RODNEY STEVENS ACOUSTICS

REPORT R240453R1

Revision 3

Noise and Vibration Impact Assessment

Proposed Mixed Use Development

241 – 245 Pennant Hills Road, Carlingford

PREPARED FOR:
Triple Eight Corporation Pty Ltd

16 October 2025

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PREPARED BY:

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R240453R1	Revision 3	17 October 2025	Brian Mendieta	Desmond Raymond	Desmond Raymond

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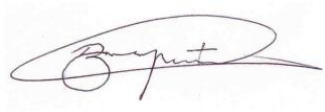
SEARs Requirements Declaration: Project

Declaration		
Name	Brian Mendieta	
Qualifications	Masters in Acoustic Design Science, Sydney University Member of the Acoustic Society	
	The undersigned declares that this Noise and Vibration Impact Assessment has been prepared in response to the following SEARs requirements issued for the Project on 16/10/2025 for SSD-84699461:	
SEARs item no.	**SEARs Requirement**	**Relevant Section of this Report**
10	Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented	Sections 3 to 10
Signed		
Dated	17 October 2025	

1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (RSA) has been engaged by Triple Eight Corporation Pty Ltd to prepare a noise impact assessment for the proposed mixed-use development with in-fill affordable housing (the proposal) to be located at 241 – 245 Pennant Hills Road, Carlingford (the site).

This report details the results of a noise survey and assesses the likely impact of noise (principally from traffic noise) incident upon the proposed mixed-use development as well as noise from the proposed Child Care Centre and proposed gymnasium upon nearby residential premises. The assessment also includes a noise and vibration impact assessment from the construction of the proposed development.

This report accompanies a State Significant Development Application that seeks approval for the demolition and construction of a mixed-use residential and commercial development including infill affordable housing, which involves the following:

- Site preparation works, including demolition of existing structures, vegetation removal as necessary, and bulk excavation.
- Construction and operation of a mixed-use development comprising commercial premises, gymnasium, child care centre and shop top housing as follows:

- One 18-storey building (Building A) in the Northeast corner of the site; and two 4-5 storey buildings (Building B & C) along the western edge of the site.
- A publicly accessible through site link between Pennant Hills Road and Felton Road.
- 6 commercial tenancies at ground floor
- A three-storey gymnasium within the southern portion of Building C
- A 98 place child care centre located on level 01 of Building A
- 2680m^2 of communal open space in the following locations:
    - the roof of Building A, B and C,
    - the two-storey podium of Building A
    - the publicly accessible through site link
- A total of 136 residential apartments across the three buildings, including 25 infill affordable apartments,
- Provision of three levels of basement parking with a total of 263 car parking spaces comprising:
- 151 residential car parking spaces (including 24 accessible spaces);
- 30 commercial car parking spaces (including 4 accessible spaces);
- 25 child care parking spaces (including 4 accessible spaces);
- 26 gymnasium parking spaces (including 2 accessible spaces);
- 28 visitor car parking spaces (including 12 accessible spaces); and
- 3 car share spaces.
- Street tree planting and landscaping, extension and augmentation of services and infrastructure as required. For a detailed project description, refer to the Environmental Impact Statement prepared by Planning Direction.

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

2 PROPOSED DEVELOPMENT

2.1 Existing Site

The site is identified as 241-245 Pennant Hills Road, Carlingford within the City of Parramatta Local Government Area (LGA). It is situated in the western portion of the Carlingford Local Centre and is located approximately 18km northwest of the Sydney Central Business District (CBD).

The site is an irregular triangular shape and comprises approximate frontages of 140m to Pennant Hills Road to the southeast, 100m to Felton Road to the north and 135m to the adjoining properties to the west. The site comprises a total area of 6331m^2, with the entirety of the site under single ownership.

The site is described in Table 2-1 below and illustrated in the Site Aerial Map in Figure 2-1 following.

Table 2-1 Site Description

Reference	Street Address	Legal Description	Area
1	**241-245 Pennant Hills Road**	**Lot 1 DP**805059	**-**
2	**241-245 Pennant Hills Road**	**Lot 2 DP**805059	**-**
3	**241-245 Pennant Hills Road**	**Lot 5 DP**805059	**-**
4	**241-245 Pennant Hills Road**	**Lot 6 DP**805059	**-**
total			**6331**m^2

Architectural plans of the proposed development are shown from Figure 2-2 to Figure 2-5.

Figure 2-1 Site Location

2.2 Proposed Childcare Centre Details

2.2.1 Childcare Centre Hours of Operation

The following hours of operation of the Child Care Centre are:

- Monday to Friday 7:00 am until 6:00 pm

2.2.2 Enrolment Numbers

The proposed Child Care Centre plans to cater for up to 98 children between the ages of 0 and 5 years of age. The number of children and their age groups are as follows:

- 0-2 years old - 15 Children
- 2-3 years old - 30 Children
- 3-5 years old - 53 Children

2.2.3 Outdoor Play Activities

In RSA's experience with Child Care Centres, potential noise issues occur primarily when children are engaged in outdoor play activities, in terms of intrusive environmental noise to the play areas and play area noise to nearby sensitive receivers.

Figure 2-2 Ground Floor Plan

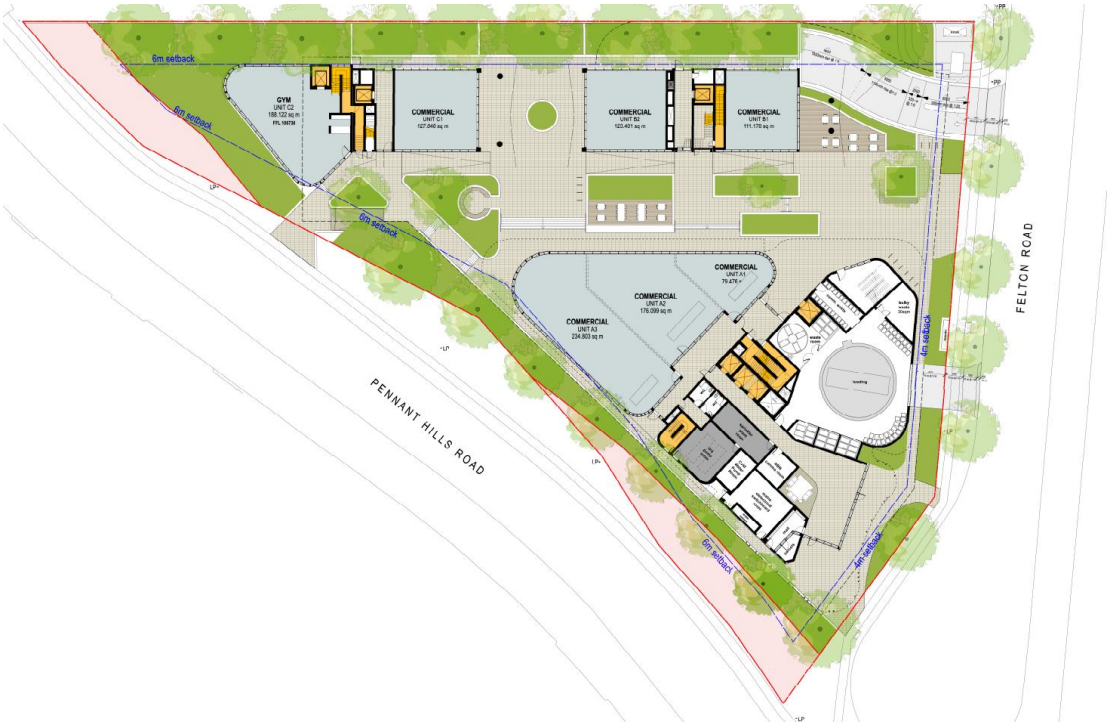


Figure 2-3 Level 1 Floor Plan (Childcare Centre)

Figure 2-4 Level 2 Floor Plan

Figure 2-5 Level 3 Floor Plan and above

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 13th and Monday 23rd June 2025 at the logging locations shown in Figure 2-1.

Logger 1 was located at a residential property located 28 Felton Road, located farther west from the site. The noise monitoring at this location is representative of the ambient noise of the area.

Logger 2 was located at a residential property at 221 Pennant Hills, Road overlooking Pennant Hills Road. The noise monitoring at this location is representative traffic noise from Pennant Hills Road.

Logger 3 was located on the north-east side of the site. The noise monitoring at this location is ambient noise influenced by noise from traffic and substation.

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 other landowners.

Instrumentation for the survey comprised of three SVAN-977 environmental noise loggers (serial numbers 99043, 97593 and 98819) fitted with microphone windshields. Calibration of the loggers was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Noise data affected by significant weather conditions (i.e. heavy rain and strong winds) was removed from the noise analysis; this includes measurement taken on the 17th June 2025.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} 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 L_{A1}, L_{A10}, L_{A90} and L_{Aeq} for each 15-minute monitoring period.

3.2 Data Processing

In order to assess noise emission from the proposed mixed-use development, the data obtained from the three noise loggers have 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 NPfI 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
Noise Logger 1 – 28 Felton Road	L_{Aeq}	55	48	45
	RBL (Background)	38	38	31
Noise Logger 2 – 221 Pennant Hills, Road	L_{Aeq}	68	67	65
	RBL (Background)	57	55	37
Noise Logger 3 – North-Eastern Boundary of Site (Pennant Hills Road)	L_{Aeq}	62	60	59
	RBL (Background)	53	52	45

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

L_{Aeq} 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.

L_{A90} 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 (Transport and Infrastructure) 2021)

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

The time periods used for this assessment are as defined in the State Environmental Planning Policy (Transport and Infrastructure) 2021and 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 SEPP 2021 Periods

Location	Period	External Noise Levels dB(A)
221 Pennant Hills Road	Day Time 7:00 am - 10:00 pm	$L_{Aeq(15hour)}$ 68
	Night Time 10:00 pm - 7:00 am	$L_{Aeq(9hour)}$ 65

4 ROAD TRAFFIC AND RAIL NOISE AND VIBRATION IMPACT ASSESMENT

4.1 Road Traffic Noise Criteria

4.1.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW Government's State Environmental Planning Policy – SEPP - (Transport and Infrastructure) 2021 was introduced to facilitate the delivery of infrastructure across the State by improving regulatory certainty and efficiency. The SEPP In accordance with the SEPP (Transport and Infrastructure) addresses roads carrying more than 20,000 Annual Average Daily Traffic (AADT). 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 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 dwelling will require mechanical ventilation is an $L_{Aeq(9hour)}$ of 55 dB(A) for bedrooms and $L_{Aeq(15hour)}$ of 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.

4.1.2 Rail Noise & Vibration Criteria

The NSW Department of Planning and Infrastructure's publication 'Development Near Rail Corridors and Busy Roads – Interim Guideline' provides acoustic assessment guidelines for new developments near rail line corridors and roads.

Section 3.5.1 of the guidelines provides an acoustic assessment zone based on distance between the noise-sensitive development from the operation train track. Any noise sensitive development within 80m from a train line for passenger and freight services moving greater than 80km/h would require some kind of acoustic assessment. An extraction of the distance guideline is provided below.

Figure 4-1 Acoustic Assessment Zone

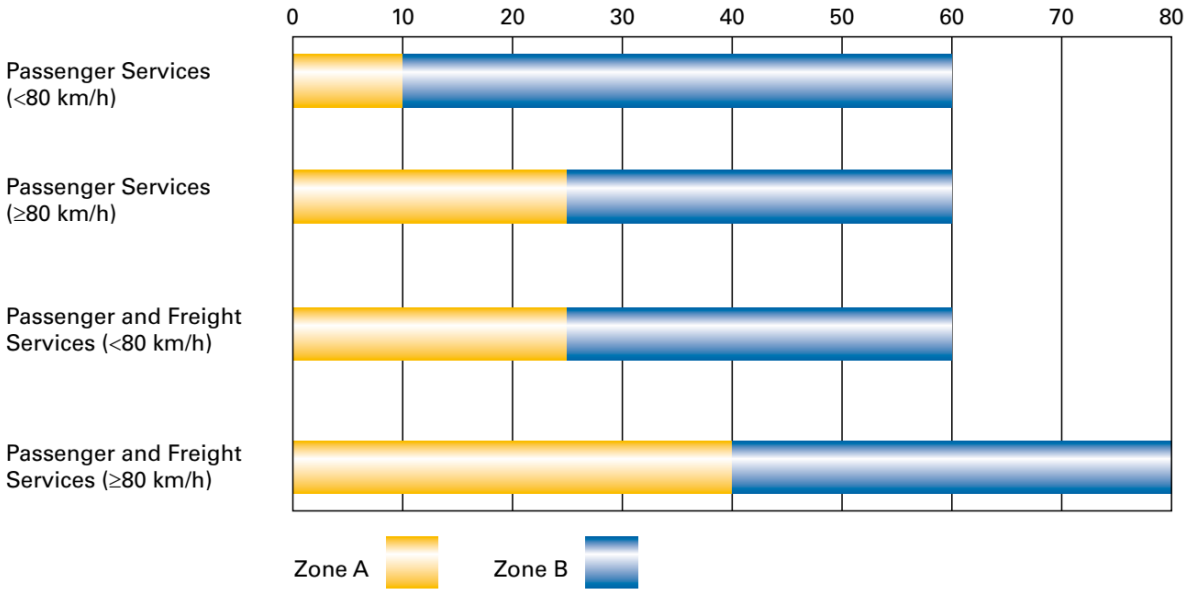


Figure 3.1: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)

The distance for rail vibration assessment requirement is between 0m and 60m, as outlined in Section 3.5.1 of the guideline. The site is approximately 100m east from nearest rail line. Therefore, rail noise and vibration assessment for this development is not required. However, road traffic noise is undertaken to ensure the development attenuates existing ambient noise levels impacting on the proposed development and achieves internal noise limits.

4.1.3 Road Traffic Noise Assessment

In order to ascertain the existing traffic noise levels from Pennant Hills Road, the measured noise logger data was processed in accordance with 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 façade acoustic requirements were determined in accordance with the methodology set out in Australian Standard 3671 – 'Road traffic noise intrusion, Building siting and construction.' The calculation for the recommended facades are based on various factors including, the measured traffic noise, indoor design sound level criteria, reverberation time, and the room and partition dimensions provided by the architectural floor plans.

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

4.2 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).

4.3 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 below.

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.

Figure 4-2 Building ID Layout

Table 4-2 presents the minimum recommended R_w (weighted noise reduction) for glazing elements.

Table 4-2 Minimum Acoustic Rating (R_w) Required for Glazing Elements

Building ID	Room	Orientation	Glazing Rw Requirement
Building A Ground to Level 5	Bedroom	South-East	Rw 41
		North	Rw 38
		West	Rw 33
	Living	South-East	Rw 40
		North	Rw 37
		West	Rw 33
	Ground Floor Commercial A3 & Child Care Centre	All	Rw 41
	Commercial A1 and A2	All	Rw 33
Building A Level 6 to 9	Bedroom	South-East	Rw 39
		North	Rw 36
		West	Rw 32
	Living	South-East	Rw 38
		North	Rw 35
		West	Rw 32
Building A Level 10 and above	Bedroom	South-East	Rw 35
		North	Rw 33
		West	Rw 32

Building ID	Room	Orientation	Glazing Rw Requirement
Building B	Living	South-East	Rw 36
		North	Rw 33
		West	Rw 32
	Bedroom	South & East	Rw 32
		North	Rw 30
		West	Rw 30
	Living	South-East	Rw 32
		North	Rw 30
		West	Rw 30
	Ground Floor Commercial	All	Rw 32
Building C	Bedroom	South & East	Rw 41
		North	Rw 32
		West	Rw 30
	Living	South & East	Rw 40
		North	Rw 33
		West	Rw 31
	Ground Floor Commercial	All	Rw 38

The following table presents the Rw ratings of different glass thicknesses, please note that these are shown as a guide only, all final glazing system selections must comply with the requirements in Section 4.3. The glazing installer must certify that all systems have been installed as per manufacturer's instructions.

Table 4-3 Glass Thickness Guideline

Glass Thickness	Rw Rating (Glass Pane Only)
5mm	26
6mm	28
6.38mm Laminated	32
8.38 Laminated	34
10.38 Laminated	36
12.38 Laminated	37
4mm – 50mm Airgap – 6mm Double Glazed	41

4.4 Roof/Ceiling

The overall acoustic rating required is Rw 45 (minimum). The proposed roof will consist of concrete slab which is greater than Rw 45. No further acoustic requirements are needed.

For all other rooves that do not consist of concrete, a roof with the following construction would comply with the Rw 45:

- A steel metal roof with minimum Bradford Anticon 60 MD over timber or steel purlins
- 165mm Bradford Gold Batts R 3.0;
- Rondo suspended ceiling system with Gyprock resilient mounts
- Furring channel at 450mm max. centres;
- 1 x 13mm Gyprock Plus Plasterboard

If ventilators, heat extraction units or other openings into the ceiling cavity for lighting, ventilation, decoration or other purposes are to be provided, then care should be taken to ensure that such units are properly attenuated and all penetrations are properly sealed off so as not to degrade the rating of the roof/ceiling construction system. Care should also be taken to avoid any noise paths into the ceiling cavity via the eaves.

4.5 External Walls

The following wall construction recommendations are given as guidance only. It is understood that the proposed wall will consist of brick/masonry with internal stud plasterboard system. The masonry external walls will be required to achieve a rating of R_w 50. This Rw rating is generally achieved with a standard construction with insulation. No further acoustic requirements are needed.

4.6 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.

4.7 Mechanical Ventilation Requirement

Table 4-4 presents the ventilation requirement for the bedroom and habitable spaces in order to achieve the internal noise limit while providing ventilation to the room in question. The ventilation may consist of either mechanical ventilation (i.e. air conditioning units), acoustic wall vents. It is recommended that the Silenceair 140mm acoustic wall ventilator or similar system be used for the units. Some rooms may have more ventilation options as they are less affected by road traffic noise. If the client wishes to change at a later stage of the development then it should be reviewed by a qualified acoustic consultant at the Construction Certificate Stage.

Table 4-4 Ventilation Requirement

Building	Orientation	Ventilation Requirement
Building A	East, North and South	Mechanical
	West	Mechanical/ Passive Air Wall Vents
Building B	East, North and South	Mechanical
	West	Mechanical/ Passive Air Wall Vents/ Open Window
Building C	East, North and South	Mechanical
	West	Mechanical/ Passive Air Wall Vents/ Open Window

5 DEVELOPMENT OPERATIONAL NOISE ASSESSMENT

5.1 Development Operational Noise Emission Criteria – Noise Policy for Industry

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 (NPfI) October 2017 which provides a framework and process for deriving project trigger noise level. The NPfI 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.

5.1.1 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 (LAeq) of the source should not be more than 5 dB(A) above the measured Rated Background Level (RBL), over any 15 minute period.

5.1.2 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.

5.1.3 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.

5.1.4 Project Specific Trigger Noise Levels

Having defined the area type, the processed results of the unattended noise monitoring have been used to determine the Project Noise Trigger Levels (PNTL). The intrusive and amenity criteria for nearby residential premises are presented in Table 5-1.

Table 5-1 Operational Project Trigger Noise Levels

Receiver	Time of Day	ANL [1] L_{Aeq}	Measured		Project Trigger Noise Levels	
			RBL [2] $L_{A90(15min)}$	Existing $L_{Aeq(Period)}$	Intrusive $L_{Aeq(15min)}$	Amenity $L_{Aeq(15min)}$
28 Felton Road Noise (West from Site)	Day	60	38	55	**43**	58
	Evening	50	38	48	**43**	48
	Night	45	31	45	**36**	43
221 Pennant Hills, Road (South from site)	Day	60	57	68	62	**58**
	Evening	50	55	67	60	**48**
	Night	45	37	65	**42**	43
North-East of Site	Day	60	53	62	**58**	**58**
	Evening	50	52	60	57	**48**
	Night	45	45	59	50	**43**
Commercial	All	65	-	-	**-**	**63**

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

Note 2: RBL = “Rating Background Level”.

5.1.5 NPfI Sleep Disturbance

The NSW EPA Noise Policy for Industry (NPfI) provides a guidance for sleep disturbance or sleep arousal assessment. The NPfI states the following:

> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages. Where the subject development/premises night-time noise levels at a residential location exceed:*
> *• LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
>
> *• LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy*
>
> *Other factors that may be important in assessing the extent of impacts on sleep include:*
>
> *• how often high noise events will occur*

• the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development

• whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)

• current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response.

The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels

5.2 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 5-1 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.

5.3 Communal Noise Impact Assessment

5.3.1 Typical Vocal Levels

Calculations of the amount of noise transmitted to these receivers from the proposed multistorey mixed-use development have been based on voice levels as referenced in the Handbook of Acoustical Measurements and Noise Control by Cyril M. Harris. This handbook provides voice spectrums for males and females as well as different vocal efforts. The spectrum is given in Table 5-2.

The spectra have been scaled based upon the overall number of patrons expected to be in the outdoor areas at any given time.

Table 5-2 Speech Spectrums - Handbook of Acoustical Measurements and Noise Control.

Type	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)							Overall dB(A)
	125	250	500	1 k	2 k	4 k	8 k	
Male (Normal)	49	55	58	51	47	43	37	58
Female (Normal)	37	51	54	49	44	43	38	55

It is generally agreed that the human voice is not capable of producing noise at 32 Hz and 63Hz octave bands at significant amplitudes

5.3.2 Tenant Sound Power Levels

Based on a maximum number of 160 tenants in the communal open space (assuming that 1 tenant per unit will be using the space), the following worst-case operational scenarios have also been assumed for our assessment:

- A total of 160 people will be using the communal open space. Therefore, 50 percent of the patrons will be talking (one person talks and one person listens), the worst case scenario will be 80 tenants talking at any one time in the communal open space.

Table 5-3 Sound Power Levels of People talking with Raised Vocal - L_w – dB(A)

Scenario	Resultant Sound Power Level per Octave Band (dB)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Building A Level 2 - 10 Tenants with Normal Vocal in the Outdoor Area	73	79	82	79	74	69	63	73
Building C Level 4 - 100 Tenants with Normal Vocal in the Outdoor Area	83	89	92	89	84	79	73	83
Building A Level 14 - 50 Tenants with Normal Vocal in the Outdoor Area	80	86	89	86	81	76	70	80

5.3.3 Noise Emissions Calculation

Calculations of the noise levels from the use of the communal open space have been carried out using the data in Table 5-3. We have used the worst case scenario where 160 tenants are using the communal open space at the same time. Calculations take into account factors such as distance, shielding from buildings and barriers.

The following figure presents the proposed development and all sensitive receivers. Table 5-4 shows the address of each affected receiver.

Figure 5-1 Sensitive Receiver Location

Table 5-4 Sensitive Receivers

Receiver	Number of Levels	Sensitive Receiver's Address
R1	3	6 Felton Road, Carlingford
R2	2	237 Pennant Hills Road, Carlingford
R3	4	292 Pennant Hills Road, Carlingford
R4	4	294-302 Pennant Hills Road, Carlingford
C1	1	7-Eleven - 243 Pennant Hills Road, Carlingford

5.3.4 Predicted Noise Levels

Predictive resultant noise levels have been calculated for residents using the communal open space. Noise emissions at the nearest residential receivers are presented in the table below. The predicted noise calculations take into account the following:

- Heights of receivers are assumed to be 1.5 meters above their respective floor level.
- The balustrade on the west, north and south boundaries is a solid 1.2 meters fence.
- Up to 160 people will be using the communal open space at a time.
- The communal open spaces should only be used between 7:00am and 10:00pm.
- Resulting noise levels have been calculated to the most affected point at the receiver location (refer to Figure 5-1)

Table 5-5 Predicted Noise Levels At Sensitive Receivers – Communal Areas

Receiver	Period	Calculated Noise Level L_{Aeq} – dB(A)	Criteria	Compliance
R1	Day	41	43	Yes
	Evening	41	43	Yes
R2	Day	31	43	Yes
	Evening	31	43	Yes
R3	Day	36	58	Yes
	Evening	36	48	Yes
R4	Day	40	58	Yes
	Evening	40	48	Yes
C1	All	26	63	Yes

We note that our calculations assumed that the communal open space will only be used by the tenants and no social gatherings will take place.

