SSDA NOISE IMPACT ASSESSMENT

SSD-35962232: Burrows Road Multi-level Warehouse, St Peters

Prepared for:

Goodman Property Services (Aust) Pty Ltd
1-11 Hayes Road
Rosebery, NSW 2018

SLR Ref: 610.30907.00100-R01
Version No: -v1.2
November 2022

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Goodman Property Services (Aust) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30907.00100-R01-v1.2	2 November 2022	Adam Sirianni	Antony Williams	Antony Williams
610.30907.00100-R01-v1.1	1 November 2022	Adam Sirianni	Antony Williams	Antony Williams
610.30907.00100-R01-v1.0	6 September 2022	Adam Sirianni	Antony Williams	Antony Williams

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1 Introduction

This Noise Impact Assessment (NIA) report has been prepared by SLR Consulting Australia Pty Ltd (SLR) to accompany a State Significant development application (SSDA) for a proposed warehouse and distribution centre development located at 1-3 Burrows Road, St Peters (the site).

This report has been prepared to assess the potential construction and operational noise impacts associated with the proposal.

SLR is suitably qualified and endorsed by the Planning Secretary to produce SSD noise impact assessments. SLR is a member of the Australian Acoustical Society (AAS) and a member firm of the Association of Australasian Acoustical Consultants (AAAC).

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

As summarised in **Table 1**, this report has also been prepared to address the relevant Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) for SSD-35962232 on 7 February 2022.

Table 1 Secretary's Environmental Assessment Requirements, SSD 35962232

Noise and Vibration	Where Addressed
Provide a noise and vibration assessment prepared in accordance with the relevant EPA guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	**Construction:** **Section 5.1**, **6.1** and **6.2** **Operation:** **Section 5.2** and **6.3** **Mitigation:** **Section 7**

2 Site Context

2.1 Site Description

The land to which this SSDA relates is located at 1-3 Burrows Road, St Peters (the site). The site comprises two parcels of land (allotments) and is legally described as follows:

- Lot 1 DP 1227450; and
- Lot 11 DP 606737.

The site is an irregular shaped allotment with a total area of approximately 34,614sqm. The site adjoins Burrows Road to the east with a primary curved frontage of approximately 528 metres and adjoins Canal Road to the west with a secondary frontage of approximately 289 metres.

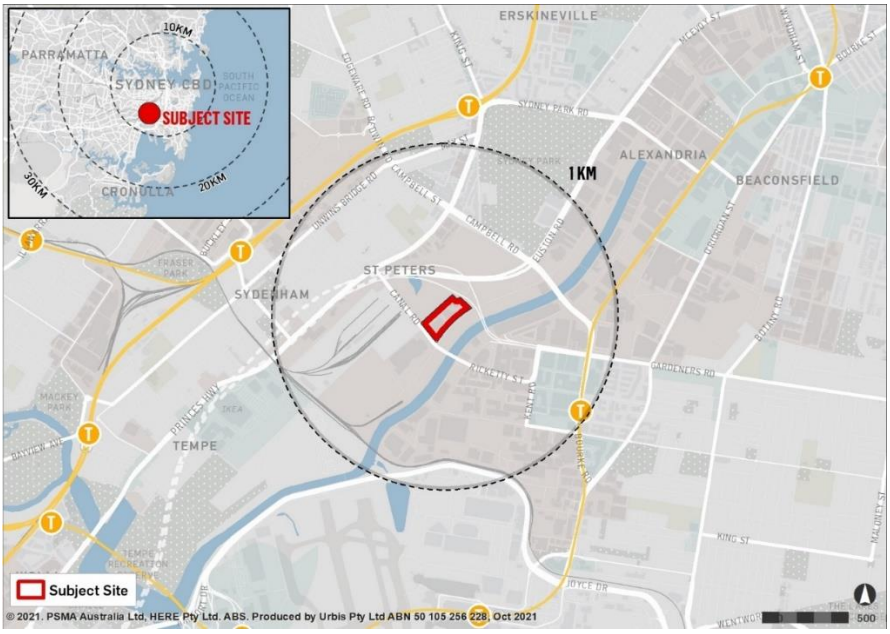
The site is located in the City of Sydney Local Government Area (LGA), at the junction with the Inner West and Bayside LGA's.

The site is currently occupied by older low-rise industrial units that are largely consistent with development in the surrounding area which is predominantly of an industrial nature. The industrial units comprise four large format steel framed warehouse / distribution facilities. These buildings no longer meet the requirements of contemporary industrial users in this market.

The site is situated within an established largely industrial area to the immediate south of the St Peters WestConnex Interchange and well-connected to the Sydney Airport. The locality surrounding the site is characterised by existing industrial and commercial developments, as well as new road and other major transport infrastructure. The Alexandra Canal is located approximately 100 metres to the south-east and east.

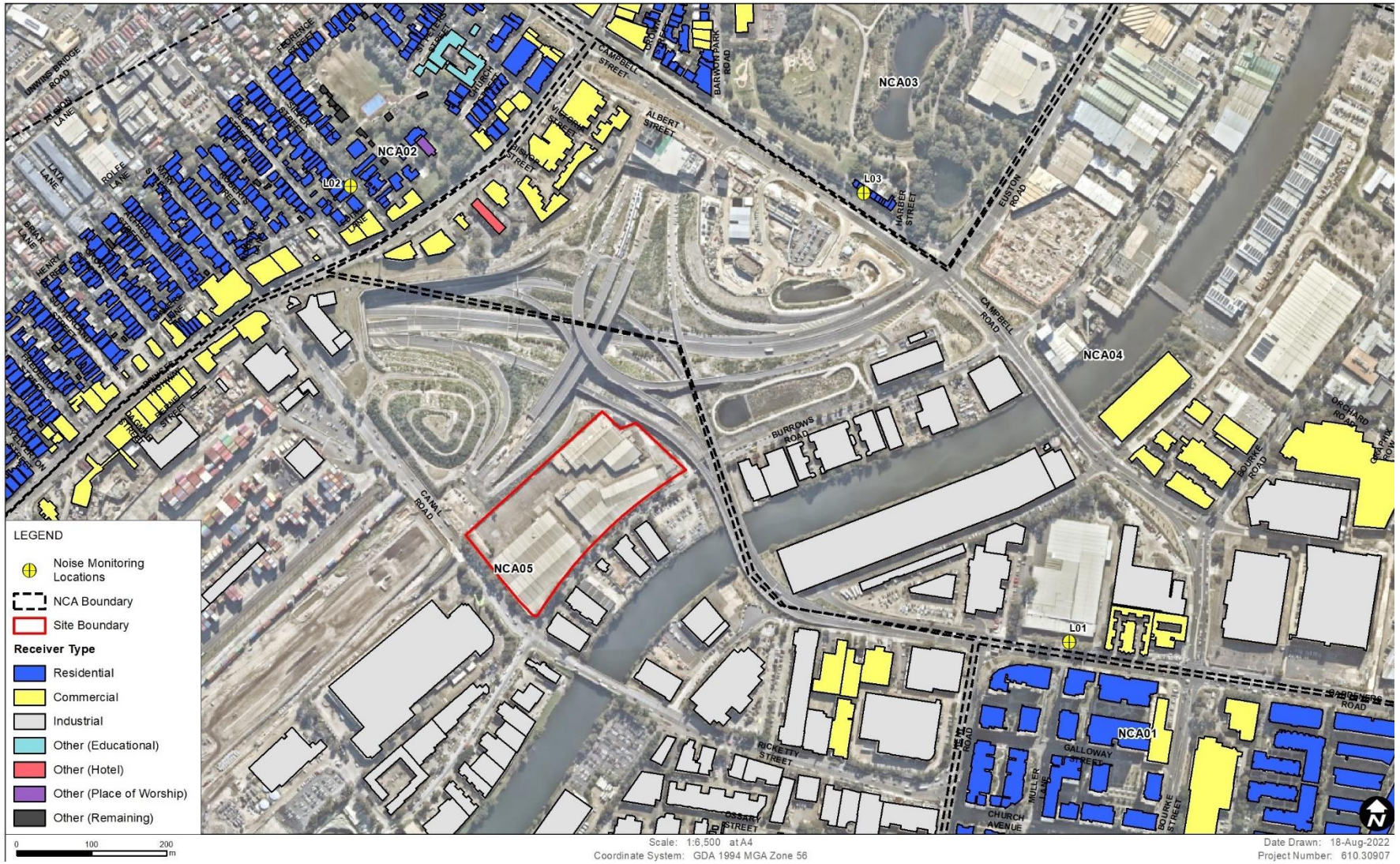
A Location Plan including the site is provided in **Figure 1** and **Figure 2**.

Figure 1 Location Plan



Source: Urbis

Figure 2 Site Location, Surrounding Receivers and Noise Monitoring Locations



2.2 Project Background

2.2.1 Planning Proposal PP-2020-298

The applicant recently obtained approval on 16 September 2020 for a Planning Proposal (PP-2020-298) at the site. The approved Planning Proposal amended the *Sydney Local Environmental Plan 2012* (SLEP 2012) by increasing the applicable maximum building height for the site from 18 metres to 30 metres. The Planning Proposal also introduced a set of site-specific controls for 1-3 Burrows Road, St Peters, in the SLEP 2012, including a 6-metre setback control to Burrows Road and Canal Road for landscaping purposes.

2.2.2 Competitive Design Alternatives Process

Goodman undertook a Competitive Design Alternatives Process (competitive design process) with three selected architectural firms following an expression of interest process.

The Jury resolved that the Welsh and Major scheme best demonstrated the ability to achieve design excellence as per Clause 6.21 of the Sydney LEP 2012 and the scheme which best met the design, planning and commercial objectives of the Competition Brief. The Welsh and Major scheme was subsequently awarded the winner of the Competitive Design Process.

SLR have been working in close collaboration with Goodman and Welsh and Major throughout the preparation of this SSDA and generally as part of the ongoing detailed design phase of the project.

2.3 Proposed Development

The vision for the project is to transform the site into a functional and adaptable multi-storey industrial warehouse building that will support industrial expansion in this highly accessible location and build upon strong ecommerce drivers close to Sydney Airport, Port Botany, Cooks River Intermodal Terminal and the Sydney CBD.

This detailed SSDA follows on from the Competitive Design Alternatives Process (competitive design process) undertaken between January and April 2022, whereby, the winning project architects Welsh and Major (W&M) were announced by the Selection Jury (Jury).

This proposed SSDA seeks approval for the following:

- Demolition of all existing structures and buildings on site.
- Tree removal both on site and for a limited number of trees in the public domain and adjoining lot.
- Site remediation, and establishment works, including minor excavation / bulk earthworks.
- Design, construction and operation of a three-storey warehouse and distribution centre building with an ancillary office building, including:
  - Approximately 52,150sqm of total GFA, comprising:
    - 47,076sqm of warehouse and distribution centre GFA; and
    - 5,014sqm of GFA for ancillary office space
    - Café tenancy within the ground floor lobby space of 60sqm GFA.
  - Maximum building height of RL 33.18 (30.14 height in metres).

- Operation 24 hours per day seven days a week.

- Provision of a single storey undercroft car parking area accessed off Burrows Road which provides 224 car parking spaces (including 12 accessible bays), 17 service vehicle spaces for vans/Utes, 19 motorcycle spaces, and bicycle parking (15 visitor spaces) and end-of-trip facilities (including 58 bicycle parking spaces, showers, lockers and change rooms for occupants).
- New crossings to Burrows Road for truck and car access.
- Single fire and utilities services ingress crossing off Canal Road.
- Site landscaping works totalling approximately 7,464sqm (or 21.6% of the site), including two 6-metre landscaped setback areas to both the Burrows and Canal Roads site frontages and the following provisions:
  - 5,293sqm or 15.3% deep soil landscaping; and
  - 5,074.82sqm or 14.7% tree canopy coverage.
- Provision of building / business identification signage.
- Provision of two chamber substations.

The layout of the warehouses are shown in **Figure 3** to **Figure 5**.

