# APPENDIX K:

## RECENT INDEPENDENT NOISE REVIEWS OF MINE COMPLEX

ABN: 73 254 053 305

78 Woodglen Close
P.O. Box 61
PATERSON NSW 2421

Phone: 02 4938 5866
Mobile: 0407 38 5866
E-mail: bridgesacoustics@bigpond.com

# MOOLARBEN COAL OPERATIONS PTY LTD

# INDEPENDENT NOISE REVIEW

# PROPERTY 300, COLLINS AND MARSHALL

# SEPTEMBER AND OCTOBER 2015

## REPORT J0222-01-R1
## 5 JANUARY 2016

Prepared for:
Department of Planning and Environment
P.O. Box 3145
SINGLETON NSW 2330

Prepared by:
Mark Bridges BE Mech (Hons) MAAS
Principal Consultant

# TABLE OF CONTENTS

# 1. INTRODUCTION

This report presents results from an independent noise review to determine Moolarben Coal's compliance with relevant conditions of Project Approval MP 05_0117 at Property 300, 927 Ridge Road Cooks Gap, owned and occupied by Mr Corey Collins and Ms Charmaine Marshall. The Review included a series of noise surveys over 10 nights in the vicinity of the residence in September and October 2015 according to a survey protocol agreed with the Department of Planning and Environment (DP&E) and the Environment Protection Authority (EPA).

The Review was commissioned by Moolarben Coal in response to a request from the DP&E by letter dated 22 May 2015, a copy of which is attached in Appendix A. A meeting with residents occurred on 30 June 2015 to discuss details of the Review, in conjunction with Moolarben Coal and DP&E representatives, which indicated mine noise was mainly an issue during the night with only occasional noise issues during the day. A noise monitoring location adjacent to the main shed on the property was agreed to be acoustically suitable while minimising disturbance to residents. Plans of the area and the property are attached in Appendix B.

## 1.1. 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. Higher frequency sound from distant sources is effectively absorbed by the atmosphere leaving sound energy in only the lower frequency bands, leading to the reduced frequency range of 20 Hz to 8 kHz typically being assessed. |
| 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), depending on frequency. An increase of 10 dB is perceived as an approximate doubling of sound level by a 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 as defined in the relevant Australian Standard means frequencies below 500 Hz and above 10 kHz 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. |
| dBC | C-weighted decibels, where the C weighting as defined in the relevant Australian Standard means frequencies below 31 Hz and above 8 kHz are artificially reduced with the majority of the audible range remaining unchanged. The C-weighted noise level, when compared to the A-weighted noise level over the same time period, is used to indicate the presence of low frequency noise and to trigger a low frequency correction of +5 dBA to the measured A-weighted noise level where required. |
| 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. |
| LA90,15min | Same as LA90 with the measurement period specifically stated. |

| | |
|---|---|
| LAeq | The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location. |
| LAeq,15min | Same as LAeq with the measurement period specifically stated. The LAeq,15min is universally used in NSW to define and assess compliance with Project Approval noise conditions. |
| LAmax | The maximum dBA noise level during the measurement period. Can be used to determine the risk of sleep disturbance during the night in lieu of LA1,1min. |
| Night | The period 10 pm to 7 am. |

# 2. PA 05_0117 CONDITIONS

Relevant conditions from Project Approval 05_0117 Mod 3 are reproduced below. The conditions have actually been taken from the later Mod 10 Project Approval, however Mod 10 has not resulted in any change to the relevant noise conditions since Mod 3 was approved.

*SCHEDULE 3*

1. *The Proponent shall ensure that the noise generated by the Moolarben mine complex does not exceed the noise criteria in Table 1 at any residence on privately-owned land or the other specified locations.*

*Table 1: Noise criteria dB(A)*

| *Land Number* | *Day* | *Evening* | *Night* | |
|---|---|---|---|---|
| | *LAeq,15min* | *LAeq,15min* | *LAeq,15min* | *LA1,1min* |
| *30, 63* | *39* | *39* | *39* | *45* |
| *70* | *37* | *37* | *37* | *45* |
| *75* | *36* | *36* | *36* | *45* |
| *31* | *36* | *36* | *36* | *45* |
| *All other privately owned residences* | *35* | *35* | *35* | *45* |
| *Ulan Primary School* | *35 (internal) when in use* | | | - |
| *Ulan Anglican Church*<br>*Ulan Catholic Church* | *35 (internal) when in use* | | | - |
| *Goulburn River National Park*<br>*Munghorn Gap Nature Reserve* | *50* | | | - |

*Note: To interpret the land referred to in Table 1 see the applicable figures in Appendix 5.*

*Noise generated by the complex is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.*

*However, these noise criteria do not apply if the Proponent has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.*

*SCHEDULE 4*

4. *If an owner of privately-owned land considers the project to be exceeding the criteria in Schedule 3, then he/she may ask the Secretary in writing for an independent review of the impacts of the project on his/her land.*

*If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision, the Proponent shall:*

*(a) commission a suitably qualified, experienced and independent expert, whose appointment has been approved by the Secretary, to:*

- *consult with the landowner to determine his/her concerns;*
- *conduct monitoring to determine whether the project is complying with the relevant impact assessment criteria in Schedule 3; and*
- *if the project is not complying with these criteria then:*
  - *determine if more than one mine is responsible for the exceedance, and if so the relative share of each mine regarding the impact on the land;*
  - *identify the measures that could be implemented to ensure compliance with the relevant criteria; and*

*(b) give the Secretary and landowner a copy of the independent review.*

Property 300 falls under the 'All other privately owned residences' category in Schedule 3 Table 1 and has therefore been assigned criteria of 35 LAeq,15min and 45 LA1,1min, which is similar to 45 LAmax, during the night.

# 3. SURVEY METHODOLOGY

## 3.1. Survey Requirements

A draft noise survey protocol was prepared on 9 June 2015 for review by Moolarben Coal and the DP&E, however the DP&E undertook to develop a preferred, standardised independent noise monitoring protocol in conjunction with the EPA and requested the noise survey be delayed while the protocol was prepared. The following noise survey requirements were received from the DP&E by email on 24 August 2015.

1) *Night time noise compliance only i.e. 10pm – 7am.*
2) *10 monitoring events (days) in a 30 day period.*
3) *No more than 2 consecutive days, or a total of 4 days in a single week (M – S)*
4) *Monitoring events to be separated by at least 3 days.*
5) *2 rounds of monitoring to be undertaken on each night separated by at least 2 hours.*
6) *If one valid 15 min reading is found to be in exceedance of criteria by more than 2 dB, then a second measurement needs to be undertaken within 75 min (but not less than 45 min). If both measurements are deemed valid, and exceed the criteria by more than 2 dB, then the night will be deemed a noise affected night. This can be triggered by either of the 2 rounds of monitoring.*
7) *The noise consultant should schedule for the most likely noisy nights with reference to meteorological forecast.*
8) *Techniques such as pausing and low pass filtering should be employed to ensure measurements are representative of Moolarben generated noise only. The technician needs to estimate the contribution of Moolarben noise to the overall noise catchment.*
9) *Leq(15 min) levels in dB(A) along with dB(C) are to be recorded.*

*10) Separate audio should be collected to cover each monitoring period. Note that it may be necessary to collect more than 15 minutes of audio to cover periods when data is paused or back erased to eliminate extraneous noise.*

*11) Data should coincide with meteorological measurements to determine if weather conditions are valid.*

Subsequent discussion resulted in one additional requirement for the noise survey, received by email on 3 September 2015:

*12) Measurements of Leq levels shall be extended beyond 15 min to a maximum of 25 minutes if required to capture 15 minutes of clean data. At the end of 25 minutes the data collected shall be an acceptable quantity if it exceeds 10 minutes of clean data. If the quantity of clean data is less than 10 minutes, then the site shall be found not to be in non-compliance.*

A final noise monitoring protocol incorporating the DP&E's requirements was prepared on 3 September 2015 and forwarded to all parties. The protocol allowed for a minimum of two primary noise measurement periods during each of 10 nights as required by the DP&E, with each measurement over 25 minutes to allow for post-processing of data. An additional one or two secondary measurement periods would occur, for a maximum of four measurement periods per night, if results from one or both primary measurements indicated a possible non-compliance in response to requirement 6 above. As compliance can only be determined after results were processed, some secondary noise measurements were taken that were subsequently determined to not be required.

## 3.2. Instruments

Noise measurements were taken using a Svan 957 Type 1 sound level meter programmed to measure and store 1-second LAeq levels in 1/3 octaves from 20 Hz to 20 kHz over each 25 minute period. The microphone was attached via a 2 m extension cable to minimise any influence from the operator on the measurement results and was either mounted on a tripod approximately 1.5 m above the ground or above the front of a vehicle approximately 2.4 m above the ground to minimise reflection from the vehicle. While the elevated microphone position does not strictly comply with relevant standards, it is a commonly adopted strategy for environmental noise surveys and, if anything, provides slightly conservative results compared to the standard microphone height of 1.5 m.

The instrument simultaneously recorded audible sound in uncompressed digital format using a digitising rate of 24 kHz and 24 bit sampling. The sound files were subsequently high pass filtered with a -3 dB point at 10 Hz to minimise high amplitude but inaudible wind noise then amplified to allow audible sounds to be more readily determined.

## 3.3. Data Post-Processing

Processing of results included the following steps:

- Review the recorded sounds through an octave band equaliser to determine the frequency range of each audible source, allowing the mine noise contribution to be separated from insect and bird noise by frequency filtering;
- Filter the one-second noise levels by time, based on a detailed review of the recorded sounds combined with notes taken during each measurement period, to separate mine noise from other sources such as wind and road traffic that cannot reasonably be separated by frequency; and
- Determine the total length of audible mine noise within each 25 minute measurement period and the average (LAeq and LCeq) and maximum (LAmax, in lieu of LA1,1min) filtered levels attributed to mine noise.

Weather conditions during each noise measurement period were determined from weather data in 15 minute periods provided daily by Moolarben Coal. Weather station WS3 is located approximately 1.6 km east of the noise monitoring location between Ulan Road and Ryans Creek which adequately measures weather conditions between the mine and the residence.

According to the NSW Industrial Noise Policy (INP) referred to Schedule 3 Condition 1 of the Project Approval, noise measurement results are considered valid if taken:

- in the absence of rain; and
- during wind speeds less than or equal to 3 m/s (measured at 10 m above the ground) at any time; or
- during a temperature inversion of up to 3 °C/100m combined with a 2 m/s drainage flow during the evening and night.

## 3.4. Low Frequency Correction

Research carried out over a number of decades by various parties has indicated environmental noise can be perceived as more noticeable or annoying if it contains one or more of the following characteristics:

- A tonal component, which is a concentration of sound energy in a narrow frequency band. Examples of tonal sources are beepers, chimes and sirens, which rely on the more noticeable nature of a tonal noise to attract attention and/or provide a warning;
- A significant low frequency component which tends to transmit more effectively over distance, over or around barriers and through building elements such as walls and windows;
- Impulsive noise which is typically caused by material impacts, pulses of gas from a pipe such as a car exhaust and similar rapidly varying sources, which appear more noticeable due to their unusual and distinctive character; and
- Intermittent noise, such as a source that periodically starts and stops, as the changes in noise level and character are more noticeable than steady state noise from a continuously operating source.

Of these four characteristics, experience indicates low frequency noise is the most likely to be encountered at a distance of a few kilometres from an operating open cut mine. Tonal, impulsive and intermittent noise can be produced by specific sources within a mine such as reverse alarms, dozer tracks and diesel exhausts, however a mine includes a large number of machines which together produce a blended noise that is typically free of tonal, impulsive and intermittent components.

The INP is the primary noise policy document for state significant industrial developments such as mines. Table 4.1 of the INP includes a recommendation that low frequency noise be assessed by comparing the mine-only dBA and dBC noise levels. Where the dBC level is more than 15 dB above the dBA level, a +5 dBA low frequency correction is recommended to be added to the measured noise level to account for the more noticeable nature of low frequency noise.

The Draft Industrial Noise Guideline (Draft ING) was published by the EPA in September 2015, after the Project Approval was issued and after this independent noise review was commissioned. Nevertheless, the Draft ING indicates future EPA noise policy and has been considered in this review.

Fact Sheet C attached to the Draft ING describes recommended corrections to calculated or measured noise levels to account for the four main characteristics listed above. The recommendations are generally similar to the INP, however additional recommendations have been added to the assessment of low frequency noise to correct previous issues with the INP recommendations and reflect the latest research results. Table C2 in the Draft ING presents threshold levels in 1/3 octaves and is reproduced in Table 1 below.

**Table 1: dBL Low Frequency Thresholds (from Table C2, Draft ING) and Equivalent dBA Values.**

| | One-Third Octave Leq,15min Threshold Levels | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency, Hz | 10 | 12.5 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| dBL Threshold | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |
| Equivalent dBA | 22 | 26 | 29 | 27 | 24 | 22 | 19 | 20 | 24 | 26 | 29 | 30 | 31 |

The ING recommends the following low frequency corrections:

- +2 dBA where the mine-only dBC level is more than 15 dB above the mine-only dBA level (identical to the INP recommendation) and one or more 1/3 octave mine-only levels are up to 5 dB above the corresponding values in Table C2; and
- +5 dBA where the mine-only dBC level is more than 15 dB above the mine-only dBA level (identical to the INP recommendation) and one or more mine-only 1/3 octave levels are more than 5 dB above the corresponding values in Table C2.

Three sets of mine-only noise levels are presented in this review report: actual calculated levels, corrected levels based on the INP recommendations and corrected levels based on the Draft ING recommendations.

# 4. RESULTS

A review of recorded noise levels in individual octave bands, particularly the recordings taken during the early morning of 1 October when mining noise was most audible, indicated noise from mining sources primarily occurred in the 31.5 Hz to 250 Hz octave bands with relatively minor audible noise in the 500 Hz octave band. Measured noise levels were therefore frequency filtered with noise in the 20 Hz to 500 Hz 1/3 octave bands attributed to mining sources and noise in the 630 Hz band and above attributed to other sources such as traffic, insects and birds.

Frequency filtering alone is not sufficient to determine mining noise levels as audible noise from specific non-mine sources such as road traffic and owl calls was also noted within the frequency range attributed to the mine. Additional filtering by time, which involved separating noise data in one-second intervals based on a detailed review of the recorded sound files, was required to separate noise from mining and other sources.

Table 2 presents a summary of measured total noise levels and calculated mine-only noise levels during the 10 night series of noise surveys. Data in italics represent results from secondary noise measurements that were taken in case the primary noise measurements showed a non-compliance with relevant criteria after the results were processed, or in the case of the secondary measurement on 20 September were taken to be closer to the end of the night period to address concerns expressed by residents.

More complete data, including charts showing measured and filtered one-second noise levels in the 25 minute period and 1/3 octave spectra along with weather conditions and a description of audible sources, are attached in Appendix C. Weather conditions were acceptable for noise monitoring during all measurement periods and all results are therefore valid according to the weather conditions defined in the INP.

**Table 2: Measured and Calculated Noise Level Summary, Collins/Marshall, 2015.**

| Noise Measurement Period | | | Total Measured Noise Level, 25 minutes | | | Moolarben (Mine Only) Noise Level | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Time Mine was Audible | LAmax | LAeq | LCeq | Low Freq Corrected | |
| Date | Start | End | LAmax | LAeq | LA90 | | | | | INP | ING |
| 8/9 | 22:35 | 23:00 | 46 | 34 | 29 | 0 | - | < 25 | - | - | - |
| 9/9 | 01:28 | 01:47 [1] | 40 | 22 | 20 | 0 | - | < 25 | - | - | - |
| 10/9 | 00:36 | 01:01 | 43 | 24 | 20 | 0 | - | < 25 | - | - | - |
| 10/9 | 03:03 | 03:28 | 39 | 24 | 21 | 0 | - | < 25 | - | - | - |
| 15/9 | 01:17 | 01:42 | 51 | 25 | 22 | 0 | - | < 25 | - | - | - |
| 15/9 | 03:46 | 04:11 | 32 | 25 | 23 | 25:00 | 32 | 23 | 43 | 28 | 23 |
| 15/9 | 22:42 | 23:07 | 58 | 38 | 22 | 0 | - | < 25 | - | - | - |
| 16/9 | 01:08 | 01:33 | 42 | 24 | 21 | 0 | - | < 25 | - | - | - |
| 20/9 | 01:07 | 01:32 | 46 | 31 | 25 | 19:37 | 33 | 26 | 46 | 31 | 26 |
| 20/9 | 04:01 | 04:26 | 50 | 37 | 31 | 0 | - | est 28 | - | - | - |
| *20/9* | *05:09* | *05:34* [2] | *53* | *41* | *34* | *0* | - | *< 25* | - | - | - |
| 20/9 | 22:21 | 22:46 | 47 | 30 | 24 | 0 | - | < 25 | - | - | - |
| 21/9 | 01:04 | 01:29 | 48 | 26 | 23 | 0 | - | < 25 | - | - | - |
| 1/10 | 00:25 | 00:50 | 45 | 30 | 28 | 21:36 | 31 | 27 | 49 | 32 | 27 |
| *1/10* | *01:32* | *01:57* | *48* | *33* | *30* | *19:15* | *33* | *28* | *49* | *33* | *28* |
| 1/10 | 02:40 | 03:05 | 52 | 35 | 32 | 19:18 | 36 | 30 | 50 | 35 | 30 |
| *1/10* | *03:46* | *04:11* | *46* | *34* | *31* | *16:34* | *36* | *30* | *49* | *35* | *30* |
| 2/10 | 01:04 | 01:29 | 33 | 22 | 19 | 0 | - | < 25 | - | - | - |
| 2/10 | 03:23 | 03:48 | 46 | 29 | 21 | 0 | - | < 25 | - | - | - |
| 15/10 | 00:49 | 01:14 | 51 | 33 | 29 | 21:08 | 35 | 29 | 49 | 34 | 29 |
| 15/10 | 03:02 | 03:27 | 44 | 28 | 26 | 24:03 | 31 | 27 | 46 | 32 | 27 |
| 15/10 | 22:19 | 22:44 | 52 | 36 | 27 | 0 | - | < 25 | - | - | - |
| 16/10 | 01:25 | 01:50 | 38 | 22 | 20 | 0 | - | < 25 | - | - | - |

1 Noise measurement period was reduced to approximately 19 minutes due to rain.

2 A second noise measurement closer to the 7:00 am end of the night period was added to the survey in response to residents commenting that mine noise is sometimes more audible at that time.

Results in Table 2 indicate all filtered mine-only noise levels, including either INP or Draft ING low frequency corrections, comply with the relevant Project Approval criterion of 35 LAeq.

## 4.1. Maximum Noise Levels

Table 2 summarises the mine-only LAmax noise levels after time and frequency filtering to remove noise from non-mine sources, for comparison with the 45 LAmax (or 45 LA1,1min) criterion specified in Schedule 3 Condition 1 of the Project Approval.

The highest mine-only levels of 36 LAmax were noted during the morning of 1 October. While a low frequency correction is not normally required for maximum noise levels, addition of a +5 dBA correction would not result in an exceedance of the 45 LAmax criterion therefore maximum noise levels from the mine comply with the Project Approval.

# 5. DISCUSSION

During the meeting in July 2015, residents commented that noise from the mine can sometimes be louder and more noticeable during the early morning period, with the noise continuing up to approximately 9 am. However, the noise measurement results presented in this review report indicate the mine is most audible during the period midnight to approximately 4 am, after which a substantial increase in road traffic noise tends to mask mining noise. The period during and after dawn also includes significant bird activity which further masks mine noise.

While a noise survey extending over only 10 nights may not be sufficient to fully describe the acoustic environment in the vicinity of the residence, it is considered likely that some noise attributed by residents to mining sources may actually be generated by road traffic, particularly during the approximate period 5 am to 7 am when traffic flows are relatively high.

# 6. CONCLUSION

This report describes results from an independent review of environmental noise levels from Moolarben Coal Mine to Property 300 owned and occupied by Mr Corey Collins and Ms Charmaine Marshall. The measured noise levels, after filtering by frequency and time to remove the influence of non-mine sources such as road traffic and insects, demonstrate compliance with relevant Project Approval 05_0117 conditions during each of the 10 nights included in the noise survey.

Based on the results of this review, no additional operational noise mitigation or management measures are recommended and no sustained mine related noise impacts are occurring at the residence.

# APPENDIX A – REQUEST FROM DP&E

Contact: Wayne Jones
Phone: 02 6575 3406
Fax: 02 6575 3515
Email: wayne.jones@planning.nsw.gov.au
Our ref: MP 05_0117 Mod 3

Mr Graham Chase
Environment & Community Manager
Moolarben Coal Operations Pty Ltd
Locked Bag 2033
MUDGEE NSW 2850

Dear Mr Chase

**Request for Independent Review - MP- 05_0017 – Moolarben Coal**

The Department has received a request for an independent review from Charmaine Marshall and Corey Collins of 927 Ridge Road Cooks Gap, NSW under Schedule 5, Condition 4 of MP 05_0117 Mod 3.

Ms Marshall and Mr Collins are concerned that Moolarben Coal Mine may be exceeding the relevant impact assessment criteria for noise and air quality at their property.

The Secretary has reviewed Ms Marshall and Mr Collins concerns, relevant monitoring data and past annual review reports to assess the reported levels of noise and air quality from monitors representative of their property.

Air quality data reported for the past twelve months at deposited dust gauges, TEOM's and Hi Volume air samplers in locations representative of the Corey residence has been reviewed. The review indicates that the air quality monitoring results are generally well less than the Project Approval criteria. The Secretary does not believe an independent review is warranted for air quality on this occasion.

The Secretary confirms that an independent review is warranted for noise on this occasion. Moolarben Coal Operations are required to commission a suitably qualified, experienced and independent person(s) within the next two months. In accordance with Schedule 5, Condition 4 the expert shall:

a) consult with Ms Marshall and Mr Collins to determine their concerns;
b) conduct monitoring to determine whether the project is complying with the noise impact assessment criteria under Schedule 3; and
c) if the project is not complying with these criteria then:
    - determine if more than one mine is responsible for the exceedance, and if so the relative share of each mine regarding the impact on Ms Marshall and Mr Collins;
    - identify measures that could be implemented to ensure compliance with the relevant criteria; and
d) give the Secretary and the landowner a copy of the independent review.

I would appreciate it if you would nominate suitably qualified and independent person(s), no later than Friday 17 July 2015, to carry out this independent review.

Singleton Office: P.O. Box 3145, Suite 14, Level 1, 1 Civic Avenue Singleton NSW 2330
Website: www.planning.nsw.gov.au

While there is no formal requirement for Moolarben Coal Operations to involve the Department in the scoping of the review, it has previously been beneficial to both parties and the Department seeks your endorsement for a Departmental representative to attend the scoping meeting with Ms Marshall and Mr Collins.

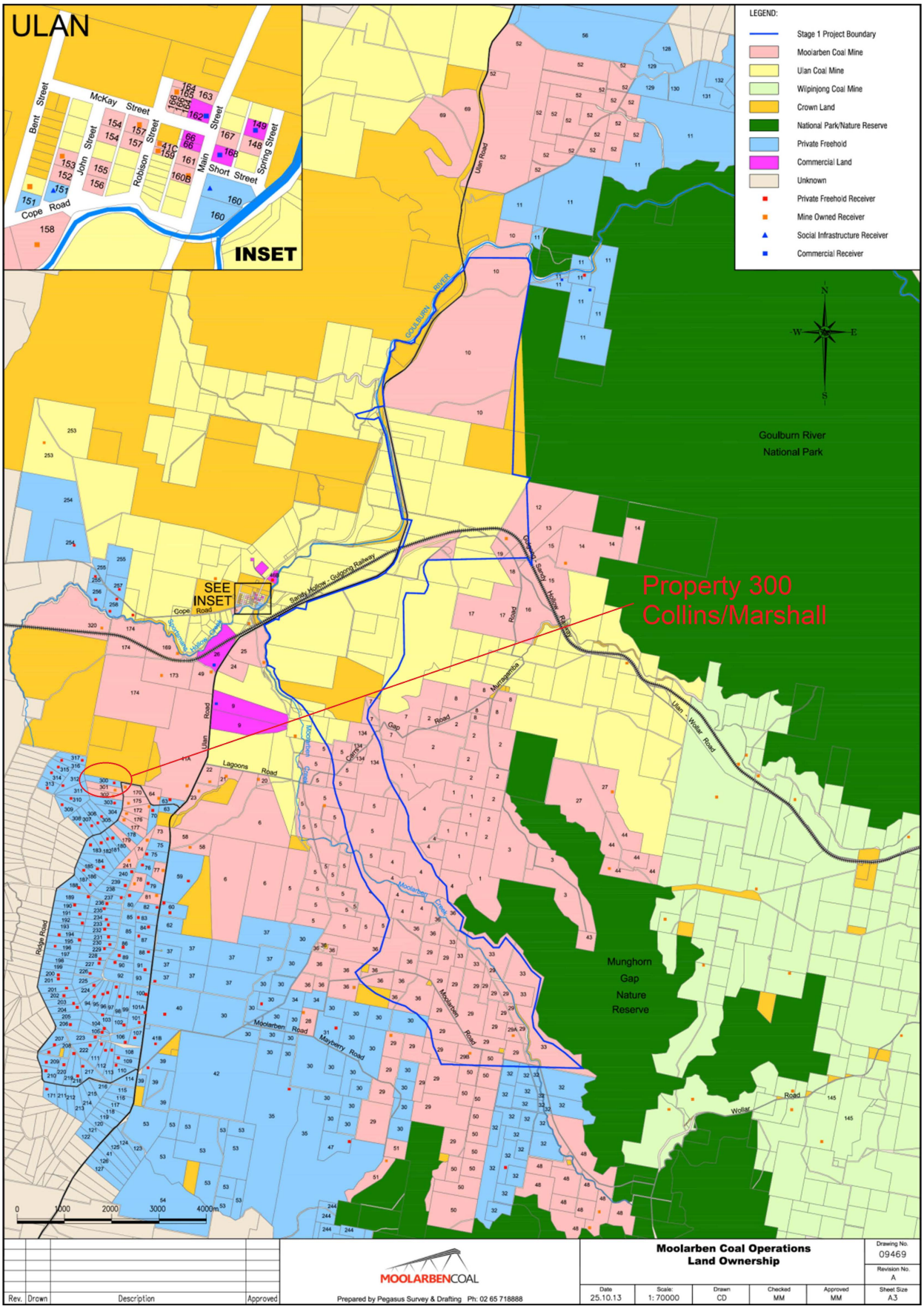
I further ask that you contact me on 6575 3406 to discuss the scope of works for the upcoming independent review.

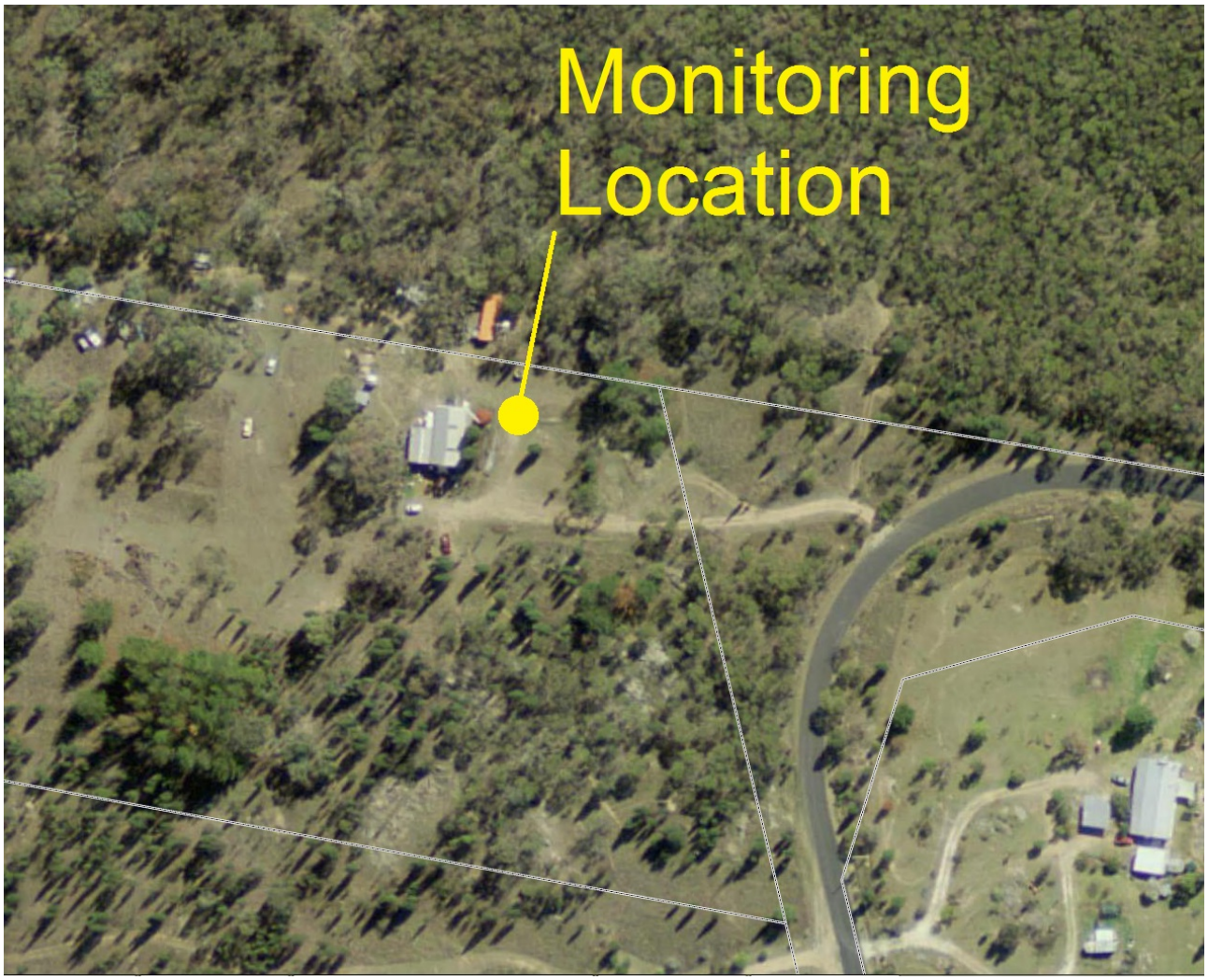
Yours sincerely

W Jones 22 May 2015.

