# APPENDIX H

## Acoustics Impact Assessment

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# COALPAC PTY LTD

# ACOUSTICS IMPACT ASSESSMENT

# COALPAC CONSOLIDATION PROJECT ENVIRONMENTAL ASSESSMENT

**REPORT J0130-29-R2**

**21 DECEMBER 2011**

Prepared for:
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# 1 INTRODUCTION

Bridges Acoustics was commissioned by Hansen Bailey on behalf of Coalpac Pty Ltd (Coalpac) to undertake a noise and vibration impact assessment for the Coalpac Consolidation Project (the Project). The purpose of this assessment is to form part of an Environmental Assessment (EA) being prepared by Hansen Bailey to support an application for a contemporary Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the development of a 21 year open cut coal mining operation and associated infrastructure.

Specifically, the Project would consist of:

- Consolidation and expansion of the existing Cullen Valley Mine and Invincible Colliery operations to produce up to a total of 3.5 Million tonnes per annum (Mtpa) of product coal, including;
  - The continuation of mining operations at Cullen Valley Mine (the area west of the Castlereagh Highway) via open cut and highwall mining methods to access an additional resource of approximately 40.1 Mt ROM; and
  - The continuation of mining operations at Invincible Colliery (including an extension north into the East Tyldesley area) via open cut and highwall mining methods to access an additional resource of approximately 68.41 Mt ROM;
- Continuation of coal supply to the local Mount Piper Power Station (MPPS) via a dedicated coal conveyor over the Castlereagh Highway (to be constructed) and emergency supply to Wallerawang Power Station (WPS) via road, with flexibility for supply to additional domestic destinations and Port Kembla for export;
- Upgrades to existing administration, transport and other infrastructure;
- Construction and operation of additional offices at Cullen Valley Mine;
- Construction and use of the previously approved Coal Deshaling Plant (CDP) at Cullen Valley Mine;
- Construction and use of a bridge over the Castlereagh Highway to link operations east and west of the Highway and the development of required access roads to the East Tyldesley area;
- Construction and operation of a bridge and haul road across the Wallerawang - Gwabegar Railway Line (WGRL) to permit access to mine the previously approved Hillcroft resource;
- Extraction of the Marangaroo Sandstone horizon from immediately below the Lithgow Coal Seam in the northern coal mining area of Cullen Valley Mine. This material would be trucked to an onsite crushing station prior to sale into the Sydney (and surrounds) industrial sand market;
- Construction of a rail siding with associated infrastructure to permit transport of coal and sand products;
- Integration of the water management of both sites into a single system; and
- Integration of the management of mine rehabilitation and conceptual final landform outcomes for Cullen Valley Mine and Invincible Colliery.

This report includes an assessment of noise and blasting impacts associated with the Project in accordance with current NSW Department of Environment Climate Change and Water (DECCW) guidelines and policies as described below.

## 1.1 Environmental Noise Policies

DECCW has developed or adopted policies and recommended procedures to assess environmental noise levels from various noise source categories. The following policy documents are relevant to this assessment:

- The *NSW Industrial Noise Policy* (INP) (EPA, 2000) is intended to guide noise investigations from existing or proposed industrial developments including coal mines. The INP recommends procedures to determine:
    - background noise levels at receiver properties;
    - existing noise levels from an industrial site;
    - recommended, not mandatory, noise criteria for existing and proposed operations;
    - predicted noise levels from proposed developments; and
    - negotiation options if recommended noise criteria are not or may not be met.
- *Interim Construction Noise Guideline* (DECC, 2009) provides criteria, recommended hours and methods for assessing noise from construction work;
- The *NSW Road Noise Policy* (RNP) (DECCW, 2011) provides recommended noise criteria and assessment procedures for road traffic noise, including Project-related traffic, from public roads but excludes noise produced by vehicle movements on the Project site. The RNP also contains recommended sleep disturbance criteria;
- *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (Interim Rail Noise Guideline) (DECC, 2007) provides criteria and methods to assess noise from train movements on publicly owned rail lines;
- The *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (Australian and New Zealand Environment Council (ANZEC), 1990) recommends residential ground vibration and overpressure limits and time restrictions for blasting;
- *Assessing Vibration – a Technical Guide* (DEC, 2006) provides recommended criteria and methods for assessing vibration, primarily from construction activities such as pile driving but excluding vibration associated with blasting; and
- *DIN 4150 Part 3 – Structural Vibration: effects of vibration on structures* (ISO, 1999).

## 1.2 Receivers

The Project is predominately located on lands within the Ben Bullen State Forest, with some areas owned by Coalpac and associated companies and by private rural landholders. Rural residential receivers adjoin the Project to the north, west and south, while the remainder of the Ben Bullen State Forest adjoins much of the eastern Project Boundary. The township of Cullen Bullen is located to the south and west of the Project, Xstrata's Baal Bone Colliery is located to the north east and MPPS is located to the south.

A land ownership plan showing land owned by Coalpac, other mining companies and private individuals or companies is included in each noise contour figure in Appendix A.

## 1.3 Glossary

The following acoustical terms are used in this report:

| | |
|---|---|
| Sound Pressure | Small air pressure variations above and below normal atmospheric pressure that are perceived by human ears as sound; |

Frequency — The rate of sound pressure fluctuations per second, expressed as cycles per second or hertz (Hz). Human ears in good condition can typically detect sound in the frequency range 20 Hz to 20,000 Hz (20 kHz), depending on sound level;

Decibels, dB — A noise level unit based on a logarithmic scale of Pascals of sound pressure above and below atmospheric pressure. Expressing a sound pressure level in decibels implies root-mean-squared (RMS) sound pressure unless explicitly stated otherwise. Human ears in good condition can typically detect sound pressures from the threshold of perception at 0 dB (20 uPa) to the threshold of pain at 140 dB (200 Pa). An increase of 10 dB is perceived as an approximate doubling of sound level by an average human ear;

dBL — Linear decibels, the same as dB but used to explicitly define a decibel scale in the absence of any frequency weighting;

dBA — A-weighted decibels, where the A weighting means frequencies below 500Hz and above 10kHz are artificially reduced to approximate the frequency response of an average human ear. Most sound monitoring instruments include an A-weighting option, enabling direct measurement of noise levels in dBA;

LA90 — The A-weighted noise level exceeded 90% of the time (which can be thought of as the quietest 10% of the time) over a defined measurement period, usually 15 minutes or one hour, and widely accepted as the background noise level;

LAeq — The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location; and

Sound Power — Sound energy emitted by a source, measured in watts (W) or expressed on a decibel scale with 0 dB representing 1 picowatt (1 pW) of sound power. While both sound pressure and sound power can be expressed on a decibel scale, they are not interchangeable or directly comparable. Sound power levels are most commonly expressed as unweighted decibels (dBL) but can be expressed as A-weighted decibels (dBA).

# 2 EXISTING ENVIRONMENT

## 2.1 Cullen Valley EIS

The *Cullen Valley Mine Extension Environmental Impact Statement* (International Environmental Consultants, 2003) included *Noise and Vibration Impact Assessment, Open Cut Extension, Cullen Valley Mine* (Atkins Acoustics, April 2003) (the Cullen Valley Atkins Report). The Cullen Valley Atkins Report includes results from background noise measurements at four representative receiver locations in the area in May 2002, as shown in Table 1.

**Table 1: Measured Background Noise Levels, Cullen Valley Atkins Report, May 2002.**

| Property Reference[1], Location | Measured Background Level, LA90,15min | | |
|---|---|---|---|
| | Day | Evening | Night |
| 139 ‘Red Springs’ | 32 | 29 | 29 |
| 179 ‘Hillcroft’ | 29 | 28 | 28 |
| 205 ‘Forest Lodge | 27 | 28 | 29 |
| 103-110 Northern Allotments | 24 | 25 | 25 |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.

## 2.2 Invincible EIS

The *Proposed Extension to the Invincible Colliery Environmental Impact Statement* (R. W. Corkery & Co. Pty Limited, 2008) included *Noise Impact Assessment of the Proposed Extension to the Invincible Colliery Open Cut Mine and Production Increase* (Environmental Resources Management Australia Pty Ltd, January 2008) (the ERM Report). The ERM Report includes results from background noise measurements at two representative receiver locations in the area in December 2005, as shown in Table 2. Both properties are now owned by Coalpac.

**Table 2: Measured Background Noise Levels, ERM Report, December 2005.**

| Property Reference[1], Location | Measured Background Level, LA90,15min | | |
|---|---|---|---|
| | Day | Evening | Night |
| 394 'Hillview' | 36 | 30[2] | 30[2] |
| 393 'Billabong' | 36 | 30[2] | 30[2] |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.

2 Background levels below 30 L90,15min were reported as 30 LA90,15min by ERM.

## 2.3 Baal Bone EIS

The *Environmental Assessment – Baal Bone Colliery* (AECOM, 2010) included *Noise Impact Assessment Baal Bone Colliery* (Atkins Acoustics, November 2009) (the Baal Bone Atkins Report). The Baal Bone Atkins Report includes results from background noise measurements at two representative receiver locations in the area in November 2008, with the Baal Bone Coal Handling and Preparation Plant (CHPP) not operating, as shown in Table 3. As these two properties are relatively close to each other, the lower background noise levels measured at property 143 have been adopted for this assessment.

**Table 3: Measured Background Noise Levels, Baal Bone Atkins Report, November 2008.**

| Property Reference[1], Location | Measured Background Level, LA90,15min | | |
|---|---|---|---|
| | Day | Evening | Night |
| 144 Muldoon | 29 | 32 | 32 |
| 143 Speirs | 32 | 33 | 33 |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.

## 2.4 Property 212 Noise Monitoring

Coalpac commissioned Global Acoustics to complete two noise surveys on Property 212 owned by Coalpac. The property is located south of Cullen Valley Mine and west of Cullen Bullen township. This location was chosen by Coalpac to assist in determining background and ambient noise levels at nearby privately owned properties. Results from long term unattended noise surveys completed in June and November 2008 are shown in Table 4.

**Table 4: Measured Background Noise Levels at Property 212, Global Acoustics, 2008.**

| Property Reference[1], Location, Time Period | Measured Background Level, LA90,15min | | |
|---|---|---|---|
| | Day | Evening | Night |
| 212 Coalpac June 2008 | 34[2] | 27 | 27 |
| 212 Coalpac November 2008 | 36[2] | 32 | 26 |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.

2 Day background levels may have been affected by Cullen Valley Mine activity and should be ignored.

## 2.5 Cullen Valley Mine Quarterly Noise Monitoring

Coalpac commissioned Global Acoustics to complete a series of quarterly noise surveys at various receiver locations near Cullen Valley Mine. Results shown in Table 5 are based on short term noise measurements, generally over periods of 15 minutes, with Cullen Valley Mine operating normally. Background levels in *italics* were noted to be at least partly due to mining or related operations, while levels in normal font did not appear to be influenced by mining noise based on comments attached to each measurement result in the Global Acoustics reports.

**Table 5: Measured Daytime Background Noise Levels, Global Acoustics, 2008 - 09.**

| Property Reference[1], Location | Measured Background Level, LA90,15min<br>12 June, 18 June, 5 August, 12 November 2008, 25 February, 28 May, 11 September 2009 | Typical Background Sources |
|---|---|---|
| 139 'Red Springs' | 32, 31, *32*, *32*,<br>32, 35, 32 | Distant traffic, birds, other natural sources |
| 179 'Hillcroft' | *39*, *38*, *32*, *33*,<br>35, *38*, *35* | Insects, *Cullen Valley mining equipment* |
| 205 'Forest Lodge | 27, 22, 20, 28,<br>33, 18, 33 | Insects, frogs, birds |
| 169 Doble[2] | 35, 31, 36, 35,<br>37, 36, 37 | Highway traffic |
| 199 Tilley | 40, 32, 36, 29,<br>42, 45, 42 | Highway traffic |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.

2 Property 169 is now owned by Coalpac.

## 2.6 Invincible Colliery Quarterly Noise Monitoring

Coalpac commissioned Global Acoustics to complete a series of quarterly noise surveys at various receiver locations near Invincible Colliery. Results shown in Table 6 are based on short term noise measurements, generally over periods of 15 minutes with Invincible Colliery operating normally.

Background levels in Table 6 in *italics* were noted to be at least partly due to mining or related operations, while levels in normal font did not appear to be influenced by mining noise based on comments attached to each measurement result in the Global Acoustics reports.

Global Acoustics also completed two long term unattended noise surveys at five locations near Invincible Colliery, generally with the Colliery operating normally, with results presented in Table 7. Background noise levels obtained during Invincible Colliery operation should be considered an upper limit to levels that would be measured in the absence of noise from the Colliery.

**Table 6: Measured 15 Minute Background Noise Levels, Global Acoustics, 2008 - 09.**

| Property Reference[1], Location | Measured Background Level, LA90,15min[2] 5 August 08, 25 February, 28 May, 10 September 09 | | Typical Background Sources |
|---|---|---|---|
| | Day | Evening | |
| 394 'Hillview'[3] | 37, 38, *49*, *39* | 32, 33, *45*, *29* | Traffic, frogs, insects, *Invincible CPP* |
| 393 'Billabong'[3] | 36, 36, *47*, 42 | 31, 34, *35*, *33* | Traffic, frogs, birds, *Invincible CPP* |
| South Cullen Bullen | - , - , 36, 33 | - , - , 28, 26 | Traffic, frogs, insects |
| West Cullen Bullen | - , - , 35, 32 | - , - , 31, 31 | Traffic, frogs, train |
| Central Cullen Bullen[4] | 34, 38, 32, 42 | *34*, 34, 25, 29 | Traffic, *CV Mine*, insects, frogs, birds |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.
2 A dash "-" denotes the location was omitted from that survey.
3 Properties 393, 394 are now owned by Coalpac.
4 Monitoring location on Invincible Avenue or Mudgee Road, Cullen Bullen.

**Table 7: Measured Long Term Background Noise Levels, Global Acoustics, 2009.**

| Property Reference[1], Location | Measured Background Level, LA90,15min 28 May – 8 June, 11 - 16 September 2009 | | |
|---|---|---|---|
| | Day | Evening | Night |
| Property 394 'Hillview'[2] | 39, 38 | 34, 34 | 30, 28 |
| Property 393 'Billabong'[2] | 36, 38 | 32, 33 | 26, 30 |
| Property 362 Cullen Bullen South | 33, 34 | 26, 31 | 24, 28 |
| Farley Street Cullen Bullen West | 31, 34 | 27, 30 | 26, 28 |
| Mudgee Road Cullen Bullen Central | 32, 38 | 26, 31 | 26, 28 |

1 Property Reference number as listed in this EA and shown on the noise contour figures in Appendix A.
2 Properties 393, 394 are now owned by Coalpac.

## 2.7 EA Long Term Background Noise Monitoring

Coalpac commissioned Global Acoustics to complete additional noise surveys during preparation of the Environmental Assessment. Global Acoustics monitored background and ambient noise levels at four representative receiver locations as shown on the figures in Appendix A:

- Location M1 – Adjacent to the Castlereagh Highway approximately 400m north of Cullen Bullen, representing receivers close to the Highway;
- Location M2 – Approximately 100m east of the Castlereagh Highway and 2.5 km north of Cullen Bullen, on Property 171 owned by Coalpac;
- Location M3 – Approximately 550m west of the Castlereagh Highway and 30m north of Red Springs Road, on Property 104; and
- Location M4 – Adjacent to Back Cullen Road approximately 740m south of Portland Cullen Bullen Road, north east of Residence 373.

Acoustic Research Laboratories EL-215 Type 2 noise monitors were installed at each location for the period 1 November to 15 November 2011 and programmed to measure and store 15 minute A-weighted percentile statistics. Results from the noise monitors were processed according to INP guidelines, including an analysis of weather conditions during the noise survey based on weather data supplied by Coalpac from the Invincible Colliery weather station.

The weather data indicated winds above 5m/s had the potential to affect measured noise levels during the day on the 2 November, 10 November and 14 November 2011. Data for these days have been highlighted in small italic font and excluded from the Rating Background Levels (RBLs) and average ambient noise levels presented in Tables 8 to 11.

**Table 8: Measured Noise Levels, Location M1 Cullen Bullen, dBA.**

| Day, Date | Background Level, LA90,15min | | | Ambient Level LAeq,15min | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| Tue 1 – Wed 2/11 | *39.4* | 30.5 | 27.5 | *62.1* | 60.0 | 59.4 |
| Wed 2 – Thu 3/11 | *37.8* | 28.8 | 28.0 | *62.6* | 59.0 | 59.4 |
| Thu 3 – Fri 4/11 | 35.2 | 29.8 | 27.5 | 63.1 | 59.8 | 58.9 |
| Fri 4 – Sat 5/11 | 34.0 | 36.8 | 27.5 | 64.2 | 63.5 | 58.1 |
| Sat 5 – Sun 6/11 | 35.7 | 33.0 | 27.0 | 64.0 | 58.6 | 55.9 |
| Sun 6 – Mon 7/11 | 35.8 | 34.0 | 28.3 | 63.5 | 60.4 | 58.0 |
| Mon 7 – Tue 8/11 | 35.5 | 34.5 | 28.8 | 62.5 | 58.9 | 58.6 |
| Tue 8 – Wed 9/11 | 36.5 | 34.0 | 28.5 | 62.2 | 60.6 | 59.3 |
| Wed 9 – Thu 10/11 | 36.0 | 36.5 | 29.7 | 62.7 | 59.2 | 58.3 |
| Thu 10 – Fri 11/11 | *37.5* | 35.0 | 31.0 | *64.4* | 60.9 | 59.6 |
| Fri 11 – Sat 12/11 | 36.5 | 34.0 | 27.8 | 64.0 | 63.0 | 57.7 |
| Sat 12 – Sun 13/11 | 35.0 | 32.8 | 27.0 | 63.0 | 58.3 | 53.8 |
| Sun 13 – Mon 14/11 | 33.5 | 30.3 | 28.0 | 62.7 | 60.0 | 58.6 |
| Mon 14 – Tue 15/11 | *35.9* | 29.7 | 27.5 | *62.5* | 59.4 | 58.8 |
| Tue 15 – Wed 16/11 | 34.5 | - | - | 62.6 | - | - |
| Weekly Median / Average | 35.5 | 33.5 | 27.9 | 63.2 | 60.4 | 58.4 |

**Table 9: Measured Noise Levels, Location M2 Property 171, dBA.**

| Day, Date | Background Level, LA90,15min | | | Ambient Level LAeq,15min | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| Tue 1 – Wed 2/11 | - | 33.4 | 28.5 | - | 54.5 | 56.3 |
| Wed 2 – Thu 3/11 | *34.2* | 30.0 | 27.3 | *65.7* | 45.5 | 53.6 |
| Thu 3 – Fri 4/11 | 35.2 | 30.0 | 28.0 | 57.4 | 44.0 | 43.3 |
| Fri 4 – Sat 5/11 | 37.5 | 35.0 | 26.5 | 63.1 | 58.0 | 44.2 |
| Sat 5 – Sun 6/11 | 34.2 | 31.0 | 27.0 | 61.8 | 46.1 | 44.3 |
| Sun 6 – Mon 7/11 | 36.5 | 31.3 | 27.0 | 58.7 | 53.9 | 47.4 |
| Mon 7 – Tue 8/11 | 33.7 | 31.8 | 29.0 | 61.1 | 48.9 | 45.8 |
| Tue 8 – Wed 9/11 | 37.6 | 28.8 | 27.0 | 72.6 | 62.2 | 42.3 |
| Wed 9 – Thu 10/11 | 32.4 | 33.0 | 30.5 | 65.9 | 48.4 | 61.8 |
| Thu 10 – Fri 11/11 | *33.0* | 29.3 | 30.5 | *64.5* | 46.9 | 46.4 |
| Fri 11 – Sat 12/11 | 40.0 | 35.0 | 27.3 | 62.0 | 64.7 | 52.1 |
| Sat 12 – Sun 13/11 | 34.2 | 28.8 | 26.5 | 60.8 | 45.5 | 44.4 |
| Sun 13 – Mon 14/11 | 37.0 | 30.0 | 27.0 | 62.0 | 49.9 | 46.3 |
| Mon 14 – Tue 15/11 | *40.0* | 31.0 | 27.5 | *71.9* | 55.8 | 48.6 |
| Tue 15 – Wed 16/11 | 37.5 | - | - | 60.0 | - | - |
| Weekly Median / Average | 36.5 | 31.0 | 27.3 | 64.8 | 56.7 | 52.9 |

**Table 10: Measured Noise Levels, Location M3 Red Springs Road, dBA.**

| Day, Date | Background Level, LA90,15min | | | Ambient Level LAeq,15min | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| Tue 1 – Wed 2/11 | 33.0 | 29.0 | 27.8 | 41.5 | 42.8 | 39.3 |
| Wed 2 – Thu 3/11 | *34.6* | 29.3 | 27.3 | *45.2* | 40.2 | 38.1 |
| Thu 3 – Fri 4/11 | 31.2 | 28.8 | 27.5 | 39.5 | 40.1 | 35.7 |
| Fri 4 – Sat 5/11 | 31.0 | 35.3 | 27.5 | 40.8 | 43.8 | 38.5 |
| Sat 5 – Sun 6/11 | 30.0 | 29.5 | 27.5 | 38.1 | 43.1 | 41.1 |
| Sun 6 – Mon 7/11 | 30.5 | 29.5 | 27.3 | 44.3 | 38.3 | 35.6 |
| Mon 7 – Tue 8/11 | 30.0 | 29.0 | 27.5 | 39.4 | 41.1 | 40.4 |
| Tue 8 – Wed 9/11 | 32.1 | 30.8 | 28.0 | 51.5 | 47.2 | 40.0 |
| Wed 9 – Thu 10/11 | 32.0 | 30.3 | 28.2 | 44.5 | 41.8 | 39.8 |
| Thu 10 – Fri 11/11 | *33.3* | 31.0 | 28.0 | *48.6* | 42.4 | 40.8 |
| Fri 11 – Sat 12/11 | 31.5 | 34.8 | 27.0 | 40.0 | 43.8 | 37.0 |
| Sat 12 – Sun 13/11 | 29.5 | 29.5 | 27.5 | 40.1 | 41.4 | 39.8 |
| Sun 13 – Mon 14/11 | 30.8 | 32.5 | 27.5 | 40.9 | 41.5 | 38.8 |
| Mon 14 – Tue 15/11 | *30.9* | 30.9 | 27.5 | *44.9* | 46.3 | 39.9 |
| Tue 15 – Wed 16/11 | 29.5 | - | - | 38.1 | - | - |
| Weekly Median / Average | 30.9 | 29.9 | 27.5 | 43.8 | 43.1 | 39.2 |

**Table 11: Measured Noise Levels, Location M4 Back Cullen Road, dBA.**

| Day, Date | Background Level, LA90,15min | | | Ambient Level LAeq,15min | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| Tue 1 – Wed 2/11 | - | 30.5 | 29.8 | - | 39.0 | 39.0 |
| Wed 2 – Thu 3/11 | *33.7* | 29.8 | 29.0 | *57.9* | 50.8 | 36.8 |
| Thu 3 – Fri 4/11 | 32.5 | 30.5 | 29.5 | 56.8 | 47.1 | 40.0 |
| Fri 4 – Sat 5/11 | 33.2 | 33.0 | 29.5 | 62.9 | 60.9 | 42.7 |
| Sat 5 – Sun 6/11 | 32.0 | 30.3 | 29.5 | 59.6 | 37.7 | 38.2 |
| Sun 6 – Mon 7/11 | 32.7 | 31.5 | 28.5 | 59.2 | 46.1 | 46.0 |
| Mon 7 – Tue 8/11 | 33.5 | 31.5 | 29.5 | 53.8 | 45.6 | 37.0 |
| Tue 8 – Wed 9/11 | 37.0 | 29.3 | 28.5 | 67.0 | 64.8 | 33.9 |
| Wed 9 – Thu 10/11 | 32.0 | 32.0 | 29.2 | 67.5 | 51.7 | 53.1 |
| Thu 10 – Fri 11/11 | *37.6* | 30.8 | 29.5 | *66.3* | 51.6 | 43.8 |
| Fri 11 – Sat 12/11 | 35.5 | 32.8 | 28.5 | 62.2 | 69.2 | 57.3 |
| Sat 12 – Sun 13/11 | 31.7 | 30.3 | 29.0 | 57.6 | 44.4 | 42.6 |
| Sun 13 – Mon 14/11 | 31.5 | 32.3 | 28.5 | 68.3 | 58.7 | 41.8 |
| Mon 14 – Tue 15/11 | *34.4* | 31.5 | 28.8 | *68.0* | 66.6 | 41.4 |
| Tue 15 – Wed 16/11 | 32.5 | - | - | 54.6 | - | - |
| Weekly Median / Average | 32.5 | 31.1 | 29.1 | 63.4 | 61.2 | 48.1 |

More complete results from the noise monitors, in the form of daily charts showing data in 15 minute intervals, are attached as Appendix D.

## 2.8 EA Short Term Background Noise Monitoring

Global Acoustics was also engaged by Coalpac to complete a series of operator attended noise surveys at each long term monitoring location covering the day, evening and night periods, primarily to identify and quantify dominant sources of background and ambient noise at each location. A Rion

NA-28 sound level meter was used to measure 1/3 octave percentile noise levels over 15 minute periods at each location while survey staff noted dominant and audible noise sources. Results from the surveys were presented by Global Acoustics in report 11330_R01 dated 24 November 2011 and are summarised in Table 12.

**Table 12: Short Term Noise Survey Results, All Locations, dBA.**

| Location | Period Date Time | Measured Noise Levels | | | Noise Sources |
|---|---|---|---|---|---|
| | | LAmax | LAeq | LA90 | |
| M1 Cullen Bullen | Day 1 2/11 10:34 | 87.1 | 70.3 | 48.5 | Highway traffic dominant, birds and breeze audible, mining not audible |
| | Day 2 15/11 15:15 | 86.0 | 67.2 | 35.6 | Highway traffic dominant, birds sheep and breeze audible, mining not audible |
| | Evening 1 1/11 19:46 | 85.0 | 62.0 | 33.0 | Highway traffic dominant, frogs in background, mining not audible |
| | Evening 2 15/11 18:54 | 87.4 | 65.7 | 36.1 | Highway traffic dominant, frogs in background, mining not audible |
| | Night 1 1/11 22:50 | 84.6 | 60.4 | 25.7 | Highway traffic dominant, insects and frogs in background, mining not audible |
| | Night 2 15/11 23:24 | 85.8 | 59.7 | 29.2 | Highway traffic dominant, insects in background, mining not audible |
| M2 Property 171 | Day 1 2/11 11:05 | 65.1 | 50.7 | 41.3 | Highway traffic dominant, breeze and insects in background, Baal Bone Colliery audible < 30 LAeq |
| | Day 2 15/11 15:49 | 61.1 | 47.7 | 34.5 | Highway traffic dominant, birds in background, mining not audible |
| | Evening 1 1/11 20:26 | 69.8 | 45.2 | 33.4 | Highway traffic dominant, frogs and insects in background, Baal Bone Colliery audible < 30 LAeq |
| | Evening 2 15/11 18:28 | 59.5 | 45.1 | 33.7 | Highway traffic dominant, birds in background, Baal Bone Colliery CHPP and dozer 44 LAmax, 33 LAeq |
| | Night 1 1/11 22:26 | 61.7 | 42.5 | 34.4 | Highway traffic, insects and birds dominant, Baal Bone Colliery CHPP 33 LAeq |
| | Night 2 15/11 22:30 | 63.9 | 47.2 | 28.1 | Highway traffic dominant, insects in background, Baal Bone Colliery CHPP 30 LAeq |

| Location | Period Date Time | Measured Noise Levels LAmax | LAeq | LA90 | Noise Sources |
|---|---|---|---|---|---|
| M3 Red Springs Road | Day 1 2/11 11:35 | 67.1 | 46.2 | 37.4 | Local traffic and breeze dominant, dogs and birds in background, Highway barely audible, Baal Bone Colliery audible not measurable |
| | Day 2 15/11 16:21 | 54.5 | 35.1 | 27.6 | Highway traffic dominant, birds and breeze in background, mining not audible |
| | Evening 1 1/11 20:54 | 53.8 | 39.4 | 32.7 | Insects dominant, Highway traffic intermittently audible, mining not audible |
| | Evening 2 15/11 18:00 | 54.6 | 38.6 | 32.2 | Highway traffic dominant, birds in background, mining not audible |
| | Night 1 1/11 22:00 | 51.2 | 39.8 | 31.0 | Frogs and insects dominant, Highway traffic audible, mining not audible |
| | Night 2 15/11 22:02 | 56.3 | 39.4 | 30.3 | Dogs, Highway traffic and insects dominant and in background, mining not audible |
| M4 Back Cullen Road | Day 1 2/11 10:11 | 69.3 | 44.7 | 36.3 | Birds and breeze dominant, mining not audible |
| | Day 2 15/11 14:45 | 60.3 | 42.3 | 34.1 | Birds, breeze and traffic dominant, mining not audible |
| | Evening 1 1/11 18:02 | 57.1 | 39.5 | 32.7 | Breeze, birds and insects dominant, mining not audible |
| | Evening 2 15/11 19:18 | 76.2 | 50.9 | 33.5 | Birds dominant, breeze and traffic audible, mining not audible |
| | Night 1 1/11 23:15 | 53.5 | 31.1 | 27.6 | Frogs, insects, distant traffic dominant, MPPS audible <25 dBA, mining not audible |
| | Night 2 15/11 22:59 | 42.8 | 30.5 | 23.9 | Distant traffic dominant, insects in background, mining not audible |

## 2.9 Adopted Background Noise Levels

A relatively large number of noise surveys have been completed in the area in recent years. Background noise levels tend to vary at most monitoring locations due to seasonal and other factors, although levels at or below 30 LA90 are common during the evening and night. Background noise levels during the day do not tend to reduce below 30 LA90 at all locations and have been subject to further investigation:

Cullen Bullen — Measured background noise levels within Cullen Bullen, with one exception, are consistently at or above 32 LA90 during the day and were 35 LA90 in the most recent survey;

Near Highway — Measured background noise levels near the Castlereagh Highway north and south of Cullen Bullen, with one exception, are consistently at or above 32 LA90 during the day and were 36 LA90 at Property 171 in the most recent survey; and

| | |
|---|---|
| Remote from Highway | Measured background noise levels at locations remote from the Castlereagh Highway regularly reduce to 30 LA90 or lower, although long term measured levels remained above 30 LA90 at all locations during the recent noise survey. |

The recent noise survey indicated a measured background level of 31 LA90 during the day at Location M3 Red Springs Road approximately 550m from the Highway. All locations closer than this distance from the Highway tend to receive a background level of 32 LA90 or above while locations further from the Highway tend to receive a background level at or below 30 LA90 at times. A distance of 500m from the Highway has therefore been adopted to indicate the boundary of the higher background noise category for the purposes of noise assessment.

Table 13 shows background levels adopted for this assessment for two receiver groups.

**Table 13: Adopted Rating Background Levels (RBLs).**

| Receiver Area | Rating Background Level, LA90,15min | | |
|---|---|---|---|
| | Day | Evening | Night |
| Group A - within 500m of the Castlereagh Highway, including Cullen Bullen township | 32 | 30 | 30 |
| Group B - more than 500m from the Highway | 30 | 30 | 30 |

While a number of noise survey results have indicated higher background levels than adopted in Table 13, the adopted levels are considered appropriately conservative and higher background levels are difficult to justify.

## 2.10 Existing Industrial Noise Levels – Baal Bone Colliery

Significant sources of industrial noise in the area would include the existing Cullen Valley Mine and Invincible Colliery, Baal Bone Colliery and MPPS. For the purposes of determining an appropriate noise amenity criterion, all other industrial developments are located too far away to significantly affect the criterion.

Existing noise levels from Cullen Valley Mine and Invincible Colliery would be replaced by proposed noise levels from the Project, so do not require further consideration when determining the amenity criterion.

Existing noise levels from Baal Bone Colliery were reported in the Baal Bone EIS and the Baal Bone Atkins Report. Table 3 in the Baal Bone Atkins Report contains long term monitoring data obtained during two time periods, initially in November 2008 without the Baal Bone CHPP operating and then in February 2009 with the Baal Bone CHPP operating normally. Table 14 shows the two sets of results and the calculated background/ambient contribution from the CHPP, assuming the CHPP is responsible for any noise level changes from one set of results to the next. As there may be other changes to the acoustic climate from November 2008 to February 2009, such as the typical level of insect activity, results from this analysis are only approximate.

Results in Table 14 indicate the Baal Bone CHPP typically produces approximately 36 LAeq,15min at both residences. Higher calculated noise levels during the evening period, in the range 41 to 45 LAeq,15min, have not been considered as they are more likely to represent an increase in insect activity during the evening.

The recent noise survey indicated Baal Bone Colliery currently produces up to 33 LAeq,15min at the Property 171 monitoring location during the evening and night and less than 30 LAeq,15min during the day, which is consistent with the results shown in Table 14.

**Table 14: Existing Baal Bone Colliery Noise Contribution.**

| Receiver | Rating Background Level, LA90,15min/LAeq,15min | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Without CHPP Operating, November 2008 | | | With CHPP Operating, February 2009 | | | Difference (Estimated CHPP Contribution) | | |
| | Day | Evening | Night | Day | Evening | Night | Day | Evening | Night |
| 144 Muldoon | 29/43 | 32/42 | 32/42 | 32/44 | 34/47 | 37/43 | 29/37 | 30/45 | 35/36 |
| 143 Speirs | 32/49 | 33/43 | 33/42 | 32/44 | 34/45 | 36/43 | - / - | 27/41 | 33/36 |

Baal Bone Colliery is currently expected to cease operations in the near future, however consideration of existing potential cumulative noise impacts from Baal Bone Colliery results in a worst case assessment and is therefore considered appropriate.

### 2.11 Existing Industrial Noise Levels – Mt Piper Power Station

Noise levels produced by the existing MPPS and the proposed future MPPS extension are discussed in the *Mt Piper Power Station Extension Environmental Assessment* (MPPS EA) (SKM, September 2009). The MPPS EA assessed existing and proposed noise levels to four locations generally in the range 2100 to 2500 m from the MPPS as shown in Figure 1-1 in the MPPS EA. Tables 5-1 and 6-1 in the MPPS EA show a predicted noise level of 34 to 36 LAeq,15min at the closest assessment locations for both the coal fired and gas fired expansion options, including a 5 dBA low frequency correction factor.

The MPPS EA does not include noise contours for prevailing weather conditions and did not assess receiver locations north of the MPPS. The property with the greatest potential to receive audible noise from both the Project and the expanded MPPS would be Property 426 which is approximately 2800 m north of the MPPS. Property 426 would therefore receive approximately 32 to 34 LAeq,15min from the expanded MPPS under prevailing weather conditions during the night, based on extrapolation of results in the MPPS EA. Other properties included in this assessment are further from the MPPS and are expected to receive lower noise levels from this source.

Recent noise monitoring data indicates a received MPPS noise contribution of less than 25 LAeq at Location M4 Back Cullen Road which is consistent with an existing MPPS noise level below 31 LAeq at Property 426.

## 3 CRITERIA

### 3.1 Mining Noise

The INP contains two sets of noise criteria for residential receivers. Intrusive criteria are set 5 dBA above the adopted Rating Background Level (RBL) in each time period and are designed to limit the relative audibility of mining or industrial operations. These criteria can be adjusted by one or more ‘modifying factors’ such as tonality or impulsiveness described in Section 4 of the INP, or alternatively the source noise levels can be adjusted to consider any modifying factors applicable to those sources. Any relevant adjustments have been applied to source noise levels in this assessment.

Amenity limits recommended in the INP depend on existing industrial noise levels and the nature of the receiver area. The amenity limits are designed to control the total or cumulative level of industrial noise at a sensitive receiver such as a residence. Amenity criteria are set to the amenity limits in cases where limited industrial noise is currently received, or to lower levels to ensure the cumulative impact of existing and proposed noise sources does not exceed the amenity limit for each time period.

As noise survey results indicate existing industrial noise levels are below 30 LAeq,15min at all locations, no corrections for existing industrial noise are required and the amenity limits have been adopted. For the purposes of determining appropriate noise amenity criteria, all assessed receivers have conservatively been assigned the 'rural' amenity category. Table 15 shows the intrusive and amenity criteria adopted for this assessment and the method used to determine these criteria for the two receiver groups shown in Table 8:

- Group A – Receivers within 500m of the Castlereagh Highway; and
- Group B – Receivers more than 500m from the Highway.
  - Noise criteria in Table 15 apply to all proposed noise sources including mining and coal processing equipment, on-site vehicle movements, train loading equipment and train movements on the rail siding. According to the INP, the criteria apply within 30m of a residence or at the receiver property boundary where the boundary is closer than 30m from the residence.
  - Car and truck traffic on public roads and train movements on public rail lines are subject to alternative noise criteria as described below.

**Table 15: Adopted Operational Noise Criteria.**

| Time Period | Day 7am – 6pm[1] | | Evening 6pm – 10pm | | Night 10pm – 7am | |
|---|---|---|---|---|---|---|
| Receiver Group | A | B | A | B | A | B |
| Adopted background noise level LA90,15min (Section 2.3) | 32 | 30 | 30 | | 30 | |
| Intrusive Criteria LAeq,15min (Background + 5 dBA) | 37 | 35 | 35 | | 35 | |
| Amenity limit LAeq,period (INP, rural category) | 50 | 50 | 45 | | 40 | |
| Existing industrial noise level LAeq,period | <36 | <36 | <36 | | <36 | |
| Amenity Criteria LAeq,period (Table 2.2 of INP)[2] | 50[2] | 50[2] | 45[2] | | 38 - 40[2, 3] | |
| Adopted Intrusive Noise Criteria LAeq,15min | 37 | 35 | 35 | | 35 | |

1 Night ends, and Day begins, at 8am on Sundays and public holidays.

2 The amenity criteria are used to assess potential cumulative noise impacts.

3 Night amenity criteria applied to the Project operating alone would be 38 LAeq,9hr at properties 142, 143, 144 and 426 and 40 LAeq,9hr at all other assessed receiver locations. Amenity criteria applied to cumulative noise impacts would be 40 LAeq,9hr night at all residential receivers.

## 3.2 Where Criteria May be Exceeded

Noise criteria listed in Table 15 should be considered the levels above which some acoustic impact may be noticed by receivers. Louder noise levels at a receiver do not necessarily imply the noise is unacceptable at that receiver. The INP describes strategies to deal with potential exceedances of the criteria such as:

- best practice noise mitigation measures applied to individual plant items and mine operating procedures designed to mitigate remaining noise impacts;
- adoption of alternative noise criteria based on achievable noise levels in conjunction with noise mitigation measures and considering other factors such as social worth attached to the development and historical noise levels from existing related developments;
- negotiation of offset arrangements with regulators and/or the affected community; and
- acquisition of properties where the predicted or measured noise impacts are unacceptable and other options cannot reasonably be negotiated.

### 3.3 Cumulative Noise Levels

The INP recommends two sets of criteria, including the intrusive criteria which would apply to the Project operating alone and the amenity criteria which are intended to control the total noise level at a receiver location from all industrial or mining developments. Cumulative noise levels are therefore assessed to the amenity criteria shown in Table 15:

- 50 LAeq,11hr during the day;
- 45 LAeq,4 hr during the evening; and
- 40 LAeq,9hr during the night.

### 3.4 Construction Noise

Construction noise levels from most industrial developments are normally assessed to the Interim Construction Noise Guideline (ICNG) (DECC, 2009). Section 1.2 of the ICNG states it does not apply to industrial sources, including construction associated with quarrying and mining, and suggests this activity be assessed under the INP. Section 1.3 of the INP, however, specifically excludes construction noise from the INP.

As the ICNG is the most recent policy document, noise criteria applied to proposed construction work are sourced from the INP and are therefore identical to mine operational criteria as shown in Table 15, although potential exceedances of the noise criteria for relatively short term construction activities are not expected to be as important as longer term operation noise impacts.

### 3.5 Sleep Disturbance

Sleep disturbance can be caused by a short, sharp sound that is noticeably louder than the typical or usual noise level within a bedroom. Historically, sleep disturbance criteria were sourced from the Environmental Noise Control Manual (EPA, 1985) and the INP Application Notes suggest the historical noise criterion of 15 dBA above the night background noise level should continue to be used in the absence of research to suggest an alternative. The INP Application Notes also point to the Environmental Criteria for Road Traffic Noise (now superseded by the NSW Road Noise Policy) for guidance on sleep disturbance criteria.

The RNP acknowledges the effects of noise on sleep disturbance have not yet been conclusively determined. Nevertheless, Section 5.4 of the RNP states:

> *From the research on sleep disturbance to date it can be concluded that:*
>
> - *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep;*
> - *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

The suggested range of 50-55 dBA inside a bedroom is approximately equivalent to an external noise level of 60-65 dBA, assuming bedroom windows remain partly open. External sleep disturbance criteria of 47 LA1,1min within 500m of the Highway and 45 LA1,1min more than 500m from the Highway based on the historical criterion, and 60 LAmax based on the RNP recommendations, for the hours 10pm to 7am (or to 8am on Sundays and public holidays) are therefore adopted for this assessment. Noise levels below 45 LA1,1min are considered very unlikely to cause sleep disturbance, while noise levels less than 60 LAmax are unlikely to cause awakening reactions according to the RNP.

### 3.6 Traffic Noise

Relevant road traffic noise criteria are listed in Table 3 in the RNP. Noise criteria for Situation 3 "Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments", which applies to road traffic on the Castlereagh Highway, are 60 LAeq,15hr during the day and 55 LAeq,9hr during the night for residential receivers. Recommended noise criteria apply to all traffic, including vehicles associated with the Project.

The LAeq,15hr and LAeq,9hr parameters refers to the average traffic noise level over an entire 15 hour day or 9 hour night.

Rail noise criteria are sourced from the *Interim Rail Noise Guideline* which recommends trigger levels of 65 LAeq,15hr during the day, 60 LAeq,9h during the night and 85 LAmax from existing rail lines such as the WGRL. Similarly, condition L6.1 of Environment Protection Licence EPL 3142 issued to the Australian Rail Track Corporation (ARTC), covering train movements on all railways controlled by ARTC, specifies noise level objectives of 65 LAeq,15hr day, 60 LAeq,9hr night and 85 LAmax at one metre from the façade of affected residential premises.

### 3.7 Low Frequency Noise

Section 4 of the INP recommends low frequency noise levels be considered in the normal operational noise criteria by the addition of a 'modifying factor' to either a source sound power level or a received noise level. Any modifying factors that are relevant to the assessment, including low frequency penalties, have been applied to the adopted sound power levels for affected mining and transportation equipment and no separate assessment of low frequency noise levels is therefore required.

Relevant factors have been applied to the source sound power levels, rather than to received noise levels, to simplify the assessment of a large number of sources that do not all require the same, or any, modifying factors.

### 3.8 Blast Overpressure and Vibration

Current noise and vibration criteria for occupied buildings such as residences, schools and hotels are recommended in the ANZEC publication *"Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration"*. Recommended noise and vibration limits in the Guideline are:

- Overpressure 115 dBL; and
- Ground vibration 5mm/s Peak Particle Velocity (PPV).

The Guideline recognises blast effects cannot always be controlled accurately and allows higher limits of 120 dBL and 10mm/s PPV for up to 5% of the total number of blasts on a site in a 12 month period. Recommended blasting criteria apply during the hours 9am to 5pm Monday to Saturday, excluding public holidays, and are designed to minimise disturbance to occupants.

The majority of occupied buildings can withstand much greater vibration levels, typically well over 20 mm/s, before the onset of superficial or cosmetic damage. Vibration levels well over 25 mm/s would typically be required to cause structural damage to these buildings. Appendix J4 of *Australian Standard 2187.2-2006 Explosives – Storage and use, Part 2: Use of explosives* suggests a vibration criterion of 15 mm/s at 4 Hz, rising to 50 mm/s at 40 Hz and above, would protect occupied buildings with light weight construction materials such as timber frames and plasterboard lining. The Standard recommends a vibration criterion of 50 mm/s for industrial and heavy commercial buildings. The recommended vibration criterion of 5 mm/s and upper limit of 10 mm/s for occupied buildings is therefore adequate to protect these buildings from even superficial or cosmetic damage.

Similarly, occupied buildings routinely withstand wind pressures, including gusts, so are not particularly sensitive to overpressure. Appendix J5 of the Standard states "From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133 dBL. Windows are the building element currently regarded as most sensitive to airblast, and damage to windows is considered improbable below 140 dBL". The recommended criterion of 115 dBL, and upper limit of 120 dBL, is therefore adequate to protect occupied buildings from damage by overpressure.

### 3.8.1 Heritage Items

Indigenous and European heritage items exist in the area, as described in the heritage reports included in the EA. Table 16 shows heritage items noted to be potentially sensitive to blasting impacts in the two heritage reports and suggested ground vibration criteria for each site. The suggested ground vibration criteria should be reviewed by a geotechnical expert based on a detailed assessment of each site. The expert should confirm the suggested criteria are appropriate or specify alternative criteria considering the resistance of each site to potential ground vibration related damage and other site specific factors. Suggested criteria for the four rock shelters in Table 16 should not be adopted in any Blast Management Plan or other document, and blasts should not occur within 400m of each rock shelter, without prior confirmation from a geotechnical expert.

**Table 16: Potentially Sensitive Heritage Sites and Indicative Vibration Criteria.**

| (I)ndigenous or (E)uropean Heritage Item | Comments | Suggested Vibration Criteria |
|---|---|---|
| (I) Rock shelter CV-RCK1-10 | Moderate significance, large overhang | 20 mm/s [1] |
| (I) Rock shelter CV-RCK2-10 | Low significance, large overhang | 20 mm/s [1] |
| (I) Rock shelter CV-RCKPAD1-10 | Moderate significance, moderate overhang | 50 mm/s [1] |
| (I) Rock shelter CV-RCKPAD2-10 | Low significance, small overhang | 100 mm/s [1] |
| (E) Cullen Bullen General Cemetery | Possible disturbance to headstones | 50 mm/s [1] |
| (E) Carleon Coach House | Occupied residence | 5 mm/s [2] |
| (E) Miner's cottages | Occupied residences | 5 mm/s [2] |
| (E) Cullen Bullen Public School | Occupied buildings | 5 mm/s [2] |
| (E) Cullen Bullen Royal Hotel | Occupied building | 5 mm/s [2] |

1 Suggested vibration criteria should be reviewed by a geotechnical expert based on a detailed assessment of each site.

2 Criteria set to minimise disturbance to occupants would also protect these items from structural damage.

# 4 ASSESSMENT

## 4.1 Noise Assessment Method

Noise levels from operation of the Project including mining and processing equipment, coal transportation and rail loadout, have all been assessed using a comprehensive model of the site based on RTA Technology's Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receiver locations or as contours over a receiver area. It is recognised in NSW as the most appropriate choice for situations involving complex topography and a large number of individual noise sources and where a detailed assessment of the effects of atmospheric conditions on noise propagation is required.

The standard ENM package includes data input modules to allow terrain and noise source information to be entered and amended, plus an initial setup page containing terrain and source lists and modelled weather conditions for each scenario. All terrain and source files were prepared for this assessment using a combination of AutoCad and Excel based data then automatically converted to ENM format terrain and source files using specially prepared software. All outputs were obtained using software equivalent to ENM's standard sectioning and contouring algorithms and are presented on a base plan. Tabulated noise levels at residences, and noise levels over 25% of contiguous property areas, have been produced by specially prepared software based on ENM's intermediate calculation files used to produce the noise contours. Noise contour figures are presented in Appendix A.

## 4.2 Initial Constraints Analysis

Initial noise modelling was completed to identify potentially affected receivers in the absence of noise mitigation and to identify appropriate noise control strategies. Additional modelling of alternative mine plans and equipment noise reduction strategies allowed the optimum strategies to be adopted, as assessed in this EA. The noise control strategy adopted in this EA is the result of 14 noise model iterations involving one or more of the following strategies.

- No mining in exposed areas or areas too close to receiver properties;
- Restrictions on operating hours, such as daytime-only operation, in specific areas;
- Equipment noise control;
- Noise barriers such as walls and bunds; and
- Selection of equipment to minimise noise where possible.

Apart from a further reduction in mining areas, which would have the undesired effect of sterilising coal resources, the proposed mine plan includes all feasible and reasonable noise mitigation measures which have been adopted at substantial cost to Coalpac.

## 4.3 Weather Conditions

Atmospheric conditions including temperature, relative humidity, wind speed, wind direction and vertical temperature gradient can all affect noise propagation and received noise levels at some distance from a source. The INP recommends noise enhancing winds or temperature inversions that occur for at least 30% of the time in any season or time period should be considered when predicting noise levels.

### 4.3.1 Gradient Winds

A number of weather datasets were supplied by Coalpac from the Cullen Valley Mine and Invincible Colliery weather stations, in addition to datasets compiled by PAE Holmes using the California Meteorological (CALMET) Model. Weather station data analysis was completed using the DECCW's Noise Enhancement Wind Analysis (NEWA) program in each of 16 compass directions, as shown in Tables 17 and 18. Values in bold font highlight potentially noise enhancing winds that occur for 30% of the time or more in any season or time period.

Table 17 shows potentially noise enhancing winds can occur from the north-east or from the west during the day and evening, based on data from the Cullen Valley Mine weather station.

Table 18 shows the same potentially noise enhancing wind from the north-east appears in the Invincible Colliery weather station data during all time periods, although these data do not include the dominant westerly breeze that appeared in the Cullen Valley Mine data.

The noise model therefore includes 3 m/s winds from the north-east during all time periods and 3 m/s winds from the west during the day and evening, representing the worst case from both sets of data.

**Table 17: Noise Enhancing Winds 2009/10, Cullen Valley Mine Weather Station.**

| Wind Direction | Occurrence of Noise Enhancing Winds, % of Season and Time Period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | | | Autumn | | | Winter | | | Spring | | |
| | Day | Even. | Night | Day | Even. | Night | Day | Even. | Night | Day | Even. | Night |
| N | **31** | 10 | 6 | 25 | 5 | 5 | 17 | 11 | 6 | 24 | 11 | 7 |
| NNE | **37** | 19 | 10 | 28 | 7 | 6 | 12 | 8 | 3 | 24 | 13 | 6 |
| NE | **42** | **34** | 17 | **35** | 14 | 9 | 12 | 6 | 2 | 26 | 17 | 7 |
| ENE | **39** | **42** | 20 | **35** | 18 | 12 | 12 | 10 | 4 | 23 | 21 | 7 |
| E | **38** | **44** | 22 | **34** | 21 | 14 | 10 | 10 | 4 | 20 | 21 | 8 |
| ESE | **32** | **47** | 24 | 30 | 25 | 16 | 9 | 10 | 4 | 18 | 21 | 8 |
| SE | 24 | **39** | 22 | 26 | 24 | 16 | 8 | 11 | 4 | 15 | 18 | 9 |
| SSE | 16 | 24 | 16 | 19 | 18 | 12 | 5 | 9 | 4 | 11 | 12 | 7 |
| S | 14 | 15 | 12 | 16 | 13 | 9 | 6 | 6 | 3 | 13 | 8 | 7 |
| SSW | 17 | 13 | 9 | 18 | 12 | 7 | 14 | 11 | 7 | 20 | 8 | 8 |
| SW | 19 | 10 | 6 | 20 | 9 | 6 | 21 | 18 | 11 | 25 | 9 | 8 |
| WSW | 22 | 8 | 5 | 22 | 9 | 6 | 28 | 23 | 14 | 29 | 11 | 10 |
| W | 24 | 8 | 4 | 22 | 8 | 6 | **33** | 26 | 17 | 30 | 13 | 10 |
| WNW | 26 | 8 | 4 | 24 | 8 | 6 | **35** | 26 | 17 | 30 | 13 | 10 |
| NW | 27 | 7 | 4 | 22 | 7 | 6 | 28 | 23 | 13 | 27 | 12 | 9 |
| NNW | 26 | 8 | 5 | 21 | 5 | 5 | 22 | 16 | 9 | 25 | 11 | 9 |

**Table 18: Noise Enhancing Winds 2009/10, Invincible Colliery Weather Station.**

| Wind Direction | Occurrence of Noise Enhancing Winds, % of Season and Time Period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | | | Autumn | | | Winter | | | Spring | | |
| | Day | Even. | Night | Day | Even. | Night | Day | Even. | Night | Day | Even. | Night |
| N | 24 | **31** | **35** | 26 | 29 | 22 | 10 | **33** | 25 | 15 | **39** | 29 |
| NNE | 29 | **51** | **54** | **34** | **53** | **37** | 14 | **40** | **32** | 20 | **56** | **39** |
| NE | 30 | **55** | **57** | **37** | **59** | **41** | 16 | **42** | **33** | 21 | **59** | **42** |
| ENE | 29 | **54** | **57** | **36** | **58** | **41** | 15 | **43** | **32** | 21 | **60** | **43** |
| E | 23 | **50** | **53** | 29 | **54** | **40** | 13 | **39** | 29 | 17 | **56** | **39** |
| ESE | 10 | 26 | 24 | 14 | **31** | 20 | 8 | 11 | 8 | 10 | 23 | 17 |
| SE | 5 | 5 | 6 | 7 | 7 | 5 | 4 | 4 | 2 | 6 | 6 | 7 |
| SSE | 6 | 2 | 4 | 5 | 3 | 2 | 5 | 5 | 4 | 7 | 3 | 5 |
| S | 9 | 6 | 7 | 8 | 10 | 6 | 13 | 17 | 13 | 13 | 7 | 9 |
| SSW | 16 | 7 | 9 | 16 | 13 | 8 | 24 | 22 | 18 | 20 | 9 | 11 |
| SW | 18 | 8 | 9 | 20 | 14 | 9 | 27 | 22 | 19 | 22 | 10 | 12 |
| WSW | 18 | 9 | 8 | 20 | 14 | 9 | 27 | 22 | 18 | 21 | 10 | 12 |
| W | 16 | 8 | 7 | 18 | 12 | 8 | 25 | 20 | 16 | 19 | 9 | 10 |
| WNW | 13 | 4 | 4 | 15 | 5 | 5 | 17 | 7 | 7 | 13 | 4 | 5 |
| NW | 7 | 3 | 2 | 8 | 3 | 2 | 6 | 1 | 2 | 5 | 2 | 3 |
| NNW | 11 | 7 | 6 | 12 | 5 | 2 | 5 | 5 | 4 | 8 | 6 | 6 |

### 4.3.2 Temperature Inversions

Weather data from the Cullen Valley Mine and Invincible Colliery weather stations include 15 minute air temperature data measured at 2 m and 10 m above the ground. Analysis of these data can indicate the presence of a temperature inversion, however the measured temperature difference over an 8m interval close to the ground cannot reasonably be extrapolated to the 100 m height interval that is required for long distance noise propagation calculations.

Analysis of the Cullen Valley Mine and Invincible Colliery data, considering measurements for the winter months from 6pm to 7am, indicates significant temperature inversions are likely to occur for approximately 47 % of the time at Cullen Valley Mine and approximately 63 % of the time at Invincible Colliery. In this case, a 'significant' temperature inversion is indicated by a 0.24 °C difference between the 2 m and 10 m temperatures which is considered approximately equivalent to an F-class inversion.

Similarly, a G-class inversion is assumed to be indicated by a 0.5 °C temperature difference between 2m and 10m above the ground and occurs for approximately 27 % of the time at Cullen Valley Mine and 39 % of the time at Invincible Colliery. While these results are only approximate, they indicate significant temperature inversions occur for at least 30% of the time in this area and therefore require assessment.

#### 4.3.3 Drainage Flows

Cold air drainage flows tend to run downhill and would therefore flow in different directions over various areas of the site depending on local terrain. A detailed inspection of topography in the area indicates the Project is located on land that is above receiver properties in all directions, indicating cold air would flow in various directions during a temperature inversion. All cases, however, there is very little catchment area for significant cold air flows to form.

Given the wide variation in drainage flow directions and small expected flows arising from minimal catchment areas, additional noise enhancement due to drainage flows associated with temperature inversions is not expected to cause significant noise enhancement and has not been included.

#### 4.3.4 Adopted Weather Conditions

Table 19 shows adopted atmospheric parameters for this assessment. The adopted weather conditions represent prevailing conditions for receivers in all directions from the site.

**Table 19: Modelled Weather Conditions.**

| Atmospheric Parameter | Day and Evening | | | Night | |
|---|---|---|---|---|---|
| | Neutral | NE Wind | W Wind | Inversion | NE Wind |
| Temperature, °C | 20 | 20 | 20 | 10 | 10 |
| Relative Humidity, % | 70 | 70 | 70 | 90 | 90 |
| Wind Speed, m/s | 0 | 3 | 3 | 0 | 3 |
| Wind Direction | - | North-east | West | - | North-east |
| Temp Gradient, °C/100 m | -1 | -1 | -1 | 3 | 0 |

Noise contour figures for prevailing weather conditions have been prepared by taking the outer envelope, or maximum noise level, of each set of weather conditions for the relevant time period. For example, the day and evening noise contours shown in Appendix A for prevailing weather conditions represent the maximum of the three sets of day and evening weather conditions listed in Table 19.

#### 4.3.5 Strong Temperature Inversions

In the absence of data clearly indicating the typical strength of temperature inversions that occur in this area, it is considered possible that inversions stronger than 3 °C/100 m may occur in the area from time to time.

Temperature inversions tend to cause increased received noise levels because they refract sound 'rays' down towards the ground. Winds also cause increased noise levels, for receivers down wind, for the same reason. Research indicates the effects of inversions and winds are approximately cumulative and the noise model software adopts this approach by combining inversions and winds into an equivalent inversion strength or an equivalent radius of curvature for sound rays. For the 'rural' terrain category in ENM software as used for this assessment, the equivalent inversion strength used for determining received noise levels is calculated by:

*Equivalent Inversion °/100m = Inversion °/100m + 2.5 x Wind speed m/s.* *Equation 1.*

Table 18 indicates the night scenarios include a 3 °/100m inversion or a 3 m/s wind from the north-east. According to Equation 1, a 3m/s wind is equivalent to a 7.5 °/100 m inversion for receivers downwind of the source. The night scenarios therefore include an equivalent inversion of 7.5 °/100 m for most receiver locations. This equivalent inversion is significantly stronger, and causes greater noise enhancement, than the INP default 3 °/100 m inversion strength.

The approach adopted in this assessment therefore satisfies the recommendations in the INP while simultaneously assessing the effects of strong noise enhancement for potentially affected receivers.

## 4.4 Noise Control Measures

Initial noise modelling with no mitigation measures in place indicated the need for a comprehensive set of noise control measures to minimise noise levels at closest privately owned receiver properties. Predicted noise levels in the absence of proposed control and mitigation measures are shown in Figure A19 in Appendix A for comparison purposes only. Figure A19 indicates received noise levels in the absence of the proposed mitigation measures would be clearly unacceptable from both socio-economic and environmental perspectives.

The following noise control and mitigation measures have been incorporated into the Project to reduce the Project's noise impacts on private receivers.

### 4.4.1 Engineering Controls for Mobile Equipment

- Excavators – The large excavators would produce a sound power level of 116 dBA (compared to 122 dBA from a standard machine) based on experience with these machines at other mine sites with the following typical modifications:
  - best practise exhaust silencers;
  - quieter aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres;
  - cooling air inlet plenums or louvres; and
  - covers over various ventilation and other openings not fitted with louvres.
- Front End Loaders – Front end loaders used at the various CHPPs and in the northern sand extraction pit would produce a sound power level of 116 dBA (compared to 120 dBA standard) based on experience with these machines at other mine sites with the following typical modifications:
  - best practise exhaust silencers;
  - quieter aerodynamic radiator fan blades and temperature based fan speed control; and
  - engine bay side cover plates or air inlet louvres.
- Overburden and Coal Trucks – all large trucks would produce a sound power level of 114 dBA (compared to 122 dBA standard) based on experience with these machines at other mine sites with the following typical modifications:

    - best practise exhaust silencers;
    - quieter aerodynamic radiator fan blades and temperature-based fan speed control;
    - radiator louvres;
    - engine bay side and belly plates; and
    - gridbox attenuators (for electric drive trucks) or gearbox cover plates (for mechanical drive trucks).
- Drills – The drills would produce a sound power level of 114 dBA (compared to 119 dBA standard) based on experience with these machines at other mine sites with the following typical modifications:
    - best practise exhaust silencers; and
    - acoustically lined engine covers.
- Dozers – all dozers would produce a sound power level of 114 dBA (compared to 118 dBA from the engine and 132 dBA from the tracks for high speed reverse for a standard machine) based on experience with these machines at other mine sites with the following typical modifications and management measures:
    - best practise exhaust silencers;
    - Engine bay side covers; and
    - Operator training and careful control of machine speed to avoid track noise during noise enhancing weather conditions or when track noise is likely to cause excessive noise at any sensitive receiver.
- Grader – the graders would be standard machines producing 113 dBA sound power level;
- Water carts – the water carts would produce a sound power level of 114 dBA (compared to 119 dBA standard) based on experience with these machines at other mine sites with the following typical modifications:
    - best practise exhaust silencers;
    - quieter aerodynamic radiator fan blades and temperature-based fan speed control;
    - gridbox attenuators (for electric drive trucks) or gearbox cover plates (for mechanical drive trucks).
- Service Truck – a standard on-road type truck, fitted with an exhaust silencer suitable for on-road use, is assumed to produce a sound power level of 108 dBA;
- Mobile Sand Crushing/Screening Plant – a standard sound power level of 112 dBA is assumed for this machine and it would operate in shielded areas of the Cullen Valley pit with a 6m bund to the west to control noise to closest receivers;
- Highwall Miner – a standard sound power level of 114 dBA would be adopted to represent the highwall mining machine and a noise controlled container mounted generator set;
- A bridge over the Castlereagh Highway would be constructed in a topographically shielded area, located away from receiver properties. Under typical circumstances, no product haul trucks would travel along the existing Cullen Bullen bypass when the bridge and associated internal haul roads are completed (ie from Year 2 onwards).

#### 4.4.2 Engineering Controls for CHP Equipment

- Invincible Coal Preparation Plant – the existing sound power level of 121 dBA as measured by Global Acoustics on site should be reduced by 12 dBA to 109 dBA based on the following noise control measures (or acoustic equivalents):
    - Removal of the existing building cladding on the western side;

    - Addition of 9mm compressed fibre cement sheets or equivalent on a suitable support structure over the entire north and west building faces; and
    - Installation of the steel cladding over the fibre cement for weather protection and appearance, where necessary.
- Invincible Multi-Products Bin – a sound power level of 115 dBA as measured on site by Global Acoustics would be reduced by 9 dBA to 106 dBA by installing a complete enclosure clad with either conveyor rubber or fibre cement sheeting around the feeders; and
- Cullen Valley Crusher – the crusher and associated conveyors, and truck movements to and from the crusher, would be shielded to the south and west by a noise barrier approximately 5m high and no more than 25m from the crusher. The barrier could be constructed using a row of shipping containers or similar materials. If the additional barrier is not constructed, the crusher would be restricted to day and evening operation.

### 4.4.3 Noise Barriers and Topographic Features

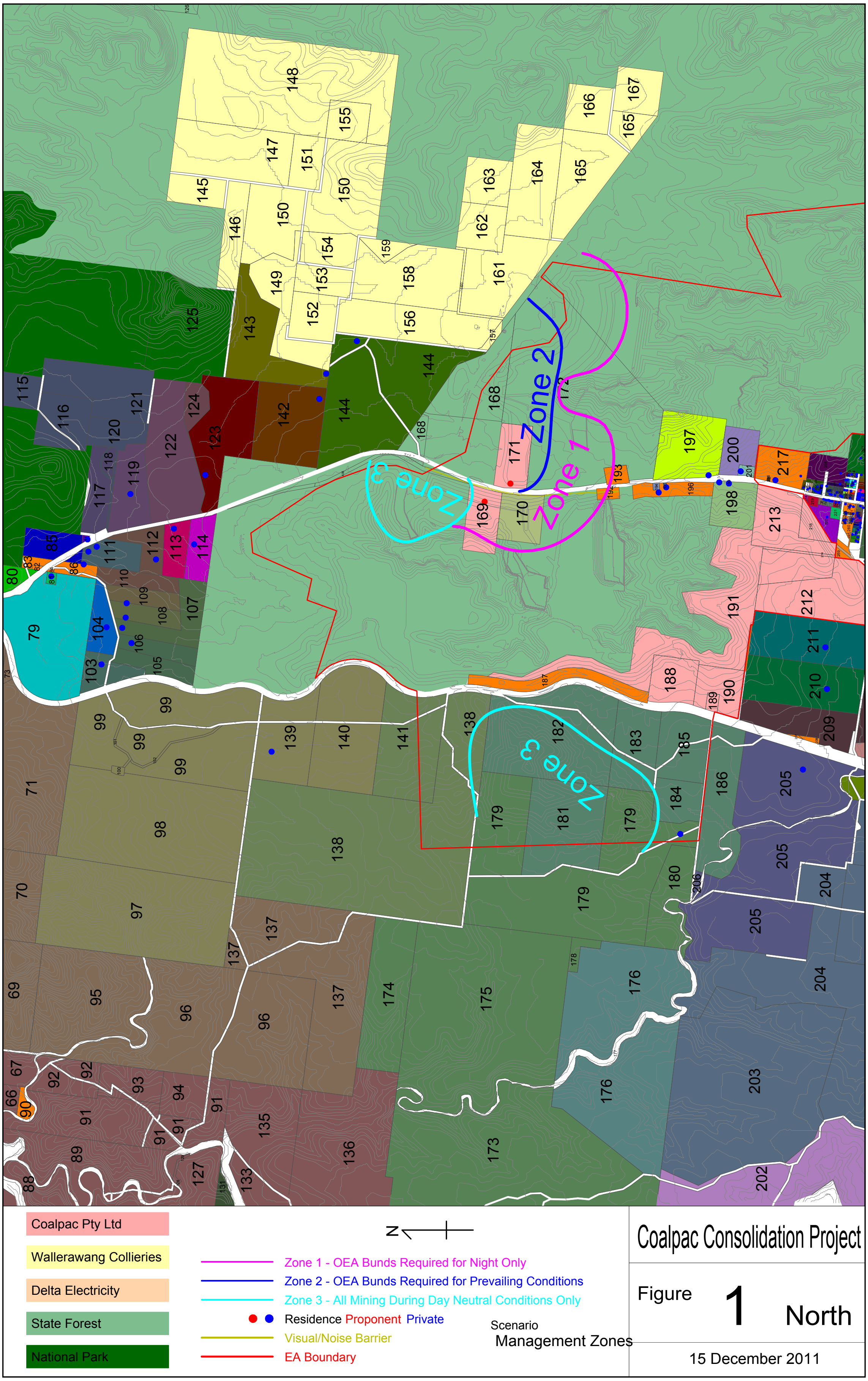
- Bund A (all years) immediately west of the rail siding at least 10m above the level of the rails or coal pad, whichever is higher, and extending at least 100m north and south of the loading area;
- Bund B (all years in which the Cullen Valley crushing area would be used) along the western side of the Cullen Valley processing area at least 8m above the ground on which the noise sources (crushing plant, mobile plant) operate. This is an existing bund;
- Bund C (all years) along the northern and eastern side of the haul road extending south from the Highway bridge for a distance of 550m and a height of 6m above the haul road;
- Bund D (all years) a bund 5m high from the southern side of the cemetery (property 193) then increasing to a minimum RL 940m (up to 14m height) from 150m south of the cemetery to the RL 940m contour approximately 650m south of the cemetery;
- Bund E (all years) extending south from Bund D for a distance of 500m is more a natural ridge than a bund but should remain at RL 940m at the northern end and RL 960m at the southern end, or higher, without being removed by mining;
- Bund F (all years) from a point no more than 350m east of the Invincible gate and extending generally north east for a distance of 2300m along the western side of the haul road. The bund should be 5m above the road no more than 50m horizontally from the centre of the haul road, or 6m above the road no more than 80m from the centre of the road;
- Overburden Emplacement Area (OEA) Bunds in various years and locations along the closest edges of OEA benches to prevent line of sight from any privately owned residence to OEA equipment such as trucks and dozers. Recommended bund heights are 6m to protect equipment working within 2400m from a residence or 8m for equipment working within 1800m from a residence. OEA bunds are generally required in years 2, 8 and 14 in the southern part of the site and in years 8, 14 and 20 in the north eastern part of the site, as shown in the source location and noise contour figures, and are not required where OEA equipment is well shielded by existing terrain. All OEA bunds would be ‘constructed’ and extended as part of normal overburden placement operations, with overburden placed on the bunds during the day (or during favourable weather conditions) and behind the bunds during the night (or during noise enhancing weather conditions). As the overburden material can be directed to an area exposed to receivers or redirected to a shielded area from time to time, this proposed mitigation measure is both responsive and effective.