Figure 3 Proposed Development – Ground Floor

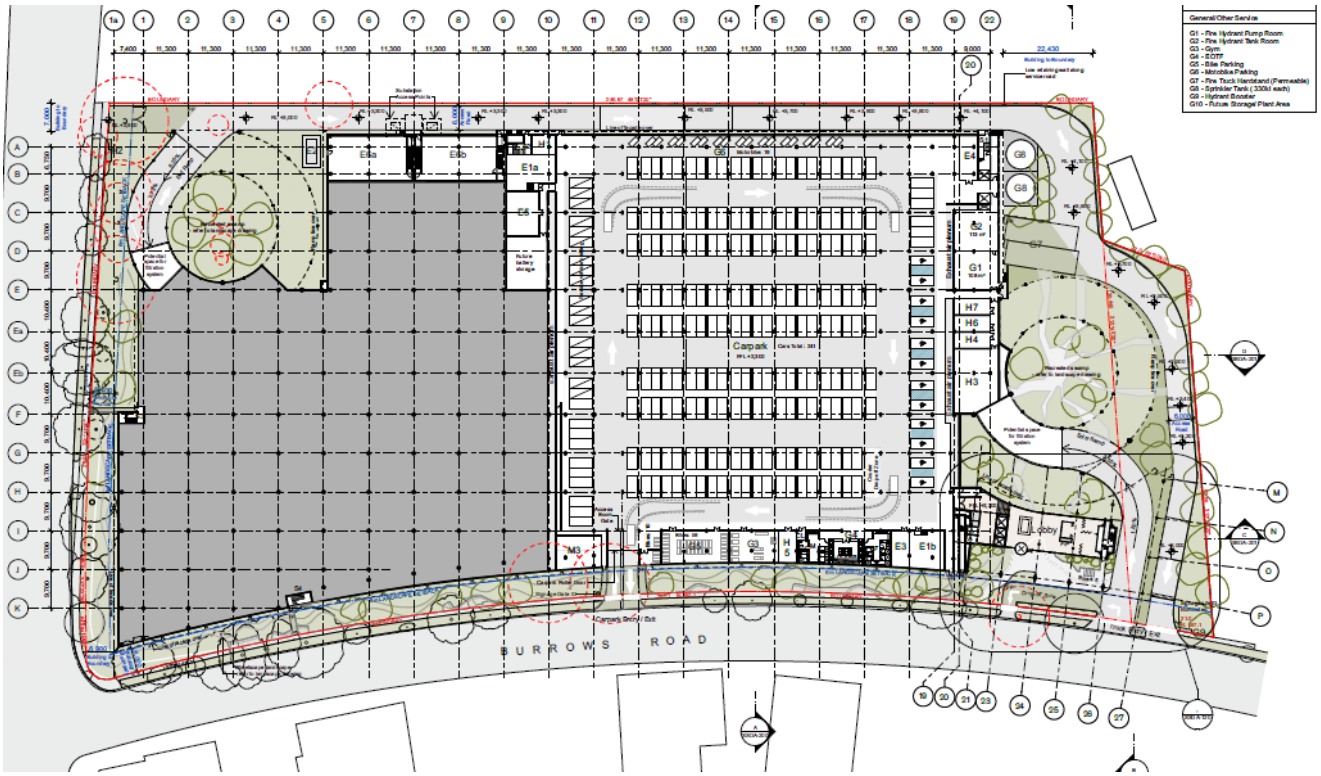


Figure 4 Proposed Development – Warehouse and Hardstand Floor Plan

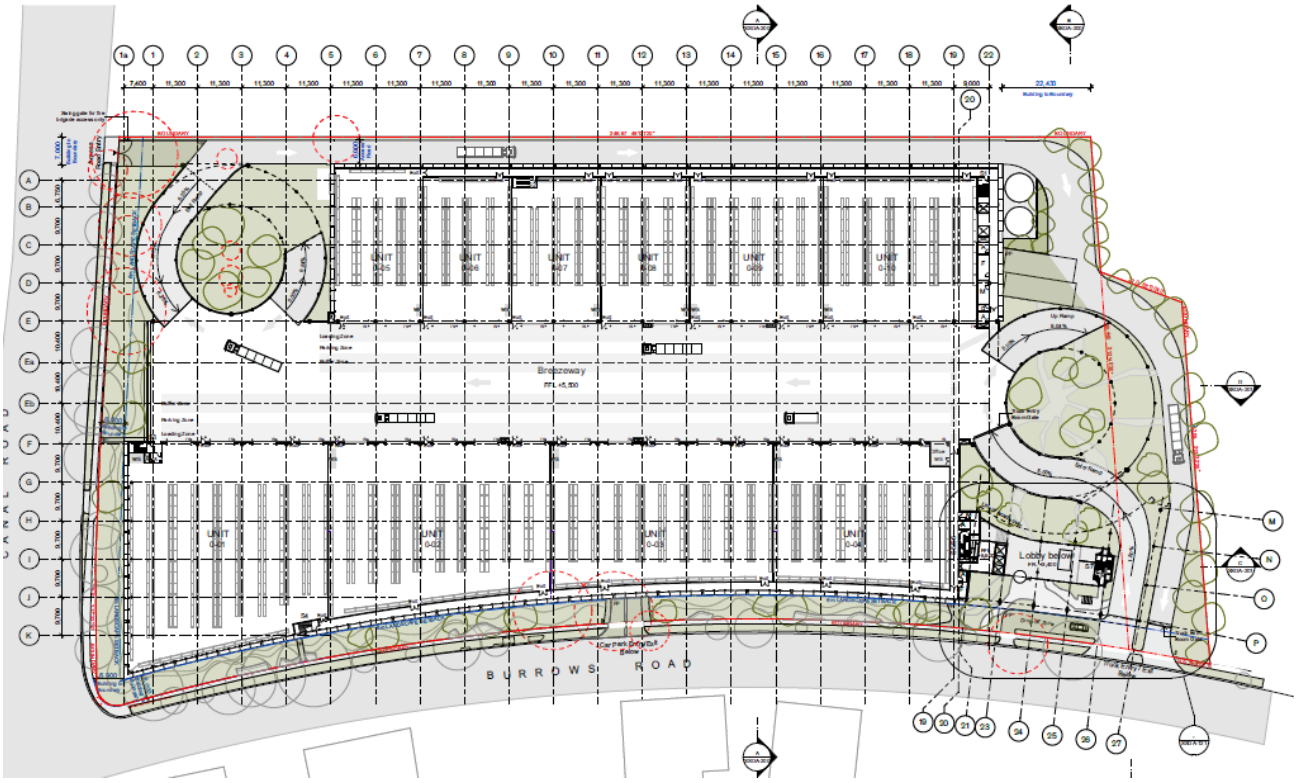
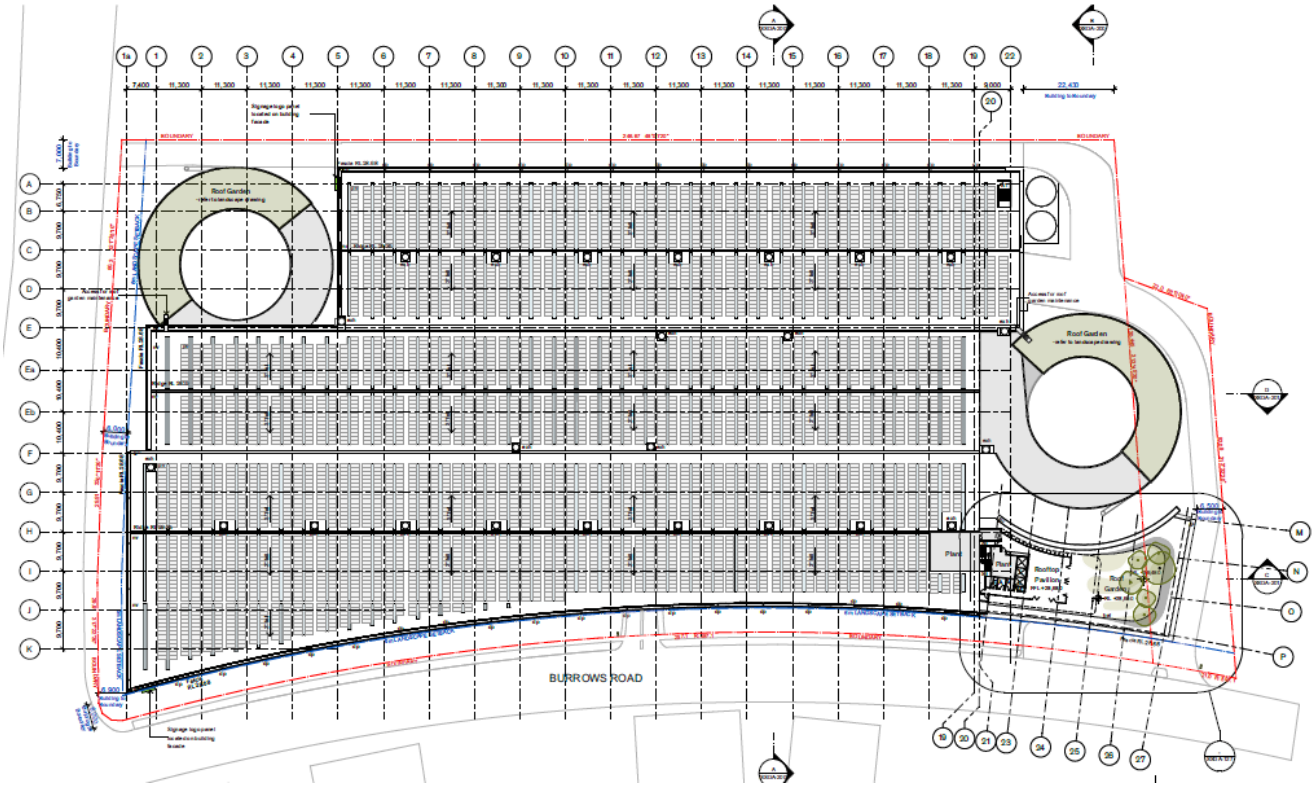


Figure 5 Proposed Development – Roof Floor Plan



2.4 Nearest Receivers

The nearest receivers are industrial developments located around 30 m to the south of the site. The nearest residential receivers are located around 400 to 500 m to northwest, northeast and southeast. The nearest receivers are shown in **Figure 2** and detailed in **Table 2**.

Table 2 Surrounding Sensitive Receivers

NCA	Direction	Distance (m)	Description
NCA01	Southeast	530	This NCA consists of mixed-use developments along Gardeners Road, which are typically multi-story residential towers with commercial uses on ground floor. Commercial and industrial receivers located in the western and northern areas of the catchment.
NCA02	Northwest	400	This NCA consists of residential and commercial receivers on Princes Highway. St Peters Anglican Church and St Peters Public School are in the north of the catchment.
NCA03	Northeast	400	This NCA consists of residential receivers along Campbell Road, with commercial receivers near Princes Highway.
NCA04	North	80	This NCA consists of mostly commercial and industrial receivers. Ibis Budget St Peters is on Princes Highway.
NCA05	South	30	This NCA consists of commercial and industrial receivers generally to the south of the site.

3 Existing Noise Environment

Unattended noise monitoring was completed in the study area in June 2022. The measured noise levels have been used to determine the existing noise environment and to set the criteria used to assess the potential impacts from the proposal.

The monitoring equipment was positioned to measure existing noise levels that are representative of receivers potentially most affected by the proposal, within constraints such as accessibility, security and landowner permission.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. All equipment carried current National Association of Testing Authorities (NATA) or manufacturer calibration certificates and equipment calibration was confirmed before and after each measurement.

The measured data has been processed to exclude noise from extraneous events and periods affected by adverse weather conditions, such as strong wind or rain (measured at the Sydney Airport Bureau of Meteorology (BOM) weather station), to establish representative existing noise levels in the study area.

The noise monitoring locations are shown in **Figure 2** and the results are summarised in **Table 3**. Details of the unattended monitoring together with graphs of the measured daily noise levels are provided in **Appendix B**.

Table 3 Summary of Unattended Noise Monitoring Results

ID	Address	Measured Noise Levels (dBA)[1]					
		Background Noise (RBL)			Average Noise (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L01	546 Gardeners Road, Alexandria	57	54	47	67	65	62
L02	8 Silver Street, St Peters	43	45	39	57	59	50
L03	14 Campbell Road, Alexandria	56	55	47	67	65	62

Note 1: The assessment periods are the daytime which is 7 am to 6 pm Monday to Saturday and 8 am to 6 pm on Sundays and public holidays, the evening which is 6 pm to 10 pm, and the night-time which is 10 pm to 7 am on Monday to Saturday and 10 pm to 8 am on Sunday and public holidays. See the NSW EPA *Noise Policy for Industry*.

Short-term attended noise monitoring was also completed. The attended measurements allow the contributions of the various noise sources at each location to be determined. Detailed observations from the attended measurements are provided in **Appendix B**.

The attended measurements were generally found to be consistent with the results of the unattended noise monitoring and show that existing ambient noise levels are typically dominated by road traffic noise from the surrounding road network, noise from aircraft arriving and departing Sydney Airport and industrial noise from existing industrial developments in the area.

4 Assessment Criteria

4.1 Construction Noise Criteria

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a proposal are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the proposal.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

4.1.1 Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 4**.

Table 4 ICNG NMLs for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays[2]	Noise affected RBL[1] + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

	Highly Noise Affected
	75 dBA
		• The Highly Noise Affected (HNA) 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 restructuring the hours that the very noisy activities can occur, taking into account:
		  • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences
		  • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Outside Standard Construction Hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where all feasible and reasonable practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

Note 2: The proposal is located in the City of Sydney LGA, therefore City of Sydney LGA standard construction hours are applicable (see (**Section 5.1.2**)

4.1.2 'Other Sensitive' Land Uses and Commercial Receivers

Non-residential land uses have been identified in the study area. The NMLs for 'other sensitive' receivers are shown in **Table 5**.

Table 5 Construction NMLs for ICNG 'Other Sensitive' Receivers

Land Use	Noise Management Level $L_{Aeq(15minute)}$ (dBA) (applied when the property is in use)	
	Internal	External
ICNG 'other sensitive' receivers		
Classrooms at schools and other educational institutions	45	55[1]
Hospital wards and operating theatres	45	65[2]
Places of worship	45	55[1]
Active recreation areas (characterised by sporting activities and activities which generate noise)	-	65
Passive recreation areas (characterised by contemplative activities that generate little noise)	-	60
Commercial	-	70
Industrial	-	75
Non-ICNG 'other sensitive' receivers		
Hotel – daytime & evening[3]	50	70[2]
Hotel – night-time[3]	40	60[2]

Note 1: It is assumed that these receivers have windows partially open for ventilation which results in internal noise levels being around 10 dB lower than the external noise level.

Note 2: It is assumed that these receivers have fixed windows which conservatively results in internal noise levels being around 20 dB lower than the external noise level.

Note 3: Taken from AS2107.

4.1.3 NML Summary

The construction NMLs for the proposal have been determined using the results from the unattended noise monitoring and are shown in **Table 6**.

Table 6 Project Specific Noise Management Levels (dBA)

Location	Receiver Type	Monitoring Location	Noise Management Level ($L_{Aeq(15minute)}$ – dBA)			
			Standard Construction (RBL +10 dB)[1,2]	Out of Hours (RBL +5 dB)		
			Daytime	Daytime	Evening	Night-time
NCA01	Residential	L01	67	62	59	52
NCA02	Residential	L02	53	48	48	44
	Place of Worship	-	55[3]	-	-	-
	Educational	-	55[3]	-	-	-
NCA03	Residential	L03	66	61	60	52
NCA04	Hotel	-	70[3]	70	70	60
-	Commercial	-	70	-	-	-
-	Industrial	-	75	-	-	-

Note 1: RBL = Rating Background Level.

Note 2: The proposal is located in the City of Sydney LGA, therefore City of Sydney LGA standard construction hours are applicable (see (**Section 5.1.2**).

4.2 Construction Vibration Criteria

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

4.2.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDVs for human comfort impacts are shown in **Table 7**.

Table 7 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

4.2.2 Effects on Building Contents

People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes, are located in buildings near to construction works. No such items of equipment have been identified in the proposal area.

4.2.3 Structural and Cosmetic Damage Vibration

If vibration from construction works is sufficiently high it can cause damage to structural elements of affected buildings. The levels of vibration required to cause cosmetic damage tend to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration.

Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. Structural damage vibration limits are contained in British Standard BS 7385 and German Standard DIN 4150.

BS 7385

British Standard BS 7385 recommends vibration limits for transient vibration judged to give a minimal risk of vibration induced damage to affected buildings. The limits for residential and industrial buildings are shown in **Table 8**.

Table 8 BS 7385 Transient Vibration Values for Minimal Risk of 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

Note 1: Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%.

For heritage buildings, the standard states that *"a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive"*.

DIN 4150

German Standard DIN 4150 also provides guideline vibration limits for different buildings. Damage is not expected to occur where the values are complied with and the values are generally recognised to be conservative. The DIN 4150 values for buildings and structures are shown in **Table 9**.

Table 9 DIN 4150 Guideline Values for Short-term Vibration on Structures

Group	Type of Structure	Guideline Values Vibration Velocity (mm/s)				
		Foundation, All Directions at a Frequency of			Topmost Floor, Horizontal	Floor Slabs, Vertical
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 **and** are of great intrinsic value (eg heritage listed buildings)	3	3 to 8	8 to 10	8	20[1]

Note 1: It may be necessary to lower the relevant guideline value markedly to prevent minor damage.

