VICKERY EXTENSION PROJECT

ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D

NOISE AND BLASTING ASSESSMENT

WHITEHAVEN COAL

ACOUSTICS AND AIR

VICKERY EXTENSION PROJECT
ENVIRONMENTAL IMPACT STATEMENT
NOISE & BLASTING ASSESSMENT

REPORT NO. 15260
VERSION A

AUGUST 2018

PREPARED FOR

WHITEHAVEN COAL LIMITED
PO BOX 600
GUNNEDAH NSW 2380

WILKINSON MURRAY

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1 INTRODUCTION

The former Vickery Coal Mine and the former Canyon Coal Mine are located approximately 25 kilometres (km) north of Gunnedah, in New South Wales (NSW) (Figure 1-1). Open cut and underground mining activities were conducted at the former Vickery Coal Mine between 1986 and 1998. Open cut mining activities at the former Canyon Coal Mine ceased in 2009. The former Vickery and Canyon Coal Mines have been rehabilitated following closure.

The approved Vickery Coal Project (herein referred to as the Approved Mine) is an approved, but yet to be constructed, project owned by Whitehaven Coal Limited (Whitehaven) involving the development of an open cut coal mine and associated infrastructure and would facilitate a run-of-mine (ROM) coal production rate of up to approximately 4.5 million tonnes per annum (Mtpa) for a period of 30 years.

Whitehaven is seeking a new Development Consent for extension of open cut mining operations at the Approved Mine (herein referred to as the Vickery Extension Project [the Project]). This would include a physical extension to the Approved Mine footprint to gain access to additional ROM coal reserves, an increase in the footprint of waste rock emplacement areas, an increase in the approved ROM coal mining rate and construction and operation of the Project Coal Handling and Preparation Plant (CHPP), train load-out facility and rail spur (Figures 1-2 and 1-3). This infrastructure would be used for the handling, processing and transport of coal from the Project, as well as other Whitehaven mining operations.

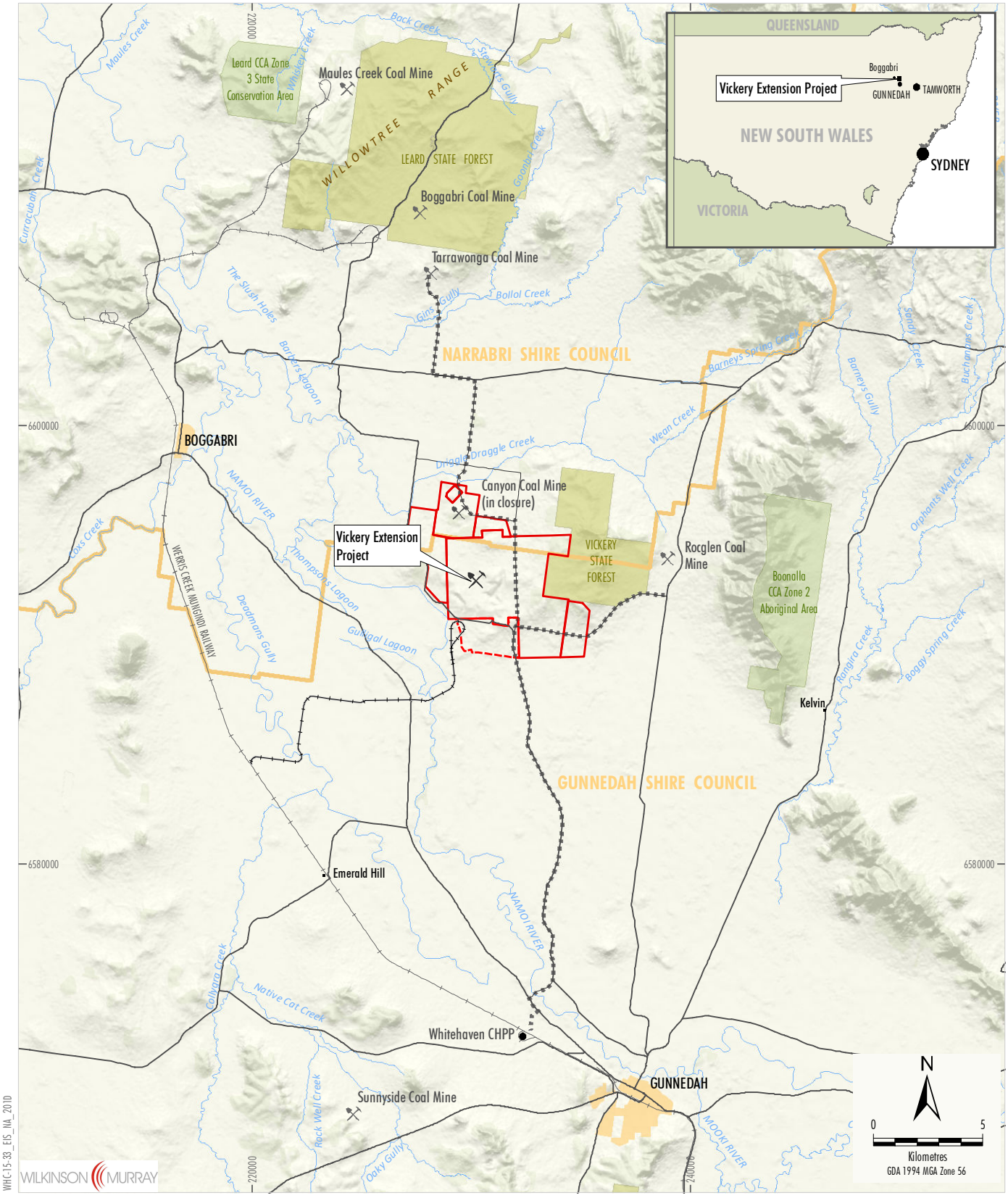
This Noise and Blasting Assessment forms part of an Environmental Impact Statement (EIS) which has been prepared to accompany a Development Application made for the Project in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

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 and blasting 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 12 March 2018, outlined as follows:

> ***Noise*** *- including:*
>
> - *an assessment of the likely operational noise impacts of the development (including construction noise) under the Noise Policy for Industry*
> - *if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline;*
> - *an assessment of the likely road noise impacts of the development under the NSW Road Noise Policy;*
>
> *…*



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application (MLA)
- Local Government Boundary
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Approved Road Transport Route
- Indicative Project Rail Spur

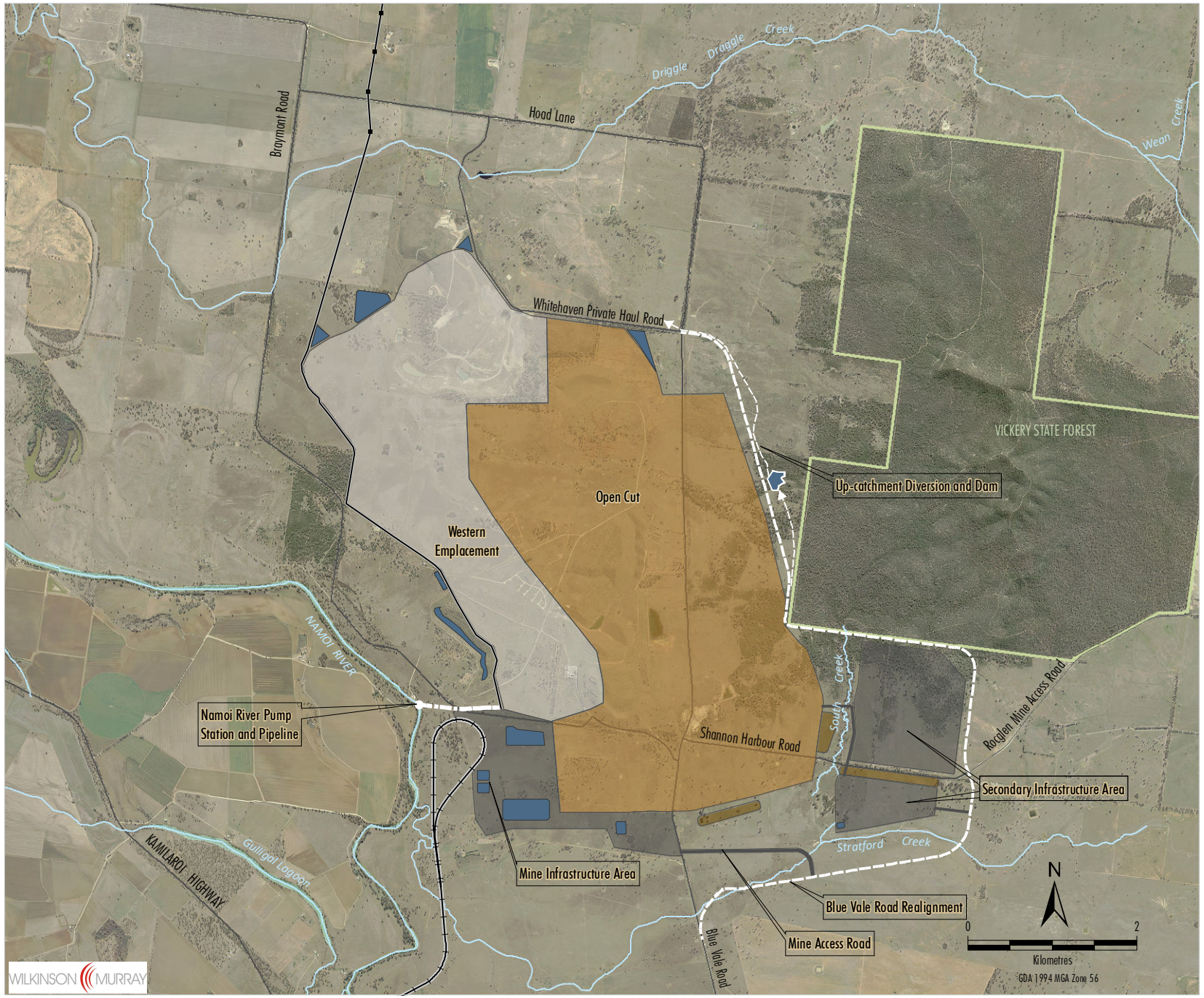
Source: LPMA - Topographic Base (2010); NSW Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project Location

Figure 1-1



LEGEND

State Forest

Project Components

- Indicative Extent of Open Cut
- Indicative Extent of Out of Pit Waste Rock Emplacement
- Indicative Extent of Infrastructure Area
- Indicative Extent of Soil Stockpile
- Indicative Extent of Water Storage
- Indicative Mine Access Road Alignment
- Indicative Namoi River Pump Station and Pipeline
- Indicative Road Realignment
- Indicative Up-catchment Diversion and Dam Location
- Indicative Rail Spur Alignment
- Indicative Location of Groundwater Bores and Pipeline

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011); Department of Industry (2015); Essential Energy (2015)

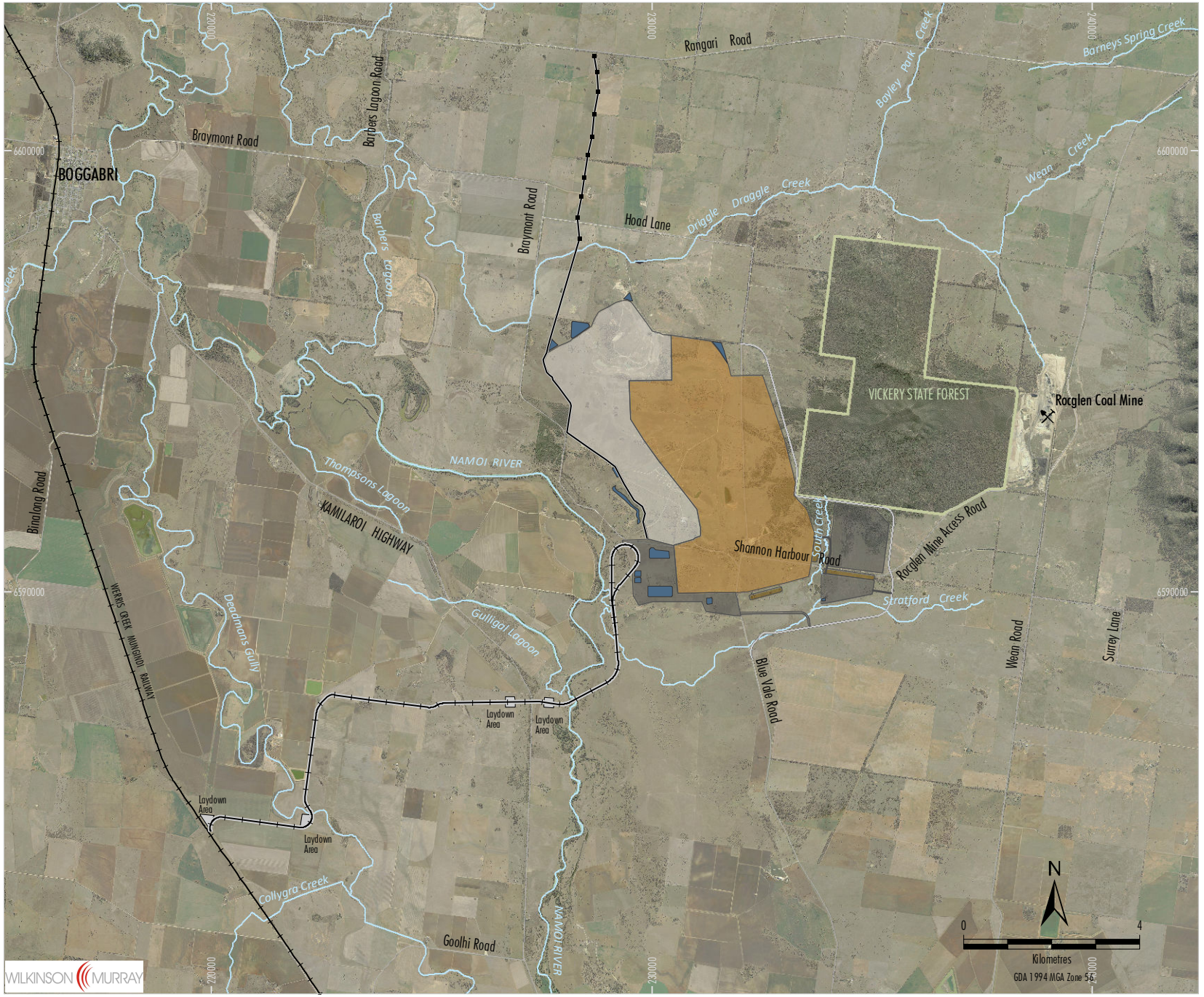
WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project General Arrangement - Project Mining Area

Figure 1-2

WHC-15-33_EIS_NA_202F



LEGEND

State Forest

Railway

Project Components

Indicative Extent of Open Cut

Indicative Extent of Out of Pit Waste Rock Emplacement

Indicative Extent of Infrastructure Area

Indicative Extent of Soil Stockpile

Indicative Extent of Water Storage

Indicative Mine Access Road Alignment

Indicative Rail Spur Alignment

Indicative Location of Groundwater Bores and Pipeline

Indicative Road Realignment

Source: Orthophoto - Department of Land and Property Information, Aerial Photography (July 2011); Department of Industry (2015)

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WHC-15-33_EIS_NA_203E

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Indicative Rail Spur Alignment and Groundwater Bore Locations

Figure 1-3

This study also addresses comments made by the Environment Protection Authority (EPA) for input into the SEARs on 9 February 2016:

> *In summary, the EPA's key information requirements for the proposal include an adequate assessment of:*
>
> *...*
>
> 2. ***Noise** – noise generation and management of potential impacts on adjacent rural residences during construction and operational phases;*
>
> *...*

2 PROJECT OVERVIEW

2.1 General Description

The Project involves mining the coal reserves associated with the Approved Mine, as well as accessing additional coal reserves within the Project area. ROM coal would be mined by open cut methods at an average rate of 7.2 Mtpa over 25 years, with a peak production of up to approximately 10 Mtpa.

As described in Section 1, the Project would include a physical extension to the Approved Mine footprint, an increase in the footprint of waste rock emplacement areas, an increase in the approved ROM coal mining rate and construction and operation of the Project CHPP, train load-out facility and rail spur (Figures 1-2 and 1-3). This infrastructure would be used for the handling, processing and transport of coal from the Project, as well as other Whitehaven mining operations.

Figures 1-2 and 1-3 illustrate the general arrangement of the Project, including the indicative rail spur alignment. A detailed description of the Project is provided in Section 2 in the Main Report of the EIS.

Three operational scenarios of the Project were assessed for potential noise impacts:

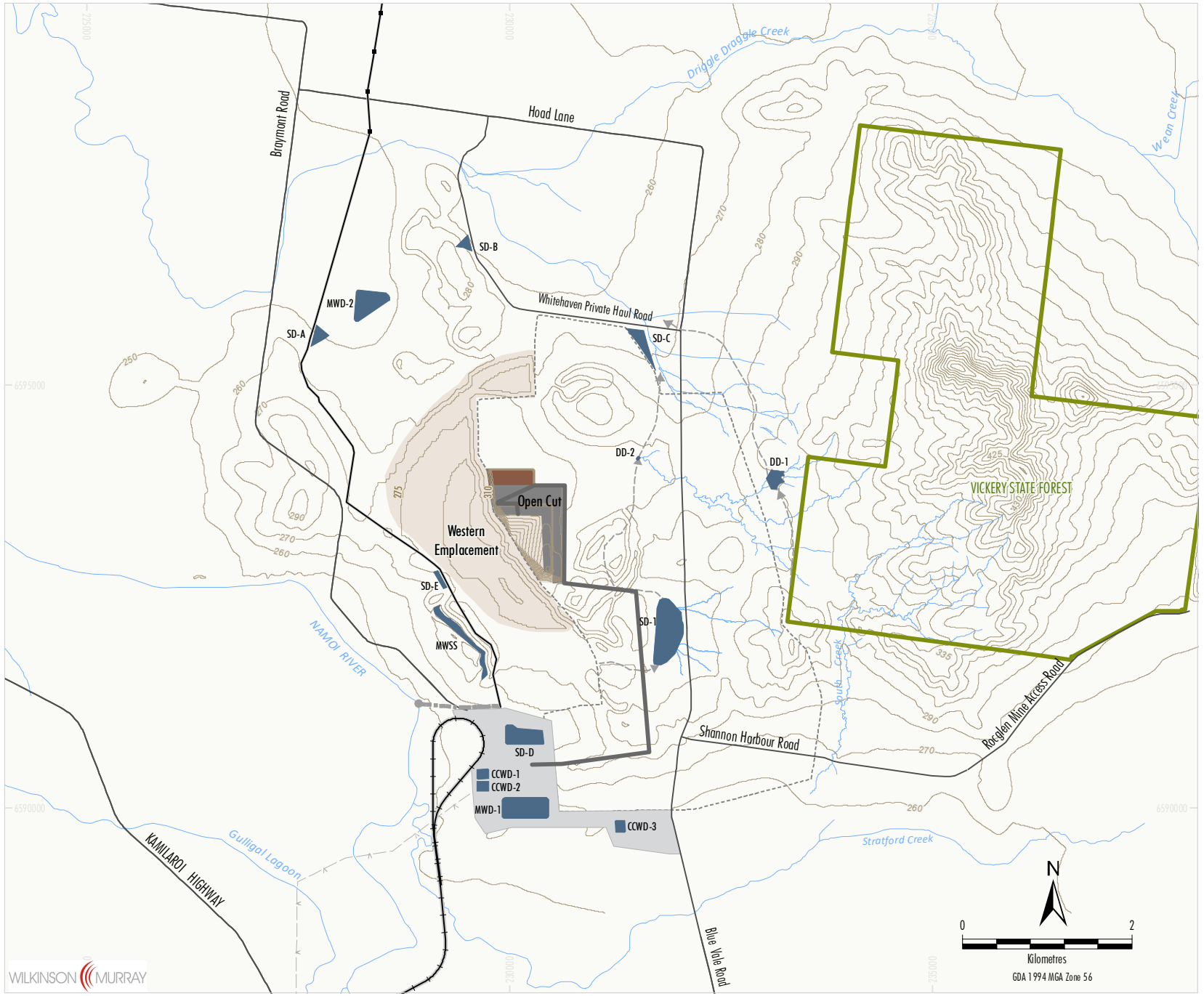
- Year 3 – representative of ongoing operations in the north-west and central portions of the open cut;
- Year 7 – representative of ongoing operations in the eastern portion of the open cut; and
- Year 21 – representative of ongoing operations in the southern extremity of the open cut.

The operational scenarios were selected in consideration of maximum potential noise emissions (e.g. to account for the maximum mobile equipment fleet and maximum active disturbance areas) to evaluate the potential impacts at the nearest privately-owned receivers over the life of the Project. Additional description of each operational scenario is provided in Section 5.1.1. General Project arrangements for Years 3, 7 and 21 are shown on Figures 2-1 to 2-3, respectively.

The mining layout and sequence shown on Figures 2-1 to 2-3 may be adjusted during the mine life to take account of localised geological features, coal market volume and quality requirements, mining economics and Project detailed engineering design.

The detailed mining sequence over any given period would be documented in the relevant Mining Operations Plan.

The subsections below provide an overview of the Project, with a focus on those elements that are material from a noise and blasting assessment perspective.



LEGEND

- State Forest
- Existing 66kV Powerline
- Indicative Up-catchment Diversion
- Indicative Namoi River Pump Station and Pipeline
- Indicative Active Mining
- Indicative Active Waste Rock Emplacement
- Indicative Soil Stripped
- Indicative Infrastructure Area
- Indicative Extent of Water Storage
- Indicative Mine Access Road
- Indicative Main ROM Coal Haul Road
- Indicative Rail Spur Alignment
- Indicative Location of Groundwater Bores and Pipeline
- Indicative Maximum Extent of Open Cut

Source: Department of Land and Property Information (2014); Department of Industry (2015)

N

0 2

Kilometres

GDA 1994 MGA Zone 56

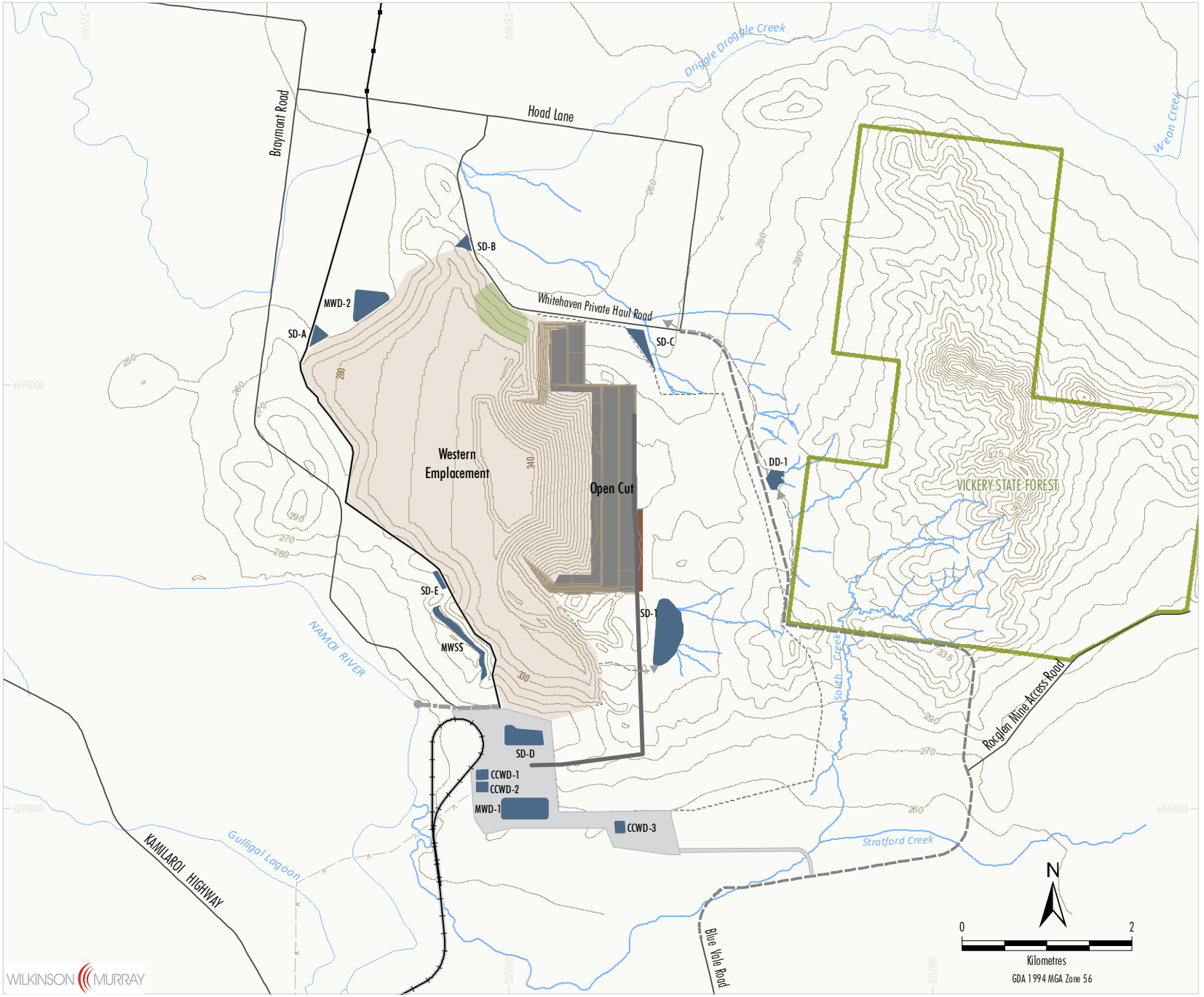
WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project General Arrangement - Year 3

Figure 2-1

WHC-15-33_EIS_NA_205F



LEGEND

- State Forest
- Existing 66kV Powerline
- Indicative Road Realignment
- Indicative Namoi River Pump Station and Pipeline
- Indicative Up-catchment Diversion
- Indicative Active Mining
- Indicative Active Waste Rock Emplacement
- Indicative Soil Stripped
- Indicative Initial Rehabilitation
- Indicative Established Rehabilitation
- Indicative Infrastructure Area
- Indicative Extent of Water Storage
- Indicative Mine Access Road
- Indicative Main ROM Coal Haul Road
- Indicative Rail Spur Alignment
- Indicative Location of Groundwater Bores and Pipeline
- Indicative Maximum Extent of Open Cut

Source: Department of Land and Property Information (2014); Department of Industry (2015)

