Appendix 13 – Acoustic Assessment

263-273 & 277-281 Pennant Hills Road, Carlingford

Planning Proposal Acoustic Assessment

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Attention To	Karimbla Constructions Services (NSW) Pty Limited

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1 INTRODUCTION

This report has been prepared to assess noise impacts associated with the proposed mixed-use development located at 263-273 & 277-281 Pennant Hills Road, Carlingford.

Impacts assessed include:

- Traffic noise impacts;
- Operational noise emissions;
- Noise emissions from proposed childcare centre; and
- Noise impacts from Pennant Hills Road into childcare centre.

The subject site and local context are indicated in Figure 1.

The report has been prepared for the sole purpose of a planning proposal application assessment and should not be used or relied on for any other purpose.

2 REFERENCED DOCUMENTS

2.1 BACKGROUND INFORMATION USED

The assessment is based on the updated drawings provided by FK Architects, job number 20188, issued 31/8/2023.

2.2 PLANNING GUIDELINES

The following planning instruments and guidelines have been used in the assessment:

- The Hills Development Control Plan (DCP) 2012;
- Australian Standard AS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;
- NSW Department of Planning, Industry, and Environment – *'Developments near Rail Corridors or Busy Roads – Interim Guideline'*;
- NSW Department of Planning, Industry, and Environment – *'State Environmental Planning Policy (SEPP) Transport and Infrastructure 2021'*; and
- NSW Department of Planning, Industry, and Environment Protection Authority document – *'Noise Policy for Industry'* (NPfI) 2017.
- AAAC – 'Guideline for Childcare Centre Acoustic Assessment (v3).

3 SITE DESCRIPTION AND THE PROPOSAL

The proposed mixed-use development consists of:

- 723 residential units, including:
    - 26 one-bedroom units
    - 129 one-bedroom + multi-purpose room units
    - 358 two-bedroom units
    - 37 two-bedroom + multi-purpose room units
    - 141 three-bedroom units
    - 32 four-bedroom units
- 2,533.7m^2 GFA of retail/commercial space
- 549.5m^2 GFA childcare centre

A total of 1303 car parking spaces over 8 levels.

3.1 NEAREST SENSITIVE RECEIVERS

The following table lists the nearest sensitive receivers surrounding the site. An aerial photo of the site indicating nearby noise sensitive receivers and measurement locations is presented in Figure 1.

Table 1 – Sensitive Receivers

Receiver (Refer Figure 1)	Land Use	Comment
R1	Residential	Residential developments along Pennant Hills Road to the south
R2	Residential	Residential developments along Pennant Hills Road to the southwest
R3	Residential	Residential developments along Shirley Street to the west
R4	Residential	Residential developments along Shirley Street to the north
C1	Commercial	Commercial development along Pennant Hills Road to the northwest
P1	Passive Recreation	Carlingford Memorial Park to the northeast

3.2 ENVIRONMENTAL NOISE SOURCES

The following significant environmental noise sources impacting the development have been identified:

- Traffic noise from Pennant Hills Road which bounds the site to the south and east.
- Traffic noise from Shirley Street which bounds the site to the north and west.

Figure 1 – Site Plan Showing Monitoring Locations and Surrounding Land Uses/Receivers Source (Six Maps)

- Unattended Noise Monitoring Location	- Residential
- Attended Noise Monitoring Location	- Commercial
	- Passive Recreation

4 AMBIENT NOISE MONITORING

Monitoring has been undertaken to obtain the following data:

- Background noise levels at the surrounding residential properties.
- Traffic noise levels.

Figure 1 above shows the monitoring locations used.

4.1 NOISE DESCRIPTORS

Ambient noise constantly varies in level from moment to moment, so it is not possible to accurately determine prevailing noise conditions by measuring a single, instantaneous noise level.

To quantify ambient noise, a 15-minute measurement interval is typically utilised. Noise levels are monitored continuously during this period, and then statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters obtained from the data are:

L_{eq} - represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of noise impact as it closely corresponds with how humans perceive the loudness of time-varying noise sources (such as traffic noise).

L_{90} – This is commonly used as a measure of the background noise level as it represents the noise level heard in the typical, quiet periods during the measurement interval. The L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

L_{10} is used in some guidelines to measure noise produced by an intrusive noise source since it represents the average of the loudest noise levels produced at the source. Typically, this is used to assess noise from licenced venues.

L_{max} is the highest noise level produced during a noise event and is typically used to assess sleep arousal impacts from short term noise events during the night. It is also used to assess internal noise levels resulting from aircraft and railway ground vibration induced noise.

L_1 is sometimes used in place of L_{max} to represent a typical noise level from several high-level, short-term noise events.

4.2 UNATTENDED LONG TERM NOISE MONITORING

4.2.1 Equipment Used

Unattended noise monitoring was conducted using a Rion NL-42 (Type 2) noise monitor.

The monitoring was continuous, with statistical noise levels recorded at 15-minute intervals throughout the monitoring period. Measurements were taken on "A" frequency weighting and fast time response.

All monitoring equipment used retains current calibration - either manufacturers' calibration or NATA certified calibration. The monitors were field calibrated at the beginning and the end of the measurement with no significant drift in calibration noted.

4.2.2 Locations Monitored

Figure 2. Monitor Location 1, east

Figure 3. Monitor Location 2, north

Noise logger locations are detailed in Figures 1-3.

Logger 1 was installed at the eastern boundary of the site to characterise the ambient noise environment for surrounding residential receivers R1 and R2 located along Pennant Hills Road and to monitor traffic noise levels from Pennant Hills Road.

Logger 2 was installed at the northern boundary of the site to characterise the ambient noise environment for surrounding residential receivers R3 and R4 located along Shirley Street and to monitor noise levels from Shirley Street.

4.2.3 Calculated Background Noise Levels

Background levels have been calculated from the long term, unattended noise monitoring data in Appendix A and B.

The ambient, assessment and rating background levels have been determined using based on the methodology in the Noise Policy for Industry Fact Sheet B. Periods affected by adverse weather conditions (as defined by NPI Fact Sheet B) or extraneous noise are also indicated. Weather data was obtained from records provided by the Bureau of Meteorology for the weather station located at Sydney Olympic Park.

The day, evening and night periods correspond to the NPfI guideline being:

- Day - period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
- Evening - the period from 6 pm to 10 pm
- Night - the remaining periods

4.2.3.1 Background Noise Levels

The following tables summarise the assessment background noise levels (ABL) for each location. Note that where no ABL is indicated, this is because that period was affected by adverse weather or other extraneous noise.

Table 2 – NPfI Assessment Background Noise Levels – Logger 1, Pennant Hills Road

Noise Monitor	Date	ABL		
		Day	Evening	Night
1	Monday 24 May 2021	-	57	-
	Tuesday 25 May 2021	63	58	39
	Wednesday 26 May 2021	63	59	42
	Thursday 27 May 2021	62	58	41
	Friday 28 May 2021	63	58	41
	Saturday 29 May 2021	61	56	42
	Sunday 30 May 2021	57	58	39
	Monday 31 May 2021	63	57	40
	Tuesday 01 June 2021	63	58	42
	Wednesday 02 June 2021	-	-	41
	RBL	**63**	**58**	**41**

Table 3– NPfI Assessment Background Noise Levels – Logger 2, Shirley Street

Noise Monitor	Date	ABL		
		Day	Evening	Night
2	Monday 24 May 2021	-	44	-
	Tuesday 25 May 2021	46	45	36
	Wednesday 26 May 2021	48	46	37
	Thursday 27 May 2021	48	46	39
	Friday 28 May 2021	49	47	39
	Saturday 29 May 2021	48	44	39
	Sunday 30 May 2021	45	44	37
	Monday 31 May 2021	47	45	37
	Tuesday 01 June 2021	48	44	37
	Wednesday 02 June 2021	-	-	38
	RBL	**48**	**45**	**37**

Table 4 – NPfI Rating Background Noise Levels

Location	Affected Receivers	Rating Background Noise Level (dB(A) L_{90}) *		
		Day	Evening	Night
Monitor 1, Pennant Hills Road	R1/R2	63	58	41
Monitor 2, Shirley Street	R3/R4	48	45	37

4.2.4 Calculated Traffic Noise Levels

Traffic noise levels have been calculated from the long term, unattended noise monitoring data in Appendix A & B.

Periods affected by adverse weather conditions or extraneous noise potentially impacting the measurements are also indicated. Weather data was obtained from records provided by the Bureau of Meteorology for the weather station located at Sydney Olympic Park.

Representative traffic noise levels have been calculated using the guidelines in the EPA Road Noise Policy.

4.2.4.1 Traffic Noise Levels

The data for the day and night periods have been processed to determine the ambient noise levels at the monitoring locations.

Table 5 – Measured Traffic Noise Levels

Location	Affected Receiver	Noise Level (dB(A) L_{eq})			
		Day (7am – 6pm)	Evening (6pm – 10pm)	Day & Evening (7am – 10pm)	Night (10pm – 7am)
Monitor 1, Pennant Hills Road	**R1/R2**	73	72	73	70
Monitor 2, Shirley Street	**R3/R4**	60	56	60	50

Typically, traffic noise levels are presented as a 15-hour daytime period and 9-hour night-time period. However, to apply the highly traffic noise affected amenity level, a delineation between day and evening periods has been presented above (refer Section 6.2.2). Notwithstanding the above, the night-time period is the most noise sensitive assessment period.

4.3 ATTENDED SHORT TERM NOISE MONITORING

Attended short term measurements were taken to supplement the long-term monitoring data.

4.3.1 Equipment Used

Attended noise monitoring was conducted using: a Norsonic N-140 Type 1 sound level meter.

The sound level meter was calibrated at the beginning and the end of the measurement; no significant drift was detected. Measurements were taken on fast time response.

4.3.2 Monitoring Period

Measurements were conducted on 24th May 2021 during the peak hour traffic period between 5:00pm and 5:30pm.

4.3.3 Locations Monitored

The measurements were taken adjacent to the site on Pennant Hills Road, approximately 2 metres from the kerb. Refer to Figure 1 for detailed location.

4.3.4 Results

Table 6 – Measurement Results

Location	Measured Noise Levels
Pennant Hills Road @ 2m rom kerb	75dB(A) $L_{eq\ (15\ min)}$

4.4 PREDICTED TRAFFIC NOISE LEVELS AT FAÇADE

SoundPlan™ 8.0 noise modelling software has been used to predict traffic noise levels at the building facades based on measured noise data detailed in the sections above. Refer to Appendix C for façade noise maps.

