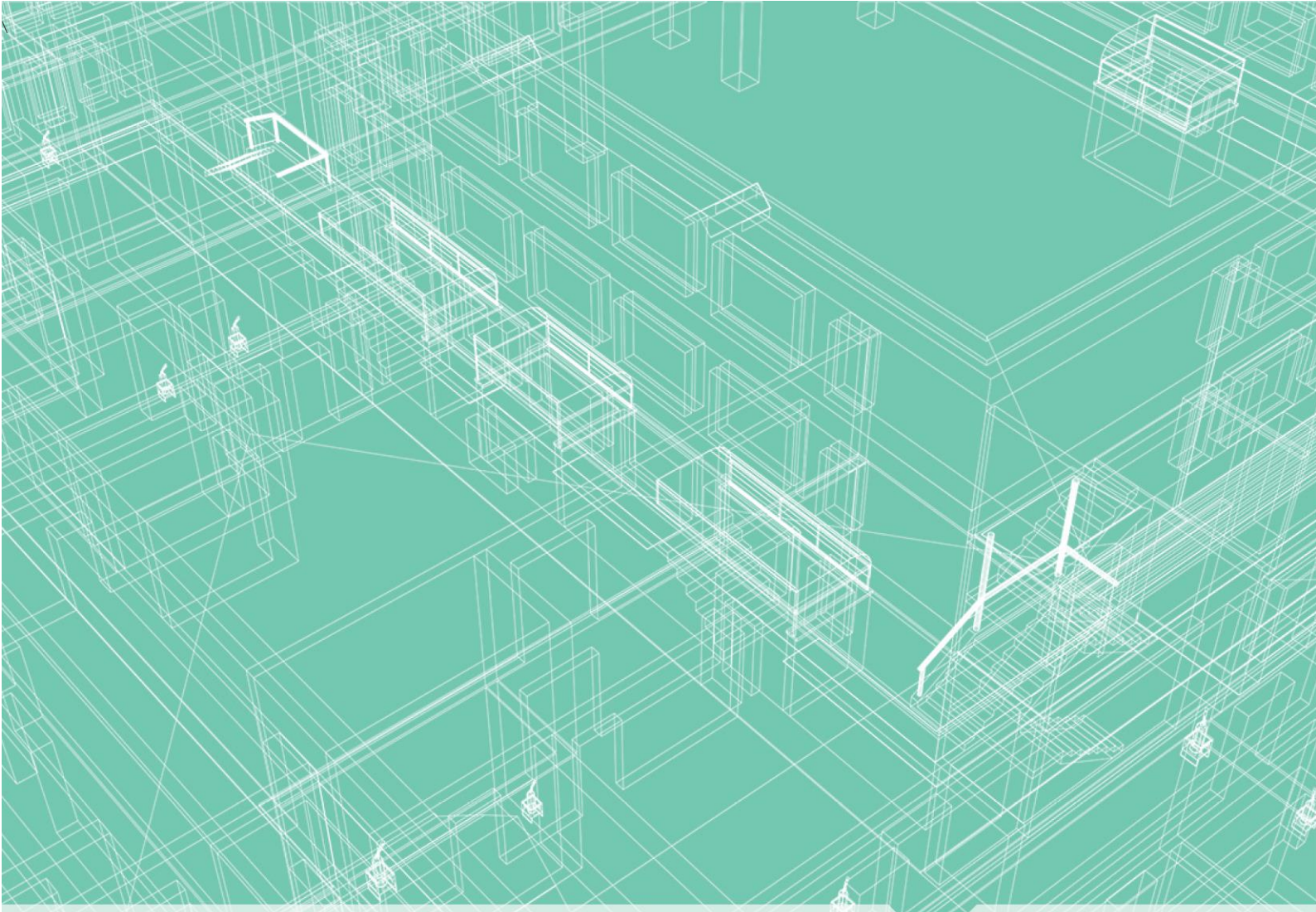

NOISE & VIBRATION IMPACT ASSESSMENT FOR SSDA (SSD-17899480)

NORTHSIDE WEST CLINIC STAGE 2

ACOUSTIC SERVICES

JHA

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CONTENTS

1 INTRODUCTION

1.1 OVERVIEW

This noise & vibration impact assessment has been prepared by JHA Consulting Engineers on behalf of Ramsey Health Care (the Applicant) and it accompanies the State Significant Development Application (SSD-17899480) for the proposed extension to the existing Northside West Clinic in Wentworthville (the Proposal) located at 23-27 Lytton Street, Wentworthville NSW.

Consent is sought for a three-storey extension (being the 'Stage 2' building) to the existing Wentworthville Northside West Clinic, as well as alterations and additions to the existing 'Stage 1' building on Site.

This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The objectives of this acoustic and vibration assessment are:

- Address the relevant SEARs dated 13 May 2021.
- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Establish appropriate noise criteria based on the noise surveys, in accordance with the relevant standards, guidelines and legislation for the following noise emissions:
  - Mechanical plant from the development to the surrounding receivers.
  - Loading bay operational noise
  - Traffic generation noise.
  - Sleep arousal.
- Determine whether the relevant criteria can be achieved based on the proposed operations and construction methods. 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 with the assessment criteria.
- Establish noise and vibration criteria for construction work based on the noise surveys, in accordance with standards and guidelines.
- Provide recommendations for Construction Noise and Vibration Planning.

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

- Architectural drawings of the proposed development.
- Noise data collected on site through the use of noise loggers and a hand held spectrum analyser.
- SEARS for SSD-17899480 dated 13 May 2021.
- Traffic Report prepared by Traffix, Ref: 15.061r03v02, dated October 2021.

This document and related work has 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.

1.2 RESPONSE TO SEARS

The acoustic report is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD-17899480. Table 1 identifies the relevant SEARs requirements and corresponding references within this report.

SEARs Item	*Report Reference*
10. Noise and Vibration *Provide a noise and vibration impact assessment that:* • *Includes a quantitative assessment of the main noise and vibration sources during demolition, site preparation, bulk excavation and construction.* • *Details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours.* • *Includes a quantitative assessment of the main sources of operational noise, including consideration of mechanical services (e.g. air conditioning plant).* • *Outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers.* • *Considers sources of external noise intrusion in proximity to the site (including, road rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards.* • *Demonstrates that the assessment has been prepared in accordance with policies and guidelines relevant to the context of the site and the nature of the proposed development.*	Sections 5, 6 & 7
Relevant Policies and Guidelines: • *NSW EPA Noise Policy for Industry (2017)* • *Interim Construction Noise Guideline (DECC) 2009* • *Assessing Vibration: A Technical Guideline 2006 (Department of Environment and Conservation, 2006)*	Section 4

Table 1: SEARs and Relevant References.

2 DESCRIPTION OF THE PROPOSAL

2.1 LOCATION / SITE DESCRIPTION

Wentworthville is a suburb of Sydney, in the Local Government Area of Greater Western Sydney, located approximately 27km West of Sydney CBD.

The proposed site is located on 23-27 Lytton Street, being approximately 500m South-West of the Wentworthville Railway Station. The Site currently contains the existing Wentworthville Northside West Clinic which is operated by Ramsey Health Care. The site is legally known as Lot 1 in DP787784.

The surrounding development is mainly single and two storey detached houses. The surrounding land uses are as follows:

- *North*: –High Density Residential zoned land comprising existing low density residential dwellings;
- *East:* –Low Density Residential zoned land comprising existing low density residential dwellings;
- *South*: –Public Recreation zoned land and Low Density Residential zoned land comprising existing low density residential development;
- *West*: – Public Recreation zoned land comprising Lytton Street Park and Finlayson's Creek.

Figure 1 shows the site boundary and surrounding area for the Stage 2 expansion of the proposed development.

Figure 1: Site boundary of proposed development.

2.2 PROPOSED WORKS

The proposal includes the construction of a three-storey extension (being the 'Stage 2' building) to the existing Wentworthville Northside West Clinic, as well as alterations and additions to the existing 'Stage 1' building on Site. The proposed three-storey extension will be located south and west of the existing building above the existing at-grade carpark. The proposed extension would result in an additional Gross Floor Area (GFA) of 4,559m^2 with an addition of 58 car-parking spaces. Specifically, the proposal entails the following:

- Construction of a three-storey extension of the existing Wentworthville Northside West Clinic located to the south and west of the existing building above the existing at-grade car parking area, comprising:
  - Addition of 95 inpatient rooms and nine consulting suites across Levels 1 to 3.
  - Provision of 15 car-parking spaces on Ground Level.
- Alterations and additions to existing Stage 1 building comprising:
  - A new lobby, gym, loading bay, ancillary office and associated amenities on Lower Ground Level.
  - A new lobby, art room and amenities on Ground Level.
- Construction of a new car park building located to the west of the existing Stage 1 building with a total of 43 car-parking spaces.
- Tree removal in the southern portion of the Site.

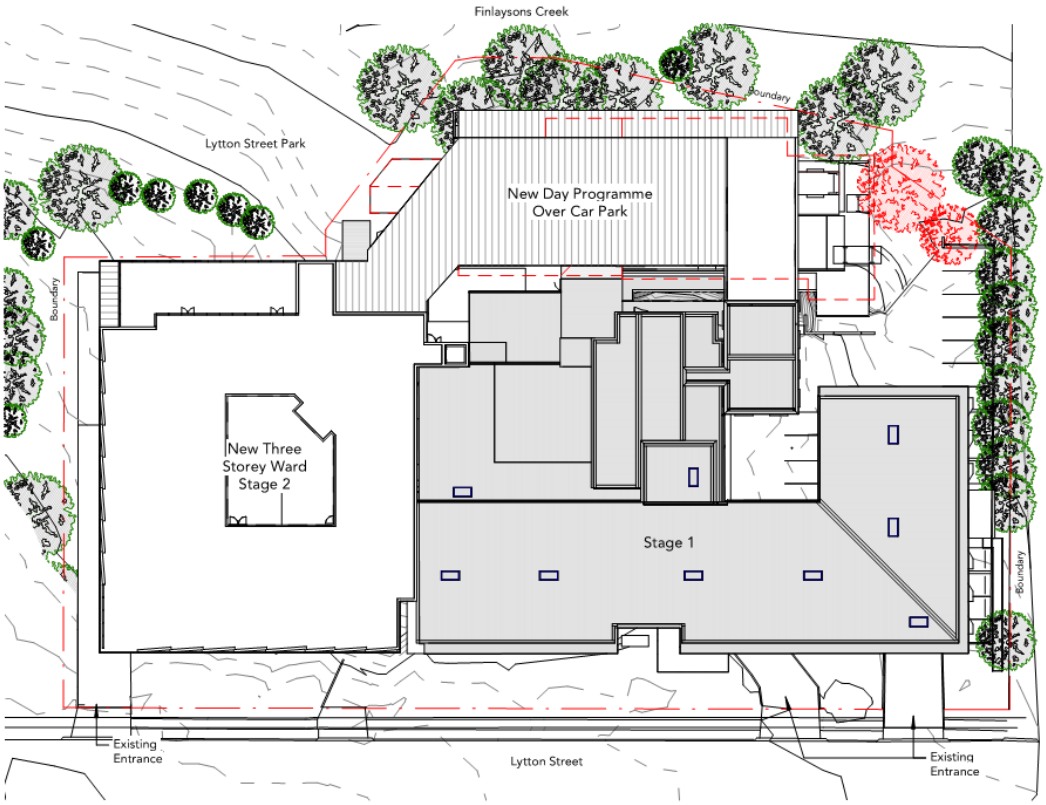

Figure 2: Proposed Northside West Clinic Stage 2 in Wentworthville.

2.3 SURROUNDING RECEIVERS

A summary of the nearest noise sensitive receivers surrounding the site is shown in Table 2, including assumed approximate distances from the noise sources of the buildings to the receiver boundaries, noting the type of noise receiver.

ID	*Sensitive Receiver*	*Receiver Type*	*Approx. Distance, m*
1	11 Lytton Street, Wentworthville	Residential	5
2 (Eastern Residential Catchment)	18/18A Lytton Street - 22 Lytton Street	Residential	25
3	48 Haig Street	Residential	38
4	31 Lytton Street	Residential	25
5	35A Lytton Street	Active Recreation	50
6	28-30 Lane Street	Residential	85
7	32 – 36 Lane Street	Residential	88

Table 2: Nearest sensitive receivers surrounding the site.

Figure 3: Nearest noise sensitive receivers surrounding the site location.

2.4 OPERATING HOURS

At this stage, it is understood that the Northside West Clinic will operate continuously over a 24-hour period, with staff shift changes occurring between 6am – 7:30am and 1:30pm – 3pm.

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys were conducted in the locations shown in Figure 4 to establish the ambient and background noise levels of the site and surrounds, in accordance with Fact Sheets A and B of the NSW Noise Policy for Industry. JHA Consulting Engineers carried out the noise surveys, in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'*.

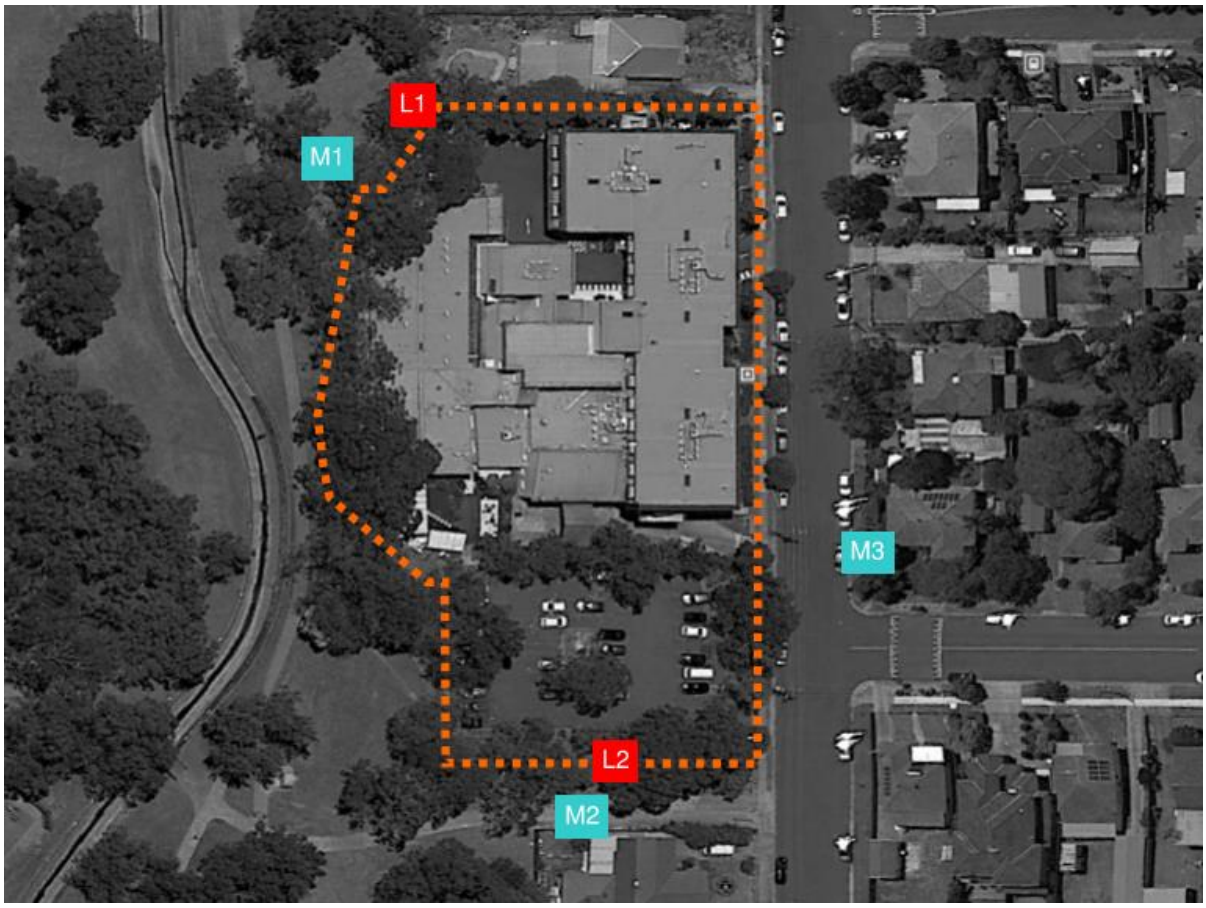

Figure 4: Noise survey locations and boundary of the site.

