarised as follows:

- Loader dumping in empty truck bodies: 115-125 dBA L_{AFmax}.
  (at the MEA prior to commissioning of the overland conveyor)
- Dozer track noise in 1st gear: 114-124 dBA L_{AFmax}.
- Infrastructure area impact noise: 115-125 dBA L_{AFmax}.
- Shunting on rail loop: <120 dBA L_{AFmax}.
- Bulk haulage truck passbys: <118 dBA L_{AFmax}.
  (prior to commissioning of the overland conveyor)

To be conservative the upper end of the level range has been used for noise predictions. The predicted night time L_{AFmax} noise levels at receivers surrounding the Project are summarised in Table 5-13. L_{AFmax} noise levels were added to the operational noise levels with mitigation measures in place (Table 5-10) and then compared with the L_{AFmax} screening level of 52 dBA. Mine-owned receivers are included for information only.

The L_{AFmax} values were modelled assuming the same plant locations used for the modelling of operational noise impacts. Each of the five event items listed above was modelled separately, and the highest predicted L_{AFmax} value from any item is presented in Table 5-13.

L_{AFmax} noise predictions are based on the relevant night time meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Tables 5-1 and 5-2). It should be noted that the reported levels in Table 5-13 are conservative as the highest levels have been assumed and the resultant L_{AFmax} noise predictions were added to the highest $L_{Aeq,15min}$ predicted levels.

Table 5-13 L_{AFmax} Levels from Night Time Operations at the Project

Receiver Group	Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
		Year 1	Year 3	Year 4	
Privately-owned Dwellings					
South	24a	22	20	20	52

Receiver Group	Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
		Year 1	Year 3	Year 4	
South	24b	22	20	20	52
South	25	23	20	20	52
South	172	26	21	18	52
South	207	26	21	18	52
South	209	27	22	19	52
South	211a	27	22	19	52
South	211b	27	21	18	52
South	211c	27	22	18	52
South	217c	28	23	22	52
South	217d	28	23	22	52
South	217e	29	23	23	52
South	217f	29	23	23	52
South	219a	31	25	24	52
South	219b	29	24	24	52
South	219c	31	25	24	52
South	219d	31	25	24	52
South	219e	30	29	29	52
South	226a	17	17	16	52
South	226b	16	16	16	52
South	226c	16	16	15	52
South	226d	20	23	22	52
South	227a	22	24	23	52
South	227b	20	23	23	52
South	227c	19	24	23	52
South	227d	24	28	28	52
South	227e	24	28	28	52
South	227f	20	19	18	52
South	228a	27	25	24	52
South	228b	27	25	24	52
South	228c	27	25	24	52
South	228e	27	25	24	52
South	228f	27	25	24	52
South	228g	27	25	25	52
South	228h	27	25	25	52
South	228i	27	25	25	52
South	228j	14	17	15	52
South	228k	27	26	25	52
South	228l	29	27	26	52
South	228m	27	27	27	52
South	228n	29	27	26	52
South	228o	29	27	26	52
South	228p	28	26	25	52
South	228q	29	27	26	52
South	228r	27	27	27	52

Receiver Group	Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
		Year 1	Year 3	Year 4	
South	230a	25	23	22	52
South	230b	24	22	22	52
South	238a	15	16	15	52
South	238b	17	20	19	52
South	238c	17	19	18	52
South	238d	13	16	15	52
South	238e	15	20	19	52
South	238f	14	20	13	52
South	238g	15	20	19	52
South	238h	15	19	18	52
South	239a	6	10	9	52
South	239b	7	21	19	52
South	239c	21	21	20	52
South	239d	21	21	20	52
South	239e	20	21	20	52
South	239f	21	21	20	52
South	239g	5	8	7	52
South	239h	5	9	8	52
South	239i	4	10	9	52
South	239j	8	9	8	52
South	239k	7	9	9	52
South	240a	23	23	23	52
South	240b	25	24	24	52
South	240c	25	24	24	52
South	240d	25	24	24	52
South	240e	25	24	24	52
South	250a	24	22	22	52
South	250b	24	22	22	52
South	253	22	20	20	52
South	254a	23	21	20	52
South	254b	23	21	20	52
South	254c	23	21	20	52
South	255	22	20	19	52
South	279	21	19	18	52
South	284	22	20	19	52
South	285	21	19	18	52
South	287	21	19	18	52
South	298a	15	16	15	52
South	298b	18	19	18	52
South	299	20	20	20	52
South	306	22	20	19	52
South	527	27	22	21	52
South	528	26	21	18	52
South	532	21	19	19	52

Receiver Group	Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
		Year 1	Year 3	Year 4	
North	384	20	38	38	52
North	385	17	45	45	52
North	386	20	41	41	52
North	390	18	51	52	52
North	398	17	49	52	52
North	399	17	49	50	52
North	400	17	48	49	52
North	402	18	51	52	52
North	403	17	50	52	52
North	411	18	51	49	52
North	418	20	48	48	52
North	419	20	48	47	52
North	420	18	47	46	52
North	421	16	48	48	52
North	423	19	49	50	52
North	424	20	48	49	52
North	425	19	47	47	52
North	427	20	46	46	52
North	429	18	44	46	52
North	432	17	43	43	52
North	433a	14	42	42	52
North	433b	14	41	41	52
North	435a	14	39	40	52
North	435b	15	41	41	52
North	438	17	37	37	52
North	440	20	42	42	52
North	441a	18	38	38	52
North	441b	19	38	38	52
North	443	18	42	42	52
North	444	18	43	43	52
North	446a	21	41	42	52
North	451	13	38	38	52
North	455	18	38	38	52
North	456	18	37	37	52
North	460	19	42	42	52
North	507	14	39	39	52
North	508	14	38	38	52
North	509	14	37	37	52
North	537	15	36	36	52
North	538	16	48	51	52
North	539	18	47	47	52
Mine-owned Dwellings					
South	57	31	28	28	n/a[1]
South	58a	17	16	16	n/a[1]

Receiver Group	Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
		Year 1	Year 3	Year 4	
South	58b	19	16	16	n/a[1]
South	60a	42	38	38	n/a[1]
South	60b	43	39	39	n/a[1]
South	60c	41	38	38	n/a[1]
South	60d	41	38	38	n/a[1]
South	145a	35	28	27	n/a[1]
South	145b	24	19	16	n/a[1]
South	145c	31	22	23	n/a[1]
South	536	38	30	29	n/a[1]
North	387	17	48	49	n/a[1]
North	389	18	50	51	n/a[1]
North	404	20	50	52	n/a[1]
North	410	17	54	51	n/a[1]
North	500	16	40	41	n/a[1]

Note:

1. Project noise trigger levels do not apply to mine-owned receivers.

Table 5-13 indicates that L_{AFmax} noise levels due to night time operations from the Project are predicted to be below the Project's L_{AFmax} trigger level for the maximum noise level event screening assessment at all privately-owned dwellings. Receiver 411 would have a 1 dB exceedance of the $L_{Aeq,15min}$ trigger level (40 dBA), but would comply with the L_{AFmax} trigger level (52 dBA).

5.11 Noise Mitigation Measures

This section outlines the approach by which Malabar would mitigate noise impacts. Potentially impacted receivers have been considered against the classification of a Noise Affectation Zone and a Noise Management Zone, as outlined in the *VLAMP* and Chapters 4 and 5 of the *NPfI*.

5.11.1 Noise Management Zone

Receivers exposed to operational noise levels of between 1 to 5 dB above the Project noise trigger levels fall within the "Noise Management Zone". Depending on the extent of the exceedance, noise impacts within the Noise Management Zone could range from "negligible" to "marginal" to "moderate". There are no receivers with predicted "moderate" noise impacts.

For noise sensitive receivers falling within the Noise Management Zone, it is recommended that management procedures be implemented, including:

- noise monitoring on-site and within the community;
- prompt response to any community issues of concern or complaints including discussions with relevant landowners;
- implementation of mine operating procedures including real-time noise monitoring and predictive meteorological forecasting system (Section 5.11.3);
- implementation of other on-site noise mitigation measures (Section 5.11.4); and
- provision of feasible and reasonable architectural treatment at receivers exposed to "marginal" noise impact, including ventilation and/or air conditioning systems.

5.11.2 Noise Affectation Zone

Receivers exposed to operational noise levels in excess of 5 dB above the Project noise trigger levels (i.e. "significant" exceedances) fall within the "Noise Affectation Zone". There are no receivers in this zone.

5.11.3 Real-time Noise Monitoring & Predictive Meteorological Forecasting System

As described in Section 5.3, it is proposed to have real-time noise monitoring and meteorological forecasting system to predict adverse weather conditions that may cause elevated noise at receivers to the north (particularly receivers 390, 398, 400, 402, 403, 411, 418, 419, 420, 421, 423, 424, 538 and 539).

Real-time noise monitors would be installed at relevant reference locations to assist with noise management and to facilitate the implementation of real-time noise controls. A Noise Management Plan would include noise level 'triggers' that would result in operational noise controls being invoked.

This system would predict the likelihood of noise-enhancing weather conditions occurring for the next 24 hours (based on wind speed, wind direction, atmospheric stability, etc.). The predictive system in conjunction with real-time monitoring would form the core components of the integrated pro-active management system (Section 5.3). The system would provide an alert for the responsible personnel to review the real-time data and manage the intensity and/or location of activities for that day as may be required.

5.11.4 Other Mitigation Measures

In addition, a number of general noise mitigation measures would be considered:

- Relevant personnel would undergo environmental training on noise control and awareness. This training would take place before the commencement of work by any contractor, or sub-contractor, whose work may create intrusive noise.
- The SWL of mobile mining equipment would be periodically tested in accordance with International Standards Organisation (ISO) 6395 *Earth-moving machinery – Determination of sound power level – Dynamic test conditions*.
- All complaints would be registered and responded to in accordance with a complaints procedure.
- Long-term monitoring of emitted noise levels would be undertaken to verify compliance with Project noise trigger levels and to assess the need, if any, for additional noise attenuation measures.
- Attended noise monitoring would be undertaken regularly to allow Project noise emission levels to be checked for compliance.
- Once the Project is operational, monitoring results would also be assessed against the *NPfI* (or any policy that supersedes the *NPfI*) with respect to modifying factors (including for low-frequency noise). If noise generated by the Project is found to contain annoying characteristics (such as dominant low-frequency content), the appropriate modifying factor would be applied to measured Project noise levels and assessed against the trigger levels.

6 CONSTRUCTION ACTIVITIES

As described in Sections 5.1.1 and 5.1.2, some construction activities associated with the Project have been assessed cumulatively with operational noise, with reference to the criteria for operational noise as per the *NPfI*. This is because the noise generated by these construction activities would likely be indistinguishable from noise generated by operational activities.

Other construction activities would be distinguishable from operational activities (i.e. initial construction works taking place before the Project becomes operational and construction of the potential Edderton Road realignment [a public road]).

For completeness, all construction activities, including those that would likely be indistinguishable from operational activities (and have therefore been assessed cumulatively with operational noise), have also been assessed in accordance with the *ICNG*.

6.1 Construction Noise Criteria

The recommended noise management levels described in the *ICNG* are provided in Table 6-1.

Table 6-1 Construction Noise Guideline Noise Management Levels

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq,15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences). 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours:	Noise affected RBL + 5 dBA	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

After: Department of Environment and Climate Change (2009).

6.2 Description of Construction Activities

Construction activities in the vicinity of the Project identified as having potential for intrusive noise are summarised in Table 6-2.

Table 6-2 Major Construction Activities

Construction Activity ID	Construction Activity	Timeframe	Time Period
CA1	Construction of the site access road	Prior to operations commencing	Daytime
CA2	Portal and MEA earthworks	Prior to operations commencing	Daytime
CA3 [1, 2]	Sealing of the site access road	Year 1	Daytime
CA4 [1]	Construction of ventilation shaft site	Year 1	Daytime / Evening / Night
CA5 [1]	Construction of drift entries	Year 1	Daytime / Evening / Night
CA6 [1]	Construction associated with MEA	Year 1	Daytime
CA7 [1, 2]	Construction of the covered overland conveyor	Years 2-3	Daytime
CA8 [1]	Construction of Maxwell Infrastructure upgrades	Years 2-3	Daytime
CA9	Construction of potential Edderton Road realignment	Later in Project life	Daytime

Notes:

Daytime: the period from 7.00 am to 6.00 pm.

Evening: the period from 6.00 pm to 10.00 pm.

Night: the period from 10.00 pm to 7.00 am.

1. Also assessed cumulatively with operational noise as described in Sections 5.1.1 and 5.1.2.
2. As described in Section 5.1.2, construction works along the transport and services corridor are expected to contribute to overall levels for relatively short durations as perceived by the northern receivers. Noise contributions from construction works at the northernmost end of the transport and services corridor were therefore not included in the assessed operational noise scenarios for the northern receivers as presented in Table 5-10. Noise contributions from construction works at the southern end of the transport and services corridor, however, were included in the operational noise predictions for the southern receivers.

Construction activities may be undertaken up to 24 hours per day, 7 days per week. Upgrades at the Maxwell Infrastructure would be limited to between 7.00 am to 6.00 pm, Monday to Sunday (inclusive).

An indicative construction fleet for all identified major construction activities, and corresponding SWLs, is shown in Table 6-3. The total SWL for each of the identified activities is also included. Note that a correction of -5 dB was applied to the total SWL to account for time correction, as the entire construction fleet would not always operate concurrently (i.e. not all plant items are expected to be operating all the time).

All SWLs relate to standard equipment except for the CAT D10 dozer used for the construction of the Maxwell Infrastructure upgrades (CA8) in Year 3, which was assumed to be fitted with a track attenuation package.

Table 6-3 Indicative Noise Sources & Sound Power Levels for Construction Equipment

Construction Activity ID	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item (dBA)	Total Sound Power Level per Activity (dBA)
CA1	4	Scraper (CAT 651)	113	117.2
	1	Dozer (CAT D8)	116	
	3	Padfoot rollers (18 tonne)	109	
	1	Excavator (14 tonne)	97	
	2	Water cart (12 kL)	100	
	3	Truck and dog	108	
CA2	2	Excavator (45 tonne)	107	125
	2	Excavator (100 tonne)	117	
	1	Grader (CAT 140M)	108	
	2	Scraper (CAT 651)	113	
	1	Scraper (CAT 637)	113	
	2	Compactor (CAT 825)	106	
	1	Water cart (12 kL)	100	
	1	Dozer (CAT D10)	121	
	1	Dozer (CAT D11)	125	
	9	Truck (CAT AD40 articulated)	113	
	6	Truck (50 tonne)	115	
CA3	4	Scraper (CAT 651)	113	121.4
	1	Dozer (CAT D8)	116	
	3	Padfoot rollers (18 tonne)	109	
	1	Smooth drum roller (12 tonne)	107	
	2	Smooth drum rollers (18 tonne)	107	
	1	Flat-bed truck	100	
	5	Truck and dog	108	
	3	Water cart (12 kL)	100	
	10	Sealing (bitumen and aggregate)	104	
	1	Grader (CAT 16H)	108	
	1	Excavator (14 tonne)	97	
	1	Excavator (CAT 349)	104	
	1	Terex Finlay J1170 (mobile crushing and screening)	120	
	1	Terex Finlay 693 (mobile crushing and screening)	110	
	1	Terex Finlay I130 (mobile crushing and screening)	120	
CA4	2	Blind bore drill rig (enclosed)	108	110.2
	2	Generator	101	
	2	Excavator (30 tonne)	103	
	2	Crane (110 tonne)	95	
	1	Watercart (12 kL)	100	
	2	Loader (20 tonne)	108	

Construction Activity ID	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item (dBA)	Total Sound Power Level per Activity (dBA)
CA5	1	Drill jumbo	124	120.4
	1	Loader	113	
	2	Truck (50 tonne)	115	
	1	Tool carrier	96	
	1	Shotcrete rig	106	
	2	Underground light vehicles	103	
	2	Underground agitator trucks	106	
CA6	1	Excavator (30 tonne)	103	124.1
	2	Excavator (45 tonne)	107	
	1	Positrac	104	
	2	Scraper (CAT 637)	113	
	2	Scraper (CAT 651)	113	
	1	Front end loader (CAT 980)	113	
	1	Dozer (CAT D10)	121	
	1	Dozer (CAT D11)	125	
	1	Grader (CAT 140M)	108	
	12	Haul trucks (CAT AD40 articulated)	113	
	2	Compactor (CAT 825)	106	
	2	Water cart (12 kL)	100	
	1	Backhoe	102	
CA7	1	Excavator (14 tonne)	97	115.5
	3	Haul trucks (CAT AD40 articulated)	113	
	1	Scraper (CAT 637)	113	
	1	Grader (CAT 140M)	108	
	1	Compactor (CAT 825)	106	
	2	Truck and dog	108	
	1	Padfoot rollers (18 tonne)	109	
	1	Water cart (12 kL)	100	
CA8	1	Franna crane/mobile crane	99	115
	1	Hand tools	94	
	1	Backhoe	102	
	1	Grader (CAT 16H)	108	
	1	Scraper (CAT 651)	113	
	1	Front end loader (CAT 980)	113	
	2	Water cart (12 kL)	100	
	2	Dozer (CAT D10) (fitted with track attenuation package)	114	

Construction Activity ID	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item (dBA)	Total Sound Power Level per Activity (dBA)
CA9	4	Scraper (CAT 651)	113	118.1
	1	Dozer (CAT D8)	116	
	3	Padfoot rollers (18 tonne)	109	
	1	Smooth drum roller (12 tonne)	107	
	2	Smooth drum rollers (18 tonne)	107	
	1	Flat-bed truck	100	
	5	Truck and dog	108	
	3	Water cart (12 kL)	100	
	1	Grader (CAT 16H)	108	
	1	Excavator (14 tonne)	97	
	1	Excavator (CAT 349)	104	

Assessment Methodology

Construction noise was predicted using the ENM (Environmental Noise Model) considering approximate work locations. All construction activities within the same assessment periods (Table 6-2) were assumed to be occurring at the same time.