5 EXTERNAL NOISE INTRUSION ASSESSMENT

5.1 NOISE INTRUSION CRITERIA

A noise intrusion assessment has been conducted based on the requirements of the following acoustic noise criteria and standards:

- The Hills Development Control Plan (DCP) 2012;
- Australian Standard AS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;
- NSW Department of Planning, Industry, and Environment – *'Developments near Rail Corridors or Busy Roads – Interim Guideline'*; and
- NSW Department of Planning, Industry, and Environment – *'State Environmental Planning Policy (SEPP) Transport and Infrastructure 2021'*.

5.1.1 The Hills DCP 2012

The Hills Shire Council DCP 2012 refers to AS/NZS 3761 regarding traffic noise intrusion for residential development:

> *Statement from a qualified acoustic consultant certifying that the design and construction of the building meets the Environmental Protection Authority – Environmental Criteria for Road Traffic Noise and Australian Standard 3671 – Road Traffic Noise Intrusion – Building Siting and Construction.*

5.1.2 Australian Standard AS 3671:1989 *'Acoustics—Road traffic noise intrusion — Building siting and construction'*

Australian Standard AS 3671-1989 notes the following in relation to traffic noise:

- Internal noise levels should be determined in accordance with the relevant standard.
- Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the L_{eq} descriptor, Acoustic Logic shall also use this descriptor.
- AS3671 does not specifically recommend a time interval. On this basis, Acoustic Logic has adopted the interval used by the EPA Road Noise Policy for main/arterial roads, that being:
    - Day – 7am to 10pm (15 hour); and
    - Night – 10pm to 7am (9 hour).

Internal noise levels have been selected in accordance with AS 2107:2016.

5.1.3 Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table 1, in Section 5 of AS 2107-2016, gives the following maximum internal noise levels for project buildings.

Table 7 – Recommended Design Sound Level

Space /Activity Type	Recommended Maximum Design Sound Level dB(A) L_{eq}
Living Areas	30-40 dB(A)L_{eq}
Sleeping Areas	30-35 dB(A)$L_{eq\ (night\text{-}time)}$

5.1.4 NSW Department of Planning, Industry, and Environment – Development near Rail Corridors or Busy Roads – Interim Guideline

In conjunction with clause 102 of the *ISEPP 2007* which has since been superseded by the *SEPP 2021*, the development will need to ensure compliance with the *DNRCBR* guideline which states the following:

> *"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP [2.99 and 2.119 of the SEPP 2021]. The procedure covers noise at developments for both road and rail.*
>
> *If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*
>
> *(a) In any bedroom in the building – 35 dB(A) at any time between 10pm and 7am,*
> *(b) Anywhere else in the building (other than a garage, kitchen, bathroom, or hallway) – 40 dB(A) at any time."*

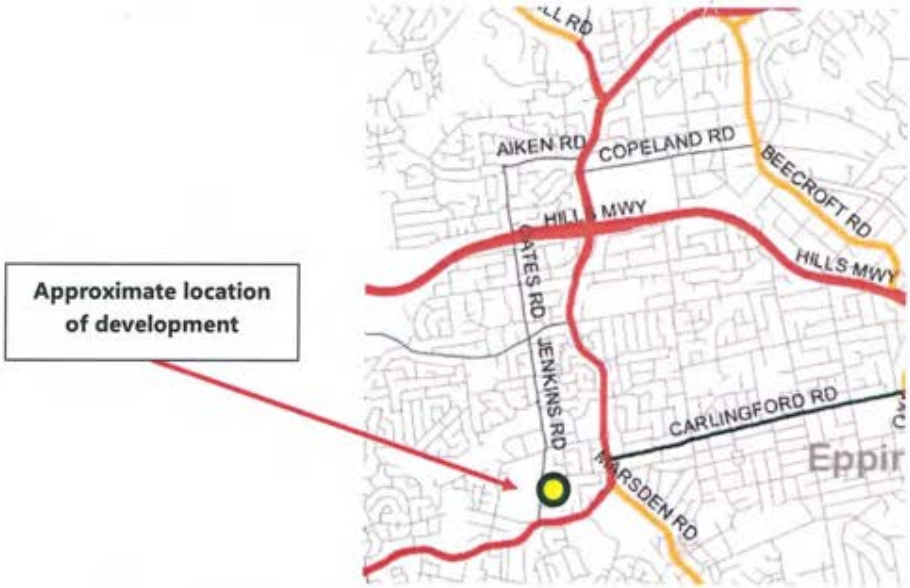
The guideline also provides guidance on the assessment of natural ventilation. The allowable internal noise goal is permitted to be 10 dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45 dB(A), and 50 dB(A) in living rooms). Where noise levels would exceed this, the NSW Planning guideline recommends that a ventilation system be provided to achieve the ventilation requirements of the NCC with windows closed. We note that where the 'open window/door' scenario cannot be achieved, this does not necessarily mean than there cannot be operable elements on these façades, only that internal noise level requirements will only be met when they are closed.

5.1.5 NSW Department of Planning, Industry, and Environment – State Environmental Planning Policy (SEPP) Transport and Infrastructure 2021

We note that the proposed development is located adjacent to Pennant Hills Road, which carries in excess of 40, 000 vehicles AADT. As such, the requirements of SEPP (Transport and Infrastructure) 2021 and the DoP's *Development near rail corridors and busy roads – Interim Guideline* will be used to determine appropriate façade constructions, the requirements of which are detailed in this section.

RTA Map No. 11 of the traffic volume maps referenced by the SEPP (Transport and Infrastructure) 2021 on the RTA website (see below), classifies the section of Pennant Hills Road where the development is located adjacent to as a road where a noise intrusion assessment is mandatory under clause 2.119 of the SEPP (Transport and Infrastructure) 2021. See RTA average annual daily road traffic volume map number 11 and the approximate location of the site can be seen in Figure 2.

Figure 2: RTA Map No. 11 and Approximate Location of Proposed Development



2.119 *"This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—*

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based childcare facility.

If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom, or hallway)—40 dB(A) at any time."

5.1.6 Summarised External Noise Intrusion Criteria

The internal noise criteria adopted for each internal space is therefore summarised below based on the relevant State, Council and Australian Standard requirements.

Table 8– Adopted Internal Noise Levels

Scenario	Space / Activity Type	Required Internal Noise Level
Windows Closed	Sleeping Areas	35 dB(A)$L_{eq\ (9\ hour)}$
	Living Areas	40 dB(A)$L_{eq\ (15\ hour)}$
Windows Open	Sleeping Areas	45 dB(A)$L_{eq\ (9\ hour)}$
	Living Areas	50 dB(A)$L_{eq\ (15\ hour)}$

5.2 COMPLYING CONSTRUCTIONS

5.2.1 Glazing/External Walls/Roof

At this stage, only general floor plans have been provided. Detailed recommendations for building envelope constructions (glazing, external walls and roof) once room layouts have been finalised. Indicatively, upgrades to the southern, eastern and western facades of buildings fronting Pennant Hills Road will be required to ensure compliance with criteria nominated in Section 5.1.4.

5.2.2 Balconies

Based on the assessment, enclosed balconies are not required to mitigate traffic noise impacts. Notwithstanding, should the applicant wish to enclose the balconies, they should be afforded the same GFA exclusion under Clause 6.22 of the Parramatta LEP 2023 relating to the development at Lots 1, 2, 5 and 6, DP 805059, 241–245 Pennant Hills Road, Carlingford.

5.2.3 Ventilation and Air Conditioning

As referenced in Section 5.1.3, the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' specifies the following controls regarding natural ventilation:

- With respect to natural ventilation of a dwelling the allowable internal noise goal is permitted to be 10 dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45 dB(A), and 50 dB(A) in living rooms). Where noise levels would exceed this, the NSW Planning guideline recommends that a ventilation system be provided to achieve the ventilation requirements of the BCA with windows closed.

Indicatively, living rooms and bedrooms along the the southern, eastern and western facades of buildings fronting Pennant Hills Road will require doors and windows to be closed in order to achieve internal noise levels.

Where the recommended internal noise levels cannot be achieved with windows open within the development, confirmation on the ventilation requirements for apartments will be required.

Any supplementary ventilation system or façade opening proposed to be installed to provide ventilation to apartments should be acoustically designed to ensure that the internal noise level requirements are achieved. In the event mechanically assisted ventilation is utilised, it should be acoustically designed so that internal noise levels within apartments are appropriate, and any external noise emissions to surrounding noise sensitive receivers is within the requirements detailed in Section 6 of this report.

5.3 NOISE INTRUSION ASSESSMENT INTO CHILDCARE CENTRE

Preliminary impacts from traffic into the childcare centre were assessed in accordance with the criteria below.

Noise impacts into childcare centre should be assessed during CC stage or after operator has been chosen to address acoustic issues after fit-out design is finalised.

5.3.1 NSW Department of Planning, Industry, and Environment – Development near Rail Corridors or Busy Roads – Interim Guideline

The interim guideline is used to assess the impact of noise from adjacent road and rail corridors on noise sensitive development such as educational institutions including childcare centres. Table 3.1 of the interim guideline recommends a maximum noise level within childcare centres of 40 dB(A) $L_{eq,1hr}$.

5.3.2 NSW Department of Planning, Industry, and Environment – State Environmental Planning Policy (SEPP) Transport and Infrastructure 2021

SEPP (Transport and Infrastructure) 2021 is being assessed based on the criteria set out in Section 5.1.4 of this report, as centre based childcare centres is part of clause 2.119 required developments for assessment.

5.3.3 Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment, Version 3.0, 2020

The AAAC *Guideline for Childcare Centre Acoustic Assessment 2020'* provides the following external noise criteria.

5.3.3.1 AAAC Criteria

A summary of the AAAC internal noise criteria applicable for the proposed development is detailed below.

Table 9 –Internal Noise Level Criteria (AAAC)

Source	Receiver	Criteria
Pennant Hills Road Traffic	Sleeping Areas	35 dB(A) $L_{eq\ (1\ hour)}$
	Indoor Play Areas	40 dB(A) $L_{eq\ (1\ hour)}$
	Outdoor Play Areas	55 dB(A) $L_{eq\ (1\ hour)}$

5.3.4 Project Criteria

A summary of the internal noise criteria applicable for the proposed development is detailed below.

Table 10 – Project Internal Noise Level Criteria

Source	Receiver	AAAC Criteria	SEPP Criteria
Pennant Hills Road Traffic	Sleeping Areas	35 dB(A) $L_{eq\ (1\ hour)}$	40 dB(A) $L_{eq\ (1\ hour)}$
	Indoor Play Areas	40 dB(A) $L_{eq\ (1\ hour)}$	40 dB(A) $L_{eq\ (1\ hour)}$
	Outdoor Play Areas	55 dB(A) $L_{eq\ (1\ hour)}$	40 dB(A) $L_{eq\ (1\ hour)}$

5.3.5 Recommendations

It is recommended that child care façade constructions be assessed once space layouts are finalised to ensure the internal noise level criteria nominated in Section 5.3.4 is met. Barriers may be required to provide screening to external play areas.