Wayne Jones
**A/Investigations (Lead), Compliance**
As Nominee for the Secretary, Department of Planning & Environment

# APPENDIX B – PLANS





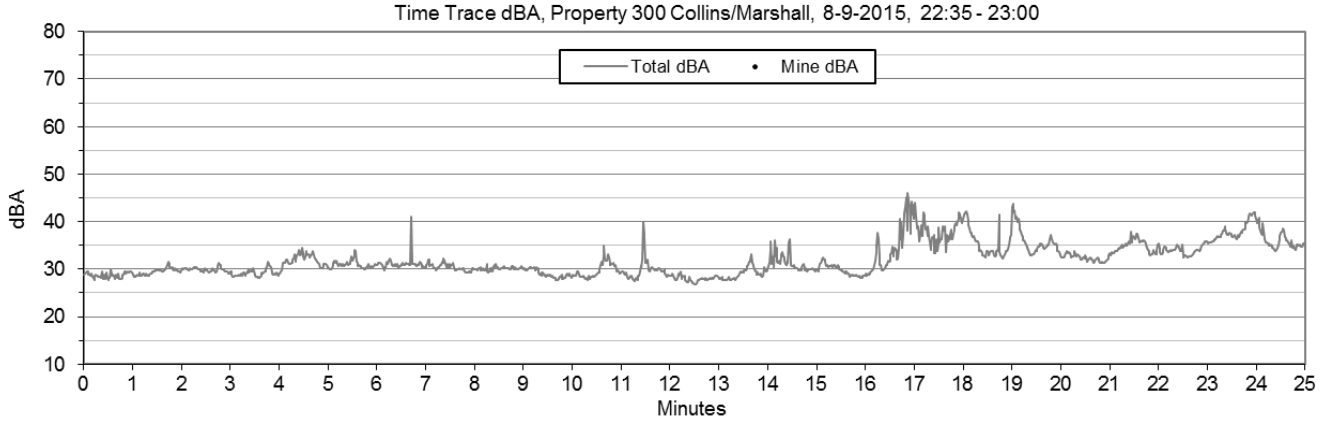

Partial view of the property showing Ridge Road, the main shed and the noise monitoring location. Base plan from SIX Maps.

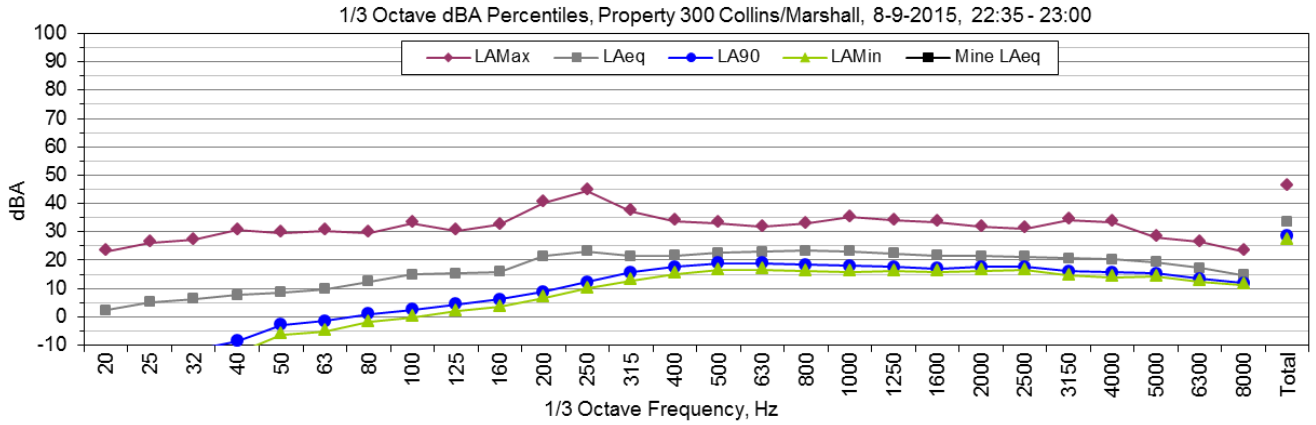
# APPENDIX C – MEASURED NOISE LEVELS

Charts on the following pages show measured noise levels at the receptor. Measured noise levels are presented in the order they were measured, with the date and time shown in each figure.

Two charts are shown for each noise measurement. The first chart shows a 'noise level trace' for the duration of the noise measurement in one second intervals in dBA. The second chart shows the measured maximum (LAmax), average (LAeq), background (LA90) and minimum (LAmin) noise levels in 1/3 octave bands from 20 Hz to 8000 Hz and total dBA noise levels, plus the mine-only LAeq where the mine was audible and the mine-only LAeq could be calculated.

**Survey 1 – Nights of Tuesday 8 and Wednesday 9 September 2015**



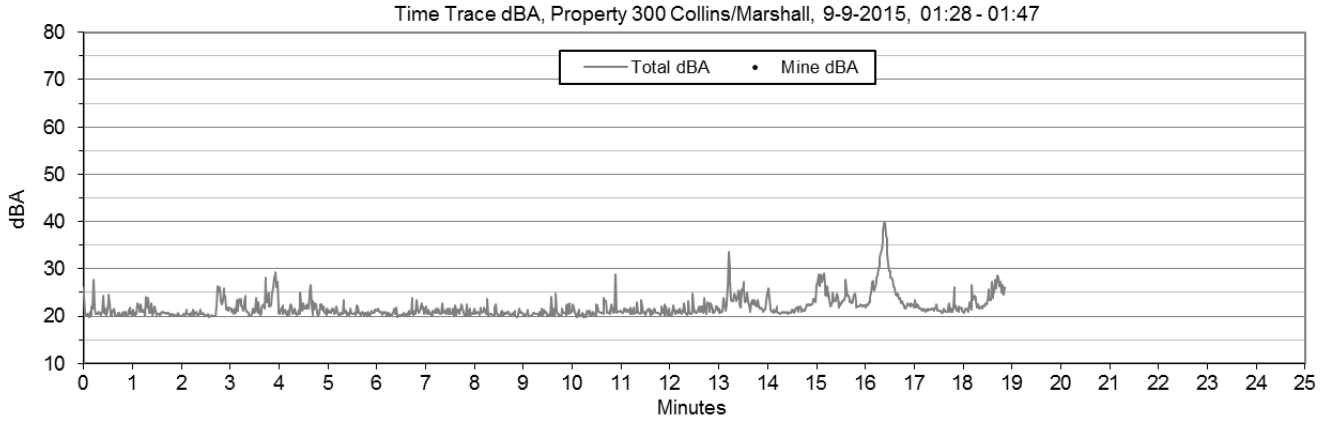



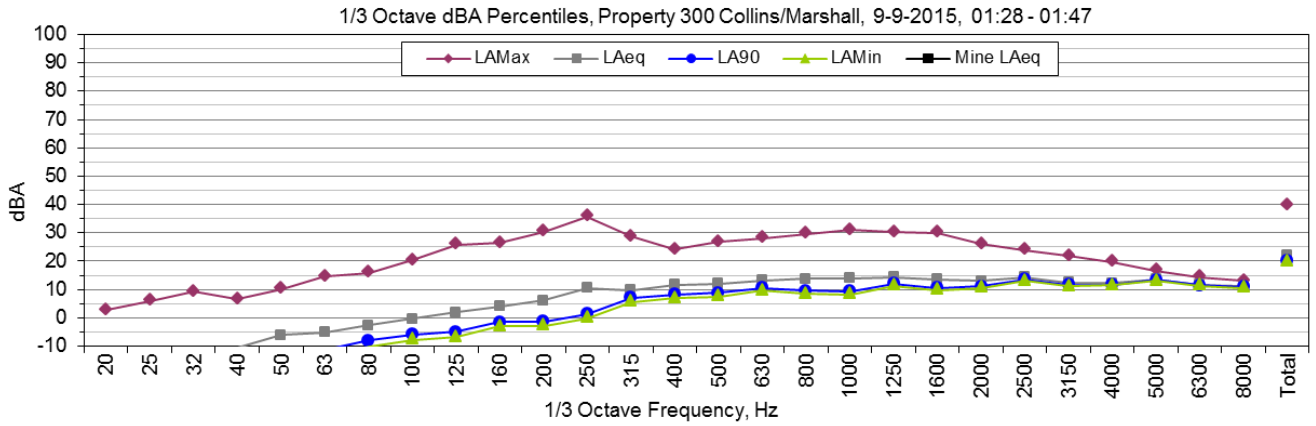

Air temperature 9 °C

Wind speed 2.4 m/s from the south

Wind sigma-theta 18°, Stability category E

Audible sources included insects and frogs, intermittent wind noise in nearby trees, intermittent and distant dogs barking, intermittent road traffic and aircraft. No mine noise was audible at any time.



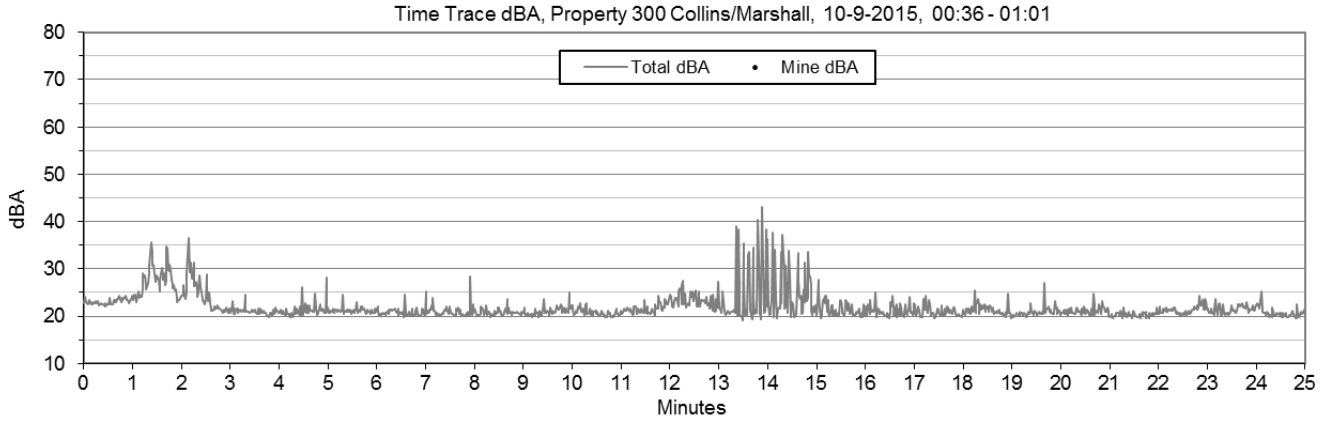



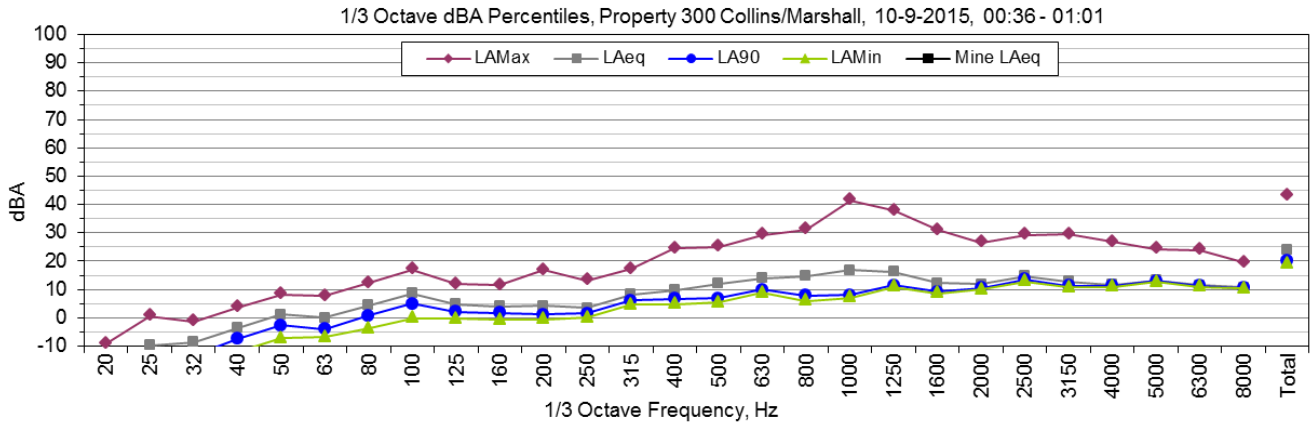

Air temperature 8 °C

Wind speed 2.5 m/s from the north west

Wind sigma-theta 13°, Stability category D

Audible sources included insects and frogs, intermittent road traffic, intermittent and barely audible mine noise and a faint buzz from the north (much like a bee hive). Mine noise was just audible at a measured noise level of approximately 20 dBA, leading to an estimated mine noise level in the range 10 to 15 LAeq. The 25 minute measurement period was interrupted by rain, however was not repeated when the rain ceased due to the very low mine noise levels and with over 15 minutes of data already collected.



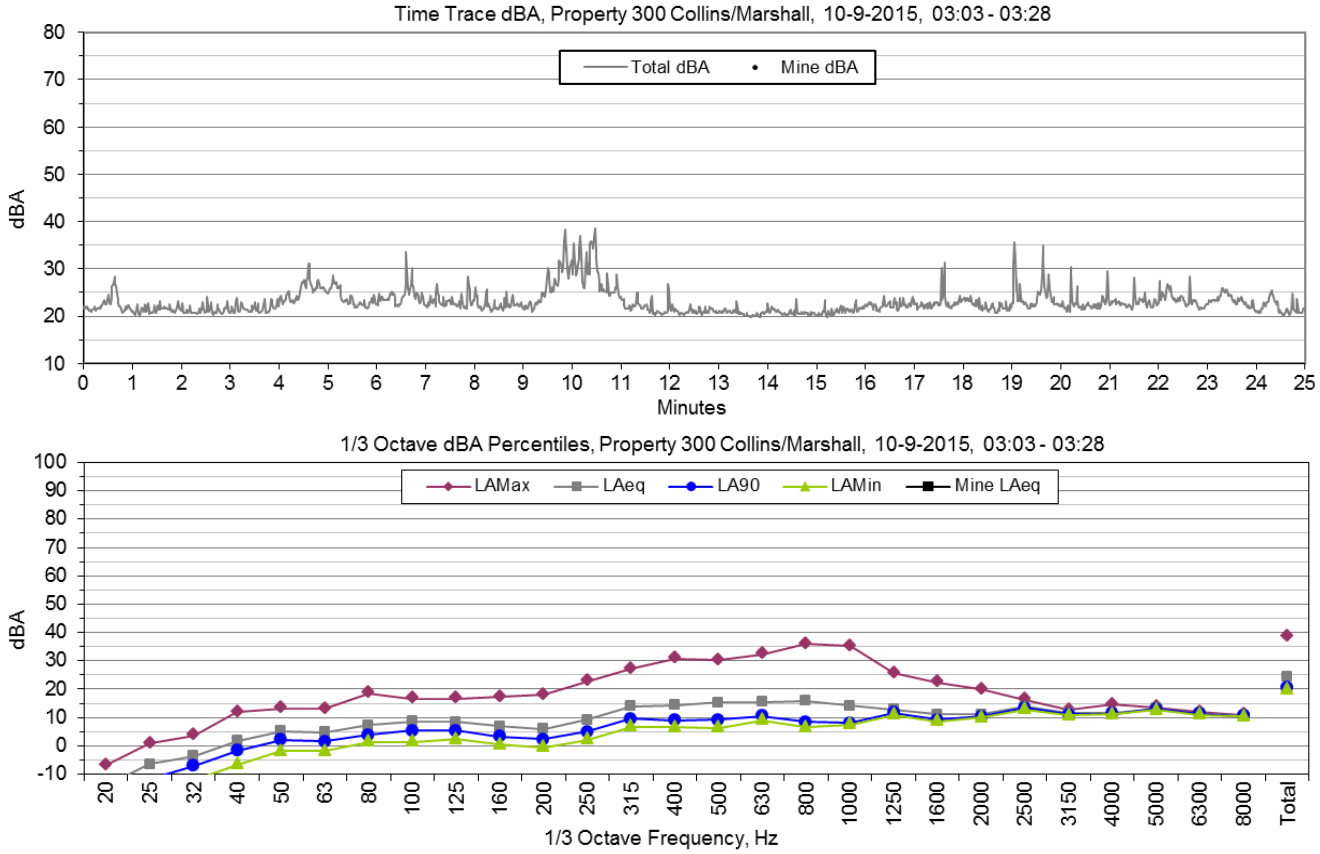




Air temperature 5 °C

Wind speed 0.8 m/s from the south

Wind sigma-theta 13°, Stability category F

Audible sounds included insects and frogs, intermittent road traffic and a barely audible mine hum. Mine noise was just audible at a measured noise level of approximately 20 dBA, leading to an estimated mine noise level in the range 10 to 15 LAeq.



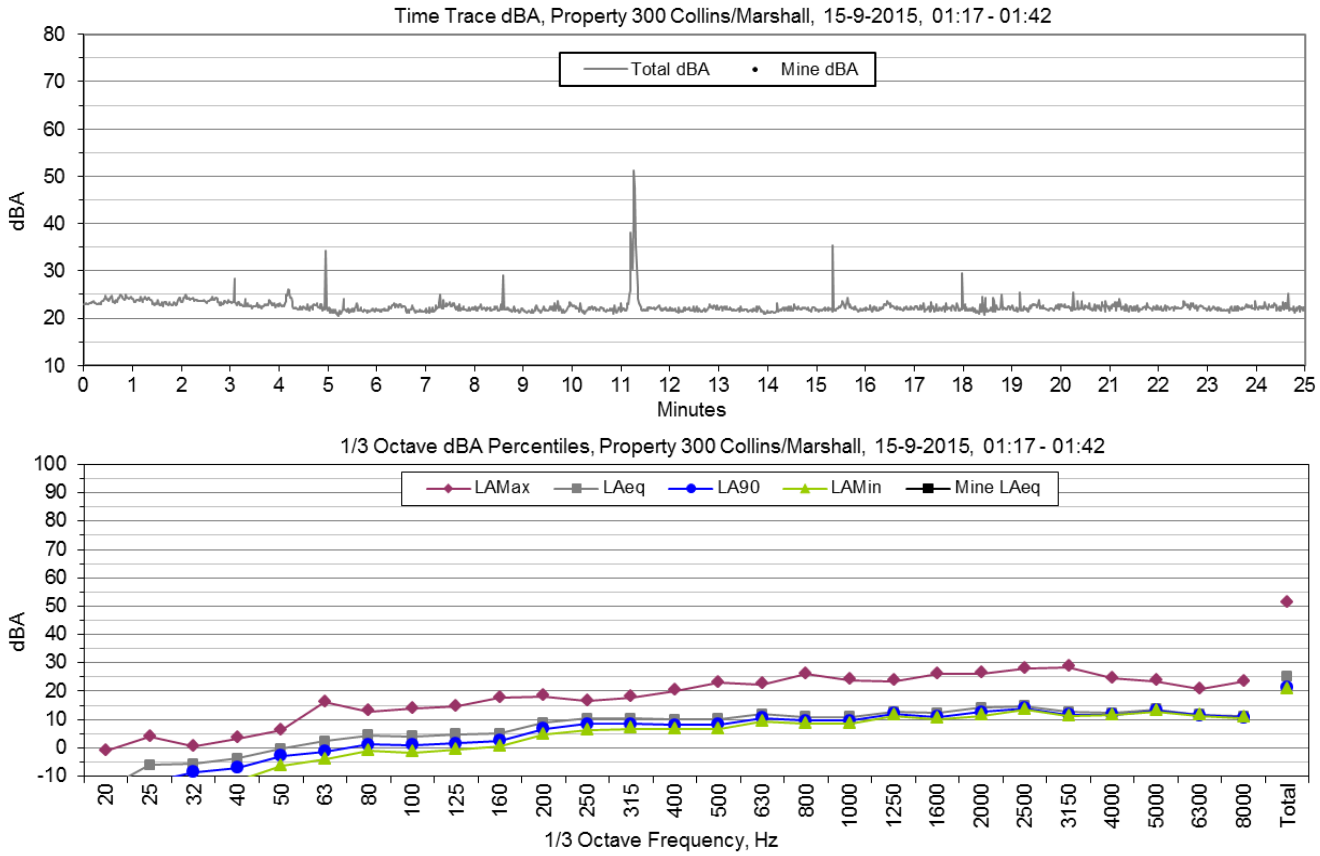

Air temperature 2 °C

Wind speed 0.9 m/s from the south

Wind sigma-theta 25°, Stability category F

Audible sounds included insects and frogs, intermittent road traffic, a mine shovel gate bang and mining truck gearboxes and engines. Mine noise was clearly audible at a measured noise level of approximately 20 dBA, leading to an estimated mine noise level in the range 18 to 22 LAeq.

## Survey 2 – Nights of Monday 14 and Tuesday 15 September 2015

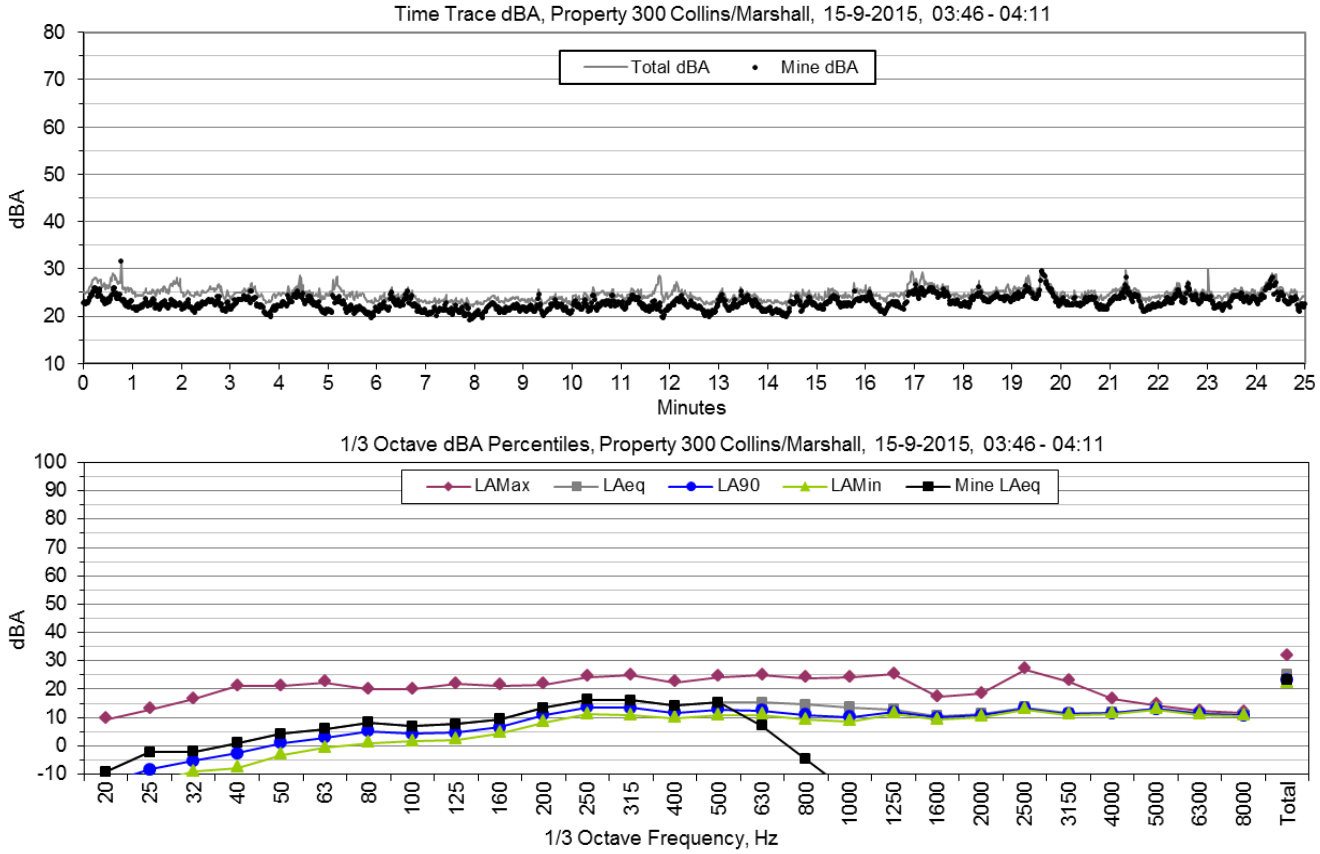



Air temperature 8 °C

Wind speed 2.1 m/s from the south

Wind sigma-theta 14°, Stability category E

Audible sounds included insects and frogs, intermittent road traffic and a barely audible mine hum at an estimated level in the range 18 to 22 LAeq. The mine hum appeared to come from the direction of the Ulan CHPP, although the noise was not sufficiently audible to determine the source with any reliability and may have been from the Moolarben CHPP or, more likely, from Moolarben mobile plant. Occasional loud peaks were due to insects buzzing very close to the microphone.

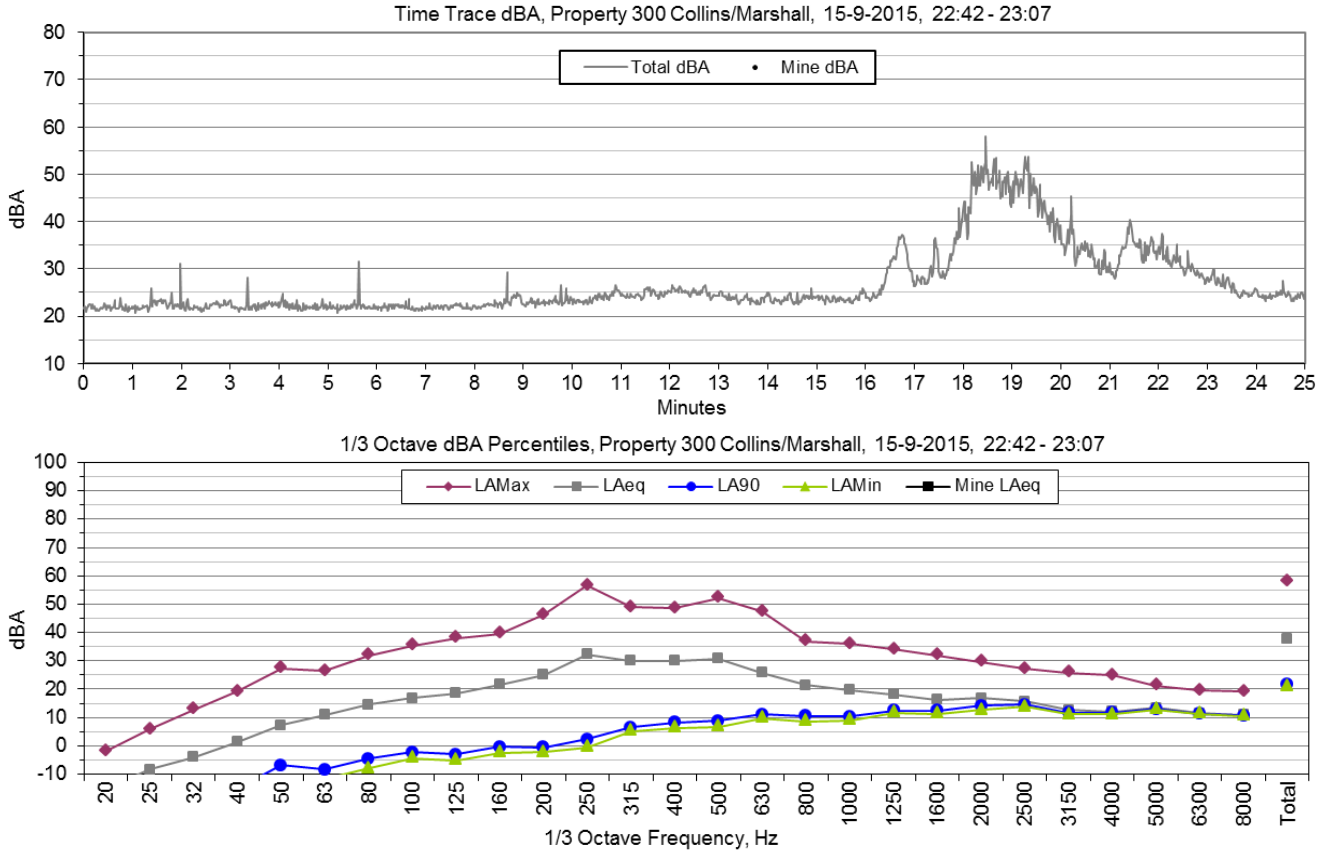



Air temperature 7 °C

Wind speed 2.4 m/s from the south

Wind sigma-theta 9°, Stability category D

Audible sounds included a constant mine hum, insects, frogs and perhaps water dripping nearby, although the last was irregular so may have been due to a different species of frog. Listening to the recorded sound in various octave bands indicates mine noise occurs in the range 20 Hz to approximately 500 Hz, therefore all measured noise above 500 Hz is either from other sources or represents the noise floor of the instrument. A mine noise contribution of 23 LAeq has been estimated by summing the measured noise levels in all frequency bands up to and including 500 Hz.

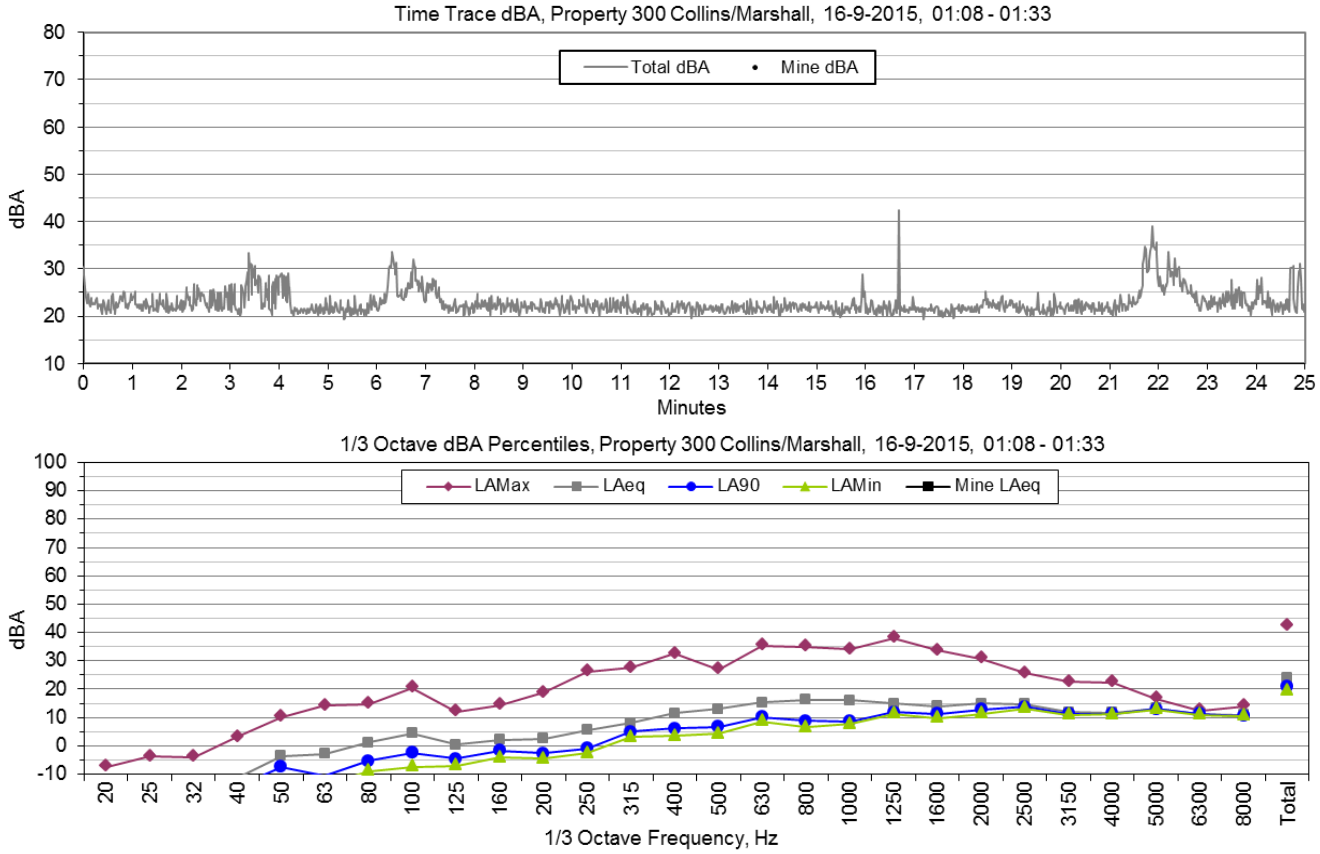



Air temperature 12 °C

Wind speed 0.9 m/s from the north

Wind sigma-theta 47°, Stability category F

Measured noise levels were dominated by occasional road traffic and a passing plane towards the end of the measurement period. Noise levels in the absence of road and air traffic were very low, with only distant insects and frogs audible. Mine noise was not noted at any time during the survey.