As explained in Section 5.1.2, noise contributions from construction works at the northernmost end of the transport and services corridor, which are not deemed representative of general noise emissions for the purpose of operational noise assessment, have been addressed when assessing construction noise levels in accordance with the *ICNG*.

Construction noise levels have been predicted under the relevant meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (outlined in Tables 5-1 and 5-2).

Noise Predictions

Table 6-4 provides the predicted construction noise levels for all receivers exclusive of noise from operational activities. Mine-owned receivers are included for information only.

Table 6-4 - Predicted $L_{Aeq,15min}$ Construction Noise Levels from Project

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1]					'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours			'Highly Noise Affected' Management Level
		Initial Works	Year 1			Year 3					
		Day	Day	Eve	Night	Day		Day	Eve	Night	
Privately-owned Dwellings											
South	24a	<20	<20	<20	20	<20	45	40	35	35	75
South	24b	<20	<20	<20	20	<20	45	40	35	35	75
South	25	<20	<20	<20	20	<20	45	40	35	35	75
South	172	<20	<20	<20	23	<20	45	40	38	38	75
South	207	20	22	<20	23	<20	45	40	38	38	75
South	209	<20	20	<20	24	<20	45	40	38	38	75
South	211a	20	22	<20	24	<20	45	40	38	38	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1]					'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours			'Highly Noise Affected' Management Level
		Initial Works	Year 1			Year 3					
		Day	Day	Eve	Night	Day		Day	Eve	Night	
South	211b	<20	20	<20	24	<20	45	40	38	38	75
South	211c	<20	<20	<20	24	<20	45	40	38	38	75
South	217c	<20	21	<20	25	<20	45	40	38	38	75
South	217d	<20	22	<20	25	<20	45	40	38	38	75
South	217e	<20	21	<20	26	<20	45	40	38	38	75
South	217f	<20	21	<20	25	<20	45	40	38	38	75
South	219a	<20	20	<20	27	<20	45	40	38	38	75
South	219b	<20	21	<20	23	<20	45	40	38	38	75
South	219c	<20	20	<20	26	<20	45	40	38	38	75
South	219d	<20	20	<20	27	<20	45	40	38	38	75
South	219e	<20	20	<20	20	<20	45	40	38	38	75
South	226a	<20	<20	<20	<20	<20	45	40	38	38	75
South	226b	<20	<20	<20	<20	<20	45	40	38	38	75
South	226c	<20	<20	<20	<20	<20	45	40	38	38	75
South	226d	<20	<20	<20	<20	<20	45	40	38	38	75
South	227a	21	23	<20	<20	<20	45	40	38	38	75
South	227b	<20	21	<20	<20	<20	45	40	38	38	75
South	227c	<20	21	<20	<20	<20	45	40	38	38	75
South	227d	<20	22	<20	<20	<20	45	40	38	38	75
South	227e	<20	20	<20	<20	<20	45	40	38	38	75
South	227f	<20	<20	<20	<20	<20	45	40	38	38	75
South	228a	22	24	<20	24	<20	45	40	38	38	75
South	228b	22	25	<20	24	<20	45	40	38	38	75
South	228c	22	25	<20	24	<20	45	40	38	38	75
South	228e	22	25	<20	24	<20	45	40	38	38	75
South	228f	22	25	<20	24	<20	45	40	38	38	75
South	228g	22	25	<20	24	<20	45	40	38	38	75
South	228h	22	25	<20	24	<20	45	40	38	38	75
South	228i	22	24	<20	24	<20	45	40	38	38	75
South	228j	<20	<20	<20	<20	<20	45	40	38	38	75
South	228k	22	24	<20	24	<20	45	40	38	38	75
South	228l	<20	22	<20	26	<20	45	40	38	38	75
South	228m	20	22	<20	<20	<20	45	40	38	38	75
South	228n	<20	<20	<20	<20	<20	45	40	38	38	75
South	228o	<20	22	<20	26	<20	45	40	38	38	75
South	228p	21	23	<20	25	<20	45	40	38	38	75
South	228q	22	25	<20	26	<20	45	40	38	38	75
South	228r	<20	<20	<20	<20	<20	45	40	38	38	75
South	230a	22	24	<20	23	<20	45	40	35	35	75
South	230b	20	22	<20	21	<20	45	40	35	35	75
South	238a	<20	<20	<20	<20	<20	45	40	35	35	75
South	238b	<20	<20	<20	<20	<20	45	40	35	35	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1]					'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours			'Highly Noise Affected' Management Level
		Initial Works	Year 1			Year 3					
		Day	Day	Eve	Night	Day		Day	Eve	Night	
South	238c	<20	<20	<20	<20	<20	45	40	35	35	75
South	238d	<20	<20	<20	<20	<20	45	40	35	35	75
South	238e	<20	<20	<20	<20	<20	45	40	35	35	75
South	238f	<20	<20	<20	<20	<20	45	40	35	35	75
South	238g	<20	<20	<20	<20	<20	45	40	35	35	75
South	238h	<20	<20	<20	<20	<20	45	40	35	35	75
South	239a	<20	<20	<20	<20	<20	45	40	35	35	75
South	239b	<20	<20	<20	<20	<20	45	40	35	35	75
South	239c	<20	22	<20	<20	<20	45	40	35	35	75
South	239d	<20	22	<20	<20	<20	45	40	35	35	75
South	239e	<20	22	<20	<20	<20	45	40	35	35	75
South	239f	<20	22	<20	<20	<20	45	40	35	35	75
South	239g	<20	<20	<20	<20	<20	45	40	35	35	75
South	239h	<20	<20	<20	<20	<20	45	40	35	35	75
South	239i	<20	<20	<20	<20	<20	45	40	35	35	75
South	239j	<20	<20	<20	<20	<20	45	40	35	35	75
South	239k	<20	<20	<20	<20	<20	45	40	35	35	75
South	240a	<20	<20	<20	<20	<20	45	40	35	35	75
South	240b	<20	<20	<20	20	<20	45	40	35	35	75
South	240c	<20	<20	<20	20	<20	45	40	35	35	75
South	240d	<20	<20	<20	20	<20	45	40	35	35	75
South	240e	<20	<20	<20	20	<20	45	40	35	35	75
South	250a	21	23	<20	22	<20	45	40	35	35	75
South	250b	20	23	<20	22	<20	45	40	35	35	75
South	253	<20	21	<20	<20	<20	45	40	35	35	75
South	254a	<20	<20	<20	20	<20	45	40	35	35	75
South	254b	<20	<20	<20	20	<20	45	40	35	35	75
South	254c	<20	<20	<20	20	<20	45	40	35	35	75
South	255	<20	20	<20	20	<20	45	40	35	35	75
South	279	22	23	<20	20	<20	45	40	35	35	75
South	284	<20	22	<20	20	<20	45	40	35	35	75
South	285	<20	22	<20	20	<20	45	40	35	35	75
South	287	<20	22	<20	20	<20	45	40	35	35	75
South	298a	<20	<20	<20	<20	<20	45	40	35	35	75
South	298b	<20	<20	<20	<20	<20	45	40	35	35	75
South	299	20	22	<20	<20	<20	45	40	35	35	75
South	306	24	26	20	21	<20	45	40	35	35	75
South	527	21	22	<20	24	<20	45	40	35	35	75
South	528	<20	20	<20	23	<20	45	40	38	38	75
South	532	<20	22	<20	20	<20	45	40	35	35	75
North	384	30	34	<20	<20	30	45	40	35	35	75
North	385	30	34	<20	<20	31	45	40	37	37	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1]					'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours			'Highly Noise Affected' Management Level
		Initial Works	Year 1			Year 3					
		Day	Day	Eve	Night	Day		Day	Eve	Night	
North	386	29	34	<20	<20	30	45	40	35	35	75
North	390	36	40	<20	<20	36	45	40	37	37	75
North	398	35	39	<20	<20	36	45	40	37	37	75
North	399	34	38	<20	<20	33	45	40	37	37	75
North	400	33	37	<20	<20	34	45	40	35	35	75
North	402	35	39	<20	<20	36	45	40	35	35	75
North	403	35	39	<20	<20	38	45	40	35	35	75
North	411	37	41	<20	<20	39	45	40	37	37	75
North	418	36	40	<20	<20	38	45	40	37	37	75
North	419	34	38	<20	<20	36	45	40	37	37	75
North	420	35	39	<20	<20	35	45	40	37	37	75
North	421	33	37	<20	<20	34	45	40	37	37	75
North	423	34	38	<20	<20	35	45	40	37	37	75
North	424	33	37	<20	<20	35	45	40	37	37	75
North	425	32	36	<20	<20	33	45	40	37	37	75
North	427	32	37	<20	<20	35	45	40	37	37	75
North	429	30	34	<20	<20	31	45	40	37	37	75
North	432	29	33	<20	<20	29	45	40	37	37	75
North	433a	28	32	<20	<20	28	45	40	37	37	75
North	433b	27	31	<20	<20	28	45	40	37	37	75
North	435a	26	30	<20	<20	27	45	40	37	37	75
North	435b	28	32	<20	<20	28	45	40	37	37	75
North	438	26	30	<20	<20	28	45	40	37	37	75
North	440	29	33	<20	<20	31	45	40	37	37	75
North	441a	29	33	<20	<20	29	45	40	35	35	75
North	441b	29	33	<20	<20	29	45	40	35	35	75
North	443	31	35	<20	<20	30	45	40	37	37	75
North	444	33	37	<20	<20	33	45	40	37	37	75
North	446a	32	35	<20	<20	33	45	40	37	37	75
North	451	29	33	<20	<20	31	45	40	35	35	75
North	455	29	33	<20	<20	30	45	40	35	35	75
North	456	28	32	<20	<20	29	45	40	35	35	75
North	460	29	33	<20	<20	31	45	40	37	37	75
North	507	26	30	<20	<20	26	45	40	35	35	75
North	508	26	30	<20	<20	25	45	40	35	35	75
North	509	25	29	<20	<20	25	45	40	35	35	75
North	537	25	29	<20	<20	25	45	40	35	35	75
North	538	33	38	<20	<20	35	45	40	35	35	75
North	539	34	38	<20	<20	35	45	40	37	37	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1]					'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours			'Highly Noise Affected' Management Level
		Initial Works	Year 1			Year 3					
		Day	Day	Eve	Night	Day		Day	Eve	Night	
Mine-owned Dwellings											
South	57	23	25	20	26	<20		n/a[2]			
South	58a	<20	<20	<20	<20	<20		n/a[2]			
South	58b	<20	<20	<20	<20	<20		n/a[2]			
South	60a	36	37	30	33	26		n/a[2]			
South	60b	35	37	31	34	25		n/a[2]			
South	60c	32	33	27	33	21		n/a[2]			
South	60d	36	36	31	32	21		n/a[2]			
South	145a	<20	21	<20	29	<20		n/a[2]			
South	145b	<20	<20	<20	<20	<20		n/a[2]			
South	145c	<20	<20	<20	<20	<20		n/a[2]			
South	536	21	23	<20	25	<20		n/a[2]			
North	387	28	32	<20	<20	34		n/a[2]			
North	389	35	39	<20	<20	36		n/a[2]			
North	404	35	39	<20	<20	37		n/a[2]			
North	410	39	43	<20	<20	40		n/a[2]			
North	500	27	31	<20	<20	27		n/a[2]			

Notes:

1. Levels highlighted indicate predictions under the relevant Fact Sheet D meteorological conditions in excess of the *ICNG* noise management levels at privately-owned receivers.
2. *ICNG* noise management levels do not apply to mine-owned receivers.

The results of Table 6-4 indicate that construction noise levels would generally comply with all the noise management levels recommended in the *ICNG*. Should these works occur outside of the *ICNG*'s recommended standard hours (e.g. on Sunday or after 1.00 pm on Saturday), construction noise is predicted to exceed the daytime 'Noise Affected' management level by 1 dB at one privately-owned receiver, namely receiver 411. The exceedance is unlikely to occur as it assumes construction works associated with the site access road would take place at the northernmost end of the transport and services corridor outside standard hours and during noise-enhancing meteorological conditions.

It should be noted that a "marginal" exceedance (between 3-5 dB according to the *VLAMP*) is predicted at receiver 411 due to operational noise emissions and as such it would already fall into the zone of management (Table 5-11).

Construction noise predictions associated with the potential Edderton Road realignment (exclusive of noise from operational activities) are presented in Table 6-5.

