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Results of Noise Monitoring

Blakebrook Quarry
Asphalt Plant Evening & Night Time Operations
550 Nimbin Road
Blakebrook NSW 2480

Prepared for

Ecoteam
13 Ewing Street
Lismore NSW 2480

Document Control				
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1 INTRODUCTION

Ambience Audio Services have been engaged by Ecoteam to conduct noise monitoring at Blakebrook Quarry, 550 Nimbin Road, Blakebrook NSW.

The current Noise and Blast Management Plan (NBMP) for Blakebrook Quarry (Lismore City Council Oct 2022) includes an Out of Hours Work Protocol (OHWP – Version 3.6) for the asphalt plant, which is anticipated to occur 10 nights per month on scheduled projects. Section 7 of the NBMP details the noise monitoring program. Section 7.3 requires noise monitoring to be conducted once every 6 months to represent winter and summer conditions. The noise monitoring and reporting is to be conducted for each assessment time period; Day - 7am to 6pm, Evening – 6pm to 10pm, Night – 10pm to 7am.

Night time noise monitoring was conducted on the 15th of September 2025 with the asphalt plant operating under normal load conditions and suitable weather conditions. The night time noise monitoring had been scheduled for late July, however was postponed several times due to unsuitable weather and changes in the scheduled night time road works.

Asphalt plant operations while noise monitoring was conducted for the night time period included: hot mix asphalt, loading of bins with a loader, loading trucks from an overhead hopper bin, and the movement of trucks on the internal haul road.

The previous mobile asphalt plant has been recently replaced with an updated mobile plant approximately 30m to the north.

To assist with the interpretation of some of the terminology used in this report, Appendix A provides definitions of acoustic terms. Appendix B is a chart of everyday sound pressure levels. Appendix C are the logged noise levels for the asphalt plant, and at each receiver location.

2 NOISE MONITORING REQUIREMENTS

The noise monitoring requirements for the Blakebrook Quarry are outlined in Section 2.2, Sections 7.1, 7.2, 7.3, 7.4, 7.5 and 7.7 of the NBMP (LCC Oct 2022).

Extracts of the relevant parts are copied below.

Section 2.2

3. *The Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 2 at any residence on privately owned land.*

Table 2: Noise Criteria dB(A)

Receiver	Day L_{Aeq} (15 minute)
Location 2 and 7	36
All other locations	35

Out of Hours Work Protocol – Asphalt Operations

The OHWP has provided management strategies for potential noise sources involving asphalt operations and truck movements. The evening and night project-specific noise level criterion is 35 dB(A) LAeq (15 minute).

L4.1 Noise from the licenced premises must not exceed an LAeq (15 minute) noise emission criteria of 36 dB(A) at Location 2 and 7, and 35 dB(A) at all other sensitive receivers, except as expressly provided by in this licence.

7.2 MONITORING LOCATIONS

The original Noise Assessment (ERM 2009) and updated NIA (Mitchel Hanlon, SEE 2019) included six (6) noise monitoring locations that were used throughout the assessment, based on proximity to nearby potentially sensitive receptors. Given the proximity between monitoring locations and the location of anticipated noise-generating plant and equipment, the monitoring locations have been revised and separated into primary and supplementary acoustic monitoring locations for the purposes of the NBMP.

Primary and supplementary acoustic locations are identified in *Figure 2*. Primary acoustic monitoring locations consist of locations **2**, **4** and **8** with the remainder of locations being supplementary acoustic monitoring locations.

An agreement was reached with the landowner located along Nimbin Road (previously identified as location 8, ERM 2009) in April 2016, wherein the landowner has agreed to the exceedances in noise levels from Quarry operations. As such the location has been removed as a primary acoustic monitoring location, and a new monitoring location selected being (current) location 8.

Primary monitoring locations will be utilised during noise compliance monitoring and are considered representative in determining compliance with the relevant Conditions of Approval.

In the event that additional monitoring is required then additional monitoring may be undertaken at the most practical supplementary acoustic monitoring locations, as well as at the primary acoustic monitoring locations.

7.4 METHODOLOGY

Noise

Operator attended noise measurements shall be conducted at all primary acoustic measurement locations (Locations 2, 4 and 8 – refer *Figure 2*) to quantify and characterise the maximum (L_{Amax}), the energy equivalent (L_{Aeq}), and the background (L_{A90}) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the L_{Aeq} (Period) noise contribution during Quarry activities, as well as the overall level of ambient noise. During attended monitoring, digital recordings will be conducted to allow for additional post analysis of the Quarry noise levels and source identification.

All acoustic instrumentation employed throughout the monitoring program shall meet with the requirements of AS/NZS IEC 61672.1 Sound level meters Specifications & AS/NZS IEC 61672.2 Sound level meters Pattern Evaluation.

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding $\pm$ 0.5 dBa.

7.5 METEOROLOGICAL PARAMETERS

Adverse meteorological conditions have the potential to increase noise levels, for example wind speeds up to 3 m/s or temperature inversions, however wind speeds above 5 m/s (and rainfall) have the potential to generate extraneous and erroneous noise events, which reduce the accuracy and confidence in measured data.

As such, meteorological parameters will be evaluated prior to undertaking works on site, to gain an understanding of the weather conditions and the potential for variations in noise levels.

All noise measurements shall be accompanied by both qualitative description (including cloud cover, approximate wind direction and speed) and quantitative measurements of prevailing local weather conditions throughout the survey period. Rainfall data and meteorological parameters will be collected from the weather station located on-site. as shown in *Table H*.

Table H: Meteorological Measurement Parameters

Measured Parameter	Unit	Sample Interval
Mean Wind Speed	m/s	15 minutes
Mean Wind Direction	Degrees	15 minutes
Aggregate Rainfall	mm	15 minutes
Mean Air Temperature	C°	15 minutes

Accounting For Annoying Noise Characteristics (Low Frequency Noise)

The *Noise Policy for Industry* (NPfI 2017) states that a noise source may exhibit a range of particular characteristics that increase annoyance, such as tones, impulses, low frequency noise and intermittent noise.

Where this is the case, an adjustment ('modifying factor corrections') is applied to the source noise level received at an assessment point before it is compared with criteria to account for the additional annoyance caused by the particular characteristic.

