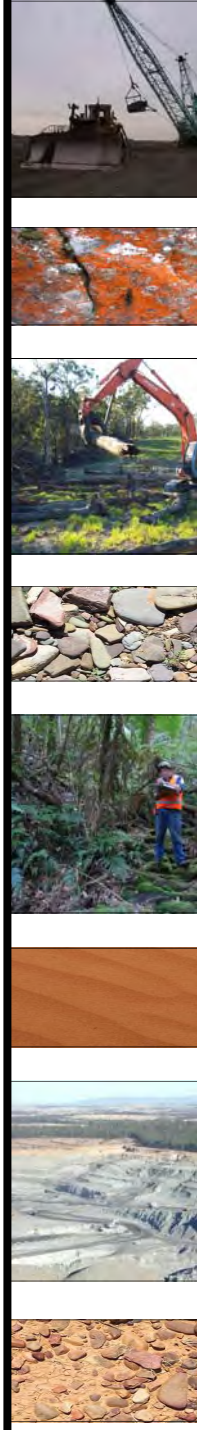
Noise and Vibration Impact Assessment (Spectrum Acoustics 2010)



APPENDIX Q

Project No: 09523

Noise and Vibration Impact Assessment
Rocglen Coal Mine Extension Project
Gunnedah, NSW

Prepared for:

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EXECUTIVE SUMMARY

A Noise and Vibration Impact Assessment (NVIA) has been prepared for an expansion of the Rocglen Coal Mine near Gunnedah, NSW. The Rocglen Coal Mine (formerly known as the Belmont Coal Project) received planning approval on 15 April 2008 and coal production commenced in late 2008. Following further drilling and definition of the local geological features, as well as additional reviews of the mine plan, Whitehaven proposes to expand operations at the Rocglen Coal Mine in order to maximise coal recovery and allow for improved mine progression. This assessment considers potential noise and vibration impacts from the expanded mine at various stages of its progression.

The assessment is based on or refers to the following Standards, policies, guidelines and documents:

- DECCW *NSW Industrial Noise Policy* (2000).
- DECCW *Environmental Criteria for Road Traffic Noise* (1999).
- ANZECC *Technical basis for guidelines to minimise annoyance due to blast overpressure and ground vibration* (2000).
- DECCW publication *Assessing Vibration: a technical guideline* (2006).
- Australian Rail Track Corporation (ARTC) Environmental pollution license EPL 3142.
- US EPA 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”.
- AS 2187.2-1993 *“Explosives – Storage, Transport and Use. Part 2: Use of Explosives”*

A brief summary of essential data, results and recommendations arising from this assessment is presented below.

Operational Noise Criteria

This assessment is based on operational noise criteria as presented in the original Project Approval (PA) 06_0198 for the Rocglen Coal Mine, and reproduced below:

Impact Assessment Criteria

7. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria set out in Table 1 at any residence on privately-owned land, or on more than 25 percent of any privately-owned land.

Location	Day	Evening	Night	
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$
All privately owned residences	35	35	35	45

Table 1: Impact assessment criteria dB(A)

However, if the Proponent has a written negotiated noise agreement with any landowner and a copy of this agreement has been forwarded to the Department and DECC, then the Proponent may exceed the noise limits in Table 1 in accordance with the negotiated noise agreement.

Notes:

- *To determine compliance with the $L_{Aeq(15\ minute)}$ noise limits, noise from the project is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the Department and DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.*
- *These limits apply under the relevant meteorological conditions outlined in the assessment procedures in Chapter 5 of the NSW Industrial Noise Policy.*
- *To determine compliance with the $L_{A1(1\ minute)}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the Department and DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).*

Road Traffic Impact Assessment Criteria

8. The Proponent shall ensure that the cumulative noise generated by road traffic associated with the project, Canyon (Whitehaven) and Tarrawonga mines on public roads does not exceed the criteria in Table 2.

Day $L_{Aeq(1\ hour)}$	Evening $L_{Aeq(1\ hour)}$	Night $L_{Aeq(1\ hour)}$	Location
60	60	50	Any residence on privately-owned land.

Table 2: Road Traffic Noise Criteria dB(A)

Summary of Affected Receivers

One receiver (R3 "Costa Vale") is in a noise acquisition zone due to noise emissions from truck movements on the Northern Emplacement Area. No other receivers are predicted to receive noise levels in excess of the criterion of 35 dB(A),$L_{eq(15\ minute)}$. The "Costa Vale" property is currently under contract for purchase by Whitehaven Coal Limited with settlement expected by the end of June 2010. Upon settlement, the "Costa Vale" residence will be considered project-related.

Sleep Disturbance

Predicted maximum noise levels are predicted to be at least 10 dB below the sleep disturbance screening criterion of 45 dB(A),$L_{1(1\ minute)}$.

Road Traffic Noise

The project will not significantly change noise emissions from off-site traffic movements and continued compliance with the traffic noise criterion is expected. Traffic noise will continue to be monitored at the "Brooklyn" residences on Blue Vale Road.

Blasting

Based on compliant blast monitoring results for the year 2008/2009, there are no anticipated blast impacts at any privately owned residence. Blast monitoring should continue to be conducted at the nearest privately owned residences north and south of the mine.

1.0 INTRODUCTION

1.1 The Proposal

Whitehaven Coal Limited (Whitehaven) is seeking to gain approval for an expansion of its Rocglen Coal Mine in the Gunnedah coalfields of NSW. The Rocglen Coal Mine (formerly known as the Belmont Coal Project) received planning approval on 15 April 2008 and coal production commenced in late 2008. Following further drilling and definition of the local geological features, as well as additional reviews of the mine plan, Whitehaven proposes to expand operations at the Rocglen Coal Mine in order to maximise coal recovery and allow for improved mine progression. This assessment considers potential noise and vibration impacts from the expanded mine at various stages of its progression.

1.2 Study Area

The Rocglen Coal Mine site is located west of Wean Road, approximately 25 km north of Gunnedah and 23 km south-east of Boggabri in the Gunnedah coalfields of NSW. The project area is characterised by the Vickery State Forest to the west and the Community Conservation Area (CCA) Zone 2 - Kelvin to the east, with elevations extending to approximately 490m and 885m Australian Height Datum (AHD) respectively. Elevations within the Rocglen Coal Mine site generally range between approximately 280m AHD and 300m AHD.

Lands to the north and south of the project site is primarily utilised for traditional agricultural pursuits comprising a combination of livestock grazing and crop cultivation.

1.3 Proposed Operations

The primary components of the Rocglen Project, over and above the current operations, relevant to noise emissions are summarised below.

a) **Expansion of open cut pit** – the footprint of the open cut pit will increase by approximately 50 hectares (ha) from the currently approved 114 ha to approximately 164 ha.

   Coal will be extracted from the expanded pit using the current methods and at the same production rate. The current mine fleet and one additional excavator will be utilised.

b) **Expansion of Northern Emplacement Area** – expansion in the footprint and height of the Northern Emplacement Area to a maximum of 340 m AHD.

1.4 Assessed Receivers

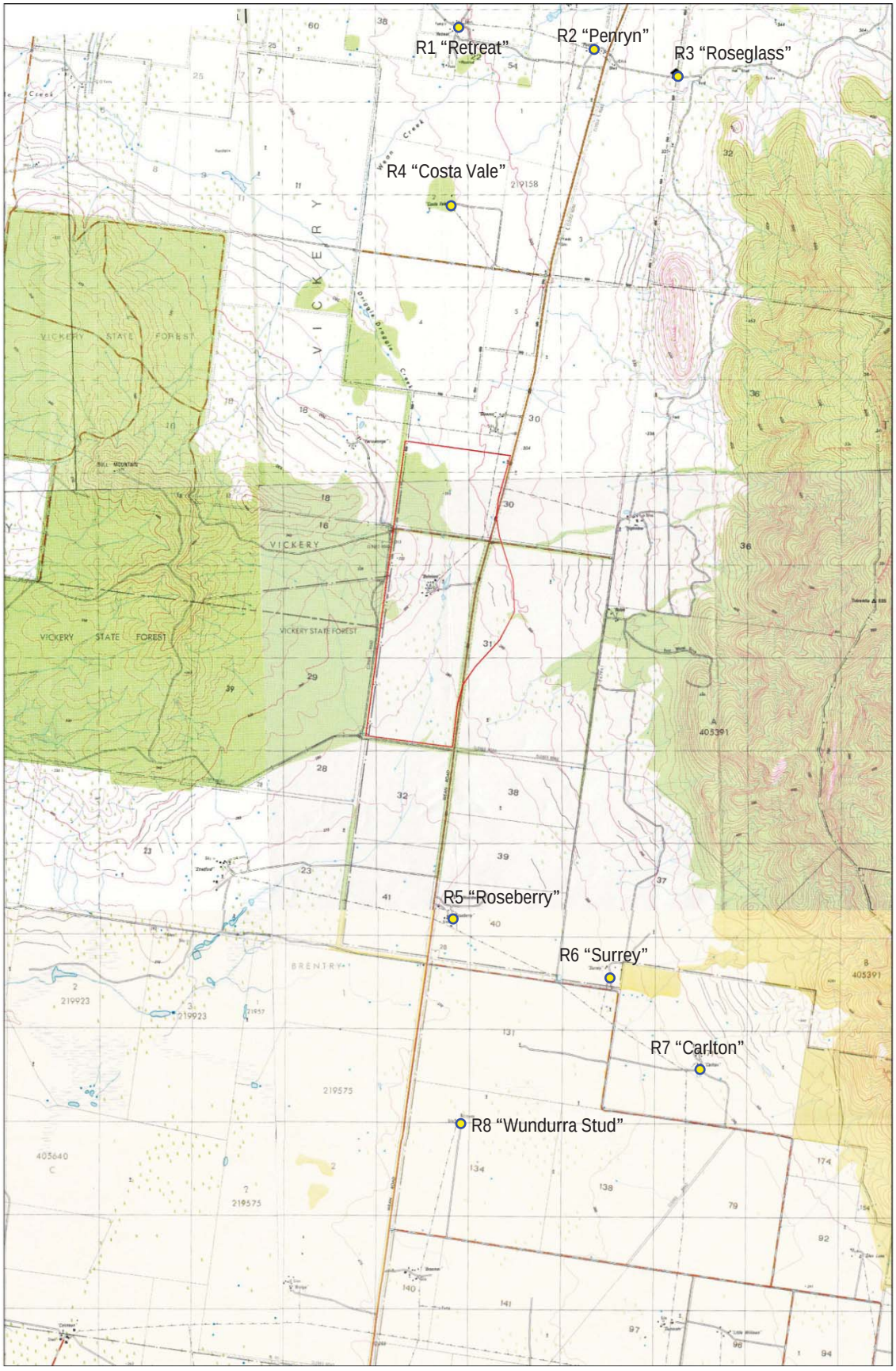
Privately owned residential receivers within approximately 4.5 km of the project site are described in Table 1 and their locations are shown in Figure 1.