Table 6-5 - Predicted $L_{Aeq,15min}$ Construction Noise Levels from Potential Edderton Road Realignment

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1] Later in Project Life Day	'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours Day	'Highly Noise Affected' Management Level
Privately-owned Dwellings					
South	24a	<20	45	40	75
South	24b	<20	45	40	75
South	25	<20	45	40	75
South	172	<20	45	40	75
South	207	<20	45	40	75
South	209	<20	45	40	75
South	211a	<20	45	40	75
South	211b	<20	45	40	75
South	211c	<20	45	40	75
South	217c	<20	45	40	75
South	217d	<20	45	40	75
South	217e	<20	45	40	75
South	217f	<20	45	40	75
South	219a	<20	45	40	75
South	219b	<20	45	40	75
South	219c	<20	45	40	75
South	219d	<20	45	40	75
South	219e	<20	45	40	75
South	226a	<20	45	40	75
South	226b	<20	45	40	75
South	226c	<20	45	40	75
South	226d	<20	45	40	75
South	227a	<20	45	40	75
South	227b	<20	45	40	75
South	227c	<20	45	40	75
South	227d	<20	45	40	75
South	227e	<20	45	40	75
South	227f	<20	45	40	75
South	228a	<20	45	40	75
South	228b	<20	45	40	75
South	228c	<20	45	40	75
South	228e	<20	45	40	75
South	228f	<20	45	40	75
South	228g	<20	45	40	75
South	228h	<20	45	40	75
South	228i	<20	45	40	75
South	228j	<20	45	40	75
South	228k	<20	45	40	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1] Later in Project Life Day	'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours Day	'Highly Noise Affected' Management Level
South	228l	<20	45	40	75
South	228m	<20	45	40	75
South	228n	<20	45	40	75
South	228o	<20	45	40	75
South	228p	<20	45	40	75
South	228q	<20	45	40	75
South	228r	<20	45	40	75
South	230a	<20	45	40	75
South	230b	<20	45	40	75
South	238a	<20	45	40	75
South	238b	<20	45	40	75
South	238c	<20	45	40	75
South	238d	<20	45	40	75
South	238e	<20	45	40	75
South	238f	<20	45	40	75
South	238g	<20	45	40	75
South	238h	<20	45	40	75
South	239a	<20	45	40	75
South	239b	<20	45	40	75
South	239c	<20	45	40	75
South	239d	<20	45	40	75
South	239e	<20	45	40	75
South	239f	<20	45	40	75
South	239g	<20	45	40	75
South	239h	<20	45	40	75
South	239i	<20	45	40	75
South	239j	<20	45	40	75
South	239k	<20	45	40	75
South	240a	<20	45	40	75
South	240b	<20	45	40	75
South	240c	20.1	45	40	75
South	240d	20	45	40	75
South	240e	<20	45	40	75
South	250a	22.9	45	40	75
South	250b	22.9	45	40	75
South	253	20.7	45	40	75
South	254a	20.3	45	40	75
South	254b	20.4	45	40	75
South	254c	20.4	45	40	75
South	255	20.1	45	40	75
South	279	21.9	45	40	75
South	284	21.2	45	40	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1] Later in Project Life Day	'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours Day	'Highly Noise Affected' Management Level
South	285	21.7	45	40	75
South	287	<20	45	40	75
South	298a	<20	45	40	75
South	298b	21.8	45	40	75
South	299	20.8	45	40	75
South	306	22.4	45	40	75
South	527	<20	45	40	75
South	528	<20	45	40	75
South	532	21.7	45	40	75
North	384	<20	45	40	75
North	385	<20	45	40	75
North	386	<20	45	40	75
North	390	<20	45	40	75
North	398	<20	45	40	75
North	399	<20	45	40	75
North	400	<20	45	40	75
North	402	<20	45	40	75
North	403	<20	45	40	75
North	411	<20	45	40	75
North	418	<20	45	40	75
North	419	<20	45	40	75
North	420	<20	45	40	75
North	421	<20	45	40	75
North	423	<20	45	40	75
North	424	<20	45	40	75
North	425	<20	45	40	75
North	427	<20	45	40	75
North	429	<20	45	40	75
North	432	<20	45	40	75
North	433a	<20	45	40	75
North	433b	<20	45	40	75
North	435a	<20	45	40	75
North	435b	<20	45	40	75
North	438	<20	45	40	75
North	440	<20	45	40	75
North	441a	<20	45	40	75
North	441b	<20	45	40	75
North	443	<20	45	40	75
North	444	<20	45	40	75
North	446a	<20	45	40	75
North	451	<20	45	40	75
North	455	<20	45	40	75

Rec Group	Rec ID	Predicted $L_{Aeq,15\ min}$ Noise Level (dBA)[1] Later in Project Life Day	'Noise Affected' Management Level – Inside Recommended Standard Hours	'Noise Affected' Management Level - Outside Recommended Standard Hours Day	'Highly Noise Affected' Management Level
North	456	<20	45	40	75
North	460	<20	45	40	75
North	507	<20	45	40	75
North	508	<20	45	40	75
North	509	<20	45	40	75
North	537	<20	45	40	75
North	538	<20	45	40	75
North	539	<20	45	40	75
Mine-owned Dwellings					
South	57	30.8	n/a[1]		
South	58a	<20	n/a[1]		
South	58b	<20	n/a[1]		
South	60a	36.2	n/a[1]		
South	60b	35.5	n/a[1]		
South	60c	34.8	n/a[1]		
South	60d	34.9	n/a[1]		
South	145a	<20	n/a[1]		
South	145b	<20	n/a[1]		
South	145c	<20	n/a[1]		
South	536	<20	n/a[1]		
North	387	<20	n/a[1]		
North	389	<20	n/a[1]		
North	404	<20	n/a[1]		
North	410	<20	n/a[1]		
North	500	<20	n/a[1]		

Note:

1. *ICNG* noise management levels do not apply to mine-owned receivers.

Table 6-5 indicates that all construction noise levels associated with the potential Edderton Road realignment (exclusive of noise from operational activities) would comply with all the noise management levels recommended in the *ICNG*.

6.3 Potential for Blasting during Construction

As an underground mining operation, surface blasting would not occur as part of operational activities.

Malabar would seek to eliminate or minimise the need for blasting during construction activities, with material preferentially removed through the use of dozers and excavators only. Blasting of material may be required during construction activities associated with the MEA and transport and services corridor. As such, potential overpressure and ground vibration impacts associated with blasting have been considered as part of this assessment.

Any blasts required for construction activities would be limited to a Maximum Instantaneous Charge (MIC) of approximately 500 kilograms (kg). This is substantially smaller than blasting that would occur in an open cut mining operation (an MIC typically in the order of 2,000 kg to 4,000 kg).

Malabar may also conduct blasting in the final voids at the Maxwell Infrastructure to improve overall and sustained stability of highwall slopes. This blasting would be conducted in accordance with a Mining Operations Plan, Mine Closure Plan and/or Blast Management Plan. The size of any blasts would be designed to limit potential overpressure and vibration impacts on nearby built features (including nearby residences, and the Liddell Power Station and associated water and flyash storages).

6.3.1 Airblast Overpressure & Vibration Criteria

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

- maximum overpressure due to blasting should not exceed 115 dB for more than 5% of blasts in any year, and should not exceed 120 dB for any blast; and
- maximum peak particle ground velocity should not exceed 5 millimetres per second (mm/s) for more than 5% of blasts in any year, and should not exceed 10 mm/s for any blast.

At sufficiently high levels, blast overpressure may in itself cause structural damage to some building elements such as windows.

Australian Standard (AS) 2187.2-2006 *Explosives – Storage and Use – Part 2 Use of explosives* indicates *"From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133dB"*.

For assessment of damage due to ground vibration, AS 2187.2-2006 recommends frequency-dependent criteria for vibration damage, derived from British Standard (BS) 7385-2 and United States Bureau of Mines Standard RI 8507. These are less stringent than the human comfort criterion of 5 mm/s noted above, and hence need to be considered only in the case of mine-owned receivers. For the frequencies typical of blast vibration, a value of 10 mm/s peak particle velocity (PPV) represents a conservatively low estimate of the level above which structural damage may possibly occur.

6.3.2 Prediction of Airblast Overpressure & Vibration Levels

Airblast overpressure and ground vibration levels from blasting are related to the "scaled distance" from the blast, which is defined as:

Scaled distance = $\frac{D}{W^{1/3}}$ for airblast overpressure; and

Scaled distance = $\frac{D}{W^{1/2}}$ for ground vibration.

- Where D is the distance from the blast (m) and W is the MIC of explosive (kg of ammonium nitrate fuel oil [ANFO] equivalent).

Predictive curves relating scaled distance to overpressure and ground vibration levels have been derived from measurements conducted at numerous sites, typically at a distance varying between 2 and 7 km.

For this assessment, Wilkinson Murray has used data from over 7,600 records of blasts undertaken in the Hunter Valley to derive relationships between scaled distance and overpressure or vibration. These relationships are designed to predict not the mean level of overpressure or vibration, as in a standard "site law", but the 95th percentile value, representing the level which would be exceeded by only 5% of blasts, given the use of current blast practice and the current level of variability in overpressure or vibration for the same scaled distance.

The raw data, and the derived prediction curves which are appropriate up to distances of 10 km, are shown in Appendix F.

For overpressure, a curvilinear relationship with log (Scaled Distance [SD]) was required to adequately explain the data:

Overpressure (dB) = $201.1 - 62.313 \log(SD) + 10.79 (\log(SD))^2$

- Where SD is the overpressure-scaled distance (as per formula given above).

For vibration, a linear relationship with log (Peak Particle Velocity) was derived:

Log (PPV) = $3.015 - 1.4359 \log(SD)$

- Where SD is the vibration-scaled distance (as per formula given above).

These formulae were used to predict vibration levels at all potentially-affected locations.

6.3.3 Predicted Overpressure & Vibration Levels

Based on the formulae above, the distance to achieve compliance with the 5% exceedance blasting and vibration criteria was calculated to be 1.5 km. The closest privately-owned receiver to potential blasting activities is 4.7 km away, therefore overpressure and ground vibration levels associated with blasting activities from the Project are predicted to comply with the relevant criteria at all privately-owned receivers.

Peak or maximum blasting levels have not been presented because these levels are typically caused by geological or blasting anomalies. Blasts would be designed in consideration of the geotechnical properties of the material being excavated and any known geological features.

7 ROAD TRANSPORTATION NOISE

The Project would generate additional traffic on the surrounding road network and as such, road transportation noise needs to be addressed as part of this assessment.

The residence potentially most affected by additional traffic associated with the Project is located along Thomas Mitchell Drive just west of New England Highway. Based on review of the Project's Road Transport Assessment (The Transport Planning Partnership, 2019), the contribution of Project traffic to road noise from other roads surrounding the site is expected to be negligible and as such, only Thomas Mitchell Drive is addressed in this road traffic noise assessment.

7.1 Road Traffic Noise Criteria

Criteria for assessment of noise from traffic on public roads are set out in the *NSW Road Noise Policy* (*RNP*) (Department of Environment, Climate Change and Water, 2011). Thomas Mitchell Drive would be considered as a "sub-arterial" road under this policy.

Table 3 of the *RNP* is reproduced in Table 7-1 with the relevant sections highlighted.

Table 6 of the *RNP* is also reproduced in Table 7-1.

Table 7-1 Criteria for Traffic Noise – Residential Receivers

Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq, (15\ hour)}$ 55 (external)	$L_{Aeq, (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads	$L_{Aeq, (15\ hour)}$ 60 (external)	$L_{Aeq, (9\ hour)}$ 55 (external)
	3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments		
Local roads	4. Existing residences affected by noise from **new** local road corridors	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)
	5. Existing residences affected by noise from **redevelopment** of existing local roads		
	6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments		

Table 6 Relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.– 7 a.m.)
Freeway/arterial/ sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq, (15\ hour)}$ + 12 dB (external)	Existing traffic $L_{Aeq, (9\ hour)}$ + 12 dB (external)

Reference is also made to Sections 3.4 and 3.4.1 of the RNP. Section 3.4 notes that "*In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.*"

Section 3.4.1 notes "*For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use developments**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*"

7.2 Road Traffic Volumes

Table 7-2 presents the projected average weekday background traffic volumes on Thomas Mitchell Drive for Project Years 6 and 13. Additional traffic volumes associated with the Project are summarised in Table 7-3 for the same years. All traffic volumes were obtained as an output of the Project's Road Transport Assessment (The Transport Planning Partnership, 2019).

Table 7-2 Average Weekday Traffic Volumes – Background Traffic

Road	Road Category	Project Year	Daytime		Night	
			Light	Heavy	Light	Heavy
Thomas Mitchell Drive west of New England Highway	Sub-arterial road	Year 6	1,841	655	837	238
		Year 13	1,198	550	615	228

Notes:
Daytime: the period from 7.00 am to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

Table 7-3 Average Weekday Traffic Volumes – Project Traffic

Road	Road Category	Project Year	Daytime		Night	
			Light	Heavy	Light	Heavy
Thomas Mitchell Drive west of New England Highway	Sub-arterial road	Year 6	254	59	120	5
		Year 13	233	44	111	4

Notes:
Daytime: the period from 7.00 am to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

7.3 Road Traffic Noise Impact

The closest residential receiver on Thomas Mitchell Drive is mine-owned receiver 410, located approximately 110 m from the road. Based on the traffic data presented in Tables 7-2 and 7-3, calculated traffic noise levels at receiver 410 have been predicted and are presented in Table 7-4.

Table 7-4 Calculated L_{Aeq} Traffic Noise Levels at Receiver 410

Scenario / Compliance	Year 6		Year 13	
	Daytime $L_{Aeq,15hr}$	**Night** $L_{Aeq,9hr}$	**Daytime** $L_{Aeq,15hr}$	**Night** $L_{Aeq,9hr}$
Background Traffic	52.7	50.8	51.6	50.3
Background + Project Traffic	53.1	51.1	52.1	50.6
Increase compared with Background Traffic	0.4	0.3	0.5	0.3
Criteria	60	55	60	55
Compliance with Base Criteria	Yes	Yes	Yes	Yes
Compliance with +2	N/A	N/A	N/A	N/A

Notes:
Daytime: the period from 7.00 am to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

Table 7-4 indicates that traffic noise levels along Thomas Mitchell Drive west of New England Highway are within the relevant road traffic noise criteria. Compliance is therefore expected at all receivers surrounding the Project.

8 RAIL TRANSPORTATION NOISE

8.1 Introduction

Product coal would be transported by rail from the Maxwell Infrastructure Rail Loop via the Antiene Rail Spur to the Main Northern Railway and through to the Port of Newcastle via Singleton and Maitland.

The *RING* outlines the methodology for assessing noise and vibration impacts from rail development projects.

Table 8-1 summarises the sections of rail line which have been considered in this assessment and the corresponding assessment method for each section.

Relevantly, the *RING* states rail-related activities occurring within the industrial premises (as defined under the Environment Protection Licence [EPL]) should be assessed using the *NPfI*. Accordingly, noise associated with the Maxwell Infrastructure Rail Loop is assessed as industrial noise cumulatively with all other site operations in accordance with the *NPfI* (Section 5). In the context of industrial noise, noise associated with the Maxwell Infrastructure Rail Loop was assumed to relate to the train loading process.

Table 8-1 Sections of Rail Line Considered in Noise Assessment

Rail Section	Assessment Method
Maxwell Infrastructure Rail Loop	Assessed cumulatively as part of all the other on-site noise in accordance with the requirements of the *NPfI* (Section 5)
Antiene Rail Spur	*RING* Appendix 3 (non-network rail lines on or exclusively servicing industrial sites)
Main Northern Railway	*RING* Appendix 2 (environmental assessment requirements for rail traffic-generating developments)

8.2 Antiene Rail Spur

The Antiene Rail Spur is regulated by Development Consent DA-106-04-00 and Project Approval 09_0062. It is approved to carry up to 30 train movements (15 trains) per day. Of these, a maximum of 12 train movements can travel to/from the Maxwell Infrastructure Rail Loop, and a maximum of 30 train movements can travel to/from the Mt Arthur Mine (i.e. on days where there are no train movements from the Maxwell Infrastructure, Mt Arthur Mine may use all of the available train movements). The Project would have a maximum of 12 train movements per day, consistent with DA-106-04-00 for the Antiene Rail Spur.

Operations at the Mt Arthur Mine are currently approved to 2026 after which the Project would be the only contributor to train movements on the Antiene Rail Spur. From 2027, the number of train movements on the Antiene Rail Spur would be significantly less than the currently approved maximum of 30 and would be limited to 12 movements per day.

Appendix 3 of the *RING* deals with non-network rail lines on or exclusively servicing industrial sites. Where a non-network rail line exclusively servicing one or more industrial sites extends beyond the boundary of the industrial premises, noise from this section of track should be assessed against the recommended acceptable $L_{Aeq,period}$ noise level from industrial noise sources for the relevant receiver type and indicative noise amenity area, as shown in Table 8-2.

Table 8-2 Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity	Time of Day	Acceptable L_{Aeq} Noise Level (dBA)
Residence	Rural	Daytime	50
		Evening	45
		Night	40

Notes:
Daytime: the period from 7.00 am to 6.00 pm.
Evening: the period from 6.00 pm to 10.00 pm.
Night: the period from 10.00 pm to 7.00 am.

Consistent with the *RING*, the assessment for non-network rail lines must consider the rail alignment from the boundary of the environment protection licence (EPL 1323), to the main line (the Main Northern Railway).

Rail spur noise levels at nearby receivers have been predicted using the ENM to allow for consideration of local meteorological data consistent with the operational noise assessment (Section 5). Noise levels and spectra were established using the Transport for NSW standard rail noise database for locomotives and freight wagons. The database levels where necessary can be adjusted for speed, locomotive type and length of trains.

Because of adverse weather conditions present at night and the more stringent night time noise criterion set in the *RING* for non-network rail lines (40 dBA $L_{Aeq,Period}$), the proposed rail spur noise assessment focuses on the night time period (10.00 pm – 7.00 am).

Noise modelling was based on the following assumptions:

- peak train movements of 10 train movements (or five trains) per night (10.00 pm - 7.00 am) to represent the period when the Project and Mt Arthur Mine would both be operating (up to and including 2026);
- peak train movements of four train movements (or two trains) per night (10.00 pm - 7.00 am) to represent the period when the Project would continue operating after the Mt Arthur Mine ceases operations (post 2026);
- train configuration of three 90 Class locomotives and 91 wagons; and
- average speed on the spur of 60 km/hr.

