2016 NOISE COMPLIANCE ASSESSMENT
PREPARED FOR
HY-TEC CONCRETE AND AGGREGATES
TINDA CREEK QUARRY

Prepared for: Daniel Reed, Strategy and Business Development Analyst
Darryl Thiedeke, National Planning and Development Manager

Prepared by: Daniele Albanese, Senior Acoustic Consultant

Report No: 161099_Noise_Rev2
August 2016
(Released: 1 August 2016)

Benbow
ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

Head Office: 13 Daking Street North Parramatta NSW 2151 AUSTRALIA
Tel: 61 2 9890 5099 Fax: 61 2 9890 5399
Email: admin@benbowenviro.com.au
Visit our website: www.benbowenviro.com.au

DOCUMENT CONTROL

Prepared by:	Position:	Signature:	Date:
Daniele Albanese	Senior Acoustic Consultant		01 August 2016

Reviewed by:	Position:	Signature:	Date:
Peter Gangemi	Acoustic Engineer		01 August 2016

Approved by:	Position:	Signature:	Date:
R T Benbow	Principal Consultant		01 August 2016

DOCUMENT REVISION RECORD

Revision	Date	Description	Checked	Approved
1	20-07-2016	Draft / Rev 1	P Gangemi	R T Benbow
2	01-08-2016	Rev 2	P Gangemi	R T Benbow

DOCUMENT DISTRIBUTION

Revision	Issue Date	Issued To	Issued By
1	20-07-2016	Hy-Tec Concrete and Aggregates	Benbow Environmental
2	01-08-2016	Hy-Tec Concrete and Aggregates	Benbow Environmental

Benbow ENVIRONMENTAL

Head Office:
13 Daking Street North Parramatta NSW 2151 Australia
P.O. Box 687 Parramatta NSW 2124 Australia
Telephone: +61 2 9890 5099 Facsimile: +61 2 9890 5399
E-mail: admin@benbowenviro.com.au
Visit our Website at www.benbowenviro.com.au

EXECUTIVE SUMMARY

Benbow Environmental undertook a Noise Compliance Assessment for the Hy-Tec Concrete and Aggregates Tinda Creek Quarry located at 6102 Putty Road, Mellong NSW.

The noise emissions from the subject site has been assessed in order to determine the status of compliance with the noise requirements stipulated in Environment Protection Licence No. 12007.

This investigation included both unattended and attended noise monitoring and all measurements were undertaken in accordance with AS 1055.1–1997 *Acoustics – "Description and Measurement of Environmental Noise"* and the requirements of the NSW Industrial Noise Policy (EPA, 2000).

Noise monitoring has been undertaken at one residential location in accordance with the site's Noise Management Plan (ref. 1731/R31/FINAL) prepared in October 2015.

Compliance with noise criteria was achieved at the monitoring location. Noise levels associated with the Tinda Creek Quarry operations were found to be well below the noise limits stipulated in EPL No. 12007.

Contents

Tables

Figures

Attachments

1. INTRODUCTION

Benbow Environmental (BE) was commissioned to undertake a noise compliance assessment for the Tinda Creek Quarry located at 6102 Putty Road, Mellong NSW.

This noise compliance assessment report presents the findings of a detailed noise study carried out to determine the status of compliance against the NSW EPA set noise limits as stipulated in the site's Environment Protection Licence (reference No. 12007).

Both long-term unattended and short-term attended noise monitoring were undertaken at one residential location in the vicinity of the site, in accordance with the site's Noise Management Plan (ref. 1731/R31/FINAL) prepared in October 2015.

1.1 SCOPE OF WORKS

The scope of the study was limited to the following:

- Undertake unattended noise monitoring utilizing environmental noise loggers at one residential location;
- Undertake attended noise monitoring utilizing a sound level meter at one residential location;
- Measure noise emissions associated with the Tinda Creek Quarry operations during at least a 24 hour period in order to assess compliance with relevant acoustic criteria;
- Outline the status of compliance against the NSW EPA set noise limits stipulated in the site's Environment Protection Licence (reference No. 12007);
- Outline further general noise control options and recommendations, where required; and
- Provide a report detailing the above findings.

A glossary of the terminology utilised throughout this report has been included in Attachment 1.

2. NSW EPA ENVIRONMENT PROTECTION LICENCE

The noise emissions from the existing on-site operations are required to satisfy specific NSW EPA requirements, as outlined in the site's Environment Protection Licence (Licence No. 12007 18-Dec-2015).

The following conditions apply:

L3 Noise limits

L3.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
All hours	$L_{Aeq(15\ minute)}$	-	35
Night	L_{max} or $L_{A1,1min}$	-	45

L3.2 For the purposes of the table under Condition L3.1 "Night" has the same meaning as in the NSW Industrial Noise Policy (EPA, 2000).

L4 Hours of operation

L4.1 Unless permitted by another condition of this licence, activities at the premises must:
a) only be undertaken between 7:00 am and 6:00 pm Monday to Friday;
b) only be undertaken between 7:00 am and 3:00 pm Saturday; and
c) not be undertaken on Sundays or public holidays.

L4.2 In addition to the limitations imposed by Condition L4.1, construction activities must not be undertaken:
a) between 7:00 am and 8:00 am Saturdays; and
b) between 1:00 pm and 3:00 pm Saturdays.

L4.3 In addition to the hours of operation specified in Condition L4.1, dispatch activities may be undertaken:
a) between 5:00 am and 10:00 pm Monday to Friday; and
b) between 6:00 am and 3:00 pm Saturdays.

L4.4 Maintenance activities may be undertaken at any time if those activities are inaudible at all residential premises.