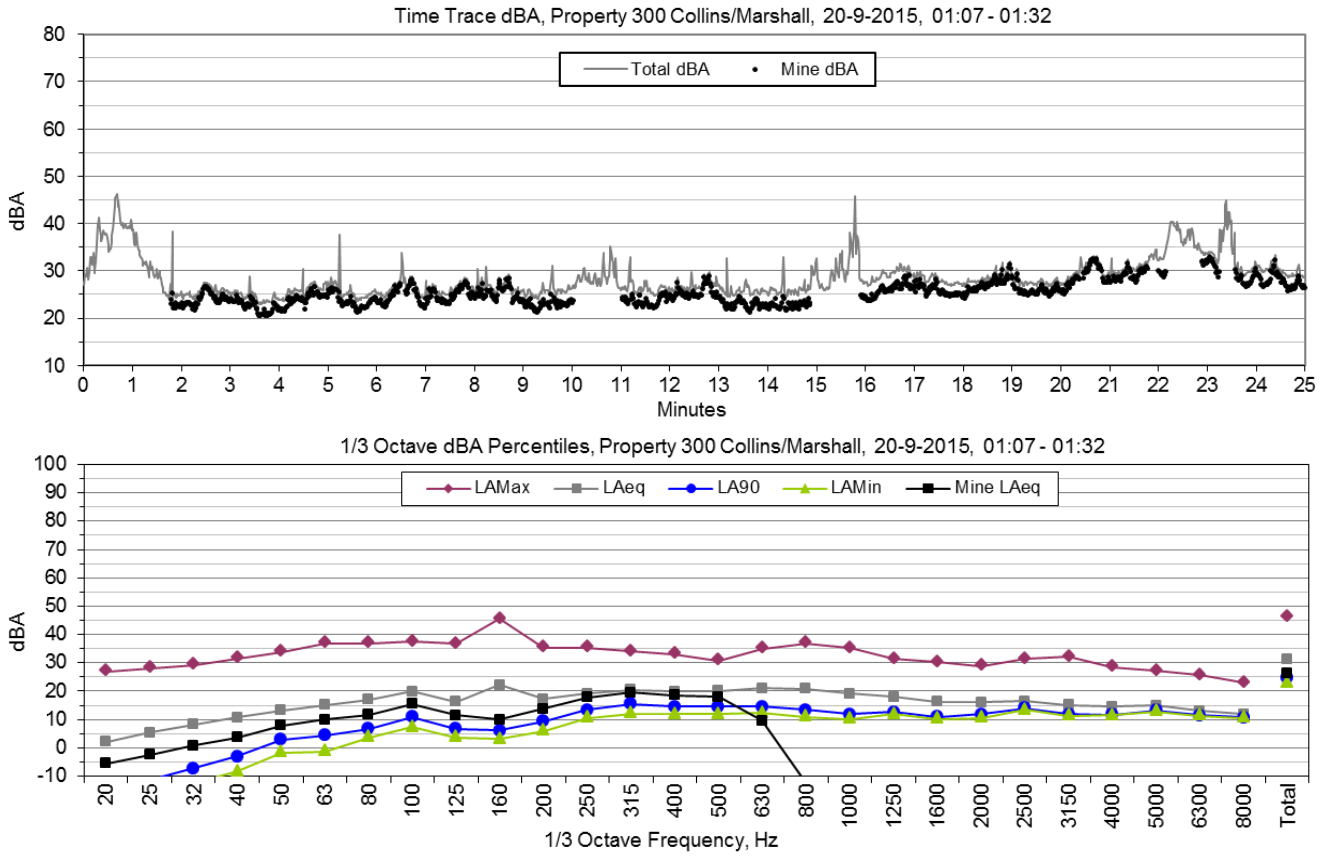

Air temperature 7 °C

Wind speed 2.3 m/s from the south

Wind sigma-theta 7°, Stability category E

Measured noise levels were primarily affected by insects and frogs, intermittent Ridge Road traffic and dogs. The highest peak just before 17 minutes was caused by an impact on the survey vehicle presumably from a large insect. A radio or television within the residence was barely audible, while a domestic water pressure pump operated for a few seconds just before the end of the measurement period. Mine noise was not audible at any time.

## Survey 3 – Nights of Saturday 19 and Sunday 20 September 2015

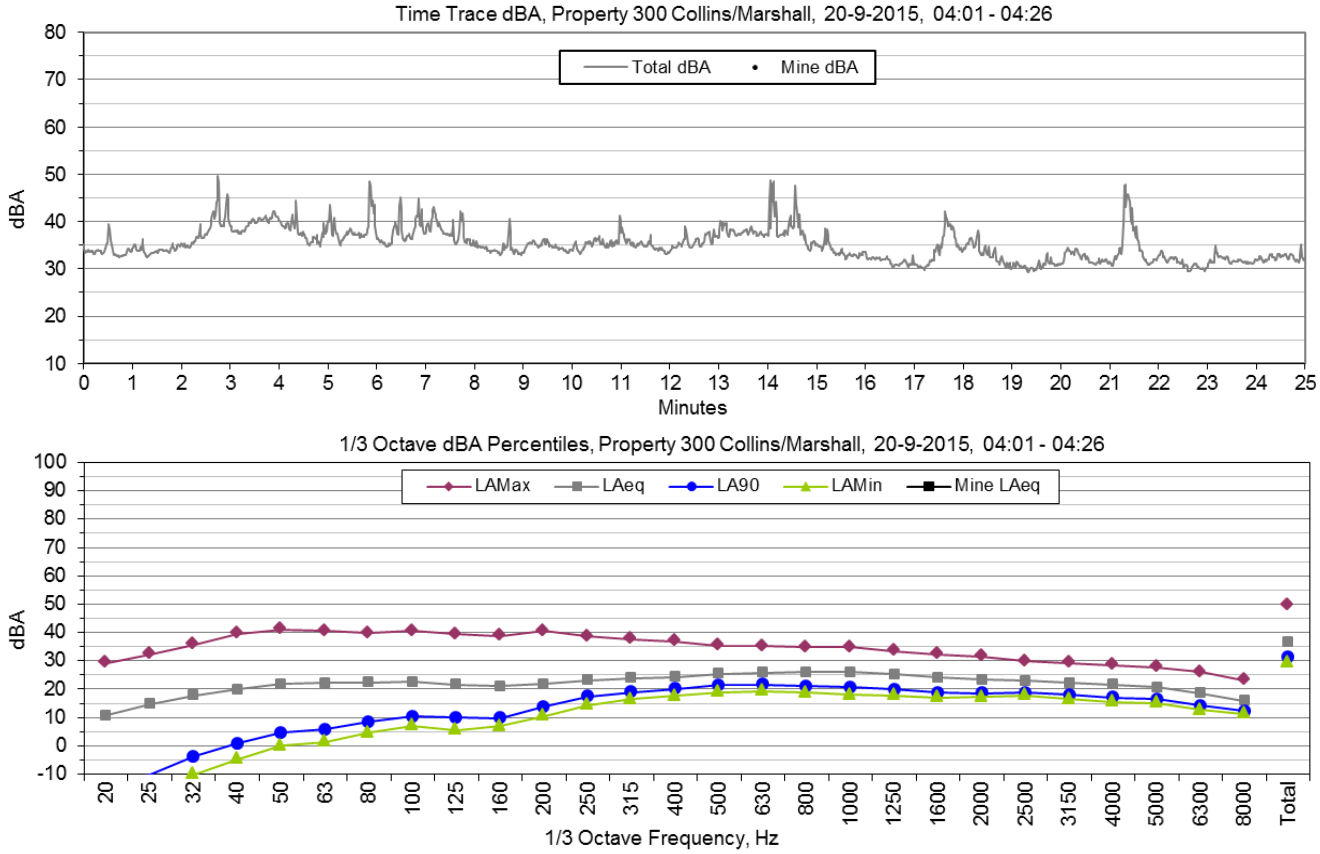



Air temperature 11 °C

Wind speed 1.9 m/s from the south east

Wind sigma-theta 12°, Stability category D

Audible sounds included insects, frogs, wind and road traffic, with mine noise in the background over much of the measurement period. Mine noise has been separated from other sources by time and frequency bands, resulting in an estimated mine noise contribution of 26 LAeq.



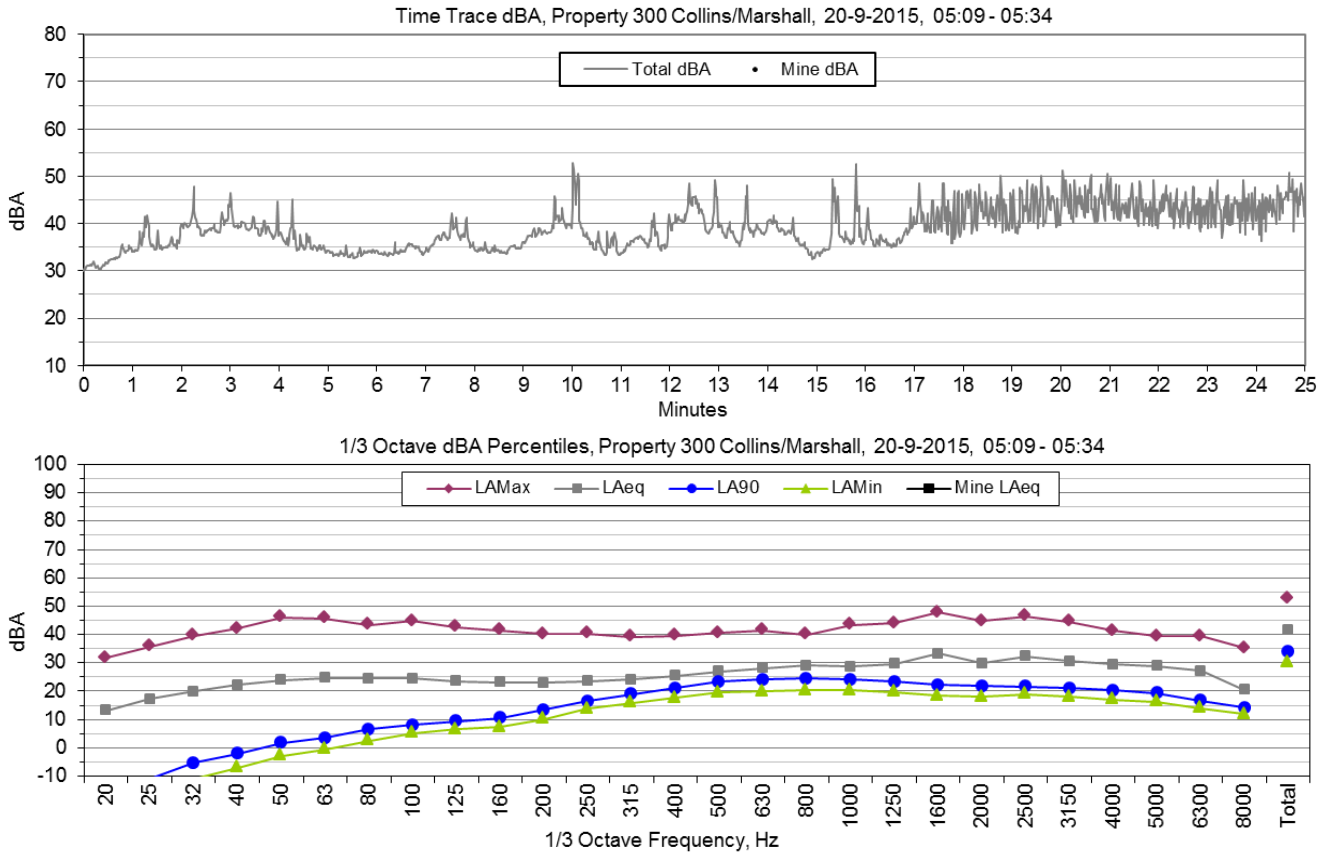

Air temperature 12 °C

Wind speed 2.9 m/s from the east south east

Wind sigma-theta 16°, Stability category D

Audible sounds included almost constant traffic noise, intermittent wind noise, insects, frogs, birds and a background mine hum in the absence of other sounds. A single horn blast at a level of 42 dBA was audible for a period of approximately 1 second and was most likely caused by a train, although the railway is not visible from the monitoring location therefore this assumption cannot be confirmed. The horn is unlikely to be related to a mining excavator or shovel as only one horn event was audible in the 25 minute period.
The highest noise levels were caused by either periods of higher wind speed or car movements on Ridge Road.

A combination of mining noise and road traffic noise, each at a similar background level, contributed to the measured background level of 31 LA90. A mining noise level of approximately 28 LAeq has therefore been estimated. Mine noise was not audible alone for any significant period of time during the survey, preventing a mine noise contribution from being calculated.

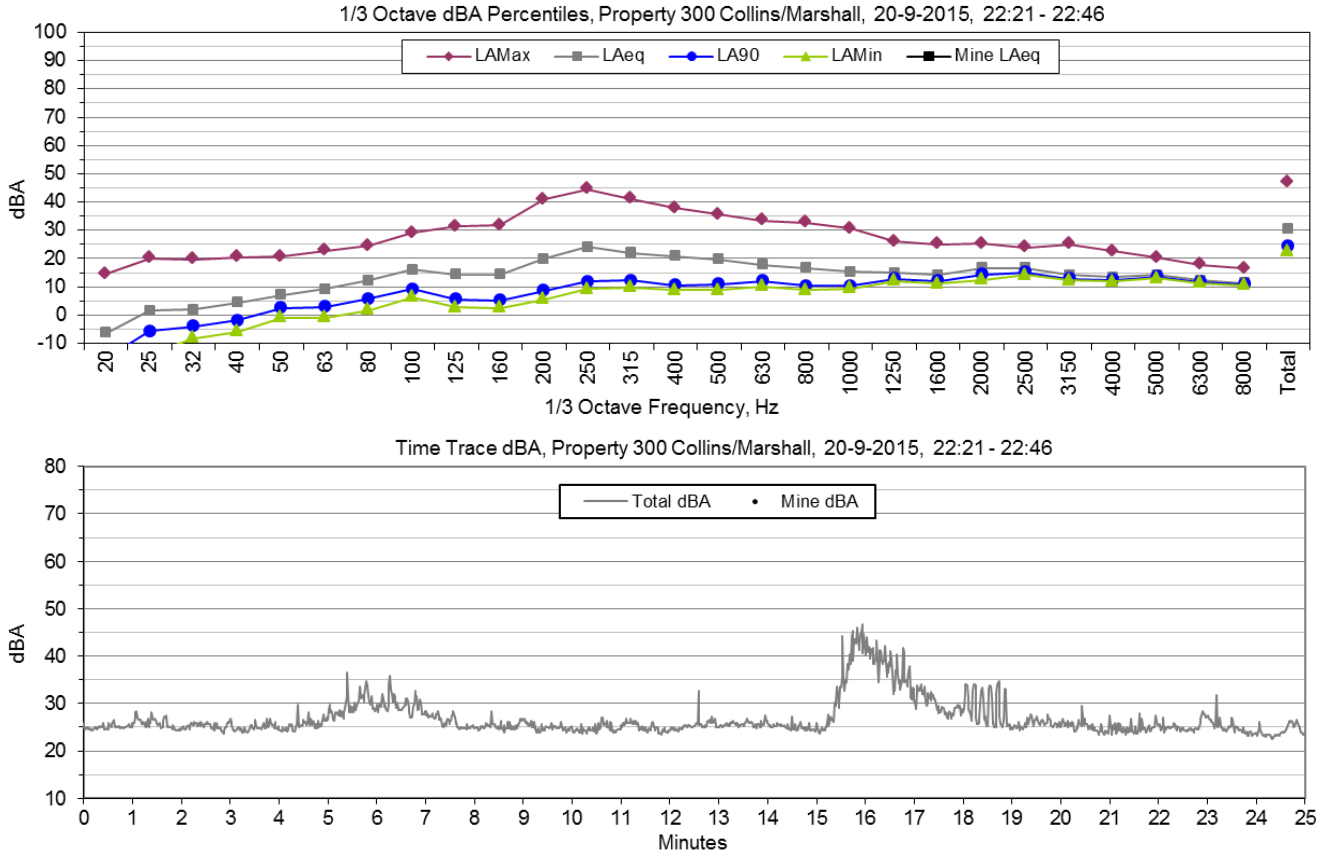



Air temperature 12 °C

Wind speed 2.1 m/s from the east

Wind sigma-theta 23°, Stability category F

Wind noise in nearby trees was the dominant sound during this survey with insects, frogs, birds and road traffic also audible. A low hum from the mine was audible for brief periods in conjunction with distant traffic noise but could not be separately measured at any time. Bird calls dominated the last 8 minutes of the measurement period, with traffic noise in the background.

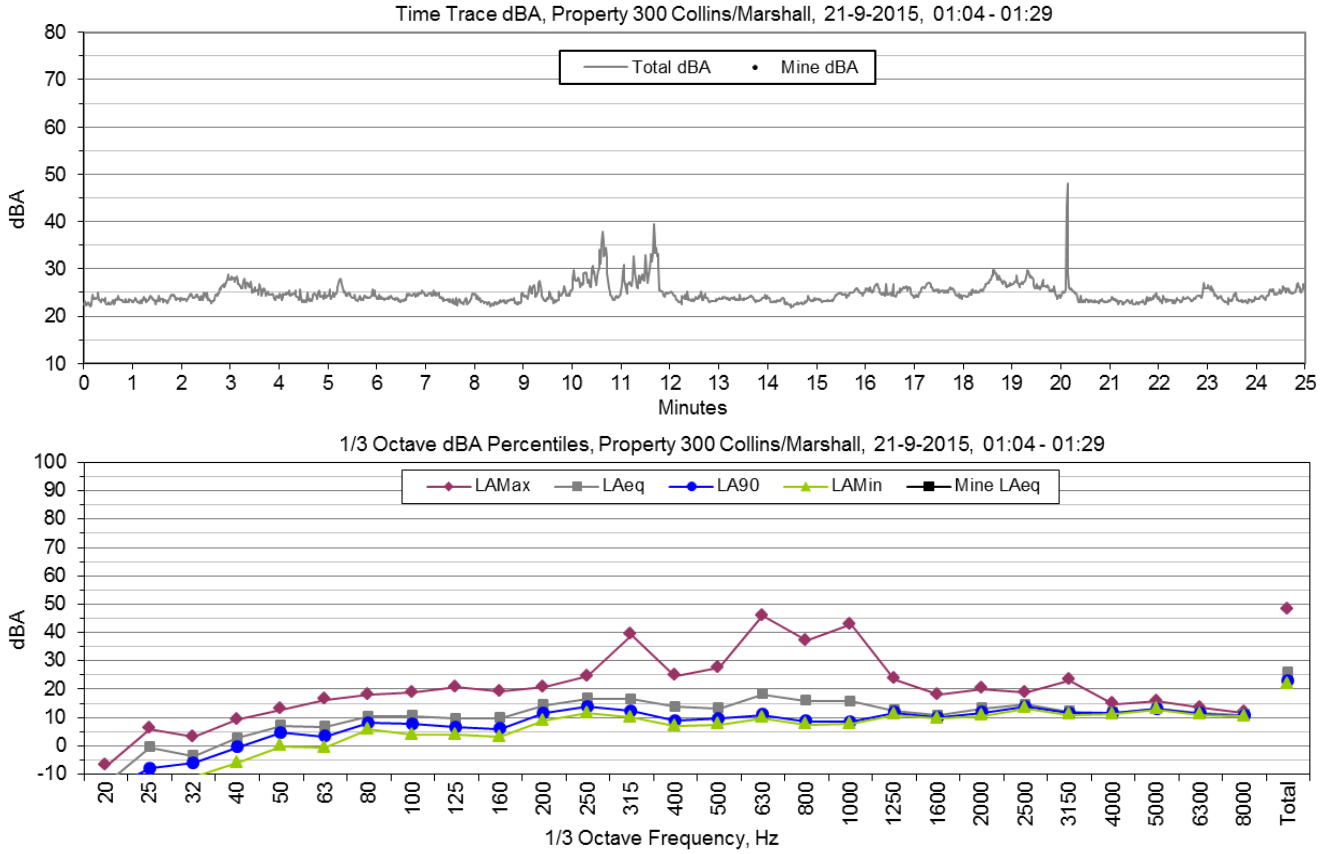



Air temperature 10 °C

Wind speed 1.4 m/s from the south

Wind sigma-theta 10°, Stability category D

Audible sounds included insects, frogs, wind, dogs, road traffic and aircraft. Mine noise was not audible during this period.



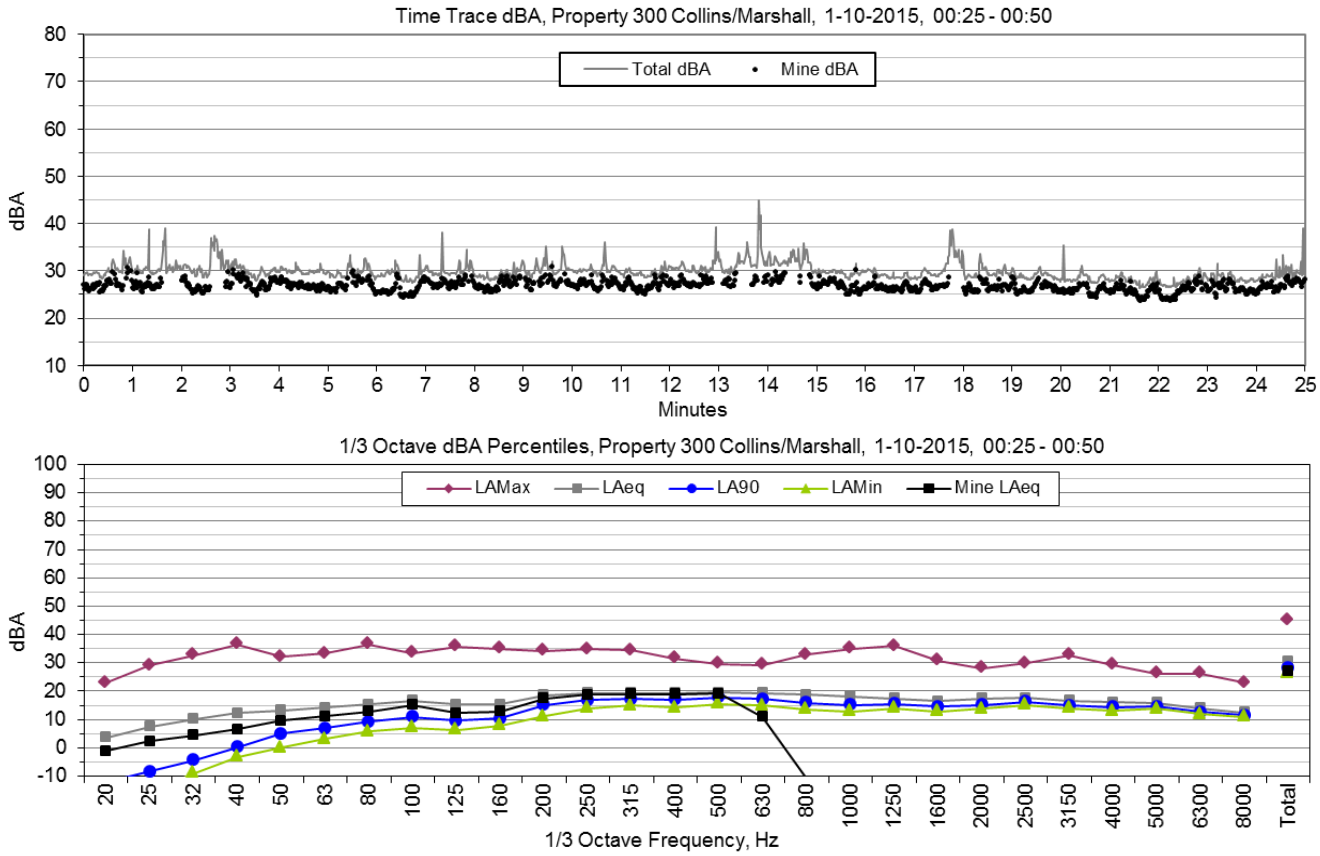

Air temperature 7 °C

Wind speed 1.3 m/s from the south

Wind sigma-theta 10°, Stability category D

Measured noise levels were influenced by intermittent road traffic, insects, frogs and a mine hum in the background at an estimated level of 22 LAeq. A loud horn was audible for a period of approximately one second at a level of 48 dBA, most likely from a train as it occurred only once and was significantly louder than has been noted from mining equipment horns in previous surveys.

## Survey 4 – Nights of Wednesday 30 September and Thursday 1 October 2015

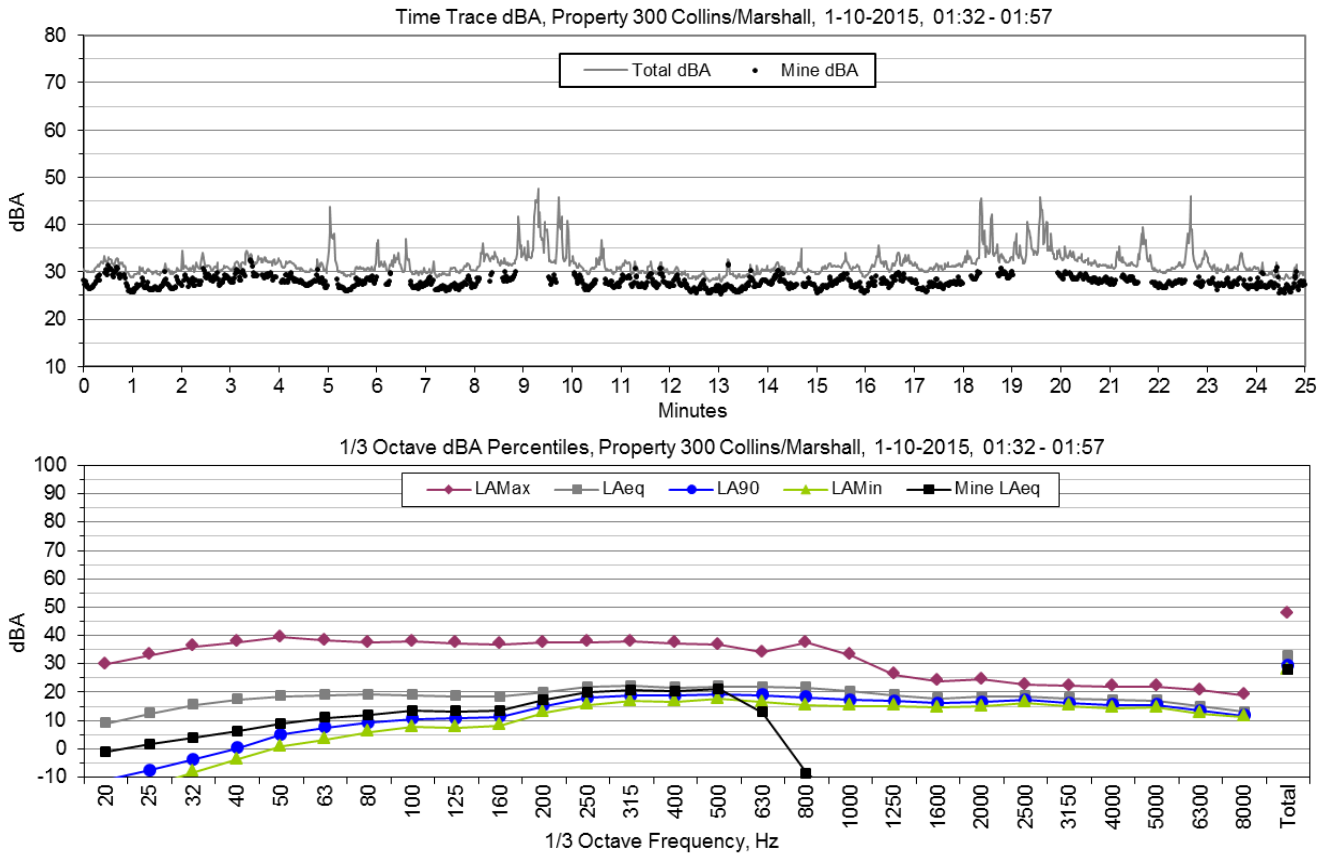



Air temperature 14 °C

Wind speed 1.3 m/s from the east south east

Wind sigma-theta 32°, Stability category F

Measured noise levels were influenced by insects, frogs and a mine hum in the background at a calculated level of 27 LAeq after removing periods affected by wind and road traffic and noise in all frequencies above 500 Hz. Audible mining equipment included a dozer and haul trucks, with additional equipment such as excavators likely to be audible despite not being separately identified. Brief periods of noise from wind, dogs and a ping from the survey vehicle's engine cooling were also audible occasionally.