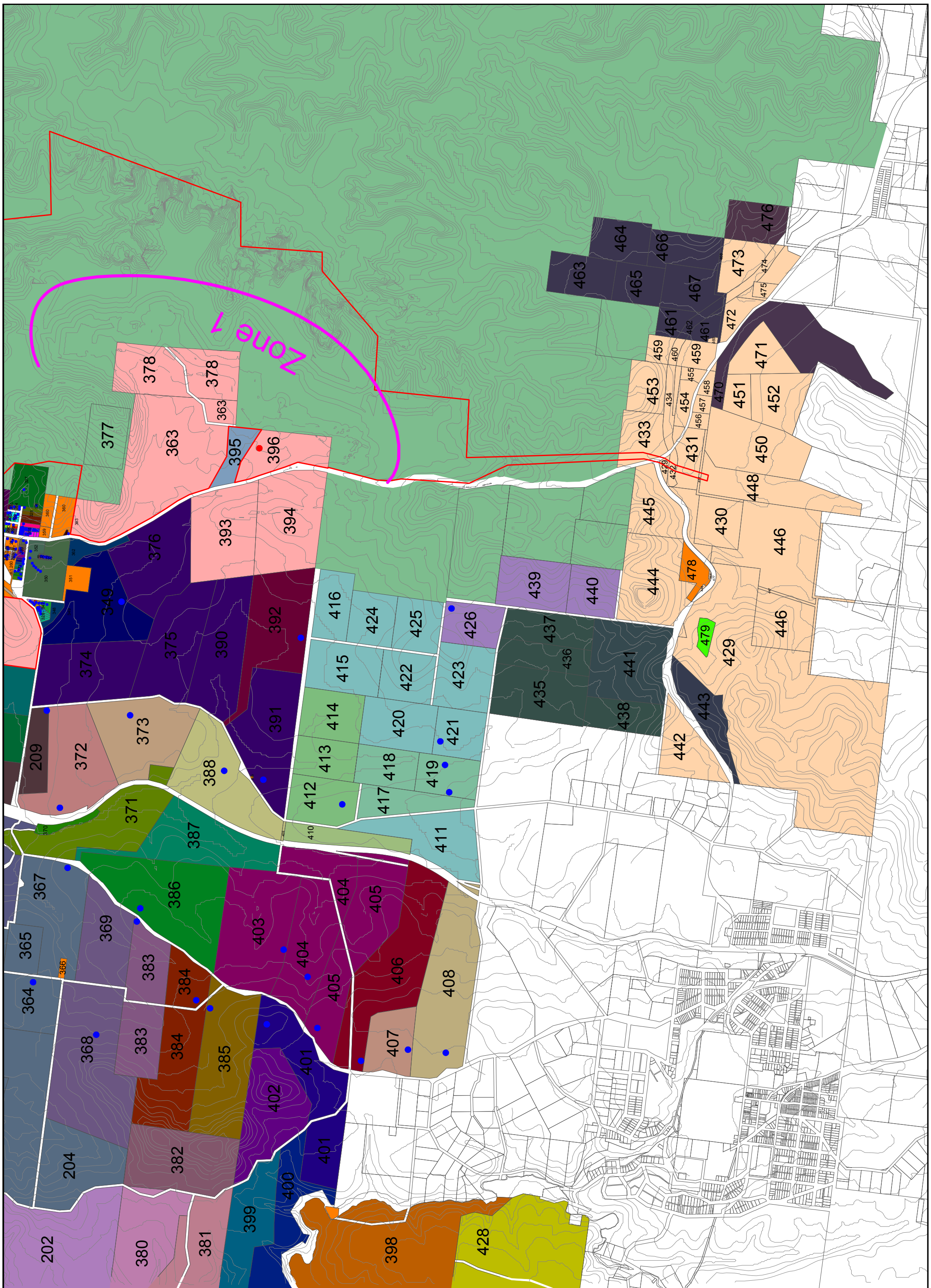
### 4.4.4 Additional Noise Management Measures

Additional noise management measures have been recommended, in the absence of or in addition to suitable engineering measures to control noise in specific situations. Figure 1 below shows the location of four noise management zones:

- Mining activity within approximately 2400m from a residence (within Zone 1 bounded by a magenta line) would include shielded OEA areas for use at night, where the shielded areas are generally behind the OEA bunds. More exposed OEA areas would be used during the day or under favourable weather conditions during the night. Provision of suitably shielded OEA areas and OEA bunds would be considered as each pit is developed and mined;
- Mining within approximately 1800m from a residence (within Zone 2 bounded by a blue line) would include shielded OEA areas for use under all except neutral weather conditions during the day. Initial construction of a bund, and raising or extending the bund to keep up with the advancing pit, would occur only under neutral weather conditions during the day;
- Mining within approximately 1800m from a residence where shielded operating areas cannot reasonably be provided due to unfavourable terrain (within Zone 3 bounded by a light blue line) would only occur under neutral weather conditions during the day;
- Real time weather monitoring would occur while mining is being completed in Zones 2 and 3 to indicate the potential for noise enhancing weather conditions, while real time noise monitoring at representative receiver locations would be used to confirm mining noise levels during all years of operation;
- Operation of the highwall miner could occur at any time and under any weather conditions, provided the miner is located in a suitably shielded area of the pit when working in Zones 2 and 3. The highwall miner is therefore generally exempt from the management measures recommended for each Zone, however coal trucks associated with the highwall miner would normally need to comply with the noise management recommendations for each Zone;
- Sand extraction, processing and haulage would only occur during the day (i.e. 7 am to 6 pm);
- Sand haul trucks would travel via internal haul roads, including the Castlereagh Highway overpass bridge, and access the site via the existing Invincible Colliery access road; and
- The Noise Management Plan will include specific measures for the rail loadout system to minimise noise from this activity, including measures to minimise or avoid train wagon bunching noise during train movements.

Preliminary noise modelling in the absence of the proposed noise control and management measures has indicated the proposed measures would achieve a significant noise reduction at all receiver locations. The proposed noise control and management measures represent the best measures that can reasonably be adopted for this Project and have therefore resulted in the lowest practically achievable environmental noise levels at all receiver properties.


Zone 1
Zone 2
Zone 3
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
N
Zone 1 - OEA Bunds Required for Night Only
Zone 2 - OEA Bunds Required for Prevailing Conditions
Zone 3 - All Mining During Day Neutral Conditions Only
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Scenario
Management Zones
Coalpac Consolidation Project
Figure 1 North
15 December 2011




Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park

Zone 1 - OEA Bunds Required for Night Only
Zone 2 - OEA Bunds Required for Prevailing Conditions
Zone 3 - All Mining During Day Neutral Conditions Only
Residence Proponent Private
Visual/Noise Barrier
EA Boundary

Scenario
Management Zones

Coalpac Consolidation Project

Figure 1 South

15 December 2011

BRIDGES Acoustics

## 4.5 Operational Noise Sources

### 4.5.1 Mining, Coal Processing and Transportation

Mining operations would require a number of items of fixed and mobile equipment to uncover, extract, process and transport coal. Sound power levels for mining and coal processing equipment have been derived from on-site noise measurements where possible or from manufacturer's data or from noise measurements around similar equipment on other mine sites. In particular, sound power levels for existing coal processing equipment within the Invincible CHPP are based on noise measurements taken by Global Acoustics in December 2010 and modified to consider the recommended noise control measures listed in Section 4.3.

Minor items of equipment that are unlikely to be audible at any receiver under any weather conditions such as pumps located in the pit, short conveyors and drives within the coal handling areas or rail wagons operating at slow speed on the rail siding during loading operations, have been shown by preliminary noise modelling to have no appreciable effect on received noise levels and have been omitted from the assessment.

Figures showing noise source locations for the mine, rail siding and product conveyor are attached in Appendix A following the noise contour figures. The figures show the modelled location of each source, where the actual location is the lower left corner of each text entity. Source heights above local ground level have been determined based on the estimated height of the acoustic centre for each source type, while sound power levels for modelled sources are shown in Table 20. Many mobile sources have been modelled in multiple locations for a proportion of the time at each location, such as four locations for 25% of the time at each location. Such sources are indicated in the source location figures in Appendix A with a '/2' or '/4' after the source code, indicating the source operates at that location for 50 % or 25 % of the time.

**Table 20: Modelled Noise Sources and Sound Power Levels.**

| Code, Source | Octave Band Centre Frequency, dBL [1] | | | | | | | | | dBL Total | dBA Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | | |
| Mining Sources | | | | | | | | | | | |
| E1, EX2500 excavator | 120 | 120 | 118 | 113 | 108 | 112 | 110 | 103 | 99 | 125.0 | 116.0 |
| E2, EX1200 excavator | 120 | 120 | 118 | 113 | 108 | 112 | 110 | 103 | 99 | 125.0 | 116.0 |
| F, Cat 992 front end loader[3] | 120 | 120 | 118 | 113 | 108 | 112 | 110 | 103 | 99 | 125.0 | 116.0 |
| C, Cat 777 coal/sand truck | 110 | 106 | 114 | 113 | 112 | 108 | 108 | 101 | 94 | 119.1 | 114.0 |
| O, Cat 785 overburden truck | 110 | 106 | 114 | 113 | 112 | 108 | 108 | 101 | 94 | 119.1 | 114.0 |
| D, Drill | 122 | 122 | 112 | 103 | 109 | 108 | 108 | 106 | 93 | 125.6 | 113.9 |
| Z, D10, D11 dozer | 119 | 119 | 119 | 109 | 109 | 108 | 106 | 105 | 99 | 124.5 | 113.9 |
| G, Grader | 117 | 117 | 119 | 117 | 112 | 101 | 102 | 99 | 91 | 124.0 | 113.2 |
| W, Water cart | 115 | 116 | 118 | 116 | 113 | 103 | 104 | 101 | 93 | 123.0 | 113.8 |
| S, Service truck | 117 | 119 | 116 | 112 | 105 | 101 | 97 | 93 | 87 | 122.8 | 108.5 |
| R1, Sand haul truck[2] | 101 | 101 | 99 | 97 | 91 | 92 | 91 | 84 | 80 | 106.3 | 97.1 |
| R2, Coal haul truck[2] | 106 | 106 | 104 | 102 | 96 | 97 | 96 | 89 | 85 | 111.3 | 102.1 |
| HM, Highwall miner | 103 | 103 | 108 | 111 | 113 | 109 | 106 | 100 | 92 | 117.5 | 114.2 |
| CHPP and Transportation Sources | | | | | | | | | | | |
| CP, Cullen Valley Crusher | 115 | 115 | 117 | 110 | 110 | 110 | 108 | 102 | 94 | 121.7 | 114.6 |
| IP, Invincible CPP | 118 | 117 | 110 | 108 | 108 | 104 | 100 | 91 | 82 | 121.3 | 109.2 |
| CB, Invincible Crusher | 110 | 110 | 106 | 105 | 103 | 102 | 99 | 93 | 84 | 114.8 | 106.4 |
| B Multi-Product Bin | 106 | 105 | 105 | 103 | 102 | 102 | 100 | 92 | 81 | 112.1 | 105.9 |
| K, Klockner Crusher | 101 | 101 | 104 | 99 | 100 | 101 | 97 | 91 | 86 | 109.4 | 104.4 |
| TP, East Tyldesley CHPP | 114 | 114 | 115 | 114 | 115 | 115 | 112 | 106 | 97 | 122.8 | 118.9 |

| Code, Source | Octave Band Centre Frequency, dBL [1] | | | | | | | | | dBL | dBA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | Total | Total |
| V, MPPS Conveyor /100 m | 100 | 95 | 96 | 96 | 92 | 88 | 86 | 83 | 76 | 104.2 | 95.0 |
| Tr, Conveyor Transfer | 114 | 111 | 110 | 101 | 101 | 98 | 95 | 87 | 76 | 117.1 | 103.4 |
| L, Locomotives x3 on siding | 105 | 105 | 106 | 103 | 98 | 95 | 94 | 85 | 80 | 111.3 | 101.4 |
| M, Sand Crushing/Screening | 101 | 101 | 106 | 109 | 111 | 107 | 104 | 98 | 90 | 115.5 | 112.2 |

1. dBL means unweighted, as opposed to A-weighted, noise levels.
2. The listed sound power level for road-type haul trucks applies to each 500m length of haul road.
3. Includes two front-end loaders on the rail siding during train loading operations

### 4.6 Predicted Mining Noise Levels

Noise levels from the Project have been modelled for representative operating scenarios, time periods and weather conditions. Noise contour figures showing predicted noise levels for years 2, 8, 14 and 20 under neutral and prevailing weather conditions are included in Appendix A, while detailed tables of noise levels at potentially affected receiver locations and over 25% of contiguous property and lot areas are presented in Appendix B. Predicted noise levels include normal mining activity, coal handling and processing, train loading, idling locomotives and operation of the product conveyor to MPPS. All noise control and mitigation measures listed in Section 4.3 have been considered in the calculations.

Table 21 summarises predicted worst case noise levels from the Project based on the results presented in Appendix B and Figures 13 and 14 in Appendix A. Shading in Table 21 indicates residences or properties that would be potentially affected by the Project. Residences and properties that are owned by a mining company or the Crown, or are subject to a private agreement with Coalpac, have been excluded from or highlighted in the table.

**Table 21: Summary of Predicted Noise Levels at Residences and Properties, LAeq,15min.**

| Owner | Residence | | | | 25% of Property Area | | | | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| Ref | Lot Ref | Day Neutral | Day/ Evening | Night | Lot Reference | Day Neutral | Day/ Evening | Night | Day/ Evening/ Night |
| 2 | 217N | 31.2 | 36.1 | 37.2 | 217 | 36.8 | 41.1 | 41.5 | 37/35/35 |
| 5 | 139 | 31.3 | 31.3 | 37.7 | 97-102,138-141 | 32.7 | 33.9 | 37.1 | 35/35/35 |
| 6 | 179 | 37.4 | 37.8 | 39.7 | 173-175,178-186 | 39.4 | 40.7 | 41.1 | 35/35/35 |
| 7 | - | - | - | - | 176 | 34.4 | 37.8 | 40.0 | 35/35/35 |
| 8 | 364 | 31.9 | 36.4 | 38.7 | 203,204,364,365, 367 | 32.3 | 36.4 | 38.6 | 35/35/35 |
| | 367 | 31.3 | 36.6 | 38.9 | | | | | |
| 9 | 205 | 33.0 | 38.4 | 40.6 | 205,206 | 37.0 | 40.6 | 42.9 | 35/35/35 |
| 10 | 368 | 29.4 | 34.7 | 37.1 | 368,369 | 30.0 | 35.6 | 37.8 | 35/35/35 |
| 11 | 383 | 29.6 | 35.5 | 37.7 | 383 | 29.1 | 35.1 | 37.3 | 35/35/35 |
| 13 | 384 | 28.7 | 34.4 | 36.6 | 384 | 28.7 | 34.4 | 36.6 | 35/35/35 |
| 14 | 385 | 28.5 | 34.2 | 36.3 | 385 | 27.6 | 33.8 | 35.7 | 35/35/35 |
| 15 | - | - | - | - | 371 | 30.4 | 35.7 | 38.1 | 35/35/35 |
| 16 | - | - | - | - | 370 | 31.6 | 36.5 | 39.1 | 35/35/35 |
| 17 | 386 | 28.9 | 35.5 | 37.7 | 386 | 28.9 | 35.5 | 37.7 | 35/35/35 |
| 18 | - | - | - | - | 387 | 28.3 | 35.1 | 37.1 | 35/35/35 |
| 23 | 403 | 27.1 | 34.5 | 36.4 | 403-405 | 27.1 | 34.6 | 36.5 | 35/35/35 |
| | 404 | 26.3 | 34.3 | 35.9 | | | | | |
| 24 | 406 | <35 | <35 | <35 | 406 | 25.8 | 34.6 | 36.2 | 35/35/35 |
| 26 | 408 | <35 | <35 | <35 | 408 | 24.8 | 34.0 | 35.4 | |
| 29 | - | - | - | - | 170 | 62.7 | 63.1 | 61.3 | 37/35/35 |

| Owner | Residence | | | | 25% of Property Area | | | | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| Ref | Lot Ref | Day Neutral | Day/ Evening | Night | Lot Reference | Day Neutral | Day/ Evening | Night | Day/ Evening/ Night |
| 30 | 198 | 36.8 | 39.3 | 39.7 | 198, 199 | 38.1 | 45.6 | 46.6 | 37/35/35 |
| | 199 | 37.3 | 39.8 | 39.5 | | | | | |
| 31 | 197 | 37.7 | 40.1 | 40.4 | 197 | 67.6 | 68.1 | 67.2 | 37/35/35 |
| 32 | - | - | - | - | 201 | 35.3 | 38.9 | 39.4 | 37/35/35 |
| 33 | 195 | 41.2 | 42.5 | 43.8 | 195 | 41.2 | 42.5 | 43.8 | 37/35/35 |
| 34 | 194 | 41.5 | 43.5 | 45.3 | 194 | 42.8 | 45.2 | 46.7 | 37/35/35 |
| 35 | - | - | - | - | 200 | 46.0 | 49.6 | 49.1 | 37/35/35 |
| 50 | 114 | 27.8 | 32.2 | 36.0 | 114 | 28.2 | 34.1 | 35.7 | 37/35/35 |
| 51 | 113 | 27.0 | 32.5 | 36.5 | 113 | 27.3 | 32.0 | 36.2 | 37/35/35 |
| 52 | 112 | 26.1 | 29.1 | 35.9 | 110,112 | 26.2 | 29.5 | 35.9 | 37/35/35 |
| 53 | 109 | 25.6 | 26.1 | 35.2 | 109 | 26.8 | 27.4 | 36.0 | 35/35/35 |
| 54 | 108 | 25.7 | 26.0 | 35.2 | 108 | 27.3 | 27.6 | 36.5 | 35/35/35 |
| 55 | 107 | 25.6 | 25.9 | 35.0 | 107 | 28.3 | 28.9 | 36.9 | 35/35/35 |
| 56 | 106 | 26.1 | 26.2 | 35.2 | 105,106 | 27.7 | 27.7 | 35.8 | 35/35/35 |
| 58 | 111 | <35 | <35 | <35 | 111 | 25.0 | 28.1 | 35.2 | 37/35/35 |
| 61 | 119 | <35 | <35 | <35 | 119 | 24.8 | 30.7 | 35.3 | 37/35/35 |
| 62 | - | - | - | - | 122 | 25.7 | 33.3 | 35.1 | 37/35/35 |
| 65 | 142 | 33.5 | 35.7 | 38.1 | 142 | 31.8 | 34.5 | 37.0 | 35/35/35 |
| 66 | 143 | 33.8 | 36.6 | 37.9 | 143 | 30.8 | 35.2 | 35.8 | 35/35/35 |
| 67 | 144 | 34.6 | 38.0 | 38.7 | 144 | 38.3 | 39.5 | 39.0 | 35/35/35 |
| 68 | 209 | 28.7 | 35.0 | 35.4 | 209 | 33.0 | 36.1 | 38.5 | 35/35/35 |
| 69 | 210 | 28.4 | 32.6 | 33.9 | 210 | 31.4 | 33.5 | 36.1 | 35/35/35 |
| 71 | - | - | - | - | 348 | 29.4 | 33.6 | 35.3 | 37/35/35 |
| | | | | | 362 | 31.3 | 32.3 | 37.0 | |
| 72 | 349 | 33.6 | 36.9 | 38.4 | 349 | 32.2 | 36.3 | 37.8 | 37/35/35 |
| 73 | 391 | 28.0 | 35.1 | 37.0 | 374-376,390,391 | 32.0 | 37.8 | 39.0 | 35/35/35 |
| 75 | 392 | 30.6 | 38.2 | 39.5 | 392 | 31.5 | 39.1 | 39.5 | 35/35/35 |
| 76 | 372 | 31.0 | 36.5 | 39.3 | 372 | 30.2 | 35.6 | 38.3 | 35/35/35 |
| 77 | 373 | 30.0 | 35.6 | 37.1 | 373 | 29.9 | 35.4 | 37.0 | 35/35/35 |
| 78 | 388 | 28.7 | 34.6 | 35.8 | 388,409 | 28.9 | 34.9 | 36.7 | 35/35/35 |
| 79 | - | - | - | - | 410 | 26.8 | 34.5 | 36.4 | 35/35/35 |
| 80 | 412 | 27.3 | 36.1 | 38.4 | 412-414 | 28.3 | 36.6 | 38.4 | 35/35/35 |
| 81 | 419 | <35 | <35 | <35 | 417-419 | 26.5 | 34.9 | 36.7 | 35/35/35 |
| 82 | 421 | <35 | <35 | <35 | 411,415,416, 420-425 | 29.8 | 38.4 | 39.4 | 35/35/35 |
| 85 | 426 | 27.7 | 35.4 | 36.3 | 426,439,440 | 23.7 | 31.8 | 33.3 | 35/35/35 |
| 97 | 220 | 26.7 | 34.3 | 32.7 | 220 | 27.5 | 35.9 | 33.2 | 37/35/35 |
| 128 | 350 | 28.2 | 33.0 | 34.8 | 350 | 29.0 | 33.2 | 35.2 | 37/35/35 |
| 137 | - | - | - | - | 216 | 31.9 | 36.6 | 37.6 | 37/35/35 |
| Total Affected Residences/ Properties | | 0 | 3 | 4 | Significant | 4 | 9 | 9 | |
| | | 3 | 6 | 18 | Moderate | 4 | 6 | 19 | |
| | | 2 | 13 | 14 | Mild | 1 | 15 | 25 | |

Red shading – a significant noise impact of 5 dBA or more above the intrusive criteria;

Blue shading – a moderate noise impact of less than 5 dBA above the intrusive criteria;

Green shading – a mild noise impact of 2 dBA or less above the intrusive criteria; and

Table 21 shows 4 residences and an additional 5 properties (shaded red) are expected to receive a significant noise impact of 5 dBA or more above the intrusive criteria in one or more modelled years and time periods. Coalpac is currently negotiating with the owners of these properties. The owners also own 4 residences that would be moderately affected by noise from the Project in one or more modelled years and time periods.

A further 14 residences and an additional 9 properties are expected to receive a moderate noise impact up to 5 dBA above the intrusive criteria, while 14 residences and an additional 13 properties are expected to receive a mild noise impact of up to 2 dBA above the intrusive criteria.

## 4.7 Recommended Noise Monitoring

Project noise levels should be monitored to confirm the predicted noise levels. The noise monitoring strategy would vary from year to year as the mine progresses and as such, development of a detailed monitoring strategy for the life of the Project is not appropriate at this stage. However the following recommendations would be considered by Coalpac when developing and updating the monitoring program for current and future operations (unless otherwise agreed with OEH and DP&I):

- Existing noise management plans should be consolidated and updated following Project approval, and reviewed annually;
- Three real time noise monitors would be deployed in receiver areas or at reference locations closer to the Project to enable ongoing noise management. Data from the real time noise monitors would be transmitted to an on-site office or control room for monitoring and action. A Triggered Action Response Plan (TARP) would be developed and implemented as part of the Noise Management Plan to detail the actions required upon detection of noise levels over the intrusive noise criteria, taking into account factors such as time of day, equipment operating locations and weather conditions.
- Quarterly operator attended noise monitoring would occur at up to four locations during normal mining operations to confirm Project noise levels. The monitoring locations would vary from time to time as the mine progresses and would be reviewed annually. Noise surveys would include one 15 minute noise measurement, and associated observations to identify and quantify dominant sources of noise, during the day, evening and night at each location; and
- Summary results from the real time noise monitors, and detailed results from the quarterly noise surveys, would be reported in the Annual Review.

## 4.8 Construction Noise

### 4.8.1 Construction Activities

The following construction works would be required as part of the Project:

- Modifications to the Cullen Valley CDP, initially including installation of an additional noise barrier and subsequently relocation of the crusher to form part of the East Tyldesley CHPP;
- Modifications to the Invincible CHPP to reduce equipment noise levels as discussed in Section 4.3;
- A haul road and a bridge over the Castlereagh Highway north of Cullen Bullen, using bored rather than driven piles;
- A product coal conveyor from the Invincible CHPP to the MPPS including a bridge over the Castlereagh Highway near MPPS, using bored rather than driven piles for the bridge foundations;
- The East Tyldesley CHPP and associated coal handling and stockpile areas, administration and other facilities;

- A rail siding and coal stockpile and loading facilities including a significant noise bund west of the WGRL near the siding;
- Construction of the Cullen Valley Mine office facilities; and
- Various noise bunds as described in Section 4.3.

The earthmoving phase for each construction activity typically produces the highest sound power level and is therefore considered in this assessment.

Proposed construction work would occur within 'daytime' hours as defined in the INP which are 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays.

### 4.8.2 Construction Noise Sources

Table 22 shows typical construction noise sources required to complete the proposed works, assuming all machines operate continuously at full power to present a worst case assessment.

**Table 22: Proposed Construction Works, Sources and Sound Power Levels.**

| Works | Typical Construction Machines | Sound Power Level, LAeq | |
|---|---|---|---|
| | | Per Machine | Total |
| Cullen Valley Mine noise barrier | Mobile crane x1 | 108 | 115 |
| | Truck x2 | 108 | |
| | Excavator x1 | 112 | |
| Relocation of Cullen Valley crusher | Mobile crane x1 | 108 | 115 |
| | Truck x2 | 108 | |
| | Excavator x1 | 112 | |
| Invincible CHPP noise control modifications | Mobile crane x1 | 108 | 115 |
| | Truck x2 | 108 | |
| | Various hand tools | 112 | |
| Haul road and Castlereagh Highway bridge | Scraper x4 | 122 | 128 |
| | Dozer x3 | 121 | |
| | Truck x4 | 111 | |
| | Excavator x3 | 117 | |
| | Grader x2 | 115 | |
| | Roller x2 | 113 | |
| | Mobile crane | 108 | |
| | Concrete truck | 108 | |
| | Concrete pump | 110 | |
| Conveyor and Bridge | Scraper x3 | 121 | 127 |
| | Dozer x2 | 119 | |
| | Truck x3 | 110 | |
| | Excavator x2 | 115 | |
| | Grader x2 | 115 | |
| | Roller x2 | 113 | |
| | Mobile crane | 108 | |
| | Concrete truck | 108 | |
| | Concrete pump | 110 | |

| Works | Typical Construction Machines | Sound Power Level, LAeq | |
|---|---|---|---|
| | | Per Machine | Total |
| East Tyldesley CHPP | Truck x2 | 108 | 121 |
| | Excavator x1 | 112 | |
| | Grader x1 | 112 | |
| | Roller x1 | 110 | |
| | Backhoe/bobcat x1 | 108 | |
| | Mobile crane x1 | 112 | |
| | Various hand tools including grinders | 118 | |
| Rail siding and train loading facilities | Scraper x2 | 119 | 125 |
| | Dozer x1 | 116 | |
| | Truck x2 | 108 | |
| | Excavator x1 | 112 | |
| | Grader x1 | 112 | |
| | Roller x1 | 110 | |
| | Backhoe/bobcat x1 | 108 | |
| | Mobile crane x1 | 112 | |
| | Various hand tools including grinders | 118 | |
| Cullen Valley Mine office | Mobile crane x1 | 108 | 112 |
| | Truck x2 | 108 | |
| | Backhoe/bobcat x1 | 108 | |
| Various noise bunds | Scraper x2 | 119 | 123 |
| | Dozer x1 | 116 | |
| | Truck x2 | 108 | |
| | Excavator x1 | 112 | |

Table 22 shows the component with the highest sound power level would be construction of the haul road and Castlereagh Highway overpass bridge, although noise sources associated with this construction project would mainly be distributed along the length of the road rather than concentrated in one location.

#### 4.8.3 Construction Noise Assessment

A reasonable worst case construction noise scenario for most receiver locations would include the following simultaneous components:

- Cullen Valley crusher noise barrier;
- Invincible CHPP noise control modifications;
- Bridge over the Castlereagh Highway and associated haul road;
- Earthworks for the conveyor to MPPS;
- Construction of the East Tyldesley CHPP; and
- Construction of the noise bund near the rail siding.

Noise levels for this worst case construction scenario have been calculated using the Project noise model, based on Year 2 terrain and the construction sources listed above. Figures 16 and 17 in Appendix A show predicted noise contour levels for this theoretical worst case situation, under neutral and prevailing weather conditions during the day and evening. The figures show:

- Predicted noise levels due to rail siding construction work, and in particular construction of the noise bund adjacent to the rail siding, would produce up to 42 LAeq,15min at Residence 139 under both neutral and prevailing weather conditions;
- Predicted worst case noise levels during construction of a bridge over the Castlereagh Highway and associated haul road would produce up to 38 LAeq,15min under neutral conditions and up to 46 LAeq,15min under prevailing weather conditions at Residence 144. Noise levels at Residences 142 and 143 would be approximately 4 to 5 dBA lower. More typical construction noise levels, with equipment more evenly distributed over the length of the haul road, would be at least 3 dBA lower than the predicted worst case levels at these three residences;
- Predicted noise levels during construction of the East Tyldesley CHPP would be similar to, or lower than, mining noise levels at all residences; and
- Predicted noise levels during reconstruction of the Invincible CHPP and construction of the conveyor to MPPS would be lower than predicted mining and Invincible CHPP operational noise levels at all residences.

#### 4.8.4 Construction Noise Control Measures

Based on the construction noise model results, the following noise management measures are recommended:

- Construction of the large bund near the rail siding would ideally be completed using quieter, noise controlled mining machines rather than more typical construction machines supplied by a general contractor;
- Construction work associated with the rail siding and associated facilities should, where practical, occur after completion of the adjacent noise bund to maximise the effectiveness of the bund;

The following additional construction noise management measures are recommended:

- Construct the bridge over the Castlereagh Highway and associated haul roads as early in the construction program as possible, to allow all future construction related traffic on the Cullen Valley Mine site to use the Invincible Colliery access road rather than the Cullen Valley Private Haul Road or the Castlereagh Highway through Cullen Bullen;
- Construct all noise bunds and other earthworks components using noise controlled mining machines where possible and practical, rather than using standard construction machines; and
- Where possible, progressively construct noise bunds early in the construction program to control noise from future construction and mining activities.

### 4.9 Sleep Disturbance

#### 4.9.1 Mining

Coal mining primarily involves a number of diesel powered machines operating to remove overburden and extract coal. Most machines, such as trucks, have very little potential to produce a noise character that is likely to disturb sleep. Other machines such as dozers can produce intermittent louder noise depending on working conditions, machine condition and operator actions.

Tracked dozers generally work in the forward direction, either pushing material with the blade or ripping hard ground with the rear-mounted ripping tines. Forward operation, particularly under load, tends to produce noise from the engine and exhaust but very little noise from the tracks. As a dozer reverses, however, lack of tension in the tracks tends to cause them to droop between the drive sprocket and the rear idler and this lack of tension can cause a regular impact noise. The level of noise a dozer can produce in reverse depends on a number of factors including machine type, condition, speed and ground conditions, with a sound power level in the range 125 to 130 dBA representing a typical maximum for this source.

Other sources of potential sleep disturbance include raw coal being dumped from a truck or loader into a steel ROM hopper, vehicle horns and equipment start alarms. A ROM hopper can produce up to 120 dBA while quieter vehicle horns and alarms can produce a sound power level in the range 110 to 115 dBA. Locomotive horns can produce a sound power level in the range 125 to 130 dBA, although locomotive horns associated with the proposed rail siding are unlikely to be required and have not been considered further. Train wagon bunching, however, can occur on the proposed rail siding as trains stop and start and a typical sound power level of 127 dBA has been adopted for this source.

This discussion indicates dozer tracks and train wagon bunching are potentially the loudest sources of noise associated with the Project, although Coalpac has committed to best practise management of these sources to minimise disturbance to residents. A theoretical worst case assessment, assuming dozer track noise at a sound power level of 127 dBA can be produced within any mining area and train bunching at the same 127 dBA sound power level can occur anywhere on the rail siding, has been modelled by placing a number of dozer track sources in the noise model at locations closest to receiver areas and three train bunching sources spread along the siding. Maximum noise level contours, generated from any one of these sources operating at any time, were then produced and are shown in Figure 18 in Appendix A.

### 4.9.2 Maximum Noise Levels – No Mitigation

Figure 18 in Appendix A shows contours from 45 LAmax to 60 LAmax, for comparison with the sleep disturbance criteria, resulting from dozer track noise or train wagon bunching. The actual source locations used in the model are shown on Figure 18. Maximum noise levels, assuming a worst case situation with dozer track noise and wagon bunching during noise enhancing weather conditions at night despite proposed management measures to avoid these sources, are predicted to reach:

- 56 LAmax at Residence 139 assuming dozer track noise occurs within mining areas north of the rail siding;
- 52 to 53 LAmax at Residences 114 and 144;
- 50 LAmax at Residences 112, 113, 123, 142 and 143;
- 47 to 48 LAmax at Residences 106, 107, 108, 109, 349 and 392;
- 45 to 46 LAmax at Residences 86, 87, 103, 104, 111, 119, 184, 367, 372 and 426; and
- Less than 45 LAmax in Cullen Bullen and at all other residences.

Results indicate the conservative 45 LA1,1min INP sleep disturbance criterion would be exceeded, while the RNP awakening criterion of 60 LAmax would not be exceeded, if the calculated worst case noise levels actually occur in practice.

### 4.9.3 Maximum Noise Levels – With Mitigation

Maximum noise levels in Section 4.9.2 represent theoretical worst case noise levels, not predicted noise levels that are likely to occur regularly. The predicted noise levels and any consequent sleep disturbance should not occur with the proposed management measures listed in Sections 4.4.1 and 4.4.4 to avoid these sources.

With proposed mitigation measures in place, there are no remaining identified sources of noise capable of exceeding the sleep disturbance criterion and exceedances of the criterion are therefore unlikely to occur.

## 4.10 Road Traffic Noise

Noise levels from vehicles travelling within the Project site are included in the site noise model, while noise from vehicles travelling on public roads such as the Castlereagh Highway is assessed in this section.

Project-related traffic associated with the Cullen Valley and Hillcroft mining areas, including coal haulage, would continue to use the Cullen Valley Haul Road until the Castlereagh Highway overpass bridge is completed in Year 2.

Completion of the proposed bridge and haul road over the Castlereagh Highway would result in all traffic using the Invincible Colliery access road, with no Project-related coal haulage vehicles using the Cullen Valley Private Haul Road to bypass Cullen Bullen. Project related vehicles passing through Cullen Bullen would continue to include staff travelling to and from the site in light vehicles and occasional material deliveries from Mudgee or other locations north of the Project. The majority of Project related vehicles would travel from the south to the site via the Castlereagh Highway from Lithgow.

### 4.10.1 Existing Traffic Flows

The Traffic and Transport Impact Assessment for the Project (Traffic Report) (Hyder Consulting, 2011) includes an assessment of existing traffic flows on the Castlereagh Highway in the vicinity of the Project. Section 2 of the Traffic Report concludes the Castlereagh Highway currently carries approximately 3500 vehicles per day of background traffic flows, with an increase in traffic flows of approximately 2% per annum. As the existing Castlereagh Highway traffic flows include traffic associated with the current Cullen Valley Mine and Invincible Colliery operations, existing traffic flows associated with those operations must be subtracted to determine existing base traffic flows.

### 4.10.2 Construction Traffic Flows

The Traffic Report estimates construction traffic flows of approximately 12 truck trips (24 movements) per week, or an average of 5 truck movements per day conservatively assuming a 5 day working week. Construction workers would add approximately 60 car trips, or 120 car movements, per day.

### 4.10.3 Operational Traffic Flows

The Traffic Report estimates the Project would generate approximately 115 truck trips (230 movements) per day to transport product coal and sand, excluding product transported via the conveyor to MPPS and by train to Port Kembla. These truck movements would replace the existing 202 truck trips (404 movements) per day under current approvals for Cullen Valley Mine and Invincible Colliery, resulting in a reduction in truck movements compared to the existing situation.

Cullen Valley Mine and Invincible Colliery currently employ 90 full time staff, while the Project would employ approximately 120 staff. The additional 30 staff are assumed to generate an additional 30 car trips (60 movements) per day.

### 4.10.4 Emergency Coal Transport

Following construction of the MPPS conveyor in Year 2, the only scenario involving transportation of product coal to MPPS by road would be under emergency conditions where coal supply by conveyor is unexpectedly disrupted, or if MPPS was unexpectedly unable to receive coal. During any period of emergency road haulage, it is anticipated that truck movements would occur between the hours of 7:00

am to 9:00 pm, not exceeding a frequency of 16 one-way truck movements per hour. Traffic noise levels associated with emergency coal transport are calculated in the following section.

#### 4.10.5 Calculated Traffic Noise Levels

Calculated traffic noise levels for the existing situation and during the proposed construction and operational phases of the Project are shown in Table 18. Traffic noise calculations are based on the Calculation of Road Traffic Noise (CoRTN) method developed by the United Kingdom Department of Transport (UKDoT), with adjustments to the base method to determine an average (LAeq) noise level. Existing and proposed traffic flows on the Castlereagh Highway are divided into the following traffic categories in Table 23:

- Base AADT — Traffic not associated with existing or proposed Cullen Valley Mine and Invincible Colliery operations;
- Trucks and Cars — Traffic associated with the current Cullen Valley Mine and Invincible Colliery or the proposed Project; and
- Total — All existing or proposed traffic flows including both of the above categories.

Section 2.3 of the Traffic Report indicates the morning peak traffic period occurs from 6 am to 7 am, with the afternoon peak from 3 pm to 5 pm. An estimated 10% of traffic in a 24 hour period occurs during the night, with the remaining 90% of traffic occurring during the day. The traffic noise calculations therefore include an assumption that 90% of the Annual Average Daily Traffic (AADT) occurs in a 15 hour day.

Table 23 shows the 60 LAeq,15hr traffic noise criterion would be met at any residence 50m from the Castlereagh Highway and additional traffic associated with the Project construction program or emergency supply of coal by road would make an insignificant difference to existing traffic noise levels. The operational situation for the Project, with some existing truck traffic replaced by the proposed conveyor and rail siding, would result in a traffic noise decrease of approximately 0.6 dBA compared to the existing situation. Emergency coal transportation by road would result in traffic noise levels a minor 0.1 dBA above the existing situation, excluding any traffic noise increase due to the assumed 2% annual increase in base traffic not associated with the Project.

**Table 23: Calculated Castlereagh Highway Traffic Noise Levels, Day, LAeq,15hr.**

| Scenario | AADT | | | | Calculated LAeq,15hr at Distance from the Road | |
|---|---|---|---|---|---|---|
| | Base Excluding Project | + Project Trucks | + Project Cars | Total Base + Project | At 50m | At 100m |
| Existing Traffic | 3006 | 404 | 90 | 3500 | 58.7 | 55.0 |
| Existing Traffic<br>+Construction | 3006<br>0 | 404<br>5 | 90<br>120 | 3625 | 58.7 | 55.1 |
| Base Traffic<br>+Project | 3006<br>0 | 0<br>230 | 0<br>120 | 3356 | 58.1 | 54.4 |
| Base Traffic<br>+Project<br>+Emergency Coal | 3006<br>0<br>0 | 0<br>230<br>224 | 0<br>120<br>0 | 3580 | 58.8 | 55.2 |
| Base Traffic Year 20<br>+Project<br>+Emergency Coal | 4460<br>0<br>0 | 0<br>230<br>224 | 0<br>120<br>0 | 5034 | 60.0 | 56.4 |

The closest residence to the Castlereagh Highway between Invincible Colliery and MPPS (excluding residences owned by Coalpac) is Residence 426 located approximately 1 km from the Highway. Traffic noise associated with the proposal would be significantly lower than the levels shown in Table 23 at this residence and would therefore be acceptable at all receivers.

## 4.11 Rail Traffic Noise

Noise levels from train movements on the WGRL are subject to the criteria described in Section 3.6 and are assessed separate to noise from train movements on the proposed siding.

Existing or proposed rail traffic on the WGRL includes:

- Charbon Colliery – up to 310 trains (620 movements) per year to transport up to 1.2 Mtpa of coal;
- Baal Bone Colliery – 4 to 5 trains per week (8 to 10 train movements per week) to transport an average of 1.5Mtpa of coal which is less than a previous long term average of over 2.5 Mtpa, although Baal Bone Colliery may cease operating before the Project begins rail haulage of product coal;
- Kandos Cement – 8000 tonnes of cement per week in 1600 tonne trains or 5 trains (10 movements) per week; and
- Other freight – no detailed information is available, however trains carrying grain and similar agricultural products are understood to use the WGRL at times. An average of one freight train (2 movements) per weekday or 10 movements per week has been assumed.

Background train traffic on the WGRL is therefore 42 movements per week or an average of 6 train movements per day. It is reasonable to assume up to 12 movements may occur on some days, particularly during the harvesting season for agricultural products such as grain.

Train movements to and from the proposed siding would occur intermittently rather than continuously, with an average of less than one train per day and an assumed theoretical maximum of 4 trains (8 movements) per day based on the assumed coal or sand loading capacity. Train movements on the WGRL would generally be audible for a period of less than 15 minutes per movement, with up to 8 movements per day causing audible train noise on the WGRL for less than 8% of the time.

Low train speeds in the vicinity of the siding would result in a lower sound power level of the train, compared to more remote locations where the train speed would be higher. Previous train noise measurements in the East Maitland area of the Hunter Valley indicate a typical 90 wagon coal train sound power level of 126 dBA at an estimated speed of 50 to 60 km/hr, with most of this sound energy contributed by the wagons. A 50 wagon train as expected to be used for the Project would produce a sound power level of 124 dBA at 50 to 60 km/hr and, as wagon noise reduces substantially as the train travels slower, approximately 120 dBA at 25 km/hr. Conversely, the same train travelling at 90 km/hr would produce a sound power level of approximately 127 dBA. A similar sound power level is assumed for all trains operating on the WGRL.

Available information indicates closest receivers to the WGRL are:

- Project Area to Portland — Residence 372 located approximately 90 m from the tracks;
- In Portland — Residences on Railway Avenue located approximately 40 m from the tracks;
- Portland to Wallerawang — No. 708 Pipers Flat Road located approximately 40 m from the tracks; and
- In Wallerawang — No. 91 Pipers Flat Road located approximately 8 m from the tracks.

Calculated noise levels produced by worst case existing train movements (12 per day) and worst case proposed situation with an additional 8 movements per day (20 per day total), to the above closest receivers, are shown in Table 24.

**Table 24: Calculated Existing and Proposed Rail Traffic Noise Levels to Closest Receivers.**

| Scenario | Noise Level LAeq and LAmax at Nominal Receiver Distance, m | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Average Level LAeq | | | | Maximum Level LAmax | | | |
| | 90 m | 40 m | 40 m | 8 m | 90 m | 40 m | 40 m | 8 m |
| Existing 90 km/hr | 51 | 55 | 55 | 62 | 80 | 87 | 87 | 101 |
| Existing 50 km/hr | 51 | 54 | 54 | 61 | 77 | 84 | 84 | 98 |
| Existing 25 km/hr | 50 | 53 | 53 | 60 | 73 | 80 | 80 | 94 |
| Proposed 90 km/hr | 53 | 57 | 57 | 64 | 80 | 87 | 87 | 101 |
| Proposed 50 km/hr | 53 | 56 | 56 | 63 | 77 | 84 | 84 | 98 |
| Proposed 25 km/hr | 52 | 55 | 55 | 62 | 73 | 80 | 80 | 94 |
| Criteria | 60 | | | | 85 | | | |

Table 24 shows average LAeq noise levels would increase by up to 2 dBA during a worst case day with up to 8 Project-related train movements. Exceedances of the 60 LAeq criterion are predicted at the closest residence in Wallerawang, however that residence is currently affected by noise from existing train movements on the WGRL. It is noted that this residence has recently been constructed, which indicates the owners have chosen to live immediately adjacent to the WGRL and would not therefore be sensitive to train noise.

Table 24 also indicates potential exceedances of the 85 LAmax criterion at three of the four assessed residences, however maximum noise levels do not increase as the number of daily movements increases. Potentially affected receivers are therefore already affected by existing train movements on the WGRL and would not be more affected as a result of the Project.

Given the limited potential for rail-related noise impacts to receivers that are not currently affected by train noise, it is considered unreasonable to recommend noise mitigation measures as part of this Project. Nevertheless, Coalpac would be prepared to contribute to and cooperate with rail managers and train operators in any regional train noise study that the operators may wish to complete in the future.

## 4.12 Blast Overpressure and Vibration

Blasting would be required to prepare overburden for removal and may be required for coal extraction with up to 20 blast events per month, or 5 blasts per week, required for the proposed production rate assuming no reduction in blast size to control blast effects. As a reduction in blast sizes would be required in areas of the site closest to receivers and sensitive structures, up to 40 blast events per week or 10 events per day may be required for limited time periods.

A consolidated Blast Management Plan would be prepared to include management measures to minimise impacts on all sensitive receivers, heritage structures, infrastructure such as public roads and the WGRL and livestock on adjoining rural properties. The Blast Management Plan for the Project would be based on existing Blast Management Plans for Cullen Valley Mine and Invincible Colliery where relevant.

Blast effects including ground vibration and overpressure depend on the following factors:

- Ground conditions including rock types and layers;
- Groundwater conditions including extent and depth;

- Distance from the blast site to a receiver;
- How well the explosive charges are confined with stemming material;
- Maximum Instantaneous Charge (MIC) for the blast event;
- Topography between the blast site and receivers; and
- Atmospheric conditions including wind speed, wind direction and vertical temperature gradient.

Blast effects have been calculated using the equations in Appendix J of *Australian Standard 2187.2-2006 Explosives – Storage and use, Part 2: Use of explosives*. A typical blast includes a number of separate charged holes which are detonated in a specific pattern to maximise the effectiveness of the blast. The MIC is determined by the weight of explosive material per hole multiplied by the maximum number of holes detonated simultaneously within the firing pattern and is typically in the range 50 to 600 kg for many previous blast events at Cullen Valley Mine and Invincible Colliery.

A database of previous blast events was supplied by Coalpac for analysis. The database included the location, MIC and measured vibration and overpressure levels at various receiver locations for all blast events that have occurred at Cullen Valley Mine and Invincible Colliery during the period January 2010 to April 2011.

Analysis of the data indicated the Australian Standard vibration and overpressure equations are appropriate for the Project based on commonly adopted values of K = 1140 and B = 1.6 for the ground vibration coefficients. Summary results from the database are attached in Appendix E.

### 4.12.1 Predicted Blast Effects

Table 25 shows calculated ground vibration and overpressure levels for closest blast events to each receiver location, taking into account topographical or other shielding between the blast site and the receiver where relevant. Results have been calculated in the absence of mitigation measures and should be compared with the 5 mm/s and 115 dB criteria for occupied residences and the criteria listed in Table 16 for heritage structures. Calculated overpressure levels assume a typical well confined bench blast. Predicted levels over the suggested criteria are highlighted in bold font.

Table 25 shows predicted blast effects in the absence of mitigation measures have the potential to exceed the ground vibration and overpressure criteria at a number of residences and heritage structures.

**Table 25: Predicted Blast Effects, No Mitigation.**

| MIC, kg | 75 | 150 | 300 | 600 | 75 | 150 | 300 | 600 | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| Receiver (closest distance) | Ground Vibration, mm/s | | | | Overpressure, dBL | | | | mm/s, dBL |
| Residence 205 (1540m) | 0.3 | 0.5 | 0.9 | 1.5 | 101 | 103 | 106 | 109 | 5, 115 |
| Residence 179 (500m) | 1.7 | 3.0 | **5.2** | **9.1** | 115 | **118** | **121** | **123** | 5, 115 |
| Residence 139 (1350m) | 0.4 | 0.6 | 1.1 | 1.9 | 102 | 105 | 108 | 111 | 5, 115 |
| Residence 114 (1300m) | 0.4 | 0.7 | 1.1 | 2.0 | 103 | 106 | 108 | 111 | 5, 115 |
| Residence 142 (960m) | 0.6 | 1.1 | 1.9 | 3.2 | 106 | 109 | 112 | 115 | 5, 115 |
| Residence 144 (1200m) | 0.4 | 0.7 | 1.3 | 2.3 | 104 | 107 | 110 | 112 | 5, 115 |
| Residences 426, 392 (1450m) | 0.3 | 0.6 | 1.0 | 1.7 | 101 | 104 | 107 | 110 | 5, 115 |
| Residence 217N (600m) | 1.3 | 2.2 | 3.9 | **6.8** | 107[1] | 110[1] | 113[1] | **116[1]** | 5, 115 |
| Residence 199 (500m) | 1.7 | 3.0 | **5.2** | **9.1** | 110[1] | 113[1] | **116**[1] | **118**[1] | 5, 115 |
| Cullen Bullen (>840m) | 0.8 | 1.3 | 2.3 | 4.0 | 103[1] | 106[1] | 109[1] | 112[1] | 5, 115 |
| Rock RCK1-10 (140m) | 13.3 | **23.1** | **40.2** | **70.1** | N/A[2] | N/A[2] | N/A[2] | N/A[2] | 20, N/A |
| Rock RCK2-10 (130m) | 14.9 | **26.0** | **45.3** | **78.9** | N/A[2] | N/A[2] | N/A[2] | N/A[2] | 20, N/A |
| Rock RCKPAD1-10 (190m) | 8.2 | 14.2 | 24.7 | 43.0 | N/A[2] | N/A[2] | N/A[2] | N/A[2] | 50, N/A |
| Rock RCKPAD2-10 (200m) | 7.5 | 13.1 | 22.8 | 39.6 | N/A[2] | N/A[2] | N/A[2] | N/A[2] | 100, N/A |
| Cemetery (200m) | 7.5 | 13.1 | 22.8 | 39.6 | N/A[2] | N/A[2] | N/A[2] | N/A[2] | 50, N/A |

1 Overpressure level reduced by 5 dBL due to significant topographical shielding.

2 Overpressure criteria are not required for the rock shelters and the cemetery as these sites are not sensitive to overpressure.

### 4.12.2 Proposed Blast Management Measures

Initial calculations have indicated exceedances of relevant vibration and overpressure criteria may occur in the absence of mitigation measures. The following mitigation and management measures have been proposed by Coalpac's blasting consultant to control and minimise blast effects to any sensitive receiver, including a residence that is not subject to a negotiated agreement or an occupied building with significant heritage value.

- Blasting would not occur closer than 500m to any occupied or sensitive building unless adequate controls are implemented to minimise the risk of fly rock;
- A qualified geotechnical expert would inspect and assess each identified building or structure with heritage significance, to determine appropriate ground vibration and overpressure limits. Recommended limits would be included in the Blast Management Plan;
- Blasts would be designed to achieve a vibration level at half of the recommended limit and an overpressure level 3 dB below the recommended overpressure limit, for each heritage site;
- Blasting in new mining areas in close proximity to heritage sites and residences (receivers) would commence furthest from the receiver and advance towards the receiver to enable a history of monitoring results to be established for that receiver and provide advance warning of possible exceedances of blast criteria;
- All blasts would be monitored to confirm acceptable blast impacts and to assist in predicting future blast effects as the blast sites approach sensitive receivers;
- Electronic detonators would be used where necessary to provide accurate timing and firing patterns to minimise the chance of excessive ground vibration, following recent Coalpac practice in mining areas close to receivers;
- Blasts requiring a reduced MIC to meet vibration criteria would include one or more of the following options:
  - Lower density explosives;

- Deck loading;
- Reduced hole diameter;
- Reduced blast area; or
- Reduced blast bench height.

- Blasts requiring a reduced overpressure level to meet relevant criteria would include one or more of the following options:
  - Appropriate aggregate of sufficient depth should be used for stemming material to contain the blast energy;
  - Sufficient burden (distance between rows) would be designed to minimise the risk of face blowout;
  - Each blast would be oriented to avoid facing towards the most sensitive receiver;
  - The hole pattern would be designed to fire the closest holes first, to minimise the risk of overpressure reinforcement;
  - Weather conditions, specifically wind speed and direction and cloud cover, would continue to be monitored before each blast and any weather related effects would be considered when predicting overpressure levels and designing the blast pattern.

Section 3.4 of the current Cullen Valley Mine Blast Management Plan contains a Livestock Blast Protocol that has been successful in managing blasting impacts on livestock on private properties adjacent to the Cullen Valley Mine. The consolidated Blast Management Plan would include any relevant updates and amendments to manage potential livestock impacts on all properties near the consolidated open cut mining areas.

### 4.13 Cumulative Noise Levels

Cumulative noise impacts would potentially be caused by simultaneous operation of the Project and other nearby industrial developments:

- Baal Bone Colliery to the north east
- Ivanhoe North Rehabilitation Project to the south west;
- The existing MPPS and the MPPS Extension Project to the south; and
- The Western Rail Coal Unloader to the south of MPPS.

Additional industrial developments that are too far from the Project to have the potential for cumulative noise impacts, and have therefore not been considered further, include:

- Angus Place/Springvale Collieries;
- Pine Dale Coal Mine, including the Yarraboldy Extension; and
- Wallerawang Power Station.

Cumulative noise levels have been assessed at potentially affected residences during the most sensitive night period, as predicted noise levels are higher at night and the amenity criterion is lower during the night period. For the purposes of this assessment, average noise levels over an entire night period (LAeq,9hr) are estimated at 3 dBA lower than the predicted LAeq,15min level listed in Table 21 due to typical variation in open cut mine operations and weather conditions during an average night.

In contrast, Baal Bone Colliery is an underground mine and the dominant sources of environmental noise from the Colliery are the CHPP, which tends to operate consistently during an entire night, and the rail loadout facility. Similarly, MPPS tends to operate consistently with minimal variation in noise level during a typical night. Noise from both developments would vary to some extent due to variable weather conditions during a night, however this variation has been conservatively ignored for the purposes of this assessment.

Existing noise levels from Baal Bone Colliery and MPPS are discussed in Sections 2.10 and 2.11 above.

Information regarding rehabilitation work associated with Ivanhoe North is available in *Ivanhoe North Rehabilitation Project Noise Monitoring Program* (Centennial Coal and R.W.Corkery & Co, 18 February 2009) which is available on Centennial Coal's website. Rehabilitation work is limited to the hours 7am to 6pm and is subject to a noise criterion of 36 LAeq,15min at any residence. Noise levels from the Ivanhoe North Rehabilitation Project would remain at least 14 dBA below the 50 LAeq,11hr day amenity criterion, would therefore have an insignificant impact on any cumulative noise levels at these residences and do not require further assessment.

Noise levels from the proposed Western Rail Coal Unloader are described in the *Western Rail Coal Unloader Environmental Assessment* (SKM, 2007), specifically in the noise impact assessment in Appendix F. Table 6-3 in the noise impact assessment indicates a predicted noise level of up to 39 LAeq,15min during adverse weather conditions at the closest Receiver 5 from combined activities associated with the Unloader including train movements, the dump hopper and conveyors. Receiver 5 is approximately 560m from the nearest point on the rail loop and approximately 1300m from the dump hopper.

Results from the cumulative noise assessment for representative private receivers are presented in Table 26. Residences expected to receive less than 33 dBA from all four assessed developments have been excluded from the table. A dash '-' in Table 26 indicates predicted noise levels less than 28 LAeq,9hr night.

**Table 26: Cumulative Noise Assessment.**

| Owner Ref | Residence Ref | Noise Level Contribution, LAeq,9hr night | | | | |
|---|---|---|---|---|---|---|
| | | Coalpac Consolidation Project | Baal Bone Colliery | MPPS and MPPS Extension Project | Western Rail Coal Unloader Project | Cumulative Noise Level |
| 2 | 217N | 34.2 | - | - | - | 34.2 |
| 5 | 139 | 34.7 | - | - | - | 34.7 |
| 6 | 179 | 36.7 | - | - | - | 36.7 |
| 8 | 364 | 35.7 | - | - | - | 35.7 |
| | 367 | 35.9 | - | - | - | 35.9 |
| 9 | 205 | 37.6 | - | - | - | 37.6 |
| 10 | 368 | 34.1 | - | - | - | 34.1 |
| 11 | 383 | 34.7 | - | - | - | 34.7 |
| 13 | 384 | 33.6 | - | - | - | 33.6 |
| 14 | 385 | 33.3 | - | - | - | 33.3 |
| 17 | 386 | 34.7 | - | - | - | 34.7 |
| 23 | 403 | 33.4 | - | 28 | - | 34.5 |
| | 404 | 32.9 | - | 28 | - | 34.1 |
| 30 | 198 | 36.7 | - | - | - | 36.7 |
| | 199 | 36.5 | - | - | - | 36.5 |
| 31 | 197 | 37.4 | - | - | - | 37.4 |
| 32 | 201 | 36.4 | - | - | - | 36.4 |
| 33 | 195 | 40.8 | - | - | - | 40.8 |
| 34 | 194 | 42.3 | - | - | - | 42.3 |
| 50 | 114 | 33.0 | - | - | - | 33.0 |

| Owner Ref | Residence Ref | Noise Level Contribution, LAeq,9hr night | | | | |
|---|---|---|---|---|---|---|
| | | Coalpac Consolidation Project | Baal Bone Colliery | MPPS and MPPS Extension Project | Western Rail Coal Unloader Project | Cumulative Noise Level |
| 51 | 113 | 33.5 | - | - | - | 33.5 |
| 65 | 142 | 35.1 | 33 | - | - | 37.2 |
| 66 | 143 | 34.9 | 35 | - | - | 38.0 |
| 67 | 144 | 35.7 | 35 | - | - | 38.4 |
| 72 | 349 | 35.4 | - | 28 | - | 36.1 |
| 73 | 391 | 34.0 | - | 29 | - | 35.2 |
| 75 | 392 | 36.5 | - | 30 | - | 37.4 |
| 76 | 372 | 36.3 | - | - | - | 36.3 |
| 77 | 373 | 34.1 | - | 28 | - | 35.1 |
| 80 | 412 | 35.4 | - | 30 | - | 36.5 |
| 85 | 426 | 33.3 | - | 34 | - | 36.7 |
| Total Affected Residences/ Properties | | 0 | 0 | 0 | 0 | 0 |
| | | 1 | 0 | 0 | 0 | 1 |
| | | 1 | 0 | 0 | 0 | 1 |

Red shading – a significant noise impact of 5 dBA or more above the night amenity criterion;
Blue shading – a moderate noise impact of less than 5 dBA above the night amenity criterion; and
Green shading – a mild noise impact of 2 dBA or less above the night amenity criterion.

Table 26 shows combined noise levels from the Project and other industrial developments would meet the 40 LAeq,9hr night amenity criterion at all residences, with the exception of Residences 194 and 195 which are predicted in Section 4.6 above to be significantly affected by the Project operating alone.

# 5 CONCLUSION

This assessment shows a number of privately owned receiver properties are predicted to receive significant, moderate or mild noise impacts, as shown in the shaded areas of Table 21. All privately owned properties not listed in Table 21 are expected to receive acceptable noise levels compared to relevant criteria. Predicted noise levels consider implementation of all reasonable and feasible noise mitigation measures as described in this report.

Construction noise levels are expected to be generally acceptable at all potentially affected residences despite predicted exceedances of the conservative construction noise criterion during the busiest periods. A Construction Management Plan should be developed and implemented to ensure all feasible and reasonable noise mitigation measures are implemented during the Project construction phase.

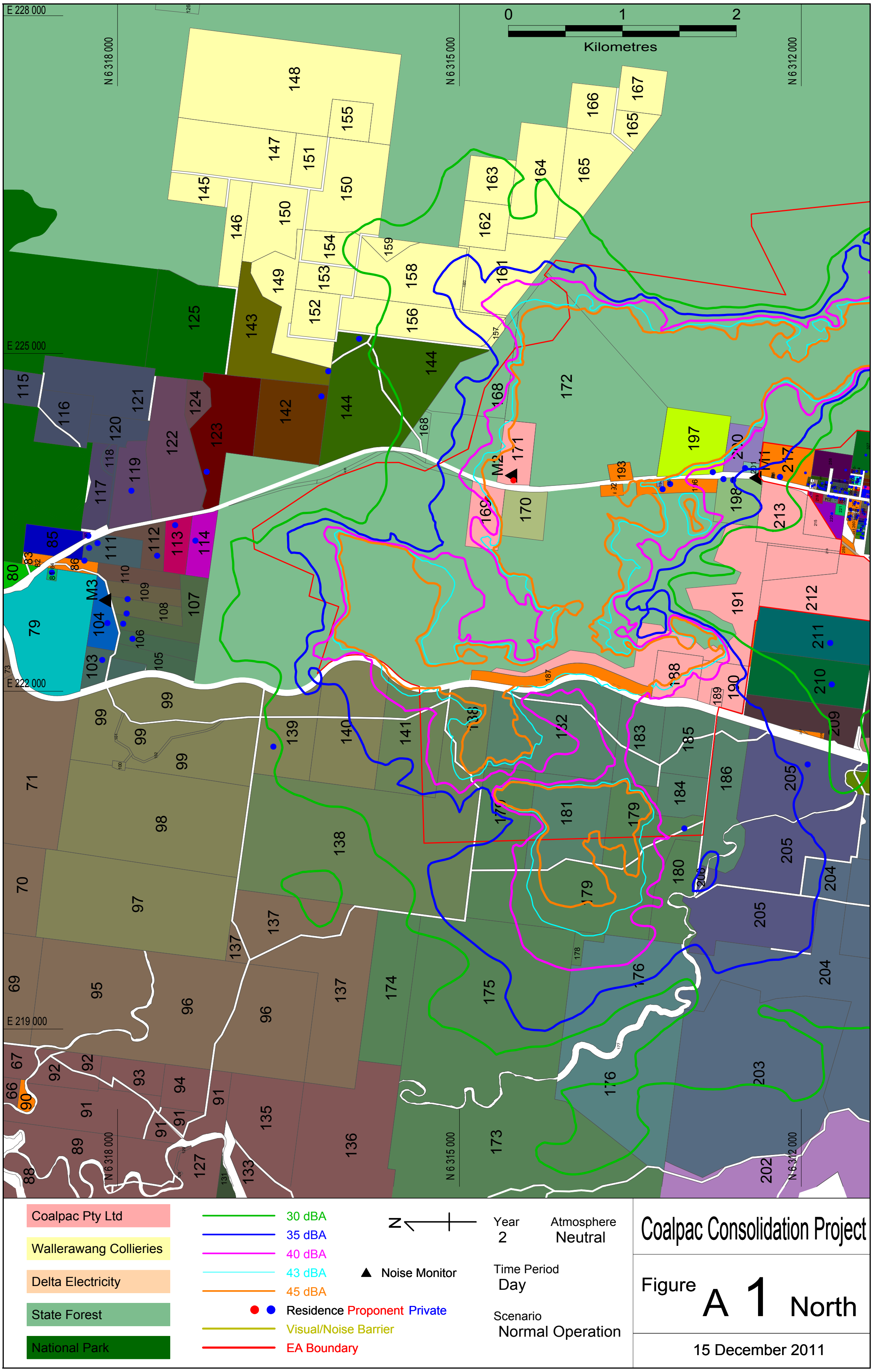
Sleep disturbance from potential impact sources within the mine, such as dozer tracks and train wagon bunching, is unlikely to occur at any privately owned property compared to the recommended criterion. Management measures to minimise or avoid high noise levels from dozer tracks or train wagon bunching have been recommended and are expected to result in maximum noise levels events occurring rarely. Predicted maximum noise levels are therefore considered acceptable.

Noise from road traffic associated with construction activities and ongoing operation of the Project would be an insignificant contributor to total traffic noise levels from the Castlereagh Highway and would be acceptable at all residences.

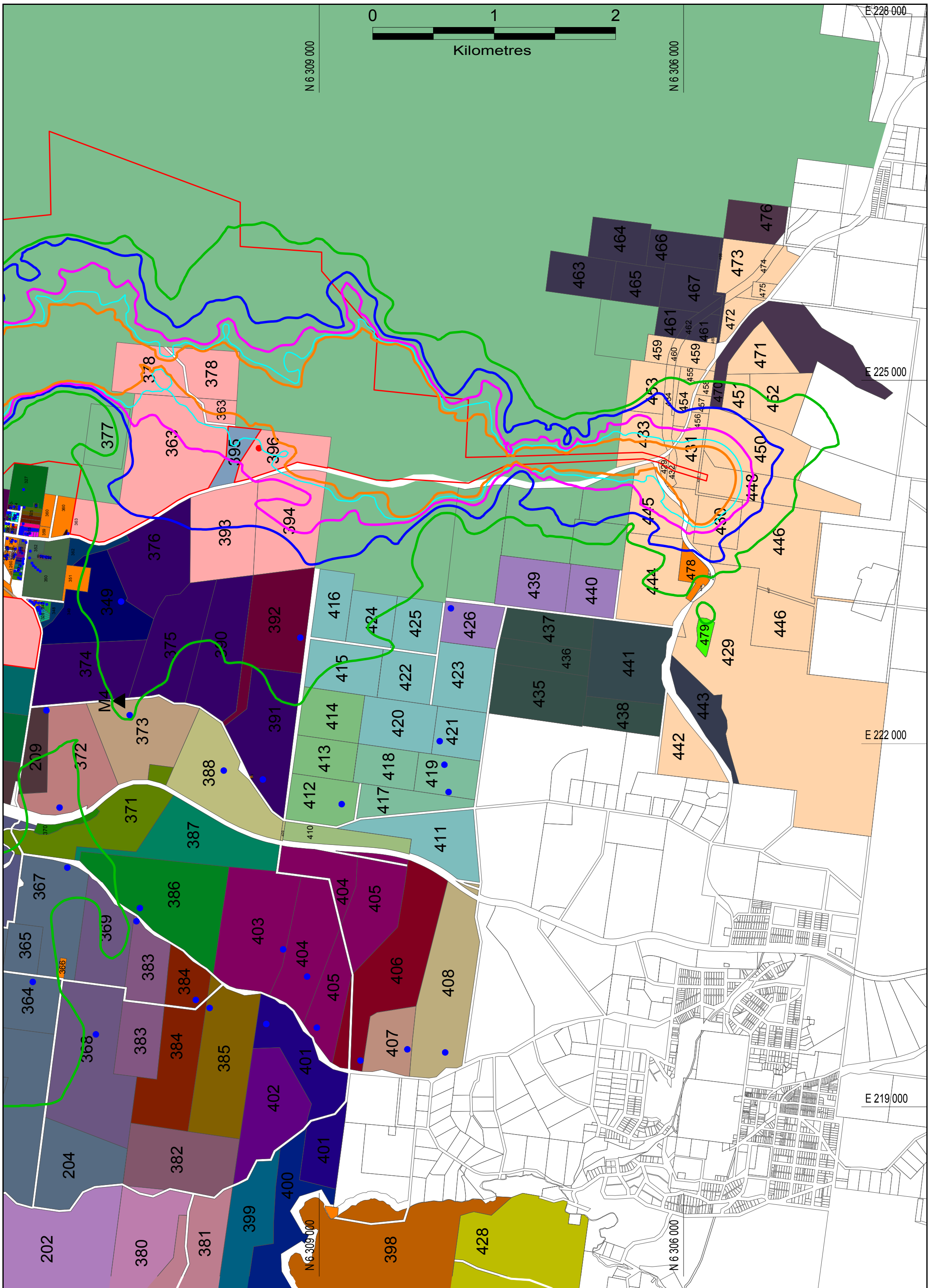
Low frequency noise levels from the Project are implicitly controlled by the intrusive noise criteria, as intended by the INP, so low frequency noise impacts are unlikely to occur at any privately owned receiver.

Blasting associated with the Project would require careful control of blast parameters, and management of blast times to avoid periods of unsuitable weather conditions, to produce acceptable blast effects at all occupied residences and other buildings. A detailed review of blast criteria and blast management measures, by a suitably qualified geotechnical expert, should be completed before any blast occurs within 400m of an indigenous heritage site. A revised Blast Management Plan for the Project is recommended including relevant criteria, management measures and monitoring strategies recommended by the expert.

