



WHITEHAVEN COAL MINING PTY LTD

ABN: 65 086 426 253

Belmont Coal Project

via Gunnedah

Noise and Vibration Assessment



Prepared by

Spectrum Acoustics Pty Ltd

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**Specialist Consultant Studies Compendium
Part 5**

Noise and Vibration Assessment

of the

Belmont Coal Project

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EXECUTIVE SUMMARY

An assessment has been conducted to determine the noise and vibration impacts of the Belmont Coal Project. Noise monitoring conducted in 2002 revealed a generally quiet rural environment and an operational noise limit of 35 dB(A), $L_{eq(15 \text{ minute})}$ was established for all non projected-related residences within the study area. This criterion applies to all periods (day, evening and night) and represents the lowest industrial noise intrusiveness criterion that can be established under NSW Department of Environment and Climate Change (DECC) guidelines. A construction noise criterion of 40 dB(A), $L_{10(15 \text{ minute})}$ was established based on a site establishment period of between 4 weeks and 6 months. Criteria for sleep disturbance $L_{A(max)}$, traffic noise, blasting and rail related vibration were also developed in accordance with the relevant guideline document.

Noise modelling was conducted using the Environmental Noise Model (ENM, version 3.06) for a site establishment and several operational scenarios throughout the life of the Project. Modelling results showed no exceedances of the established criteria for site establishment, operations or sleep disturbance with the exception of a minor (1dB) exceedance north of the site under adverse conditions when the northern emplacement was utilised. A recommendation has been made that a 10m bund be constructed along the northern edge of the emplacement to mitigate potential noise exceedances under adverse conditions, thereby reducing the received noise level by 5dB(A) to a compliant level.

Traffic noise levels were also predicted to meet the nominated criteria, even considering the cumulative noise level associated with the concurrent operation of the Belmont, Tarrawonga and Whitehaven Coal Mines.

Air overpressure and ground vibration associated with the proposed blasting of the Project was predicted to easily meet the relevant criteria. Similarly, an increase in the number of trains on the Main Northern Line as a result of the Project would not lead to increased noise and vibration levels above those nominated in EPL 3142, held by Australian Rail Transport Commission.

While exceedances of the nominated criteria are not predicted, recommendations have been made with regard to managing noise emissions from the Project. These include managing the noisier construction activities to avoid simultaneous operation, creating acoustic barriers through placement of soil stockpiles around the perimeter of the Project Site, undertaking in-pit overburden placement activities in preference to out-of-pit placement during noise enhancing conditions and implementation of a driver code of conduct which would include a requirement to minimise truck generated noise.

It is concluded that the Project could operate without adversely impacting upon the acoustical amenity of any non-project related residential receiver, after implementation of noise control recommendations given in this report.

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1 INTRODUCTION

1.1 Scope

Whitehaven Coal Mining Pty Limited (the “Proponent”) is seeking to establish a coal mine centred on the “Belmont” property 25km north of Gunnedah and 23km southeast of Boggabri, in northern NSW (see **Figure 1**). The “Belmont Coal Project” is classified as a Major Project in accordance with the State Environmental Planning Policy (Major Projects) (2005) and, consequently, the Minister for Planning is the approval authority and an *Environmental Assessment* report is required to be submitted to support the project approval application. Accordingly, a Noise and Vibration Impact Assessment (NVIS) has been conducted in accordance with the Department of Environment and Climate Change (DECC) *NSW Industrial Noise Policy* (INP, 2000) for reference in the Environmental Assessment (EA) for the project.

1.2 Study Area

The study area for the NVIS includes an area incorporating the proposed open cut mine and associated activities, collectively referred to as the Project Site (**Figure 2a**), as well as the route for the transport of coal between the Project Site and Whitehaven Coal Handling and Preparation Plant and Rail Loading Facility to the northwest of the Gunnedah township (**Figure 2b**). The Project Site is surrounded to the north, south and east by relatively flat agricultural land and to the west by the moderate slopes of Vickery State Forest. The transport route is also generally surrounded by relatively flat agricultural land. While the Proponent owns a substantial area of land on and surrounding the Project Site, there are three non project-related residences within a 3km radius of the boundary of the Project Site.

The three non project-related residences are further discussed in Section 3.2.

1.3 Proposed Operations

The Project, if approved, would involve the following activities.

- Coal mining by open cut mining methods over the area defined by the “limit of mining” (114.1ha). The limit of open cut mining has been defined by drilling and a review of economic, geological and environmental considerations as described in Section 2.3. The area proposed for auger mining is identified beyond the western limit of open cut mining and incorporation of this into the mine plan would be determined primarily by economic factors at the time.
- Open cut mining would be by the conventional haulback method involving the sequential removal of soil and overburden / interburden materials above and within the coal seams, coal removal, and progressive backfilling and rehabilitation of the mined-out areas. Open cut mining may be supplemented by auger mining, to a distance of 200m beyond the western limit of the open cut.
- Annual ROM coal production would increase from an initial level of approximately 0.75Mtpa to a maximum annual rate of 1.5Mtpa.
- Programmed placement of overburden and interburden materials from the open cut area to a combination of out-of-pit and in-pit overburden emplacements.

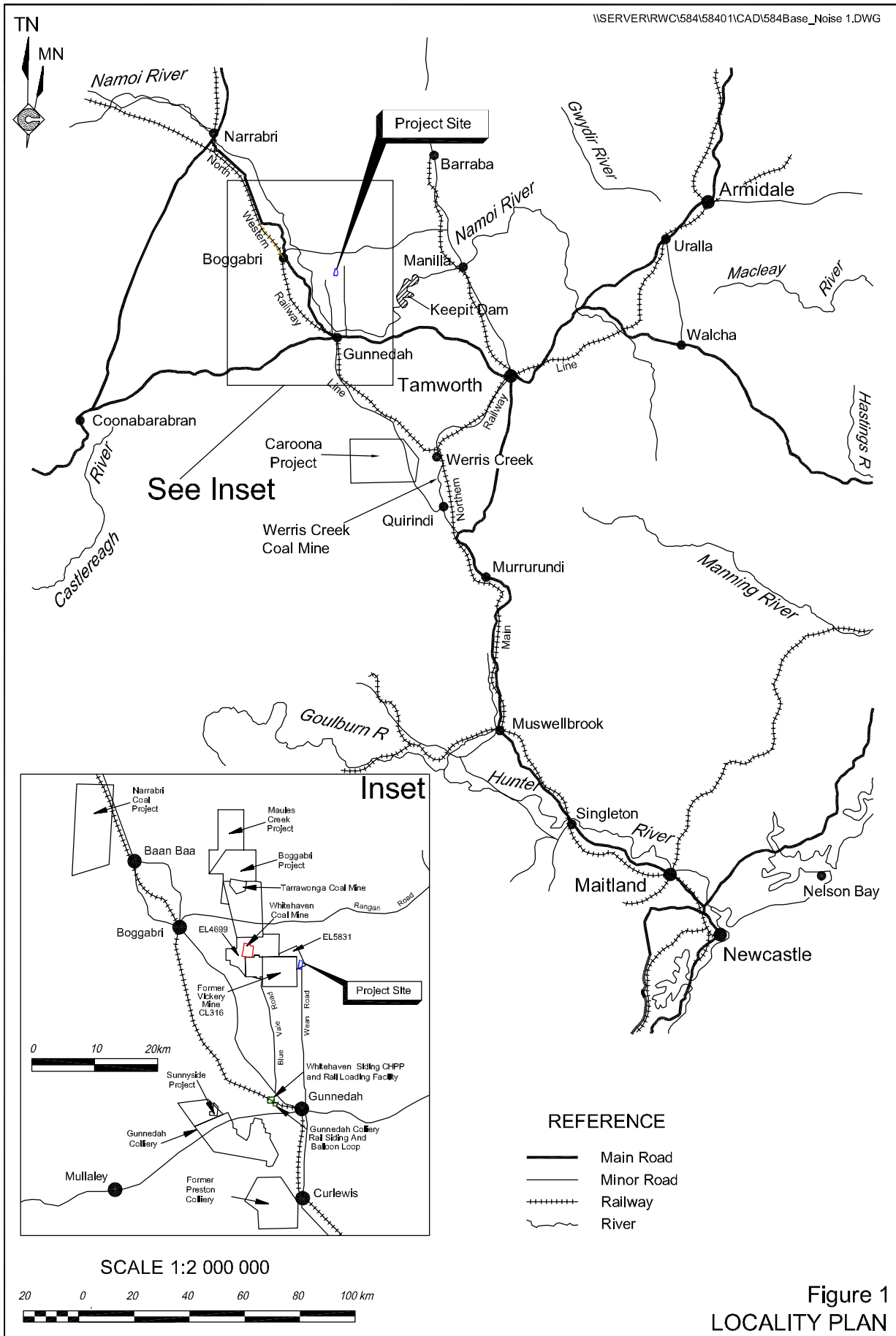
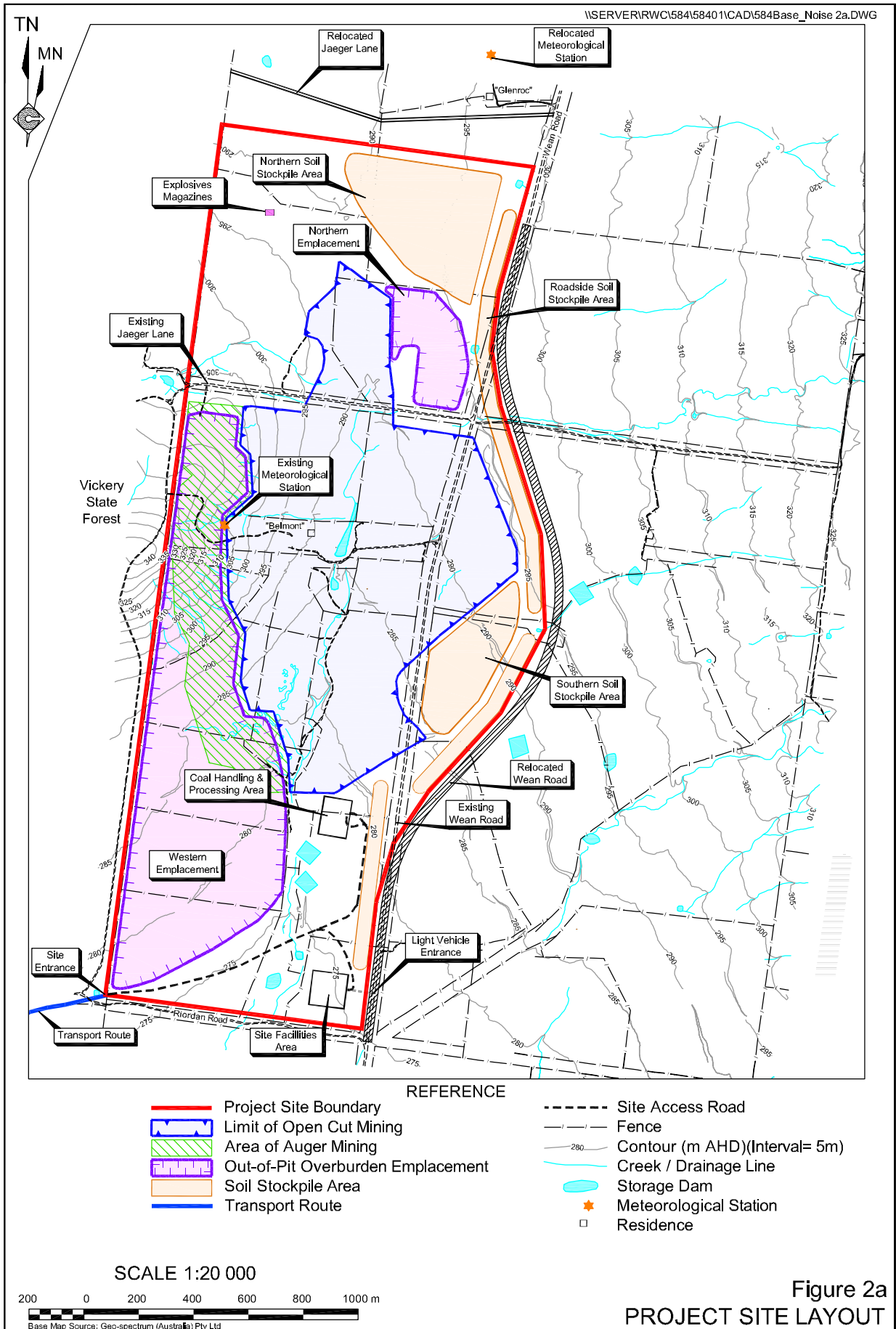
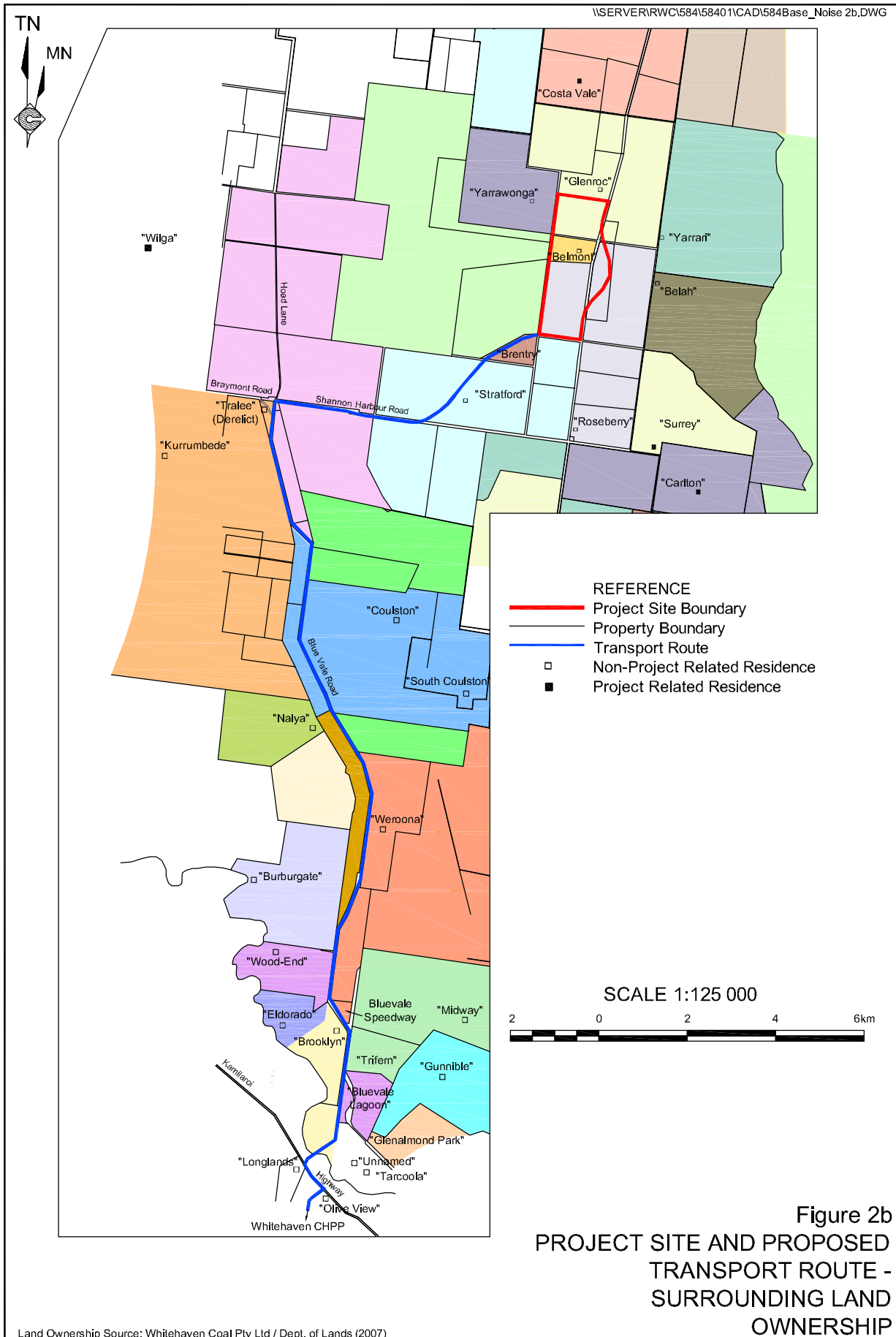