4.2.4 Minimum Working Distances for Vibration Intensive Works

Minimum working distances for typical vibration intensive construction equipment are provided in the Roads and Maritime (now Transport for NSW) *Construction Noise and Vibration Guideline* (CNVG) and are shown in **Table 10**. The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort (from the NSW EPA Vibration Guideline). They are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

Table 10 Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Distance		
		Cosmetic Damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
Vibratory Roller	<50 kN (1–2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	13 m	20 m
	<200 kN (4–6 tonne)	12 m	25 m	40 m
	<300 kN (7–13 tonne)	15 m	31 m	100 m
	>300 kN (13–18 tonne)	20 m	40 m	100 m
	>300 kN (>18 tonne)	25 m	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	15 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	44 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	5 m to 40 m	20 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	5 m	4 m
Jackhammer	Hand held	1 m (nominal)	3 m	2 m

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to cosmetic damage of typical buildings under typical geotechnical conditions.

4.3 Operational Noise Criteria

The NSW *Noise Policy for Industry* (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW.

The NPfI defines how to determine 'trigger levels' for noise emissions from industrial developments. Where a development is likely to exceed the trigger levels at existing noise sensitive receivers, feasible and reasonable noise management measures are required to be considered to reduce the impacts.

There are two types of trigger levels – one to account for 'intrusive' noise impacts and one to protect the 'amenity' of particular land uses:

- The **intrusiveness** of an industrial noise source is generally considered acceptable if the L_{Aeq} noise level of the source, measured over a period of 15-minutes, does not exceed the representative background noise level by more than 5 dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.
- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended **amenity** levels specified in the NPfI for that particular land use.

Intrusive and amenity noise levels are not used directly as regulatory limits. They are used to assess the potential impact of noise, assess feasible and reasonable mitigation options and subsequently determine achievable noise requirements.

The NPfI provides guidance on assigning residential receiver amenity noise categories based on the site-specific features shown in **Table 11**.

Table 11 Residential Receiver Amenity

Receiver Category	Typical Planning Land Use Zoning	Typical Existing Background Noise Levels (RBL)	Description
Rural	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime <40 dBA Evening <35 dBA Night <30 dBA	Rural – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime <45 dBA Evening <40 dBA Night <35dBA	Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime >45 dBA Evening >40 dBA Night >35 dBA	Urban – an area with an acoustical environment that: • Is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • Has through-traffic with characteristically heavy and continuous traffic flows during peak periods • Is near commercial districts or industrial districts • Has any combination of the above.

Amenity noise categories for the surrounding receivers have been determined with reference to the NPfI. The assessment is shown in **Table 12**.

Table 12 Residential Receiver Amenity Category Assessment

Area	Land Use Zoning	Existing Background Noise Levels RBL (dBA)			Resulting Amenity Classification	Discussion
		Day	Eve	Night		
NCA01	R4 – high density residential	57	54	47	Urban	The surrounding area is zoned as R4 – high density residential and existing noise levels are controlled by road traffic noise and urban hum from nearby industrial districts, therefore residences have been classified as urban.
NCA02	R2 – low density residential	43	45	39		The surrounding area is zoned as R2 – low density residential, however existing noise levels are high and controlled by road traffic noise from nearby major roads and urban hum from nearby industrial districts. Residences have therefore been classified as urban.
NCA03	R1 – general residential	56	55	47		The surrounding area is zoned as R1 – general residential and existing noise levels are controlled by road traffic noise and urban hum, therefore residences have been classified as urban.

4.3.1 Project Noise Trigger Levels

The trigger levels for industrial noise from the proposal are summarised in **Table 13**. They are based on the previously measured background noise levels, where appropriate. The Project Noise Trigger Levels (PNTL) are the most stringent of the intrusiveness and amenity trigger level for each period and are highlighted below.

Table 13 Project Noise Trigger Levels

Location	Receiver Type	Period	Amenity Noise Level L_{Aeq} (dBA)	Measured Noise Level (dBA)		Project Noise Trigger Levels $L_{Aeq(15minute)}$ (dBA)	
				RBL[1]	$L_{Aeq(period)}$	Intrusiveness	Amenity[2,3]
NCA01	Residential	Day	60	57	67	62	**58**
		Evening	50	54	65	59	**53**[4]
		Night	45	47	62	52	**50**[4]
NCA02	Residential	Day	60	43	57	**48**	58
		Evening	50	43 (45 actual)	59	**48**	48
		Night	45	39	50	44	**43**
	Place of Worship	When in use	50[5]	-	-	-	**48**
	Educational	When in use	45[5]	-	-	-	**43**
NCA03	Residential	Day	60	56	67	61	**58**
		Evening	50	55	65	60	**53**[4]
		Night	45	47	62	52	**50**[4]
NCA04	Hotel	Day	65	-	-	-	**63**
		Evening	55	-	-	-	**53**
		Night	50	-	-	-	**48**
-	Commercial	When in use	65	-	-	-	**63**
-	Industrial	When in use	70	-	-	-	**68**

Note 1: RBL = Rating Background Level.

Note 2: The recommended amenity noise levels have been reduced by 5 dB, where appropriate, to give the project amenity noise levels due to other sources of industrial noise being present in the area, as outlined in the NPfI.

Note 3: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.

Note 4: The measured L_{Aeq} noise level was dominated by existing road traffic noise and exceeds the recommended amenity noise level by 10 dB or more, therefore, the 'high traffic project amenity noise level' is the existing $L_{Aeq(traffic)}$ noise level minus 15 dB, as outlined in the NPfI.

Note 5: The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are therefore 10 dB higher than the corresponding internal level, which is generally considered representative of windows being partially open for ventilation.

4.3.2 Sleep Disturbance

The potential for sleep disturbance from maximum noise level events during the night-time period from the development is required to be considered.

The NPfI defines the sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater.

The sleep disturbance screening levels for the development are shown in **Table 14**.

Table 14 Sleep Disturbance Screening Levels

Location	Noise Level (dBA)	
	Measured Prevailing Night-time Background Level	Sleep Disturbance Screening Level[1]
NCA01	47	62
NCA02	39	54
NCA03	47	62

Note 1: The sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater

A detailed maximum noise level event assessment should be completed where the sleep disturbance screening level is exceeded. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

The NPfI refers to the *Road Noise Policy* (RNP) for additional information regarding sleep disturbance. enHealth Council studies are referenced which indicate that for short-term or transient noise events, for good sleep over eight hours the indoor L_{AFmax} sound pressure level should ideally not exceed around 45 dBA more than 10 or 15 times per night.

The RNP goes on to conclude that from the research on sleep disturbance to date:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep
- One or two events per night with maximum internal noise levels of 65-70 dBA are not likely to affect health and wellbeing significantly.

4.3.3 Corrections for Annoying Noise Characteristics

Sources of industrial noise can cause greater annoyance where they contain certain characteristics, such as tonality, intermittency or dominant low-frequency content. The NPfI specifies the following modifying factor corrections, shown in **Table 15**, which are to be applied where annoying characteristics are present. The corrections are to be added to the noise level at the receiver before comparison with the Project Noise Trigger Levels.

Table 15 NPfI Modifying Factor Corrections

Factor	Assessment/Measurement	When to Apply	Correction[1]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by the levels defined in the NPfI.	5 dB[2]
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements	Measure/assess source contribution C and A weighted $L_{eq,t}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and the level to which the thresholds defined in the NPfI are exceeded.	2 or 5 dB[2]
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level	The source noise heard at the receiver varies by more than 5 dB and the intermittent nature of the noise is clearly audible. The NPfI further defines intermittent noise as noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB, for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.	5 dB[3]
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated.	Maximum correction of 10 dB[2] (excluding duration correction)

Note 1: Corrections to be added to the measured or predicted levels.

Note 2: Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

Note 3: Adjustment to be applied to night-time only.

Details of the modifying factor corrections applied in the assessment are provided in **Section 5.2**.

4.3.4 Traffic on Surrounding Roads

The potential impacts from proposal related traffic on the surrounding public roads are assessed using the NSW EPA *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB. Where this is considered likely, further assessment is required using the RNP criteria shown in **Table 16**.

Table 16 RNP/NCG Criteria for Assessing Traffic on Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am – 10 pm)	Night-time (10 pm – 7 am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

5 Methodology

5.1 Construction Noise and Vibration Assessment

A noise model of the study area has been used to predict noise levels from the proposed construction work to all surrounding receivers. The model uses ISO 9613 algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the construction sites and surrounding areas.

5.1.1 Construction Activities

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the proposal. These scenarios are shown in **Table 17**.

The assessment uses 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

The sound power levels for the construction equipment used in each scenario is presented in **Appendix C.**

Table 17 Construction Equipment

Scenario	Works Activity	Equipment
W.01	Vegetation clearing	Chainsaw, chipper, dozer, dump truck, excavator, front end loader, water truck
W.02	Demolition	Rockbreaker, dozer, front end loader, truck, water truck
W.03	Earthworks	Dozer, dump truck, excavator, front end loader, grader, vibratory roller, water truck
W.04	Construction of roads	Bitumen spray truck, line marking plant, paving machine, vibratory roller
W.05	Construction of pads and hardstands	Concrete pump, concrete truck/agitator, concrete vibrator
W.06	Construction of structures	Elevated working platform, flatbed truck, hand tools, mobile crane

5.1.2 Hours of Construction

Construction activities for the proposal would generally be undertaken during the following standard construction hours within the City of Sydney LGA:

- 7:30 am to 5:30 pm, Mondays to Fridays
- 7:30 am to 3:30 pm on Saturdays
- At no time on Sundays or Public Holidays.

5.2 Operational Noise Assessment

The project is in the early design stages and the future tenants are currently unknown. Several assumptions have been made regarding the future tenants and sources of noise, based on the likely warehouse and distribution uses. These assumptions have been used to develop representative worst-case noise modelling scenarios that reflect the expected highest noise emissions that the development would likely emit.

The potential operational noise levels from the proposal have been predicted to the surrounding receivers using the CONCAWE industrial noise algorithm in SoundPLAN. The model includes ground topography, ground type (ground absorption modelled as 0.1 for urban areas and 0.5 for residential areas), buildings and representative worst-case noise sources from the proposal.

The potential impacts have been determined by comparing the predicted worst-case noise levels to the NPfI PNTLs in a 15-minute assessment period.

5.2.1 Operational Noise Sources

1-3 Burrows Road is a speculative development with no tenants committed. The facility has been designed to accommodate typical warehouse and distribution centre uses.

The development comprises of two, three-floor warehouse buildings with associated ancillary offices, roads, heavy vehicle access, hardstands, light vehicle access and carparking. Vehicles would access the site from Burrows Road. Heavy vehicles would park in the hardstand loading areas of the various floors while they are loaded/unloaded, before exiting the site. The facility has been designed to require only forward vehicle movements in the hardstand areas and access roads, meaning heavy vehicle reversing alarms would not be required. Light vehicle basement carparking is provided underneath each warehouse and would generally be used by staff.

Internal noise sources would generally be minimal and associated with typical logistical, distribution, warehousing and office space activities. There would be no use of manufacturing equipment within any warehouses.

Roof mounted mechanical plant would be provided for each office and warehouse. It has been assumed that 25% of the site would be temperature controlled with associated mechanical plant and refrigerated truck movements. The development would operate 24 hours a day.

The main sources of operational noise at the development are expected to include:

- On-site light and heavy vehicle movements
- Loading dock activities in hardstands
- Mechanical plant
- Off-site vehicle movements.

A summary of the expected noise sources and worst-case assessment scenarios associated with the operation of the development is provided below.

On-Site Traffic

On-site vehicles have been modelled using the data in **Table 18**. The volumes are representative of the expected worst-case 15-minute period for the daytime, evening and night-time. The volumes conservatively assume that light and heavy vehicles concurrently access the various warehouse tenancies during the worst-case 15-minute assessment period. In reality, vehicle access to each warehouse would be unlikely to occur concurrently, particularly during the night-time.

Heavy vehicle deliveries to the warehouses would likely be via a range of freight vehicles including medium trucks (ie rigid trucks) and heavy trucks (ie semi-trailers and b-doubles). While heavy trucks would possibly access the development during the night-time period, it is expected that the majority of deliveries during this period would be via rigid (ie medium) trucks, which are significantly quieter. Two assessment scenarios have been considered – one which conservatively assumes heavy truck deliveries and one assuming medium trucks. Increased sound power levels have been applied to trucks on the ramps to allow for acceleration/deceleration noise when on inclines.

Table 18 Vehicle Traffic Data – Worst-case 15-Minute Period

Vehicle Type	Location	Sound Power Level (dBA)[2]	Vehicle Speed (km/h)	Number of Vehicles in Worst-case 15-minute Period[1]		
				Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
Level 0						
Heavy trucks	Access routes	108[2]	25	4	2	1
	Loading docks		5			
Medium Trucks	Access routes	103[2]	25			
	Loading docks		5			
Light vehicles	Car park	96[3]	20	70	33	22
Level 1						
Heavy trucks	Access routes	108[2]	25	4	2	1
	Loading docks		5			
	Ramps	111[2]	20			
Medium Trucks	Access routes	103[2]	25			
	Loading docks		5			
Level 2						
Heavy trucks	Access routes	108[2]	25	5	2	2
	Loading docks		5			
	Ramps	111[2]	20			
Medium Trucks	Access routes	103[2]	25			
	Loading docks		5			

Note 1: Total vehicles, includes both inbound and outbound vehicles.

Note 2: Sound power level for 'heavy trucks' based on 106 dBA for trucks at slow speed for 80% of the time and 111 dBA for trucks accelerating for 20% of the time and is representative of trucks with three or more axles. Sound power level for 'medium trucks' based on 100 dBA for

trucks at slow speed for 80% of the time and 106 dBA for trucks accelerating for 20% of the time and is representative of trucks with two axles and six tires. Trucks on ramps are assumed to be accelerating 100% of the time. Sound power levels taken from the Federal Highway Administration's Traffic Noise Model.

Note 3: Sound power level taken from *Road Traffic Noise Prediction Model "ASJ RTN-Model 2013" Proposed by the Acoustical Society of Japan – Part 2: Study on Sound Emission of Road Vehicles*, OKADA et al, Internoise 2014, and accounts for vehicles accelerating.

Hardstands and Loading Docks

Details of the hardstand and loading dock noise sources are shown in **Table 19**. The various sources have been modelled in the hardstand areas (see **Figure 6**) based on the corresponding number of heavy vehicle movements in the worst-case 15-minute periods (see **Table 18**).

Table 19 Typical Hardstand and Loading Dock Noise Sources

Noise Source	Sound Power Level (dBA)[1]	Typical Duration of Use in Worst-case 15-minute Period
All Warehouses		
Forklift reversing alarm	102[2,3]	90 seconds
Air brakes	118	1 second
Roller door	94	15 seconds
Electric forklift	84	900 seconds
Cold Storage Warehouses (assumed at 25% of tenancies)		
Refrigeration truck trailer	102[4]	900 seconds

Note 1: SWLs based on measurement data, where appropriate.

Note 2: SWL based on recommendation to use broadband reversing alarms, see **Section 7.2**.

Note 3: SWL includes a -3 dB reduction due to alarms being discrete events.

Note 4: SWL based *Sound Power Levels and Directivity Patterns of Refrigerated Transport Trailers*, Roy et al, 2017.