TABLE 1
Privately owned residential receivers considered in this assessment.

Receiver	Owner / Description
R1	"Retreat"
R2	"Penryn"
R3	"Roseglass"
R4	"Costa Vale" – under contract for purchase by Whitehaven.
R5*	"Roseberry"
R6	"Surrey"
R7	"Carlton"
R8	"Wundurra Stud"

* Privately owned but has elevated noise limit under agreement with the proponent.

Figure 1. Assessed receiver locations.



2.0 DESCRIPTION OF TERMS

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 conditions 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".

2.1 General Terms

Sound Power Level

The amount of acoustic energy (per second) emitted by a noise source. Usually written as "L_w" or "SWL", the Sound Power Level is expressed in decibels (dB) and cannot be directly measured. L_w 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. 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" will move faster than the bottom. This bends (refracts) sound back towards the ground. The result is a "trapping" of sound energy near the ground and an increase in noise levels. Similarly, daytime air temperatures typically reduce with altitude (approximately 1-2 ^{0}C/100m called the adiabatic lapse rate) and sound refracts upward slightly. The result is slightly reduced noise levels compared with a uniform or 'neutral' atmosphere.

Wind Shear

A moving air mass will experience 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 2** shows several examples of how atmospheric effects can bend sound waves.

FIGURE 2
Sound refraction under temperature inversions and wind gradients.

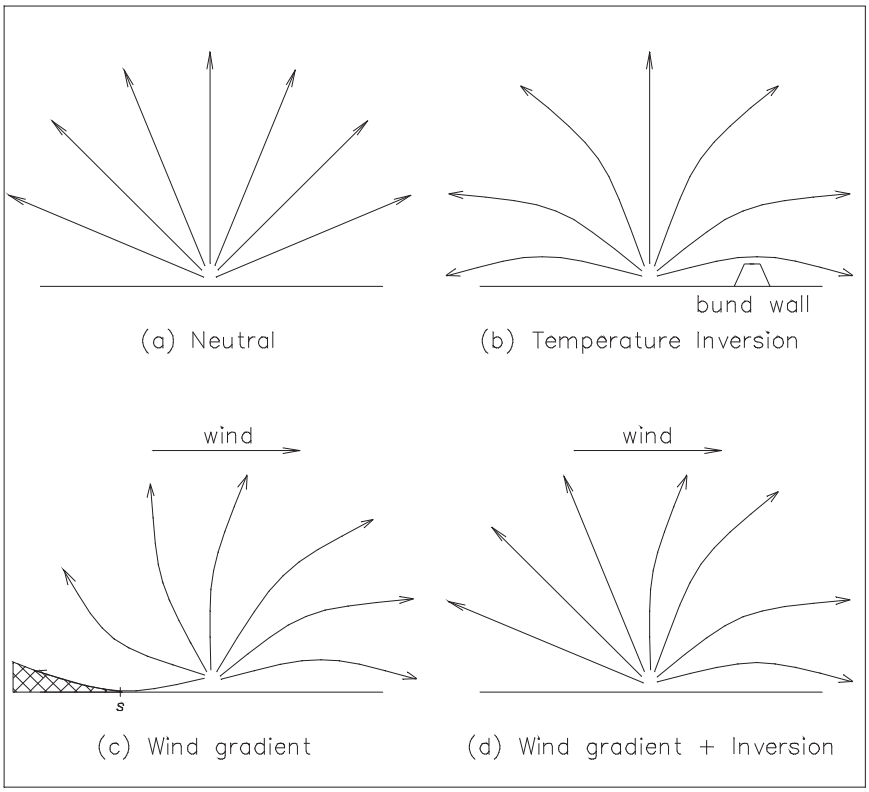


Figure 2 shows that sound rays can be refracted over a barrier (usually a bund wall or small hill) during a temperature inversion, increasing noise levels in the 'shadow zone'.

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 will 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 will typically include seasonal wind directions and velocities. Temperature inversions will be included as prevailing if they occur, on average, for more than 2 nights per week in winter.

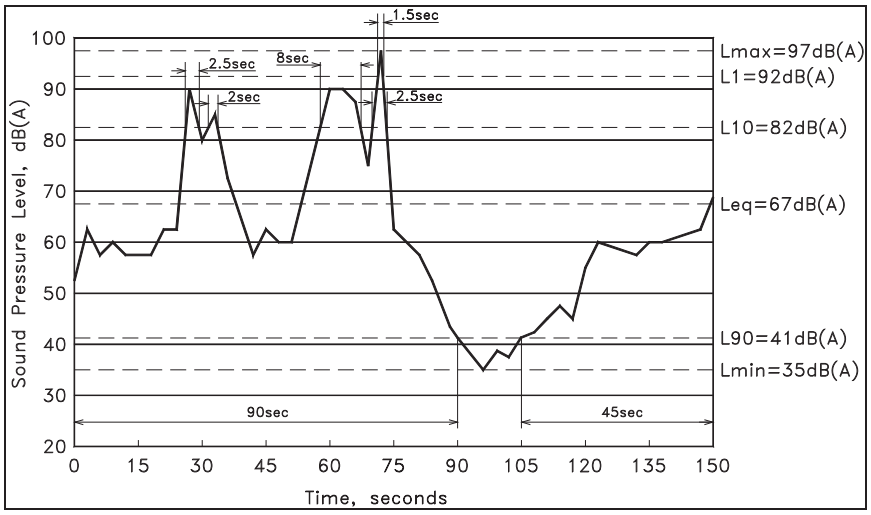
Adverse Atmospheric Conditions

Adverse conditions will 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.

2.2 Noise Level 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 will be explained by considering the hypothetical time signal in **Figure 3**.

FIGURE 3
Hypothetical time signal to illustrate noise level percentiles.



The signal in Figure 3 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 60 dB (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 startled into silence as 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; and
- The measurement stops at 150 seconds, just when an approaching car starts to become audible.

L_{A1} Noise Level

Near the top of Figure 3, there is a dashed line at 92 dB(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 92 dB(A) and is from the truck's air horn. The L_1 percentile is often called the *average peak noise level* and is used by the NSW Department of Environment, Climate Change and Water (DECCW) as a measure of potential disturbance to sleep.

L_{A10} Noise Level

The dashed line at 82 dB(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 82 dB(A). The L_{A10} percentile is called the *average maximum noise level* and has been widely used as an indicator of annoyance caused by noise.

L_{A90} Noise Level

In similar fashion to L_{A1} and L_{A10}, Figure 3 shows that the noise level of 41 dB(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 41 dB(A). The L_{A90} percentile is called the *background noise level*.

L_{Aeq} Noise Level

Equivalent continuous noise level. As the name suggests, the L_{Aeq} 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_{Aeq} can be thought of as a kind of 'average' noise level. Recent research suggests that L_{Aeq} is the best indicator of annoyance caused by industrial noise and the DECCW *NSW Industrial Noise Policy* (INP) takes this into consideration.

L_{Amax} and L_{Amin} Noise Levels

These are the maximum and minimum SPL values occurring during the sample. Reference to Figure 3 shows these values to be 97 dB(A) and 35 dB(A), respectively.