5.4 Development Noise Control Recommendations

5.4.1 Communal Area Noise Management

The following communal rooftop management plan are to be implemented:

- The Communal space should not be used during the night period (between 10:00pm and 7:00am).
- Background music is permitted between 9am and 6pm but not during the evening and night time period between 6pm and 7am.
- All tenants should be provided with contact details of the Strata Board Committee members to permit tenants to make a complaint to excessive noise from the communal area.

5.4.2 Loading Dock Noise Management

Noise Management of the loading dock should include:

- Amplified music within the storage/docking area should not be played between 10:00pm and 7:00am. Speakers should be inside the commercial building and not outside.
- Deliveries should only be made between the hours of 7:00am and 6:00pm.
- Truck drivers onsite should avoid extended period of engine idling.
- Regular maintenance of roller should be undertaken to minimise .
- The loading dock ceiling on the ground floor should be fitted with absorption material/panels with a Noise Reduction Coefficient (NRC) of 0.7 to absorb noise emission from the loading dock.
- The loading dock roller door should be isolated from the building structure to minimise structure borne noise transmission.
- The turning table within the floor of the ground level is to be vibration isolated from the building structure.

6 CHILDCARE CENTRE NOISE ASSESSMENT

6.1 Child Care Centre Noise Criteria

A guideline for the assessment of noise from child care centres has been prepared by the Association of Australian Acoustical Consultants (AAAC). The document, *AAAC Technical Guideline Child Care Centre Noise Assessment V3.0*, provides criteria for the assessment of noise intrusion into and noise emissions from Child Care Centres and also provides recommendations for treatment to minimise acoustical impacts upon neighbouring premises.

6.1.1 Outdoor Play Noise Criteria

Since the time in which children are involved in outdoor play can be limited, the potential impact associated with these noise emissions reduces. The AAAC considers a total limit of 4 hours outdoor play per day (typically 2 hours in the morning and 2 hours in the afternoon) reasonable to apply a criterion of $L_{Aeq(15minute)}$ noise level emitted from the outdoor play area not exceed the background noise level by more than 10 dB at the assessment location. However, if the proposed outdoor play time is more than 4 hours per day, the $L_{Aeq(15minute)}$ noise level emitted from the outdoor play area must not exceed the background noise level by more than 5 dB at the assessment location.

Where the measured ambient noise level of a particular area is below 40 dB(A), the AAAC provides a specific base criterion in Section 3.2.1 of the guidelines. A base criterion of a contributed $L_{eq,15min}$ 45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A). In this case the noise criteria for outdoor play area noise is 45 dB(A).

We have assumed that the proposed child care centre will not operate more than 4 hours of outdoor play time per day, therefore, the noise criterion for noise emissions from outdoor activities to all surrounding residential receivers is

- R1 Noise Logger (Western Residential Receivers): daytime 45 **dB(A)**
- R2 Noise Logger (Onsite Receivers): daytime L_{A90} 53dB(A) + 5 dB(A) **$L_{Aeq(15minute)}$ 58 dB(A)**
- R3 Noise Logger (South-Western Receivers): daytime L_{A90} 63dB(A) + 5 dB(A) **$L_{Aeq(15minute)}$ 61 dB(A)**

6.1.2 Road Noise Intrusion to Outdoor Playground

For the assessment of road traffic noise impact on the outdoor play areas, the Association of Australian Acoustical Consultants (AAAC). The document, *AAAC Technical Guideline Child Care Centre Noise Assessment V3.0* has been used to determine the appropriate noise level. In accordance with the AAAC, the noise criterion for outdoor play areas is as follow:

- Outdoor play areas – $L_{Aeq,(1hour)}$ 55 dB(A) (external).

6.1.3 Noise Intrusion to Indoor Areas

For the assessment of road traffic noise impact on the indoor play areas, the Association of Australian Acoustical Consultants (AAAC). The document, *AAAC Technical Guideline Child Care Centre Noise Assessment V3.0* has been used to determine the appropriate noise level. In accordance with the AAAC, the noise criterion for outdoor play areas is as follow:

- Indoor play areas – $L_{Aeq,(1hour)}$ 40 dB(A) (internal).
- Sleeping areas – $L_{Aeq,(1hour)}$ 35 dB(A) (internal)

6.1.4 Other Noise Emissions

Based on Section 3.2.2 of the AAAC guidelines, the cumulative $L_{eq,15\ minute}$ noise emission level resulting from the use and operation of the child care centre, with the exception of noise emission from outdoor play shall not exceed the background noise level by more than 5 dB at the assessment location. This includes the noise emission resulting from:

- Indoor play
- Mechanical plant
- Drop off and pick up
- Other activities/operations (not including outdoor play).

6.1.5 Other Sensitive Receivers

The NSW EPA's Noise policy for Industry (NPfI) provides noise criteria for non-residential sensitive receivers the specific noise criteria is presented below:

Table 6-1 Other Sensitive Receivers – Noise Criteria

Receiver	Time of Day	Recommended L_{Aeq}
School Classrooms – External	When in Use	45

6.1.6 Noise Criteria Summary

The following table presents a summary of the noise criteria required for each activity generated by the childcare centre.

Table 6-2 Noise Criteria Summary

Activity	Noise Criteria $L_{Aeq(T)}$
External Noise	
Outdoor Play	Residential R1 and R2 **45 dB(A)** Residential R3 and R4 **63 dB(A)** Building A, B and C onsite **58 dB(A)**
Indoor Play	Residential R1 and R2 **43 dB(A)** Residential R3 and R4 **63 dB(A)** Building A, B and C onsite **58 dB(A)**
Carpark	Residential R1 and R2 **43 dB(A)** Residential R3 and R4 **63 dB(A)** Building A, B and C onsite **58 dB(A)**

Activity	Noise Criteria $L_{Aeq(T)}$
Mechanical	Residential R1 and R2 **43 dB(A)** Residential R3 and R4 **63 dB(A)** Building A, B and C onsite **58 dB(A)**
Other activities/operations (not including outdoor play)	Residential R1 and R2 **43 dB(A)** Residential R3 and R4 **63 dB(A)** Building A, B and C onsite **58 dB(A)**
Internal Noise	
Indoor Play Areas	40
Sleeping Areas	35

6.2 Road Traffic Noise Intrusion into Centre

6.2.1 Outdoor Play Area

Based on the measured road traffic noise level of $L_{Aeq(1hour)}$ 73 dB(A) from Pennant Hills Road, the predicted traffic noise impacts at the outdoor play areas are presented in Table 6-3.

The following assumptions have been made in the noise modelling of the road traffic noise impacts on the outdoor play areas:

- Solid transparent wall ranging between surrounding the 3-5 year old and 0–2-year old outdoor play areas ranging between 1.8m and 4.5m high. It is also assumed the window on the east side of the 2-3 year old outdoor play area is closed.
- The outdoor play areas are located to the north-east, south-east and west side of the site.
- Road traffic noise impacts have been modelled from the centre line of the road to approximately the middle of the outdoor play areas.

Table 6-3 Predicted Road Traffic Noise Levels Into Outdoor Play Areas

Area	Predicted L_{Aeq} Road Traffic Noise Level – dB(A)	Noise Criterion L_{Aeq} – dB(A)	Compliance (Yes / No)
Outdoor Play Area – 0-2 Years	39	55	Yes
Outdoor Play Area – 2-3 Years	55	55	Yes

Area	Predicted L_{Aeq} Road Traffic Noise Level – dB(A)	Noise Criterion L_{Aeq} – dB(A)	Compliance (Yes / No)
Outdoor Play Area – 3-6 Years	50	55	Yes

Existing road traffic noise levels in the Outdoor Play areas are predicted to comply with the $L_{Aeq,(1hour)}$ 55 dB(A) (external) criterion stipulated in Section 6.1, provided the noise barrier recommendations are implemented.

6.2.2 Indoor Areas

The typical outdoor to indoor noise reductions provided by most standard glazed facades (i.e. without special acoustical treatment) is generally accepted as being 10 dB(A) through an open window and in the order of 20 dB(A) with windows closed.

The facade road traffic noise at the proposed child care centre building was measured to be $L_{Aeq(1hour)}$ 68 dB(A) from Pennant Hills Road. Taking into account the distance, shielding and glazing performance, the resultant indoor noise levels for opened and closed windows at the northern facade, corresponding to the typical noise reductions are as follow:

Table 6-4 Predicted Road Traffic Noise Levels Into Indoor Areas

Area	Predicted L_{Aeq} Road Traffic Noise Level – dB(A)		R_w Glazing Requirement	Noise Criterion L_{Aeq} – dB(A)	Compliance (Open / Closed)
	Windows Open	Windows Closed			
0-2 Indoor Play Area	29	<20	32	40	Open
2-3 Indoor Play Area	43	33	38	40	Closed
3-5 Indoor Play Areas	59	40	38	40	Closed

We 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 necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting the specified requirements.

6.3 Mechanical Plant Noise Assessment

Mechanical ventilation may be installed at the proposed childcare centre, the operation of such mechanical plant must be in accordance with the relevant regulations such as the Building Code of Australia (BCA Vol.1, Part 4.5 *Ventilation of rooms*) and AS1668.2-2002 *The use of ventilation and air conditioning in buildings* will be required.

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 relevant noise criteria may 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.

6.4 Operational Noise Emissions to Nearby Residences

6.4.1 Outdoor Play Activities Noise Impact

Potential noise management issues occur primarily when children are engaged in outdoor play activities. Noise generated by the children in the outdoor play area will occur at limited times throughout the day, with numbers of children playing and periods of play managed by the Centre staff.

The Association of Australian Acoustical Consultants (AAAC) technical guideline for Child Care Centre Noise Assessment V3.0 provides the following sound power levels (L_W) for various age groups of children.

Table 6-5 Effective Sound Power Levels ($L_{Aeq,\ 15min}$) for Groups of 10 Children Playing

Noise Descriptor	Noise Level (dB) at Octave Band Centre Frequency (Hz)								
	63	125	250	500	1 k	2 k	4 k	8 k	Overall dB(A)
0 to 2 Years	54	60	66	72	74	71	67	64	78
2 to 3 Years	61	67	73	79	81	78	74	70	85
3 to 5 Years	64	70	75	81	83	80	76	72	87

If applicable, an adjustment to the above sound power levels of -6 dB could be applied in each age group for children involved in passive play.

Calculations have been made based on the spectra above assuming all the children will be playing outside at the one time. The levels were scaled to reflect the overall sound power levels presented by the AAAC to determine the likely noise levels at nearby receivers due to 98 children playing in the Outdoor Play areas of the proposed Child Care Centre.

The following assumptions have been made in the noise modelling of the Outdoor Play areas noise impacts on the neighbouring residences:

- 15 between the ages of 0 and 2 with total sound power level of 79 dB(A), 30 children between the ages of 2 and 3 with total sound power level of 89 dB(A) and 53 children between the ages of 3 and 5 with total sound power level of 94dB(A) will be playing in the proposed outdoor play areas;
- The height of the residential receivers has been assumed to be 1.5 metres for residential buildings on their respective level;
- Source height in the outdoor play area, i.e. children height, have been taken to be 1 meter from the ground;
- Noise Barrier onsite, as per our noise control recommendation in Section 6.5 and the architectural plans consists of the following:

- A 1.8 meters high solid barrier along the eastern boundary of the site.
- Solid transparent wall ranging between surrounding the 3-5 year old and 0–2-year old outdoor play areas ranging between 1.8m and 4.5m high.

- Resulting noise levels have been calculated to the most affected point on the boundary of the affected receivers

The following figure shows the receiver locations in relation to the proposed Child Care Centre. Table 5-4 shows the address of each affected receiver

Figure 6-1 Receiver Locations

Table 6-6 Sensitive Receivers

Receiver	Number of Levels	Sensitive Receiver's Address
R1	3	6 Felton Road, Carlingford
R2	2	237 Pennant Hills Road, Carlingford
R3	4	292 Pennant Hills Road, Carlingford
R4	4	294-302 Pennant Hills Road, Carlingford
C1	1	7-Eleven - 243 Pennant Hills Road, Carlingford
Building A	17	Building A - 241-245 Pennant Hills Rd
Building B	4	Building B - 241-245 Pennant Hills Rd
Building C	4	Building C - 241-245 Pennant Hills Rd

The predicted noise levels experienced by nearest residential receivers are presented in Table 6-7 below. Noise levels have been calculated at the most affected boundary heights. The noise levels presented below are representative of the worst-case scenarios for receiver.

Table 6-7 Predicted Outdoor Play Activities Noise Emission

Receiver	Predicted Outdoor Play Activities Noise at Neighbouring Residents – dB(A)	Criteria	Compliance
R1	36	45	Yes
R2	28	45	Yes
R3	33	63	Yes
R4	45	63	Yes
C1	36	63	Yes
Building A	51	58	Yes
Building B	56	58	Yes
Building C	51	58	Yes

Noise from the outdoor play activities at the surrounding residences is predicted to comply with the noise criteria with scenario presented above.

6.4.2 Noise Emissions from Indoor Activities

Calculations have been carried out to ascertain the noise breakout from indoor activities to the neighbouring premises. The predicted noise levels indicate that the noise criteria will not be exceeded if the windows are in the configuration shown in Figure 6-2 the resulting noise levels are presented in Table 6-8 below. Noise levels have been calculated at the most affected boundary heights.

Table 6-8 Predicted Indoor Play Activities Noise Emission

Receiver	Predicted Indoor Play Activities Noise at Neighbouring Residents – dB(A)	Criteria	Compliance
R1	25	43	Yes
R2	20	43	Yes
R3	22	63	Yes
R4	49	63	Yes
C1	41	63	Yes
Building A	26	58	Yes
Building B	30	58	Yes
Building C	42	58	Yes

The assessment criterion for indoor playrooms can be achieved with the windows in the configuration shown in Figure 6-2.

6.4.3 Carpark Emission

The proposed car park is to be located on in the basement calculations of noise from the carpark have been based on typical noise generating events within a carpark such as, door slams, engine starts and cars driving away. We have assumed a scenario were 25 cars enter or leave the carpark in a span of 15 minutes.

The sound power levels of the vehicle movements have been sourced from RSA's noise spectra library and include the following:

Table 6-9 Carpark Sound Power Levels

Activity	Sound Power Level dB(A)
Door Slam	L_{Aeq} 88dB(A) and L_{Amax} 94dB(A)
Engine Start	L_{Aeq} 83dB(A)
Vehicle Pass By	L_{Aeq} 84dB(A)

The calculated noise levels from the activities carried out within the carpark are presented in the table below:

Table 6-10 Predicted Noise Levels at sensitive receivers - Carpark

Receiver	Period	Calculated Noise Level L_{Aeq} – dB(A)	Criteria	Compliance
R1	Day	27	43	Yes
	Evening	27	43	Yes
	Night	27	36	Yes
R2	Day	<20	43	Yes
	Evening	<20	43	Yes
	Night	<20	36	Yes
R3	Day	<20	58	Yes
	Evening	<20	48	Yes
	Night	<20	43	Yes
R4	Day	<20	58	Yes
	Evening	<20	48	Yes
	Night	<20	43	Yes
Building A	Day	<20	58	Yes
	Evening	<20	48	Yes

Receiver	Period	Calculated Noise Level L_{Aeq} – dB(A)	Criteria	Compliance
	Night	<20	42	Yes
Building B	Day	20	58	Yes
	Evening	20	48	Yes
	Night	20	42	Yes
Building C	Day	24	58	Yes
	Evening	24	48	Yes
	Night	24	42	Yes
C1	All	<20	63	Yes

Table 6-11 presents the L_{Max} noise prediction of vehicles entering the centre at night time. Noise prediction results are compared against the night time L_{Max} Sleep Disturbance criterion.

Table 6-11 Car Park Sleep Disturbance Noise Prediction

Receiver	Predicted Staff entering carpark before 7am noise at Neighbouring Residents – dB(A)	Morning Shoulder L_{Max} Criteria	Compliance
R1	43	**52**	Yes
R2	23	**52**	Yes
R3	<20	**60**	Yes
R4	21	**60**	Yes
Building A	<20	52	Yes
Building B	<20	52	Yes
Building C	36	52	Yes

Noise from vehicle movement on the premises is predicted to comply the sleep disturbance criterion.

6.4.4 Cumulative Noise Emissions

The following table presents the cumulative noise emissions from indoor play area and carpark. These results assume that all these noise generating activities are occurring simultaneously.

Table 6-12 Cumulative Child Care Centre Noise Levels

Receiver	Predicted Cumulative Noise at Neighbouring Residents – dB(A)	Criteria	Compliance
R1	29	43	Yes
R2	21	45	Yes
R3	22	63	Yes
R4	49	63	Yes
C1	41	63	Yes
Building A	26	58	Yes
Building B	30	58	Yes
Building C	42	58	Yes

Noise from vehicle movement on the premises is predicted to comply the relevant criteria.

6.5 Childcare Centre Noise Control Plan

The following recommendations must be implemented in order to achieve compliance with the criteria requirements:

6.5.1 Outdoor Play Areas

In order to achieve compliance with council's noise requirements for outdoor play, the following must be implemented:

- All children can engage in outdoor play at a time.
- No music is to be played in the outdoor areas.
- Children must be supervised at all times.

6.5.2 Indoor Play Areas

In order to achieve compliance with council's noise requirements for outdoor play, the following must be implemented:

- The windows must follow the configuration shown in Figure 6-2,

- The glazing for the windows indoor playrooms must adhere to the recommendations made in Table 4-2 and Table 6-4.

6.5.3 Car Park Noise Control Measures

The following noise control measures and management plan should be implemented for the carpark space:

- Parents and guardians should be informed of the importance of noise minimisation when entering or exiting the site, dropping off or picking up children. This includes avoiding raising your voice within the centre's carpark area or beeping car horn.

6.5.4 Noise Barrier Recommendation

Noise Barrier onsite should consist of a 1.8 meters high solid barrier along the western boundary of the site.

Acoustic barrier is required to provide the adequate noise attenuation, the construction material of the barriers must have a surface density of 15 kg/m^2 and be free from holes and gaps. Some suitable materials include:

- 25 mm thick plywood timber panelling
- 9 mm thick fibre cement sheet
- 75mm thick Hebel Powerpanel
- 12 mm thick Perspex, polycarbonate or Danpalon
- 6 mm toughened laminated safety glass
- Any other approved material which meets the above surface density specification

A typical material used in childcare centres is Perspex, which is a polycarbonate material. The use of the 12 mm thick Perspex or 6 mm glass for this purpose which has a surface mass of 14.3 kg/m^2 will meet the mass requirements detailed above and be suitable for use as it is transparent and will not unduly restrict light or vision.

All barriers must be free of gaps and penetrations and it is particularly important to ensure that the gap at the bottom of the barrier is minimised as far as practicable. The base of the barriers should be well sealed at the junction where the barrier meets the floor, but still be designed to allow proper water drainage.

Figure 6-2 Layout of Noise Control Requirements

7 GYM NOISE AND VIBRATION IMPACT ASSESSMENT

7.1 Gym Noise and Vibration Criteria - Association of Australasian Acoustical Consultants (AAAC) Gym Guidelines

The AAAC provides a guideline to access noise from gymnasiums and exercise facilities, the noise criteria is required to be in one octave band frequency. The noise logger used for the unattended measurements has the capability of recording noise data in one octave band frequency allowing us to establish spectral information of typical background noise levels experienced by the nearby residential receivers.

7.1.1 Noise Criteria for General Noise Emissions - Residential

a) The LA10(15min) noise contribution from music, patrons and staff emitted from the gymnasium or exercise facility shall not exceed the background noise level in any octave band frequency (31.5 Hz to 8 kHz inclusive) by more than 5 dB at the boundary, or within at any affected residence between 7am and 10pm (*8am on Sundays and public holidays).*

b) The LA10(15min) noise contribution from music, patrons and staff emitted from the gymnasium or exercise facility shall not exceed the background noise in any octave band centre frequency (31.5 Hz to 8 kHz inclusive) at the boundary, or within any affected residence between 10pm and 7am (*8am on Sundays and public holidays).*

c) Notwithstanding compliance of the above, noise from music, patrons and staff at the gymnasium or exercise facility shall not be audible in any habitable room in any residential premises between the hours of 10pm and 7am (*8am on Sundays and public holidays).”*

d) Where the LA10(15min) noise level is below the threshold of hearing, Tf at any Octave Band Centre Frequency as defined in Table 1 of International Standard ISO 226:2003 “Acoustics – Normal equal-loudness-level contours” then the value of Tf corresponding to that Octave Band Centre Frequency shall be used instead.

7.1.2 International Standard ISO 226-2023

The International Standard ISO 226 : 2023- Normal Equal-Loudness-Level Contours provides a set of values in decibels that represent the minimum amount of sound that the human ear can register (threshold of hearing) per frequency band. The threshold of hearing values are presented in Table 1 of the ISO standard, the specific values are presented in the table below:

Table 7-1 Threshold of Hearing in Accordance to ISO 226-2003

Description	Tf Level per Octave Band -dB								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
Threshold of hearing	60	38	22	11	4	2	-1	-5	13
A-Weightings	-39	-26	-16	-9	-3	0	1	1	-1

Description	Tf Level per Octave Band -dB								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
A-Weighted Hearing Threshold for Reference	21	12	6	2	1	2	0	-4	12

7.1.3 Project Specific Noise Criteria

Based on the spectral data from the noise logger the project specific noise criteria for the operation of the proposed gym have been established in accordance with the AAAC noise guidelines. The project specific noise criteria for the proposed gym is presented in tables below.

Table 7-2 External Criteria for Operational Noise

Description	Ambient Noise Level per Octave Band								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
R1 & R2 Measured Daytime L_{90} Background Noise Level	60	45	39	36	33	32	26	17	16
R1 & R2 - A Weighted L90 Background Noise Level	20	19	23	27	30	32	27	18	15
R1 & R2 L_{A10} Daytime Criterion (Between 7 am and 10 pm): At Surrounding Residences	**25**	**24**	**28**	**32**	**35**	**37**	**32**	**23**	**20**
Onsite Receivers Measured Daytime L_{90} Background Noise Level	60	57	55	54	45	47	43	33	23
Onsite Receivers - A Weighted L90 Background Noise Level	20	31	39	45	42	47	44	34	21
Onsite Receivers L_{A10} Daytime Criterion (Between 7 am and 10 pm): At Surrounding Residences	**25**	**36**	**44**	**50**	**47**	**52**	**49**	**39**	**26**
R1 & R2 Measured Night-time L_{90} Background Noise Level	60	40	35	31	27	25	18	15	16
R1 & R2 - A Weighted L90 Background Noise Level	20	14	19	23	24	25	19	16	15
R1 & R2 **L_{A10} and L_{Aeq} Night-time Criterion (Between 12 midnight and 7 am): At Surrounding Residences**	**20**	**14**	**19**	**23**	**24**	**25**	**19**	**16**	**15**
Onsite Receivers Measured Night-time L_{90} Background Noise Level	60	53	58	50	38	36	29	19	16

Description	Ambient Noise Level per Octave Band								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
Onsite Receivers - A Weighted L90 Background Noise Level	20	27	42	41	35	36	30	20	15
Onsite Receivers L_{A10} and L_{Aeq} **Night-time Criterion (Between 12 midnight and 7 am): At Surrounding Residences**	**20**	**27**	**42**	**41**	**35**	**36**	**30**	**20**	**15**

Internal noise limit for the nearest residential receiver must be inaudible during the night. Once the site is constructed, this can be established with internal noise measurement. At this stage of the development the internal inaudibility criterion should adhere to the levels outlined in Section 7.1.2.

