NAMOI MINING PTY LTD

ABN: 24 071 158 373

Sunnyside Coal Project

Via Gunnedah

Noise and Vibration Assessment

Prepared by

Spectrum Acoustics Pty Ltd

March, 2008

Specialist Consultant Studies Compendium
Part 2

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Noise and Vibration Assessment

of the

Sunnyside Coal Project

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March, 2008

CONTENTS

Page

CONTENTS

Page

APPENDICES

FIGURES

TABLES

EXECUTIVE SUMMARY

An assessment has been conducted to determine the noise and vibration impact of the proposed Sunnyside Coal Mine ("the Project").

Introduction

The Mine would be located within an area of approximately 231ha (the Project Site) on the "Sunnyside" property approximately 15km west of Gunnedah.

The Project Site is located just north of the Oxley Highway and the former Gunnedah Colliery No. 5 facilities and west of Coocooboonah Lane.

Mining and associated activities would be undertaken within Lot 12 and Lot 462 DP755503 "Sunnyside" owned by Namoi Mining Pty Ltd (NMPL). There would be a purpose-built transport corridor parallel to and east of Coocooboonah Lane. This would be located on part of the "Plain View" property and would remain open for public use.

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

- Open cut (and potential auger) coal mining over an area of approximately 80-100 ha.
- Programmed placement of overburden and interburden materials from the open cut, initially to an out-of-pit overburden emplacement during excavation of the Pit entry and subsequently to the open cut void.
- On-site coal processing (size reduction and screening only).
- Transportation of product coal from the on-site size reduction and screening facility to the Whitehaven CHPP and Rail Loading Facility by road.
- Despatch of export coal products by rail to Port Newcastle.
- Installation of a range of services, structures and transportable buildings.
- Progressive shaping and rehabilitation of the open cut mining area, overburden emplacement and associated areas of disturbance.

Residential Receivers

The Project Site is surrounded by rural properties with residences significantly separated from each other. Residences have been identified by their respective property names as summarised in **Table S1**.

TABLE S1 **Residential receivers near the Project Site**		
R1 "Flodden"	R7 "Woodlawn"	R13 "Merralong"
R2 "Ivanhoe"	R8 "Sugarloaf"	R14 "Skipton"
R3 "Werona"[1]	R9 "Lilydale"	R15 "Glendower"
R4 "Illili"	R10 "Mulwalla" (1)	R16 "Carramar"
R5 "Ferndale"	R11 "Mulwalla" (2)	R17 "Crendon"
R6 "Plain View"	R12 "Lyndon Park"	R18 "Glenfenzie"

1 This property has recently been purchased by the proponent.

Site Establishment/Construction Phase

The first year of activities on site would see the establishment of site roads, excavation of the open cut pit access ramp and establishment of environmental bunds in the first 6 months. These activities would be subject to construction noise criteria and would occur during daytime only. Out-of-pit overburden emplacement is expected to be completed in the following 6 months. This activity would be considered an operational activity (that is, not subject to a "construction" noise criterion). No exceedances of the construction noise criteria have been predicted at any receiver except R9 "Lilydale" (see discussion below).

Constructing the re-aligned section of Coocooboonah Lane is an off-site construction activity and has been assessed against a construction noise criterion. Exceedances of up to 9dB have been predicted for the short period (two weeks or less) when construction activities are closest to the residence at R9 "Lilydale" (approximately 200m). Road construction activities on the northern half of Coocooboonah Lane would comply with the construction noise criterion. Site establishment activities are not predicted to result in site noise criterion exceedances at this receiver. A Construction Noise Management Plan (CNMP) would be implemented to minimise construction noise levels at impacted receivers.

Minor to moderate (1-3dB) exceedances of the operational noise criterion have been predicted at R1 "Flodden", R4 "Illili", R5 "Ferndale", R6 "Plain View" and R15 "Glendower" during completion of the out-of-pit emplacement under inversion conditions. A major (5dB) exceedance has been predicted at R2 "Ivanhoe" under inversion conditions. Out-of-pit emplacement would be timed so as to avoid inversion conditions and the predicted exceedances at the above five receivers.

Minor to moderate (1-4dB) exceedances of the operational noise criterion have been predicted at R2 "Ivanhoe", R4 "Illili", R5 "Ferndale", and R15 "Glendower" during completion of the out-of-pit emplacement under adverse wind conditions.

Due to the daytime-only nature of the activities, their relatively short duration in the life of the Project and the difficulty/cost of effectively reducing noise emissions, it is recommended that the predicted noise levels up to 4dB above the operational criterion would be set as the noise criteria for this activity and noise monitoring would be conducted monthly during this period to determine compliance. Activities at the out-of-pit emplacement would be completed no more than 6 months after completion of the environmental bunds and other construction activities.

Operational Phase (Mining)

There would be no predicted exceedances of the noise criterion during Year 1, except for brief periods when scrapers would be used at ground level. With two scrapers operating in tandem, 1 dB exceedances are predicted at R5 “Ferndale” and R15 “Glendower” under adverse wind conditions. A 2 dB exceedance is predicted at R4 “Illili” under the same conditions. Reducing the number of active scrapers from two to one mitigates the 1 dB exceedances and reduces the 2 dB exceedance to 1 dB. This minor exceedance at one receiver would only occur infrequently and it is not recommended that noise mitigation is required.

A low-level in-pit emplacement area would be available from approximately the end of Year 1 to Year 4. No criterion exceedances are predicted during this period. Overburden emplacement at high level locations could occur during calm conditions or winds generally from the east without the noise criterion being exceeded at any receiver.

By Year 5, when the pit has progressed to the east, noise levels 5 dB or more above the criteria are predicted at two receivers from overburden emplacement at a high level exposed location under inversion conditions. In the absence of a negotiated agreement between the proponent and these receivers, operating at high level under inversion conditions must be avoided. This would be relatively easy to achieve since the direction of mining would leave a substantial low-level in-pit area for further overburden emplacement.

When mining would be nearing completion in Year 5, blasts would need to be appropriately modified when mining progresses to within 1500m of the nearest residence to ensure compliance with the overpressure criterion. This would have the added benefit of also reducing ground vibration levels. No exceedances of the maximum overpressure limit of 120dB or the vibration criteria were predicted. It has been recommended that a blast monitor would be installed near the “Lilydale’ residence.

No exceedances of the traffic noise criteria have been predicted, although levels equal to the ‘local road’ criterion were predicted at the two residences set back from Torrens Road. Recommendations have been made to test coal haul trucks against Australian Design Standards prior to their use and routinely monitor actual traffic noise levels.

No exceedances of noise and vibration criteria for rail transportation of coal have been predicted.

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 and management recommendations given in this report.

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1 INTRODUCTION

Namoi Mining Pty Limited (NMPL) proposes to establish a coal mine west of Gunnedah, NSW. The proposed development is a "Major Project" and therefore the Minister for Planning is the approval authority. Accordingly, a Noise and Vibration Impact Assessment (NVIS) has been conducted in accordance with the Guidelines for the Preparation of an Environmental Impact Statement (EIS) – Coal Mines and Associated Infrastructure. This NVIS accompanies the major projects application by Namoi Mining Pty Limited (NMPL) and supporting *Environmental Assessment.*

1.1 Study Area

The Mine would be located within an area of approximately 231ha (the "Project Site") on the "Sunnyside" property approximately 15km west of Gunnedah. **Figure 1** shows the Project Site and surrounding area. The Project Site is located just north of the Oxley Highway and the former Gunnedah Colliery No. 5 facilities and west of Coocooboonah Lane.

The Project Site represents the area of potential maximum surface disturbance associated with all mining-related activities. The Whitehaven Coal Handling and Preparation Plant (CHPP) and Rail Loading Facility, are located approximately 5km northwest of Gunnedah and 17km by road east of the Project Site.

Mining and associated activities would be undertaken within Lot 12 and Lot 462 DP755503 "Sunnyside" owned by NMPL. There would be a purpose built transport corridor parallel and east of Coocooboonah Lane. This would be located on Lots 162 and 163 DP755503 which are part of the "Plain View" property. A negotiated agreement has been reached with the owner of this property for the construction and use of the road during the operation life of the Project.

1.2 Proposed Operations

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

- Open cut (and potential auger) coal mining over an area of approximately 43ha.
- Programmed placement of overburden and interburden materials from the open cut, initially to an out-of-pit overburden emplacement during excavation of the open cut entry and subsequently to the open cut void.
- On-site coal processing (size reduction and screening only).
- Transportation of product coal from the on-site size reduction and screening facility to the Whitehaven CHPP and Rail Loading Facility along a coal transport route described in greater detail in Section 1.3.
- Despatch of export coal products by rail to Port Newcastle.
- Installation of a range of services, structures and transportable buildings.
- Progressive shaping and rehabilitation of the open cut mining area, overburden emplacement and associated areas of disturbance.

Figure 2 shows the proposed Project Site layout.

