



REPORT R190192R1

Revision 0

**Traffic Noise Assessment**  
**Proposed Mixed Use Development**  
**1-3 Hope Street, Penrith NSW 2750**

PREPARED FOR:  
DA Consultants Pty Ltd  
C/o: Morson Group  
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5 November 2019



# Traffic Noise Assessment

## Proposed Mixed Use Development

### 1-3 Hope Street, Penrith NSW 2750

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Reference	Status	Date	Prepared	Checked	Authorised
190192R1	Revision 0	5 November 2019	Thomas Carney	Desmond Raymond	Rodney Stevens



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Figure 2-1 Site Location



## 1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (here forth referred to as RSA) has been engaged by DA Consultants Pty Ltd to conduct a road noise impact assessment for development application (DA) lodgement of the proposed mixed use development at 1-3 Hope Street, Penrith NSW 2750.

This report addresses the road traffic noise impacts from Hope Street on the amenity of the proposed mixed use development.

This assessment is to form part of the supporting documentation for the DA submission to Penrith City Council. Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in Appendix A.

## 2 PROJECT DESCRIPTION

### 2.1 Site Location

The proposed development site is located at 1-3 Hope Street, Penrith. The site will be bounded by residential dwellings to the north and west Hope Street to the south and The Northern Road (Parker Street) to the east. The site and its surroundings are shown in Figure 2-1.

Figure 2-1 Site Location



Aerial image courtesy of Near Map © 2019



## 2.2 Proposed Development

The proposal is to construct a new 6 storey multi residential mixed use development. The floor plans of the proposed mixed use development are presented in Appendix D.

## 3 BASELINE NOISE SURVEY

### 3.1 Unattended Noise Monitoring

In order to characterise the existing acoustical environment of the area, unattended noise monitoring was conducted between Friday 6th September and Friday 13th September 2019 at the logging location shown in Figure 2-1. Two noise loggers were set up on site. The first logger was located in the front yard of the site overlooking The Northern Road and Hope Street, this location is representative of the traffic noise levels that the site will be exposed to.

The second logger was located towards the rear of the site, noise monitoring at this location is representative of the typical acoustic environment of the site.

Logger locations were selected with consideration to other noise sources which may influence readings, security issues for noise monitoring equipment and gaining permission for access from residents and landowners.

Instrumentation for the survey comprised of two RION NL-42 environmental noise loggers (serial numbers 117376 and 221356) fitted with microphone windshields. Calibration of the logger was checked prior to and following measurements. Drift in calibration did not exceed  $\pm 0.5$  dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Measured data has been filtered to remove data measured during adverse weather conditions upon consultation with historical weather reports provided by the Bureau of Meteorology (BOM).

The logger determines LA1, LA10, LA90 and LAeq levels of the ambient noise. LA1, LA10, LA90 are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions in Appendix A). Detailed results at the monitoring location are presented in graphical format in Appendix B. The graphs show measured values of LA1, LA10, LA90 and LAeq for each 15-minute monitoring period.

### 3.2 Ambient Noise Results

In order to establish the ambient noise criteria of the area, the data obtained from the noise logger has been processed in accordance with the procedures contained in the NSW Environmental Protection Authority's (EPA) *Noise Policy for Industry* (NPfI, 2017) to establish representative noise levels that can be expected in the residential vicinity of the site. The monitored baseline noise levels are detailed in



Table 3-1.



Table 3-1 Measured Baseline Noise Levels Corresponding to Defined NPfl Periods

Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Daytime 7 am - 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm – 7 am
Logger at western boundary of site	LAeq	58	52	53
	RBL (Background)	45	42	35

Notes: All values expressed as dB(A) and rounded to nearest 1 dB(A);

LAeq Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

LA90 Noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

### 3.3 Noise Intrusion (State Environmental Planning Policy (Infrastructure) 2007)

To assess noise intrusion into the proposed multi residential mixed use development, the data obtained from the first logger location has been processed to establish representative ambient noise levels at the facades most exposed to The Northern Road.

The time periods used for this assessment are as defined in the State Environmental Planning Policy (Infrastructure) 2007 and the Development near Rail Corridors and Busy Roads Interim Guideline. Results are presented below in Table 3-2.

Table 3-2 Traffic Noise Levels Corresponding to Defined SEEP 2007 Periods

Location	Period	External Noise Levels dB(A)
Approximately 7m from The Northern Road (Parker Street)	Day Time 7:00 am - 10:00 pm	LAeq(15hour) 68
	Night Time 10:00 pm - 7:00 am	LAeq(9hour) 64





## 4 NOISE GUIDELINES AND CRITERIA

### 4.1 Road Noise Criteria

The determination of an acceptable level of traffic noise impacting the internal residential spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities.

As sleep is the activity most affected by road noise, bedrooms are considered to be the most sensitive internal living areas. Higher levels of noise are acceptable in living areas without interfering with activities such as reading, listening to the television etc. Noise levels in utility spaces such as kitchens, bathrooms, laundries etc. can be higher.

### 4.2 Penrith City Council Requirements

Penrith City Council in their DCP 2014 Part D2, Section 2.2.19 – Visual and Acoustic Privacy and Outlook states:

#### 2.2.19 Visual and Acoustic Privacy and Outlook

##### A. Objective

- a. Provide an outlook from dwellings and their private open space, and achieve levels of acoustic and visual privacy that are reasonable for a residential neighbourhood.
- b. The recommended night-time internal noise levels in living and sleeping areas is 35-40 dB(A). – WHO.
- c. To provide a high level of visual and acoustic privacy for residents and neighbours in dwellings and private open space.
- d. To ensure that building design minimises overlooking problems.

##### B. Controls

1) Demonstrate a package of measures that achieves reasonable privacy:

- a) for adjacent dwellings: at least 3m between any facing windows, screened by landscaping or other means including courtyard walls, or pergolas to prevent cross viewing from first storey windows;
- b) dormer windows generally to be oriented to face the street or the rear boundary;
- c) private courtyards should be screened by pergolas and masonry walls to prevent direct cross-viewing and excessive transmission of noise;
- d) screening measures, including:
  - i) offsetting of windows; or
  - ii) oblique orientation for windows; or
  - iii) external screens to windows; or
  - iv) courtyard walls and pergolas;
  - v) note that landscaping (other than established trees and shrubs that are proposed to be retained) should not provide the principal means of screening;
- e) rooms other than bedrooms should have any windows facing a driveway screened by landscaped verges at least 2m wide;
- f) bedroom windows facing a driveway should be screened by masonry walls at least 1.5m tall located at least 1m from the face of the window;
- g) All balconies and decks higher than 800mm above existing ground level shall incorporate privacy measures such as screening or landscape planting.



- h) for windows of habitable rooms with a direct outlook onto windows of habitable rooms of adjacent dwellings:
  - i) are offset by a distance sufficient to limit views between windows; or
  - ii) have sill heights of 1.7 m above floor level; or
  - iii) have fixed obscure glazing in any part of the window below 1.7 m.
- 2) Demonstrate measures that protect dwellings from external noise sources:
  - a) windows to ground-level living rooms screened by landscaped verges at least 2m wide;
  - b) within any dwelling, bedrooms should not adjoin the garage or living rooms of a neighbouring dwelling; internally, bedrooms should be segregated and separated from living areas by hallways, stairs or service rooms;
  - c) sound resisting construction of separating walls, floors and windows, in accordance with BCA;
  - d) zoning of dwellings into active living areas and passive sleeping areas, separated by corridors and/or service zones;
  - e) plant and equipment should be effectively screened and located away from sleeping areas;
  - f) along frontages to noisy arterial roads or the rail corridor:
    - i) locate habitable rooms and private open spaces away from noise sources and if required protect with appropriate noise shielding devices;
    - ii) comply with the requirements of relevant noise and vibration guidelines published by the NSW Government. The NSW Government sets standards in relation to acceptable noise levels for all operations and land uses through the Environment

Protection Authority's Environmental Noise Control Manual. These standards apply in all cases.

- iii) provide a detailed acoustic design report that demonstrates compliance with the above requirements;
- iv) provide a certificate of compliance at completion of construction;
- v) under extreme circumstances identified by Council, employ fixed glazing with air-conditioning for street-frontage bedrooms.

#### 4.2.1 State Environmental Planning Policy (Infrastructure) 2007

The NSW Government's State Environmental Planning Policy (Infrastructure) 2007 (SEPP (Infrastructure) 2007) was introduced to facilitate the delivery of infrastructure across the State by improving regulatory certainty and efficiency. In accordance with the SEPP, Table 3.1 of the NSW Department of Planning and Infrastructure's "*Development near Rail Corridors and Busy Roads - Interim Guideline*" (the DP&I Guideline) of December 2008 provides noise criteria for residential and non-residential buildings. These criteria are summarised in Table 4-1.

Table 4-1 DP&I Interim Guideline Noise Criteria

Type of occupancy	Noise Level dB(A)	Applicable time period
Sleeping areas (bedroom)	35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40	At any time

Note 1: Airborne noise is calculated as  $L_{Aeq(15hour)}$  daytime and  $L_{Aeq(9hour)}$  night-time

The following guidance is also provided in the DP&I Guideline:



*“These criteria apply to all forms of residential buildings as well as aged care and nursing home facilities. For some residential buildings, the applicants may wish to apply more stringent design goals in response to market demand for a higher quality living environment.*

*The night-time “sleeping areas” criterion is 5 dB(A) more stringent than the “living areas” criteria to promote passive acoustic design principles. For example, designing the building such that sleeping areas are less exposed to road or rail noise than living areas may result in less onerous requirements for glazing, wall construction and acoustic seals. If internal noise levels with windows or doors open exceed the criteria by more than 10 dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.”*

The noise criteria presented in Section 4.2.1 and in Table 4-1 apply to a ‘windows closed condition’. Standard window glazing of a building will typically attenuate noise ingress by 20 dB(A) with windows closed and 10 dB(A) with windows open (allowing for natural ventilation). Accordingly, the external noise threshold above which a development will require mechanical ventilation is an  $L_{Aeq(9hour)}$  55 dB(A) for bedrooms and  $L_{Aeq(15hour)}$  60 dB(A) for other areas.

