Liddell Coal Operations

Environmental Noise Monitoring
June 2019

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1 INTRODUCTION

1.1 Background

Global Acoustics were engaged by Liddell Coal Operations Pty Ltd (LCO) to conduct a monthly noise survey around its operations, an open cut mine near Ravensworth, NSW.

Attended environmental noise monitoring described in this report was undertaken during the night of 6/7 June 2019 at two monitoring locations. Figure 1 shows the monitoring locations.

The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with the specified limits detailed in Section 2.3.

1.2 Attended Noise Monitoring Locations

There were two attended monitoring locations during this survey as detailed in Table 1.1 and shown on Figure 1.

<table>
<thead>
<tr>
<th>Table 1.1: ATTENDED NOISE MONITORING LOCATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptor</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>1246 Hebden Road</td>
</tr>
<tr>
<td>1317 Hebden Road</td>
</tr>
</tbody>
</table>

Notes:

1. As indicated in Section 3.1 of the LCO Noise Monitoring Program.
Figure 1: LCO Noise Monitoring Locations
1.3 Terimnology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.2.

Table 1.2: TERMINOLOGY & ABBREVIATIONS

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>L&lt;sub&gt;A&lt;/sub&gt;</td>
<td>The A-weighted root mean squared (RMS) noise level at any instant</td>
</tr>
<tr>
<td>L&lt;sub&gt;A&lt;/sub&gt;max</td>
<td>The maximum A-weighted noise level over a time period or for an event</td>
</tr>
<tr>
<td>L&lt;sub&gt;A1&lt;/sub&gt;</td>
<td>The noise level which is exceeded for 1 per cent of the time</td>
</tr>
<tr>
<td>L&lt;sub&gt;A1,1minute&lt;/sub&gt;</td>
<td>The noise level which is exceeded for 1 per cent of the specified time period of 1 minute</td>
</tr>
<tr>
<td>L&lt;sub&gt;A10&lt;/sub&gt;</td>
<td>The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels</td>
</tr>
<tr>
<td>L&lt;sub&gt;A50&lt;/sub&gt;</td>
<td>The noise level which is exceeded for 50 per cent of the time</td>
</tr>
<tr>
<td>L&lt;sub&gt;A90&lt;/sub&gt;</td>
<td>The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L&lt;sub&gt;A90&lt;/sub&gt; level is often referred to as the “background” noise level and is commonly used to determine noise criteria for assessment purposes</td>
</tr>
<tr>
<td>L&lt;sub&gt;Amin&lt;/sub&gt;</td>
<td>The minimum A-weighted noise level over a time period or for an event</td>
</tr>
<tr>
<td>L&lt;sub&gt;Aeq&lt;/sub&gt;</td>
<td>The average noise energy during a measurement period</td>
</tr>
<tr>
<td>dB(A)</td>
<td>Noise level measurement units are decibels (dB). The “A” weighting scale is used to describe human response to noise</td>
</tr>
<tr>
<td>SPL</td>
<td>Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals</td>
</tr>
<tr>
<td>Hertz (Hz)</td>
<td>Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together</td>
</tr>
<tr>
<td>VTG</td>
<td>Vertical temperature gradient in degrees Celsius per 100 metres altitude. Estimated from wind speed and sigma theta data</td>
</tr>
<tr>
<td>IA</td>
<td>Inaudible. When site-only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location</td>
</tr>
<tr>
<td>NM</td>
<td>Not Measurable. If site-only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified</td>
</tr>
<tr>
<td>Day</td>
<td>This is the period 7:00am to 6:00pm</td>
</tr>
<tr>
<td>Evening</td>
<td>This is the period 6:00pm to 10:00pm</td>
</tr>
<tr>
<td>Night</td>
<td>This is the period 10:00pm to 7:00am</td>
</tr>
</tbody>
</table>
2 DEVELOPMENT CONSENT

2.1 Development Consent

The original development consent (DA 305-11-01) for LCO was granted by the Minister for Planning in 2002. The development consent has been modified most recently in January 2019. Relevant noise conditions from the most recent modification are reproduced in Appendix A. Relevant criteria are detailed in Table 2.1.

2.2 Environment Protection Licence

LCO holds Environment Protection Licence (EPL) No. 2094 issued by the Environmental Protection Authority (EPA) most recently on 1 April 2019. Relevant noise conditions from the EPL are reproduced in Appendix A.

2.3 Noise Monitoring Program

Specific noise monitoring requirements are detailed in the LCO Noise Monitoring Program (NMP). The most recent version of the NMP was approved in October 2018. Relevant sections are reproduced in Appendix A.

Impact assessment criteria for LCO, outlined in the NMP, are detailed in Table 2.1.