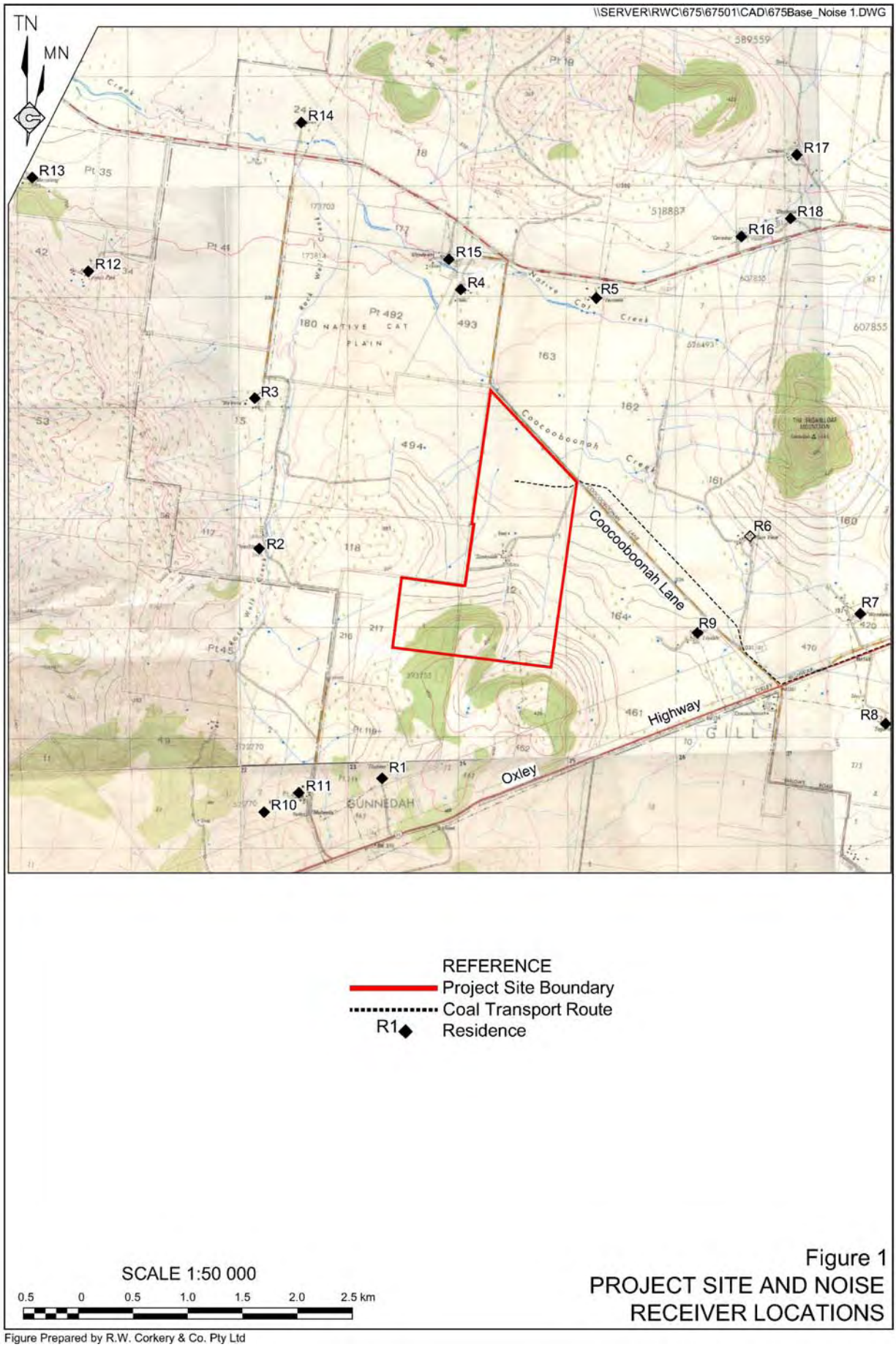

Figure 1
PROJECT SITE AND NOISE RECEIVER LOCATIONS

Figure Prepared by R.W. Corkery & Co. Pty Ltd

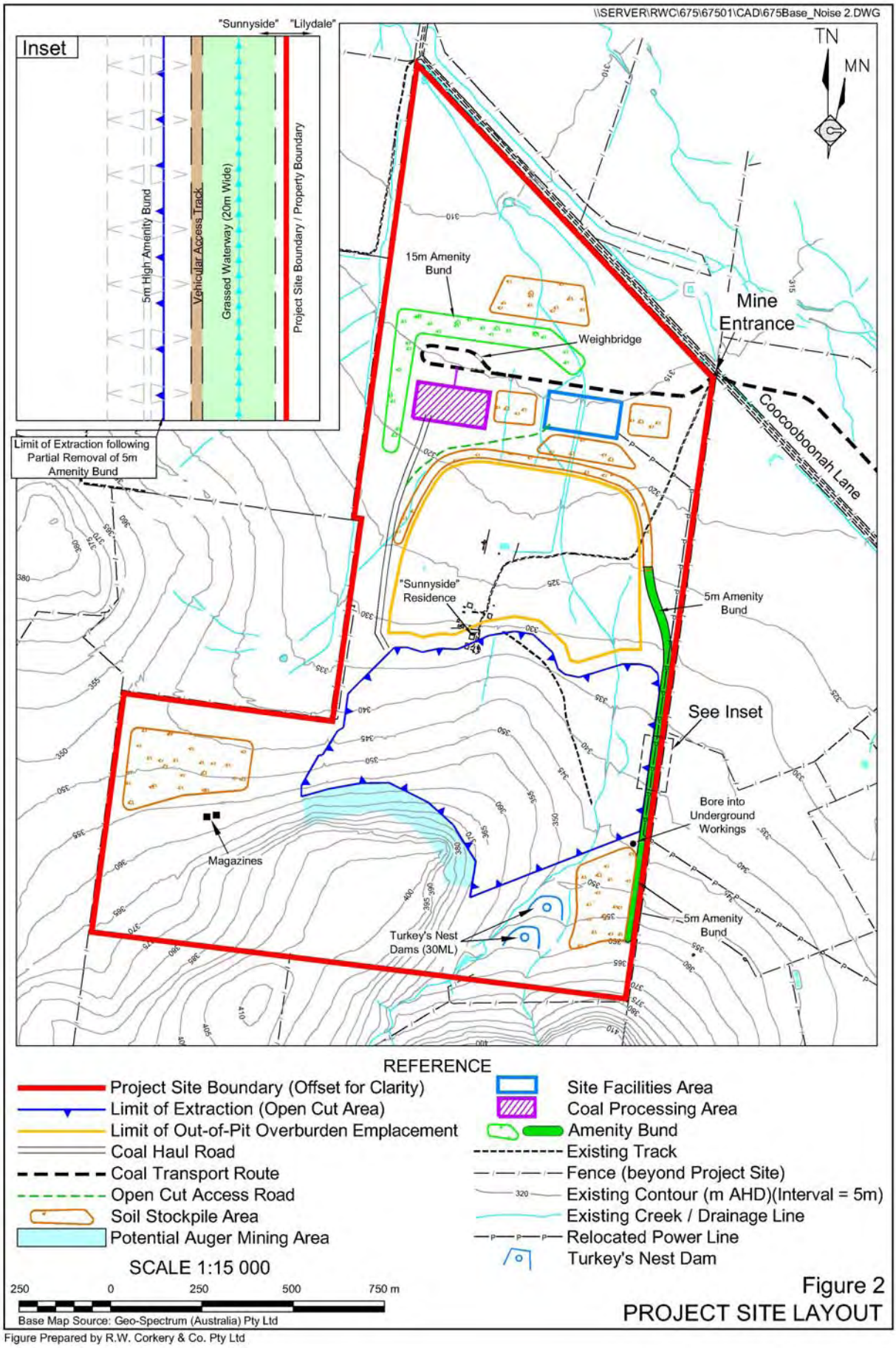

Figure 2
PROJECT SITE LAYOUT

Figure Prepared by R.W. Corkery & Co. Pty Ltd

1.3 Coal Handling and Transport

Figure 3 shows the coal transport route between the Sunnyside Project Site and the Whitehaven CHPP and Rail Loading Facility.

Coal trucks of nominal 40t capacity would be loaded on site under the load-out bin adjacent to the ROM Coal Pad. They would leave the Project Site and cross over the existing Coocooboonah Lane via an at-grade crossing and proceed along a re-alignment of Coocooboonah Lane approximately 100m east of and parallel to the existing road.

Approximately 300m before the existing intersection of Coocooboonah Lane with the Oxley Highway, the re-alignment would rejoin the existing lane.

Trucks would turn left out of Coocooboonah Lane and proceed eastwards along the Oxley Highway before turning left into Blackjack Road. Blackjack Road was used in the past to transport coal from the Gunnedah Colliery to the old Gunnedah Mine rail siding opposite the Whitehaven CHPP. At the end of Blackjack Road, trucks would turn right into Quia Road, then turn left and pass under a rail overpass, and immediately turn left again and proceed directly to the Whitehaven CHPP via Torrens Road and the Torrens Road access way.

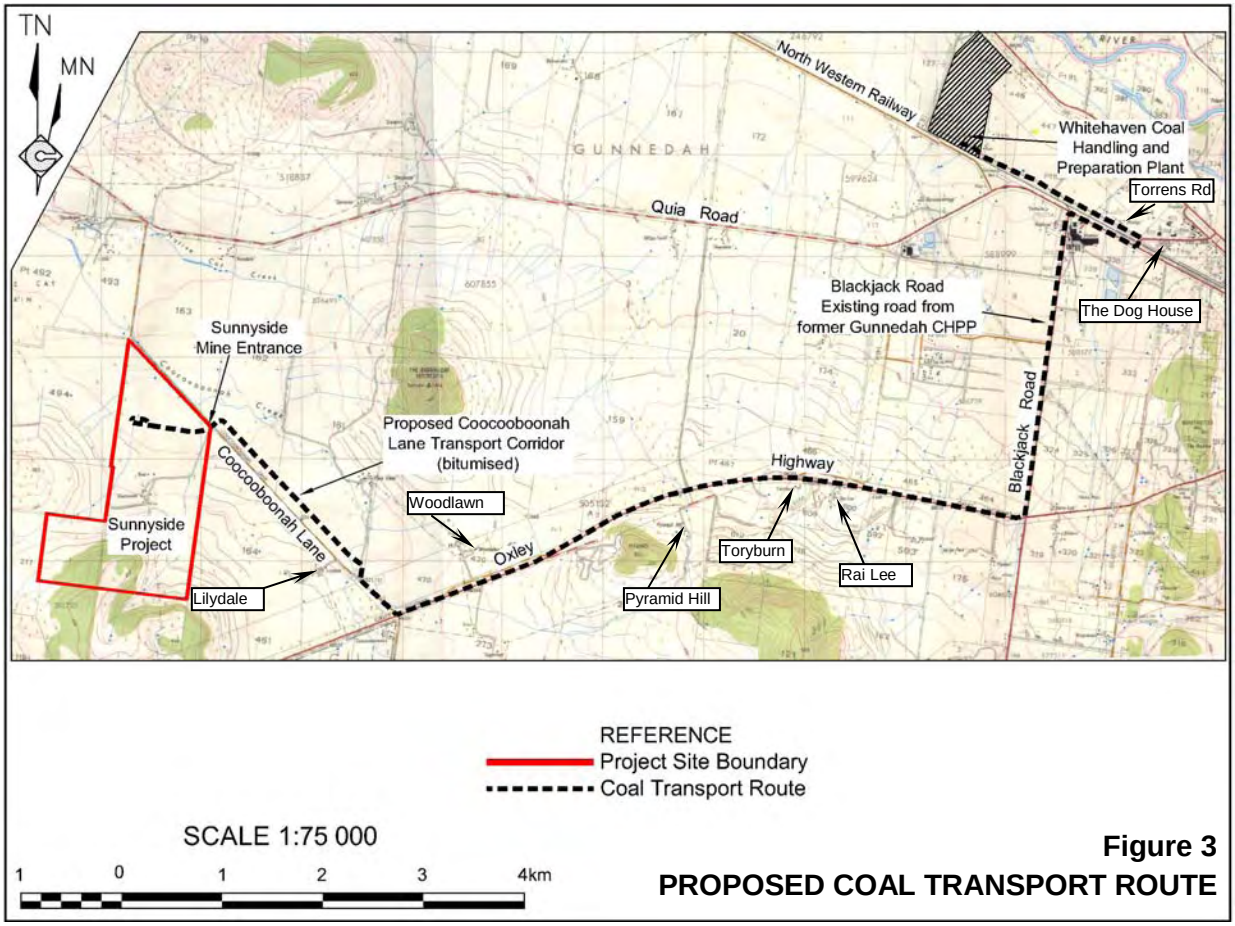

Figure 3
PROPOSED COAL TRANSPORT ROUTE

The trucks would unload at the CHPP and return to the Sunnyside Mine along the same route. Unloaded Sunnyside coal would be blended and prepared for loading onto trains through the Whitehaven load-out bin.

Coal would be transported to Port Newcastle by rail.

2 DESCRIPTION OF TERMS

2.1 Introduction

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” moves 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 experiences a “friction drag” at the ground in much the same way as a lava flow will 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 4** shows several examples of how atmospheric effects can bend sound waves.

Figure 4 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’.

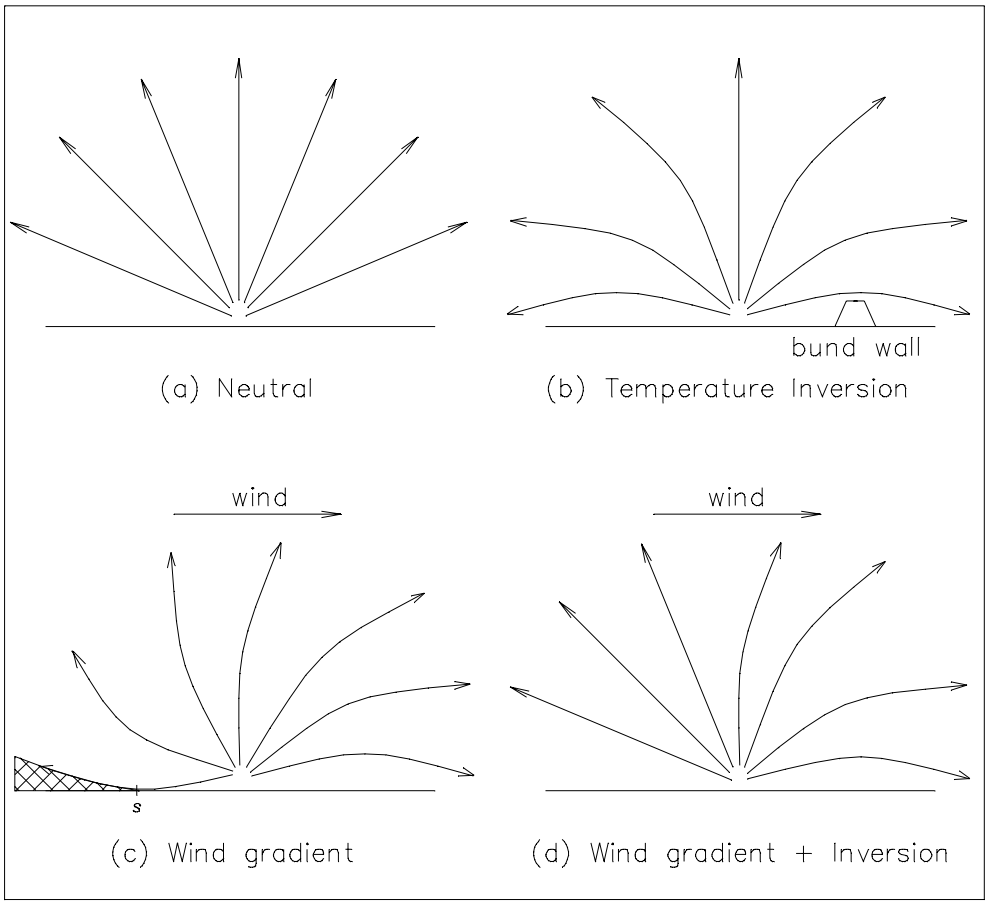

Figure 4
Sound Refraction under Temperature Inversions and Wind Gradients

Neutral Atmospheric Conditions

An atmosphere that is at a temperature of approximately 23^0C 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 usually varies 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 typically include seasonal wind directions and velocities. Temperature inversions are included as prevailing if they occur, on average, for more than 2 nights per week in winter.

Adverse Atmospheric Conditions

Adverse conditions include source-receiver winds and temperature inversions, both of which generally increase noise levels at the receiver. The worst case scenario for potential noise enhancement is often a temperature inversion with source-receiver drainage-flow wind.

2.3 Noise Level Percentiles

A noise level percentile (Ln) is the noise level (SPL) in decibels which is exceeded for "n" % of a given monitoring period. Several important Ln percentiles can be explained by considering the hypothetical time signal in **Figure 5**.

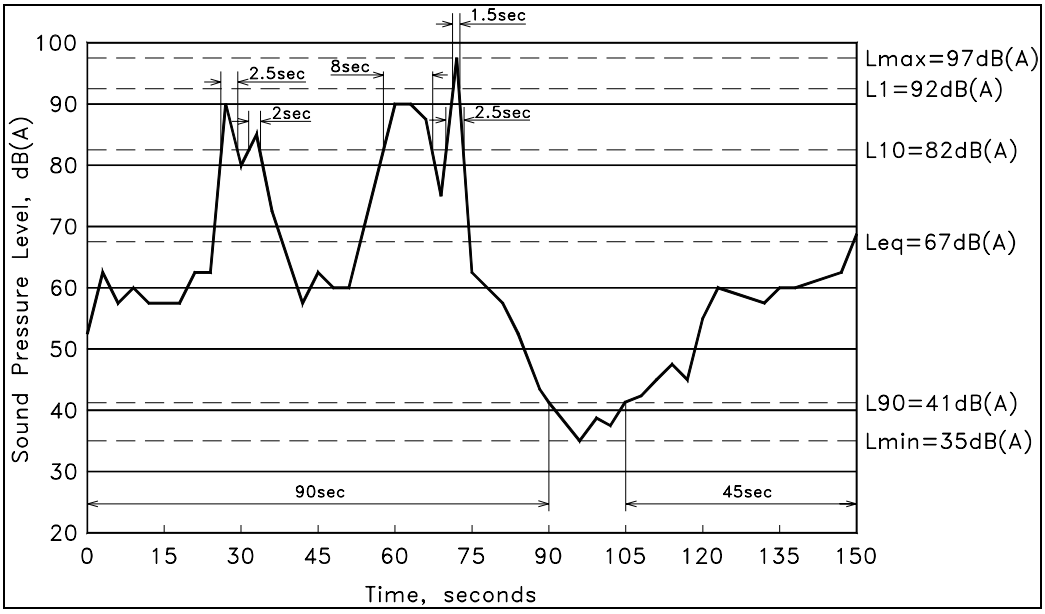

Figure 5
Time-trace of Hypothetical 150-Second Sample

The signal in **Figure 5** has a duration of 2.5 minutes (ie 150 seconds) with noises occurring as follows.

- The instrument is located 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.

L_1 Noise Level

Near the top of **Figure 5**, 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 LA_1 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 NSW Department of Environment and Conservation (DEC) as a measure of potential disturbance to sleep.

L_{10} 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_{10} 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 5** 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_{90} 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 DECC *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 5** 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. Since the Project would only involve day and evening operations, temperature inversions are not formally required to be assessed under the INP. DECC (Armidale) has requested, however, that an assessment of operational noise levels under inversion conditions be included, so the INP default $+4^0$C/100m inversion strength has been adopted for this purpose.