6 NOISE EMISSION CRITERIA

The noise emission from the project site shall comply with the requirements of the following documents:

- The Hills Development Control Plan (DCP) 2012; and
- NSW Department of Environment and Heritage, Environmental Protection Authority document – *'Noise Policy for Industry'* (NPI) 2017.

6.1 THE HILLS DEVELOPMENT CONTROL PLAN (DCP) 2012

The Hills Development Control Plan (DCP) 2012 contains the following controls for noise emissions for commercial development:

> *A statement of compliance from an acoustic consultant may be required to demonstrate that the noise generated by the development generally does not exceed 5dB(A) above the background noise levels, where measured at any boundary adjoining or adjacent to a residential property.*

We note that the background noise + 5 noise emission criteria corresponds to the NSW EPA 'Intrusiveness Criterion' discussed in Section 6.2.1.

6.2 NSW DEPARTMENT OF ENVIRONMENT AND HERITAGE, ENVIRONMENTAL PROTECTION AUTHORITY DOCUMENT – 'NOISE POLICY FOR INDUSTRY' (NPI) 2017

The EPA NPI has two criteria which both are required to be satisfied, namely Intrusiveness and amenity. The NPI sets out acceptable noise levels for various localities. The policy indicates four categories to assess the appropriate noise level at a site. They are rural, suburban, urban, and urban/industrial interface. Under the policy the nearest residential receivers would be assessed against the urban criteria.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

6.2.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Table 4. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

6.2.2 Project Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The EPA's NPI sets out acceptable noise levels for various localities. The recommended noise amenity area is based upon several factors, including the measured noise levels at the sensitive receiver.

Based on measured noise levels, we note that residents located along Pennant Hills Road (**R1** & **R2**) are affected by high levels of traffic. The Noise Policy for Industry suggest the adoption of the 'High Traffic Project Amenity' categorisation for such areas. The procedure for applying the 'High Traffic Project Amenity' categorisation is outlined in Section 2.4.1 of the NPI as follows:

> *The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the L_{Aeq} noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the $L_{Aeq,\ period(traffic)}$ minus 15 dB(A).*
>
> *This high traffic project amenity noise level may be applied only if all of the following apply:*
>
> - *traffic noise is identified as the dominant noise source at the site.*
> - *the existing traffic noise level (determined using the procedure outlined in A2, Fact Sheet A, that is, measuring traffic instead of industrial noise) is 10 dB or more above the recommended amenity noise level for the area.*
> - *it is highly unlikely traffic noise levels will decrease in the future.*

With respect to residents along Pennant Hills Road (**R1** & **R2**), measured traffic noise levels front and side facades are sufficiently high for the above correction to apply.

Based on the measured noise levels detailed in Table 4 and zoning for receivers **R3** and **R4**, the Noise Policy for Industry suggests the adoption of the 'urban' categorisation.

The NPI requires project amenity noise levels to be calculated in the following manner:

$L_{Aeq,15min}$ = *Recommended Amenity Noise Level – 5 dB(A) + 3 dB(A)*

The amenity levels appropriate for the receivers surrounding the site are presented in Table 12.

Table 11– EPA High Traffic Project Amenity Noise Levels

Type of Receiver	Time of day	Measured Traffic Noise Level $L_{Aeq, period (traffic)}$	High Traffic Project Amenity Noise Level $L_{Aeq, period (traffic)}$ minus 15
High Traffic Project Amenity **(R1 & R2)**	Day (7am – 6pm)	73	58
	Evening (6pm – 10pm)	72	57
	Night (10pm – 7am)	70	55

Table 12– EPA Amenity Noise Levels

Type of Receiver	Time of day	Recommended Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq (15 minute)}$
Residential –Urban **(R3 & R4)**	Day (7am – 6pm)	60	58
	Evening (6pm – 10pm)	50	48
	Night (10pm – 7am)	45	43
Commercial	When in use	65	63
Passive Recreation	When in use	50	48

The NSW EPA Noise Policy for Industry (2017) defines:

- Day as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.
- Evening as the period from 6pm to 10pm.
- Night as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

6.2.3 Sleep Arousal Criteria

The Noise Policy for Industry recommends the following noise limits to mitigate sleeping disturbance:

Where the subject development / premises night -time noise levels at a residential location exceed:

- *$L_{eq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
- *L_{Fmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*

a detailed maximum noise level even assessment should be undertaken.

Table 13 – Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
R1/R2	41 dB(A) L_{90}	46 dB(A)$L_{eq,\ 15min}$; 56 dB(A)L_{Fmax}
R3/R4	37 dB(A) L_{90}	42 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}

6.3 SUMMARISED NOISE EMISSION CRITERIA

Table 14– EPA NPFI Noise Emission Criteria (for Mechanical Plant)

Receiver	Time Period	Rating Background Noise Level dB(A)L_{90}	Project Amenity Criteria dB(A)L_{eq} (period)	High Traffic Amenity Noise Level dB(A)L_{eq} (period)	Intrusiveness Criteria $L_{eq\ (15min)}$	NPI Criteria for Sleep Disturbance
R1/R2	Day (7am – 6pm)	63	58	**58**	68	N/A
	Evening (6pm – 10pm)	58	48	**57**	63	N/A
	Night (10pm – 7am)	41	43	55	**46**	**46 dB(A)$L_{eq,\ 15min}$; 56 dB(A)L_{Fmax}**
R3/R4	Day (7am – 6pm)	48	58	N/A	**53**	N/A
	Evening (6pm – 10pm)	45	**48**	N/A	50	N/A
	Night (10pm – 7am)	37	43	N/A	**42**	**42 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}**
C1 (Commercial)	When in use	N/A	**63**	N/A	N/A	N/A
P1 (Passive Recreation)	When in use	N/A	**48**	N/A	N/A	N/A

The project noise trigger levels are indicated by the bolded values in the table above.

6.4 CRITERIA FOR NOISE EMISSIONS FROM CHILDCARE CENTRE

6.4.1 For Residents External to the Development

The AAAC Guideline will be adopted in determining noise emission criteria for the childcare centre.

6.4.1.1 AAAC Guideline

The AAAC – *'Guideline for Childcare Centre Acoustic Assessment (v3)'* states the following regarding childcare centre noise emissions:

OUTDOOR PLAY AREA

Base Criteria – *With the development of child care centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed Leq,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).*

Background Greater Than 40 dB(A) – *The contributed Leq,15min noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (ie background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).*

Up to 4 hours (total) per day – *If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15 minute noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*

More than 4 hours (total) per day – *If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15 minute noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.*

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:

- *1.5 m above ground level;*
- *On a balcony at 1.5 m above floor level;*
- *Outside a window on the ground or higher floors.*

OTHER NOISE EMISSION

The cumulative Leq,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 discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above. This includes the noise emission resulting from:

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

6.4.2 For Residents Within the Development

The ongoing design and development of the project allows for acoustic treatments to be incorporated within the residential façades (rather than at the source of noise). It is proposed that internal noise criteria instead be adopted, to be applied with the doors and windows of residences closed. This approach is consistent with the assessment of other external noise sources (such as road/rail impacts).

Australian Standard AS2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* recommends the following internal noise targets for residential uses:

- Sleeping areas (night-time) 35-40dB(A) L_{eq}
- Living areas 35-45dB(A) L_{eq}

For sleeping areas, 35dB(A) is adopted and 40dB(A) for living areas.

6.4.3 Summarised Noise Emission Criteria for Childcare Centre

Table 15– Summarised AAAC Criteria – OUTDOOR PLAY

Receiver	Measured Background Noise Level	AAAC Criteria (BG +10) up to four hours play per day	AAAC Criteria (BG +5) More than four hours play per day
External Receivers R1/R2	63 dB(A) L_{90}	73 dB(A) $L_{eq\ (15\ min)}$	68 dB(A) $L_{eq\ (15\ min)}$
External Receivers R3/R4	48 dB(A) L_{90}	58 dB(A) $L_{eq\ (15\ min)}$	53 dB(A) $L_{eq\ (15\ min)}$
Internal Receivers (Apartments above CCC)	N/A	35-40 dB(A) $L_{eq(15min)}$ (Internal Noise Level) *	

*Refer Section 6.4.2

Table 16– Summarised AAAC Criteria – INDOOR PLAY

Receiver	Measured Background Noise Level	AAAC Criteria (BG +5)
External Receivers R1/R2	63 dB(A) L_{90}	68 dB(A) $L_{eq\ (15\ min)}$
External Receivers R3/R4	48 dB(A) L_{90}	53 dB(A) $L_{eq\ (15\ min)}$
Internal Receivers (Apartments above CCC)	N/A	35-40 dB(A) $L_{eq(15min)}$ (Internal Noise Level) *

*Refer Section 6.4.2

7 NOISE EMISSION ASSESSMENT

7.1 NOISE FROM MECHANICAL PLANT WITHIN PROPOSED SITE GENERALLY

Detailed plant selection and location has not been undertaken at this stage. Satisfactory levels will be achievable through appropriate plant selection, location and if necessary, standard acoustic treatments such as duct lining, acoustic silencers, and enclosures.

Noise emissions from all mechanical services to the closest residential receiver should comply with the requirements of Section 5.3.

Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

7.2 RETAIL TENANCIES

The primary sources of noise generated by these commercial uses are likely to be loading dock activities, mechanical plant servicing the building and outdoor patron noise associated with food and beverage outlets. It is expected that all individual retail/commercial tenancies would be subject to a separate development application, at which time the specific measures required to control noise emissions could be addressed. Key acoustic considerations for the proposed tenancies are detailed below.

- Retail outlets are expected to have minimal impact on the proposed residential uses.
- Licensed tenancies (especially those which are proposed to operate during the night-time period) will likely have a higher potential acoustic impact, pending their capacity and siting. Tenancies of this nature would require a noise impact assessment to be conducted to determine appropriate management controls and treatments in order to mitigate noise impacts to nearby residents of the development.

Notwithstanding the above, it is recommended that all proposed retail/commercial/hospitality uses within the site be subject to a separate development application once specific uses and operators have been determined. At this time, individual tenancies should demonstrate that noise emission requirements are able to be met, and the specific management controls/building treatments which may be implemented to ensure compliance. Further, the cumulative impacts of noise from the combined operation of all retail tenancies should be considered when assessing noise from individual tenancies.

7.3 CHILDCARE CENTRE

The childcare centre at this stage does not have an operator. As such, a full and proper assessment of the childcare centre cannot be undertaken at this stage.

Notwithstanding the above, through use of appropriate management controls and acoustic treatments to internal spaces and facade, use and operation of the childcare centre has the ability to comply with the criteria detailed in Section 6.1 of this report. Examples of treatments which may be required to achieve the criteria detailed above include (but are not necessarily limited to):

- Design of outdoor play areas to minimise potential impact on neighbouring residents
- Use of building form as an acoustic barrier
- Absorptive treatments where appropriate
- Treatment to building façade to prevent noise transmission through lightweight elements such as glazing.