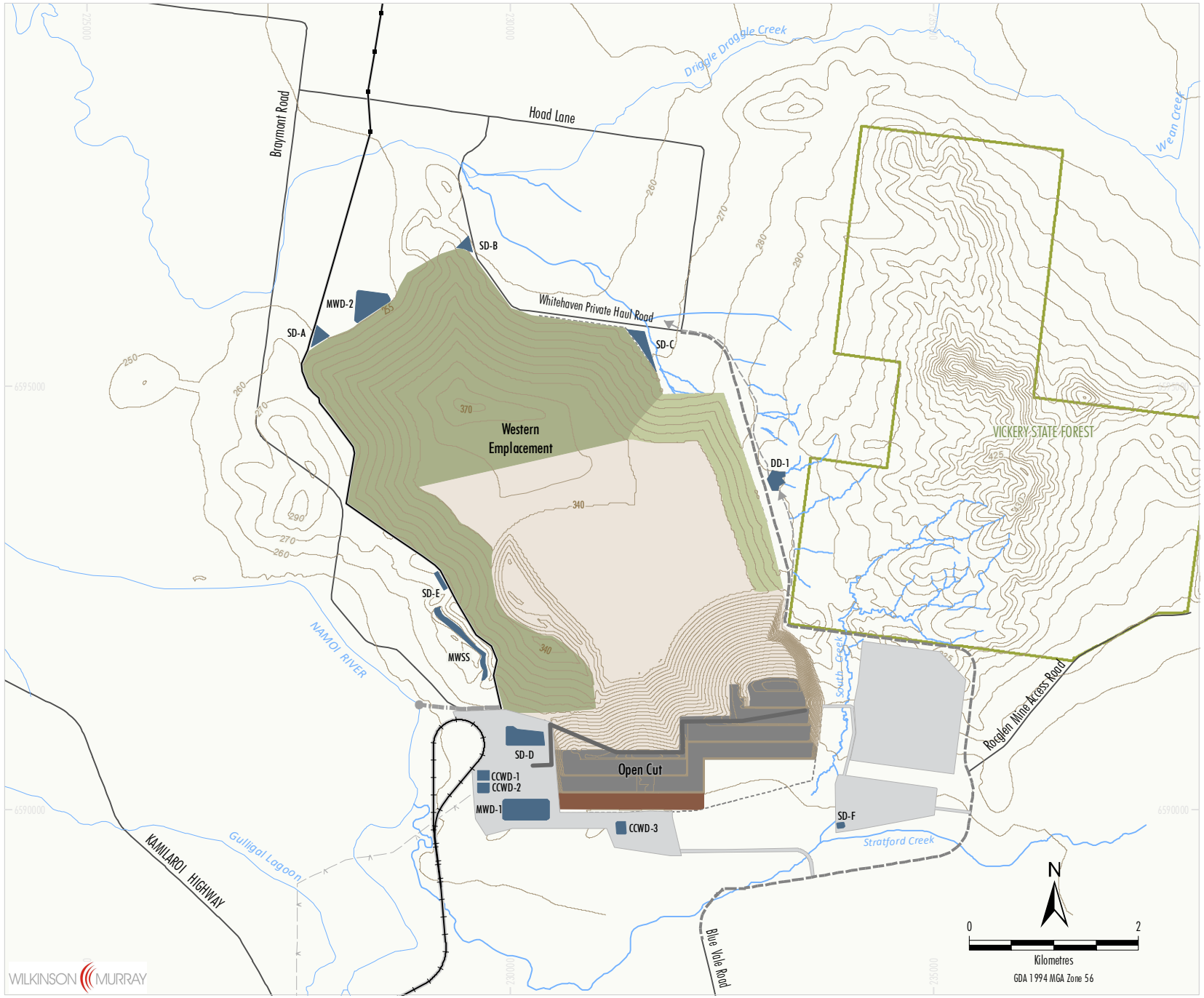
WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project General Arrangement - Year 7

Figure 2-2

WHC-15-33_EIS_NA_206E



LEGEND

- State Forest
- Existing 66kV Powerline
- Indicative Road Realignment
- Indicative Namoi River Pump Station and Pipeline
- Indicative Up-catchment Diversion
- Indicative Active Mining
- Indicative Active Waste Rock Emplacement
- Indicative Soil Stripped
- Indicative Initial Rehabilitation
- Indicative Established Rehabilitation
- Indicative Infrastructure Area
- Indicative Extent of Water Storage
- Indicative Mine Access Road
- Indicative Main ROM Coal Haul Road
- Indicative Rail Spur Alignment
- Indicative Location of Groundwater Bores and Pipeline
- Indicative Maximum Extent of Open Cut

Source: Department of Land and Property Information (2014); Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Project General Arrangement - Year 21

Figure 2-3

WHC-15-33_EIS_NA_207E

2.2 Project Activities

The indicative Project general arrangement is shown on Figure 1-2. Additional details of each of the main Project components are discussed below, with further detail included in Section 2 in the Main Report of the EIS.

2.2.1 Development Activities

Construction/development activities associated with the Project include construction of the mine infrastructure area, development of a temporary infrastructure area, development of the Project rail spur and loop, realignment of Blue Vale Road, construction of water management infrastructure, and development of water and electricity supply infrastructure, and the construction of the approved Kamilaroi Highway overpass and private haul road (if required).

For some construction components such as the construction of the mine infrastructure area and rail loop, activities would occur in areas adjacent to operational mining activities and would largely be indistinguishable from operational mining activities. Such construction components have conservatively been assessed against the Project noise trigger levels rather than the recommended noise management levels described in the *Interim Construction Noise Guideline*.

Construction/development activities would generally be undertaken between 7.00 am to 6.00 pm, Monday to Sunday (inclusive).

Activities undertaken outside of these hours would include:

- activities that cause $L_{Aeq(15\ minute)}$ noise levels of no more than 35 dB at any privately-owned residence, or at a higher level that has been agreed with the resident;
- deliveries required to be undertaken outside of normal construction hours for safety reasons; and
- emergency work to avoid loss of life, damage to property or to prevent environmental harm.

Mine Infrastructure Areas, Site Access and Site Services

A mine infrastructure area would be constructed to the south of the Western Emplacement (Figure 1-2). The mine infrastructure area would include:

- ROM coal and product coal pads and stockpiles, ROM handling and dumping facilities, product coal stacking and reclaim facilities;
- CHPP incorporating coal handling, reject handling, crushing, screening and washing infrastructure;
- rail spur, rail loop and train load-out facilities;
- water and flood management infrastructure;
- administration, crib room, ablution and first aid facilities;
- emergency management facilities;
- light and heavy vehicle parking and delivery facilities;
- bulk fuel, liquid petroleum gas, lubrication and other hazardous goods storage and handling facilities;
- stores, light vehicle and heavy vehicle workshop facilities;

- tyre change and storage facilities;
- communication facilities;
- a laydown and waste management area;
- hot work areas;
- vehicle wash facilities;
- soil stockpiles;
- light and heavy vehicle roads;
- substation and electricity distribution infrastructure;
- sewage and water treatment facilities; and
- other associated minor ancillary infrastructure.

Construction of the mine infrastructure area would be undertaken in stages and augmentations may occur over the life of the Project.

Secondary infrastructure areas would be constructed to the east of the open cut, south of the Vickery State Forest (Figure 1-2). These infrastructure areas would support open cut mining operations as they progress to the south of the open cut. The secondary infrastructure areas may include laydown and storage areas, vehicle parking areas, waste management areas and/or soil storage areas. If required, mine water surge storage dams and water supply dams would also be constructed in the secondary infrastructure areas.

Temporary Infrastructure Area

An existing infrastructure area associated with previous mining activities at the Vickery Coal Mine may be developed into a temporary infrastructure area during the initial stage of the Project. Consistent with the Approved Mine, the temporary infrastructure area may include development of temporary ROM coal crushing and screening facilities, a truck load-out facility, workshops, offices, washdown facilities, laydown areas, fuel storage and associated mining and water management infrastructure.

Development of the temporary infrastructure area would allow for the early commencement of open cut mining as it would facilitate road transport of ROM coal to the Whitehaven CHPP prior to construction of the Project CHPP.

Road Realignment

The approved Blue Vale Road realignment would be constructed for the Project adjacent to the western and southern boundaries of the Vickery State Forest and around the secondary infrastructure areas to allow continued public access around the Project.

The Blue Vale Road realignment would generally follow the existing topography, in the section to the south of the Vickery Open Cut and to the west of the Vickery State Forest. Construction noise impacts associated with the approved road realignments are described in the *Vickery Coal Project Environmental Impact Statement* (Whitehaven, 2013). Construction of the Blue Vale Road realignment would occur consistent with the relevant noise criteria for the Project.

A small realignment of the southern section of Braymont Road was approved as part of the Approved Mine. This was required because the planned open cut extended into the current road alignment. Under the Project, the open cut would intersect the southern portion of Braymont Road. As a result, Whitehaven would seek to permanently close and mine through this portion of the road. The alternative route for traffic that currently uses this road would be via the existing/realigned Blue Vale Road.

Approved Private Haul Road and Kamilaroi Highway Overpass

The private haul road (Section 6.1) and Kamilaroi Highway overpass are components of the Approved Mine and are to be constructed if the combined road haulage of ROM coal from Whitehaven mining operations to the Whitehaven CHPP exceed the relevant limit.

Although Whitehaven intends to construct the Project rail and CHPP infrastructure in the early stages of the Project, it intends to retain the ability to transport ROM coal from the Project (and other Whitehaven mines) by road to the Whitehaven CHPP consistent with the Approved Mine Development Consent (and transport reject from the Whitehaven CHPP to Whitehaven mines consistent with approved operations). If constructed, Whitehaven would comply with the noise criteria that currently relate to construction and operation of the overpass.

2.2.2 Open Cut Mining Operations

The Project would involve mining up to approximately 10 Mtpa of ROM coal via open cut methods. One open cut mining area (including south, west and north extensions), would be mined.

The indicative general sequence of open cut mining would be as follows:

1. Pre-clearance surveys.
2. Vegetation clearance.
3. Soil stripping.
4. Removal of weathered or friable overburden.
5. Use of drill and blast techniques for the removal of competent overburden (and interburden). Overburden (and interburden) would be removed and placed in the waste rock emplacement areas.
6. Mining of exposed coal seams by loaders, excavators and/or shovels and loading into trucks for haulage to the ROM pad at the mine infrastructure area via internal haul roads.
7. Progressive landform profiling and rehabilitation of the waste rock emplacement areas.

The mining fleet would typically consist of excavators and/or shovels and haul trucks, with a support fleet that includes dozers, scrapers, graders, front end loaders, drill rigs and water trucks. Mining equipment would be selected as part of detailed design.

Life of Mine

The proposed mining life of the Project is approximately 25 years.

Operational Hours

Operational activities would be undertaken 24 hours per day, 7 days per week.

2.2.3 Coal Processing, Handling & Transport Infrastructure

The Project CHPP would be constructed at the mine infrastructure area for handling, sizing and select washing of ROM coal at the Project (Figure 1-2).

Once the train load-out facility and Project rail spur is commissioned, product coal would be conveyed to the train load-out facility located at the rail loop. Product coal would then be loaded onto trains for transportation to market.

The Project would include the construction and operation of train load-out facility and rail spur and loop. The rail spur and loop would connect to the Werris Creek Mungindi Railway (Figure 1-3).

2.2.4 Mine Waste Rock Management

Mine waste rock (including overburden and interburden) generated from the open cut would be placed in the Western Emplacement (Figure 1-2) or within the footprint of the open cut void.

2.2.5 Other Activities

Other activities that would be conducted as a component of the Project include water management, coal rejects management, exploration, monitoring, rehabilitation and development of other associated minor infrastructure, plant, equipment and activities.

2.2.6 Project Integration

The Project CHPP, rail infrastructure and coal reject management infrastructure would be designed with sufficient capacity to also process ROM coal from other Whitehaven mines.

ROM coal produced by the Project may be transported by road and processed at the Whitehaven CHPP (consistent with the Approved Mine Development Consent [SSD-5000]) prior to the Project CHPP, train load-out facility and Project rail spur reaching full operational capacity.

Should sized ROM coal be transported by road from the Project to the Whitehaven CHPP, Whitehaven would schedule the ROM coal production rates from its operations such that the overall quantity of sized ROM coal that is transported from its operations along the Approved Road Transport Route to the Whitehaven CHPP would be consistent with the operations' Development Consents/Project Approvals.

3 NOISE RECEIVERS & SURROUNDING LAND USES

The majority of the Project mining area is located within previously cleared agricultural areas and rehabilitated open cut workings from historical mining activities.

Dry land cropping and grazing of cattle is conducted to the north, west and south of the Project mining area on the flatter lands near the Namoi River and its tributaries. There are also several irrigated cropping enterprises in the vicinity of the Project, to the west of the Namoi River and to the north-west of the Project.

The Vickery State Forest is located to the east of the Project mining area. No mining, waste rock emplacement or disturbance is proposed within the Vickery State Forest.

Open cut and underground mining activities were previously conducted in the Project mining area. Three areas associated with former open cuts and associated waste rock emplacements are located within the Project mining area. In addition, part of the final void associated with the former Canyon Coal Mine (mining ceased in 2009) occurs in the north-west portion of the Project mining area.

To the north, south, east and west of the Project there are a range of mine-owned and private rural receivers, all of which have been considered in this assessment. These receivers are listed in Table 3-1 and shown on Figure 3-1. Eastings and Northings are in Map Grid of Australia (MGA) 84 coordinates, Zone 56.

Table 3-1 Receivers Considered in this Assessment

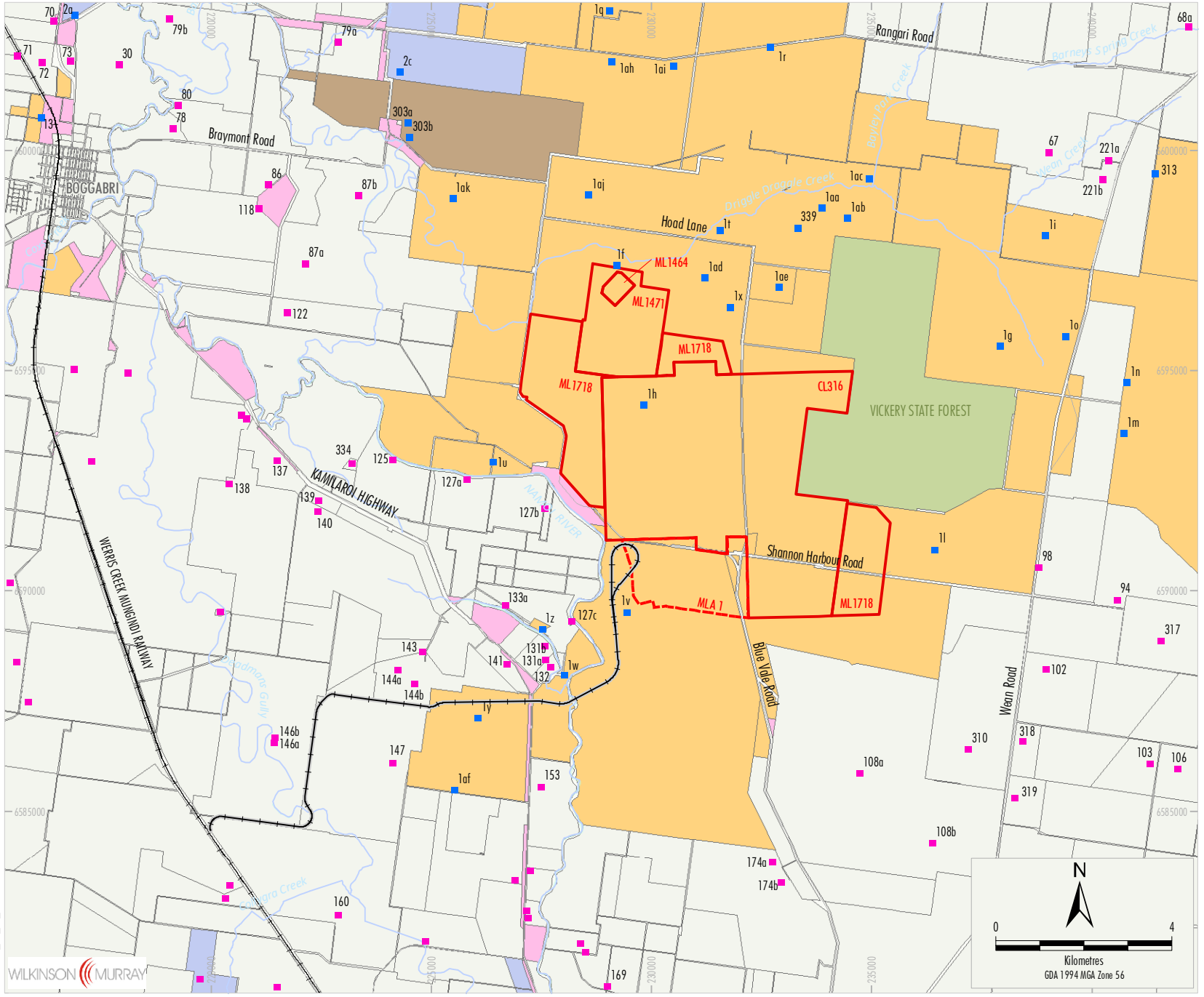
Receiver ID	Dwelling Name	Ownership	Easting	Northing
Privately-owned Dwellings				
67	Retreat	Richard Lindsay Penrose Katriona Ann Penrose as joint tenants	239020	6599961
86	-	Peter J Watson Holdings Pty Ltd	221297	6599230
87a	Croydon	David Sinclair Riley	222139	6597432
87b	Yarrah	David Sinclair Riley	223342	6598974
94	Surrey	Rodney James Barnes Angela Barnes as tenants in common in equal shares	240569	6589808
98	Roseberry	Ronald Stanley Rennick	238803	6590526
102	Wundurra	James Christopher Meyers Jeanette Elizabeth Meyers as joint tenants	238951	6588235
103	-	Keith Gascoyne Perrett	241327	6586074
108a	Colstoun	Anthony Charles Wannan Pauline May Winter as joint tenants	234727	6585868
108b	Colstoun	Anthony Charles Wannan Pauline May Winter as joint tenants	236385	6584280
118	Kilmarnock	Andrew David Watson	221075	6598682
122	-	Nandewar Pty Limited	221722	6596321
125	Undoolya	Stephen Maunder Anita Jane Maunder as joint tenants	224132	6592990
127a	-	James Karl Barlow	225805	6592537
127b	Mirrabinda	James Karl Barlow	227568	6591875
127c	-	James Karl Barlow	228190	6589314
131a	Dennison	Brian John Keeler Denise Patricia Keeler as joint tenants	227562	6588753

Receiver ID	Dwelling Name	Ownership	Easting	Northing
131b	-	Brian John Keeler Denise Patricia Keeler as joint tenants	227591	6588442
132	Lanreef	Estate: Perpetual Lease Eric James Hannan Carol Anne Hannan as joint tenants	227705	6588285
133a	Clinton	Grant Archie Mcilveen	226677	6589676
137	Milchengowrie	Anthony Clarence Carrigan Georgina Therese Carrigan as tenants in common in equal shares	221496	6592978
138	Dia-Lynn	Anthony Clarence Carrigan	220402	6592427
139	Gowrie	Kenneth Leslie Crawford Susan Ruth Crawford as tenants in common in equal shares	222442	6592051
140	Erinvale	David Alexander Watt Janet Elizabeth Watt as tenants in common in equal shares	222425	6591809
141	-	Dee Micheal Heinemann Amanda Maree Heinemann as joint tenants	226706	6588336
143	-	Scott Llewellyn Johns	224801	6588624
144a	-	Errol Frederick Darley & Jennifer Therese Darley	224237	6588209
144b	-	Errol Frederick Darley & Jennifer Therese Darley	224612	6587904
146a	-	Graeme Charles Carrigan	221436	6586562
146b	-	Graeme Charles Carrigan	221424	6586689
147a	Killara	Trevor John Loveridge Colleen Loveridge as tenants in common in equal shares	224118	6586104
147b	Yamba	Trevor John Loveridge Colleen Loveridge as tenants in common in equal shares	224886	6582073
153	Avona	Robert George Mansfield Heather Kaye Mansfield as joint tenants	227491	6585556
160	Emerald Hills	RS Blackmore	222858	6582588
174a	-	Selkirk Pastoral Co Pty Limited	232731	6583847
174b	Nayla	Selkirk Pastoral Co Pty Limited	232948	6583387
221a	Penryn	Margaret Eleanor Geddes	240378	6599756
221b	-	Margaret Eleanor Geddes	240241	6599341
310	Brolga	Alexander Jock Laurie & Lynette Elizabeth Laurie	237192	6586408
317	Carlton	Theos Dimarchos & Patricia Ann Dimarchos	241581	6588865
318	Braemar	John Charles Wise & Linda Dorothy Miller & Walter Lichti & Marianne Lichti	238432	6586589
319	Wilgamere	Lachlan James Barker & Jayne Louise Barker	238238	6585305
334	River Bend	David Luke Stuart & Kamilla Joan Stuart	223205	6592888
		Mine-owned Dwellings		
1aa	-	Whitehaven Coal Limited	233861	6598699
1ab	-	Whitehaven Coal Limited	234447	6598461
1ac	-	Whitehaven Coal Limited	234948	6599352
1ad	Merton	Whitehaven Coal Limited	231216	6597110
1ae	Woodland	Whitehaven Coal Limited	232895	6596896
1af	Ingleburn	Whitehaven Coal Limited	225528	6585491
1aj	Bungalow	Whitehaven Coal Limited	228572	6598981
1f	Whitehaven	Whitehaven Coal Limited	229210	6597384
1g	-	Whitehaven Coal Limited	237902	6595557
1h	Wilga*	Whitehaven Coal Limited	229822	6594225
1i	Costa Vale	Whitehaven Coal Limited	238936	6598071

Receiver ID	Dwelling Name	Ownership	Easting	Northing
1l	Stratford	Whitehaven Coal Limited	236436	6590934
1m	Belah	Whitehaven Coal Limited	240723	6593582
1n	Yarrari	Whitehaven Coal Limited	240796	6594733
1o	Glenroc	Whitehaven Coal Limited	239405	6595779
1t	Gundawarra	Whitehaven Coal Limited	231547	6598184
1u	Broadwater	Whitehaven Coal Limited	226404	6592924
1v	Kurrumbede	Whitehaven Coal Limited	229434	6589512
1w	-	Whitehaven Coal Limited	228025	6588084
1x	Will-Gai	Whitehaven Coal Limited	231784	6596439
1y	-	Whitehaven Coal Limited	226067	6587121
1z	Long Way Round	Whitehaven Coal Limited	227521	6589134
88	Braymont	Whitehaven Coal Limited	225481	6598912
303a	Callandar	Whitehaven Coal Mining Limited & Boggabri Coal Pty Limited	224469	6600621
303b	Callandar	Whitehaven Coal Mining Limited & Boggabri Coal Pty Limited	224507	6600300
313	Roseglass	Aston Coal 2 Pty Limited & Icra Mc Pty Limited & J-Power Australia Pty Limited	241425	6599480
339	Silkdale	Whitehaven Coal Limited	233318	6598234

* Would not be occupied during the Project, therefore not assessed further.

It is noted the owners of property 144 have advised Whitehaven they hold entitlement to build a dwelling in the eastern portion of the property, approximately half way between receivers 141 and 1y. As no dwelling currently exists, this potential future dwelling has not been specifically identified in the noise assessment for the Project. Notwithstanding, potential impacts at this location have been described in this assessment where relevant.



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application (MLA)
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately Owned Land
- Railway
- Mine-owned Dwelling
- Private Dwelling
- Indicative Rail Spur Alignment

Source: Department of Land and Property Information - Land Tenure (2016); Department of Industry (2017); Whitehaven Coal (2016)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Land Ownership

Figure 3-1

WHC-15-33_EIS_MA_208K

WILKINSON MURRAY

4 OPERATIONAL NOISE ASSESSMENT CRITERIA

4.1 Background Noise Survey

The intent of a background noise survey is to establish background noise levels which would be used to define Project noise trigger levels.

A background noise survey was carried out in late 2011 by Wilkinson Murray as part of the noise and blasting impact assessment for the Approved Mine (Wilkinson Murray, 2013b).

Measured background noise levels in the vicinity of the Project were found to be low and generally only affected by natural noise sources associated with fauna and rustling foliage. In some locations it is believed distant traffic noise did, to a small extent, contribute to background noise levels during the daytime. Since no material change to the local road network has occurred since 2011, distant traffic noise levels are believed to have remained relatively similar to those at the time of the Approved Mine noise assessment.

To describe background noise levels, the measure recommended by the NSW *Noise Policy for Industry (NPfI)* (EPA, 2017) is the Rating Background Level (RBL). This is based on the L_{A90} noise descriptor as defined in the *NPfI*. Note a glossary of terms is provided in Appendix A.

Based on the background noise survey conducted in 2011, and in accordance with the *NPfI*, RBLs of 35 dBA, 30 dBA, and 30 dBA (i.e. the most conservatively low RBLs possible in accordance with the *NPfI*) have been adopted for the day, evening and night periods, respectively.

Additional detail of the background noise monitoring (e.g. details of the monitoring locations and analysis procedures) is provided in the noise and blasting assessment for the Approved Mine (Wilkinson Murray, 2013b).

4.2 Project Noise Trigger Levels

4.2.1 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 4-1 summarises the adopted RBLs and the intrusiveness noise levels relevant to the Project.

Table 4-1 Project Intrusiveness Noise Levels

	Day	Evening	Night Time
Adopted RBLs	35 $L_{Aeq,15min}$ (dBA)	30 $L_{Aeq,15min}$ (dBA)	30 $L_{Aeq,15min}$ (dBA)
Project Intrusiveness Noise Levels	40 $L_{Aeq,15min}$ (dBA)	35 $L_{Aeq,15min}$ (dBA)	35 $L_{Aeq,15min}$ (dBA)

Notes:
Day: 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.

4.2.2 Amenity Noise Levels and Project Amenity Noise Levels

The *NPfI* specifies an amenity noise level which aims to maintain noise amenity over the whole daytime, evening or night time period where it is subjected to cumulative noise from a number of industrial sources.

The amenity noise level is relevant in the context of controlling cumulative noise impacts resulting from the concurrent operation of the Project and the other potential sources of industrial noise (for example, the Tarrawonga Coal Mine located approximately 10 km north of the Project [Figure 1-1]). The amenity noise level sets upper limits to control the total $L_{Aeq,Period}$ noise levels at a given receiver from all industrial sources over day, evening and night periods. In this case, the surrounding 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* sets an amenity noise level applicable to the Project in order to ensure total industrial noise levels remain within the recommended amenity levels as follows:

Project amenity noise level = Amenity noise level – 5 dB

Table 4-2 summarises the Project amenity noise levels.