M5 Noise monitoring

M5.1 To assess compliance with the noise limits specified within this licence, the licensee must undertake operator attended noise monitoring at each specified noise monitoring point in accordance with the table below.

Assessment period	Minimum frequency in a reporting period	Minimum duration within assessment period	Minimum number of assessment period
All hours when in use	Yearly	1 hour	1 operation day

M5.2 The licensee must undertake noise monitoring as directed by an authorised officer of the EPA.

M5.3 All noise monitoring required by this licence must be undertaken in accordance with Australian Standard AS 2659.1–1988: *Guide to the use of sound measuring equipment–Portable sound level meters*, or any revisions of that standard that may be made by Standards Australia, and the compliance monitoring guidance provided in the NSW Industrial Noise Policy.

Other reporting conditions
Noise monitoring results

R4.1 a) The licensee must submit the results of any noise monitoring undertaken in accordance with the requirements of Condition M5.1 or Condition M5.2 to the EPA within three weeks of the noise monitoring being undertaken.
b) The noise monitoring results submitted to the EPA must include:

(i) a map of each noise monitoring location in relation to the noise source, including relevant distances;
(ii) an analysis of the noise monitoring results;
(iii) any detected exceedance of the noise limits specified in Condition L4.1;
(iv) details of any remedial action taken or proposed to be taken in relation to any exceedance of the noise limits specified in Condition L4.1;
(v) details of the prevailing meteorological conditions during the period when the noise monitoring was undertaken; and
(vi) confirmation that noise monitoring was/was not undertaken in accordance with Condition M5.3.

Regarding condition M5.3, it should be noted that the Australian Standard AS 2659.1 *Guide to the use of sound measuring equipment–Portable sound level meters* referenced in the EPL was withdrawn in 2006. Australian Standard AS 1055.1–1997 *Acoustics – Description and Measurement of Environmental Noise* has been referenced instead.

3. NOISE MONITORING LOCATIONS AND METHODOLOGY

A brief outline of the methodology applied to the measurement of existing noise levels has been detailed below. Unattended noise monitoring was conducted between 14th July 2016 and 18th July 2016. Attended noise measurements were conducted on 14th July 2016 and 18th July 2016 during placement and retrieval of the noise logger.

3.1 INSTRUMENTATION AND METHODOLOGY

The attended noise measurements were carried out using a SVANTEK SVAN957 Type 1 Precision Sound Level Meter. Unattended noise monitoring was undertaken by using one ARL Ngara environmental noise logger. The instrument set was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument set complies with AS IEC 61672.1–2004.

To ensure accuracy and reliability in the results, field reference checks were applied both before and after the measurement period with an acoustic calibrator Bruel & Kjaer 4230. There were no excessive variances observed in the reference signal between the pre-measurement and post-measurement calibration. The instruments were set on A-weighted, Fast Response. QA/QC procedures applied for the measurement and analysis of noise levels have been presented in Attachment 2. The microphones were fitted with windsocks and were positioned between 1.2 and 1.5 meters above ground level. Calibration certificates have been included in Attachment 3

The operator attended noise monitoring was undertaken over 15-minute statistical intervals during what was considered to be normal site operating conditions.

Unattended noise monitoring data was filtered excluding the data recorded during the presence of adverse weather conditions, in accordance with the NSW EPA Industrial Noise Policy. Audio data was recorded by the long-term environmental noise logger with a sampling rate of 48 kHz in order to obtain a 1/3 octave band centre frequency spectral data. This methodology allows us to determine the presence of extraneous noise on the unattended noise monitoring results.

All measurements were carried out in accordance with AS 1055.1–1997 *Acoustics–Description and Measurement of Environmental Noise*. Details of the instrumentation utilised are provided in Table 3-1.

Table 3-1: Instrumentation and Setup Details

Equipment	Serial Number	Setup Details
Svantek SVAN957 Type 1 Integrating Sound and Vibration analyser	15336	A-weighted Fast Response C-weighted Fast Response A-weighted Impulse Response 15 minute integration period 1/3 octave band recorded every 100ms Logger file Recorded at steps of 100ms
ARL Environmental Noise Logger Ngara	8780ac	A-weighted Fast Response C-weighted Fast Response Audio recording WAV at 48kHz Sampling rate

3.2 NOISE MONITORING LOCATIONS

The noise monitoring location used in the current noise investigation was selected in accordance with the Noise Management Plan requirements. A description of the location and the type of monitoring undertaken is presented Table 3-2. A photograph of the monitoring location is shown in Figure 3-1.

An aerial photograph of the site, surrounding receivers and the monitoring location R1 is shown in Figure 3-2, extracted from the Umwelt Noise Management Plan report.

Table 3-2: Noise Monitoring Locations

Location ID - Name	Address	Description
R1	6255 Putty Road, Mellong	The residential dwelling is located approximately 260 metres from the monitoring location. Measurements were undertaken at the gate of the residence

Figure 3-1: Monitoring Location Photograph

Figure 3-2: Aerial View of the Site and Compliance Monitoring Location

4. NOISE MONITORING RESULTS

This section presents the results of the detailed noise monitoring program. Relevant observations are also presented in this section.

Observed noise levels were generally consistent with the values recorded by the environmental noise loggers.

Several noise sources were identified during the measurements. Thus, during the attended monitoring period, the site-related noise levels have been observed and reported for this assessment.

Unattended noise monitoring data was filtered excluding the data recorded during the presence of adverse weather conditions, in accordance with the NSW EPA Industrial Noise Policy.

Meteorological data including precipitation and wind speed was obtained from the nearest available Bureau of Meteorology automatic weather station of Richmond RAAF (ID 067105). The data was considered to be representative of the weather conditions at the noise logger locations. Noise logger data recorded during potentially inclement weather including precipitation and wind speeds greater than 5 m/s was excluded from the analysis.

