Prepared for
Transport for NSW
ABN: 18 804 239 602

Lewisham Station Upgrade

Noise and Vibration Impact Assessment

14-Mar-2025
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Prepared by

AECOM Australia Pty Ltd
Gadigal Country, Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

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1.0 Introduction

1.1 Proposal overview

Transport for NSW (Transport) proposes to provide accessibility upgrades at Lewisham Station, as part of the Safe Accessible Transport program (the Proposal), a NSW Government initiative announced in February 2024 that aims to make public transport safe, inclusive and easy to use for all passengers, especially people with a disability, older people, people with prams or luggage and others who may be experiencing mobility problems.

The Proposal would improve accessibility of the station in line with the requirements of the *Commonwealth Disability Discrimination Act 1992* (DDA) and the *Disability Standards for Accessible Public Transport 2002* (DSAPT).

Lewisham Station is located around 6.5 kilometres southwest of Sydney CBD, within the Inner West Local Government Area (LGA). The station has two platforms, serviced by the T2 Inner West and Leppington Line, providing connection to the Sydney Trains network (intercity and suburban). Adjacent stations to Lewisham are Petersham to the east and Summer Hill to the west.

The Proposal would be carried out on land owned by Transport as well as the Transport Asset Manager of NSW (TAM) (previously known as Transport Asset Holding Entity (TAHE)) and managed by Sydney Trains within the station precinct, with some work also proposed along the station entrances and adjoining footpaths which are managed by the Inner West Council. The location of the Proposal is shown in Figure 1-1 and an overview of the Proposal is provided in Figure 1-2.

This report will focus on a noise and vibration impact assessment of the construction and operation of Lewisham Station.

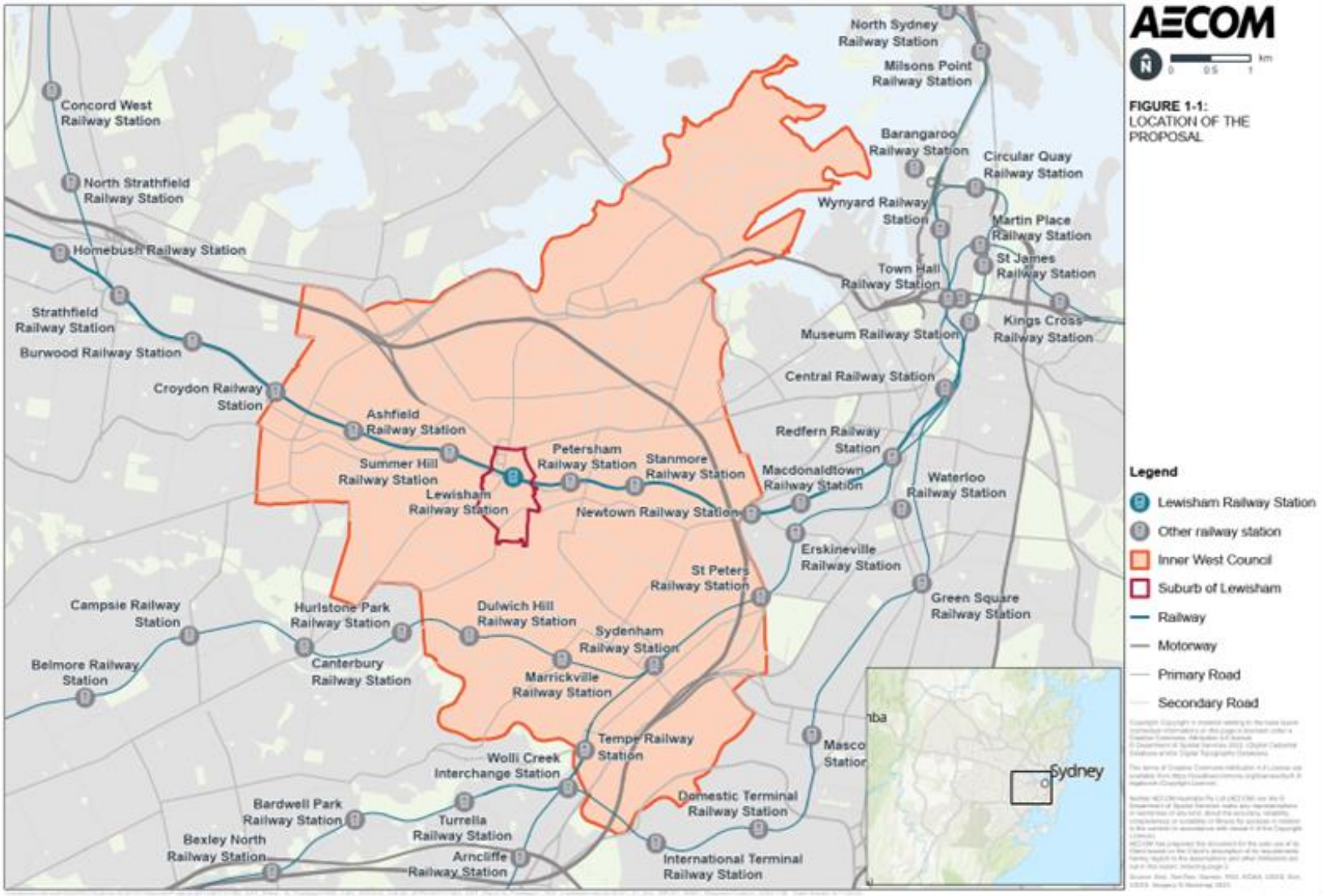


Figure 1-1 Location of the Proposal

Figure 1-2 The Proposal (indicative only, subject to detailed design)

1.2 Proposal surroundings

Lewisham Station is bound by Thomas Street to the north and Railway Terrace to the south. The station is located in a dense urban environment, with land uses to the north primarily comprising detached houses, places of worship, aged care facilities and educational facilities. Land uses to the south are more varied, comprising detached houses, terraces, and multi-unit complexes as well as commercial establishments located adjoining the Railway Terrace/Victoria Street station entrance canopy and in the surrounding area along Railway Terrace and Victoria Street. The closest residential receivers are located on Railway Terrace and Thomas Street.

Nearby recreational facilities include Petersham Park, Cadigal Reserve and Hudson Street Park. Lewisham Estate Heritage Conservation Area is located to the south of the station and a cluster of heritage items are present to the north.

The Proposal area and receivers are shown on Figure 1-3.

Figure 1-3 Proposal area and assessment receivers

2.0 Methodology

2.1 Scope

This assessment provides a noise and vibration impact assessment of the construction and operation of the Proposal.

In summary, the scope of this noise and vibration impact assessment is to:

- establish the existing background noise levels in the vicinity of the Proposal
- establish construction noise management levels and vibration limits that would apply to the Proposal
- predict noise levels at affected residential and non-residential receivers due to the construction of the Proposal
- consider the noise impact from the operation of the station upgrade
- outline mitigation measures, if required, relating to noise and vibration during the construction and operational phases of the Proposal.

This assessment has been prepared and reviewed by suitably qualified professionals (refer to Appendix A for CVs).

2.2 Policies and guidelines

The policies and guidelines listed below have been considered in the preparation of this assessment.

2.2.1 Construction

- *Interim Construction Noise Guideline* (NSW Department of Environment and Climate Change, 2009) (ICNG)
- *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006) (AVTG)
- *NSW Road Noise Policy* (Department of Environment, Climate Change and Water, 2011) (RNP)
- *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* (Transport, 2023) (CNVG-PTI)
- *Australian Standard AS 2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites*
- *British Standard 5228: Part 1 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise*, 2009, including Amendment 1, 2014
- *DIN Standard 4150: Part 3 2016 Vibration in Buildings - Effects on Structures 1999*
- *British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings 1993*
- *British Standard 6472: Evaluation of human exposure to vibration in buildings (1-80 Hz) 1992.*

2.2.2 Operation

- *NSW Protection of the Environment Operations Act 1997* (POEO Act 1997)
- *NSW Noise Policy for Industry* (NSW Environment Protection Authority, 2017) (NPfI)
- *Rail Infrastructure Noise Guideline* (NSW Environment Protection Authority, 2013) (RING)
- *NSW Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water, 2011)
- *Road Noise Criteria Guideline* (RNCG) (Transport for NSW, 2023)
- *Road Noise Model Validation Guideline* (RNMVG) (Transport for NSW, 2022)

Definitions for acoustic terminology used within this report can be found in Appendix B.

3.0 Proposal description

3.1 The Proposal

The Proposal would involve an accessibility upgrade of Lewisham Station, which would improve accessibility and amenities for customers.

The key features of the Lewisham Station upgrade include:

- provision of four (4) new lifts
- modification of the underpass including drainage, lowered floor and new openings for lift access
- new canopies at lift entries and replacement canopies at Thomas Street and Victoria Street entrances to the station
- a new station building on Platform 1 including a family accessible toilet, a unisex ambulant toilet, station office, electrical services enclosure and a station storage room
- platform regrading and resurfacing, new tactile ground surface indicators (TGSIs) and relocated platform furniture
- a new station access ramp from Railway Terrace to Platform 2
- road adjustments and upgrades to station forecourts including:
    - Victoria Street – adjustment to vehicle direction of travel, footpath widening and regrading, roadwork, paving, landscaping, new seating, relocation of bicycle hoops and a new kiss and ride space
    - Hunter Street – an accessible parking space, roadwork, kerb ramp and footpath adjustments
    - Thomas Street – adjustments to kerb alignment, roadwork, paving, landscaping, new seating, new bicycle hoops, a new kiss and ride space and an accessible parking space
    - Railway Terrace – adjustment to kerb ramps, footpath and roadwork
- lighting, including to the pathway between Thomas Street and West Street
- ancillary work including station power supply upgrade, protection and relocation of services and utilities, handrails and fencing, new ticketing facilities including additional Opal card readers, improvement to station communication systems (including CCTV cameras and help points), landscaping, wayfinding and regulatory signage, drainage work including track drainage and public art.

Key features of the Proposal are shown on Figure 3-1.

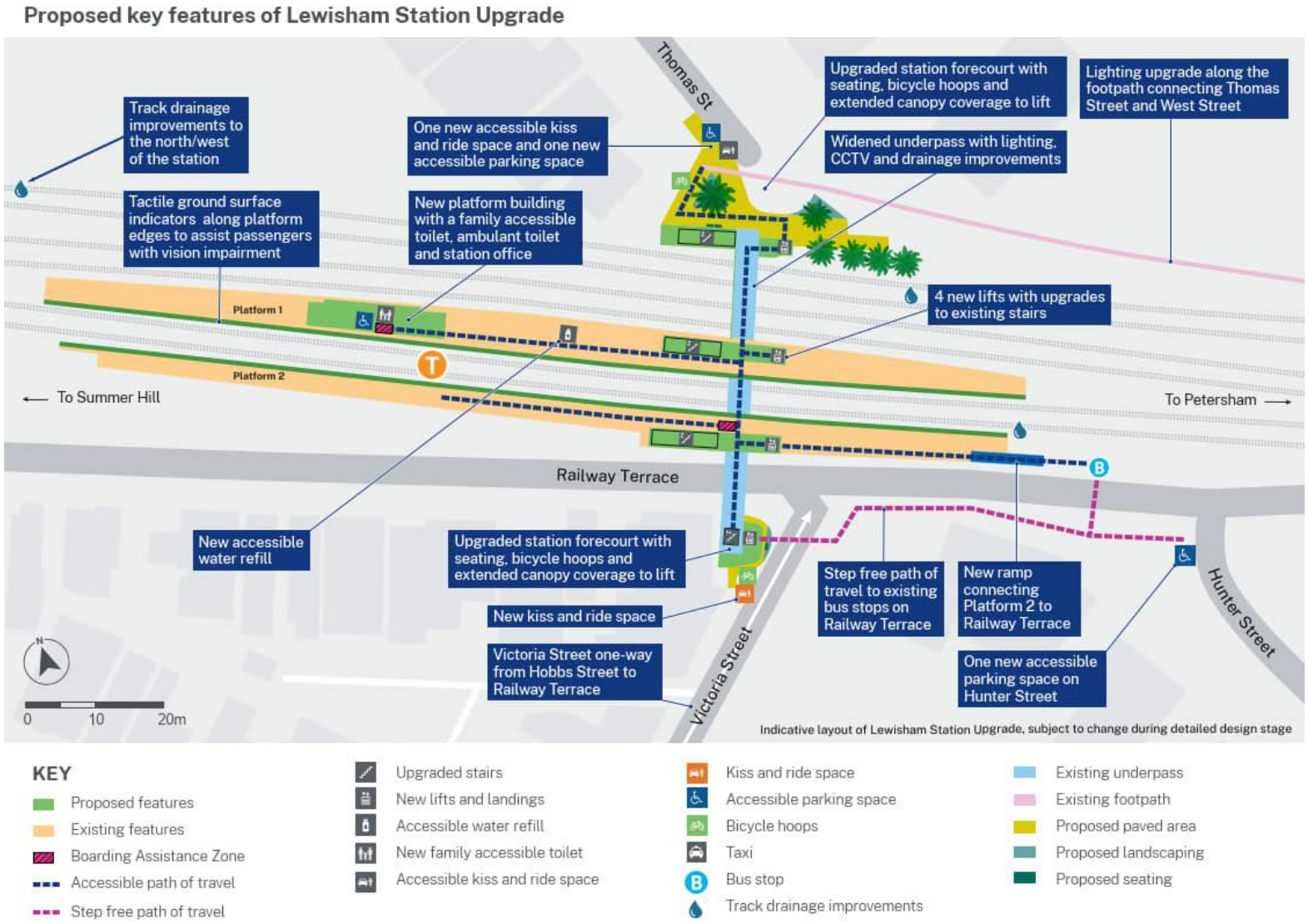


Figure 3-1 Key features of the Proposal (indicative only, subject to detailed design)

3.2 Construction

3.2.1 Construction staging

Subject to approval, the Proposal is expected to commence in early 2026 and take around 24 months to complete. Enabling work would commence in the first four months with 20 months required to undertake the main work for the upgrade of the station. The indicative construction stages, corresponding activities and scheduling times are shown in Table 3-1. The construction methodology would be further developed during the detailed design of the Proposal by the nominated Contractor in consultation with Transport.

Table 3-1 Indicative construction staging

Stage no.	Construction work	Activities	Scheduling
1	Site establishment and enabling work	• establishment of construction compounds (i.e. erect fencing, site offices, amenities and plant/material storage areas) • establishment of temporary facilities (e.g. hoarding, construction staff toilets, station master's office etc.) • relocation of services • additional site investigations and surveys.	Early 2026
2	Weekend Rail Possession 1	• complete service diversions and changeovers • Platform 1, Platform 2 and Railway Terrace lift piling work • local underpass floor / wall breakout and removal • Platform 1 and Platform 2 stair breakout • new station building excavation and buried ducting on Platform 1 • new Platform 1 and Platform 2 temporary stair • new underpass temporary floor • complete temporary hoarding in platform work area • track drainage improvements	9-10 May 2026
3	Main Work 1	• civil work at Thomas Street and Railway Terrace • relocation of Telstra, Gas, Sydney Water services • new platform building formwork and steel reinforcement • railway Terrace lift piling work • vegetation removal for padmount transformer civil work • padmount transformer civil work.	May – July 2026
4	Weekend Rail Possession 2	• Platform 1 lift piling (trackside) • Platform 2 lift piling • Platform 2 stair work (damp-proof membrane, formwork and steel reinforcement) • Platform 2 bin store area work • reinstall temporary Platform 2 stairs • local underpass drainage, waterproofing and blinding • track drainage improvements.	18-19 July 2026
5	Main Work 2	• Railway Terrace civil work • relocate Telstra, Gas, Sydney Water services • drainage connections work	July – August 2026

Stage no.	Construction work	Activities	Scheduling
		• new station building formwork and steel reinforcement on Platform 1 • new platform ducting work on Platforms 1 and 2 • crane in new padmount transformer.	
6	Weekend Rail Possession 3	• complete service diversions and changeovers along Thomas Street retaining wall • Thomas Street lift piling work (trackside) • Thomas Street staircase removal and temporary work to maintain stairway access • continue Platform 1 lift piling work (trackside) • platform 1 stair work (damp-proof membrane , formwork, steel reinforcement) • new platform building concrete pour • underpass wall breakout and removal • re-install temporary underpass floor and Platform 1 stairs • Railway Terrace piling work (contingency) • padmount civil work • Galvanised steel trench (GST) for new Ausgrid power supply.	29-30 August 2026
7	Main Work 3	• Thomas Street piling and civil work • Railway Terrace lift and civil work • station building structure work • station building canopy work • drainage connections work • electrical Ausgrid supply and distribution boards work.	August – October 2026
8	Weekend Rail Possession 4	• complete Platform 1 lift piling (trackside). • local underpass base slab (concrete pour) • excavate Platform 2 for lift pile caps • Platform 2 stair work (first concrete pour) • Platform 2 bin store area work • reinstall temporary Platform 2 stairs.	24-25 October 2026
9	Main Work 4	• Railway Terrace civil and lift work • station building structural work on Platform 1.	October 2026
10	Weekend Rail Possession 5	• excavate Platform 1 for lift pile caps • platform 1 stair work (first concrete pours) • re-install temporary Platform 1 stairs • complete new underpass walkway • complete Thomas Street lift piling work (trackside) • Thomas Street stair (damp-proof membrane , formwork, steel reinforcement) • complete Ausgrid supply.	31 October - 1 November 2026
11	Main Work 5	• Thomas Street civil and lift work • Railway Terrace civil and lift work • Platform 1 and Platform 2 lift pile caps (form, steel reinforcement and pour) • Platform 1 and Platform 2 lift excavation (Top Down) • Platform building fit out work • new platform lighting and comms work	November 2026 – February 2027

Stage no.	Construction work	Activities	Scheduling
		• form and steel reinforcement Platform 1 and Platform 2 lift upstands.	
12	Weekend Rail Possession 6	• continue excavation for Platform 1 and Platform 2 lifts • form, steel reinforcement and pour Platform 1 and Platform 2 lift upstands • Platform 1 and Platform 2 stair work (concrete finishing) • install underpass structural walls • install canopy elements on new station building • complete Platform 2 bin store area work • Ausgrid supply changeover (from Sydney Trains) • decommission existing Sydney Trains supply.	13 – 14 February 2027
13	Main Work 6	• civil work for Sydney Trains Supply Transformer • Thomas Street lift and civil work • platform building fit out civil work.	February – April 2027
14	Weekend Rail Possession 7	• Thomas Street lift and lobby excavation work • Platform 1 lift wall work (trackside) • install underpass services and wall cladding and finishes • civils work for Sydney Trains supply transformer • crane in new Sydney Trains padmount.	1 – 2 May 2027
15	Main Work 7	• Thomas Street lift and civil work • Railway Terrace civil work • Platform 1 and Platform 2 lift concrete work completion • Thomas Street and Railway Terrace lift concrete work completion • completion of platform lighting and comms work.	May – July 2027
16	Weekend Rail Possession 8	• crane in Platform 1 and Platform 2 lift and canopy top hats • Platform 1 and Platform 2 stair completion • Thomas Street stair completion • Railway Terrace stair completion • underpass upgrade completion • commission new distribution boards and Sydney Trains supply • Ausgrid supply transferred to backup • complete canopy work on new platform building.	17-18 July 2027
17	Main Work 8	• Railway Terrace lift fit out civil work • Platform 1 and Platform 2 lift fit out civil work • finalise and commission services installation and tidy up work in underpass. • Thomas Street and Railway Terrace canopy work • entrance lighting and comms work • Victoria Street / Railway Terrace roadwork and landscaping work • Thomas Street roadwork and landscaping.	July – August 2027
18	Weekend Rail Possession 9	• Thomas Street lift and lobby excavation work • lift lobby completion • deliver Thomas Street canopy top hat	21-22 August 2027

Stage no.	Construction work	Activities	Scheduling
		• Thomas Street canopy work.	
19	Main Work 9	• Thomas Street, Railway Terrace, Platforms 1 and 2 lift fit out work • Thomas Street and Railway Terrace canopy work* • commission platform lighting and comms work • commission new entrance lighting and comms • Victoria Street / Railway Terrace roadwork and landscaping • Thomas Street roadwork and landscaping • commission new lifts (x4). *Note: opportunities would be explored to bring the canopy work forward, subject to detailed design and final construction methodology	August – October 2027
20	Weekend Rail Possession 10	• resurfacing on Platforms 1 and 2 • install new platform furniture, tactiles etc. • commission final work.	30-31 October 2027
21	Main Work 10	• tidy-up work • demobilisation of construction compounds • handover.	November 2027

3.2.2 Temporary ancillary facilities

A maximum of two (2) temporary construction ancillary facilities would be required for the Proposal to accommodate a site compound, laydown and storage areas for equipment. Three suitable areas for the compounds have been identified at Alfred Street, Longport Street and Thomas Street; however, only two would be used during construction. Temporary construction compounds would be established during Stage 1.

3.2.3 Hi-rail access pads

There are three (3) hi-rail access pads located near Lewisham Station that will be utilised during rail possessions only. Large equipment, such as piling equipment and hi-rail excavators, would access the site via the nearest hi-rail access pad and travel on the rail until Lewisham Station. The hi-rail access pads would be used for movement and storage of spoil. The closest hi-rail access pads proposed to be used are at Petersham, Stanmore and Ashfield, as shown in Figure 3-2.

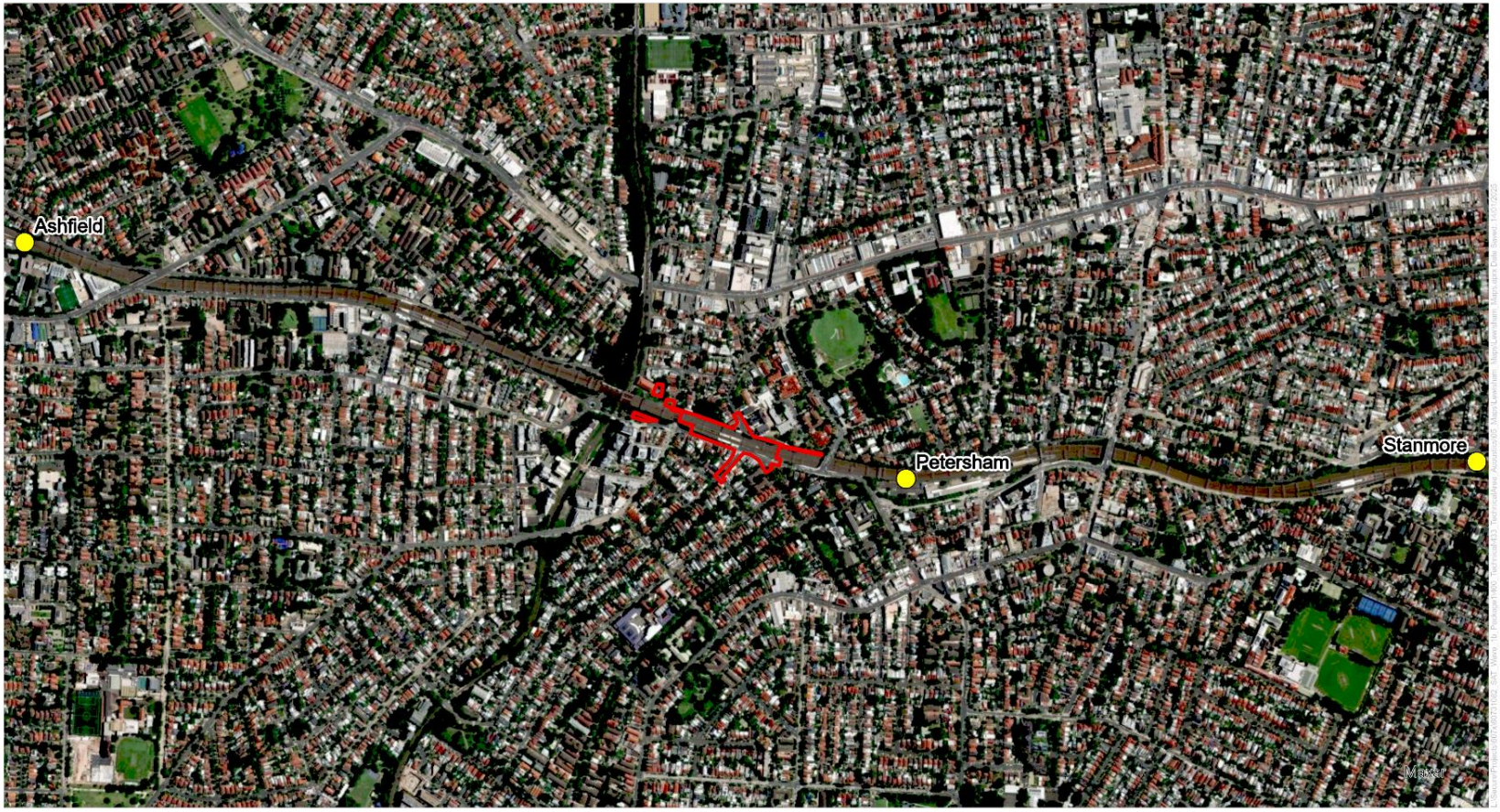


Figure 3-2 Hi-rail access pad locations

3.2.4 Construction equipment and vehicles

An indicative list of the plant and equipment that would be used to construct the Proposal is provided in Table 3-2. The plant/equipment list would be further refined during detailed design.

Table 3-2 Indicative construction equipment and plant – Rail Possession Work

Equipment	Required possession period	Notes
Piling equipment	1, 2, 3, 4, 5	600 mm dia. CFAs (2 no. rigs) – 15 t max
Hi-rail piling equipment	2, 4, 5 (Contingency)	600 mm dia. CFA (1 no. rig)
Crane equipment	1, 3, 8	150 t Crane (25 m reach/15 t max lift)
Crane equipment	6, 9, 10	120 t Crane (25 m reach/15 t max lift)
Mini excavators	1, 2, 4, 5, 6	Required for platforms/subways/stairs work
	3, 5, 7	Required for Thomas Street work
	8	Required for platforms
Hi-rail excavator and wagons	1, 2, 3, 5, 6	Required for Platform 1 work and track drainage improvements
	2, 4, 7	Required for Ausgrid padmount work
Concrete pump and truck	1, 2, 3, 4, 7, 8, 10	-
Spoil trucks – arrival and departure	1, 2, 3, 4, 7, 8, 10	-
Mini rollers, excavators	10	-
Asphalt paving machine	10	-
Concrete saws	1, 2, 3, 4, 5, 6, 7, 8	-
Concrete vibrators	1, 2, 3, 4, 5, 6, 7, 8	-
Flatbed trucks	1, 2, 3, 4, 5, 6, 7, 8, 10	-
Forklifts	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	-
Grinders	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	-
Hand tools	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	-
Jackhammers	1, 2, 3, 4, 5, 6, 7, 8, 9	-
Lighting towers	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Diesel generator
Suction trucks	1, 2, 3, 7	-
Vibratory rollers	1, 2, 3, 4	-
Dump trucks	1, 2, 3, 5, 6, 7, 9	-
Elevated work platforms (EWP)	1, 3, 4, 5, 6, 8, 9	-
Road sweeper	1	-
Semi-trailer	1, 2, 3, 4, 5, 6	-
Rail cutting machine / Rail saw	1, 2	
Welding equipment	1, 2	-

The following equipment will be required for the ten main work scenarios:

- Asphalt paving machine
- Concrete pump and truck
- Concrete saws
- Concrete vibrator
- Spoil trucks – arrival and departure
- Elevated work platforms (EWP)
- Flatbed trucks
- Forklifts
- Grinders
- Hand tools
- Jackhammers
- Mini rollers
- Excavators
- Road sweeper
- Semi-trailers
- Suction trucks
- Mobile cranes
- Dump trucks
- Vibratory rollers.

Semi-trailers will be required at the compound sites to accommodate deliveries and store equipment.

Spoil trucks and hi-rail excavators and wagons will also be required at hi-rail access pads during rail possessions.

3.2.5 Construction traffic

During the construction of the Proposal, there would be minor increases in traffic volumes on the local road network associated with construction vehicle movements. Construction vehicles would access the site from Old Canterbury Road, Thomas Street, West Street, Railway Terrace, Henry Street and Victoria Street. Daily construction traffic numbers are shown in Table 3-3.

Table 3-3 Estimated construction vehicle numbers

Construction period	Light vehicles		Heavy vehicles	
	Average	Maximum	Average	Maximum
Possession	35	60	3	15
Non-possession	12	25	3	15

Construction vehicles would also access hi-rail access pads at Petersham Training College, Stanmore, and Ashfield via Railway Terrace/Gordon Street, Railway Avenue and Grimmond Avenue, respectively. During each possession, 10 heavy vehicles are projected to access the respective hi-rail access pads for removal of equipment, materials and excavated spoil. It is anticipated that the Stanmore hi-rail access pad would be used during three planned rail possessions and Petersham Training College and/or Ashfield location(s) utilised during four planned rail possessions.

3.2.6 Construction hours

Most of the construction work required for the Proposal would be undertaken during standard construction hours. The ICNG defines standard construction hours as follows:

- Monday – Friday 7:00 am to 6:00 pm
- Saturday 8:00 am to 1:00 pm
- No work on Sundays or public holidays.

Certain work may need to occur outside standard hours and would include night work and work during routine rail possessions. Rail possessions are scheduled closures that would occur regardless of the Proposal when part of the rail network is temporarily closed, and trains are not operating. It is estimated that approximately 10 rail possessions would be required for the Proposal.

Out-of-hours work is required in some cases to minimise disruptions to customers, pedestrians, motorists and nearby sensitive receivers, and to ensure the safety of railway workers and operational assets.

Out-of-hours work may also be scheduled outside rail possession periods which might reduce the overall impact of the Proposal on the wider community and road network, for example to facilitate oversized plant and material deliveries, undertake minor road work, and other platform work which would otherwise impact train passengers.

Approval from Transport would be required for any out-of-hours work and the affected community would be notified as outlined in Transport's CNVG-PTI.

3.3 Operation

Upon completion, the station's accessibility would be improved, and key elements of the station would be compliant with DSAPT. The future operation and maintenance of the station elements within the Proposal is subject to further discussions with Sydney Trains, Transport and Inner West Council. It is likely that assets outside of the rail corridors, such as garden/landscape areas, kiss and ride parking spaces, accessible parking spaces, footpaths, pedestrian crossings, paving, bicycle hoops and lighting within the pathway between Thomas Street and West Street, would be maintained by Inner West Council.

The back-up power supply to Lewisham Station Installation Main Switch Board is proposed to be provided from Ausgrid's Street network. The back-up power supply would be upgraded through the installation of a new 200 kVA padmount transformer at the intersection of Old Canterbury Road and Alfred Street and a kiosk substation next to the existing padmount on Longport Street.

The Proposal also includes changes to traffic and vehicle access routes near Lewisham Station. A permanent adjustment of the existing traffic arrangement on Victoria Street is proposed to remove bi-directional vehicle movements and designate a one direction travel lane between Hobbs Street and Railway Terrace. This would permit vehicles to travel in a north easterly direction and would restrict vehicles from turning onto Victoria Street from Railway Terrace. Vehicles will be diverted to Hunter Street or Henry Street, as illustrated in Figure 3-3.