Where windows must be kept closed, the adopted ventilation systems must meet the requirements of the Building Code of Australia and Australian Standard 1668 – The use of ventilation and air conditioning in buildings.

### 4.3 Operational Noise Project Trigger Noise Levels

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the EPA. The EPA oversees the Noise Policy for Industry (NPI) October 2017 which provides a framework and process for deriving project trigger noise level. The NPI project noise levels for industrial noise sources have two (2) components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity for particular land uses for residents and sensitive receivers in other land uses.

#### 4.3.1 Intrusiveness Noise Levels

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness noise level essentially means that the equivalent continuous noise level ( $L_{Aeq}$ ) of the source should not be more than 5 dB(A) above the measured Rated Background Level (RBL), over any 15 minute period.

#### 4.3.2 Amenity Noise Levels

The amenity noise level is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The noise levels relate only to other industrial-type noise sources and do not include road, rail or community noise. The existing noise level from industry is measured.

If it approaches the project trigger noise level value, then noise levels from new industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the project trigger noise level.



### 4.3.3 Area Classification

The NPfI characterises the “Urban” noise environment as an area with an acoustical environment that:

- is dominated by ‘urban hum’ or industrial source noise,
- where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources
- has through-traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above.

The area surrounding the proposed development falls under the “Urban” area classification.

### 4.3.4 Project Specific Trigger Noise Levels

Having defined the area type, the processed results of the attended noise monitoring have been used to determine project specific project trigger noise level. The intrusive and amenity project trigger noise level for nearby residential premises are presented in Table 4-2. These project trigger noise levels are nominated for the purpose of assessing potential noise impacts from the proposed development.

In this case, the ambient noise environment is not controlled by industrial noise sources and therefore the project amenity noise level are assigned as per Table 2.2 of the NPfI (Recommended Amenity Noise Levels). For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive project trigger noise level are adopted. These are shown in bold text in Table 4-2.

Table 4-2 Operational Project Trigger Noise Levels

Receiver	Time of Day	ANL <sup>1</sup> L <sub>Aeq</sub> (15min)	Measured		Project Trigger Noise Levels	
			RBL <sup>2</sup> L <sub>A90</sub> (15min)	Existing L <sub>Aeq</sub> (Period)	Intrusive L <sub>Aeq</sub> (15min)	Amenity L <sub>Aeq</sub> (15min)
Residential	Day	60	45	58	<b>50</b>	63
	Evening	50	42	52	<b>47</b>	53
	Night	45	35	53	<b>40</b>	48

Note 1: ANL = “Amenity Noise Level” for residences in Urban Areas.

Note 2: RBL = “Rating Background Level”.

## 5 NOISE IMPACT ASSESMENT

### 5.1 Traffic Noise Assessment

In order to ascertain the existing traffic noise levels from The Northern Road, the measured noise logger data was processed in accordance to the NSW Department of Planning and Infrastructure’s “*Development near Rail Corridors and Busy Roads - Interim Guideline*” assessment time periods as shown in Table 3-2.

The final façade noise levels were predicted for each time period taking into account the distance attenuation from each respective source, virtual source, façade’s orientation and any barrier effects.

The required noise reduction via the building façade for each respective room for each time period will be compared to determine the appropriate design criteria levels.



It is typically accepted that an open window (fractionally open to meet ventilation requirements) results in an attenuation of external noise by 10 dB. This reduction has been used to predict the room noise level in the window open condition.

## 5.2 Recommended Noise Control Treatment

The calculation procedure establishes the required noise insulation performance of each surface component such that the internal noise level is achieved whilst an equal contribution of traffic noise energy is distributed across each component. Building envelope components with a greater surface area must therefore offer increased noise insulation performance.

The recommended acoustic treatment is based on the following floor finishes:

- Bedrooms: Carpet and underlay
- Living Room: Hard Flooring
- Kitchen/Wet Areas: Tiles

The acoustic requirements shown in this report will increase further where the bedroom floor finishes are tiled or timber.

All recommendations must be checked by others to ensure compliance with other non-acoustic requirements that Council or other authority may impose (e.g. Thermal requirements for BASIX compliance).

## 5.3 Glazing

The  $R_w$  rating required for each window will vary from room to room. Recommendations for windows also apply to any other item of glazing located on the external facade of the building in a habitable room unless otherwise stated.

Note that the  $R_w$  rating is required for the complete glazing and frame assembly. The minimum glazing thicknesses will not necessarily meet the required  $R_w$  rating without an appropriate frame system. It will be therefore necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting the requirements in Table 5-1.

The window systems must be tested in accordance with both of the following:

- Australian Window Association Industry Code of Practice Window and Door – Method of Acoustic Testing; and
- AS 1191 Acoustics – Method for laboratory measurement of airborne sound insulation of building elements.

It is necessary to submit such Laboratory certification for the proposed glazing systems (i.e. windows and framing systems) (e.g. NAL or CSIRO) for approval by RSA prior to ordering or commitment.

The entire frame associated with the glazing must be sealed into the structural opening using acoustic mastics and backer rods. Normal weather proofing details do not necessarily provide the full acoustic insulation potential of the window system. The manufacturers' installation instructions for the correct acoustic sealing of the frame must be followed.

It is possible that structural demands for wind loading or fire rating or the like may require more substantial glass and framing assemblies than nominated above. Where this is the case the acoustic requirements must clearly be superseded by the structural or fire rating demands.

Table 5-1 presents the minimum recommended  $R_w$  (weighted noise reduction) for glazing elements.



Table 5-1 Minimum Acoustic Rating ( $R_w$ ) Required for Glazing Elements

Unit	Room	Window	Sliding Door/Door
Unit 101	Living Areas	Rw 34	Rw 34
	Bedrooms	Rw 34	Rw 34
Unit 102	Living Areas	Rw 28	Rw 28
	Bedrooms	Rw 28	Rw 28
Unit 103	Living Areas	Rw 26	Rw 26
	Bedrooms	Rw 26	Rw 26
Unit 104	Living Areas (Hope Street facing)	Rw 34	Rw 34
	Living Areas (West facing)	Rw 26	Rw 26
	Bedroom (Hope Street facing)	Rw 34	Rw 34
	Bedroom (West facing)	Rw 26	Rw 26
Unit 105	Living Areas	Rw 34	Rw 34
	Bedrooms	Rw 34	Rw 34
Unit 106	Living Areas	Rw 34	Rw 34
	Bedrooms	Rw 34	Rw 34
Unit 201	Living Areas	Rw 34	Rw 34
	Bedrooms	Rw 34	Rw 34
Unit 202	Living Areas	Rw 28	Rw 28
	Bedrooms	Rw 28	Rw 28
Unit 203	Living Areas	Rw 26	Rw 26
	Bedrooms	Rw 26	Rw 26
Unit 204	Living Areas (Hope Street facing)	Rw 34	Rw 34
	Living Areas (West facing)	Rw 26	Rw 26
	Bedroom (Hope Street facing)	Rw 34	Rw 34
	Bedroom (West facing)	Rw 26	Rw 26
Unit 205	Living Areas	Rw 34	Rw 34
	Bedrooms	Rw 34	Rw 34



Unit 301	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35
Unit 302	Living Areas	Rw 30	Rw 30
	Bedrooms	Rw 30	Rw 30
Unit 303	Living Areas	Rw 28	Rw 28
	Bedrooms	Rw 28	Rw 28
Unit 304	Living Areas (Hope Street facing)	Rw 35	Rw 35
	Living Areas (West facing)	Rw 28	Rw 28
	Bedroom (Hope Street facing)	Rw 35	Rw 35
	Bedroom (West facing)	Rw 28	Rw 28
Unit 305	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35
Unit 306	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35
Unit 401	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35
Unit 402	Living Areas	Rw 30	Rw 30
	Bedrooms	Rw 30	Rw 30
Unit 403	Living Areas	Rw 28	Rw 28
	Bedrooms	Rw 28	Rw 28
Unit 404	Living Areas (Hope Street facing)	Rw 35	Rw 35
	Living Areas (West facing)	Rw 28	Rw 28
	Bedroom (Hope Street facing)	Rw 35	Rw 35
	Bedroom (West facing)	Rw 28	Rw 28
Unit 405	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35



Unit 501	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35
Unit 502	Living Areas	Rw 35	Rw 35
	Bedrooms	Rw 35	Rw 35

A glazing thickness guideline is presented in Appendix E for further reference

#### 5.4 Detailing

Note that well-detailed construction and careful installation is needed to achieve the required  $R_w$  acoustic ratings. All gaps are to be minimised and fully sealed with an acoustic rated sealant, such as FireBan One by Bostik or Sikaflex Pro 2HP by Sika.

#### 5.5 Mechanical Plant Noise Assessment

A specific mechanical plant selection has not been supplied at this stage. It is anticipated that the building will be serviced by typical mechanical ventilation/air conditioning equipment.

It is likely that the criteria set out in Table 4-2 will be met through the use of conventional noise control methods (e.g. selection of equipment on the basis of quiet operation and, where necessary, providing enclosures, localised barriers, silencers and lined ductwork).

An appropriately qualified acoustic consultant should review the mechanical plant associated with the development at the detailed design stage when final plant selections have been made.

## 6 CONCLUSION

RSA has conducted a traffic noise impact assessment of the proposed mixed use development at 1-3 Hope Street, Penrith NSW 2750. The assessment has comprised the establishment of noise criteria and assesses noise impacts with regard to relevant statutory requirements.

A noise survey has been conducted and the processed data has been used to determine traffic noise from The Northern Road and Hope Street at the project site.

Based on the noise impact study conducted, the proposed development is assessed to comply with the SEPP (Infrastructure) 2007 noise criteria with recommendations from this report. It is therefore recommended that planning approval be granted for the proposed development on the basis of acoustics.

Noise emissions criteria for mechanical plant have been established, a future noise survey may be required once the detailed mechanical plan schedules are available at Construction Certificate assessment stage.

Approved:-

Rodney Stevens

Manager/Principal





## Appendix A Acoustic Terminology

### **A-weighted sound pressure**

The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level  $dB(A)$  to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted  $dB(\text{linear})$ .