Application of these modifying factors is described in. *Fact Sheet C: Corrections for annoying noise characteristics* and outlines correction factors to be applied to the source noise level at the receiver before comparison with the project noise trigger levels to account for the additional annoyance caused by those modifying factors.

The modifying factor corrections should be applied having regard to:

- the contribution noise level from the premises when assessed/measured at a receiver location, and
- the nature of the noise source and its characteristics (as set out in this fact sheet).

The NPfI provides the following definitions to support the modifying factor corrections:

- Tonal Noise – Containing a prominent frequency and characterised by a definite pitch.
- Low Frequency Noise – Containing major components within the low frequency range (20 Hz to 250 Hz) of the frequency spectrum.
- Impulsive Noise – Having a high peak of short duration or a sequence of such peaks.
- Intermittent Noise – The level suddenly drops to that of the background noise several times during the assessment period, with a noticeable change in noise level of at least 5 dB.

The modifying factor corrections (and how they are applied) are present in *Table C1* of the NPfI and vary depending on the noise characteristic being assessed. All noise levels generated by the Quarry, which may generate tonal or low frequency content, will be assessed as part of the NBMP monitoring with due regard to these modifying factor penalties, and in accordance with the requirements presented in the NPfI.

Impulsive and intermittent noise, as defined by the NPfI, are not typical characteristics of the Quarry, hence tonal and low frequency noise (LFN) are most relevant to the Quarry and those modifying corrections are reproduced in *Table I*.

Tonal Noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (*ISO1996.2-2007 – Annex D*)	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB [2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. **Note:** Narrow-band analysis using the reference method in *ISO1996-2:2007, Annex C* may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low Frequency Noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.	2 or 5 dB [2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Notes:
1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the *ISO1996-2:2007* standard.

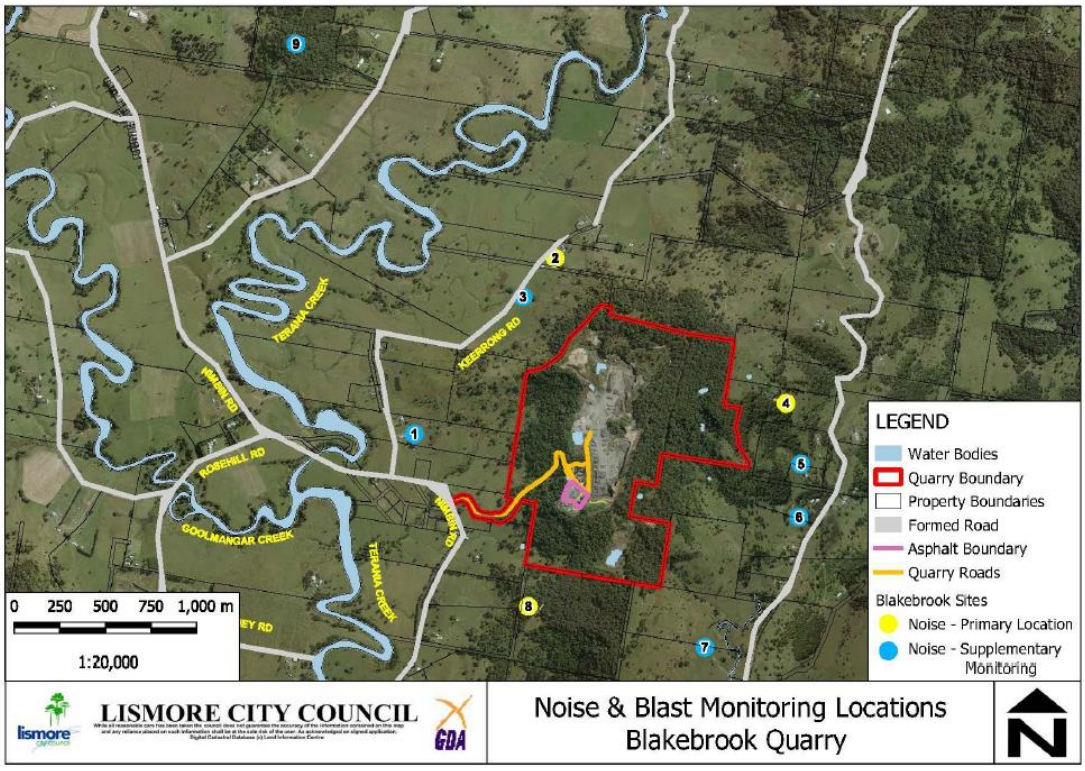
Noise monitoring at the receiver locations were conducted within 30m of the residential dwelling in the direction of the asphalt plant for Receivers 4 and 8. Measurements at Receiver 2 were conducted approximately 100m to the south west, so as not to disturb dogs during the night.

Table 2.1 Primary Receiver Locations

Receiver	Street Address
2	[redacted] Keerrong Rd Blakebrook
4	[redacted] Booerie Creek Road Booerie Creek
8	[redacted] Nimbin Rd Blakebrook

Figure 2.1 Noise Monitoring Locations

Figure 2: Noise & Blast Monitoring Locations Map



3 MEASUREMENT PROCEDURE AND RESULTS

3.1 Instrumentation

Table 3.1 Instrumentation		
Instrument	**Serial #**	**Calibration Date**
Bruel & Kjaer 2250 G4 Sound Level Meter	3006868	Oct 2023
Bruel & Kjaer 2250 G4 Sound Level Meter	3031300	Oct 2024
Bruel & Kjaer 2250 G4 Sound Level Meter	3028735	Jan 2024
Bruel & Kjaer 4231 Calibrator	2292735	Jan 2025
Bruel & Kjaer 4231 Calibrator	3029274	Oct 2024

The sound level meters (SLM) used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) as type 1 precision sound level meters, and have an accuracy suitable for both field and laboratory use.
The meters' calibrations were checked before and after the measurement periods with a Bruel & Kjaer acoustic calibrator. No significant system drift occurred over the measurement periods.

The SLMs and calibrator have been checked, adjusted and aligned to conform to the factory specifications and issued with conformance certificates by a certified NATA facility.