From observations during the noise survey, it is noted that ambient noise levels are dominated by low activity of residential, active recreation using the adjacent park and local traffic using the existing car park and Lytton Street.

3.2 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site. On Wednesday 12th May 2021, short-term noise measurements were carried out during day-time. Short-term noise measurements were carried out with a 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 3.

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
M1	12/05/2021 11:40am	$L_{90,15min}$	47	51	47	43	42	42	38	36	28
		$L_{eq,15min}$	48	53	49	44	43	43	41	42	33
		$L_{10,15min}$	52	57	53	47	46	46	46	47	38
M2	12/05/2021 11:58am	$L_{90,15min}$	50	53	50	46	46	45	36	35	30
		$L_{eq,15min}$	53	58	57	50	50	48	42	42	35
		$L_{10,15min}$	58	63	62	54	53	53	48	46	38
M3	12/05/2021 12:15pm	$L_{90,15min}$	52	53	54	46	47	46	40	38	31
		$L_{eq,15min}$	58	56	55	51	51	53	50	51	41
		$L_{10,15min}$	62	60	59	57	56	59	55	54	44

Table 3: Results of short-term noise monitoring.

3.3 LONG-TERM NOISE MONITORING

Long-term noise monitoring was carried out from Thursday 12th May to Thursday 19th May 2021 with two Rion NL-52 noise loggers (Serial Numbers 1054192 and 1254316). The noise loggers 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 loggers were checked before and after use and no deviations were recorded.

The noise loggers were located on the boundaries of the proposed development site – as shown in Figure 4. The locations were secured and are considered to be representative of the typical ambient and background noise levels.

The noise loggers' microphones were mounted 1.5 metres above the ground and windshields were used to protect the microphones. Weather conditions were monitored during the unattended noise monitoring period.

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 Assessment Background Levels (ABLs) 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 RBLs (Rating Background Levels) for each assessment period.

These RBLs are shown in Table 5 and Table *4*, together with the ambient noise levels (L_{Aeq}) measured for each time period.

Date	Assessment Background Levels, dB(A)			L_{Aeq} Ambient Noise Levels, dB(A)		
	Day 0700-1800	Evening 1800-2200	Night 2200-0700	Day 0700-1800	Evening 1800-2200	Night 2200-0700
Wednesday, 12 May 2021	---	43	39	---	48	48
Thursday, 13 May 2021	43	---	43	51	---	49
Friday, 14 May 2021	49	44	43	53	51	49
Saturday, 15 May 2021	46	48	43	53	51	49
Sunday, 16 May 2021	44	46	42	52	50	50
Monday, 17 May 2021	45	46	43	54	50	50
Tuesday, 18 May 2021	43	45	42	59	50	51
Wednesday, 19 May 2021	41	45	42	51	51	49
Rating Background Levels	**44**	**45**	**42**	---	---	---
Ambient Noise Levels	---	---	---	**54**	**50**	**49**

Table 4: Results of long-term noise monitoring at Location L1.

Date	Assessment Background Levels, dB(A)			L_{Aeq} Ambient Noise Levels, dB(A)		
	Day 0700-1800	Evening 1800-2200	Night 2200-0700	Day 0700-1800	Evening 1800-2200	Night 2200-0700
Wednesday, 12 May 2021	---	43	39	---	53	51
Thursday, 13 May 2021	---	---	43	---	---	50
Friday, 14 May 2021	49	45	42	56	53	50
Saturday, 15 May 2021	47	47	42	55	53	49
Sunday, 16 May 2021	44	47	42	54	53	51
Monday, 17 May 2021	45	47	42	55	53	51
Tuesday, 18 May 2021	43	43	42	54	52	51
Wednesday, 19 May 2021	42	47	42	54	53	51
Rating Background Levels	**44**	**46**	**42**	---	---	---
Ambient Noise Levels	---	---	---	**55**	**53**	**51**

Table 5: Results of long-term noise monitoring at Location L2.

3.4 TRAFFIC NOISE MONITORING

Based on the long-term noise monitoring results at location L2, the traffic noise levels are summarised below in Table 6.

Location	*Measured Noise Levels, dB(A)*			
	Day period (7am-10pm)	*Day Noisiest 1h*	*Night period (10pm-7am)*	*Night Noisiest 1h*
L2	$L_{Aeq,15hour}$ 55	$L_{Aeq,1hour}$ 63	$L_{Aeq,9hour}$ 52	$L_{Aeq,1hour}$ 56

Table 6: Traffic Noise Levels.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

4.1 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
  - Cumberland/Holroyd Council Planning Framework.
- Noise Emissions
  - NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017.
- Transport Noise
  - NSW DECCW, Road Noise Policy (RNP) 2011.
  - Australian Standard 2107:2016 *'Acoustics - Recommended Design Sound Level and Reverberation Times for Building Interiors'*
- Construction Noise and Vibration
  - NSW DECCW, Interim Construction Noise Guideline (ICNG) 2009.
  - 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*'.
  - NSW EPA, Draft Construction Noise Guideline 2020.

4.2 REGULATORY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A 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 identification of acceptable noise criteria which may be defined in a Development Control Plan, or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protecting, restoring and enhancing 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.

…"

4.3 PLANNING FRAMEWORK

4.3.1 HOLROYD LOCAL ENVIRONMENTAL PLAN 2013

The Holroyd Local Environmental Plan (H-LEP 2013) is the environmental planning instrument that applies to the site. The existing site is zoned as High Density Residential (R4). Figure 5 shows the land zoning as per information extracted from H-LEP map 3950_COM_LZN_005_010_20200804.

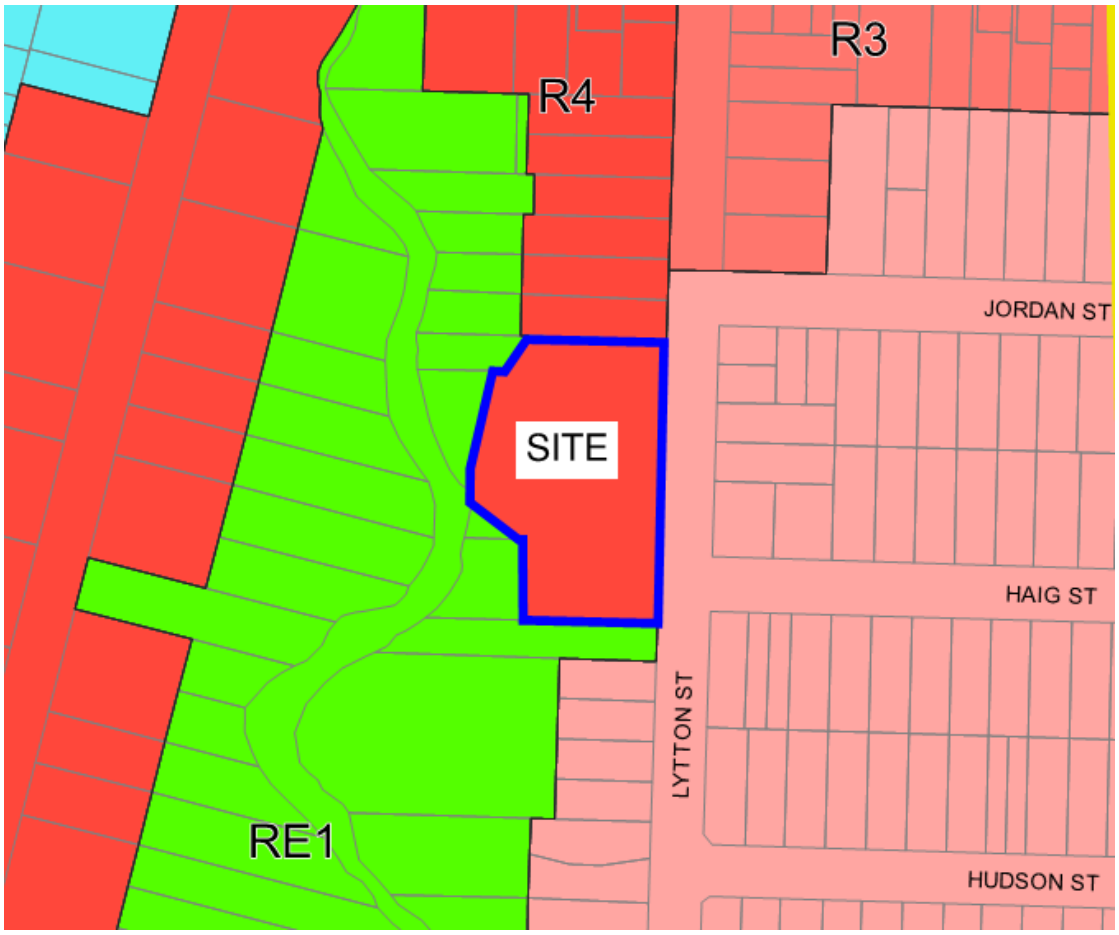

Figure 5: Land Zoning of the site and surroundings.

4.3.2 DRAFT CUMBERLAND DEVELOPMENT CONTROL PLAN

At present, the Draft Cumberland Development Control Plan is being finalized by the Cumberland council. As per the Cumberland Council Planning Website "*Until the Draft Cumberland Development Control Plan is finalised by Council, the existing DCPs from the three former Councils areas remain in place.´* Therefore, the Holroyd Development Control Plan shall be considered.

4.3.3 HOLROYD DEVELOPMENT CONTROL PLAN 2013

The Holroyd Council Development Control Plan (H-DCP) Part C – Commercial Development provides the following provisions for acoustic privacy for consulting rooms as follows.

"…

11.4. Privacy

Acoustic Privacy

> *C5. All development shall comply with the requirements of the Building Code of Australia (BCA) which deal with noise transmission.*
>
> *C6. Professional consulting rooms shall be designed to minimise noise transmission between buildings and from the development to adjoining dwelling houses or other buildings.*
>
> *C7. Sources of noise such as driveways, parking areas, air conditioning plants and any other externally located machinery shall be sited away from adjoining properties and shall, where necessary, be screened by walls or high trees. Where appropriate, an acoustically enclosed cover designed by a suitably qualified acoustic consultant may be required in some instances to contain noise emissions.*
>
> *C8. To minimise the transmission of sound, the maximum amount of planting and grassed areas should be provided around the development.*

…"

4.4 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 of the two criteria sets the Project Noise Trigger Level (PNTL).

4.4.1 INTRUSIVENESS CRITERIA

The NSW NPI defines the intrusiveness criteria 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, and does not exceed the background noise level by more than 5dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the measured background noise levels on site, Table 7 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Rating Background Level dB(A)*	*Intrusiveness Criterion dB(A)*
Medium Density Residential (R2/R3)	Day	44	49
	Evening	46	51
	Night	42	47
High Density Residential (R4)	Day	44	49
	Evening	45	50
	Night	42	47

Table 7: Determination of the intrusiveness criterion.

4.4.2 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 land zoning of the noise sensitive receivers plus amenity criteria definition, Table 8 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 ($L_{Aeq15min}$) dB(A)*
Medium Density Residential (R2/R3)	Day	55	53 (55-5+3)
	Evening	45	43 (45-5+3)
	Night	40	38 (40-5+3)
High Density Residential (R4)	Day	60	58 (60-5+3)
	Evening	50	48 (50-5+3)
	Night	45	43 (45-5+3)
Public Recreation (RE1)	When In Use	55	53 (55-5+3)

Table 8: Determination of amenity criterion.

4.4.3 PROJECT NOISE TRIGGER LEVELS

The PTNL's are shown in Table 6 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point of within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion dB(A)*	*Amenity Criterion dB(A)*
Medium Density Residential (R2/R3)	Day	49	53
	Evening	51	43
	Night	47	38
High Density Residential (R4)	Day	49	58
	Evening	50	48
	Night	47	43
Public Recreation (RE1)	When In Use	--	53

Table 9: PNTLs for noise sensitive receivers.

4.5 TRANSPORT NOISE

4.5.1 NSW ROAD NOISE POLICY

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

- Existing roads,
- 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 up to 2.0dB (i.e. less than 2.1dB)[1] above the existing noise levels. An increase of up to 2.0dB represents a minor impact that is considered barely perceptible to the average person.

4.5.2 SLEEP AROUSAL

The potential of sleep disturbance from short-duration noise events from the proposed development – use of on-grade and basement car parks – during the night-time period needs to be considered. Sleep disturbance occurs through changes in sleep state and awakenings. For continuous traffic flow, L_{Aeq} appears to be an acceptably correlated with sleep disturbance.

However, for intermittent traffic flow, which often occurs at night time ($L_{AFmax} - L_{Aeq}$) or ($L_{Afmax} - L_{A90}$) are better correlated with sleep disturbance.

NSW EPA NPI recommends the following criteria:

[1] NSW Roads and Maritime Service. Noise Criteria Guideline 2015. Page 10.

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

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

A greater maximum noise level event assessment should be undertaken.

The detailed noise assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period."

Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy as follows:

- Maximum internal noise levels below 50-55dB(A) are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65-70dB(A), are not likely to affect health and wellbeing significantly.