Hourly wind data from Gunnedah airport covering the period December 2001-August 2006 have been analysed to determine the percentage occurrence of winds from various directions. The analysis of winds was conducted by sorting the data into the four seasons covering summer 2001-02 to winter 2006. This produced 19 sets of data ie (four seasons for five years, minus spring 2006). Each data set was then filtered to determine 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 6** below. For each data set, 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 + 22.5^0 and -22.5^0 were then considered. (As an example, if the current primary direction ***P*** is NE, then ***P***+22.5^0 is ENE and ***P***-22.5^0 is NNE).

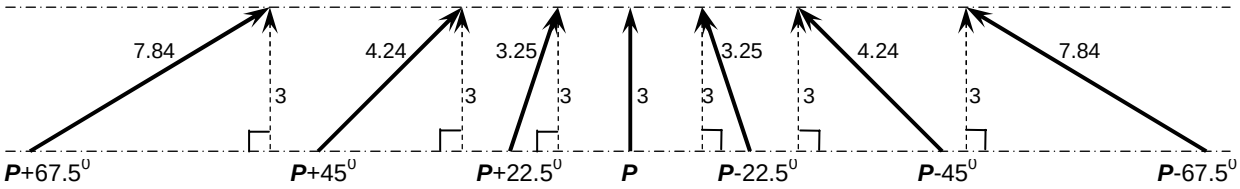

Figure 6
Vector Components of Source-Receiver Winds

Figure 6 shows that winds from ***P***±22.5^0 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***±22.5^0 were added to the summation for primary direction ***P***. Similarly, the percentage occurrences of winds up to 4.24 m/s from ***P***±45^0 were added to the summation. (In the above example, ***P***+45^0 would be East and ***P***-45^0 would be North).

Finally, **Figure 6** shows that at ***P***±67.5^0 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***±67.5^0 were added to the summation. (In the above example, ***P***+67.5^0 would be ESE and ***P***-67.5^0 would be NNW).

This process was repeated for each of the 16 primary wind directions and each of the 19 data sets. Because the assessment of winds in each direction includes information from six 'side-band' directions, and excludes all winds greater than 5 m/s, the results may bare little resemblance to wind roses of the same data set. Winds occurring more than 30% of the time during all seasons, averaged over the five years are summarised in **Table 1**. Winds from these directions are required to be assessed under the INP for the corresponding season and time period. 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	Winds greater than 30% up to 3m/s (vector sum)
Summer	--
Autumn	ENE (36.8%), SSW (35.3%)
Winter	SSW (36.9%), ENE (34.9%)
Spring	SSW (30.3%)

Table 1 shows that, for the purposes of this assessment, assessable winds are from the ENE and SSW in all seasons except summer. A wind speed of 3 m/s at 10m above ground level was modelled from the ENE and SSW for all scenarios.

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

3.2 Ambient Noise Levels

Several site visits were conducted during August-October 2006 to locate the residential receivers and gain an appreciation of the Project Site. All of the receivers are in a rural setting with no industrial noise present. It has been assumed that the background noise level at all receivers is at or below 30dB(A),L_{90} day, evening and night.

4 NOISE AND VIBRATION CRITERIA

4.1 Introduction

This section of the report presents noise and vibration criteria for potentially affected residential properties not owned by NMPL.

4.2 Construction Noise

The Project would require the following construction works with the potential to have a noise impact on residential receivers.

- Tree clearing and topsoil removal.
- Construction of Project Site roads and re-alignment of Coocooboonah Lane.

- Construction of coal handling and surface facilities.
- Excavation of pit access ramp.

Recommended construction noise criteria vary depending on construction duration, as outlined in Section 157 of the DECC *Environmental Noise Control Manual* (ENCM) and reproduced below:

- Construction period less than 4 weeks:
  $L_{10(15minute)}$ level restricted to background (L_{90}) + 20dB
- Construction period more than 4 weeks but less than 26 weeks:
  $L_{10(15minute)}$ level restricted to background (L_{90}) + 10dB

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

It is expected that construction of the Coocooboonah Lane re-alignment would be completed within the first six months of the Project and the criterion of 'daytime background level + 10dB(A)' or **40dB(A),$L_{10(15minute)}$** would apply. Excavation of the pit access ramp and construction of environmental bunds along the eastern edge of the out-of-pit emplacement area would also take less than six months and be subject to the construction noise criteria. Completion of the out-of-pit emplacement is expected to take up to a further six months and the operational noise criterion discussed in the following section would apply (after establishment of the eastern edge as an environmental bund).

4.3 Operational Noise Goals

The INP specifies two noise criteria: an *intrusiveness criterion* which limits short-term L_{eq} 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 industrial noise near the Project Site, and there are relatively low levels of road traffic noise, only the intrusiveness criteria are relevant. The Project-Specific Noise Levels (PSNL) are therefore **35dB(A),$L_{eq(15minute)}$** day and evening at all receivers near the Project Site.

4.4 Train Noise and Vibration

4.4.1 Train Noise Criteria

The operation of Sunnyside Coal Mine would result in additional train movements on the rail line between the Project Site and Port Newcastle. There would 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 will be considered here in the assessment of *cumulative train noise levels* as a result of the Sunnyside Coal Mine.

4.4.2 Train Vibration Levels

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 2** 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 2
Vibration Criteria Multiplication Factors

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

Figure 7 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.

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

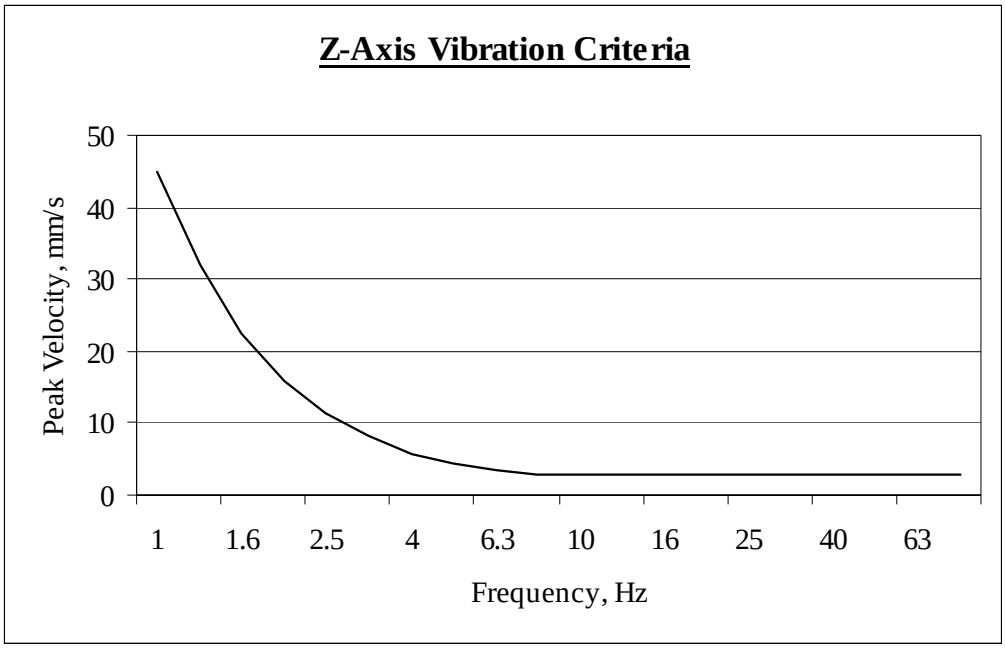

Figure 7
Night Time Criteria for Vertical Vibration Velocity

4.5 Road Traffic Noise

Trucks transporting coal to the Whitehaven CHPP would first use a new section of Coocooboonah Lane to be constructed parallel to the existing road on the "Plain View" property. This road would be constructed to avoid the Koala habitat along the existing lane and would remain open to public use.

Trucks would turn left out of Coocooboonah Lane and proceed along the Oxley Highway before turning left into Blackjack Road. At the end of Blackjack Road, trucks would turn right into Quia Road. They would then turn left and pass under a rail overpass, then immediately turn left again and proceed directly to the Whitehaven Mining CHPP. There are residences adjacent to the Oxley Highway, Quia Road, and Torrens Road.

Noise criteria for the generation of additional traffic on public roads were sourced from the DECC *Environmental Criteria for Road Traffic Noise* (ECRTN). Coocooboonah Lane is a local road, Blackjack Road and Quia Road are collector roads and, while the Oxley Highway is a highway, it carries a relatively small traffic volume and will also be considered as a collector road for the purposes of setting noise criteria. The applicable ECRTN criteria are as follows.

Category	Day (7am-10pm)	Night (10pm-7am)
Land use development with potential to create additional traffic on local roads	55dB(A),$L_{eq(1hr)}$	50dB(A),$L_{eq(1hr)}$
Land use development with potential to create additional traffic on collector roads	60dB(A),$L_{eq(1hr)}$	55dB(A),$L_{eq(1hr)}$

4.6 Blasting

4.6.1 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 5 mm/s Peak Vector Sum (PVS).
- The PVS level of 5 mm/s may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 10 mm/s at any time.
- Blasting should generally only be permitted during the hours of 9 am to 5 pm Monday to Saturday, and should not take place on Sundays and Public Holidays.
- Blasting should generally take place no more than once per day.

4.6.2 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 3**.

Table 3
Building Damage Blast Criteria (AS2187)

Building Type	Vibration Level (mm/s)	Airblast Level (dB re 20 μPa)
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 3**) and will be taken as the governing criteria for the Sunnyside Coal Project.

5 ASSESSMENT METHODOLOGY

5.1 Construction Noise

For modelling purposes, it was assumed that excavation of the open cut access ramp, road construction 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 (ENM) v3.06. Noise levels under calm (neutral) conditions, prevailing winds and temperature inversions conditions were calculated.

5.2 Operational Noise

Assessment of operational noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. The noise sources were modelled at their known (for stationary sources such as the truck loading area) or most exposed (for mobile sources such as haul trucks and dozers) positions and noise contours and/or point calculations were generated for the surrounding area.

5.2.1 Noise Sources

Noise data for significant sources associated with the Project were obtained from Spectrum Acoustics' extensive database of measured plant items. All sound power levels used in the modelling were obtained from measurements results at other operating mines in the Gunnedah area. Sound power levels of operational noise sources are shown in **Appendix A**.

5.2.2 Modelled Scenarios

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

- *Daytime lapse* - 20^0C, 70% relative humidity (RH), no wind, -1^oC/100m vertical temperature gradient (dry adiabatic lapse rate, DALR).
- *Inversion* – 5^0C, 70% R.H., $+4^o$C/100m vertical temperature gradient.
- *Prevailing winds* – 20^0C, 70% R.H., 3m/s wind from ENE and SSW.

In addition to the Year 0 (construction) and Year 0 (out-of-pit emplacement) scenarios, noise models were generated for Year 1, Year 2 and Year 5 mining operations, for each of the above atmospheric conditions.

***YEAR 1 (mining)*:** Commencement of mining including excavators and trucks in the pit at the western end of the mining area, in-pit overburden placement (with dozer) and all aspects of coal handling including crushing and road haulage on the private coal transport route adjacent to Coocooboonah Lane (off-site rail movements are assessed separately). Noise source locations for this scenario are shown in **Figure B1** in **Appendix B**.

YEAR 2: Mining activities have progressed to the east. The out-of-pit emplacement has been completed to approximately 15m height along the eastern edge and is being progressively back-filled towards the west. Scenario includes coal crushing/sizing, haulage and stockpiling in the Rail Loading Facility. Noise source locations for this scenario are shown in **Figure B2** in **Appendix B**.

YEAR 5: Mining has progressed to the eastern extent of the open cut area. Noise source locations for this scenario are shown in **Figure B3** in **Appendix B**.

Results were generated for both low-level and high-level in-pit overburden emplacement for the Years 2 and 5 scenarios due to availability of two different bench heights behind the advancing highwall.

5.3 Rail Noise

Additional rail traffic generated by the Project would 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 8**. 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.

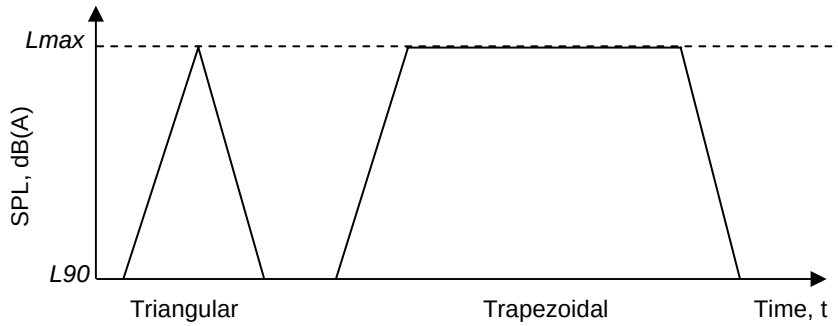

Figure 8
Triangular and Trapezoidal Time Signals

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.

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

where,

L_{max} = maximum train noise at residence, dB(A)
L_b = background noise level, dB(A)
ΔL = 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.

5.4 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. Train vibration levels will therefore not be considered further in this report.

5.5 Off-site Road Traffic Noise

The value of $L_{Aeq,T}$ for a series of identical triangular time patterns (see **Figure 7**) having maximum levels of L_{Amax} is given by **Equation 2**. A triangular time signal is a good approximation to the SPL signal of a vehicle as it passes an observation point.

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

where,

L_{max} = maximum vehicle noise at residence, dB(A)
L_b = ambient equivalent noise level, dB(A)
ΔL = L_{max} - L_b
T = assessment period (minutes)
τ = “10dB-down” duration per vehicle (minutes), and
n = number of vehicles during assessment period.

Based on the proposed mine productivity, there would be up to 14 truck movements along the coal transport route per hour during the day (including return trips and assuming no night time truck movements). For a 1-hour period, n = 14 and T = 60. The duration per truck, τ, is calculated from the distance between source and receiver, D, and the vehicle speed, v, by $\tau = 6D/v$ (sec). **Table 4** shows various parameters used in the calculation of truck noise at receivers within 60m of public roads.

Table 4
Parameters for Truck Noise Calculations

Distance from road, m	Vehicle speed, km/h (m/s)	Duration (τ), s	Pass-by L_{max}, dB(A)
20	60 (16.7)	7.2	75
	80 (22.3)	5.4	80
	100 (27.9)	4.3	85
40	60 (16.7)	14.4	69
	80 (22.3)	10.8	74
	100 (27.9)	8.6	79
60	60 (16.7)	21.6	66
	80 (22.3)	16.2	71
	100 (27.9)	12.9	76

5.6 Blasting

The following sections provide standard equations for predicting blast overpressure and ground vibration levels, sourced from the United States Bureau of Mines as endorsed by ANZECC. Blast data from coal mines in the Hunter Valley were analysed to determine suitable correction factors that would align the equations with actual measured results. The modified equations were then used to predict blast overpressure and vibration levels from the Project.