3.2 Measurement Procedure

Measurements were made in general accordance with procedures in:

1. Australian Standard AS 1055 : 2018 *Acoustics - Description and measurement of environmental noise*

2. The NSW Government *Noise Policy for Industry* (EPA Oct 2017)

The microphone of a B&K 2250 G4 SLM was mounted at a height of 1.2m above the ground and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was located at a location approximately 50m south of the asphalt plant to monitor noise levels while measurements were being conducted at the receiver locations. The SLM was set to record continuously for the duration of receiver monitoring with 1 second samples. The sound recording feature was utilised.

Two other B&K 2250 G4 SLMs were utilised to conduct noise monitoring at the 3 residential receiver locations. The microphone was mounted on a 1.2m – 1.5m high tripod. Markers and sound recording were utilised on the sound level meter for post event analysis of acoustic events during each monitoring period.

A 15 minute measurement was recorded at each receiver location for the evening and night time periods with A and C weighting, fast response, and 1 second samples. Spectrum data was recorded with a linear (Z) weighting in 1/3 octave bands.

The clocks on the three SLMs were synchronised to enable comparison of noise levels at the asphalt plant reference location with noise levels at the receiver locations.

3.3 Weather Conditions

Weather conditions were good for acoustic measurements. Observations were taken at each receiver location with a Kestrel 3000 pocket weather meter.

Table 3.2 Receiver Locations Weather Summary 15th September 2025

Receiver	Time	Temp	Relative Humidity	Wind	Wind Dir	Cloud Cover
		˚C	%	Speed (m/s)		
2	8:15pm	17	70	Calm		0/8
4	8:30pm	18	66	0.8	North	0/8
8	8:45am	17	65	Calm		0/8
8	10:15pm	16	90	Calm		0/8
4	10:10pm	18	63	Calm		0/8
2	10:50pm	12	85	Calm		0/8

Weather data from the weather station at Blakebrook Quarry is presented in Table 3.3 below.

Table 3.3 Blakebrook Quarry Weather Station Observations 15th September 2025							
Time	AVERAGE Air Temperature 10m (Deg C)	AVERAGE Wind Speed 10m (km/h)	AVERAGE Wind Speed 10m (m/s)	AVGDIR Wind Direction 10m (Degs)	S-THETA Wind Direction 10m – (Degs)	STDEV Wind Speed 10m (km/h)	TOTAL Rain Gauge (mm)
7:30 pm	19.1	10.1	2.8	26.5	20.3	1.1	0
7:40 pm	19	11	3.1	24.4	16.1	1	0
7:50 pm	18.8	10.8	3.0	24.7	20.2	2	0
8:00 pm	18.8	11.1	3.1	24.2	16.9	2	0
8:10 pm	18.7	10.2	2.8	27.5	14.7	1.5	0
8:20 pm	18.7	8.6	2.4	19.4	24.6	1.4	0
8:30 pm	18.6	8.4	2.3	18.2	25.1	1	0
8:40 pm	18.3	8.3	2.3	25.6	15.1	1.1	0
8:50 pm	18.2	6.8	1.9	27	16.4	0.8	0
9:00 pm	18	5.7	1.6	19.9	27.2	0.9	0
9:10 pm	17.7	4	1.1	3.2	29.4	0.7	0
9:20 pm	17.4	3	0.8	8.9	27.6	0.7	0
9:30 pm	17.2	3.8	1.1	349.6	20.8	0.8	0
9:40 pm	17.3	4	1.1	359.5	29.9	0.8	0
9:50 pm	17.3	4	1.1	4	29.6	0.8	0
10:00 pm	17.3	3.9	1.1	8.4	27.3	0.7	0
10:10 pm	17.1	2.3	0.6	13.8	35.3	1	0
10:20 pm	16.8	2.1	0.6	28.2	30.9	1	0
10:30 pm	16.7	2.2	0.6	11.6	33.6	0.3	0
10:40 pm	16.7	2.3	0.6	345.1	36.8	0.5	0
10:50 pm	16.4	1.4	0.4	348.9	28.4	0.7	0
11:00 pm	16.4	1.9	0.5	359.7	28.8	0.5	0
11:10 pm	16.4	1.9	0.5	7.5	27.3	0.8	0
11:20 pm	16.2	1.1	0.3	350.5	53.4	0.7	0
11:30 pm	16.3	2.1	0.6	312.5	37.7	0.6	0

Wind Direction O and 360 degrees – North, 90 degrees – East,

180 degrees South, 270 degrees - West

3.4 Measurement Results

Table 3.4 Receivers Measurement Summary Total 15/09/2025 (All measurements 15 mins)							
Receiver	Start Time	L_{AFmax} [dB]	L_{Aeq} [dB]	L_{Ceq} [dB]	$L_{Ceq-LAeq}$ [dB]	$L_{AF10.0}$ [dB]	$L_{AF90.0}$ [dB]
2	15/09/2025 20:05	74	46	49	3	39	36
4	15/09/2025 20:24	58	42	43	1	45	38
8	15/09/2025 20:45	47	36	53	17	39	32
8	15/09/2025 22:00	46	34	52	18	37	30
4	15/09/2025 22:08	58	40	50	10	42	38
2	15/09/2025 22:39	64	36	43	6	33	26

Note:
The above results are the total ambient noise levels and includes noise from the rural surroundings and quarry noise if audible.