The daily noise logger graphs have been included in Attachment 4. The unattended noise monitoring results summary is presented in section 4.2.

As indicated in the NSW EPA Industrial Noise Policy (section 11.1.3), the site is considered non-compliant with the applicable noise limits if the monitored noise levels were found to be more than 2 dB above the specified criteria.

4.1 ATTENDED NOISE MONITORING RESULTS – LOCATION R1

This section presents the results of the attended noise monitoring. Observations were made in order to determine the site noise contribution at the monitoring location.

Table 4-1: Measured Noise Levels – Attended Noise Monitoring – Location R1 – dB(A)

Date/ Time	L_{F90}	L_{eq}	Observations	Site Noise Contribution	Criteria
				$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$
Daytime 14/07/2016 11:30am	28	44	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <25 dB(A)** Cars on Putty Rd ≤49 dB(A) SPL Light wind through leaves ≤35 dB(A) SPL Birds ≤41 to 53 dB(A) SPL Site inaudible when noise level is 25 dB(A)	<25	35
Daytime 14/07/2016 12:12pm	28	44	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <25 dB(A)** Cars on Putty Rd ≤47 dB(A) SPL Light wind through leaves ≤31 dB(A) SPL Birds ≤34 to 58 dB(A) SPL Site inaudible when noise level is 25 dB(A)	<25	35
Daytime 18/07/2016 12:11pm	42	47	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <29 dB(A)** Cars on Putty Rd ≤44 dB(A) SPL Wind through leaves ≤48-55 dB(A) SPL Birds ≤58 dB(A) SPL Site inaudible when noise level is 39 dB(A)	<29	35
Daytime 18/07/2016 12:26pm	42	48	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <29 dB(A)** Cars on Putty Rd ≤44 dB(A) SPL Wind through leaves ≤48-55 dB(A) SPL Birds ≤55 dB(A) SPL Site inaudible when noise level is 39 dB(A)	<29	35
Daytime 18/07/2016 12:41pm	38	44	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <25 dB(A)** Cars on Putty Rd ≤38 dB(A) SPL Insects ≤38 dB(A) SPL Wind through leaves ≤46 dB(A) SPL Birds ≤54 dB(A) SPL Site inaudible when noise level is 33 dB(A)	<25	35
Daytime 18/07/2016 12:57pm	35	42	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <25 dB(A)** Cars on Putty Rd ≤38 dB(A) SPL Wind through leaves ≤38-46 dB(A) SPL Wind gust through leaves =52 dB(A) SPL Birds ≤63 dB(A) SPL Site inaudible when noise level is 31 dB(A)	<25	35

4.2 UNATTENDED NOISE MONITORING RESULTS – LOCATION R1

The results of the unattended noise monitoring are presented in the following Table 4-2.

Table 4-2: Unattended Noise Monitoring Results– Location R1 – dB(A)

Date	L_{A90}			L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
14/07/2016	25	23	23	39	37	35
15/07/2016	24	21	20	38	38	33
16/07/2016	24	22	20	40	33	32
17/07/2016	23	35	24	40	40	39

The L_{A90} indicates the background noise level, which can be associated with the on-site steady state noise.

The L_{Aeq} ambient noise level was observed to be affected mainly by wildlife and local traffic on Putty Road. Noise levels associated with the site's operations were observed to be well below the measured L_{Aeq}.

As the long term monitoring data is affected by extraneous noise, a number of 15-minute periods from the audio recordings have been selected and analysed in order to obtain readings similar to the attended noise monitoring.

Listening to the recorded audio data as well as observing the 1/3 octave band centre frequency data allowed the extraneous noise sources to be identified and the site noise contribution to be obtained.

Table 4-3 presents the analysis of the long-term unattended noise monitoring for a number of 15-minute period intervals.

Table 4-3: Unattended Noise Monitoring Data Analysis– Location R1 – dB(A)

Date/ Time	L_{F90}	L_{eq}	Observations	Site Noise Contribution		Criteria	
				$L_{Aeq(15\ minute)}$	L_{Amax}	$L_{Aeq(15\ minute)}$	L_{Amax}
Daytime 14/07/2016 12:45pm	26	37	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <27 dB(A)** Cars on Putty Rd ≤45 dB(A) SPL Light wind through leaves ≤29 dB(A) SPL Birds ≤45 dB(A) SPL	<27	-	35	45
Daytime 14/07/2016 1:00pm	25	37	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <27 dB(A)** Truck on Putty Rd ≤50 dB(A) SPL Cars on Putty Rd ≤44 dB(A) SPL Light wind through leaves ≤32 dB(A) SPL Birds ≤46 dB(A) SPL	<27	-	35	45

Table 4-3: Unattended Noise Monitoring Data Analysis– Location R1 – dB(A)