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- The distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development.
- Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).
- Current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Table 10 summarizes the noise level criteria for sleep disturbance based on the NSW EPA NPI recommendations and highlight the criteria to apply.

Condition	*Sleep Arousal Noise Criteria*
Condition 1	$L_{Aeq,15min}$ 40dB(A) || **RBL+5 = 47dB(A)**
Condition 2	L_{AFmax} 52dB(A) || **RBL+15 = 57dB(A)**

Table 10: Sleep Arousal Noise Criteria.

4.5.3 AS2107:2016 INTERNAL NOISE LEVELS

Australian Standard 2107:2016 *'Acoustics - Recommended Design Sound Level and Reverberation Times for Building Interiors'* establishes criteria for design sound levels within buildings. Table 11 summarizes the noise level criteria for design sound levels within habitable areas of the development.

Type of Occupancy/activity	*Design Sound level ($L_{Aeq,t}$)*
Living Areas	40
Sleeping areas (night-time)	35

Table 11: AS:2107:2016 Design Sound levels

4.6 CONSTRUCTION NOISE AND VIBRATION

4.6.1 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 12 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Medium Density Residential (R2/R3)	Noise affected / External	RBL+10	RBL+5
	Highly noise affected / External	75	N/A
High Density Residential (R4)	Noise affected / External	RBL+10	RBL+5
	Highly noise affected / External	75	N/A
Public Recreation (RE1)	External	65	65

Table 12: 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.

4.6.2 VIBRATION CRITERIA

4.6.2.1 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.

4.6.2.2 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 14 below, in terms of vibration velocity levels.

Place	*Time*	*Vibration velocity, mm/s (r.m.s.) [dB re 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 14: 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 15 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 15: Intermittent vibration criteria applicable to the site.

5 OPERATIONAL NOISE EMISSIONS ASSESSMENT

Noise break-out from the proposed development has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Mechanical plant from the proposed development.
- New loading bay.
- Traffic generation noise.
- Car Park noise.
- Sleep Arousal.

Each of these noise sources has been considered in the noise impact assessment. The noise impact assessments have also considered the following:

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Lowest background levels measured.

5.1 EXTERNAL MECHANICAL PLANT

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

Mechanical plant will operate continuously during operating hours. At this stage, mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions.

Noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant areas to the nearest noise sensitive receivers meets the NSW NPI noise level criteria – refer to Section 4.4.3.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of mechanical plant to ensure the cumulative noise levels 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 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.

5.2 LOADING BAY

An acoustic assessment for the use of the new loading bay has been conducted to predict the noise levels to the nearest noise sensitive receiver. The loading bay activities will take place on the lower-ground level service area. Figure 6 shows the approximate distance from the loading bay to the nearest noise sensitive receiver at 31 Lytton Street. Ground level of new loading bay is lower than noise sensitive receiver, plus there is a retaining wall which will provide shielding of the noise emissions.

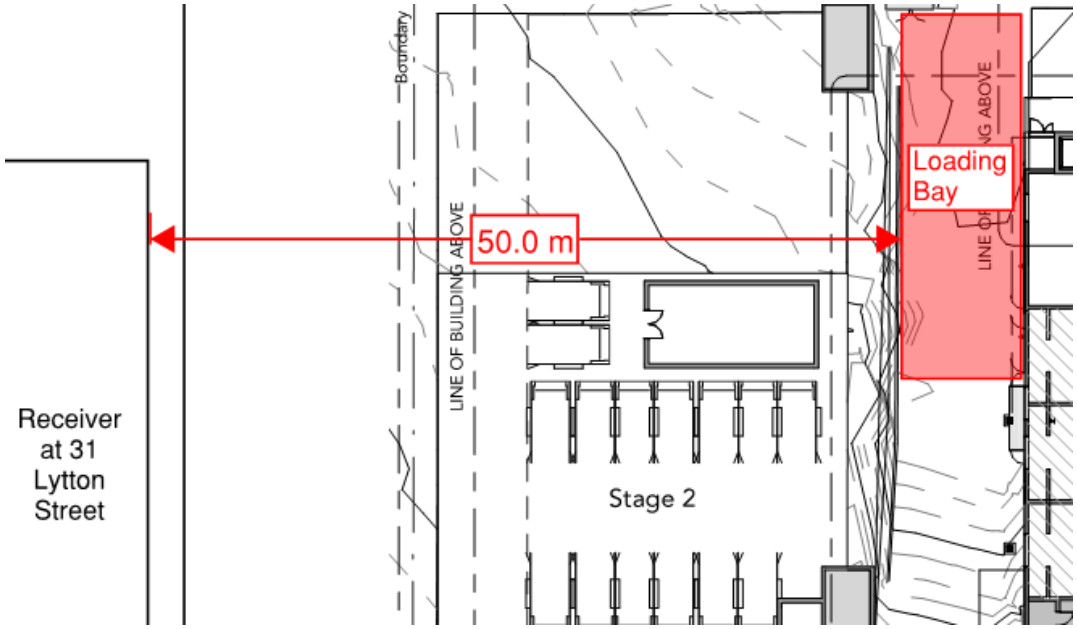

Figure 6: Loading Bay Location

The following assumptions have been used for the prediction of noise emissions from the loading bay:

- One delivery during assessment period, activities include arrival, unloading, vehicle start-up, reversal and departure.
- It is understood that deliveries will occur between 6am and 12pm, therefore the worst-case scenario will be deliveries occurring during the night-time period (6am – 7am).
- Assessment period to be 15 minutes.
- Assumed nearest residential receiver is the residential receiver at 31 Lytton Street.

The predicted noise levels are shown below in Table 16.

Calculation	*Noise Levels, dB(A)*
$L_{Aeq,\ 15minutes}$ of loading bay operations	67
Directivity / Reflection / Shielding Correction	3
Distance attenuation (50m), dB	-34
Resulting level at receiver boundary	**36**
Noise Level Criterion Night-Time / Complies?	**42** / Yes

Table 16: Loading bay noise assessment.

Based on the noise assessment, operational noise associated with use of the loading bay meets the required noise level criteria (background + 0dB) during the night-time period (6am – 7am). However, it is recommended that deliveries will not take place between 10:00pm and 7:00am in order to minimise any potential risk.

5.3 TRAFFIC GENERATION NOISE

The traffic impact report for the proposed development prepared by Traffix (dated October 2021) provides an analysis of the existing traffic flows and the predicted increase due to traffic generation from the proposed development. This is summarised in the Table 17.

Road	*Direction*	*Weekday Morning Peak*		*Weekday Afternoon Peak*	
		Current	*Predicted increase*	*Current*	*Predicted increase*
Lytton Street	Northbound	194	+6	137	+14
	Southbound	110	+6	94	+14

Table 17: Two-way peak hour traffic flows plus traffic generated by the proposed development.

As noted in Section 4.5.1, when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational) the NSW Road Noise Policy (RNP) states that an increase up to 2.0dB in relation to existing noise levels is anticipated to be insignificant. As shown in Table 18, the increase of traffic noise levels due to the proposed development, is less than the maximum allowable increase of 2.1dB(A).

Road	*Direction*	*Weekday Morning Peak*	*Weekday Afternoon Peak*
		Increase $L_{Aeq,1hour}$ dB(A)	
Lytton Street	Northbound	+0.1	+0.4
	Southbound	+0.2	+0.6

Table 18: Predicted noise level increase due to traffic movements from the proposed development.

Therefore, the traffic increase due to the proposed development will not result in any noticeable change in traffic noise levels and is expected to meet the NSW Road Noise Policy requirements.

5.4 SLEEP AROUSAL

A sleep disturbance has been conducted for both carpark areas. The sleep arousal assessments have considered the following assumptions:

- Shift changes times are understood to be 6am – 7:30am and & 1:30pm – 3pm, therefore the worst-case scenario for car-park noise is during the night-time period (6am – 7am).
- Noise level has been considered as continuous over a 15 minute assessment period to provide the worst-case scenario.
- Car noise levels are based on the highest value of the maximum sound power level range for a worst-case scenario.
- Noise predictions are based on distance attenuation, ground reflection, building reflection/shielding and directivity.

- Where internal noise levels are predicted, a typical bedroom size was assumed and a 10dB reduction in noise level applied through open windows for natural ventilation.

5.4.1 BASEMENT CAR PARK

Due to the staff shift changes, a sleep arousal noise assessment of the car movements from the basement carpark has been carried out. It is expected that vehicles will be moving slowly (approx. 10km/h) and the number of vehicle movements during night-time will be low compared with day-time and evening-periods. Figure 7 shows the approximate distance from the basement carpark to the nearest noise sensitive receiver.

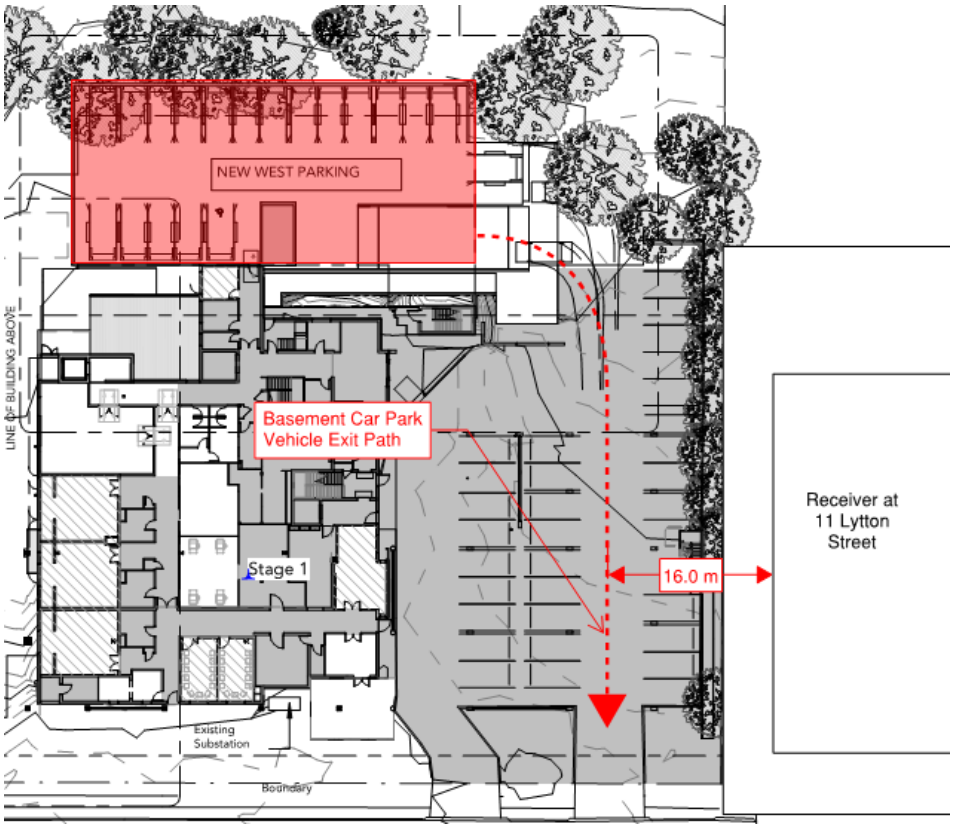

Figure 7: Basement Car Park Vehicle Path.

For the sleep arousal assessment purpose, departing car noise impact from the development are likely to generate the noise level range as per Table 19.

Noise Source	*Maximum Sound Power Level dB(A), ref 1pW*
Car Accelerating (L_{Aeq})	82-87

Table 19: Noise level range for car departures from the development.

Refer to Table 20 and Table 21 for the results of the sleep disturbance assessment.

Calculation	*Overall A-Weighted Noise Level, in dB(A)*
L_{Aeq} *of vehicle movement accelerated at 1m*	82
Distance attenuation (16m), dB	-24
1 minute over 15 minutes operations time correction, dB	-12
$L_{Aeq,15min}$ *resulting at residential façade*	46
NPI Sleep Arousal Criteria. Condition 1 / Complies?	47 / Yes

Table 20: Sleep arousal noise assessment at residential receiver from vehicle departures during night-time. Condition 1.

Calculation	*Maximum Sound Power Level dB(A), ref 1pW*
L_{Amax} *of vehicle movement accelerated at 1m*	87
Distance attenuation to facade (16m), dB	-24
L_{Amax} *resulting at residential façade*	63
L_{Amax} *resulting within a bedroom with windows open*	53
NPI Sleep Arousal Criteria. Condition 2 / Complies?	57 / Yes

Table 21: Sleep arousal noise assessment at residential receiver from vehicle departure during night-time. Condition 2.

Based on the above, internal noise levels are at a level that according to NSW RNP are unlikely to cause awakening reactions.

5.4.2 ON-GRADE CAR PARK

A sleep disturbance of the on-grade carpark has been conducted due to the staff shift changes occurring during the night-time period (6:00am to 7.30am). Figure 8 shows the approximate distance from the on-grade carpark to the nearest noise sensitive receiver at 31 Lytton Street.

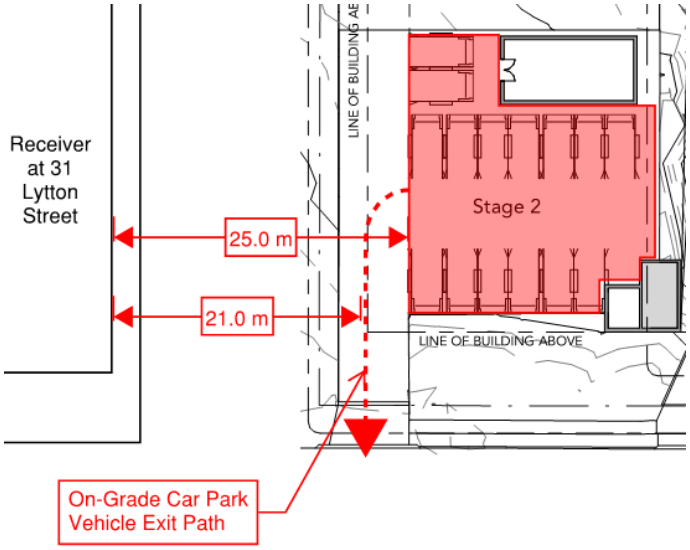

Figure 8: On-Grade Car park vehicle exit path.

For the sleep arousal assessment purpose, departing car movements from the development are likely to generate the noise level ranges as per Table 22.

Noise Source	*Maximum Sound Power Level dB(A), ref 1pW*
Car Accelerating (L_{Aeq})	82-87
Car door Slam (L_{Amax})	92

Table 22: Noise level range for car departures from the on-grade car park

Refer to Table 23 and Table 24 for the results of the on-grade carpark sleep disturbance assessment.

