ACOUSTIC NOISE & VIBRATION SOLUTIONS P/L

-Part 1-Acoustic Report

-Acoustic Assessment of Environmental Noise -

-Part 2 Construction Noise and Vibration Management Plan-

For proposed development at

No. 118-120 Station Street, Penrith

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Document Control

Date	***Revision History***	***Prepared By:***	***Reviewed and Authorised by:***
11/08/2020	Initial Report	Domeniki Tsagaris	Moussa Zaioor
10/09/2020	Final Report	Domeniki Tsagaris	Moussa Zaioor
25/09/2020	Rev.1 Communal Area fencing	Domeniki Tsagaris	Moussa Zaioor
20/11/2020	Rev. 2 Latest architectural plans	Domeniki Tsagaris	Moussa Zaioor

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1.0 SCOPE REPORT

The aim of this report is to determine the building materials to be used and the construction methods to be adopted such that the proposed development at No. 118-120 Station Street, Penrith is built to achieve acceptable internal noise levels as per Penrith City Council requirements.

Noise intrusion levels are to be within the limits adopted by the Building Code of Australia, Australian/New Zealand Standard AS/NZS 2107:2016 '*Acoustics – Recommended Design Sound Levels and Reverberation Times'* and Penrith City Council requirements, such that all habitable rooms in the proposed development shall be designed to limit internal noise levels.

Noise breakout from the use of the proposed building, including all proposed mechanical plant and equipment is to comply with the Noise Guide for Local Government and NSW Noise Policy for Industry (2017).

1.1 Project Description

The proposed site is located on the corner of Station Street and Reserve Street in the suburb of Penrith (Figure 1 – Site Location).The architectural plans by Architecture Design Studio Pty Ltd dated November 19th, 2020 are for the proposed construction of a six (6) storey mix use commercial and residential development comprising of commercial use on the ground floor and residential units at the remaining upper floors with two (2) level of basement parking.

According to Penrith LEP 2010, the proposed development and adjacent to the subject site is zoned B4 mixed use with RE1 Public Recreations located north of the site. The site is surrounded by a mixture of commercial, retail and residential properties Figure 2 – Surrounding Environment). The subject site is located opposite to Nepean Village Shopping centre and its associated carpark as well as opposite to the aquatic centre, Ripples Penrith and its associated carpark. Penrith Station is located approximately 660metre east from the subject site (Figure 2 -Surrounding Environment).

The associated operating hours of the above mention locations are as follows

- **Nepean Village Shopping Centre**
  - Monday – Wednesday & Friday – Saturday: 9:00am – 5:30pm
  - Thursday: 9:00am – 9:00pm
  - Sunday: 10:00am – 4:00pm
- **Coles Penrith (located within Nepean Village Shopping Centre)**
  - Monday – Sunday: 6:00am – 12:00am
- **Kmart Penrith (located within Nepean Village Shopping Centre)**
  - Monday – Friday: 6:00am – 12:00am
  - Saturday – Sunday: 8:00am – 12:00am
- **Penrith Ripples are as follows:**

- Monday – Friday: 5:30am – 7:00pm
- Saturday – Sunday: 8:00am – 6:00pm

Therefore, Nepean Village Shopping Centre and Ripples Penrith associated on-ground carpark will be operating throughout majority of the day. The existing background noise levels for the proposed development is dominated by the operation of Nepean Village Shopping Centre and Ripples Penrith, including the on-ground carpark, as well as traffic noise from Mulgoa Road, Station Street and surrounding streets and residential activities (Figure 2 -Surrounding Environment).

Figure 1 - Site Location

Figure 2 - Surrounding Environment

2.0 ACOUSTIC DESCRIPTORS

L_{Amax} – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

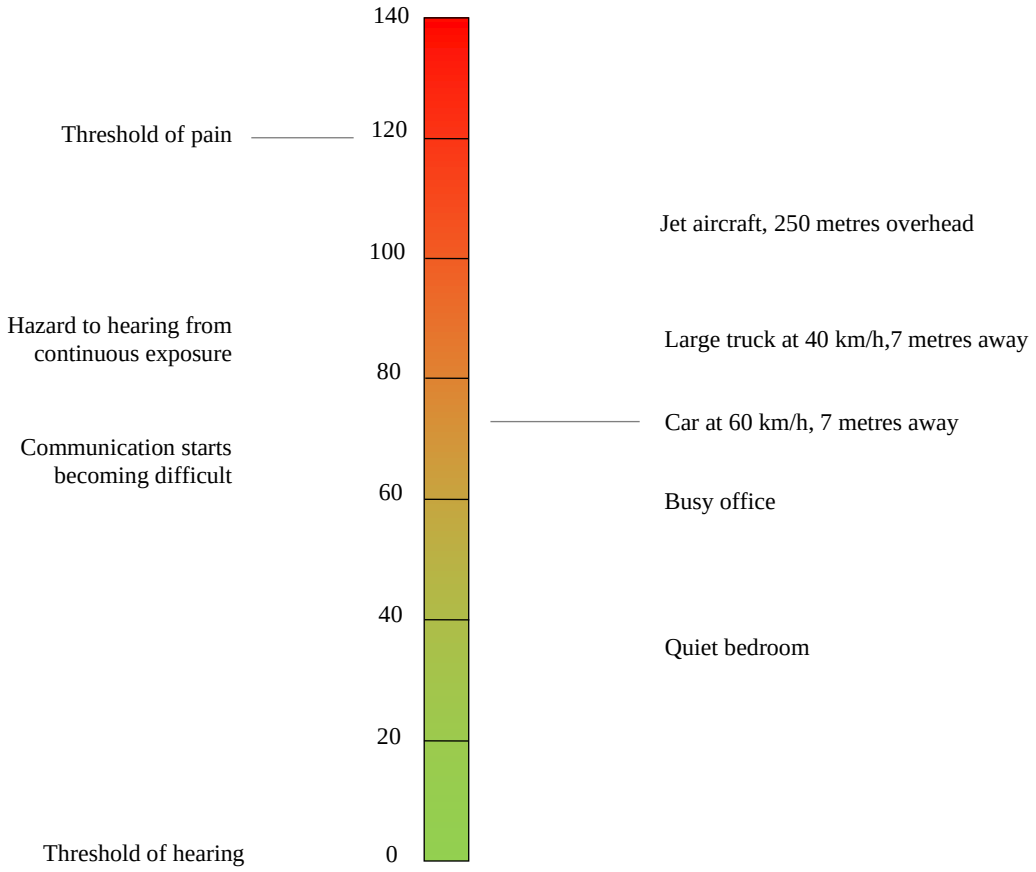
L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and nighttime) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and nighttime.

The level of common sounds on the dB(A) scale as the figure below:



3.0 ACOUSTICAL STUDY

3.1 Australian/New Zealand Standard AS/NZS 2107:2016

The above standard has formulated the criteria for developments situated in urban areas.

As traffic noise levels are not constant, a Leq noise level descriptor is used when assessing this type of noise source. The Leq is the mean energy level of noise being measured and has been found to accurately describe the level of annoyance caused by traffic noise.

It is usual practice, when we find it necessary to recommend internal sound levels in buildings to refer to Australian/New Zealand Standard AS/NZS 2107:2016 "*Acoustics – Recommended Design Sound Levels and Reverberations times for Building Interiors*".

AS/NZS 2107:2016 sets out design internal noise levels and reverberation times for different buildings depending on the use of these structures. The noise levels recommended in AS/NZS 2107:2016 take into account the function of the area and apply that to the sound level measured within the space unoccupied although ready for occupancy.

In Table 1, Page 13, the standard recommends the following noise levels for residential buildings proposed next to minor Roads.

Type of occupancy/activity	Design sound level ($L_{Aeq,t}$) range	Design reverberation time (T) range, s
RESIDENTIAL BUILDINGS (see Note 5 and Clause 5.2)		
Houses and apartments in inner city areas or entertainment districts or near major roads—		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	—
Living areas	35 to 45	—
Sleeping areas (night time)	35 to 40	—
Work areas	35 to 45	—
Houses and apartments in suburban areas or near minor roads—		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	—
Living areas	30 to 40	
Sleeping areas (night time)	30 to 35	
Work areas	35 to 40	—

4.0 NOISE SURVEY, INSTRUMENTATION & RESULTS

On August 21st, 2020, Acoustic, Vibration & Noise Pty Ltd went to the above address to carry out acoustic attended and unattended measurements at the boundaries of the site (Figure 3 – Noise Reading Locations). The current site is empty land.

The unattended environmental noise monitoring was conducted for seven (7) days between August 21st, 2020 and August 28th, 2020, at the south-eastern boundary of the site, adjacent to the nearest residential receivers (Figure 3 – Noise Reading Locations Point A). Unattended noise readings were carried out to determine existing background noise levels.

Additional attended noise readings were carried out at the front boundary facing Station Street (Figure 3 – Noise Reading Location Point B). The attended noise readings were taken between 4:30pm and 5:30pm (expected to be peak hour traffic) on Friday August 21st 2020, to determine traffic noise generated on Station St and distant traffic noise from surrounding streets.

All sound pressure levels are rounded to the nearest whole decibel. All measurements were taken in accordance with the Australian Standards AS 1055 "*Acoustics- Description and Measurements of Environmental Noise*".

The measurement procedure and the equipment used for the noise survey are described below. All sound pressure levels are rounded to the nearest whole decibel. All sound level measurements and analysis carried throughout this report are carried with Svantek 977/957 (Figure 4 - Calibration Certificate) Noise and vibration level meter which has the following features:

- Type 1 sound level measurements meeting IEC 61672:2002
- General vibration measurements (acceleration, velocity and displacement) and HVM meeting ISO 8041:2005 standard
- Three parallel independent profiles
- 1/1 and 1/3 octave real time analysis
- Acoustic dose meter function
- FFT real time analysis (1920 lines in up to 22.4 kHz band)
- Reverberation Time measurements (RT 60)
- Advanced Data Logger including spectra logging
- USB Memory Stick providing almost unlimited logging capacity
- Time domain signal recording
- Advanced trigger and alarm functions
- USB 1.1 Host & Client interfaces (real time PC "front end" application supported)
- RS 232 and IrDA interfaces
- Modbus protocol

The noise loggers were positioned at a maximum height of 1.5m from the ground. The machine was calibrated prior and after reading using our Svantek SV 33A S/N: 90200 class 1 Calibrator. Any readings affected by strong wind or rain have been disregarded.