## APPENDIX A – NOISE CONTOUR FIGURES



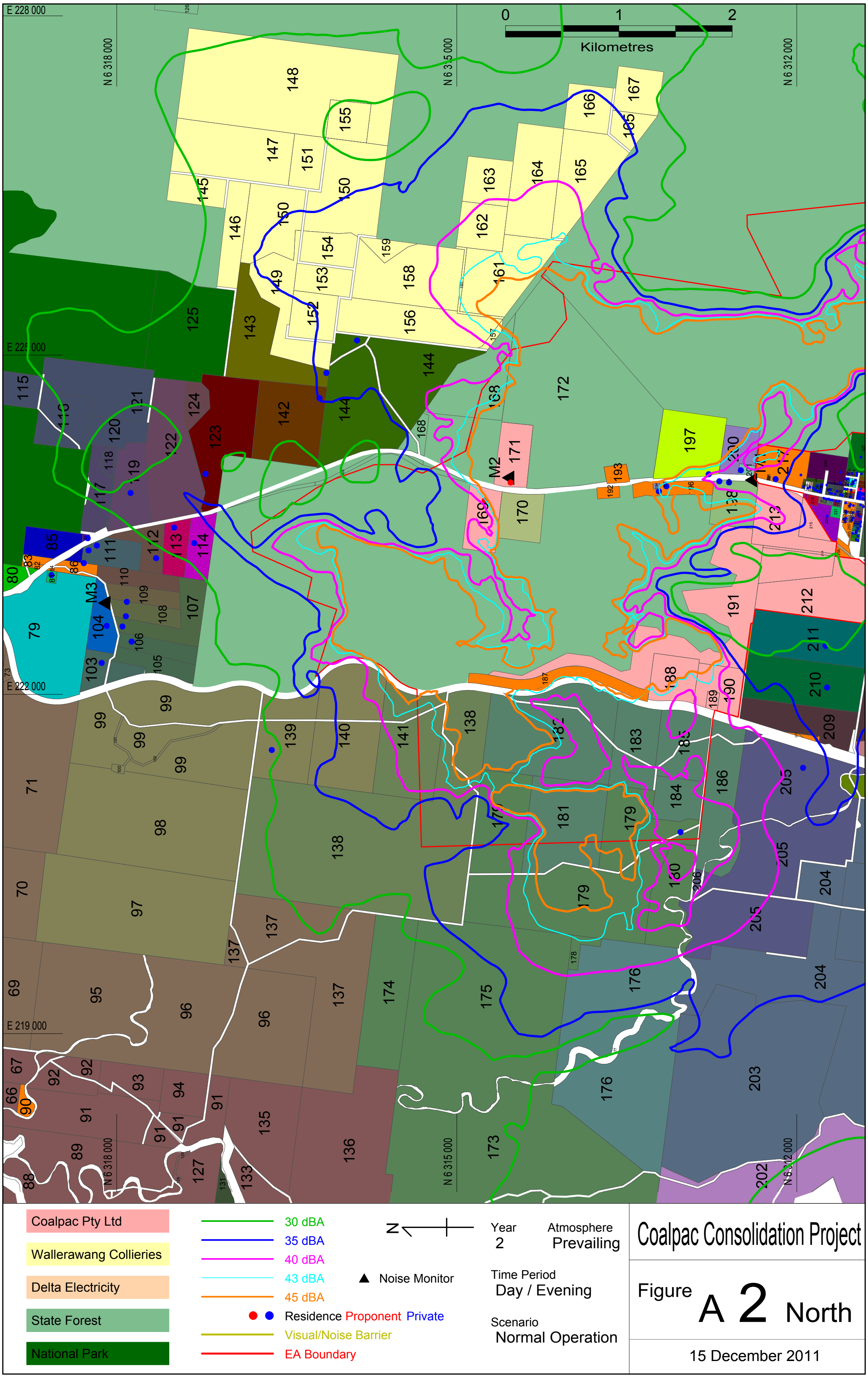

BRIDGES Acoustics



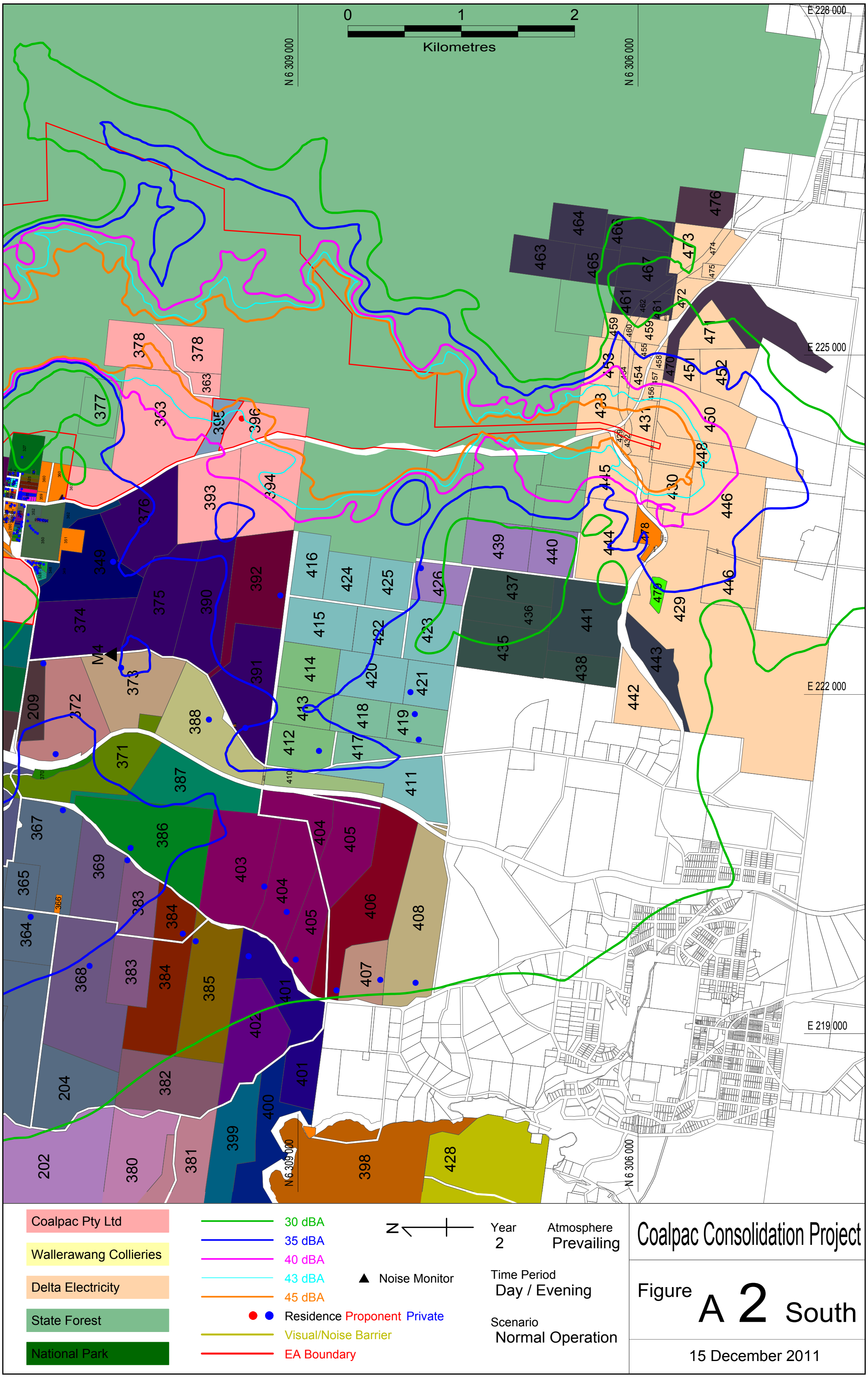

Coalpac Consolidation Project

Figure A 1 South

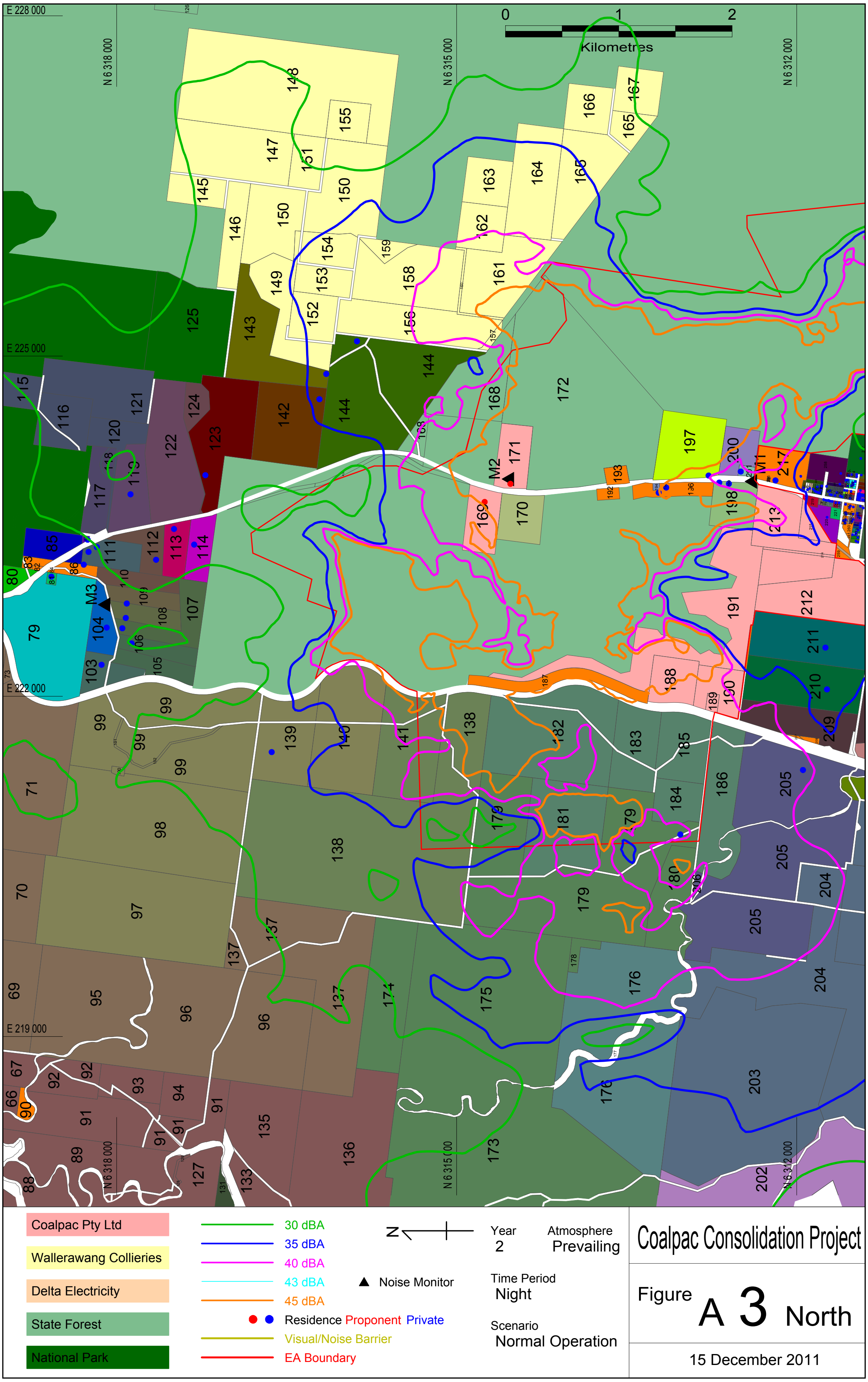
15 December 2011



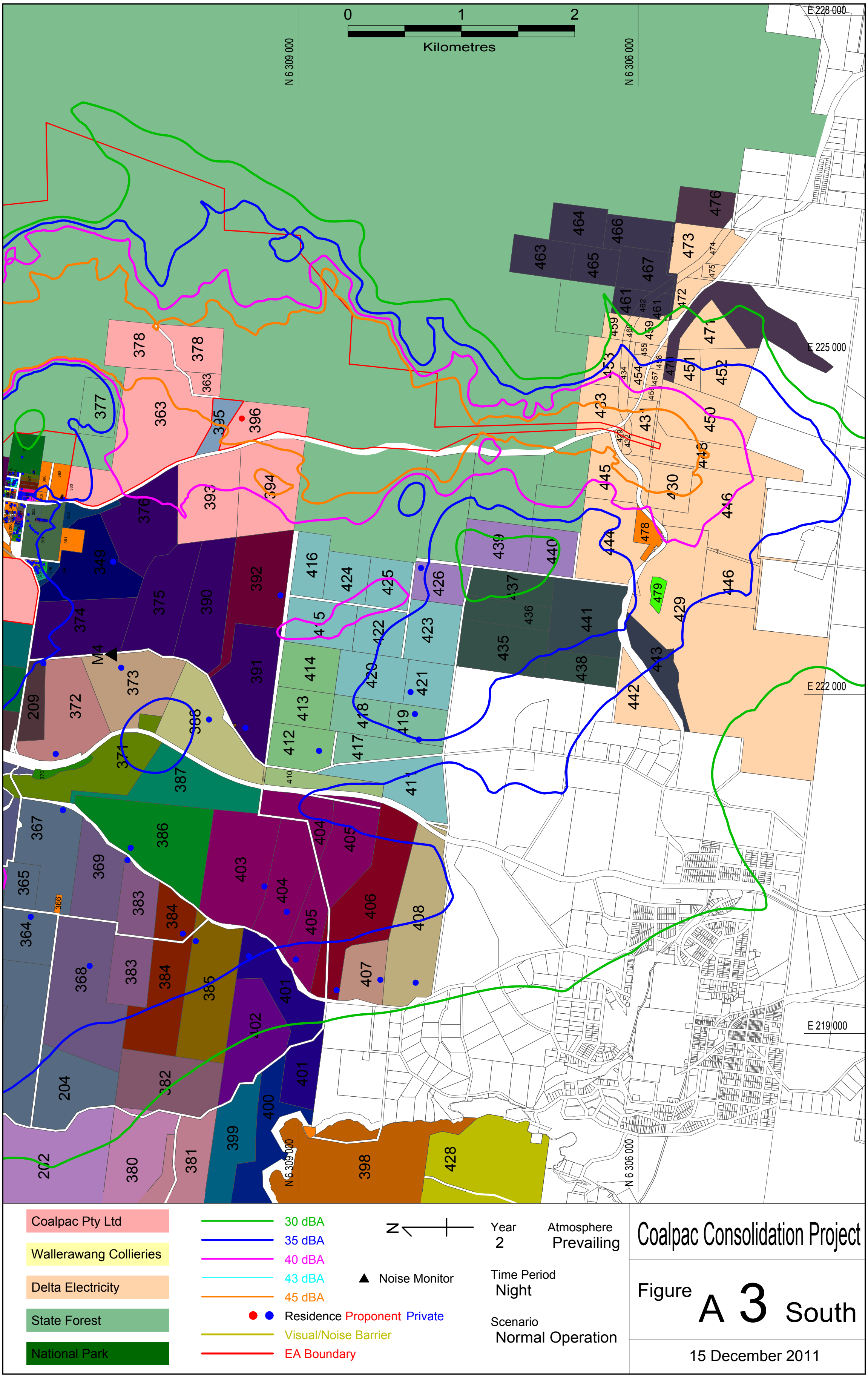

BRIDGES Acoustics



0 1 2
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Noise Monitor
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Year
2
Atmosphere
Prevailing
Time Period
Day / Evening
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A 2 South
15 December 2011




BRIDGES Acoustics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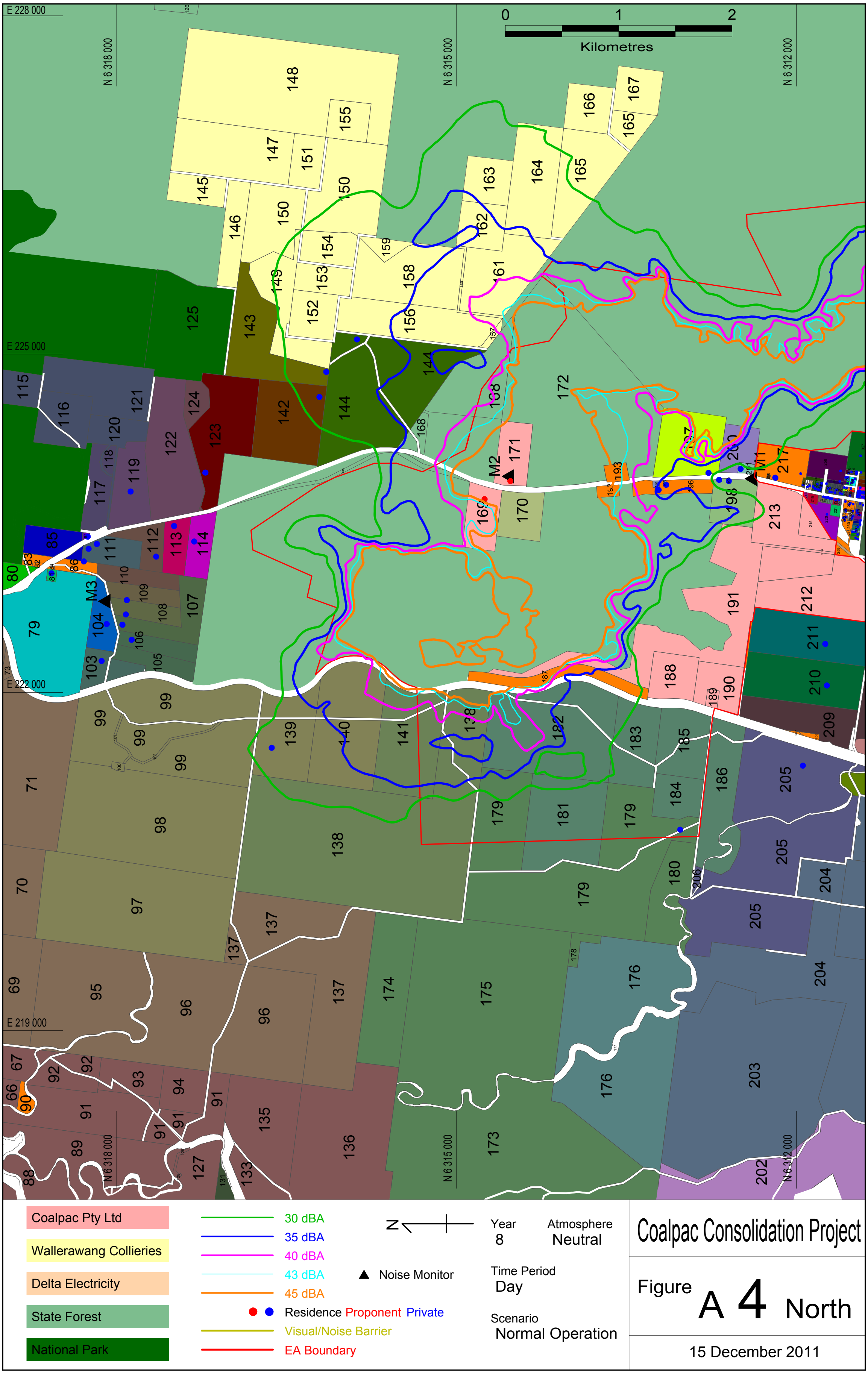
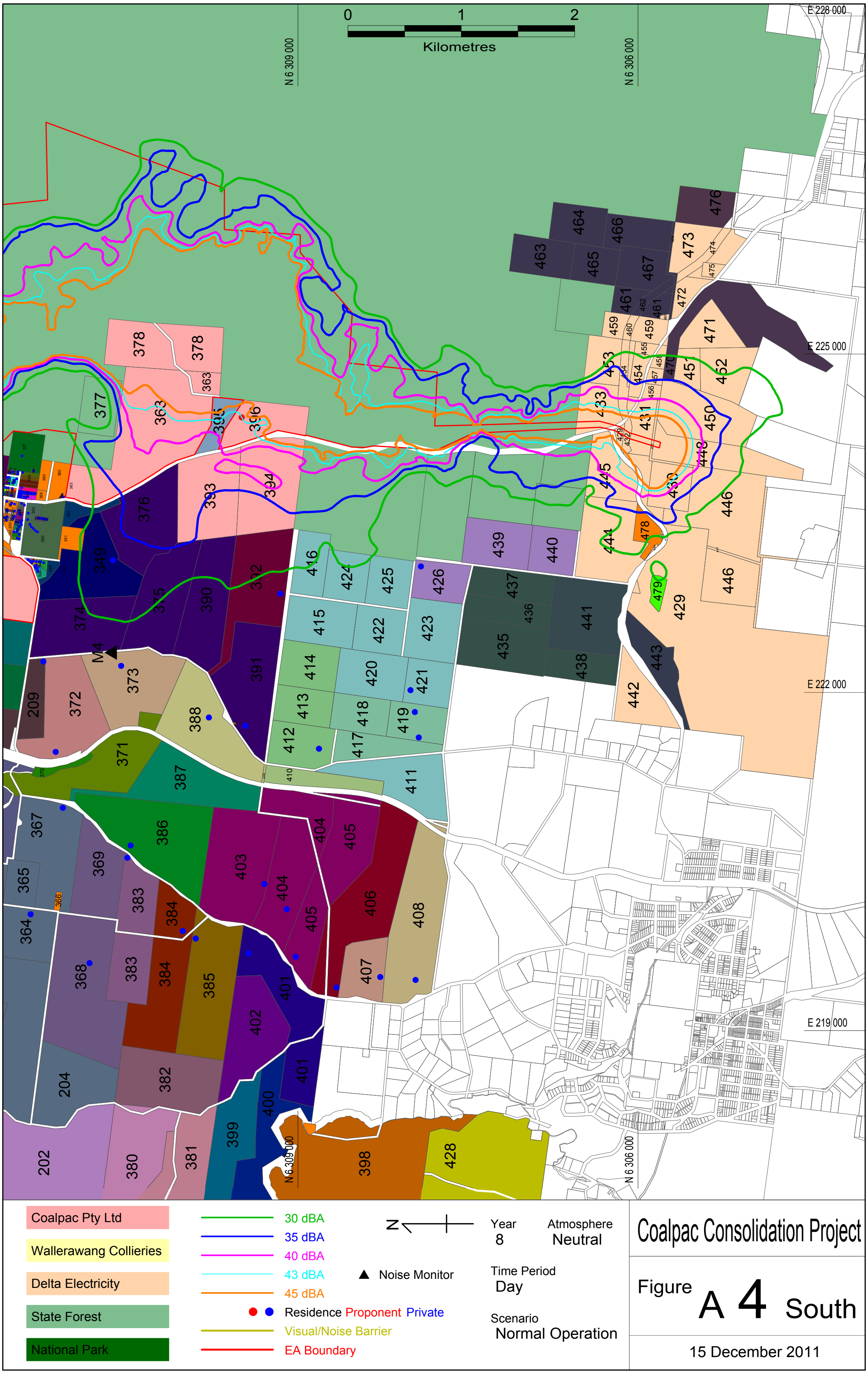
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year
2
Atmosphere
Prevailing
Time Period
Night
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A 3 South
15 December 2011




BRIDGES Acoustics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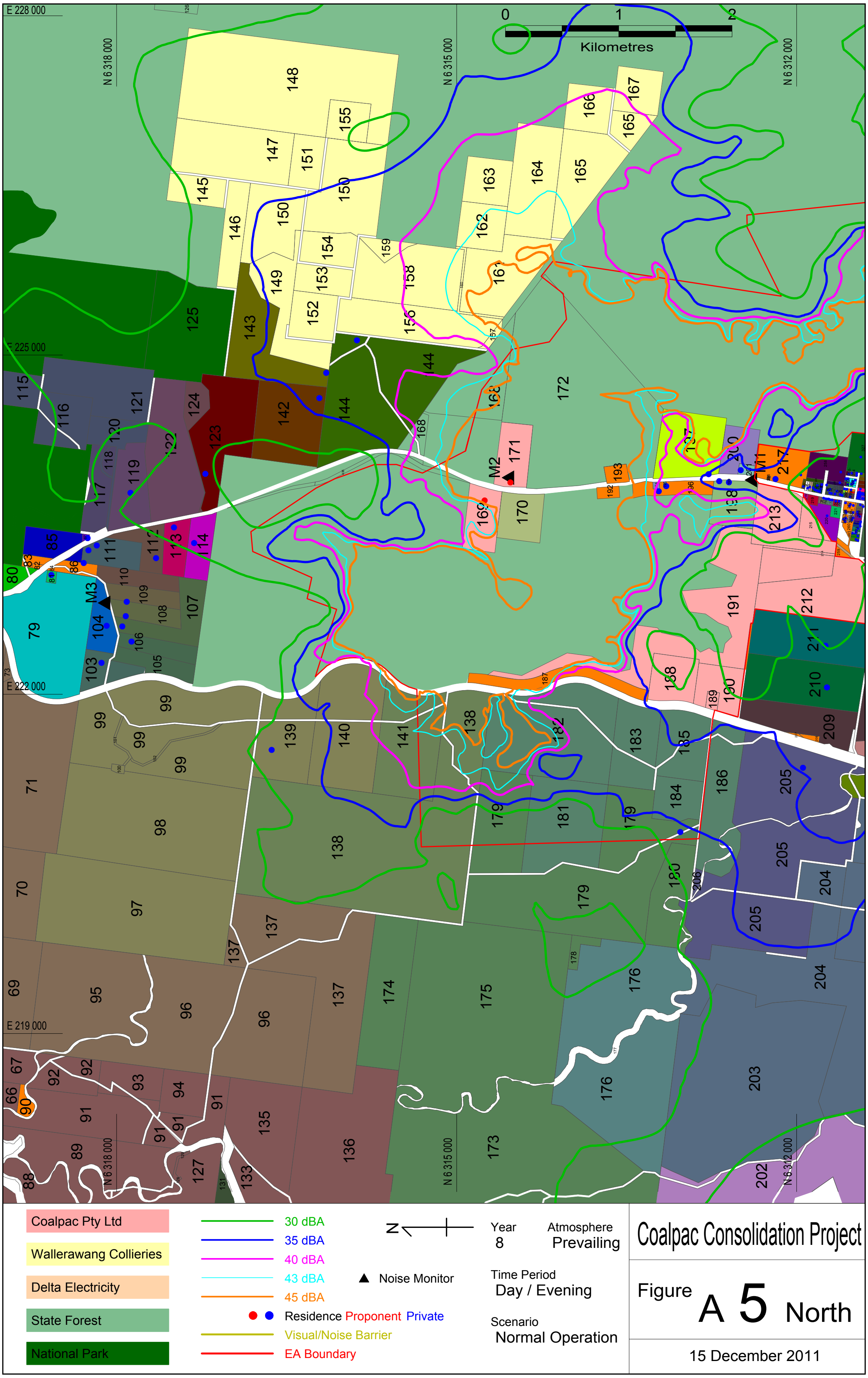
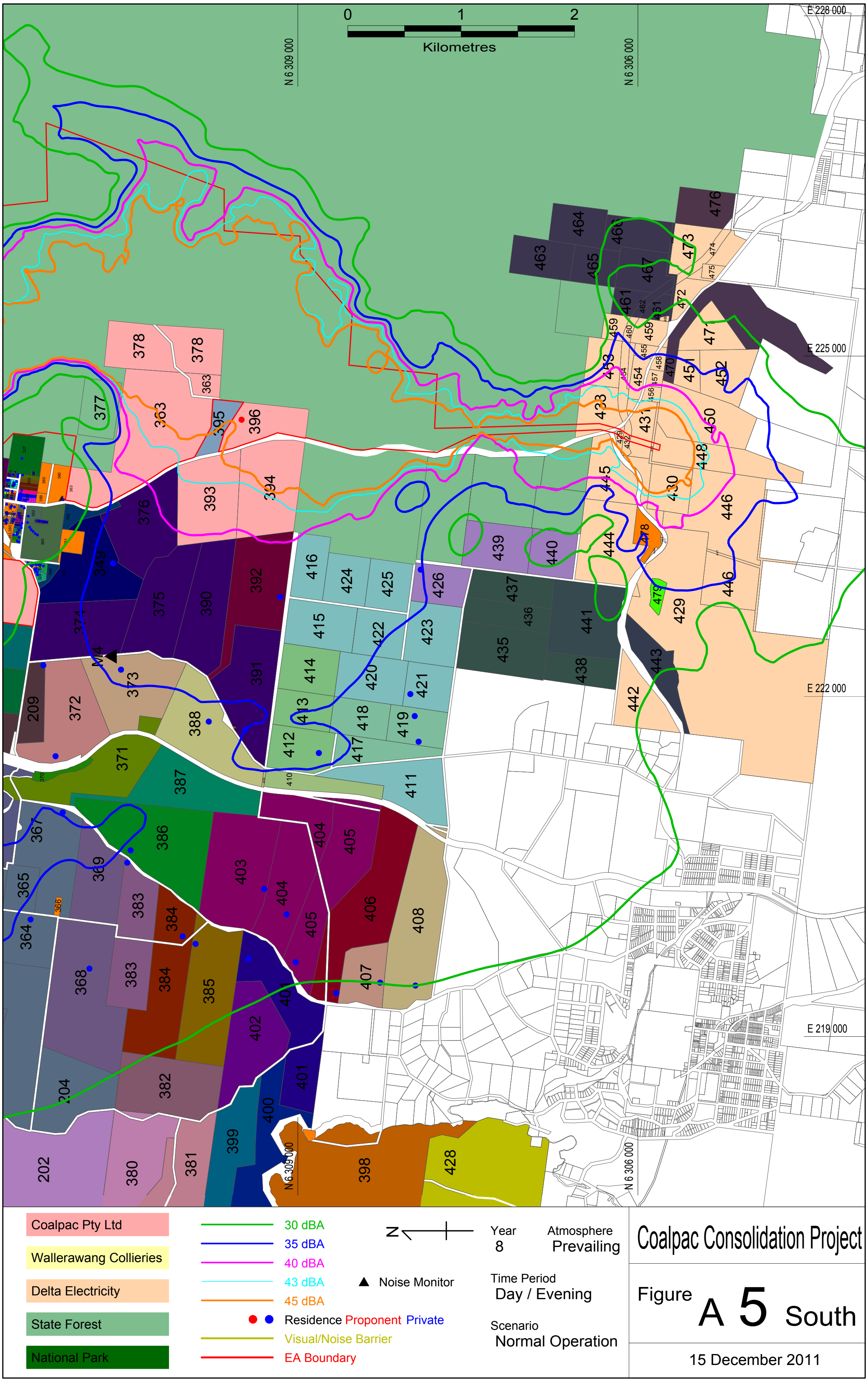
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year 8
Atmosphere Neutral
Time Period Day
Scenario Normal Operation
Coalpac Consolidation Project
Figure A 4 South
15 December 2011




BRIDGES Acoustics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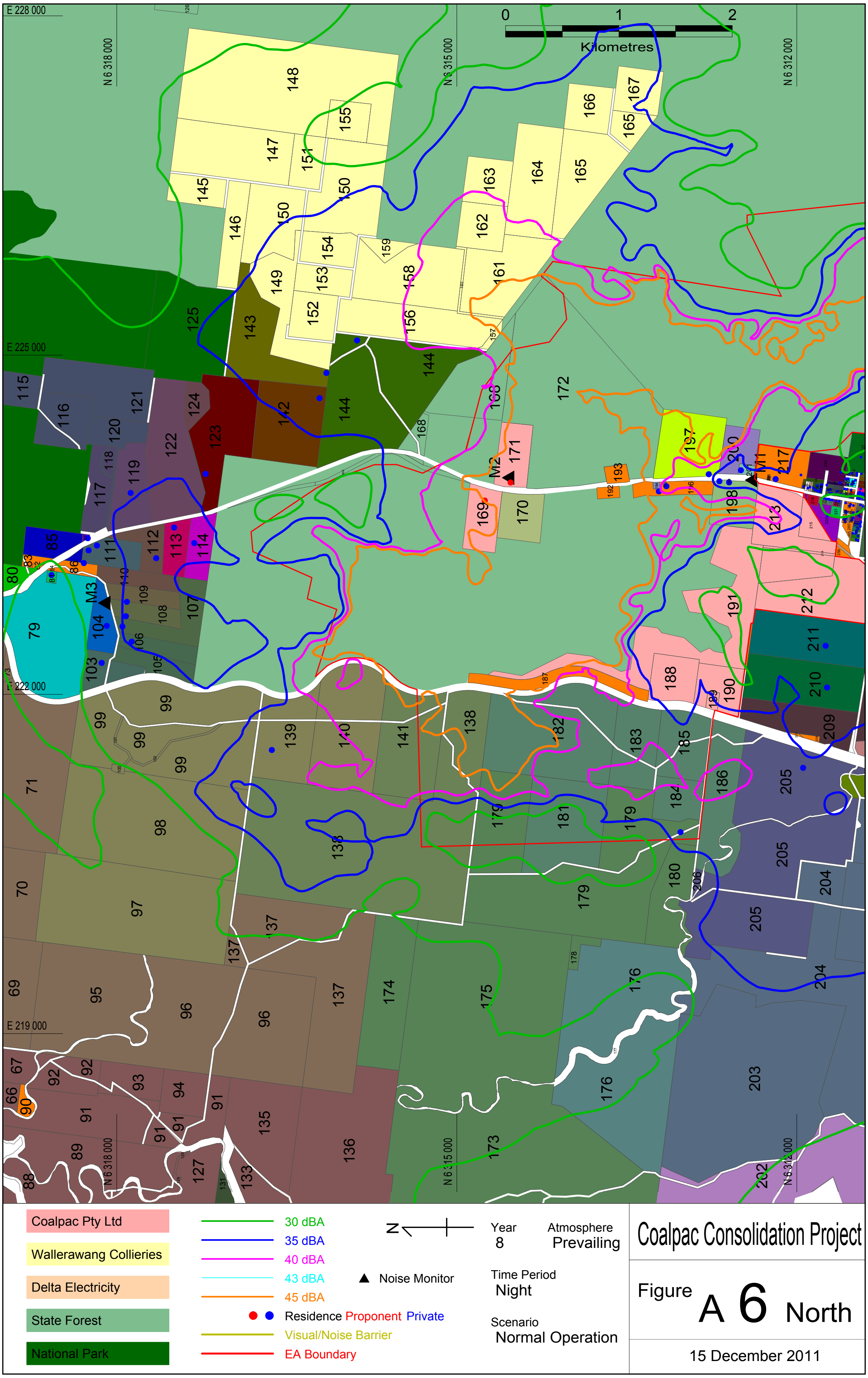
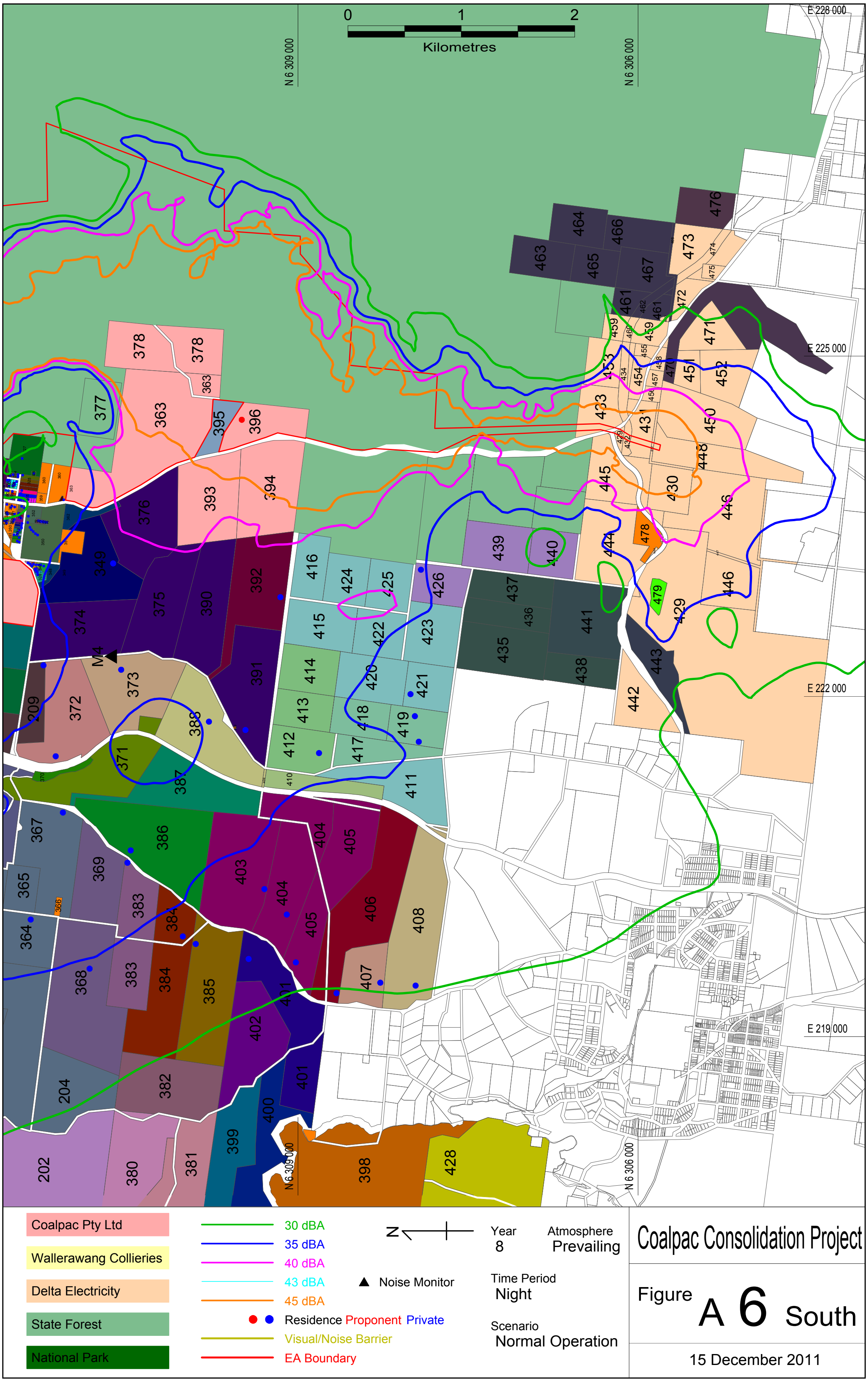
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year
8
Atmosphere
Prevailing
Time Period
Day / Evening
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A 5 South
15 December 2011




BRIDGES Acoustics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Kilometres
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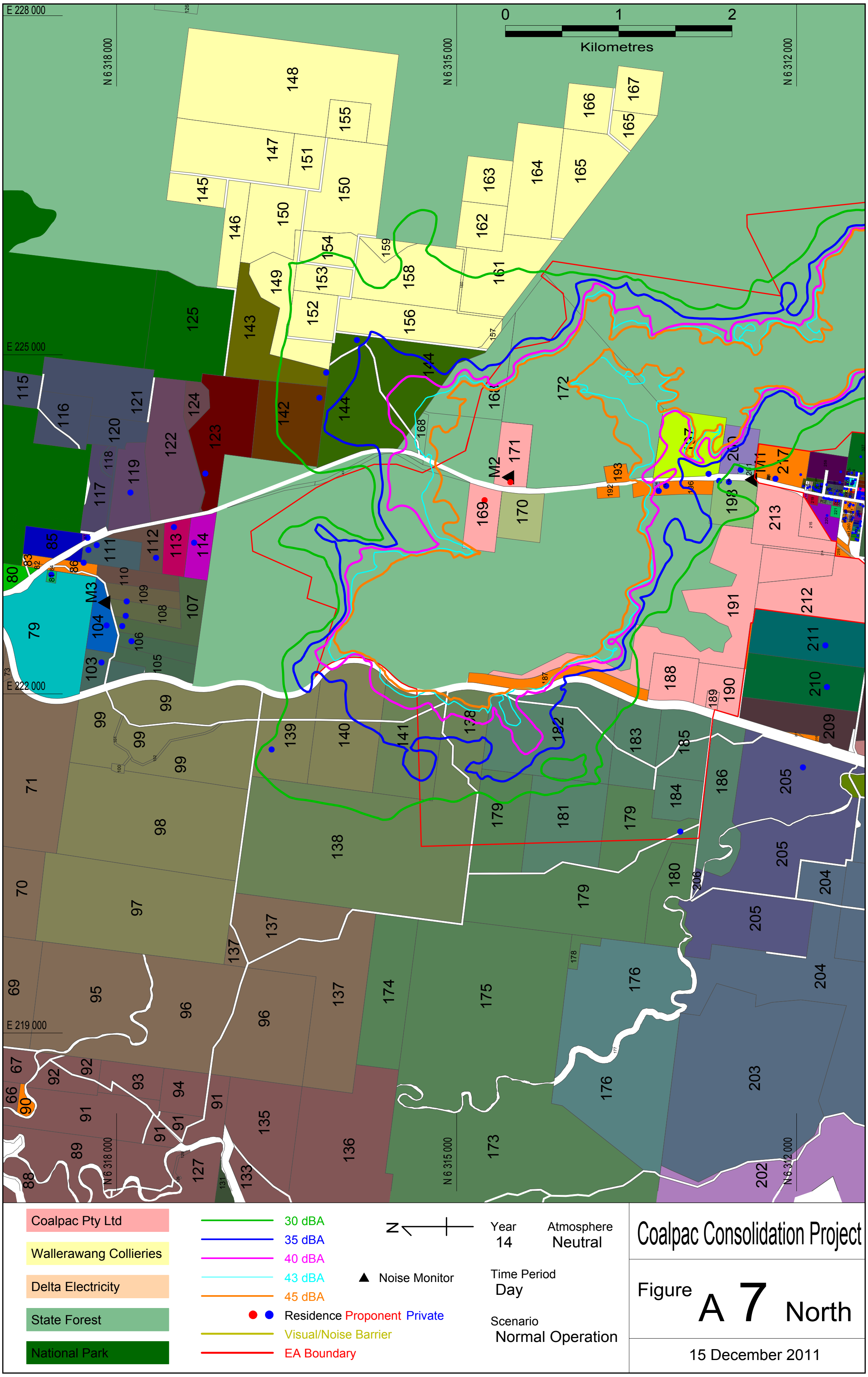
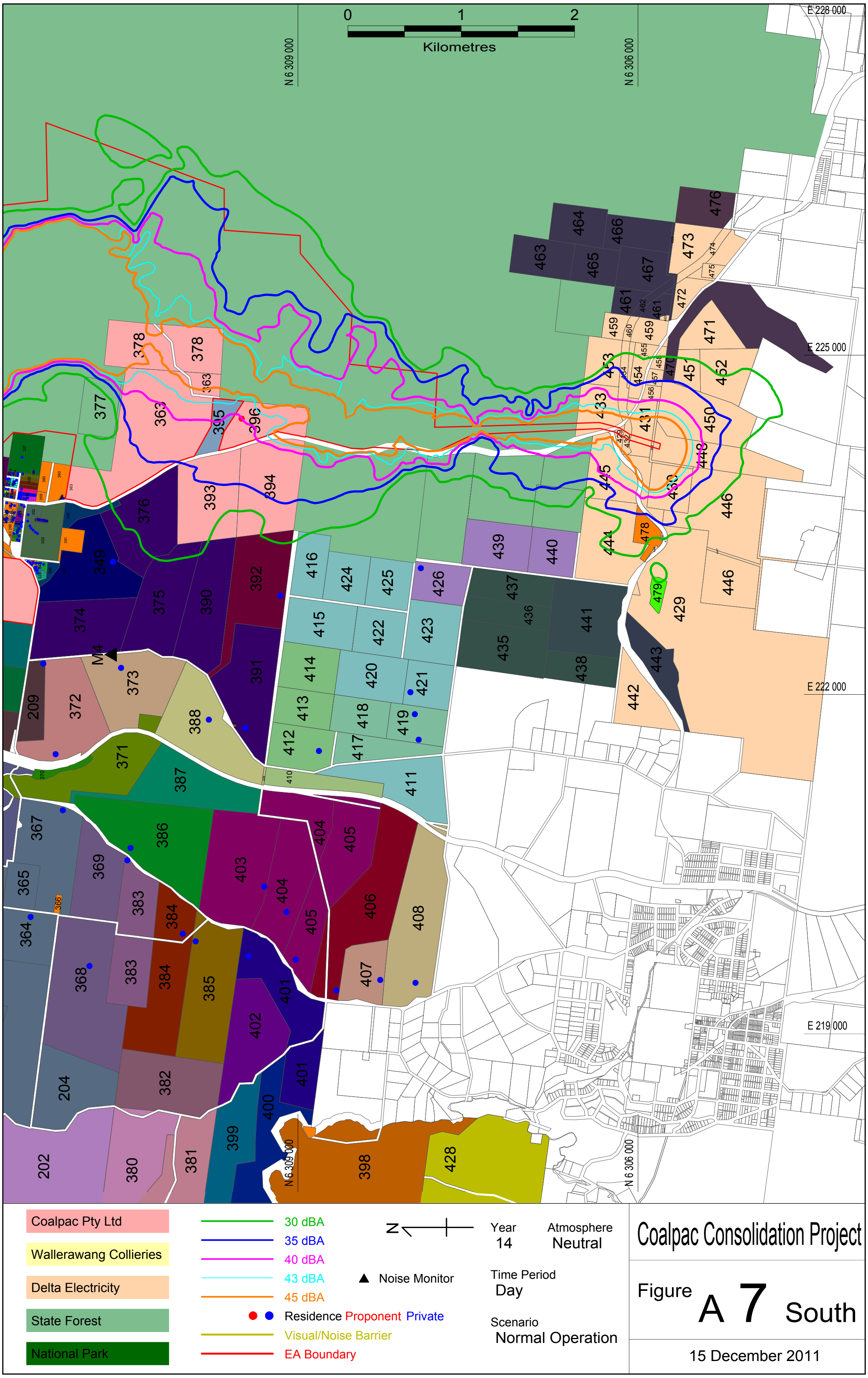
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year
8
Atmosphere
Prevailing
Time Period
Night
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A 6 South
15 December 2011




BRIDGES Acoustics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Kilometres
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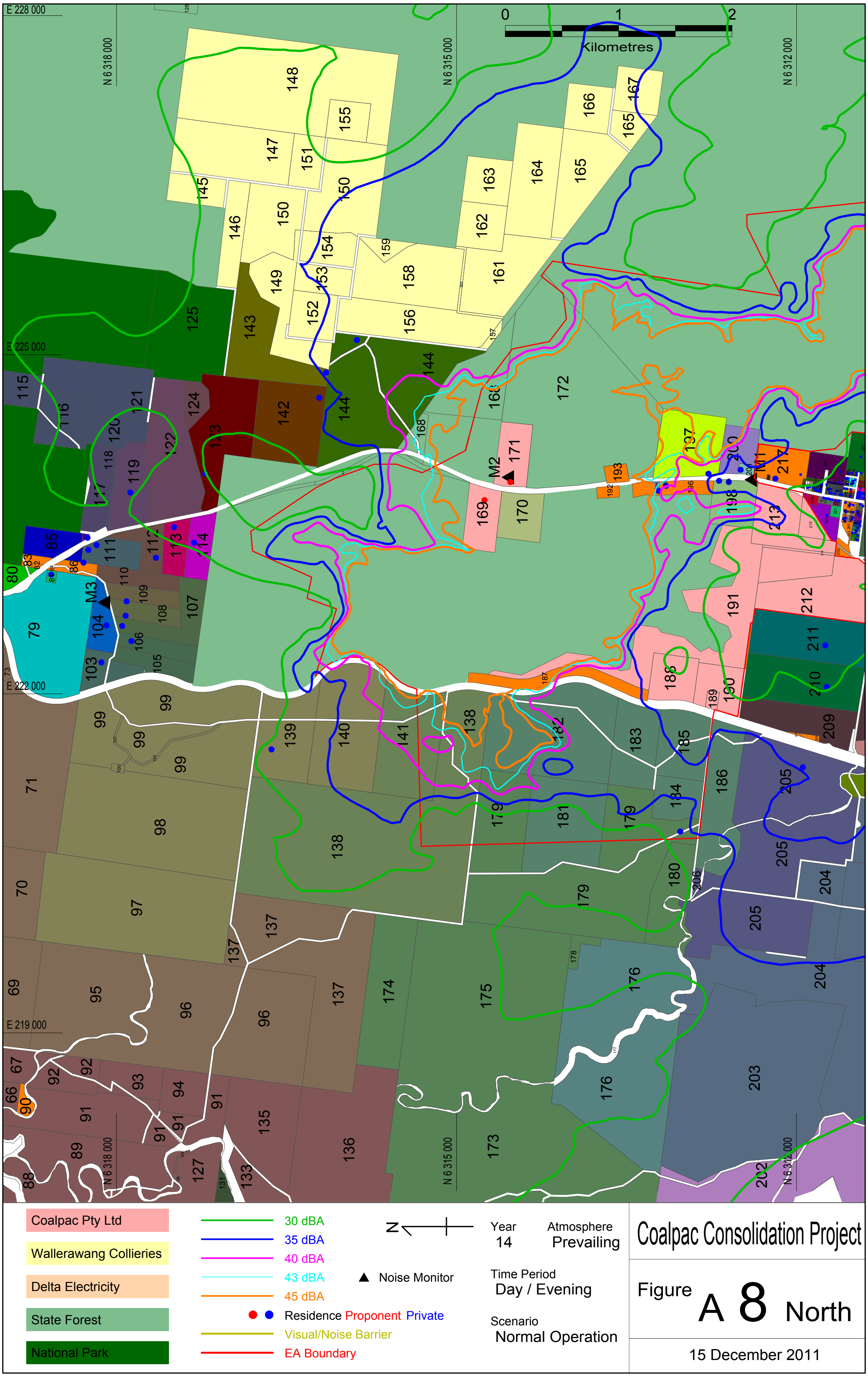
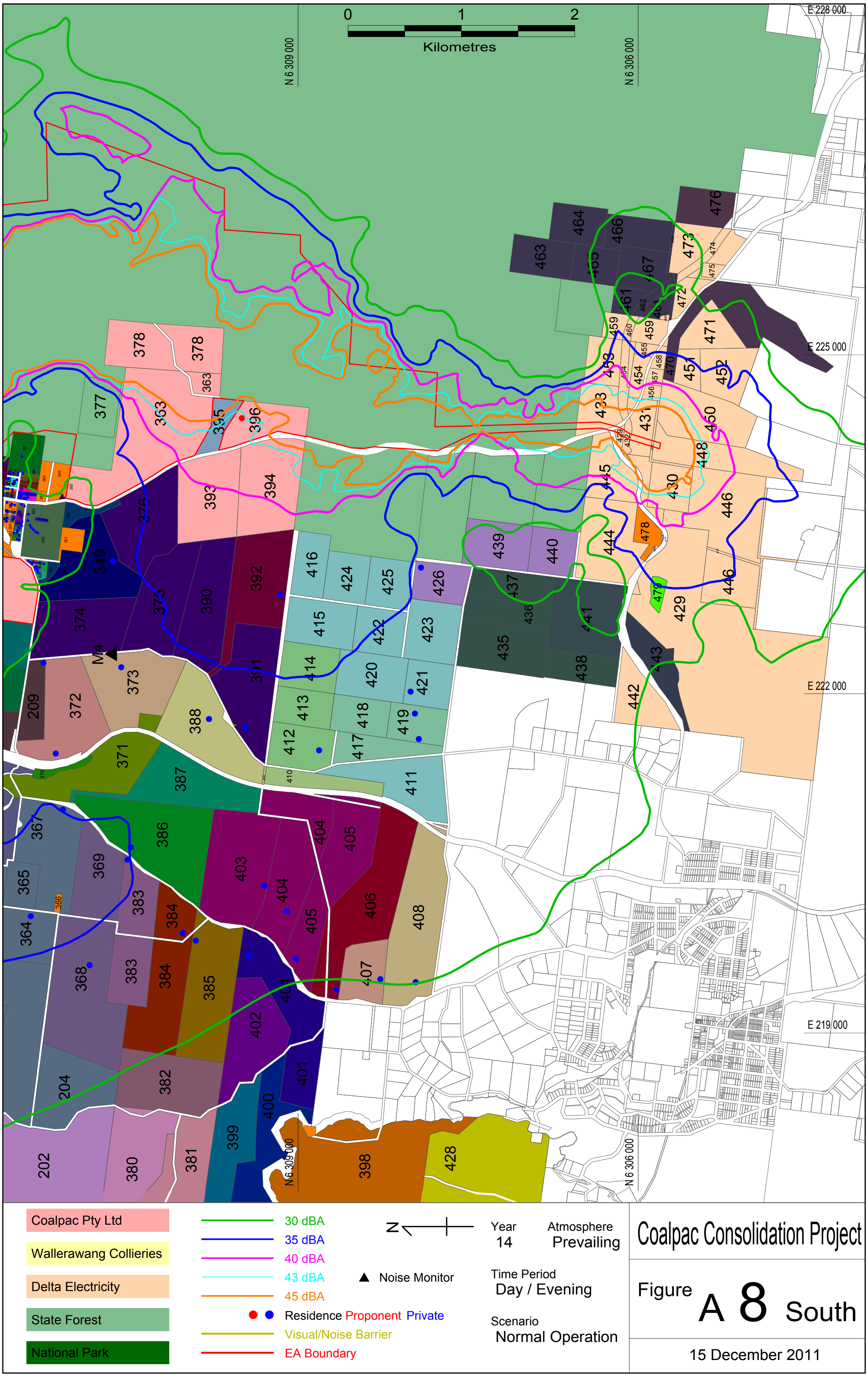
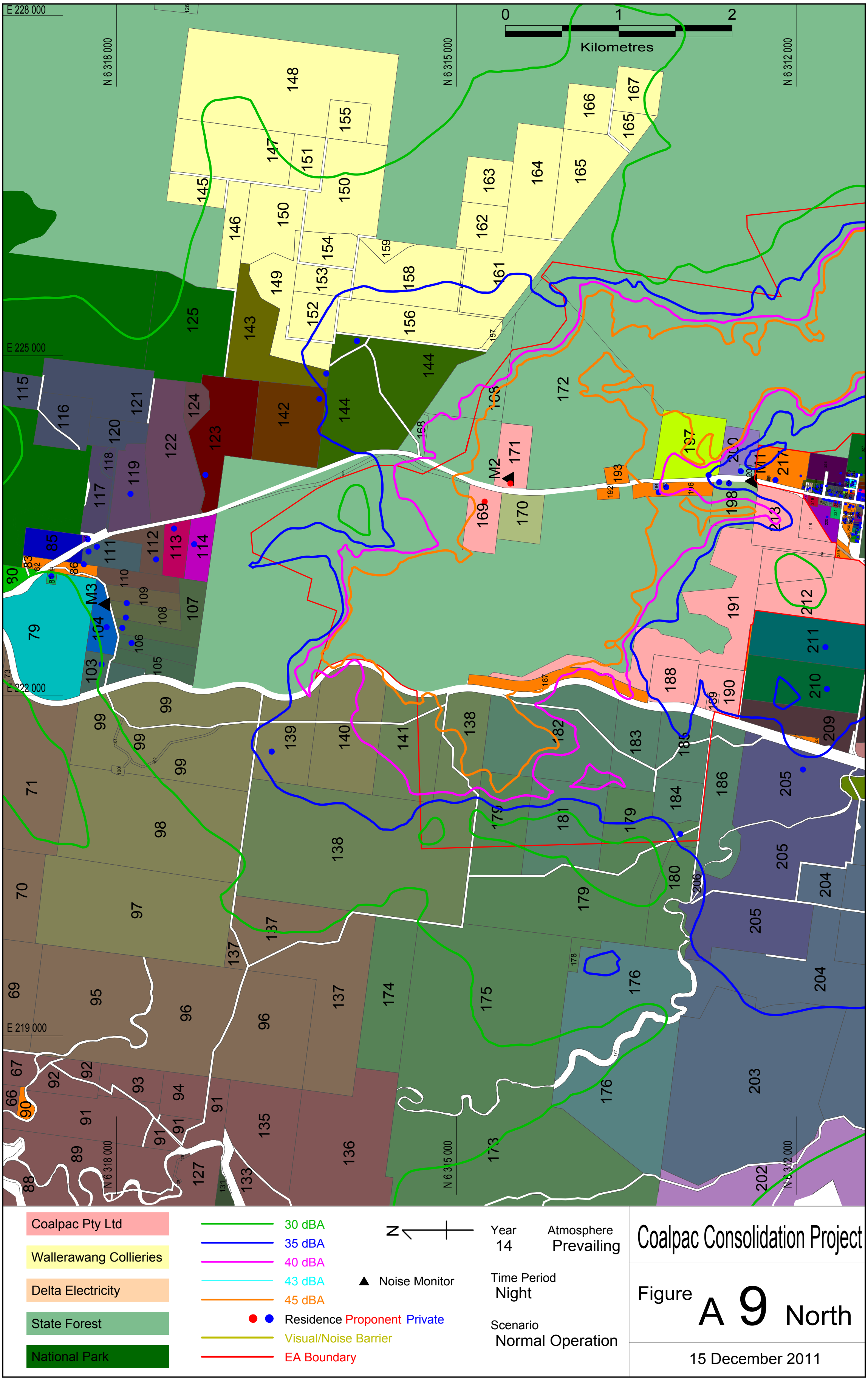
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year 14
Atmosphere Neutral
Time Period Day
Scenario Normal Operation
Coalpac Consolidation Project
Figure A 7 South
15 December 2011




BRIDGES Acoustics



0 1 2
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Noise Monitor
Year 14
Atmosphere Prevailing
Time Period Day / Evening
Scenario Normal Operation
Coalpac Consolidation Project
Figure A 8 South
15 December 2011

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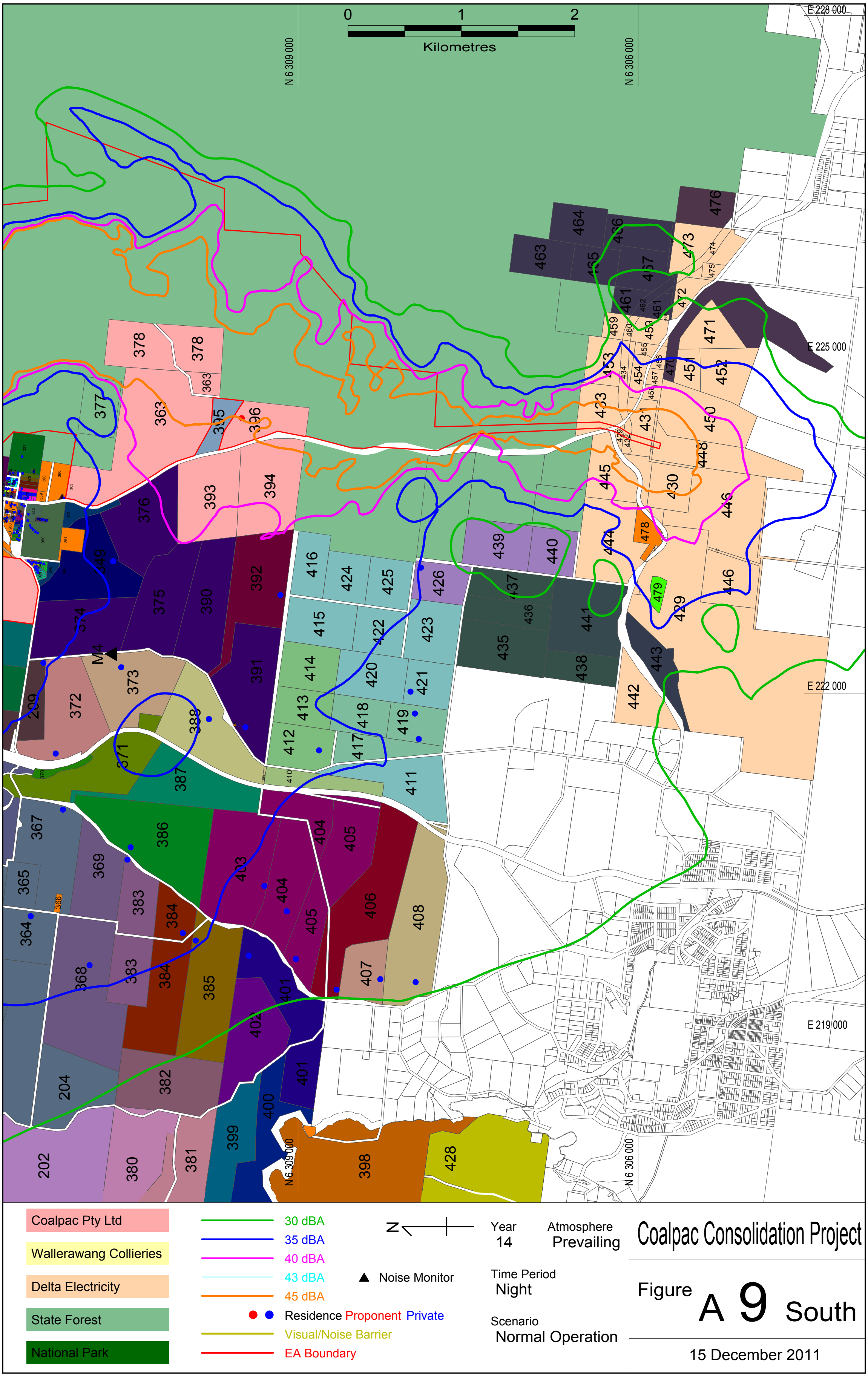
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Kilometres
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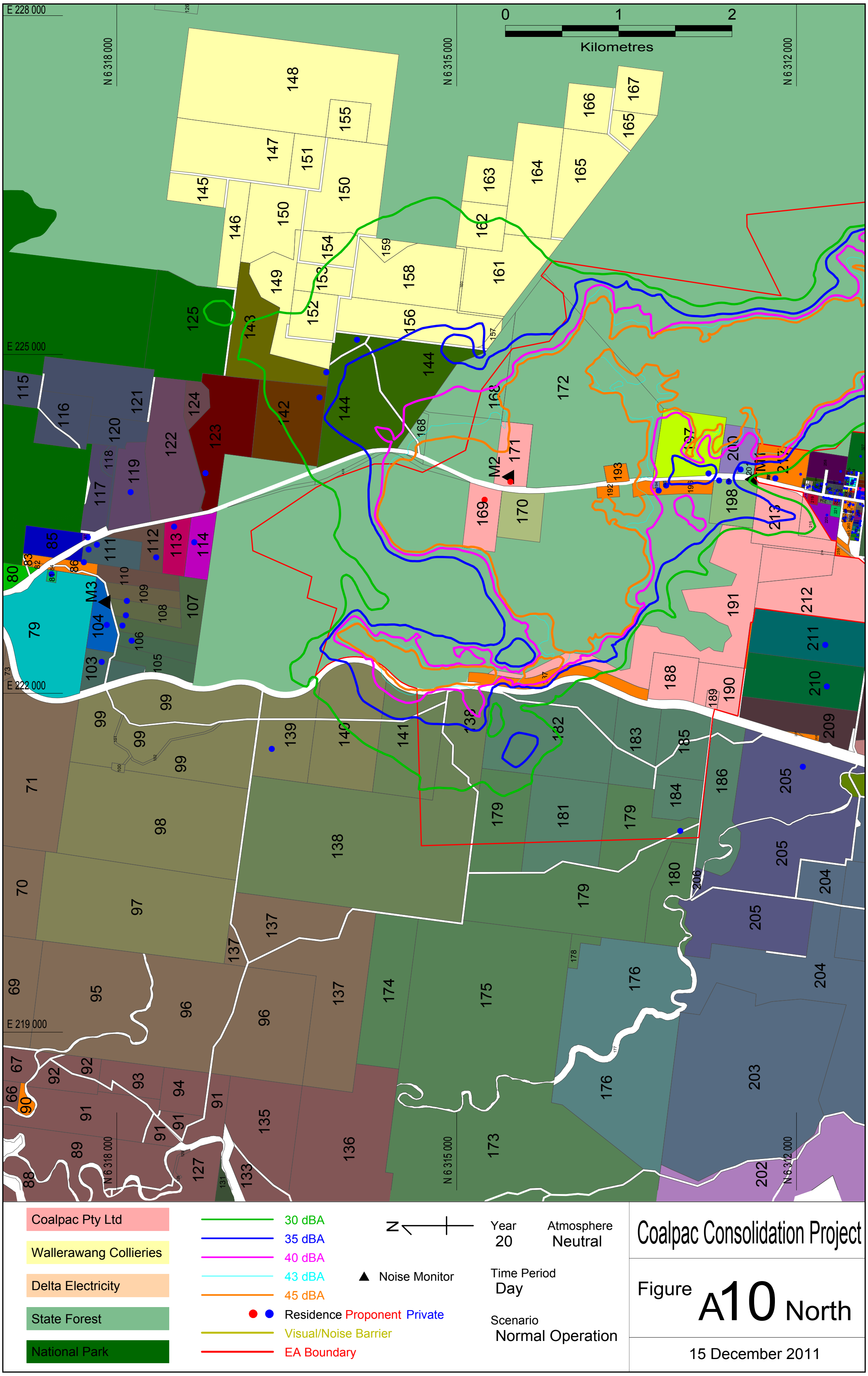
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year 14
Atmosphere Prevailing
Time Period Night
Scenario Normal Operation
Coalpac Consolidation Project
Figure A 9 South
15 December 2011

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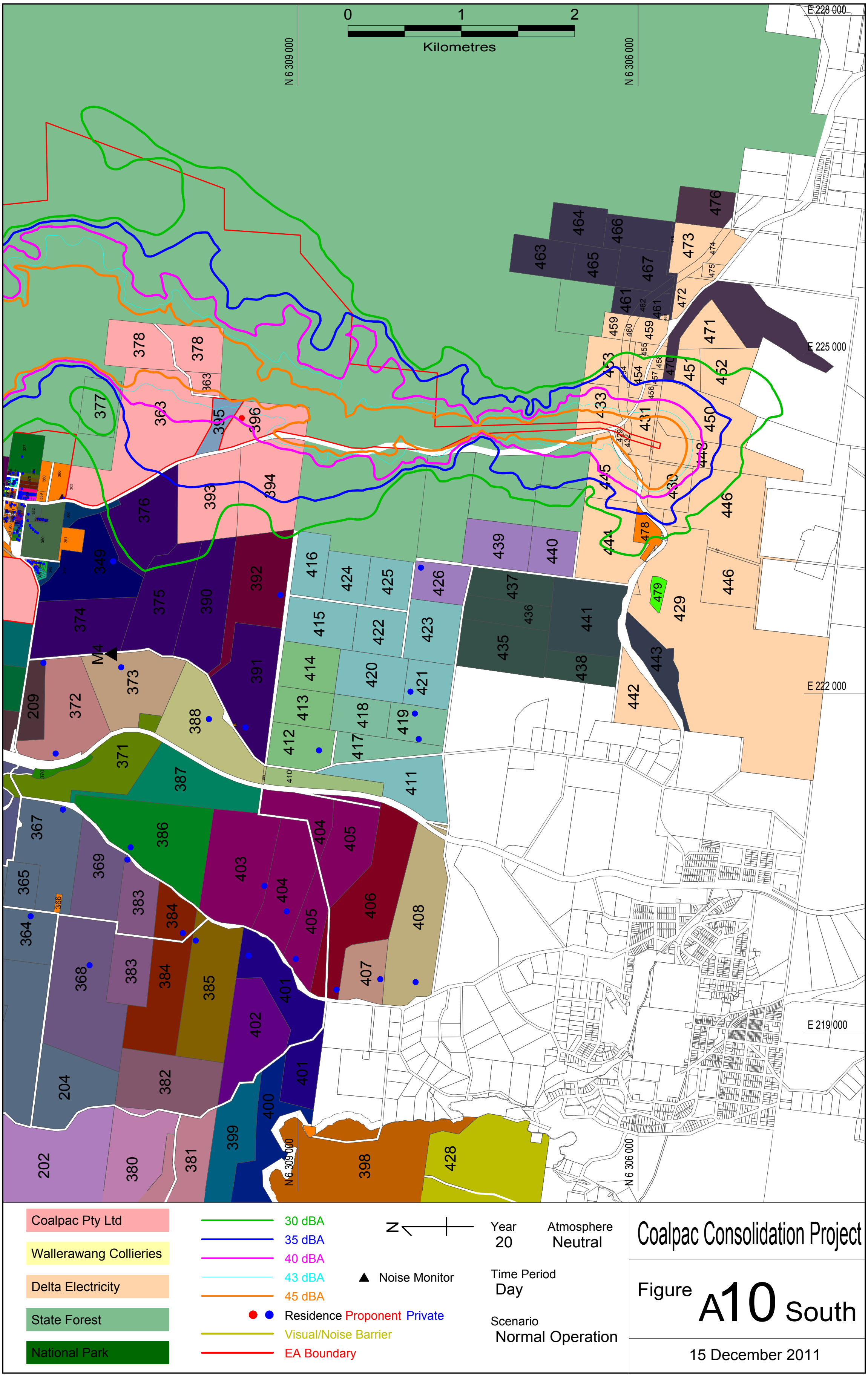
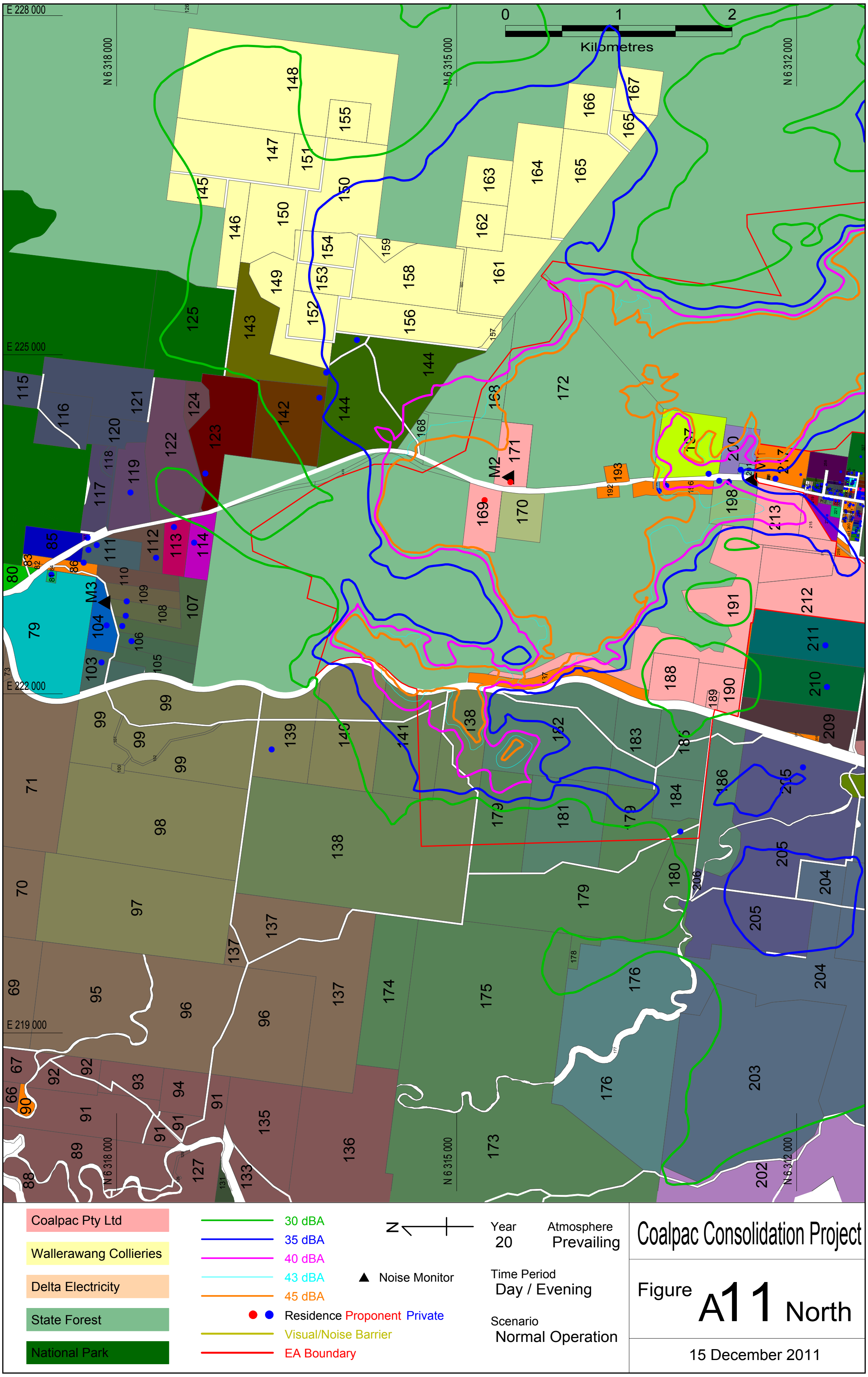
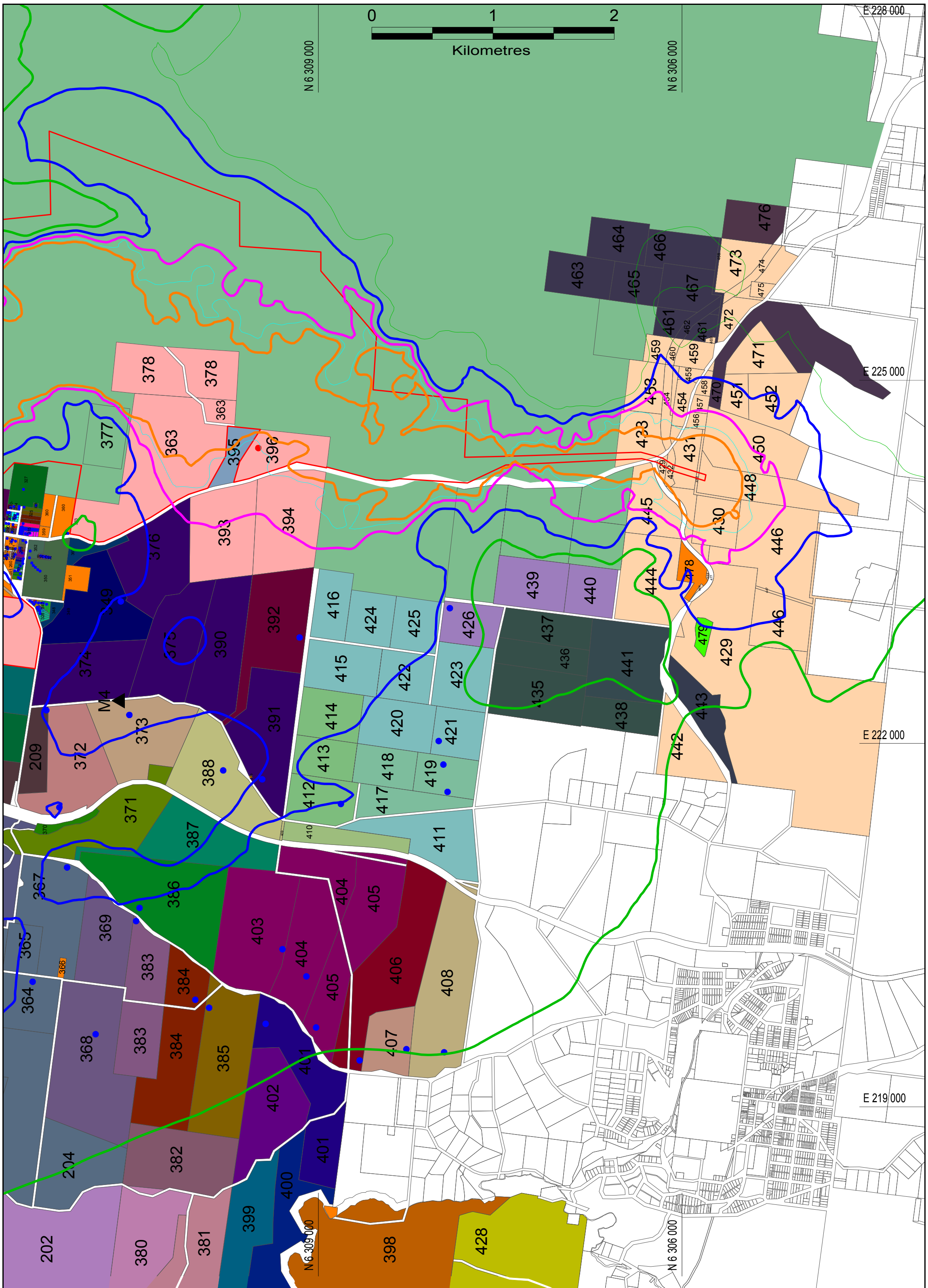

0 1 2
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Noise Monitor
Year
20
Atmosphere
Neutral
Time Period
Day
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A10 South
15 December 2011

