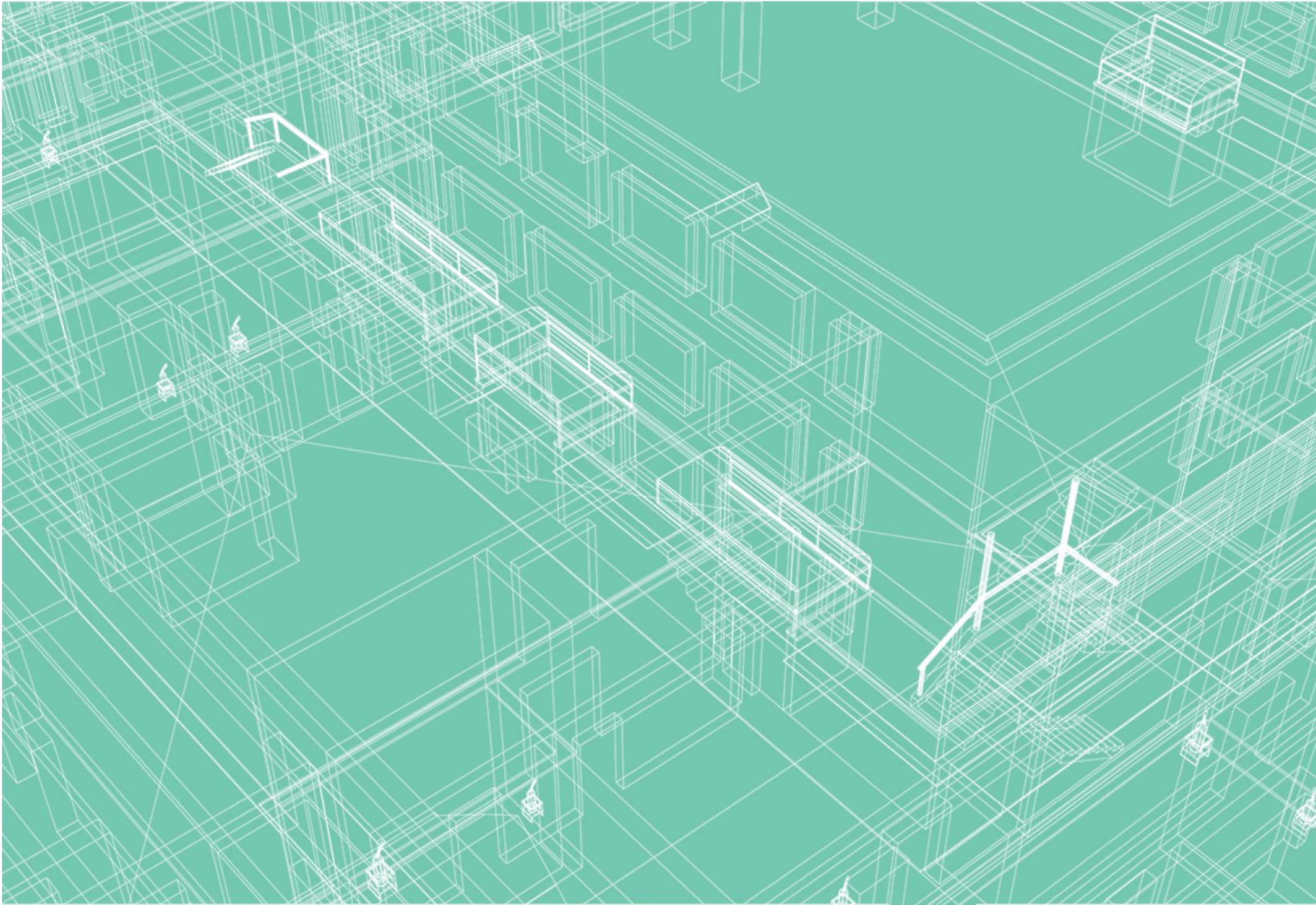

NOISE & VIBRATION IMPACT ASSESSMENT FOR REF

ROUSE HILL HIGH SCHOOL UPGRADE, ROUSE HILL

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Project Number	220210
Project Name	Rouse Hill High School, Rouse Hill
Description	Noise & Vibration Impact Assessment for REF
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	DATE					

CONTENTS

1 INTRODUCTION

1.1 GENERAL

This noise and vibration impact assessment has been prepared to accompany a Review of Environmental Factors (REF) for the Department of Education (DoE) Rouse Hill High School Upgrade (the activity) under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and *State Environmental Planning Policy (Transport and Infrastructure) 2021* (SEPP TI).

This document has been prepared in accordance with the *Guidelines for Division 5.1 assessments* (the Guidelines) by the Department of Planning, Housing and Infrastructure.

This report examines and takes into account the relevant environmental factors in the Guidelines and *Environmental Planning and Assessment Regulations 2021* under Section 170, Section 171 and Section 171A of the EP&A Regulation as outlined in Table 1.

Regulation / Guideline Section	*Requirement*	*Response*	*Report Section*
Clause 171 a). Environmental impact on community. Building Services Noise **EPI:** NSW EPA Noise Policy for Industry (NPI) 2016	To comply with the established criteria within this report and in line with the NSW NPI	The proposed mechanical plant layout includes an acoustic enclosure around the mechanical plant made up of a solid wall to the north and acoustic louvres to the south, east and west. The height of the enclosure shall be a minimum of 300mm above the tallest element of the mechanical plant. The northern solid wall shall be a minimum surface mass of 12kg/m^2. The acoustic louvres shall achieve a minimum insertion loss equivalent to ACRAN200 acoustic louvres. Acoustic assessment of all mechanical plant shall continue during the design phases of the project in order to confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.	Section 4.2
Clause 171 r). other relevant environmental factors Noise intrusion **EPI:** NSW Department of Education (DoE) Design Checklist-0001c	To comply with the NSW DoE Design Checklist - 0001c	Recommendations that the glazing achieves a sound insulation rating of R_W32 have been provided as a minimum sound insulation performance of the external glazing likely required to meet the internal noise levels for the spaces as per NSW DoE Design Checklist - 0001c.	Section 5

Clause 171 a). Environmental impact on community. Construction Noise **EPI:** Interim Construction Noise Guideline (ICNG) 2009	To comply with the NSW and Department of Environment and Climate Change (DECC) ICNG	Currently a head contractor has not been engaged and therefore, construction program, plant and staging are unknown. This report has provided general Construction Noise and Vibration Planning recommendations only, applicable criteria plus feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed activity. The preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known.	Section 6
Clause 171 a). Environmental impact on community. Construction Noise **EPI:** Interim Construction Noise Guideline (ICNG) 2009	To comply with the NSW and Department of Environment and Climate Change (DECC) ICNG	Construction activities should be planned and carried out with all feasible and reasonable acoustic mitigation measures implemented.	Section 6.4

Table 1: Summary of Relevant Section of the Part 5 Guidelines and EP&A Regulation.

1.2 PROPOSED ACTIVITY DESCRIPTION

The proposed activity for the Rouse Hill High School Upgrade including:

- Demolition of existing footpaths, stairs, and the relocation of existing seating shelters to the west of Block F;
- Tree removal;
- Construction of a two (2) storey classroom building (known as Building L), comprising ten (10) general learning spaces (GLS), one (1) enhanced Multi-Purpose Space for senior study and 2 Science Labs;
- Construction of new footpaths and a new covered bicycle parking space;
- New emergency vehicle accessway; and
- Landscaping, including the planting of trees.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation of the proposed change of use.
- Carry out a noise survey to determine existing ambient and background noise levels on site.
- Establish the appropriate noise level criteria in accordance with the relevant standards, guidelines and legislation for the following issues:
  - Noise emissions from external mechanical plant in the proposed development.
  - Noise emissions from traffic generated by the proposed development.

- Noise emissions from the operation of the proposed classrooms.
- Traffic and mechanical noise intrusion.
- Construction noise and vibration.

- Carry out an acoustic assessment to determine whether the relevant criteria can be achieved based on proposed operations. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure compliance with the relevant noise level criteria.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

The following documentation has been used for the preparation of this report:

- Architectural drawings prepared by DJRD Architects.
- Noise data collected on site through the use of a noise logger and a handheld spectrum analyser by JHA Consulting Engineers.
- Rapid Transport Assessment, issued by Stantec, dated 08 September 2022.

This document and related work have been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001:2015 and ISO 14001:2015 respectively.

1.3 ACTIVITY SITE

The project site is located on Withers Road in Rouse Hill and is legally described as Lot 105 in Deposited Plan (DP) 1108407. Rouse Hill High School is located on the western side of Withers Road. Figure 1 provides an aerial photograph of the site.

Figure 1: Aerial Photograph.

The site is located within an urban residential environment, being characterised by medium levels of activity during the day. The site is surrounded by residential and educational buildings to the South-East and South, respectively, with passive recreational areas to the North, East and West. It is assumed that premises will operate between 8am and 4:30pm weekdays.

Figure 2 shows the proposed site location (orange shadow), specific location of proposed works (yellow shadow with red-dashed line), residential receivers (green shadow), public recreational (red shadow), conservation (purple shadow) and educational receiver (blue shadow) around the site.

Figure 2: Aerial view showing the location of the site (orange shadow) with location of proposed works (yellow shadow with red-dashed line) and surrounding receivers.

It is noted that if noise impacts associated with the proposed development are controlled at the nearest noise sensitive receivers, then compliance with the recommended criteria at all noise sensitive receivers will be achieved.

A summary of the nearest sensitive receivers surrounding the site location is shown in Table 2, including the approximate distances between closest lot boundaries.

ID	Sensitive Receiver	Receiver Type	Distance (m)
01	20 – 34 Caballo Street	Residential	25
02	Iron Bark Ridge Reserve	Public Recreation	20
03	Kanebridge Oval	Public Recreation	25
04	Wither Road Reserve	Public Recreation	65
05	Iron Bark Public School	Educational	20
06	Rouse Hill High School	Educational	< 5

Table 2: Nearest sensitive receivers surrounding the site location plus distances.

2 SITE MEASUREMENTS

2.1 GENERAL

An unattended noise survey was conducted in the location shown in Figure 3 in order to establish the ambient and background noise levels of the site and surrounds. The noise survey has been carried out in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'*.

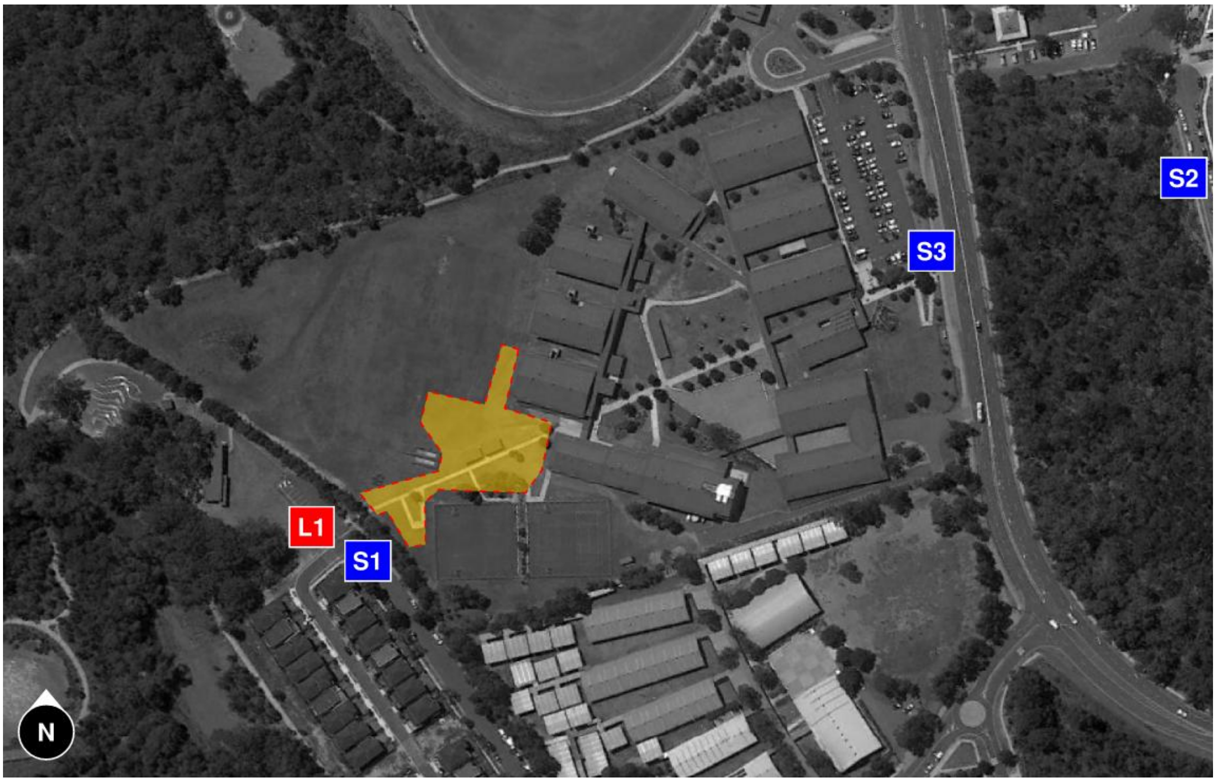


Figure 3: Noise survey monitoring location.

2.2 UNATTENDED NOISE MONITORING

Long-term noise monitoring was carried out from Friday 24th of June to Friday 15th of July 2022 using a Rion NL-52 noise logger (Serial Number 01254316). The noise logger recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded.

The noise logger was located in position L1 as per Figure 3. The location was secure and considered to be representative of the typical ambient and background noise levels. The noise logger microphone was mounted 1.5 meters above the ground and a windshield was used to protect the microphone.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW NPI, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shaded in the Appendix A graphs).

The Rating Background Levels (RBLs) have been established in general accordance with the methodology described in the NSW NPI, i.e. 10th percentile background noise level (L_{A90}) for each period of each day of the ambient noise survey. The median of these levels is then presented as the RBL for each assessment period.

These RBLs are shown in Table 3, together with the ambient noise levels (L_{Aeq}) measured for each period.

Location	L_{Aeq} Ambient Noise Levels, dB(A)			Rating Background Levels, dB(A)		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
L1	51	47	44	41	42	34

Table 3: Results of unattended noise monitoring.

2.3 ATTENDED NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site. On Friday 24th June and Friday 15th of July 2022, short-term noise measurements were carried out during day-time on in the locations (S1, S2 and S3) shown in Figure 3. Short-term noise measurements were carried out with an NTI XL-2 hand-held Sound Level Meter (SLM) (Serial Number A2A-13742-E0). The calibration of the SLM was checked before and after each use and no deviations were recorded.

The SLM microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free-field – i.e. more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the attended noise monitoring.

A summary of the results of the short-term noise monitoring are shown in Table 4.