The Full Average Statistical Noise Parameters **$L_{(Aeq, 15\ minutes)}$**, **$L_{(A90, 15\ minutes)}$**, **$L_{(A10, 15\ minutes)}$**, **$L_{(A1, 15\ minutes)}$** are presented in Figure 5 – Noise Survey. Summary of the unattended noise readings at Point A are presented in the Table 4.1 below:

Table 4.1- Summary of Unattended Noise Readings between 21st August, 2020 – 28th August, 2020

Location	***Period***	***Arithmetic Mean LAeq dB(A)***	***Arithmetic Mean LA90 dB(A)***	***RBL dB(A)***
Point A – South-Eastern Boundary	**Day Time – 7:00am-6:00pm**	59	54	52
	Evening Time – 6:00pm-10:00pm	56	52	50
	Night/Early Morning Time – 10:00pm-7:00am	53	46	40

A Summary of the attended noise readings carried out at the front boundary facing Station Street (Figure 3 - Point B) between 4:30pm and 5:30pm on August 21, 2020, is listed in Table 4.2 below:

Table 4.2- Octave Band Centre Frequencies Summary of Attended Noise Readings on August 21st, 2020 between 4:30pm – 5:30pm

Noise Reading Location	***Monitoring Period***	***Arithmetic Mean LAeq dB(A)***	***Arithmetic Mean LA90 dB(A)***
Point B – Front boundary facing Station Street	4:30pm – 5:30pm	**62**	**56**

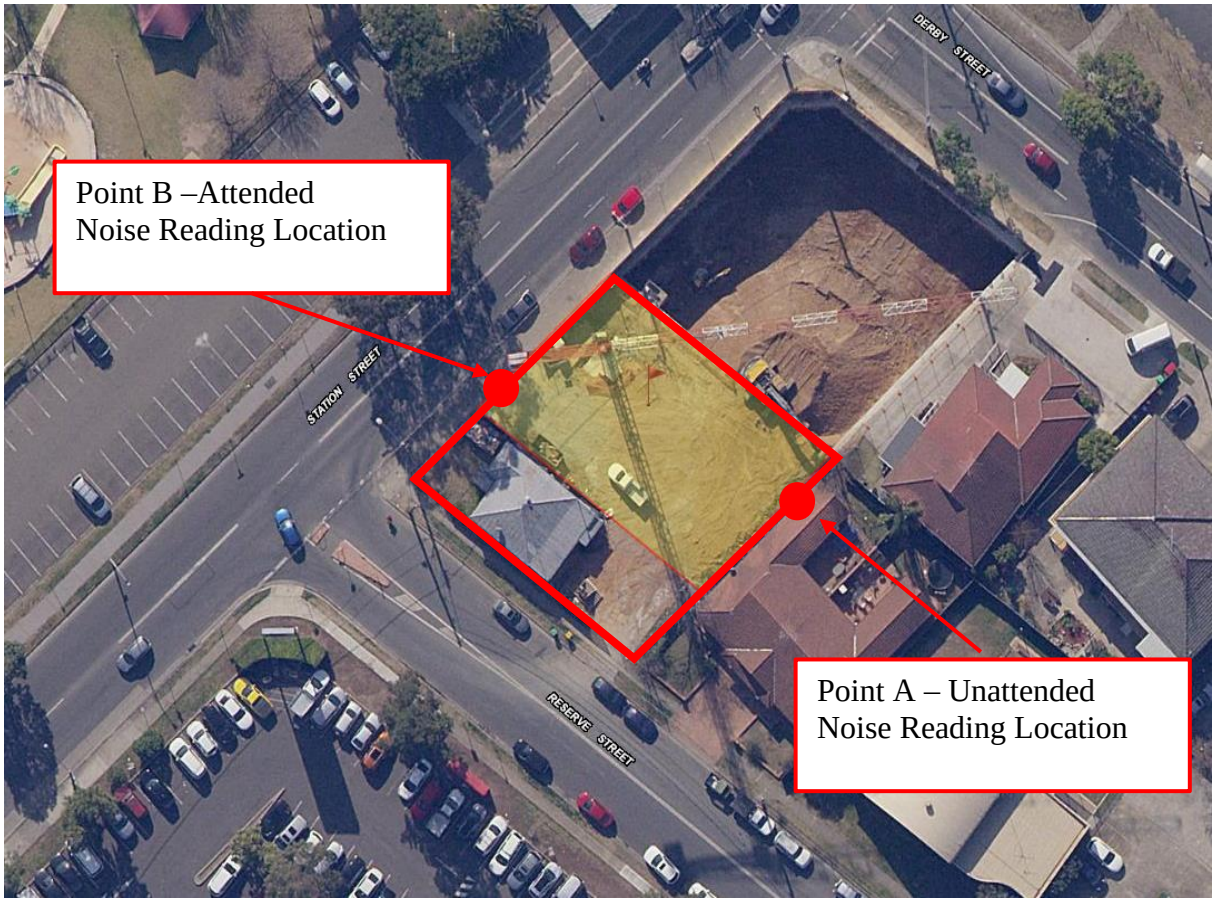
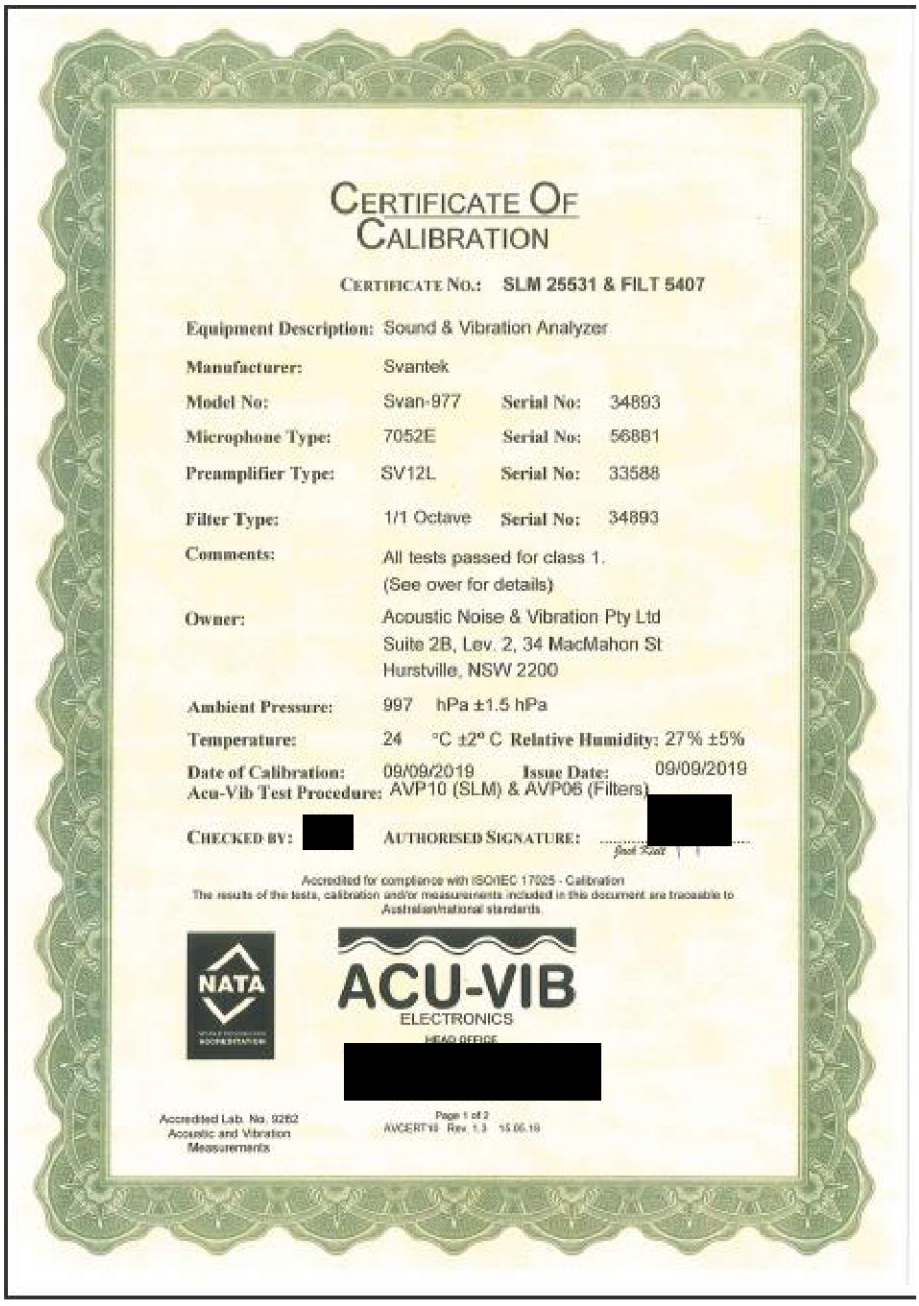


Figure 3 - Noise Reading Locations



CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 25531 & FILT 5407

Equipment Description:	Sound & Vibration Analyzer		
Manufacturer:	Svantek		
Model No:	Svan-977	Serial No:	34893
Microphone Type:	7052E	Serial No:	56881
Preamplifier Type:	SV12L	Serial No:	33588
Filter Type:	1/1 Octave	Serial No:	34893
Comments:	All tests passed for class 1. (See over for details)		
Owner:	Acoustic Noise & Vibration Pty Ltd Suite 2B, Lev. 2, 34 MacMahon St Hurstville, NSW 2200		
Ambient Pressure:	997 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	Relative Humidity:	27% ±5%
Date of Calibration:	09/09/2019	Issue Date:	09/09/2019
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: [redacted] AUTHORISED SIGNATURE: [redacted]

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

NATA

ACU-VIB ELECTRONICS
HEAD OFFICE [redacted]

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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Figure 4 - Calibration Certificate