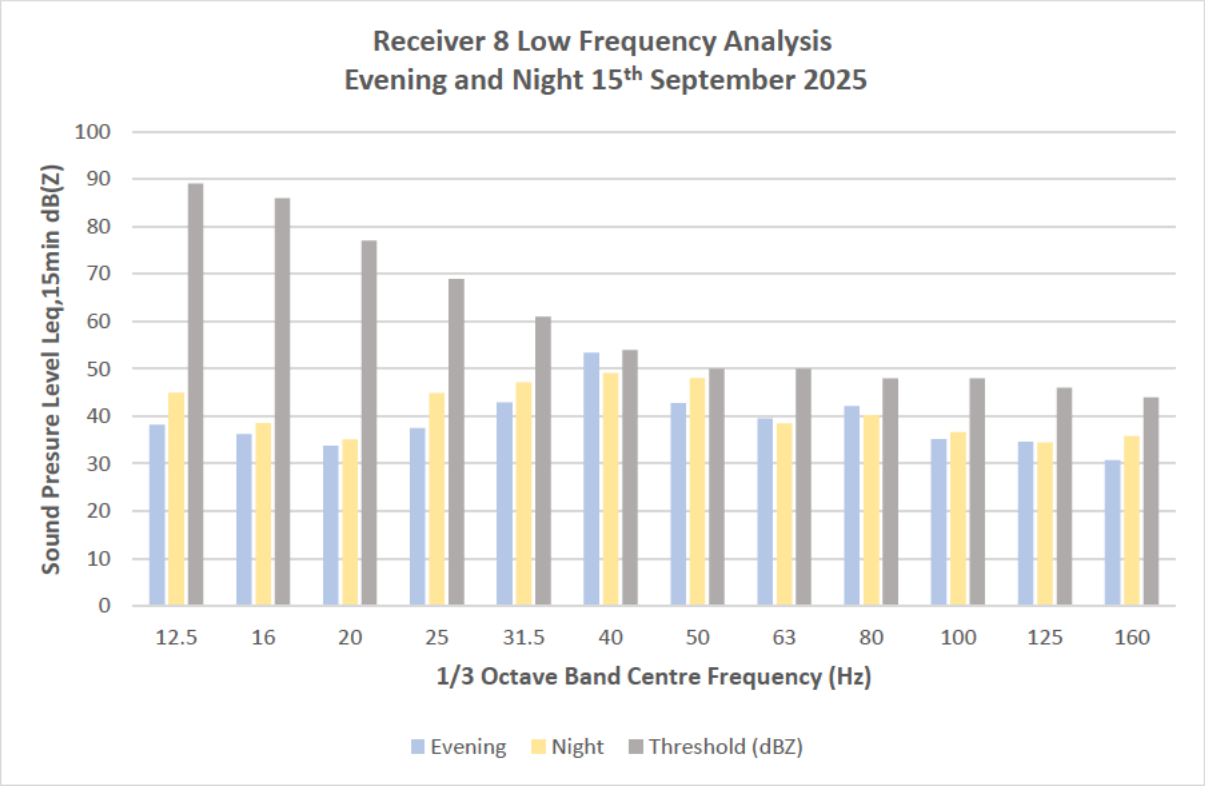
Post processing was conducted in Bruel & Kjaer BZ 5505 sound processing software to exclude other noise sources for the receiver location measurements.
The exclude function was enabled for the traffic, animal and other markers. The total – exclude data enables a more accurate assessment of the noise source under investigation, by eliminating the periods that other random noise sources occur during monitoring.

Table 3.5 Receivers Measurement Summary Total - Exclude 15/09/2025								
Receiver	**Start Time**	**Duration** h:mm:ss	L_{AFmax} [dB]	L_{Aeq} [dB]	L_{Ceq} [dB]	$L_{Ceq-LAeq}$ [dB]	$L_{AF10.0}$ [dB]	$L_{AF90.0}$ [dB]
2	15/09/2025 20:05	00:15:00	74	46	49	3	39	36
4	15/09/2025 20:25	00:14:45	49	42	43	1	44	38
8	15/09/2025 20:45	00:15:00	47	36	53	17	39	32
8	15/09/2025 22:00	00:11:33	38	32	50	17	34	30
4	15/09/2025 22:08	00:11:19	48	40	44	4	41	38
2	15/09/2025 22:39	00:15:00	64	36	43	6	33	26

Table 3.6 Noise Observations at Receiver Locations 15th September 2025 (All measurements 15 mins)			
Receiver	**Start Time**	**Observed Noise Sources**	**Asphalt Plant Noise**
2	8:05pm	Insects 1.6kHz, 5 kHz, 6.3 kHz, one vehicle on Keerrong Road, distant dog barking, occasional distant traffic Nimbin Road	Asphalt plant not audible.
4	8:24pm	Slight wind, frogs and insects in background 4kHz - 6.3kHz.	Asphalt plant not audible.
8	8:45pm	Occasional traffic on Nimbin Road	Asphalt plant audible, reversing quacker on loader audible, low frequency of loader audible at times, occasional banging of bucket on loader
8	10:00pm	Occasional traffic on Nimbin Road, helicopter near the end of measurement	Asphalt plant audible, reversing quacker on loader audible, low frequency of loader audible at times, occasional banging of bucket on loader
4	10:08pm	Frogs and insects in background, 4kHz - 6.3kHz. Dogs barking in distance. Helicopter flyover in second quarter of log. Faint rumble. Occasional traffic on Nimbin Road.	Asphalt plant just audible at times. Some noise from plant vehicles just audible at times. Indistinct low frequency rumble (31.5 Hz)
2	10:39pm	Frogs, insects 4kHz - 6.3kHz, distant dog barking, occasional distant vehicle on Nimbin Road	Asphalt plant not audible.

3.5 Low Frequency Analysis

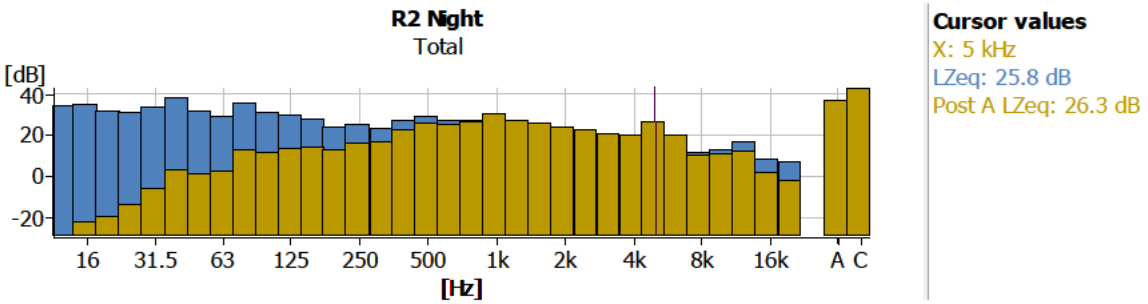
The difference between the A and C L_{eq} levels at Receiver 8 was greater than 15 decibels during both the Evening and Night-Time measurements. A further low frequency analysis step is required and presented below.



4 DISCUSSION OF RESULTS

Receiver 2

Quarry noise was not audible during the monitoring period. However, insect noise and frog noise, along with a load vehicle in the distance, increased the L_{Aeq} value higher than the expected background noise level.