Location	Date and Time	Parameter	Sound Pressure Level, dB (re 20μPa)								
			Overall dB(A)	Octave Band Centre Frequency, Hz							
				63	125	250	500	1k	2k	4k	8k
S1	15/07/2022 11.45am – 12.01am	$L_{10,15min}$	50	62	55	44	42	46	42	37	38
		$L_{eq,15min}$	52	59	53	47	46	49	44	38	39
		$L_{90,15min}$	44	53	47	36	36	39	36	35	38
S2	15/07/2022 10.54am – 11.09am	$L_{10,15min}$	49	60	56	48	43	43	39	37	38
		$L_{eq,15min}$	47	58	53	46	41	42	38	37	39
		$L_{90,15min}$	45	52	47	40	38	40	36	35	38
S3	24/06/2022 01.29pm – 01.44pm	$L_{10,15min}$	75	74	70	68	68	71	68	59	50
		$L_{eq,15min}$	72	74	75	70	66	69	65	57	50
		$L_{90,15min}$	58	57	53	50	51	55	51	41	28

Table 4: Results of attended noise monitoring.

3 RELEVANT STANDARDS AND GUIDELINES

3.1 STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Regulatory Framework:
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
- Planning Framework:
  - The Hills Local Environment Plan (B-LEP 2019).
  - The Hills Development Control Plan (TH-DCP 2012).
- Operational Noise
  - NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017.
  - NSW Department of Environment Climate Change and Water (DECCW) Noise Guide for Local Government (NGLG) 2013.
  - State Environmental Planning Policy, Educational Establishments and Child Care Facilities 2017.
  - NSW Department of Education (DoE) Design Checklist – 0001c, version 2.0, 2022
- Transport Noise
  - NSW DECCW, Road Noise Policy (RNP) 2011.
- Construction Noise and vibration
  - NSW DECCW, Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DECC, Assessing Vibration: A Technical Guideline 2006.
  - NSW Road Maritime Service (RMS), Construction Noise and Vibration Guideline 2016.
  - Australian Standard AS 2436:2010 '*Acoustics – Guide to Noise Control on Construction, Maintenance & Demolition Sites*'.

3.2 REGULATORY FRAMEWORK

3.2.1 ENVIRONMENTAL PLANNING AND ASSESSMENT (EP&A) ACT 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulation framework for the protection of the environment in New South Wales. The Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the use of acceptable noise criteria which either may be defined in a Development Control Plan, or derived from principles using guidelines like NSW EPA NPI or Noise Guideline for Local Government (NGLG 2023).

3.2.2 PROTECTION OF THE ENVIRONMENTAL OPERATION (POEO) ACT 1997

The Protection of the Environment Operations (POEO) Act 1997 has the objective to protect, restore and enhance the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of "offensive noise" as follows:

"(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations."

3.3 PLANNING FRAMEWORK

Relevant Planning Documents of The Hills Shire Legislation have been reviewed for any noise requirement or criteria.

The Hills Local Environmental Plan (TH-LEP 2019) sets the Land Zoning as shown in Figure 4 The site is categorised as Medium Density Residential (R3) next to Public Recreational (RE1) and Conservation (C2).

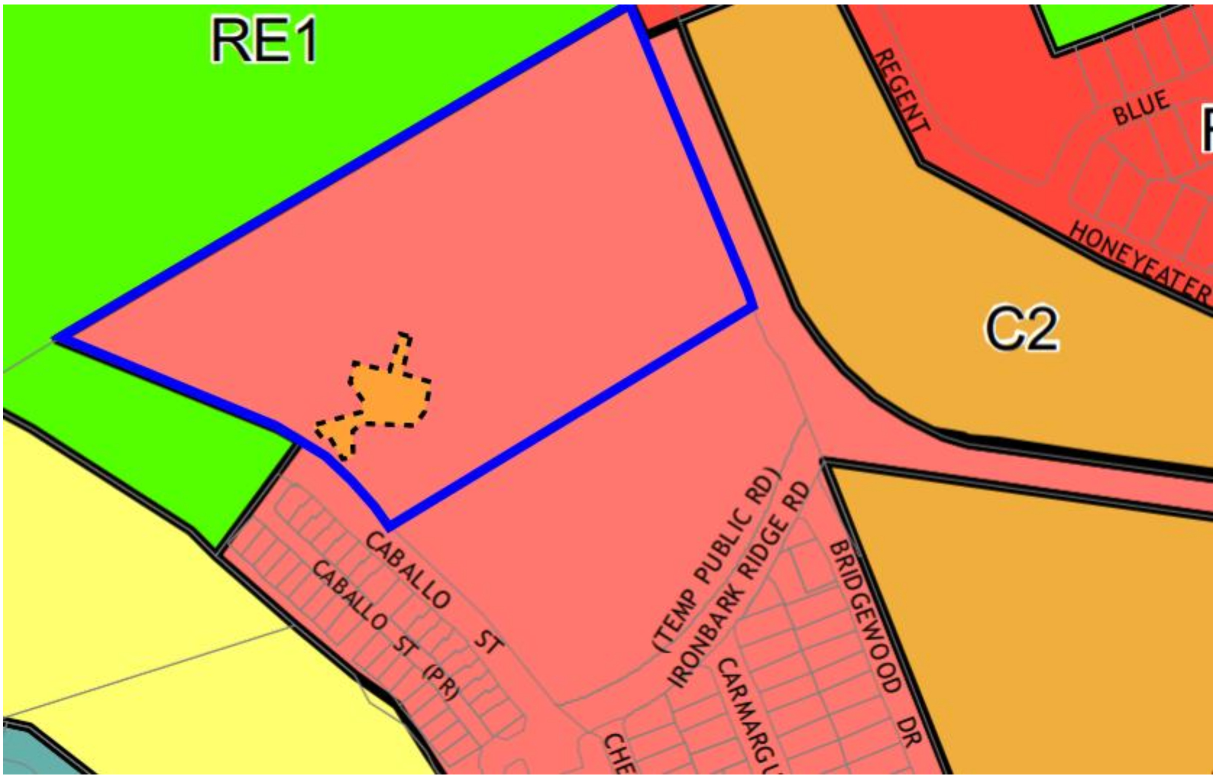


Figure 4: Landzoning of the site (blue outline) and approximate area of proposed works (dashed black outline) and surrounds.

The Hills Development Control Plan (TH-DCP 2012) has been reviewed for any relevant noise requirements or criteria for the proposed development. There are no specific noise level criteria, but rather sections of the TH-DCP 2012 provide general planning strategies.

3.4 OPERATIONAL NOISE

3.4.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources – scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent sets the Project Noise Trigger Level (PNTL's).

3.4.1.1 Intrusiveness Criteria

The NSW NPI defines the intrusiveness criterion as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."

Based on the intrusiveness criterion definition and the estimated background noise levels on site, Table 5 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Measured Rating Background Level, dB(A)*	*Intrusiveness Criteria, dB(A)*
Residential (R3)	Day	41	46
	Evening	42	46*
	Night	34	39

Table 5: Determination of the intrusiveness criteria for residential noise sensitive receivers. *Note: the project intrusiveness noise levels for evening shall be set no greater than the project intruseveness noise level for daytime

3.4.1.2 Amenity Criteria

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Based on the amenity criteria definition and the land zoning, Table 6 shows the amenity criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level ($L_{Aeq, period}$), dB(A)*	*Amenity Criterion ($L_{Aeq,15min}$), dB(A)*
Residential (R3)	Day	55	53 (55-5+3)
	Evening	45	43 (45-5+3)
	Night	40	38 (40-5+3)
School / Education (external)	Nosiest 1-hour	45	43 (45-5+3)
Passive Recreation (RE2)	When in use	50	48 (48-5+3)

Table 6: Determination of the amenity criterion for noise sensitive receivers. Note: External noise levels assume an increase of 10dB from internal noise levels with windows open for ventilation.

3.4.1.3 Project Noise Trigger Levels

The PNTL's are shown in Table 7 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point on or within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion*	*Amenity Criterion*
Residential (R3)	Day	46	53
	Evening	46	43
	Night	39	38
School / Education (external)	Nosiest 1-hour	---	43
Public Recreation (RE2)	When in use	---	48

Table 7: Determination of PNTL's (light grey highlight) for noise sensitive receivers.

3.4.2 STATE ENVIRONMENTAL PLANNING POLICY – TRANSPORT & INFRASTRUCTURE

The NSW State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021 provides the noise criteria for the use of the school. The policy states:

"A new building or (if the development is an alteration or addition to an existing building for the purpose of changing its use) an existing building that is to be used for the purpose of a school or school-based child care must be designed so as not to emit noise exceeding an L_{Aeq} of 5dB(A) above background noise when measured at any lot boundary."

Based on the long-term unattended noise results of background noise levels, the following table shows the noise level criteria for operational noise.

Receiver	Time Period	Measured RBL dB(A)	Noise Level Criteria $L_{Aeq,15min}$ dB(A)
General Residential	Day	41	46
	Evening	42	47
	Night	34	39

Table 8: SEPP Operational Noise Criteria.

3.4.3 SUMMARY OF OPERATIONAL NOISE LEVEL CRITERIA

Based on the criteria from the relevant noise standards and guidelines detailed in this section, Table 9 summarizes the noise level criteria for operational noise. For noise assessment purposes, the corresponding criteria is based on background noise level measured, the lowest value has been used.

Noise Emission	Receiver	Time Period	Noise Level Criteria $L_{Aeq,15min}$ dB(A)
External Mechanical Plant	General Residential (R3)	Day Time (7am – 6pm)	46
		Evening Time (6pm – 10pm)	43
		Nighttime (10pm – 7am)	38
	School / Educational (external)	Noisiest 1-hour	43
	Passive Recreation	When in use	48
Operational Noise	General Residential	Day Time (7am – 6pm)	46
		Evening (6pm – 10pm)	47
		Night (10pm – 7am)	39

Table 9: Summary of the noise level criteria at the nearest noise sensitive receivers.

3.5 TRANSPORT NOISE

The NSW DECC Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing road.
- New road projects.
- Road development projects.
- New traffic generated by developments.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2dB above the existing noise levels. An increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person.

In cases where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria.

3.6 CONSTRUCTION NOISE AND VIBRATION

3.6.1 NOISE CRITERIA

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the Management Level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. Table 10 below summarises the airborne construction noise criteria for receivers surrounding the site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Residential Receivers	Noise affected / External	RBL+10	RBL+5
	Highly noise affected / External	75	N/A
Active Recreation	External	65	N/A
Existing Classrooms	Internal	45	N/A

Table 10: ICNG construction airborne noise criteria for noise sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) - internal
- Night: $L_{Aeq,15min}$ 35dB(A) - internal

The internal noise levels are assessed at the centre of the most affected habitable room.

3.6.2 VIBRATION CRITERIA

3.6.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed the document '*Assessing Vibration: A Technical Guideline*' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 '*Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting*'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Vibration criteria for continuous and impulsive vibration are presented in Table 11 below, in terms of vibration velocity levels.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-6}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]

Table 11: Continuous and impulsive vibration criteria applicable to the site.

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 12 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*Vibration Dose Values, m/s$^{1.75}$*	
		Preferred	*Maximum*
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80

Table 12: Intermittent vibration criteria applicable to the site.

3.6.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:2016 *'Vibration in Buildings – Effects on Structures'* are to be adopted. Guideline values from DIN 4150.3:2016 are presented in Table 13.

Structural type	*Vibration velocity, mm/s (Peak Particle Velocity - PPV)*				
	Foundation			*Plane of floor uppermost full storey in horizontal direction*	*Floor slabs, vertical direction*
	1Hz to 10Hz	*10Hz to 50Hz*	*50Hz to 100Hz*	*All frequencies*	*All frequencies*
Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
Type 2: Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
Type 3: Structures that because their particular sensitivity to vibration, cannot be classified under Type 1 and 2 and are of great intrinsic value (e.g. heritage buildings)	3	3 to 8	8 to 10	8	20

Table 13: DIN 4150.3:2016 Guideline values of vibration velocity (PPV) for evaluating the effects of short-term vibration.

4 OPERATIONAL NOISE EMISSIONS ASSESSMENT

4.1 OVERVIEW

Noise emissions from the proposed change of use have the potential to impact on existing noise sensitive receivers. For the purpose of these noise impact assessments, the noise sources are assumed as follows:

- Noise emissions from external mechanical plant.
- Noise emissions from generated traffic.
- Noise emissions from operation of classrooms.

4.2 EXTERNAL MECHANICAL PLANT

Noise from the proposed development mechanical plant should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers.

The mechanical plant will operate continuously during all day periods. At this stage, a preliminary selection of the external mechanical plant has been provided and a noise assessment at the nearest noise sensitive receivers has been carried out based on the noise data from the manufacturers. The selected units and their Sound Power Levels (SWL) noise levels are listed below:

- 8 x Condenser Units Daikin (REYQ20BYM) – SPL 65dB(A) @ 1m, as per the product data sheet.

The following assumptions have been made in the noise assessment:

- The location of the external plant is as per Figure 5.
- The nearest noise sensitive receivers are:
  - Existing buildings on the Rouse Hill High School site,
  - 34 Caballo Street (to the south west),
  - Ironbark Ridge Primary School (to the south east).
- There is an enclosure around the external mechanical plant. The enclosure consists of a solid wall to the north and acoustic louvres to the south, east and west.
- The solid wall to be at least 12kg/m^2 and 300mm above the tallest element of the plant.
- The acoustic louvres shall have the insertion loss equivalent to that of ACRAN 200 acoustic louvres and at least 300mm above the tallest element of the plant.

The noise assessment of the mechanical plant is summarised in Table 14.

Figure 5: Proposed location of external mechanical plant (red shadow).

Calculation	*Overall A-weighted noise level in dB(A).*		
	Rouse Hill High School (nearest existing building Block B - Hall)	*34 Caballo Street*	*Ironbark Ridge Primary School*
Sound Pressure Level of L_{Aeq} CUs @1m	74	74	74
Distance Attenuation, dB	-28	-37	-35
Acoustic Louvre Insertion Loss, dB	-9	-9	-9
$L_{Aeq,15min}$ resulting at residential receiver	37	28	30
Daytime criteria NPI / Complies?	45 / Yes	46 / Yes	43 / Yes

Table 14: Noise assessment of external mechanical plant to the nearest noise sensitive receiver.

Based on this assessment and the NSW NPI noise level criteria in Table 14, the mechanical plant will meet the noise level criteria at the nearest noise sensitive receivers.

If there are any changes to the mechanical layout or selection during the design stages, usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of plant to ensure the cumulative noise level at the receiver boundaries is met.

- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - In-duct attenuation.
  - Noise enclosures as required.
  - Sound absorptive panels.
  - Acoustic louvres as required.
  - Noise barriers as required.

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures. If new or replacing external mechanical plant is proposed, then an acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures.

4.3 GENERATED TRAFFIC

The Rapid Transport Assessment[1] for Rouse Hill High School does not provide specific existing and proposed traffic volume information (trips) for comparison. However, it does provide the current percentage (77%) of private vehicles used for students arriving at the school as well as an overall proposed increase from 1,000 to 1,200 students. Based on this, a 0.8dB increase in relation to existing noise levels is expected from the increased population of the school.

As noted in Section 4.6.2, when considering land use development and the impact on sensitive land uses the NSW Road Noise Policy (RNP) states that an increase up to 2dB in relation to existing noise levels is anticipated to be insignificant.

Therefore, it can be stated that there will be no significant increase in road traffic as a result of the development due to the additional students and traffic noise associated with the development is expected to meet the NSW RNP recommendations.