Vehicles accessing Victoria Street from the east will need to follow a diverted route via Hunter Street, Denison Road and Hobbs Street. Vehicles accessing Victoria Street from the west will need to follow a diverted route via Old Canterbury Road and Henry Street. Overall, the one-way proposal for Victoria Street will enhance the operation of the Railway Terrace/Victoria Street intersection by diverting vehicles on alternative routes.

Figure 3-3 Diverted vehicle access routes to Victoria Street

4.0 Existing acoustic environment

4.1 Noise sensitive receivers

The existing acoustic environment is largely defined by light industrial and commercial sites, rail, and road traffic noise. Noise sensitive receivers which could potentially be affected by the Proposal are shown in Figure 1-3. This assessment considers noise sensitive receivers within a one (1) kilometre radius from the Proposal. The closest residential receivers that could potentially be affected by the Proposal are as follows:

- residential properties to the south along Railway Terrace, Hunter Street, Denison Road, Hobbs Street, Henry Street, Jubilee Street and Victoria Street.
- residential properties to the north along Barker Street and Thomas Street.

Several non-residential sensitive receivers that could potentially be affected by the Proposal have also been identified as follows:

- Church of Saint Thomas of Canterbury (about 10 metres from the Proposal area)
- Eileen O'Connor Catholic College (about 4 metres from the Proposal area)
- The John Berne School (about 58 metres from the Proposal area)
- Maternal Heart of Mary Catholic Church (about 105 metres from the Proposal area)
- Catholic Healthcare Lewisham Retirement Hostel (about 16 metres from the Proposal area)
- Catholic Healthcare Lewisham Nursing Home (about 56 metres from the Proposal area).

4.2 Noise catchment areas

To assist in determining noise criteria for the receivers surrounding the Proposal, three (3) noise catchment areas (NCAs) were identified. The noise environment at each residential receiver within each NCA is considered to be similar. The NCAs are shown in Figure 4-1. NCA 1 consists of a noise environment dominated by general suburban noise and some aircraft and rail noise. NCA 2 consists of a noise environment dominated by road traffic noise from Railway Terrace and rail noise. NCA 3 consists of a noise environment dominated by general suburban noise and some road traffic and aircraft noise.

Figure 4-1 Noise catchment areas

4.3 Unattended noise monitoring

Long term unattended noise monitoring was conducted at three (3) locations between 21 November 2024 and 3 December 2024. The noise loggers were calibrated prior to and after the monitoring period with a drift in calibration not exceeding ± 0.5 dB. The noise monitoring locations and logger details are presented in Table 4-1. Figure 4-1 also shows the noise logger locations relative to the Proposal.

All acoustic instrumentation employed during the noise measurements comply with the requirements of AS IEC 61672.1 – 2019 *Electroacoustics – Sound level meters – Specifications* and were within their current National Association of Testing Authorities (NATA) Australia certified in-calibration period (i.e. calibrated in the last two years).

Table 4-1 Noise monitoring details

Logger	Location	Model	Serial number
L1	13 Barker Street, Lewisham	Rion NL-52	553967
L2	59 Railway Terrace, Lewisham	Rion NL-52	164395
L3	7 Henry Street, Lewisham	Rion NL-52	898334

In accordance with the Environment Protection Authority's (EPA) NSW NPfI, noise monitoring affected by adverse weather conditions of extraneous noise events was excluded from the monitoring data. The NPfI advises that data may be affected where adverse weather, such as wind speed higher than 5 m/s or rain, occurs. Weather data were acquired from the Bureau of Methodology's Canterbury weather station (station ID: 94766).

The loggers measured the noise levels over the sample period and then determined L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} noise levels are the levels exceeded for 1%, 10% and 90% of the measurement period respectively. The L_{A90} is taken as the background level. The L_{A1} is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The L_{A90} noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the NPfI for each monitoring location. The ABL is established by determining the lowest ten-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.

4.3.1 Attended noise measurement methodology

Attended noise measurements were conducted at the three unattended monitoring locations on 21 November 2024 during the daytime. Each measurement was conducted over a 15-minute period. Weather conditions were fine and partly cloudy.

Attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter. The sound level meter used is designated as a Class 1 instrument and has accuracy suitable for laboratory and field use. The sound level meter was calibrated prior to and after the monitoring period with a drift in calibration not exceeding ± 0.5 dB.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of AS IEC 61672.1 – 2019 and were within their current NATA Australia certified in-calibration period (i.e. calibrated in the last two years).

4.4 Noise monitoring results

The background noise level is defined by the EPA as '*the underlying level of noise present in ambient noise… when extraneous noise is removed*'. It can include sounds that are normal features of a location and may include birds, traffic, insects, etc. The background noise level is represented by the L_{A90} descriptor. The noise levels previously measured provide a single RBL for each day, evening, and night

period in accordance with the EPA's NPfI for each monitoring location. The RBL is established by determining the lowest tenth percentile level of the L_{A90} noise data acquired over each period of interest. A summary of the measurement data is presented in Table 4-2. The unattended noise monitoring graphical results are provided in Appendix C.

Table 4-2 Existing background (L_{A90}) and ambient (L_{Aeq}) noise levels

Noise monitoring location	L_{Aeq} ambient noise levels, dB(A)			L_{A90} background noise levels, dB(A)		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
L1	60	58	53	44	42	34
L2	65	65	62	53	49	34
L3	61	60	56	48	46	33

Notes:

1. *Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays. Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays. Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.*

The results of the attended noise monitoring are presented in Table 4-3. The daytime measurements indicated that the residential receivers are generally affected by road traffic noise.

Table 4-3 Attended noise measurements

Noise monitoring location	Date	Time	L_{Aeq} dB(A)	L_{A90} dB(A)	Comments
L1	21/11/2024	11:37 AM	64	49	Aircraft noise, 71-81 dB(A). Truck passby on Barker Street, 70 dB(A). Cicada noise. Construction noise from neighbouring residential properties on Barker Street. Distant rail noise from Lewisham Station.
L2	21/11/2024	1:23 PM	63	51	Road traffic noise on Railway Terrace dominant, 60-70 dB(A). Bus passby on Railway Terrace, 69 dB(A). Rail noise from Lewisham Station (more dominant than L1). Insect noise.
L3	21/11/2024	2:35 PM	62	52	Aircraft passby, 66-80 dB(A). Car passby on Henry Street, 60-68 dB(A). Traffic noise from Old Canterbury Road dominant. Insect noise.

4.5 Heritage items

There are a number of heritage-listed items located within 100 metres of the Proposal listed on Schedule 5 of the Inner West Local Environment Plan 2022 and the Transport Asset Manager (TAM) Section 170 (S170) Heritage and Conservation Register:

- St Thomas's Catholic Church, School and Presbytery, including interiors (LEP# I1182)
- Lewisham (Old Canterbury Road) Underbridge (LEP #I1173, S170 #4801518)
- Two-storey Federation Queen Anne style residence (LEP# I1176, 17 Railway Terrace)
- Lewisham Estate Heritage Conservation Area (LEP #C61, various properties near Hunter Street and Victoria Street)
- Former Petersham Cemetery Archaeological Site (LEP #A11)
- Lewisham Railway Substation (LEP# I1167, S170 #4803260)
- Lewisham Railway viaducts over Long Cove Creek and Lewisham (Long Cove Creek) Underbridge (LEP# I1169, SHR #01043)

- Lewisham Sewerage Aqueduct (Sydney Water heritage asset #4570955) (LEP #I1170) (SHR #01326).

5.0 Construction noise and vibration criteria

5.1 Construction noise

The potential risk of adverse construction noise impacts on a receiver is determined by the extent of its emergence above the existing background noise level, the duration of the event and the characteristics of the noise.

The ICNG is a NSW Government document (DECC, 2009) that identifies ways to manage impacts of construction noise on residences and other sensitive land uses. It is the principal guideline for the assessment and management of construction noise in NSW and is used to establish construction noise management levels.

As the construction stage of the Proposal is expected to continue for a period of more than three weeks and construction activity would occur within relatively close proximity to noise sensitive receivers, a quantitative assessment based on 'reasonable' worst case construction scenarios, has been carried out for this work, in accordance with the ICNG.

Noise levels resulting from construction activities are predicted at nearby noise sensitive receivers using environmental noise modelling software SoundPLAN 8.2 and compared to the noise management levels, derived in accordance with the ICNG.

Where an exceedance of the noise management levels is predicted, the ICNG advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially affected residents of the nature of the work to be carried out, the expected noise level and duration, as well as provide contact details to facilitate feedback from affected residents during construction.

Where construction noise levels at a receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

The ICNG defines what is considered to be feasible and reasonable as follows:

Feasible

> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*

Reasonable

> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.*

The construction noise management levels (NMLs) for the residential receivers in proximity to the Proposal are detailed below.

5.1.1 Residential receivers

Guidance for setting construction noise management levels for residential receivers is summarised in Table 5-1.

Table 5-1 ICNG residential noise management levels

Time of day	NML, $L_{Aeq,15min}$, dB(A)[1]	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	'Noise affected' level RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	'Highly noise Affected' level 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences/places of worship) 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	'Noise affected' level RBL + 5 dB	• A strong justification would typically be required for work outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community • The ICNG provides guidance on negotiating agreements.

Notes:

1. *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence.*

The CNVG-PTI sets out community perceptions of construction noise dependent upon the level of exceedance of the RBL and NMLs. These are presented in Table 5-2.

Table 5-2 Community perception of construction noise

Perception	dB(A) above rating background level	dB(A) above noise management level – Standard hours	dB(A) above noise management level – Out-of-hours
Noticeable	5-10	0	0-5
Clearly audible	11-20	1-10	6-15
Moderately intrusive	21-30	11-20	16-25
Highly intrusive	>30	>20	>25

Details of the construction noise management levels for residential receivers in each NCA are provided in Table 5-3.

Table 5-3 Noise catchment areas and construction noise management levels

NCA	Representative logger	Period	Rating background level, dB(A)	Construction noise management level (NML)[1]
1	L1	Day	44	54 (49)[2]
		Evening	42	47
		Night	34	39
2	L2	Day	53	63 (58)[2]
		Evening	49	54
		Night	34	39
3	L3	Day	48	58 (53)[2]
		Evening	46	51
		Night	33	38

Notes:
1. *Standard hours day noise management levels = RBL + 10 dB(A), out-of-hours (OOH) daytime/evening/night noise management levels = RBL + 5 dB(A)*
2. *Daytime OOH.*

5.1.2 Non-residential criteria

Construction noise management levels recommended by the ICNG for non-residential sensitive land uses, such as schools, hospitals or places of worship are provided in Table 5-4. Noise management levels for commercial and industrial premises are provided in Table 5-5.

Table 5-4 Construction noise management levels – non-residential sensitive land uses

Land use	Construction noise management level, $L_{Aeq(15\ min)}$
Education (classrooms at schools and other educational institutions)	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended “maximum” internal levels in AS2107 for specific uses.

Table 5-5 Construction noise management levels – commercial and industrial land uses

Land use	Construction noise management level, $L_{Aeq(15min)}$
Industrial premises	External noise level 75 dB(A)
Offices, retail outlets	External noise level 70 dB(A)

5.1.3 Sleep disturbance criteria

The ICNG requires a sleep disturbance analysis where construction work is planned to extend over more than two (2) consecutive nights. The L_{A1} noise levels and number of expected L_{A1} noise events should be predicted in order to determine the likelihood of potential sleep disturbance.

The EPA recommends that to minimise the risk of sleep disturbance during the night-time period (10.00 pm to 7.00 am), the $L_{A1(1\ min),}$ noise level outside a bedroom window should not exceed the $L_{A90\ (15\ minute)}$ background noise level by more than 15 dB(A). If this screening criterion is found to be exceeded, then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

Sleep disturbance research presented in the RNP concludes that *'maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions'*. Therefore, given that an open window provides approximately 10 dB in noise attenuation from outside to inside, external noise levels of 60-65 dB(A) are unlikely to result in awakening reactions.

Based on the measured background noise levels during the night-time period, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in Table 5-6.

Table 5-6 Sleep disturbance criteria

Noise catchment area	Night-time background noise level (L_{A90}), dB(A)	Sleep disturbance criteria, $L_{A1(1\ minute)}$, dB(A) (external)	
		Screening level	Awakening reaction
1	34	49	60 – 65
2	34	49	60 – 65
3	33	48	60 – 65

5.1.4 Construction road traffic noise criteria

Noise from construction traffic on public roads is not covered by the ICNG. However, the ICNG does refer to the RNP for the assessment of noise arising from construction traffic on public roads.

In accordance with the RNP, to assess noise impacts from construction traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than two dB(A). Where the predicted noise increase is two dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than two dB(A), and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The road category specific criteria are presented in Table 5-7 below. The RNP does not require assessment of noise impacts to commercial or industrial receivers.

Table 5-7 Road traffic noise assessment criteria

Road category	Type of land use	Assessment criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15\ hour)}$ 60 dB(A)	$L_{Aeq(9\ hour)}$ 55 dB(A)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1\ hour)}$ 55 dB(A)	$L_{Aeq(1\ hour)}$ 50 dB(A)

5.2 Construction vibration criteria

The relevant standards and guidelines for the assessment of construction vibration are summarised in Table 5-8.

Table 5-8 Standards/guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	• Heritage structures – *German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures* • Non-heritage structures – *Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385: Part 2-1993)*
Human comfort (tactile vibration)	• NSW Department of Environment and Conservation, *Assessing Vibration: A Technical Guideline, 2006 (AVATG, 2006)*[1]

Notes:

1. *This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. Although a new version of BS 6472 has been published, the EPA still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.*

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive, or intermittent as follows:

- continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities
- impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, or the use of jackhammers.

5.2.1 Structural damage

At present, no Australian Standards exist for the assessment of building damage caused by vibration. DIN 4150-3 and BS 7385-2 provide recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 5-9 and Table 5-10. DIN 4150-3 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. Structural damage criteria for heritage items have been taken from DIN 4150-3, whilst criteria for commercial/residential items have been taken from BS 7385-2.

Table 5-9 Structural damage safe limits (DIN 4150-3) for building vibration

Group	Type of structure	At foundation – Less than 10 Hz	At foundation - 10 Hz to 50 Hz	At foundation - 50 Hz to 100 Hz[1]	Vibration at the horizontal plane of the highest floor for all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order/heritage listed)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Notes:

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values.

Table 5-10 BS 7385-2: Transient vibration guide values for cosmetic damage

Group	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

5.2.2 Human comfort

Humans are sensitive to vibration such that they can detect vibration levels well below those required to cause any risk of damage to a building or its contents. Criteria to avoid annoyance are therefore more stringent than those to prevent structural damage.

5.2.2.1 Intermittent vibration

The assessment of intermittent vibration outlined in AVTG is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 5-11. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

Table 5-11 Preferred and maximum vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Day time		Night-time	
	Preferred	Max	Preferred	Max
Critical areas[1]	0.10	0.20	0.10	0.20
Residences[2]	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:

1. *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria.*
2. *Criteria for residences are lower than schools as people expect to be able to relax/sleep in their homes without annoyance and are generally more concerned about structural damage than would be the case within schools and offices.*

5.2.2.2 Continuous and impulsive vibration

Acceptable levels of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space. AVTG provides the preferred values for continuous and impulsive vibration. These are presented in Table 5-12.

There is low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values in Table 5-12. Situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short duration. Vibration levels above those indicated in Table 5-12 may be dealt with through negotiation with the regulator of the affected community.

Table 5-12 Peak particle velocity for continuous and impulsive vibration (mm/s)

Location	Assessment period	Preferred	Maximum
Continuous vibration			
Residences[1]	Day Night	0.28 0.20	0.56 0.40
Offices, schools, educational institutions and places of worship	When in use	0.56	1.10
Impulsive vibration			
Residences[1]	Day Night	8.60 2.80	17.0 5.60
Offices, schools, educational institutions and places of worship	When in use	18.0	36.0

Notes:

1. *Criteria for residences are lower than schools as people expect to be able to relax/sleep in their homes without annoyance and are generally more concerned about structural damage than would be the case within schools and offices.*

6.0 Operational noise criteria

The Proposal involves changes and upgrades to the station, as well as upgrades to back-up power supply, including the installation of a new padmount transformer at the intersection of Old Canterbury Road and Albert Street and an Ausgrid kiosk substation on Longport Street. As a result, operational noise is to be assessed in accordance with the EPA NPfI, rather than with the EPA RING.

6.1 EPA – NSW *Noise Policy for Industry*

The NPfI provides guidance in relation to acceptable noise limits for industrial noise emissions, which includes, but is not limited to, noise emissions from mechanical plant. The NPfI sets out a procedure to determine project noise trigger levels relevant to a development. If it is predicted that the development is likely to exceed the project noise trigger level at existing noise sensitive receivers, then management measures need to be considered to reduce the predicted noise level.

The assessment procedure in the NPfI has two components:

- Controlling **intrusive** noise impacts in the short term for residences
- Maintaining noise level **amenity** for residences and other land uses.

Both components are assessed at the boundary of the noise sensitive receiver site, or if the site boundary is more than 30 metres from the noise sensitive building, a distance of 30 metres from the noise sensitive building.

6.1.1 Intrusive noise impacts

The NPfI states that the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (L_{Aeq} level), measured over a 15-minute period, does not exceed the background noise level measured by more than 5 dB. The RBL is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the NPfI.

The intrusive noise criteria for the Proposal are shown in Table 6-1.

Table 6-1 Recommended $L_{Aeq,\ 15\ minute}$ intrusive noise criteria levels from industrial noise sources

Noise catchment area	Time of day[1]	RBL ($L_{A90,\ 15\ minute}$), dB(A)	Intrusive criterion RBL + 5 ($L_{Aeq,\ 15\ minute}$)
NCA 1	Day	44	49
	Evening	42	47
	Night	34	39
NCA 2	Day	53	58
	Evening	49	54
	Night	34	39
NCA 3	Day	48	53
	Evening	46	51
	Night	33	38

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.*

6.1.2 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the NPfI.

The Proposal area and its surroundings consist of commercial premises, rail, and continuous traffic flows along Railway Terrace and Old Canterbury Road. Therefore, the residential receivers are considered to be within a suburban amenity area. The relevant amenity criteria is shown in Table 6-2.

Table 6-2 Recommended L_{Aeq} amenity noise levels from industrial noise sources

Type of Receiver	Time of Day	Recommended L_{Aeq} Noise Level dB(A)
Residences - Suburban[1]	Day	55
	Evening	45
	Night	40
School classroom - Internal	Noisiest 1-hour period when in use	40[2]
Place of worship – Internal	When in use	40
Active recreation area	When in use	55
Passive recreation area	When in use	50
Commercial premises	When in use	65
Industrial premises	When in use	70

Notes:

1. *The 'Suburban' residential category from the NPfI was chosen as receivers surrounding the Proposal area are located in an area that has local traffic with characteristically intermittent traffic flows and some limited commerce.*
2. *In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hr)}$.*

According to Section 2.4 of the NPfI, the amenity level applicable to the Proposal is equal to the recommended level minus 5 dB(A). This takes into account the cumulative impacts of other industrial noise sources in the area.

As per the NPfI, the project amenity level is converted to a 15-minute period by adding three dB(A).

A summary of the project amenity levels for residential and non-residential receivers is presented in Table 6-3.

Table 6-3 Project $L_{Aeq,15\ minute}$ amenity noise levels

Type of Receiver	Time of Day	Project $L_{Aeq,15\ minute}$ Amenity Noise Level dB(A)
Residences – Suburban	Day	53
	Evening	43
	Night	38
School classroom - Internal	Noisiest 1-hour period when in use	40
Place of worship – Internal	When in use	40
Active recreation area	When in use	55
Passive recreation area	When in use	50
Commercial premises	When in use	65
Industrial premises	When in use	70

6.1.3 Project specific noise criteria

A summary of the project noise trigger levels for the Proposal is presented in Table 6-4. The project specific noise trigger levels are the lower of the intrusive and amenity noise levels.

Table 6-4 Project specific noise levels

Receiver area	Period[1]	Project specific noise criteria, ($L_{Aeq,15\ minute}$)[1]
Residences - NCA 1	Day	49
	Evening	43
	Night	38
Residences - NCA 2	Day	53
	Evening	43
	Night	38
Residences - NCA 3	Day	53
	Evening	43
	Night	38
School classroom - Internal	Noisiest 1-hour period when in use	40
Place of worship – Internal	When in use	40
Active recreation area	When in use	55
Passive recreation area	When in use	50
Commercial premises	When in use	65
Industrial premises	When in use	70

Notes:

1. Project specific noise levels for residences are determined as the lowest of the intrusive and amenity criteria.

6.2 Operational vibration

Operational vibration is not expected to be an issue as a result of the Proposal as the operational activities would not involve vibration generating activities that would create significant vibration levels at nearby sensitive receivers or adjacent properties. Therefore, an assessment of the operational vibration impacts is not required.

6.3 Operational road traffic noise criteria

Noise criteria are assigned to sensitive receivers using the RNCG. The RNCG provides guidance on how to apply the RNP.

The RNP requires the consideration of two scenarios, the ‘no-build’ option (without the proposal) and the ‘build’ option (with the Proposal). The ‘no-build’ option represents the scenario if the proposal was not to proceed. The ‘build’ option represents the scenario if the proposal was to proceed. Each of these scenarios must be considered at two points in time, the year of opening and the design year, typically ten years after opening. For this Proposal, the year 2027 has been assessed.

The operational road traffic noise study area covers residential receivers located on the roads where traffic volumes may increase: Henry Street, Hobbs Street, Dennison Road and Hunter Street.

The road traffic noise assessment criteria for existing residences affected by additional traffic due to a land use development are presented in Table 6-5. For this assessment Henry and Hobbs Streets are considered local roads, Dennison Road and Hunter Street are considered sub-arterial roads.

Table 6-5 Road traffic noise assessment criteria for residential land uses

Existing road category	External target noise levels, dB(A)	
	Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/arterial/sub-arterial road	$L_{Aeq\ (15hr)}$ 60	$L_{Aeq\ (9hr)}$ 55
Local road	$L_{Aeq\ (1hr)}$ 55	$L_{Aeq\ (1hr)}$ 50

The external noise criteria are applied at one (1) metre from the façade that is most exposed to traffic noise and at a height of 1.5 metres from the floor level. The criteria includes an allowance for noise reflected from the façade.

7.0 Construction noise and vibration assessment

7.1 Construction noise modelling scenarios

Table 7-1 provides a summary of the construction noise scenarios modelled, including the proposed construction plant/equipment for each scenario and their associated sound power levels (SWLs). For the assessment of each scenario, the SWL of the noisiest equipment or plant has been selected to represent the overall SWL of the scenario. The following construction scenarios were assessed:

- Compound operation
- Weekend Rail Possession 4
- Weekend Rail Possession 10
- Main Work 5
- Hi-rail access pads.

Weekend Rail Possession 4 was assessed as it has similar equipment and work area to weekend rail possession periods 1-9 and was therefore considered representative of the other weekend rail possession periods. Similarly, Main Work 5 was assessed as it was considered representative of the other main work construction stages. Weekend Rail Possession 10 was assessed as it required less equipment and was overall a quieter scenario than the other possession periods. The compound operation and hi-rail access pad scenarios were modelled and assessed due to their locations outside of the main construction work area and different equipment requirements.

Out-of-hours work would likely be required during approximately 10 rail shutdown periods over the 20-month construction period to ensure safety of railway workers and operational assets and reduce the overall impact of the Proposal on the wider community and road network. It should be noted that night-time construction work during scheduled rail shutdown periods would effectively serve as a respite mitigative measure as work would not take place over more than two (2) consecutive nights. This would provide some respite to surrounding receivers during weekdays between work.

Minor road work may be undertaken outside standard construction hours under a Road Occupancy Licence to reduce impacts on the road network, however noise impacts from minor road work are anticipated to be less than weekend possession work.

Table 7-1 Construction assessment stages, scheduling and equipment

ID	Construction stage	Construction hours	Equipment	SWL per unit, dB(A)[1]
-	Compound operation	Standard hours and outside standard hours	Spoil trucks	108[2,3]
			Semi-trailers	108[3]
8	Weekend Rail Possession 4	Standard hours and outside standard hours	Piling – 600 mm CFA	104
			Hi-rail piling – 600 mm CFA	104
			Mobile cranes	99
			Mini excavator	101
			Hi-rail excavator and wagons	101
			Concrete pump	105
			Concrete truck	105[3]
			Spoil trucks	108[3]
			Mini roller	105
			Excavators	101

ID	Construction stage	Construction hours	Equipment	SWL per unit, dB(A)[1]
			Concrete saws	112[2,3,4]
			Concrete vibrators	103
			Flatbed trucks	106[3]
			Forklifts	98
			Grinders	108[3,4]
			Hand tools	105
			Jackhammers	111[3,4]
			Lighting towers (diesel generator)	93
			Vibratory rollers	105[4]
			Elevated work platforms	95
			Semi-trailer	108[3]
20	Weekend Rail Possession 10	Standard hours and outside standard hours	Asphalt paving machine	105
			Flatbed trucks	106[3]
			Forklifts	98
			Grinders	108[2,3,4]
			Hand tools	105
			Lighting towers (diesel generator)	93
			Elevated work platforms	95
11	Main Work 5	Standard hours	Piling – 600 mm CFA	104
			Hi-rail piling – 600 mm CFA	104
			Mobile cranes	99
			Mini excavators	101
			Hi-rail excavator and wagons	101
			Concrete pump	105
			Concrete truck	105[3]
			Spoil trucks	108[3]
			Excavators	101
			Concrete saws	112[2,3,4]
			Concrete vibrators	103
			Flatbed trucks	106[3]
			Forklifts	98
			Grinders	108[3,4]
			Hand tools	105
			Jackhammers	111[3,4]
			Suction trucks	105[3]
			Vibratory rollers	105[4]

ID	Construction stage	Construction hours	Equipment	SWL per unit, dB(A)[1]
			Dump trucks	108[3]
			Elevated work platforms	95
			Semi-trailer	108[3]
-	Hi-rail access pads	Standard hours and outside standard hours	Spoil trucks	108[2,3]
			Hi-rail excavator and wagons	101

Notes:

1. *It is highly unlikely that all construction stage noise sources would be generating noise simultaneously*
2. *Highest SWL to be used for the assessment of the scenario*
3. *Equipment assumed to only be operational for 33% of a 15-minute period*
4. *Equipment with special audible characteristics.*

7.2 Noise modelling methodology

Noise levels due to the construction activities shown in Section 7.1 have been predicted at nearby noise sensitive receivers using SoundPLAN 8.2 noise modelling software and the CONCAWE (Concawe, 1981) method. This method is suited to predicting noise propagation because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

The noise model was created to represent 'reasonable' worst-case periods of construction work. The following features were included in the noise model:

- ground topography
- ground absorption and reflection
- receivers
- construction noise sources.

There may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant/equipment in operation during the measurement and also the location of the plant/equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction plant/equipment moves around the site.

7.2.1 Construction modelling assumptions

The following assumptions have been made in modelling all construction noise scenarios in order to present a reasonable worst-case scenario:

- for all construction scenarios, the noisiest piece of equipment would be operating at all times, unless noted otherwise
- plant/equipment is spread out within the Proposal boundary.
- neutral atmospheric conditions, i.e. relatively calm, no wind.

Additionally, it is assumed that limited deliveries would be received during out-of-hours and therefore this has not been assessed in detail. Emergency situations have also not been assessed in detail during out-of-hours. It is assumed that receipt of deliveries and emergency activities would be undertaken in accordance with an Out-of-hours Works procedure.

7.3 Predicted construction noise levels

The identified residential and non-residential receivers have been assessed against the standard hours and out-of-hours night-time NMLs. The level of impact may change depending on the final construction methodology and further assessment would be undertaken if required.

Compound operation, Weekend Rail Possession Periods 4 and 10, and Main Work 5 were all assessed during standard construction hours. Compound operation and possession periods 4 and 10 were also

assessed during night-time hours to assess the noise impacts during rail possession periods. Construction noise contours calculated at 1.5 metres above ground level are presented in Appendix D.

The hi-rail access pad scenario was assessed separately to the other construction scenarios as the locations of the hi-rail access pads were outside of the NCAs determined for the Proposal. Buffer distances up to which noise levels are expected to exceed the NMLs during night-time hours (worst case) at each hi-rail access pad location are also presented in Appendix D.

7.3.1 Residential receivers

Table 7-2 and Table 7-3 present the construction noise modelling results for residential receivers and show the number of receivers where the construction NMLs are likely to be exceeded during standard hours and night-time hours respectively. The tables also present the number of receivers where noise levels are predicted to exceed the highly affected level, 75 dB(A).

Table 7-2 Number of residential receivers where noise levels may exceed NMLs during standard construction hours

Construction stage	Number of predicted noise affected residential receivers			
	Level of exceedance of NMLs during ICNG standard construction hours			Highly affected
	1 – 10 dB(A)	11 – 20 dB(A)	> 20 dB(A)	> 75 dB(A)
NCA 1				
Compound operation	7	9	1	1
Weekend Rail Possession 4	21	9	3	3
Weekend Rail Possession 10	12	4	2	2
Main Work 5	21	9	3	3
NCA 2				
Compound operation	2	0	0	0
Weekend Rail Possession 4	4	19	0	17
Weekend Rail Possession 10	4	17	0	16
Main Work 5	4	19	0	17
NCA 3				
Compound operation	1	0	0	0
Weekend Rail Possession 4	17	7	2	2
Weekend Rail Possession 10	12	3	1	2
Main Work 5	17	7	2	2

Table 7-3 Number of residential receivers where noise levels may exceed NMLs during night-time work

Construction stage	Number of predicted noise affected residential receivers				
	Level of exceedance of NMLs outside of ICNG standard construction hours (night-time)				Highly affected
	1 – 5 dB(A)	6 – 15 dB(A)	16 – 25 dB(A)	> 25 dB(A)	> 75 dB(A)
NCA 1					
Compound operation	16	26	7	10	1
Weekend Rail Possession 4	317	110	21	12	3
Weekend Rail Possession 10	113	49	12	6	2
NCA 2					
Compound operation	4	30	4	1	0
Weekend Rail Possession 4	2	9	10	23	17
Weekend Rail Possession 10	1	12	8	21	16
NCA 3					
Compound operation	44	13	3	0	0
Weekend Rail Possession 4	360	311	65	15	2
Weekend Rail Possession 10	239	188	23	10	2

Table 7-4 presents the number of residential receivers where noise levels may exceed NMLs during the night-time while the hi-rail access pads are being utilised for rail possessions.

