

Ambience Audio Services

Acoustic Measurement and Analysis

15 Tamarind Close
Richmond Hill NSW 2480

Phone: 02 6625 1733
Mobile: 0429 405 070

Results of Noise Monitoring

**Blakebrook Quarry
550 Nimbin Road
Blakebrook NSW 2480**

Prepared for

**Ecoteam
13 Ewing Street
Lismore NSW 2480**

Prepared by
Garry Hall
December 4th 2020

Table of Contents

1	INTRODUCTION	3
2	NOISE MONITORING REQUIREMENTS	3
3	MEASUREMENT PROCEDURE AND RESULTS	8
3.1	Instrumentation	8
3.2	Measurement Procedures.....	8
3.3	Weather Conditions	9
3.3	Measurement Results	10
4	DISCUSSION OF RESULTS.....	12
5	SUMMARY	13
APPENDIX A	14
	Definitions of Terms	14
APPENDIX B	17
	Comparison of Sound Pressure Levels.....	17
APPENDIX C	18
	Quarry Operations 1 st Dec 2020	18

1 INTRODUCTION

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

Noise monitoring was conducted on the 1st of December 2020 with the quarry operating and suitable weather conditions.

Quarry operations while noise monitoring was conducted included: crushing, screening and stockpiling on the southern side of the quarry floor, asphalt production at the mobile plant at the top of the quarry, and trucks and loader on the quarry floor and internal haul roads. A diagram of equipment operating on the quarry floor during noise monitoring at residential receivers is provided in Appendix C.

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.

2 NOISE MONITORING REQUIREMENTS

The noise monitoring requirements for the Blakebrook Quarry are outlined in Section 2.2, Sections 7.1, 7.2, 7.4, 7.5 and 7.7 of the Noise and Blast Management Plan Revision 3.1 (Aug 2018) prepared by Environmental Resources Management Australia Pty Ltd (ERM).

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	36
All other locations	35

Noise generated by the project is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy. Appendix 5 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, the noise criteria in Table 2 do not apply if the Proponent has an agreement with the relevant landowner to exceed the noise criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

L6.1 Noise from the premises must not exceed:

(a) 35dB(A) L_{Aeq}(15 minute) during the day (7am to 6pm) Monday to Saturday;

Where L_{Aeq} means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

7.1 *MONITORING OBJECTIVES*

The noise measurement procedures employed throughout the monitoring program shall be guided by the requirements of AS 1055-1997 "Acoustics - Description and Measurement of Environmental Noise" and the NSW EPA Noise Policy for Industry (EPA, 2017).

7.2 *MONITORING LOCATIONS*

The Noise Assessment (ERM, 2009) included seven 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 this NBMP.

Primary and supplementary acoustic monitoring locations are identified in *Figure 1.3*. Primary acoustic monitoring locations consist of **locations 2, 4 and 8**, with the remainder consisting of 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 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.

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

7.4 *METHODOLOGY*

Noise

Operator attended noise measurements shall be conducted at all primary acoustic measurement locations (Locations 2, 4 and 9 - refer *Figure 1.3*) to quantify and characterise the maximum (LA_{max}), the energy equivalent (LA_{eq}), and background (LA₉₀) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the LA_{eq} (Period) noise contribution during day time activities from each of the quarrying operations, 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 1259.2-1990, "Sound Level Meters".

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ± 0.5 dBA.

Adverse meteorological conditions have the potential to increase noise levels, for example wind speeds up to 3m/s or temperature inversions, however wind speeds above 5m/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 will be collected from the rain gauge located on-site. All other weather data for the monitoring period will be purchased from the Bureau of Meteorology (BoM) website for the Lismore Observation Station, which is programmed to continuously record the meteorological parameters as shown in *Table 7.1*.

Table 7.1 *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

Modifying Factor Corrections

Factor	Assessment and Measurement	When to Apply	Correction	Comment
Tonal Noise	One-third octave or narrow band analysis.	<p>Level of one-third octave band exceeds the level of the adjacent bands on both sides by:</p> <ul style="list-style-type: none"> 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz. 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive. 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz. 	5 dB	Narrow-band frequency analysis may be required to precisely detect occurrence.
Low Frequency Noise	Measurement of C-weighted and A-weighted level.	Measure/assess C and A weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more.	5 dB	C-weighting is designed to be more responsive to low-frequency noise.