4.4 CLASSROOM ASSESSMENT

There will not be significant noise emissions from the use of the classrooms as, generally, noise levels within teaching spaces in a high school are expected to be low, plus the typical façade sound insulation performance minimise the noise impacts to the nearest noise sensitive receivers.

Based on the distance of the new building to the nearest noise sensitive receivers, noise breakout from general classroom activities is not expected to exceed operational noise level criteria.

In order to achieve a sufficient façade sound insulation performance, surface of ventilation openings shall be minimised, and the surface and sound insulation performance of glazing shall not reduce the overall sound insulation performance of the building façade.

[1] Rouse Hill High School, Rapid Transport Assessment, issued by Stantec, dated 08 September 2022.

5 NOISE INTRUSION ASSESSMENT

Traffic noise from Withers Road as well as the external mechanical plant deck has the potential to impact upon the facades of the proposed activity. In order to meet the NSW DoE Design Checklist – 0001c internal noise levels criteria for high school teaching spaces being 40dB(A), JHA has carried out a review of traffic and mechanical noise impacts and recommends the minimum glazing thickness for the proposed building.

The following assumptions have been considered for the traffic noise impacts:

- Traffic noise levels for the assessment are as per measured levels on site by JHA Consulting Engineers. Refer to Section 2.3.
- External mechanical plant noise levels are as per Section 4.2.
- Internal noise levels are predicted based on noise levels incident at the façade of each space, which are based on the above measurements and noise levels.
- External glazing is the weakest elements of the façade, and solid sections of the façade are typically to provide a sound reduction index of R_W50.
- Calculations have been based on achieving the internal noise level criteria as per NSW DoE Design Checklist – 0001c.

To achieve the internal noise levels in accordance with Educational Facilitates Standards and Guidelines (EFSG), and based on the above assumptions, the following is required:

- External glazing is recommended to provide a minimum sound reduction index of R_W32. A 6.38mm laminated fixed single glazing system achieves the nominated sound reduction index.

Notwithstanding with the glazing recommendations provided above, the acoustic performance of the glazing and building façade shall be reviewed during the detailed design of the project once glazing and façade areas will be defined. The acoustic requirements are to be achieved based on the performance of the framing and glass together.

6 CONSTRUCTION NOISE AND VIBRATION PLANNING

Currently a detailed construction program is not yet full defined. This section of the Construction Noise and Vibration Planning provides general preliminary recommendations only and provides applicable criteria together with feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed activity.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known.

Any noise from demolition and construction activities to be carried out on site must not result in *'offensive noise'* to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

6.1 RELEVANT STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 3.6 of this report contains the relevant legislation, codes, and standards in addition to construction noise and vibration criteria for this project.

6.2 WORKING HOURS

The following construction hours are proposed as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sundays and Public Holidays: No excavation or construction works.

It is noted that the proposed construction hours are within the recommended EPA hours. Noise control measures are to be implemented during these hours following consultation and engagement with the community.

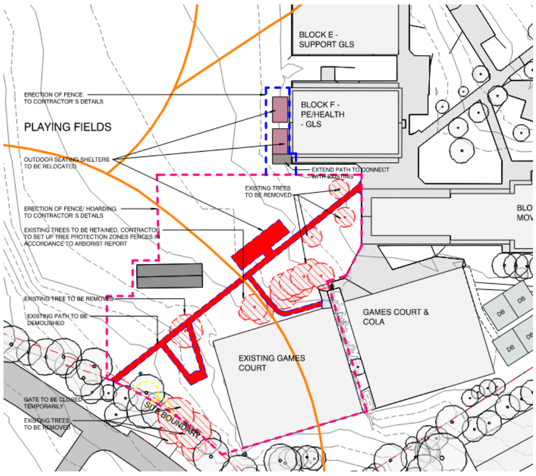
It is recommended that high noise level works – i.e. piling, excavation, etc – shall be scheduled to not occur during shoulder periods of the recommended standard hours – i.e 7am to 8am and 5pm to 6pm. A detailed Construction Noise & Vibration Management Plan (CNVMP) shall further assess the noise impact of construction works and shall include a protocol to minimise any potential noise impacts to identified sensitive receivers and ensure that appropriate noise control measures are defined and implemented to comply with all relevant noise guidelines.

6.3 PRELIMINARY CONSTRUCTION NOISE ASSESSMENT

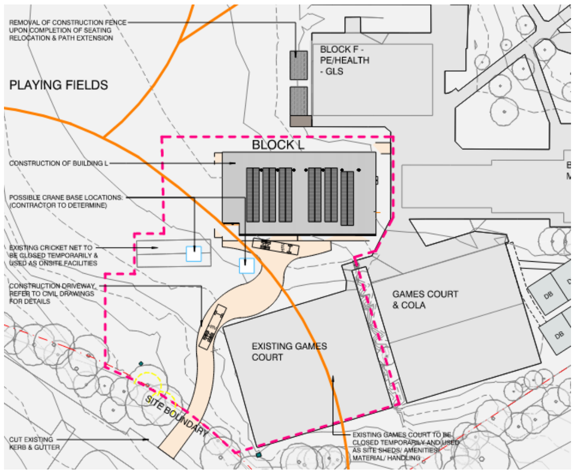
A preliminary construction noise assessment has been carried out based on typical plant and machinery expected throughout the construction stages. The preliminary noise assessment has been considered at the nearest existing residential receivers plus existing school buildings.

6.3.1 CONSTRUCTION STAGING

Construction will be carried in three stages. Figure 6 shows the three main stages of the construction.

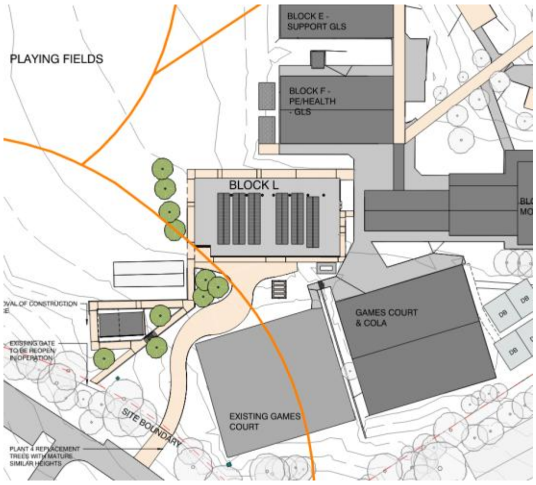


Stage 1



Stage 2

Stage 3



Stage 4

Figure 6: Construction staging plan.

Based on the construction site compound as shown in Figure 6 it has been assumed that as a worst case, works will commence approximately 15m from the nearest residential (southern – Caballo Street) receiver boundaries, 5m from the occupied school areas, and 45 metres from the eastern educational receiver of Iron Bark Ridge Public School.

6.3.2 NOISE

A high-level noise assessment has been carried out to predict the worst-case noise level at the nearest noise sensitive receivers. The existing school has also been considered as a sensitive receiver for this high-level assessment as during construction there will be students attending the existing school. We note that the predicted noise levels consider the worst-case scenario, i.e., construction activities being carried out at the boundary of the construction areas as per Figure 6.

A Detailed CNVMP addressing impacts should be conducted during the construction stages when specific information around construction methodology is known, to provide acoustic mitigation measures and management measures based on specific construction works, equipment and locations.

The expected construction noise sources and the predicted noise levels at the nearest residential receivers plus existing school receivers are shown below in Table 15. The equipment noise levels are based on the database published by the UK Department for Environmental, Food and Rural Affairs (DEFRA) & Australian Standard AS2436:2010 *'Guide to Noise Control on Construction, Maintenance & Demolition Sites'* for a 15-minute period.

Item	*Typical Power Noise Level L_{A10} (dB ref 1pW)*	*Typical Noise Level $L_{A10,15m}$ at 7m (dB ref 20μPa)*	*Predicted Noise Level $L_{Aeq,15m}$*			*Complies with Highly Noise Affected Criteria*
			Nearest Residential receiver	*Existing school receiver*	*Nearest Educational receiver*	
Angle grinders	104	76	67 – 72	77 – 82	58 – 63	Yes
Truck (>20 tonne)	108	80	71 – 76	81 – 86	62 – 67	No
Circular saw	115	87	78 – 83	88 – 93	69 – 74	No
Piling rig	120	92	83 – 88	93 – 98	74 – 79	No
10-40tn Excavator	117	89	80 – 85	90 – 95	71 – 76	No
40-50tn Mobile crane	111	83	74 – 79	84 – 89	65 – 70	No
Concrete pump	114	86	77 – 82	87 – 92	68 – 73	No
Concrete truck	110	82	73 – 78	83 – 88	64 – 69	No
Drill	94	66	57 – 62	67 – 72	48 – 53	Yes

Table 15: Anticipated airborne noise levels for construction equipment / plant used during construction works.

Based on the results of the preliminary assessment as shown above, the noise associated with the construction works is expected to exceed the noise limits for highly noise affected receivers within standard hours. This assessment is based on typical noise levels associated with construction sites and machinery.

Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures such as acoustic screening around the site. These noise mitigation measures are to be provided in a detailed Construction Noise & Vibration Management Plan and prepared by a qualified acoustic consultant prior to Construction Certificate.

6.3.3 VIBRATION

The NSW RMS '*Construction Noise and Vibration Guideline*' provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DECC's '*Assessing Vibration: A Technical Guideline*'). The recommended safe working distances for typical construction plant are provided in Table 16.

Plant Item	*Description*	*Cosmetic Damage*	*Human Response*
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Handheld	1m	Avoid Contact with Structure

Table 16: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

For any vibration intensive plant expected to be within proximity of the minimum distances described above, the contractor must engage a qualified engineer to carry out a vibration survey in order to assess any potential risks.

The vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimized as far as practicable.

6.4 MITIGATION MEASURES

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a CNVMP and undertake noise and vibration monitoring for the duration of the project.

6.4.1 PROJECT SPECIFIC ACOUSTIC MEASURES

Acoustic amelioration measures will be required due to the expected exceedances of the noise level criteria. Temporary shielding such as solid hoarding/acoustic curtains may reduce the expected noise impacts and is proposed as a noise control measure during construction. The location and extent of the shielding are to be defined in the detailed Construction Noise and Vibration Management Plan (CNVMP).

6.4.2 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort. Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.
  - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
  - Selecting plant and equipment with low vibration generation characteristics.
  - Operate plant in a quietest and most effective manner.
  - Where appropriate, limit the operating noise of equipment.
  - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- *On site noise management.* Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
  - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods, to reduce impact on examinations.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.

- Have a documented complaints process and keep register of any complaints.
- Give complaints a fair hearing and provide for a quick response.
- Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.4.3 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds ether the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.4.4 CONSTRUCTION TRAFFIC NOISE

Noise emissions due to construction vehicle traffic (particularly heavy vehicles) will need to be assessed and management to ensure the amenity of the surrounding receivers are not overtly affected.

Management of heavy vehicle to and from the site should be scheduled to occur outside the busiest traffic periods but also to avoid noise-sensitive times – i.e., exam periods within the school. Truck engine or heavy braking or accelerating should be avoided, as well as and excessive idling, particularly in residential streets.

Construction vehicle routes, parking and sub-contractor / driver behaviour should be observed and monitored to ensure considerate behaviour is maintained.

A Construction Traffic Management Plan will need to address the minimisation of construction traffic noise.

7 SUMMARY AND CONCLUSIONS

A noise impact assessment has been carried out for the proposed Rouse Hill High School Upgrade. This report has been prepared as part of the Review of Environmental Factors (REF) for The Hills Shire Council.

This report presents the results of the noise survey carried out on site, establishes relevant noise level criteria and details the acoustic assessment. An ambient and background noise survey has been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

7.1 SUMMARY

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact.

<u>External Mechanical Plant:</u> At this stage, a preliminary mechanical plant selection has been made. Based on the mechanical assessment and the NSW NPI noise level criteria in Table 14, the mechanical plant will meet the noise level criteria at the nearest noise sensitive receivers. If new or replacing external mechanical plant is proposed, then an acoustic assessment of all mechanical plant shall be carried out in order to confirm any noise control measures if required to achieve NSW EPA NPI noise level criteria.

<u>Generated Traffic:</u> The traffic report states there is a predicted increase of 200 students at Rouse Hill High School. No significant increase in road traffic as a result of the development due to the additional students and traffic noise associated with the development is expected to meet the NSW RNP recommendations.

<u>Classroom Operational Noise:</u> The noise impact from the use of the classrooms is predicted to meet the established noise level criteria at the nearest noise sensitive receivers.

<u>Noise intrusion:</u> Traffic noise from Withers Road has the potential to impact upon the facades of the proposed activity. Likewise, mechanical noise from the external mechanical plant. A minimum sound insulation performance has been obtained to meet the internal noise level criteria as per DoE Design Checklist – 0001c. Acoustic design of the façade, other external building elements and ventilation openings of the school will need to be considered throughout the design stages in order to meet the noise level criteria

<u>Construction Noise and Vibration Planning:</u> A preliminary construction noise assessment has been carried out. Based on the results of the preliminary assessment, noise associated with worst-case scenario construction works is expected to exceed the noise limits in accordance with the ICNG Guideline. Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures. These noise mitigation measures are to be provided in a detailed Construction Noise & Vibration Management Plan prepared by a qualified acoustic consultant prior to Construction Certificate. The detailed CNVMP is to include noise impacts and mitigation measures for the surrounding noise sensitive receivers plus the existing school.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical plant, modifications to the building and introduction of any additional noise sources.

Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, based on the information presented in this report, it can be stated that relevant objectives will be satisfied and therefore approval is recommended to be granted.