Date/ Time	L_{F90}	L_{eq}	Observations	Site Noise Contribution		Criteria	
				$L_{Aeq(15\ minute)}$	L_{Amax}	$L_{Aeq(15\ minute)}$	L_{Amax}
Night time 14/07/2016 10:00pm	23	34	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ ≤23 dB(A)** **L_{Amax} <32 dB(A)** Cars on Putty Rd ≤54 dB(A) SPL Wind through leaves <33 dB(A) SPL Insects <25 dB(A) SPL	≤23	<32	35	45
Shoulder Period 15/07/2016 6:00am	22	39	**Site Noise Barely Audible** **$L_{Aeq,15\ minute}$ ≤23 dB(A)** Truck on Putty Rd ≤53 dB(A) SPL Cars on Putty Rd ≤48 dB(A) SPL Distant truck ≤26 dB(A) SPL	≤23	<30	35	45
Daytime 15/07/2016 10:00am	25	34	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <25 dB(A)** Truck on Putty Rd ≤48 dB(A) SPL Cars on Putty Rd ≤41 dB(A) SPL Light wind through leaves ≤30 dB(A) SPL Birds ≤50 dB(A) SPL	<25	-	35	45
Daytime 15/07/2016 4:00pm	24	37	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ <27 dB(A)** Cars on Putty Rd ≤44 dB(A) SPL Light wind through leaves ≤24 dB(A) SPL Birds ≤48 dB(A) SPL	<27	-	35	45
Night time 15/07/2016 11:00pm	23	29	**Site Noise Inaudible** **$L_{Aeq,15\ minute}$ ≤23 dB(A)** Dogs <41 dB(A) SPL Cars on Putty Rd ≤43 dB(A) SPL Insects ≤21 dB(A) SPL	≤23	<30	35	45
Shoulder Period 16/07/2016 6:00am	26	37	**Site Noise Barely Audible** **$L_{Aeq,15\ minute}$ ≤26 dB(A)** Cars on Putty Rd ≤46 dB(A) SPL	≤26	<30	35	45

Comments:

At location R1 the noise emissions from the Tinda Creek Quarry site are not audible or barely audible at times when the background noise level is very low.

Noise levels associated with the site's operations are generally well below the noise limit of $L_{Aeq(15minute)}$ 35 dB(A).

The noise levels associated with the site's operations comply with the noise limits outlined in the site's Environment Protection Licence (Licence No.12007).

Compliance with the noise limits was found during both daytime and night time based on the results of the operator attended short term noise monitoring.

Long term noise monitoring was also carried out. The analysis of the long term noise monitoring data also showed that the noise levels associated with the Tinda Creek Quarry's operations comply with the noise limits.

5. RECOMMENDATIONS AND CONCLUSIONS

This report presents the findings of the detailed environmental noise compliance study undertaken for Hy-Tec Concrete and Aggregates Tinda Creek Quarry located at 6102 Putty Road, Mellong NSW.

The scope of the works was to assess the noise emissions from the subject site and assess compliance with the Environment Protection Licence No. 12007.

This investigation included both unattended and attended noise monitoring.

Compliance with noise criteria was achieved at the monitoring location. Noise levels associated with the Tinda Creek Quarry operations were found to be well below the noise limits stipulated in EPL No. 12007.

This concludes the 2016 noise compliance assessment for Hy-Tec Concrete and Aggregates Tinda Creek.

Daniele Albanese
Senior Acoustic Engineer

R T Benbow
Principal Consultant

6. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Hy-Tec Concrete and Aggregates, as per our agreement for providing environmental services. Only Hy-Tec Concrete and Aggregates is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Hy-Tec Concrete and Aggregates for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

ATTACHMENTS

'A' FREQUENCY WEIGHTING

The 'A' frequency weighting roughly approximates to the Fletcher-Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the character of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (L_{Aeq},T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc.. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (L_{A90}, T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days). For a 15 minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

DECIBEL

The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10} (10^{(50/10)} + 10^{(50/10)})$ and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - L_{Aeq}) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the L_{Aeq} noise level than any other descriptor.

'F'(FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

IMPULSE NOISE

An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997). "Offensive Noise means noise:
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:
(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or
(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or
(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m^2).

SOUND PRESSURE LEVEL, Lp

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_P = 10 \log_{10} (Pa/Po)^2$ dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20×10^{-6} Pa) for airborne sound. L_p varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, Lw

The sound power level of a noise source is the inherent noise of the device. Therefore sound power level does not vary with distance from the noise source or with a different acoustic environment. $Lw = Lp + 10 \log_{10}$ 'a' dB, re: 1pW, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

STATISTICAL NOISE LEVELS, Ln.

Noise which varies in level over a specific period of time 'T' (standard measurement times are 15 minute periods) may be quantified in terms of various statistical descriptors for example:-

- The noise level, in decibels, exceeded for 1 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF1}, T. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.
- The noise level, in decibels, exceeded for 10 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF10}, T. In most countries the LAF10, T is measured over periods of 15 minutes, and is used to describe the average maximum noise level.
- The noise level, in decibels, exceeded for 90 % of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as L_{AF90}, T. In most countries the LAF90, T is measured over periods of 15 minutes, and is used to describe the average minim um or background noise level.

STEADY NOISE

Noise, which varies in level by 6 dB or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997).

UNATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

ARL noise logger type Ngara were used to conduct the long-term unattended noise monitoring. This equipment complies with AS IEC 61672.1–2004 and is designated as a Type 2 instrument suitable for field use.

The measured data is processed statistically and stored in memory every 15 minutes. The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer 4230 sound level calibrator. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 3.

METEOROLOGICAL CONSIDERATION DURING MONITORING

For the long-term attended monitoring, meteorological data for the relevant period were provided by the Bureau of Meteorology, which was considered representative of the site for throughout the monitoring period.

Measurements affected by wind or rain over certain limits were excluded from the final analyses of the recorded data in accordance with the EPA's Industrial Noise Policy (INP). The wind data were modified to take into account the difference of height between the AWS (Automatic Weather Station) used by the Bureau of Meteorology (10m above ground level), and the microphone (1.5m above ground level). The correction factor applied to the data was calculated according to the Australian Standard AS1170.2 1989 Section 4.2.5.1.