3.0 THE EXISTING ENVIRONMENT

The existing meteorological and acoustic environments have been studied as part of this Environmental Assessment (EA) and the original Rocglen Coal Mine (then Belmont Coal Project) EA.

3.1 Meteorology

Whitehaven operates a weather station at the Rocglen site that records values every 15 minutes. Meteorological data from this weather station (sourced via the air quality consultants engaged for the project, PAEHolmes) have been analysed to determine prevailing wind speeds and directions and the potential for inversions to occur. The following data are the most significant with respect to noise propagation:

- Relative humidity (RH) generally increases with decreasing air temperature. For modelling purposes, a value of 70% RH was adopted for daytime, 80% RH for evenings and non-winter nights and 90% for winter nights (inversion conditions);

- Temperature inversions (F class Pasquill stability) occur during more than 30% of nights in winter, with only a minimal occurrence of G class conditions. An inversion strength of $+3^0$C/100m is often adopted in noise models (as per procedures in the INP, Appendix C). Previous experience in the Gunnedah area has found, however, that stronger inversions are likely to regularly occur. A value of $+6^0$C/100m has been adopted for recent projects and will be adopted here; and

- Wind roses for 2007 show that gradient winds (vector component up to 3 m/s) are predominantly north-northeasterly and south to south-southeasterly at various times throughout the year. A wind speed of 3m/s (at 10m above ground level) from the south and north-northeast was modelled to determine the noise impact under these 'prevailing' wind conditions.

Typical calm daytime conditions of no wind, 70% RH and -1^oC/100m vertical temperature gradient (ie, dry adiabatic lapse rate, DALR) were also modelled to represent daytime noise levels under calm conditions.

4.0 OPERATIONAL NOISE

4.1 Operational Noise Criteria

Operational noise criteria from the original Project Approval are reproduced below. These criteria, which are also included in the Environmental Protection Licence (EPL), will be adopted for the current assessment.

Impact Assessment Criteria

7. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria set out in Table 1 at any residence on privately-owned land, or on more than 25 percent of any privately-owned land.

Location	Day	Evening	Night	
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$
All privately owned residences	35	35	35	45

Table 1: Impact assessment criteria dB(A)

However, if the Proponent has a written negotiated noise agreement with any landowner and a copy of this agreement has been forwarded to the Department and DECC, then the Proponent may exceed the noise limits in Table 1 in accordance with the negotiated noise agreement.

Notes:

- *To determine compliance with the $L_{Aeq(15\ minute)}$ noise limits, noise from the project is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the Department and DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.*
- *These limits apply under the relevant meteorological conditions outlined in the assessment procedures in Chapter 5 of the NSW Industrial Noise Policy.*
- *To determine compliance with the $L_{A1(1\ minute)}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the Department and DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).*

4.2 Noise Impact Assessment Procedure

The assessment of operational noise was conducted using the Environmental Noise Model (ENM v 3.06) noise modelling software. All major noise producing items were modelled at their known (for stationary sources such as the surface facilities) or typical (for mobile sources such as dump trucks) positions and noise contours and point calculations were generated for the surrounding area and receivers.

The rural terrain category was adopted for noise modelling and various ground types were assigned to ground contours. Areas of disturbance within the mine site were assigned ground type 9 (exposed earth). The open land was assigned ground type 4 (grass).

4.2.1 Noise Sources

Sound power levels of major operational noise sources used in the modelling are shown below in **Table 2**. These sources have all been

measured on site by Spectrum Acoustics at various times since commencement of the Rocglen Coal Mine.

TABLE 2
Operational noise source sound power levels. (Calculated 15-minute L_{Aeq} levels as used in the noise model and measured maximum levels).

Operational noise source	Sound power level, dB(A)		Source Height, m
	$L_{eq(15\ min)}$	L_{max}	
Processing plant	113	115	4
Front-end loader at processing area	113	118	3
Tracked dozer	115	126	2
Overburden drill	114	116	2
O/B excavator	116	122	5
Coal excavator	115	121	5
Overburden dump*	115	122	3
Overburden haul (on slope)*	114	122	3
Overburden haul (on flat)*	112	118	3
Coal haul (from pit to processing area)*	111	118	3
Scraper (per source at 350m spacing)	110	118	3
On-site product haulage (per 350m)	95	108	2

* All sources involving scrapers and trucks are calculated equivalent point sources per 350m section of route of travel based upon site measurements of existing plant.

4.2.2 Modelled Scenarios

Noise modelling was conducted for the following atmospheric conditions:

- *Daytime calm (neutral)* – Air temperature 20^0C, 70% relative humidity (RH), no wind, -1^oC/100m vertical temperature gradient;
- *Inversion* – Air temperature 2^0C, 90% RH, $+6^o$C/100m vertical temperature gradient;
- *Prevailing wind (all times)* – Air temperature 20^0C, 70% RH, 3m/s wind from south; and
- *Prevailing wind (all times)* – Air temperature 20^0C, 70% RH, 3m/s wind from NNW.

Noise models were generated for each of the following operational scenarios, under the atmospheric conditions discussed above. These scenarios are considered to be the worst case in terms of noise generation and potential impacts.

Scenario (1) Year 1 of expanded operation**:** All overburden going to Northern Emplacement at 330 m AHD, 24 hrs. Topsoil placement on the northern face of Northern Emplacement, and spreading by dozer, occurring ***daytime only***. ROM coal haulage, processing and product haulage occurring 24 hrs. Noise sources for this scenario are shown in **Figure A1 in Appendix A**.

Scenario (2) Year 5 of expanded operation: All overburden going to southern edge of Northern Emplacement at 310 m AHD, 24 hrs. Topsoil placement on the top of both Northern and Western Emplacements, and spreading by dozer, occurring ***daytime only***. ROM coal haulage, processing and product haulage occurring 24 hrs. Noise sources for this scenario are shown in **Figure A2 in Appendix A**.

Scenario (3) Year 10 of expanded operation: All overburden going to eastern face of Western Emplacement at 320 m AHD, 24 hrs. Topsoil placement on the southern face of the Western Emplacement, and spreading by dozer, occurring ***daytime only***. ROM coal haulage, processing and product haulage occurring 24 hrs. Noise sources for this scenario are shown in **Figure A3 in Appendix A**.

Operational noise level predictions in this report apply to times of day as summarised in **Table 3**.

TABLE 3
Applicable times for predicted noise levels.

Met Condition	Applicable time(s) for predicted noise levels
Neutral	Daytime, during calm conditions
ENE wind	Day, evening and night during spring-summer
SW wind	Day, evening and night during autumn-spring
Inversion	Night, winter only (per INP)

4.3 Predicted Operational Noise Levels

Operational noise levels predicted using the ENM point calculation mode are presented below for the modelled operational and meteorological scenarios. In all following tables of predicted noise levels, exceedances of the criterion by less than 5 dB are shown in bold type and exceedances of 5 dB or more are in bold type and shaded grey.

4.3.1 Scenario 1: Year 1 of Expanded Operation

Predicted noise levels for the Year 1 scenario are summarised in **Table 4**. Topsoil placement by scrapers, and spreading by dozer, on the overburden emplacements is included in daytime models only. All other activities are occurring 24 hrs. Noise contours for the worst case scenarios (daytime NNW and S winds and night time inversions) are shown in **Figures B1 to B3** in **Appendix B**.

TABLE 4
Predicted Year 1 noise levels.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$						Criterion
	Neutral (day)	Wind (day)		Wind (eve/night)		Invers. (night)	
		S	NNW	S	NNW		
R1	24	33	21	33	20	34	35
R2	24	31	21	30	20	33	35
R3	24	30	21	28	20	32	35
R4	32	40	30	39	26	41	35
R5	25	22	34	23	35	36	40*
R6	21	<20	30	<20	30	32	35
R7	<20	<20	26	<20	25	29	35
R8	<20	<20	27	<20	27	31	35

* Elevated noise limit under agreement with the proponent.

4.3.2 Scenario 1 Recommendations

Exceedances of the criterion have been predicted at R4 “Costa Vale”. The main contributing noise sources are trucks depositing overburden on the Northern Emplacement with a lesser contribution from topsoil spreading activities (daytime only).

Noise mitigation to achieve the minimum 6 dB reduction would require all trucks to be retro-fitted with attenuator packages. The proponent has advised that while this may be technically feasible, it would be impractical given the large cost involved and only one affected receiver. Whitehaven has entered into a contract for purchase of the property and it is expected settlement will be completed by the end of June 2010, at which time “Costa Vale” will be project-related.

Receiver R1 “Retreat” or R2 “Penryn” should be included as a noise monitoring location, along with R6 “Surrey” which is currently a monitoring location.

4.3.3 Scenario 2: Year 5 of Expanded Operation

Predicted noise levels for the Year 5 scenario are summarised in **Table 5**. Topsoil placement by scrapers, and spreading by dozer, on the overburden emplacements is included in daytime models only. All other activities are occurring 24 hrs. Noise contours for the worst case scenarios (daytime NNW and S winds and night time inversions) are shown in **Figures B4 to B6** in **Appendix B**.