5.6.1 Blast Overpressure

Unweighted airblast overpressure levels, OP, are predicted from **Equation 3** below.

$$OP = 165 - 24(\log_{10}(D) - 0.3 \log_{10}(Q)), \text{ dB} \quad (3)$$

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

5.6.2 Blast Vibration

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

$$PPV = 1140\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \quad \text{(for average ground type)} \quad (4)$$

$$PPV = 500\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \quad \text{(for hard rock)} \quad (5)$$

where D and Q are defined as in Equation 3.

Note that the only difference between equations (4) and (5) is the value of the coefficient (either 1140 or 500). Geological data for the Project Site show that most of the material to be mined contains bands of sandstone, conglomerate and mudstone, all of which may be considered as relatively hard materials. A coefficient value of 1000 was adopted in the equation to provide a conservative estimate of ground vibration levels from blasting.

6 IMPACT ASSESSMENT

This section of the report presents predicted noise and vibration levels and provides mitigation recommendations where criterion exceedances are predicted. Noise contours showing worst case predicted levels for each assessed year of operations (excluding inversion conditions) are shown as **Figures B4** to **B8** in **Appendix B**.

6.1 Construction Noise

6.1.1 Predicted Noise Levels

Predicted noise levels from earthworks (pit ramp/environmental bund construction and off-site roadworks) and surface facilities construction during the initial 6-month construction period are shown in **Tables 5-7**. **Table 5** shows levels from construction of the southern section of Coocooboonah Lane, **Table 6** summarises results for construction of the northern section and **Table 7** summarises noise emissions during construction of site facilities, open cut access ramp and environmental bunds. All criterion exceedances are highlighted in bold type.

Table 5
Predicted Construction Noise Levels – Southern section of Coocooboonah Lane

Location*	Meteorological Condition				Criterion
	Calm	ENE wind	SSW wind	Inversion	
R1 “Flodden”	<20	24	<20	25	40
R2 “Ivanhoe”	<20	20	<20	23	40
R4 “Illili”	<20	<20	<20	<20	40
R5 “Ferndale”	<20	<20	<20	<20	40
R6 “Plainview”*	32	28	35	35	N/A
R7 “Woodlawn”	28	25	30	32	40
R8 “Sugarloaf”	21	20	21	26	40
R9 “Lilydale”	**44**	**46**	**41**	**45**	40
R10 “Mulwalla” (1)	<20	21	<20	23	40
R11 “Mulwalla” (2)	<20	<20	<20	<20	40
R12 “Lyndon Park”	<20	<20	<20	<20	40
R13 “Merralong”	<20	<20	<20	<20	40
R14 “Skipton”	<20	<20	<20	<20	40
R15 “Glendower”	<20	<20	<20	<20	40
R16 “Carramar”	<20	<20	21	24	40
R17 “Crendon”	<20	<20	20	23	40
R18 “Glenfenzie”	<20	<20	21	24	40

* This location is subject to an agreement with NMPL concerning the re-alignment of Coocooboonah Lane on the “Plain View” property. This location is therefore project-related with respect to construction and use of this section of Coocooboonah lane by NMPL.

Table 6
Predicted Construction Noise Levels – Northern section of Coocooboonah Lane

Location*	Meteorological Condition				Criterion
	Calm	ENE wind	SSW wind	Inversion	
R1 “Flodden”	<20	25	<20	27	40
R2 “Ivanhoe”	<20	23	<20	25	40
R4 “Illili”	<20	<20	<20	<20	40
R5 “Ferndale”	<20	<20	<20	<20	40
R6 “Plainview”*	28	25	30	31	N/A
R7 “Woodlawn”	<20	<20	<20	20	40
R8 “Sugarloaf”	<20	<20	<20	<20	40
R9 “Lilydale”	27	28	24	30	40
R10 “Mulwalla” (1)	<20	21	<20	24	40
R11 “Mulwalla” (2)	<20	21	<20	24	40
R12 “Lyndon Park”	<20	<20	<20	20	40
R13 “Merralong”	<20	<20	<20	<20	40
R14 “Skipton”	<20	<20	<20	<20	40
R15 “Glendower”	<20	<20	<20	<20	40
R16 “Carramar”	<20	<20	20	22	40
R17 “Crendon”	<20	<20	<20	22	40
R18 “Glenfenzie”	<20	<20	20	23	40

Table 7
Predicted Construction Noise Levels – Site facilities, Pit access ramp, bunds*

Location*	Meteorological Condition				Criterion
	Calm	ENE wind	SSW wind	Inversion	
R1 “Flodden”	<20	31	<20	33	40
R2 “Ivanhoe”	<20	36	<20	35	40
R4 “Illili”	<20	24	35	37	40
R5 “Ferndale”	21	26	37	38	40
R6 “Plainview”*	22	24	33	37	N/A
R7 “Woodlawn”	<20	<20	26	34	40
R8 “Sugarloaf”	<20	<20	20	32	40
R9 “Lilydale”	22	26	27	36	40
R10 “Mulwalla” (1)	<20	32	<20	34	40
R11 “Mulwalla” (2)	<20	30	<20	31	40
R12 “Lyndon Park”	<20	<20	<20	25	40
R13 “Merralong”	<20	<20	<20	24	40
R14 “Skipton”	<20	<20	23	28	40
R15 “Glendower”	<20	22	32	35	40
R16 “Carramar”	<20	<20	29	32	40
R17 “Crendon”	<20	<20	24	27	40
R18 “Glenfenzie”	<20	<20	28	31	40

* 10m bund north of truck loading point and 15m eastern side of out-of-pit emplacement.

6.1.2 Discussion of Impacts and Recommendations

Location R9 "Lilydale" may receive noise levels up to 6dB(A) above the criterion when the southern end of the Coocooboonah Lane re-alignment is being constructed. The maximum noise criterion exceedance at R9 "Lilydale" would only be short-term (two weeks or less) when the Coocooboonah Lane re-alignment is under construction at the nearest point to this receiver (approximately 200m). When activities are at the northern end of Coocooboonah Lane, road construction noise levels would be as low as 30dB(A), which is well below the construction noise criterion, A Construction Noise Management Plan (CNMP) would be implemented to reduce the short-term construction noise impacts at this receiver. This would include turning engines off when plant is not in use; use of residential grade mufflers; communication with the affected receiver(s) to establish critical times for noise nuisance, etc.

Noise levels of up to 43 dB(A) under the assessed meteorological conditions for construction noise have also been predicted at R9 "Lilydale" when soil stripping occurs at the southeastern extent of the Project Site (ie at the closest point to R9 "Lilydale"). While this is not a major exceedance, the CNMP would incorporate a noise monitoring program at this location to determine the actual level of exceedance. This activity is likely to be completed in 1 to 2 days.

6.2 Operational (Mine) Noise

6.2.1 Predicted Year 0 (out-of-pit emplacement) Noise Levels

After completion of the open cut access ramp, environmental bunds, surface facility and road construction during the initial 6-month period, overburden would continue to be placed on the out-of-pit emplacement for a further 6 months (approximately) before in-pit emplacement areas would be available. **Table 8** shows predicted noise levels with overburden emplacement occurring behind (to the west of) the completed 15m environmental bund which would form the eastern edge of the emplacement.

Minor to moderate (1-4dB) criterion exceedances are predicted at R1 "Flodden", R4 "Illili", R5 "Ferndale", R6 "Plain View" and R15 "Glendower" from activities at the out-of-pit emplacement. These locations are generally north and west of the Project Site (they do not receive shielding from the 15m bund along the eastern edge of the emplacement) and would experience worst case noise levels under inversions and prevailing wind conditions. A major (5dB) exceedance is predicted at R2 "Ivanhoe" under inversion conditions.

Noise emissions from the out-of-pit area would be difficult to reduce, from the point of view of these receivers to the north and west, due to the slope of the Project Site. The out-of-pit emplacement area is at a lower elevation than the extraction area and the emplacement would not be sufficiently high to provide acoustic shielding for haul trucks travelling between the two areas (the 15m eastern environmental bund would provide attenuation for receivers to the east). The dozer working on the out-of-pit emplacement would also generally be visible from these residences. The main noise issue associated with tracked dozers is track-slap while the vehicle is travelling in reverse. Noise tests conducted by Spectrum Acoustics at the Whitehaven CHPP in December 2007 found that track noise from a D9R dozer was 7-8 dB less when travelling in first gear than in second gear. The NMP should include a requirement that only first gear would be used by a dozer travelling in reverse on the out-of-pit emplacement during adverse conditions.

Reducing haul truck noise emissions to below the criterion by applying noise attenuation packages would be prohibitively costly and would not be economically feasible given the comparatively small scale of the operation. It is recommended that activities on the out-of-pit emplacement would not occur during inversion conditions which may result in delaying the commencement of the day shift starting time on clear, calm mornings in winter months. It is also recommended that predicted levels in **Table 8** that are less than 5dB in excess of the assessment criteria be set as criteria for the maximum 6 month period required to complete the out-of-pit emplacement. Noise monitoring should be conducted monthly during the period of out-of-pit emplacement formation , concentrating on the early morning and evening periods.

Table 8
Predicted Year 0 (out-of-pit emplacement) Noise Levels

Location	Meteorological Condition				Criterion dB(A)
	Calm	ENE wind	SSW wind	Inversion	
R1 "Flodden"	19	34	17	**36**	35
R2 "Ivanhoe"	20	**38**	20	**40**	35
R4 "Illili"	32	32	**39**	**37**	35
R5 "Ferndale"	33	32	**39**	**37**	35
R6 "Plain View"*	30	28	32	**36**	35
R7 "Woodlawn"	26	22	28	31	35
R8 "Sugarloaf"	23	21	25	29	35
R9 "Lilydale"	27	26	25	31	35
R10 "Mulwalla" (1)	17	34	15	32	35
R11 "Mulwalla" (2)	16	33	14	30	35
R12 "Lyndon Park"	13	24	15	27	35
R13 "Merralong"	13	21	19	25	35
R14 "Skipton"	22	25	28	28	35
R15 "Glendower"	30	30	**36**	33	35
R16 "Carramar"	20	19	34	32	35
R17 "Crendon"	18	16	30	31	35
R18 "Glenfenzie"	18	16	32	31	35

* This location is subject to an agreement with NMPL concerning the re-alignment of Coocooboonah Lane on the "Plain View" property. This location is therefore project-related with respect to construction and use of this section of Coocooboonah Lane by NMPL.

6.2.2 Predicted Year 1 Noise Levels

Predicted noise levels for the Year 1 operational scenario are shown in **Table 9** where it is assumed that a pair of scrapers is operating at natural ground level ahead of (ie to the east of) the mining operation. Criterion exceedances are highlighted in bold type. **Table 10** shows predicted noise levels without the scrapers operating.

Table 9
Predicted Year 1 Noise Levels (With tandem scrapers)

Location	Meteorological Condition				Criterion dB(A)
	Calm	ENE wind	SSW wind	Inversion	
R1 “Flodden”	<20	32	<20	31	35
R2 “Ivanhoe”	<20	32	<20	30	35
R4 “Illili”	24	23	**37**	**36**	35
R5 “Ferndale”	23	20	**36**	35	35
R6 “Plainview”	26	25	30	33	35
R7 “Woodlawn”	20	<20	26	29	35
R8 “Sugarloaf”	<20	<20	<20	23	35
R9 “Lilydale”	26	25	27	34	35
R10 “Mulwalla” (1)	<20	30	<20	30	35
R11 “Mulwalla” (2)	<20	28	<20	29	35
R12 “Lyndon Park”	<20	22	20	25	35
R13 “Merralong”	<20	20	<20	23	35
R14 “Skipton”	<20	<20	26	27	35
R15 “Glendower”	22	22	**36**	35	35
R16 “Carramar”	<20	<20	24	24	35
R17 “Crendon”	<20	<20	21	20	35
R18 “Glenfenzie”	<20	<20	23	21	35

Table 10
Predicted Year 1 Noise Levels (No scrapers)

Location	Meteorological Condition				Criterion dB(A)
	Calm	ENE wind	SSW wind	Inversion	
R1 “Flodden”	<20	32	<20	31	35
R2 “Ivanhoe”	<20	32	<20	30	35
R4 “Illili”	22	22	35	34	35
R5 “Ferndale”	21	20	35	33	35
R6 “Plain View”	24	21	28	30	35
R7 “Woodlawn”	21	<20	24	26	35
R8 “Sugarloaf”	<20	<20	<20	22	35
R9 “Lilydale”	26	24	24	31	35
R10 “Mulwalla” (1)	<20	30	<20	30	35
R11 “Mulwalla” (2)	<20	27	<20	29	35
R12 “Lyndon Park”	<20	<20	<20	22	35
R13 “Merralong”	<20	<20	<20	21	35
R14 “Skipton”	<20	<20	26	26	35
R15 “Glendower”	<20	<20	34	33	35
R16 “Carramar”	<20	<20	23	23	35
R17 “Crendon”	<20	<20	20	<20	35
R18 “Glenfenzie”	<20	<20	22	20	35

6.2.3 Discussion of Impacts and Recommendations (Year 1)

Table 9 shows that with the scrapers operating, the total mining noise results in minor (1-2dB) criterion exceedances at R4 "Illili", R5 "Ferndale" and R15 "Glendower" under SSW winds and temperature inversion conditions. **Table 10** shows no criterion exceedances under the same mining scenario without the scrapers. The scrapers would be subcontracted for short campaigns of less than two weeks to clear ground for several months of upcoming mining. Should these periods coincide with winter months, their use could be delayed to commence at some time after 7am when inversions (if present) have lifted. Under adverse wind conditions, the number of scrapers in use could be reduced from two to one, if noise is identified as an issue through monitoring or complaints. This would generally reduce noise levels in **Table 9** by 1 dB and reduce the number of exceedances to a 1 dB exceedance at R4. Since the predicted exceedances are minor, the machinery is owned by subcontractors and would only be used occasionally, it is not considered reasonable or feasible to apply noise control beyond reducing the number of scrapers from two to one under adverse conditions. Any scrapers to be used on site would, however, be limited to daytime (7am-6pm) use only.