Table 4-2 Project Amenity Noise Levels

	Day	Evening	Night Time
Project Amenity Noise Levels	45 $L_{Aeq,Period}$ (dBA)	40 $L_{Aeq,Period}$ (dBA)	35 $L_{Aeq,Period}$ (dBA)

Notes:
Day: 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.

4.2.3 Project Noise Trigger Levels

The *NPfI* describes the 'Project noise trigger levels' as being the lower (i.e. more stringent) of the Project intrusiveness noise level and Project amenity noise levels. The policy also stipulates that Project trigger noise levels should be expressed as $L_{Aeq,15min}$ values and provides the following method to convert $L_{Aeq,Period}$ levels into $L_{Aeq,15min}$ levels:

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

In view of the above, Table 4-3 summarises the Project noise trigger levels used for all identified receivers in this assessment. The project intrusive noise levels are the lower (i.e. more stringent) compared to the Project amenity noise levels and therefore become the Project trigger noise levels.

Table 4-3 Project Noise Trigger Levels

Trigger Level	Day	Evening	Night Time
Project Intrusiveness Noise Levels	40 $L_{Aeq,15min}$ (dBA)	35 $L_{Aeq,15min}$ (dBA)	35 $L_{Aeq,15min}$ (dBA)
Project Amenity Noise Levels	48 $L_{Aeq,15min}$ (dBA)	43 $L_{Aeq,15min}$ (dBA)	38 $L_{Aeq,15min}$ (dBA)
Project Noise Trigger Levels	**40 $L_{Aeq,15min}$ (dBA)**	**35 $L_{Aeq,15min}$ (dBA)**	**35 $L_{Aeq,15min}$ (dBA)**

Notes:
Day: 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 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 (day) 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*

4.4 Residual Noise Impacts

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

Table 4.1 of the *NPfI*, which interprets the significance of any potential noise exceedances, is reproduced below in Table 4-4. These significance categories (i.e. negligible, marginal, moderate and significant) are generally consistent with Table 1 of the *Voluntary Land Acquisition and Mitigation Policy* (*VLAMP*) (DP&E, 2014) which addresses noise and air quality impacts from State significant mining, petroleum and extractive industry developments. An updated draft version of this policy (DP&E, 2017) was released in November 2017. Given the policy is still in draft form, the revised policy has not been considered in this assessment.

Table 4-4 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

The *NPfI* also gives examples of noise mitigation measures addressing residual noise impacts in Table 4.2 of the policy. Table 4.2 of the *NPfI* is reproduced in Table 4-5.

Table 4-5 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.

4.5 Assessment Methodology

Table 4-6 presents the methodology for assessing noise levels which may exceed the *NPfI* Project noise trigger levels at privately-owned residences.

Table 4-6 Project Noise Impact Assessment Methodology

Noise Management Zone		Noise Affectation Zone
1-2 dB above Project noise trigger levels (refer Table 4-3)	**3-5 dB above Project noise trigger levels (refer Table 4-3)**	**> 5 dB Project noise trigger levels (refer Table 4-3)**
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.

4.6 Maximum Noise Level Event Assessment

To help protect residents from sleep disturbance (awakening or disturbance to sleep stages), the *NPfI* states 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 RBL for the night period is assumed to be 30 dBA, the Project's trigger levels for the above maximum noise level event screening assessment are:

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

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

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 Department of Planning and Environment for use in environmental noise assessments. The assessment models the total noise at each receiver from the operation of the Project. Total predicted operational noise levels are then compared with the Project noise trigger levels presented in Table 4-3.

5.1.1 Noise Assessment Scenarios

Noise modelling was undertaken for the day, evening and night operating scenarios for Project Years 3, 7 and 21. These Project Years were selected for the following reasons:

- Project Year 3 (Figure 2-1) considers mining operations in the north-west and central portions of the open cut; and waste rock emplacement at the Western Emplacement. The acoustic centre of the mining operations considered in this scenario is closest to the west and north-west receivers. Although this scenario would use a reduced fleet (compared with subsequent scenarios with increased waste rock and ROM coal mining sites), shielding by the Western Emplacement would also be reduced (compared with subsequent scenarios).
- Project Year 7 (Figure 2-2) considers mining operations in the eastern portion of the open cut; and waste rock emplacement at the Western Emplacement. The acoustic centre of the mining operations considered in this scenario is closest to the east and north-east receivers.
- Project Year 21 (Figure 2-3) considers mining operations in the southern portion of the open cut. The acoustic centre of the mining operations considered in this scenario is closest to the south, south-west and south-east receivers.

5.1.2 Meteorological Environment for Noise Assessment Purposes

NPfI Meteorological Conditions

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 0.5m/s at 10m AGL*
Noise-enhancing meteorological conditions	*Day/evening: stability categories A-D with light winds (up to 3m/s at 10m AGL)* *Night: stability categories A-D with light winds (up to 3m/s at 10m AGL) and/or stability category F with winds up to 2m/s at 10m AGL*

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

Fact Sheet D provides two options when considering meteorological effects:

- Conservatively adopt noise-enhancing meteorological conditions without processing meteorological data local to the site; or
- Determine the significance of noise-enhancing meteorological conditions based on meteorological data local to the site and 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 realistic estimate of noise impacts.

The significance of noise-enhancing meteorological conditions is based on the same monitoring location used for the Approved Mine, which was obtained from the Vickery meteorological station located at the former Canyon Coal Mine (approximately 1 km to the north of the Project's Western Emplacement) for the three-year period spanning from 1 January 2013 to 31 December 2015. It includes wind speed, wind direction and observations of sigma-theta used to determine Pasquill 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, evening and night time periods. Appendix B provides a summary of the methodology used to determine the significance of those noise-enhancing meteorological conditions. The resultant noise-enhancing meteorological conditions relevant to the Project are summarised in Table 5-1 along with the standard meteorological conditions.

Although moderate-to-strong temperature inversions are not considered significant to the Project according to Fact Sheet D of the *NPfI* (i.e. based on the site-specific meteorological data considered – see Section B.2 of Appendix B), they have conservatively been considered as part of the night time noise enhancing conditions. Given the location of the Project in the Gunnedah Basin, it is expected the percentage of occurrence of moderate-to-strong temperature inversions could possibly, some years, be above the threshold of occurrence of 30%.

All meteorological conditions presented in Table 5-1 have been considered for the assessment since noise-enhancing meteorological conditions do not necessarily result in higher noise levels when compared with standard meteorological conditions at a particular receiver location.

Table 5-1 Relevant *NPfI* (Fact Sheet D) Meteorological Conditions

Assessment Period	*NPfI* Meteorological Condition	Description of Meteorological Parameters
Day	Noise-enhancing meteorological conditions	3m/s wind in SSE, S & SSW directions; stability categories A-D
	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D
Evening	Noise-enhancing meteorological conditions	3m/s wind in N, NNE, NE, ENE & E directions; stability categories A-D
	Standard meteorological conditions	0.5m/s wind in source-to-receiver direction; stability categories A-D

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

*Notes:

- m/s = metre per second
- SSE = South South East
- S = South
- SSW = South South West
- N = North
- NNE = North North East
- NE = North East
- ENE = East North East
- E = East
- NNW = North North West
- Wind in source-to-receiver direction was considered using the closest direction in a 16-direction compass to the source-to-receiver direction.

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

Fact Sheet D of the *NPfI* does not provide guidance regarding the use of drainage flow winds during temperature inversions (e.g. a frequency of occurrence threshold or the presence of certain topography). A pragmatic risk management approach has therefore been adopted, whereby temperature inversions with drainage flow winds are only considered in the assessment when the frequency of occurrence is greater than 10% in any season. Based on recent discussions with a senior NSW Environment Protection Authority (EPA) officer, this approach is considered reasonable and acceptable.

Analysis of the meteorological data following the methodology directed in Fact Sheet D establishes a frequency of occurrence of night time meteorological conditions involving temperature inversions with drainage flow winds at less than 10% in any season. Such infrequent noise-enhancing meteorological conditions will be managed by Whitehaven using a pro-active noise management system with identification of modified operating scenarios (Section 5.3) to maintain compliance with relevant Development Consent conditions in the event that adverse weather conditions are experienced.

P10 Meteorological Conditions

The *NPfI* states the following:

> *Prediction approaches that present a statistical distribution of noise levels based on a range of prevailing meteorological conditions are useful in explaining to the community the range of noise levels that could result from a development.*

Therefore, a statistical analysis of noise levels based on the meteorological data local to the site is also presented in the assessment to provide further depth and breadth to the prediction of potential noise impacts to the community.

Statistical occurrences of meteorological conditions can be used to calculate a 10th percentile exceedance noise level, or P10 noise level (i.e. the level that is exceeded 10% of the time). This alternative prediction procedure involves significantly greater computational complexity than the use of a single set of meteorological conditions (Table 5-1). The P10 methodology provides a recognised and rigorous method for the prediction of potential noise impacts and a useful reference point for noise predictions determined in accordance with Fact Sheet D of the *NPfI*. It is also consistent with a risk-based approach to noise management. Prior to the publication of the *NPfI*, the approach of using the 10th percentile calculated noise level as a principal measure of noise impacts has been considered acceptable by the DP&E and the EPA for previous similar mining project assessments.

It should be noted that this approach can be considered to be generally consistent with the *NPfI*'s approach to amenity noise levels. When referring to the latter, the *NPfI* states the following:

> *They are based on protecting the majority of the community (90%) from being highly annoyed by industrial noise.*

The data for wind direction and wind speed are classified into eight directional intervals and five speed intervals (between 0.5 m/s and 3 m/s - with all other instances of wind speed described as "calm").

The above procedure considers all meteorological conditions at all receivers, and the conditions which determine the 10th percentile noise level would differ between receivers.

In addition to the highest noise predictions under the relevant meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (described in Table 5-1), this assessment also presents 10th percentile calculated noise levels (P10).

5.2 Investigation of Feasible & Reasonable Noise Mitigation Measures

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

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

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

a. Removal of a proposed open cut close to receivers south-west of the Project.

b. Redesign of the waste rock emplacement area and mine progression direction to provide opportunities for shielding of operations during adverse meteorological conditions.

c. Treatment of a selection of mobile plant and infrastructure items to reduce emitted noise levels.

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

Table 5-2 provides a summary of the specific mitigation measures proposed for the Project in order to reduce potential noise emissions.

Table 5-2 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 of selected infrastructure items in the mine infrastructure area.
All Project Life	Acoustic design incorporated into mine planning, including optimising shielding of selected haul roads, truck numbers assigned to haul roads (with more trucks using haul roads further away from receivers), and alignment of haul roads away from receivers where possible.
All Project Life	Real-time monitoring and forecasting system, incorporating noise and meteorological monitoring, with the purpose of anticipating upcoming periods of very noise-enhancing meteorological conditions that may generate noise exceedances at receivers surrounding the mine. Such a system would allow the mine operator to prepare to modify operations to reduce noise levels as far as reasonably and feasibly practical 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.

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

It is proposed to have a real-time monitoring and forecasting system in place to assist with managing noise levels during upcoming periods of very noise-enhancing meteorological conditions. This system would be used for all stages of the Project life to assist with the management of noise. Very noise-enhancing meteorological conditions would be identified by a combination of noise and meteorological monitoring and meteorological forecasting, where noise monitoring indicates the trend in actual noise levels at a location and meteorological monitoring and forecasting 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, mine operators should 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.

Whitehaven has been successfully implementing and managing real-time monitoring and forecasting systems for other similar mining projects (e.g. Maules Creek Coal Project, Tarrawonga Coal Mine).

5.4 Indicative Fleet List

Table 5-3 presents an indicative schedule of equipment and the period of operation of plant (i.e. day/evening/night) used for impact assessment purposes. Mining fleet would be confirmed during detailed mine design.

Table 5-3 Indicative Fleet List

Fleet/ Infrastructure Item	Location/ Function	Number of Equipment			Period
		Year 3	Year 7	Year 21	
Ultra Class Rear-dumping Haul Truck	Haul roads (waste rock removal)	12	45	39	Day, evening, night
	Haul roads (coal removal)	7	5	4	Day, evening, night
Dozer ~640 kilowatt (kW)	Waste Emplacement	2	3	3	Day, evening, night
Dozer ~100 tonne (t) / 900 horsepower (HP)	Coal and Partings Preparation	2	5	5	Day, evening, night
	Drill Preparation and Pit Support	1	2	2	Day, evening, night
Dozer ~46 t / 580 HP	Excavation Support	2	4	4	Day, evening, night
Dozer ~640 kilowatt (kW)	Product Stockpile Reclaim	3	3	3	Day, evening, night
Excavator ~800 t / 2x1,900 HP	Waste rock removal	2	6	6	Day, evening, night
Excavator ~350 t / 1,350 HP	Waste rock removal	1	2	2	Day, evening, night
	Coal removal	1	1	1	Day, evening, night
Blasthole Drill ~440 HP / 225 mm hole	Waste rock removal	2	1	0	Day, evening, night
	Coal removal	2	6	7	Day, evening, night
Grader ~530 HP	Haul roads	1	5	5	Day, evening, night
Water Truck ~100 t capacity	Haul roads	1	4	3	Day, evening, night
Front End Loader ~600 kW	Infrastructure area	1	1	1	Day, evening, night
Road Truck	Infrastructure area	1	1	1	Day, evening, night
Mine Infrastructure Area	Infrastructure area	-	-	-	Day, evening, night
Locomotive *	Rail loop	3	3	3	Day, evening, night

* Note: The Project would 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 as trains with three locomotives have been assessed in all scenarios.

5.5 Indicative Sound Power Levels

Table 5-4 presents modelled plant sound power levels (SWLs), a description of modelled noise controls implemented to plant items where relevant, and references for all the SWLs used in the assessment in accordance with the *NPfI*.

The nominated SWLs included in Table 5-4 are generally indicative of leading practice mining equipment (for noise performance). Mobile fleet and acoustic designs for infrastructure items would be selected as part of the detailed mine design, however it is expected SWLs would be generally consistent with those presented in Table 5-4.

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

Table 5-4 Indicative Equipment Sound Power Levels

Fleet/ Infrastructure Item		Indicative Sound Power Level L_{Aeq} (dBA) [1]	Comments	Reference
Mobile Fleet	Ultra Class Rear-dumping Haul Truck [2]	113	Mitigated - full suppression kit (engine cooling fan silencer; and low noise emission muffler/exhaust system)	Sound Power Level of Ultra Class Trucks letter (Liebherr Australia, February 2018) [3]
	Dozer ~100 tonne (t) / 900 HP [4]	113	Mitigated - full suppression kit; restricted to 1st gear (forward & reverse) during adverse conditions; minimal track slapping	Mt Arthur Coal Open Cut Modification - Noise & Blasting Assessment (Wilkinson Murray, January 2013)
	Dozer ~46 t / 580 HP [4]	110	Mitigated - full suppression kit; restricted to 1st gear (forward & reverse) during adverse conditions; minimal track slapping	Mt Arthur Coal Open Cut Modification - Noise & Blasting Assessment (Wilkinson Murray, January 2013)
	Dozer ~640 kW	107	Mitigated – 1st gear restricted during adverse conditions; Hushpak sound attenuated idlers & grouser dampers	Komatsu D4775A-5EO Moolarben Coal Operations Unit 311 - Sound Power and Operator Noise Exposure Assessment (Global Acoustics, March 2016); Komatsu D475 Undercarriage Noise Testing - Pre and Post Grouser Damper Fitting (Hushpak Engineering, September 2016)
	Excavator ~350 t / 1,350 HP	113	Mitigated - full suppression kit	Maules Creek Coal Project - Excavator, Grader, Water Cart, and Wheel Loader Sound Power Survey 2017 (Global Acoustics, March 2018)
	Excavator ~800 t / 2x1,900 HP	114	Mitigated - full suppression kit	Maules Creek Coal Project - Excavator, Grader, Water Cart, and Wheel Loader Sound Power Survey 2017 (Global Acoustics, March 2018); Sound Power Level of Hitachi EX8000 Excavators letter (Hitachi Construction Machinery, March 2018) [3]
	Blasthole Drill ~440 HP / 225 mm hole	113	-	Belmont Coal Project Via Gunnedah - Noise and Vibration Assessment (Spectrum Acoustics, August 2007)
	Water Truck ~100 t capacity	112	-	Maules Creek Coal Project - Excavator, Grader, Water Cart, and Wheel Loader Sound Power Survey 2017 (Global Acoustics, March 2018)
	Front End Loader ~600 kW	110	-	Maules Creek Coal Project - Excavator, Grader, Water Cart, and Wheel Loader Sound Power Survey 2017 (Global Acoustics, March 2018)
	Grader ~530 HP	106	-	Maules Creek Coal Project - Sound Power Evaluation (Global Acoustics, November 2017)

Fleet/ Infrastructure Item		Indicative Sound Power Level L_{Aeq} (dBA) [1]	Comments	Reference
	Road Truck [5]	107	Assumed to be travelling between 30 and 40 kilometres per hour when on site	Narrabri Mine Stockpile Extension Modification - Noise Assessment (Spectrum Acoustics, April 2015)
Mine Infrastructure Area	Coal Preparation Plant	115	No detailed acoustic design; at least partial enclosure/acoustic shrouding	Maules Creek Coal Project - Excavator, Grader, Water Cart, and Wheel Loader Sound Power Survey 2017 (Global Acoustics, March 2018)
	Sizer	103	Acoustic design - select façades (e.g. double skin and insulation); special design of penetrations; etc.	Ulan Coal Mine Continued Operations - Noise & Vibration Assessment (Wilkinson Murray, August 2009)
	Train Loadout Bin	101	Acoustic design - select façades (e.g. double skin and insulation); enclosure containing wagons being loaded	Ulan Coal Mine Continued Operations - Noise & Vibration Assessment (Wilkinson Murray, August 2009)
	Surge Bin	96	Acoustic design - select façades (e.g. double skin and insulation); special design of penetrations; etc.	Mt Arthur Coal Open Cut Modification - Noise & Blasting Assessment (Wilkinson Murray, January 2013)
	Reject Bin	96	Acoustic design - select façades (e.g. double skin and insulation); special design of penetrations; etc.	Mt Arthur Coal Open Cut Modification - Noise & Blasting Assessment (Wilkinson Murray, January 2013)
	Stacker	102	No acoustic design	Maules Creek Coal Project - Sound Power Evaluation (Global Acoustics, November 2017)
	Conveyors	77/m	Acoustic design - polyethylene idlers; shielded near belt	Ulan Coal Mine Continued Operations - Noise & Vibration Assessment (Wilkinson Murray, August 2009)
	Locomotive during loading process	102	No acoustic treatment	Direct measurements of Pacific National locomotives during loading process at Maules Creek Coal Project (Wilkinson Murray, 15 March 2018)

Notes: 1) Indicative sound power levels with noise controls. Mining fleet would be selected during detailed mine design.
2) Based on the dispatch system of the Maules Creek Coal Project operated by Whitehaven and considered to be representative of the Project in the way it is operated, approximately 32% of haul trucks are found to be stationary (i.e. either waiting to be loaded inside the pit, loading inside the pit, waiting to unload at the mine infrastructure area, or unloading at the mine infrastructure area), approximately 35% travelling uphill loaded, and approximately 32% travelling downhill unloaded at any one time during a typical busy period.
3) Letter included in Appendix C.
4) The assessment has considered mine-operated routines which dictate that at least 50% of pit dozers are expected to be stationary during a typical busy 15-minute period.
5) Based on the length of the proposed access road and the assumed road truck speed, only one truck movement (either to or from the mine infrastructure area) was considered in the assessment.

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 relevant Project noise trigger levels.

As stated in Section 4.3, 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 (Table 5-1) resulting in the highest noise levels.

Table 5-5 sets out the assessed receivers and receivers contained in the different catchment areas.

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

Direction	Assessed Receiver	Catchment Area Receivers
North	1t	Receivers 1aa, 1ab, 1ac, 1ad, 1ae, 1aj, 1f, 1x, 1t and 339
North-East	221b	Receivers 67, 221a, 221b, 313 and 1i
East	1o	Receivers 1g, 1m, 1n and 1o
East	98	Receivers 94, 98, 102, 317 and 1l
South-East	108a	Receivers 103, 108a, 108b, 174a, 174b, 310, 318 and 319
South-West	131b	Receivers 127c, 131a, 131b, 132, 133a, 141, 1v, 1w and 1z
South-West	147a	Receivers 143, 144a, 144b, 146a, 146b, 147a, 147b, 153, 160, 1af and 1y
West	1u	Receivers 127a, 127b and 1u
West	139	Receivers 125, 137, 138, 139, 140 and 334
North-West	87b	Receivers 86, 87a, 87b, 88, 118, 122, 303a and 303b

Table 5-6 summarises the C-weighted noise level minus A-weighted noise level assessment results for all three Project Years modelled.

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

Assessed Receiver	$L_{Ceq,15min}$ Noise Level - $L_{Aeq,15min}$ Noise Level (dB)		
	Year 3	Year 7	Year 21
1t	16.2	15.9	16.8
221b	13.4	13.7	12.4
1o	13.2	15.5	15.6
98	16	16.8	15
108a	17.7	17.2	18.4
131b	12	11.1	15.8
147a	10	12	13.7
1u	13.5	14.9	17.1
139	16	15.2	14.5
87b	15.2	14.8	14.5

Notes: 1. Levels highlighted in yellow indicate differences of 15 dB or more

A typical low-frequency spectrum shape of long distance mining noise in third octave bands between 10 Hz to 160 Hz was measured as part of a noise audit conducted at Bulga Village (*Bulga Village Noise Audit – Final Report*, Wilkinson Murray, 2016). The spectrum shape, shown in Table 5-7, corresponds to an average of 37 low-frequency measurements of mining noise from an open cut coal mine comparable in size and operation to the Project (i.e. using loaders and excavators and loading into trucks for haulage to the ROM pad at the mine infrastructure area via internal haul roads). The low-frequency measurements were conducted at an approximate distance of 3 to 4 km from the open cut coal mine with a propagation path comparable to those surrounding the Project.

Table 5-7 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

Project

The low-frequency spectrum shape was then normalised to the 63 Hz third-octave component of the predicted noise levels at each of the assessed receivers and compared against the third-octave low-frequency noise threshold curve (Section 4.3). The 63 Hz third-octave component is considered to be the most reliable third-octave as source spectra were not always available at lower third-octaves.

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.

5.7 Predicted Operational Noise Levels from the Project

The predicted $L_{Aeq,15min}$ operational noise levels at each receiver are presented in Table 5-8. Results are presented for each of Project Years 3, 7 and 21 under both Fact Sheet D and 10th percentile (P10) meteorological conditions (Section 5.1.2). The maximum result of applicable Fact Sheet D meteorological conditions (i.e. standard conditions and noise-enhancing conditions) is presented.

Figures showing indicative noise contours of noise levels predicted under the relevant Fact Sheet D meteorological conditions (Table 5-1) for each of the three Project Years modelled are presented in Appendix D.

Within Table 5-8, operational noise levels predicted under the relevant Fact Sheet D meteorological conditions (Table 5-1) at privately-owned receivers in excess of the Project noise trigger levels are shown in yellow. The mine-owned receivers are included in Table 5-8 for the purpose of information only.

Operational noise levels predicted under P10 meteorological conditions have been included to provide further contextualisation of noise impacts to the community. However, P10 noise levels have not been used for assessment purposes.

As described in Section 5.1.2, the meteorological conditions for assessment determined in accordance with Fact Sheet D of the *NPfI* are considered conservative. The resulting maximum noise predictions are therefore also considered conservative.

This conservatism is evident when reviewing the predicted P10 levels, which are generally some 2 to 3 dB below the maximum noise levels predicted in accordance with Fact Sheet D of the *NPfI*.

Upon review of the predicted noise levels at receivers 141 and 1y, it can be inferred that no exceedances of the relevant criteria would be expected at the approved dwelling location on property 144.