7.1.4 Noise Criteria for General Noise Emissions – Non-Residential

The AAAC recommends that the $L_{Aeq,15min}$ noise emission level resulting from the operation of the gymnasium or exercise facility should not exceed the lower extent of the design sound level range or the use given in Table 1 of AS2107, at the assessment location at all times. This includes both airborne and structure-borne noise from general noise sources such as music, patrons and staff associated with the operation.

Table 7-3 AS/NZS 2107:2016 – Recommended Internal Noise Levels

Type of Occupancy/Activity	Recommended Design Sound Level, L_{Aeq} dB(A)
	Design Sound Level ($L_{Aeq,t}$) Range
Small Retail	< 50
Show Rooms	< 50
Restaurants	40 - 50
General Office Areas	40 - 45
Lecture Rooms	30 - 35
Open Plan Teaching Spaces	35 - 45
Places of Worship	30 - 40

7.1.5 Noise Criteria for Impulsive Noise Emissions – Residential Receivers

This noise criteria applies to impulsive noise from weight drops or other similar sources such as medicines balls, ropes etc

LAFmax(ΣOct,31.5-2500Hz) ≤ 35 dB for daytime[1]

LAFmax(ΣOct,31.5-250Hz) ≤ 30 dB for evening[2]

LAFmax(ΣOct,31.5-250Hz) ≤ 25 dB for night-time[3]

Notes:

1. Daytime is 7am to 6pm

2. Evening is 6pm to 10pm

3. Night-time is 10pm to 7am (*8am on Sundays and public holidays)*

4. Justification would be required of the acoustician to vary any of the above

7.1.6 Noise Criteria for Impulsive Noise Emissions – Non-Residential Receivers

This noise criteria applies to impulsive noise from weight drops or other similar sources such as medicines balls, ropes etc

LAFmax(ΣOct,31.5-250Hz) ≤ 40 dB for general uses[1]

LAFmax(ΣOct,31.5-250Hz) ≤ 35 dB for sensitive uses[2]

LAFmax(ΣOct,31.5-250Hz) ≤ 30 dB for critically sensitive uses[3]

Notes:

1. General uses may include office spaces and general working areas

2. Sensitive uses may include private offices, classrooms, childcare and movie cinemas

3. Critically sensitive uses may include noise sensitive laboratories and board rooms

4. Justification would be required of the acoustician for the objective criteria adopted

7.1.7 Vibration Emission – General Operations

For the provision of guidance, the AAAC considers that the “Continuous” levels may be used for guidance when assessing vibration from cardio areas, and repetitious or cyclical activities, given vibration resulting from such activities is typically continuous in nature, when in use.

The vibration events resulting from the dropping of weights may be classified as “occasional”, typically with several occurrences per day, or per assessment period. Where the number of such events is only occasional the Preferred “Impulsive” levels may be used for guidance when assessing vibration from the weights areas. Where many weight dropping events are expected to occur during each period values below the “Impulsive” levels may be more appropriate. An acoustician should use their judgement for the assessment of specific uses and activities within the gymnasium or exercise facility.

The NSW EPA Guideline provides guidance on assessing intermittent vibration using vibration dose value (VDV). The AAAC does not consider the use of VDV to be appropriate for assessment of the effect of vibration resulting from the use and operation of gymnasiums and exercise facilities. The acceptable weighted r.m.s. vibration acceleration values for impulsive vibration set out in Table 2.2 of the NSW EPA Guideline are presented within Table below.

Table 7-4 EPA Acceptable Impulsive Vibration Weighted R.M.S. Acceleration Values (mm/s^2) (1-80Hz)

Location	Assessment Period	Preferred Value		Maximum Value	
		Z-Axis	X-and Y Axes	Z-Axis	X-and Y Axes
Critical Areas	Daytime or Night-time	5	3.6	10	7.2
Residences	Daytime	300	210	600	420
	Night-time	100	71	200	140
Offices, schools, educational institutions and places of worship	Daytime or Night-time	640	460	1280	92
Workshop	Daytime or Night-time	640	460	1280	92

The acceptable weighted r.m.s. vibration acceleration values for continuous vibration set out in Table 2.2 of the NSW EPA Guideline are presented within Table below.

Table 7-5 EPA Acceptable Continuous Vibration Weighted R.M.S. Acceleration Values (mm/s^2) (1-80Hz)

Location	Assessment Period	Preferred Value		Maximum Value	
		Z-Axis	X-and Y Axes	Z-Axis	X-and Y Axes
Critical Areas	Daytime or Night-time	5	3.6	10	7.2
Residences	Daytime	10	7.1	20	14
	Night-time	7	5	14	10

Location	Assessment Period	Preferred Value		Maximum Value	
		Z-Axis	X-and Y Axes	Z-Axis	X-and Y Axes
Offices, schools, educational institutions and places of worship	Daytime or Night-time	20	14	40	28
Workshop	Daytime or Night-time	40	29	80	58

The vibration generated from the dropping of weights onto the gym floor typically induces maximum acceleration in the vertical axis. Accordingly, the “Preferred Value, z-axis” criteria in Table 1 and Table 2 above should be applied to the analysis and assessment.

The criteria for r.m.s. vibration velocity and peak velocity values for impulsive vibration set out in Table C1.1 of the NSW EPA Guideline are summarised within Table below.

Table 7-6 EPA Criteria for Exposure to Impulsive Vibration Velocity Values (mm/s^2)

Location	Assessment Period	RMS Velocity		Peak Velocity	
		Preferred	Maximum	Preferred	Maximum
Critical Working Areas	Daytime or Night-time	0.10	0.20	0.14	0.28
Residences	Daytime	6	12	8.6	17
	Night-time	2	4	2.8	5.6
Offices	Daytime or Night-time	13	26	18	36
Workshop	Daytime or Night-time	13	26	18	36

The criteria for r.m.s. vibration velocity and peak velocity values for continuous vibration set out in Table C1.1 of the NSW EPA Guideline are summarised within Table below.

Table 7-7 EPA Criteria for Exposure to Continuous Vibration Velocity Values (mm/s2)

Location	Assessment Period	RMS Velocity		Peak Velocity	
		Preferred	Maximum	Preferred	Maximum
Critical Working Areas	Daytime or Night-time	0.10	0.20	0.14	0.28
Residences	Daytime	0.2	0.4	0.28	0.56
	Night-time	0.14	0.28	0.20	0.40
Offices	Daytime or Night-time	0.40	0.80	0.56	1.10
Workshop	Daytime or Night-time	0.80	1.60	1.10	2.20

7.2 Gymnasium Noise and Vibration Control Measures

The operation of the Gym has been assessed to comply with the project specific noise criteria with the implementation of the following noise controls to ensure compliance is maintained:

- All patrons must be instructed to not cause unnecessary noise in particular when handling weights
- The sound system must be fitted with a noise limiter and graphic equaliser, all music inputs must be connected to the system. Only management must have access to the sound system controls
- When glazing and internal fittings of the gym are constructed, a speaker noise compliance test must be conducted to calibrate the correct noise limiter settings for the gym. Noise measurement must be conducted at onsite residential receiver location and at receiver R2.
- All speakers must be installed on resilient mounts or stands. Direct fixing speakers to the wall/ceiling or inside the ceiling void is not permitted
- Speakers can be resiliently mounted along the walls
- The sound system must be calibrated prior to commission
- The ceiling must be suspended with 50mm Bradford glass wool insulation in the cavity, if this is not possible and an open ceiling is proposed, the underside of the ceiling around the free weights area must be lined with absorptive material having an NRC of 0.8
- Regupol® Sonusfit 4080 88mm rubber matting (or equivalent) must be installed in the free weights/dumbbell area. A 5mm gap must be left around the perimeter where the floor meets the wall, this gap must be sealed with rubber mat material or resilient sealant to avoid any noise/vibration transmission through the structure.
- All dumbbells and weight plates are to be either rubber coated or rubber design.

- Deadlifts must be assigned a specific area, the activities must be conducted on a purpose built platform consisting of spring mounted flooring provided by Embelton (See Appendix E). The sub floor system should consist of the following layout:
    - A layer of Regupol Sonusfit 4080 48mm
    - 2 x layers 19mm structural ply
    - NXS14 Spring & Steel Channel in between

  If the tenant proposes an alternative floor system, then it recommended a noise and vibration impact test of the proposed floor to be undertaken by a suitably qualified acoustic engineer to ensure weight drops within the gym comply with the noise and vibration criteria as outlined in Section 7.1 at the nearest receiver location. The noise and vibration measurement should consist of dropping various weights (including dumbbell and barbell and any other impact activities) onto the proposed floor samples, while noise and vibration measurements are taken in the commercial underneath.

  A noise and vibration impact assessment report is to be prepared to advise whether the proposed gym floor achieves the acoustic floor impact requirements. If it does not comply, then noise control recommendations are to be provided or the Regupol Sonusfit 4080 88mm system are to be implemented.
- Signs to be posted near the deadlift stations advising patrons that deadlifts are only to be conducted at the assigned areas.
- Any weight racks or equipment which is secured to the floor must be done so *on Embelton vibration isolation system (or suitable equivalent)*
- Pin loaded machines to be isolated from the slab utilising manufacturer recommended mounts.
- Larger pin loaded machines to have manufacturer recommended rubber mounts.
- Rubber panels must be placed at the base of the pin weights to reduce any noise when the weights hit the base
- Treadmill and any running track must be installed on Regupol Machine Vibration Plates
- All equipment must be resiliently installed
- Patrons must not be able to have access to the controls for the music systems.

8 CONSTRUCTION NOISE AND VIBRATION IMPACT ASSESSMENT

8.1 Construction Noise Management Levels

Construction noise is managed in accordance with the EPA *Interim Construction Noise Guideline* (ICNG, 2009) which provides management objectives for construction noise at residential and other sensitive land uses.

The ICNG airborne noise goals are to be applied to assess noise impacts and determine requirement for the reasonable and feasible management of construction noise to minimise potential for disturbance.

8.1.1 Residential Receivers

Table 8-1 details the ICNG guidelines for determining construction noise management levels at residential receivers.

Table 8-1 Construction airborne noise management levels for residences (ICNG)

Time of Day	Noise Management Level. L_{Aeq} dB(A)	How to Apply
Recommended standard hours (SH): Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected Rating Background Level (RBL) + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (OOH) - All other times including Public Holidays	Noise affected Rating Background Level (RBL) + 5 dB(A)	A strong justification would typically be required for works outside the recommended standard hours.

Time of Day	Noise Management Level. L_{Aeq} dB(A)	How to Apply
		The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Site specific L_{Aeq} construction NML in Table 8-2 have been established adopting measured existing baseline L_{A90} noise levels (Rating Background Level, RBL) and the ICNG corrections for the time of construction work.

Table 8-2 Adopted Construction Noise Management Levels for Residential Receivers

Receiver	Daytime NML dB(A)	Highly Noise Affected Level dB(A)
R1 & R2	48	75
R3 & R4	67	75

8.1.2 Commercial and Industrial Premises

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories. The external noise levels should be assessed at the most-affected occupied point of the premises:

- Industrial premises: external $L_{Aeq\ (15\ min)}$ 75 dB(A)
- Offices, retail outlets: external $L_{Aeq\ (15\ min)}$ 70 dB(A)
- Other businesses that may be very sensitive to noise, where the noise level is project specific as discussed below.

Examples of other noise-sensitive businesses are theatres and childcare centres. The proponent should undertake a special investigation to determine suitable noise levels on a project-by-project basis; the recommended 'maximum' internal noise levels in AS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors may assist in determining relevant noise levels (Standards Australia 2000).

The proponent should assess construction noise levels for the project and consult with occupants of commercial and industrial premises prior to lodging an application where required.

During construction, the proponent should regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work

8.1.3 Vibration Damage Criteria - Surface Structures

Most commonly specified "*safe*" structural vibration limits are designed to minimise the risk of threshold or cosmetic surface cracks, and are set well below the levels that have potential to cause damage to the main structure.

8.1.3.1 British Standard 7385: Part 2 - 1993

In terms of the most recent relevant vibration damage criteria, Australian Standard AS 2187: Part 2-2006 "*Explosives - Storage and Use - Part 2: Use of Explosives*" recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2*" as they "are applicable to Australian conditions".

The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 8-3 and graphically in Figure 8-1.

Table 8-3 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

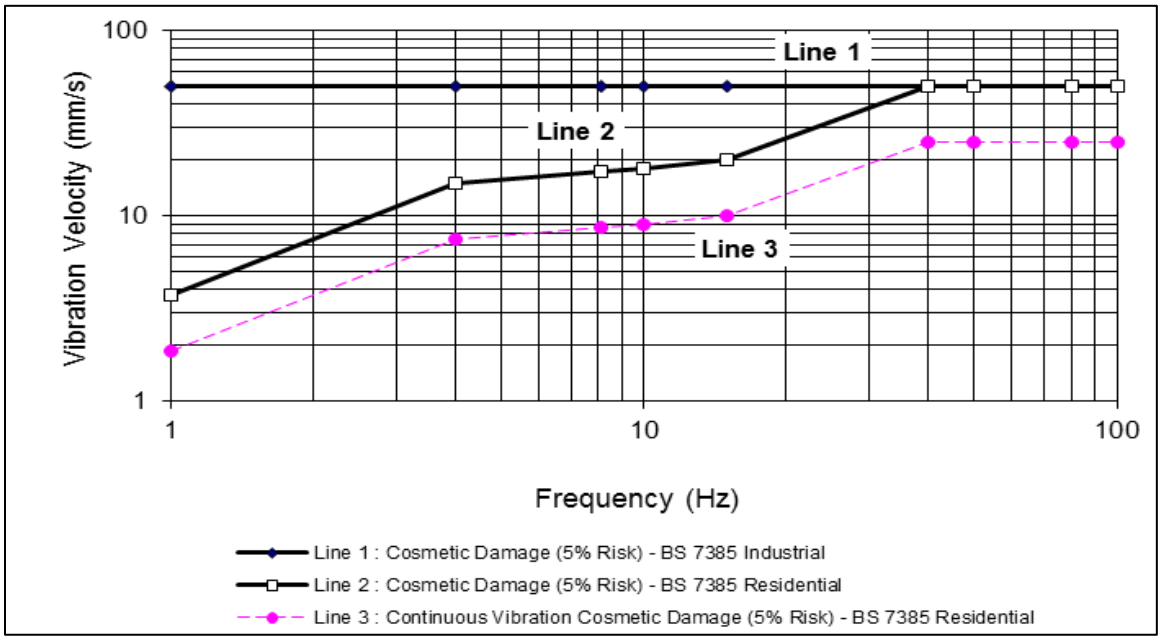
Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures industrial and heavy commercial buildir	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structure Residential or light commercial type buildings	15 mm/s at 4 Hz increasi to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increas to 50 mm/s at 40 Hz an above

The standard states that the guide values in Table 8-3 relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 8-3 may need to be reduced by up to 50%.

Note: rock breaking/hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures (e.g. residences) and it may therefore be appropriate to reduce the transient values by 50%.

Figure 8-1 Graph of Transient Vibration Guide Values for Cosmetic Damage



In order to assess the likelihood of cosmetic damage due to vibration, AS 2187 specifies that vibration measured should be undertaken at the base of the building and the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) should be compared with the criteria curves presented in Table 8-3.

8.1.4 Human Comfort Vibration Criteria

8.1.4.1 General

Humans are far more sensitive to vibration than is commonly realised. They can detect vibration levels which are well below those causing any risk of damage to a building or its contents.

The actual perception of motion or vibration may not, in itself, be disturbing or annoying. An individual's response to that perception, and whether the vibration is "normal" or "abnormal", depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

Human tactile perception of random motion, as distinct from human comfort considerations, was investigated by Diekmann. On this basis, the resulting degrees of perception for humans are suggested by the vibration level categories given in Table 8-4.

Table 8-4 Peak Vibration Levels and Human Perception of Motion

Approximate Vibration Level	Degree of Perception
0.10 mm/s	Not felt
0.15 mm/s	Threshold of perception
0.35 mm/s	Barely noticeable
1 mm/s	Noticeable
2.2 mm/s	Easily noticeable
6 mm/s	Strongly noticeable
14 mm/s	Very strongly noticeable

Note: These approximate vibration levels (in floors of building) are for vibration having a frequency content in the range of 8 Hz to 80 Hz.

Table 8-4 suggests that people will just be able to feel floor vibration at levels of about 0.15 mm/s and that the motion becomes “noticeable” at a level of approximately 1 mm/s.

8.1.5 Human Comfort Criteria for Construction Vibration

British Standard 6472-2008 “*Guide to evaluation of human exposure to vibration in building*” nominates criteria for various categories of disturbance, the most stringent of which are the levels of building vibration associated with a “low probability of adverse comment” from occupants. The “low probability of adverse comment” level for residential buildings is:

- 0.4 to 0.8 $m/s^{1.75}$ (16 hour daytime Vibration Dose Value)
- 0.2 to 0.4 $m/s^{1.75}$ (8 hour night-time Vibration Dose Value)

BS 6472-2008 provides criteria for continuous, transient and intermittent (in the case of road traffic) events that are based on a Vibration Dose Value (VDV), rather than a continuous vibration level. The vibration dose value is dependent upon the level and duration of the short-term vibration event, as well as the number of events occurring during the daytime or night-time period.

The criteria presented in BS 6472 supersede the EPA’s *“Assessing Vibration: A Technical Guideline”*.

8.1.5.1 Vibration Dose Limits

The permissible rms particle velocity levels corresponding to the vibration dose value vary according to the duration of exposure. Table 8-5 shows the range of satisfactory vibration dose values for which various degrees of adverse comment may be expected in the buildings surrounding the project.

Table 8-5 Vibration Dose Values (m/s$^{1.75}$) above which Various Degrees of Adverse Comment May Be Expected in Residential Buildings, Offices and Workshops

Location	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Offices 16 hour day	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2
Workshops 16 hour day	0.8 to 1.6	1.6 to 3.2	3.2 to 6.4

Situations exist where motion magnitudes above the dose levels given in BS 6472 can be acceptable, particularly for temporary disturbances and infrequent events of short-term duration. An example is a construction project.

When short-term works such as piling, demolition or compaction give rise to impulsive vibrations, it should be considered that undue restriction on vibration levels can significantly prolong these operations and result in greater annoyance.

In certain circumstances, the use of higher magnitudes of acceptability may be considered, e.g. for projects having social worth or broader community benefits or in view of the economic or practical feasibility of reducing vibration to the recommended levels. In such cases, best management practices should be employed to reduce levels as far as practical.

8.2 Construction Noise Calculations

8.2.1 Typical Equipment Noise Levels

The construction works are divided into four construction phases:

1. Demolition
2. Excavation & Compacting
3. Piling
4. Construction of the multistorey development

A detailed construction assumed various tools/machines for each construction phase. We have used equipment noise levels in accordance to Australian Standard AS2436-2010, Construction Noise and Vibration Strategy (CNVS) Transport for NSW and the RSA noise library. The following table presents the sound power levels (SWL) from the related equipment.

Table 8-6 Typical Sound Levels of Construction Equipment

Plant Description	SWL	Quantity	Stage
20t Excavator with hyrdraulic hammer	118	2	1
20t Excavator	105	3	1 & 2
Compacter	106	2	2
Vibratory Piling Rig	126 Lmax	1	3
Mobile Crane	113	1	2 & 3
Concrete Truck	114	1	3
Hand Tools	102	10	3 & 4
Crane	113	1	4
Forklift	94	2	4
Delivery Truck	110	1	1 - 4

8.2.2 Construction Noise Impact Results

Calculations of the minimum and maximum noise levels at the nearest sensitive receivers when all construction equipment are operating are presented in Table 8-7, below. We note that all noise levels are external $L_{Aeq(15min)}$. It is unlikely that all construction equipment will operate at the same time or will operate continuously within a 15-minute period; however, this has been considered to assess the worst-case noise impact.

A minimum and maximum range has been provided in the table below. The range is based on the location of the works, nearest to the boundary and farthest from the boundary.

Table 8-7 Calculated Noise Level Results

Receive	Predicted Noise Level dB(A)				Criteria		Complies
	Demolition	Excavatior	Piling	Constructior	Day NMI	Highly Nois Affected	
R1	78	73	77	72	48	75	No
R2	75	70	74	69	48	75	No
R3	74	68	72	68	48	75	No
R4	77	71	75	70	48	75	No

Receive	Predicted Noise Level dB(A)				Criteria		Complies
	Demolition	Excavatior	Piling	Constructior	Day NMI	Highly Nois Affected	
C1	72	67	71	66	55	75	No

The predicted noise level during each construction stage exceed the day time NML and most noise impact exceed the Highly Noise Affected Level of 75dB(A). Noise impact is highly likely to cause annoyance to residents next door. The major noise workings during the is the hydraulic hammer and operation of the mobile crane.

8.2.3 Noise Impact Discussion

As shown in Section 8.2.2, all four stages of construction works exceed the day time noise criterion. It should be noted that the surrounding receivers, particularly R1 and R2, are close to the construction site. The use of hydraulic hammer and the vibratory piling rig are likely to cause the most annoyance to the neighbouring receivers, as these machines have the highest Sound Power Level. Noise control measures should focus mainly on these machine/tools. Mitigation to minimise the construction noise impact is provided in Section 6.

8.2.4 Vibration Impact

Piling rig and an excavator with hydraulic hammer may emit vibration level and may be of concern if these sources are in close proximity to a residential structure.

The Transport for NSW (TfNSW) Construction Noise and Vibration Strategy (CNVS, 4.2 2019) provides minimum safe working distances for various vibration intensive plant items. The working distance guide is provided to avoid cosmetic damage to property and to minimise human annoyance.

The minimum safe working distance for the piling rig and hydraulic hammer are presented in Table 8-8.

Table 8-8 Recommended Minimum Working Distance from Intensive Plant

Equipment	Minimum Distance for Cosmetic Damage	Minimum Distance for Human Annoyance
Piling rig – hammer 12 t down force	15 m	50 m
12 - 18t Excavator with Hydraulic Hammer	7 m	23 m
18 - 34t Excavator with Hydraulic Hammer	22 m	73 m

If the proposed vibration sources outlined in the table above are operating within or near the minimum distance for cosmetic damage, then vibration monitoring at the nearest potentially affected receiver should be undertaken during the vibration works.

9 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

9.1 Noise Monitoring

Noise monitoring will be performed in the event of a complaint received by the construction contractor, by an Acoustical Consultant engaged directly by the client.

Noise monitoring would be undertaken using statistical noise loggers supplemented by attended monitoring (where necessary) in order to differentiate between construction noise sources and other sources (such as road traffic and aircraft noise) and also in order to observe and identify any abnormally noisy construction equipment or operations.

During attended monitoring, typical maximum noise levels associated with particular operations and/or plant items will be noted. Where possible, extraneous noise events such as road and air traffic noise will be excluded from the results or highlighted in accompanying notes.