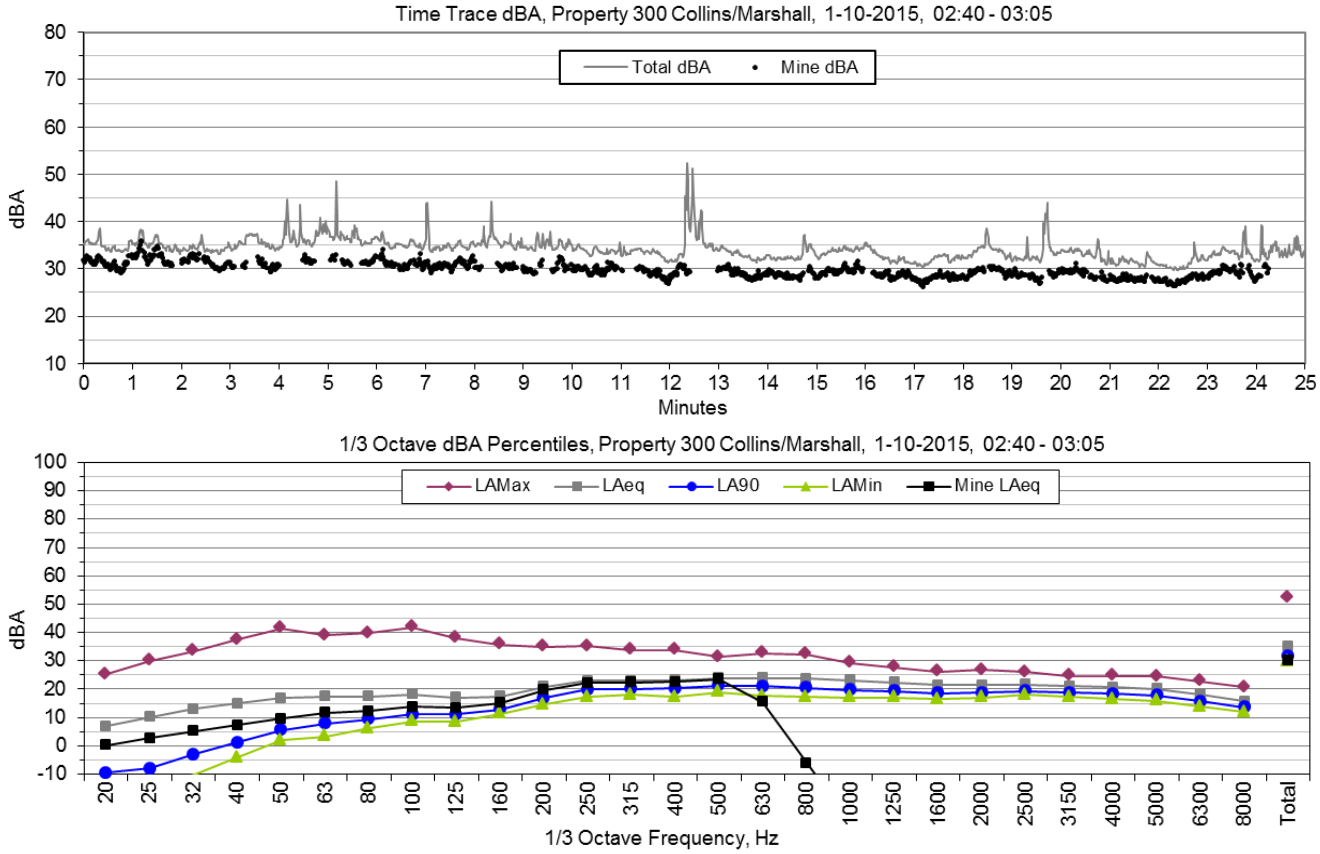



Air temperature 14 °C

Wind speed 1.0 m/s from the south

Wind sigma-theta 53°, Stability category F

Measured noise levels were influenced by insects, frogs and a mine hum in the background at a calculated level of 28 LAeq after removing periods affected by wind and road traffic and noise in all frequencies above 500 Hz. Audible mining equipment included a dozer and haul trucks, with additional equipment such as excavators likely to be audible despite not being separately identified. Brief periods of noise from wind and dogs were also audible occasionally.

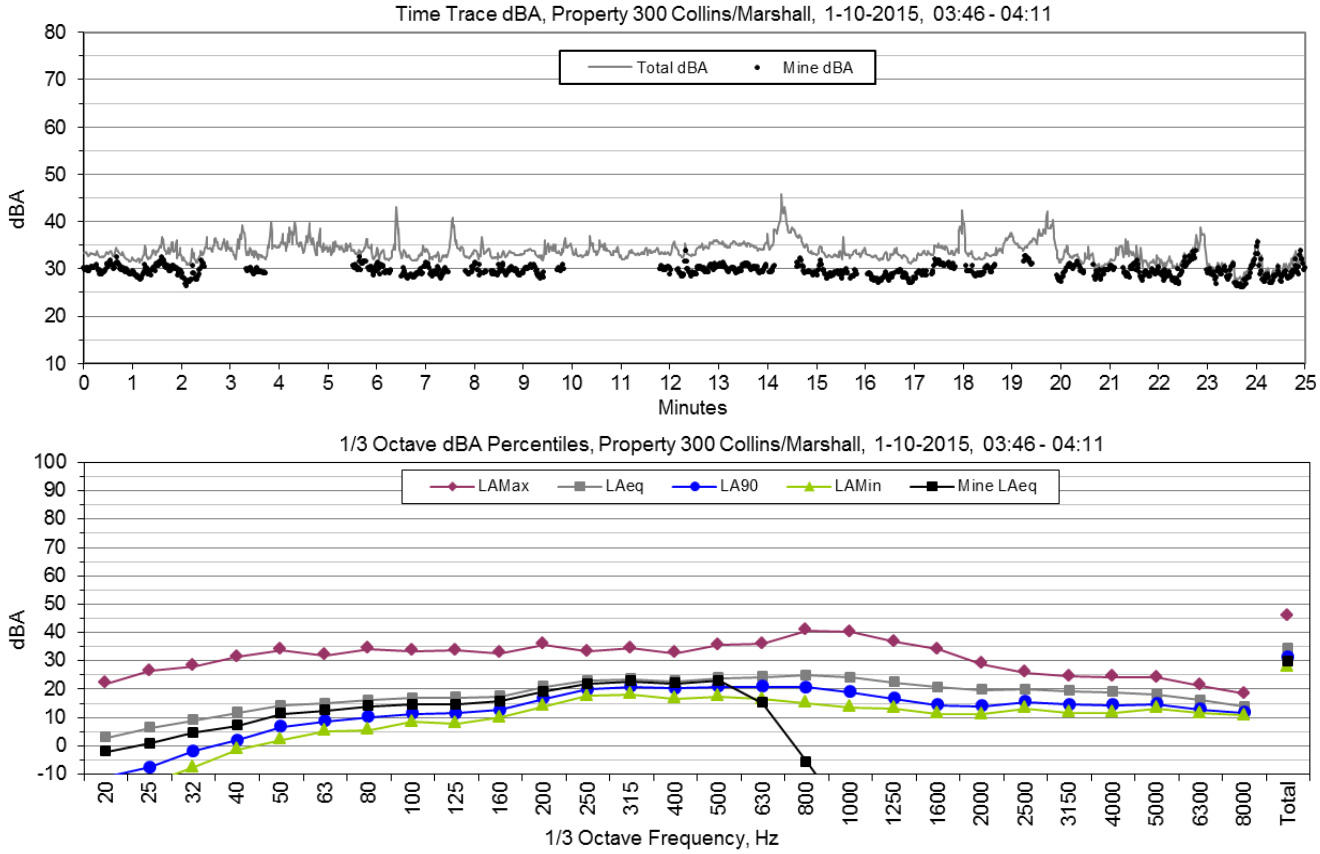



Air temperature 13 °C

Wind speed 0.9 m/s from the west south west

Wind sigma-theta 40°, Stability category F

Measured noise levels were influenced by insects, frogs and a mine hum in the background at a calculated level of 30 LAeq after removing periods affected by other sources and noise in all frequencies above 500 Hz. Audible mining equipment included a dozer and haul trucks.

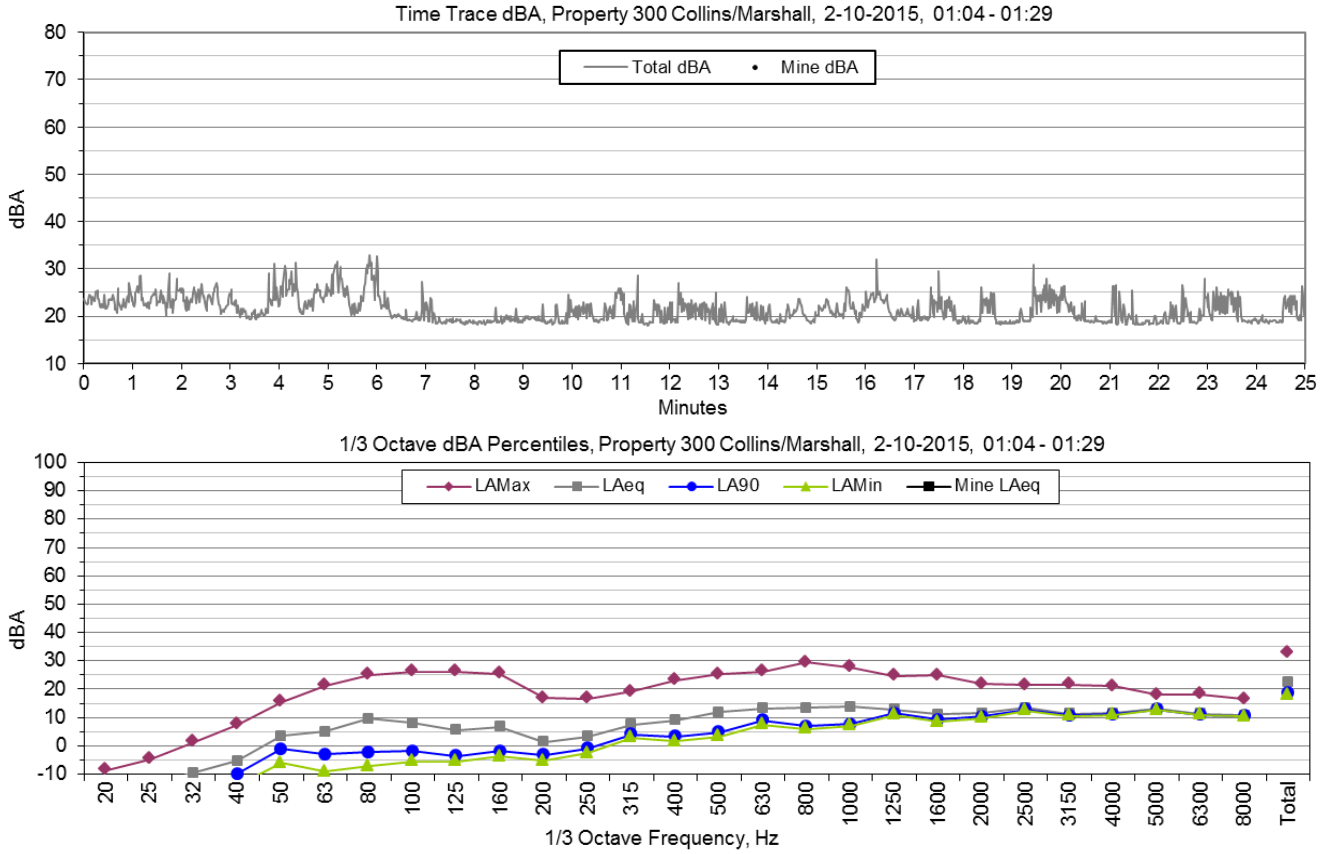



Air temperature 12 °C

Wind speed 1.0 m/s from the north

Wind sigma-theta 68°, Stability category F

Measured noise levels were influenced by insects, frogs and a mine hum in the background at a calculated level of 30 LAeq after removing periods affected by other sources and noise in all frequencies above 500 Hz. Audible mining equipment included a dozer and haul trucks.

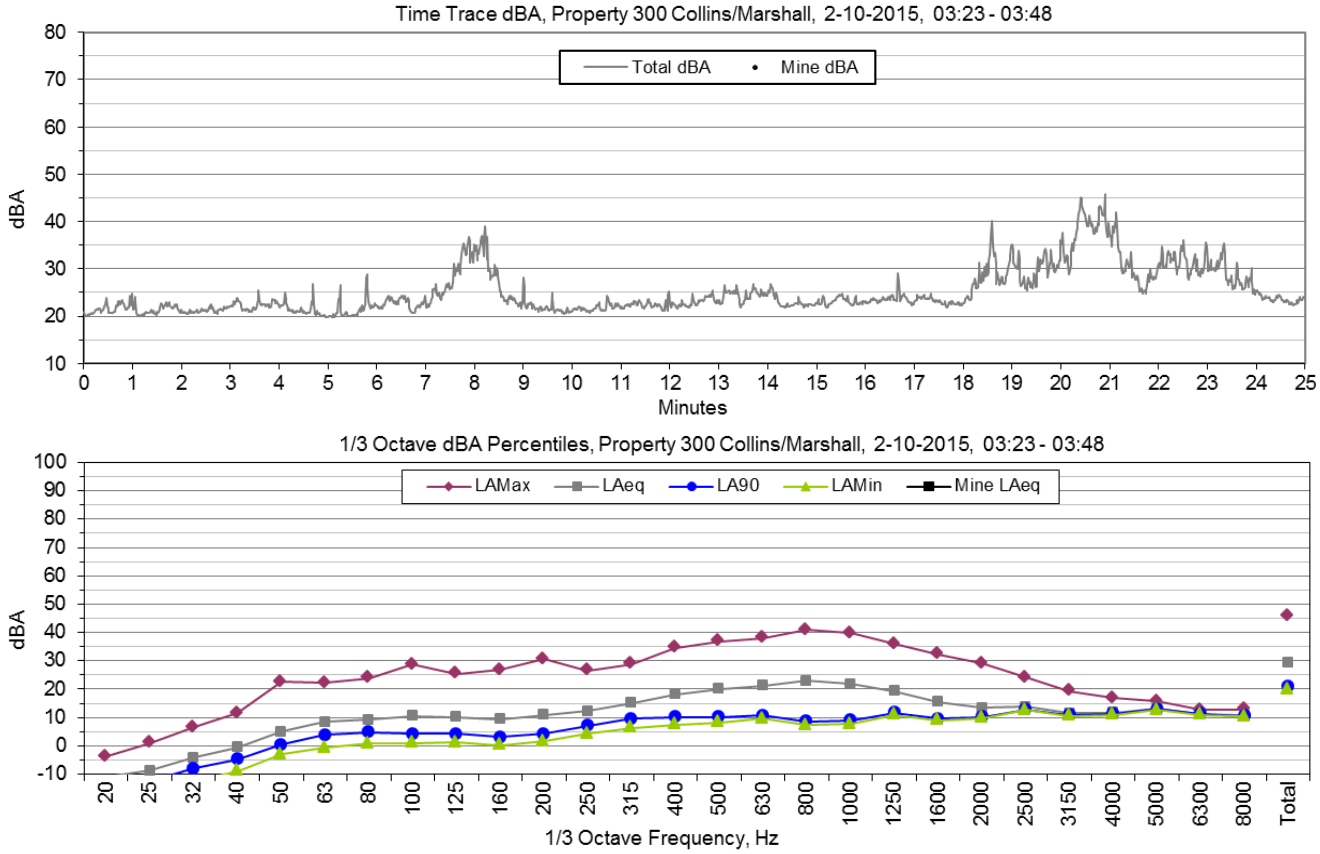



Air temperature 8 °C

Wind speed 2.2 m/s from the south

Wind sigma-theta 6°, Stability category E

Insects, frogs, occasional dogs and distant road traffic were the main sources of audible noise, with a barely audible mine hum and occasional periods of dozer noise also audible for part of the measurement period. Actual noise levels were most likely significantly lower than indicated due to the instrument's noise floor being reached. A mine noise level could not be determined due to the low levels.



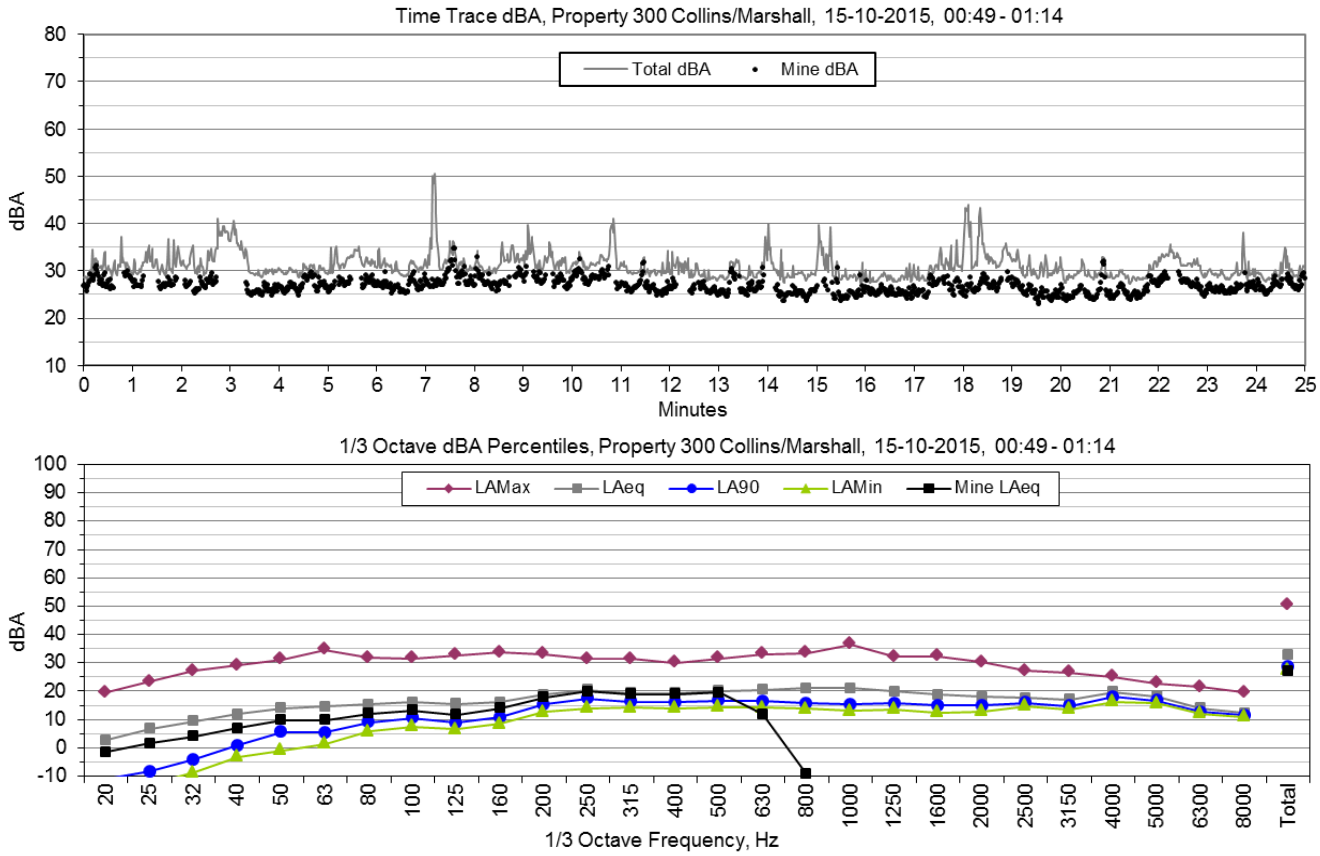

Air temperature 6 °C

Wind speed 1.7 m/s from the south

Wind sigma-theta 14°, Stability category E

Insects, frogs, occasional dogs and distant road traffic were the main sources of audible noise, with a barely audible mine hum and occasional periods of dozer noise also audible for part of the measurement period. A mine noise level could not be determined due to the low levels.

## Survey 5 – Nights of Wednesday 14 and Thursday 15 October 2015

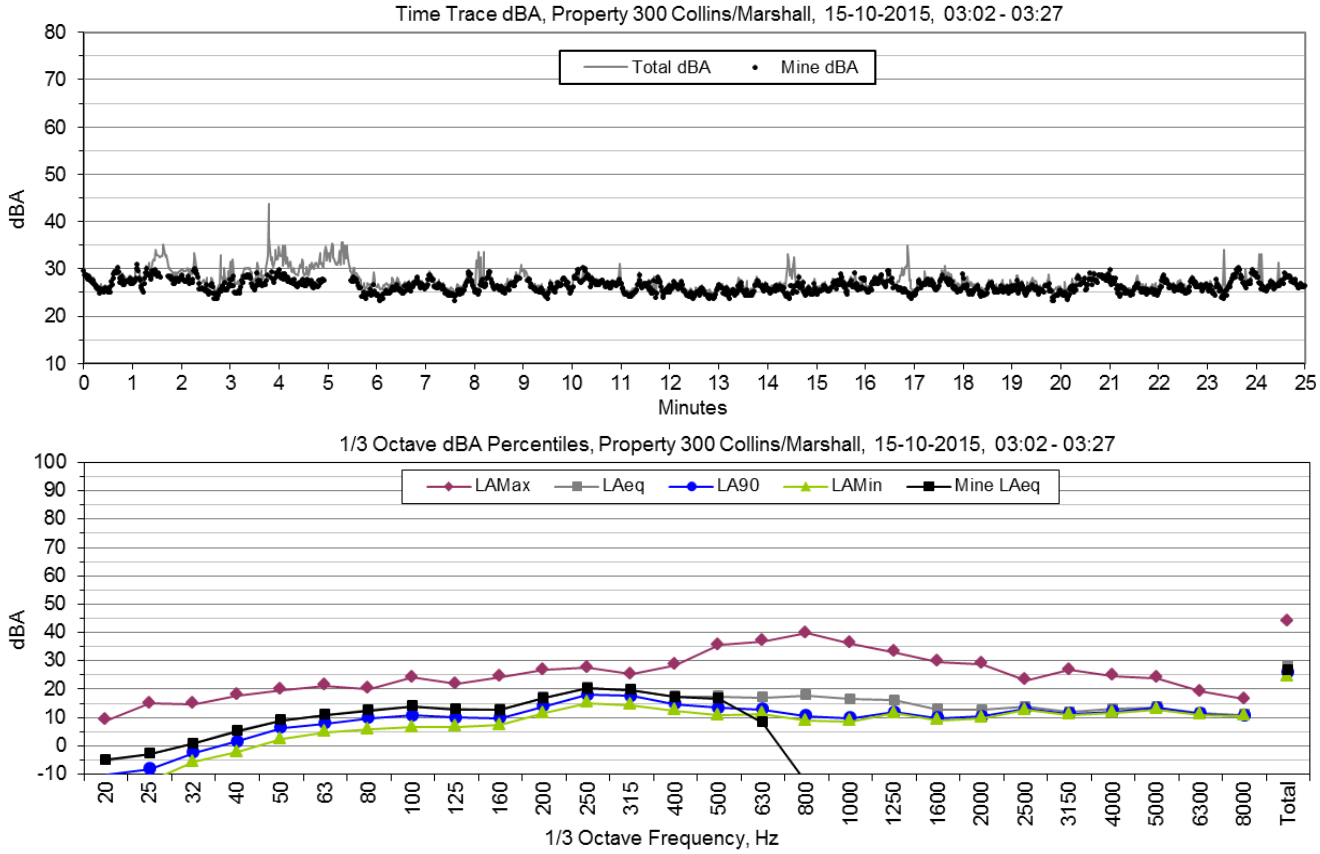



Air temperature 14 °C

Wind speed 0.6 m/s from the south south west

Wind sigma-theta 32°, Stability category F

Audible sounds included insects, frogs, wind and a background mine hum with occasional periods of more distinct mine noise, typically from haul trucks and a dozer. Noise from a door on a nearby shed swinging in the breeze was also audible intermittently. An average mine noise level of 29 LAeq was calculated in the absence of other sources.

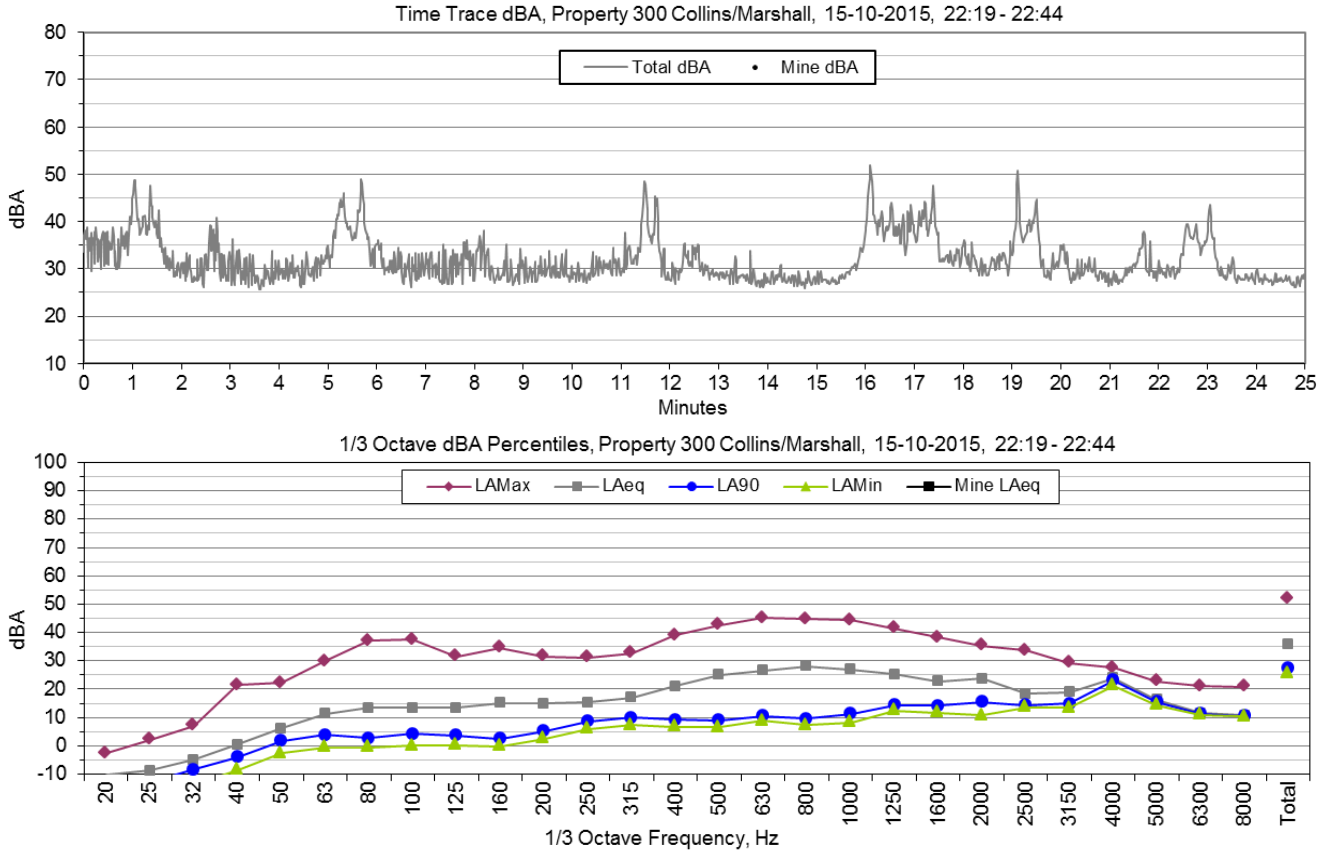



Air temperature 13 °C

Wind speed 2.2 m/s from the south

Wind sigma-theta 9°, Stability category D

Audible sounds included insects, frogs, intermittent traffic, a constant mine hum and intermittent more distinct haul truck noise. An average mine noise level of 27 LAeq was calculated in the absence of other sources.

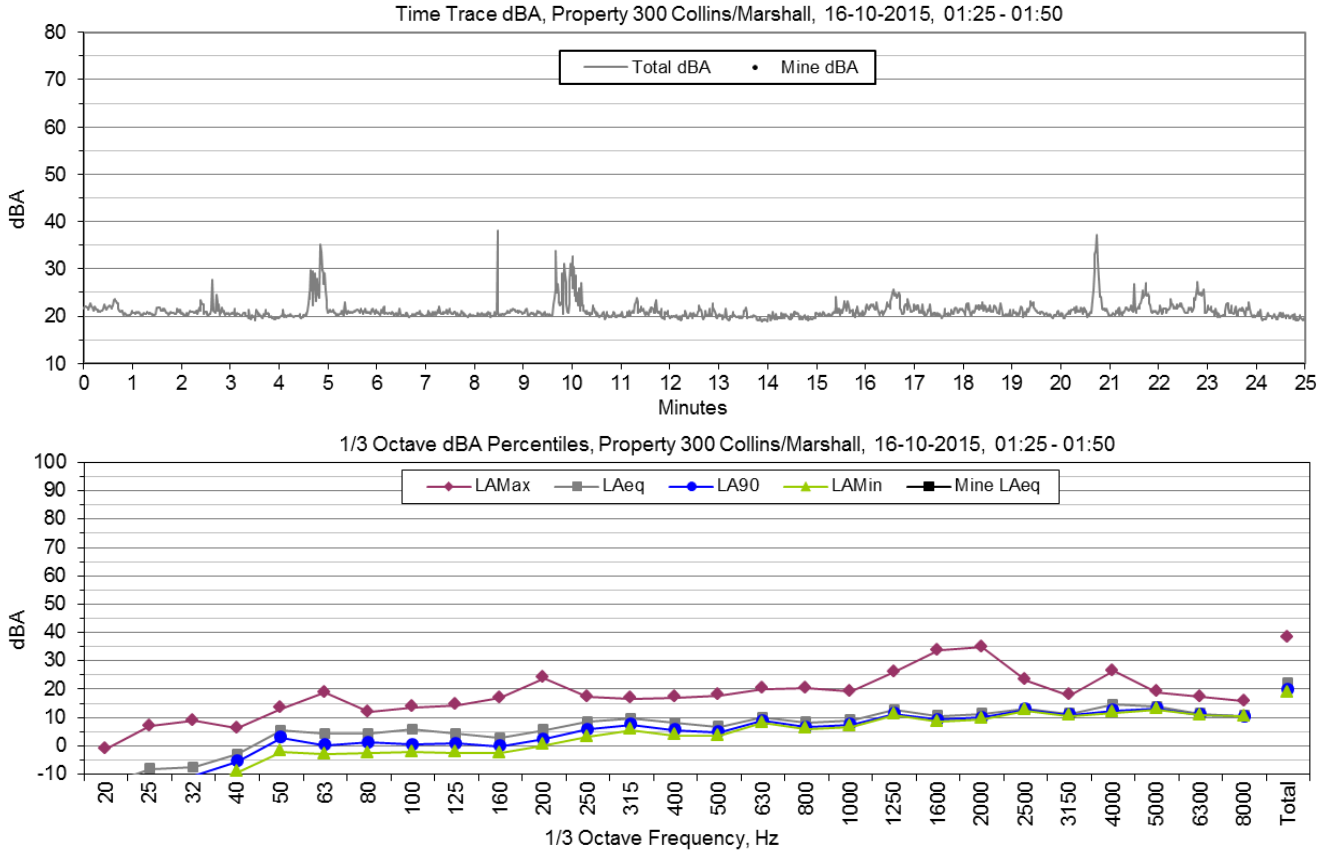



Air temperature 14 °C

Wind speed 0.7 m/s from the south south east

Wind sigma-theta 44°, Stability category F

Audible sounds included insects, frogs, dogs and road traffic. Mine noise was not audible during the survey.




Air temperature 11 °C

Wind speed 1.7 m/s from the south

Wind sigma-theta 8°, Stability category D

Audible sounds included insects, frogs, birds and road traffic. Mine noise was barely audible as a low background hum during the survey. Occasional brief periods of louder noise were caused by insects close to the microphone or by a group of birds.