7.2 MITIGATION MEASURES

Regulation / Guideline Section	Requirement	Response	Report Section
Clause 171 a). Environmental impact on community. Building Services Noise **EPI:** NSW EPA Noise Policy for Industry (NPI) 2016	To comply with the established criteria within this report and in line with the NSW NPI	The proposed mechanical plant layout includes an acoustic enclosure around the mechanical plant made up of a solid wall to the north and acoustic louvres to the south, east and west. The height of the enclosure shall be a minimum of 300mm above the tallest element of the mechanical plant. The northern solid wall shall be a minimum surface mass of 12kg/m^2. The acoustic louvres shall achieve a minimum insertion loss equivalent to ACRAN200 acoustic louvres. Acoustic assessment of all mechanical plant shall continue during the design phases of the project in order to confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.	Section 4.2
Clause 171 r). other relevant environmental factors Noise intrusion **EPI:** NSW Department of Education (DoE) Design Checklist-0001c	To comply with the NSW DoE Design Checklist - 0001c	Recommendations that the glazing achieves a sound insulation rating of R_W32 have been provided as a minimum sound insulation performance of the external glazing likely required to meet the internal noise levels for the spaces as per NSW DoE Design Checklist - 0001c.	Section 5
Clause 171 a). Environmental impact on community. Construction Noise **EPI:** Interim Construction Noise Guideline (ICNG) 2009	To comply with the NSW and Department of Environment and Climate Change (DECC) ICNG	Currently a detailed construction program is not yet fully defined. This report has provided general Construction Noise and Vibration Planning recommendations only, applicable criteria plus feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed activity. The preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known.	Section 6

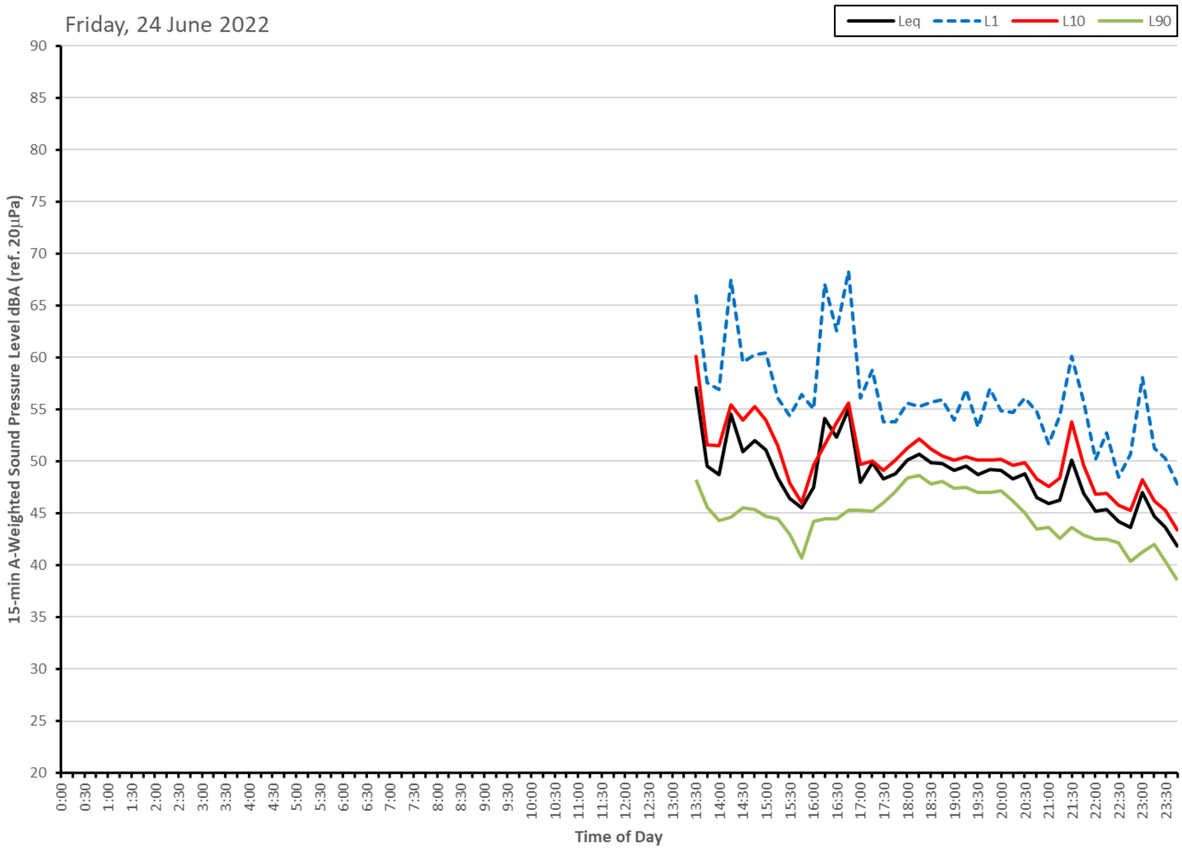
Clause 171 a). Environmental impact on community. Construction Noise EPI: Interim Construction Noise Guideline (ICNG) 2009	To comply with the NSW and Department of Environment and Climate Change (DECC) ICNG	Construction activities should be planned and carried out with all feasible and reasonable acoustic mitigation measures implemented.	Section 6.4

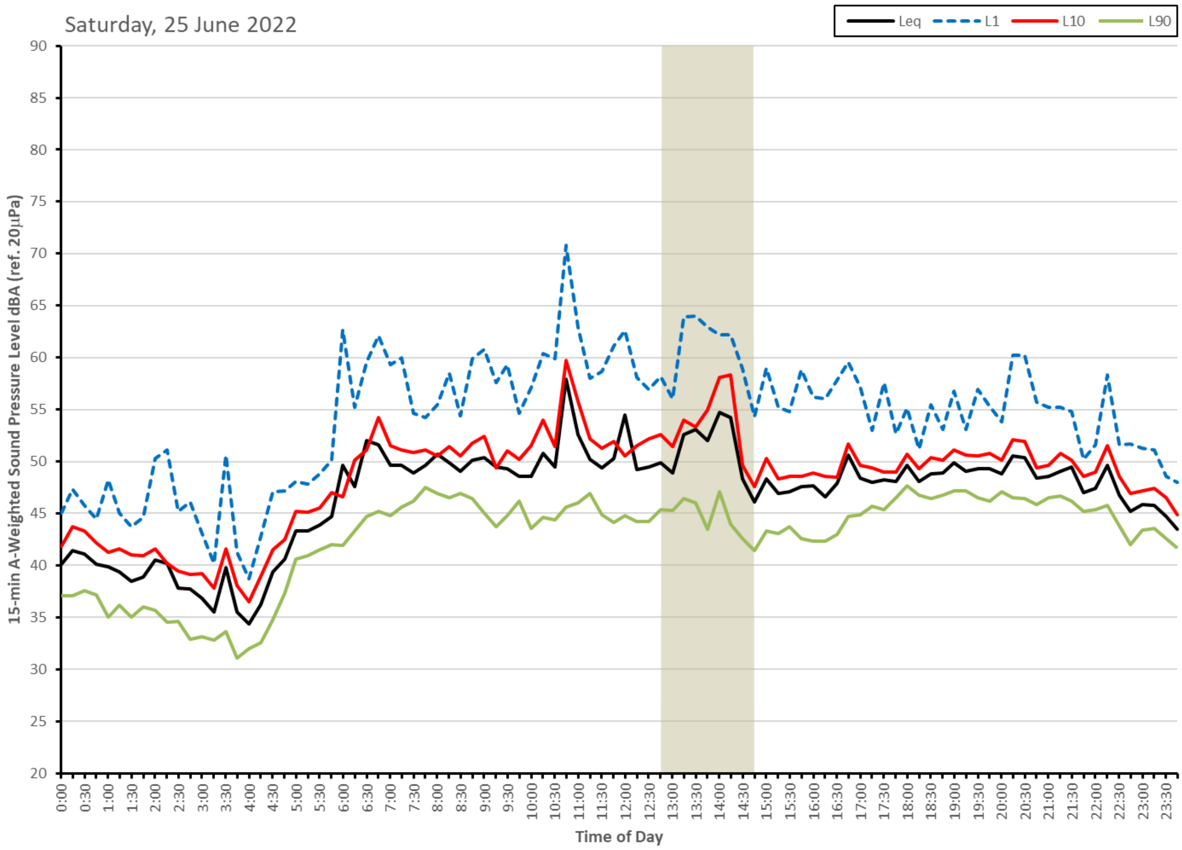
Table 17: Summary of Relevant Section of the Part 5 Guidelines and EP&A Regulation.

7.3 EVALUATION OF ENVIRONMENTAL IMPACTS

An assessment of the environmental impacts of the upgrades to Rouse Hill High School has been conducted. Based on the information presented in this report, the extent and nature of potential impacts are low and will not have a significant impact on the locality, community and/or the environment. Potential impact can be appropriately mitigated or managed to ensure that there is minimal impact on the locality, community and/or the environment.

APPENDIX A: LONG TERM NOISE MONITORING





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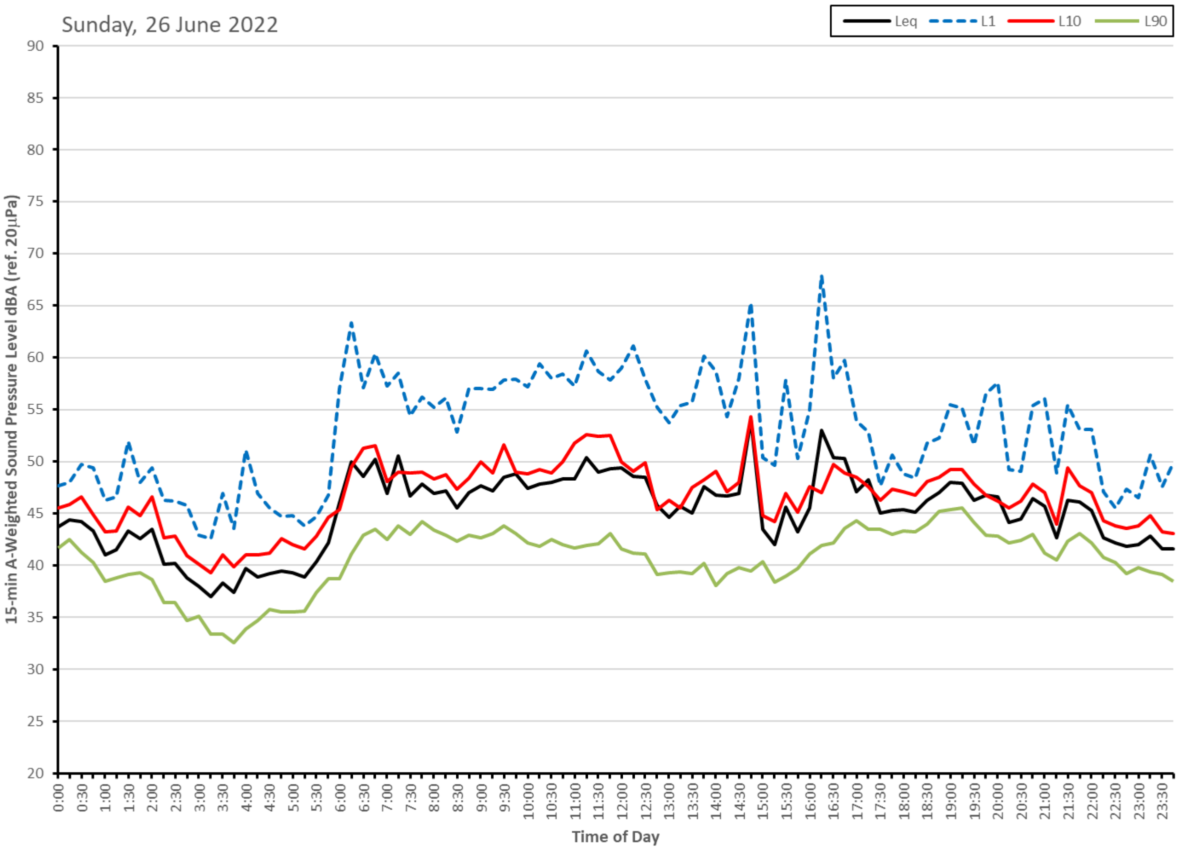

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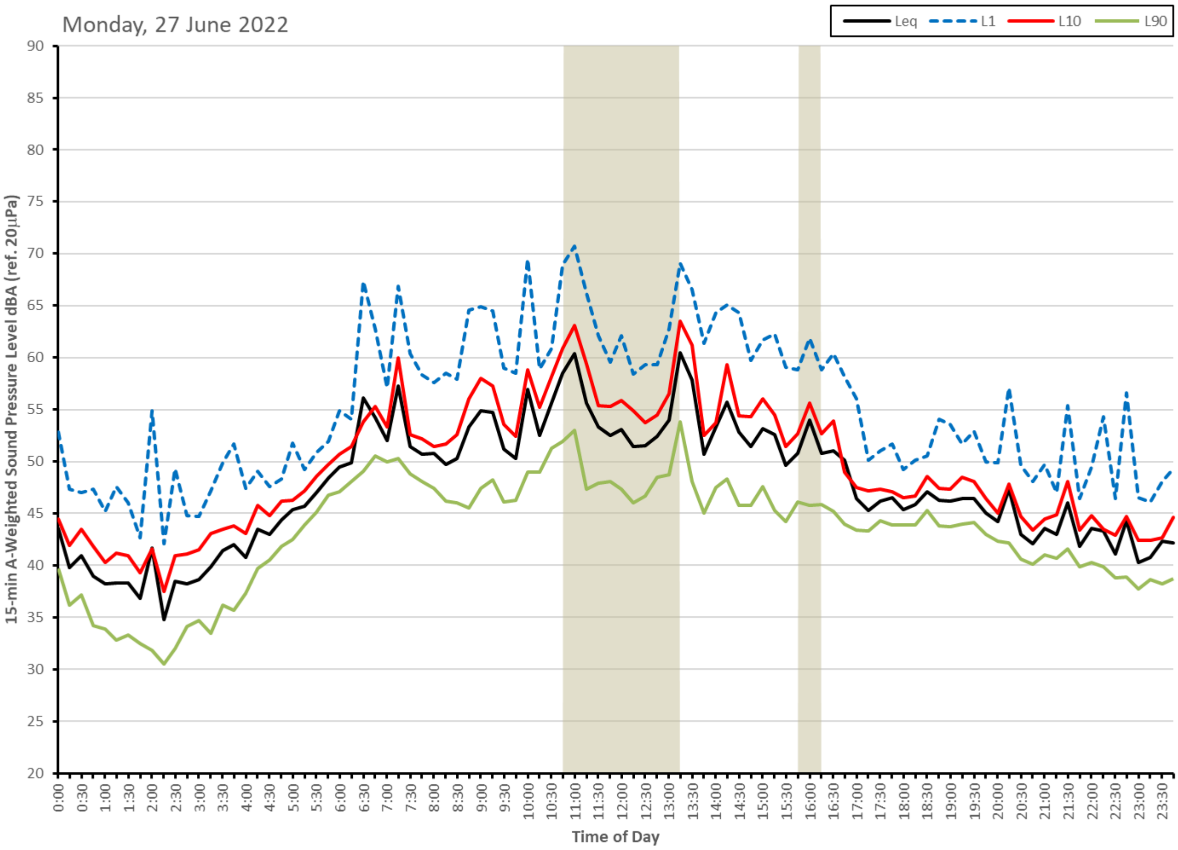