DESCRIPTORS & FILTERS USED FOR MONITORING

Noise levels are commonly measured using A-weighted filters and are usually described as dB(A). The "A-weighting" refers to standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low frequency sound than it is to high frequency sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Noise environments can be described using various descriptors depending on characteristics of noise or purpose of assessments. For this survey the L_{A90}, L_{Aeq} and L_{Amax} levels were used to analyse the monitoring results. The statistical descriptors L_{A90} measures the noise level exceeded for 90% of the sample measurement time, and is used to describe the "Background noise". Background noise is the underlying level of noise present in the ambient noise, excluding extraneous noise or the noise source under investigation. The L_{Aeq} level is the equivalent continuous noise level or the level averaged on an equal energy basis which is used to describe the "Ambient Noise". The L_{Amax} noise levels are maximum sound pressure levels measured over the sampling period and this parameter is commonly used when assessing noise impact.

Measurement sample periods were fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the noise monitoring location are presented in Attachment 4.

Calibration of Sound Level Meters

A sound level meter requires regular calibration to ensure its measurement performance remains within specification. Benbow Environmental sound level meters are calibrated by a National Association of Testing Authority (NATA) registered laboratory or a laboratory approved by the NSW Environment Protection Authority (EPA) every two years and after each major repair, in accordance with AS IEC 61672.1-2004.

The calibration of the sound level meter was checked immediately before and after each series of measurements using an acoustic calibrator. The acoustic calibrator provides a known sound pressure level, which the meter indicates when the calibrator is activated while positioned on the meter microphone.

The sound level meters also incorporate an internal calibrator for use in setting up. This provides a check of the electrical calibration of the meter, but does not check the performance of the microphone. Acoustical calibration checks the entire instrument including the microphone. Calibration certificates for the instrument sets used have been included as Attachment 3.

Care and Maintenance of Sound Level Meters

Noise measuring equipment contains delicate components and therefore must be handled accordingly. The equipment is manufactured to comply with international and national standards and is checked periodically for compliance. The technical specifications for sound level meters used in Australia are defined in AS IEC 61672.1-2004.

The sound level meters and associated accessories are protected during storage, measurement and transportation against dirt, corrosion, rapid changes of temperature, humidity, rain, wind, vibration, electric and magnetic fields. Microphone cables and adaptors are always connected and disconnected with the power turned off. Batteries are removed (with the instrument turned off) if the instrument is not to be used for some time.

Investigation Procedures

All investigative procedures were conducted in accordance with AS 1055.1-1997 *Acoustics – "Description and Measurement of Environmental Noise (Part 1: General Procedures)"*.

The following information was recorded and kept for reference purposes:

- type of instrumentation used and measurement procedure conducted;
- description of the time aspect of the measurements, ie. measurement time intervals; and
- positions of measurements and the time and date were noted.

As per AS 1055.1-1997, all measurements were carried out at least 3.5 m from any reflecting structure other than the ground. The preferred measurement height of 1.2 m above the ground was utilised. A sketch of the area was made identifying positions of measurement and the approximate location of the noise source and distances in meters (approx.).

ATTENDED NOISE MONITORING

NOISE MONITORING EQUIPMENT

The attended short-term noise monitoring was carried out using a SVANTEK SVAN957 Class 1 Precision Sound Level Meter. The instrument was calibrated by a NATA accredited laboratory within two years of the measurement period. The instrument sets comply with AS IEC 61672.1-2004 and was set on A-weighted, fast response.

The microphone was positioned at 1.2 to 1.5 metres above ground level and was fitted with a windsock. The instrument was calibrated using a Bruel & Kjaer 4230 sound level calibrator prior and subsequent to the measurement period to ensure the reliability and accuracy of the instrument sets. There were no significant variances observed in the reference signal between the pre-measurement and post-measurement calibrations. Instrument calibration certificates have also been included in Attachment 3.

WEATHER CONDITIONS

The weather conditions during all attended noise monitoring were observed to be adequate.

METHODOLOGY

The attended noise measurements were carried out generally in accordance with Australian Standard AS 1055–1997 *Acoustics – Description and Measurement of Environmental Noise*.

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. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C15638

Client Details Benbow Environmental
13 Daking Street
NORTH PARRAMATTA NSW 2151

Equipment Tested/ Model Number : ARL Ngara
Instrument Serial Number : 8780AC
Microphone Serial Number : 317859
Pre-amplifier Serial Number : 27984

Atmospheric Conditions
Ambient Temperature : 21.4°C
Relative Humidity : 49.5%
Barometric Pressure : 100.09kPa

Calibration Technician : Dennis Kim
Secondary Check: Sandra Minto
Calibration Date : 07/12/2015
Report Issue Date : 08/12/2015
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10.2.2: Absolute sensitivity	*Pass*	10.3.4: Inherent system noise level	*Pass*
10.2.3: Frequency weighting	*Pass*	10.4.2: Time weighting characteristic F and S	*Pass*
10.3.2: Overload indications	*Pass*	10.4.3: Time weighting characteristic I	*Pass*
10.3.3: Accuracy of level range control	*Pass*	10.4.5: R.M.S performance	*Pass*
8.9: Detector-indicator linearity	*Pass*	9.3.2: Time averaging	*Pass*
8.10: Differential level linearity	*Pass*	9.3.5: Overload indication	*Pass*

Least Uncertainties of Measurement -

Acoustic Tests
31.5 Hz to 8kHz *±0.120dB*
12.5kHz *±0.165dB*
16kHz *±0.245dB*

Electrical Tests
31.5 Hz to 20 kHz *±0.098dB*

Environmental Conditions
Temperature *±0.3°C*
Relative Humidity *±4.1%*
Barometric Pressure *±0.1kPa*

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

The sound level meter under test has been shown to conform to the type 1 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.

NATA
WORLD RECOGNISED ACCREDITATION

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.