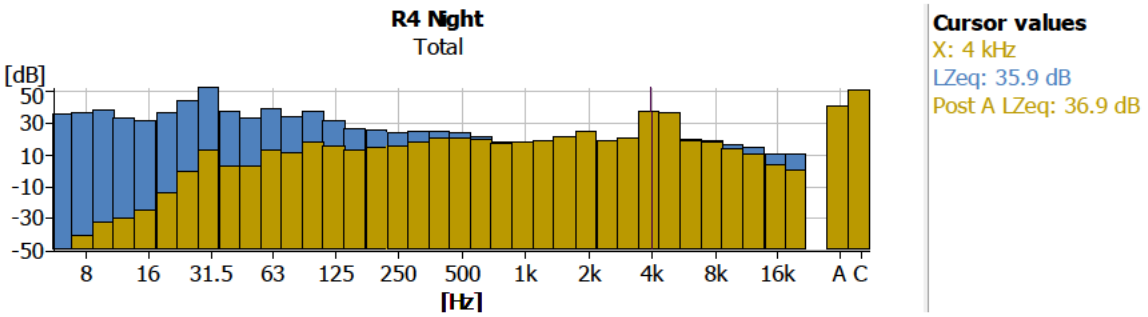


The $L_{Aeq,15\ min}$ of the asphalt plant operations is estimated to be below 30 dB(A). $L_{eq,15min}$ for calm meteorological conditions.

Receiver 4

During the evening monitoring, the asphalt plant was inaudible.

During the night-time monitoring period a constant but faint rumble was just audible (31.5 Hz) but it was not obvious what the source was. Occasionally, heavy plant vehicles were just discernible. Analysis of the spectrum data indicates consistent insect noise was the dominant noise source.



The $L_{Aeq,15\ min}$ of the asphalt plant operations is estimated to be below 30 dB(A). $L_{eq,15min}$ for calm meteorological conditions.

Receiver 8

The asphalt plant noise was audible during both monitoring periods. The front-end loader was audible at times as was the banging of the loader bucket.

There was a minor exceedance of 1 decibel over the evening and night time noise limit of 35 dB(A) $L_{Aeq,15\ min}$, for the evening monitoring period, 8:45pm – 9:00pm.

The asphalt plant noise level was 3 decibels below the evening and night noise limit for the 10:00pm – 10:15pm noise monitoring period.

Analysis of the spectrum data and listening to the recorded sound files indicates the 31.5 Hz, 1/3 octave band increased in level at times and was audible at Reciver 8 at times.

There was an increase in level in the 40 Hz, 50 Hz and 80 Hz 1/3 octave bands for part of the eveing monitoring period, however did not significantly increase the A weighted noise level. The low frequency analysis indicated no exceedance of any 1/3 octave band linear weighted threshold frequency in Table C2 of the EPA NPfI.

The logged data and sound files were investigated by the Asphalt Plant Foreman. The foreman was unable to account for the increase in the low frequency during the evening monitoring period after listening to the the sound files and examining the asphalt plant's operational logged data.

Based on analysis of the logged data of the reference noise monitor at the asphalt plant and the logged data at Receiver 8, the asphalt plant is generally 32 dB(A) $L_{Aeq,15\ min}$, for the evening and night time periods, however an unexplained event during the evening period increased the noise level to 36 dB(A) $L_{Aeq,15\ min}$, during one of the measurement periods.

Tables 4.1 and 4.2 of the EPA NPfI provide a guide to the acceptability of residual noise impacts (exceedances). An exceedance of less than 2 decibels is considered neglible and would not be discernible by the average listener.

5 SUMMARY AND CONCLUSION

A noise monitoring survey was conducted to assess compliance of the evening and night time asphalt plant operational noise levels at Blakebrook Quarry, Blakebrook, via Lismore NSW. Measurements were undertaken with calibrated noise monitoring equipment on the 15th of September 2025, and conducted in general accordance with procedures in Australian Standard AS 1055:2018 and the NSW Noise Policy for Industry.

The Blakebrook Quarry operates under the New South Wales Government Environment Protection Authority, Environmental Protection Licence, EPL No. 3384. Noise emissions from the quarry and asphalt plant operations at nearby residential receivers, is managed by the Noise and Blast Management Plan (NBMP) for Blakebrook Quarry (Lismore City Council Oct 2022), and includes an Out of Hours Work Protocol (OHWP) for the asphalt plant, which is anticipated to occur 10 nights per month on scheduled projects.

Day time (7am – 6pm) noise limits at residential receivers without a written agreement with the quarry are 36 dB(A) $L_{Aeq,15min}$ for receivers 2 and 7, and 35 dB(A) $L_{Aeq,15min}$ for all other receivers.

The evening (6pm – 10pm) and night time (10pm – 7am) noise limit is 35dB(A) $L_{Aeq,15min}$ at all receiver locations without a written agreement with the quarry.

Measurements were conducted at the 3 primary receiver locations (Receivers 2, 4, 8) while the asphalt plant was operating under normal load conditions.

The asphalt plant operations were not audible at Receiver 2. It is estimated plant operations at Receiver 2 are below 30 dB(A) $L_{Aeq,15min,}$ for calm meteorological conditions, which is below the night-time noise limit of 35 dB(A) $L_{Aeq,15min}$.

The asphalt plant operations were just audible during one of the monitoring periods at Receiver 4. Based on analysis of the low frequency spectrum data, it is estimated asphalt plant operations at Receiver 4 are below 30 dB(A) $L_{Aeq,15min,}$ for calm meteorological conditions, which is below the night-time noise limit of 35 dB(A) $L_{Aeq,15min.,}$

The asphalt operations were audible at Receiver 8. Based on analysis of the logged data of the reference noise monitor at the asphalt plant, the logged data at Receiver 8, the asphalt plant is generally 32 dB(A) $L_{Aeq,15\ min}$, for the evening and night time periods, however an unexplained event during the 15 minute evening monitoring period increased the noise level to 36 dB(A) $L_{Aeq,15\ min}$, which is 1 decibel above the night-time noise limit of 35 dB(A) $L_{Aeq,15min.}$ A one decibel exceedance is considered negligible.

[redacted]
Acoustic Consultant
Ambience Audio Services

APPENDIX A

Definitions of Terms

Sound pressure level (L_p): A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure compared to a reference pressure. Sound pressure levels are measured in decibels whereas sound pressure is measured in pascals (N/m^2).