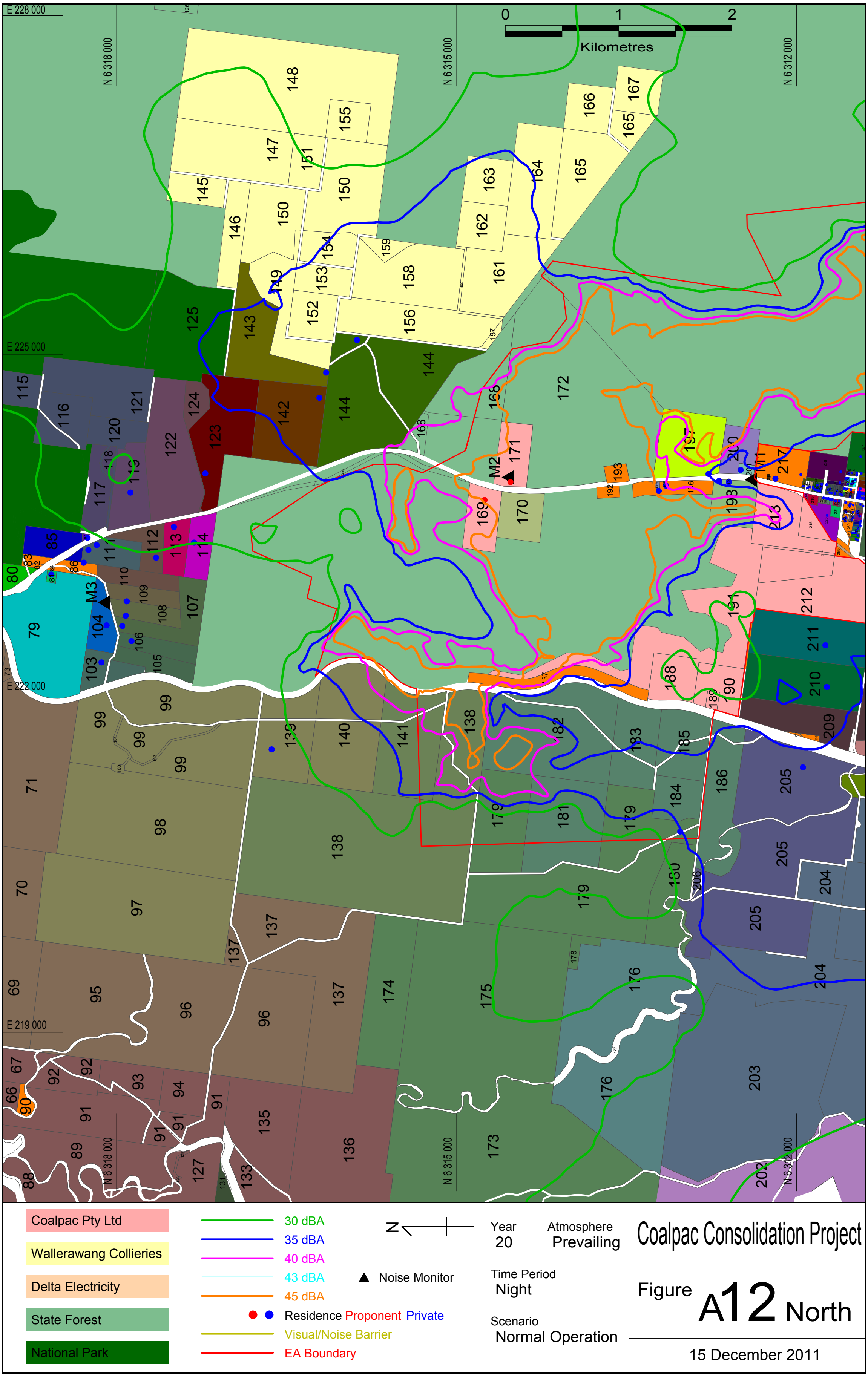

E 228 000
E 225 000
E 222 000
E 219 000
N 6 318 000
N 6 315 000
N 6 312 000
0
1
2
Kilometres
M2
M3
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Noise Monitor
Year
20
Atmosphere
Prevailing
Time Period
Day / Evening
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A11 North
15 December 2011



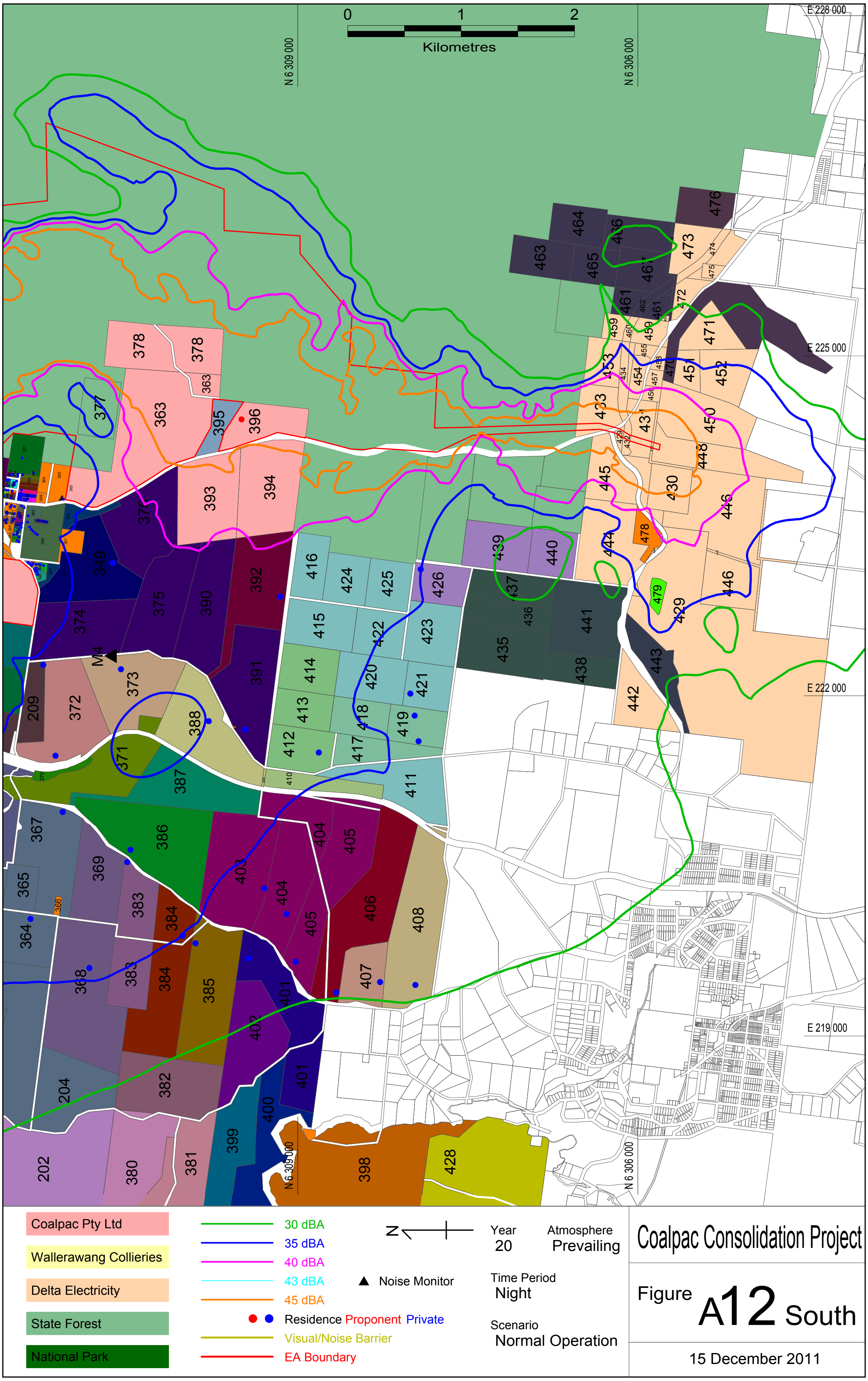

Coalpac Consolidation Project

Figure A11 South

15 December 2011



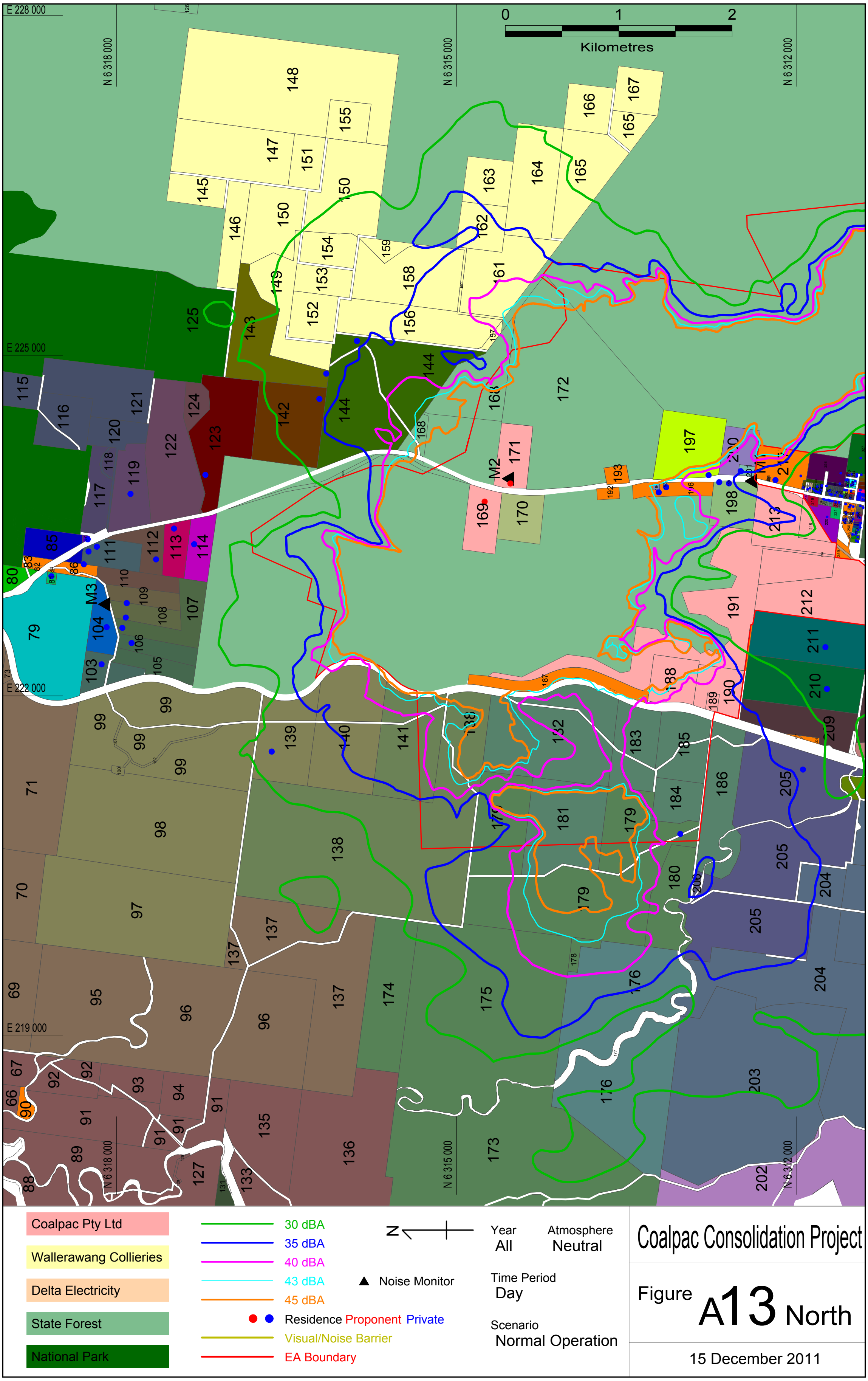

BRIDGES Acoustics



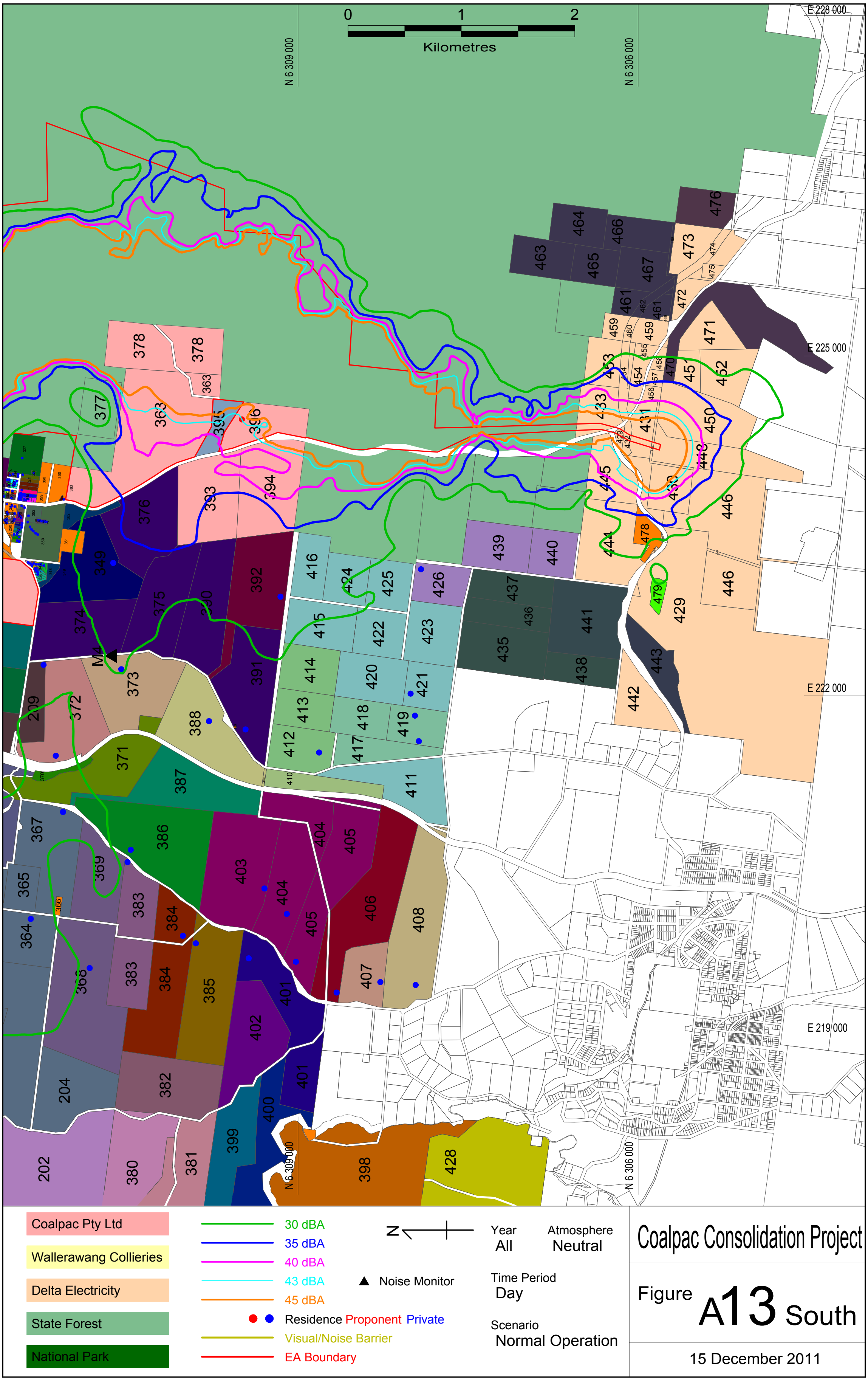

Coalpac Consolidation Project

Figure A12 South

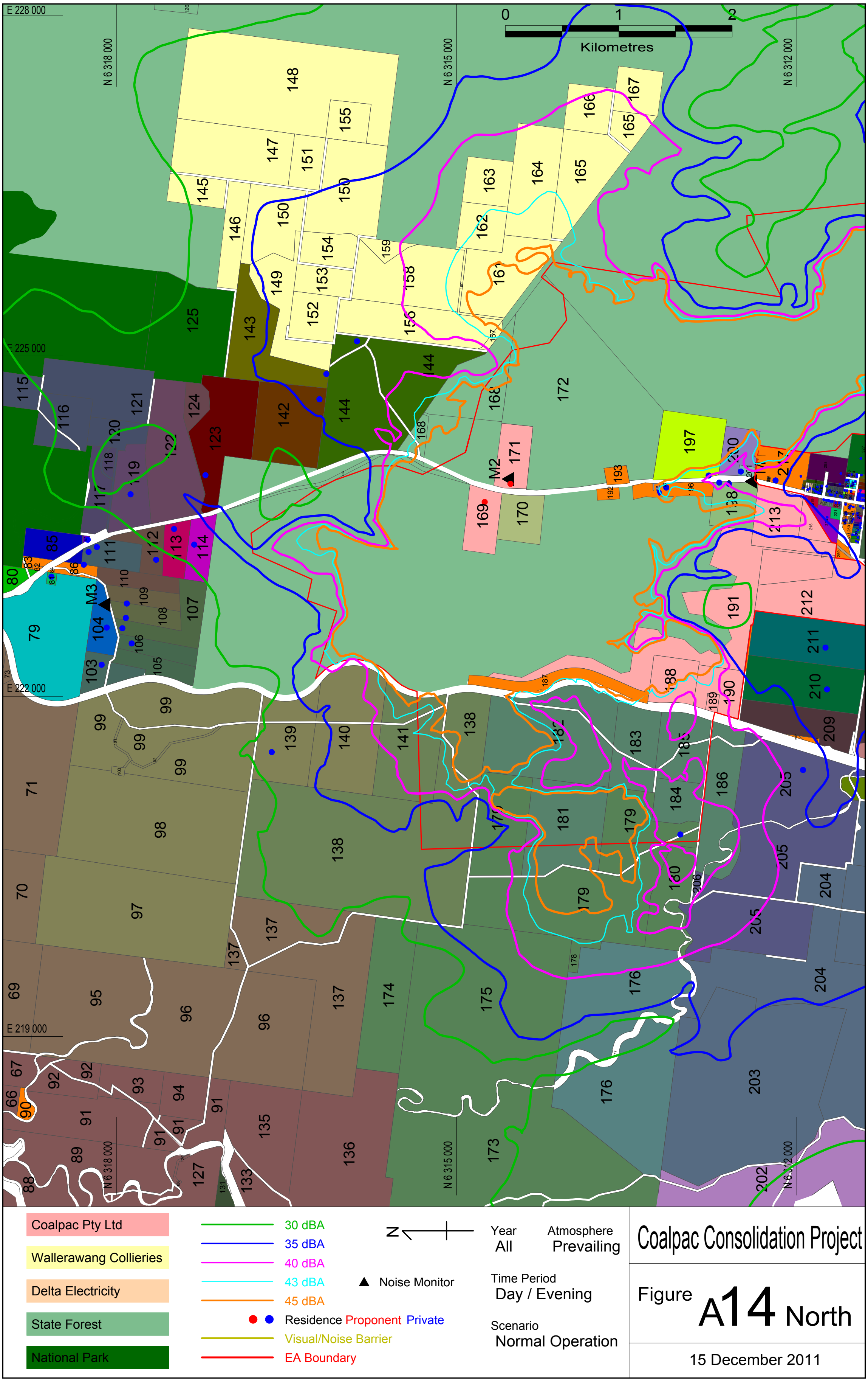
15 December 2011



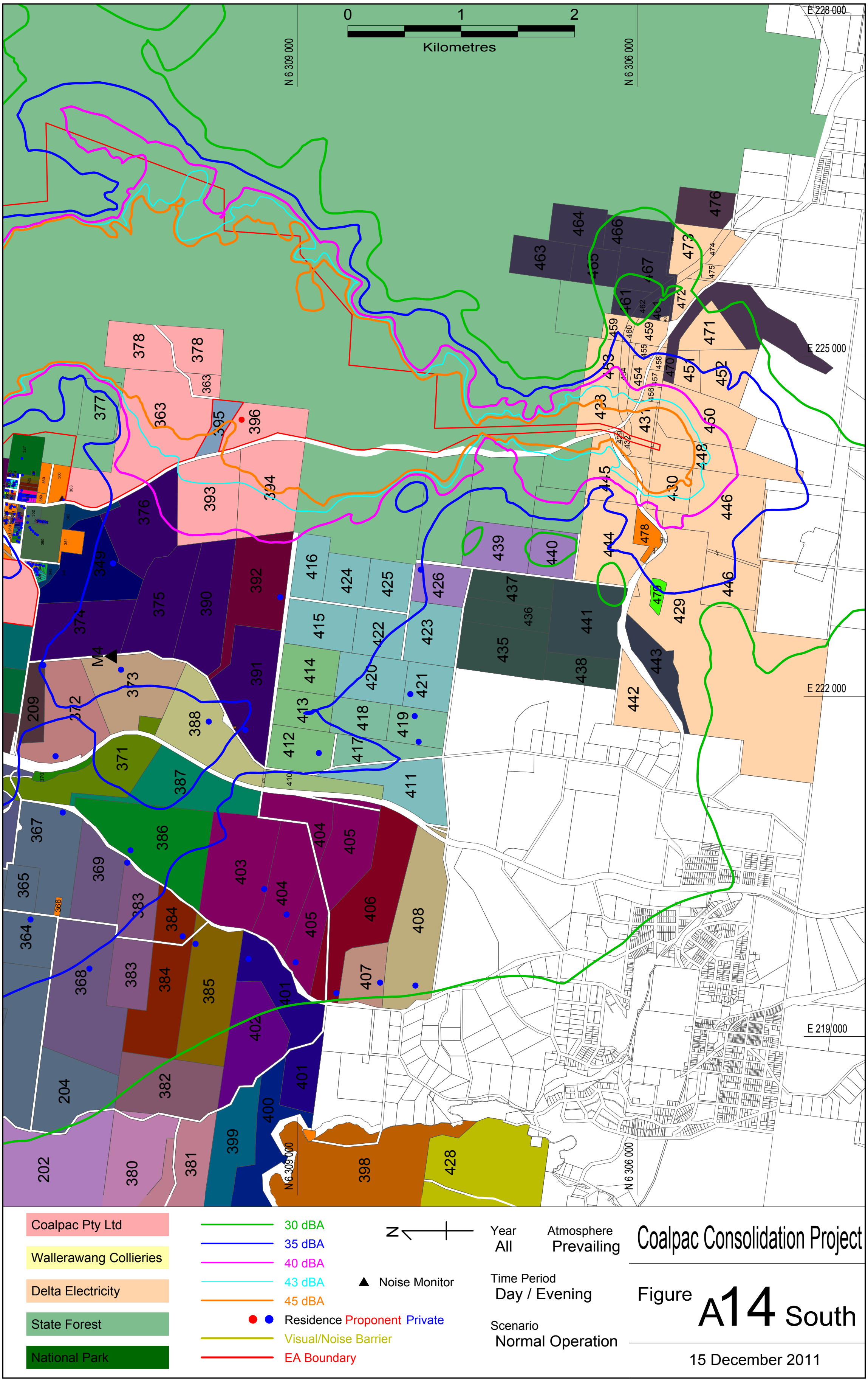

BRIDGES Acoustics



0 1 2
Kilometres
N 6 309 000
N 6 306 000
E 226 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Noise Monitor
Year
All
Atmosphere
Neutral
Time Period
Day
Scenario
Normal Operation
Coalpac Consolidation Project
Figure A13 South
15 December 2011



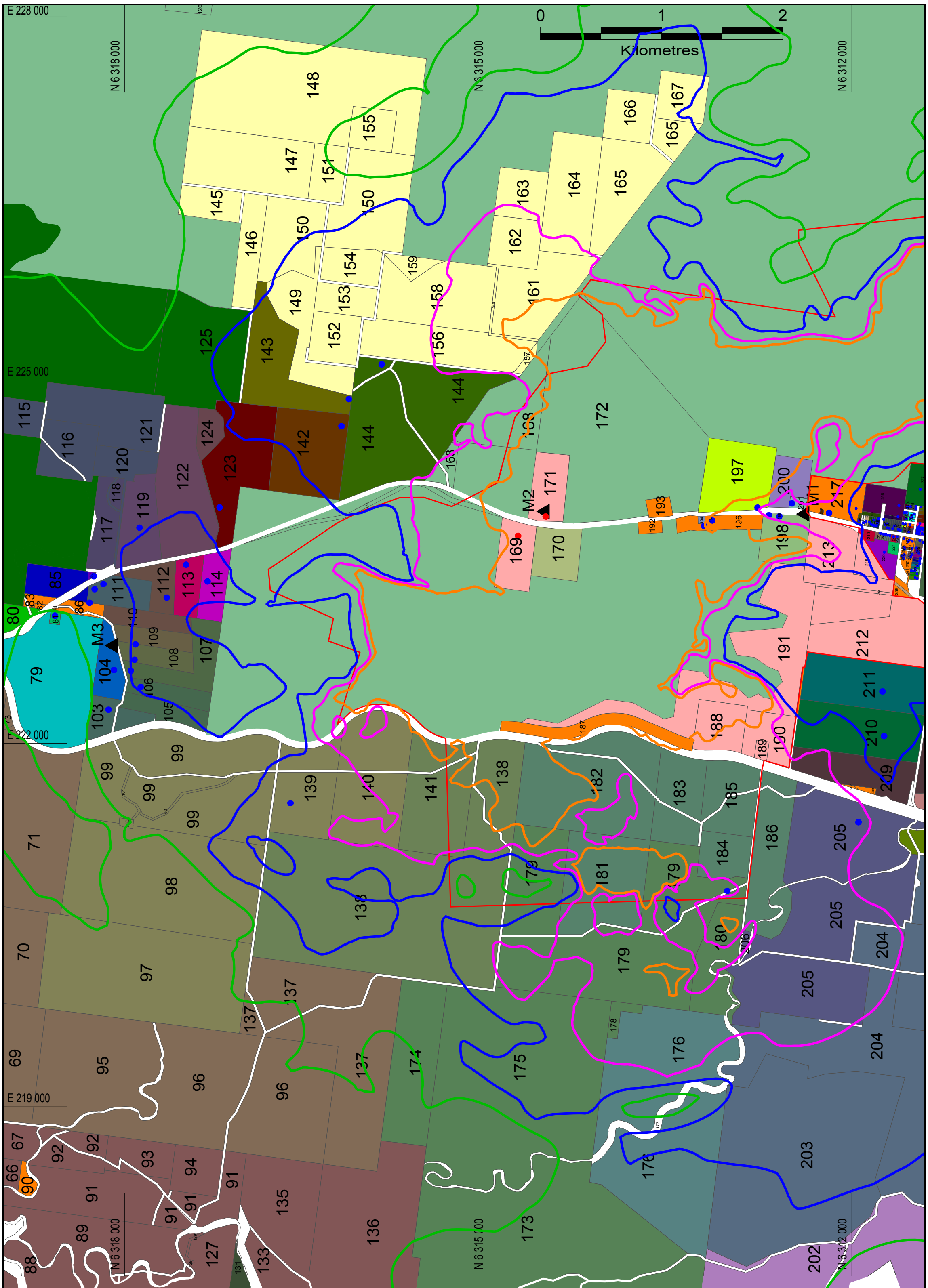

BRIDGES Acoustics




Coalpac Consolidation Project

Figure A14 South

15 December 2011




Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park

30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary

N

Noise Monitor

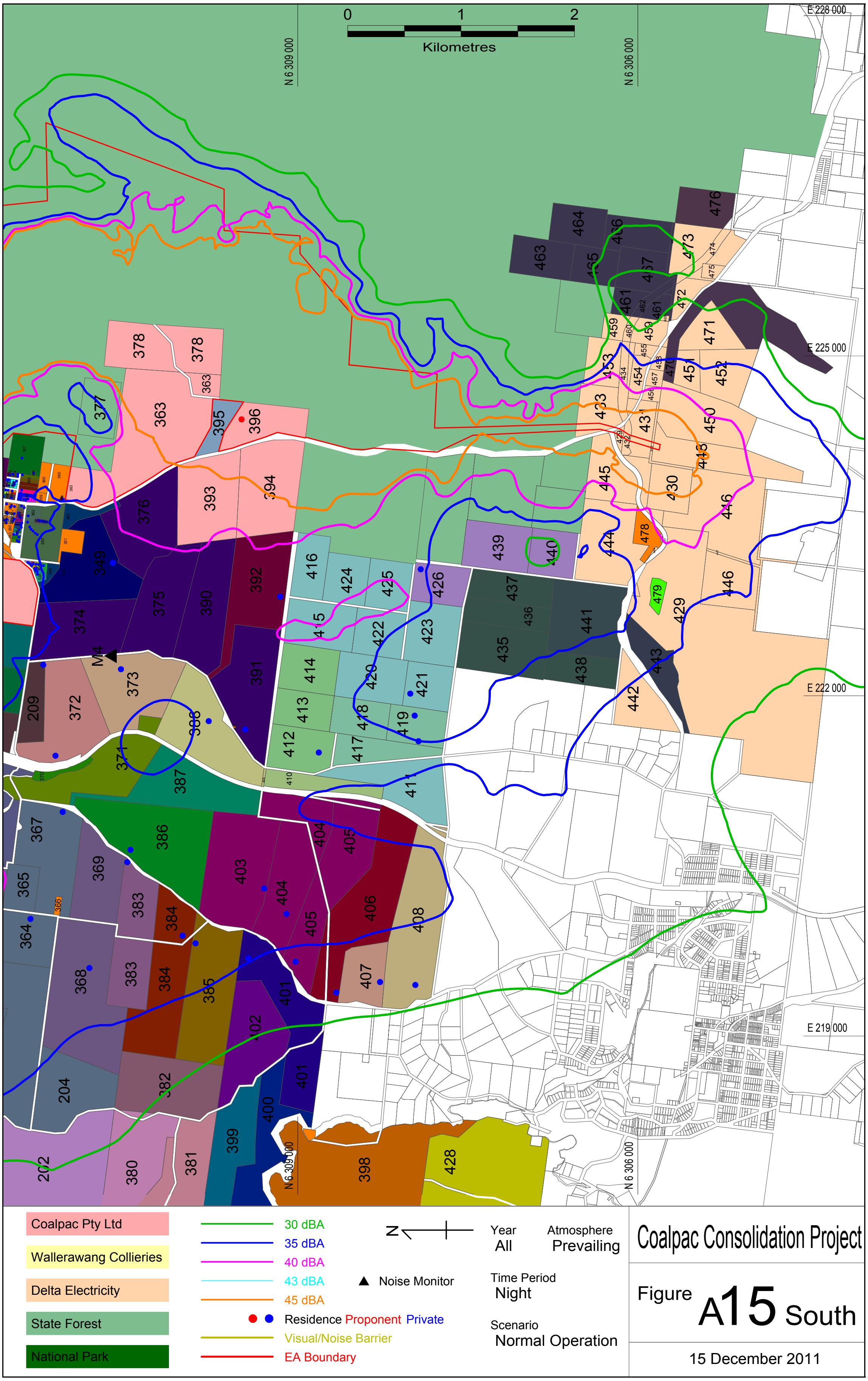
Year All
Atmosphere Prevailing
Time Period Night
Scenario Normal Operation

Coalpac Consolidation Project

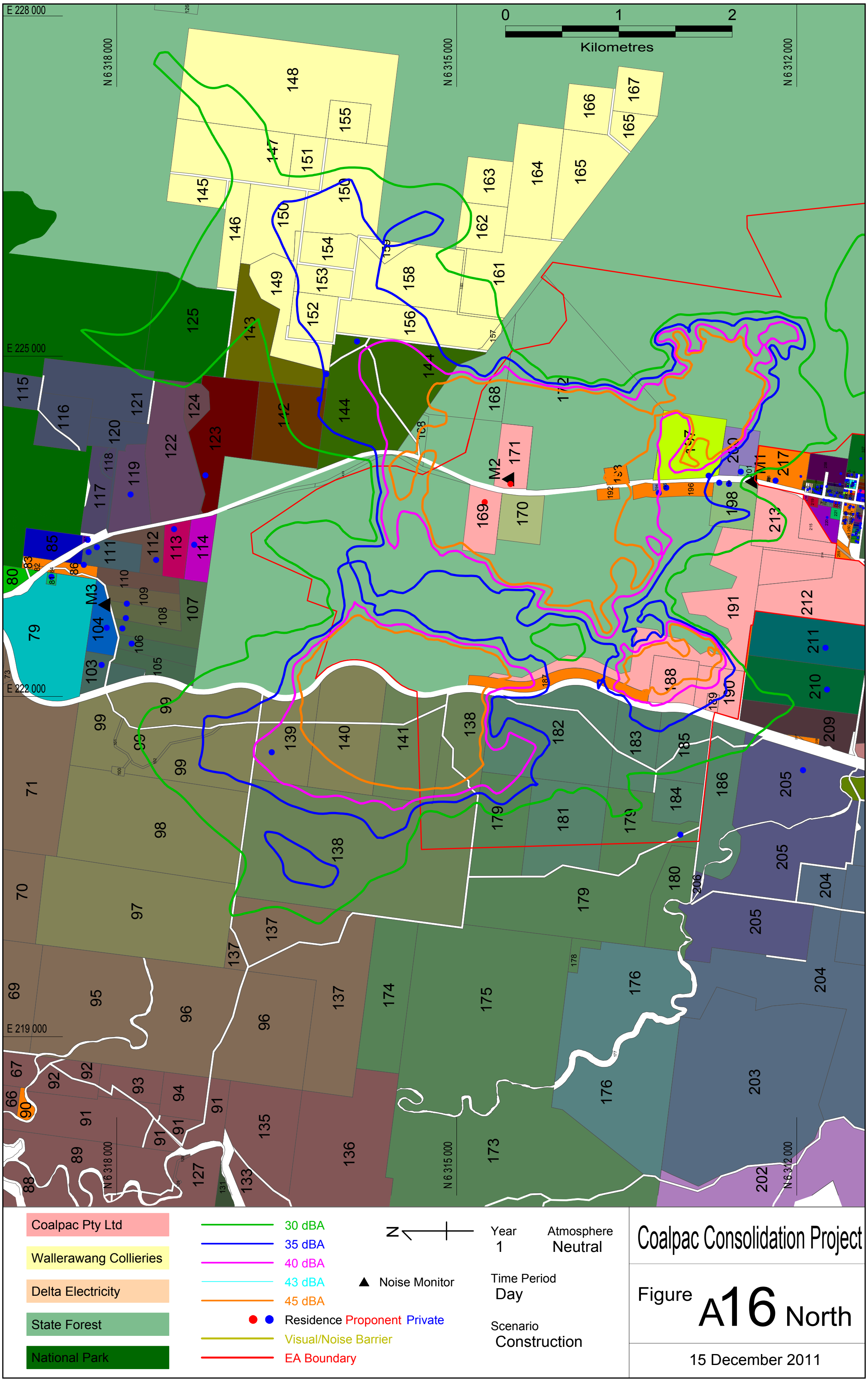
Figure A15 North

15 December 2011

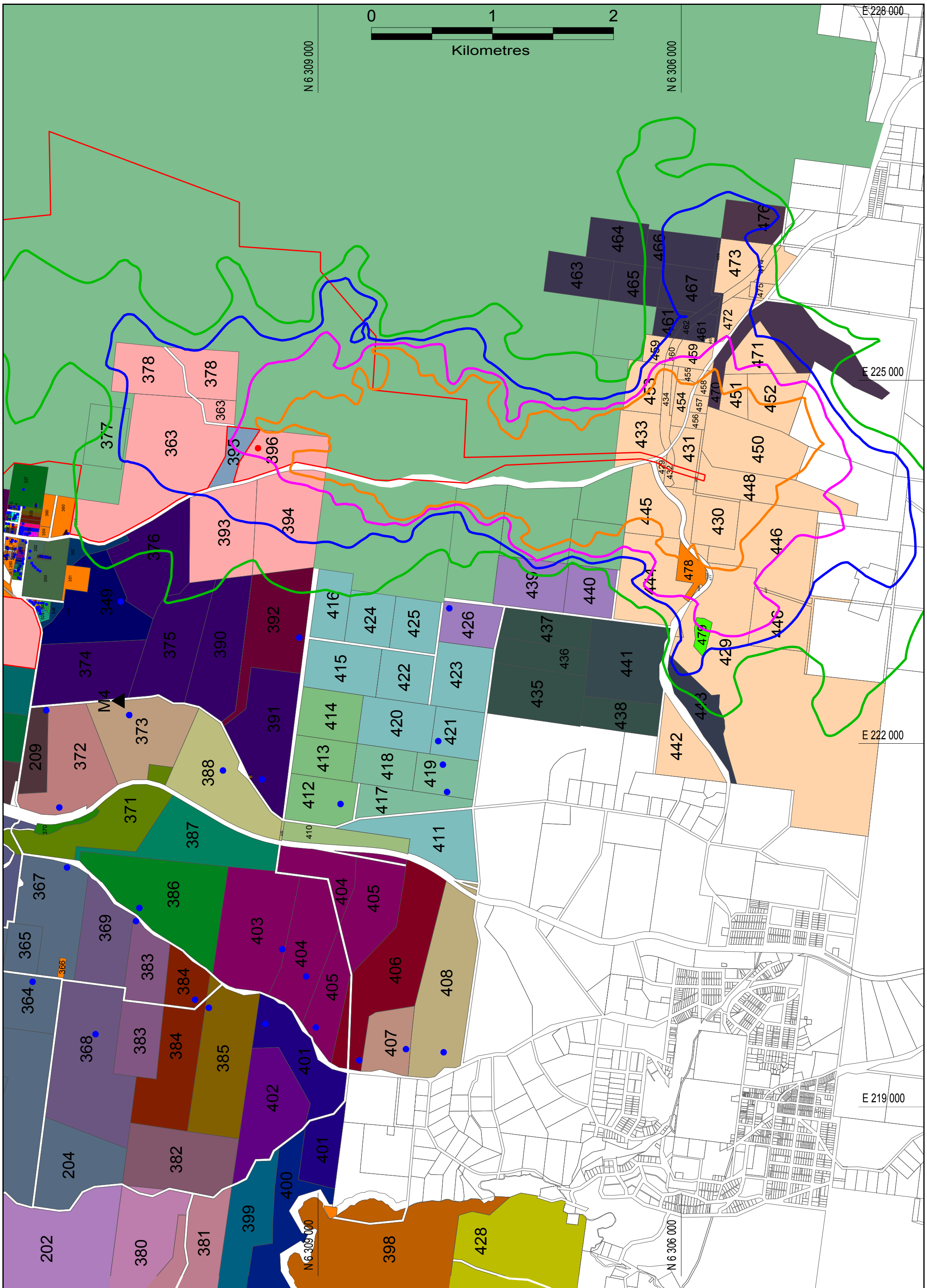
BRIDGES Acoustics



0 1 2
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Noise Monitor
Year All
Atmosphere Prevailing
Time Period Night
Scenario Normal Operation
Coalpac Consolidation Project
Figure A15 South
15 December 2011




BRIDGES Acoustics




Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park

30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary

N

Noise Monitor

Year
1

Atmosphere
Neutral

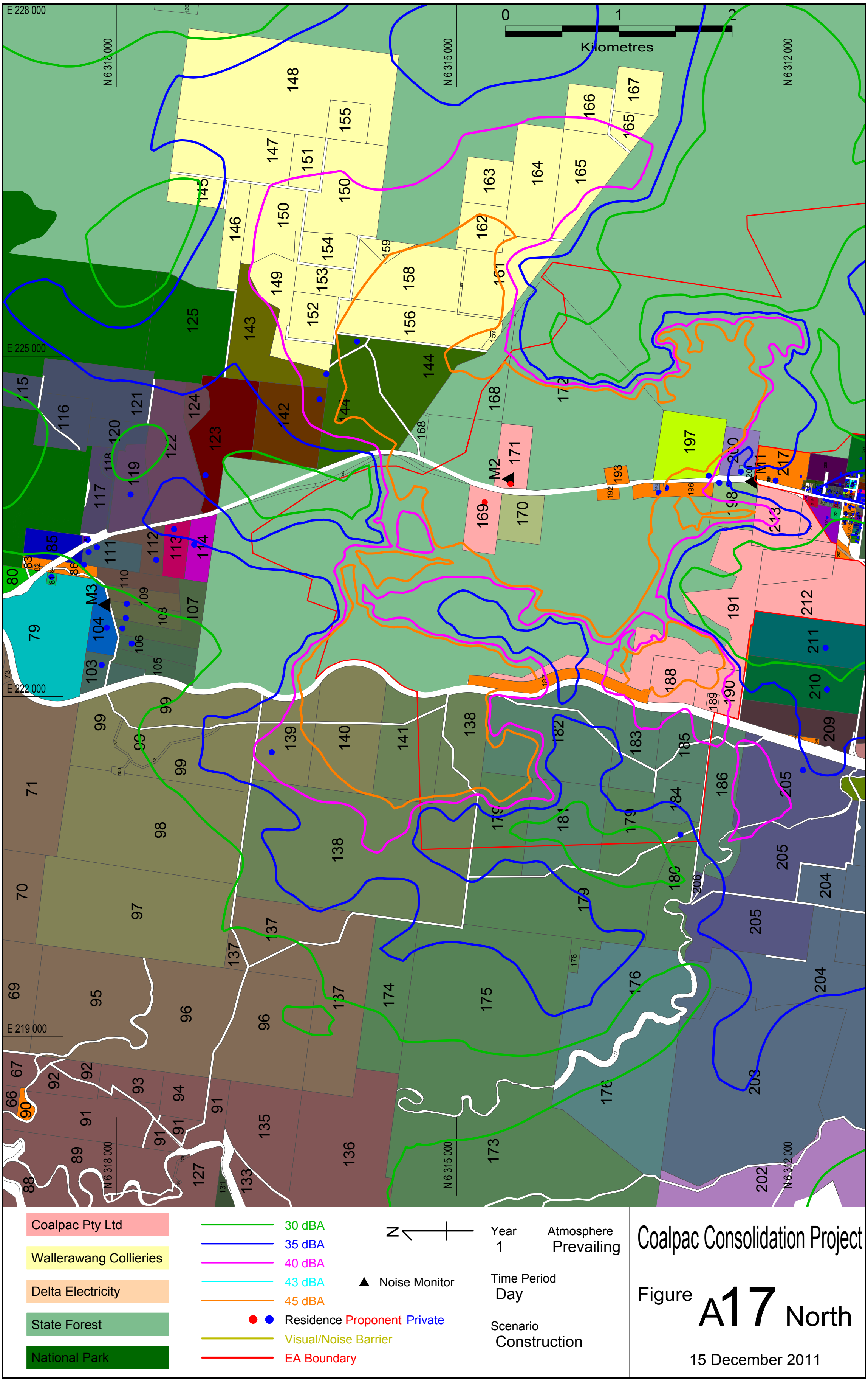
Time Period
Day

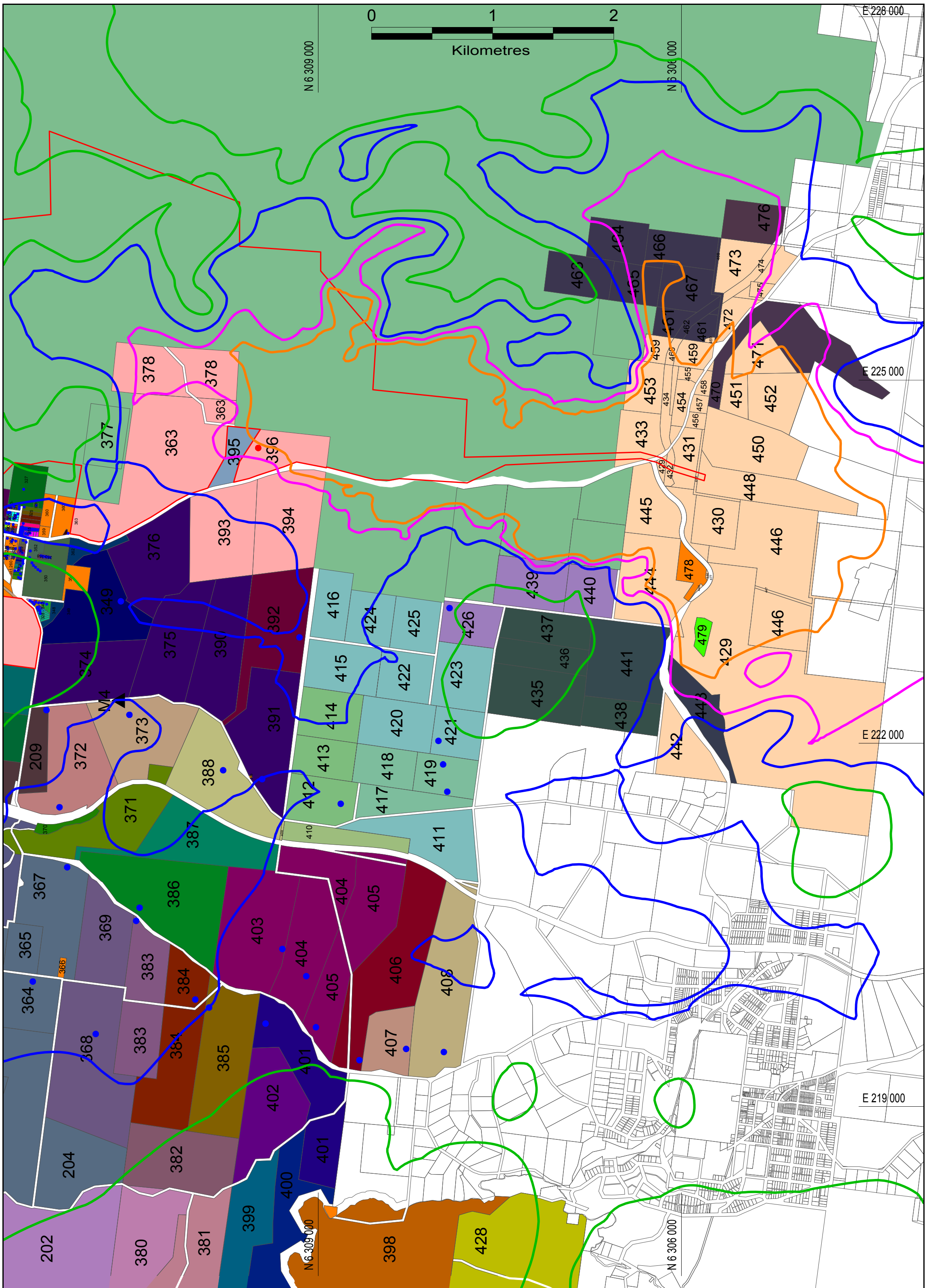
Scenario
Construction

Coalpac Consolidation Project

Figure A16 South

15 December 2011


0 1 2
Kilometres
E 228 000
E 225 000
E 222 000
E 219 000
N 6 318 000
N 6 315 000
N 6 312 000
M1
M2
M3
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
30 dBA
35 dBA
40 dBA
43 dBA
45 dBA
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
Noise Monitor
N
Year
1
Atmosphere
Prevailing
Time Period
Day
Scenario
Construction
Coalpac Consolidation Project
Figure A17 North
15 December 2011

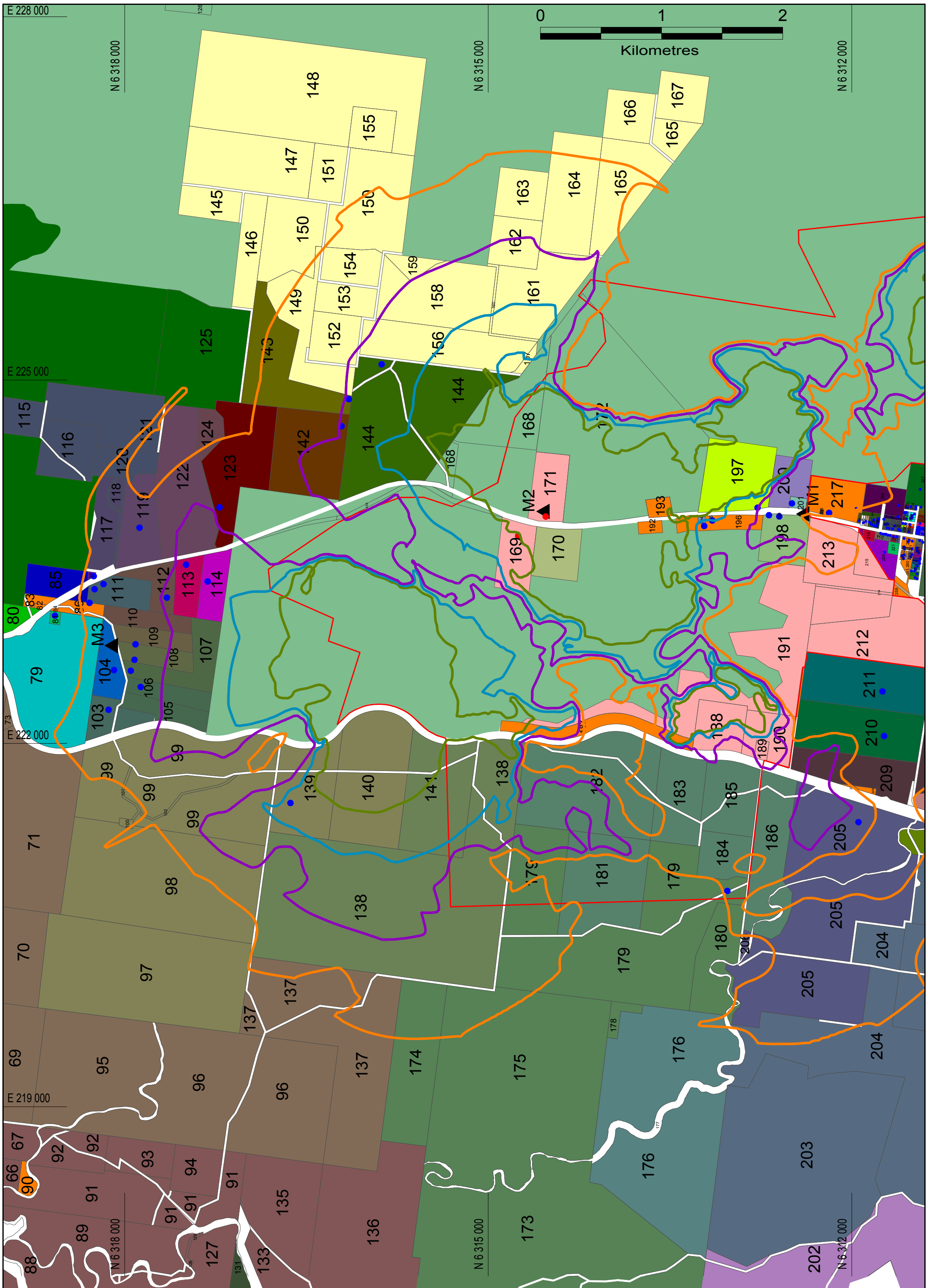


| | | | |
|---|---|---|---|
| Coalpac Pty Ltd | 30 dBA | Year 1 | Atmosphere Prevailing |
| Wallerawang Collieries | 35 dBA | Time Period Day | |
| Delta Electricity | 40 dBA | Scenario Construction | |
| State Forest | 43 dBA | | |
| National Park | 45 dBA | | |
| | Noise Monitor | | |
| | Residence Proponent Private | | |
| | Visual/Noise Barrier | | |
| | EA Boundary | | |

Coalpac Consolidation Project

Figure A17 South

15 December 2011

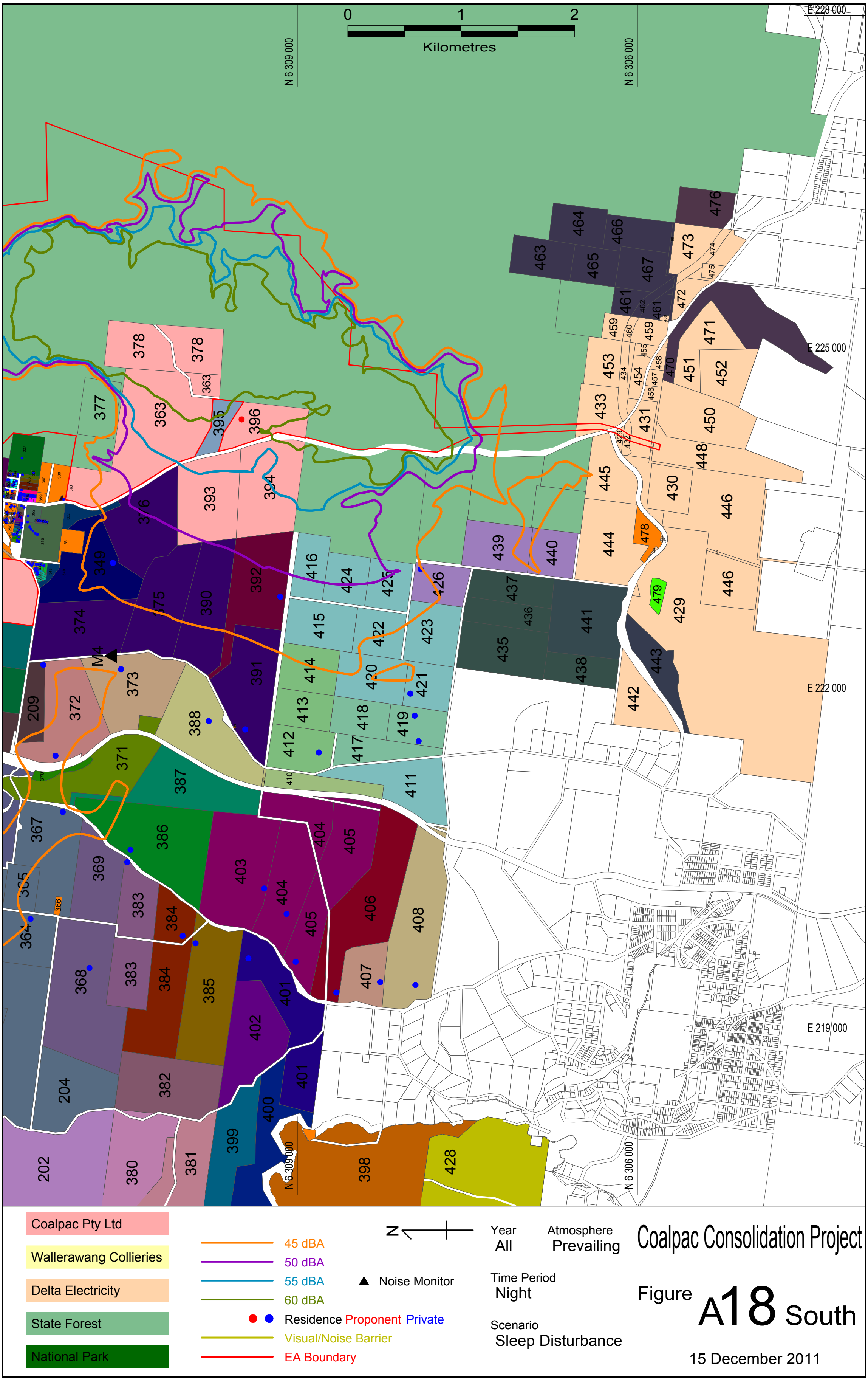



Coalpac Consolidation Project

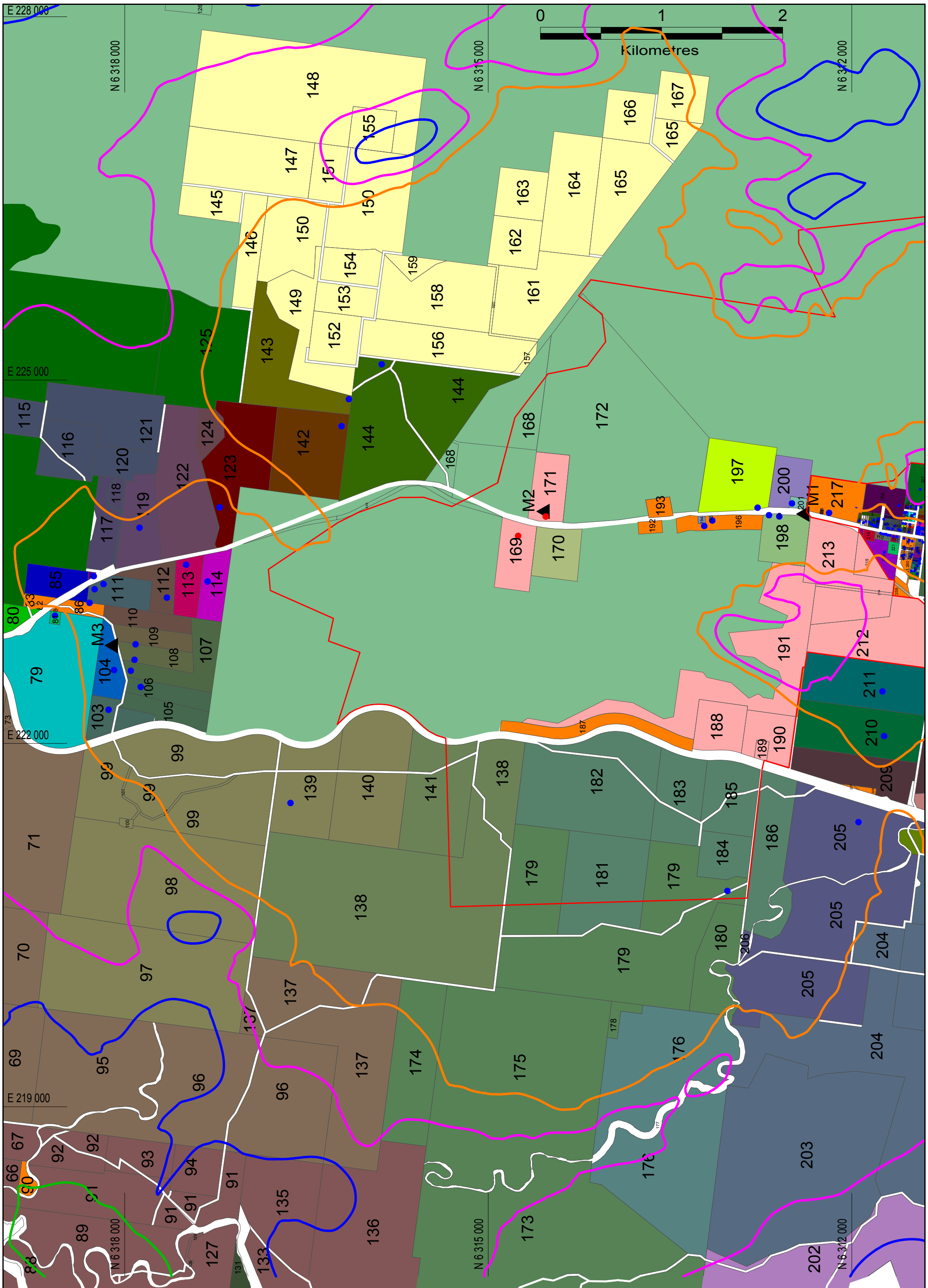
Figure A18 North

15 December 2011

BRIDGES Acoustics


0 1 2
Kilometres
N 6 309 000
N 6 306 000
E 228 000
E 225 000
E 222 000
E 219 000
Coalpac Pty Ltd
Wallerawang Collieries
Delta Electricity
State Forest
National Park
45 dBA
50 dBA
55 dBA
60 dBA
Noise Monitor
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Year All
Atmosphere Prevailing
Time Period Night
Scenario Sleep Disturbance
Coalpac Consolidation Project
Figure A18 South
15 December 2011

| | |
|---|---|
| FIGURE A19 | NOISE CONTOUR FIGURE<br>All years no noise mitigation, night, prevailing weather conditions<br>(for comparison purposes only) |




| Legend | | |
|---|---|---|
| Coalpac Pty Ltd | 30 dBA | Noise Monitor |
| Wallerawang Collieries | 35 dBA | |
| Delta Electricity | 40 dBA | |
| State Forest | 43 dBA | |
| National Park | 45 dBA | |
| | Residence Proponent Private | |
| | Visual/Noise Barrier | |
| | EA Boundary | |

N

Year All

Atmosphere Prevailing

Time Period Night

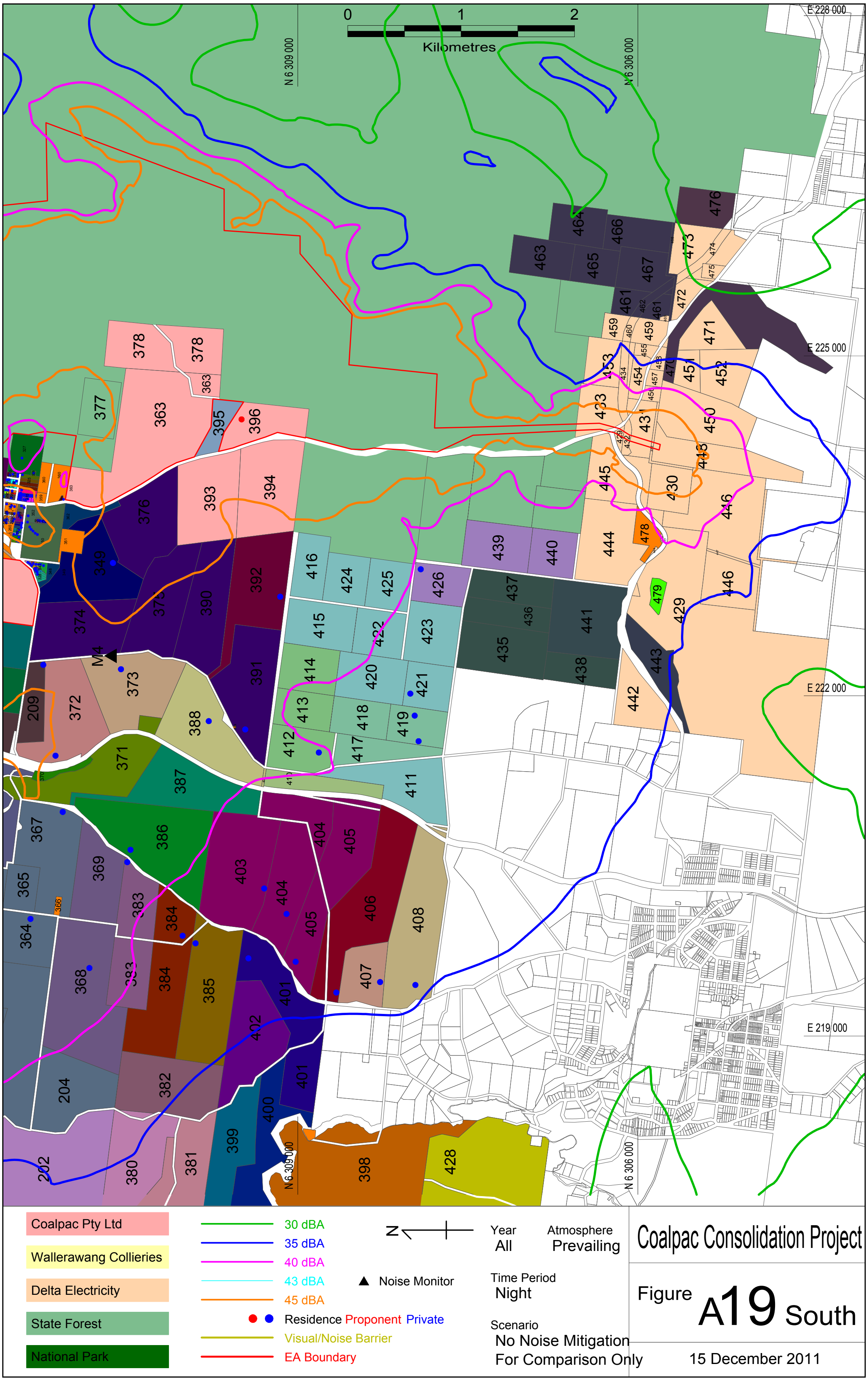
Scenario No Noise Mitigation For Comparison Only

Coalpac Consolidation Project

Figure A19 North

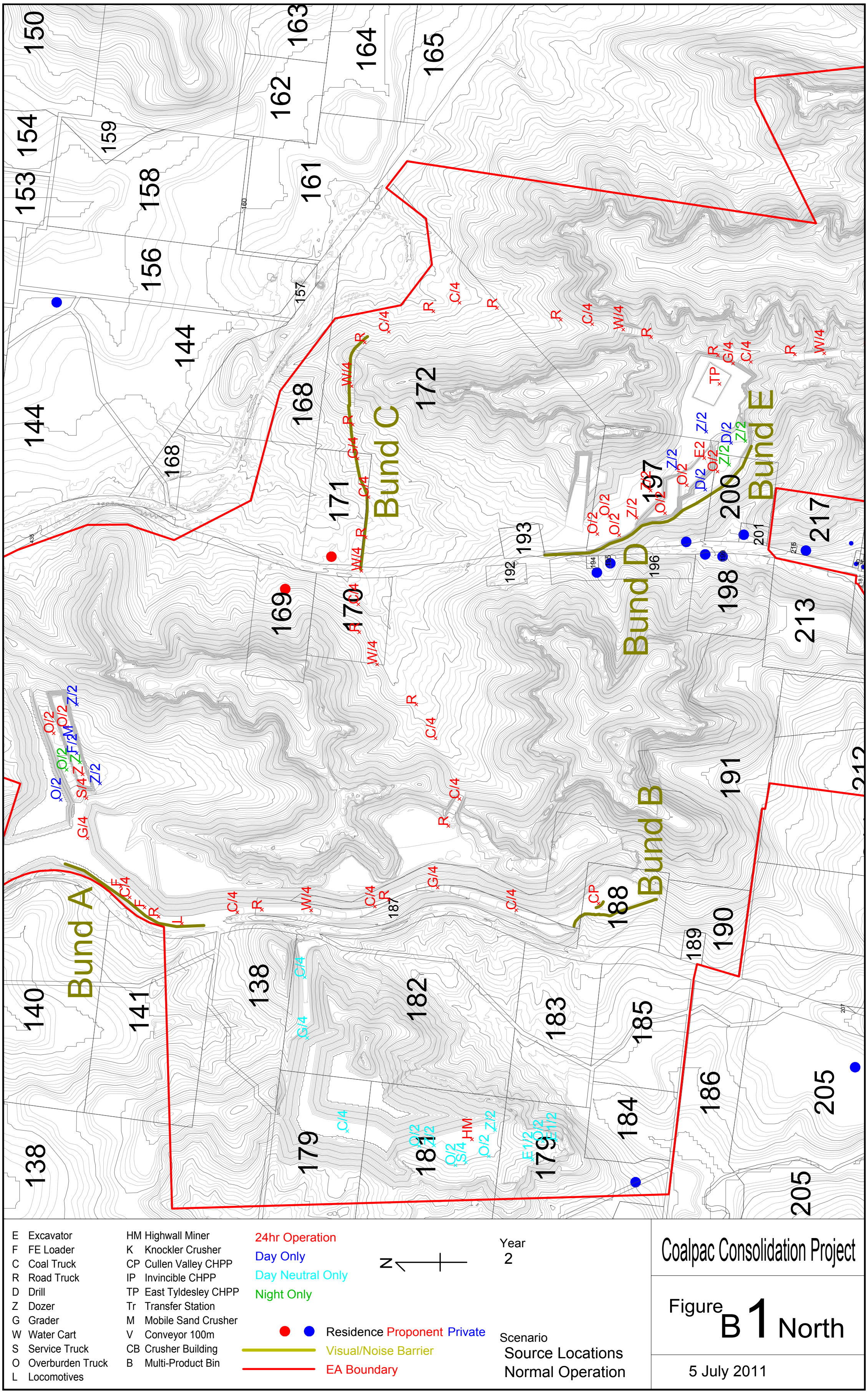
15 December 2011

BRIDGES Acoustics

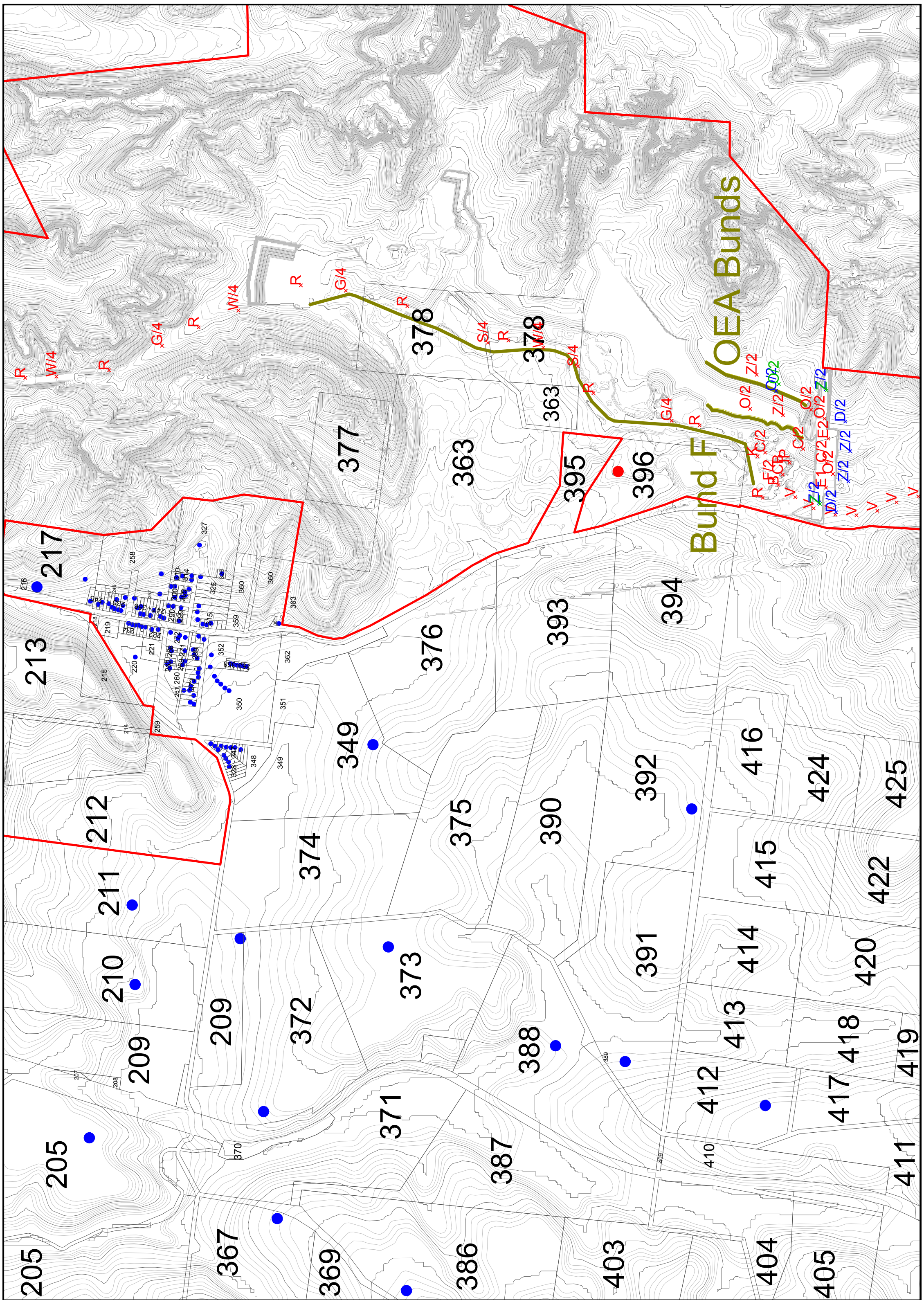



BRIDGES Acoustics

## APPENDIX B – NOISE SOURCE LOCATION FIGURES




BRIDGES Acoustics




E Excavator
F FE Loader
C Coal Truck
R Road Truck
D Drill
Z Dozer
G Grader
W Water Cart
S Service Truck
O Overburden Truck
L Locomotives