Table 2.1: LCO IMPACT ASSESSMENT CRITERIA (dB)

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Day L_Aeq,15minute</th>
<th>Evening L_Aeq,15minute</th>
<th>Night L_Aeq,15minute</th>
<th>Night L_A1,1minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1246 Hebden Road</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>1317 Hebden Road</td>
<td>36</td>
<td>35</td>
<td>36</td>
<td>45</td>
</tr>
</tbody>
</table>

2.4 Meteorological Conditions

Appendix 6 of the development consent outlines meteorological conditions required for criteria to be applicable. Noise criteria detailed in the consent applies under all meteorological conditions except for the following:

(a) during periods of rain or hail;

(b) average wind speed at microphone height exceeds 5m/s;

(c) wind speeds greater than 3 m/s measured at 10m above ground level; or

(d) temperature inversion conditions greater than 3°C/100m, or alternatively stability class F and G.
As LCO does not have an inversion tower (or similar method) available to measure temperature inversion conditions directly, the stability class method of evaluating meteorological conditions has been adopted.

2.5 Modifying Factors

The EPA ‘Noise Policy for Industry’ (NPfI, 2017) was approved for use in NSW in October 2017, and supersedes the EPA’s Industrial Noise Policy (INP, 2000). Assessment and reporting of modifying factors is to be carried out in accordance with Fact Sheet C of the NPfI.

NPfI modifying factors, as they are applicable to mining noise, are described in more detail below.

2.5.1 Tonality and Intermittent Noise

As defined in the NPfI:

* Tonal noise contains a prominent frequency and is characterised by a definite pitch.

* Intermittent noise is noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB(A); for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.

2.5.2 Low-Frequency Noise

As defined in the NPfI:

* Low frequency noise is noise with an unbalanced spectrum and containing major components within the low-frequency range (10 – 160 Hz) of the frequency spectrum.

The NPfI contains the current method of assessing low-frequency noise, which is a 2 step process as detailed below:

* Measure/assess source contribution C-weighted and A-weighted $L_{eq,T}$ levels over the same time period. The low frequency noise modifying factor correction is to be applied where the C-A level is 15 dB or more and:

  * where any of the 1/3 octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured A weighted levels applies for the evening/night period; and

  * where any of the 1/3 octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured A weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.
Table C2 and associated notes from the NPfI is reproduced below:

**Table C2: One-third octave low-frequency noise thresholds.**

<table>
<thead>
<tr>
<th>Hz/dB(Z)</th>
<th>10</th>
<th>12.5</th>
<th>16</th>
<th>20</th>
<th>25</th>
<th>31.5</th>
<th>40</th>
<th>50</th>
<th>63</th>
<th>80</th>
<th>100</th>
<th>125</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (Hz)</td>
<td>92</td>
<td>89</td>
<td>86</td>
<td>77</td>
<td>69</td>
<td>61</td>
<td>54</td>
<td>50</td>
<td>50</td>
<td>48</td>
<td>48</td>
<td>46</td>
<td>44</td>
</tr>
</tbody>
</table>

**Notes:**
- dB(Z) = decibel (Z frequency weighted).
- For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to 5 metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler, 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.
- Low-frequency noise corrections only apply under the standard and/or noise-enhancing meteorological conditions.
- Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.
- Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or environment protection licence, and at locations nominated in the development consent or licence.
3 METHODOLOGY

3.1 Overview

All noise monitoring was conducted at the nearest residences in accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise', relevant NSW EPA requirements, and the LCO NMP.

3.2 Attended Noise Monitoring

During this survey, monthly attended monitoring was undertaken during the night period, once at each location. The duration of each measurement was 15 minutes.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits as it allows the most accurate determination of the contribution, if any, to measured noise levels by the source of interest, in this case LCO.

If the exact contribution of the source of interest cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise levels, for example, \( L_{A10} \), \( L_{A50} \) or \( L_{A90} \). This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods (e.g. measure closer and back calculate) to determine a value for reporting.

All sites noted as NM in this report are due to one or more of the following reasons:

- Site noise levels were extremely low and unlikely, in many cases, to be even noticed;
- Site noise levels were masked by another relatively loud noise source that is characteristic of the environment (e.g. breeze in foliage or continuous road traffic noise) that cannot be eliminated by moving closer; and/or
- It was not feasible or reasonable to employ methods such as move closer and back calculate. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

A measurement of \( L_{A1,1\text{minute}} \) corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level, or \( L_{A\text{max}} \), received from the site during the entire
measurement period (i.e. the highest level of the worst minute during the 15 minute measurement).

### 3.3 Meteorological Data

Meteorological data was obtained from the LCO meteorological station located near the office and car park (south-east of the operation). Atmospheric parameters included wind speed, wind direction, rainfall and sigma theta. This data allowed correlation of atmospheric parameters and measured noise levels. Meteorological data was available in 5 minute intervals.

When meteorological data is provided in less than 15-minute intervals, an analysis must be conducted to determine the meteorological conditions present for the majority of the measurement period and whether those conditions relate to noise criteria being applicable. In order to accurately compare 5-minute meteorological data to 15-minute noise level measurement periods, a rolling 15-minute meteorological interval was produced by converting each 5-minute meteorological interval into an average of the preceding three 5-minute intervals. The rolling 15-minute meteorological interval which most closely matched the 15-minute noise level measurement period was then adopted as the predominant meteorological conditions for that measurement period.

Where rolling averages could not be used (such as stability class), the predominant condition, corresponding with the majority of 5-minute meteorological intervals, was adopted.