Noise monitoring will, if required, be undertaken by the Acoustical Consultant and reported weekly. Equipment and methods will comply with AS 1055.1-1989. The statistical parameters to be measured will be the L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq} evaluated over consecutive 15 minute periods.

9.2 Vibration Monitoring

Vibration monitoring, will be performed in the event of a complaint received by the construction contractor. Additionally, vibration monitoring will be performed where sensitive assets are identified, these include but are not limited to heritage buildings, infrastructure utilities i.e. water and gas pipes and the like. Monitoring will be carried out by an Acoustical Consultant engaged directly by the client. Vibration monitoring would be carried out continuously on the closest, potentially most affected structures during any works considered to potentially generate significant levels of vibration.

A single geophone mounting plate would be installed on the adjacent buildings/structures. The monitoring locations would be on a stiff part of the structures (at the foundations) on the side of the structures adjacent to the subject excavation works, in accordance with BS 7385:1993 Part 2.

The vibration monitoring system will be configured to record the peak vibration levels and to trigger an audible/visual alarm when predetermined vibration thresholds are exceeded. The thresholds correspond to an “Operator Warning Level” and an “Operator Halt Level”, where the Warning Level is 75% of the Halt Level

The vibration threshold will be set to an “Operator Warning Level” of 6 mm/s (ppv) and an “Operator Halt Level” of 8 mm/s (ppv), the exceedance of which will be indicated by the audible/visual alarm in the construction site.

Based on the foregoing information, the nominated site control vibration criteria are presented in Table 9-1 and correspond to the minimal risk of cosmetic damage criterion from BS 7385.

Table 9-1 Nominated Site Control Vibration Criteria (ie Operator Warning and Halt Levels)

Structure	Site Control Criteria	
	Operator Warning Level	Operator Halt Level
Nearest Potentially Affected	6 mm/s	8 mm/s

Exceedance of the "Operator Warning Level" does not require excavation activity to cease but rather alerts the construction contractor to proceed with caution at reduced force or load. An exceedance of the "Operator Halt Level" requires the construction contractor to implement an alternative excavation technique. The vibration monitoring equipment would be downloaded on a weekly basis by the Acoustical Consultant.

Weekly reports of the measured vibration levels and their likely impacts would be prepared by the Acoustical Consultant and distributed by the Project Manager.

Attended vibration monitoring will, if considered necessary, be conducted by the Acoustical Consultant. Attended vibration monitoring (structural damage and/or human comfort) will also be carried out in response to complaints or to structural damage criterion exceedances. This monitoring will provide direct feedback to the operators in order to allow appropriate modification of excavation techniques.

9.3 Construction Noise Mitigation Measures

The following noise mitigation measures will be implemented by the construction contractor, where reasonable and feasible, apply best practice noise mitigation measures including:

- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers.
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers.
- Minimising consecutive works in the same locality.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.
- A temporary 2m high noise barrier is to be constructed along the western side of the site.

Further, in order to minimise noise impacts during the works, the construction contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers. Silenced air compressors fitted with noise labels indicating a maximum (L_{Amax}) sound pressure level of not more than 75 dB(A) at 7 m will be used on site. The sound pressure level of noise emitted from a compressor used will comply with noise label requirements.

9.4 Vibration Mitigation Measures

The following vibration mitigation measures will be implemented by the construction contractor:

- Relocate any vibration generating plant and equipment to areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of excavation plant and equipment e.g. smaller capacity rock breaker hammers.
- Minimise consecutive works in the same locality (if applicable).
- Schedule a minimum respite period of at least 0.5 hour before activities commence which are to be undertaken for a continuous 4-hour period.
- Use only dampened rock breakers and/or “city” rock breakers to minimise the impacts associated with rock breaking works.

9.5 Summary of Construction Mitigation Measures

The noise and vibration mitigation measures to be implemented by the construction contractor are summarised in Table 9-2.

Table 9-2 Noise and Vibration Mitigation Measures

Item	Description
Construction Hours	Works will be carried out within the approved construction hours.
Deliveries	Deliveries will be carried out within the approved construction hours.
Site Layout	Where possible, plant and equipment will be located and orientated to direct nois away from sensitive receivers.
Quietest Suitable Equipmer	Plant and equipment will be selected to minimise noise emission, where possible whilst maintaining efficiency of function. Residential grade silencers will be fitted a all noise control equipment will be maintained in good order.
Reversing Alarms	Mobile plant and trucks operating on site for a significant portion of the project w have reversing alarm noise emissions minimised, where possible, recognising th need to maintain occupational safety standards.
PA System	No public address system will be used at this site.

Item	Description
Vibration Monitoring	Vibration monitoring will be carried during the demolition, excavation and piling works should be carried out where there is considered to be a risk that vibration levels may exceed the relevant structural damage criteria.
Truck Noise (off site)	All trucks regularly used for the project are to have mufflers and all noise contro equipment will be maintained in good working order. Trucking routes will use ma roads, where feasible.
Community Liaison	A programme of community liaison and complaint response will be implemented
Training	Site induction training will include a noise awareness component.

9.6 Identifying and Managing Future Noise and Vibration Issues

If additional activities or plant are found to be necessary that will emit noise and/or vibration emissions significantly exceeding those assumed for this assessment, these will be assessed by the Acoustical Consultant on a case-by-case basis and appropriate mitigation measures will be implemented.

Progressive impact assessments will be conducted as the works proceed in the event that works significantly deviate from those originally planned.

9.7 Non-Compliance and Corrective Action

Where the noise and/or vibration monitoring identifies non-compliance with the relevant criteria, the construction contractor will plan and carry out corrective action. The corrective action may involve supplementary monitoring in order to identify the source of the non-conformance and/or may involve modification of the construction techniques or program to avoid any recurrence or minimise its adverse effects.

9.8 Complaint Handling

The construction contractor will adopt the following protocol for handling complaints. This protocol is intended to ensure that the issues are addressed and that appropriate corrective action is identified and implemented as necessary:

- The construction contractor will record all verbal and telephone complaints in writing and will forward all complaints to the Project Manager together with details of the circumstance leading to the complaint and all subsequent actions.
- Complaints received by the Project Manager will, as an initial step, be referred to the construction contractor. The construction contractor will respond as described above.
- The Project Manager will investigate the complaint in order to determine whether a criterion exceedance has occurred or whether noise and/or vibration have occurred unnecessary.

- If excessive or unnecessary noise and/or vibration have been caused, corrective action will be planned and implemented by the construction contractor.
- Complainants will be informed by the Project Manager that their complaints are being addressed, and (if appropriate) that corrective action is being taken.
- Follow up monitoring or other investigations will be carried out by the Project Manager and the construction contractor to confirm the effectiveness of the corrective action.
- Complainants will be informed of the implementation of the corrective action that has been taken to mitigate the adverse effects.

9.9 Community Consultation and Liaison

Community consultation will be undertaken via the construction contractor and will include:

- Advising the community of work to be undertaken.
- Recording and managing any complaints.

These and other elements of the community consultation will be addressed under the relevant procedures for the subject works.

10 NOISE CONTROL PLAN SUMMARY

This section provides a summary of the operational noise control measures to be implemented. The architectural acoustic recommendation for the development are outlined in Section 4.2 to minimise road traffic noise impacting on the development.

10.1 Outdoor Play Areas

In order to achieve compliance with council's noise requirements for outdoor play, the following must be implemented:

- All children can engage in outdoor play at a time.
- No music is to be played in the outdoor areas.
- Children must be supervised at all times.

10.2 Indoor Play Areas

In order to achieve compliance with council's noise requirements for outdoor play, the following must be implemented:

- The windows must follow the configuration shown in Figure 6-2,
- The glazing for the windows indoor playrooms must adhere to the recommendations made in Table 4-2 and Table 6-4.

10.3 Car Park Noise Control Measures

The following noise control measures and management plan should be implemented for the carpark space:

- Parents and guardians should be informed of the importance of noise minimisation when entering or exiting the site, dropping off or picking up children. This includes avoiding raising your voice within the centre's carpark area or beeping car horn.

10.4 Communal Area Noise Management

The following communal rooftop management plan are to be implemented:

- The Communal space should not be used during the night period (between 10:00pm and 7:00am).
- Background music is permitted between 9am and 6pm but not during the evening and night time period between 6pm and 7am.
- All tenants should be provided with contact details of the Strata Board Committee members to permit tenants to make a complaint to excessive noise from the communal area.

10.5 Loading Dock Noise Management

Noise Management of the loading dock should include:

- Amplified music within the storage/docking area should not be played between 10:00pm and 7:00am. Speakers should be inside the commercial building and not outside.
- Deliveries should only be made between the hours of 7:00am and 6:00pm.
- Truck drivers onsite should avoid extended period of engine idling.
- Regular maintenance of roller should be undertaken to minimise .
- The loading dock ceiling on the ground floor should be fitted with absorption material/panels with a Noise Reduction Coefficient (NRC) of 0.7 to absorb noise emission from the loading dock.
- The loading dock roller door should be isolated from the building structure to minimise structure borne noise transmission.
- The turning table within the floor of the ground level is to be vibration isolated from the building structure.

10.6 Gymnasium Noise Control Measures

The operation of the Gym has been assessed to comply with the project specific noise criteria with the implementation of the following noise controls to ensure compliance is maintained:

- All patrons must be instructed to not cause unnecessary noise in particular when handling weights
- The sound system must be fitted with a noise limiter and graphic equaliser, all music inputs must be connected to the system. Only management must have access to the sound system controls
- When glazing and internal fittings of the gym are constructed, a speaker noise compliance test must be conducted to calibrate the correct noise limiter settings for the gym. Noise measurement must be conducted at onsite residential receiver location and at receiver R2.
- All speakers must be installed on resilient mounts or stands. Direct fixing speakers to the wall/ceiling or inside the ceiling void is not permitted
- Speakers can be resiliently mounted along the walls
- The sound system must be calibrated prior to commission
- The ceiling must be suspended with 50mm Bradford glass wool insulation in the cavity, if this is not possible and an open ceiling is proposed, the underside of the ceiling around the free weights area must be lined with absorptive material having an NRC of 0.8
- Regupol® Sonusfit 4080 88mm rubber matting (or equivalent) must be installed in the free weights/dumbbell area. A 5mm gap must be left around the perimeter where the floor meets the wall, this gap must be sealed with rubber mat material or resilient sealant to avoid any noise/vibration transmission through the structure. (See Appendix D)
- All dumbbells and weight plates are to be either rubber coated or rubber design.
- Deadlifts must be assigned a specific area, the activities must be conducted on a purpose built platform consisting of spring mounted flooring provided by Embelton (See Appendix E). The sub floor system should consist of the following layout:
    - A layer of Regupol Sonusfit 4080 48mm
    - 2 x layers 19mm structural ply
    - NXS14 Spring & Steel Channel in between

If the tenant proposes an alternative floor system, then it recommended a noise and vibration impact test of the proposed floor to be undertaken by a suitably qualified acoustic engineer to ensure weight drops within the gym comply with the noise and vibration criteria as outlined in Section 7.1 at the nearest receiver location. The noise and vibration measurement should consist of dropping various weights (including dumbbell and barbell and any other impact activities) onto the proposed floor samples, while noise and vibration measurements are taken in the commercial underneath.

A noise and vibration impact assessment report is to be prepared to advise whether the proposed gym floor achieves the acoustic floor impact requirements. If it does not comply, then noise control recommendations are to be provided or the Regupol Sonusfit 4080 88mm system are to be implemented.

- Signs to be posted near the deadlift stations advising patrons that deadlifts are only to be conducted at the assigned areas.
- Any weight racks or equipment which is secured to the floor must be done so *on Embelton vibration isolation system (or suitable equivalent)*
- Pin loaded machines to be isolated from the slab utilising manufacturer recommended mounts.
- Larger pin loaded machines to have manufacturer recommended rubber mounts.
- Rubber panels must be placed at the base of the pin weights to reduce any noise when the weights hit the base
- Treadmill and any running track must be installed on Regupol Machine Vibration Plates
- All equipment must be resiliently installed
- Patrons must not be able to have access to the controls for the music systems.

10.7 Acoustic Barrier and Awning Details

Noise Barrier onsite should consist of A 1.8 meters high solid barrier along the western boundary of the site.

Acoustic barrier is required to provide the adequate noise attenuation, the construction material of the barriers must have a surface density of 15 kg/m^2 and be free from holes and gaps. Some suitable materials include:

- 25 mm thick plywood timber panelling
- 9 mm thick fibre cement sheet
- 75mm thick Hebel Powerpanel
- 12 mm thick Perspex, polycarbonate or Danpalon
- 6 mm toughened laminated safety glass
- Any other approved material which meets the above surface density specification

A typical material used in childcare centres is Perspex, which is a polycarbonate material. The use of the 12 mm thick Perspex or 6 mm glass for this purpose which has a surface mass of 14.3 kg/m^2 will meet the mass requirements detailed above and be suitable for use as it is transparent and will not unduly restrict light or vision.

All barriers must be free of gaps and penetrations and it is particularly important to ensure that the gap at the bottom of the barrier is minimised as far as practicable. The base of the barriers should be well sealed at the junction where the barrier meets the floor, but still be designed to allow proper water drainage.

Figure 10-1 Layout of Noise Control Requirements

11 CONCLUSION

Rodney Stevens Acoustics has conducted a review of the proposed mixed-use development at 241 – 245 Pennant Hills Road, Carlingford. The review has assessed the noise generation and intrusion of the site and compared it with the noise criteria required by relevant standards.

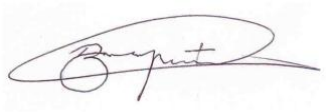
Section 4 presents details of the road traffic noise assessment. The section provides the relevant internal noise limit requirement to protect against road traffic noise, the methodology of the assessment and the noise control recommendation.

A noise assessment of the proposed child care centre was undertaken and a noise and vibration assessment of the proposed gym was also undertaken. Operational noise control measures are provided in this report and are summarized in Section 10. Details of the operational noise assessment, are provided in Sections 5, 6 and 7.

This assessment has also addressed the potential construction noise and vibration impacts of the project and found that noise impacts have been predicted to exceed the noise management level at the majority of considered receiver locations. Consequently, feasible and reasonable work practices and best practice methods utilised on construction and demolition sites have been recommended to avoid, mitigate and manage any adverse noise throughout the work activities for the proposed site.

Based on the noise impact study conducted, the proposed development is assessed to comply with relevant 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.

Prepared by:



Brian Mendieta

Senior Acoustic Consultant

Approved by:

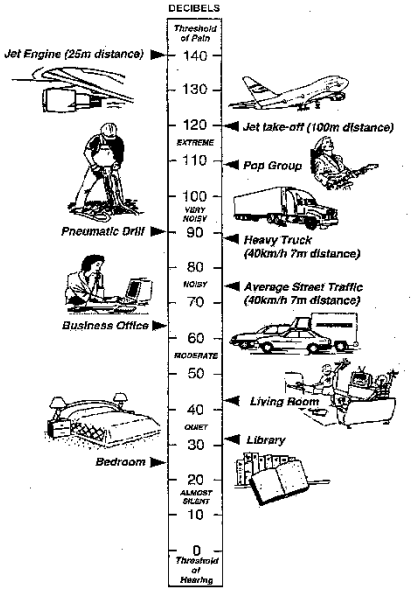
Desmond Raymond

Director

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(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).
Noise level (goal)	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.
Rating Background Level (RBL)	Rating background noise level (RBL) – the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). The rating background level is the median L_{A90} 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)	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 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



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)

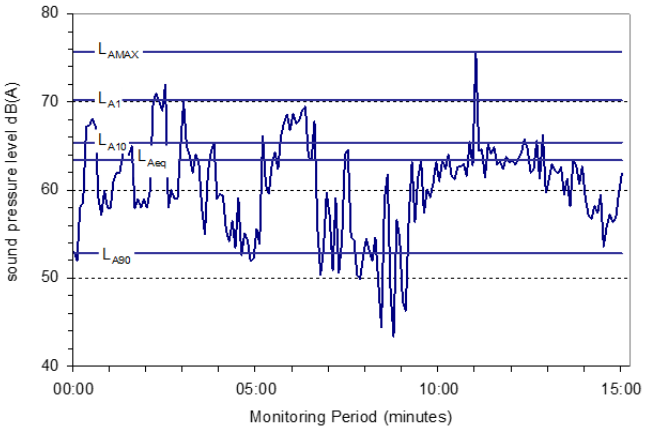
The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

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:

L_{Amax} Maximum recorded noise level.

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.

L_{Aeq} 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.

L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

Threshold

The lowest sound pressure level that produces a detectable response (in an instrument/person).

Tonality

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

Appendix B – Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM50963

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Svantek		
Type No:	SVAN-977D	**Serial No:**	99043
Mic. Type:	MK255	**Serial No:**	21629
Pre-Amp. Type:	SV 12L	**Serial No:**	126999
Filter Type:	1/3 Octave	**Test No:**	F050966

Owner: Acu-Vib Electronics
Unit 14/22 Hudson Ave
Castle Hill, NSW 2154

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1005	hPa ±1 hPa	**Date of Receipt :**	20/08/2024
Temperature	24	°C ±1° C	**Date of Calibration :**	20/08/2024
Relative Humidity	49	% ±5%	**Date of Issue :**	21/08/2024

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: .....

AUTHORISED SIGNATURE: .....

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

Acu-Vib Electronics
ACOUSTICS AND VIBRATIONS
Head Office & Calibration Laboratory
Unit 14, 22 Hudson Avenue, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Laboratory No. 9262
Acoustic and Vibration Measurements

Page 1 of 2 Calibration Certificate
AVCERT10.3 Rev.2.0 14/04/2021

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM52734

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Svantek		
Type No:	SVAN 977C	**Serial No:**	97593
Mic. Type:	MG MK255	**Serial No:**	21255
Pre-Amp. Type:	SV 12L	**Serial No:**	110576
Filter Type:	1/3 Octave	**Test No:**	F052735

Owner: Acu-Vib Electronics
Unit 14, 22 Hudson Ave.
Castle Hill NSW 2154

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	997	hPa ±1 hPa	**Date of Receipt :**	10/02/2025
Temperature	25	°C ±1° C	**Date of Calibration :**	10/02/2025
Relative Humidity	46	% ±5%	**Date of Issue :**	12/02/2025

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: .....

AUTHORISED SIGNATURE: .....
Hein Soe

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Page 1 of 2 Calibration Certificate
AVCERT10.3 Rev.2.0 14/04/2021

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM54108

EQUIPMENT TESTED: Sound Level Meter

Make & Model:	Svantek SVAN 977C	**Serial No:**	98819
Mic. Model:	MTG MK255	**Serial No:**	21053
Pre-Amp. Model:	Svantek SV 12L	**Serial No:**	86575
Band-Pass Filter:	1/3 Octave	**Test No:**	F054109

Owner: Acu-Vib Electronics
Unit 14/22 Hudson Ave
Castle Hill NSW 2154

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1005	hPa ±1 hPa	**Date of Receipt :**	04/06/2025
Temperature	23	°C ±1° C	**Date of Calibration :**	04/06/2025
Relative Humidity	45	% ±5%	**Date of Issue :**	05/06/2025

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: L. Gail

AUTHORISED SIGNATURE: Hein Soe

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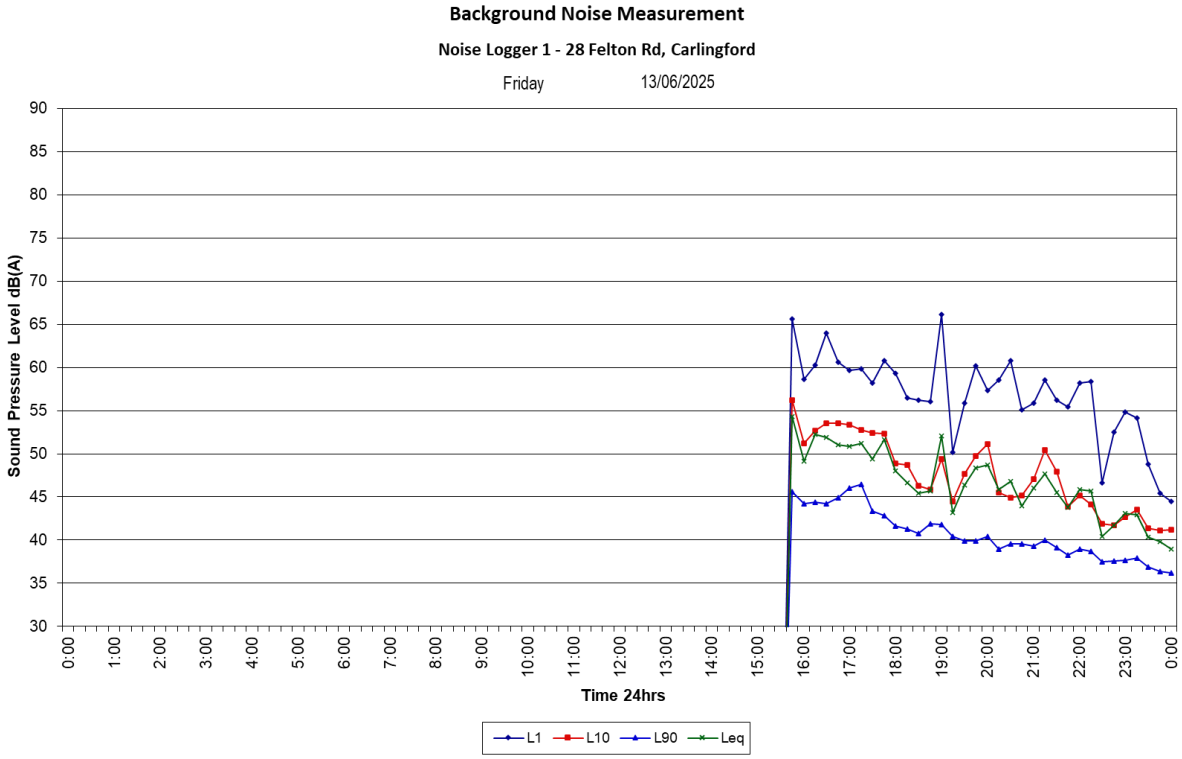
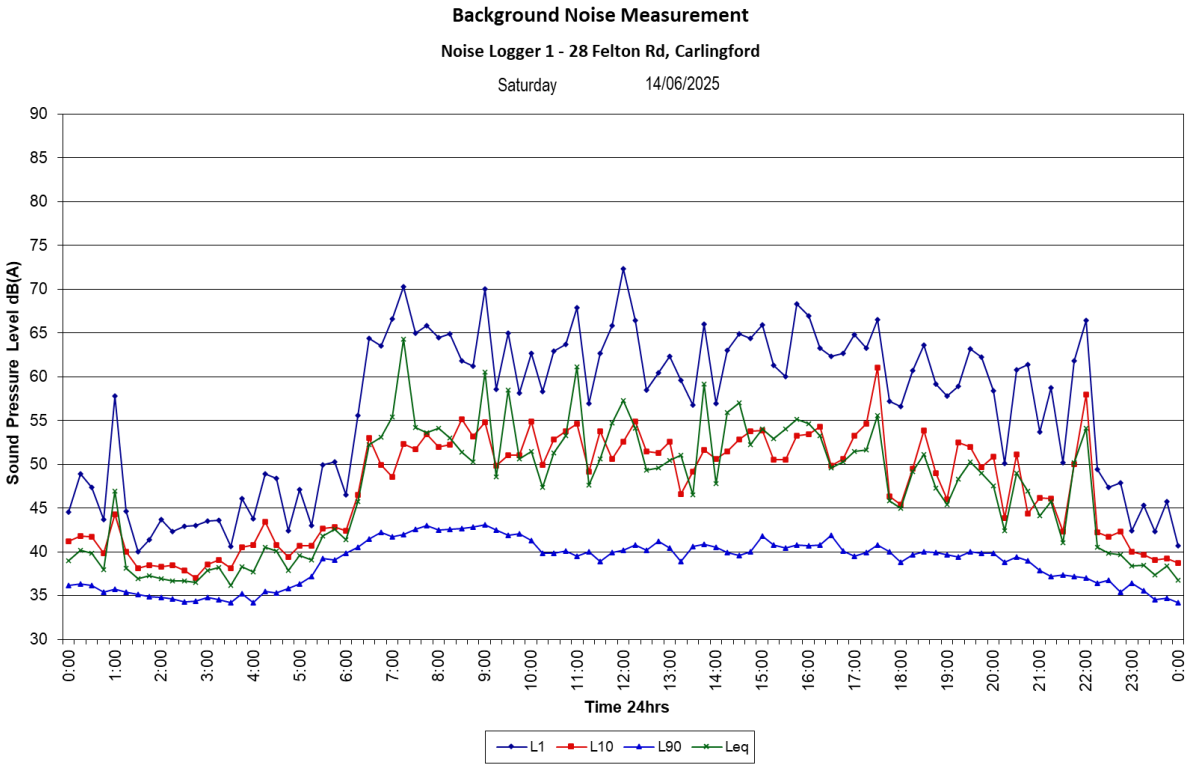
Appendix C – Noise Monitoring Graphs