### Ambient noise

The total noise in a given situation, inclusive of all noise source contributions in the near and far field.

### **Community annoyance**

Includes noise annoyance due to:

character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content)

character of the environment (e.g. very quiet suburban, suburban, urban, near industry)

miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations)

human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).

### Compliance

The process of checking that source noise levels meet with the noise limits in a statutory context.

### Cumulative noise level

The total level of noise from all sources.

### **Extraneous noise**

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

### **Feasible and reasonable measures**

Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:

Noise mitigation benefits (amount of noise reduction provided, number of people protected).

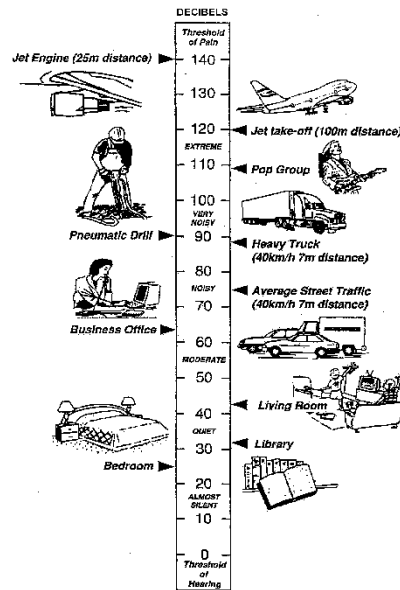
Cost of mitigation (cost of mitigation versus benefit provided).

Community views (aesthetic impacts and community wishes).

Noise levels for affected land uses (existing and future levels, and changes in noise levels).



Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
<b>Noise level (goal)</b>	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on 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.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
<b>Rating Background Level (RBL)</b>	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10 <sup>th</sup> percentile min L <sub>A90</sub> noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	<p>Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of <math>2 \times 10^{-5}</math> Pa.</p> <p>The picture below indicates typical noise levels from common noise sources.</p>



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in  $dB(A)$ .

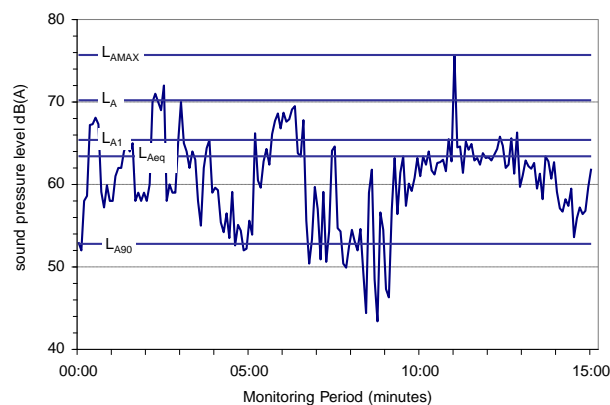
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in  $dB(A)$ , as measured by a standard sound level meter with a pressure microphone. The sound pressure level in  $dB(A)$  gives a close indication of the subjective loudness of the noise.

Statistic noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



Key descriptors:



	<p><math>L_{Amax}</math> Maximum recorded noise level.</p>
	<p><math>L_{A1}</math> The noise level exceeded for 1% of the 15 minute interval.</p>
	<p><math>L_{A10}</math> Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.</p>
	<p><math>L_{Aeq}</math> Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.</p>
	<p><math>L_{A90}</math> Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).</p>
Threshold	<p>The lowest sound pressure level that produces a detectable response (in an instrument/person).</p>
Tonality	<p>Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics</p>