ABN: 73 254 053 305

78 Woodglen Close
P.O. Box 61
PATERSON NSW 2421

Phone: 02 4938 5866
Mobile: 0407 38 5866
E-mail: bridgesacoustics@bigpond.com

# MOOLARBEN COAL OPERATIONS PTY LTD

# INDEPENDENT NOISE REVIEW

# PROPERTY 76, CARBONE

# SEPTEMBER AND OCTOBER 2015

## REPORT J0222-01-R2
## 5 JANUARY 2016

Prepared for:
Department of Planning and Environment
P.O. Box 3145
SINGLETON NSW 2330

Prepared by:
Mark Bridges BE Mech (Hons) MAAS
Principal Consultant

# TABLE OF CONTENTS

# 1. INTRODUCTION

This report presents results from an independent noise review to determine Moolarben Coal's compliance with relevant conditions of Project Approval MP 05_0117 at Property 76, 398 Winchester Road Cooks Gap, owned and occupied by Mr Sebastian and Mrs Patricia Carbone. The Review included a series of noise surveys over 10 nights in the vicinity of the residence in September and October 2015 according to a survey protocol agreed with the Department of Planning and Environment (DP&E) and the Environment Protection Authority (EPA).

The Review was commissioned by Moolarben Coal in response to a request from the DP&E by letter dated 22 April 2015, a copy of which is attached in Appendix A. A meeting with residents occurred on 30 June 2015 to discuss details of the Review, in conjunction with Moolarben Coal and DP&E representatives, which indicated mine noise was mainly an issue during the night with only occasional noise issues during the day. A noise monitoring location on the side of Winchester Road directly north of the residence was agreed to be acoustically suitable while minimising disturbance to residents. Plans of the area and the property are attached in Appendix B.

## 1.1. 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. Higher frequency sound from distant sources is effectively absorbed by the atmosphere leaving sound energy in only the lower frequency bands, leading to the reduced frequency range of 20 Hz to 8 kHz typically being assessed. |
| 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), depending on frequency. An increase of 10 dB is perceived as an approximate doubling of sound level by a 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 as defined in the relevant Australian Standard means frequencies below 500 Hz and above 10 kHz 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. |
| dBC | C-weighted decibels, where the C weighting as defined in the relevant Australian Standard means frequencies below 31 Hz and above 8 kHz are artificially reduced with the majority of the audible range remaining unchanged. The C-weighted noise level, when compared to the A-weighted noise level over the same time period, is used to indicate the presence of low frequency noise and to trigger a low frequency correction of +5 dBA to the measured A-weighted noise level where required. |
| 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. |
| LA90,15min | Same as LA90 with the measurement period specifically stated. |

| | |
|---|---|
| LAeq | The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location. |
| LAeq,15min | Same as LAeq with the measurement period specifically stated. The LAeq,15min is universally used in NSW to define and assess compliance with Project Approval noise conditions. |
| LAmax | The maximum dBA noise level during the measurement period. Can be used to determine the risk of sleep disturbance during the night in lieu of LA1,1min. |
| Night | The period 10 pm to 7 am. |

# 2. PA 05_0117 CONDITIONS

Relevant conditions from Project Approval 05_0117 Mod 3 are reproduced below. The conditions have actually been taken from the later Mod 10 Project Approval, however Mod 10 has not resulted in any change to the relevant noise conditions since Mod 3 was approved.

*SCHEDULE 3*

1. *The Proponent shall ensure that the noise generated by the Moolarben mine complex does not exceed the noise criteria in Table 1 at any residence on privately-owned land or the other specified locations.*

*Table 1: Noise criteria dB(A)*

| *Land Number* | *Day* | *Evening* | *Night* | |
|---|---|---|---|---|
| | *LAeq,15min* | *LAeq,15min* | *LAeq,15min* | *LA1,1min* |
| *30, 63* | *39* | *39* | *39* | *45* |
| *70* | *37* | *37* | *37* | *45* |
| *75* | *36* | *36* | *36* | *45* |
| *31* | *36* | *36* | *36* | *45* |
| *All other privately owned residences* | *35* | *35* | *35* | *45* |
| *Ulan Primary School* | *35 (internal) when in use* | | | - |
| *Ulan Anglican Church*<br>*Ulan Catholic Church* | *35 (internal) when in use* | | | - |
| *Goulburn River National Park*<br>*Munghorn Gap Nature Reserve* | *50* | | | - |

*Note: To interpret the land referred to in Table 1 see the applicable figures in Appendix 5.*

*Noise generated by the complex is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.*

*However, these noise criteria do not apply if the Proponent has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.*

*SCHEDULE 4*

4. *If an owner of privately-owned land considers the project to be exceeding the criteria in Schedule 3, then he/she may ask the Secretary in writing for an independent review of the impacts of the project on his/her land.*

*If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision, the Proponent shall:*

*(a) commission a suitably qualified, experienced and independent expert, whose appointment has been approved by the Secretary, to:*

- *consult with the landowner to determine his/her concerns;*
- *conduct monitoring to determine whether the project is complying with the relevant impact assessment criteria in Schedule 3; and*
- *if the project is not complying with these criteria then:*
  - *determine if more than one mine is responsible for the exceedance, and if so the relative share of each mine regarding the impact on the land;*
  - *identify the measures that could be implemented to ensure compliance with the relevant criteria; and*

*(b) give the Secretary and landowner a copy of the independent review.*

Property 76 falls under the 'All other privately owned residences' category in Schedule 3 Table 1 and has therefore been assigned criteria of 35 LAeq,15min and 45 LA1,1min, which is similar to 45 LAmax, during the night.

# 3. SURVEY METHODOLOGY

## 3.1. Survey Requirements

A draft noise survey protocol was prepared on 9 June 2015 for review by Moolarben Coal and the DP&E, however the DP&E undertook to develop a preferred, standardised independent noise monitoring protocol in conjunction with the EPA and requested the noise survey be delayed while the protocol was prepared. The following noise survey requirements were received from the DP&E by email on 24 August 2015.

1) *Night time noise compliance only i.e. 10pm – 7am.*
2) *10 monitoring events (days) in a 30 day period.*
3) *No more than 2 consecutive days, or a total of 4 days in a single week (M – S)*
4) *Monitoring events to be separated by at least 3 days.*
5) *2 rounds of monitoring to be undertaken on each night separated by at least 2 hours.*
6) *If one valid 15 min reading is found to be in exceedance of criteria by more than 2 dB, then a second measurement needs to be undertaken within 75 min (but not less than 45 min). If both measurements are deemed valid, and exceed the criteria by more than 2 dB, then the night will be deemed a noise affected night. This can be triggered by either of the 2 rounds of monitoring.*
7) *The noise consultant should schedule for the most likely noisy nights with reference to meteorological forecast.*
8) *Techniques such as pausing and low pass filtering should be employed to ensure measurements are representative of Moolarben generated noise only. The technician needs to estimate the contribution of Moolarben noise to the overall noise catchment.*
9) *Leq(15 min) levels in dB(A) along with dB(C) are to be recorded.*

*10) Separate audio should be collected to cover each monitoring period. Note that it may be necessary to collect more than 15 minutes of audio to cover periods when data is paused or back erased to eliminate extraneous noise.*

*11) Data should coincide with meteorological measurements to determine if weather conditions are valid.*

Subsequent discussion resulted in one additional requirement for the noise survey, received by email on 3 September 2015:

*12) Measurements of Leq levels shall be extended beyond 15 min to a maximum of 25 minutes if required to capture 15 minutes of clean data. At the end of 25 minutes the data collected shall be an acceptable quantity if it exceeds 10 minutes of clean data. If the quantity of clean data is less than 10 minutes, then the site shall be found not to be in non-compliance.*

A final noise monitoring protocol incorporating the DP&E's requirements was prepared on 3 September 2015 and forwarded to all parties. The protocol allowed for a minimum of two primary noise measurement periods during each of 10 nights as required by the DP&E, with each measurement over 25 minutes to allow for post-processing of data. An additional one or two secondary measurement periods would occur, for a maximum of four measurement periods per night, if results from one or both primary measurements indicated a possible non-compliance in response to requirement 6 above. As compliance can only be determined after results were processed, some secondary noise measurements were taken that were subsequently determined to not be required.

## 3.2. Instruments

Noise measurements were taken using a Svan 957 Type 1 sound level meter programmed to measure and store 1-second LAeq levels in 1/3 octaves from 20 Hz to 20 kHz over each 25 minute period. The microphone was attached via a 2 m extension cable to minimise any influence from the operator on the measurement results and was either mounted on a tripod approximately 1.5 m above the ground or above the front of a vehicle approximately 2.4 m above the ground to minimise reflection from the vehicle. While the elevated microphone position does not strictly comply with relevant standards, it is a commonly adopted strategy for environmental noise surveys and, if anything, provides slightly conservative results compared to the standard microphone height of 1.5 m.

The instrument simultaneously recorded audible sound in uncompressed digital format using a digitising rate of 24 kHz and 24 bit sampling. The sound files were subsequently high pass filtered with a -3 dB point at 10 Hz to minimise high amplitude but inaudible wind noise then amplified to allow audible sounds to be more readily determined.

## 3.3. Data Post-Processing

Processing of results included the following steps:

- Review the recorded sounds through an octave band equaliser to determine the frequency range of each audible source, allowing the mine noise contribution to be separated from insect and bird noise by frequency filtering;
- Filter the one-second noise levels by time, based on a detailed review of the recorded sounds combined with notes taken during each measurement period, to separate mine noise from other sources such as wind and road traffic that cannot reasonably be separated by frequency; and
- Determine the total length of audible mine noise within each 25 minute measurement period and the average (LAeq and LCeq) and maximum (LAmax, in lieu of LA1,1min) filtered levels attributed to mine noise.

Weather conditions during each noise measurement period were determined from weather data in 15 minute periods provided daily by Moolarben Coal. Weather station WS3 is located approximately 1.9 km north east of the noise monitoring location between Ulan Road and Ryans Creek which adequately measures weather conditions between the mine and the residence.

According to the NSW Industrial Noise Policy (INP) referred to Schedule 3 Condition 1 of the Project Approval, noise measurement results are considered valid if taken:

- in the absence of rain; and
- during wind speeds less than or equal to 3 m/s (measured at 10 m above the ground) at any time; or
- during a temperature inversion of up to 3 °C/100m combined with a 2 m/s drainage flow during the evening and night.

## 3.4. Low Frequency Correction

Research carried out over a number of decades by various parties has indicated environmental noise can be perceived as more noticeable or annoying if it contains one or more of the following characteristics:

- A tonal component, which is a concentration of sound energy in a narrow frequency band. Examples of tonal sources are beepers, chimes and sirens, which rely on the more noticeable nature of a tonal noise to attract attention and/or provide a warning;
- A significant low frequency component which tends to transmit more effectively over distance, over or around barriers and through building elements such as walls and windows;
- Impulsive noise which is typically caused by material impacts, pulses of gas from a pipe such as a car exhaust and similar rapidly varying sources, which appear more noticeable due to their unusual and distinctive character; and
- Intermittent noise, such as a source that periodically starts and stops, as the changes in noise level and character are more noticeable than steady state noise from a continuously operating source.

Of these four characteristics, experience indicates low frequency noise is the most likely to be encountered at a distance of a few kilometres from an operating open cut mine. Tonal, impulsive and intermittent noise can be produced by specific sources within a mine such as reverse alarms, dozer tracks and diesel exhausts, however a mine includes a large number of machines which together produce a blended noise that is typically free of tonal, impulsive and intermittent components.

The INP is the primary noise policy document for state significant industrial developments such as mines. Table 4.1 of the INP includes a recommendation that low frequency noise be assessed by comparing the mine-only dBA and dBC noise levels. Where the dBC level is more than 15 dB above the dBA level, a +5 dBA low frequency correction is recommended to be added to the measured noise level to account for the more noticeable nature of low frequency noise.

The Draft Industrial Noise Guideline (Draft ING) was published by the EPA in September 2015, after the Project Approval was issued and after this independent noise review was commissioned. Nevertheless, the Draft ING indicates future EPA noise policy and has been considered in this review.

Fact Sheet C attached to the Draft ING describes recommended corrections to calculated or measured noise levels to account for the four main characteristics listed above. The recommendations are generally similar to the INP, however additional recommendations have been added to the assessment of low frequency noise to correct previous issues with the INP recommendations and reflect the latest research results. Table C2 in the Draft ING presents threshold levels in 1/3 octaves and is reproduced in Table 1 below.

**Table 1: dBL Low Frequency Thresholds (from Table C2, Draft ING) and Equivalent dBA Values.**

| | One-Third Octave Leq,15min Threshold Levels | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency, Hz | 10 | 12.5 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| dBL Threshold | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |
| Equivalent dBA | 22 | 26 | 29 | 27 | 24 | 22 | 19 | 20 | 24 | 26 | 29 | 30 | 31 |

The ING recommends the following low frequency corrections:

- +2 dBA where the mine-only dBC level is more than 15 dB above the mine-only dBA level (identical to the INP recommendation) and one or more 1/3 octave mine-only levels are up to 5 dB above the corresponding values in Table C2; and
- +5 dBA where the mine-only dBC level is more than 15 dB above the mine-only dBA level (identical to the INP recommendation) and one or more mine-only 1/3 octave levels are more than 5 dB above the corresponding values in Table C2.

Three sets of mine-only noise levels are presented in this review report: actual calculated levels, corrected levels based on the INP recommendations and corrected levels based on the Draft ING recommendations.

# 4. RESULTS

A review of recorded noise levels in individual octave bands, particularly the recordings taken during the early morning of 1 October when mining noise was most audible, indicated noise from mining sources primarily occurred in the 31.5 Hz to 250 Hz octave bands with relatively minor audible noise in the 500 Hz octave band. Measured noise levels were therefore frequency filtered with noise in the 20 Hz to 500 Hz 1/3 octave bands attributed to mining sources and noise in the 630 Hz band and above attributed to other sources such as traffic, insects and birds.

Frequency filtering alone is not sufficient to determine mining noise levels as audible noise from specific non-mine sources such as road traffic and owl calls was also noted within the frequency range attributed to the mine. Additional filtering by time, which involved separating noise data in one-second intervals based on a detailed review of the recorded sound files, was required to separate noise from mining and other sources.

Table 2 presents a summary of measured total noise levels and calculated mine-only noise levels during the 10 night series of noise surveys. Data in italics represent results from secondary noise measurements that were taken in case the primary noise measurements showed a non-compliance with relevant criteria after the results were processed, or in the case of the secondary measurement on 20 September were taken to be closer to the end of the night period to address concerns expressed by residents.

More complete data, including charts showing measured and filtered one-second noise levels in the 25 minute period and 1/3 octave spectra along with weather conditions and a description of audible sources, are attached in Appendix C. Weather conditions were acceptable for noise monitoring during all measurement periods and all results are therefore valid according to the weather conditions defined in the INP.

**Table 2: Measured and Calculated Noise Level Summary, Carbone, 2015.**

| Noise Measurement Period | | | Total Measured Noise Level, 25 minutes | | | Moolarben (Mine Only) Noise Level | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Time Mine was Audible | LAmax | LAeq | LCeq | Low Freq Corrected | |
| Date | Start | End | LAmax | LAeq | LA90 | | | | | INP | ING |
| 8/9 | 23:26 | 23:51 | 43 | 29 | 24 | 0 | - | < 25 | - | - | - |
| 9/9 | 02:00 | 02:25 | 36 | 26 | 22 | 0 | - | < 25 | - | - | - |
| 10/9 | 01:11 | 01:36 | 47 | 32 | 21 | 0 | - | < 25 | - | - | - |
| 10/9 | 03:37 | 04:02 | 49 | 36 | 27 | 0 | - | < 25 | - | - | - |
| 15/9 | 01:55 | 02:20 | 55 | 36 | 26 | 20:09 | 33 | 27 | 47 | 32 | 27 |
| 15/9 | 04:21 | 04:46 | 53 | 43 | 35 | 05:05 | 34 | 29 | 49 | 34 | 29 |
| 15/9 | 23:15 | 23:40 | 52 | 32 | 24 | 0 | - | < 25 | - | - | - |
| 16/9 | 01:40 | 02:05 | 50 | 40 | 20 | 0 | - | < 25 | - | - | - |
| 20/9 | 01:42 | 02:07 | 37 | 29 | 27 | 23:43 | 35 | 28 | 48 | 33 | 28 |
| 20/9 | 04:35 | 05:00 | 61 | 46 | 35 | 0 | - | < 25 | - | - | - |
| *20/9* | *05:45* | *06:10* [1] | *59* | *46* | *40* | *0* | - | *< 25* | - | - | - |
| 20/9 | 22:55 | 23:20 | 46 | 32 | 24 | 0 | - | < 25 | - | - | - |
| 21/9 | 01:37 | 02:02 | 35 | 29 | 27 | 22:51 | 34 | 28 | 48 | 33 | 28 |
| 1/10 | 00:59 | 01:24 | 47 | 32 | 26 | 20:54 | 37 | 29 | 48 | 34 | 29 |
| *1/10* | *02:06* | *02:31* | *66* | *41* | *32* | *16:46* | *38* | *33* | *55* | *38* | *33* |
| 1/10 | 03:14 | 03:39 | 52 | 35 | 32 | 22:19 | 40 | 33 | 49 | 38 | 33 |
| *1/10* | *04:20* | *04:45* | *51* | *41* | *32* | *04:13* | *34* | *29* | *46* | *34* | *29* |
| 2/10 | 01:37 | 02:02 | 52 | 33 | 23 | 0 | - | < 25 | - | - | - |
| 2/10 | 03:55 | 04:20 | 46 | 33 | 26 | 19:38 | 32 | 27 | 48 | 32 | 27 |
| 15/10 | 01:24 | 01:49 | 66 | 39 | 26 | 21:58 | 40 | 30 | 48 | 35 | 30 |
| 15/10 | 03:49 | 04:14 | 45 | 32 | 29 | 21:33 | 37 | 31 | 49 | 36 | 31 |
| 15/10 | 22:52 | 23:17 | 50 | 37 | 23 | 07:10 | 27 | 21 | 43 | 26 | 21 |
| 16/10 | 01:57 | 02:22 | 52 | 37 | 23 | 18:49 | 32 | 25 | 46 | 30 | 25 |

1 A second noise measurement closer to the 7:00 am end of the night period was added to the survey in response to residents commenting that mine noise is sometimes more audible at that time.

Results in Table 2 indicate filtered mine-only noise levels exceed the 35 LAeq Project Approval criterion for two measurement periods during the early morning of 1 October 2015 and one period during the morning of 15 October if the INP low frequency correction applies, however these results do not mean noise from the mine is non-compliant at this residence without further consideration. Requirement 6 listed in Section 3.1 of this review report, which is designed by DP&E to identify a 'sustained' exceedance rather than occasional exceedances, requires a second exceedance within 45 to 75 minutes after a primary exceedance before the night is considered affected by mining noise.

Following is a more detailed discussion of the noise levels measured during the early morning of 1 October and 15 October 2015 and subsequent mine-only levels calculated after time and frequency filtering:

- The first primary noise measurement on 1 October starting at 00:59 am indicated compliance with the 35 LAeq criterion, therefore the secondary noise measurement starting at 02:06 am was not required and can be ignored;
- The second primary noise measurement on 1 October starting at 03:14 am indicated a non-compliance with the 35 LAeq criterion plus a 2 dBA allowance assuming the INP low frequency correction applies, therefore the secondary noise measurement starting at 04:20 am is required. This secondary

measurement indicated compliance with the 35 LAeq criterion which means the exceedance was not sustained and the night is not considered affected by mine noise; and

- The second primary measurement on 15 October starting at 03:49 am indicated a mine-only noise level of 36 LAeq which is within 2 dBA of the 35 LAeq criterion. A secondary noise measurement is therefore not required and the night is not considered affected by mine noise.

All mine-only noise levels would comply with the 35 LAeq criterion if the Draft ING low frequency assessment recommendations are adopted, as all mine-only noise levels remain below the threshold spectrum in Table 1 in all relevant frequency bands.

### 4.1. Maximum Noise Levels

Table 2 summarises the mine-only LAmax noise levels after time and frequency filtering to remove noise from non-mine sources, for comparison with the 45 LAmax (or 45 LA1,1min) criterion specified in Schedule 3 Condition 1 of the Project Approval.

The highest mine-only levels of 40 LAmax were noted during the morning of 1 October and 15 October. While a low frequency correction is not normally required for maximum noise levels, addition of a +5 dBA correction would not result in an exceedance of the 45 LAmax criterion therefore maximum noise levels from the mine comply with the Project Approval.

## 5. DISCUSSION

During the meeting in July 2015, residents commented that noise from the mine can sometimes be louder and more noticeable during the early morning period, with the noise continuing up to approximately 9 am. However, the noise measurement results presented in this review report indicate the mine is most audible during the period midnight to approximately 4 am, after which a substantial increase in road traffic noise tends to mask mining noise. The period during and after dawn also includes significant bird activity which further masks mine noise.

While a noise survey extending over only 10 nights may not be sufficient to fully describe the acoustic environment in the vicinity of the residence, it is considered likely that some noise attributed by residents to mining sources may actually be generated by road traffic, particularly during the approximate period 5 am to 7 am when traffic flows are relatively high.

## 6. CONCLUSION

This report describes results from an independent review of environmental noise levels from Moolarben Coal Mine to Property 76 owned and occupied by Mr and Mrs Sebastian and Patricia Carbone. The measured noise levels, after filtering by frequency and time to remove the influence of non-mine sources such as road traffic and insects, demonstrate sustained compliance with relevant Project Approval 05_0117 conditions during each of the 10 nights included in the noise survey.

Based on the results of this review, no additional operational noise mitigation or management measures are recommended and no sustained mine related noise impacts are occurring at the residence.

# APPENDIX A – REQUEST FROM DP&E

Contact: Wayne Jones
Phone: 02 6575 3406
Fax: 02 6575 3515
Email: wayne.jones@planning.nsw.gov.au
Our ref: MP 05_0117 Mod 3

Mr Graham Chase
Environment & Community Manager
Moolarben Coal Operations Pty Ltd
Locked Bag 2033
MUDGEE NSW 2850

Dear Mr Chase

**Request for Independent Review - MP- 05_0017 – Moolarben Coal**

The Department has received a request for an independent review from Patricia & Sebastian Carbone of 398 Winchester Crescent, Cooks Gap, NSW under Schedule 5, Condition 4 of MP 05_0117 Mod 3.

The Carbone's are concerned that Moolarben Coal Mine may be exceeding the relevant impact assessment criteria for noise at their property.

The Secretary's representative has reviewed the Carbone's concerns, and confirms that an independent review is warranted on this occasion. Moolarben Coal Operations are required to commission a suitably qualified, experienced and independent person(s) within the next two months. In accordance with Schedule 5, Condition 4 the expert shall:

a) consult with the Carbone's to determine their concerns;
b) conduct monitoring to determine whether the project is complying with the noise impact assessment criteria under Schedule 3; and
c) if the project is not complying with these criteria then:
    - determine if more than one mine is responsible for the exceedance, and if so the relative share of each mine regarding the impact on the Carbone's;
    - identify measures that could be implemented to ensure compliance with the relevant criteria; and
d) give the Secretary's representative and the landowner a copy of the independent review.

I would appreciate it if you would nominate suitably qualified and independent person(s), no later than Friday 26 June 2015, to carry out this independent review.

While there is no formal requirement for Moolarben Coal Operations to involve the Department in the scoping of the review, it has previously been beneficial to both parties and the Department seeks your endorsement for a Departmental representative to attend the scoping meeting with the Carbone's.

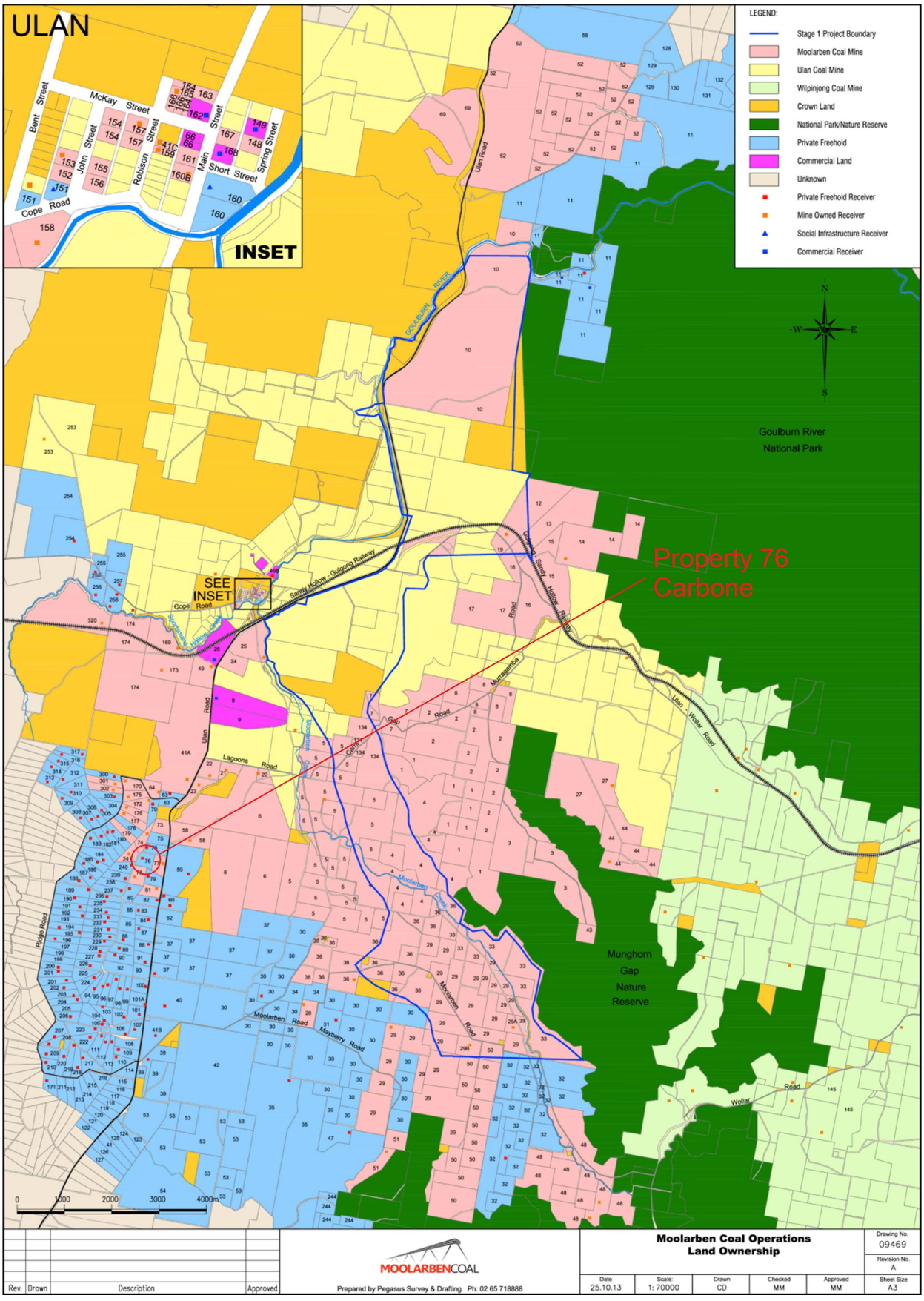
I further ask that you contact Wayne Jones on 6575 3406 to discuss the scope of works for the upcoming independent review.