Calculation	*Overall A-Weighted Noise Level, in dB(A)*
L_{Aeq} of vehicle movement accelerated at 1m	82
Distance attenuation (21m), dB	-26
1 minute over 15 minutes operations time correction, dB	-12
$L_{Aeq,15min}$ resulting at residential façade	**44**
NPI Sleep Arousal Criteria. Condition 1 / Complies?	**47 / Yes**

Table 23: Sleep arousal noise assessment at residential receiver from vehicle departures during night-time. Condition 1

Calculation	*Maximum Sound Power Level dB(A), ref 1pW*
L_{Amax} of car door slam at 1m	92
Distance attenuation to facade (25m), dB	-28
L_{Amax} resulting at residential façade	64
L_{Amax} resulting within a bedroom with windows opened	**54**
NPI Sleep Arousal Criteria. Condition 2 / Complies?	**57 / Yes**

Table 24: Sleep arousal noise assessment at residential receiver from vehicle departure during night-time. Condition 2.

Based on the above, internal noise levels are at a level that according to NSW RNP are unlikely to cause awakening reactions.

6 NOISE INTRUSION

A noise assessment for traffic noise intrusion on the development from Lytton Street has been carried out. Noise levels at the most affected façade of the building from the road have been predicted in accordance with the Calculation of Road Traffic Noise (CoRTN) methodology and the noise surveys results in Section 3. This method is recognized and endorsed by regulatory authorities around Australia.

The acoustic assessment has been based on the following:

- Worst affected facades are considered to be facing Lytton Street.
- Worst-case scenario has been established as the night-time period (10pm-7am).
- Detailed noise survey as shown in Section 3.
- Receivers within bedrooms have been located at 3m above ground level.
- Apartment areas based on architectural drawings provided by Team Architects.
- Solid sections of the façade with a sound reduction index of R_W50.
- No specific meteorological characteristics such as dominant wind direction and speed or temperature.

Based on the assessment, recommended glazing systems and their corresponding sound insulation performances are presented below in Table 25.

Location	*Glazing*	*Min. R_W Rating*
Glazing within Facades overlooking Lytton Street	6.38mm Laminated	32

Table 25: Glazing Recommendations.

Based on the above, we consider that traffic noise break-in will not be an issue if a typical façade design and the nominated glazing recommendations are followed. Nevertheless, the acoustic design of the façade is to be progressed further throughout the design stage.

7 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 a preliminary noise assessment, general 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 development.

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.

7.1 RELEVANT STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 4.5.3 of this report contains the relevant legislation, codes and standards in addition to construction noise and vibration criteria for this project.

Table 26 below shows the NMLs of the identified noise sensitive receivers surrounding the site.

Sensitive Receiver ID	*Receiver Type*		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
			Within Standard Hours	*Outside Standard Hours*
1, 2, 3, 4, 6 and 7	Residential	Noise affected / External	54	49
		Highly noise affected / External	75	N/A
5	Public Recreation	Noise affected / External	65	65

Table 26: Surrounding noise sensitive receivers and their NMLs.

Assumed worst-affected noise sensitive receivers are 2, 3 and 4 as receiver 1 will be shielded by the existing building and receivers 6 and 7 are further away than the assumed worst-affected 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.

7.2 ASSUMPTIONS

7.2.1 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 NSW EPA hours. Noise control measures are to be implemented during these hours following consultation and engagement with the community.

Respite periods should generally be implemented into the work methodology in order to reduce the impact onto the surrounding noise sensitive receivers. The following general respite periods should be applied during these phases of demolition and excavation, primarily due to the use of rock breakers and excavators:

- No use of rock breakers or large excavation equipment before 8am or after 5pm.
- Rock breaking and excavation should not occur for more than 3 hours continuously, and at least a 1-hour respite period in between.

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.

7.2.2 TYPICAL EQUIPMENT AND NOISE LEVELS

In order to assess potential noise and vibration impacts during works from a quantitative point of view, the following construction noise sources for the works occurring during the project and the associated equipment noise levels have been assumed as typical plant and they are listed in Table 27.

These levels are based on the databases published by Australian Standard 2436:2010 *'Guide to Noise Control on Construction, Maintenance & Demolition Sites'*, Roads and Maritime Services '*Construction Noise and Vibration Guideline'* and the UK Department for Environmental, Food and Rural Affairs (DEFRA).

Stage of works	*Item*	*Typical Noise Level (dB ref 1pW)*	*Typical Sound Pressure Level L_{Aeq} at 10m (dB ref 20μPa)*
Demolition	30t Excavator	117	89
	Truck (>25tonne)	114	86
	Front end loader	116	88
	Excavator Rock breaker	119	91
	Demolition Saw	116	88
Earthworks	30t Excavator	117	89
	Truck (>20tonne)	107	79
	Bored Piling Rig	116	88
	Front end loader	116	88
Structure	Concrete pump	110	82
	Concrete mixer	112	84
	Mobile Crane	104	76
	Electric Hand-Tools	102	74
	Angle grinders	102	74
Façade	Mobile Crane	104	76
	Electric Hand-Tools	102	74

Table 27: Anticipated maximum airborne noise levels for equipment / plant used during the different stages of the works.

7.3 PRELIMINARY CONSTRUCTION AND VIBRATION NOISE ASSESSMENT

A preliminary construction noise assessment has been carried out based on typical plant and machinery assumed throughout the construction stages. The preliminary noise assessment has been considered at the nearest existing noise sensitive receivers.

7.3.1 NOISE ASSESSMENT METHODOLOGY

An assessment of the likely noise and vibration impacts of the assumed stage of works on the most affected noise sensitive receivers surrounding the site has been carried out. The assessment has been considered the following:

- Typical construction activities considered in the noise assessment are detailed in Section 7.2.2.
- Proposed construction hours as per Section 7.2.1.
- Typical noise source levels considered in the noise assessment are detailed in Section 7.2.2.
- Project specific noise criteria at noise sensitive receivers as outlined in Section 4.6 and Table *26*.
- The predictions consider continuous operation of the construction plant over the 15-minute assessment period plus a range of distances from the site boundaries.

It should be noted that the predicted noise levels generated during the construction works may vary depending on many factors including:

- Final selection of plant and equipment which could differ from the plant presented in Table 27.
- Exact location of equipment and plant on site – relative to the noise sensitive receivers.
- Shielding of noise provided by structures and hoardings on and around the site.
- Reflections provided by existing structures on and around the site.

7.3.2 NOISE ASSESSMENT

Refer to Sections below for the predicted noise levels for the assumed stages of work as detailed in 7.2.2. These levels are typically representative of the worst case 15 minutes that would be expected. The predicted noise levels at noise sensitive receiver locations are calculated to 1.5m above ground level, at the most affected point.

It is noted that if construction noise impacts associated with the proposed development are controlled at the nearest sensitive receivers, then compliance with the recommended criteria at all noise sensitive receivers will be achieved. Therefore, noise sensitive receivers 2, 3 and 4 have been modelled in the tables below for being the nearest sensitive receivers.

The ICNG requires, and it is usual practice, to predict the reasonable worst-case noise level. For construction-type activities this will typically be when plant is operating close to an assessment location. However, it shall be considered that on larger construction sites (such as this one) where plant moves around, noise will not be at the reasonable worst-case noise level throughout the entire duration of the activity: it will be lower when the plant is further away. Therefore, it can be stated that noise levels will be lower at times throughout the construction activity.

Two assessments for each assumed stage of construction have been conducted:

1. Construction activities occurring at distances of between 5m and 40m from the boundary of the site without a hoarding around the construction site.
2. Construction activities occurring at distances of between 5m and 40m from the boundary of the site with a 2.4m high hoarding around the construction site.

7.3.2.1 Demolition

Table 28 shows the predicted range of sound pressure levels of demolition activities occurring at distances of between 5m and 40m from the boundary of the site without a hoarding around the construction site.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – no hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
30t Excavator	117	69-51	69-51	71-53
Truck (>25tonne)	114	66-48	66-48	68-50
Front end loader	116	68-50	68-50	70-52
Excavator Rock breaker	119	71-53	71-53	73-55
Demolition Saw	116	68-50	68-50	70-52
Total	---	76-58	76-58	78-60

Table 28: Predicted airborne noise levels for equipment used during demolition works at the nearest residential receivers.

Table 29 shows the predicted range of sound pressure levels of demolition activities occurring at distances of between 5m and 40m with a 2.4-metre-high hoarding around the construction site. Allowances have been made for distances attenuation and reflections.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – with hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
30t Excavator	117	54-37	54-37	56-39
Truck (>25tonne)	114	51-34	51-34	53-36
Front end loader	116	53-36	53-36	55-38
Excavator Rock breaker	119	56-39	56-39	58-41
Demolition Saw	116	53-36	53-36	55-38
Total		61-44	61-44	63-46

Table 29: Predicted airborne noise levels for equipment used during demolition works at the nearest residential receivers with a 2.4-metre-high hoarding around the construction site.

Results show that without the hoarding around the construction site all predicted demolition activities are expected to cause exceedances of the NML (orange font) at close distances for the nearest residential

receivers. The Highly Affected Noise level of 75dB(A) (red font) is predicted to be exceeded at the nearest residential receivers when plant activities are running cumulatively at close distances.

With the hoarding around the construction site, all predicted demolition activities, except the excavator with rock breaker attachment and demolition saw, are predicted to be within the NML for residential receivers 2 and 3 at close and far distances. The 30-tonne excavator, excavator with rock breaker and demolition saw are expected to exceed the NML at close distances for residential receiver 4. The NML of all the nearest residential receivers is also predicted to be exceeded with all plant activities are running cumulatively at close distances.

The predicted exceedance of the NMLs in the nearest residential receivers triggers the proponent to apply all reasonable and feasible work practices to minimise the noise as much as possible and community consultation for the noisy construction activities, as per the requirements of the ICNG. Refer to Section 7.4 for details.

7.3.2.2 Earthworks

Table 30 shows the predicted range of sound pressure levels of earthworks activities occurring at distances of between 5m and 40m from the boundary of the site without a hoarding around the construction site.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – no hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
30t Excavator	117	69-51	69-51	71-53
Truck (>20tonne)	107	59-41	59-41	61-43
Bored Piling Rig	116	68-50	68-50	70-52
Front end loader	116	68-50	68-50	70-52
Total	---	73-55	73-55	76-58

Table 30: Predicted airborne noise levels for equipment used during earthworks works at the nearest residential receivers.

Table 31 shows the predicted range of sound pressure levels of earthworks activities occurring at distances of between 5m and 40m with a 2.4-metre-high hoarding around the construction site. Allowances have been made for distances attenuation and reflections.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – with hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
30t Excavator	117	54-37	54-37	56-39
Truck (>20tonne)	107	44-27	44-27	46-29
Bored Piling Rig	116	53-36	53-36	55-38
Front end loader	116	53-36	53-36	55-38
Total	---	58-41	58-41	61-44

Table 31: Predicted airborne noise levels for equipment used during earthworks works at the nearest residential receivers with a 2.4-metre-high hoarding around the construction site.

Results show that, without the hoarding around the construction site, all predicted earthworks activities are predicted to exceed the NML (orange font) when at close distances at the nearest residential receivers. The

Highly Affected Noise level of 75dB(A) (red font) is predicted to be exceeded at receiver 4 with all plant activities are running cumulatively at close distances.

With the hoarding around the construction site, all predicted earthworks activities were within the NML for residential receivers 2 and 3 at close and far distances. All earth-works activities, except the truck, are predicted to exceed the NML at close distances for residential receiver 4. The NML of all the nearest residential receivers is predicted to be exceeded with all plant activities are running cumulatively at close distances.

The predicted exceedance of the NMLs in the nearest residential receivers triggers the proponent to apply all reasonable and feasible work practices to minimise the noise as much as possible and community consultation for the noisy construction activities, as per the requirements of the ICNG. Refer to Section 7.4 for details.

7.3.2.3 Structure

Table 32 shows the predicted range of sound pressure levels of structural activities occurring at distances of between 5m and 40m from the boundary of the site without a hoarding around the construction site.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – no hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
Concrete pump	110	62-44	62-44	64-46
Concrete mixer	112	64-46	64-46	66-48
Mobile Crane	104	56-38	56-38	58-40
Electric Hand-Tools	102	54-36	54-36	56-38
Angle grinders	102	54-36	54-36	56-38
Total	---	67-49	67-49	69-51

Table 32: Predicted airborne noise levels for equipment used during structural works at the nearest residential receivers.

Table 33 shows the predicted range of sound pressure levels of structural activities occurring at distances of between 5m and 40m with a 2.4-metre-high hoarding around the construction site. Allowances have been made for distances attenuation and reflections.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – with hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
Concrete pump	110	47-30	47-30	49-32
Concrete mixer	112	49-32	49-32	51-34
Mobile Crane	104	41-24	41-24	43-26
Electric Hand-Tools	102	39-22	39-22	41-24
Angle grinders	102	39-22	39-22	41-24
Total	---	52-35	52-35	54-37

Table 33: Predicted airborne noise levels for equipment used during structural works at the nearest residential receivers with a 2.4-metre-high hoarding around the construction site.

Results show that, without the hoarding around the construction site, all the structural activities except the electric hand tools and angle grinder, are predicted to exceed of the NML (orange font) at the nearest residential receivers 2 and 3 at close distances. All structural activities, without the hoarding around the construction site, are predicted to exceed the NML for residential receiver 4 at close distances. Without the hoarding, the NML of all the nearest residential receivers is predicted to be exceeded with all plant activities are running cumulatively at close distances.

With the hoarding around the construction site, all of the structural activities, including a cumulative total, are predicted to be within the NML for all the nearest residential receivers at close and far distances.

7.3.2.4 Façade

Table 34 shows the predicted range of sound pressure levels of façade activities occurring at distances of between 5m and 40m from the boundary of the site without a hoarding around the construction site.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – no hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
Mobile Crane	104	56-38	56-38	58-40
Electric Hand-Tools	102	54-36	54-36	56-38
Total	---	58-40	58-40	61-43

Table 34: Predicted airborne noise levels for equipment used during façade works at the nearest residential receivers.

Table 35 shows the predicted range of sound pressure levels of façade activities occurring at distances of between 5m and 40m with a 2.4-metre-high hoarding around the construction site. Allowances have been made for distances attenuation and reflections.

Item	*Typical Noise Level (dB ref 1pW)*	*Predicted Noise Levels $L_{Aeq,15min}$, dB(A) (re. 20μPa) – with hoarding*		
		Receiver 2	*Receiver 3*	*Receiver 4*
Mobile Crane	104	47-30	47-30	49-32
Electric Hand-Tools	102	39-22	39-22	41-24
Total	---	48-31	48-31	50-33

Table 35: Predicted airborne noise levels for equipment used during façade works at the nearest residential receivers with a 2.4-metre-high hoarding around the construction site.