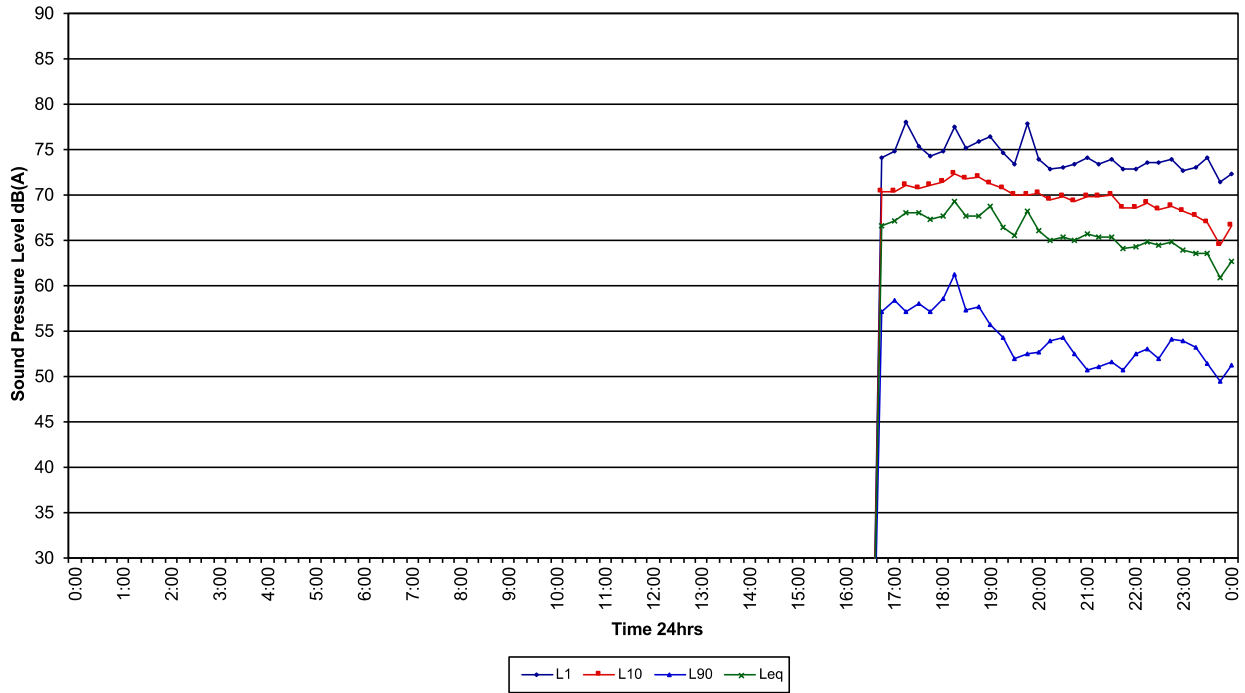
## Appendix B      Logger Graphs

### Traffic Logger

#### 1-3 Hope St, Penrith

##### Road Traffic

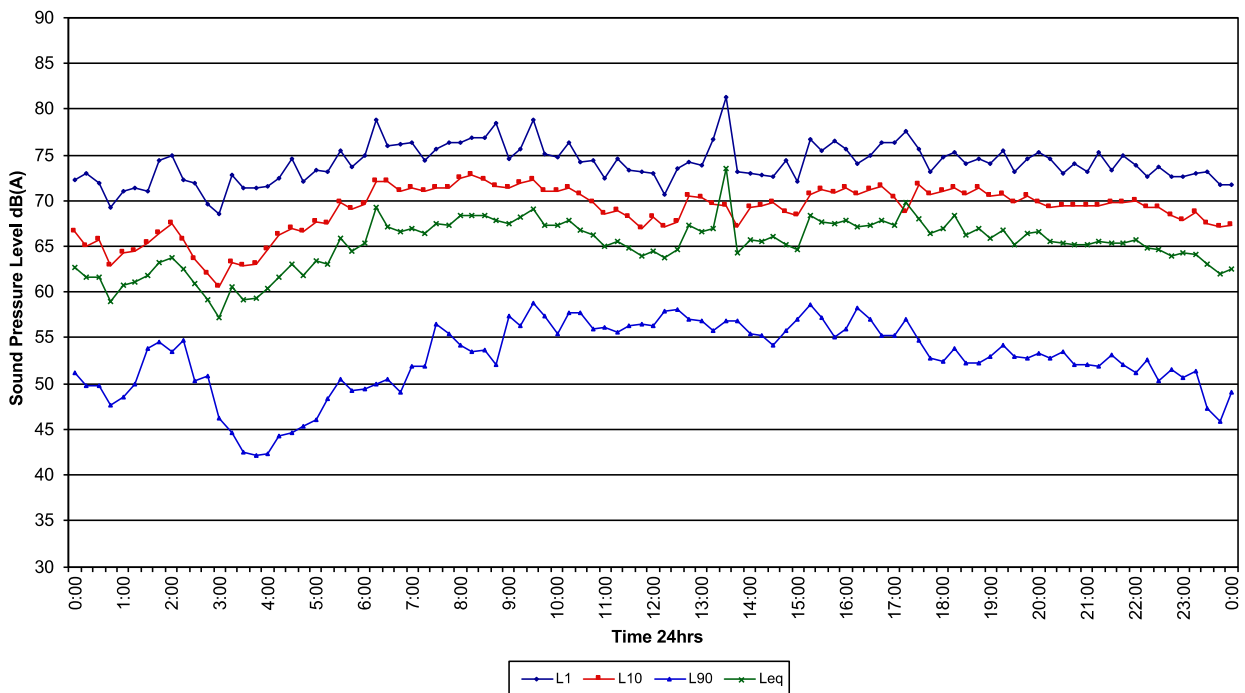
Friday      6/9/19



#### 1-3 Hope St, Penrith

##### Road Traffic

Saturday      7/9/19

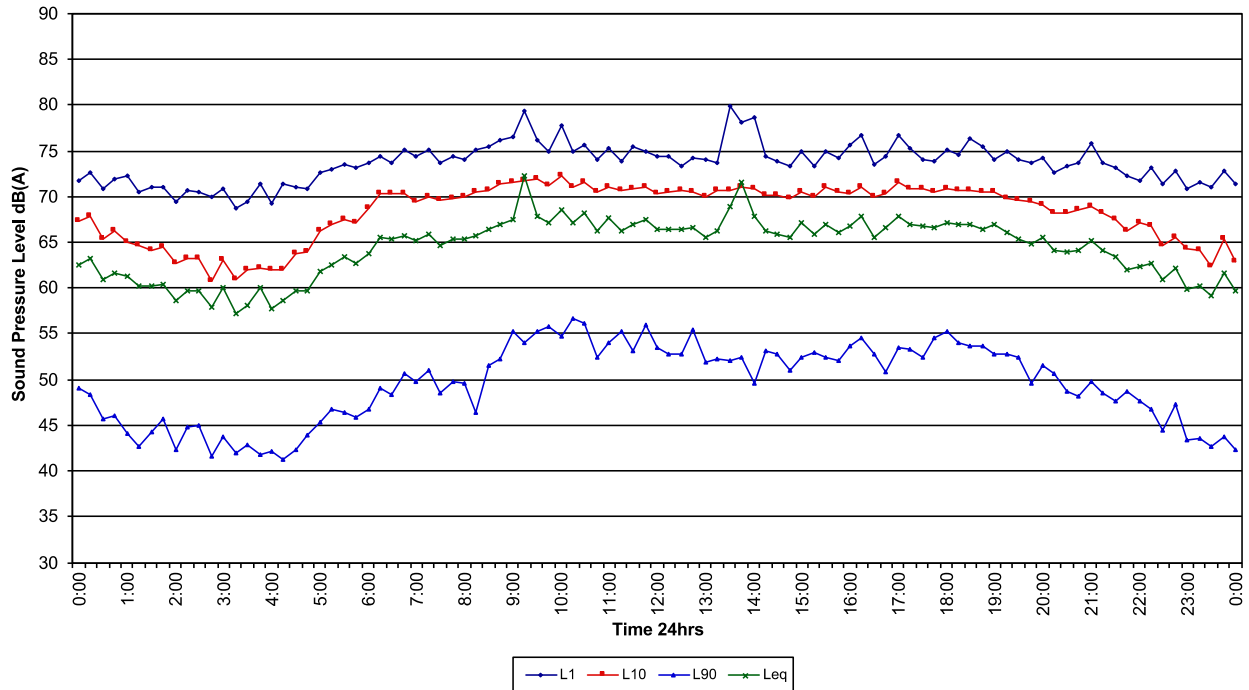




### 1-3 Hope St, Penrith

Road Traffic

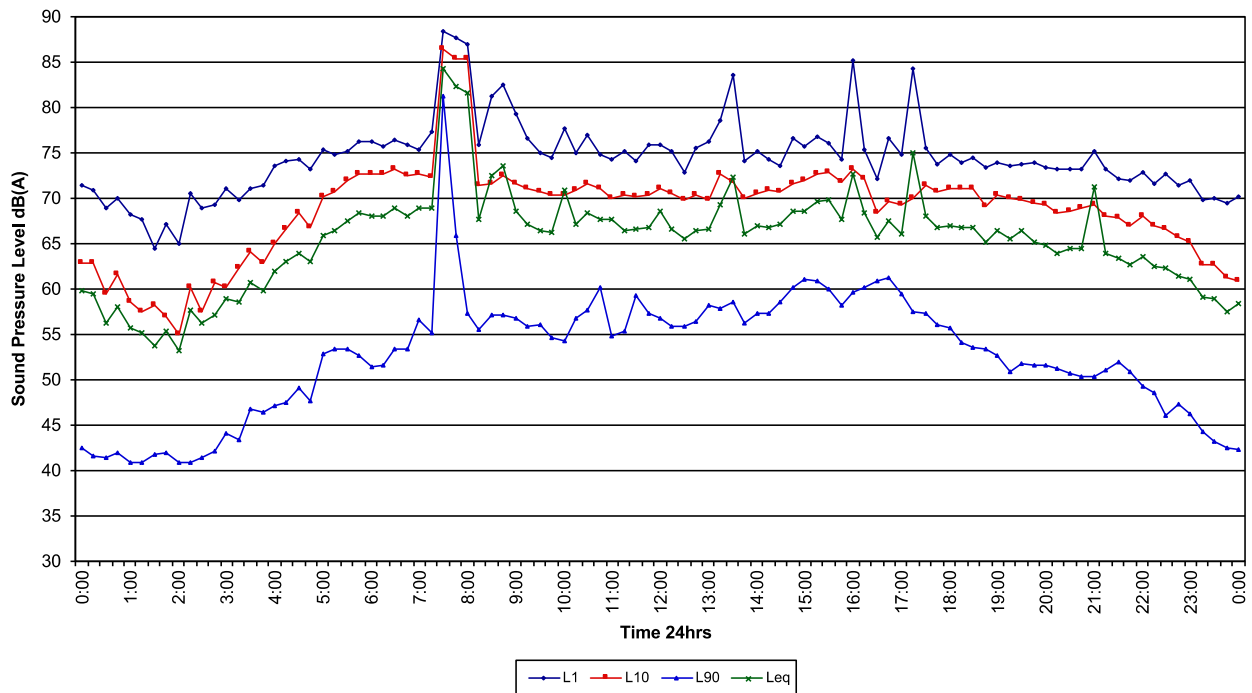
Sunday 8/9/19



### 1-3 Hope St, Penrith

Road Traffic

Monday 9/9/19

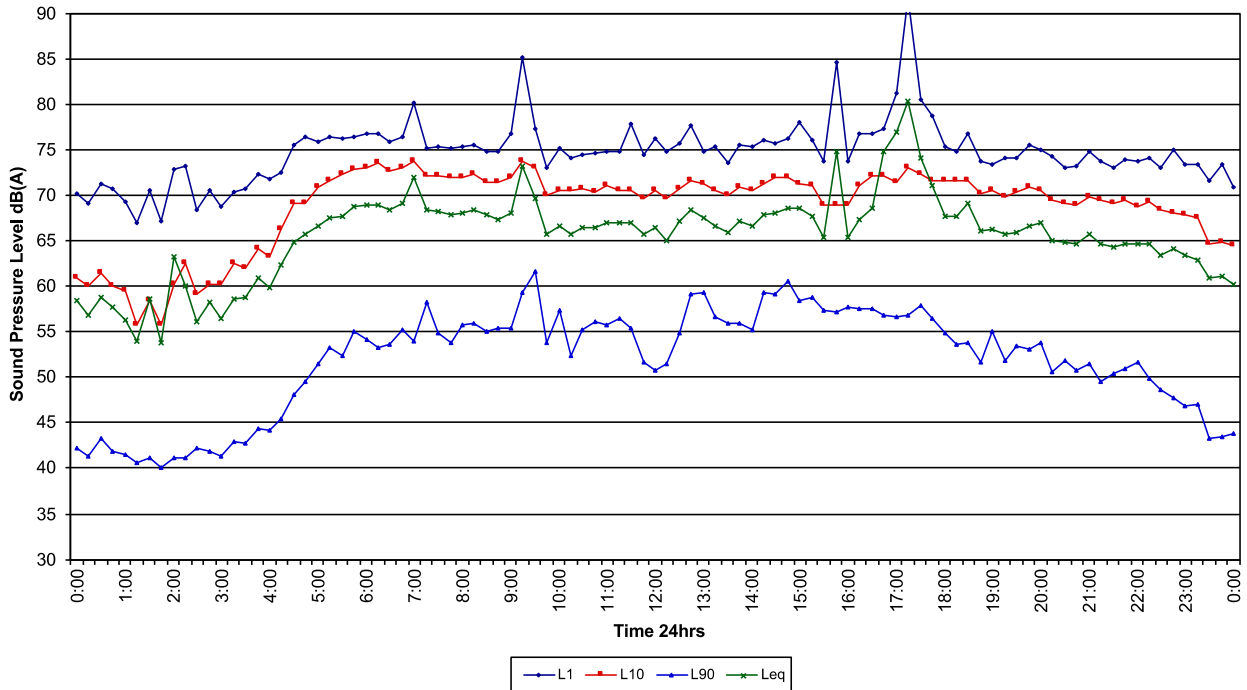




### 1-3 Hope St, Penrith

#### Road Traffic

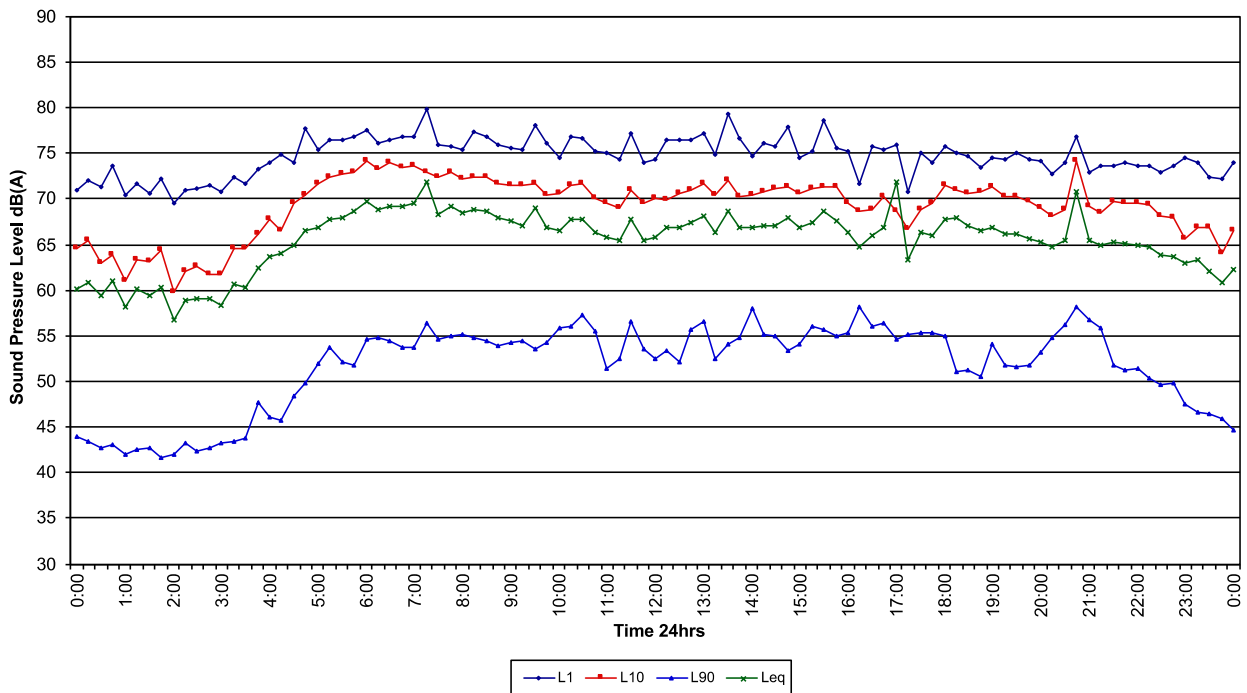
Tuesday 10/9/19



### 1-3 Hope St, Penrith

#### Road Traffic

Wednesday 11/9/19

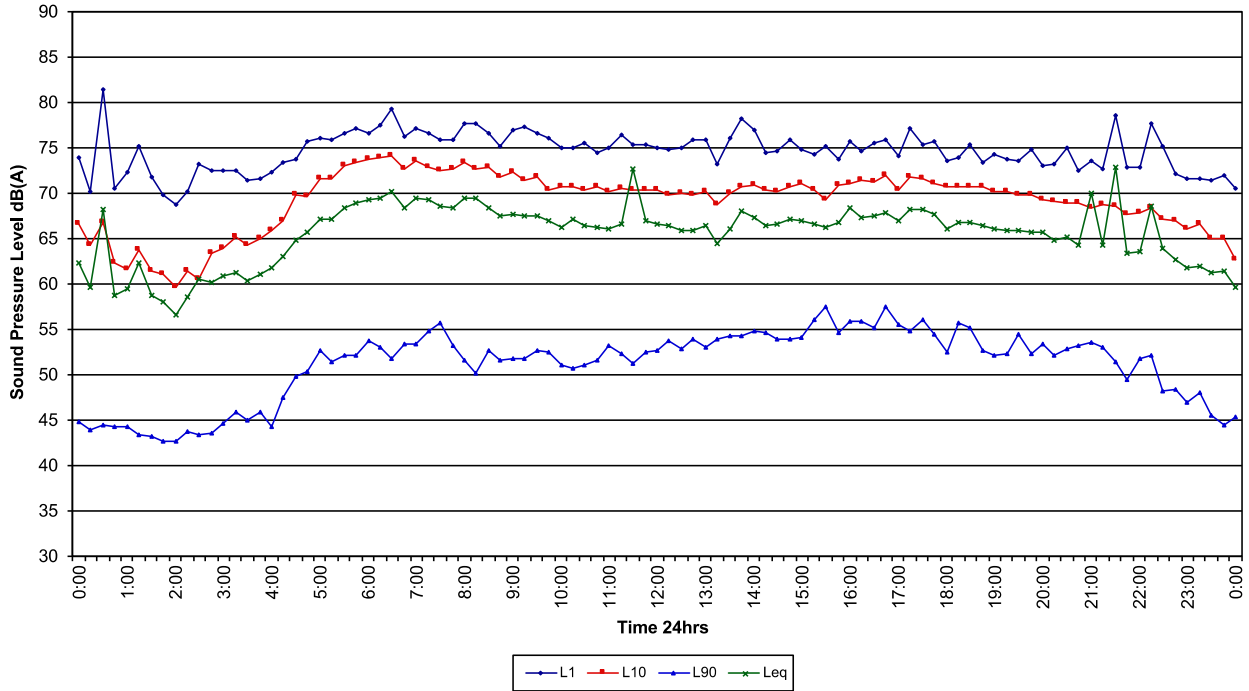