6.2.4 Predicted Year 2 Noise Levels

Predicted noise levels for the Year 2 operational scenario are shown in **Tables 11 and 12**, with and without scrapers operating at ground level, respectively. Criterion exceedances are highlighted in bold type. Results for low-level (Low) and high-level (High) in-pit overburden emplacement are shown for the adverse meteorological conditions.

Table 11
Predicted Year 2 Noise Levels (With tandem scrapers)

	Meteorological Condition							
		ENE wind		SSW wind		Inversion		Criterion
Location	Calm	Low*	High*	Low	High	Low	High	dB(A)
R1 "Flodden"	<20	30	30	<20	<20	30	30	35
R2 "Ivanhoe"	23	31	31	<20	20	30	30	35
R4 "Illili"	24	23	24	35	**38**	34	**37**	35
R5 "Ferndale"	25	23	24	35	**38**	34	**36**	35
R6 "Plain View"	29	25	27	32	**36**	32	**37**	35
R7 "Woodlawn"	24	20	22	25	29	28	32	35
R8 "Sugarloaf"	21	<20	<20	21	23	27	30	35
R9 "Lilydale"	31	30	31	32	33	35	**39**	35
R10 "Mulwalla" (1)	<20	27	28	<20	<20	28	28	35
R11 "Mulwalla" (2)	<20	26	26	<20	<20	27	27	35
R12 "Lyndon Park"	<20	22	24	20	22	25	27	35
R13 "Merralong"	<20	21	22	<20	<20	22	25	35
R14 "Skipton"	<20	<20	20	29	30	29	30	35
R15 "Glendower"	24	22	24	34	**36**	33	35	35
R16 "Carramar"	<20	<20	<20	27	28	25	25	35
R17 "Crendon"	<20	<20	<20	22	24	22	23	35
R18 "Glenfenzie"	<20	<20	<20	24	25	22	24	35

* Low-level and high-level in-pit overburden emplacement as shown in Figure B2, Appendix B.

Table 12
Predicted Year 2 Noise Levels (No scrapers)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low	High	Low	High	Low	High	
R1 "Flodden"	<20	30	30	<20	<20	29	30	35
R2 "Ivanhoe"	<20	31	31	<20	<20	28	29	35
R4 "Illili"	23	22	24	35	**38**	33	**36**	35
R5 "Ferndale"	25	23	24	34	**38**	34	35	35
R6 "Plain View"	29	25	26	32	35	31	**36**	35
R7 "Woodlawn"	23	20	22	25	28	28	32	35
R8 "Sugarloaf"	21	<20	<20	21	21	27	29	35
R9 "Lilydale"	30	28	30	30	32	34	**37**	35
R10 "Mulwalla" (1)	<20	27	27	<20	<20	27	28	35
R11 "Mulwalla" (2)	<20	25	24	<20	<20	26	27	35
R12 "Lyndon Park"	<20	<20	<20	<20	<20	24	25	35
R13 "Merralong"	<20	<20	20	<20	<20	22	23	35
R14 "Skipton"	<20	<20	<20	29	29	28	28	35
R15 "Glendower"	22	21	23	33	35	32	34	35
R16 "Carramar"	<20	<20	<20	26	27	23	24	35
R17 "Crendon"	<20	<20	<20	22	23	22	22	35
R18 "Glenfenzie"	<20	<20	<20	24	25	22	23	35

* Low-level and high-level in-pit overburden emplacement as shown in Figure B2, Appendix B.

6.2.5 Discussion of Impacts and Recommendations (Year 2)

Tables 11 and **12** generally show only a 0-2 dB difference in noise level due to the presence or absence of the scrapers. Both tables show minor to moderate (1-4dB) criterion exceedances at R4 "Illili", R5 "Ferndale", R6 "Plain View", R9 "Lilydale" and R15 "Glendower" when a high-level emplacement location is used. These exceedances can be mitigated under all atmospheric conditions by utilising a low-level in-pit overburden emplacement area. This mitigation measure would be reasonably simple to implement and would be clearly detailed in a Noise Management Plan (NMP). Noise levels at R9 "Lilydale" with the scrapers in operation become marginal under inversion conditions and it may be necessary, depending on noise monitoring results, to avoid the use of more than one scraper at locations directly exposed to R9 "Lilydale" early on calm winter mornings.

6.2.6 Predicted Year 5 Noise Levels

Predicted noise levels for the Year 5 operational scenario are shown in **Tables 13 and 14**, with and without scrapers operating, respectively. Criterion exceedances are highlighted in bold type. Results for low-level (Low) and high-level (High) in-pit overburden emplacement are shown for the adverse meteorological conditions.

Table 13
Predicted Year 5 Noise Levels (With tandem scrapers)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low*	High*	Low	High	Low	High	
R1 “Flodden”	<20	33	33	<20	<20	25	32	35
R2 “Ivanhoe”	<20	29	34	<20	<20	25	30	35
R4 “Illili”	21	22	24	34	35	34	**37**	35
R5 “Ferndale”	23	21	23	**37**	**39**	35	**39**	35
R6 “Plain View”	34	26	28	34	**39**	**36**	**40**	35
R7 “Woodlawn”	25	20	24	26	29	30	**36**	35
R8 “Sugarloaf”	23	<20	22	24	26	29	35	35
R9 “Lilydale”	34	27	31	30	**37**	**36**	**44**	35
R10 “Mulwalla” (1)	<20	29	30	<20	<20	27	31	35
R11 “Mulwalla” (2)	<20	28	28	<20	<20	26	30	35
R12 “Lyndon Park”	<20	20	24	20	21	25	29	35
R13 “Merralong”	<20	20	21	<20	<20	21	27	35
R14 “Skipton”	<20	<20	20	25	28	25	31	35
R15 “Glendower”	23	20	22	33	**36**	31	35	35
R16 “Carramar”	20	<20	<20	29	30	27	33	35
R17 “Crendon”	<20	<20	<20	24	26	25	30	35
R18 “Glenfenzie”	<20	<20	<20	25	28	25	31	35

* Low-level and high-level in-pit overburden emplacement as shown in Figure B2, Appendix B.

Table 14
Predicted Year 5 Noise Levels (No scrapers)

Location	Meteorological Condition							Criterion dB(A)
	Calm	ENE wind		SSW wind		Inversion		
		Low	High	Low	High	Low	High	
R1 “Flodden”	<20	32	32	<20	<20	24	30	35
R2 “Ivanhoe”	<20	27	33	<20	<20	25	29	35
R4 “Illili”	21	21	23	32	35	33	**36**	35
R5 “Ferndale”	21	<20	21	35	**38**	33	**37**	35
R6 “Plain View”	32	<20	28	27	**37**	35	**38**	35
R7 “Woodlawn”	21	<20	23	<20	<20	30	35	35
R8 “Sugarloaf”	<20	<20	22	24	31	27	29	35
R9 “Lilydale”	25	24	30	26	35	35	**42**	35
R10 “Mulwalla” (1)	<20	29	29	<20	<20	25	30	35
R11 “Mulwalla” (2)	<20	28	27	<20	<20	26	30	35
R12 “Lyndon Park”	<20	<20	<20	<20	<20	24	27	35
R13 “Merralong”	<20	<20	<20	<20	<20	20	25	35
R14 “Skipton”	<20	<20	<20	24	27	24	29	35
R15 “Glendower”	21	<20	21	33	35	30	33	35
R16 “Carramar”	<20	<20	<20	25	27	25	31	35
R17 “Crendon”	<20	<20	<20	23	26	24	28	35
R18 “Glenfenzie”	<20	<20	<20	25	27	24	29	35

* Low-level and high-level in-pit overburden emplacement as shown in Figure B2, Appendix B.

6.2.7 Discussion of Impacts and Recommendations

Tables 13 and 14 show a similar pattern of minor to moderate noise criterion exceedances to **Tables 11 and 12**. Due to the easterly location of the pit, however, major exceedances (5 dB or greater) are predicted at R6 "Plain View" and R9 "Lilydale" under inversion conditions if a high level emplacement location is used. The use of a high level emplacement area must be avoided during inversions and SSW winds. Reducing the number of active scrapers at ground level from two to one under SSW wind conditions would reduce the exceedance at R5 "Ferndale" from 2 dB to 1 dB.

Since Year 5 is the final proposed year of mining, the proposed noise mitigation measure of making a low in-pit overburden emplacement area available for use during adverse wind conditions from the start of Year 2 would result in noise compliance at all assessed receivers for the life of the mine, except for a minor (1dB) exceedance at R5 "Ferndale" when a scraper is operating at an exposed location under SSW winds in the final year of the project. Marginal compliance at R5 "Ferndale" and R9 "Lilydale" under worst case conditions suggests that these receivers would be added as noise monitoring locations.

Since the operational noise (except the out-of-pit emplacement) can generally be managed to achieve the noise criterion to within 1 dB, it is recommended that the 35 dB(A) criterion be applied, should the project be approved. Any identified noise criterion exceedance could then be mitigated or managed as required, or negotiated agreement could be reached with the affected receiver(s). Recommended achievable noise criteria for the project are summarised in **Table 15**.

Table 15
Recommended Achievable Noise Criteria dB(A), $L_{eq(15\ min)}$

Location	Out-of-pit emplacement (up to 6 months)	After completion of emplacement
R1 "Flodden"	35	35
R2 "Ivanhoe"	38	35
R4 "Illili"	39	35
R5 "Ferndale"	39	35
R6 "Plain View"	35	35
R7 "Woodlawn"	35	35
R8 "Sugarloaf"	35	35
R9 "Lilydale"	35	35
R10 "Mulwalla" (1)	35	35
R11 "Mulwalla" (2)	35	35
R12 "Lyndon Park"	35	35
R13 "Merralong"	35	35
R14 "Skipton"	35	35
R15 "Glendower"	36	35
R16 "Carramar"	35	35
R17 "Crendon"	35	35
R18 "Glenfenzie"	35	35

6.2.8 Non-residential receivers

In addition to the residential receivers considered in this report, there is a requirement to consider noise impacts on vacant land that could be developed for residential use. Such land is considered noise affected if the noise criterion is exceeded over more than 25% of that land.

The Gunnedah Local Environment Plan (LEP, 1998) shows that the Project Site and surrounding land is zoned either Rural 1(a) or 1(b). Allowable land subdivision sizes and minimum formed road frontages for these zonings are as follows:

Zoning	Description	Minimum size	Minimum road frontage
Rural 1(a)	Agricultural Protection	200ha	400m
Rural 1(b)	Rural General	40ha	400m

Figure 8 shows landholdings around the Project site. All landholdings include residences which have been assessed, except Lot 494 (owned by R.O. White) which adjoins the northwestern site boundary. This property contains no residence but could possibly have a residence approved, subject to satisfaction of the minimum road frontage and Gunnedah Council approval.

A review of all noise contours (including the worst-case contours in Appendix B) reveals that Lot 494 would be noise–affected for the life of the Project under all meteorological conditions. An agreement has been reached, however, between the Proponent and the landowner to purchase this property with settlement occurring in December 2007.

6.3 Road Traffic Noise

Residences within 400m of the coal transport route between the Project Site and Whitehaven CHPP are identified in **Table 16**. These receivers are indicated on **Figure 2**. The table shows the distance of the residence from the coal transport route, the relevant section of the route, the posted speed limit and the predicted noise level.

Table 16
Receivers along Off-site Coal Transport Route and Predicted Levels

Receiver	Section of coal transport route	Distance, m	Speed, km/h	Criterion dB(A),$L_{eq(1hr)}$	Predicted [1] dB(A),$L_{eq(1hr)}$
“Lilydale” (R9)	Coocooboonah Lane	200	80	55	34
“Woodlawn”	Oxley Highway	290	100	60	<50
“Pyramid Hill”	Oxley Highway	360	100	60	<50
“Toryburn”	Oxley Highway	100	100	60	50.5
“Rai Lee”	Oxley Highway	150	100	60	<50
“Roslyn”	Torrens Road	40	60	55	55
”The Dog House”	Quia Rd (rail underpass)	260	60	60	<50

[1] Worst case predicted level over all years and weather conditions, assuming 40-tonne trucks.

Figure 9
Surrounding Land Ownership and Residences

The results in **Table 15** show that predicted truck noise levels may be equal to the criterion at the two Torrens Road residences. A specific Traffic Noise Management Plan (TNMP) should be prepared to monitor and manage truck noise at these residences. Since the trucks are all on-road vehicles, the TNMP should require that all trucks undergo acoustic testing to ensure that they comply with the noise requirements of ADR 28/01. Noise monitoring at one of these residences should not only record the total L_{Aeq} level, but should also consider each individual truck to ensure continued compliance with ADR limits. Any excessive noise (often due to maintenance issues or degraded muffler performance) should be highlighted and rectified by the haulage contractor.

Although Coocooboonah Lane (existing sections and proposed re-alignment) is a public local road subject to a daytime traffic noise criterion of 55dB(A), **Table 16** shows that the worst case predicted noise level from trucks would be 1 dB below the more stringent site noise criterion of 35dB(A) at R9 "Lilydale".

6.4 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 79dB(A) and 72.3dB(A),L_{eq} over a period of 83 seconds.

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

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

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

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	L_{Aeq} (12 trains movements)	Criterion (EPL 3142)
L_{Aeq} (9 hr) night	57.2dB(A)	60dB(A)
L_{Aeq} (15 hr) day	55.0dB(A)	65dB(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.

6.5 Blasting

6.5.1 Residential Receivers

The Proponent has indicated that Maximum Instantaneous Charge (MIC) weights for overburden blasts would be 50 kg for 5 m benches, 960 kg on average for 15-20 m benches and up to 1952 kg for 45 m benches. Blast overpressure and ground vibration levels have

been calculated at the nearest two residences for all three charge weights. Predicted blast overpressure is shown in **Figure 10** and ground vibration is shown in **Figure 11**. In both Figures, the green dotted line represents the level not to be exceeded for more than 10% of blasts at any residential receiver and the red dotted line represents the level not to be exceeded by any blast.