Figure 1
LOCALITY PLAN



Note: A Colour Version of this figure is available on the project CD



- On-site size reduction of the ROM coal using a crushing plant positioned within the Coal Handling and Processing Area.
- Relocation of a section of Wean Road.
- Upgrading sections of Shannon Harbour Road and its intersection onto Hoad Lane to be incorporated into the transport route.
- Transportation of coal from the Project Site to the Whitehaven CHPP for washing and/or despatch to export markets via rail to Port Newcastle. At least 85% of the Project ROM coal would require washing.
- Backloading of coarse and fine reject material from the Whitehaven CHPP for placement in the mined-out areas within the limit of mining.
- Installation of a range of services, structures and transportable buildings.
- Progressive shaping and rehabilitation of the areas of disturbance within the Project Site.

1.4 Coal Handling and Transport

Figure 2b identifies those sections of the transport route which would require upgrading or construction, ie. between the site entrance and Hoad Lane, a distance of approximately 6.1km. This 'purpose built' section of the transport route comprises two distinct sections of road, one occurring predominantly on private land adjacent to Riordan Road, Vickery State Forest and over the "Brentry" and "Stratford" properties, the second occurring predominantly within the Shannon Harbour Road easement.

The transport route would exit the Project Site from the southwestern corner and cross the western end of Riordan Road. A private section of road would be constructed through the "Brentry" property, along the southern edge of Vickery State Forest (1.1km). A private section of road would be constructed across the "Stratford" property (2.5km) to link the Riordan Road (SR 192) section of the transport route to Shannon Harbour Road (SR 93). The transport route would then incorporate a 2.5km length of an upgraded Shannon Harbour Road before intersecting with Hoad Lane (SR 95) approximately 200m north of the intersection between Hoad Lane and Blue Vale Road (SR 7).

The remainder of the transport route would be on public roads and part of an established coal haulage route on Hoad Lane, Blue Vale Road and the Kamilaroi Highway. Suitable noise criteria are discussed in Section 4.5.

The trucks would unload at the Whitehaven CHPP and rail loading facility and return to the Project Site along the same route. A proportion of the coarse and fine reject material generated by the Whitehaven CHPP would be backloaded to the Project Site via the transport route.

Coal would be washed at the Whitehaven CHPP and be transported to the Port of Newcastle by rail. CHPP activities are covered by existing approvals and will therefore not be considered as part of the NVIS. Train movements generated by the project and cumulative train noise impacts at residences in Gunnedah will be assessed against relevant criteria.

2 DESCRIPTION OF TERMS

2.1 Scope

This section of the report aims to convey an understanding of several commonly used acoustical terms. Various terms are explained in plain language and the effects of certain atmospheric phenomena on noise propagation are discussed. Noise level percentiles are explained with the aid of a diagram of a hypothetical noise signal.

The descriptions in this section are not formal definitions of the terms. Formal definitions may be found in AS1633-1985 "Acoustics – Glossary of terms and related symbols".

2.2 General Terms

Sound Power Level

The amount of acoustic energy (per second) emitted by a noise source. Usually written as "Lw" or "SWL", the Sound Power Level is expressed in decibels (dB) and cannot be directly measured. Lw is usually calculated from a measured sound pressure level.

Sound Pressure Level

The "noise level", in decibels (dB), heard by our ears and/or measured with a sound level meter. Written as "SPL", the sound pressure level generally decreases with increasing distance from a source. Noise levels are often written as dB(A) rather than dB. The "A-weighting" is a correction applied to the measured noise signal to account for the ear's ability to hear sound differently at different frequencies. For example, 40dB at 500Hz (speech frequency) is clearly audible but 40dB at 50Hz (very low bass) would be far less audible. The A-weighted sound pressure level therefore represents the measured (or predicted) noise level as it would be heard by the typical human ear.

Temperature Inversion

An atmospheric state in which the air temperature increases with altitude. Sound travels faster in warmer air than in cold air, so that during an inversion the top of a "sound wave" would move faster than the bottom. This bends (refracts) sound back towards the ground just as light bends upon entering and exiting a glass prism. The result is a "trapping" of sound energy near the ground and an increase in noise levels.

Wind Shear

A moving air mass would experience a "friction drag" at the ground in much the same way as a lava flow would flow quickly on top and "roll over" the lava beneath which must drag along the ground. This increasing wind speed with altitude is called "wind shear".

For a sound wave travelling down wind, the top of the wave moves faster than the bottom and the wave bends towards the ground. However, for a wave travelling into the wind the top of the wave is slowed down more than the bottom is and the wave bends upwards. **Figure 3** shows several examples of how atmospheric effects can bend sound waves.

Figure 3 shows that sound rays can be refracted over a barrier (usually a bund wall or small hill) during a temperature inversion, increasing noise levels in the 'shadow zone'.