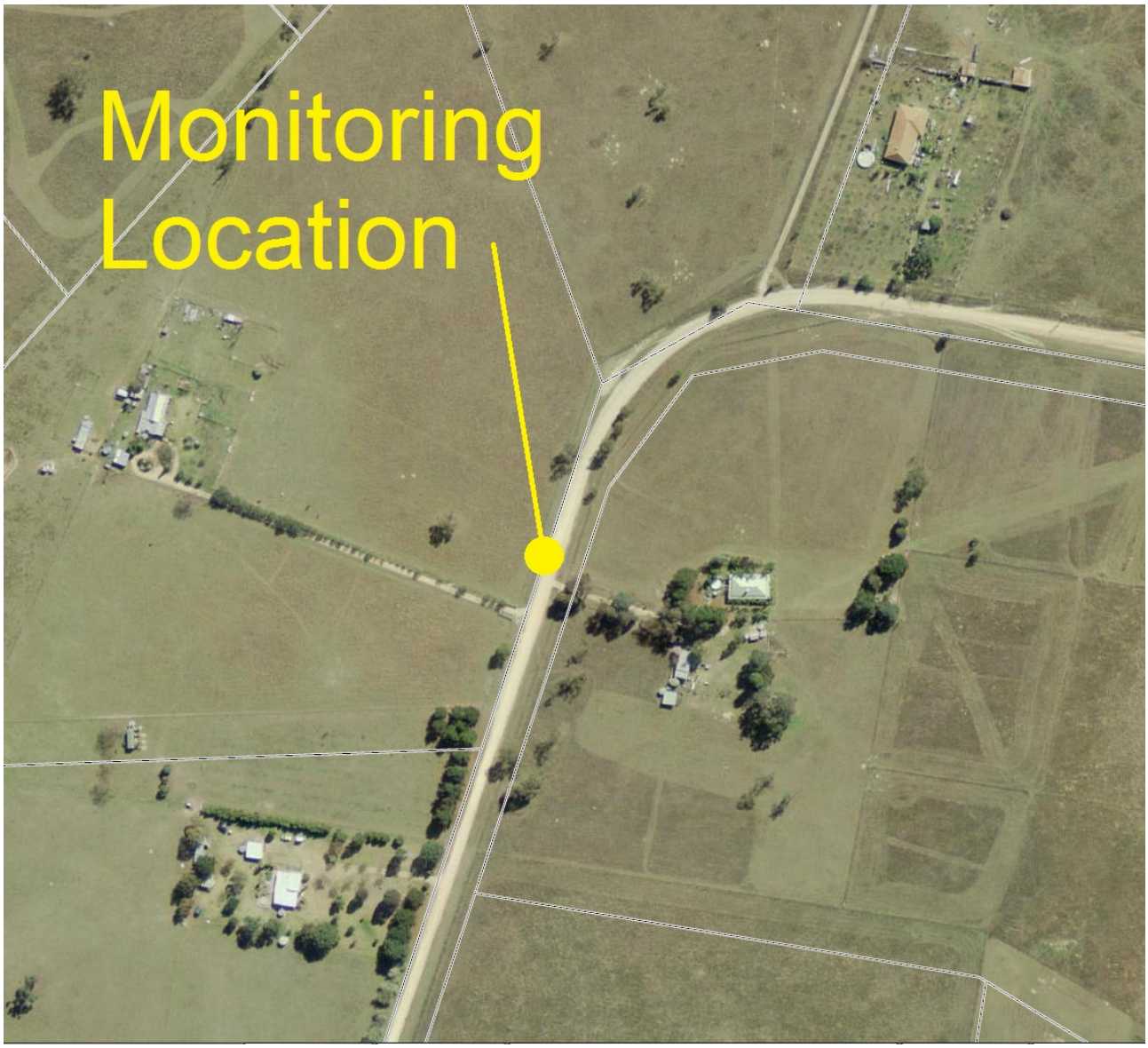
Yours sincerely

Scott Brooks 22-4-2015
**Investigations (Lead), Compliance**
As Nominee for the Secretary, Department of Planning & Environment

Singleton Office: P.O. Box 3145, Suite 14, Level 1, 1 Civic Avenue Singleton NSW 2330
Website: www.planning.nsw.gov.au

# APPENDIX B – PLANS





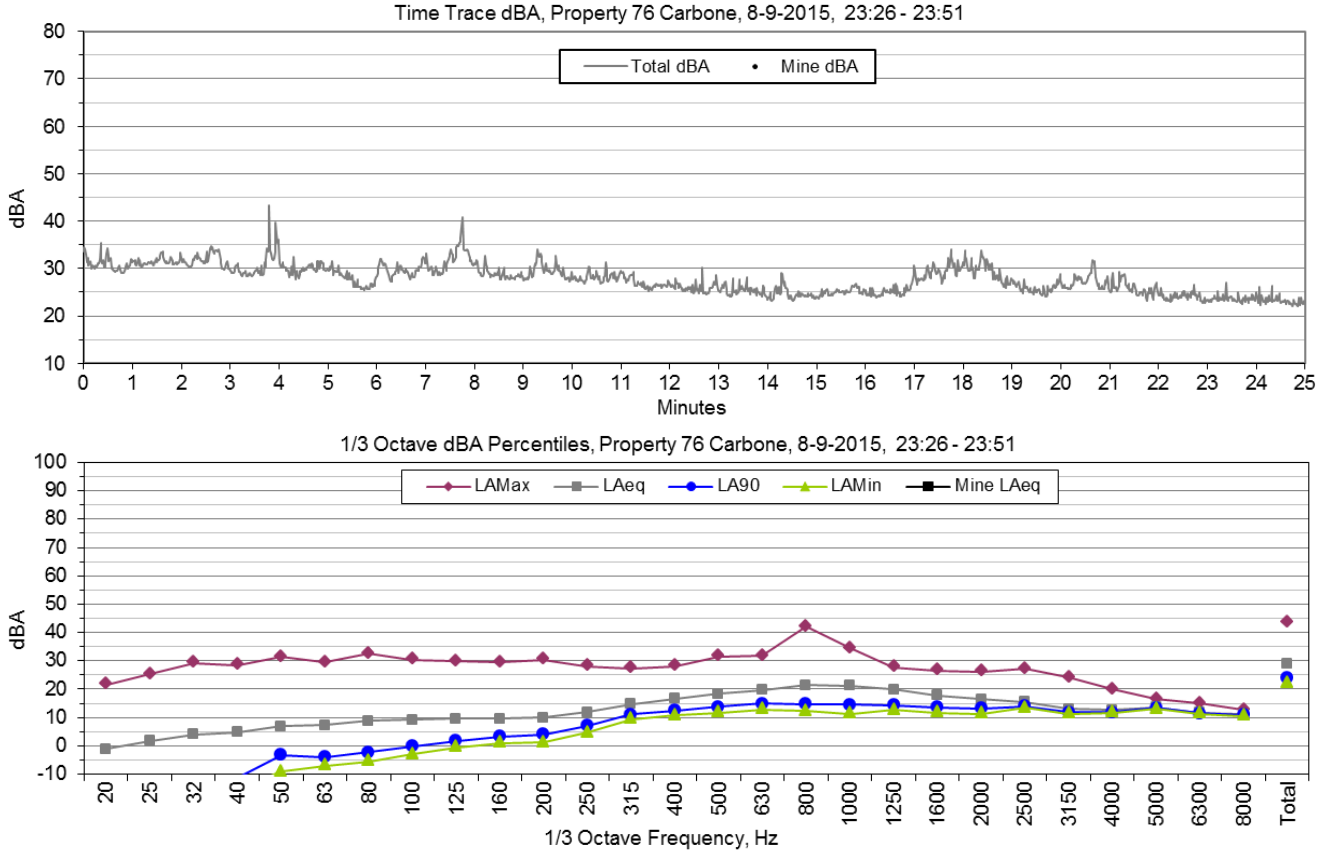

Partial view of the property showing Winchester Road, the residence and the noise monitoring location. Base plan from SIX Maps.

# APPENDIX C – MEASURED NOISE LEVELS

Charts on the following pages show measured noise levels at the receptor. Measured noise levels are presented in the order they were measured, with the date and time shown in each figure.

Two charts are shown for each noise measurement. The first chart shows a 'noise level trace' for the duration of the noise measurement in one second intervals in dBA. The second chart shows the measured maximum (LAmax), average (LAeq), background (LA90) and minimum (LAmin) noise levels in 1/3 octave bands from 20 Hz to 8000 Hz and total dBA noise levels, plus the mine-only LAeq where the mine was audible and the mine-only LAeq could be calculated.

**Survey 1 – Nights of Tuesday 8 and Wednesday 9 September 2015**

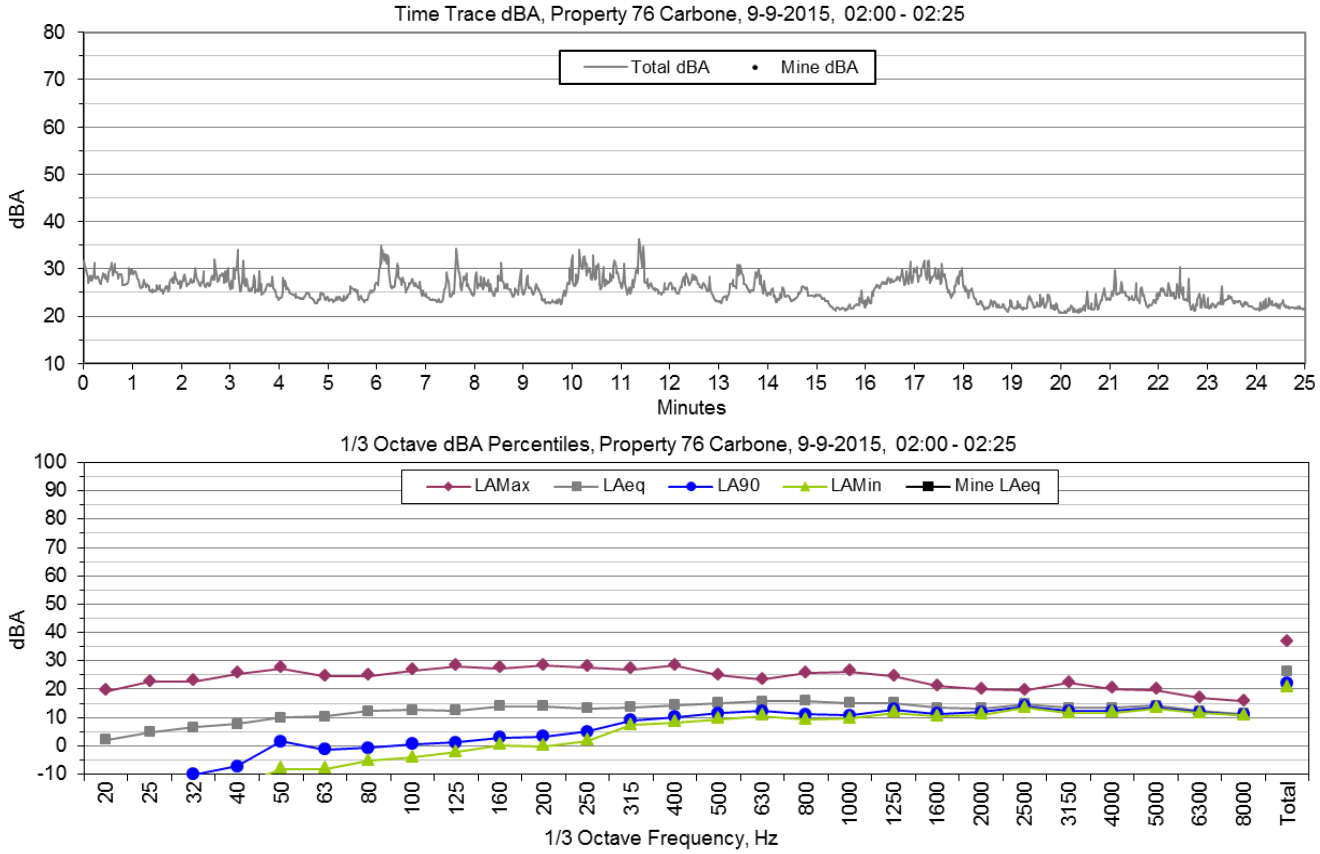



Air temperature 9 °C

Wind speed 2.2 m/s from the west

Wind sigma-theta 14°, Stability category E

Audible sources included insects and frogs, intermittent wind noise in nearby trees, intermittent and distant dogs barking and intermittent road traffic. No mine noise was audible at any time.

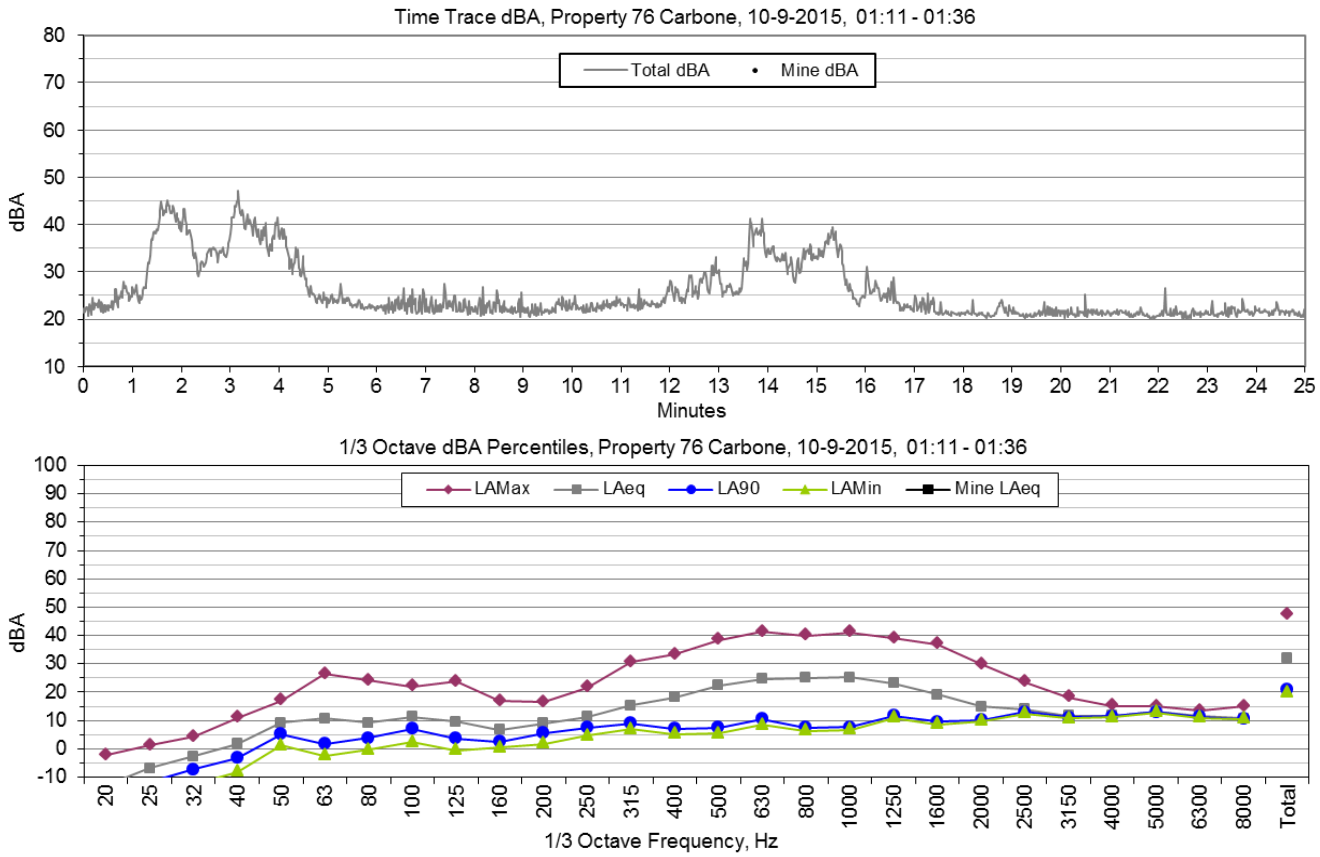



Air temperature 8 °C

Wind speed 2.6 m/s from the north west

Wind sigma-theta 9°, Stability category D

Audible sources included insects and frogs, intermittent wind noise in nearby trees and intermittent road traffic. No mine noise was audible at any time.

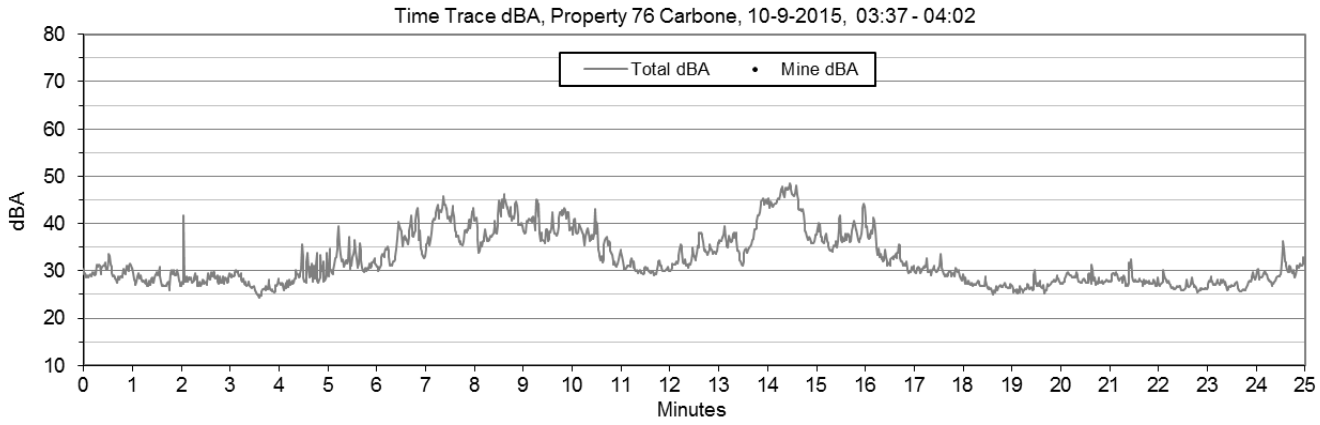


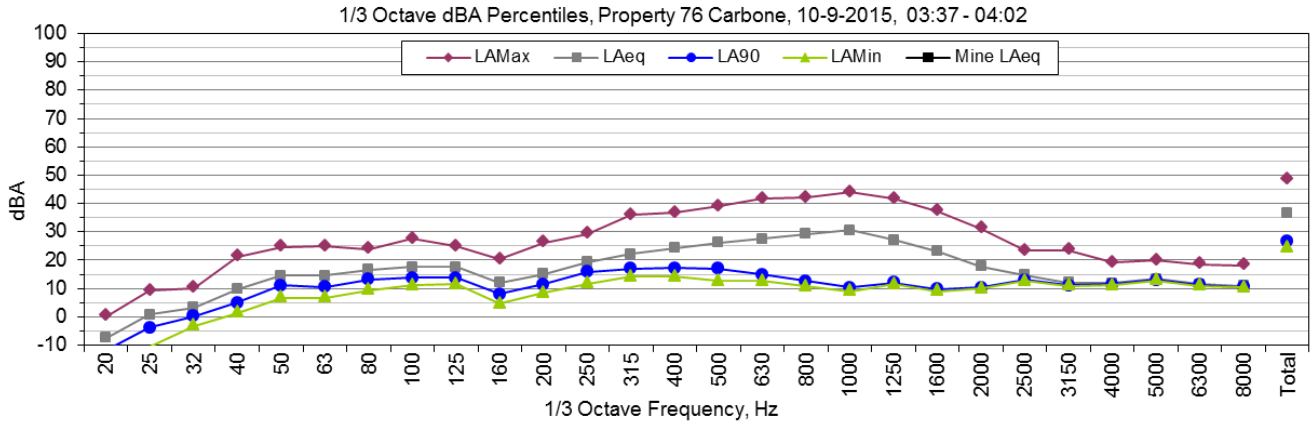

Air temperature 3 °C

Wind speed 1.1 m/s from the south south west

Wind sigma-theta 8°, Stability category D

Audible sources included insects and frogs, intermittent road traffic and a barely audible mine hum during otherwise quiet periods, leading to an estimated mine noise level in the range 10 to 15 LAeq.



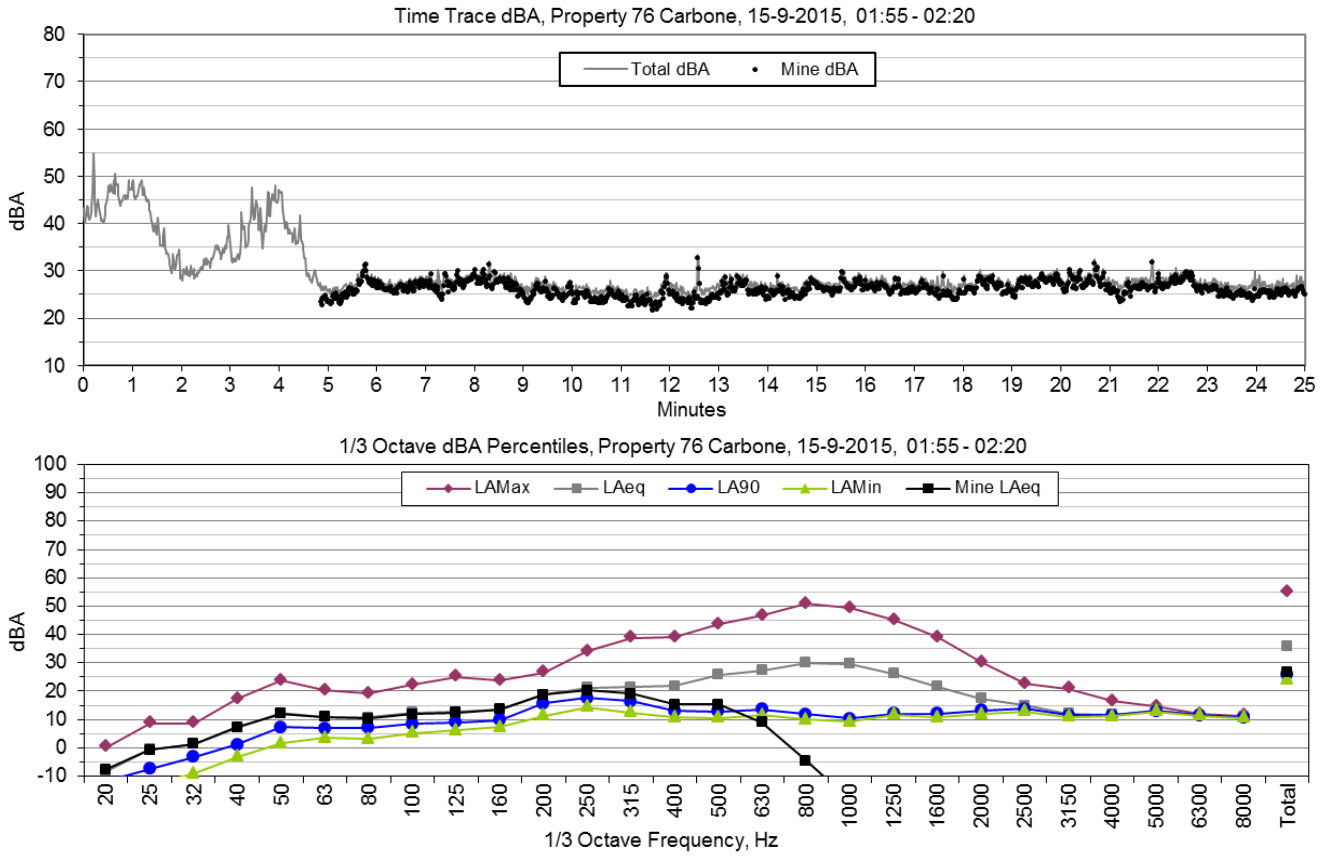

Air temperature 2 °C

Wind speed 1.0 m/s from the south

Wind sigma-theta 18°, Stability category F

Audible sounds included insects and frogs, intermittent road traffic, cows in adjacent paddocks and a mine shovel gate bang and a mining hum mainly comprising truck gearboxes and engines. Mine noise was sometimes clearly audible at a measured noise level of approximately 25 dBA, leading to an estimated mine noise level in the range 23 to 27 LAeq.

**Survey 2 – Nights of Monday 14 and Tuesday 15 September 2015**



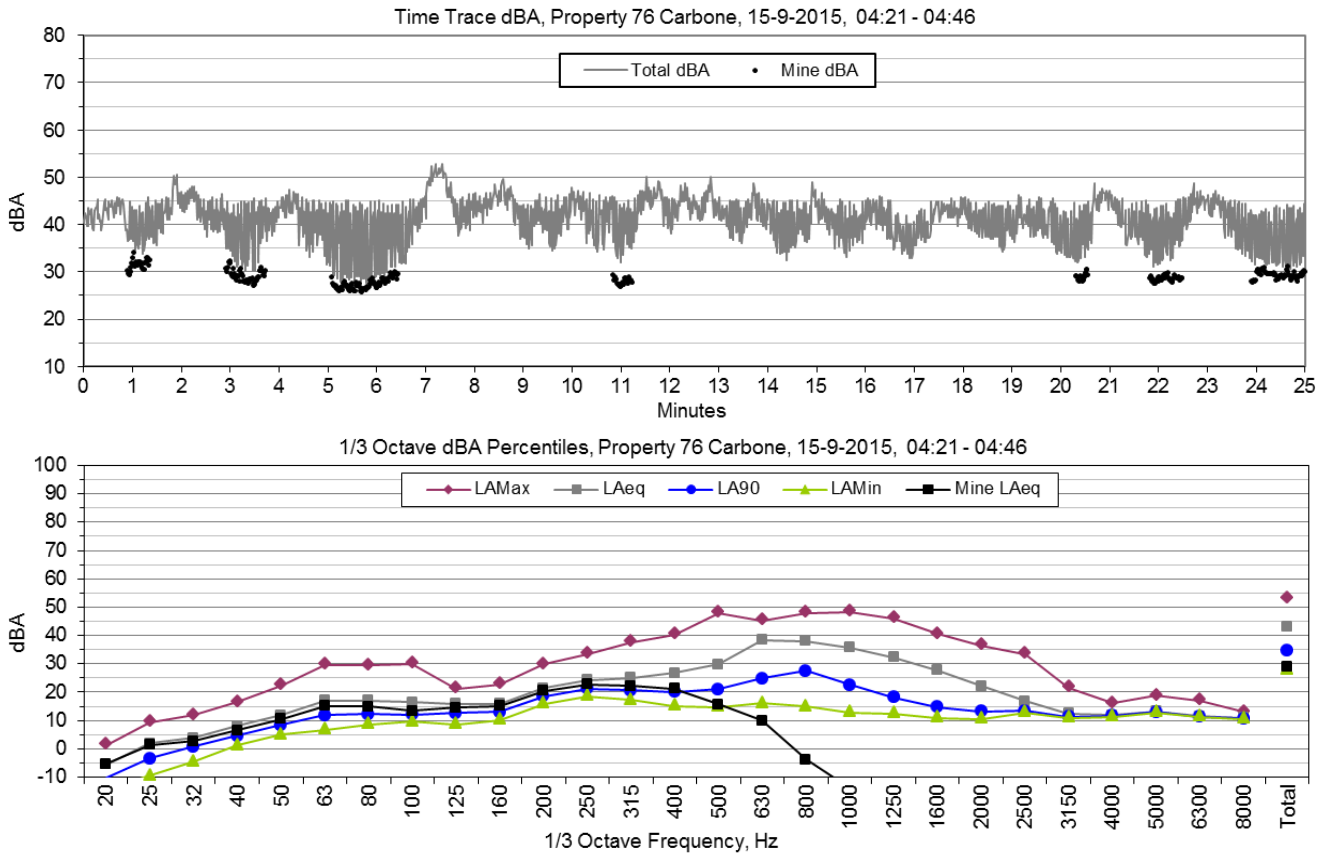

Air temperature 8 °C

Wind speed 1.2 m/s from the south south east

Wind sigma-theta 28°, Stability category F

Road traffic was the dominant source for the first five minutes. Audible sounds during the remaining time included a constant mine hum, insects, frogs and birds. Listening to the recorded sound in various octave bands indicates mine noise occurs in the range 20 Hz to approximately 500 Hz, therefore all measured noise above 500 Hz is either from other sources or represents the noise floor of the instrument. A mine noise contribution of 27 LAeq has been determined by summing the measured noise levels in all frequency bands up to and including 500 Hz after the 5 minute point.

The most common bird noise, due to an owl, was produced in the 500 Hz and 1000 Hz octave bands and was therefore partly included in the reported mine noise for this measurement period.

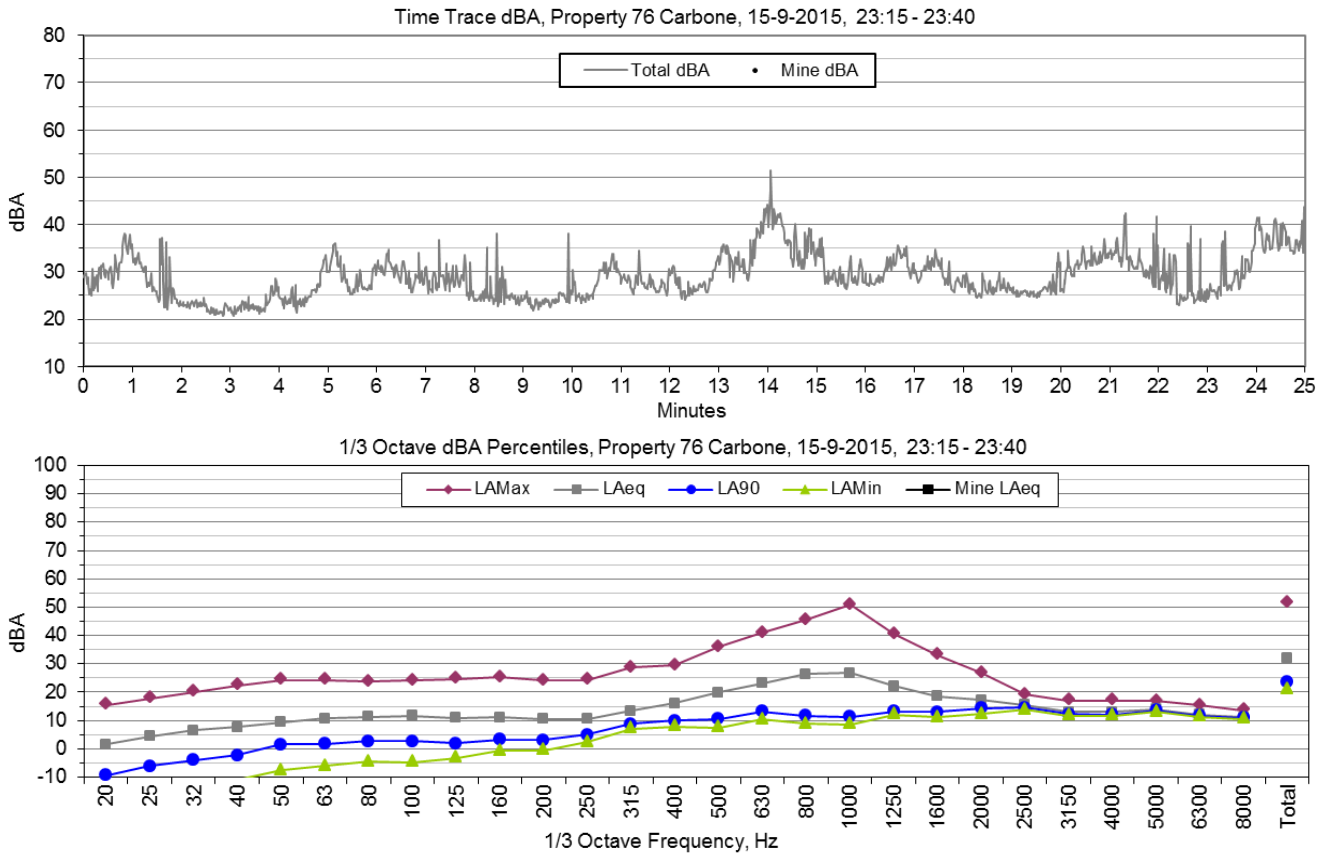



Air temperature 7 °C

Wind speed 2.4 m/s from the south

Wind sigma-theta 16°, Stability category D

Measured noise levels were dominated by a combination of road traffic and an owl in a nearby tree. Noise that was most likely from the mine was occasionally audible during breaks in traffic and owl calls, for a total of approximately 5 minutes during the 25 minute measurement period and an estimated mine noise level of 29 LAeq.

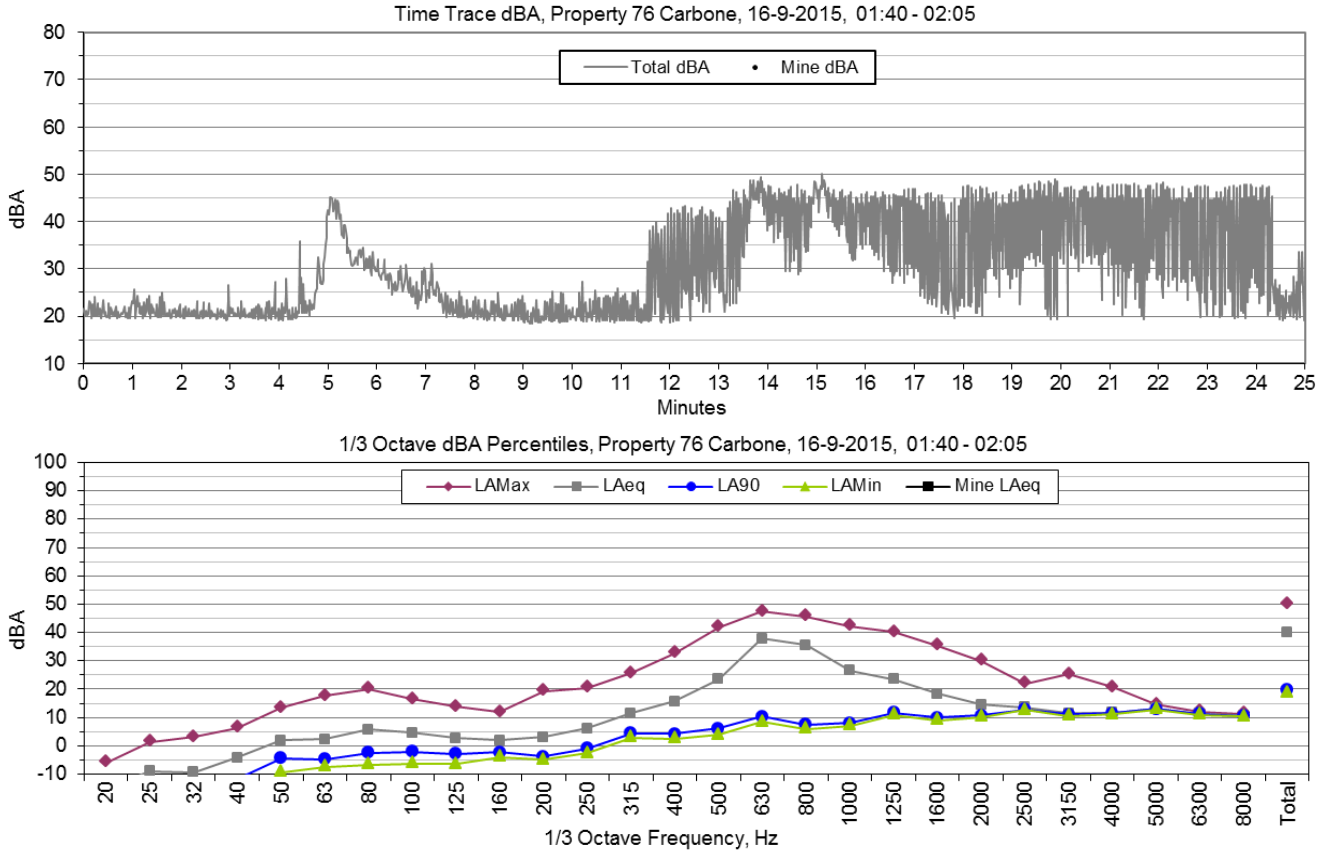



Air temperature 11 °C

Wind speed 0 m/s

Wind sigma-theta 0°, Stability category F

Measured noise levels were dominated by road traffic with some noise from insects, frogs, dogs, birds and wind. Mine noise was not noted at any time. The loud peak at approximately 14 minutes was caused by simultaneous dogs barking and wind noise.



