# Appendices

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AshtonCoal
PART OF THE YANCOAL AUSTRALIA GROUP

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# Appendix 1

## Noise Compliance Report 2020

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12 February 2021

Amrish Trivedi
Environment and Community Coordinator
Ashton Coal Operations Pty Ltd
PO Box 699
Singleton NSW 2330 Australia

**Re: EPL 11879 - Noise compliance assessment report 2020**

Dear Amrish,

# 1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged by Ashton Coal Operations Pty Limited (Ashton Coal) to prepare this Noise Compliance Assessment Report for the period 1 January 2020 to 31 December 2020. The Noise Compliance Assessment Report is required as per Condition R5.1 of Environment Protection Licence (EPL) 11879 dated 3 February 2020 which is reproduced as follows:

> R5.1 Noise Compliance Assessment Report
>
> A noise compliance assessment report must be submitted to the EPA on an annual basis with the Annual Return as set out in Condition R1. The report must be prepared by an accredited acoustical consultant and determine compliance with noise limits at noise monitoring points specified in Condition (s) P1.4 and L4.2 to L4.4.

# 2 EPL amendments

EPL 11879 was varied once during the 2020 reporting period. Some conditions in EPL 11879 relating to noise were updated on 3 February 2020 (within the reporting period) and are summarised as follows:

- Condition P1.4 was updated, including reference to the two inversion towers (EPA Points 32 and 33) used for the purposes of calculating temperature inversion conditions, which is used to determine applicability of noise limits;
- Condition L4.1 was updated to tabulate the attended noise monitoring locations (EPA Points 13, 14 and 15);
- Condition L4.2 was updated to reference the noise limit table in condition L4.1;
- Condition L4.4 was added to include use of temperature inversion data calculated from EPA Points 32 and 33;
- Conditions L4.3 and L4.6 were removed;
- Condition M4.1 was updated to reference approved methods to calculate temperature inversions; and
- Condition E.1 was removed, as the requirements of this condition had been completed.

## 3 Compliance

Monthly attended noise monitoring was undertaken by EMM for the period relevant to this report (refer Appendix A to Appendix L for complete noise monitoring reports).

As presented in the attached monthly reports, results of routine attended monitoring confirm that noise emissions from Ashton Coal operations satisfied the relevant EPL noise limits (Condition L4.1 of EPL 11879) at all assessment locations during periods when noise limits were applicable.

## 4 EPA correspondence

During this reporting period, the NSW Environment Protection Authority (EPA) also provided comments on the Ashton Coal monthly noise compliance monitoring reports. The EPA provided comment in relation to the following items:

- The requirements outlined in Section 7.1.3 of the NSW EPAs Noise Policy for Industry (NPfI) and Australian Standards; and
- The addition of one-third octave frequency analysis of the measurements in the monthly noise compliance monitoring reports.

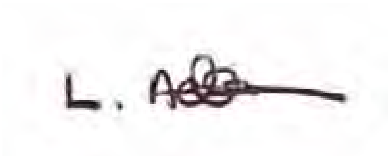
Ashton Coal and EMM welcomed the comments and are fully aware of the EPAs expectations in regard to managing and mitigating noise, both under non-noise enhancing and noise enhancing meteorological conditions. Further, the subsequent monthly compliance noise reports included graphs of the noise levels measured in the one-third octave band frequencies for direct comparison to the LFN thresholds.

## 5 Conclusion

Monthly attended noise monitoring undertaken during the relevant reporting period (1 January 2020 to 31 December 2020) demonstrated that noise emissions from Ashton Coal night-time operations satisfied the relevant limits at all monitoring points in accordance with the EPL 11879.

We trust the preceding meets your current requirements. If you have any questions or need anything further, please do not hesitate to contact our office.

Yours sincerely



**Lucas Adamson**
Senior Acoustic Consultant
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Review: Najah Ishac (19/1/2021)

Appendix A

# Monthly attended noise monitoring report - January 2020

# Ashton Coal

Monthly attended noise monitoring
January 2020

Prepared for Ashton Coal Operations Pty Ltd
February 2020

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# Ashton Coal

Monthly attended noise monitoring - January 2020

Prepared for Ashton Coal Operations Pty Ltd
February 2020

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# Ashton Coal

## Monthly attended noise monitoring - January 2020

**Report Number**

H190832 RP1

**Client**

Ashton Coal Operations Pty Ltd

**Date**

4 February 2020

**Version**

v1-0 Final


| Prepared by | Approved by |
| --- | --- |
| **Lucas Adamson** | **Katie Teyhan** |
| Senior Acoustic Consultant | Associate |
| 4 February 2020 | 4 February 2020 |

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 20 January 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 20 January 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 20 January 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 20 January 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

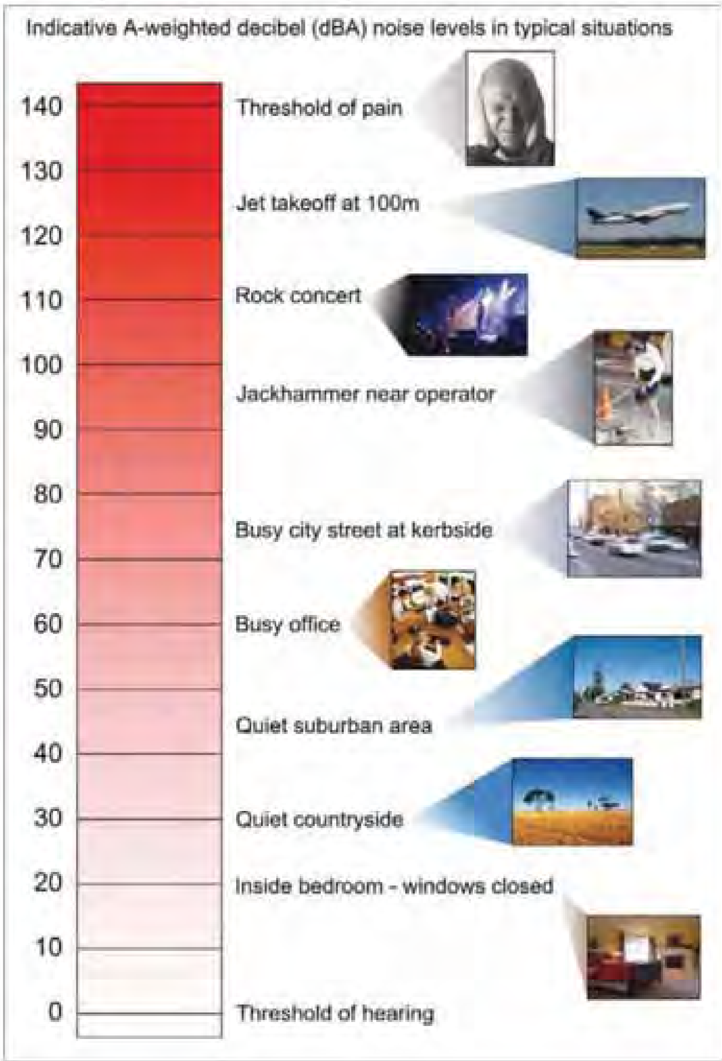
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

### Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

### Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$
>
> | Location | Day | Evening | Night |
> |---|---|---|---|
> | Camberwell Village | 55 | 45 | 40 |
> | All other privately-owned land | 50 | 45 | 40 |
>
> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$
>
> | Location | Day | Evening | Night |
> |---|---|---|---|
> | Camberwell Village | 60 | 50 | 45 |
> | All other privately-owned land | 55 | 50 | 45 |
>
> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

### Table 3.2 One-third octave low-frequency noise thresholds

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be “unannounced” and, to EMM’s knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.


*Source: EMM (2019); DFSI (2017); GA (2011)*

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

### Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 20 January 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one - third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits.

**Table 5.1 Ashton Coal attended noise monitoring results – January 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 20/1 | 22:01 | 34 | 37 | 49 | 52 | 58 | 66 | 58 | Nil | 35 | 44 | 36 | 46 | 2.8 m/s @ 263° E class stability -0.4°C/100m VTG Y | Nil | **Ashton Coal hum consistently audible with engine revs and dozer tracks on occasion.** Insects, traffic on the New England Highway and another mine in the vicinity consistently audible. |
| N3 | 20/1 | 22:19 | 35 | 38 | 43 | 45 | 51 | 59 | 56 | Nil | 36 | 45 | 36 | 46 | 1.4 m/s @ 294° E class stability -0.1°C/100m VTG Y | Nil | **Ashton Coal hum consistently audible with engine revs and dozer tracks on occasion.** Insects and another mine in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Resident noise and nearby animals occasionally audible. |
| N4 | 20/1 | 22:40 | 25 | 29 | 37 | 41 | 46 | 64 | 55 | Nil | IA | IA | 36 | 46 | 1.3 m/s @ 312° E class stability -0.4°C/100m VTG Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Bird noise, distant dogs barking, powerline hum occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum, with engine revs and dozer tracks on occasion. The Ashton Coal mine noise contribution was estimated at up to 35 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 44 dB $L_{Amax}$. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway and insects.

Mining operations in the vicinity were also consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 38 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum, with engine revs and dozer tracks on occasion. The Ashton Coal mine noise contribution was estimated at up to 36 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 45 dB $L_{Amax}$. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, insects, resident noise and nearby animals.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 36 dB ($L_{Aeq,15\ minute}$ 39 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 29 dB $L_{A90}$, the Ashton Coal mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, traffic on the New England Highway distant dogs barking, powerline hum and bird noise.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <23 dB ($L_{Aeq,15\ minute}$ <26 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 20 January 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

# APPENDIX 6
# ALTERNATE NOISE CONDITIONS

## NOISE

### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\ (15min)}$) | Evening ($L_{Aeq\ (15min)}$) | Night ($L_{Aeq\ (15min)}$) | Night ($L_{A1\ (1\ min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\ (15min)}$) | Evening ($L_{Aeq\ (15min)}$) | Night ($L_{Aeq\ (15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 32 and 33.

# 4 Operating Conditions

## O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 24152

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.81 | 989.84 | 1.58 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
**Temperature:** 20 °C ±2° C
**Date of Calibration:** 14/02/2019 **Issue Date:** 15/02/2019
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** ...JK **AUTHORISED SIGNATURE:** ..........................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 22129 & FILT 4384**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMGA Mitchell Mclennan
Ground Floor, Suite 01, 20 Chandos St
St Leonards NSW 2065

**Ambient Pressure:** 1008 hPa ±1.5 hPa

**Temperature:** 25 °C ±2° C **Relative Humidity:** 48% ±5%

**Date of Calibration:** 07/02/2018 **Issue Date:** 09/02/2018

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** ....... **AUTHORISED SIGNATURE:** ..........................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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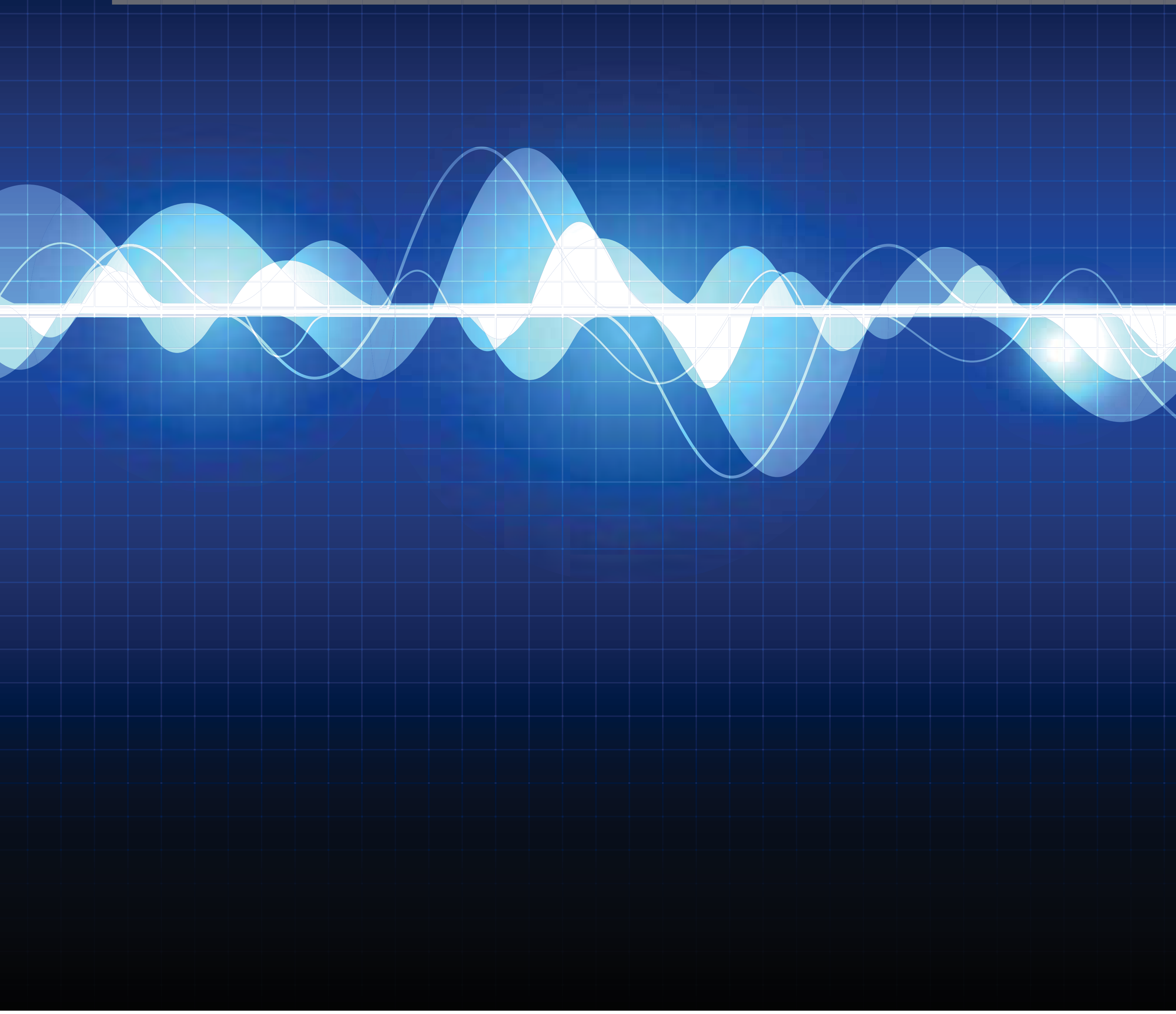
Appendix B

# Monthly attended noise monitoring report - February 2020

# Ashton Coal

## Monthly attended noise monitoring
## February 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**March 2020**



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South Melbourne VIC 3205

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PO Box 8155
Fremantle WA 6160

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PO Box 9148
Deakin ACT 2600


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# Ashton Coal

Monthly attended noise monitoring - February 2020

Prepared for Ashton Coal Operations Pty Ltd
March 2020

EMM Newcastle
Level 3, 175 Scott Street
Newcastle NSW 2300

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E info@emmconsulting.com.au

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# Ashton Coal

## Monthly attended noise monitoring - February 2020

**Report Number**

H190832 RP2

**Client**

Ashton Coal Operations Pty Ltd

**Date**

19 March 2020

**Version**

v1-0 Final

**Prepared by**


**Lucas Adamson**
Senior Acoustic Consultant
19 March 2020


**Approved by**


**Katie Teyhan**
Associate
19 March 2020


This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 25 February 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 25 February 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 25 February 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 25 February 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

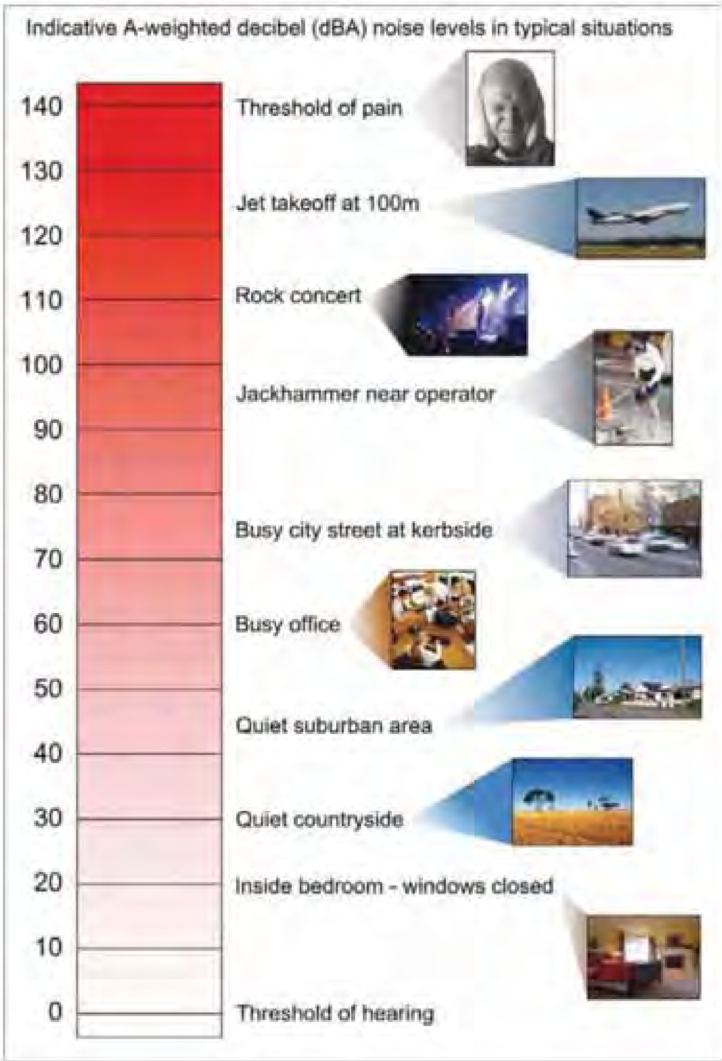
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

### Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

### Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be “unannounced” and, to EMM’s knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
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## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

As one the weather stations (M1) specified in Condition L4.4 was not operational at the time of the February noise monitoring, a nearby weather station (M3) was utilised for the purposes of determining the relevant stability categories at the time of the measurements. M3 was deemed an appropriate alternative as it is located in a similar topographic area (ie Camberwell village) and is also at a similar height to M1.

The temperature lapse rate between the two weather stations (M3 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M3 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M3 (equal to 71 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

### Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 25 February 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M3 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background ($L_{A90}$) level.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

**Table 5.1 Ashton Coal attended noise monitoring results – February 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] Limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 25/2 | 22:04 | 30 | 34 | 49 | 54 | 61 | 64 | 61 | Nil | IA | IA | 36 | 46 | 1.6 m/s @ 115°<br>E class stability<br>1.1°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Dogs barking, nearby animals, resident noise and trains on the main line (unrelated to Ashton Coal) occasionally audible. |
| N3 | 25/2 | 22:22 | 32 | 35 | 38 | 40 | 45 | 52 | 59 | Nil | IA | IA | 36 | 46 | 1.8 m/s @ 126°<br>E class stability<br>1.1°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking, nearby animals, resident noise and trains on the main line (unrelated to Ashton Coal) occasionally audible. |
| N4 | 25/2 | 22:44 | 33 | 37 | 40 | 42 | 46 | 52 | 62 | Nil | IA | IA | 36 | 46 | 1.9 m/s @ 179°<br>E class stability<br>-0.3°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects, frogs and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of $L_{A90}$ 34 dB, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included insects, nearby animals, dogs barking, resident noise, trains on the main line (unrelated to Ashton Coal), traffic on the New England Highway and other mines in the vicinity.

Mining operations in the vicinity were also consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 28 dB ($L_{Aeq,15\ minute}$ 31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of $L_{A90}$ 35 dB, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included insects, nearby animals, dogs barking, resident noise, trains on the main line (unrelated to Ashton Coal), traffic on the New England Highway and other mines in the vicinity.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 31 dB ($L_{Aeq,15\ minute}$ 34 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 37 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 34 dB ($L_{Aeq,15\ minute}$ 37 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 25 February 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M3 and M2) located to the east of the site. Noise limits were found to be applicable during all three noise measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References


Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ..........
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Acoustic and Vibration Measurements

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Mobile: 0413 809806
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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ............ Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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ACU-VIB ELECTRONICS

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Accredited Lab. No. 9262
Acoustic and Vibration
Measurements

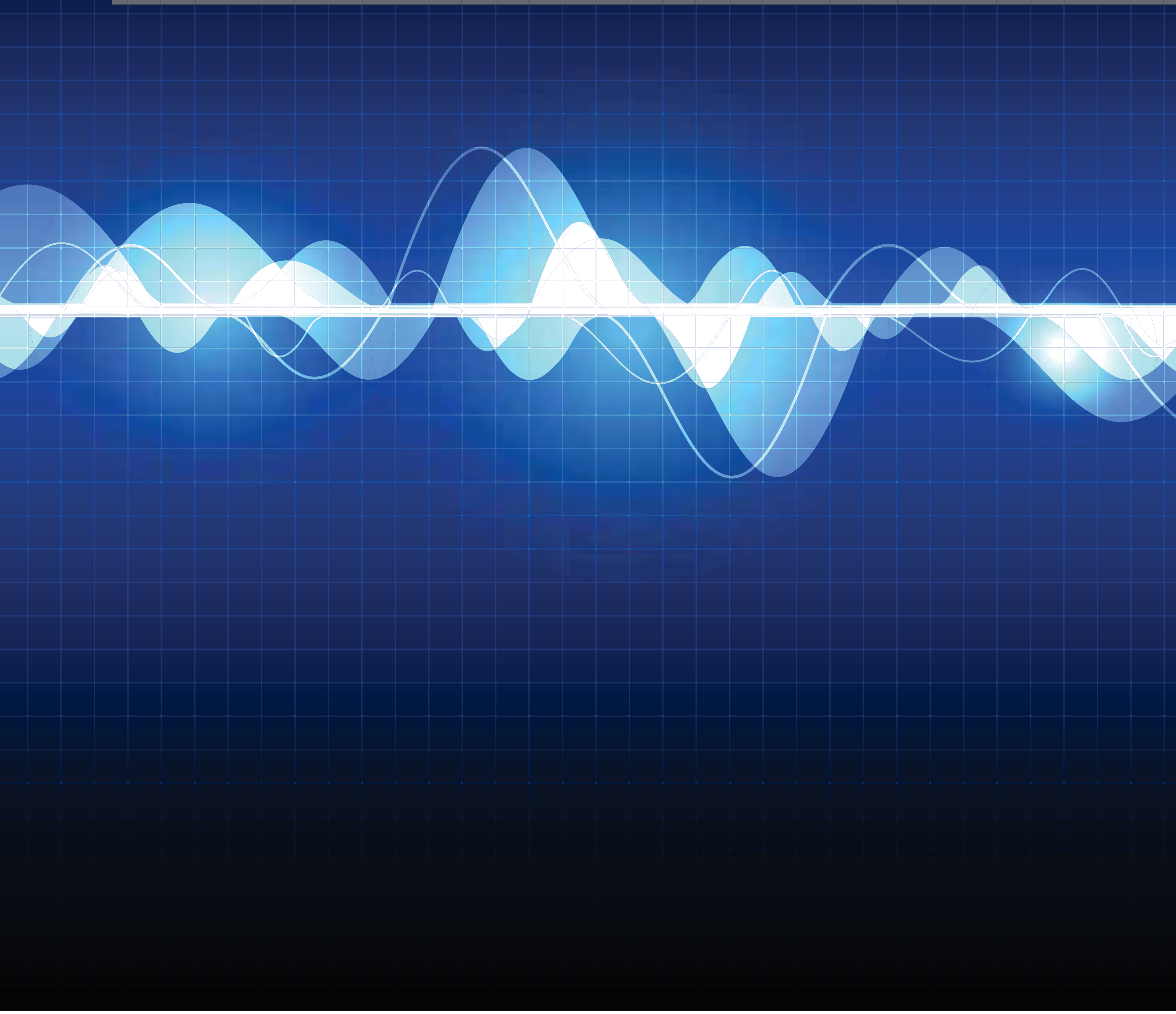
Appendix C

# Monthly attended noise monitoring report - March 2020

# Ashton Coal

## Monthly attended noise monitoring
## March 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**March 2020**



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Deakin ACT 2600

# Ashton Coal

Monthly attended noise monitoring - March 2020

Prepared for Ashton Coal Operations Pty Ltd
March 2020

EMM Newcastle
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Newcastle NSW 2300

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E info@emmconsulting.com.au

www.emmconsulting.com.au

# Ashton Coal

## Monthly attended noise monitoring - March 2020

**Report Number**

H190832 RP3

**Client**

Ashton Coal Operations Pty Ltd

**Date**

19 March 2020

**Version**

v1-0 Final


**Prepared by**

**Lucas Adamson**
Senior Acoustic Consultant
19 March 2020

**Approved by**

**Katie Teyhan**
Associate
19 March 2020

# Table of Contents



## Appendices



## Tables

Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 12 March 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 12 March 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 12 March 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 12 March 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

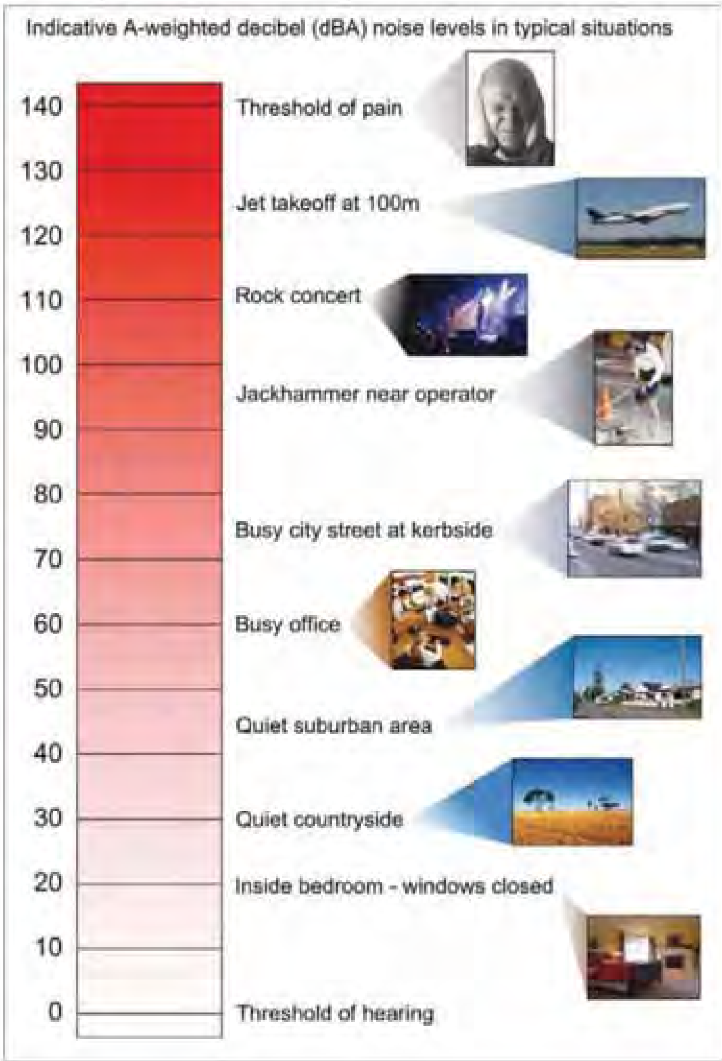
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

### Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

### Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site ‘C-weighted' and site ‘A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site ‘C-weighted' and site ‘A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be “unannounced” and, to EMM’s knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

#### Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | $\Delta T < -1.9$ |
| B | $-1.9 \leq \Delta T < -1.7$ |
| C | $-1.7 \leq \Delta T < -1.5$ |
| D | $-1.5 \leq \Delta T < -0.5$ |
| E | $-0.5 \leq \Delta T < 1.5$ |
| F | $1.5 \leq \Delta T < 4.0$ |
| G | $\Delta T \geq 4.0$ |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 12 March 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Results of noise monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background ($L_{A90}$) level. Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits at all monitoring locations.

Low frequency noise was conservatively assessed by comparison of the total measured one - third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

## Table 5.1 Ashton Coal attended noise monitoring results – March 2020

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 12/3 | 22:00 | 28 | 32 | 41 | 45 | 50 | 56 | 54 | Nil | IA | IA | 36 | 46 | 2.9 m/s @ 89°<br>E class stability<br>1.0°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway and nearby animals frequently audible. Bird noise, distant dogs barking and wind in foliage occasionally audible. |
| N3 | 12/3 | 22:17 | 27 | 31 | 36 | 38 | 43 | 62 | 54 | Nil | IA | IA | 36 | 46 | 2.8 m/s @ 96°<br>E class stability<br>0.7°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Bird noise, distant dogs barking and wind in foliage occasionally audible. |
| N4 | 12/3 | 22:38 | 31 | 35 | 40 | 43 | 47 | 55 | 58 | Nil | IA | IA | 36 | 46 | 2.7 m/s @ 112°<br>F class stability<br>1.5°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Bird noise and a train on the main line (unrelated to Ashton Coal) occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of $L_{A90}$ 32 dB, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included insects, bird noise, nearby animals, dogs barking, traffic on the New England Highway and other mines in the vicinity.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ ≤28 dB ($L_{Aeq,15\ minute}$ ≤31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of $L_{A90}$ 31 dB, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included insects, bird noise, nearby animals, dogs barking, traffic on the New England Highway and other mines in the vicinity.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ ≤28 dB ($L_{Aeq,15\ minute}$ ≤31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 35 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included insects, bird noise, a train on the main line (unrelated to Ashton Coal), traffic on the New England Highway and other mines in the vicinity.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ ≤28 dB ($L_{Aeq,15\ minute}$ ≤31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 12 March 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq (15min)}$) | Evening ($L_{Aeq (15min)}$) | Night ($L_{Aeq (15min)}$) | Night ($L_{A1 (1 min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq (15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq (15min)}$) | Evening ($L_{Aeq (15min)}$) | Night ($L_{Aeq (15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** ......KB **AUTHORISED SIGNATURE:** ..............................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: SLM 26291 & FILT 5615

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS

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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** SLM 26291 & FILT 5615

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ..................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Appendix D

# Monthly attended noise monitoring report - April 2020

# Ashton Coal

## Monthly attended noise monitoring
## April 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**May 2020**

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# Ashton Coal

Monthly attended noise monitoring - April 2020

Prepared for Ashton Coal Operations Pty Ltd
May 2020

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# Ashton Coal

## Monthly attended noise monitoring - April 2020

**Report Number**

H190832 RP4

**Client**

Ashton Coal Operations Pty Ltd

**Date**

12 May 2020

**Version**

v2-0 Final

| Prepared by | Approved by |
| --- | --- |
| L. A | |
| **Lucas Adamson** | **Katie Teyhan** |
| Senior Acoustic Consultant | Associate |
| 12 May 2020 | 12 May 2020 |

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 14 April 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 14 April 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 14 April 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 14 April 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

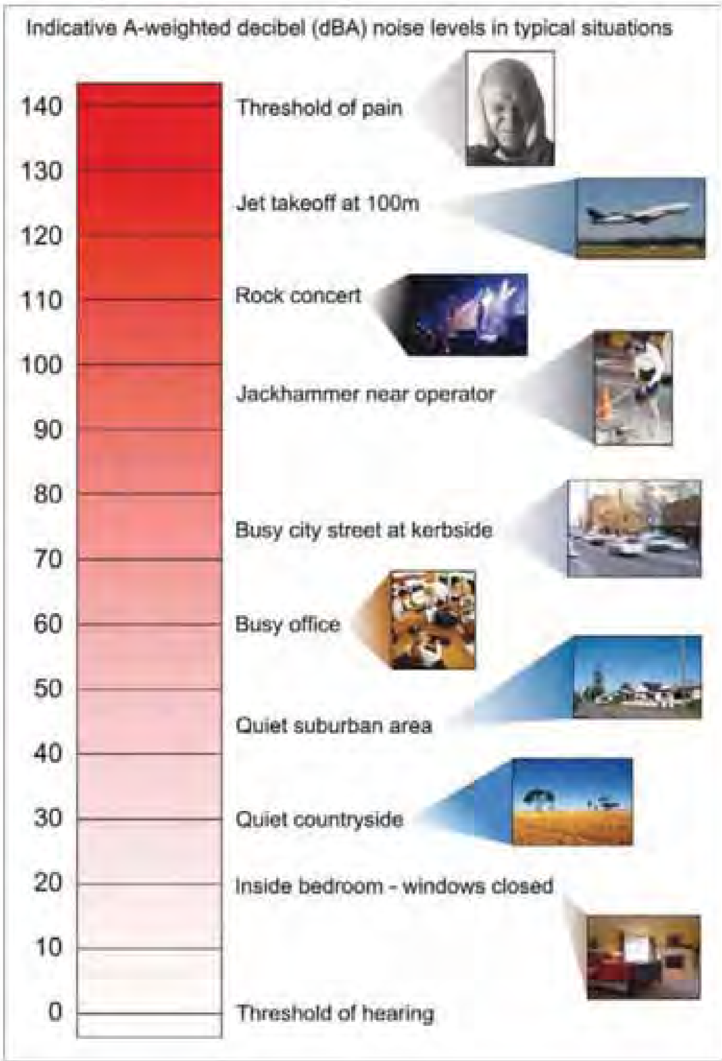
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

### Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

### Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be “unannounced” and, to EMM’s knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.


*Source: EMM (2019); DFSI (2017); GA (2011)*

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
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## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.

- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).

- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.

- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and

- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

**Table 4.2 Stability categories and temperature lapse rates**

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M1, as the wine vane of meteorological station M2 was offline at the time of the monitoring.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 14 April 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during all three measurements due to the presence of a G class stability category at the time of the measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

## Table 5.1 Ashton Coal attended noise monitoring results – April 2020

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 14/4 | 22:02 | 37 | 41 | 51 | 55 | 61 | 65 | 62 | Nil | 35 | 35 | 36 | 46 | 0.0 m/s (Calm)<br>G class stability<br>6.6°C/100m VTG<br>N | N/A | **Ashton Coal mine hum consistently audible.** Insects, frogs, traffic on the New England Highway and other mines in the vicinity consistently audible. Train on the main line (unrelated to Ashton Coal), bird noise and distant dogs barking occasionally audible. |
| N3 | 14/4 | 22:19 | 36 | 38 | 45 | 46 | 54 | 70 | 59 | Nil | 34 | 34 | 36 | 46 | 0.2 m/s @ 344°<br>G class stability<br>6.3°C/100m VTG<br>N | N/A | **Ashton Coal mine hum consistently audible.** Insects, frogs and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Car passby, aircraft noise and distant dogs barking occasionally audible. |
| N4 | 14/4 | 22:41 | 36 | 38 | 43 | 46 | 52 | 62 | 62 | Nil | 31 | 31 | 36 | 46 | 0.0 m/s (Calm)<br>G class stability<br>5.3°C/100m VTG<br>N | N/A | **Ashton Coal mine hum consistently audible.** Insects, frogs and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 35 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 35 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects, frogs, bird noise, distant dogs barking and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 34 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 34 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects, frogs, a car passby, aircraft noise and distant dogs barking.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 34 dB ($L_{Aeq,15\ minute}$ 37 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 31 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 31 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects and frogs.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 34 dB ($L_{Aeq,15\ minute}$ 37 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 14 April 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during all three measurements due to the presence of a G class stability category at the time of the measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\ (15min)}$) | Evening ($L_{Aeq\ (15min)}$) | Night ($L_{Aeq\ (15min)}$) | Night ($L_{A1\ (1\ min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\ (15min)}$) | Evening ($L_{Aeq\ (15min)}$) | Night ($L_{Aeq\ (15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

### L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

### L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

## 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ........
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

**HEAD OFFICE**
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## Certificate No.: SLM 26291 & FILT 5615

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Acoustic and Vibration Measurements

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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** SLM 26291 & FILT 5615

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Acoustic and Vibration Measurements

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Appendix E

# Monthly attended noise monitoring report - May 2020

# Ashton Coal

Monthly attended noise monitoring
May 2020

Prepared for Ashton Coal Operations Pty Ltd
June 2020

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# Ashton Coal

Monthly attended noise monitoring - May 2020

Prepared for Ashton Coal Operations Pty Ltd
June 2020

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# Ashton Coal

## Monthly attended noise monitoring - May 2020

**Report Number**

H190832 RP5

**Client**

Ashton Coal Operations Pty Ltd

**Date**

10 June 2020

**Version**

v1-0 Final


**Prepared by**

**Lucas Adamson**
Senior Acoustic Consultant
10 June 2020

**Approved by**

**Katie Teyhan**
Associate
10 June 2020

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 27 May 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 27 May 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 27 May 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 27 May 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

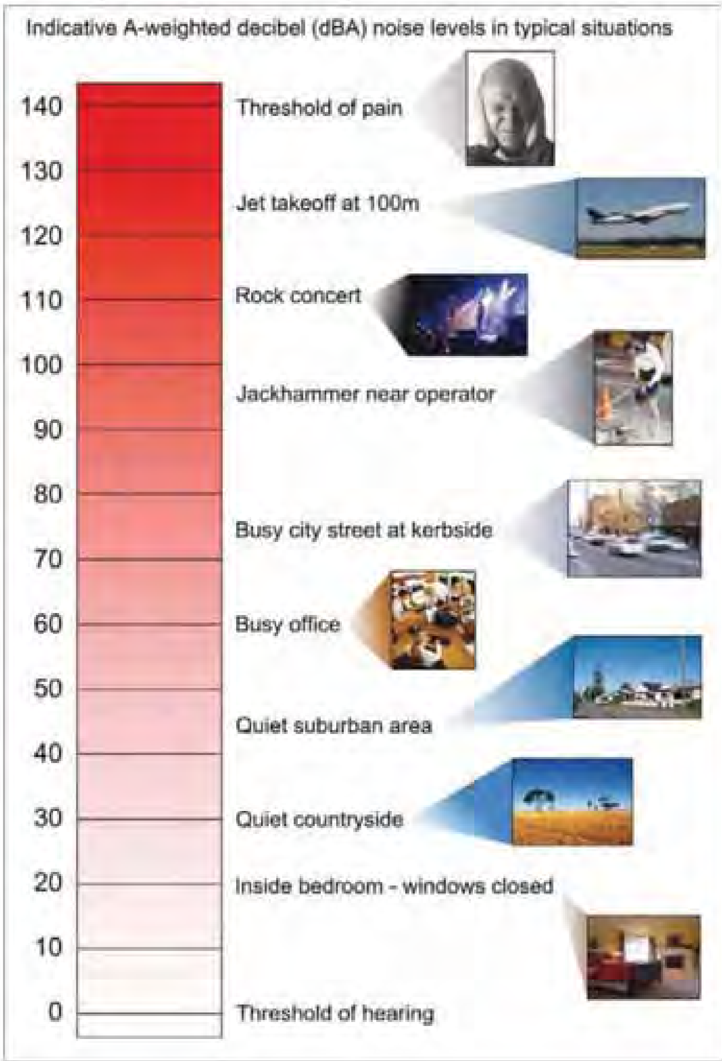
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

**Table 2.2 Perceived change in noise**

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

**Figure 2.1 Common noise levels**

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

### Table 4.1 Attended noise monitoring locations

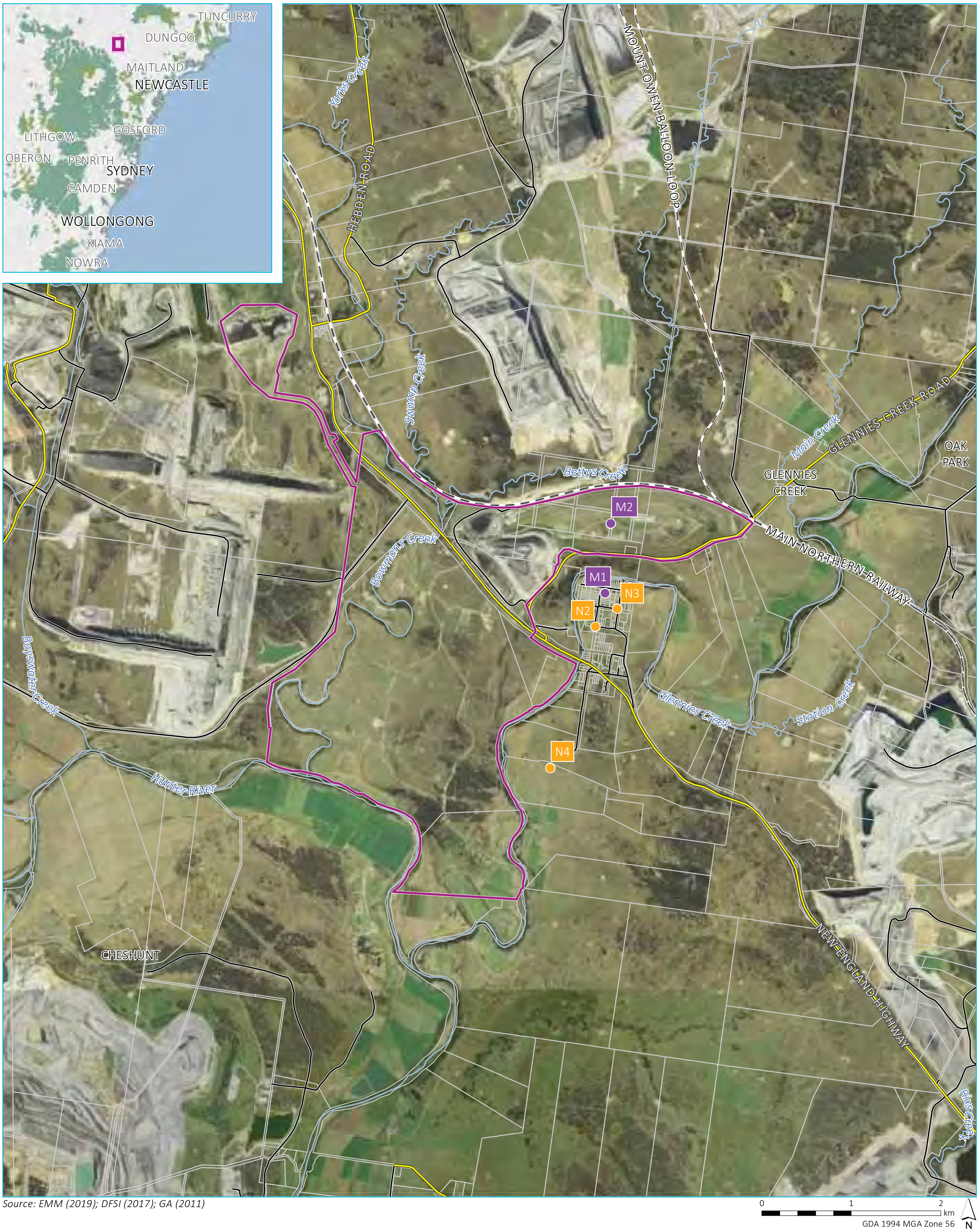
| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.




Source: EMM (2019); DFSI (2017); GA (2011)

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

\\emmsvr1\EMM\Jobs\2019\H190081 - Ashton Coal Noise Monitoring\8 GIS\02_Maps\N001_NoiseMonitoring_20190312_02.mxd 12/03/2019

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

### Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 27 May 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during one of the three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurement.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

**Table 5.1 Ashton Coal attended noise monitoring results – May 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 27/5 | 22:03 | 39 | 42 | 48 | 52 | 55 | 63 | 62 | Nil | <33 | <33 | 36 | 46 | 1.0 m/s @ 194° F class stability 3.6°C/100m VTG N | N/A | **Ashton Coal engine revs occasionally audible.** Insects and other mine in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Train on the main line (unrelated to Ashton Coal) occasionally audible. |
| N3 | 27/5 | 22:21 | 40 | 43 | 46 | 49 | 52 | 59 | 61 | Nil | <35 | 40 | 36 | 46 | 1.0 m/s @ 219° F class stability 3.0°C/100m VTG Y | Nil | **Ashton Coal engine revs and dozer tracks occasionally audible.** Insects, frogs and other mine in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Bird noise and a train on the main line (unrelated to Ashton Coal) occasionally audible. |
| N4 | 27/5 | 22:43 | 35 | 37 | 39 | 40 | 45 | 49 | 61 | Nil | IA | IA | 36 | 46 | 1.0 m/s @ 205° F class stability 3.0°C/100m VTG Y | Nil | **Ashton Coal inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Livestock and a train on the main line (unrelated to Ashton Coal) occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were occasionally audible during the operator-attended noise survey including engine revs. The Ashton Coal mine noise contribution was estimated at up to <33 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated <33 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 36 dB ($L_{Aeq,15\ minute}$ 39 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were occasionally audible during the operator-attended noise survey including dozer tracks and engine revs. The Ashton Coal mine noise contribution was estimated at up to <35 dB $L_{Aeq,15\ minute}$. Engine revs and dozer tracks from site generated an estimated 40 dB $L_{Amax}$. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects, frogs, bird noise and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 37 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included insects, livestock, a train on the main line (unrelated to Ashton Coal), traffic on the New England Highway and other mines in the vicinity.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 38 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 27 May 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during one of the three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurement.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References


Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ............
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
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Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

**HEAD OFFICE**
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.: SLM 26291 & FILT 5615**

| | | | |
|---|---|---|---|
| **Equipment Description:** | Sound Level Meter | | |
| **Manufacturer:** | B & K | | |
| **Model No:** | 2250 | **Serial No:** | 2759405 |
| **Microphone Type:** | 4189 | **Serial No:** | 2888134 |
| **Preamplifier Type:** | ZC0032 | **Serial No:** | 16037 |
| **Filter Type:** | 1/3 Octave | **Serial No:** | 2759405 |
| **Comments:** | All tests passed for class 1.<br>(See over for details) | | |
| **Owner:** | EMM Consulting<br>Level 3, 175 Scott Street<br>Newcastle, NSW 2300 | | |
| **Ambient Pressure:** | 1007 hPa ±1.5 hPa | | |
| **Temperature:** | 24 °C ±2° C | **Relative Humidity:** | 53% ±5% |
| **Date of Calibration:** | 05/02/2020 | **Issue Date:** | 05/02/2020 |
| **Acu-Vib Test Procedure:** | AVP10 (SLM) & AVP06 (Filters) | | |

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ........................

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
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Accredited Lab. No. 9262
Acoustic and Vibration
Measurements

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Appendix F

# Monthly attended noise monitoring report - June 2020

# Ashton Coal

Monthly attended noise monitoring
June 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**June 2020**

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# Servicing projects throughout Australia and internationally


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Monthly attended noise monitoring - June 2020

Prepared for Ashton Coal Operations Pty Ltd
June 2020

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# Ashton Coal

Monthly attended noise monitoring - June 2020

**Report Number**

H190832 RP6

**Client**

Ashton Coal Operations Pty Ltd

**Date**

30 June 2020

**Version**

v1-0 Final


| Prepared by | Approved by |
|---|---|
| **Lucas Adamson** | **Katie Teyhan** |
| Senior Acoustic Consultant | Associate |
| 30 June 2020 | 30 June 2020 |

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 17 June 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 17 June 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 17 June 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 17 June 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

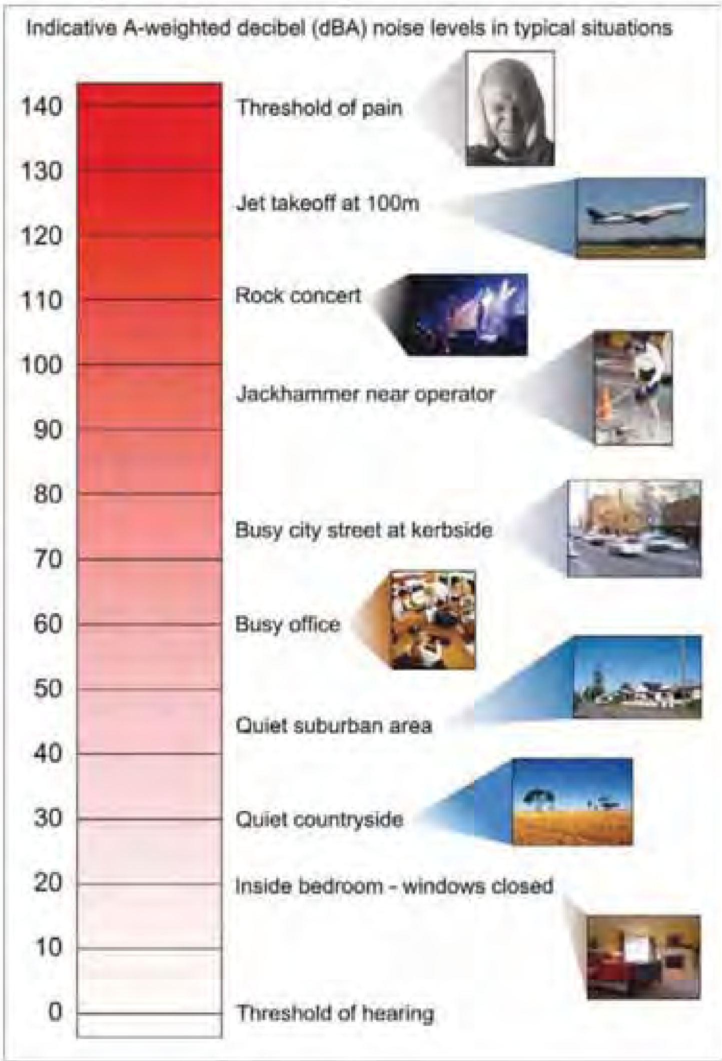
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

## Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

## Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be “unannounced” and, to EMM’s knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal, after the noise monitoring was completed, confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.


*Source: EMM (2019); DFSI (2017); GA (2011)*

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

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## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

### Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 17 June 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all of the three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

## Table 5.1 Ashton Coal attended noise monitoring results – June 2020

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 17/6 | 22:03 | 30 | 35 | 48 | 52 | 58 | 61 | 57 | Nil | IA | IA | 36 | 46 | 2.3 m/s @ 139°<br>E class stability<br>-0.3°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects, frogs, other mines in the vicinity and traffic on the New England Highway consistently audible. Wind in foliage and a train on the main line (unrelated to Ashton Coal) occasionally audible. |
| N3 | 17/6 | 22:20 | 33 | 37 | 44 | 47 | 51 | 63 | 59 | Nil | IA | IA | 36 | 46 | 2.0 m/s @ 137°<br>E class stability<br>-0.4°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, dripping water at a nearby residence and traffic on the New England Highway consistently audible. Wind in foliage, distant dogs barking and a train on the main line (unrelated to Ashton Coal) occasionally audible. |
| N4 | 17/6 | 22:42 | 30 | 34 | 39 | 42 | 45 | 49 | 57 | Nil | IA | IA | 36 | 46 | 2.0 m/s @ 128°<br>E class stability<br>-0.3°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Insects, frogs and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Livestock occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 35 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, wind in foliage and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <27 dB ($L_{Aeq,15\ minute}$ <30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 37 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, dripping water at a nearby residence, traffic on the New England Highway, wind in foliage, distant dogs barking and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <29 dB ($L_{Aeq,15\ minute}$ <32 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 34 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway and livestock.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <28 dB ($L_{Aeq,15\ minute}$ <31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 17 June 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all of the three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** ...KB **AUTHORISED SIGNATURE:** ..................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ........