Table 7-4 Number of residential receivers where noise levels may exceed NMLs during night-time work at hi-rail access pads

Hi-rail access pad location	Number of residential receivers where noise levels may exceed NML across the Proposal area			
	Level of exceedance of NMLs outside of ICNG standard construction hours (night-time)			
	1 – 5 dB(A)	6 – 15 dB(A)	16 – 25 dB(A)	> 25 dB(A)
Ashfield	97	53	6	0
Petersham	142	129	8	0
Stanmore	203	159	0	0

The results show that construction noise levels are predicted to exceed the NMLs during both standard hours and (out-of-hours) night-time hours for all assessed construction scenarios. The largest number of total exceedances occurs within NCA 1 during Weekend Rail Possession 4 and Main Work 5 for standard hours work, and within NCA 3 during Weekend Rail Possession 4 for night-time work.

For the hi-rail access pad scenario, the largest number of NML exceedances occur at Stanmore during night-time due to the higher density of residential receivers located near the railway corridor and hi-rail access pad.

It is important to consider that this assessment is representative of the worst-case 15-minute period of construction activity, with the construction equipment located at the closest distance from each sensitive receiver location. The assessed scenarios do not represent the ongoing day-to-day noise impact at noise sensitive receivers for an extended period of time.

Particularly noisy activities, such as concrete sawing, are likely to persist for only a fraction of the overall construction period. Typical noise levels could be 5 to 10 dB(A) lower dependent on the site and nature of work.

All construction scenarios except the hi-rail access pad scenario assessed during standard and night-time hours predicted 'highly affected' residential receivers located on Thomas Street, Railway Terrace, and/or Hunter Street. The largest number of 'highly affected' residential receivers are predicted within NCA 2 during Weekend Rail Possession 4 and Main Work 5. The ICNG states additional consideration for mitigation should be afforded for 'highly noise affected' receivers. These receivers would receive additional consultation with regards to specific timing and impacts of construction work. Respite periods would also be considered for these receivers in accordance with the ICNG.

Feasible and reasonable mitigation measures would be detailed in a Construction Noise and Vibration Management Plan (CNVMP) for the Proposal (refer to Section 7.8.1).

7.3.2 Non-residential receivers

Table 7-5 presents the construction noise modelling results for non-residential receivers and shows the number of receivers where the NMLs are likely to be exceeded during the receivers' hours of use.

Table 7-5 Number of non-residential receivers where noise levels may exceed NMLs when in use

Construction stage	Number of non-residential receivers where noise levels may exceed NML across the Proposal area		
	1 – 10 dB(A)	11 – 20 dB(A)	> 20 dB(A)
Compound operation	1	3	0
Weekend Rail Possession 4	0	1	3
Weekend Rail Possession 10	1	2	1
Main Work 5	0	1	3

The results show that construction activities are expected to exceed the NMLs at a number of non-residential receivers for the assessed scenarios. Three (3) non-residential receivers are predicted to experience NML exceedances greater than 20 dB(A) during Weekend Rail Possession 4 and Main Work. Non-residential sensitive receivers that may experience NML exceedances include buildings within Eileen O'Connor Catholic College, The John Berne School, and the Church of Saint Thomas of Canterbury.

Although the commercial receivers near the intersection of Railway Terrace and Victoria Street are not considered highly sensitive noise receivers, they may experience noise levels up to 10 dB(A) above their NMLs.

7.4 Sleep disturbance assessment

A sleep disturbance assessment was undertaken to assess the potential impact of night-time work during the rail possession periods on sleep disturbance. Table 7-6 below presents the number of residential receivers where predicted noise levels exceed the sleep disturbance criteria and the sleep awakening reaction criteria.

Table 7-6 Number of residential receivers where noise levels exceed the sleep disturbance criteria

Construction stage	Sleep disturbance criteria, dB(A)	Awakening reaction criteria, dB(A)	Number of receivers where predicted noise levels exceed	
			Sleep disturbance criteria	Awakening reaction criteria
NCA 1				
Compound operation	49	65	54	15
Weekend Rail Possession 4			308	22
Weekend Rail Possession 10			120	15
NCA 2				
Compound operation	49	65	39	5
Weekend Rail Possession 4			43	29
Possession 10			42	25
NCA 3				
Compound operation	48	65	30	2
Weekend Rail Possession 4			615	33
Weekend Rail Possession 10			333	20

A large number of exceedances of the sleep disturbance screening criteria, particularly in NCA 3, have been predicted due to the night-time construction work associated with the Proposal. Exceedances of the awakening reaction screening criterion have also been predicted at several receivers. These exceedances are attributed to the close proximity of the construction site to the residences.

It is noted that the majority of construction activities, including particularly noisy activities, would be undertaken during the day where feasible.

Given the number of sleep disturbance exceedances, an effective communication plan and noise management measures must be developed during detailed design to minimise the impacts upon affected residential receivers.

7.5 Construction traffic assessment

Construction vehicles would access the site from Old Canterbury Road, Thomas Street, West Street, Railway Terrace, Henry Street and Victoria Street. The main access roads for construction vehicles to the hi-rail locations at Petersham and Stanmore are Gordon Street and Railway Avenue respectively. These streets are listed in Table 7-7. There are no residential receivers located on the main road to the Ashfield hi-rail pad (Grimmond Avenue) and therefore, it has not been assessed for construction traffic. The external noise criteria are applied one (1) metre from the external façade of an affected building.

Table 7-7 Roads used by construction traffic

Road	Type	Residential receivers	Estimated existing Annual Average Daily Traffic (AADT)[1]
Old Canterbury Road	Arterial	Yes	20,000[1]
Thomas Street	Local road	Yes	877[3,4]
West Street	Sub Arterial	Yes	2,357[3,5]
Railway Terrace	Sub Arterial	Yes	20,000[1,2]
Henry Street	Local road	Yes	549[3]
Victoria Street	Sub Arterial	Yes	877[3,4]
Gordon Street	Sub-Arterial	Yes	20,000[6]
Railway Avenue	Local road	Yes	877[3,4]

Notes:

1. *Volumes estimated from data from Transport for NSW Traffic Volume Viewer (2009 volumes)*
2. *Volumes assumed to be similar to Longport Street*
3. *Daily traffic volumes extracted from traffic tube counts conducted by TTM between the 22 and 28 November 2024 inclusive*
4. *Volumes assumed to be similar to Denison Street*
5. *Volumes assumed to be similar to Hunter Street*
6. *Volumes assumed to be similar to Railway Terrace.*

Table 7-8 Resultant noise level changes due to worst case additional construction traffic volumes during non-possession periods

Road	Existing noise level, dB(A)		Predicted noise level, dB(A)		Change in noise level, dB(A)		Change in noise level greater than 2 dB(A)?
	Day	Night	Day	Night	Day	Night	
Old Canterbury Road	70	66	70	66	0.1	0.0	No
Thomas Street	60	52	61	52	1.3	0.0	No
West Street	61	55	62	55	0.5	0.0	No
Railway Terrace	74	70	74	70	0.1	0.0	No
Henry Street	58	52	59	52	1.2	0.0	No
Victoria Street	56	49	57	49	1.4	0.0	No
Gordon Street	71	68	71	68	0.0	0.0	No
Railway Avenue	57	49	58	49	0.6	0.0	No

Table 7-9 Resultant noise level changes due to worst case additional construction traffic volumes during possession periods

Road	Existing noise level, dB(A)		Predicted noise level, dB(A)		Change in noise level, dB(A)		Change in noise level greater than 2 dB(A)?
	Day	Night	Day	Night	Day	Night	
Old Canterbury Road	70	66	70	66	0.1	0.2	No
Thomas Street[1]	60	52	61 (60)	57 (54)	1.0 (0.3)	5.2 (2.3)	**Yes**
West Street	61	55	61	56	0.1	0.3	No
Railway Terrace	74	70	74	70	0.1	0.2	No
Henry Street[1]	58	52	59 (58)	56 (54)	0.9 (0.3)	3.7 (1.5)	**Yes**
Victoria Street	56	49	56	50	0.1	0.9	No
Gordon Street	71	68	71	68	0.0	0.1	No
Railway Avenue	57	49	58 (57)	53 (51)	0.6 (0.3)	3.8 (2.3)	**Yes**

Notes:

1. *Predicted noise levels and changes in noise levels due to average additional construction traffic volumes presented in brackets for Thomas Street, Henry Street and Railway Avenue.*

As shown in Table 7-8, the worst case additional construction traffic on the roads used by construction traffic during non-possession periods would have a minor impact on existing road traffic noise levels at residential receivers, where traffic noise levels are not expected to increase by more than two dB(A) during construction.

During possession periods, the additional construction traffic on Thomas Street, Henry Street and Railway Avenue (for access to the Stanmore hi-rail pad) would have a noticeable impact on existing road traffic noise levels at residential receivers during the night. The increase in traffic noise at residential receivers would be greater than two dB(A) during the night, but less than two dB(A) during the day. It should be noted that the additional construction traffic volumes used were the worst-case volumes for the peak construction period (a maximum of 15 heavy vehicles on Thomas Street and Henry Street, and maximum of 10 heavy vehicles on Railway Avenue). The change in traffic noise levels at residential receivers on Henry Street, Thomas Street and Railway Avenue would decrease with average additional construction traffic volumes (as shown in Table 7-9), with the increase in traffic noise on Henry Street being less than two dB(A) during the night.

To minimise the construction traffic noise levels at residential receivers on Thomas Street, Henry Street and Railway Avenue, construction traffic management should be considered as part of the CNVMP.

7.6 Cumulative construction noise impacts

7.6.1 Overlapping construction stages

While most construction activities are expected to occur at distinct scheduled times and at different locations, it is possible that construction activities for the Proposal may occur at the same time, such as the use of hi-rail access pads and weekend possession work. Since the activities undertaken at the hi-rail pads are quieter and quite a distance away from the Proposal area, it is unlikely that the cumulative noise impacts would result in more than a three dB(A) increase in the highest noise level predicted for the possession work (assuming that at any one location equal noise levels from two stages of work are experienced). In this case, this increase is not expected to create any further exceedances in the NMLs.

Overlapping construction stages and identification of receivers subject to increased noise levels would be determined during detailed design. Additional mitigation measures would also be identified during detailed design if required.

7.7 Construction vibration assessment

Vibration intensive work may include the use of the following items of equipment:

- mini roller
- vibratory roller
- jackhammer
- bored piling rig.

The minimum working distances of these items of equipment from off-site receivers are shown in Table 7-10. These minimum distances are based on recommendations of the Transport CNVG-PTI and AECOM's previous project experience. If these minimum working distances are complied with, no adverse impacts from vibration intensive work are likely in terms of human response or cosmetic damage.

The closest residential and commercial receivers are less than two (2) metres from the Proposal, including residential receivers on Thomas Street and commercial receivers on Railway Terrace/Victoria Street. Several of the commercial properties on Victoria Street are also considered within the Lewisham Estate Heritage Conservation Area. Mitigation measures to control excessive vibration would need to be implemented as outlined in Section 7.8, if vibration intensive work is required within the minimum working distances outlined in Table 7-10.

Table 7-10 Recommended safe working distances for vibration intensive plant

Plant	Rating/ Description	Minimum working distances		
		Cosmetic damage		Human response
		Heritage	Commercial/ Residential	
Vibratory roller	< 50 kN (typically 1-2 t)	14 m	5 m	15-20 m
	< 100 kN (Typically 2-4 tonnes)	16 m	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	33 m	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	41 m	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	54 m	20 m	100 m
	> 300 kN (> 18 tonnes)	68 m	25 m	100 m
Jackhammer	Handheld	2 m	1 m (nominal)	2 m
Piling rig – bored	≤ 800 mm	5 m	2 m (nominal)	7 m

7.8 Construction mitigation measures

7.8.1 Construction Noise and Vibration Management Plan

A CNVMP would be developed and implemented for the Proposal. The CNVMP would include feasible and reasonable safeguards to manage noise emissions from the Proposal and complaints received in relation to construction noise or vibration. The CNVMP should include, as a minimum, the following:

- identification of nearby residences and other sensitive land uses
- description of approved hours of work
- description and identification of all construction activities, including work areas, equipment, and duration

- description of what work practices (generic and specific) would be applied to minimise noise and vibration
- a complaints handling process
- noise and vibration monitoring procedures, including for heritage structures
- overview of community consultation required for identified high impact work.

Construction work should be planned and carried out during standard construction hours wherever possible.

Table 7-11 presents a summary of the standard mitigation measures contained within the CNVG-PTI which should be considered as mitigation measures within the CNVMP.

Table 7-11 Transport's CNVG-PTI standard mitigation measures

Action required	Safeguard details
Management measures	
Implement stakeholder consultation measures	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least seven (7) days prior to commencement of relevant work. In addition to periodic notification, the following strategies may be adopted on a case-by-case basis: • project-specific website • project infoline • construction response line • email distribution list • web-based surveys • social media • community and stakeholder meetings • community-based forums (if required by approval conditions).
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on noise generating activities with special audible characteristics • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.
Monitoring	A noise monitoring program should be carried out for the duration of work in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.

Action required	Safeguard details
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding three (3) hours each, with a minimum respite period of one (1) hour between each block. 'Continuous' includes any period during which there is less than a one-hour respite between ceasing and commencing any of the work. No more than two (2) consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.
Source mitigation measures	
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable.
Maximum noise levels	The noise levels of plant and equipment must have operating sound power or sound pressure levels compliant with the allowable noise levels in Appendix C of the CNVG-PTI.
Rental plant and equipment	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the allowable noise levels in Appendix C of the CNVG-PTI.
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work, including delivery vehicles.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.

Action required	Safeguard details
Silencers on mobile plant	Where possible, reduce noise from mobile plant through additional fittings including: • residential grade mufflers • damped hammers such as 'City' Model Rammer Hammers • air Parking brake engagement is silenced.
Construction related traffic	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.
Vibration minimum working distances	If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage, as presented in Table 7-10, then attended vibration measurements would be undertaken when work commences, to determine "site specific minimum working distances". The minimum working distances for cosmetic damage from Table 7-10 are generally considered to be conservative. Working within them would not necessarily result in damage as factors such as work practices, and intervening structures can affect vibration levels. Alternative construction methodology with smaller minimum working distances would be adopted if feasible and reasonable, including consideration of avoiding use of vibration generating equipment. In addition, vibration intensive work would not proceed within the site-specific minimum working distances unless a permanent vibration monitoring system is installed approximately one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective. It is also advisable to carry out building condition surveys of sensitive historical structures before construction work begins.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.

7.8.2 Community consultation and complaints handling

All residents and sensitive receivers impacted by noise levels from the Proposal where noise levels are expected to exceed the NML should be consulted prior to the commencement of the particular activity, with the highest consideration given to those that are predicted to be most affected as a result of the work.

The information provided to the residents would include:

- programmed times and locations of construction work
- the hours of proposed work
- construction noise and vibration impact predictions
- construction noise and vibration mitigation measures being implemented on site.

Community consultation regarding construction noise and vibration would be detailed in a Community Liaison Plan for the construction of the Proposal and would include a 24-hour hotline and complaints management process.

7.8.3 Transport CNVG-PTI – Additional mitigation measures

The CNVG-PTI provides practical guidance on how to minimise, to the fullest extent practicable, the impacts on the community from airborne noise, ground-borne noise and vibration generated during the construction of Transport projects. This is managed through the application of all feasible and reasonable mitigation measures. Where exceedances are still expected to occur after standard mitigation measures have been applied, the CNVG-PTI recommends the implementation of additional mitigation measures. These mitigation measures are specified within the CNVG-PTI and presented in Table 7-12.

The provision of additional mitigation is based on the predicted exceedances above RBLs and when the exceedances occur. The construction noise contours in Appendix D indicate where these additional mitigation measures should be applied in accordance with the CNVG-PTI. Transport would confirm the application of these at each receiver and implement the measures during detailed design/construction planning and construction as relevant.

Table 7-12 Additional mitigation measures matrix

Time period		Action level[1] (mitigation measures)[2]				
		dB(A) above RBL				
		0 – 10 Noticeable	>10 – 20 Clearly audible	20 – 30 Moderately intrusive	>30 Highly intrusive	≥75
Standard	Weekday (7am - 6pm), Saturday (8am - 1pm), Sunday/PH (Nil)	-	-	PN, V	PN, V	PN, V SN
Out-of-Hours Work Period 1	Weekday (6pm - 10pm), Saturday (7am - 8am, 1pm - 10pm), Sunday/PH (8am - 6pm)	-	PN, RP[3], DR[3]	PN, V, SN, RO, RP[3], DR[3]	PN, V, SN, RO, RP[3], DR[3]	-
Out-of-Hours Work Period 2	Monday - Saturday (12am - 7am, 10pm – 12am), Sunday/Pub Hol (12am – 8am, 6pm - 12am)	PN	PN, V, SN, RO[4], RP[3] DR[3]	PN, V, SN, RO[4], RP[3] DR[3]	PN, V, SN, RO[4], RP[3] DR[3], AA	-

Notes:

3. *Action level is $L_{Aeq(15\ minute)}$ noise level above background (RBL) - qualitative assessment of noise levels*
4. *The following abbreviations have been used (refer to* Table 7-13 *for further details):*
   - *PN: Project notification*
   - *V: Verification monitoring*
   - *SN: Specific notification*
   - *RP: Respite period*
   - *DR: Duration Respite*
   - *RO: Project specific respite offer*
   - *AA: Alternative accommodation*
5. *Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only (i.e. Saturday 7am-8am and 1pm-6pm, Sundays/Public Holidays 8am-6pm)*
5. *Respite offers during OOHW Period 2 are only applicable for evening periods (i.e. Sundays/Public Holidays 6pm-10pm) and may not be required if a respite offer has already been made for the immediately preceding OOHW Period 1.*

Table 7-13 describes the additional mitigation measures, as outlined in the CNVG-PTI.

Table 7-13 Description of additional mitigation measures

Abbreviation	Mitigation measure	Explanation
PN	Periodic notification	For each Transport project, a notification is produced and distributed to stakeholders via letterbox drop or distributed to the project post and/or email mailing lists. The same information will be published on the Transport corporate website or equivalent. Periodic notifications provide an overview of current and upcoming work across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions can assist in reducing the impact on stakeholders. The approval conditions for projects specify requirements for notification to sensitive receivers where work may impact them. Content and length are determined on a project-by-project basis and must be approved by Transport prior to distribution. Most projects distribute notifications on a monthly basis.
V	Verification monitoring	Verification monitoring of noise and/or vibration during construction may be conducted at the affected receiver or a nominated representative location. Monitoring can be in the form of either unattended logging or operator attended surveys. Verification must be undertaken by suitably qualified, trained and experienced personnel using appropriate equipment and methodology, with reference to AS1055. The purpose of monitoring is to confirm that: • Construction noise and vibration from the project are consistent with the predictions in the noise assessment • Mitigation and management of construction noise and vibration is appropriate for receivers affected by the work Where noise monitoring finds that the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required and the Construction Noise and Vibration Impact Statement amended.

Abbreviation	Mitigation measure	Explanation
SN	Specific notifications	Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. In addition to Specific Notifications and letters, communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing. • Letters may be letterbox dropped, hand distributed or emailed. • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs. • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that would be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project. • Specific notifications are used to support periodic notifications, or to advertise unscheduled work or high impact work and must be approved by Transport prior to implementation/distribution. Where impacts have already been captured in a Periodic Notification, a Specific Notification may not be required.
RO	Respite offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact. The offer could comprise pre-purchased supermarket vouchers, movie tickets, bowling activities, meal vouchers or similar offers designed to provide residents with a short break from impact of construction activity outside of their home. This measure is determined on a case-by-case basis and may not be applicable to all Transport projects.
AA	Alternative accommodation	Alternative accommodation options may be provided for residents living near construction activities likely to incur unreasonably high impacts. Alternative accommodation will be determined on a case-by-case basis and should provide a like-for-life replacement for permanent residents, including provisions for pets, where reasonable and feasible.
RP	Respite period	OOHW during evening and night periods will be restricted so receivers are impacted for no more than three consecutive evenings and no more than two consecutive nights in the same NCA in any one week, except where this is a Duration Reduction. A minimum respite period of four evenings/five nights shall be implemented between periods of consecutive evening and/or night work. Strong justification must be provided where it is not feasible and reasonable to implement these period restrictions (e.g. to minimise impacts to rail operations), and approval must be given by Transport through the OOHW Approval Protocol.

Abbreviation	Mitigation measure	Explanation
DR	Duration reduction	Where Respite Periods are counterproductive to reducing noise and vibration impacts to the community, it may be beneficial to increase the number of consecutive evenings and/or nights through Duration Reduction to minimise the duration of the activity. This measure is determined on a project-by-project basis. Impacted receivers must be consulted and evidence of community support for the Duration Reduction must be provided as justification for the Duration Reduction. A community engagement strategy must be agreed with and implemented in consultation with Transport Community and Stakeholder Engagement Representatives.

8.0 Operational noise

8.1 Station noise

Additional operational components at the station would include four (4) new lifts, new canopy structures, two (2) pumps located within a pump room, and station room upgrades including a new family accessible toilet. All of these components would not produce significant noise emissions and would be expected to comply with the most stringent project specific noise criteria (night-time) of 38 dB(A).

If required, operational noise emissions would be further addressed during the detailed design phase in order to comply with operational noise criteria as per the NPfI. Operational noise criteria are presented in Section 6.0.

8.2 Padmount transformer and kiosk noise

A 200 kVA padmount transformer would typically have a SWL of 56 dB(A), in accordance with AS 60076.10:2009 *Power transformers, Part 10: Determination of sound levels*. The SWL of the kiosk substation would likely be lower than 56 dB(A). The noise levels at the closest residential receivers to the padmount transformer and kiosk substation – 54 Old Canterbury Road and 3 Longport Street respectively – are predicted to be less than 30 dB(A), which complies with the most stringent project specific noise criteria (night-time) of 38 dB(A).

8.3 Road traffic noise

To determine the potential impact of the operational traffic noise arising from the Proposal as a result of the diverted vehicle access routes from Victoria Street (outlined in Section 3.3), future road traffic noise levels have been modelled at the most affected residential receivers for the 'build' (with the Proposal) and 'no build' (without the Proposal) scenarios for the 'Year of Opening' (2027).

Noise levels at sensitive receivers along Denison Road, Henry Street, Hobbs Street, and Hunter Street were assessed against the criteria outlined in Section 6.3.

8.3.1 Road traffic noise modelling methodology

Road traffic noise levels were calculated using SoundPLAN 8.2 software, which implements the 'Calculation of Road Traffic Noise' (CoRTN) algorithm. The United Kingdom Department of Transport devised the CoRTN algorithm and with suitable corrections, this method has been shown to give accurate predictions of road traffic noise and has been found to consistently model noise predictions for Transport's road projects.

CoRTN is the most widely used algorithm for the prediction of road traffic noise within Australia and is an accepted algorithm under the EPA's RNP (Appendix B4).

The modelling parameters which are included in the noise model are detailed in Table 8-1.

Table 8-1 Road traffic noise modelling parameters

<table>
<tr><th>Parameter</th><th>Comment</th></tr>
<tr><td>Calculation search radius</td><td>2,000 metres</td></tr>
<tr><td>Assessment area</td><td>Henry Street, Hobbs Street, Denison Road and Hunter Street</td></tr>
<tr><td>Source heights and corrections</td><td>Four noise source heights were used in the model as follows:
<table>
<tr><th>Source</th><th>Height (m)</th><th>Correction (dB)</th></tr>
<tr><td>Light vehicles engine and tyres</td><td>0.5</td><td>0.0</td></tr>
<tr><td>Heavy vehicles tyres</td><td>0.5</td><td>-5.4</td></tr>
<tr><td>Heavy vehicles engine</td><td>1.5</td><td>-2.4</td></tr>
<tr><td>Heavy vehicles exhaust</td><td>3.6</td><td>-8.5</td></tr>
</table></td></tr>
<tr><td>Existing road alignment</td><td>The existing roads were modelled using satellite imagery.</td></tr>
</table>

Parameter	Comment
Road gradient	The road gradient was calculated based on elevation information system data.
Existing pavement	The existing road pavements were modelled as dense grade asphalt (DGA), and no corrections were applied.
Façade reflection	+2.5 dB correction for façade reflected receivers
L_{10} to L_{eq}	-3 dB correction
Receiver heights	1.5 metres
Receiver locations	1 metre from the façade of receivers
Buildings, structures and walls	All buildings and structures were included where acoustically relevant
Topography	1 metre interval data up to 1 kilometre either side of the Proposal
Traffic volumes	Future traffic volumes for the 'Year of Opening' (2027) were derived from existing 2024 traffic counts
Traffic speeds	17-33 km/h
Noise sensitive receivers	In accordance with the RNP this includes residences, school classrooms, places of worship, open spaces (active and passive use), mixed use developments, childcare facilities and aged facilities.

8.3.2 Validation noise model

An existing road traffic noise model was developed incorporating the existing traffic flows for validation with road traffic noise measurements. The traffic flows used in the model were provided by tube counts that were deployed concurrently with noise logging for the Proposal.

The measured traffic volumes derived from the tube counts are presented in Table 8-2.

Table 8-2 Measured existing traffic volumes

Location	Daytime (7 am to 10 pm)		Night-time (10 pm to 7 am)		Speed (km/h)
	Light	Heavy	Light	Heavy	
Henry Street	494	10	44	1	33
Hobbs Street	169	2	11	0	17
Denison Street	792	17	67	1	30
Hunter Street	2,087	47	217	6	32
Old Canterbury Road[1]	16,150	850	2,850	150	50

Notes:

1. Traffic volumes for Old Canterbury Road were estimated from data provided on the Transport Traffic Volume Viewer.

The model was validated in accordance with the RNMVG. The RNVMG provides guidance and procedures for validating operational road traffic noise models. The guideline discusses error (the difference between measured and predicted noise levels), principles to be applied when completing monitoring, and modelling to minimise error and use of calibration adjustments.

The logger placed at 7 Henry Street, Lewisham was included in the validation process. Table 8-3 presents the measured existing traffic noise levels at 7 Henry Street (for the period from the 22 to 28 November) and the validation of the model.

Table 8-3 Noise model validation results for logger at 7 Henry Street

Logger ID	Address	Daytime $L_{Aeq,15hr}$, dB(A)			Night-time $L_{Aeq,9hr}$, dB(A)		
		Predicted	Measured	Difference	Predicted	Measured	Difference
L3	7 Henry Street	59.1	59.5	0.4	53.4	53.6	0.2

8.3.3 Traffic noise model

The 'Year of Opening' (2027) traffic volumes are presented in Table 8-4 and Table 8-5, and are used in the 'Year of Opening' road traffic noise models for the 'no build' and 'build' scenarios respectively. These models are used to assess the potential road traffic noise impacts from the Proposal during 2027. The 'Year of Opening' traffic volumes were derived from existing 2024 traffic counts conducted by TTM Group between the 22 and 28 November 2024 inclusive. It should be noted that Old Canterbury Road has been included in the noise model as it affects noise levels on Henry Street however no increase in traffic volume is predicted on this road for the build scenario. The existing traffic volumes have been used for Old Canterbury Road for the No-build and Build scenarios.

Table 8-4 'Year of Opening' (2027) predicted traffic volumes - No build

Location	Daytime (7 am to 10 pm)		Night-time (10 pm to 7 am)		Speed (km/h)
	Light	Heavy	Light	Heavy	
Henry Street	468	10	45	1	33
Hobbs Street	158	2	11	0	17
Denison Street	744	16	67	1	30
Hunter Street	1,972	42	219	6	32

Table 8-5 'Year of Opening' (2027) predicted traffic volumes - Build

Location	Daytime (7 am to 10 pm)		Night-time (10 pm to 7 am)		Speed (km/h)
	Light	Heavy	Light	Heavy	
Henry Street	563	14	64	2	33
Hobbs Street	392	5	38	1	17
Denison Street	1,077	20	106	2	30
Hunter Street	2,305	46	257	7	32

8.3.4 Proposal impact

Road traffic noise levels were predicted to be higher in the 'build' scenario compared to noise levels predicted in the 'no build' scenario, which is attributed to the increase in the number of vehicles permanently diverted from Victoria Street onto the adjacent local roads. The maximum noise level increase between the 'no build' and 'build' scenarios is 2.9 dB(A) at residential receivers on Hobbs Street during the day, and 4.2 dB(A) at 2 Hobbs Street during the night-time.

Although the noise levels are predicted to increase by more than two dB(A) for the 'build' scenario at some residential receivers on Hobbs Street, the overall 'build' noise levels at receivers would remain below the RNP criteria. Therefore, treatment or mitigation is not triggered for the receivers on Hobbs Street. At all other assessed roads, the noise levels are not predicted to increase by more than two dB(A) at any assessed receiver. Refer to Appendix E for the full summary for the operational road traffic results.

9.0 Conclusions

A construction and operational Noise and Vibration Impact Assessment has been completed for the Proposal. Noise and vibration sensitive receivers were identified. Measured noise levels from unattended monitoring were used to establish construction NMLs and operational noise criteria.

The Proposal is expected to commence construction in early 2026 and take up to 24 months to complete. The majority of construction work would be undertaken during standard construction hours. Some work would need to occur outside standard hours and would include night work and work during approximately 10 routine weekend rail possession periods, which are scheduled closures that would occur regardless of the Proposal.

Indicative construction work stages and the proposed equipment and plant have been described within this report. There were 21 distinct construction stages identified, and three stages, in addition to a compound operation and a hi-rail access pad scenario, were used in a computer-based noise model to predict the noise levels from construction work at sensitive receivers. Construction noise impacts were assessed at all residential and non-residential noise sensitive receivers within a one kilometre radius from the Proposal.

9.1 Construction noise

The predicted construction noise levels exceed the construction NMLs for all scenarios at a number of residential and non-residential noise sensitive receivers during standard hours. Noise exceedances are generally unavoidable given the proposed work and proximity to receivers, notwithstanding the implementation of feasible and reasonable noise mitigation measures. The largest impacts during standard hours would be experienced by residents within NCA 1 during Weekend Rail Possession 4 and Main Work 5. There are also 13 residential receivers within NCA 2 predicted to be ‘highly affected’ (noise levels greater than 75 dB(A)) during Weekend Rail Possession 4 and Main Work 5.

During night-time work, noise levels at a large number of receivers are expected to exceed the NMLs for all three night-time scenarios. The highest number of total exceedances is predicted to occur during Weekend Rail Possession 4 within NCA 3. These NML exceedances would be limited to the rail possession periods where work would not be undertaken for more than two consecutive nights. Construction work generating high noise and/or vibration levels would be scheduled during less sensitive time periods as far as practicable. During night-time work, Weekend Rail Possession 4 is also likely to result in the largest number of ‘highly affected’ residential receivers within NCA 1 and NCA 2. There are no ‘highly affected’ receivers predicted for NCA 3 during any of the assessed scenarios for both standard hours and night-time work.

For the hi-rail access pad utilisation scenario, the largest number of night-time NML exceedances are predicted to occur around the Stanmore hi-rail access pad location. This is likely due to the higher density of residential receivers located near the railway corridor and hi-rail access pad, when compared to the other locations at Ashfield and Petersham.

Implementation of mitigation measures outlined in Section 7.8 would aim to minimise and manage noise impacts where possible. Mitigation measures have been recommended in line with Transport’s CNVG-PTI in order to minimise and manage the impact of construction noise on noise sensitive receivers.