It has been assumed that any future tenant of this space would be required to submit a development application prior to commencement, at which time compliance with the acoustic criteria detailed in Section 6.4.3 of this report would be demonstrated.

7.4 NOISE FROM RETAIL USE OF CARPARK/DRIVEWAY

Noise from retail/commercial use of carpark and driveway are to be assessed in accordance with the NSW EPA Noise Policy for Industry. Car movements along the driveway are to comply with the project noise trigger levels outlined in Table 14. A full assessment is to be carried out once peak trip generation predictions have been provided.

7.5 NOISE FROM USE OF LOADING DOCK

Three loading docks are proposed to service the retail/commercial tenancies within the development. One loading dock is located on ground floor of Building E, a second loading dock is located on ground floor of Building D, and another loading dock is located on ground floor of buildings C & F. All docks are fully enclosed. Access to the loading docks is via Shirley Street.

If it is proposed to operate the loading dock during the night-time period (10:00pm – 7:00am) such as for large deliveries or waste collection, then consideration must be given to the potential for sleep disturbance from peak noise events. Given that the loading docks are enclosed and the distance to nearby residential receivers, predicted noise levels to the façade of nearby residences are expected to be less than the sleep disturbance trigger level of 52dB(A)L_{Fmax} **(R3 & R4)** and 56dB(A)L_{Fmax} **(R1)** for truck movements in the driveway.

However, for trucks idling inside the loading dock and reversing (with reverse beep), noise levels are expected to be greater than sleep disturbance trigger level of 52dB(A)L_{Fmax} **(R3 & R4)**.

Having this in mind, it is recommended that no trucks/use of loading dock is to be allowed during night-time period from 10:00pm-7:00am.

If night-time operation of the loading dock is required, and after waste collection and delivery services have been selected/finalised, further acoustic assessment is recommended. Acoustic treatments might include that the full extent of the soffit (excluding services requirements) be lined with minimum 50mm thick 32kg/m3 glasswool insulation, facing to be lined with minimum 11% open area perforated metal. Alternative treatments which achieve a minimum NRC of 0.9 are also acceptable. Management controls might include that all trucks must be off when inside the loading dock (no idling) and should employ a non-tonal reversing beacon.

8 CONCLUSION

AL has conducted an acoustic assessment of the noise impacts associated with the proposed mixed-use development located at 263-273 & 277-281 Pennant Hills Road, Carlingford.

Noise intrusion has been assessed in accordance with the following documents:

- The Hills Development Control Plan (DCP) 2012;
- Australian and New Zealand AS/NZS 3671:1989 'Acoustics—Road traffic noise intrusion—Building siting and construction';
- Australian Standard AS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;
- NSW Department of Planning, Industry, and Environment – *'Developments near Rail Corridors or Busy Roads – Interim Guideline'*; and
- NSW Department of Planning, Industry, and Environment – *'State Environmental Planning Policy (SEPP) Transport and Infrastructure 2021'*.
- AAAC – 'Guideline for Childcare Centre Acoustic Assessment (v3).

Noise emissions have been assessed in accordance with the following documents:

- The Hills Development Control Plan (DCP) 2012;
- NSW Department of Planning, Industry, and Environment Protection Authority document – *'Noise Policy for Industry'* (NPfI) 2017; and
- AAAC – 'Guideline for Childcare Centre Acoustic Assessment (v3).

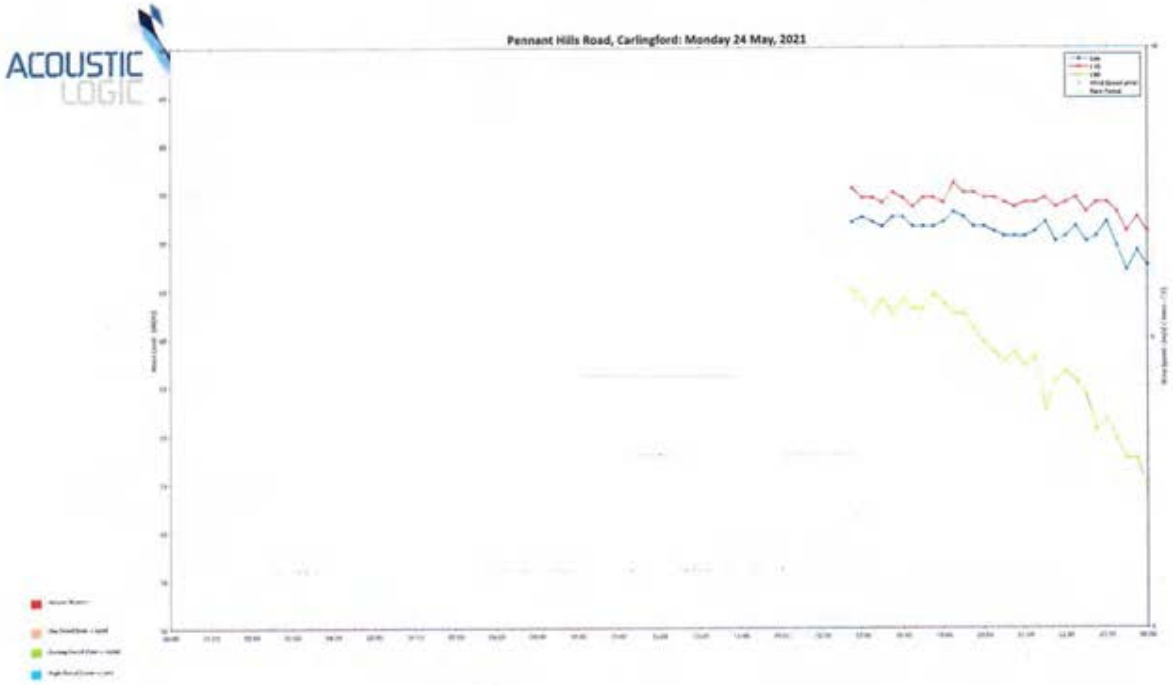
Provided the recommendations outlined in Sections 5.2, 5.3, 7.4, and 7.5 are implemented, noise objectives for the development can be achieved. A full assessment of mechanical plant noise emissions is to be carried out after equipment selections have been finalised.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Ross Ferraro