Table 5-8 - Predicted $L_{Aeq,15min}$ Operational Noise Levels from Project

Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)																		Noise Trigger Level D/E/N (dBA)
	Year 3						Year 7						Year 21						
	Day		Eve		Night		Day		Eve		Night		Day		Eve		Night		
	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	
Privately-owned Dwellings																			
67	20	18	16	18	19	18	24	23	21	23	23	23	22	20	14	21	21	21	40 / 35 / 35
86	11	9	11	9	11	10	18	17	19	17	19	18	11	9	10	9	10	10	40 / 35 / 35
87a	21	20	21	20	21	20	26	25	27	25	27	26	22	21	22	21	22	21	40 / 35 / 35
87b	22	21	22	21	22	21	28	27	28	27	28	27	23	21	22	21	22	21	40 / 35 / 35
94	14	17	16	18	18	17	19	21	20	21	22	21	20	25	18	25	25	25	40 / 35 / 35
98	15	18	17	19	19	19	20	23	22	24	24	23	25	28	21	28	28	28	40 / 35 / 35
102	16	19	20	20	21	20	19	22	23	23	24	22	19	27	25	28	29	28	40 / 35 / 35
103	12	15	16	16	17	16	16	18	19	18	19	18	15	20	21	21	22	21	40 / 35 / 35
108a	18	21	24	23	24	22	21	23	27	25	27	25	22	26	30	28	30	28	40 / 35 / 35
108b	15	18	20	19	20	19	18	21	23	21	23	21	18	22	24	23	25	23	40 / 35 / 35
118	18	17	18	17	18	17	24	23	24	23	24	23	20	19	20	19	20	20	40 / 35 / 35
122	20	19	21	20	21	20	25	25	26	25	26	25	23	21	23	22	23	22	40 / 35 / 35
125	21	25	29	26	29	26	26	29	31	29	31	30	27	26	28	27	28	27	40 / 35 / 35
127a *	25	29	34	31	34	31	28	31	35	33	35	33	30	29	32	30	32	30	40 / 35 / 35
127b *	34	34	38	36	38	36	34	35	40	37	40	38	36	35	38	36	38	36	40 / 35 / 35
127c *	36	38	42	39	42	39	37	38	42	40	42	40	35	37	41	38	41	39	40 / 35 / 35
131a	30	31	36	33	36	33	30	32	37	34	37	34	29	32	37	34	37	34	40 / 35 / 35
131b	28	30	34	32	34	32	29	31	36	33	36	33	28	31	36	33	36	33	40 / 35 / 35
132	28	30	34	32	34	31	28	31	35	33	35	33	28	31	36	33	36	33	40 / 35 / 35
133a	27	30	34	31	34	31	27	30	35	33	35	33	29	32	35	33	35	34	40 / 35 / 35
137	18	20	23	21	23	21	22	24	26	25	26	25	23	22	24	23	24	23	40 / 35 / 35
138	17	18	20	19	20	19	20	22	24	23	24	23	22	21	23	21	23	22	40 / 35 / 35
139	18	22	25	23	25	23	21	25	27	26	27	26	24	24	26	24	26	24	40 / 35 / 35

Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)																		Noise Trigger Level D/E/N (dBA)
	Year 3						Year 7						Year 21						
	Day		Eve		Night		Day		Eve		Night		Day		Eve		Night		
	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	
Privately-owned Dwellings																			
140	18	22	24	23	24	23	20	25	27	26	27	26	24	24	26	24	26	24	40 / 35 / 35
141	24	27	31	28	31	28	25	28	33	30	33	30	25	28	33	30	33	30	40 / 35 / 35
143	20	23	26	25	26	25	21	26	29	28	29	28	21	26	29	27	29	27	40 / 35 / 35
144a	19	21	25	23	25	23	20	25	28	26	28	26	20	25	27	26	27	26	40 / 35 / 35
144b	19	21	25	23	25	23	21	25	28	26	28	26	20	24	28	26	28	26	40 / 35 / 35
146a	14	16	19	17	19	17	17	21	23	22	23	22	17	19	21	20	21	20	40 / 35 / 35
146b	14	16	19	17	19	17	17	21	23	22	23	22	17	19	21	20	21	20	40 / 35 / 35
147a	16	19	22	20	22	20	19	22	25	24	25	24	18	22	25	23	25	23	40 / 35 / 35
147b	13	15	17	16	17	16	17	19	21	20	21	20	16	18	20	19	20	19	40 / 35 / 35
153	20	22	26	24	26	24	22	25	28	27	28	26	22	25	29	27	29	27	40 / 35 / 35
160	12	14	16	15	17	15	16	18	20	19	20	19	15	16	19	17	19	17	40 / 35 / 35
174a	18	19	22	20	22	20	20	22	25	24	25	23	19	22	26	24	26	24	40 / 35 / 35
174b	17	18	21	20	21	19	19	21	24	23	24	23	18	22	25	24	25	24	40 / 35 / 35
221a	18	17	15	17	18	17	23	22	20	22	22	22	21	20	14	20	20	20	40 / 35 / 35
221b	19	17	15	18	18	18	23	22	20	22	23	22	22	20	14	20	21	20	40 / 35 / 35
310	17	20	21	21	22	20	19	22	24	23	25	23	20	26	28	27	29	27	40 / 35 / 35
317	14	16	16	17	18	17	18	20	20	20	21	20	17	23	20	23	24	23	40 / 35 / 35
318	15	19	20	19	20	19	18	21	23	22	23	22	18	25	26	26	27	25	40 / 35 / 35
319	15	18	19	18	19	18	18	20	22	21	22	21	17	22	24	23	25	23	40 / 35 / 35
334	20	23	26	24	26	24	24	27	29	28	29	28	25	25	27	25	27	25	40 / 35 / 35
Mine-owned Dwellings																			
1aa	23	20	16	21	20	20	33	31	27	31	31	31	27	24	15	25	25	25	n/a
1ab	27	24	20	25	24	25	31	29	26	30	29	29	23	19	12	20	20	20	n/a
1ac	20	17	13	18	18	18	28	26	23	27	27	26	23	20	8	21	20	21	n/a
1ad	36	32	26	33	33	33	47	44	41	45	44	45	31	28	17	27	27	28	n/a

Receiver ID	$L_{Aeq,15min}$ Noise Level (dBA)																		Noise Trigger Level D/E/N (dBA)
	Year 3						Year 7						Year 21						
	Day		Eve		Night		Day		Eve		Night		Day		Eve		Night		
	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	Max	P10	
1ae	33	30	25	31	30	30	41	38	35	39	39	39	33	29	17	29	29	29	n/a
Mine-owned Dwellings																			
1af	16	19	22	21	22	21	20	23	26	24	26	24	19	22	26	24	26	24	n/a
1aj	28	25	23	25	26	26	38	35	34	35	36	36	26	24	20	24	24	24	n/a
1f	35	33	27	33	33	33	48	45	44	45	46	46	28	25	21	25	25	26	n/a
1g	22	22	7	22	22	22	27	26	15	26	27	26	23	21	9	21	22	21	n/a
1i	20	19	16	19	20	19	25	24	22	24	25	24	24	22	13	22	22	22	n/a
1l	17	23	18	23	23	23	19	25	24	26	27	26	29	32	25	33	32	32	n/a
1m	19	19	17	20	20	19	23	23	21	23	24	23	24	23	18	23	23	23	n/a
1n	19	19	17	19	20	19	23	23	20	23	23	23	24	23	19	24	23	23	n/a
1o	20	19	16	20	20	20	24	24	18	24	24	24	25	24	18	24	24	24	n/a
1t	32	29	23	30	29	29	41	38	34	39	39	39	30	27	14	27	27	27	n/a
1u	28	30	35	32	35	32	30	32	37	34	37	34	32	31	33	31	33	31	n/a
1v	47	47	51	49	51	49	47	47	51	49	51	49	46	47	51	49	51	49	n/a
1w	29	30	35	32	35	32	29	31	36	33	36	33	29	32	37	34	37	34	n/a
1x	36	33	25	34	34	34	49	45	43	47	46	46	32	28	15	28	28	28	n/a
1y	20	23	27	25	27	25	22	26	29	27	29	27	21	25	30	28	30	28	n/a
1z	31	33	37	35	37	35	32	34	39	36	39	36	30	33	38	34	38	35	n/a
88	26	24	25	24	25	24	32	30	31	30	31	31	23	21	22	21	22	22	n/a
303a	21	19	20	19	20	20	27	26	27	26	27	26	21	20	21	20	21	20	n/a
303b	22	20	21	20	21	20	28	26	27	26	27	27	22	20	21	20	21	20	n/a
313	18	17	15	17	17	17	22	21	19	21	22	21	21	19	14	19	20	19	n/a
339	30	28	24	28	28	28	39	36	32	37	36	36	30	28	17	28	28	28	n/a

* The owner of this property has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.

Notes: 1. P10 = Noise levels predicted to result under 10th percentile meteorological conditions as described in Section 5.1.2.

2. Max = Maximum noise levels predicted under the relevant Fact Sheet D meteorological conditions (Table 5-1) as described in Section 5.1.2. Values may be less than the calculated P10 value.

3. Levels highlighted in yellow indicate predictions under the relevant Fact Sheet D meteorological conditions in excess of the Project noise trigger levels at privately-owned receivers.

"Significant" evening and night time exceedances (greater than 5 dB according to the *VLAMP*) are predicted at receiver 127c for the maximum predicted noise level, while "moderate" evening and night time exceedances (between 3-5 dB according to the *VLAMP*) are predicted at receiver 127b. Whitehaven has been in dialogue with the owner of the property (receivers 127a, 127b and 127c) regarding entering into a potential noise agreement and in addition, the owner of these receivers has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.

"Negligible" evening and night time exceedances (between 1-2 dB according to the *VLAMP*) are predicted at receivers 131a, 131b and 132. As described in the *VLAMP*, such "negligible" exceedances would not be discernible by the average listener.

A summary of those receivers predicted to exceed the Project noise trigger levels under the relevant meteorological conditions is provided in Table 5-9. The receivers are segregated according to noise impacts as interpreted by the *VLAMP* (Section 4.4) during the Project year/assessment period with potentially the most impact.

Table 5-9 Summary of Potential Exceedances at Privately-owned Properties

Zone	Exceedance Level	Receivers exceeding under relevant meteorological conditions		
		Years 1-6	**Years 7-15**	**Years 16-25**
Noise Management Zone	**1 to 2 dB**	Receiver 131a	Receivers 131a and 131b	Receivers 131a, 131b and 132
	3 to 5 dB	Receiver 127b*	Receiver 127b*	Receiver 127b*
Noise Affectation Zone	**>5 dB**	Receiver 127c*	Receiver 127c*	Receiver 127c*

* The owner of these properties has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine for predicted noise impacts.

Section 5.12 provides a description of Whitehaven's obligations with respect to these zones of management and affectation. As shown in Table 5-9, noise levels after the implementation of noise mitigation measures are predicted to exceed the 35 dBA $L_{Aeq,15min}$ trigger noise level at a total of five receivers located on three privately-owned properties. This relatively limited number of exceedances indicates that, with the implementation of proposed mitigation, noise from the Project is being managed to the maximum extent possible, and no other measures would be of material benefit.

5.8 Conservatism of Fact Sheet D Meteorological Conditions

5.8.1 Difference in Outcome using P10 and Maximum Noise Levels Predicted under the Relevant Fact Sheet D Meteorological Conditions

Noise predictions under P10 meteorological conditions (Section 5.1.2) have not been used for assessment purposes to provide a conservative appraisal of noise impacts. Assessing P10 noise levels against the Project trigger noise levels would have resulted in evening and night time exceedances at two receivers only, namely receivers 127b and 127c (both located on the same privately-owned property). Exceedances at receiver 127b would have been considered "negligible" while those expected at receiver 127c would have qualified as "moderate" (according to the *VLAMP*).

As such, noise impacts would have been considered as less severe had the assessment been conducted under P10 meteorological conditions.

5.8.2 Conservatism of Fact Sheet D Wind-Related Noise-Enhancing Meteorological Conditions

For receivers located downwind of the nominated Fact Sheet D wind-related noise-enhancing conditions (e.g. receivers located south, south-west or west of the Project in the evening and night periods), a 1 to 4 dB difference is generally found between the maximum noise levels predicted in accordance with Fact Sheet D of the *NPfI* and P10 noise predictions, with the former representing the higher levels.

As shown in Appendix B, the process to determine the significance of wind-related noise-enhancing conditions in accordance with Fact Sheet D of the *NPfI* is conservative as it considers all winds within a 112.5 degree arc when assessing the significance of winds in a particular direction. For example, to assess whether a north-easterly wind is deemed significant during a particular assessment period and season, all winds included in the arc spanning 348.75 degrees to 101.25 degrees are considered, even though a component of wind in that 112.5 degree-arc does in fact prevent the propagation of noise in the south-westerly direction.

Therefore, receivers located south-west of the Project may in fact not be exposed to north-easterly winds with the potential to enhance noise levels for more than 30% of the time (during a particular assessment period and season) as the threshold of occurrence from the methodology set out in Fact Sheet D of the *NPfI* may suggest.

Appendix E provides a selection of cumulative frequency of occurrence noise graphs showing the percentage of time for which noise levels are expected to be exceeded in a particular assessment period and season. The six graphs included in Appendix E show the cumulative frequency of occurrence of night time noise levels in winter for receivers 127b, 127c, 131a, 131b, 132 and 133a. Only the Project Year generating the highest noise levels was plotted (i.e. Project Year 7 for receivers 127b, 127c and 131a, and Project Year 21 for receivers 131b, 132 and 133a).

Table 5-10 summarises the maximum noise levels predicted under the relevant Fact Sheet D meteorological conditions ('Max' noise predictions in Table 5-8) together with various percentile exceedance noise levels to provide further understanding as to how often the 'Max' predictions are expected at the above six identified receivers during the night time assessment and winter season. Table 5-10 includes the $L_{Aeq,15min}$ noise level that is exceeded 1% of the winter night time period (P1), 10% of the winter night time period (P10), 50% of the winter night time period (P50) and 90% of the winter night time period (P90).

Table 5-10 Maximum Fact Sheet D Noise Predictions & Percentile Exceedance Noise Levels (Night Time Period, Winter Season)

Receiver ID	Project Year	$L_{Aeq,15min}$ Noise Level (dBA)				
		Percentile Exceedance Noise Level				Max (See Table 5-8)
		P1	P10	P50	P90	
127b	Year 7	40	38	33	29	40
127c	Year 7	42	40	37	31	42
131a	Year 7	37	35	30	24	37
131b	Year 21	36	33	29	25	36
132	Year 21	36	33	29	25	36
133a	Year 21	35	34	28	24	35

Review of the graphs and Table 5-10 indicates that the maximum noise predictions under meteorological conditions determined in accordance with Fact Sheet D are in fact expected to occur between 1 and 2% of the night time period in Winter (i.e. considerably less than 30% of the time as implied by the *NPfI*). Table 5-10 shows that for the selected graphs, the maximum noise levels predicted in accordance with Fact Sheet D of the *NPfI* are the same as the P1 noise levels.

Provided the difference of 1-4 dB found between the Fact Sheet D and P10 noise predictions at receivers located downwind of the nominated Fact Sheet D wind-related noise-enhancing conditions, it is expected the frequency of occurrence at which Fact Sheet D noise predictions occur would be comparable to those indicated in the Appendix E graphs (i.e. less than 2%).

5.8.3 Conservatism of Vertical Temperature Gradients assumed for Inversion and Non-Inversion Meteorological Conditions in accordance with Fact Sheet D

When addressing all standard meteorological conditions and all wind-related noise-enhancing conditions which are representative of stability categories A-D, a vertical temperature gradient of -0.5 degrees Celsius per 100 metres (°C/100 m) was adopted for noise modelling purposes. This is a conservative approach as -0.5°C/100 m represents the maximum vertical temperature gradient for stability category D in accordance with the *NPfI*, with lower vertical temperature gradient values resulting in lower noise predictions. It is expected that during standard meteorological conditions and the nominated wind-related noise-enhancing conditions, noise levels at the identified receivers would at times be 1-2 dB lower than the noise predictions reported in the assessment.

When addressing noise-enhancing conditions for stability category F, a vertical temperature gradient of 4°C/100 m was adopted for noise modelling purposes. This is considered conservative as 4°C/100 m represents the minimum vertical temperature gradient for stability category G in accordance with the *NPfI*. During temperature inversions, noise levels might be 1-4 dB lower than those predicted using a vertical temperature gradient of 4°C/100 m.

5.9 Temporary Infrastructure Area

As discussed in Section 2.2.1, the Project would include a temporary infrastructure area, as per the Approved Mine.

Given the temporary infrastructure area would be developed further toward the centre of the mine site in comparison with the mine infrastructure area, and that during its operation the Project would use approximately 40% of the mining fleet required for Project Year 3, it is expected the temporary infrastructure area would result in no additional noise impacts at privately-owned receivers in comparison with the results predicted for Project Year 3.

5.10 Vacant Land Noise Assessment

According to the *VLAMP*, the Project is subject to noise criteria applicable to "more than 25% of any privately-owned land".

Wilkinson Murray has reviewed potential impacts on the closest privately-owned property, namely property 127 (noting that operational noise impacts at receivers on property 127 are considered in Table 5-8).

At property 127, the area of exceedance of the vacant land noise criterion would be less than 25% of the total land and as such this property would not be subject to acquisition upon request as a result of the vacant land noise assessment.

5.11 Cumulative Noise

If approved, the Project may operate concurrently with the Rocglen Coal Mine, the Tarrawonga Coal Mine, the Boggabri Coal Mine and the Maules Creek Coal Mine. In this event, receivers may potentially be exposed to noise from all five (5) industrial sources simultaneously.

It should be noted that the Maules Creek Coal Mine (located some 20 km north-west of the Project) is expected to have a negligible impact on the receivers in the vicinity of the Project and therefore the cumulative noise calculations does not include the Maules Creek Coal Mine.

Cumulative noise levels were calculated considering the relative noise contributions from the Project, and the following adjacent mines:

- Rocglen Coal Mine – open cut coal mine approved to haul up to 1.5 Mtpa of ROM coal along the Approved Whitehaven ROM coal road transport route. Project Approval 10_0015 for the Rocglen Coal Mine Extension Project approved in 2011.
- Tarrawonga Coal Mine – open cut coal mine approved to haul up to 3 Mtpa of ROM coal. Project Approval 11_0047 for the Tarrawonga Coal Project approved in 2013.
- Boggabri Coal Mine – open cut coal mine approved to extract up to 8.6 Mtpa ROM coal. Project Approval 09_0182 for the Boggabri Coal Mine Continuation Project approved 2012.

The contribution of noise from the Rocglen Coal Mine, Tarrawonga Coal Mine and Boggabri Coal Mine has been taken from predictions of noise emissions included in the following documents:

- *Tarrawonga Coal Project Environmental Assessment Noise and Blasting Impact Assessment* prepared by Wilkinson Murray (2011a).
- *Acoustic Impact Assessment Continuation of Boggabri Coal Mine Environmental Assessment* prepared by Bridges Acoustics (2010).
- *Noise and Vibration Impact Assessment Rocglen Coal Mine Extension Project* prepared by Spectrum Acoustics (2010).

The methodology used for the cumulative noise predictions was to logarithmically sum the predicted night time noise levels for the Project, Rocglen Coal Mine, Boggabri Coal Mine and Tarrawonga Coal Mine for key receivers.

The cumulative noise predictions consider the average L_{Aeq} noise level over the entire night period (10.00 pm to 7.00 am, a period of nine [9] hours). The night time period was selected as it is the worst-case period in terms of the predicted Project noise levels, and therefore there is more potential for the Project to contribute to cumulative noise issues in this period.

Noise predictions associated with the Project and the Tarrawonga Coal Mine represent $L_{Aeq,9hr}$ levels as calculated using ENM. For these receivers, the $L_{Aeq,15min}$ noise levels presented in Table 5-8 were conservatively converted to $L_{Aeq,9hr}$ levels by subtracting 2 dB. In addition, because no $L_{Aeq,9hr}$ levels were readily available for the Rocglen Coal Mine and Boggabri Coal Mine and the receivers are generally further from these mines then to the Project, the reported $L_{Aeq,15min}$ noise levels were conservatively converted to $L_{Aeq,9hr}$ levels by subtracting 3 dB, rather than 2 dB.

The Tarrawonga Coal Project and Boggabri Coal Continuation Project started in 2013 while the Rocglen Coal Mine Extension Project started in 2012. For the purposes of cumulative predictions, the closest available corresponding noise prediction years for the two (2) projects years were selected. Based on the approved mine lives of the Tarrawonga Coal Mine, Boggabri Coal Mine and Rocglen Coal Mine, operations at these mines will cease before Year 23 of the Project. Therefore a cumulative assessment of this year has not been completed. The summation of the various noise predictions used for cumulative noise predictions is summarised below:

- Cumulative Year 3 = Year 3 Project + Year 10 Rocglen Coal Mine Extension Project + Year 4 Tarrawonga Coal Project + Year 5 Boggabri Coal Continuation Project.
- Cumulative Year 7 = Year 7 Project + Year 16 Tarrawonga Coal Project + Year 10 Boggabri Coal Continuation Project.

The cumulative noise predictions was undertaken for all receivers at which there is predicted noise level data for the Project and predicted noise level data for at least one of the Rocglen Coal Mine Extension Project, Tarrawonga Coal Project or Boggabri Coal Continuation Project. Noise predictions for those receivers were based on point source calculations, where available, or noise contours from the abovementioned documents. The predicted cumulative noise levels are presented in Table 5-11.

Table 5-11 indicates that night time cumulative noise levels would comply with the recommended acceptable amenity criterion (40 dBA $L_{Aeq,9hr}$) at all privately-owned receivers, including the approved dwelling location on property 144.

Table 5-11 Predicted Night Time Cumulative $L_{Aeq,9hr}$ Operational Noise from the Project, Boggabri Coal Continuation Project, Tarrawonga Coal Project & Rocglen Coal Mine Extension Project

Night Time $L_{Aeq,9hr}$ Noise Level (dBA)									Recommended Acceptable Criterion $L_{Aeq,9hr}$ (dBA)
	Project		Tarrawonga Coal Project		Boggabri Coal Continuation Project	Rocglen Coal Mine Extension Project	Cumulative Noise		
Rec ID	Year 3	Year 7	Year 4	Year 16	Years 5 and 10	Year 10	Year 3	Year 7	
Privately-owned Dwellings									
67	17	21	23	22	<31	27	33	29	40
86	9	17	26	24	<31	-	32	25	40
87a	19	25	25	22	<31	-	32	27	40
87b	20	26	27	25	<31	-	33	29	40
94	16	20	-	-	-	32	32	32	40
98	17	22	-	-	-	36	36	36	40
102	19	22	-	-	-	28	29	29	40
103	15	17	-	-	-	-	15	17	40
108a	22	25	-	-	-	-	22	25	40
108b	18	21	-	-	-	-	18	21	40
118	16	22	20	17	<31	-	31	23	40
122	19	24	24	20	<31	-	32	25	40
125	27	29	-	-	-	-	27	29	40
127a *	32	33	<24	<20	<30	-	35	33	40
127b *	36	38	<24	<20	<30	-	37	38	40
127c *	40	40	<24	<20	<30	-	40	40	40
131a	34	35	-	-	-	-	34	35	40
131b	32	34	-	-	-	-	32	34	40
132	32	33	-	-	-	-	32	33	40
133a	32	33	-	-	-	-	32	33	40
137	21	24	-	-	-	-	21	24	40
138	18	22	-	-	-	-	18	22	40
139	23	25	-	-	-	-	23	25	40
140	22	25	-	-	-	-	22	25	40
141	29	31	-	-	-	-	29	31	40

Night Time $L_{Aeq,9hr}$ Noise Level (dBA)									Recommended Acceptable Criterion $L_{Aeq,9hr}$ (dBA)
	Project		Tarrawonga Coal Project		Boggabri Coal Continuation Project	Rocglen Coal Mine Extension Project	Cumulative Noise		
Rec ID	Year 3	Year 7	Year 4	Year 16	Years 5 and 10	Year 10	Year 3	Year 7	
143	24	27	-	-	-	-	24	27	40
144a	23	26	-	-	-	-	23	26	40
144b	23	26	-	-	-	-	23	26	40
146a	17	21	-	-	-	-	17	21	40
146b	17	21	-	-	-	-	17	21	40
147	20	23	-	-	-	-	20	23	40
153	15	19	-	-	-	-	15	19	40
174a	24	26	-	-	-	-	24	26	40
174b	15	18	-	-	-	-	15	18	40
221a	20	23	22	20	<31	27	33	29	40
221b	19	22	22	20	<31	27	33	29	40
310	16	20	-	-	-	<32	32	32	40
317	16	21	-	-	-	28	28	29	40
318	20	23	-	-	-	<32	32	33	40
319	16	19	-	-	-	-	16	19	40
334	18	21	-	-	-	-	18	21	40
1aa	18	29	28	28	<31	-	33	32	n/a
1ab	22	27	27	27	<31	<27	34	32	n/a
1ac	16	25	27	25	<31	<27	34	31	n/a
1ad	31	42	26	25	<31	-	35	42	n/a
1ae	28	37	25	24	<31	-	33	37	n/a
1af	20	24	-	-	-	-	20	24	n/a
1aj	24	34	30	29	<31	-	34	35	n/a
1f	31	44	28	27	<31	-	35	44	n/a
1g	20	25	21	20	<31	38	39	38	n/a
1i	18	23	22	20	<31	32	35	33	n/a
1l	21	25	-	-	-	35	35	35	n/a
1m	18	22	-	-	-	42	42	42	n/a

Night Time $L_{Aeq,9hr}$ Noise Level (dBA)									Recommended Acceptable Criterion $L_{Aeq,9hr}$ (dBA)
	Project		Tarrawonga Coal Project		Boggabri Coal Continuation Project	Rocglen Coal Mine Extension Project	Cumulative Noise		
Rec ID	Year 3	Year 7	Year 4	Year 16	Years 5 and 10	Year 10	Year 3	Year 7	
1n	18	21	-	-	-	40	40	40	n/a
1o	18	22	-	-	<31	40	41	40	n/a
1t	27	37	28	26	<31	-	34	37	n/a
1u	33	35	-	-	-	-	33	35	n/a
1v	49	49	-	-	-	-	49	49	n/a
1w	33	34	-	-	-	-	33	34	n/a
1x	32	44	25	24	<31	-	35	44	n/a
1y	25	27	-	-	-	-	25	27	n/a
1z	35	37	-	-	-	-	35	37	n/a
88	23	29	29	27	<31	-	34	31	n/a
303a	18	25	31	29	<31	-	34	30	n/a
303b	19	25	31	29	<31	-	34	30	n/a
313	15	20	21	20	<31	27	33	28	n/a
339	26	34	28	29	<31	-	34	35	n/a

* The owner of this property has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine for predicted noise and/or air quality impacts.

5.12 Maximum Noise Level Event Assessment

As described in Section 4.6, the Project's trigger levels for the above maximum noise level event screening assessment are:

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

Review of Table 5-8 indicates that night time $L_{Aeq,15min}$ noise predictions are exceeding 40 dBA at receiver 127c. Whitehaven has been in dialogue with the owner of receiver 127c regarding entering into a potential noise agreement. In addition, the owner of this receiver has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.

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:

- Excavator dumping in empty truck bodies 115-125 dBA L_{AFmax}
- Dozer track noise in 1st gear 114-124 dBA L_{AFmax}
- Infrastructure area impact noise 115-125 dBA L_{AFmax}
- Haul truck passbys <118 dBA L_{AFmax}

To be conservative the upper level rang has been used for the noise predictions. The predicted night time L_{AFmax} noise levels at receivers surrounding the Project are summarised in Table 5-12. L_{AFmax} noise levels were added to the operational noise levels (Table 5-8) and then compared with the L_{AFmax} screening level of 52 dBA for this assessment. Mine-owned receivers are included for the purpose of information only.

The L_{AFmax} values were modelled using the same plant locations used for the modelling of operational noise impacts. Each of the four event items listed above was modelled separately, and the highest predicted L_{AFmax} value from any item is presented in Table 5-12.