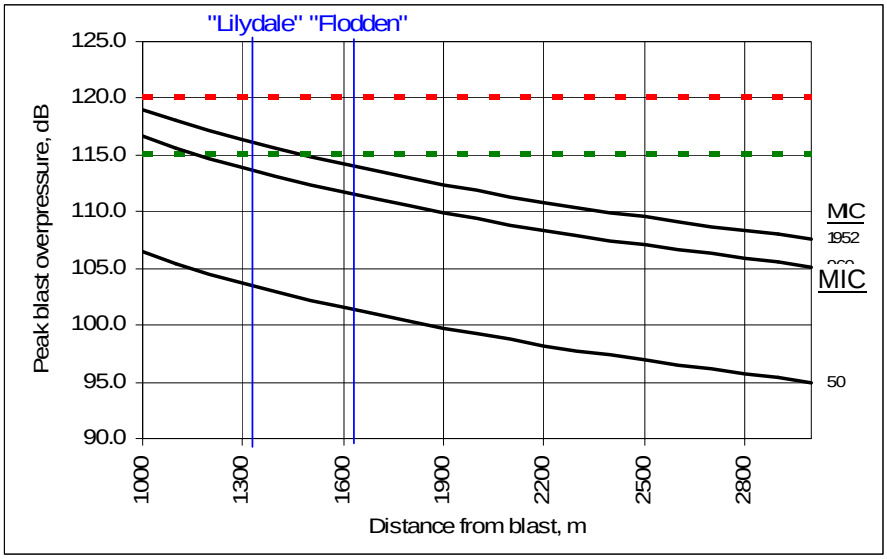

Figure 10
Predicted Blast Overpressure Levels

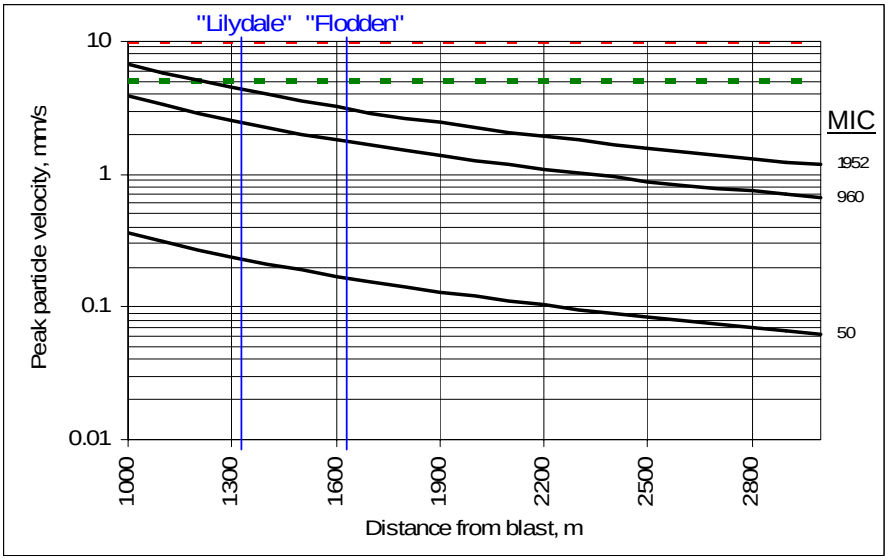

Figure 11
Predicted Ground Vibration Levels

The results in **Figures 10** and **11** show compliance with all blast criteria at "Flodden" for all anticipated blast sizes. Compliance may be assumed at all receivers further from the proposed mine. Ground vibration levels are predicted to be below the 5 mm/s criterion at "Lilydale", whereas the potential exists for overpressure from the larger blasts to exceed the 115dB blast overpressure criterion near the end of the mine life when operations are at the closest point to this residence. No exceedance of the 120dB blast overpressure criterion is predicted.

The Proponent would ensure that blasts near the later stages of the mine are designed to meet the 115dB overpressure criterion at "Lilydale". This could be achieved by ensuring that the maximum charge weight is reduced below 1952kg as the mine progresses to within 1500m of "Lilydale". Reducing the MIC to achieve compliance with the overpressure criterion would have the added benefit of reducing ground vibration levels as well. As the closest dwelling to the mine, it would be an appropriate commitment to undertake blast monitoring at "Lilydale".

6.5.2 Heritage Sites

An Aboriginal axe-grinding groove, called "Sunnyside AGG1" in the Aboriginal Heritage Assessment, has been found on top of the western end of the hill which essentially defines the southern limit of mining. In previous assessments by Spectrum Acoustics and others, and accepted by DEC, a limit of 80 mm/s vertical vibration velocity has been adopted to protect against damaging such structures within, or atop, sandstone outcrops.

Figure 12 below shows MIC values versus the distance at which the 80 mm/s limit is met. As the results show, average size blasts (MIC 960kg) would not occur within 150 m of AGG1. Large blasts (MIC 1952kg) would occur at distances greater than 210 m while MIC 50kg blasts could occur as close as 34 m to AGG1.

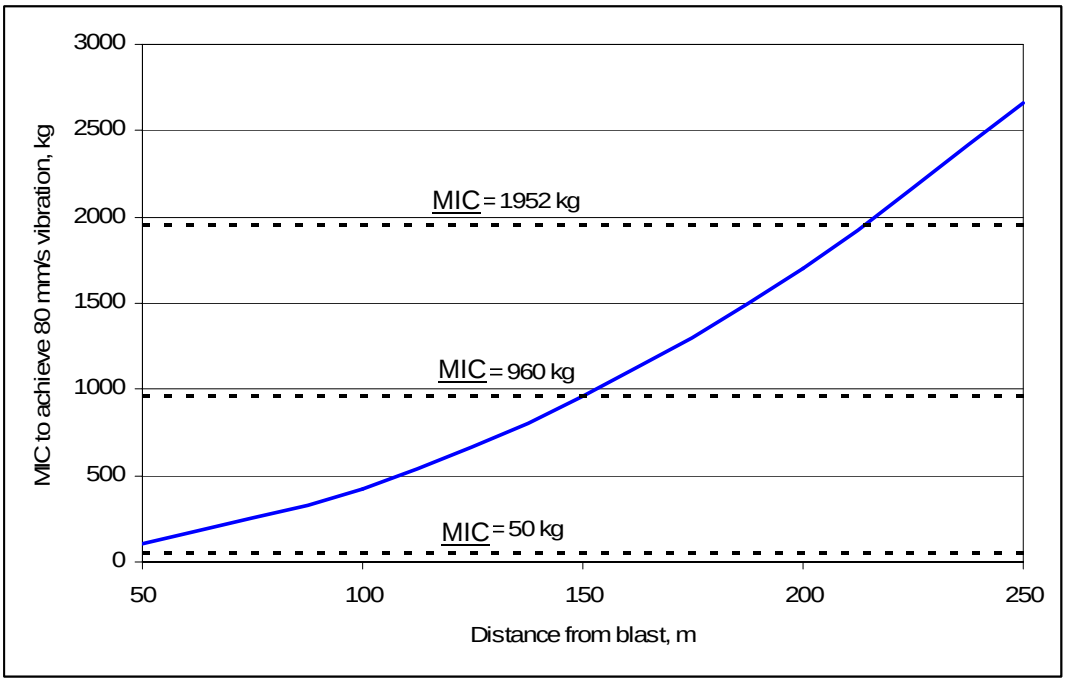

Figure 12
Distance from AGG1 to Achieve Vibration Limit

7 Monitoring Program

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 would be included in a Noise Management Plan prepared to assist site personnel should project approval be granted.

7.1 Noise Monitoring

7.1.1 Construction Noise

Construction noise monitoring would be conducted on at least two occasions at representative locations north of the Project Site and at "Lilydale" when the off-site coal transport route is being constructed.

7.1.2 Operational Noise

Operational noise compliance monitoring would be conducted monthly for the first six 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 would be reviewed after the initial 12 months with a view to continuing the quarterly surveys.

7.2 Blast Monitoring

A blast vibration / airblast overpressure monitor would be positioned at "Lilydale". 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 proposed Sunnyside Coal Mine.

The first year of activities on site would see the construction of site roads, excavation of a pit access ramp, environmental bund formation and out-of-pit overburden emplacement. These activities would only occur during the daytime. Minor to moderate (1-4dB) exceedances of the operational noise criterion have been predicted at some receivers during completion of the out-of-pit emplacement. Due to the daytime-only nature of the activities, their relatively short duration in the life of the Project and the difficulty/cost of effectively reducing noise emissions, it is recommended that the predicted noise levels up to 4dB above the operational criterion would be set as the noise criteria for this activity.

Constructing the re-aligned section of Coocooboonah Lane is a genuine off-site construction activity and has been assessed against a construction noise criterion. Exceedances of up to 6dB have been predicted for the short period (approximately two weeks) when construction activities are closest to the residence at "Lilydale" (approximately 200m). A Construction Noise Management Plan (CNMP) would be implemented to minimise the impact of construction noise at this residence.

Minor to moderate (1-3dB) exceedances of the operational noise criterion have been predicted at some receivers and a recommendation has been made to include these locations in a noise monitoring program. After the first year of mining, the in-pit area would be progressively back-filled with overburden and two emplacement areas at different heights within the pit would be available. Utilisation of the low-level emplacement area during adverse weather conditions would result in compliance with the noise criterion at all receivers for the majority of time when there would either be no scrapers on site, or the scrapers would be working below natural ground level. It is recommended that this noise control measure be formally documented in a Noise Management Plan (NMP).

When mining would be nearing completion in Year 5, exceedances of the 115dB criterion for blast overpressure have been predicted at the nearest receiver "Lilydale' for the maximum anticipated charge weight (MIC 1952 kg). Blasts would need to be appropriately modified when mining progresses to within 1500m of the nearest residence to ensure compliance with the overpressure criterion. This would have the added benefit of also reducing ground vibration levels. No exceedances of the maximum overpressure limit of 120dB or the vibration criteria were predicted. It has been recommended that a blast monitor would be installed near this residence.

No exceedances of the traffic noise criteria have been predicted, although levels equal to the 'local road' criterion were predicted at two residences set back from Torrens Road. Recommendations have been made to test coal haul trucks against Australian Design Standards prior to their use and routinely monitor actual traffic noise levels.

No exceedances of noise and vibration criteria for rail transportation of coal have been predicted.

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 and management recommendations given in this report.

APPENDICES

(No. of pages excluding this page = 9)

Appendix A Noise Source Sound Power Levels

Appendix B Figures

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Appendix A

Noise Source Sound Power Levels

(No. of pages excluding this page = 1)

Major Construction Noise Sources, dB,L_{10}

Source	dB(A)	Octave band centre frequency, Hz							
		31.5	63	125	250	500	1k	2k	4k
Earthworks (grader + scraper + truck)	115	--	110	110	110	111	110	108	104
Water cart and roller	116	110	115	116	108	112	112	108	100

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

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 plus trucks	114	113	103	109	110	111	107	108	103
Excavator plus trucks	114	113	104	110	111	110	106	107	101
Overburden trucks hauling on slope[3]	115	118	118	119	112	111	109	110	104
Overburden trucks hauling on flat	112	115	115	116	109	108	106	107	101
Overburden 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 haul trucks per 15 minutes and D11 dozer.
3. Four uphill and four down hill per 15 minutes.

Appendix B

Figures

(No. of pages excluding this page = 8)

Notes:

1) **Figures B1 – B3 show noise source locations. There are tandem topsoil scrapers (not shown) approximately 100m east of the drills (sources 1 and 2) at natural ground level in each scenario.**
2) **Noise contours in Figures B4 – B8 do not include topsoil scrapers. Noise levels with scrapers included are summarised in the Tables is Section 6.2.**