APPENDIX A – UNATTENDED NOISE MONITORING DATA – MONITOR 1, PENNANT HILLS ROAD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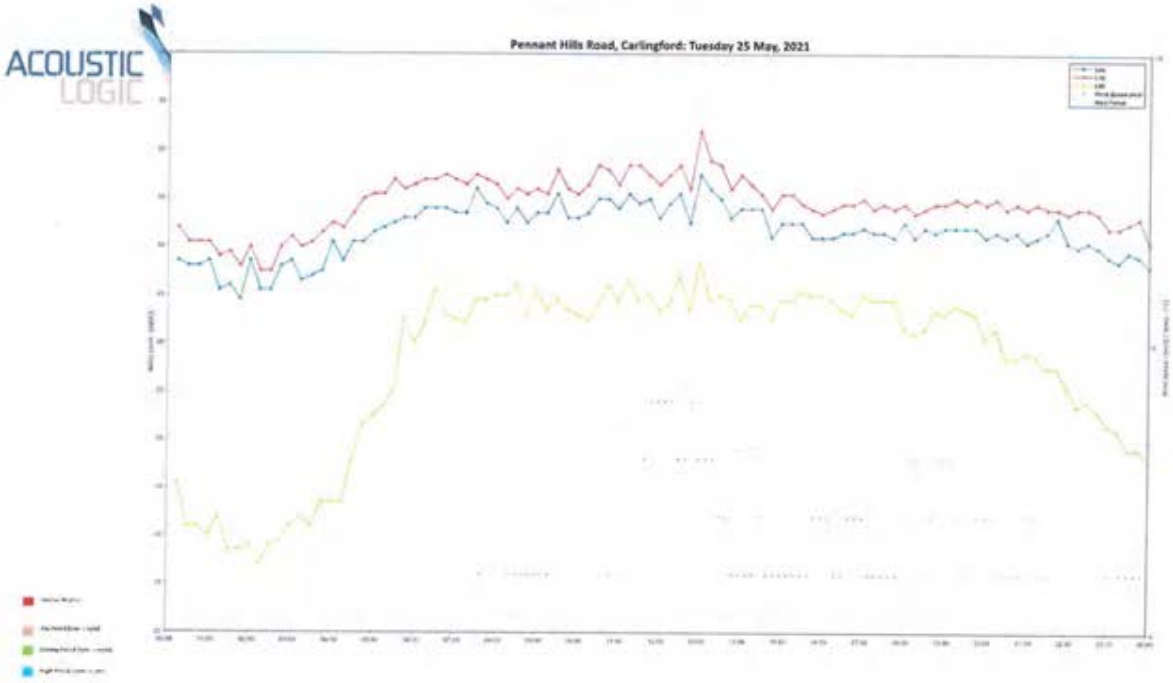
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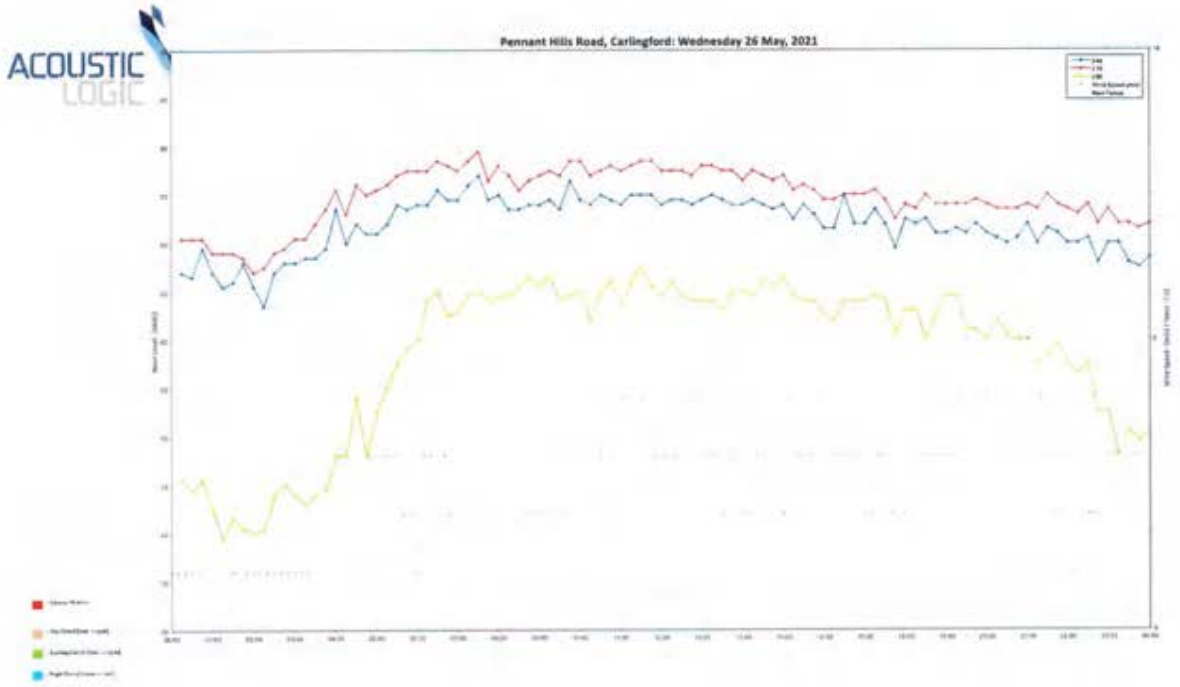
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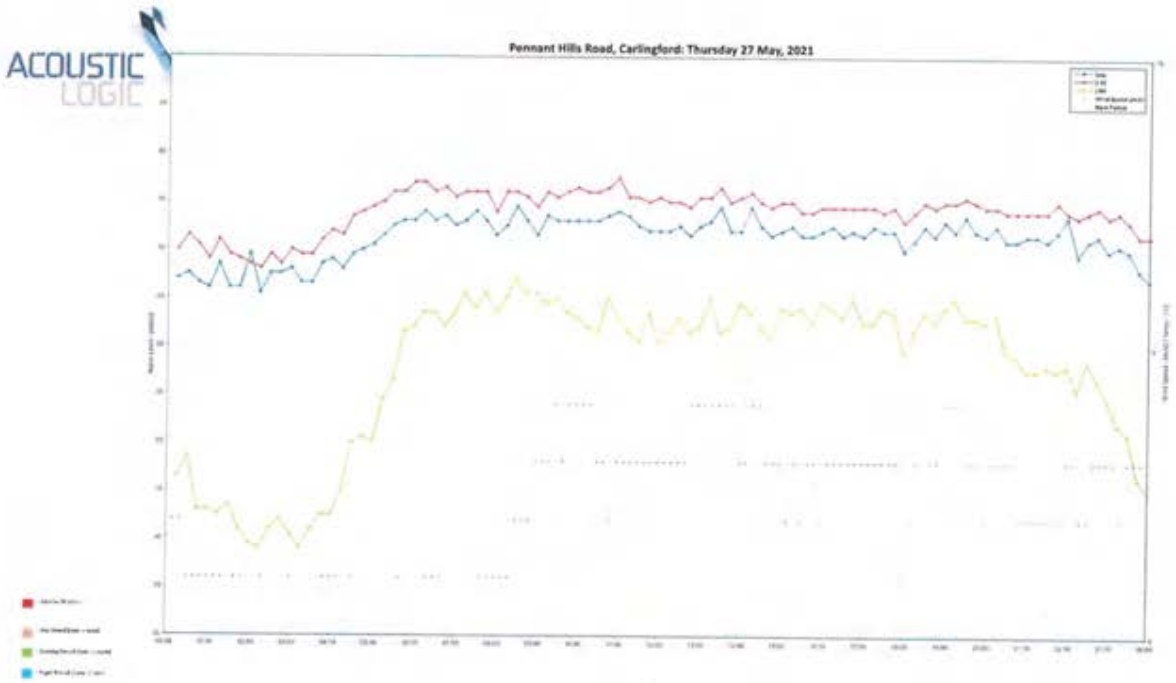
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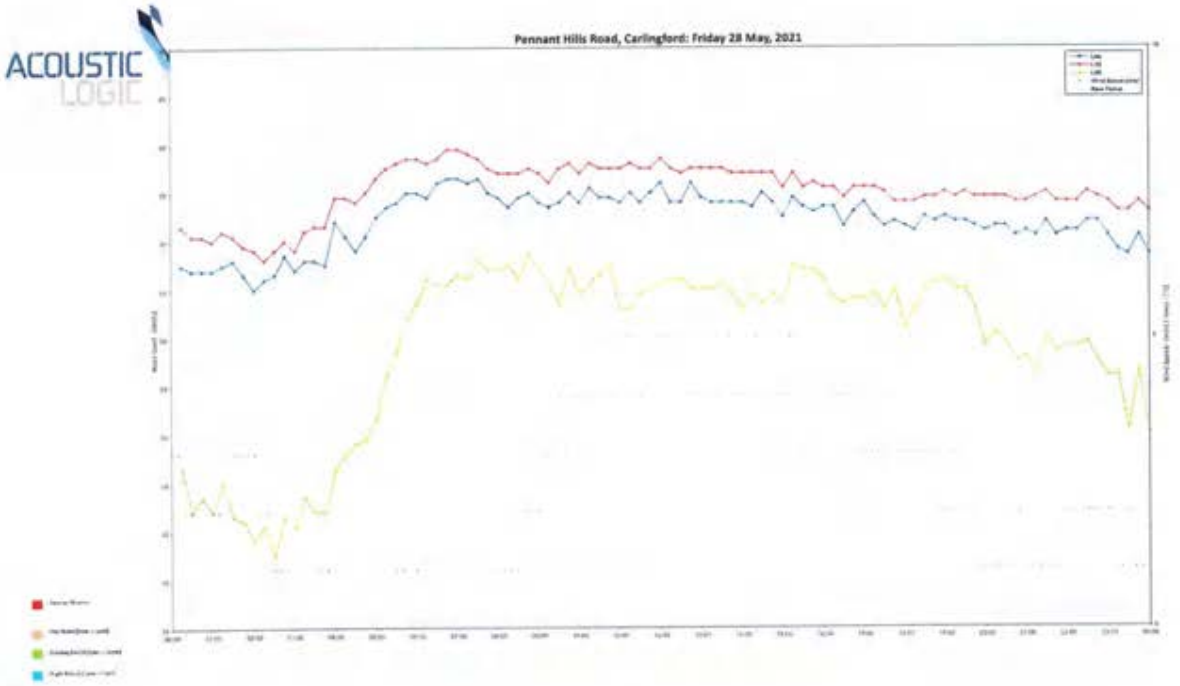