### 3.4 Modifying Factors

Years of monitoring have indicated that noise levels from mining operations, particularly those measured at significant distances from the source are relatively continuous and broad spectrum. Given this, noise levels from LCO at the monitoring locations are unlikely to be intermittent or tonal.

Assessment of low-frequency modifying factors is necessary when application of the maximum correction could potentially result in an exceedance of the relevant site-only $L_{Aeq}$ criterion. Low-frequency analysis is therefore undertaken for measurements in this report where:

- meteorological conditions resulted in criteria being applicable;
- contributions from LCO were audible and directly measurable, such that the site-only $L_{Aeq}$ was not “NM” or less than a maximum cut off value (e.g. “<20 dB” or “<30dB”);
- contributions from LCO were within 5 dB of the relevant $L_{Aeq}$ criterion, as 5 dB is the maximum penalty that can be applied by low-frequency modifying factors; and
- LCO was the only low-frequency noise source.

All measurements meeting these conditions were evaluated for possible low-frequency penalty applicability in accordance with the NPfI.
3.5 Attended Monitoring Equipment

The equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix B.

Table 3.1: ATTENDED NOISE MONITORING EQUIPMENT

<table>
<thead>
<tr>
<th>Model</th>
<th>Serial Number</th>
<th>Calibration Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rion NA-28 sound level analyser</td>
<td>30131882</td>
<td>05/02/2021</td>
</tr>
<tr>
<td>Pulsar 106 acoustic calibrator</td>
<td>78226</td>
<td>01/02/2021</td>
</tr>
</tbody>
</table>
4 RESULTS

4.1 Total Measured Noise Levels

Overall noise levels measured at each location during attended measurement are provided in Table 4.1. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.1: MEASURED NOISE LEVELS – JUNE 2019

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date and Time</th>
<th>$L_{A\text{max}}$ dB</th>
<th>$L_{A1}$ dB</th>
<th>$L_{A10}$ dB</th>
<th>$L_{A50}$ dB</th>
<th>$L_{A\text{eq}}$ dB</th>
<th>$L_{A90}$ dB</th>
<th>$L_{A\text{min}}$ dB</th>
<th>$L_{C\text{eq}}$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1246 Hebden Road</td>
<td>6/6/19 22:21</td>
<td>46</td>
<td>42</td>
<td>40</td>
<td>37</td>
<td>38</td>
<td>35</td>
<td>33</td>
<td>57</td>
</tr>
<tr>
<td>1317 Hebden Road</td>
<td>6/6/19 22:00</td>
<td>55</td>
<td>38</td>
<td>35</td>
<td>32</td>
<td>33</td>
<td>30</td>
<td>28</td>
<td>55</td>
</tr>
</tbody>
</table>

Notes:
1. Levels in this table are not necessarily the result of activity at LCO.

4.2 Modifying Factors

Measured LCO only levels were assessed for the applicability of modifying factors in accordance with the EPA’s NPfi.

There were no intermittent or tonal noise sources, as defined in the NPfi, audible from site during the survey.

None of the measurements satisfied the conditions outlined in Section 3.4 when assessing low-frequency noise. Therefore no further assessment of modifying factors was undertaken.
4.3 Attended Noise Monitoring

Table 4.2 to Table 4.3 detail noise levels from LCO in the absence of other noise sources. Criteria are then applied if weather conditions are in accordance with LCO’s development consent. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

**Table 4.2: L_{Aeq,15 minute} GENERATED BY LCO AGAINST IMPACT ASSESSMENT CRITERIA – JUNE 2019**

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date and Time</th>
<th>Wind Speed m/s</th>
<th>Stability Class</th>
<th>Criterion dB</th>
<th>Criterion Applies?</th>
<th>LCO L_{Aeq,15min} dB</th>
<th>Exceedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1246 Hebden Road</td>
<td>6/6/19 22:21</td>
<td>1.4</td>
<td>-1.0</td>
<td>35</td>
<td>Yes</td>
<td>NM</td>
<td>Nil</td>
</tr>
<tr>
<td>1317 Hebden Road</td>
<td>6/6/19 22:00</td>
<td>1.2</td>
<td>-1.0</td>
<td>36</td>
<td>Yes</td>
<td>31</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Notes:
1. Atmospheric data is from LCO weather station;
2. Noise emission limits apply for all meteorological conditions except during rain, hail, winds greater than 3 metres per second (at a height of 10 metres), or stability class F or G;
3. These are results for LCO in the absence of all other noise sources. NM denotes audible but not measurable, IA denotes inaudible;
4. Bold results in red are those greater than the relevant criterion (if applicable); and
5. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.