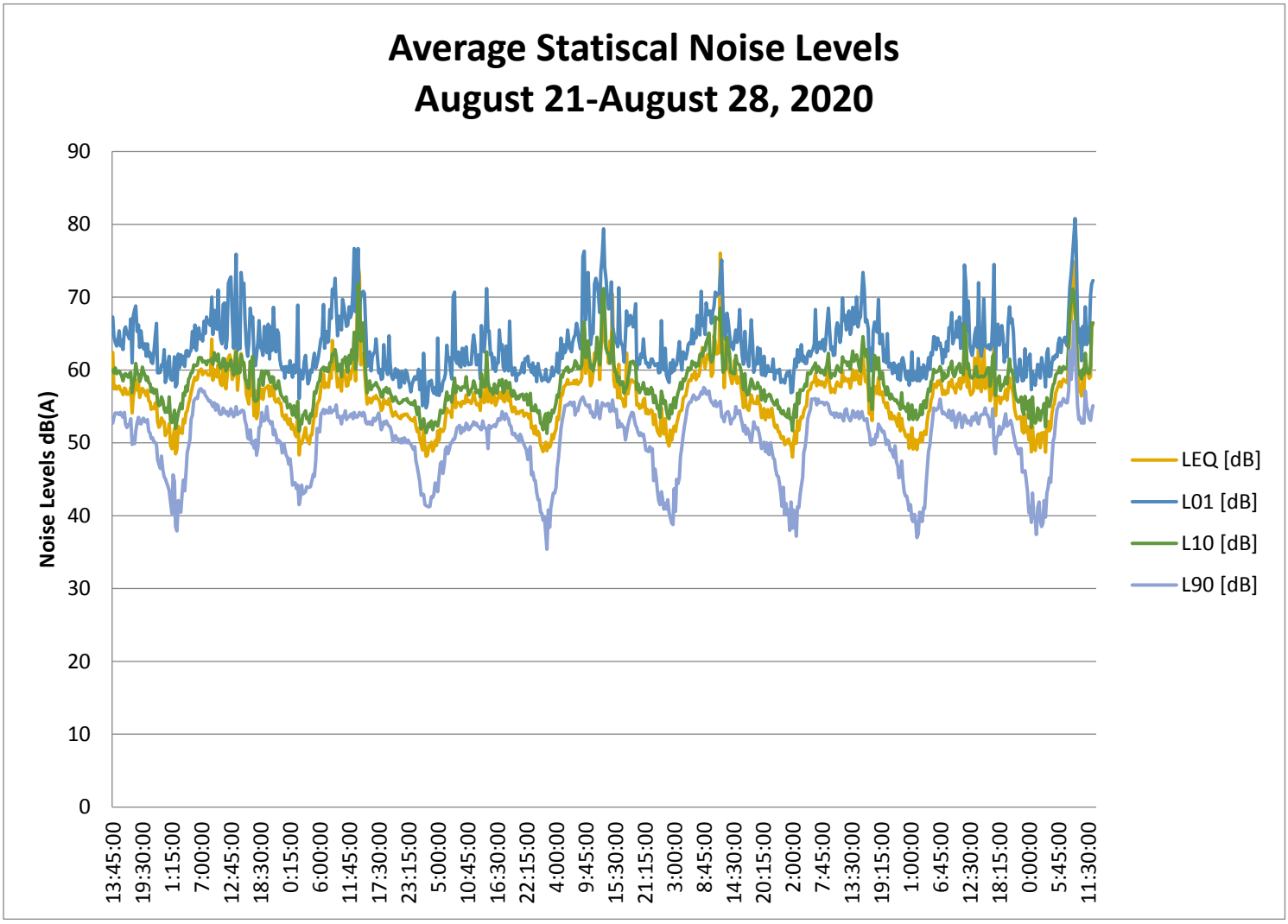


Figure 5 - Noise Survey – Unattended Noise Reading (Point A)

5.0 BUILDING RECOMMENDATIONS

5.1 Windows/Sliders, Walls, Doors and Roofs

Building Component	Rw Rating to be Achieved
Windows & Sliding Doors in Living/Dining/Kitchen and Bedroom Areas of all Units facing Station Street and Reserve Street are to be 10.38 mm laminated with full perimeter Schlegel Q-Lon acoustic seals (1).	**35**
All other Windows & Sliding Doors in Living/Dining/Kitchen and Bedroom Areas of all Units are to be 6.38 mm laminated with full perimeter Schlegel Q-Lon acoustic seals (1).	**32**
Windows in all other Areas (Bathrooms/Ensuites/Laundries/Staircase etc) are to be unrestricted and to be in accordance with AS 2047 (Windows in Buildings). (1)	**-**
External Doors are to be Solid Core with acoustic seals fitted around the door. A drop seal is required at the base of the external door (2).	**30**
External Walls are to be 270/250 mm double brick, brick veneer, AFS, Hebel construction or any other method of wall construction with an Rw of 44.	**40-44**
Roof of all Units is to be Minimum 150mm Concrete Roof AND/OR Galvanised Steel Trough Roofing (0.5mm), on 10 gypsum plaster board ceiling with 75mm thick, 11kg/m³ mineral wool batts between ceiling joists (2).	**39-41**

NB: This report is to be read in conjunction with the BASIX certificate and any other related building specification.
(1). No through weep holes in windows/sliders. All gaps between window & door frames and the masonry walls are to be sealed using acoustic foam Hilti CP620 or similar. Glass wool batts can be applied prior to the application of the foam to seal larger gaps. (2). All gaps are to be acoustically sealed.

****Glazing Notes -Leaks & Glazing Attenuation-**

- The Acoustic performance of a glazing system highly depends on the leaks around and within the glazing frame and façade. A double-glazing system with Rw of 40 will have its acoustic performance dropped to Rw of 30 (less than that of 6.38 mm glass) at a leak of 0.1 %. Moreover, a double-glazing system with Rw of 40 will have its acoustic performance dropped to Rw of 20 (less than that of 3.0 mm float glass) at a leak of 1 % of the glazing area.

- A 10.38mm laminated glazing system with Rw of 35 will have its acoustic performance dropped to Rw of 29 (less than that of 6.38 mm glass) at a leak of 0.1 %. Moreover, 10.38m mm laminated glazing system with Rw of 35 will have its acoustic performance dropped to Rw of 20 (less than that of 3.0 mm float glass) at a leak of 1 % of the glazing area.

- A double-glazing system with Rw of 40, a 10.38m mm laminated glazing system with Rw of 35, and a 6.38 mm laminated glazing system with Rw of 32 will all attain almost the same Rw of around 20 (less than that of 3.0 mm float glass) at a leak of 1 % in the façade or a within/around the glazing system.

The graph below shows the actual transmission loss achieved inside a room with different glazing thicknesses relative to small leaks occurring along the window frame and façade.

A test report is to be provided from a recognized acoustic laboratory, verifying that the glazing system (glass, frame and seals) will meet the nominated sound rating required.

6.0 PROPOSED MECHANICAL PLANT, CAR PARK AREA AND GARAGE ROLLER DOOR

A range of mechanical plant, equipment and ventilation will be included in the proposed development at No. 118-120 Station Street, Penrith emitted using the proposed mechanical plant is assessed by the NSW Noise Policy for Industry (2017).

The proposed two level of basement parking is located below ground level and that makes providing natural ventilation not possible and a mechanical extract system should be used. The mechanical ventilation system needs to achieve all required air changes for exhaust fume and extract smoke clearance in accordance with Australian Standard AS 1668.2:2012 '*The use of ventilation and air-conditioning in buildings Mechanical ventilation in buildings'.*

A garage roller door may also be located at the entry of the car park. Predicted noise levels from the operation of garage roller doors have been estimated according to typical rollers doors installed at other developments. The average time duration for a garage roller door to fully open or close is approximately 30 seconds.

7.0 ACCEPTABLE NOISE LEVEL – *Noise Break Out-*

7.1 Noise Guide for Local Government

The Department of Environment and Conservation (NSW) published the amended *Noise Guide for Local Government* in October 2010. The policy is specifically aimed at assessing noise from light industry, shops, entertainment, public buildings, air conditioners, pool pumps and other noise sources in residential areas.

Section 2.2.1 of the Noise Guide for Local Government states that a noise source is generally considered to be intrusive if the noise from the source when measured over a 15-minute period exceeds the background noise by more than 5 dB(A). Therefore, noise criteria are as follows:

- **Day period: 54 + 5 = 59 dB(A)**
- **Evening period: 52 + 5 = 57 dB(A)**
- **Night period: 46 + 5 = 51 dB(A)**

The appropriate regulatory authority (Local Council) may, by notice in writing given to such a person, prohibit the person from causing, permitting or allowing:

1. any specified activity to be carried on at the premises, or
2. any specified article to be used or operated at the premises.

or both, in such a manner as to cause the emission from the premises, at all times or on specified days, or between specified times on all days or on specified days, of noise that, when measured at any specified point (whether within or outside the premises,) is in excess of a specified level.

It is an offence to contravene a noise control notice. Prior to being issued with a noise control notice, no offence has been committed.

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

7.2 NSW Noise Policy for Industry (2017)

The above policy seeks to promote environmental well-being through preventing and minimizing noise by providing a framework and process for deriving noise limits conditions for consent and licenses.

The Noise Policy for Industry 2017 recommends two separate noise criteria to be considered, the Intrusive Noise Criteria and the Amenity Noise Criteria. A project noise trigger level being the lowest of the amenity and the intrusiveness noise level is then determined.

If the predicted noise level L_{Aeq} from the proposed project exceeds the noise trigger level, then noise mitigation is required. The extent of any 'reasonable and feasible' noise mitigation required whether at the source or along the noise path is to ensure that the predicted noise level L_{Aeq} from the project at the boundary of most affected residential receiver is not greater than the noise trigger level.

7.2.1 Amenity Noise Criteria

The amenity noise levels presented for different residential categories are presented in Table 2.2 of the Noise Policy for Industry 2017. These levels are introduced as guidance for appropriate noise levels in residential areas surrounding industrial areas.