TABLE 5
Predicted Year 5 noise levels.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$						Criterion
	Neutral (day)	Wind (day)		Wind (eve/night)		Inver. (night)	
		S	NNW	S	NNW		
R1	22	31	20	30	<20	32	35
R2	22	30	20	29	<20	33	35
R3	21	29	20	27	<20	32	35
R4	29	37	26	34	20	36	35
R5	28	25	36	23	34	36	40*
R6	25	23	33	20	31	34	35

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$						
	Neutral (day)	Wind (day)		Wind (eve/night)		Inver. (night)	Criterion
		S	NNW	S	NNW		
R7	22	<20	29	<20	27	30	35
R8	21	<20	30	<20	27	31	35

* Elevated noise limit under agreement with the proponent.

4.3.4 Scenario 2: Recommendations

Minor (1-2dB) criterion exceedances are predicted at R4 "Costa Vale" under adverse conditions. As stated above in Section 4.3.2, Whitehaven has entered into a contract for purchase for this property, with settlement expected at the end of June 2010, at which time it will become project-related..

4.3.5 Scenario 3: Year 10 of Expanded Operation

Predicted noise levels for the Year 10 scenario are summarised in **Table 6**. Topsoil placement by scrapers, and spreading by dozer, on the southern end of the Western Emplacement is included in daytime models only. All other activities are occurring 24 hrs. Noise contours for the worst case scenarios (daytime NNW and S winds and night time inversions) are shown in **Figures B7 to B9** in **Appendix B**.

TABLE 6
Predicted Year 10 noise levels.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$						
	Neutral (day)	Wind (day)		Wind (eve/night)		Inver. (night)	Criterion
		S	NNW	S	NNW		
R1	<20	27	<20	29	<20	30	35
R2	<20	26	<20	29	<20	30	35
R3	<20	25	<20	27	<20	30	35
R4	20	33	<20	34	<20	35	35
R5	30	27	38	26	38	39	40*
R6	28	25	34	25	34	35	35
R7	24	20	30	20	30	31	35
R8	24	20	31	<20	31	31	35

* Elevated noise limit under agreement with the proponent.

4.3.6 Scenario 3 Recommendations

The results in **Table 6** show no exceedances of the criterion at any receiver. Receiver R6 "Surrey" and either R1 "Retreat" or R2 "Penryn" should remain as noise monitoring locations.

4.4 Sleep Disturbance

Assessment of potential sleep disturbance during night time hours usually begins by considering the DECCW recommendation that further

assessment is required if maximum noise levels[1] (L_{Amax}) exceed the background level (L_{A90}) by more than 15 dB at a bedroom window. If this level is exceeded then further consideration of potential disturbance to sleep includes the nature and level of ambient noise in the area, with some guidance also offered in Appendix B of the DECCW *Environmental Criteria for Road Traffic Noise* (ECRTN, 1999).

Maximum noise levels at the nearest or potentially worst impacted receiver for each component of the project are conservatively estimated by adding the difference between source L_{Aeq} and L_{max} sound power levels in Table 2 to the predicted levels from the five main sources contributing to the total predicted L_{Aeq}. Worst case maximum night time levels over all modelled meteorological conditions are included in the following analysis.

4.4.1 Scenario 1 Maximum Levels

The most impacted receiver in the Year 1 scenario (apart from R3 "Costa Vale", which is in a noise acquisition zone for this scenario and subject to contract for purchase by Whitehaven) is R1 "Retreat" to the north of the site. The five highest contributing sources to worst case predicted $L_{Aeq(15min)}$ levels are shown below, along with the differences between L_{eq} and L_{max} levels for those sources and the estimated L_{max} for each source.

Source No. and description		L_{Aeq}	L_{max}-L_{Aeq}	L_{max}(est.)
23	Dumping (North)	26.8	7	34
8	Truck on dump (slope)	25.4	8	33
20	Excavator 1	24.1	6	30
9	Truck on flat	23.9	6	30
21	Excavator 3	23.9	6	30
TOTAL L_{Aeq} (all sources)		**34**		

The above results show that maximum noise levels from individual sources are more than 10 dB below the 45 dB(A) sleep disturbance 'screening' level, and are also no greater than the total LAeq level from the entire mine. This is typical at large distances from a coal mine (in this case, 4.5 km) where the overall 'mine hum' is reasonably constant and individual sources are not generally identifiable, and full analysis of maximum noise levels for the Year 5 and Year 10 scenarios is not considered necessary.

[1] The sleep disturbance criterion is technically the $L_{A1(1minute)}$ level. As this is the loudest 0.6s during a 1-minute period, the L_{Amax} level is usually adopted.

5.0 OFF-SITE ROAD TRAFFIC

5.1 Traffic Noise Criteria

Road traffic noise criteria for vehicles travelling on public roads are contained in the existing project approval (and EPL) as reproduced below:

Road Traffic Impact Assessment Criteria

8. The Proponent shall ensure that the cumulative noise generated by road traffic associated with the project, Canyon (Whitehaven) and Tarrawonga mines on public roads does not exceed the criteria in Table 2.

Day $L_{Aeq(1\ hour)}$	Evening $L_{Aeq(1\ hour)}$	Night $L_{Aeq(1\ hour)}$	Location
60	60	50	Any residence on privately-owned land.

Table 2: Road Traffic Noise Criteria dB(A)

5.2 Traffic Noise Assessment

The nearest receiver to the public road section of the haul route is "Brooklyn" which is approximately 70m from Blue Vale Road and is located several kilometres south of the intersection with Shannon Harbour Road. Coal trucks from the Canyon (now closed), Tarrawonga and Rocglen mines all pass this receiver. **Table 7** summarises historical traffic noise measurements (all mine-related vehicles) conducted at "Brooklyn" by Spectrum Acoustics between March 2008 and December 2009.

TABLE 7
Historical traffic noise measurement results at "Brooklyn".

Date	Trucks/hour	Measured level dB(A), $L_{eq(1h)}$
March 2008	36	54
September 2008	16	51
December 2008	38	51
March 2009	48	52
June 2009	27	54
September 2009	42	57
December 2009	40	52
AVERAGE*	35	53.5

* Arithmetic average for truck numbers and geometric average for measured noise levels.

The measured traffic noise levels in **Table 7** range from 3-9 dB below the 60 dB(A) criterion. The current proposal will not significantly alter the total number of trucks passing "Brooklyn", resulting in no significant change to current traffic noise levels.

6.0 BLAST OVERPRESSURE AND VIBRATION

6.1 Blasting Criteria

Blast overpressure and ground vibration criteria are contained in the current project approval (and the EPL) and are reproduced below. Future blasting at the Rocglen Mine will be required to achieve these criteria.

Airblast Overpressure Impact Assessment Criteria

11. The Proponent shall ensure that the airblast overpressure level from blasting at the project does not exceed the criteria in Table 3 at any residence on privately-owned land.

Airblast overpressure level (dB(Lin Peak))	Allowable exceedance
115	5% of the total number of blasts in a 12 month period
120	0%

Table 3: Airblast overpressure impact assessment criteria

Note: The overpressure values in Table 3 apply when the measurements are performed with equipment having a lower cut-off frequency of 2 Hz or less. If the instrumentation has a higher cut-off frequency a correction of 5 dB should be added to the measured value. Equipment with a lower cut-off frequency exceeding 10 Hz should not be used.

Ground Vibration Impact Assessment Criteria

12. The Proponent shall ensure that the ground vibration level from blasting, or any other activity at the project does not exceed the criteria in Table 4 at any residence on privately-owned land.

Peak particle velocity (mm/s)	Allowable exceedance
5	5% of the total number of blasts in a 12 month period
10	0%

Table 4: Ground vibration impact assessment criteria

6.2 Blast Impact Assessment Procedure

Blast monitoring results for 2008/2009 are included in the Rocglen Mine Annual Environmental Monitoring Report (AEMR) and have been supplied for consideration of the potential blasting impacts associated with the current proposal.

Blast monitoring was conducted at the nearest residence to the north (R4 "Costa Vale") and south (R5 "Roseberry") of the mine for most blasts. **Table 8** summarises the results at these two locations.

TABLE 8
Blast monitoring results for "Costa Vale" and "Roseberry", 2008-2009.