Section 7.4 (Methodology – Noise) in the ERM NBMP v3.1 indicates noise monitoring to be conducted at receiver locations 2, 4 and 9, and refers to figure F1.3. Monitoring was conducted at receiver location 8 instead of Receiver 9 as F1.3 identifies Receiver 8 as the primary receiver and receiver 9 as a supplementary receiver.

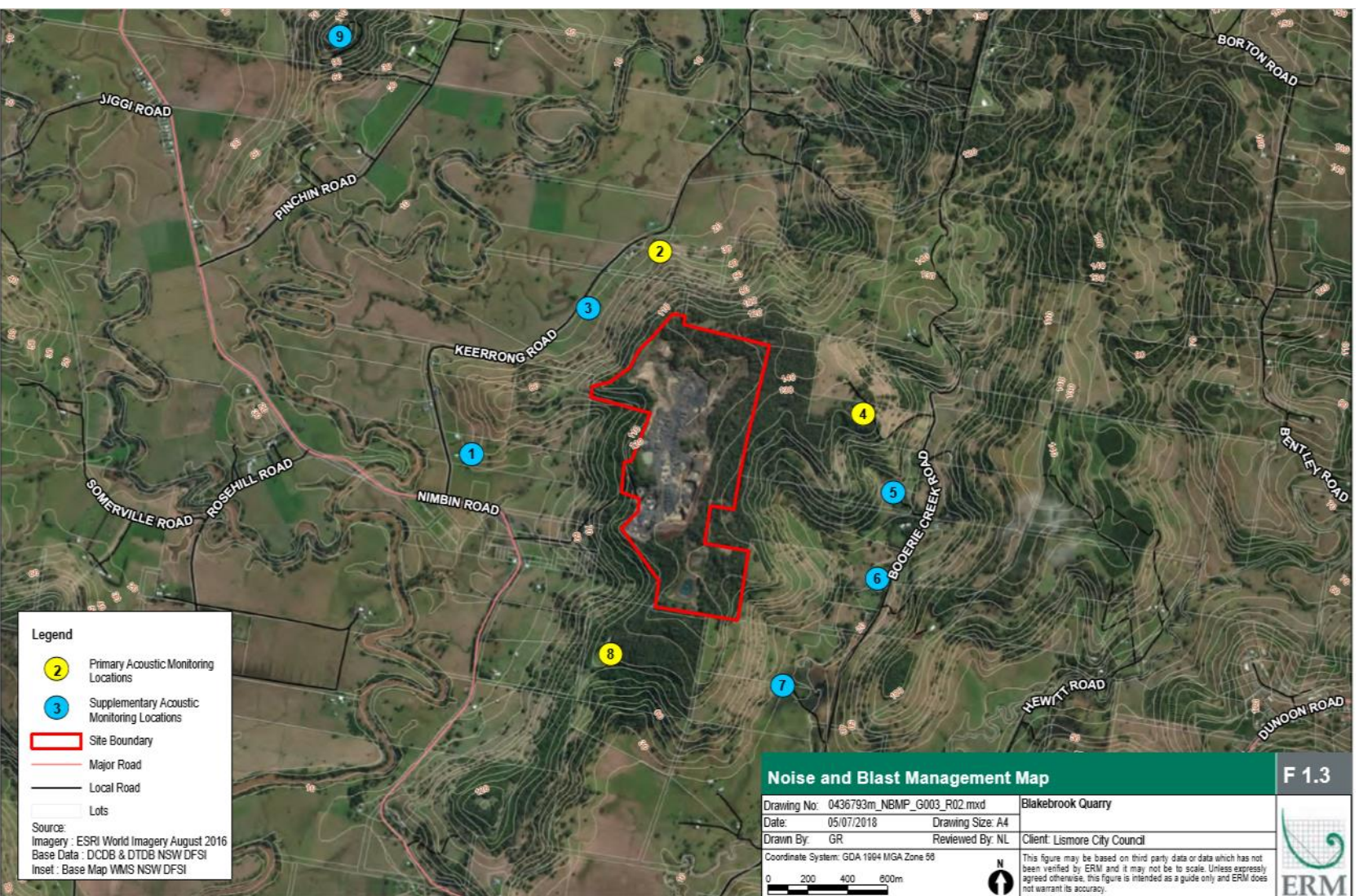
Noise monitoring at locations 2 and 4 were conducted within 30m of the residential dwelling in the direction of the quarry.