For the proposed mixed development at No. 118-120 Station Street, Penrith the recommended amenity noise levels are presented in Table 7.2.1.1 below:

Table 7.2.1.1 - Recommended Noise Levels from Industrial Noise Sources

Type of Receiver	*Area*	*Time Period*	*Recommended Leq Noise Level, dB(A)*
Residence	Urban	Day	60
		Evening	50
		Night	45

Where a noise source contains certain characteristics such as tonality, intermittency, irregularity or dominant low-frequency content, a correction is to be applied which is to be added to the measured or predicted noise levels at the receiver, before comparison with the criteria. Shown below are the correction factors that are to be applied:

Table 7.2.1.2 – Modifying Factor Corrections as per Fact Sheet C (Noise Policy for Industry 2017)

Factor	*Correction*
Tonal Noise	+ 5 dB [1,2]
Low-Frequency Noise	+ 2 or 5 dB [1]
Intermittent Noise	+ 5 dB
Duration	+ 0 to 2 dB(A)
Maximum Adjustment	Maximum correction of 10 dB(A) [1] (excluding duration correction)

1. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
2. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

Correction for duration is to be applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aequ,15min}$ equivalent noise criterion is depicted in Table 7.2.1.3 for the duration of the event. This adjustment accounts for unusual and one-off events and does not apply to regular and/or routine high-noise level events.

Table 7.2.1.3 – Adjustment for Duration as per Fact Sheet C (Noise Policy for Industry 2017)

Allowable duration of noise (one event in any 24-hour period)	*Allowable exceedance of LAeq,15min equivalent project noise trigger level at receptor for the period of the noise event, dB(A)*	
	Daytime & evening (7 am–10 pm)	*Night-time (10 pm–7 am)*
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

According to Section 2.4 of the above policy, the project amenity noise level is determined as follows:

> **Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)**

To convert from a period level to a 15-minute level, a plus 3 is added as per section 2.2 of the policy.

Therefore, the project amenity noise level for the proposed development at No. 118-120 Station Street, Penrith is as follows:

Daytime: **60 – 5 + 3 = 58** **dB(A)**
Evening: **50 – 5 + 3 = 48** **dB(A)**
Night-time: **45 – 5 + 3 = 43** **dB(A)**

7.2.2 Intrusive Noise Criteria

Section 2.3 of the Noise Policy for Industry summarizes the intrusive criteria as below:

> $L_{Aeq,\,15\,minute} \leq$ rating background level plus 5

While the background noise level known as $LA_{90,15\ minutes}$ is the Noise exceeded 90% percent of a time period over which annoyance reactions may occur (taken to be 15 minutes). The RBL is defined as the overall single-figure $L_{A90,15\ minutes}$ background level representing each assessment period (day/evening/night) over the whole monitoring period.

For the short-term method, the rating background noise level is simply the lowest measured LAF90,15min level. For the long-term method, the rating background noise level is defined as the median value of:

- All day assessment background levels over the monitoring period for the day,
- All evening assessment background levels over the monitoring period for the evening, or,
- All night assessment background levels over the monitoring period for the night.

The predicted noise from the source $L_{Aeq,15\ min}$ is measured as at the most affected point within the most affected residential at the point where the most impact occurs.

Therefore, the acceptable L_{eq} noise intrusiveness criterion for broadband noise during the day, evening & night is as follows:

- **52 + 5 = 57 dB (A)** during the day,
- **50 + 5 = 55 dB (A)** during the evening and
- **40 + 5 = 45 dB (A)** during the night.

7.2.3 Project Noise Trigger Level

A summary of intrusiveness and amenity noise levels as determined in Section 7.2.1 and 7.2.2 are shown in Table 7.2.3 below:

Table 7.2.3 - Summary of Intrusiveness and project amenity noise levels

Period	*Intrusiveness Noise Level dB(A)*	*Project Amenity Noise level dB(A)*
Day Time (7:00am-6:00pm)	57	58
Evening Time (6:00pm-10:00pm)	55	48
Night & Early Morning (10:00pm – 7:00am)	45	43

The project noise trigger level is the lower (that is, the most stringent) value of the amenity and intrusiveness noise levels for the day, evening and night-time. Therefore, the project noise trigger levels for the proposed development are as shown below

Daytime: $L_{Aeq,15\ min}$ **57 dB(A)**
Evening: $L_{Aeq,15\ min}$ **48 dB(A)**
Night-time: $L_{Aeq,15\ min}$ **43 dB(A)**

The proposed mixed development and its activities including all mechanical plant will not exceed the project noise trigger level at the most sensitive location, provided all noise control recommendations in Section 8.0 are adhered to.

8.0 NOISE LEVELS FROM TRUCKS, MECHANICAL PLANT & LOADING DOCK SERVICING COMMERCIAL AREA

The noise associated with the use of the proposed building and its retail/commercial stores, will be the combination of all the following major noise activities:

- Cars entering and exiting the basement
- Delivery trucks entering and exiting the commercial basement,
- Unloading of all trucks including the use of forklifts and compactors,
- Refrigeration units servicing the commercial shops,
- AC units servicing the commercial shops,
- People talking,
- Garbage collection,
- Carpark exhaust fans servicing the basements,
- Carpark air supply fans servicing the basements,
- Other small fans servicing the building like the garbage shot, lobby, hydrant room etc..

The following table is a summary of noise levels associated with the above listed activities.

Table 8.1– Expected Sound Power Levels from different Noise Sources

Noise Sources Servicing Proposed Development	***Sound Power Level Leq dB(A)***
Trucks	**100**
Small vans	**87**
Garbage trucks	**106**
Cars entering and existing the basement	**85**
Forklift	**95**
Compactor – with tonality added-	**95**
Refrigeration condensers & Compressors	**84**
Air condition unit	**86**
Unloading from trucks	**82**
Roller door - Noisy-	**85**
Other fans - combined	**70**
10 people talking loudly	**85**

Regarding the above-mentioned noise sources, the following is noted:

- Noise from mechanical plant and equipment is based on file data of pervious similar projects.
- The data calculated by our office ranged widely and is dependent on whether quieter and well-maintained equipment is used or not.

- The refrigeration mechanical plant will always operate, irrespective of whether the commercial units are operating or not. However, when the commercial units are closed, the ambient temperature is lower, thus the refrigeration condensers will operate on low speed.
- The air-condition equipment for commercial/retail properties will only operate during operating hours.

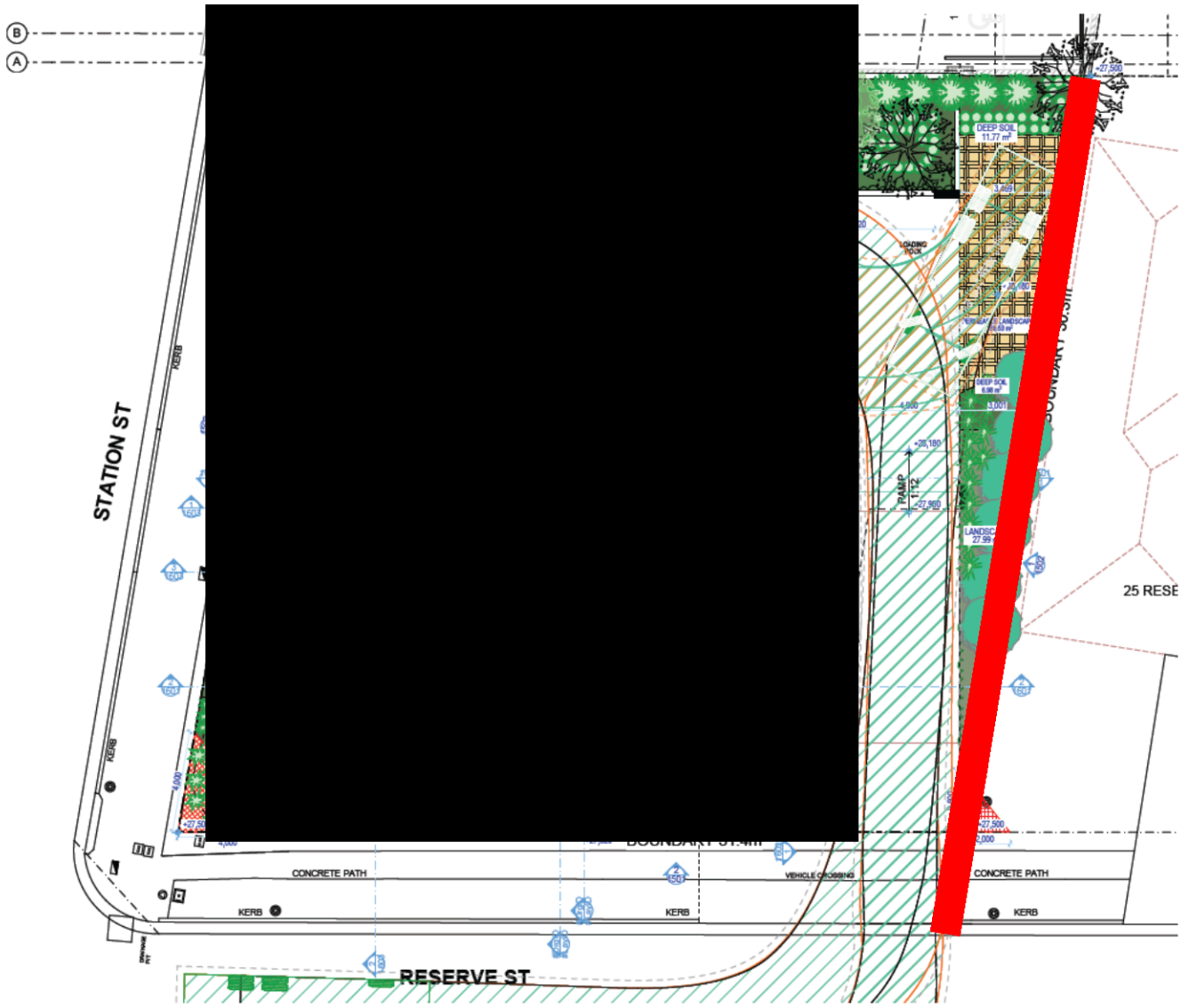
The loading docks is to be located on the ground floor level of the proposed development that will service the proposed retail tenants on the ground floor and will accommodate a maximum of (1) truck at a time [5-10 tonnes] (Figure 6). Access to the waste collection bin storage area can be made from the loading dock driveway. This will also contribute as an additional noise source.

Noise produced by trucks and smaller vehicles using the proposed loading docks may affect the nearest residential receivers (No. 19 Reserve Street) and future residential properties at the proposed site.