Internal Activities

The future tenants of the warehouses would likely be associated with typical warehousing and distribution uses. Internal noise-generating activities at all warehouses are expected to generally be minimal. A sound power level of 75 dBA has been applied at openings in the facades of each warehouse to cover potential break-out noise from general internal activities, based on observations of loading activities at similar warehouse facilities. Warehouse roller shutter doors are assumed to be open during loading dock activities.

Mechanical Plant

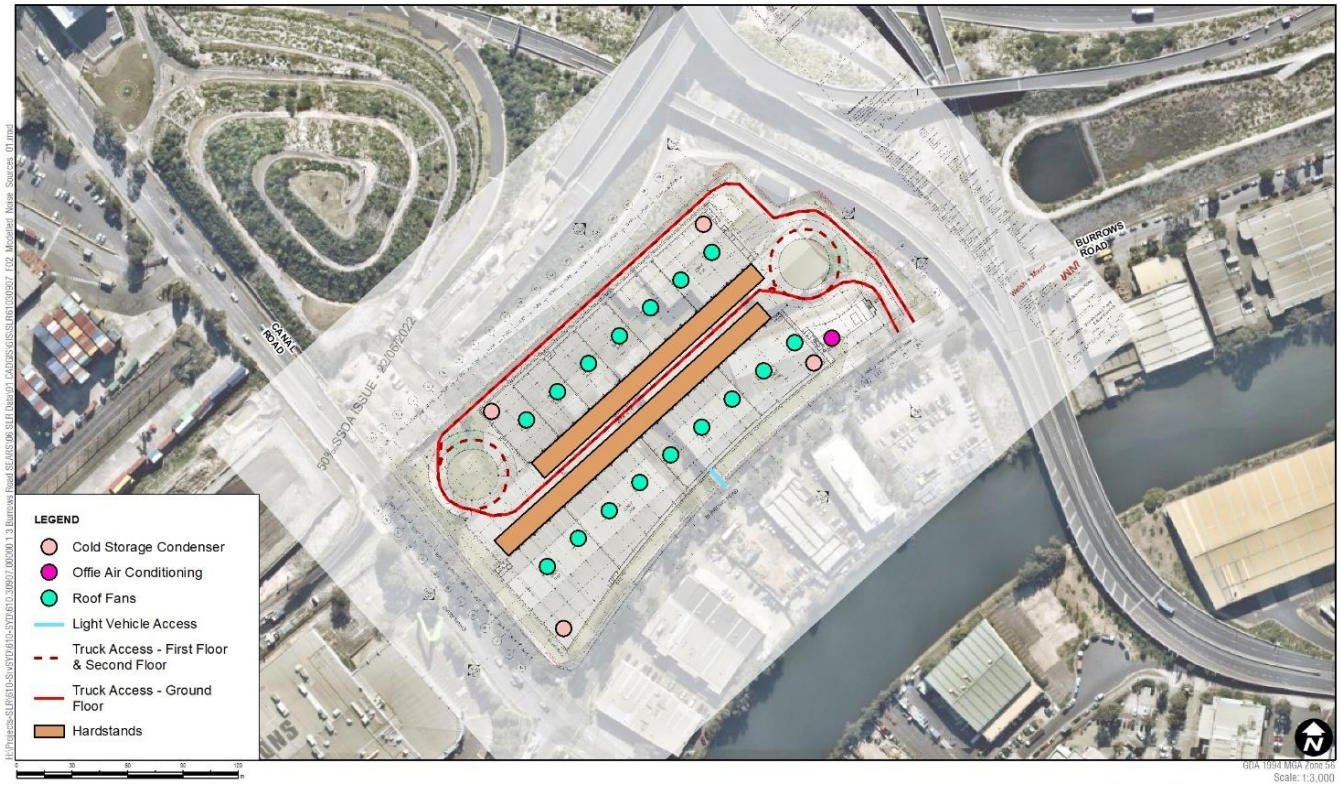
At this early stage of the development the specific mechanical plant requirements for each warehouse have not been determined. Reasonable assumptions have been made that air-conditioning equipment would serve the office building and rooftop extraction fans would be required on the warehouse roofs.

External mechanical plant has been modelled with indicative SWL data for equipment typical to a development of this size, as shown in **Table 20**. The locations of the sources are shown in **Figure 6**.

Table 20 Mechanical Plant

Noise Source	Sound Power Level (dBA)	Location and Operating Hours
All Warehouses		
Air-conditioning equipment	78	Office roof. Assumed to operate 8 am to 6 pm.
Extraction fans	90 (cumulative per warehouse)	Warehouse roofs. Assumed to operate 24/7
Cold Storage Warehouses (assumed at 25% of tenancies)		
Refrigeration compressor	98	Would likely be in warehouse plant rooms which would have precast concrete facades resulting in negligible breakout noise.
Refrigeration condenser	100 – daytime 95 – evening and night (on low power)	Warehouse roofs.

Figure 6 Modelled Noise Sources



5.2.2 Corrections for Annoying Noise Characteristics

The potential annoying noise characteristics and modifying factor corrections relevant to the proposal are:

- **Tonality** – the only source identified with potential tonal characteristics is forklift reversing alarms (noting trucks would only require forward movements so do not require reversing alarms). However, when considering broadband reversing alarms have been recommended as a noise mitigation measure (see **Section 7.2**), it is unlikely that this noise source would result in tonal noise impacts and no corrections have been applied.
- **Low frequency noise** – previous measurements of sources similar to those operating at the development indicate that no sources are expected to result in low frequency noise impacts.
- **Intermittent noise** – the NPfI defines intermittent noise as noise heard at the receiver where the level suddenly drops or increases several times during the assessment period, with a noticeable change of at least 5 dB. The audibility of noise would depend on several factors occurring at the time of potentially intermittent noise events, including the other noise sources operating at the development site and the existing background noise level at the receiver.

  The only source identified with potential intermittent characteristics is forklift reversing alarms. However, when considering broadband reversing alarms have been recommended as a noise mitigation measure (see **Section 7.2**), no corrections for intermittent noise have been applied.

5.2.3 Noise Sources with Potential for Sleep Disturbance

As the development is proposed to operate 24-hours a day, noise emissions during the night-time require assessment for potential sleep disturbance at the nearest residential receivers. The details of typical activities with the potential to cause sleep disturbance are shown in **Table 21**.

Table 21 Sleep Disturbance Noise Events – L_{Amax} Sound Power Levels

Noise Source	Sound Power Level L_{amax} (dBA)
Heavy truck movement	111
Heavy truck airbrake	118
Forklift reversing alarm	105
Roller door	94

5.2.4 Off-site Road Traffic

Traffic associated with the development is planned to enter and exit the site from the south via Burrows Road, with the majority of traffic travelling directly to Canal Road to the west or Campbell Road around 400 m to the east.

The potential noise impacts from development related traffic on public roads are expected to be negligible given there are no sensitive receivers on this route and the route is major arterial or sub-arterial roads with high existing traffic volumes and have not been considered further. The site is also located next to St Peters Interchange and existing noise levels in the area are high and influenced by continuous road traffic noise.

5.2.5 Weather Conditions

Certain weather conditions can increase noise levels by focusing noise towards receivers. Noise-enhancing weather conditions can occur where wind blows from the source to the receiver, or where temperature inversions occur.

The NPfI defines 'standard' and 'noise-enhancing' weather conditions as shown in **Table 22**. Noise-enhancing weather should be included in the assessment where it occurs for more than 30% of the daytime, evening or night-time period in any season.

Table 22 Standard and Noise-enhancing Weather Conditions

Weather Conditions	Meteorological Parameters
Standard	Daytime/evening/night-time: stability categories A–D with wind speed up to 0.5 m/s
Noise-enhancing	Daytime/evening: stability categories A–D with light winds up to 3 m/s Night-time: stability categories A–D with light winds up to 3 m/s and/or stability category F with winds up to 2 m/s

The NPfI contains guidance for determining noise enhancing weather. Data measured between January 2017 and December 2021 at the Sydney Airport BOM weather station has been used to determine the occurrence of noise-enhancing weather conditions at the site and a summary is shown in **Table 23**.

Table 23 Occurrence of Noise-enhancing Weather Conditions

Period	Wind Speed from 0.5 to 3 m/s (Frequency of Occurrence > 30%)								Atmospheric Stability Class F or G[1]
	N	NE	E	SE	S	SW	W	NW	
Daytime	-	-	-	-	-	-	-	-	n/a
Evening	-	-	-	-	-	-	-	-	n/a
Night-time	-	-	-	-	-	-	-	-	-

Note 1: Noise-enhancing conditions for temperature inversions based on atmospheric stability class are only applied to the night-time assessment.

The weather analysis shows that noise-enhancing weather conditions are not expected to be a feature of the site, winds up to 3 m/s occurring for less than 30% of the daytime and night-time periods in winter. As a result standard weather conditions have been used in the assessment and are shown in **Table 24**.

Table 24 Modelled Weather Conditions

Period	Weather Condition	Meteorological Parameters used in Assessment
Daytime	Standard	Stability category D with source to receiver wind up to 0.5 m/s
Evening	Standard	Stability category D with source to receiver wind up to 0.5 m/s
Night-time	Standard	Stability category D with source to receiver wind up to 0.5 m/s

6 Assessment of Impacts

6.1 Construction Noise

The predicted noise levels at the most-affected sensitive receivers surrounding the site are shown in **Table 25** and exceedances of the NMLs are shown in **Table 26**.

The predictions represent a realistic worst-case scenario where the equipment in each scenario is working concurrently and the nearest location to each receiver. It is expected that noise levels would frequently be lower than the worst-case levels presented.

Table 25 Predicted Construction Noise Levels at Nearest Receivers

Location	Type	NML	Predicted Noise Level – $L_{Aeq(15minute)}$ (dBA)					
			Vegetation Clearing	Demolition	Earthworks	Construction of Roads	Construction of pads and hardstands	Construction of Structures
NCA01	Residential	67	57	58	52	51	48	49
NCA02	Residential	53	58	59	53	52	49	50
	Place of Worship	55	58	59	53	52	49	50
	Educational	55	54	55	49	48	45	46
NCA03	Residential	66	55	56	50	49	46	47
NCA04	Hotel	70	60	61	55	54	51	52
-	Commercial	70	60	61	55	54	51	52
-	Industrial	75	79	80	74	73	70	71

Table 26 Predicted Exceedance at Nearest Receivers

Location	Type	NML	Predicted Noise Level – $L_{Aeq(15minute)}$ (dBA)					
			Vegetation Clearing	Demolition	Earthworks	Construction of Roads	Construction of pads and hardstands	Construction of Structures
NCA01	Residential	67	-	-	-	-	-	-
NCA02	Residential	53	5	6	-	-	-	-
	Place of Worship	55	3	4	-	-	-	-
	Educational	55	-	-	-	-	-	-
NCA03	Residential	66	-	-	-	-	-	-
NCA04	Hotel	70	-	-	-	-	-	-
-	Commercial	70	-	-	-	-	-	-
-	Industrial	75	4	5	-	-	-	-
Legend (NML exceedances)		= Minor to marginal (1 to 10 dB exceedance)		= Moderate (11 to 20 dB exceedance)			= High (>20 dB exceedance)	

The above worst-case predictions show the following:

- Noise levels are expected to comply with the NMLs at the nearest residential receivers during most construction works.
- The highest impacts are seen during work that uses noise intensive equipment such as rockbreakers during demolition works (*W.02 – Demolition*), where exceedances of up to 6 dB are predicted at the nearest residential receivers to the northwest of the site in NCA02. These items of equipment would, however, only be required occasionally and would be unlikely to be in use for long periods of time.
- No residential receivers are predicted to be Highly Noise Affected during any of the works.
- Minor exceedances of the NMLs of between 3 and 4 dBA at the place of worship in NCA02 are predicted during *W.01 – Vegetation Clearing* and *W.02 – Demolition*.
- Construction noise levels are predicted to comply with the commercial NML at the nearest existing commercial receivers.
- Construction noise levels are predicted to exceed the industrial NML by up to 5 dB at the nearest existing industrial receivers during some of the noisy work scenarios.
- Works would only occur during Standard Daytime Construction Hours. There is no expectation for evening or night-time work to be required.

The presented impacts would only be expected to occur when noisy work is being completed close to the site boundaries, relative to each receiver. When work is in central areas of the site, or when less noise intensive equipment is being used, the noise levels would reduce accordingly.

Feasible and reasonable construction noise mitigation measures should be applied where exceedances of the NMLs are predicted. Construction noise mitigation and management measures are discussed in **Section 7.1**.

6.2 Construction Vibration

The major potential sources of vibration from the proposed construction activities would likely be during:

- 'Construction of Roads' when vibratory rollers are being used
- 'Demolition' when hydraulic hammers are being used

Vibration offset distances have been determined from the CNVG minimum working distances for cosmetic damage and human comfort (see **Table 10**) and the assessment is summarised in **Figure 7** for a large vibratory roller. Buildings within the minimum working distances are shown in the figure.

Figure 7 Construction Vibration – Large Vibratory Roller

Cosmetic Damage Assessment

The above figure shows that the nearest industrial buildings to the south of the site are likely within the minimum working distance when vibratory rollers are in use at the south eastern boundary of the construction site. All residential buildings are sufficiently distant from the site to be outside the minimum working distance and cosmetic damage impacts are not considered likely.

Human Comfort Vibration Assessment

The above figure indicates that nearest industrial buildings surrounding the site are within the human comfort minimum working distance and occupants of these buildings may be able to perceive vibration impacts at times when vibratory rollers are in use nearby. Where impacts are perceptible, they would likely only be apparent for relatively short durations when vibration intensive equipment is in use.

Feasible and reasonable construction vibration mitigation measures should be applied where vibration intensive works are required within the minimum working distances. Construction mitigation and management measures are discussed further in **Section 7.1**.

6.3 Operational Noise

6.3.1 Predicted Noise Levels

A summary of the worst-case operational noise assessment at the receivers surrounding the proposal is shown in **Table 27**. Impacts have been predicted at all floors of the nearest receivers. The predicted worst-case levels are compared to the PNTLs to determine the potential impact from the proposal.

A detailed assessment of all potential feasible and reasonable mitigation measures that could be applied to the development to minimise the impacts has been completed and is summarised in **Section 7.2**. The following predictions include the recommended mitigation measures, where appropriate.