L_{AFmax} noise predictions are based on the relevant night time meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Table 5-1). It should be noted that the reported levels in Table 5-12 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 5-12 L_{AFmax} Levels from Night Time Operations at the Project

Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
	Year 3	Year 7	Year 23	
Privately-owned Dwellings				
67	25	28	24	52
86	21	27	14	52
87a	27	32	25	52
87b	28	34	25	52
94	25	27	28	52
98	28	30	32	52

Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
102	27	29	32	52
103	22	23	25	52
108a	32	33	36	52
108b	26	27	29	52
118	23	29	23	52
122	28	32	26	52
125	38	39	33	52
127a *	44	44	38	52
127b *	47	48	44	52
127c *	47	47	45	52
131a	42	42	41	52
131b	41	40	40	52
132	41	40	40	52
133a	41	41	39	52
137	30	31	27	52
138	27	29	26	52
139	32	34	29	52
140	32	33	29	52
141	38	38	37	52
143	33	35	33	52
144a	32	33	31	52
144b	32	33	32	52
146a	24	26	25	52
146b	24	26	25	52
147a	28	29	28	52
147b	22	24	24	52
153	33	33	33	52
160	21	23	22	52
174a	30	30	32	52
174b	29	29	31	52
221a	24	26	23	52
221b	24	26	24	52
310	29	30	33	52
317	23	25	27	52
318	26	27	31	52
319	25	27	29	52
334	35	36	31	52
Mine-owned Dwellings				
1aa	29	39	30	n/a
1ab	34	36	25	n/a
1ac	27	33	25	n/a
1ad	44	50	34	n/a
1ae	42	45	35	n/a
1af	29	30	30	n/a
1aj	36	43	29	n/a
1f	45	55	32	n/a
1g	30	32	28	n/a
1i	26	29	25	n/a
1l	35	36	37	n/a

Receiver ID	L_{AFmax} Noise Level (dBA)			L_{AFmax} Trigger Level (dBA)
1m	27	28	27	n/a
1n	26	28	27	n/a
1o	28	29	28	n/a
1t	40	44	33	n/a
1u	47	47	39	n/a
1v	55	55	55	n/a
1w	41	41	41	n/a
1x	45	52	36	n/a
1y	34	34	34	n/a
1z	43	44	42	n/a
88	31	39	26	n/a
303a	25	32	23	n/a
303b	26	33	24	n/a
313	23	25	22	n/a
339	37	43	32	n/a

* The owner of this property has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine for predicted noise and/or air quality impacts.

Table 5-10 indicates that L_{AFmax} noise levels due to night 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, including the approved dwelling location on property 144.

It is Wilkinson Murrays' experience from measurements around coal mines that at a distance from a coal mine operation, instantaneous changes in noise level are typically relatively small as the received noise is due to dozens of lower level noise sources. The Wilkinson Murray measurements indicate that the maximum L_{AFmax} noise level at receivers would typically be less than 5-7dBA above the $L_{Aeq,15min}$ level. The calculated L_{AFmax} noise levels for this project are consistent with this trend.

5.13 Construction Noise

5.13.1 Construction Noise Criteria

The recommended noise management levels described in the *Interim Construction Noise Guideline* are provided in Table 5-13.

Table 5-13 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 Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays	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.
	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:

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
		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: DECC (2009).

5.13.2 Construction Noise in the Vicinity of the Project

Description of Construction Activities

Construction/development activities in the vicinity of the Project are described in Section 2.2. The two major construction activities that have been identified as having potential for intrusive noise (and their expected durations) are:

- construction of the mine infrastructure area (approximately 12 months); and
- construction of the rail loop (approximately 12 months).

As described in Section 2.2, construction/development activities would generally be undertaken between 7.00 am to 6.00 pm, Monday to Sunday (inclusive).

Both construction activities would commence with an earthmoving phase, followed by installation activities relevant to the particular construction type.

Because of the fleet items used, earthmoving works are expected to have the highest potential for off-site noise impact and are therefore assessed in the construction noise assessment. Earthmoving works would require additional mobile plant including dozers, piling rigs, excavators, graders, rollers and trucks. An indicative earthmoving fleet for both construction components, and corresponding SWLs, is summarised in Table 5-14.

Table 5-14 Indicative Noise Sources & Sound Power Levels - Construction of Mine Infrastructure Area & Rail Loop

Construction Component	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item (dBA)
Construction of Mine Infrastructure Area	2	Truck	108
	2	Excavator	112
	1	Grader	112
	1	Roller	110
	1	Backhoe / Bobcat	108
	2	Rough Terrain Crane	113
	3	Mobile Crane	112
	1	Hand Tools (incl. Grinder)	119

Construction Component	Modelled Number of Items	Item Description	Indicative Sound Power Level per Item (dBA)
Construction of Rail Loop	1	Scraper	119
	2	Piling Rig	115
	3	Mobile Crane	112
	2	Dozer	116
	3	Truck	108
	2	Excavator	112
	1	Roller	110

A correction of -3 dB was applied to the total SWL of both construction components 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).

The estimated total SWL from the concurrent operation of all construction plant is 121 dBA and 122 dBA for the construction of the mine infrastructure area and the rail loop, respectively.

Assessment Methodology

Noise from earthmoving works associated with the construction of the mine infrastructure area and rail loop was predicted using the ENM.

As perceived by receivers in the vicinity of the Project, noise from activities associated with the construction of the mine infrastructure area and rail loop would largely be indistinguishable from operational mining activities given that similar plant would be deployed and that construction activities would occur in areas adjacent to operational mining activities. Therefore, construction noise has been compared to the *Interim Construction Noise Guideline* noise management levels (Table 5-13) and the day Project noise trigger level of 40 dBA (Table 4-3).

The construction of the mine infrastructure area and the rail loop is expected to take place during the first 12 months of the Project (Year 1) and as such, it was conservatively assumed both construction components would occur simultaneously.

There would be some overlap between the commencement of mining operations and construction of the mine infrastructure area and rail loop. As such, predicted construction noise levels have been combined with operational noise levels, with the combined noise level compared against the day Project noise trigger level. To be conservative, the Year 3 operational noise scenario has been used, which includes the use of the mine infrastructure area and more mobile equipment than what would likely be used for mining in Year 1.

Construction works associated with the realignment of Blue Vale Road would take place later in the life of the Project (approximately Year 7). Preliminary calculations have shown that noise associated with the realignment of Blue Vale Road would have a negligible impact when compared with noise generated by the mining operations at Year 7. Therefore, construction noise associated with the realignment of Blue Vale Road has not been considered further.

Noise Predictions

Table 5-15 provides the predicted construction noise levels for all receivers in the vicinity of the Project. The noise predictions are given as daytime levels under the relevant daytime meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Table 5-1) resulting in the highest noise predictions. Mine-owned receivers are included for the purpose of information only.

Table 5-15 Construction Noise Modelling Results - Construction of Mine Infrastructure Area & Rail Loop

Rec ID	$L_{Aeq,15\ min}$ (dBA)				
	Noise Level Construction Only	***Interim Construction Noise Guideline* 'Noise Affected' Management Level**	***Interim Construction Noise Guideline* 'Highly Noise Affected' Management Level**	**Noise Level Combined Year 3 & Construction**	**Day Project Noise Trigger Level (dBA)**
Privately-owned Dwellings					
67	<20	45	75	21	40
86	<20	45	75	<20	40
87a	<20	45	75	21	40
87b	<20	45	75	23	40
94	<20	45	75	<20	40
98	<20	45	75	<20	40
102	<20	45	75	<20	40
103	<20	45	75	<20	40
108a	<20	45	75	<20	40
108b	<20	45	75	<20	40
118	<20	45	75	<20	40
122	<20	45	75	20	40
125	<20	45	75	22	40
127a *	20	45	75	27	40
127b *	28	45	75	35	40
127c *	46	45	75	46	40
131a	33	45	75	35	40
131b	33	45	75	34	40
132	32	45	75	34	40
133a	29	45	75	31	40
137	<20	45	75	<20	40
138	<20	45	75	<20	40
139	<20	45	75	<20	40
140	<20	45	75	<20	40
141	26	45	75	28	40
143	<20	45	75	22	40
144a	<20	45	75	20	40
144b	<20	45	75	21	40
146a	<20	45	75	<20	40

Rec ID	$L_{Aeq,15\ min}$ (dBA)				
	Noise Level Construction Only	***Interim Construction Noise Guideline* 'Noise Affected' Management Level**	***Interim Construction Noise Guideline* 'Highly Noise Affected' Management Level**	**Noise Level Combined Year 3 & Construction**	**Day Project Noise Trigger Level (dBA)**
Privately-owned Dwellings					
146b	<20	45	75	<20	40
147a	<20	45	75	<20	40
147b	<20	45	75	<20	40
153	<20	45	75	23	40
160	<20	45	75	<20	40
174a	<20	45	75	<20	40
174b	<20	45	75	<20	40
221a	<20	45	75	<20	40
221b	<20	45	75	20	40
310	<20	45	75	<20	40
317	<20	45	75	<20	40
318	<20	45	75	<20	40
319	<20	45	75	<20	40
334	<20	45	75	20	40
Mine-owned Dwellings					
1aa	<20	45	75	23	n/a
1ab	<20	45	75	27	n/a
1ac	<20	45	75	20	n/a
1ad	26	45	75	36	n/a
1ae	24	45	75	33	n/a
1af	<20	45	75	<20	n/a
1aj	<20	45	75	28	n/a
1f	22	45	75	36	n/a
1g	21	45	75	25	n/a
1i	<20	45	75	22	n/a
1l	<20	45	75	<20	n/a
1m	<20	45	75	22	n/a
1n	<20	45	75	21	n/a
1o	<20	45	75	23	n/a
1t	23	45	75	32	n/a
1u	21	45	75	29	n/a
1v	55	45	75	55	n/a
1w	32	45	75	34	n/a
1x	26	45	75	37	n/a
1y	20	45	75	23	n/a
1z	36	45	75	37	n/a
88	<20	45	75	26	n/a
303a	<20	45	75	21	n/a

Rec ID	$L_{Aeq,15\ min}$ (dBA)				
	Noise Level Construction Only	***Interim Construction Noise Guideline* 'Noise Affected' Management Level**	***Interim Construction Noise Guideline* 'Highly Noise Affected' Management Level**	**Noise Level Combined Year 3 & Construction**	**Day Project Noise Trigger Level (dBA)**
Privately-owned Dwellings					
303b	<20	45	75	22	n/a
313	<20	45	75	<20	n/a
339	22	45	75	30	n/a

* The owner of this property has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine for predicted noise and/or air quality impacts.

Notes:

1. Levels highlighted in yellow indicate exceedances of the *Interim Construction Noise Guideline* noise management level of 45 dBA $L_{Aeq,15\ min}$ (recommended standard hours) and/or day Project noise trigger level of 40 dBA $L_{Aeq,15min}$ at privately-owned receivers.

The results of Table 5-15 indicate construction noise levels would comply with the *Interim Construction Noise Guideline* 'highly noise affected' management level at all privately-owned receivers, including the approved dwelling location on property 144. Construction noise levels are predicted to exceed the day Project noise trigger level at one privately-owned receiver, namely receiver 127c. Note this is based on a conservative assumption that both the construction of the mine infrastructure area and the rail loop would occur simultaneously, and construction would take place in conjunction with operations comparable to the Year 3 operational scenario (which includes the use of the mine infrastructure area and more mobile equipment than what would likely be used for mining in Year 1).

It is important to note that Whitehaven has been in dialogue with the owner of receiver 127c regarding entering into a potential noise agreement. In addition, the owner of this receiver has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.

5.13.3 Construction Noise Associated with the Rail Spur

Description of Construction Activities

As described in Section 2.2, construction/development activities would include the construction of the Project rail spur from the rail loop to the main line (Werris Creek Mungindi Railway).

Construction/development activities associated with the Project rail spur would last for approximately 12 months and would occur during the hours outlined in Section 2.2.

The rail spur would involve bridges and an elevated section of rail line. Construction of the rail spur would have multiple working areas occurring simultaneously, including the two bridge sites and three work fronts outside the bridge sections (approximately 3 km apart).

The construction phase with the highest potential for noise impacts on the surrounding community is expected to be crainage of pre-fabricated sections. During that phase, the construction fleet for a bridge section would generally comprise of two mobile cranes, two trucks, and one excavator. For a viaduct working area, the fleet would generally comprise of two mobile cranes and two trucks.

The total SWL for a bridge site is estimated to be 115 dBA, while the total SWL for the viaduct section working areas is estimated to be 113 dBA. A correction of -3 dB was applied to the total sound power level of both construction components to account for time correction, as the construction fleet would not always operate concurrently.

Assessment Methodology

As construction noise associated with the rail spur would be distinct to operational noise levels (i.e. given the distance separating mining operations from sections of the rail spur), this construction noise has been assessed against the *Interim Construction Noise Guideline* noise management levels. This is considered justified given relevant receivers would be potentially exposed to temporary construction-related impacts (i.e. associated with the construction of the rail spur in a linear fashion), rather than longer-term operational impacts.

It should be noted that Whitehaven may also carry out construction of the Project rail spur outside recommended standard hours (e.g. in the afternoon on a Saturday or on a Sunday during the day). This is considered to be justified as it could allow continuity of work for the construction crew which would assist in reducing the length of the construction period and therefore the period of impact at receivers. As such, the 'noise affected' level selected for the construction assessment is 45 dBA (35 dBA + 10 dBA) $L_{Aeq,15min}$ during recommended standard hours and 40 dBA (35 dBA + 5 dBA) $L_{Aeq,15min}$ outside recommended standard hours for all privately-owned receivers on the basis that the RBL for daytime in the area was established at 35 dBA (Section 4).

Noise from the construction works associated with the rail spur were predicted using the ENM.

Activities associated with the construction of the rail spur would by nature progressively move along the proposed rail spur corridor and would involve a number of work fronts operating simultaneously. As such, the assessment of construction noise only addresses receivers closest to the rail spur corridor. Compliance with those receivers would imply compliance at all identified receivers in the vicinity of the Project is achieved.

Construction noise levels were determined by modelling a working area on the closest point of the Project rail spur to each receiver, with an additional two working areas modelled 3 km on either side, and the two bridge sites.

Noise Predictions

Table 5-16 summarises the predicted rail spur construction noise levels at the nearest privately-owned receivers. The noise predictions are given as daytime levels under the relevant daytime meteorological conditions determined in accordance with Fact Sheet D of the *NPfI* (Table 5-1) resulting in the highest noise predictions.

It is expected rail spur construction noise levels at the approved dwelling location on property 144 would be similar to those predicted for receiver 1y (if the approved dwelling was constructed prior to construction of the rail spur).

Table 5-16 Predicted Noise Levels - Construction of Rail Spur

Receiver ID	Predicted $L_{Aeq,15min}$ Noise Level (dBA)	*Interim Construction Noise Guideline* 'Noise Affected' Management Level $L_{Aeq,15\ min}$ (dBA) – Recommended Standard Hours
Privately-owned Dwellings		
127c	35	45
131a	33	45
131b	37	45
132	40	45
133a	25	45
141	37	45
143	29	45
144a	36	45
144b	42	45
146a	34	45
146b	34	45
147a	25	45
147b	10	45
153	25	45
160	14	45
Mine-owned Dwellings		
1af	21	45
1v	47	45
1w	43	45
1y	46	45
1z	30	45

The results of Table 5-16 indicate that noise levels due to construction of the rail spur would not exceed the 'highly noise affected' noise level of 75 dBA, including the approved dwelling location on property 144.

The 'noise affected' noise level of 45 dBA during recommended standard hours is not expected to be exceeded at any privately-owned receivers. If the approved dwelling on property 144 is constructed prior to construction of the rail spur, construction noise levels would be managed to comply with the 'noise affected' noise level of 45 dBA.

Construction works occurring outside recommended standard hours (Saturday afternoon and Sunday during the day) may result in noise exceedances of the *Interim Construction Noise Guideline* noise management level for periods outside recommended standard hours at privately-owned receivers 132 and 144b, as well as the approved dwelling location on property 144 (if the approved dwelling was constructed prior to construction of the rail spur). Such exceedances are however unlikely to occur since it would only arise if works are occurring relatively close to the receiver, on Saturday afternoon or Sunday during the day, and during noise enhancing conditions.

All other privately-owned receivers (including those not described in Table 5-16) are not predicted to be 'noise affected' by the construction of the rail spur.

5.14 Noise Management Measures

This section outlines the approach by which Whitehaven may manage noise impacts from its proposed operations. Central to the approach is the classification of potentially impacted receivers into the Noise Affectation Zone and Noise Management Zone, in accordance with the *VLAMP* and Chapters 4 and 5 of the *NPfI*.

5.14.1 Noise Management Zone

Receivers expected to be exposed to operational noise levels of between 1 to 5 dB above the Project noise trigger levels are said to fall within the Noise Management Zone (Table 4-6). Depending on the extent of the exceedance of the Project noise trigger levels, noise impacts at receivers within the Noise Management Zone could range from "negligible" to "moderate" (in terms of the perceived noise level). 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;
- refinement of on-site noise mitigation measures and mine operating procedures; and
- provision of feasible and reasonable architectural treatment at receivers exposed to "moderate" noise impact (3-5 dB above Project noise trigger levels according to the *VLAMP*) including ventilation and upgraded façade elements.

5.14.2 Noise Affectation Zone

Receivers expected to be exposed to operational noise levels "significantly" in excess of 5 dB above the Project noise trigger levels are said to fall within the Noise Affectation Zone (Table 4-6). Exposure to noise levels corresponding to this zone may be of some concern to some landowners, particularly at night time. For noise receivers located within this zone, it is recommended that Whitehaven considers adopting the following management measures:

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

5.14.3 Real-time Noise Monitoring & Predictive Meteorological Forecasting System

As described in Section 5.3, it is proposed to have a real-time noise monitoring and meteorological forecasting system in place with the purpose of anticipating upcoming periods of adverse weather conditions that may cause elevated noise levels at receivers to the west and south-west of the mine (particularly receivers 127b, 127c, 131a, 131b and 132).

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 be prepared to include details of noise level 'triggers' that would result in operational noise controls being invoked.

This system would predict meteorological conditions for the coming day to determine, in advance, where the risk of noise-enhancing weather conditions may occur (e.g. based on wind speed, direction and atmospheric stability). The predictive meteorological forecasting system would be used as part of the integrated pro-active management system (Section 5.3) and in conjunction with the real-time noise monitoring system, providing an alert for the appropriate personnel to review the real-time data and manage the intensity and/or location of activities for that day as may be required.

5.14.4 Other Management Measures

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

- Relevant personnel would undergo environmental training on noise control and awareness of noise issues. This training would take place before the commencement of work by any contractor, or sub-contractor, whose work is likely to create intrusive noise.
- The SWL of mobile mining equipment would be periodically tested in accordance with International Standards Organisation (ISO) 6395 *Acoustics – Measurement of exterior noise emitted by earth-moving machinery – 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 during mining operations to verify compliance with 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 levels to be checked for compliance against relevant noise trigger levels.
- 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.
- Earthmoving works associated with the construction of the rail spur would generally be conducted between 7.00 am and 6.00 pm unless an agreement has been reached with all privately-owned residences that may experience $L_{Aeq,15min}$ noise levels above 40 dBA.
- Consistent with the *Interim Construction Noise Guideline,* Whitehaven would inform all potentially impacted residents of the nature of the construction works to be carried out that would be distinguishable from operational activities, the expected noise levels and duration, and contact details of Whitehaven representatives.

6 ROAD TRANSPORTATION NOISE

6.1 Introduction

The Approved Road Transport Route generally runs north to south between the Tarrawonga Coal Mine and the Whitehaven CHPP along Blue Vale Road and east to Rocglen Coal Mine. The Approved Road Transport Route currently passes through the Project. This route currently allows for the cumulative haulage of up to 3.5 Mtpa of ROM coal from the Approved Mine, the Tarrawonga Coal Mine and the Rocglen Coal Mine to the Whitehaven CHPP, and associated transport of reject from the Whitehaven CHPP to Whitehaven mines.

Until the Project CHPP, train load-out facility and rail spur reach full operational capacity, ROM coal from the Project would be transported to the Whitehaven CHPP, via the Approved Road Transport Route including Blue Vale Road and a short section of the Kamilaroi Highway.

As mentioned in Section 2.2.1, should the combined total ROM coal transported to the Whitehaven CHPP exceed 3.5 Mtpa, the approved Kamilaroi Highway overpass would be constructed.

This assessment has considered road noise associated with the following Project years and associated assumptions:

- Year 1 – Project-related construction traffic and combined ROM coal haulage from the Project and the Tarrawonga and Rocglen Coal Mines (approximately 3.5 Mtpa) to the Whitehaven CHPP on the Approved Road Transport Route.
- Year 8 – Project at full development with no haulage of Project ROM coal by road (i.e. coal haulage off-site via Project rail spur, including coal from other Whitehaven mining operations).

Hauling ROM coal to the Whitehaven CHPP from the Project would occur between 6.00 am and 9.15 pm Monday to Friday and between 7.00 am and 5.15 pm on Saturdays, consistent with the Development Consent for the Approved Mine.

The road transportation noise assessment focuses on Blue Vale Road and the Kamilaroi Highway, as these roads are the most likely to be affected by noise generated by road transport movements associated with the Project.

6.2 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). The Kamilaroi Highway would clearly be considered as an "arterial" or "sub-arterial" road under this policy. The Approved Road Transport Route along Blue Vale Road has previously been identified as a "principal haulage route" (Spectrum Acoustics, 2005) and, for the purpose of noise assessment, the *RNP* considers this to be equivalent to an arterial/sub-arterial road.

Table 3 of the *RNP* is reproduced in Table 6-1 with the relevant sections highlighted noting the requirements to consider "principal haulage routes" as arterial roads (Section 2.2.2 of the *RNP*).

Table 6 of the *RNP* is also reproduced in Table 6-1, although the proposed changes in traffic volumes will not result in increases greater than 12 dB.

Table 6-1 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'."*

6.3 Road Traffic Volumes

Projected traffic volumes associated with the Project are expected to be relevant to noise on Blue Vale Road and the Kamilaroi Highway. Impacts on the other roads surrounding the site are expected to be negligible from a road noise perspective and as such, only Blue Vale Road and the Kamilaroi Highway are addressed in the road traffic noise assessment.

Table 6-2 presents the 2010/2011 average weekday traffic volumes counted on public roads between the Project and the Whitehaven CHPP as well as the estimated Year 1 and Year 8 including, where relevant, those associated with the Tarrawonga Coal Mine, Rocglen Coal Mine, other approved mining operations (e.g. Maules Creek Coal Mine, Boggabri Coal Mine and Narrabri Coal Mine) and background growth. Figure 6-1 shows the relevant traffic count locations.

Table 6-2 Average Weekday Traffic Volumes without the Approved Mine

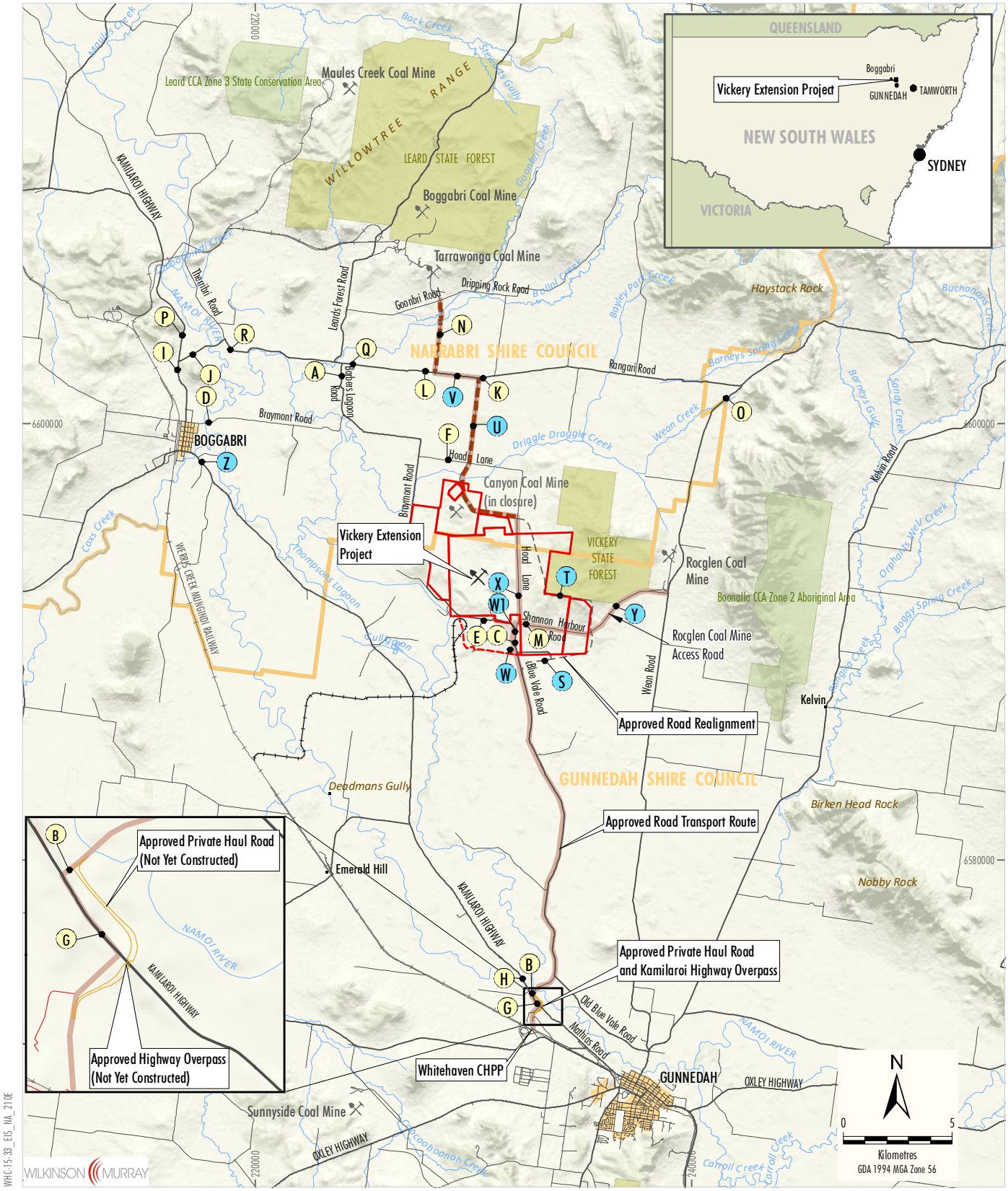
Traffic Count Location	Road	Road Category	Year	Day		Night	
				Light	Heavy	Light	Heavy
C	Blue Vale Road south of Shannon Harbour Road	Principal Haulage Route	2010/2011	149	420	47	36
			Year 1	209	718	65	41
			Year 8	213	177	67	4
B	Blue Vale Road north-east of Kamilaroi Highway	Principal Haulage Route	2010/2011	814	559	98	44
			Year 1	928	873	121	51
			Year 8	971	340	126	14
G	Kamilaroi Highway between Blue Vale Road and CHPP	Arterial road	2010/2011	1990	978	233	87
			Year 1	2197	1344	167	104
			Year 8	2304	829	279	69

Table 6-3 summarises the additional traffic associated with the Approved Mine and other background increases during Project Years 1 and 8.

Table 6-3 Average Weekday Traffic Volumes with the Approved Mine

Traffic Count Location	Road	Road Category	Project Year	Day		Night	
				Light	Heavy	Light	Heavy
C	Blue Vale Road south of Shannon Harbour Road	Principal Haulage Route	1	352	725	124	52
			8	505	1272	149	81
B	Blue Vale Road north-east of Kamilaroi Highway	Principal Haulage Route	1	1071	880	180	62
			8	1263	1435	208	91
G	Kamilaroi Highway between Blue Vale Road and CHPP	Arterial road	1	2340	1351	325	115
			8	2596	1924	360	146

The traffic generated by the Project and the Tarrawonga and Rocglen Coal Mines including coal haulage (Year 1 scenario only), construction (Year 1 scenario only), employee vehicles and deliveries, and its distribution on the surrounding road network is summarised in Table 6-4.