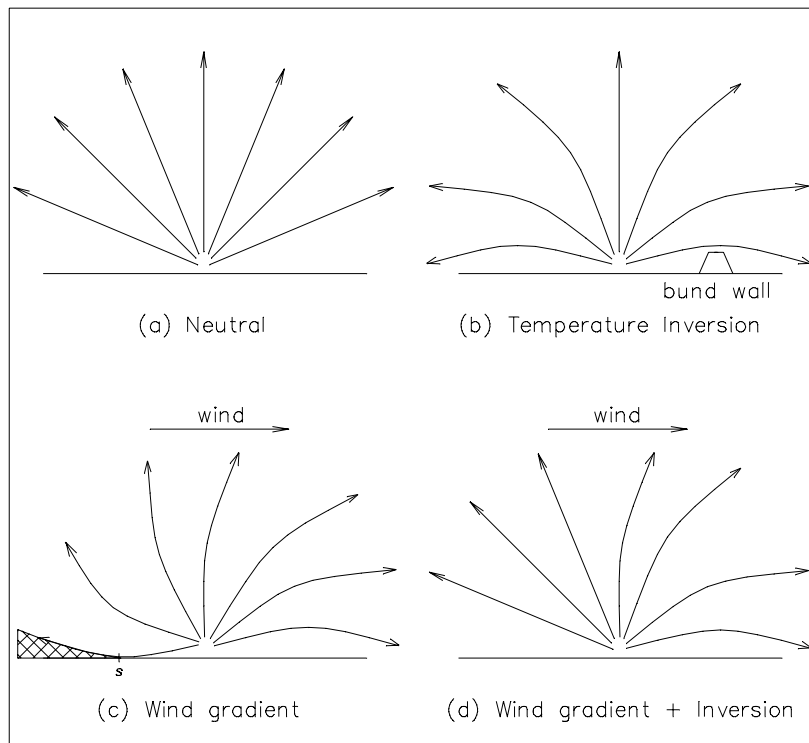


Figure 3
Sound refraction under temperature inversions and wind gradients

Neutral Atmospheric Conditions

An atmosphere that is at a temperature of approximately 23°C from ground level to an altitude of 200m or more. There are no fluctuations in density or humidity and no wind. Such conditions rarely occur, as temperature would usually vary with altitude and there is always movement in various directions in different layers of the atmosphere.

Prevailing Atmospheric Conditions

Atmospheric conditions (with regards to potential effects on noise propagation) which are characteristic of the study area. These would typically include seasonal wind directions and velocities. Temperature inversions would be included as prevailing if they occur, on average, for more than 2 nights per week in winter.

Adverse Atmospheric Conditions

Adverse conditions would include simultaneous winds and temperature inversions, even if the inversions occur for less than 2 nights per week in winter. This represents the worst case scenario for potential noise enhancement due to atmospheric effects.

2.3 Noise Levels Percentiles

A noise level percentile (L_n) is the noise level (SPL) in decibels which is exceeded for “n” % of a given monitoring period. Several important L_n percentiles would be explained by considering the hypothetical time signal in **Figure 4**.

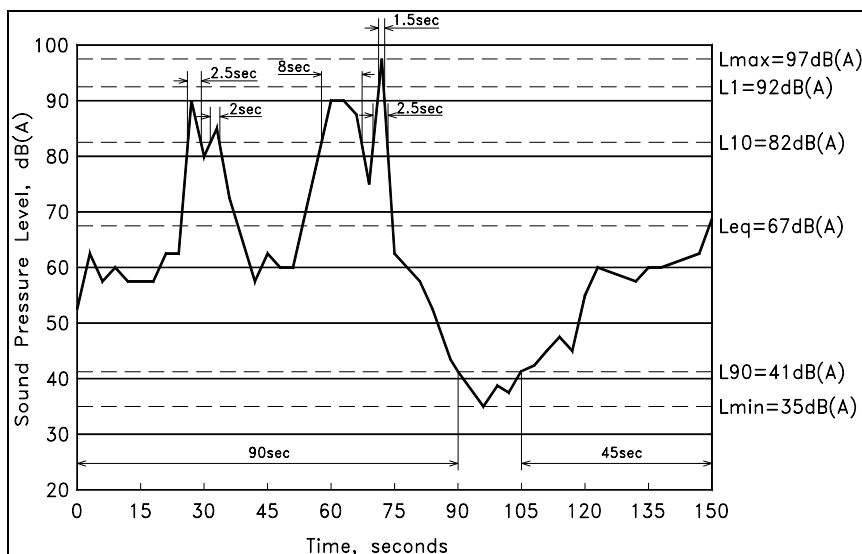


Figure 4
Time-trace of hypothetical 150-second sample

The signal in **Figure 4** has a duration of 2.5 minutes (ie. 150 seconds) with noises occurring as follows.

- The instrument is positioned beside a road and records crickets in nearby grass at a level of around 60dB (A).
- At about the 30 second mark a motorcycle passes on the road, followed by a car.
- At 60 seconds a truck passes.
- After the truck passes it sounds its air horn at the 73 second mark.
- The crickets are frightened into silence and the truck fades into the distance.
- All is quiet until 105 seconds when the crickets slowly start to make noise, reaching full pitch by 120 seconds.
- The measurement stops at 150 seconds, just when an approaching car starts to become audible.

L₁ Noise Level

Near the top of **Figure 4** there is a dashed line at 92dB(A). A small spike of 1.5 sec duration extends above this line at around 73 seconds. Since 1.5 sec is 1% of the signal duration (150 seconds), the L_1 (or L_{A1} to signify A-weighting) noise level of this sample is 92dB(A). The L_1 percentile is often called the *average peak noise level* and is used by the DECC as a measure of potential disturbance to sleep.

L₁₀ Noise Level

The dashed line at 82dB(A) is exceeded for four periods of duration 2.5 sec, 2 sec, 8 sec and 2.5 sec, respectively. The total of these is 15 sec, which is 10% of the total sample period. Therefore, the L_{A10} noise level of this sample is 82dB(A). The L_{10} percentile is called the *average maximum noise level* and has been widely used as an indicator of annoyance caused by noise.

***L*₉₀ Noise Level**

In similar fashion to L_1 and L_{10} , **Figure 4** shows that the noise level of 41dB(A) is exceeded for 135 seconds (90 + 45 = 135). As this is 90% of the total sample period, the L_{A90} noise level of this sample is 41dB(A). The L_{90} percentile is called the *background noise level*.

***L*_{eq} Noise Level**

Equivalent continuous noise level. As the name suggests, the L_{eq} of a fluctuating signal is the continuous noise level which, if occurring for the duration of the signal, would deliver equivalent acoustic energy to the actual signal. L_{eq} can be thought of as a kind of 'average' noise level. Recent research suggests that L_{eq} is the best indicator of annoyance caused by industrial noise and the EPA NSW *Industrial Noise Policy* takes this into consideration.

***L*_{max} and *L*_{min} Noise Levels**

These are the maximum and minimum SPL values occurring during the sample. Reference to **Figure 4** shows these values to be 97dB(A) and 35dB(A), respectively.

3 THE EXISTING ENVIRONMENT

3.1 Meteorology

The atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds (indicative of possible wind shear) and relative humidity. From long-term weather monitoring data at Gunnedah airport and more recent continuous data collected at the Whitehaven Coal Mine and Belmont Coal Project weather stations, the existing environment near this location is well classified.

The following data are the most significant with respect to noise propagation.

- Extremes of relative humidity (RH) are rarely experienced. For modelling purposes, a value of 70% RH was adopted.
- Mild temperature inversions are likely to occur on more than 30% of mornings and evenings in winter, as inferred from Appendix F of the INP. The DECC default value of +3°C/100m vertical temperature gradient for non-arid areas (INP, Appendix E) was adopted in the noise models. Since the mine would be located near the apex of a saddle (ie at higher altitude than receivers to the south) a northerly drainage-flow wind of 2 m/s was included in the "inversion" scenarios for Years 1, 3 and 7. A southerly drainage flow was modelled for the Year 5 scenario, to predict worst case levels from the northern emplacement area.

Wind roses have been generated from 2005 site data by Heggies (2007). These have been analysed to determine the percentage occurrence of winds from various directions. The analysis of winds was conducted by determining the percentage occurrence of winds from each of 16 compass directions (N, NNE, NE, ..., WNW, NW, NNW) in the wind speed ranges 0-0.5 m/s (calm), up to 3 m/s, up to 3.25 m/s, up to 4.24 m/s and up to 5 m/s.

The analysis of source-receiver wind speeds is explained with the aid of **Figure 5**. For each seasonal wind rose, each of the 16 compass directions was considered in turn as the primary (**P**) source-receiver direction. The percentage occurrence of winds from this direction up to 3m/s commenced the summation of total source-receiver winds from this direction. The two neighbouring compass directions at + 22.5° and -22.5° were then considered. (As an example, if the current primary direction **P** is NE, then **P**+22.5° is ENE and **P**-22.5° is NNE).

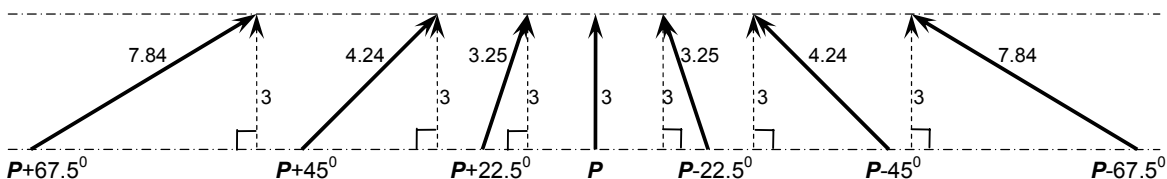


Figure 5
Vector components of source-receiver winds.

Figure 5 shows that winds from $P\pm 22.5^\circ$ with total speed of 3.25 m/s have a vector component of 3 m/s parallel to P . The percentage occurrences of winds up to 3.25 m/s from $P\pm 22.5^\circ$ were added to the summation for primary direction P . Similarly, the percentage occurrences of winds up to 4.24 m/s from $P\pm 45^\circ$ were added to the summation. (In the above example, $P+45^\circ$ would be East and $P-45^\circ$ would be North).

Finally, **Figure 5** shows that at $P\pm 67.5^\circ$ winds up to 7.84 m/s have components up to 3 m/s parallel to P . Total wind speeds above 5 m/s are not considered, however, in noise assessments so the percentage occurrences of winds up to 5 m/s from $P\pm 67.5^\circ$ were added to the summation. (In the above example, $P+67.5^\circ$ would be ESE and $P-67.5^\circ$ would be NNW).

This process was repeated for each of the 16 primary wind directions in each of the four seasons. Because the assessment of winds from each primary direction includes information from six 'side-band' directions, the results may bear little resemblance to wind roses of the same data set. Winds occurring more than 30% of the time during each season are summarised in **Table 1**. Winds from these directions are required to be assessed under the INP for the corresponding season. The wind speed for use in noise modelling is 3 m/s at a height of 10m above ground level.

Table 1
Summary of assessable wind directions

Season	Directions >30% vector component
Summer	NNE, SSE, W
Autumn	ESE, SSE, SSW
Winter	NNW, NNE, SSE, SSW, W
Spring	NNW, NNE, SSE, SSW, W

Since the assessed receivers are NNE and SE of the project site, only the source-receiver winds highlighted in bold type in **Table 1** are assessed to represent worst case noise impacts.

Typical calm daytime conditions of no wind, 70% RH and $-1^\circ\text{C}/100\text{m}$ vertical temperature gradient (ie, dry adiabatic lapse rate, DALR) were also modelled.