Noise monitoring at Receiver 8 was conducted approximately 40m from the residential dwelling in the direction of the quarry due to a horse in the paddock near the dwelling.

Table 2.1 Primary Receiver Noise Monitoring Locations

Primary Receiver Locations	
Receiver	Street Address
2	[REDACTED]
4	[REDACTED]
8	[REDACTED]

Figure 2.1 Noise Monitoring Locations NBMP v3.1



3 MEASUREMENT PROCEDURE AND RESULTS

3.1 Instrumentation

Table 3.1 Instrumentation for Noise Monitoring

Instrument	Serial #	Calibration Date
Brüel and Kjær 2250L Sound Level Meter	3006868	July 2019
Brüel and Kjær 2250 Sound Level Meter	3028735	January 2020
SVAN SV30 Acoustic Calibrator	3849	September 2020

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 SVAN SV30 acoustic calibrator. No significant system drift occurred over the measurement periods.

The SLMs and calibrators 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 Procedures

Measurements were made in general accordance with procedures laid down 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 2250L SLM was mounted on a 1.5m high tripod and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was located above the cliff face where the working equipment was operating, 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. A sound recording was conducted simultaneously.

The microphone of a B&K 2250 SLM was mounted on a 1.5m high tripod and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was used at the various receiver locations to monitor noise levels while the quarry was operating.

A 15 minute period was recorded at each receiver location with 1 second samples with a simultaneous sound recording.

3.3 Weather Conditions

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

Table 3.2 Observed Weather Conditions at Receiver Locations

Receivers Weather Summary 01/12/2020						
Time	Receiver	Temp	Relative Humidity	Wind	Wind Dir	Cloud Cover
		°C	%	Speed (m/s)		
10:15am	4	27	61	0 - 0.15	N	6/8
11:40am	8	29	56	0 - 1.0	N	7/8
12:20pm	2	32	58	0 - 1.0	NE	2/8

Data from the local weather station near the weighbridge at Blakebrook Quarry is presented in Table 3.3.

Table 3.3 Blakebrook Quarry Local Weather Station

Blakebrook Quarry Local Weather Station 01/12/2020					
Time	Temp °C	Relative Humidity %	Wind		
			Dir.	Speed	
				(km/h)	(m/s)
09:00am	24.2	80	ENE	0	0.0
09:30am	25.6	75	ESE	0	0.0
10:00am	27.2	71	NE	0	0.0
10:30am	28.2	66	NE	0	0.0
11:00am	28.3	66	ENE	1.6	0.4
11:30am	30.4	58	ESE	1.6	0.4
12:00pm	30.6	60	WNW	1.6	0.4
12:30pm	31.7	54	W	1.6	0.4
1:00pm	33.9	50	W	1.6	0.4

The meteorological data for Lismore Airport (approximately 7kms to the south) for the monitoring period was downloaded from the Bureau of Meteorology website and is provided in Table 3.4.

Table 3.4 Weather Observations at Lismore Airport

Lismore Airport Weather 01/12/2020					
Time	Temp °C	Relative Humidity %	Wind		
			Dir.	Speed	
				(km/h)	(m/s)
09:00am	24.1	69	S	7	1.9
09:30am	24.8	66	N	6	1.7
10:00am	25.6	62	N	9	2.5
10:30am	26.3	61	NW	6	1.7
11:00am	27.8	56	NNW	6	1.7
11:30am	28.6	56	NNE	9	2.5
12:00pm	28.5	53	NNE	13	3.6
12:30pm	29.7	48	E	9	2.5
1:00pm	31.0	51	ENE	7	1.9

3.3 Measurement Results

Table 3.5 Measurement Results

Measurement Summary 01/12/2020							
Measurement	Start Time	Elapsed Time (h:mm:ss)	L _{AFmax} [dB]	L _{Zeq} [dB]	L _{Aeq} [dB]	L _{AF10} [dB]	L _{AF90} [dB]
Receiver 4	10:17:36	0:15:00	82.2	60.2	44.7	29.2	24.8
Receiver 8	11:42:51	0:15:00	70.5	52.0	44.4	43.8	36.2
Receiver 2	12:20:33	0:15:00	65.3	63.6	45.3	45.7	29.8
Top of Quarry	9:42:37	3:14:09	85.7	79.7	69.1	71.5	66.0