LEGEND

- Mining Tenement Boundary (ML & CL)
- Mining Lease Application (MLA)
- Local Government Boundary
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Whitehaven Private Haul Road
- Approved Road Transport Route
- Indicative Project Rail Spur
- (A) Traffic Count Location
- (S) Traffic Forecast Location

Source: LPMA - Topographic Base (2010); NSW Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Local Road Network and Traffic Survey Locations

Figure 6-1

Table 6-4 Average Weekday Traffic Volumes with the Project

Traffic Count Location	Road	Road Category	Project Year	Day		Night	
				Light	Heavy	Light	Heavy
C	Blue Vale Road south of Shannon Harbour Road	Principal Haulage Route	1	421	776	113	41
			8	765	228	207	9
B	Blue Vale Road north-east of Kamilaroi Highway	Principal Haulage Route	1	1140	931	169	51
			8	1523	391	266	19
G	Kamilaroi Highway between Blue Vale Road and CHPP	Arterial road	1	2429	1410	319	104
			8	2856	880	419	74

Review of the predicted Project traffic volumes compared to the "no Project" scenarios with and without the Approved Mine indicates a potential increase in light vehicle numbers associated with employees, however a significant reduction in heavy vehicles once the Project CHPP, train load-out facility and rail spur reach full operational capacity. The calculated percentage change in traffic volumes is provided in Appendix F.

6.4 Road Traffic Noise Impact – Blue Vale Road

There are two principal receivers along Blue Vale Road between Old Blue Vale Road and Shannon Harbour Road.

The closest residential receiver on Blue Vale Road south of Shannon Harbour Road is the Weroona receiver approximately 280 metres (m) from Blue Vale Road. The closest residential receiver on Blue Vale Road north-east of the Kamilaroi Highway is the Brooklyn receiver approximately 70 m from Blue Vale Road.

Based on the traffic data presented in Table 6-2, Table 6-3 and Table 6-4, calculated traffic noise levels at the Weroona and Brooklyn receivers have been predicted and are presented in Table 6-5 and Table 6-6 respectively.

Table 6-5 Calculated L_{Aeq} Traffic Noise Levels (dB) at the Weroona Receiver (along Blue Vale Road south of Shannon Harbour Road)

Scenario / Compliance	Year 1		Year 8	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
Existing without Approved Mine	49.4	40.0	43.9	34.7
Existing with Approved Mine	49.6	41.5	51.9	43.1
Total with Project	49.9	40.6	46.1	39.2
Increase compared with Existing without Approved Mine	0.5	0.6	2.2	4.5
Increase compared with Existing with Approved Mine	0.3	-0.9	-5.8	-3.9
Criteria	60	55	60	55
Compliance with Base Criteria	Yes	Yes	Yes	Yes
Compliance with +2 (with Approved Mine)	N/A	N/A	N/A	N/A

The traffic noise levels along Blue Vale Road south of Shannon Harbour Road are dominated by the Project during Years 1 and 8. However, the predicted traffic noise levels at the Weroona receiver are within the relevant road traffic noise criteria.

In addition, the maximum increase in noise level compared with "Existing without Approved Mine" levels is 4.5 dB (at night), which is within the maximum "relative increase" criterion of 12 dB as set out in the *RNP*.

Table 6-6 Calculated L_{Aeq} Traffic Noise Levels (dB) at the Brooklyn Receiver (along Blue Vale Road north-east of Kamilaroi Highway)

Scenario / Compliance	Year 1		Year 8	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
Existing without Approved Mine	58.9	49.5	55.8	46.5
Existing with Approved Mine	59.0	50.6	60.9	52.0
Total with Project	59.3	50.0	56.9	49.0
Increase compared with Existing without Approved Mine	0.4	0.5	1.1	2.5
Increase compared with Existing with Approved Mine	0.3	-0.6	-4.0	-3.0
Criteria	60	55	60	55
Compliance with Base Criteria	Yes	Yes	Yes	Yes
Compliance with +2 (with Approved Mine)	N/A	N/A	N/A	N/A

The total traffic noise levels at the Brooklyn receiver are also within the relevant road traffic noise criteria.

In addition, the maximum increase in noise level compared with "Existing without Approved Mine" levels is 2.5 dB (at night), which is within the maximum "relative increase" criterion of 12 dB as set out in the *RNP*.

As the predicted traffic noise levels at the Weroona and Brooklyn receivers meet the proposed criteria, then the criteria would be met at all other receivers along the road.

6.5 Road Traffic Noise Impact – Kamilaroi Highway

There are residential receivers on the Kamilaroi Highway between Blue Vale Road and the Whitehaven CHPP. The closest residential receiver on the Kamilaroi Highway would be the Longlands receiver (receiver 223) approximately 70 m from the road.

In Year 1 and Year 8 of the Project, the noise impact is assessed in terms of an increase in traffic volumes on the existing Kamilaroi Highway.

Traffic noise levels at the closest residential receiver, namely the Longlands receiver (receiver 223), have been calculated and are presented in Table 6-7.

Table 6-7 Calculated L_{Aeq} Traffic Noise Levels (dB) at the Longlands Receiver (along Kamilaroi Highway)

Scenario/Compliance	Year 1		Year 8	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
Existing without Approved Mine	61.0	52.7	59.6	51.6
Existing with Approved Mine	61.2	53.3	62.5	54.1
Total with Project	61.4	53.0	60.1	52.6
Increase compared with Existing without Approved Mine	0.4	0.3	0.5	1.0
Increase compared with Existing with Approved Mine	0.2	-0.3	-2.4	-1.5
Criteria	60	55	60	55
Compliance with Base Criteria	No	Yes	Yes	Yes
Compliance with +2 (with Approved Mine)	Yes	N/A	N/A	N/A

The traffic noise levels along the Kamilaroi Highway are dominated by non-Project traffic in Years 1 and 8. There is a marginal exceedance of the base criteria predicted for Year 1 for the "Existing without Approved Mine" scenario, however the increase in noise due to the Project is less than 2 dB.

As the predicted traffic noise levels at the Longlands receiver meets the proposed criteria then the criteria would be met at all other receivers along the road.

6.6 Conclusion

The road traffic noise study has found that coal haulage noise levels resulting from the Project would be similar to the Approved Mine, prior to the Project CHPP, train load-out facility and rail spur reaching full operational capacity. After this, significant reductions in road traffic noise are anticipated along the Approved Road Transport Route as a result of coal from the Project, Tarrawonga Coal Mine and Rocglen Coal Mine being transported from the Project CHPP by rail (rather than being hauled to the Whitehaven CHPP by road).

7 RAIL TRANSPORTATION NOISE

7.1 Introduction

Product coal would be transported by rail from the Project CHPP and coal handling facilities via the Project rail loop and rail spur to the Werris Creek Mungindi Railway to Werris Creek, and from there to the junction with the Main Northern Line and via the Ardglen Tunnel, Muswellbrook Junction via Singleton and Maitland to the Port of Newcastle.

The *RING* (EPA, 2013) (detailed in Section 7.2.2) has requirements for the geographic extent of rail noise assessments for rail traffic generating development. Specifically, assessment extends 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.

Review of rail movements indicates that the Werris Creek Mungindi Railway, which starts at the major rail centre of Werris Creek and heads north to Moree via the towns of Boggabri, Gunnedah and Curlewis, requires consideration. In addition, the section of the Main Northern Railway as far south as the Muswellbrook Junction has been considered.

Table 7-1 summarises the sections of rail line which have been considered and the standard NSW approach to noise assessment.

Table 7-1 Standard NSW Approach to Rail Noise Assessment

Rail Section	Assessment Method	Comment
Rail Loop	*NPfI*	This noise is assessed cumulatively as part of all the other on-site noise in accordance with the requirements of the *NPfI.*
Rail Spur from Rail Loop to the Werris Creek Mungindi Railway (approximately 14 km)	*RING*	This noise is assessed under the *RING* as non-network rail lines on or exclusively servicing industrial sites.
Werris Creek Mungindi Railway		
1. Project Rail Spur to Whitehaven CHPP (approximately 19 km)	*RING*	This noise is assessed under the *RING* as environmental assessment requirements for rail traffic-generating developments.
2. Whitehaven CHPP to Junction with Watermark Spur (approximately 20 km)		
3. Junction of Watermark Spur to Werris Creek Mungindi Railway (approximately 20 km)		
4. Werris Creek Mungindi Railway to Main Northern Railway (approximately 5 km)		
Main Northern Railway		
5. Werris Creek Mungindi Railway to Muswellbrook Junction (approximately 100 km)	*RING*	This noise is assessed under the *RING* as environmental assessment requirements for rail traffic-generating developments.

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. There is approval for up to 10 trains per day from the Whitehaven CHPP. Average daily train movements used to assess potential impacts are summarised in Table 7-2.

Note that coal mines (including the Project) have been assumed to use trains with three locomotives. Since some coal mines (including Maules Creek Coal Mine and the Project) also use Queensland Rail (QR) trains which operate with only two locomotives per train (Aurizon locomotives), rail movements summarised in Table 7-2 may at times be conservative.

The peak approved/proposed train movements have not been assessed, as it is extremely unlikely the peak movements from a number of projects would occur in the same 24 hour period. It is also expected that the capacity of the Werris Creek Mungindi Railway and Main Northern Railway would be less than the sum of the peak approved train movements on each railway.

Table 7-2 Average Daily Train Movements - Project Rail Spur to Muswellbrook Junction

Scenario	Trains & Sections	Locomotive Configuration	Daily Train Nos. – Passbys		
			Day	Night	24 hour
Existing / Approved	**From Section 1 (Junction of Werris Creek Mungindi Railway and Project Rail Spur to Whitehaven CHPP)**				
	Passenger [1]	XPT Passenger	2	0	2
	Cotton, Grain, General Freight [1]	2x 82 Class	5.6	3.4	9
	Boggabri Coal Mine [2]	3x 82 Class	3.5	2	5.5
	Narrabri Coal Mine [3]	3x 82 Class	5	3	8
	Maules Creek Coal Mine [4]	3x 82 Class	6	4	10
		Total	**22.1**	**12.4**	**34.5**
	From Section 2 (Whitehaven CHPP to Junction with Watermark Spur)				
	Approved Mine + Tarrawonga / Rocglen [5]	3x 82 Class	2	2	4
		Total	**24.1**	**14.4**	**38.5**
	From Section 3 (Junction of Watermark Spur to Junction with Werris Creek Mungindi Railway)				
	Watermark Coal Project [6]	3x 82 Class	5	3	8
		Total	**29.1**	**17.4**	**46.5**
	From Section 4 (Werris Creek Mungindi Railway to Main Northern Railway)				
	Cotton, Grain, General Freight [1]	2x 82 Class	2	2	4
		Total	**31.1**	**19.4**	**50.5**
	From Section 5 (Main Northern Railway to Muswellbrook Junction)				
	Passenger [7]	XPT Passenger	2	0	2
	Werris Creek Coal Mine [8]	3x 82 Class	4	2	6
		Total	**37.1**	**21.4**	**58.5**
Project	**From Section 1**				
	Vickery Extension Project [9]	3x 82 Class	6	4	10
		Total	**6**	**4**	**10**
Total (without Project)		**Section 1**	**22.1**	**12.4**	**34.5**
		Section 2	**24.1**	**14.4**	**38.5**
		Section 3	**29.1**	**17.4**	**46.5**
		Section 4	**31.1**	**19.4**	**50.5**
		Section 5	**37.1**	**21.4**	**58.5**

Scenario	Trains & Sections	Locomotive Configuration	Daily Train Nos. – Passbys		
			Day	Night	24 hour
Total (with Project)		**Section 1**	**28.1**	**16.4**	**44.5**
		Section 2	**28.1**	**16.4**	**44.5**
		Section 3	**33.1**	**19.4**	**52.5**
		Section 4	**35.1**	**21.4**	**56.5**
		Section 5	**41.1**	**23.4**	**64.5**

Notes:

1. KMH Environmental (2011) *Burilda Passing Loop Review of Environmental Factors*.
2. Hansen Bailey (2011) *Continuation of Boggabri Coal Mine Environmental Assessment*. It is noted that Boggabri Coal Mine also has approval to transport coal from the Tarrawonga Coal Mine via rail. In the event that this occurs, there would be no change in cumulative rail movements in Sections 2, 3, 4 and 5, and the change has already been assessed in Section 1.
3. Wilkinson Murray (2015) *Narrabri Mine Modification 5 – Noise Assessment*.
4. Bridges Acoustics (2011) *Acoustic Impact Assessment Maules Creek Coal Project Environmental Assessment.*
5. Wilkinson Murray (2013b) *Vickery Coal Project Environmental Impact Statement Noise and Blasting Impact Assessment.*
6. Bridges Acoustics (2013) *Watermark Coal Project Environmental Impact Statement Acoustics Impact Assessment*.
7. North West Region Tranlink Timetable.
8. R.W. Corkery & Co. Pty Limited (2010) *Werris Creek Coal Mine LOM Project Environmental Assessment Section 2: Project Description*.
9. This would replace the Approved Mine (and offset Tarrawonga and Rocglen Coal Mine rail movements if the ROM coal from these mines is processed at the Project CHPP) from Section 2.

As can be seen from Table 7-2, the Project contribution to average 24 hour rail traffic on Section 4 of the Werris Creek Mungindi Railway (between the proposed Project rail spur and Werris Creek) for the additional 6 movements associated with the Project (i.e. on the basis that movements from the Whitehaven CHPP associated with transporting coal from the Tarrawonga and Rocglen Coal Mines and the Approved Mine do not occur simultaneously with the Project) would be approximately 12% of existing/approved rail movements and approximately 11% of existing/approved plus proposed rail movements.

In relation to Section 5 on the Main Northern Railway, the Project contribution to average 24 hour rail traffic would be approximately 10% of existing/approved rail movements and approximately 9% of existing/approved plus proposed rail movements.

7.2 Rail Noise Criteria

7.2.1 Environment Protection Licence

Australian Rail Track Corporation (ARTC) operates the Werris Creek Mungindi Railway and Main Northern Railway. Noise emissions from railways operated by ARTC are regulated via ARTC's Environment Protection Licence (EPL) 3142. EPL Section L6 does not nominate specific environmental noise limits but notes that:

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

Based on the information presented above, the following noise criteria have been adopted for the Project:

- $L_{Aeq,9\ hour}$ = 60 dBA;
- $L_{Aeq,15\ hour}$ = 65 dBA; and
- L_{Amax} = 85 dBA.

7.2.2 Rail Infrastructure Noise Guideline

Appendix 2 of the *RING* deals with land-use developments, other than rail projects, that are likely to generate additional rail traffic on an existing rail network. 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} (5th 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} (95th percentile) 85 dB(A).*
> - *Implement all feasible and reasonable noise mitigation measures where the cumulative noise level exceeds the noise assessment trigger levels and project-related noise increases are predicted.*
> - *Where the L_{Aeq} noise level increases are more than 2 dB(A), which is equivalent to approximately 60% 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% of the total line or corridor rail traffic.*

Appendix 3 of the *RING* deals with non-network rail lines on or exclusively servicing industrial sites, and states the following:

> *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} noise level from industrial noise sources for the relevant receiver type and indicative noise amenity area in Table 2.1 of the INP...*

Table 2.1 of the *INP* is partly reproduced below. Note that L_{Aeq} noise levels outlined in Table 2.1 of the *INP* correspond to $L_{Aeq,Period}$ noise levels.

INP Table 2.1 Recommended L_{Aeq} noise levels from industrial noise sources

Type of Receiver	*Indicative Noise Amenity*	*Time of Day*	*Acceptable L_{Aeq} Noise Level – dB(A)*
Residence	*Rural*	*Day*	*50*
		Evening	*45*
		Night	*40*

It is noted that the *INP* acceptable noise levels are consistent with the *NPfi* recommended amenity noise levels (Section 4.4.2).

7.3 Rail Noise Impacts

7.3.1 Non-Network Rail Line

Consistent with the *RING*, the assessment for non-network rail lines must consider the rail alignment from the Project rail loop to the main line (Werris Creek Mungindi Railway).

It is proposed to have the Project rail spur constructed in a generally elevated configuration in order to allow the crossing of the flood plain located directly to the west of the Project site. Noise modelling was conducted for the assessment of rail noise between the Project rail loop and the junction where the Project rail spur meets with Werris Creek Mungindi Railway based on the elevated design of the rail spur.

Project 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 5.1.2).

Noise levels and spectra were established using the Transport for NSW (TfNSW) standard rail noise database for locomotives and freight wagons. The database levels can be adjusted for speed, locomotive type and length of trains, where necessary. Noise monitoring data of comparable rolling stock carried out in the Bylong valley (Wilkinson Murray, 2011b; Wilkinson Murray, 2013c) was used to validate the noise model. The freight rail noise data was based on approximately two hundred individual rail pass-bys measured between 200 and 640 m from the rail track, predominately at night in April and June.

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 Project rail spur noise assessment focuses on the night time period (10.00 pm to 7.00 am).

Noise modelling was based on the following assumptions:

- Peak train movements of three trains or six movements per night (10.00 pm to 7.00 am);
- Average speed of 40 kilometres per hour (km/hr) on the Project rail spur; and
- Configuration of three locomotives and 82 wagons.

Note that the Project would 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.

Table 7-3 presents the predicted noise levels under calm isothermal conditions and considering local meteorology at the closest and potentially most impacted receivers including 14 privately-owned residences (Figure 3-1).

Table 7-3 Predicted Night Time Rail Spur Noise Levels

Receiver ID[1]	Night Time $L_{Aeq,9hours}$ (dBA)	
	With Local Meteorology	Calm Isothermal Conditions
Privately-owned Dwellings		
127c	30	29
131a	30	29
131b	34	33

Receiver ID[1]	Night Time $L_{Aeq,9hours}$ (dBA)	
	With Local Meteorology	Calm Isothermal Conditions
Privately-owned Dwellings		
132	37	35
133a	20	19
141	35	34
143	28	27
144a	35	34
144b	40	39
146a	35	33
146b	35	33
147a	26	25
147b	10	10
153	22	21
160	16	15
Mine-owned Dwellings		
1af	20	20
1v	42	40
1w	40	39
1y	43	43
1z	26	25

Notes: 1. Predictions at façade.

Review of Table 7-3 indicates all predicted levels comply with the *RING* night time noise criterion (40 dBA $L_{Aeq,period}$) for non-network rail lines at privately-owned dwellings.

If the approved dwelling on property 144 was constructed, no more than negligible (i.e. 1-2 dB) exceedances of the *RING* criterion would be experienced with the implementation of reasonable and feasible mitigation during the night-time (e.g. reducing train speed and/or noise barriers) in the absence of an agreement with the landowner.

It is important to note that Whitehaven proposes to have a suitably qualified person/s review the rail design to determine whether it incorporates all reasonable and feasible mitigation and to undertake commissioning trials of the spur to determine optimal speed to minimise noise impacts.

7.3.2 Network Rail Lines

Network rail lines have been addressed in three ways as follows:

- Calculating increases in L_{Aeq} noise levels, considering the Project only as new movements, with the Approved Mine assumed to be part of the existing movements from Section 2.
- Calculating increases in L_{Aeq} noise levels, considering all the rail movements using the Project rail spur as new movements, with the previously Approved Mine (including the Tarrawonga and Rocglen Coal Mines) not assumed to be part of the existing movements from Section 2.
- Calculating the increase in setback distance to the rail line to achieve ARTC and *RING* criteria, resulting from the proposed increases in rail movements, for Sections 1-5.

Table 7-4 shows predicted increases in noise levels, under both the above assumptions concerning existing movements.

This assumes the additional movements have the same mix of wagons with audible wheel defects as the existing fleet on the network. In all cases the increase is less than 2 dB.

Table 7-4 Predicted Project Increases in L_{Aeq} Noise Levels - Sections 1-5

Section [1]	Period	Increases in Noise Level (dB) Relative to:	
		Existing (Including Approved Mine)	Existing (Excluding Approved Mine)
1	Day (15hr)	1.2	1.2
	Night (9hr)	1.3	1.3
2	Day (15hr)	0.7	1.2
	Night (9hr)	0.6	1.3
3	Day (15hr)	0.6	1.2
	Night (9hr)	0.5	1.3
4	Day (15hr)	0.6	1.1
	Night (9hr)	0.5	1.2
5	Day (15hr)	0.5	0.9
	Night (9hr)	0.4	1.1

Notes: 1. Refer to Table 7-2.

Using the above data on train movements, it is possible to calculate the distance from the rail line at which ARTC criteria are met using the noise levels from the TfNSW standard rail noise database for passenger trains, locomotives and freight wagons. A façade correction of 2.5 dB is also applied. The data is significantly impacted by the audible wheel defects on wagons which occur on a significant proportion of trains.

Distances at which the ARTC and *RING* criteria are met for both existing and proposed movements are illustrated in Table 7-5. There is no change in the maximum pass-by noise (L_{Amax}) hence no change in distance for this noise parameter, however it is also shown in Table 7-5 in relation to trains both with and without wagons with audible wheel defects for speeds up to 80 km/hr. Table 7-5 demonstrates the night time period is the most critical.

Table 7-5 Offset Distances to Achieve ARTC and *RING* Criteria - Sections 1-5

Section	ARTC/RING Criteria (dBA)	Distance from Track (m)		
		Existing/Approved Movements	Existing/Approved Plus Other Proposed Movements	Existing/Approved /Proposed plus Project Movements
1	65 (15 hr/day)	86	86	116
	60 (9 hr/night)	222	222	294
2	65 (15 hr/day)	98	98	116
	60 (9 hr/night)	259	259	294
3	65 (15 hr/day)	121	121	138
	60 (9 hr/night)	312	312	345
4	65 (15 hr/day)	121	146	162
	60 (9 hr/night)	312	378	410
5	65 (15 hr/day)	138	162	177
	60 (9 hr/night)	345	410	441
All	L_{Amax} – 85 dBA with wheel defects	130	130	130
	without wheel defects (based on loco)	55	55	55

7.4 Conclusion

Along the non-network rail line section, noise levels were predicted using the ENM. It was found that compliance with the *RING* noise criteria for non-network rail lines would be achieved at all surrounding noise sensitive receivers.

The network rail line noise assessment presented above indicates that the Project rail movements would result in increases in noise levels greater than 0.5 dB, with any increase in rail noise being less than 2 dB (which is the relevant trigger threshold in the *RING* rail noise assessment requirements).

For increases in noise greater than 0.5 dB the *RING* has a requirement to consider feasible and reasonable noise mitigation. The document recognises that the land use developer neither owns the rail corridor or the rolling stock, so is limited in its ability to directly manage noise, although it can ensure it contracts to a rail service provider who would use best practice rolling stock, including locomotives approved to operate on the NSW rail network in accordance with environment protection licences issued by the EPA.

The only feasible mitigation measure is to work with rail service providers to help in identifying wagons with audible wheel defects to remove them from the rail fleet.

It should be noted that voluntary mitigation or land acquisition does not apply to residences affected by noise from the public rail network.

The buffer distance from the rail line at which the relevant ARTC and *RING* L_{Aeq} criteria would be met would increase due to the Project. In addition, L_{Amax} pass-by noise levels would not change due to the Project.

8 BLASTING ASSESSMENT

The removal of competent overburden (and interburden) material at the Project would be undertaken using a drill and blast programme.

A range of explosive materials would be used for the Project.

Blast designs and sizes would vary over the life of the Project and would depend on numerous factors including the depth of coal seams and the design of open cut benches.

Blasting at the Project would only occur between the hours of 9.00 am and 5.00 pm Monday to Saturday inclusive (excluding public holidays).

The number of blasts per week would typically be five; however, up to six blasts per week may occur on some occasions. A blast event includes up to three individual blasts located within the boundary of the mine and fired in succession.

Additional blasts, which generate ground vibration of 0.5 millimetres per second (mm/s) or less at any residence on privately-owned land, or blasts required to ensure the safety of the mine or its workers, may be conducted. At various stages in the Project life, some sections of Blue Vale Road and Braymont Road would be temporarily closed during blast events within 500 m of the public road. Areas of the Vickery State Forest would also be within 500 m of blasts.

8.1 Airblast Overpressure & Vibration Criteria

8.1.1 Criteria for the Minimisation of Human Annoyance from Blasting

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 mm/s for more than 5% of blasts in any year, and should not exceed 10 mm/s for any blast.

8.1.2 Criteria for the Prevention of Structural Damage to Buildings

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.

8.1.3 Criteria for the Prevention of Structural Damage to Heritage Items

A previously recorded grinding groove site (registered on the Aboriginal Heritage Information Management System Database) is located south-west of the proposed mine site (MGA 84 coordinates [Zone 56] of 228826E, 6591320N). Blasting is proposed to occur at a minimum distance of 465 m.

There are no criteria relating to the potential for vibration damage to rock carvings or engravings on rock existing in the natural environment. There are a number of Standards which deal with potential vibration damage to structures (mostly buildings) that are commonly used in Australia including a British Standard BS 7385 and German Standard DIN 4150 Part 3. These include vibration limits over a range of frequencies.

We are aware of studies from the US in relation to unlined tunnels, where vibration levels of 460 mm/s have been measured with no observed damage. On this basis, limits of 250 mm/s have been previously nominated, however, in the absence of inspection of the Aboriginal heritage site these are considered too high.

Wilkinson Murray consider the most appropriate criteria to adopt for the grinding groove is to consider the effect of vibration on buried pipework. The DIN 4150 recommends a range of criteria from:

- 50 mm/s for masonry and plastic pipework;
- 80 mm/s for clay, concrete, reinforced concrete, prestressed concrete, metal pipework; and
- 100 mm/s for steel pipework.

Wilkinson Murray consider the 80 mm/s criterion be established until such time the site has been inspected by a structural engineer and vibration limits adjusted accordingly.

In most instances it is expected that higher limits would be able to be applied, but there may be some sites, for example with stone arrangements, where lower limits may be necessary.

The Kurrumbede Homestead (ID 1v, which is owned by the mine) has European heritage significance. Blasting is proposed to occur at a minimum distance of 1,235 m. We understand the structure is in good condition. On this basis, a vibration limit of 10 mm/s and airblast limit of 133 dB are nominated for this structure.

However, it is recommended the building is inspected by a structural engineer and the limits adjusted accordingly.