9.2 Sleep disturbance assessment

A sleep disturbance assessment was undertaken for the proposed night work based on the construction information available. A large number of exceedances of the sleep disturbance screening criteria have been predicted for the night-time construction work associated with the Proposal. Noise associated with some of the work would also exceed the awakening reaction screening criteria at a number of residential receivers. The exceedances are attributed to the close proximity of the receivers to the Proposal.

It should be noted that the predicted construction noise levels are the worst-case noise levels, therefore the majority of the actual $L_{A1(1min)}$ noise levels are likely to be less than those predicted.

Implementation of mitigation measures outlined in Section 7.8 would aim to minimise and manage noise impacts where possible.

9.3 Construction vibration

Minimum working distances to nearby structures have been recommended for nominated vibration intensive plant. If the minimum working distances are maintained, then no adverse impact from the vibration intensive work is likely in terms of human response or cosmetic damage. If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage, then attended vibration measurements would be undertaken when work commences, to determine site specific minimum working distances.

In addition, vibration intensive work would not proceed within the site-specific minimum working distances unless a permanent vibration monitoring system is installed approximately one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective.

Before construction work begins, building condition surveys of sensitive heritage structures would be completed and opportunities to utilise lower vibration emitting equipment would be explored.

9.4 Operational noise

Additional operational components at the station, which include new lifts, new canopy structures, two pumps located within a pump room, and station room upgrades would not produce significant noise emissions. As such, the operational noise environment of the station is expected to remain largely unchanged.

An operational road traffic noise screening assessment has been completed in accordance with the RNP. The installation of a one way travel lane on Victoria Street and the consequent diversion of vehicles from Victoria Street to other access routes was identified as the main contributor to changes in road traffic noise levels as a result of the Proposal.

Analysis of the road traffic noise modelling results has concluded that there are no noise level increases of two dB(A) or more predicted at assessed residential receivers on Denison Road, Henry Street, and Hunter Street across the ‘no build’ and ‘build’ scenarios in the ’Year of Opening’ (2027). Noise levels at assessed residential receivers on Hobbs Street were predicted to increase by more than two dB(A) during the day and night-time, however the overall road traffic noise levels at the receivers for the ‘build’ option would remain below the RNP criteria. Therefore, no further operational traffic assessment or consideration of road traffic noise mitigation is required for the Proposal.

Appendix A

Curriculum Vitaes

SARAH LU

Acoustic Engineer

Qualifications
BE (Honours) (Aerospace) /
BA (Chinese and Film Studies),
University of New South Wales,
2023

Affiliations
Associate Member of the
Australian Acoustical Society
Graduate Member of Engineers
Australia

Sarah has been involved in the delivery of noise and vibration assessments for several infrastructure projects across NSW. Sarah has worked on multiple environmental projects where she conducted noise modelling and analyses with SoundPLAN software across a wide program of construction and operational works.

Selected Experience

BUILDINGS

Create NSW Unlocking Venues: Soundproofing Grant, Sydney, March 2024 – April 2024

Graduate Acoustic Engineer – Assisted with acoustic assessment services for three potential live music venues in New South Wales. Conducted on-site inspections and acoustic testing, including background noise and reverberation measurements. Prepared acoustic reports detailing mitigation recommendations to reduce sound emission and ensure compliance with relevant criteria.

HMAS Albatross, Nowra, April 2023

Graduate Acoustic Engineer – Assisted with Weighted Level Difference (D_w) testing of audio security level rated spaces within three buildings at HMAS Albatross. Calculated and produced D_w rating certificates for each space that was tested.

ENERGY

Tomago BESS, Tomago, May 2023 – August 2023

Graduate Acoustic Engineer – Modelled the construction and operational noise impact of a battery energy storage system (BESS) facility at Tomago using SoundPLAN software. Conducted analysis work for the construction and operational noise assessments.

ENVIRONMENTAL

Hawkesbury Nepean Valley Flood Resilience Road Upgrade Program, Sydney, November 2023 – Present

Graduate Acoustic Engineer – Completing a combination of construction noise and vibration estimator tool assessments, detailed construction noise and vibration assessments, and operational noise and vibration assessments for 12 sites related to flood evacuation infrastructure improvements within the Hawkesbury Nepean Valley. Carrying out modelling and analysis of the works using ArcGIS and SoundPLAN. Conducted attended measurements and deployed noise loggers at two site locations.

Loganlea Station Relocation, Brisbane, October 2023 – December 2023

Graduate Acoustic Engineer – Assisted with the assessment of over 15 construction vibration scenarios related to the project. Liaised with the GIS team to produce construction noise and vibration maps. Collated mapping instructions and GIS data into Excel templates which enabled the GIS team to automate and accelerate the creation of over 30 maps.

Moss Vale Station and Stabling Yard Upgrade, Moss Vale, July 2023 – November 2023

Graduate Acoustic Engineer – Prepared a construction noise, cumulative construction noise and operational noise assessment for the accessibility upgrade of Moss Vale Station and an upgrade to its adjoining Stabling Yard to accommodate new regional intercity trains. Completed all the noise modelling and analysis work for the project.

Career History

- AECOM Australia Pty Ltd, Sydney, 2023 – Current
- Acoustic Solutions Pty Ltd, Sydney, 2022.

Geoff Lucas Principal Acoustic Engineer

Qualifications
PhD(Mech), University of NSW, 2008
BE(Mech) , University of NSW, 2004

Affiliations
Member of the Australian Acoustical Society
Member of the Institute of Engineers Australia

Referee
Natasha Ray – Assistant Resident Engineer (Structures)
Infrastructure Development – Pacific Highway Office
Roads and Maritime Services
0411 129 302 - natasha.ray@rms.nsw.gov.au

Proposed Role: Lead Engineer

Areas of expertise

Geoff has recent and relevant experience in the delivery of high quality transport infrastructure projects. This includes:

- 16+ years' experience in operational noise and vibration assessments for large infrastructure projects
- Recent and relevant experience in the delivery of large road and tunnel operational noise and vibration impact assessments
- Specialised in the vibration measurements, analysis and control.

Career history

Geoff is a Principal acoustic and vibration engineer who joined AECOM in February 2008. Geoff obtained his PhD in 2008 in Mechanical Engineering, specialising in Vibrations and Acoustics. During his PhD Geoff conducted numerous noise and vibration measurements and developed many Finite Element models. He also completed the following courses; Machine Condition Monitoring, Advanced Vibration Analysis and Fundamentals of Noise and Vibration Measurement. Geoff's experience includes noise and vibration assessments, completion of noise and vibration measurements, recommendation of suitable and practical noise and vibration control measures

Geoff maintains excellent working relationships with a range of clients (including Government and Building Contractors) built on understanding client needs and delivering high quality and timely advice. In his consulting career Geoff has worked on a broad range of types of projects including road and rail road infrastructure projects and industrial developments.

His experience in noise and vibration assessments includes determination of appropriate criteria, completion of noise and vibration measurements and the recommendation of suitable and practical noise and vibration control measures. His experience with SoundPLAN (noise modelling software), ArcGIS (mapping software) and Abaqus (finite element vibration analysis software) allows him to provide high quality vibration and acoustic advice within tight timeframes.

Project experience

Mandagery's Creek Bridge replacement, Transport for NSW, 2019, 2024: Transport for NSW is replacing the existing bridge located over Mandagery Creek (B4317) on Henry Parkes Way in Manildra, NSW with a new concrete bridge. Since the upstream half of the bridge has been completed and open to traffic AECOM has completed attended and long-term unattended vibration monitoring to determine existing vibration levels due to traffic on the upstream half of the bridge. The measurements have confirmed that construction of the downstream half of the bridge can be undertaken next to live traffic without detrimental effects on the concrete. This resulted in significant cost savings due to the avoidance of road closures. Geoff was the lead engineer for this work.

Pacific Highway Upgrade – Nambucca Heads to Urunga, $780m, Roads and Maritime Services, 2016-2017
The Nambucca Heads to Urunga project (NH2U) comprised the construction of 22 km of new dual carriageway highway including three grade separated interchanges, two major river crossings and a railway overbridge. AECOM was commissioned to complete the post construction noise assessment after the road was completed in November 2016. Geoff was the project manager on this project and was responsible for the post construction reporting.

Katoomba Subway, Sydney Trains, Noise and Vibration Lead, 2023
A pedestrian subway tunnel is located under the eastern end of the Katoomba Station platform. The tunnel allows pedestrians access to the station from either Bathurst Road/Gang Gang Street or Goldsmith Place. As part of a repair programme of works, the current ballasted track over the tunnel will be replaced with slab track. Geoff undertook vibration and noise measurements within the tunnel. These measurements allowed for the prediction of future noise and vibration levels due to the upgrade.

Australian Institute of Nanoscience, University of Sydney, NSW
This project involves the development of a major science research and education facility for the University of Sydney. This new AIN building will be integrated with the existing heritage-protected Physics Building and will contain

multiple floors and zones whose conditions span a range of functions and very specific technical requirements on cleanliness, acoustic, vibration and electromagnetic environment. The new AIN building will also integrate facilities for undergraduate education and laboratory training with advanced research facilities. Geoff has developed a finite element model in order to assess footfall induced vibration in sensitive laboratory spaces against the developed criteria.

Monash University Ramaciotti Centre for Cryo-Electron Microscopy, Melbourne VIC
The Monash University Ramaciotti Centre for Cryo-Electron Microscopy (Cryo-EM) planned to expand their research within the Monash University Clayton Campus. To facilitate their expansion, the university planned to acquire and install a highly vibration sensitive Transmission Electron Microscope (TEM), the Titan Krios G3. AECOM was engaged by Monash University to assess the feasibility of temporarily housing the TEM in one of two locations. The TEM manufacture's installation vibration limits were VC-E and VC-F vertical and horizontal directions respectively. As part of the site's feasibility assessment, Geoff conducted vibration measurements over a two-day period. The vibration sources captured during the survey included, people walking within the building, doors closing, cars using the loading dock ramp, construction nearby and vehicle traffic. Based on the results of the vibration measurements Geoff provided recommendations to isolate the TEM.

Royal Hobart Hospital Redevelopment, TAS
The Royal Hobart Hospital is the principal referral hospital for Tasmania and a major teaching and research facility with links to the University of Tasmania. The redevelopment project involved the construction of a new 11 storey building in the centre of the highly congested Hospital site. Key factors included the identification of noise and vibration likely to impact the development. Sensitive spaces included surgical and critical care facilities. Footfall vibrations were the most significant source of structure-borne vibration. Geoff predicted structure-borne vibration levels using Finite Element Analysis.

Princes Highway upgrade program (Burrill Lake to Batemans Bay) – Strategic Design Services, TfNSW, 2020-Current
The project is to undertake strategic investigation and develop design options followed by recommendations for the preferred options with a prioritised program for further development. Geoff completed the noise modelling to assess the noise implications of strategic alignment options and provided advice to the design team to minimise community impacts as part of the Princes Highway upgrade.

Singleton Bypass, Transport for NSW, 2017 – Current
TfNSW proposes to build an eight kilometre bypass at Singleton. The proposal is located to the west of Singleton and connects the New England Highway to the north and south of Singleton. Geoff was responsible for the noise modelling component of the noise and vibration impact assessment which forms part of the Review of Environmental Factors (REF). The assessment considered construction noise and vibration and road traffic noise levels. Proposed noise mitigation measures included noise walls and at-receiver noise treatment.

Warringah Freeway NAP, RMS (now Transport for New South Wales [TfNSW]), Technical Lead, 2018 – 2019
The Warringah Freeway is a three kilometre freeway running from North Sydney to Naremburn, NSW. AECOM was commissioned to complete a noise assessment of properties along the freeway which identified where noise criteria was likely to be exceeded as part of the Noise Abatement Program. Geoff completed noise modelling to create maps showing noise levels for every façade and storey of every noise sensitive receiver.

Pacific Highway Upgrade – Woolgoolga to Glenugie, Roads and Maritime Services, 2018-current
The Woolgoolga to Glenugie project (W2G) comprises the construction of 26 km of new dual carriageway highway, a rest area, a heavy vehicle inspection bay and several u-turn bays. AECOM was commissioned to complete the post construction noise assessment after the road was completed in early 2018. Geoff is the project manager on this project and is responsible for the post construction reporting.

Hunter Expressway, $1.7b, Roads and Maritime Services, 2013 & 2015
The Hunter Expressway is a new motorway standard road which provides 40 kilometres of dual carriageway between the M1 Pacific Highway near Seahampton and the New England highway west of Branxton. The Hunter Expressway opened to traffic on March 2014.

Geoff undertook post opening noise assessment and measurements considering the acoustic performance of the trial concrete road. The road surfaces included DGA, SMA, longitudinally tyned concrete, conventional diamond ground concrete, low noise diamond ground concrete and transversely tyned concrete.

Pacific Highway Upgrade - Ballina Bypass, $640m, Ballina Bypass Alliance, 2007-2013
Geoff undertook noise measurements and completed an operational noise and vibration assessment in accordance with the requirements detailed in the Minister's Conditions of Approval for this12 km dual carriageway road upgrade. Extensive road noise modelling was completed for this project in accordance with RMS requirements. Quiet road surfacings were utilised and a number of properties received at house noise mitigation measures.

Northern Beaches Hospital Road Upgrade, $500m, Ferrovial York Joint Venture, 2015-current
This project includes the development of an operational noise and vibration assessment for the development. Geoff undertook traffic noise monitoring and noise modelling for this project including the prediction of traffic noise and design of noise barriers.

Pacific Highway Upgrade, Sapphire to Woolgoolga Upgrade, Leighton Fulton Hogan Joint Venture, 2010-2014
This project comprises a 25 km upgrade of the pacific highway between Sapphire and Woolgoolga. Geoff completed a construction noise and vibration impact strategy for works involved with this project was developed to assess noise impacts on and recommend noise mitigation measures for nearby sensitive receivers. This project was concerned with the upgrade of the pacific highway between Sapphire and Woolgoolga.

Gayle Greer Technical Director/NSW Acoustics Team Lead

Qualifications
PhD, University of Ulster, 2000
Diploma in Acoustics and Noise Control, UK Institute of Acoustics
BSc (Hons) Environmental Health, University of Ulster, 1996
Chartered Engineer, UK Institute of Acoustics

Affiliations
Member of the Australian Acoustical Society
Member of the Institute of Acoustics

Referee
Mark Woods – Senior Environment and Sustainability Officer
Environment | Safety, Environment & Regulation
Transport for NSW
0438 226 252 – mark.woods@transport.nsw.gov.au

Proposed Role: Noise and Vibration Lead

Areas of expertise

Gayle has extensive relevant experience in the delivery of high-quality transport infrastructure projects. For example she has:

- Over 25 years' experience in environmental noise and vibration assessments
- Extensive experience with major road projects throughout NSW including urban motorways, tunnels and regional roads
- Recent experience with environmental approvals, operational noise compliance assessments, independent verification work and expert witness advice

Career history

Gayle has over 25 years' experience assessing noise and vibration for major transportation projects from the Route Options Analysis stage right through to post opening compliance. She is passionate about providing Clients with a responsive and proactive team, which strives to provide on-time and cost-effective mitigation solutions.

Gayle has an extensive understanding of infrastructure projects and the associated environmental approval process. She has an excellent working understanding of the Australian guidelines relating to environmental noise emissions infrastructure projects and to construction noise and vibration assessments.

Gayle has worked closely with both Government and Constructors as clients and has also worked alongside various stakeholders and been involved with community consultation.

She has an avid and active interest in reducing road traffic noise by the optimising road surfaces to reduce tyre/noise interfacial noise and has excellent technical understanding of road traffic noise generation mechanisms having completed a PhD entitled 'An investigation into the factors which affect the acoustical characteristics of bituminous porous road surfacings'.

Project experience

Mandagery's Creek Bridge replacement, Transport for NSW, 2019, 2024: Transport for NSW is replacing the existing bridge located over Mandagery Creek (B4317) on Henry Parkes Way in Manildra, NSW with a new concrete bridge. Gayle was responsible for the technical review of the noise and vibration impact assessment for the replacement of the bridge which was included with the REF. Since the upstream half of the bridge has been completed and open to traffic AECOM has completed attended and long-term unattended vibration monitoring to determine existing vibration levels due to traffic on the upstream half of the bridge. The measurements have confirmed that construction of the downstream half of the bridge can be undertaken next to live traffic without detrimental effects on the concrete. This resulted in significant cost savings due to the avoidance of road closures. Gayle was the technical reviewer for this work.

Raised Threshold Devices – Shoalhaven City Council, 2018: Shoalhaven City Council installed six new traffic calming "raised threshold devices" to physically slow traffic speeds at existing pedestrian crossings close to schools. To address local residents' concerns about the change in noise environment, AECOM was asked to complete a study into the acoustic impact of the devices at nearby residential properties. Gayle was technical lead on this project.

Princes Highway upgrade program (Burrill Lake to Batemans Bay) – Strategic Design Services, TfNSW, Noise Lead, 2020-2021: The project is to undertake strategic investigation and develop design options followed by recommendations for the preferred options with a prioritised program for further development. Gayle is the noise modelling lead assessing the noise implications of strategic alignment options and providing advice to the design team to minimise community impacts as part of the Princes Highway upgrade.

Great Western Highway Upgrade (Blackheath to Little Hartley), Transport for NSW, 2022-2023: Transport investigated a wide range of upgrade options and the upgrade option proposed was a tunnel bypass of all surface roads between Blackheath and Little Hartley, including twin tunnels with two lanes in each tunnel. AECOM completed the Environmental Impact Assessment and Gayle led the delivery of the Noise and Vibration Technical Paper. The assessment considered the road traffic noise impacts to nearby residential areas, and construction noise and

vibration impacts from surface and tunnelling construction works. Gayle was also the technical review for the Noise and Vibration Technical Report amendment for the GWH Little Hartley to Lithgow project.

Pacific Highway Upgrade – Glenugie to Pimlico, Pacific Complete, 2020-2022: The Glenugie to Pimlico project forms part of the 155 km Woolgoolga to Ballina project. AECOM was commissioned to complete the Operational Noise Compliance Review (ONCR). Gayle was the technical reviewer on this project. Through DPIE reviews of the ONCR a number of challenges were made to the measurements and CoRTN modelling and associated measurements for Stage 1. Additional analysis was completed including engine braking analysis to the satisfaction of DPIE.

Princes Highway Upgrade, Gerringong to Bomaderry, Roads and Maritime Services, 2007-2014: Gayle was responsible for the technical review of the 'Route options analysis' noise assessment which provided a comprehensive assessment of various route options resulting in simple ranked ordering of options. She also completed the noise and vibration assessment for the REF for section 1 (Gerringong Upgrade) and provided the technical review for the 'Environmental Assessment' for section 2 (Foxground to Berry Bypass) and section 3 (Berry to Bomaderry Upgrade). She has also been involved in the community consultation process for this project, preparing and presenting information to the community.

Western Harbour Tunnel Stage 2, ACCIONA, 2023-current: The Western Harbour Tunnel is a major transport infrastructure project that will create a western bypass of the Sydney CBD. It connects to WestConnex at the Rozelle Interchange, crosses underneath Sydney Harbour between Birchgrove and Waverton, and connects with the Warringah Freeway near North Sydney via a 6.5 kilometre tunnel with three lanes in each direction. The AECOM acoustic team has been working with ACCIONA on the operational noise and vibration review to meet all the Minister's Conditions of Approval.

Barton Highway Upgrade Stage 1, Roads and Maritime Services, 2018-2019: The Barton Highway is a rural highway linking the southern and western areas of NSW to the ACT. The project comprises the construction of a new two lane northbound carriageway from the NSW/ACT border towards Murrumbateman and modifying the existing Barton Highway to a two lane southbound carriageway. Gayle completed the technical review of the construction and operational noise impact assessment which formed part of the Environmental Impact Statement.

Outer Sydney Orbital Stage 2 Corridor Options Investigation, Transport for NSW, Technical Reviewer, 2023 – Current: AECOM has been engaged to conduct strategic investigations for the potential future development of the Outer Sydney Orbital Stage 2 (OSO2). This second stage will extend from the Hume Motorway at Menangle to the Illawarra-Shoalhaven region. A route options noise assessment report consisting of an assessment of noise impacts of the operation of the Project for various potential route options and has been completed in accordance with the NSW Environment Protection Authority's Road Noise Policy (RNP) and Transport's Road Route Options Noise Assessment Report Procedure (RRONAR). The assessment is considering three sectors.

Hunter Expressway, $1.7b, Roads and Maritime Services, 2013 & 2015: Gayle completed a review of the operational noise management plan and test reports of the road surface test sections as part of the Project Verification team. Gayle also recently led the post opening noise assessment and a study considering the acoustic performance of the trial concrete road. The road surfaces included DGA, SMA, longitudinally tyned concrete, conventional diamond ground concrete, low noise diamond ground concrete and tranversely tyned concrete.

Warringah Freeway Upgrade Construction Noise Management, Transport for NSW, Technical Lead, 2019 – 2020: Gayle completed a global best practice review of the management of night-time construction noise to identify any practices which could potentially be implemented on the Warringah Freeway Upgrade. Following the review a construction noise management framework was developed outlining the how the implementation of additional mitigation measures would be managed while maintaining peak traffic capacity and road user safety.

Westlink M7 Widening, Transurban, 2021-2023: Transport for NSW is widening the Westlink M7, within the existing median by adding one lane in each direction between the M5 interchange at Prestons to the Westlink M7 bridge in Oakhurst/Glendenning. Once complete, there will be three lanes of traffic in each direction. Widening the Westlink M7 will improve journey times for freight and motorists and support the future M12 Motorway and the Western Sydney International Airport. AECOM Australia Pty Ltd was commissioned by Transurban to complete a noise and vibration impact assessment as part of the modification application for the proposed widening of the Westlink M7. The proposal received approval in February 2023 after undergoing a rigorous approval process to ensure it will deliver benefit to the community, motorists and industry. Gayle was the Technical Reviewer for the modification report noise and vibration impact assessment and continues to provide technical reviews of the operational noise and vibration reviews (ONVR).

Northern Beaches Hospital Road Upgrade, $500m, Ferrovial York Joint Venture, 2015-2021: This project included the development of an operational noise and vibration assessment for the development. AECOM also recently successfully completed the ONCR. Gayle was responsible for the technical review of the noise and vibration assessment including the prediction of traffic noise and design of noise barriers.

Warringah Freeway Noise Abatement Program, Transport for NSW), Technical Lead, 2018 – 2019: The Warringah Freeway is a three kilometre freeway running from North Sydney to Naremburn, NSW. AECOM was commissioned to complete a noise assessment of properties along the freeway which identified where noise criteria was likely to be exceeded as part of the Noise Abatement Program. Gayle provided the technical review of the custom outputs which included maps showing noise levels for every façade and storey of every noise sensitive receiver.

Appendix B

Acoustic Terminology

Appendix B Acoustic Terminology

The following is a brief description of acoustic terminology used in this report.

Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Decibel [dB]	The measurement unit of sound.
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.

L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Noise catchment area [NCA]	The noise environment at each of the sensitive receivers within a noise catchment area is considered to be similar to the unattended monitoring location within that NCA.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's *Noise Policy for Industry* and the EPA's *Road Noise Policy*.

Appendix C

Unattended noise monitoring results

Noise Logger Report

13 Barker Street, Lewisham

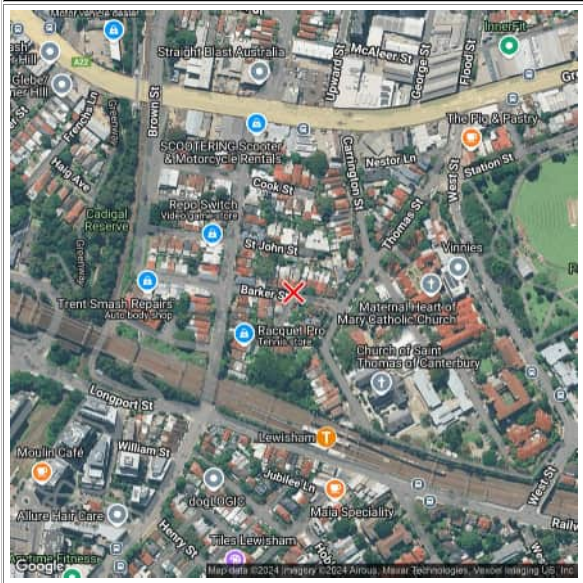
Item	Information
Logger Type	NL-52
Serial number	553967
Address	13 Barker Street, Lewisham
Location	13 Barker Street, Lewisham
Facade / Free Field	Free field
Environment	Aircraft noise, 71-81 dB. Truck passby on Barker Street, 70 dB. Cicada noise. Construction noise from neighbouring residential properties. Distant rail noise from Lewisham Station.

Measured noise levels

Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu Nov 21 2024	61	58	52	-	43	-	60	52
Fri Nov 22 2024	60	59	52	44	44	33	60	52
Sat Nov 23 2024	59	59	54	44	42	35	59	54
Sun Nov 24 2024	59	60	51	42	42	34	60	51
Mon Nov 25 2024	60	58	55	45	43	33	60	55
Tue Nov 26 2024	60	58	53	-	41	34	60	53
Wed Nov 27 2024	61	52	51	-	41	34	59	51
Thu Nov 28 2024	60	54	53	44	-	37	60	53
Fri Nov 29 2024	56	-	53	-	-	-	56	53
Sat Nov 30 2024	60	58	54	-	-	-	60	54
Sun Dec 1 2024	57	58	55	-	40	33	57	55
Mon Dec 2 2024	58	58	55	-	42	34	58	55
Tue Dec 3 2024	59	-	52	-	-	-	59	52
Summary	**60**	**58**	**53**	**44**	**42**	**34**	**59**	**53**

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location



Logger Deployment Photo

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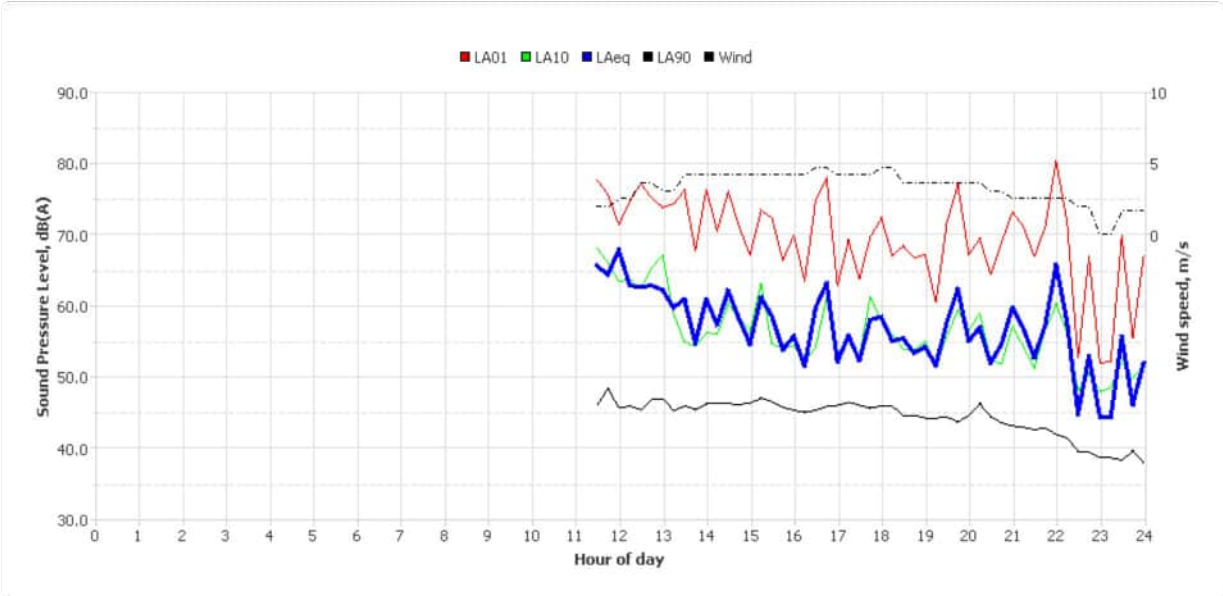

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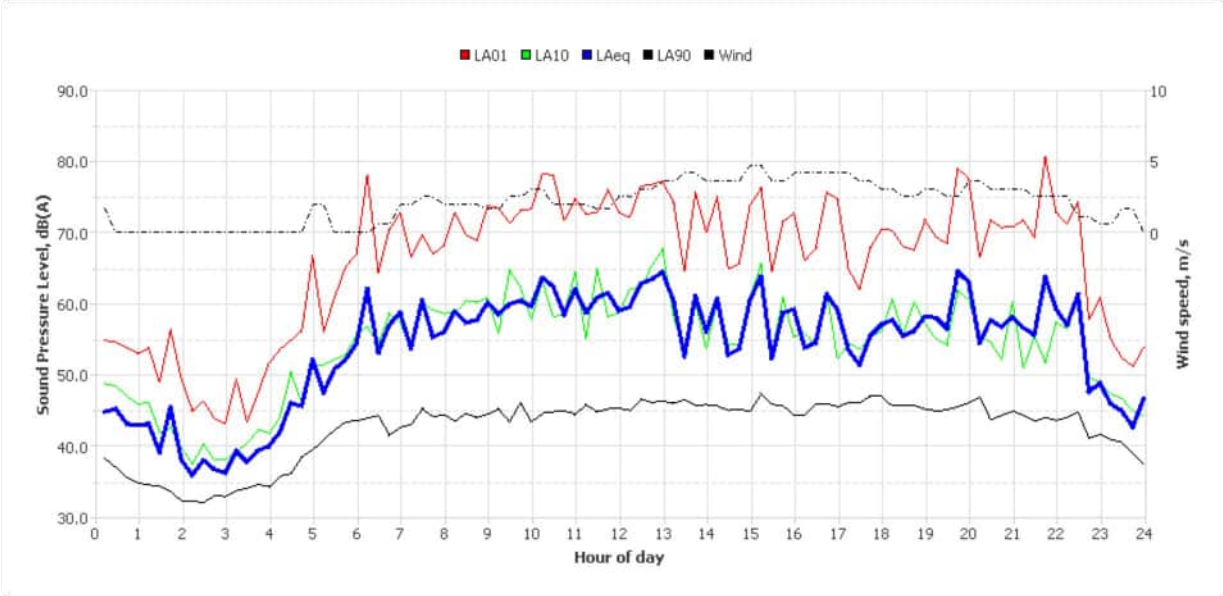