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration
Measurements

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Appendix G

# Monthly attended noise monitoring report - July 2020

# Ashton Coal

Monthly attended noise monitoring
July 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**July 2020**

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South Melbourne VIC 3205

PERTH
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Fremantle WA 6160

CANBERRA
PO Box 9148
Deakin ACT 2600

# Ashton Coal

Monthly attended noise monitoring - July 2020

Prepared for Ashton Coal Operations Pty Ltd
July 2020

EMM Newcastle
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E info@emmconsulting.com.au

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# Ashton Coal

## Monthly attended noise monitoring - July 2020

**Report Number**

H190832 RP7

**Client**

Ashton Coal Operations Pty Ltd

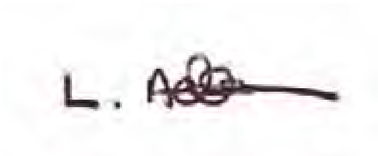
**Date**

28 July 2020

**Version**

v1-0 Final

**Prepared by**



**Lucas Adamson**
Senior Acoustic Consultant
28 July 2020

**Approved by**

**Katie Teyhan**
Associate
28 July 2020

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 22 July 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 22 July 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 22 July 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 22 July 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

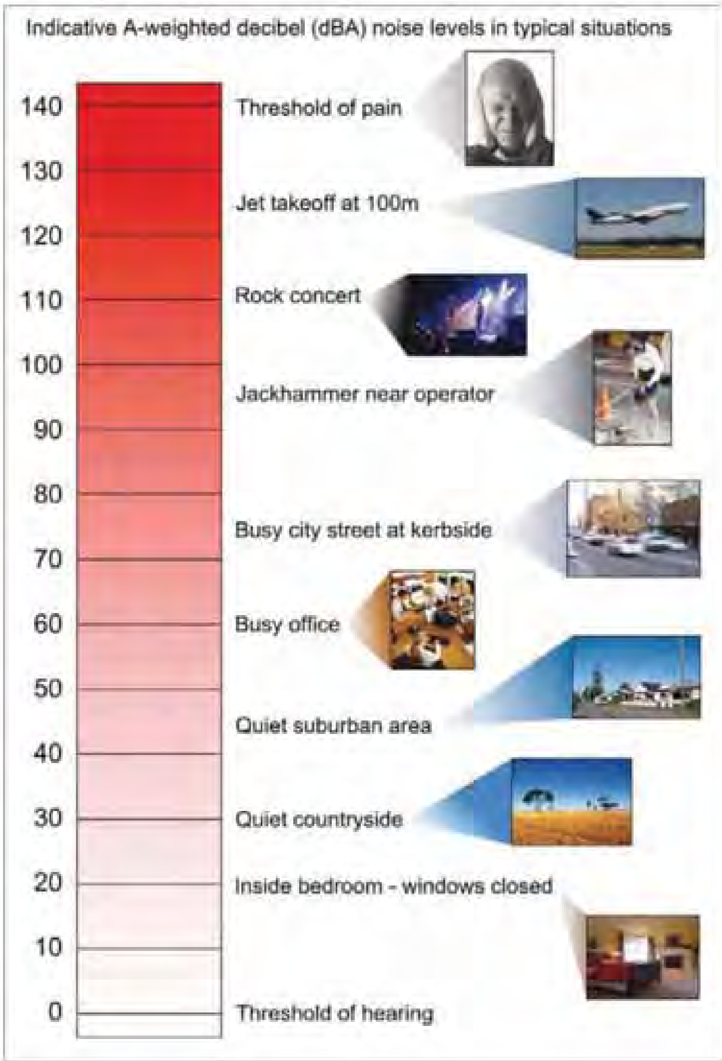
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

### Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

### Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day<br>$L_{Aeq,15\ minute}$, dB | Evening<br>$L_{Aeq,15\ minute}$, dB | Night<br>$L_{Aeq,15\ minute}$, dB | Night<br>$L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

\\emmsvr1\EMM\Jobs\2019\H190081 - Ashton Coal Noise Monitoring\8 GIS\02_Maps\N001_NoiseMonitoring_20190312_02.mxd 12/03/2019

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM creating opportunities

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

## Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 22 July 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

**Table 5.1 Ashton Coal attended noise monitoring results – July 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 22/7 | 22:30 | 37 | 39 | 52 | 57 | 58 | 62 | 62 | Nil | 35 | 40 | 36 | 46 | 1.1 m/s @ 300°<br>G class stability<br>4.7°C/100m VTG<br>N | N/A | **Ashton Coal conveyor hum consistently audible, with engine revs on occasion.** Insects, frogs, other mines in the vicinity and traffic on the New England Highway consistently audible. Livestock occasionally audible. |
| N3 | 22/7 | 22:48 | 38 | 40 | 45 | 48 | 52 | 67 | 59 | Nil | 36 | 44 | 36 | 46 | 1.3 m/s @ 293°<br>G class stability<br>4.4°C/100m VTG<br>N | N/A | **Ashton Coal conveyor hum consistently audible, with engine revs and bangs on occasion.** Insects, frogs, other mines in the vicinity and traffic on the New England Highway consistently audible. Nearby animals, bird noise, nearby sprinkler and a train on the main line (unrelated to Ashton Coal) frequently audible. |
| N4 | 22/7 | 22:09 | 34 | 36 | 42 | 45 | 50 | 66 | 58 | Nil | IA | IA | 36 | 46 | 1.7 m/s @ 297°<br>F class stability<br>3.8°C/100m VTG<br>N | N/A | **Ashton Coal inaudible.** Other mines in the vicinity and traffic on the New England Highway consistently audible. Insects occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\,minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to 35 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 40 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway and livestock.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 36 dB ($L_{Aeq,15\ minute}$ 39 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum with engine revs and bangs on occasion. The Ashton Coal mine noise contribution was estimated at up to 36 dB $L_{Aeq,15\ minute}$. A bang from site generated an estimated 44 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, a nearby sprinkler, nearby animals, bird noise, a train on the main line (unrelated to Ashton Coal) and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 36 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 32 dB ($L_{Aeq,15\ minute}$ 35 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 22 July 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References


Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ............
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| Tests Performed: | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS

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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ........................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Measurements

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Appendix H

# Monthly attended noise monitoring report - August 2020

# Ashton Coal

Monthly attended noise monitoring
August 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**August 2020**

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# Ashton Coal

Monthly attended noise monitoring - August 2020

Prepared for Ashton Coal Operations Pty Ltd
August 2020

EMM Newcastle
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Newcastle NSW 2300

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E info@emmconsulting.com.au

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# Ashton Coal

## Monthly attended noise monitoring - August 2020

**Report Number**

H190832 RP8

**Client**

Ashton Coal Operations Pty Ltd

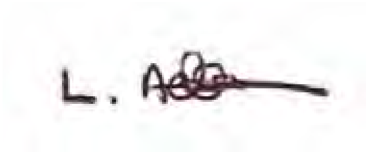
**Date**

21 August 2020

**Version**

v1-0 Final

**Prepared by**



**Lucas Adamson**
Senior Acoustic Consultant
21 August 2020

**Approved by**

**Katie Teyhan**
Associate
21 August 2020

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 11 August 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 11 August 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 11 August 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 11 August 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

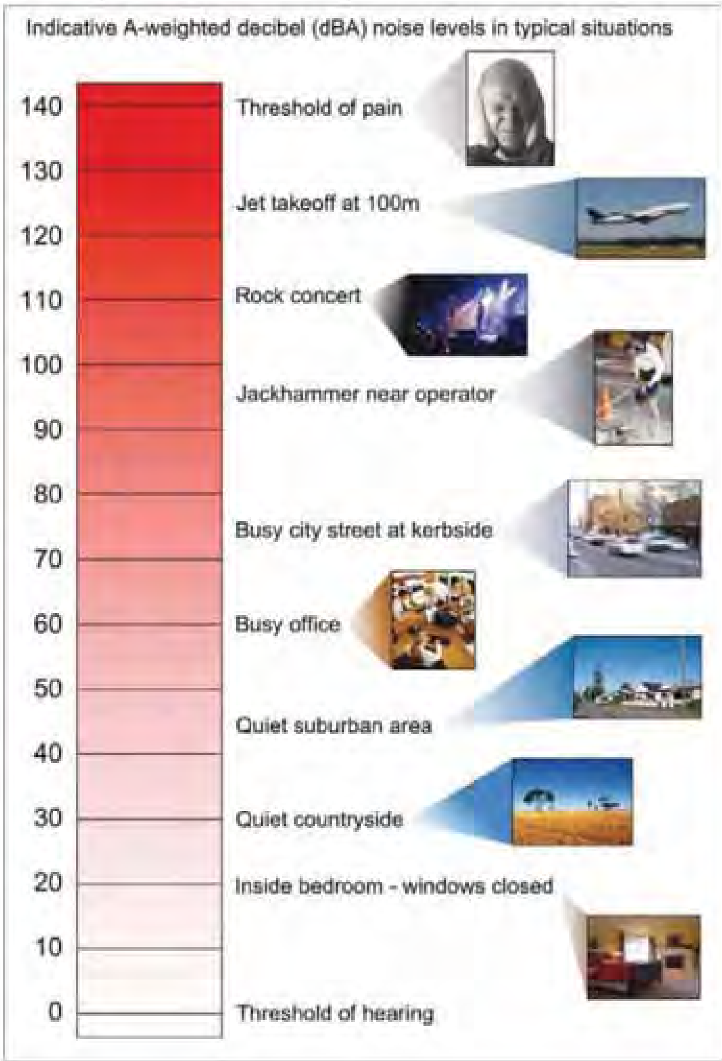
## Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

## Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

## Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

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## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

## Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 11 August 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during the first two measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

**Table 5.1 Ashton Coal attended noise monitoring results – August 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 11/8 | 22:00 | 32 | 36 | 47 | 52 | 57 | 66 | 60 | Nil | IA | IA | 36 | 46 | 2.1 m/s @ 116° F class stability 3.6°C/100m VTG N | N/A | **Ashton Coal inaudible.** Other mines in the vicinity, insects, frogs and traffic on the New England Highway consistently audible. Distant dogs barking and resident noise occasionally audible. |
| N3 | 11/8 | 22:17 | 32 | 36 | 47 | 50 | 56 | 65 | 60 | Nil | IA | IA | 36 | 46 | 1.5 m/s @ 148° F class stability 3.3°C/100m VTG N | N/A | **Ashton Coal inaudible.** Other mines in the vicinity, insects, frogs, dripping/running water and traffic on the New England Highway consistently audible. Distant dogs barking, livestock and a train on the main line (unrelated to Ashton Coal) occasionally audible. Bird noise briefly audible. |
| N4 | 11/8 | 22:38 | 39 | 41 | 44 | 46 | 49 | 62 | 61 | Nil | IA | IA | 36 | 46 | 2.6 m/s @ 179° F class stability 2.1°C/100m VTG Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects, frogs and power line hum consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 36 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, distant dogs barking and resident noise.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 28 dB ($L_{Aeq,15\ minute}$ 31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 36 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, dripping/running water, traffic on the New England Highway, distant dogs barking, livestock, a train on the main line (unrelated to Ashton Coal) and bird noise.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 29 dB ($L_{Aeq,15\ minute}$ 32 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 41 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, power line hum, traffic on the New England Highway and distant dogs barking.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 33 dB ($L_{Aeq,15\ minute}$ 36 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 11 August 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during the first two measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ............
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: SLM 26291 & FILT 5615

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration
Measurements

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Appendix I

# Monthly attended noise monitoring report - September 2020

# Ashton Coal

## Monthly attended noise monitoring
## September 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**October 2020**

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# Ashton Coal

Monthly attended noise monitoring - September 2020

Prepared for Ashton Coal Operations Pty Ltd
October 2020

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# Ashton Coal

## Monthly attended noise monitoring - September 2020

**Report Number**

H190832 RP9

**Client**

Ashton Coal Operations Pty Ltd

**Date**

12 October 2020

**Version**

v1-0 Final

| **Prepared by** | **Approved by** |
|---|---|
| **Lucas Adamson** | **Katie Teyhan** |
| Senior Acoustic Consultant | Associate |
| 12 October 2020 | 12 October 2020 |

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 23 September 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 23 September 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 23 September 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 23 September 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

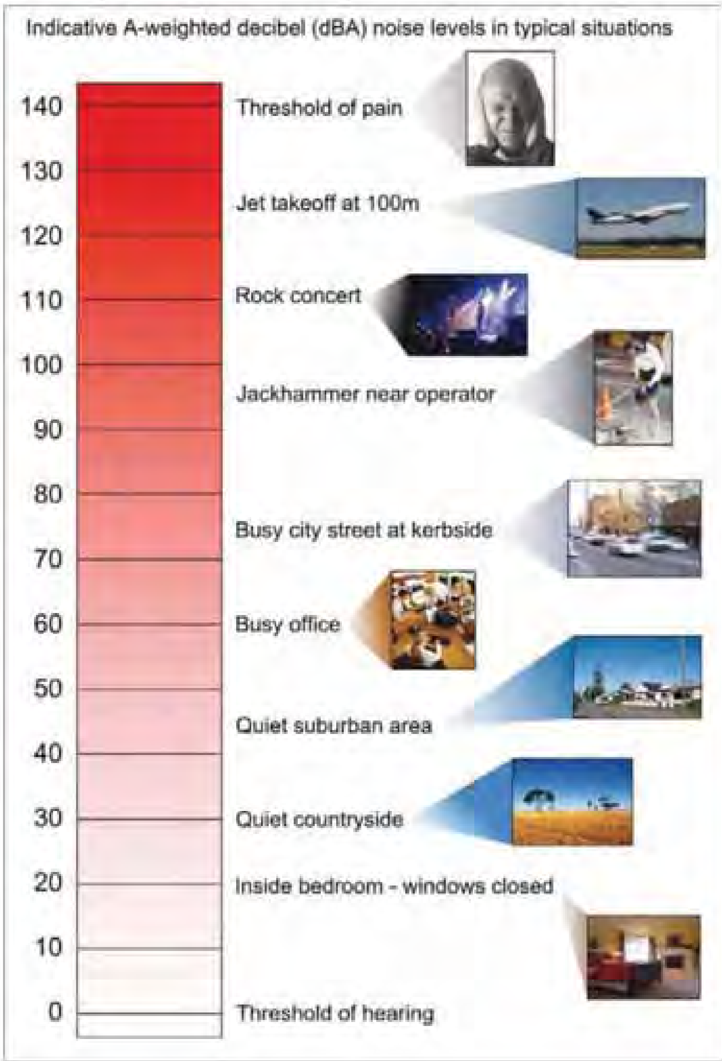
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

## Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

## Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.


*Source: EMM (2019); DFSI (2017); GA (2011)*

0 1 2 km
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM creating opportunities

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

## Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 23 September 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during the second measurement due to the presence of wind speeds greater than 3m/s at the time of the measurement.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

## Table 5.1 Ashton Coal attended noise monitoring results – September 2020

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 23/9 | 22:02 | 41 | 44 | 50 | 54 | 58 | 60 | 62 | Nil | 36 | 39 | 36 | 46 | 2.9 m/s @ 298° E class stability 0.8°C/100m VTG Y | Nil | **Ashton Coal mine hum consistently audible with engine revs on occasion.** Other mines in the vicinity, insects, frogs and traffic on the New England Highway consistently audible. Wind in foliage and resident noise occasionally audible. |
| N3 | 23/9 | 22:20 | 39 | 43 | 46 | 49 | 53 | 55 | 62 | Nil | 36 | 40 | 36 | 46 | 3.4 m/s @ 293° E class stability 0.8°C/100m VTG N | N/A | **Ashton Coal mine hum consistently audible with engine revs on occasion.** Other mines in the vicinity, insects, frogs and traffic on the New England Highway consistently audible. Livestock, wind in foliage and dogs barking occasionally audible. |
| N4 | 23/9 | 22:41 | 30 | 33 | 42 | 43 | 52 | 66 | 57 | Nil | 26 | 26 | 36 | 46 | 2.9 m/s @ 285° E class stability -0.4°C/100m VTG Y | Nil | **Ashton Coal mine hum consistently audible.** Other mines in the vicinity, insects, frogs, powerline hum and traffic on the New England Highway consistently audible. Car passby audible for approximately two minutes. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\,minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum and engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to 36 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 39 dB $L_{Amax}$. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects, frogs, wind in foliage and resident noise.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum and engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to 36 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 40 dB $L_{Amax}$. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects, frogs, livestock, wind in foliage and a dog barking.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum. The Ashton Coal mine noise contribution was estimated at up to 26 dB $L_{Aeq,15\ minute}$. Mine hum from site generated an estimated 26 dB $L_{Amax}$. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, insects, frogs, powerline hum and a car passby.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 28 dB ($L_{Aeq,15\ minute}$ 31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 23 September 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during the second measurement due to the presence of wind speeds greater than 3m/s at the time of the measurement.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ..................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS

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web site: www.acu-vib.com.au

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ..................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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Appendix J

# Monthly attended noise monitoring report - October 2020

# Ashton Coal

## Monthly attended noise monitoring
## October 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**November 2020**

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# Ashton Coal

Monthly attended noise monitoring - October 2020

Prepared for Ashton Coal Operations Pty Ltd
November 2020

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# Ashton Coal

## Monthly attended noise monitoring - October 2020

**Report Number**

H190832 RP10

**Client**

Ashton Coal Operations Pty Ltd

**Date**

10 November 2020

**Version**

v1-0 Final

**Prepared by**

**Lucas Adamson**
Senior Acoustic Consultant
10 November 2020

**Approved by**

**Katie Teyhan**
Associate
10 November 2020

# Table of Contents



## Appendices



## Tables

Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 27 October 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 27 October 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 27 October 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 27 October 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

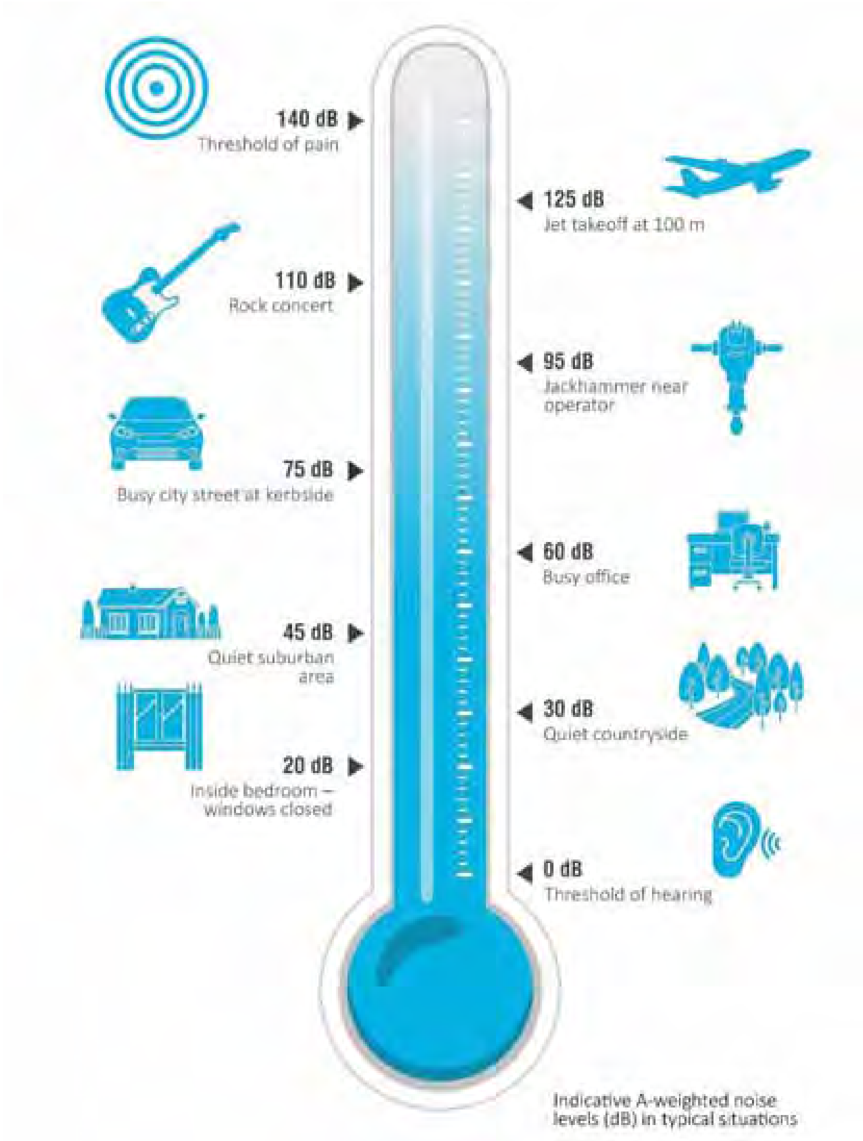
**Table 2.1 Glossary of acoustic terms**

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

## Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

## Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

### Table 3.2 One-third octave low-frequency noise thresholds

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 56
N

\\emmsvr1\EMM\Jobs\2019\H190081 - Ashton Coal Noise Monitoring\8 GIS\02_Maps\N001_NoiseMonitoring_20190312_02.mxd 12/03/2019

KEY
- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.

- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).

- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.

- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and

- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

### Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | ΔT < -1.9 |
| B | -1.9 ≤ ΔT < -1.7 |
| C | -1.7 ≤ ΔT < -1.5 |
| D | -1.5 ≤ ΔT < -0.5 |
| E | -0.5 ≤ ΔT < 1.5 |
| F | 1.5 ≤ ΔT < 4.0 |
| G | ΔT ≥ 4.0 |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 27 October 2020.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable, at all monitoring locations.

**Table 5.1 Ashton Coal attended noise monitoring results – October 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 27/10 | 22:00 | 31 | 35 | 43 | 46 | 53 | 56 | 56 | Nil | IA | IA | 36 | 46 | 1.7 m/s @ 104°<br>E class stability<br>-0.1°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects, frogs and traffic on the New England Highway consistently audible. Bird noise and distant dogs barking occasionally audible. |
| N3 | 27/10 | 22:17 | 32 | 35 | 39 | 41 | 45 | 64 | 54 | Nil | IA | IA | 36 | 46 | 1.8 m/s @ 112°<br>E class stability<br>0.1°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects, frogs and dripping water at nearby residence consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking and a train on the main line (unrelated to Ashton Coal) occasionally audible. |
| N4 | 27/10 | 22:39 | 38 | 42 | 44 | 46 | 47 | 47 | 56 | Nil | IA | IA | 36 | 46 | 1.7 m/s @ 101°<br>E class stability<br>0.3°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects, frogs and traffic on the New England Highway consistently audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1 minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 35 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15 minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, distant dogs barking and bird noise.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <27 dB ($L_{Aeq,15 minute}$ <30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 35 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15 minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, dripping water, traffic on the New England Highway, dogs barking and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 28 dB ($L_{Aeq,15 minute}$ 31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 42 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15 minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <27 dB ($L_{Aeq,15 minute}$ <30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 27 October 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References


Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** KB **AUTHORISED SIGNATURE:** ............
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
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ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ..................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

Appendix K

# Monthly attended noise monitoring report - November 2020

# Ashton Coal

Monthly attended noise monitoring
November 2020

**Prepared for Ashton Coal Operations Pty Ltd**
**December 2020**

# Servicing projects throughout Australia and internationally


SYDNEY
Ground floor, 20 Chandos Street
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T 02 9493 9500

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Level 1, 146 Hunter Street
Newcastle NSW 2300
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BRISBANE
Level 10, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

ADELAIDE
Level 1, 70 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
187 Coventry Street
South Melbourne VIC 3205

PERTH
PO Box 8155
Fremantle WA 6160

CANBERRA
PO Box 9148
Deakin ACT 2600



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# Ashton Coal

Monthly attended noise monitoring - November 2020

Prepared for Ashton Coal Operations Pty Ltd
December 2020

EMM Newcastle
Level 3, 175 Scott Street
Newcastle NSW 2300

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# Ashton Coal

## Monthly attended noise monitoring - November 2020

**Report Number**

H190832 RP11

**Client**

Ashton Coal Operations Pty Ltd

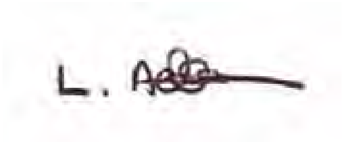
**Date**

11 December 2020

**Version**

v1-0 Final

**Prepared by**



**Lucas Adamson**
Senior Acoustic Consultant
11 December 2020

**Approved by**

**Katie Teyhan**
Associate
11 December 2020

# Table of Contents



## Appendices



## Tables

## Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 24 and 25 November 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 24 November 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 24 November 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 24 November 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

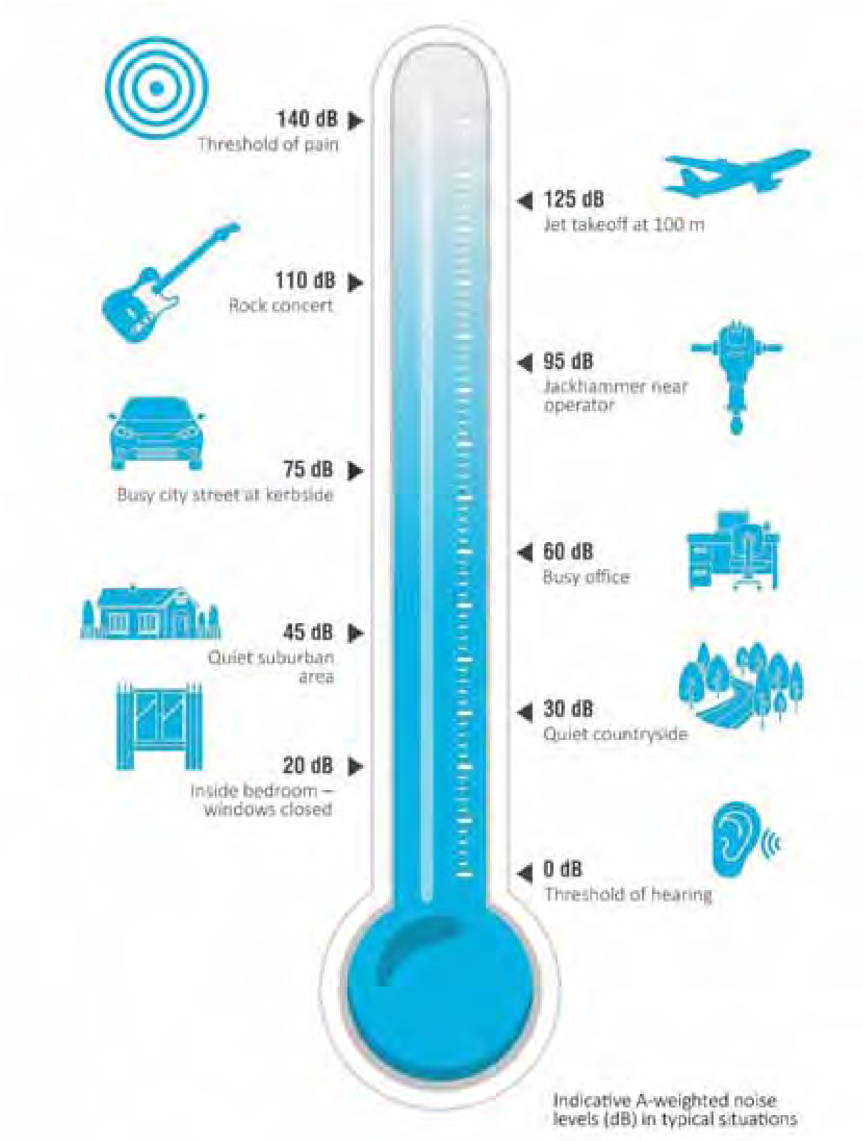
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

## Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

## Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15 minute}$, dB | Evening $L_{Aeq,15 minute}$, dB | Night $L_{Aeq,15 minute}$, dB | Night $L_{A1,1 minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1 minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1 minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

**Table 4.2 Stability categories and temperature lapse rates**

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | $\Delta T < -1.9$ |
| B | $-1.9 \leq \Delta T < -1.7$ |
| C | $-1.7 \leq \Delta T < -1.5$ |
| D | $-1.5 \leq \Delta T < -0.5$ |
| E | $-0.5 \leq \Delta T < 1.5$ |
| F | $1.5 \leq \Delta T < 4.0$ |
| G | $\Delta T \geq 4.0$ |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 24 and 25 November 2020. Noise from Ashton Coal operations were not audible during any operator-attended noise survey.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Total measured noise levels did not exceed the relevant LFN thresholds during any of the measurements. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable, at all monitoring locations.

**Table 5.1 Ashton Coal attended noise monitoring results – November 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 24/11 | 23:56 | 31 | 38 | 50 | 53 | 62 | 68 | 56 | Nil | IA | IA | 36 | 46 | 2.1 m/s @ 127°<br>E class stability<br>-0.3°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects and frogs consistently audible. Traffic on the New England Highway and bird noise frequently audible. Car passby and nearby animals occasionally audible. Train horn (unrelated to Ashton Coal) briefly audible. |
| N3 | 25/11 | 00:13 | 29 | 31 | 35 | 37 | 41 | 53 | 51 | Nil | IA | IA | 36 | 46 | 2.1 m/s @ 122°<br>E class stability<br>-0.3°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Bird noise and nearby animals occasionally audible. Train on the main line (unrelated to Ashton Coal) audible for approximately 10 minutes.. |
| N4 | 25/11 | 00:33 | 26 | 29 | 34 | 36 | 42 | 56 | 50 | Nil | IA | IA | 36 | 46 | 1.9 m/s @ 126°<br>E class stability<br>-0.1°C/100m VTG<br>Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, powerline hum, insects and frogs consistently audible. Traffic on the New England Highway and livestock frequently audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 38 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise, a car passby, nearby animals and a train horn (unrelated to Ashton Coal). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

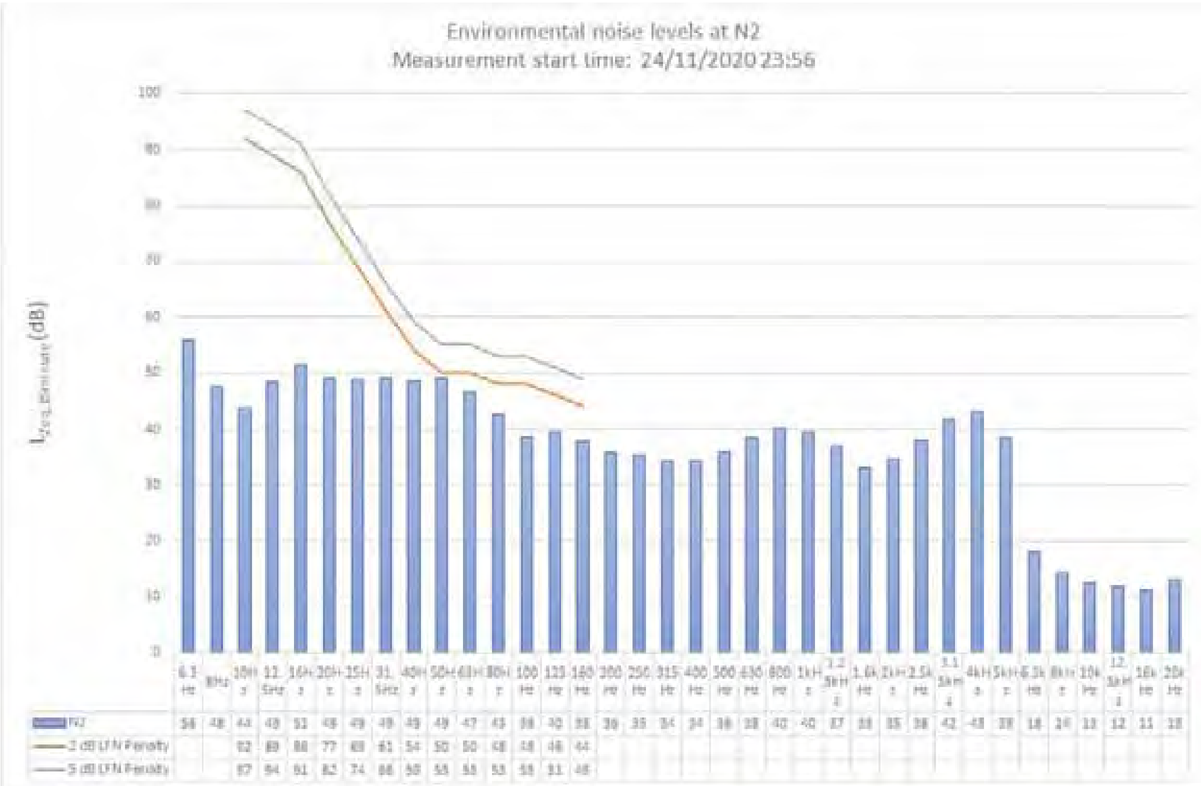



**Figure 5.1 N2 total measured one-third octave band frequencies**

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <23 dB ($L_{Aeq,15\ minute}$ <26 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 31 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise, nearby animals and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

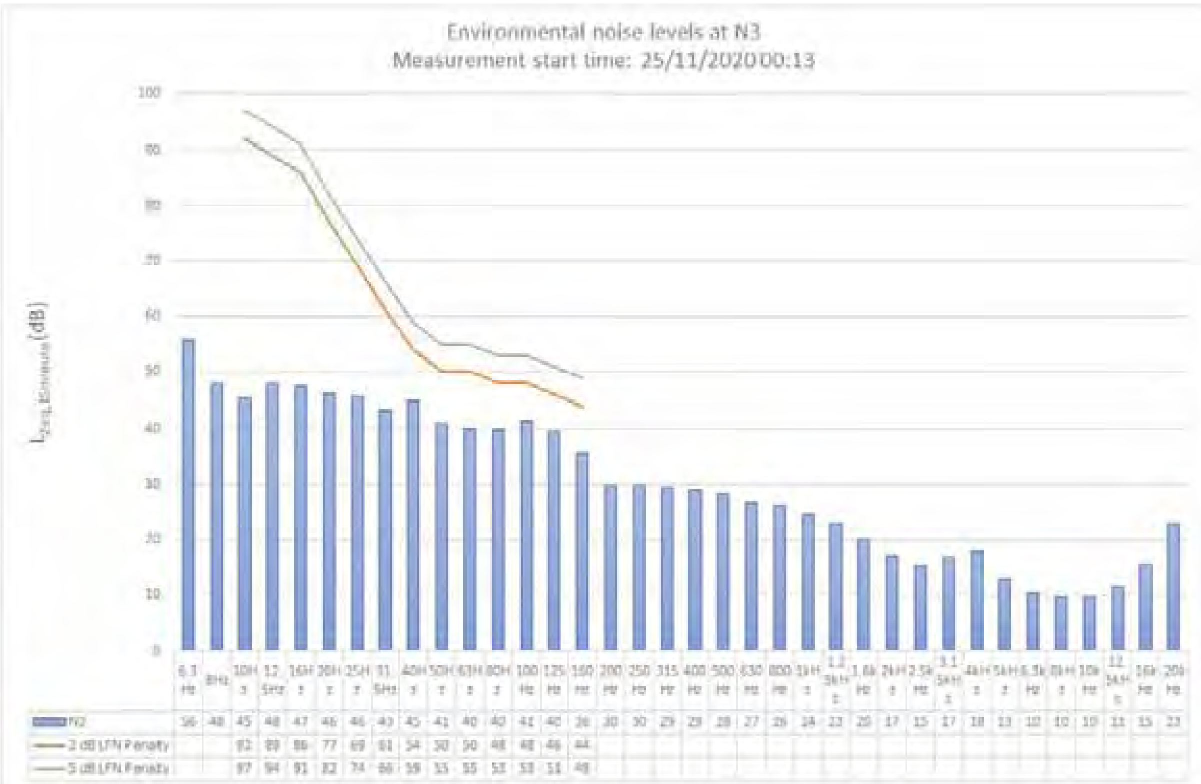



**Figure 5.2 N3 total measured one-third octave band frequencies**

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <23 dB ($L_{Aeq,15\ minute}$ <26 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 29 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, powerline hum, insects, frogs, traffic on the New England Highway and livestock. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

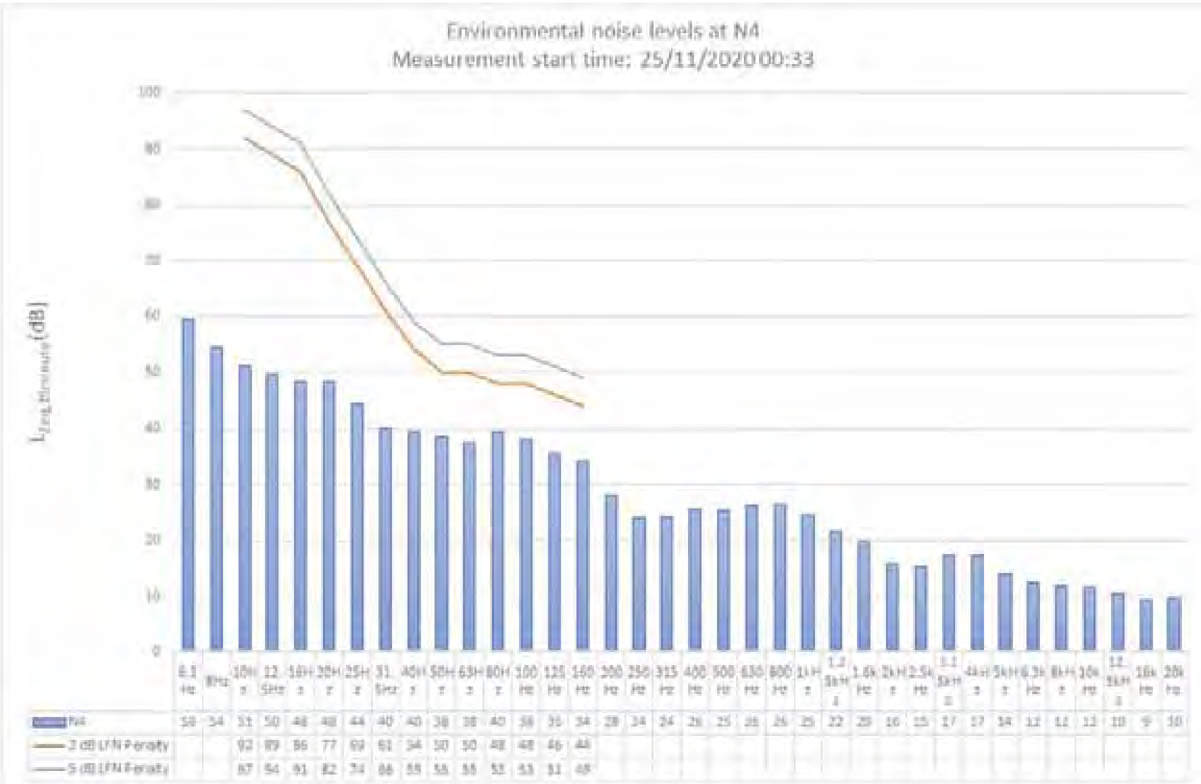



**Figure 5.3 N4 total measured one-third octave band frequencies**

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 22 dB ($L_{Aeq,15\ minute}$ 25 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 24 and 25 November 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

# APPENDIX 6
# ALTERNATE NOISE CONDITIONS

## NOISE

### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| Uncertainty: | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** ..KB.. **AUTHORISED SIGNATURE:** ..............................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ...................

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Appendix L

# Monthly attended noise monitoring report - December 2020

# Ashton Coal

Monthly attended noise monitoring
December 2020

Prepared for Ashton Coal Operations Pty Ltd
January 2021

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# Servicing projects throughout Australia and internationally


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# Ashton Coal

Monthly attended noise monitoring - December 2020

Prepared for Ashton Coal Operations Pty Ltd
January 2021

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# Ashton Coal

## Monthly attended noise monitoring - December 2020

**Report Number**

H190832 RP12

**Client**

Ashton Coal Operations Pty Ltd

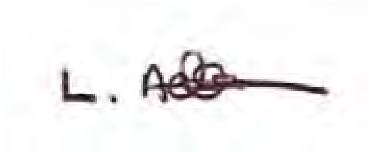
**Date**

19 January 2021

**Version**

v1-0 Final


**Prepared by**



**Lucas Adamson**
Senior Acoustic Consultant
19 January 2021

**Approved by**

**Katie Teyhan**
Associate
19 January 2021


This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

# Table of Contents



## Appendices



## Tables

Figures

# 1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 23 December 2020.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 23 December 2020);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 23 December 2020);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 23 December 2020);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

# 2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

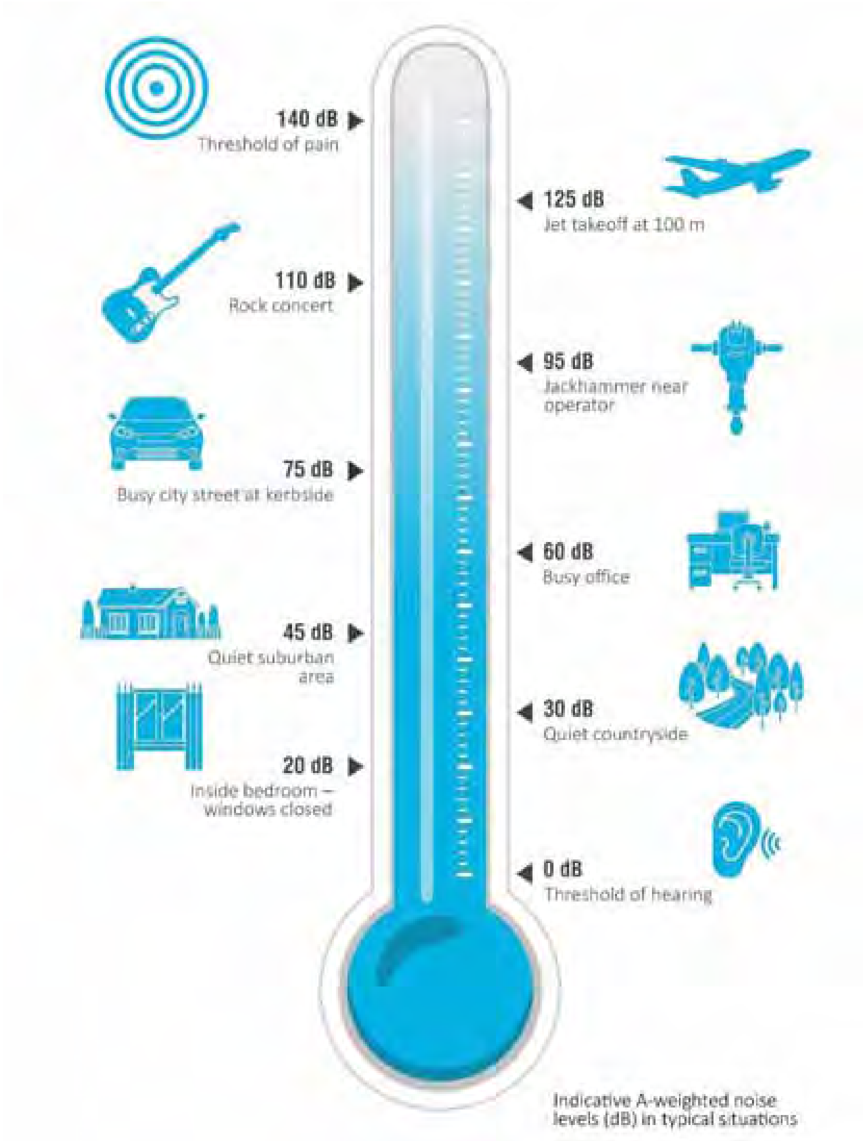
### Table 2.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| $L_{A1}$ | The 'A-weighted' noise level which is exceeded 1% of the time. |
| $L_{A1,1\ minute}$ | The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute. |
| $L_{A10}$ | The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level. |
| $L_{A90}$ | Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an $L_{Aeq}$ noise level measured over a 15-minute period. |
| $L_{Amin}$ | The minimum 'A-weighted' noise level received during a measuring interval. |
| $L_{Amax}$ | The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval. |
| $L_{Ceq}$ | The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an $L_{Ceq}$ noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am. |
| Temperature inversion | A meteorological condition where the atmospheric temperature increases with altitude. |

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

## Table 2.2 Perceived change in noise

| Change in sound pressure level (dB) | Perceived change in noise in surrounding environment |
|---|---|
| up to 2 | not perceptible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |




Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

## Figure 2.1 Common noise levels

# 3 Noise limits

## 3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

**Table 3.1 Noise impact assessment criteria**

| Monitoring location | Day $L_{Aeq,15\ minute}$, dB | Evening $L_{Aeq,15\ minute}$, dB | Night $L_{Aeq,15\ minute}$, dB | Night $L_{A1,1\ minute}$, dB |
|---|---|---|---|---|
| N2 | 38 | 38 | 36 | 46 |
| N3 | 38 | 38 | 36 | 46 |
| N4 | 38 | 38 | 36 | 46 |

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded $L_{Amax}$ has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or $L_{Amax}$ metrics (EPA 2013), with use of $L_{Amax}$ resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

## 3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 55 | 45 | 40 |
| All other privately-owned land | 50 | 45 | 40 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.
>
> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.
>
> Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

| Location | Day | Evening | Night |
|---|---|---|---|
| Camberwell Village | 60 | 50 | 45 |
| All other privately-owned land | 55 | 50 | 45 |

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

## 3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

**Table 3.2 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The following modifying factor correction is to be applied where the site ‘C-weighted' and site ‘A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site ‘C-weighted' and site ‘A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

# 4 Assessment methodology

## 4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

**Table 4.1 Attended noise monitoring locations**

| Monitoring location | Description | MGA56 | |
|---|---|---|---|
| | | Easting | Northing |
| N2 | Camberwell Village (west) | 320297 | 6405670 |
| N3 | Camberwell Village (north east) | 320554 | 6405839 |
| N4 | South of New England Highway | 319776 | 6404101 |

Attended noise monitoring is scheduled to be “unannounced” and, to EMM’s knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

## 4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.


Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km
GDA 1994 MGA Zone 56
N

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

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## 4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

## 4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- $\Delta T$ = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- $\Delta H$ = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

## Table 4.2 Stability categories and temperature lapse rates

| Stability category | Temperature lapse rate (ΔT) (°C/100 m) |
|---|---|
| A | $\Delta T < -1.9$ |
| B | $-1.9 \leq \Delta T < -1.7$ |
| C | $-1.7 \leq \Delta T < -1.5$ |
| D | $-1.5 \leq \Delta T < -0.5$ |
| E | $-0.5 \leq \Delta T < 1.5$ |
| F | $1.5 \leq \Delta T < 4.0$ |
| G | $\Delta T \geq 4.0$ |

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

# 5 Review of data and discussion

## 5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 23 December 2020. Noise from Ashton Coal operations were not audible during any operator-attended noise survey.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave $L_{Aeq}$ noise levels to the NPfI one-third octave low-frequency noise thresholds. Total measured noise levels did not exceed the relevant LFN thresholds during any of the measurements. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable, at all monitoring locations.

**Table 5.1 Ashton Coal attended noise monitoring results – December 2020**

| Location | Date | Start time | Total noise levels, dB | | | | | | | Site contributions, dB | | | Noise limits, dB | | Meteorological conditions[3] limits apply (Y/N) | Exceedance, dB | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $L_{Amin}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ | $L_{Ceq}$ | LFN mod. factor[1] | $L_{Aeq}$ | $L_{Amax}$[2] | $L_{Aeq}$ | $L_{Amax}$[2] | | | |
| N2 | 23/12 | 22:03 | 28 | 33 | 43 | 46 | 51 | 62 | 54 | Nil | IA | IA | 36 | 46 | 1.9 m/s @ 113° E class stability -0.3°C/100m VTG Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking, livestock, wind in foliage and nearby animals occasionally audible. |
| N3 | 23/12 | 22:20 | 27 | 30 | 35 | 38 | 41 | 45 | 51 | Nil | IA | IA | 36 | 46 | 1.9 m/s @ 116° E class stability -0.1°C/100m VTG Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Wind in foliage, resident noise and a train on the main line (unrelated to Ashton Coal) occasionally audible. |
| N4 | 23/12 | 22:41 | 32 | 35 | 39 | 40 | 44 | 60 | 55 | Nil | IA | IA | 36 | 46 | 2.0 m/s @ 113° E class stability 0.1°C/100m VTG Y | Nil | **Ashton Coal inaudible.** Other mines in the vicinity, insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking and bird noise occasionally audible. |

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the $L_{Amax}$ and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

## 5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 33 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, distant dogs barking, livestock and wind in foliage). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

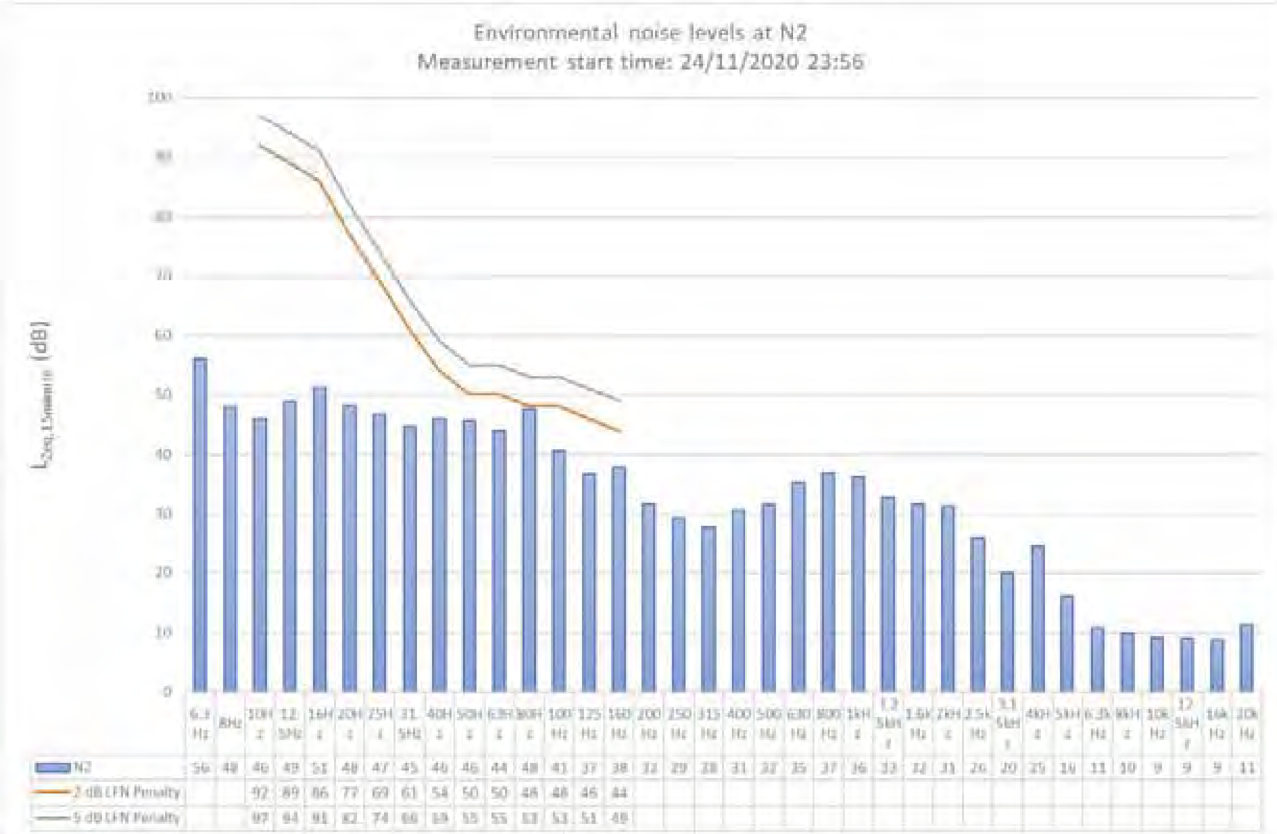


**Figure 5.1 N2 total measured one-third octave band frequencies**

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <20 dB ($L_{Aeq,15\ minute}$ <20 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 30 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, wind in foliage, resident noise and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

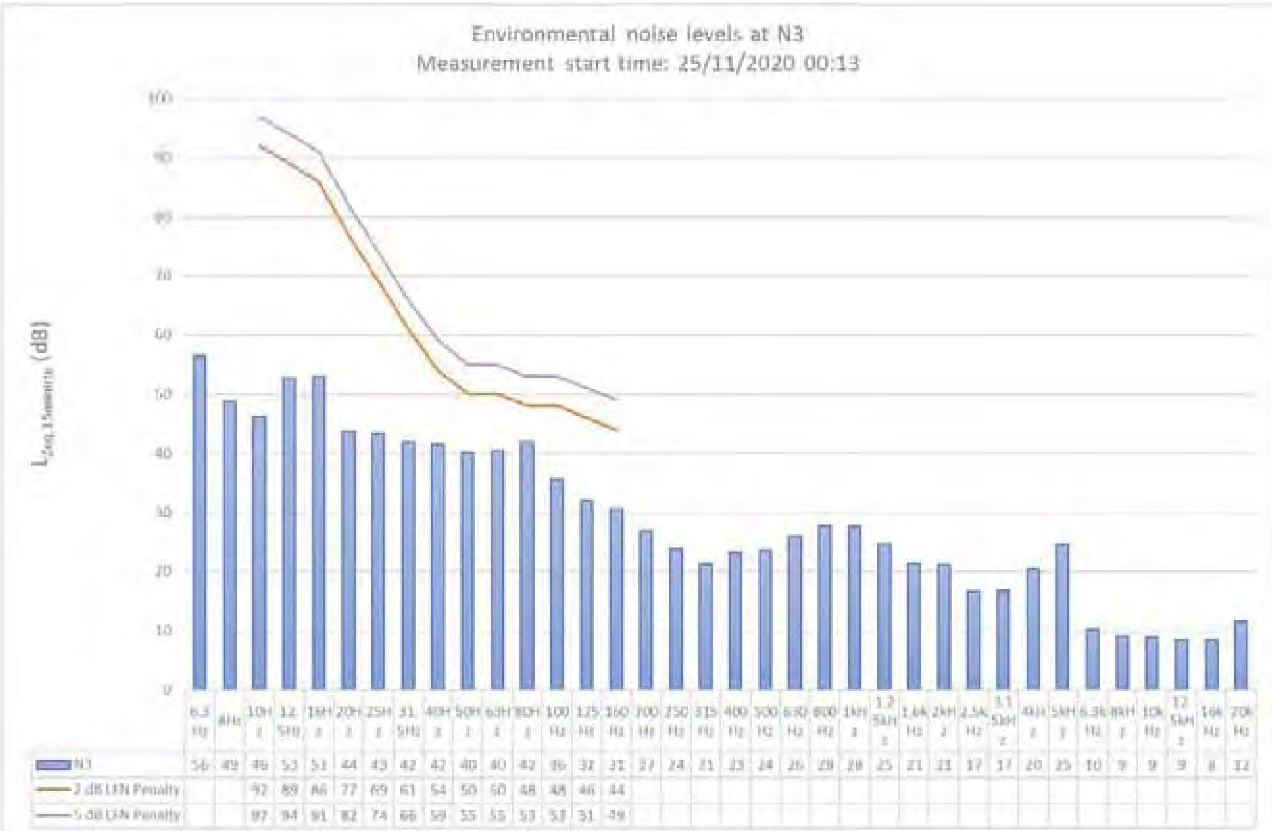


**Figure 5.2 N3 total measured one-third octave band frequencies**

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <20 dB ($L_{Aeq,15\ minute}$ <20 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

## 5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 35 dB $L_{A90}$, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, distant dogs barking and bird noise. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

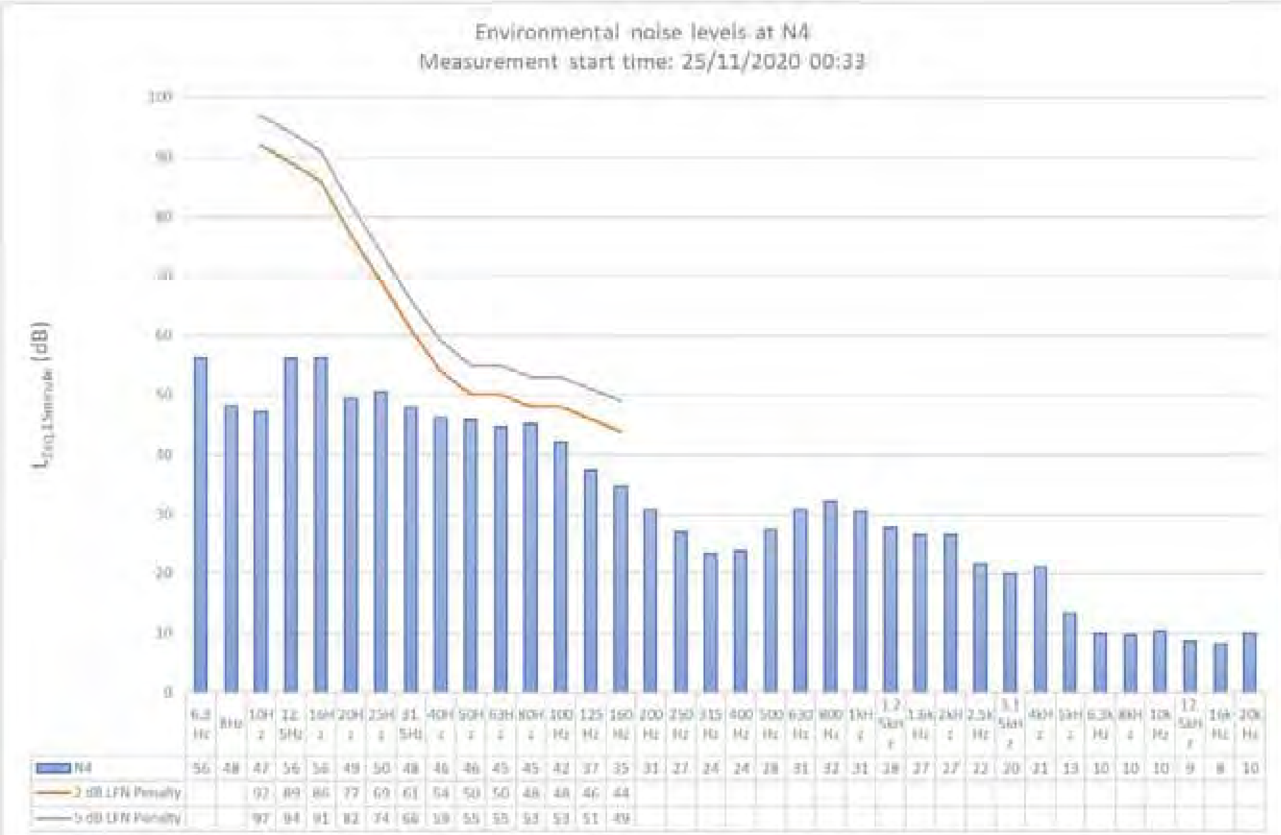


**Figure 5.3 N4 total measured one-third octave band frequencies**

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <20 dB ($L_{Aeq,15\ minute}$ <23 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

# 6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 23 December 2020.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

# References


Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

# Project approval extract

## APPENDIX 6
## ALTERNATE NOISE CONDITIONS

### NOISE

#### Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

#### Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

*Table 1. Noise Criteria dB(A)*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) | Night ($L_{A1\,(1\,min)}$) |
|---|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 36 | 46 |

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

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

#### Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

*Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\,(15min)}$*

| Receiver No. | Receiver | Day ($L_{Aeq\,(15min)}$) | Evening ($L_{Aeq\,(15min)}$) | Night ($L_{Aeq\,(15min)}$) |
|---|---|---|---|---|
| - | All privately-owned land | 38 | 38 | 38 |

*Notes:*

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

## APPENDIX 8
## NOISE COMPLIANCE ASSESSMENT

### Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

### Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

# EPL extract

## L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of this Licence.

## L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

| Location | Day LAeq(15 minute) | Evening LAeq(15 minute) | Night LAeq(15 minute) | Night LAeq(1 minute) |
|---|---|---|---|---|
| EPA Point 13 | 38 | 38 | 36 | 46 |
| EPA Point 14 | 38 | 38 | 36 | 46 |
| EPA Point 15 | 38 | 38 | 36 | 46 |
| All other privately owned residences | 38 | 38 | 36 | 46 |

L4.2 For the purpose of Condition L4.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 12 and 32.

# 4 Operating Conditions

Appendix C

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26290

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** B & K
**Type No:** 4230 **Serial No:** 1276091
**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| Level 1: | NA | N | 93.84 | 990.59 | 2.82 |
| Level 2: | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** ...KB **AUTHORISED SIGNATURE:** ..........
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

**CERTIFICATE NO.: SLM 26291 & FILT 5615**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Entered |
| *Electrical Noise* | 11.2 | Entered |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | NA |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Checked by:** IKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS

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web site: www.acu-vib.com.au

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 26291 & FILT 5615**

**Equipment Description:** Sound Level Meter

**Manufacturer:** B & K

**Model No:** 2250 **Serial No:** 2759405

**Microphone Type:** 4189 **Serial No:** 2888134

**Preamplifier Type:** ZC0032 **Serial No:** 16037

**Filter Type:** 1/3 Octave **Serial No:** 2759405

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** EMM Consulting
Level 3, 175 Scott Street
Newcastle, NSW 2300

**Ambient Pressure:** 1007 hPa ±1.5 hPa

**Temperature:** 24 °C ±2° C **Relative Humidity:** 53% ±5%

**Date of Calibration:** 05/02/2020 **Issue Date:** 05/02/2020

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** VKB **AUTHORISED SIGNATURE:** ....................
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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ACU-VIB
ELECTRONICS

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Acoustic and Vibration
Measurements

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# Appendix 2

## Annual Groundwater

## Monitoring Review 2020

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Australasian Groundwater and
Environmental Consultants Pty Ltd

Report on

# Yancoal Ashton Annual Groundwater Monitoring Review 2020

Prepared for
Yancoal Australia Limited

Project No. G1922L March 2021
www.ageconsultants.com.au ABN 64 080 238 642

# Document details and history

## *Document details*

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## *List of appendices*

*Report on*

# Yancoal – Ashton Coal
# Annual Groundwater Monitoring Review 2020

## 1 Introduction

The Ashton Coal Project (ACP) is located 14 km north-west of Singleton in the Hunter Valley region of New South Wales (NSW) (Figure 1.1). The ACP consists of decommissioned open cut and active underground mining to access a series of coal seams within the Permian Foybrook Formation. Ashton Coal Operations Ltd (ACOL) is wholly owned and operated by Yancoal Australia Limited (Yancoal).

Between 2003 and 2011, coal was recovered from eleven seams of varying thickness, down to and including the Lower Barrett Seam (LB), from an open cut mine known as the North-East Open Cut (NEOC). Between 2007 and 2016, underground longwall (LW) mining extracted coal from the Pike's Gully Seam (PG), the Upper Liddell (ULD) and the Upper Lower Liddell Seams (ULLD). Mining in longwall panel LW203 within the ULLD extracted coal between October 2019 and May 2020. Works on longwall panel LW204 within the ULLD began in July 2020.

The underground mine is located south of the New England Highway and includes a diversion of Bowmans Creek via two excavated and lined channels. The channels have re-routed Bowmans Creek to areas located above abandoned longwall panels.