Noise contours of the predicted worst-case operational noise impacts are in **Appendix D.**

Table 27 Operational Noise Assessment

Location	Receiver Type	Period	Noise Level $L_{Aeq(15minute)}$ (dBA)			Compliance
			Noise Criteria	Predicted	Exceedance	
NCA01	Residential	Day	58	43	-	Yes
		Evening	53	40	-	Yes
		Night – heavy trucks	50	38	-	Yes
		Night – medium trucks	50	36	-	Yes
NCA02	Residential	Day	48	45	-	Yes
		Evening	48	41	-	Yes
		Night – heavy trucks	43	40	-	Yes
		Night – medium trucks	43	38	-	Yes
	Place of Worship	When in Use	48	45	-	Yes
	Educational	When in use	43	39	-	Yes
NCA03	Residential	Day	58	47	-	Yes
		Evening	53	44	-	Yes
		Night – heavy trucks	50	42	-	Yes
		Night – medium trucks	50	40	-	Yes
NCA04	Hotel	Day	63	47	-	Yes
		Evening	53	44	-	Yes
		Night – heavy trucks	48	42	-	Yes
		Night – medium trucks	48	39	-	Yes
-	Commercial	When in Use	63	49	-	Yes
-	Industrial	When in Use	68	59	-	Yes

The above shows that operational noise levels from the development are predicted to comply with the project noise trigger levels at all identified sensitive receivers during all periods.

6.3.2 Sleep Disturbance

The predicted night-time maximum noise levels at the nearest residential receivers are shown in **Table 28**. Note that only receiver types where sleep disturbance is applicable have been included below.

Table 28 Sleep Disturbance Assessment

Location	Receiver Type	Source	Maximum Noise Level L_{Amax} (dBA)			Below Screening Level
			Sleep Dist. Screening Level	Predicted	Exceedance	
NCA01	Residential	Heavy vehicle movements	62	50	-	Yes
		Heavy truck airbrake		56	-	Yes
		Forklift reversing alarm		43	-	Yes
		Roller door		32	-	Yes
NCA02	Residential	Heavy vehicle movements	54	49	-	Yes
		Heavy truck airbrake		57	3	**No**
		Forklift reversing alarm		44	-	Yes
		Roller door		33	-	Yes
NCA03	Residential	Heavy vehicle movements	62	49	-	Yes
		Heavy truck airbrake		57	-	Yes
		Forklift reversing alarm		44	-	Yes
		Roller door		33	-	Yes

The above shows that maximum noise levels are generally expected to comply with the sleep disturbance screening level except for receivers close to the Princes Highway in NCA02 when truck airbrakes are used at the hardstands. It is noted that the majority of heavy vehicles that would access the development during the night-time are expected to be rigid trucks which generally do not use airbrakes and existing noise levels in this area are relatively high.

The NPfI requires a detailed maximum noise level assessment to be completed where night-time noise levels exceed the screening level.

6.3.2.1 Detailed Maximum Noise Level Assessment

The detailed maximum noise level assessment is summarised in **Table 29**. Residential receivers NCA02 are predicted to have an exceedance of the sleep disturbance screening level from heavy truck airbrakes when stopping in the hardstands. It is noted the potentially impacted receivers are near the Princes Highway where existing noise levels are relatively high and generally dominated by existing traffic noise.

The majority of heavy vehicles that would access the development during the night-time are expected to be rigid trucks which generally do not use airbrakes. Notwithstanding, the potential noise impacts from airbrakes have been assessed on the assumption that they may occur during the night on an infrequent basis.

Table 29 Detailed Maximum Noise Level Assessment

Receiver	Maximum Noise Level L_{Amax} (dBA)					Comments
	Sleep Disturbance Goals (dBA)		Development Related Maximum Noise Events		Existing Maximum Noise Levels	
	Awakening Response[1]	Good Sleep[2]	Predicted	Frequency of Occurrence		
NCA02	65	Around 55 (10 to 15 times per night)	57	<10 to 15 events	60-65	**Awakening Response:** maximum noise levels from infrequent use of airbrakes of heavy trucks when stopping at the hardstands are predicted to be below the 'awakening response' level at all receivers. **Good Sleep:** around 10 articulated trucks are expected to access the site during the night-time and the majority of these are likely to be rigid trucks which do not have airbrakes. Maximum noise events from truck airbrakes are, therefore, not expected adversely affect 'good sleep' (ie they are not expected to occur more than 10-15 times per night). **Existing maximum noise levels:** The unattended noise monitoring showed that existing night-time maximum noise levels were measured to frequently be in the order of 60 to 65 dBA in NCA02, with occasional events above 70 dBA. The attended noise monitoring indicated existing noise levels in this area are dominated by existing road traffic noise from the nearby Princes Highway and St Peters Interchange. Development related maximum noise levels are likely to be lower than existing maximum noise levels.

Note 1: Based on RNP guidance that maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep. This equates to an external noise level of 65 dBA when assuming a 10 dB loss for partially open windows for ventilation.

Note 2: Based on RNP guidance that for a good sleep over eight hours the indoor L_{amax} sound pressure level should not exceed around 45 dBA more than 10 or 15 times per night. This equates to an external noise level of around 55 dBA when assuming a 10 dB loss for partially open windows for ventilation.

The predicted maximum noise levels in NCA02 from infrequent truck airbrakes are expected to be below the levels outlined in the RNP that would be considered to have the potential to result in sleep disturbance and are likely to be lower than existing maximum noise levels, which are dominated by existing road traffic noise from the nearby Princes Highway and St Peters Interchange.

Additionally, it is noted that the use of airbrakes during the night-time would likely be an infrequent event. It has also been conservatively assumed that airbrake events could occur anywhere within the hardstand areas, however it is expected that the majority of these would occur within the central hardstand area and as a result be significantly lower than presented in **Table 29** due to increased shielding provided by the warehouses.

Based on the above, the predicted sleep disturbance screening level exceedance is considered of low significance, unlikely to result in adverse impacts, and does not require any specific mitigation.

7 Mitigation and Management Measures

7.1 Construction Impacts

The impacts during construction of the project are predicted to be relatively minor and consistent with major construction work near to sensitive receivers. No works outside of Standard Construction Hours are currently proposed.

The use of standard mitigation measures to minimise the impacts is considered sufficient to control the majority of the impacts. Examples of measures which could be applied to the work are provided in the Roads and Maritime (now Transport for NSW) *Construction Noise and Vibration Guideline* (see **Appendix E**).

A Construction Noise and Vibration Management Plan (CNVMP) would be prepared before any work begins. This would identify all potentially impacted receivers, assess the potential noise and vibration impacts from the project and provide details regarding how the impacts would be minimised through the use of all feasible and reasonable mitigation measures. The CNVMP would also contain procedures for handling complaints, should they occur, and detail any compliance monitoring requirements.

7.2 Operational Noise Mitigation

Where operational noise impacts from the development are predicted to exceed the relevant noise criteria, feasible and reasonable operational noise mitigation and management measures should be considered, with the aim of reducing noise emissions to the relevant criteria.

The typical hierarchy for mitigation and management of industrial noise sources is as follows:

- Reducing noise emissions at the source (ie noise source control)
- Reducing noise in transmission to the receiver (ie noise path control)
- Reducing noise at the receiver (ie at-receiver control).

A detailed assessment of potential feasible and reasonable mitigation measures that can be applied to the development to minimise the operational noise impacts has been completed and is summarised in **Table 30**.

The measures should be regarded as indicative and would be further refined during detailed design when more details regarding specific tenants are known.

Table 30 Operational Noise Mitigation Options

Ref.	Mitigation Option	Noise Impact/Benefit	Reasonable and Feasible to Apply
Source Control			
S1	Optimised site layout to minimise noise emissions from the site	Where possible, the site layout has been designed so that the warehouse buildings screen the noisier areas of the development (ie hardstands and truck routes) from the nearest receivers. The top floor hardstand and loading dock areas are also enclosed with a roof which reduces potential break-out noise.	Yes – applied during design of the concept
S2	Limit vehicle movements	A reduction in concurrent vehicle movements across the site by staggering delivery/pickup times and/or employee shift change times could reduce noise emissions. In practice, this would occur naturally across the estate due to operational requirements of the different tenants.	No – vehicle volumes used in this assessment are likely needed to meet tenant's requirements. Placing restrictions on allowable vehicle movements across the different tenancies is unlikely to be feasible and reasonable.
S3	Hardstand/external equipment use	Minimising the concurrent use of forklifts or other mobile plant outside the warehouses and/or limiting their use to the less sensitive day and evening periods. In practice, this would occur naturally across the estate due to operational requirements of the different tenants.	No – placing restrictions on allowable external use of forklifts and equipment across the different tenancies is unlikely to be feasible and reasonable.
S4	Use broadband and/or ambient sensing alarms on forklifts where they are required to reverse during the night-time.	Reduce potential for annoying noise emissions during the night-time.	Yes – use broadband and/or ambient sensing alarms on forklifts where they are required to reverse during the night-time
S5	Appropriate specification and location of mechanical plant during detailed design.	If noise impacts from mechanical plant are identified during detailed design, quieter plant could be selected, or the plant could be relocated to a location screened from view of the nearest receivers, where appropriate.	Yes – noise impacts from mechanical plant would be investigated further during detailed design or construction certificate stages when specific plant requirements are identified.
S6	Appropriate design of warehouses during detailed design.	Appropriate warehouse materials to minimise noise break-out from internal activities would be selected during detailed design.	Yes – noise impacts from internal equipment would be investigated further during detailed design or construction certificate stages if tenant requires manufacturing plant or other noisy equipment.

Ref.	Mitigation Option	Noise Impact/Benefit	Reasonable and Feasible to Apply
S7	Roller doors kept closed when loading/unloading is not occurring.	Reduce potential for noise breakout from internal warehouse activity.	Yes – roller doors should be kept closed when not in use for loading/unloading trucks.
S8	Appropriate design of site layout to minimise the need for trucks to stop or brake outside of loading docks with line of sight to residential receivers.	Minimise noise emissions, particularly from truck airbrakes.	Yes – applied during design of the concept masterplan
S9	Production of an Operational Noise Management Plan.	This would detail the measures that could be used by the various tenants to minimise general noise emissions from the site. Reference can be made to the Best Management Practice (BMP) and Best Available Technology Economically Available (BATEA) measures listed in the NPfI (see **Appendix F**).	Yes
Path Control			
P1	Not considered required	n/a	n/a
Receiver Control			
R1	Not considered required	n/a	n/a

The project is a speculative development without any tenants committed and the exact operational procedures of the site are not known at this time. Several assumptions have been made regarding the likely future uses and sources of noise. The noise predictions in this report should be regarded as indicative for planning purposes and are required to be confirmed at a later stage when detailed information is available.

8 Conclusion

SLR has been engaged to assess the potential construction and operational noise emissions from the proposed development at 1-3 Burrows Road, St Peters. The proposal includes the operation of two three-storey warehouses, which would be in use 24/7.

The potential impacts from the proposal have been assessed against the noise and vibration specific Secretary's Environmental Assessment Requirements.

Construction noise levels are generally expected to comply the management levels at the surrounding receivers. Minor exceedances are predicted at some of the nearest sensitive receivers during certain noisy stages of the work. Exceedances are predicted at residential receivers to the north of the proposal and nearest industrial receivers surrounding the proposal, however, this would only be expected to occur when noisy work is being completed. Standard mitigation measures have been recommended to address the potential construction impacts.

Operational noise levels are expected to comply with the trigger levels at all sensitive receivers. A minor exceedance of the sleep disturbance screening level is predicted at some of the nearest receivers to the north, however, this is considered to be of low significance given the high existing noise levels in the area. A range of feasible and reasonable mitigation measures have been recommended to control the impacts.

Based on the predicted levels and indicative mitigation measures, the proposal is considered appropriate from an acoustic standpoint.

Appendix A:

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

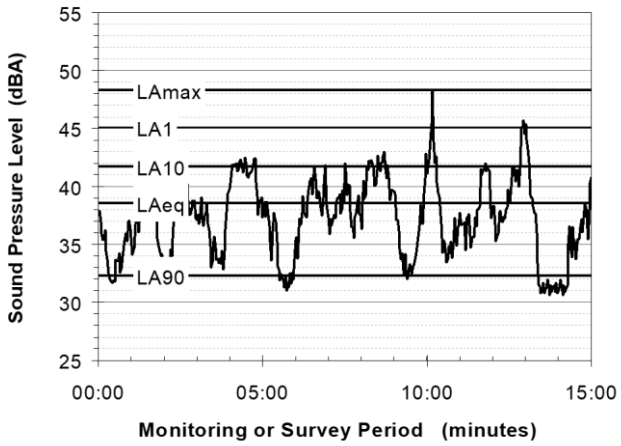
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

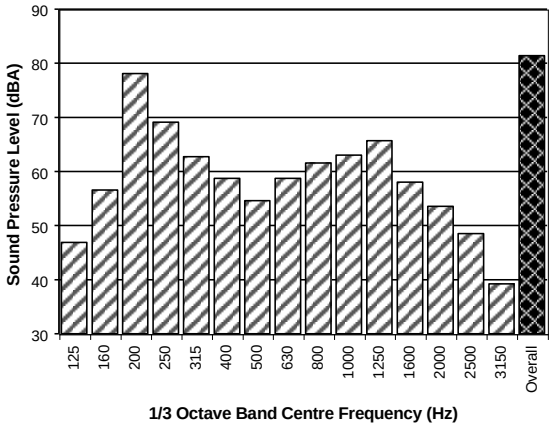
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

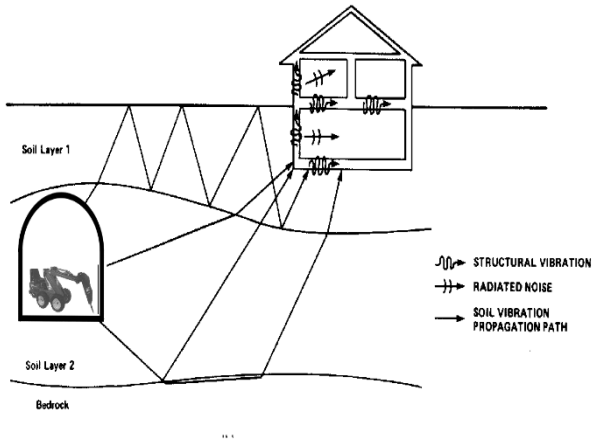
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

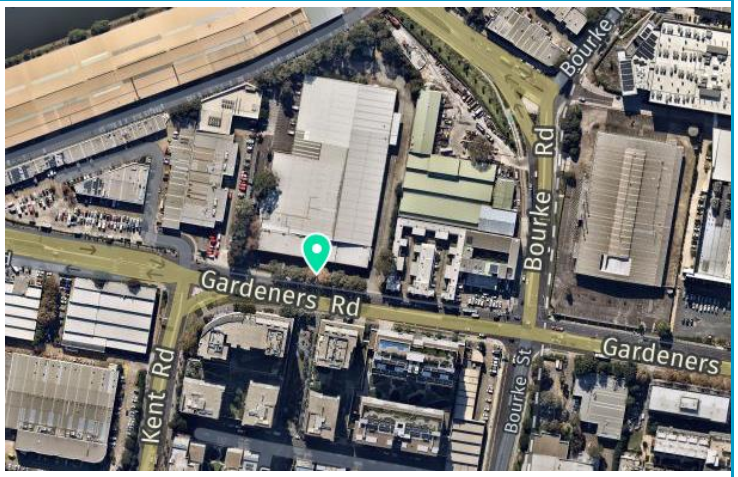
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Appendix B:

Noise Monitoring Summary

Noise Monitoring Location	L01	Map of Noise Monitoring Location
Noise Monitoring Address	**546 Gardeners Road, Alexandria**	

Logger Device Type: Svantek 957, Logger Serial No: 23245
Sound Level Meter Device Type: Brüel and Kjær 2250L, Sound Level Meter Serial No: 3004636

Ambient noise logger deployed at 546 Gardeners Road, Alexandria. Logger located with view of Gardeners Road to the south and Kent Road to the southwest and Bourke Street to the east.