Note that the Project could also use trains which operate with only two locomotives per train (Aurizon locomotives). Therefore, rail noise impacts predicted in the assessment may at times be conservative.

Wheel defects of rolling stock can make a material difference to potential rail noise impacts. As such, predicted noise levels are presented for rolling stock with both low wheel defects and medium wheel defects.

Table 8-3 presents the predicted noise levels at the façade of the northern receivers.

Table 8-3 Transportation Noise Predictions from Antiene Rail Spur

Receiver ID	$L_{Aeq,Period}$ Noise Level (dBA)[1] (Medium Wheel Defects)		$L_{Aeq,Period}$ Noise Level (dBA)[1] (Low Wheel Defects)		RING Night $L_{Aeq,Period}$ Noise Limit (dBA)
	Project and Mt Arthur Mine (up to and including 2026)	Project Only (post 2026)	Project and Mt Arthur Mine (up to and including 2026)	Project Only (post 2026)	
Privately-owned Dwellings					
384	27	23	23	20	40
385	30	26	26	22	40
386	20	16	16	13	40
390	31	27	27	24	40
398	30	26	27	23	40
399	30	27	27	23	40
400	30	26	27	23	40
402	30	26	27	23	40
403	31	27	27	23	40
411	38	34	35	31	40
418	33	29	30	26	40
419	33	29	29	25	40
420	36	32	32	28	40
421	31	27	27	23	40
423	31	27	28	24	40
424	31	27	28	24	40
425	30	26	27	23	40
427	30	26	27	23	40
429	30	26	27	23	40
432	28	25	25	21	40
433a	28	24	24	21	40
433b	27	24	24	20	40
435a	27	23	23	20	40
435b	27	23	24	20	40
438	24	20	20	17	40
440	30	26	26	22	40
441a	27	23	24	20	40
441b	28	24	25	21	40
443	26	22	22	19	40
444	35	31	32	28	40
446a	36	32	33	29	40
451	36	33	33	29	40
455	27	23	24	20	40
456	27	23	23	19	40
460	29	25	26	22	40
507	27	23	23	19	40
508	26	22	23	19	40
509	26	22	22	18	40
537	18	14	15	11	40

Receiver ID	$L_{Aeq,Period}$ Noise Level (dBA)[1] (Medium Wheel Defects)		$L_{Aeq,Period}$ Noise Level (dBA)[1] (Low Wheel Defects)		RING Night $L_{Aeq,Period}$ Noise Limit (dBA)
	Project and Mt Arthur Mine (up to and including 2026)	Project Only (post 2026)	Project and Mt Arthur Mine (up to and including 2026)	Project Only (post 2026)	
538	31	27	27	23	40
539	29	25	25	21	40
Mine-owned Dwellings					
387	30	26	26	22	n/a[2]
389	32	28	29	25	n/a[2]
404	31	27	27	23	n/a[2]
410	44	40	40	36	n/a[2]
500	27	23	24	20	n/a[2]

Notes:

1. Predictions include a correction of +2.5 dB for the façade reflection effect in accordance with the *RING*.
2. *RING* noise limits do not apply to mine-owned receivers.

Table 8-3 indicates noise levels generated by the Project and Mt Arthur Mine trains are predicted to comply with the *RING* criteria for non-network rail lines on or exclusively servicing industrial sites at all privately-owned receivers with medium and low wheel defects. It follows that noise levels after closure of the Mt Arthur Mine are also expected to comply with the relevant *RING* criteria with medium and low wheel defects.

8.3 Main Northern Railway

The *RING* (EPA, 2013) has requirements for the geographic extent of rail noise assessments for rail traffic generating developments. The requirements are summarised below.

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

Notes:

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

Specifically, the assessment is not required to extend to where Project rail traffic represents less than 10% of total line/corridor rail traffic, as in this case the change in noise exposure is equivalent to less than 0.5 dB. Therefore, rail movements along the Main Northern Railway at the point that the Antiene Rail Spur joins the line were reviewed and considered.

Currently, there are a number of approvals in place relating to rail movements from a variety of projects. There are also other projects in the planning phase which will potentially involve additional future movements. Average daily train movements used to assess potential noise impacts are summarised in Table 8-4.

Table 8-4 Average Daily Train Movements – Main Northern Railway

Scenario	Train Type / Origin	Locomotive Configuration	Daily Average Train Movements		
			Daytime	Night	24-hour
Existing / Approved	Passenger[1]	XPT Passenger	2	0	2
	Freight[2,3]	2 x Locomotives	11.6	5.4	17
	Ulan Mine[2]	3 x Locomotives	8	4	12
	Moolarben Mine[4]	3 x Locomotives	10	4	14
	Wilpinjong Coal Mine*	3 x Locomotives	-	-	-
	Mangoola Mine[5]	3 x Locomotives	5	3	8
	Bengalla Mine[6]	3 x Locomotives	5.3	3	8.3
	Mount Pleasant Operation[2]	3 x Locomotives	4	2	6
	Narrabri Coal Mine[3]	3 x Locomotives	5	3	8
	Maules Creek Coal Mine[3]	3 x Locomotives	6	4	10
	Boggabri Coal Mine[7]	3 x Locomotives	3.5	2	5.5
	Vickery Coal Mine, Tarrawonga and Rocglen[3]	3 x Locomotives	2	2	4
	Werris Creek Mine[8]	3 x Locomotives	4	2	6
	Mt Arthur Mine[9]	3 x Locomotives	14	7	21
Proposed Mines / Modifications	Bylong Coal Project[10]	3 x Locomotives	3	1	4
	Vickery Extension Project[3]	3 x Locomotives	4	2	6
	Moolarben MOD 14[4]	3 x Locomotives	1	1	2
	Dartbrook Coal Mine MOD 7[11]	3 x Locomotives	3	1.6	4.6
	Mangoola Coal Continued Operations[12]	3 x Locomotives	-	-	-
Total Existing/Approved/Proposed (without Project)			**91.4**	**47**	**138.4**
Total Existing/Approved (without Project)			**80.4**	**41.4**	**121.8**
The Project		3 x Locomotives	4	2	6
Total Existing/Approved/Proposed (with Project)			**95.4**	**49**	**144.4**
Total Existing/Approved (with Project)			**84.4**	**43.4**	**127.8**

Notes:
One movement = one train arriving or departing.
Daytime: the period from 7.00 am to 10.00 pm.

Night: the period from 10.00 pm to 7.00 am.

1. NSW Transport (September 2018) *New South Wales Train Link Timetable for the North Western Region.*
2. Wilkinson Murray (2017a) *Mount Pleasant Modification 3 – Noise & Blasting Assessment.*
3. Wilkinson Murray (2017b) *Vickery Extension Project – Noise & Blasting Assessment.*
4. SLR Consulting Australia Pty Ltd (2017) *Moolarben Coal Complex Open Cut Optimisation Modification – Noise Assessment.*
5. Xstrata Coal (2013) *Mangoola Coal Modification 6 – Environmental Assessment Main Report.*
6. Bridges Acoustics (2013) *Bengalla Continuation of Mining Project – Acoustic Impact Assessment.*
7. Idemitsu (2011) *Continuation of Boggabri Coal Mine – Environmental Assessment.*
8. Whitehaven Coal (2010) *Werris Creek Coal Mine LOM Project – Environmental Assessment Section 2: Project Description.*
9. Estimated from maximum annual product coal production Mt Arthur's current Project Approval (Project Approval 09_0062).
10. Pacific Environment Limited (2015) *Bylong Coal Project – Noise and Blasting Impact Assessment.*
11. Estimated from maximum annual product coal production in *Dartbrook Mine Modification 7 – Environmental Assessment Main Text* (Australian Pacific Coal Limited, 2018).
12. No change proposed to the currently approved volume of coal as per Glencore (2017) *Mangoola Coal Continued Operations Project – Preliminary Environmental Assessment*

* Wilpinjong Coal Mine rail movements have been excluded from Table 8-4, as the majority of product coal currently travels along the Sandy Hollow Gulgong Railway to AGL Macquarie Pty Limited (AGL) (Peabody, 2016). The current coal supply contract with AGL is expected to be completed by 2026, at which point all the product coal is likely to be transported along the Main Northern Rail Line to the Port of Newcastle for export (Peabody, 2016). This assessment conservatively excludes Wilpinjong Coal Mine rail movements, which reduces the estimated total train movements on the Main Northern Railway and therefore increases the percentage of Project train movements on the Main Northern Railway.

As can be seen from Table 8-4, the Project's contribution to rail traffic on the Main Northern Railway at the point the Antiene Rail Spur joins the line would be less than 5% of the existing/approved rail movements during the daytime, night and 24-hour period. The Project contribution to rail traffic would represent an even smaller percentage of the total traffic if the proposed mines/modifications are developed. The percentage contribution of Project rail movements to the Main Northern Railway would be even lower further downstream on the Main Northern Railway after the contribution of other proximal mining operations, including the Hunter Valley Operations and the Greater Ravensworth Area Operations (including Liddell Coal Operations, Ravensworth Operations and Mt Owen Complex). Therefore, rail movements along the Main Northern Railway have not been considered any further in the assessment.

9 CONCLUSION

This assessment has addressed potential operational noise and construction impacts associated with the Project, which has a proposed mine life of approximately 26 years.

9.1 Project Operational Noise

- Operational noise impacts were assessed for three years (Project Years 1, 3 and 4), for different periods of the day (daytime, evening and night time) and with regard for noise-enhancing meteorological conditions including winds with speeds of up to 3 m/s and temperature inversions of up to 4°C/100 m.
- The significance of noise-enhancing meteorological conditions (in accordance with Fact Sheet D of the *NPfI*) was determined based on local meteorological data and noise predictions were conducted for both standard meteorological conditions and significant noise-enhancing conditions. The assessment presents the highest noise predictions under the relevant meteorological conditions, which are considered conservative.
- Modelling resulted in mitigation measures being proposed, including:
  - consideration of good practice sound power levels in the selection of mobile plant and infrastructure items; and
  - use of a noise management system with predictive meteorological forecasting and modified operating regimes during noise-enhancing meteorological conditions.
- With the above controls in place, exceedances of the Project noise trigger levels are predicted for privately-owned receivers 390, 398, 400, 402, 403, 411, 418, 419, 420, 421, 423, 424, 538 and 539 for certain periods during the life of the Project. Notwithstanding the conservatism associated with the meteorological conditions modelled, exceedances predicted at receivers 390, 398, 400, 418, 419, 420, 421, 423, 424 and 539 are considered to be "negligible" (between 1-2 dB according to the *NPfI* and *VLAMP*) and would not be discernible (when compared to compliance with the Project noise trigger levels) by the average listener, in accordance with the *NPfI* and *VLAMP*. The exceedances predicted at receivers 402, 403, 411 and 538 are characterised as "marginal" in accordance with the *NPfI* and *VLAMP*. These four properties would therefore be afforded mitigation upon request rights in accordance with the *VLAMP*.
- A low-frequency noise assessment was conducted which indicates that it is unlikely that any of the receivers surrounding the Project would be subject to dominant low-frequency noise. Therefore, no modifying factor correction for low-frequency noise is warranted.

9.2 Vacant Land Assessment

- No vacant land would be affected by noise in excess of 45 dBA $L_{Aeq,Period}$.

9.3 Cumulative Noise

- Cumulative noise predictions from the operation of the Project and the Mt Arthur Mine were conducted.
- The assessment indicates that cumulative noise levels resulting from the concurrent operation of these projects would comply with the relevant amenity noise levels at all identified receivers.

9.4 Maximum Noise Level Event Assessment

- Modelling of L_{AFmax} noise levels at nearby receivers was undertaken for typical instantaneous mine-site noise sources, such as loaders dumping into hoppers, and dozer track noise from the infrastructure area. This analysis indicates that predicted L_{AFmax} noise levels would comply with the L_{AFmax} noise trigger of 52 dBA at all receivers. The night time $L_{Aeq,15min}$ noise predictions are predicted to exceed the $L_{Aeq,15min}$ noise trigger of 40 dBA by 1 dB at receiver 411 based on the conservative meteorological conditions.

9.5 Construction Activities

- The operational noise scenarios for Year 1 and Year 3 include construction activities that would be indistinguishable from operational mining and coal processing activities, and would be representative of general noise emissions throughout the year. This includes construction of the MEA (including construction of drift entries and ventilation shafts), Maxwell Infrastructure upgrades and some construction activities along the transport and services corridor.
- Elevated noise levels would occur during the daytime at the northern receivers during construction of the northernmost section of the transport and services corridor. This noise would occur for relatively short durations and are not representative of general noise emissions. The noise levels would not warrant noise mitigation or acquisition as the *VLAMP* excludes construction noise impacts.
- In addition to the above assessment, for completeness, all construction activities have been assessed in accordance with the *ICNG*. All construction noise levels would comply with the *ICNG* 'highly noise affected' management level. A negligible (1 dB) exceedance of the *ICNG* 'noise affected' management level is predicted at one privately-owned receiver (411) in Year 1 if these works occur outside of recommended standard hours during the daytime (e.g. on Sunday or after 1.00 pm on Saturday).
- Overpressure and ground vibration levels associated with construction blasting are expected to comply with the relevant limits at all identified privately-owned receivers.

9.6 Road and Rail Traffic Noise

- Compliance of the relevant road traffic noise criteria is expected at all receivers surrounding the Project.
- Along the Antiene Rail Spur, it was found that compliance with the *RING* noise criteria for non-network rail lines would be achieved at all surrounding noise sensitive receivers before and after closure of the Mt Arthur Mine.

10 REFERENCES

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APPENDIX A

GLOSSARY OF TERMS & DEFINITIONS

GLOSSARY OF TERMS & DEFINITIONS

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

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

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

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

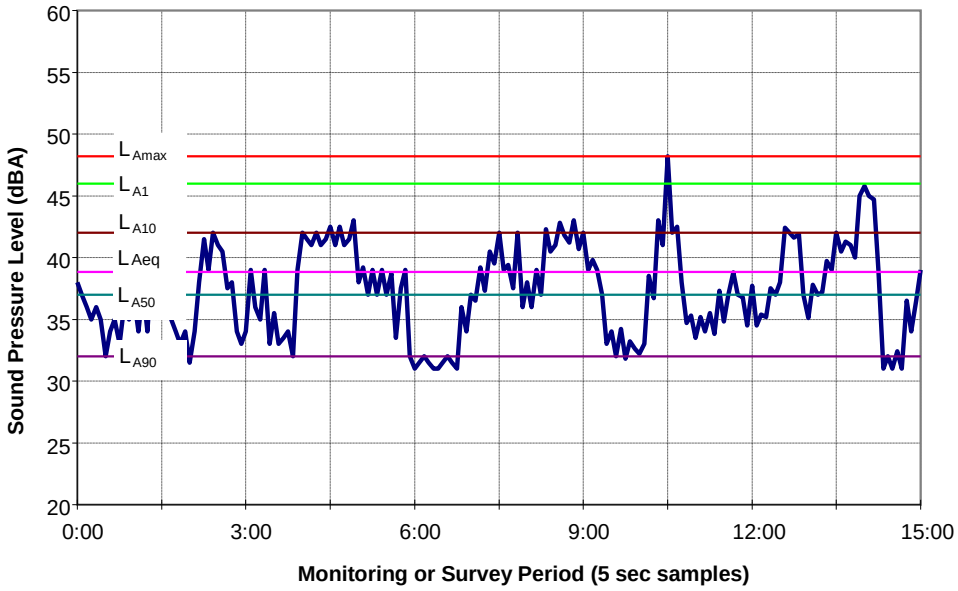
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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

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

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

Typical Graph of Sound Pressure Level vs Time



APPENDIX B

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

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

B.1 Wind-Related Noise-Enhancing Conditions – Northern Receivers

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

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

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

Table B-1 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Day (Northern Receivers)