Date	Location	Peak Vibration (mm/s)	Peak Pressure (dB)
22 Aug 2008	Costa Vale	DNT*	DNT
3 Sep 2008	Costa Vale	0.1	110.2
11 Sep 2008	Costa Vale	DNT	DNT
25 Sep 2008	Costa Vale	DNT	DNT
26 Sep 2008	Costa Vale	DNT	DNT
2 Oct 2008	Costa Vale	0.65	102.3
	Roseberry	0.66	102.1

Date	Location	Peak Vibration (mm/s)	Peak Pressure (dB)
21 Oct 2008	Costa Vale	0.35	110.5
	Roseberry	0.86	107.5
31 Oct 2008	Costa Vale	DNT	DNT
	Roseberry	DNT	DNT
28 Nov 2008	Costa Vale	0.36	105.5
	Roseberry	1.04	103.2
12 Dec 2008	Costa Vale	1.46	115.0
	Roseberry	1.5	114.9
30 Jan 2009	Costa Vale	1.48	114.8
	Roseberry	1.46	114.9
10 Feb 2009	Costa Vale	0.53	111.2
	Roseberry	DNT	DNT
25 Feb 2009	Costa Vale	0.51	107.2
	Roseberry	0.33	102.2
27 Feb 2009	Costa Vale	0.36	114.9
	Roseberry	DNT	DNT
12 Mar 2009	Costa Vale	0.56	113.2
	Roseberry	1.22	114.6
25 Mar 2009	Costa Vale	0.4	111.7
	Roseberry	0.71	107.2
8 Apr 2009	Costa Vale	0.71	107.2
	Roseberry	0.3	114.8
24 Apr 2009	Costa Vale	Monitors not set	
	Roseberry	Monitors not set	
8 May 2009	Costa Vale	0.43	103.3
	Roseberry	DNT	DNT
25 May 2009	Costa Vale	0.76	109.1
	Roseberry	0.46	111.5
1 Jun 2009	Costa Vale	0.48	87.4
	Roseberry	DNT	DNT
4 Jun 2009	Costa Vale	DNT	DNT
	Roseberry	DNT	DNT
16 Jun 2009	Costa Vale	DNT	DNT
	Roseberry	DNT	DNT
26 Jun 2009	Costa Vale	0.43	107.2
	Roseberry	0.43	104.6
7 Jul 2009	Costa Vale	0.68	106.7
	Roseberry	DNT	DNT
27 Jul 2009	Costa Vale	0.78	103.7
	Roseberry	0.47	100.2

* Did Not Trigger. Levels were below threshold setting, not equipment fault.

The blast monitoring results in **Table 8** show no exceedances of either the ground vibration or blast overpressure criteria at “Costa Vale” and “Roseberry”. “Costa Vale” is in a noise acquisition zone (see Section 4.3.2) and the nearest privately owned residence to the north (R1 “Retreat”) is approximately 2km further from the mine than “Costa Vale”

and no significant blasting impacts are expected. As the nearest residence to the north, blast monitoring should be conducted at R1 once purchase of “Costa Vale” has been finalised.

Blast monitoring should continue at “Roseberry” and continued compliance with the blasting criteria will imply compliance at receivers further south.

7.0 SUMMARY

A Noise and Vibration Impact Assessment (NVIA) has been prepared for the proposed expansion of the Rocglen Coal Mine near Gunnedah, NSW.

The assessment has found that one privately owned receiver (“Costa Vale”) is likely to be impacted from noise associated with activities on the proposed Northern Emplacement Area. The proponent is in the final stages of purchase of this property, and it is expected to be considered project-related by the end of June 2010.

Based on historical measurement results for the Rocglen Mine, there are no anticipated exceedances of either offsite road traffic or blasting criteria at any privately owned residence. Blast monitoring should continue to be conducted at the nearest privately owned residences to the north and south of the mine.

Off-site traffic noise levels are expected to remain compliant with the existing traffic noise criterion. Traffic noise monitoring should continue to be conducted at the “Brooklyn” residences on Blue Vale Road.

APPENDIX A

Noise Source Locations

Figure A1. Year 1 noise source locations.

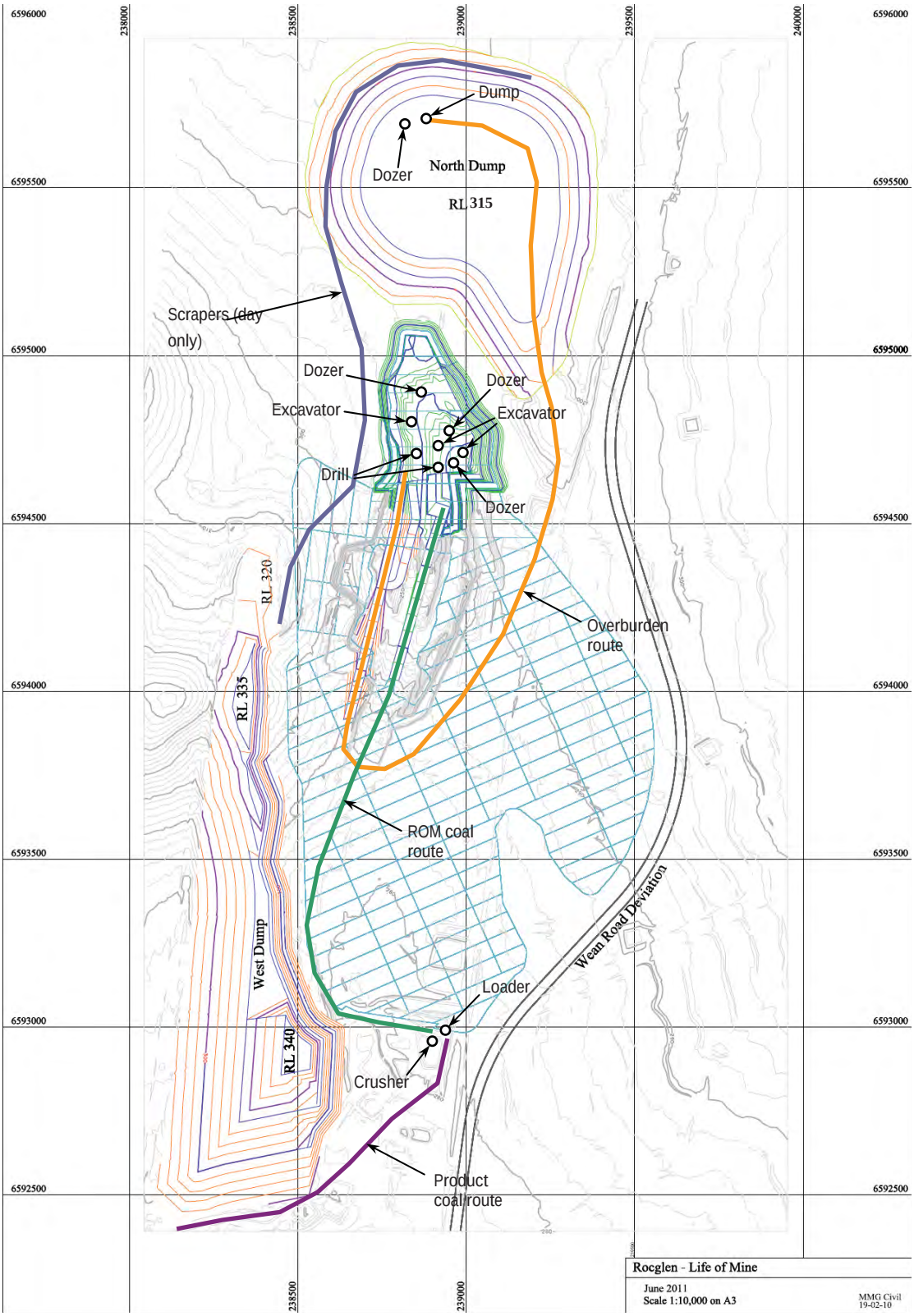


Figure A2. Year 5 noise source locations.