HM Highwall Miner
K Knockler Crusher
CP Cullen Valley CHPP
IP Invincible CHPP
TP East Tyldesley CHPP
Tr Transfer Station
M Mobile Sand Crusher
V Conveyor 100m
CB Crusher Building
B Multi-Product Bin

24hr Operation
Day Only
Day Neutral Only
Night Only

N

Residence Proponent Private
Visual/Noise Barrier
EA Boundary

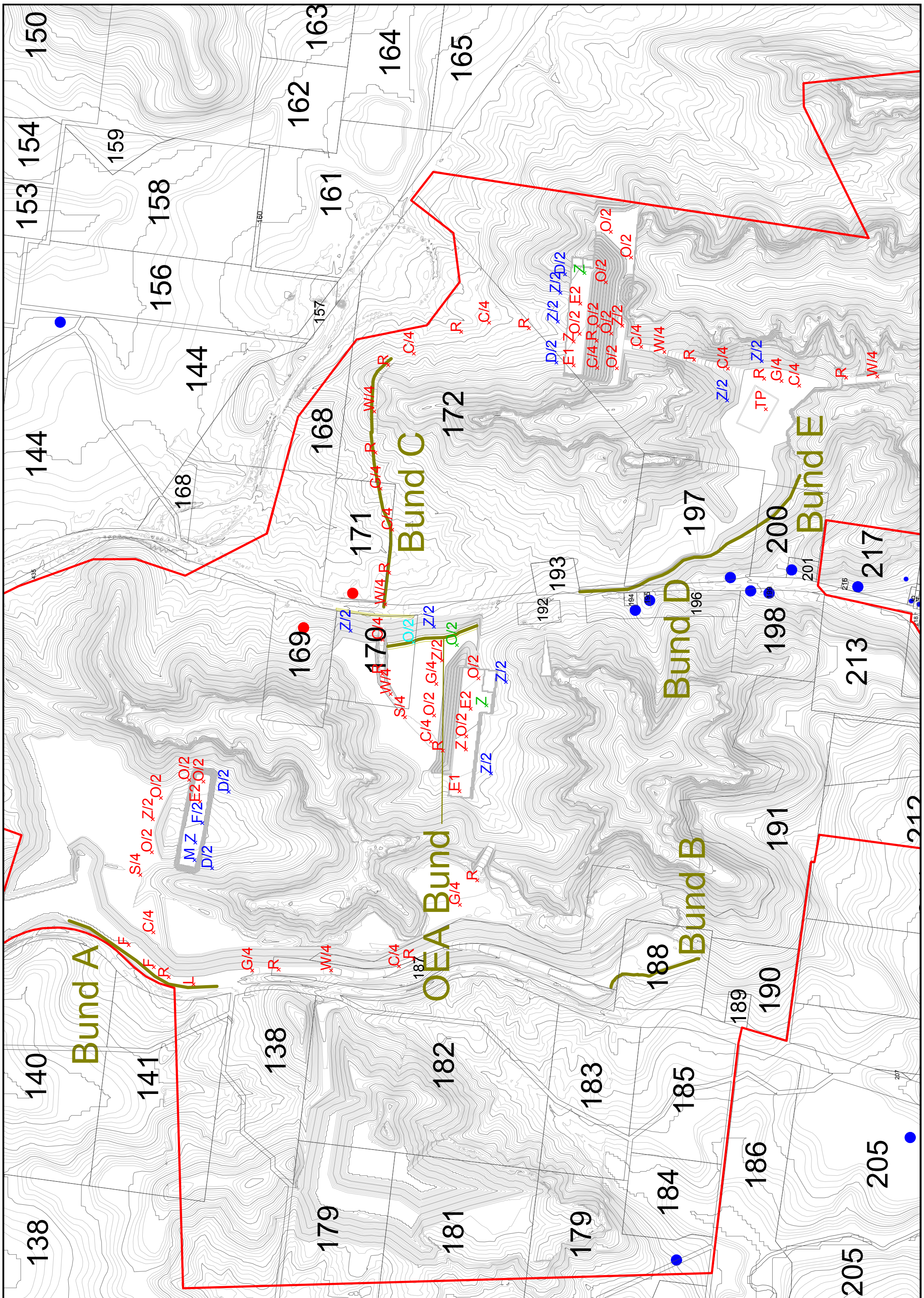
Year
2

Scenario
Source Locations
Normal Operation

Coalpac Consolidation Project

Figure B 1 South

5 July 2011




| | | | |
|---|---|---|---|
| E Excavator | HM Highwall Miner | 24hr Operation | Year 8 |
| F FE Loader | K Knockler Crusher | Day Only | |
| C Coal Truck | CP Cullen Valley CHPP | Day Neutral Only | |
| R Road Truck | IP Invincible CHPP | Night Only | |
| D Drill | TP East Tyldesley CHPP | | |
| Z Dozer | Tr Transfer Station | | |
| G Grader | M Mobile Sand Crusher | | |
| W Water Cart | V Conveyor 100m | Residence Proponent Private | Scenario |
| S Service Truck | CB Crusher Building | Visual/Noise Barrier | Source Locations |
| O Overburden Truck | B Multi-Product Bin | EA Boundary | Normal Operation |
| L Locomotives | | | |

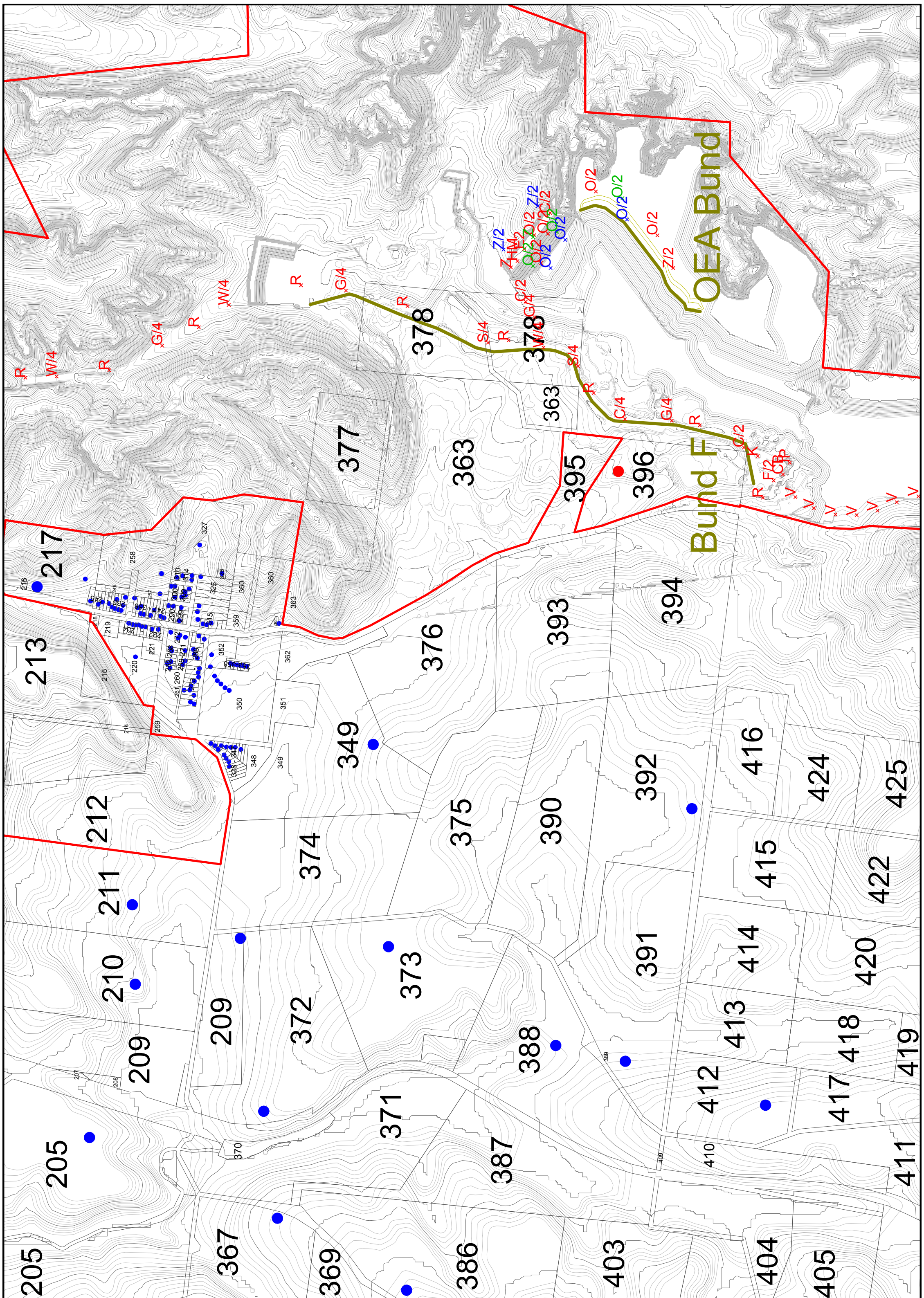
N

Coalpac Consolidation Project

Figure B2 North

5 July 2011

BRIDGES Acoustics




E Excavator
F FE Loader
C Coal Truck
R Road Truck
D Drill
Z Dozer
G Grader
W Water Cart
S Service Truck
O Overburden Truck
L Locomotives

HM Highwall Miner
K Knockler Crusher
CP Cullen Valley CHPP
IP Invincible CHPP
TP East Tyldesley CHPP
Tr Transfer Station
M Mobile Sand Crusher
V Conveyor 100m
CB Crusher Building
B Multi-Product Bin

24hr Operation
Day Only
Day Neutral Only
Night Only

N

Residence Proponent Private
Visual/Noise Barrier
EA Boundary

Year
8

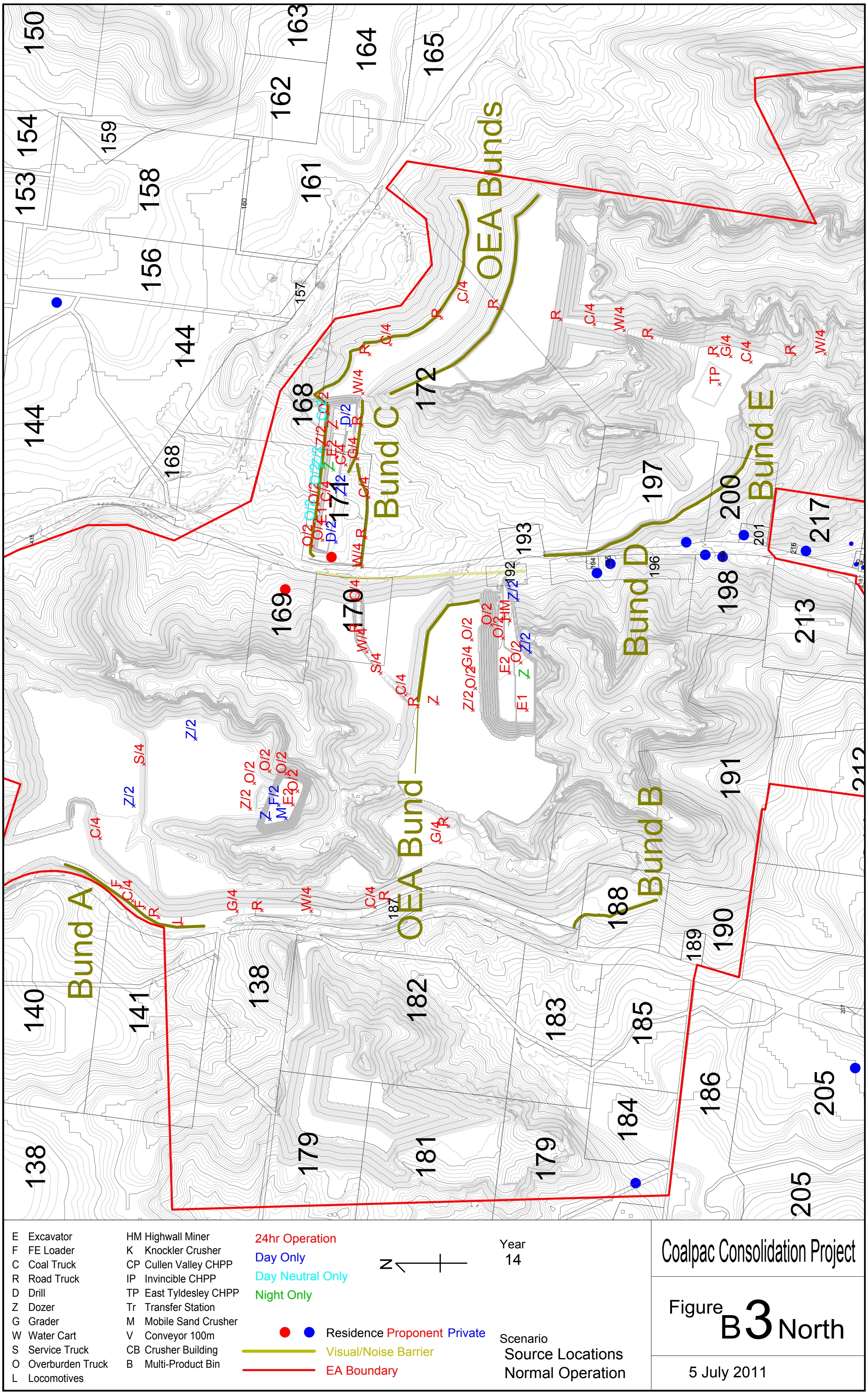
Scenario
Source Locations
Normal Operation

Coalpac Consolidation Project

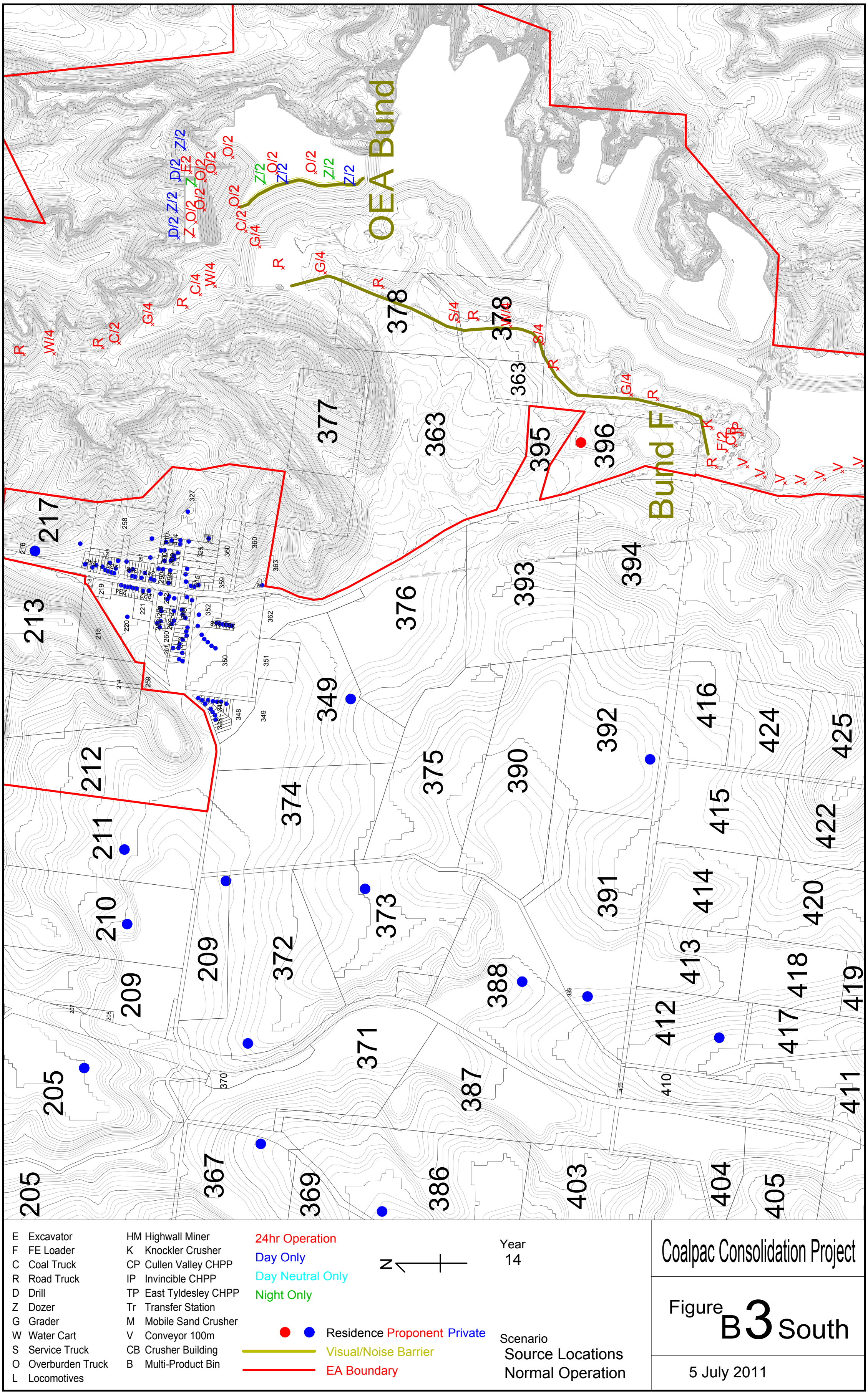
Figure B2 South

5 July 2011

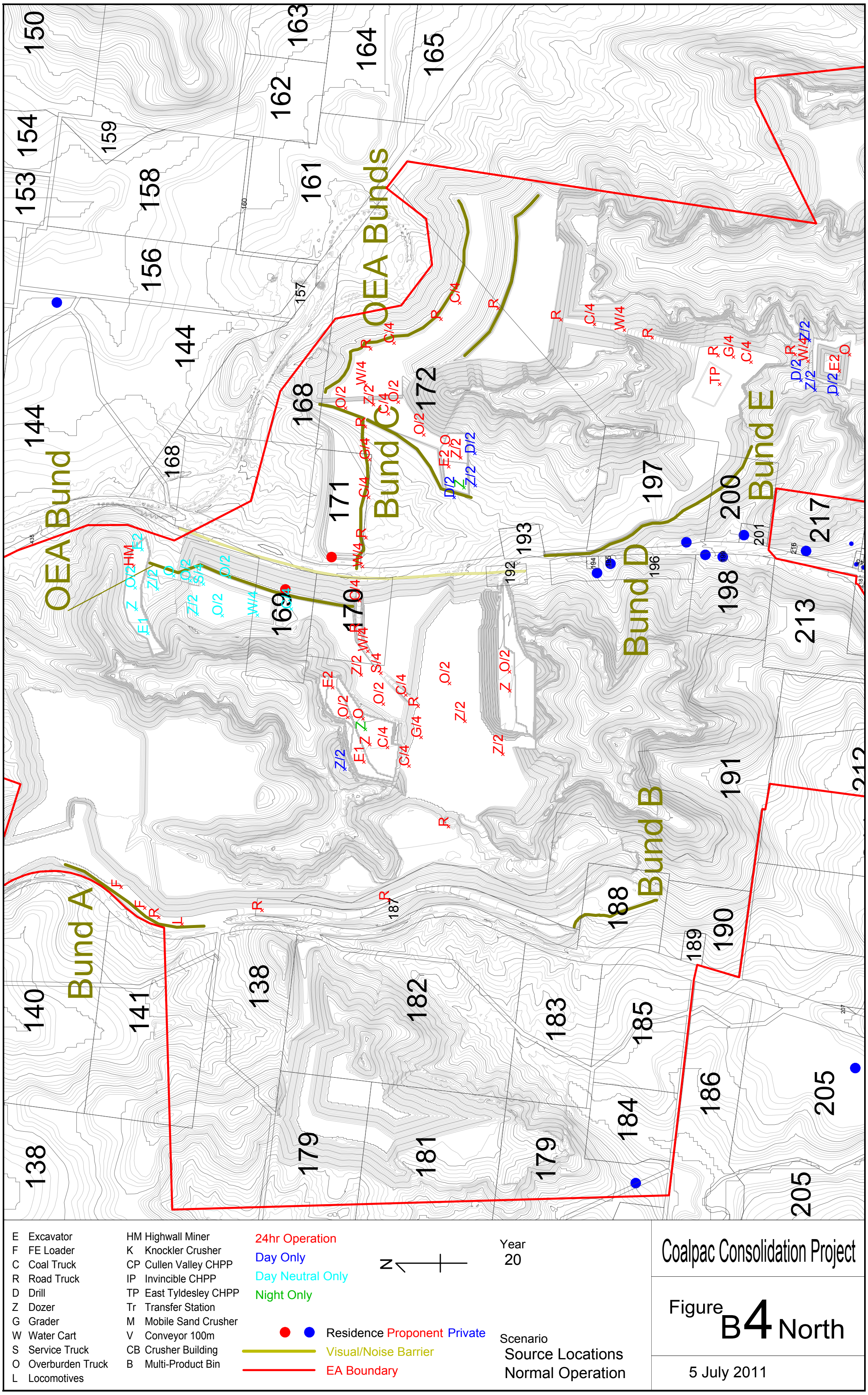
**BRIDGES Acoustics**



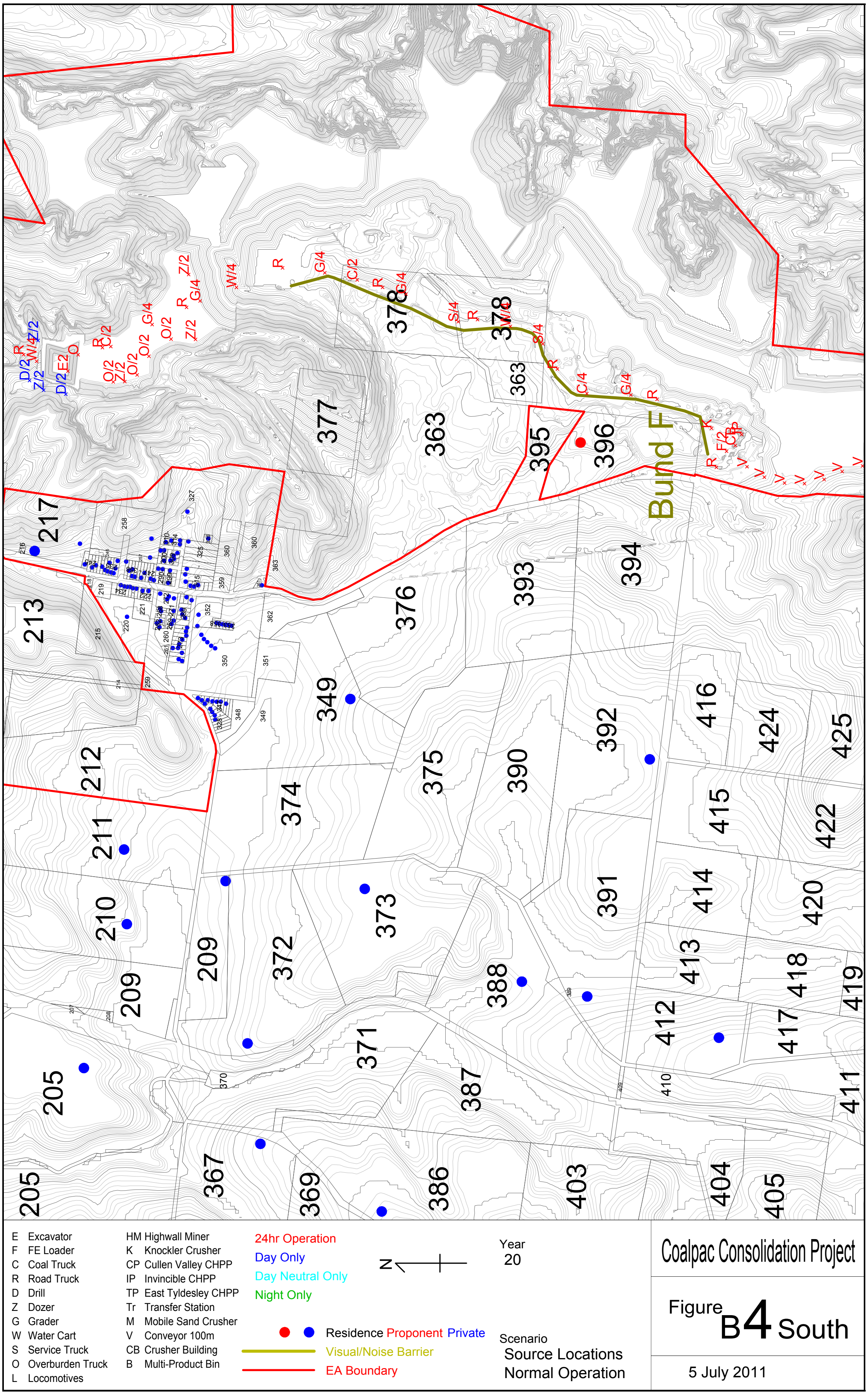

BRIDGES Acoustics




BRIDGES Acoustics




BRIDGES Acoustics


E Excavator
F FE Loader
C Coal Truck
R Road Truck
D Drill
Z Dozer
G Grader
W Water Cart
S Service Truck
O Overburden Truck
L Locomotives
HM Highwall Miner
K Knockler Crusher
CP Cullen Valley CHPP
IP Invincible CHPP
TP East Tyldesley CHPP
Tr Transfer Station
M Mobile Sand Crusher
V Conveyor 100m
CB Crusher Building
B Multi-Product Bin
24hr Operation
Day Only
Day Neutral Only
Night Only
Residence Proponent Private
Visual/Noise Barrier
EA Boundary
N
Year
20
Scenario
Source Locations
Normal Operation
Coalpac Consolidation Project
Figure B4 South
5 July 2011
Bund F

# APPENDIX C – PREDICTED NOISE LEVEL TABLES

| TABLE | DESCRIPTION |
|---|---|
| C1 | Operational noise levels at residences, LAeq,15min |
| C2 | Operational noise levels over 25% of property areas, LAeq,15min |

Residences, properties or lots omitted from the tables are predicted to receive less than 35 LAeq,15min during all time periods and weather conditions. Construction and sleep disturbance noise levels are not included.

Entries in the tables are shaded using the following colours:

- Red – a significant noise impact of 5 dBA or more above the intrusive criteria;
- Blue – a moderate noise impact of less than 5 dBA above the intrusive criteria; and
- Green – a mild noise impact of 2 dBA or less above the intrusive criteria.

**Table C1: Operational Noise Levels at Residences, LAeq,15min**

| Owner ID | Residence ID | Predicted Noise Level, LAeq,15min | | | | | | | | | | | | Criteria Day/ Evening/ Night |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day/Evening Neutral | | | | Day/Evening Prevailing | | | | Night Prevailing | | | | |
| | | Year 2 | Year 8 | Year 14 | Year 20 | Year 2 | Year 8 | Year 14 | Year 20 | Year 2 | Year 8 | Year 14 | Year 20 | |
| 2 | 217N | 31.2 | 27.2 | 27.5 | 28.9 | 36.1 | 31.7 | 31.6 | 33.6 | 37.2 | 33.5 | 32.2 | 33.3 | 37/35/35 |
| | 217S | 28.7 | 25.8 | 26.8 | 28.6 | 33.0 | 29.8 | 31.7 | 33.4 | 34.3 | 32.0 | 31.4 | 32.4 | 37/35/35 |
| 5 | 139 | 29.5 | 31.3 | 30.4 | 24.8 | 29.5 | 31.3 | 30.4 | 24.8 | 33.1 | 37.7 | 35.7 | 29.0 | 35/35/35 |
| 6 | 179 | 37.4 | 25.2 | 23.9 | 21.5 | 37.8 | 34.4 | 33.9 | 32.1 | 39.7 | 36.9 | 36.4 | 34.7 | 35/35/35 |
| 8 | 364 | 31.9 | 24.2 | 22.0 | 22.5 | 36.4 | 34.8 | 35.7 | 34.7 | 38.7 | 36.2 | 37.6 | 36.5 | 35/35/35 |
| | 367 | 31.3 | 25.1 | 21.9 | 22.9 | 36.6 | 35.0 | 35.0 | 35.3 | 38.9 | 36.8 | 37.2 | 37.2 | 35/35/35 |
| 9 | 205 | 33.0 | 25.8 | 23.5 | 23.9 | 38.4 | 34.0 | 33.9 | 34.0 | 40.6 | 35.9 | 36.3 | 36.5 | 35/35/35 |
| 10 | 368 | 29.4 | 23.2 | 20.7 | 20.9 | 34.7 | 33.6 | 34.2 | 33.9 | 37.1 | 34.7 | 35.8 | 35.4 | 35/35/35 |
| 11 | 383 | 29.6 | 24.4 | 21.4 | 21.8 | 35.5 | 34.8 | 35.0 | 34.8 | 37.7 | 35.9 | 37.0 | 36.6 | 35/35/35 |
| 13 | 384 | 28.7 | 23.7 | 20.6 | 20.7 | 34.4 | 33.6 | 33.9 | 33.6 | 36.6 | 34.4 | 35.4 | 35.0 | 35/35/35 |
| 14 | 385 | 28.5 | 23.7 | 20.6 | 20.6 | 34.2 | 33.4 | 33.7 | 33.4 | 36.3 | 34.2 | 35.1 | 34.7 | 35/35/35 |
| 17 | 386 | 28.9 | 25.5 | 21.9 | 22.8 | 35.5 | 35.0 | 35.0 | 35.0 | 37.7 | 36.2 | 37.0 | 37.0 | 35/35/35 |
| 23 | 403 | 27.1 | 24.1 | 21.4 | 21.5 | 34.5 | 33.1 | 33.1 | 33.1 | 36.4 | 34.0 | 34.4 | 34.3 | 35/35/35 |
| | 404 | 26.3 | 23.7 | 20.9 | 21.0 | 34.3 | 32.6 | 32.6 | 32.8 | 35.9 | 33.5 | 33.8 | 34.0 | 35/35/35 |
| 30 | 198 | 36.2 | 29.5 | 30.1 | 36.8 | 39.3 | 33.4 | 33.5 | 38.8 | 39.7 | 34.2 | 33.8 | 34.5 | 35/35/35 |
| | 199 | 35.1 | 29.1 | 29.2 | 37.3 | 38.9 | 33.4 | 32.8 | 39.8 | 39.5 | 34.0 | 33.7 | 34.1 | 37/35/35 |
| 31 | 197 | 37.7 | 30.5 | 32.3 | 32.9 | 40.1 | 34.7 | 36.0 | 36.1 | 40.4 | 36.2 | 34.9 | 35.1 | 35/35/35 |
| 32 | 201 | 35.3 | 29.5 | 29.4 | 33.2 | 38.9 | 33.8 | 32.9 | 35.8 | 39.4 | 33.9 | 33.3 | 33.5 | 37/35/35 |
| 33 | 195 | 41.2 | 33.4 | 37.4 | 35.4 | 42.5 | 37.2 | 40.3 | 39.5 | 43.8 | 39.0 | 38.2 | 40.2 | 37/35/35 |
| 34 | 194 | 41.5 | 34.3 | 37.5 | 37.5 | 43.1 | 38.6 | 41.1 | 43.5 | 45.3 | 40.5 | 40.4 | 43.6 | 37/35/35 |
| 50 | 114 | 27.8 | 24.7 | 25.3 | 23.3 | 32.2 | 31.2 | 30.8 | 27.8 | 31.2 | 36.0 | 33.9 | 30.1 | 37/35/35 |
| 51 | 113 | 27.0 | 24.2 | 25.1 | 23.9 | 32.5 | 31.6 | 31.3 | 28.7 | 31.9 | 36.5 | 34.6 | 31.3 | 37/35/35 |
| 52 | 112 | 26.1 | 23.9 | 24.8 | 22.3 | 29.1 | 28.0 | 28.4 | 25.7 | 30.9 | 35.9 | 34.2 | 29.7 | 37/35/35 |
| 53 | 109 | 25.6 | 24.6 | 25.4 | 21.3 | 26.1 | 25.7 | 26.1 | 22.5 | 29.8 | 35.2 | 33.5 | 29.1 | 35/35/35 |
| 54 | 108 | 25.7 | 24.8 | 25.5 | 21.0 | 26.0 | 25.2 | 25.8 | 21.9 | 29.7 | 35.2 | 33.4 | 28.8 | 35/35/35 |
| 56 | 106 | 26.1 | 24.7 | 25.3 | 20.7 | 26.2 | 24.8 | 25.5 | 21.1 | 30.0 | 35.2 | 33.3 | 28.2 | 35/35/35 |
| 65 | 142 | 26.1 | 31.2 | 33.1 | 33.5 | 35.0 | 35.7 | 34.1 | 33.7 | 35.7 | 37.3 | 34.7 | 38.1 | 35/35/35 |
| 66 | 143 | 26.7 | 31.8 | 32.8 | 33.8 | 35.3 | 36.6 | 35.3 | 34.7 | 36.4 | 37.9 | 35.7 | 37.6 | 35/35/35 |
| 67 | 144 | 29.3 | 33.9 | 34.6 | 33.8 | 36.4 | 38.0 | 36.6 | 37.0 | 38.0 | 38.7 | 36.1 | 37.1 | 35/35/35 |

BRIDGES Acoustics

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 68 | 209 | 28.7 | 27.4 | 23.5 | 25.2 | 32.2 | 33.0 | 31.7 | 35.0 | 35.1 | 34.1 | 34.7 | 35.4 | 35/35/35 |
| 72 | 349 | 32.0 | 33.6 | 28.6 | 29.2 | 34.7 | 36.9 | 32.8 | 35.2 | 37.8 | 38.4 | 35.8 | 37.7 | 35/35/35 |
| 73 | 391 | 28.0 | 26.7 | 23.2 | 23.3 | 35.1 | 35.0 | 34.4 | 35.1 | 36.9 | 36.1 | 36.4 | 37.0 | 35/35/35 |
| 75 | 392 | 30.6 | 29.6 | 27.7 | 26.9 | 37.4 | 38.2 | 37.5 | 37.5 | 38.4 | 39.0 | 39.0 | 39.5 | 35/35/35 |
| 76 | 372 | 31.0 | 25.5 | 22.7 | 23.1 | 36.5 | 34.8 | 34.6 | 35.1 | 39.3 | 37.5 | 37.4 | 37.7 | 37/35/35 |
| 77 | 373 | 30.0 | 29.1 | 25.0 | 25.9 | 35.0 | 35.3 | 34.4 | 35.6 | 37.1 | 36.4 | 36.4 | 37.1 | 35/35/35 |
| 78 | 388 | 28.7 | 27.0 | 23.5 | 23.9 | 34.0 | 34.6 | 33.6 | 33.7 | 35.8 | 35.2 | 35.6 | 35.2 | 35/35/35 |
| 80 | 412 | 27.3 | 26.3 | 23.4 | 23.7 | 36.1 | 35.4 | 34.8 | 35.0 | 38.4 | 36.8 | 36.5 | 36.9 | 35/35/35 |
| 85 | 426 | 27.7 | 26.4 | 25.1 | 24.4 | 34.5 | 35.4 | 33.5 | 33.2 | 36.3 | 35.8 | 34.6 | 35.1 | 35/35/35 |

**Table C2: Operational Noise Levels over 25% of Property Areas, LAeq,15min**

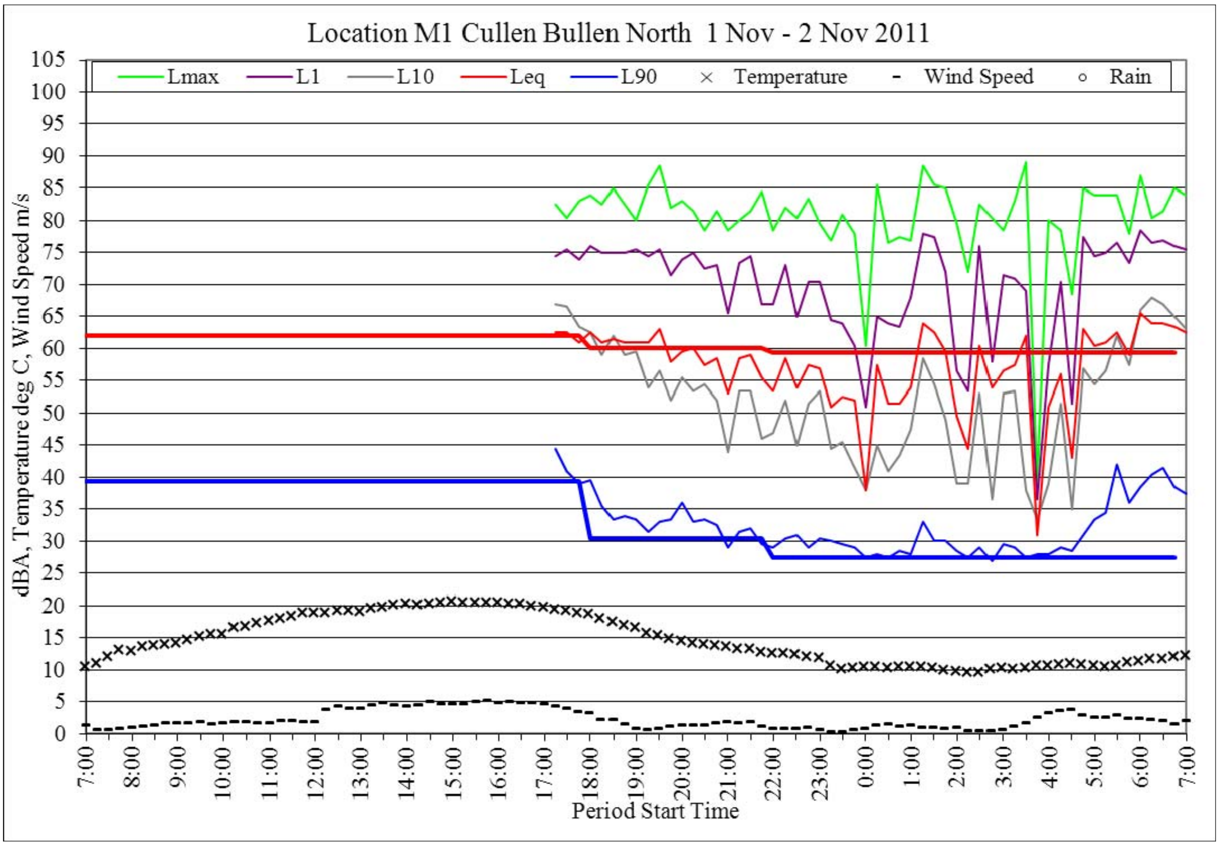
| Owner ID | Property ID | Predicted Noise Level, LAeq,15min | | | | | | | | | | | | Criteria Day/ Evening/ Night |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day/Evening Neutral | | | | Day/Evening Prevailing | | | | Night Prevailing | | | | |
| | | Year 2 | Year 8 | Year 14 | Year 20 | Year 2 | Year 8 | Year 14 | Year 20 | Year 2 | Year 8 | Year 14 | Year 20 | |
| 2 Crown | 192 Waste | 45.3 | 45.3 | 57.1 | 48.2 | 48.8 | 49.5 | 58.9 | 53.1 | 51.0 | 50.9 | 50.7 | 51.1 | 70/ - / - |
| | 193 Cemetary | 48.3 | 45.2 | 50.6 | 51.6 | 48.9 | 48.8 | 53.5 | 56.2 | 52.8 | 48.7 | 49.1 | 51.4 | 65/ - / - |
| | 196 Vacant | 42.8 | 36.6 | 41.5 | 40.6 | 45.1 | 41.8 | 45.3 | 47.9 | 46.9 | 43.7 | 43.6 | 46.1 | - / - / - |
| | 217 | 35.9 | 30.2 | 30.7 | 36.8 | 40.9 | 36.2 | 34.8 | 41.1 | 41.5 | 36.2 | 34.7 | 35.3 | 37/35/35 |
| 5 | 97-102, 138-141 | 32.7 | 30.5 | 30.0 | 25.3 | 33.9 | 33.2 | 32.4 | 26.4 | 34.3 | 37.1 | 35.2 | 29.3 | 35/35/35 |
| 6 | 173-175, 178-186 | 39.4 | 22.5 | 22.7 | 21.4 | 40.7 | 30.6 | 31.3 | 29.8 | 41.1 | 32.9 | 33.8 | 32.2 | 35/35/35 |
| 7 | 176 | 34.4 | 19.5 | 19.7 | 19.1 | 37.8 | 29.6 | 30.5 | 29.2 | 40.0 | 31.6 | 32.6 | 31.1 | 35/35/35 |
| 8 | 203,204,364, 365,367 | 32.3 | 22.4 | 20.9 | 21.1 | 36.4 | 34.0 | 34.7 | 34.1 | 38.6 | 35.6 | 36.7 | 35.8 | 35/35/35 |
| 9 | 205,206 | 37.0 | 25.3 | 23.5 | 23.2 | 40.6 | 35.9 | 36.1 | 35.4 | 42.9 | 37.9 | 38.5 | 38.0 | 35/35/35 |
| 10 | 368,369 | 30.0 | 23.6 | 21.2 | 21.6 | 35.6 | 34.6 | 35.2 | 34.5 | 37.8 | 35.8 | 37.1 | 36.2 | 35/35/35 |
| 11 | 383 | 29.1 | 23.6 | 20.9 | 21.1 | 35.1 | 34.3 | 34.7 | 34.4 | 37.3 | 35.4 | 36.5 | 36.0 | 35/35/35 |
| 13 | 384 | 28.7 | 23.5 | 20.5 | 20.7 | 34.4 | 33.5 | 33.9 | 33.6 | 36.6 | 34.4 | 35.4 | 35.0 | 35/35/35 |
| 14 | 385 | 27.6 | 23.3 | 20.2 | 20.3 | 33.8 | 32.7 | 33.0 | 32.8 | 35.7 | 33.3 | 34.3 | 34.1 | 35/35/35 |
| 15 | 371 | 30.4 | 25.1 | 22.3 | 22.8 | 35.7 | 34.3 | 34.2 | 34.8 | 38.1 | 36.3 | 36.5 | 37.0 | 35/35/35 |
| 16 | 370 | 31.6 | 25.2 | 22.5 | 22.6 | 36.5 | 34.5 | 34.4 | 34.9 | 39.1 | 37.0 | 37.1 | 37.3 | 35/35/35 |
| 17 | 386 | 28.9 | 25.8 | 22.2 | 23.1 | 35.5 | 34.9 | 34.8 | 35.1 | 37.7 | 36.3 | 36.9 | 37.0 | 35/35/35 |
| 18 | 387 | 28.3 | 26.1 | 22.7 | 23.1 | 34.9 | 34.7 | 34.5 | 35.1 | 37.1 | 36.0 | 36.6 | 37.0 | 35/35/35 |
| 23 | 403-405 | 27.1 | 24.4 | 21.5 | 21.6 | 34.6 | 33.5 | 33.5 | 33.5 | 36.5 | 34.5 | 34.9 | 34.7 | 35/35/35 |
| 24 | 406 | 25.8 | 23.5 | 20.7 | 20.7 | 34.6 | 33.0 | 32.5 | 32.5 | 36.2 | 33.9 | 33.8 | 34.0 | 35/35/35 |
| 26 | 408 | 24.8 | 22.7 | 20.4 | 19.7 | 34.0 | 32.5 | 32.0 | 31.9 | 35.4 | 33.4 | 33.2 | 33.3 | 35/35/35 |
| 29 | 170 | 60.4 | 62.7 | 57.9 | 59.1 | 61.2 | 63.1 | 59.2 | 60.3 | 61.3 | 60.2 | 58.9 | 60.0 | 37/35/35 |
| 30 | 198,199 | 37.6 | 34.2 | 32.1 | 38.1 | 45.6 | 43.0 | 40.7 | 43.9 | 46.6 | 43.2 | 43.2 | 43.9 | 37/35/35 |
| 31 | 197 | 67.6 | 44.5 | 43.3 | 43.4 | 68.1 | 47.1 | 46.1 | 46.1 | 67.2 | 47.9 | 47.7 | 47.7 | 37/35/35 |
| 32 | 201 | 35.3 | 29.5 | 29.4 | 33.2 | 38.9 | 33.8 | 32.9 | 35.8 | 39.4 | 33.9 | 33.3 | 33.5 | 37/35/35 |
| 33 | 195 | 41.2 | 33.4 | 37.4 | 35.4 | 42.5 | 37.2 | 40.3 | 39.5 | 43.8 | 39.0 | 38.2 | 40.2 | 37/35/35 |
| 34 | 194 | 42.8 | 35.8 | 41.4 | 38.4 | 44.0 | 40.7 | 44.4 | 45.2 | 46.7 | 42.2 | 42.2 | 45.0 | 37/35/35 |
| 35 | 200 | 46.0 | 39.8 | 39.2 | 42.6 | 49.6 | 43.9 | 43.1 | 44.7 | 49.1 | 44.2 | 43.8 | 43.9 | 37/35/35 |
| 50 | 114 | 28.2 | 25.0 | 25.7 | 24.2 | 34.1 | 32.1 | 32.1 | 29.3 | 31.7 | 35.7 | 34.1 | 30.9 | 35/35/35 |
| 51 | 113 | 27.3 | 24.3 | 25.0 | 23.6 | 32.0 | 31.1 | 30.8 | 28.2 | 31.7 | 36.2 | 34.4 | 30.9 | 37/35/35 |
| 52 | 110,112 | 26.2 | 24.1 | 25.1 | 22.6 | 29.5 | 28.6 | 28.8 | 26.4 | 31.2 | 35.9 | 34.2 | 30.4 | 37/35/35 |
| 53 | 109 | 26.8 | 24.8 | 25.6 | 21.7 | 27.4 | 26.2 | 26.6 | 23.3 | 29.9 | 36.0 | 34.1 | 29.2 | 35/35/35 |
| 54 | 108 | 27.3 | 25.3 | 25.9 | 21.5 | 27.6 | 26.0 | 26.4 | 22.7 | 29.9 | 36.5 | 34.3 | 29.0 | 35/35/35 |
| 55 | 107 | 28.3 | 25.7 | 26.2 | 22.0 | 28.9 | 26.5 | 26.7 | 23.5 | 30.0 | 36.9 | 34.4 | 28.6 | 35/35/35 |
| 56 | 105,106 | 27.7 | 25.7 | 25.9 | 21.7 | 27.7 | 25.8 | 26.0 | 22.0 | 29.8 | 35.8 | 33.6 | 28.2 | 35/35/35 |
| 58 | 111 | 25.0 | 23.5 | 24.5 | 22.2 | 28.1 | 27.5 | 27.9 | 25.3 | 30.7 | 35.2 | 33.8 | 29.9 | 37/35/35 |
| 61 | 119 | 24.8 | 23.5 | 24.4 | 23.5 | 30.7 | 30.1 | 29.9 | 27.7 | 31.6 | 35.3 | 33.5 | 31.3 | 37/35/35 |

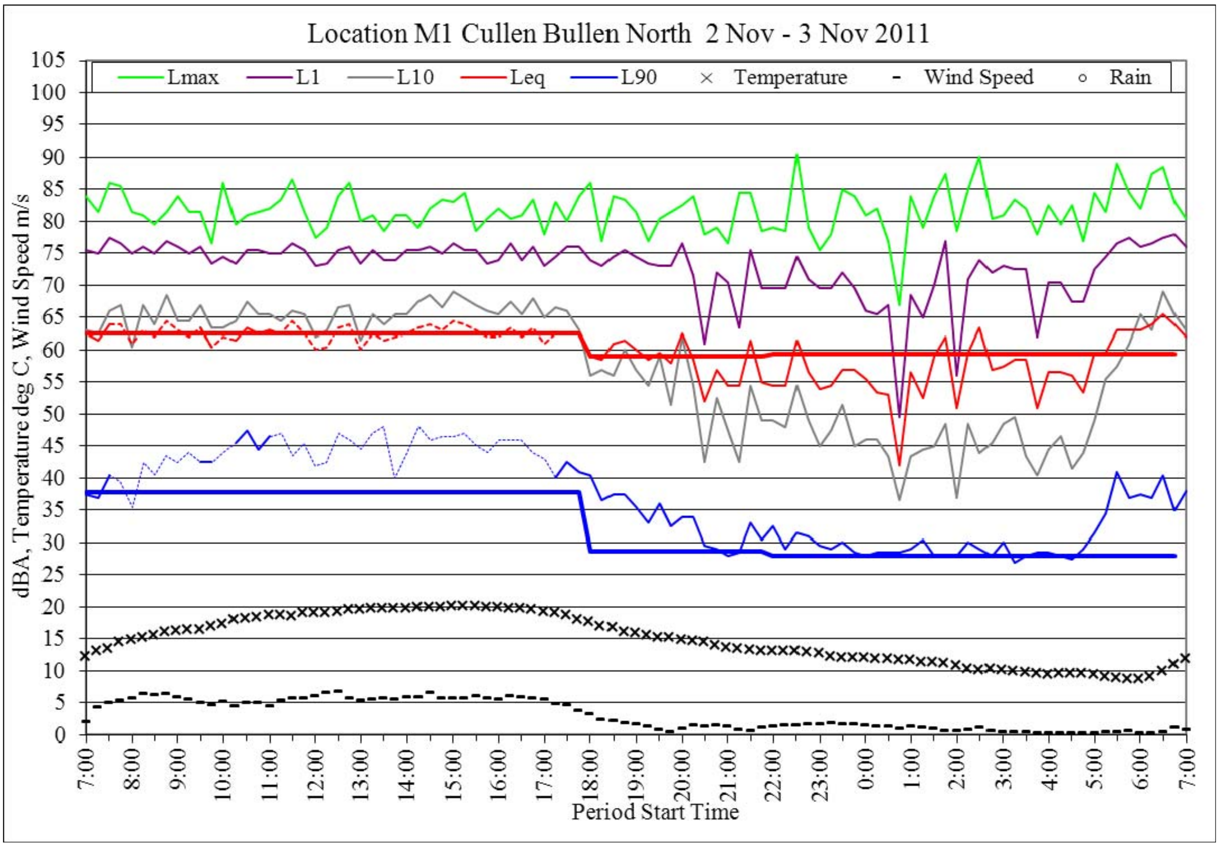
| Owner ID | Property ID | Predicted Noise Level, LAeq,15min | | | | | | | | | | | | Criteria Day/ Evening/ Night |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day/Evening Neutral | | | | Day/Evening Prevailing | | | | Night Prevailing | | | | |
| | | Year 2 | Year 8 | Year 14 | Year 20 | Year 2 | Year 8 | Year 14 | Year 20 | Year 2 | Year 8 | Year 14 | Year 20 | |
| 62 | 122 | 25.3 | 24.7 | 25.7 | 25.2 | 33.3 | 32.8 | 32.0 | 30.3 | 32.6 | 35.1 | 33.8 | 33.7 | 37/35/35 |
| 65 | 142 | 25.2 | 29.5 | 31.8 | 31.8 | 33.1 | 34.5 | 33.3 | 32.1 | 34.1 | 35.8 | 33.9 | 37.0 | 35/35/35 |
| 66 | 143 | 26.0 | 29.8 | 29.5 | 30.8 | 34.6 | 35.2 | 33.9 | 33.1 | 33.9 | 35.8 | 34.1 | 35.7 | 35/35/35 |
| 67 | 144 | 30.6 | 35.1 | 38.3 | 38.2 | 37.0 | 39.5 | 38.5 | 38.8 | 38.7 | 38.9 | 36.7 | 39.0 | 35/35/35 |
| 68 | 209 | 33.0 | 26.4 | 24.0 | 24.5 | 36.1 | 33.3 | 32.9 | 34.2 | 38.5 | 35.1 | 35.2 | 35.5 | 35/35/35 |
| 69 | 210 | 31.4 | 26.0 | 23.8 | 25.2 | 33.5 | 31.5 | 30.6 | 33.1 | 36.1 | 33.6 | 33.9 | 34.4 | 35/35/35 |
| 71 | 348 | 29.4 | 28.1 | 25.5 | 26.4 | 31.0 | 31.1 | 28.6 | 33.6 | 35.2 | 35.3 | 33.5 | 34.0 | 35/35/35 |
| | 362 | 31.3 | 30.1 | 27.5 | 28.1 | 32.3 | 31.6 | 30.0 | 30.7 | 37.0 | 37.0 | 35.6 | 36.0 | 37/35/35 |
| 72 | 349 | 31.5 | 32.2 | 27.9 | 28.6 | 34.4 | 36.3 | 32.5 | 35.4 | 37.2 | 37.8 | 35.7 | 37.1 | 37/35/35 |
| 73 | 374-376, 390,391 | 31.5 | 32.0 | 28.8 | 29.1 | 35.2 | 37.8 | 35.9 | 36.1 | 38.1 | 39.0 | 37.8 | 38.6 | 35/35/35 |
| 75 | 392 | 31.5 | 30.8 | 28.9 | 28.3 | 37.3 | 39.1 | 37.9 | 37.5 | 38.2 | 39.3 | 38.9 | 39.5 | 35/35/35 |
| 76 | 372 | 30.2 | 27.5 | 23.7 | 25.0 | 35.6 | 34.4 | 33.9 | 35.1 | 38.3 | 36.5 | 36.5 | 36.9 | 35/35/35 |
| 77 | 373 | 29.9 | 29.0 | 25.2 | 26.0 | 34.8 | 35.3 | 34.3 | 35.4 | 37.0 | 36.5 | 36.2 | 36.9 | 35/35/35 |
| 78 | 388,409 | 28.9 | 27.4 | 24.0 | 24.4 | 34.7 | 34.9 | 34.4 | 34.9 | 36.6 | 35.9 | 36.3 | 36.7 | 35/35/35 |
| 79 | 410 | 26.8 | 25.4 | 22.6 | 22.8 | 34.4 | 34.5 | 34.2 | 34.4 | 36.4 | 35.6 | 35.7 | 36.1 | 35/35/35 |
| 80 | 412-414 | 28.3 | 27.5 | 24.8 | 24.7 | 36.3 | 36.6 | 34.9 | 35.5 | 38.4 | 37.7 | 36.8 | 37.7 | 35/35/35 |
| 81 | 417-419 | 26.5 | 25.6 | 22.8 | 22.7 | 34.9 | 34.6 | 33.4 | 33.7 | 36.7 | 35.7 | 35.0 | 35.5 | 35/35/35 |
| 82 | 411,415,416, 420-425 | 29.8 | 29.6 | 27.6 | 26.6 | 38.0 | 38.4 | 37.0 | 37.0 | 39.0 | 39.4 | 38.6 | 39.1 | 35/35/35 |
| 97 | 220 | 27.3 | 24.2 | 24.5 | 27.5 | 31.9 | 28.9 | 28.9 | 35.9 | 33.2 | 31.1 | 31.2 | 32.8 | 35/35/35 |
| 128 | 350 | 29.0 | 26.0 | 24.7 | 25.9 | 31.5 | 28.7 | 28.2 | 33.2 | 35.2 | 33.9 | 33.4 | 34.7 | 37/35/35 |
| 137 | 216 | 31.9 | 27.7 | 27.8 | 29.2 | 36.6 | 32.0 | 31.7 | 33.6 | 37.6 | 33.5 | 32.4 | 33.3 | 37/35/35 |

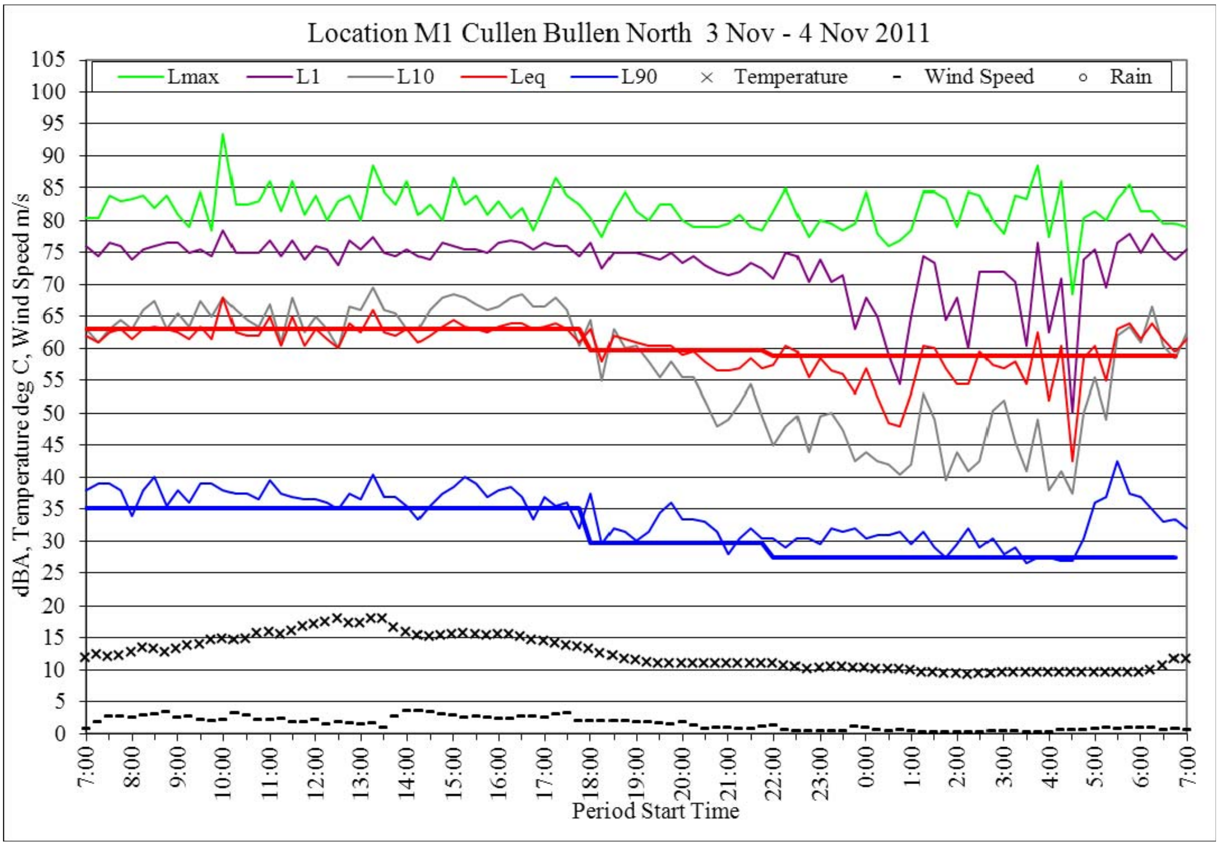
## APPENDIX D – DETAILED NOISE SURVEY RESULTS

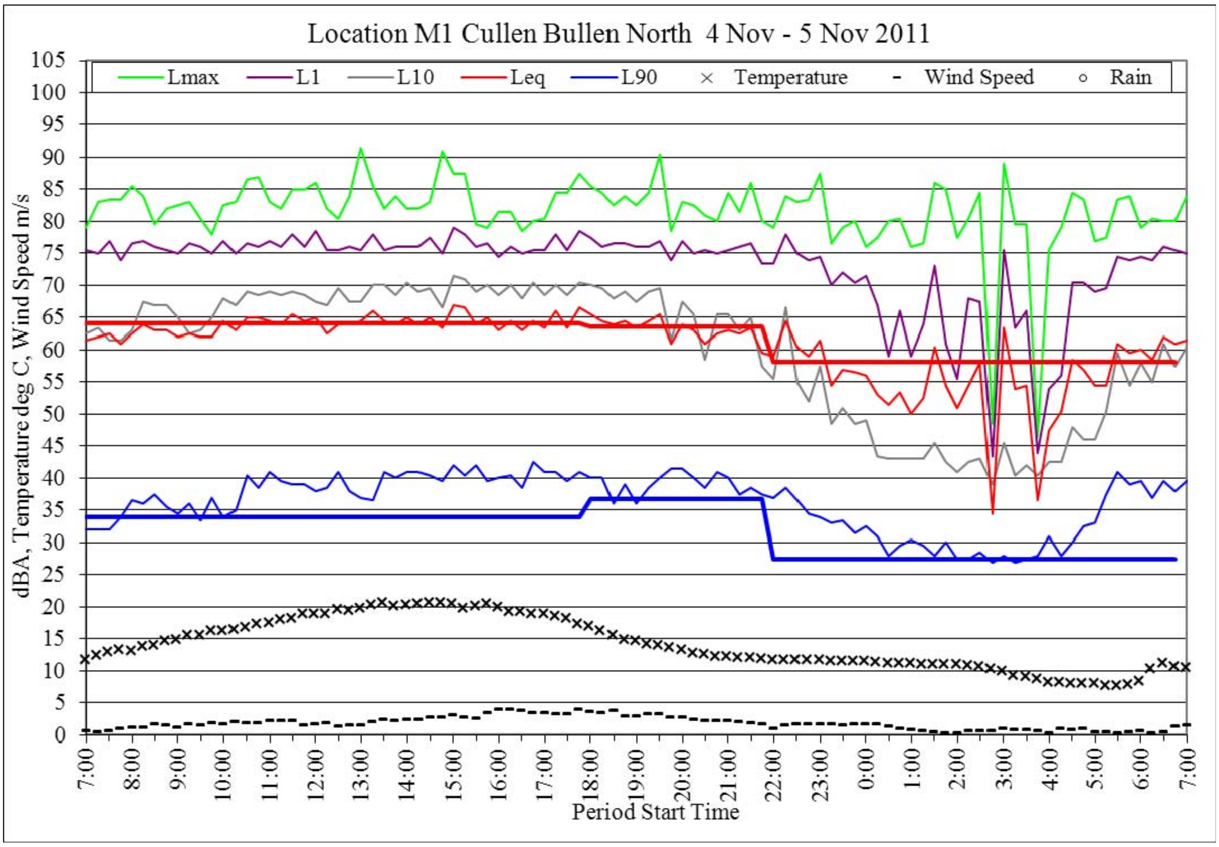
Environmental noise level charts on the following pages show 15 minute percentile statistics from noise loggers installed by Global Acoustics at four representative receiver locations in November 2011, with each chart showing a 24 hour period beginning at 7:00am. Each chart includes:

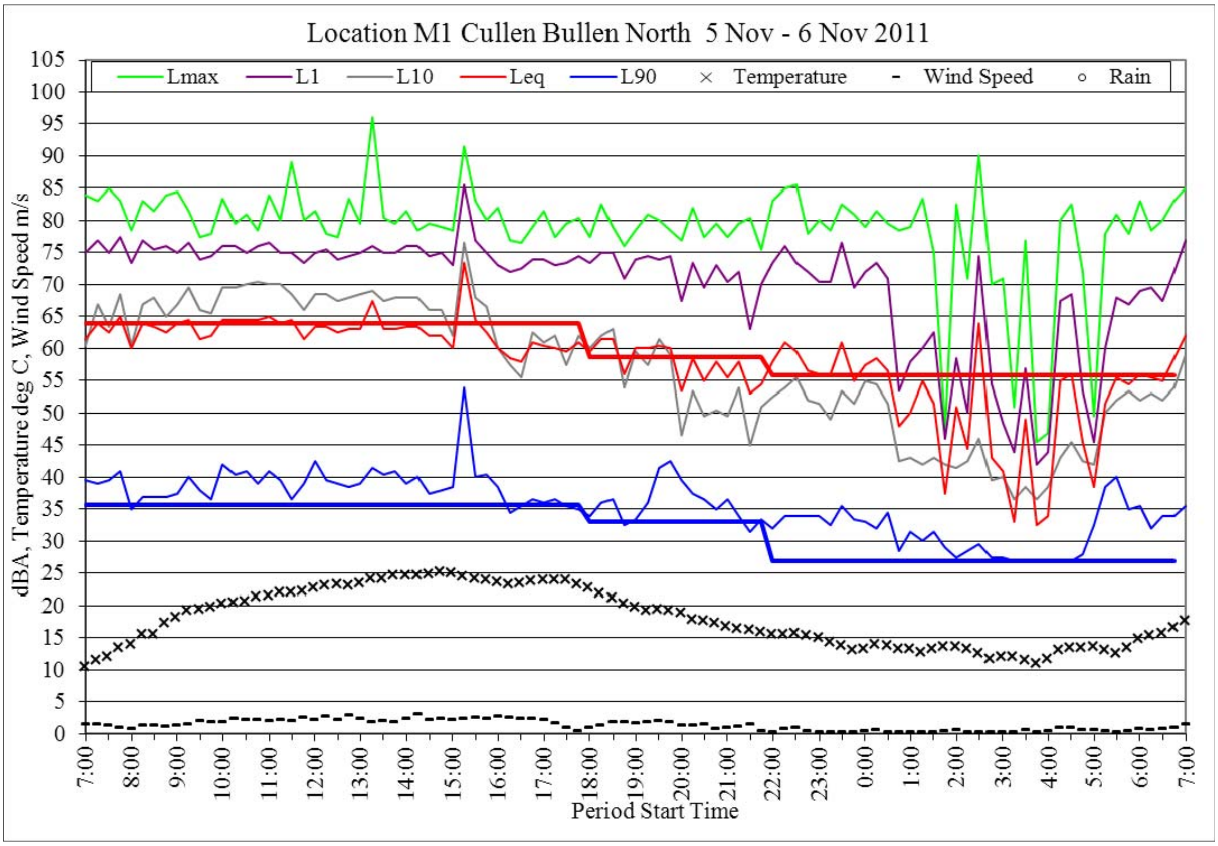
| | |
|---|---|
| Lmax - | The highest line on the chart, shown with a light green line. The Lmax is the maximum dBA noise level measured in each 15 minute period. |
| L1 - | The second highest line on the chart, shown with a violet line and representing the loudest 1 percent of the time (9 seconds) in each 15 minute period. |
| L10 - | The third highest line on each chart without data markers, shown as a grey line and representing the loudest 10% of the time (90 seconds) during each 15 minute period. |
| Leq - | the equivalent continuous (acoustic average) noise level in each 15 minute period, shown as a red line. The Leq can be above or below the L10 line and can, in extreme cases, extend above the L1 line. |
| Period Leq - | the equivalent continuous (acoustic average) noise level in each day, evening or night period, calculated from the average of all 15 minute Leq values in that time period excluding those affected by wind over 5m/s or rain. The Period Leq line is shown as a heavy red line. |
| L90 - | the lowest line on the chart, shown by a blue line, representing the quietest 10 percent of the time in each 15 minute period and accepted as the background noise level. Sections of line shown dotted indicate periods affected by wind over 5m/s or rain. |
| Period L90 - | The 'L90 of the 15 minute L90s' for each day, evening and night period, representing the Assessment Background Levels (ABLs) for each period. The Period L90 represents the lowest 10% of all 15 minute L90 values in that time period, excluding those affected by wind or rain, and is shown as a heavy blue line. |
| Temperature - | Air temperature measured at 10m above the ground by the Invincible Colliery weather station and indicated by a cross symbol. |
| Wind Speed - | Wind speed measured at 10m above the ground and indicated by small horizontal lines. |
| Rain - | The occurrence of rain in a 15 minute period, indicated by a small circle at the bottom of each chart. |

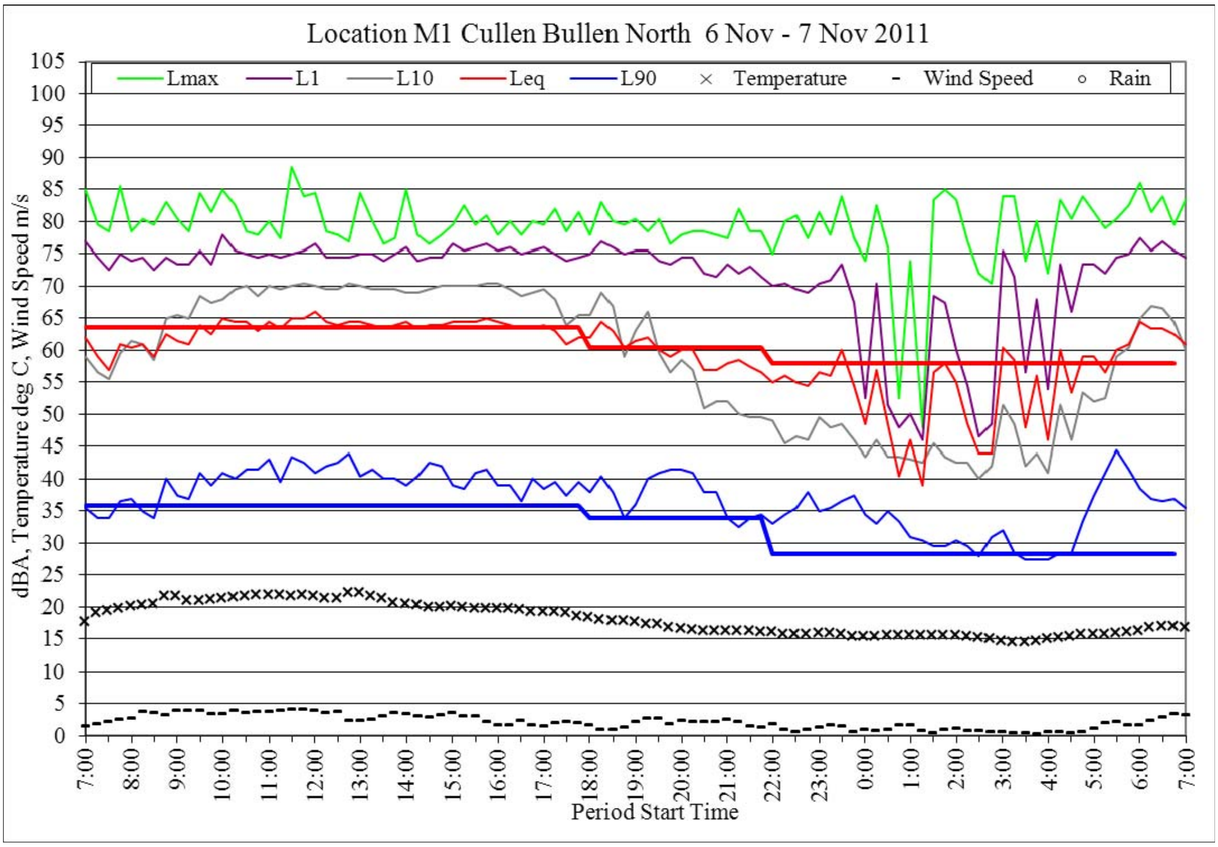

Location M1 Cullen Bullen North 1 Nov - 2 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