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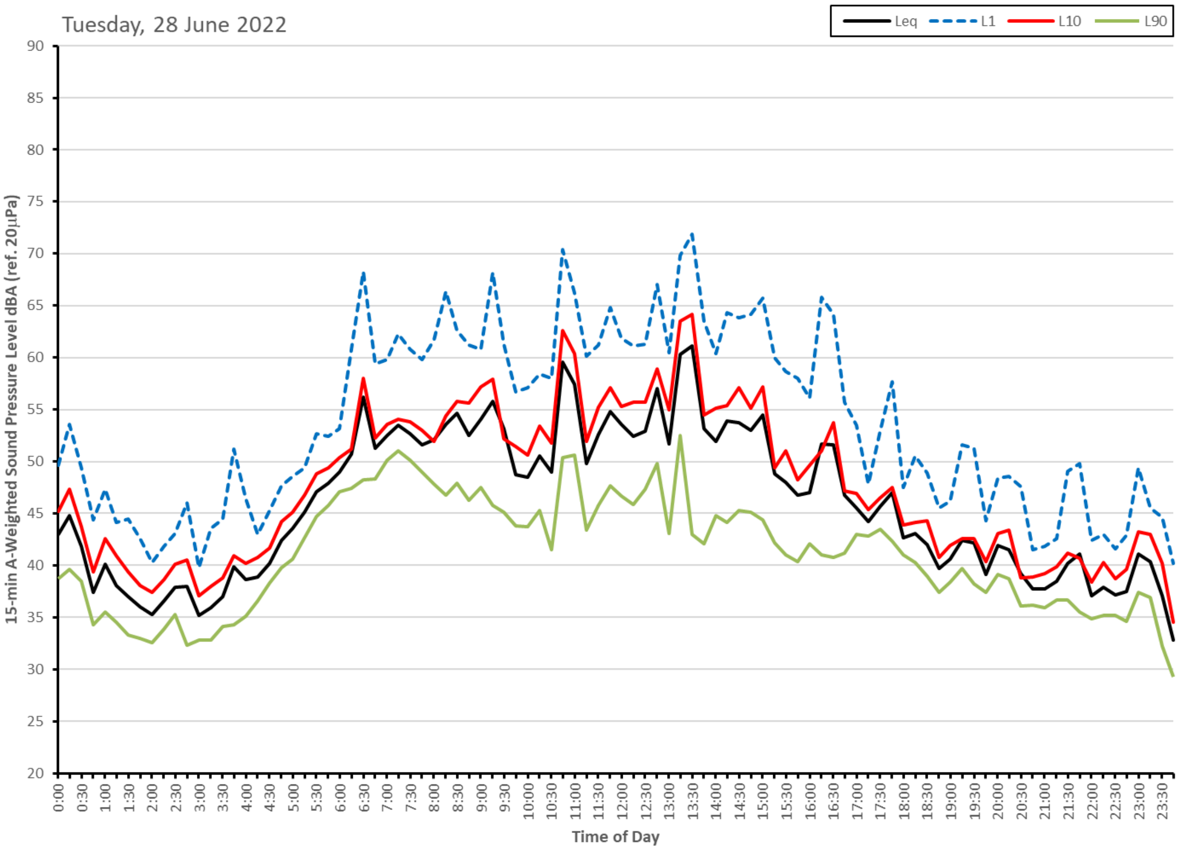
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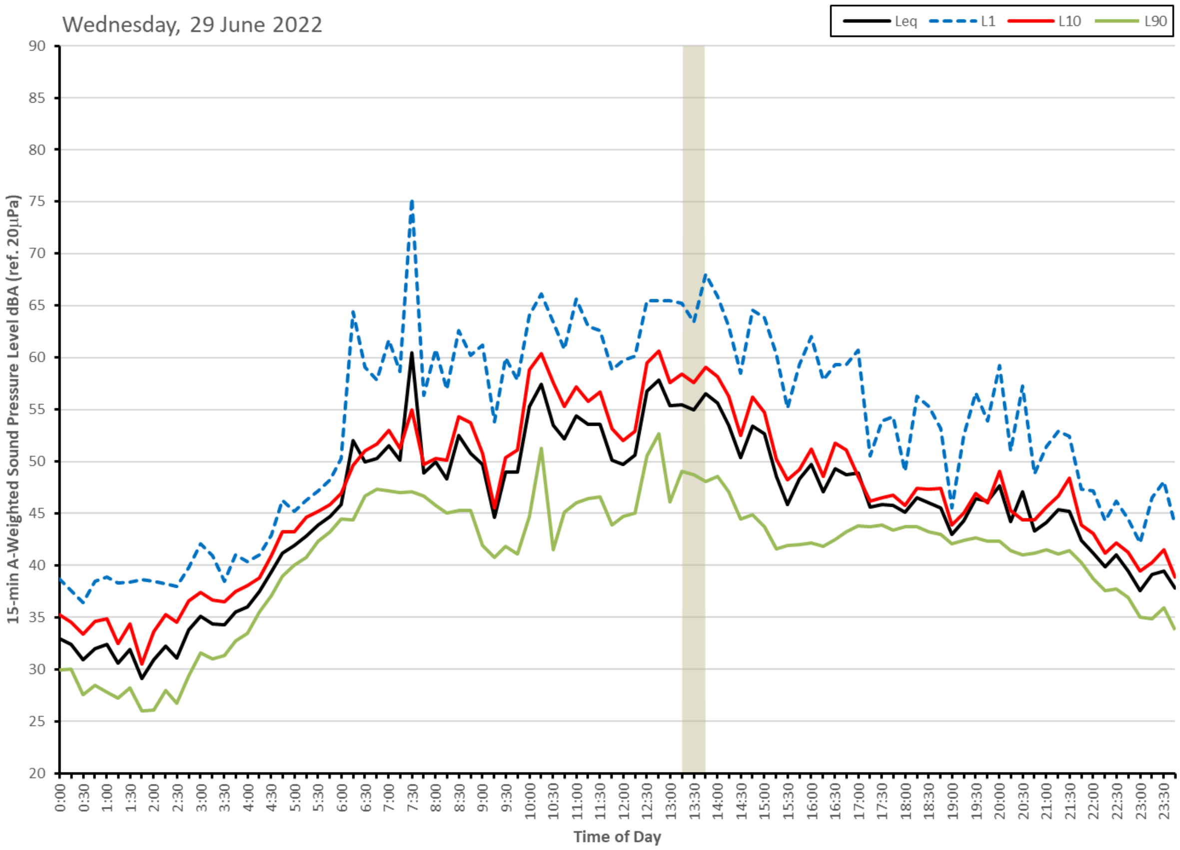
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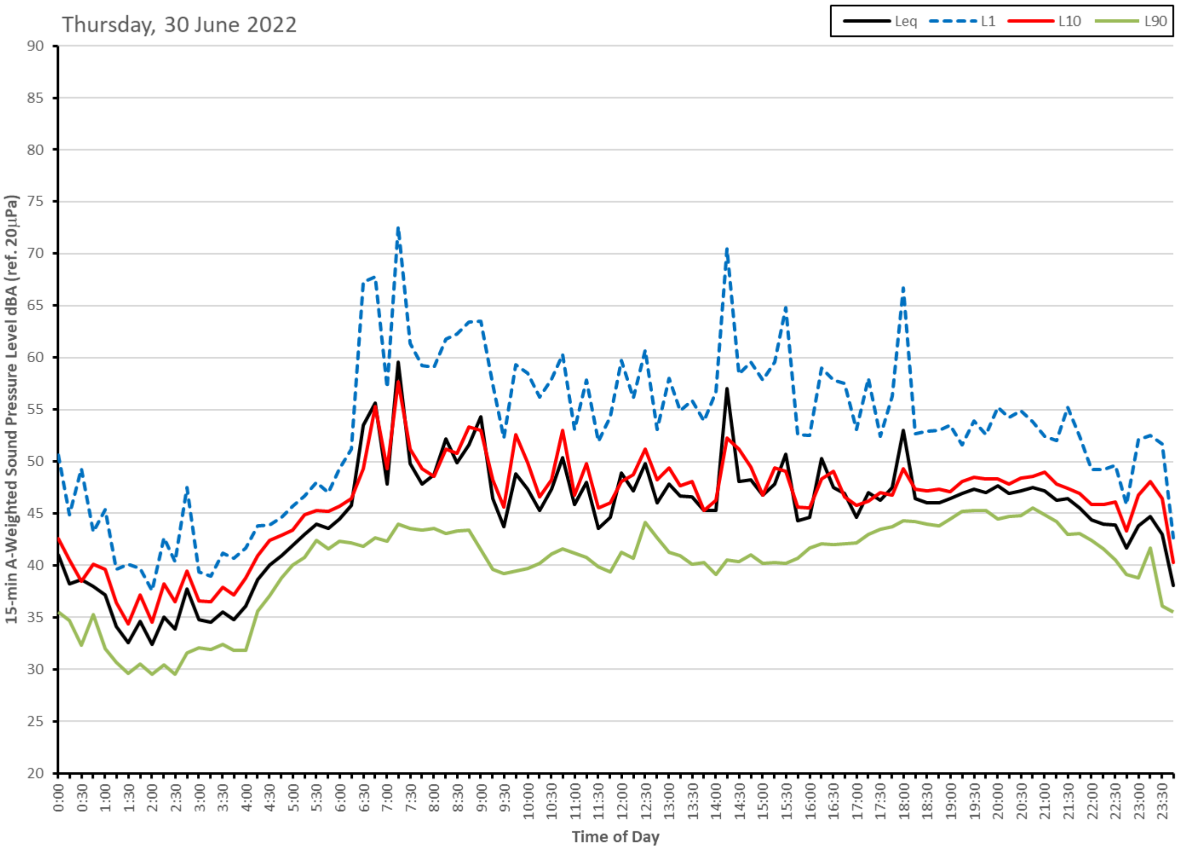
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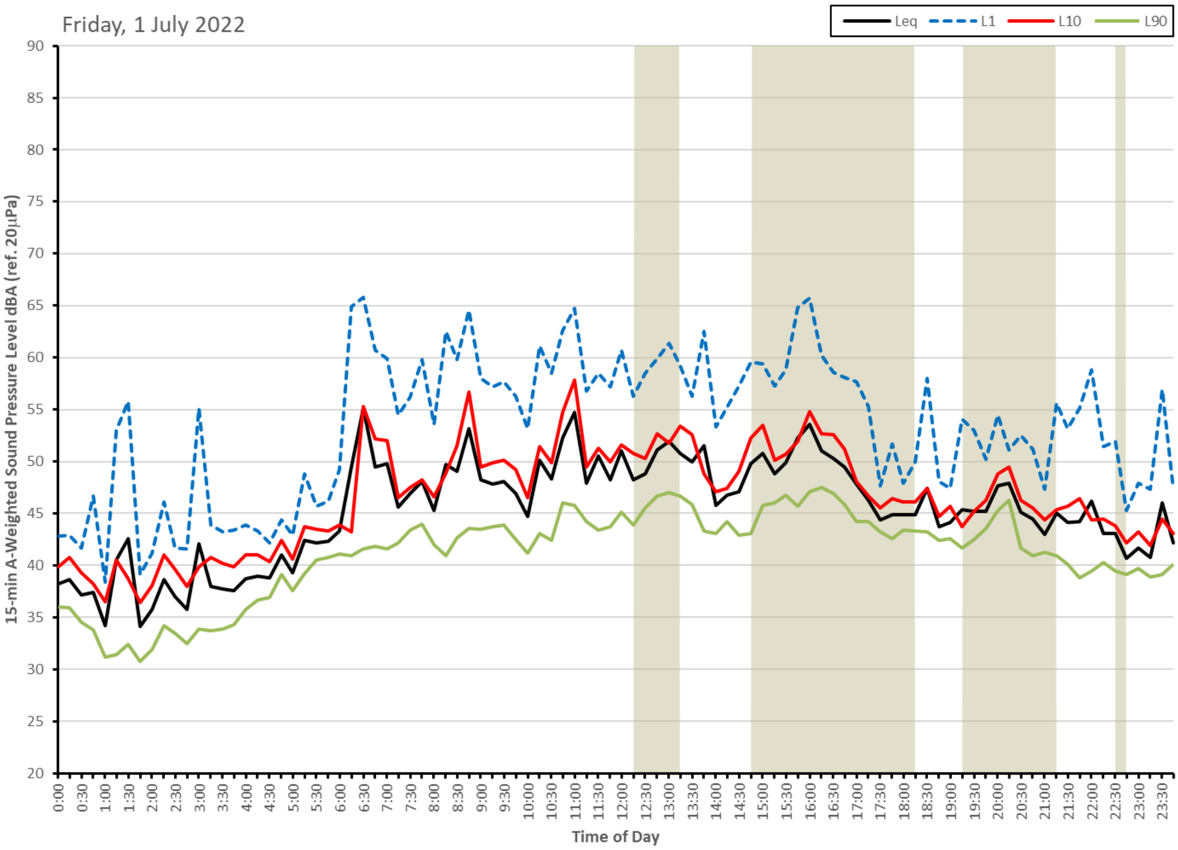
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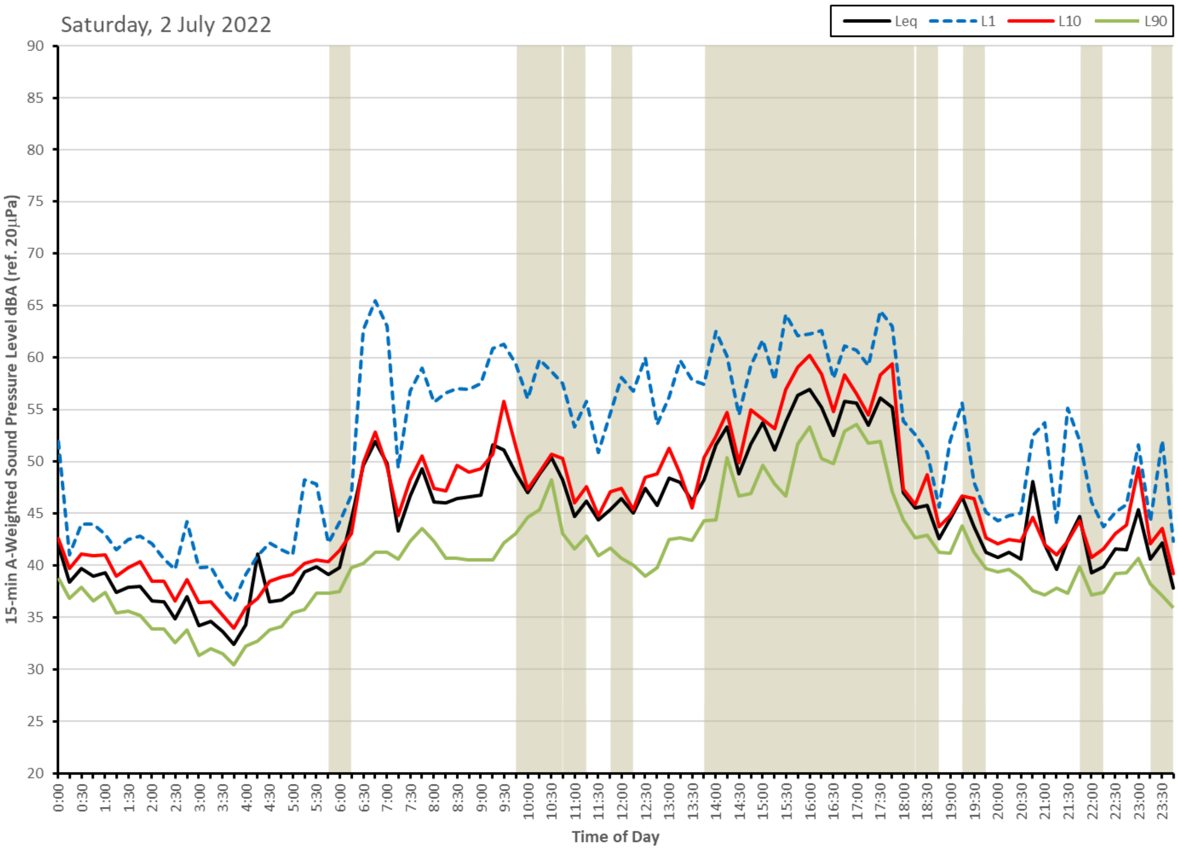