Direction	Spring	Summer	Autumn	Winter
N	11.7%	5.7%	14.5%	21.0%
NNE	2.6%	1.8%	3.3%	3.8%
NE	3.2%	3.9%	3.9%	2.7%
ENE	9.9%	14.4%	13.8%	7.9%
E	19.6%	29.4%	29.6%	17.8%
ESE	24.0%	35.8%	36.0%	22.3%
SE	25.4%	37.2%	37.1%	23.3%
SSE	25.1%	36.1%	36.0%	22.9%
S	20.7%	27.3%	27.6%	19.0%
SSW	14.3%	15.0%	14.1%	11.3%
SW	15.8%	12.7%	12.4%	11.7%
WSW	24.8%	16.4%	22.5%	26.2%
W	32.9%	19.5%	32.9%	42.9%
WNW	32.0%	18.4%	33.3%	44.2%
NW	28.6%	15.6%	31.0%	42.0%
NNW	22.5%	11.5%	26.2%	36.8%

Table B-2 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Evening (Northern Receivers)

Direction	Spring	Summer	Autumn	Winter
N	5.3%	1.9%	4.0%	8.2%
NNE	0.9%	0.5%	0.8%	1.3%
NE	0.6%	0.8%	0.5%	0.2%
ENE	2.7%	5.0%	3.4%	1.4%
E	5.7%	9.1%	8.4%	4.1%
ESE	6.6%	9.8%	9.5%	5.0%
SE	7.0%	9.9%	9.9%	5.5%
SSE	6.8%	9.4%	9.8%	5.7%
S	4.9%	5.2%	7.1%	4.7%
SSW	2.0%	1.2%	2.3%	2.2%
SW	1.9%	1.0%	1.6%	1.7%
WSW	4.2%	2.0%	2.8%	4.3%
W	8.5%	3.5%	5.9%	11.0%
WNW	9.0%	3.7%	6.3%	12.0%
NW	8.8%	3.6%	6.1%	11.8%
NNW	8.0%	3.1%	5.7%	11.3%

Table B-3 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Night (Northern Receivers)

Direction	Spring	Summer	Autumn	Winter
N	6.0%	2.8%	5.9%	10.0%
NNE	1.0%	0.6%	1.1%	1.4%
NE	0.5%	0.7%	0.7%	0.3%
ENE	2.1%	3.8%	2.8%	1.0%
E	6.1%	10.4%	7.3%	2.4%
ESE	7.5%	12.2%	8.6%	3.0%
SE	8.0%	12.8%	9.0%	3.4%
SSE	8.0%	12.5%	8.8%	3.4%
S	6.5%	9.6%	6.9%	2.9%
SSW	2.8%	3.1%	2.7%	1.8%
SW	2.1%	1.7%	1.9%	2.1%
WSW	4.5%	2.5%	3.9%	5.8%
W	9.3%	4.6%	8.6%	14.3%
WNW	9.9%	4.7%	9.2%	15.3%
NW	9.7%	4.5%	8.9%	15.0%
NNW	9.0%	4.1%	8.4%	14.1%

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

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

Direction	Day	Evening	Night
N	21.0%	8.2%	10.0%
NNE	3.8%	1.3%	1.4%
NE	3.9%	0.8%	0.7%
ENE	14.4%	5.0%	3.8%
E	29.6%	9.1%	10.4%
ESE	36.0%	9.8%	12.2%
SE	37.2%	9.9%	12.8%
SSE	36.1%	9.8%	12.5%
S	27.6%	7.1%	9.6%
SSW	15.0%	2.3%	3.1%
SW	15.8%	1.9%	2.1%
WSW	26.2%	4.3%	5.8%
W	42.9%	11.0%	14.3%
WNW	44.2%	12.0%	15.3%
NW	42.0%	11.8%	15.0%
NNW	36.8%	11.3%	14.1%

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

- Day - ESE; SE; SSE; W; WNW; NW and NNW.

B.2 Wind-Related Noise-Enhancing Conditions – Southern Receivers

The process followed for the southern receivers was the same as that followed for the northern receivers (Section B.1).

Tables B-5, B-6 and B-7 summarise the frequencies of occurrence for all seasons for the day, evening and night periods, respectively. Highlighted cells indicate percentages of occurrence exceeding the threshold of occurrence of 30 per cent.

Table B-5 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Day (Southern Receivers)

Direction	Spring	Summer	Autumn	Winter
N	11.0%	9.1%	13.4%	14.1%
NNE	7.8%	8.1%	8.8%	8.1%
NE	6.9%	6.9%	8.2%	6.8%
ENE	7.4%	9.0%	10.0%	7.4%
E	8.8%	12.0%	13.3%	9.7%
ESE	9.1%	13.1%	14.8%	10.8%
SE	9.2%	13.5%	15.7%	11.4%
SSE	8.5%	12.4%	14.6%	10.5%
S	7.1%	10.1%	12.0%	8.9%
SSW	5.8%	7.0%	8.8%	6.8%
SW	6.8%	6.4%	9.0%	8.0%
WSW	9.3%	6.8%	11.8%	12.3%
W	12.6%	7.9%	16.3%	18.2%
WNW	14.3%	10.5%	18.2%	20.4%
NW	14.8%	10.7%	18.9%	21.3%
NNW	13.6%	10.2%	17.3%	19.1%

Table B-6 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Evening (Southern Receivers)

Direction	Spring	Summer	Autumn	Winter
N	1.3%	0.8%	1.4%	2.4%
NNE	0.9%	0.7%	1.1%	1.5%
NE	0.9%	0.7%	1.0%	1.1%
ENE	1.0%	0.8%	1.4%	1.1%
E	1.4%	1.1%	2.4%	2.0%
ESE	1.8%	1.3%	3.4%	3.3%
SE	2.2%	1.5%	4.2%	4.6%
SSE	2.2%	1.4%	4.4%	5.0%
S	2.0%	1.2%	4.0%	4.8%
SSW	1.7%	0.9%	3.1%	4.0%
SW	1.4%	0.9%	2.2%	3.3%
WSW	1.5%	0.9%	1.7%	3.0%
W	1.8%	0.9%	1.7%	3.4%
WNW	1.9%	0.9%	1.8%	3.8%
NW	2.0%	1.0%	1.9%	3.9%
NNW	1.7%	1.0%	1.7%	3.4%

Table B-7 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Night (Southern Receivers)

Direction	Spring	Summer	Autumn	Winter
N	3.4%	2.1%	3.8%	4.4%
NNE	2.1%	1.6%	2.2%	2.2%
NE	1.7%	1.9%	1.7%	1.3%
ENE	2.0%	2.9%	2.2%	1.0%
E	3.1%	4.5%	4.0%	1.6%
ESE	4.4%	6.1%	6.0%	2.4%
SE	6.0%	7.3%	8.7%	4.1%
SSE	6.9%	7.5%	10.6%	5.5%
S	6.7%	6.6%	10.2%	5.8%
SSW	5.7%	4.9%	8.6%	5.5%
SW	5.2%	3.6%	7.1%	5.7%
WSW	4.9%	2.8%	5.8%	6.0%
W	4.9%	2.7%	5.2%	6.6%
WNW	5.3%	2.9%	5.6%	7.2%
NW	5.5%	3.0%	5.8%	7.4%
NNW	4.8%	2.7%	5.3%	6.4%

Table B-8 summarises all percentages of occurrence for the worst-case seasons for day, evening and night at the southern receivers.

Table B-8 Wind-Related Noise-Enhancing Conditions - Percentages of Occurrence – Worst-Case Season (Southern Receivers)

Direction	Day	Evening	Night
N	14.1%	2.4%	4.4%
NNE	8.8%	1.5%	2.2%
NE	8.2%	1.1%	1.9%
ENE	10.0%	1.4%	2.9%
E	13.3%	2.4%	4.5%
ESE	14.8%	3.4%	6.1%
SE	15.7%	4.6%	8.7%
SSE	14.6%	5.0%	10.6%
S	12.0%	4.8%	10.2%
SSW	8.8%	4.0%	8.6%
SW	9.0%	3.3%	7.1%
WSW	12.3%	3.0%	6.0%
W	18.2%	3.4%	6.6%
WNW	20.4%	3.8%	7.2%
NW	21.3%	3.9%	7.4%
NNW	19.1%	3.4%	6.4%

Based on the percentages of occurrence summarised in Table B-8, no wind-related noise-enhancing conditions are considered significant for the southern receivers.

B.3 Temperature Inversion Noise-Enhancing Condition

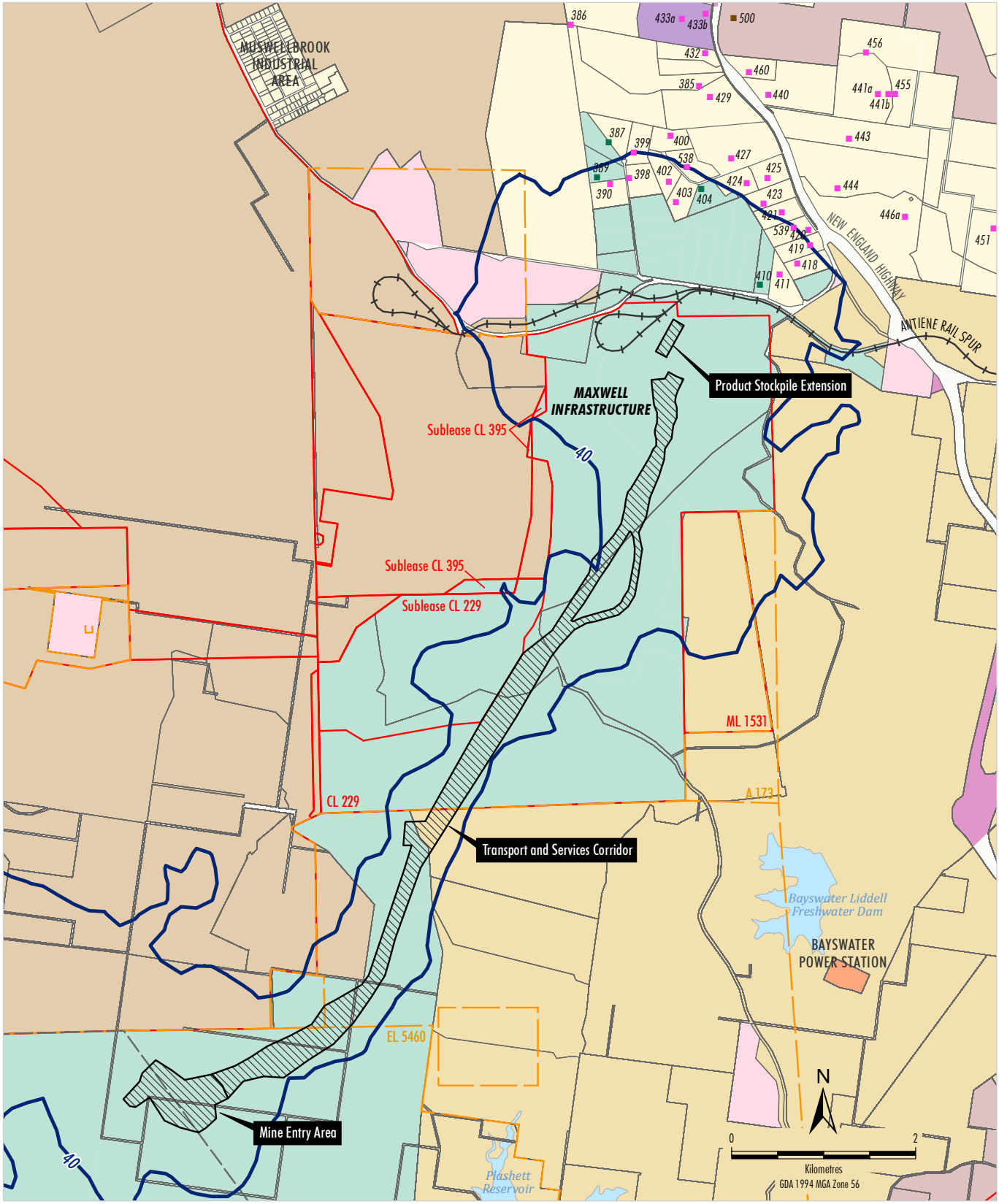
The following process was followed:

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

The percentage of occurrence was determined to be 27.5 per cent and 12.5 per cent for the northern and southern receivers, respectively, and as such moderate-to-strong temperature inversions are not considered significant to the Project.

APPENDIX C

NOISE CONTOURS



SHM-18-03 Maxwell_EIS_App Noise_204C

LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (40 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

* The daytime Project Noise Trigger Level for receivers in the north is 40 dBA.

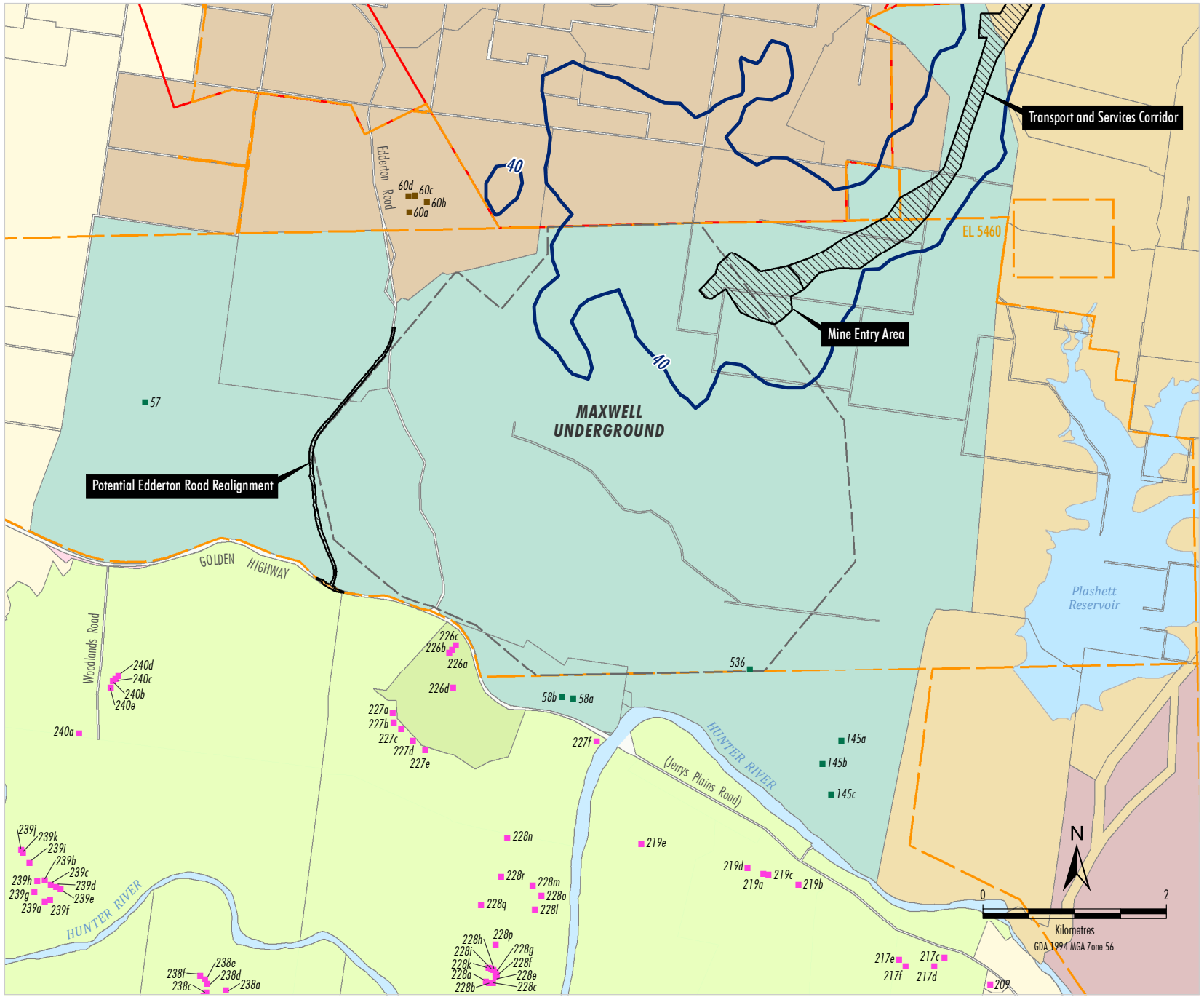
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 1 – Day

Figure C-1a



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (40 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

* The daytime Project Noise Trigger Level for receivers in the south is 40 dBA.