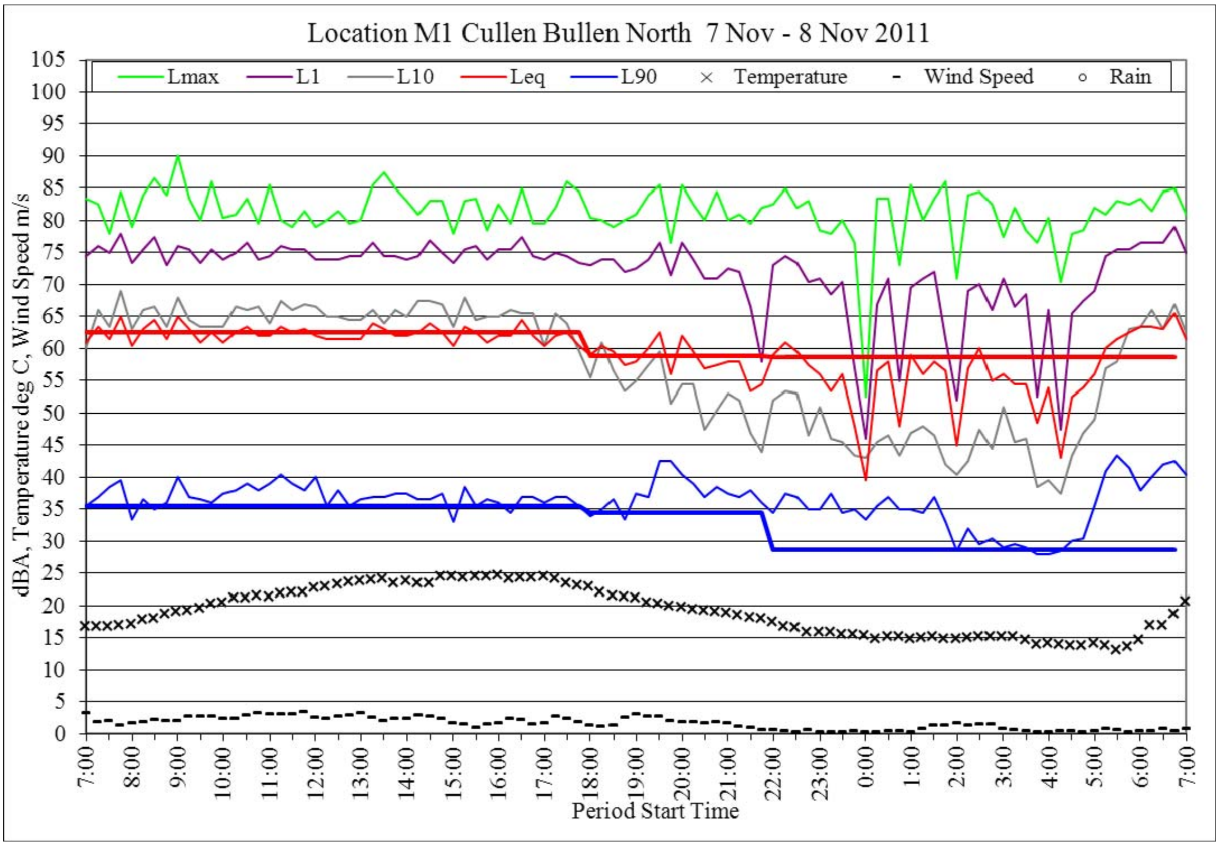

Location M1 Cullen Bullen North 2 Nov - 3 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

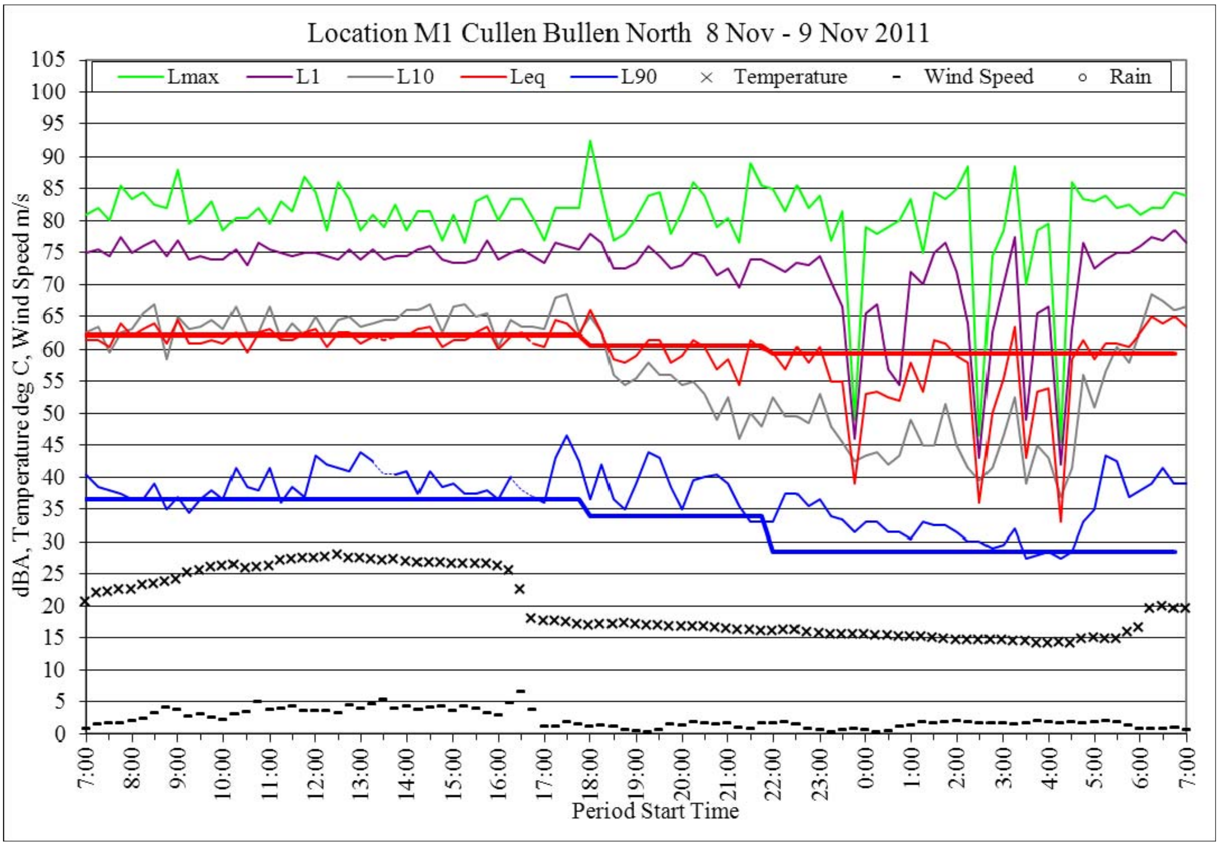

Location M1 Cullen Bullen North 3 Nov - 4 Nov 2011
Lmax L1 L10 Leq L90 Temperature Wind Speed Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M1 Cullen Bullen North 4 Nov - 5 Nov 2011
Lmax L1 L10 Leq L90 Temperature Wind Speed Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M1 Cullen Bullen North 5 Nov - 6 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
Period Start Time


Location M1 Cullen Bullen North 6 Nov - 7 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
Period Start Time


Location M1 Cullen Bullen North 7 Nov - 8 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
Period Start Time


Location M1 Cullen Bullen North 8 Nov - 9 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
7:00
8:00
9:00
10:00
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16:00
17:00
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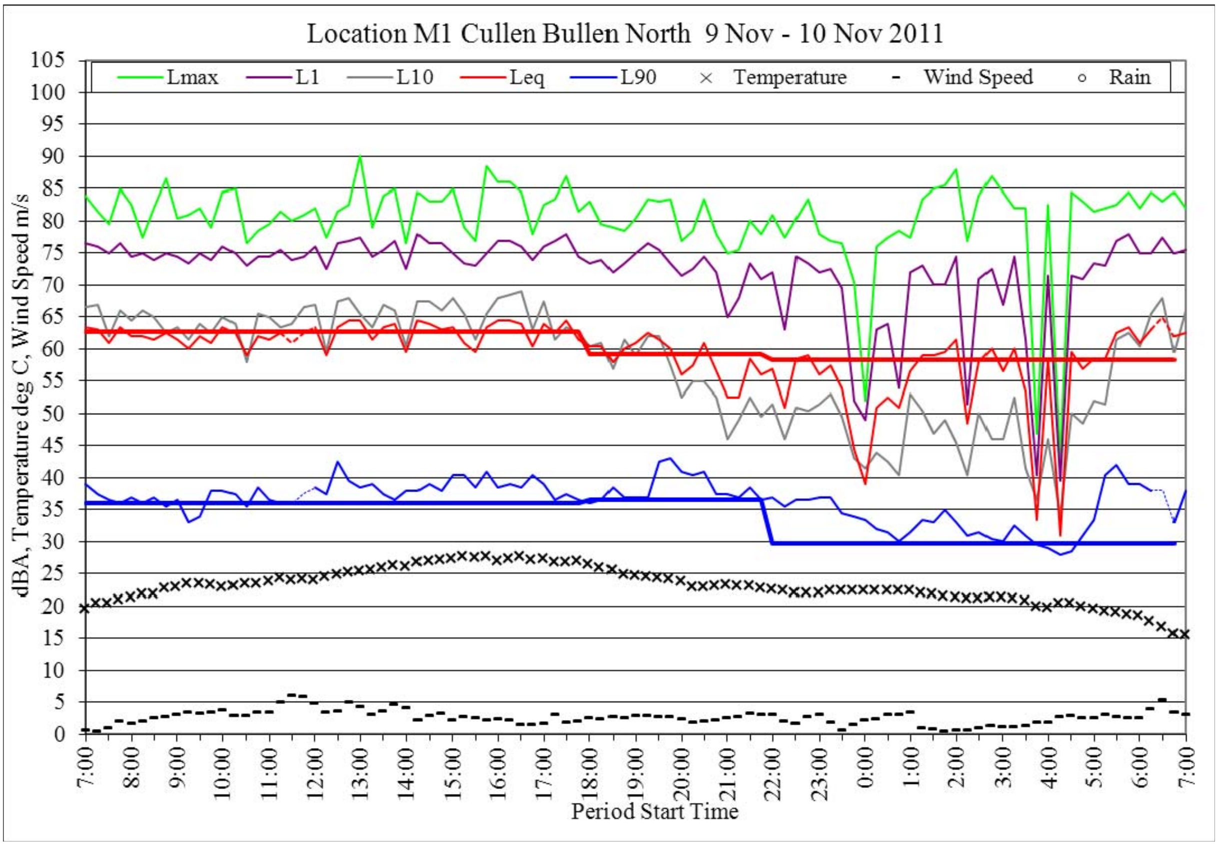
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
Period Start Time



Location M1 Cullen Bullen North 9 Nov - 10 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
7:00
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9:00
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20:00
21:00
22:00
23:00
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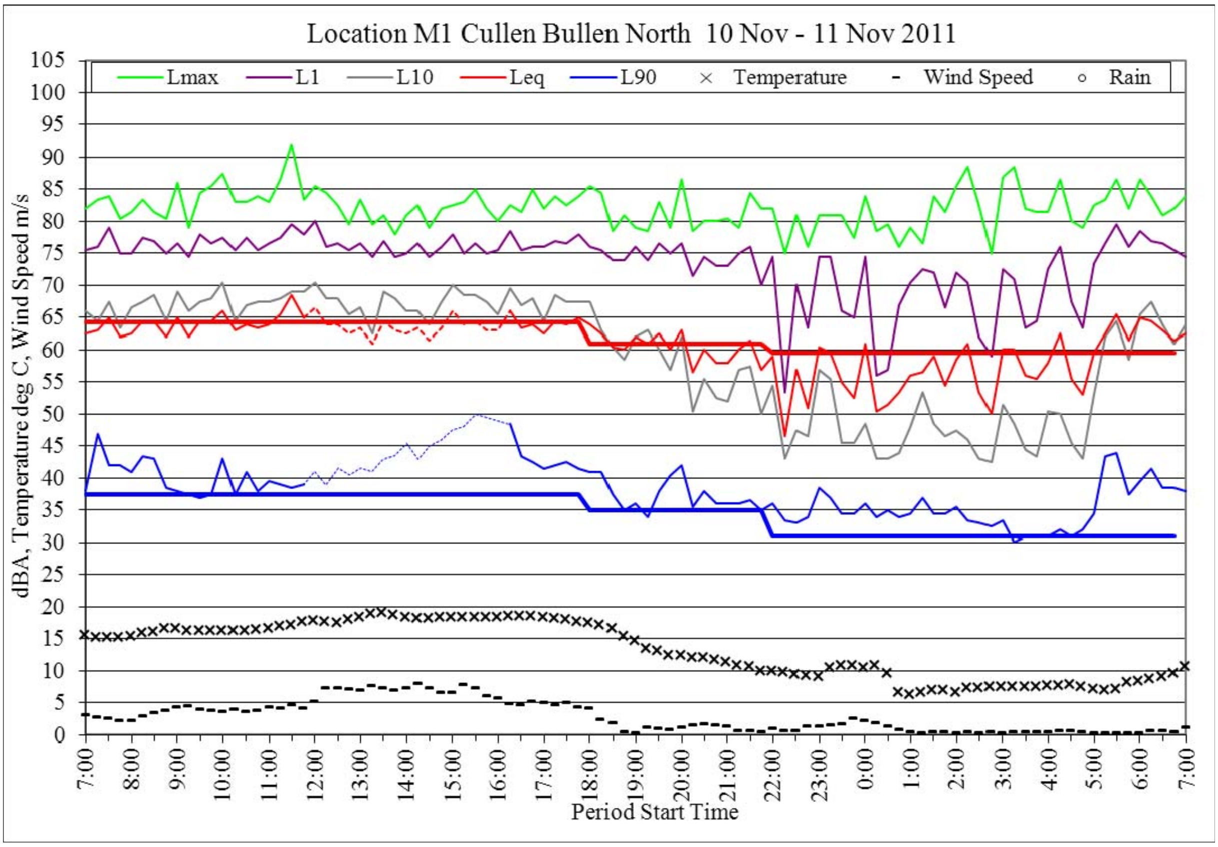
5:00
6:00
7:00
Period Start Time

Location M1 Cullen Bullen North 10 Nov - 11 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
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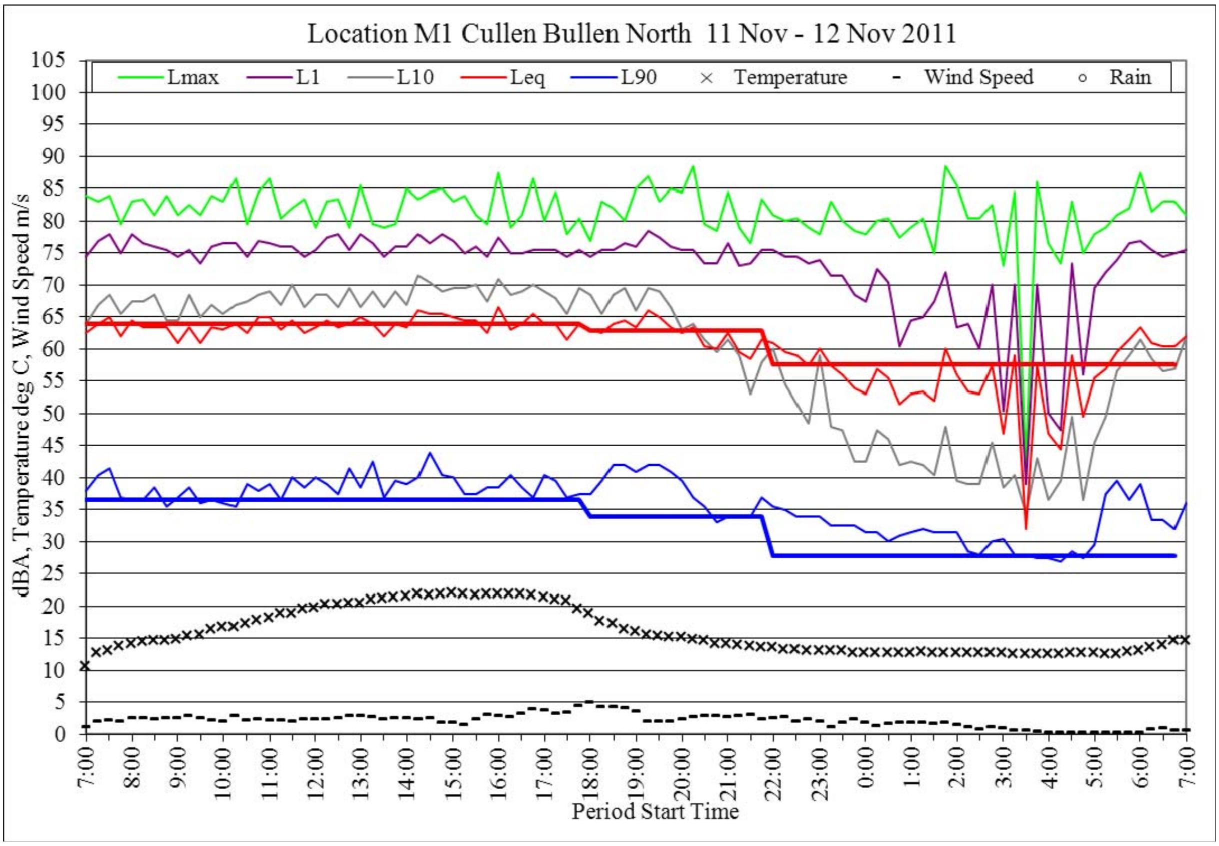
7:00
Period Start Time


Location M1 Cullen Bullen North 11 Nov - 12 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
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25
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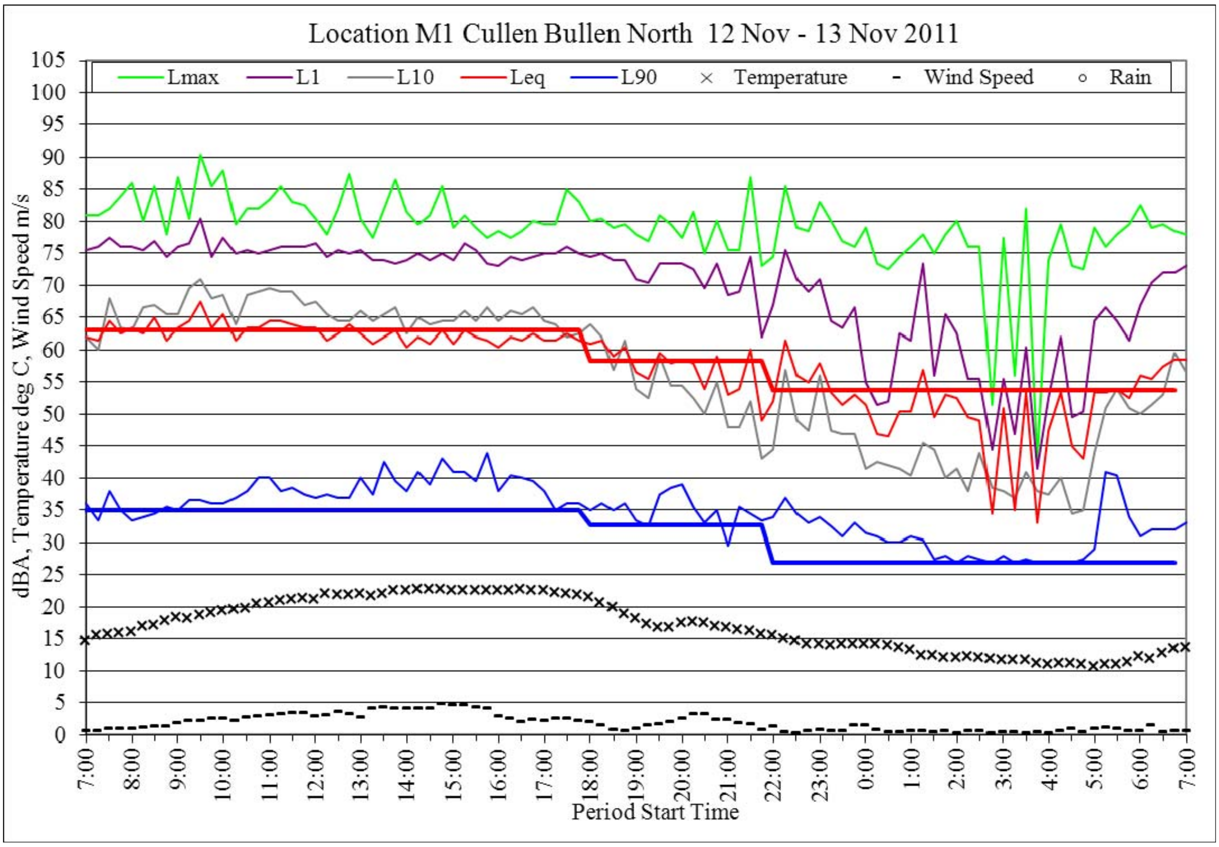
5:00
6:00
7:00
Period Start Time


Location M1 Cullen Bullen North 12 Nov - 13 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
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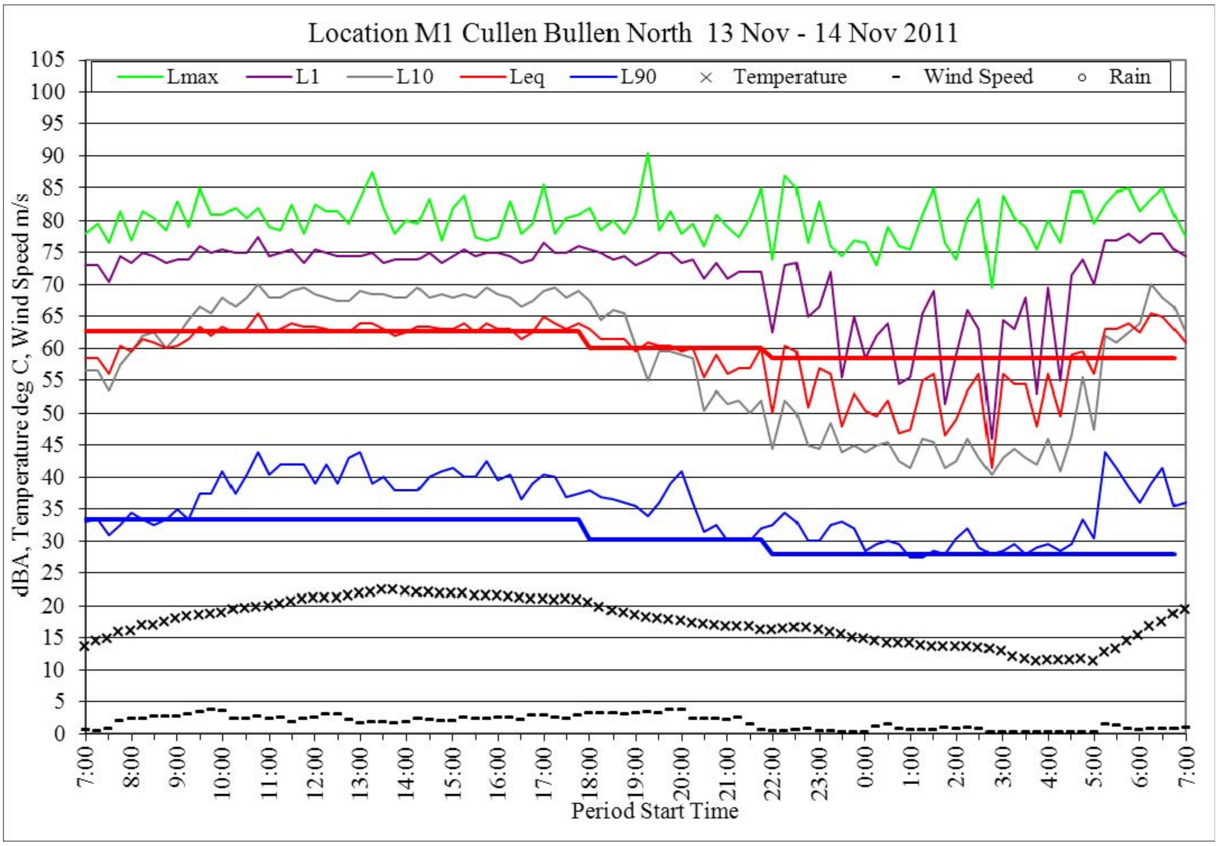
7:00
Period Start Time


Location M1 Cullen Bullen North 13 Nov - 14 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
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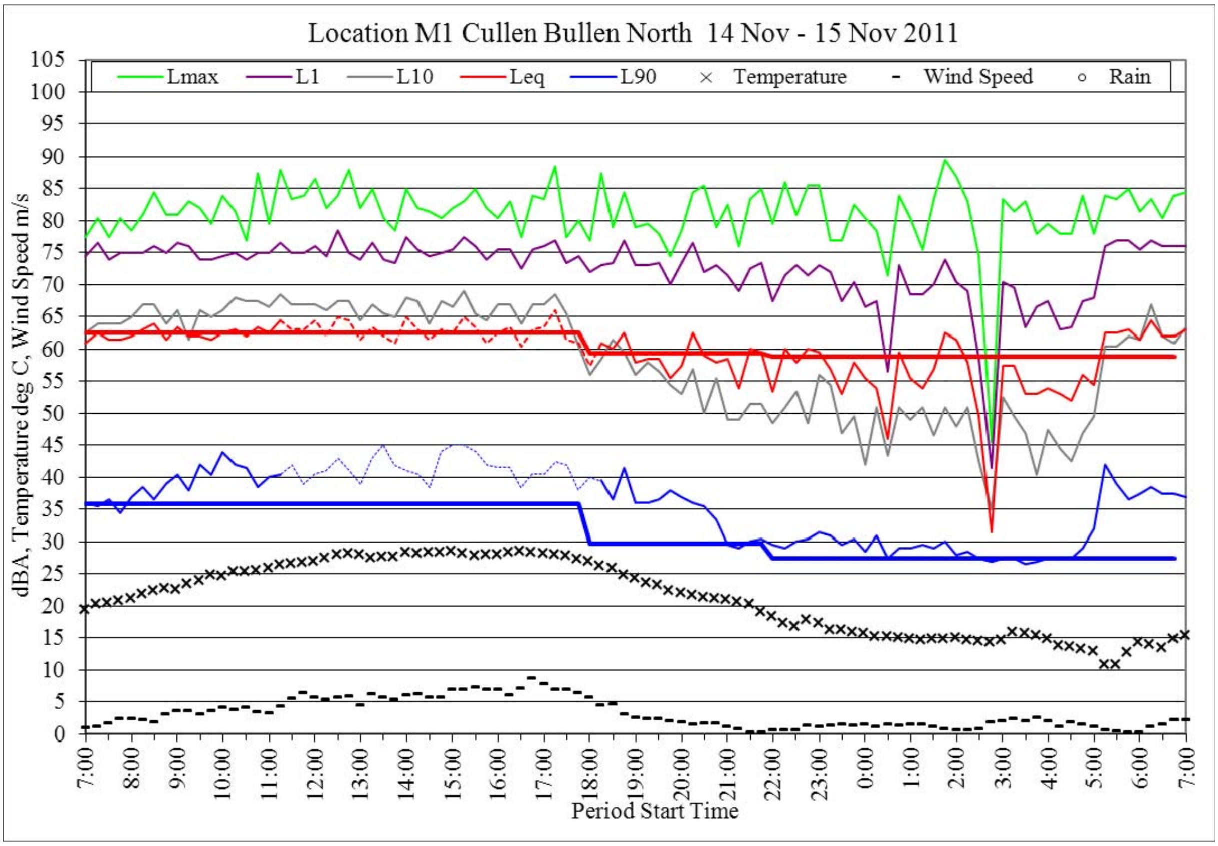
Location M1 Cullen Bullen North 14 Nov - 15 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
105
100
95
90
85
80
75
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65
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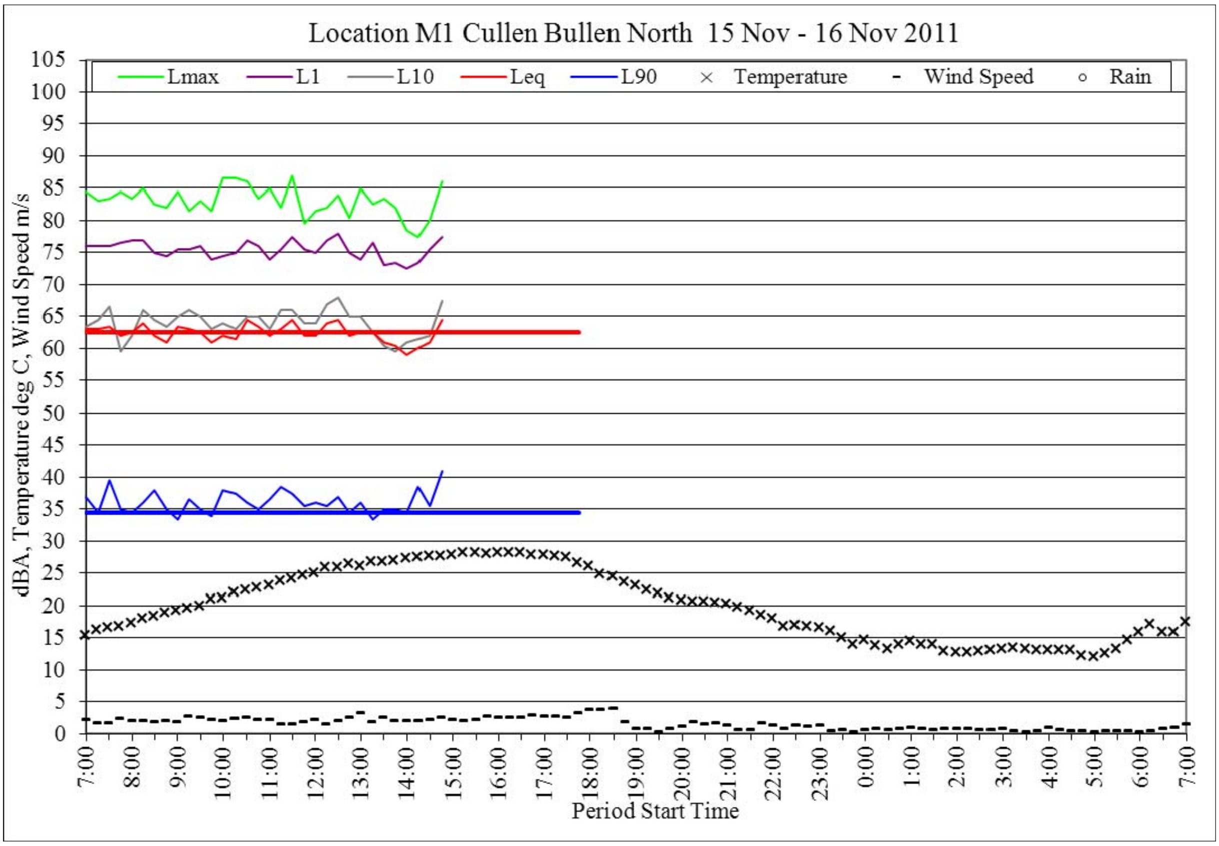
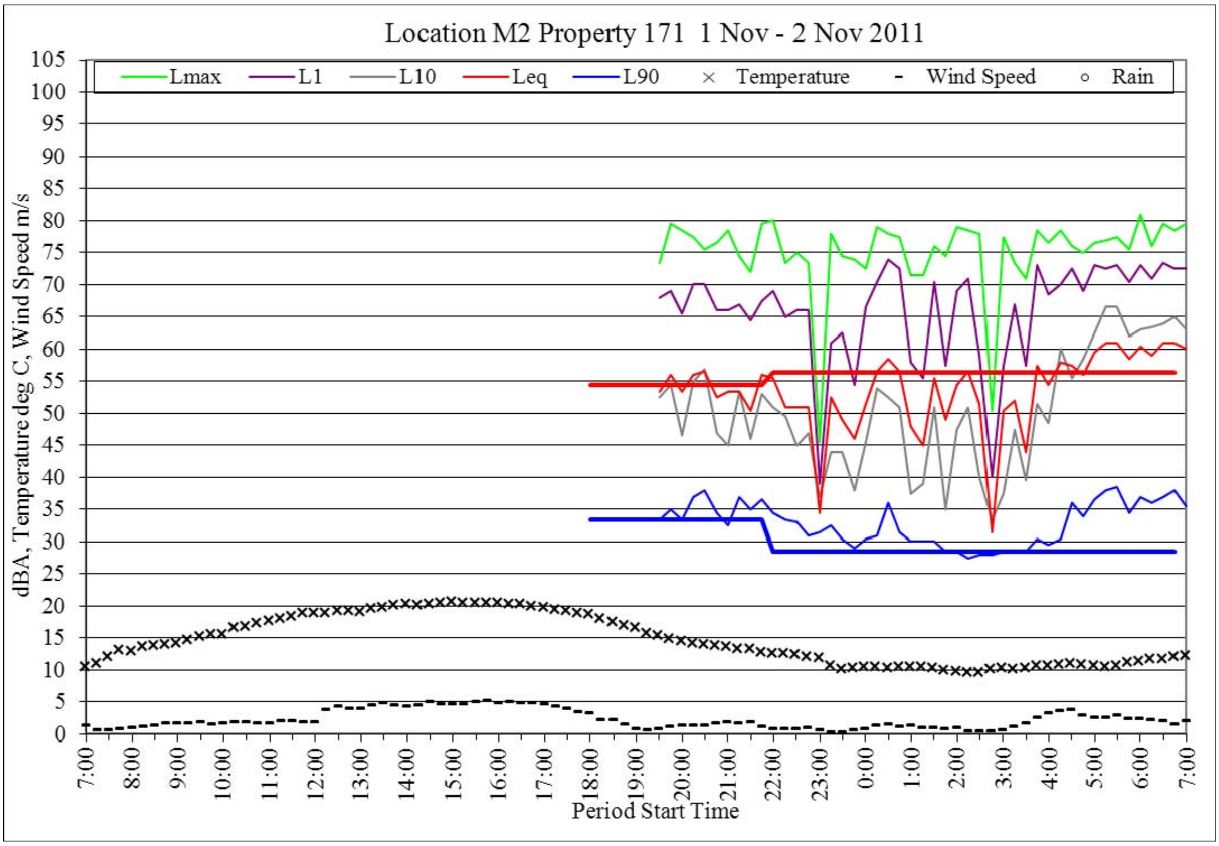
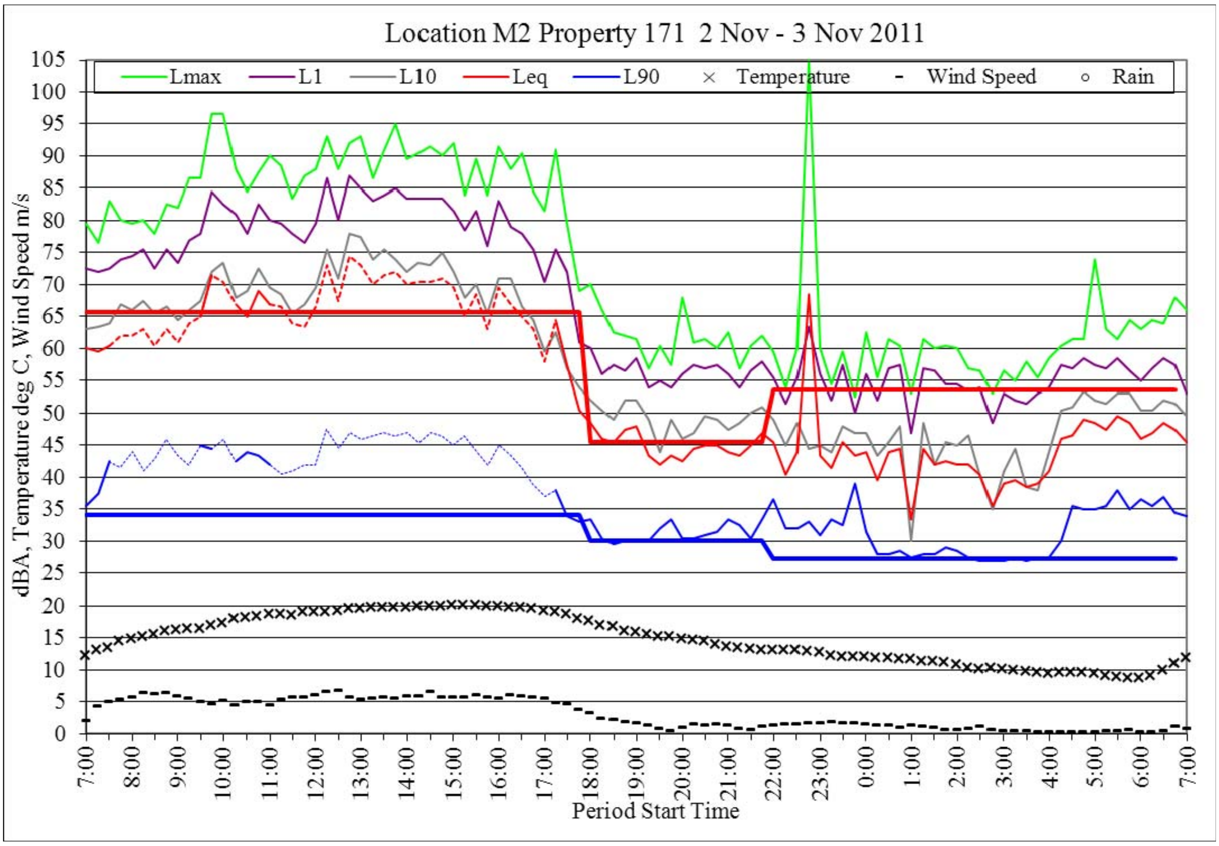
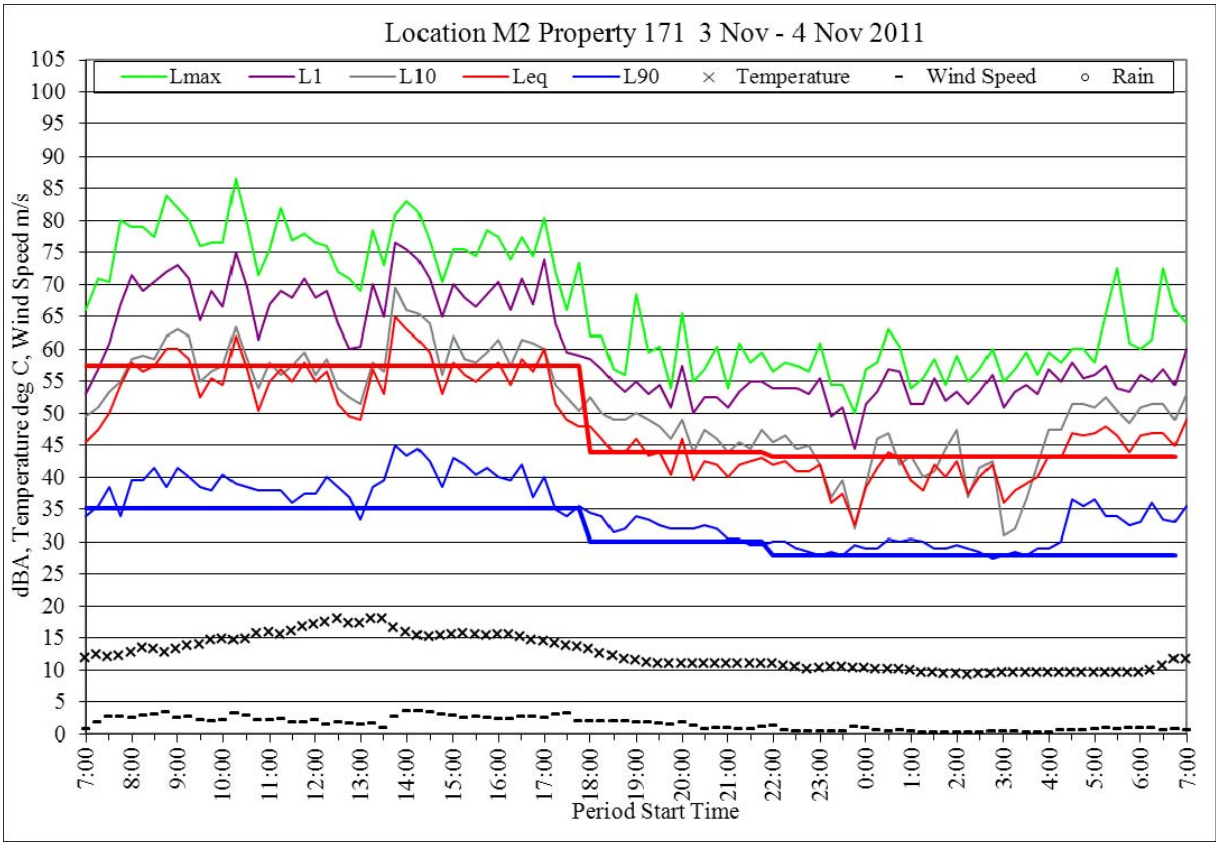
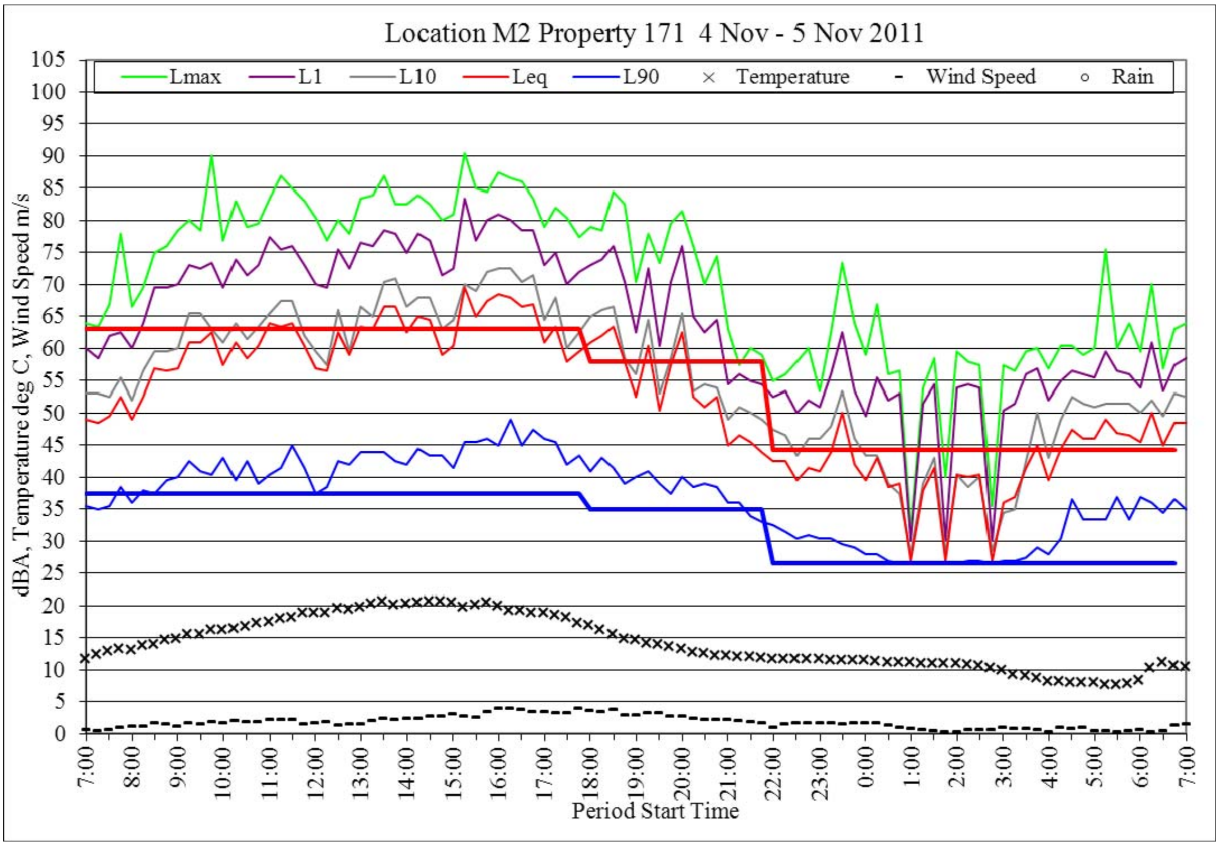

Location M1 Cullen Bullen North 15 Nov - 16 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M2 Property 171 1 Nov - 2 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M2 Property 171 2 Nov - 3 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M2 Property 171 3 Nov - 4 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time



Location M2 Property 171 4 Nov - 5 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
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0:00
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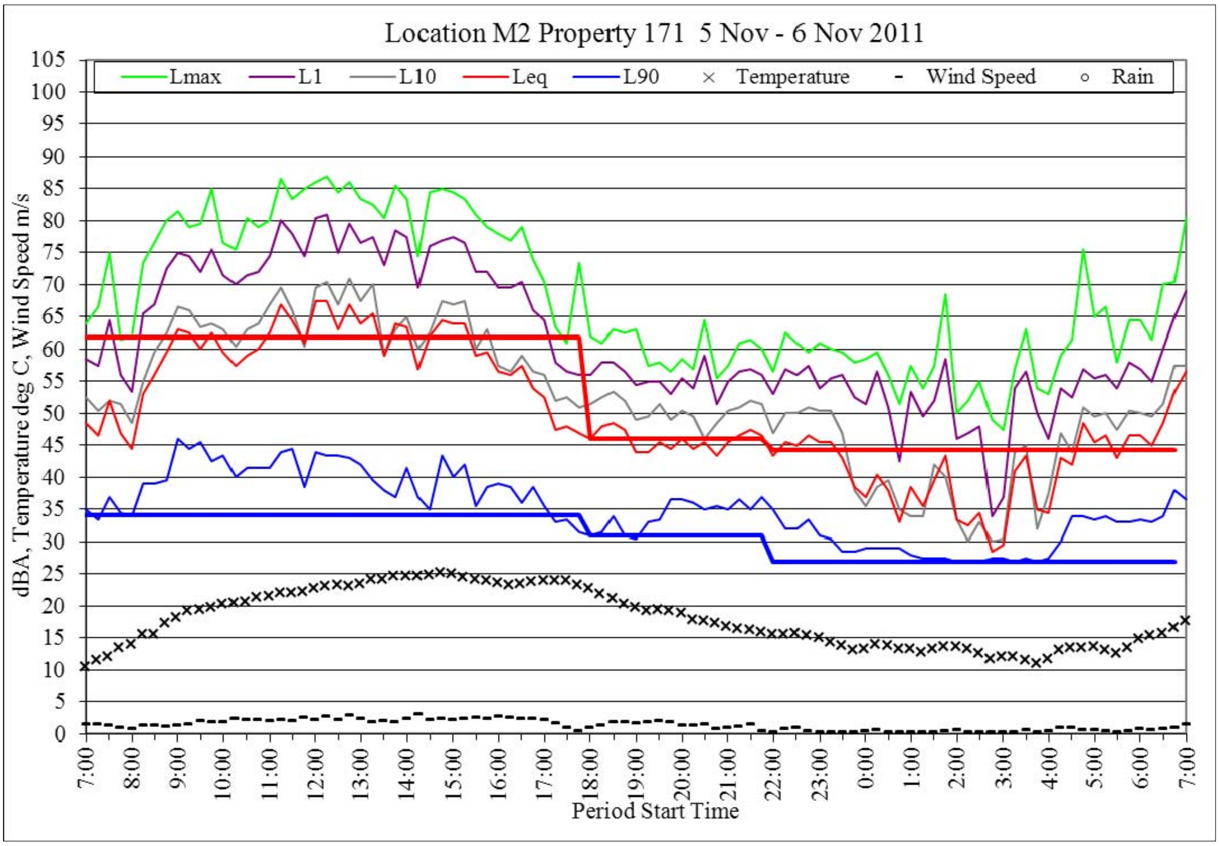
5:00
6:00
7:00
Period Start Time

Location M2 Property 171 5 Nov - 6 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
7:00
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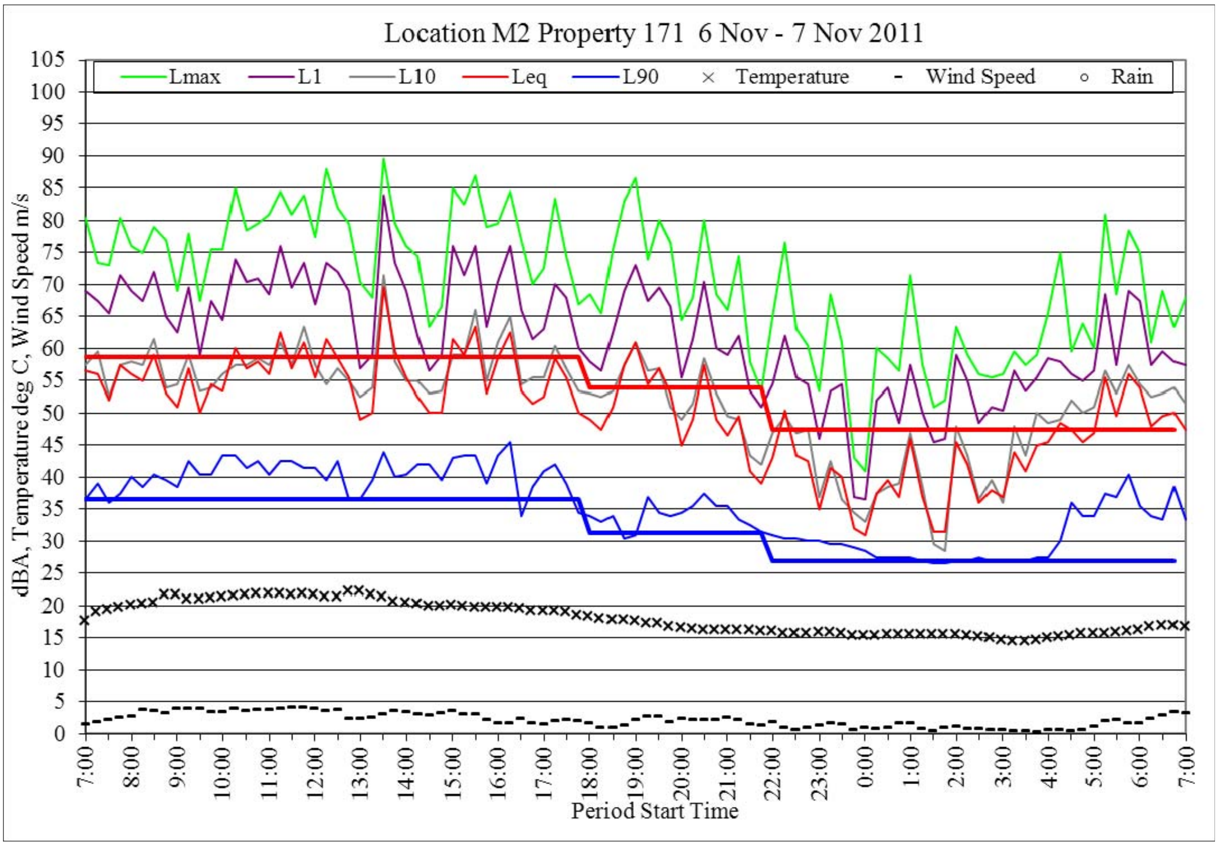
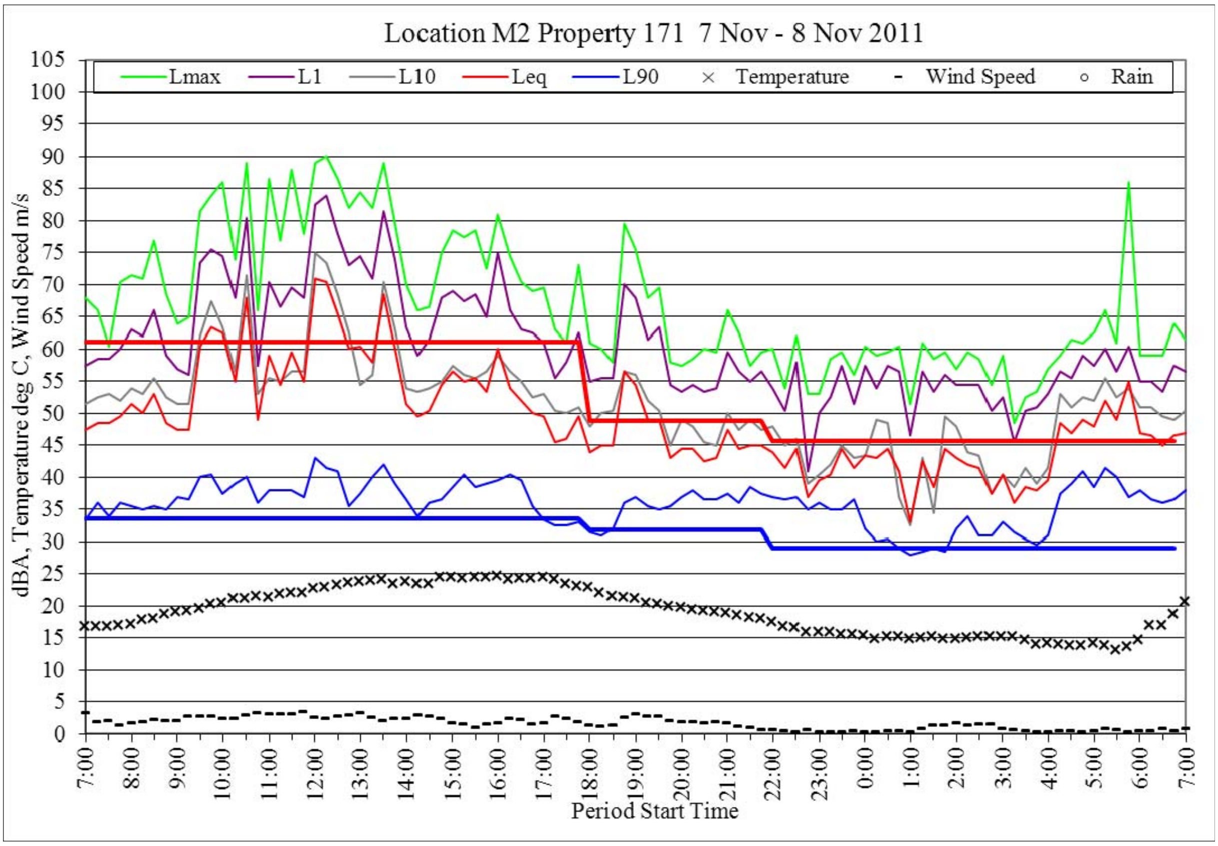
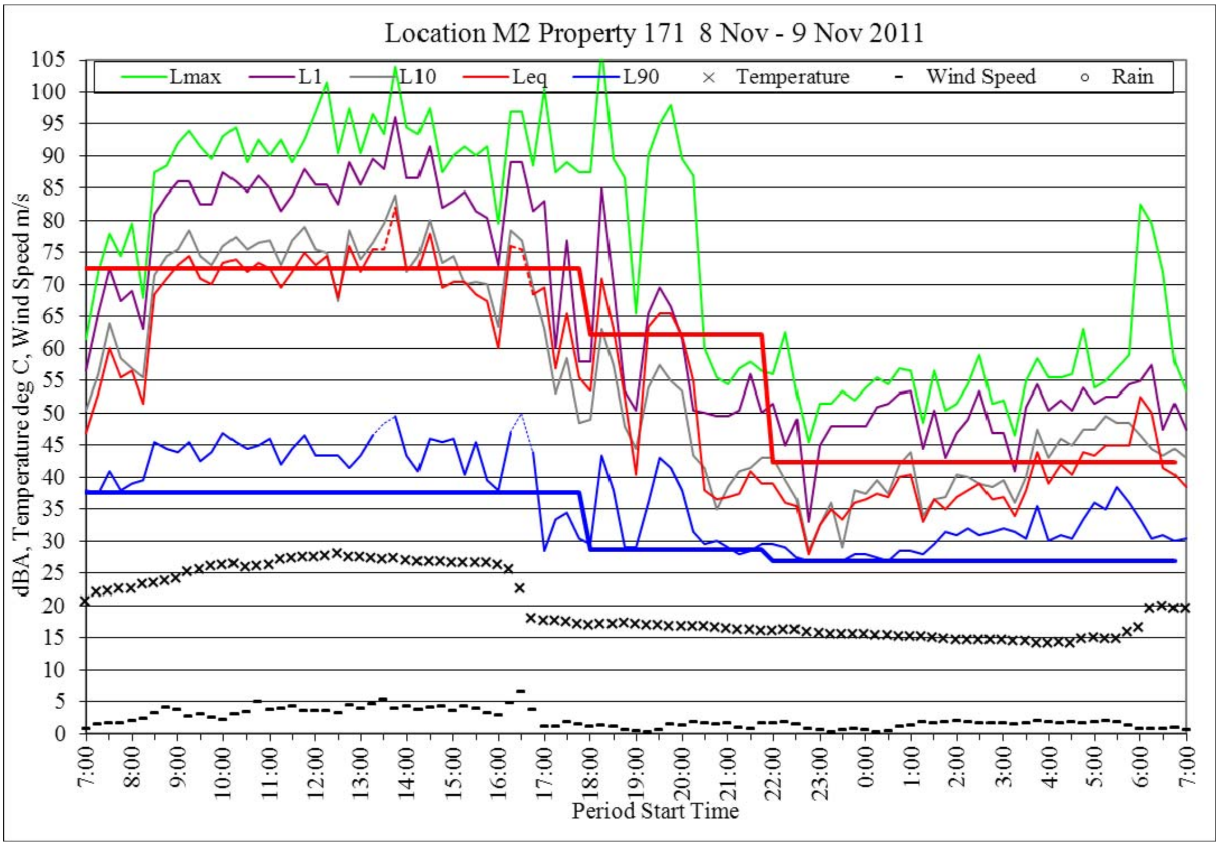
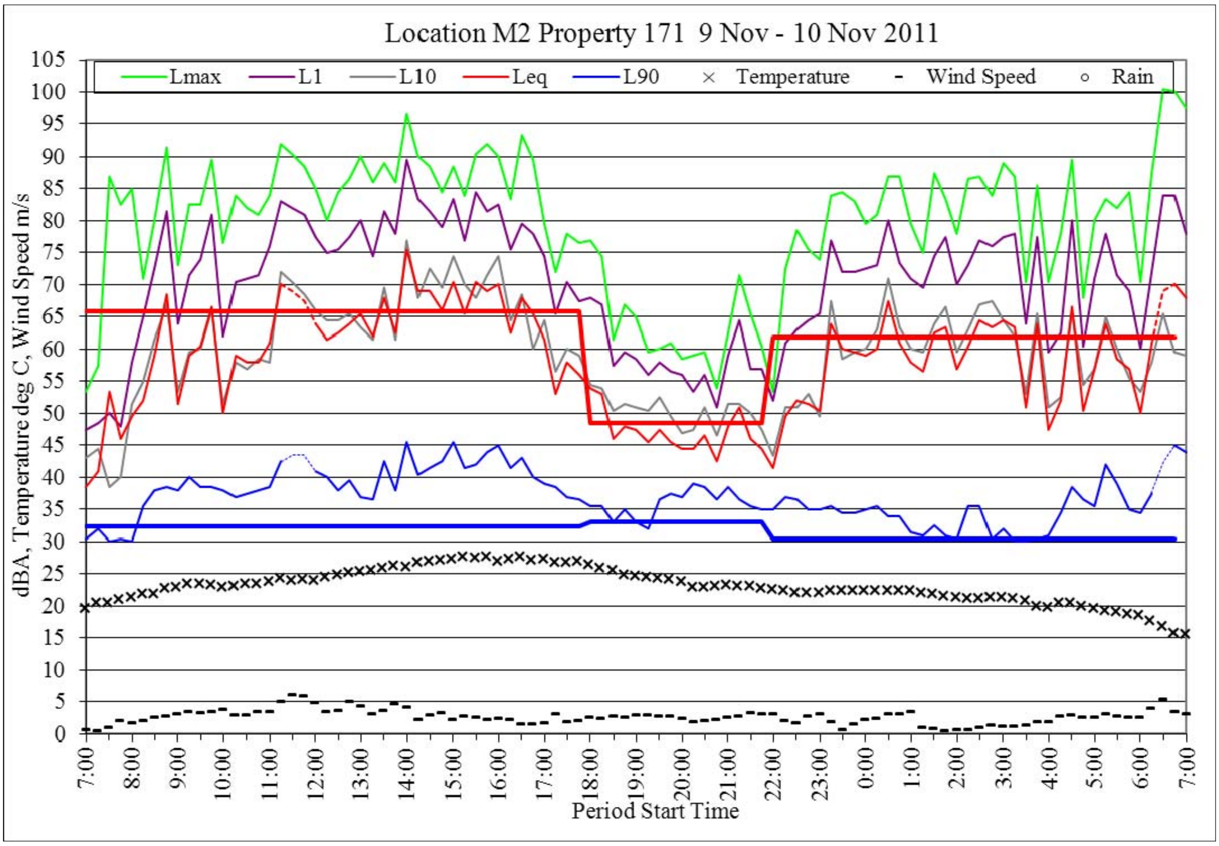
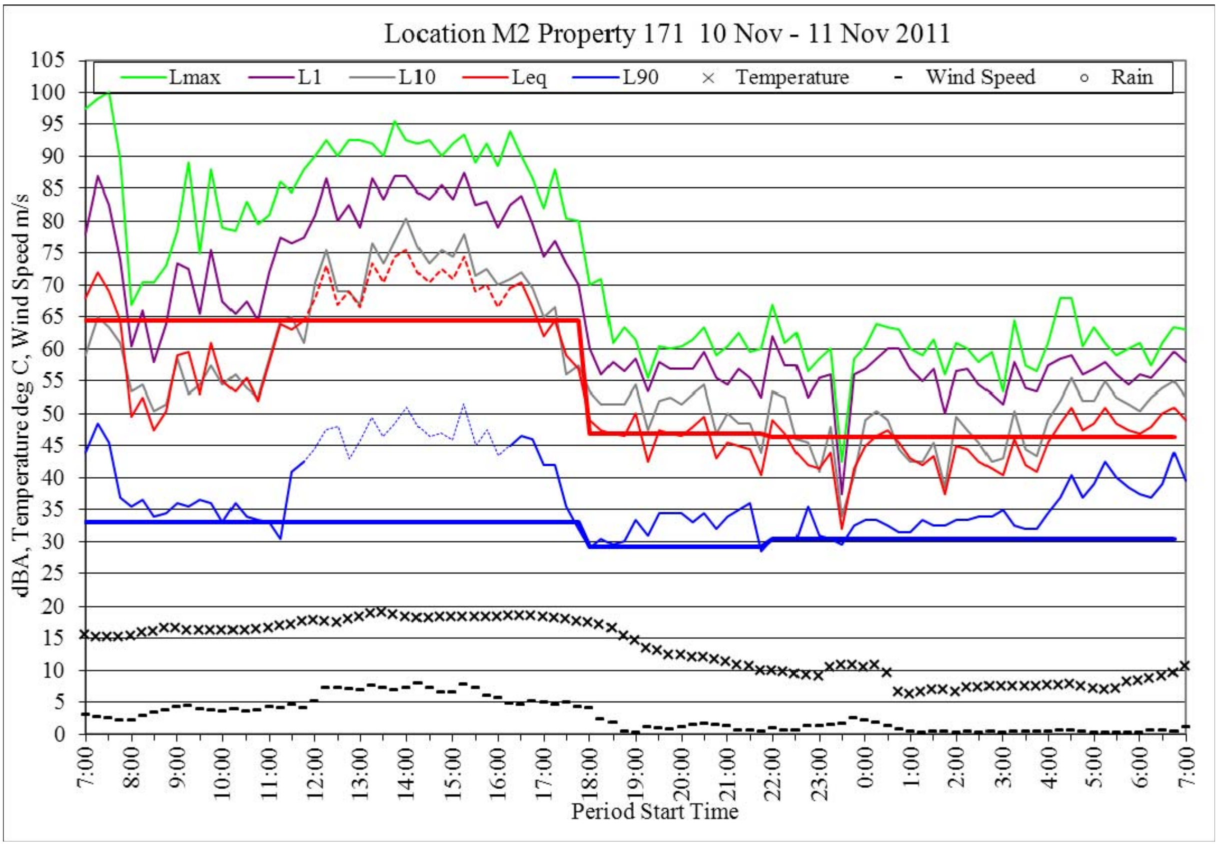
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
Period Start Time


Location M2 Property 171 6 Nov - 7 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

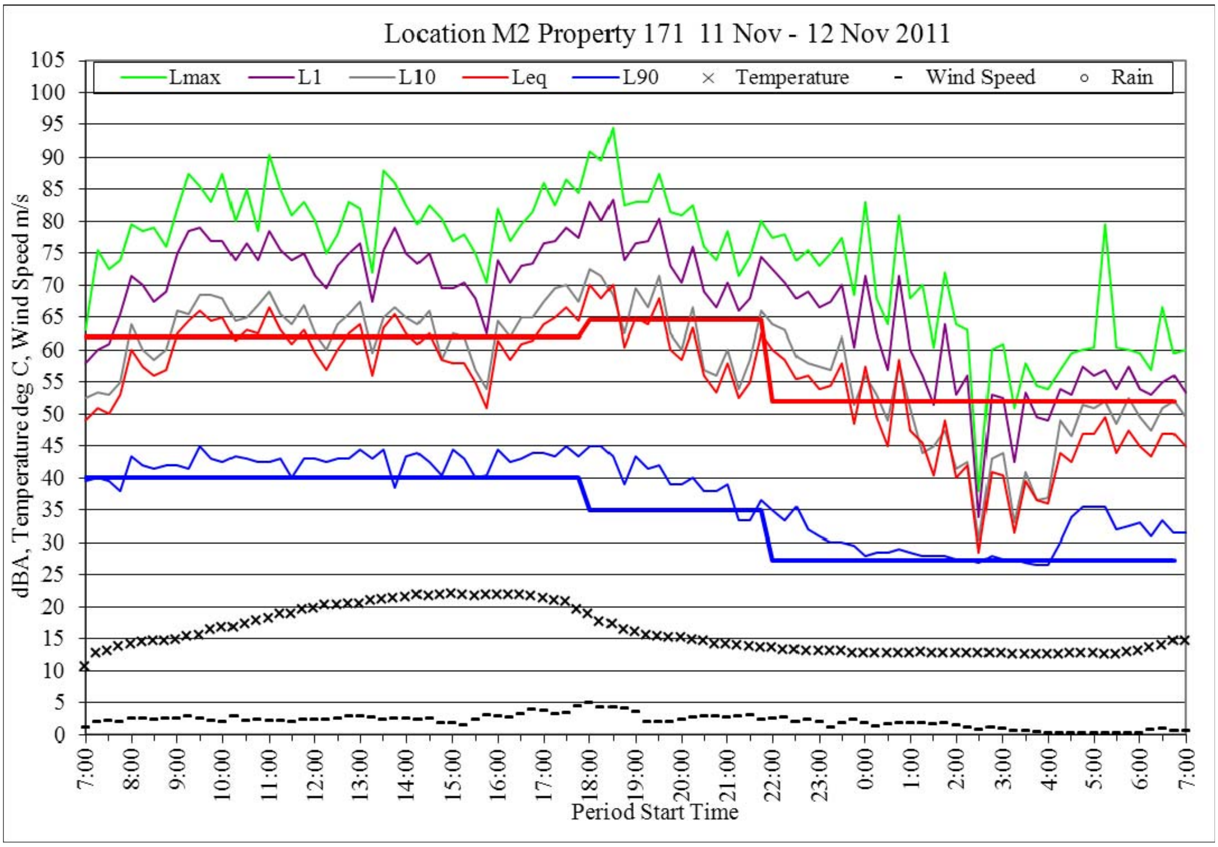

Location M2 Property 171 7 Nov - 8 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M2 Property 171 8 Nov - 9 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

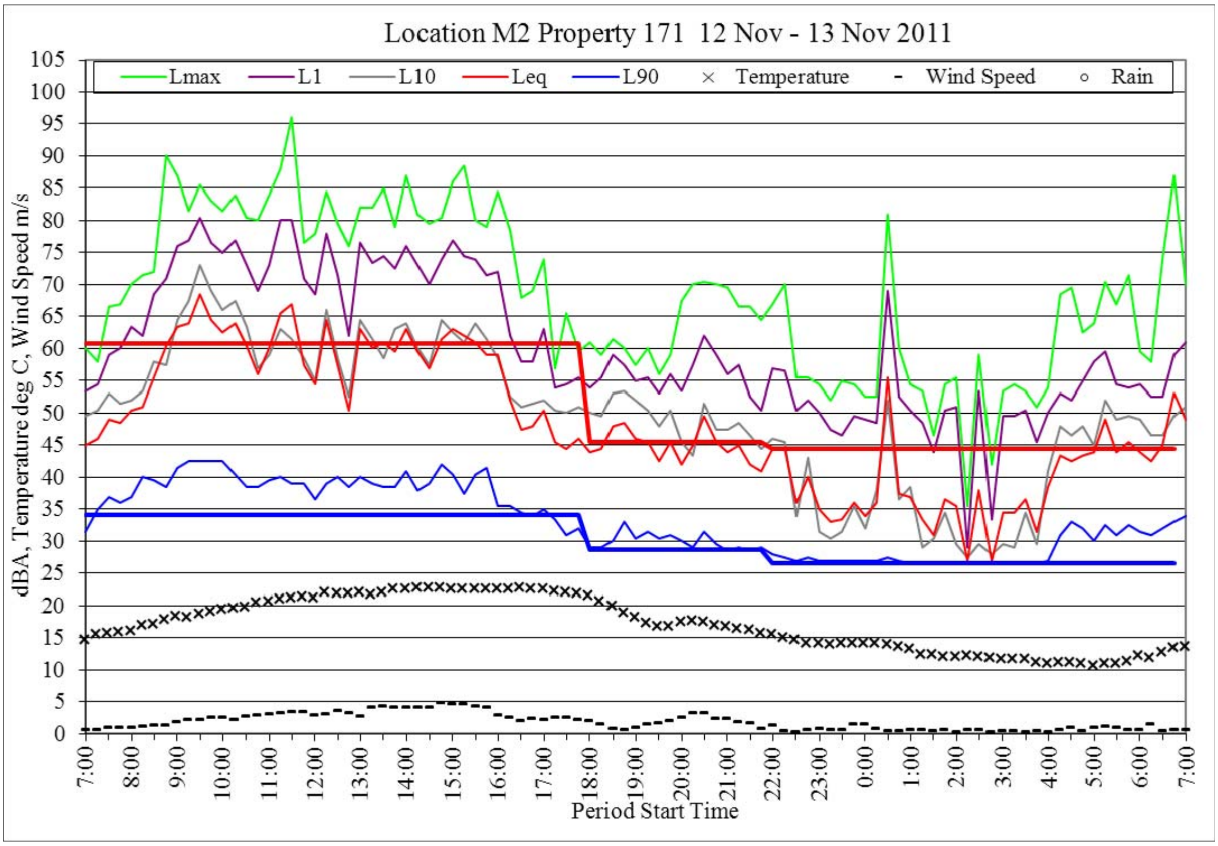

Location M2 Property 171 9 Nov - 10 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time



Location M2 Property 171 10 Nov - 11 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