### 1.1 Objective

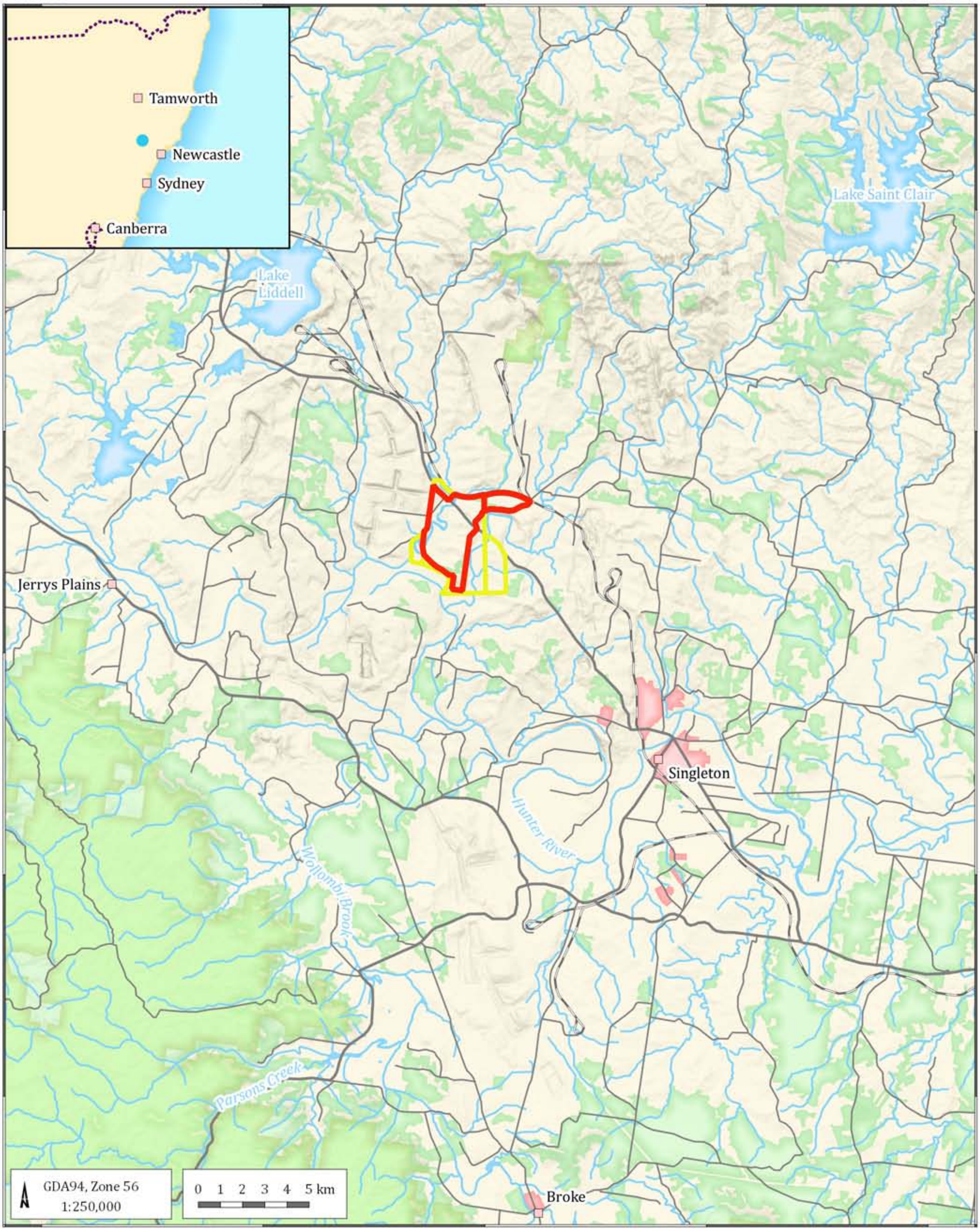
The ACOL development consent (DA 309-11-2001-i – 11 February 2002; last modified June 2016), requires that groundwater be monitored for potential impacts from mining. In 2020, the Department of Planning and Environment (DPE) approved the current water management plan (WMP; Ashton document HSEC Management System Plan Doc. No. 3.4.1.8 version 11, dated 15 September 2020). The WMP outlines the groundwater monitoring program and establishes trigger values for groundwater levels and quality in the various groundwater systems located within the ACP site.

This report summarises the monthly data collected by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) from January 2020 to December 2020. The aim of this report is to provide a consolidated summary of groundwater conditions at ACP throughout 2020.

### 1.2 Scope

The scope undertaken to achieve the objectives includes:

- review and assess rainfall, groundwater levels, pH, electrical conductivity (EC) and water chemistry data from groundwater monitoring campaigns;
- comparison of groundwater monitoring results against WMP triggers;
- notify ACOL of exceedances which require the enactment of the WMP groundwater response plan; and
- make recommendations regarding the groundwater monitoring network and program, where necessary, to ensure ongoing quality control/assurance of groundwater monitoring.




LEGEND

- Ashton mining lease
- Ashton exploration lease
- Study area location
- Populated place
- Built up area
- Major road
- Minor road
- Rail
- Watercourse
- Water area
- Reserve
- Vegetation
- Land

Yancoal Ashton - AGMR 2020 (G1922L)

**Study area location**

AGE

DATE 15/12/2020

FIGURE No: **1.1**


N:\GroundwaterJobs\G1922L.Yancoal Ashton compliance reporting 2020\3_GIS\G1922L_Ashton_site_location.qgs

# 2 Physical setting

The Ashton underground mine is located south of the New England Highway, bounded by the Hunter River to the south and two Hunter River tributaries – Glennies Creek and Bowmans Creek to the east and west, respectively (Figure 1.1). Underground operations intend extracting four coal seams; PG, ULD, ULLD and LB, via a longwall arrangement.

The underground workings (LW1 to LW8) extracted coal from the PG seam and underlying ULD seam (LW101 to LW108). Noteworthy, LW notation increases from east westward 1 to 8. Currently, longwall mining is taking place within LW204 of the ULLD seam (LW201 to LW208). LW204 is situated centrally within the mining lease (ML), with the Hunter River and the Hunter River alluvium to the south. The final LW panels within ULLD seams are located down dip of LW204, in the western portion of the ML.

## 2.1 Climate and rainfall

Climate monitoring data was collected by Ashton Weather Station and the Bureau of Meteorology (BOM) station at Bulga (South Wambo) (BOM station 061191), located about 19 km south-west of Ashton. The Ashton Weather station has 14 years of rainfall data for the period 1 July 2005 to present, while the Bulga (South Wambo) station has 61 years of rainfall data dating from 1959 to present. A summary of average monthly rainfall from the Bulga (South Wambo) station and the Ashton Weather station for 2020 is presented in Table 2.1. Rainfall at Ashton increased significantly in 2020 compared to the previous year with above average rainfall between February to April, July to October and December. The data presented in Table 2.1 shows that rainfall at Ashton in 2020 was below average for three months (May, June and November), and rainfall at the Bulga (South Wambo) station was below average for five months of 2020 (January, April, May, June and November).

**Table 2.1 Average Monthly Rainfall 2020 – Ashton Coal and Bulga**

| Month | Ashton average monthly rainfall (mm) | % of long-term average | Bulga (South Wambo) average monthly rainfall (mm) | % of long-term average |
|---|---|---|---|---|
| Jan | 62.0 | 100% | 65.4 | 76% |
| Feb | 169.0 | 213% | 197.6 | 230% |
| Mar | 108.2 | 123% | 130.6 | 193% |
| Apr | 71.2 | 123% | 43.0 | 94% |
| May | 30.0 | 91% | 16.6 | 42% |
| Jun | 43.8 | 63% | 30.6 | 70% |
| Jul | 121.4 | 410% | 66.2 | 216% |
| Aug | 39.2 | 125% | 42.4 | 124% |
| Sep | 53.6 | 130% | 45.8 | 119% |
| Oct | 126.2 | 265% | 96.6 | 176% |
| Nov | 29.6 | 41% | 43.4 | 71% |
| Dec | 144.2 | 223% | 192 | 261% |

An evapotranspiration (ET) rate of 765 mm/year was sourced from the Bureau of Meteorology (BOM)[1] database for the Camberwell area.

Long-term rainfall trends can be characterised using the Cumulative Rainfall Departure (CRD) method (Bredenkamp et al., 1995). CRD shows trends in rainfall relative to the long-term monthly average and provides a historical record of wetter and drier periods. A rising gradient in the CRD plot indicates periods of above average rainfall, while a declining slope indicates periods of below average rainfall. CRD has been used in this study to provide context to variations in groundwater levels and chemistry.

The CRD for Ashton weather station and Bulga (South Wambo) (BOM station 061191) are shown on Figure 2.1. CRD trends for both stations show above average rainfall for 2020, as represented by an increasing CRD.

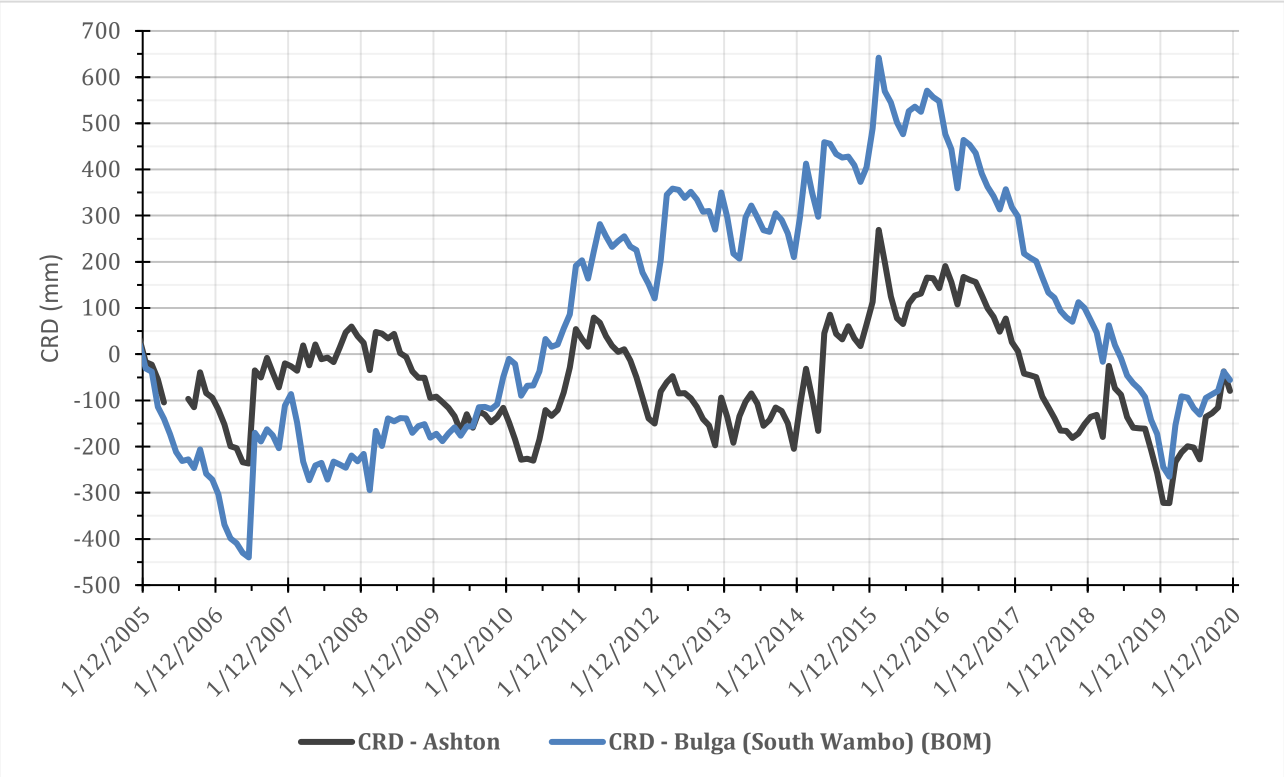



**Figure 2.1 Cumulative Rainfall Departure – Ashton Coal and Bulga**

[1] Bureau of Meteorology (2016). Average annual & monthly evapotranspiration. Available at: http://www.bom.gov.au/jsp/ncc/climate_averages/evapotranspiration/index.jsp

## 2.2 Surface water

The Ashton mine lease is bounded by Bowmans Creek to the west, Bettys Creek (tributary of Bowmans Creek) to the north, Glennies Creek to the east side and Hunter River to the south. Both Bowmans and Glennies Creeks are an affluent of the Hunter River. The three main water courses are described below:

- Hunter River is the main surface water body with a catchment area at Bowmans Creek of 13,590 $km^2$. The flow is regulated by Glenbawn Dam and by other licensed extractions and releases.
- Glennies Creek and its associated alluvium are located to the east of the underground workings and the PG sub-crop area. The catchment area is approximately 600 $km^2$. Up to half of the Glennies Creek catchment feeds into Lake St. Clair, located within the far north-eastern section of the catchment. Water from Lake St. Clair discharges into Glennies Creek under controlled release.
- Bowmans Creek natural channel is above the longwall panel LW6B/LW106B and its associated alluvium is over LW5 to LW8. It is the main water course over the underground workings area. Bowmans creek was diverted in two locations to minimise the impact of mining on both the creek and the potential inflows to the underground workings. The construction of the eastern diversion commenced in March 2011 and the western diversion commenced in February 2012. Both diversions were commissioned in November 2012 and are located within the Bowmans Creek Alluvium (BCA). The diversions were designed to replicate the natural creek setting in terms of channel cross-sectional variability in bed level and ecological features (i.e. resting pools). The diversions were lined with a geosynthetic clay liner to minimise leakage from the creek.
- Bowmans Creek flow is not regulated and is monitored according to the WMP. The streamflow gauging station (no. 210130 - regulated by WaterNSW), was installed in October 1993 and is used as a flow baseline for Bowmans creek with a catchment area of 240 $km^2$. This station is in the middle section of the creek on the ML, upstream to the western diversion.

## 2.3 Mining

The longwall panels accessing the ULLD (including active LW204) are generally offset 24 m to the east and 10 m south from the overlying ULD longwall panels. This offset is designed to reduce the resulting subsidence and associated impacts to the surrounding environment. That said, the northern extent of PG, ULD, ULLD longwalls, and the main gate road are aligned resulting in a “stacked edge” where subsidence impacts are slightly more noticeable at the surface than elsewhere.

The start and end dates of longwall panel mining at ACP are summarised in Table 2.2.

**Table 2.2 Longwall panel schedule**

| Longwall panel | Target seam | Start date | End date |
|---|---|---|---|
| LW1 | PG | 12/03/2007 | 15/10/2007 |
| LW2 | PG | 10/11/2007 | 21/07/2008 |
| LW3 | PG | 20/08/2008 | 03/03/2009 |
| LW4 | PG | 02/04/2009 | 15/10/2009 |
| LW5 | PG | 04/01/2010 | 07/06/2010 |
| LW6A | PG | 09/07/2010 | 22/11/2010 |

| Longwall panel | Target seam | Start date | End date |
|---|---|---|---|
| LW7A | PG | 22/03/2011 | 08/08/2011 |
| LW7B | PG | 03/10/2011 | 17/01/2012 |
| LW8 | PG | 27/02/2012 | 05/06/2012 |
| LW101 | ULD | 31/07/2012 | 16/06/2013 |
| LW6B | PG | 14/07/2013 | 10/10/2013 |
| LW102 | ULD | 10/11/2013 | 24/07/2014 |
| LW103 | ULD | 21/08/2014 | 21/06/2015 |
| LW104A | ULD | 23/07/2015 | 16/01/2016 |
| LW104B | ULD | 03/02/2016 | 11/04/2016 |
| LW105 | ULD | 17/05/2016 | 26/09/2016 |
| LW106A | ULD | 18/10/2016 | 31/05/2017 |
| LW201 | ULLD | 07/07/2017 | 04/05/2018 |
| LW202 | ULLD | 07/06/2018 | 20/08/2019 |
| LW203 | ULLD | 08/10/2019 | 25/05/2020 |
| LW204 | ULLD | 02/07/2020 | Present |

## 2.4 Conceptual hydrogeology

### *2.4.1 Hydrostratigraphy*

Ashton is located in the central Hunter Valley of NSW where the lower sequences of the Wittingham Coal Measures (Singleton Supergroup) subcrop (Figure 2.2). Within the Ashton mining lease, the Hebden seam to the Bayswater seam (inclusive) subcrop. The underground operation targets the PG, ULD, ULLD and the LB seams.

The Wittingham Coal Measures dip west south-west in the Ashton area, an orientation locally controlled by the Camberwell Anticline to the east of the mine and the Bayswater Syncline to the west. The top target coal seam at Ashton, the PG seam, subcrops under the Glennies Creek Alluvium (GCA) approximately 150 m east of the mine, while the lowest target coal seam, the LB seam, subcrops under regolith approximately 2 km to the east of the mine. In the western portion of the mining area, the overburden above the PG seam ranges in thickness between 100 m (north end of LW7) and 190 m (south end of LW7).

The stratigraphic sequence in the region comprises two distinct units: Quaternary alluvium and Permian strata. The Permian strata comprise coal seams (typically 2 m to 2.5 m thick) with overburden and interburden (typically 30 m thick between successive seams) consisting of sandstone, siltstone, tuffaceous mudstone, and conglomerate. The Quaternary alluvium consists of unconsolidated silt, sand and gravel in the alluvial floodplains of the Hunter River (HR), Bowmans Creek (BC) and Glennies Creek (GC). The alluvium unconformably overlies the Permian within the floodplains of the HR, BC and GC. Elsewhere, the Permian is overlain by a regolith comprising colluvium, eluvium and completely weathered rock, which interfaces with the floodplain alluvium at the flanks of the valleys.

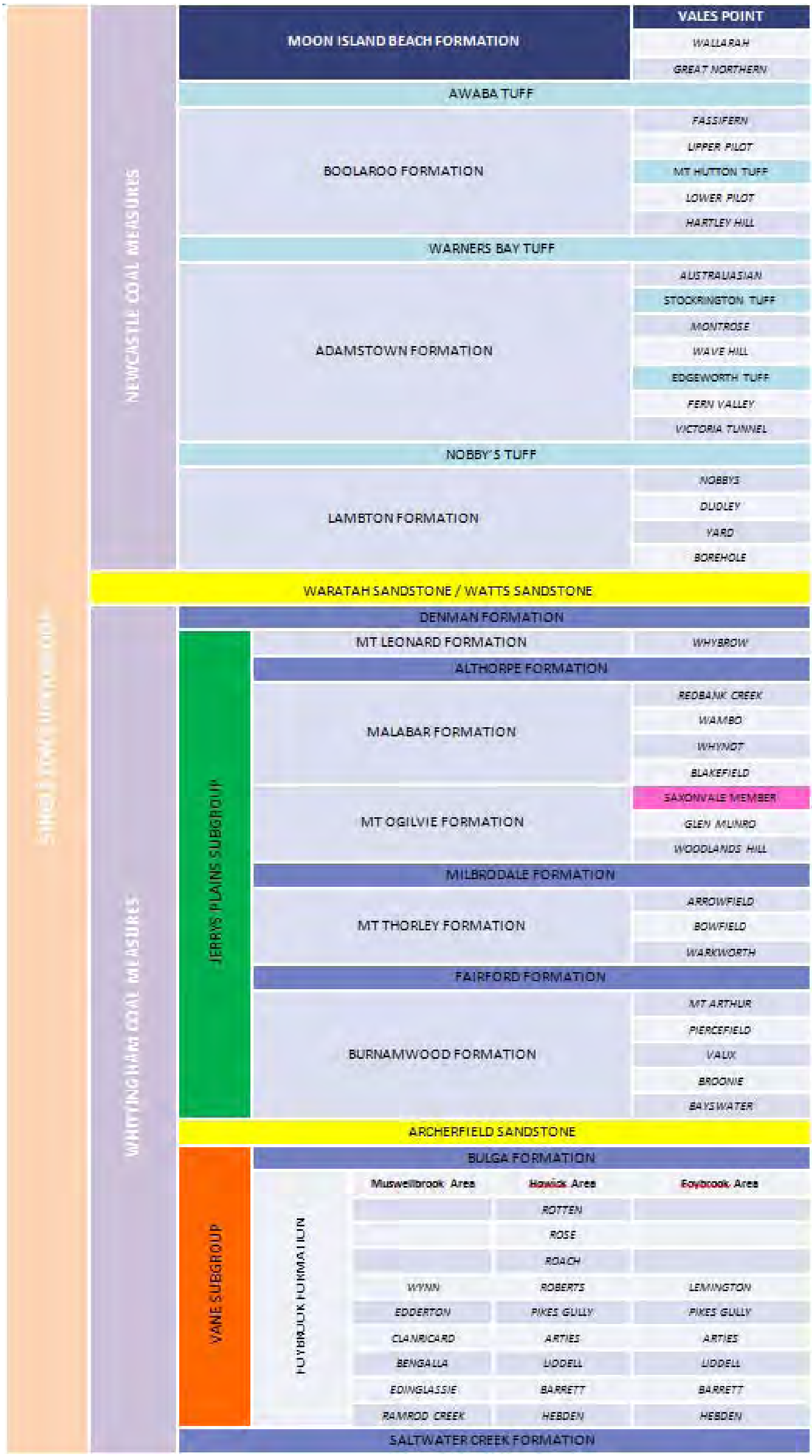



**Figure 2.2 Singleton Super Group sequence stratigraphy (AGE, 2016)**

#### 2.4.1.1 Quaternary alluvium/Regolith

Ashton is overlain by Quaternary alluvium associated with the HR, BC and GC. The Bowmans Creek Alluvium (BCA) and Glennies Creek Alluvium (GCA) are in direct connection to the Hunter River alluvium (HRA). The Quaternary/recent aged alluvium/colluvium along the HR, GC and BC flood plains comprises two distinct depositional units; a surficial fine-grained sediment and a coarser basal material. The surficial alluvium comprises shallow sequences of clay, silty sand and sands. Along the minor drainage lines, the surficial alluvium is typically constrained within 500 m of the creeks and is between 7 m to 15 m thick.

Away from the floodplain areas, the Permian coal measures sequence is overlain by a layer of regolith, comprising colluvium/eluvium, and completely weathered rock that collectively have soil rather than rock properties and interface with the alluvium at the flanks of the floodplain areas. The regolith layer varies in thickness, though is typically 15 m to 20 m thick above rock.

#### 2.4.1.2 Permian strata

The Wittingham Coal Measures comprise Permian aged coal seams interbedded with siltstone, sandstone, shales and conglomerates. The Wittingham Coal Measures are up to 400 m thick at Ashton, but regionally they range from approximately 250 m to 600 m thickness. At Ashton, the lower portion of the Wittingham Coal Measures is present on site. The profile extends from above the Bayswater seam to the Hebden seam (Figure 2.2).

Locally, the Wittingham Coal Measures are further divided into (AGE, 2016):

- four main target coal seams – PG, ULD, ULLD and the LB;
- a large number of coal seams and plies of varying thickness, including the Bayswater seam, up to 20 Lemington seam plies, the Arties seam, and a number of Liddell seam and Barrett seam plies that are not proposed to be mined in the Ashton underground mine; and
- interburden sediments comprising siltstone, sandstone, conglomerate and claystone.

Over 20 plies of the Lemington seam profile and the overlying Bayswater seam are present within the PG seam overburden. The largest Lemington seam plies are of similar thickness as the four target seams and may have similar hydraulic properties.

### 2.4.2 Recharge

Recharge is interpreted to occur from direct rainfall to the ground surface, infiltrating into the formations through the thin soil cover and regolith. The coal measures also occur at subcrop in localised zones beneath the HRA, GCA, and the BCA. In these areas, the Permian coal measures are interpreted to be recharged by downward seepage and then downdip flow along the most permeable strata in the sequence, primarily the coal seams (Aquaterra, 2009 and AGE, 2016).

The combined surface water catchment area potentially providing recharge to the Ashton area is significantly greater in size than the mine area itself. Ashton is located immediately adjacent the confluences of the Hunter River with Bowmans and Glennies Creeks. The Ashton surface and underground infrastructure is located entirely within the Bowmans and Glennies Creek catchments, which extend approximately 30 km and 45 km to the north of Ashton, respectively.

Bowmans and Glennies Creek have up to fourth order tributaries up-stream of the site and rainfall falling within the respective catchments flows through the Ashton area. The Bowmans and Glennies Creeks catchments span approximately 300 km$^2$ and 600 km$^2$, respectively.

### 2.4.3 Groundwater flow

The Quaternary alluvium and regolith combined is interpreted (AGE, 2016) to be an unconfined groundwater system that is recharged by rainfall infiltration, streamflow and upward leakage from the underlying stratigraphy, particularly along GC and BC.

The water table in the alluvium/regolith is a subdued reflection of topography. Groundwater within the HRA flows generally in an easterly direction, while groundwater within GCA and the BCA flows generally in a southerly direction towards the HR, with local flow towards the respective river/creeks.

The direction of groundwater flow for the coal seams is influenced by the local geomorphology and structural geology as well as the long history of mining within the region. Groundwater flow within the Permian coal measures is understood to be to the south-west consistent with the dip direction of the coal seams.

The mining of the PG seam and ULD seam has impacted the groundwater regime at Ashton. Mining has induced subsidence cracking that extends to the ground surface above parts of Ashton, and to a lesser height above the goaf in other areas where the cover depth above the PG seam is greater (i.e. near the western side of the mine area). It is likely that in areas of shallower cover depth, this cracking has penetrated both the overburden of the PG, along with the BCA. Surface cracking is also visible along and across the longwall panel areas immediately following subsidence. This surface cracking is expected to extend for only a limited depth below surface and may or may not intersect with the subsidence cracking emanating up from the goaf, depending on cover depth and subsidence magnitude.

There is also potential for recharge from the GCA through connectivity with the PG seam (AGE, 2016), which hydraulic testing showed was significantly more permeable close to outcrop than at depth (Peter Dundon and Associates, 2006). Inflows into the workings during mining of LW1 were not significantly greater than during mining of LW1 tailgate (TG1A). This would indicate that mining of LW1 did not increase the connectivity or flow from the PG seam in subcrop beneath the GCA. Although inflows were higher during mining of TG1A than subsequent inflows from subsided strata during extraction of LW1, the total inflows to the end of LW1 were below predicted inflows, and the observed impacts on GCA were less than predicted, confirming that the proximity to Glennies Creek has not resulted in an unexpected level of connectivity and inflows from the Glennies Creek floodplain.

The presence of subsidence cracking over parts of the underground mine increases the potential connectivity of the mine with the water within the creeks and associated alluvium. Planned LW panels within the underlying ULLD and LB seams may allow for reactivation of subsidence and subsidence related fracturing within these areas (AGE, 2016).

The conceptual hydrogeology is depicted in Figure 2.3.

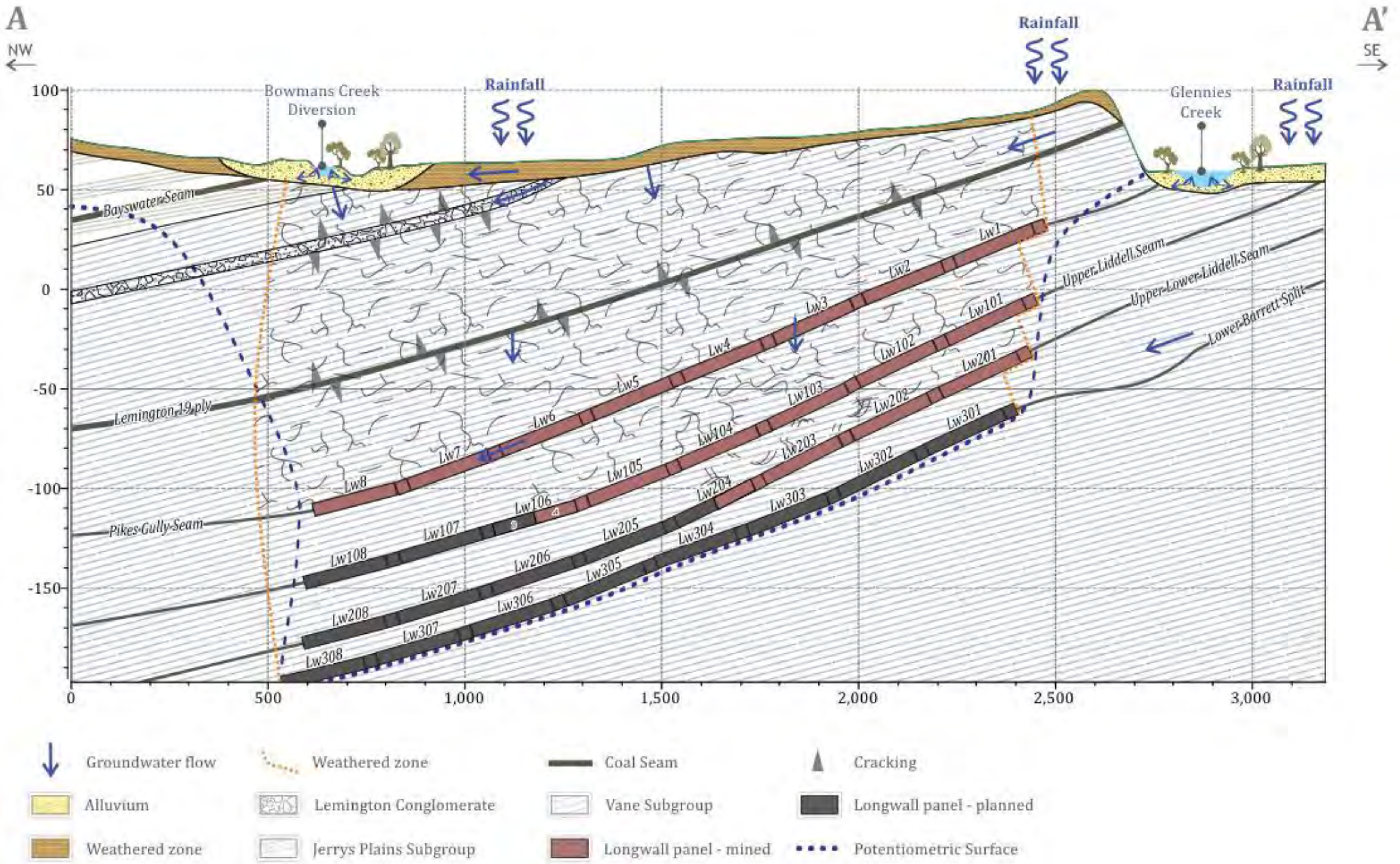



**Figure 2.3 Conceptual hydrogeology – north-west to south-east – not to scale**

# 3 Groundwater management plan

The previous WMP (2018) was updated and submitted to DPI Water for approval in March 2018. The updated WMP (2020) (herein referred to as WMP) includes an update to targeted water quality triggers. Details of the monitoring locations are summarised in Appendix D. The groundwater monitoring plan, including monitoring parameters and frequency, is summarised in Appendix B. The WMP received approval in September 2020, therefore, groundwater monitoring was conducted as per WMP version 11 (2020) following its approval.

## 3.1 Groundwater monitoring network

The ACOL groundwater monitoring network consists of more than 100 monitoring bores. Of these, 64 bores and ten vibrating wire piezometer (VWP) installations are monitored as part of the WMP throughout monthly, quarterly, and annual campaigns (Appendix A). The WMP outlines the monitoring plan and key monitoring locations in areas potentially sensitive to mining impacts.

Monitoring of groundwater levels, VWP pressure heads, and water quality parameters at these bores sufficiently captures the lateral groundwater system behaviour of the alluvial aquifers, the interburden and the coal seam aquifers at the site. The current groundwater monitoring network is considered suitable to detect changes to groundwater across the site.

The WMP monitoring locations and respective monitoring targets are presented in Figure 3.1. Details of these monitoring locations are summarised in Appendix A (Table A1).

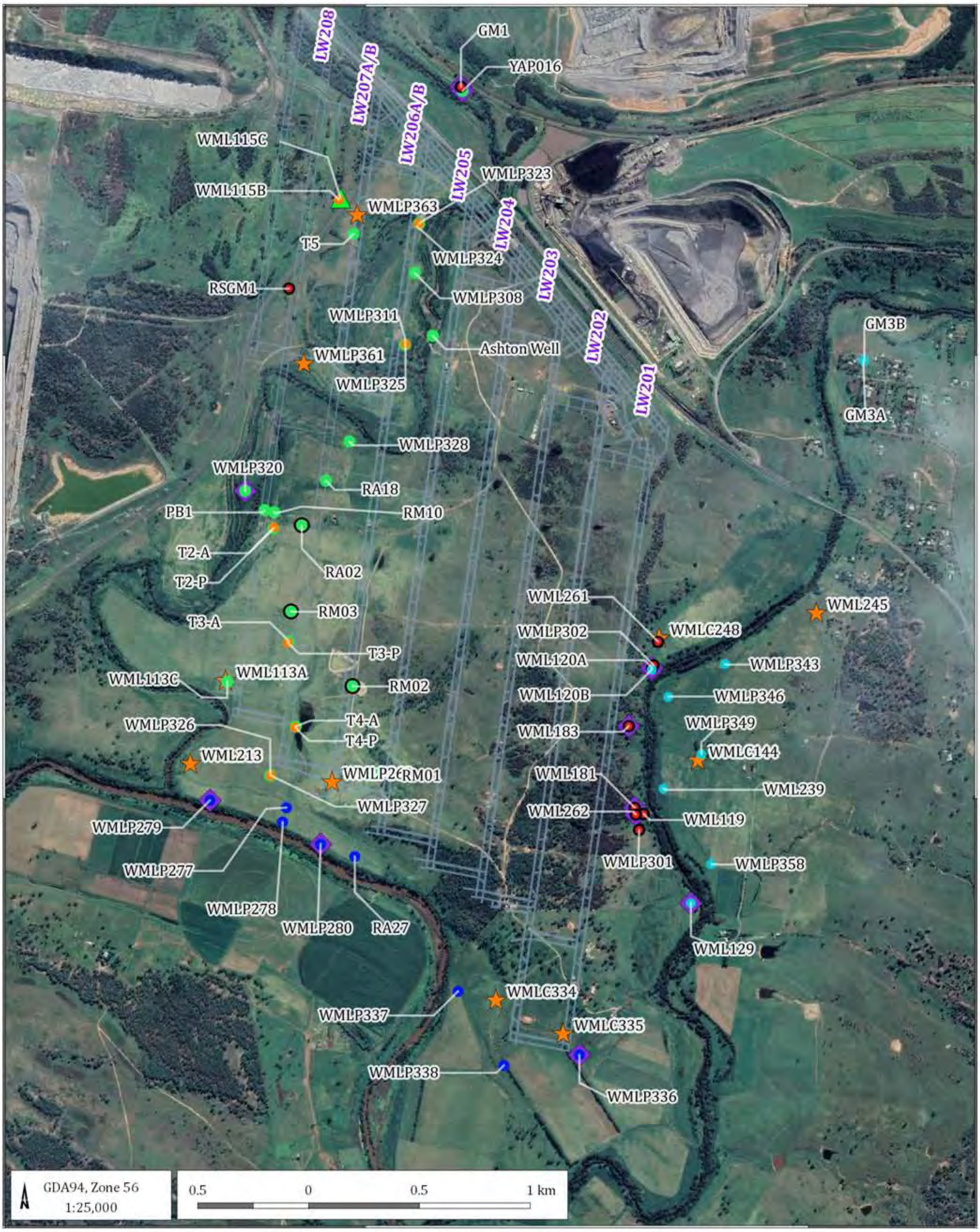
The groundwater monitoring program includes the monitoring of:

- groundwater levels;
- groundwater (piezometric) pressures;
- field water quality parameters – pH, EC, temperature and total dissolved solids (TDS);
- groundwater sampling for minor chemical lab analysis (including pH, EC, TDS, major ions (calcium, magnesium, sodium, potassium, chloride and sulfate as SO4) and alkalinity);
- groundwater sampling for comprehensive chemical lab analysis (including pH, EC, TDS, major ions, alkalinity, cations/anions, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, zinc, turbidity, cyanide, nitrate, nitrite, Kjeldahl nitrogen, total nitrogen and total phosphorous); and
- monitoring of groundwater levels and EC as required by Environmental Protection Licence (EPL) 11879.

Monitoring frequency is as follows (Appendix B):

- monthly monitoring at selected alluvial piezometers for water level and field water quality;
- monthly monitoring of water level and piezometric pressure in longwall-specific piezometers during active extraction at relevant longwalls;
- quarterly monitoring at selected piezometers for water level, field water quality and minor chemical analysis;
- biannual monitoring for bores specified by EPL 11879; and
- annual sampling at selected piezometers for minor and comprehensive chemical analysis.

The groundwater monitoring plan, including monitoring parameters and frequencies, is summarised in Appendix B (Table B1).




LEGEND

- Longwall panels (ULLD)
- Bowmans Creek Alluvium
- Bowmans Creek Alluvium and Coal Measure Overburden
- Bowmans Creek Colluvium
- Coal measure
- Coal measure overburden
- EPL Bores - Updated Nov 2019
- Glennies Creek Alluvium
- Hunter River Alluvium
- VWPs

Yancoal Ashton - Monthly Reporting (G1922L)

**WMP groundwater monitoring network**

AGE

DATE 21/12/2020

FIGURE No: **2.1**


N:\GroundwaterJobs\G1922L.Yancoal Ashton compliance reporting 2020\3_GIS\G1922L_WMP_groundwater_monitoring_network_2020.qgs

## 3.2 Trigger values

The WMP outlines trigger values for groundwater level and quality for monitoring bores in the Bowmans Creek Alluvium (BCA), Glennies Creek Alluvium (GCA) and the Hunter River Alluvium (HRA).

A recorded water level below the defined trigger level at a monitoring bore at any time between March 2018 and the end of mining of LW204 in the ULLD, sustained for three consecutive months, would trigger a response under the WMP. Groundwater elevation trigger levels are summarised in Table 3.1. Groundwater quality trigger levels are summarised in Table 3.2. As for groundwater elevation, three consecutive measurements outside of these values trigger a response under the WMP. In addition, if a recorded value at a monitoring bore differs extremely from the preceding three readings at that location and there are no unusual events that could have caused the difference, a response would be triggered. The WMP groundwater response plan, for cases where trigger values are exceeded, is summarised in Appendix C.

### Table 3.1 Groundwater elevation trigger levels for alluvial monitoring bores

| Aquifer | Monitoring bore | Base of alluvium elevation (mAHD) | Assigned trigger value end of mining in LW204 (Upper Lower Liddell Seam) (mAHD) |
|---|---|---|---|
| BCA* | WMLP311 | 55.64 | 57.50 |
| | WMLP323 | 59.47 | 59.20 |
| | WMLP328 | 49.42 | 55.15 |
| | T2A | 49.69 | 54.17 |
| GCA | WML120B | 51.12 | 51.45 |
| | WML129 | 45.44 | 49.80 |
| | WML239 | 50.82 | 49.78 |
| | WMLP343 | 50 | 51.33 |
| | WMLP346 | 49.18 | 51.35 |
| | WMLP349 | 48.84 | 50.82 |
| | WMLP358 | 50.16 | 50.79$ |
| HRA | WMLP279 | 45.1 | 48.82 |
| | WMLP280 | 44.92 | 48.63 |
| | WMLP337 | 48.05 | 47.73 |
| | WMLP336 | 47.87 | 48.15 |

**Notes:** ** Bowmans Creek alluvium is approved to be dewatered in areas above the mine plan by end of mining of the Upper Liddell seam (Aquaterra, 2009). Trigger values are therefore intended as a guide representing updated, more conservative, impact predictions from the updated groundwater model (AGE, 2016).*

*$ This water level trigger is based on the second lowest water level measured, as the lowest measured water level is an outlier in the dataset.*

**Table 3.2 Groundwater quality trigger levels for alluvial monitoring bores**

| Aquifer | Monitoring bore | Groundwater pH trigger - Lower (5th percentile) | Groundwater pH trigger - Upper (95th percentile) | Groundwater EC trigger (µS/cm) (95th percentile) |
|---|---|---|---|---|
| BCA | WMLC113C | 6.6 | 7.4 | 1445 |
| | WMLP311 | 6.5 | 8.0 | 1289 |
| | WMLP323 | 6.5 | 8.1 | 1241 |
| | WMLP326 | 6.6 | 7.5 | 2078 |
| | WMLP328 | 6.6 | 8.2 | 1175 |
| | T2A | 6.7 | 7.7 | 1422 |
| GCA | WML120B | 6.4 | 7.7 | 1387 |
| | WML129 | 6.7 | 8.0 | 740 |
| | WML239 | 6.3 | 7.4 | 984 |
| | WMLP343 | 6.7 | 7.2 | 994 |
| | WMLP346 | 6.5 | 7.1 | 750 |
| | WMLP349 | 6.5 | 6.8 | 983 |
| | WMLP358 | 6.2 | 6.9 | 401 |
| HRA | WMLP279 | 6.3 | 7.5 | 1276 |
| | WMLP280 | 6.6 | 7.9 | 2034 |
| | WMLP337 | 6.8 | 7.8 | 3254 |
| | WMLP336 | 6.2 | 8.2 | 1708 |

***Notes:*** *Data reviewed for trigger derivation includes historical data to June 2017.*

## 3.3 Sampling methods

Groundwater sampling at Ashton in 2020 adhered to the following standards and procedures:

- Australian Government – National Water Commission (2020). *"Minimum Construction Requirements for Water Bores in Australia".* Fourth edition ISBN 978-0-646-81881-8.
- Standards Australia (1998). *"Water Quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples".* Australian/New Zealand Standard 5667.1:1998.
- Sundaram, B. (2009). *"Groundwater Sampling and Analysis – A Field Guide",* Australian Government – Geoscience Australia. GeoCat 60901.

Groundwater levels/pressure heads at Ashton in 2020 were measured as follows:

- manual measurements using a water level dipper;
- download of VWP data;
- downloadable pressure transducer (PT); and
- telemetric PT.

Groundwater quality field parameters were measured using a calibrated water quality meter. Water quality laboratory analysis is conducted by National Association of Testing Authorities (NATA) accredited group Australian Laboratory Services (ALS).

Throughout 2020, groundwater sampling was conducted by AGE Hydrogeologists, Walter Rowlands, Glen Brumm and Jordan Reeds.

# 4 Groundwater monitoring results

Groundwater monitoring and sampling was conducted at the locations and frequencies outlined in the WMP (Section 7.3). Groundwater levels and quality trends for alluvial bores are presented in Figure 4.1 through Figure 4.22. Groundwater levels and quality data for non-alluvial monitoring locations are presented in Figure 4.23 through Figure 4.29.

## 4.1 Alluvium monitoring

### *4.1.1 WMP compliance groundwater levels*

The groundwater level trends and trigger levels for the BCA, GCA and HRA compliance monitoring bores are presented in Figure 4.1, Figure 4.2, Figure 4.3 and Figure 4.4, respectively. Daily rainfall measurements and CRD have also been plotted and used to compare water level trends. The river and creek water levels (sourced from WaterNSW online database[2]) are presented graphically in Figure 4.5.

The following observations can be noted for 2020:

- BCA regulatory bore water levels increased throughout 2020 (Figure 4.1). Over the course of the year, three of the previously dry BCA trigger bores returned water level readings; T2A during August, WMLP328 and WMLP311 during April. All BCA trigger bores were recorded above respective trigger values from April, except for T2A which recorded readings above trigger value from August. Other previously dry BCA bores returned water level readings in 2020 (PB1, RA18 and T5). Groundwater level increase within these bores corresponds to an increasing CRD throughout 2020. Unlike the GCA and HRA, the BCA is not a regulated stream. It should be noted that ACP is approved to intercept the BCA groundwater resource under DA 309-11-2011-i MOD 5.
- GCA groundwater levels were generally stable throughout the year (Figure 4.2 and Figure 4.3). A minor decline in groundwater level was recorded between February to June 2020 in monitoring bore WML120B. All GCA groundwater levels remained above established triggers in 2020.
- HRA regulatory bore water levels were relatively steady throughout the year, except for monitoring bore WMLP280 and WMLP279 which increased through 2020 (Figure 4.4). The stability of HRA water levels can be partly attributed to controlled releases upstream of the HR section that traverses ACP. All HRA groundwater levels remained above established triggers in 2020.
- Surface water elevation has continuously been recorded in Bowmans Creek since August following above average rainfall throughout 2020. Large spikes in surface water level in April, August and November can be attributed to heavy rainfall in the region (Figure 4.5). The Glennies Creek water level was relatively steady throughout the year, with sharp increases in water level recorded after heavy rainfall. Several sharp recorded declines in water level are suspected false readings. Hunter River elevation was variable throughout 2020, with large spikes in water level observed following high rainfall in February, April, August, and November. Hunter River water elevation remained stable throughout periods of low rainfall.

The site area has experienced a period of prolonged above average rainfall over 2020, as indicated by an increasing CRD. Groundwater levels, not associated with regulated water bodies, have increased primarily due to increased rainfall recharge. No mining impacts outside of predictions are noted in the alluvium.

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[2] WaterNSW (2020). Real-time water data. Available at: http://realtimedata.water.nsw.gov.au/water

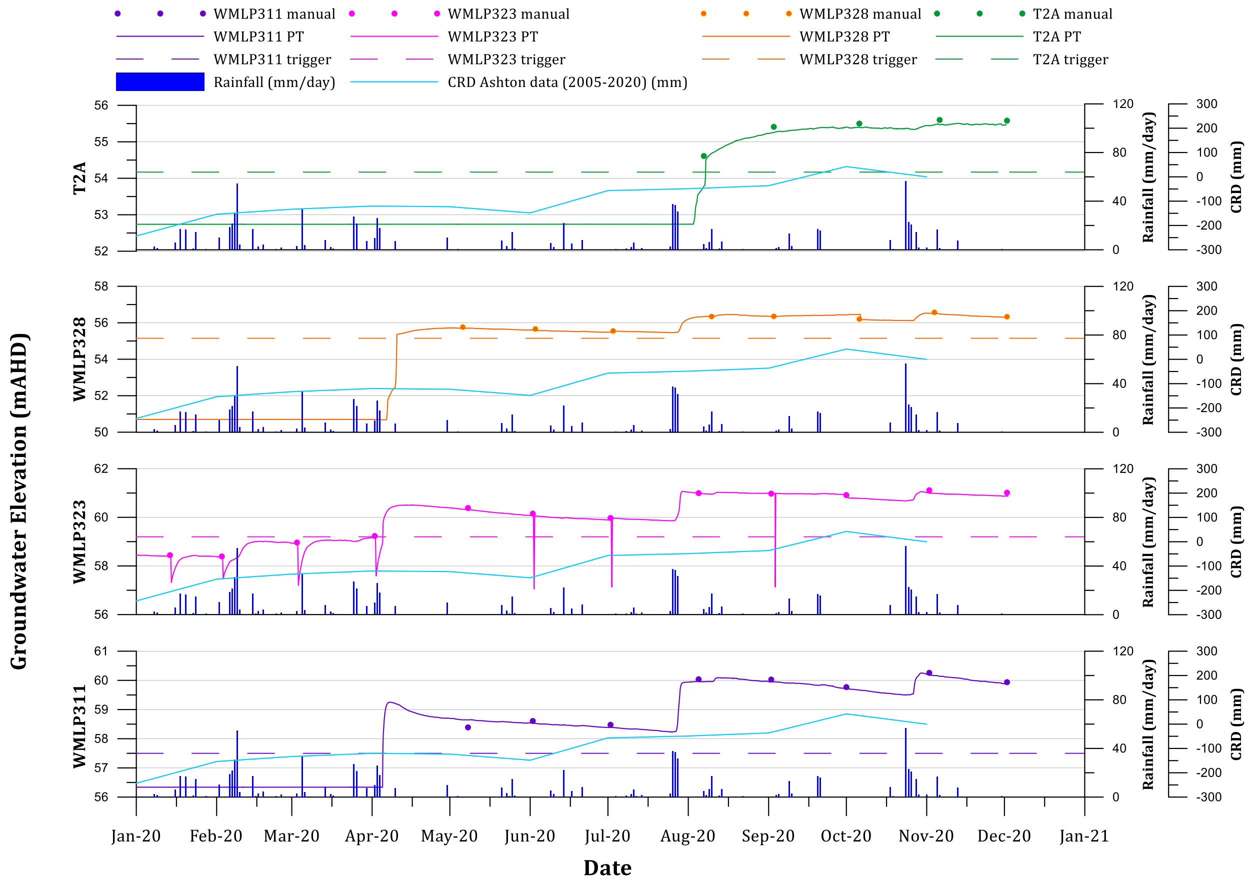



**Figure 4.1** Bowmans Creek alluvium trigger bore hydrographs

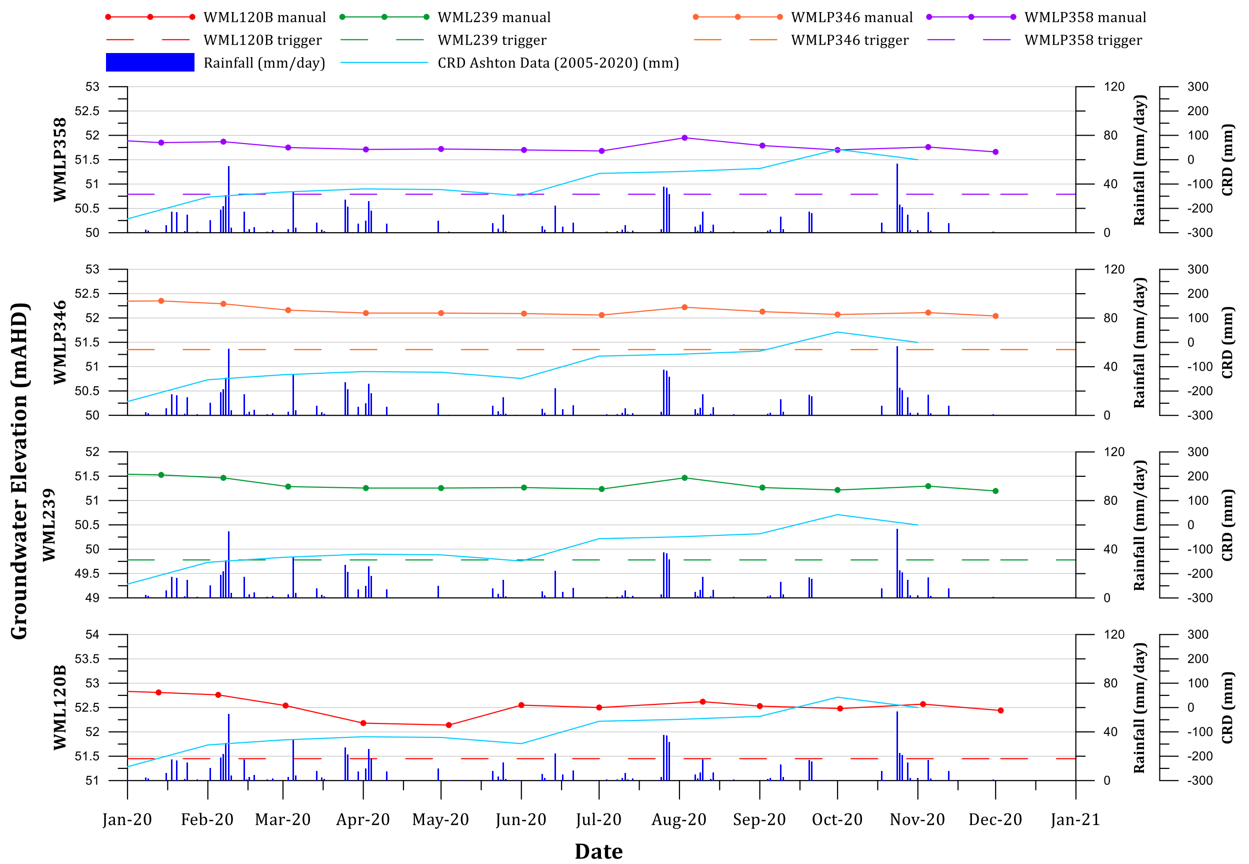



**Figure 4.2** Glennies Creek alluvium trigger bore hydrographs (1)

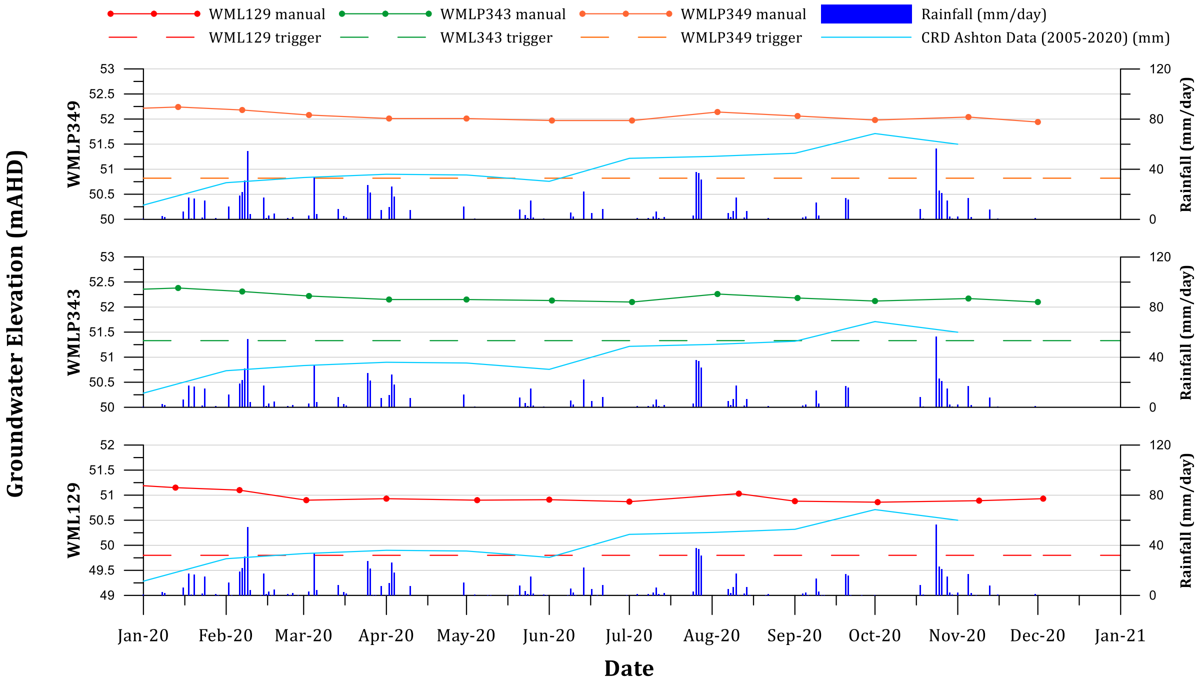



**Figure 4.3 Glennies Creek alluvium trigger bore hydrographs (2)**

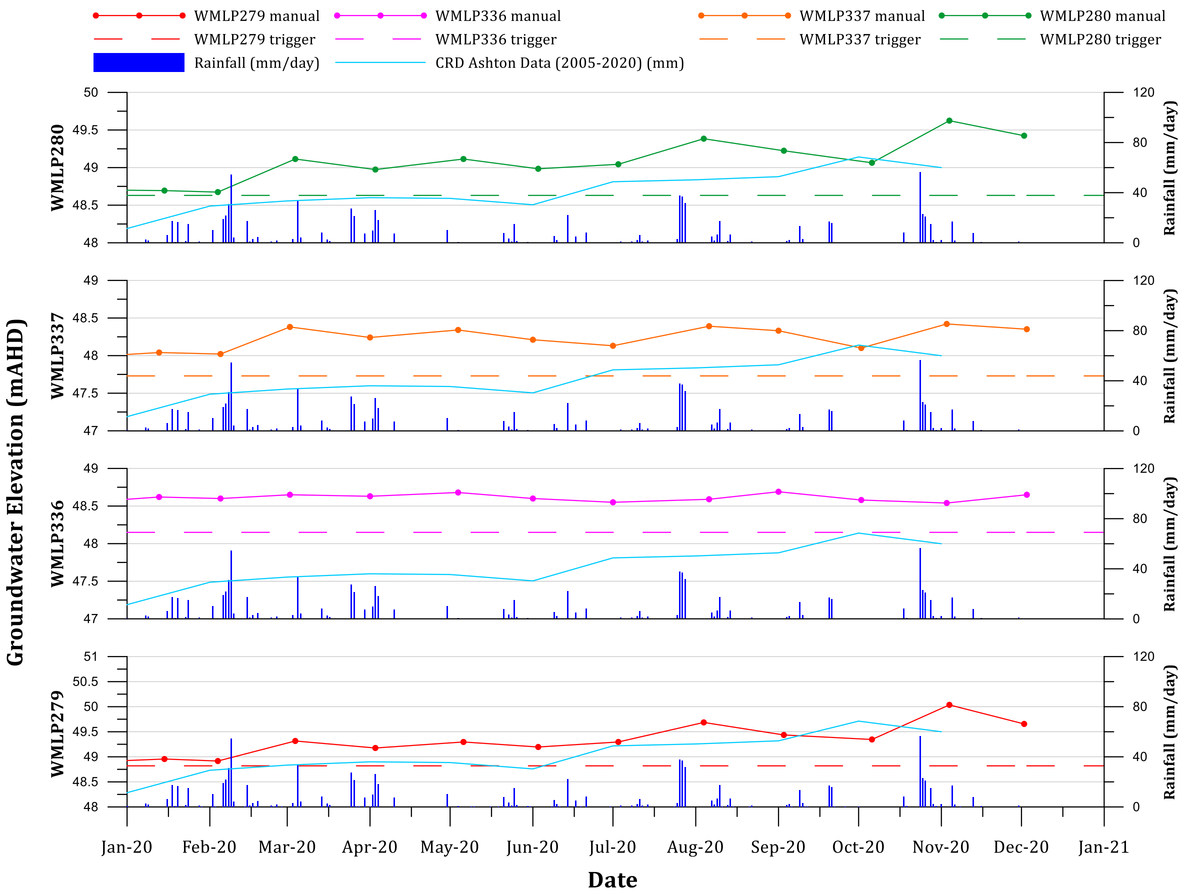



**Figure 4.4 Hunter River alluvium trigger bore hydrographs**

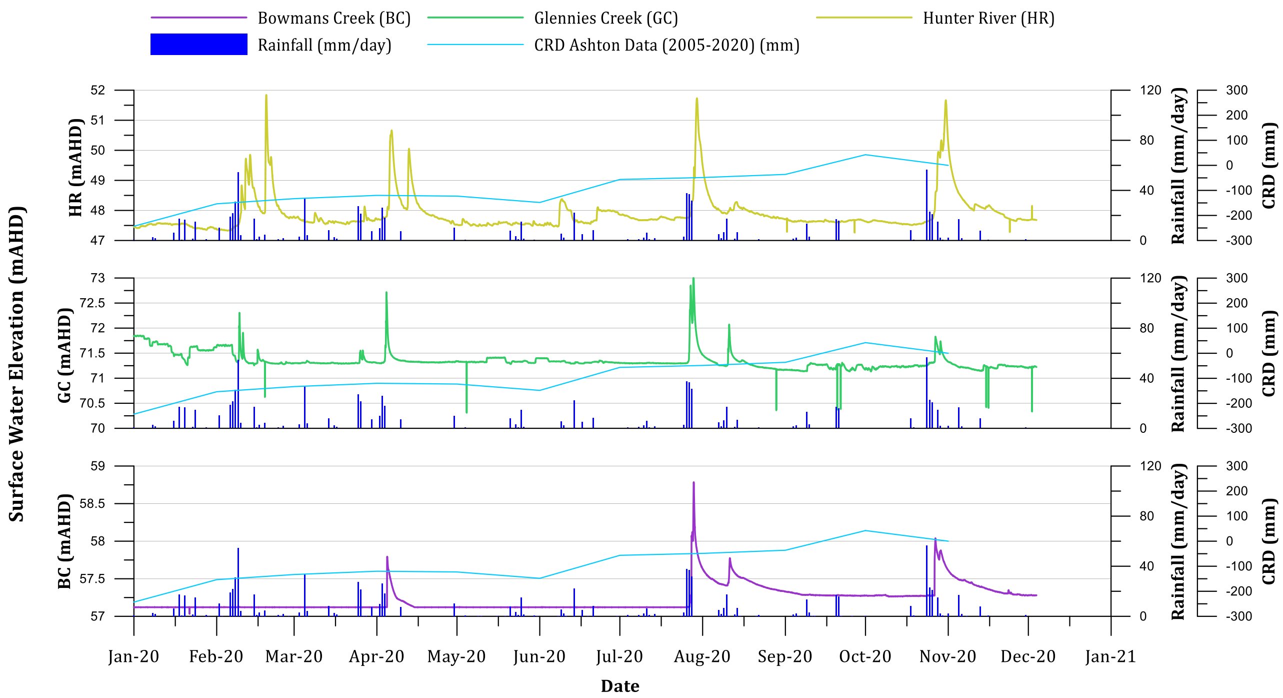
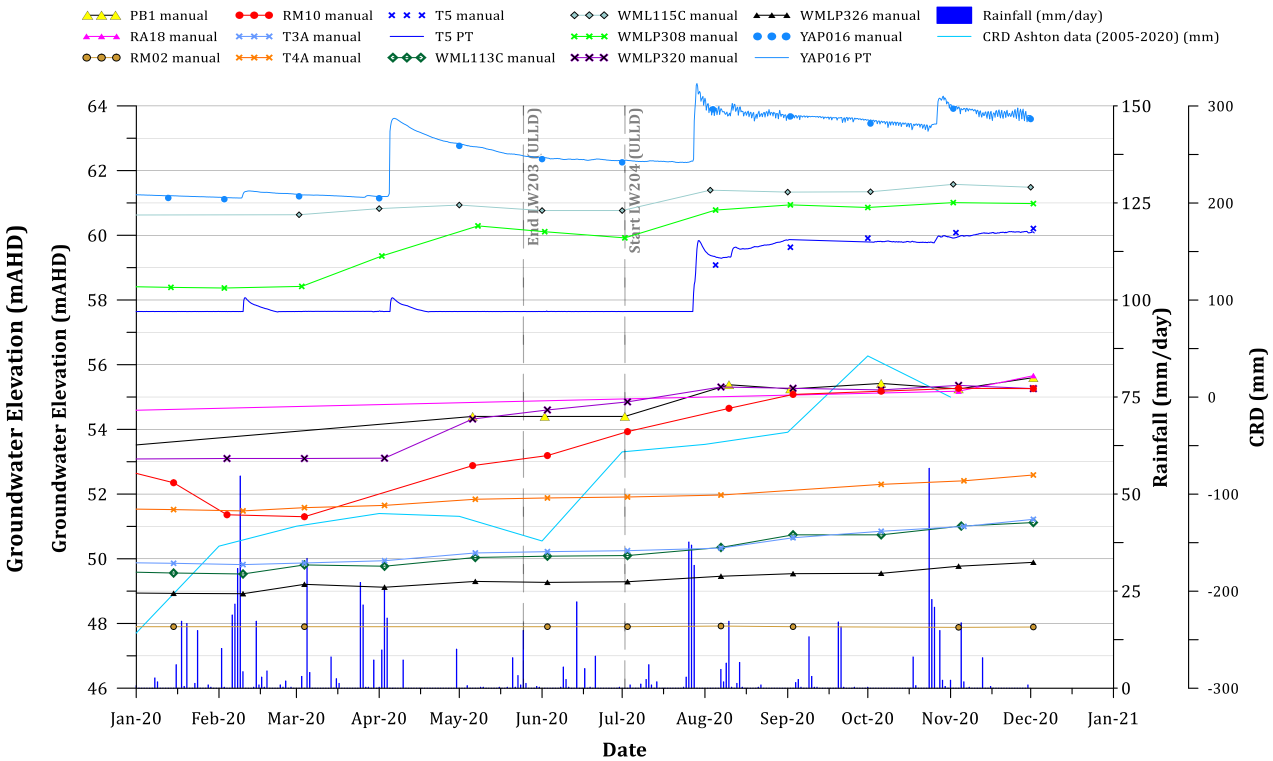