Results show that, without the hoarding around the construction site, the mobile crane, at close distances, is predicted to exceed the NML (orange font) for the nearest residential receivers. Electric hand tools are also predicted to exceed the NML at residential receiver 4 at close distances. Without the hoarding, the NML of all the nearest residential receivers is predicted to be exceeded (orange font) when all plant is running cumulatively at close distances.

Results show that, with hoarding around the construction site, all façade activities, including a cumulative total, are predicted to be within the NML for the nearest residential receivers.

7.3.3 VIBRATION ASSESSMENT

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 36.

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	Hand held	1m	Avoid Contact with Structure

Table 36: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

For any vibration intensive plant expected to be within close 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.

7.4 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 Construction Noise and Vibration Management Plan and undertake noise and vibration monitoring for the duration of the project.

7.4.1 SPECIFIC NOISE CONTROL MEASURES

7.4.1.1 Construction Site Boundary

Acoustic screening is recommended during all phases of the construction work, except for the internal refurbishments works. The acoustic screening should be 2.4m high acoustic screen (Class A hoarding or equivalent) and constructed from minimum 19mm thick plywood or similar mass surface, and be free of any air gaps.

7.4.1.2 Impact to Existing Premises

To minimise the noise and vibration impacts to the existing premises of the development, the following noise control measures are recommended:

- Incorporate respite periods for noisy activities as per Section 7.2.1.
- Provide information to clinic staff before and during construction.
- Implement all feasible and reasonable measures to address the noise source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any

adverse noise impacts to clinic patients and staff are minimised when noise goals cannot be met due to space constraints.

7.4.2 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.

  - 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.
- *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.

7.4.3 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 the CNVMP 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 noise sensitive receivers are minimised when noise goals cannot be met due to safety or space constraints.

7.4.4 CONSULTATION AND NOTIFICATION

The community is more likely to be understanding and accepting of noise if the information provided is frank, does not attempt to understate the likely noise level, and if commitments are firmly adhered to. Recommended actions before and during construction:

- Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside standard hours, inform affected residents and other sensitive land use occupants between 5 and 14 days before commencement.

- Provide information to neighbours before and during construction through media such letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English.
- If unplanned noisy works are required, provide information to neighbours through letterbox drops with a minimum of 24 hours' notice.
- Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. The signage should be clearly visible from the outside and include after-hours emergency contact details.
- Maintain good communication between the community and project staff.
- Appoint a community liaison officer where required.
- For larger projects, consider a regular newsletter with site news, significant project events and timing of different activities.
- Provide a toll-free contact phone number for enquiries during the works.
- Facilitate contact with people to ensure that everyone can see that the site manager understands the potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.
- Depending on the level of community interest and feedback in the first three months of the construction phase, the Principal and Contractor may consider the establishment of supplementary community forums to enable information and feedback. This may include activities such as a community liaison committee.

To assist in the management of noise and vibration complaints, various procedures are to be followed. These include:

- Clearly visible signage identifying any key personnel along with their contact details to be erected along the perimeter of the building site including a 24 hour contact name, phone number and email address provided for the resident to address any complaint.
- Give complaints a fair hearing.
- Have a documented complaint process, including an escalation procedure so that if a complaint is not satisfied there is a clear path to follow.
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance.
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information.
- Assign the issue to the appropriate staff for resolution.
- Try to ascertain from the complaint which equipment / plant is causing the problem.
- Where necessary, establish from the monitoring equipment and or attended monitoring if the allowable noise and vibration levels have been complied with.
- Establish if the equipment / plant positioning has previously been highlighted as a problem area. If not, and the noise levels are above the allowable limits, then the equipment / plant and its position shall be noted.
- Implement all feasible and reasonable measures to address the source of the complaint plus advise the individual who raised the issue of the resolution.

- Follow-up corrective measures after seven days to ensure that they are satisfactory.
- The Communications Register is to be kept by the Contractor to keep a record of complaints and detail any information associated with them. The registration of a particular item will remain open until the compliant has been appropriately dealt with. The contents of the register will include:
  - The name and the address of the complaint
  - Time and date of the complaint
  - The nature of the complaint (Noise/Vibration)
  - Subsequent details
  - Remedial action undertaken

The contents of the Communications Register will be maintained and updated with any new complaint without delay. The report will be reported to both Authority and the Contractor. The investigation of the complaint and any remedial actions will be performed by the builder and/or client representative. Client representative will need to be informed of any and all complaints regarding noise and remedial actions undertaken.

8 SUMMARY AND CONCLUSIONS

A noise and vibration impact assessment has been carried out for the proposed extension to the existing Northside West Clinic in Wentworthville. This report forms part of the documentation package submitted to the Department of Planning, Industry & Environment as part of the State Significant Development Application (SSD-17899480).

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development. Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

At this stage, mechanical plant selections have not been made. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the mechanical plant of the proposed development to the nearest sensitive receivers.

Noise from the loading bay is expected to meet the required criteria.

The traffic noise impact due to number of vehicles due to the proposed development – based on the information provided in the traffic report – is anticipated to be insignificant, as the noise levels will not increase more than 2dB at the sensitive noise receivers. It is not expected that vehicles exiting the proposed development during the night-time period will cause awakenings.

Noise break-in from traffic noise has been assessed for the external glazing facing Lytton Street. Minimum sound insulation rating of the glazing shall be R_W32 in order to control the internal noise levels as per the nominated criteria shown in Section 4.

A preliminary construction noise assessment has been carried out with assumed construction plant and stages. Based on the results, the noise levels associated with some normal construction works are expected to exceed the NML criteria in accordance with the ICNG Guideline. Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures – to be provided in a detailed Construction Noise & Vibration Management Plan prepared by a qualified acoustic consultant prior to the Construction Certificate once construction plant and stages will be known.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