Note:

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

Table 3.6 Noise Observations at Receiver Locations

Noise Observations at Receiver Locations (All measurements 15 mins)			
Receiver	Start Time	Observed Noise Sources	Quarry Noise
4	10:17	Generally, very quiet background noise. Occasional birds, occasional insects, occasional frogs, distant aircraft	Quarry not audible
8	11:42	Birds, wind in trees, distant traffic on Nimbin Rd, nearby horse, occasional dog barking, insects	Generally, quarry not audible. Low frequency of loader just audible at times.
2	12:20	Birds, insects, occasional wind in trees, occasional local traffic on Keerrong Rd, distant cattle, occasional insects, distant aircraft	Quarry not audible

4 DISCUSSION OF RESULTS

The measurements were undertaken while the quarry was operating. It was noted that there was less crushing equipment operating compared to last year and no rock hammers. The quarry management indicated that there was less material to crush and were waiting for a blast in a few weeks to obtain more material for crushing. The noise logger above the quarry indicated that there was consistent quarry noise during the measurement periods at receiver locations.

Receiver 2 - quarry noise was not audible. The $L_{A90,15\text{min}}$ was 29.8 dB(A). The $L_{Aeq,15\text{min}}$ of the quarry operations is estimated to be below 30 dB(A).

Receiver 4 - quarry noise was not audible. The background was very quiet at this location. The $L_{A90,15\text{min}}$ was 24.8 dB(A). The $L_{Aeq,15\text{min}}$ of the quarry operations is estimated to be below 25 dB(A).

The resident noted at times the quarry was audible and mainly dependent on the wind. There was an object dropped near the sound level meter which increased the L_{Aeq} .

Receiver 8 - quarry noise was barely audible. The $L_{A90,15\text{min}}$ was 36.2 dB(A) and mainly attributed to distant traffic on Nimbin Road and wind in trees. Low frequency from the loader was just audible occasionally. The measurement was undertaken in a downwind condition from the quarry operations and represents a worst-case for this particular day. The $L_{Aeq,15\text{min}}$ of the quarry operations is estimated to be below 35 dB(A).

The resident noted that the quarry was audible at times depending on wind conditions and the equipment being used.

No tonal or low frequency noise characteristics were observed at the receiver locations.

5 SUMMARY

A noise monitoring survey was conducted to assess compliance of quarry operational noise levels at Blakebrook Quarry, Blakebrook, via Lismore NSW. Measurements were undertaken with calibrated noise monitoring equipment on the 1st of December 2020 and conducted in general accordance with procedures laid down in Australian Standard AS 1055:2018 and the NSW Noise Policy for Industry.

The Blakebrook Quarry operates under EPL No. 3384. Condition L6.1 stipulates that noise from the premises must not exceed 35dB(A) $L_{Aeq,15min}$ during the day (7am to 6pm) Monday to Saturday at residential receiver locations. The current Noise and Blast Management Plan v3.1 (Aug 2018) allows a limit of 36dB(A) $L_{Aeq,15min}$ at Receiver 2.

Measurements were conducted at the 3 primary receiver locations while the quarry was operating. The quarry operations were not audible at receiver locations 2 and 4, and occasional low frequency was observed at Receiver 8.

The quarry operational noise levels ($L_{Aeq,15min}$) were not able to be accurately assessed at residential receiver monitoring locations, as the quarry noise was not audible, or barely audible against other noise sources such as distant traffic, insects, birds or moving foliage.

It is estimated from the recorded $L_{A90,15min}$ levels and observations, that the quarry noise levels are below the Project Specific Noise Level of 35 dB(A) $L_{eq,15min}$ at receiver locations 4 and 8, and below the Project Specific Noise Level of 36 dB(A) $L_{eq,15min}$ at receiver location 2.

The current crushing, screening, rock hammering and stock piling operations are on the main pit floor, which provides a substantial noise barrier to receivers. If crushing, screening, rock hammering and stock piling operations change to a higher ground level, then there is potential for increased noise impact at receivers and it is recommended that noise monitoring be conducted at residential receivers.

Receiver 8 is close to the southern cell. It is recommended that noise monitoring be conducted at Receiver 8 when work in the southern cell is undertaken, to assess the noise impact at Receiver 8.

Garry Hall



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.