Decibels (dB): a ratio of energy flows. When used for sound measurement, it is the ratio between a measured quantity of sound pressure and an agreed reference sound pressure. The dB scale is logarithmic and uses the threshold of hearing of 20 μPa (micro pascals) as the reference pressure. This reference level is defined as 0 dB.

Frequency (Hz): The number of pressure variations per second (cycles per second) is called the **frequency** of sound and is measured in **Hertz (Hz)**. The rumble of distant thunder has a low frequency, while a whistle has a high frequency. The normal range of hearing for a healthy young person extends from approximately 20Hz up to 20 000 Hz (20 kHz) while the range from the lowest to highest note on a piano is approximately 27.5 Hz to 4.2 kHz.

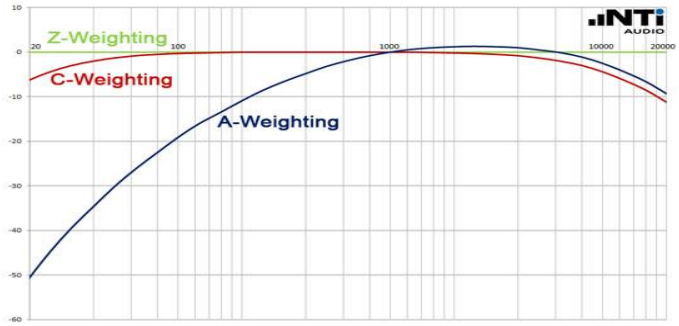
Spectral characteristics: The frequency content of noise.

Octave: a logarithmic unit for ratios between frequencies, with one octave corresponding to a doubling of frequency. For example, the frequency one octave above 40 Hz is 80 Hz.

1/3 Octave: a logarithmic unit of frequency ratio equal to one third of an octave.

"A" frequency weighting: The method of frequency weighting the electrical signal within a noise-measuring instrument to give a very approximate simulate to the human perception of loudness. The symbols for the noise parameters often include the letter "A" (e.g., L_{Aeq}, dBA) to indicate that frequency weighting has been included in the measurement. "A" weighting is most commonly used with regard to noise control issues, regulations and environmental standards.

"C" frequency weighting: The filters used in C weighting captures lower frequencies than A weighting as indicated in the chart below.



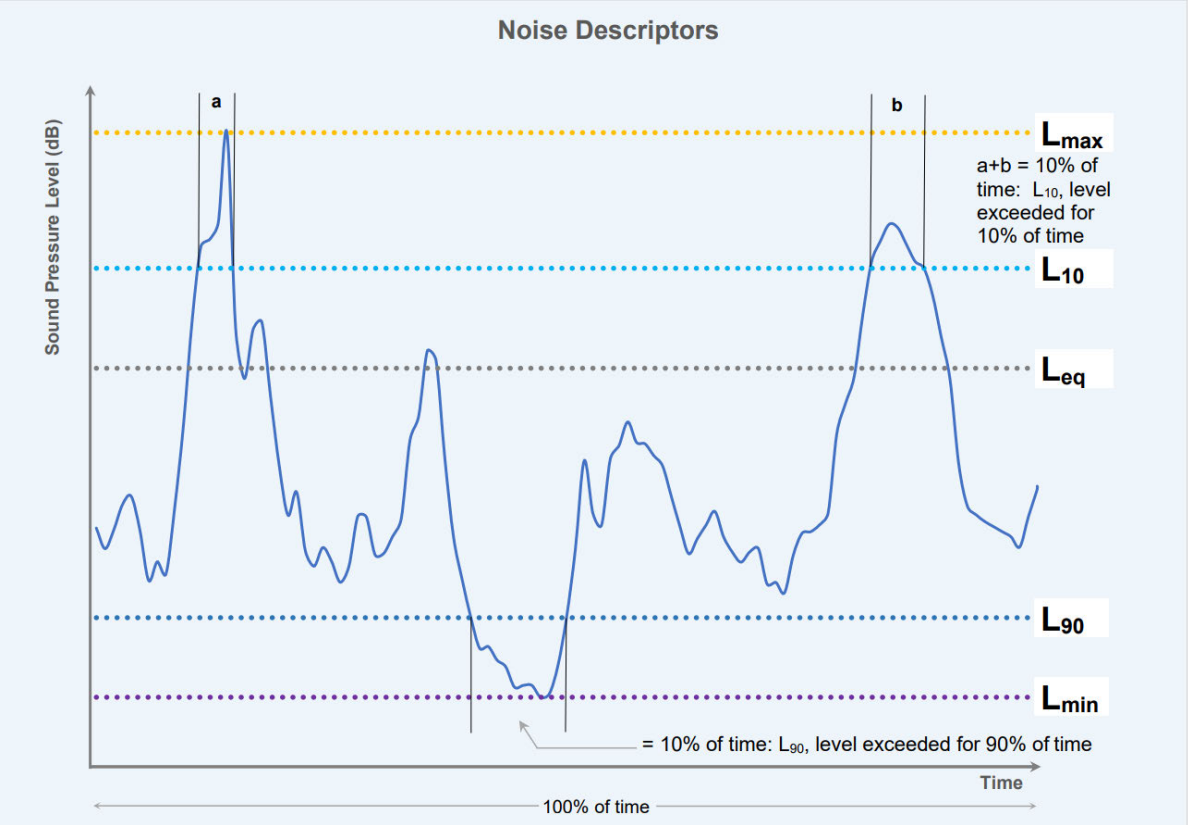
The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.

Fast, Slow and Impulse time weightings: Standardised root-mean-square (rms) averaging times to help define fluctuating noise levels. Impulsive noises have high peak levels with a very short duration (e.g., gun shot), or a sequence of such peaks. The 'Slow' time weighting averages the fluctuations over a one second time base whilst the 'Fast' time weighting averages the fluctuations over a one-eighth of a second time base. Environmental assessment standards usually specify the time weighting (**F**, **S**, or **I**) to be used.

L_{Aeq}: The A-weighted equivalent continuous noise level. A widely used noise descriptor which provides an average of the energy of a constant level of noise which is the same as the varying noise signal being measured. The time in which the measurement was sampled, is indicated with a subscripted number e.g. $L_{Aeq,15\ minute}$ is a 15-minute sample.