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

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 17824

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 565912
Owner: Benbow Environmental
13 Daking Street
North Parramatta NSW 2151

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

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.44	988.70	0.32
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05 Hz	±0.2 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 990 hPa ±1.5 hPa **Relative Humidity:** 42% ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 03/09/2015 **Issue Date:** 03/09/2015
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2004
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Per. Jack Kielt

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

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

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

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 41048 & FILT 0932

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-957	**Serial No:**	15336
Microphone Type:	7052E	**Serial No:**	47869
Filter Type:	1/3 Octave	**Serial No:**	15336
Comments:	All tests passed for type 1. (See over for details)		
Owner:	Benbow Environmental 13 Daking Street North Parramatta 2151		
Ambient Pressure:	1018 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	42% ±5%
Date of Calibration:	21/07/2015	**Issue Date:**	23/07/2015

Acu-Vib Test Procedure: AVP05 (SLM) & AVP06 (Filters)

CHECKED BY: DAL **AUTHORISED SIGNATURE:** .....

Jack Kielt

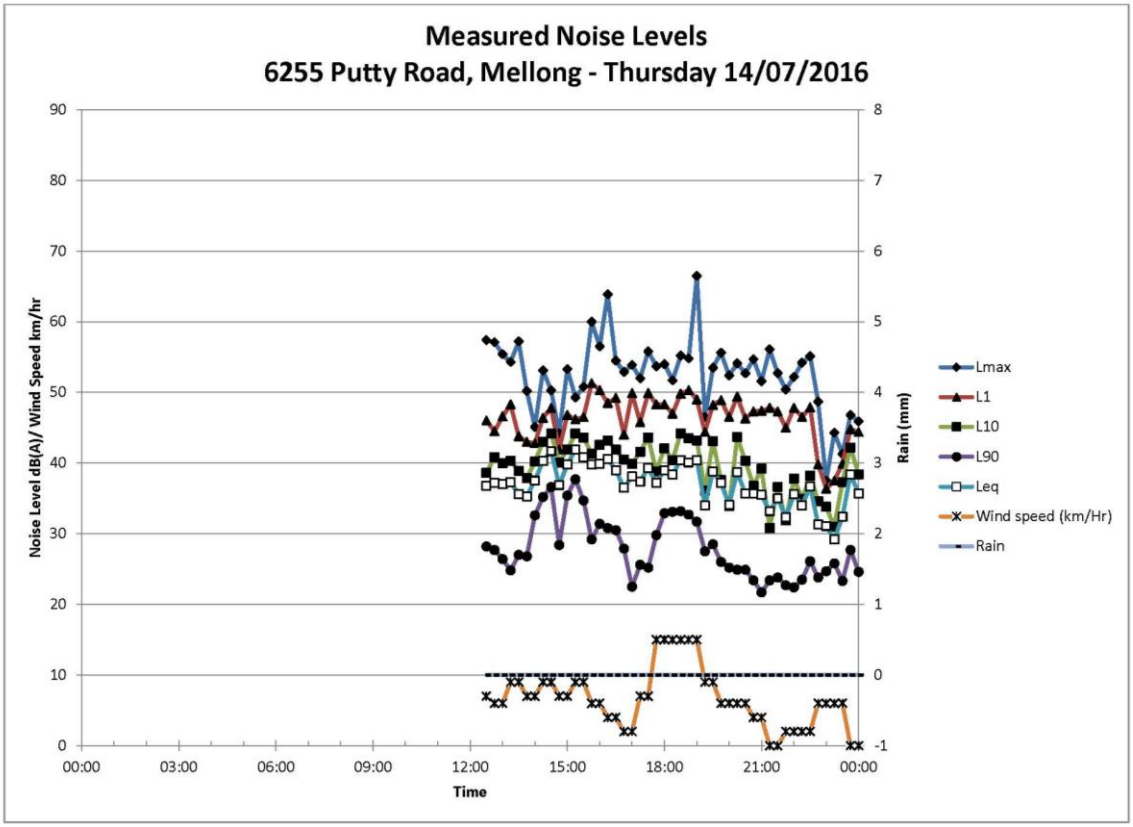
Accredited for compliance with ISO/IEC 17025
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