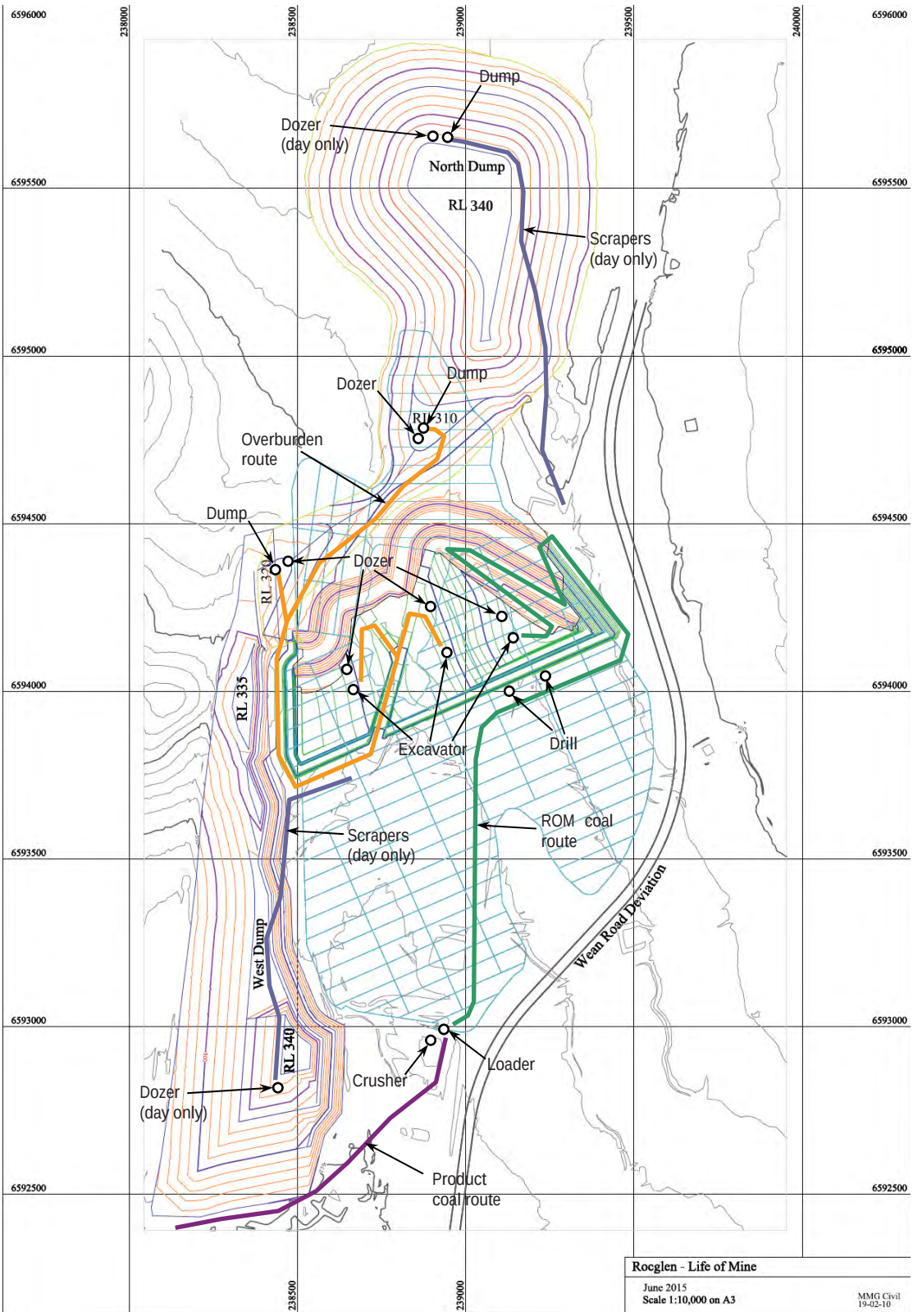
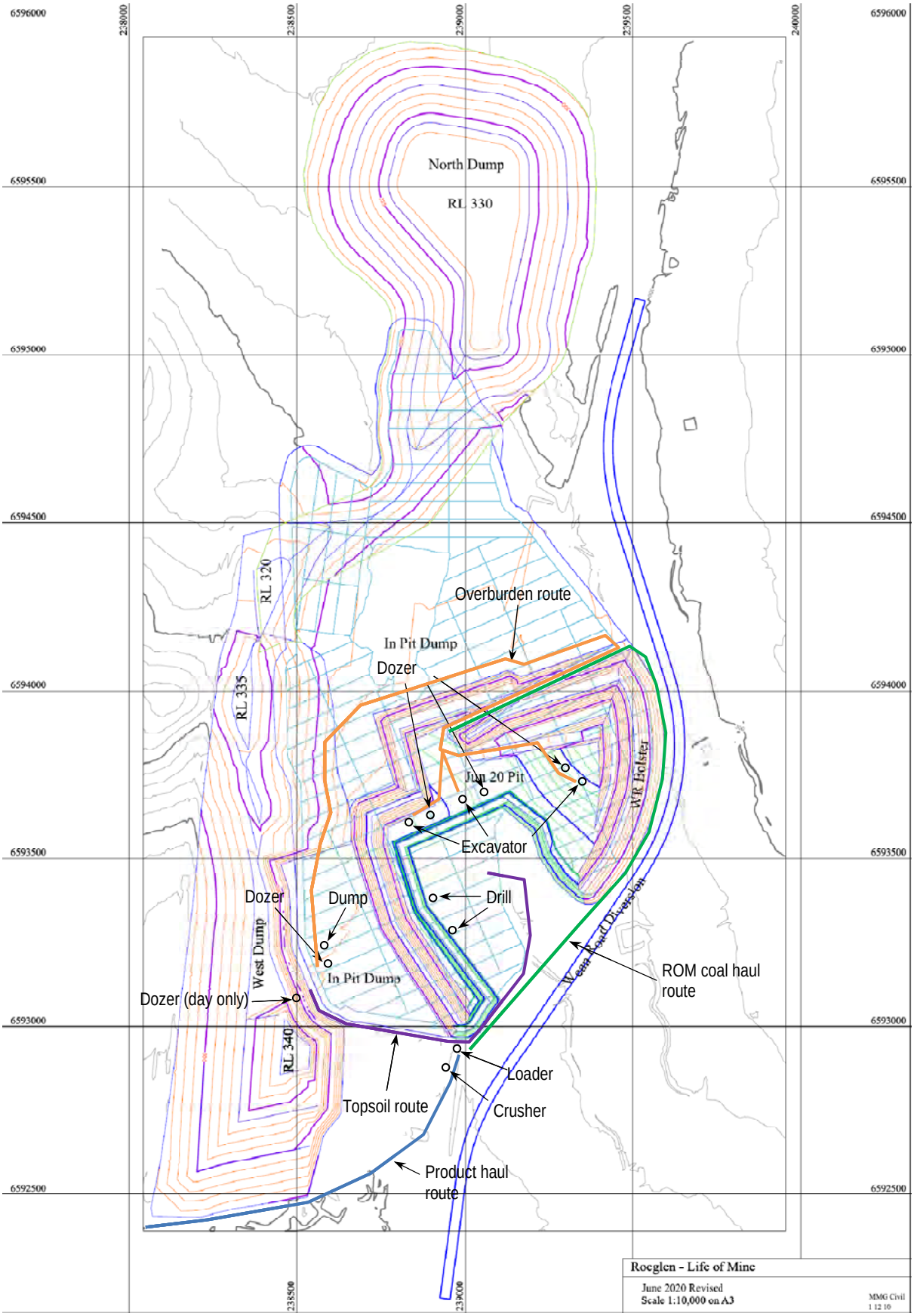
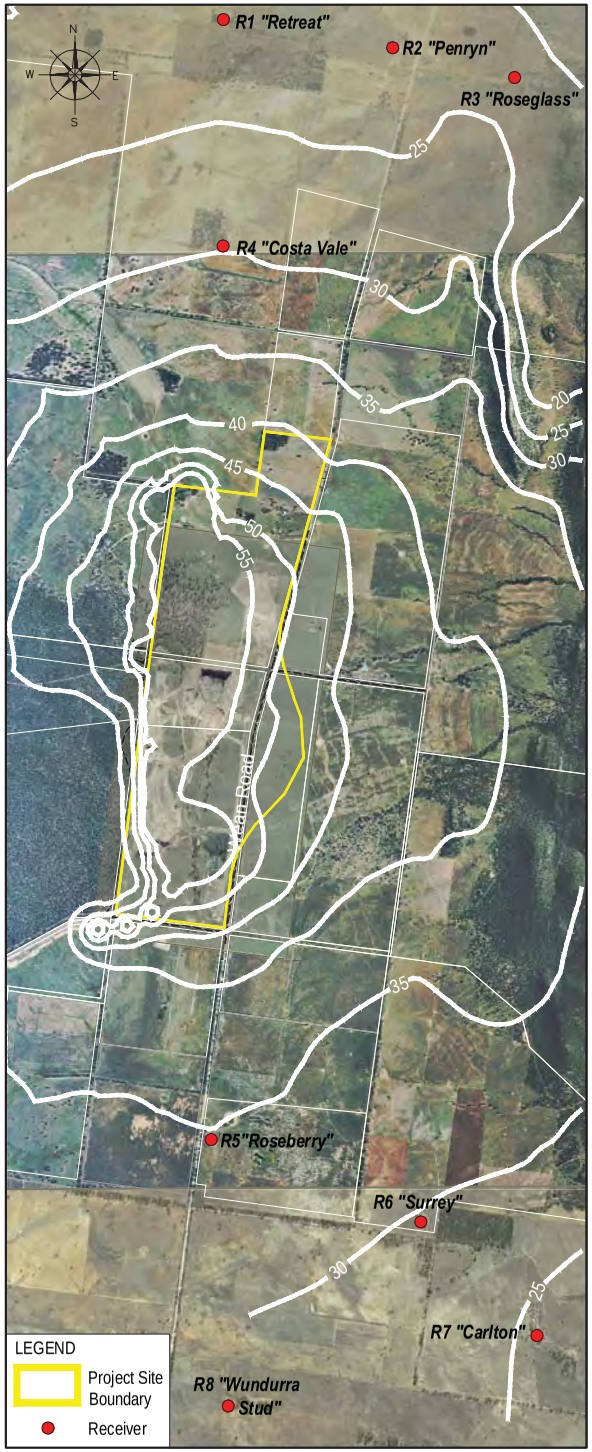


Figure A3. Year 10 noise source locations.