### 1-3 Hope St, Penrith

#### Road Traffic

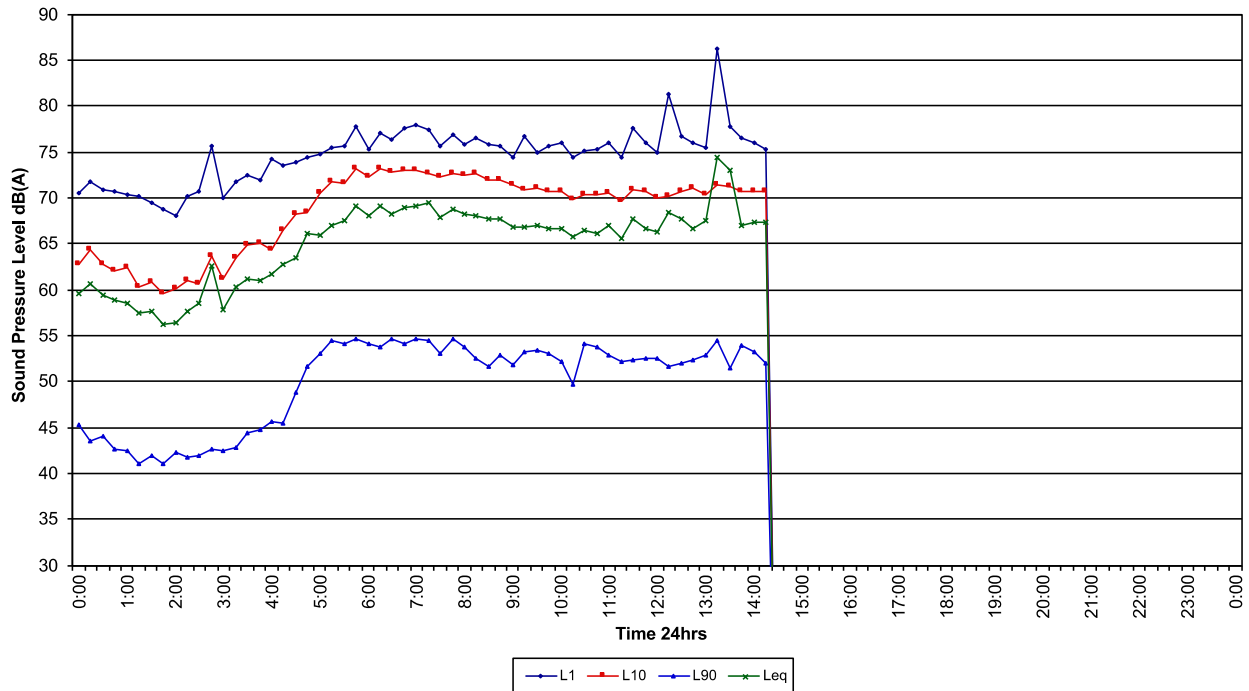
Thursday 12/9/19



### 1-3 Hope St, Penrith

#### Road Traffic

Friday 13/9/19





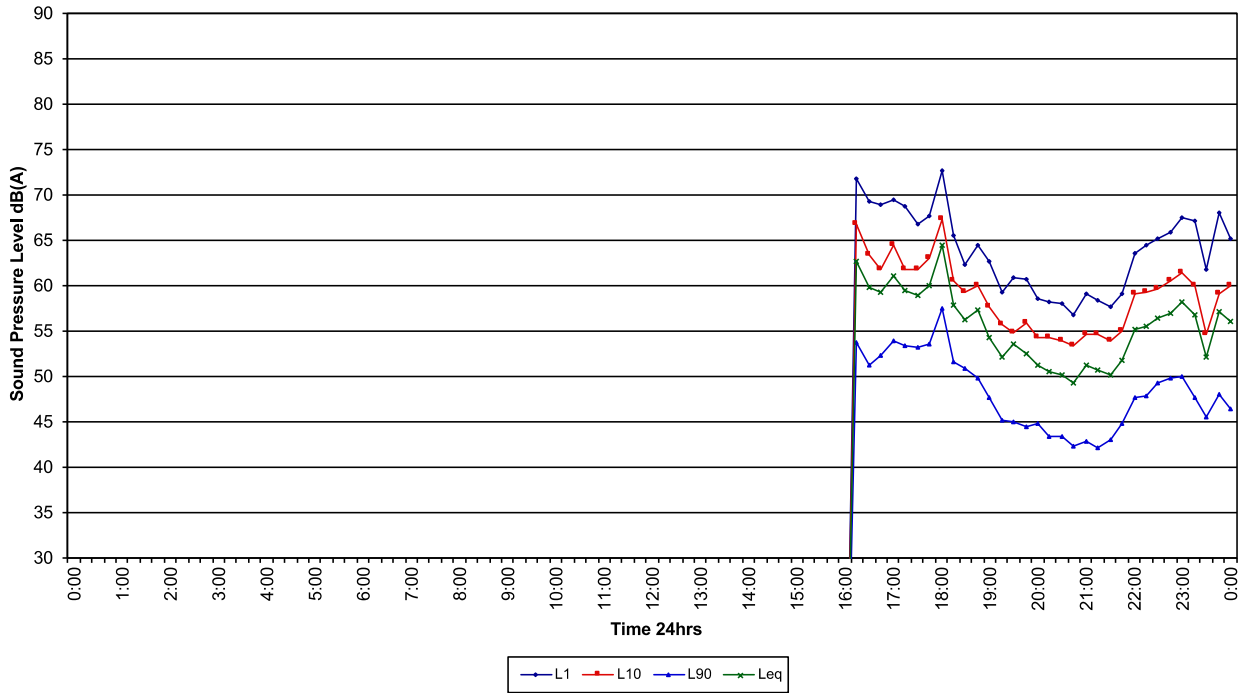


Ambient Logger

1-3 Hope St, Penrith

Ambient

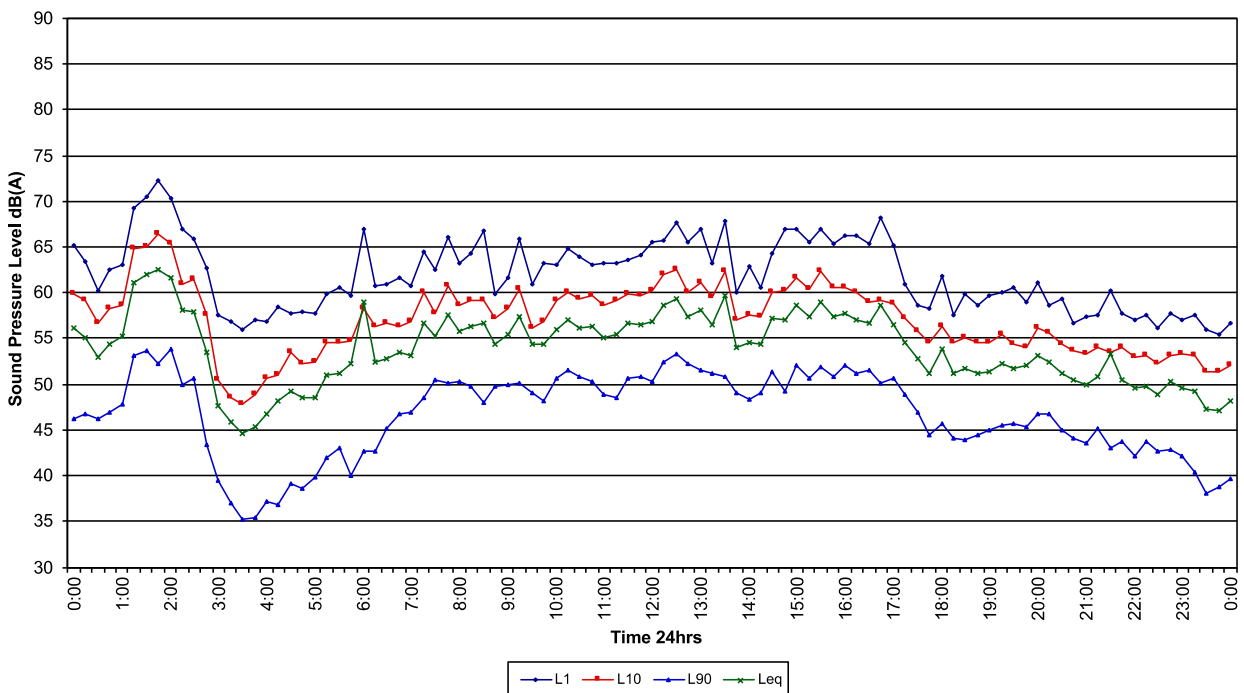
Friday 6/9/19



1-3 Hope St, Penrith

Ambient

Saturday 7/9/19

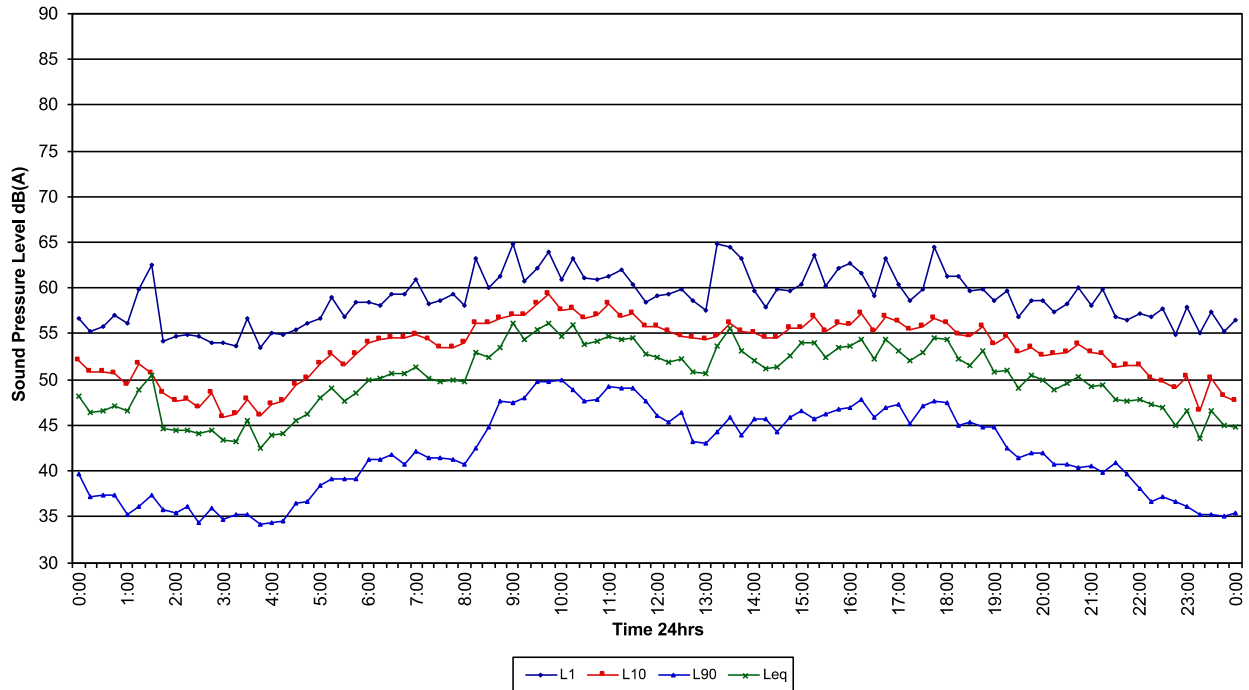




### 1-3 Hope St, Penrith

Ambient

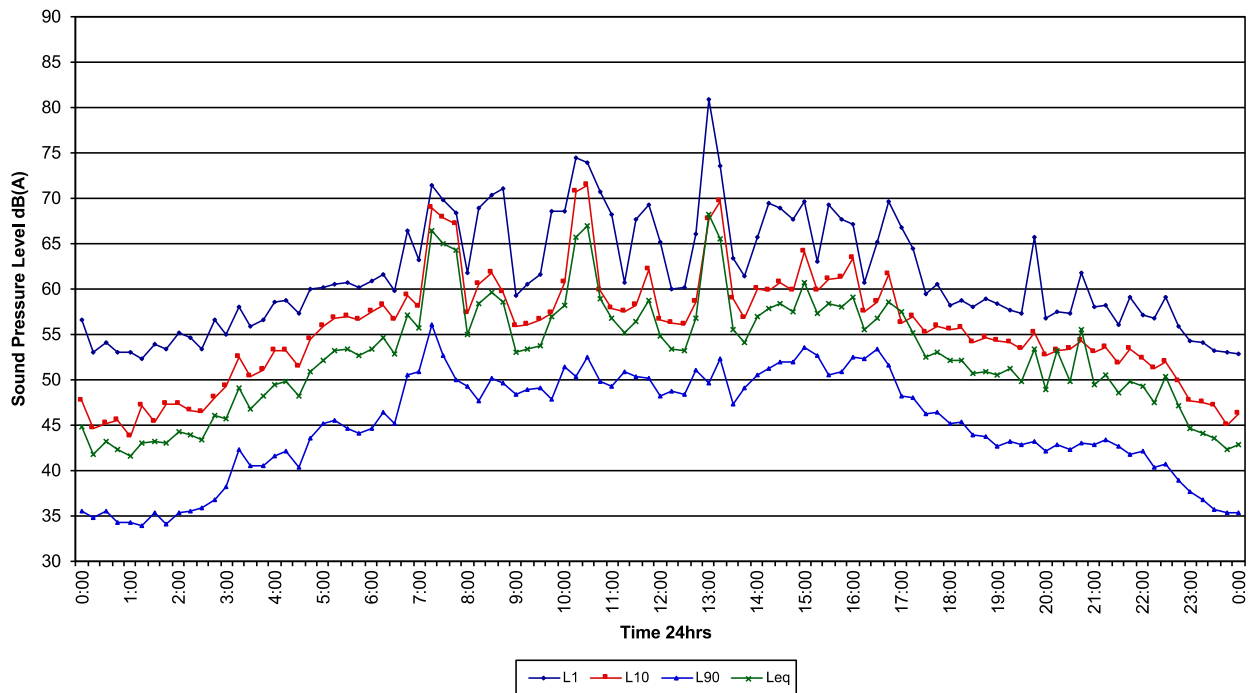
Sunday 8/9/19



### 1-3 Hope St, Penrith

Ambient

Monday 9/9/19

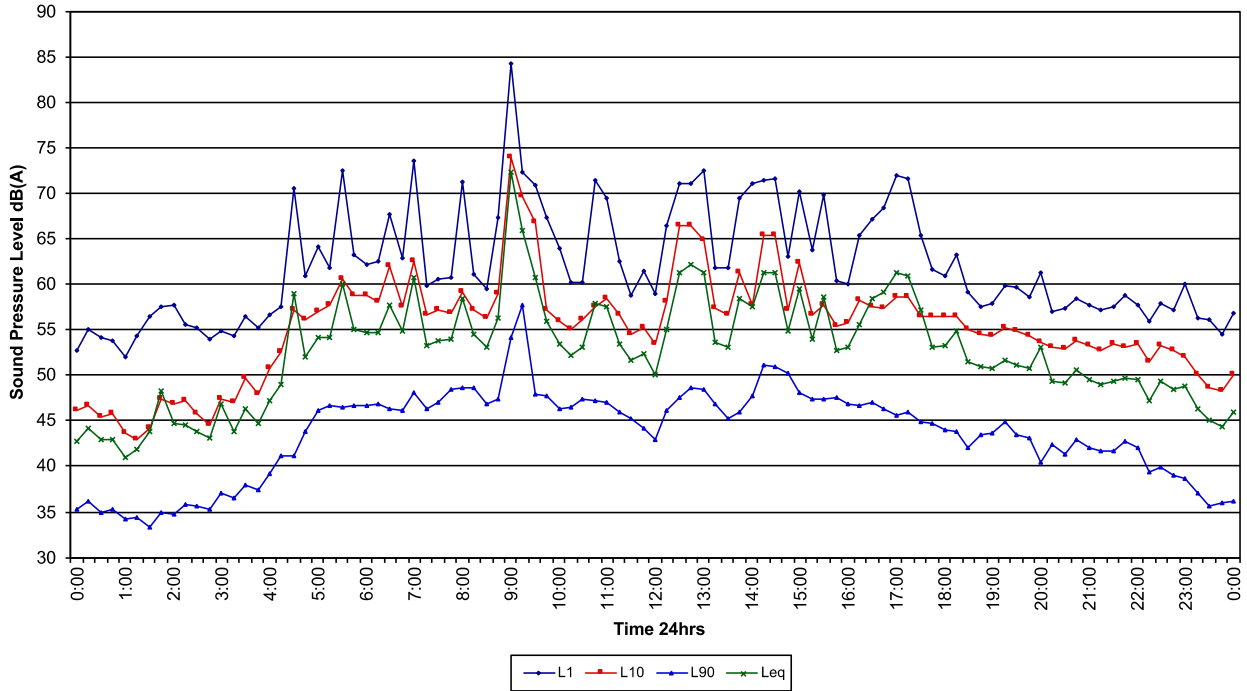




### 1-3 Hope St, Penrith

Ambient

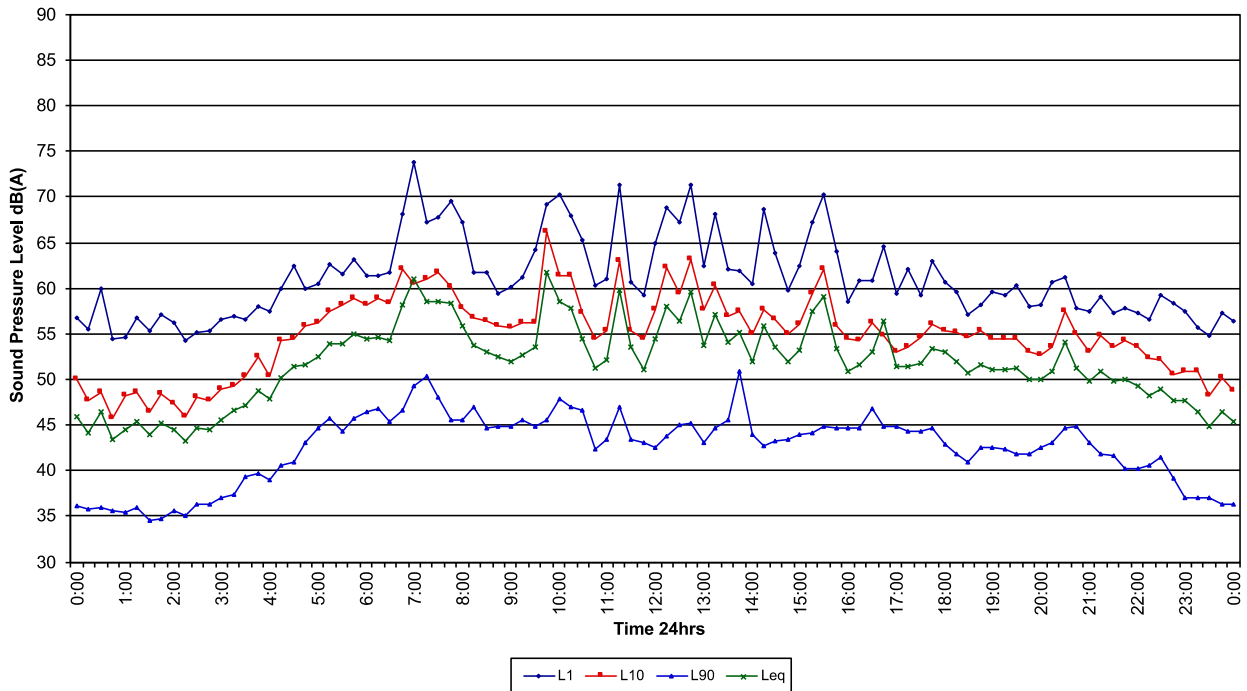
Tuesday 10/9/19



### 1-3 Hope St, Penrith

Ambient

Wednesday 11/9/19

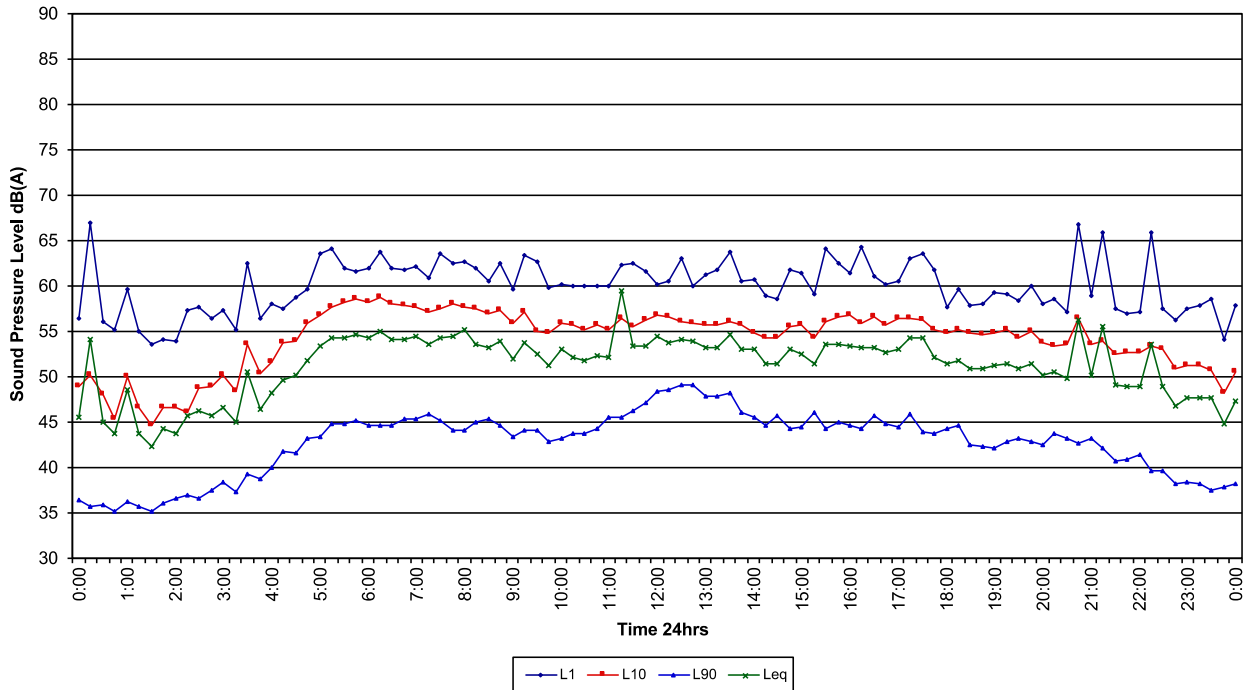