APPENDIX A: LONG-TERM NOISE MONITORING

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

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

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

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

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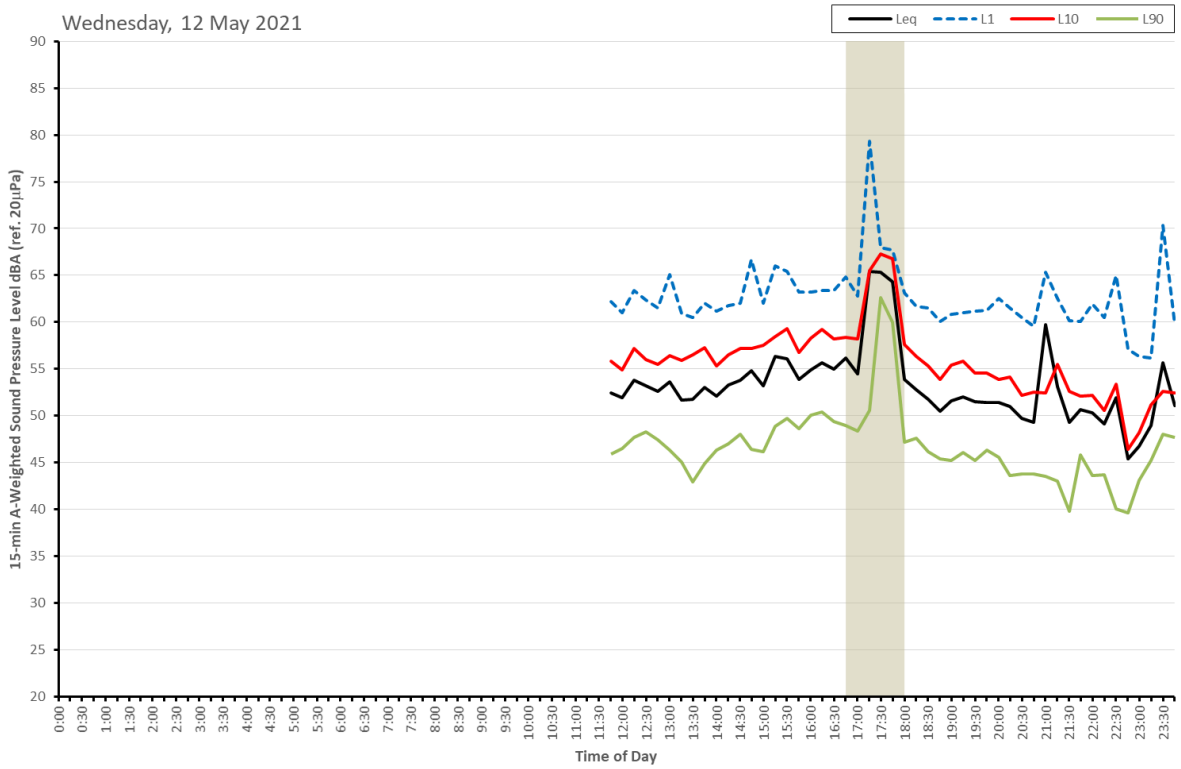
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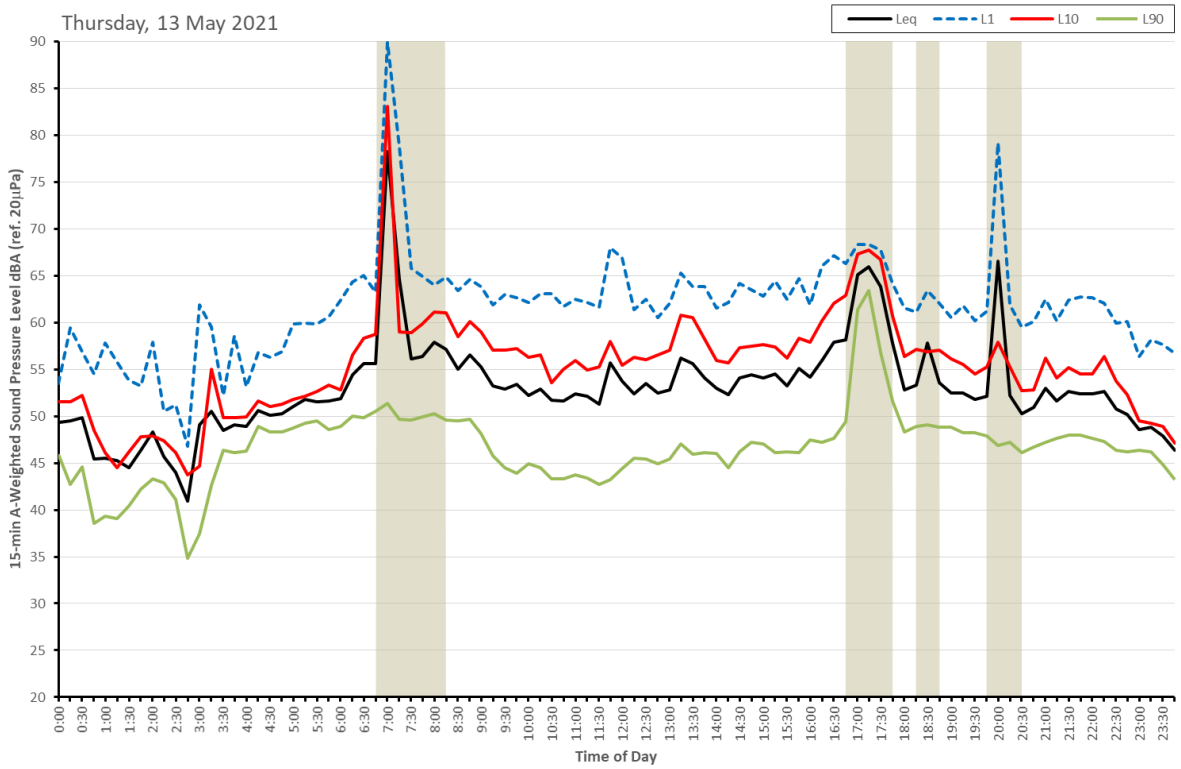
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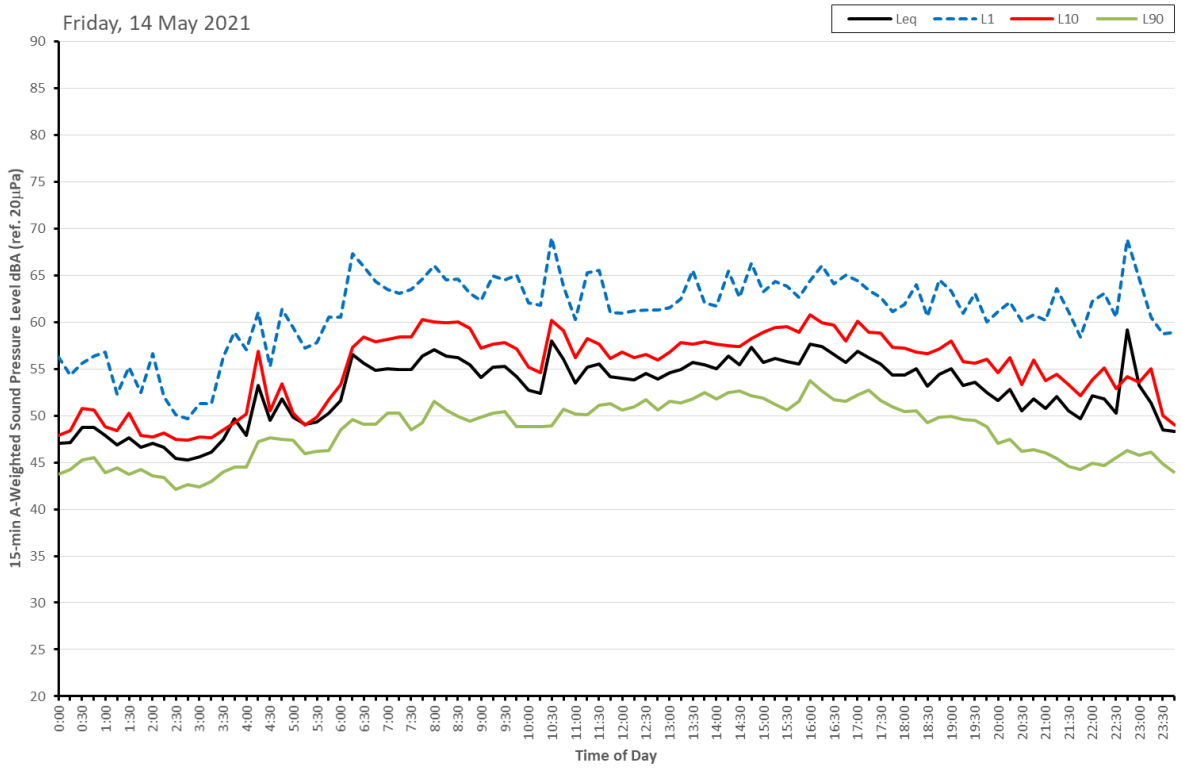
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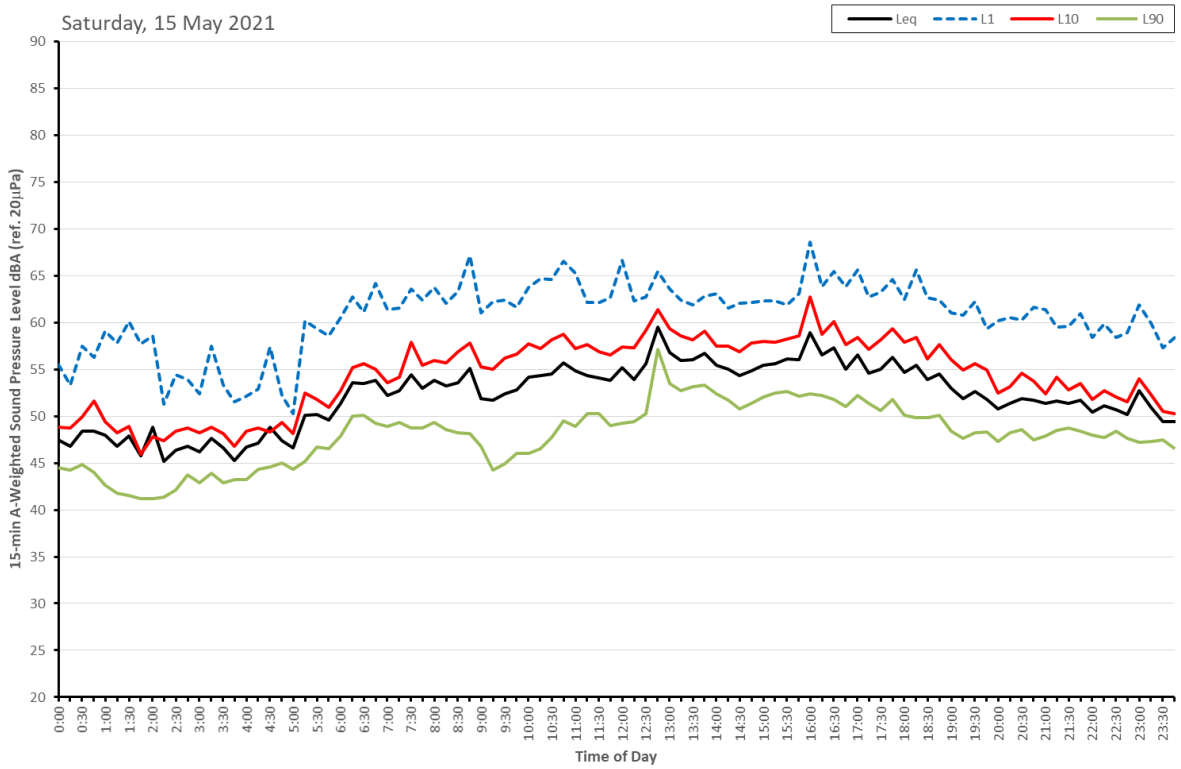