**Table 4.3: L_{A1,1 minute} GENERATED BY LCO AGAINST IMPACT ASSESSMENT CRITERIA – JUNE 2019**

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date and Time</th>
<th>Wind Speed m/s</th>
<th>Stability Class</th>
<th>Criterion dB</th>
<th>Criterion Applies?</th>
<th>LCO L_{A1,1min} dB</th>
<th>Exceedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1246 Hebden Road</td>
<td>6/6/19 22:21</td>
<td>1.4</td>
<td>-1.0</td>
<td>45</td>
<td>Yes</td>
<td>NM</td>
<td>Nil</td>
</tr>
<tr>
<td>1317 Hebden Road</td>
<td>6/6/19 22:00</td>
<td>1.2</td>
<td>-1.0</td>
<td>45</td>
<td>Yes</td>
<td>36</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Notes:
1. Atmospheric data is from LCO weather station;
2. Noise emission limits apply for all meteorological conditions except during rain, hail, winds greater than 3 metres per second (at a height of 10 metres), or stability class F or G;
3. These are results for LCO in the absence of all other noise sources. NM denotes audible but not measurable, IA denotes inaudible;
4. Bold results in red are those greater than the relevant criterion (if applicable); and
5. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.
4.4 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.4. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain or hail.

Table 4.4: MEASURED ATMOSPHERIC CONDITIONS – JUNE 2019

<table>
<thead>
<tr>
<th>Location</th>
<th>Start Date and Time</th>
<th>Temperature (°C)</th>
<th>Wind Speed (m/s)</th>
<th>Wind Direction (°MN)</th>
<th>Cloud Cover (1/8ths)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1246 Hebden Road</td>
<td>6/6/19 22:21</td>
<td>7</td>
<td>0.6</td>
<td>330</td>
<td>0</td>
</tr>
<tr>
<td>1317 Hebden Road</td>
<td>6/6/19 22:00</td>
<td>7</td>
<td>0.6</td>
<td>330</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes:
1. Noise criteria do not apply if wind speeds at the microphone height exceed 5.0 metres per second. If this occurs, the measurement must be repeated; and
2. “−” indicates that conditions were calm at 1.8 metres.

Data obtained from the LCO meteorological station is used to determine compliance with criteria.
5 DISCUSSION

5.1 Noted Noise Sources

Section 4 presents data gathered during attended monitoring. These noise levels are the result of many sounds reaching the sound level meter microphone during monitoring. Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of LCO's contribution, if any, to measured levels. At each receptor location, LCO's $L_{A_{eq,15\text{minute}}}$ and $L_{A_{1,1\text{minute}}}$ (in the absence of any other noise) was measured directly, where possible, or determined by frequency analysis.

Time variations of noise sources in each measurement, their temporal characteristics, are taken into account via statistical descriptors. From these observations, summaries have been derived for each location. The following chapter sections provide these summaries. Statistical 1/3 octave band analysis of environmental noise was undertaken, and the following figures display the frequency ranges for various noise sources at each location for $L_{A1}$, $L_{A10}$, $L_{A_{eq}}$, $L_{A_{50}}$, and $L_{A_{90}}$. These figures also provide, graphically, statistical information for these noise levels.

An example is shown in Figure 2, where it can be seen that frogs and insects are generating noise at frequencies above 1000 Hz; mining noise is at frequencies less than 1000 Hz (this is typical). Adding levels at frequencies that relate to mining only allows separate statistical results to be calculated. This analysis cannot always be performed if there are significant levels of other noise at the same frequencies as mining; this can be dogs, cows, or, most commonly, road traffic.

It should be noted that the method of summing statistical values up to a cut-off frequency can overstate the $L_{A1}$ result by a small margin, but is entirely accurate for $L_{A_{eq}}$. 
Figure 2: Sample graph (See Section 5.1 for explanation)
5.1.1 1246 Hebden Road

A continuum was audible from LCO during the measurement however it was denoted as not measurable.

Trains were primarily responsible for the measured levels. Frogs were also noted.
5.1.2 1317 Hebden Road

A continuum and dozer tracks were audible from LCO during the measurement, generating a site only $L_{Aeq}$ of 31 dB. Dozer tracks generated the $L_{A1,1minute}$ of 36 dB. Impact noise was also noted.

LCO was primarily responsible for the measured levels. A train and an aircraft contributed to the measured $L_{A1}$, $L_{A10}$ and $L_{Aeq}$.

Frogs were also noted.
6 SUMMARY OF COMPLIANCE

Global Acoustics were engaged by LCO to conduct a monthly noise survey around its operations, an open cut mine near Ravensworth, NSW.

Attended environmental noise monitoring described in this report was undertaken during the night of 6/7 June 2019 at two monitoring locations. The purpose of the survey is to quantify and describe the acoustic environment around the site and compare with specified limits.

Activities from LCO complied with the relevant noise limits during the June 2019 survey as shown in Table 4.2 and Table 4.3. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd
APPENDIX

A  DEVELOPMENT CONSENT, EPL, AND NMP
Relevant sections of the project approval, EPL, and NMP are reproduced below.

Development Consent

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS

NOISE

Impact Assessment Criteria

1. The Applicant must ensure that the noise generated by the development does not exceed the noise impact assessment criteria in Table 1 at any residence.