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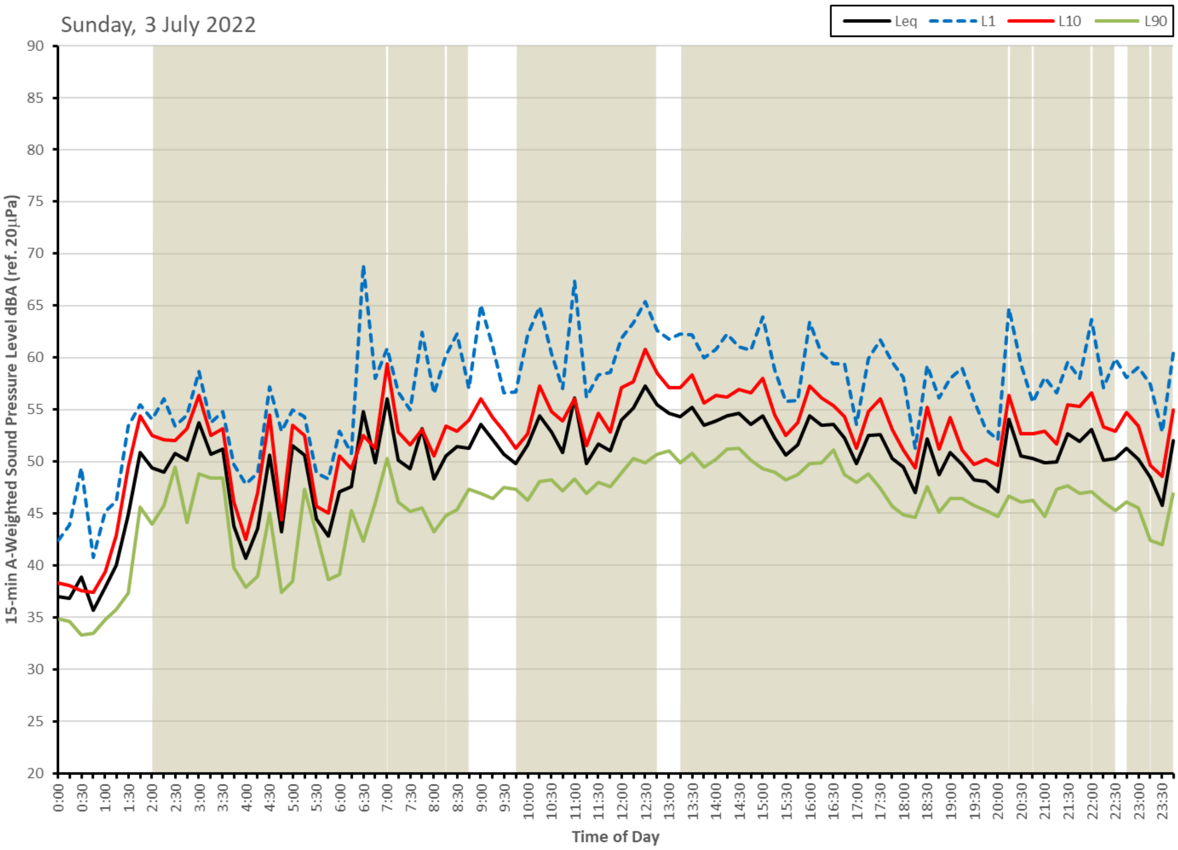

