MOOLARBEN COAL PROJECT

APPENDIX 4

Noise and Vibration Impact Assessment

Project No: 04098

Noise and Vibration Impact Assessment
Proposed Moolarben Coal Mine
Ulan, NSW

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EXECUTIVE SUMMARY

A Noise and Vibration Impact Assessment (NVIA) has been conducted for the proposed Moolarben Coal Mine near Ulan, NSW. The assessment is based on or refers to the following Standards, policies, guidelines and documents:

- DEC *NSW Industrial Noise Policy* (2000).
- DEC *Environmental Criteria for Road Traffic Noise* (1999).
- ANZECC *Technical basis for guidelines to minimise annoyance due to blast overpressure and ground vibration* (2000).
- DEC publication *Assessing Vibration: a technical guideline* (2006).
- Australian Rail Track Corporation (ARTC) Environmental pollution license EPL 3142.
- Wilpinjong Noise and Blasting Impact Assessment, Richard Heggie Associates (RTA, 2005).
- Traffic Impact Assessment (TIA) for the Moolarben Coal project, Sinclair Knight Merz (SKM, 2006).
- 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.

Ambient Noise Levels

Ambient noise monitoring was conducted at six residential receivers surrounding the project site during the period 12 July 2005 to 27 July 2005 (refer to Figure 1 on p2 for noise monitoring locations). Existing L_{Aeq} and L_{A90} (Rating Background levels, RBL) levels are summarised in **Table S1**.

Location	L_{Aeq}, period			L_{A90}, period		
	Day	Evening	Night	Day	Evening	Night
P. Renshaw *N6*	49	48	46	30	31	30
G. Tuck-Lee *N4*	55	44	44	33	36	34
D. Rayner *N1*	43	37	42	30	30	30
M. Powers (Ulan) *N5*	55	53	51	42	41	40
T. Roberts *N3*	49	45	39	34	33	32
B. Reid *N2*	47	40	37	30	30	30

TABLE S1
Measured ambient noise levels (July 2005).
(L_{90} values below 30 dB(A) have been set to 30dB(A) per DEC guidelines.)

Operational Noise Criteria

Recommended noise criteria for locations potentially affected by Pit 1 operations are shown in **Table S2**. Increased noise criteria have been recommended at some locations for the first six months of the project to allow the formation of an acoustic bund along the western edge of the Pit 1 out-of-pit emplacement area (OOP1). Bund formation and other construction activities on site would only occur during the day and not into the evening or night. When 24 hour mining commences the pre-established bund is predicted to reduce noise emissions by up to 7 dB at residences in and around the village of Ulan.

TABLE S2
Recommended noise criteria for locations impacted by Pit 1.

Rec. #	Description	Criterion $L_{Aeq(15\ min)}$ 0-6 months	Criterion $L_{Aeq(15\ min)}$ 6-12 months	Criteria After 12 months[1]			
				D	E	N	SD
2	S.E. Birt & K.M. Hayes	35	35	35	35	35	45
8	C.N. & H.L. Davies	35	35	35	35	35	45
46G	UCML (Mitchell)	35	35	35	35	35	45
16	D.J. Little & A.K. Salter	35	35	35	35	35	45
7	Wallis	35	35	35	35	35	45
13	P.F. Renshaw	35	35	35	35	35	45
12	M. & J. Transport	Noise affectation zone – Rail loop					
157	Ulan Village – M.Powers	47	47	40	39	38	48
160A	Ulan School	50	50	50	--	--	--
168	Ulan Church	50	50	50	50	50	--
46A	Flannery Centre	46	46	39	38	37	47
169	"Primo Park"	40	37	35	35	35	45
49	"Olive Lea"	43	38	35	35	35	45
26	G.F. Robinson	43	38	35	35	35	45
25	G.G. Tuck-Lee	Noise affectation zone – Pit 1					
5	M. & P. Swords	35	35	35	35	35	45
20	A.J. & N.N. Williamson	40	35	35	35	35	45
41A	P.P. Libertis	35	35	35	35	35	45
170	T. Roberts	35	35	35	35	35	45
58	M.L & J.L Bevege	35	35	35	35	35	45
All other receivers		35	35	35	35	35	45

[1] Day (D), evening (E) and night (N) operational $L_{Aeq(15\ min)}$ criteria and night time sleep disturbance (SD) criterion, $L_{A1(1\ min)}$.

Summary of affected receivers

One location (*R25* Tuck-Lee) has predicted noise levels more than 5 dB above the noise criterion after establishment of the acoustic bund at OOP1 and is in a noise "affectation zone", where "affectation zone" is used in this report to identify receivers where predicted noise levels are 5 dB or more above the noise criteria. This location is also in the blasting affectation zone for Pit 1. The Swords residence (*R5*) is in the noise affectation zones for Pits 2 and 3 and the blasting affectation zone for Pit 2. Also included in the Pit 2 affectation zone is the Williamson residence (*R20*). The Rayner residence (*R36*) is in the blast affectation zone for Pit 3. Locations *R29A* (Mayberry) and *R29B* (Mayberry) are both in the noise and blasting affectation zones for Pit 3.

Two other locations, *R13* (Renshaw) and *R12* (M&J Transport), are in a noise affectation zone near the proposed rail loop.

Locations *R169* ("Primo Park"), *R49* ("Olive Lea") and *R26* (Robinson) have predicted noise levels that may exceed the noise criteria by 1-3 dB under adverse conditions after 24 hour mining commences in Pit 1. These locations will be included in a noise monitoring / management program and provision would be made in the project approval for further negotiations with Moolarben Coal Mines Pty Ltd should noise criterion exceedances be experienced.

This recommendation has been made because of the relative difficulty in achieving the noise criteria at these three locations. The acoustic bund at OOP1 is predicted to provide up to 7 dB attenuation of mining noise. Achieving the night time criteria in Table S2 at these locations would require all mobile plant (excavators, haul trucks, dozers) to be attenuated by a further 3 dB. Given the small number of receivers involved, the minor to moderate level of predicted exceedances and the high cost of noise attenuation (in terms of both purchase cost and ongoing maintenance) it is not considered feasible or reasonable to recommend attenuation at this stage.

Many of the minor exceedances could be mitigated by avoiding certain operations at times of adverse weather conditions. A Noise Management Plan will be developed for the project and noise monitoring will be conducted from commencement of activities on site. If the need arises to attenuate specific plant items, then the best practice approach will be adopted.

Train Noise Predictions

The assessment found that some of the proposed MCP trains were included in the cumulative train noise impact assessment for Wilpinjong Mine (Richard Heggie Associates, 2005). Specifically, two 650m trains per day were included for Ulan Phase 2 Underground (now part of the MCP lease area) as part of the currently approved train traffic on the Gulgong – Sandy Hollow Rail Line. Taking this into account, the calculated cumulative daytime train noise levels east of the site increased by 1 dB from those presented in the Wilpinjong EIS (which included existing trains from Ulan Coal Mine) as a result of introducing additional trains from MCP. No measurable increase in L_{Aeq} levels was calculated for additional night time train movements.

It is understood that train noise on the Gulgong – Sandy Hollow Rail Line is the responsibility of the Australian Rail Track Corporation (ARTC) with noise goals and Pollution Reduction Program guidelines contained in their Environmental Pollution License (EPL 3124). The set-back distance for achieving the ARTC noise goals at locations between the project site and Muswellbrook remains at 70 m (as established in the Wilpinjong EIS) and is governed by predicted night time L_{Aeq} levels.

Twenty-two residences were identified as being within 70 m of the rail line between the site and Muswellbrook during a helicopter survey of the rail line in April 2006. Most of these residences are in the town of Denman with the remaining residences being in rural areas. The rail line was in deep cut near several of the identified residences and two residences appeared to have acoustic bunds between the rail line and residence. Any future assessment of rail noise impacts would therefore need to be specific for each receiver and not reliant upon the predictions in this report.

Trains from MCP may also travel west to Lithgow. The set-back distance is 30 m, based on a noise objective of 85 dB(A),L_{max} in the ARTC EPL. Since this is an L_{Amax} set-back, it is not influenced by the number of trains.

Sixteen residences were identified as being within 30 m of the rail line between the site and Lithgow. These mainly include older residences in Mudgee, Kandos, Portland, Wallerawang and Rylstone. Two rural residences were identified as being within the 30 m set-back distance. The rail line is in cut near many of the residences in towns and some of the rural residences, so received maximum noise levels may be considerably lower than 85 dB(A) at these locations. Approximately 175 residences are within the set-back distance of 70 m that would be required to achieve the more stringent DEC train noise criteria. Again, these residences are mostly in Mudgee, Kandos, Portland, Wallerawang and Rylstone.

Road traffic noise

A Traffic Impact Assessment (TIA) for the project has been prepared by Sinclair Knight Merz (SKM). Results from that assessment have been used to estimate the potential for road traffic noise impacts.

The TIA assumed that all mine workers will live in Mudgee (75%) and Gulgong (25%). The increased light vehicle movements through Ulan village around shift changes are considered to represent the greatest potential for traffic noise impacts. Additional delivery vehicles on Ulan Road will not significantly increase the current road traffic volume and any increase in noise levels will be negligible.

Based on the assumption that the entire day shift will arrive between 6:30 am and 7 am and the night shift will all leave between 7 am and 7:30 am, an estimated maximum of 48 employee vehicles may travel on Cope Road, (MR 598) which links the site with Gulgong and passes through Ulan village. It is acknowledged in the TIA that the total shift change traffic is likely to occur over a period closer to two hours so the above assumption is worst case.

Based on this assessment, the traffic noise level in Ulan village at shift change will be 51 dB(A),$L_{eq(1\ hr)}$ which is well below the night time traffic noise criterion of 55 dB(A),$L_{eq(1\ hr)}$.

Sleep Disturbance

An assessment of potential sleep disturbance under a worst case operating scenario has predicted levels that are not likely to disturb the sleep of any receiver. With the acoustic bund in place, the noise will be a general mine 'hum' with approximately ± 5dB fluctuation and sources typically identified with sleep disturbance (bucket impacts, dozer tracks, overburden dumping) will be shielded by the OOP1 acoustic bund at times when these sources may be a problem. This will be specifically addressed in the Noise Management Plan.

Mobile plant items will be fitted with broadband reverse alarms which have proven very effective in mitigating the noise impact from reverse beepers. Examples previously tested by Spectrum Acoustics are 10 dB quieter (perceived as half as loud) in the tonal frequency bands of standard alarms. The total noise is spread over many frequency bands so the sound is not tonal, it is more of a "static hiss" that dissipates rapidly with distance.

Blasting

Excessive vibration levels from blasting have been predicted at some receivers close to proposed Pits 2 and 3. Negotiated agreements will need to be reached between these receivers and MCMPL. No blasting criteria exceedances (ground vibration or airblast overpressure) have been predicted in Ulan village. In terms of both noise and blasting, residents in Ulan village will benefit from the fact that the MCP will commence at approximately the nearest point to the village and advance towards the northeast, thereby reducing both noise and vibration levels in the village over a relatively short period of time. Also, the resource is closest to the surface at the western edge of Pit 1 (closest to Ulan village) so the assessed large blasts are unlikely to be required there.

Blasting will occur within 700m of the Moolarben Dam wall. Predicted ground vibration levels at the dam wall from blasting in Pit 1 will be approximately 6.2 mm/s. Since dam walls are constructed to withstand earthquakes, which are far more intense than blasting vibration magnitudes, there is no risk to the dam from MCP blasting activities.

Two rock shelter sites (referred to in the archaeological report as S1MC55 and S1MC56) in the escarpment near Pit 2 will receive vibration levels from blasting in Pit 2 which are well below the 80mm/s limit cited in the Wilpinjong EIS.

In summary, it has been found that through a combination of negotiated agreements with a small number of significantly impacted receivers, an initial period of allowable elevated noise emissions to form an acoustic bund west of Pit 1 during daytime hours, a comprehensive Noise Management Plan incorporating the best practice engineering noise control process, noise monitoring and the opportunity for future negotiations to be conducted, the Moolarben Coal Mine can operate within the applicable noise and vibration guidelines.

1.0 INTRODUCTION

1.1 The Proposal

Moolarben Coal Mines Pty Limited (MCMPL) is seeking to establish a coal mine in the Western Coalfields of NSW, 40 km northeast of Mudgee and 25 km east of Gulgong. The proposal is State Significant Development and therefore the Minister for Planning is the consent authority. Accordingly, a Noise and Vibration Impact Assessment (NVIS) has been conducted for inclusion in the Environmental Assessment (EA) in accordance with the Department of Planning (DoP) Guidelines for the Preparation of an Environmental Impact Statement (EIS) – *Coal Mines and Associated Infrastructure*.

1.2 Study Area

The proposed Moolarben Coal Mine site lies south and east of the existing Ulan Mine and immediately west of the approved Wilpinjong Mine. The project area is characterised by substantial topographic relief, with land elevation ranging from about 400m RL in valleys to over 600m RL on adjacent ridges. The proposed open-cut pits lie adjacent to the western escarpments of the Munghorn Gap Nature Reserve.

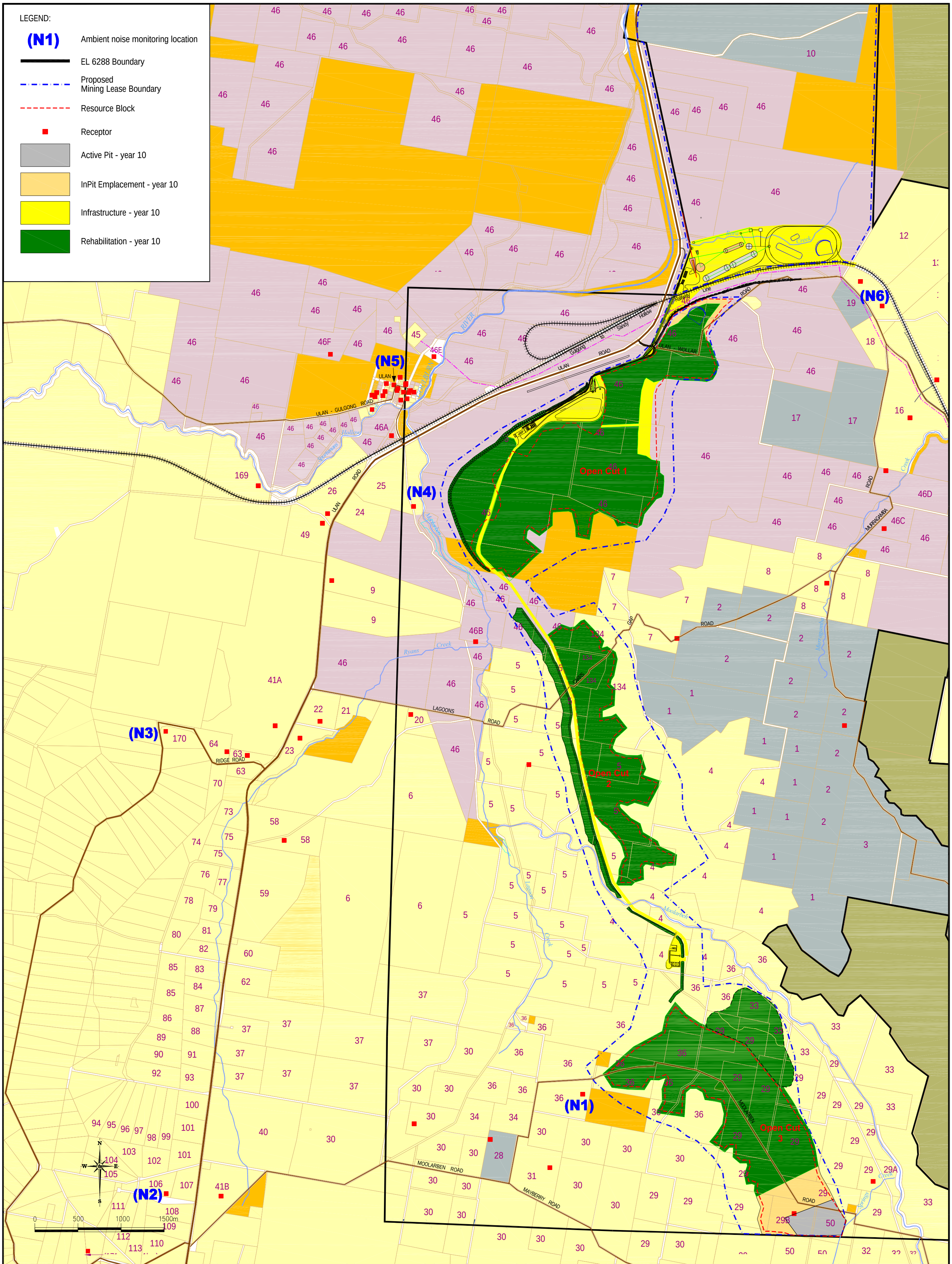
Assessed residential receivers and noise monitoring locations are shown in **Figure 1** and detailed in **Table 1**. A more thorough discussion is included in **Section 3.2**. A more complete description of the project site and surrounds (that is, general aspects unrelated to noise) is given elsewhere in the EA.

1.3 Proposed Operations

The development is to be known as the Moolarben Coal Project (MCP), which comprises an underground mine and three open-cut areas with coal processing facilities and an on-site rail loop.

Infrastructure will be located on both sides of the Gulgong – Sandy Hollow Railway Line. This will comprise coal stockpiling, washing plant and rail loading facilities. A balloon rail loop will enable coal to be transported by rail to either Lithgow or Newcastle.

The underground and open-cut mines would operate concurrentlywith all coals washed on site in a two-stage Dense Medium Cyclone (DMC) plant yielding up to approximately 10 Mtpa of product coal.



Pegasus Technical

Moolarben Coal Project

Noise Monitoring Locations and Assessed Receivers

SPECTRUM ACOUSTICS

Figure 1

CAD FILE: Figure 1 NP

TABLE 1
Assessed receivers (per Figure 1).

Receiver	Owner / Description
3	B.W. & H.J. Best (no residence)
1	M.J. Carlisle (no residence)
2	S.E. Birt & K.M. Hayes (unoccupied)
8	C.N. & H.L. Davies “East Lynne”
46C	Ulan Coal Mines Ltd (UCML) “Murragamba” (unoccupied)
46G	UCML (Mitchell)
16	D.J. Little & A.K. Salter “Hillview”
7	Wallis
13 *(N6)*	P.F. Renshaw
12	M. & J. Transport
157 *(N5)*	M. Powers (Ulan village)
168	Ulan Church
160A	Ulan School
46A	Flannery Centre
169	“Primo Park”
49	“Olive Lea”
26	G.F. Robinson
25 *(N4)*	G.G. Tuck-Lee
5	M. & P. Swords “The Lagoon”
20	A.J. & N.N. Williamson
41A	P.P. Libertis “Lancley Downs”
170 *(N3)*	T. Roberts “Pine Haven”
58	M.L & J.L Bevege “Kozara”
171	Ridge Rd Railway Museum
106 *(N2)*	T.B & J.H. Reid
41B	P. Libertis “Clear Springs”
30	R Cox “Moolarben”
28	D Chinner
31	M Cox “Barcoo”
36 *(N1)*	D & Y Rayner
29C	E Mayberry (no residence)
29B	Mayberry
29A	Mayberry “Croydon”
47	Herbert
32	D. & J. Stokes “Coonaroo”

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 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".

2.1 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.

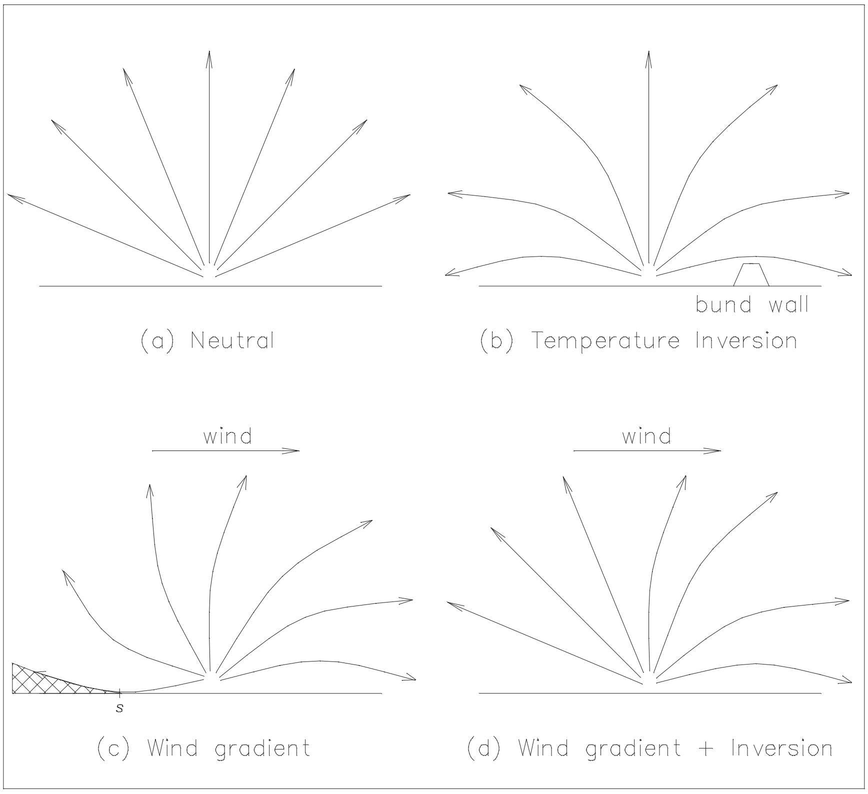


Figure 2 shows that sound rays can be refracted over a barrier (usually a bund wall or small hill) during a temperature inversion, increasing noise levels in the ‘shadow zone’.

Neutral Atmospheric Conditions

An atmosphere that is at a temperature of approximately 23^{0}C from ground level to an altitude of 200m or more. There are no fluctuations in density or humidity and no wind. Such conditions rarely occur, as temperature 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.

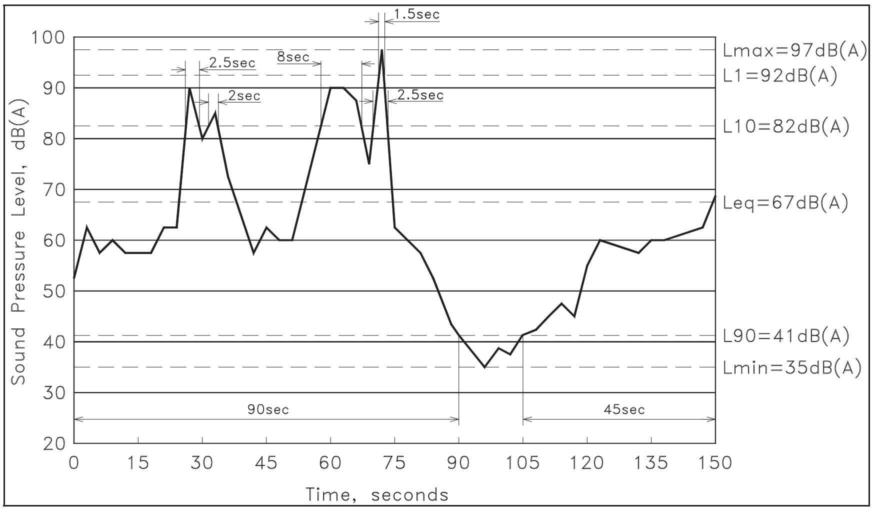
Adverse Atmospheric Conditions

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-trace of 150-second sound signal.



The signal in Figure 3 has a duration of 2.5 minutes (ie 150 seconds) with noises occurring as follows:

- The person holding the instrument is standing beside a road and hears 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;
- 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 trhe 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 and Conservation (DEC) 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 DEC *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 EA. The acoustical climate has been quantified at six representative residential locations around the project site.

3.1 Meteorology

The atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds (indicative of possible wind shear) and relative humidity. Meteorological data for weather monitoring stations near the Rayner residence (*N1*) and in Ulan village (*N5*) have been analysed by Holmes Air Sciences (HAS) and results provided for this noise impact assessment. These data are discussed in greater detail in the EA document. The following data are the most significant with respect to noise propagation:

- Extremes of relative humidity (RH) are rarely experienced. For modelling purposes, a value of 70% RH was adopted;

- Mild temperature inversions are likely to occur during at least 20-25% of nights in winter. An inversion strength of +3^{0}C/100m was adopted in the noise models (as per procedures in the INP, Appendix C). Meteorological data from the weather station in Ulan village suggest that winds are predominantly from the northeast under F and G Pasquill-Gifford stability conditions (indicative of potential inversions). A 2m/s wind from the NE was therefore modelled with the temperature inversion for the Pit 1 assessment. At the Rayner weather station, winds coinciding with temperature inversions are predominantly from the southeast, so this drainage wind was modelled with the inversion for assessment of Pits 2 and 3.

- Gradient winds are predominantly east-northeasterly in summer and south westerly in winter. A wind speed of 3m/s (at 10m above ground level) from each of these directions was modelled to determine the noise impact under each of these 'prevailing' wind conditions.