Attended noise measurements indicate the ambient noise environment at this location is dominated by road traffic noise Gardeners Road and Kent Road. Existing industrial noise also contributes to the LAeq at this location

Recorded Noise Levels (LAmax) 19/08/2022:
Light vehicle traffic Gardeners Road: 67-87 dBA, Heavy vehicle traffic Gardeners Road: 72-82 dBA, Aircraft flyover: 62-71 dBA, Industry 61-63

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L_{10}	L_1
Daytime	57	67	71	76
Evening	54	65	68	74
Night-time	47	62	63	72

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	68	68
Night-time (10pm-7am)	62	66

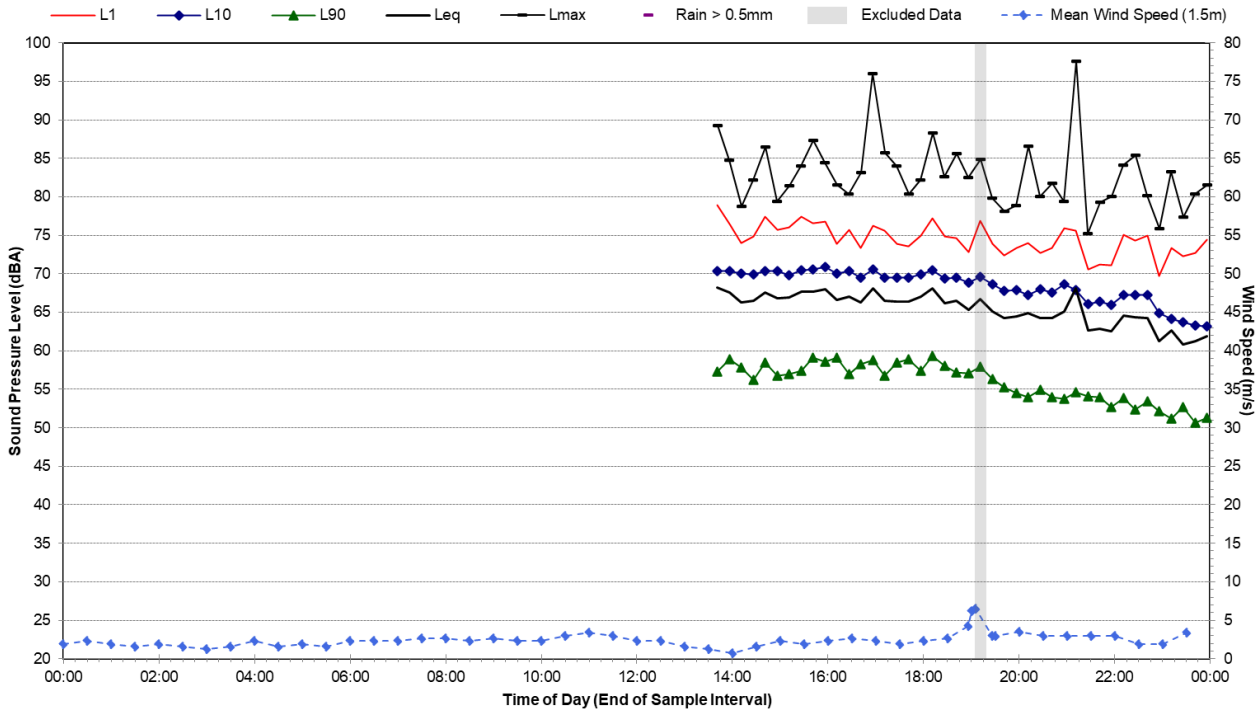
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
19/08/2022	10:52	58	68	87

Photo of Noise Monitoring Location

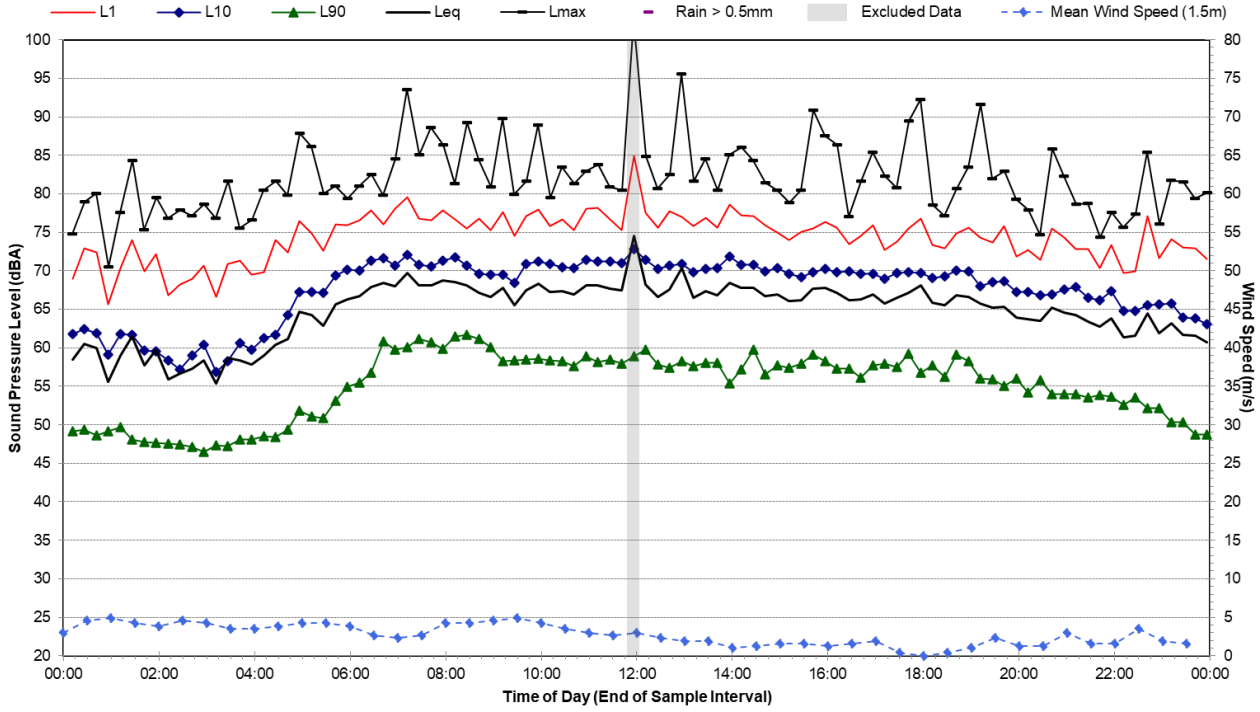
Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Tuesday, 21 June 2022



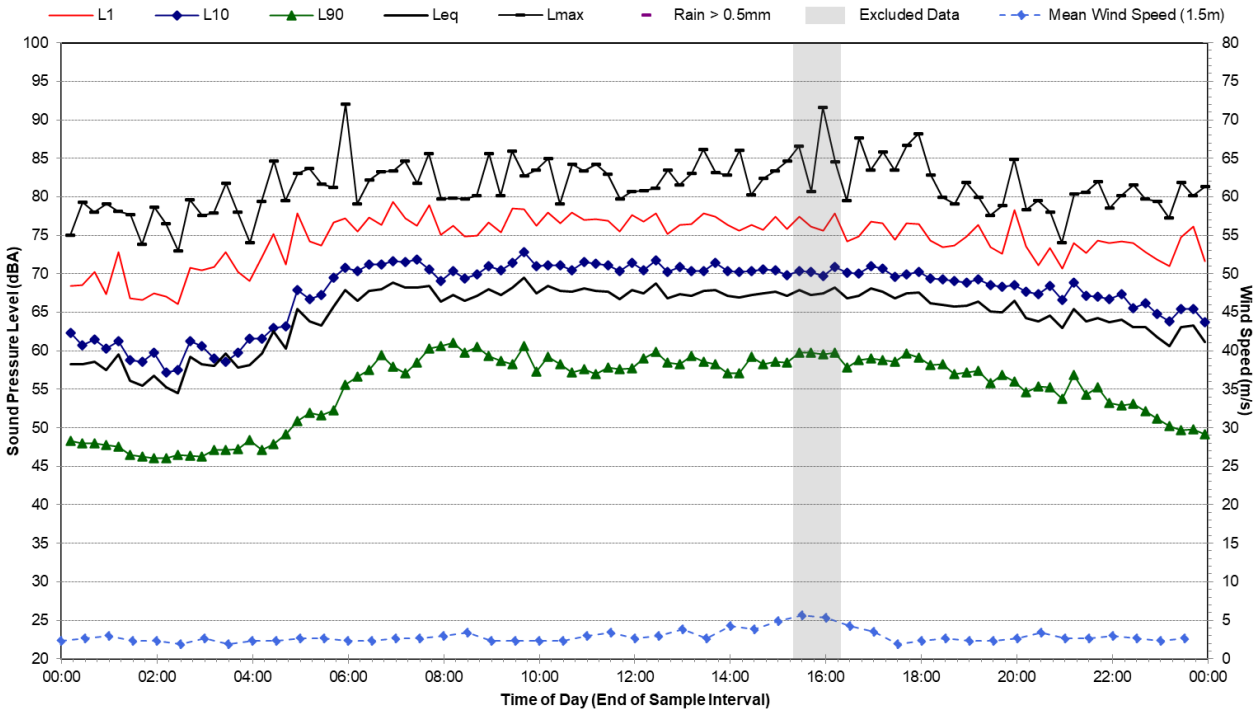
Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Wednesday, 22 June 2022



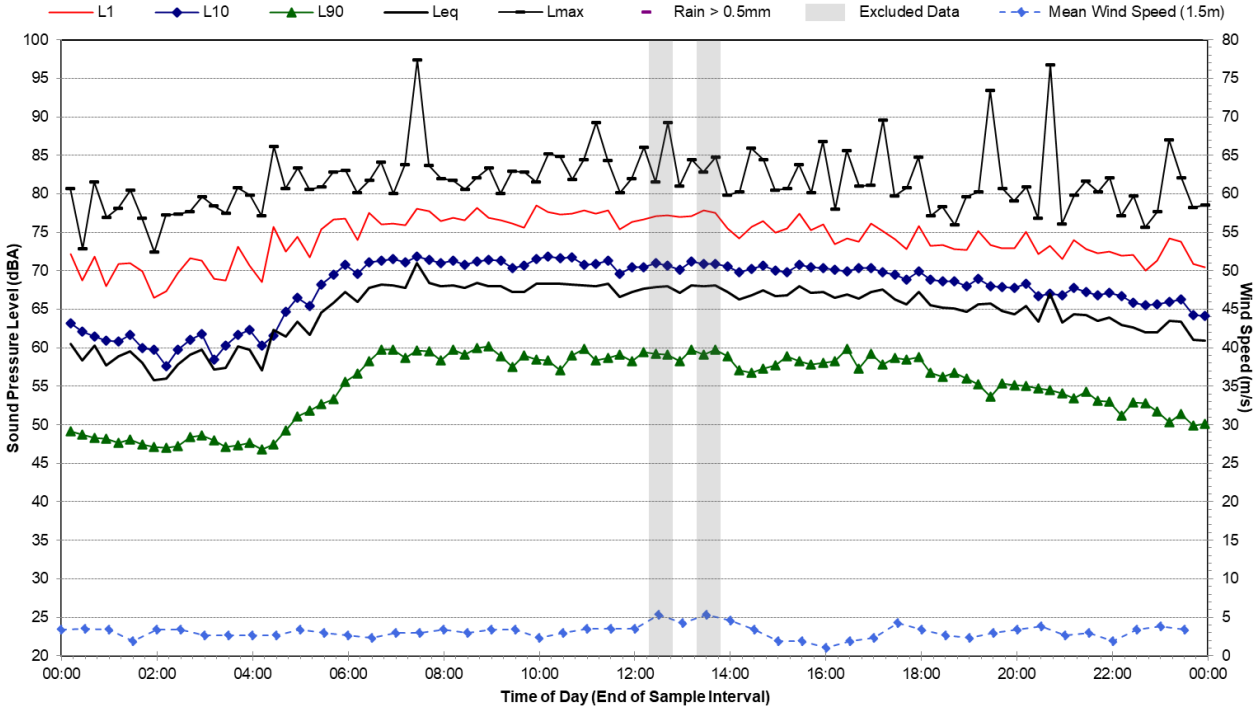
Statistical Ambient Noise Levels

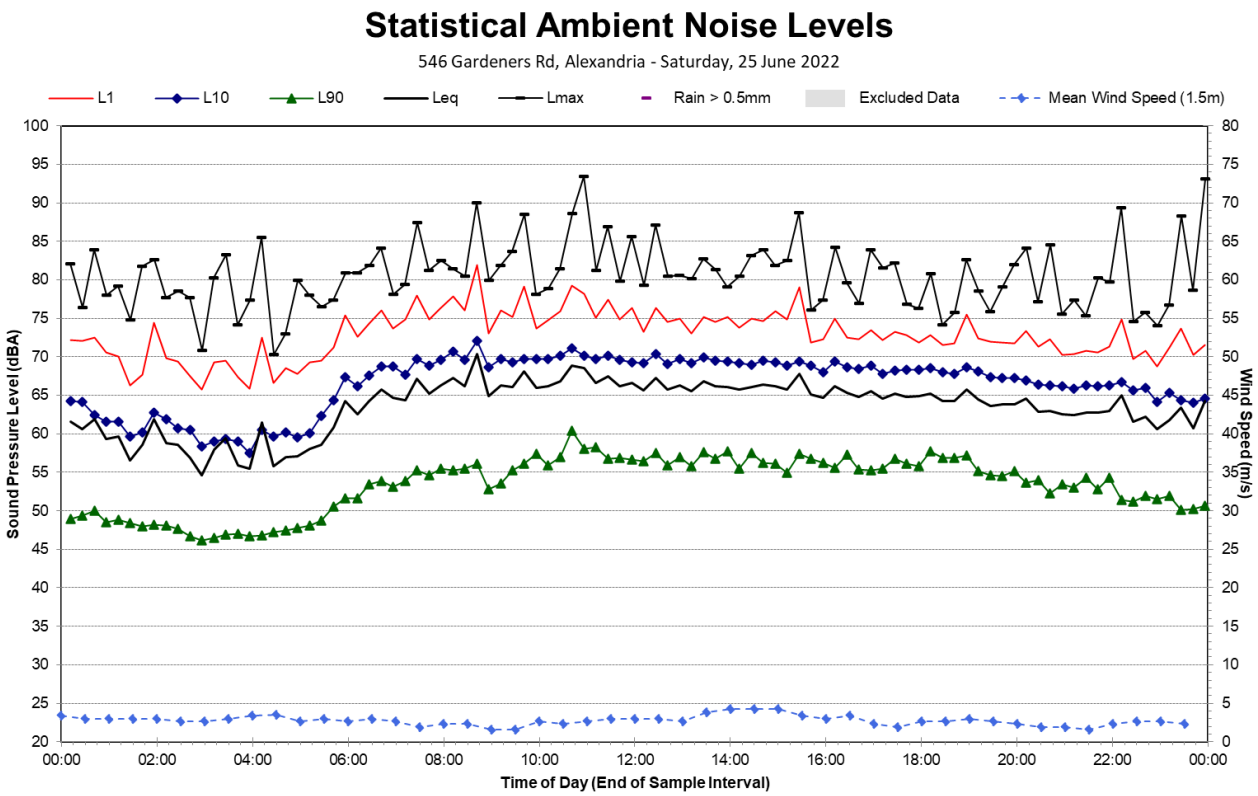
546 Gardeners Rd, Alexandria - Thursday, 23 June 2022