<table>
<thead>
<tr>
<th>Assigned residential location number</th>
<th>Day (L_Aeq,1min)</th>
<th>Evening (L_Aeq,1min)</th>
<th>Night (L_Aeq,1min)</th>
<th>Night (L_Aeq,1min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,5,6,7,8,9,10,11,12,14</td>
<td>35</td>
<td>35</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>35</td>
<td>35</td>
<td>38</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>35</td>
<td>36</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>35</td>
<td>36</td>
<td>45</td>
</tr>
<tr>
<td>All other privately-owned land</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

Note: To interpret the locations referred to in Table 1, see Appendix 5

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

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

Operating Conditions

2. The Applicant must
   (a) implement all reasonable and feasible measures to minimise the construction, operational, road and rail noise of the development;
   (b) operate a noise management system on site that uses attended noise monitoring data to ensure compliance with the relevant conditions of consent;
   (c) evaluate the effectiveness of the noise management system;
   (d) minimise the noise impacts of the development during meteorological conditions when the noise criteria in this consent does not apply (see Appendix 6), and
   (e) monitor and report on compliance with the relevant noise conditions of this consent, to the satisfaction of the Secretary.

Monitoring Program

3. The Applicant must update and subsequently implement the Noise Monitoring Program for the development to the satisfaction of the Secretary. This program must be submitted to the Secretary by the end of May 2015, and must include regular attended monitoring in accordance with Appendix 6, and a noise monitoring protocol for evaluating compliance with the noise impact assessment criteria in this consent.
APPENDIX 6
NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Table 1 of Schedule 3 are to apply under all meteorological conditions except the following:
   (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 measured at 10 m above ground level;
   (d) temperature inversion conditions greater than 5°C/100 m, or alternatively stability class F and G.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station on or in the vicinity of the site.

Compliance Monitoring

3. Attended monitoring is to be used to determine compliance with the relevant conditions of this consent.

4. This monitoring must be carried out at least once a month (but at least two weeks apart), unless the Secretary directs otherwise.
   Note: The Secretary may direct that the frequency of attended monitoring increase or decrease at any time during the life of the development.

5. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements 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) meteorological conditions during which collection of noise data is not appropriate;
   (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   (d) modifications to noise data collected including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration, with the exception of applying appropriate modifying factors for low frequency noise during compliance testing. This should be undertaken in accordance with Fact Sheet C of the NSW Noise Policy for Industry (EPA, 2017).
A.1.1 Environment Protection Licence

8 Pollution Studies and Reduction Programs

U1 Premises Noise Limits

U1.1 The licensee must conduct a noise assessment in accordance with the document, ‘NSW Industrial Noise Policy’, (EPA 2000) for the operations and activities carried out at the licensed premises and submit a report to the Manager, Hunter Region, by no later than 31 May 2013.

U1.2 The report referred to in condition U1.1 must include, but is not limited to the following:

1. Project Specific Noise Levels for the nearest noise sensitive receiver location(s). The project specific noise levels may be sourced from recent documentation submitted in support of a project approval applications, or determined specifically in response to this condition, provided that:
   (a) The source of the project specific noise levels are stated;
   (b) The project specific noise levels have been derived in accordance with the NSW industrial Noise Policy (EPA 2000), (“INP”);
   (c) Details are provided of how the project specific noise levels have been derived; and
   (d) The nearest noise sensitive receiver locations chosen are representative of those potentially most affected by noise from the premises.

2. Predicted or measured noise level contributions for the noise sensitive receiver locations identified in U1.2.1 above as a result of all activities and operations carried out at the premises. These may be sourced from recent documentation submitted in support of a project approval or determined specifically in response to this conditions provided that:
   (a) The source of the predicted or measured noise level(s) are stated;
   (b) Noise levels have been predicted or measured in accordance with the INP; and
   (c) Details of how the noise levels have been predicted are provided.

3. Noise limits proposed for the location(s) identified in U1.2.1 above, derived with regard to the project specific noise levels and predicted noise level contributions from U1.2.1 and U1.2.2 above, that can be placed on the licence, for all activities and operations carried out at the premises.

4. Details of methods to be used to determine compliance with limits in U1.2.3 above.

Note: (a) A reference to the INP includes a reference to INP Application Notes; and
(b) Noise sensitive receiver locations do not include any locations owned by the licensee or another coal mine or where a negotiated agreement (as outlined in the INP) is in place between the landowner and any licence holder.
A.1.2 Noise Monitoring Program

3.1 Monitoring Locations

A review of noise monitoring locations was conducted by Global Acoustics in March 2013 (refer Appendix A) and determined that the number of sites could be reduced to two (1246 (R1, R3) and 1307 (R4, R5, R6) Hebden Road) on the basis of:

- The Environment Protection Authority (EPA) has advised LCO, as part of the Pollution Reduction Program, that ‘Noise sensitive receiver locations do not include any mines or other coal mine or where a negotiated agreement (as outlined in the Industrial Noise Policy) is in place between the landowner and any licence holder’. While this statement refers to ‘another coal mine’ it is considered reasonable to substitute ‘another noise generating industry’ such as AGL Macquarie Liddell and Bayswater Power Stations into this statement. AGL Macquarie (R15) owns the Liddell Recreational Area (LRA) (R13) and monitoring has indicated it is significantly affected by Power Station generated noise.