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

3.2 Ambient Noise Levels

Ambient noise monitoring was conducted at six residential receivers surrounding the project site during the period 12 July 2005 to 27 July 2005 (refer to Figure 1 for noise monitoring locations *N1-N6*). Existing

TABLE 2
Measured ambient noise levels (July 2005).

L_{Aeq} and L_{A90} (Rating Background levels, RBL) levels are summarised in **Table 2**. Noise data charts are shown in **Appendix B**.

Location	L_{Aeq}, period			L_{A90}, period		
	Day	Evening	Night	Day	Evening	Night
R13 Renshaw *N6*	49	48	46	29	31	29
R25 Tuck-Lee *N4*	55	44	44	33	36	34
R36 Rayner *N1*	43	37	42	28	26	24
R157 Powers (Ulan) *N5*	55	53	51	42	41	40
R170 Roberts *N3*	49	45	39	34	33	32
R106 Reid *N2*	47	40	37	27	24	23

For the purposes of setting noise criteria relative to ambient noise levels, the INP considers a Rating Background Noise level (RBL) which is equal to:

- The measured background noise level if this is >=30 dB(A),L_{90}, or

- 30dB(A) if the measured level is <30 dB(A),L_{90}.

The contribution of existing industrial and transport noise sources to the measured ambient L_{Aeq} levels is estimated as follows:

Renshaw

No industrial noise sources observed nearby and no industrial noise audible during deployment or retrieval of noise logger. The nearby rail line may have contributed to L_{Aeq} levels, but this is generally not quantifiable in an unattended noise survey.

Tuck-Lee

Constant noise hum from nearby coal processing plant audible (and dominant) during deployment and retrieval of noise logger. Estimated industrial noise level (L_{Aeq}) is 35 dB(A), being 2 dB above the minimum background level of 33 dB(A).

Rayner

No industrial or transportation noise sources observed nearby and no industrial noise audible during deployment or retrieval of noise logger.

Powers (Ulan village)

Constant noise hum from nearby coal processing plant audible (and dominant) during deployment and retrieval of noise logger. While the measured total night-time L_{Aeq} level was 51 dB(A), the industrial noise level (L_{Aeq}) is conservatively estimated at 42 dB(A), being 2 dB above the night time background level of 40 dB(A),L_{90}.

Roberts

The noise logger "flat-lines" at 32dB(A),L_{90} which is well above the instrument's noise floor, suggesting a constant noise source. Coal processing plant noise was faintly audible on deployment of the logger. Estimated L_{Aeq} level from industrial noise is 33 dB(A).

Reid

No industrial or transportation noise sources observed nearby and no industrial noise audible during deployment or retrieval of noise logger.

Based on these considerations, **Table 3** provides a summary of measured RBL's and estimated L_{Aeq} noise levels from industrial noise sources at the six monitored locations.

TABLE 3
Estimated industrial noise levels and Rating Background Levels (RBL).

Location	L_{Aeq} (industrial) , period			RBL (L_{A90}), period		
	Day	Evening	Night	Day	Evening	Night
R13 Renshaw *N6*	N/A	N/A	N/A	30	31	30
R25 Tuck-Lee *N4*	35	35	35	33	35[1]	34
R36 Rayner *N1*	N/A	N/A	N/A	30	30	30
R157 Powers (Ulan) *N5*	42	42	42	42	41	40
R46A Flannery Centre	41	41	41	41	40	39
R49 "Olive Lea"	35	35	35	33	35[1]	34
R26 Robinson	35	35	35	33	35[1]	34
R169 "Primo Park"	34	34	34	32	34	33
R170 Roberts *N3*	33	33	33	33[1]	33	32
R106 Reid *N2*	N/A	N/A	N/A	30	30	30

[1] The measured levels have been reduced by 1 dB so as not to exceed the estimated L_{Aeq} contribution from Ulan Coal Mine.

[*Explanatory note to Table 3*: Supplementary short-term attended noise monitoring conducted in August 2006 found that the contribution to the background noise level (L_{A90}) from Ulan Coal Mine at *R49* ("Olive Lea") was 6 dB lower than in Ulan village. The measurements also found that the difference between L_{Aeq} and L_{A90} levels was 1.2 dB in Ulan village and 2.2 dB at *R49* ("Olive Lea") illustrating the relatively constant nature of noise emissions from Ulan Coal Mine's surface facilities.

Based on these measurements, noise logger results at the Tuck-Lee residence will be adopted for *R49* ("Olive Lea") and *R26* (Robinson) as the 6 dB difference between background noise levels is reflected in the critical evening and night periods. Receiver *R169* ("Primo Park") is slightly further west of Ulan Coal Mine than *R49* ("Olive Lea") (refer to Figure 1) and estimated noise levels from Ulan Coal Mine at *R169* ("Primo Park") are 1 dB lower at 34 dB(A),L_{eq} and 32/34/33 dB(A),L_{90}.

The noise from UCML was measured to be approximately 1 dB lower at *R46A* (The Flannery centre) than in the centre of Ulan village. The adopted UCML noise levels for day/evening/night at this location are therefore 41 dB(A),L_{eq} and 41/40/39 dB(A),L_{90}.]

4.0 OPERATIONAL NOISE (INITIAL DAYTIME OPERATIONS)

During the first six months of the project life, topsoil and overburden would be removed from the western end of Pit 1 (closest to Ulan village) and deposited to form a 15m high acoustic bund between Pit 1 and the village. This will occur during daytime hours only. During the first 12 months of the project life construction of surface facilities will take place, also during daytime hours only. Since this period is longer than six months, "construction" noise criteria defined in the DEC *Environmental Noise Control Manual* (ENCM) would not apply and all activities on site would be subject to operational noise criteria established under the INP.

Noise impacts during the initial period of daytime operations are assessed below.

4.1 Operational Noise Criteria

The INP specifies two noise criteria for the determination of potential impacts: an *intrusive criterion* which limits L_{Aeq} noise levels from the industrial source to a value of 'background plus 5dB' and an *amenity criterion* which aims to protect against excessive noise levels where an area is becoming increasingly developed.

Both DEC and DoP have requested that Ulan village be assessed as a 'rural' noise amenity area. This assessment follows that recommendation, although the history of high mining noise levels in Ulan village and the close proximity to Ulan Coal Mine suggest a more urban acoustic environment. Table 2.1 of the INP recommends that Acceptable Noise Levels (ANL) from industrial sources should not exceed the values shown in **Table 4** at rural residential receivers. ANL's for non-residential receivers within Ulan village (ie the school and church) are also shown.

TABLE 4
Recommended acceptable industrial noise levels for various receiver types. (From Table 2.1, INP)

Noise Amenity Area	Time of day	Acceptable noise level from industrial sources, dB(A),$L_{eq(period)}$
Rural	Day	50
	Evening	45
	Night	40
School Classroom (internal)	Noisiest 1-hour period when in use	40
Church (internal)	When in use	40

The existing industrial noise levels in Table 3 are compared with the ANLs in Table 4 to determine the noise amenity criteria for a new noise source via rules given in INP Table 2.2, summarised below in **Table 5**.

Note that the existing industrial noise levels and the derived amenity criteria will not, when logarithmically added together, exceed the ANLs in Table 4. This process of setting noise criteria for a new noise source based on existing industrial noise levels therefore comprises a cumulative noise impact assessment, with the total levels being equal to the relevant ANLs.

For the non-residential receivers, it is generally accepted by DEC that the facade of a typical light framed building with the windows partly open to allow adequate air flow will attenuate approximately 10 dB(A). The cumulative industrial noise level outside the Ulan school and church must, therefore, not exceed an effective ANL (external) of 50 dB(A),L_{eq}.

TABLE 5
Reproduction of Table 2.2, INP.

Total existing L_{Aeq} noise level from Industrial sources, dB(A)	Maximum L_{Aeq} noise level for noise from new sources alone, dB(A)
Greater than or equal to ANL plus 2	If existing noise level is likely to decrease in future: ANL minus 10 If existing noise level is un likely to decrease in future: existing level minus 10
ANL + 1	ANL - 8
ANL	ANL – 8
ANL – 1	ANL – 6
ANL – 2	ANL – 4
ANL – 3	ANL – 3
ANL – 4	ANL – 2
ANL – 5	ANL – 2
ANL – 6	ANL – 1
Less than ANL – 6	ANL

An example of an amenity criterion calculation is given below for the daytime period within Ulan Village.

Existing daytime industrial noise (Table 3):	42 dB(A),L_{eq}
ANL Daytime, ‘rural’ (Table 4):	50 dB(A),L_{eq}
Existing industrial noise equals:	ANL – 8
Amenity criterion (Table 5):	50 dB(A),L_{eq} (ie = ANL)

Intrusive (RBL + 5dB) and amenity criteria for assessed receivers are summarised in **Table 6**. Finally, the project-specific noise levels (PSNL) are defined in the INP as the lower of the intrusive and amenity criteria in each time period.

TABLE 6
Intrusive and amenity noise criteria and PSNL's for initial 12 month period of daytime operations.

Receiver/Location	Intrusive criterion, dB(A),$L_{eq(15\ min)}$	Amenity criterion, dB(A),$L_{eq(period)}$	Project Specific Noise Levels
R13 Renshaw *N6*	35	50	35 dB(A),$L_{eq(15\ min)}$
R25 Tuck-Lee *N4*	38	50	38 dB(A),$L_{eq(15\ min)}$
R36 Rayner *N1*	35	50	35 dB(A),$L_{eq(15\ min)}$
R157 Powers (Ulan) *N5*	47	50	47 dB(A),$L_{eq(15\ min)}$
R160A Ulan School	N/A	50	50 dB(A),$L_{eq(1\ hr)}$
R168 Ulan Church	N/A	50	50 dB(A),L_{eq}
R46A Flannery Centre	46	50	46 dB(A),$L_{eq(15\ min)}$
R49 "Olive Lea"	38	50	38 dB(A),$L_{eq(15\ min)}$
R26 Robinson	38	50	38 dB(A),$L_{eq(15\ min)}$
R169 "Primo Park"	37	50	37 dB(A),$L_{eq(15\ min)}$
R170 Roberts *N3*	39	50	39 dB(A),$L_{eq(15\ min)}$
R106 Reid *N2*	35	50	35 dB(A),$L_{eq(15\ min)}$
All other receivers	35	50	35 dB(A),$L_{eq(15\ min)}$

Chapter 4 of the INP also lists several "modifying factor" adjustments to be added to predicted (or measured) noise levels if the noise contains annoyance characteristics such as tones and low frequency content, or if the noise is tonal or intermittent in nature. A scanned copy of INP Table 4.1 describing these modifying factors is shown in **Figure 4** below.

FIGURE 4
Scanned copy of INP modifying factor corrections.

Table 4.1. Modifying factor corrections

(See definitions in *Section 4.2*)

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: —5 dB or more if the centre frequency of the band containing the tone is above 400 Hz —8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive —15 dB or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB[2]	Narrow-band frequency analysis may be required to precisely detect occurrence
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB[2]	C-weighting is designed to be more responsive to low-frequency noise
Impulsive noise	A-weighted fast response and impulse response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB.	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s
Intermittent noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for **night-time only.**
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	One event in any 24-hour period	0 to –20 dB(A)	The acceptable noise level may be increased by an adjustment depending on duration of noise. (See *Table 4.2*)
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10 dB(A)[2] (excluding duration correction)	

Notes:
1. *Corrections to be added to the measured or predicted levels.*
2. *Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range.*

4.2 Noise Impact Assessment Procedure

The assessment of operational noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. All major noise producing items were modelled at their known (for stationary sources such as the rail load-out and surface facilities) or most exposed (for mobile sources such as dump trucks) positions and noise contours and/or point calculations were generated for the surrounding area.

4.2.1 Noise Sources

Noise data for significant sources associated with the construction phase of the Project were obtained from Spectrum Acoustics' extensive database of measured coal mining plant items. All data used were for machinery identical to that proposed for MCP (CAT 793/789 haul trucks, Hitachi EX 5500/2500 excavators, CAT D10/D11 dozers, etc.)

Sound power levels and heights above ground level of construction noise sources used in the modelling are shown below in **Table 7**. Preliminary modelling has shown that construction of surface facilities (CHPP, rail loop etc) would be minimal or inaudible at all receivers in and around Ulan village. The loudest activity would be construction of the environmental bund west of Pit 1, so the construction noise assessment has focussed on this activity.

TABLE 7
Construction noise source sound power levels. These are calculated 15-minute L_{Aeq} levels as used in the noise model.

Construction noise source	Sound power level dB(A),$L_{eq(15\ min)}$	Source height above ground level, m
D11 dozer on dump	115	3
Overburden drill	114	2
Overburden excavator and trucks	116	5
Overburden dump (per pit)*	115	3
Overburden haul (on slope)*	115	3
Overburden haul (on flat)*	113	3
Small excavator (at rail loop)	110	3
Grader (at rail loop)	111	2

* All sources involving trucks assume 8-10 truck pass-bys per 15 minute period and were calculated from maximum pass-by levels. Haulage sources placed at approximately 500m intervals on haul routes.

4.2.2 Modelled Scenarios

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

- *Daytime lapse* – Air temperature 20^{0}C, 70% relative humidity (RH), no wind, -1^{o}C/100m vertical temperature gradient (boundary layer adiabatic lapse);
- *Prevailing wind (spring/summer)* – Air temperature 20^{0}C, 70% R.H., 3m/s wind from ENE.
- *Prevailing wind (autumn/winter)* – Air temperature 20^{0}C, 70% R.H., 3m/s wind from SW.

Temperature inversions have not been modelled for the daytime construction activities in accordance with INP recommendations.

Point calculations and noise contours were generated for bund construction activities under each of the three atmospheric conditions discussed above. The scenarios included two overburden excavators and CAT 789 haul trucks at ground level at the southwestern end of Pit 1, overburden dumping (with dozer) along the western edge of the out of pit emplacement (OOP1) at the closest point to Ulan village. No coal haulage or processing is assessed in this construction scenario. Noise sources locations are shown in **Figure 5** in **Appendix A**..

4.3 Predicted Daytime Noise Levels

As discussed above, bund formation (excavation, overburden removal and emplacement) would initially occur at natural ground level with the western edge of OOP1 being formed to a height of 15m.

Predicted noise levels when emplacing overburden on OOP1 at 15m above natural ground level (with haul road along the top of the bund) are summarised in **Table 8**. Exceedances of the INP derived PSNL's (Table 6) are in bold type. Noise contours for this scenario are shown in **Figures 9 to 12** in **Appendix A**.

Supplementary noise modelling (point calculations only) has shown that construction of surface facilities during the initial 12 months will produce noise levels less than 35 dB(A) at all receivers except *R12* (M & J Transport) and *R13* (Renshaw). Results for rail loop construction are included for these two locations in Table 8 but are not reflected in the noise contours of Figures 9 to 12.

TABLE 8
Predicted construction noise levels, dB(A),Leq(15-min). Dumping of overburden is at 15m above natural ground level on the western edge of OOP1.

Receiver	Description	Meteorological condition			PSNL
		Lapse	ENE wind	SW wind	
2	S.E. Birt & K.M. Hayes	<25	<25	<25	35
8	C.N. & H.L. Davies	<25	<25	<25	35
46G	UCML (Mitchell)	<25	<25	<25	35
16	D.J. Little & A.K. Salter	<25	<25	<25	35
7	Wallis	<25	<25	<25	35
13	P.F. Renshaw	30	30	33	35
12	M. & J. Transport	32	33	35	35
157	Ulan (residences)	40	44	41	47
160A	Ulan School	41	44	41	50
168	Ulan Church	40	44	41	50
46A	Flannery Centre	42	45	42	46
169	"Primo Park"	30	40	30	37
49	"Olive Lea"	35	43	34	38
26	G.F. Robinson	35	43	34	38
25	G.G. Tuck-Lee	49	53	49	38
5	M. & P. Swords	27	35	27	35
20	A.J. & N.N. Williamson	30	40	28	35
41A	P.P. Libertis	28	35	26	35
170	T. Roberts	<25	26	<25	39
58	M.L & J.L Bevege	<25	31	<25	35
All other receivers		<< 35			35

4.4 Recommendations

The results shown in Table 8 show several exceedances of the PSNL's as summarised in **Table 9**.

TABLE 9
Predicted PSNL exceedances during construction of Pit 1 acoustic bund.

Predicted exceedances of construction noise criteria		
0 – 2 dB	Between 2 and 5 dB	5dB or greater
Nil	*R169* "Primo Park"	*R49* "Olive Lea" *R26* Robinson *R25* Tuck-Lee *R20* Williamson

It will be shown in following sections that the environmental bund along the western edge of OOP1 would provide noise attenuation of up to 7 dB at the receivers in Table 9 for continued mining operations in Pit 1 under adverse meteorological conditions. As such, the bund would serve an essential noise reduction purpose and its establishment could be subject to noise criteria higher than the PSNL's for a period not exceeding six months. It is recommended that predicted noise levels up to 5 dB above the PSNL be set as the noise criteria for the initial six month construction period for the bund. At locations where the predicted noise level is more than 5 dB above the PSNL, the noise criterion should be limited to the PSNL + 5 dB. These proposed construction noise criteria and PSNL's are summarised in **Table 10**.

TABLE 10
Proposed noise criteria during initial six month period of bund construction and PSNL's for continued daytime construction activities.

Receiver	Description	Proposed noise criteria dB(A),$L_{eq(15min)}$	
		0-6 mths	6 – 12 mths
2	S.E. Birt & K.M. Hayes	35	35
8	C.N. & H.L. Davies	35	35
46G	UCML (Mitchell)	35	35
16	D.J. Little & A.K. Salter	35	35
7	Wallis	35	35
13	P.F. Renshaw	35	35
12	M. & J. Transport	35	35
157	Ulan (residences)	47	47
160A	Ulan School	50	50
168	Ulan Church	50	50
46A	Flannery Centre	46	46
169	"Primo Park"	40	37
49	"Olive Lea"	43	38
26	G.F. Robinson	43	38
25	G.G. Tuck-Lee	Noise affectation zone	
5	M. & P. Swords	35	35
20	A.J. & N.N. Williamson	40	35
41A	P.P. Libertis	35	35
170	T. Roberts	35	35
58	M.L & J.L Bevege	35	35
All other receivers		35	35

Noise levels greater than (PSNL + 5 dB) are predicted at *R25* (Tuck-Lee) under all atmospheric conditions placing this receiver in a noise affectation zone.

It should be noted that while noise levels up to 45 dB(A) have been predicted in Ulan village and at *R46A* (The Flannery Centre) during the first six months of bund formation, the level would drop to 35 dB(A) or lower for the remainder of the 12 month period when surface facilities would be constructed.

Noise levels at *R169* ("Primo Park"), *R49* ("Olive Lea), *R26* (Robinson) and *R47* (Williamson) will also be well below the noise criteria for most of the six month construction period between completion of the acoustic bund and commencement of 24-hour mining.

5.0 OPERATIONAL NOISE (24-HOUR OPERATIONS)

After the initial six month period of bund formation and total 12 month period of surface infrastructure construction it is proposed that 24-hour coal production, processing and transportation would commence. This section of the report establishes noise criteria for the day, evening and night-time operations and assesses the consequent noise impact of the extended operating hours.

5.1 Operational Noise Criteria

The daytime noise criteria established in Section 4.1 are based upon formal application of the INP under the current acoustic environment which is dominated by noise from the Ulan Coal Mining Limited (UCML) surface facilities adjacent to Ulan village. UCML was recently granted approval for an extension of their operations and it is stated in the DoP assessment report that UCML proposes to undertake specific noise control measures in the coal handling and preparation area, under a noise reduction program negotiated with DEC, with the aim of achieving a level of 34 dB(A) in Ulan Village. DoP supported this approach and set a noise amenity criterion of 34 dB(A),$L_{eq(night)}$ in Ulan Village. Intrusive criteria of 35 dB(A),$L_{eq(15\ min)}$ (all times) are also shown in Schedule 3 of the UCML consent.

It is expected that the UCML noise mitigation works will be completed before 24-hour operations commence at MCP. Below is an assessment of the MCP noise criteria for residential receivers taking into consideration the assumption that Ulan Coal Mine will achieve its noise criterion of 35 dB(A),$L_{eq(15\ min)}$ in Ulan village.

Reducing the noise level from Ulan Coal Mine operations to 35 dB(A),L_{eq} in Ulan village represents a reduction of 7 dB from measured levels (see Table 3). Assuming that this level of noise reduction would also be experienced at other locations, **Table 11** shows estimates of the acoustic environment that would result at the receiver locations nominated in the current assessment. The amended background (L_{A90}) levels have been determined by assuming the minimum level of 30 dB(A) at all locations currently affected by Ulan Coal Mine noise except in Ulan Village where the ‘new’ background level is determined by subtracting 7 dB from the background noise levels shown in Table 3.

TABLE 11
Estimated industrial noise levels and Rating Background Levels (RBL) after completion of UCML noise reduction program.

Location	L_{Aeq} (industrial) , period			RBL (L_{A90}), period		
	Day	Evening	Night	Day	Evening	Night
R13 Renshaw	N/A	N/A	N/A	30	31	30
R25 Tuck-Lee	28	28	28	30	30	30
R36 Rayner	N/A	N/A	N/A	30	30	30
R157 Powers (Ulan)	35	35	35	35	34	33
R46A Flannery Centre	34	34	34	34	33	32
R49 "Olive Lea"	28	28	28	30	30	30
R26 Robinson	28	28	28	30	30	30
R169 "Primo Park"	27	27	27	30	30	30
R170 Roberts	26	26	26	30	30	30
R106 Reid	N/A	N/A	N/A	30	30	30

Assuming all residential receivers are 'rural' type and applying the procedure in section 4.1 above for setting amenity and intrusiveness criteria yields noise criteria as summarised in **Table 12**.

TABLE 12
Intrusiveness and amenity noise criteria for MCP resulting from reduction of UCML noise emissions.

Receiver/Location	Intrusiveness criterion, dB(A),$L_{eq(15\ min)}$			Amenity criterion, dB(A),$L_{eq(period)}$		
	Day	Evening	Night	Day	Evening	Night
R13 Renshaw	35	36	35	50	45	40
R25 Tuck-Lee	35	35	35	50	45	40
R36 Rayner	35	35	35	50	45	40
R157 Powers (Ulan)	40	39	38	50	45	38
R46A Flannery Centre	39	38	37	50	45	40
R49 "Olive Lea"	35	35	35	50	45	40
R26 Robinson	35	35	35	50	45	40
R169 "Primo Park"	35	35	35	50	45	40
R170 Roberts	35	35	35	50	45	40
R106 Reid	35	35	35	50	45	40

The MCP PSNL's for the above residential receivers are summarised in **Table 13**. The PSNL at all residential locations is the intrusive criterion ($L_{Aeq(15min)}$). Since the evening criterion is higher than the day criterion at *R13* (Renshaw), the day criterion has been adopted for the evening period.

TABLE 13
INP derived Project-specific noise levels for the Moolarben Coal Project.

Receiver/Location	Project-specific noise levels, dB(A),$L_{eq(15min)}$		
	Day	Evening	Night
R13 Renshaw	35	35	35
R12 M & J Transport	35	35	35
R25 Tuck-Lee	35	35	35
R157 Powers (Ulan)	40	39	38
R46A Flannery Centre	39	38	37
R49 "Olive Lea"	35	35	35
R26 Robinson	35	35	35
R169 "Primo Park"	35	35	35
R170 Roberts	35	35	35
R106 Reid	35	35	35
R5 Swords	35	35	35
R20 Williamson	35	35	35
R30 Cox "Moolarben"	35	35	35
R31 Cox "Barcoo"	35	35	35
R28 Chinner	35	35	35
R36 Rayner	35	35	35
R29A Mayberry	35	35	35
*R20*Mayberry "Croydon"	35	35	35
All other receivers	35	35	35

5.2 Noise Impact Assessment Procedure

The assessment of operational noise was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. All major noise producing items were modelled at their known (for stationary sources such as the rail load-out and surface facilities) or most exposed (for mobile sources such as dump trucks) 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 MCP were obtained from Spectrum Acoustics' extensive database of measured coal mining plant items. All data used were for machinery identical to that proposed for MCP (CAT 793/789 haul trucks, Hitachi EX 5500/2500 excavators, CAT D10/D11 dozers, coal load-out facility, diesel locomotives, etc.)

Sound power levels of operational noise sources used in the modelling are shown below in **Table 14**.

TABLE 14
Operational noise source sound power levels. These are 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}	
Loading empty coal wagons	101	116	3
3 x loco's idling on loop	105	111	3
Trucks at ROM hopper	115	125	3
Primary crusher	114	118	5
D11 dozer on dump	115	130	2
Overburden drill	114	116	1
O/B excavator (EX5500) and trucks	116	125	5
Coal excavator (EX 2500) and trucks	115	122	5
Overburden dump (per pit)*	115	125	3
Overburden haul (on slope)*	115	123	3
Overburden haul (on flat)*	113	121	3
Coal haul (from pit to processing area)*	111	120	3
Transfer station	115	118	5
Coal washery	116	118	10
Conveyors (per 100m)	76	N/A	2-10
Stacker/reclaimers (each)	105	N/A	10

* All sources involving trucks assume 8-10 truck pass-bys per 15 minute period and were calculated from maximum pass-by levels. Haulage sources placed at approximately 500m intervals on haul routes.