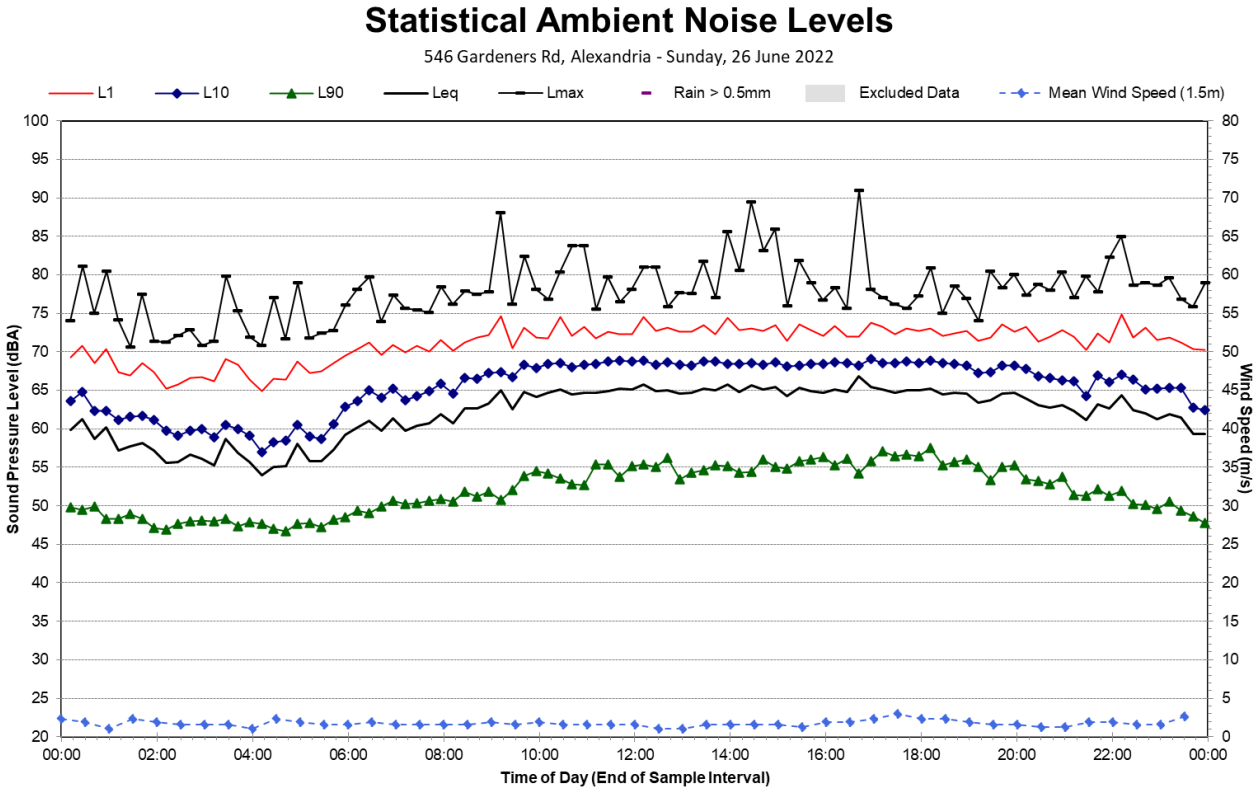


Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Friday, 24 June 2022

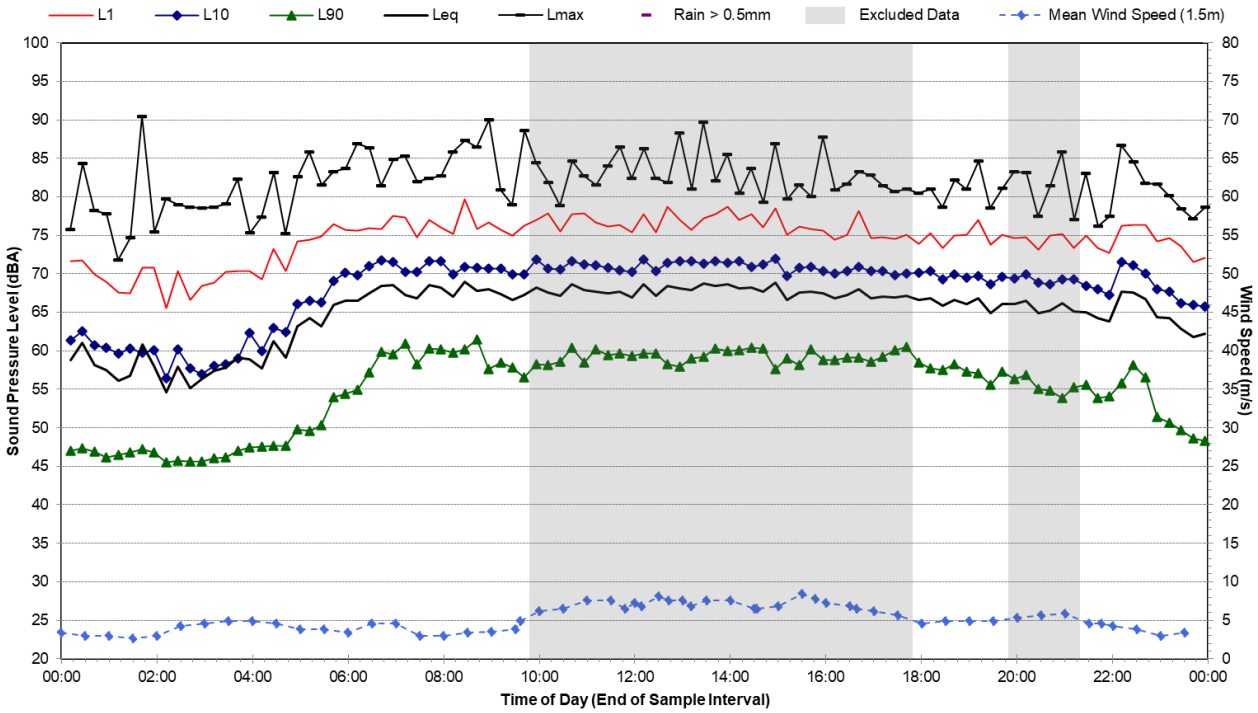



Statistical Ambient Noise Levels
546 Gardeners Rd, Alexandria - Saturday, 25 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
546 Gardeners Rd, Alexandria - Sunday, 26 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

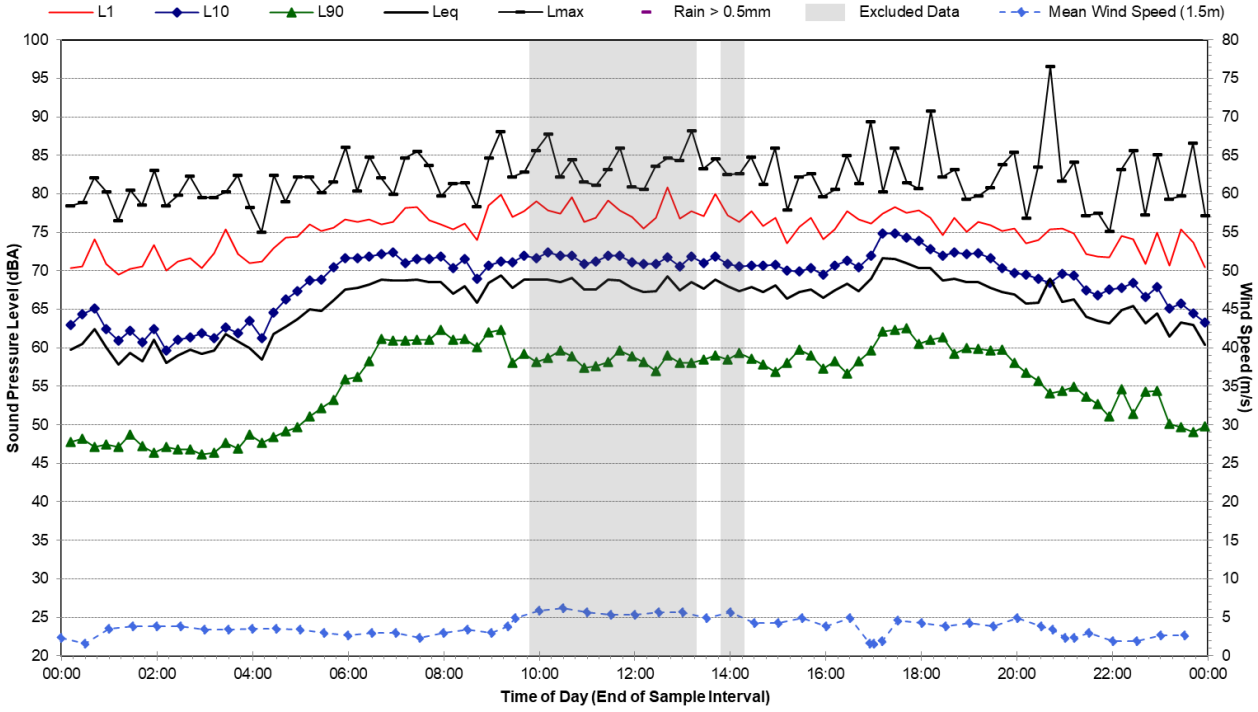
Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Monday, 27 June 2022



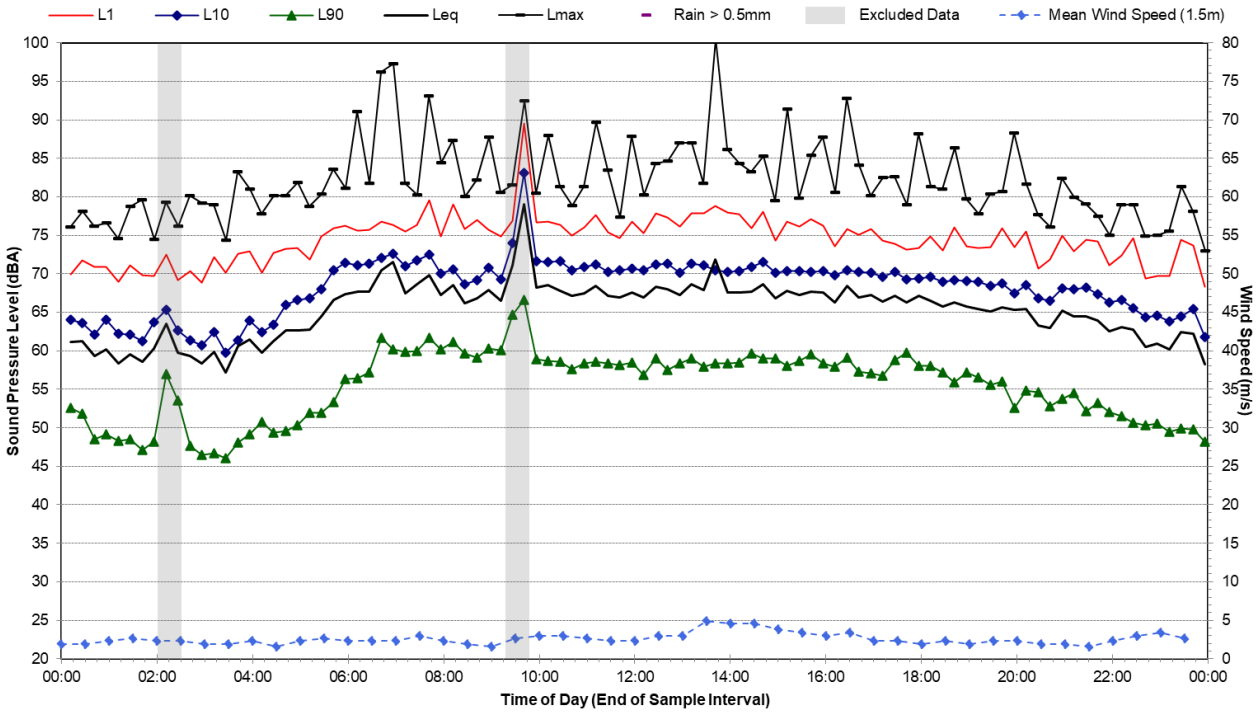
Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Tuesday, 28 June 2022



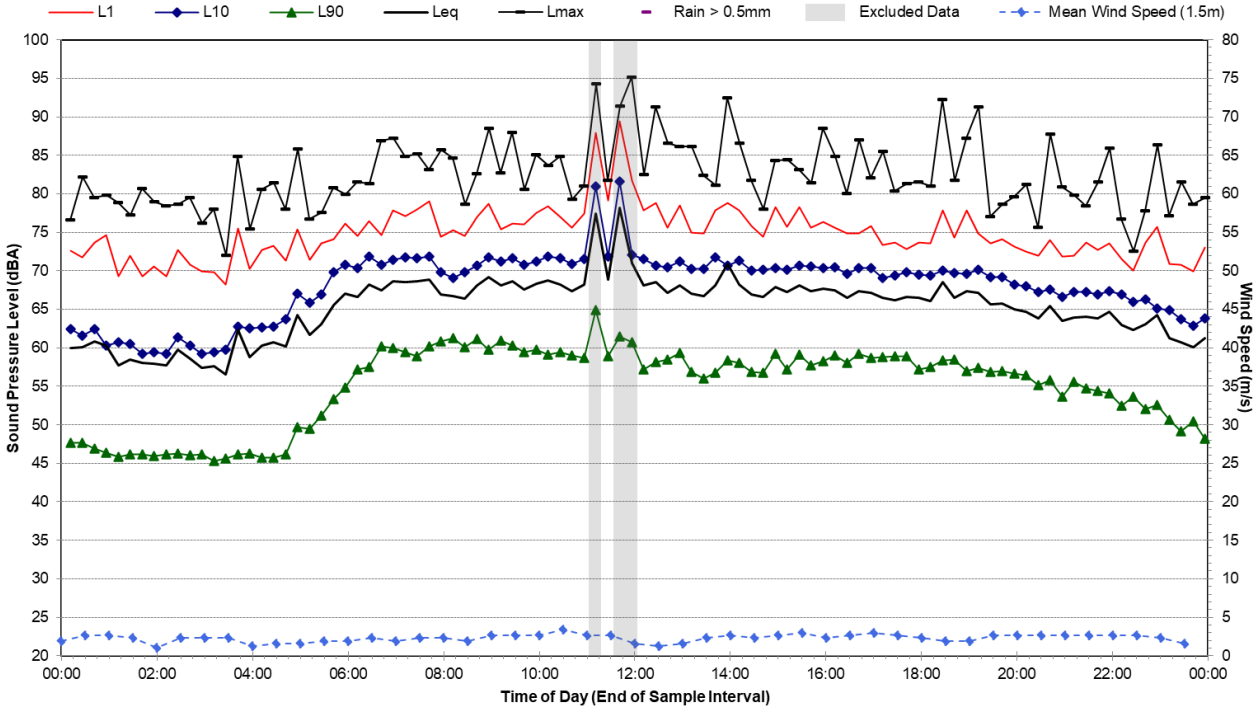
Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Wednesday, 29 June 2022



Statistical Ambient Noise Levels

546 Gardeners Rd, Alexandria - Thursday, 30 June 2022



Noise Monitoring Location	L02	Map of Noise Monitoring Location
Noise Monitoring Address	**8 Silver Street, St Peters**	

Logger Device Type: Svantek 957, Logger Serial No: 20664
Sound Level Meter Device Type: Brüel and Kjær 2250L, Sound Level Meter Serial No: 3004636

Ambient noise logger deployed at residential address 8 Silver Street, St Peters. Logger located with view of Silver Street to the north and Princes Highway to the south.