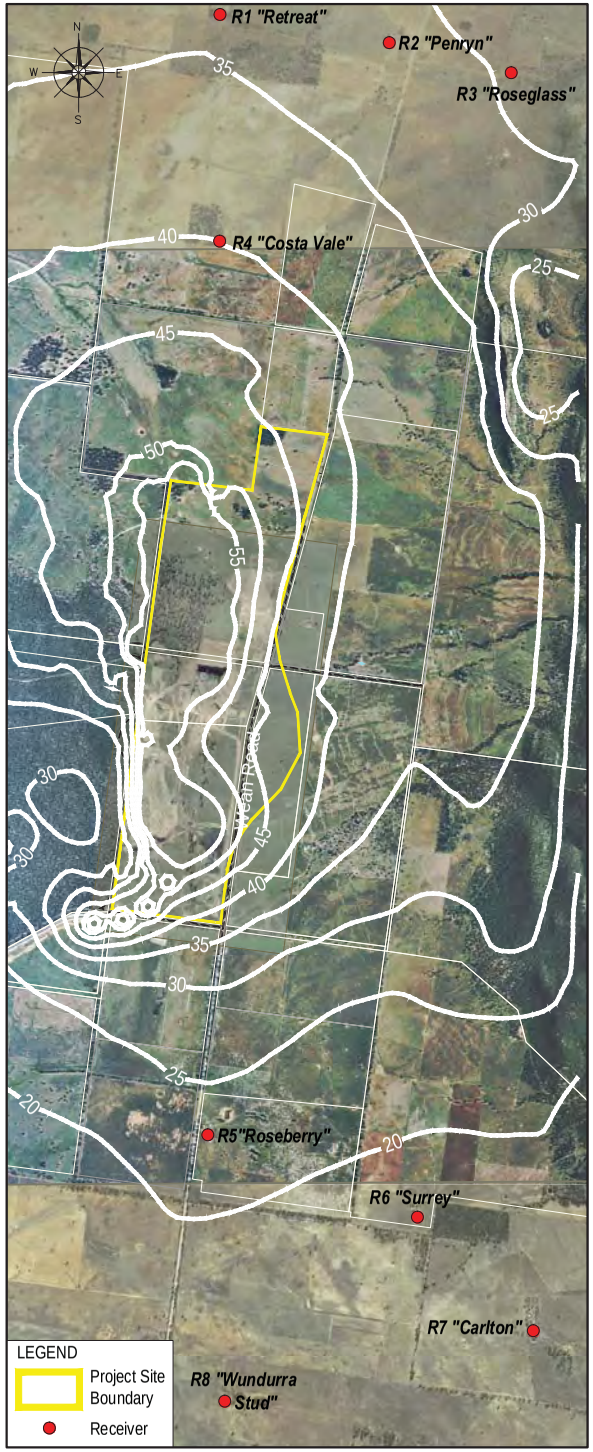
APPENDIX B

Noise Level Contours



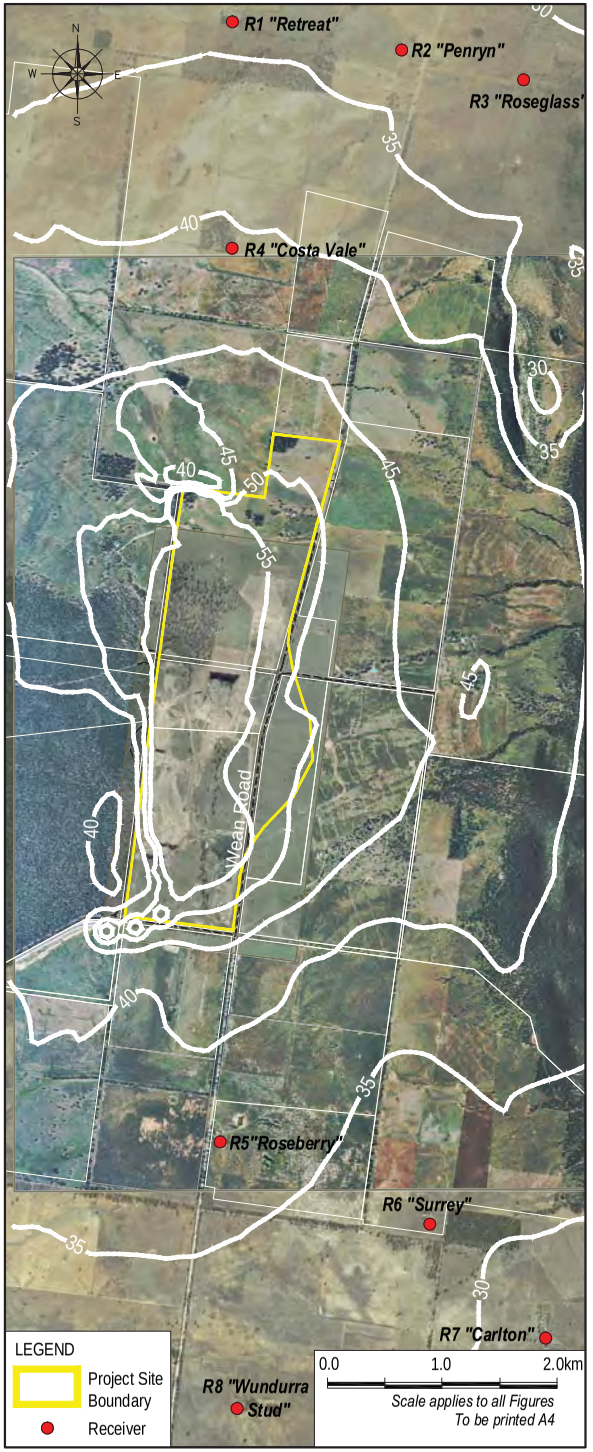
Scenario 1 - Year 1 of Expanded Operations
Noise Contours dB(A) - Daytime NNW Wind

Figure B1



Scenario 1 - Year 1 of Expanded Operations
Noise Contours dB(A) - Daytime South Wind

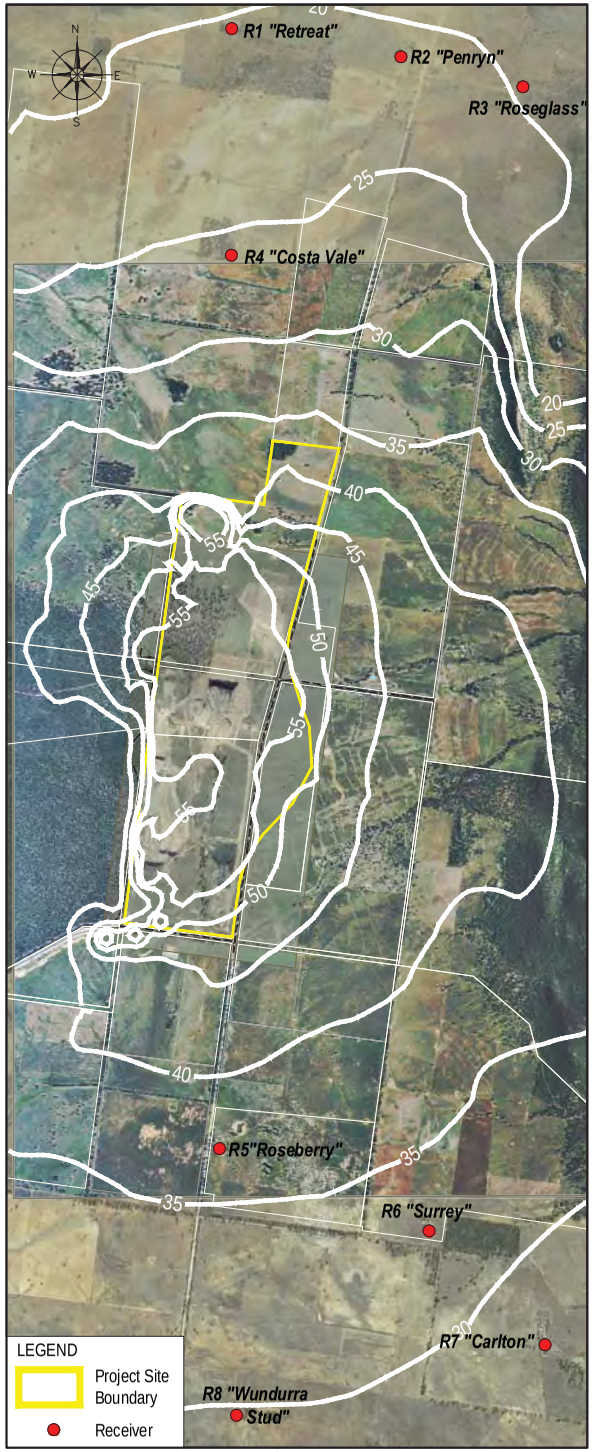
Figure B2



Scenario 1 - Year 1 of Expanded Operations
Noise Contours dB(A) - Night-time Inversion

Figure B3

Base Plan Data Sources: Google Earth, RWC, Geo-spectrum (Australia) Pty Ltd, and Whitehaven Coal Limited
Prepared by GSS Environmental