5.2.2 Modelled Scenarios

Noise modelling was conducted for the following atmospheric conditions:

- *Daytime lapse* – Air temperature 20^0C, 70% relative humidity (RH), no wind, -1^oC/100m vertical temperature gradient (boundary layer adiabatic lapse);
- *Inversion* – Air temperature 5^0C, 70% R.H., $+3^o$C/100m vertical temperature gradient with 2m/s drainage flow[1];
- *Prevailing wind (summer)* – Air temperature 20^0C, 70% R.H., 3m/s wind from ENE; and
- *Prevailing wind (winter)* – Air temperature 20^0C, 70% R.H., 3m/s wind from SW.

[1] NE drainage flow for Pit 1 Ulan village and SE drainage flow for Pits 2 and 3.

These are the same conditions as modelled in the assessment of construction noise levels, with the addition of inversion conditions during the night time in winter.

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

1) YEAR 1[2]: Pit 1 (with bund)**:** Same as the construction noise scenario except the western edge of OOP1 has been formed to a height of 15m above natural ground level as an environmental bund and overburden emplacement is occurring behind this bund. Excavators are modelled at 20m below natural ground surface level with an additional excavator working on coal extraction and CAT 789 trucks hauling coal to the ROM hopper. Coal transfer, processing and rail facility are in full operation. Noise sources for this scenario are shown in **Figure 6** in **Appendix A**..

2) YEAR 2: Pit 1 (continuing)**:** As (1) above except mining has advance further into Pit 1 and further overburden emplacement is occurring at 15m above natural ground level (ie, behind the acoustic bund but at the same height). Haul road to OOP1 is behind existing bund.

3) YEAR 6a: Pit 2 (start)**:** Commencement of mining at northern end of Pit 2 after completion of Pit 1. Pit 2 emplacement (OOP2) commences at natural ground level with no screening. Mining noise sources for this scenario are shown in **Figure 7** in **Appendix A**.. Coal transport and handling sources are as shown in Figure 6.

4) YEAR 6b: Pit 2 (continuing)**:** Same as above scenario (3) except OOP2 has been completed west of current mining area to a height of 15m during a 4-6 month period. Further overburden emplacement is occurring behind this bund.

5) YEAR 8: Pit 3 (north)**:** Commencement of mining at the northern end of Pit 3 nearest to the most exposed receivers. Pit 2 is nearing completion at its southern end. Coal haulage is behind the continuous acoustic bunds, OOP1 and OOP2 formed during operations in Pits 1 and 2. Noise sources for this scenario are shown in **Figure** 8. Sources for the northern and of the coal haul route and surface infrastructure are as shown in Figures 6 and 7.

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[2] First year of mining in Pit 1 after the initial 12 month construction period.

6) YEAR 10: Pit 3 (south): Mining at the southern end of Pit 3. Sources for the northern end of the coal haul route and surface infrastructure are as shown in Figure 6.

Tables 16-21 show predicted noise levels for the four assessed meteorological conditions. These predictions apply to times of day as summarised in **Table 15**.

TABLE 15
Applicable times for predicted noise levels.

Met Condition	Applicable time(s) for predicted noise levels
Lapse	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)

5.3 Scenario 1: Year 1 (Pit 1, with bund)

After the initial 12 month period, coal extraction and further mining operations would continue at the south-western end of Pit 1. The western edge of the OOP1 would have been completed to 15m above natural ground level and the coal haulage (via CAT 789 trucks), transfer, processing and loading activities would be operational.

5.3.1 Predicted Operational Noise Levels

Predicted noise levels when dumping behind the 15m western edge of the OOP1 (with haul road also behind the bund) are summarised in **Table 16**. All exceedances of the most stringent (night time) criteria are shaded grey and major (5 dB or more) exceedances are shown in bold type. Noise contours for this scenario are shown in **Figures 13 to 16** in Appendix A.

TABLE 16
Predicted Year 1 (Pit 1) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is behind the completed 15m western edge of OOP1.

Receiver	Description	Lapse	ENE wind	SW wind	Inversion	PSNL*		
						D	E	N
2	S.E. Birt & K.M. Hayes	<25	<25	<25	30	35	35	35
8	C.N. & H.L. Davies	<25	<25	<25	25	35	35	35
46G	UCML (Mitchell)	<25	<25	25	26	35	35	35
16	D.J. Little & A.K. Salter	<25	<25	25	25	35	35	35
7	Wallis	<25	30	<25	31	35	35	35
13	P.F. Renshaw	25	25	35	38	35	35	35
12	M. & J. Transport	26	27	37	40	35	35	35
157	Ulan (residences)	28	37	29	38	40	39	38
160A	Ulan School	28	37	29	38	50	50	50
168	Ulan Church	28	37	29	38	50	50	50
46A	Flannery Centre	28	38	29	39	39	38	37
169	“Primo Park”	<25	35	<25	35	35	35	35
49	“Olive Lea”	25	38	<25	38	35	35	35
26	G.F. Robinson	25	38	<25	38	35	35	35
25	G.G. Tuck-Lee	31	40	30	40	35	35	35
5	M. & P. Swords	<25	36	<25	37	35	35	35
20	A.J. & N.N. Williamson	25	38	<25	38	35	35	35

41A	P.P. Libertis	<25	35	<25	35	35	35	35
170	T. Roberts	<25	29	<25	28	35	35	35
58	M.L & J.L Bevege	<25	32	<25	32	35	35	35
All other		<< 35				35	35	35

* Project Specific Noise Levels (dB(A),$L_{eq(15min)}$) for day (D), evening (E) and night (N).

5.3.2 Recommendations

The predicted noise level of 40 dB(A) at *R12* (M&J Transport) is mainly attributed to coal trains on the MCP site. It may not be economically feasible to construct a suitable acoustic barrier to mitigate this exceedance and this receiver would be in a noise affectation zone, along with *R25* (Tuck-Lee) which was identified as significantly impacted in the previous section.

Criterion exceedances of 1 – 3 dB have been predicted at *R46A* (The Flannery Centre), *R49* (“Olive Lea”), *R26* (Robinson), *R5* (Swords) and *R20* (Williamson) suggesting that noise emissions should be managed to minimise impacts at these locations. As with the bund construction scenario considered in the previous section, overburden dumping was modelled at a location approximately 1200m north of the Pit 1 extraction area. A more southerly dumping area (nearer to the Pit) could be utilised during ENE wind conditions and inversions to reduce noise levels at *R46A* (The Flannery Centre), *R49* (“Olive Lea”) and *R26* (Robinson) by approximately 3 dB. Alternatively, an in-pit dumping location could be made available to further reduce noise emissions. The exact details of this management process would be assessed and documented in the Noise Management Plan (NMP).

It is recommended at this stage that the 1-3 dB exceedances in Table 16 could be mitigated by allowing for multiple dump sites and it is not proposed that the predicted levels should be adopted as the noise criteria in preference to the (lower) PSNL’s. If noise management procedures are not successful for unforseen reasons, then a best practice approach of targeted investigation and engineered noise reduction of specific plant items would be initiated or MCMPL would enter into a negotiated agreement with the impacted receiver.

5.4 Scenario 2: Year 2 (Pit 1 continued)

This scenario is approximately the same as the construction noise scenario considered in the previous section, except that mining has progressed deeper into the pit and it would be necessary at times for dump trucks to operate at the height of the 15m acoustic bund when placing overburden behind it. This could be done with a haul road behind the bund and only a short spur rising to the top of the bund.

5.4.1 Predicted Noise Levels

Table 17 shows predicted noise levels and compares them with the PSNL's. All modelled exceedances during the critical night-time period are shaded grey, with major (5 dB or more) exceedances in bold type.

TABLE 17

Predicted Year 2 (Pit 1) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is behind, but at the same height as, the western edge of OOP1.

Receiver	Description	Lapse	ENE wind	SW wind	Inversion	PSNL		
						D	E	N
2	S.E. Birt & K.M. Hayes	<25	<25	<25	31	35	35	35
8	C.N. & H.L. Davies	<25	<25	<25	25	35	35	35
46G	UCML (Mitchell)	<25	<25	25	26	35	35	35
16	D.J. Little & A.K. Salter	<25	<25	25	29	35	35	35
7	Wallis	<25	30	<25	31	35	35	35
13	P.F. Renshaw	25	25	35	35	35	35	35
12	M. & J. Transport	Noise affectation zone – rail loop				35	35	35
157	Ulan (residences)	35	39	35	44	40	39	38
46A	Flannery Centre	35	40	34	45	39	38	37
169	"Primo Park"	25	33	25	40	35	35	35
49	"Olive Lea"	30	36	28	43	35	35	35
26	G.F. Robinson	30	36	28	43	35	35	35
25	G.G. Tuck-Lee	Noise affectation zone – Pit 1				35	35	35
5	M. & P. Swords	<25	33	<25	40	35	35	35
20	A.J. & N.N. Williamson	25	36	<25	40	35	35	35
41A	P.P. Libertis	<25	32	<25	37	35	35	35
170	T. Roberts	<25	25	<25	30	35	35	35
58	M.L & J.L Bevege	<25	29	<25	35	35	35	35
All other receivers		<< 35				35	35	35

5.4.2 Recommendations

Under all modelled conditions except inversions, Table 15 suggests that high level overburden emplacement may occur on OOP1 without creating more than a 1 dB noise criterion exceedance at *R49* ("Olive Lea"), *R26* (Robinson) and *R20* (Williamson) and in Ulan village, and a 3 dB exceedance at *R46A* (The Flannery Centre) during the critical night time period. Again, these predicted levels are for a dumping location nearest to the receivers.

The NMP will formally require low level (behind the bund or in-pit) dumping locations, and the high level areas will only to be utilised when there is no temperature inversion present or ENE wind (subject to confirmation by attended noise monitoring). In this way, OOP1 could be completed without producing exceedances of the PSNL's. After Year 2, Pit 1 will have advanced further to the east, OOP1 eill have been completed and noise emissions at the most impacted receivers will reduce.

5.4.3 Sleep Disturbance

The ENCM (Ch. 19) advises that sleep may be disturbed if maximum noise levels (taken as an $L_{A1(1\ min)}$ but conservatively assessed as L_{max}) exceed the night time background noise level by 15 dB or more. Since the night-time PSNL's in Table 16 above are equal to (background + 5 dB), the sleep disturbance assessment criteria are 10 dB above these values.

Typical mining sources (and maximum sound power levels) that may potentially disturb sleep include dozer tracks (130 dB(A)), coal trucks under full load (123 dB(A)), rock impacts from shovels loading trucks (125 dB(A)), impacts within rotary breaker (118 dB(A)) and reverse alarms (115 dB(A)). Since reverse alarms are tonal and a well known offensive noise source within the mining industry, all mobile plant will be fitted with suitable broad-band alarms.

The assessment in the previous sections has established that night-time operations would be required under the NMP to occur behind the pre-established acoustic bund under inversion (worst case) conditions. With dumping on OOP1 occurring behind (but at the same height as) the bund the highest predicted noise levels in Table 17 are 40 dB(A),$L_{eq(15\ min)}$ at *R46A* (The Flannery Centre) and 39 dB(A),$L_{eq(15\ min)}$ at residences in Ulan village under an ENE wind.

Taking Ulan village as an example, the contributions from significant sources to the predicted level of 39 dB(A) are summarised below.

Source	dB(A),L_{eq}
Dump	33.7
Shovel 1 and trucks	32.4
Drill	32.0
Overburden haul on flat (behind bund)	30.2
Dozer on dump	29.0
Coal haulage	28.8
Shovel 2 and trucks	26.2
TOTAL	39.3

Maximum noise levels in Ulan village are conservatively estimated by adding the difference between source L_{Aeq} and L_{max} sound power levels in Table 14 to the predicted contributions shown above as follows:

Source	dB(A),L_{max}
Dump	43.7
Shovel 1 and trucks	41.4
Drill	34.0
Overburden haul on flat (behind bund)	38.2

Dozer on dump	44.0
Coal haulage	38.8
Shovel 2 and trucks	35.2

Since short term impacts rarely occur simultaneously, the predicted worst case impact noise level within Ulan village is 44 dB(A),L_{max} from dozer tracks which is less than the criterion of 48 dB(A),$L_{1(1\ min)}$. This maximum estimated level is also below the 45 dB(A) criterion at locations further from Ulan Coal Mine.

The NMP will address potential sleep disturbance issues by limiting the operation of dozers at high level locations under adverse conditions when 24 hour operations commence.

5.5 Scenarios 3 & 4: Year 6 (Start Pit 2)

At the start of Year 6 mining will commence at the northern end of Pit 2. In this scenario, overburden would initially be placed in an exposed location along the western edge of OOP2. Locations identified in the previous section as significantly noise impacted have not been included in the Pit 2 scenarios.

5.5.1 Predicted Noise Levels

Predicted noise levels at potentially affected receivers are summarised in **Table 18**. All PSNL exceedances are shaded grey, with major (5 dB or more) exceedances in bold type. Noise contours for ENE wind conditions are shown in **Figure 17** in Appendix A.

TABLE 18
Predicted Year 6 (Start Pit 2) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is at ground level at the western edge of OOP2.

Rec. #	Description	Lapse	ENE wind	SW wind	Inversion	PSNL		
						D	E	N
2	S.E. Birt & K.M. Hayes	<20	<20	30	<20	35	35	35
8	C.N. & H.L. Davies	<20	<20	35	23	35	35	35
46G	UCML	<20	<20	25	25	35	35	35
16	D.J. Little & A.K. Salter	<20	<20	30	24	35	35	35
7	Wallis	27	28	34	30	35	35	35
13	P.F. Renshaw	25	24	41	32	35	35	35
157	Ulan Village	28	35	28	40	40	39	38
46A	Flannery Centre	28	36	28	40	39	38	37
169	"Primo Park"	25	35	25	36	35	35	35
49	"Olive Lea"	29	37	27	39	35	35	35
26	G.F. Robinson	29	37	27	39	35	35	35
5	M. & P. Swords	35	42	35	40	35	35	35
20	A.J. & N.N. Williamson	35	43	35	43	35	35	35
41A	P.P. Libertis	30	36	28	36	35	35	35
170	T. Roberts	20	30	<20	30	35	35	35
58	M.L & J.L Bevege	25	35	25	35	35	35	35
30	R Cox "Moolarben"	<30	<30	<30	<30	35	35	35
28	D Chinner	<30	<30	<30	<30	35	35	35
31	M Cox "Barcoo"	<30	<30	<30	<30	35	35	35
36	D & Y Rayner	<30	<30	<30	<30	35	35	35
29B	Mayberry	<30	<30	<30	<30	35	35	35

29A	Mayberry "Croydon"	<30	<30	<30	<30	35	35	35
47	Herbert	<30	<30	<30	<30	35	35	35
32	D. & J. Stokes	<30	<30	<30	<30	35	35	35
All other receivers		<<35				35	35	35

Another Pit 2 scenario was run in which overburden emplacement was located behind a 10m emplacement (ie western edge of OOP2) formed during the first few months of mining in Pit 2. This scenario was generated to determine the effectiveness of OOP2 as an acoustic bund at locations that showed major exceedances of the PSNL's in Table 18.

Predicted noise levels under this additional scenario are summarised in **Table 19**. Noise contours for this additional scenario under ENE wind conditions are shown in **Figure 18** in Appendix A. All criterion exceedances are shaded grey, with major (5 dB or more) exceedances in bold type.

TABLE 19
Predicted Year 6 (Pit 2) noise levels, dB(A),$L_{eq(15min)}$. Dumping of overburden is behind the 10m high OOP2 formed in the first months of mining in Pit 2.

Rec. #	Description	Lapse	ENE wind	SW wind	Inversion	PSNL		
						D	E	N
2	S.E. Birt & K.M. Hayes	<20	<20	30	<20	35	35	35
8	C.N. & H.L. Davies	<20	<20	35	23	35	35	35
46G	UCML	<20	<20	25	25	35	35	35
16	D.J. Little & A.K. Salter	<20	<20	30	24	35	35	35
7	Wallis	27	28	34	29	35	35	35
13	P.F. Renshaw	25	23	41	32	35	35	35
157	Ulan Village	28	34	28	38	40	39	38
46A	Flannery Centre	28	35	28	37	39	38	37
169	"Primo Park"	24	30	23	35	35	35	35
49	"Olive Lea"	26	35	25	36	35	35	35
26	G.F. Robinson	26	35	25	36	35	35	35
5	M. & P. Swords	28	39	29	30	35	35	35
20	A.J. & N.N. Williamson	26	37	25	34	35	35	35
41A	P.P. Libertis	22	35	21	33	35	35	35
170	T. Roberts	<20	27	<20	24	35	35	35
58	M.L & J.L Bevege	21	32	20	30	35	35	35
30	R Cox "Moolarben"	<30	<30	<30	<30	35	35	35
28	D Chinner	<30	<30	<30	<30	35	35	35
31	M Cox "Barcoo"	<30	<30	<30	<30	35	35	35
36	D & Y Rayner	<30	<30	<30	<30	35	35	35
29B	Mayberry	<30	<30	<30	<30	35	35	35
29A	Mayberry "Croydon"	<30	<30	<30	<30	35	35	35
47	Herbert	<30	<30	<30	<30	35	35	35
32	D. & J. Stokes	<30	<30	<30	<30	35	35	35
All other receivers		<<35				35	35	35

5.5.2 Recommendations

A comparison of the results in Tables 18 and 19 shows that utilising the western edge of OOP2 as an acoustic bund, after its formation during the first few months of mining in Pit 2, would reduce the major exceedances at *R5* (Swords) and *R20* (Williamson) to minor/moderate exceedances under ENE wind conditions. The major exceedances at these locations would be reduced to compliant levels under the modelled temperature inversion conditions.

Since OOP2 would be formed in a narrow strip running from northwest to southeast as Pit 2 progresses to the southeast, there may be limited opportunity to establish two emplacement sites – one "protected" and one "exposed" from the point of view of *R5* (Swords) and *R20* (Williamson). This would mean that overburden emplacement in exposed locations would occur regularly on OOP2 and the noise levels shown in Table 16 at *R5* (Swords) and *R20* (Williamson) would be difficult to avoid. For this reason, it is considered that these two locations would be in the Pit 2 noise affectation zone.

Noise from Pit 2 would add to rail loop noise at *R13* (Renshaw) placing this residence in the Rail loop/Pit2 noise affectation zone.

Only very minor (1 dB) exceedances would remain at *R49* ("Olive Lea") and *R26* (Robinson) under temperature inversion conditions, with OOP2 progressing to the southeast and thereby providing an acoustic barrier from the point of view of these receivers. Worst case mining noise levels at these two receivers would reduce as Pit 2 progresses to the south.

5.6 Scenarios 5 & 6: Years 8-10 (Pit 3)

Mining at the north western end of Pit 3 would commence approximately at the start of Year 8. Mining at the southern end of Pit 2 would be nearing completion at this time. The coal haul road from Pit 2 would be east of the completed OOP2 and a 7m bund would be constructed along the section of coal haul road between Pits 2 and 3.

5.6.1 Predicted Noise Levels

Predicted noise levels at potentially affected receivers in Year 8 (commencement of Pit 3) are summarised in **Table 20**. Noise contours for temperature inversion conditions are shown in **Figure 19**, Appendix A.

TABLE 20

Predicted Year 8 (Start Pit 3) noise levels, dB(A),$L_{eq(15min)}$.

Rec. #	Description	Lapse	ENE wind	SW wind	Inversion	Criterion*
5	M. & P. Swords	30	38	30	40	35
20	A.J. & N.N. Williamson	27	35	25	36	35
41A	P.P. Libertis	23	32	22	35	35
170	T. Roberts	20	29	<20	30	35
58	M.L & J.L Bevege	22	31	20	33	35
171	Railway Museum	<20	22	<20	22	35
106	T.B & J.H. Reid	<20	27	<20	28	35
41B	P. Libertis	<20	28	<20	29	35
30	R Cox "Moolarben"	23	36	20	37	35
28	D Chinner	23	36	20	35	35
31	M Cox "Barcoo"	20	30	<20	25	35
36	D & Y Rayner	29	36	27	40	35

29B	Mayberry	25	25	25	26	35
29A	Mayberry "Croydon"	23	23	28	25	35
47	Herbert	<20	30	<20	23	35
32	D. & J. Stokes	<20	20	<20	20	35

* The 35 dB(A) criterion applies day, evening and night at all locations.

Noise level predictions for Year 10 (end of Pit 3) are summarised in **Table 21**. All modelled exceedances of the PSNL's are shaded grey, with major (5 dB or more) exceedances in bold type. Noise contours for temperature inversion conditions are shown in **Figure 20** in Appendix A.

TABLE 21
Predicted Year 10 (End Pit 3) noise levels, dB(A),$L_{eq(15min)}$.

Rec. #	Description	Lapse	ENE wind	SW wind	Inversion	Criteria
5	M. & P. Swords	30	35	29	39	35
20	A.J. & N.N. Williamson	26	35	25	35	35
41A	P.P. Libertis	22	31	21	34	35
170	T. Roberts	<20	26	<20	29	35
58	M.L & J.L Bevege	21	30	20	31	35
171	Railway Museum	<20	20	<20	20	35
106	T.B & J.H. Reid	<20	26	<20	26	35
41B	P. Libertis	<20	26	<20	26	35
30	R Cox "Moolarben"	<20	32	<20	35	35
28	D Chinner	<20	34	<20	35	35
31	M Cox "Barcoo"	<20	29	<20	35	35
36	D & Y Rayner	25	30	24	30	35
29B	Mayberry	52	55	50	>55	35
29A	Mayberry "Croydon"	50	46	55	55	35
47	Herbert	<20	30	<20	25	35
32	D. & J. Stokes	20	25	20	25	35

5.6.2 Recommendations

Receivers *R29A* (Mayberry) and *R29B* (Mayberry) are in the "affectation zone" for Pit 3 operations with noise levels expected to exceed the 35 dB(A) criterion by more than 5 dB at around Year 9. It is understood that negotiations with both landowners have commenced.

Receiver *R36* (Rayner) may receive noise levels up to 5 dB above the criterion at the commencement of Pit 3 under inversion conditions. No significant exceedances are predicted at this location under all other atmospheric conditions. Since Pit 3 would advance quickly to the southeast, increased distance and a natural hill would act to greatly reduce noise levels at this location. The predicted criterion exceedances would be of relatively short duration with compliant levels expected within a few months of commencing Pit 3. MCMPL would be required to negotiate with the landowner at *R36* (Rayner).

Worst case noise levels at *R20* (Williamson), *R30* (R Cox) and *R28* (Chinner) are predicted to be only 1-2 dB above the criterion. Again, noise levels at these locations would reduce to compliant levels over a short period of time as Pit 3 progresses to the south east. It is recommended that the 35 dB(A) criterion be applied at these locations, with an allowance for up to 2 dB exceedances under worst case meteorological conditions during the first 6 months of mining in Pit 3.

Receiver *R5* (Swords) would be in the Pit 3 noise "affectation zone". It has been found earlier in this report that this location would fall into the Pit 2 noise "affectation zone" well before commencement of mining in Pit 3. Receiver *R20* (Williamson) was also identified as significantly impacted in the assessment of Pit 2.

5.7 Cumulative Mining Noise Impacts

Cumulative noise impacts with existing and possible future (reduced) noise emissions from Ulan Coal Mine have been addressed earlier in this report in the establishment of amenity criteria. Noise criteria for the initial six month period of environmental bund establishment and further 12 months of surface facilities construction were relative to the existing daytime noise emissions from Ulan Coal Mine. Noise criteria for 24-hour mining operations at MCP were based on the completion of a noise reduction program by Ulan Coal Mine.

Reference to the Wilpinjong EIS shows the only residences that could potentially be affected by mine noise from both Wilpinjong and MCP are east of the project site (locations *R2* (Hayes), *R8* (Davies), *R7* (Wallis), *R16* (Little & Salter), *R46C* (UCML, unoccupied), *R13* (Renshaw) and *R46G* (UCML, Mitchell)). It is noted that these locations are all west of the Wilpinjong Mine site and the worst case noise levels at these locations reported for any operational scenario in the Wilpinjong EIS were under easterly wind conditions. Under these conditions, the noise levels predicted in the current assessment are generally less than 20 dB(A) and up to 25 dB(A),$L_{eq\ (15\ min)}$ at *R13* (Renshaw) only. Noise levels from Ulan Coal Mine at these locations under an easterly wind would be even lower.