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

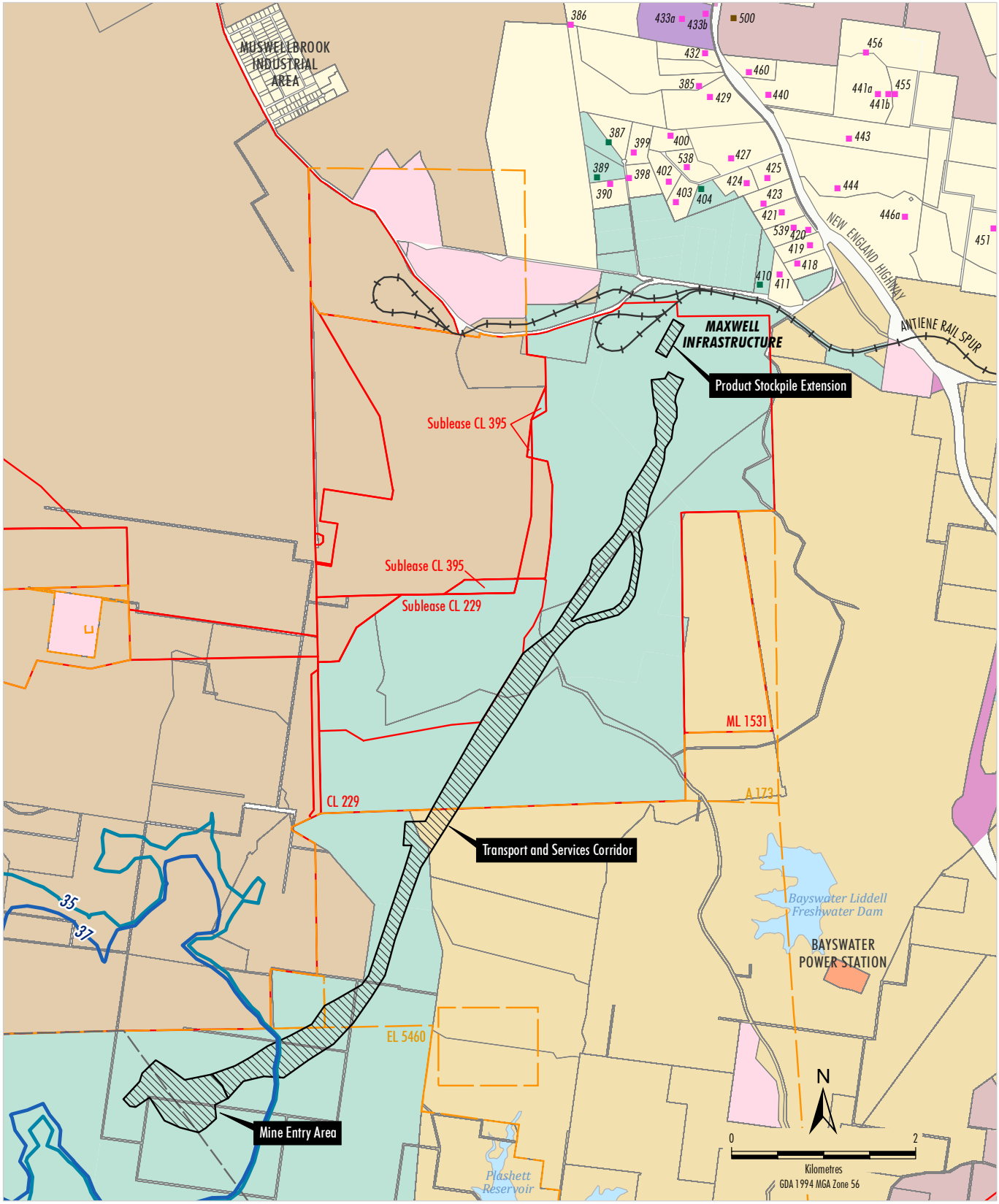
MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 1 – Day

Figure C-1b

SHM-18-03 Maxwell_EIS_App Noise_205D



SHM-18-03 Maxwell_EIS_App Noise_210C

LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (35 dBA) *
- Noise Contour (37 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

* The night time Project Noise Trigger Levels for receivers in the north are either 35 or 37 dBA (refer to Table 4-6).

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

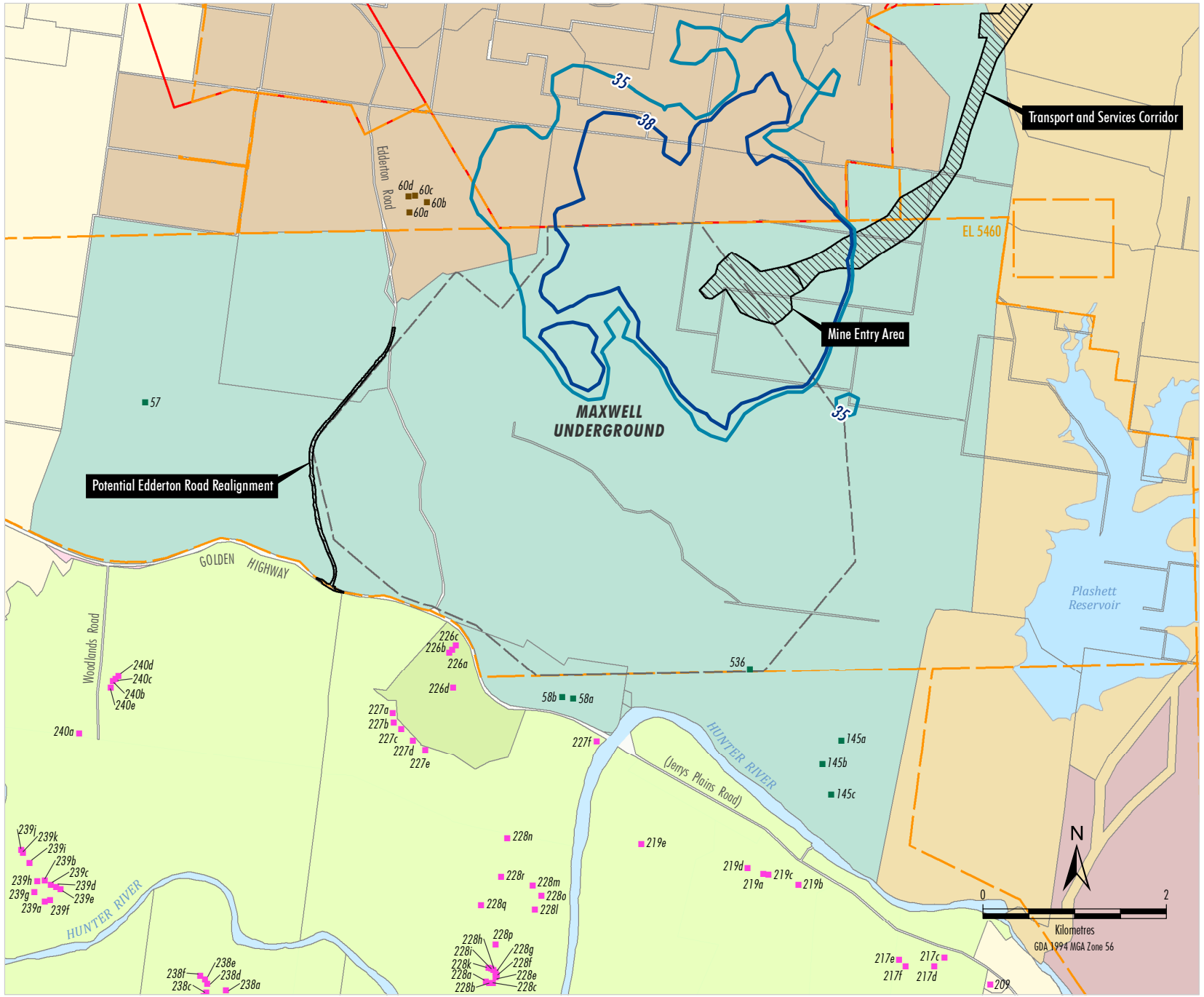
Note: There are no activities at the Maxwell Infrastructure during the night time in Year 1.

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 1 – Night

Figure C-2a



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (35 dBA) *
- Noise Contour (38 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

* The night time Project Noise Trigger Levels for receivers in the south are either 35 or 38 dBA (refer to Table 4-6).

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

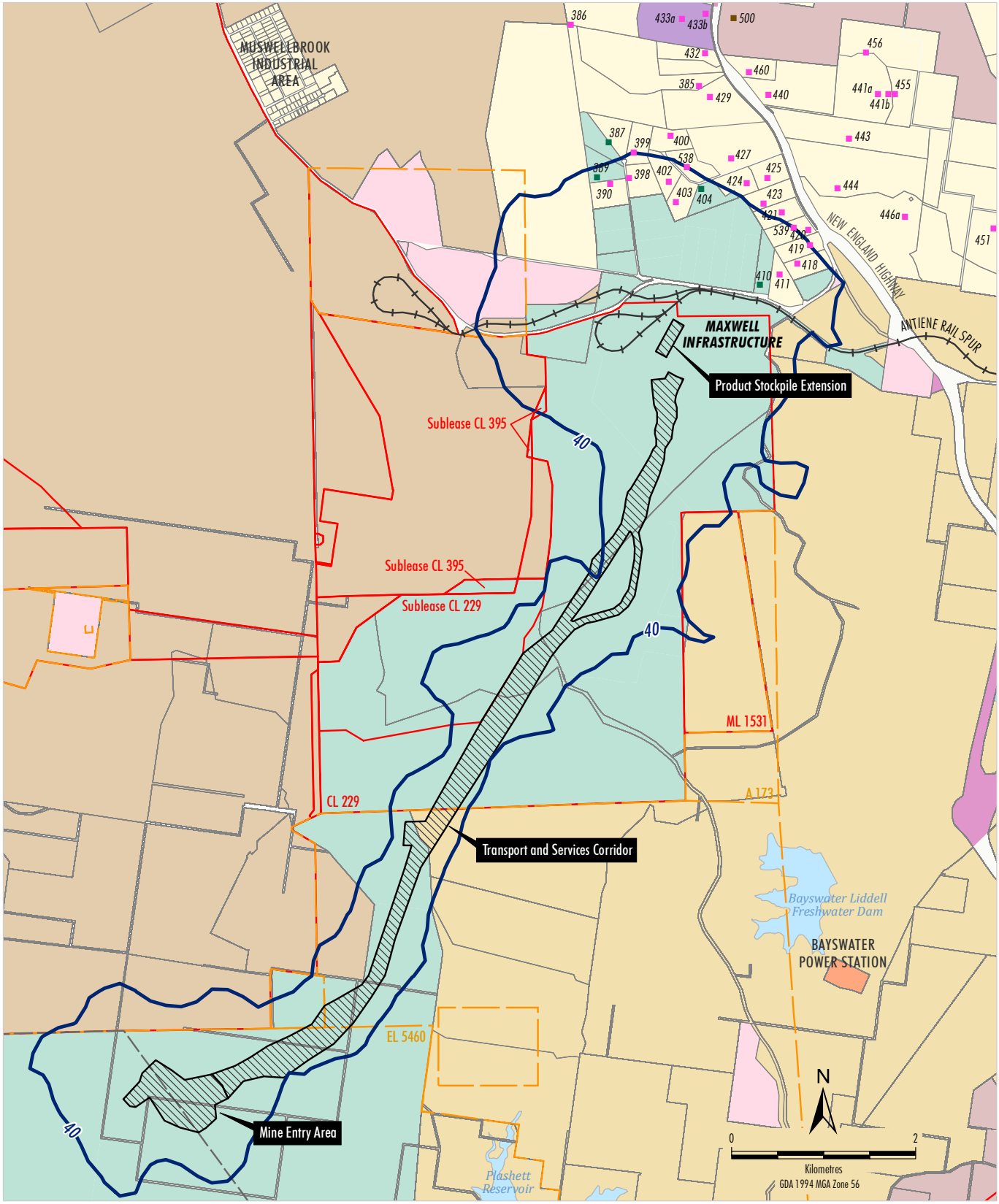
MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 1 – Night

Figure C-2b

SHM-18-03 Maxwell_EIS_App Noise_211D



SHM-18-03 Maxwell_EIS_App Noise_206C

LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (40 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

* The daytime Project Noise Trigger Level for receivers in the north is 40 dBA.

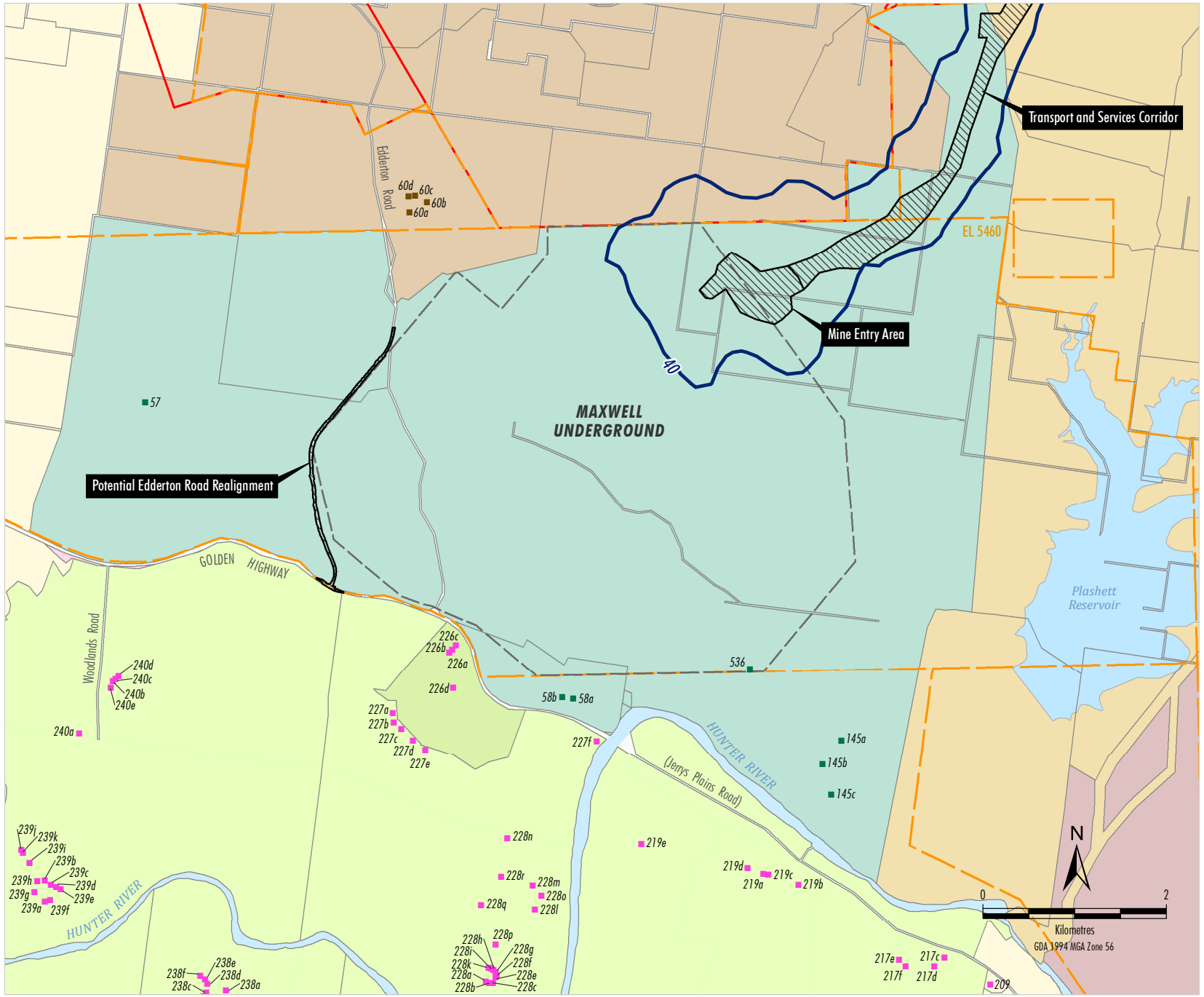
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 3 – Day

Figure C-3a



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (40 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

* The daytime Project Noise Trigger Level for receivers in the south is 40 dBA.