8.2 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 in metres and W is the Maximum Instantaneous Charge of explosive, in 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, NSW 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 G.

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.

8.3 Predicted Overpressure & Vibration Levels

8.3.1 Residences

Based on the predictive equations outlined in Section 8.2, Table 8-1 indicates the range of 5% exceedance overpressure and ground vibration levels expected at the nearest residences. These include mine-owned residences and privately-owned residences. The 5% exceedance levels are the levels that should be compared to the 5% exceedance criteria of 115 dBLinear (dBL) for overpressure and 5 mm/s for vibration. Peak or maximum blasting levels are not presented because these levels are typically caused by geological or blasting anomalies, which are unpredictable.

The assumed blast characteristics are representative of deep interburden/overburden blasts for an open cut coal mine.

Table 8-1 Predicted Overpressure & Vibration (1) Levels Resulting from Blasting within Project Open Cut (5% Exceedance Levels)

Rec ID	Direction	Peak Overpressure (dBL)	PPV Ground Vibration (mm/s)
Privately-owned Dwellings			
Rec 67	North-East	111.2 to 111.3	0.3 to 0.6
Rec 98	East	111.1 to 112.1	0.5 to 1.3
Rec 108a	South-East	111.1 to 112.4	0.4 to 1.4
Rec 127a (2)	West	111.2 to 113.0	0.7 to 1.8
Rec 127b (2)	West	111.6 to 114.7	1.0 to 3.1
Rec 127c (2, 3)	South-West	111.4 to 115.0	0.8 to 3.5
Mine-owned Dwellings			
Rec 1ad	North	111.4 to 119.3	0.8 to 8.4
Rec 1ae	North	111.4 to 117.3	0.8 to 5.7
Rec 1f	North-West	111.2 to 116.9	0.6 to 5.2
Rec 1g	East	111.2 to 111.9	0.5 to 1.2
Rec 1l	East	111.3 to 114.5	0.7 to 3.0
Rec 1t	North	111.2 to 115.2	0.6 to 3.6
Rec 1u	West	111.3 to 113.9	0.7 to 2.5
Rec 1v	South-West	111.5 to 120.2	0.9 to 9.7
Rec 1x	North	111.5 to 124.6	0.9 to 18.8
Rec 88	North-West	111.2 to 111.8	0.4 to 1.1

Notes:

1. Overpressure and ground vibration levels likely to result from indicative blasts for an open cut coal mine.
2. Whitehaven has been in dialogue with the owner of this property regarding entering into a potential noise agreement. In addition, the owner of this property has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.
3. Overpressure and ground vibration levels predicted for blasts at least 2,540 m from the receiver.

There are a range of exceedances of both overpressure and vibration limits at the mine-owned residences, including an exceedance of the upper 120 dBL and 10 mm/s limits at two mine-owned receivers, namely receivers 1x and 1v.

Blasts within the western part of the open cut, where the distance to privately-owned residences is closest, would be conducted using site rules to be developed using site specific blast monitoring data gathered during the initial stage of mining operations.

8.3.2 Heritage Sites

Based on the minimum distance from blast events of 1,235 m, the predicted airblast and vibration levels at Kurrumbede (1v) are as follows:

- Airblast – 120.2 dB.
- Vibration – 9.7 mm/s.

Accordingly, the predicted levels are below the relevant building damage criteria for airblast and vibration. Notwithstanding, it is recommended that airblast and vibration monitoring is undertaken at the Kurrumbede homestead and that the results of monitoring are used as a guide to blast design (i.e. blast designs should be revised if actual airblast/vibration levels approach criteria).

At the grinding groove site, at least 1,660 m from blast events, a vibration level of 6.3 mm/s is predicted. This complies with the limit of 80 mm/s nominated. However, this site should be inspected to confirm limits and vibration monitoring undertaken, with the results informing blast design.

These two heritage items will need to be addressed in the Blast Management Plan.

8.4 Potential Flyrock Impacts

Flyrock is any material ejected from the blast site by the force of the blast.

Flyrock would be managed through appropriate blast design in order to minimise risk to the public using Blue Vale Road, Braymont Road and parts of the Vickery State Forest, and to nearby residential receivers and livestock.

Consistent with the advice of both the NSW Division of Resources and Geoscience (within the DP&E) and the appropriate roads authority (Gunnedah and Narrabri Shire Councils), the section of Blue Vale Road and Braymont Road within 500 m of blasting activities would be closed and public access restricted during blasting events by use of road closure signs and sentries at either end of the roadway.

No blasts would occur within 500 m of land not owned by Whitehaven (other than Blue Vale Road, Braymont Road and the Vickery State Forest).

8.5 Airblast Overpressure & Vibration Mitigation

Blast and vibration management would be conducted in accordance with a Blast Management Plan which would be prepared for the Project.

Consistent with advice previously received from the NSW Division of Resources and Geoscience and the appropriate roads authority (Gunnedah and Narrabri Shire Councils), the sections of Blue Vale Road, Braymont Road (i.e. prior to physical closure of the portion of Braymont Road proposed for closure) and the Vickery State Forest within 500 m of blasting activities would be closed and public access restricted during blasting events by use of road closure signs and sentries at either end of the roadway.

A Blast Management Plan would be prepared to include the above measures for the Project, and would also include procedures for the management of livestock in close proximity to blast events.

9 CONCLUSION

This assessment has addressed potential noise and blasting impacts associated with the Project, which has a proposed mine life of approximately 25 years.

9.1 Project Operational Noise

- Operational noise impacts were assessed for three years (Project Years 3, 7 and 21), 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 4ºC/100 m.
- The significance of noise-enhancing meteorological conditions (in accordance with Fact Sheet D of the *NPfI*) was determined based on meteorological data local to the site and noise predictions were conducted for both standard meteorological conditions and significant noise-enhancing conditions. The assessment presents the highest noise predictions under the relevant meteorological conditions, which are considered conservative.
- The 10th percentile methodology was also used, whereby noise levels were predicted for a number of representative meteorological conditions experienced at the site and the 10th percentile exceedance level reported. The 10th percentile noise levels were presented in the assessment to provide further description of potential noise impacts to the community.
- Initial modelling resulted in various mitigation measures being proposed for the Project, including:
  - consideration of removal of a proposed open cut close to receivers south-west of the Project;
  - redesign of the waste rock emplacement to provide shielding opportunities; and
  - treatment of mobile plant to reduce emitted noise levels.
- With the above controls in place, exceedances of the Project noise trigger levels are predicted for privately-owned receivers 127b, 127c, 131a, 131b and 132 for periods of time during the life of the Project. Notwithstanding the conservatism associated with the meteorological conditions modelled, exceedances predicted at receivers 131a, 131b and 132 are considered to be "negligible" (between 1-2 dB according to the *VLAMP*) and would not be discernible (when compared to compliance with the Project noise trigger levels) by the average listener, in accordance with the *VLAMP*. Whitehaven has been in dialogue with the owner of receivers 127b and 127c regarding entering into a potential noise agreement. Additionally, the owner of receivers 127b and 127c has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.
- A low-frequency noise assessment was conducted which indicates that it is unlikely that any of the receivers surrounding the Project would be subject to low-frequency noise. Therefore, no modifying factor correction for low-frequency noise is warranted for the Project.

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, Tarrawonga Coal Mine, Boggabri Coal Mine and the Rocglen Coal Mine were conducted.
- The assessment indicates that cumulative noise levels resulting from the concurrent operation of these projects would comply with the night time recommended acceptable amenity criterion (40 dBA) for all privately-owned receivers.

9.4 Sleep Disturbance

- Modelling of L_{Amax} noise levels at nearby receivers was undertaken for typical instantaneous mine-site noise sources, such as excavator dumping in empty truck bodies, dozer track noise and impact 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 the identified receivers. The night time $L_{Aeq,15min}$ noise predictions are predicted to exceed the $L_{Aeq,15min}$ noise trigger of 40 dBA at receiver 127c based on the conservative meteorological conditions assessed. Whitehaven has been in dialogue with the owner of receiver 127c regarding entering into a potential noise agreement. In addition, the owner of this receiver has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.

9.5 Construction Noise

- Assessment of the potential for noise impacts from construction associated with the mine infrastructure area and the rail loop indicates that construction noise levels, would comply with the *Interim Construction Noise Guideline* 'highly noise affected' management level. A negligible (1 dBA) exceedance of the *Interim Construction Noise Guideline* 'noise affected' level is predicted at 1 privately-owned receiver (127c).
- When added to Year 3 operational noise levels, construction noise may trigger exceedances (above the day Project noise trigger level of 40 dBA) at receiver 127c. Whitehaven has been in dialogue with the owner of receiver 127c regarding entering into a potential noise agreement due to predicted exceedances due to operational noise. In addition, the owner of this receiver has the right to acquisition upon request in Development Consent (SSD-5000) for the Approved Mine.
- Assessment of the potential for noise impacts from construction associated with the rail spur indicates that construction noise levels would comply with the *Interim Construction Noise Guideline* 'noise affected' level during standard hours at all receivers and may exceed the 'noise affected' level only outside recommended standard hours (e.g. Saturday afternoon and Sunday daytime) at privately-owned receivers 132 and 144b. Construction noise levels would be managed to comply with the 'noise affected' level at the approved dwelling location on property 144 (if the approved dwelling was constructed prior to construction of the rail spur). During construction actual noise impacts at the receivers would be monitored.

- Consistent with the *Interim Construction Noise Guideline,* Whitehaven would inform all potentially impacted residents of the nature of the rail construction works to be carried out, the expected noise levels and duration, and contact details of Whitehaven representatives.

9.6 Road and Rail Traffic Noise

- Following the Project CHPP, train load-out facility and rail spur reaching full operational capacity, significant reductions in road traffic noise are anticipated along the Approved Road Transport Route as a result of coal from the Project being transported by rail.
- Along the Project rail spur, it was found that compliance with the RING noise criteria for non-network rail lines would be achieved at all surrounding privately-owned noise sensitive receivers. Night time rail spur levels would be managed such that, if the approved dwelling on property 144 was constructed, no more than negligible (i.e. 1-2 dB) exceedances of the *RING* criterion would be experienced at the approved dwelling location.
- Several sections of railway on the ARTC's network were assessed for potential increases in rail noise associated with product coal train movements. In all sections, the *RING* criteria are already exceeded at distances up to approximately 220-350 m from the railway.
- Project rail movements would increase the offset distance from the railway where the *RING* criteria are met, however the predicted noise level increase in all cases is less than 2 dB.

9.7 Blasting

- Blasts within the western part of the open cut, where the distance to privately owned residences is closest, would be conducted using site rules to be developed using site specific blast monitoring data gathered during the initial stage of mining operations.
- Predicted airblast and vibration levels at the Kurrumbede Homestead are below the relevant building damage criteria for heritage sites. Notwithstanding, it is recommended that monitoring is undertaken at the Kurrumbede Homestead and that the results of monitoring be used as a guide to blast design (i.e. blast designs should be revised should actual airblast/vibration levels approach criteria).
- The sections of Blue Vale Road, Braymont Road and the Vickery State Forest within 500 m of blasting activities would be temporarily closed during blast events.

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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 and these 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 here defined.

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.

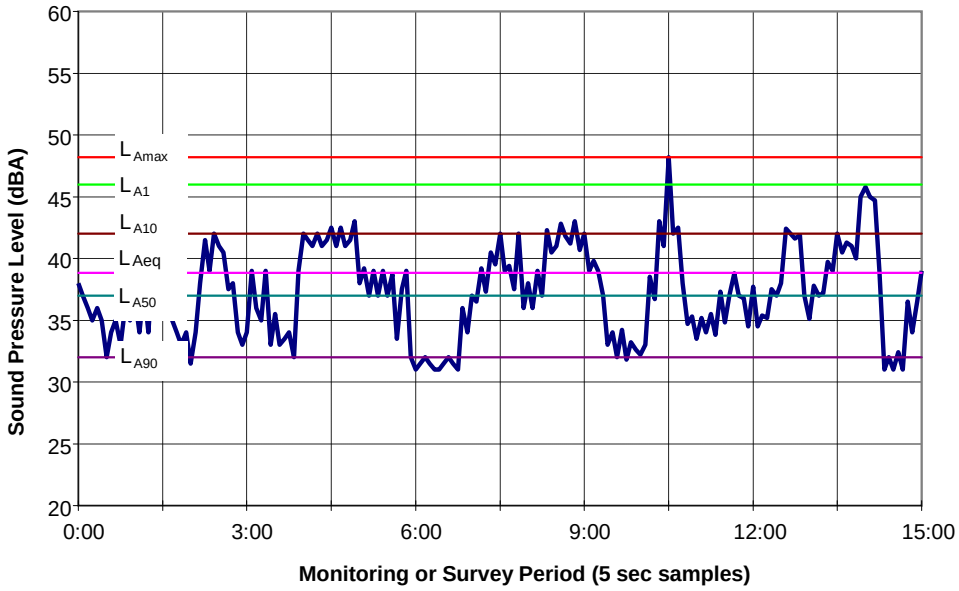
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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 10^{th} percentile (lowest 10^{th} 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

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

Direction	Spring	Summer	Autumn	Winter
N	9.4%	10.3%	11.6%	13.1%
NNE	8.2%	10.9%	11.2%	11.4%
NE	7.9%	12.4%	12.0%	11.3%
ENE	9.1%	15.2%	15.1%	12.3%
E	12.2%	18.0%	20.5%	15.8%
ESE	14.8%	19.8%	25.1%	20.0%
SE	17.9%	21.1%	28.2%	24.2%
SSE	21.7%	22.0%	30.9%	27.9%
S	24.7%	21.7%	32.1%	31.0%
SSW	25.8%	21.2%	29.3%	30.0%
SW	28.1%	20.4%	26.4%	28.3%

Direction	Spring	Summer	Autumn	Winter
WSW	28.2%	19.3%	24.8%	27.4%
W	25.5%	17.3%	22.1%	25.5%
WNW	21.4%	14.6%	17.6%	20.7%
NW	17.5%	12.2%	14.9%	17.9%
NNW	12.4%	10.4%	13.0%	16.0%

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

Direction	Spring	Summer	Autumn	Winter
N	23.1%	12.0%	25.0%	35.8%
NNE	22.4%	12.4%	26.4%	38.4%
NE	23.1%	13.9%	27.3%	39.9%
ENE	22.2%	15.0%	27.6%	39.3%
E	16.8%	15.6%	23.7%	30.8%
ESE	12.3%	15.9%	20.9%	20.9%
SE	14.1%	16.1%	20.4%	18.6%
SSE	16.1%	15.7%	20.3%	18.5%
S	16.4%	13.9%	18.4%	18.5%
SSW	17.4%	12.0%	15.9%	17.8%
SW	21.3%	11.1%	14.1%	19.1%
WSW	20.9%	10.9%	13.5%	18.9%
W	18.9%	10.5%	12.3%	18.9%
WNW	18.4%	10.8%	12.3%	16.8%
NW	18.4%	11.2%	14.4%	18.3%
NNW	20.2%	11.6%	20.6%	26.9%

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

Direction	Spring	Summer	Autumn	Winter
N	26.3%	19.9%	29.3%	36.7%
NNE	27.8%	22.5%	31.8%	37.3%
NE	28.7%	24.2%	33.8%	38.0%
ENE	28.7%	25.2%	34.8%	37.2%
E	23.2%	23.8%	30.3%	29.3%
ESE	20.6%	21.6%	29.0%	24.4%
SE	22.2%	20.2%	28.7%	25.0%
SSE	22.6%	18.5%	27.1%	25.6%

Direction	Spring	Summer	Autumn	Winter
S	21.0%	15.7%	22.7%	23.4%
SSW	18.2%	12.5%	17.0%	18.3%
SW	19.7%	10.1%	13.4%	15.2%
WSW	18.0%	8.8%	11.3%	14.2%
W	16.0%	8.2%	10.0%	13.6%
WNW	15.3%	8.6%	10.4%	13.5%
NW	16.5%	10.8%	14.7%	17.4%
NNW	22.0%	15.6%	24.8%	30.2%

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

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

Direction	Day	Evening	Night
N	13.1%	35.8%	36.7%
NNE	11.4%	38.4%	37.3%
NE	12.4%	39.9%	38.0%
ENE	15.2%	39.3%	37.2%
E	20.5%	30.8%	30.3%
ESE	25.1%	20.9%	29.0%
SE	28.2%	20.4%	28.7%
SSE	30.9%	20.3%	27.1%
S	32.1%	18.5%	23.4%
SSW	30.0%	17.8%	18.3%
SW	28.3%	21.3%	19.7%
WSW	28.2%	20.9%	18.0%
W	25.5%	18.9%	16.0%
WNW	21.4%	18.4%	15.3%
NW	17.9%	18.4%	17.4%
NNW	16.0%	26.9%	30.2%

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

- Day SSE; S; and SSW
- Evening N; NNE; NE; ENE; and E
- Night N; NNE; NE; ENE; E; and NNW

B.2 Temperature Inversion Noise-Enhancing Condition

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 *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 23.8 per cent and therefore moderate-to-strong temperature inversions are not considered significant to the Project.

APPENDIX C

EQUIPMENT SOUND POWER LEVEL LETTERS FROM MANUFACTURERS

LIEBHERR

Liebherr-Australia Pty Ltd
ABN 65 007 970 452

Mining Equipment
Hydraulic Excavators
Dump Trucks

Construction Equipment
Bulldozers
Hydraulic Excavators
Wheel Loaders

Cranes
Mobile Cranes
Crawler Cranes

EGM Project Delivery
Whitehaven Coal
PO Box 600
Gunnedah, 2380

Attention: B Cole

:

Date:
01.03.2018

Prepared by:
Jay Sheppard
Telephone: +61 2 6575 1003
Mobile: +61 4 4886 0011
jay.sheppard@liebherr.com

Sound Power Level of Ultra Class Trucks

Dear Brian,

Liebherr Australia has supplied sound attenuated ultra class rear dump trucks to a number of mines throughout Australia.

These trucks have been subject to independent sound power evaluation under dynamic test conditions and reflecting of site conditions and the LwA has generally been measured at 112 to 113dBa.

Measurement and calculation was conducted generally in accordance with:

- AS 2012.1-1990 'Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition – Determination of Compliance with Limits for External Noise';
- AS 2012.2-1990 'Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition – Operator's Position';
- ISO 3744-2010 'Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane';
- ISO 6393:2008(E) 'Earth-moving machinery – Determination of sound power level – Stationary test conditions'; and

Liebherr-Australia Pty Ltd
1 Dr. Willi Liebherr Drive
Para Hills West SA 5096
Australia
Telephone +61 8 8344 0200
www.liebherr.com.au

Managing Directors:
Andrew Schultz
Trent Wehr

Bank Details:
Westpac Banking Corporation
BSB 034-081
Account No; 58-1200
Account Name: Liebherr-Australia Pty Ltd
Swift Code: WPACAU2S

Sound Power Level of Ultra Class LIEBHERR

- ISO 6395:2008(E) 'Earth-moving machinery – Determination of sound power level noise emissions – Dynamic test conditions'.

Should you require any additional information, please contact me directly on:
mobile 0448 860 011 or email jay.sheppard@liebherr.com.

Kind regards,
LIEBHERR-AUSTRALIA PTY LTD

Jay Sheppard
Sales Executive NSW/NZ - Mining

HITACHI
Hitachi Construction Machinery (Australia) Pty Ltd

HITACHI BELL JOHN DEERE Marubeni Equipment Finance

Date: 20/3/2018

Brian Cole
EGM Project Delivery
Whitehaven Coal
PO Box 600
Gunnedah, 2380

Dear Brian,

Sound Power Level of Hitachi EX8000 Excavators

I have been following up on your query regarding the sound power levels and acoustic treatment for the EX8000 excavators in operation at Maules Creek following the recent monitoring of sound power levels by Global Acoustics.

I can advise that EXC263 has additional acoustic treatment over and above the treatment on the other excavators in this category. The treatment consists of additional louvres on the hydraulic coolers which would explain why EXC263 has a lower sound power level compared generally with the other excavators in the fleet.

Hitachi is planning to retrofit the same treatment to the other excavators in the fleet. Therefore the measured sound power level for EXC263 can be considered representative of the fleet.

Like the Hitachi RDT fleet at Maules Creek, Hitachi is continuing to explore ways to lower the sound power level of the mining fleet.

Don't hesitate to contact me if you require further details.

Yours Faithfully,

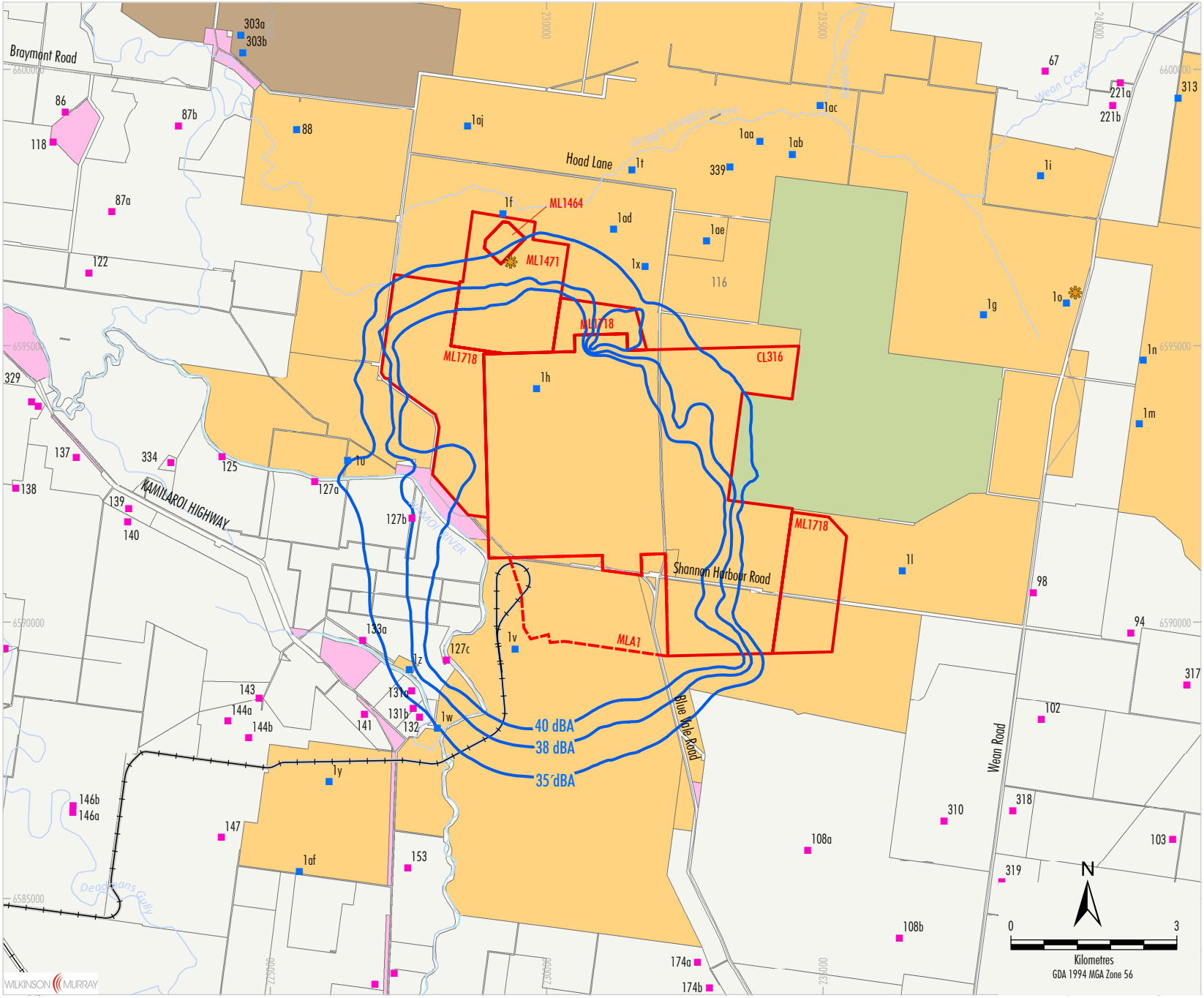
Ben Murray

Account Manager – Mining
Hitachi Construction Machinery (Australia) Pty Ltd
PO Box / Locked Bag 228
CAROLE PARK, 4300

Hitachi Construction Machinery (Australia) Pty Ltd ABN 62 000 060 179 ACN 000 060 179
Bldg 3, 1 Foundation Pl, Greystanes, NSW 2145 Locked Bag 6726, Blacktown BC, Blacktown NSW 2148 P 02 8863 4800 F 02 8863 4899

APPENDIX D

NOISE CONTOURS



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application (MLA)
- Indicative Rail Spur Alignment
- Mine-owned Dwelling
- Private Dwelling
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Privately Owned Land and Other Land
- Meteorological Station
- Noise Contour

Source: Department of Land and Property Information - Land Tenure (2016); Department of Industry (2015)