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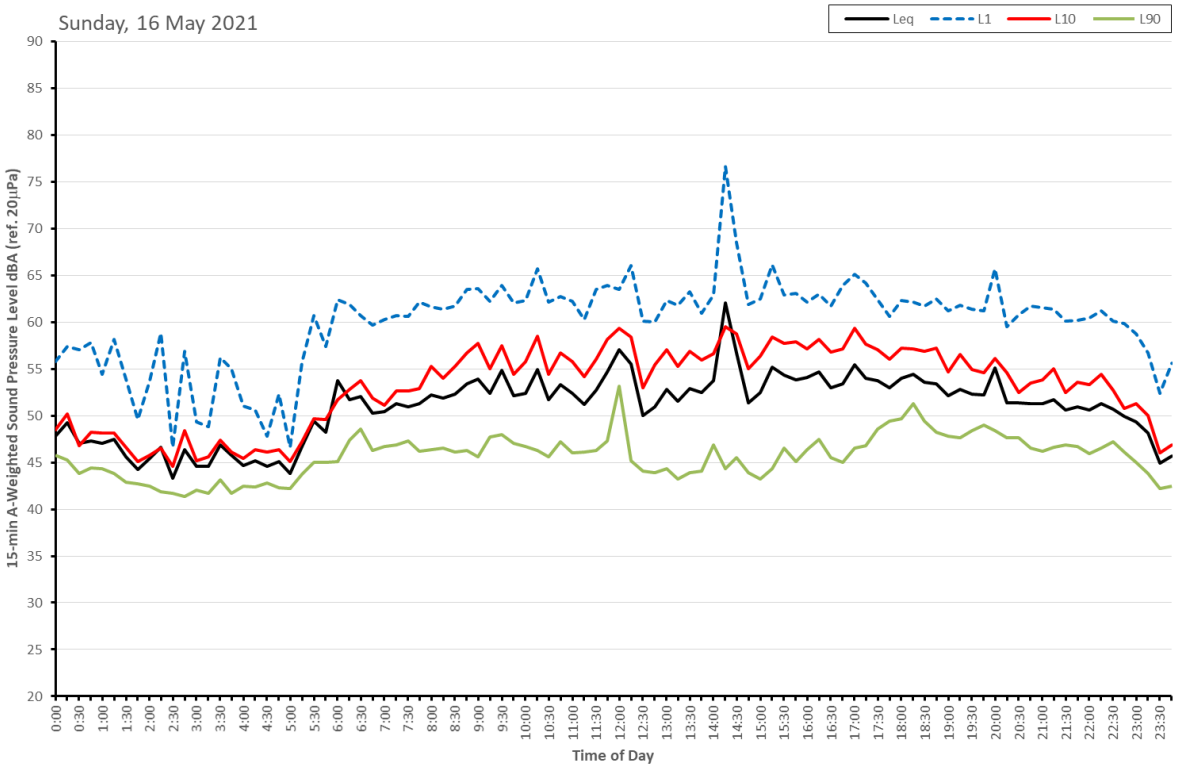
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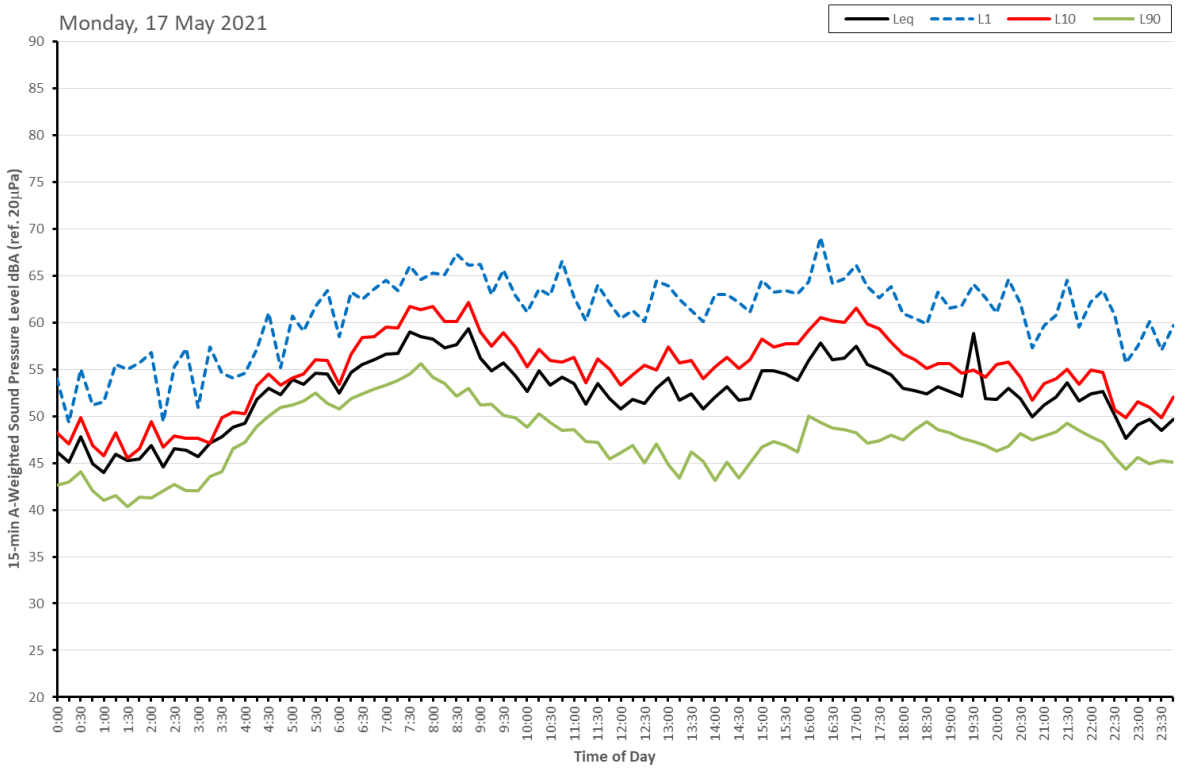
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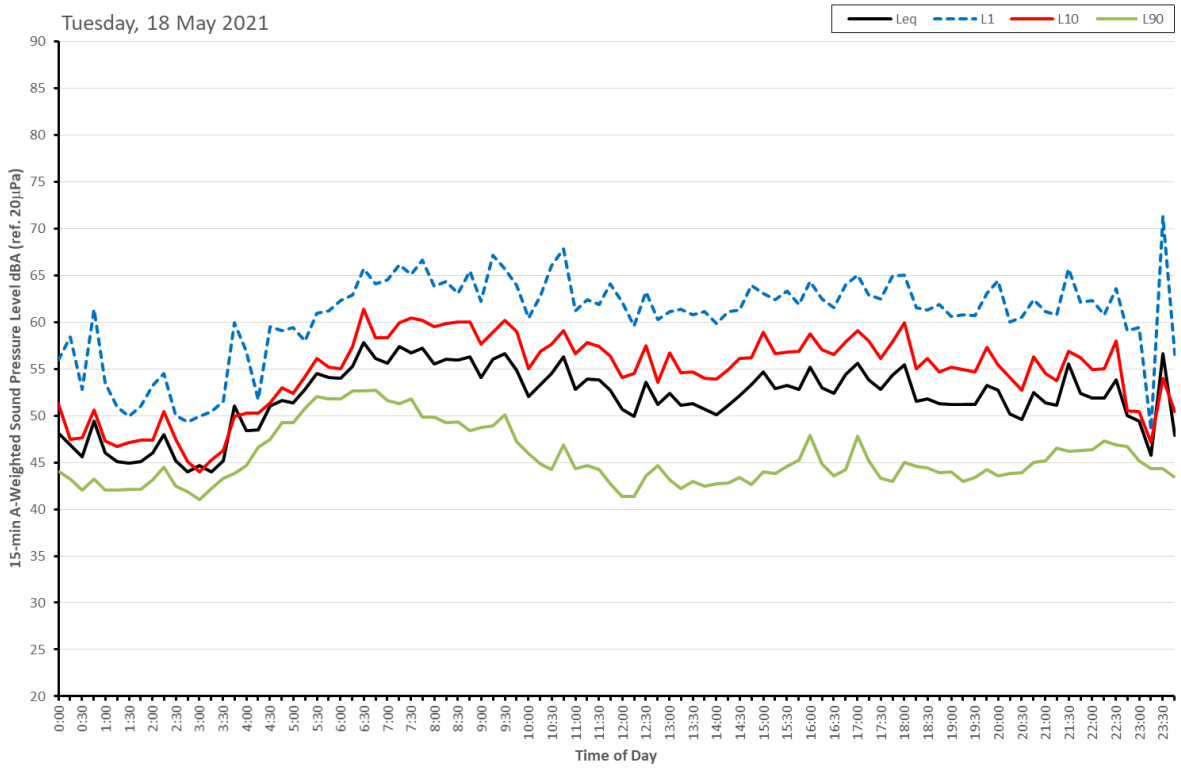
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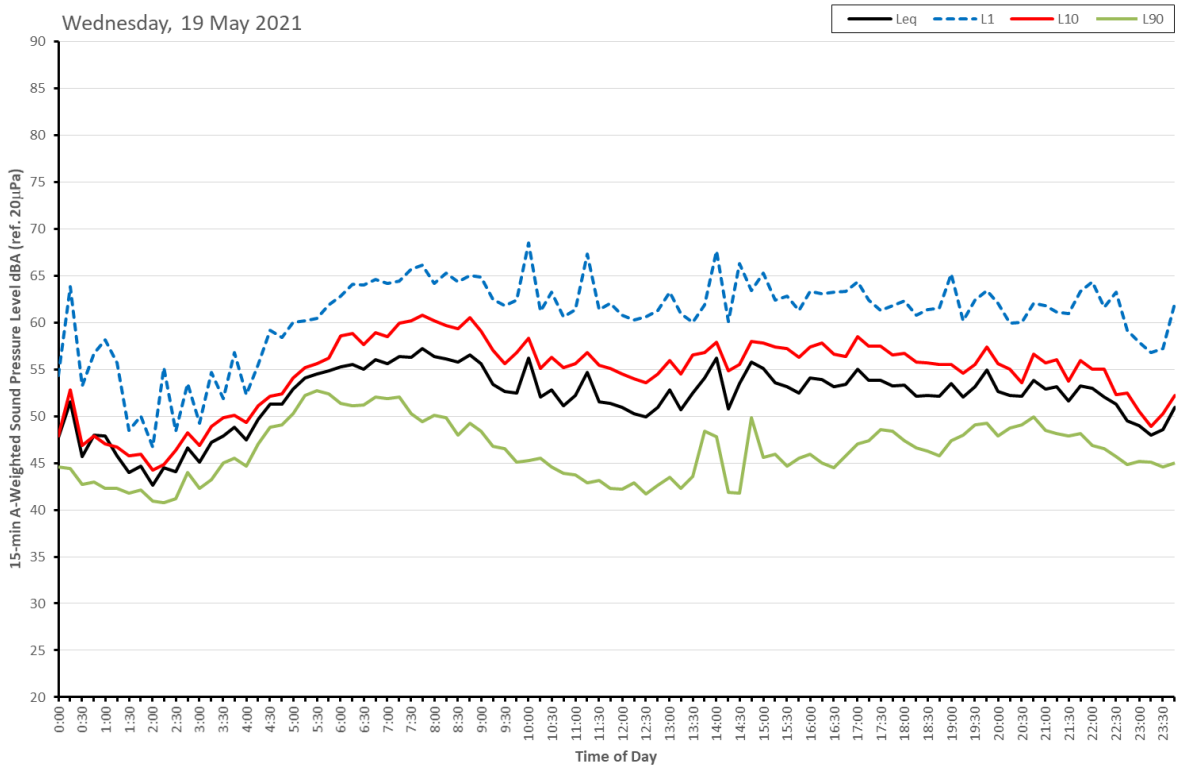
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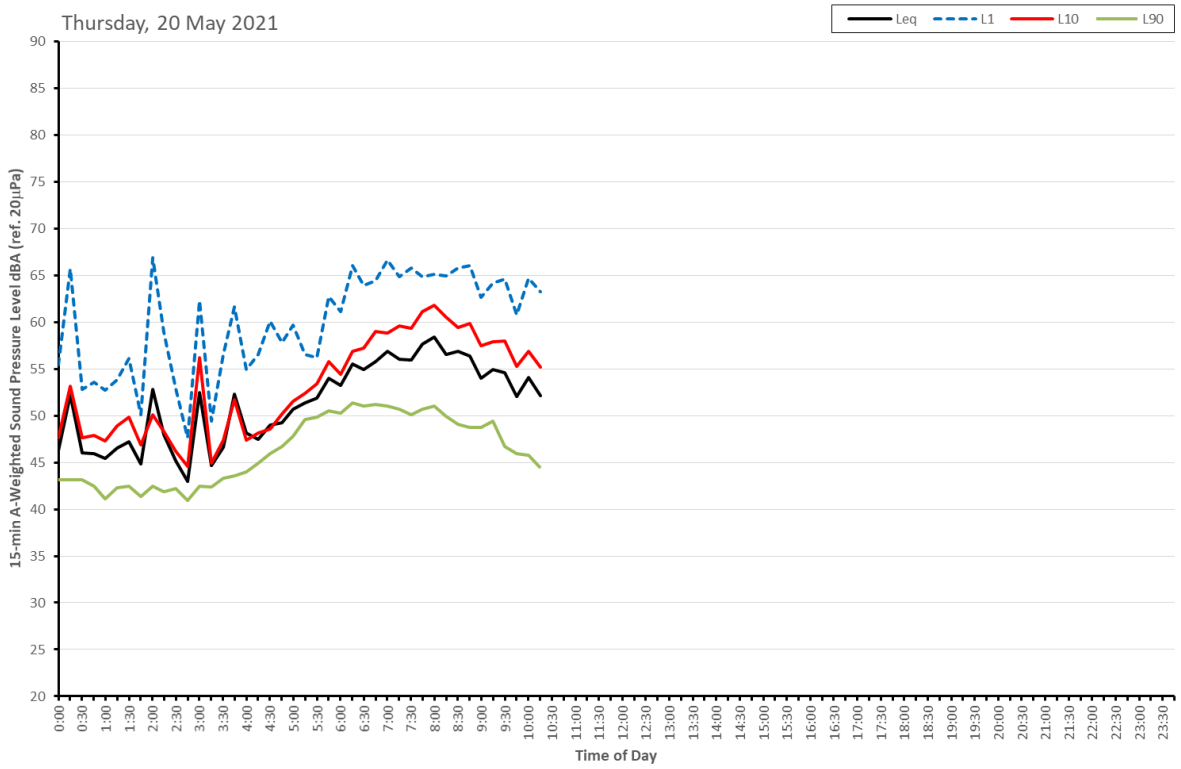
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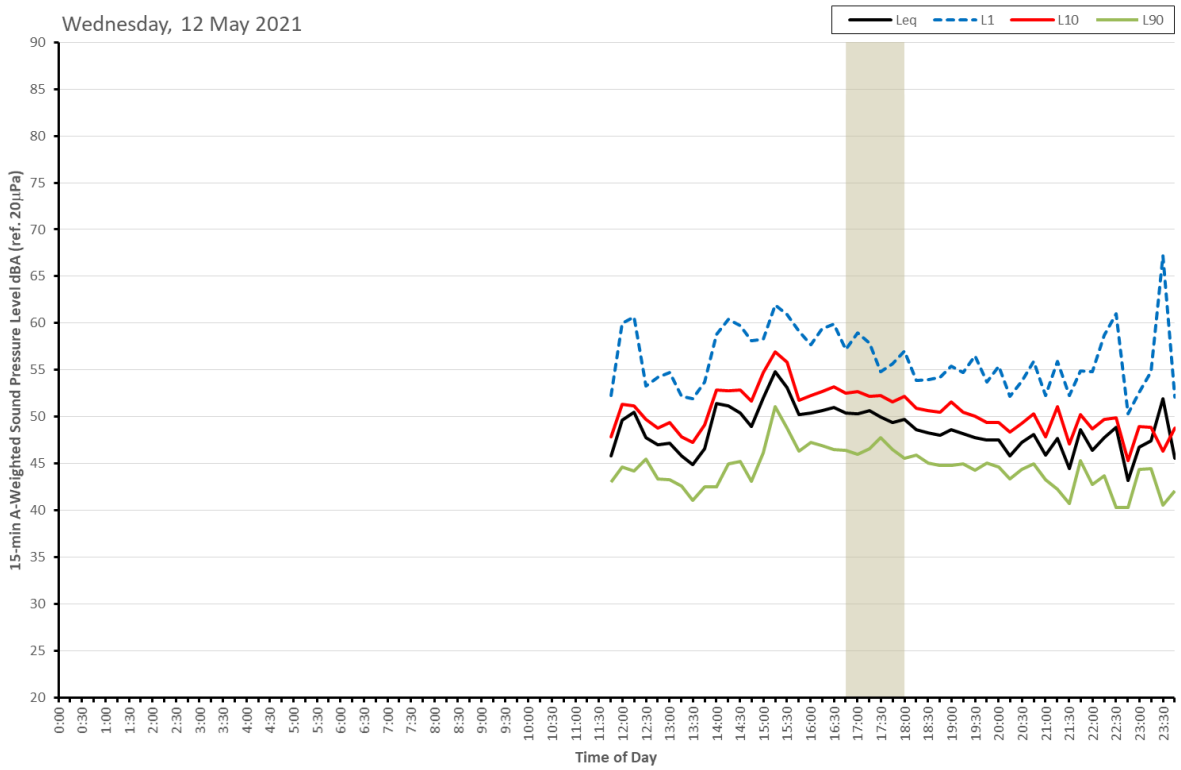
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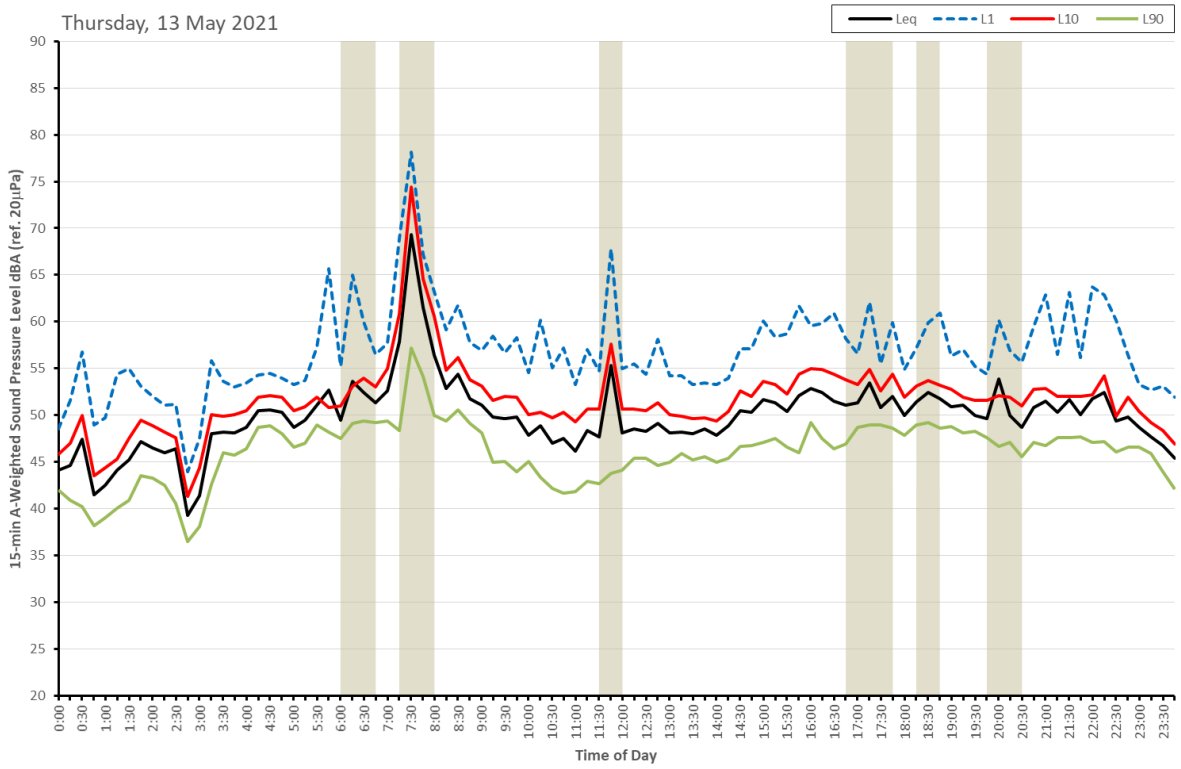