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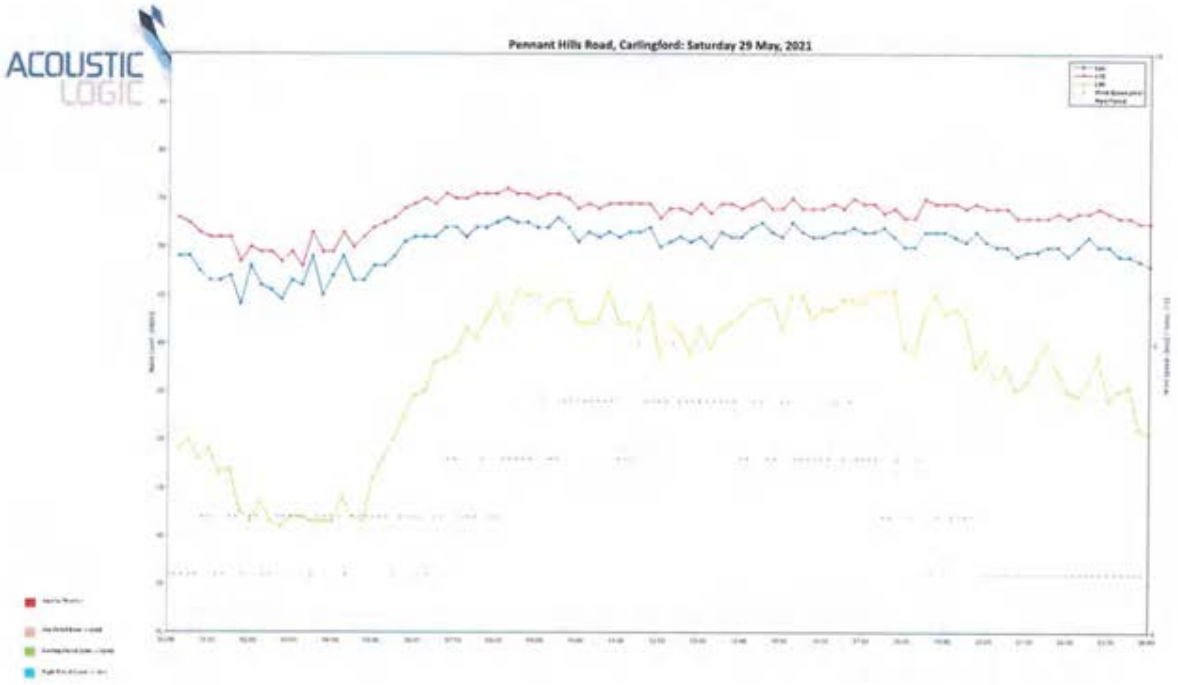
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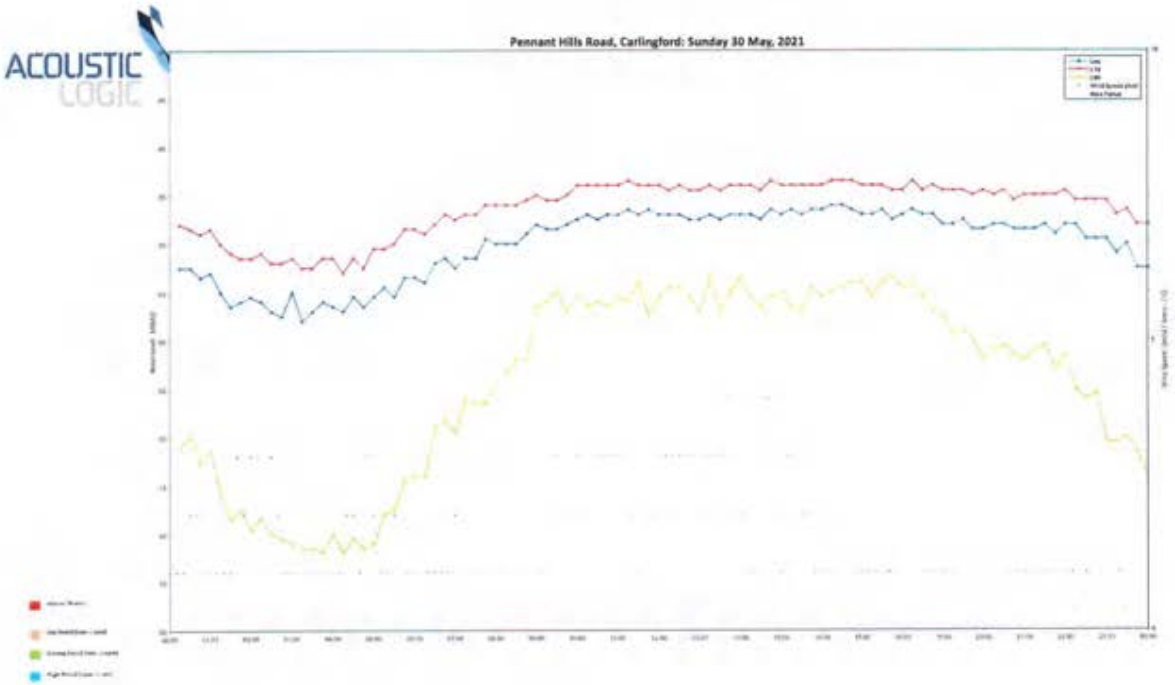
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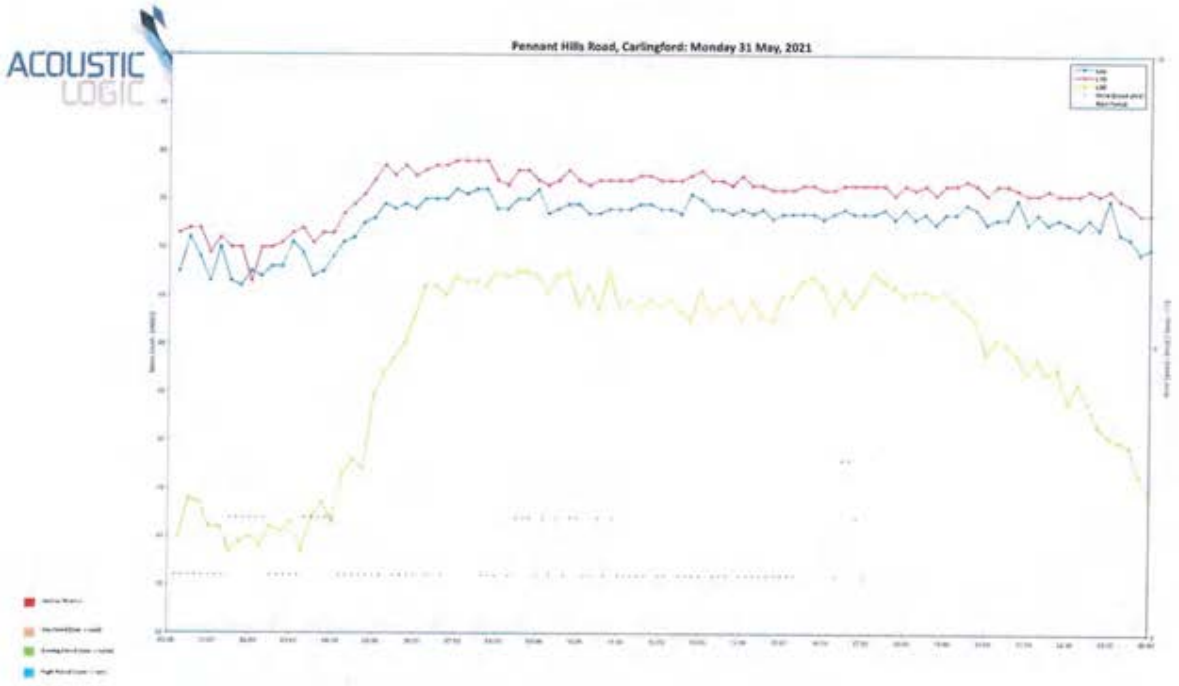
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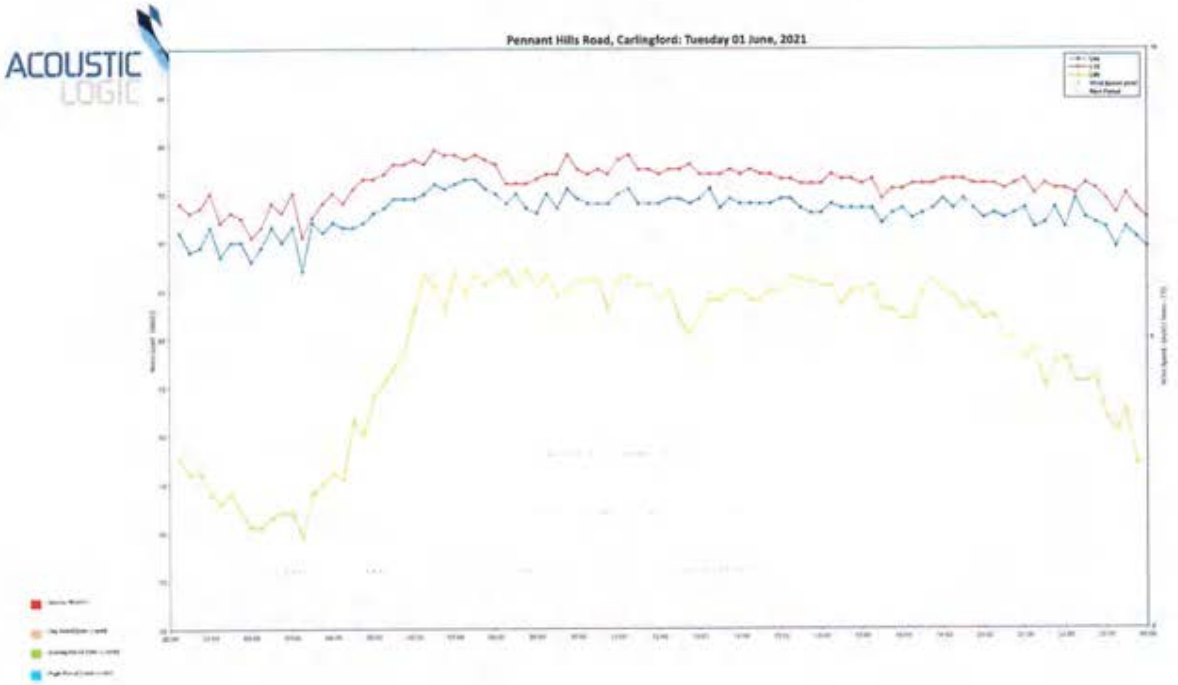
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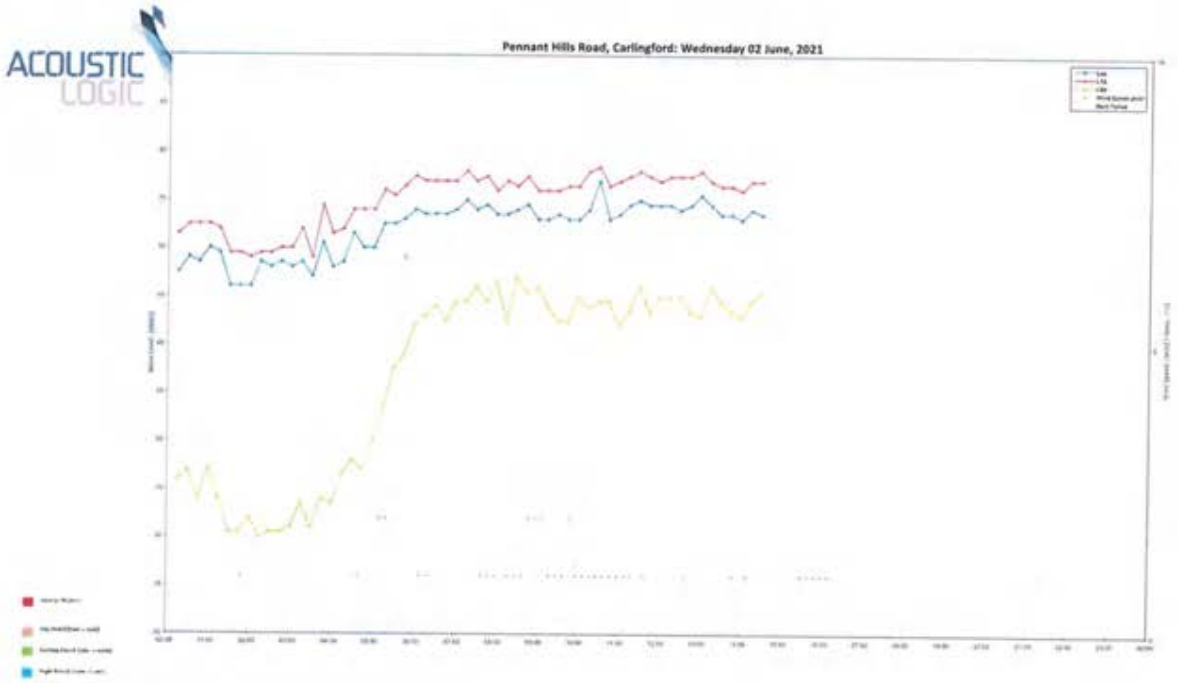