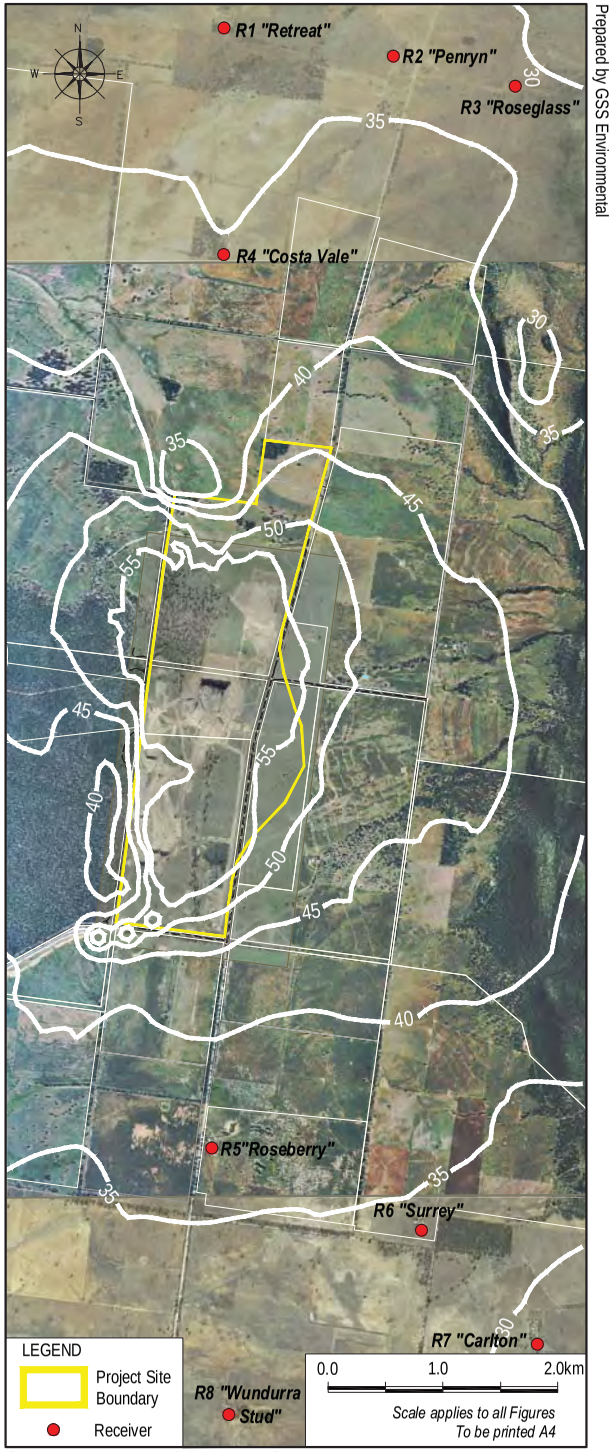


Scenario 2 - Year 5 of Expanded Operations
Noise Contours dB(A) - Daytime NNW Wind

Figure B4

Scenario 2 - Year 5 of Expanded Operations
Noise Contours dB(A) - Daytime South Wind

Figure B5

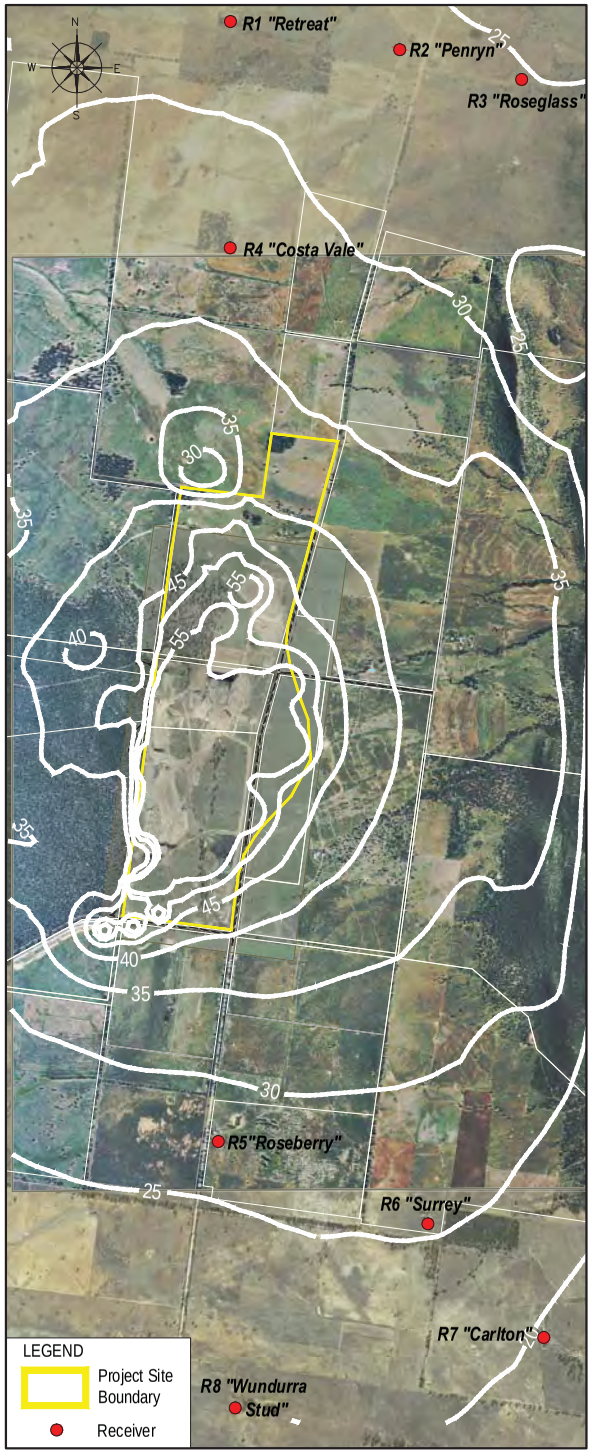


Scenario 2 - Year 5 of Expanded Operations
Noise Contours dB(A) - Night-time Inversion

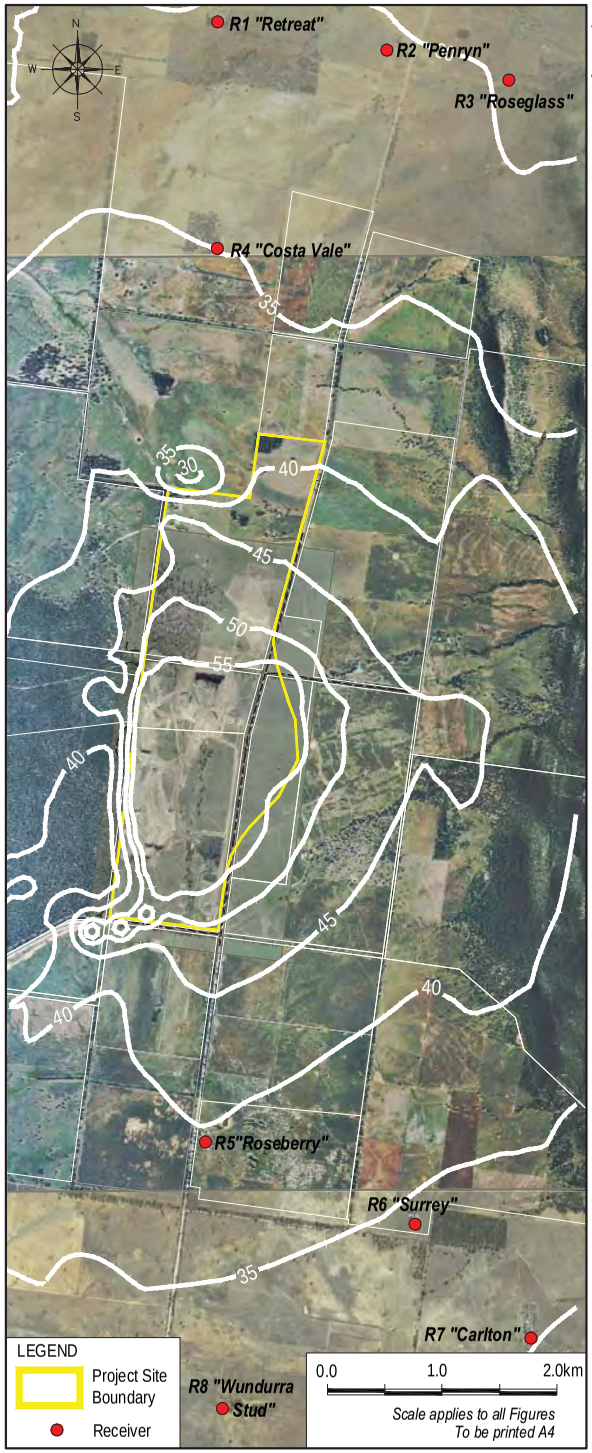
Figure B6

Base Plan Data Sources: Google Earth, RWC, Geo-spectrum (Australia) Pty Ltd. and Whitehaven Coal Limited
Prepared by GSS Environmental

Scenario 3 - Year 10 of Expanded Operations
Noise Contours dB(A) - Daytime NNW Wind **Figure B7**



Scenario 3 - Year 10 of Expanded Operations
Noise Contours dB(A) - Daytime South Wind **Figure B8**



Scenario 3 - Year 10 of Expanded Operations
Noise Contours dB(A) - Night-time Inversion **Figure B9**

Base Plan Data Sources: Google Earth, RWC, Geo-spectrum (Australia) Pty Ltd, and Whitehaven Coal Limited
Prepared by GSS Environmental