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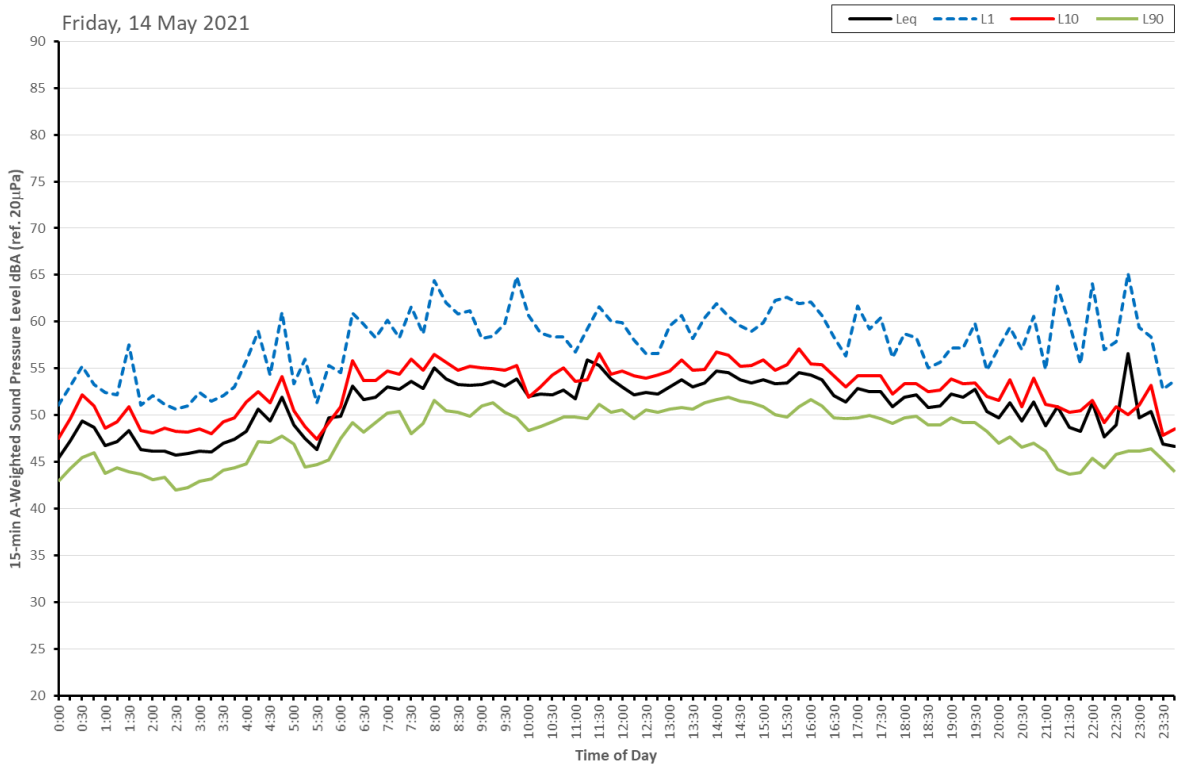
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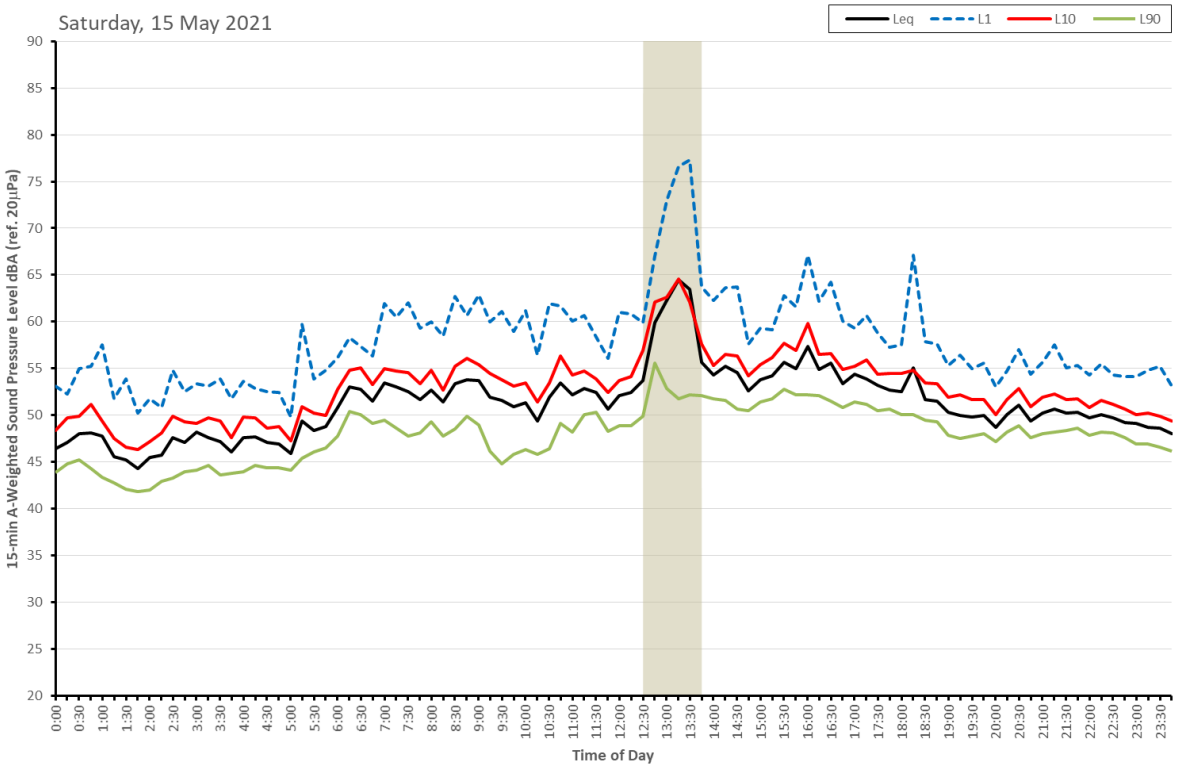
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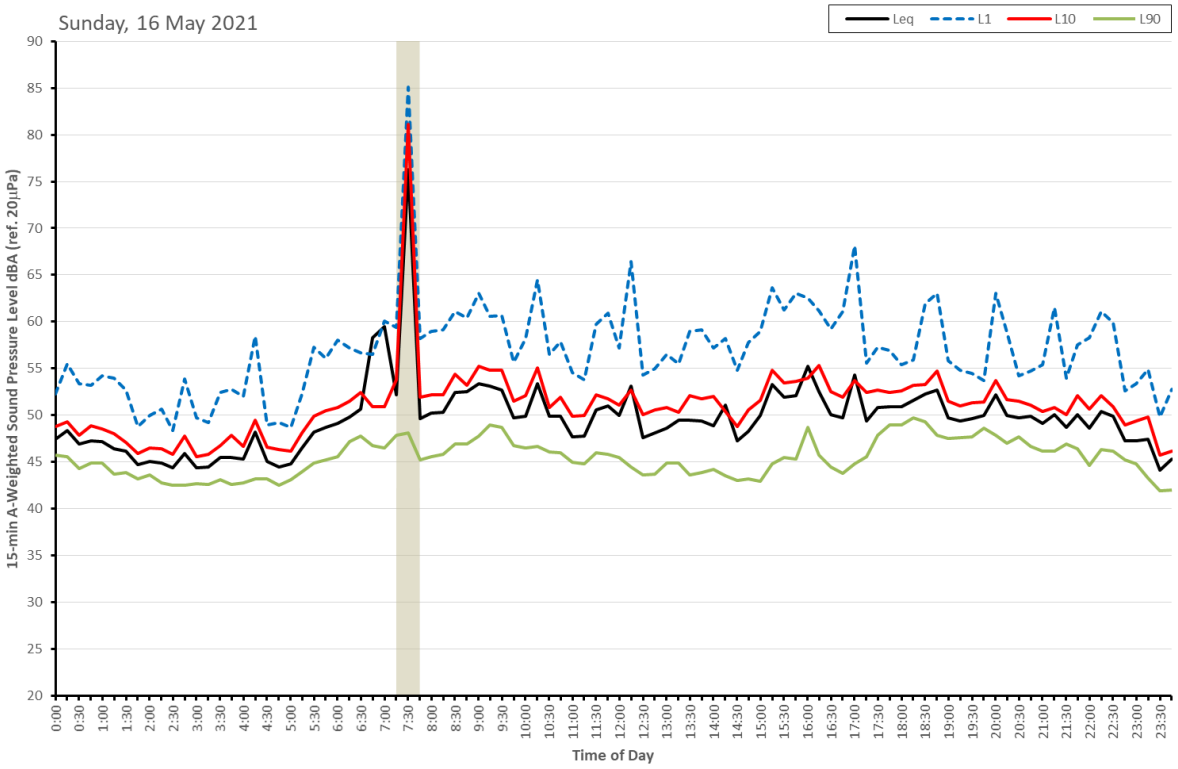
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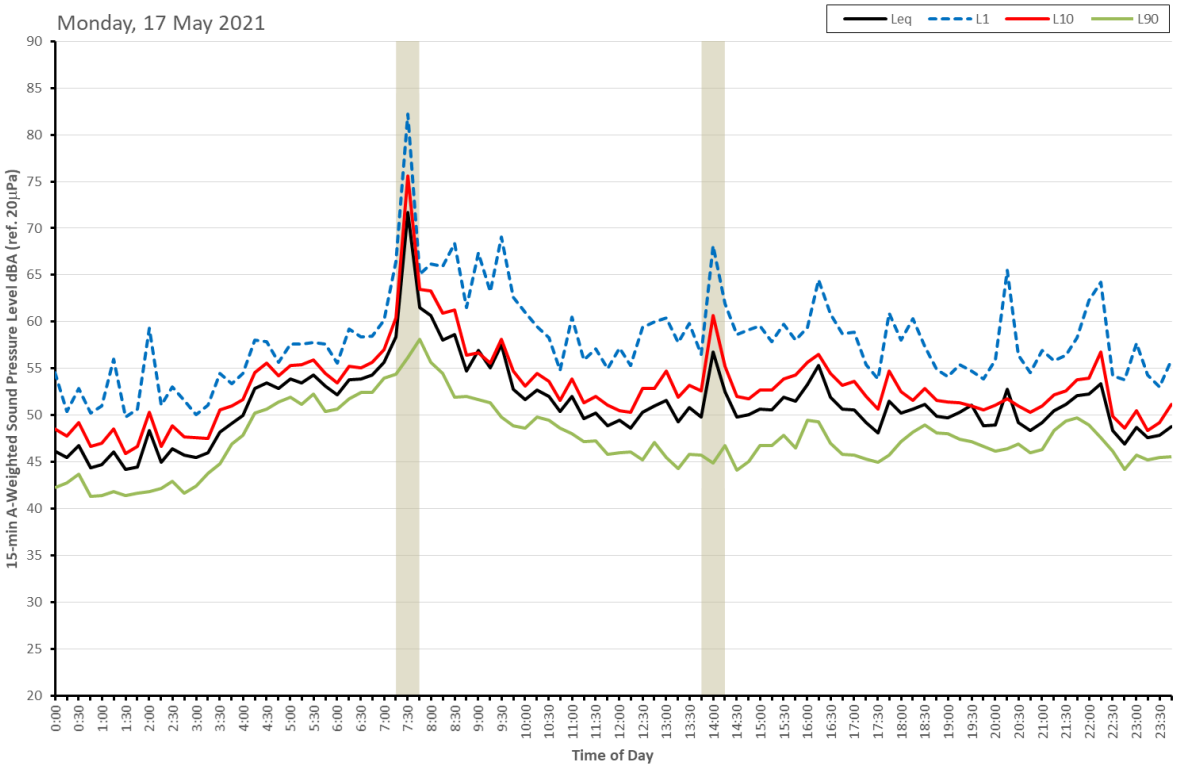
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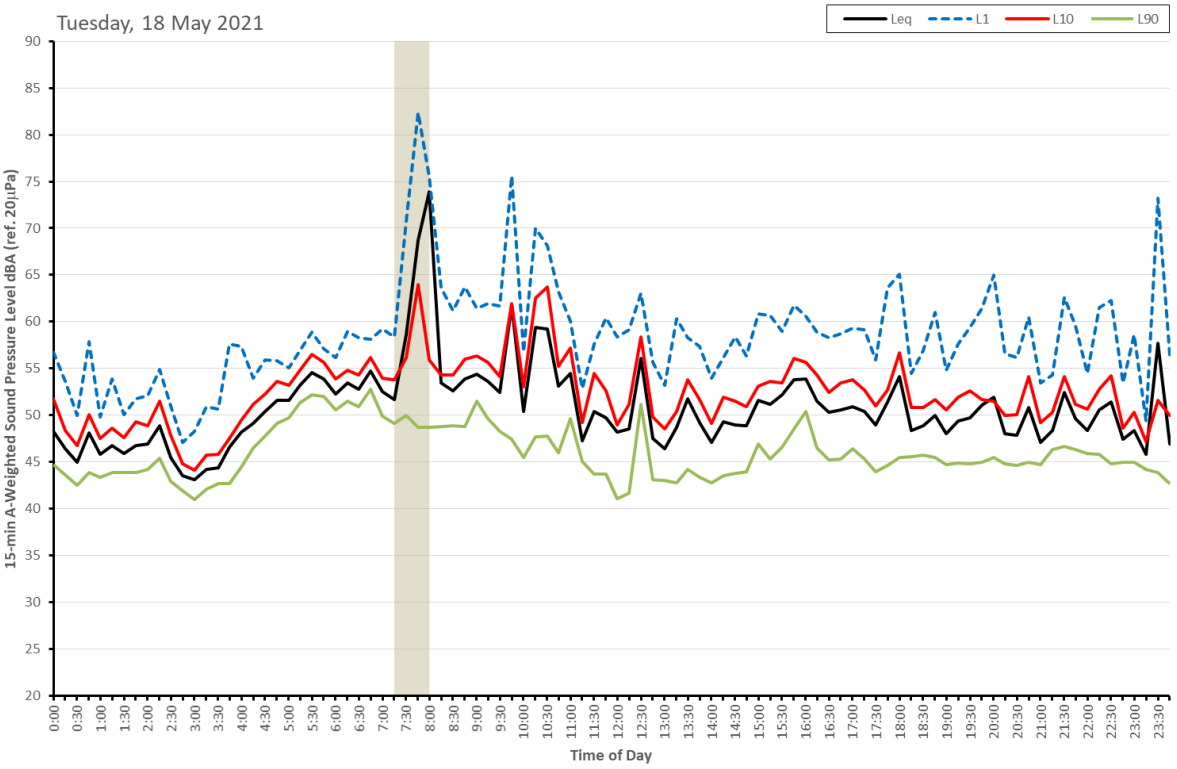
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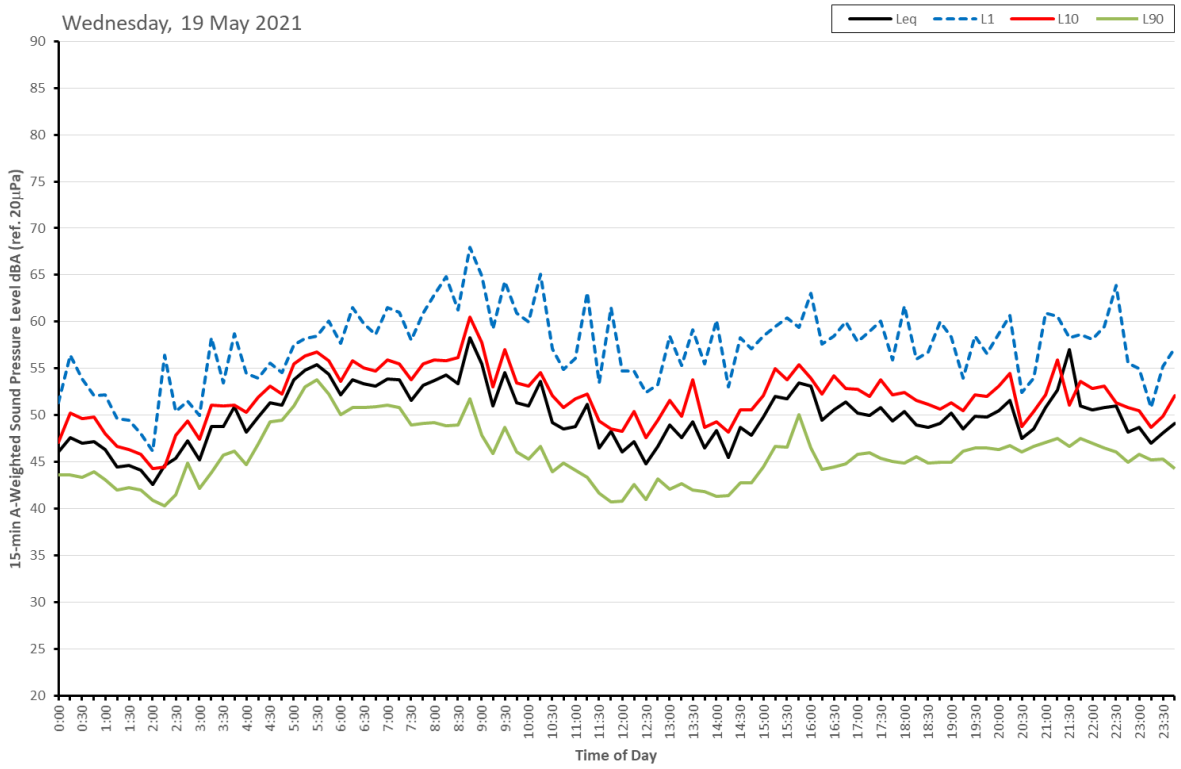
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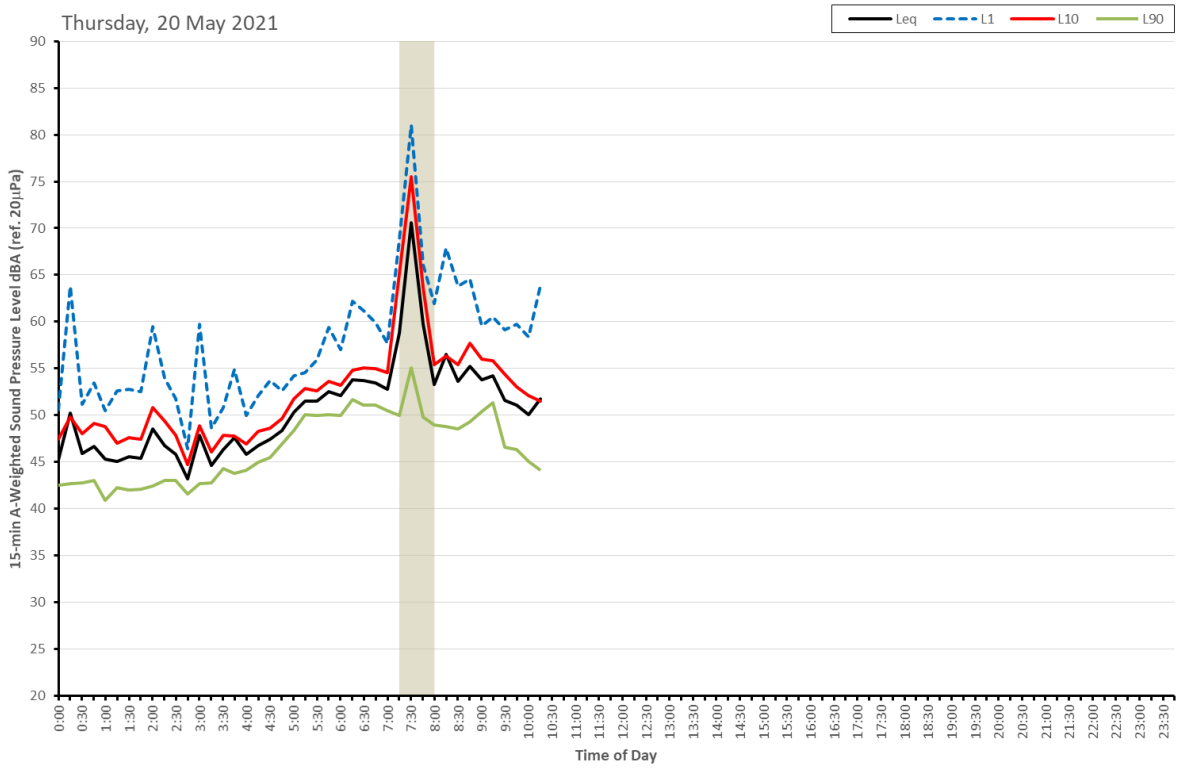
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