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

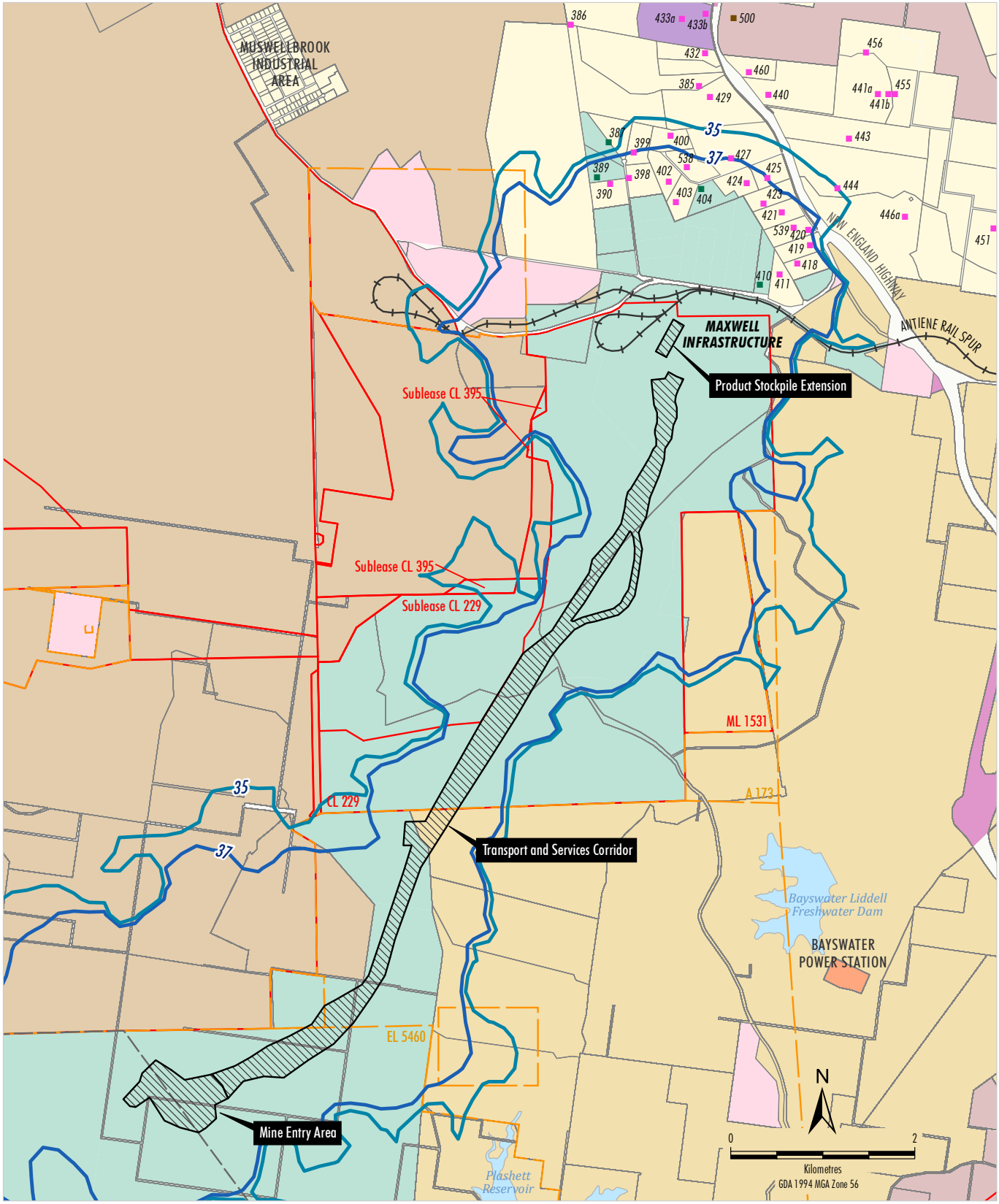
MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 3 – Day

Figure C-3b

SHM-18-03 Maxwell_EIS_App Noise_207C



SHM-18-03 Maxwell_EIS_App Noise_212C

LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (35 dBA) *
- Noise Contour (37 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

* The night time Project Noise Trigger Levels for receivers in the north are either 35 or 37 dBA (refer to Table 4-6).

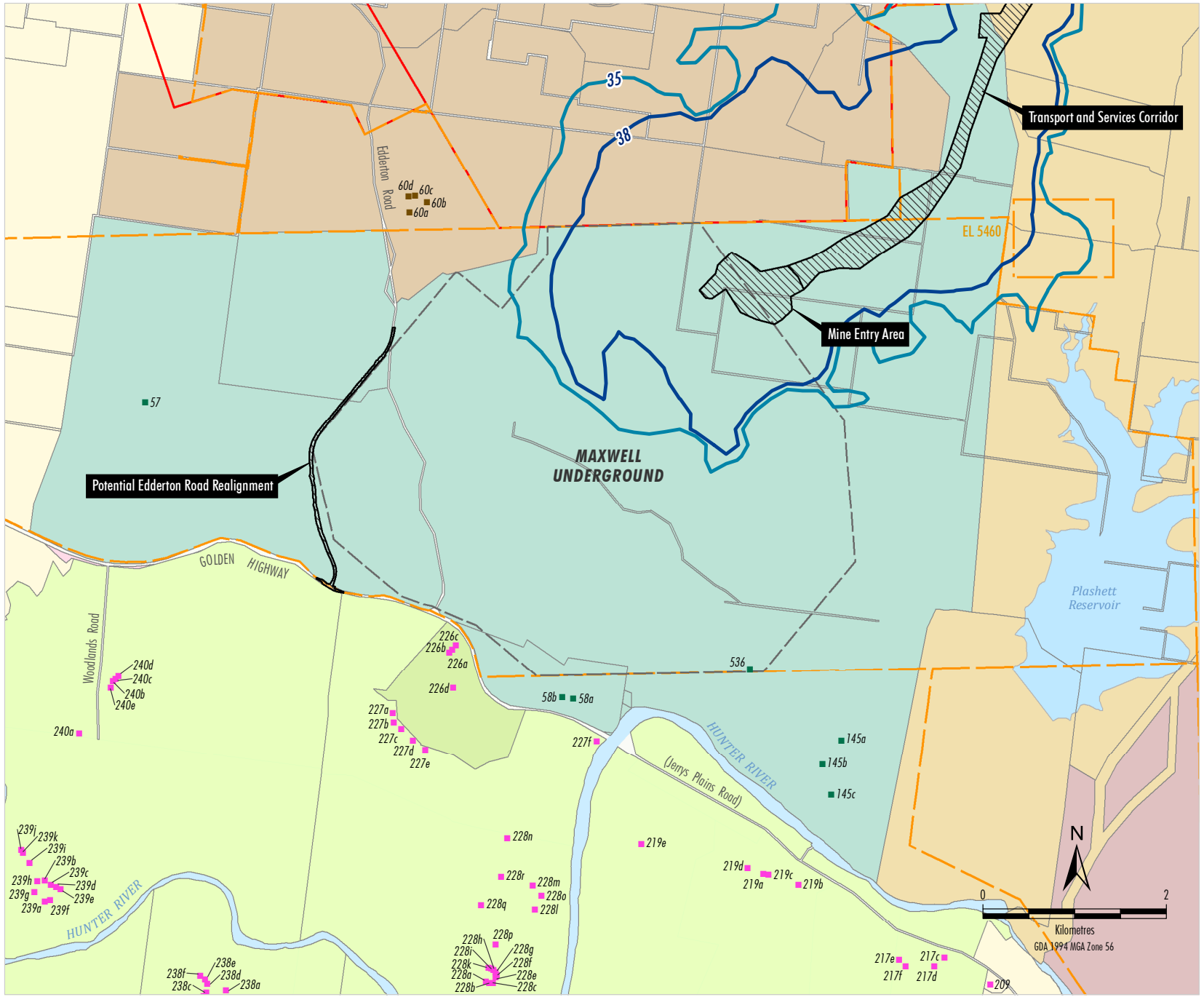
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 3 – Night

Figure C-4a



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (35 dBA) *
- Noise Contour (38 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

* The night time Project Noise Trigger Levels for receivers in the south are either 35 or 38 dBA (refer to Table 4-6).

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

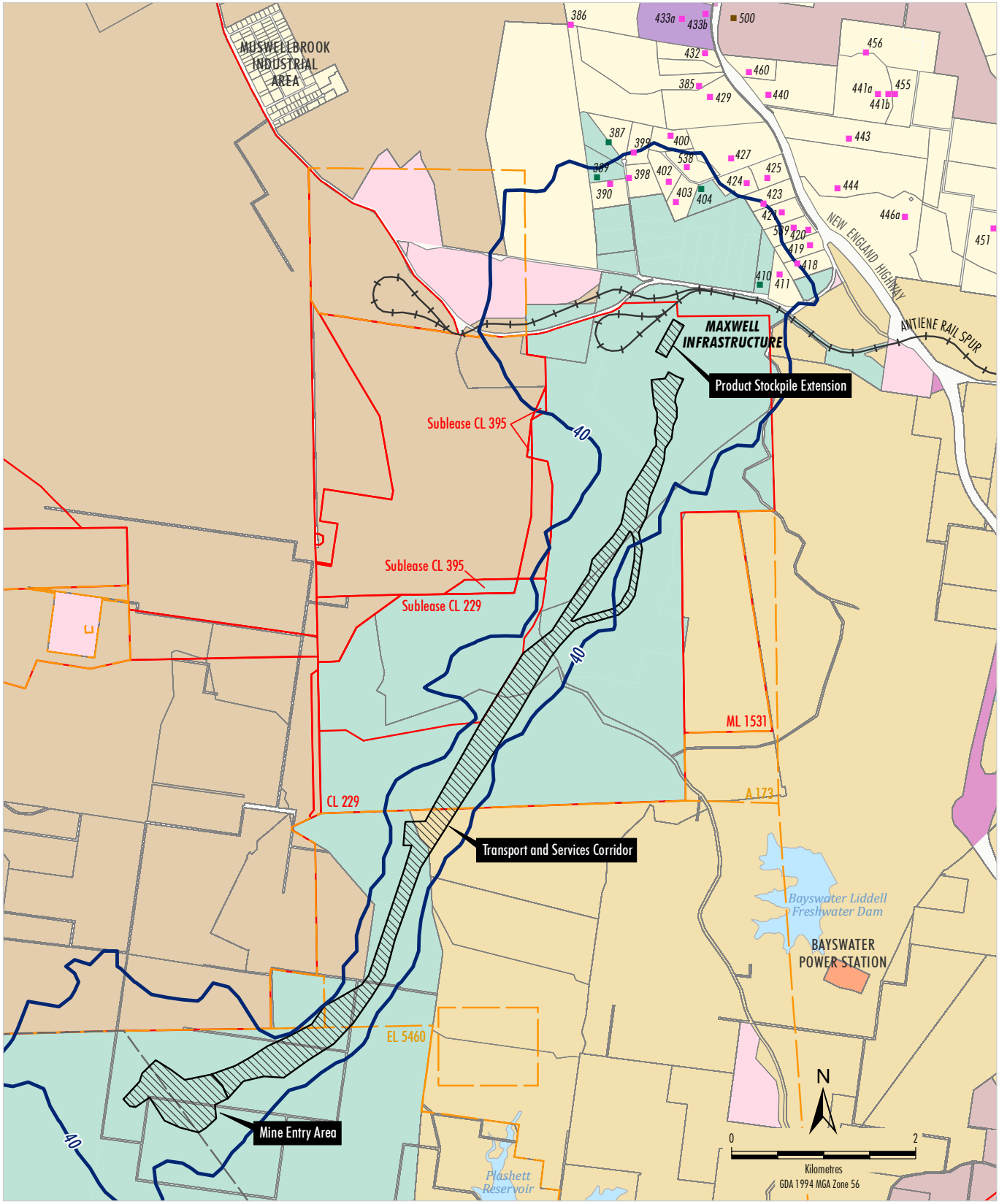
MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 3 – Night

Figure C-4b

SHM-18-03 Maxwell_EIS_App Noise_213D



SHM-18-03 Maxwell_EIS_App Noise_208C

LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (40 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

* The daytime Project Noise Trigger Level for receivers in the north is 40 dBA.

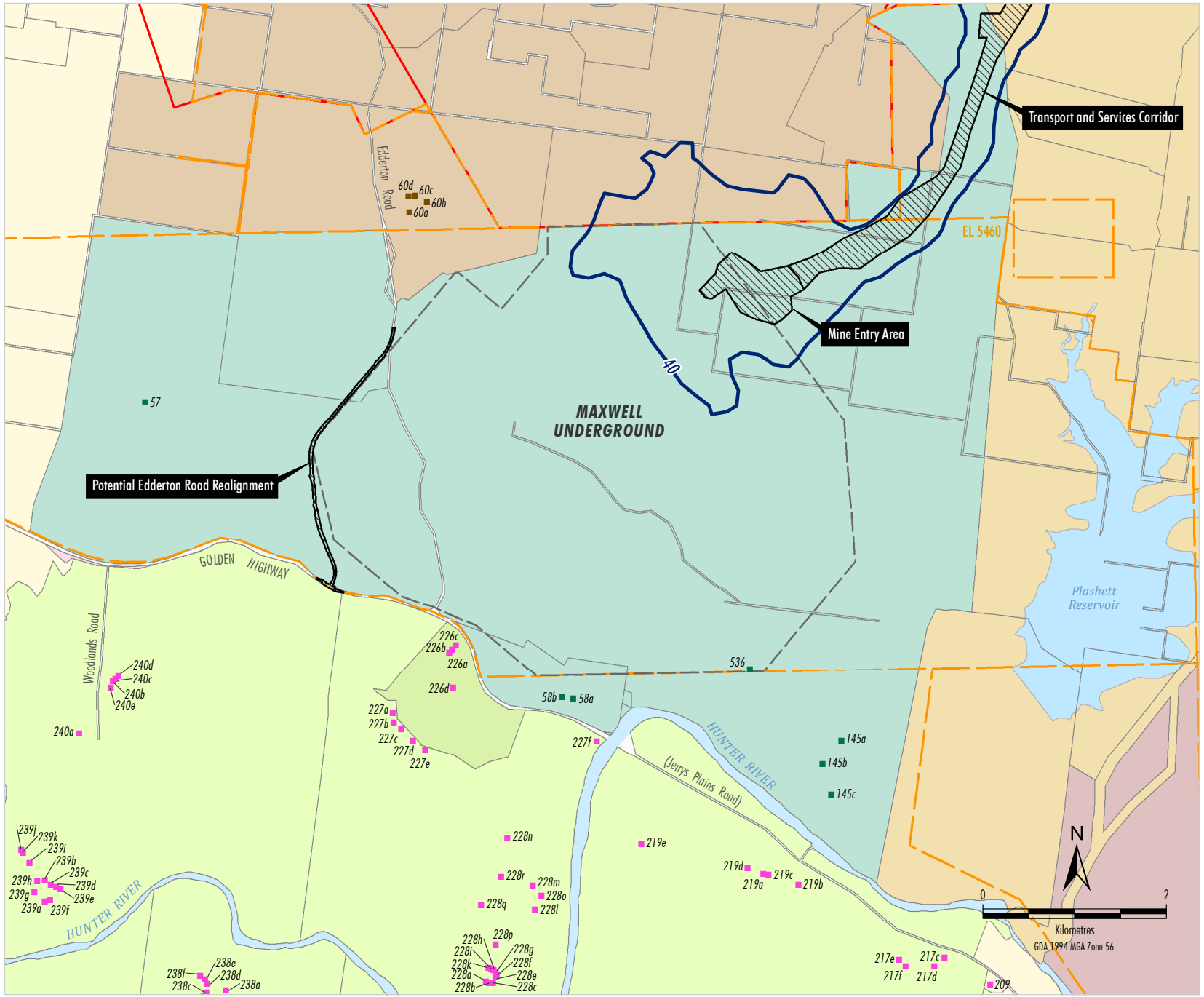
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 4 – Day

Figure C-5a



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (40 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

* The daytime Project Noise Trigger Level for receivers in the south is 40 dBA.