- Noise monitoring has been undertaken at 1412 (R7) and 1525 (R9) Hebden Road on nominally three occasions per quarter, since quarter 4, 2010. The total sample count at both locations is 25 with a maximum mining L\text{Aeq} at these locations of 32 dB, measured at 1412 (R7) Hebden Road; and

- Prior to and up until the review in March 2013, mining noise has been insignificant and inaudible, less than L\text{Aeq} 20 dB, or, not measurable due to low level mine noise impact for 88 and 88 percent of the samples at 1412 (R7) and 1525 (R9) Hebden Road respectively. Therefore it can be said these locations have a history of receiving low to zero mining noise levels from LCO.

Noise Monitoring at LCO will be undertaken at the locations shown on Figure 1 — Noise Monitoring Locations. These locations have been selected to be representative of the local LCO community and likely properties that may be impacted by LCO operational noise. The locations are representative of currently occupied properties identified for monitoring in the Development Approval.

Current monitoring locations and a reference to the 2013 EIS residential property reference is provided in Table 3.

Table 3: Current noise monitoring locations and references to 2013 EIS property reference.

<table>
<thead>
<tr>
<th>Current Noise monitoring Location</th>
<th>Representative residential receivers from the 2013 EIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1317 Hebden Rd</td>
<td>12 R4 (also representative of R5 and R6)</td>
</tr>
<tr>
<td>1246 Hebden Rd</td>
<td>14 R1 (also representative of R2 and R3)</td>
</tr>
</tbody>
</table>

Residence 1246 Hebden Rd (14) is the closest occupied non-mined owned residence to Liddell Coal.

3.2 Monitoring Protocol

3.2.1 Attended Noise Monitoring

Attended noise monitoring will be undertaken once per calendar month at the representative locations nominated in Section 3.1 in accordance with the Environment Protection Authority (EPA) ‘Industrial Noise Policy’ (INP) guidelines and Australian Standard AS 1055 ‘Acoustics, Description and Measurement of Environmental Noise’.

The attended noise monitoring survey is used to quantify and describe the acoustic environment at each monitoring location. Typically the results are compared with the noise criteria defined in the DA 305-11-01 to assess compliance. Attended noise monitoring is often considered the preferred method for determining compliance with prescribed limits because it allows for an accurate determination of the contribution made by industrial noise sources, if any, to measured ambient noise levels. The attended noise monitoring program is used to:
- identify individual sources contributing to the ambient noise environment;
- quantify mine noise levels;
- determine whether a modifying factor should be applied to the contributing mine noise levels (in accordance with the INP);
- gain an understanding of the effects of meteorological conditions on the propagation of the noise from LCO to the monitoring location; and
- allow, by comparison, evaluation of real-time monitoring data for accuracy of noise management.

Historical monitoring and industry accepted experience, shows that mining noise is generally inaudible during the day. Additionally, it is accepted that night-time measurements are conservatively representative of evening results. Therefore, attended noise monitoring will only be undertaken during the night period (10:00 pm to 7:00 am) unless otherwise requested by DP&E.

All noise measurements will be accompanied by both qualitative description (including cloud cover) and quantitative measurements of prevailing weather conditions throughout the monitoring period. Quantitative data will be sourced from the meteorological monitoring station utilised by LCO.

During the attended noise measurements, the noise consultant will also note any significant mining generated noise sources (i.e. haul trucks, dozers, etc).

To avoid disturbance to residents, monitoring locations at slight distances from actual residences are often used to measure compliance. In most cases, suitable monitoring locations where noise levels are likely to be the highest are chosen.

To determine compliance with the LAeq(15 minute) and LA(1 minute) noise limits, attended noise measurements are taken at representative locations. To demonstrate that the current noise monitoring locations used for LCO are representative of the nearest sensitive receptor, approximate difference in noise levels between actual monitoring locations and the residence (house) being represented by each were determined.

Approximate distances between actual monitoring locations, residence (house) locations and the nearest point of site were determined. Calculations were then made to establish the approximate difference in mining noise levels that is likely between the monitoring locations and the residence (house) locations if there were operations at the nearest point.

The nearest point of site was used as a worst case scenario; activity on site but further away should result in smaller differences between received noise levels at the monitoring and residence (house) locations.

Approximate changes in received noise levels between actual monitoring location and residence (house) locations are provided in Table 4.

**Table 4: LCO Monitoring Locations and Change in Received Noise Levels**

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Residence represented (Modification 5 of DA-305-11-01 reference)</th>
<th>Change in dB between the monitoring location and the residence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1246 Hebben Rd</td>
<td>R1</td>
<td>-0.1</td>
</tr>
<tr>
<td>1246 Hebben Rd</td>
<td>R3</td>
<td>-0.4</td>
</tr>
<tr>
<td>1317 Hebben Rd</td>
<td>R4</td>
<td>0.0</td>
</tr>
<tr>
<td>1317 Hebben Rd</td>
<td>R5</td>
<td>-0.1</td>
</tr>
<tr>
<td>1317 Hebben Rd</td>
<td>R6</td>
<td>-0.5</td>
</tr>
</tbody>
</table>

As shown above, there are insignificant changes in noise levels between monitoring and residence (house) locations. In all cases noise levels at residences are expected to be equal to or less than would be measured at the monitoring locations based on these distance calculations. The approximate change in received noise levels between actual monitoring locations and the residences they represent is within 0.5 of a decibel which is within the error range of a Type 1 sound level meter used for environmental monitoring. Additionally, 0.5 dB is well below the change in noise levels perceptible to the human ear in a steady state environment. On this basis, all monitoring locations can be considered to be representative of the receptors they were chosen to represent.