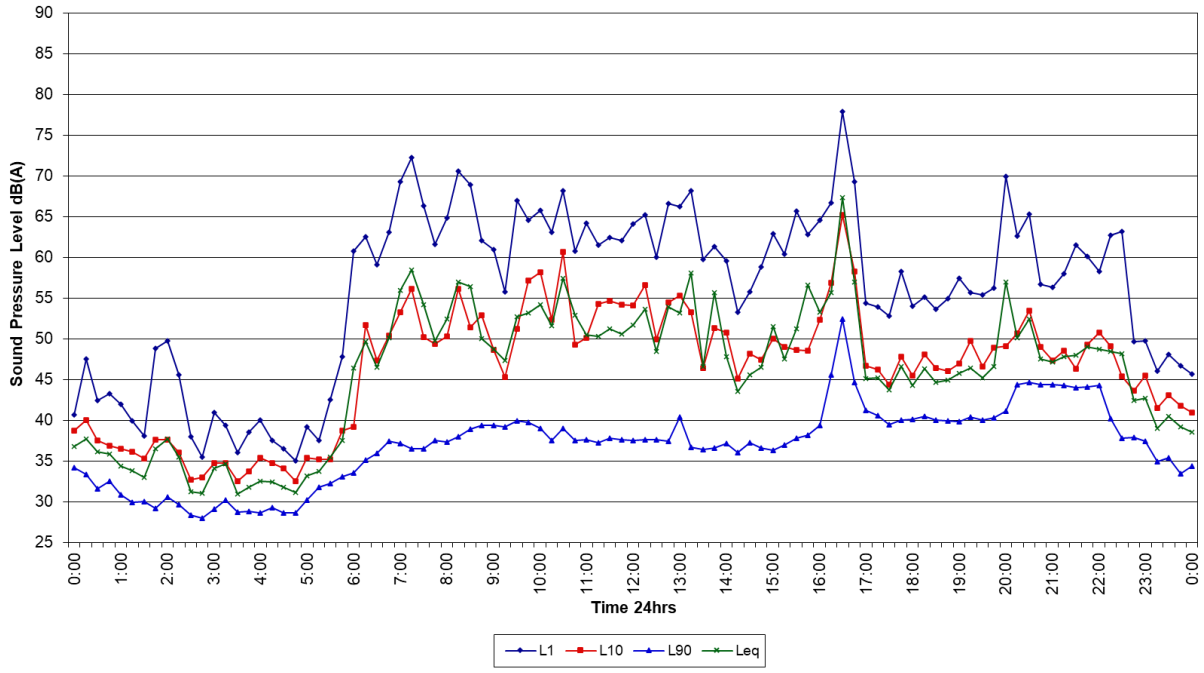




Background Noise Measurement

Noise Logger 1 - 28 Felton Rd, Carlingford

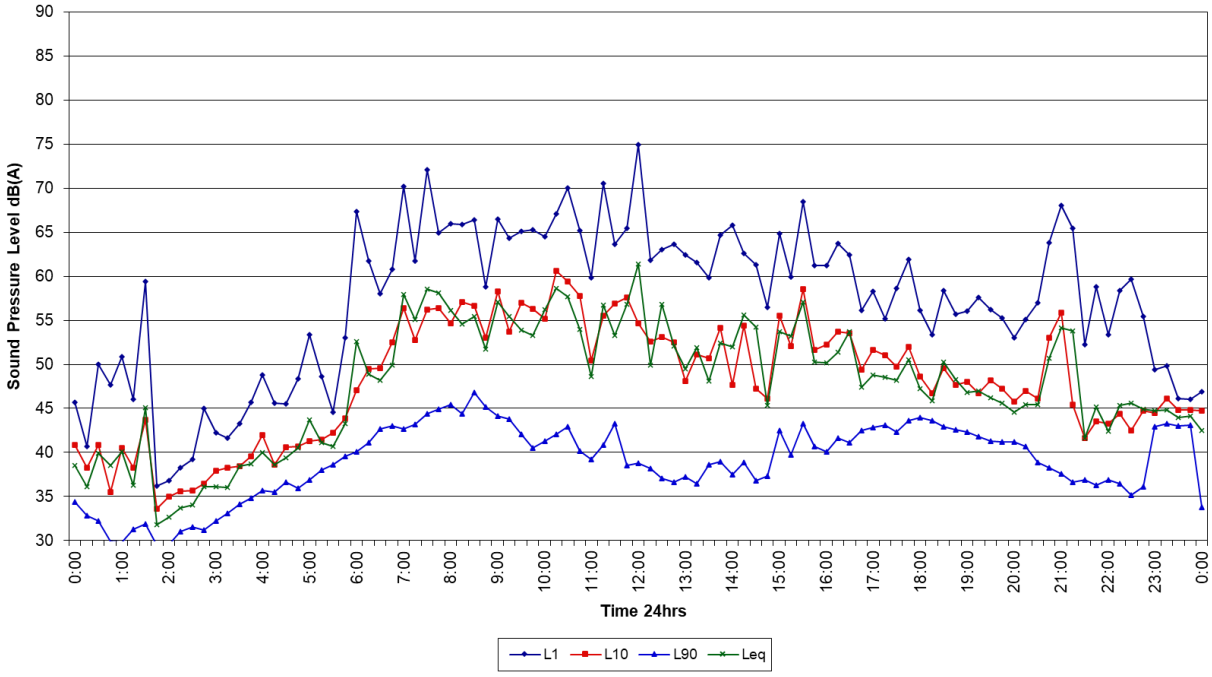
Sunday 15/06/2025



Background Noise Measurement

Noise Logger 1 - 28 Felton Rd, Carlingford

Monday 16/06/2025



Background Noise Measurement

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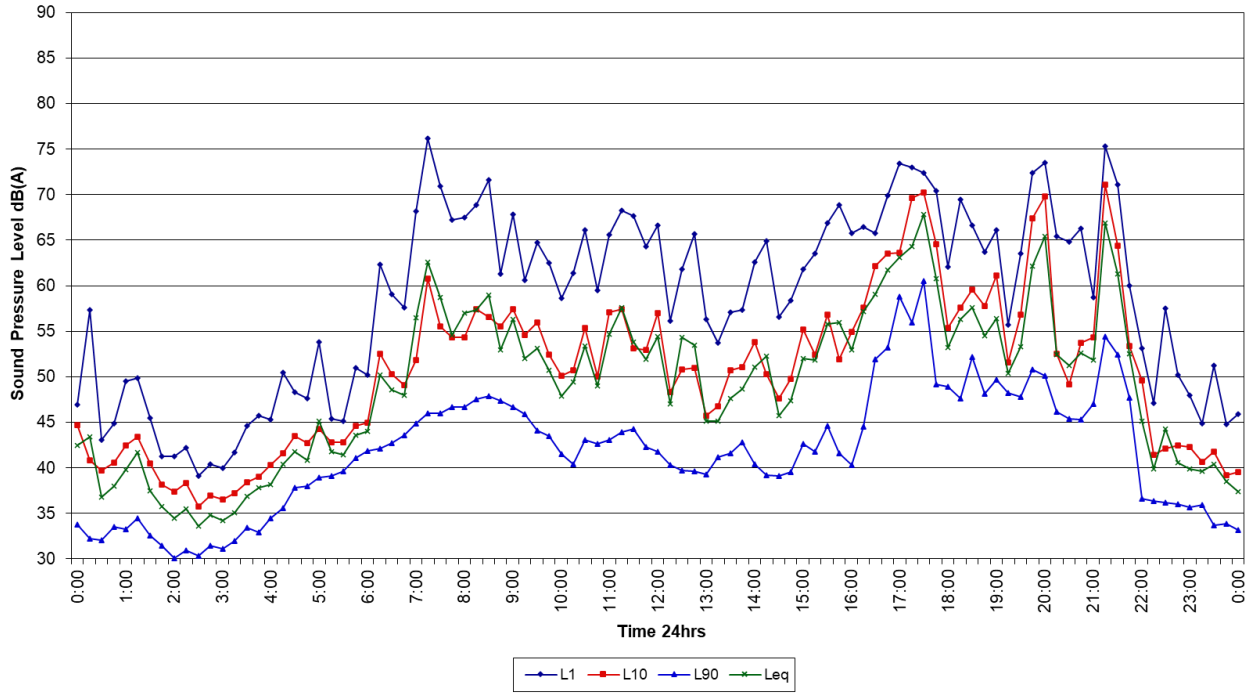
Tuesday 17/06/2025



Background Noise Measurement

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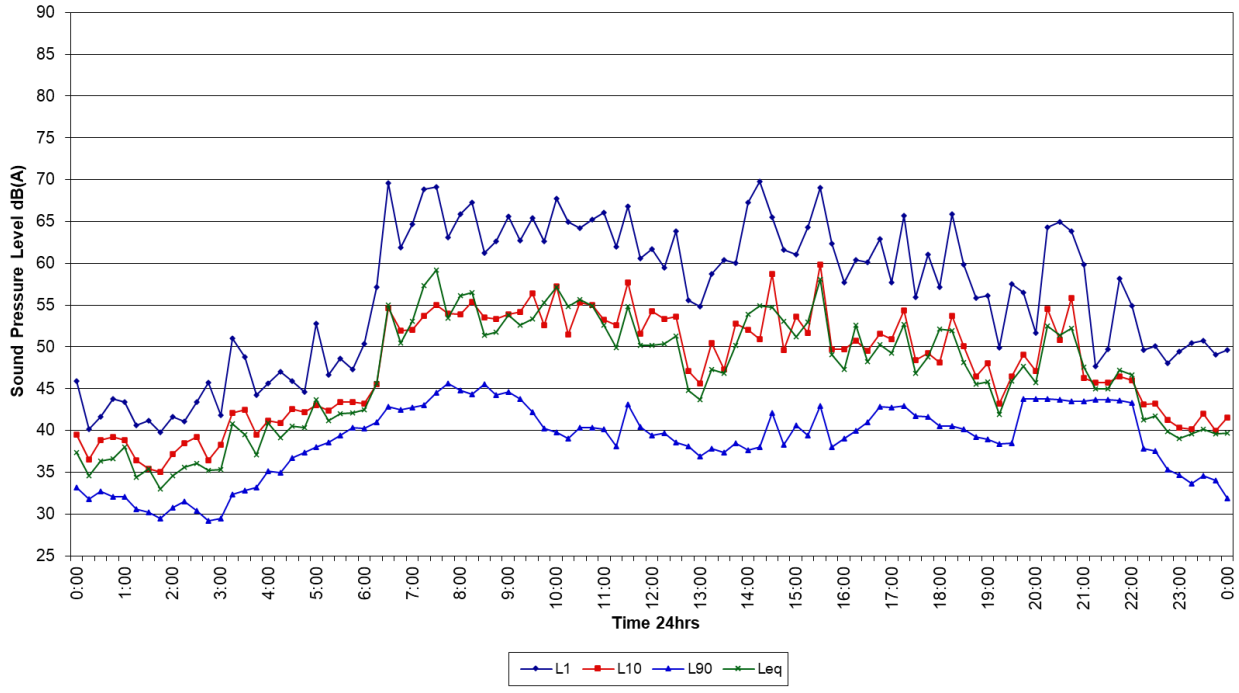
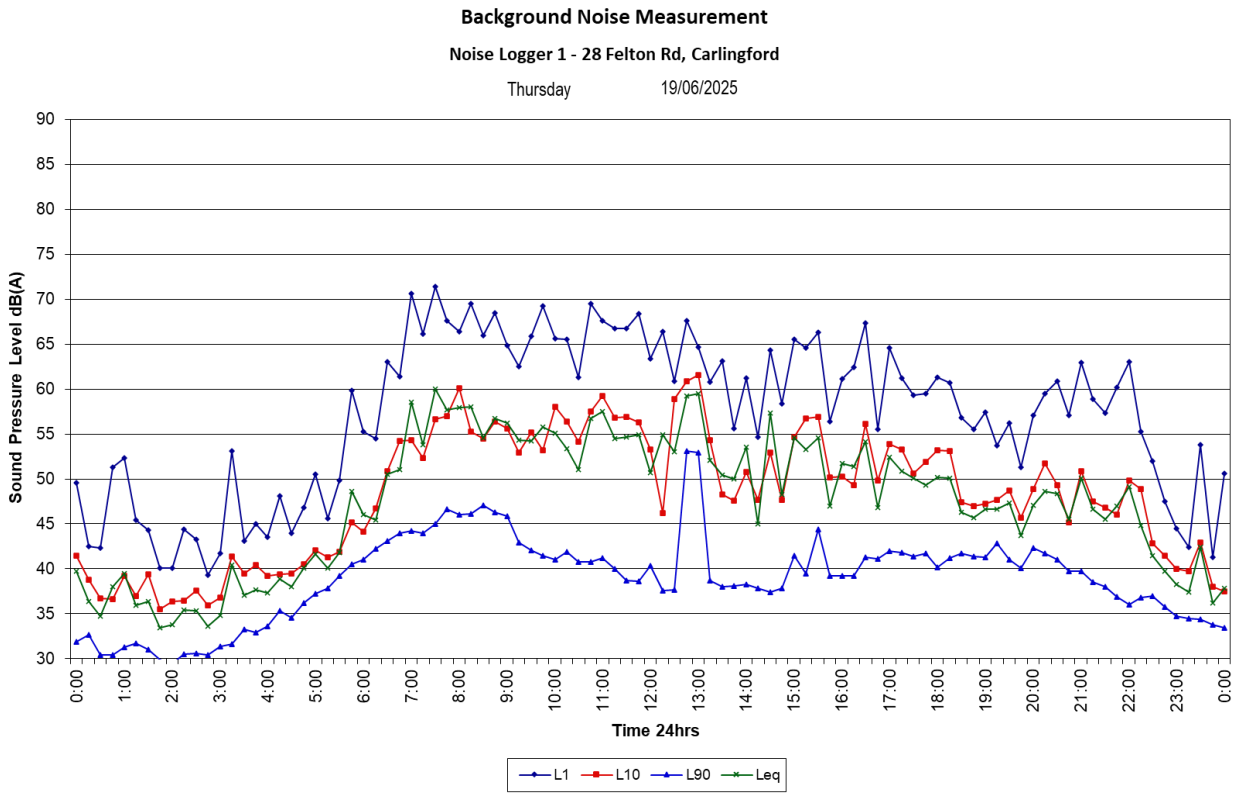
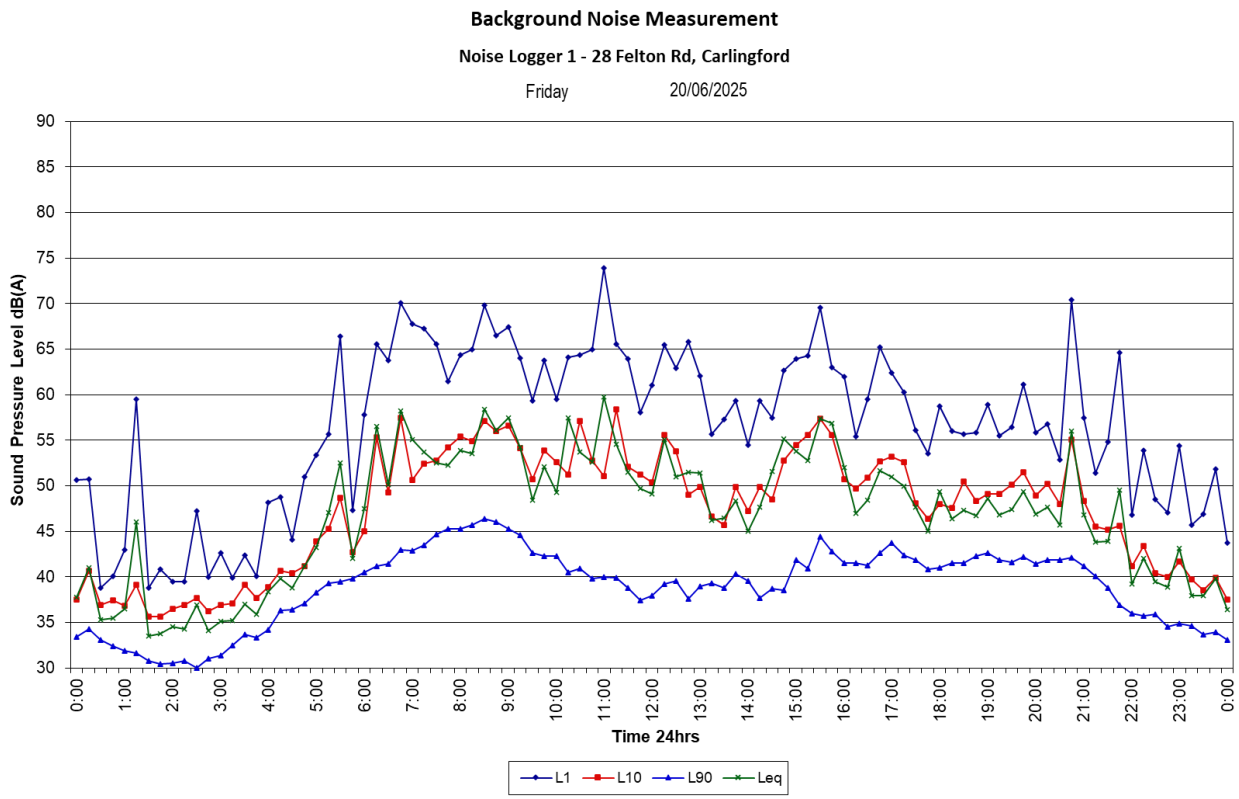
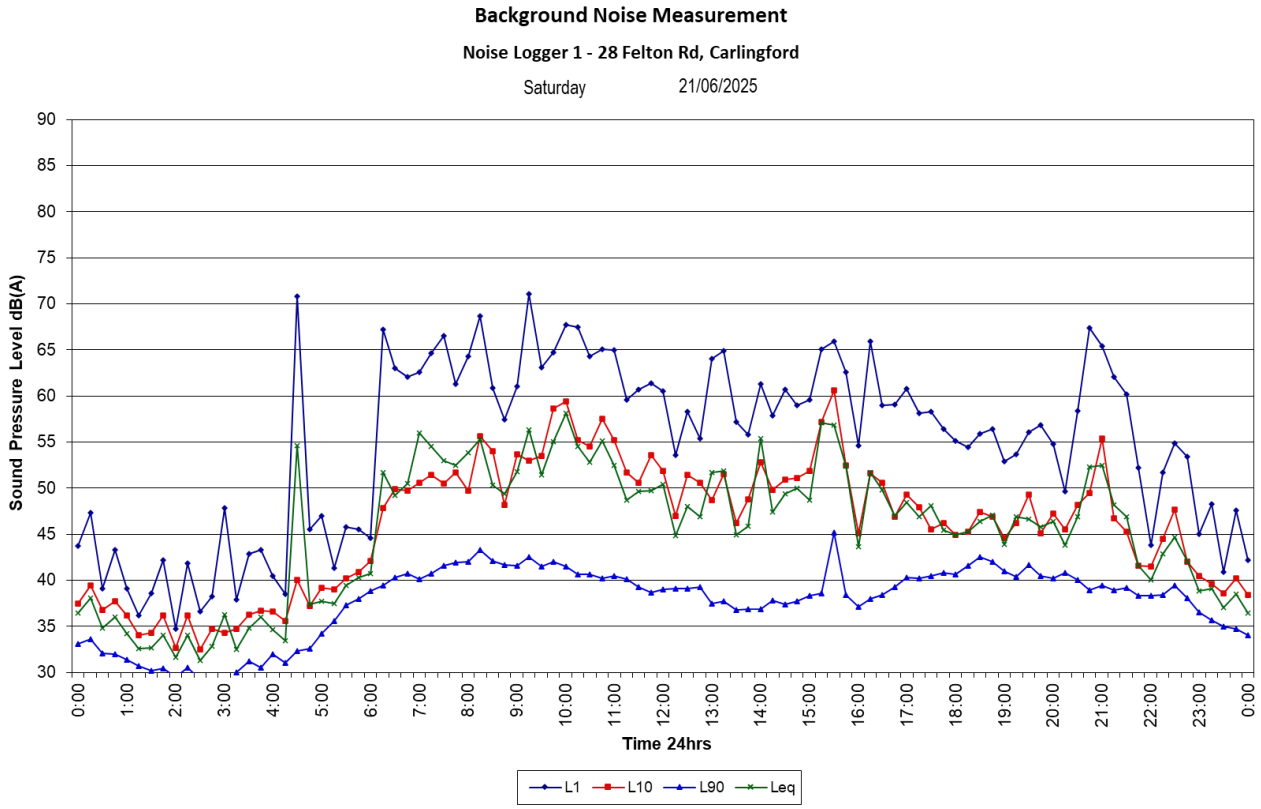
Wednesday 18/06/2025




Background Noise Measurement
Noise Logger 1 - 28 Felton Rd, Carlingford
Thursday 19/06/2025
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq