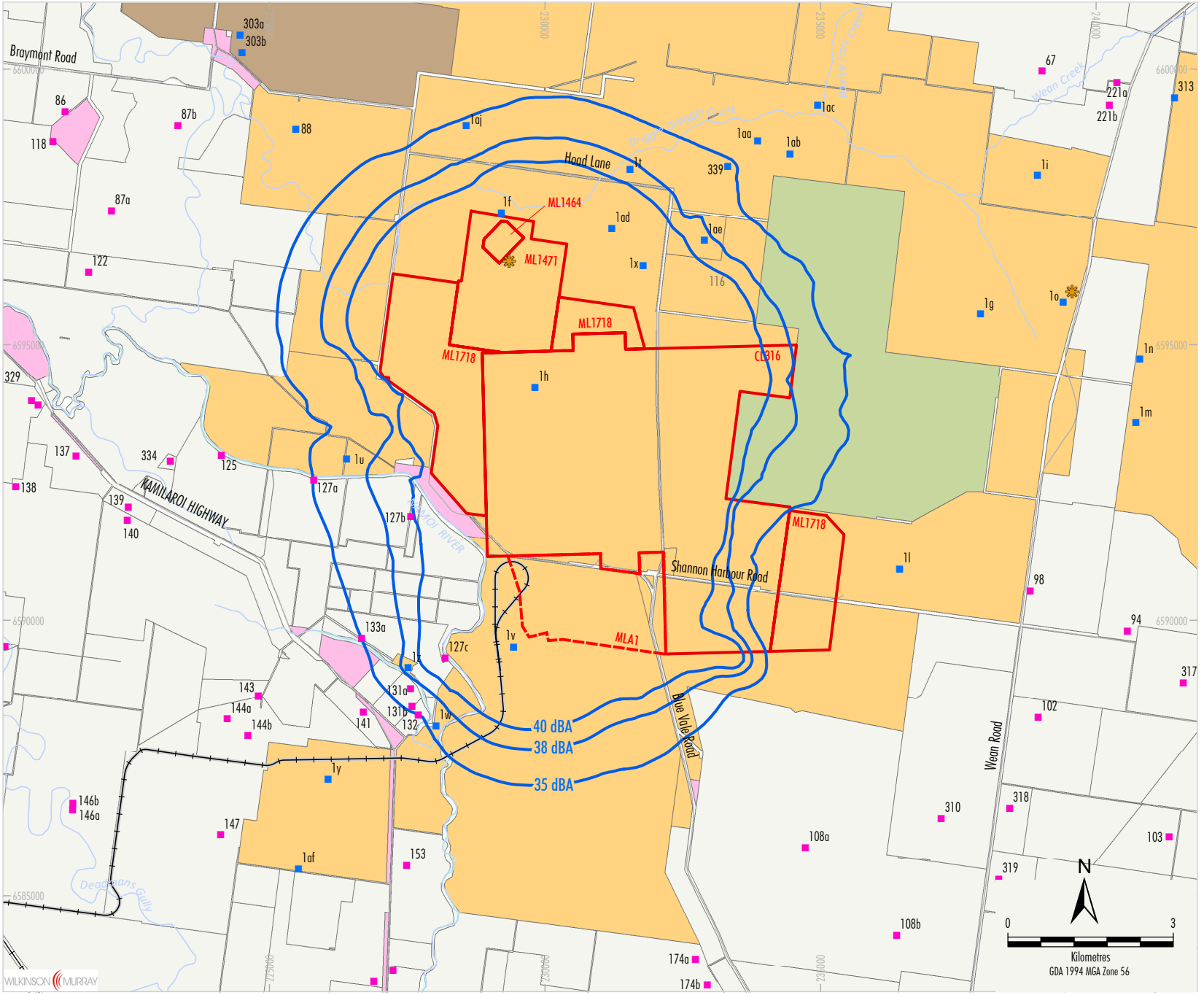
WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Maximum Predicted Noise Level - All Assessable NPFI Meteorological Conditions - Y03 - Night

Figure D-1

WHC-15-33_EIS_NA_AppC_202C



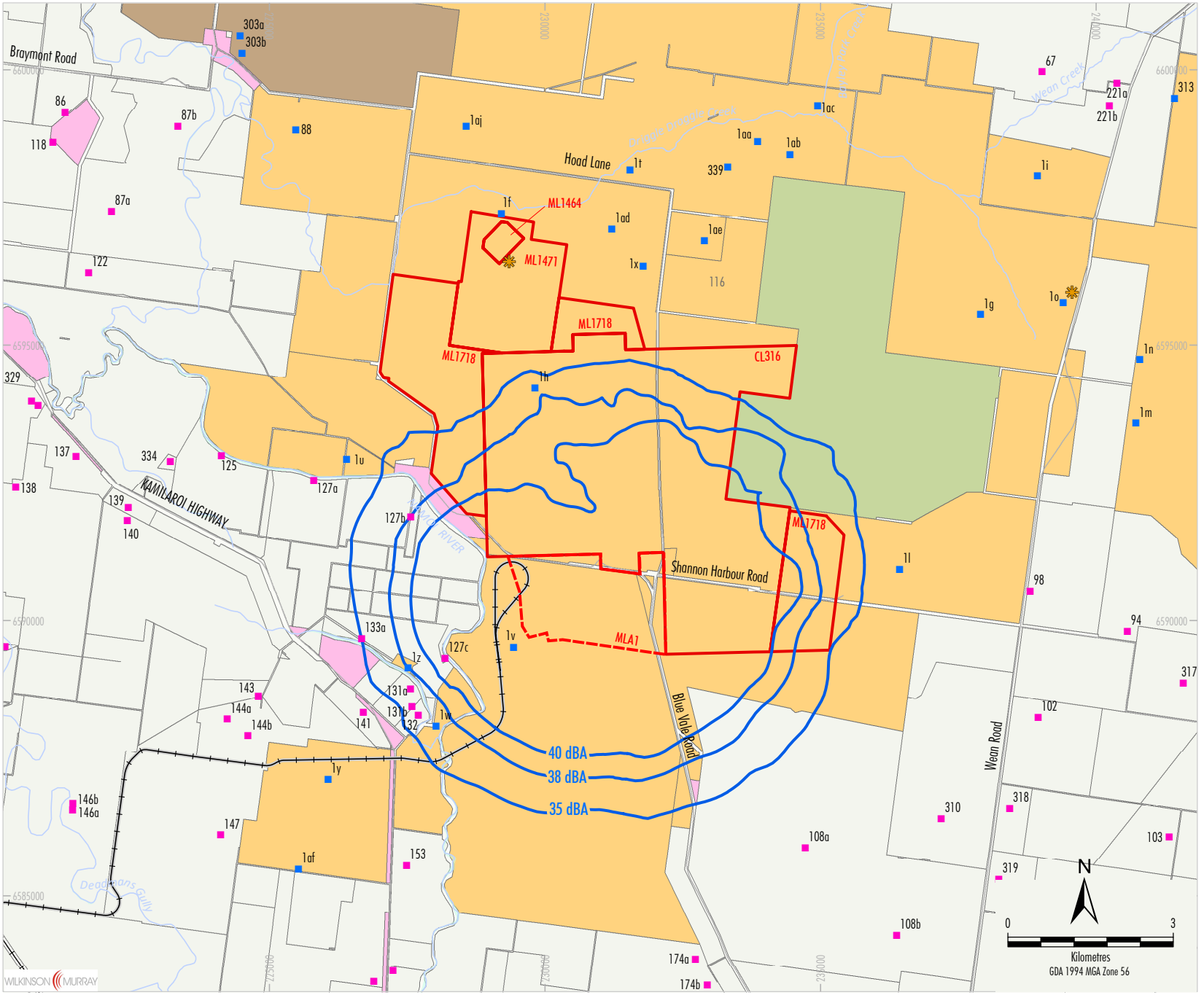
Source: Department of Land and Property Information - Land Tenure (2016); Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Maximum Predicted Noise Level - All Assessable NPFI Meteorological Conditions - Y07 - Night

Figure D-2



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application (MLA)
- Indicative Rail Spur Alignment
- Mine-owned Dwelling
- Private Dwelling
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Privately Owned Land and Other Land
- Meteorological Station
- Noise Contour

Source: Department of Land and Property Information - Land Tenure (2016); Department of Industry (2015)

WHITEHAVEN COAL

VICKERY EXTENSION PROJECT

Maximum Predicted Noise Level - All Assessable NPFI Meteorological Conditions - Y21 - Night

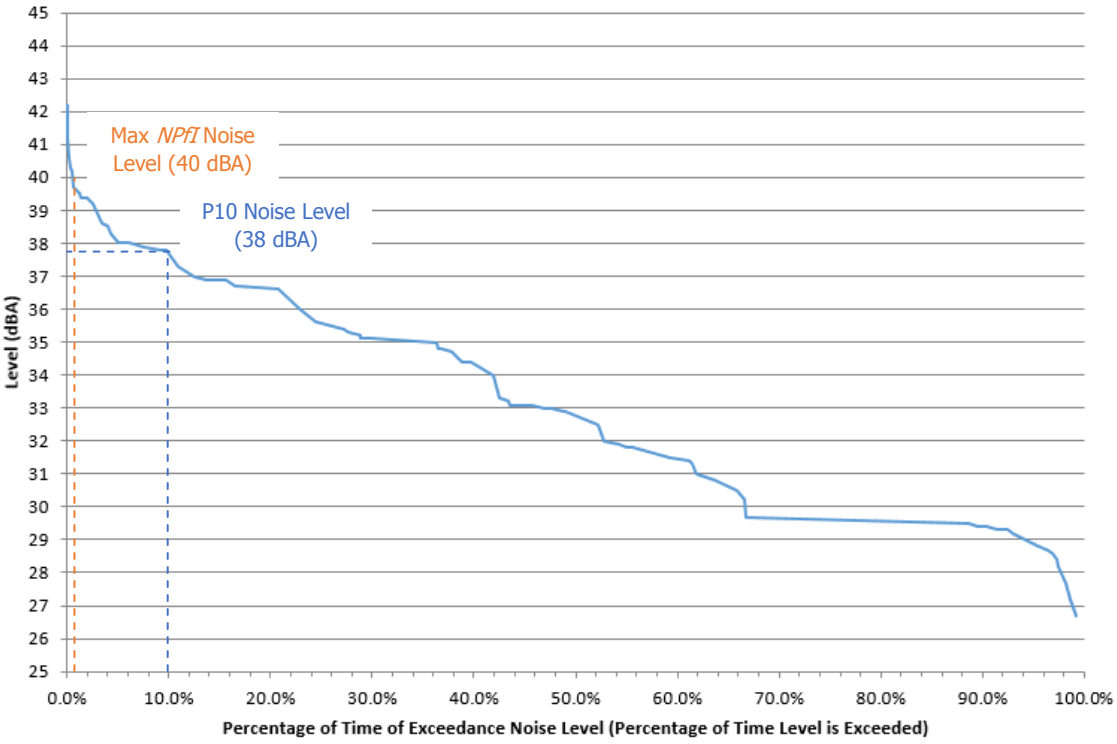
Figure D-3

WHC-15-33_EIS_NA_AppC_204C

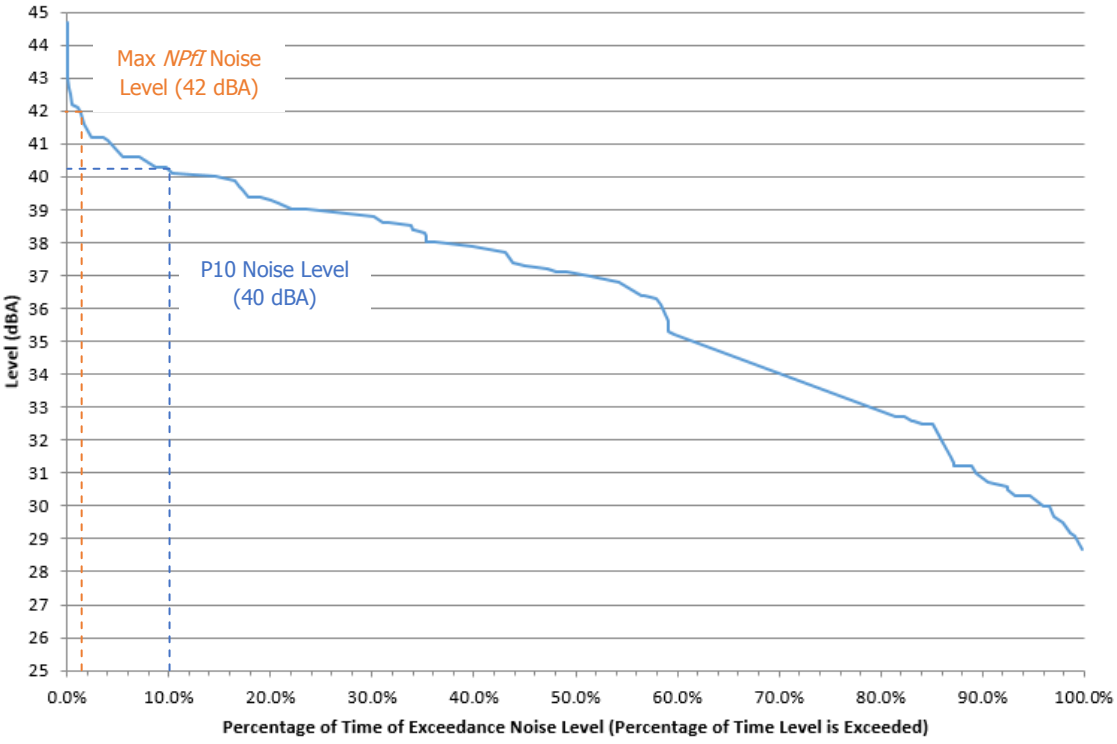
APPENDIX E

CUMULATIVE FREQUENCY OF OCCURRENCE NOISE GRAPHS

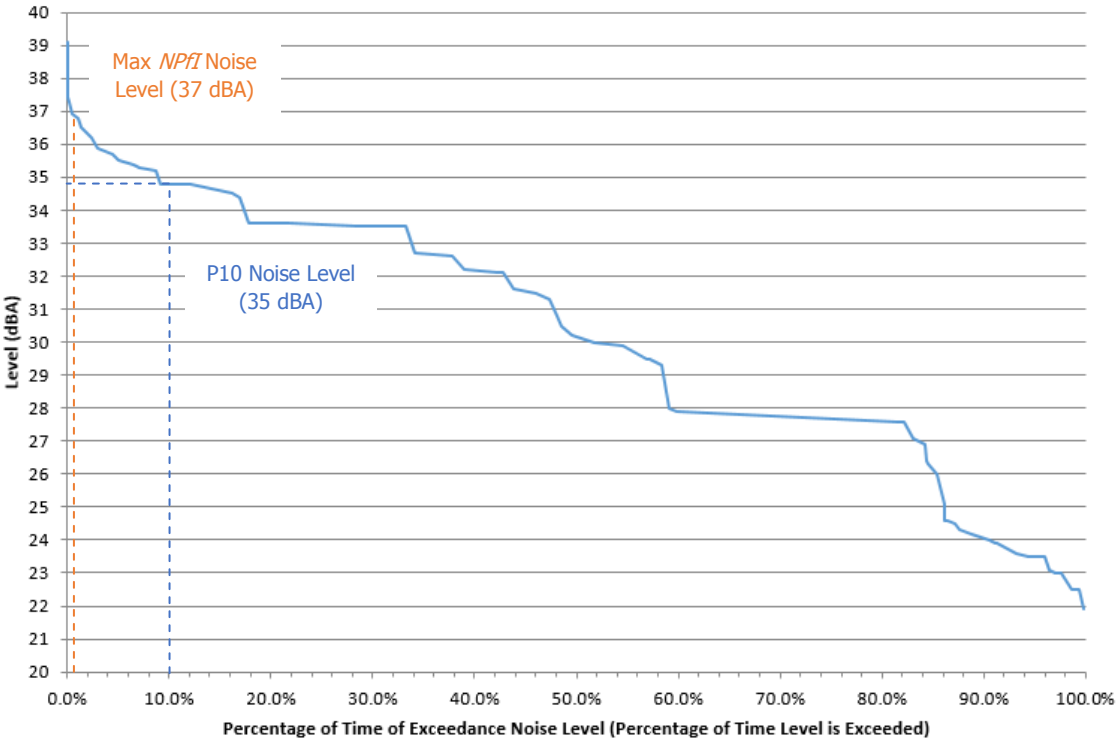
Y07 - Winter Night - Receiver 127b



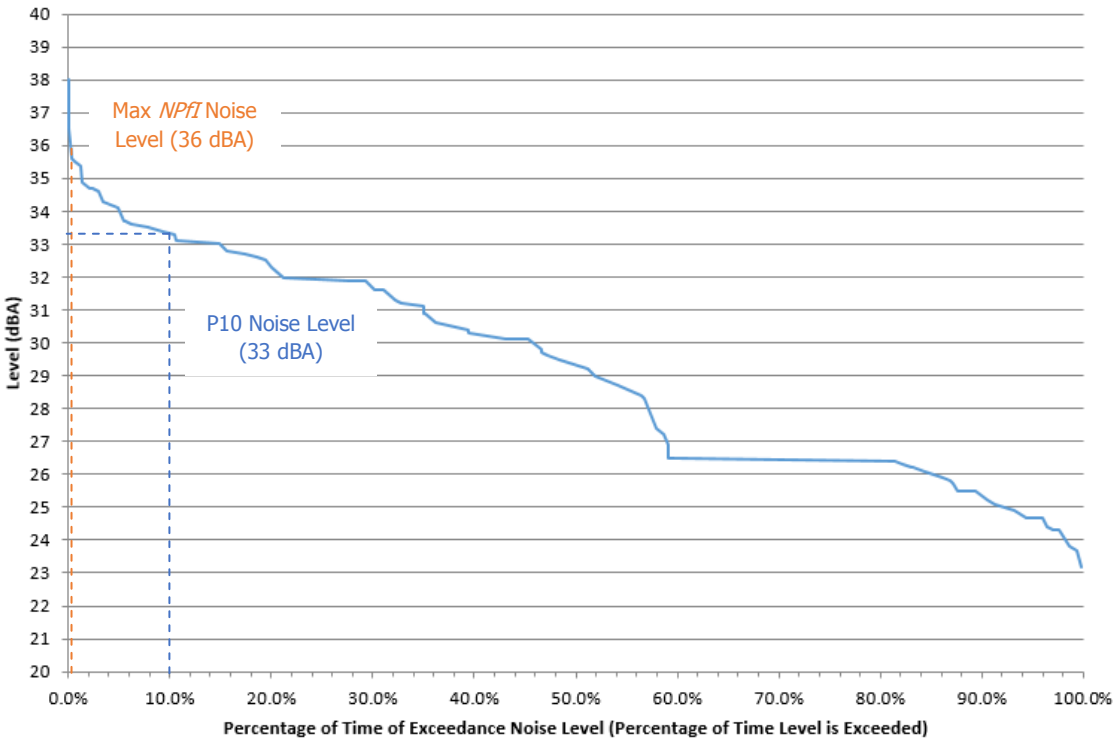
Y07 - Winter Night - Receiver 127c



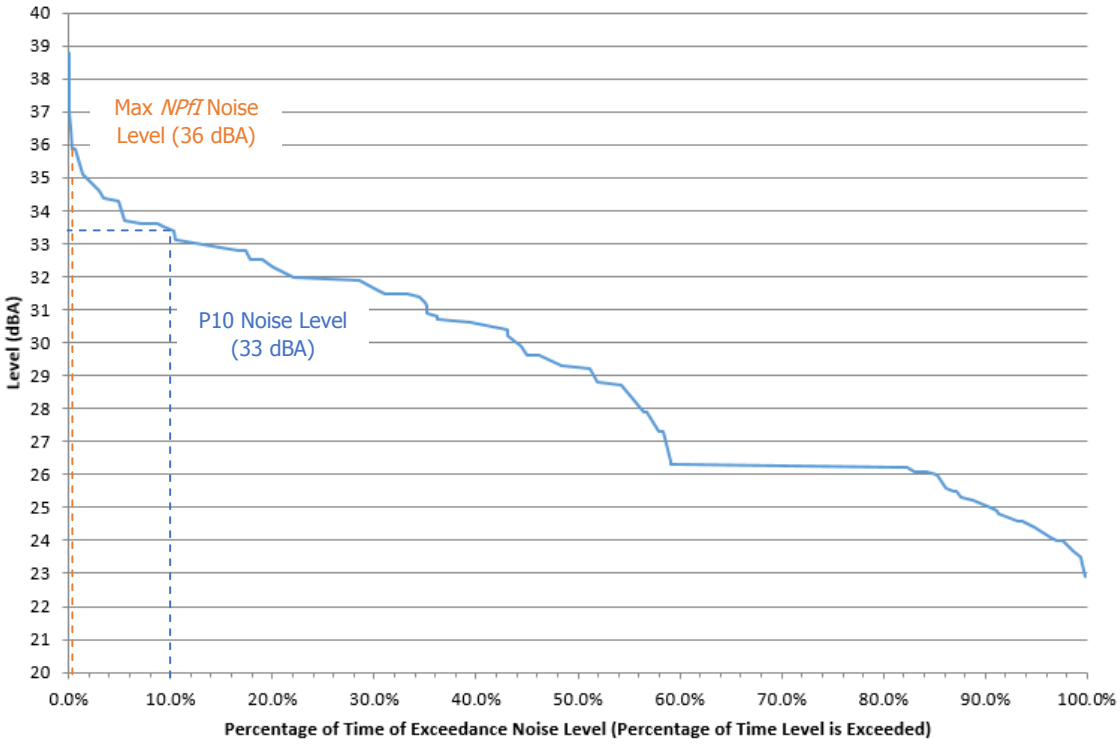
Y07 - Winter Night - Receiver 131a



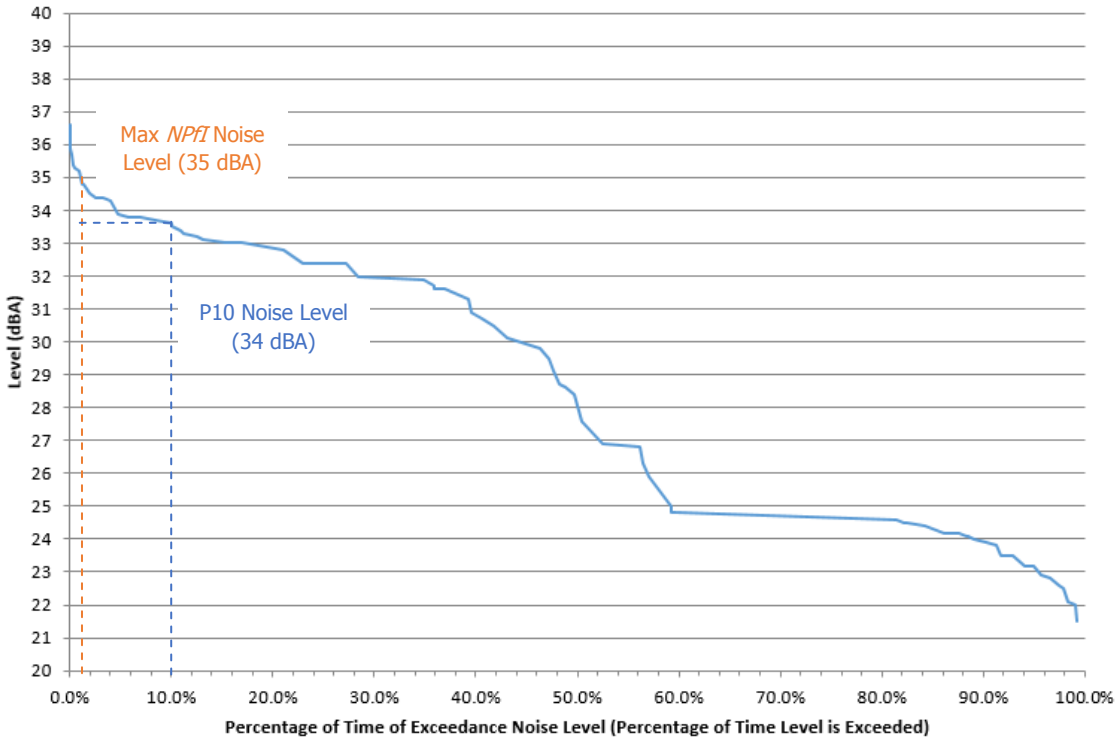
Y21 - Winter Night - Receiver 131b



Y21 - Winter Night - Receiver 132



Y21 - Winter Night - Receiver 133a



APPENDIX F

CALCULATED PERCENTAGE CHANGE IN TRAFFIC VOLUMES

Table F-1 Average Change in Weekday Traffic Volumes due to the Project

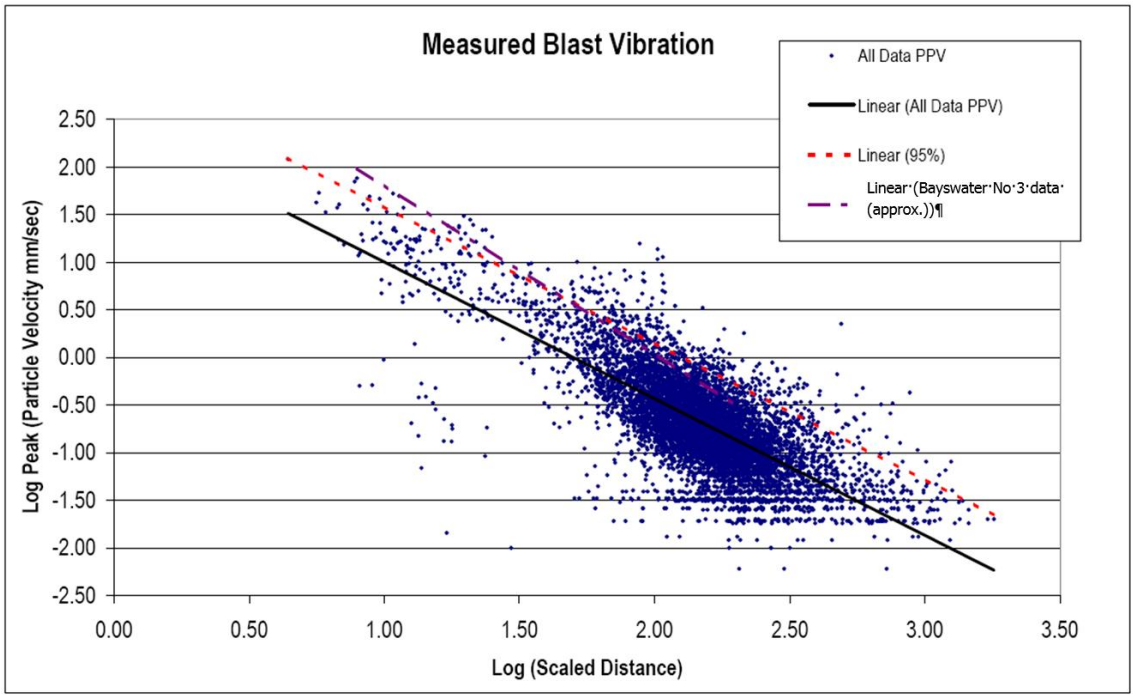
Traffic Count Location	Road	Road Category	Project Year	Day		Night	
				Light	Heavy	Light	Heavy
C	Blue Vale Road south of Shannon Harbour Road	Principal Haulage Route	Without Approved Mine 1	101%	8%	74%	0%
			Without Approved Mine 13	259%	29%	209%	125%
			With Approved Mine 1	20%	7%	-9%	-21%
			Without Approved Mine 13	51%	-82%	39%	-89%
B	Blue Vale Road northeast of Kamilaroi Highway	Principal Haulage Route	Without Approved Mine 1	23%	7%	40%	0%
			Without Approved Mine 13	57%	15%	111%	35%
			With Approved Mine 1	6%	6%	-6%	-18%
			Without Approved Mine 13	21%	-73%	28%	-79%
G	Kamilaroi Highway between Blue Vale Road and CHPP	Arterial road	Without Approved Mine 1	11%	5%	19%	0%
			Without Approved Mine 13	24%	6%	50%	7%
			With Approved Mine 1	4%	4%	-2%	-10%
			Without Approved Mine 13	10%	-54%	16%	-49%

APPENDIX G

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 G.1 illustrates the measured data and associated linear trend lines for vibration.

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