Noise emission from the loading dock will not exceed existing background noise levels by more than 5 db(A) at the nearest residential receiver (No. 19 Reserve Street) and future residential properties at the proposed development provided the following recommendations are adhered to:

- Loading docks are not used between 10:00pm and 7:00am
- Proposed 2.1 metre lapped & capped timber, colourbond, or brick fence be constructed around the loading dock area at the western boundary (Figure 6 – Proposed Barrier on Ground Floor).
- Loading dock is to be roofed/awning
- Ensure compactors are enclosed and used during the day

We recommend further acoustic assessment of the loading dock use is carried out at CC stage when further design details have been finalised.



2.1metre High Barrier Fence

Figure 6 - Proposed Barrier - Ground Floor

9.0 NOISE FROM CAR PARK OPERATION, CAR PARK MECHANICAL PLANT & AC UNITS

A range of mechanical plant, equipment and ventilation system(s) will be included in the proposed development at No. 118-120 Station Street, Penrith.

Typical noise levels from car park exhaust fans, air-conditions, and security roller doors are presented in the table below:

Table 9.1 – Typical Mechanical Plant LAeq Sound Power Levels

FREQUENCY [Hz]	63	125	250	500	1k	2k	4k	8k	dBA
Typical Car park Exhaust fan	80	82	84	87	86	83	78	71	**90**
Typical Condensing Unit	71	69	67	61	58	54	47	44	**64**
$L_{eq,\ 15\ min}$ Garage Roller Door	69	63	65	65	77	78	80	79	**85**

Noise emitted using the proposed mechanical plant is assessed by the Noise Policy for Industry 2017, and Penrith City Council conditions/requirements.

Air-conditioning might also be installed in the proposed development.
For the operation of the car park and basement garage door to meet the requirements of the NSW Noise Policy for Industry 2017, we recommend the following:

- Ensure maintenance and lubrication of motor bearings, door tracks and joints.
- The proposed security door fitted to the car parking area entrance must be independently mounted on rubber pads to prevent vibration noise transmission through the concrete walls and/or columns.

As the proposed development is still in the initial application stage, we recommend that further acoustic assessment is carried out when the development has been approved and Mechanical Services plans have been prepared for our review.

In general, we recommend that all new external air-conditioning units are to be acoustically enclosed or set away by more than 3.0m from any boundary. The assessment of the mechanical plans once available will recommend proper silencer/(s) and duct lagging such that noise levels emitted from the mechanical plant servicing the proposed development at No. 118-120 Station Street, Penrith, meet the requirements of Section 7.0 of this report.

10.0 PREDICTED NOISE FROM COMMUNAL SPACE

The proposed development is to have a communal open space on level 6 (Figure 7 – Proposed Common Open Space). The common open space is for residents and visitors only. It is not expected that all residences would visit the common space at one time.

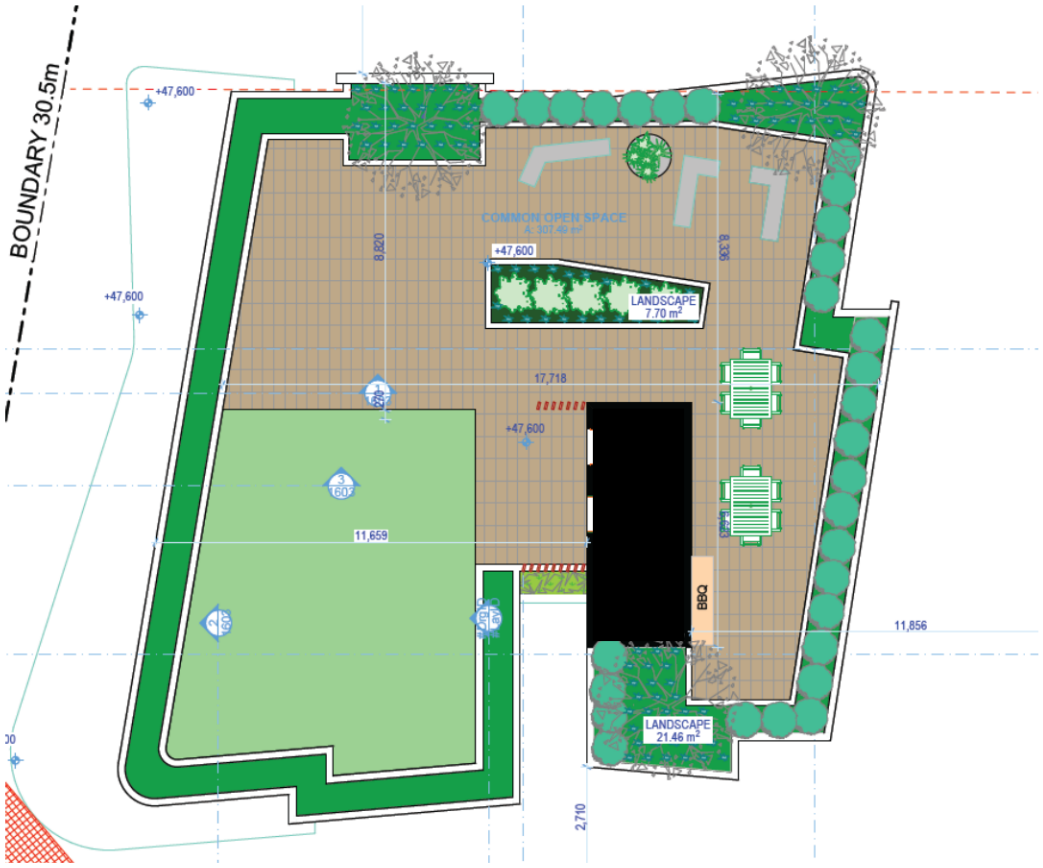


Figure 7 - Proposed Common Open Space

The following table lists the sound level of different level of speech.

Table 10.1 – Noise Produced in Conversation (Mean speech levels -Men-)

Descriptor	***Mean Sound Level***	***Standard Deviation***
Casual Speech	52 dB(A)	± 4dB
Normal Speech	58 dB(A)	± 4dB
Raised Speech	65 dB(A)	± 6dB
Loud Speech	76 dB(A)	± 6dB
Shouting	89 dB(A)	± 7dB

The noise level from the crowd inside/outside the communal area is estimated by the following equation:

$L_{w,Aeq}$ (A weighted sound power level) = 15logN + 64 dB (A)…..; (N is the crowd size)

The predicted noise levels at the receivers from people congregating in the rooftop seating area is calculated in accordance with ISO 9613.2 '*Acoustics – Attenuation of sound during propagation outdoors — Part 2: General method of calculation'*. All predicted noise levels have been calculated such the acoustic impact is predicted at the parameter of the neighbouring properties and that the noise source is assumed at the center of the rooftop area. It is assumed that a 1.2metre gap free fence is constructed above a minimum 0.6metre high planter box around the open common space on level 6, totaling a minimum of 1.8metres high from the ground, as depicted in Figure 8 – Proposed Barrier – Level 6.

Table 10.2 - Predicted Noise from Outdoor Communal Open Space at External Façade of Residential Receiver

Activity	***External window/slider of residential receiver***	***Period***	***Expected. Leq dB(A) at Façade of Receiver***	***Complies with Background level + 5 *****
Residences in Outdoor Communal Open Space (50% talking)	No. 114-116 Station Street	7.00am - 6.00pm (Day) 6.00pm-10:00pm (Evening) 10:00pm – 7:00am	50 dB(A)	Yes ✓ Day – 54 + 5 = 59 Evening – 52 + 5 = 57
	No. 19 Reserve Street	7.00am - 6.00pm (Day) 6.00pm-10:00pm (Evening) 10:00pm – 7:00am	44 dB(A)	Yes ✓ Day – 54 + 5 = 59 Evening – 52 + 5 = 57

*** NSW Noise Policy for Industry does not apply to noise from lodgers (Section 1.5 of the NPI exclusions). Background noise level + 5 applies.*

1.2metre high gap free fence on
Min. 0.6metre high planter box = Min. 1.8 from Ground.

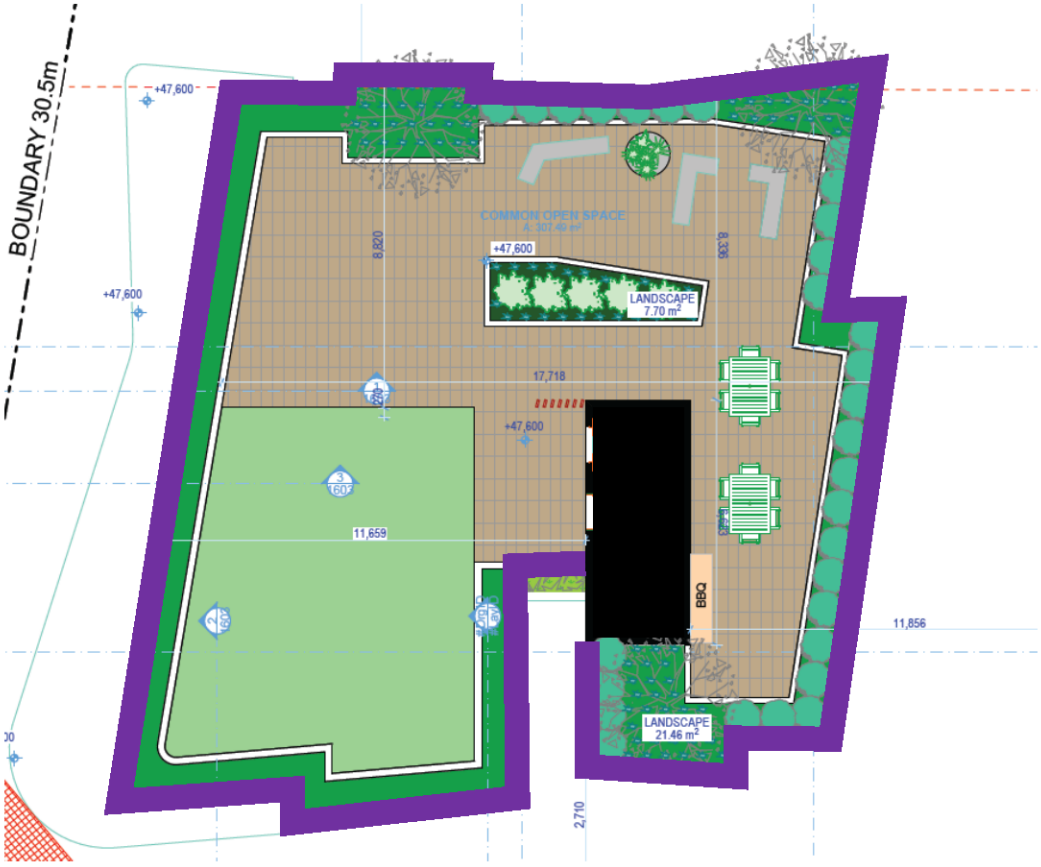


Figure 8 - Proposed Barrier - Level 6

11.0 NOISE FROM INSIDE COMMERCIAL PREMISES

The acoustic design for the proposed development is only for the base building design. Noise from any commercial space and noise inside commercial spaces (supermarkets, cafes, restaurants, office spaces, etc.) is not covered in this report as it will be subject to a separate DA once the base building is approved. Future reports/plans accompanying the DA for these commercial spaces should ensure that the combined noise levels from these facilities including their mechanical plant is below the noise trigger level described in section 7.2.3 of this report.