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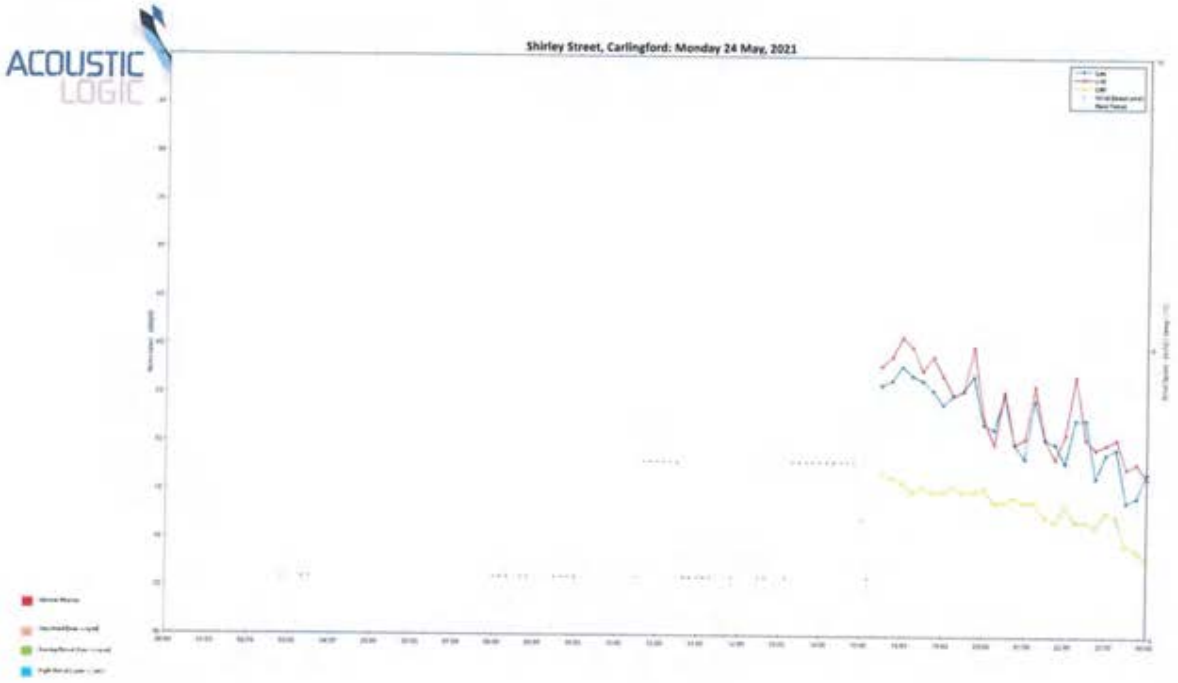
APPENDIX B – UNATTENDED NOISE MONITORING DATA – MONITOR 2, SHIRLEY STREET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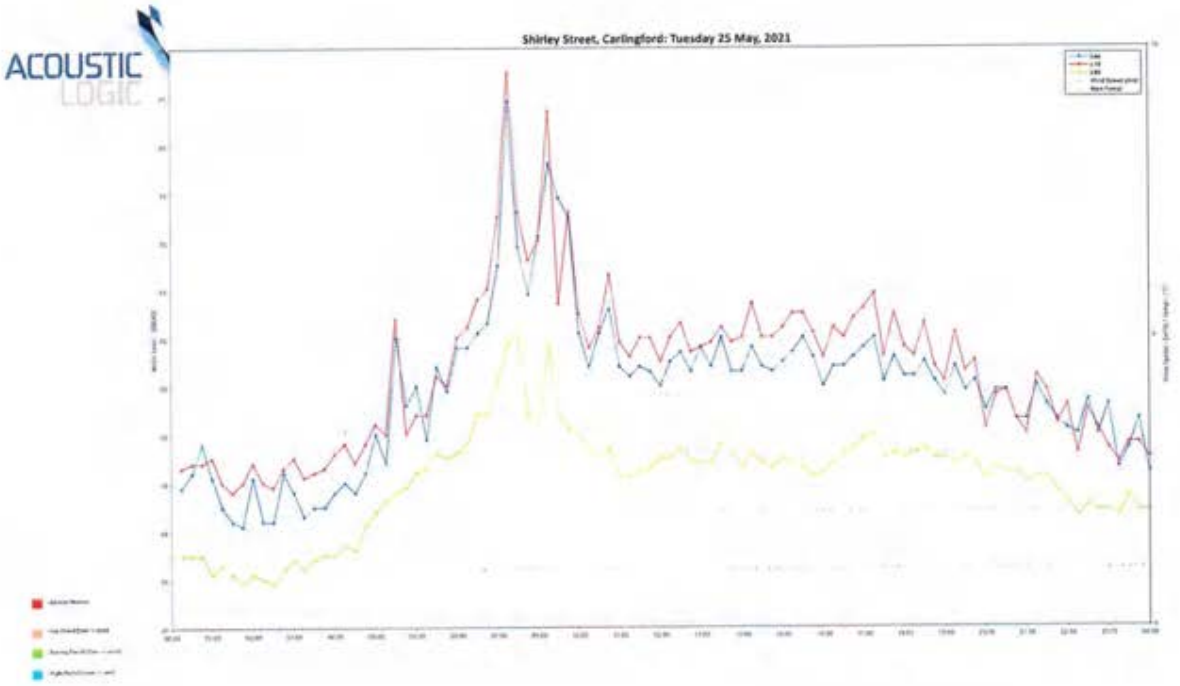
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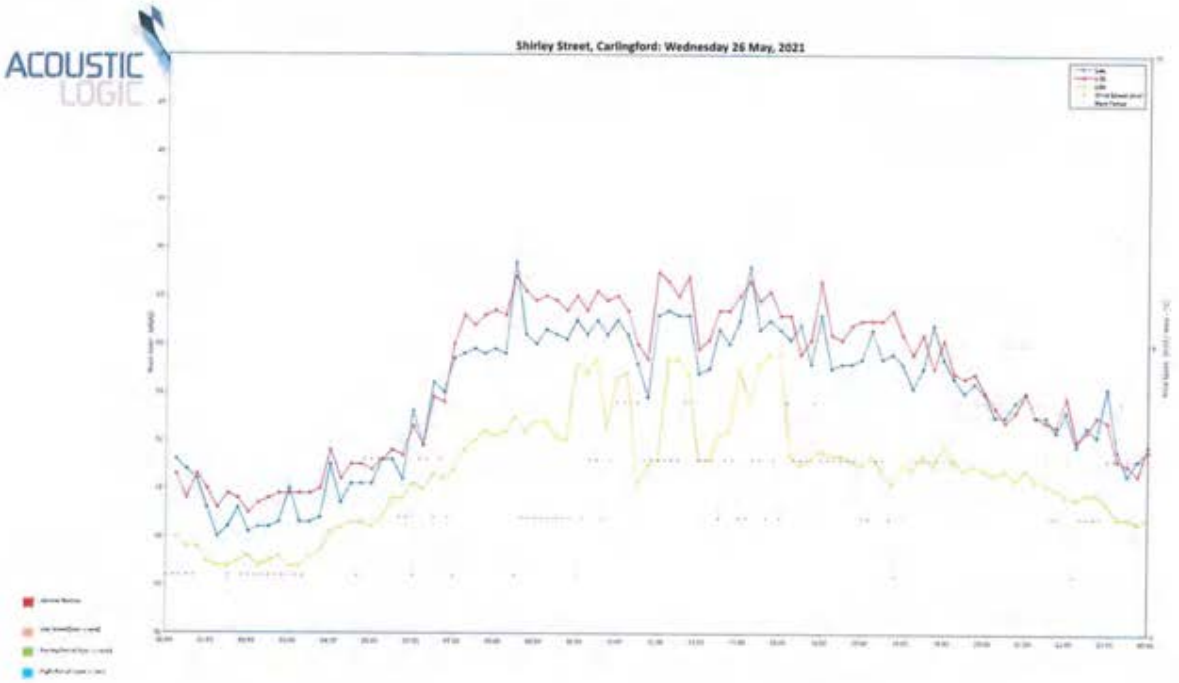
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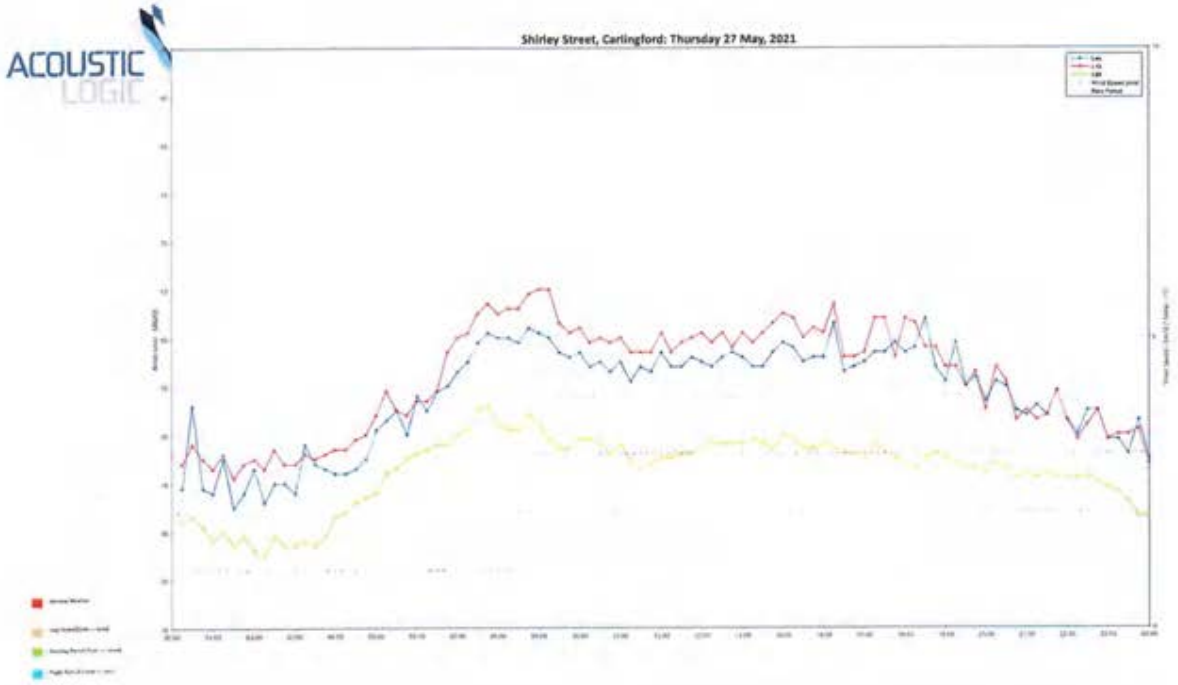
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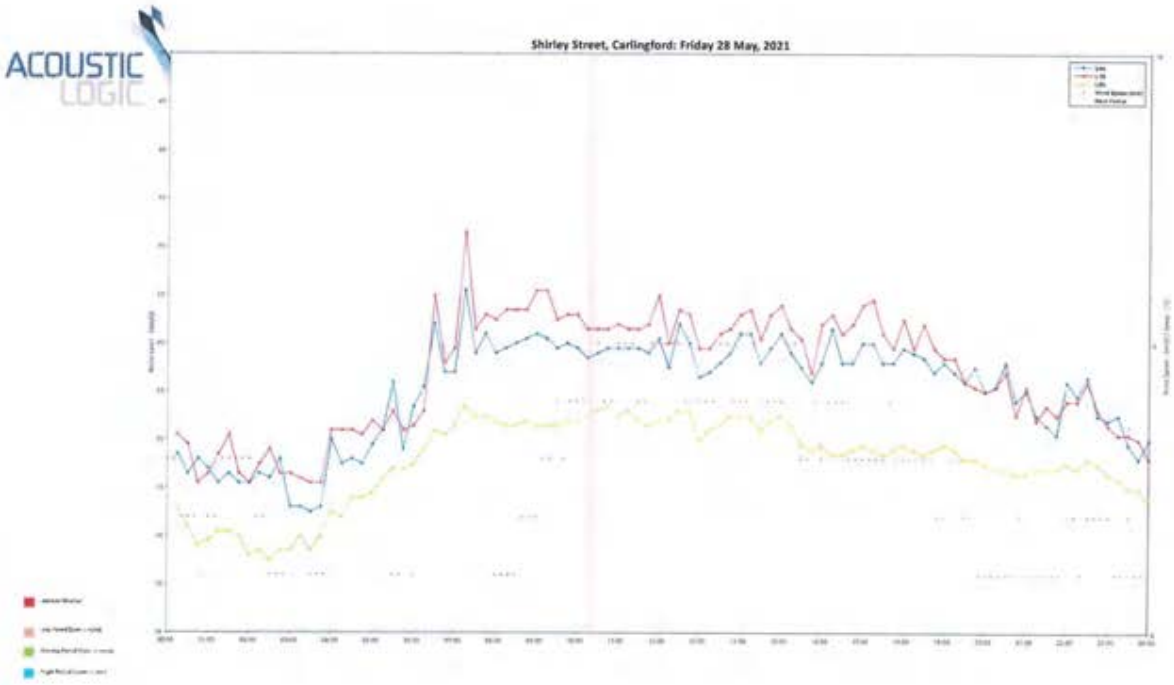