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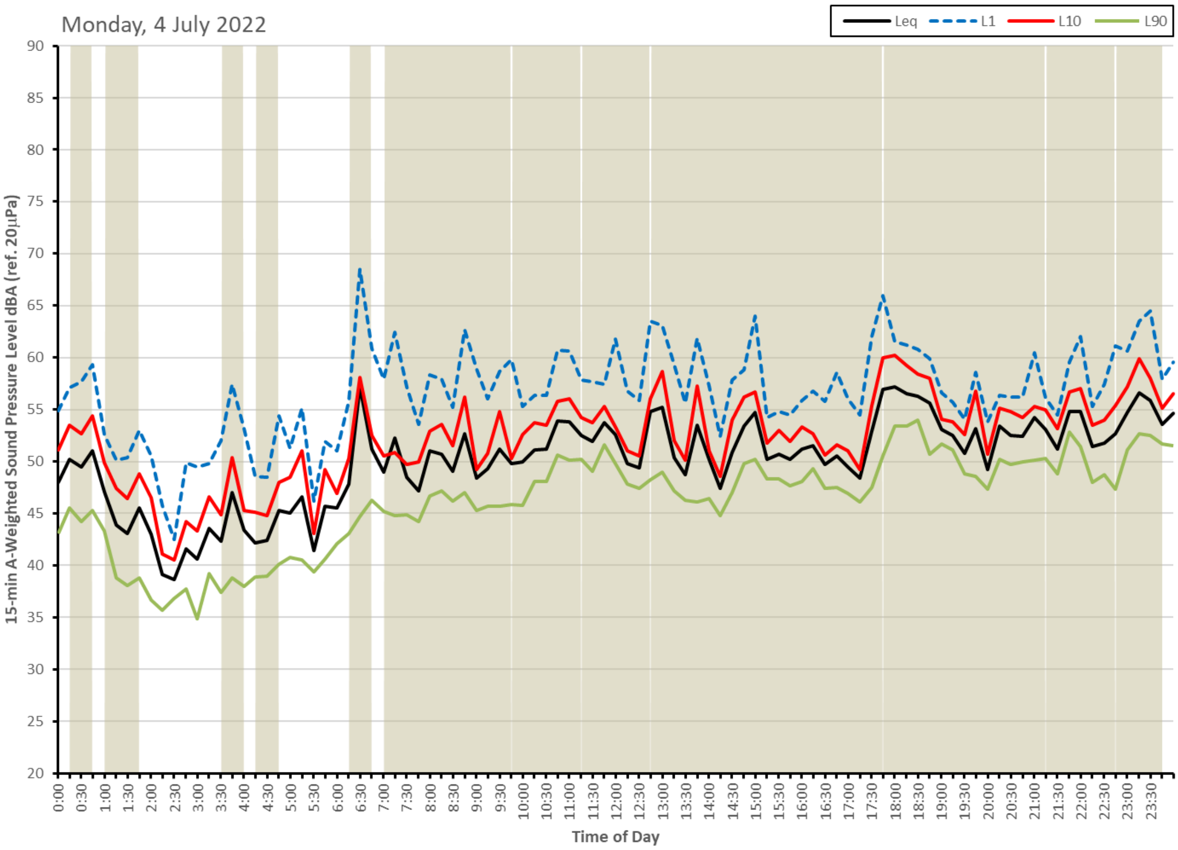
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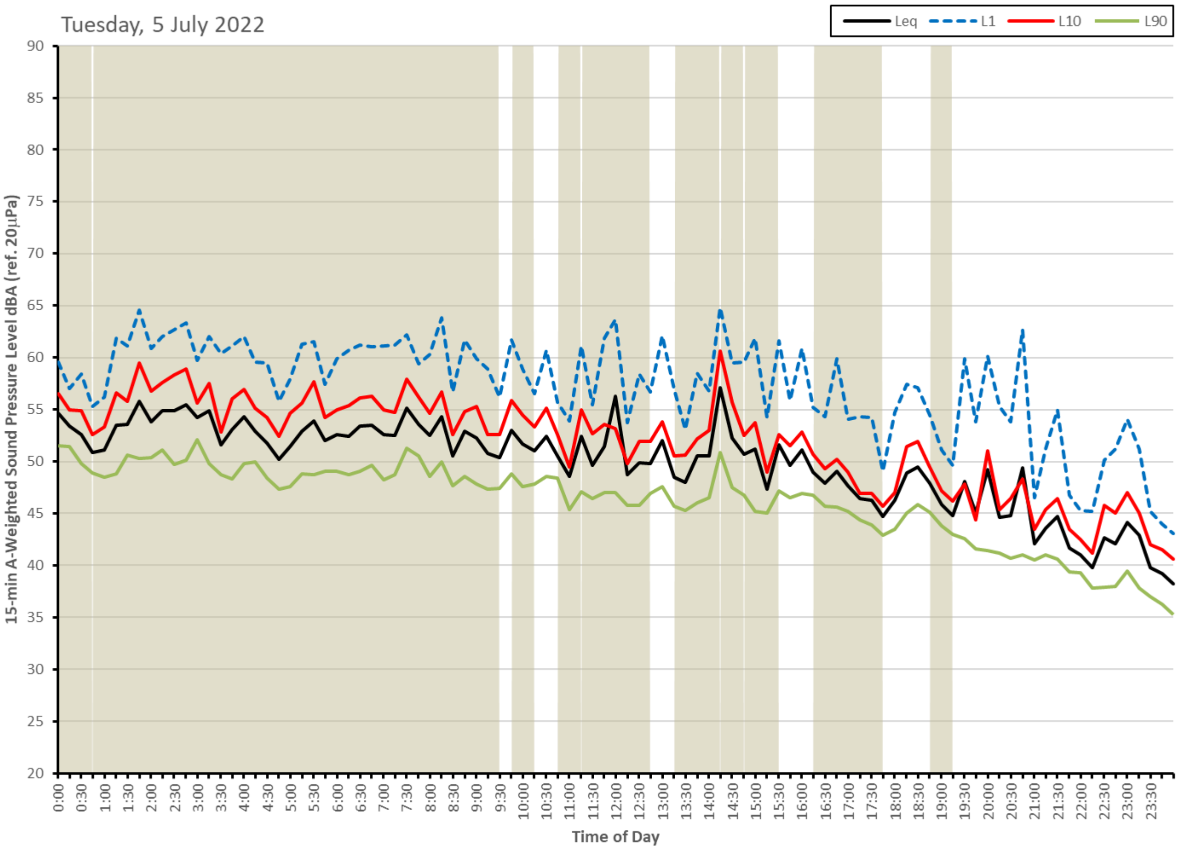
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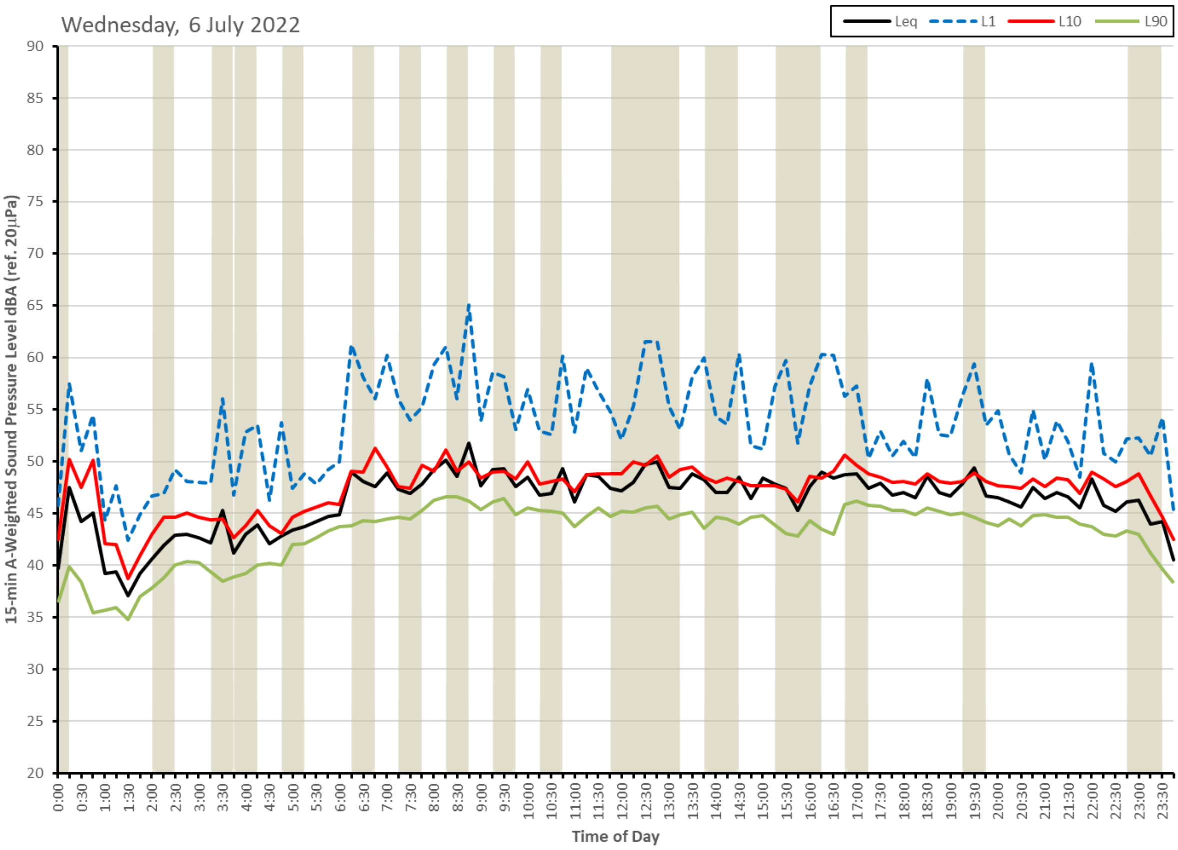
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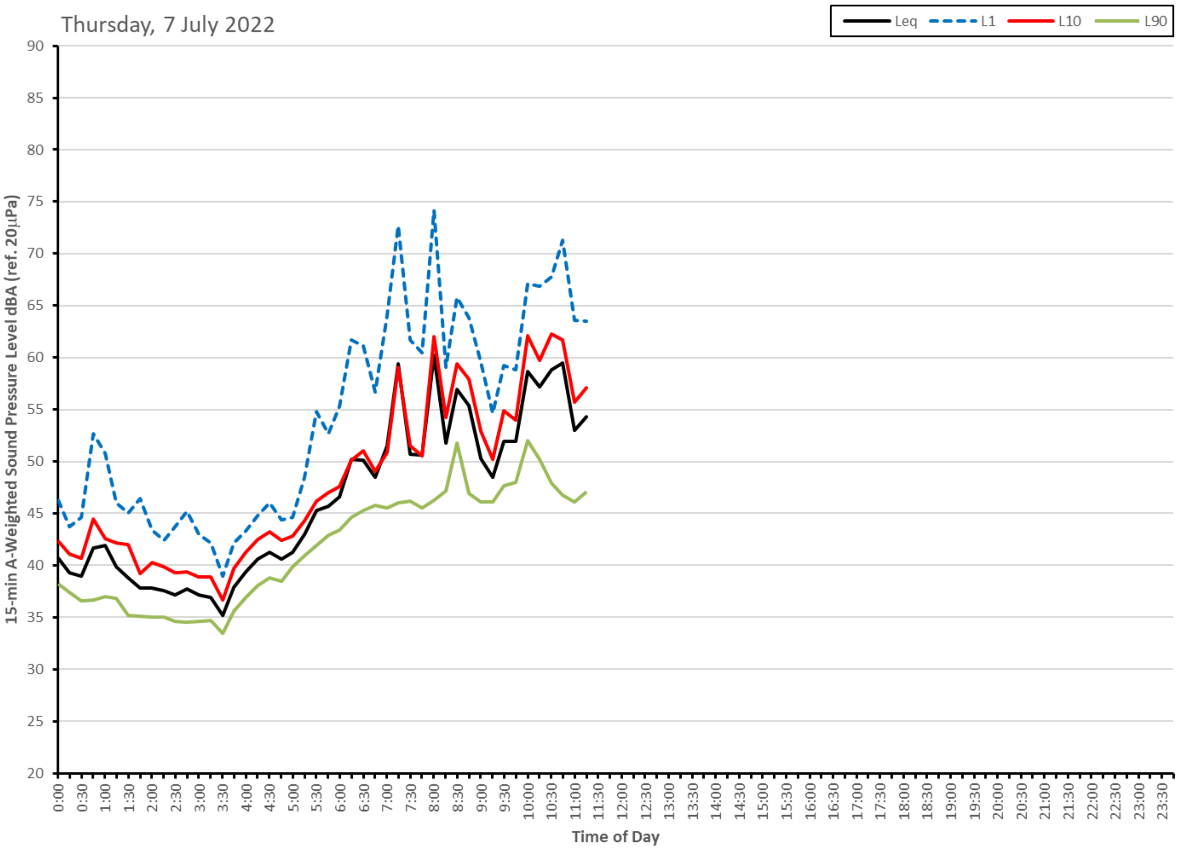
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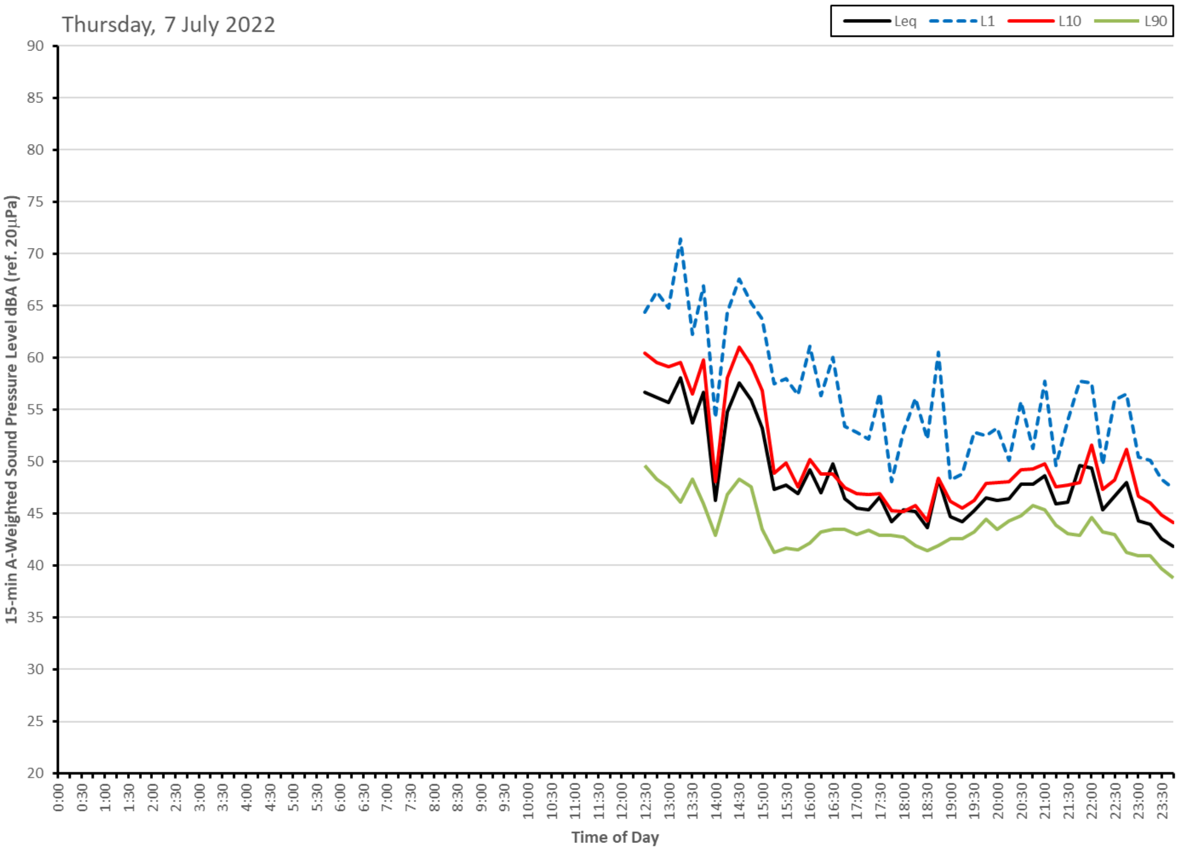
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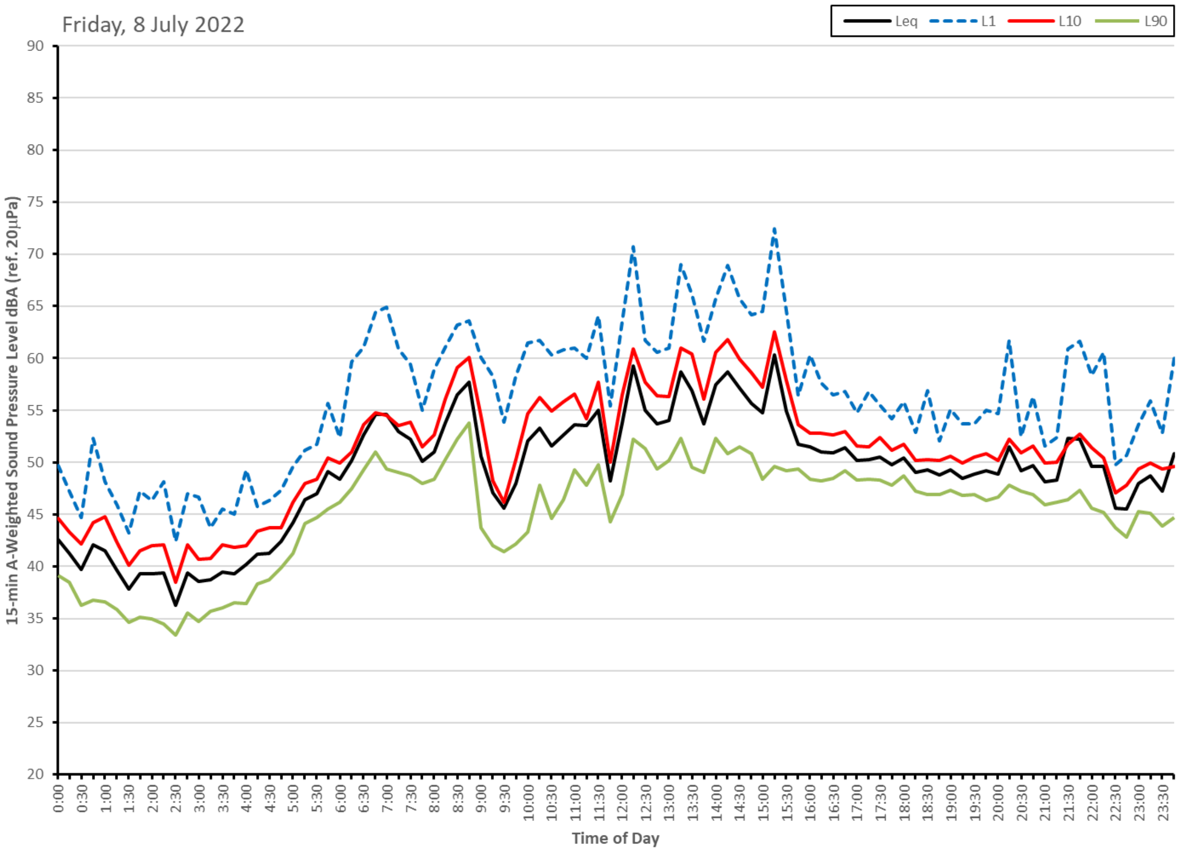
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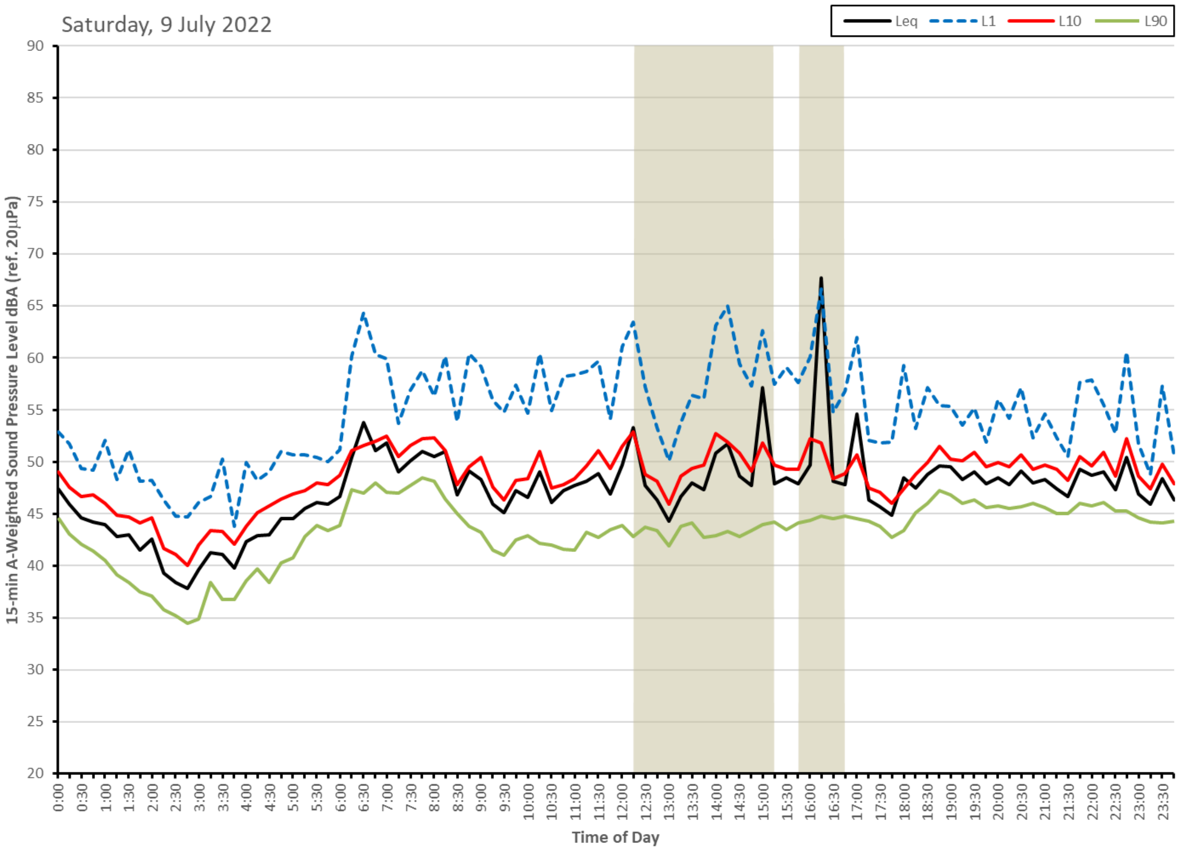
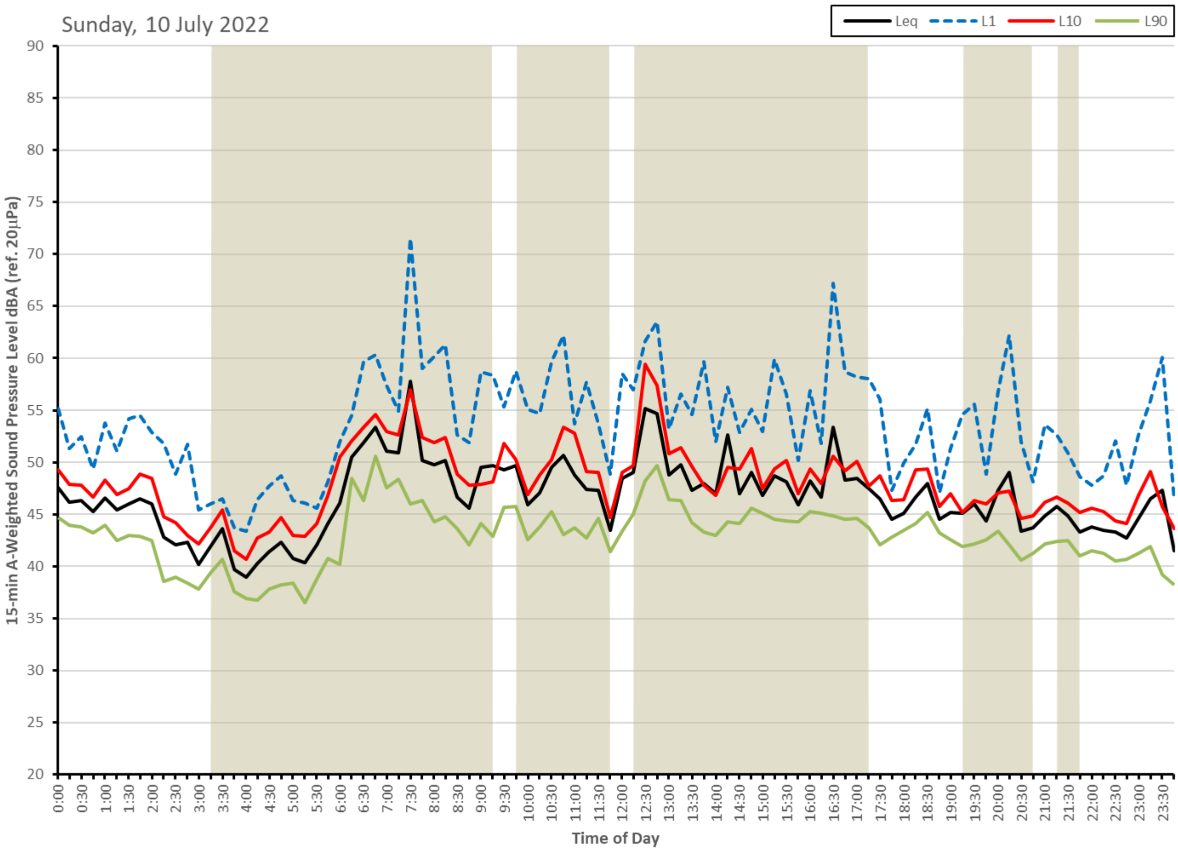
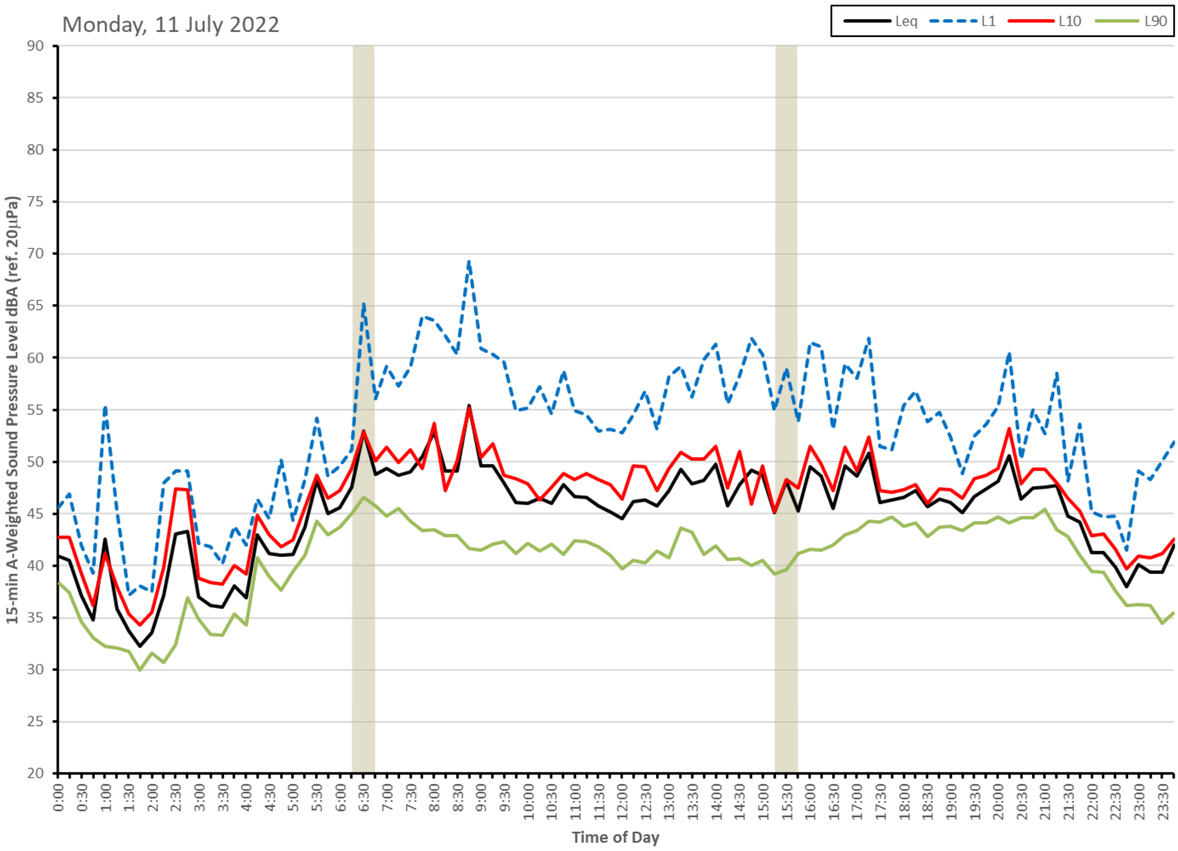
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