Similarly, the worst case noise predictions from MCP are under winds from the southwest with levels approaching (and equalling) the 35 dB(A) criterion at locations *R8* (Davies) and *R46C* (UCML, unoccupied). These predicted maximum levels coincide with mining near the northern end of Pit 2 where a saddle in the topography provides a low point between these receivers and Pit 2. Under all operational scenarios presented in the Wilpinjong EIS noise levels were below 20 dB(A) at these receivers under the modelled WNW wind.

Under both worst case scenarios (winds generally from the east for Wilpinjong and from the west for MCP) there is little potential for cumulative mining noise impacts at any receivers.

6.0 OFF-SITE RAIL TRAFFIC

6.1 Train Noise and Vibration Criteria

6.1.1 Train Noise Criteria – MCP

The operation of MCP will result in additional train movements to the east on the Gulgong – Sandy Hollow Rail Line between the site and Muswellbrook and to the west between the site and Lithgow. There will be a corresponding increase in noise exposure at residences along the train line with the section between the site and Muswellbrook bearing the greater proportion of existing and proposed train movements.

Chapter 163 of the DEC *Environmental Noise Control Manual* (ENCM) specifies limits on train noise levels as follows:

Descriptor	Planning Levels	Maximum Levels
Leq, 24 hour	55dB(A)	60dB(A)
Lmax	80dB(A)	85dB(A)

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

6.1.2 Train Noise Criteria – Cumulative

The Australian Rail Track Corporation (ARTC) operates the Gulgong-Sandy Hollow and Main Northern railways. ARTC's 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 Gulgong-Sandy Hollow and Main Northern railways are 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
Leq, (15 hour), day	65dB(A)
Leq, (9 hour), night	60dB(A)
Lmax (24 hour)	85dB(A)

These criteria will be considered here in the assessment of cumulative train noise levels as a result of the MCP.

6.1.3 Train Vibration Levels

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

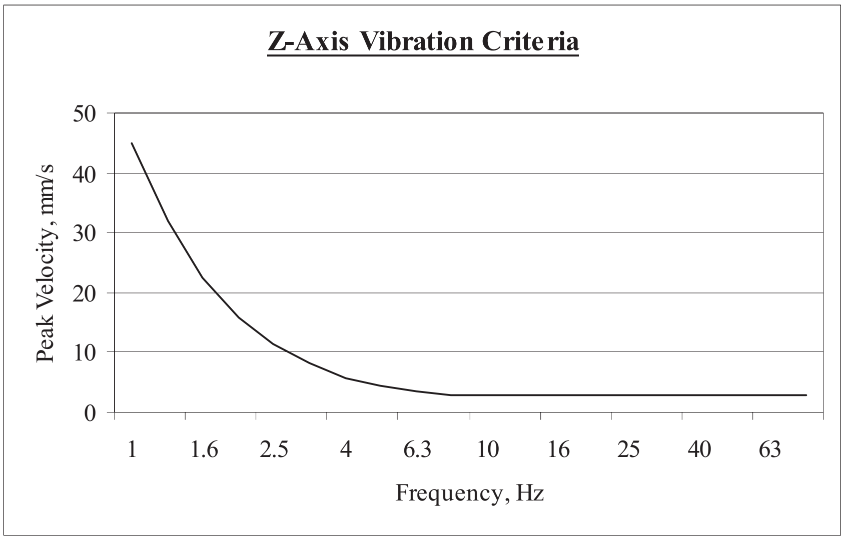
DEC limits are for vibration in buildings, and relate to personal comfort and not structural integrity of the building. **Table 22** shows the applicable multiplying factors, taken from Table B1.1 of the AVTG, which are applied to the base vibration velocity curves in Figures B1.3 and B1.4 of the guideline.

TABLE 22
DEC vertical axis vibration (acceleration) criteria - multiplying factors.

Area, Time	Continuous	Intermittent / Impulsive
Residential - Day	2 -4	60 - 90
Residential - Night	1.4	20

Figure 21 displays the Z-axis (vertical) vibration criteria (expressed in vibration velocity, mm/s) based on an intermittent vibration source in a residential area during night-time hours.

FIGURE 21
Night time criteria for vertical vibration velocity, due to passing coal trains.



As train-induced ground vibrations typically comprise frequencies greater than 10Hz, and the vertical vibration criteria are more stringent than the horizontal vibration criteria, a maximum allowable vertical vibration velocity of 2.82mm/s applies.

6.2 Train Noise Impact Assessment

The Wilpinjong EIS considered noise impacts from existing and consented freight trains (including coal trains from Ulan Coal mine) travelling east from the site as well as the cumulative levels including proposed trains from Wilpinjong. Results are summarised in Table 37 of the Wilpinjong Noise and Blasting Impact Assessment (WNBIS) conducted by Richard Heggie Associates (RHA, 2005).

Based on a rail haulage volume of 9.7 Mtpa, the WNBIS gives the projected numbers of trains from Wilpinjong as four 1542m trains per day on average and up to six per day during peak periods. Up to 3.85 trains per day (ie approximately four) would be required to haul MCP coal.

Subtracting the predicted day and night time existing / consented L_{Aeq} train noise levels from the predicted cumulative levels given in the WNBIS provides a good estimate of the predicted contribution from Wilpinjong trains alone. These values are summarised in **Table 23** below.

TABLE 23
Predicted noise levels from Wilpinjong coal trains (source RHA, 2005).

Distance to receiver	Daytime (Wilpinjong trains only)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	58	58	85
60 m	55	55	81
90 m	53	54	78
Distance to receiver	Night time (Wilpinjong trains only)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	57	58	85
60 m	54	55	81
90 m	52	53	78

Since the product coal tonnages and calculated train numbers (ie four 1542m trains per day) for Wilpinjong and MCP are almost identical, the calculated train noise levels for both mines will be equal. Based on the results in Table 23 the predicted noise levels from MCP trains (all considered to be travelling east from the site) are summarised in **Table 24**.

TABLE 24
Predicted noise levels from MCP based on 10 Mtpa product coal volume.

Distance to receiver	Daytime (Moolarben trains only)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	58	58	85
60 m	55	55	81
90 m	53	54	78
Distance to receiver	Night time (Moolarben trains only)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	57	58	85
60 m	54	55	81

90 m	52	53	78

Predicted cumulative train noise levels as presented in the WNBIS (Table 37) are reproduced below in **Table 25**.

TABLE 25

Predicted cumulative train noise levels in WNBIS (RHA, 2005).

Distance to receiver	Daytime (existing/consented trains + Wilpinjong trains)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	65	65	85
60 m	62	62	81
90 m	60	61	78
Distance to receiver	Night time (existing/consented trains + Wilpinjong trains)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	64	65	85
60 m	61	65	81
90 m	59	60	78

It is noted below Table 36 in the WNBIS that the cumulative train noise calculations included existing Ulan Mine trains and two consented trains (650m long) per day from “Ulan Stage 2”, referring to Underground Mine No 4, which was granted approval in 1985. This approved underground mine is now included as part of the MCP, so almost one-quarter of MCP’s projected number of train movements have already been included in the Wilpinjong cumulative train noise assessment.

Specifically, the WNBIS included one 650m train (two movements) during both the day and the night, whereas the total estimated average number of train movements from MCP for 10Mtpa product coal is approximately three 1500m trains (six movements) during the day and one train at night. The WNBIS, therefore, already includes train movements that are equal to 42% of the MCP trains at night (ie, (1x650m)/(1x1500m) = 0.42) and 14% of the MCP daytime trains (ie, (1X650m)/(3x1500m) = 0.14).

The total cumulative *daytime* train noise level may be calculated by subtracting 0.7 dB from daytime L_{Aeq} values in Table 24 (ie assuming 14% of MCP coal trains during the day have been accounted for in the WNBIS) and logarithmically adding these to the daytime values in Table 25.

Similarly, the total cumulative night time train noise level may be calculated by subtracting 2.4 dB from night time L_{Aeq} values in Table 24 (ie assuming 42% of MCP trains during the night have been accounted for in the WNBIS) and logarithmically adding these to the night time values in Table 25. These calculations are summarised in **Table 26** below.

TABLE 26

Predicted cumulative train noise levels including projected train numbers from MCP.

Distance to	Daytime (existing/consented* trains + Moolarben trains)		
	Average	Peak	Passby

receiver	$L_{Aeq(15\ hour)}$	$L_{Aeq(15\ hour)}$	L_{Amax}
30 m	66	66	85
60 m	63	63	81
90 m	61	62	78
Distance to receiver	Night time (existing/consented* trains + Moolarben)		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	64	65	85
60 m	61	65	81
90 m	59	60	78

* These now include Wilpinjong trains as the project has been approved.

6.3 Discussion of Train Noise Impacts

Comparison of Tables 25 and 26 shows that the introduction of four 1500m trains per day from MCP would increase the cumulative rail noise level presented in the WNBIS by 1dB during the day with no significant increase during the night.

The "set-back" distances at which the noise criteria are met for trains travelling on the Gulgong – Sandy Hollow Railway between the project site and Muswellbrook would not change from those presented in the WNBIS, since the limiting factor was (and still would be) night time L_{Aeq} noise levels.

6.3.1 DEC Train Noise Criteria – East of site

As discussed in Section 5.1.1 the DEC train noise criteria (Planning Levels) applicable to trains from MCP alone are:

Descriptor	Planning Levels	Maximum Levels
$L_{eq\ (24\ hour)}$	55dB(A)	60dB(A)
L_{max}	80dB(A)	85dB(A)

Reference to Table 24 shows that the "set-back" distance to achieve these criteria would be 70m, governed by the maximum passby level and not the L_{Aeq} level. That is, the L_{Aeq} level would be achieved at approximately 60 m, whereas the L_{Amax} level of 80 dB(A) would be met at approximately 70 m.

6.3.2 ARTC Train Noise Goals – East of site

The ARTC train noise goals in EPL 3142 appear to be guided by the "Maximum" rather than the "Planning" levels recommended by DEC. These levels are reproduced below and will be assessed against the cumulative noise levels shown in Table 26.

Descriptor	Design Goal
Leq, (15 hour), day	65dB(A)
Leq, (9 hour), night	60dB(A)

Lmax (24 hour) 85dB(A)

In this case, the set-back distances would be determined by the L_{Aeq} levels rather than L_{Amax} levels. The L_{Amax} level of 85 dB(A) would be achieved at 30 m, whereas the day and night L_{Aeq} set-back distances would be 40 m and 70 m respectively.

In summary, the set-back distance for MCP trains travelling to Muswellbrook would be 70 m and is governed by L_{Amax} levels relative to the DEC criteria. The setback distance for cumulative train noise levels is also 70 m, governed by night time L_{Aeq} levels relative to the ARTC noise goals.

6.3.3 ARTC Train Noise Goals – West of site

As a worst case, it will be assumed that all coal trains from MCP may travel west to the Mount Piper and Wallerawang power stations near Lithgow. Under these conditions, the DEC set-back distance of 70 m remains. The set-back distance to achieve the ARTC noise goal reduces to 30 m. Both noise limit objectives are governed by L_{Amax} levels. It is considered that the ARTC noise goals would be the governing condition on this section of the rail line.

6.4 Potentially Affected Receivers

An aerial survey of the train line between Muswellbrook and Lithgow (approximately 350 km) was conducted via helicopter in April 2006. All residences within approximately 200 m of the rail line were located using a Global Positioning System (GPS) and later transposed to locations on 1:25000 scale topographic maps. Photographs and videos were also taken to identify these residences and verify distances from the rail line. Receivers have been defined as potentially affected based on the ARTC set-back distances.

6.4.1 Receivers East of site

Twenty-two residences were identified as being within 70 m of the rail line between the site and Muswellbrook. Most of these are in the town of Denman with the remaining residences being in rural areas.

6.4.2 Receivers West of site

Sixteen residences were identified as being within 30 m of the rail line between the site and Lithgow. These mainly include residences in Mudgee, Kandos, Portland, Wallerawang and Rylstone. Two rural residences were identified within the 30 m set-back distance.

The rail line is in cut near many of the residences in towns and some of the rural residences. As a result received maximum noise levels may be considerably lower than 85 dB(A) at 30 m. L_{Aeq} levels at these residences will also be lower than predicted in the above Tables.

Approximately 175 residences were identified as being within the 70 m set-back distance to achieve the more stringent DEC recommended targets for train noise. It is acknowledged that the responsibility for managing noise from off-site train movements rests with ARTC and not MCP.

7.0 OFF-SITE ROAD TRAFFIC

A Traffic Impact Assessment (TIA) for the project has been prepared by Sinclair Knight Merz (SKM). Results from that assessment have been used to estimate the potential for road traffic noise impacts.

The TIA assumed that all mine workers will live in Mudgee and Gulgong. While most heavy vehicles delivering goods to the site are expected to use Ulan Road (MR 214), an estimated 25% of employee vehicles will travel on Cope Road (MR 598) which links the site with Gulgong and passes through Ulan village. The increased traffic numbers through Ulan village around shift changes is considered to represent the greatest potential for traffic noise impacts from the project.

Only a very minor proportional increase in daytime traffic on Ulan Road is expected due to site delivery vehicles and the additional noise from this minor increase has not been assessed.

7.1 Traffic Noise Criteria

Noise criteria for the generation of additional traffic on public roads were sourced from the DEC *Environmental Criteria for Road Traffic Noise* (ECRTN). Considering MR214 and MR 598 as collector roads, the ECRTN criteria are as follows:

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

Since these are 1-hour criteria, they will be applied to shift changes as the worst case for maximum traffic noise impacts.

7.2 Assessment Methodology

Off-site vehicle movements 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 assessment 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 main parameters considered in the traffic noise assessment are

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

The facade of the nearest residence to MR 598 in Ulan village is assumed to be 20 m from the centre of the road, at which distance the maximum noise level (L_{max}) from a passing light vehicle is approximately 65 dB(A) at town speed (60 km/h). The TIA estimates the maximum hourly traffic load of up to 190 vehicles would occur around the morning shift change at 7 am. Of these approximately 25% (or 48 vehicles) may pass through Ulan village in a 1-hour period and, therefore, n = 48 and T = 60.

The duration per vehicle, τ, is calculated from the distance between source and receiver, D, and the vehicle speed, v, by $\tau = 0.1D/v$. Substituting values gives τ = 0.12 min (7 s). A value of 10 s was used in the calculation to allow for slower speeds at corners.

7.3 Predicted Traffic Noise Levels

Using the parameters discussed above, a traffic noise level of 51 dB(A),$L_{eq(1\ hr)}$ was calculated at 20 m from the centre of the road. It must be noted that this number may be high, since all workers were assumed to travel to work on MR 215 (from Mudgee) or MR 598 (from Gulgong), whereas some workers may come from other areas. It was also assumed that the entire day shift would arrive between 6:30 am and 7 am and the night shift would all leave between 7 am and 7:30 am. It is acknowledged in the TIA that the total shift change traffic is likely to occur over a period closer to two hours.

Based on this assessment, the traffic noise level in Ulan village at shift change will be below the night time noise criterion of 55 dB(A),$L_{eq(1\ hr)}$.

8.0 BLAST OVERPRESSURE AND VIBRATION

8.1 Blasting Criteria

8.1.1 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 115 dB;
- The level of 115 dB may be exceeded for up to 5% of the total number of blasts over a 12-month period, but should not exceed 120 dB 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; and
- Blasting should generally take place no more than once per day.

8.1.2 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 27.**

TABLE 27
Blasting criteria to limit damage to buildings (AS 2187).

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 25) and will be taken as the governing criteria for the assessment of impacts from the MCP. Also, DEC typically indicates that blasting should achieve a long-term maximum ground vibration level of 2 mm/s PVS.

8.2 Blast Impact Assessment Procedure

The following sections provide standard equations for predicting blast overpressure and ground vibration levels, sourced from the United States Bureau of Mines.

8.2.1 Blast Overpressure

Unweighted airblast overpressure levels (OP) are predicted from **Equation 1** below.

$$\text{OP} = 165 - 24(\log_{10}(D) - 0.3\log_{10}(Q)),\quad \text{dB} \qquad (1)$$

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

Analysis of 12 months blast data for a coal mine in the Hunter Valley has shown Equation 1 to underestimate overpressure levels by up to 3 dB for small blasts (MIC 100-400kg) and overestimate by 1 dB for larger blasts (MIC > 400kg). Given the range of MIC values considered in this assessment (450-850 kg) no correction has been applied to Equation 1 to provide a small element of conservatism.

8.2.2 Blast Vibration

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

$$\text{PPV} = 1140\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \quad \text{(for average ground type)} \qquad (2)$$

$$\text{PPV} = 500\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \quad \text{(for hard rock)} \qquad (3)$$

where D and Q are defined as in Equation 1.

A coefficient value of 1000 has been used to approximate reasonably soft ground in the blast vibration calculations to provide a conservative assessment as no specific site law has been established through trial blasting.

8.3 Blast Impact Predictions

8.3.1 Residential Receivers

Predicted blast overpressure and ground vibration levels are shown in **Table 28** for receivers within 2000 m of proposed Pits 1 – 3. Calculations are based on a range of charge weights (Maximum Instantaneous Charge weight, MIC) up to the maximum value of 850 kg provided by the Mining Engineer. Levels greater than the 5% exceedance limits (115 dB overpressure and 5 mm/s vibration) are shaded grey. Levels equal to or exceeding the absolute limits (120 dB overpressure and 10 mm/s vibration) are in bold type.

TABLE 28
Predicted blast overpressure and ground vibration levels.

Receiver	Distance (m)[a]	MIC = 450 kg		MIC = 650 kg		MIC = 850 kg	
		PPV[b]	OP[c]	PPV	OP	PPV	OP
R157 Ulan village	1325	1.4	111	1.9	113	2.3	114
R25 Tuck-Lee	715	3.7	118	5.0	119	6.2	120
R49 Olive-Lea	1630	1.0	109	1.3	110	1.6	111
R26 Robinson	1600	1.0	109	1.3	110	1.6	111
R5 Swords	510	6.4	121	8.6	122	10.6	123
R20 Williamson	1225	1.6	112	2.1	113	2.6	114
R36 Rayner	715	3.1	118	5.0	119	6.2	120
R28 Chinner	1630	1.0	109	1.3	110	1.6	111
R31 M Cox	1325	1.4	111	1.9	113	2.3	114
R29B Mayberry	<100m	83.7	138	112.3	139	139.2	140
R29A Mayberry	300m	14.4	127	19.4	128	20.0	129
R32 Stokes	1835	0.8	107	1.1	109	1.4	110

[a] Distance from receiver to closest point of nearest Pit.
[b] Peak vertical ground vibration, mm/s.
[c] Blast overpressure, dB.

8.3.2 Non-residential Locations

The closest sensitive road/rail infrastructure to blasting activities is the Ulan Road bridge over the Gulgong – Sandy Hollow rail line east of the UCML rail loop. Blasting in the north-eastern corner of Pit 1 may come within 300m of this bridge. At this distance, MIC values less than 650 kg must be used if the 20mm/s vibration limit for rail culverts is to be satisfied.

It should be noted that blasting will commence at large distances from any sensitive road/rail structures and ample site data will be available to enable appropriate blast design near these structures.

Blasting will occur within 700m of the Moolarben Dam wall. Moolarben Dam is a prescribed dam which is 12m high and of rockfill construction. Predicted ground vibration levels at the dam wall from blasting in Pit 1 will be approximately equally to the maximum 6.2 mm/s predicted at *R25* (Tuck-Lee).

The NSW Dams Safety Committee (DSC) 2004/05 Annual Report identifies no significant safety risks at Moolarben Dam, suggesting that it is structurally sound. Since dam walls must be constructed to withstand earthquakes, which are far more intense than blasting vibration magnitudes, there is no risk to the dam from MCP blasting activities.

Two rock shelter sites (referred to in the archaeological report as S1MC55 and S1MC56) in the escarpment near Pit 2 will receive vibration levels from blasting in Pit 2 that are well below the 80mm/s limit cited in the Wilpinjong EIS. Again, site specific data would be available to more accurately estimate vibration impacts well before blasting commences in Pit 2.

8.4 Discussion of Blast Impacts and Recommendations

Two locations, *R29A* (Mayberry) and *R29B* (Mayberry), will be extremely impacted by blasting in Pit 3 and the dwellings would not be able to withstand the predicted level of ground vibration. A negotiated agreement should be made between these landowners and MCMPL before commencement of mining in Pit 3.

The Swords residence (*R5*) would be significantly impacted by blast overpressure and ground vibration from mining in Pit 2. The amenity criteria (115 dB overpressure and 5 mm/s vibration) are likely to be exceeded for all blasts and the 10 mm/s criterion for potential building damage is likely to be exceeded for the larger blasts.

Small to moderately sized blasts are predicted to approach and slightly exceed the criteria at both *R25* (Tuck-Lee, Pit1) and *R36* (Rayner, Pit 3). In both of these cases, the relevant Pit will advance directly away from the residence so the maximum impact from blasting would be relatively brief at these locations. Also, smaller blasts would be required at the western edge of the resource and the larger blasts would only be required further east as the seams dip. Vibration levels well below the 10mm/s criterion for potential building damage are predicted at both locations even for the larger blasts.

Two of these three impacted locations, *R20* (Williamson) and *R5* (Swords), are within the noise affectation zones for the respective Pits and a negotiated agreement should be made between these landowners and MCMPL before commencement of mining in Pit 2.

It is recommended that a negotiated agreement be reached between MCMPL and the landowner at *R36* (Rayner) before commencement of mining in Pit 3. It should be noted that there would be several years of blast monitoring results available before the commencement of Pit 3 to gain a better understanding of the site-specific blast propagation law and therefore a more reliable estimate of blast impacts could be made.

The DEC long term goal of 2 mm/s vibration would be achieved at distances beyond 1430m for the larger blasts (MIC 850kg). Mining is expected to be this distance from Ulan village after the second year, with operations continuing to move further away. Again, it is unlikely that large blasts would be required at the western extent of Pit 1 (ie closest to Ulan village) since this is where the resource is closest to the surface.

In many cases, the relevant Pit will be between the blast site and residential receiver (ie Pits 2 and 3 advance away from the nearest receivers). While this is not allowed for in the calculations of blast impacts, it is expected that the pit void would provide a ground vibration "barrier" and lower levels of ground vibrations may be experienced.

9.0 SUMMARY OF IMPACTS AND RECOMMENDATIONS

9.1 Pit 1 Mining

Based on the results of noise modelling for the initial mining and Year 1 scenarios, it was found that a period of up to six months would be required to establish an acoustic bund between Pit 1 and the most affected residential receivers. The bund was found to attenuate Pit 1 mining noise levels by up to 7 dB within Ulan village and it was recommended that elevated noise criteria be approved for the first six months of the project.

Construction of surface facilities is expected to occur during the first 12 months of the project with 24-hour mining, coal processing and transportation to commence after this time. The recommended noise criteria for locations potentially affected by noise from Pit 1 are summarised in **Table 29** below.

TABLE 29
Recommended noise criteria for locations impacted by Pit 1.

Rec. #	Description	Criterion $L_{Aeq(15\ min)}$ 0-6 months	Criterion $L_{Aeq(15\ min)}$ 6-12 months	Criteria After 12 months[1]			
				D	E	N	SD
2	S.E. Birt & K.M. Hayes	35	35	35	35	35	45
8	C.N. & H.L. Davies	35	35	35	35	35	45
46G	UCML (Mitchell)	35	35	35	35	35	45
16	D.J. Little & A.K. Salter	35	35	35	35	35	45
7	Wallis	35	35	35	35	35	45
13	P.F. Renshaw	35	35	35	35	35	45
12	M. & J. Transport	Noise affectation zone – Rail loop					
157	Ulan Village	47	47	40	39	38	48
160A	Ulan School	50	50	50	--	--	--

168	Ulan Church	50	50	50	50	50	--
46A	Flannery Centre	45	43	39	38	37	47
169	"Primo Park"	40	36	35	35	35	45
49	"Olive Lea"	41	36	35	35	35	45
26	G.F. Robinson	41	36	35	35	35	45
25	G.G. Tuck-Lee	Noise affectation zone – Pit 1					
5	M. & P. Swords	35	35	35	35	35	45
20	A.J. & N.N. Williamson	40	35	35	35	35	45
41A	P.P. Libertis	35	35	35	35	35	45
170	T. Roberts	35	35	35	35	35	45
58	M.L & J.L Bevege	35	35	35	35	35	45
All other receivers		35	35	35	35	35	45

[1] Day (D), evening (E) and night (N) operational $L_{Aeq(15\ min)}$ criteria and night time sleep disturbance (SD) criterion, $L_{A1(1\ min)}$.

The residences predicted to be significantly impacted by Pit 1 operations are *R12* (M&J Transport, impacted by rail noise) and *R25* (Tuck-Lee, impacted by noise and blasting). An agreement should be negotiated between MCMPL and these receivers prior to commencement of activities in Pit 1.

Locations *R13* (Renshaw), *R46A* (The Flannery Centre), *R49* ("Olive Lea"), *R26* (Robinson), *R5* (Swords), and *R20* (Williamson) are predicted to have minor – moderate noise criterion exceedances. These locations would be placed in a noise "management zone" and should be included in a noise monitoring program (other noise monitoring locations may be nominated at the discretion of DEC). Provisions should be made in the project Consent for negotiations to occur between these residents and MCMPL should noise monitoring results confirm criterion exceedances.