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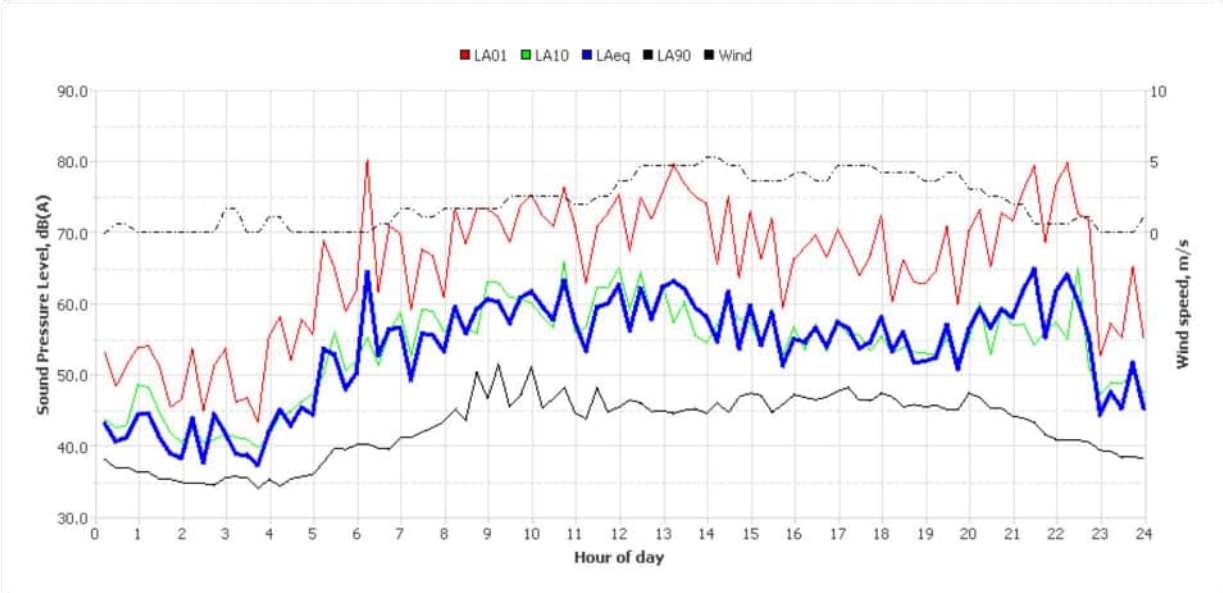

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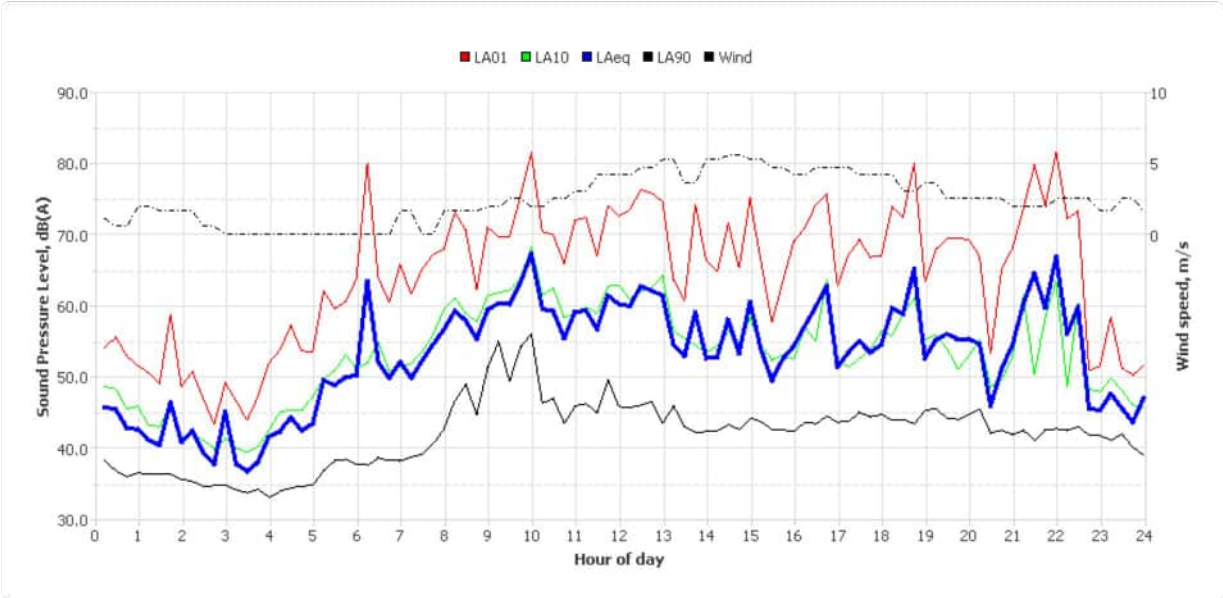

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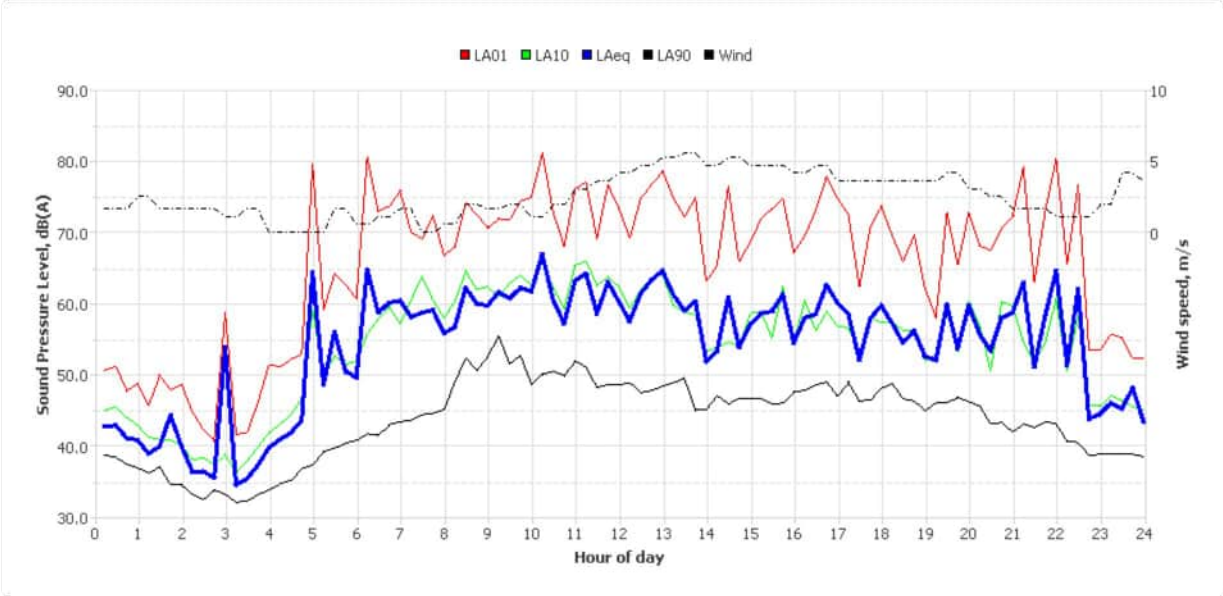

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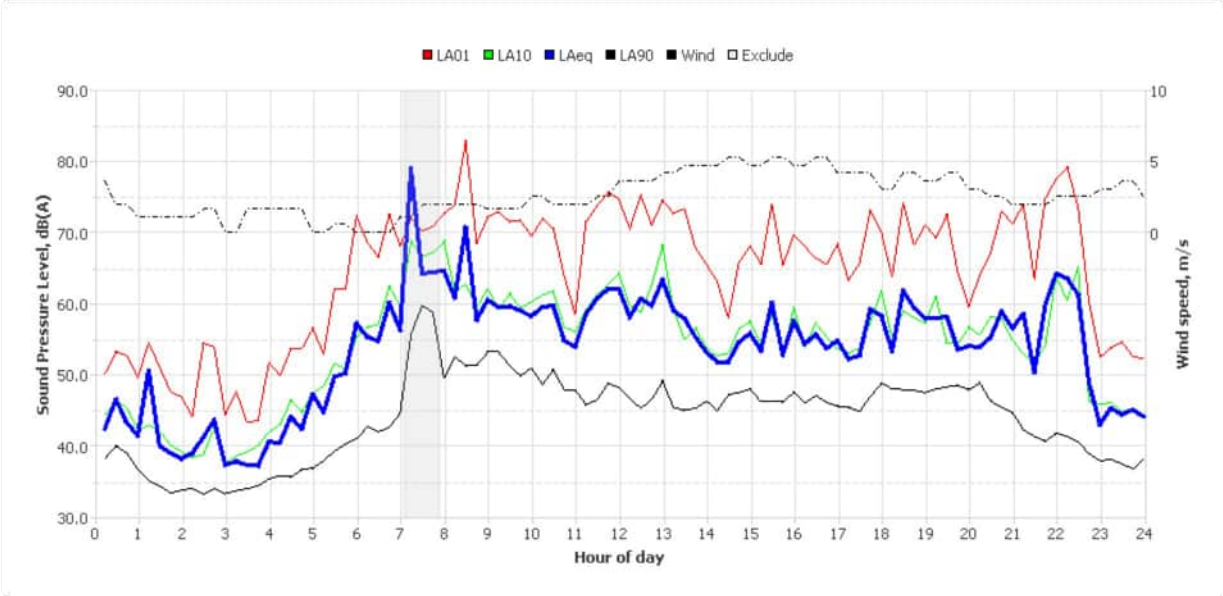

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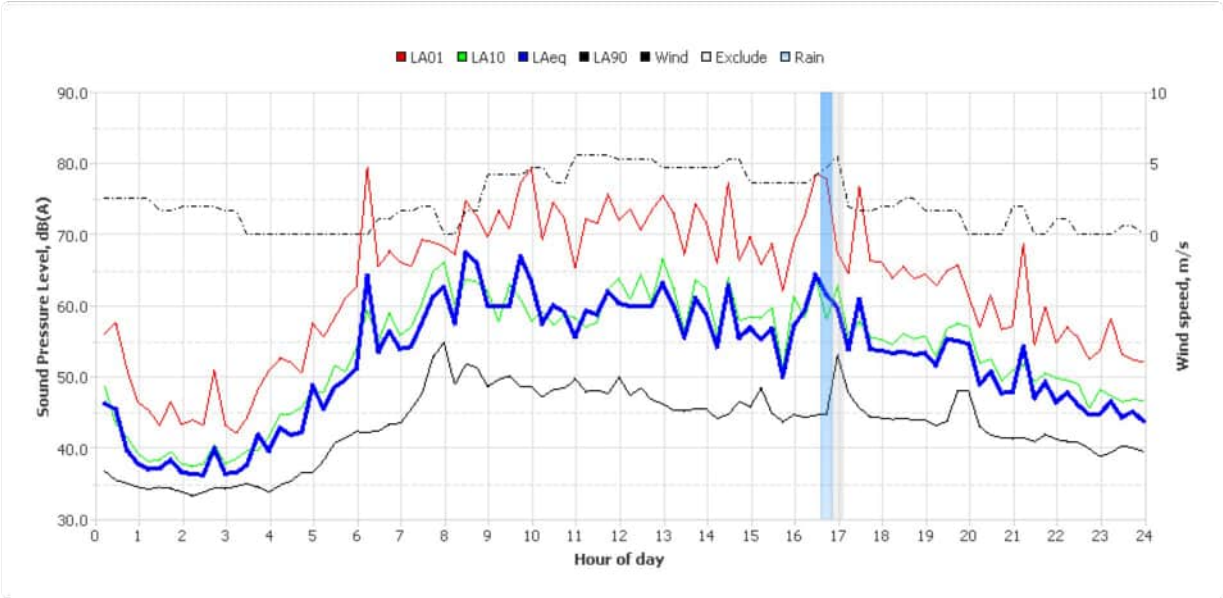

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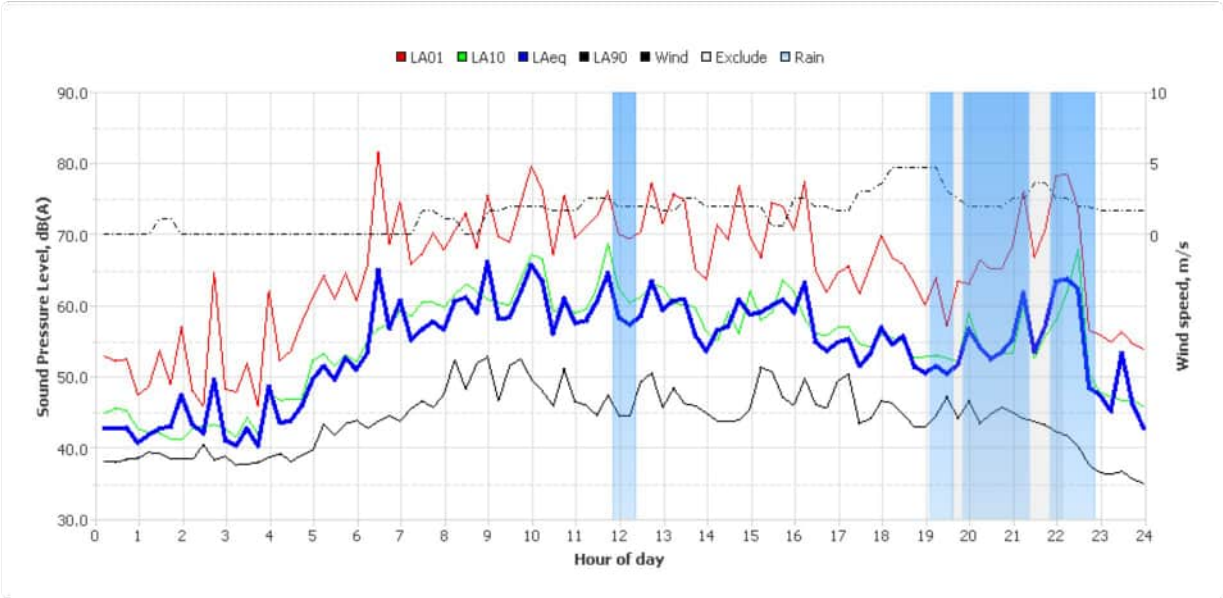

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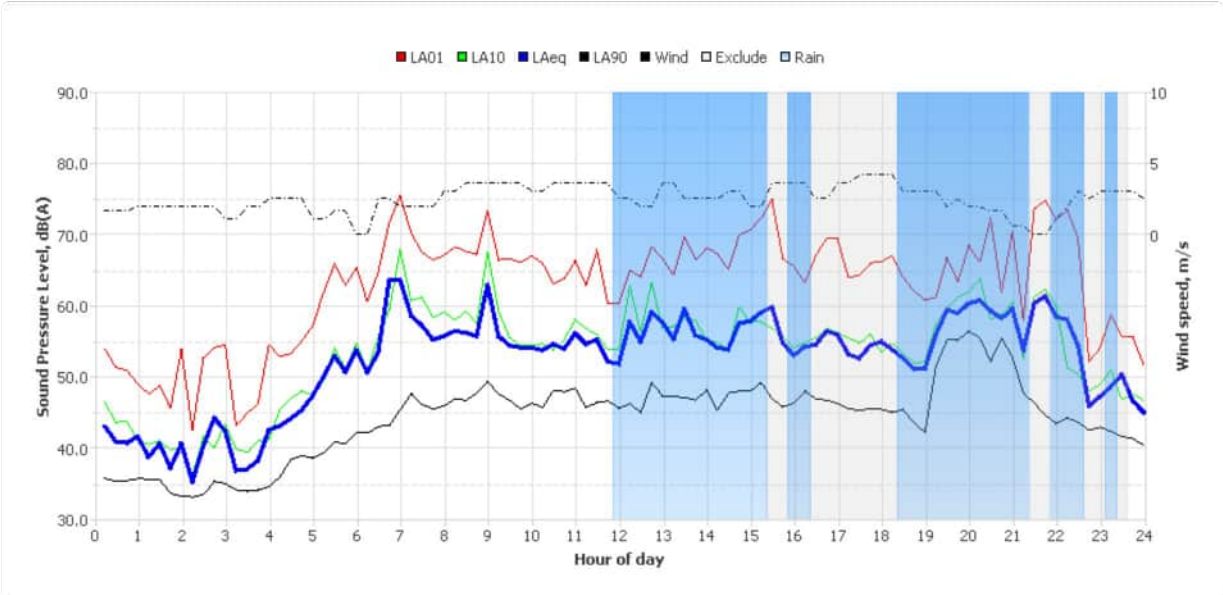

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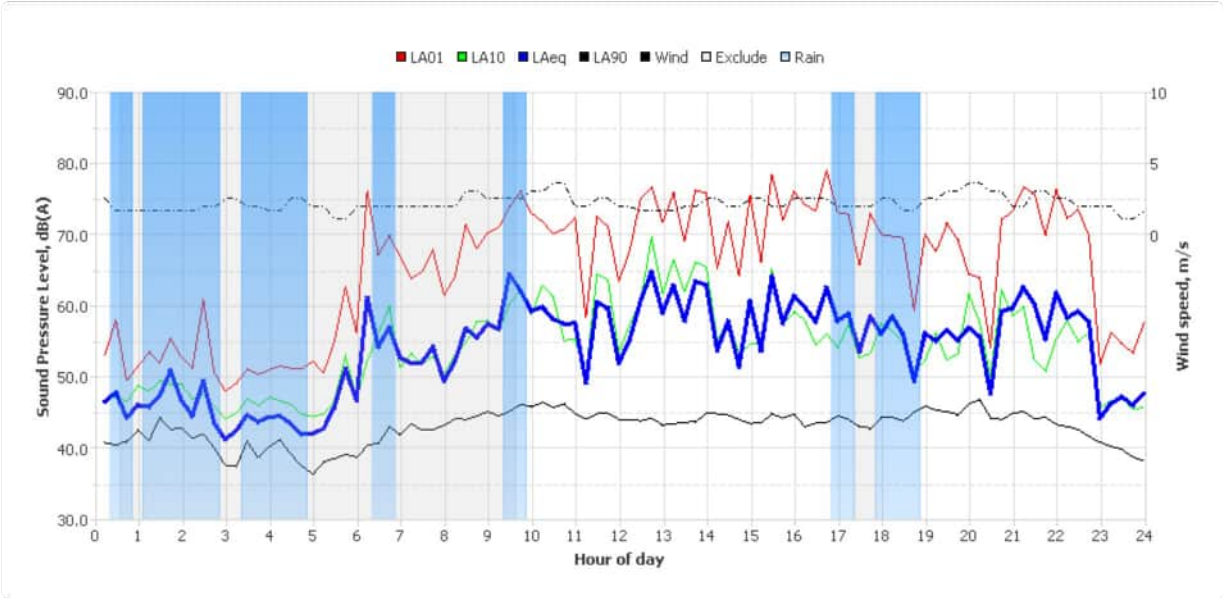

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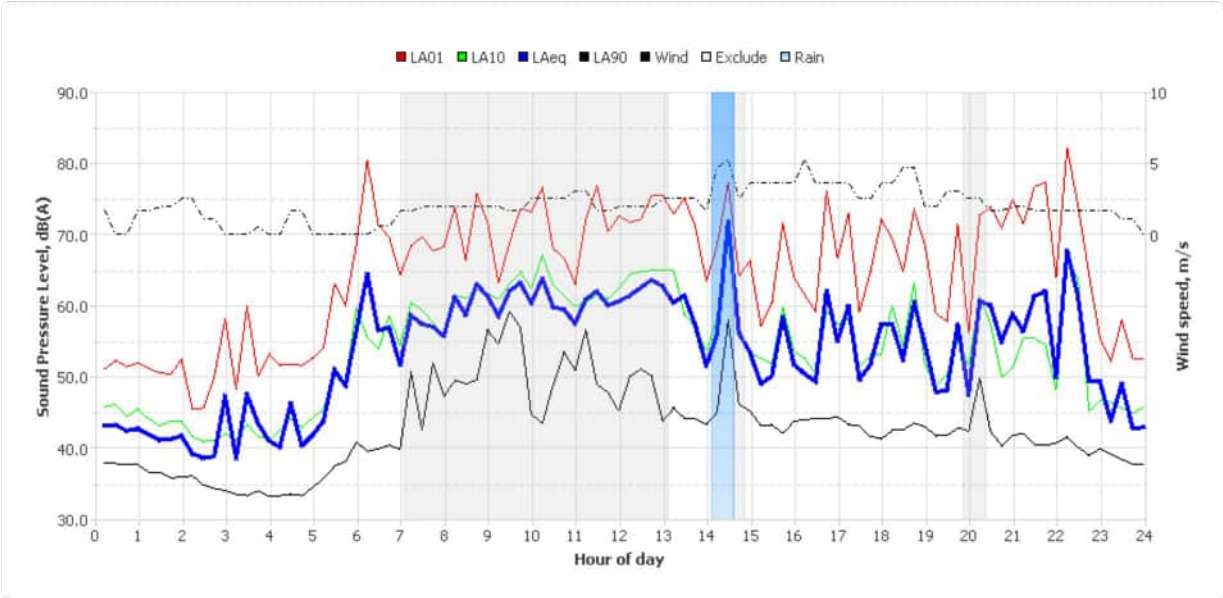

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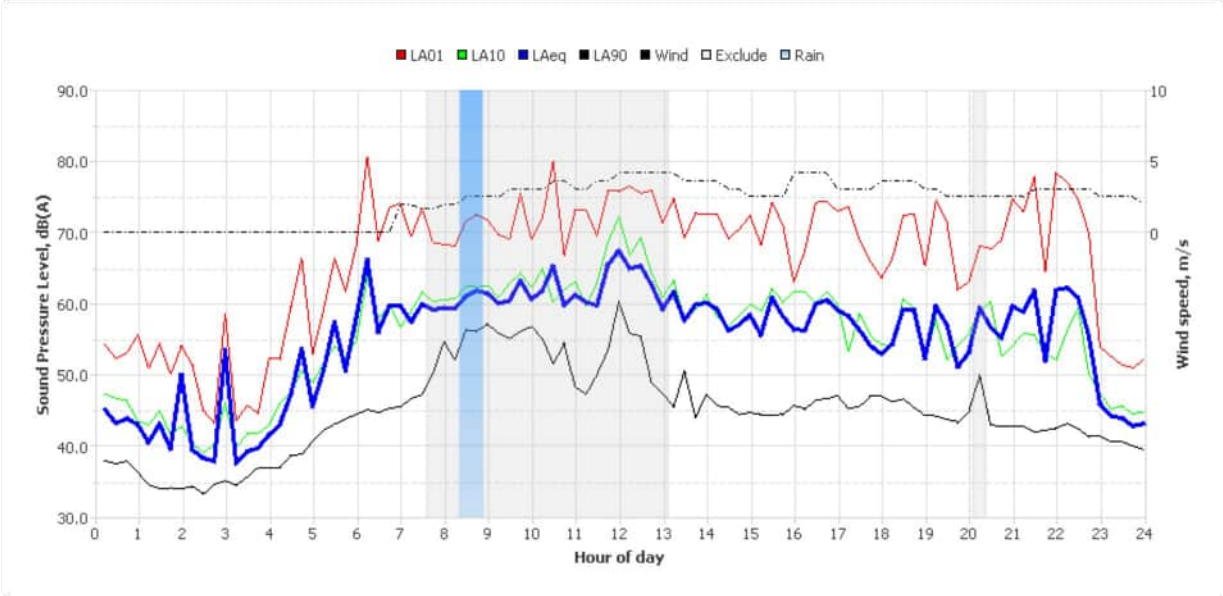

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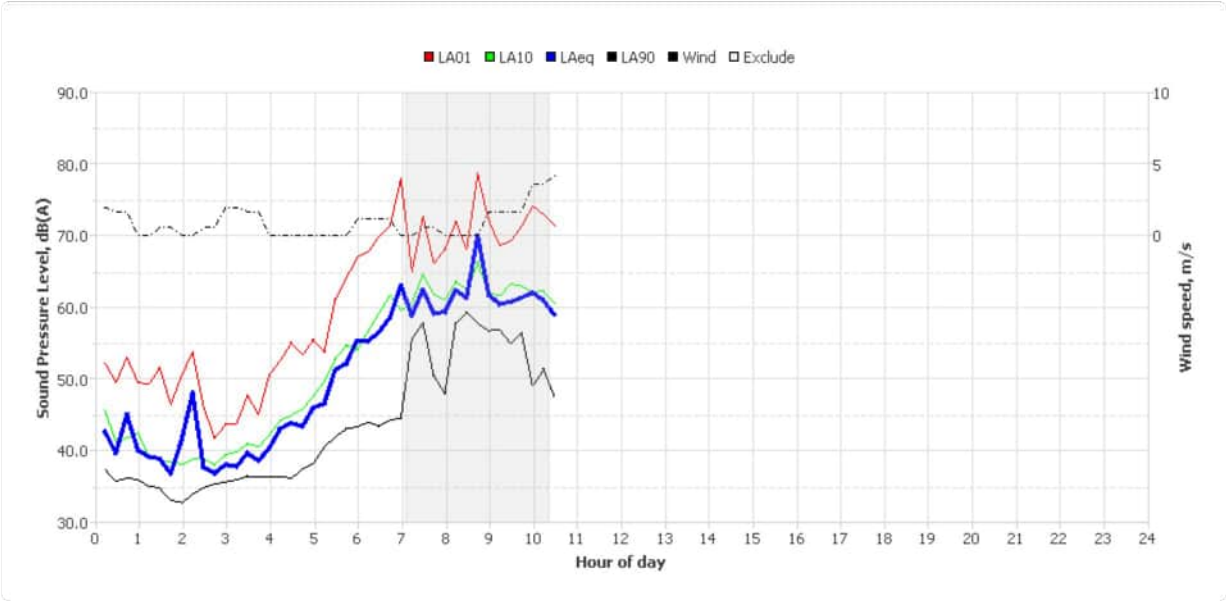


Noise Logger Report

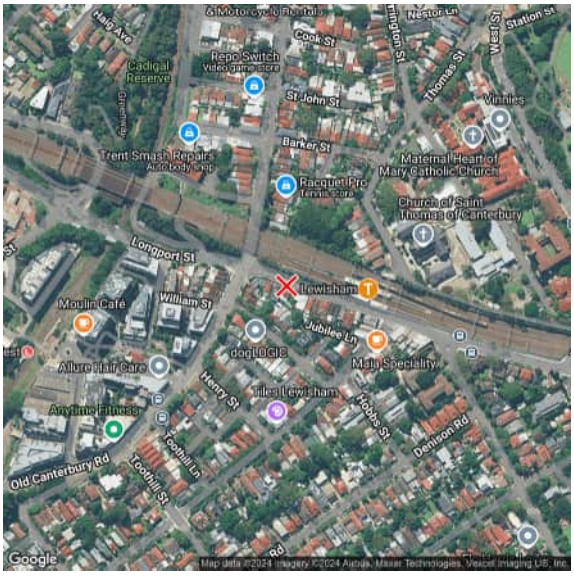
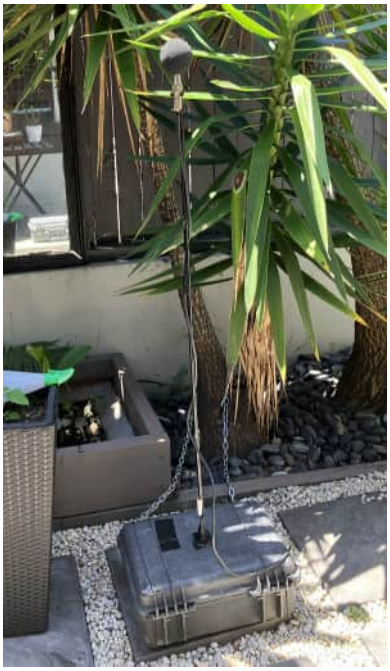
59 Railway Terrace, Lewisham

Item	Information
Logger Type	NL-52
Serial number	164395
Address	59 Railway Terrace, Lewisham
Location	59 Railway Terrace, Lewisham
Facade / Free Field	Free field
Environment	Road traffic noise on Railway Terrace dominant, 60-70 dB.Bus passby on Railway Terrace, 69 dB. Rail noise from Lewisham Station. Insect noise.