3.2 Surrounding Residences

The Proponent owns the freehold land within the Project Site ("Belmont" property) and the neighbouring properties of "Yarrowonga", "Glenroc", "Yarrari", "Belah", "Stratford", "Brentry" and a non-residential portion of the "Roseberry" property to the south. Vickery State Forest, which is owned by the Crown, is to the immediate west of the Project Site.

Table 2 lists the non-project related residences surrounding the Project Site together with the distance to the closest proposed mining or processing activities in Year 1 and Year 7. These receivers are shown in **Figure 1**.

Table 2
Proximity of Non-Project-related Residences

Property Name	Closest distance to mining/processing activity (m)	
	Year 1	Year 7
"Costa Vale"	3 060	4 030
"Surrey"	4 320	3 480
"Carlton"	5 690	4 900

3.3 Ambient Noise Levels

None of the residences near the Project Site are currently receiving substantial noise levels from traffic or industrial sources. As a quiet rural environment, the existing background levels will be below 30dB(A),L₉₀ day, evening and night.

It is a standard DECC requirement that noise levels below 30dB(A) shall be taken as 30dB(A) for the purposes of assessing industrial noise, so that the **30dB(A),L₉₀** background level would be adopted for all residential receivers during the day, evening and night.

4 NOISE AND VIBRATION CRITERIA

4.1 Construction Noise

Recommended noise criteria for off-site construction works vary depending on construction duration, as outlined in Section 157 of the ENCM and reproduced below:

- Construction period less than 4 weeks:
L_{A10} level restricted to background (L_{A90}) + 20dB
- Construction period more than 4 weeks but less than 26 weeks:
L_{A10} level restricted to background (L_{A90}) + 10dB

DECC recommends construction during daytime hours only. For construction periods longer than 26 weeks, the operational criteria presented in Section 4.3 are assumed to apply.

Construction of surface facilities, on-site and off-site sections of the transport route is expected to be completed within 6 months and the criterion of 'daytime background level + 10dB' or **40dB(A),L₁₀**, would apply.

4.2 Operational Noise

The INP specifies two noise criteria:

- an *intrusiveness criterion* which limits L_{Aeq} noise levels from the industrial source to a value of 'background plus 5dB';and
- an *amenity criterion* which aims to protect against excessive noise levels where an area is becoming increasingly developed.

Since there is no existing major industry dominating noise levels at any receivers near the Project Site, and there is negligible road traffic, only the intrusiveness criteria will be considered for setting project-specific operational noise limits.

Based on the existing background noise level of 30dB(A), L_{90} the intrusiveness criterion is **35dB(A), $L_{eq(15\text{-minute})}$** at all non-project related residences.

4.3 Sleep Disturbance

To help protect against people waking from their sleep, the DECC recommends that 1-minute L_{A1} noise levels (effectively, the maximum noise level from impacts, etc) should not exceed the background level by more than 15dB(A) when measured/computed at a building facade. The “sleep disturbance” criterion is only applicable to night-time operations.

The sleep disturbance criterion applicable for this project at each receiver location is equal to the intrusiveness criterion plus 10dB(A), that is, **45dB(A), $L_{1(1\text{-minute})}$** .

4.4 Traffic Noise

In NSW, noise from vehicle movements associated with an industrial source is assessed in terms of the INP if the vehicles are on the industrial site (the mining lease in this case). If the vehicles are on a public road, the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN) applies. The transport route from the Project Site to the Whitehaven CHPP is on both public and private roads (to be constructed).

Truck movements on the Project Site and private section of the transport route (on the “Stratford” property) would be subject to the 35dB(A), $L_{eq(15\text{ minute})}$ criterion for total site noise emissions.

The criteria for Shannon Harbour Road (SR 93 - a public local road) are 55dB(A), $L_{eq(1hr)}$ day and 50dB(A), $L_{eq(1hr)}$ night for periods of peak vehicle movements. For the purposes of traffic noise assessment, the daytime period is defined as 7am – 10pm and the night time period is 10pm – 7am.

The section of the transport route between Hoad Lane and Whitehaven CHPP is currently used by Whitehaven Coal Mine and Tarrawonga Coal Mine as a coal haulage route. Noise criteria of 60dB(A), $L_{eq(1hr)}$ (day) and 55dB(A), $L_{eq(1hr)}$ (night) are currently in force. These criteria apply to vehicles associated with all mining activities and therefore must not be exceeded by the addition of trucks from the project.

Table 3 summarises the traffic noise criteria for the various sections of the transport route.

Table 3
Road Traffic Noise Criteria

Section of haul route	Recommended Criteria – dB(A)		
	Day 7.00am to 10.00pm	Evening 6.00pm to 10.00pm	Night 10.00pm to 7.00am
Project Site, private land*	$L_{Aeq(15min)}$ 35	$L_{Aeq(15min)}$ 35	$L_{Aeq(15min)}$ 35
Shannon Harbour Road	$L_{Aeq(1hr)}$ 55	$L_{Aeq(1hr)}$ 55	$L_{Aeq(1hr)}$ 50
Hoad Lane, Blue Vale Road to the Whitehaven CHPP	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 55

* Site noise criteria apply to emissions from all site noise sources.

4.5 Blasting

4.5.1 Annoyance Criteria

Noise and vibration levels from blasting are assessable against criteria proposed by the Australian and New Zealand Environment and Conservation Council (ANZECC) in their publication *“Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration – September 1990”*. These criteria are summarised as follows.

- The recommended maximum overpressure level for blasting is 115dB.
- The level of 115dB may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 120dB at any time.
- The recommended maximum vibration velocity for blasting is 5mm/s Peak Vector Sum (PVS).
- The PVS level of 5mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 10mm/s at any time.
- Blasting should generally only be permitted during the hours of 9am to 5pm Monday to Saturday, and should not take place on Sundays and Public Holidays.
- Blasting should generally take place no more than once per day.

These criteria are typically adopted by the DECC when issuing Environment Protection Licences for projects involving blasting. It is not uncommon, however, for the ANZECC recommended times and blasting frequency to be modified based on the blasting requirements for individual mines and to cater for timing of blasts to avoid adverse weather conditions.

4.5.2 Building Damage Criteria

Building damage assessment criteria are nominated in AS 2187.2-1993 *“Explosives – Storage, Transport and Use Part 2: Use of Explosives”* and summarised in **Table 4**.

Table 4
Blasting Criteria to Limit Damage to Buildings (AS 2187)

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

The annoyance (ANZECC) criteria are more stringent than the building damage criteria (**Table 4**) and would be taken as the governing criteria for the proposed Belmont Coal Mine.

4.6 Train Noise and Vibration

4.6.1 Train Noise Criteria

The operation of Belmont Coal Mine will result in additional train movements on the rail line between the site and the Port of Newcastle. There will be a corresponding increase in noise exposure at residences along the rail line.

Chapter 163 of the ENCM specifies limits on train noise levels as follows:

Descriptor	Planning Levels	Maximum Levels
L _{eq} , 24 hour	55dB(A)	60dB(A)
L _{max}	80dB(A)	85dB(A)

These criteria will be assessed as the DECC preferred maximum levels from train noise generated by the Project.

The Australian Rail Track Corporation (ARTC) operates the rail line. ARTC's Environmental Pollution License (EPL 3142) does not contain environmental noise limits but states the objective of progressive reduction of noise levels from rail lines through Pollution Reduction Programs (PRPs).

While the Main Northern railway is not currently subject to a PRP, Section U1.1 of EPL 3142 provides the following goals to work towards in developing a PRP:

Descriptor	Design Goal
L _{eq} , (15 hour), day	65dB(A)
L _{eq} , (9 hour), night	60dB(A)
L _{max} (24 hour)	85dB(A)

These criteria are considered in the assessment of cumulative train noise levels as a result of the Belmont Coal Project. The L_{max} goals are assumed to apply to pass-by levels of moving trains and not to horns, which must be sounded near crossings for safety purposes.

4.6.2 Train Vibration Criteria

Various authorities have set maximum limits on allowable ground and building vibration in different situations. Vibration criteria for this assessment were obtained from the DECC publication "Assessing Vibration: A Technical Guideline" (AVTG, 2006).

DECC limits are for vibration in buildings, and relate to personal comfort and not structural integrity of the building. Table 5 shows the applicable multiplying factors, taken from Table B1.1 of the AVTG, which are applied to the base vibration velocity curves in Figures B1.3 and B1.4 of the guideline.

Table 5
Vibration criteria multiplication factors

Area, Time	Continuous	Intermittent / Impulsive
Residential - Day	2	60
Residential - Night	1.4	20

Figure 6 displays the Z-axis (vertical) vibration criteria (expressed in vibration velocity, mm/s) based on an intermittent vibration source in a residential area during night-time hours.

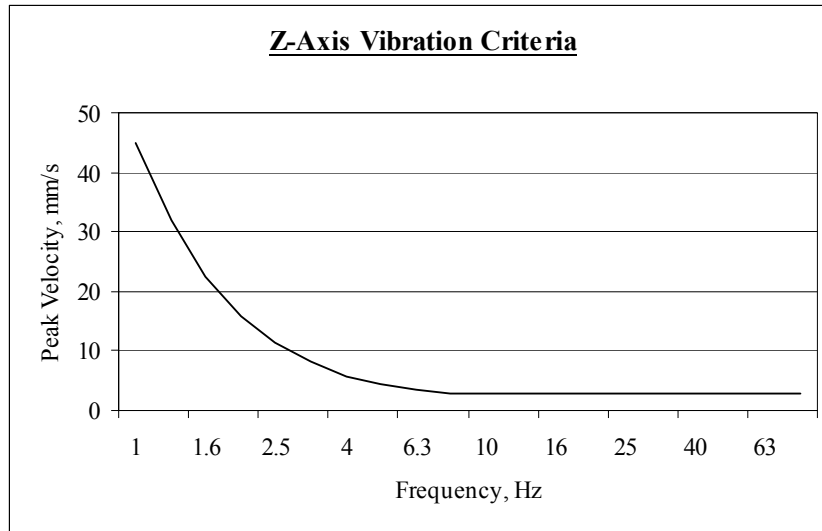


Figure 6
Night time criteria for vertical vibration velocity

As train-induced ground vibrations are typically at frequencies greater than 10Hz, a maximum allowable vibration velocity of 2.82mm/s applies.

5 ASSESSMENT METHODOLOGY

5.1 Site Establishment / Construction Noise

The project would require the following construction works with the potential for noise impact on residential receivers.

- Limited tree clearing and topsoil removal within the footprint of the northern emplacement.
- Construction of the site entrance and site access road.
- Construction of the off-site private section of the transport route.
- Construction of the site facilities area and coal processing area.

For modelling purposes, it was assumed that initial earthworks (road construction and topsoil removal at the northern end of the site) and construction of surface facilities would take place simultaneously. Noise levels for typical construction machinery have been sourced from our extensive noise database and are shown in **Appendix A**. Assessment of construction noise was conducted using RTA Technology's Environmental Noise Model v3.06 (ENM) under neutral and adverse atmospheric conditions.