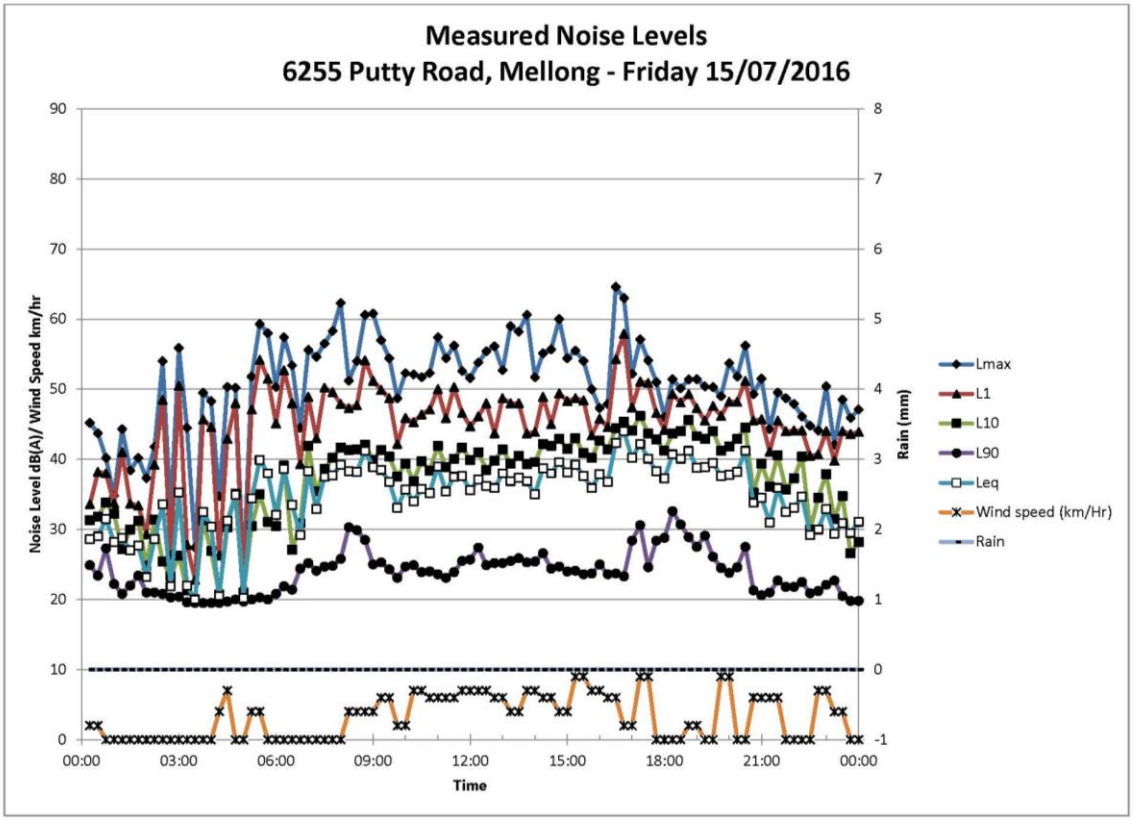
NATA
WORLD RECOGNISED ACCREDITATION

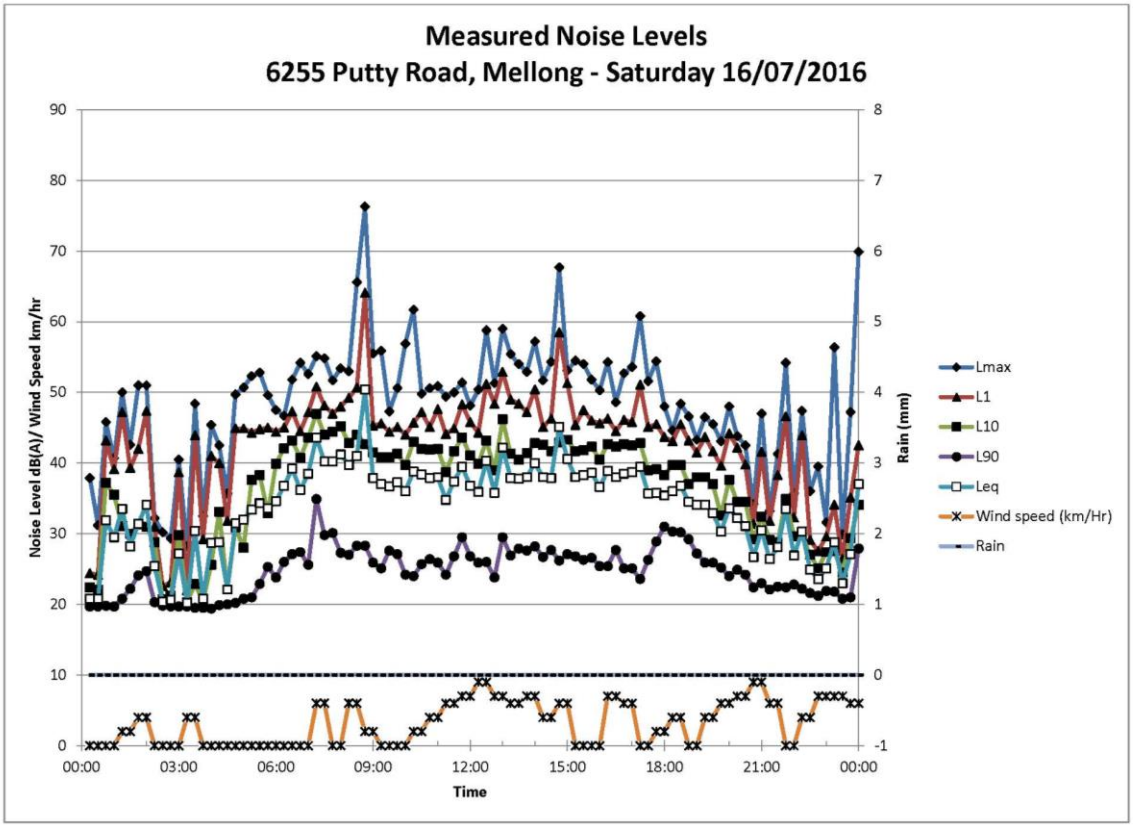
Accredited Lab. No. 9262
Acoustic and Vibration Measurements