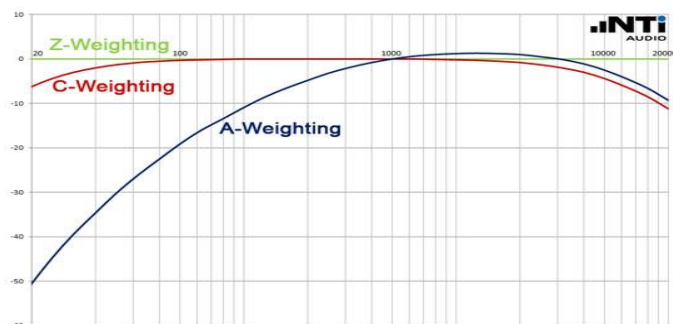
Spectral characteristics: The frequency content of noise.

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.



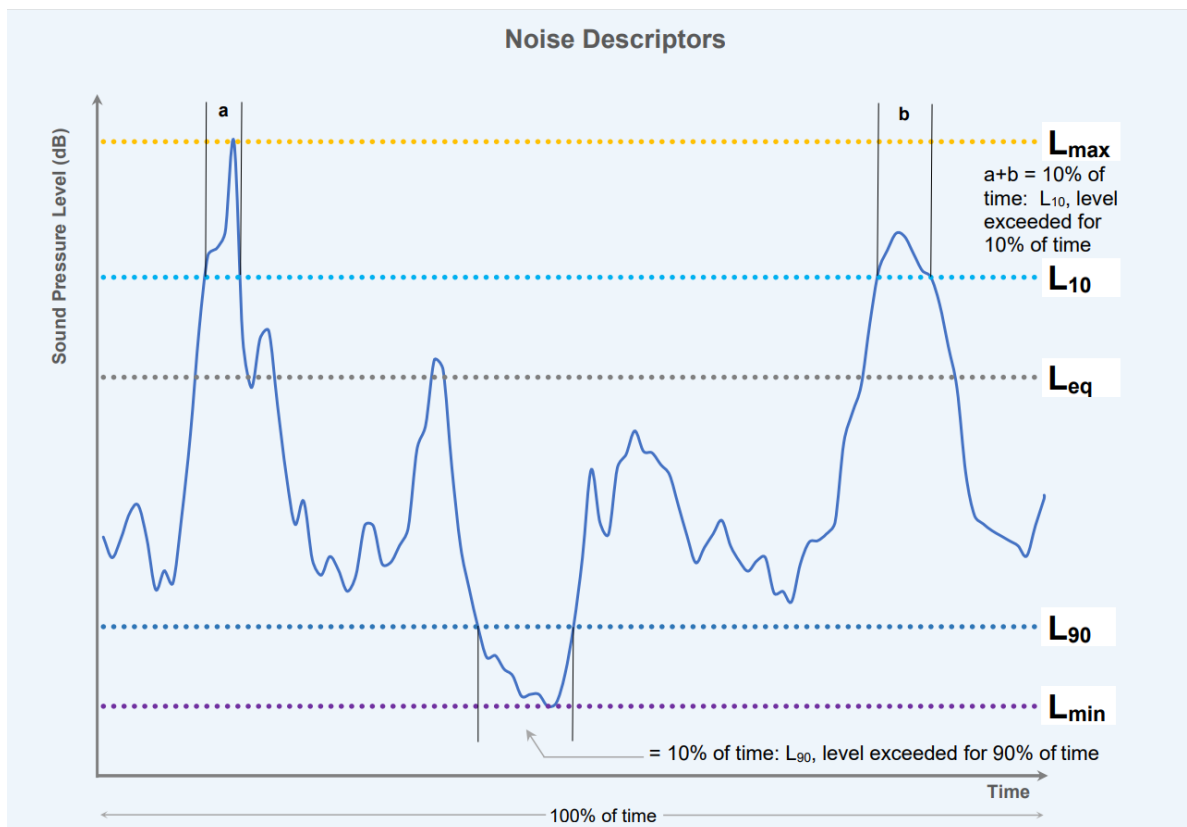
The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.