Background Noise Measurement
Noise Logger 1 - 28 Felton Rd, Carlingford
Friday 20/06/2025
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq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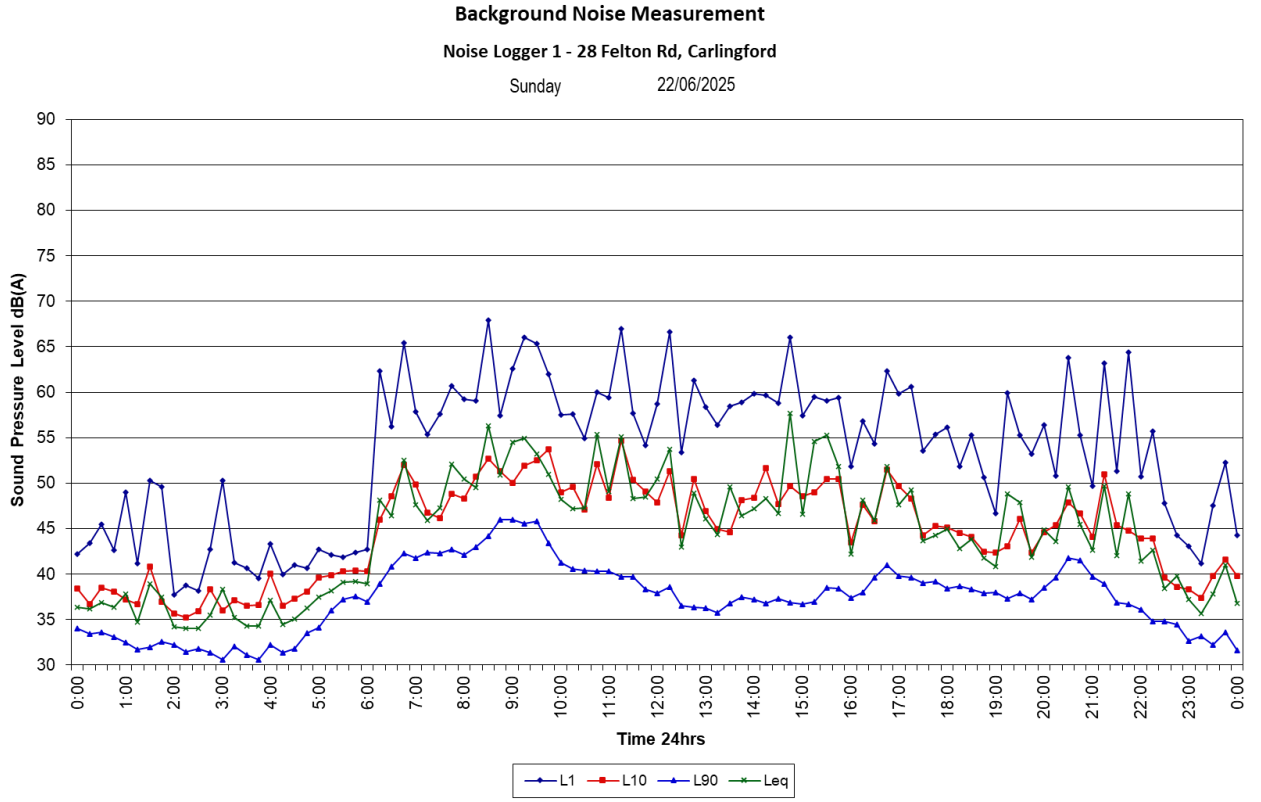
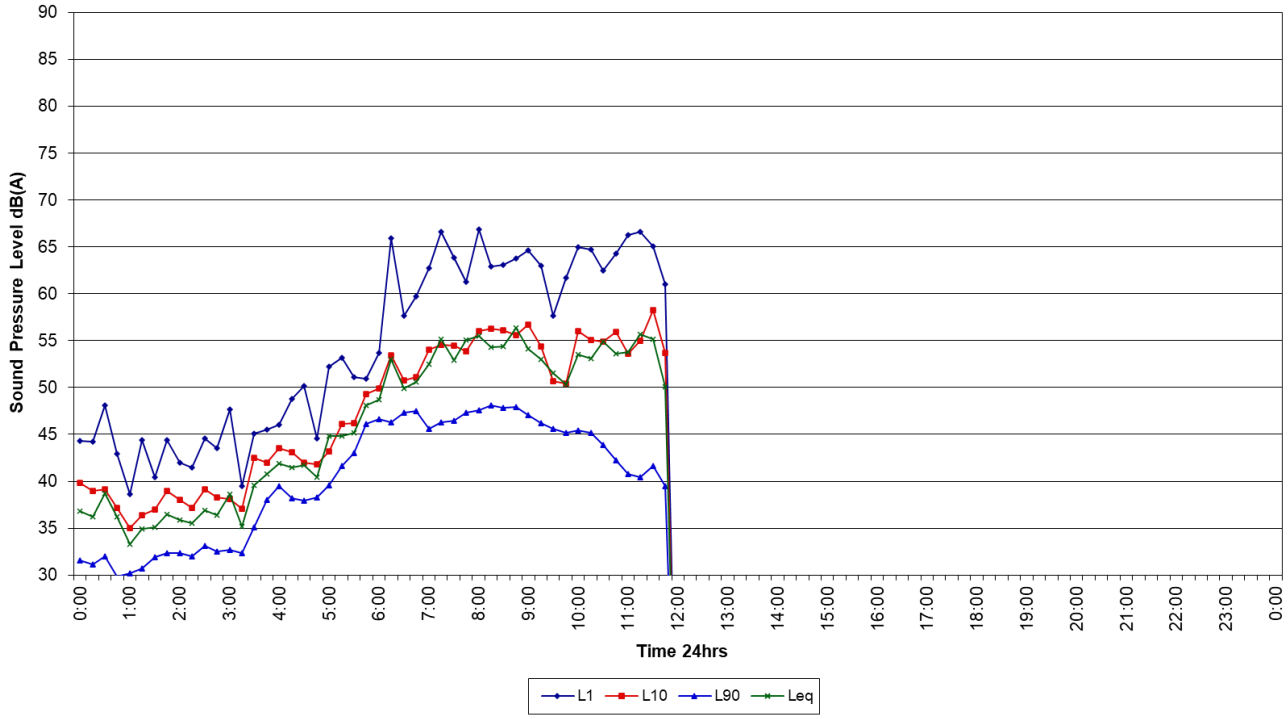
Saturday 21/06/2025
Sound Pressure Level dB(A)
Time 24hrs
L1 L10 L90 Leq


Background Noise Measurement
Noise Logger 1 - 28 Felton Rd, Carlingford
Sunday 22/06/2025
Sound Pressure Level dB(A)
Time 24hrs
L1 L10 L90 Leq

Background Noise Measurement

Noise Logger 1 - 28 Felton Rd, Carlingford

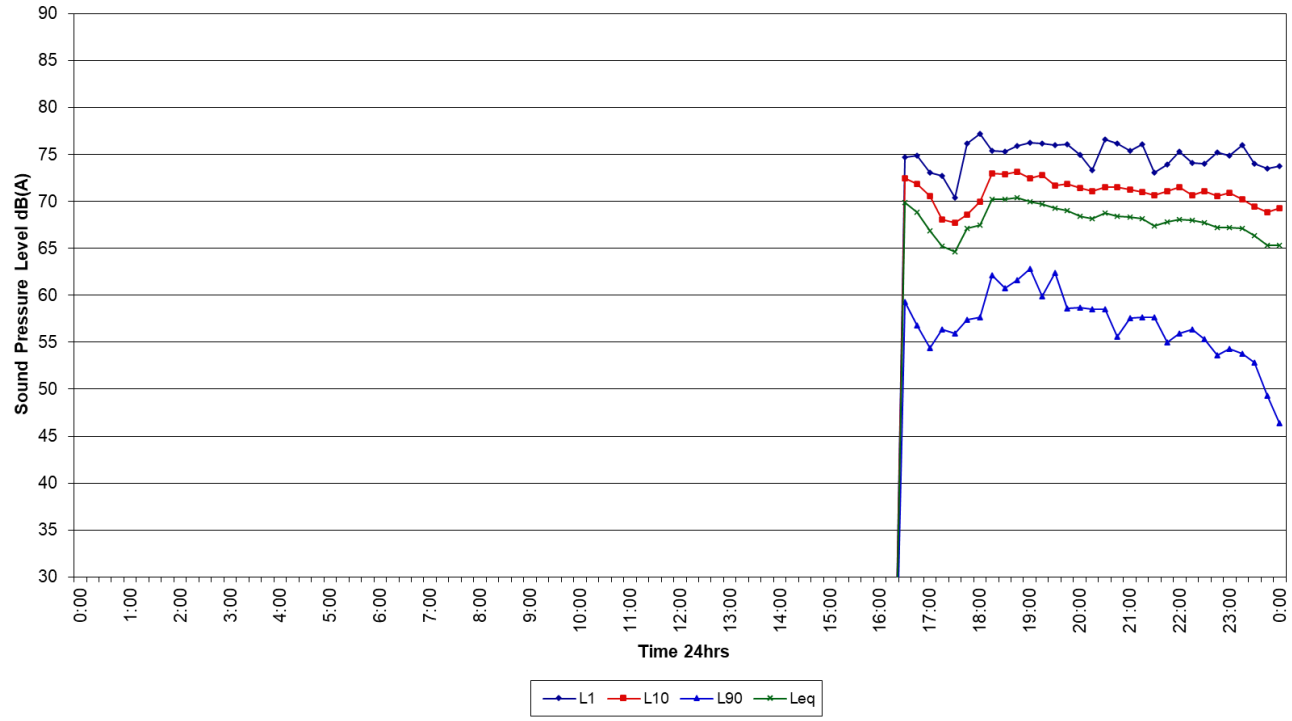
Monday 23/06/2025

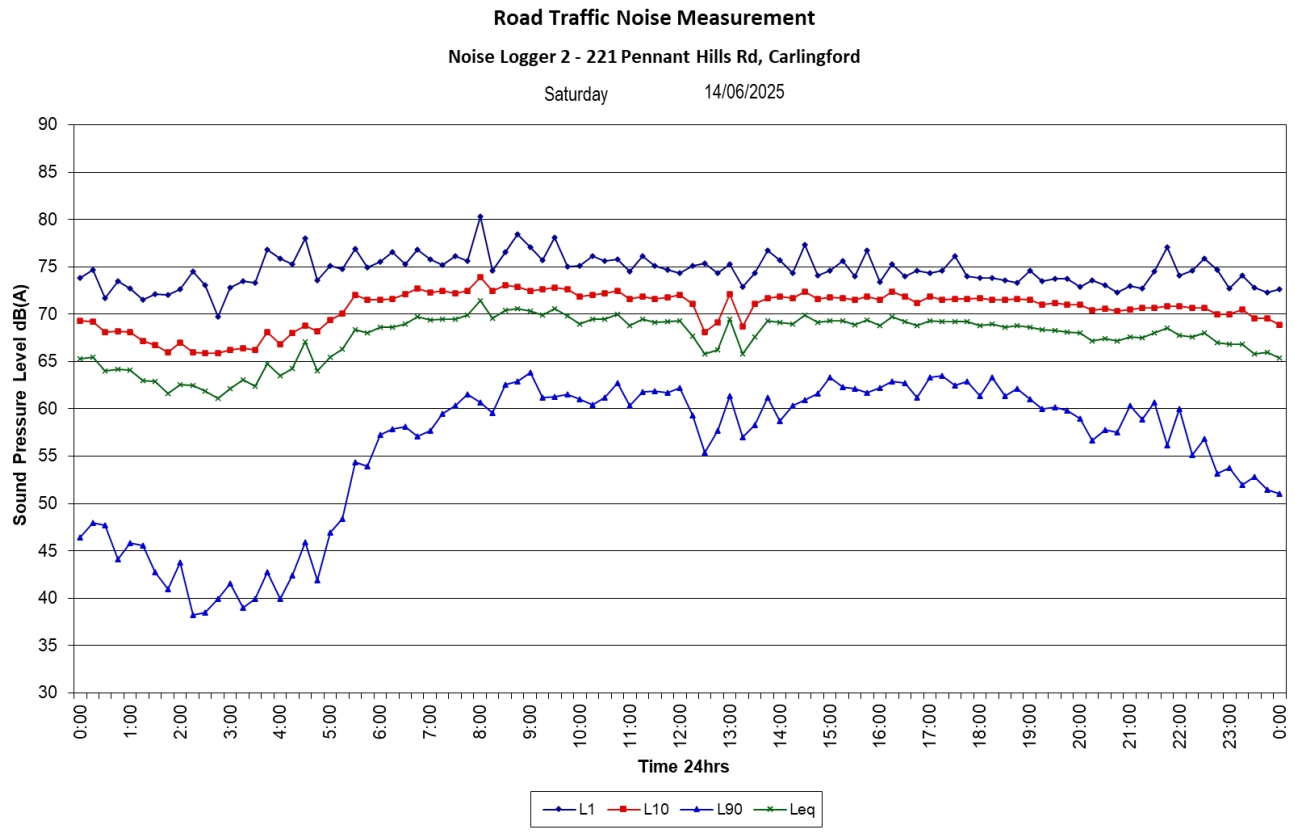


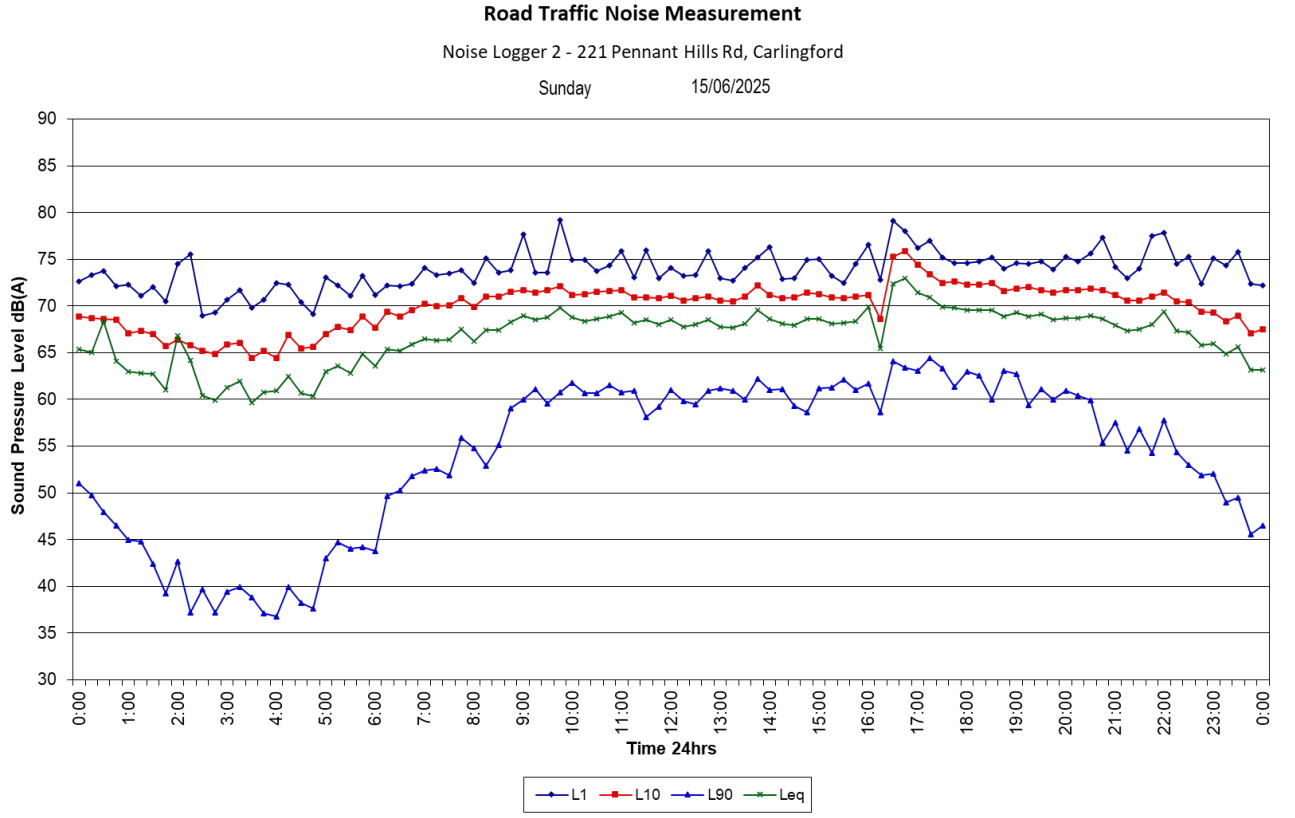
Road Traffic Noise Measurement

Noise Logger 2 - 221 Pennant Hills Rd, Carlingford

Friday 13/06/2025



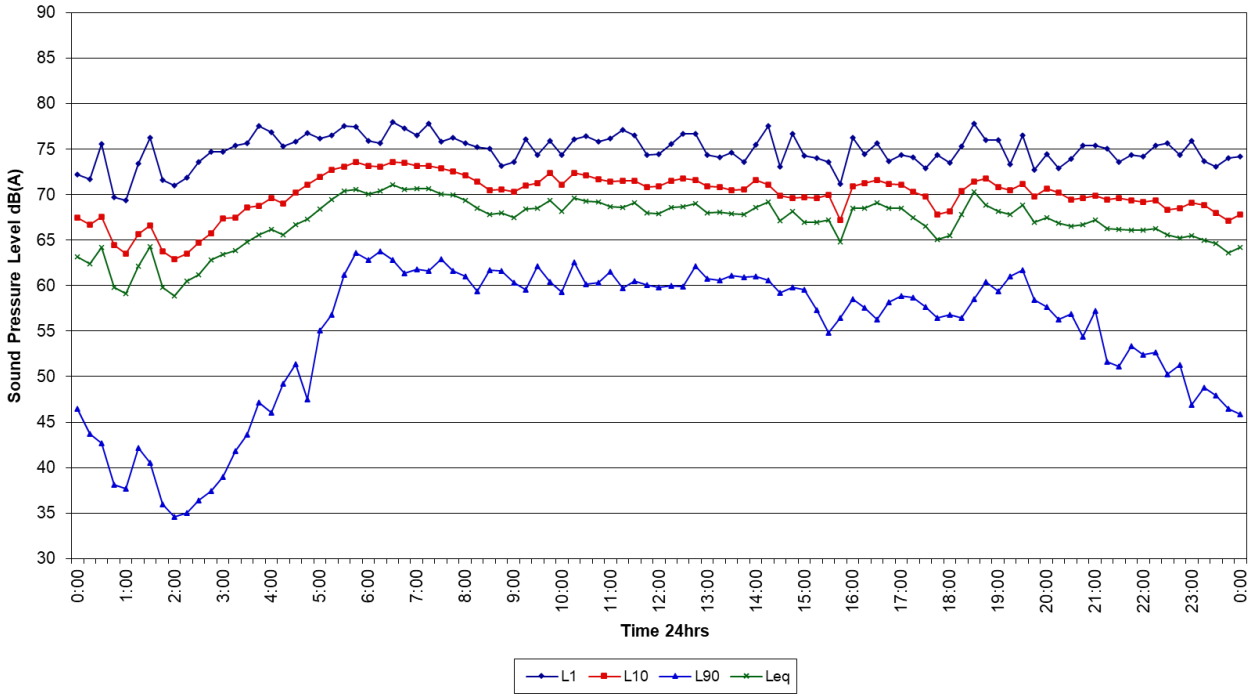

Road Traffic Noise Measurement
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford
Saturday 14/06/2025
Sound Pressure Level dB(A)
Time 24hrs
L1 L10 L90 Leq


Road Traffic Noise Measurement
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford
Sunday 15/06/2025
Sound Pressure Level dB(A)
Time 24hrs
L1 L10 L90 Leq