5.2 Operational Noise

5.2.1 Introduction

Assessment of operational noise was conducted using the ENM software. The noise sources were modelled at their known (for stationary sources such as the coal handling and processing area) or most exposed (for mobile sources such as haul trucks) positions and noise contours and/or point calculations were generated for the surrounding area.

5.2.2 Noise Sources

Noise data for significant sources associated with the project were either provided by the Proponent or obtained from Spectrum Acoustics' extensive database of measured plant items. Where multiple database entries exist for the same plant item, the higher noise levels have been adopted for conservatism. Sound power levels of operational noise sources are shown in **Appendix A**.

5.2.3 Modelled Scenarios

As discussed in Section 3.1, modelling was conducted for the following atmospheric conditions.

- *Daytime lapse* - 20°C, 70% relative humidity (RH), no wind, -1°C/100m vertical temperature gradient (dry adiabatic lapse rate, DALR);
- *Inversion* – 5°C, 70% R.H., +3°C/100m vertical temperature gradient and 2m/s drainage-flow wind from the north (drainage wind from the south for Year 5, northern emplacement scenario); and
- *Prevailing wind* – 20°C, 70% R.H., 3m/s wind from SSE, SSW, NNW and NNE.

In addition to the construction scenario, noise models were generated for the following operational (mining) scenarios for each of the above atmospheric conditions.

1. **Year 1.** Excavation 20m below ground level in the northern most part of the open cut area and adjacent to the Northern Emplacement, overburden placement to the northern end of the Western Emplacement, on-site coal processing and despatch. Overburden/coal haulage, blasthole drill and two scrapers are all working at natural ground level.
2. **Year 3.** Excavation 20m below ground level towards the centre of the open cut area and just to the south of the current location of Jaeger lane, out-of-pit overburden placement to the southern end of the Western Emplacement and in-pit overburden placement to the immediate north of ongoing excavation activities (over the previous location of Jaeger Lane), on-site coal processing and despatch. Overburden/coal haulage, blasthole drill and two scrapers are all working at natural ground level.
3. **Year 5.** Mining approximately 200m south of the Year 3 scenario. Overburden placement at the northern emplacement as well as in-pit. The western emplacement has been completed by this stage. Overburden/coal haulage, blasthole drill and two scrapers are all working at natural ground level.
4. **Year 7.** Excavation 30m below ground level adjacent to the southern limit of open cut mining, overburden placement in-pit to the immediate north of the ongoing excavation activities, on-site coal processing and despatch. Coal haulage, blasthole drill and two scrapers are all working at natural ground level.

These scenarios, presented as **Figures B1 to B4** in **Appendix B**, represent the planned progression of mining from the northern to southern limits of the open cut mining area over a period of between seven and ten years.

5.3 Sleep Disturbance

A potential for sleep disturbance would occur during mining operations due to general impact noise from excavation/placement of overburden activities, coal loading into empty trucks and dozer tracks. Sound power levels of modelled L_{Amax} noise sources (as an estimation of L_{A1} levels) are shown in **Appendix A**.

Impact noise was modelled using the ENM program under the noise-enhancing atmospheric conditions discussed in Section 3.2.

5.4 Traffic Noise

Spectrum Acoustics has conducted attended road traffic noise measurements for the Whitehaven and Tarrawonga Coal Mines over the past 18 months. In particular, coal haulage noise levels at the "Brooklyn" residence on Hoad Lane have been measured over two 1-hour periods (ie. over 50 individual truck movements have been measured). This is the nearest residence to any point on the haul route and traffic associated with all three mines (Tarrawonga, Whitehaven and Belmont) would pass this location.

Additional noise monitoring was undertaken along Blue Vale Road in June 2007 to measure the noise levels of new purpose-built B-doubles that have been trialled at the Tarrawonga Coal Mine and which would be used by the haulage contractor for all haulage from the Belmont Coal Project and Tarrawonga and Whitehaven Coal Mines should 24 hour transport operations be approved¹. A description of the B-doubles that would be used for the Belmont Coal Project has been provided by the haulage contractor and is provided as **Appendix C**. The number of truck movements, pass-by noise levels from each truck and overall measured and calculated $L_{Aeq(1hr)}$ noise levels was used to accurately estimate the noise contribution from additional trucks from the project as well as cumulative traffic noise levels from all mines.

Heavy vehicle movements for the three mines have been analysed by R.W. Corkery and Co and the results for three scenarios provided for analysis of potential noise impacts. The three scenarios are:

- 1) Restricted transportation hours – coal truck movements from all mines are limited to the hours 7am to 10pm.
- 2) 24 hour transportation (restricted) – Night time coal trucks movements generated by Belmont Mine are restricted to half the number of hourly movements during the day.
- 3) 24 hour transportation (constant) – Night time coal trucks movements generated by Belmont Mine are equal to number of hourly movements during the day.

Projected 2008 hourly truck movements (for the Belmont Coal Project only, as well as total movements for the three coal mines) past "Brooklyn" for the above scenarios are summarised in **Table 6**.

5.5 Blasting

The following sections provide standard equations for predicting blast overpressure (ie. noise) and ground vibration levels, sourced from the United States Bureau of Mines and accepted by DECC.

¹ 24 hour operations would require fewer vehicles for the haulage of coal, improving cost efficiency and therefore making the commissioning of the construction of the purpose-built B-doubles a viable option.

Table 6
Summary of Coal Truck Movements

Transportation Scenario	Period			
	Day (7am – 10pm)		Night (10pm – 7am)	
	Belmont	Total	Belmont	Total
1) Restricted Transportation hours	15.4	30.6	0	0
2) 24 hour transportation (restricted)	12.4	26.9	6.2	6.2
3) 24 hour transportation (unrestricted)	10	24.7	10	10

For the traffic noise impact assessment, it was assumed that hourly heavy vehicle numbers at least 25% greater than the values in **Table 6** could occur as a worst case.

5.5.1 Blast Overpressure

Unweighted airblast overpressure levels, OP, are predicted from **Equation (2)** below.

$$OP = 165 - 24(\log_{10}(D) - 0.3 \log_{10}(Q)), \quad \text{dB} \quad (2)$$

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

Equation 2 has often been found to underestimate blast overpressure levels by up to 3dB, so 3dB has been added to the predicted levels presented in this report.

5.5.2 Blast Vibration

The basic equations for calculation of peak particle vibration (PPV) levels from blasting are as follows:

$$PPV = 1140 \left(\frac{D}{Q^{0.5}} \right)^{-1.6}, \quad \text{mm/s} \quad (\text{for average ground type}) \quad (3)$$

$$PPV = 500 \left(\frac{D}{Q^{0.5}} \right)^{-1.6}, \quad \text{mm/s} \quad (\text{for hard rock}) \quad (4)$$

where D and Q are as defined in **Equation (2)**.

It is noted that the only difference between **Equations (3)** and **(4)** is the value of the coefficient (either 1140 or 500). Geological data for the site show hard conglomerate overburden above the top (Upper Glenroc) coal seam. Interburden layers of sideritic shales are also relatively hard for the purposes of blast vibration assessment. It would be appropriate to apply a coefficient value of 500 although a value of 1000 has been used to allow a sizeable margin for error.

5.6 Rail Traffic

5.6.1 Rail Noise

Additional rail traffic generated by the proposal will be of an intermittent rather than constant nature. There are many methods available for calculating the cumulative noise impact arising from intermittent signals of various shapes. The methodology employed in this Section was sourced from the US Environmental Protection Agency document No. 550/9-74-004 "Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974".

The document refers to 'triangular' and 'trapezoidal' time signals, which are illustrated in **Figure 7**. A triangular time signal rises from the background level to a peak noise level and then immediately begins to subside. A trapezoidal time signal rises from the background level to a maximum level and sustains that level for a period of time before subsiding.

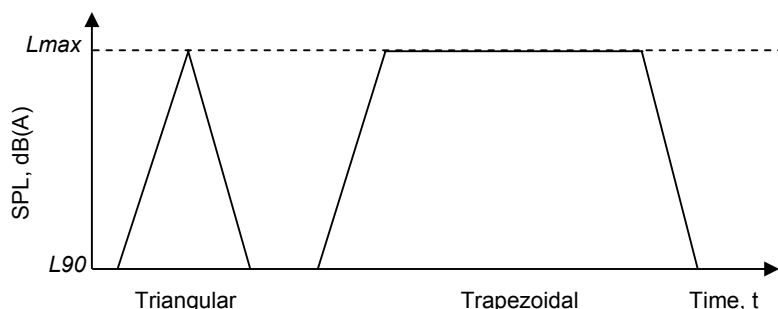


Figure 7
Triangular and trapezoidal time signals.

The value of $L_{eq,T}$ for a series of identical trapezoidal time patterns having maximum levels of L_{max} is given by **Equation (1)**. A trapezoidal time signal is a good approximation to the SPL signal of a train as it passes an observation point.

$$L_{eq,T} = 10 \log \left[\frac{N\tau}{T} \left(\frac{1}{\frac{(\tau - \xi)\Delta L}{10} + \frac{\xi}{2}} \right) \left\{ 10^{\frac{L_b}{10}} \left(\frac{(\tau - \xi)}{2.3} \right) \left(10^{\frac{\Delta L}{10}} - 1 \right) + 10^{\frac{L_{max}}{10}} \left(\frac{\xi}{2} \right) \right\} \right] \quad (1)$$

where,

L_{max} = maximum train noise at residence, dB(A)

L_b = background noise level, dB(A)

$\Delta L = L_{max} - L_b$

T = assessment period (minutes)

τ = duration of noise from each train (minutes)

ξ = duration of L_{max} , and

N = number of trains during assessment period.

5.6.2 Rail Vibration

Vibration levels from laden and unladen coal trains have been widely studied in the Hunter Valley. A thorough assessment conducted in 1997 (*Noise and Vibration Assessment, Jerrys Plains Rail Spur, Wilkinson Murray Pty Limited*) found train vibration levels at 20m from the rail line to be considerably less than the 2.82 mm/s criterion. In most train vibration measurements at this distance conducted by Spectrum Acoustics, the vibration logger has not triggered when set as low as 0.5 mm/s. The maximum vibration level measured by Spectrum Acoustics at 20m from a passing coal train on a ballasted track is 0.56mm/s. Train vibration levels will therefore not be considered further in this report.

6 IMPACT ASSESSMENT

This section of the report presents predicted noise and vibration levels and provides mitigation recommendations where criterion exceedances are predicted. Representative noise contours for various operational scenarios are shown in **Figures B5 to B8** in **Appendix B**.

6.1 Construction Noise

6.1.1 Predicted Noise Levels

Predicted noise levels during the initial construction period are shown in **Table 7** which also shows the “differentials” between the predicted levels (maximum over all meteorological conditions) and the noise criteria. In Table 5 and all following tables, criterion exceedances are highlighted in bold type.