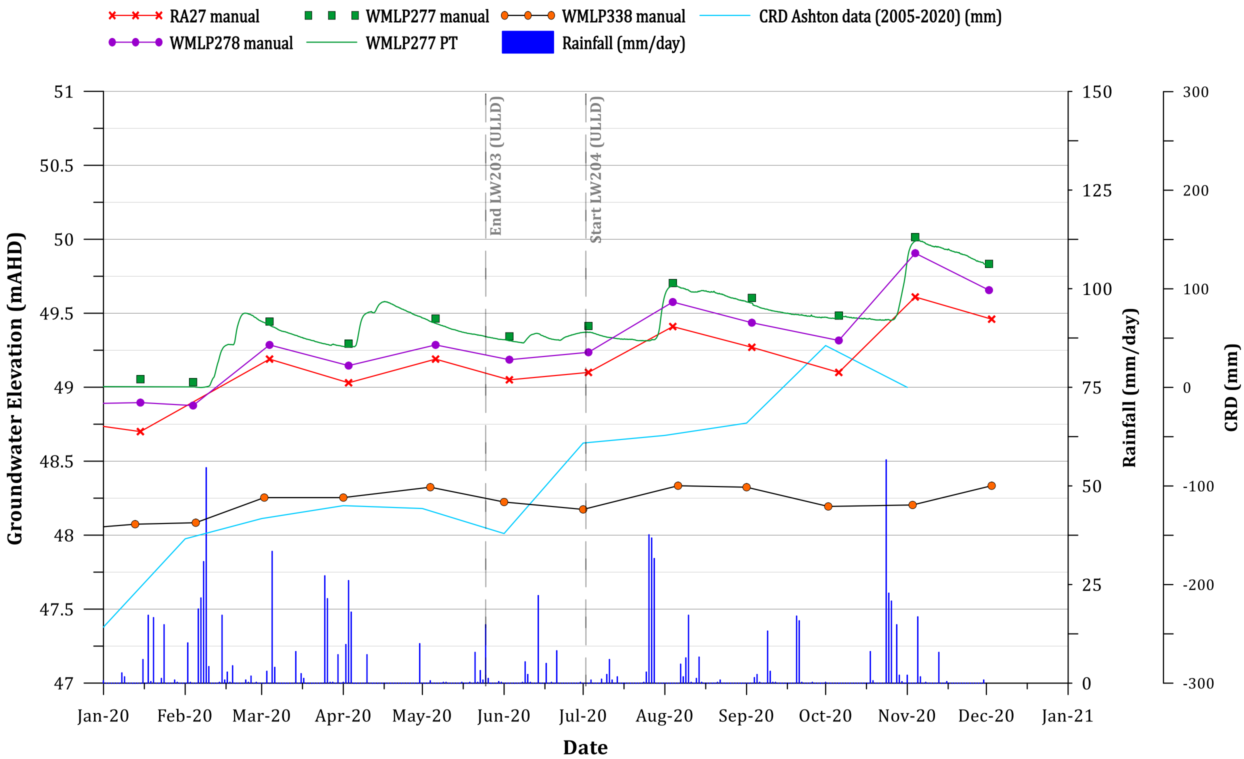

**Figure 4.5 Surface water level hydrographs**

### *4.1.2 Other alluvium groundwater levels*

Groundwater level trends observed in 2020 for other BCA and HRA monitoring bores across the monitoring network are presented in Figure 4.6 and Figure 4.7, respectively. Daily rainfall measurements and CRD have been plotted and used to assess water level trends. As for the BCA regulatory bores, the other BCA alluvial bores recorded an overall increase in water levels. Previously dry monitoring bores T5 and RA18 recorded water levels in August and November, respectively. The other HRA bores responded to increased rainfall throughout 2020 with water levels increasing throughout the year. No mining impacts outside of predictions are noted.




## Figure 4.6 Other Bowmans Creek alluvium monitoring bore hydrographs




## Figure 4.7 Other Hunter River alluvium monitoring bore hydrographs

### *4.1.3 pH, electrical conductivity and major ions*

All alluvial bores across the ACP monitoring network were sampled for pH, EC and major ions throughout 2020, and the results are presented graphically in Figure 4.8 through to Figure 4.22. A complete table of results for the aforementioned parameters is presented in Table D1; together with comprehensive analysis measurements recorded during annual sampling in August 2020. All associated laboratory files can be found in Appendix F.

As has been the case in preceding years, groundwater pH in alluvial bores was slightly acidic to neutral in 2020. One bore recorded an exceedance of pH trigger value throughout the year (WMLP349), however the event was not consecutive and as such did not require a response under the WMP. Values for pH were stable in 2020, generally ranging from pH 6.5 to 7.5, with only a few outliers outside this range. Discrepancies in pH were minor and considered within natural variation. The specific pH ranges measured within the BCA, GCA and HRA in 2020 were:

- BCA – pH 6.62 (WMLP323) to 7.62 (RM10);
- GCA – pH 6.25 (WMLP358) to 7.10 (WMLP343); and
- HRA – pH 6.52 (WMLP336) to 7.28 (WMLP337).

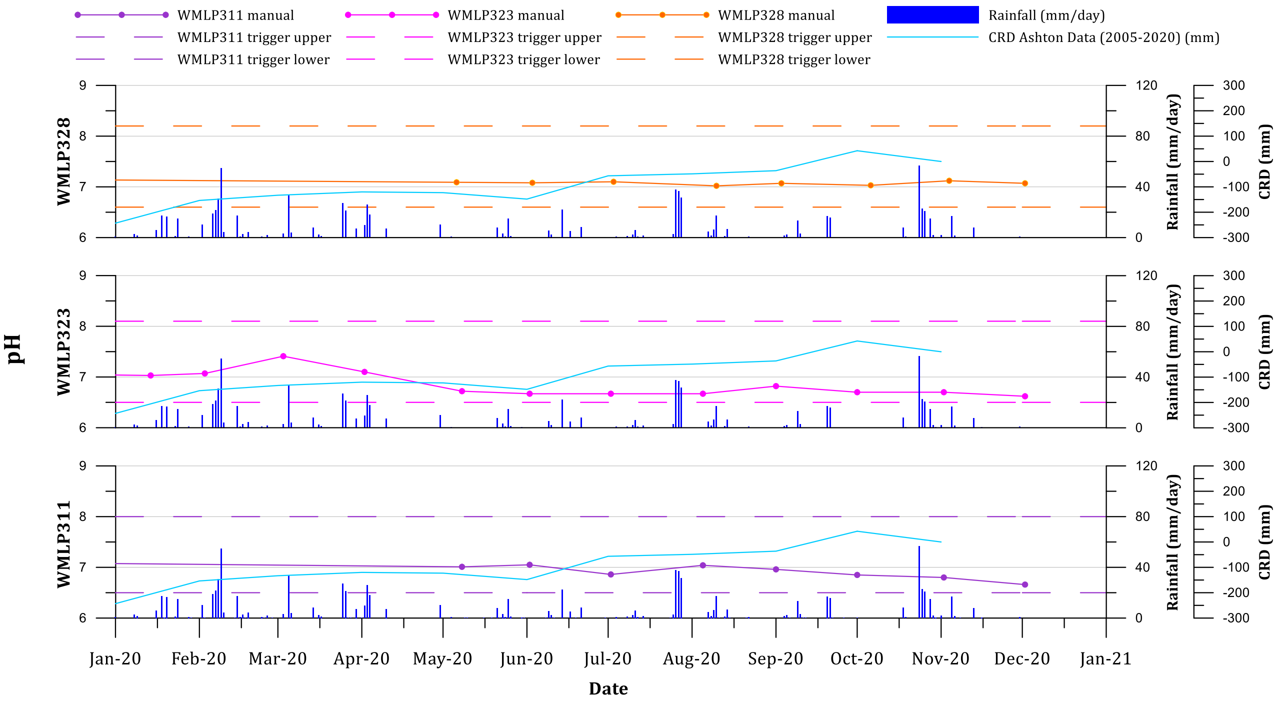
Groundwater EC was fresh to slightly brackish across the BCA, GCA and HRA monitoring network over 2020; mirroring the conditions in previous years. Two bores exceeded EC triggers over three consecutive periods during 2020 – monitoring bores WMLP323 and WMLP328. These bores are BCA bores and have been investigated (AGE, 2020). The investigation concluded that BCA EC levels have increased as a result of reduced rainfall since 2018. A prolonged dry period decreased water levels in all the bores to unprecedented levels. This allowed salts to accumulate in the unsaturated zone. These salts were then remobilised by a rising water table after significant rainfall in early 2020, causing the EC exceedances in groundwater at WMLP323 and WMLP328.

GCA and HRA EC levels in 2020 were steady overall, with the exception of HRA bores WMLP337 and WMLP279 which both recorded declining EC values over the year. BCA bores WML113C, WMLP328, WMLP323 and WMLP311 all recorded a significant decline in EC over the 2020 monitoring period. For alluvial bores, the observed EC ranges in 2020 were:

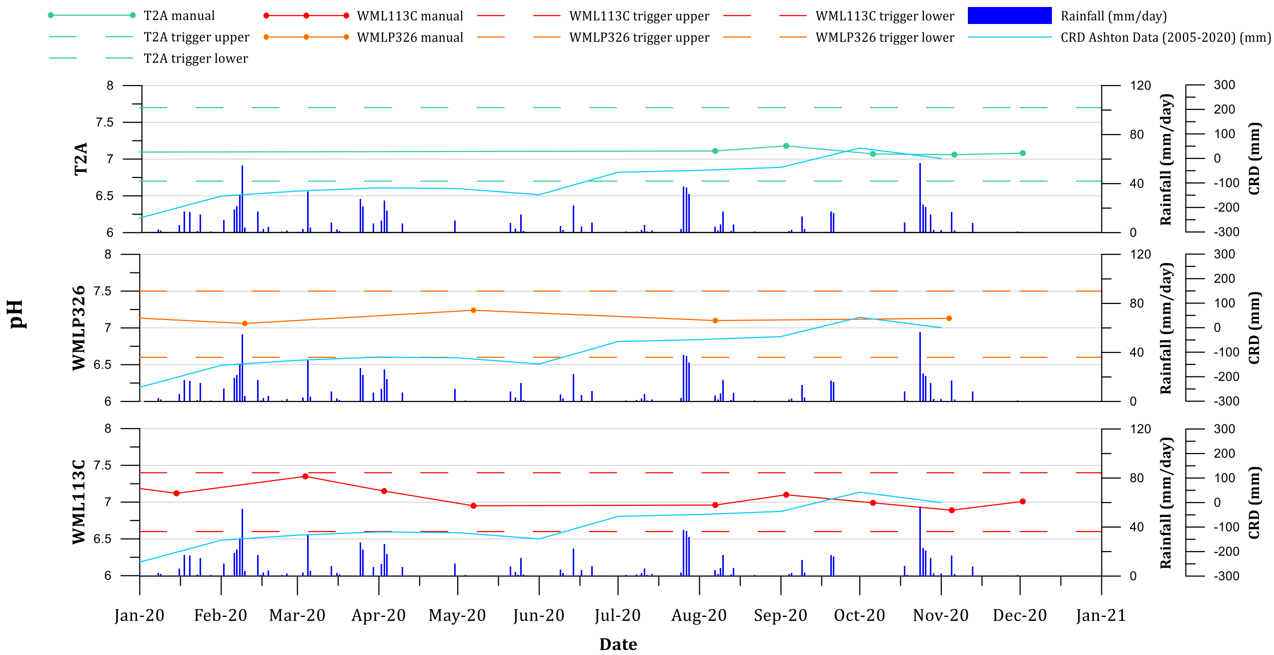
- BCA – 732 (WMLP311) to 3,680 µS/cm (PB1);
- GCA – 323 (WMLP358) to 902 µS/cm (WMLP349); and
- HRA – 509 (WMLP336) to 2,945 µS/cm (WMLP337).

River and creek EC levels (sourced from the WaterNSW online database) were also examined over 2020. Bowmans Creek remained dry at the gauge until August 2020, with EC increasing thereafter until decreasing suddenly following heavy rainfall in late October. Glennies Creek EC was stable throughout the year. Hunter River EC oscillated over the course of 2020, with fluctuations remaining within historic ranges.

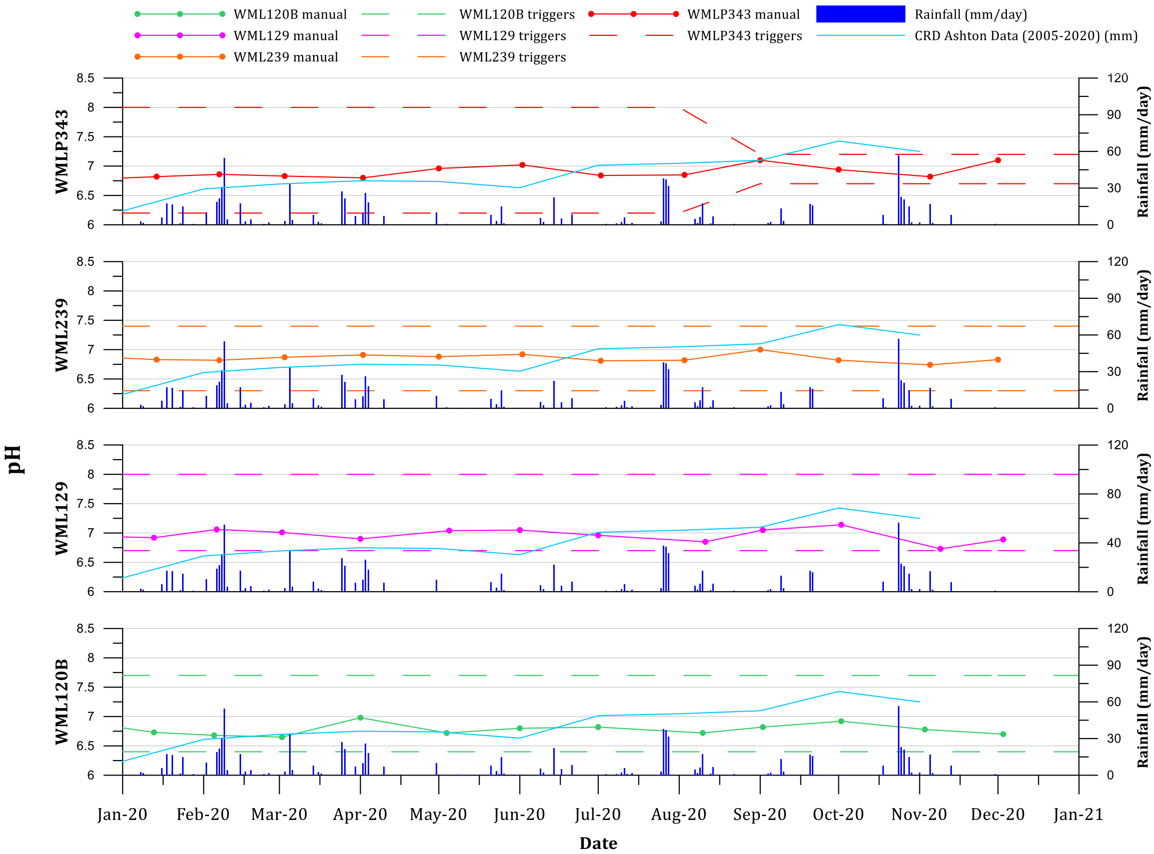
The major ion content of each alluvial system was also assessed in 2020 as shown in the classification table and Piper diagram from August 2020 (Appendix E). The cation water type in all monitoring bores were Na or Ca dominant. With respect to anions, Cl dominates over $HCO_3$ and $SO_4$ ions in the alluvial monitoring bores. The BCA and HRA water types are similar and can be distinguished from the GCA water types due to the water source and the recharge/discharge mechanism associated with each body.



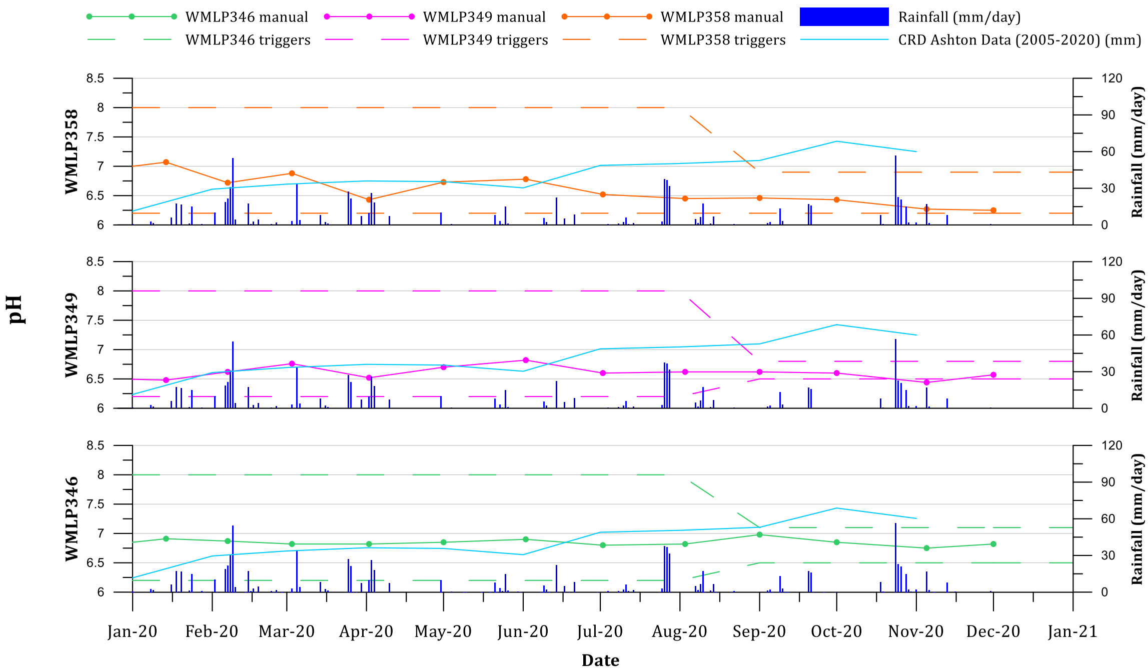

## Figure 4.8 Bowmans Creek alluvium trigger bore pH trends (1)



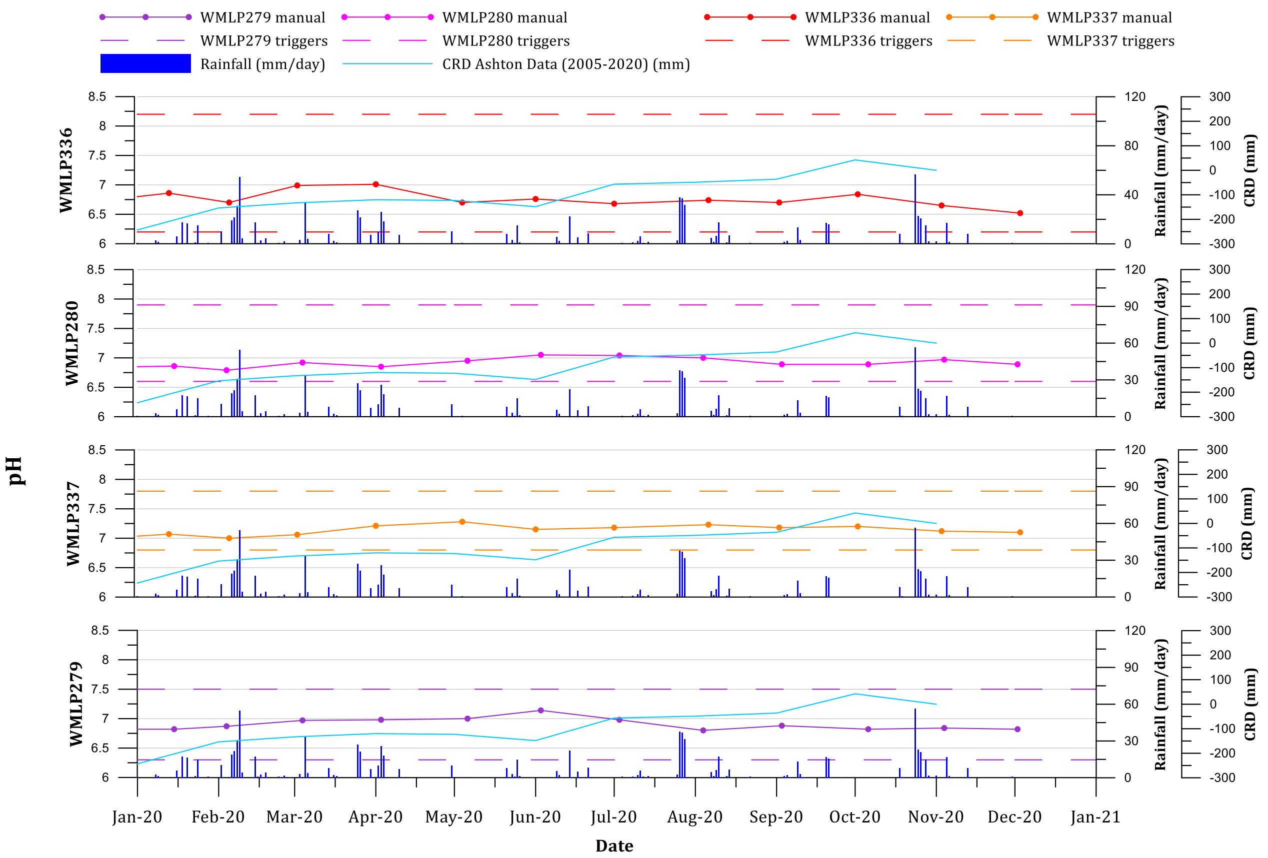

## Figure 4.9 Bowmans Creek alluvium trigger bore pH trends (2)



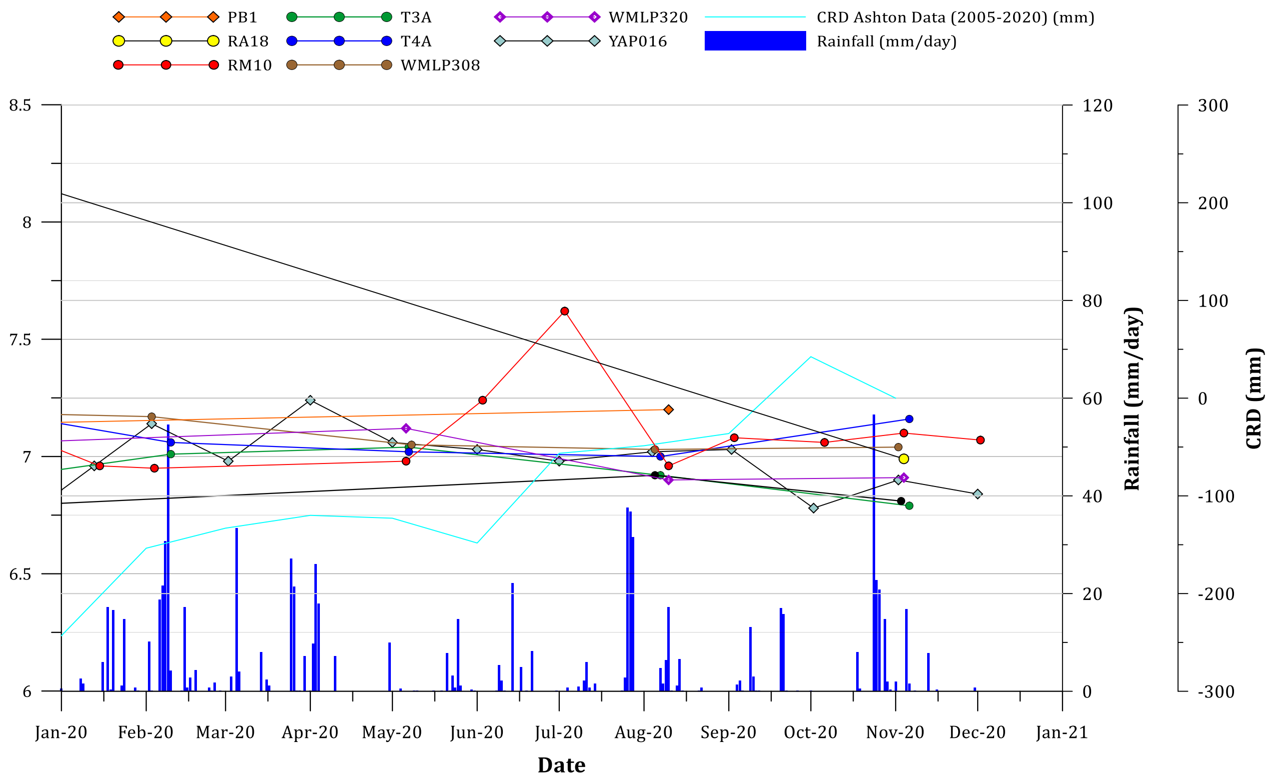

# Figure 4.10 Glennies Creek alluvium trigger bore pH trends (1)



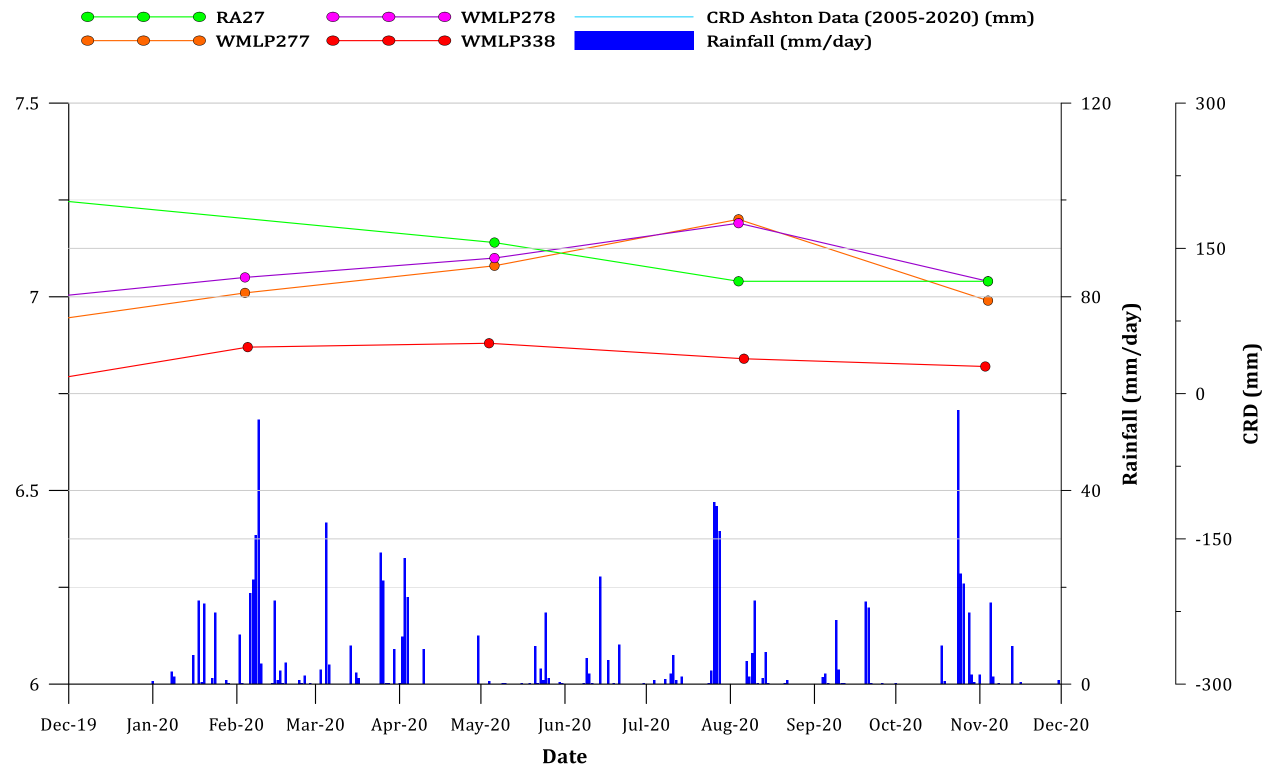

# Figure 4.11 Glennies Creek alluvium trigger bore pH trends (2)



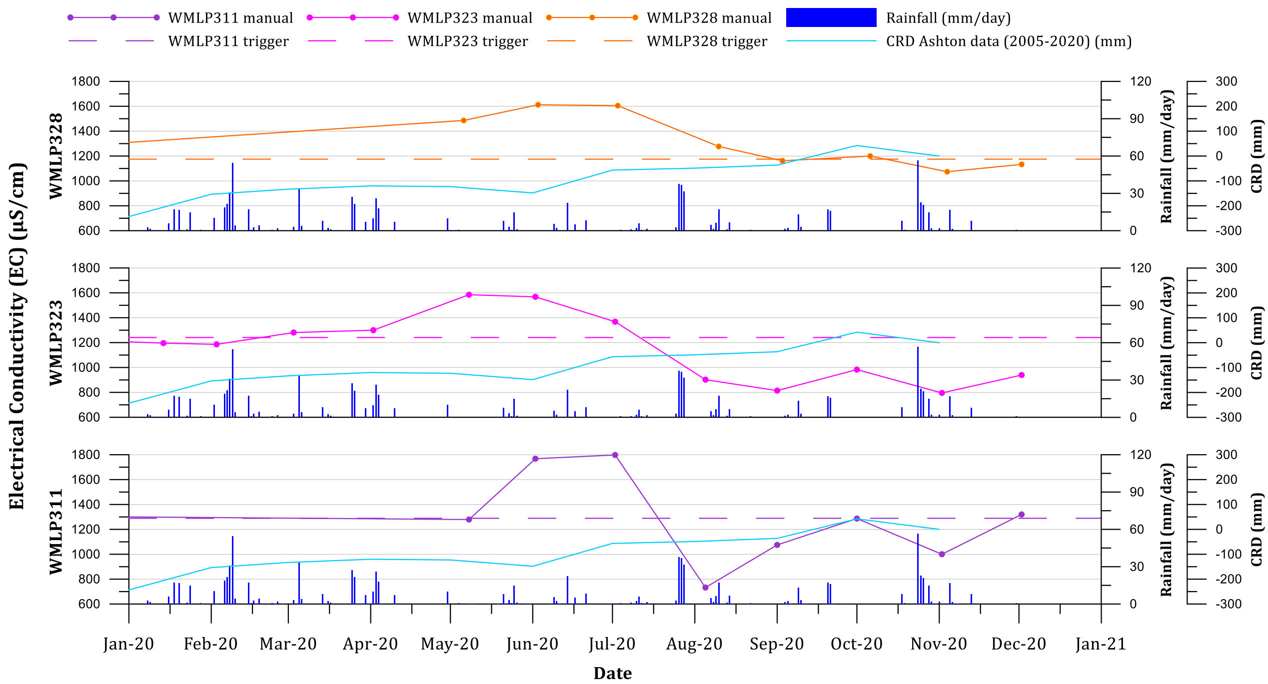

## Figure 4.12 Hunter River alluvium trigger bore pH trends




## Figure 4.13 Other Bowmans Creek alluvium bore pH trends




## Figure 4.14 Other Hunter River alluvium bore pH trends




## Figure 4.15 Bowmans Creek alluvium trigger bore EC trends (1)

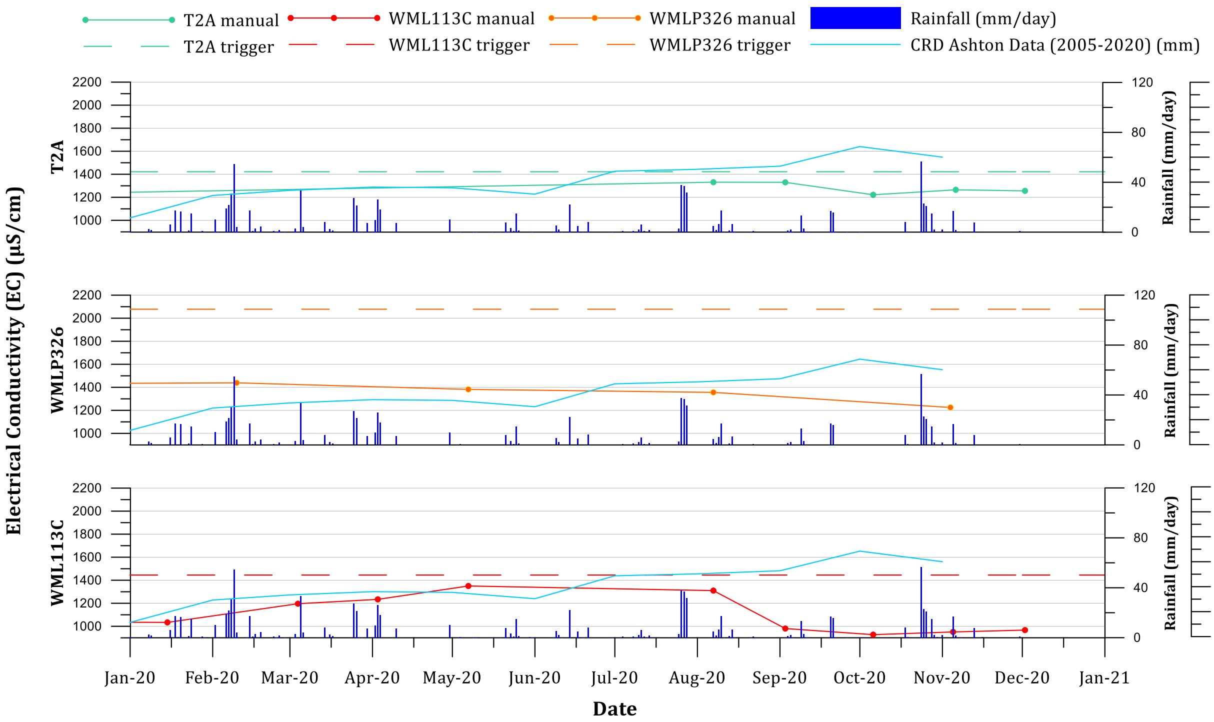



**Figure 4.16 Bowmans Creek alluvium trigger bore EC trends (2)**

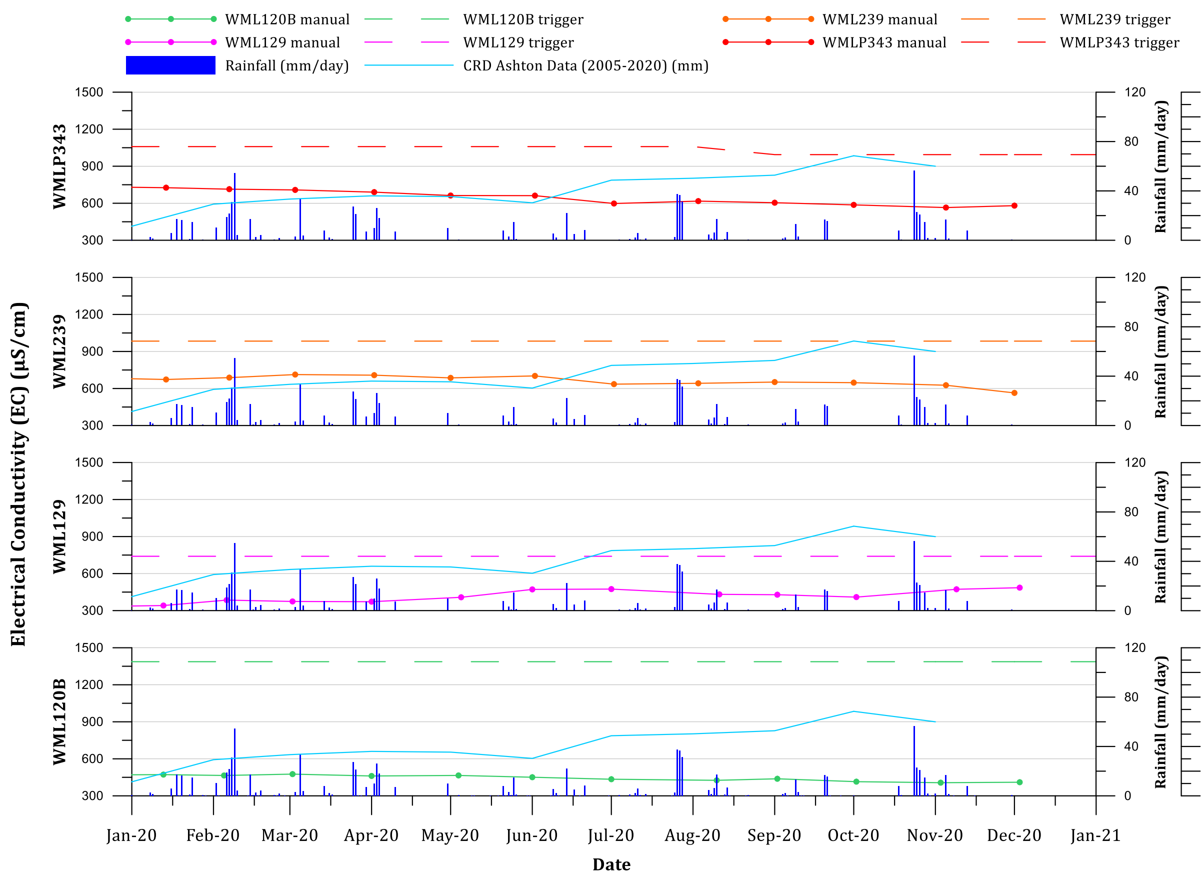
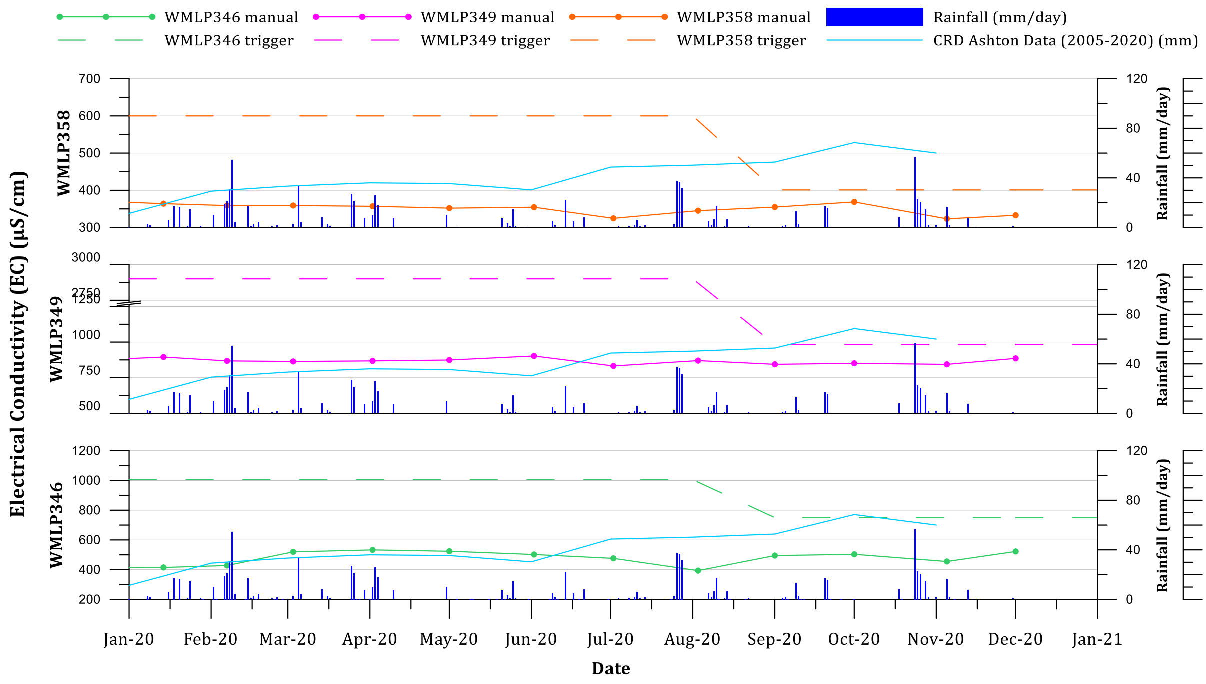
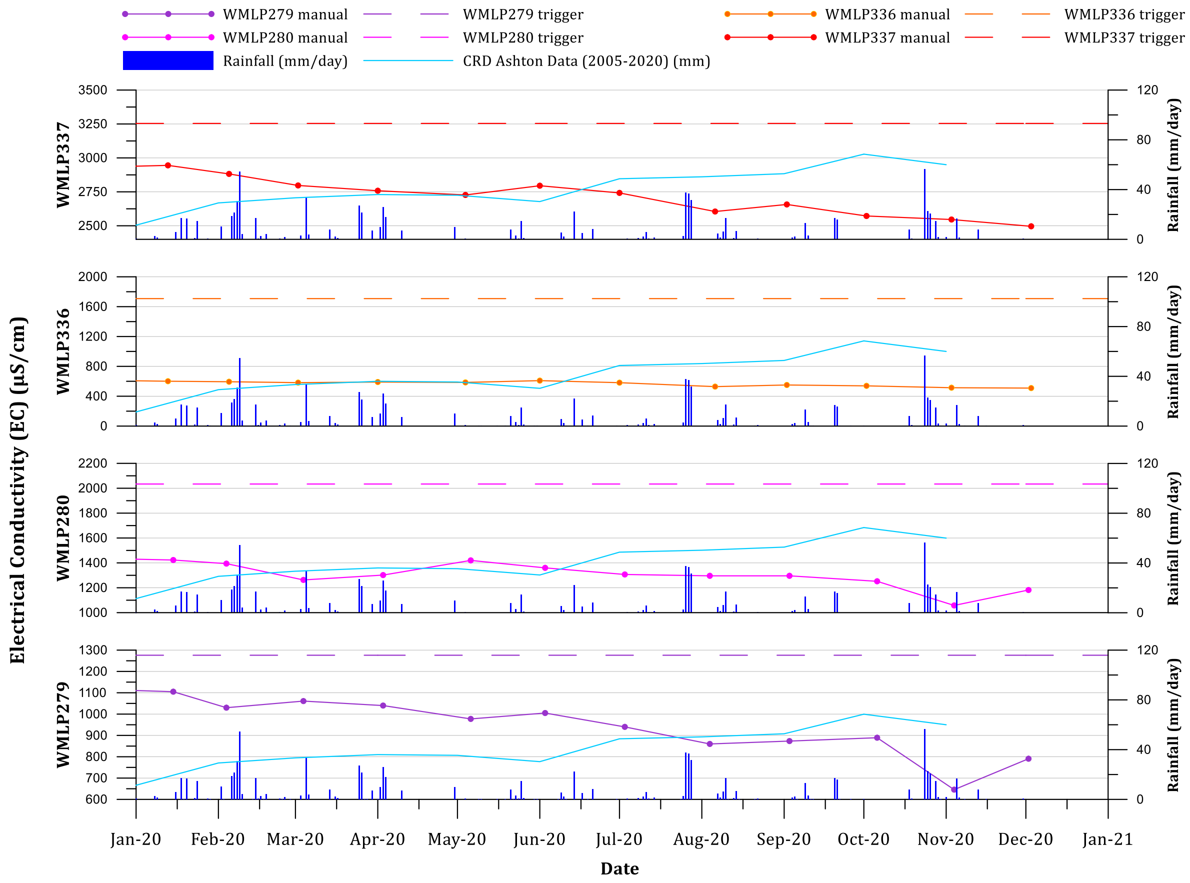



**Figure 4.17 Glennies Creek alluvium trigger bore EC trends (1)**




## Figure 4.18 Glennies Creek alluvium trigger bore EC trends (2)




## Figure 4.19 Hunter River alluvium trigger bore EC trends

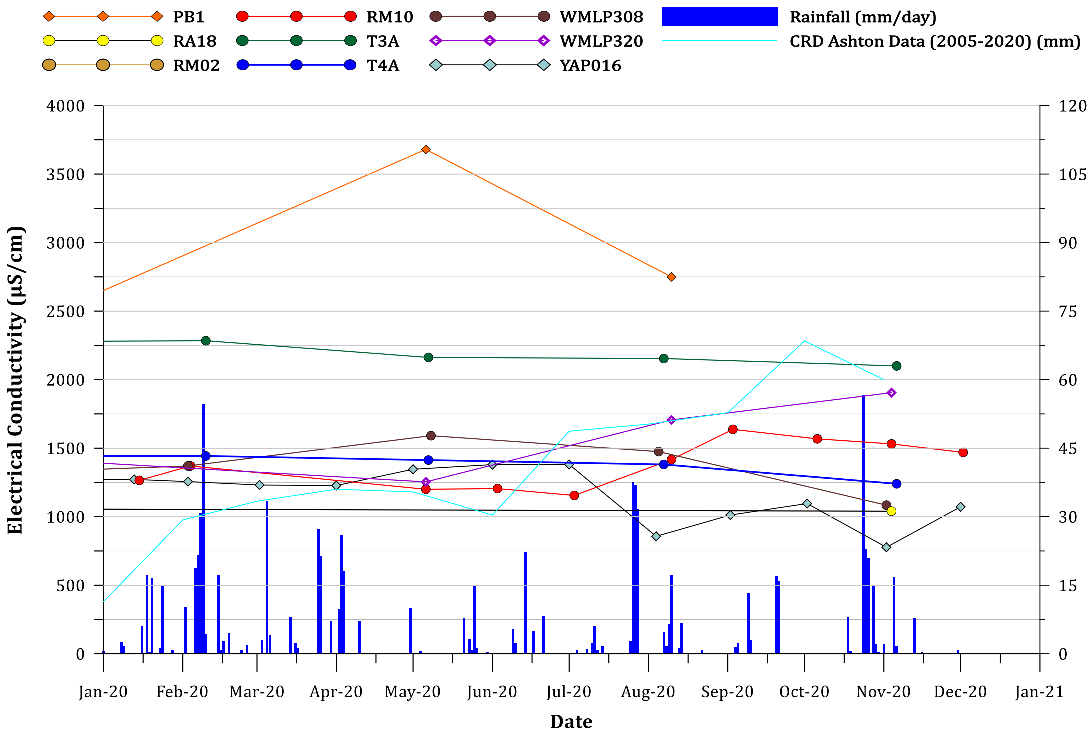



**Figure 4.20 Other Bowmans Creek alluvium bore EC trends**

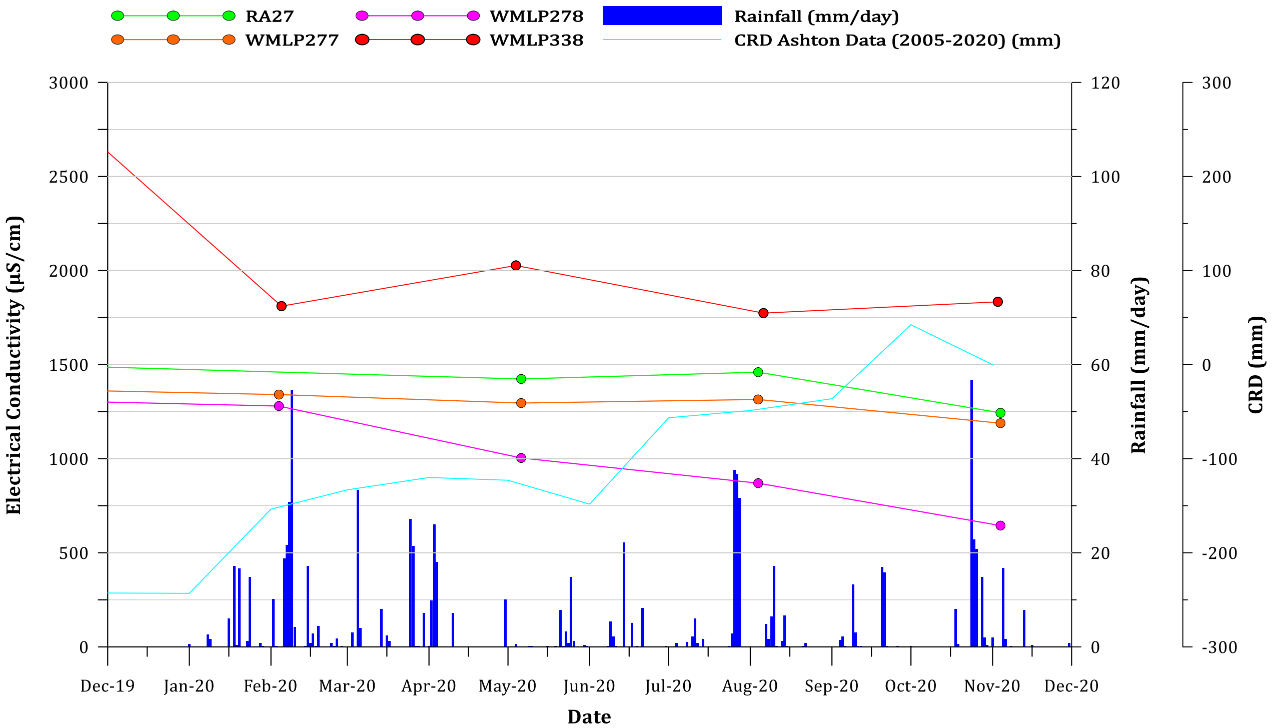



**Figure 4.21 Other Hunter River alluvium bore EC trends**

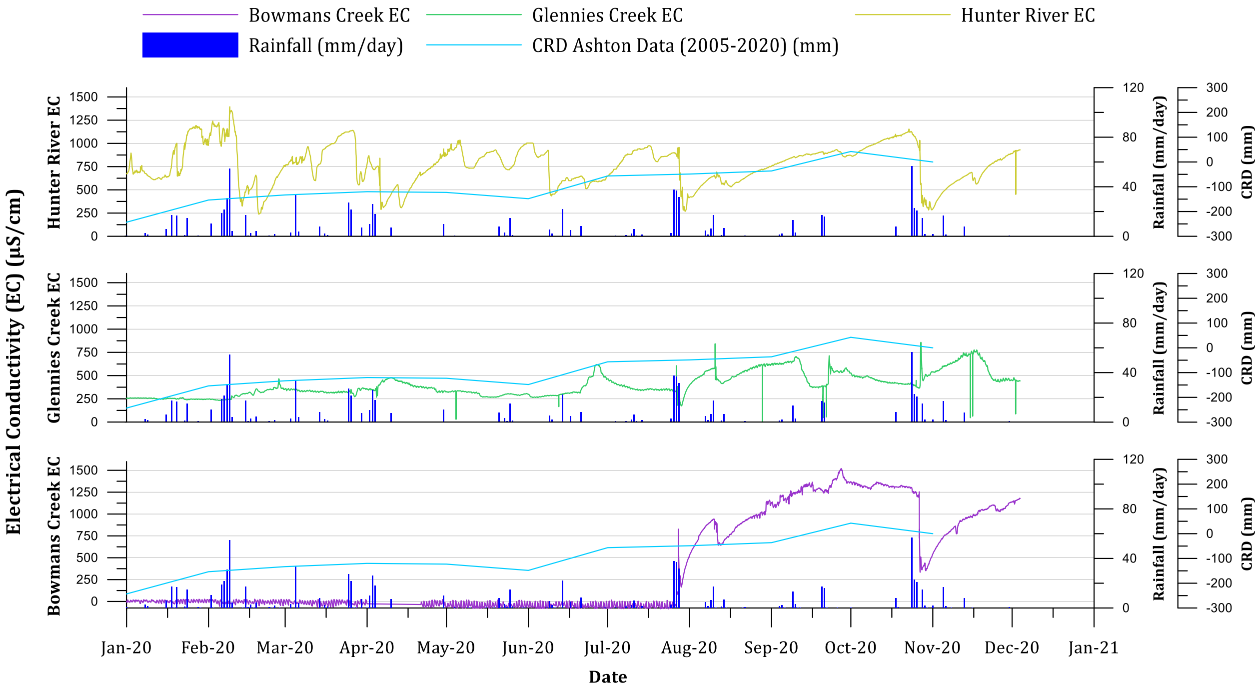



**Figure 4.22 Surface water EC trends**

### *4.1.4 Dissolved metals, select nutrients, turbidity and cyanide*

Comprehensive lab analysis during August 2020 incorporated the measurement of select dissolved metals, select nutrients, turbidity and cyanide as tabulated in Appendix D. Dissolved metals concentrations were compared against ANZECC|ARMCANZ livestock limits (ANZECC & ARMCANZ, 2000), revealing no breaches for any of the metals assessed (arsenic, cadmium, chromium, copper, lead, nickel, selenium and zinc). Manganese and iron were detected at very low concentrations, though neither of these metals are regarded as specifically toxic at such concentrations; and no ANZECC|ARMCANZ livestock limit is established for these metals.