Percentile Levels L_N: The sound pressure level that is exceeded for N per cent of the time over which a given sound is measured. e.g. **L_{A90}** is the A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured.

L_{A90} is commonly used to describe the **background noise level** for community noise assessments.



Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Extraneous noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by events such as concerts or sporting events. Normal daily traffic is not to be considered extraneous.

Background noise: The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the $\mathbf{L_{A90}}$ descriptor, fast time weighting.

Intrusive Noise: Refers to noise that intrudes above the background level by more than 5 decibels.

Noise limits: Enforceable noise levels that appear in consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.

References:

Measuring Sound Brüel and Kjær Sound & Vibration Measurements A/S September 1984

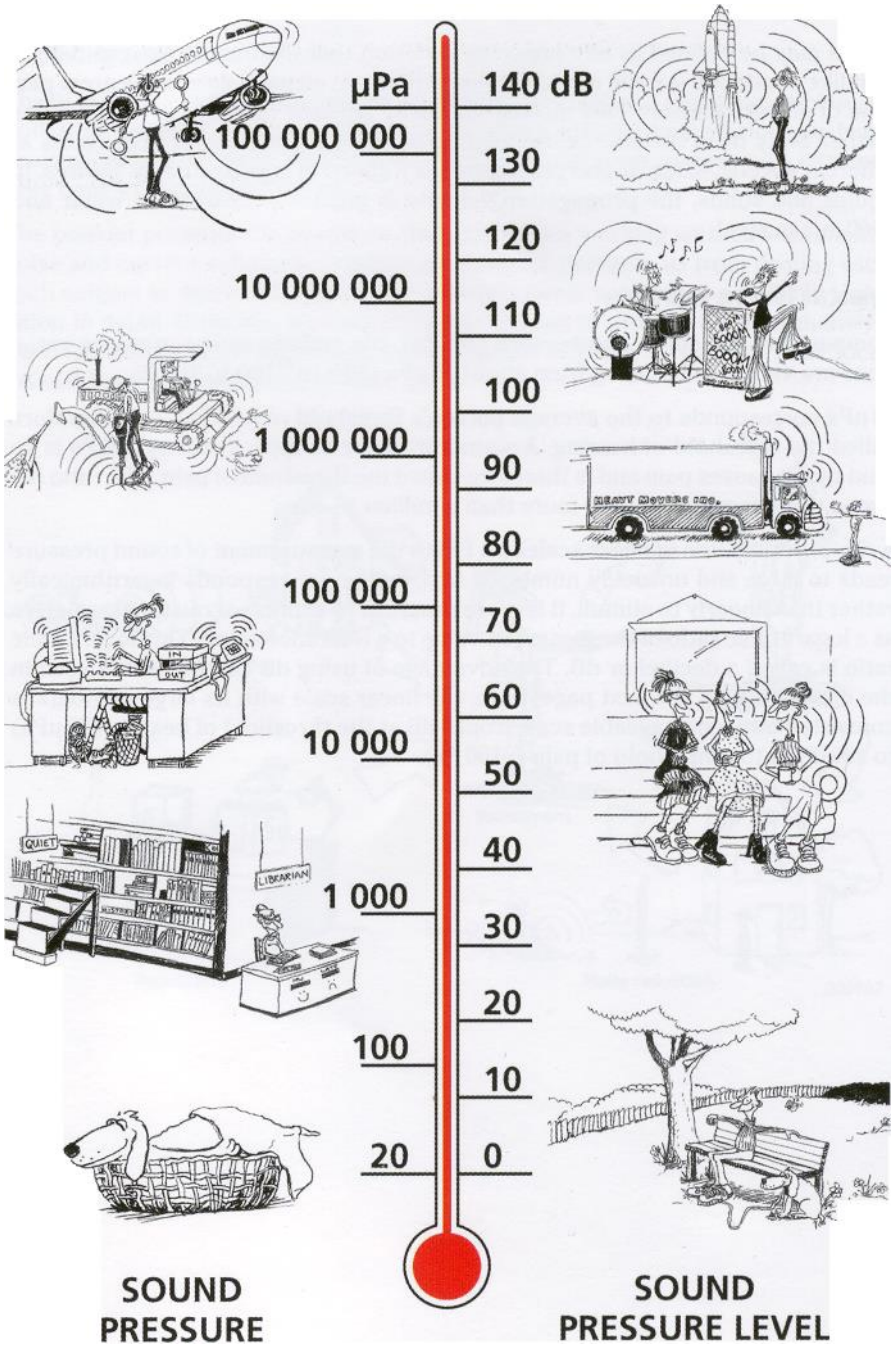
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

New South Wales Industrial Noise Policy NSW Environment Protection Authority January 2000

https://www.nti-audio.com/en/support/know-how/frequency-weightings-for-sound-level-measurements

APPENDIX B

Comparison of Sound Pressure Levels

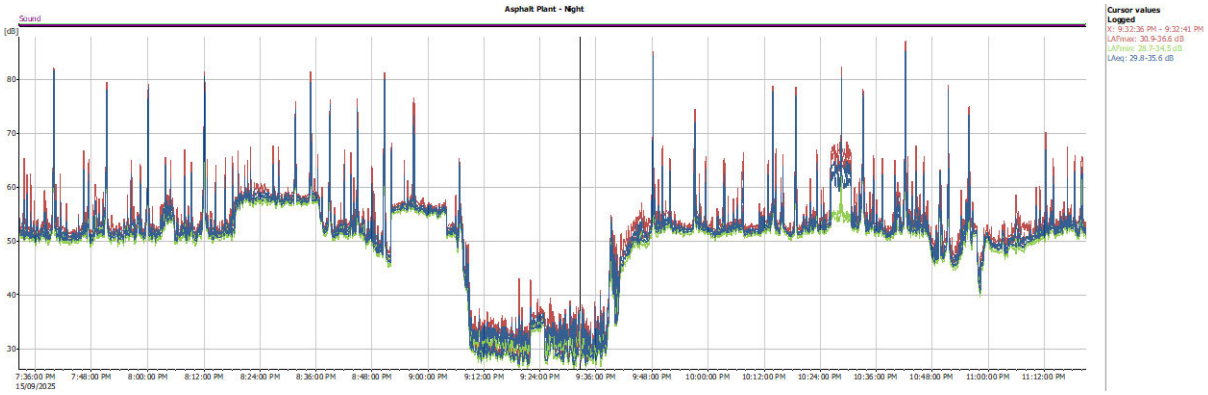


Our hearing covers a wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable.
Reproduced from:
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