Table 7
Predicted construction noise levels

Location*	Meteorological Condition				
	Lapse	SSW	NNW wind	Criterion	Differential
“Costa Vale”	<20	34	20	40	-6
“Surrey”	<20	20	36	40	-4
“Carlton”	<20	<20	31	40	-9

* see Figure 2b

6.1.2 Noise Control Recommendations - Construction

No exceedances of construction noise criteria are predicted at any assessed receiver.

6.2 Year 1 Mining Operations

6.2.1 Predicted Noise Levels

Predicted noise levels for the Year 1 mining scenario are summarised in **Table 8** where all values are dB(A),_{L_{eq}(15min)}. Any exceedances of the relevant criterion are highlighted in bold.

6.2.2 Noise Control Recommendations – Year 1

No exceedances of the noise criteria are predicted for the Year 1 operational scenario.

Table 8
Predicted Year 1 operational noise levels

Location*	Meteorological Condition							Criterion	Differential
	Lapse	SSE wind	SSW wind	NNW wind	NNE wind	Inversion			
"Costa Vale"	25	34	35	20	20	27	35	0	
"Surrey"	22	21	22	30	29	33	35	-2	
"Carlton"	<20	<20	<20	24	23	28	35	-7	

* see Figure 2b

6.3 Year 3 Mining Operations

6.3.1 Predicted Noise Levels

Predicted noise levels for the Year 3 mining scenario are summarised in **Table 9** where all values are dB(A)_{L_{eq}(15min)}. Any exceedances of the relevant criterion are highlighted in bold.

Table 9
Predicted Year 3 operational noise levels

Location*	Meteorological Condition							Criterion	Differential
	Lapse	SSE wind	SSW wind	NNW wind	NNE wind	Inversion			
"Costa Vale"	24	32	33	<20	<20	26	35	-2	
"Surrey"	23	20	23	30	28	34	35	-1	
"Carlton"	<20	<20	<20	24	23	29	35	-6	

* see Figure 2b

6.3.2 Noise Control Recommendations – Year 3

No exceedances of the noise criteria are predicted for the Year 3 operational scenario.

6.4 Year 5 Mining Operations

6.4.1 Predicted Noise Levels

Predicted noise levels for the Year 5 mining scenario are summarised in **Table 10** where all values are dB(A)_{L_{eq}(15min)}. Any exceedances of the relevant criterion are highlighted in bold.

Table 10
Predicted Year 5 operational noise levels

Location*	Meteorological Condition							Criterion	Differential
	Lapse	SSE wind	SSW wind	NNW wind	NNE wind	Inversion			
"Costa Vale"	23	33	33	23	23	36¹	35	+1	
"Surrey"	<20	<20	<20	33	32	24	35	-2	
"Carlton"	<20	<20	<20	26	24	20	35	-9	

Note 1: When modelled with 10m bund along the northern edge of the emplacement, the predicted noise level received reduces to 31dB(A)

* see Figure 2b

6.4.2 Noise Control Recommendations – Year 5

A minor (1dB) exceedance of the noise criterion is predicted at “Costa Vale” under temperature inversion conditions. The noise sources responsible for the exceedance are trucks and a dozer at the proposed northern emplacement. Forming a 10m bund along the northern edge of this emplacement during favourable conditions has reduced the worst case noise level at “Costa Vale” to 31dB(A) in supplementary modelling. Should the project be approved, it should be a formal requirement that this bund be in place before using the northern emplacement at night or under adverse conditions.

6.5 Year 7 Mining Operations

6.5.1 Predicted Noise Levels

Predicted noise levels for the Year 7 mining scenario are summarised in **Table 11** where all values are dB(A), $L_{eq(15min)}$. Any exceedances of the relevant criterion are highlighted in bold.

Table 11
Predicted Year 7 operational noise levels

Location*	Meteorological Condition							Criterion	Differential
	Lapse	SSE wind	SSW wind	NNW wind	NNE wind	Inversion			
“Costa Vale”	<20	24	24	<20	<20	<20	35	-11	
“Surrey”	<20	<20	<20	30	28	31	35	-4	
“Carlton”	<20	<20	<20	25	22	25	35	-10	

* see **Figure 2b**

6.5.2 Noise Control Recommendations – Year 7

No exceedances of the noise criteria are predicted for the Year 7 operational scenario. Worst case noise levels less than 30 dB(A) are predicted to occur at any residences north and northwest of “Costa Vale” under all assessed scenarios.

6.6 Modifying Factor Corrections

Point calculations for several of the worst case scenarios presented above show a difference between C-weighted and A-weighted noise levels (often referred to as the “(C–A) level”) within the range 9 to 12dB at the most affected project related receiver (“Costa Vale”). As this difference is not greater than 15 dB, there is no low-frequency correction applicable under the INP. Predicted $L_{Aeq(15-minute)}$ sound pressure levels also did not contain tonal components as defined in the INP above.

6.7 Sleep Disturbance

An assessment of noise impact for the Year 1, Year 5 and Year 7 operational scenarios has been conducted to determine the potential for sleep disturbance during operating hours. In particular, the major potential source of impact noise is the overburden emplacement operation which is proposed to be conducted on a 24 hour basis Monday to Saturday.

6.7.1 Year 1 Sleep Disturbance Levels

Predicted maximum noise levels under neutral and inversion conditions for the Year 1 scenario are shown in **Table 12** with results under source to receiver wind conditions shown in **Table 13**. Exceedances of the 45dB(A) criterion, if any, are shown in bold type in the following Tables.

Table 12
Predicted Year 1 sleep disturbance levels

Location* (Source#)	Neutral				Inversion			
	1	2	3	4	1	2	3	4
"Costa Vale"	20	20	29	32	25	35	36	39
"Surrey"	<20	<20	25	28	<20	32	31	34
"Carlton"	<20	<20	22	25	<20	26	27	30

#Noise sources included in the L_{Amax} calculations:

1. Filling trucks at coal processing facility;
2. Excavator and haul trucks in the pit;
3. Placing overburden at the northern end of the western emplacement area; and
4. Dozer operating at the emplacement area.

* see **Figure 2b**

Table 13
Predicted Year 1 sleep disturbance levels

Location* (Source#)	SSW wind				NNW wind			
	1	2	3	4	1	2	3	4
"Costa Vale"	26	37	38	41	<20	<20	27	30
"Surrey"	<20	<20	27	30	<20	34	33	37
"Carlton"	<20	<20	22	25	<20	29	28	32

#Noise sources included in the L_{Amax} calculations:

1. Filling trucks at coal processing facility;
2. Excavator and haul trucks in the pit;
3. Placing overburden at the northern end of the western emplacement area; and
4. Dozer operating at the emplacement area.

* see **Figure 2b**

There are no predicted exceedances of the sleep disturbance assessment criterion of 45 dB(A), L_{max} for the Year 1 operational scenario.

6.7.2 Year 5 Sleep Disturbance Levels

Predicted maximum noise levels under neutral and inversion conditions for the Year 1 scenario are shown in **Table 14** with results under source to receiver wind conditions shown in **Table 15**. Exceedances of the 45dB(A) criterion, if any, are shown in bold type in the following Tables.

There are no predicted exceedances of the sleep disturbance assessment criterion of 45 dB(A), L_{max} for the Year 5 operational scenario.

6.7.3 Year 7 sleep disturbance levels

Predicted maximum noise levels under neutral and inversion conditions for the Year 7 scenario are shown in **Table 16** with results under source to receiver wind conditions shown in **Table 17**. Exceedances of the 45dB(A) criterion, if any, are shown in bold type in the following Tables.

Table 14
Predicted Year 5 sleep disturbance levels

Location* (Source#)	Neutral				Inversion			
	1	2	3	4	1	2	3	4
"Costa Vale"	<20	<20	26	30	24	22	32	35
"Surrey"	<20	<20	<20	21	<20	31	23	27
"Carlton"	<20	<20	<20	<20	<20	28	21	25

#Noise sources included in the L_{Amax} calculations:

1. Filling trucks at coal processing facility;
2. Excavator and haul trucks in the pit;
3. Placing overburden at the northern emplacement area (behind 10m bund); and
4. Dozer operating at the northern emplacement area (behind 10m bund).

* see **Figure 2b**

Table 15
Predicted Year 5 sleep disturbance levels

Location* (Source#)	SSW wind				NNW wind			
	1	2	3	4	1	2	3	4
"Costa Vale"	25	23	34	37	<20	<20	<20	<20
"Surrey"	<20	<20	<20	22	<20	33	25	28
"Carlton"	<20	<20	<20	<20	<20	29	22	24

#Noise sources included in the L_{Amax} calculations:

1. Filling trucks at coal processing facility;
2. Excavator and haul trucks in the pit;
3. Placing overburden at the northern emplacement area (behind 10m bund); and
4. Dozer operating at the northern emplacement area (behind 10m bund).

* see **Figure 2b**

Table 16
Predicted Year 7 sleep disturbance levels

Location* (Source#)	Neutral				Inversion			
	1	2	3	4	1	2	3	4
"Costa Vale"	<20	<20	<20	23	24	<20	<20	21
"Surrey"	<20	<20	<20	<20	<20	31	34	37
"Carlton"	<20	<20	<20	<20	<20	28	28	31

#Noise sources included in the L_{Amax} calculations:

1. Filling trucks at coal processing facility;
2. Excavator and haul trucks in the pit;
3. Placing overburden at the southern end of the western emplacement area; and
4. Dozer operating at the emplacement area.

* see **Figure 2b**

Table 17
Predicted Year 7 sleep disturbance levels

Location (Source*)	SSW wind				NNW wind			
	1	2	3	4	1	2	3	4
"Costa Vale"	25	28	<20	22	<20	<20	<20	<20
"Surrey"	<20	<20	<20	<20	<20	33	36	39
"Carlton"	<20	<20	<20	<20	<20	29	31	34

#Noise sources included in the L_{Amax} calculations:

1. Filling trucks at coal processing facility;
2. Excavator and haul trucks in the pit;
3. Placing overburden at the southern end of the western emplacement area; and
4. Dozer operating at the emplacement area.

* see **Figure 2b**

There are no predicted exceedances of the sleep disturbance assessment criterion of 45 dB(A), L_{max} for the Year 7 operational scenario.

6.8 Transport Noise on the Transport Route

The nearest non-project related residence along the transport route is on the “Brooklyn” property on Blue Vale Road². Noise compliance monitoring conducted by Spectrum Acoustics at the “Brooklyn” residence between 11:44am and 12:44pm on Thursday 28th September 2006 has confirmed a noise level of 52.3 dB(A), $L_{eq(1hr)}$ from the passage of 24 coal trucks in a period of exactly one hour. Further monitoring at this location between 8:01am and 9:01am on Tuesday 27th March 2007 recorded a level of 53.2 dB(A), $L_{eq(1hr)}$ from the passage of 28 coal trucks. Light vehicle movements during both surveys contributed less than 40dB(A) and therefore had no influence on the total mine-related noise.