Road Traffic Noise Measurement

Noise Logger 2 - 221 Pennant Hills Rd, Carlingford

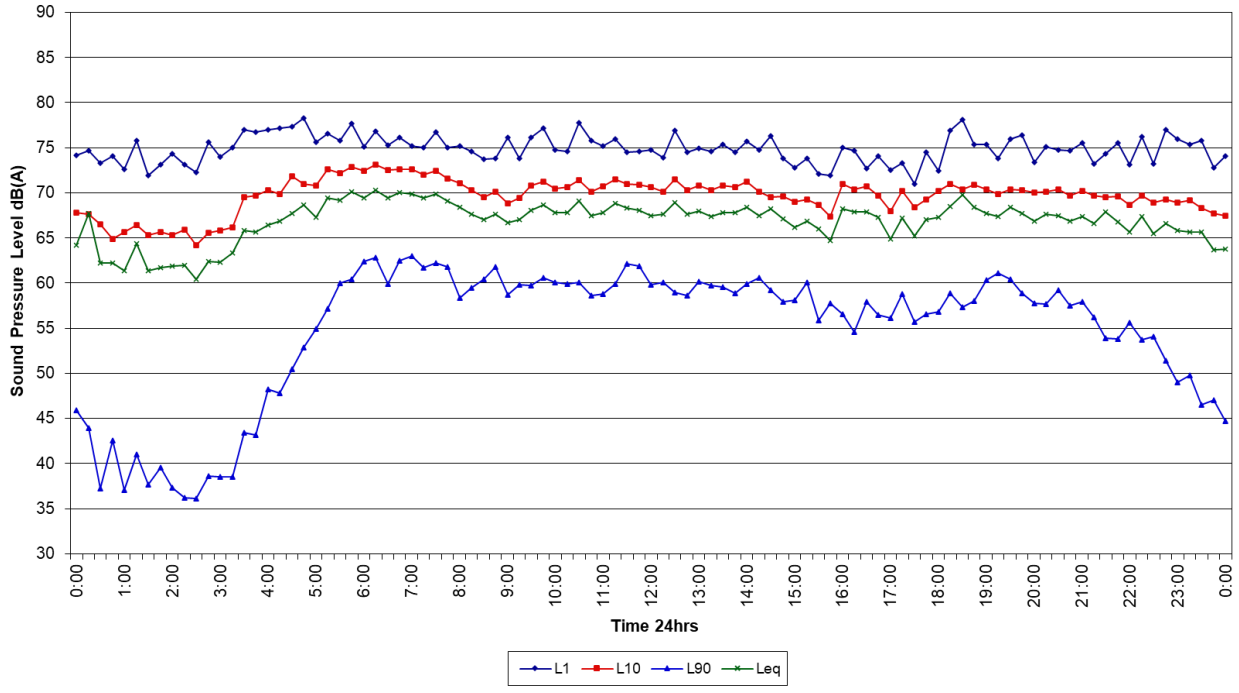
Monday 16/06/2025

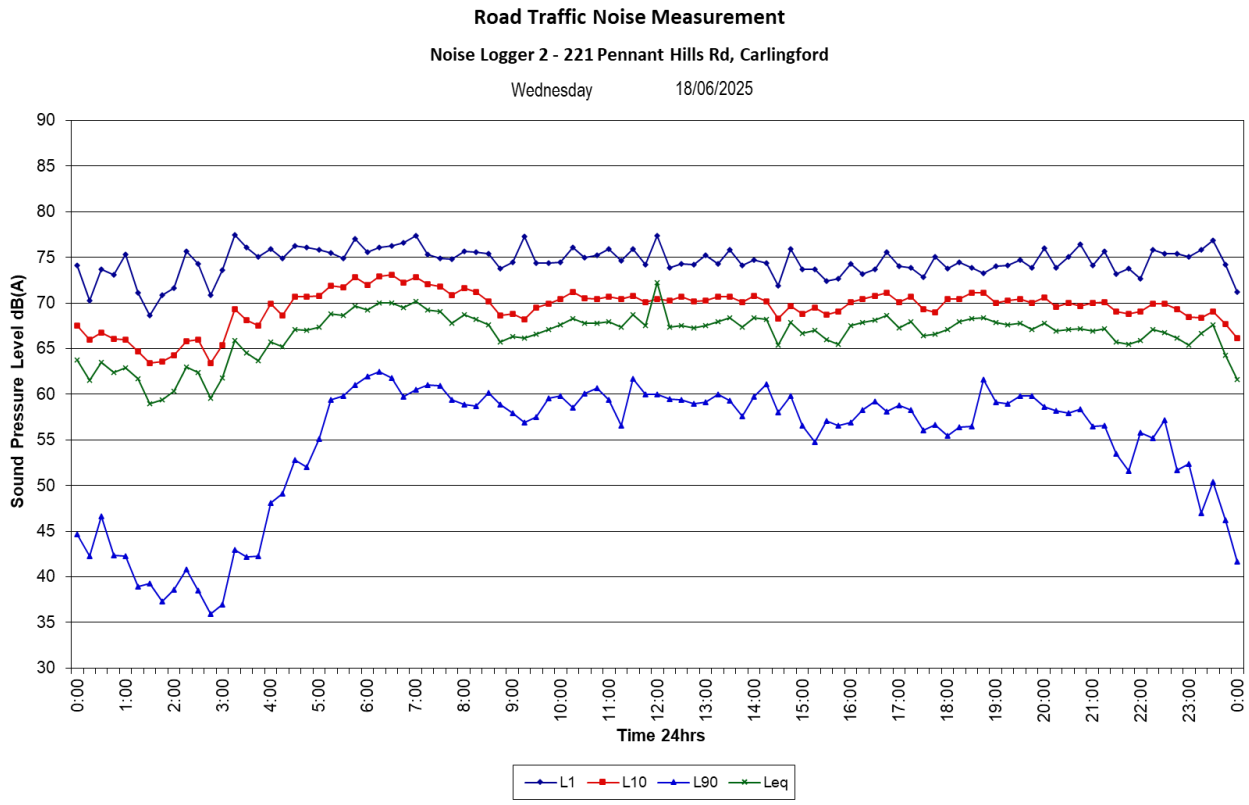


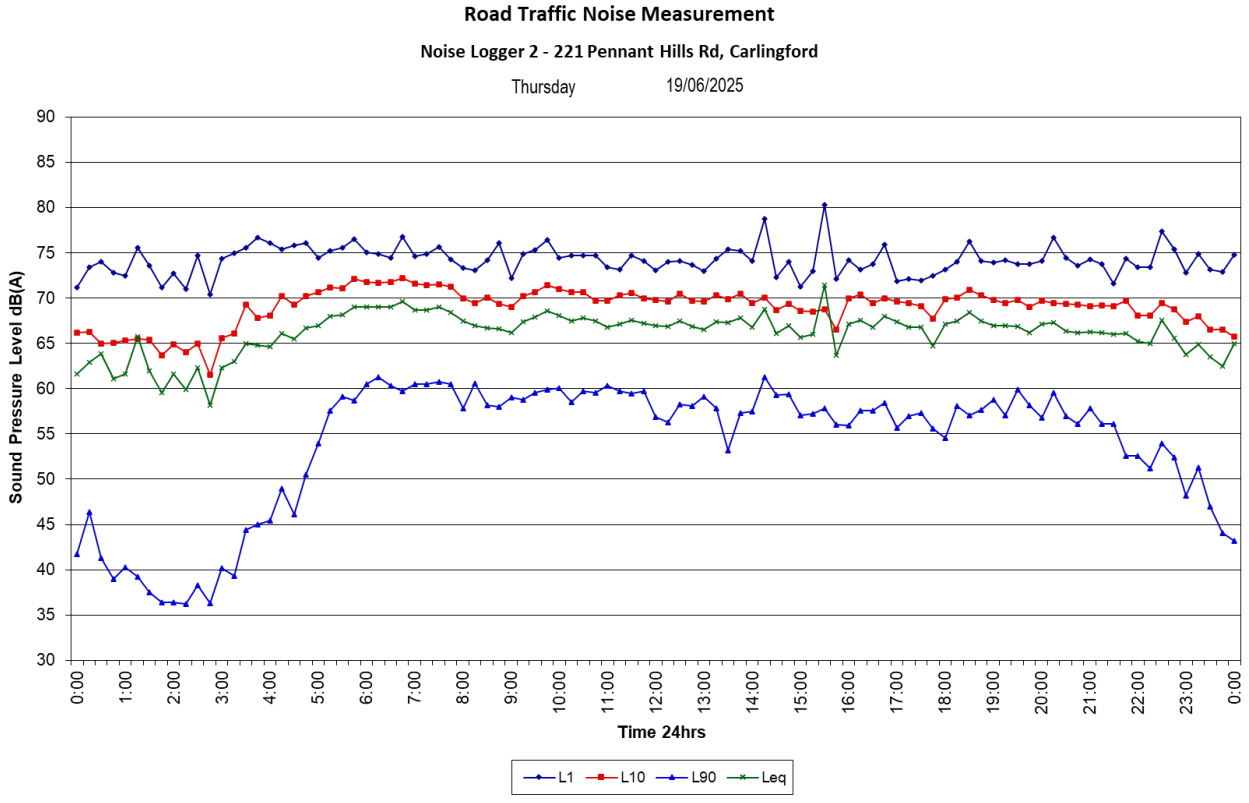
Road Traffic Noise Measurement

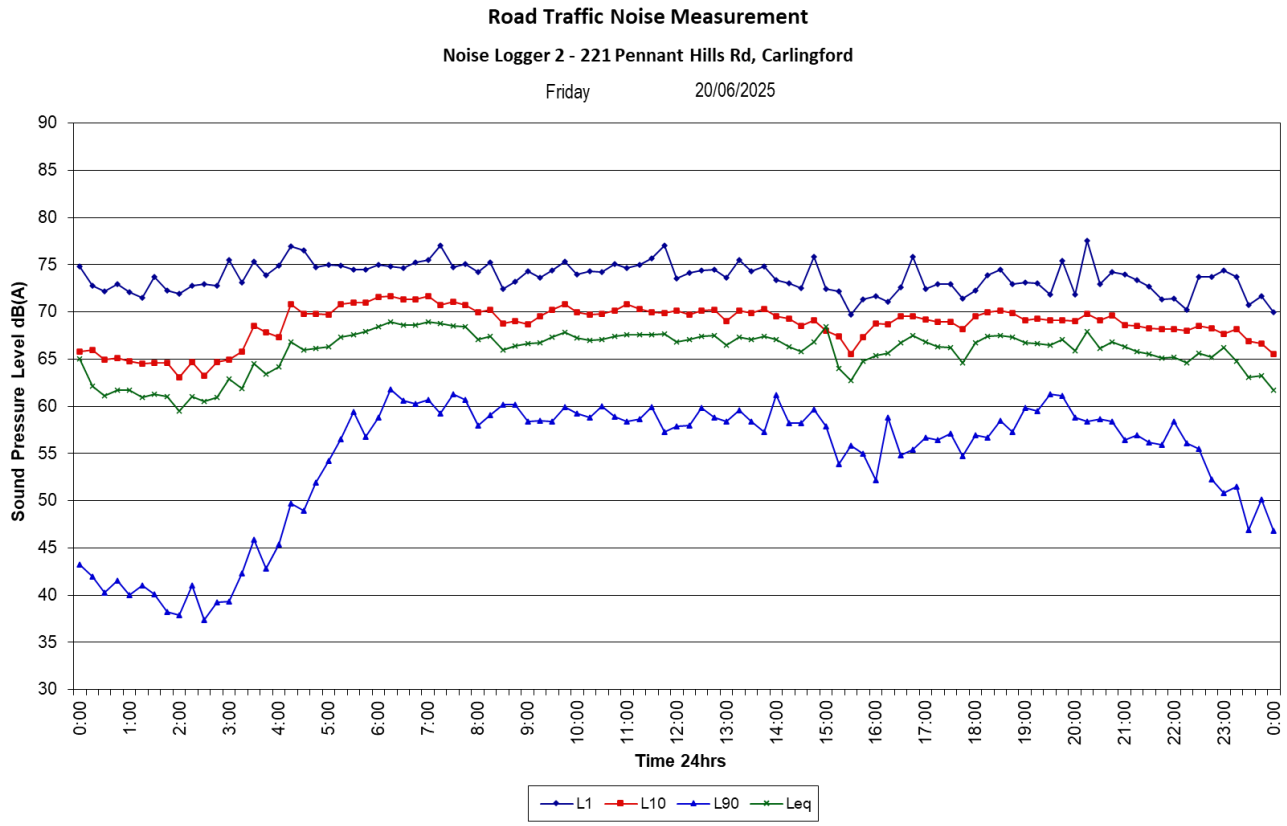
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford

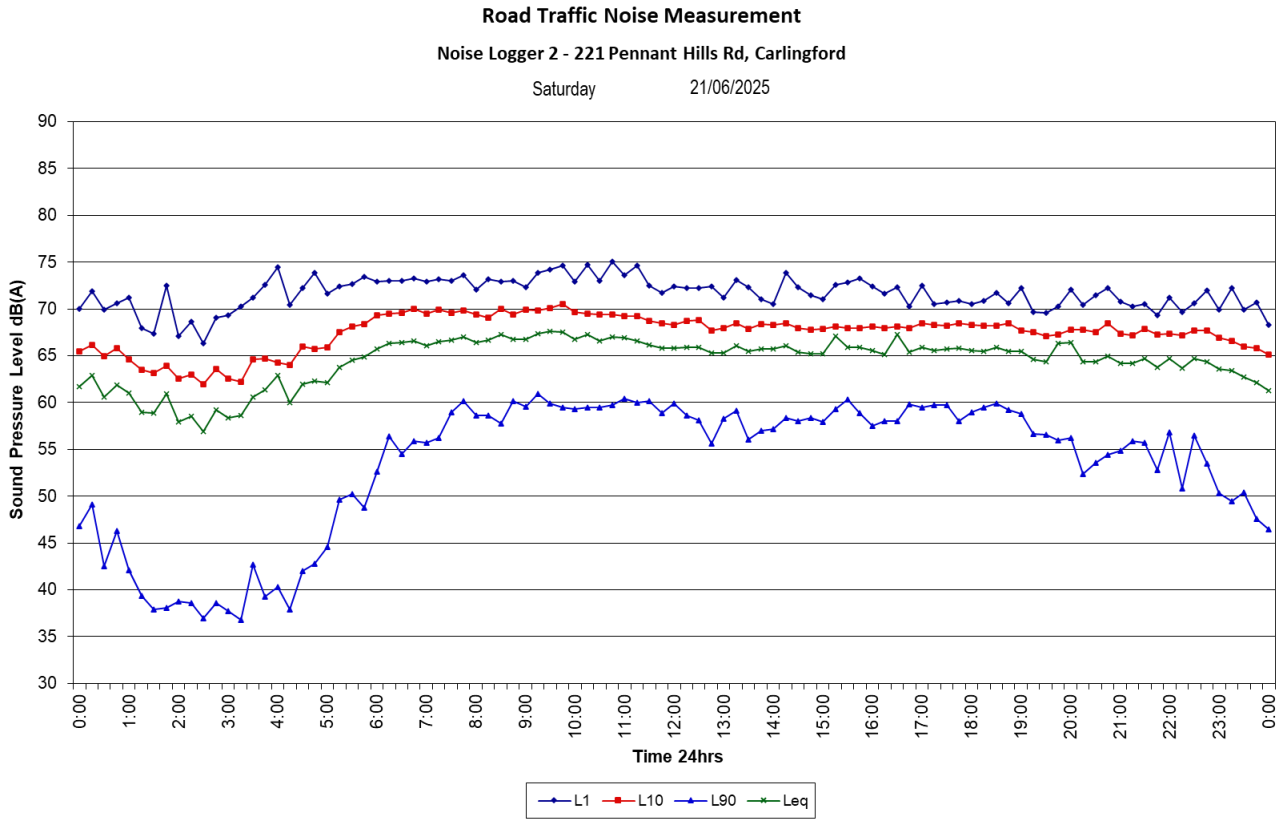
Tuesday 17/06/2025




Road Traffic Noise Measurement
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford
Wednesday 18/06/2025
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq


Road Traffic Noise Measurement
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford
Thursday 19/06/2025
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq

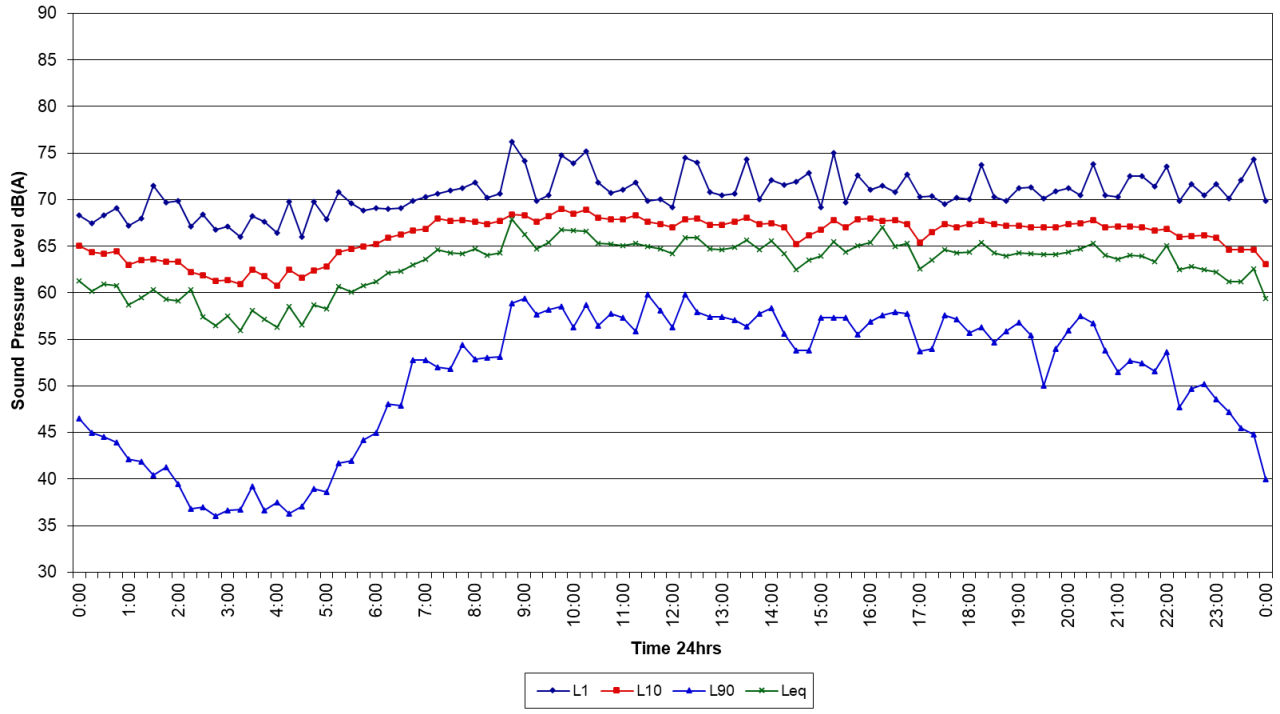

Road Traffic Noise Measurement
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford
Friday 20/06/2025
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq


Road Traffic Noise Measurement
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford
Saturday 21/06/2025
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq

Road Traffic Noise Measurement

Noise Logger 2 - 221 Pennant Hills Rd, Carlingford

Sunday 22/06/2025

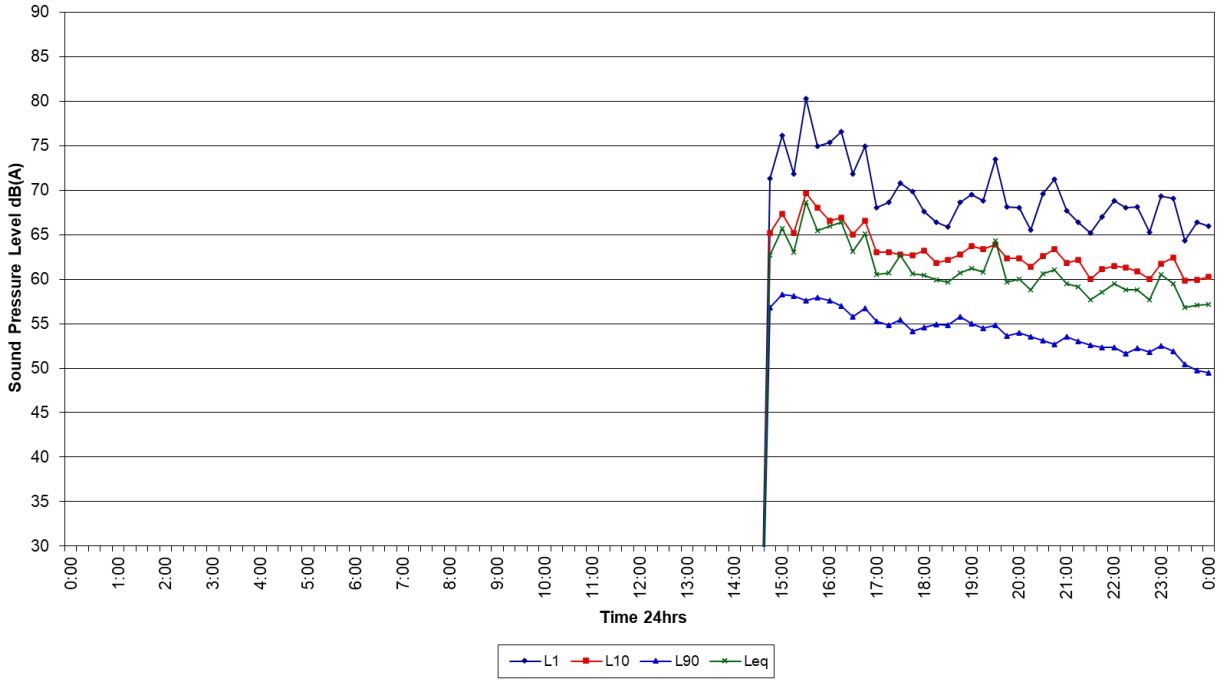


Road Traffic Noise Measurement

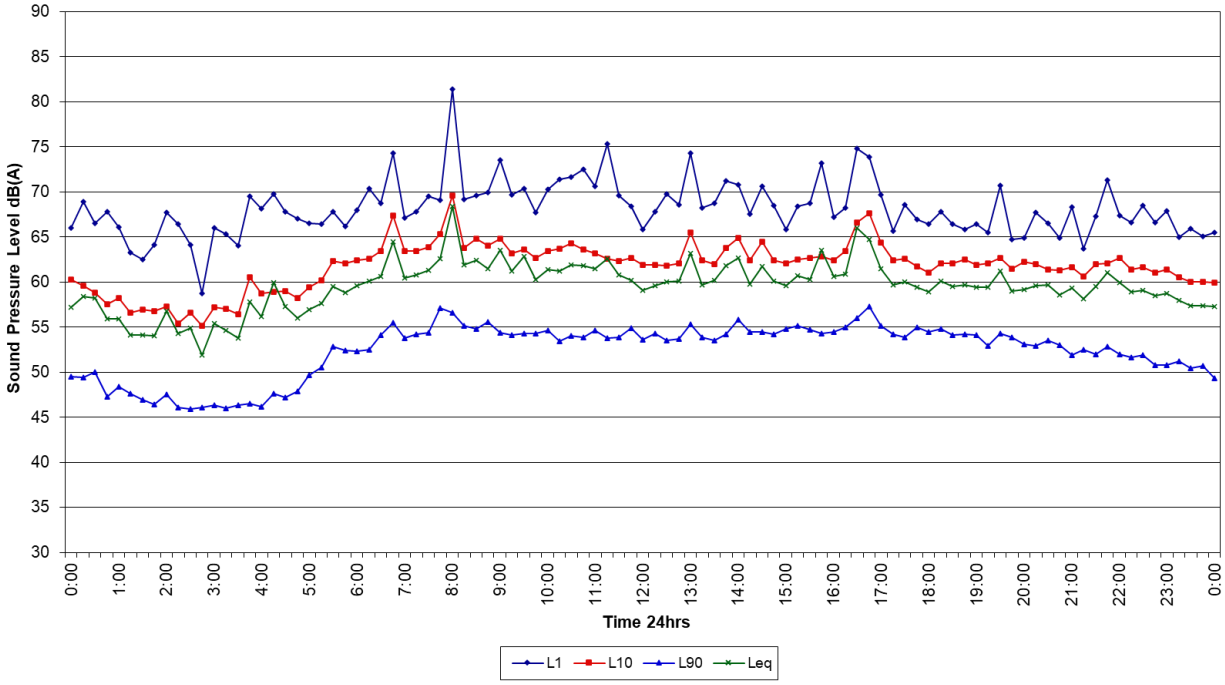
Noise Logger 2 - 221 Pennant Hills Rd, Carlingford

Monday 23/06/2025

Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Friday 13/06/2025



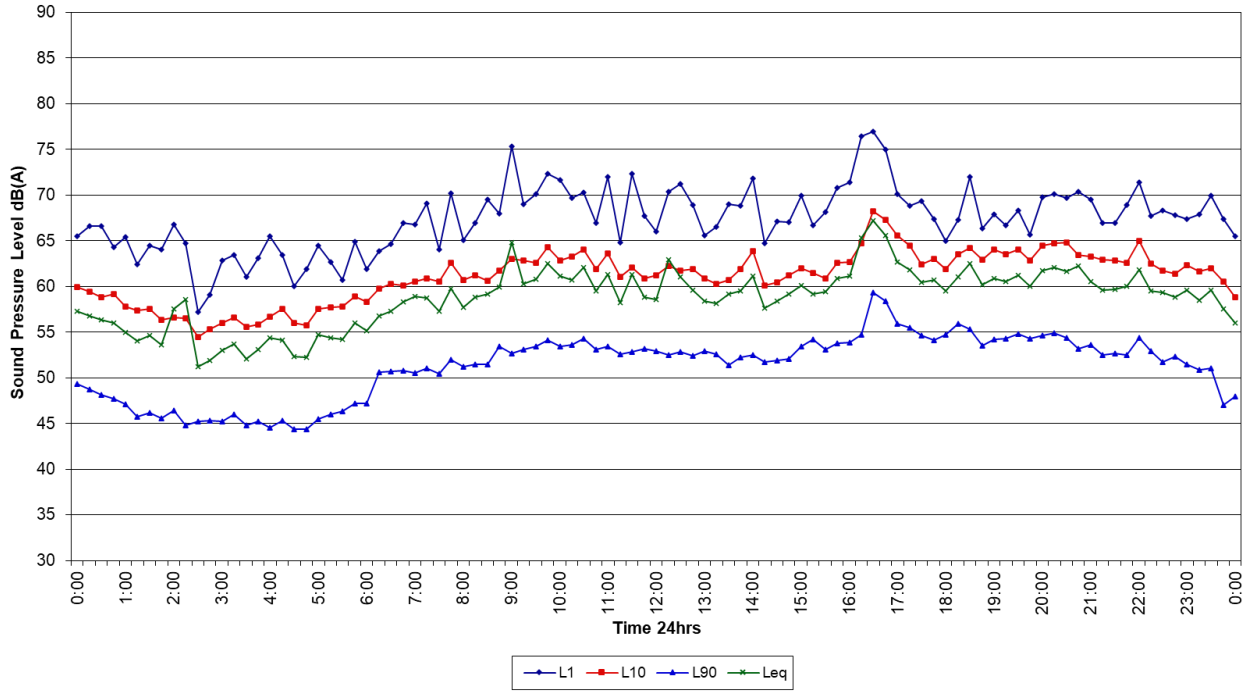
Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Saturday 14/06/2025