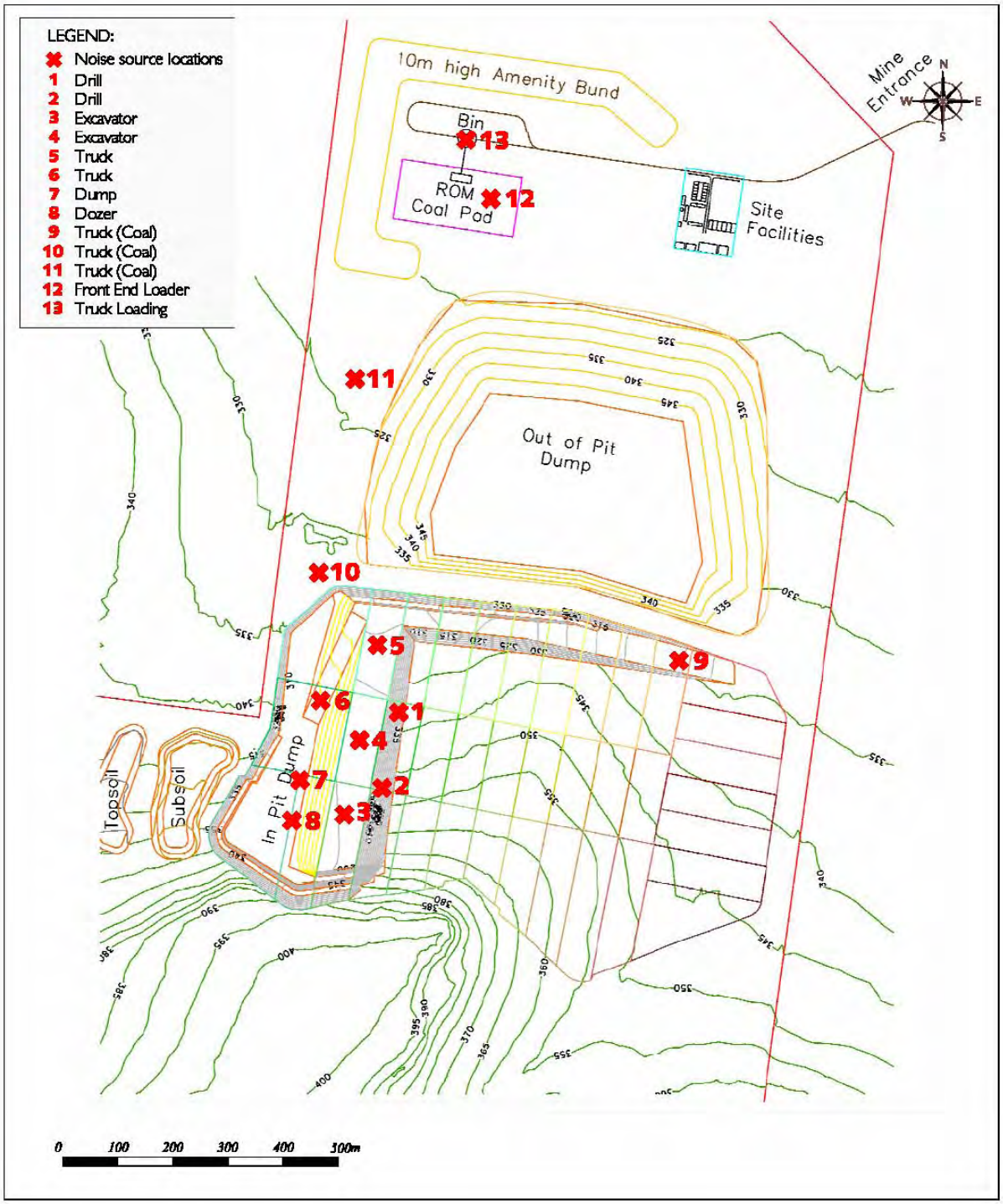


FIGURE B1

Sunnyside Project - Noise Source Locations
Year 1 Mine Development

KG4093_FIG81.DWG JUNE 2007

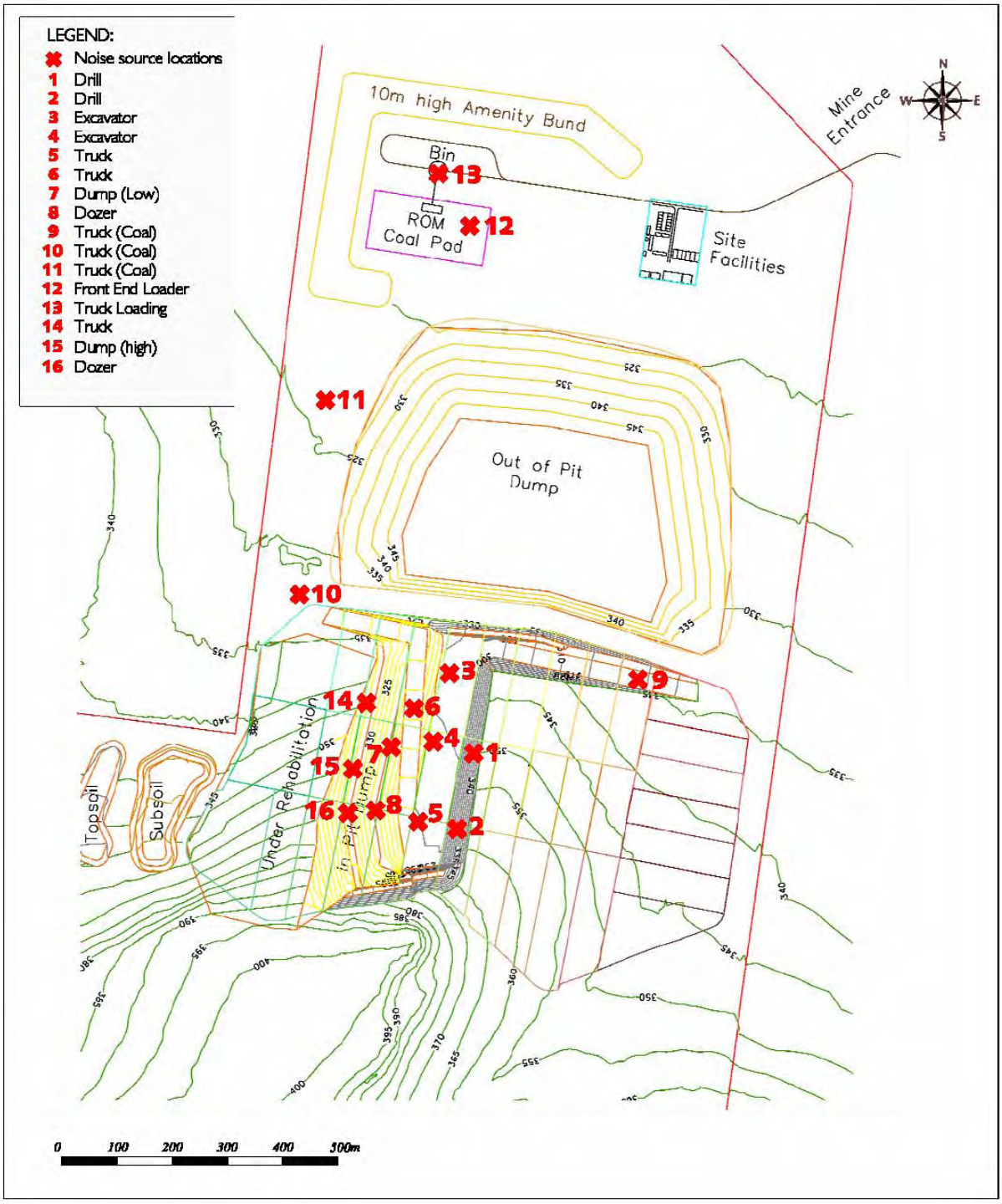


FIGURE B2

Sunnyside Project - Noise Source Locations
Year 2 Mine Development

KG4093_FIGB2.DWG JUNE 2007

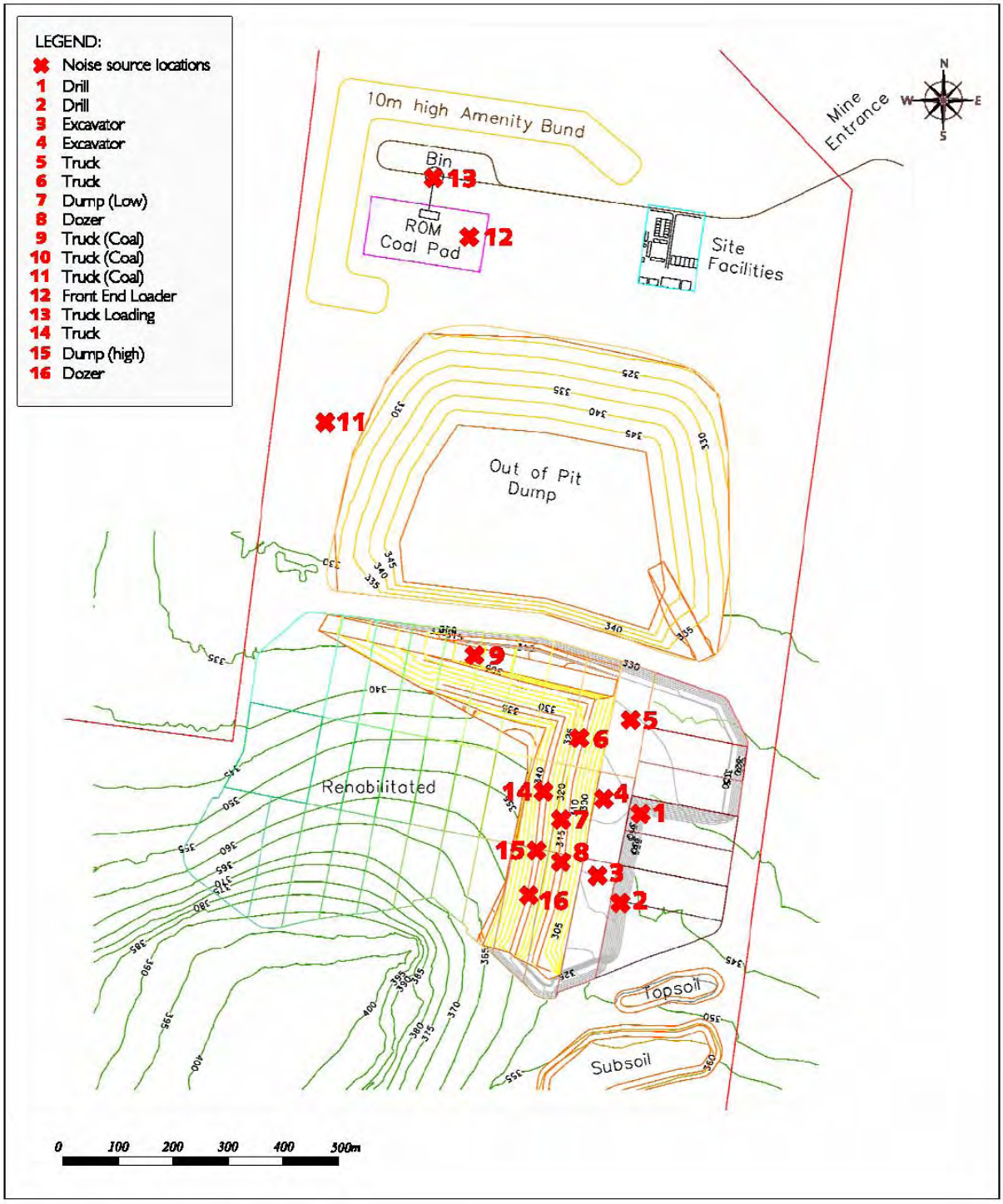
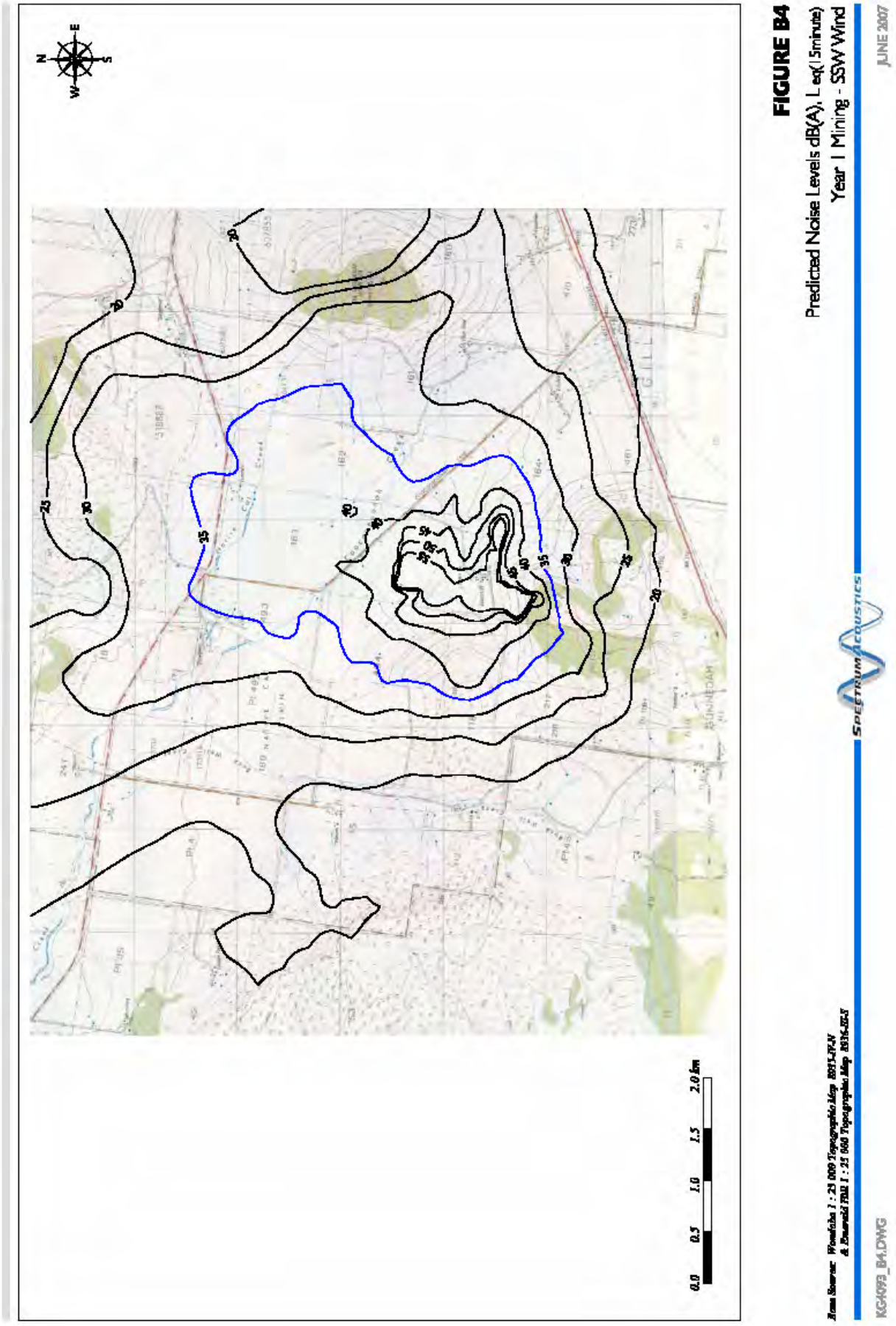


FIGURE B3

Sunnyside Project - Noise Source Locations
Year 5 Mine Development

KG4093_FIGB3.DWG JUNE 2007


N
E
S
W
20
25
30
35
40
45
50
55
0.0
0.5
1.0
1.5
2.0 km
FIGURE B4
Predicted Noise Levels dB(A), Leq(15minute)
Year 1 Mining - SSW Wind
SPECTRUM ACOUSTICS
JUNE 2007
KG4093_B4.DWG