Location M2 Property 171 11 Nov - 12 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M2 Property 171 12 Nov - 13 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
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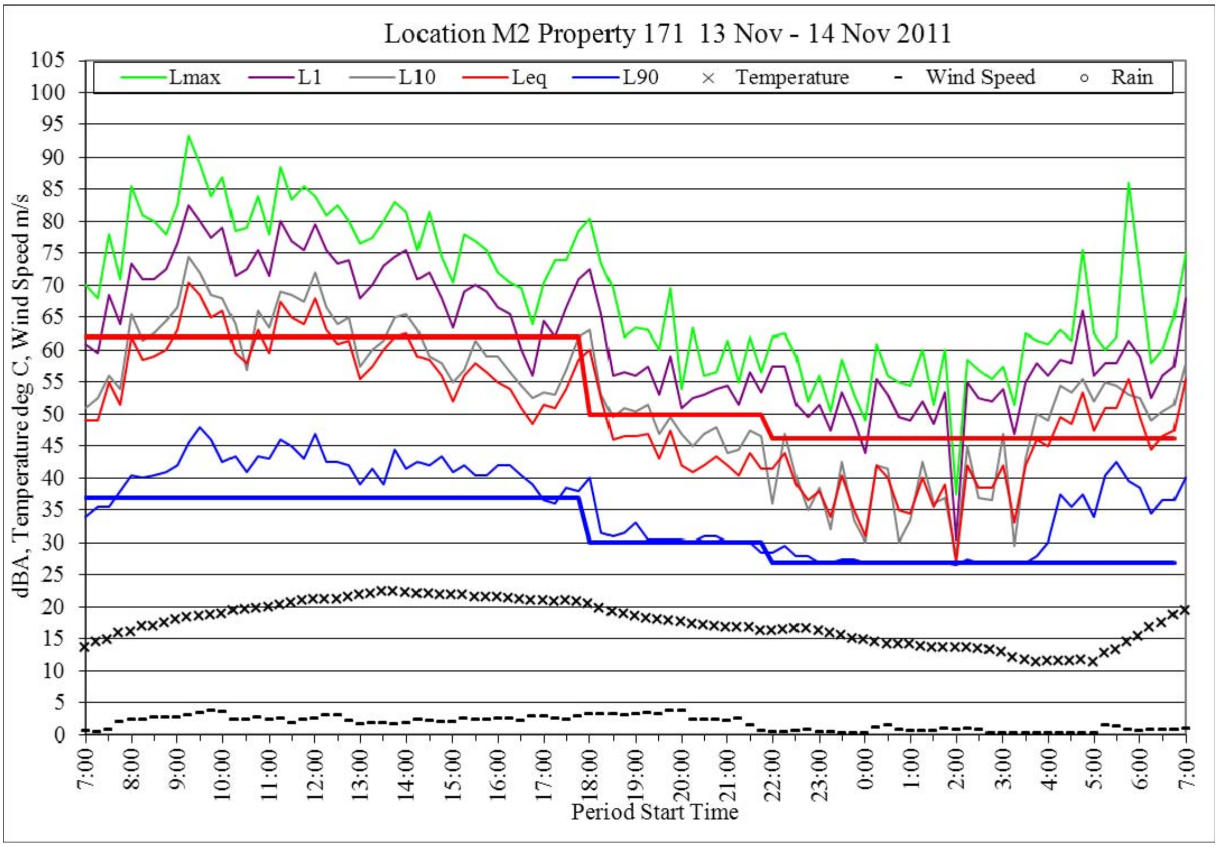
7:00
Period Start Time


Location M2 Property 171 13 Nov - 14 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
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75
70
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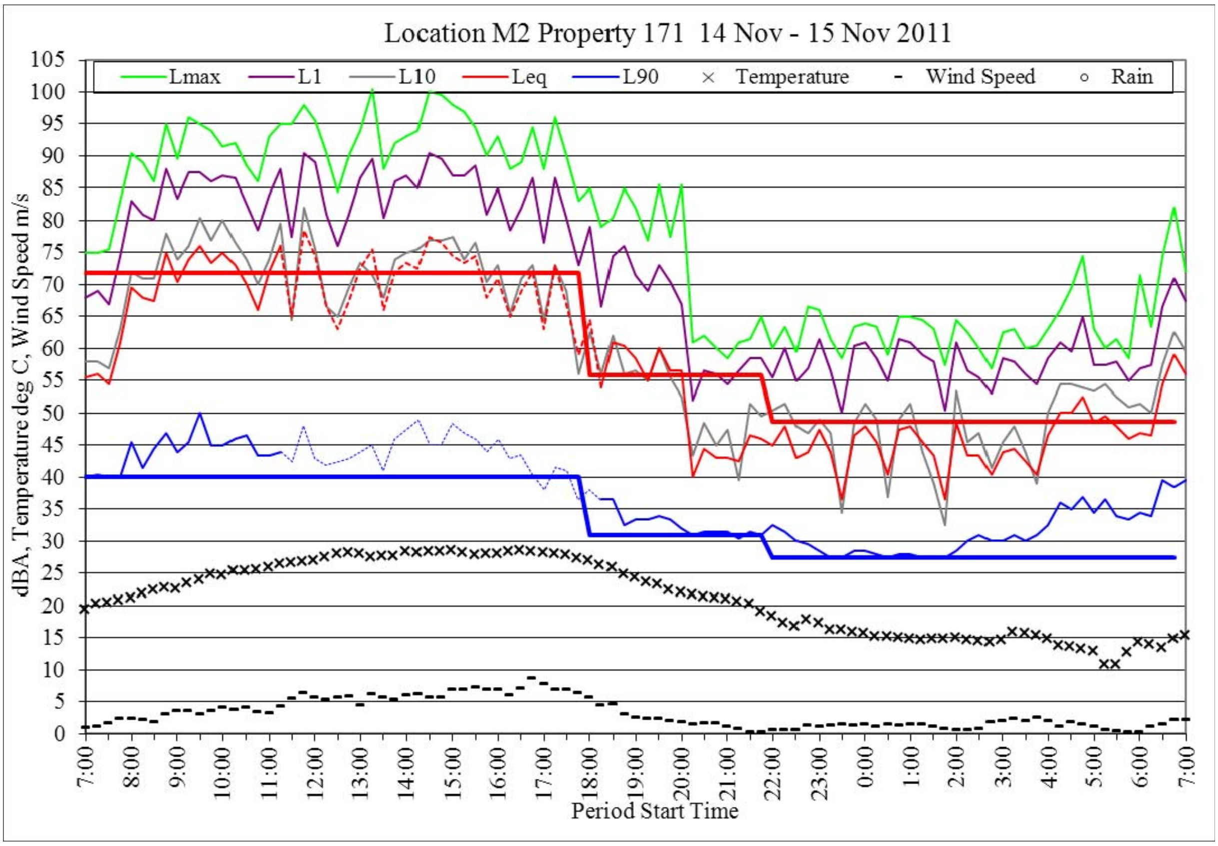
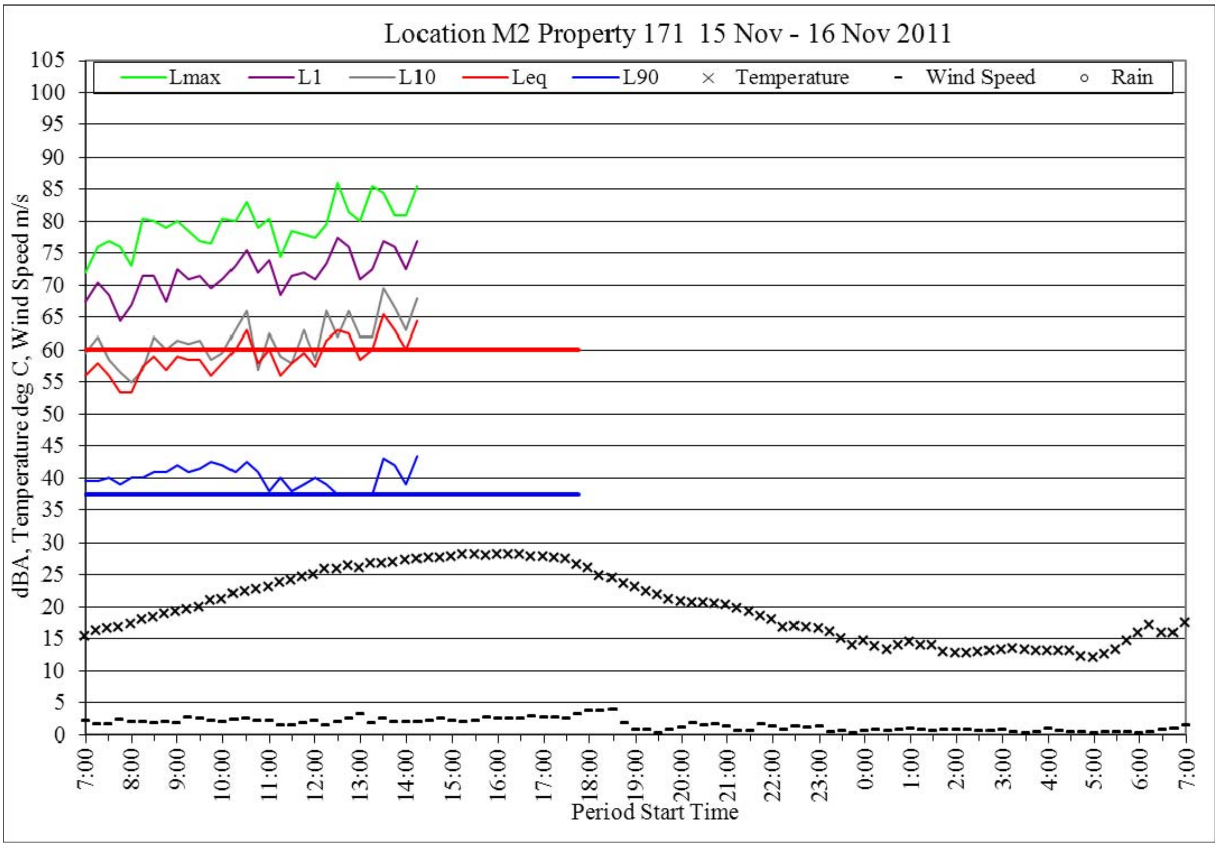
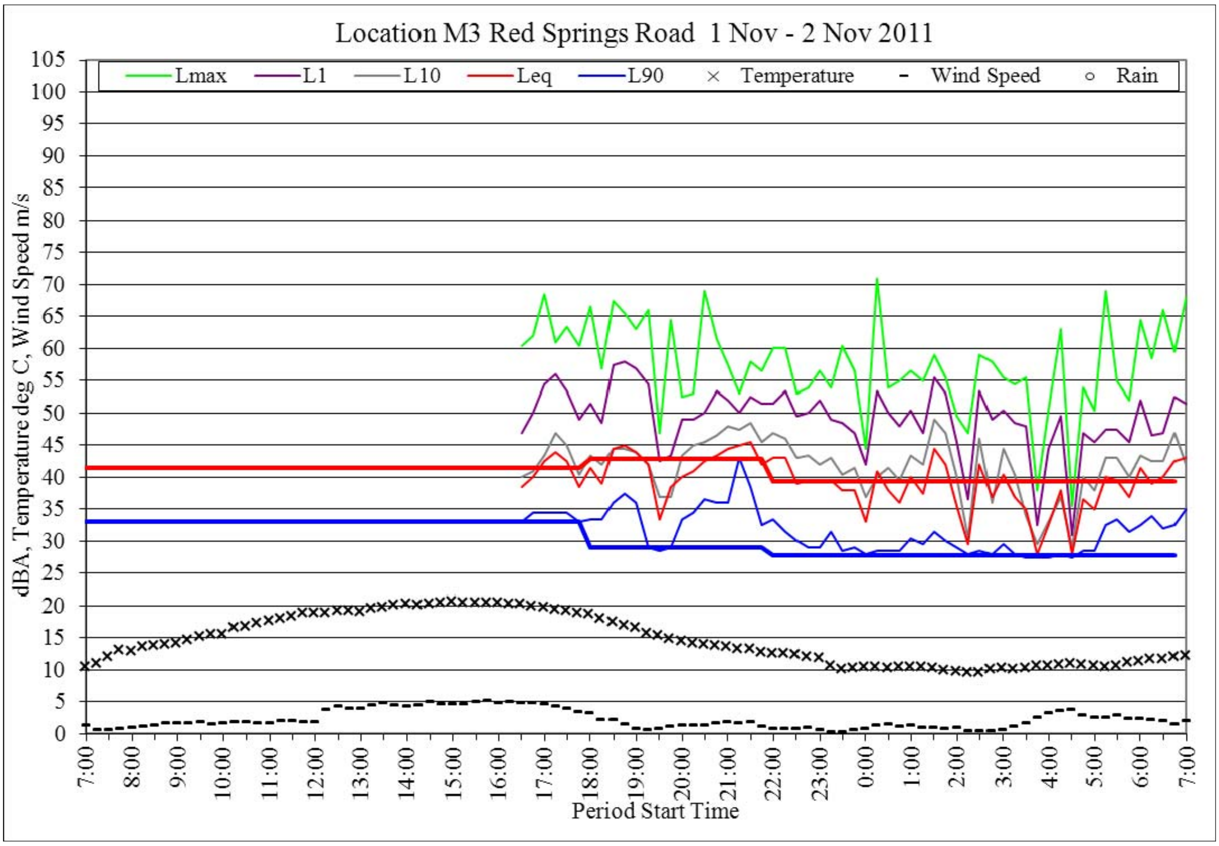
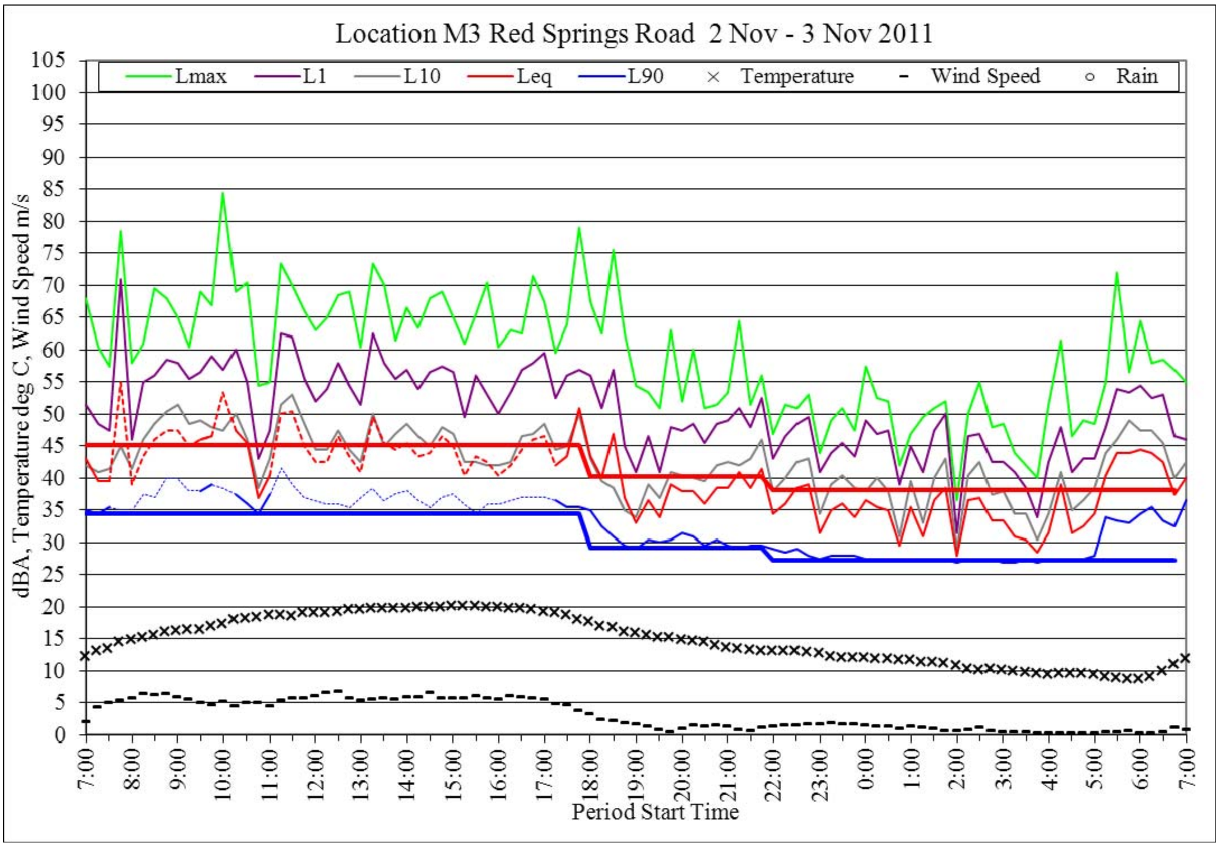
7:00
Period Start Time

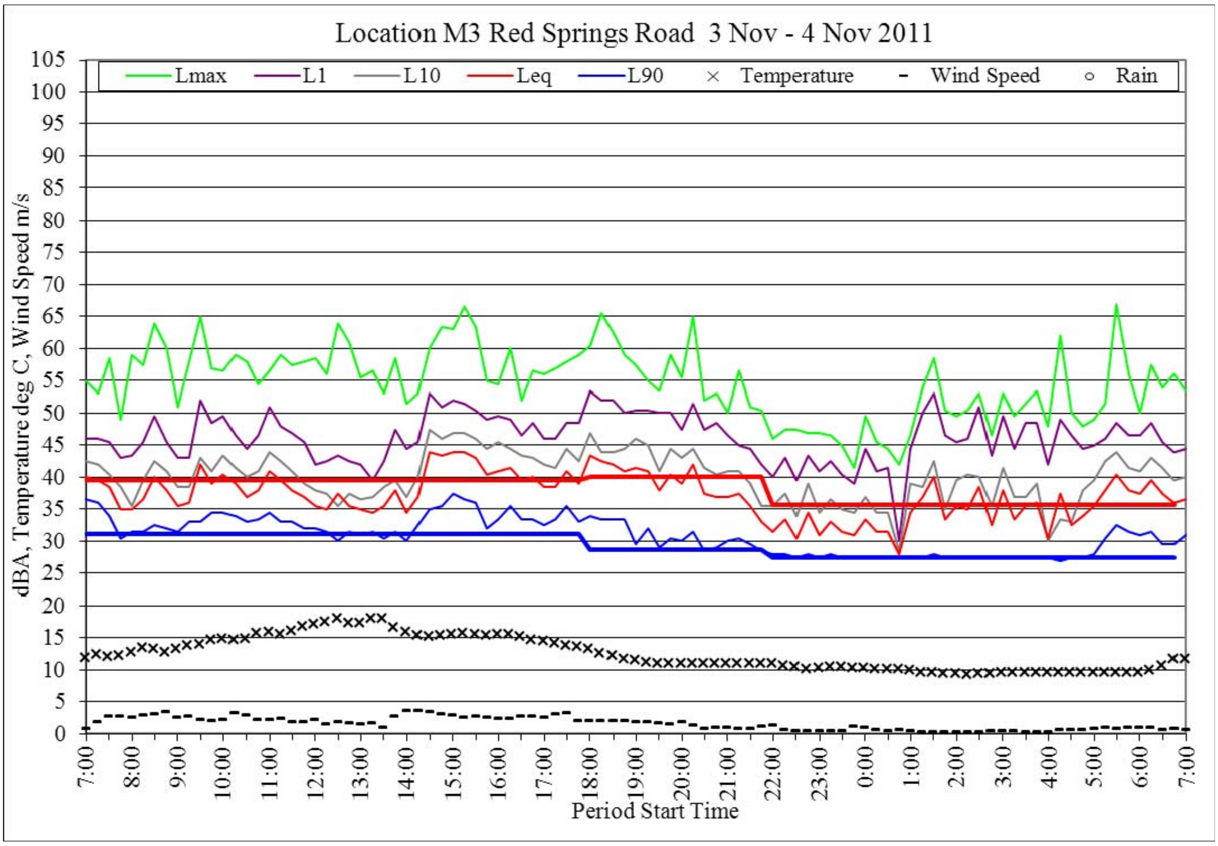



BRIDGES Acoustics


Location M3 Red Springs Road 1 Nov - 2 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M3 Red Springs Road 2 Nov - 3 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time



Location M3 Red Springs Road 3 Nov - 4 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
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85
80
75
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65
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45
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25
20
15
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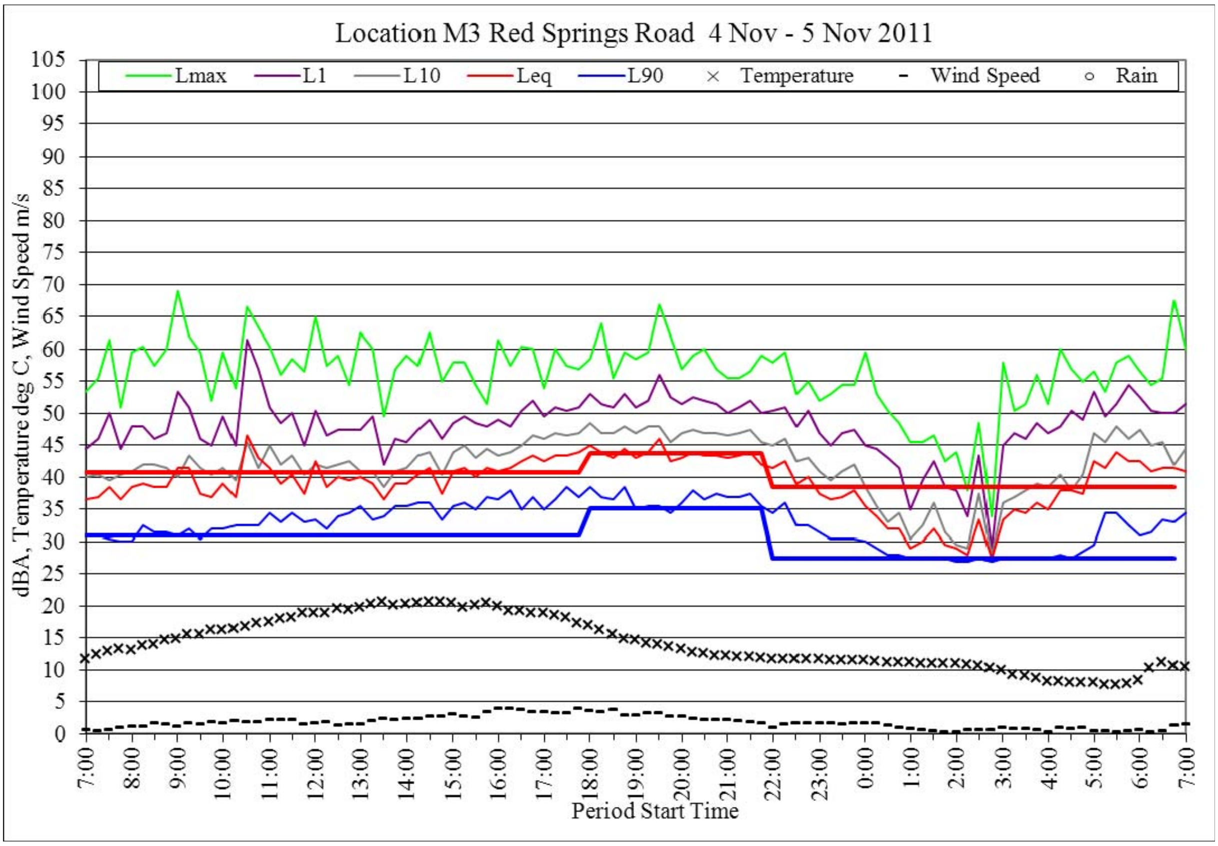
Period Start Time

Location M3 Red Springs Road 4 Nov - 5 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
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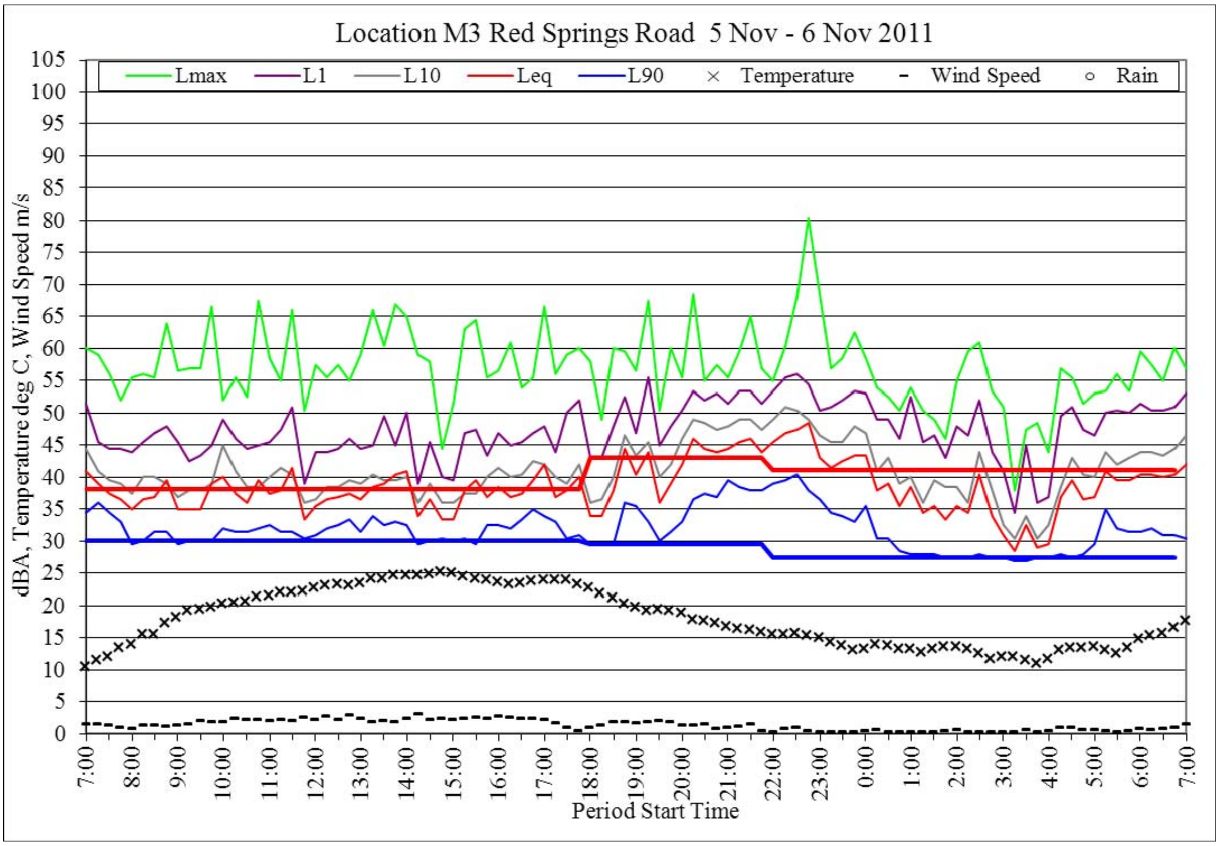
7:00
Period Start Time


Location M3 Red Springs Road 5 Nov - 6 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
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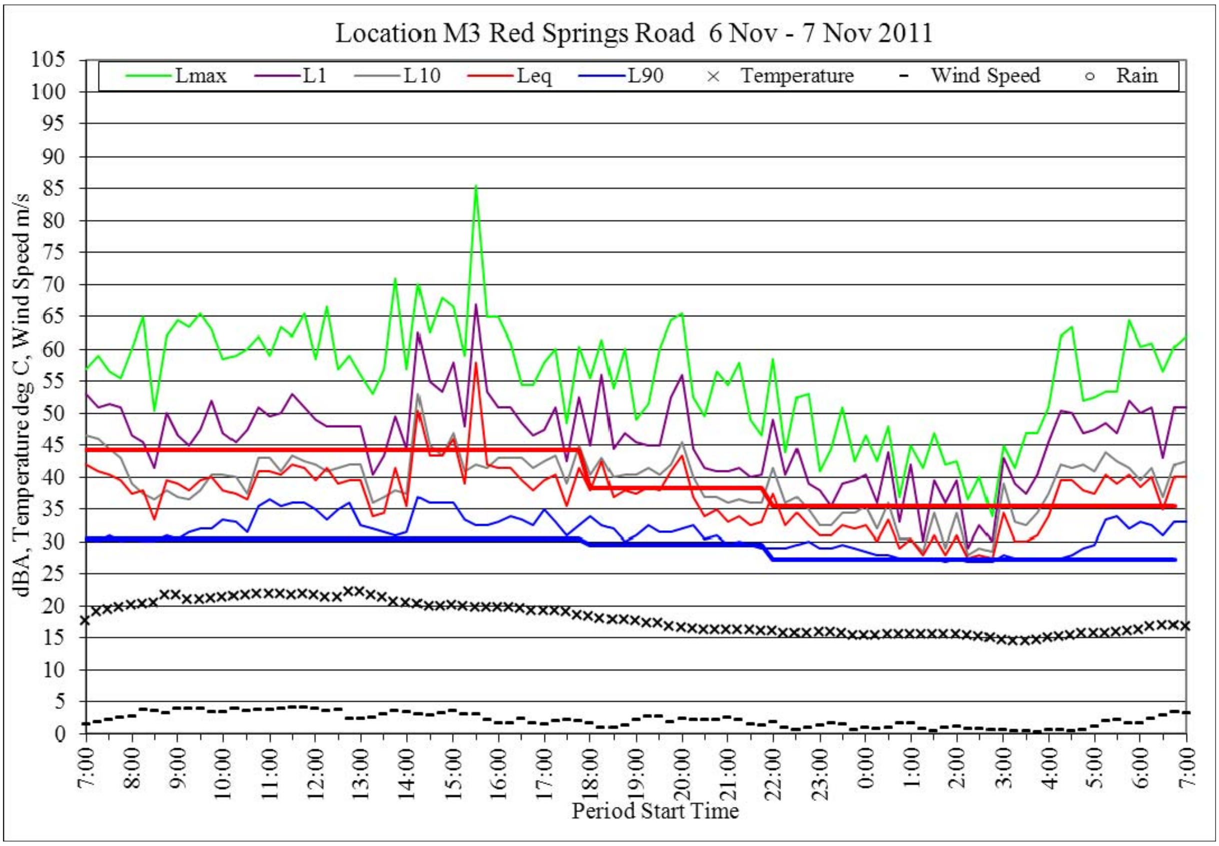
Period Start Time


Location M3 Red Springs Road 6 Nov - 7 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
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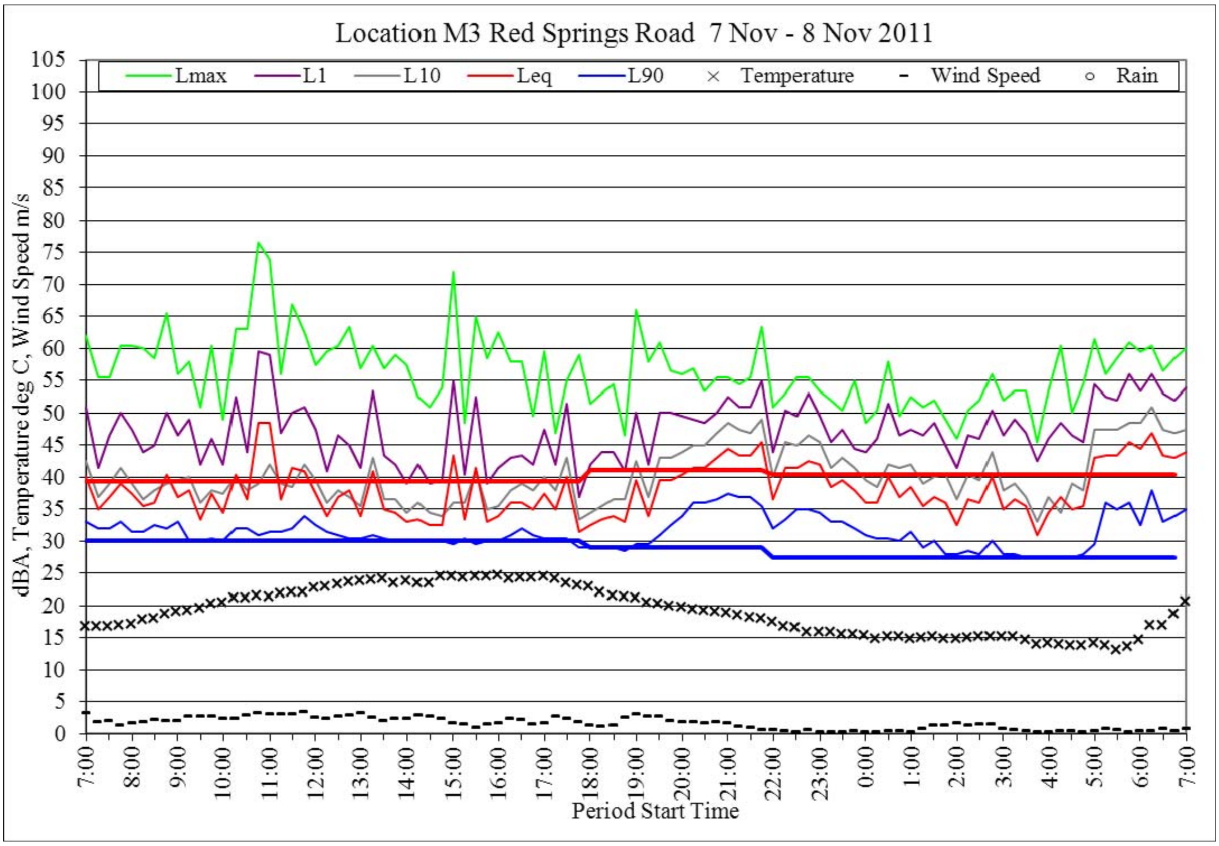
Period Start Time


Location M3 Red Springs Road 7 Nov - 8 Nov 2011
Lmax
L1
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Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
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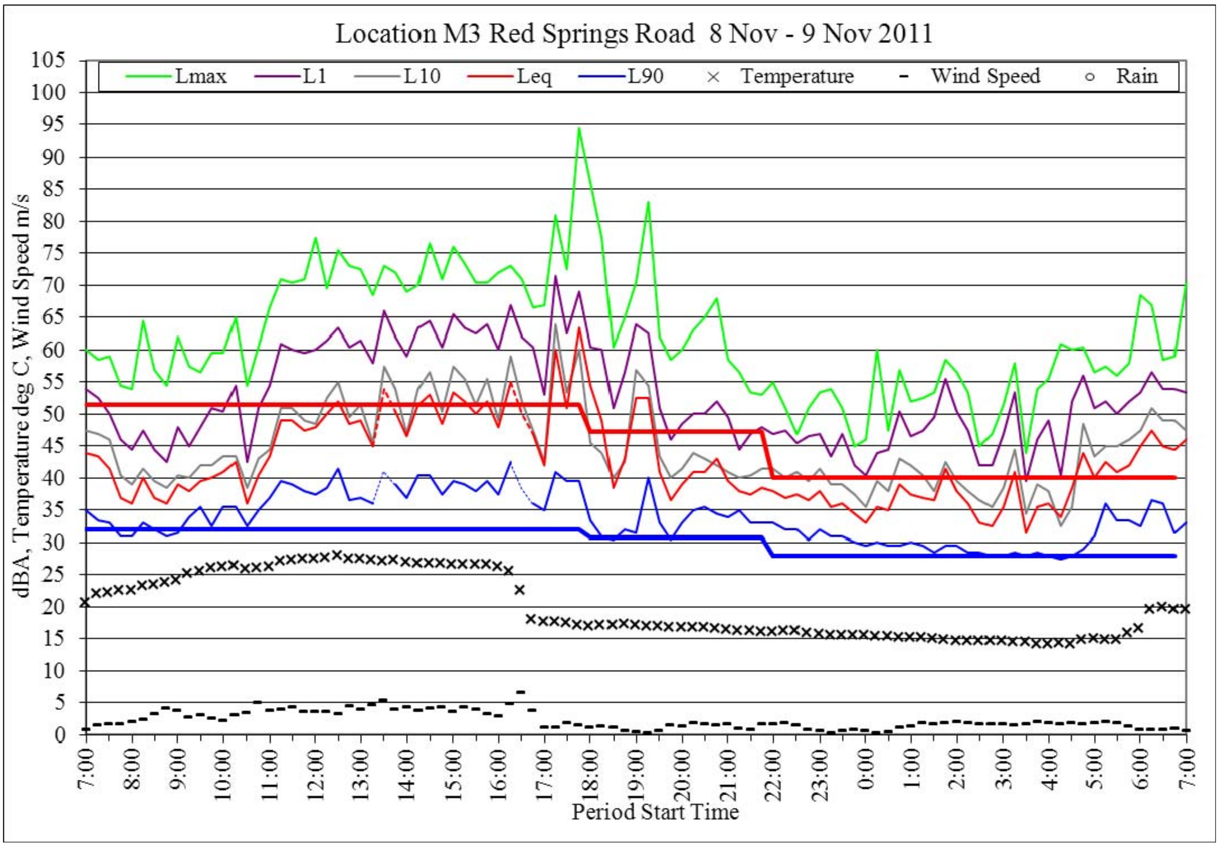
Location M3 Red Springs Road 8 Nov - 9 Nov 2011
Lmax
L1
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Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
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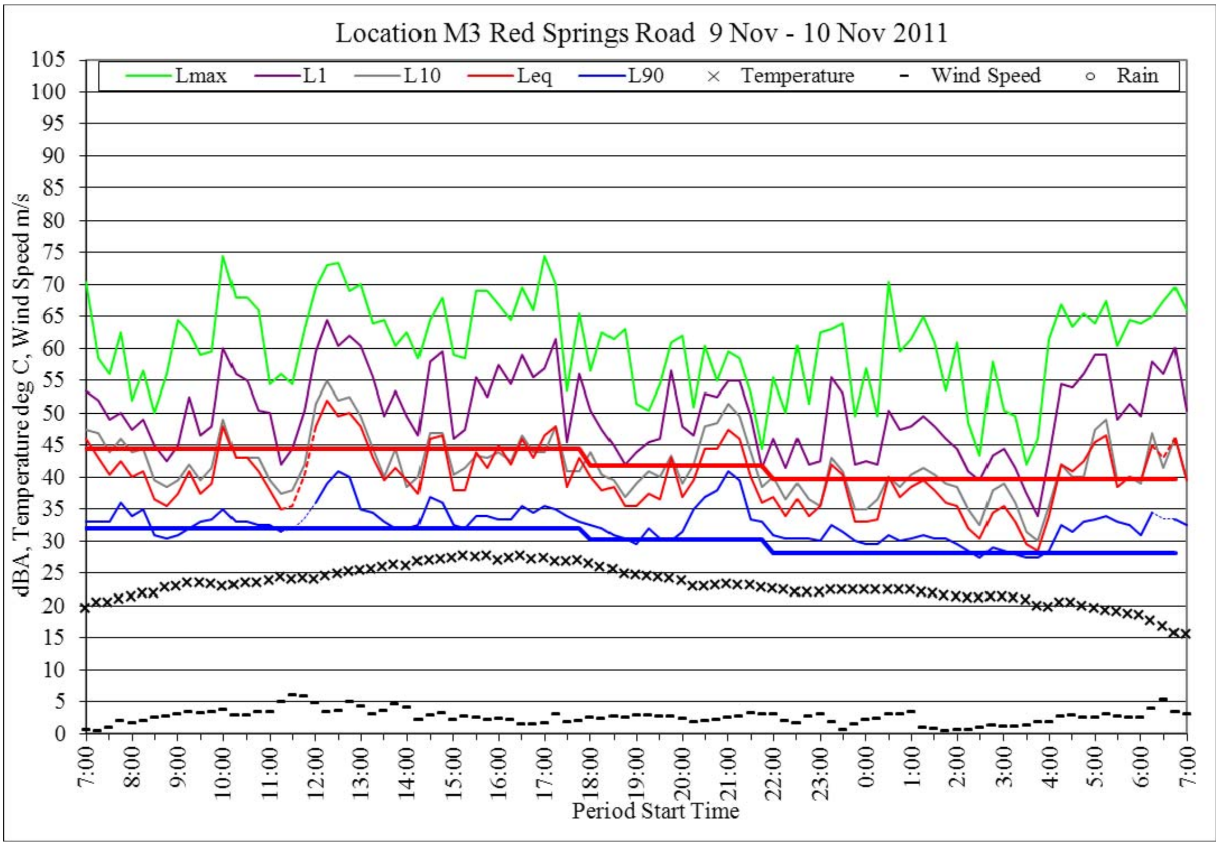

Location M3 Red Springs Road 9 Nov - 10 Nov 2011
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Leq
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Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
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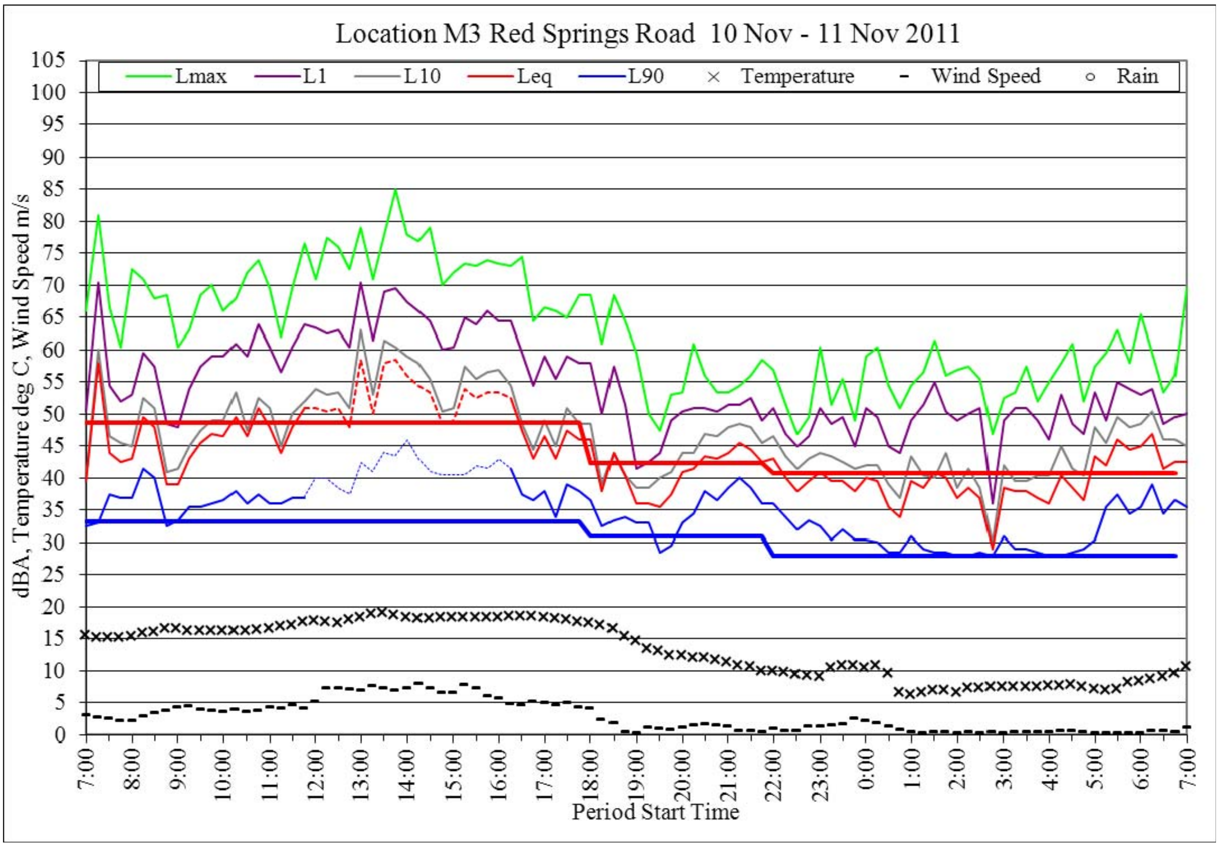

Location M3 Red Springs Road 10 Nov - 11 Nov 2011
Lmax
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Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
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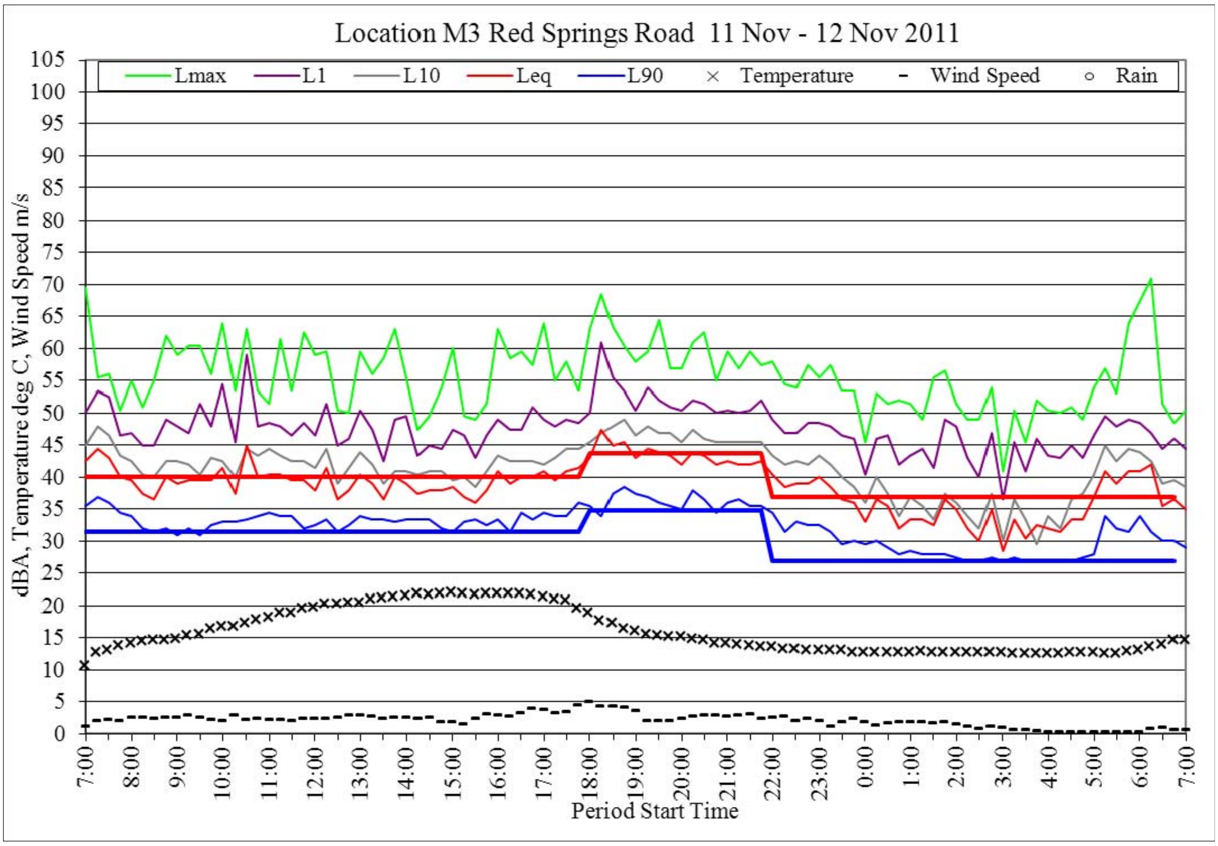
Location M3 Red Springs Road 11 Nov - 12 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
105
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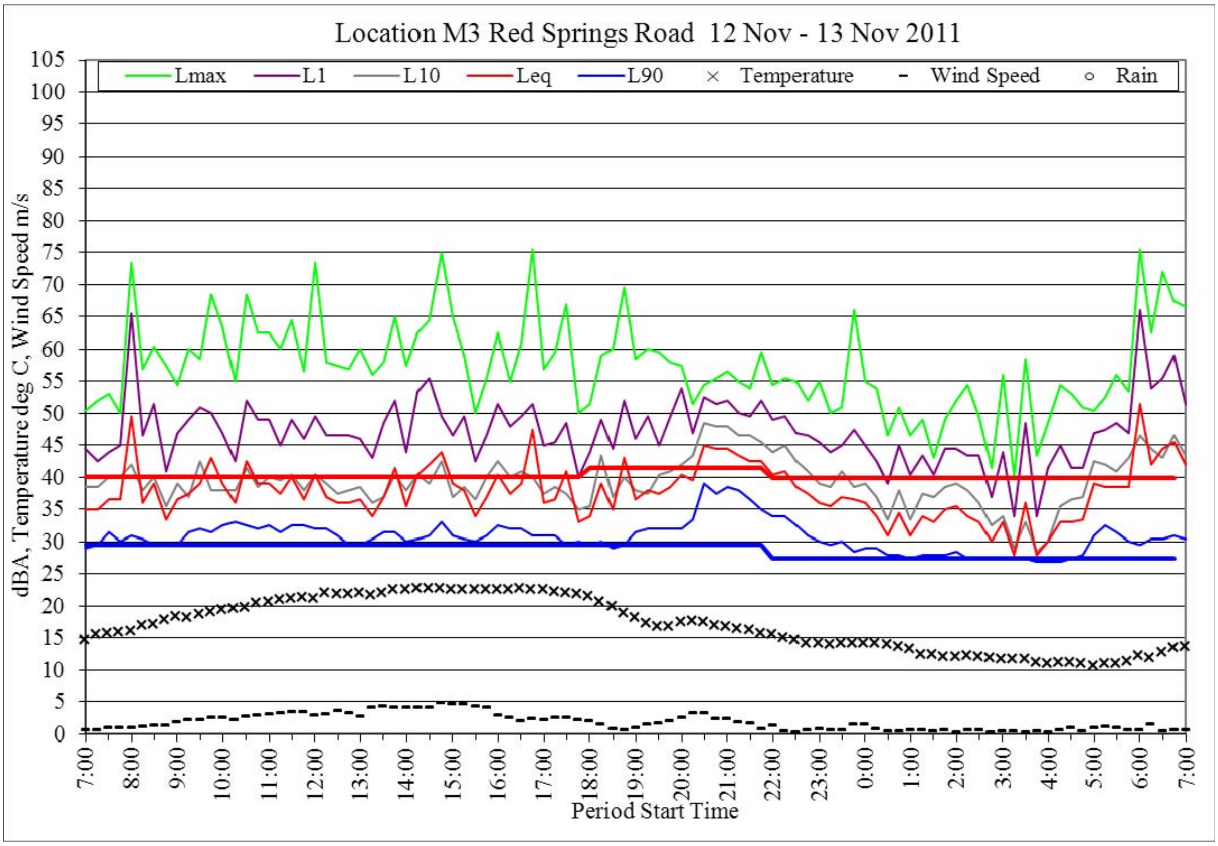
Location M3 Red Springs Road 12 Nov - 13 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
105
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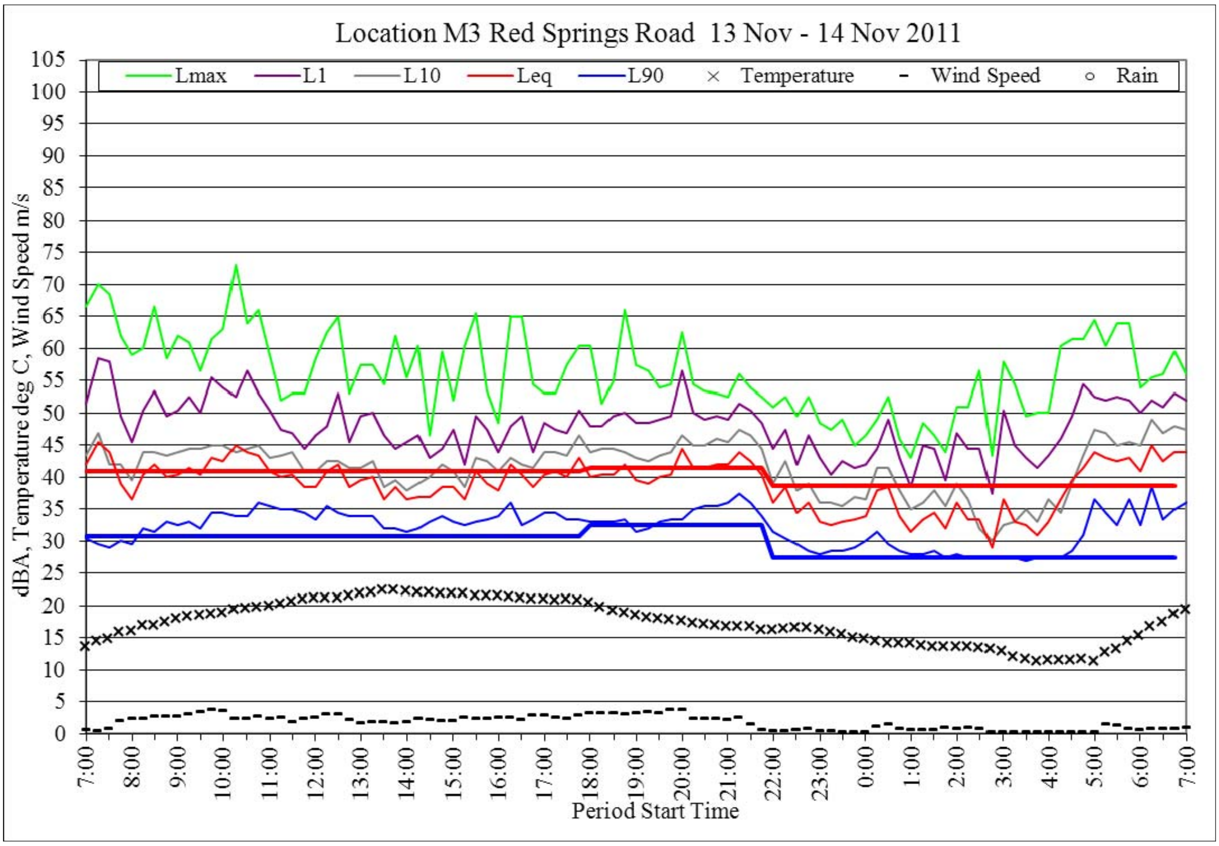
Location M3 Red Springs Road 13 Nov - 14 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
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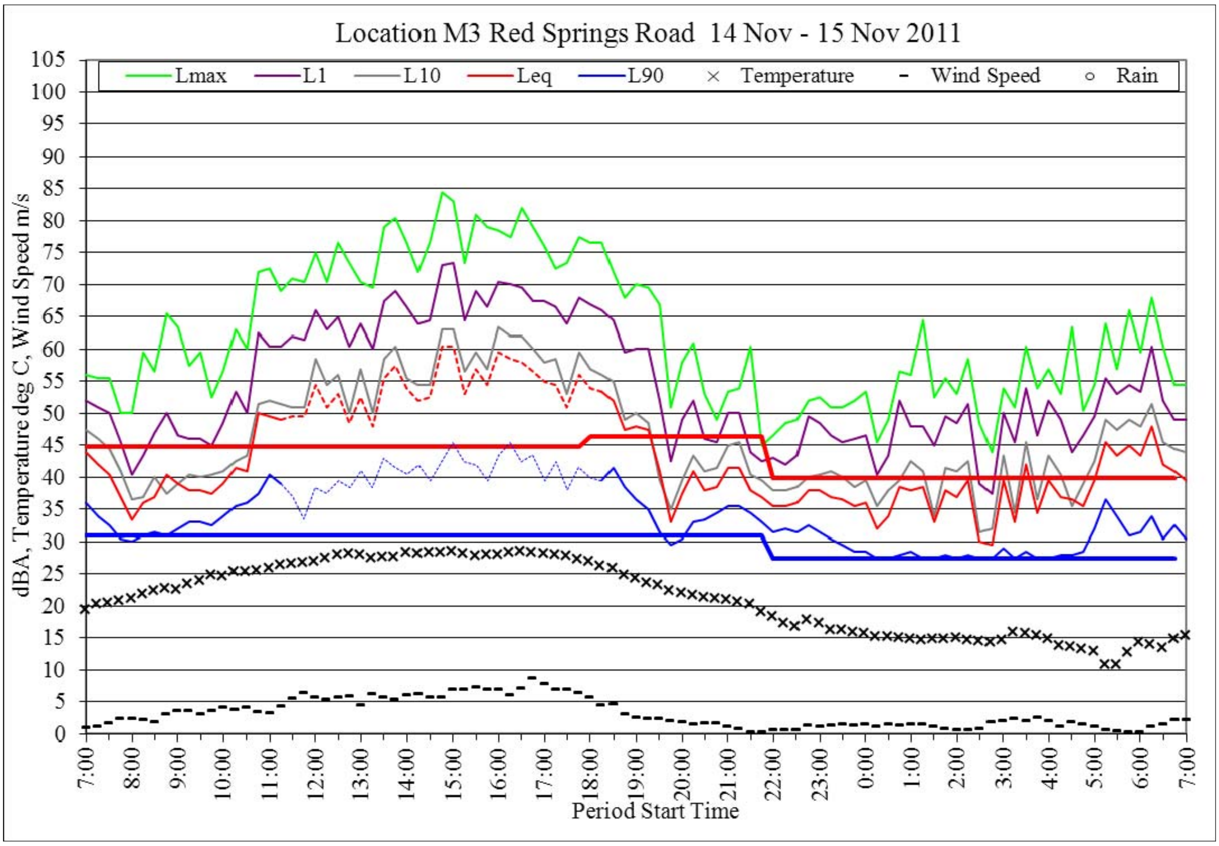
Period Start Time


Location M3 Red Springs Road 14 Nov - 15 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
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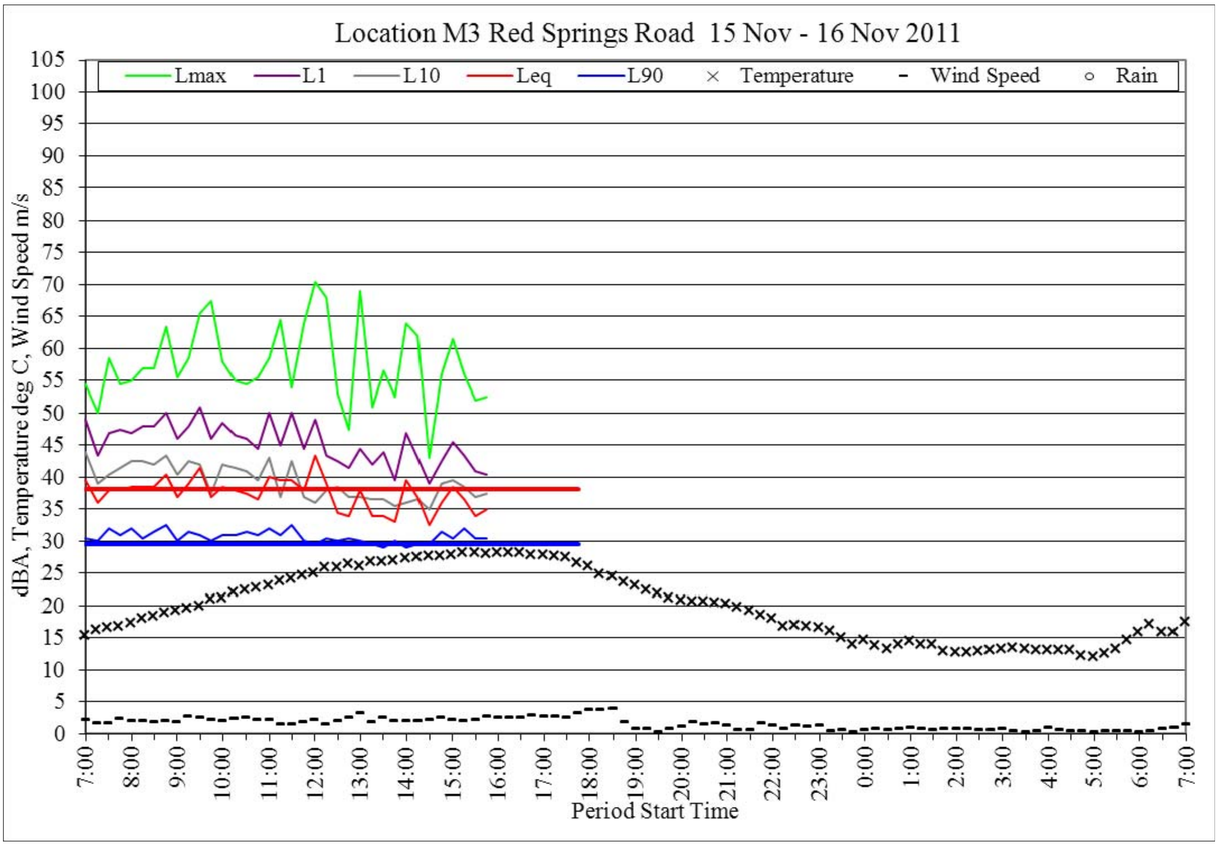
Period Start Time


Location M3 Red Springs Road 15 Nov - 16 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
100
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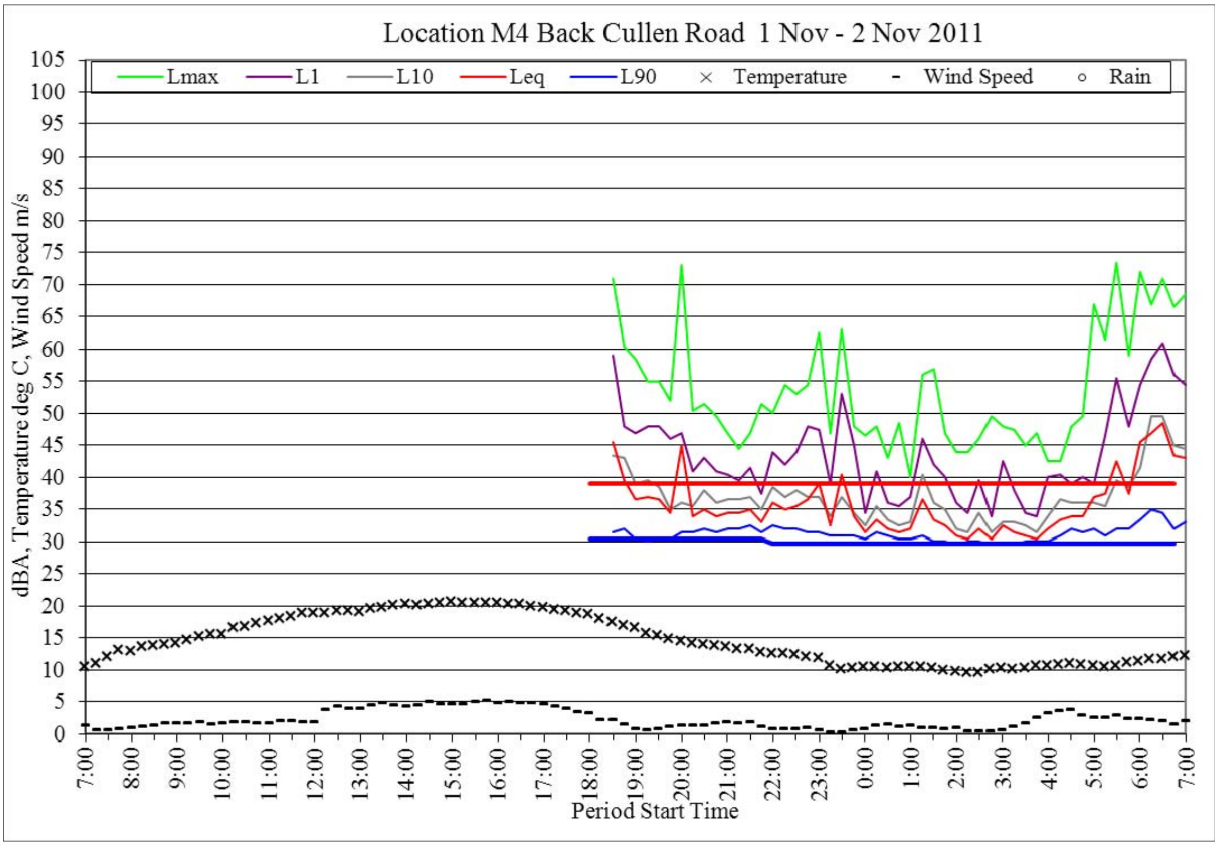
Period Start Time


Location M4 Back Cullen Road 1 Nov - 2 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
105
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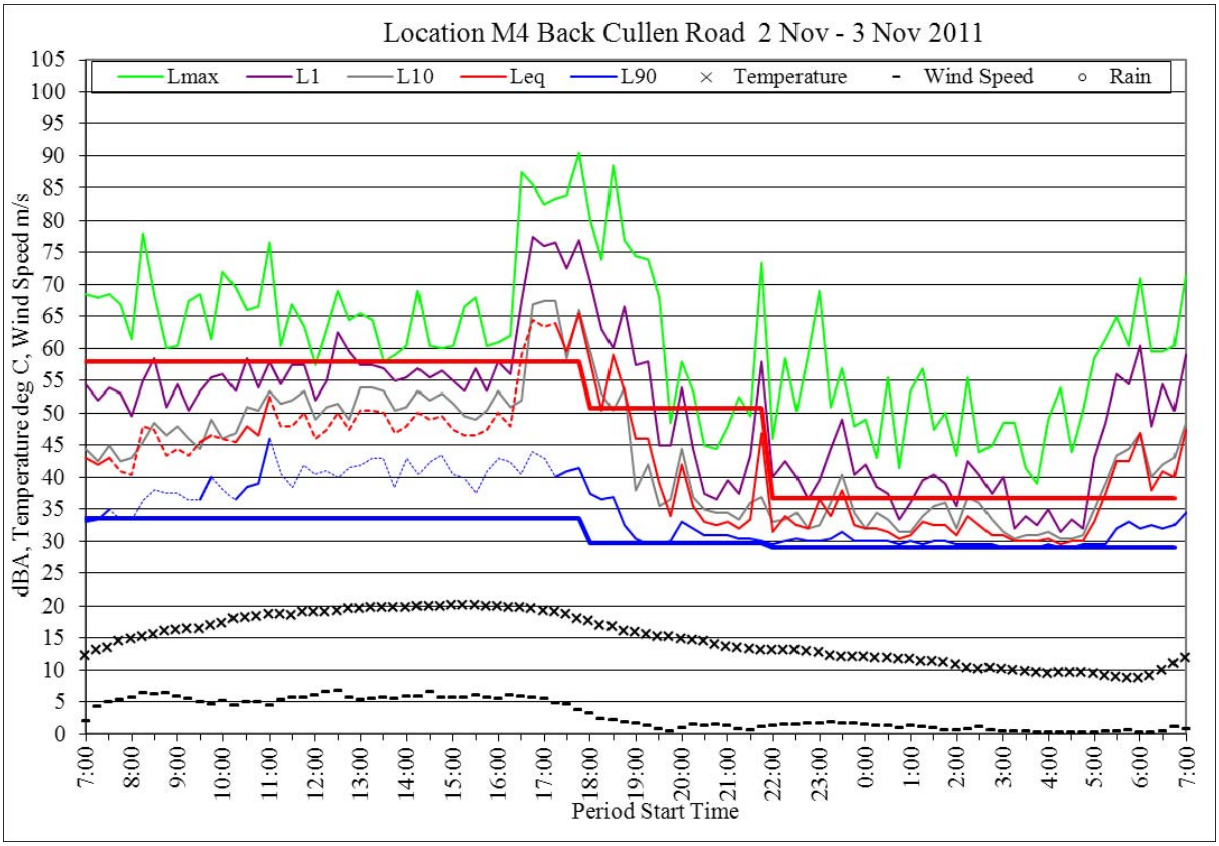
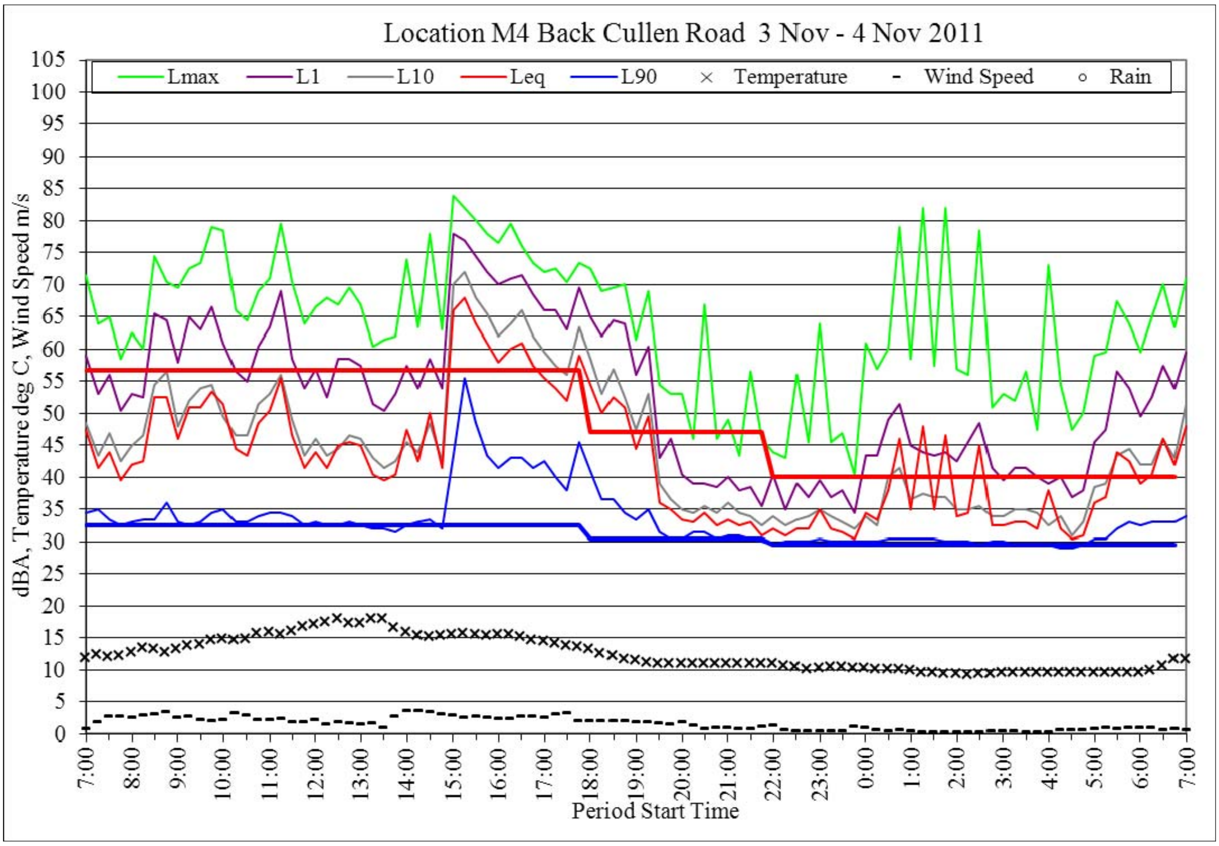
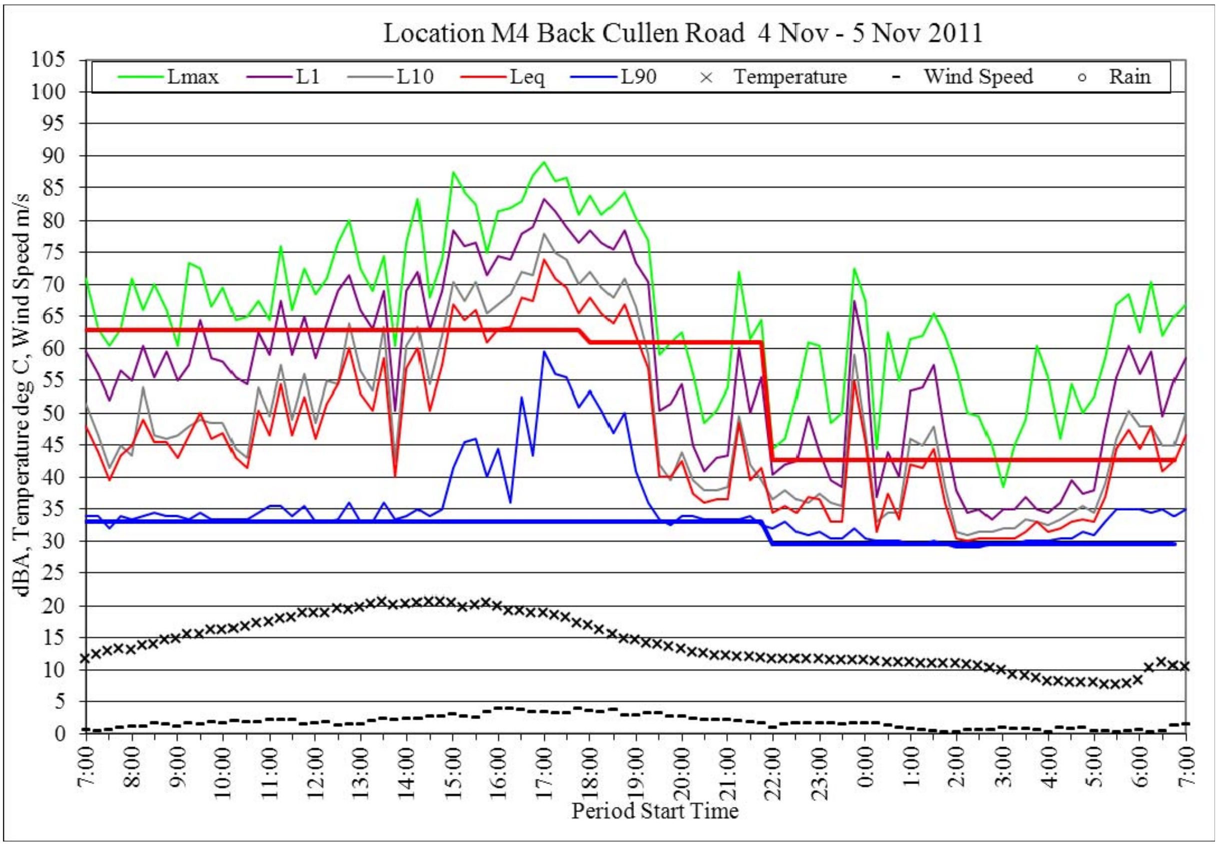
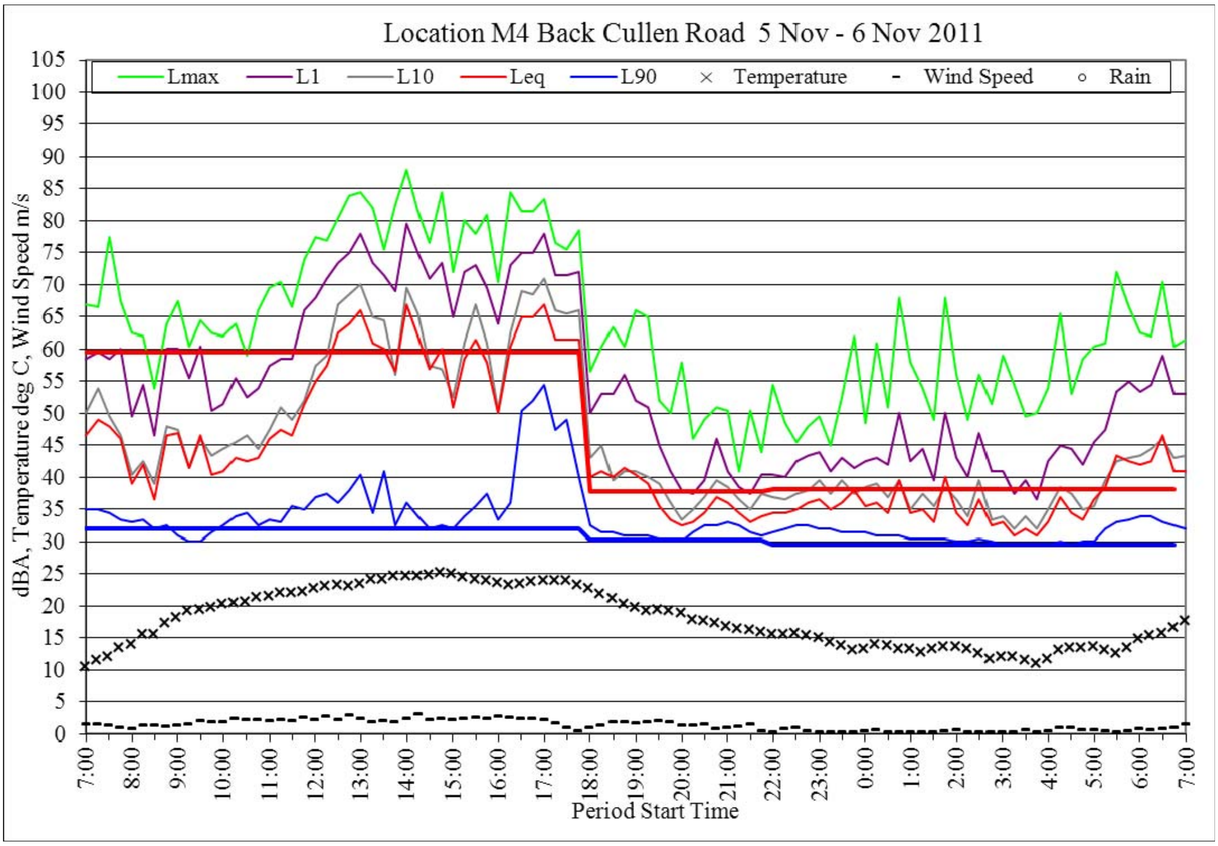
7:00
Period Start Time