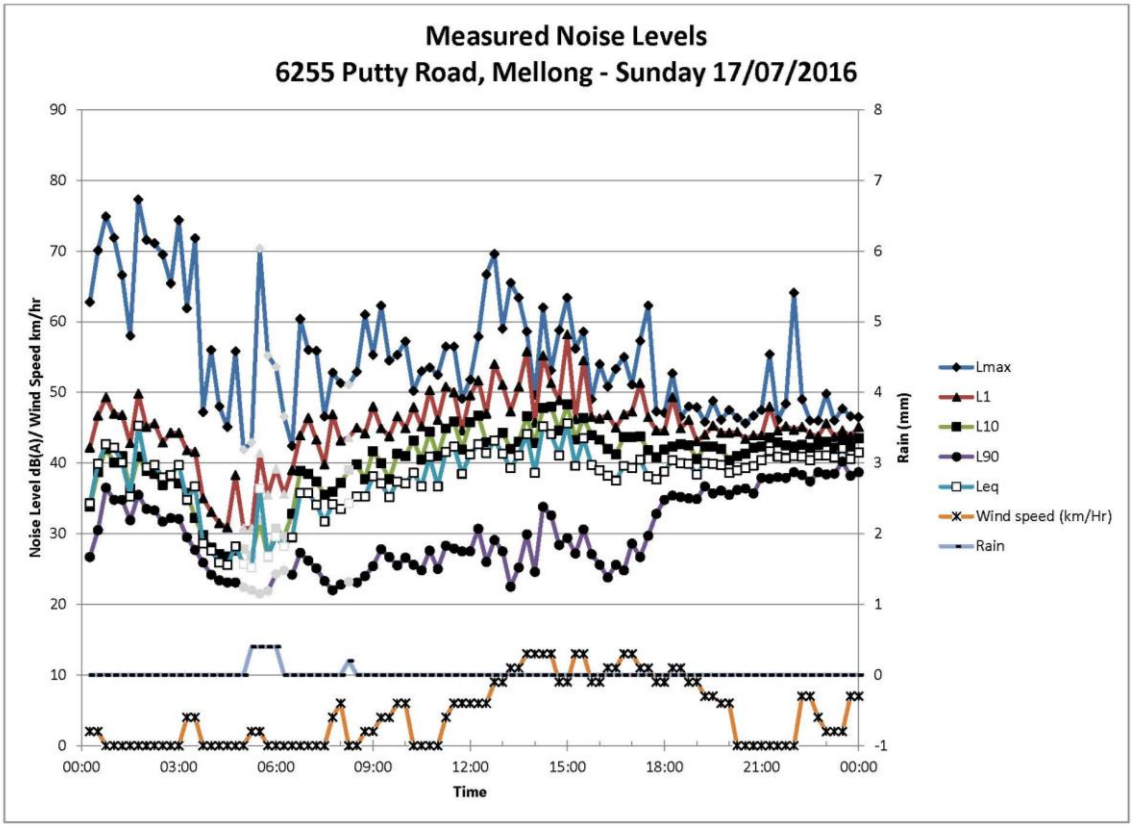
ACU-VIB
ELECTRONICS

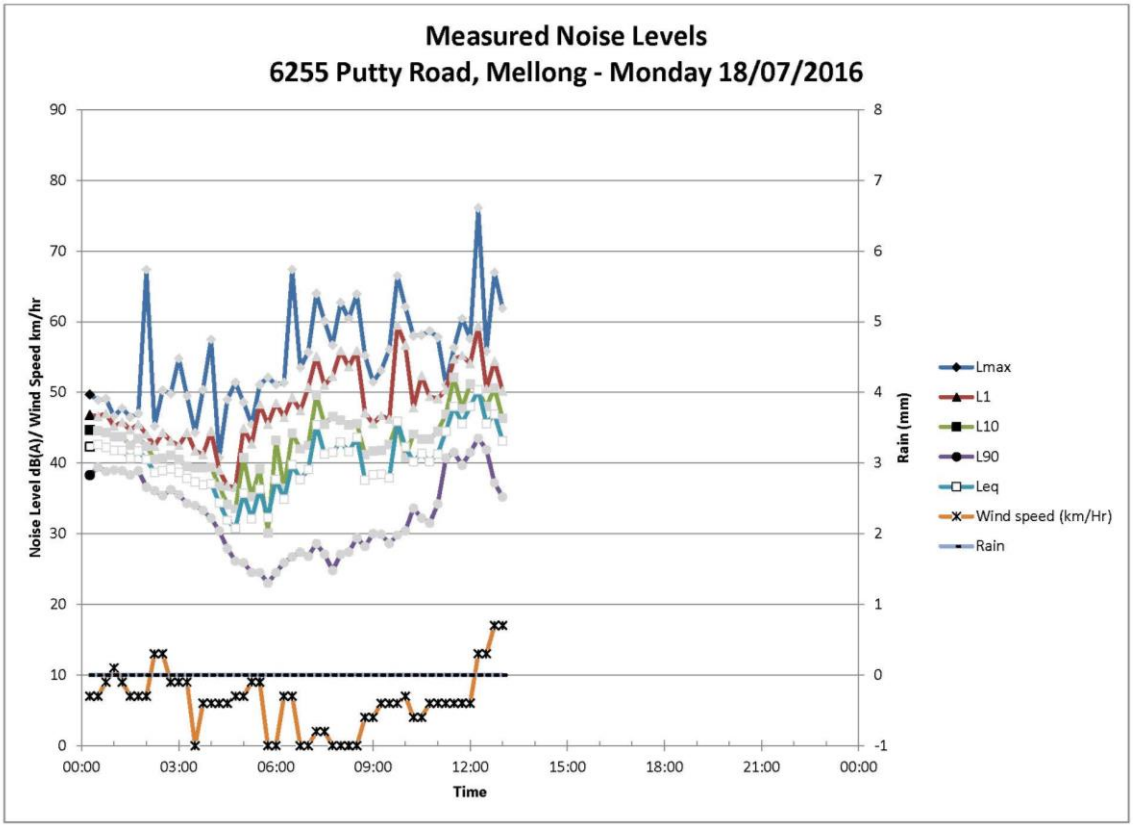
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au


Measured Noise Levels
6255 Putty Road, Mellong - Thursday 14/07/2016
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
6255 Putty Road, Mellong - Friday 15/07/2016
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
6255 Putty Road, Mellong - Saturday 16/07/2016
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
6255 Putty Road, Mellong - Sunday 17/07/2016
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain


Measured Noise Levels
6255 Putty Road, Mellong - Monday 18/07/2016
Noise Level dB(A)/ Wind Speed km/hr
Rain (mm)
Time
90
80
70
60
50
40
30
20
10
0
8
7
6
5
4
3
2
1
0
-1
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
Lmax
L1
L10
L90
Leq
Wind speed (km/Hr)
Rain