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 **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:

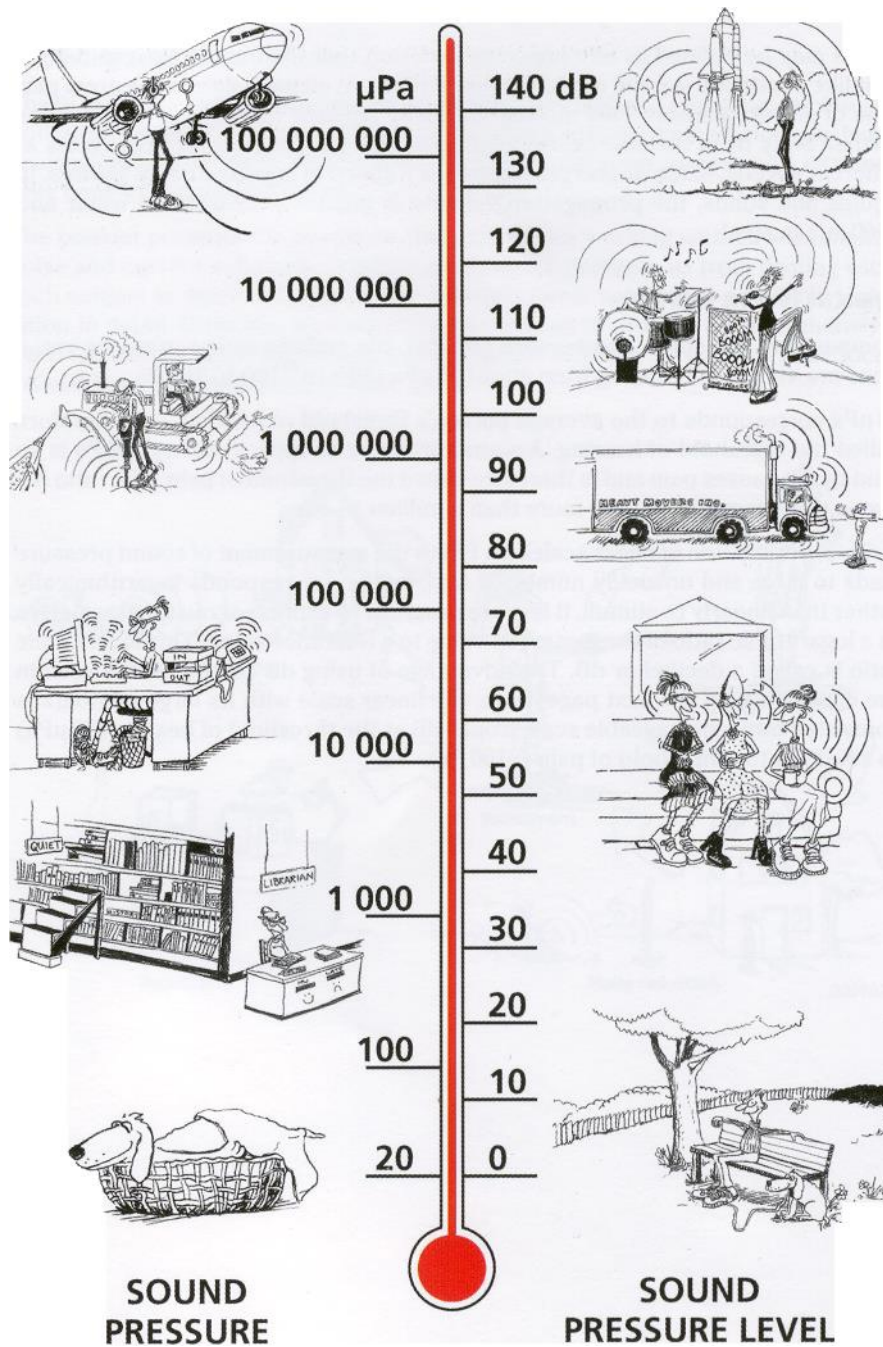
Measuring Sound Brüel and Kjær Sound & Vibration Measurements A/S
September 1984

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
Quarry Operations 1st Dec 2020



Source – Google Earth – Image Date 13/02/2019
Note : Aerial photo not of operations on 1st Dec 2020

Quarry Pit Floor Operations 1st December 2020



Equipment in use during noise monitoring

- 1 XR400 Pegson jaw crusher
- 1 MAXTRACK cone crusher
- 1 2100 power screen
- 1 Cat 329D excavator
- 1 front end loader
- 1 water truck
- various haul trucks
- various service vehicles

The mobile asphalt plant was also operating at times