Measured noise levels

Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu Nov 21 2024	66	65	61	-	51	-	66	61
Fri Nov 22 2024	66	65	62	53	51	34	66	62
Sat Nov 23 2024	64	66	64	52	50	36	65	64
Sun Nov 24 2024	64	67	60	47	48	35	65	60
Mon Nov 25 2024	66	64	62	53	49	34	66	62
Tue Nov 26 2024	66	64	61	53	49	35	65	61
Wed Nov 27 2024	65	63	62	-	50	34	65	62
Thu Nov 28 2024	65	64	62	53	-	34	65	62
Fri Nov 29 2024	65	-	61	-	-	-	65	61
Sat Nov 30 2024	66	65	62	-	-	-	66	62
Sun Dec 1 2024	65	65	62	51	49	35	65	62
Mon Dec 2 2024	66	64	62	54	49	34	65	62
Tue Dec 3 2024	65	-	62	-	-	-	65	62
Summary	**65**	**65**	**62**	**53**	**49**	**34**	**65**	**62**

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

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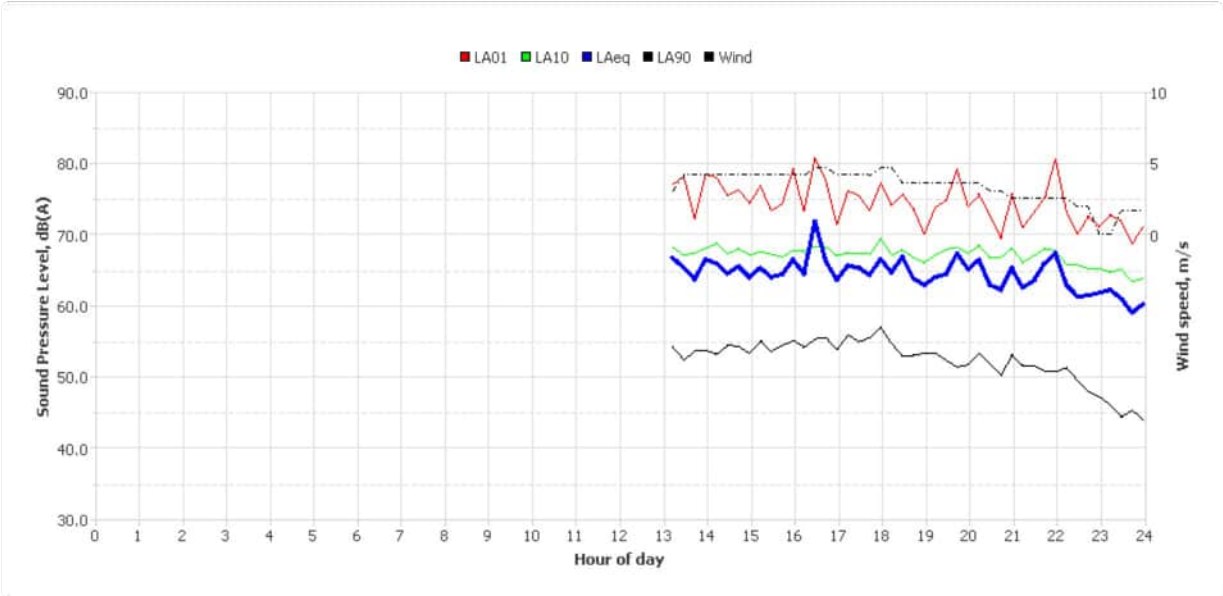

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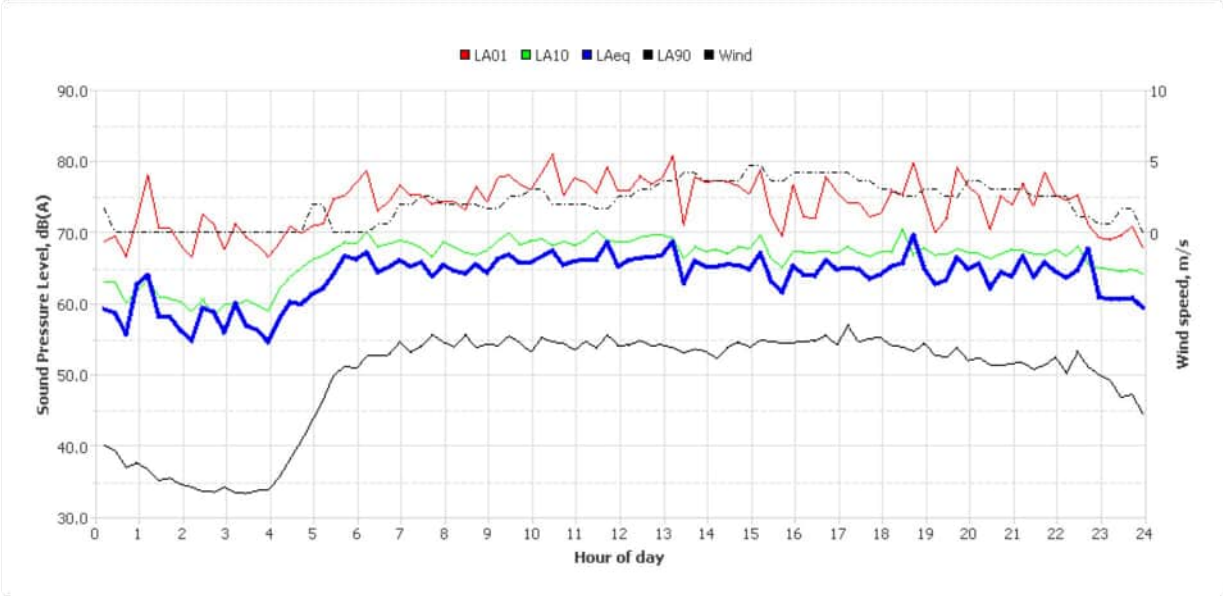

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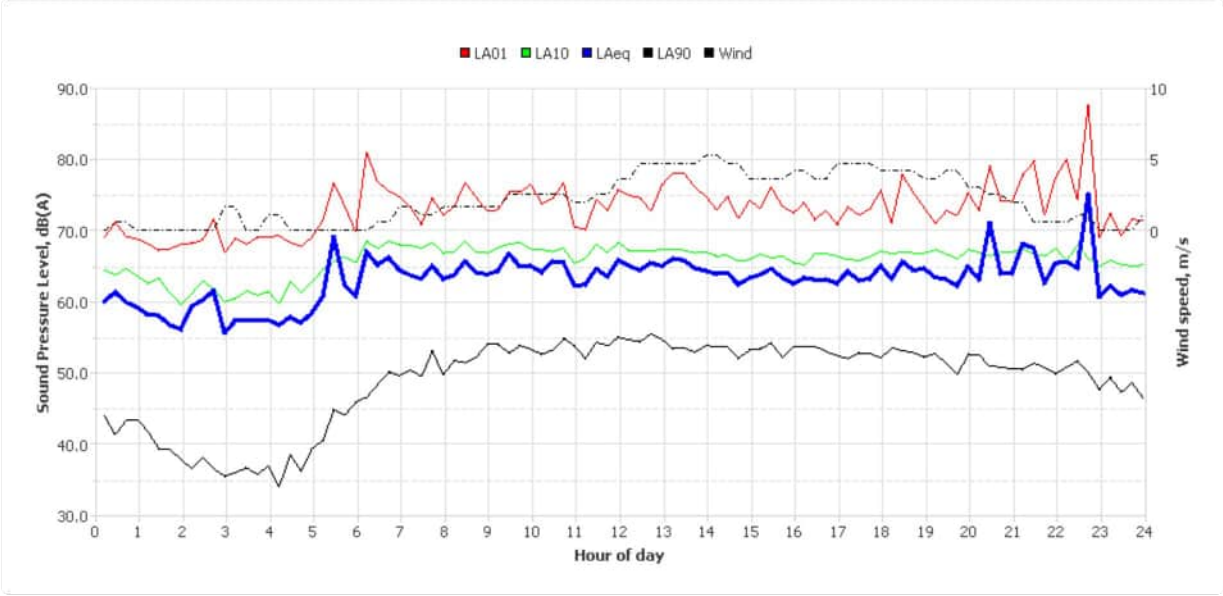

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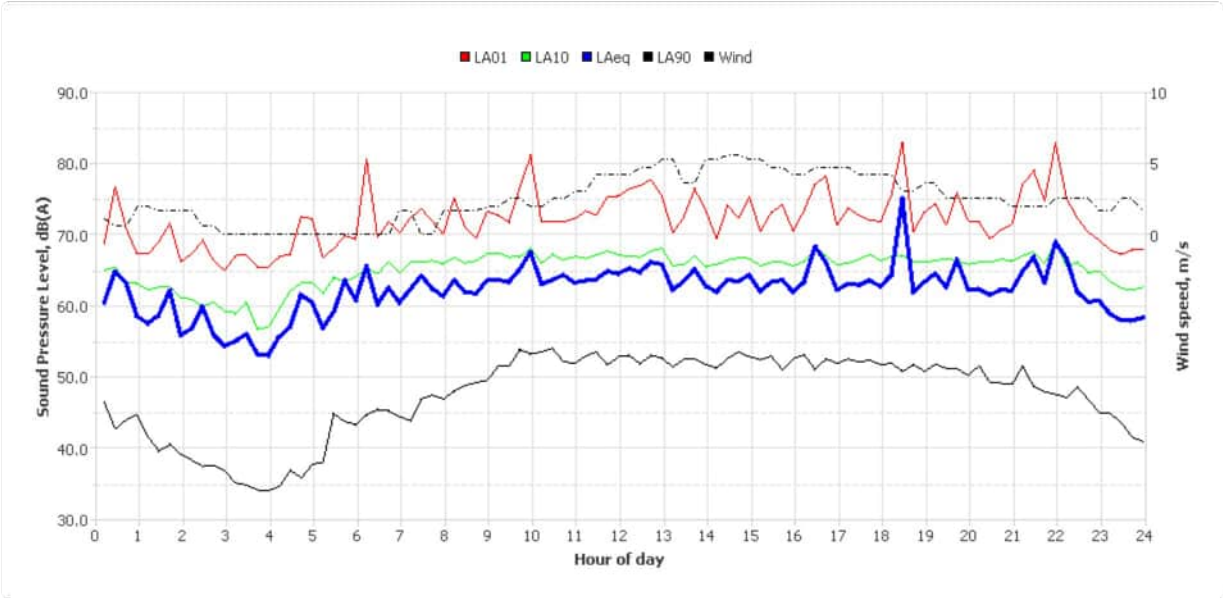

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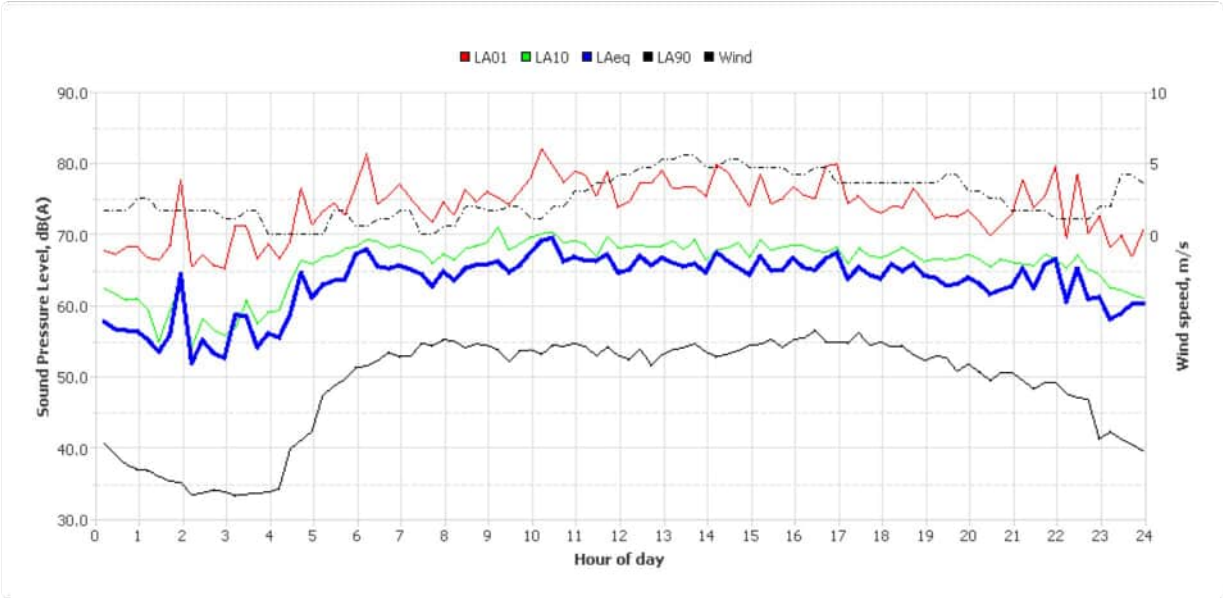

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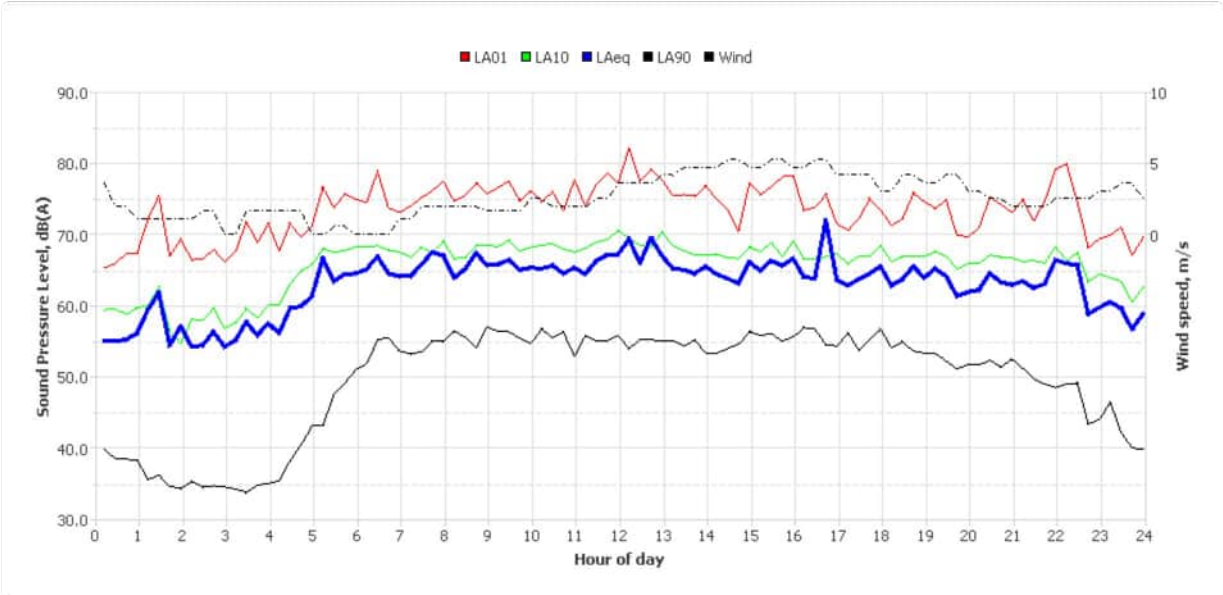

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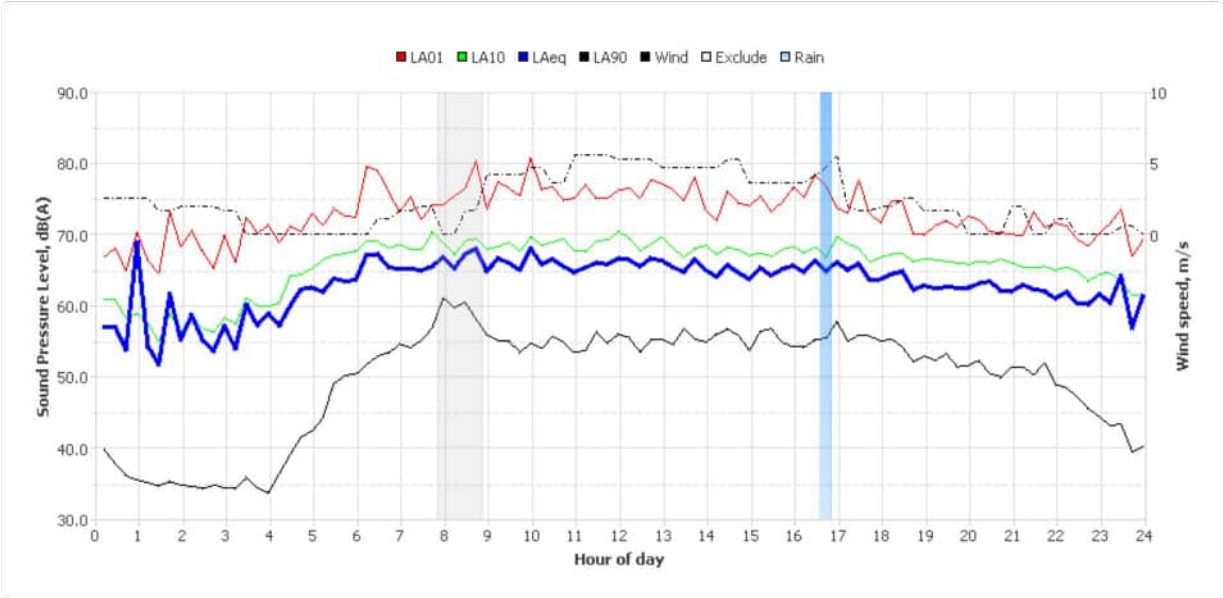

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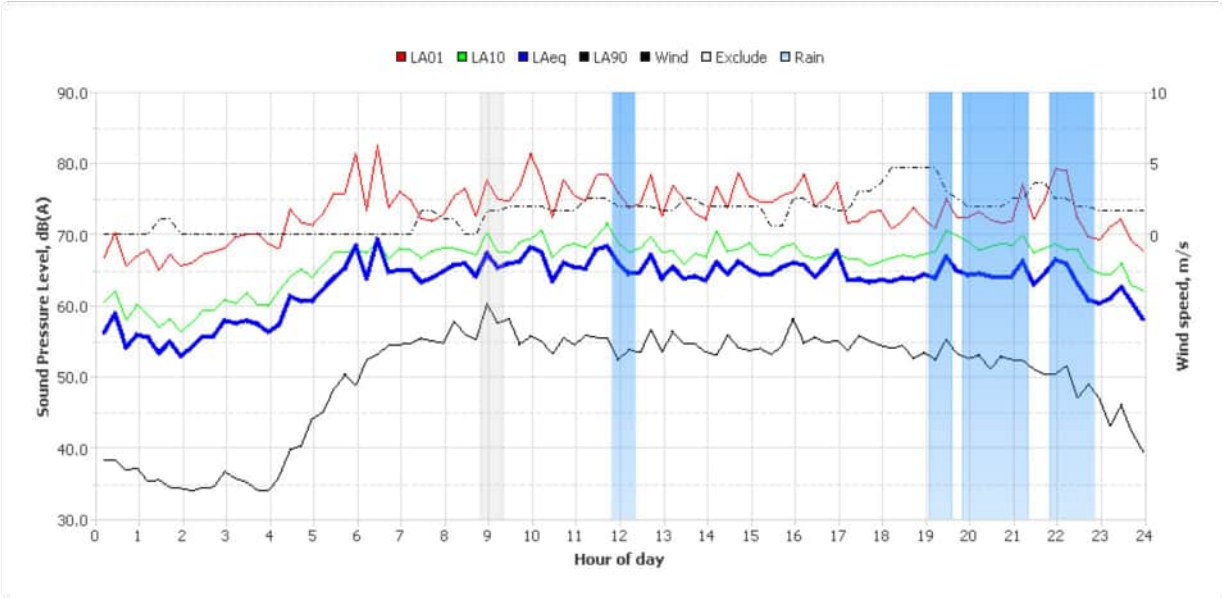

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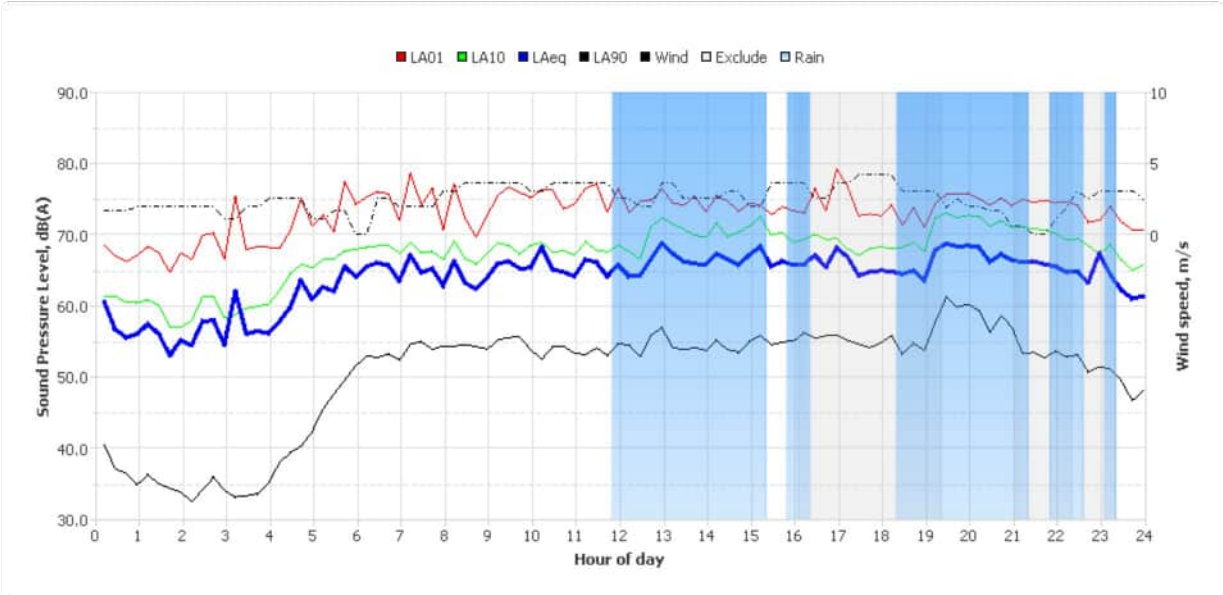

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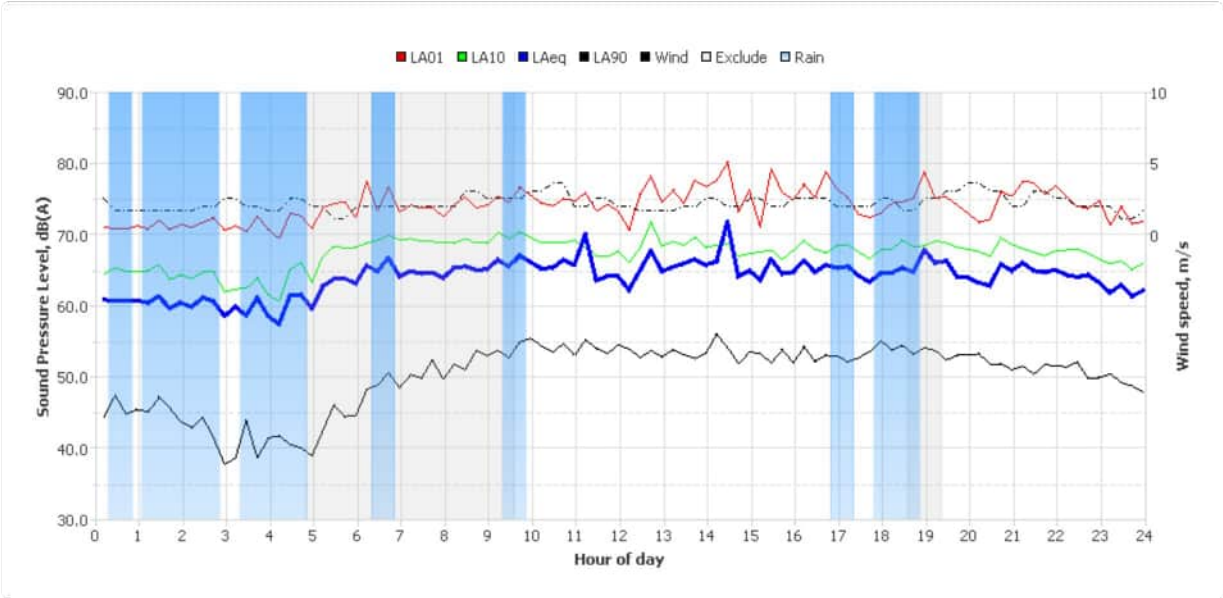

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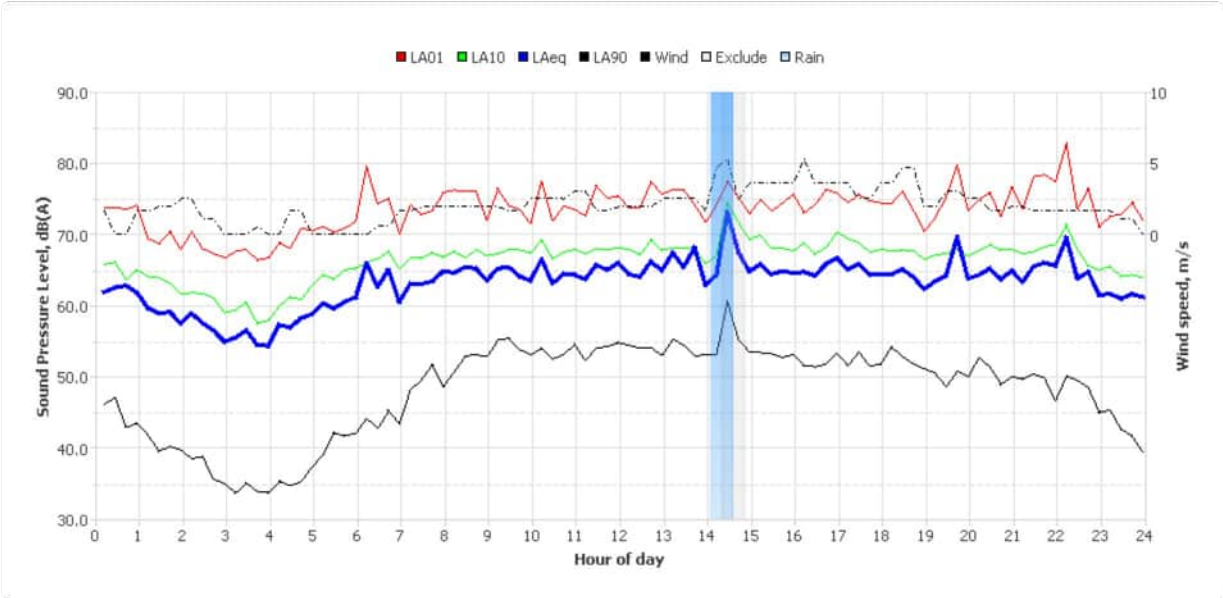

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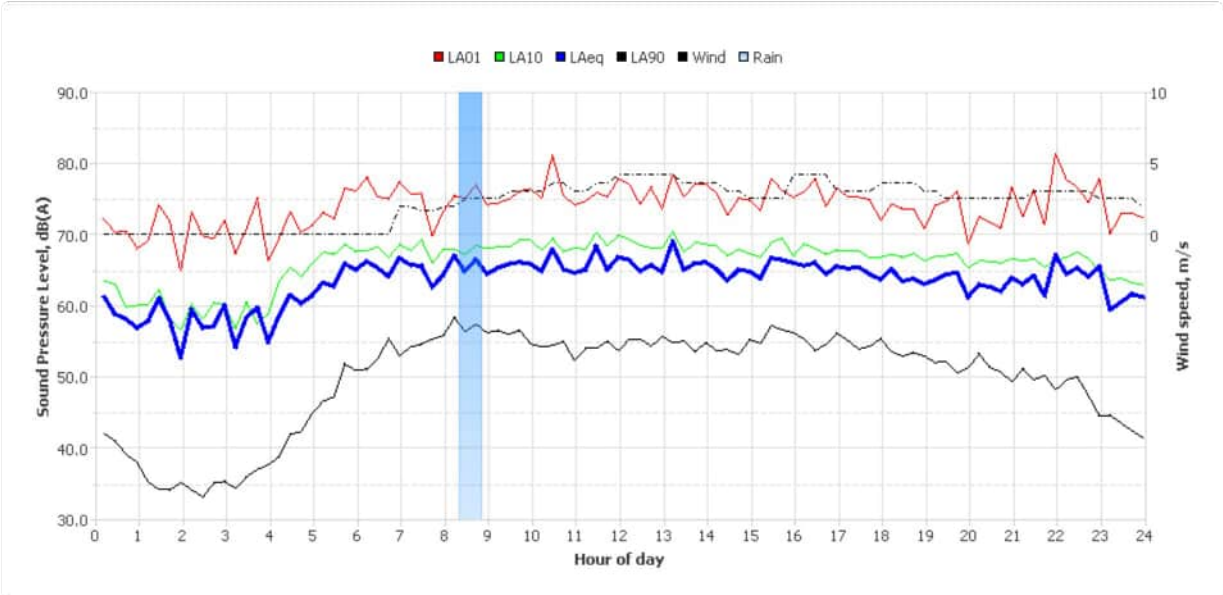

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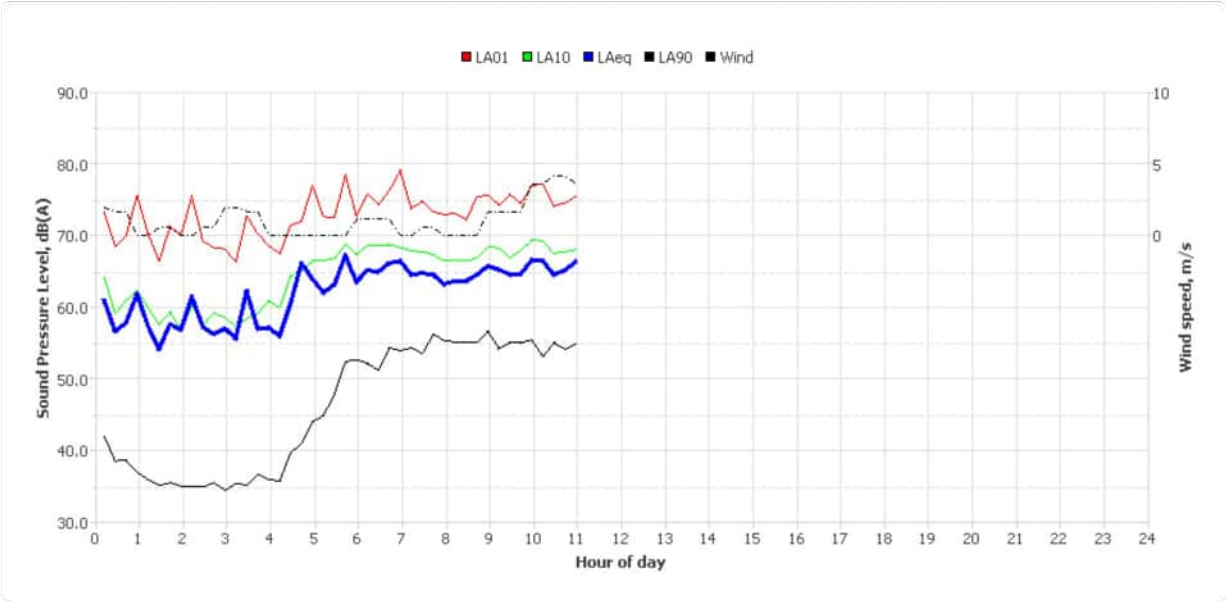


Noise Logger Report

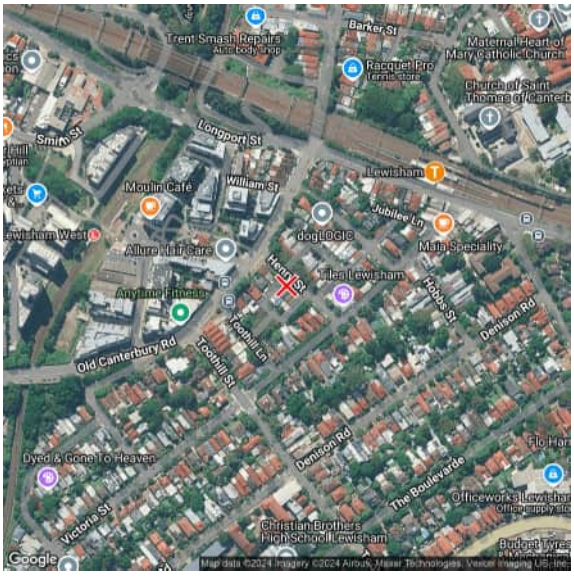
7 Henry Street, Lewisham

Item	Information
Logger Type	NL-52
Serial number	898334
Address	7 Henry Street, Lewisham
Location	7 Henry Street, Lewisham
Facade / Free Field	Free field
Environment	Aircraft passby, 66-80 dB. Car passby on Henry Street, 60-68 dB. Traffic noise from Old Canterbury Road. Insect noise.