The truck noise measurements comprised 52 passing coal trucks and were conducted at the actual assessment point for the present assessment. There is no calculation methodology which can furnish traffic noise predictions as accurately as predictions based on actual measurements at the small distances (<100m) involved here. That is, any calculation methodology would require back-calculation of sound power levels and estimates of pass-by times for the purpose of re-calculating what has already been measured. Any difference between the two sets of values would only serve to highlight inaccuracies in the calculation methodology.

For noise sources that are essentially identical in level and duration, a simple logarithmic calculation is sufficient to estimate the noise from differing numbers of sources. As an example, the noise from 28 truck movements based on measurement of 24 movements is achieved by adding $10\log(28/24)$ to the level from 24 trucks. This calculation yields 53.0dB(A) for 28 trucks based on 52.3 dB(A) from 24 trucks. The measured value of 53.2dB(A) differs from this calculated level by 0.2dB(A), which is less than half the measurement error of a laboratory quality sound level meter.

Table 18 shows calculated heavy vehicle noise levels relative to the measured level from 28 movements (worst case) for estimated maximum hourly truck movements as discussed in Section 5.4 (ie. at least 25% greater than the average values in **Table 6**). Truck numbers are shown beside the predicted noise levels in parentheses.

Table 18
Predicted Coal Truck Noise Levels dB(A), $L_{eq(1\text{ hour})}$

Transportation Scenario	Period			
	Day (7am – 10pm)		Night (10pm – 7am)	
	Belmont	Total	Belmont	Total
1) Restricted Transportation hours	51.7 (20)	55.0 (42.8)	N/A (0)	N/A (0)
2) 24 hour transportation (restricted)	50.1 (15.3)	54.4 (37.4)	47.6 (7.7)	47.6 (7.7)
3) 24 hour transportation (unrestricted)	49.7 (12.5)	54.0 (34.5)	49.7 (12.5)	49.7 (12.5)

The results in **Table 18** show that the adopted traffic noise criteria of 60dB(A) (day) and 55dB(A) (night) at the worst affected “Brooklyn” residence would not be exceeded after the introduction of additional coal trucks from the project. Blue Vale Road has been used as a haulage route during the daytime for many years and the established criterion is 60 dB(A).

² There are two residences on this property: one at 70m from Blue Vale Road and one at 200m from the road. All measurements and calculations discussed in this assessment relate to the most impacted residence at 70m from the road.

The introduction of heavy vehicle traffic noise at night, however, would be a new noise source and it may be appropriate to consider the local road criterion of 50 dB(A) for night-time haulage only. **Table 18** shows that the predicted noise level from worst case traffic movements at night satisfies this criterion.

The above analysis is based on measured noise emissions from existing haul trucks (a mixture of semi-trailers and B-doubles). Measurements conducted at a point 20m from Blue Vale Road on 27 June 2007 recorded the passage of 31 coal trucks in a 1-hour period, including six passages of new B-doubles intended for use at the Belmont Coal Project (should 24 hour transport be approved).

The measurements were of sufficient resolution (1-second statistics) that the individual trucks could be separated to allow analysis of the noise levels from the new and existing trucks separately. The average pass-by L_{Aeq} of all truck types was 72 dB(A). The new B-doubles were speed limited to 93 km/h and their average pass-by time was 22.7 sec, compared with 22.2 sec for the unrestricted trucks. Consequently, the calculated average $L_{Aeq(1-hour)}$ contribution per truck was 56.1 dB(A) for the unrestricted trucks and slightly higher at 56.4 dB(A) for the new B-doubles.

A difference of 0.3 dB is, again, less than the measurement error of a laboratory quality sound level meter and the pass-by levels of the existing and new trucks may be considered equal. The results in **Table 18** are therefore valid for the proposed new B-double trucks. Furthermore, the general noise mitigation provided by the new B-doubles, eg. speed limitation, use of airbag "road friendly" suspension and disabling of engine compression brakes, would ensure that the measured pass-by noise level would not be exceeded (by limiting speed levels) and eliminate the potentially sleep disturbing noises caused by short timeframe, high intensity noise sources (such as engine compression braking or impact of the trailer against the truck body).

6.9 Blasting

The Proponent has indicated that Maximum Instantaneous Charge (MIC) for overburden blasts would generally be restricted to. Allowing for the possibility that MIC values up to 2300kg may be required, blast overpressure and ground vibration levels have been calculated at the nearest residence for both charge weights. Predicted blast overpressure is shown in **Figure 8** and ground vibration is shown in **Figure 9**.

Figure 8 shows maximum and average blast overpressure levels of 110.8dB and 109.4dB respectively at the nearest residence ("Costa Vale", 3050 m from closest point of blasting in Block 1) while **Figure 9** shows maximum and average ground vibration levels of 1.3mm/s and 0.8mm/s respectively. Since the blasting criteria are satisfied at the nearest residence, they will be satisfied at all assessed residences and no further study of blasting impacts is required.

6.10 Train Noise

An attended measurement was conducted on 12 December 2006 by Spectrum Acoustics in the rear yard of a Barber St, Gunnedah, property at approximately 20m from the rail line. A passing coal train recorded an L_{max} of 79 dB(A) and 72.3 dB(A), L_{eq} over a period of 83 seconds.

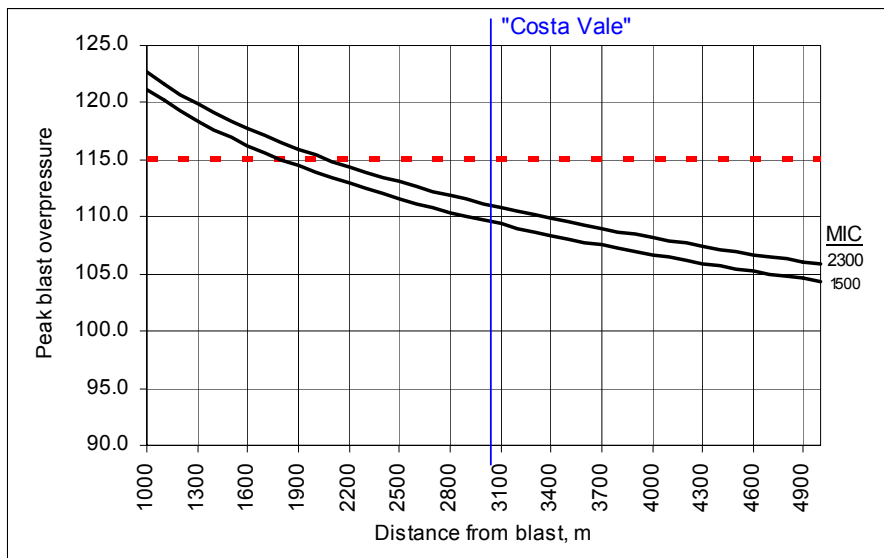


Figure 8
Predicted Blast overpressure levels

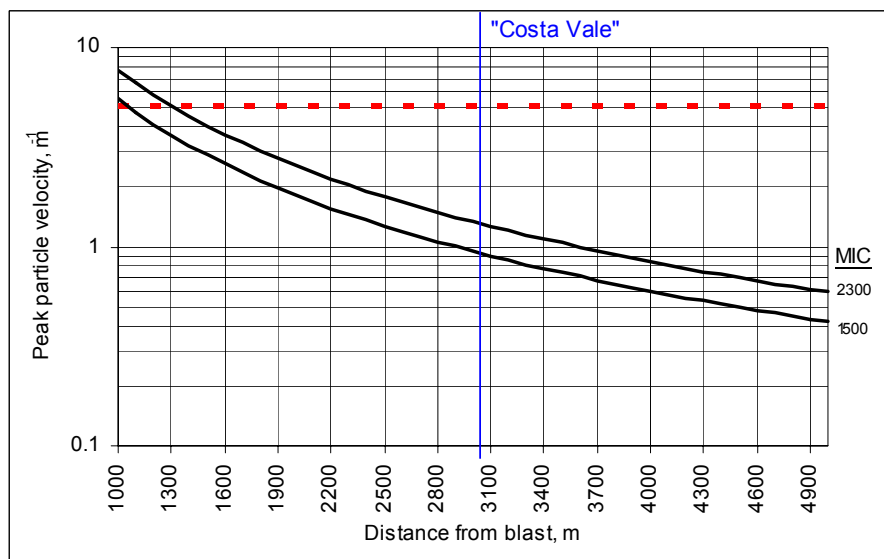


Figure 9
Predicted ground vibration levels

Using the measured parameters as input for Equation (1) gives the following results:

L_{Aeq} (9 hr) night	46.4 dB(A)
L_{Aeq} (15 hr) day	44.2 dB(A)
L_{Aeq} (24 hr)	42.2 dB(A)

The predicted level of 42.2 dB(A), $L_{Aeq(24 \text{ hr})}$ is almost 15 dB below the DECC criterion of 55 dB(A), $L_{Aeq(24 \text{ hr})}$.

The rail line from Gunnedah back to the Main Northern Line at Werris creek currently has the capacity to carry up to six coal trains per day. Assuming the unlikely worst case that all six trains (ie 12 movements) could occur in the day or the night, the overall cumulative coal train noise levels are summarised below.

Period	LAeq (12 trains movements)	Criterion (EPL 3142)
L _{Aeq} (9 hr) night	57.2 dB(A)	60 dB(A)
L _{Aeq} (15 hr) day	55.0 dB(A)	65 dB(A)

Again, with the line carrying coal trains at full capacity, the resulting noise levels are below the noise goals given in ARTC's EPL 3142.

7 MONITORING PROGRAM

7.1 Introduction

This section of the report sets out a recommended noise and vibration monitoring program sufficient to determine compliance with the relevant criteria. Specific details of measurement, analysis and reporting methods will be included in a Noise Management Plan prepared to assist site personnel should development consent be granted.

7.2 Noise Monitoring

7.2.1 Construction Noise

Construction of roads and infrastructure are only short term daytime activities and no noise goal exceedances were predicted. It is recommended that construction noise monitoring should be conducted once during road construction operations and then in response to complaints only.

7.2.2 Operational Noise

Operational noise compliance monitoring should be conducted monthly for the first three months of mining operations, reverting to quarterly for the remainder of the year. Subject to noise measurements confirming predicted levels and an absence of noise complaints, the noise monitoring program should be reviewed after the initial 12 months with a view to potentially conducting 6-monthly surveys.

7.2.3 Road Traffic Noise

Road traffic noise monitoring should be conducted to confirm the truck numbers and noise levels adopted and predicted in this assessment. If approved, traffic noise monitoring for Belmont Mine should be incorporated into the existing noise monitoring program for Whitehaven and Tarrawonga Coal Mines.

7.3 Blast Monitoring

A blast vibration / airblast overpressure monitor should be positioned at "Costa Vale". Logger data could be accessed by mine personnel for reporting requirements.