Select nutrients analysis included nitrite and nitrate as N, total Kjeldahl nitrogen as N, total nitrogen as N and total phosphorous as P. All N related concentrations were low, and no nitrate concentration was close to 400 mg/L. Nor was any nitrite concentration near 30 mg/L as defined in the ANZECC|ARMCANZ livestock standards. Total N figures were significantly less than the short-term trigger range of 25- 125 mg/L. Several bores exceeded the lower trigger of P concentration (0.8-12 mg/L), however it is outlined in the guidelines that the value or range for P needs to be determined specific to a site. No site- specific analysis has been conducted at Ashton to define an appropriate P trigger at this time. Turbidity does not have a defined livestock limit for comparison, though analysis of the results indicates that bores that are typically hand bailed rather than pumped yield the greatest turbidity. Cyanide concentrations were so low across samples that no reading was detected above the limit of reporting (LOR). Cyanide levels did not breach any outlined standards.

## 4.2 Coal measure and coal measure overburden (CMOB) aquifer monitoring

Groundwater level and quality measurements for coal measure and CMOB monitoring bores were taken throughout 2020. Longwall specific VWP pressure heads were also recorded. Hydrographs for these bores are presented in Figure 4.23 through to Figure 4.31.

### *4.2.1 Coal measure and CMOB aquifer groundwater levels*

The groundwater level trends for coal measure and CMOB monitoring bores are presented in Figure 4.23 and Figure 4.24, respectively. Groundwater level measurements for LW203 specific monitoring bores are presented in Figure 4.25, and groundwater trends for the recently started longwall LW204 are depicted in Figure 4.26. Longwall specific VWP readings for LW203 and LW204 are shown in Figure 4.27. Daily rainfall measurements and CRD have also been plotted and used to compare water level trends.

The following observations can be noted for 2020:

- Water levels were relatively stable in coal measure bores, except for monitoring bore GM1 which fluctuated throughout the year (Figure 4.23).
- Groundwater elevation in CMOB bores generally increased in 2020, correlating with an increasing CRD (Figure 4.24).
- Groundwater levels in monitoring bores within the vicinity of LW203 and LW204 remained stable over 2020 (Figure 4.25 and Figure 4.26, respectively).
- VWP measurements in WMLP269 (adjacent LW203/204) remained stable throughout the year (Figure 4.27), except for Lemington 7 and Lemington 19 sensors. Lemington 7 recorded a decline in pressure head in August, stabilising thereafter. Lemington 19 also recorded a pressure head decline in August, with pressure head remaining depressed thereafter. No impacts associated with mining of LW203/LW204 are evident from VWP monitoring in 2020. However, it should be noted that VWP WMLP269 is not situated particularly close to LW203 and is only used as the monitoring reference as it is the closest proximity VWP to current mining operations.
- Overall, coal measure and CMOB bores did not appear to be impacted by mining outside of predictions in 2020.

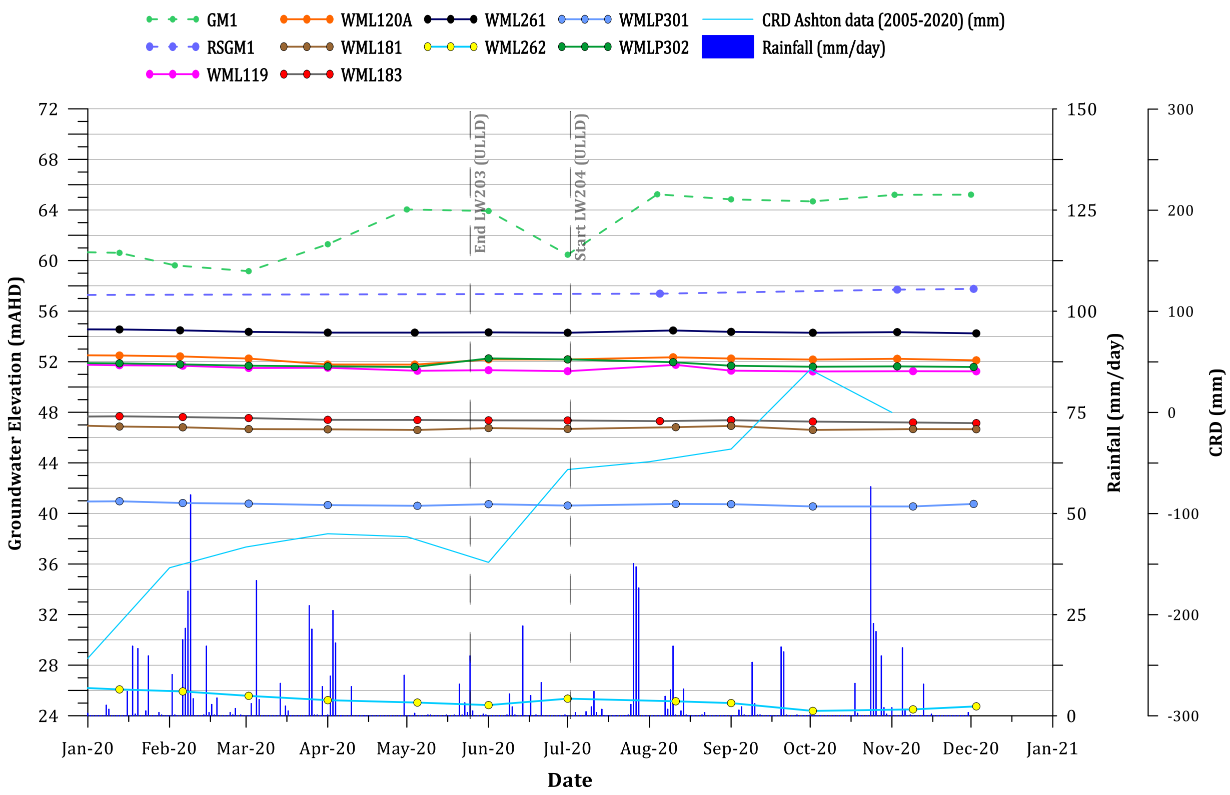
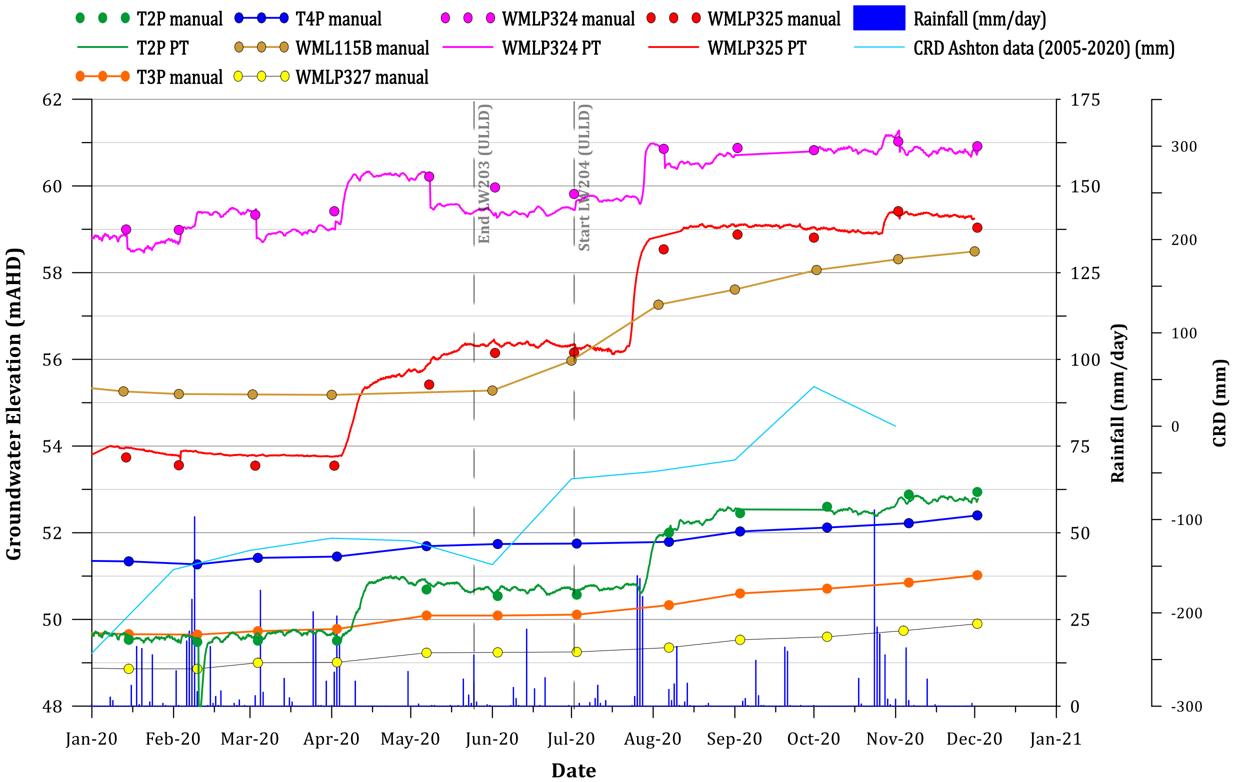
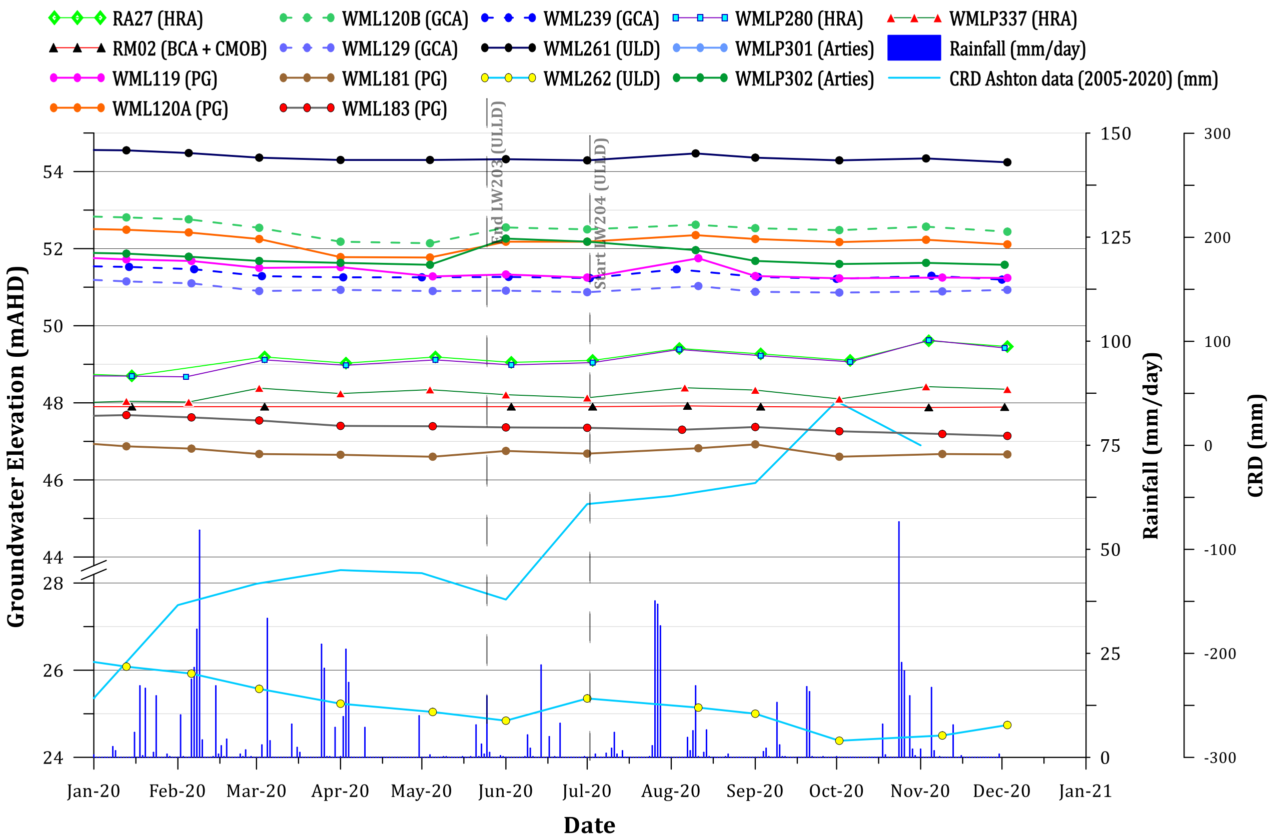


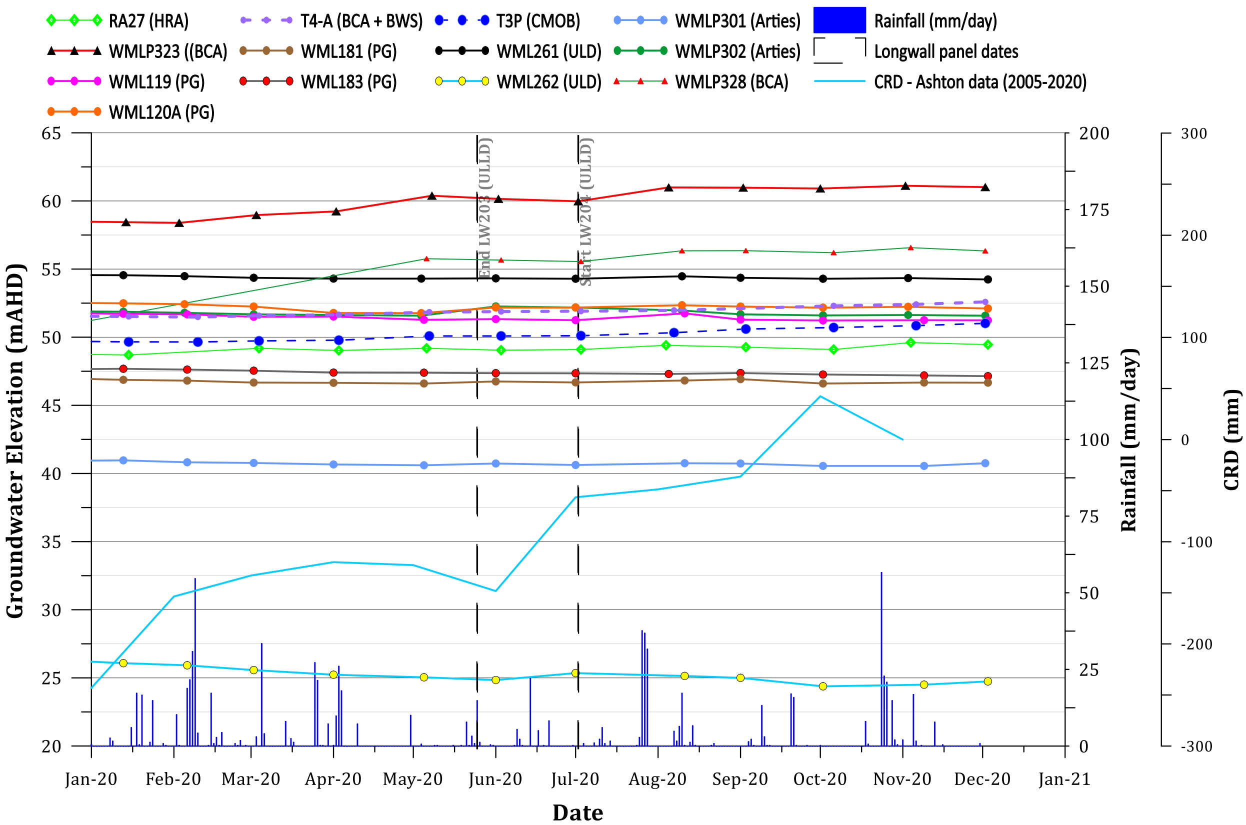

**Figure 4.23 Coal measure bore hydrographs**



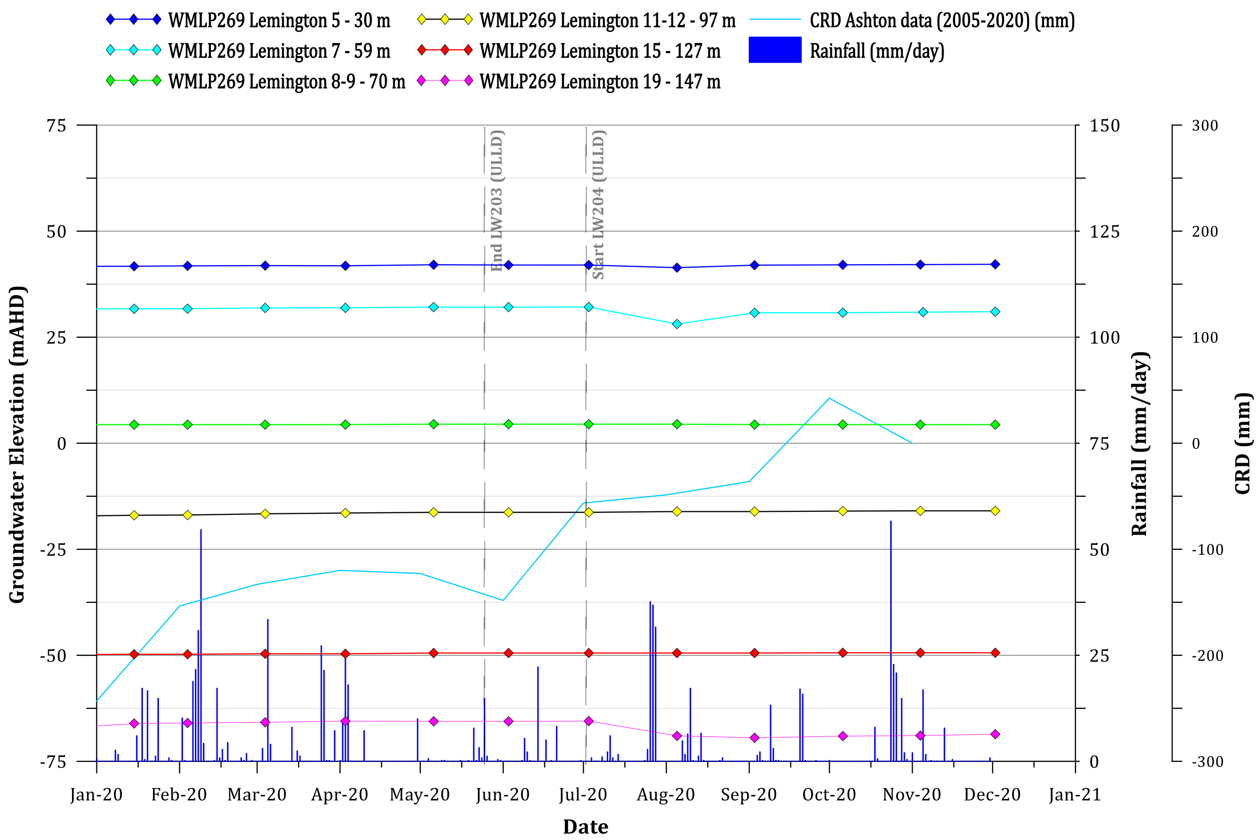

## Figure 4.24 Coal measure overburden bore hydrographs




## Figure 4.25 Hydrographs for monitoring bores in vicinity of LW203




## Figure 4.26 Hydrographs for monitoring bores in vicinity of LW204




## Figure 4.27 Hydrographs for VWP WMLP269 in vicinity of LW203/LW204

### 4.2.2 pH, electrical conductivity and major ions

Coal measure and CMOB bores across the ACP monitoring network were sampled for pH, EC and major ions during 2020, and the results are presented graphically in Figure 4.28 through to Figure 4.31. A complete table of results for the aforementioned parameters is presented in Appendix D; together with comprehensive analysis measurements recorded during annual sampling in August 2020. All associated laboratory files can be found in Appendix F.

Groundwater pH in coal measure and CMOB bores was generally neutral to slightly alkaline in 2020, as has been the case in previous years. pH readings were broadly stable over 2020, predominantly ranging from pH 6.75 to 8. Exceptions to the outlined pH range were few and minor, with the degree of variation considered within natural variation. The specific pH ranges measured within coal measure and CMOB bores in 2020 were:

- Coal measure – pH 6.42 (WMLP302) to 8.08 (WML262); and
- CMOB – pH 6.61 (T2P) to 7.50 (T3P).

Groundwater EC was fresh to brackish across the coal measure and CMOB monitoring network in 2020. EC levels were relatively steady throughout 2020, except for WMLP325 which recorded a sharp drop in EC between the May and August monitoring round. No other prevailing trends were evident. Minor fluctuations occurred during the year, though the overall trend was stable. EC ranges for coal measure and CMOB bores in 2020 were:

- Coal measure – 580 (WML120A) to 4,218 µS/cm (WML183); and
- CMOB – 896 (WMLP324) to 2,408 µS/cm (WML115B).

The major ion content for coal measure and CMOB bores was also assessed in 2020 (Appendix E). The cation water type in all monitoring bores were Na or Ca dominant . With respect to anions, Cl dominates coal measure and CMOB monitoring bores. The coal measure water types are easily distinguished from the CMOB water types with coal measure bores bearing greater Mg concentration, whilst CMOB bores contained higher Ca concentrations.

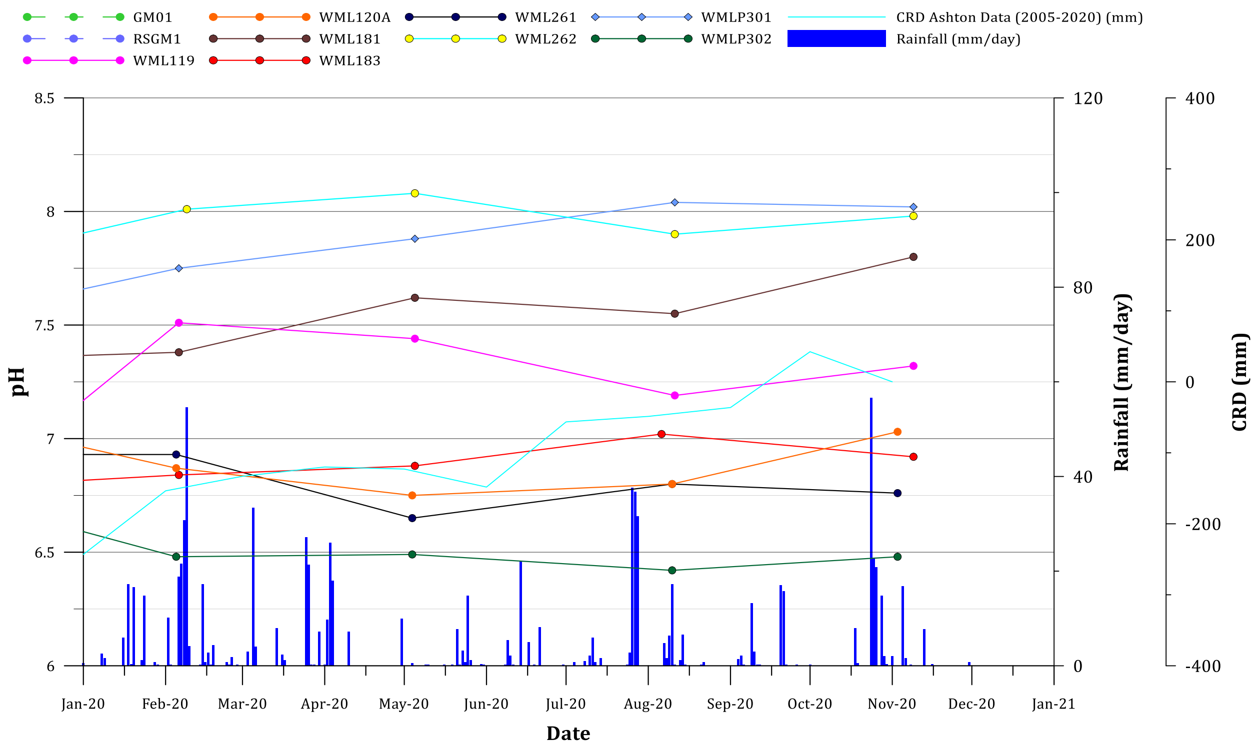



**Figure 4.28 Coal measure bore pH trends**

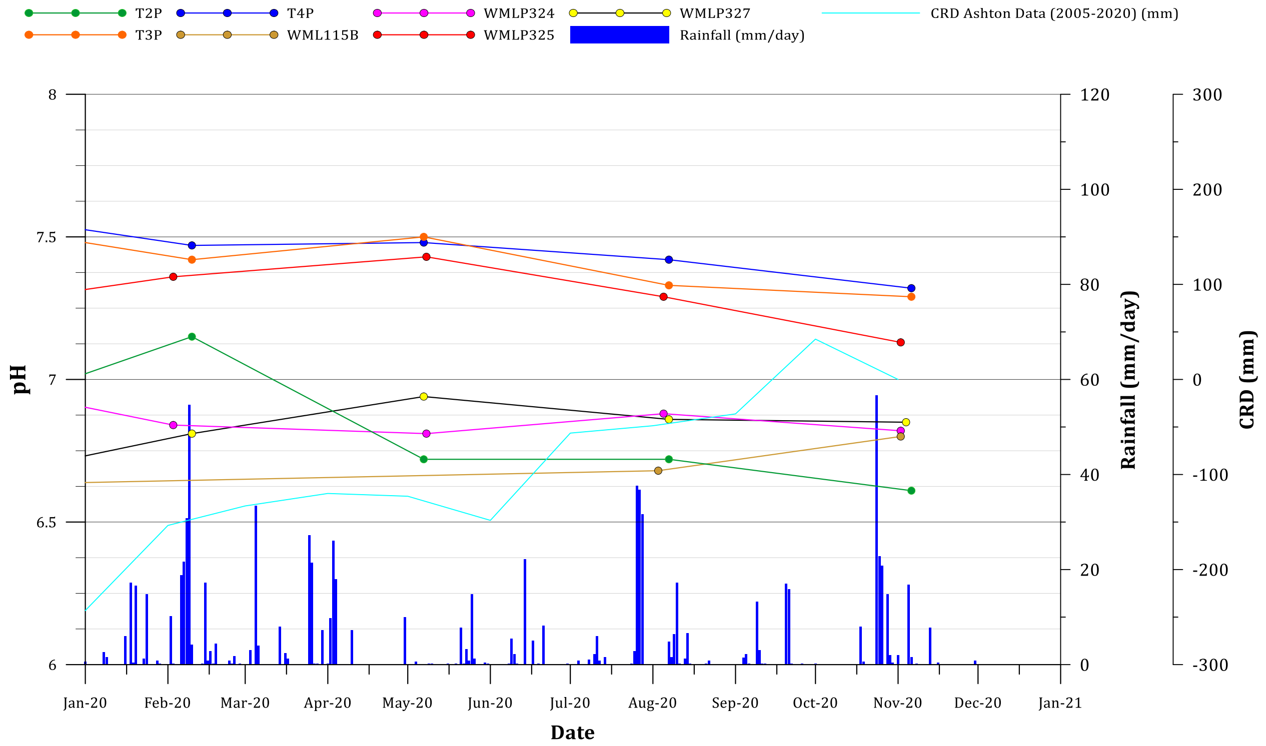



**Figure 4.29 Coal measure overburden bore pH trends**

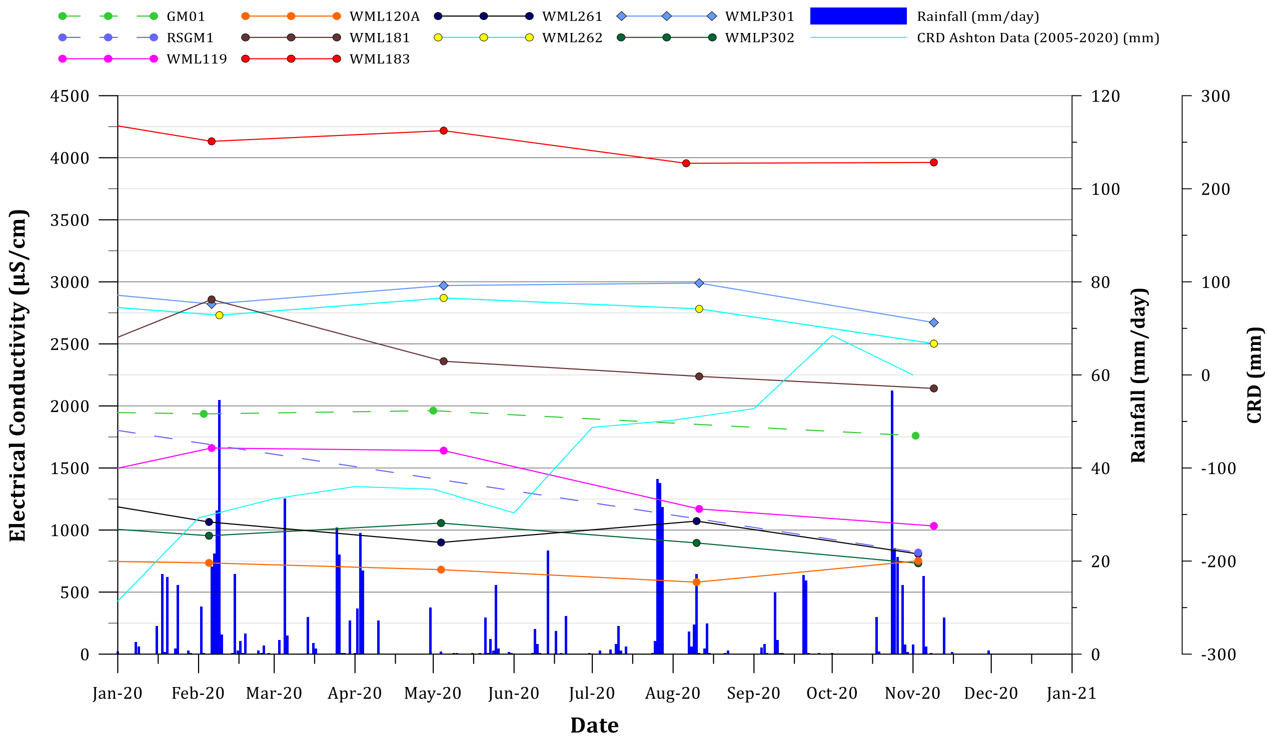



**Figure 4.30 Coal measure bore EC trends**

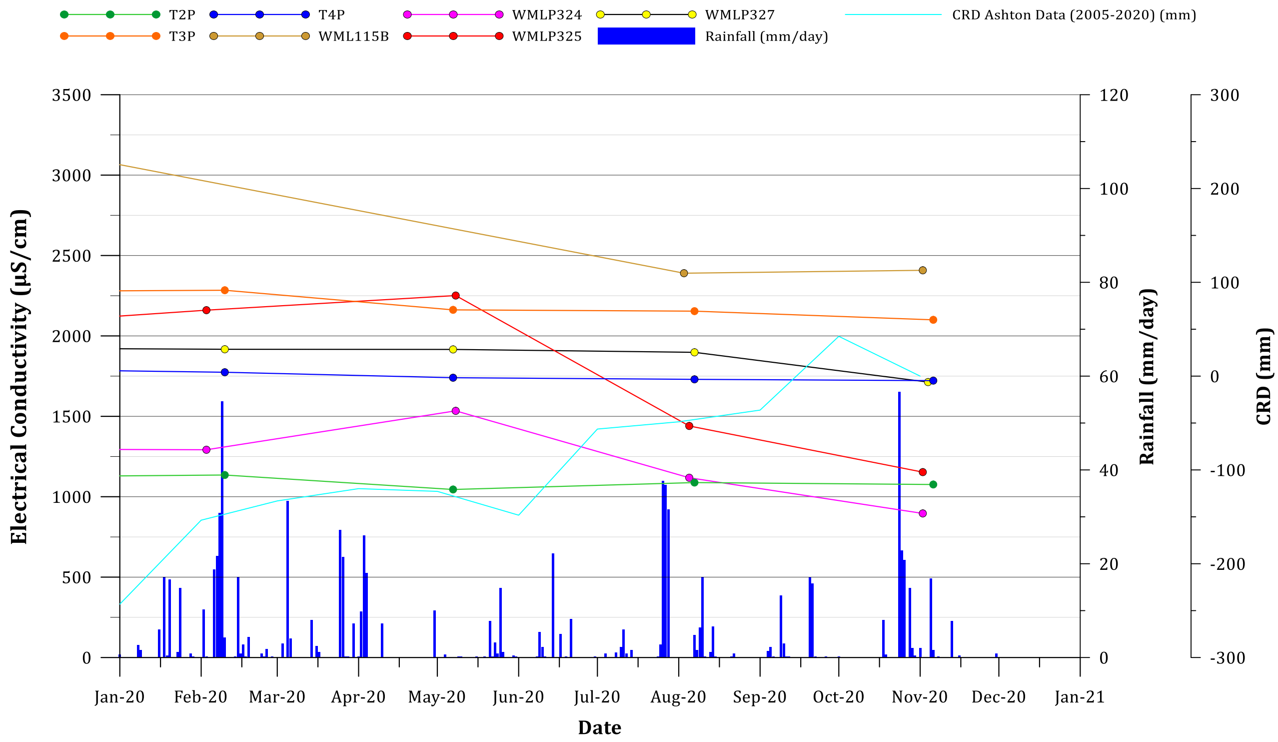



**Figure 4.31 Coal measure overburden bore EC trends**

### *4.2.3 Dissolved metals, select nutrients, turbidity and cyanide*

Comprehensive lab analysis during August 2020 incorporated the measurement of select dissolved metals, select nutrients, turbidity and cyanide as tabulated in Appendix D.

Dissolved metals concentrations were compared against ANZECC|ARMCANZ livestock limits (ANZECC & ARMCANZ, 2000), revealing no breaches for any of the metals assessed (arsenic, cadmium, chromium, copper, lead, nickel, selenium and zinc). Manganese and iron were detected at very low concentrations, though neither of these metals are regarded as specifically toxic at such concentrations; and no ANZECC|ARMCANZ livestock limit is established for these metals.

Select nutrients analysis included nitrite and nitrate as N, total Kjeldahl nitrogen as N, total nitrogen as N and total phosphorous as P. All N related concentrations were low, and no nitrate concentration was close to 400 mg/L. Nor was any nitrite concentration near 30 mg/L as defined in the ANZECC|ARMCANZ livestock standards. Total N figures were significantly less than the short-term trigger range of 25- 125 mg/L. Several bores exceeded the lower trigger of P concentration (0.8-12 mg/L), however it is outlined in the guidelines that the value or range for P needs to be determined specific to a site. No site- specific analysis has been conducted at Ashton to define an appropriate P trigger at this time. Turbidity does not have a defined livestock limit for comparison, though analysis of the results indicates that bores that are typically hand bailed rather than pumped yield the greatest turbidity. Cyanide concentrations were so low across samples that no reading was detected above the limit of reporting (LOR). Cyanide levels did not breach any outlined standards.

# 5 EPL 11879 monitoring bores

Results for 2020 monitoring of EPL 11879 monitoring bores (per Licence Variation November 2019) are summarised in Table 5.1 (levels) and Table 5.2 (EC).

**Table 5.1 EPL 11879 monitoring bore groundwater levels (2020)**

| Bore ID | Feb 2020 | Aug 2020 | Dec 2020 |
|---|---|---|---|
| | Groundwater levels (mTOC) | | |
| YAP016 | 6.18 | 3.40 | 3.70 |
| WMLP320 | 8.86 | 6.65 | 6.70 |
| WMLP279 | 13.28 | 12.51 | 12.54 |
| WMLP280 | 11.85 | 11.14 | 11.10 |
| WML120B | 7.75 | 7.89 | 8.07 |
| WML129 | 4.24 | 4.31 | 4.41 |
| WMLP336 | 12.20 | 12.21 | 12.15 |
| GM1 | 13.82 | 8.20 | 8.23 |
| WML120A | 8.53 | 8.60 | 8.84 |
| WML262 | 33.80 | 34.58 | 34.98 |
| WML181 | 17.49 | 17.48 | 17.64 |
| WML183 | 29.10 | 29.42 | 29.58 |

***Notes***: *mtoc = metres top of casing*.

## Table 5.2 EPL 11879 monitoring bore groundwater EC measurements (2020)

| Bore ID | Feb 2020 | Aug 2020 | Dec 2020 |
|---|---|---|---|
| | Groundwater EC (µS/cm) | | |
| YAP016 | 1256 | 857 | 1072 |
| WMLP320 | -* | 1706 | -$ |
| WMLP279 | 1030 | 860 | 791 |
| WMLP280 | 1394 | 1296 | 1182 |
| WML120B | 465 | 426 | 410 |
| WML129 | 385 | 432 | 486 |
| WMLP336 | 594 | 529 | 509 |
| GM1 | 1936 | 1908 | -$ |
| WML120A | 735 | 580 | -$ |
| WML262 | 2731 | 2782 | -$ |
| WML181 | 2858 | 2238 | -$ |
| WML183 | 4132 | 3955 | -$ |

***Notes:*** *$ No EC measurements recorded*

*# Registered a water level, but insufficient water to sample.*

# 6 Mine inflow

Ashton underground mine inflows are calculated through a review of dewatering abstraction volumes and a water balance assessment. The water balance assessment is the most appropriate tool to assess mine inflows as the volume of abstracted water comprises water from several sources, including but not limited to groundwater, surface water, incidental take and groundwater transitioning from the point of entry to the abstraction point. The transition time of this “stored” water is assumed to be in the order of years and is normally not considered inflow that has occurred in the past year. It is considered that the stored water is largely from the groundwater sources (predominantly hardrock) rather than surface water. A proportion of abstracted water is understood to have in-flowed prior to 2020 and was stored temporarily in the goaf. A proportion of the 2020 incidental take has continued to be stored underground or was lost through coal moisture and water vapour via outgoing air.

Data utilised in the assessment includes:

- metered water volumes pumped to the mine from the various sources;
- metered water abstracted from the mine;
- partitioned water takes (from the groundwater modelling) from the surface water sources and the separate groundwater sources; and
- estimate of stored water pumped from the mine.

These volumes are summarised in Table 6.1. During 2020, Ashton abstracted 396 ML of water via borehole 5 (BH5), borehole 6 (BH6) and the underground portal. Of that volume, 245.5 ML was introduced into the mine as operational water; therefore, the difference of 150.5 ML is considered a portion of the incidental water take. The remainder of the predicted incidental water (348.4 ML) is considered to be stored in the underground workings or to have been lost through the coal moisture and water vapour via out-by air. The value for estimated stored volume of incidental take of 348.4 ML is considered large and the water level in the underground workings has not increased recently. Therefore, we suggest that this value is not entirely representative of the inflow and that further investigation needs to be undertaken. Additionally, the site abstraction rate and metering should also be reviewed.

The groundwater model (AGE, 2020) predicted that the underground inflow rate into the mine for the period of 2020 would have been 15.8 L/sec. The average 2020 water abstraction rate was 12.6 L/sec.

**Table 6.1 Breakdown of abstracted water volumes (2020)**

<table>
<tr><td rowspan="2">Total water abstracted from mine via BH5, BH6 and Portal</td><td rowspan="2">396 ML</td><td>Mine water input (metered)</td><td>245.5 ML</td><td></td><td></td></tr>
<tr><td>Estimate of abstracted water considered inflow water</td><td>150.5 ML</td><td rowspan="2">498.9 ML</td><td rowspan="2">Total predicted incidental water-take for 2020 (from 2020 GW)</td></tr>
<tr><td></td><td></td><td>Portion of incidental water take considered stored in underground and/or lost via coal moisture and water vapour in out-by air</td><td>348.4 ML</td></tr>
</table>

# 7 Summary

Groundwater monitoring over the 2020 reporting period was consistent with the requirements outlined in the WMP. A summary of the findings of this report is as follows:

- Two BCA bores exceeded EC triggers over three consecutive periods during 2020 – monitoring bores WMLP323 and WMLP328, triggering an investigation. The investigation concluded that BCA EC levels have increased as a result of reduced rainfall since 2018. A prolonged dry period decreased water levels in all the bores to unprecedented levels. This allowed salts to accumulate in the unsaturated zone. These salts were then remobilised by a rising water table after significant rainfall in early 2020, causing the EC exceedances in groundwater at WMLP323 and WMLP328. It should be noted that ACP is approved to intercept the BCA groundwater resource under DA 309-11-2011-i MOD 5.
- BCA regulatory bore water levels increased throughout 2020. Over the course of the year, three of the previously dry BCA trigger bores returned water level readings; T2A during August, WMLP328 and WMLP311 during April. All BCA trigger bores were recorded above respective trigger values from April, except for T2A which recorded readings above trigger value from August.
- Other previously dry BCA bores recorded water level measurements in 2020 including; PB1, RA18 and T5. Groundwater level increase within these bores corresponds to an increasing CRD throughout 2020.
- GCA groundwater levels were generally stable throughout 2020. All GCA monitoring bores remained above established triggers in 2020.
- HRA regulatory bore water levels were relatively steady throughout the year, except for monitoring bore WMLP280 and WMLP279 which increased during 2020. All HRA monitoring bores remained above established triggers in 2020.
- Bowmans Creek has returned surface water elevation readings since August after being dry throughout 2019 and early 2020. Glennies Creek and Hunter River water levels were relatively steady over the year, with sudden water level spikes following heavy rainfall events.
- Water levels were relatively stable in coal measure bores, except for monitoring bore GM1 which fluctuated throughout the year. Groundwater elevation in CMOB bores display a general increased in 2020, which corresponds to an increasing CRD and increased rainfall recharge.
- VWP measurements in WMLP269 (adjacent LW203/204) remained stable throughout the year, except for Lemington 7 and Lemington 19 sensors. Lemington 7 recorded a decline in pressure head in August before returning to a stable reading the following month. Lemington 19 also recorded a pressure head decline in August, with pressure head remaining depressed thereafter. No impacts associated with mining of LW203/LW204 are evident from VWP monitoring in 2020.
- Groundwater pH measurements were stable during 2020. No consecutive pH exceedances occurred, and slight changes in pH are attributed to natural variation.
- GCA and HRA EC levels in 2020 were steady overall, except for HRA bores WMLP337 and WMLP279 which both recorded a significant decline in EC values. BCA monitoring bores WML113C, WMLP328, WMLP323 and WMLP311 all recorded a significant decline in EC over the 2020 monitoring period. Lower recorded EC values throughout 2020 is attributed to increased rainfall in the region.
- Coal measure and CMOB EC levels were relatively steady over the year, except for WMLP325 which recorded a sharp decline in EC between the May and August monitoring rounds. No other prevailing trends were evident.
- Major ion analysis indicated that the CMOB, BCA and HRA water types are similar and can be distinguished from the GCA and the coal measure water types, which is due to the water source and the recharge/discharge mechanism associated with each body.

- Dissolved metals, select nutrients, turbidity and cyanide concentrations within ACP monitoring bores were compared against ANZECC|ARMCANZ livestock limits (ANZECC & ARMCANZ, 2000), revealing no breaches for any of the analytes assessed. Several bores exceeded the lower trigger of phosphorous concentration (0.8-12 mg/L), however it is outlined in the guidelines that the value or range for phosphorous needs to be determined specific to a site. No site-specific analysis has been conducted at Ashton to define an appropriate phosphorous trigger at this time.
- EPL 11879 listed monitoring bore water levels displayed varying results overall throughout 2020. EC in some EPL 11879 bores decreased, whilst other bores displayed an increase in EC during 2020.
- Underground mine inflows are within predicted limits, but a review of site data is recommended to confirm the accuracy of abstraction volume estimates.

Generally, the site has experienced no mining impacts to the BCA, GCA and HRA alluvial aquifers and impacts are within predictions in the coal measures.

# 8 References


Ashton Coal (2018), *Water Management Plan version 10, HSEC Management System– Plan, Doc No. 3.4.1.8*. Yancoal.

Ashton Coal (2020), *Water Management Plan version 11, HSEC Management System – Plan, Doc No. 3.4.1.8.*, Yancoal.

Australasian Groundwater & Environmental Consultants (AGE) (2019), *Yancoal – Ashton Coal Operartions Groundwater Model Three-Year inflows and impact predictions*, Project No. G1922J.

Australasian Groundwater & Environmental Consultants (AGE) (2020), *Yancoal – Ashton WMLP323 EC trigger investigation,* Project No. G1922N.

Australian and New Zealand Environment and Conservation Council (ANZECC), and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 1: The Guidelines (Chapters 1-7)*, National Water Quality Management Strategy Paper No. 4. October 2000.

Department of Primary Industries Office of Water (2016), *Rivers and Streams Digital Data*, http://realtimedata.water.nsw.gov.au/water, Sydney NSW.

Food and Agricultural Organisation of the United Nations (FAO), (1992) *The use of saline waters for crop production – FAO irrigation and drainage paper 48*. http://www.fao.org/docrep/t0667e/t0667e05.htm

# *Appendix A* Summary of WMP monitoring locations

## Table A1 GWMP monitoring bore locations

| ID | Type | Easting (GDA94 Z56) | Northing (GDA94 Z56) | Top of casing (mAHD) | Depth (mBGL) |
|---|---|---|---|---|---|
| Ashton Well | Monitoring bore | 318355 | 6406029 | 62 | - |
| GM1 | EPL Monitoring bore* | 318431 | 6407214 | 67 | 203 |
| GM3A | Monitoring bore | 320246.5 | 6405976.9 | 59 | 7.5 |
| GM3B | Monitoring bore | 320250.9 | 6405976.7 | 59 | 16.2 |
| PB1 | Monitoring bore | 317545 | 6405301 | 61.1 | 7.8 |
| RA02 | Monitoring bore | 317712.8 | 6405233 | 55.2 | 11.3 |
| RA18 | Monitoring bore | 317821.8 | 6405434.2 | 62.6 | 8.5 |
| RA27 | Monitoring bore | 317952.1 | 6403738 | 61.6 | 10.7 |
| RM01 | Monitoring bore | 318041 | 6404109.5 | 69.4 | 9.8 |
| RM02 | Monitoring bore | 317942 | 6404506 | 61.1 | 12.9 |
| RM03 | Monitoring bore | 317667 | 6404844.5 | 62.1 | 9.5 |
| RM10 | Monitoring bore | 317589 | 6405292 | 61.6 | 10.5 |
| RSGM1 | Monitoring bore | 317655 | 6406302 | 65.6 | 8.5 |
| T2-A | Monitoring bore | 317583.3 | 6405217.4 | 60.8 | 7.9 |
| T2-P | Monitoring bore | 317587 | 6405222 | 60.7 | 14.5 |
| T3-A | Monitoring bore | 317654.2 | 6404708 | 59.9 | 10.8 |
| T3-P | Monitoring bore | 317650 | 6404702 | 59.8 | 22.8 |
| T4-A | Monitoring bore | 317685.8 | 6404323.1 | 58.6 | 10.7 |
| T4-P | Monitoring bore | 317683 | 6404319 | 58.5 | 17.5 |
| T5 | Monitoring bore | 317946.1 | 6406549.4 | 65.3 | 8.3 |
| WML113A | Vibrating wire piezometer | 317369 | 6404529 | 60.2 | 125 |
| WML113C | Monitoring bore | 317377 | 6404526 | 60.2 | 11.2 |
| WML115B | Monitoring bore | 317881 | 6406704 | 66.4 | 13 |
| WML115C | Monitoring bore | 317888 | 6406710 | 66.2 | 6.2 |
| WML119 | Monitoring bore | 319255.3 | 6403930.1 | 61.5 | 25.8 |
| WML120A | EPL Monitoring bore* | 319292 | 6404579.6 | 60.4 | 15 |
| WML120B | EPL Monitoring bore* | 319293.6 | 6404587.5 | 60.1 | 9 |
| WML129 | EPL Monitoring bore* | 319468.4 | 6403527.8 | 55.3 | 4.6 |
| WML181 | EPL Monitoring bore* | 319215 | 6403958.3 | 64.3 | 36.7 |
| WML183 | EPL Monitoring bore* | 319188.2 | 6404325.2 | 76.7 | 45.5 |
| WML213 | Vibrating wire piezometer | 317210 | 6404154 | 61.5 | 316 |
| WML239 | Monitoring bore | 319345 | 6404044.8 | 58.8 | 12.2 |
| WML245 | Vibrating wire piezometer | 320035 | 6404835 | 64.9 | 110 |
| WML261 | Monitoring bore | 319320.2 | 6404705.9 | 58.7 | 43 |

| ID | Type | Easting (GDA94 Z56) | Northing (GDA94 Z56) | Top of casing (mAHD) | Depth (mBGL) |
|---|---|---|---|---|---|
| WML262 | EPL Monitoring bore* | 319220.1 | 6403927.7 | 63.2 | 60.3 |
| WMLP269 | Vibrating wire piezometer | 317850 | 6404073 | 65.5 | 147 |
| WMLC144 | Vibrating wire piezometer | 319500 | 6404170 | 59.3 | 132 |
| WMLC248 | Vibrating wire piezometer | 319326 | 6404721 | 58.5 | 144.6 |
| WMLC334 | Vibrating wire piezometer | 318589 | 6403088 | 75.9 | 218.5 |
| WMLC335 | Vibrating wire piezometer | 318892 | 6402936 | 64.5 | 200.5 |
| WMLP277 | Monitoring bore | 317643.2 | 6403958.5 | 59 | 13.3 |
| WMLP278 | Monitoring bore | 317626.3 | 6403894.2 | 62.3 | 11.5 |
| WMLP279 | EPL Monitoring bore* | 317298.9 | 6403991.8 | 62.7 | 17.2 |
| WMLP280 | EPL Monitoring bore* | 317797.6 | 6403793.4 | 62.5 | 14.9 |
| WMLP301 | Monitoring bore | 319235 | 6403858 | 60.2 | 41.5 |
| WMLP302 | Monitoring bore | 319299.6 | 6404600.2 | 59.7 | 25.2 |
| WMLP308 | Monitoring bore | 318222.7 | 6406373 | 65.7 | 8.9 |
| WMLP311 | Monitoring bore | 318178.9 | 6406047.9 | 63.6 | 7.6 |
| WMLP320 | EPL Monitoring bore* | 317457.2 | 6405388 | 61.5 | 8.5 |
| WMLP323 | Monitoring bore | 318242.2 | 6406594.7 | 64.5 | 7.3 |
| WMLP324 | Monitoring bore | 318240 | 6406594 | 64.5 | 14.1 |
| WMLP325 | Monitoring bore | 318181 | 6406050 | 63.7 | 14.6 |
| WMLP326 | Monitoring bore | 317571 | 6404103.2 | 59.3 | 11.9 |
| WMLP327 | Monitoring bore | 317573 | 6404103 | 59.4 | 18.3 |
| WMLP328 | Monitoring bore | 317927.3 | 6405611.6 | 62.8 | 11.5 |
| WMLP336 | EPL Monitoring bore* | 318965.4 | 6402841.9 | 60.6 | 15.5 |
| WMLP337 | Monitoring bore | 318418 | 6403129 | 59.9 | 13.5 |
| WMLP338 | Monitoring bore | 318624.7 | 6402794 | 58.8 | 12.9 |
| WMLP343 | Monitoring bore | 319623 | 6404606 | 61 | 9.6 |
| WMLP346 | Monitoring bore | 319366.5 | 6404457.2 | 60.68 | 11.5 |
| WMLP349 | Monitoring bore | 319516 | 6404198 | 58.3 | 8.7 |
| WMLP358 | Monitoring bore | 319560 | 6403704 | 59.49 | 9.3 |
| WMLP361 | Vibrating wire piezometer | 317722 | 6405962 | 62.9 | 191 |
| WMLP363 | Vibrating wire piezometer | 317963 | 6406634 | 66 | 164 |
| YAP016 | EPL Monitoring bore* | 318438 | 6407195 | 66.8 | 7.3 |

***Note***: * *Per EPL 11879 (Licence version date: 21 November 2019).*

# *Appendix B* Summary of GWMP Plan – parameters and frequency

## Table B1 Summary of groundwater monitoring program

| ID | Type | Data recording method | Targets | Monthly | Quarterly | Annually |
|---|---|---|---|---|---|---|
| Ashton Well | Monitoring bore | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| GM1 | EPL Monitoring bore* | - | Coal measure | Water level only | Monthly plus field EC only | Quarterly plus field parameters and **comprehensive** analysis |
| GM3A | Monitoring bore | - | GCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| GM3B | Monitoring bore | - | GCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| PB1 | Monitoring bore | - | BCA | Water level only | Monthly plus field EC only | Quarterly plus minor lab analysis |
| RA02 | Monitoring bore | - | BCA + CMOB | Water level only | Monthly plus field EC only | Quarterly plus field parameters and **comprehensive** analysis |
| RA18 | Monitoring bore | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| RA27 | Monitoring bore | - | HRA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| RM01 | Monitoring bore | - | BCA | Water level only | Monthly plus field EC only | Quarterly plus minor lab analysis |
| RM02 | Monitoring bore | - | BCA + CMOB | Water level only | Monthly plus field EC only | Water level and field EC only |
| RM03 | Monitoring bore | - | BCA + CMOB | Water level only | Monthly plus field EC only | Quarterly plus minor lab analysis |
| RM10 | Monitoring bore | - | BCA + CMOB | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus minor lab analysis |
| RSGM1 | Monitoring bore | - | Coal measure (BWS) | Water level only | Monthly plus field EC only | Quarterly plus field parameters and **comprehensive** analysis |
| T2-A | Monitoring bore | Pressure transducer | BCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |

| ID | Type | Data recording method | Targets | Monthly | Quarterly | Annually |
|---|---|---|---|---|---|---|
| T2-P | Monitoring bore | Pressure transducer | CMOB | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| T3-A | Monitoring bore | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| T3-P | Monitoring bore | - | CMOB | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| T4-A | Monitoring bore | - | BCA + BWS | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| T4-P | Monitoring bore | - | CMOB | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| T5 | Monitoring bore | Pressure transducer | BCA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| WML113A | Vibrating wire piezometer | - | BW 2, Lem 4, Lem 9, Lem 11-12, Lem 15 | Pressure head | Pressure head | Pressure head |
| WML113C | Monitoring bore | Pressure transducer | BCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML115B | Monitoring bore | - | CMOB & Lem 3-4 | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| WML115C | Monitoring bore | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| WML119 | Monitoring bore | - | PG | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML120A | EPL Monitoring bore* | - | PG | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML120B | EPL Monitoring bore* | - | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML129 | EPL Monitoring bore* | Pressure transducer | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |

| ID | Type | Data recording method | Targets | Monthly | Quarterly | Annually |
|---|---|---|---|---|---|---|
| WML181 | EPL Monitoring bore* | - | PG | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML183 | EPL Monitoring bore* | - | PG | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML213 | Vibrating wire piezometer | - | BWS, Lem 8-9, Lem 15, Lem 19, PG, ULD, ULLD, LB | Pressure head | Pressure head | Pressure head |
| WML239 | Monitoring bore | Pressure transducer | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML245 | Vibrating wire piezometer | - | ULD, MLD, LB, LB-HEB int | Pressure head | Pressure head | Pressure head |
| WML261 | Monitoring bore | - | ULD | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WML262 | EPL Monitoring bore* | - | ULD | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP269 | Vibrating wire piezometer | - | Lem 5, Lem 7, Lem 8-9, Lem 11-12, Lem 15, Lem 19 | Pressure head | Pressure head | Pressure head |
| WMLC144 | Vibrating wire piezometer | - | ULD, MLD1, MLD2, ULLD, LLLD, UBS, LB | Pressure head | Pressure head | Pressure head |
| WMLC248 | Vibrating wire piezometer | - | ULD, ULLD, LB, HEB | Pressure head | Pressure head | Pressure head |
| WMLC334 | Vibrating wire piezometer | - | Lem 13, Lem 15, Lem 18/19, Art, ULD, ULLD, UB, LB | Pressure head | Pressure head | Pressure head |
| WMLC335 | Vibrating wire piezometer | - | Lem 15B, Lem 17, PG Upper, Art, ULD, LLLD, UB, LB | Pressure head | Pressure head | Pressure head |
| WMLP277 | Monitoring bore | Pressure transducer | HRA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| WMLP278 | Monitoring bore | - | HRA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |

| ID | Type | Data recording method | Targets | Monthly | Quarterly | Annually |
|---|---|---|---|---|---|---|
| WMLP279 | EPL Monitoring bore* | - | HRA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP280 | EPL Monitoring bore* | - | HRA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP301 | Monitoring bore | - | Arties Seam | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP302 | Monitoring bore | - | Arties Seam | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP308 | Monitoring bore | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| WMLP311 | Monitoring bore | Pressure transducer | BCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP320 | EPL Monitoring bore* | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| WMLP323 | Monitoring bore | Pressure transducer | BCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP324 | Monitoring bore | Pressure transducer | CMOB | Water level only | Monthly plus field parameters and minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP325 | Monitoring bore | Pressure transducer | CMOB | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| WMLP326 | Monitoring bore | - | BCA | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| WMLP327 | Monitoring bore | - | CMOB | Water level only | Monthly plus field parameters | Quarterly plus minor lab analysis |
| WMLP328 | Monitoring bore | Pressure transducer | BCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP336 | EPL Monitoring bore* | - | HRA + CMOB | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |

| ID | Type | Data recording method | Targets | Monthly | Quarterly | Annually |
|---|---|---|---|---|---|---|
| WMLP337 | Monitoring bore | - | HRA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP338 | Monitoring bore | - | HRA | Water level only | Monthly plus field parameters | Quarterly plus **comprehensive** analysis |
| WMLP343 | Monitoring bore | Pressure transducer | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP346 | Monitoring bore | Pressure transducer | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP349 | Monitoring bore | - | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP358 | Monitoring bore | - | GCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |
| WMLP361 | Vibrating wire piezometer | VWP datalogger | Lem 5, Lem 8, Lem 15A, Art, ULD | Pressure head | Pressure head | Pressure head |
| WMLP363 | Vibrating wire piezometer | VWP datalogger | CMOB, Lem 8, Lem 9-10 int, Lem 12, Lem 14, Lem 15, PG roof, ULD | Pressure head | Pressure head | Pressure head |
| YAP016 | EPL Monitoring bore* | Pressure transducer | BCA | Water level and field parameters | Monthly plus minor lab analysis | Quarterly plus **comprehensive** analysis |

***Note***: * *Per EPL 11879 (Licence version date: 21 November 2019).*

# *Appendix C* Extract GWMP protocol for exceedance of groundwater trigger values (Yancoal, 2018)

In the event of a groundwater assessment criterion (Table 23 and Section 7.2) being exceeded, the following protocol will be followed:

1. Check and validate the data which indicates an exceedance of the criterion, including whether the exceedance is ongoing.
2. A preliminary investigation will be undertaken to establish the cause(s) and determine whether changes to the water management system or operations are required. This will involve the consideration of the monitoring results in conjunction with:
    a) site activities being undertaken at the time;
    b) activities at nearby operations (cumulative affects);
    c) groundwater extraction by others;
    d) baseline monitoring results and natural fluctuations;
    e) predictive modelling;
    f) groundwater monitoring at nearby locations;
    g) the prevailing and preceding meteorological and streamflow conditions; and
    h) changes to the land use/activities being undertaken nearby.
3. If the preliminary investigation shows that the impact is linked to activities undertaken by ACOL, a report will be emailed to the DPE and any other relevant department. Causal factors will be addressed and rectified if possible. Contingency measures will be developed in consultation with the DPE and any other relevant department and implemented in response to the outcomes of the investigation.
4. Remedial/compensatory measures will be developed in consultation with DPE and any other relevant department and implemented in response to the outcomes of the investigations.
5. Monitoring would be implemented as required to confirm the effectiveness of remedial measures.
6. Where required, an independent hydrogeologist will be engaged to conduct investigations. ACOL will seek the Secretary of DPE's approval in selecting a hydrogeologist.