### 1-3 Hope St, Penrith

Ambient

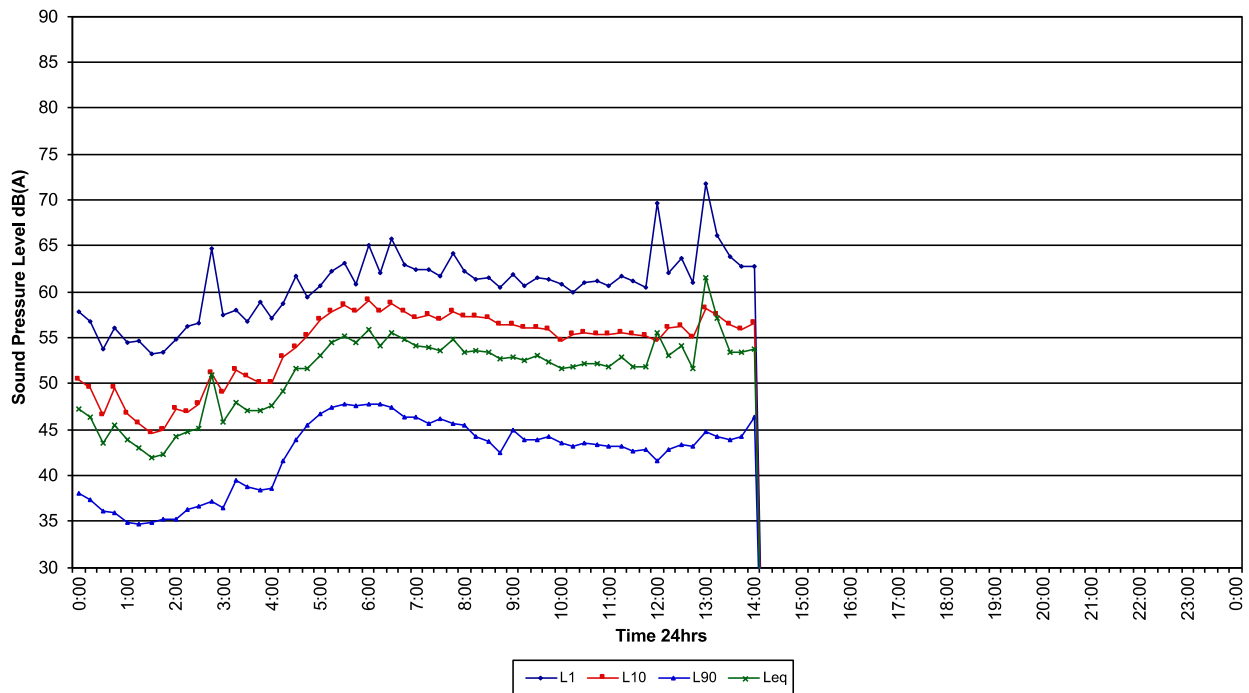
Thursday 12/9/19



### 1-3 Hope St, Penrith

Ambient

Friday 13/9/19





## Appendix C

## Calibration Certificates



**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

IEC 61672-3:2013

## Calibration Certificate

Calibration Number C19042

**Client Details** Acoustic Research Labs Pty Ltd  
Level 7, Building 2, 423 Pennant Hills Road  
Pennant Hills NSW 2120

**Equipment Tested/ Model Number :** RION 42-EX  
**Instrument Serial Number :** 01173760  
**Microphone Serial Number :** 167371  
**Pre-amplifier Serial Number :** 74514

**Pre-Test Atmospheric Conditions**  
**Ambient Temperature :** 24.7°C  
**Relative Humidity :** 49.3%  
**Barometric Pressure :** 99.05kPa

**Post-Test Atmospheric Conditions**  
**Ambient Temperature :** 24.2°C  
**Relative Humidity :** 56%  
**Barometric Pressure :** 99.53kPa

**Calibration Technician :** Lucky Jaiswal  
**Calibration Date :** 24 Jan 2019

**Secondary Check:** Lewis Boorman  
**Report Issue Date :** 24 Jan 2019

**Approved Signatory :**

Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	Pass
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	Pass
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement -			
Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	±0.16dB	Temperature	±0.05°C
12.5kHz	±0.21dB	Relative Humidity	±0.46%
16kHz	±0.29dB	Barometric Pressure	±0.017kPa
Electrical Tests			
31.5 Hz to 20 kHz	±0.12dB		