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

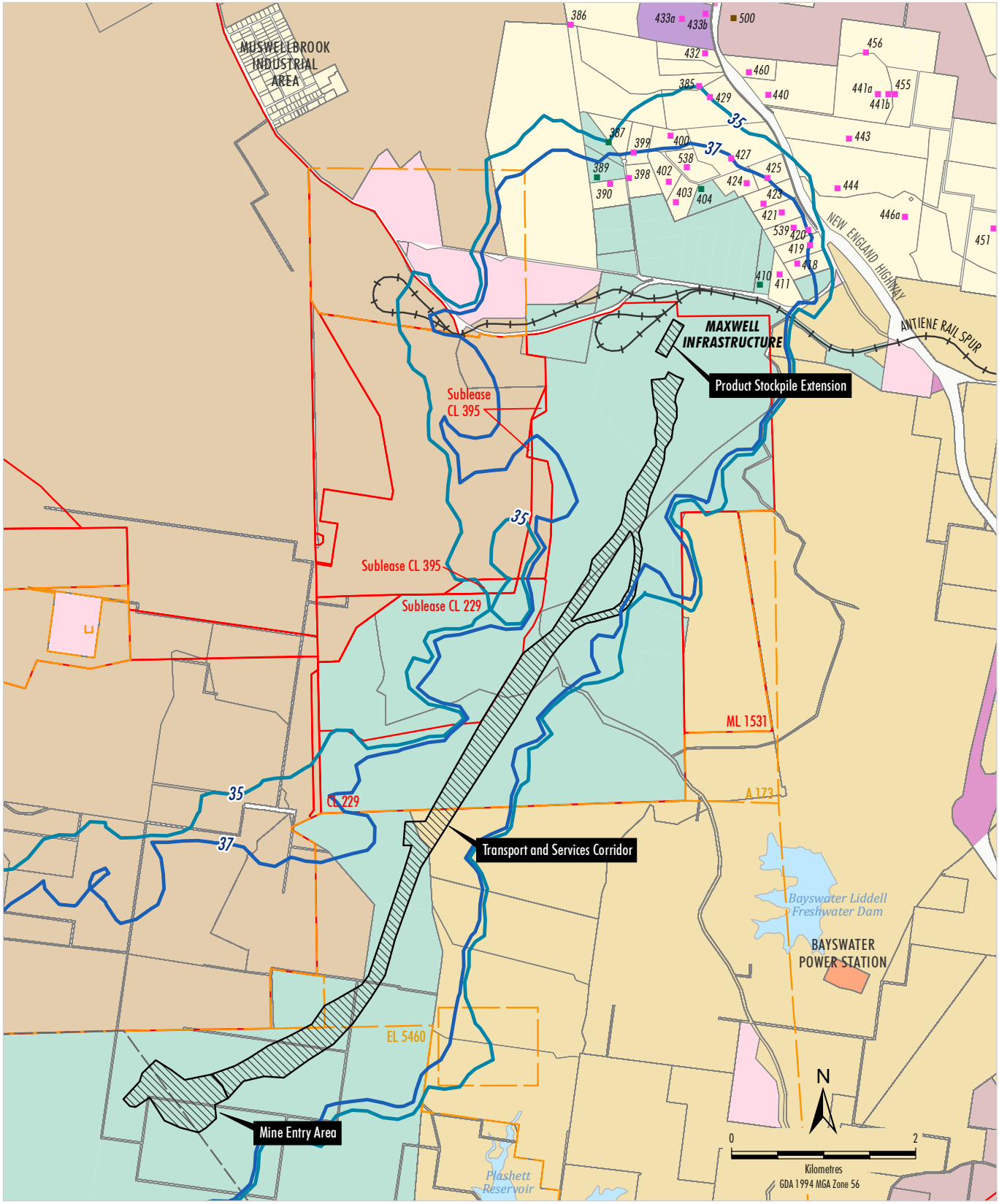
MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 4 – Day

Figure C-5b

SHM-18-03 Maxwell_EIS_App Noise_209C



SHM-18-03 Maxwell_EIS_App Noise_214C

LEGEND

- Railway
- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (35 dBA) *
- Noise Contour (37 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- TransGrid
- RMS
- Council
- Crown
- Other Privately Owned Land

* The night time Project Noise Trigger Levels for receivers in the north are either 35 or 37 dBA (refer to Table 4-6).

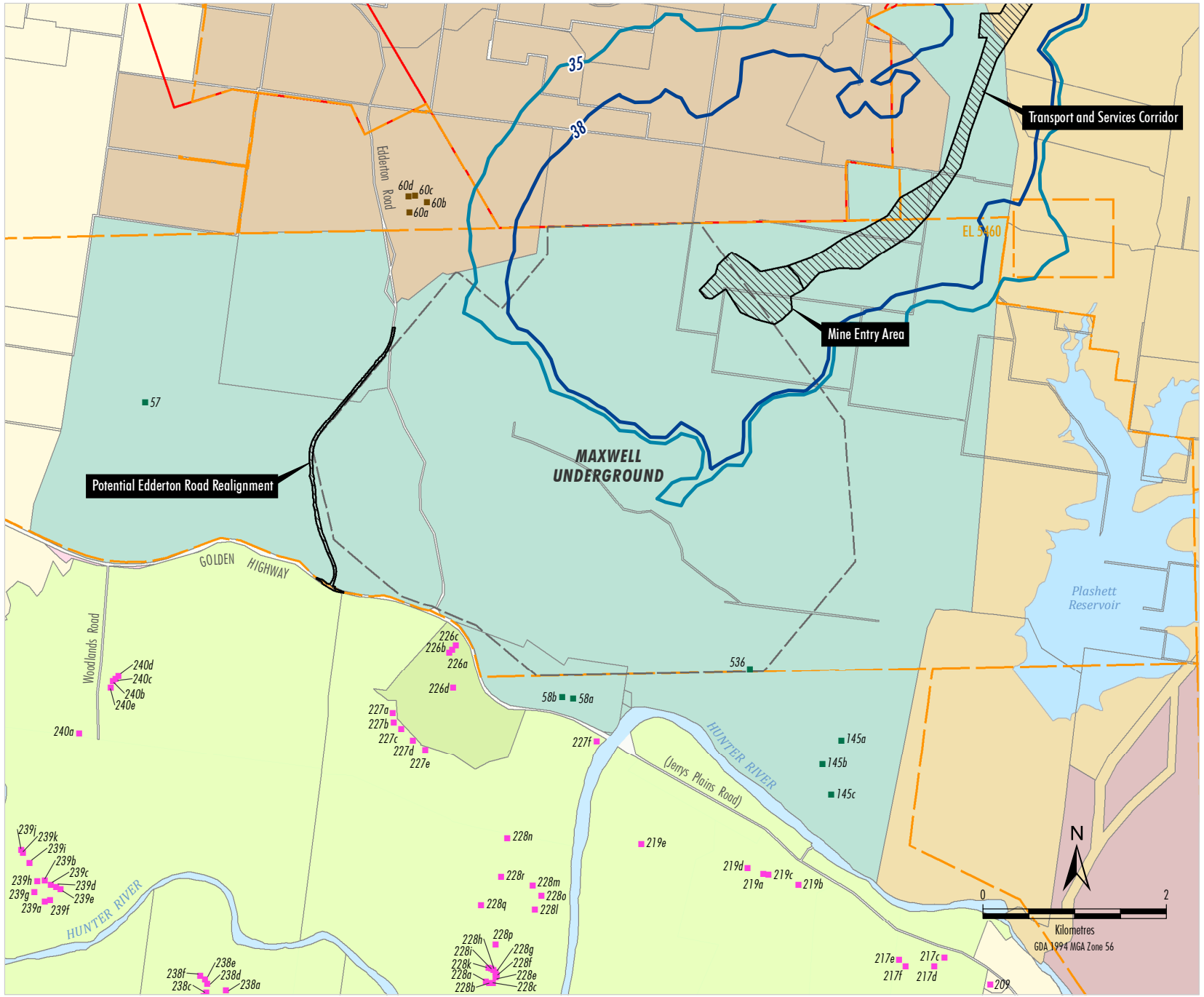
Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 4 – Night

Figure C-6a



LEGEND

- Exploration Licence Boundary
- Mining and Coal Lease Boundary
- Indicative Extent of Underground Development
- Indicative Surface Development Area
- Noise Contour (35 dBA) *
- Noise Contour (38 dBA) *
- Malabar-owned
- Other mine-owned
- Privately-owned

Land Ownership

- Malabar Coal
- Mt Arthur Mine (BHP)
- Hunter Valley Operations (Yancoal/Glencore)
- AGL
- RMS
- Crown
- Equine Enterprise
- Viticulture Enterprise
- Other Privately Owned Land

* The night time Project Noise Trigger Levels for receivers in the south are either 35 or 38 dBA (refer to Table 4-6).

Source: © NSW Department of Planning and Environment (2019); NSW Department of Finance, Services & Innovation (2019)

MALABAR COAL

MAXWELL PROJECT

Maximum Predicted Noise Level
All Assessable Meteorological Conditions
Year 4 – Night

Figure C-6b

SHM-18-03 Maxwell_EIS_App Noise_215D

APPENDIX D

PREDICTED NOISE LEVELS AT KEY RECEIVERS WITHOUT PRO-ACTIVE AND REACTIVE MITIGATION MEASURES

Table D-1 - Predicted $L_{Aeq,15min}$ Operational Noise Levels at Key Receivers Without Pro-Active and Reactive Mitigation Measures

Receiver Group	Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)									Noise Trigger Level D/E/N (dBA)
		Year 1			Year 3			Year 4			
		Day	Eve	Night	Day	Eve	Night	Day	Eve	Night	
Privately-owned Dwellings											
North	390	43	<20	<20	43	35	40	44	36	41	40 / 37 / 37
North	398	42	<20	<20	42	34	39	43	36	40	40 / 37 / 37
North	399	41	<20	<20	41	33	38	41	34	39	40 / 37 / 37
North	400	40	<20	<20	39	31	37	40	33	38	40 / 35 / 35
North	402	42	<20	<20	42	32	39	43	35	41	40 / 35 / 35
North	403	43	<20	<20	43	32	40	45	36	42	40 / 35 / 35
North	411	44	<20	<20	44	35	41	42	34	40	40 / 37 / 37
North	418	42	<20	<20	42	35	40	40	33	38	40 / 37 / 37
North	419	41	<20	<20	41	34	39	39	32	38	40 / 37 / 37
North	420	40	<20	<20	40	34	38	38	32	37	40 / 37 / 37
North	421	40	<20	<20	39	33	39	38	33	38	40 / 37 / 37
North	423	40	<20	<20	40	32	39	40	32	40	40 / 37 / 37
North	424	40	<20	<20	40	31	38	39	31	38	40 / 37 / 37
North	425	39	<20	<20	39	31	38	37	31	38	40 / 37 / 37
North	538	41	<20	<20	41	31	38	42	34	40	40 / 35 / 35
North	539	41	<20	<20	40	32	39	38	31	38	40 / 37 / 37

APPENDIX E

NOISE PREDICTIONS AT NORTHERN RECEIVERS WITH CONSTRUCTION AT NORTHERN END OF TRANSPORT AND SERVICES CORRIDOR

Table E-1 - Predicted $L_{Aeq,15min}$ Day Operational Noise Levels at Northern Receivers with Construction at Northern End of Transport Corridor (Years 1 & 3)

Receiver Group	Receiver ID	Day $L_{Aeq,15min}$ Noise Level (dBA)[1]	
		Year 1	Year 3
Privately-owned Dwellings			
North	384	36	33
North	385	38	36
North	386	37	34
North	390	44[2]	43[2]
North	398	44[2]	42[2]
North	399	42[2]	41[2]
North	400	41[2]	40
North	402	44[2]	43[2]
North	403	44[2]	44[2]
North	411	45[2]	44[2]
North	418	44[2]	43[2]
North	419	42[2]	41[2]
North	420	42[2]	40[2]
North	421	41[2]	40
North	423	42[2]	41[2]
North	424	41[2]	40
North	425	40[2]	39
North	427	40[2]	40
North	429	39	37
North	432	37	35
North	433a	36	34
North	433b	35	33
North	435a	34	32
North	435b	35	32
North	438	33	31
North	440	38	36
North	441a	36	33
North	441b	36	33
North	443	38	35
North	444	40	38
North	446a	39	37
North	451	35	33
North	455	36	33
North	456	35	33
North	460	37	36
North	507	34	32
North	508	33	31
North	509	33	30
North	537	32	29
North	538	42[2]	41[2]
North	539	42[2]	41[2]

Receiver Group	Receiver ID	Day $L_{Aeq,15min}$ Noise Level (dBA)[1]	
		Year 1	Year 3
Mine-owned Dwellings			
North	387	39	38
North	389	44	42
North	404	44	42
North	410	47	45
North	500	35	33

Notes:

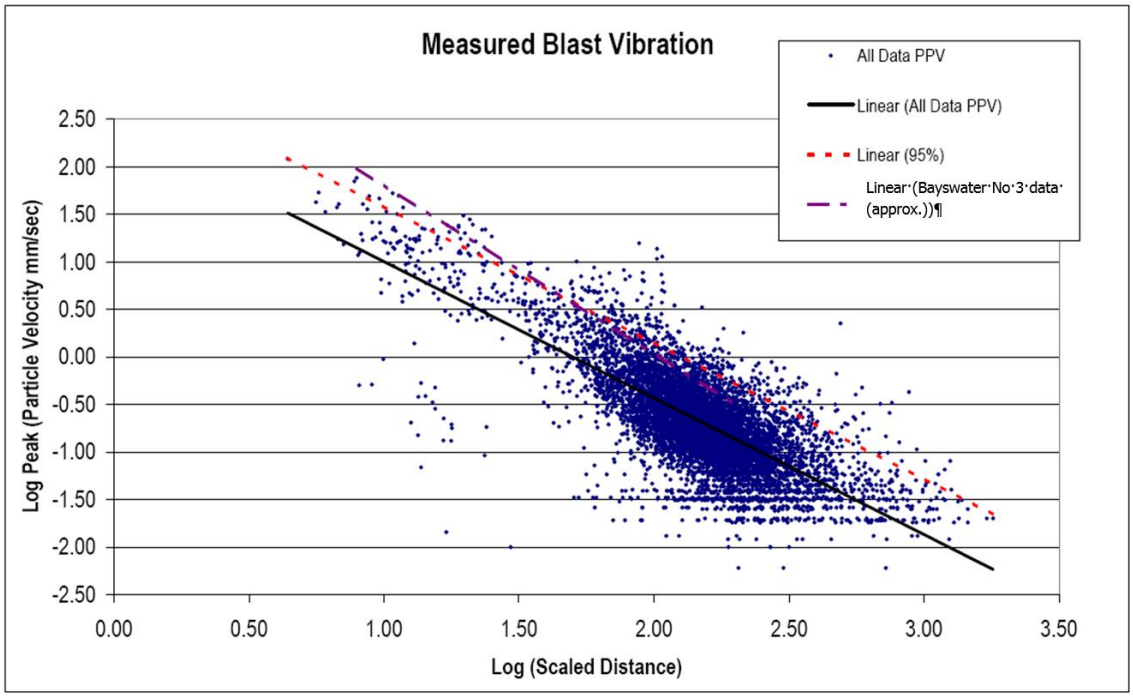
1. Levels highlighted indicate predictions under the relevant Fact Sheet D meteorological conditions in excess of the Project noise trigger levels at privately-owned receivers.
2. Noise prediction with integrated pro-active and reactive management measures in place. Note that a mitigated level is only presented for receivers where exceedances of the relevant criteria were predicted in the absence of pro-active and reactive management measures. The implementation of pro-active and reactive management measures would also benefit other receivers surrounding the Project.

APPENDIX F

BLASTING PREDICTION CURVES

For this study, Wilkinson Murray has derived predictive equations for vibration and overpressure using measurement data from approximately 7,000 blasts. Figure F.1 illustrates the measured data and associated linear trend lines for vibration.

Figure F.1 Measured Peak Particle Velocity from Blasts at Mt Arthur North (logarithmic scale) and Comparison with Data from Bayswater No 3



The figure shows a revised best fit line, a 95 percentile line, and also the previously-adopted 95 percentile based on 1999 data from Bayswater No 3. The correlation with the old data is close, although the new 95 percentile shows slightly lower vibration levels at shorter scaled distance – in the order of 0.2 to 0.3 millimetres per second (mm/s).

Figure F.2 shows data for overpressure. Analysis of these data showed that the relationship between measured peak overpressure and scaled distance is better defined with a polynomial equation (blue) at close range rather than a standard linear equation (red). At relatively low values of scaled distance, the new polynomial 95 percentile curve is approximately 5 decibels (dB) lower than the linear trend line derived from the previous Bayswater No 3 data.

Figure F.2 Measured Peak Overpressure from blasts at Mt Arthur North, and Comparison with Data from Bayswater No 3