Any exceedances and responses taken to ameliorate these exceedances will be reported in the Annual Review.

# *Appendix D* Annual groundwater quality laboratory results 2020

## Table D1 Annual groundwater quality results – field and laboratory (2020)

| Bore ID | Geology | Laboratory ID | Date | pH Value (Field) | pH Value (Lab) | pH RPD | EC (Field) | EC (Lab) | EC RPD | Total Dissolved Solids (TDS) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Units** | | | | **pH** | **pH** | **%** | **µS/cm** | **µS/cm** | **%** | **mg/L** |
| **Limit of Reporting (LOR)** | | | | | **0.01** | | | **1** | | **10** |
| **ANZECC livestock limits** | | | | | | | **5970** | **5970*** | | **4000** |
| Ashton Well | BCA | ES2028057015 | 5/08/2020 | 7.50 | 7.50 | 0.00 | 355 | 349 | 1.59 | 237 |
| PB1 | BCA | ES2028057038 | 10/08/2020 | 7.20 | 7.66 | -6.19 | 2750 | 2610 | 5.22 | 2060 |
| RM10 | BCA | ES2028057039 | 10/08/2020 | 6.96 | 6.82 | 2.03 | 1417 | 1520 | -7.01 | 1001 |
| T2A | BCA | ES2028057034 | 7/08/2020 | 7.11 | 7.13 | -0.28 | 1331 | 1370 | -2.89 | 826 |
| T3A | BCA | ES2028057032 | 7/08/2020 | 6.92 | 7.10 | -2.57 | 2154 | 2080 | 3.50 | 1260 |
| T4A | BCA | ES2028057029 | 7/08/2020 | 7.00 | 7.26 | -3.65 | 1381 | 1400 | -1.37 | 812 |
| T5 | BCA | ES2028057016 | 5/08/2020 | 6.92 | 6.75 | 2.49 | 707 | 623 | 12.63 | 456 |
| WML113C | BCA | ES2028057031 | 7/08/2020 | 6.96 | 6.99 | -0.43 | 1310 | 1320 | -0.76 | 778 |
| WML115C | BCA | ES2028057002 | 03/08/2020 | 7.28 | 7.17 | 1.52 | 571 | 432 | 27.77 | 387 |
| WMLP308 | BCA | ES2028057020 | 5/08/2020 | 7.03 | 7.14 | -1.55 | 1475 | 1500 | -1.68 | 903 |
| WMLP311 | BCA | ES2028057022 | 5/08/2020 | 7.04 | 6.94 | 1.43 | 733 | 749 | -2.23 | 504 |
| WMLP320 | BCA | ES2028057037 | 10/08/2020 | 6.90 | 7.11 | -3.00 | 1706 | 1720 | -0.82 | 1224 |
| WMLP323 | BCA | ES2028057018 | 5/08/2020 | 6.67 | 6.92 | -3.68 | 902 | 904 | -0.20 | 566 |
| WMLP326 | BCA | ES2028057027 | 7/08/2020 | 7.10 | 7.43 | -4.54 | 1356 | 1340 | 1.19 | 960 |
| WMLP328 | BCA | ES2028057036 | 10/08/2020 | 7.02 | 7.03 | -0.14 | 1277 | 1320 | -3.31 | 865 |
| YAP016 | BCA | ES2028057009 | 4/08/2020 | 7.02 | 7.01 | 0.14 | 857 | 848 | 1.03 | 553 |
| T2P | CMOB | ES2028057035 | 7/08/2020 | 6.72 | 6.86 | -2.06 | 1088 | 1090 | -0.18 | 665 |
| T3P | CMOB | ES2028057033 | 7/08/2020 | 7.33 | 7.67 | -4.53 | 1878 | 1850 | 1.50 | 945 |
| T4P | CMOB | ES2028057030 | 7/08/2020 | 7.42 | 7.69 | -3.57 | 1730 | 1710 | 1.16 | 1000 |
| WML115B | CMOB | ES2028057001 | 3/08/2020 | 6.68 | 7.15 | -6.80 | 2390 | 2480 | -3.70 | 1783 |
| WMLP324 | CMOB | ES2028057019 | 5/08/2020 | 6.88 | 6.81 | 1.02 | 1118 | 1160 | -3.69 | 694 |
| WMLP325 | CMOB | ES2028057021 | 5/08/2020 | 7.29 | 7.32 | -0.41 | 1440 | 1480 | -2.74 | 836 |
| WMLP327 | CMOB | ES2028057028 | 7/08/2020 | 6.86 | 7.30 | -6.21 | 1898 | 1630 | 15.19 | 1365 |
| GM1 | Coal | ES2028057008 | 04/08/2020 | 7.11 | 7.43 | -4.40 | 1908 | 1850 | 3.09 | 1090 |
| WML119 | Coal | ES2028057046 | 11/08/2020 | 7.19 | 7.72 | -7.11 | 1170 | 1250 | -6.61 | 720 |

| Bore ID | Geology | Laboratory ID | Date | pH Value (Field) | pH Value (Lab) | pH RPD | EC (Field) | EC (Lab) | EC RPD | Total Dissolved Solids (TDS) |
|---|---|---|---|---|---|---|---|---|---|---|
| Units | | | | pH | pH | % | µS/cm | µS/cm | % | mg/L |
| Limit of Reporting (LOR) | | | | | 0.01 | | | 1 | | 10 |
| ANZECC livestock limits | | | | | | | 5970 | 5970* | | 4000 |
| WML120A | Coal | ES2028057042 | 10/08/2020 | 6.80 | 7.07 | -3.89 | 580 | 590 | -1.71 | 340 |
| WML181 | Coal | ES2028057047 | 11/08/2020 | 7.55 | 8.07 | -6.66 | 2238 | 2210 | 1.26 | 1390 |
| WML183 | Coal | ES2028057026 | 6/08/2020 | 7.02 | 7.53 | -7.01 | 3955 | 3880 | 1.91 | 3120 |
| WML261 | Coal | ES2028057040 | 10/08/2020 | 6.80 | 7.28 | -6.82 | 1072 | 1140 | -6.15 | 646 |
| WML262 | Coal | ES2028057048 | 11/08/2020 | 7.90 | 8.31 | -5.06 | 2782 | 2730 | 1.89 | 1730 |
| WMLP301 | Coal | ES2028057045 | 11/08/2020 | 8.04 | 8.25 | -2.58 | 2990 | 2980 | 0.34 | 2220 |
| WMLP302 | Coal | ES2028057041 | 10/08/2020 | 6.42 | 6.91 | -7.35 | 896 | 946 | -5.43 | 526 |
| WML120B | GCA | ES2028057043 | 10/08/2020 | 6.72 | 6.94 | -3.22 | 426 | 439 | -3.05 | 258 |
| WML129 | GCA | ES2028057044 | 11/08/2020 | 6.85 | 6.78 | 1.03 | 432 | 439 | -1.72 | 236 |
| WML239 | GCA | ES2028057004 | 3/08/2020 | 6.82 | 6.95 | -1.89 | 642 | 672 | -4.57 | 393 |
| WMLP343 | GCA | ES2028057007 | 3/08/2020 | 6.85 | 7.15 | -4.29 | 617 | 646 | -4.56 | 375 |
| WMLP346 | GCA | ES2028057006 | 3/08/2020 | 6.82 | 6.92 | -1.46 | 394 | 422 | -6.91 | 243 |
| WMLP349 | GCA | ES2028057005 | 3/08/2020 | 6.62 | 6.88 | -3.85 | 870 | 914 | -4.93 | 537 |
| WMLP358 | GCA | ES2028057003 | 3/08/2020 | 6.45 | 6.59 | -2.15 | 345 | 364 | -5.30 | 244 |
| RA27 | HRA | ES2028057010 | 4/08/2020 | 7.04 | 7.35 | -4.31 | 1460 | 1460 | 0.00 | 852 |
| WMLP277 | HRA | ES2028057011 | 4/08/2020 | 7.20 | 7.33 | -1.79 | 1315 | 1320 | -0.38 | 766 |
| WMLP278 | HRA | ES2028057012 | 4/08/2020 | 7.19 | 7.29 | -1.38 | 870 | 718 | 19.17 | 544 |
| WMLP279 | HRA | ES2028057013 | 4/08/2020 | 6.80 | 7.05 | -3.61 | 860 | 850 | 1.17 | 544 |
| WMLP280 | HRA | ES2028057014 | 4/08/2020 | 7.00 | 7.27 | -3.78 | 1296 | 1150 | 11.94 | 688 |
| WMLP336 | HRA | ES2028057025 | 6/08/2020 | 6.74 | 6.87 | -1.91 | 529 | 558 | -5.39 | 326 |
| WMLP337 | HRA | ES2028057023 | 6/08/2020 | 7.23 | 7.63 | -5.38 | 2605 | 2590 | 0.58 | 1600 |
| WMLP338 | HRA | ES2028057024 | 6/08/2020 | 6.84 | 7.28 | -6.23 | 1774 | 1830 | -3.11 | 1100 |

| Bore ID | Geology | Laboratory ID | Calcium | Magnesium | Sodium | Potassium | Chloride |
|---|---|---|---|---|---|---|---|
| Units | | | mg/L | mg/L | mg/L | mg/L | mg/L |
| Limit of Reporting (LOR) | | | 1 | 1 | 1 | 1 | 1 |
| ANZECC livestock limits | | | | | | | |
| Ashton Well | BCA | ES2028057015 | 20 | 10 | 37 | 2 | 41 |
| PB1 | BCA | ES2028057038 | 219 | 108 | 247 | 8 | 274 |
| RM10 | BCA | ES2028057039 | 77 | 40 | 182 | 3 | 254 |
| T2A | BCA | ES2028057034 | 68 | 35 | 167 | 2 | 209 |
| T3A | BCA | ES2028057032 | 57 | 54 | 314 | <1 | 571 |
| T4A | BCA | ES2028057029 | 47 | 28 | 199 | <1 | 284 |
| T5 | BCA | ES2028057016 | 28 | 13 | 99 | 1 | 81 |
| WML113C | BCA | ES2028057031 | 79 | 33 | 141 | 2 | 230 |
| WML115C | BCA | ES2028057002 | 4 | 2 | 93 | <1 | 25 |
| WMLP308 | BCA | ES2028057020 | 68 | 44 | 186 | 3 | 263 |
| WMLP311 | BCA | ES2028057022 | 27 | 18 | 98 | 2 | 110 |
| WMLP320 | BCA | ES2028057037 | 106 | 55 | 194 | 3 | 263 |
| WMLP323 | BCA | ES2028057018 | 41 | 25 | 110 | 2 | 82 |
| WMLP326 | BCA | ES2028057027 | 48 | 25 | 193 | <1 | 204 |
| WMLP328 | BCA | ES2028057036 | 73 | 42 | 150 | 3 | 143 |
| YAP016 | BCA | ES2028057009 | 28 | 18 | 122 | 1 | 101 |
| T2P | CMOB | ES2028057035 | 76 | 37 | 86 | 2 | 207 |
| T3P | CMOB | ES2028057033 | 45 | 42 | 309 | 3 | 387 |
| T4P | CMOB | ES2028057030 | 52 | 37 | 276 | 3 | 318 |
| WML115B | CMOB | ES2028057001 | 71 | 37 | 438 | 2 | 462 |
| WMLP324 | CMOB | ES2028057019 | 55 | 32 | 135 | 2 | 150 |
| WMLP325 | CMOB | ES2028057021 | 62 | 35 | 199 | 2 | 292 |
| WMLP327 | CMOB | ES2028057028 | 70 | 38 | 268 | 3 | 295 |
| GM1 | Coal | ES2028057008 | 66 | 49 | 273 | 3 | 294 |
| WML119 | Coal | ES2028057046 | 32 | 28 | 225 | 3 | 168 |
| WML120A | Coal | ES2028057042 | 24 | 20 | 72 | 1 | 82 |

| Bore ID | Geology | Laboratory ID | Calcium | Magnesium | Sodium | Potassium | Chloride |
|---|---|---|---|---|---|---|---|
| Units | | | mg/L | mg/L | mg/L | mg/L | mg/L |
| Limit of Reporting (LOR) | | | 1 | 1 | 1 | 1 | 1 |
| ANZECC livestock limits | | | | | | | |
| WML181 | Coal | ES2028057047 | 19 | 20 | 493 | 3 | 462 |
| WML183 | Coal | ES2028057026 | 115 | 172 | 656 | 8 | 865 |
| WML261 | Coal | ES2028057040 | 26 | 29 | 173 | 2 | 202 |
| WML262 | Coal | ES2028057048 | 7 | 6 | 681 | 3 | 479 |
| WMLP301 | Coal | ES2028057045 | 6 | 4 | 728 | 2 | 565 |
| WMLP302 | Coal | ES2028057041 | 21 | 26 | 141 | 2 | 170 |
| WML120B | GCA | ES2028057043 | 20 | 13 | 54 | <1 | 54 |
| WML129 | GCA | ES2028057044 | 22 | 13 | 44 | 2 | 63 |
| WML239 | GCA | ES2028057004 | 39 | 18 | 72 | 1 | 114 |
| WMLP343 | GCA | ES2028057007 | 40 | 20 | 69 | <1 | 72 |
| WMLP346 | GCA | ES2028057006 | 22 | 13 | 49 | <1 | 50 |
| WMLP349 | GCA | ES2028057005 | 40 | 24 | 114 | <1 | 192 |
| WMLP358 | GCA | ES2028057003 | 27 | 13 | 25 | <1 | 54 |
| RA27 | HRA | ES2028057010 | 40 | 34 | 221 | <1 | 273 |
| WMLP277 | HRA | ES2028057011 | 39 | 26 | 201 | <1 | 231 |
| WMLP278 | HRA | ES2028057012 | 29 | 16 | 134 | <1 | 60 |
| WMLP279 | HRA | ES2028057013 | 46 | 21 | 99 | <1 | 118 |
| WMLP280 | HRA | ES2028057014 | 47 | 29 | 186 | <1 | 168 |
| WMLP336 | HRA | ES2028057025 | 31 | 16 | 59 | 1 | 75 |
| WMLP337 | HRA | ES2028057023 | 94 | 121 | 333 | 5 | 665 |
| WMLP338 | HRA | ES2028057024 | 81 | 56 | 237 | <1 | 425 |

| Bore ID | Geology | Laboratory ID | Hydroxide Alkalinity as CaCO3 | Carbonate Alkalinity as CaCO3 | Bicarbonate Alkalinity as CaCO3 | Total Alkalinity | Sulfate as SO4 |
|---|---|---|---|---|---|---|---|
| **Units** | | | **mg/L** | **mg/L** | **mg/L** | **mg/L** | **mg/L** |
| **Limit of Reporting (LOR)** | | | **1** | **1** | **1** | **1** | **1** |
| **ANZECC livestock limits** | | | | | | | **1000** |
| Ashton Well | BCA | ES2028057015 | <1 | <1 | 79 | 79 | 38 |
| PB1 | BCA | ES2028057038 | <1 | <1 | 326 | 326 | 984 |
| RM10 | BCA | ES2028057039 | <1 | <1 | 164 | 164 | 324 |
| T2A | BCA | ES2028057034 | <1 | <1 | 158 | 158 | 304 |
| T3A | BCA | ES2028057032 | <1 | <1 | 196 | 196 | 129 |
| T4A | BCA | ES2028057029 | <1 | <1 | 224 | 224 | 112 |
| T5 | BCA | ES2028057016 | <1 | <1 | 95 | 95 | 106 |
| WML113C | BCA | ES2028057031 | <1 | <1 | 141 | 141 | 221 |
| WML115C | BCA | ES2028057002 | <1 | <1 | 153 | 153 | 32 |
| WMLP308 | BCA | ES2028057020 | <1 | <1 | 230 | 230 | 229 |
| WMLP311 | BCA | ES2028057022 | <1 | <1 | 119 | 119 | 101 |
| WMLP320 | BCA | ES2028057037 | <1 | <1 | 170 | 170 | 461 |
| WMLP323 | BCA | ES2028057018 | <1 | <1 | 155 | 155 | 130 |
| WMLP326 | BCA | ES2028057027 | <1 | <1 | 272 | 272 | 90 |
| WMLP328 | BCA | ES2028057036 | <1 | <1 | 143 | 143 | 400 |
| YAP016 | BCA | ES2028057009 | <1 | <1 | 127 | 127 | 147 |
| T2P | CMOB | ES2028057035 | <1 | <1 | 156 | 156 | 139 |
| T3P | CMOB | ES2028057033 | <1 | <1 | 403 | 403 | 109 |
| T4P | CMOB | ES2028057030 | <1 | <1 | 409 | 409 | 110 |
| WML115B | CMOB | ES2028057001 | <1 | <1 | 505 | 505 | 294 |
| WMLP324 | CMOB | ES2028057019 | <1 | <1 | 170 | 170 | 205 |
| WMLP325 | CMOB | ES2028057021 | <1 | <1 | 241 | 241 | 140 |
| WMLP327 | CMOB | ES2028057028 | <1 | <1 | 322 | 322 | 59 |
| GM1 | Coal | ES2028057008 | <1 | <1 | 330 | 330 | 139 |
| WML119 | Coal | ES2028057046 | <1 | <1 | 480 | 480 | <1 |
| WML120A | Coal | ES2028057042 | <1 | <1 | 189 | 189 | 9 |

| Bore ID | Geology | Laboratory ID | Hydroxide Alkalinity as CaCO3 | Carbonate Alkalinity as CaCO3 | Bicarbonate Alkalinity as CaCO3 | Total Alkalinity | Sulfate as SO4 |
|---|---|---|---|---|---|---|---|
| **Units** | | | **mg/L** | **mg/L** | **mg/L** | **mg/L** | **mg/L** |
| **Limit of Reporting (LOR)** | | | **1** | **1** | **1** | **1** | **1** |
| **ANZECC livestock limits** | | | | | | | **1000** |
| WML181 | Coal | ES2028057047 | <1 | <1 | 705 | 705 | <1 |
| WML183 | Coal | ES2028057026 | <1 | <1 | 1010 | 1010 | 397 |
| WML261 | Coal | ES2028057040 | <1 | <1 | 293 | 293 | 39 |
| WML262 | Coal | ES2028057048 | <1 | 28 | 1010 | 1040 | <1 |
| WMLP301 | Coal | ES2028057045 | <1 | 2 | 942 | 944 | 9 |
| WMLP302 | Coal | ES2028057041 | <1 | <1 | 248 | 248 | 25 |
| WML120B | GCA | ES2028057043 | <1 | <1 | 145 | 145 | 9 |
| WML129 | GCA | ES2028057044 | <1 | <1 | 97 | 97 | 26 |
| WML239 | GCA | ES2028057004 | <1 | <1 | 180 | 180 | 16 |
| WMLP343 | GCA | ES2028057007 | <1 | <1 | 231 | 231 | 4 |
| WMLP346 | GCA | ES2028057006 | <1 | <1 | 153 | 153 | 1 |
| WMLP349 | GCA | ES2028057005 | <1 | <1 | 188 | 188 | 27 |
| WMLP358 | GCA | ES2028057003 | <1 | <1 | 106 | 106 | <1 |
| RA27 | HRA | ES2028057010 | <1 | <1 | 278 | 278 | 110 |
| WMLP277 | HRA | ES2028057011 | <1 | <1 | 265 | 265 | 110 |
| WMLP278 | HRA | ES2028057012 | <1 | <1 | 240 | 240 | 34 |
| WMLP279 | HRA | ES2028057013 | <1 | <1 | 180 | 180 | 83 |
| WMLP280 | HRA | ES2028057014 | <1 | <1 | 268 | 268 | 62 |
| WMLP336 | HRA | ES2028057025 | <1 | <1 | 156 | 156 | 17 |
| WMLP337 | HRA | ES2028057023 | <1 | <1 | 496 | 496 | 118 |
| WMLP338 | HRA | ES2028057024 | <1 | <1 | 382 | 382 | 61 |

| Bore ID | Geology | Laboratory ID | Arsenic | Cadmium | Chromium | Copper | Iron | Lead | Manganese | Nickel | Selenium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| Limit of Reporting (LOR) | | | 0.001 | 0.0001 | 0.001 | 0.001 | 0.05 | 0.001 | 0.001 | 0.001 | 0.01 | 0.005 |
| ANZECC livestock limits | | | 0.5 | 0.01 | 1 | 0.4 | | 0.1 | | 1 | 0.02 | 20 |
| Ashton Well | BCA | ES2028057015 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| PB1 | BCA | ES2028057038 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| RM10 | BCA | ES2028057039 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| T2A | BCA | ES2028057034 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.002 | 0.002 | <0.01 | <0.005 |
| T3A | BCA | ES2028057032 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.048 | 0.026 | <0.01 | <0.005 |
| T4A | BCA | ES2028057029 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.05 | <0.001 | 0.067 | 0.004 | <0.01 | <0.005 |
| T5 | BCA | ES2028057016 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.003 | 0.002 | <0.01 | <0.005 |
| WML113C | BCA | ES2028057031 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.003 | 0.001 | <0.01 | 0.051 |
| WML115C | BCA | ES2028057002 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| WMLP308 | BCA | ES2028057020 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.007 | 0.002 | <0.01 | <0.005 |
| WMLP311 | BCA | ES2028057022 | <0.001 | <0.0001 | 0.006 | <0.001 | 0.05 | <0.001 | 0.010 | 0.010 | <0.01 | <0.005 |
| WMLP320 | BCA | ES2028057037 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| WMLP323 | BCA | ES2028057018 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.004 | 0.002 | <0.01 | <0.005 |
| WMLP326 | BCA | ES2028057027 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| WMLP328 | BCA | ES2028057036 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.08 | <0.001 | 0.003 | <0.001 | <0.01 | <0.005 |
| YAP016 | BCA | ES2028057009 | <0.001 | <0.0001 | <0.001 | 0.001 | <0.05 | <0.001 | 0.006 | 0.001 | <0.01 | <0.005 |
| T2P | CMOB | ES2028057035 | 0.008 | <0.0001 | <0.001 | <0.001 | 3.61 | <0.001 | 0.351 | 0.014 | <0.01 | <0.005 |
| T3P | CMOB | ES2028057033 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.22 | <0.001 | 0.034 | <0.001 | <0.01 | <0.005 |
| T4P | CMOB | ES2028057030 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.21 | <0.001 | 0.033 | <0.001 | <0.01 | <0.005 |
| WML115B | CMOB | ES2028057001 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| WMLP324 | CMOB | ES2028057019 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.032 | 0.003 | <0.01 | <0.005 |
| WMLP325 | CMOB | ES2028057021 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.80 | <0.001 | 0.375 | 0.002 | <0.01 | <0.005 |
| WMLP327 | CMOB | ES2028057028 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| GM1 | Coal | ES2028057008 | 0.001 | <0.0001 | <0.001 | <0.001 | 1.04 | <0.001 | 0.610 | <0.001 | <0.01 | <0.005 |

| Bore ID | Geology | Laboratory ID | Arsenic | Cadmium | Chromium | Copper | Iron | Lead | Manganese | Nickel | Selenium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| Limit of Reporting (LOR) | | | 0.001 | 0.0001 | 0.001 | 0.001 | 0.05 | 0.001 | 0.001 | 0.001 | 0.01 | 0.005 |
| ANZECC livestock limits | | | 0.5 | 0.01 | 1 | 0.4 | | 0.1 | | 1 | 0.02 | 20 |
| WML119 | Coal | ES2028057046 | <0.001 | <0.0001 | 0.018 | <0.001 | 0.11 | <0.001 | 0.092 | 0.009 | <0.01 | <0.005 |
| WML120A | Coal | ES2028057042 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.66 | <0.001 | 0.117 | 0.002 | <0.01 | <0.005 |
| WML181 | Coal | ES2028057047 | <0.001 | <0.0001 | 0.005 | <0.001 | <0.05 | <0.001 | 0.019 | <0.001 | <0.01 | <0.005 |
| WML183 | Coal | ES2028057026 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.12 | <0.001 | 0.176 | 0.006 | <0.01 | 0.011 |
| WML261 | Coal | ES2028057040 | <0.001 | <0.0001 | <0.001 | <0.001 | 1.09 | <0.001 | 0.029 | 0.001 | <0.01 | <0.005 |
| WML262 | Coal | ES2028057048 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.08 | <0.001 | 0.034 | <0.001 | <0.01 | <0.005 |
| WMLP301 | Coal | ES2028057045 | <0.001 | <0.0001 | <0.001 | 0.015 | <0.05 | <0.001 | 0.029 | 0.007 | <0.01 | 0.016 |
| WMLP302 | Coal | ES2028057041 | <0.001 | <0.0001 | 0.024 | <0.001 | 1.52 | <0.001 | 0.026 | 0.025 | <0.01 | <0.005 |
| WML120B | GCA | ES2028057043 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.011 | 0.002 | <0.01 | <0.005 |
| WML129 | GCA | ES2028057044 | 0.001 | <0.0001 | <0.001 | <0.001 | 0.12 | <0.001 | 0.204 | 0.001 | <0.01 | <0.005 |
| WML239 | GCA | ES2028057004 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.13 | <0.001 | 0.028 | 0.006 | <0.01 | <0.005 |
| WMLP343 | GCA | ES2028057007 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.010 | 0.002 | <0.01 | <0.005 |
| WMLP346 | GCA | ES2028057006 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.10 | <0.001 | 0.057 | <0.001 | <0.01 | <0.005 |
| WMLP349 | GCA | ES2028057005 | <0.001 | <0.0001 | <0.001 | 0.001 | 0.56 | <0.001 | 0.165 | 0.002 | <0.01 | 0.010 |
| WMLP358 | GCA | ES2028057003 | <0.001 | <0.0001 | <0.001 | 0.001 | <0.05 | <0.001 | 0.016 | <0.001 | <0.01 | <0.005 |
| RA27 | HRA | ES2028057010 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.008 | 0.008 | <0.01 | <0.005 |
| WMLP277 | HRA | ES2028057011 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.030 | 0.006 | <0.01 | <0.005 |
| WMLP278 | HRA | ES2028057012 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.018 | 0.004 | <0.01 | <0.005 |
| WMLP279 | HRA | ES2028057013 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.008 | 0.005 | <0.01 | <0.005 |
| WMLP280 | HRA | ES2028057014 | <0.001 | <0.0001 | 0.056 | <0.001 | 0.73 | <0.001 | 0.051 | 0.107 | <0.01 | <0.005 |
| WMLP336 | HRA | ES2028057025 | <0.001 | <0.0001 | 0.004 | <0.001 | 0.07 | <0.001 | 0.010 | 0.013 | <0.01 | <0.005 |
| WMLP337 | HRA | ES2028057023 | <0.001 | <0.0001 | <0.001 | <0.001 | <0.05 | <0.001 | 0.136 | 0.002 | <0.01 | 0.009 |
| WMLP338 | HRA | ES2028057024 | 0.001 | <0.0001 | <0.001 | <0.001 | 0.83 | <0.001 | 0.621 | 0.009 | <0.01 | 0.008 |

| Bore ID | Geology | Laboratory ID | Turbidity | Total Cyanide | Nitrite + Nitrate as N | Total Kjeldahl Nitrogen as N | Total Nitrogen as N | Total Phosphorous as P | Total Anions | Total Cations | Ionic Balance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | | | NTU | mg/L | mg/L | mg/L | mg/L | mg/L | meq/L | meq/L | % |
| Limit of Reporting (LOR) | | | 0.1 | 0.004 | 0.01 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 | 0.01 |
| ANZECC livestock limits | | | | | | | | | | | |
| Ashton Well | BCA | ES2028057015 | ---- | ---- | ---- | ---- | ---- | ---- | 3.53 | 3.48 | 0.64 |
| PB1 | BCA | ES2028057038 | ---- | ---- | ---- | ---- | ---- | ---- | 34.70 | 30.80 | 6.05 |
| RM10 | BCA | ES2028057039 | ---- | ---- | ---- | ---- | ---- | ---- | 17.20 | 15.10 | 6.37 |
| T2A | BCA | ES2028057034 | 0.9 | <0.004 | 0.59 | 0.1 | 0.7 | 0.03 | 15.40 | 13.60 | 6.19 |
| T3A | BCA | ES2028057032 | 221 | <0.004 | 0.98 | 0.3 | 1.3 | 0.23 | 22.70 | 20.90 | 4.04 |
| T4A | BCA | ES2028057029 | 17.3 | <0.004 | 0.71 | 0.1 | 0.8 | 0.14 | 14.80 | 13.30 | 5.38 |
| T5 | BCA | ES2028057016 | 11.7 | <0.004 | 4.11 | 0.9 | 5.0 | 0.03 | 6.39 | 6.80 | 3.10 |
| WML113C | BCA | ES2028057031 | 145 | <0.004 | 5.12 | 2.0 | 7.1 | 0.56 | 13.90 | 12.80 | 3.98 |
| WML115C | BCA | ES2028057002 | ---- | ---- | ---- | ---- | ---- | ---- | 4.43 | 4.41 | 0.21 |
| WMLP308 | BCA | ES2028057020 | 0.8 | <0.004 | 1.14 | 0.2 | 1.3 | 0.01 | 16.80 | 15.20 | 5.01 |
| WMLP311 | BCA | ES2028057022 | 4.4 | <0.004 | 1.68 | 0.4 | 2.1 | 0.03 | 7.58 | 7.14 | 2.99 |
| WMLP320 | BCA | ES2028057037 | ---- | ---- | ---- | ---- | ---- | ---- | 20.40 | 18.30 | 5.37 |
| WMLP323 | BCA | ES2028057018 | 2.6 | <0.004 | 2.76 | 0.7 | 3.5 | 0.03 | 8.12 | 8.94 | 4.82 |
| WMLP326 | BCA | ES2028057027 | ---- | ---- | ---- | ---- | ---- | ---- | 13.10 | 12.80 | 0.83 |
| WMLP328 | BCA | ES2028057036 | 9.7 | <0.004 | 1.82 | 0.4 | 2.2 | 0.03 | 15.20 | 13.70 | 5.25 |
| YAP016 | BCA | ES2028057009 | 4.6 | <0.004 | 1.61 | 0.2 | 1.8 | <0.01 | 8.45 | 8.21 | 1.42 |
| T2P | CMOB | ES2028057035 | 8.7 | <0.004 | 0.02 | <0.1 | <0.1 | 0.02 | 11.80 | 10.60 | 5.43 |
| T3P | CMOB | ES2028057033 | 2.8 | <0.004 | 0.01 | 0.5 | 0.5 | 0.03 | 21.20 | 19.20 | 4.99 |
| T4P | CMOB | ES2028057030 | 6.1 | <0.004 | 0.02 | 0.4 | 0.4 | 0.02 | 19.40 | 17.70 | 4.60 |
| WML115B | CMOB | ES2028057001 | ---- | ---- | ---- | ---- | ---- | ---- | 29.20 | 25.70 | 6.47 |
| WMLP324 | CMOB | ES2028057019 | 15.1 | <0.004 | 1.14 | 0.3 | 1.4 | 0.02 | 11.90 | 11.30 | 2.56 |
| WMLP325 | CMOB | ES2028057021 | 40.5 | <0.004 | 0.02 | 0.2 | 0.2 | 0.08 | 16.00 | 14.70 | 4.19 |
| WMLP327 | CMOB | ES2028057028 | ---- | ---- | ---- | ---- | ---- | ---- | 16.00 | 18.40 | 6.90 |

| Bore ID | Geology | Laboratory ID | Turbidity | Total Cyanide | Nitrite + Nitrate as N | Total Kjeldahl Nitrogen as N | Total Nitrogen as N | Total Phosphorous as P | Total Anions | Total Cations | Ionic Balance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Units** | | | **NTU** | **mg/L** | **mg/L** | **mg/L** | **mg/L** | **mg/L** | **meq/L** | **meq/L** | **%** |
| **Limit of Reporting (LOR)** | | | **0.1** | **0.004** | **0.01** | **0.1** | **0.1** | **0.01** | **0.01** | **0.01** | **0.01** |
| **ANZECC livestock limits** | | | | | | | | | | | |
| GM1 | Coal | ES2028057008 | 561 | <0.004 | 0.04 | 0.3 | 0.3 | 1.20 | 17.80 | 19.30 | 4.04 |
| WML119 | Coal | ES2028057046 | 117 | <0.004 | <0.01 | 1.3 | 1.3 | 0.22 | 14.30 | 13.80 | 2.01 |
| WML120A | Coal | ES2028057042 | 49.9 | <0.004 | 0.02 | 0.2 | 0.2 | 0.07 | 6.28 | 6.00 | 2.24 |
| WML181 | Coal | ES2028057047 | 78.8 | <0.004 | <0.01 | 1.1 | 1.1 | 0.16 | 27.10 | 24.10 | 5.86 |
| WML183 | Coal | ES2028057026 | 6420 | <0.004 | 0.02 | 4.2 | 4.2 | 1.06 | 52.80 | 48.60 | 4.15 |
| WML261 | Coal | ES2028057040 | 27 | <0.004 | 0.01 | 0.4 | 0.4 | 0.05 | 12.40 | 11.30 | 4.67 |
| WML262 | Coal | ES2028057048 | 56.8 | <0.004 | 0.03 | 1.4 | 1.4 | 0.61 | 34.30 | 30.50 | 5.78 |
| WMLP301 | Coal | ES2028057045 | 1540 | <0.004 | 0.01 | 4.1 | 4.1 | 1.88 | 35.00 | 32.30 | 3.92 |
| WMLP302 | Coal | ES2028057041 | 1.4 | <0.004 | 0.01 | 0.8 | 0.8 | 0.04 | 10.30 | 9.37 | 4.58 |
| WML120B | GCA | ES2028057043 | 1.7 | <0.004 | 0.06 | <0.1 | <0.1 | 0.09 | 4.61 | 4.42 | 2.12 |
| WML129 | GCA | ES2028057044 | 1 | <0.004 | 1.33 | 0.3 | 1.6 | 0.05 | 4.26 | 4.13 | 1.48 |
| WML239 | GCA | ES2028057004 | 53.2 | <0.004 | 0.02 | <0.1 | <0.1 | 0.08 | 7.14 | 6.58 | 4.08 |
| WMLP343 | GCA | ES2028057007 | 0.4 | <0.004 | 0.06 | 0.1 | 0.2 | 0.04 | 6.73 | 6.64 | 0.64 |
| WMLP346 | GCA | ES2028057006 | 0.6 | <0.004 | 0.02 | 0.1 | 0.1 | 0.04 | 4.49 | 4.30 | 2.15 |
| WMLP349 | GCA | ES2028057005 | 3.8 | <0.004 | 0.02 | <0.1 | <0.1 | 0.06 | 9.73 | 8.93 | 4.31 |
| WMLP358 | GCA | ES2028057003 | <0.1 | <0.004 | 0.04 | 0.1 | 0.1 | 0.06 | 3.64 | 3.50 | 1.91 |
| RA27 | HRA | ES2028057010 | 10.4 | <0.004 | 0.67 | 0.2 | 0.9 | 0.26 | 15.50 | 14.40 | 3.80 |
| WMLP277 | HRA | ES2028057011 | 36 | <0.004 | 0.41 | 0.1 | 0.5 | 0.22 | 14.10 | 12.80 | 4.72 |
| WMLP278 | HRA | ES2028057012 | 4.5 | <0.004 | 1.52 | 0.3 | 1.8 | 0.07 | 7.20 | 8.59 | 8.85 |
| WMLP279 | HRA | ES2028057013 | 23.6 | <0.004 | 1.93 | 0.3 | 2.2 | 0.09 | 8.65 | 8.33 | 1.90 |
| WMLP280 | HRA | ES2028057014 | 6.8 | <0.004 | 0.30 | 0.2 | 0.5 | 0.12 | 11.40 | 12.80 | 5.94 |
| WMLP336 | HRA | ES2028057025 | 3.3 | <0.004 | 0.58 | 0.2 | 0.8 | 0.08 | 5.59 | 5.46 | 1.18 |
| WMLP337 | HRA | ES2028057023 | 2940 | <0.004 | 0.03 | 2.0 | 2.0 | 2.02 | 31.10 | 29.30 | 3.09 |
| WMLP338 | HRA | ES2028057024 | 114 | <0.004 | 0.21 | 0.2 | 0.4 | 0.11 | 20.90 | 19.00 | 4.85 |

| Client sample ID (Primary) | Sample Date | pH Value (field) pH units | pH Value (Lab) pH units | cumulative pH (retain excel formula) | Electrical Conductivity (field) uS/cm | Electrical Conductivity @ 25°C (Lab) uS/cm | cumulative EC uS/cm (retain excel formula) | Total Dissolved Solids (TDS) at 180 C mg/L |
|---|---|---|---|---|---|---|---|---|
| RM10 | 15/01/2020 | 6.96 | | 6.96 | 1265 | | 1265 | 886 |
| T2A | | | | | | | | |
| WML113C | 15/01/2020 | 7.12 | | 7.12 | 1034 | | 1034 | 718 |
| WML120B | 13/01/2020 | 6.73 | | 6.73 | 472 | | 472 | 319 |
| WML129 | 13/01/2020 | 6.92 | | 6.92 | 341 | | 341 | 227 |
| WML239 | 14/01/2020 | 6.83 | | 6.83 | 673 | | 673 | 459 |
| WMLP279 | 15/01/2020 | 6.82 | | 6.82 | 1105 | | 1105 | 773 |
| WMLP280 | 15/01/2020 | 6.86 | | 6.86 | 1423 | | 1423 | 1004 |
| WMLP311 | | | | | | | | |
| WMLP323 | 14/01/2020 | 7.03 | | 7.03 | 1196 | | 1196 | 832 |
| WMLP328 | | | | | | | | |
| WMLP336 | 13/01/2020 | 6.86 | | 6.86 | 601 | | 601 | 409 |
| WMLP337 | 13/01/2020 | 7.07 | | 7.07 | 2945 | | 2945 | 2220 |
| WMLP343 | 14/01/2020 | 6.82 | | 6.82 | 726 | | 726 | 497 |
| WMLP346 | 14/01/2020 | 6.91 | | 6.91 | 415 | | 415 | 278 |
| WMLP349 | 14/01/2020 | 6.48 | | 6.48 | 895 | | 895 | 619 |
| WMLP358 | 14/01/2020 | 7.07 | | 7.07 | 364 | | 364 | 243 |
| YAP016 | 13/01/2020 | 6.96 | | 6.96 | 1272 | | 1272 | 895 |
| ASHTON WELL | | | | | | | | |
| GM1 | 3/02/2020 | | | | 1936 | | 1936 | |
| PB1 | | | | | | | | |
| RA18 | | | | | | | | |
| RA27 | | | | | | | | |
| RM02 | | | | | | | | |
| RM10 | 4/02/2020 | 6.95 | | 6.95 | 1370 | | 1370 | 965 |
| RSGM1 | | | | | | | | |
| T2A | | | | | | | | |
| T2P | 10/02/2020 | 7.15 | 7.82 | 7.82 | 1135 | 1150 | 1150 | 794 |
| T3A | 10/02/2020 | 7.01 | | 7.01 | 2284 | | 2284 | 1697 |
| T3P | 10/02/2020 | 7.42 | | 7.42 | 1708 | | 1708 | 1227 |
| T4A | 10/02/2020 | 7.06 | 7.67 | 7.67 | 1443 | 1450 | 1450 | 1021 |
| T4P | 10/02/2020 | 7.47 | 7.86 | 7.86 | 1774 | 1790 | 1790 | 1276 |
| T5 | | | | | | | | |
| WML113C | 10/02/2020 | | | | | | | |
| WML115B | 3/02/2020 | | | | | | | |
| WML115C | | | | | | | | |
| WML119 | 6/02/2020 | 7.51 | 7.91 | 7.91 | 1661 | 1600 | 1600 | 1188 |
| WML120A | 5/02/2020 | 6.87 | 7.58 | 7.58 | 735 | 746 | 746 | 503 |
| WML120B | 5/02/2020 | 6.68 | 7.36 | 7.36 | 465 | 476 | 476 | 313 |
| WML129 | 6/02/2020 | 7.06 | 7.47 | 7.47 | 385 | 393 | 393 | 258 |
| WML181 | 6/02/2020 | 7.38 | 8.05 | 8.05 | 2858 | 3100 | 3100 | 2172 |
| WML183 | 6/02/2020 | 6.84 | 7.61 | 7.61 | 4132 | 4240 | 4240 | 3205 |
| WML239 | 7/02/2020 | 6.82 | 7.49 | 7.49 | 688 | 709 | 709 | 470 |
| WML261 | 5/02/2020 | 6.93 | 7.42 | 7.42 | 1065 | 1020 | 1020 | 746 |
| WML262 | 9/02/2020 | 8.01 | 8.3 | 8.30 | 2731 | 2810 | 2810 | 2065 |
| WMLP277 | 4/02/2020 | 7.01 | | 7.01 | 1341 | | 1341 | 945 |
| WMLP278 | 4/02/2020 | 7.05 | | 7.05 | 1280 | | 1280 | 900 |
| WMLP279 | 4/02/2020 | 6.87 | 7.41 | 7.41 | 1030 | 1050 | 1050 | 725 |
| WMLP280 | 4/02/2020 | 6.79 | 7.47 | 7.47 | 1394 | 1390 | 1390 | 983 |
| WMLP301 | 6/02/2020 | 7.75 | 8.31 | 8.31 | 2821 | 2910 | 2910 | 2140 |
| WMLP302 | 5/02/2020 | 6.48 | 7.23 | 7.23 | 954 | 987 | 987 | 662 |
| WMLP308 | 3/02/2020 | 7.17 | | 7.17 | 1370 | | 1370 | 966 |
| WMLP311 | | | | | | | | |
| WMLP320 | | | | | | | | |
| WMLP323 | 3/02/2020 | 7.07 | 7.57 | 7.57 | 1186 | 1200 | 1200 | 831 |
| WMLP324 | 3/02/2020 | 6.84 | 7.51 | 7.51 | 1292 | 1310 | 1310 | 907 |
| WMLP325 | 3/02/2020 | 7.36 | | 7.36 | 2160 | | 2160 | 1606 |
| WMLP326 | 10/02/2020 | 7.06 | | 7.06 | 1439 | | 1439 | 1018 |
| WMLP327 | 10/02/2020 | 6.81 | | 6.81 | 1917 | | 1917 | 1388 |
| WMLP328 | | | | | | | | |
| WMLP336 | 5/02/2020 | 6.70 | 7.27 | 7.27 | 594 | 617 | 617 | 404 |
| WMLP337 | 5/02/2020 | 7.00 | 7.66 | 7.66 | 2882 | 2960 | 2960 | 2165 |
| WMLP338 | 5/02/2020 | 6.87 | | 6.87 | 1811 | | 1811 | 1305 |
| WMLP343 | 7/02/2020 | 6.86 | 7.58 | 7.58 | 714 | 733 | 733 | 488 |
| WMLP346 | 7/02/2020 | 6.87 | 7.53 | 7.53 | 428 | 436 | 436 | 287 |
| WMLP349 | 7/02/2020 | 6.62 | 7.29 | 7.29 | 868 | 877 | 877 | 600 |
| WMLP358 | 7/02/2020 | 6.72 | 7.19 | 7.19 | 359 | 366 | 366 | 240 |
| YAP016 | 3/02/2020 | 7.14 | 7.53 | 7.53 | 1256 | 1270 | 1270 | 881 |
| RM10 | | | | | | | | |
| T2A | | | | | | | | |
| WML113C | 4/03/2020 | 7.35 | | 7.35 | 1196 | | 1196 | 839 |
| WML120B | 2/03/2020 | 6.65 | | 6.65 | 476 | | 476 | 320 |
| WML129 | 2/03/2020 | 7.01 | | 7.01 | 374 | | 374 | 250 |
| WML239 | 3/03/2020 | 6.87 | | 6.87 | 713 | | 713 | 488 |
| WMLP279 | 4/03/2020 | 6.97 | | 6.97 | 1061 | | 1061 | 741 |
| WMLP280 | 4/03/2020 | 6.92 | | 6.92 | 1263 | | 1263 | 888 |
| WMLP311 | | | | | | | | |
| WMLP323 | 3/03/2020 | 7.41 | | 7.41 | 1281 | | 1281 | 901 |
| WMLP328 | | | | | | | | |
| WMLP336 | 2/03/2020 | 6.99 | | 6.99 | 582 | | 582 | 394 |
| WMLP337 | 2/03/2020 | 7.06 | | 7.06 | 2797 | | 2797 | 2122 |
| WMLP343 | 3/03/2020 | 6.83 | | 6.83 | 708 | | 708 | 484 |
| WMLP346 | 3/03/2020 | 6.82 | | 6.82 | 520 | | 520 | 351 |
| WMLP349 | 3/03/2020 | 6.76 | | 6.76 | 864 | | 864 | 590 |
| WMLP358 | 3/03/2020 | 6.88 | | 6.88 | 359 | | 359 | 240 |
| YAP016 | 2/03/2020 | 6.98 | | 6.98 | 1231 | | 1231 | 864 |

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|---|---|---|---|---|---|---|---|---|
| RM10 | | | | | | | | |
| T2A | | | | | | | | |
| WML113C | 3/04/2020 | 7.15 | | 7.15 | 1234 | | 1234 | 867 |
| WML120B | 1/04/2020 | 6.98 | | 6.98 | 461 | | 461 | 310 |
| WML129 | 1/04/2020 | 6.90 | | 6.90 | 372 | | 372 | 249 |
| WML239 | 2/04/2020 | 6.91 | | 6.91 | 708 | | 708 | 484 |
| WMLP279 | 3/04/2020 | 6.98 | | 6.98 | 1040 | | 1040 | 722 |
| WMLP280 | 3/04/2020 | 6.85 | | 6.85 | 1302 | | 1302 | 916 |
| WMLP311 | | | | 0.00 | | | | |
| WMLP323 | 2/04/2020 | 7.10 | | 7.10 | 1300 | | 1300 | 912 |
| WMLP328 | | | | 0.00 | | | | |
| WMLP336 | 1/04/2020 | 7.01 | | 7.01 | 590 | | 590 | 401 |
| WMLP337 | 1/04/2020 | 7.21 | | 7.21 | 2758 | | 2758 | 2087 |
| WMLP343 | 2/04/2020 | 6.80 | | 6.80 | 690 | | 690 | 471 |
| WMLP346 | 2/04/2020 | 6.82 | | 6.82 | 533 | | 533 | 360 |
| WMLP349 | 2/04/2020 | 6.52 | | 6.52 | 868 | | 868 | 600 |
| WMLP358 | 2/04/2020 | 6.43 | | 6.43 | 357 | | 357 | 239 |
| YAP016 | 1/04/2020 | 7.24 | | 7.24 | 1227 | | 1227 | 861 |
| ASHTON WELL | 8/05/2020 | 7.19 | | 7.19 | 1601 | | 1601 | 1143 |
| GM1 | 1/05/2020 | | | 0.00 | 1962 | | 1962 | |
| PB1 | 6/05/2020 | | | 0.00 | 3680 | | 3680 | |
| RA18 | 6/05/2020 | | | 0.00 | | | 0 | |
| RA27 | 6/05/2020 | 7.14 | | 7.14 | 1424 | | 1424 | 1007 |
| RM02 | | | | 0.00 | | | 0 | |
| RM10 | 6/05/2020 | 6.98 | 6.6 | 6.60 | 1200 | 1210 | 1210 | 842.4 |
| RSGM1 | | | | 0.00 | | | 0 | |
| T2A | | | | 0.00 | | | 0 | |
| T2P | 7/05/2020 | 6.72 | 6.87 | 6.87 | 1045 | 1050 | 1050 | 727.1 |
| T3A | 7/05/2020 | 7.04 | | 7.04 | 2162 | | 2162 | 727.1 |
| T3P | 7/05/2020 | 7.50 | | 7.50 | 1640 | | 1640 | 1600 |
| T4A | 7/05/2020 | 7.02 | 7.02 | 7.02 | 1413 | 1420 | 1420 | 1600 |
| T4P | 7/05/2020 | 7.48 | 7.44 | 7.44 | 1740 | 1770 | 1770 | 997.8 |
| T5 | | | | 0.00 | | | 0 | |
| WML113C | 7/05/2020 | 6.95 | | 6.95 | 1350 | | 1350 | 951.8 |
| WML115B | | | | 0.00 | | | 0 | |
| WML115C | 1/05/2020 | 7.02 | | 7.02 | 485.7 | | 485.7 | 327 |
| WML119 | 5/05/2020 | 7.44 | 7.53 | 7.53 | 1640 | 1650 | 1650 | 1172 |
| WML120A | 4/05/2020 | 6.75 | 6.98 | 6.98 | 680.9 | 663 | 663 | 464 |
| WML120B | 4/05/2020 | 6.72 | 6.88 | 6.88 | 465.3 | 470 | 470 | 313 |
| WML129 | 5/05/2020 | 7.04 | 7.02 | 7.02 | 407.8 | 418 | 418 | 272.4 |
| WML181 | 5/05/2020 | 7.62 | 7.66 | 7.66 | 2360 | 2430 | 2430 | 1759 |
| WML183 | 5/05/2020 | 6.88 | 6.98 | 6.98 | 4218 | 4440 | 4440 | 3275 |
| WML239 | 1/05/2020 | 6.88 | 6.89 | 6.89 | 686 | 713 | 713 | 469 |
| WML261 | 4/05/2020 | 6.65 | 6.83 | 6.83 | 900 | 877 | 877 | 622.5 |
| WML262 | 5/05/2020 | 8.08 | 8.13 | 8.13 | 2870 | 2980 | 2980 | 2161 |
| WMLP277 | 6/05/2020 | 7.08 | | 7.08 | 1296 | | 1296 | 914.5 |
| WMLP278 | 6/05/2020 | 7.10 | | 7.10 | 1004 | | 1004 | 700.5 |
| WMLP279 | 6/05/2020 | 7.00 | 6.85 | 6.85 | 977.4 | 992 | 992 | 677 |
| WMLP280 | 6/05/2020 | 6.95 | 6.93 | 6.93 | 1420 | 1420 | 1420 | 1005 |
| WMLP301 | 5/05/2020 | 7.88 | 8.01 | 8.01 | 2970 | 3140 | 3140 | 2239 |
| WMLP302 | 4/05/2020 | 6.49 | 6.7 | 6.70 | 1056 | 1060 | 1060 | 740.5 |
| WMLP308 | 8/05/2020 | 7.05 | | 7.05 | 1591 | | 1591 | 1135 |
| WMLP311 | 8/05/2020 | 7.01 | 6.92 | 6.92 | 1279 | 1280 | 1280 | 896.6 |
| WMLP320 | 6/05/2020 | 7.12 | | 7.12 | 1254 | | 1254 | 882.2 |
| WMLP323 | 8/05/2020 | 6.72 | 6.64 | 6.64 | 1585 | 1600 | 1600 | 1137 |
| WMLP324 | 8/05/2020 | 6.81 | 6.85 | 6.85 | 1534 | 1550 | 1550 | 1091 |
| WMLP325 | 8/05/2020 | 7.43 | | 7.43 | 2251 | | 2251 | 1675 |
| WMLP326 | 7/05/2020 | 7.24 | | 7.24 | 1382 | | 1382 | 975.1 |
| WMLP327 | 7/05/2020 | 6.94 | | 6.94 | 1916 | | 1916 | 1388 |
| WMLP328 | 6/05/2020 | 7.09 | 7.1 | 7.10 | 1486 | 1500 | 1500 | 1056 |
| WMLP336 | 4/05/2020 | 6.70 | 6.63 | 6.63 | 585 | 602 | 602 | 397.4 |
| WMLP337 | 4/05/2020 | 7.28 | 7.23 | 7.23 | 2727 | 2810 | 2810 | 2060 |
| WMLP338 | 4/05/2020 | 6.88 | | 6.88 | 2027 | | 2027 | 1476 |
| WMLP343 | 1/05/2020 | 6.96 | 6.98 | 6.98 | 662.6 | 690 | 690 | 451.1 |
| WMLP346 | 1/05/2020 | 6.85 | 6.84 | 6.84 | 524 | 546 | 546 | 354.1 |
| WMLP349 | 1/05/2020 | 6.70 | 6.61 | 6.61 | 874.2 | 907 | 907 | 604.3 |
| WMLP358 | 1/05/2020 | 6.73 | 6.52 | 6.52 | 352 | 365 | 365 | 234 |
| YAP016 | 1/05/2020 | 7.06 | 6.98 | 6.98 | 1346 | 1360 | 1360 | 946 |