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

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



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

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

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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**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 IEC 61672-3:2013 Calibration Certificate

Calibration Number C18259

<b>Client Details</b>	Acoustic Research Labs Pty Ltd Level 7, Bld 2, 423 Pennant Hills Road Pennant Hills NSW 2120
<b>Equipment Tested/ Model Number :</b>	Rion NL-42EX
<b>Instrument Serial Number :</b>	00221356
<b>Microphone Serial Number :</b>	138581
<b>Pre-amplifier Serial Number :</b>	141369
<b>Pre-Test Atmospheric Conditions</b>	<b>Post-Test Atmospheric Conditions</b>
Ambient Temperature : 22°C	Ambient Temperature : 22.2°C
Relative Humidity : 46%	Relative Humidity : 46%
Barometric Pressure : 98.96kPa	Barometric Pressure : 98.96kPa
<b>Calibration Technician :</b> Lucky Jaiswal	<b>Secondary Check:</b> Lewis Boorman
<b>Calibration Date :</b> 13 Jun 2018	<b>Report Issue Date :</b> 13 Jun 2018
<b>Approved Signatory :</b>	Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	Pass
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	Pass
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement - Environmental Conditions			
Acoustic Tests		Temperature	±0.3°C
31.5 Hz to 8kHz	±0.15dB	Relative Humidity	±2.5%
12.5kHz	±0.21dB	Barometric Pressure	±0.017kPa
16kHz	±0.29dB		
Electrical Tests			
31.5 Hz to 20 kHz	±0.12dB		

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



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

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

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

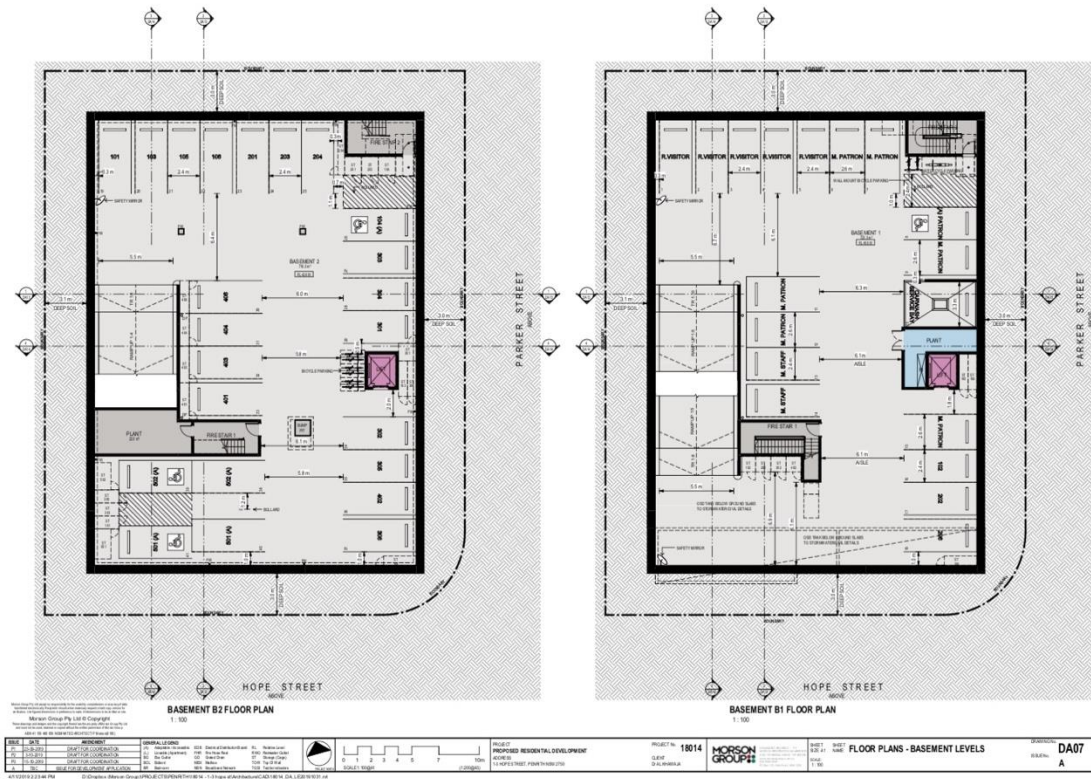
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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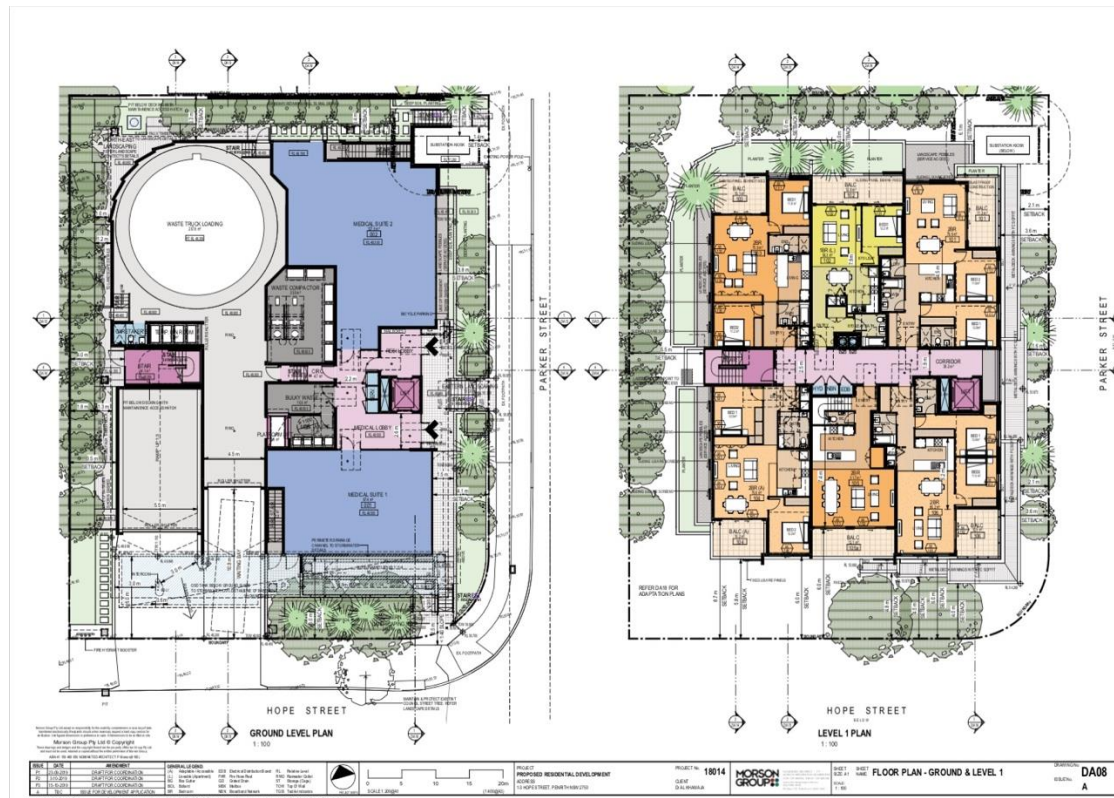


## Appendix D Architectural Plans

### Proposed Basement One and Two Plans



### Proposed Ground and First Floor Plans





### Proposed Second and Third Floor Plans



### Proposed Fourth and Fifth Floor Plans









# Streetscape



STREETSCAPE ELEVATION - HOPE STREET (SOUTH)  
1:200



STREETSCAPE ELEVATION - PARKER STREET (EAST)  
1:200

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<b>DATE</b> 2019/12/19	<b>REVISION</b> 0	<b>ELEVATION &amp; SECTION LABEL</b> STREETSCAPE ELEVATION - HOPE STREET (SOUTH)	<b>SCALE</b> 1:200	<b>PROJECT</b> PROPOSED RESIDENTIAL DEVELOPMENT	<b>PROJECT NO.</b> 19014	<b>CLIENT</b> DA CONSULTANTS	<b>DATE</b> 2019/12/19	<b>SHEET</b> SITE ANALYSIS - SHEET 2	<b>REVISION</b> A	<b>MOHSON GROUP</b>	



## Appendix E – Glazing Guideline

A table showing typical glass thicknesses and their  $R_w$  Values is provided in Appendix E. Please note that these table must be used as a **GUIDE** only, please note that the  $R_w$  rating is required for the complete glazing and frame assembly. The minimum glazing thicknesses will not necessarily meet the required  $R_w$  rating without an appropriate frame system. It will be therefore necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting the requirements in

Aluminium Awning Window					
	Glass	4mm Float	6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals	Standard	Qlon	Qlon	Qlon
	STC	28	33	34	34
	RW	29	33	33	34
Aluminium Sliding Window					
	Glass	4mm Float	6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals	Standard	Fin	Fin	Fin
	STC	23	24	25	25
	RW	22	24	25	25
Aluminium Double Hung					
	Glass	5mm Float	6.38 Laminated		
	Seals	Standard	Fin		
	STC	24	27		
	RW	24	26		
Aluminium Fixed Window (Awning Frame)					
	Glass	4mm Float	6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals	-	-	-	-
	STC	28	32	33	34
	RW	28	33	33	33
Secondary Glazing - Sound Barrier Window (AAW/ASW)					
	Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals		Qlon	Qlon	Qlon
	STC		44	45	46
	RW		44	45	45
Aluminium Sliding Door					
	Glass	4mm Toughened	6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals	standard	Fin	Fin	Fin
	STC	22	30	33	33
	RW	21	29	33	33
Aluminium Glazing - Sound Barrier Door					
	Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals		Fin	Fin	Fin
	STC		44	45	46
	RW		44	44	45
Aluminium Hinged Door*					
	Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals		Qlon	Qlon	Qlon
	STC		29	30	30
	RW		29	30	30
Aluminium Bifold Door*					
	Glass		6.38 Laminated	8.38 Laminated	10.38 Laminated
	Seals		Qlon	Qlon	Qlon
	STC		25	29	29
	RW		27	29	29