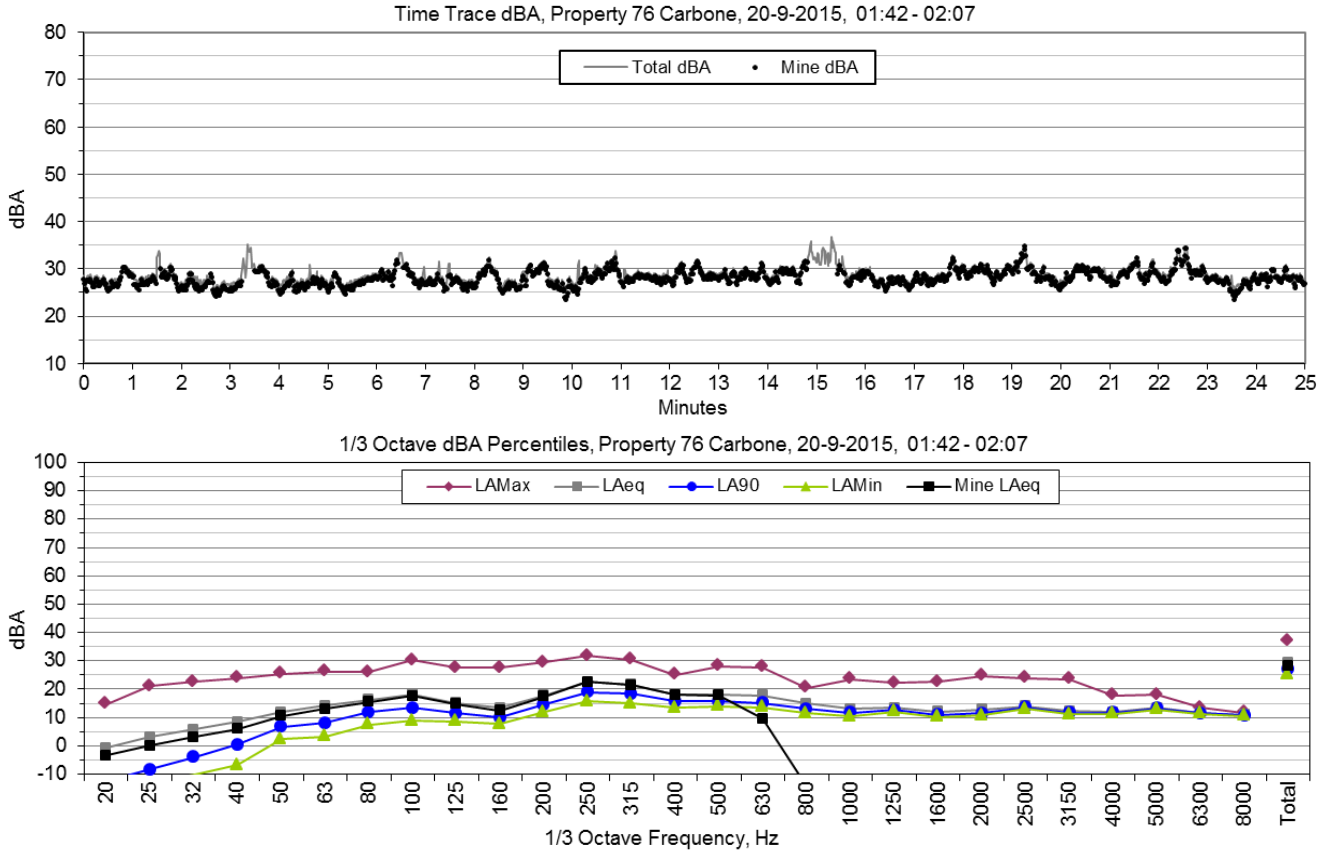

Air temperature 6 °C

Wind speed 1.2 m/s from the south

Wind sigma-theta 9°, Stability category D

Audible sounds included intermittent road traffic, insects, frogs and birds, with two nearby owls contributing significant noise for the second half of the measurement period. A sound believed to be mine noise, but may have been distant traffic noise, was just audible for brief periods in the absence of other sources but at a very low level which made positive identification difficult.

## Survey 3 – Nights of Saturday 19 and Sunday 20 September 2015

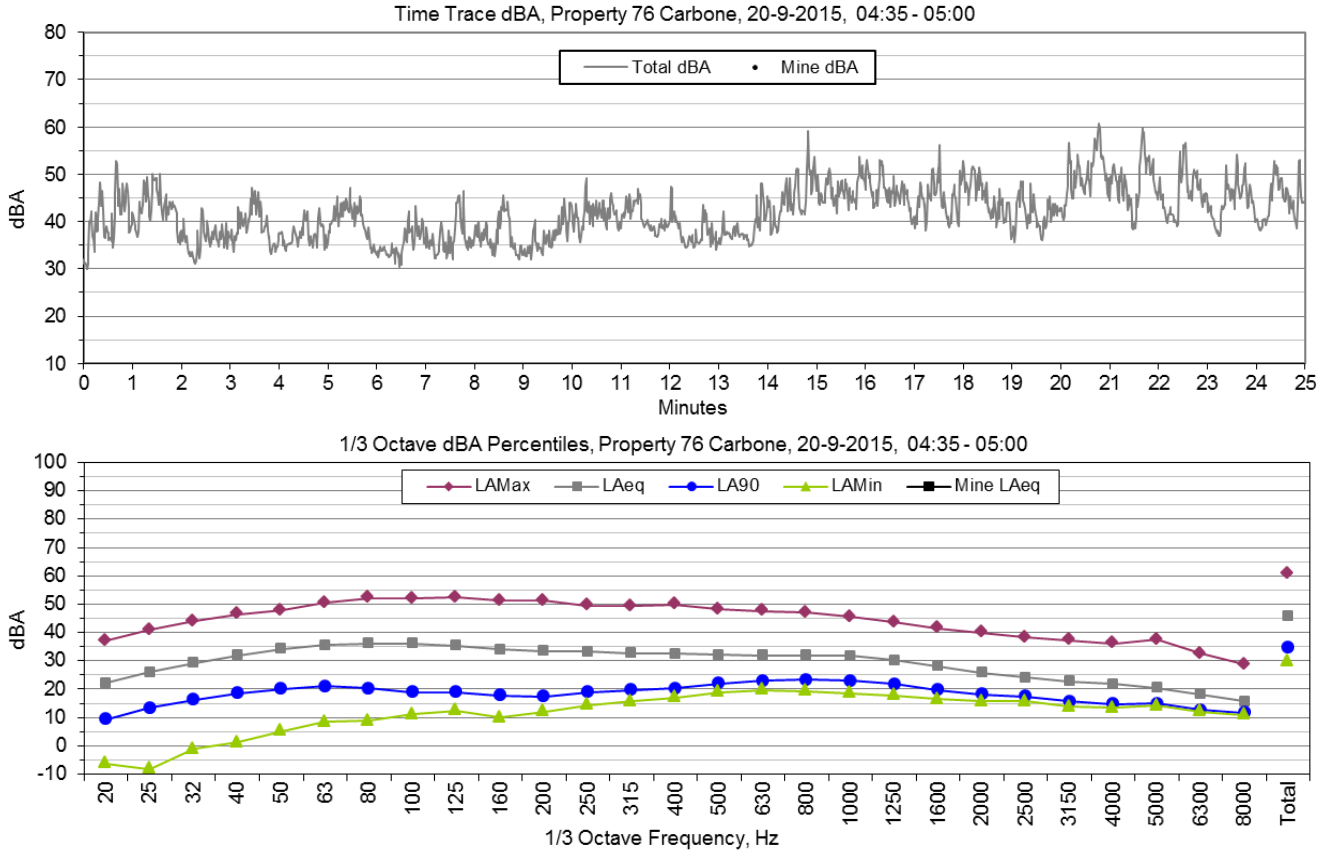



Air temperature 12 °C

Wind speed 1.7 m/s from the south east

Wind sigma-theta 21°, Stability category F

Audible sounds included insects, frogs, animals in the adjacent paddock, intermittent wind noise and constant noise from mining equipment. The mining noise level has been estimated by excluding relatively brief periods of dominant wind noise and filtering to reduce or exclude noise in frequency bands above 500 Hz, resulting in an estimated mine noise level of 28 LAeq.

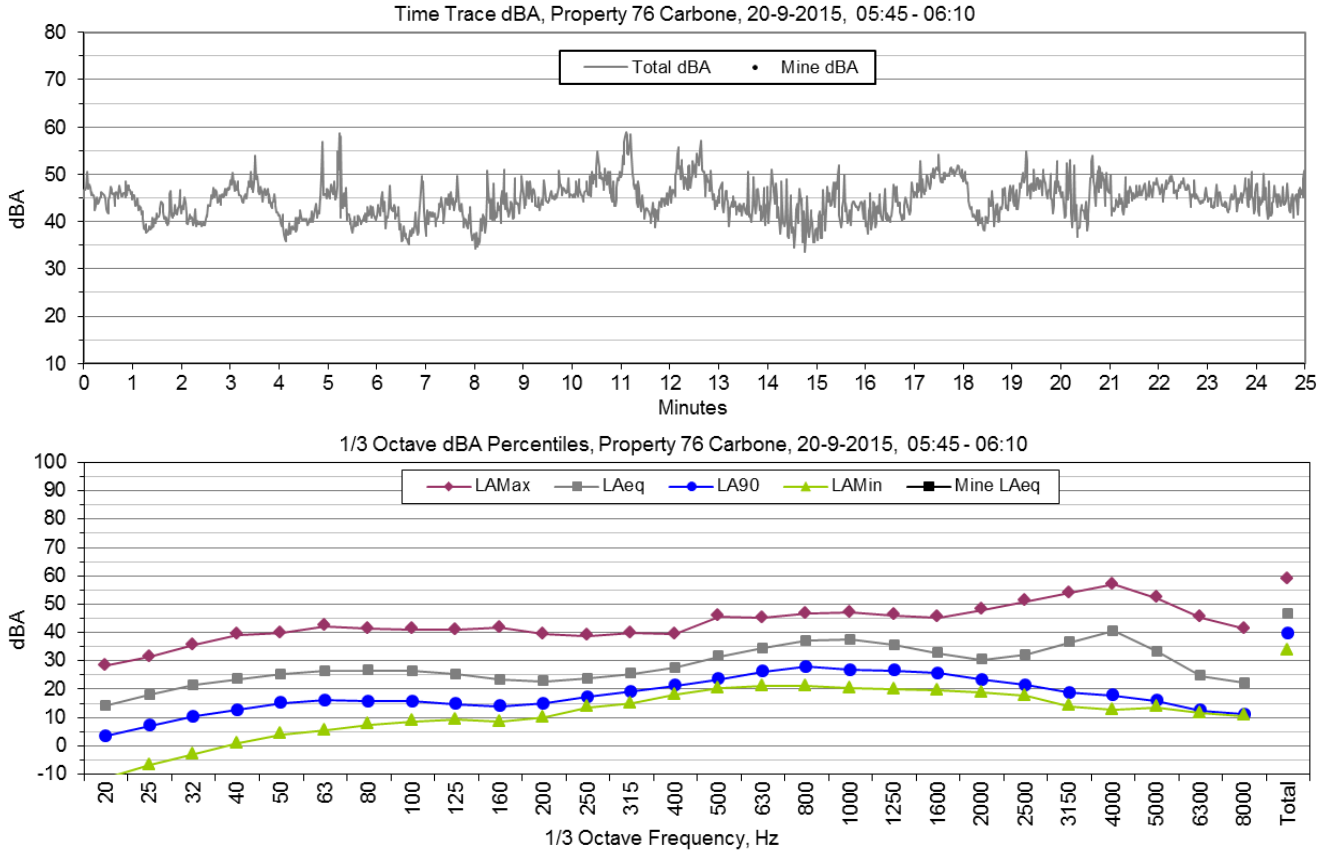



Air temperature 12 °C

Wind speed 1.7 m/s from the east

Wind sigma-theta 20°, Stability category F

Wind noise in nearby trees was the dominant source during this measurement period. Other sounds audible between gusts of wind included road traffic, insects, frogs and nearby animals. Mine noise was barely audible, in conjunction with more dominant traffic noise, during otherwise quiet periods.

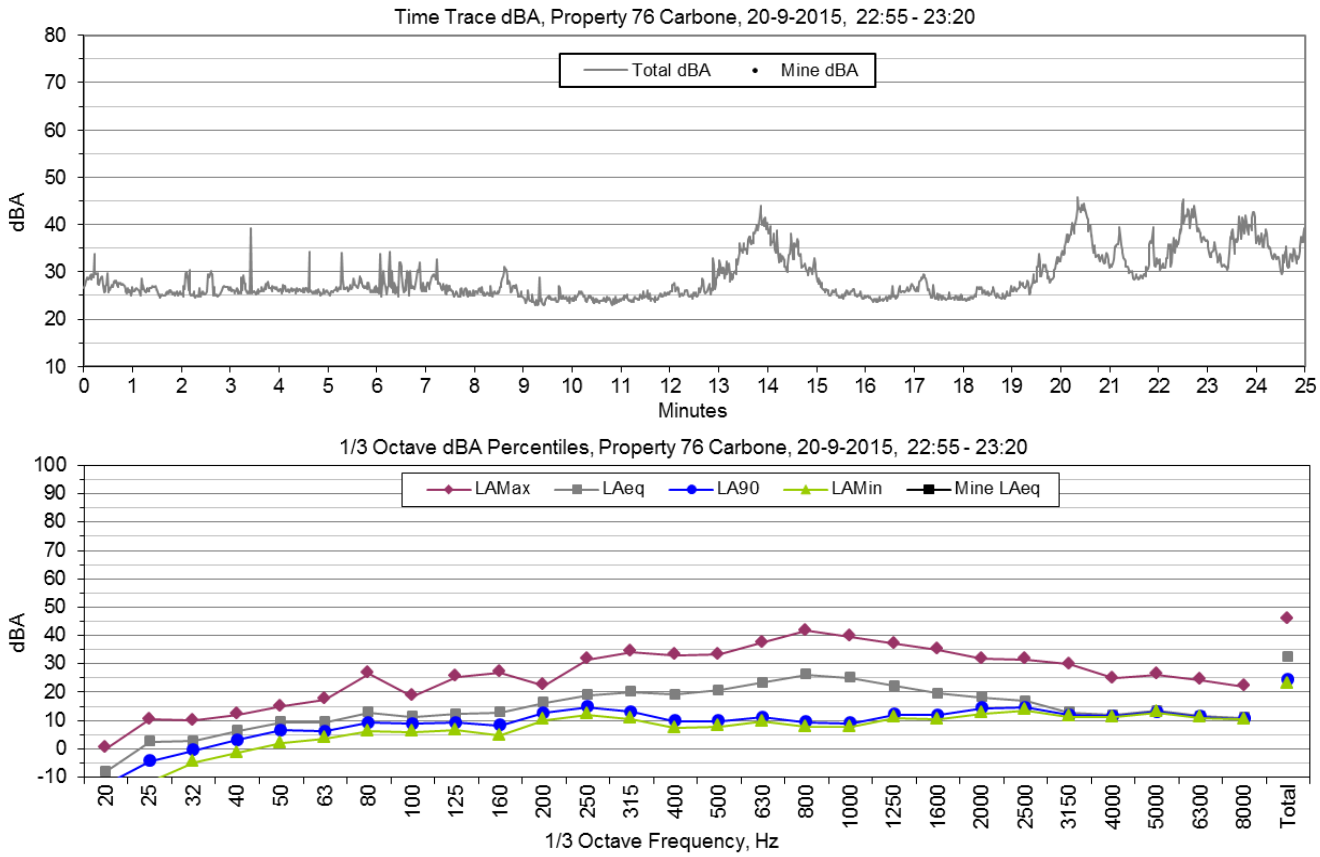



Air temperature 12 °C

Wind speed 2.8 m/s from the east south east

Wind sigma-theta 16°, Stability category C

Wind, birds and traffic noise were all dominant during this measurement period, with no significant mine noise audible at any time.

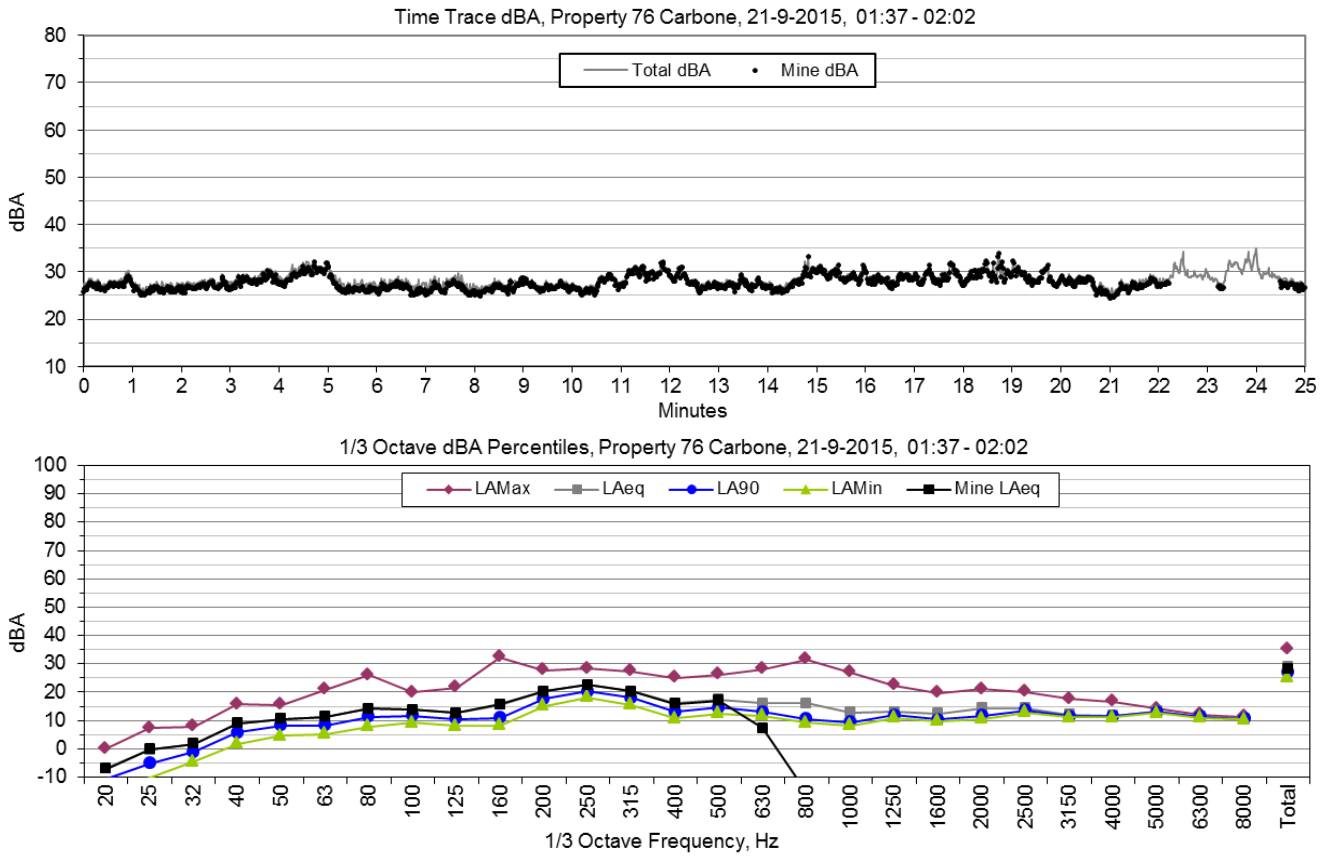



Air temperature 9 °C

Wind speed 1.8 m/s from the south

Wind sigma-theta 5°, Stability category E

Measured noise levels were primarily influenced by intermittent road traffic with insects, frogs and mining equipment in the background and occasional dog, horse and bird noise. Mining sources were audible as a low hum rather than as distinct sources, at an estimated level of approximately 22 LAeq.



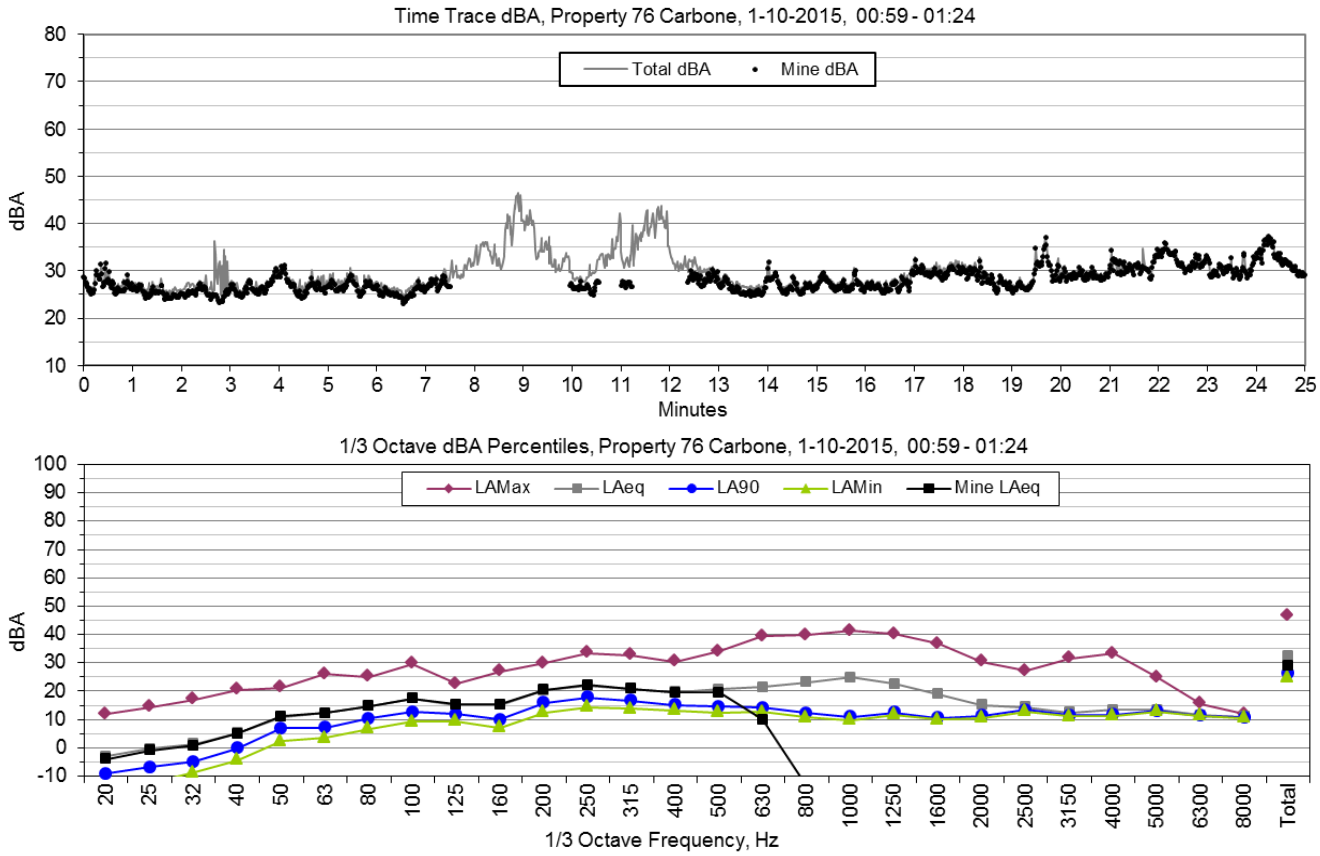

Air temperature 7 °C

Wind speed 1.7 m/s from the south

Wind sigma-theta 8°, Stability category D

Measured noise levels were influenced by a combination of insects, frogs, birds and mining equipment, with all sources almost constantly audible during this period. Road traffic was also audible on a few occasions. Audible mining equipment included a dozer, haul trucks and an excavator, at a calculated level of 28 LAeq after removing periods affected by audible road traffic and noise in frequencies above 500 Hz.

**Survey 4 – Nights of Wednesday 30 September and Thursday 1 October 2015**

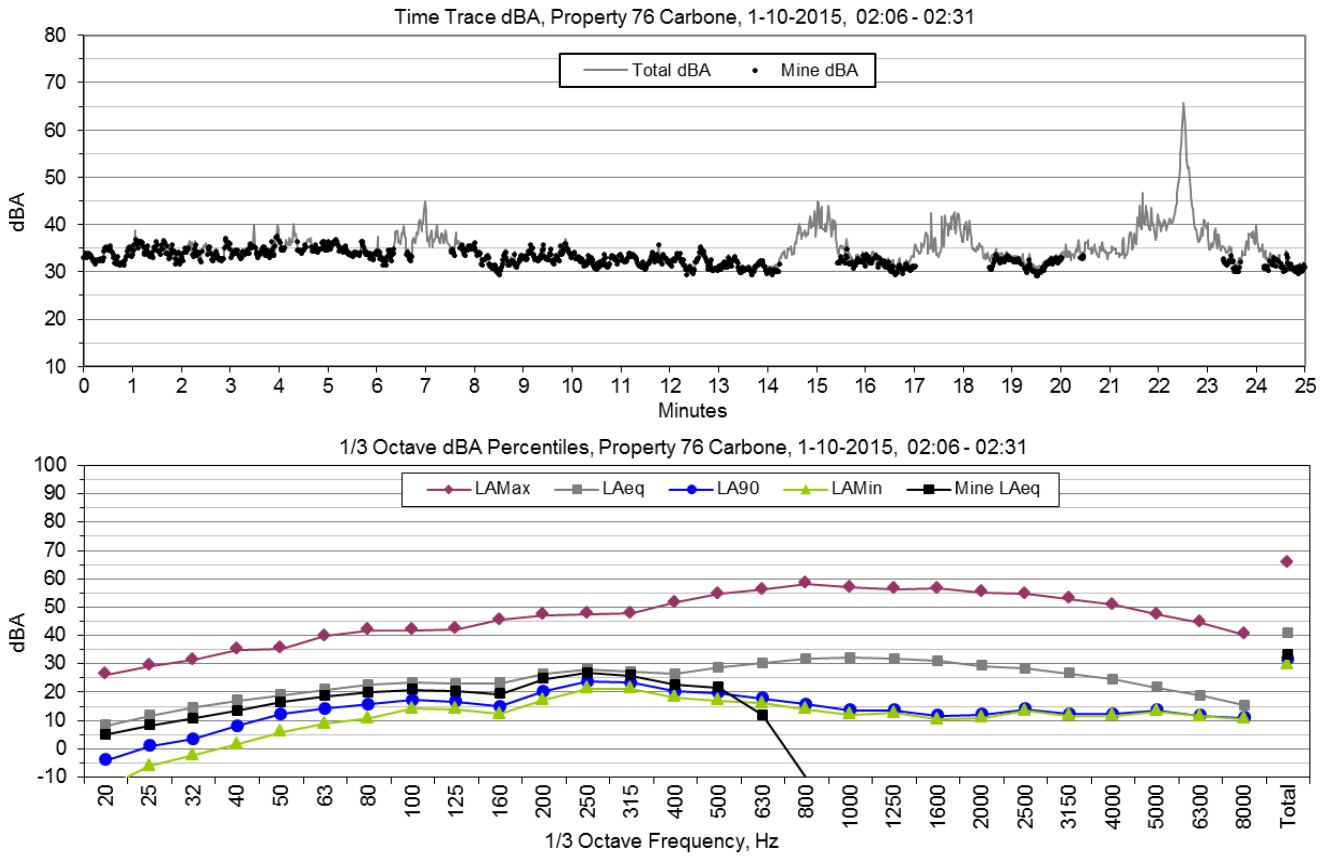



Air temperature 14 °C

Wind speed 1.3 m/s from the south south east

Wind sigma-theta 32°, Stability category F

Measured noise levels were influenced by insects, frogs and a mine hum in the background at a calculated level of 29 LAeq after removing periods affected by birds and road traffic and noise in all frequencies above 500 Hz. Audible mining equipment included a dozer and haul trucks, with additional equipment such as excavators likely to be audible despite not being separately identified.