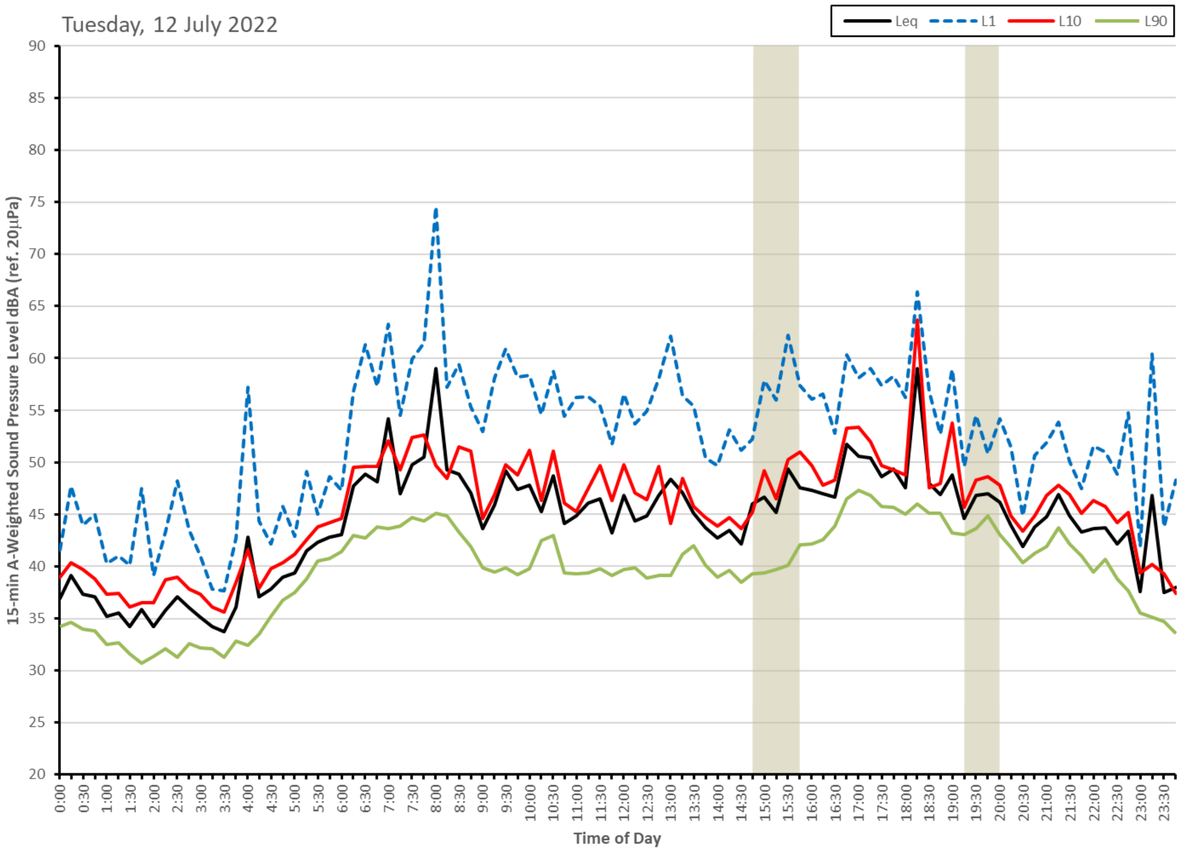

Saturday, 9 July 2022
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

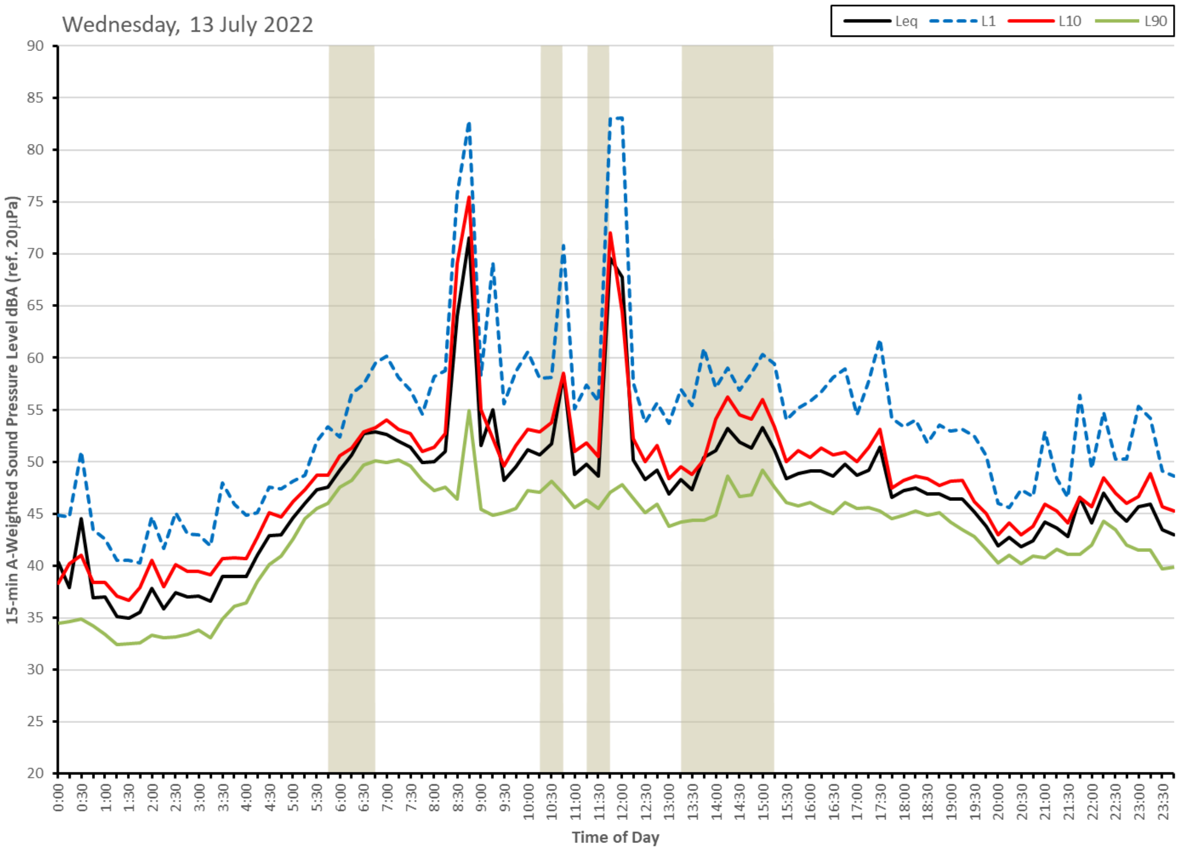

Sunday, 10 July 2022
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

Monday, 11 July 2022

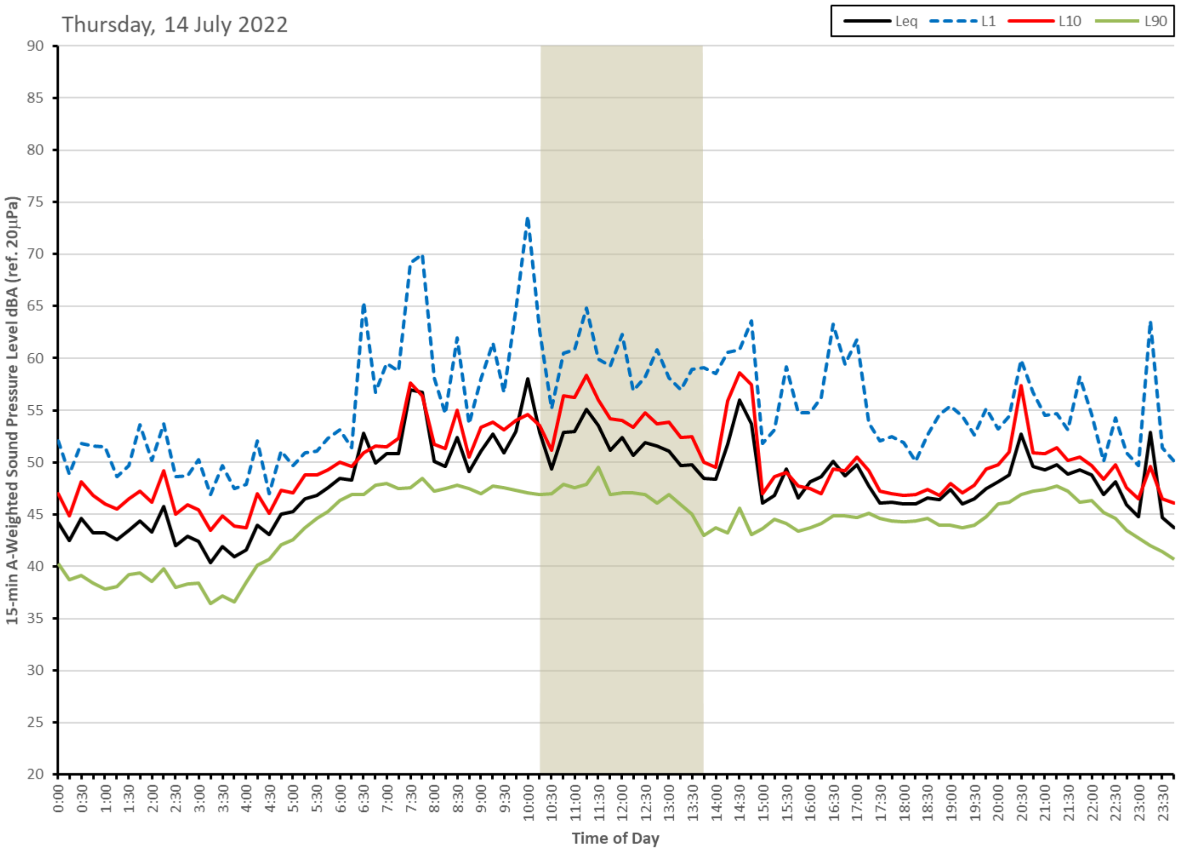


Tuesday, 12 July 2022

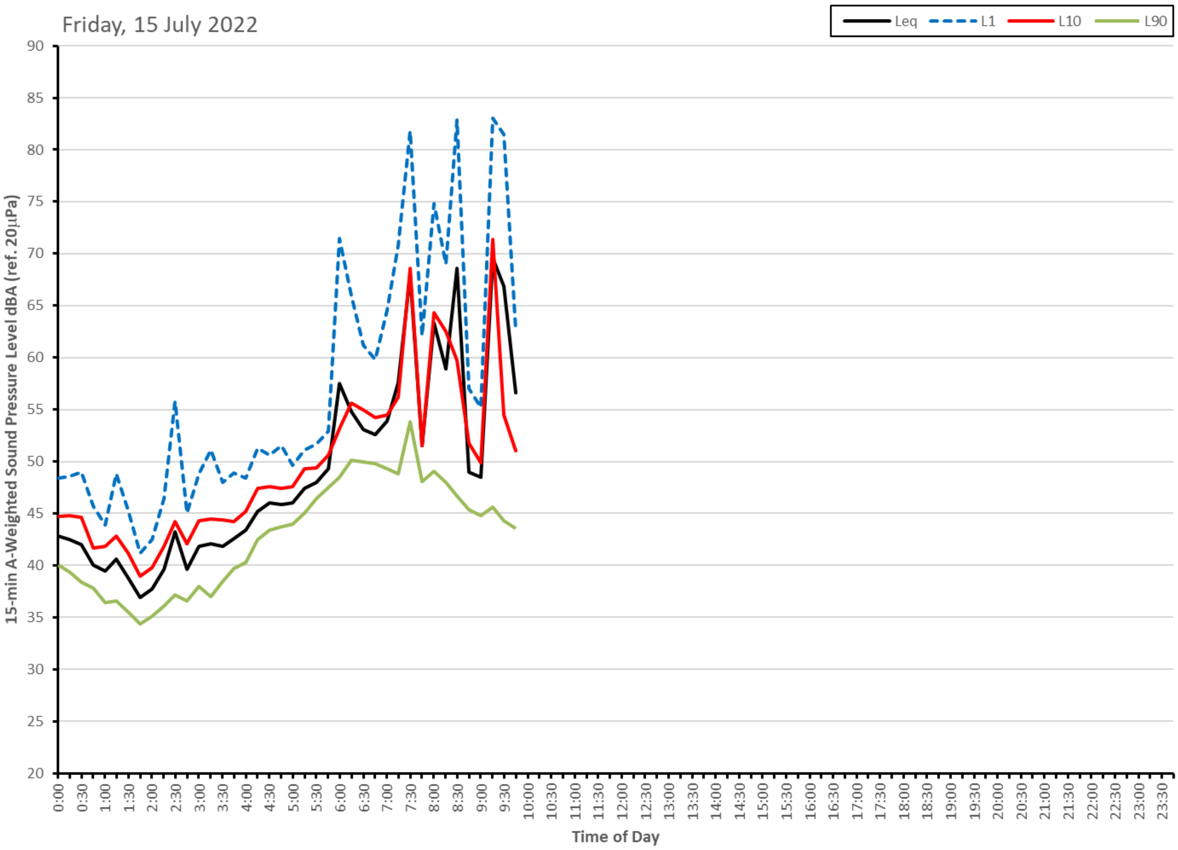




Wednesday, 13 July 2022
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day



Thursday, 14 July 2022
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Friday, 15 July 2022
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30
22:00
22:30
23:00
23:30
Time of Day