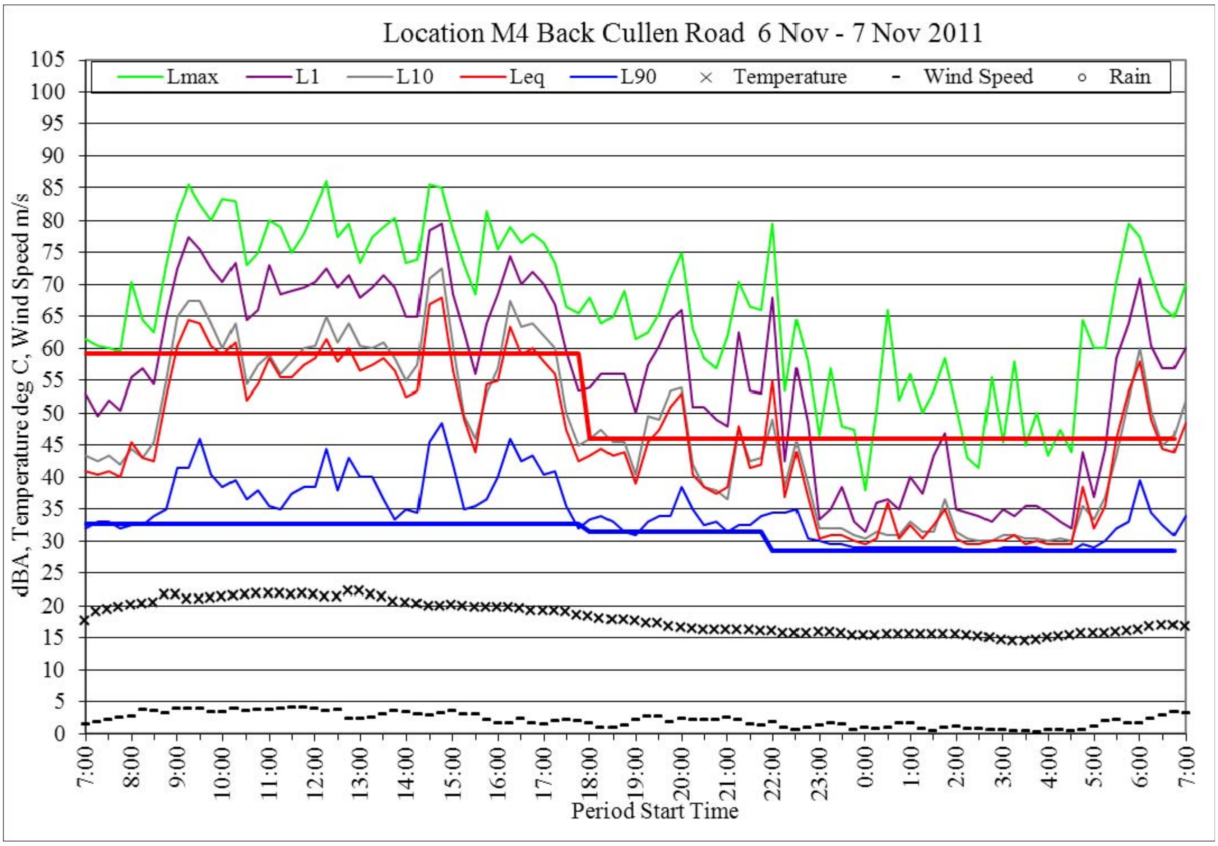

Location M4 Back Cullen Road 2 Nov - 3 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

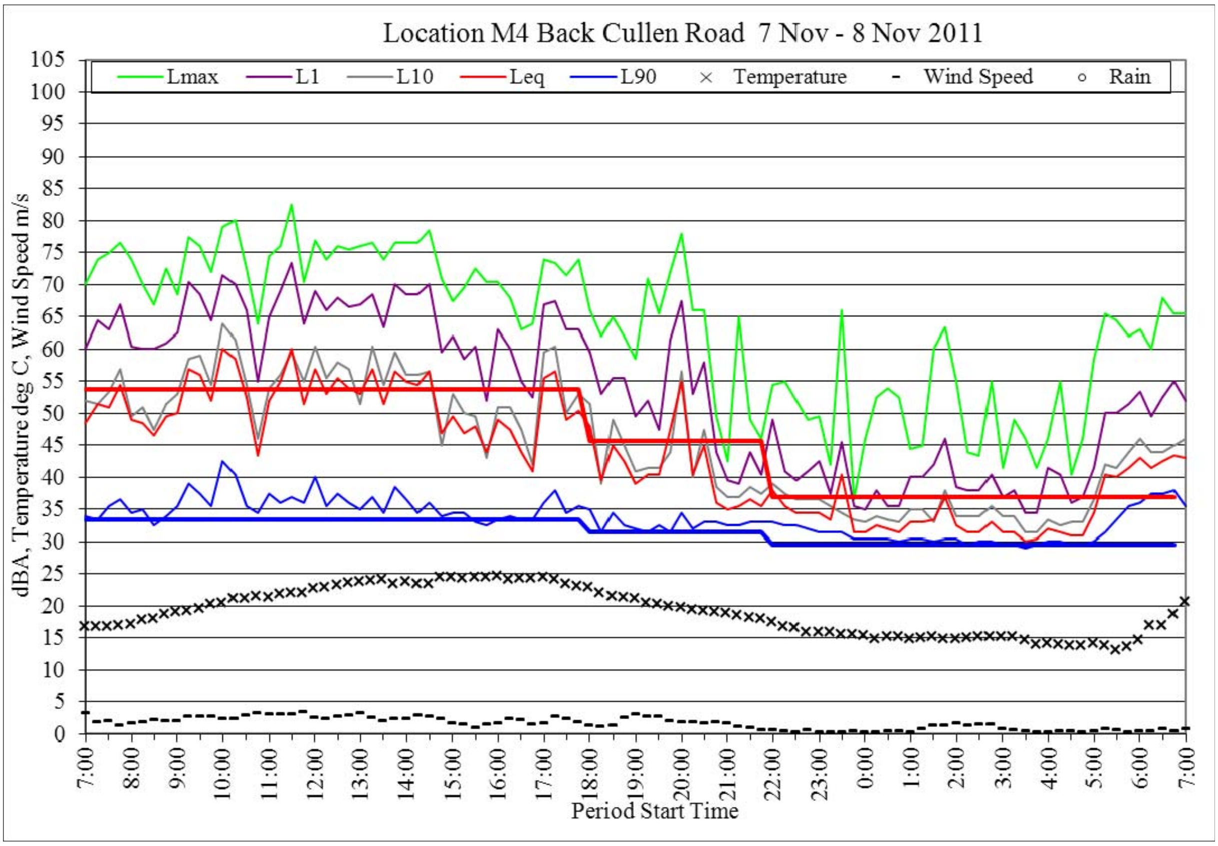

Location M4 Back Cullen Road 3 Nov - 4 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

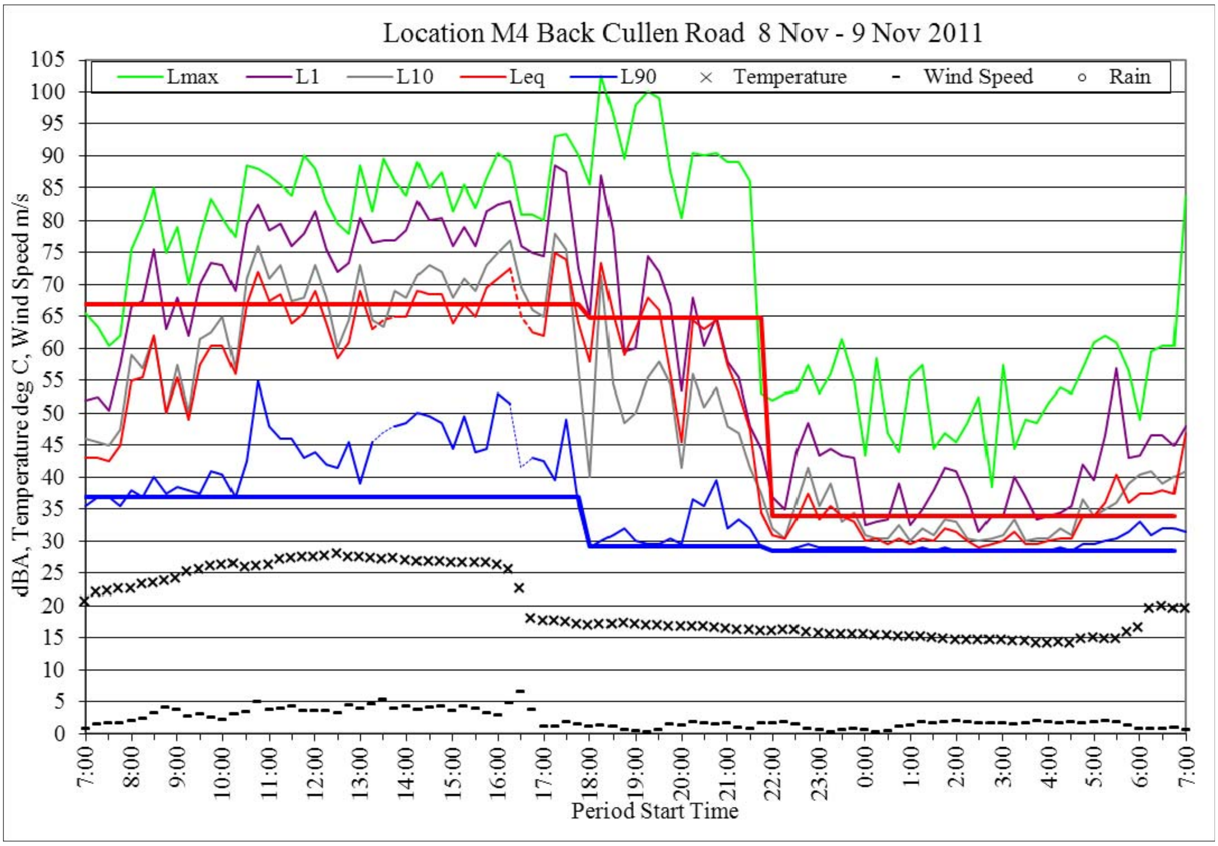


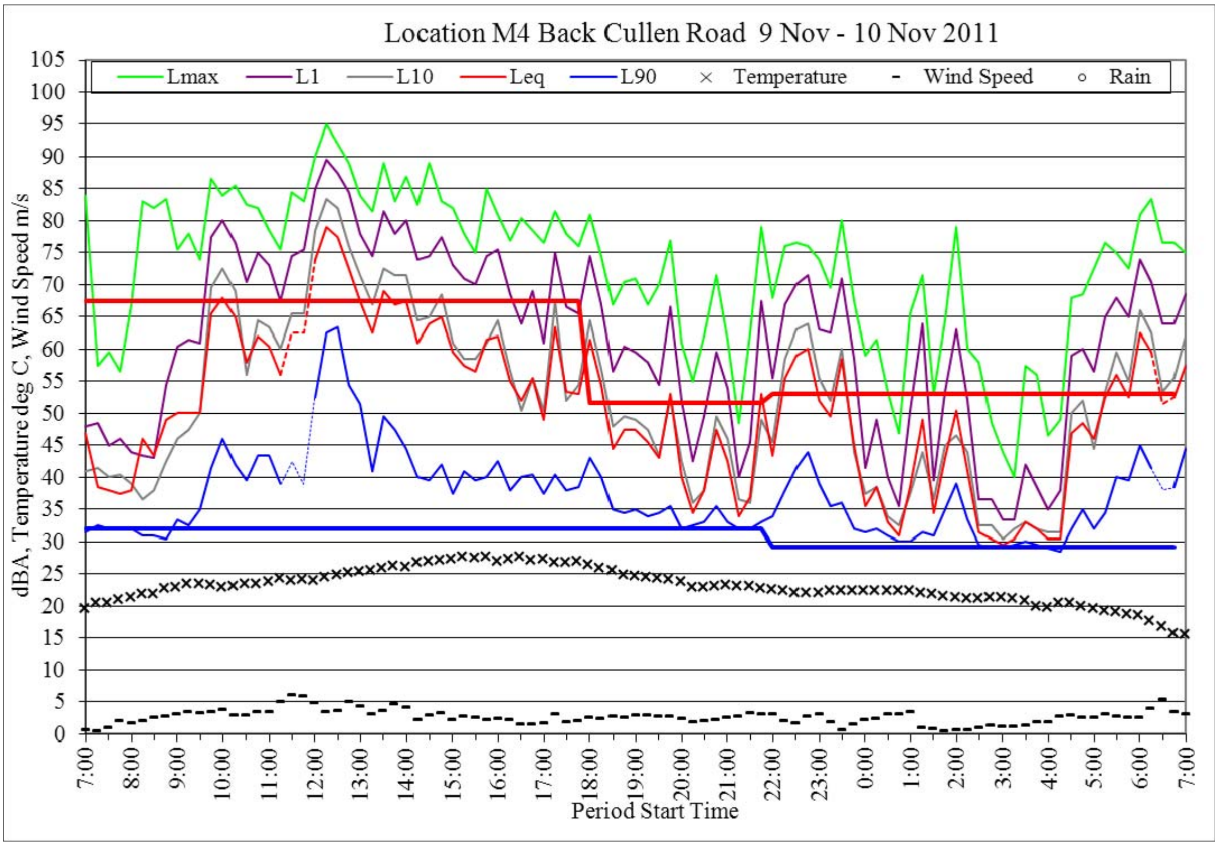

BRIDGES Acoustics


Location M4 Back Cullen Road 6 Nov - 7 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

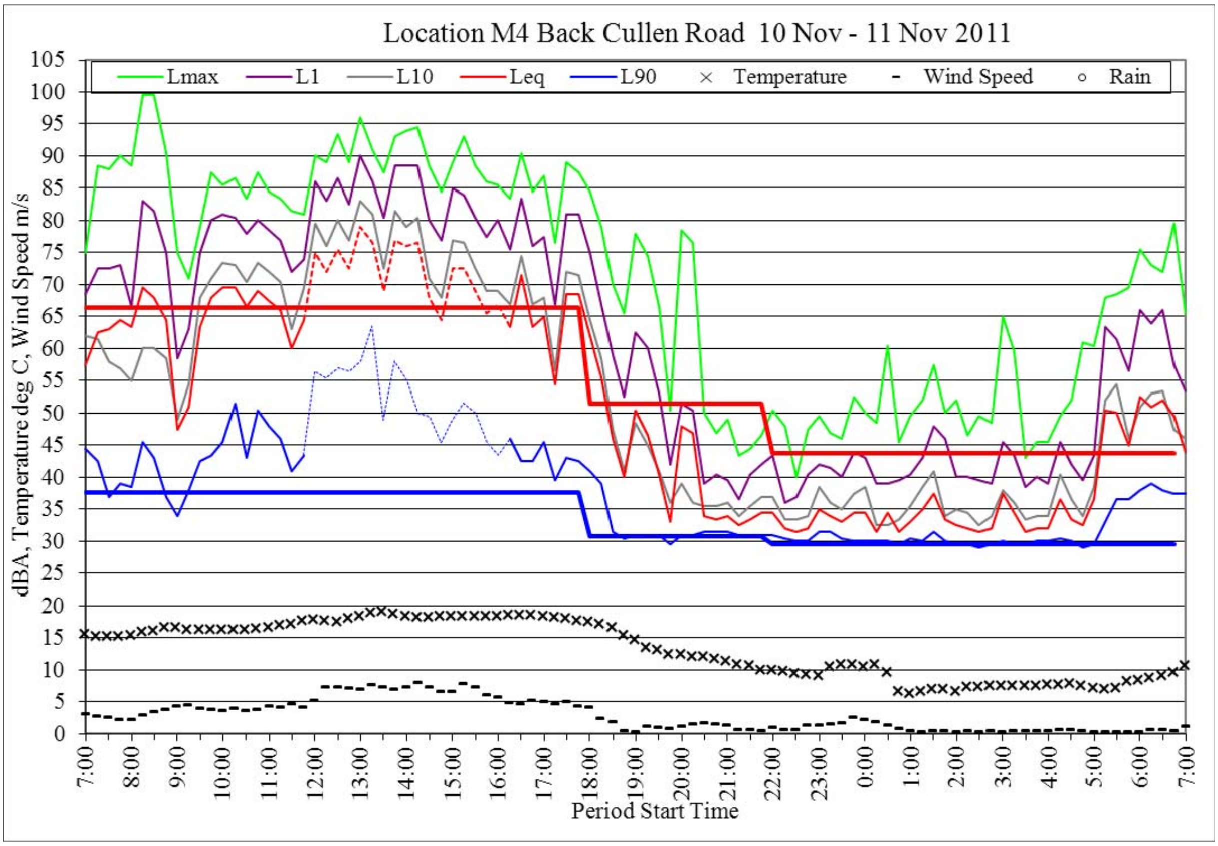

Location M4 Back Cullen Road 7 Nov - 8 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time



Location M4 Back Cullen Road 8 Nov - 9 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

Location M4 Back Cullen Road 9 Nov - 10 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M4 Back Cullen Road 10 Nov - 11 Nov 2011
Lmax
L1
L10
Leq
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Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
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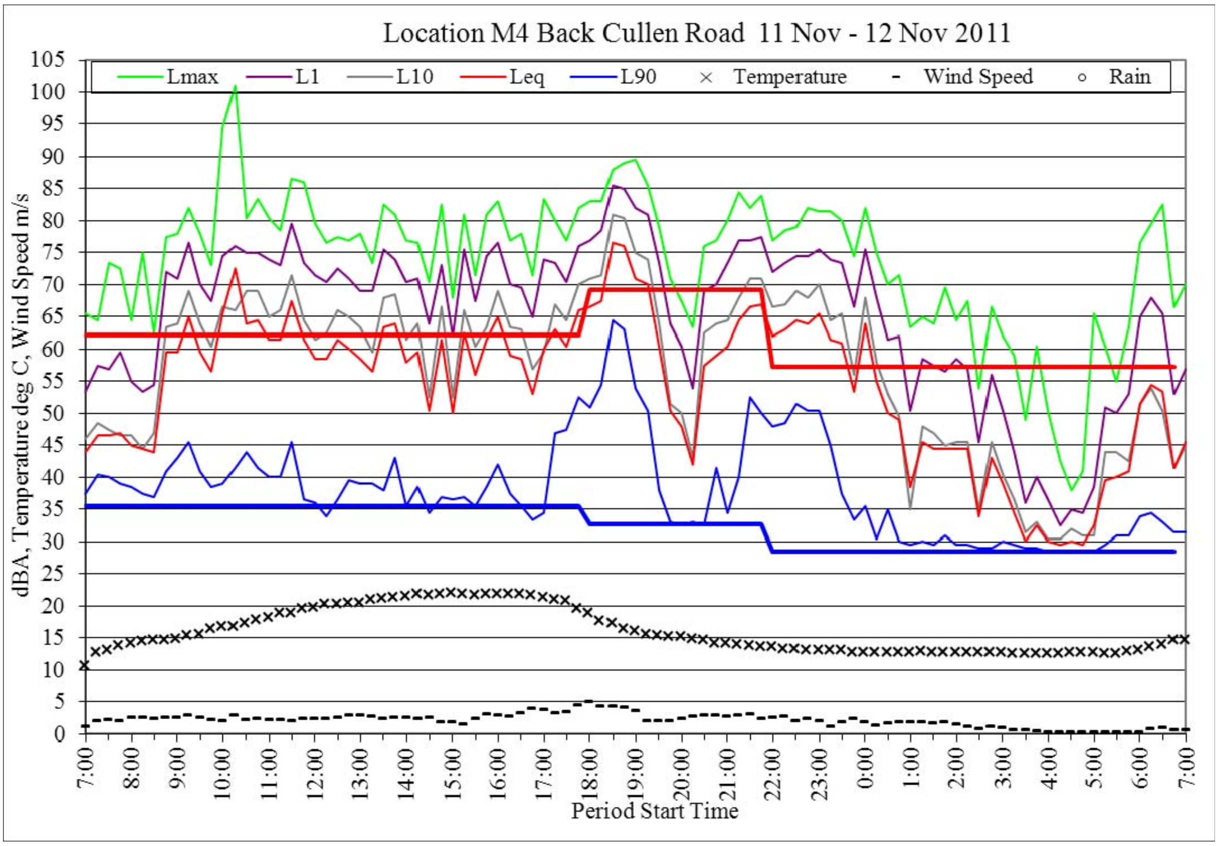
Location M4 Back Cullen Road 11 Nov - 12 Nov 2011
Lmax
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Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time
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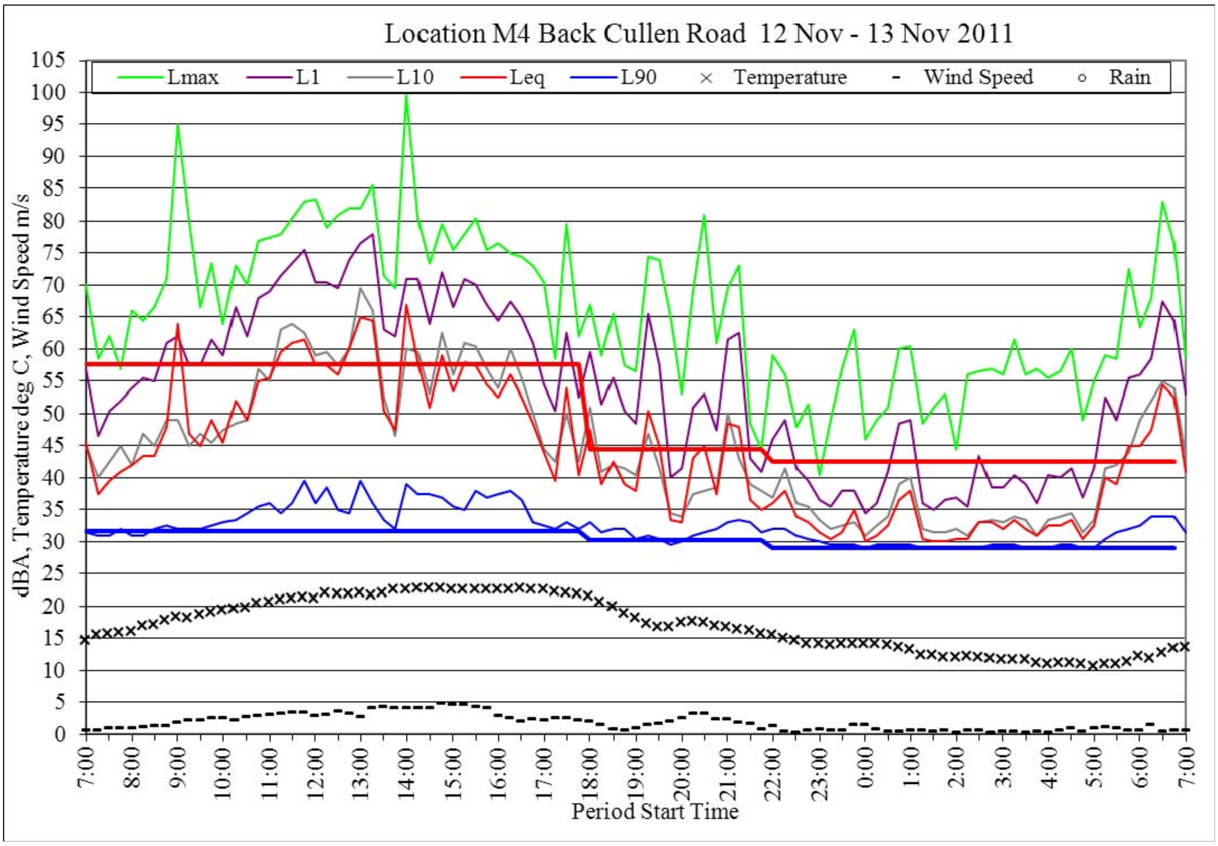
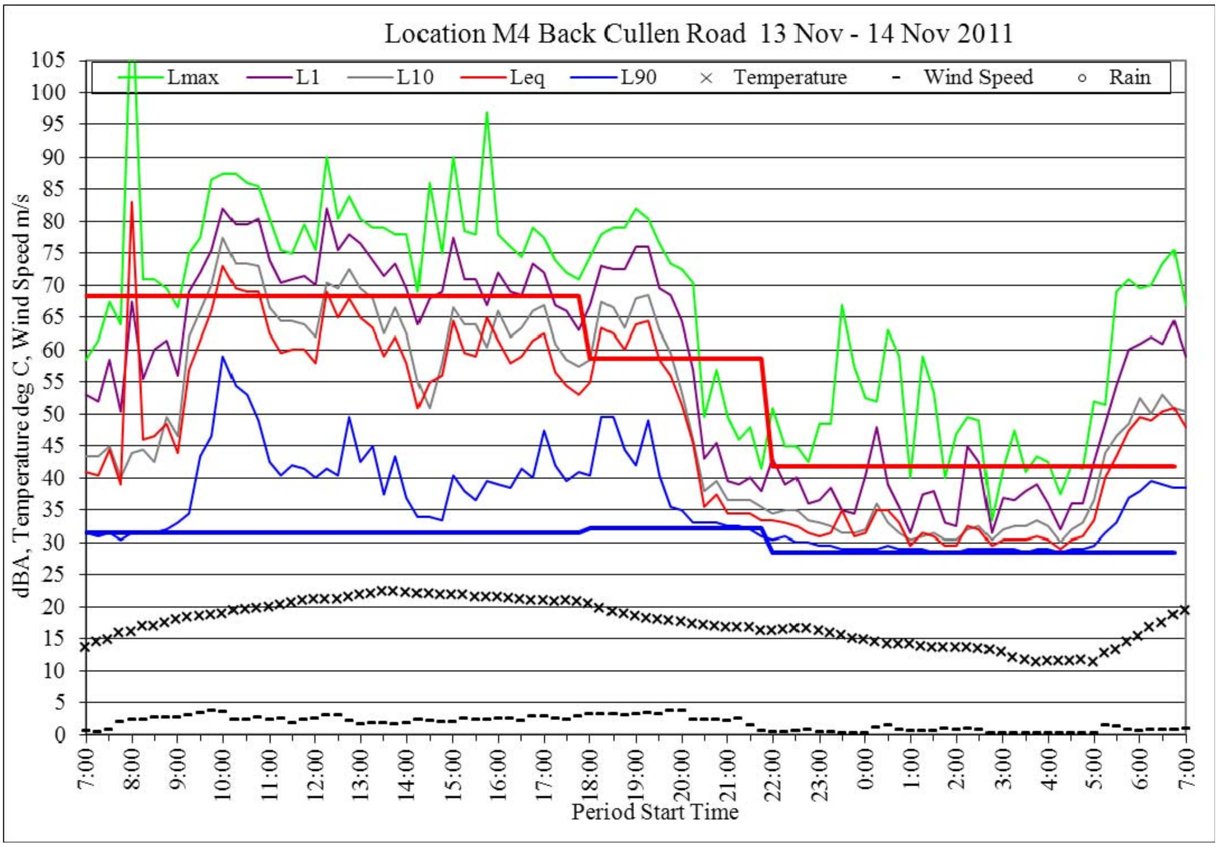
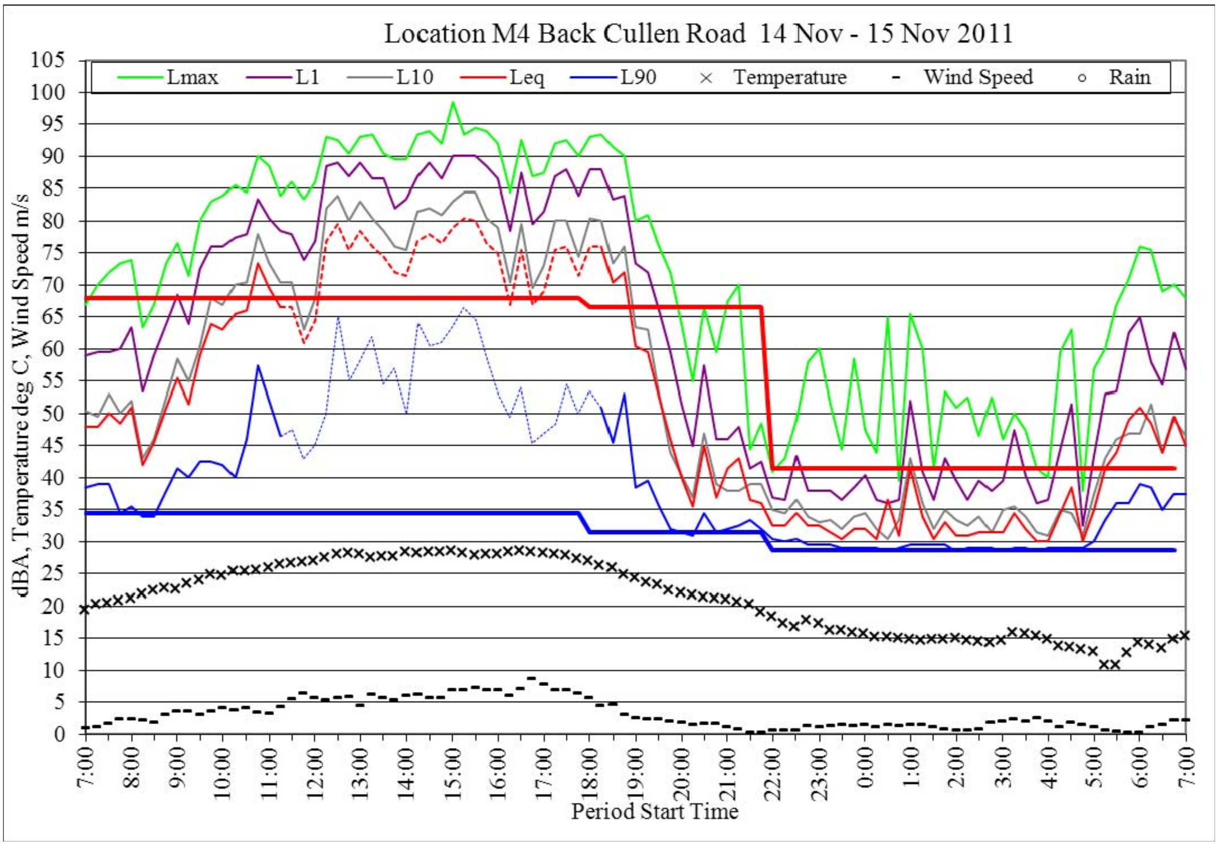
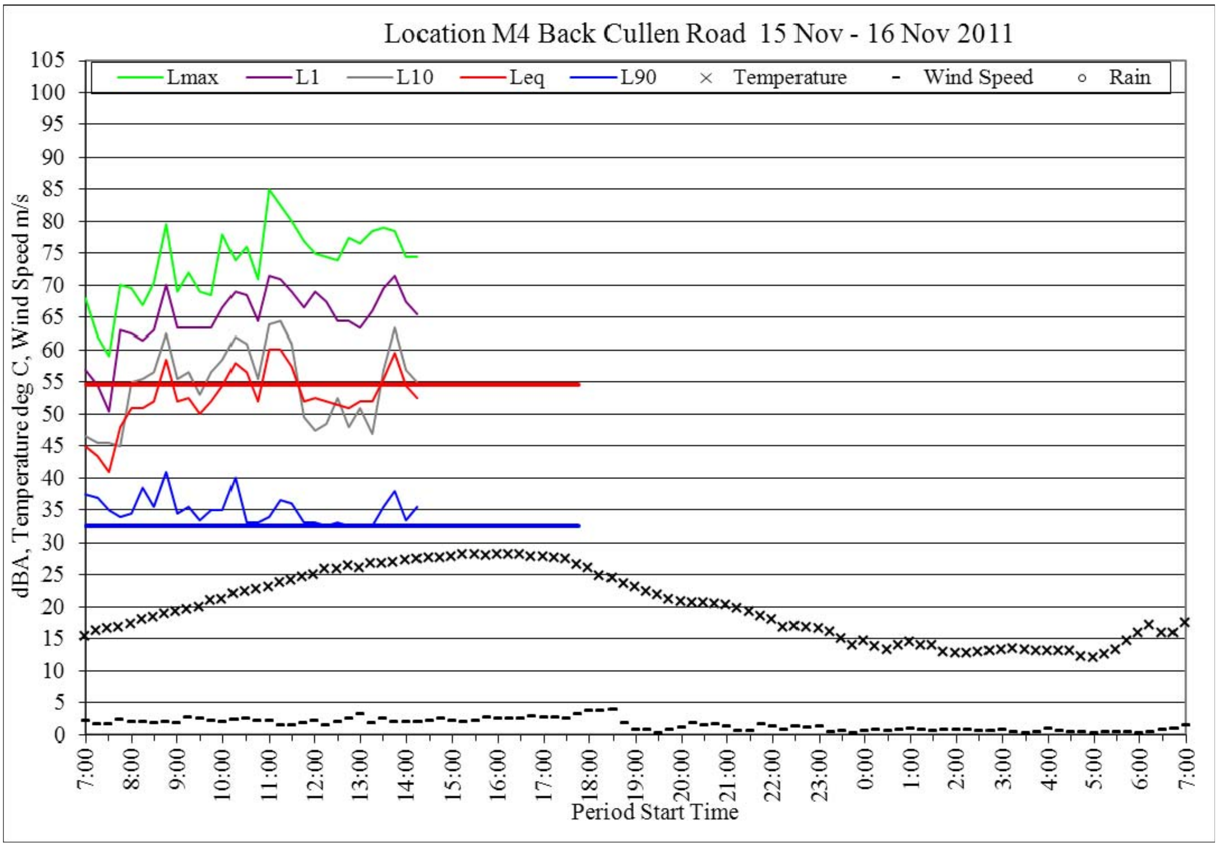



BRIDGES Acoustics


Location M4 Back Cullen Road 14 Nov - 15 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time


Location M4 Back Cullen Road 15 Nov - 16 Nov 2011
Lmax
L1
L10
Leq
L90
Temperature
Wind Speed
Rain
dBA, Temperature deg C, Wind Speed m/s
Period Start Time

# APPENDIX E – COALPAC BLASTING DATABASE



Figures E1 to E8 show measured and analysed blast monitoring data obtained by Coalpac or Coalpac's contractors during the period January 2010 to April 2011 at seven representative receiver locations near the existing mines.

A total of 85 Cullen Valley Mine blasts and 91 Invincible Colliery blasts occurred during the 16 month period covered by the supplied blast monitoring database, which is an average of 11 blast events per month or 2.5 events per week for the two mines combined.

The database included information regarding the pit number and block number for each blast which allowed each blast site to be pinpointed to an accuracy of approximately 25 m. This in turn allowed the distance from each blast to each receiver location to be determined to the nearest 25 m which is considered very accurate.

**Figure E1: Cullen Valley Mine – Measured Ground Vibration Levels, mm/s**

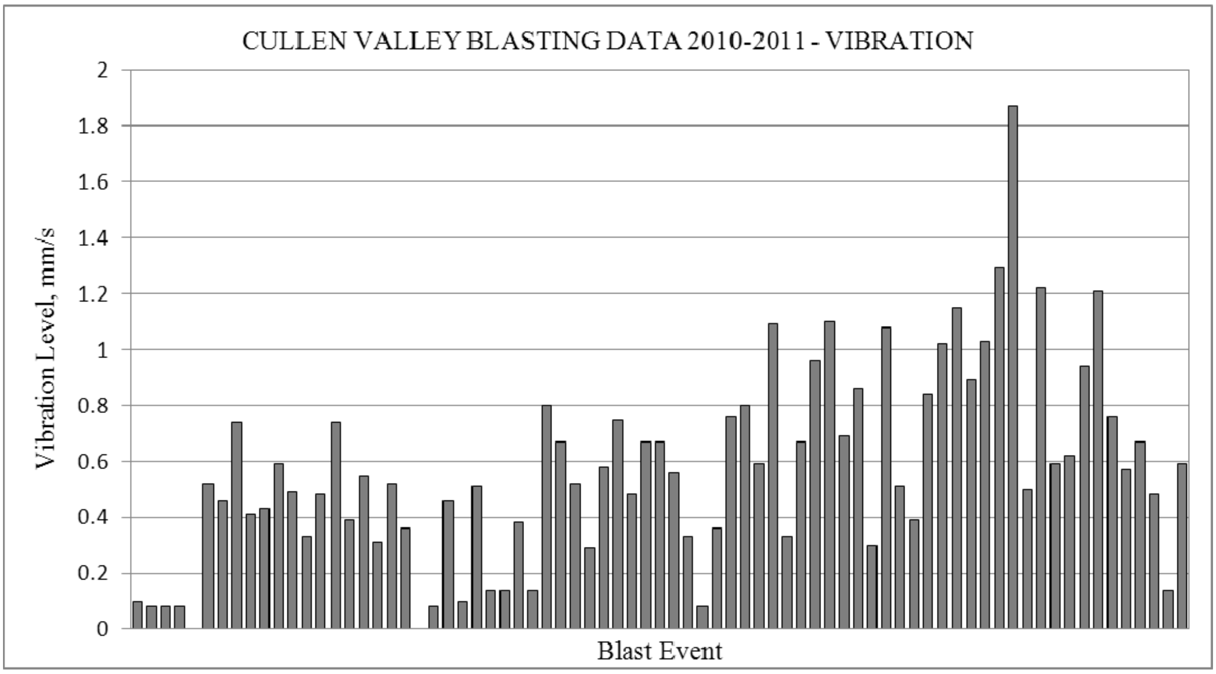
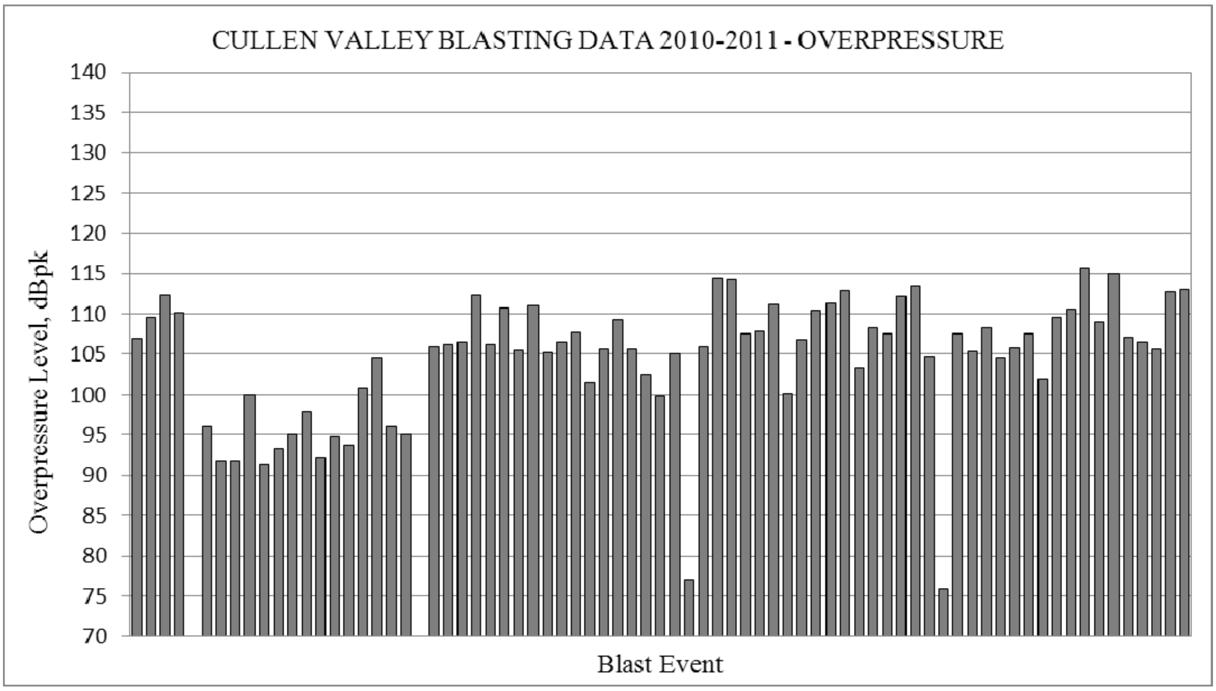
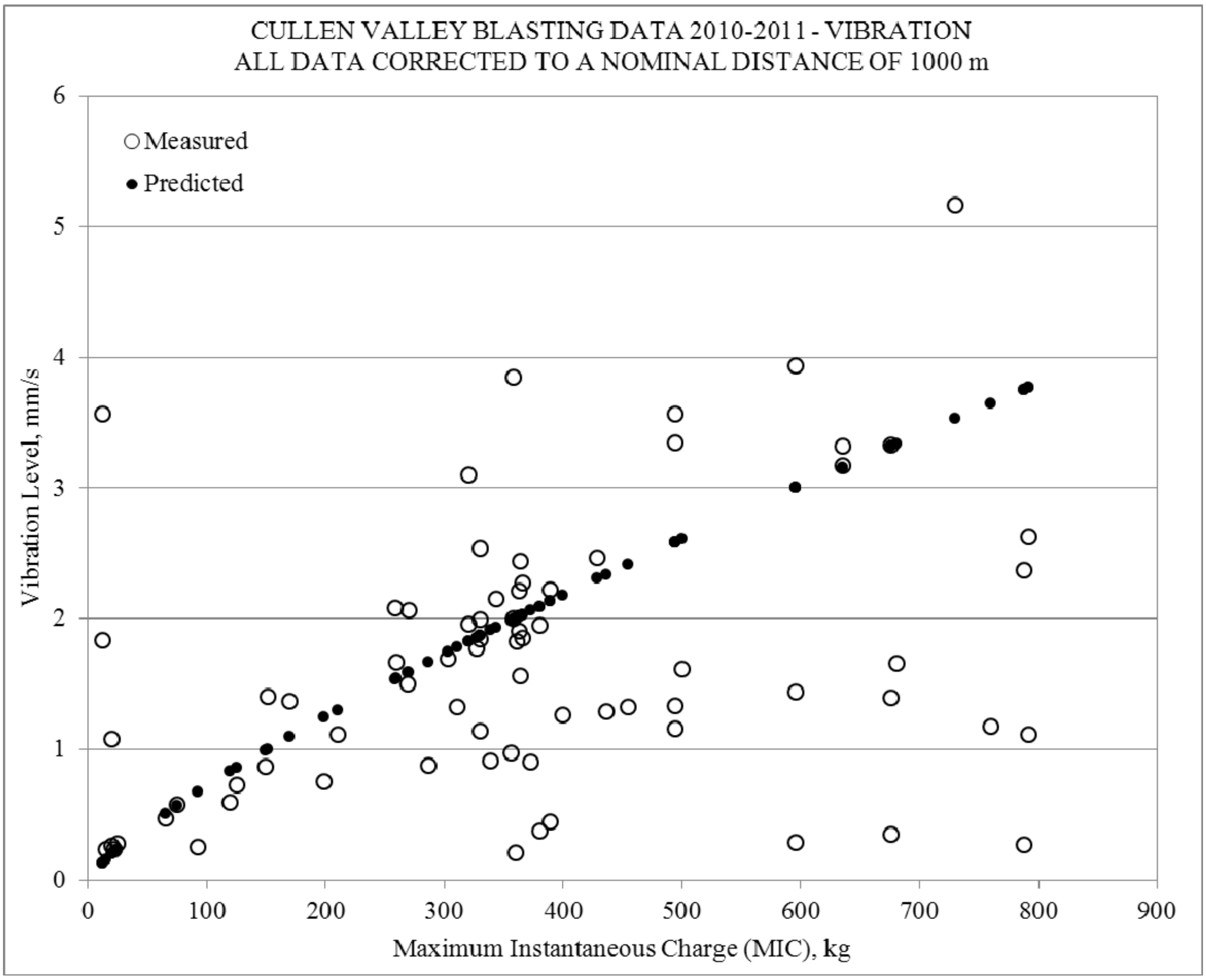



**Figure E2: Cullen Valley Mine – Measured Overpressure Levels, dB**




Figures E1 and E2 show measured ground vibration and overpressure data at receivers 179 Hillcroft, 198 Tilley and 139 Forest Lodge, for all blast events measured at these receivers in 2010-2011. Measured ground vibration levels did not exceed 2 mm/s while only one event produced an overpressure level over 115 dB and all events produced a measured overpressure level below 120 dB.

**Figure E3: Cullen Valley Mine – Ground Vibration Analysis**



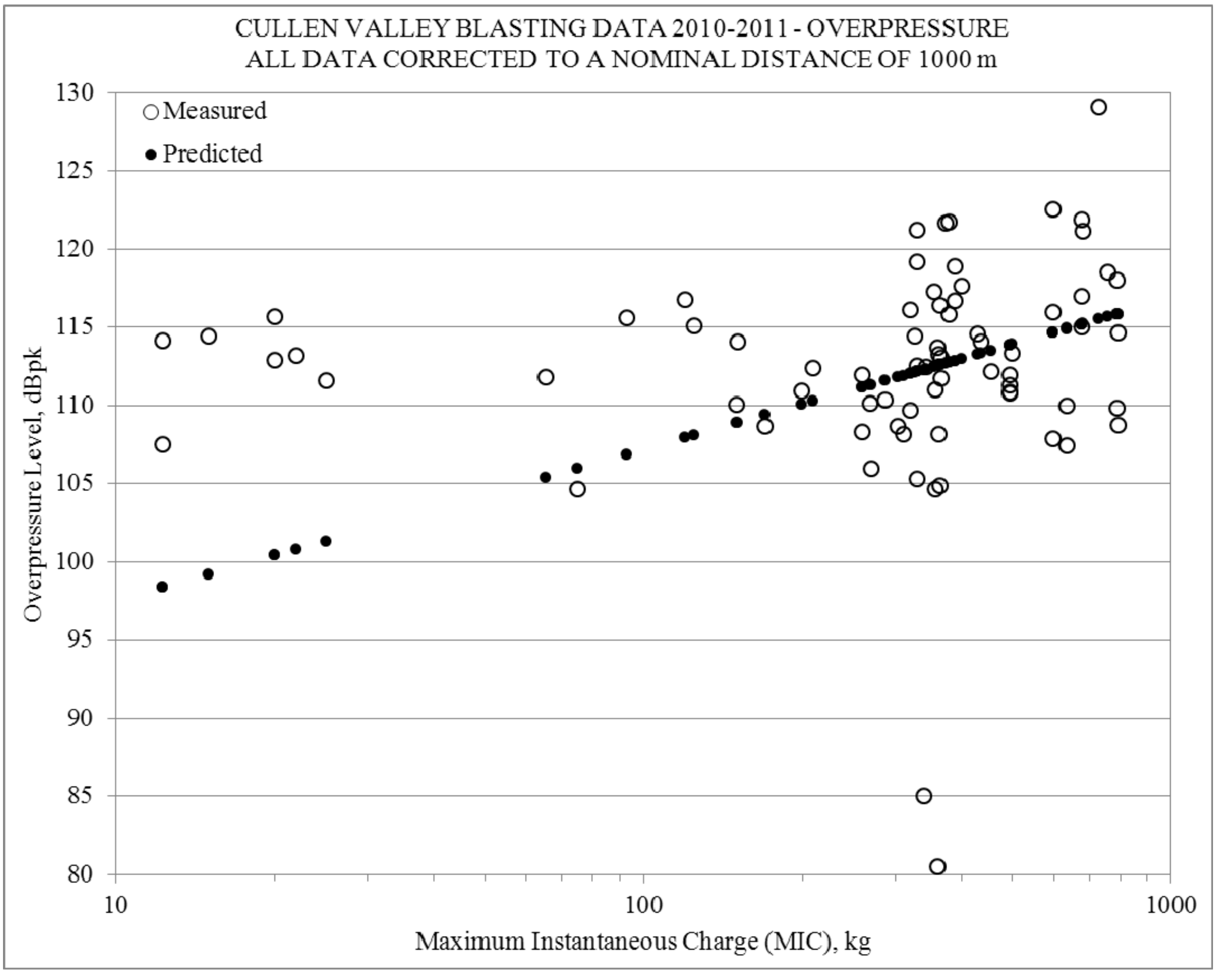

Ground vibration levels produced by a blast event depend on the MIC and the distance from the blast site to the receiver or monitoring location, as well as other factors such as ground conditions. With two primary factors (MIC and distance) affecting received vibration levels, it is difficult to present a concise analysis of measured vibration levels compared to predicted levels. Such an analysis would ideally only involve one variable or factor at any time.

Figure E3 therefore shows measured ground vibration levels corrected to a nominal distance of 1000 m from the blast site. The distance correction allows ground vibration levels to be compared to the MIC for each blast event to allow more meaningful comparisons between individual events and to allow direct comparisons with predicted vibration levels based on the Australian Standard.

As many blast events occurred more than 1000 m from a receiver, most measured vibration levels have been increased above the measured levels to present the vibration levels that would have occurred at a distance of 1000 m. As Figure E3 shows corrected rather than measured vibration levels, values over 5 mm/s in Figure E3 do not indicate an exceedance of the criterion has occurred for that event. Actual measured vibration levels, in the absence of the distance correction, are shown in Figure E1 above.

Figure E3 indicates the Australian Standard prediction method is broadly consistent with the measured data and is considered appropriate for use in the assessment.

**Figure E4: Cullen Valley Mine – Overpressure Analysis**




Overpressure levels produced by a blast event depend on the MIC and the distance from the blast site to the receiver or monitoring location, as well as other factors such as wind conditions and any topographic or other shielding effects. With two primary factors (MIC and distance) affecting received overpressure levels, it is difficult to present a concise analysis of measured levels compared to predicted levels. Such an analysis would ideally only involve one variable or factor at any time.

Figure E4 therefore shows measured overpressure levels corrected to a nominal distance of 1000 m from the blast site. The distance correction allows overpressure levels to be compared to the MIC for each blast event to allow more meaningful comparisons between individual events and to allow direct comparisons with predicted overpressure levels based on the Australian Standard.

As many blast events occurred more than 1000 m from a receiver, most measured overpressure levels have been increased above the measured levels to present the overpressure levels that would have occurred at a distance of 1000 m. As Figure E4 shows corrected rather than measured levels, values over 115 dB and 120 dB in Figure E4 do not indicate exceedances of the criteria have occurred for that event. Actual measured overpressure levels, in the absence of the distance correction, are shown in Figure E2 above.

Figure E4 indicates the Australian Standard prediction method is broadly consistent with the measured data and is considered appropriate for use in the assessment. Variations between the measured and predicted levels would in most cases be caused by either topographic shielding effects or wind conditions.

**Figure E5: Invincible Colliery – Measured Ground Vibration Levels, mm/s**

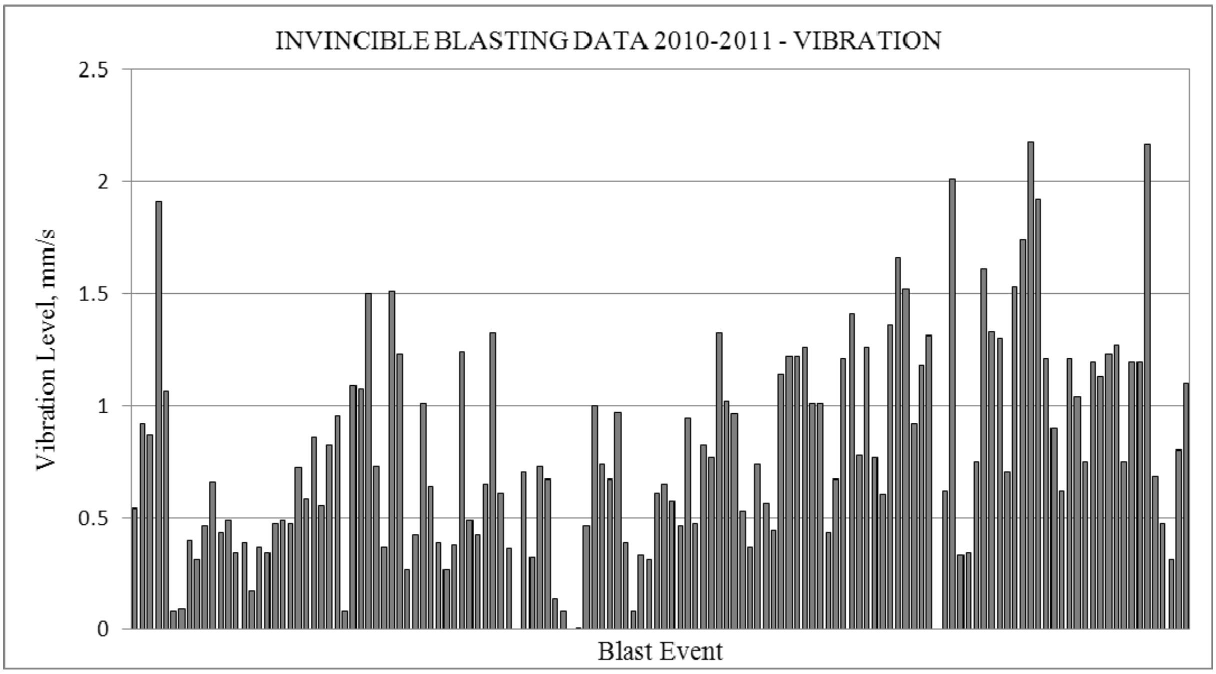
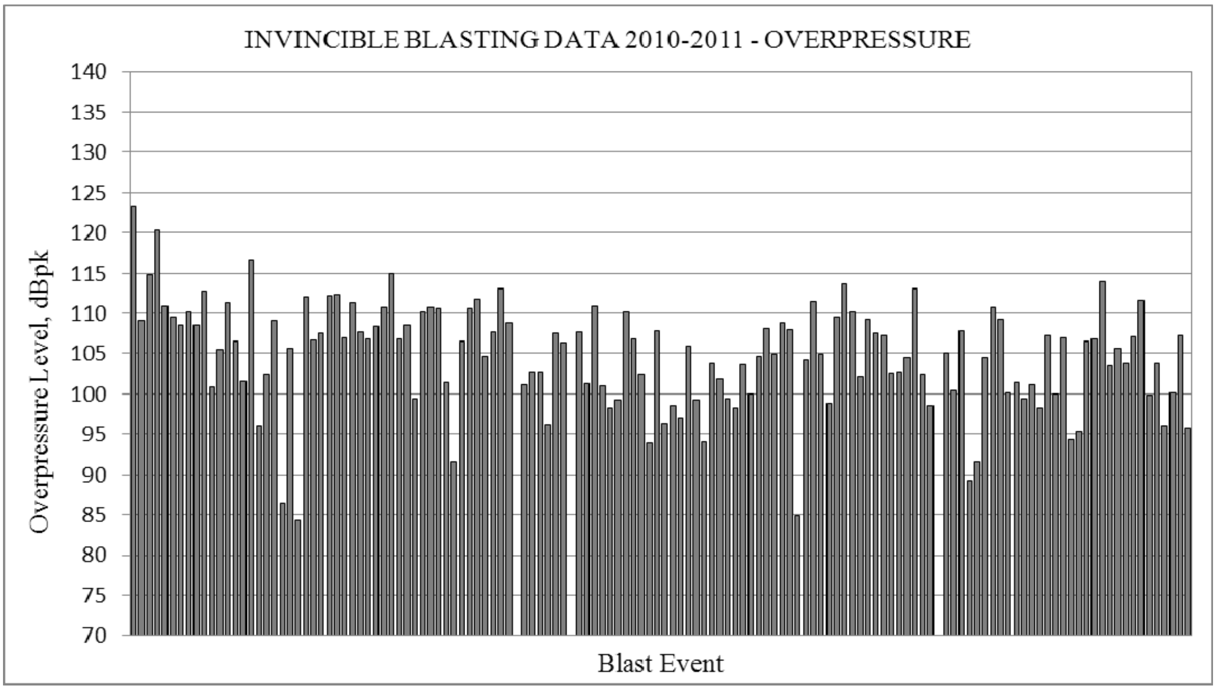
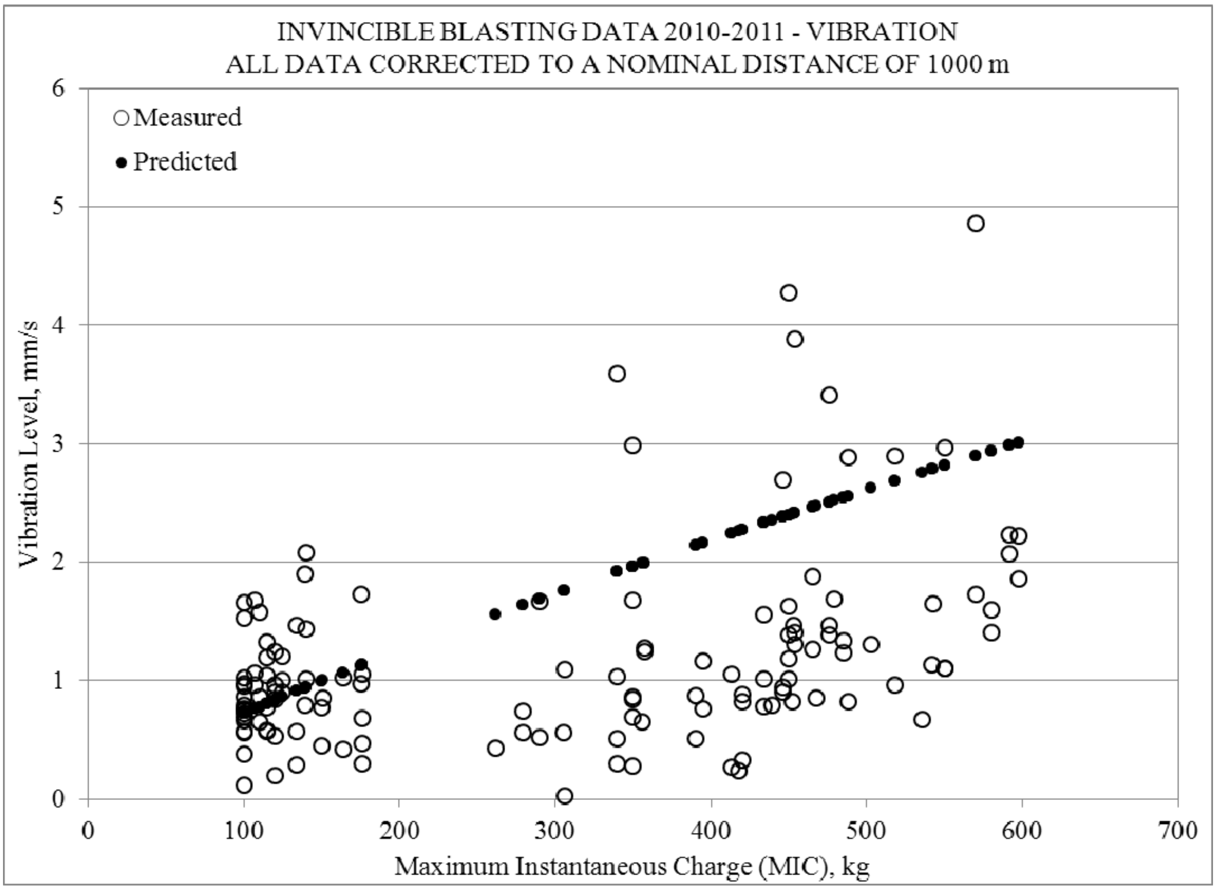



**Figure E6: Invincible Colliery – Measured Overpressure Levels, dB**




Figures E5 and E6 show measured ground vibration and overpressure data at receivers 393 Billabong, 351 Speedway, 327 Playford and 315 Godden, for all blast events measured at these receivers in 2010-2011. Measured ground vibration levels did not exceed 2.5 mm/s while only three events produced an overpressure level over 115 dB and two events produced a measured overpressure level over 120 dB. All exceedances of the overpressure criteria occurred at 393 Billabong which is owned by Coalpac.

**Figure E7: Invincible Colliery – Ground Vibration Analysis**



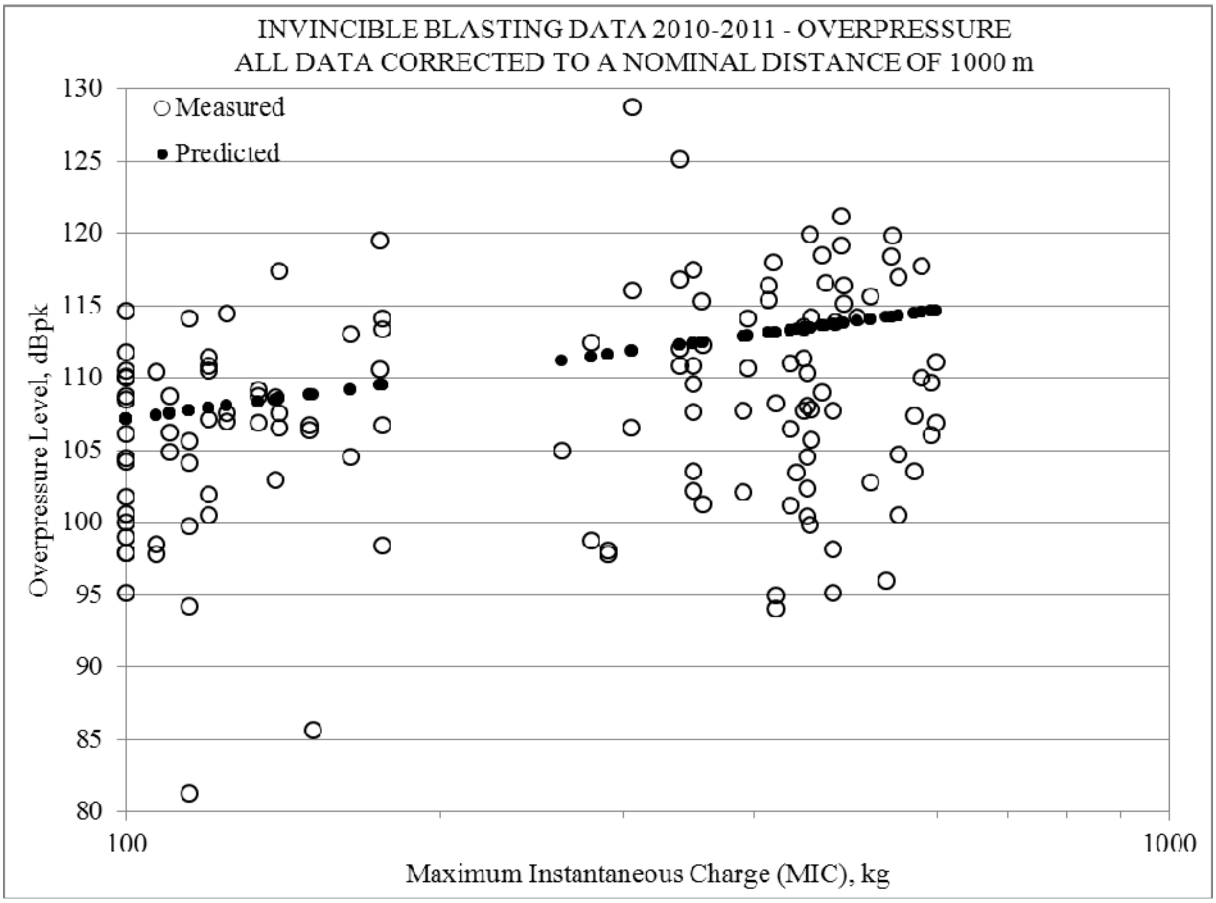

Ground vibration levels produced by a blast event depend on the MIC and the distance from the blast site to the receiver or monitoring location, as well as other factors such as ground conditions. With two primary factors (MIC and distance) affecting received vibration levels, it is difficult to present a concise analysis of measured vibration levels compared to predicted levels. Such an analysis would ideally only involve one variable or factor at any time.

Figure E7 therefore shows measured ground vibration levels corrected to a nominal distance of 1000 m from the blast site. The distance correction allows ground vibration levels to be compared to the MIC for each blast event to allow more meaningful comparisons between individual events and to allow direct comparisons with predicted vibration levels based on the Australian Standard.

As many blast events occurred more than 1000 m from a receiver, many measured vibration levels have been increased above the measured levels to present the vibration levels that would have occurred at a distance of 1000 m. As Figure E7 shows corrected rather than measured vibration levels, values close to or over 5 mm/s in Figure E7 do not indicate an exceedance of the criterion has occurred or almost occurred for that event. Actual measured vibration levels, in the absence of the distance correction, are shown in Figure E5 above.

Figure E7 indicates the Australian Standard prediction method is broadly consistent with the measured data and is considered appropriate for use in the assessment. The Australian Standard predictions tend to over-predict vibration levels for the majority of Invincible Colliery blast events.

**Figure E8: Invincible Colliery – Overpressure Analysis**




Overpressure levels produced by a blast event depend on the MIC and the distance from the blast site to the receiver or monitoring location, as well as other factors such as wind conditions and any topographic or other shielding effects. With two primary factors (MIC and distance) affecting received overpressure levels, it is difficult to present a concise analysis of measured levels compared to predicted levels. Such an analysis would ideally only involve one variable or factor at any time.

Figure E8 therefore shows measured overpressure levels corrected to a nominal distance of 1000 m from the blast site. The distance correction allows overpressure levels to be compared to the MIC for each blast event to allow more meaningful comparisons between individual events and to allow direct comparisons with predicted overpressure levels based on the Australian Standard.

As many blast events occurred more than 1000 m from a receiver, most measured overpressure levels have been increased above the measured levels to present the overpressure levels that would have occurred at a distance of 1000 m. As Figure E8 shows corrected rather than measured levels, values over 115 dB and 120 dB in Figure E8 do not indicate exceedances of the criteria have occurred for that event. Actual measured overpressure levels, in the absence of the distance correction, are shown in Figure E6 above.

Figure E8 indicates the Australian Standard prediction method is broadly consistent with the measured data and is considered appropriate for use in the assessment. Variations between the measured and predicted levels would in most cases be caused by either topographic shielding effects or wind conditions.