Measured noise levels

Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu Nov 21 2024	60	60	55	-	47	-	60	55
Fri Nov 22 2024	61	60	54	49	48	32	61	54
Sat Nov 23 2024	60	60	56	47	45	35	60	56
Sun Nov 24 2024	59	61	54	44	46	35	60	54
Mon Nov 25 2024	60	60	55	48	45	33	60	55
Tue Nov 26 2024	59	59	54	48	44	33	59	54
Wed Nov 27 2024	60	54	53	-	43	32	59	53
Thu Nov 28 2024	60	55	54	47	-	30	60	54
Fri Nov 29 2024	57	-	52	-	-	31	57	52
Sat Nov 30 2024	60	59	56	48	-	-	60	56
Sun Dec 1 2024	62	62	58	45	49	34	62	58
Mon Dec 2 2024	64	64	58	53	51	45	64	58
Tue Dec 3 2024	63	-	57	-	-	-	63	57
Summary	**61**	**60**	**56**	**48**	**46**	**33**	**61**	**56**

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

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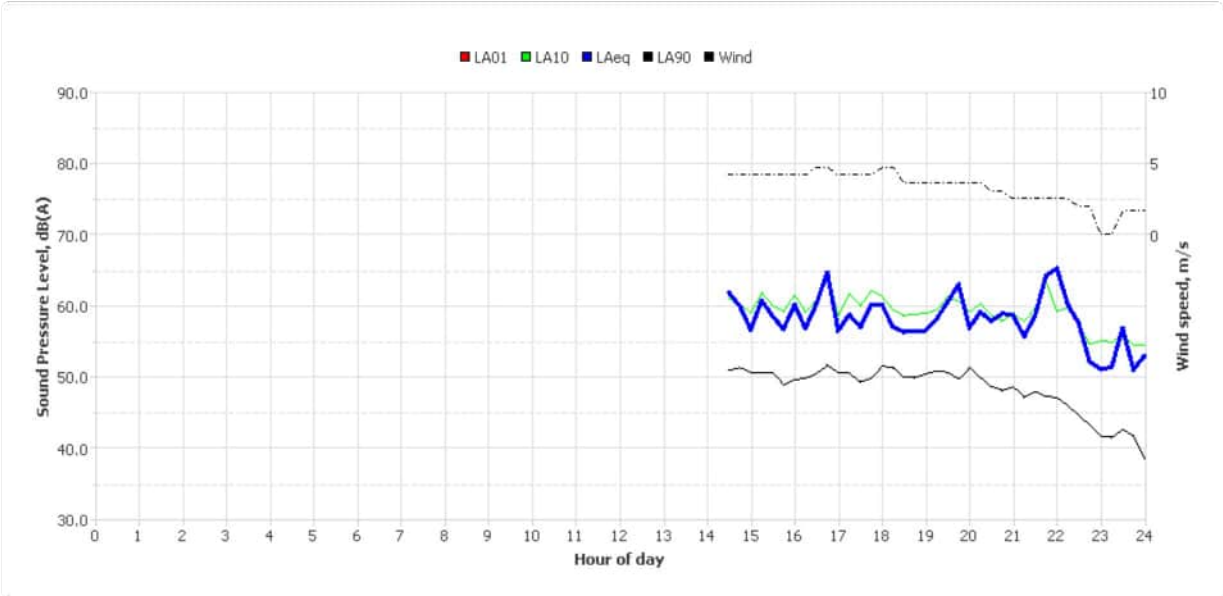

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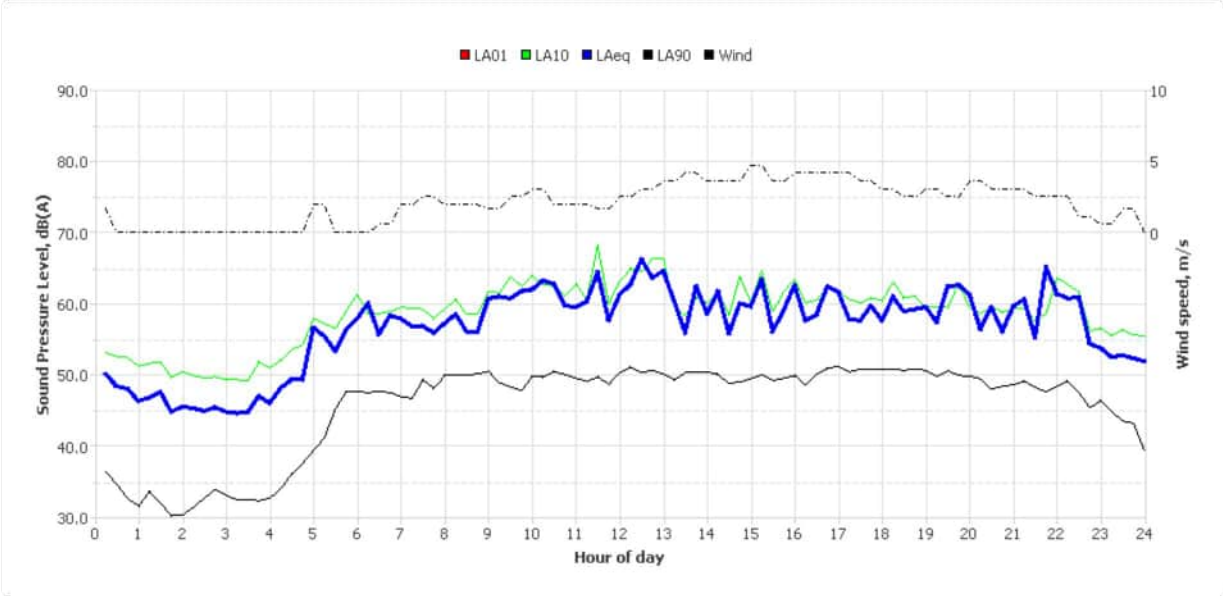

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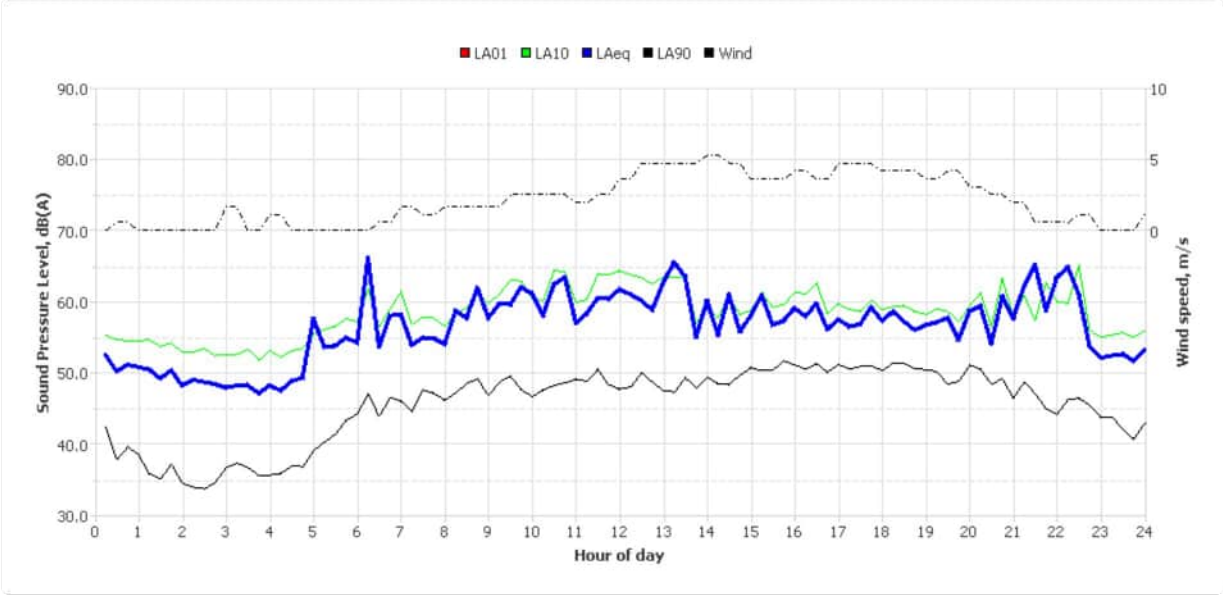

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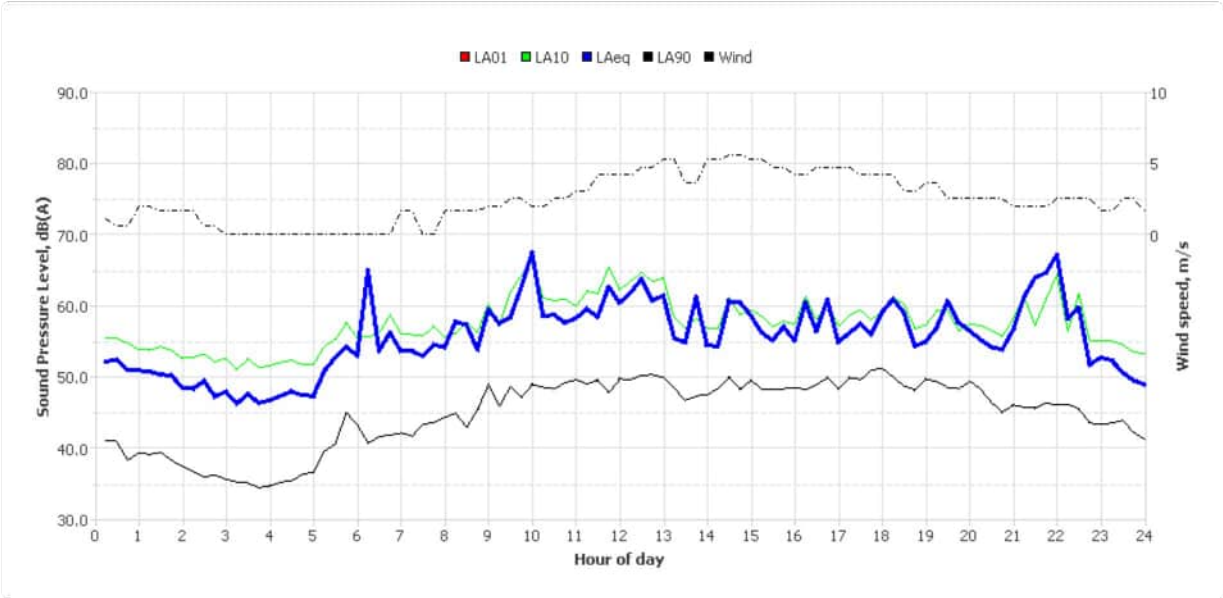

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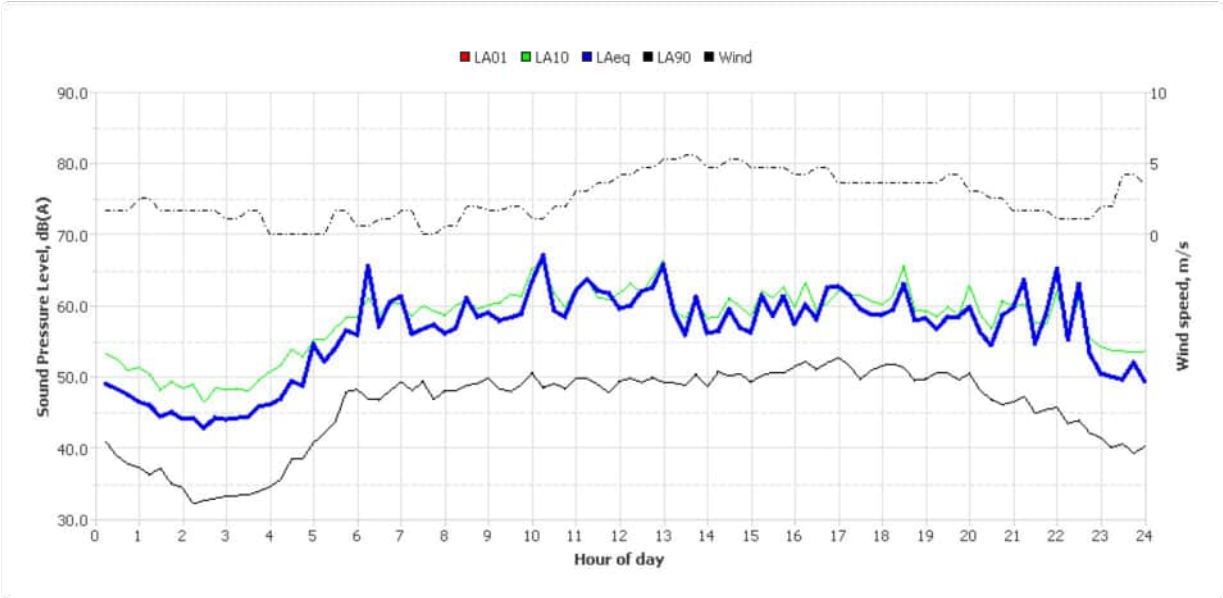
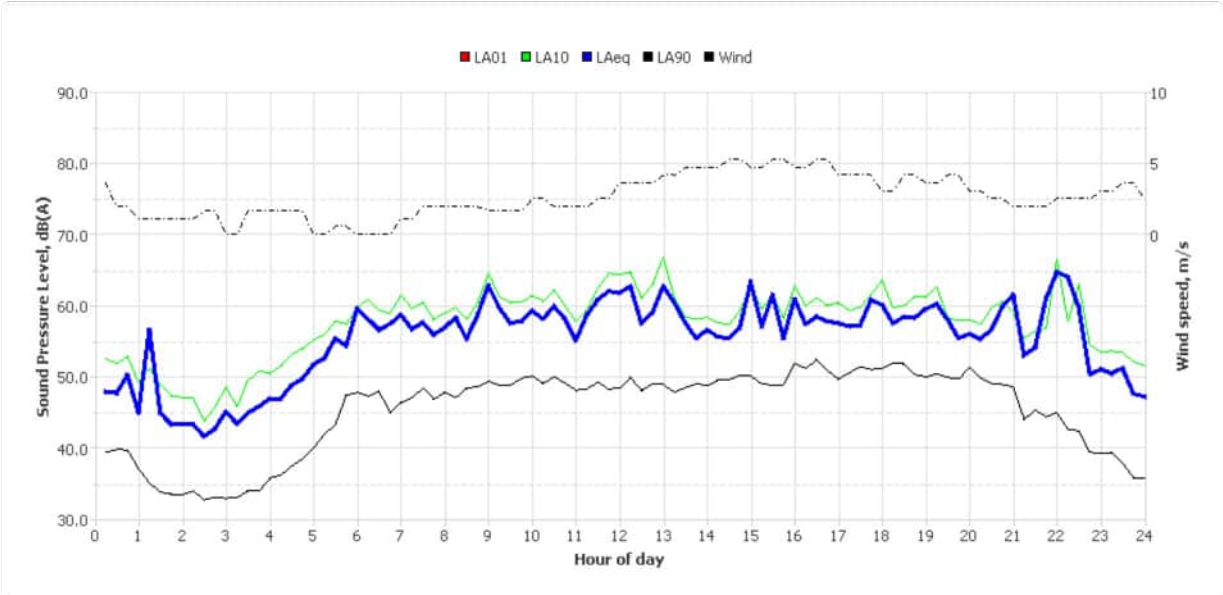
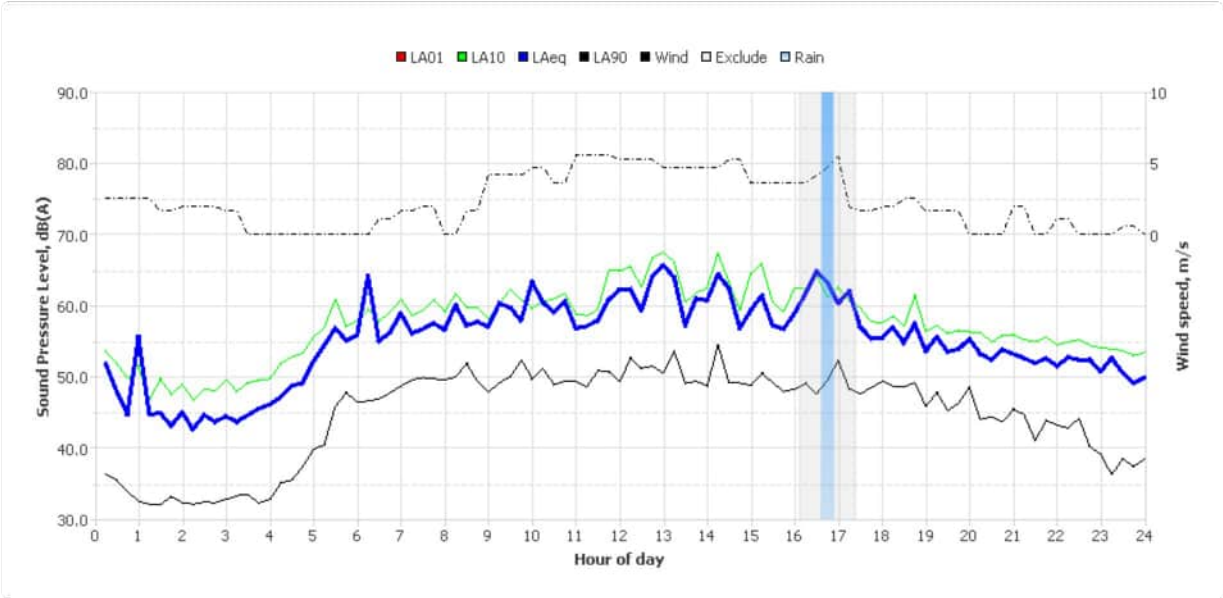