Noise monitoring for MCP during the construction period should also determine the noise contribution from Ulan Coal Mine operations with the results made available to DEC and DoP. This would assist the regulatory agencies in assessing the effectiveness of the Ulan Coal Mine noise reduction program.

9.2 Pit 2 Mining

All residential receivers not shown in Table 29 will have noise criteria of 35 dB(A),$L_{eq(15min)}$ day, evening and night.

The residences predicted to be significantly impacted by Pit 2 operations are *R13* (Renshaw, impacted by Pit 2 mining combined with rail noise), *R25* (Tuck-Lee, impacted by noise), *R5* (Swords, impacted by noise and blasting) and *R20* (Williamson, impacted by noise). These locations may be omitted as noise monitoring locations for Pit 2, although other locations may be included by DEC.

It is recommended that agreements be negotiated between these residents and MCMPL prior to commencement of mining in Pit 2.

9.3 Pit 3 Mining

The residences predicted to be significantly impacted by Pit 3 operations are *R29B* (Mayberry, impacted by End Pit 3 noise and blasting), *R29A* (Mayberry, impacted by End Pit 3 noise and blasting), *R5* (Swords, impacted by Start Pit 3 noise) and *R36* (Rayner, impacted by Start Pit 3 noise).

It is recommended that agreements be negotiated between these residents and MCMPL prior to commencement of mining in Pit 3.

Minor (ie no greater than 2 dB) noise criterion exceedances were predicted at *R30* (Cox) and *R28* (Chinner) under worst case meteorological conditions at the commencement of Pit 3. These locations should be included in a noise monitoring program. Other locations may be nominated by DEC.

10.0 CONCLUSION

A noise and vibration impact assessment has been conducted for the proposed Moolarben Coal Project in the Western Coalfields of NSW, 40 km northeast of Mudgee and 25 km east of Gulgong.

The assessment has found several locations that would be adversely impacted by the project and recommendations have been made regarding negotiated agreements between the affected residents and Moolarben Coal Mines Pty Ltd (MCMPL).

It was also found that the leading (western) edge of the Pit 1 out of pit emplacement (OOP1) could be formed within a period of approximately six months and would significantly reduce noise levels of night-time operations by up to 7 dB in Ulan village and at some rural residences to the west of the project site.

A recommendation has been made to allow higher noise criteria for the period of bund formation. After completion of the bund, daytime noise limits would be in force until 24-hour mining commences. At this time, operation noise criteria would apply.

Some minor to moderate exceedances of the operational noise criteria were predicted. Since the possibility of further reducing noise levels (lower than the levels achieved with the acoustic bund) would be prohibitively costly, it has been recommended that the affected receivers be incorporated in a noise monitoring program. The results of noise measurements would be considered in any future negotiations between these residents and MCMPL. Since the proposed acoustic bund would be over 1500m long, there would be the possibility of planning multiple dumping locations to minimise noise impacts under adverse weather conditions. A comprehensive Noise Management Plan would be developed prior to construction activities commencing.

It has also been found that some of the residences impacted by noise would also be adversely impacted by blast overpressure and ground vibration. Two locations near the proposed rail loop were predicted to receive excessive noise from coal trains on the MCP rail loop. Negotiations between these landowners and MCMPL have commenced.

It was found that 22 receivers east of the site and 16 receivers west of the site may be close enough to the train line to receive noise levels from coal trains that would exceed the ARTC design goals in EPL 3124. Approximately 175 residences west of the site may receive noise levels higher than the more stringent DEC recommended train noise levels. The potential impacts east of the site (towards Muswellbrook) would depend on the total number of trains while impacts to the west (towards Lithgow) would depend on maximum levels from individual trains.

The exact impact of train noise generated by the project, when considered cumulatively with all other rail users, is difficult to determine based on the available information. For example, the proportion of trains that may travel east and west of the site is unknown.

It is acknowledged by DEC, DoP and the ARTC that management of noise from coal trains travelling on the RIC corridor is the responsibility of ARTC and would be addressed by them should the issue of noise arise when the number of trains increases.
An assessment of potential sleep disturbance under the worst case scenario has predicted levels that are not likely to disturb the sleep of any receiver. With the acoustic bund in place, the noise will be a general mine 'hum' with approximately ± 5dB fluctuation and sources typically identified with sleep disturbance (bucket impacts, dozer tracks, overburden dumping) will be shielded by the OOP1 acoustic bund at times when these sources may be a problem. Plant items will be fitted with broadband reverse alarms which have proven very effective in mitigating their noise impact.

Noise levels from light vehicles travelling to site at shift-change were predicted to be below the DEC criterion. No significant traffic noise impact will occur from heavy vehicle deliveries to the MCP site during the daytime.

Excessive vibration levels from blasting have been predicted at some receivers close to proposed Pits 2 and 3. Negotiated agreements will need to be reached between these receivers and MCMPL. No blasting criteria exceedances (ground vibration or airblast overpressure) have been predicted in Ulan village. In terms of both noise and blasting, residents in Ulan village will benefit from the fact that the MCP will commence at approximately the nearest point to the village and advance towards the northeast, thereby reducing both noise and vibration levels in the village over a relatively short period of time.

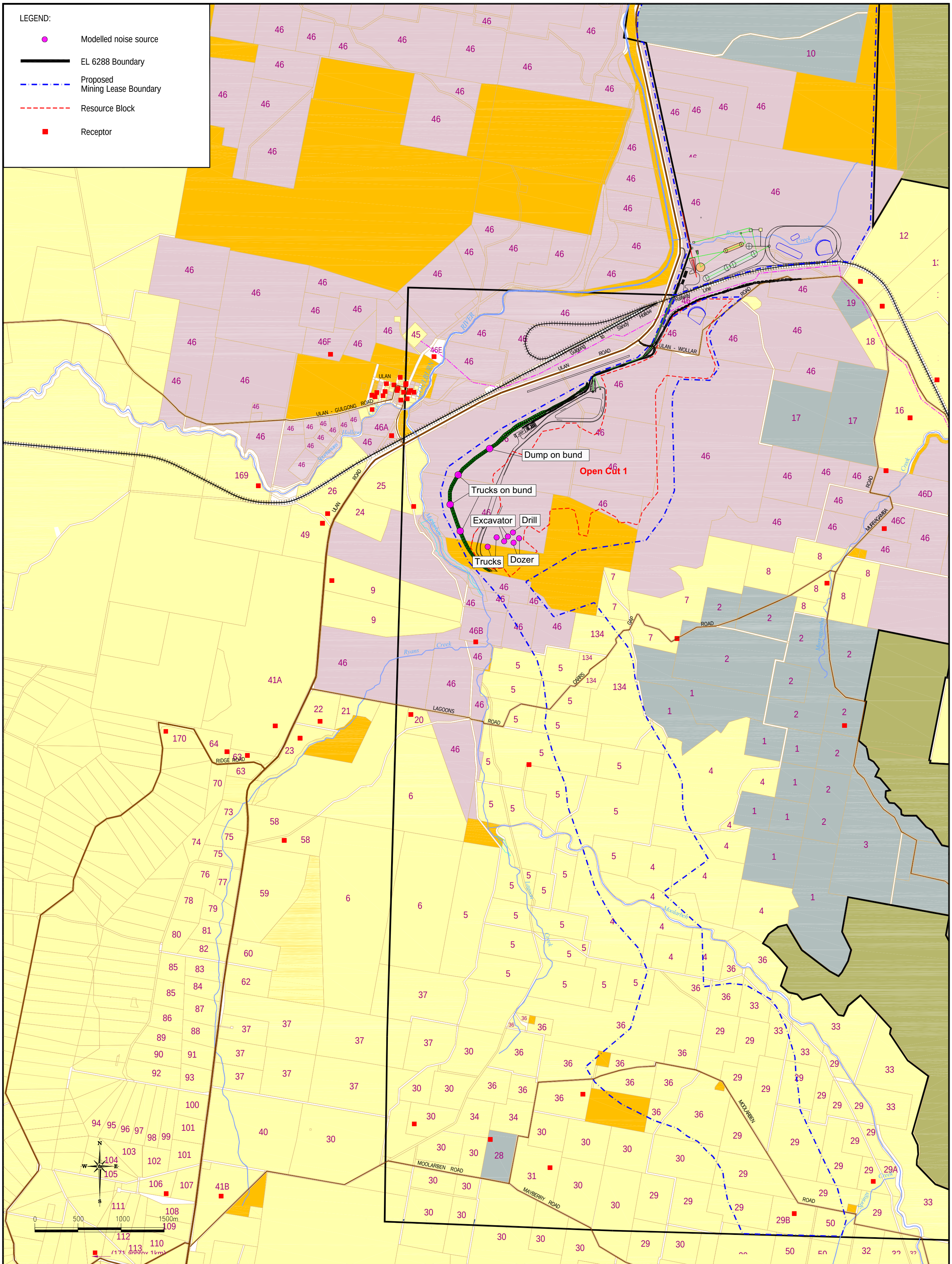
Blasting will occur within 700m of the Moolarben Dam wall. Predicted ground vibration levels at the dam wall from blasting in Pit 1 will be approximately 6.2 mm/s. Since dam walls must be constructed to withstand earthquakes, which are far more intense than blasting vibration magnitudes, there is no risk to the dam from MCP blasting activities.

Two rock shelter sites (referred to in the archaeological report as S1MC55 and S1MC56) in the escarpment near Pit 2 will receive vibration levels from blasting in Pit 2 which are well below the 80mm/s limit cited in the Wilpinjong EIS.

In summary, it has been found that through a combination of negotiated agreements, an initial period of allowable elevated noise emissions to form an acoustic bund west of Pit 1, noise monitoring, a comprehensive Noise Management Plan and the opportunity for future negotiations to be conducted, the Moolarben Coal Mine could operate within the applicable noise and vibration guidelines.