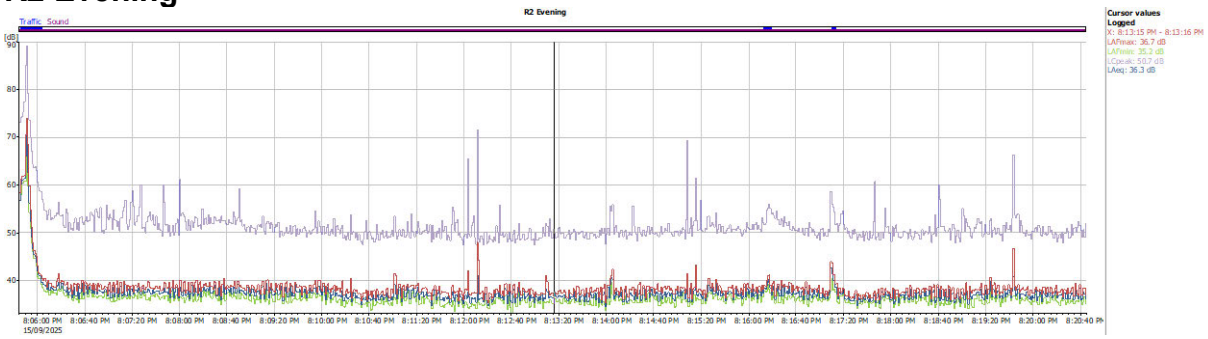
APPENDIX C

L_{AFmax} Logged Noise Level Graphs 15th September 2025

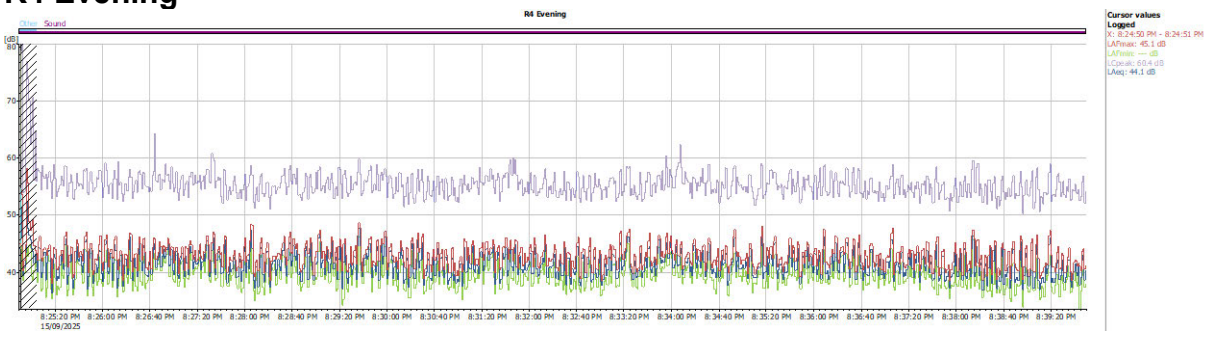
Graph C1
Asphalt Plant reference monitor



Graph C2
R2 Evening

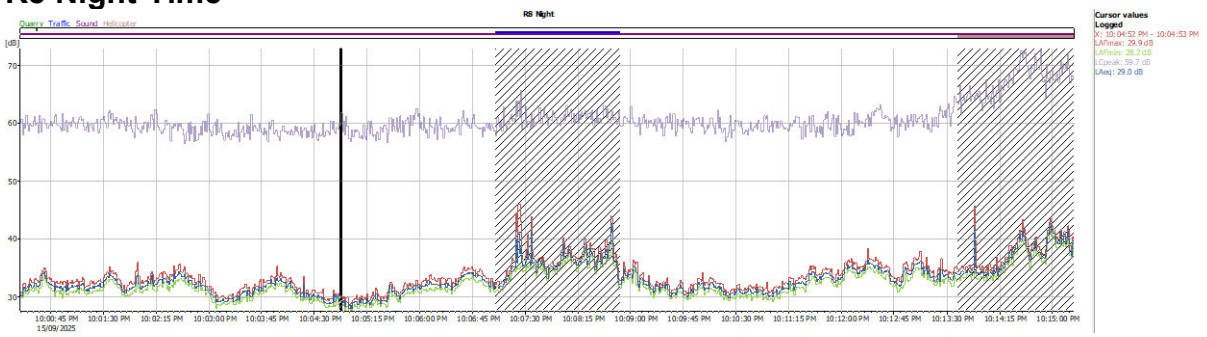


Graph C3
R4 Evening

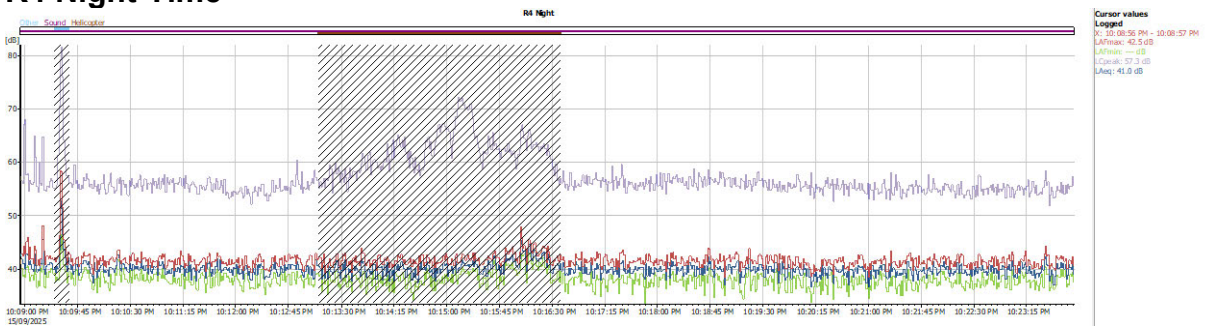


Graph C4
R8 Evening

Graph C5
R8 Night-Time



Graph C6
R4 Night-Time



Graph C7
R2 Night-Time