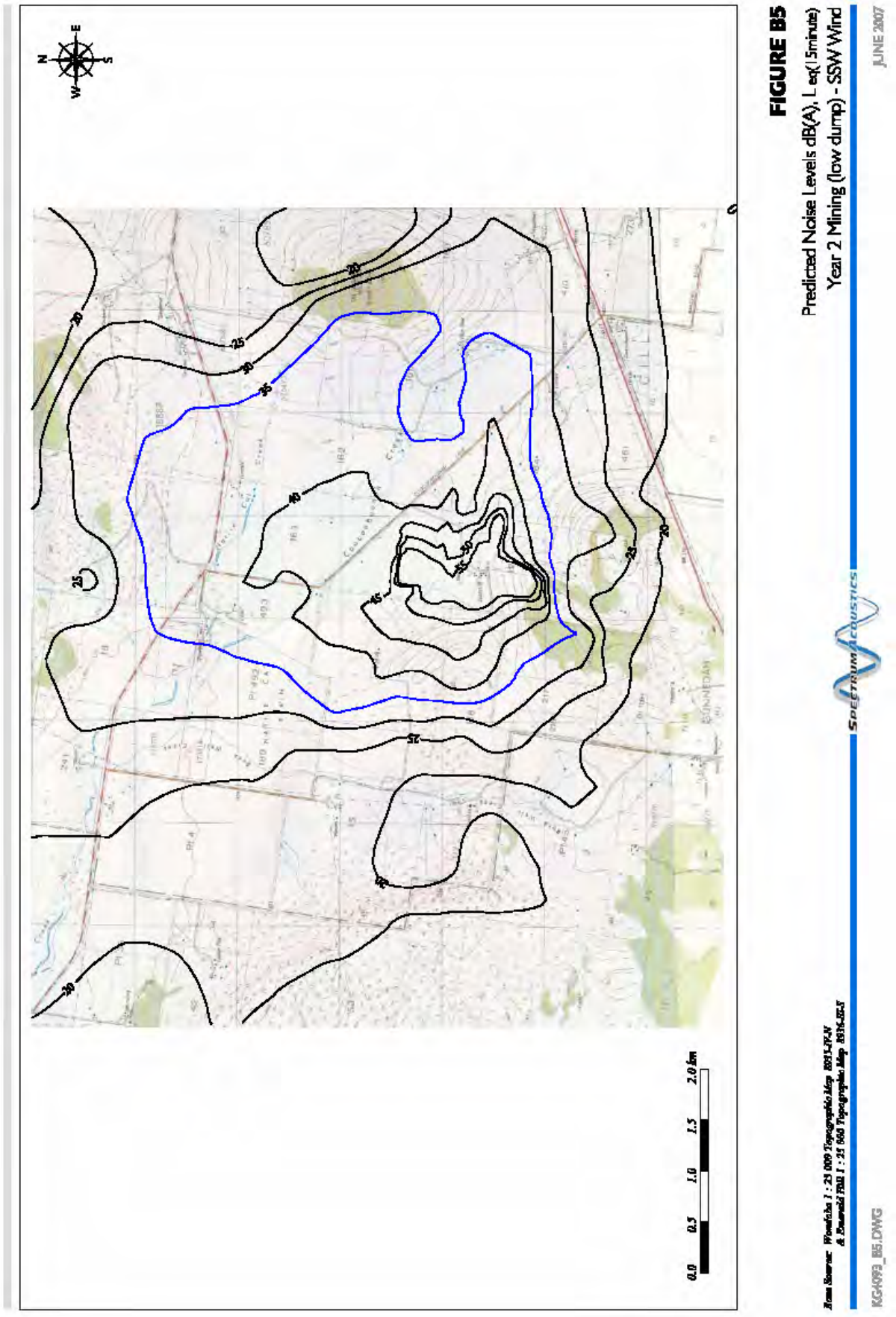
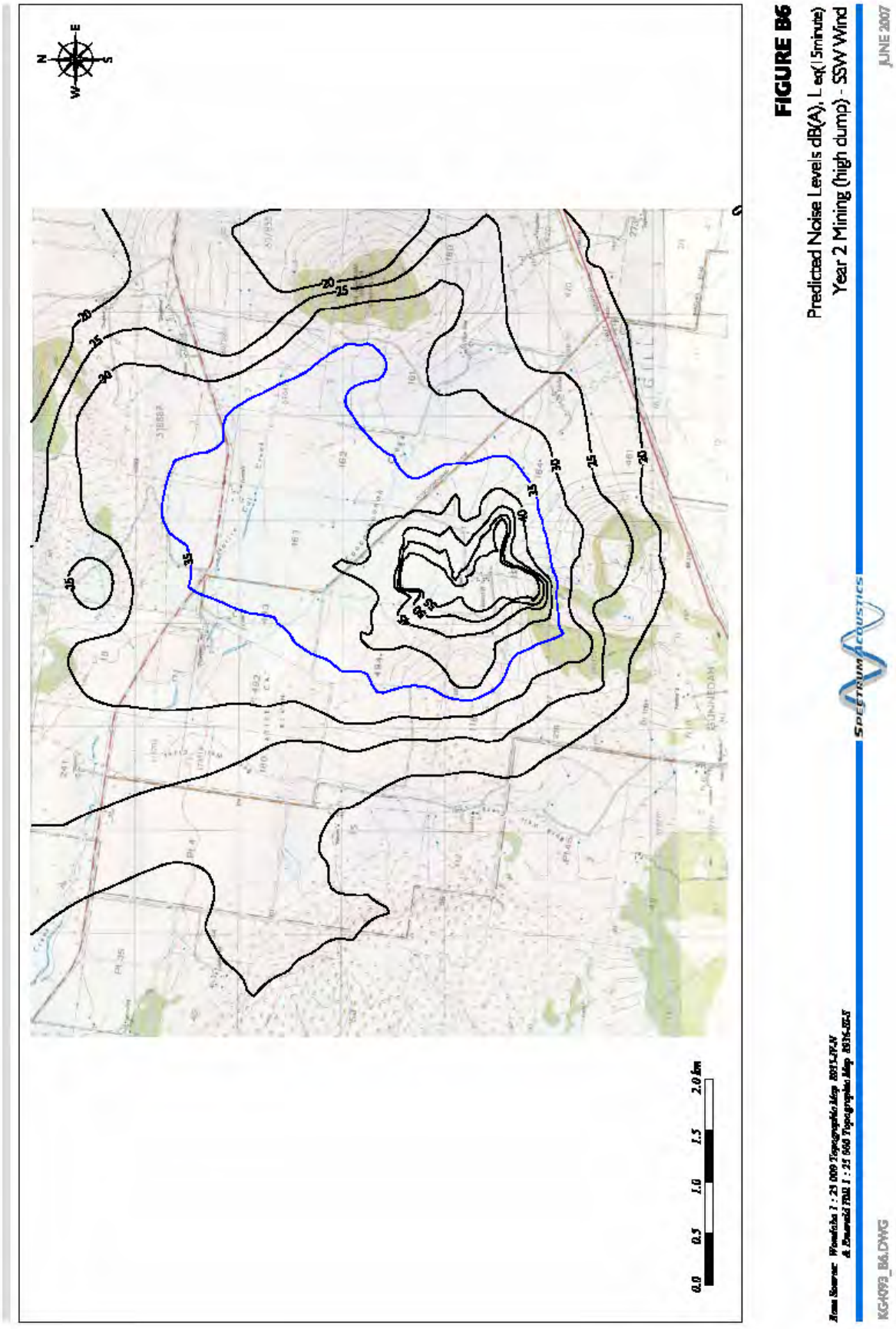


FIGURE B5
Predicted Noise Levels dB(A), L eq(15minute)
Year 2 Mining (low dump) - SSW Wind
JUNE 2007
SPECTRUM ACOUSTICS
KG4993_B5.DWG
0.0
0.5
1.0
1.5
2.0 km


N
E
S
W
20
25
30
35
40
45
0.0
0.5
1.0
1.5
2.0 km
FIGURE B6
Predicted Noise Levels dB(A), L eq(15minute)
Year 2 Mining (high dump) - SSW Wind
SPECTRUM ACOUSTICS
JUNE 2007
KG4093_B6.DWG

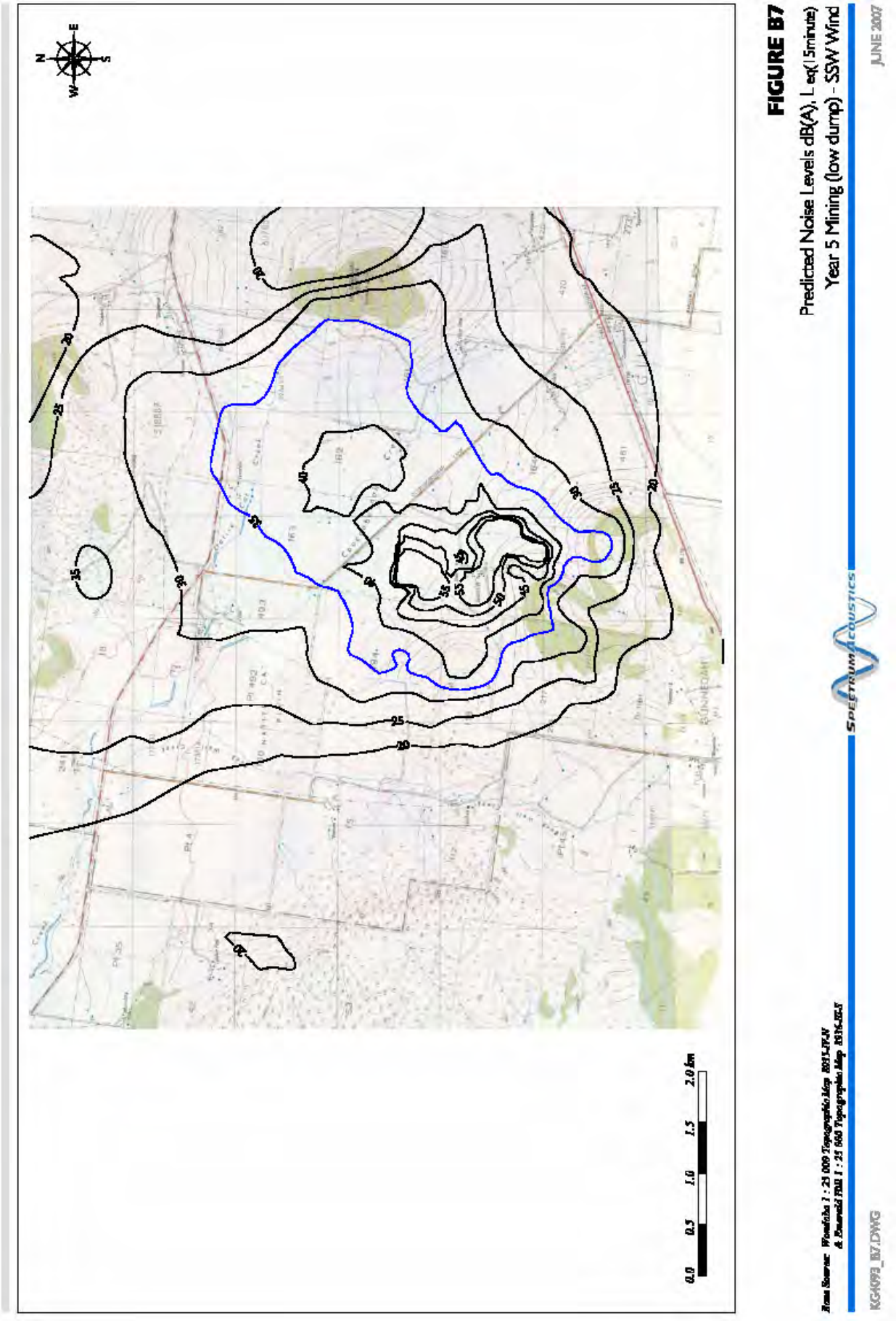


FIGURE B7
Predicted Noise Levels dB(A), L_{eq}(15minute)
Year 5 Mining (low dump) - SSW Wind

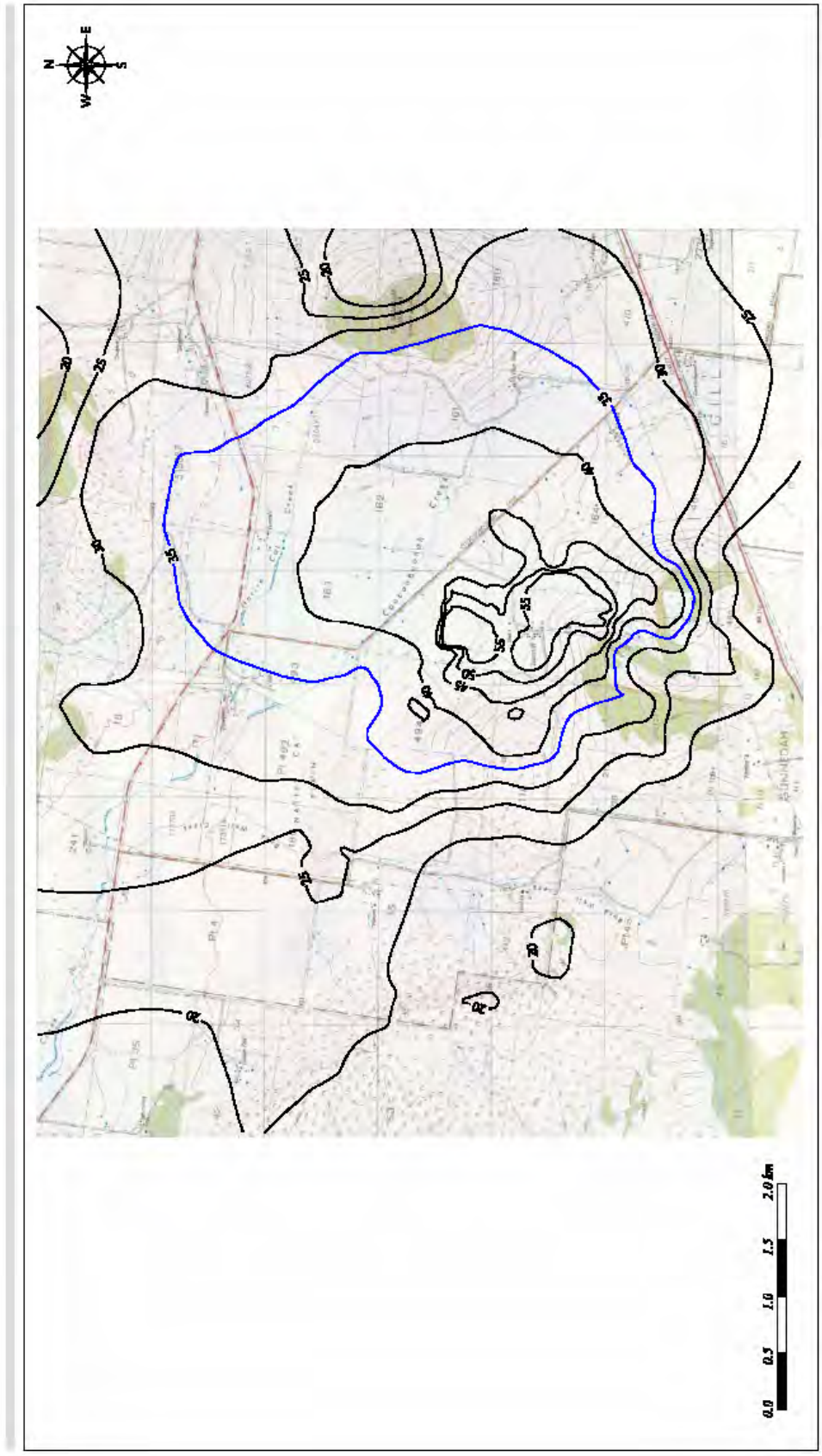


FIGURE B8
Predicted Noise Levels dB(A), L eq(15minute)
Year 5 Mining (high dump) - SSW Wind
SPECTRUM ACOUSTICS
JUNE 2007
KG4099_B8.DWG

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