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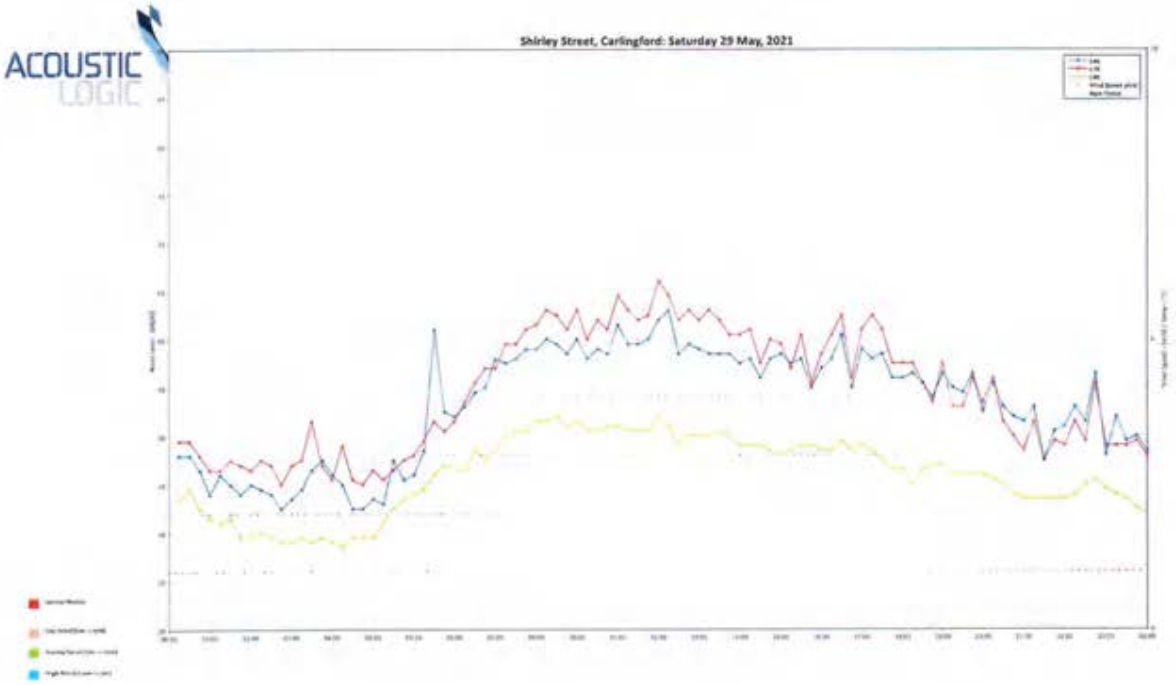
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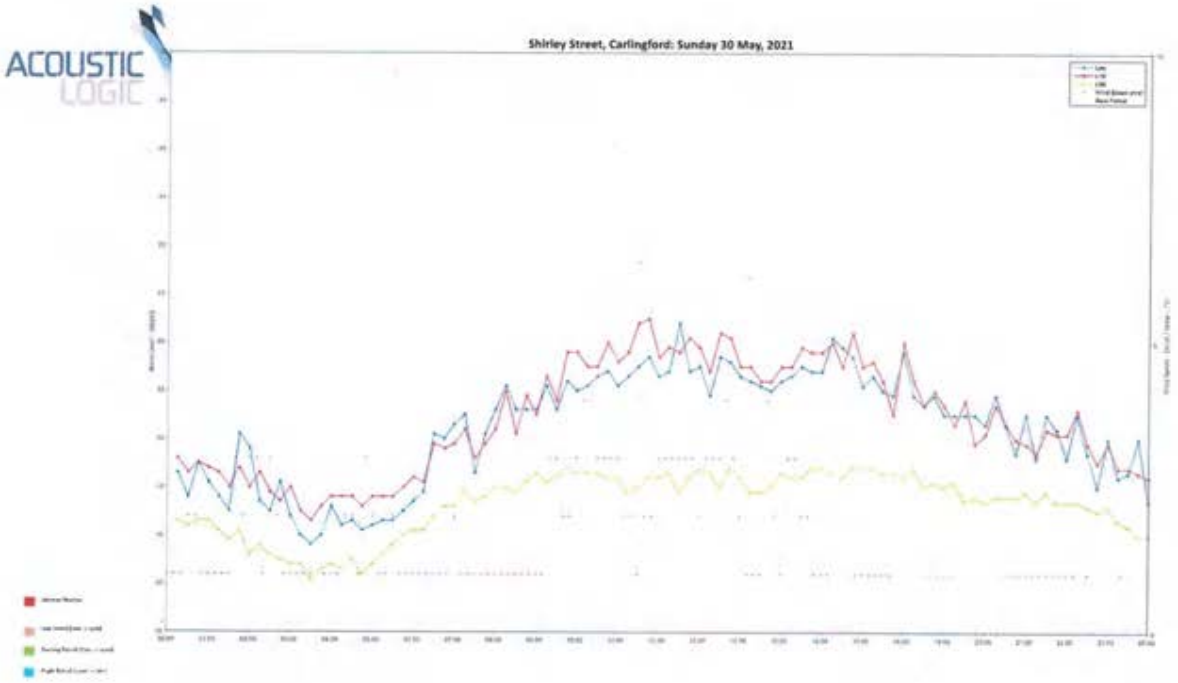
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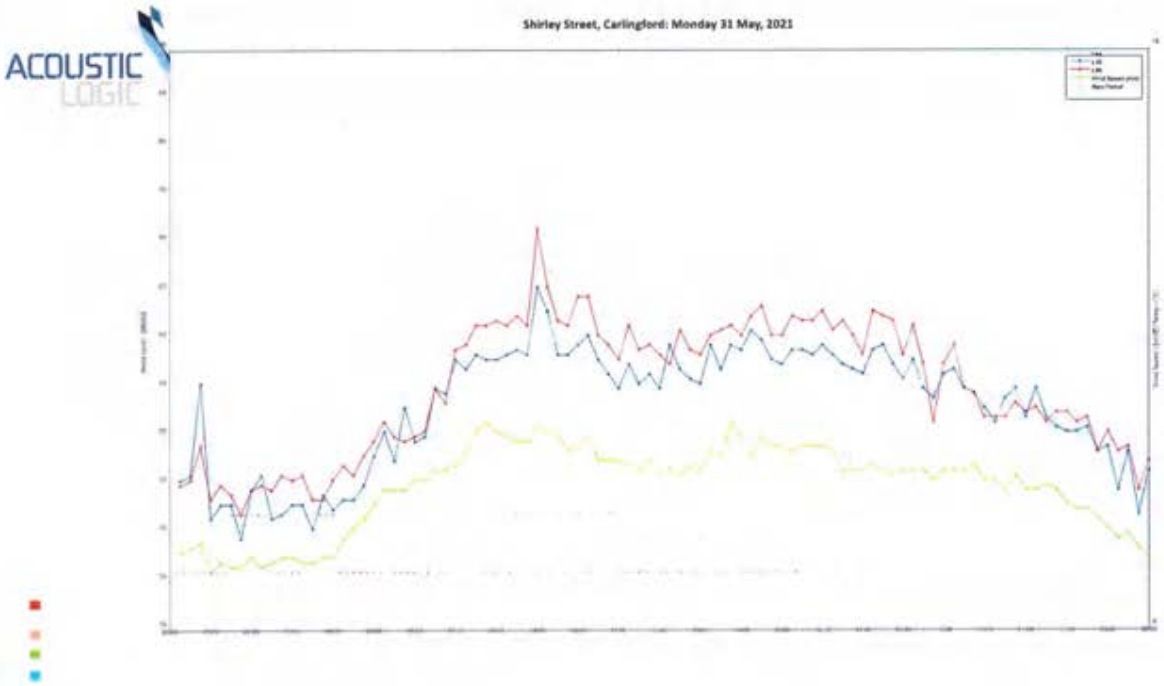
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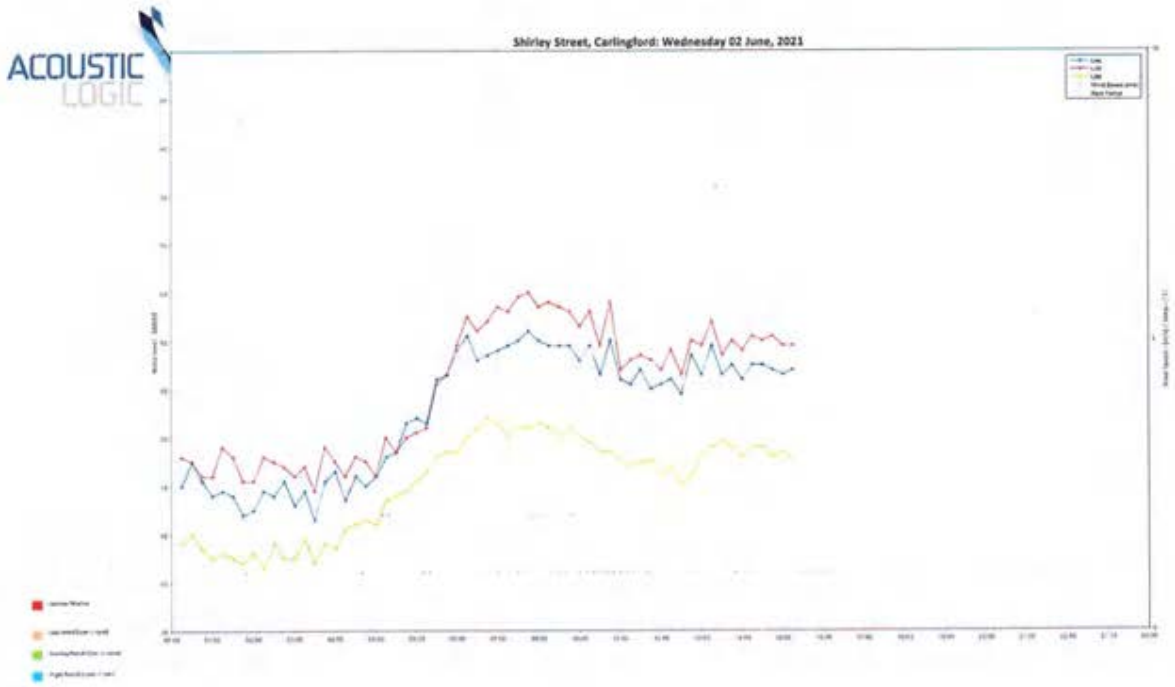
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