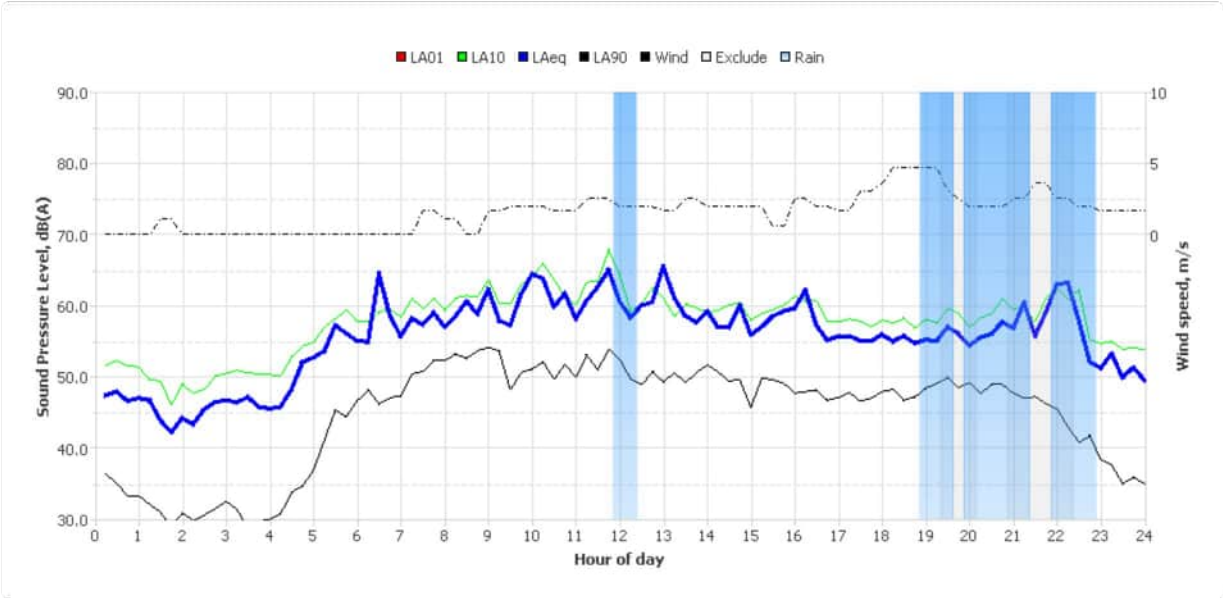
Tuesday, 26 Nov 2024



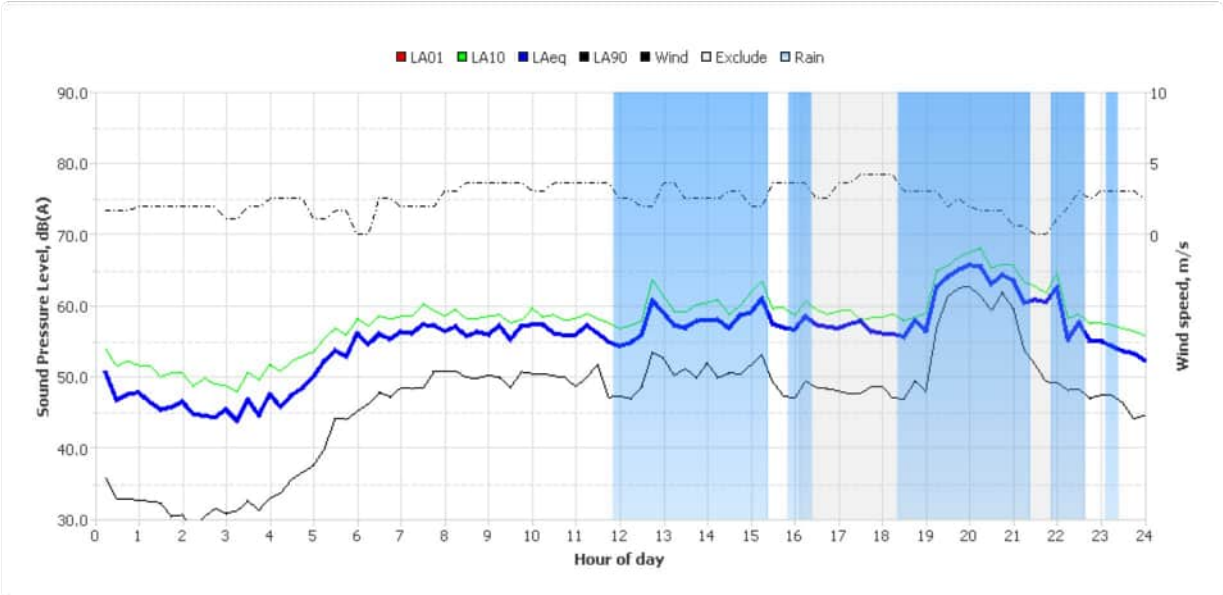
Wednesday, 27 Nov 2024



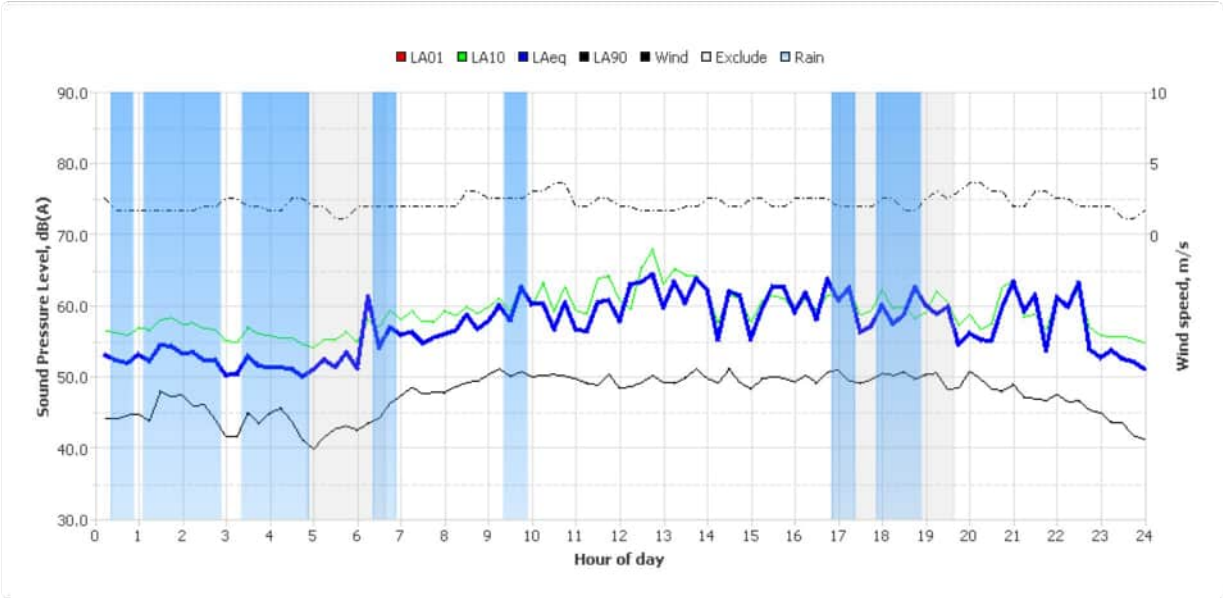
Thursday, 28 Nov 2024



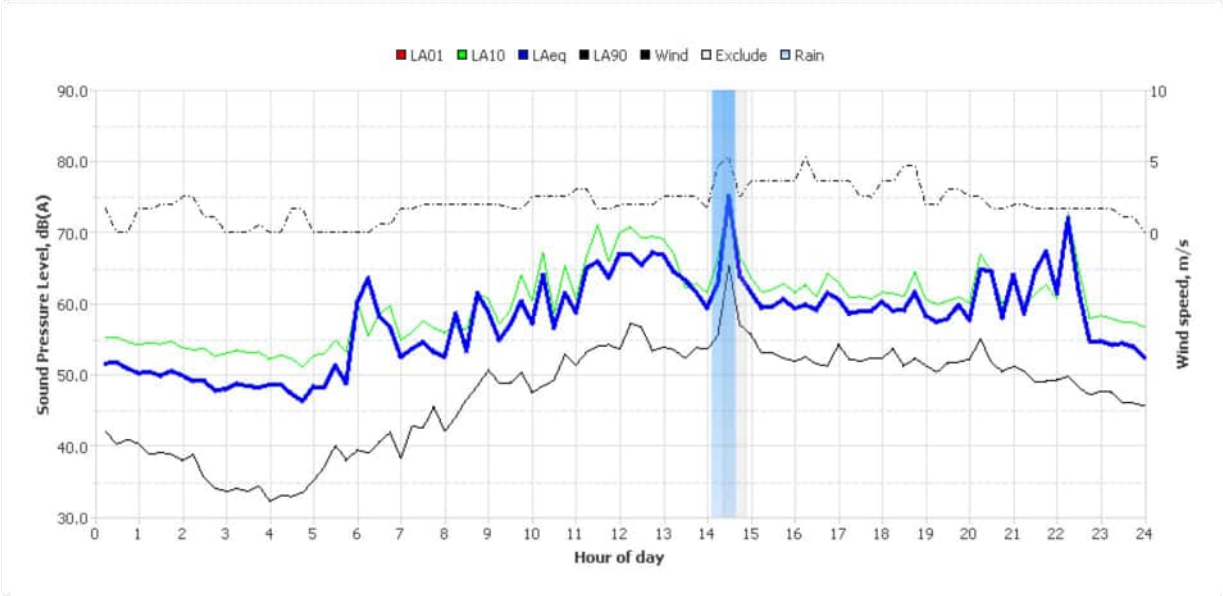
Friday, 29 Nov 2024



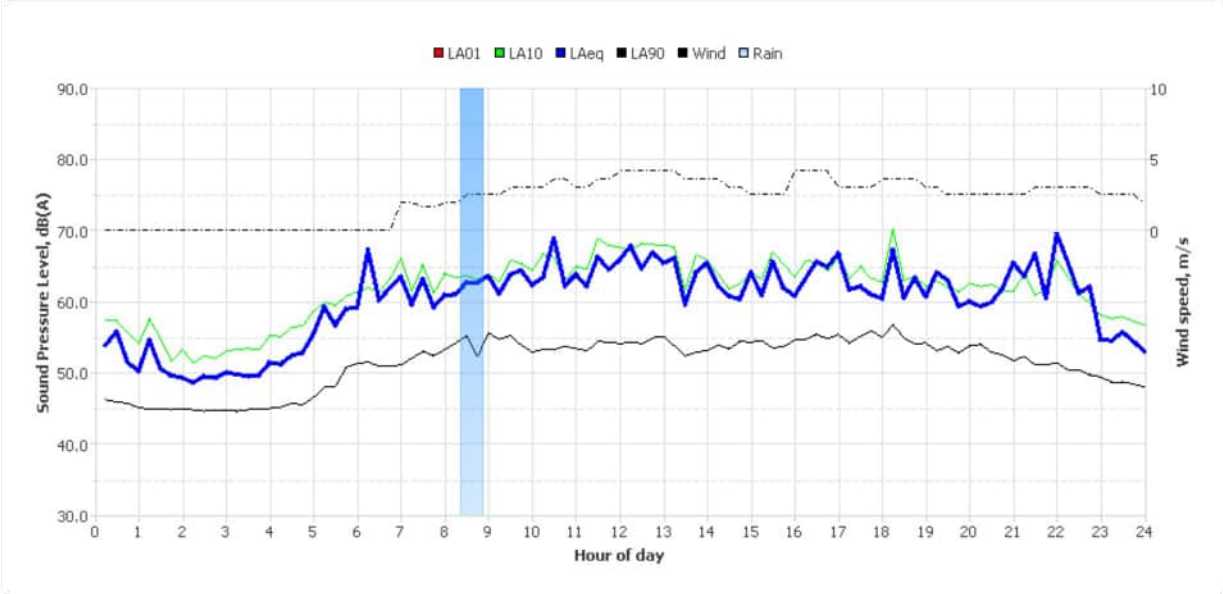
Saturday, 30 Nov 2024



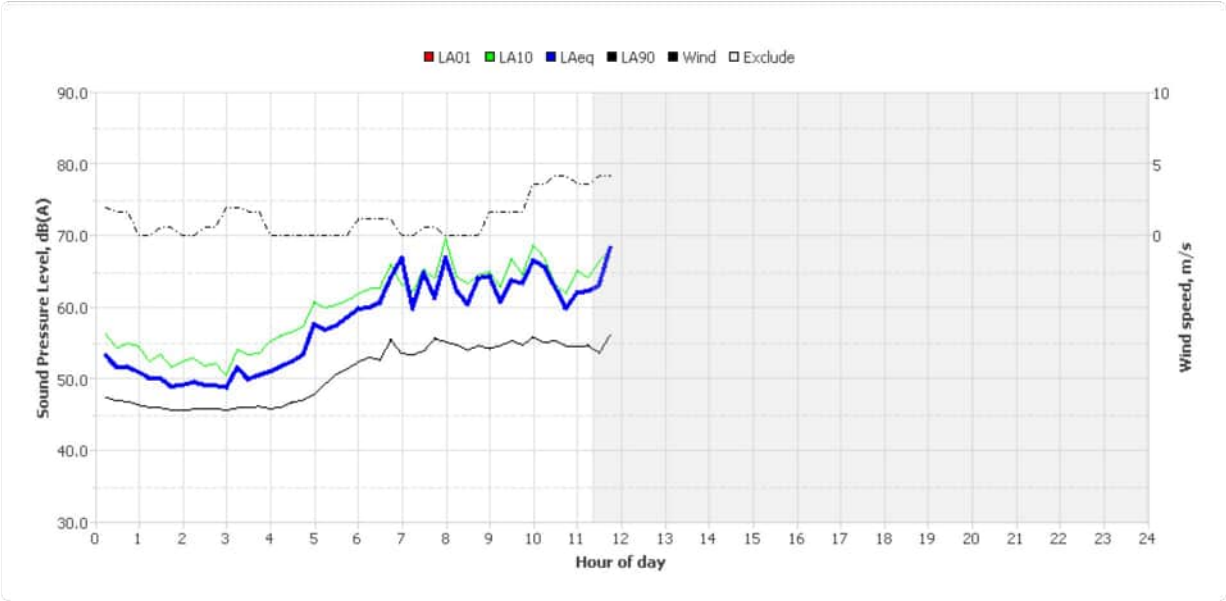
Sunday, 01 Dec 2024



Monday, 02 Dec 2024

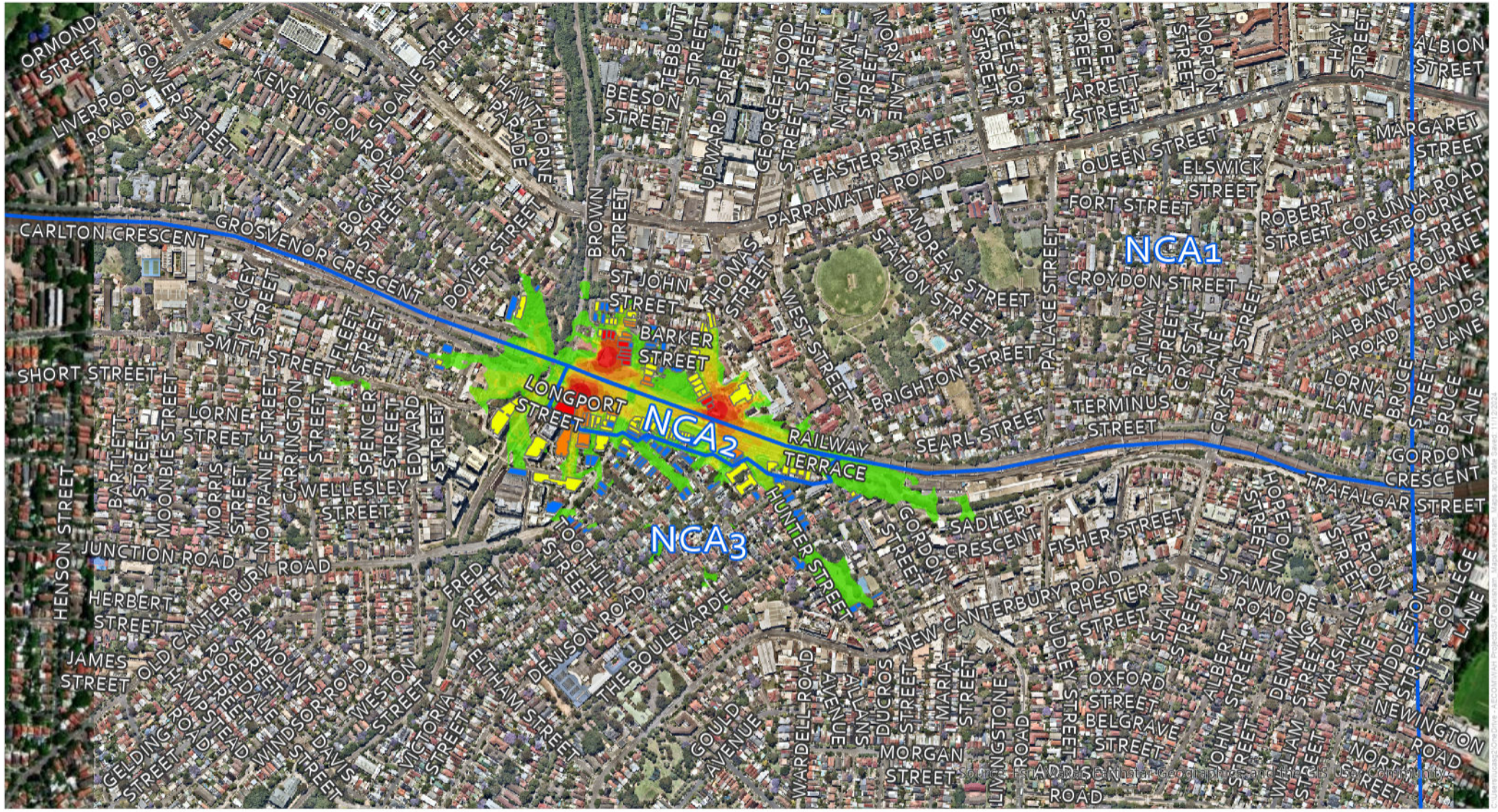


Tuesday, 03 Dec 2024



Appendix D

Predicted Noise Contours - Construction



SAT Lewisham - Compounds

NCA

Sound Pressure Level, L_{Aeq} dBA

38-44 45-49 50-54 55-59 60-64 65-69 > 69

Exceedance of NMLs

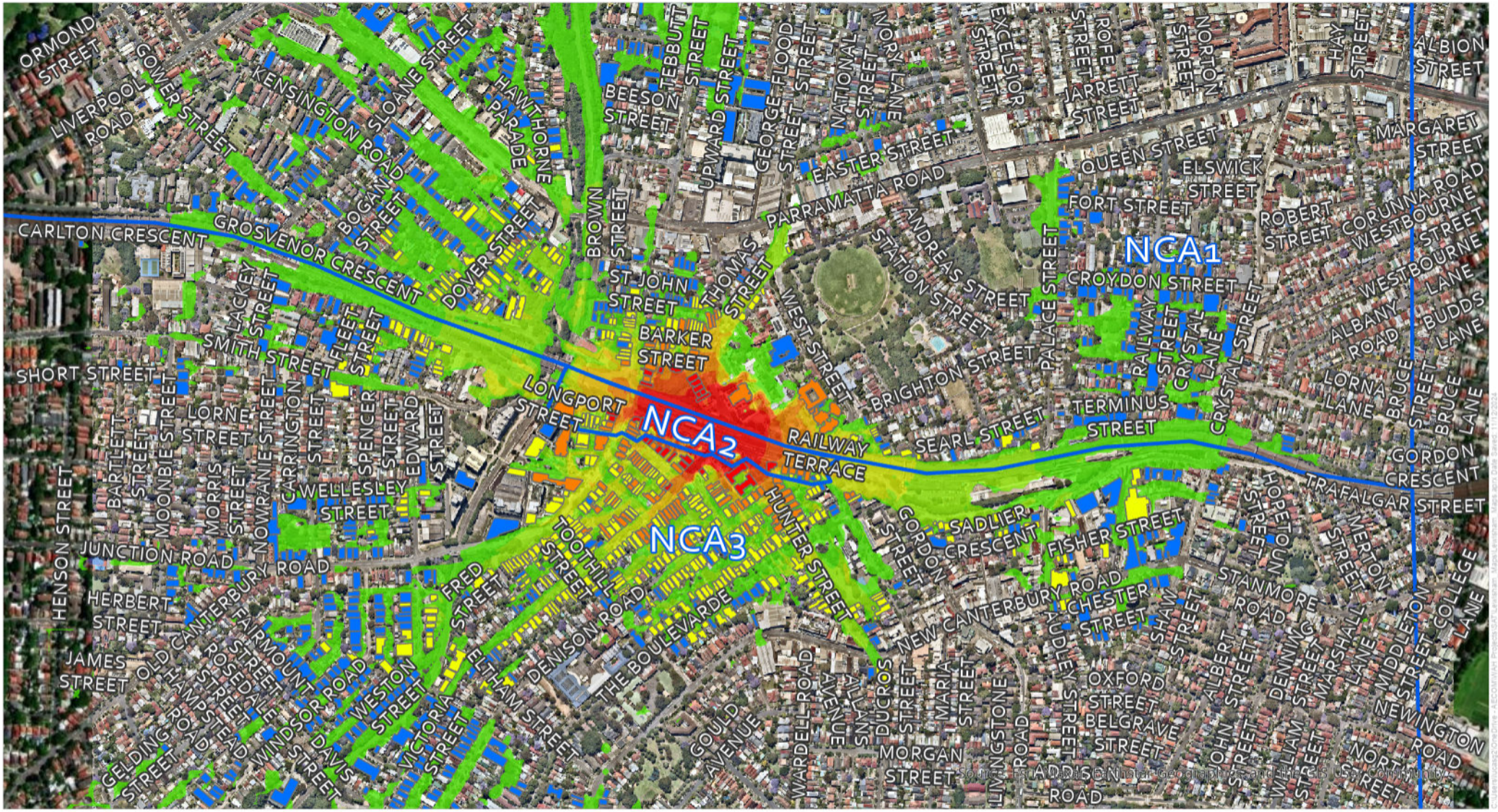
1 - 5
6 - 15
16 - 25
> 25

N

0 140 280 Meters

AECOM

Source: Nearmap 2024



SAT Lewisham - Possession 4

NCA

Sound Pressure Level, L_{Aeq} dBA

38-44 45-49 50-54 55-59 60-64 65-69 > 69

Exceedance of NMLs

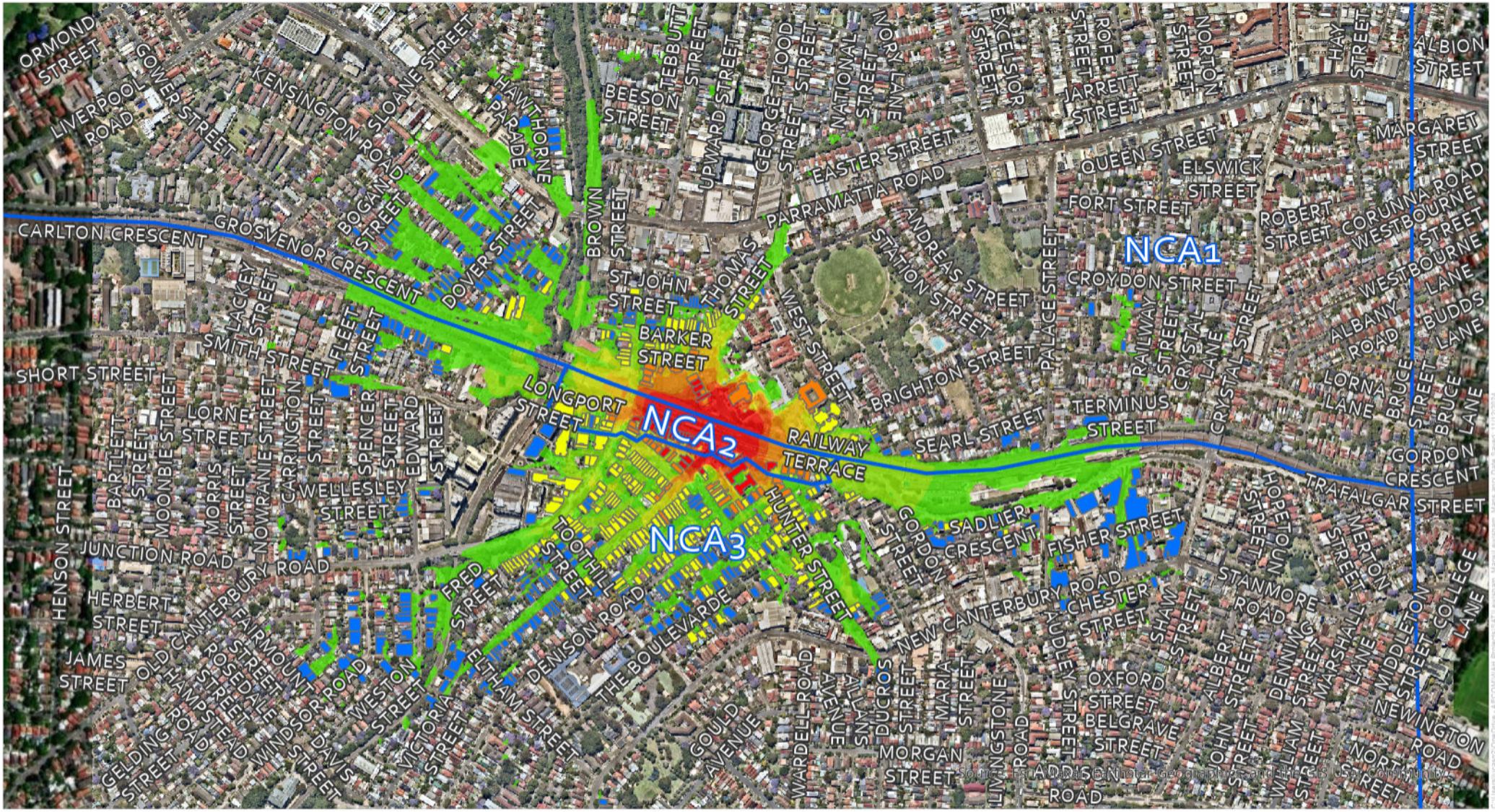
1 - 5
6 - 15
16 - 25
> 25

N

0 140 280 Meters

AECOM

Source: Nearmap 2024



SAT Lewisham - Possession 10

NCA

Sound Pressure Level, L_{Aeq} dBA

38-44 45-49 50-54 55-59 60-64 65-69 > 69

Exceedance of NMLs

1 - 5
6 - 15
16 - 25
> 25

N

0 140 280 Meters

AECOM

Source: Nearmap 2024

SAT Lewisham - Main Works 5

NCA

Sound Pressure Level, L_{Aeq} dBA

50-54 55-59 60-64 65-69 > 69

Exceedance of NMLs

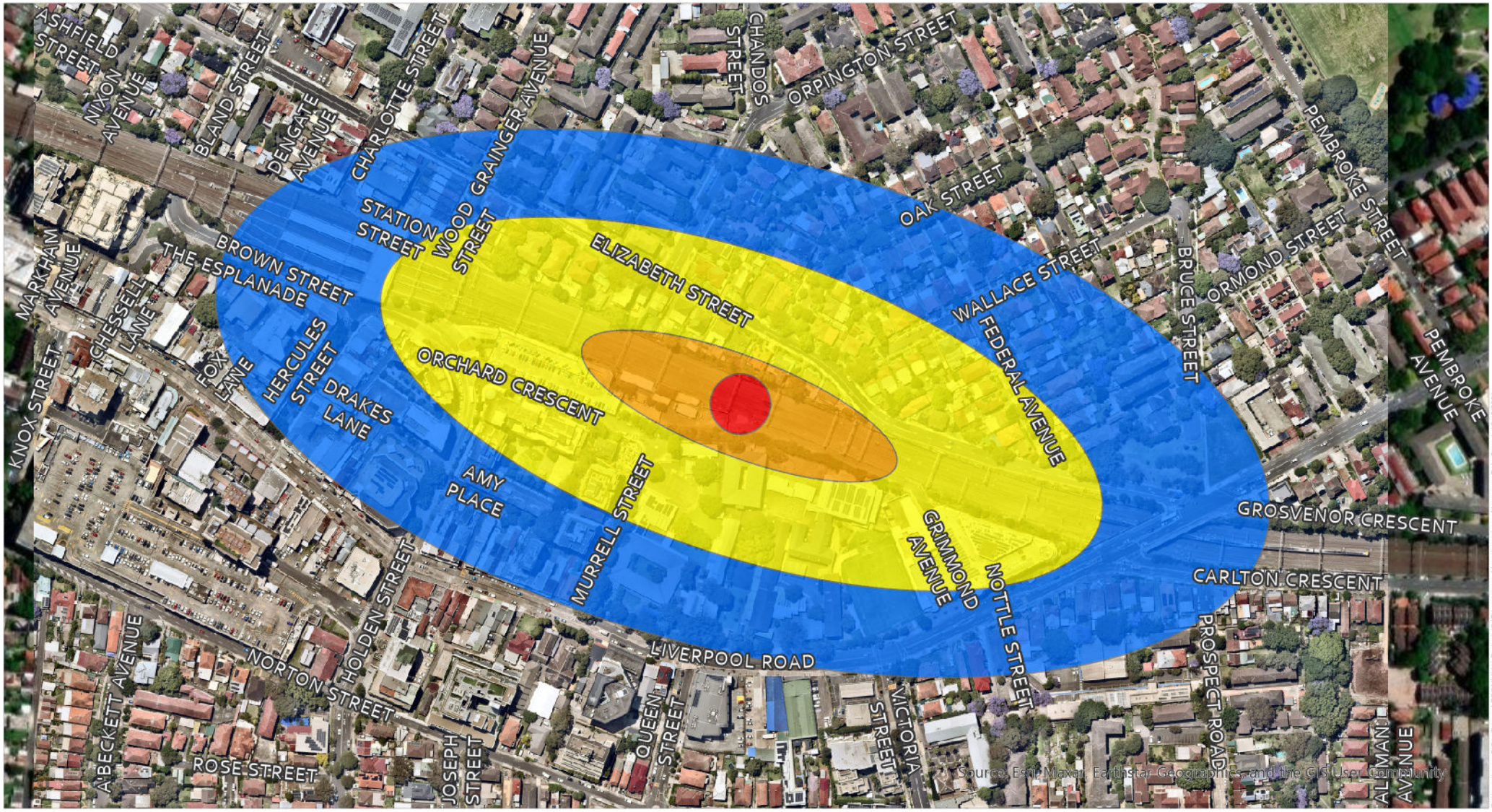
1 - 10
11 - 20
> 20

N

0 140 280 Meters

AECOM

Source: Nearmap 2024



SAT Lewisham - High Rail Pads Ashfield

Exceedance of NMLs

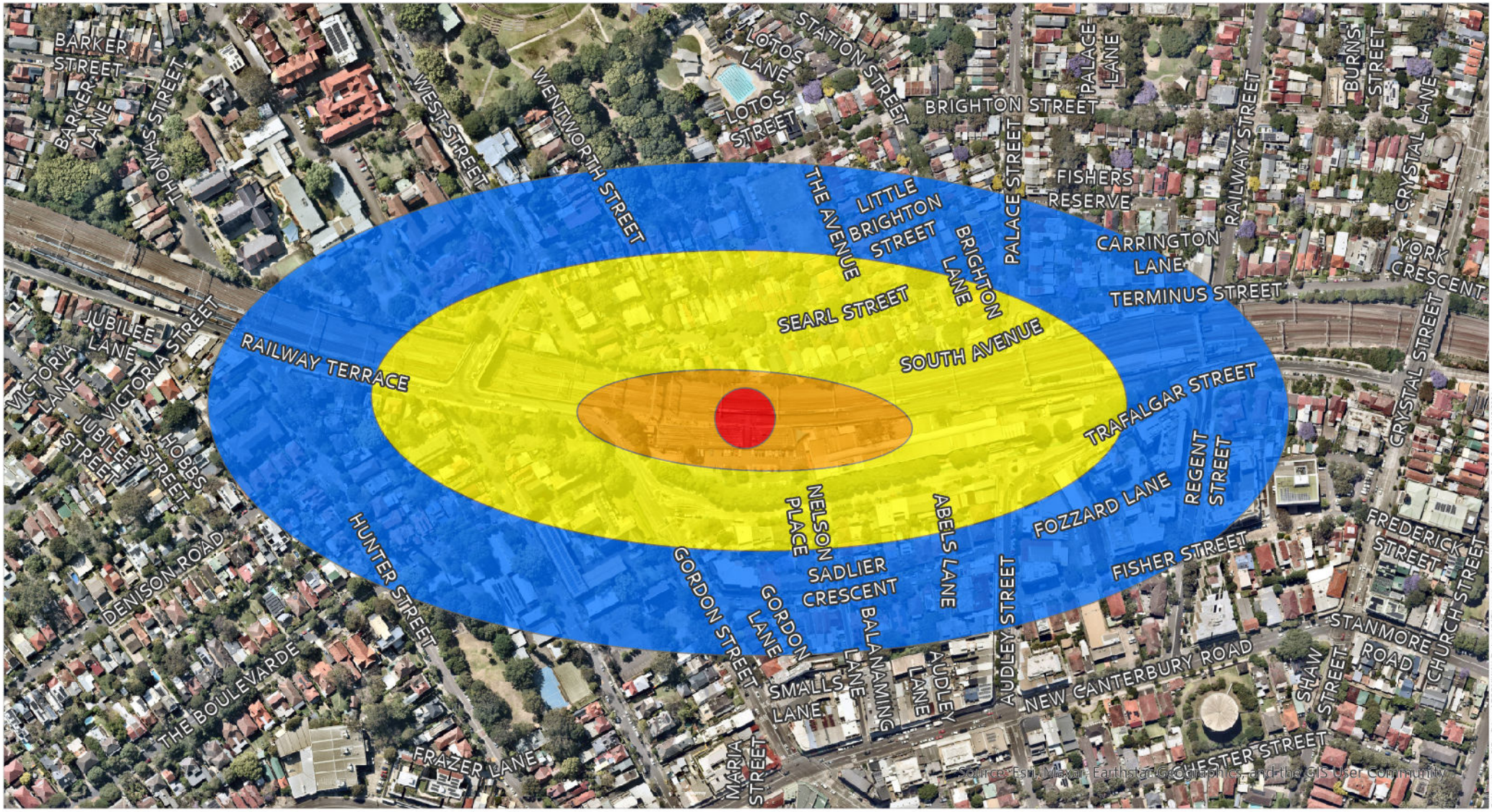
- 1 - 5
- 16 - 25
- 5 - 15
- > 25

N

0 50 100 Meters

AECOM

Source: Nearmap 2024



SAT Lewisham - High Rail Pads Petersham

Exceedance of NMLs

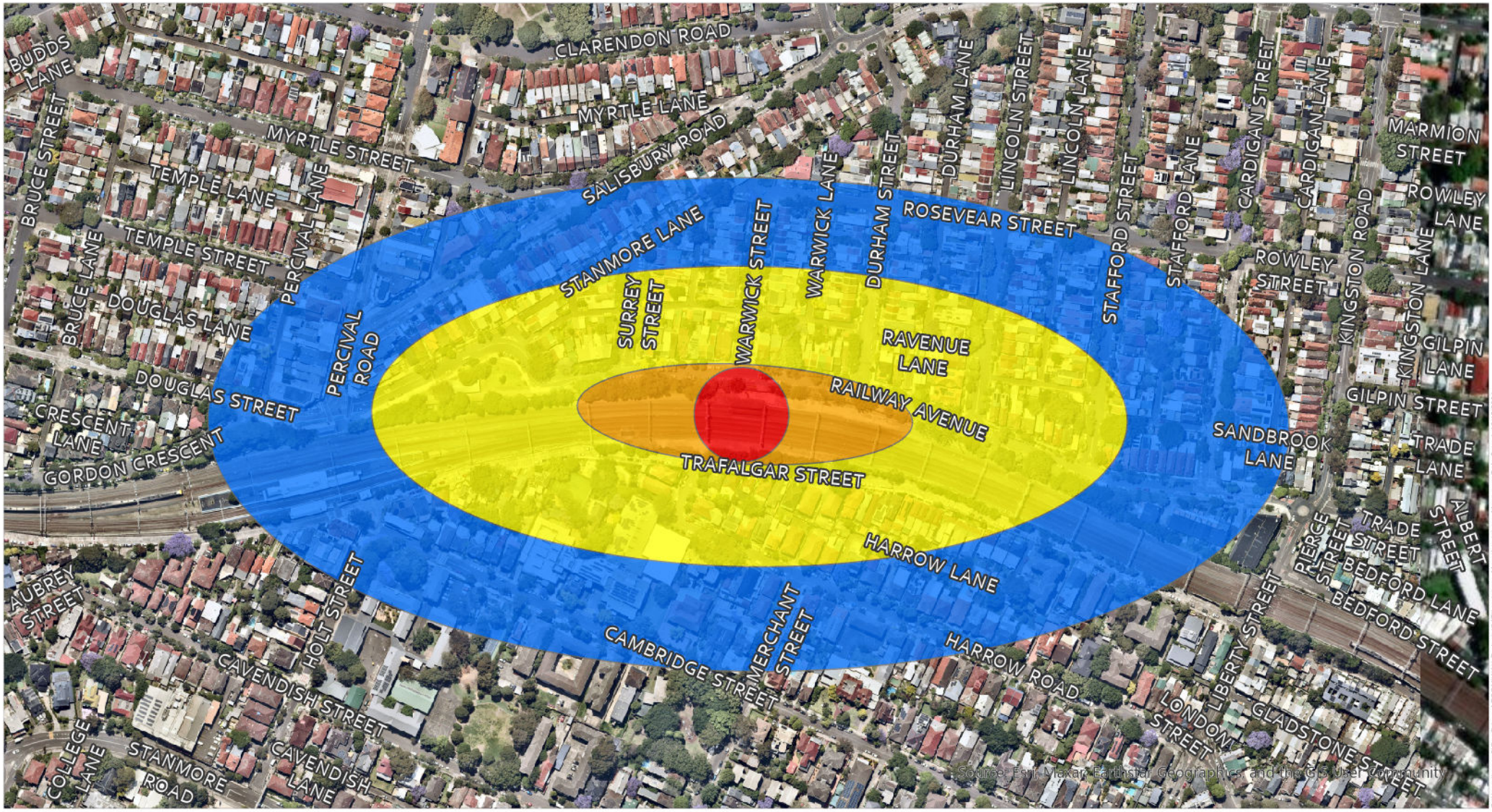
- 1 - 5
- 16 - 25
- 5 - 15
- > 25

N

0 50 100 Meters

AECOM

Source: Nearmap 2024



SAT Lewisham - High Rail Pads Stanmore

Exceedance of NMLs

- 1 - 5
- 16 - 25
- 5 - 15
- > 25

N

0 50 100 Meters

AECOM

Source: Nearmap 2024

Appendix E

Operational Traffic Noise Results

Appendix D - Operational road traffic noise results

Building ID	Day criteria, dB(A)	Night criteria, dB(A)	No build - Day, dB(A)	No build - Night, dB(A)	Build - Day, dB(A)	Build - Night, dB(A)	Noise level increase (day), dB(A)	Noise level increase (night), dB(A)	Exceedance
1 DENISON RD, LEWISHAM NSW 2049	60	55	60.5	51.8	60.7	51.9	0.2	0.1	No
1 HENRY ST, LEWISHAM NSW 2049	55	50	57.7	51.7	57.9	52	0.2	0.3	No
1 HOBBS ST, LEWISHAM NSW 2049	55	50	49.8	40.8	52.8	44.8	3	4	No
1 HUNTER ST, LEWISHAM NSW 2049	60	55	60	52.5	61	52.8	1	0.3	No
10 DENISON RD, LEWISHAM NSW 2049	60	55	56.2	46.2	57.1	47.7	0.9	1.5	No
10 HENRY ST, LEWISHAM NSW 2049	55	50	58.4	52.5	58.6	52.8	0.2	0.3	No
10 HOBBS ST, LEWISHAM NSW 2049	55	50	50.7	41.8	53.5	45.6	2.8	3.8	No
11 DENISON RD, LEWISHAM NSW 2049	60	55	56.1	46.2	57	47.7	0.9	1.5	No
11 HOBBS ST, LEWISHAM NSW 2049	55	50	50.6	41.5	53.4	45.4	2.8	3.9	No
12 DENISON RD, LEWISHAM NSW 2049	60	55	55.1	44.9	56	46.4	0.9	1.5	No
12 HENRY ST, LEWISHAM NSW 2049	55	50	59	53.2	59.1	53.4	0.1	0.2	No
12 HOBBS ST, LEWISHAM NSW 2049	55	50	50.7	41.6	53.5	45.6	2.8	4	No
14 HENRY ST, LEWISHAM NSW 2049	55	50	56.8	51.1	57	51.3	0.2	0.2	No
14 HOBBS ST, LEWISHAM NSW 2049	55	50	51	41.9	53.8	45.8	2.8	3.9	No
15 DENISON RD, LEWISHAM NSW 2049	60	55	56.1	46.1	57	47.6	0.9	1.5	No
16 DENISON RD, LEWISHAM NSW 2049	60	55	53.7	43.3	54.6	44.9	0.9	1.6	No
16 HENRY ST, LEWISHAM NSW 2049	55	50	62.4	56.9	62.5	57	0.1	0.1	No
17 RAILWAY TCE, LEWISHAM NSW 2049	60	55	73.7	68.3	73.7	68.3	0	0	No
18 DENISON RD, LEWISHAM NSW 2049	60	55	55.9	45.6	56.3	46.4	0.4	0.8	No
18 HENRY ST, LEWISHAM NSW 2049	55	50	63.7	58.2	63.8	58.3	0.1	0.1	No
2 DENISON RD, LEWISHAM NSW 2049	60	55	61.2	53.4	62.4	53.7	1.2	0.3	No
2 HENRY ST, LEWISHAM NSW 2049	55	50	56.1	49.7	56.4	50.2	0.3	0.5	No
2 HOBBS ST, LEWISHAM NSW 2049	55	50	50.5	41.2	53.4	45.4	2.9	4.2	No
20 HENRY ST, LEWISHAM NSW 2049	55	50	65.5	60.1	65.6	60.1	0.1	0	No
21 DENISON RD, LEWISHAM NSW 2049	60	55	56.1	46.1	56.8	47.2	0.7	1.1	No
22 HENRY ST, LEWISHAM NSW 2049	55	50	67.9	62.5	67.9	62.5	0	0	No
26 VICTORIA ST, LEWISHAM NSW 2049	60	55	56.9	50.5	57.3	51	0.4	0.5	No
3 DENISON RD, LEWISHAM NSW 2049	60	55	56.2	46.3	57.1	47.7	0.9	1.4	No
3 HENRY ST, LEWISHAM NSW 2049	55	50	58	52.1	58.2	52.4	0.2	0.3	No
3A HUNTER ST, LEWISHAM NSW 2049	60	55	60.7	52.4	61.6	52.7	0.9	0.3	No
4 DENISON RD, LEWISHAM NSW 2049	60	55	57.3	47.4	58.1	48.7	0.8	1.3	No
4 HENRY ST, LEWISHAM NSW 2049	55	50	56.8	50.6	57.2	51	0.4	0.4	No
4-6 HUNTER ST, LEWISHAM NSW 2049	60	55	65.1	59.4	65.3	59.4	0.2	0	No
5 DENISON RD, LEWISHAM NSW 2049	60	55	56.2	46.3	57	47.7	0.8	1.4	No
5 HENRY ST, LEWISHAM NSW 2049	55	50	58.7	52.9	58.9	53.1	0.2	0.2	No
5 HOBBS ST, LEWISHAM NSW 2049	55	50	49.3	40.3	52.2	44.3	2.9	4	No
5 HUNTER ST, LEWISHAM NSW 2049	60	55	60.3	51.6	60.7	51.8	0.4	0.2	No
6 DENISON RD, LEWISHAM NSW 2049	60	55	56.7	46.7	57.6	48.1	0.9	1.4	No
6 HENRY ST, LEWISHAM NSW 2049	55	50	57.1	51.1	57.4	51.5	0.3	0.4	No
6 HOBBS ST, LEWISHAM NSW 2049	55	50	50.4	41.3	53.3	45.4	2.9	4.1	No
7 HENRY ST, LEWISHAM NSW 2049	55	50	59.4	53.7	59.5	53.9	0.1	0.2	No
7 HOBBS ST, LEWISHAM NSW 2049	55	50	48.2	39.5	51.1	43.3	2.9	3.8	No
75 OLD CANTERBURY RD, LEWISHAM NSW 2049	60	55	72.1	66.7	72.1	66.7	0	0	No

7A DENISON RD, LEWISHAM NSW 2049	60	55	56	46.1	56.9	47.5	0.9	1.4	No
8 DENISON RD, LEWISHAM NSW 2049	60	55	56.4	46.3	57.3	47.8	0.9	1.5	No
8 HENRY ST, LEWISHAM NSW 2049	55	50	57.7	51.7	57.9	52.1	0.2	0.4	No
8 HOBBS ST, LEWISHAM NSW 2049	55	50	50.7	41.7	53.5	45.6	2.8	3.9	No
8 HUNTER ST, LEWISHAM NSW 2049	60	55	61.2	55	61.8	55.1	0.6	0.1	No
9 DENISON RD, LEWISHAM NSW 2049	60	55	56.2	46.2	57	47.7	0.8	1.5	No
9 HOBBS ST, LEWISHAM NSW 2049	55	50	50.4	41.2	53.3	45.3	2.9	4.1	No