Background & Road Traffic Noise Measurement

Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford

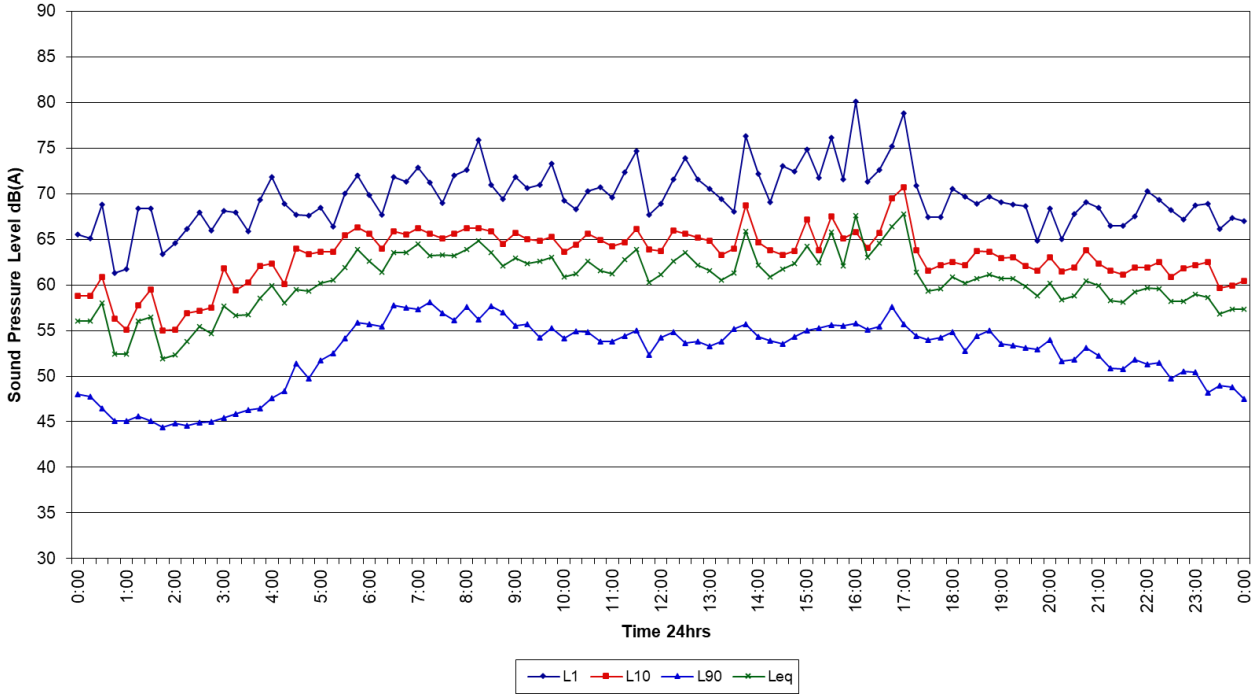
Sunday 15/06/2025



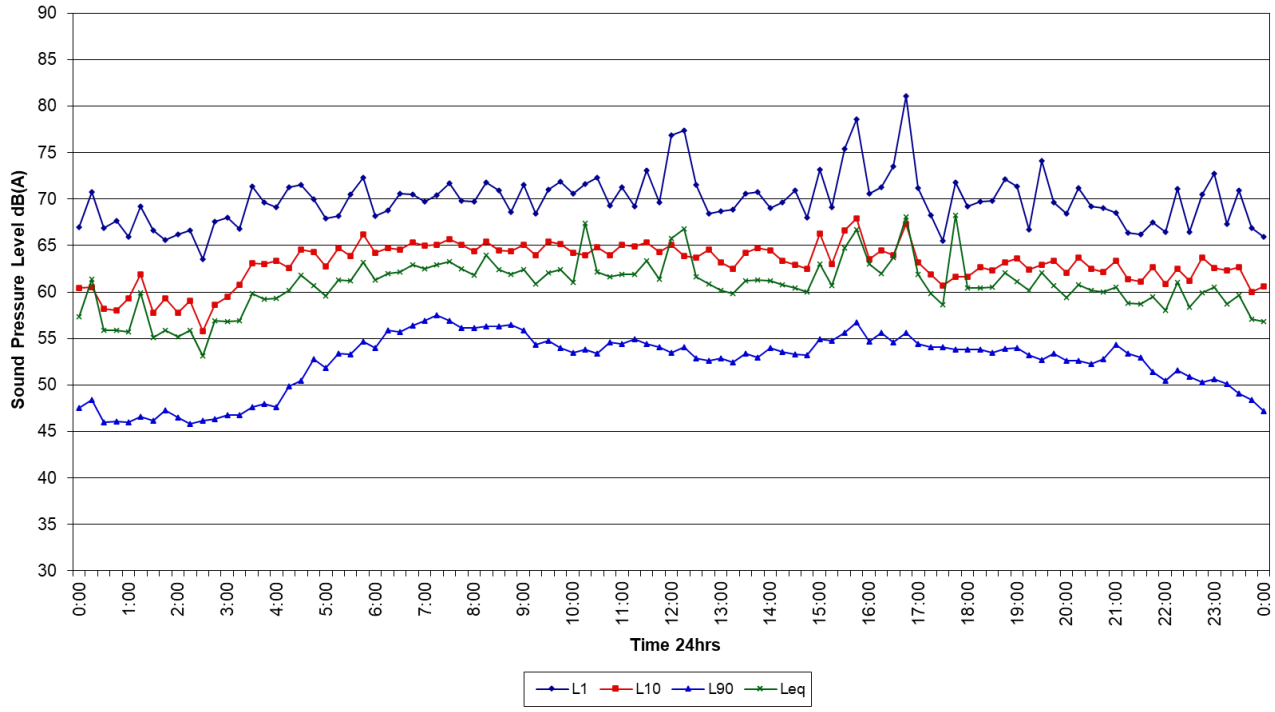
Background & Road Traffic Noise Measurement

Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford

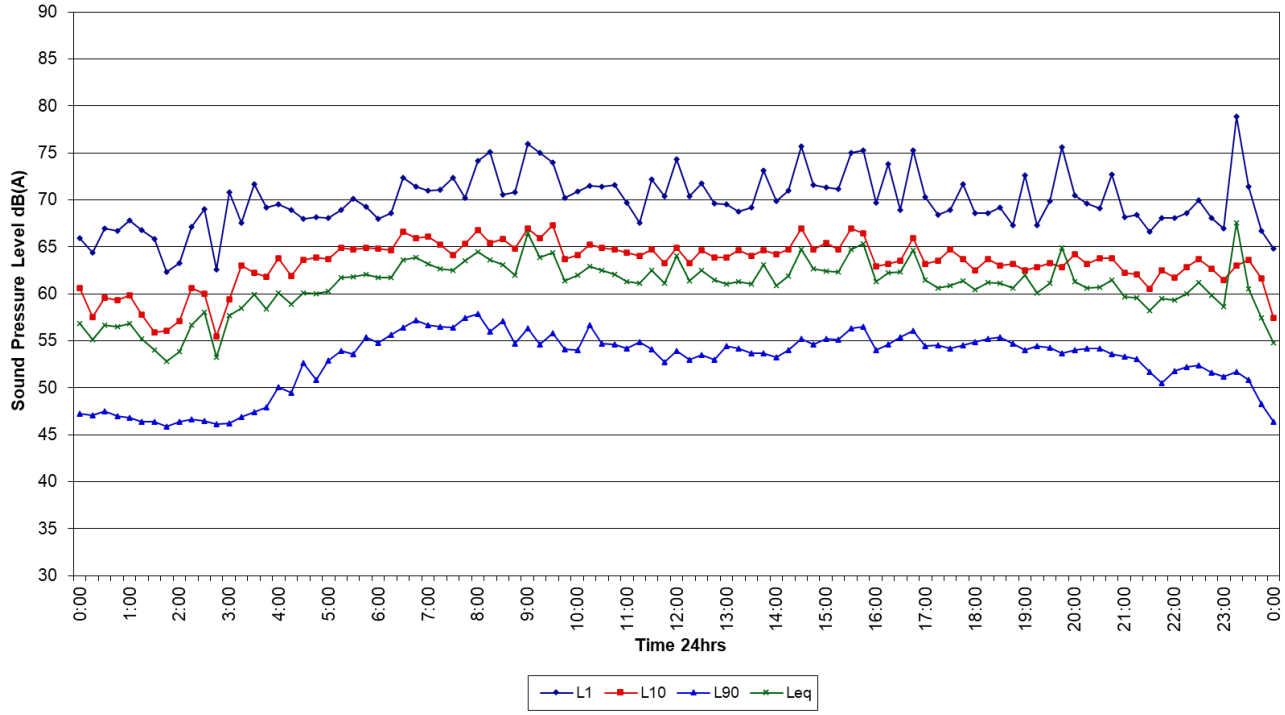
Monday 16/06/2025



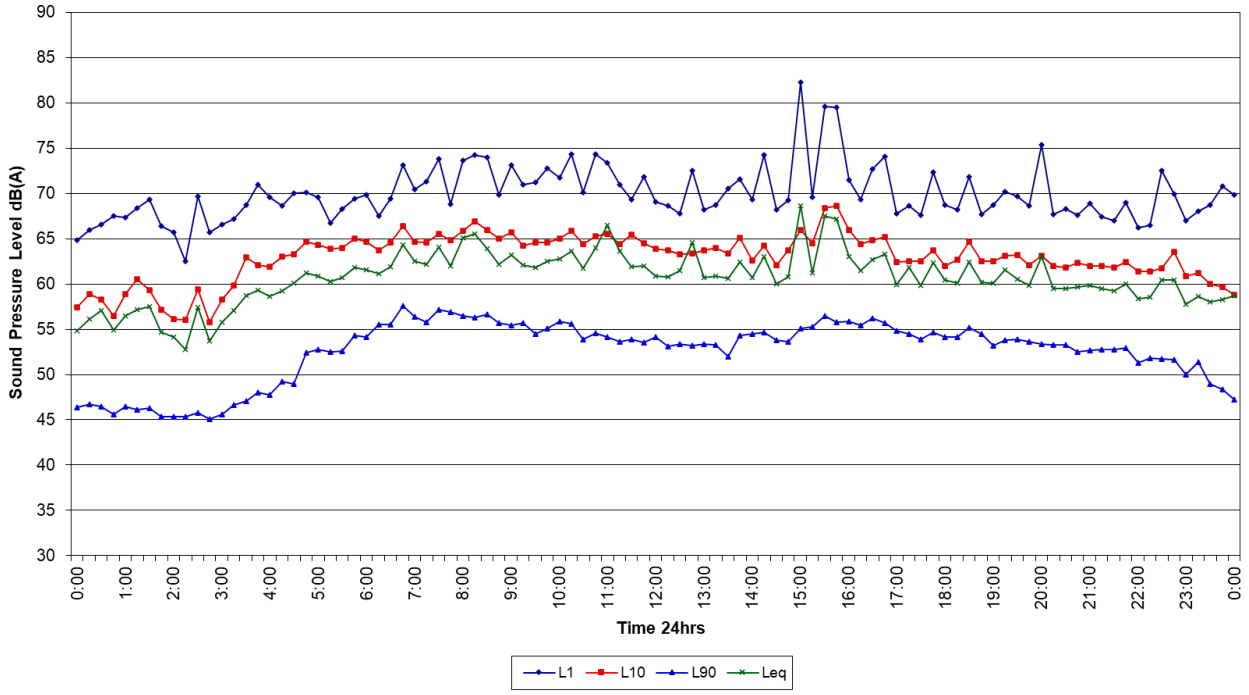
Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Tuesday 17/06/2025



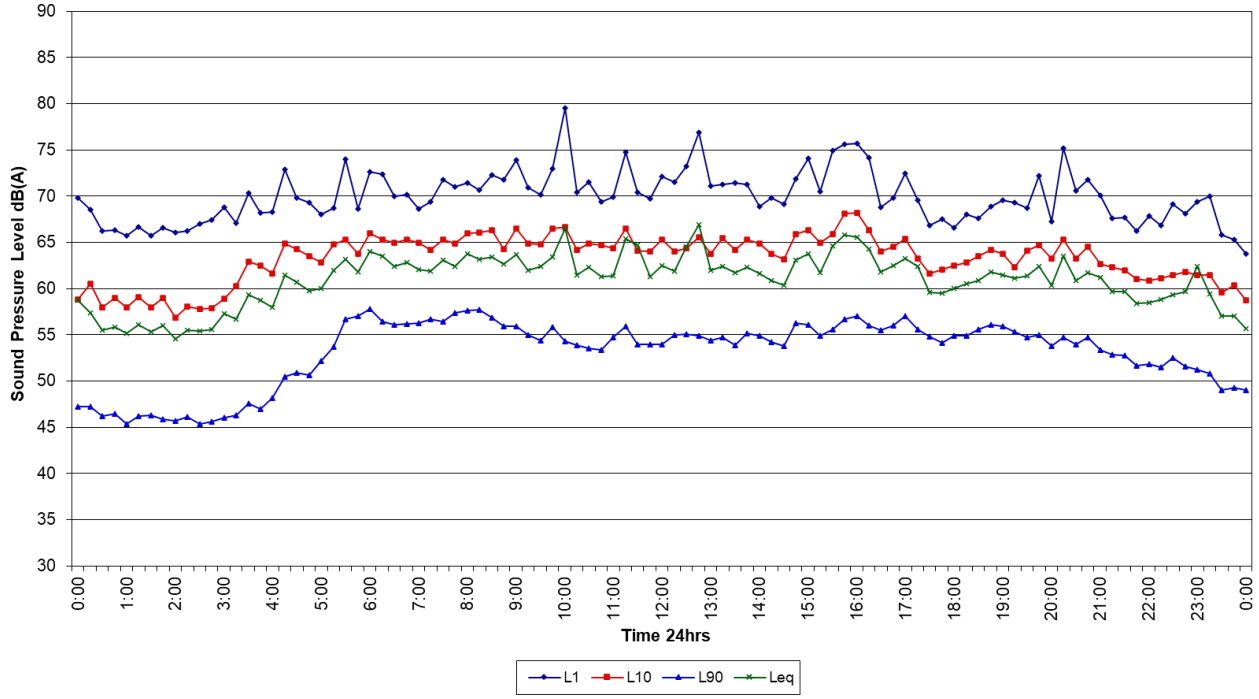
Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Wednesday 18/06/2025



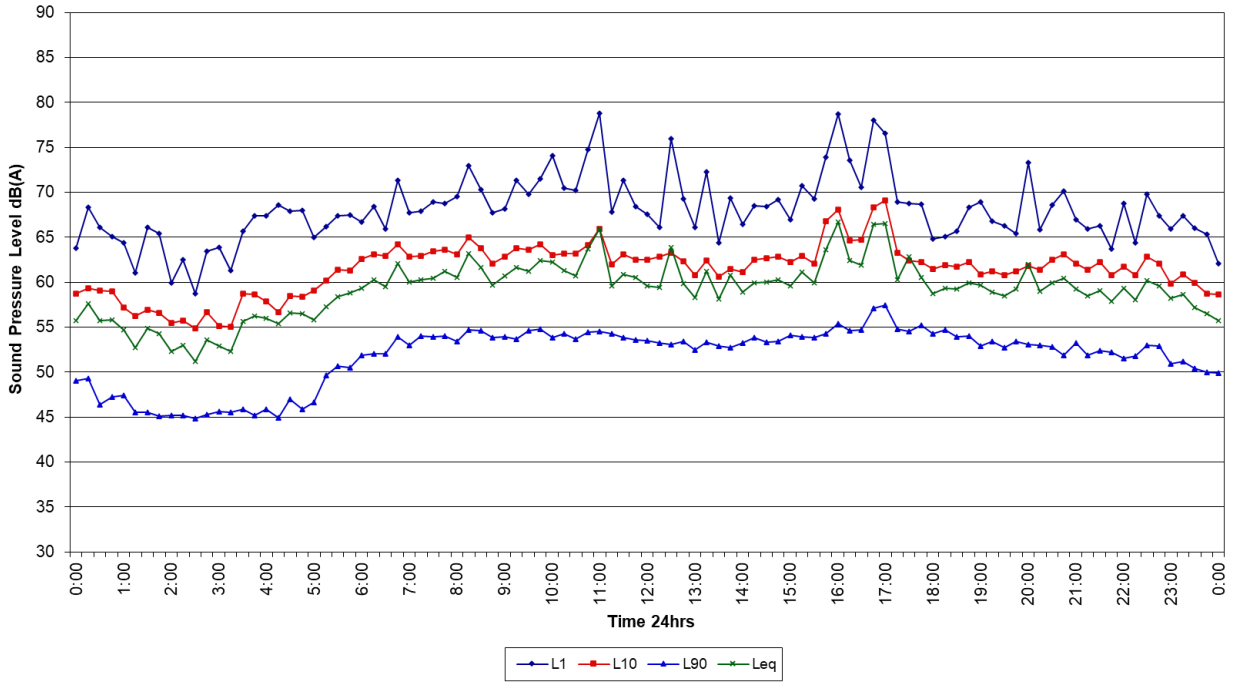
Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Thursday 19/06/2025



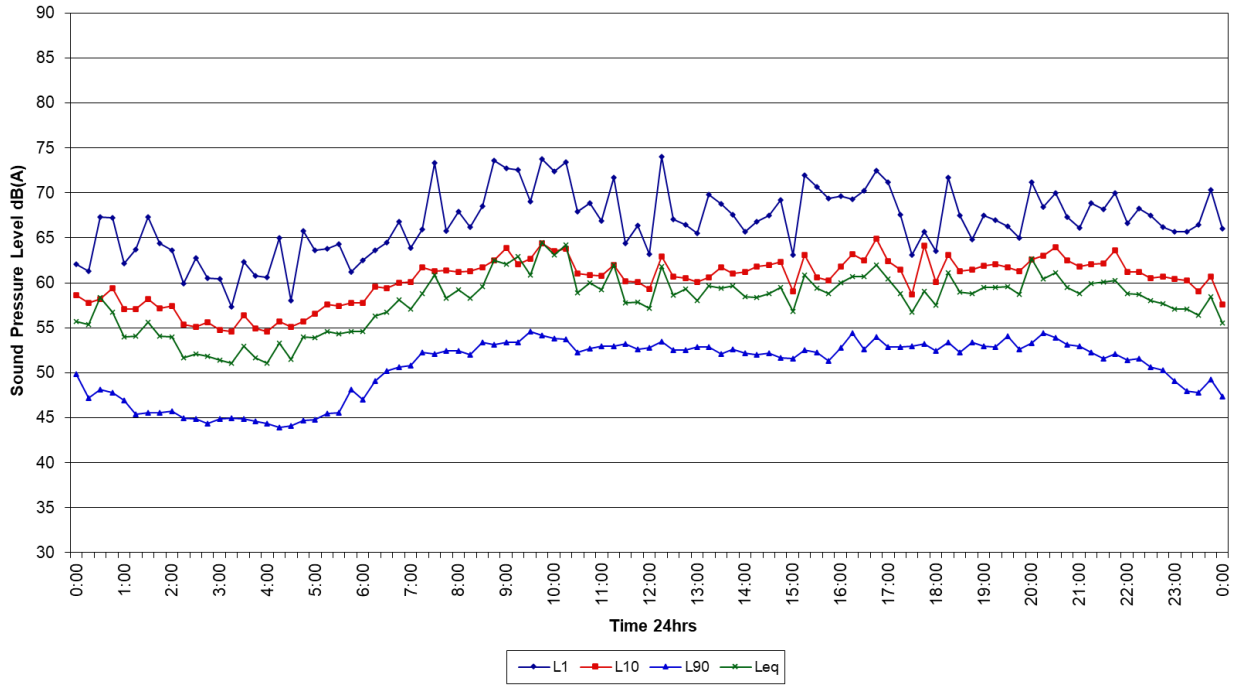
Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Friday 20/06/2025



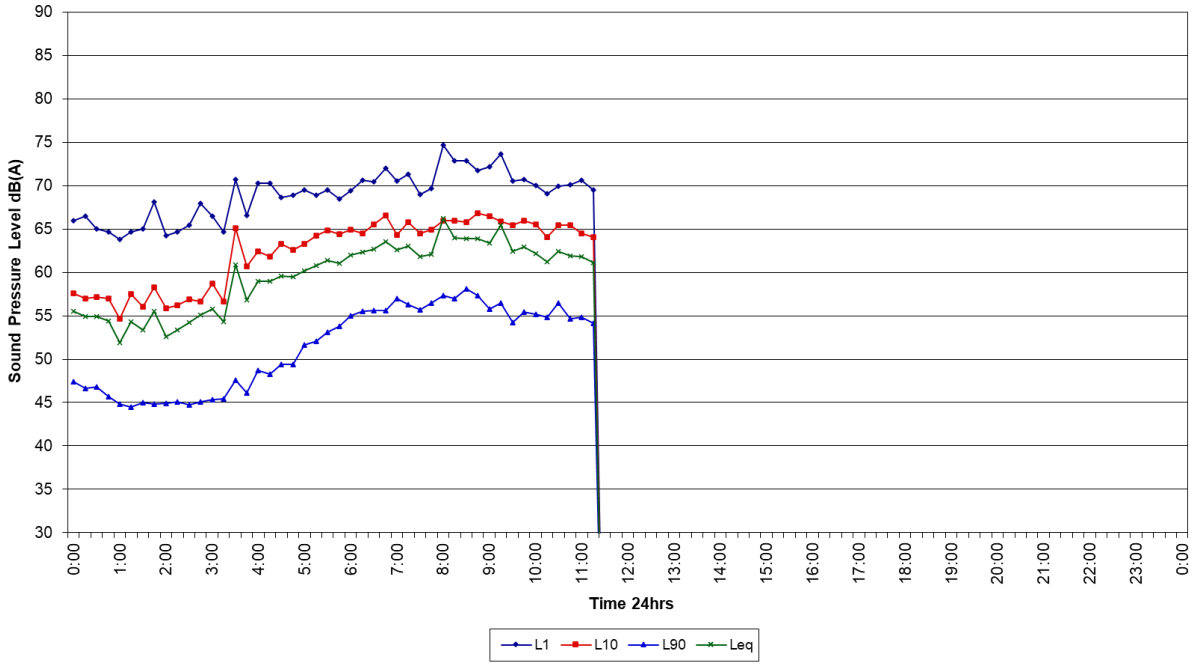
Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Saturday 21/06/2025



Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Sunday 22/06/2025



Background & Road Traffic Noise Measurement
Noise Logger 3 - North-East Area of 241-245 Pennant Hills Rd, Carlingford
Monday 23/06/2025



Appendix D – Noise Complaint Handling Strategy

In the absence of a pre-existing noise complaint handling strategy the following strategy may be adopted for all noise enquiries / complaints. The strategy provides guidance on actions to be undertaken by site management or nominated personnel to actively address complaints received from the surrounding community.

[1]. On receipt of a noise enquiry/complaint, site management or nominated personnel will complete a Record of Construction Noise Complaint, including specific details as follows:

- full name and contact details of the complainant;
- time and date of the incident;
- details of the complainant's location;
- description of construction noise;
- any other details the complainant may wish to provide; and
- whether the complainant requests further action.

[2]. The noise enquiry is then referred to site management for investigation. Upon completion of the investigation, the complainant will be contacted by site management or nominated personnel to discuss the event that caused the noise enquiry. Contact with the complainant should take place as soon as practicable, but no later than 1 day from when the complaint was recorded.

[3]. If the complaint requires further action, or site management believes the matter warrants further investigation, an independent acoustic consultant should be engaged to undertake attended noise measurements at the location of the complainant during works identified as giving rise to the complaint.

[4]. In the event that attended noise measurements reveal that construction noise levels comply with the applicable noise criteria for the location, no further action is required however it is advised to provide the complainant with relevant information about the construction works.

[5]. Should the attended noise measurements reveal that construction noise levels exceed the applicable noise criteria for the location, all feasible, reasonable and practical work practices must be investigated and implemented in order to reduce the current level of construction noise. Noise levels should then be re-measured in order to evaluate the level of reduction achieved.

[6]. If the construction noise levels have been satisfactorily reduced to comply with the applicable noise criteria no further action is required. If the construction noise levels continue to exceed the applicable noise criteria for the location number 5 should be repeated in order to further reduce construction noise levels.