8 CONCLUSION

An assessment has been conducted to determine the noise and vibration impact of the Belmont Coal Project.

The mine would progress from north to south within the mine lease and modelling of Years 1, 3, 5 and 7, as well as an initial construction period, has been conducted to determine the potential noise impacts throughout the life of the mine.

Since the Proponent has purchased the land on the Project Site and most of the surrounding properties, there are only three potentially affected receivers within approximately 5km of the mining area.

No exceedances of the construction or operational noise criteria have been predicted, with the exception that initial development of the northern overburden emplacement may result in a minor (1dB) criterion exceedance at one receiver north of the site under adverse conditions. To mitigate this potential exceedance, a 10m high leading (northern) edge of this emplacement would be formed under favourable conditions. Further placement of material in this area would then occur behind this bund. This is the natural way in which this emplacement area would be formed, as it progresses from north to south.

No exceedances of the established daytime road traffic noise criterion or the proposed night time traffic noise criterion have been predicted. The assessment of traffic noise levels took into account the cumulative contributions from Whitehaven, Tarrawonga and Belmont Coal Mines.

Train noise levels (project-specific and cumulative) are predicted to be below the noise criteria set by DECC and implicit in ARTC'S EPL 3142.

It has been recommended that both site noise compliance and road traffic noise monitoring be conducted, should the project be approved.

We conclude that the project could operate without adversely impacting upon the acoustical amenity of any non-project related residential receiver, after implementation of noise control recommendations given in this report.

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APPENDIX A

Noise Source Sound Power Levels

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Major Construction Noise Sources, dB,L₁₀

Source	dB(A)	Octave band centre frequency, Hz							
		31.5	63	125	250	500	1k	2k	4k
Earth works (grader + scraper)	115	--	110	110	110	111	110	108	104
Tree felling with dozer	116	110	115	116	108	112	112	108	100

Major Operational Noise Sources, dB,L_{eq(15-minute)}

Source	dB(A)	Octave band centre frequency, Hz							
		31.5	63	125	250	500	1k	2k	4k
Coal processing area ¹	113	109	113	112	111	112	109	108	101
Overburden placement ²	115	118	120	121	119	114	104	105	102
Excavator O)&K RH170 plus trucks	114	113	103	109	110	111	107	108	103
Excavator EX 1800 plus trucks	114	113	104	110	111	110	106	107	101
CAT 785 trucks hauling on slope ³	115	118	118	119	112	111	109	110	104
CAT 785 trucks hauling on flat	112	115	115	116	109	108	106	107	101
CAT 777 trucks hauling coal	111	112	115	116	105	108	105	103	98
DM 45 Blasthole drill	113	109	111	111	110	110	109	106	101

1. Coal crushing plant and CAT 988 front end loader.

2. Four CAT 785 trucks per 15 minutes and D11 dozer.

3. Four uphill and four down hill per 15 minutes.

Major Impact Sources, dB,L_{max}

Source	dB(A)	Octave band centre frequency, Hz							
		31.5	63	125	250	500	1k	2k	4k
Overburden placement (with dozer)	128	--	125	128	130	123	121	120	115
Excavator plus trucks	125	--	127	123	120	121	121	119	114
Overburden transport route (flat section)	118	--	123	125	117	116	111	109	104
Overburden transport route (downhill)	124	116	123	117	114	117	122	117	113

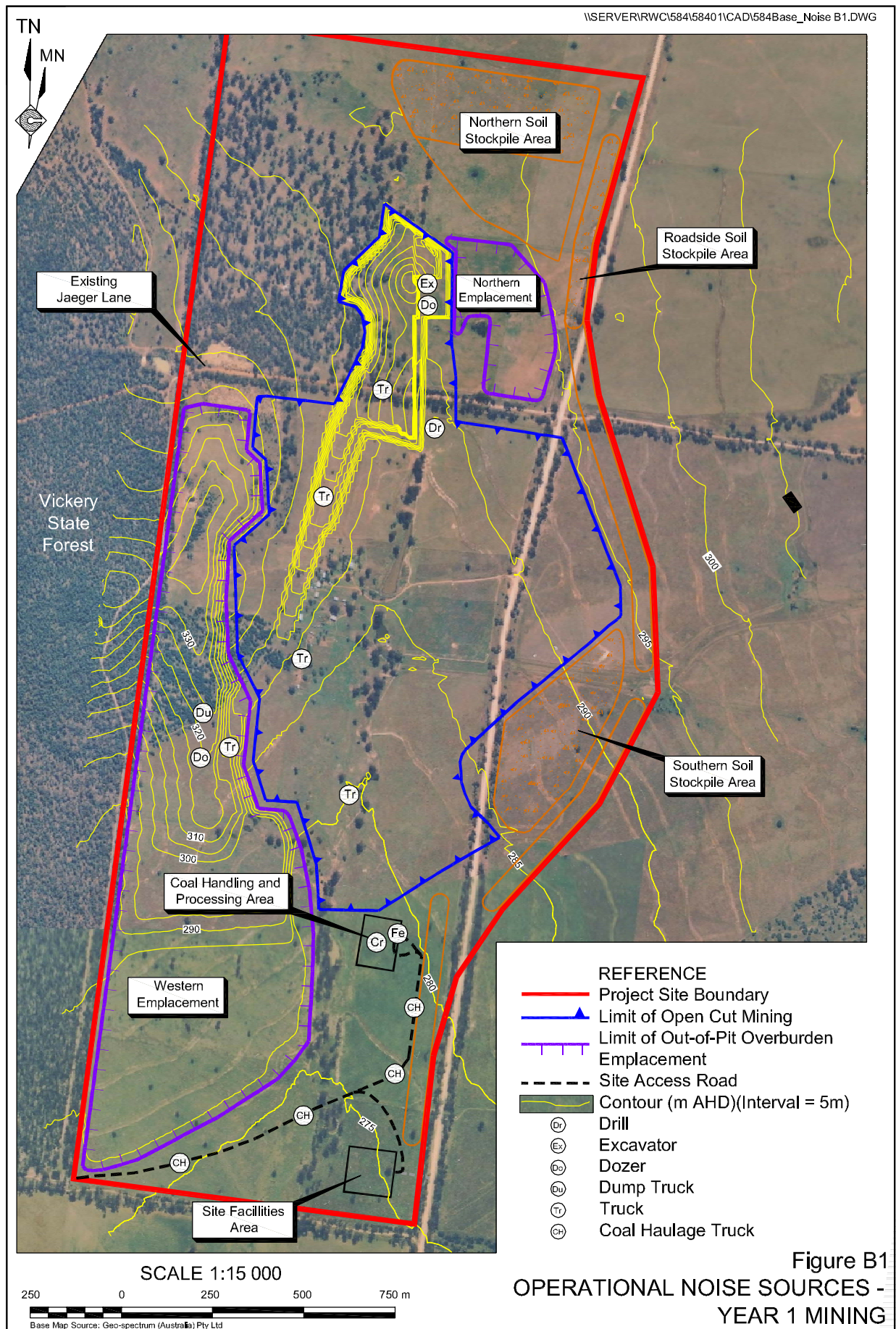
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APPENDIX B

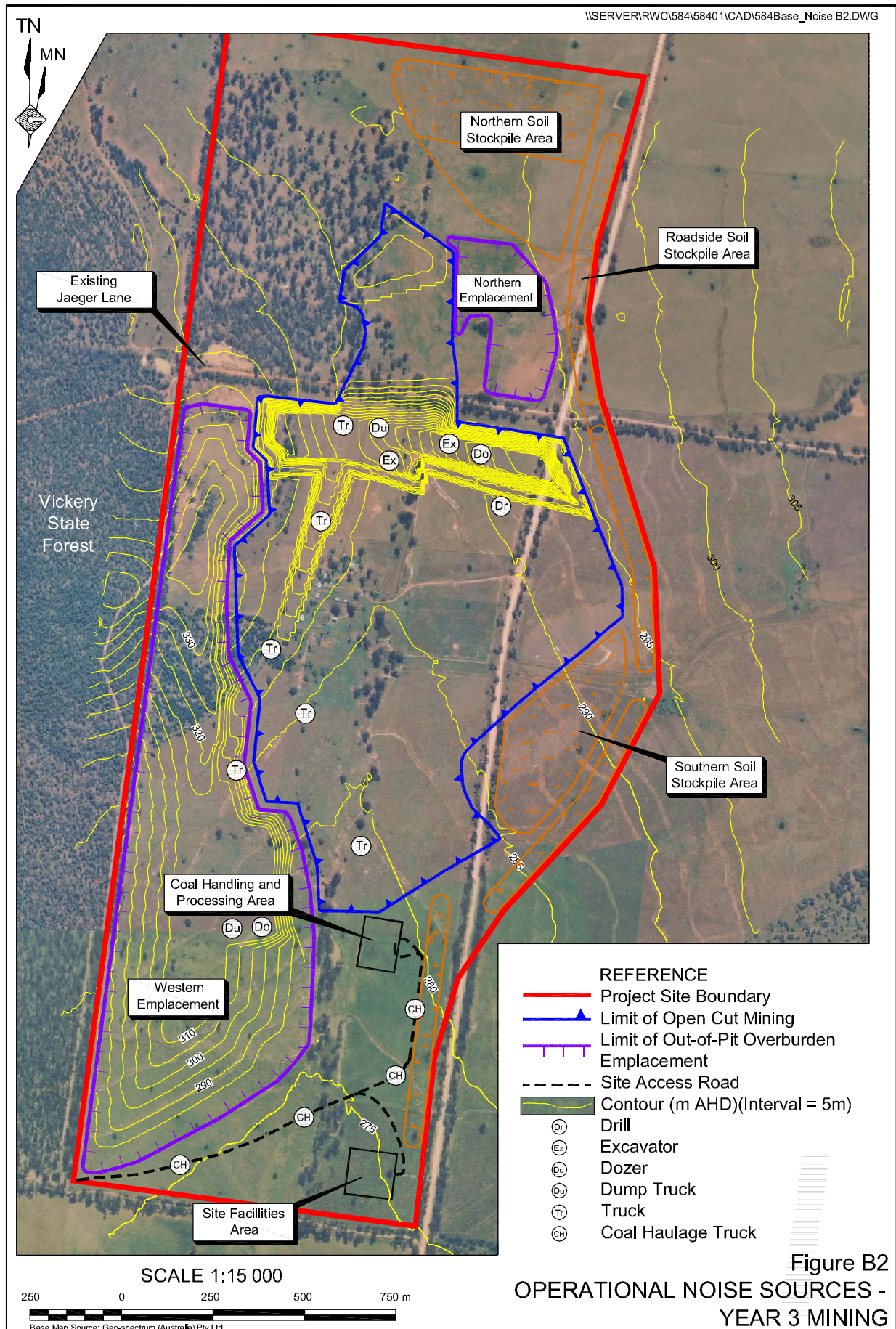
Operational Scenarios and Noise Contours

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Note: A Colour Version of this figure is available on the project CD



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