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|---|---|---|---|---|---|---|---|---|
| RM10 | 3/06/2020 | 7.24 | | 7.24 | 1205 | | 1205 | 847 |
| T2A | 3/06/2020 | | | | | | | |
| WML113C | 3/06/2020 | | | | | | | |
| WML120B | 1/06/2020 | 6.80 | | 6.80 | 450.8 | | 450.8 | 302.4 |
| WML129 | 1/06/2020 | 7.05 | | 7.05 | 471.6 | | 471.6 | 318.5 |
| WML239 | 2/06/2020 | 6.92 | | 6.92 | 702 | | 702 | 478.1 |
| WMLP279 | 3/06/2020 | 7.14 | | 7.14 | 1005 | | 1005 | 702.2 |
| WMLP280 | 3/06/2020 | 7.05 | | 7.05 | 1360 | | 1360 | 956.5 |
| WMLP311 | 2/06/2020 | 7.05 | | 7.05 | 1768 | | 1768 | 1270 |
| WMLP323 | 2/06/2020 | 6.67 | | 6.67 | 1568 | | 1568 | 1119 |
| WMLP328 | 3/06/2020 | 7.08 | | 7.08 | 1612 | | 1612 | 1154 |
| WMLP336 | 1/06/2020 | 6.76 | | 6.76 | 609 | | 609 | 412.6 |
| WMLP337 | 1/06/2020 | 7.15 | | 7.15 | 2795 | | 2795 | 2120 |
| WMLP343 | 2/06/2020 | 7.02 | | 7.02 | 661.7 | | 661.7 | 453.2 |
| WMLP346 | 2/06/2020 | 6.90 | | 6.90 | 502.1 | | 502.1 | 340.6 |
| WMLP349 | 2/06/2020 | 6.82 | | 6.82 | 902.5 | | 902.5 | 624 |
| WMLP358 | 2/06/2020 | 6.78 | | 6.78 | 354.5 | | 354.5 | 236.4 |
| YAP016 | 1/06/2020 | 7.03 | | 7.03 | 1380 | | 1380 | 973.5 |
| RM10 | 3/07/2020 | 7.62 | | 7.62 | 1155 | | 1155 | 805.6 |
| T2A | 3/07/2020 | | | | | | | |
| WML113C | 3/07/2020 | | | | | | | |
| WML120B | 1/07/2020 | 6.82 | | 6.82 | 434.6 | | 434.6 | 291.7 |
| WML129 | 1/07/2020 | 6.96 | | 6.96 | 474.2 | | 474.2 | 319.2 |
| WML239 | 2/07/2020 | 6.81 | | 6.81 | 635.3 | | 635.3 | 433.1 |
| WMLP279 | 3/07/2020 | 6.98 | | 6.98 | 940 | | 940 | 652.2 |
| WMLP280 | 3/07/2020 | 7.04 | | 7.04 | 1307 | | 1307 | 920.1 |
| WMLP311 | 2/07/2020 | 6.86 | | 6.86 | 1798 | | 1798 | 1290 |
| WMLP323 | 2/07/2020 | 6.67 | | 6.67 | 1368 | | 1368 | 959.6 |
| WMLP328 | 3/07/2020 | 7.10 | | 7.10 | 1605 | | 1605 | 1146 |
| WMLP336 | 1/07/2020 | 6.68 | | 6.68 | 581.5 | | 581.5 | 396.1 |
| WMLP337 | 1/07/2020 | 7.18 | | 7.18 | 2742 | | 2742 | 2075 |
| WMLP343 | 2/07/2020 | 6.84 | | 6.84 | 597.8 | | 597.8 | 406.7 |
| WMLP346 | 2/07/2020 | 6.80 | | 6.80 | 476.2 | | 476.2 | 320.4 |
| WMLP349 | 2/07/2020 | 6.60 | | 6.60 | 832.5 | | 832.5 | 578.6 |
| WMLP358 | 2/07/2020 | 6.52 | | 6.52 | 324.6 | | 324.6 | 215.8 |
| YAP016 | 1/07/2020 | 6.98 | | 6.98 | 1381 | | 1381 | 973.8 |
| Ashton well | 5/08/2020 | 7.50 | 7.5 | 7.50 | 354.6 | 349 | 349 | 236.5 |
| GM1 | 04/08/2020 | 7.11 | 7.43 | 7.43 | 1908 | 1850 | 1850 | 1090 |
| PB1 | 10/08/2020 | 7.20 | 7.66 | 7.66 | 2750 | 2610 | 2610 | 2060 |
| RA27 | 4/08/2020 | 7.04 | 7.35 | 7.35 | 1460 | 1460 | 1460 | 852 |
| RM10 | 10/08/2020 | 6.96 | 6.82 | 6.82 | 1417 | 1520 | 1520 | 1001 |
| T2A | 7/08/2020 | 7.11 | 7.13 | 7.13 | 1331 | 1370 | 1370 | 826 |
| T2P | 7/08/2020 | 6.72 | 6.86 | 6.86 | 1088 | 1090 | 1090 | 665 |
| T3A | 7/08/2020 | 6.92 | 7.1 | 7.10 | 2154 | 2080 | 2080 | 1260 |
| T3P | 7/08/2020 | 7.33 | 7.67 | 7.67 | 1878 | 1850 | 1850 | 945 |
| T4A | 7/08/2020 | 7.00 | 7.26 | 7.26 | 1381 | 1400 | 1400 | 812 |
| T4P | 7/08/2020 | 7.42 | 7.69 | 7.69 | 1730 | 1710 | 1710 | 1000 |
| T5 | 5/08/2020 | 6.92 | 6.75 | 6.75 | 707 | 623 | 623 | 456 |
| WML113C | 7/08/2020 | 6.96 | 6.99 | 6.99 | 1310 | 1320 | 1320 | 778 |
| WML115B | 3/08/2020 | 6.68 | 7.15 | 7.15 | 2390 | 2480 | 2480 | 1783 |
| WML115C | 03/08/2020 | 7.28 | 7.17 | 7.17 | 571.3 | 432 | 432 | 386.7 |
| WML119 | 11/08/2020 | 7.19 | 7.72 | 7.72 | 1170 | 1250 | 1250 | 720 |
| WML120A | 10/08/2020 | 6.80 | 7.07 | 7.07 | 580 | 590 | 590 | 340 |
| WML120B | 10/08/2020 | 6.72 | 6.94 | 6.94 | 425.8 | 439 | 439 | 258 |
| WML129 | 11/08/2020 | 6.85 | 6.78 | 6.78 | 431.5 | 439 | 439 | 236 |
| WML181 | 11/08/2020 | 7.55 | 8.07 | 8.07 | 2238 | 2210 | 2210 | 1390 |
| WML183 | 6/08/2020 | 7.02 | 7.53 | 7.53 | 3955 | 3880 | 3880 | 3120 |
| WML239 | 3/08/2020 | 6.82 | 6.95 | 6.95 | 642 | 672 | 672 | 393 |
| WML261 | 10/08/2020 | 6.80 | 7.28 | 7.28 | 1072 | 1140 | 1140 | 646 |
| WML262 | 11/08/2020 | 7.90 | 8.31 | 8.31 | 2782 | 2730 | 2730 | 1730 |
| WMLP277 | 4/08/2020 | 7.20 | 7.33 | 7.33 | 1315 | 1320 | 1320 | 766 |
| WMLP278 | 4/08/2020 | 7.19 | 7.29 | 7.29 | 870.2 | 718 | 718 | 544 |
| WMLP279 | 4/08/2020 | 6.80 | 7.05 | 7.05 | 860 | 850 | 850 | 544 |
| WMLP280 | 4/08/2020 | 7.00 | 7.27 | 7.27 | 1296 | 1150 | 1150 | 688 |
| WMLP301 | 11/08/2020 | 8.04 | 8.25 | 8.25 | 2990 | 2980 | 2980 | 2220 |
| WMLP302 | 10/08/2020 | 6.42 | 6.91 | 6.91 | 896 | 946 | 946 | 526 |
| WMLP308 | 5/08/2020 | 7.03 | 7.14 | 7.14 | 1475 | 1500 | 1500 | 903 |
| WMLP311 | 5/08/2020 | 7.04 | 6.94 | 6.94 | 732.5 | 749 | 749 | 504 |
| WMLP320 | 10/08/2020 | 6.90 | 7.11 | 7.11 | 1706 | 1720 | 1720 | 1224 |
| WMLP323 | 5/08/2020 | 6.67 | 6.92 | 6.92 | 902.2 | 904 | 904 | 566 |
| WMLP324 | 5/08/2020 | 6.88 | 6.81 | 6.81 | 1118 | 1160 | 1160 | 694 |
| WMLP325 | 5/08/2020 | 7.29 | 7.32 | 7.32 | 1440 | 1480 | 1480 | 836 |
| WMLP326 | 7/08/2020 | 7.10 | 7.43 | 7.43 | 1356 | 1340 | 1340 | 960 |
| WMLP327 | 7/08/2020 | 6.86 | 7.3 | 7.30 | 1898 | 1630 | 1630 | 1365 |
| WMLP328 | 10/08/2020 | 7.02 | 7.03 | 7.03 | 1277 | 1320 | 1320 | 865 |
| WMLP336 | 6/08/2020 | 6.74 | 6.87 | 6.87 | 528.7 | 558 | 558 | 326 |
| WMLP337 | 6/08/2020 | 7.23 | 7.63 | 7.63 | 2605 | 2590 | 2590 | 1600 |
| WMLP338 | 6/08/2020 | 6.84 | 7.28 | 7.28 | 1774 | 1830 | 1830 | 1100 |
| WMLP343 | 3/08/2020 | 6.85 | 7.15 | 7.15 | 617.2 | 646 | 646 | 375 |
| WMLP346 | 3/08/2020 | 6.82 | 6.92 | 6.92 | 393.8 | 422 | 422 | 243 |
| WMLP349 | 3/08/2020 | 6.62 | 6.88 | 6.88 | 870 | 914 | 914 | 537 |
| WMLP358 | 3/08/2020 | 6.45 | 6.59 | 6.59 | 345.2 | 364 | 364 | 244 |
| YAP016 | 4/08/2020 | 7.02 | 7.01 | 7.01 | 856.8 | 848 | 848 | 553 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| YAP016 | 2/09/2020 | 7.03 | | 7.03 | 1012 | | 1012 | 705 |
| WMLP337 | 2/09/2020 | 7.18 | | 7.18 | 2657 | | 2657 | 2004 |
| WMLP336 | 2/09/2020 | 6.70 | | 6.70 | 550.6 | | 550.6 | 372.5 |
| WML129 | 2/09/2020 | 7.05 | | 7.05 | 428.6 | | 428.6 | 287 |
| WMLP358 | 1/09/2020 | 6.46 | | 6.46 | 354.8 | | 354.8 | 238.5 |
| WML239 | 1/09/2020 | 7.00 | | 7.00 | 652 | | 652 | 444 |
| WMLP349 | 1/09/2020 | 6.62 | | 6.62 | 844 | | 844 | 582.9 |
| WMLP346 | 1/09/2020 | 6.98 | | 6.98 | 495 | | 495 | 332 |
| WMLP343 | 1/09/2020 | 7.10 | | 7.10 | 604.2 | | 604.2 | 410 |
| WMLP323 | 1/09/2020 | 6.82 | | 6.82 | 814.2 | | 814.2 | 560 |
| WMLP311 | 1/09/2020 | 6.96 | | 6.96 | 1075 | | 1075 | 749.4 |
| WMLP328 | 3/09/2020 | 7.07 | | 7.07 | 1162 | | 1162 | 811.2 |
| RM10 | 3/09/2020 | 7.08 | | 7.08 | 1637 | | 1637 | 1166 |
| WMLP279 | 3/09/2020 | 6.88 | | 6.88 | 873.5 | | 873.5 | 604 |
| WMLP280 | 3/09/2020 | 6.89 | | 6.89 | 1296 | | 1296 | 912.8 |
| WML113C | 3/09/2020 | 7.10 | | 7.10 | 980.6 | | 980.6 | 678.9 |
| WML120B | 2/09/2020 | 6.82 | | 6.82 | 438.2 | | 438.2 | 295 |
| T2A | 3/09/2020 | 7.18 | | 7.18 | 1330 | | 1330 | 938.4 |
| YAP016 | 2/10/2020 | 6.78 | | 6.78 | 1096 | | 1096 | 766.6 |
| WMLP337 | 2/10/2020 | 7.20 | | 7.20 | 2572 | | 2572 | 1935 |
| WMLP336 | 2/10/2020 | 6.84 | | 6.84 | 539 | | 539 | 364.5 |
| WML129 | 2/10/2020 | 7.14 | | 7.14 | 409.3 | | 409.3 | 273.9 |
| WMLP358 | 1/10/2020 | 6.43 | | 6.43 | 368.7 | | 368.7 | 246.2 |
| WML239 | 1/10/2020 | 6.82 | | 6.82 | 647.4 | | 647.4 | 440.8 |
| WMLP349 | 1/10/2020 | 6.60 | | 6.60 | 851.1 | | 851.1 | 586.8 |
| WMLP346 | 1/10/2020 | 6.85 | | 6.85 | 503.5 | | 503.5 | 339.5 |
| WMLP343 | 1/10/2020 | 6.94 | | 6.94 | 586.7 | | 586.7 | 398.7 |
| WMLP323 | 1/10/2020 | 6.70 | | 6.70 | 983.2 | | 983.2 | 682 |
| WMLP311 | 1/10/2020 | 6.85 | | 6.85 | 1287 | | 1287 | 902.6 |
| WMLP328 | 6/10/2020 | 7.03 | | 7.03 | 1200 | | 1200 | 842 |
| RM10 | 6/10/2020 | 7.06 | | 7.06 | 1568 | | 1568 | 1115 |
| WMLP279 | 6/10/2020 | 6.82 | | 6.82 | 889.2 | | 889.2 | 614.2 |
| WMLP280 | 6/10/2020 | 6.89 | | 6.89 | 1252 | | 1252 | 879.8 |
| WML113C | 6/10/2020 | 6.99 | | 6.99 | 927.5 | | 927.5 | 643.1 |
| WML120B | 2/10/2020 | 6.92 | | 6.92 | 414.8 | | 414.8 | 277.8 |
| T2A | 6/10/2020 | 7.07 | | 7.07 | 1222 | | 1222 | 858 |
| Ashton well | 2/11/2020 | 7.35 | | 7.35 | 486.1 | | 486.1 | 327.4 |
| GM1 | 2/11/2020 | | | 0.00 | 1760 | | 1760 | |
| RA27 | 4/11/2020 | 7.04 | | 7.04 | 1244 | | 1244 | 874.7 |
| RM10 | 4/11/2020 | 7.10 | 7.09 | 7.09 | 1531 | 1730 | 1730 | 1085 |
| T2A | 6/11/2020 | 7.06 | 7.22 | 7.22 | 1265 | 1360 | 1360 | 889.1 |
| T2P | 6/11/2020 | 6.61 | 6.9 | 6.90 | 1076 | 1150 | 1150 | 752.3 |
| T3A | 6/11/2020 | 6.79 | | 6.79 | 2100 | | 2100 | 1530 |
| T3P | 6/11/2020 | 7.29 | | 7.29 | 1788 | | 1788 | 1280 |
| T4A | 6/11/2020 | 7.16 | 7.31 | 7.31 | 1240 | 1340 | 1340 | 874.5 |
| T4P | 6/11/2020 | 7.32 | 7.74 | 7.74 | 1722 | 1830 | 1830 | 1234 |
| T5 | 3/11/2020 | 6.81 | | 6.81 | 809.6 | | 809.6 | 556.8 |
| WML113C | 5/11/2020 | 6.89 | 7.04 | 7.04 | 951 | 1090 | 1090 | 659.5 |
| WML115B | 2/11/2020 | 6.80 | | 6.80 | 2408 | | 2408 | 1796 |
| WML115C | 2/11/2020 | 7.35 | | 7.35 | 557.2 | | 557.2 | 376.4 |
| WML119 | 9/11/2020 | 7.32 | 7.73 | 7.73 | 1033 | 1190 | 1190 | 720.2 |
| WML120A | 3/11/2020 | 7.03 | 7.26 | 7.26 | 751.8 | 809 | 809 | 514.3 |
| WML120B | 3/11/2020 | 6.78 | 7.03 | 7.03 | 406.5 | 466 | 466 | 270 |
| WML129 | 9/11/2020 | 6.73 | 6.72 | 6.72 | 472.6 | 546 | 546 | 318 |
| WML181 | 9/11/2020 | 7.80 | 7.96 | 7.96 | 2141 | 2410 | 2410 | 1563 |
| WML183 | 9/11/2020 | 6.92 | 7.54 | 7.54 | 3962 | 4560 | 4560 | 3063 |
| WML239 | 5/11/2020 | 6.74 | 7.13 | 7.13 | 626.6 | 721 | 721 | 426.8 |
| WML261 | 3/11/2020 | 6.76 | 7.14 | 7.14 | 807.7 | 892 | 892 | 556.5 |
| WML262 | 9/11/2020 | 7.98 | 8.13 | 8.13 | 2502 | 2880 | 2880 | 1875 |
| WMLP277 | 4/11/2020 | 6.99 | | 6.99 | 1189 | | 1189 | 832.2 |
| WMLP278 | 4/11/2020 | 7.04 | | 7.04 | 644.6 | | 644.6 | 432.2 |
| WMLP279 | 4/11/2020 | 6.84 | 7.06 | 7.06 | 645.7 | 727 | 727 | 431 |
| WMLP280 | 4/11/2020 | 6.97 | 7.31 | 7.31 | 1058 | 1210 | 1210 | 738.1 |
| WMLP301 | 9/11/2020 | 8.02 | 8.22 | 8.22 | 2672 | 3060 | 3060 | 2016 |
| WMLP302 | 3/11/2020 | 6.48 | 6.74 | 6.74 | 732.2 | 840 | 840 | 510.4 |
| WMLP308 | 2/11/2020 | 7.04 | | 7.04 | 1084 | | 1084 | 756 |
| WMLP311 | 2/11/2020 | 6.80 | 7.18 | 7.18 | 1000 | 1130 | 1130 | 693.1 |
| WMLP320 | 4/11/2020 | 6.91 | | 6.91 | 1905 | | 1905 | 1377 |
| WMLP323 | 2/11/2020 | 6.70 | 6.93 | 6.93 | 795.4 | 912 | 912 | 544.9 |
| WMLP324 | 2/11/2020 | 6.82 | 7.1 | 7.10 | 896.2 | 1030 | 1030 | 620 |
| WMLP325 | 2/11/2020 | 7.13 | | 7.13 | 1153 | | 1153 | 806.6 |
| WMLP326 | 4/11/2020 | 7.13 | | 7.13 | 1225 | | 1225 | 859 |
| WMLP327 | 4/11/2020 | 6.85 | | 6.85 | 1713 | | 1713 | 1224 |
| WMLP328 | 4/11/2020 | 7.12 | 7.17 | 7.17 | 1074 | 1240 | 1240 | 750 |
| WMLP336 | 3/11/2020 | 6.65 | 6.97 | 6.97 | 514 | 592 | 592 | 348 |
| WMLP337 | 3/11/2020 | 7.12 | 7.67 | 7.67 | 2546 | 2870 | 2870 | 1912 |
| WMLP338 | 3/11/2020 | 6.82 | | 6.82 | 1834 | | 1834 | 1834 |
| WMLP343 | 5/11/2020 | 6.82 | 7.29 | 7.29 | 565 | 648 | 648 | 382 |
| WMLP346 | 5/11/2020 | 6.75 | 6.96 | 6.96 | 455.1 | 517 | 517 | 305.9 |
| WMLP349 | 5/11/2020 | 6.44 | 6.76 | 6.76 | 843.7 | 957 | 957 | 581.9 |
| WMLP358 | 5/11/2020 | 6.27 | 6.71 | 6.71 | 323.3 | 371 | 371 | 214.4 |
| YAP016 | 2/11/2020 | 6.90 | 7.07 | 7.07 | 776.7 | 890 | 890 | 533.2 |
| RSGM1 | 3/11/2020 | | | 0.00 | 818.8 | | 818.8 | |
| RA18 | 4/11/2020 | 6.99 | | 6.99 | 1040 | | 1040 | 722 |
| YAP016 | 1/12/2020 | 6.84 | | 6.84 | 1072 | | 1072 | 747 |
| WMLP337 | 3/12/2020 | 7.10 | | 7.10 | 2496 | | 2496 | 1873 |
| WMLP336 | 3/12/2020 | 6.52 | | 6.52 | 509 | | 509 | 343.4 |
| WML129 | 3/12/2020 | 6.89 | | 6.89 | 485.6 | | 485.6 | 326.8 |
| WMLP358 | 1/12/2020 | 6.25 | | 6.25 | 332.8 | | 332.8 | 220.8 |
| WML239 | 1/12/2020 | 6.83 | | 6.83 | 564.2 | | 564.2 | 445.4 |
| WMLP349 | 1/12/2020 | 6.57 | | 6.57 | 885.6 | | 885.6 | 611.6 |
| WMLP346 | 1/12/2020 | 6.82 | | 6.82 | 522.6 | | 522.6 | 351.6 |
| WMLP343 | 1/12/2020 | 7.10 | | 7.10 | 580.5 | | 580.5 | 392.5 |
| WMLP323 | 2/12/2020 | 6.62 | | 6.62 | 939.3 | | 939.3 | 651.4 |
| WMLP311 | 2/12/2020 | 6.66 | | 6.66 | 1320 | | 1320 | 928.6 |
| WMLP328 | 2/12/2020 | 7.07 | | 7.07 | 1133 | | 1133 | 792.1 |
| RM10 | 2/12/2020 | 7.07 | | 7.07 | 1469 | | 1469 | 1040 |
| WMLP279 | 2/12/2020 | 6.82 | | 6.82 | 790.7 | | 790.7 | 543.5 |
| WMLP280 | 2/12/2020 | 6.89 | | 6.89 | 1182 | | 1182 | 828.3 |
| WML113C | 2/12/2020 | 7.01 | | 7.01 | 967.1 | | 967.1 | 671.4 |
| WML120B | 3/12/2020 | 6.70 | | 6.70 | 410.2 | | 410.2 | 274.4 |
| T2A | 2/12/2020 | 7.08 | | 7.08 | 1256 | | 1256 | 881.4 |

# *Appendix E* Groundwater chemistry – aquifer speciation

**Table E1 August 2020 Ashton monitoring bore water classifications**

| Bore ID | Geology | Individual Water Type | General Water Type |
|---|---|---|---|
| T5 | BCA | Na-Ca-Cl-SO4-HCO3 | Na-Ca |
| WML113C | | Na-Ca-Mg-Cl-SO4 | |
| Ashton well | | Na-Ca-Mg-HCO3-Cl-SO4 | |
| T2A | | Na-Ca-Mg-SO4-Cl | |
| WMLP320 | | Na-Ca-Mg-SO4-Cl | |
| WMLP328 | | Na-Ca-Mg-SO4-Cl | |
| WMLP325 | CMOB | Na-Ca-Cl-HCO3 | |
| WMLP327 | | Na-Ca-Cl-HCO3 | |
| RM10 | | Na-Ca-Mg-Cl-SO4 | |
| WMLP336 | | Na-Ca-Mg-HCO3-Cl | |
| WMLP324 | | Na-Ca-Mg-SO4-Cl-HCO3 | |
| WML129 | GCA | Na-Ca-Mg-Cl-HCO3 | |
| WML239 | | Na-Ca-Mg-Cl-HCO3 | |
| WMLP349 | | Na-Ca-Mg-Cl-HCO3 | |
| WMLP343 | | Na-Ca-Mg-HCO3-Cl | |
| WMLP346 | | Na-Ca-Mg-HCO3-Cl | |
| WMLP279 | HRA | Na-Ca-Mg-Cl-HCO3-SO4 | |
| T2P | CMOB | Ca-Na-Mg-Cl-SO4-HCO3 | Ca-Na |
| WMLP358 | GCA | Ca-Na-Mg-HCO3-Cl | |
| PB1 | BCA | Ca-Na-Mg-SO4-Cl | |
| T4A | BCA | Na-Cl-HCO3 | Na-Cl |
| WMLP326 | | Na-Cl-HCO3 | |
| T3P | CMOB | Na-Cl-HCO3 | |
| T4P | | Na-Cl-HCO3 | |
| WML181 | Coal | Na-Cl-HCO3 | |
| WMLP301 | | Na-Cl-HCO3 | |
| WML115B | | Na-Cl-HCO3-SO4 | |
| RA27 | HRA | Na-Cl-HCO3 | |
| WMLP277 | | Na-Cl-HCO3 | |
| WMLP308 | BCA | Na-Mg-Ca-Cl-SO4-HCO3 | Na-Mg |
| WMLP323 | | Na-Mg-Ca-SO4-HCO3-Cl | |
| T3A | | Na-Mg-Cl | |
| WMLP311 | | Na-Mg-Cl-SO4-HCO3 | |
| WML120A | Coal | Na-Mg-Ca-HCO3-Cl | |
| GM1 | | Na-Mg-Cl-HCO3 | |
| WML183 | | Na-Mg-Cl-HCO3 | |
| WML261 | | Na-Mg-Cl-HCO3 | |
| WMLP302 | | Na-Mg-Cl-HCO3 | |
| WML120B | GCA | Na-Mg-Ca-HCO3-Cl | |
| WMLP280 | HRA | Na-Mg-Ca-Cl-HCO3 | |
| WMLP338 | | Na-Mg-Ca-Cl-HCO3 | |
| WMLP337 | | Na-Mg-Cl-HCO3 | |
| WML115C | BCA | Na-HCO3 | Na-HCO3 |
| WML119 | Coal | Na-HCO3-Cl | |
| WML262 | | Na-HCO3-Cl | |
| WMLP278 | HRA | Na-HCO3-Cl | |
| YAP016 | BCA | Na-SO4-Cl-HCO3 | Na-SO4 |

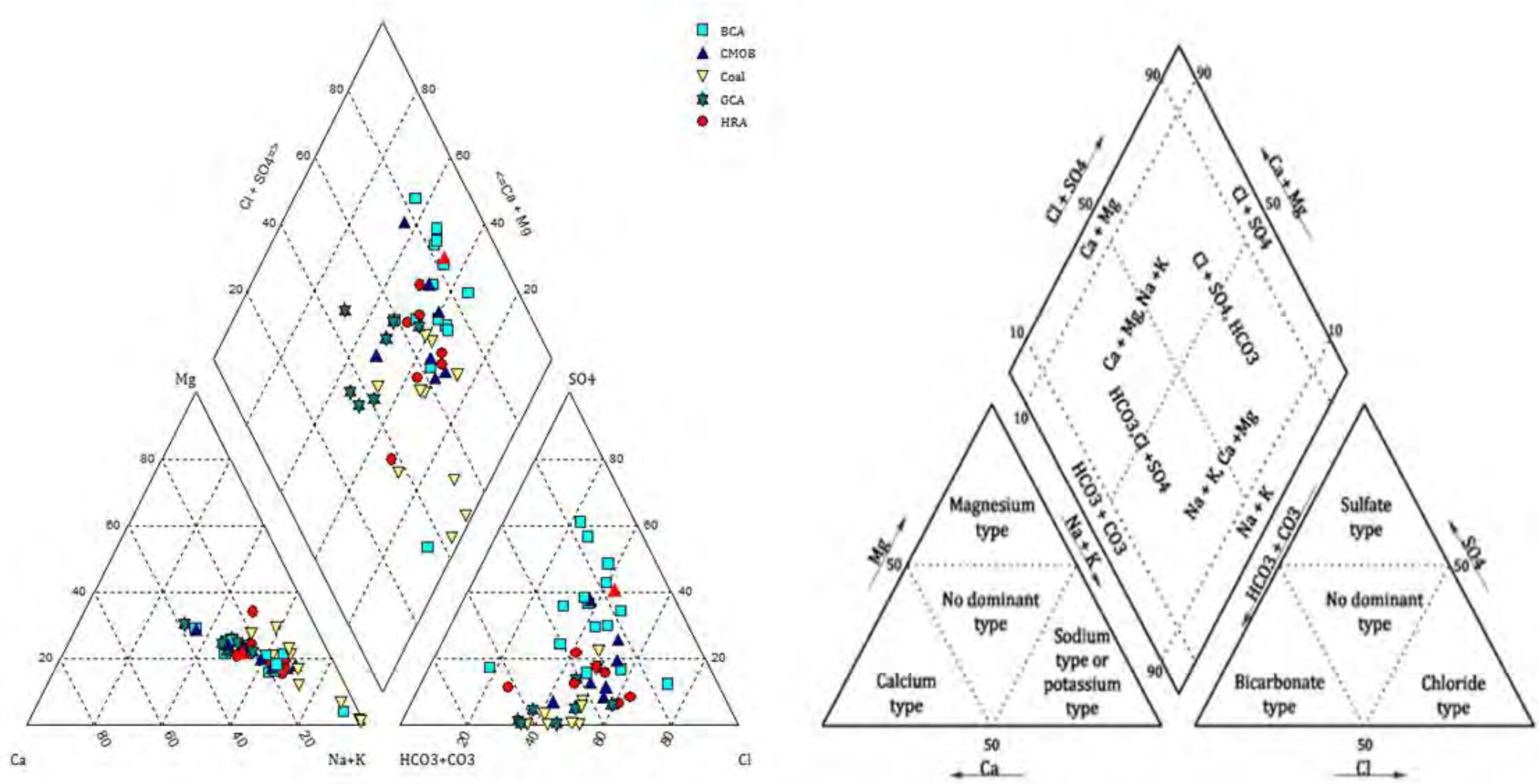


**Figure E1 August 2020 Ashton monitoring bore Piper Diagram**

# *Appendix F* Laboratory certificate of analysis and chain of custody documents (August 2020)

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2028057** | Page | : 1 of 22 |
| Client | : **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : BRYCE McKAY | Contact | : Customer Services ES |
| Address | : 4 HUDSON STREET HAMILTON NSW 2303 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : +61 02 4926 2091 | Telephone | : +61-2-8784 8555 |
| Project | : G1922K Ashton Annual Sampling | Date Samples Received | : 12-Aug-2020 11:55 |
| Order number | : ---- | Date Analysis Commenced | : 13-Aug-2020 |
| C-O-C number | : ---- | Issue Date | : 19-Aug-2020 17:29 |
| Sampler | : Glen Brumm | | |
| Site | : ---- | | |
| Quote number | : EN/222 | | |
| No. of samples received | : 48 | | |
| No. of samples analysed | : 48 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ankit Joshi | Inorganic Chemist | Sydney Inorganics, Smithfield, NSW |
| Ivan Taylor | Analyst | Sydney Inorganics, Smithfield, NSW |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EN055: Ionic Balance out of acceptable limits for sample ES2028057-#012 due to analytes not quantified in this report.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML115B | WML115C | WMLP358 | WML239 | WMLP349 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 03-Aug-2020 13:30 | 03-Aug-2020 13:45 | 03-Aug-2020 08:45 | 03-Aug-2020 10:45 | 03-Aug-2020 09:30 |
| Compound | CAS Number | LOR | Unit | ES2028057-001 | ES2028057-002 | ES2028057-003 | ES2028057-004 | ES2028057-005 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | **7.15** | **7.17** | **6.59** | **6.95** | **6.88** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | **2480** | **432** | **364** | **672** | **914** |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | ---- | ---- | **244** | **393** | **537** |
| **EA045: Turbidity** | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | ---- | ---- | <0.1 | **53.2** | **3.8** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | **505** | **153** | **106** | **180** | **188** |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | **505** | **153** | **106** | **180** | **188** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | **294** | **32** | <1 | **16** | **27** |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | **462** | **25** | **54** | **114** | **192** |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| **Calcium** | 7440-70-2 | 1 | mg/L | **71** | **4** | **27** | **39** | **40** |
| **Magnesium** | 7439-95-4 | 1 | mg/L | **37** | **2** | **13** | **18** | **24** |
| **Sodium** | 7440-23-5 | 1 | mg/L | **438** | **93** | **25** | **72** | **114** |
| **Potassium** | 7440-09-7 | 1 | mg/L | **2** | <1 | <1 | **1** | <1 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | ---- | ---- | <0.001 | <0.001 | <0.001 |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | ---- | ---- | <0.0001 | <0.0001 | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | ---- | ---- | <0.001 | <0.001 | <0.001 |
| **Copper** | 7440-50-8 | 0.001 | mg/L | ---- | ---- | **0.001** | <0.001 | **0.001** |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | ---- | ---- | <0.001 | **0.006** | **0.002** |
| **Lead** | 7439-92-1 | 0.001 | mg/L | ---- | ---- | <0.001 | <0.001 | <0.001 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | ---- | ---- | <0.005 | <0.005 | **0.010** |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | ---- | ---- | **0.016** | **0.028** | **0.165** |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | ---- | ---- | <0.01 | <0.01 | <0.01 |
| **Iron** | 7439-89-6 | 0.05 | mg/L | ---- | ---- | <0.05 | **0.13** | **0.56** |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| **Total Cyanide** | 57-12-5 | 0.004 | mg/L | ---- | ---- | <0.004 | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML115B | WML115C | WMLP358 | WML239 | WMLP349 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 03-Aug-2020 13:30 | 03-Aug-2020 13:45 | 03-Aug-2020 08:45 | 03-Aug-2020 10:45 | 03-Aug-2020 09:30 |
| Compound | CAS Number | LOR | Unit | ES2028057-001 | ES2028057-002 | ES2028057-003 | ES2028057-004 | ES2028057-005 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | ---- | ---- | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | ---- | ---- | **0.04** | **0.02** | **0.02** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | ---- | ---- | **0.04** | **0.02** | **0.02** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | ---- | ---- | **0.1** | <0.1 | <0.1 |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | ---- | ---- | **0.1** | <0.1 | <0.1 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | ---- | ---- | **0.06** | **0.08** | **0.06** |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **29.2** | **4.43** | **3.64** | **7.14** | **9.73** |
| ø Total Cations | ---- | 0.01 | meq/L | **25.7** | **4.41** | **3.50** | **6.58** | **8.93** |
| ø Ionic Balance | ---- | 0.01 | % | **6.47** | **0.21** | **1.91** | **4.08** | **4.31** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP346 | WMLP343 | GM01 | YAP016 | RA27 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 03-Aug-2020 11:30 | 03-Aug-2020 12:15 | 04-Aug-2020 08:40 | 04-Aug-2020 08:10 | 04-Aug-2020 10:20 |
| Compound | CAS Number | LOR | Unit | ES2028057-006 | ES2028057-007 | ES2028057-008 | ES2028057-009 | ES2028057-010 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 6.92 | 7.15 | 7.43 | 7.01 | 7.35 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 422 | 646 | 1850 | 848 | 1460 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 243 | 375 | 1090 | 553 | 852 |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | 0.6 | 0.4 | 561 | 4.6 | 10.4 |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 153 | 231 | 330 | 127 | 278 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 153 | 231 | 330 | 127 | 278 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 1 | 4 | 139 | 147 | 110 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 50 | 72 | 294 | 101 | 273 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 22 | 40 | 66 | 28 | 40 |
| Magnesium | 7439-95-4 | 1 | mg/L | 13 | 20 | 49 | 18 | 34 |
| Sodium | 7440-23-5 | 1 | mg/L | 49 | 69 | 273 | 122 | 221 |
| Potassium | 7440-09-7 | 1 | mg/L | <1 | <1 | 3 | 1 | <1 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | 0.001 | <0.001 | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.002 | <0.001 | 0.001 | 0.008 |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.057 | 0.010 | 0.610 | 0.006 | 0.008 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Iron | 7439-89-6 | 0.05 | mg/L | 0.10 | <0.05 | 1.04 | <0.05 | <0.05 |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP346 | WMLP343 | GM01 | YAP016 | RA27 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 03-Aug-2020 11:30 | 03-Aug-2020 12:15 | 04-Aug-2020 08:40 | 04-Aug-2020 08:10 | 04-Aug-2020 10:20 |
| Compound | CAS Number | LOR | Unit | ES2028057-006 | ES2028057-007 | ES2028057-008 | ES2028057-009 | ES2028057-010 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | 0.02 | 0.06 | 0.04 | 1.61 | 0.67 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.02 | 0.06 | 0.04 | 1.61 | 0.67 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 0.1 | 0.1 | 0.3 | 0.2 | 0.2 |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | 0.1 | 0.2 | 0.3 | 1.8 | 0.9 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | 0.04 | 0.04 | 1.20 | <0.01 | 0.26 |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | 4.49 | 6.73 | 17.8 | 8.45 | 15.5 |
| ø Total Cations | ---- | 0.01 | meq/L | 4.30 | 6.64 | 19.3 | 8.21 | 14.4 |
| ø Ionic Balance | ---- | 0.01 | % | 2.15 | 0.64 | 4.04 | 1.42 | 3.80 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP277 | WMLP278 | WMLP279 | WMLP280 | Ashton Well |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 04-Aug-2020 11:40 | 04-Aug-2020 12:30 | 04-Aug-2020 12:45 | 04-Aug-2020 11:15 | 05-Aug-2020 08:45 |
| Compound | CAS Number | LOR | Unit | ES2028057-011 | ES2028057-012 | ES2028057-013 | ES2028057-014 | ES2028057-015 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 7.33 | 7.29 | 7.05 | 7.27 | 6.82 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1320 | 718 | 850 | 1150 | 349 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | ---- | ---- | ---- | 688 | ---- |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 766 | 544 | 544 | ---- | ---- |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | 36.0 | 4.5 | 23.6 | 6.8 | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 265 | 240 | 180 | 268 | 79 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 265 | 240 | 180 | 268 | 79 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 110 | 34 | 83 | 62 | 38 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 231 | 60 | 118 | 168 | 41 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 39 | 29 | 46 | 47 | 20 |
| Magnesium | 7439-95-4 | 1 | mg/L | 26 | 16 | 21 | 29 | 10 |
| Sodium | 7440-23-5 | 1 | mg/L | 201 | 134 | 99 | 186 | 37 |
| Potassium | 7440-09-7 | 1 | mg/L | <1 | <1 | <1 | <1 | 2 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | 0.056 | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | 0.006 | 0.004 | 0.005 | 0.107 | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.030 | 0.018 | 0.008 | 0.051 | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | <0.05 | <0.05 | 0.73 | ---- |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP277 | WMLP278 | WMLP279 | WMLP280 | Ashton Well |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 04-Aug-2020 11:40 | 04-Aug-2020 12:30 | 04-Aug-2020 12:45 | 04-Aug-2020 11:15 | 05-Aug-2020 08:45 |
| Compound | CAS Number | LOR | Unit | ES2028057-011 | ES2028057-012 | ES2028057-013 | ES2028057-014 | ES2028057-015 |
| | | | | Result | Result | Result | Result | Result |
| **EK026SF: Total CN by Segmented Flow Analyser - Continued** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | 0.41 | 1.52 | 1.93 | 0.30 | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.41 | 1.52 | 1.93 | 0.30 | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 0.1 | 0.3 | 0.3 | 0.2 | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | 0.5 | 1.8 | 2.2 | 0.5 | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | 0.22 | 0.07 | 0.09 | 0.12 | ---- |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | 14.1 | 7.20 | 8.65 | 11.4 | 3.53 |
| ø Total Cations | ---- | 0.01 | meq/L | 12.8 | 8.59 | 8.33 | 12.8 | 3.48 |
| ø Ionic Balance | ---- | 0.01 | % | 4.72 | 8.85 | 1.90 | 5.94 | 0.64 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | T5 | DUPLICATE | WMLP323 | WMLP324 | WMLP308 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 05-Aug-2020 12:45 | 04-Aug-2020 00:00 | 05-Aug-2020 11:45 | 05-Aug-2020 11:15 | 05-Aug-2020 09:15 |
| Compound | CAS Number | LOR | Unit | ES2028057-016 | ES2028057-017 | ES2028057-018 | ES2028057-019 | ES2028057-020 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | **6.75** | **7.32** | **6.92** | **6.81** | **7.14** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | **623** | **862** | **904** | **1160** | **1500** |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | **456** | **538** | **566** | **694** | **903** |
| **EA045: Turbidity** | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | **11.7** | **4.5** | **2.6** | **15.1** | **0.8** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | **95** | **265** | **155** | **170** | **230** |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | **95** | **265** | **155** | **170** | **230** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | **106** | **53** | **130** | **205** | **229** |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | **81** | **106** | **82** | **150** | **263** |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| **Calcium** | 7440-70-2 | 1 | mg/L | **28** | **33** | **41** | **55** | **68** |
| **Magnesium** | 7439-95-4 | 1 | mg/L | **13** | **17** | **25** | **32** | **44** |
| **Sodium** | 7440-23-5 | 1 | mg/L | **99** | **132** | **110** | **135** | **186** |
| **Potassium** | 7440-09-7 | 1 | mg/L | **1** | <1 | **2** | **2** | **3** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **Copper** | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | **0.002** | **0.004** | **0.002** | **0.003** | **0.002** |
| **Lead** | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | **0.003** | **0.017** | **0.004** | **0.032** | **0.007** |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Iron** | 7439-89-6 | 0.05 | mg/L | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| **Total Cyanide** | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | T5 | DUPLICATE | WMLP323 | WMLP324 | WMLP308 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 05-Aug-2020 12:45 | 04-Aug-2020 00:00 | 05-Aug-2020 11:45 | 05-Aug-2020 11:15 | 05-Aug-2020 09:15 |
| Compound | CAS Number | LOR | Unit | ES2028057-016 | ES2028057-017 | ES2028057-018 | ES2028057-019 | ES2028057-020 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | 4.11 | 1.46 | 2.76 | 1.14 | 1.14 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 4.11 | 1.46 | 2.76 | 1.14 | 1.14 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 0.9 | 0.6 | 0.7 | 0.3 | 0.2 |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | 5.0 | 2.1 | 3.5 | 1.4 | 1.3 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | 0.03 | 0.17 | 0.03 | 0.02 | 0.01 |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | 6.39 | 9.39 | 8.12 | 11.9 | 16.8 |
| ø Total Cations | ---- | 0.01 | meq/L | 6.80 | 8.79 | 8.94 | 11.3 | 15.2 |
| ø Ionic Balance | ---- | 0.01 | % | 3.10 | 3.30 | 4.82 | 2.56 | 5.01 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP325 | WMLP311 | WMLP337 | WMLP338 | WMLP336 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 05-Aug-2020 10:00 | 05-Aug-2020 10:30 | 06-Aug-2020 09:00 | 06-Aug-2020 10:45 | 06-Aug-2020 11:45 |
| Compound | CAS Number | LOR | Unit | ES2028057-021 | ES2028057-022 | ES2028057-023 | ES2028057-024 | ES2028057-025 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 7.32 | 6.94 | 7.63 | 7.28 | 6.87 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1480 | 749 | 2590 | 1830 | 558 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 836 | 504 | 1600 | 1100 | 326 |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | 40.5 | 4.4 | 2940 | 114 | 3.3 |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 241 | 119 | 496 | 382 | 156 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 241 | 119 | 496 | 382 | 156 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 140 | 101 | 118 | 61 | 17 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 292 | 110 | 665 | 425 | 75 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 62 | 27 | 94 | 81 | 31 |
| Magnesium | 7439-95-4 | 1 | mg/L | 35 | 18 | 121 | 56 | 16 |
| Sodium | 7440-23-5 | 1 | mg/L | 199 | 98 | 333 | 237 | 59 |
| Potassium | 7440-09-7 | 1 | mg/L | 2 | 2 | 5 | <1 | 1 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.006 | <0.001 | <0.001 | 0.004 |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | 0.002 | 0.010 | 0.002 | 0.009 | 0.013 |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | 0.009 | 0.008 | <0.005 |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.375 | 0.010 | 0.136 | 0.621 | 0.010 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Iron | 7439-89-6 | 0.05 | mg/L | 0.80 | 0.05 | <0.05 | 0.83 | 0.07 |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP325 | WMLP311 | WMLP337 | WMLP338 | WMLP336 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 05-Aug-2020 10:00 | 05-Aug-2020 10:30 | 06-Aug-2020 09:00 | 06-Aug-2020 10:45 | 06-Aug-2020 11:45 |
| Compound | CAS Number | LOR | Unit | ES2028057-021 | ES2028057-022 | ES2028057-023 | ES2028057-024 | ES2028057-025 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | **0.02** | **1.68** | **0.03** | **0.21** | **0.58** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | **0.02** | **1.68** | **0.03** | **0.21** | **0.58** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | **0.2** | **0.4** | **2.0** | **0.2** | **0.2** |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | **0.2** | **2.1** | **2.0** | **0.4** | **0.8** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.08** | **0.03** | **2.02** | **0.11** | **0.08** |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **16.0** | **7.58** | **31.1** | **20.9** | **5.59** |
| ø Total Cations | ---- | 0.01 | meq/L | **14.7** | **7.14** | **29.3** | **19.0** | **5.46** |
| ø Ionic Balance | ---- | 0.01 | % | **4.19** | **2.99** | **3.09** | **4.85** | **1.18** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML183 | WMLP326 | WMLP327 | T4-A | T4-P |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 06-Aug-2020 14:40 | 07-Aug-2020 09:00 | 07-Aug-2020 09:15 | 07-Aug-2020 10:30 | 07-Aug-2020 10:00 |
| Compound | CAS Number | LOR | Unit | ES2028057-026 | ES2028057-027 | ES2028057-028 | ES2028057-029 | ES2028057-030 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | **7.53** | **7.43** | **7.30** | **7.26** | **7.69** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | **3880** | **1340** | **1630** | **1400** | **1710** |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | **3120** | ---- | ---- | **812** | **1000** |
| **EA045: Turbidity** | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | **6420** | ---- | ---- | **17.3** | **6.1** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | **1010** | **272** | **322** | **224** | **409** |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | **1010** | **272** | **322** | **224** | **409** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | **397** | **90** | **59** | **112** | **110** |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | **865** | **204** | **295** | **284** | **318** |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| **Calcium** | 7440-70-2 | 1 | mg/L | **115** | **48** | **70** | **47** | **52** |
| **Magnesium** | 7439-95-4 | 1 | mg/L | **172** | **25** | **38** | **28** | **37** |
| **Sodium** | 7440-23-5 | 1 | mg/L | **656** | **193** | **268** | **199** | **276** |
| **Potassium** | 7440-09-7 | 1 | mg/L | **8** | <1 | **3** | <1 | **3** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | <0.001 | ---- | ---- | <0.001 | <0.001 |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | <0.0001 | ---- | ---- | <0.0001 | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | <0.001 | ---- | ---- | <0.001 | <0.001 |
| **Copper** | 7440-50-8 | 0.001 | mg/L | <0.001 | ---- | ---- | <0.001 | <0.001 |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | **0.006** | ---- | ---- | **0.004** | <0.001 |
| **Lead** | 7439-92-1 | 0.001 | mg/L | <0.001 | ---- | ---- | <0.001 | <0.001 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | **0.011** | ---- | ---- | <0.005 | <0.005 |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | **0.176** | ---- | ---- | **0.067** | **0.033** |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | <0.01 | ---- | ---- | <0.01 | <0.01 |
| **Iron** | 7439-89-6 | 0.05 | mg/L | **0.12** | ---- | ---- | **0.05** | **0.21** |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| **Total Cyanide** | 57-12-5 | 0.004 | mg/L | <0.004 | ---- | ---- | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML183 | WMLP326 | WMLP327 | T4-A | T4-P |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 06-Aug-2020 14:40 | 07-Aug-2020 09:00 | 07-Aug-2020 09:15 | 07-Aug-2020 10:30 | 07-Aug-2020 10:00 |
| Compound | CAS Number | LOR | Unit | ES2028057-026 | ES2028057-027 | ES2028057-028 | ES2028057-029 | ES2028057-030 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | ---- | ---- | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | 0.02 | ---- | ---- | 0.71 | 0.02 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.02 | ---- | ---- | 0.71 | 0.02 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 4.2 | ---- | ---- | 0.1 | 0.4 |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | 4.2 | ---- | ---- | 0.8 | 0.4 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | 1.06 | ---- | ---- | 0.14 | 0.02 |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | 52.8 | 13.1 | 16.0 | 14.8 | 19.4 |
| ø Total Cations | ---- | 0.01 | meq/L | 48.6 | 12.8 | 18.4 | 13.3 | 17.7 |
| ø Ionic Balance | ---- | 0.01 | % | 4.15 | 0.83 | 6.90 | 5.38 | 4.60 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML113C | T3-A | T3-P | T2-A | T2-P |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 07-Aug-2020 11:10 | 07-Aug-2020 12:45 | 07-Aug-2020 12:30 | 07-Aug-2020 13:55 | 07-Aug-2020 14:10 |
| Compound | CAS Number | LOR | Unit | ES2028057-031 | ES2028057-032 | ES2028057-033 | ES2028057-034 | ES2028057-035 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 6.99 | 7.10 | 7.67 | 7.13 | 6.86 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1320 | 2080 | 1850 | 1370 | 1090 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 778 | 1260 | 945 | 826 | 665 |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | 145 | 221 | 2.8 | 0.9 | 8.7 |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 141 | 196 | 403 | 158 | 156 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 141 | 196 | 403 | 158 | 156 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 221 | 129 | 109 | 304 | 139 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 230 | 571 | 387 | 209 | 207 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 79 | 57 | 45 | 68 | 76 |
| Magnesium | 7439-95-4 | 1 | mg/L | 33 | 54 | 42 | 35 | 37 |
| Sodium | 7440-23-5 | 1 | mg/L | 141 | 314 | 309 | 167 | 86 |
| Potassium | 7440-09-7 | 1 | mg/L | 2 | <1 | 3 | 2 | 2 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | 0.008 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | 0.001 | 0.026 | <0.001 | 0.002 | 0.014 |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | 0.051 | <0.005 | <0.005 | <0.005 | <0.005 |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.003 | 0.048 | 0.034 | 0.002 | 0.351 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | <0.05 | 0.22 | <0.05 | 3.61 |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML113C | T3-A | T3-P | T2-A | T2-P |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 07-Aug-2020 11:10 | 07-Aug-2020 12:45 | 07-Aug-2020 12:30 | 07-Aug-2020 13:55 | 07-Aug-2020 14:10 |
| Compound | CAS Number | LOR | Unit | ES2028057-031 | ES2028057-032 | ES2028057-033 | ES2028057-034 | ES2028057-035 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | **5.12** | **0.98** | **0.01** | **0.59** | **0.02** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | **5.12** | **0.98** | **0.01** | **0.59** | **0.02** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | **2.0** | **0.3** | **0.5** | **0.1** | <0.1 |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | **7.1** | **1.3** | **0.5** | **0.7** | <0.1 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.56** | **0.23** | **0.03** | **0.03** | **0.02** |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **13.9** | **22.7** | **21.2** | **15.4** | **11.8** |
| ø Total Cations | ---- | 0.01 | meq/L | **12.8** | **20.9** | **19.2** | **13.6** | **10.6** |
| ø Ionic Balance | ---- | 0.01 | % | **3.98** | **4.04** | **4.99** | **6.19** | **5.43** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP328 | WMLP320 | PB1 | RM10 | WML261 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 10-Aug-2020 10:15 | 10-Aug-2020 09:30 | 10-Aug-2020 09:00 | 10-Aug-2020 08:00 | 10-Aug-2020 11:30 |
| Compound | CAS Number | LOR | Unit | ES2028057-036 | ES2028057-037 | ES2028057-038 | ES2028057-039 | ES2028057-040 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 7.03 | 7.11 | 7.66 | 6.82 | 7.28 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1320 | 1720 | 2610 | 1520 | 1140 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 865 | ---- | ---- | ---- | 646 |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | 9.7 | ---- | ---- | ---- | 27.0 |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 143 | 170 | 326 | 164 | 293 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 143 | 170 | 326 | 164 | 293 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 400 | 461 | 984 | 324 | 39 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 143 | 263 | 274 | 254 | 202 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 73 | 106 | 219 | 77 | 26 |
| Magnesium | 7439-95-4 | 1 | mg/L | 42 | 55 | 108 | 40 | 29 |
| Sodium | 7440-23-5 | 1 | mg/L | 150 | 194 | 247 | 182 | 173 |
| Potassium | 7440-09-7 | 1 | mg/L | 3 | 3 | 8 | 3 | 2 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | ---- | ---- | ---- | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | 0.001 |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | ---- | ---- | ---- | <0.005 |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.003 | ---- | ---- | ---- | 0.029 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | <0.01 |
| Iron | 7439-89-6 | 0.05 | mg/L | 0.08 | ---- | ---- | ---- | 1.09 |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | ---- | ---- | ---- | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP328 | WMLP320 | PB1 | RM10 | WML261 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 10-Aug-2020 10:15 | 10-Aug-2020 09:30 | 10-Aug-2020 09:00 | 10-Aug-2020 08:00 | 10-Aug-2020 11:30 |
| *Compound* | *CAS Number* | *LOR* | *Unit* | **ES2028057-036** | **ES2028057-037** | **ES2028057-038** | **ES2028057-039** | **ES2028057-040** |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| **Nitrite as N** | 14797-65-0 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| **Nitrate as N** | 14797-55-8 | 0.01 | mg/L | **1.82** | ---- | ---- | ---- | **0.01** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| **Nitrite + Nitrate as N** | ---- | 0.01 | mg/L | **1.82** | ---- | ---- | ---- | **0.01** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| **Total Kjeldahl Nitrogen as N** | ---- | 0.1 | mg/L | **0.4** | ---- | ---- | ---- | **0.4** |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ **Total Nitrogen as N** | ---- | 0.1 | mg/L | **2.2** | ---- | ---- | ---- | **0.4** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| **Total Phosphorus as P** | ---- | 0.01 | mg/L | **0.03** | ---- | ---- | ---- | **0.05** |
| **EN055: Ionic Balance** | | | | | | | | |
| ø **Total Anions** | ---- | 0.01 | meq/L | **15.2** | **20.4** | **34.7** | **17.2** | **12.4** |
| ø **Total Cations** | ---- | 0.01 | meq/L | **13.7** | **18.3** | **30.8** | **15.1** | **11.3** |
| ø **Ionic Balance** | ---- | 0.01 | % | **5.25** | **5.37** | **6.05** | **6.37** | **4.67** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP302 | WML120A | WML120B | WML129 | WMLP301 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 10-Aug-2020 12:30 | 10-Aug-2020 13:00 | 10-Aug-2020 13:30 | 11-Aug-2020 08:20 | 11-Aug-2020 09:45 |
| Compound | CAS Number | LOR | Unit | ES2028057-041 | ES2028057-042 | ES2028057-043 | ES2028057-044 | ES2028057-045 |
| | | | | Result | Result | Result | Result | Result |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | 6.91 | 7.07 | 6.94 | 6.78 | 8.25 |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 946 | 590 | 439 | 439 | 2980 |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | 526 | 340 | 258 | 236 | 2220 |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | 1.4 | 49.9 | 1.7 | 1.0 | 1540 |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | <1 | <1 |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | <1 | <1 | 2 |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 248 | 189 | 145 | 97 | 942 |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 248 | 189 | 145 | 97 | 944 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 25 | 9 | 9 | 26 | 9 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | 170 | 82 | 54 | 63 | 565 |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | 21 | 24 | 20 | 22 | 6 |
| Magnesium | 7439-95-4 | 1 | mg/L | 26 | 20 | 13 | 13 | 4 |
| Sodium | 7440-23-5 | 1 | mg/L | 141 | 72 | 54 | 44 | 728 |
| Potassium | 7440-09-7 | 1 | mg/L | 2 | 1 | <1 | 2 | 2 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | 0.024 | <0.001 | <0.001 | <0.001 | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | 0.015 |
| Nickel | 7440-02-0 | 0.001 | mg/L | 0.025 | 0.002 | 0.002 | 0.001 | 0.007 |
| Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | <0.005 | <0.005 | 0.016 |
| Manganese | 7439-96-5 | 0.001 | mg/L | 0.026 | 0.117 | 0.011 | 0.204 | 0.029 |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Iron | 7439-89-6 | 0.05 | mg/L | 1.52 | 0.66 | <0.05 | 0.12 | <0.05 |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| Total Cyanide | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WMLP302 | WML120A | WML120B | WML129 | WMLP301 |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 10-Aug-2020 12:30 | 10-Aug-2020 13:00 | 10-Aug-2020 13:30 | 11-Aug-2020 08:20 | 11-Aug-2020 09:45 |
| Compound | CAS Number | LOR | Unit | ES2028057-041 | ES2028057-042 | ES2028057-043 | ES2028057-044 | ES2028057-045 |
| | | | | Result | Result | Result | Result | Result |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | **0.01** | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | **0.01** | **0.02** | **0.06** | **1.32** | **0.01** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | **0.01** | **0.02** | **0.06** | **1.33** | **0.01** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | **0.8** | **0.2** | <0.1 | **0.3** | **4.1** |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | **0.8** | **0.2** | <0.1 | **1.6** | **4.1** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | **0.04** | **0.07** | **0.09** | **0.05** | **1.88** |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | **10.3** | **6.28** | **4.61** | **4.26** | **35.0** |
| ø Total Cations | ---- | 0.01 | meq/L | **9.37** | **6.00** | **4.42** | **4.13** | **32.3** |
| ø Ionic Balance | ---- | 0.01 | % | **4.58** | **2.24** | **2.12** | **1.48** | **3.92** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML119 | WML181 | WML262 | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 11-Aug-2020 10:35 | 11-Aug-2020 11:45 | 11-Aug-2020 12:45 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2028057-046 | ES2028057-047 | ES2028057-048 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | **7.72** | **8.07** | **8.31** | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | **1250** | **2210** | **2730** | ---- | ---- |
| **EA015: Total Dissolved Solids dried at 180 ± 5 °C** | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | **720** | **1390** | **1730** | ---- | ---- |
| **EA045: Turbidity** | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | **117** | **78.8** | **56.8** | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | <1 | <1 | <1 | ---- | ---- |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | <1 | <1 | **28** | ---- | ---- |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | **480** | **705** | **1010** | ---- | ---- |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | **480** | **705** | **1040** | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | <1 | <1 | <1 | ---- | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | **168** | **462** | **479** | ---- | ---- |
| **ED093F: Dissolved Major Cations** | | | | | | | | |
| **Calcium** | 7440-70-2 | 1 | mg/L | **32** | **19** | **7** | ---- | ---- |
| **Magnesium** | 7439-95-4 | 1 | mg/L | **28** | **20** | **6** | ---- | ---- |
| **Sodium** | 7440-23-5 | 1 | mg/L | **225** | **493** | **681** | ---- | ---- |
| **Potassium** | 7440-09-7 | 1 | mg/L | **3** | **3** | **3** | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | ---- | ---- |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | <0.0001 | ---- | ---- |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | **0.018** | **0.005** | <0.001 | ---- | ---- |
| **Copper** | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | ---- | ---- |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | **0.009** | <0.001 | <0.001 | ---- | ---- |
| **Lead** | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | <0.001 | ---- | ---- |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | <0.005 | ---- | ---- |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | **0.092** | **0.019** | **0.034** | ---- | ---- |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **Iron** | 7439-89-6 | 0.05 | mg/L | **0.11** | <0.05 | **0.08** | ---- | ---- |
| **EK026SF: Total CN by Segmented Flow Analyser** | | | | | | | | |
| **Total Cyanide** | 57-12-5 | 0.004 | mg/L | <0.004 | <0.004 | <0.004 | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | WML119 | WML181 | WML262 | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 11-Aug-2020 10:35 | 11-Aug-2020 11:45 | 11-Aug-2020 12:45 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2028057-046 | ES2028057-047 | ES2028057-048 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | <0.01 | <0.01 | 0.01 | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | <0.01 | <0.01 | 0.02 | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.03 | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 1.3 | 1.1 | 1.4 | ---- | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | 1.3 | 1.1 | 1.4 | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | 0.22 | 0.16 | 0.61 | ---- | ---- |
| **EN055: Ionic Balance** | | | | | | | | |
| ø Total Anions | ---- | 0.01 | meq/L | 14.3 | 27.1 | 34.3 | ---- | ---- |
| ø Total Cations | ---- | 0.01 | meq/L | 13.8 | 24.1 | 30.5 | ---- | ---- |
| ø Ionic Balance | ---- | 0.01 | % | 2.01 | 5.86 | 5.78 | ---- | ---- |