12.0 DISCUSSION & CONCLUSION

The construction of the proposed development at No. 118-120 Station Street, Penrith, if carried out as recommended in the plans and specifications and including the acoustic recommendations in this report, will meet the required noise reduction levels as required in AS/NZS 2107:2016 *'Acoustics – Recommended Design Sound Levels and Reverberation Times'* and Penrith City Council Conditions/Requirements.

All proposed mechanical plant & equipment will comply with the NSW Noise Policy for Industry (2017) provided recommendations are adhered to.

Should you require further explanations, please do not hesitate to contact us.

Yours Sincerely,

M. Zaioor
M.S. Eng'g Sci. (UNSW).
M.I.E.(Aust), CPEng
Australian Acoustical Society (Member)

PART 2: NOISE & VIBRATION MANAGEMENT PLAN

During the Construction of No. 118-120 Station St Penrith

1.0 INTRODUCTION

Acoustic, Noise & Vibration Solutions Pty Ltd was commissioned to assess, and where required make recommendations to reduce and manage the noise impact at the nearest potentially affected receivers resulting from the construction of the proposed mixed-use development at No. 118-120 Station Street, Penrith as per Penrith City Council Requirements.

The proposed development is located on the corner of Station Street and Reserve Street in the suburb of Penrith (Figure 1 – Site Location). The architectural plans by Architecture Design Studio Pty Ltd dated November 19th, 2020 are for the proposed construction of a six (6) storey mix use commercial and residential development comprising of commercial use on the ground floor and residential units at the remaining upper floors with two (2) level of basement parking.

This report presents the relevant noise emission criteria, noise prediction calculations, an impact assessment and recommendations for mitigation and management measures to be implemented, to minimise the potential for adverse impact at the nearest potentially affected receivers, resulting from construction works.

This report will comply with Penrith City Council Requirements and the following the relevant industry and professional standards and guidelines:

- Section 80A of the Environmental Planning & Assessment Act, 1979
- Protection of the Environment Operations Act 1997 (NSW)
- Protection of the Environment Operations (Noise Control) Regulation 2008 (NSW).
- Interim Construction Noise Guideline, Department of Environment & Climate Change July 2009;
- NSW Industrial Noise Policy, January 2000; (Noise Policy for Industry 2017 does not apply. Exclusion; item 4, section 1.5 of the policy exclusions)
- Assessing Vibration: A Technical Guideline, Department of Environment & Climate Change 2006;
- Assessing Vibration: A Technical Guideline (DEC 2006)
- Australian Standard AS 2436-2010 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*"

Acoustic readings will be measured in accordance with AS 1055:1.2.1997.

2.0 ACOUSTIC DESCRIPTORS

L_{Amax} – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.
L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night-time.

3.0 DESCRIPTION OF OPERATIONS AND ENVIRONS

The construction works will be undertaken on site at No. 118-120 Station Street, Penrith. The current site is an empty land lot. According to Penrith LEP 2010, the proposed development and adjacent to the subject site is zoned B4 mixed use with RE1 Public Recreations located north of the site. The site is surrounded by a mixture of commercial, retail and residential properties (Figure 2 – Surrounding Environment). The subject site is located opposite to Nepean Village Shopping centre and its associated carpark as well as opposite to the aquatic centre, Ripples Penrith and its associated carpark. Penrith Station is located approximately 660metre east from the subject site. The background noise in the local area is dominated by the traffic noise from Station St and Reserve St, nearby industrial activities as well as residential activities.

The most affected residential receiver affected by the construction work, is located south-east of the site at No. 19 Reserve St and east of the site the units at No. 116 Station Street (Figure 3 – Nearest Residential Receivers).

Acoustic, Noise & Vibration Solutions Pty Ltd understands that the construction works are proposed over several months, during the daytime hours only. Works are generally undertaken between the following hours only, as per Penrith City Council Conditions/Requirements.

- All construction:
    - Monday to Friday – 7:00am to 6:00pm
    - Saturday – 7:00am to 1:00pm (if inaudible on neighbouring properties), otherwise 8:00am to 1:00pm
    - Sunday & public holidays - No work permitted

A site location map and aerial photo are included within the Appendix (Figures 1, 2 & 3), showing the location of the site and nearest potentially affected receivers.

4.0 VIBRATION LIMITS, EXPECTED VIBRATION LEVELS & COMPLIANCE

Vibration caused by the project works can be classified as intermittent vibration under the DECCW's *"Assessing Vibration: a technical guideline"*. The human comfort goals for intermittent vibration from this guideline applicable for the project are shown in the table below.

Table 1 - Preferred and maximum vibration dose values for human comfort

Building Type	***Intermittent Vibration ($m/s^{1.75}$)***	
	Preferred	***Maximum***
Critical working areas (e.g. hospital operating theatres, laboratories)	0.10	0.20
Residential daytime (7:00am to 10:00pm)	0.20	0.40

Residential night-time (10:00pm to 7:00am)	0.13	0.26
Offices, educational institutions. Places of worship	0.40	0.80
Workshops	0.80	1.60

The 'human annoyance' criteria for intermittent vibration are cumulative dose values, rather than instantaneous particle velocities or acceleration. Determining dose values depends not only on vibration levels but the length of time over which they affect a receiver. Vibration generating equipment is not often used constantly, making accurate predictions of dose values for intermittent vibration difficult in practice. Determining vibration dose values and compliance with the criteria relies on field measurements during the activity.

The vibration criteria in relation to surface structures are adopted from the German Standard DIN 4150 Part 3-1999 *"Structural Vibration in Buildings – Effects on Structures".* These are shown below.

Table 2 - Vibration velocity guide values – short term vibration on structures (mm/s)

Building Type	***Vibration at the foundation at a frequency of:***			***Vibration at horizontal plane of highest floor at all 1Hz to frequencies***
	1Hz to 10Hz	***10Hz to 50Hz***	***50Hz to 100Hz***	
Buildings used for commercial purposes, industrial buildings and buildings of a similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value	3	3 to 8	8 to 10	8

The proposed development site at No. 118-120 Station St, Penrith is located in a predominantly clayey area (refer to structural plans).

The most contributing sources of ground vibration during the construction of the above project are as follows:

- The installation of contiguous piers/hit & miss piers supporting the excavation.

To give an indication where the vibration criteria presented in Tables 1 & 2 above might be exceeded, the information presented in Tables 3 and 4 below can been used for critical machineries and piling methods proposed in the construction of this project.

Table 3 - Safe Working Distance of Critical Machineries to be used

Plant Item	Rating/Description	Indicative Safe Working Distance	
		Structural Damage	Human Response[1]
Small hydraulic hammer	(300 kg - 5 to 12t excavator)	5 m	10 m
Medium hydraulic hammer	(900 kg - 12 to 18t excavator)	15 m	25 m
Large hydraulic hammer	(1600 kg - 18 to 34t excavator)	40 m	75 m
Vibratory pile driver	Sheet piles	8 m	20 m
Pile boring	≤ 800 mm	4 m	8 m
Jackhammer	Hand held	2 m	Avoid contact with structure

Note 1: The working distances for Human Response assume that the source of the vibration is continuous throughout the daytime period. Higher levels of vibration are acceptable when the vibration levels are intermittent or impulsive. The safe working distances are therefore considered to be conservative and it is likely that the safe working distances corresponding to a "low probability of adverse comment" would be lower than indicated.

Table 4 - Safe Working Distance of Piling Methods Used in Installing Sheet Piling.

	Piling method		
	Press-in	25 kJ drop hammer	170 kW 27Hz vibrohammer
Architectural merit	2.6 m	29.6 m	27.7 m
Residential	0.5 m	11.8 m	13.8 m
Light commercial	0.14 m	5.9 m	5.5 m
Heavy industrial	0.06 m	3.9 m	3.7 m
Buried services	0.03 m	2.9 m	2.2 m

Prior to the commencement of demolition and construction of the project at No. 118-120 Station St, Penrith the following shall occur:

- Engineer to identify properties at risk from impact / damage based on the criteria in Table 2 above;
- For the properties identified at risk from damage, a risk assessment will be undertaken by appropriately qualified and experienced geotechnical and construction engineering experts. Inspections of those properties at risk will be undertaken prior to construction, and a Dilapidation report to be produced in accordance with *AS 4349.1 'Inspection of Buildings';*
- The owners of all properties on which inspections and dilapidation reports are to be conducted will be contacted at least two weeks before the inspection, or as otherwise agreed by the affected property owners;
- Copy of the property dilapidation report will be provided to the owner of each property inspected at least one week prior to construction commencing; and
- A register will be maintained of all properties inspected, indicating whether the owner accepted or refused the property inspection offer.

Any property damage caused directly or indirectly because of construction works will be rectified at no cost to the property owner. Alternatively, property owners will be offered compensation for any damage.

5.0 PROJECT SPECIFIC NOISE CRITERIA

The following sections outlines the relevant construction noise emission criteria and conditions applicable to the works.