Each monthly attended noise survey comprises up to two 15-minute measurements at each location.
DP&E require monitoring to determine if any impacts are systemic/sustained. Accordingly, if a noise criterion exceedance is measured, then a second measurement is to be made within the next 75 minutes. If the second measurement also results in an exceedance, this location would be deemed noise affected for that night. This will trigger follow up monitoring that will be undertaken at that specific location (not all locations) on one night during the following one week. The regular monitoring frequency will be resumed if no further exceedances are measured. However, if a further exceedance is measured during the follow up period (one week), then a comprehensive survey will be undertaken, to the satisfaction of the DP&E, to determine if these impacts are regular (systemic/sustained).

For each 15 minute monitoring period, the following information will be recorded:

- operator’s name;
- monitoring location;
- date and time that monitoring began at each location;
- quantitative meteorological data such as temperature, wind speed, wind direction and humidity;
- qualitative meteorological information such as cloud cover, fog, and rainfall;
- instrument calibration details before and after the monitoring period;
- the value or estimate of the LCO$_{15\text{minute}}$;
- the highest mining L$_{A1,1\text{minute}}$ noise level (to allow comparison with the relevant sleep arousal criterion);
- the overall L$_{A1,1\text{minute}}$ and L$_{C15\text{minute}}$;
- statistical noise level descriptors: L$_{A0}$, L$_{A50}$, L$_{A10}$, L$_{A1}$ and L$_{Amax}$;
- notes that identify the noise source that generated the highest L$_{A1,1\text{minute}}$ (L$_{Amax}$);
- measurements in one-third octave bands from 25 Hz to 10 kHz inclusive (or a broader range of bands) to assess the mining noise has characteristics that may require modifying factors to be applied; and
- data suitable for assessing the relative contribution of mine-generated noise to the overall noise being measured by using a suitable low-pass filter.

In accordance with the methodology outlined in Section 3.4 of the INP (EPA, 2000), if any of the data in a 15 minute period is affected by rain or wind speeds in excess of 5 m/s then another entire 15 minute period of data unaffected by rain or excessive wind shall be undertaken.

### 3.2.3 Meteorological Conditions

The local meteorological data collected during the attended monitoring program and by the unattended noise monitoring units will be supplemented by more detailed records from the LCO weather station (refer to Figure 1.). The meteorological data recorded by the weather stations include:

- wind speed, wind direction and sigma-theta;
- temperature;
- humidity; and
- rainfall.

The meteorological data is recorded at 15-minute intervals and is linked directly to the LCO real time monitoring system allowing for access to real time weather conditions.

In accordance with Section 9.2 of the Industrial Noise Policy (INP, 2000) and Appendix 6 of DA-305-11-01, noise limits will apply under all meteorological conditions except:

- during periods of rain or hail
- if average wind speed at microphone height exceeds 5 m/s
- Wind speeds greater than 3 m/s measured at 10 m above ground level; or
- Temperature inversion conditions greater than 3°C/100 m, or alternatively stability class F and G (the methodology for determining stability class is described in Appendix E of the INP).

Noise exceedances identified to have occurred during the above meteorological conditions are considered to be ‘extraneous noise’ as detailed in the INP.
3.3 Compliance Assessment Protocol

3.3.1 Noise Impact Assessment Criteria

The $L_{A_{eq}, 15\, \text{minute}}$ noise assessment criteria provided in Section 2.0 represent the allowable noise levels from mining activities at the LCO at each of the respective monitoring locations. Should noise levels exceed an allowable noise level criterion provided in Section 2.0, LCO will be required to implement appropriate noise mitigation measures.

The results from the attended noise monitoring program provide a quantitative assessment of noise levels from mining activities at LCO at each of the respective monitoring locations at the time of monitoring. The measured noise levels are compared against the noise criteria, taking into account the following considerations:

- Whether criteria are applicable during weather conditions prevailing at the time of measurement;
- Whether modifying factors apply at the time of measurement;

LCO is considered to be compliant if, at the time of monitoring, the measured noise levels from the mine do not exceed the noise assessment criteria.

The monitoring program is also used to assess the performance of all mining machinery as a whole. Equipment selection will be governed by the noise performance of the mine, not necessarily individual items of equipment. A continued program of regular sound power screening testing is undertaken at LCO and assists in managing sound power levels, as well as identifying plant items requiring maintenance to noise attenuation packages.

3.3.2 $L_{A_{1,1\, \text{minute}}}$ Noise Criterion

The attended noise surveys include the assessment of night time $L_{A_{1,1\, \text{minute}}}$ noise levels generated by the mine at the time of monitoring. The measured $L_{A_{1,1\, \text{minute}}}$ noise levels are compared with the relevant $L_{A_{1,1\, \text{minute}}}$ criterion in Section 2 to assess compliance of the mine with the DA 305-11-01. LCO is considered to be compliant if, at the time of monitoring, the measured noise levels do not exceed the $L_{A_{1,1\, \text{minute}}}$ criterion provided in Section 2.