ALS

# CHAIN OF CUSTODY

ALS Laboratory: please tick →

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E-MAILED

**CLIENT:** AGE Consultants
**OFFICE:** Newcastle
**PROJECT:** Ashton Annual Sampling
**PROJECT ID:** G1922K
**PROJECT MANAGER:** Bryce McKay    **CONTACT PH:** 0414 324 504
**SAMPLER:** Glen Brumm    **SAMPLER MOBILE:** 0428 283 457
**COC Emailed to ALS?** YES    **EDD FORMAT (or default):** XTAB, ENMRG, ESDAT, PDF, MONPRO
**Email Reports to:** Glen@ageconsultants.com.au, bryce@ageconsultants.com.au
**Email Invoice to:** As above + accounts@ageconsultants.com.au

**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☑ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

**ALS QUOTE NO.:** EN/222

LAB OF ORIGIN: NEWCASTLE

**COC SEQUENCE NUMBER (Circle)**
coc: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

**FOR LABORATORY USE ONLY (Circle)**
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: 2.5 °C
Other comment:

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| Glen Brumm | [signature] | | HJ |
| DATE/TIME: 12/08/2020, 11:55 | DATE/TIME: 12/8/20 11:55 | DATE/TIME: | DATE/TIME: 7:45pm 12.8.20 |

**COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:**

| ALS USE | SAMPLE DETAILS MATRIX: SOLID (S) WATER (W) | | | CONTAINER INFORMATION | | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | | | | | | | | | | | Additional Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAB ID | SAMPLE ID | DATE / TIME | MATRIX | TYPE & PRESERVATIVE (refer to codes below) | TOTAL CONTAINERS | pH & EC | NT-1 & NT-2 | W-1 (7 metals) | EG020 - Fe, Mn, Se | EA015H - TDS | EA045 - turbidity | NT-11 - Total P, Total N | EK058G - NO3 | ED035 - HCO3 | EK026SF | | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| 1 | WML115B | 3/8/20; 13:30 | W | P | 1 | X | X | | | | | | | | | | |
| 2 | WML115C | 3/8/20; 13:45 | W | P | 1 | X | X | | | | | | | | | | |
| 3 | WMLP358 | 3/08/2020; 8:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 4 | WML239 | 3/8/20; 10:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 5 | WMLP349 | 3/8/20; 9:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 6 | WMLP346 | 3/8/20; 11:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 7 | WMLP343 343 | 3/8/20; 12:15 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 8 | GM01 | 4/8/20; 8:40 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 9 | YAP016 | 4/8/20; 8:10 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 10 | RA27 | 4/8/20; 10:20 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 11 | WMLP277 | 4/8/20; 11:40 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 12 | WMLP278 | 4/8/20; 12:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| | | | | TOTAL | 52 | | | | | | | | | | | | |

*Water Container Codes:* P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Environmental Division
Sydney
Work Order Reference
ES2028057

Telephone : + 61-2-8784 8555

# CHAIN OF CUSTODY

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E-MAILED

CLIENT: AGE Consultants
OFFICE: Newcastle
PROJECT: Ashton Annual Sampling
PROJECT ID: G1922K
PROJECT MANAGER: Bryce McKay — CONTACT PH: 0414 324 504
SAMPLER: Glen Brumm — SAMPLER MOBILE: 0428 283 457
COC Emailed to ALS? YES — EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF, MONPRO
Email Reports to: Glen@ageconsultants.com.au, bryce@ageconsultants.com.au
Email Invoice to: As above + accounts@ageconsultants.com.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☑ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: EN/222

LAB OF ORIGIN: NEWCASTLE

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: 7.5 °C
Other comment:

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| G Brumm | [signature] | | HJ |
| DATE/TIME: 12/08/2020, 11:55 | DATE/TIME: 12/8/20 11:55 | DATE/TIME: | DATE/TIME: 12.8.20 7:45pm |

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

| ALS USE | SAMPLE DETAILS MATRIX: SOLID (S) WATER (W) | | | CONTAINER INFORMATION | | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | | | | | | | | | | | Additional Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAB ID | SAMPLE ID | DATE / TIME | MATRIX | TYPE & PRESERVATIVE (refer to codes below) | TOTAL CONTAINERS | pH & EC | NT-1 & NT-2 | W-1 (7 metals) | EG020 - Fe, Mn, Se | EA015H - TDS | EA045 - turbidity | NT-11 - Total P, Total N | EK058G - NO3 | ED035 - HCO3 | EK026SF | | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| 13 | WMLP279 | 4/8/20; 12:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 14 | WMLP280 | 4/8/20; 11:15 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 15 | Ashton Well | 5/8/2020; 8:45 | W | P | 1 | X | X | | | | | | | | | | |
| 16 | T5 | 5/8/2020; 12:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 17 | DUPLICATE | 4/08/2020 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 18 | WMLP323 | 5/8/2020; 11:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 19 | WMLP324 | 5/8/2020; 11:15 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 20 | WMLP308 | 5/8/2020; 9:15 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 21 | WMLP325 | 5/8/2020; 10:00 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 22 | WMLP311 | 5/8/2020; 10:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 23 | WMLP337 | 6/8/2020; 9:00 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 24 | WMLP338 | 6/08/2020; 10:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| | | | | TOTAL | 56 | | | | | | | | | | | | |

*Water Container Codes:* P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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**CLIENT:** AGE Consultants
**OFFICE:** Newcastle
**PROJECT:** Ashton Annual Sampling
**PROJECT ID:** G1922K
**PROJECT MANAGER:** Bryce McKay — **CONTACT PH:** 0414 324 504
**SAMPLER:** Glen Brumm — **SAMPLER MOBILE:** 0428 283 457
**COC Emailed to ALS?** YES — **EDD FORMAT (or default):** XTAB, ENMRG, ESDAT, PDF, MONPRO
**Email Reports to:** Glen@ageconsultants.com.au, bryce@ageconsultants.com.au
**Email Invoice to:** As above + accounts@ageconsultants.com.au

**TURNAROUND REQUIREMENTS:** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☑ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

**ALS QUOTE NO.:** EN/222

**COC SEQUENCE NUMBER (Circle)**
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

**FOR LABORATORY USE ONLY (Circle)**
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment: 2.5

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| | | | HJ |
| DATE/TIME: 12/08/2020, 11:55 | DATE/TIME: 12/8/20 11:55 | DATE/TIME: | DATE/TIME: 7:45pm 12.8.20 |

**COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:**

| ALS USE | SAMPLE DETAILS MATRIX: SOLID (S) WATER (W) | | | CONTAINER INFORMATION | | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | | | | | | | | | | | Additional Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAB ID | SAMPLE ID | DATE / TIME | MATRIX | TYPE & PRESERVATIVE (refer to codes below) | TOTAL CONTAINERS | pH & EC | NT-1 & NT-2 | W-1 (7 metals) | EG020 - Fe, Mn, Se | EA015H - TDS | EA045 - turbidity | NT-11 - Total P, Total N | EK058G - NO3 | ED035 - HCO3 | EK026SF | | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| 25 | WMLP336 | 6/08/2020; 11:45 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 26 | WML183 | 6/08/2020; 14:40 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 27 | WMLP326 | 7/08/2020; 9:00 | W | P | 1 | x | x | | | | | | | | | | |
| 28 | WMLP327 | 7/08/2020; 9:15 | W | P | 1 | x | x | | | | | | | | | | |
| 29 | T4-A | 7/08/2020; 10:30 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 30 | T4-P | 7/08/2020; 10:00 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 31 | WML113C | 7/08/2020; 11:10 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 32 | T3-A | 7/08/2020; 12:45 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 33 | T3-P | 7/08/2020; 12:30 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 34 | T2-A | 7/08/2020; 13:55 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 35 | T2-P | 7/08/2020; 14:10 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| 36 | WMLP328 | 10/08/2020; 10:15 | W | P, N, S, SP | 5 | x | x | x | x | x | x | x | x | x | x | | |
| | | | | TOTAL | 52 | | | | | | | | | | | | |

*Water Container Codes:* P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

# CHAIN OF CUSTODY

ALS Laboratory: please tick →

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E-MAILED

CLIENT: AGE Consultants
OFFICE: Newcastle
PROJECT: Ashton Annual Sampling
PROJECT ID: G1922K
PROJECT MANAGER: Bryce McKay — CONTACT PH: 0414 324 504
SAMPLER: Glen Brumm — SAMPLER MOBILE: 0428 283 457
COC Emailed to ALS? YES — EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF, MONPRO
Email Reports to: Glen@ageconsultants.com.au, bryce@ageconsultants.com.au
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TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
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COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7
8 8

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment: 2.5

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| [signature] | ~~LAB~~ OF ORIGIN: NEWCASTLE | | HJ |
| DATE/TIME: 12/08/2020, 11:55 | DATE/TIME: 12/8 1155 | DATE/TIME: | DATE/TIME: 7:45pm 12.8.20 |

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

| ALS USE | SAMPLE DETAILS MATRIX: SOLID (S) WATER (W) | | | CONTAINER INFORMATION | | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | | | | | | | | | | | Additional Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAB ID | SAMPLE ID | DATE / TIME | MATRIX | TYPE & PRESERVATIVE (refer to codes below) | TOTAL CONTAINERS | pH & EC | NT-1 & NT-2 | W-1 (7 metals) | EG020 - Fe, Mn, Se | EA015H - TDS | EA045 - turbidity | NT-11 - Total P, Total N | EK058G - NO3 | ED035 - HCO3 | EK026SF | | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| 37 | WMLP320 | 10/8/2020; 9:30 | W | P, ~~N, S, SP~~ | ~~5~~ 1 | X | X | ~~X~~ | ~~X~~ | ~~X~~ | ~~X~~ | ~~X~~ | ~~X~~ | ~~X~~ | ~~X~~ | | |
| 38 | PB1 | 10/8/2020; 9:00 | W | P | 1 | X | X | | | | | | | | | | |
| 39 | RM10 | 10/8/2020; 8:00 | W | P | 1 | X | X | | | | | | | | | | |
| 40 | WML261 | 10/8/2020; 11:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 41 | WMLP302 | 10/8/2020; 12:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 42 | WML120A | 10/8/2020; 13:00 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 43 | WML120B | 10/8/2020; 13:30 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 44 | WML129 | 11/8/2020; 8:20 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 45 | WMLP301 | 11/8/2020; 9:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 46 | WML119 | 11/8/2020; 10:35 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 47 | WML181 | 11/8/2020; 11:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| 48 | WML262 | 11/8/2020; 12:45 | W | P, N, S, SP | 5 | X | X | X | X | X | X | X | X | X | X | | |
| | | | | TOTAL | 52 | | | | | | | | | | | | |

***Water Container Codes:*** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

# *Appendix G* WMLP EC trigger exceedance investigation

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BM/AB:ak
G1922N.Yancoal Ashton WMLP323 EC exceedance v02.01

3 September 2020

**Yancoal Australia**
Ashton Coal Mine
Camberwell NSW
*via email*

Attention: Phillip Brown
cc: Dorian Walsh

Dear Phillip,

# RE: Ashton Coal Mine – Compliance Monitoring Exceedance Investigation - Monitoring Bores WMLP323, WMLP328, WML113C

## 1 Introduction

The Ashton Coal Mine (Ashton) routinely monitors groundwater levels and quality in the groundwater systems overlying the underground mining area. The monitoring network targets the Quaternary alluvium and Permian interburden/coal units with open monitoring bores and vibrating wire piezometers (VWP). Monitoring campaigns are conducted on a monthly basis to collect water level and quality data from the monitoring network. The data collected from key monitoring is reviewed on a monthly basis, whilst the remainder of bores are reviewed annually, in accordance with the Water Management Plan (WMP[1]).

Monitoring bores WMLP323, WMLP328 and WML113C are screened in the Bowmans Creek Alluvium (BCA; Figure 1.1). In May 2020, bore WMLP323 was found to have exceeded the site WMP electrical conductivity (EC) trigger for three consecutive monitoring rounds. The WMP requires three consecutive exceedances of the EC trigger be investigated.

[1] Water Management Plan (WMP) - reviewed and updated by Gilbert & Associates Pty Ltd and Australasian Groundwater and Environmental (AGE) on behalf of Ashton and approved by the NSW Department of Planning & Environment (DPE) on 27 October 2015. The groundwater monitoring program was changed and came into force the 1st November 2015. Further amendments to the WMP following DPE comments saw the latest iteration issued on 1 March 2018.

BCA monitoring bore WMLP328 recorded a spike in EC in May 2020. This bore has had EC values above its EC trigger level since June 2019, and has been investigated previously as a result of exceeding WMP EC trigger criteria.

BCA monitoring bore WML113C did not exceed the WMP EC trigger criteria in May 2020, however EC values within this bore have been steadily increasing. As of June 2020, there has been insufficient water in this bore to allow for groundwater to be sampled.

These three bores have recorded a general decline in groundwater levels since August 2017; correlating with a declining cumulative rainfall departure (CRD). WMLP323 has recorded groundwater levels below the respective trigger since June 2019. WMLP328 levels have been below the groundwater level trigger since June 2018. WML113C does not have a groundwater level trigger. This general trend of decreasing groundwater levels and increasing EC in the BCA has been investigated previously, and was found to be due to below average rainfall[2] [3].

Figure 1.1 shows the locations of WMLP323, WMLP328 and WML113C with the extent of mapped Quaternary alluvium, the inferred extent of saturated alluvium (after Aquaterra 2009[4]), and the location of mined longwall panels.

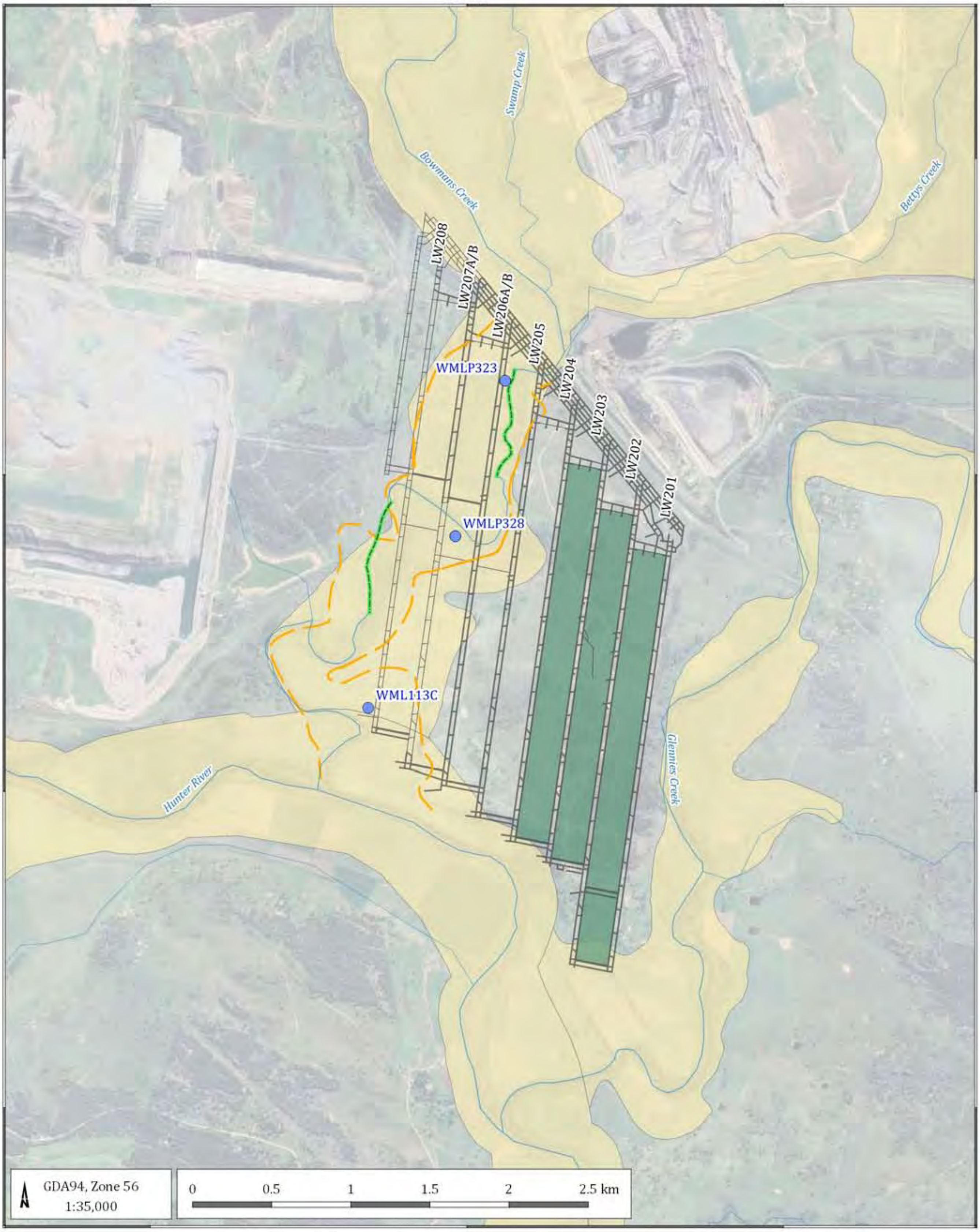
Ashton engaged Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to investigate and report on the elevated EC values in these bores. Whilst the focus of the investigation is concerned with the recorded EC exceedances in WMLP323, commentary and analysis of WMLP328 and WML113C is also provided due to the latest recorded EC values in these bores. This report summarises the results of the investigation.

---

[2] AGE (2018), AGE (2018), Ashton Coal Mine – July monitoring Exceedance Review – Investigation of Monitoring Bore WMLP311. AGE Report No G1922E submitted to Yancoal 31 July 2018.

[3] AGE (2019), Ashton Coal Mine – T2A Monitoring Bore Investigation. AGE Report No G1922I dated 20 September 2019.

[4] Aquaterra (2009), Ashton Underground Mine Extension of Development Consent Area - Groundwater Impact Assessment.




LEGEND

- Monitoring bore
- Drainage
- Drainage
- Diversion
- Longwall panels (ULLD)
- Saturated BCA (Aquaterra 2009)
- Alluvium
- Mined longwall panel (ULLD)

Yancoal Ashton - Monthly Reporting (G1858B)

**Location of WMLP323, WMLP328, and WML113C**

AGE

DATE 12/08/2020

FIGURE No: **1.1**


G:\Projects\G1922N.Ashton_WMLP323_EC_Trigger_Exceedance\3_GIS\Workspaces\001_Deliverable1\01.01_G1922N_Bore locations plan.qgs

# 2 Investigation and results

## 2.1 Monitoring bores – WMLP323, WMLP328 and WML113C

Monitoring bore WMLP323 was drilled by Hunter Drilling and installed under the supervision of Aquaterra on 10 February 2011 at the request of Ashton. The purpose of this bore was to assess how groundwater in the BCA interacts with that from the weathered profile of the underlying coal measures overburden. This shallow bore overlies the unmined section of longwall panel LW205 (refer Figure 1.1).

WMLP323 was installed to a depth of 7.34 metres below ground level (mbgl), and is screened across multiple lithologies (alluvial sand and gravel and weathered Permian sandstone) between 3.34 mbgl and 6.34 metres below ground level (mbgl).

WMLP328 was also drilled by Hunter Drilling and installed under the supervision of Ashton on 1 March 2011. This bore overlies longwall panel LW206A/B, was drilled to 8 mbgl, and is screened in gravel between 4.5 mbgl and 7.5mbgl. WMLP328 did not intersect the weathered Permian overburden.

WML113C was drilled to 12 mbgl and is located slightly to the west of longwall panel LW207A/B. WML113C is screened across multiple lithologies (alluvium and weathered interbedded sandstone/siltstone/mudstone) between 8.5 mbgl and 11.5 mbgl.

The Ashton WMP outlines the groundwater monitoring program and lists trigger criteria (groundwater level and quality) to be used to assess the potential for mining to impact the alluvial groundwater system. The WMP includes bore-specific triggers for groundwater level, and aquifer-specific water quality impact assessment criteria for each of the three alluvial aquifers on site: BCA, Glennies Creek Alluvium (GCA), and the Hunter River Alluvium (HRA).

As described within the WMP, the groundwater trigger values account for natural variation using data collected between 2011 to 2015. The water level trigger values also account for approved impacts of the mine[5] indicated by predicted drawdown[6]. The result is a practical trigger level that accounts for both approved mining impacts and natural variability. As noted above, the water levels in both WMLP323 and WMLP328 have been below the respective triggers since 2019, and 2018. This is an indication that the contribution of the declining CRD to decreasing water levels is significant. BCA is approved to be dewatered in areas above the mine plan by the end of mining of the Upper Liddell seam[3]. Trigger values are therefore intended as a guide representing updated, more conservative, impact predictions from the updated groundwater model.[7]

Similar to groundwater levels, groundwater quality varies naturally. Water quality triggers are based on groundwater quality records and use the calculated 5th and 95th percentile of the historical data for pH and EC. These percentiles are more conservative than those outlined in the procedure recommended by ANZECC/ARMCANZ (2000).

The trigger criteria and recorded measurements to May 2020 for groundwater levels and EC within WMLP323, WMLP328 and WML113C are shown in Table 2.1. Exceedances are shown in orange. The WMP requires three consecutive exceedances to be investigated.

---

5 Aquaterra (2009). "*Bowmans Creek Diversion: Groundwater Impact Assessment Report*". Reference No. S55G/011g, dated 21 October 2009.

6 RPS (2014). "*Ashton coal groundwater model*". Reference No. S55N/022b, dated 09 May 2014.

7 AGE (2016) "*Yancoal – Ashton Coal. Longwall LW201 to LW204 - Surface and Groundwater Impact Assessment*". AGE report No G1758N submitted Yancoal, 7 November 2016.

## Table 2.1 WMLP323, WMLP328 and WML113C groundwater levels, EC trigger criteria, EC monitoring results and exceedances

| Bore ID | Groundwater level trigger (mAHD) | Groundwater EC trigger (µS/cm) (95th percentile) | April 2020 groundwater level (mAHD) | May 2020 groundwater level (mAHD) | March 2020 EC (µS/cm) | April 2020 EC (µS/cm) | May 2020 EC (µS/cm) |
|---|---|---|---|---|---|---|---|
| WMLP323 | 59.2 | 1241 | 59.23 | 60.38 | 1281 | 1300 | 1585 |
| WMLP328 | 55.15 | 1175 | dry | 55.76 | dry | dry | 1486 |
| WML113C | - | 1445 | 49.77 | 50.04 | 1196 | 1234 | 1350 |

Figure 2.1 shows the long term trend of the WMLP323 groundwater level and EC compared to the CRD (longwall panel start or finish dates are indicated by a vertical dashed line). The CRD is an analysis of the monthly rainfall compared with the long-term average for the same month. A rising trend in the CRD plot indicates months of above average rainfall, whilst a falling slope indicates periods when rainfall is below the long-term average. The CRD declined strongly from the beginning of 2017 until the start of 2020. The CRD increased from January 2020 until May 2020, declining thereafter to July 2020. The decline in CRD is a reflection of the drier period the region experienced up until the beginning of 2020. The increasing CRD in the first half of 2020 is due to significant, but short-lived rainfall. Since 2017 the general overall long term trend is that of a declining CRD.

Figure 2.2 shows the EC results for WMLP323, WMLP328 and WML113C compared to the CRD within this predominantly dry period. Figure 2.3 shows the groundwater levels for WMLP323, WMLP328 and WML113C compared to the CRD over the same time. Trends are discussed further below.

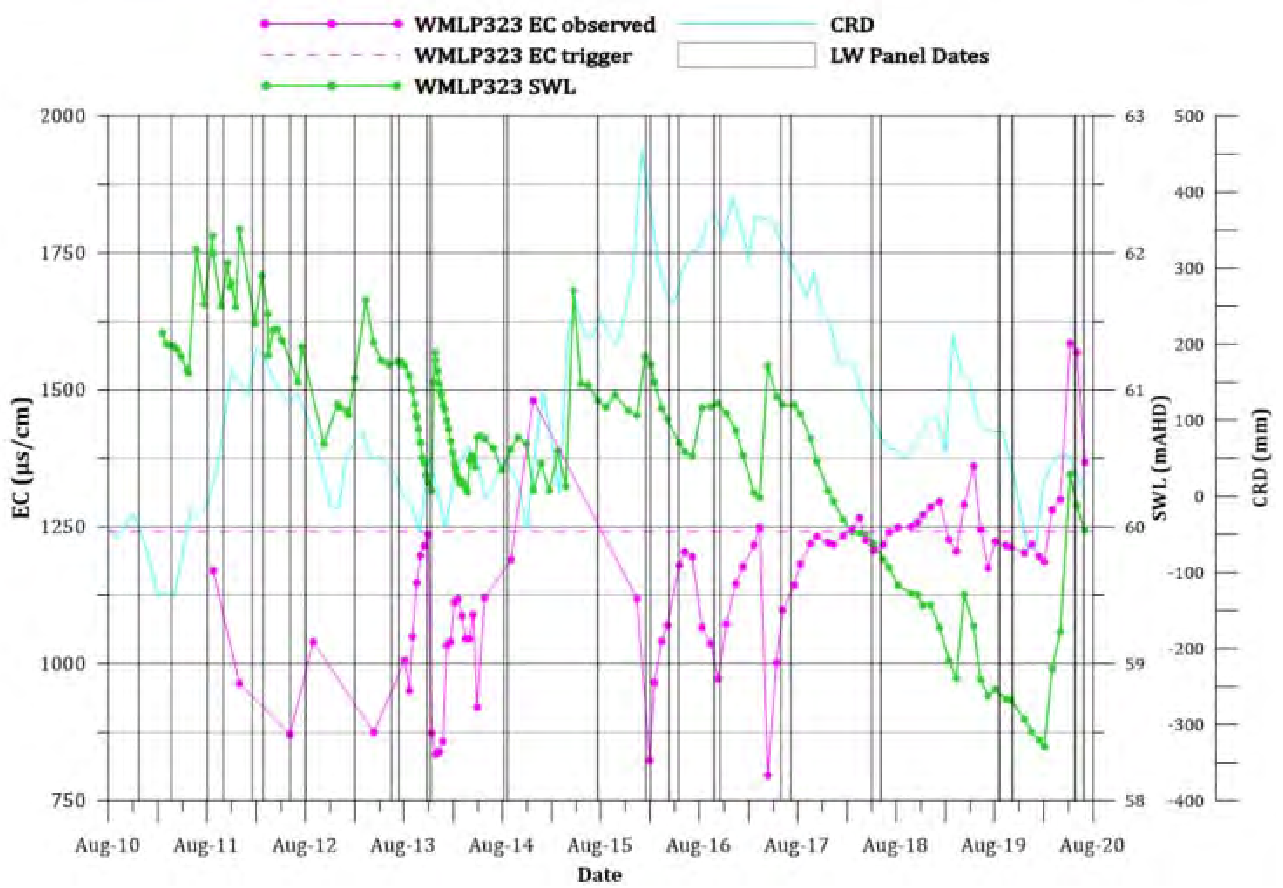



Figure 2.1 WMLP323 groundwater level and EC results vs CRD

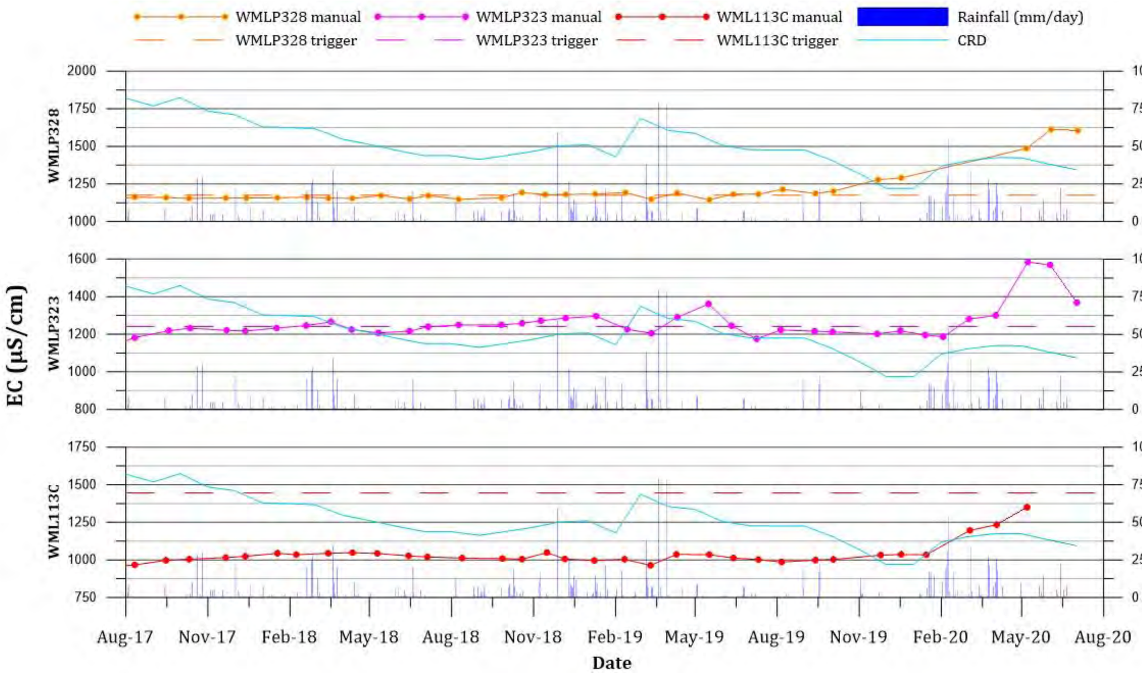



**Figure 2.2 WMLP323, WMLP328 and WML113C EC results vs CRD**

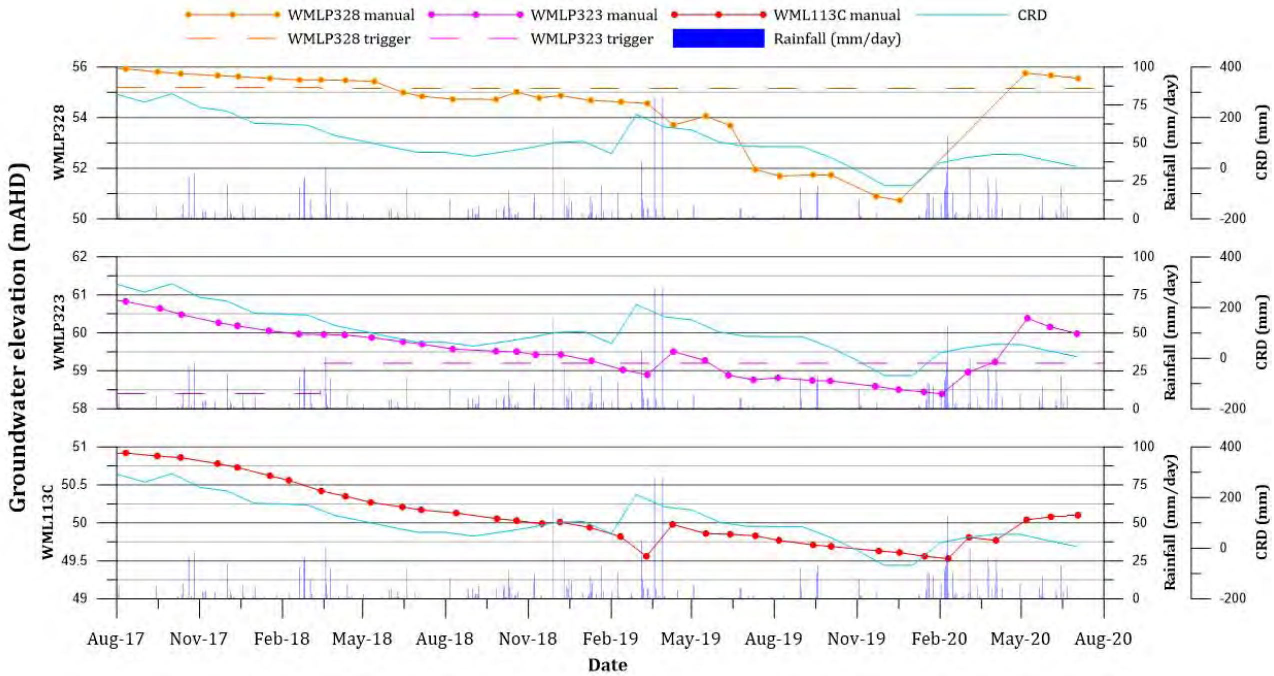



**Figure 2.3 WMLP323, WMLP328 and WML113C groundwater level results vs CRD**

The groundwater level in WMLP323 increases concurrently with periods of increasing CRD, indicating that the BCA is recharged by rainfall/runoff recharge and from Bowmans Creek itself, whether directly from the surface or via through-flow within the alluvial aquifer. Figure 2.4 shows that Bowmans Creek had low or no flow between August 2018 and April 2020, with flow subsiding again thereafter. Thus, the historically low groundwater levels seen within WMLP323 also correspond to a period of no flow and historically low surface water levels within Bowmans Creek (refer Figure 2.4).

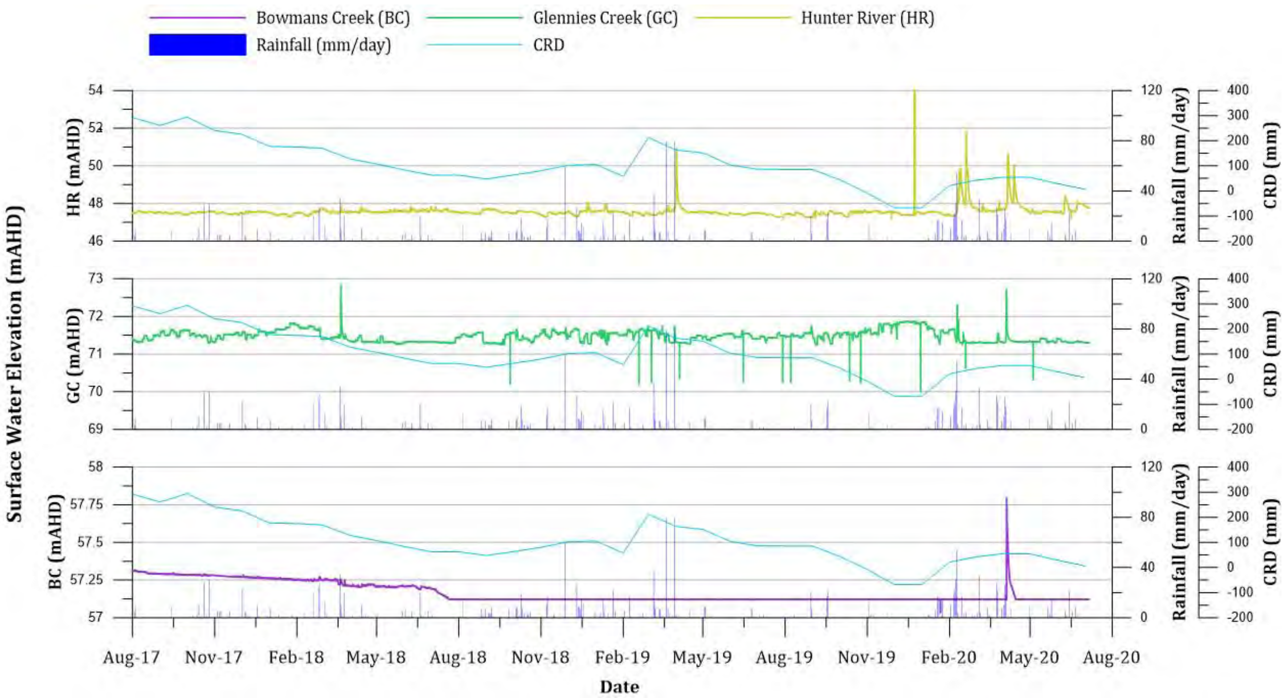



**Figure 2.4 Surface water level trends**

Further observations gleaned from the relationships between rainfall, groundwater levels, and groundwater EC (Figure 2.1, Figure 2.2 and Figure 2.3) :

- An inverse relationship generally exists between groundwater levels and EC values over an extended time scale. This relationship is most clearly defined over the latest period of below average rainfall (2017 to 2019).
- Bores screened within the BCA all showed a decline in groundwater level and a gradual increase in EC over this dry period.
- The case for the recent EC exceedance at WMLP323 is different, as it coincided with a water level increase.
- Significant rainfall events (i.e. March/April 2019 and February to April 2020) correlate with increases in EC. Recorded EC within BCA bores return to historical values shortly thereafter (refer June/July EC values WMLP323 Figure 2.2).
- Whilst WMLP323 has not been undermined, the commencement or termination of longwall panels appears to have no bearing on either groundwater level or EC in WMLP323.

Of the 84 historic WMLP323 EC measurements, 18 (21%) are above the EC trigger of 1,241 µS/cm. Prior to 2018, periods of low and/or declining CRD coincide with periods of generally increasing EC, and there is an inverse relationship between groundwater levels and EC values in WMLP323 (Figure 2.1). This indicates a dilution mechanism of rainfall recharge, where the solutes in rainwater are less concentrated, and act to lower the EC of groundwater when recharge occurs.

In contrast, the relationship between EC and water level at WMLP323 since 2018 has changed, with concurrent increases and decreases of both parameters (Figure 2.1). Indeed the recent EC exceedance at WMLP323 is characterised by synchronous increase in water level, above the height of 60.4 mAHD, which had not been reached since late 2017 (Figure 2.1). This relationship indicates a different mechanism between salinity and recharge, where recharge to the groundwater introduces additional solutes (dissolved salts). It appears that during this prolonged dry period (denoted by ongoing groundwater level decline between 2017 and 2019; Figure 2.1) salts were accumulating in the unsaturated zone (between 61 mAHD and 58.5 mAHD). In early 2020, when significant rainfall led to the groundwater level rising through this zone, the solids were dissolved, contributing to an increase in the groundwater salinity, and hence an increase in EC. The reason this mechanism is not active in the time prior to 2018 may be that the groundwater level has rarely been this low, especially for a sustained period of time (Figure 2.1).

The dissolution of salt (halite) form the unsaturated zone during the recent 2020 exceedance event is supported by the mass ratio of sodium to chloride (Na/Cl) in groundwater from WMLP323. The ratio at this bore is often above 0.8 (Figure 2.5), which is likely to be close to continental rain water ratios.[8] However, the ratio from the May 2020 sample with high EC is 0.61 (Figure 2.5), which is very close to the pure halite mass ratio for Na/Cl of 0.65.

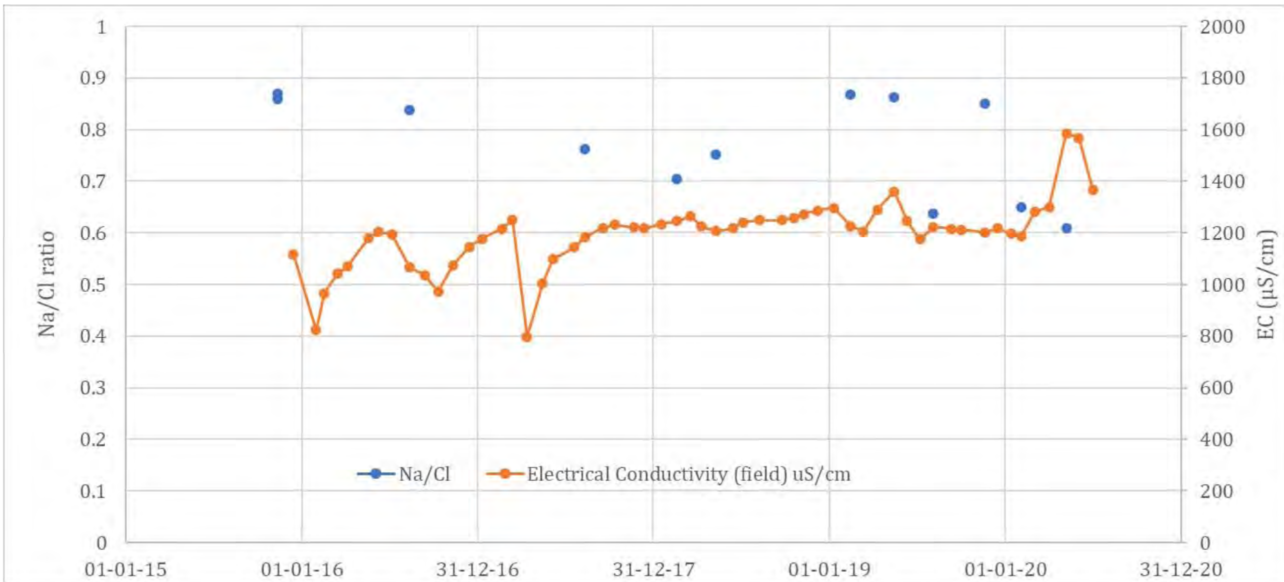



**Figure 2.5 Groundwater Na/Cl mass ratio and EC in WMLP323**

Table 2.1 and Table 2.2 summarise statistics for the WMLP323, WMLP328 and WML113C monitoring data. The data show that EC for this bore is often close to the trigger value of 1,241 µS/cm, averaging 1,147 µS/cm (data set August 2011 – July 2020 - refer Table 2.1 for trigger values). As discussed, extended periods of below average rainfall result in higher EC readings in WMLP323. Thus, this recent exceedance is not unprecedented.

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[8] Hutton and Leslie, (1958). Accession of non-nitrogenous ions dissolved in rainwater to soils in Victoria. *Australian Journal of Agricultural Research* 9(4) 492 – 507.

Similarly, monitoring bore WMLP328 records an average EC value (1,103 µS/cm) close to the EC trigger value of 1,175 µS/cm (data set June 2010 – July 2020). Significant rainfall events, particularly after periods of prolonged drought, result in spikes in EC values in WMLP328. Mobilisation of salts from the unsaturated zone are the most likely explanation of these patterns.

WML113C does not record an average EC value close to the relevant trigger (1,105 µS/cm average vs. 1,445 µS/cm trigger – data set November 2007 – July 2020). WML113C has not historically exceeded its EC trigger and is included in this investigation due to a trend of increasing EC values between February and May, 2020, following heavy rain earlier in that same year. WML113C has had insufficient water to enable a sample to be taken since June 2020. As with the other bores, the water level in WML113C recently rose above a level that has not been reached for several years (Figure 2.3). Dissolution of salts from this zone is the likely cause of the increase in EC.

**Table 2.2 Summary of WMLP328, WMLP323 and WMLP311 quality statistics**

| Statistic | WMLP328 | | WMLP323 | | WML113C | |
|---|---|---|---|---|---|---|
| | EC (µS/cm) | pH | EC (µS/cm) | pH | EC (µS/cm) | pH |
| Range | 844 - 1,612 | 6.55 - 8.38 | 796 - 1,585 | 6.47 - 8.12 | 902 - 1,368 | 6.58 - 7.75 |
| Mean | 1,103 | 7.17 | 1,147 | 7.11 | 1,055 | 7.04 |
| Median | 1,102 | 7.09 | 1,188 | 7.07 | 1,027 | 6.99 |
| 5th percentile | 911 | 6.64 | 860 | 6.55 | 922 | 6.69 |
| 95th percentile | 1,290 | 7.84 | 1,352 | 7.77 | 1,278 | 7.42 |

A copy of the bore construction logs for WMLP323, WMLP328 and WML113C is included as Attachment 1. The bore construction logs show bore WMLP323 is screened across multiple lithologies; both within sands and gravels of the BCA and Permian sandstone. Other BCA bores are known to have subcropping coal seams less than 5 m beneath the base of the alluvium (i.e.T3A). Despite this, the groundwater levels (and therefore quality) are evidently less influenced by mining activities, and more closely linked to climatic changes.

WML113C log shows the Bayswater seam subcropping approximately 8 m below the base of the bore. Whilst WMLP323 only intersected approximately 2 m of Permian strata, it is likely that coal would have been intersected had the borehole continued much deeper. Given the likely proximity of coal seams to the base of the alluvium there is the potential for groundwater exchange between the alluvium and the more saline groundwater associated with the fractured rock. The possibility of this groundwater exchange is increased during times of reduced hydraulic head in the BCA, and low surface water flows in Bowmans Creek. However, inflow of groundwater from the Permian strata is very unlikely to be the cause of the recent EC exceedances, as they are associated with an increase in water level in the BCA.

# 3 Summary

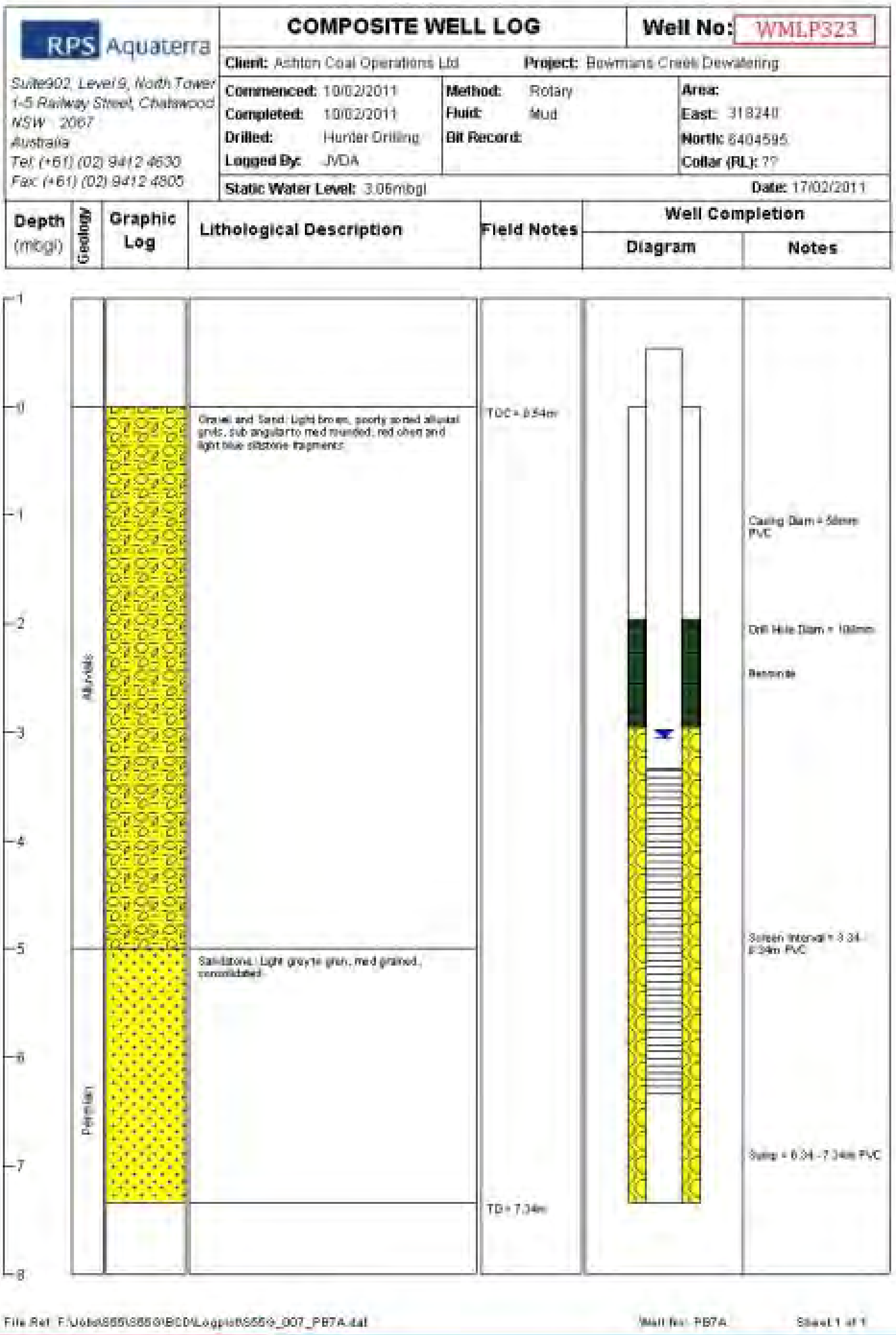
In summary:

- Prior to 2018, an inverse relationship exists between groundwater levels and EC values in WMLP323, and also in WMLP328 and WML311. This relationship is most clearly defined over the latest period of below average rainfall (2017 - 2019) and is further supported by available pH data.
- Since 2018, a prolonged dry period decreased water levels in all the bores to unprecedented levels. This appears to have allowed salts to accumulate in the unsaturated zone.
- These salts were then remobilised by a rising watertable after significant rainfall in early 2020, causing the EC exceedances in groundwater at WMLP323 and WMLP328.
- Groundwater levels in BCA bores are strongly influenced by rainfall. The current extended period of below average rainfall has seen a commensurate decline in groundwater levels within BCA bores.
- Whilst WMLP323 has not been undermined, the commencement or termination of longwall panels appears to have no bearing on either groundwater levels or EC in WMLP323.

Given time, a return to average rainfall values, and in increased hydraulic head in Bowmans Creek and associated alluvium, it is likely that EC levels within WMLP323 will decline from the current level of 1,368 µS/cm and return to levels nearer the trigger value of 1,241 µS/cm.

Although the impacts are not considered mining related, they are within the approved impacts. There is no change in the beneficial use of the groundwater, and no environmental impact is expected as a result of the EC change.

## *Attachment 1* WMLP323, WMLP328 and WML113C bore construction logs




**Monitoring bore WMLP323**

**Figure -**

Ashton WMLP323 EC Trigger Exceedance (G1922N)

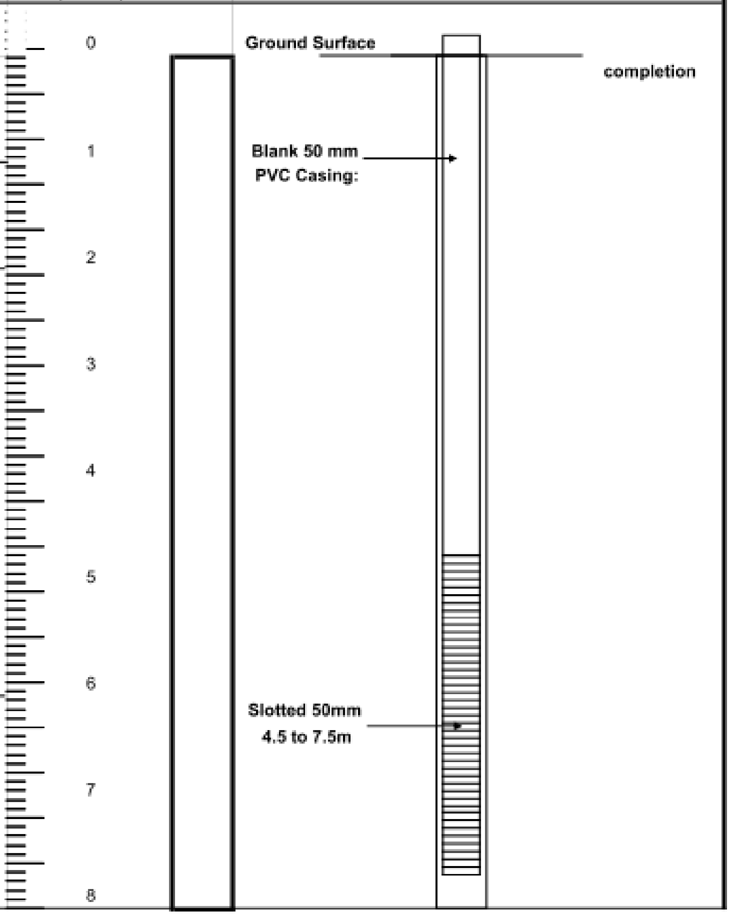
***Aquaterra Consulting Pty Ltd***

***Logging Sheet***

## BORE: WMLP328

| | | | |
|---|---|---|---|
| | | Project No: | S55G |
| Client: **Ashton Coal Operations Ltd** | Elevation (Concr): | 62.60 mAHD | |
| | Elevation (TOC): | 64mAHD | |
| Location: **Ashton Coal** | Stickup: | 1.24 | |
| | Hole Depth: | 8.00 m | |
| Drilling Contractor: **Hunter Drilling** | Date Started: | | Supervised By: Ashton |
| | Date Completed: | 01-Mar-11 | |

| Description | Depth (metres) | Well Construction Details: |
|---|---|---|
| **SOIL** - brown, very low strength. | 0–1 | |
| **CLAY** - brown, slightly stony, low strength. | 1–2 | |
| **GRAVEL** - brown, sandy, medium strength | 2–6.1 | |
| **GRAVEL** - brown, medium strength. | 6.1–8 | |



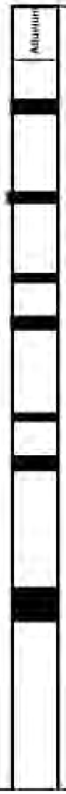
***Aquaterra Consulting Pty Ltd***
***Logging Sheet***

## BORES: WML 113C

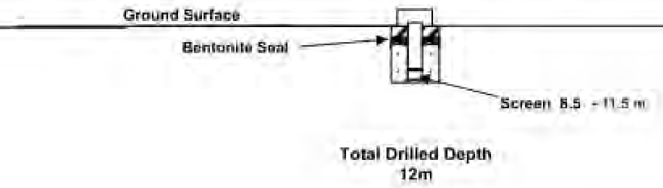
| Project No: | S03 (05 - 0166) |
|---|---|

| Client: | Bore: | Elevation (GL): | Elevation (TOC): | Stickup: | Drilling Contractor: | Date Started: | Date Finished: |
|---|---|---|---|---|---|---|---|
| Ashton Coal Operations Pty Ltd | | | | | | | |
| Location: | | | | | | | |
| Ashton Coal Project | WML113C | 60.43 mAHD | 60.96 m | 0.53 m | Hunter Drilling Services | ? | |
| | | | Hole depths: | | | Supervised By: | |
| | | | As shown | | | R McCallum | |

| Description | Depth (metres) |
|---|---|
| Brown and dark brown alluvium | 0 |
| Grey sand- and siltstone with dark grey mudstone | 10 |
| Coal (Bayswater 1 Seam) | 20 |
| Grey sand- and siltstone with mudstone | |
| Multicolored conglomerate | 30 |
| Coal (Bayswater 2 Seam) | 40 |
| Grey sand- and siltstone with pebbly conglomerate | 50 |
| Coal (Lemington 1/2 Seams) | 60 |
| Grey silt- and sandstone | |
| Coal (Lemington 3/4 Seams) | 70 |
| Grey siltstone with grey sandstone | |
| Pebbly conglomerate with little sand- and siltstone | 80 |
| Coal | 90 |
| Grey siltstone with grey sandstone | |
| Coal | 100 |
| Grey siltstone and sandstone, with mudstone | 110 |
| Multicolored pebbly conglomerate | 120 |
| Coal (Lemington 10, 11 and 12 Seams) | |
| Grey sand and siltstone | 130 |
| | 140 |
| | 150 |
| | 160 |




**Well Construction Details:** WML 113C



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