APPENDIX A

NOISE LEVEL CONTOURS



Pegasus Technical

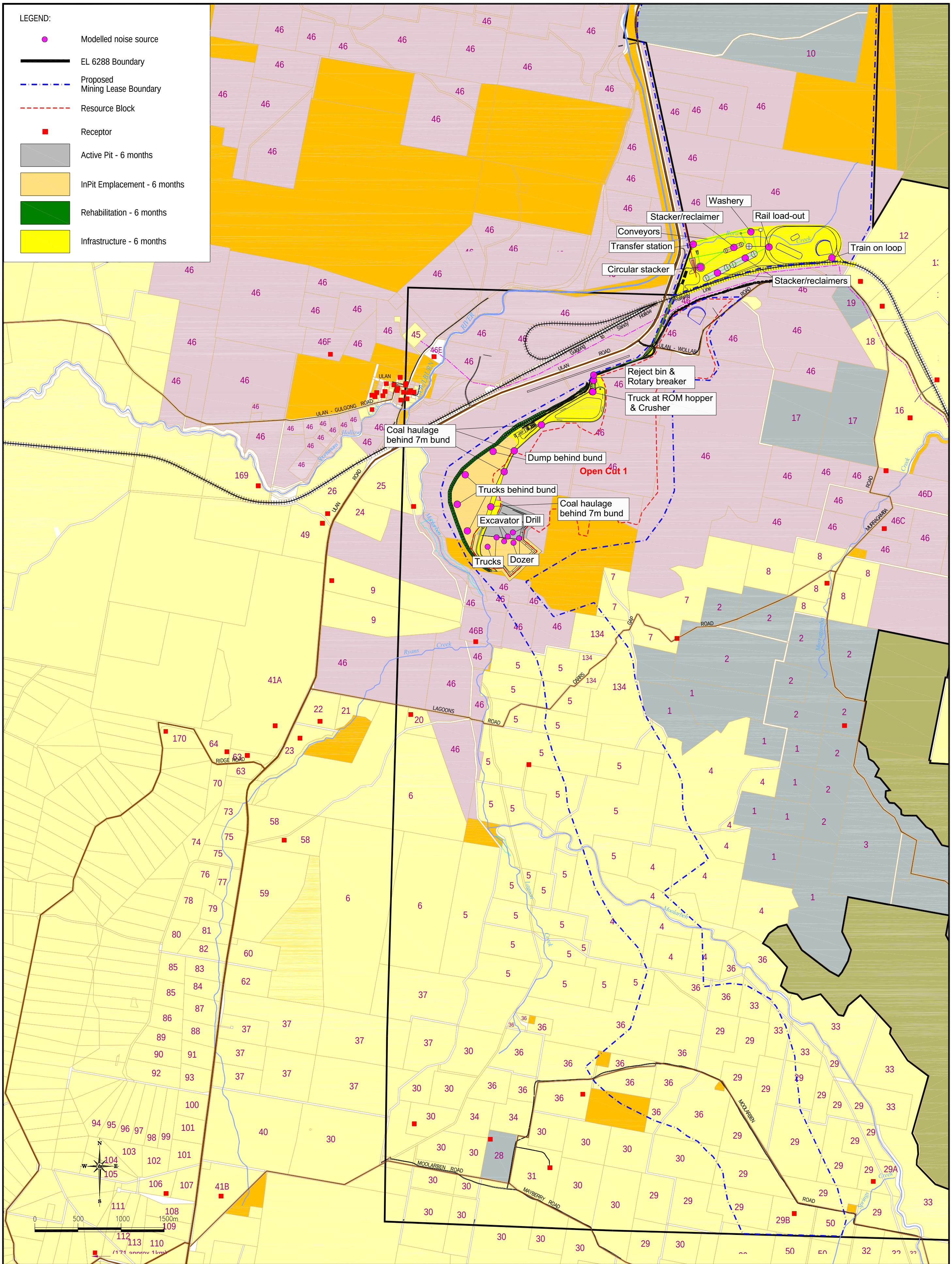
Moolarben Coal Project

Locations of modelled noise sources for Pit 1 (start) operations

SPECTRUM ACOUSTICS

Figure 5

CAD FILE: Figure 5 NP



Pegasus Technical

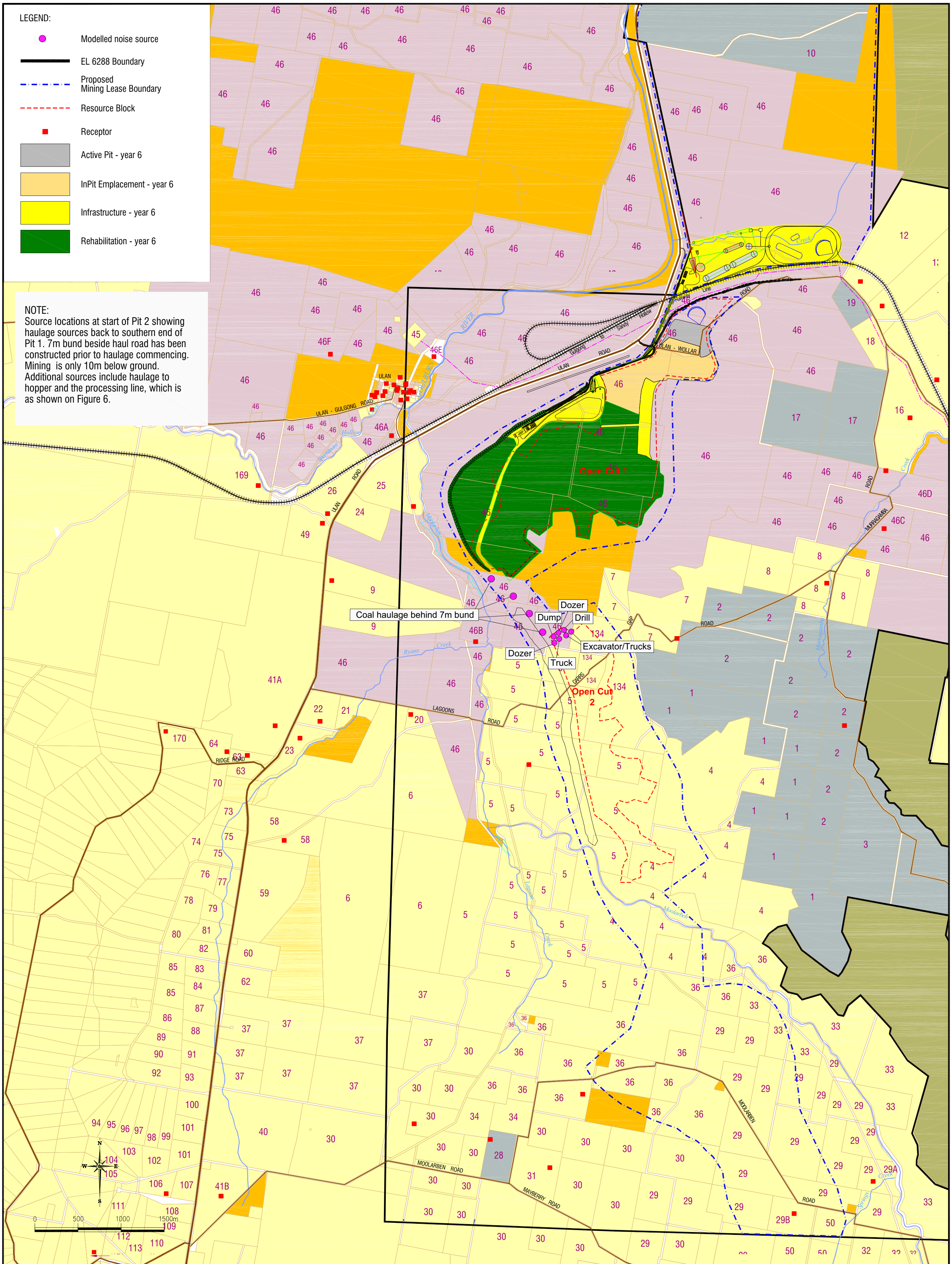
CAD FILE: Figure 6 NP

Moolarben Coal Project

Locations of modelled sources for Pit 1 operations

SPECTRUM ACOUSTICS

Figure 6



Pegasus Technical

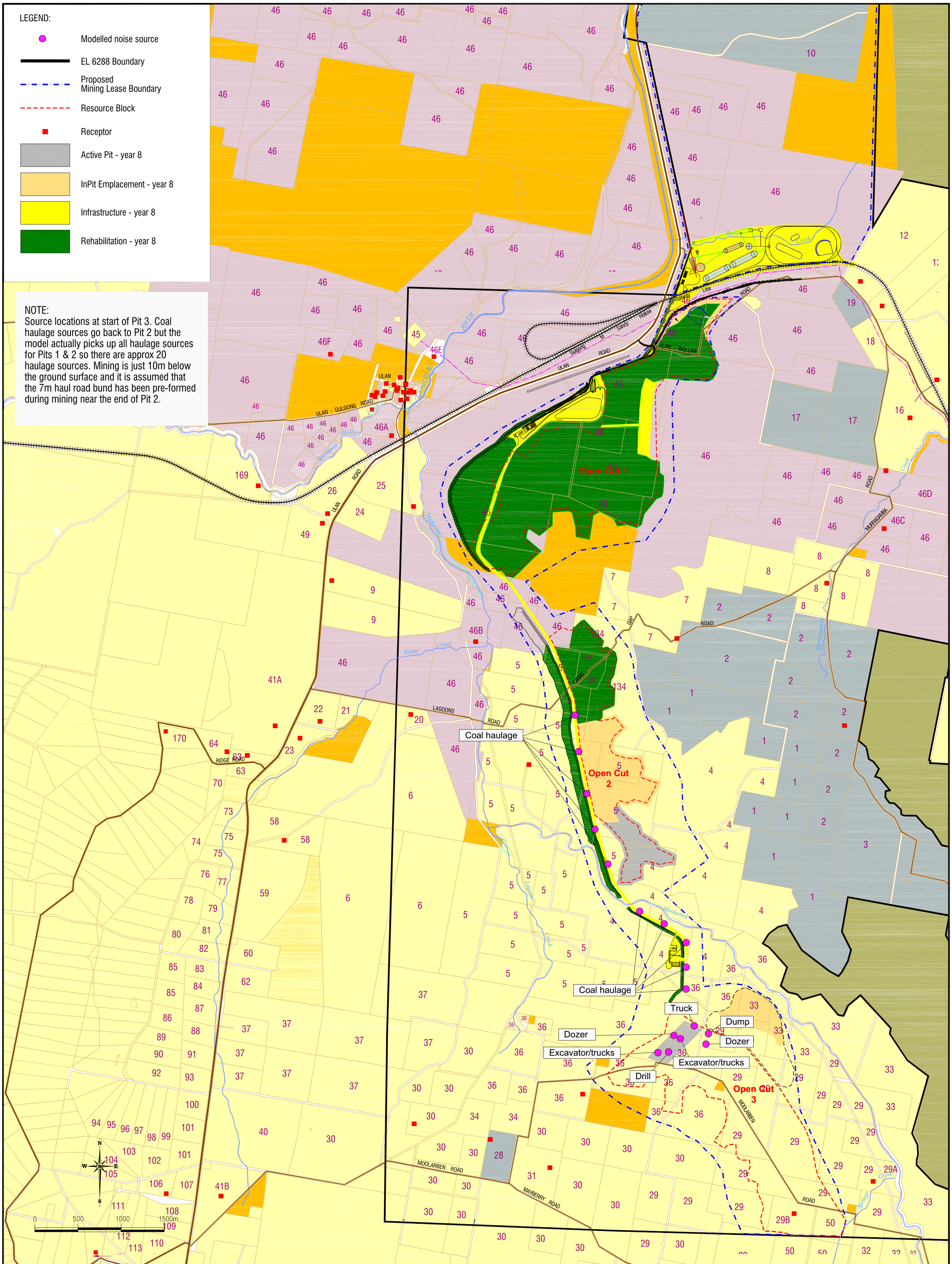
Moolarben Coal Project

Location of modelled sources for Pit 2 (start) operations

SPECTRUM ACOUSTICS

Figure 7

CAD FILE: Figure 6a NP



Pegasus Technical

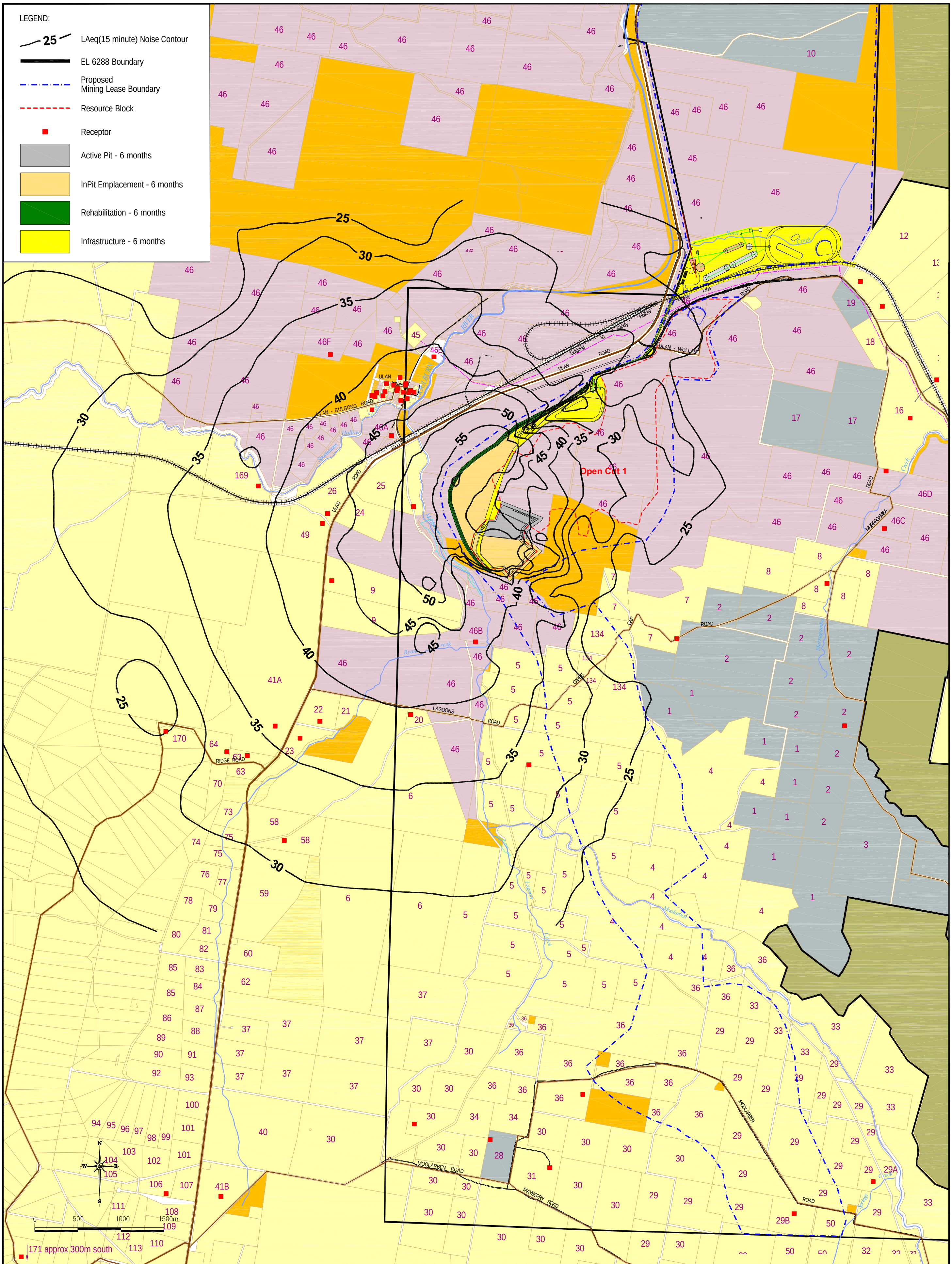
Moolarben Coal Project

Location of modelled sources for Pit 3 (start) operations

SPECTRUM ACOUSTICS

Figure 8

CAD FILE: Figure 5.9



Pegasus Technical

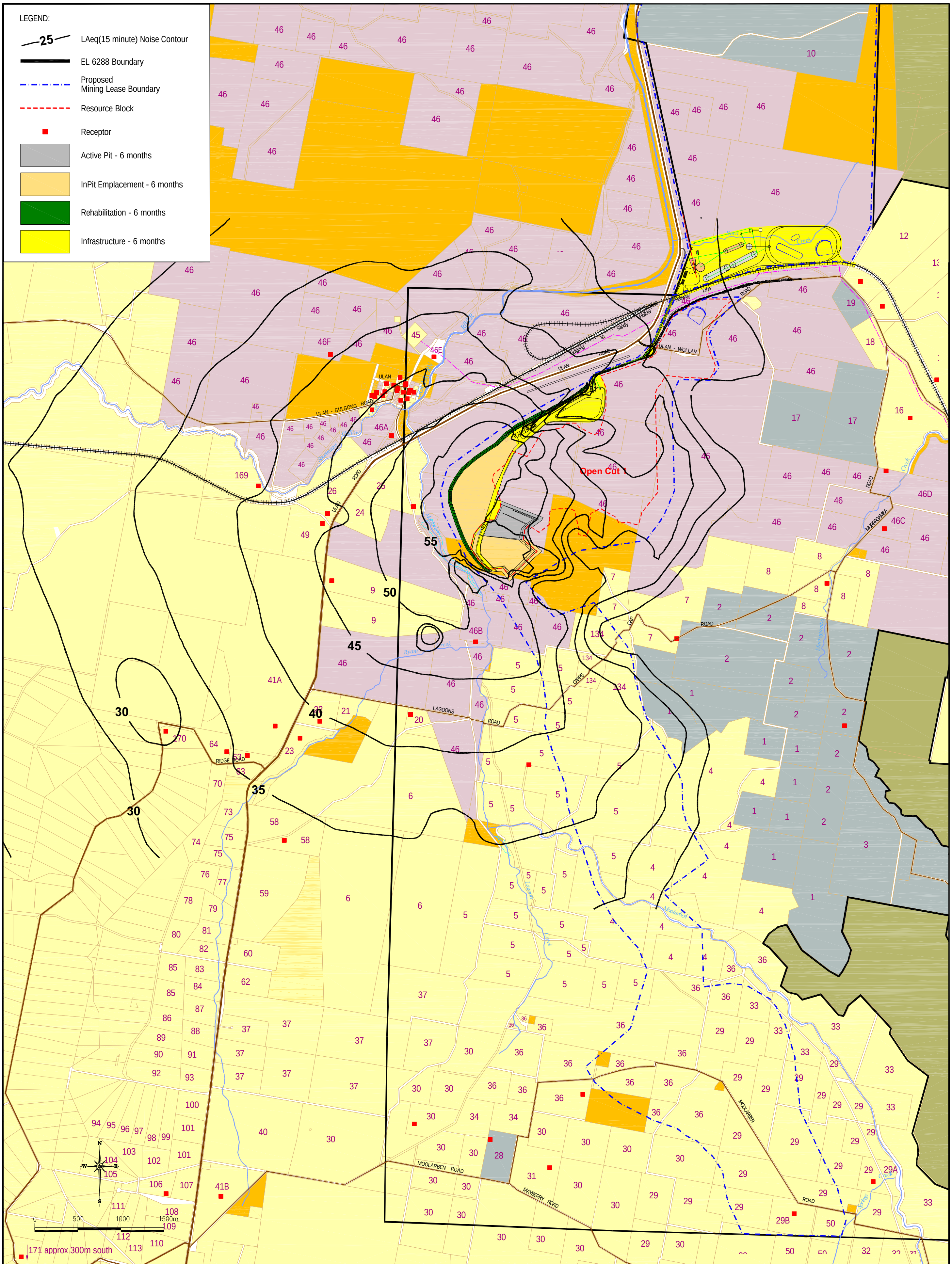
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Initial 6 months bund formation - daytime lapse

SPECTRUM ACOUSTICS

Figure 9

CAD FILE: Plan 9 NP



Moolarben Coal Project

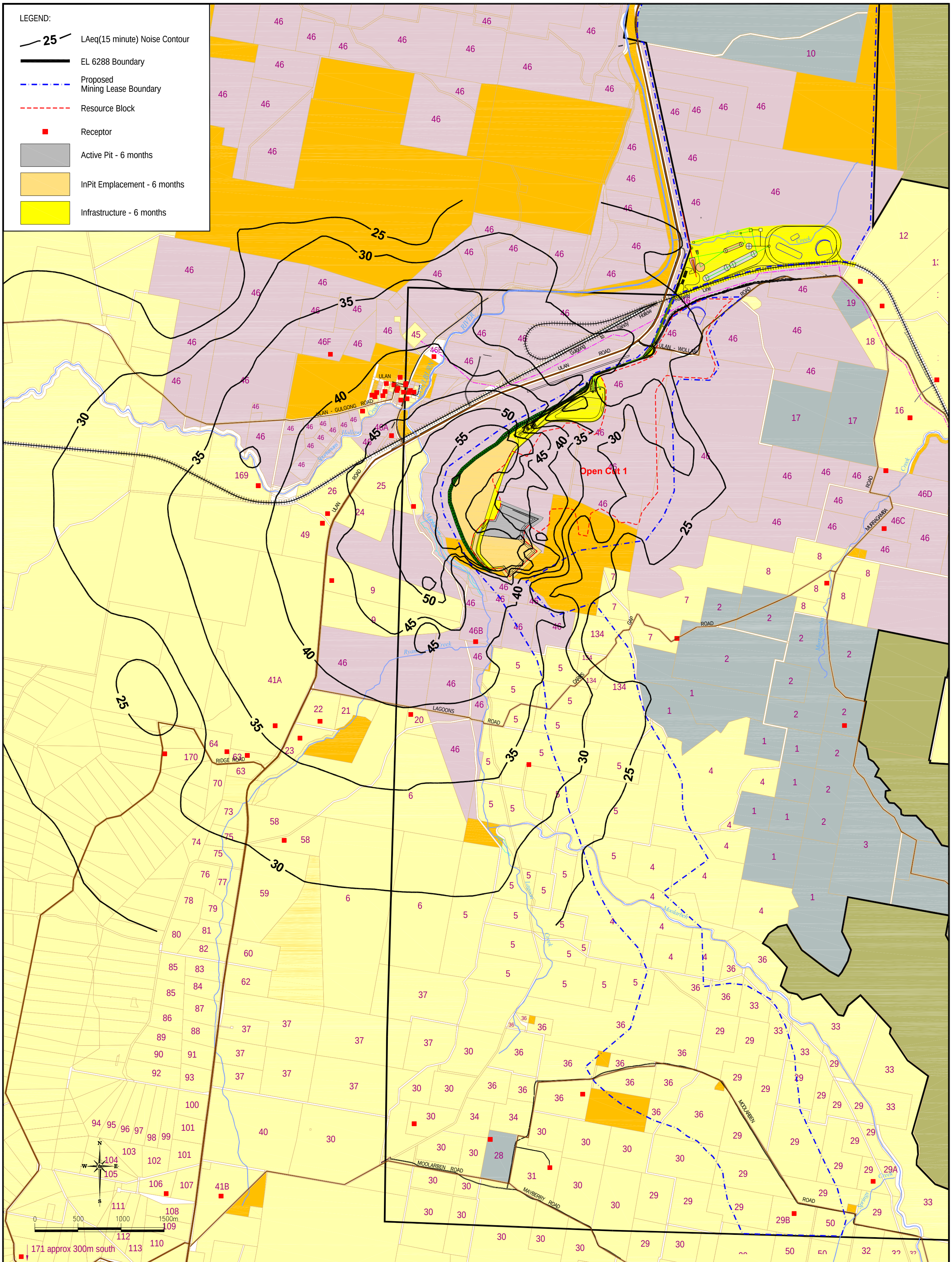
Predicted LAeq(15 minute) noise levels. Initial 6 month bund formation - Inversion + NE drainage wind

SPECTRUM ACOUSTICS

Figure 10

Pegasus Technical

CAD FILE: Figure 10 NP



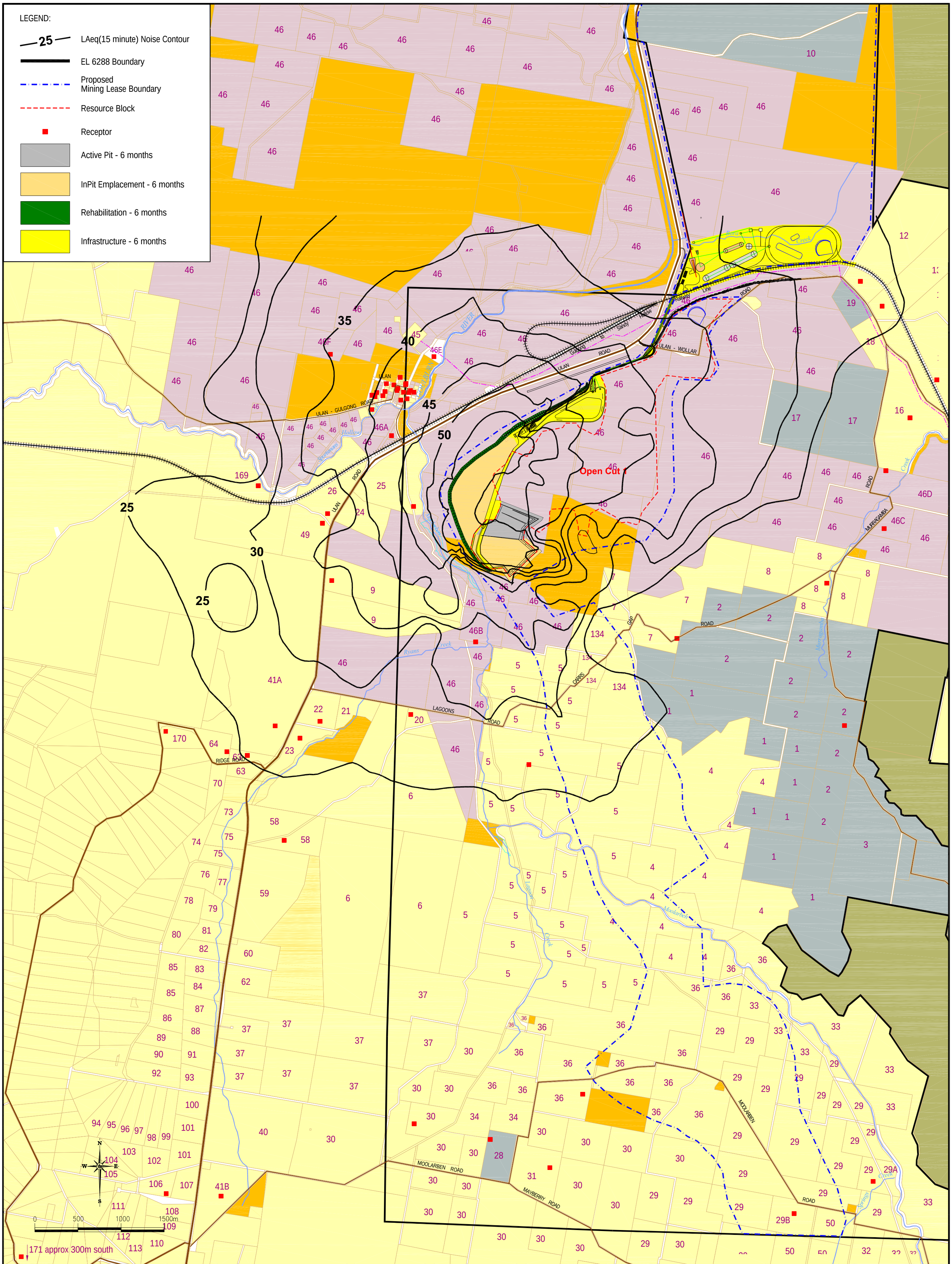
Pegasus Technical

Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Initial 6 months bund formation - NE wind

SPECTRUM ACOUSTICS

Figure 11



Moolarben Coal Project

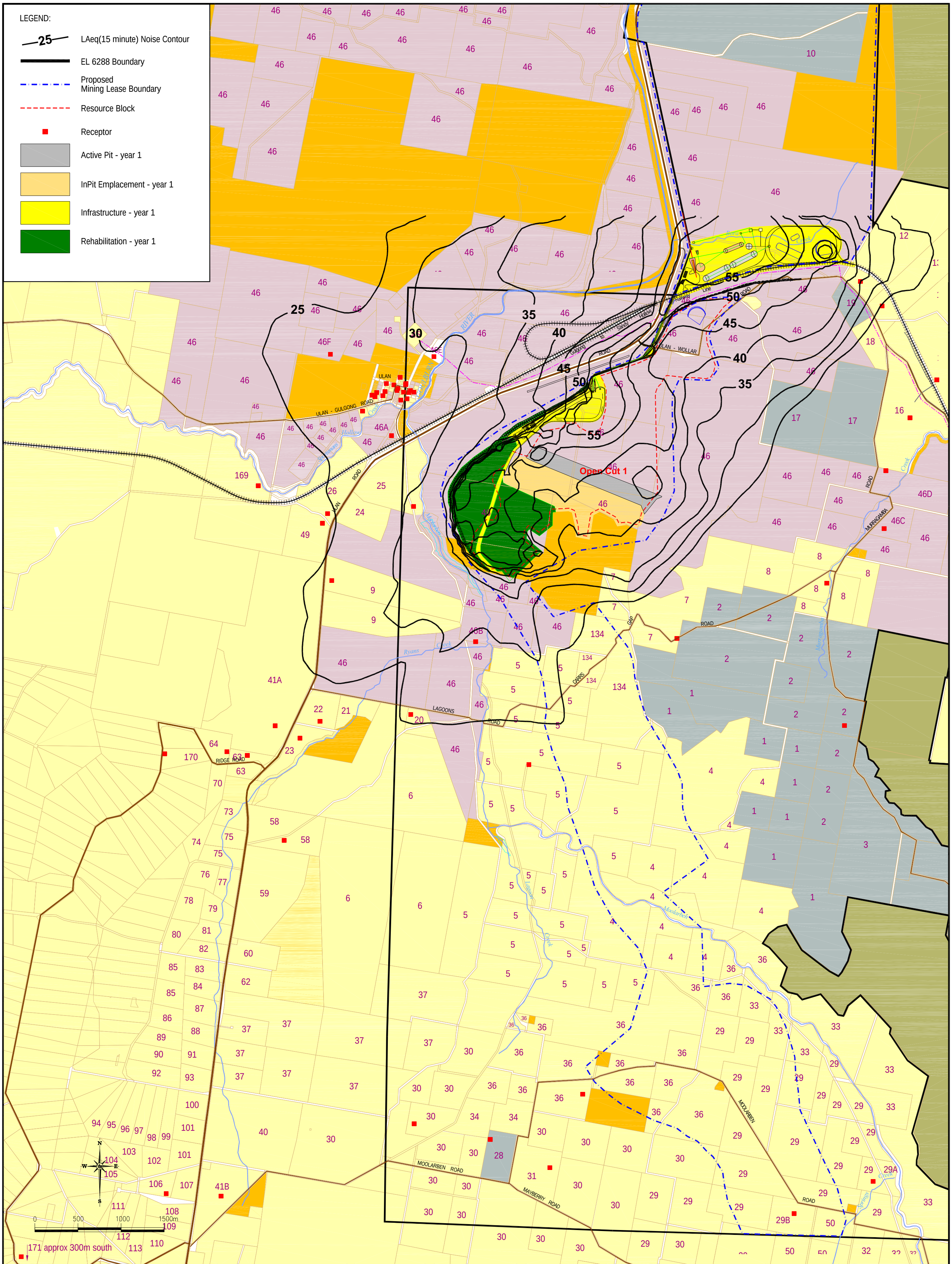
Predicted LAeq(15 minute) noise levels. Initial 6 month bund formation - SW wind

SPECTRUM ACOUSTICS

Pegasus Technical

Figure 12

CAD FILE: Figure 12 NP



Pegasus Technical

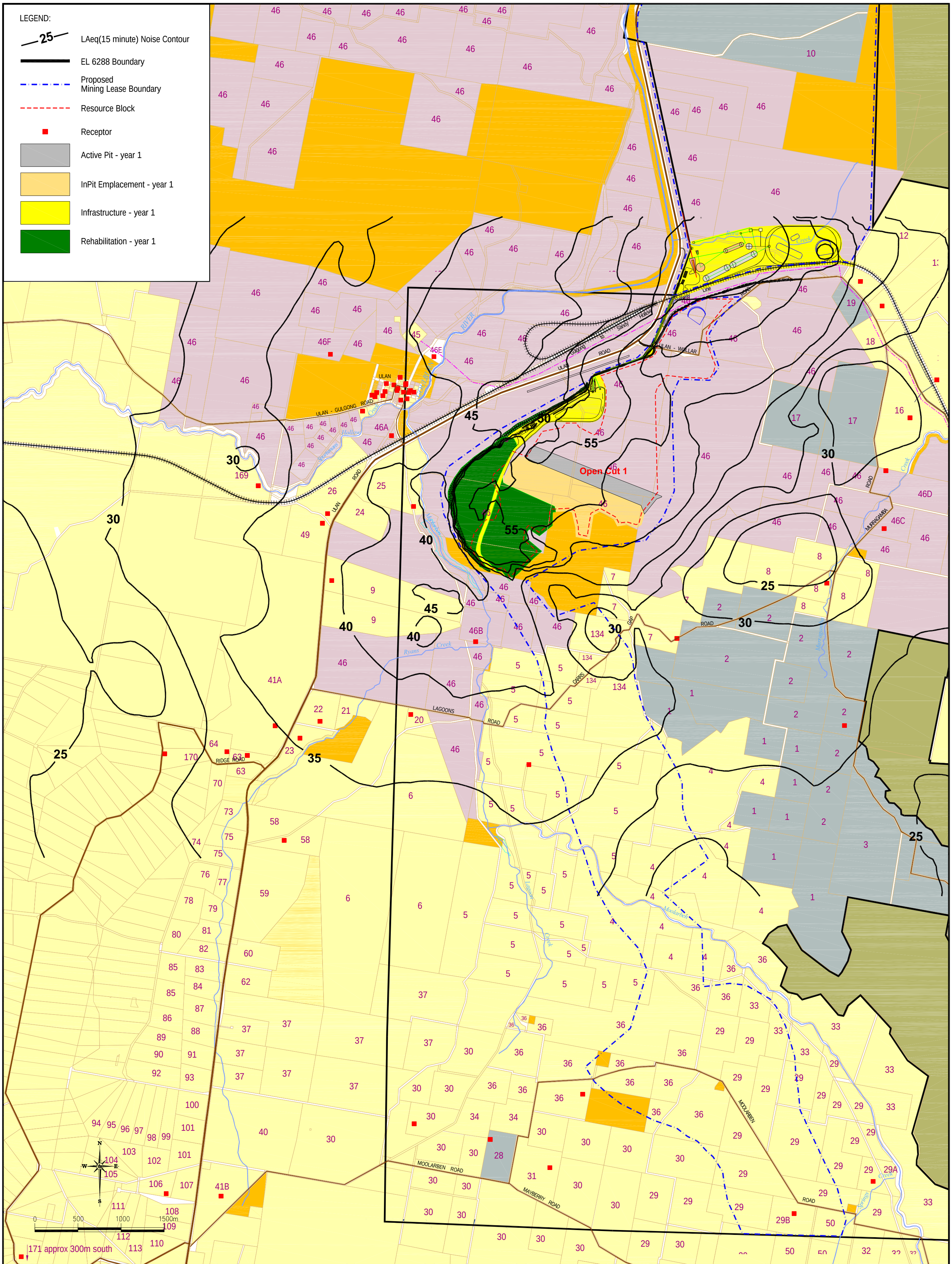
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Year 1 operations dumping behind 15m bund - Daytime lapse

SPECTRUM ACOUSTICS

Figure 13

CAD FILE: Figure 13 NP



Pegasus Technical

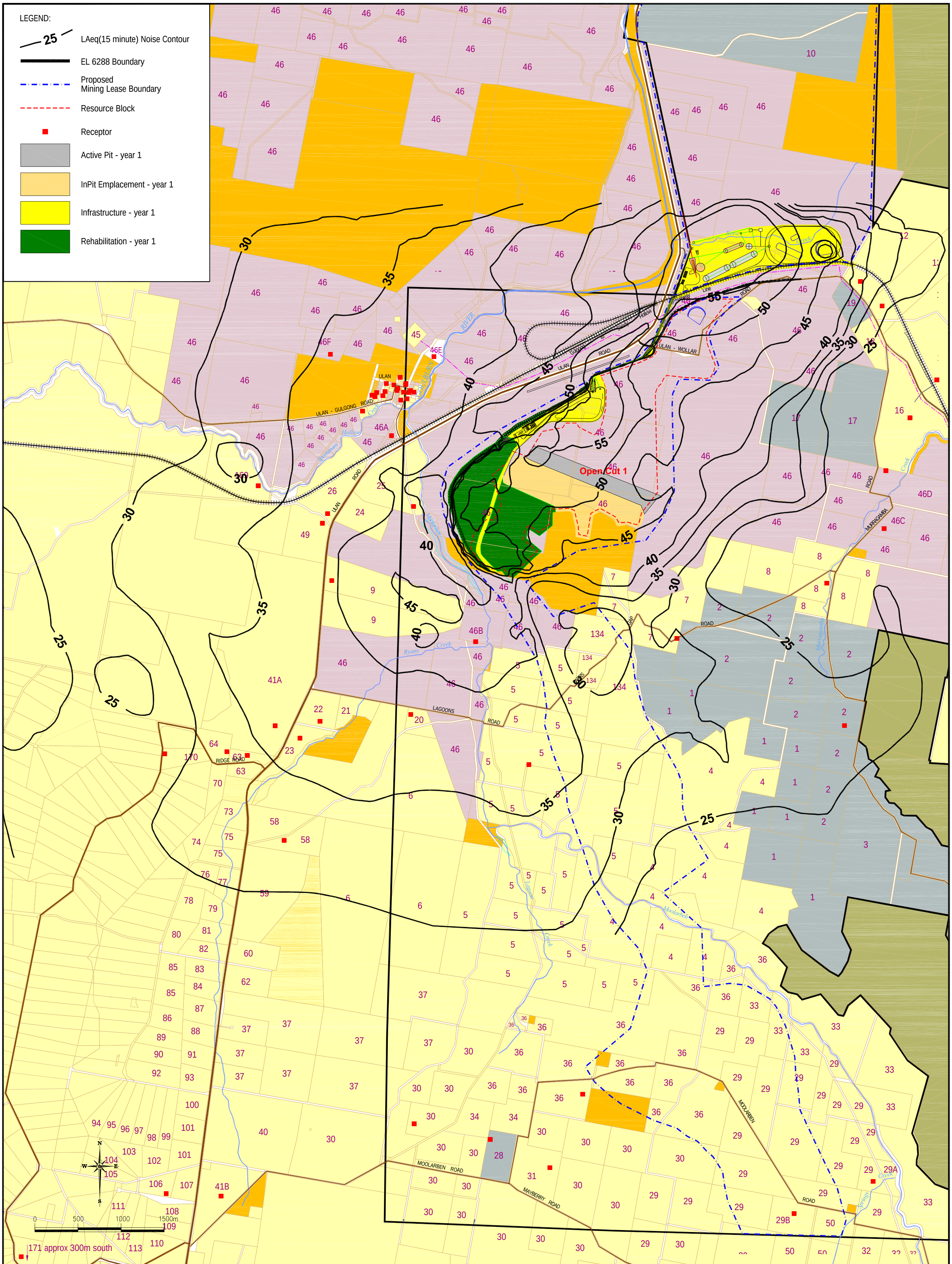
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Year 1 operations dumping behind 15m bund - Inversion