5.1 DECCW CONSTRUCTION NOISE CRITERIA

In this section, the relevant construction noise emission criteria and conditions applicable to the works are outlined, based on the NSW Department of Environment, Climate Change's and Water's (DECCW) Interim Construction Noise Guideline (ICNG).

The ICNG is the appropriate guideline for use in construction noise assessments and is to be used when establishing specific construction noise management levels for a particular project.

The NSW DECCW's ICNG is developed to manage noise from construction works. The ICNG advises that a qualitative methodology for assessment of construction noise emission may be undertaken for short-term works (less than 3 weeks). However, for larger construction projects, a quantitative assessment of construction noise should be undertaken.

Section 4 of the ICNG classifies noise criteria into the following categories:

- Airborne noise;
- Ground-borne noise;
- Sleep disturbance at residences;
- Blasting and vibration; and
- Predicting noise levels – quantitative assessment.

The ICNG also goes on to state that when developing noise mitigation strategies for reducing construction noise emission focus should be given to *"applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts".*

The ICNG provides management levels (criteria) for construction noise emission at residential receivers, and other various sensitive receivers. The management noise levels at residential receivers are dependent upon the relevant Rated Background Level (RBL) at the residential receiver, and the time of day that the construction noise is to be generated. Acoustic Noise & Vibration Solutions has determined the daytime ambient background noise environment of the nearest residential receivers at No. 116 Station St and No. 19 Reserve St Penrith.

5.1.1 Airborne Noise

Criteria for residential receivers are set using the information in the table below.

Table 5 - Measured Ambient Noise Environment

Time of day	***Management Level $L_{Aeq,\ (15min)}$***	***How to apply***
Recommended standard hours: All construction: Monday to Friday – 7:00am to 6:00pm Saturday – 7:00am to 1:00pm (if inaudible on neighbouring properties), otherwise 8:00am to 1:00pm Sunday & public holidays - No work permitted	Noise affected RBL + 10 dB	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	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • 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 (ICNG)

6.0 NOISE MEASUREMENT PROCEDURE AND INSTRUMENTATION

Acoustic, Noise & Vibration Solutions Pty Ltd carried out sound pressure measurements that were conducted in accordance with the Australian Standard *AS 1055.1 "Acoustics - Description and Measurement of Environmental Noise. Part 1: General Procedures"*. Those Measurements were carried out using precision sound level meters conforming to the requirements of Australian Standard AS1259 *"Sound Level Meters".*

6.1 NOISE SURVEY RESULTS

For the purpose of this report, we will adopt the RBLs as per Noise Readings (21st August till 28th August 2020) shown in the table below.

Table 6 – Assumed minimum RBL, in accordance with Section 2.3 of the Noise Policy for Industry 2017

Time of Day	***Minimum Assumed Rating Background Level (RBL) dB(A)***
Day 7am – 6pm	52
Evening 6pm – 10pm	N/A
Night 10pm – 7am	N/A

- All construction:
  - Monday to Friday – 7:00am to 6:00pm
  - Saturday – 7:00am to 1:00pm (if inaudible on neighbouring properties), otherwise 8:00am to 1:00pm
  - Sunday & public holidays - No work permitted

Based on the measured background noise environment, Table 7 presents the construction noise emission management levels/criteria, as detailed in the DECCW's ICNG, for the nearest residential receivers.

Table 7 - Site Specific Construction Noise Criteria at Residential Receiver

Receiver	***Time of Day***	***DECCW Management Level*** (1) ($L_{Aeq\ (15\ min)}$)	***Site Specific Construction Noise Emission Criteria*** ($L_{Aeq(15\ min)}$)
Boundary of Nearest Residential Receivers	All construction: Monday to Friday – 7:00am to 6:00pm	RBL + 10 dB	62 dB(A)

	Saturday – 7:00am to 1:00pm (if inaudible on neighbouring properties), otherwise 8:00am to 1:00pm Sunday & public holidays - No work permitted		
	Outside Recommended Standard Hours	RBL + 5dB	57 dB(A)

Note:
(1) Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence
(2) Recommended standard hours are as stated in DECCW's Interim CNG

Further to the criteria at residential receiver locations, Table 8 reproduces the construction noise emission management levels as detailed in the DECCW's Interim CNG for the various other relevant receivers:

7.0 METHODOLOGY FOR EMISSION PREDICTION AND ASSESSMENT

Acoustic, Noise &Vibration Solutions Pty Ltd understands that the following items of noise emitting equipment and machinery are likely to be used during the demolition and construction works on site:

Construction (duration around 75 to 85 weeks)

- Concrete Trucks;
- Bobcats;
- Trades (Brick Layers, Concreters, Renderers, Roofers, Carpenters, Plumbers etc.);
- Concrete Pumps; and
- Trucks (for deliveries & removal of materials).

Accordingly, assessment of the operation of above items requires calculation of their noise emission levels to nearby potentially affected receiver locations.

Acoustic, Noise & Vibration Solutions Pty Ltd has conducted operator-attended noise monitoring of similar equipment/activities at many other sites on numerous occasions. Based on previous operator-attended noise surveys, manufacture sound level details, and Australian Standard AS2436-2010 *"Guide to Noise Control on Construction- and other manufacturer released data"*, prediction calculations have been undertaken to predict the noise impact at receiver locations, resulting from the proposed work.

In our noise prediction calculations and modelling, the noise emission contribution from the above items of equipment has been incorporated into the prediction calculations and modelling along with various loss factors, including:

- Losses due to distance and ground topography;
- Airborne noise losses;
- Losses due to direction;
- Weather conditions; and
- Acoustic shielding.

8.0 NOISE EMISSION PREDICTION AND ASSESSMENT

Acoustic Noise & Vibration Solutions Pty Ltd advises that the project will not require any demolition or excavation work. Therefore, the proposal will only require construction work.

Acoustic Noise & Vibration Pty Ltd understands construction works can take up to a period of 40 to 65 weeks.

8.1 NOISE EMISSION PREDICTION CALCULATIONS

Acoustic, Noise & Vibration Solutions Pty Ltd has performed prediction calculations and determined maximum LAeq noise emission levels at adjacent receiver locations, resulting from proposed demolition, excavation and construction activities, including use of the tools and equipment listed in Section 7.

For the purpose of this noise assessment, the noise levels (sound power level Lw) arising from different machines, equipment and tools to be used during each of the construction stages are detailed below. Such levels are adopted from Table A1, AS2436-2010 *"Guide to Noise Control on Construction- and other manufacturer released data".*

Construction (Around 75 to 85 weeks duration)

- Bobcat (Large) Piers/ Footings excavation- 105 dB (A).
- Concrete Pumps & Truck discharging concrete— 103 dB (A);
- Bricklayers, Roofers, Carpenters 55 -65 dB (A); and
- Trucks (for removal of materials) — 105 dB (A).

The expected noise levels arising from the excavation and construction of the site are presented in Table 8 below. The following have been calculated assuming the cumulative noise generating scenario for the worst 15-minutes. The assumptions are made in the calculations (presented in Table 8) of the predicted construction noise impact are as follows:

- Construction noise sources have been assumed to be located at the middle of the project site.
- Construction noise impacts to all residential receivers have been predicted at the nearest external openings (sliding doors, windows) with 10 dB(A) outside to inside reduction in noise levels (AS 2436 Table B4).

- The sound pressure level at a distance, r(m), is calculated using the formula

$$Lp = Lw - 20\log(r) - 8.$$

Table 8 - Maximum Demolition, Excavation, and Construction Noise Emission at Boundaries

Time Period	***Location of Residential Receiver Boundary***	***Maximum Predicted LAeq Level dB(A) from Building Works***	***Site specific construction noise emission criteria ($L_{Aeq(15\ min)}$)- Table 7***	***Criteria Exceeded by***
<u>All construction</u>: Monday to Friday – 7:00am to 6:00pm Saturday – 7:00am to 1:00pm (if inaudible on neighbouring properties), otherwise 8:00am to 1:00pm Sunday & public holidays - No work permitted	No. 116 Station St, Penrith	58 * at critical façade, 48 inside any room (windows opened)	62 dB(A)	OK
	No. 19 Reserve St, Penrith	58 * at critical façade, 48 inside any room (windows opened)	62 dB(A)	OK

*Note should be made that the predicted noise levels above, are the <u>maximum</u> predicted LAeq (associated mainly with piling). Typically, received LA_{eq} noise emission levels would be expected to be lower during most of the excavation and construction works.

As per Table 8 above, the noise levels at the outside façade of the critical residential receivers will comply with the noise criteria outlined in Section 6.1 of the report.

Due to the fact that highest noise emitting items during the construction of the project at No. 118-120 Station St, Penrith are unlikely to occur for a long duration then it is unlikely to lead to complaints.

8.2 <u>NOISE ASSESSMENT</u>

The maximum predicted noise emission levels presented in Table 8 above indicate LAeq noise emission associated with the proposed demolition, excavation and building works will exceed the relevant construction noise criterion at certain times.

To ensure that construction noise emission levels from the proposed works are kept to a minimum, Acoustic, Noise &Vibration Solutions Pty Ltd provides recommendations for feasible and reasonable noise mitigation and management, which should be incorporated into the noise management plan for the proposed demolition, excavation and construction.

9.0 DISCUSSION AND MITIGATION RECOMMENDATIONS

Further to the predicted noise emission levels presented in Section 8, Acoustic, Noise & Vibration Solutions Pty Ltd advises that measures are required to minimise and manage noise emission and impact from the proposed construction works at the site.

We understand that proposed works at No. 118-120 Station St, Penrith will only be carried out during daytime hours only:

- All construction:
    - Monday to Friday – 7:00am to 6:00pm
    - Saturday – 7:00am to 1:00pm (if inaudible on neighbouring properties), otherwise 8:00am to 1:00pm
    - Sunday & public holidays - No work permitted

We recommend the following measures be implemented to minimise and manage noise emission from the subject demolition, excavation and construction:

9.1 NOISE INDUCTION OF ALL SITE STAFF

We recommend that all site staff be inducted, ensuring each person is aware of the noise management and mitigation procedures applicable to the site and site works.

All site managers should be made aware of noise and vibration limits, applicable control measures and methods. They should ensure that all agreed noise and vibration measures are carried out by employees and sub-contractors.