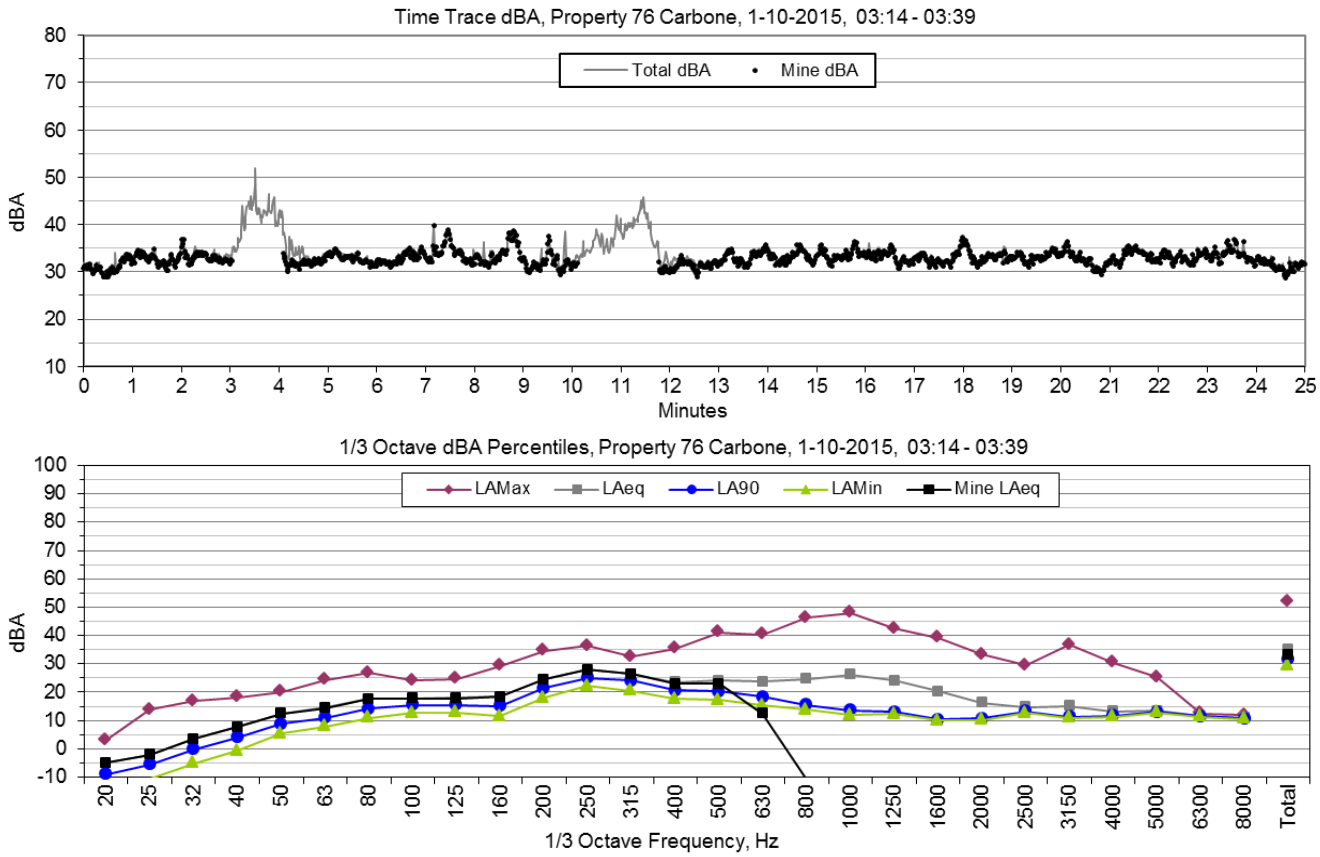



Air temperature 14 °C

Wind speed 1.5 m/s from the north north east

Wind sigma-theta 36°, Stability category F

Measured noise levels were influenced by road traffic, insects, frogs and a mine hum in the background at a calculated level of 33 LAeq after removing periods affected by birds and traffic and noise in all frequencies above 500 Hz. Mining noise was generally audible as an indistinct hum with few sources separately audible, most likely due to the windy conditions which tend to mask the noise.

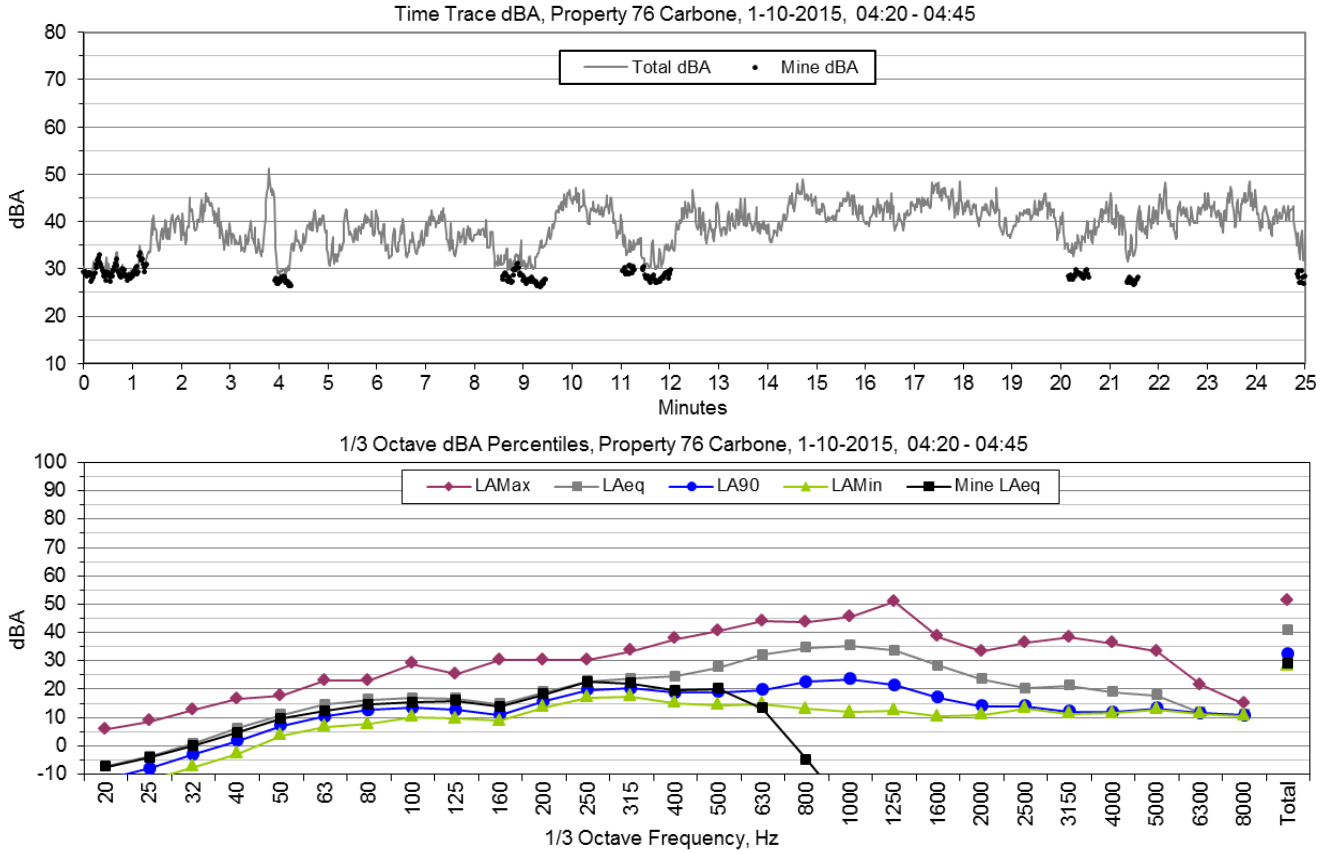



Air temperature 13 °C

Wind speed 1.3 m/s from the south south east

Wind sigma-theta 28°, Stability category F

Measured noise levels were influenced by road traffic, insects, frogs, dogs, roosters and a mine hum in the background at a calculated level of 33 LAeq after removing periods affected by other sources and noise in all frequencies above 500 Hz. Mining noise was generally an indistinct hum from multiple haul trucks with dozers separately audible at times.

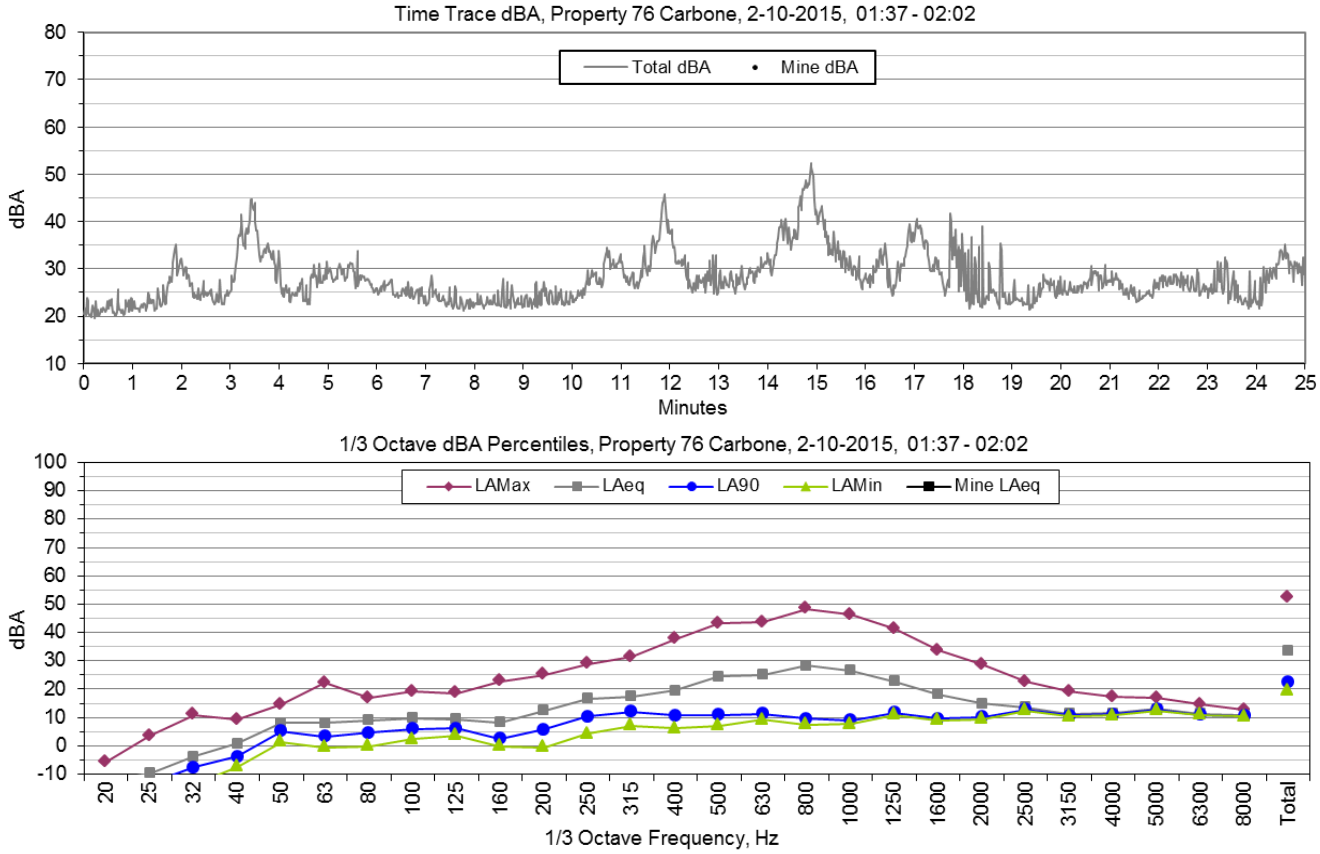



Air temperature 12 °C

Wind speed 0.8 m/s from the north

Wind sigma-theta 61°, Stability category F

Road traffic noise dominated this measurement period, with few relatively quiet gaps between vehicles. Insects, frogs and birds were almost constantly audible, while an indistinct mine hum was audible during brief breaks in traffic. A mining noise level could not be correctly determined with less than 10 minutes of audible mine noise, however an average mine noise level of approximately 29 LAeq would have been likely in the absence of road traffic.

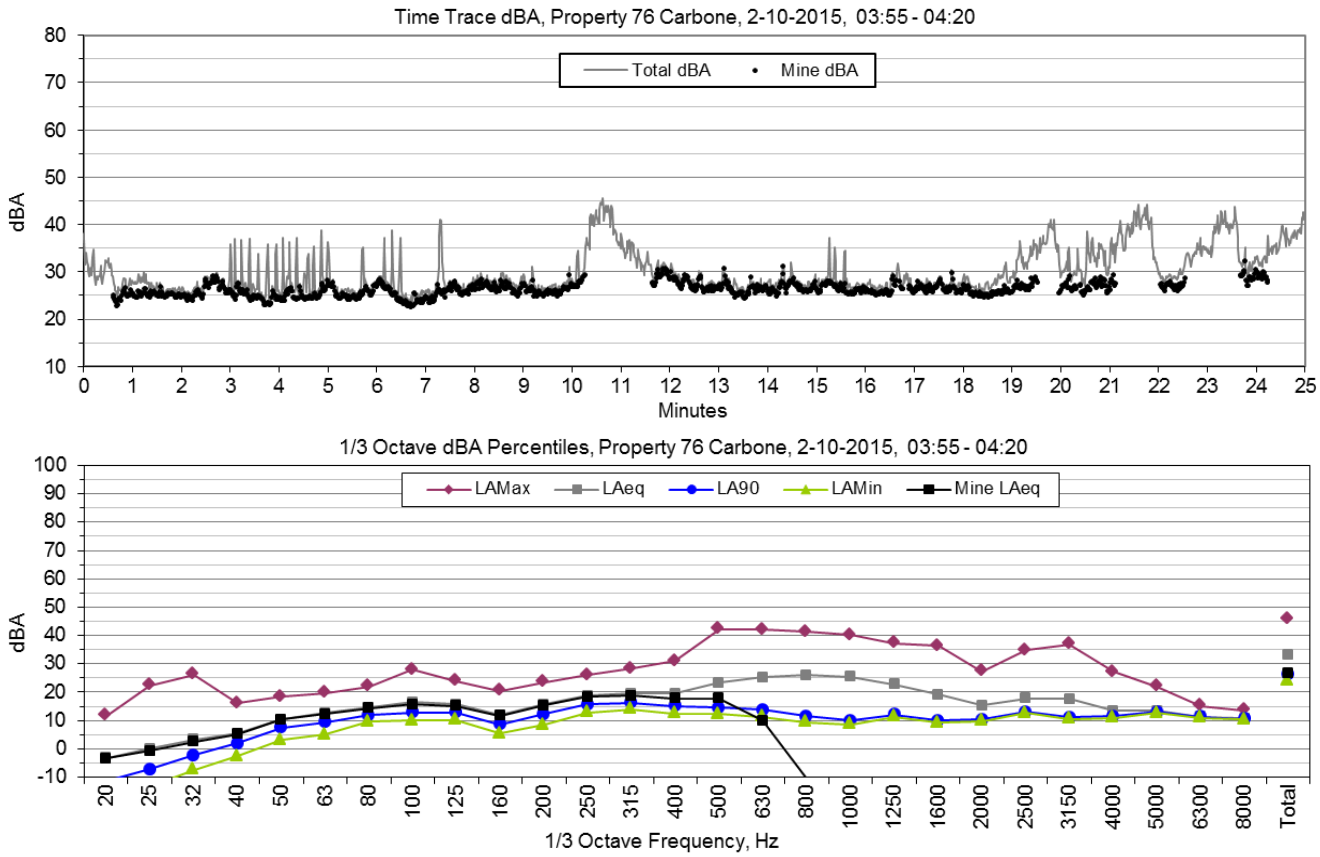



Air temperature 7 °C

Wind speed 0.8 m/s from the east south east

Wind sigma-theta 52°, Stability category F

Insects, frogs, dogs, horses and road traffic were the main sources of audible noise, with a barely audible mine hum and occasional periods of dozer noise also audible for part of the measurement period. A mine noise level could not be determined due to the low levels.



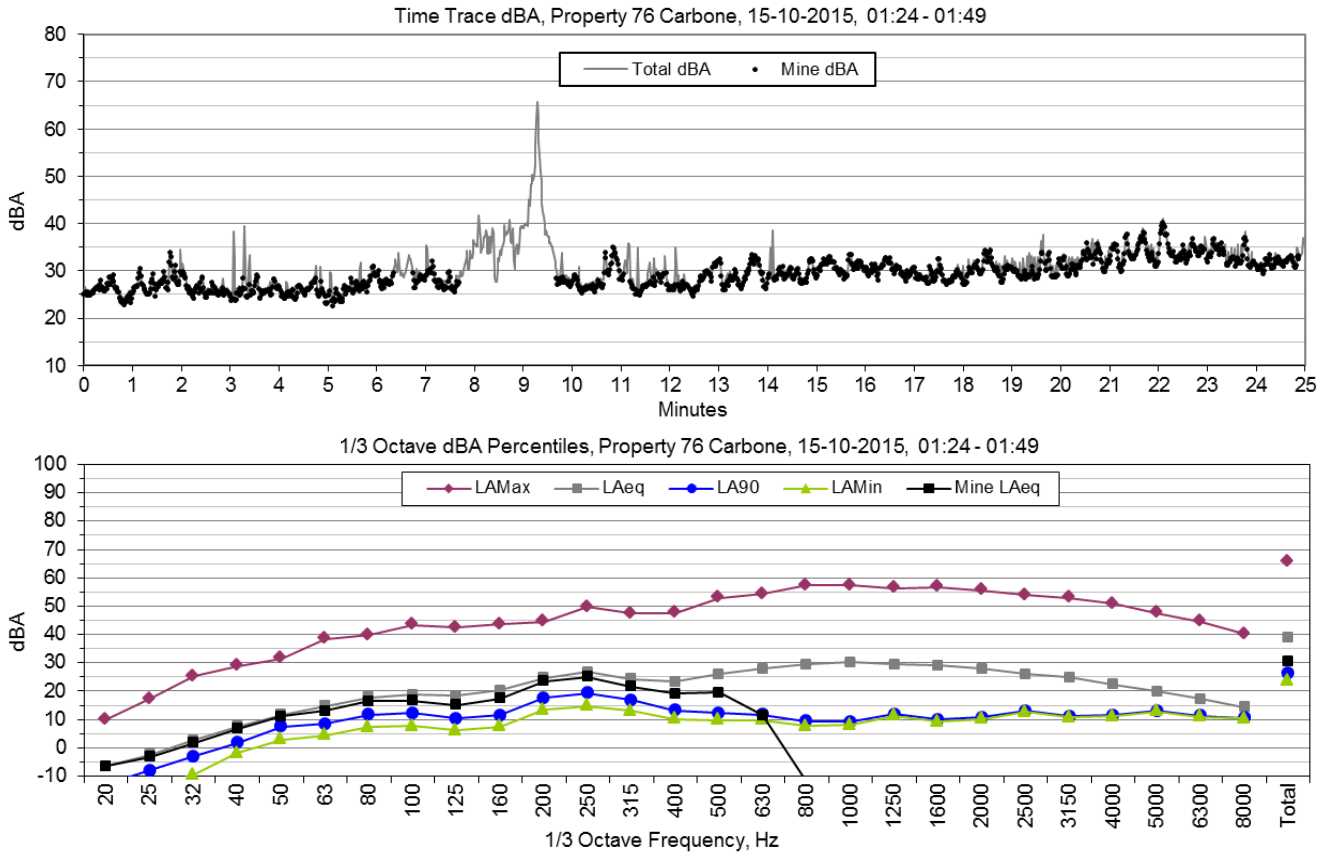

Air temperature 5 °C

Wind speed 0.8 m/s from the south east

Wind sigma-theta 17°, Stability category E

Measured noise levels were dominated by road traffic noise and intermittent bird calls, with a relatively constant mine hum in the background at a calculated level of 27 LAeq.

## Survey 5 – Nights of Wednesday 14 and Thursday 15 October 2015

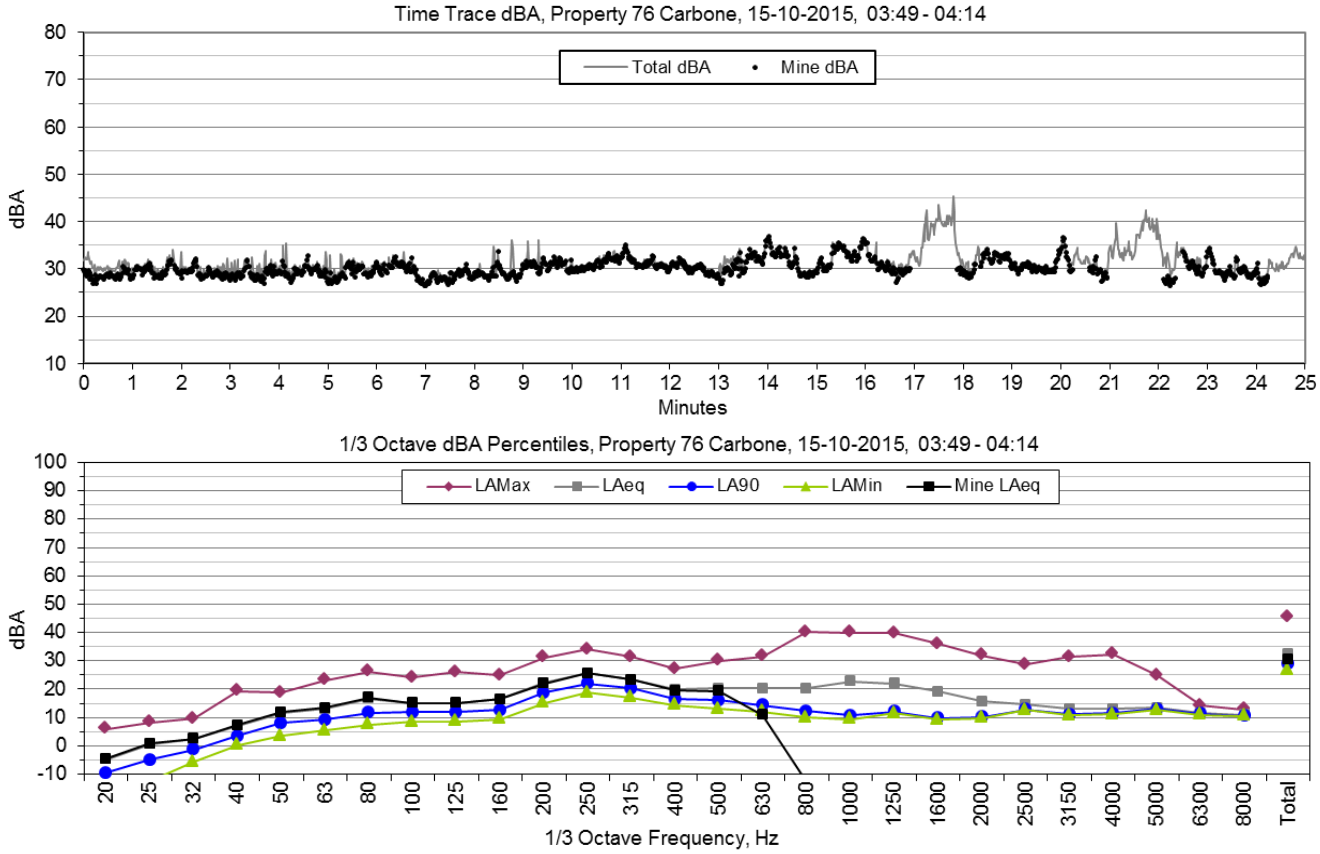



Air temperature 14 °C

Wind speed 1.2 m/s from the south

Wind sigma-theta 16°, Stability category E

Audible sounds included insects, frogs, intermittent road traffic, a constant mine hum and intermittent periods of more distinct mine noise due to a dozer and haul trucks. A mine noise level of 30 LAeq has been calculated after excluding other sources.

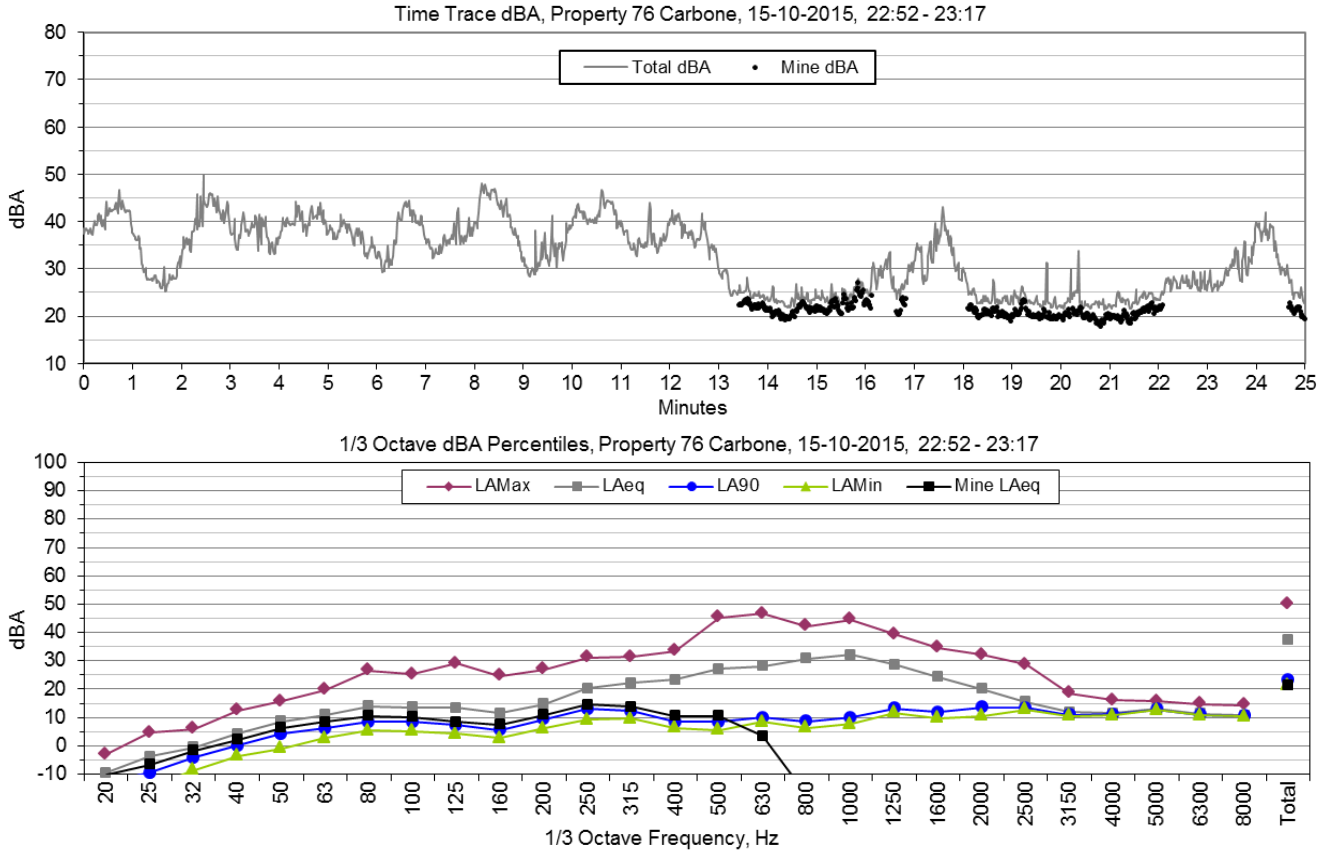



Air temperature 11 °C

Wind speed 0.7 m/s from the north north west

Wind sigma-theta 45°, Stability category F

Audible sounds included insects, frogs, intermittent road traffic, a constant mine hum and intermittent periods of more distinct mine noise due to a dozer and haul trucks. A mine noise level of 31 LAeq has been calculated after excluding other sources.

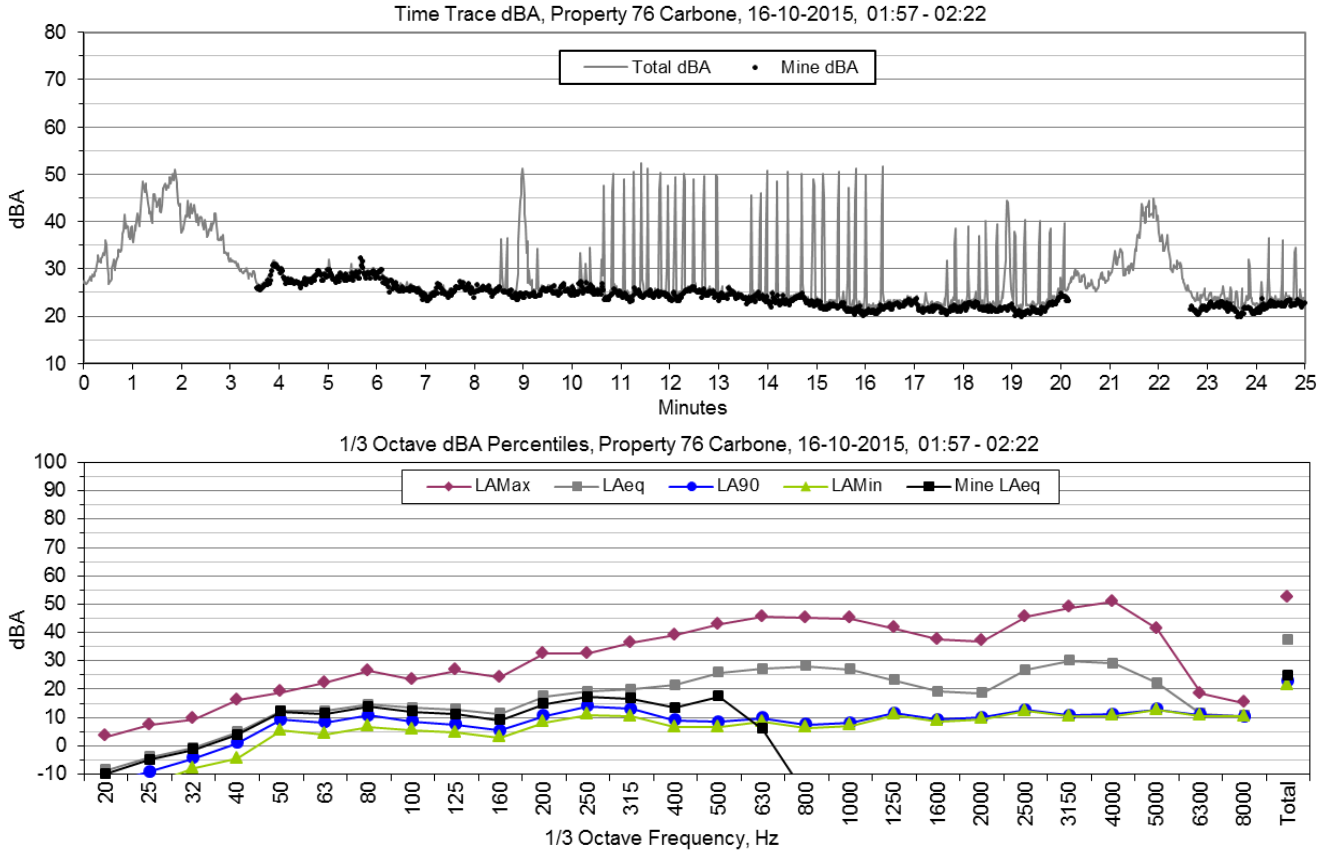



Air temperature 15 °C

Wind speed 1.9 m/s from the south

Wind sigma-theta 10°, Stability category D

Audible sounds included insects, frogs, dogs, horses, road traffic and a background mine hum at a calculated average level of 21 LAeq excluding other sources despite mine noise being audible for less than 10 minutes in the 25 minute period.




Air temperature 11 °C

Wind speed 1.9 m/s from the south

Wind sigma-theta 16°, Stability category E

Measured noise levels were primarily affected by road traffic and nearby bird calls, with mining noise audible as a low hum in the background and intermittent dogs barking. An average mine noise level of 25 LAeq was calculated after removing noise from other sources.