SPECTRUM ACOUSTICS

Figure 14

CAD FILE: Figure 14 NP



Moolarben Coal Project

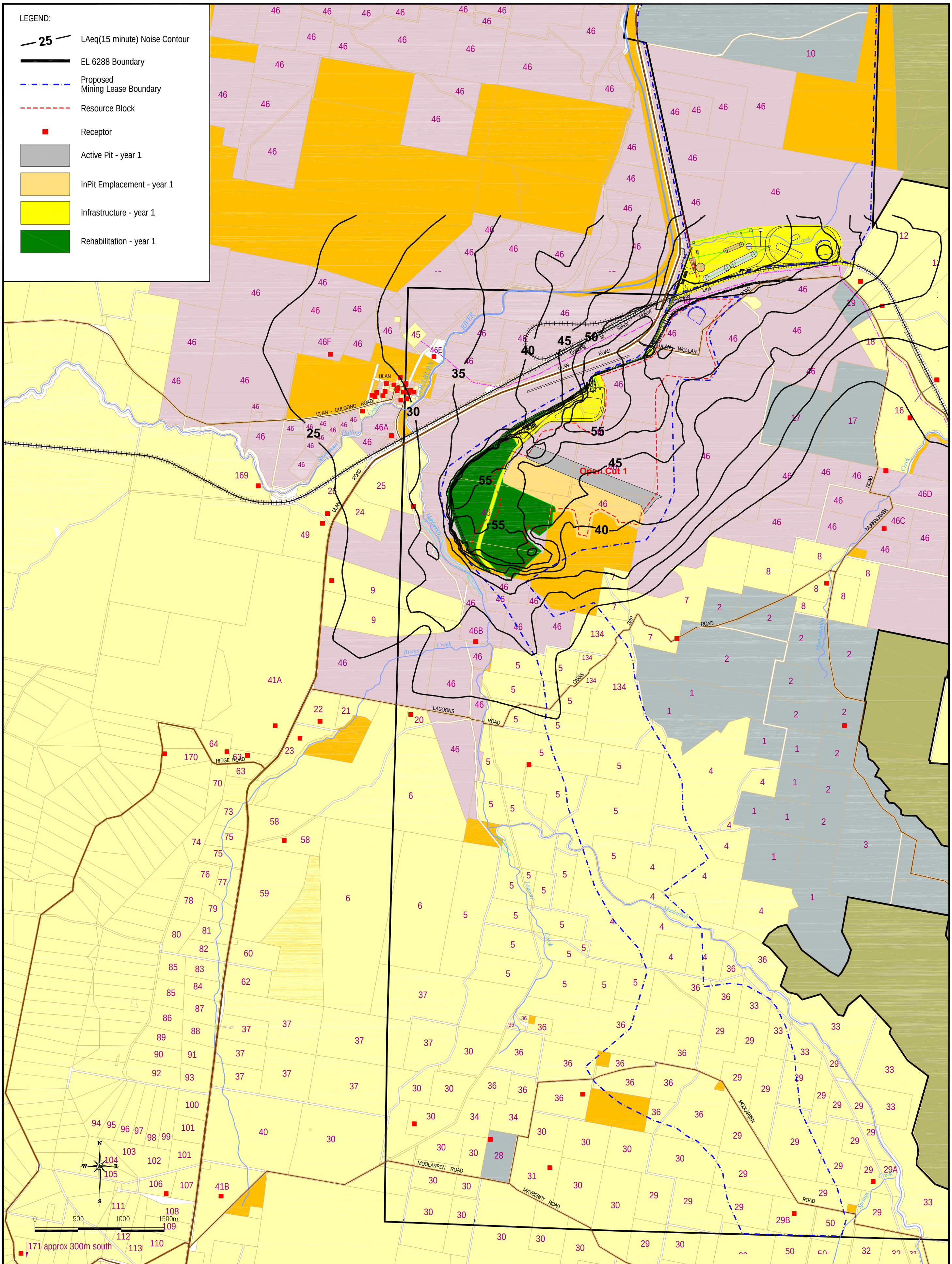
Predicted LAeq(15 minute) noise levels. Year 1 operations dumping behind 15m bund - ENE wind

SPECTRUM ACOUSTICS

Figure 15

Pegasus Technical

CAD FILE: Figure 15 NP



Pegasus Technical

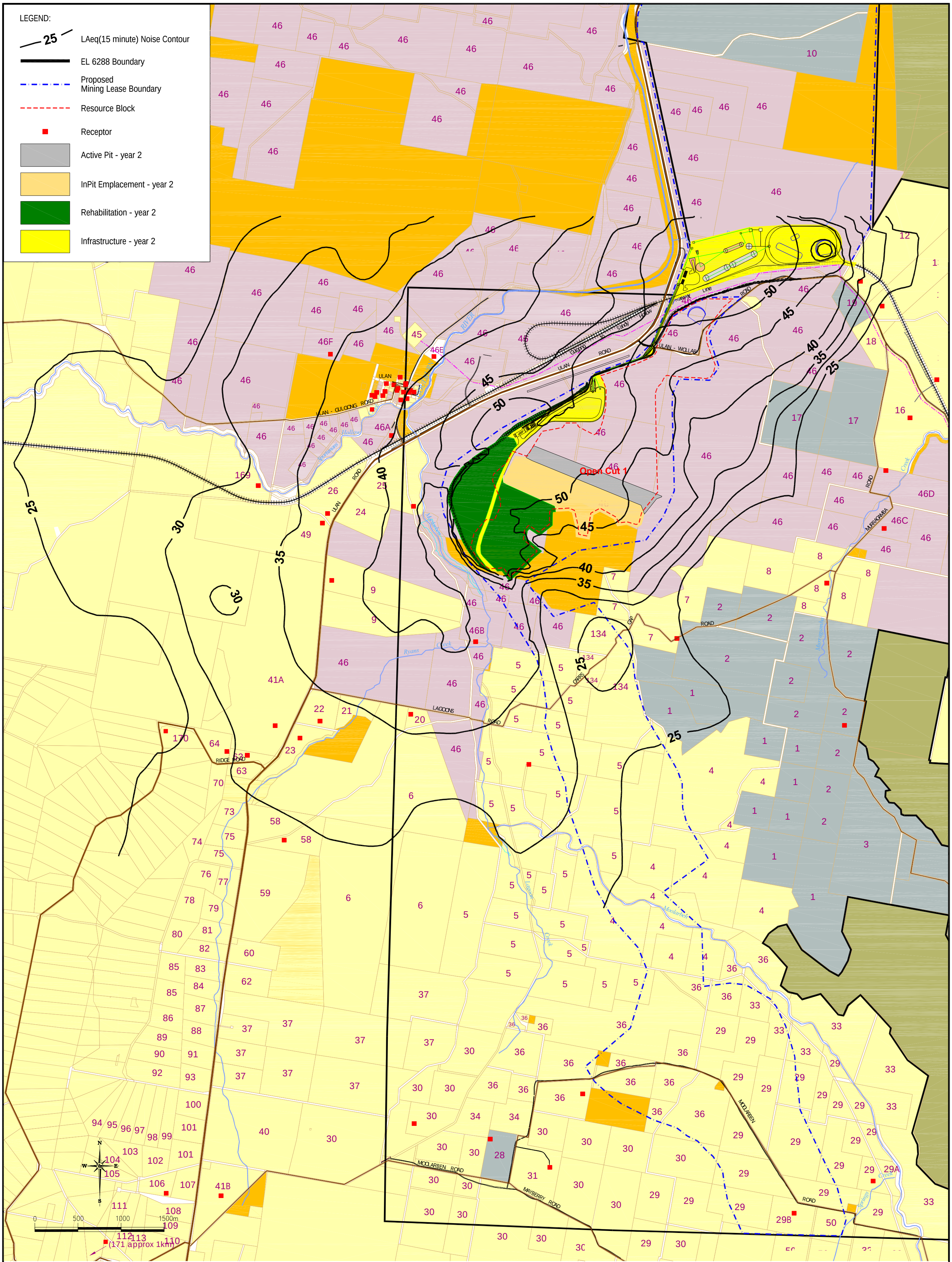
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Year 1 operations dumping behind 15m bund - SW wind

SPECTRUM ACOUSTICS

Figure 16

CAD FILE: Figure 16 NP



Pegasus Technical

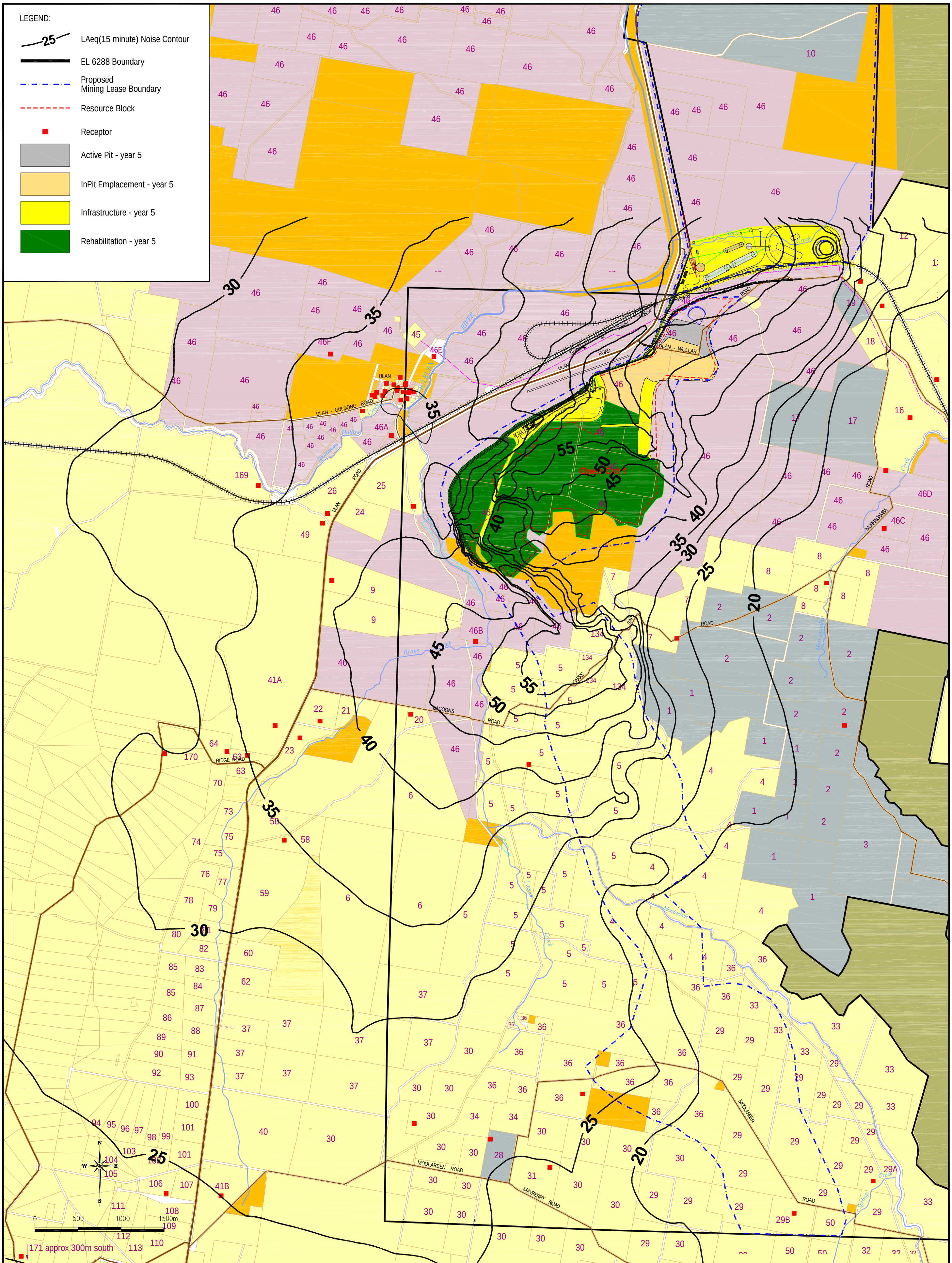
CAD FILE: Figure 16a

Moolarben Coal Project

Year 2 - Predicted LAeq(15 minute) noise levels - ENE wind

SPECTRUM ACOUSTICS

Figure 16a



Pegasus Technical

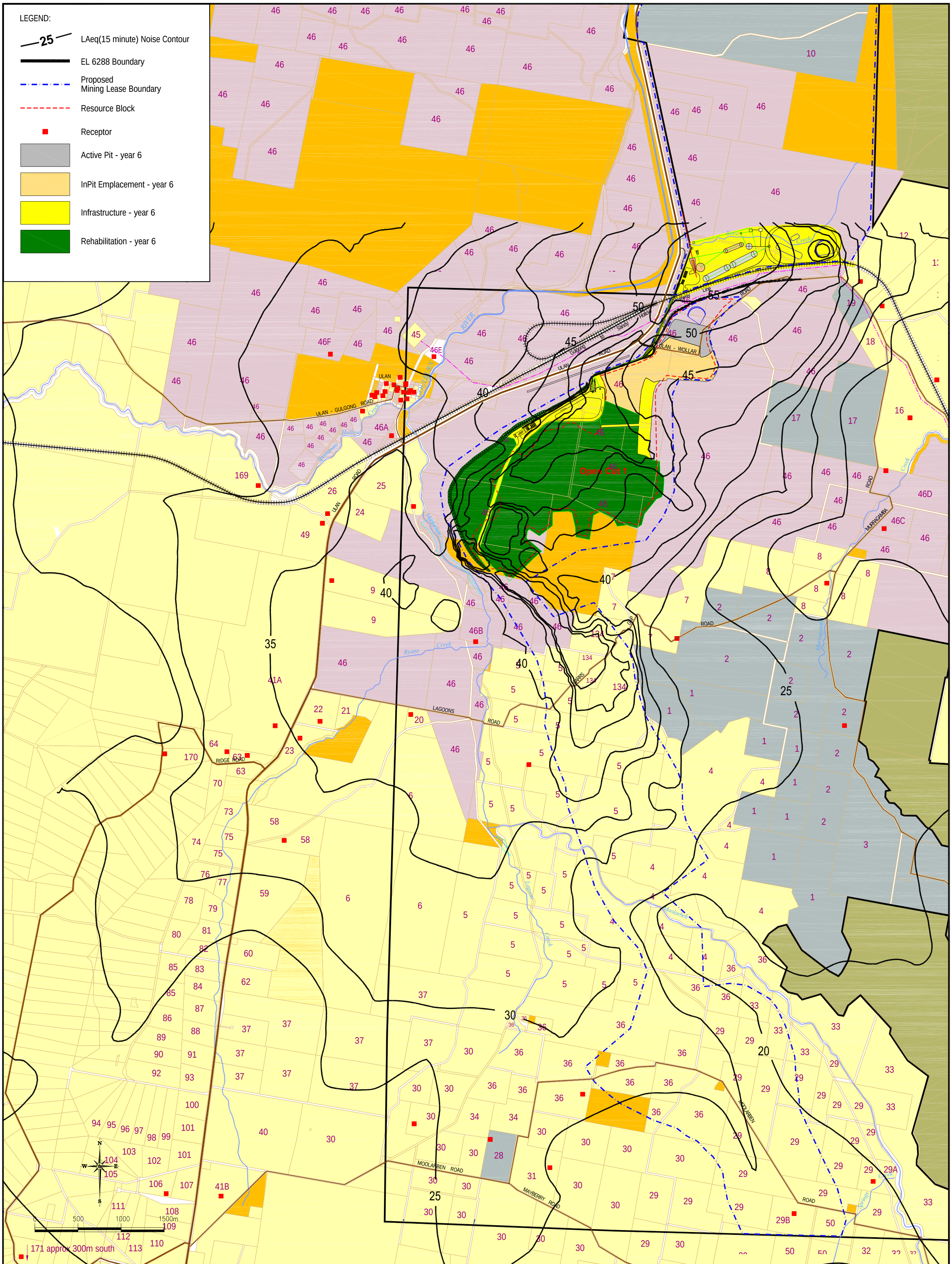
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Start of Pit 2 dumping at ground level - ENE wind wind

SPECTRUM ACOUSTICS

Figure 17

CAD FILE: Figure 17 NP



Pegasus Technical

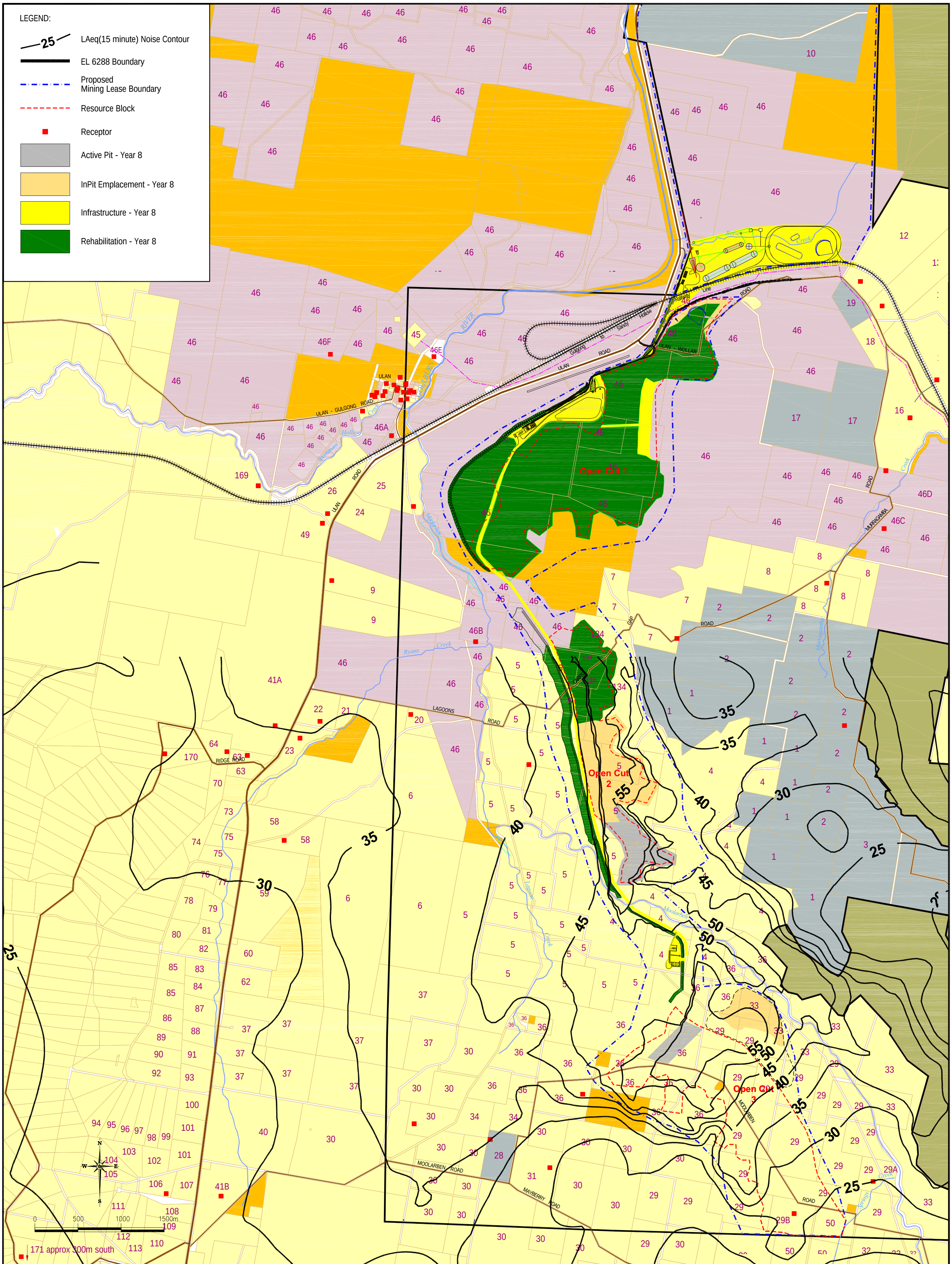
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels. Pit 2 dumping behind 10m high western edge of OOP2 - ENE wind

SPECTRUM ACOUSTICS

Figure 18

CAD FILE: Figure 18 NP



Pegasus Technical

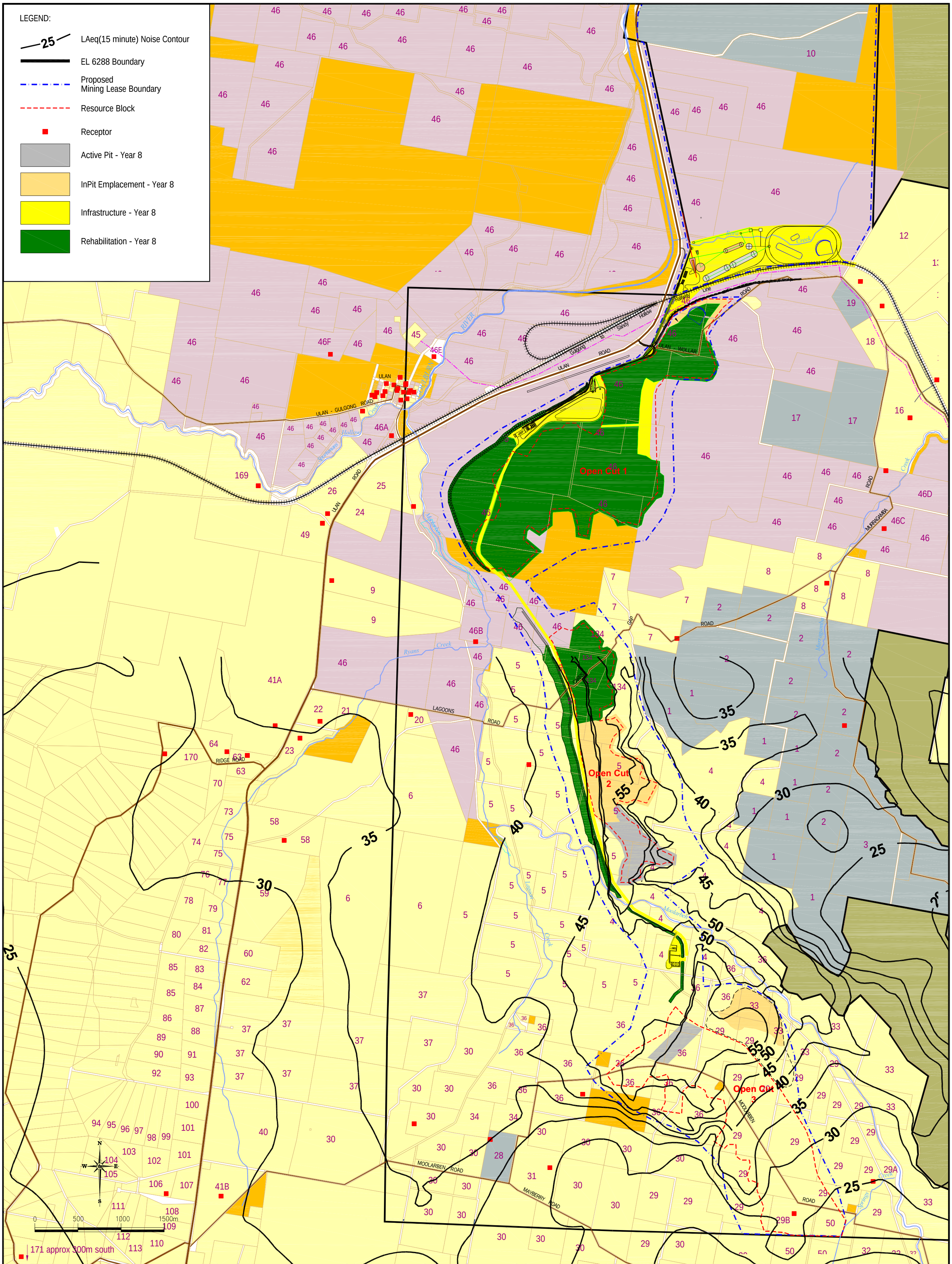
CAD FILE: Figure 19 NP

Moolarben Coal Project

Predicted LAeq(15 minute) noise levels - Year 7 start of Pit 3 (inversion)