When a builder/contractor has made noise reduction commitments all staff needs to be made aware of them. Workers and sub-contractors need to be trained to follow noise management practices (a toolbox meeting may be an effective way to do this).

Embedding requirements to manage noise in tenders, employment contracts or sub-contractor agreements can be an effective tool for pro-active noise management. This ensures that responsibility for noise rests with all people involved.

9.2 IMPLEMENTATION OF AN APPROPRIATE COMMUNITY LIAISON PROCEDURE

Acoustic Noise &Vibration Solutions recommends implementation of an appropriate community liaison procedure, including a noise management and compliant procedure, and continual liaison with the nearby potentially affected receivers.

9.2.1 Community Liaison

Community consultation is an essential part of managing noise from a construction project. Builders/contractors should aim to:

- Establish good working relationships with community stakeholders;
- Give and receive feedback on construction activity and performance during a project; and
- Discuss the community's concerns and be proactive in complaint resolution.

As part of a community consultation strategy, neighbouring premises should be given written notification of the project. The information should outline the type and duration of works, likely noise impacts, and provide contact details for feedback and/or complaints. The minimum notification period is 48 hours before noisy work is scheduled.

Methods of notification for noisy works and ongoing communication about a project's progress can include:

- Letterbox drops;
- Meetings;
- Individual contact;
- A website (for larger projects); or
- A regular newsletter with site news, project planning etc.

In some areas, provision of multi-lingual notification may be required.

9.2.2 Complaint Resolution

A person may have experienced noise disturbance for some time before they approach the builder/contractor or the Council and may have become tense and angry. This is particularly important to acknowledge when the complaint refers to disturbed sleep and/or noise that is tonal (beeping, metal-on- metal), impulsive (hammering, pile driving) or low frequency (truck engine, heavy machinery).

The builder/contractor should respond respectfully to a complaint and implement all feasible and reasonable measures to address the issue. High impact projects should have a readily accessible contact point such as a 24-hour toll-free information and complaints line. The builder/contractor should call back as soon as possible, and then maintain communication about how the issue is to be resolved.

The complaint management process should be well documented, with details about the following:

- The noise/s, vibration or dust issue in question;
- The time of the complaint and the person making it;
- The person dealing with the complaint and how they plan to do so;
- How resolution of the complaint is to be communicated to the person who made the complaint, the community and the council;
- Who should be contacted if the complaint cannot be resolved; and
- The time taken for responses.

9.3 IMPLEMENTATION OF MONITORING AND REPORTING PROGRAMMES

Noise and vibration monitoring and reporting that is to be undertaken during the main stages of work and is to be the course of action to be taken following receipt of a complaint concerning noise and vibration from the proposed works should they arise.

In response to requests by the builder or owner Acoustic, Noise &Vibration Solutions Pty Ltd will attend site and carry out operator-attended noise and vibration measurements and monitoring of site equipment and operations.

9.3.1 Noise monitoring and reporting methodology

Upon request of the builder or owner, Acoustic Noise &Vibration Solutions would carry out additional noise monitoring at the boundary of the nearest potential receiver or at any other location where there is a complaint, in a similar method as discussed in Section 7.0 of this report.

9.3.2 Vibration monitoring and reporting methodology

All excavation proposed on site for footings/piers and basement, are expected to be carried out in clay. Therefore, vibration monitoring may be carried out where predicted vibration levels approach or exceed structural damage criteria, in response to complaints or for the purpose of refining construction methods or techniques to minimise vibrations. Monitoring will be carried out in accordance with:

- For structural damage vibration– German Standard DIN 4150 and British Standard BS 7385-2:1993 '*Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'* and
- For human exposure to vibration– the evaluation criteria presented in the *Environmental Noise Management Assessing Vibration: A Technical Guideline* (DECC 2006).

9.4 NOISE MITIGATION MEASURES

The following noise mitigation producers are to be carried out during construction:

- In the case of using impact piling, use resilient (dolly) between pile and hammerhead [2 layers of non-flammable cloth stuffed with glass fibre].
- Enclose all proposed-on site generators /compressors.
- Excessive noisy plant or earth moving equipment are not allowed to operate on site.
- Provide alternative less noisy equipment when possible.
- No radio or music to be audible in areas outside the construction site.
- Use acoustic barriers, noise shields where feasible and possible.
- Avoid simultaneous noise activities.
- Operating noisy hand-held equipment are to be used inside and away from any window/opening.
- Ensure all machinery and equipment are well maintained and don not produce excessive noise due to malfunctioning.
- Avoid drooping material from high levels. Provide rubber matting on ground when material to be dropped from high levels.
- All site staffs and employees to use appropriate protective equipment when operating or in the vicinity of a noise generating equipment.

9.5 TRAINING & COMMUNICATIONS WITH AFFECTED NEIGHBOURS

All site staffs, employees and subcontractors are to be induct into the CNVMP. This induction will clearly explain the sensitive receivers, the work hours in relation to noise generation, and employees and subcontractors obligation to ensure that the site complies with the noise criteria outlined in this report.

Builder also to contact the owners/residents of the neighbouring potentially affected sites, including but not limited to No. 116 Station St and No. 19 Revers St, Penrith. A letter to be dropped in the mail explaining what noise controls are established. Letter also to identify the person and telephone number to contact when issues are raised concerning loud noise or vibration generated from the site.

10.0 CONCLUSION

Acoustic, Noise &Vibration Solutions Pty Ltd has undertaken a quantitative assessment of the noise and vibration impact at the nearest potentially affected receivers resulting from the, excavation and associated activities of the proposed development at No. 118-120 Station Street, Penrith in accordance with the requirements of Penrith City Council and the NSW DECCW's Interim Construction Noise Guideline.

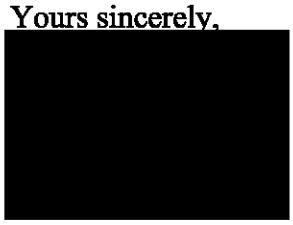
The estimated vibration and calculated noise emission associated with the proposed excavation and construction of proposed development is unlikely to generate "offensive noise", as described in the POEC Act *1997,* at the surrounding residential receiver locations provided all recommendations in this report are adhered to.

Acoustic, Noise & Vibration Solutions Pty Ltd advises that implementation of the recommendations contained in Section 4 and 9 of this report will assist with the mitigation and management of noise and vibration emission from demolition, excavation and construction of the subject development site.

This report addresses the requirements of Penrith City Council Conditions/Requirements & Assessment Act 1979.

We hope this report meets your requirements. Should you require further explanations, please do not hesitate to contact us.

Yours sincerely,



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11.0 APPENDIX

Figure 1 - Site Location

Figure 2 - Surrounding Environment

Figure 3 - Nearest Residential Receivers

TABLE 1

CATEGORIES OF WORKING HOURS, AND NOISE CRITERIA

DAY	TIME ZONE	CATEGORY	NOISE CRITERIA (which must not be exceeded)
Monday to Friday	00.00 - 07.00	4	Background + 0 dBA
	07.00 - 08.00	1	Background + 5 dBA
	08.00 - 19.00	1	Background + 5 dBA + 5 dBA to be determined on a site basis
	19.00 - 23.00	2	Background + 3 dBA
	23.00 - 24.00	4	Background + 0 dBA
Saturday	00.00 - 07.00	4	Background + 0 dBA
	07.00 - 08.00	1	Background + 5 dBA
	08.00 - 17.00	1	Background + 5 dBA + 5 dBA to be determined on a site basis
	17.00 - 23.00	2	Background + 3 dBA
	23.00 - 24.00	4	Background + 0 dBA
Sundays and Public Holidays	00.00 - 07.00	4	Background + 0 dBA
	07.00 - 17.00	3	Background + 3 dBA
	17.00 - 24.00	4	Background + 0 dBA

NOTE: 00.00 or 24.00 means 12.00 midnight.

1. All noise levels to be $L_{A\ av\ max}$ (15 minute) measured at the nearest Nominated Occupancy.

2. The permissible noise level is to be complied with during each fifteen (15) minute period during the relevant Category of Hours.

3. The guidelines for control of construction noise as outlined in AS2436 shall be applied, where appropriate.

4. Background is "Background Noise Level" as defined in para 18.j (page 5).

Figure 4 - Categories of Working Hours and Noise Criteria

SCHEDULE 1

LISTED APPLIANCES AND ALLOWABLE NOISE LEVELS

GROUP A (see Note 2)	GROUP B 90dBA	GROUP C 85dBA	GROUP D 80dBA	GROUP E 75dBA	GROUP F 70Dba
Pile drivers Hydraulic hammers Machine mounted rock breakers Sand blasters Steam cleaners Mole borers	Earthmoving equipment of engine capacity above 200kW NEP Warning sirens* Reversing alarms+ Trucks	Impulsive tools - air, electric or hydraulic Earthmoving equipment of engine capacity between 100kW and 200kW NEP Explosive power tools Impact wrenches Refuse chutes* Scabblers Chain saws Rock drills	Concrete agitators Concrete pumps Concrete saws Cranes (fixed) Cranes (mobile) Earthmoving equipment up to and including engine capacities of 100kW NEP Concrete vibrators Portable hand tools Vibratory compacters	Air compressors above 170 L/s capacity Construction dumpers over 1m^3 capacity Public address system* Internal combustion or electrically driven equipment (unless grouped elsewhere) over 14kW NEP	Air compressors up to 170 L/s capacity Fluid pumps Internal combustion or electrically driven equipment (unless grouped elsewhere) up to 14kW NEP

* To be measured at the site boundary closest to the affected area.
\+ Reversing alarms must be controlled so that noise levels produced do not exceed the background sound level by more than 10dBA.

Notes

1. Where any appliance is unable to comply with the allowable noise level, para 43 applies.

2. A Certificate of Acoustic Performance (see Form D) shall be provided for each appliance listed in Group A.

3. All noise levels are to be $L_{A\ av\ max}$ (1 minute) measured at 7 m from the point nearest to an Appliance.

4 "NEP" means the Net Engine Power and shall be determined in accordance with Australian Design Rule No.28/00 External Noise of Motor Vehicles, Other Than L-Group Vehicles dated March 1989;

Figure 5 - Listed Appliances and Allowable Noise Levels