The noise recordings from the unattended noise monitoring network can also be used to help identify noise sources generated by the mine that could contribute to the night time $L_{A_{1,1\, \text{minute}}}$ noise levels.

4.4 Noise Exceedance Protocol

In accordance with the INP (EPA 2000), compliance will be determined by attended monitoring surveys. Accordingly, if a noise criterion exceedance is measured, the person conducting the attended noise monitoring is required to advise the relevant Supervisor at LCO of the exceedance and conduct another 15 minute attended noise survey within 76 minutes. The relevant Supervisor will document and report to the Environment and Community Superintendent any actions that they implemented following the notification of the exceedance. This is also required to be reported to the DP&E by the Environment and Community Superintendent (or delegate) the following day of detecting the exceedance. If the second measurement also results in an exceedance, this location would be deemed noise affected for that night.

Another attended noise monitoring survey will be scheduled and completed within 1 week following the exceedance. Outcomes of the attended noise monitoring surveys and any actions taken will be provided to DP&E as requested (refer to Section 4.4.1 of this NMP for reporting requirements).
APPENDIX

B CALIBRATION CERTIFICATES
Acoustic Research Labs Pty Ltd

Sound Level Meter
IEC 61672-2:2013
Calibration Certificate

Calibration Number: C19073

Client Details: Global Acoustics Pty Ltd
12/16 Huntleigh Drive
Thornon NSW 2322

Equipment Tested/Model Number: NA-28
Instrument Serial Number: 393131832
Microphone Serial Number: 04739
Pre-amplifier Serial Number: 11942

Pre-Test Atmospheric Conditions
Ambient Temperature: 24.5°C
Relative Humidity: 54.5%
Barometric Pressure: 99.39kPa

Post-Test Atmospheric Conditions
Ambient Temperature: 23.6°C
Relative Humidity: 51%
Barometric Pressure: 99.36kPa

Calibration Technician: Jamie Neil
Calibration Date: 5 Feb 2019
Secondary Check: Lewis Boorman
Report Issue Date: 6 Feb 2019

Approved Signatory: Ken Williams

Clause and Characteristic Tested
Result

Clause and Characteristic Tested
Result

12: Acoustic Snugness
13: Electrical Snugness
14: Frequency and time weightings at 1kHz
15: Long Term Stability
16: Level linearity on the reference level range
Pass
Pass
Pass
Pass
Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-2:2013, for the environmental conditions under which the tests were performed.

As a public authority was available, from an independent testing organisation responsible for approving the results of testing evaluations performed in accordance with IEC 61672-2:2013, to determine that the model of sound level meter fully conformed to the requirements in IEC 61672-2:2013, the sound level meter submitted for testing conformed to the class 1 requirements of IEC 61672-2:2013.

Least Deviations of Measurement

Environment Conditions
Temperature
Relative Humidity
Barometric Pressure

Acoustic Tests
31.5 Hz to 8kHz
27.5Hz
20kHz

Electrical Tests
31.5 Hz to 20kHz

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to internationally accepted standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection results.
Acoustic Research Labs Pty Ltd
Level 7 Building 2, 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 150 399 319
www.acousticresearch.com.au

Sound Calibrator
IEC 60942-2017

Calibration Certificate
Calibration Number: C19074

Client Details: Global Acoustics Pty Ltd
12/16 Huntingdale Drive
Thornlie, WA 6108

Equipment Tested/Model Number: Model 105
Instrument Serial Number: 78256

Atmospheric Conditions
Ambient Temperature: 23.8°C
Relative Humidity: 55.5%
Barometric Pressure: 99.5% Pa

Calibration Technician: Charlie Neil
Calibration Date: 1 Feb 2019

Secondary Check: Lewis Boorman
Report Issue Date: 6 Feb 2019

Approved Signatory: Ken Williams

Characteristic Tested

- Generated Sound Pressure Level
- Frequency Generated
- Total Distortion

Result
Pass
Pass
Pass

Nominal Level | Nominal Frequency | Measured Level | Measured Frequency
--- | --- | --- | ---
Pre Adjustment | 94.0 | 1000.0 | 94.4 | 1000.38
Post Adjustment | 94.0 | 1000.0 | 94.1 | 1000.29

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942-2017 for the sound pressure level and frequency response. All test were performed under the environmental conditions stated under which the tests were performed.

The uncertainties of measurement:

<table>
<thead>
<tr>
<th>Specific Tests</th>
<th>Environmental Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generated SPL</td>
<td>Temperature ±0.27°C</td>
</tr>
<tr>
<td>Frequency Error</td>
<td>Relative Humidity ±2.5%</td>
</tr>
<tr>
<td>Distortion</td>
<td>Barometric Pressure ±0.15 kPa</td>
</tr>
</tbody>
</table>

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be used in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/International standards.
NATA is a signatory to the ILAC Mutual Recognition Arrangement for mutual acceptance of the equivalence of testing, calibration and inspection reports.