SPECTRUM ACOUSTICS

Figure 19



Pegasus Technical

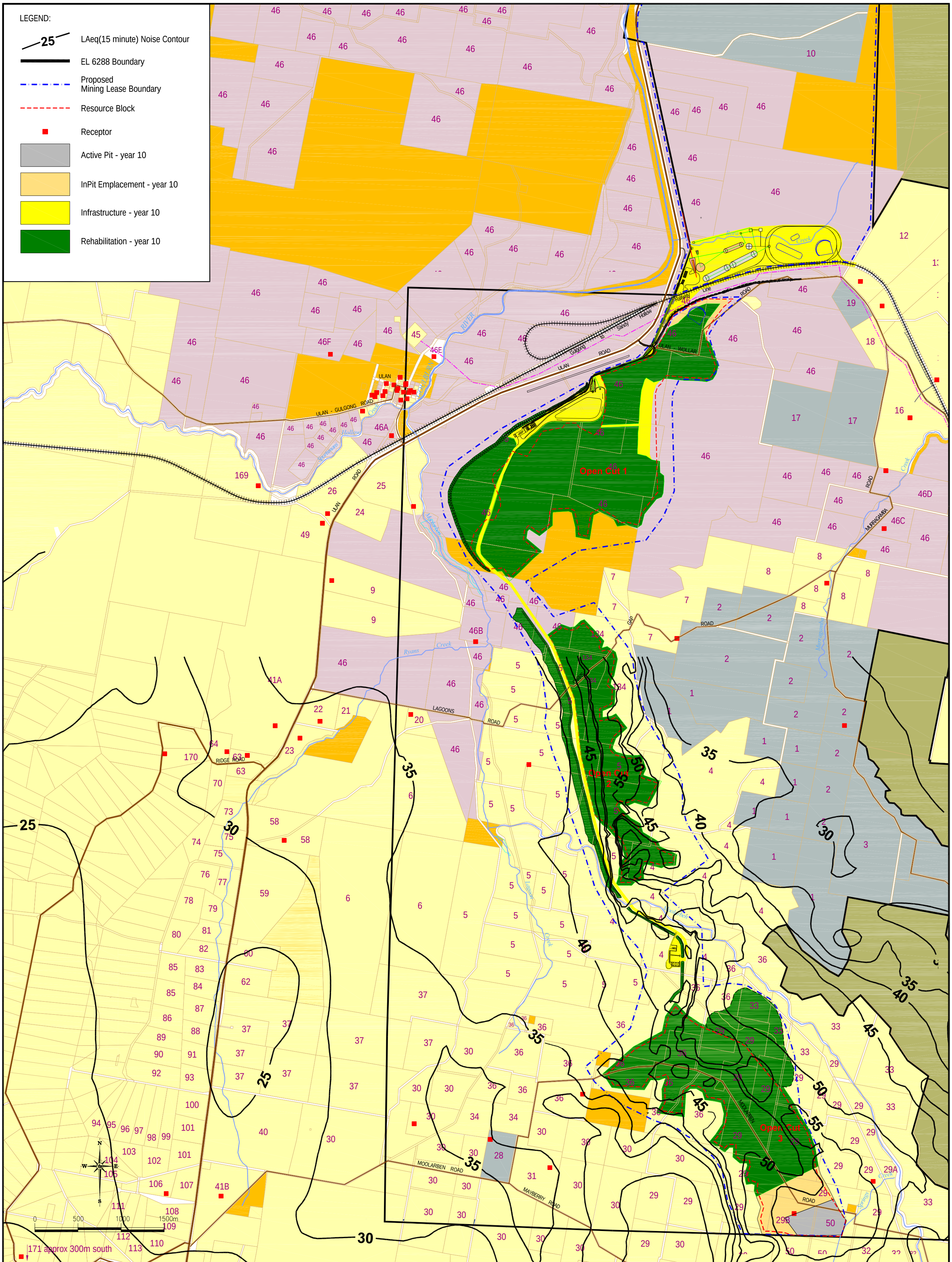
Moolarben Coal Project

Predicted LAeq(15 minute) noise levels - Year 7 start of Pit 3 (inversion)

SPECTRUM ACOUSTICS

Figure 19

CAD FILE: Figure 19 NP



Moolarben Coal Project

Predicted LAeq(15 minute) noise levels - Year 9 end of Pit 3 (inversion)

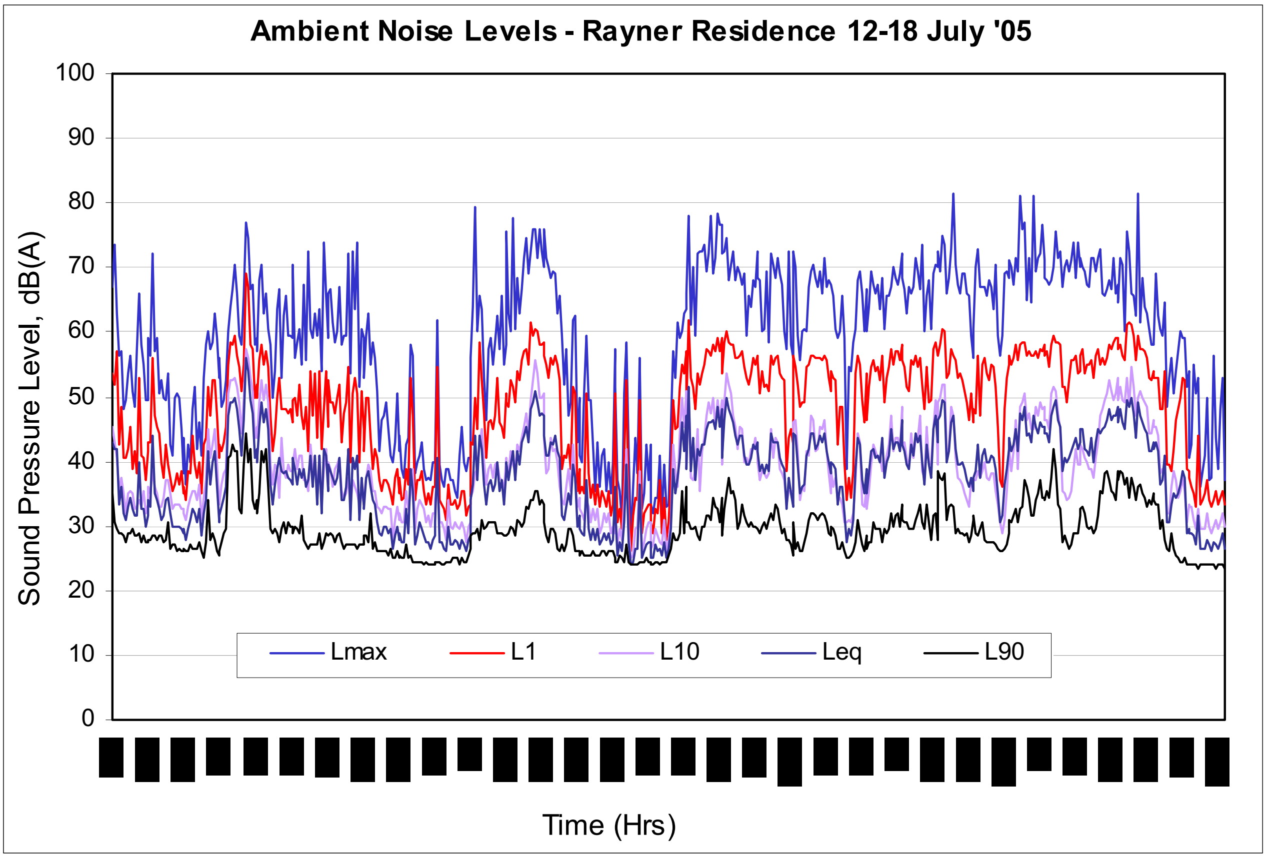
SPECTRUM ACOUSTICS

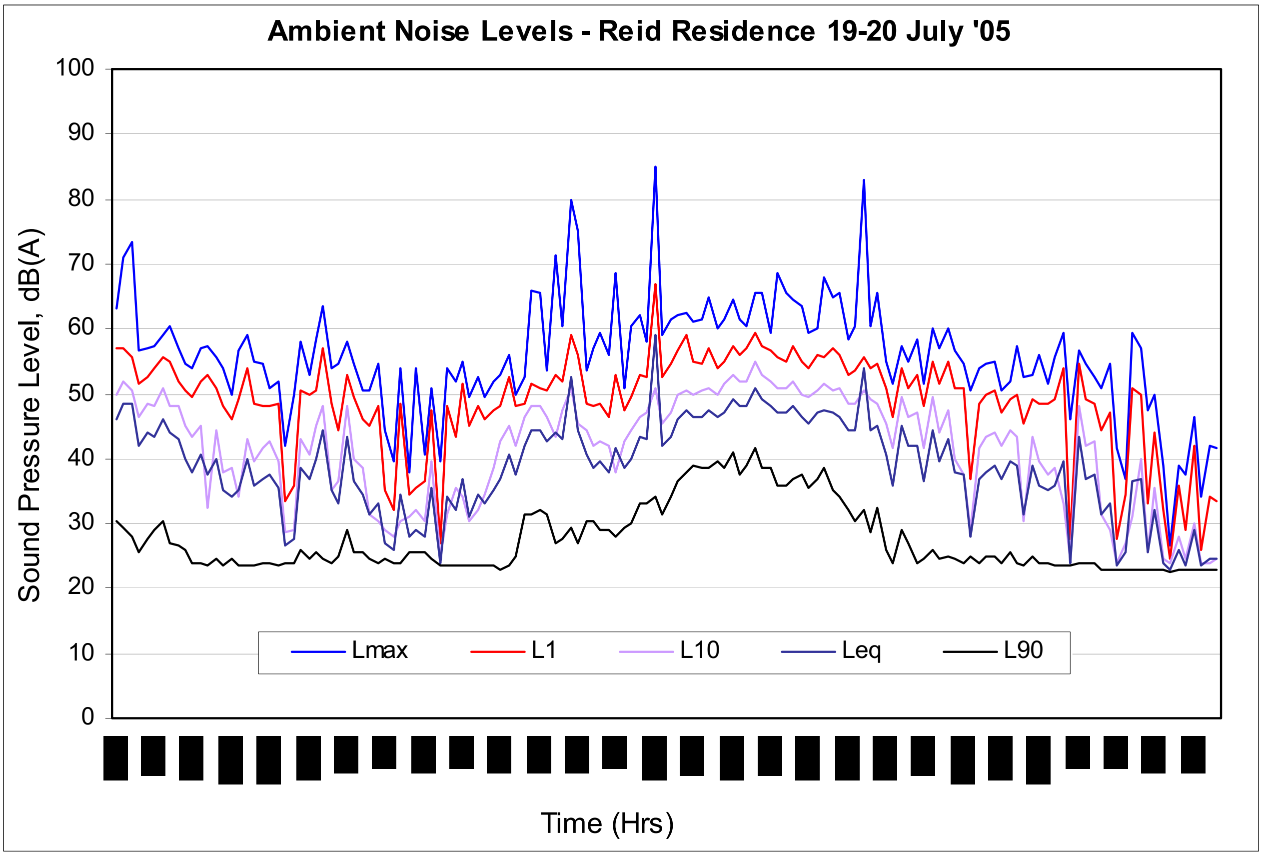
Figure 20

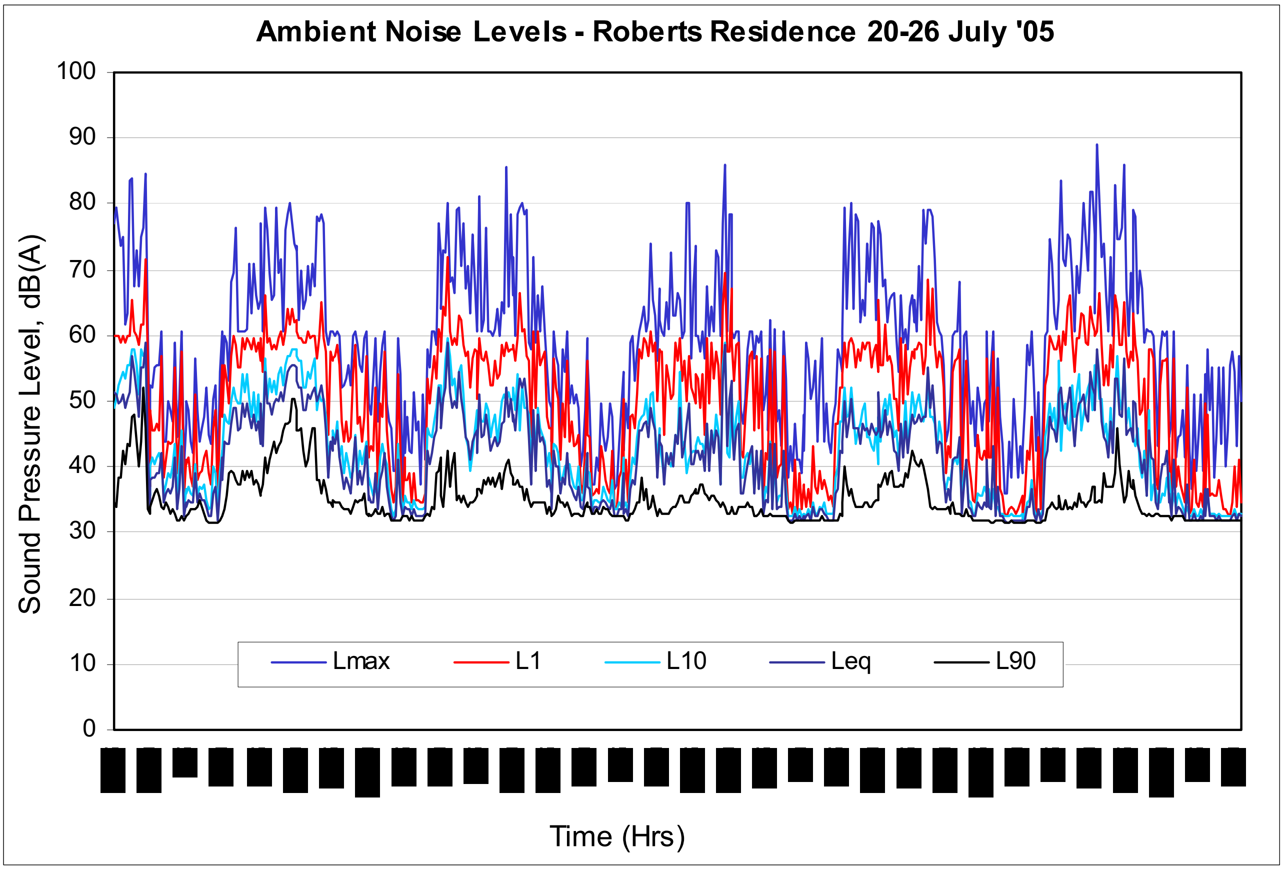
CAD FILE: Figure 20 NP

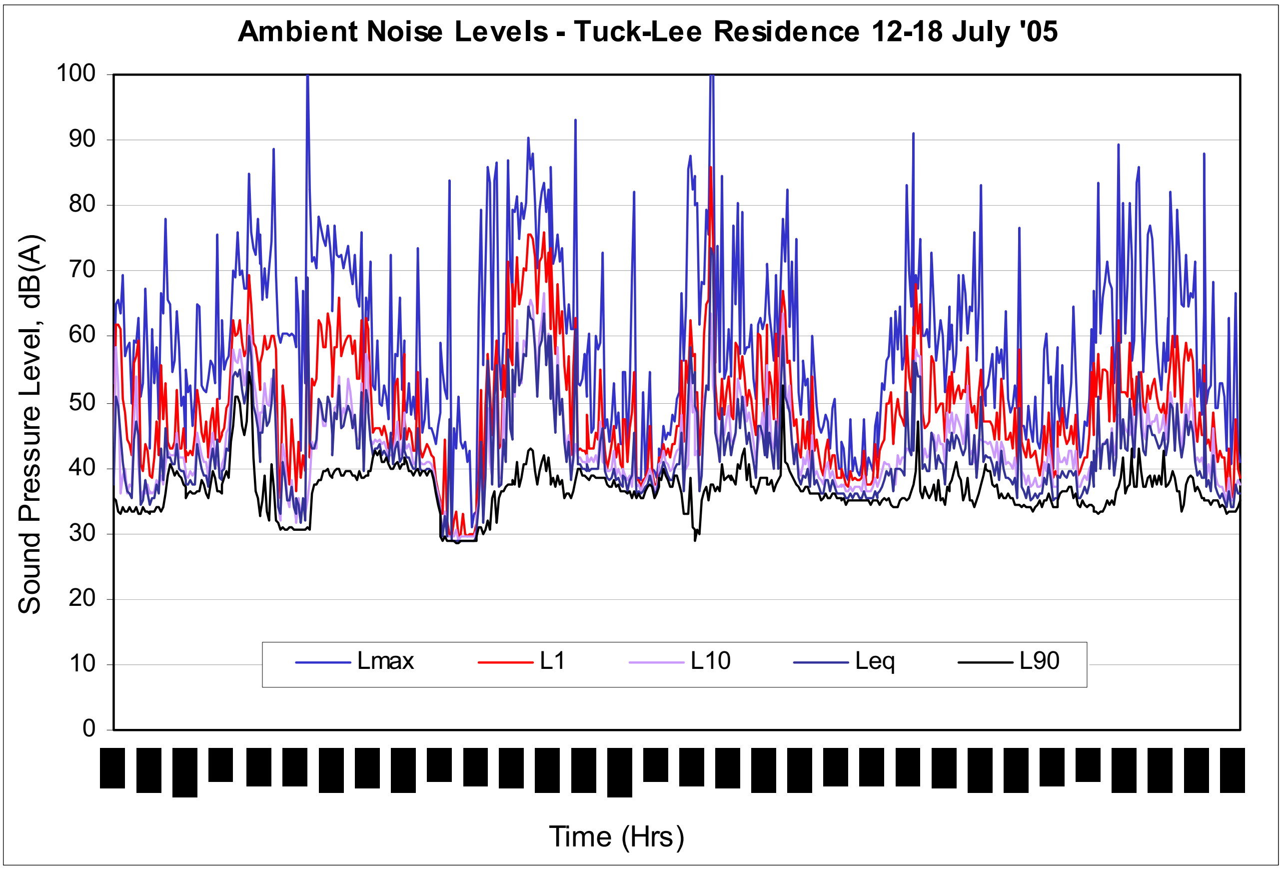
APPENDIX B

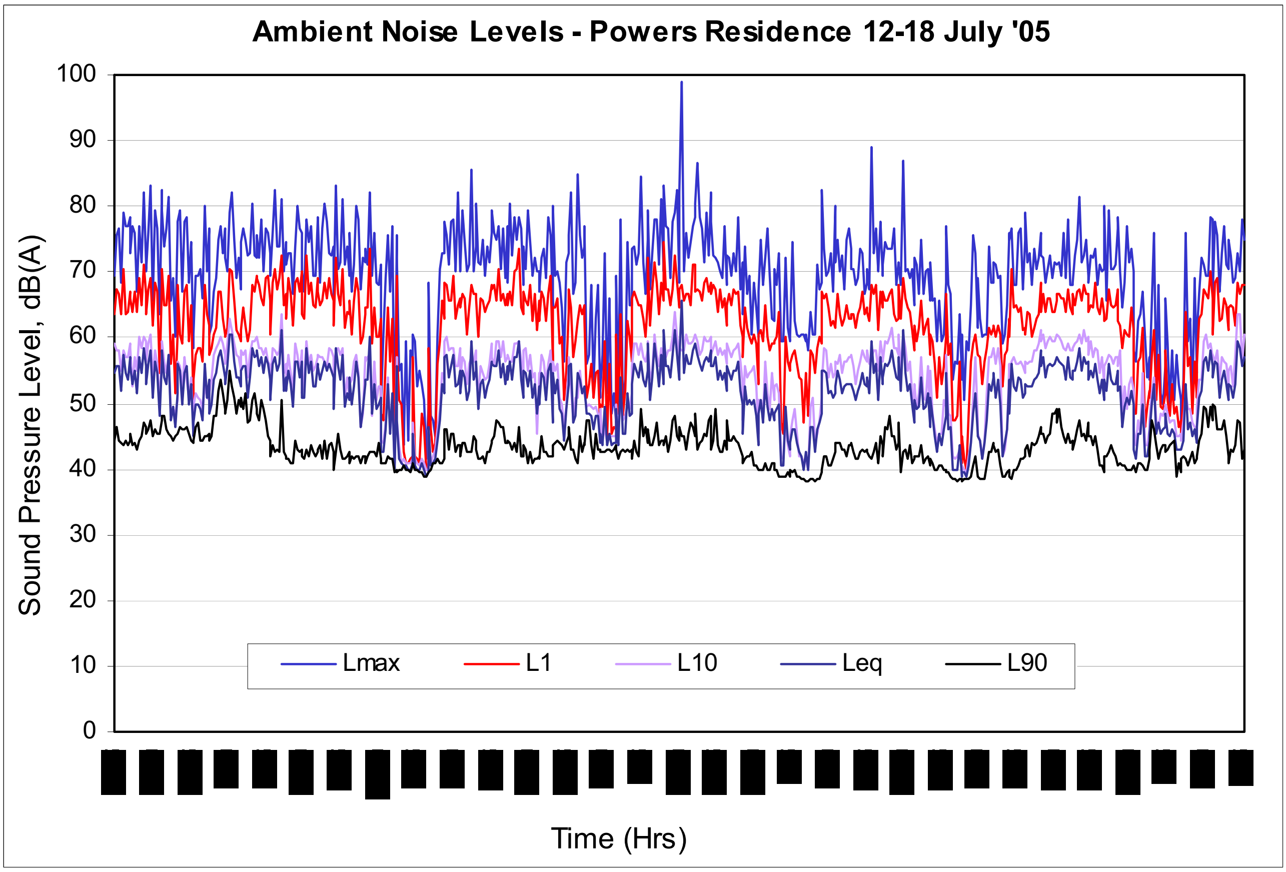
MEASURED AMBIENT NOISE DATA CHARTS

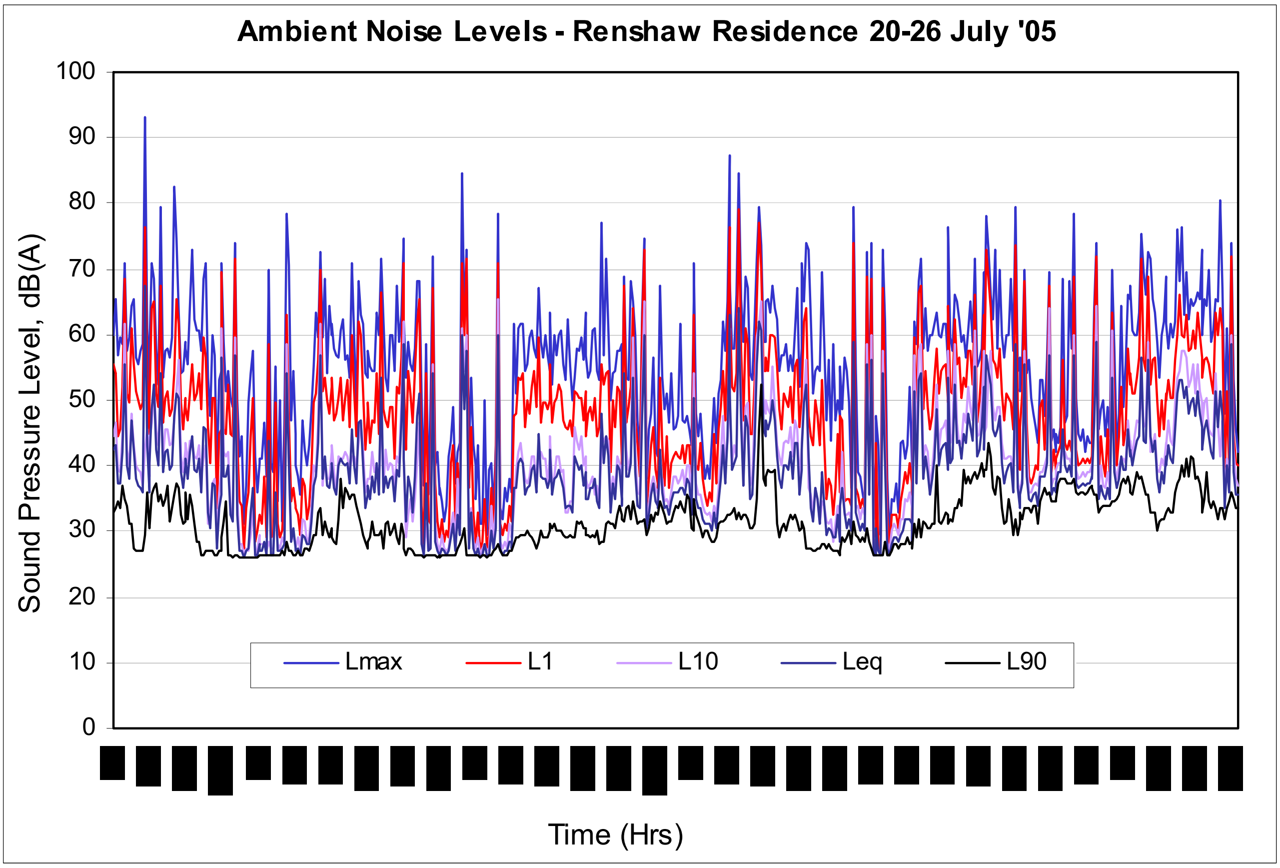

Ambient Noise Levels - Rayner Residence 12-18 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Reid Residence 19-20 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Roberts Residence 20-26 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Tuck-Lee Residence 12-18 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Powers Residence 12-18 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)


Ambient Noise Levels - Renshaw Residence 20-26 July '05
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
0
Lmax
L1
L10
Leq
L90
Time (Hrs)