Attended noise measurements indicate the ambient noise environment at this location is dominated by road traffic noise from Princes Highway and aircraft flyovers to and from Sydney Airport.

Recorded Noise Levels (L_{Amax}) 29/07/2022:

Light vehicle traffic Princes Highway: 50-56 dBA, Heavy vehicle traffic Princes Highway: 53-60 dBA, Aircraft flyover: 61-79 dBA, Local traffic Silver Street: 57-69 dBA, Birds: 52-70 dBA

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L_{10}	L_1
Daytime	43	57	57	68
Evening	45	59	58	72
Night-time	39	50	47	53

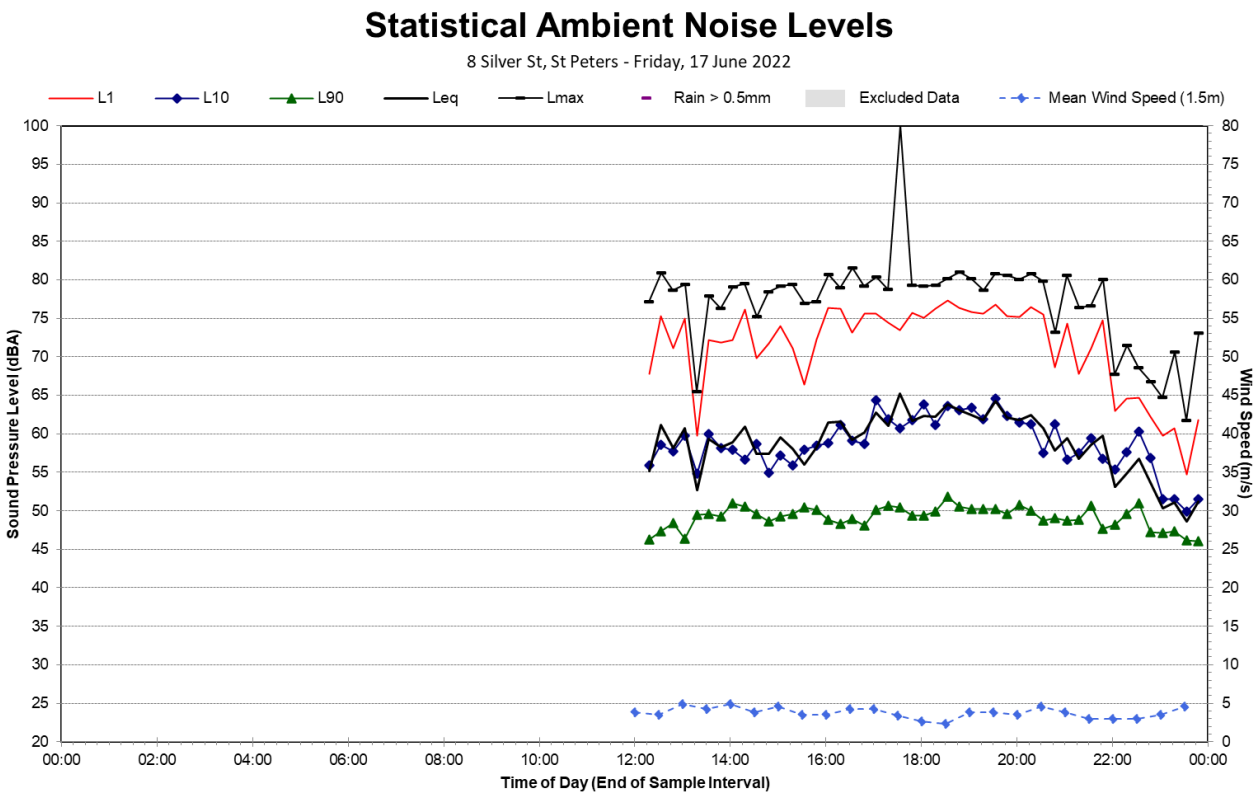
Ambient Noise Logging Results – RNP Defined Time Periods

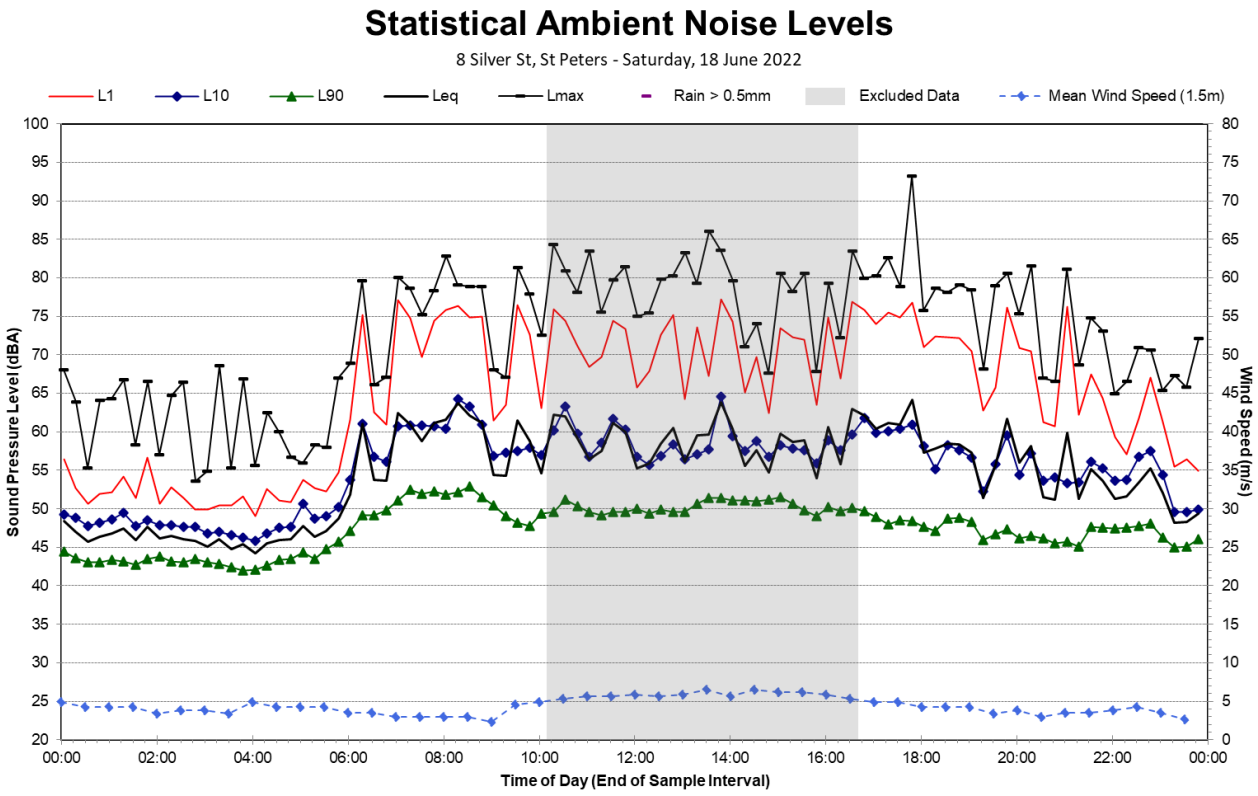
Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	59	61
Night-time (10pm-7am)	50	54

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
29/07/2022	09:39	46	63	81

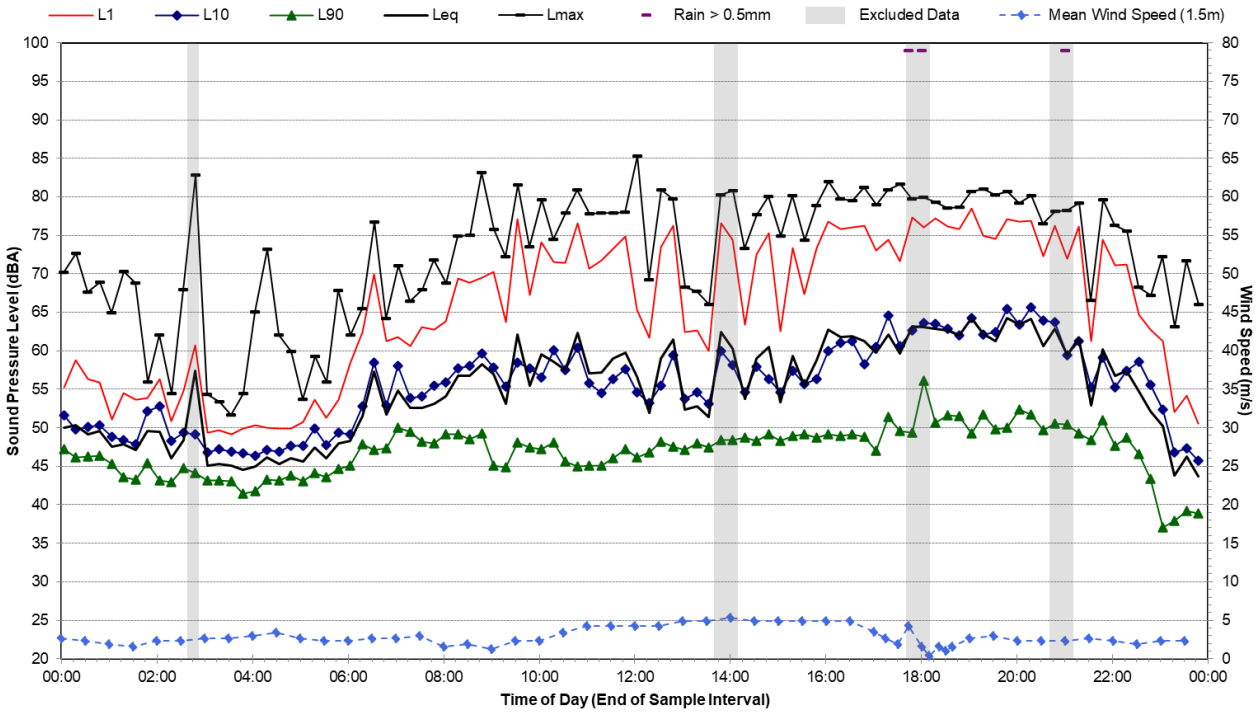
Photo of Noise Monitoring Location


Statistical Ambient Noise Levels
8 Silver St, St Peters - Friday, 17 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Silver St, St Peters - Saturday, 18 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

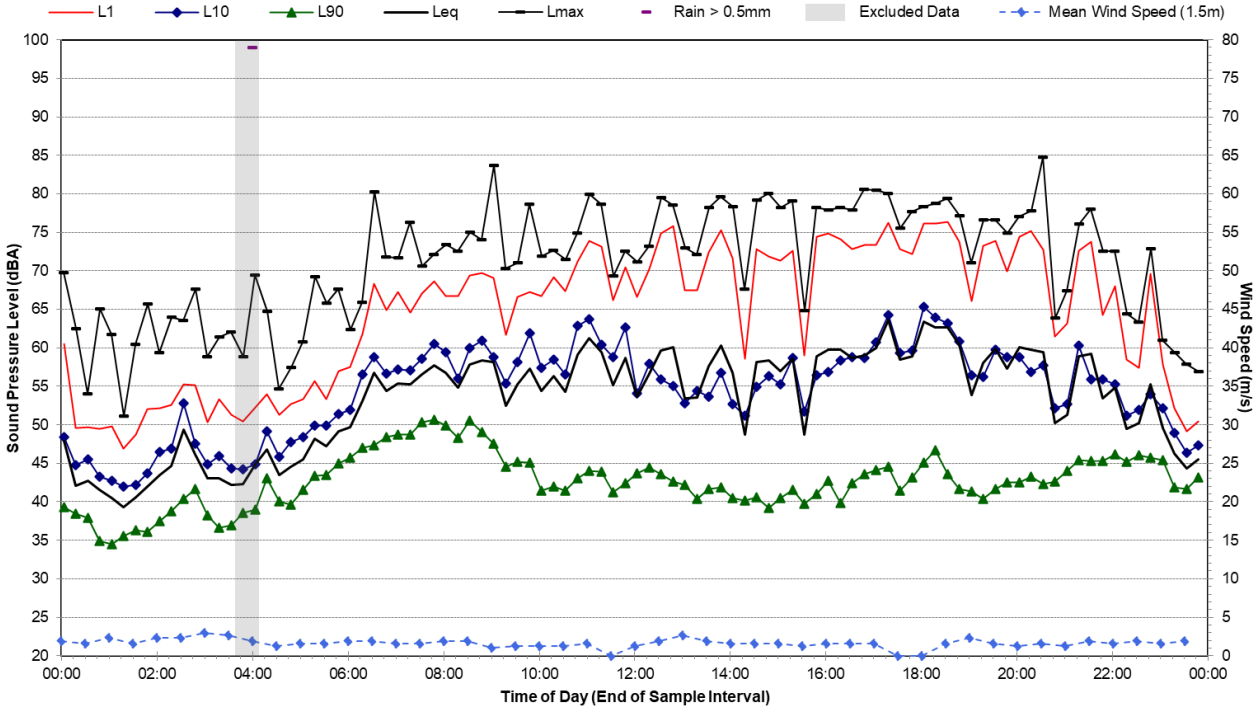
Statistical Ambient Noise Levels

8 Silver St, St Peters - Sunday, 19 June 2022



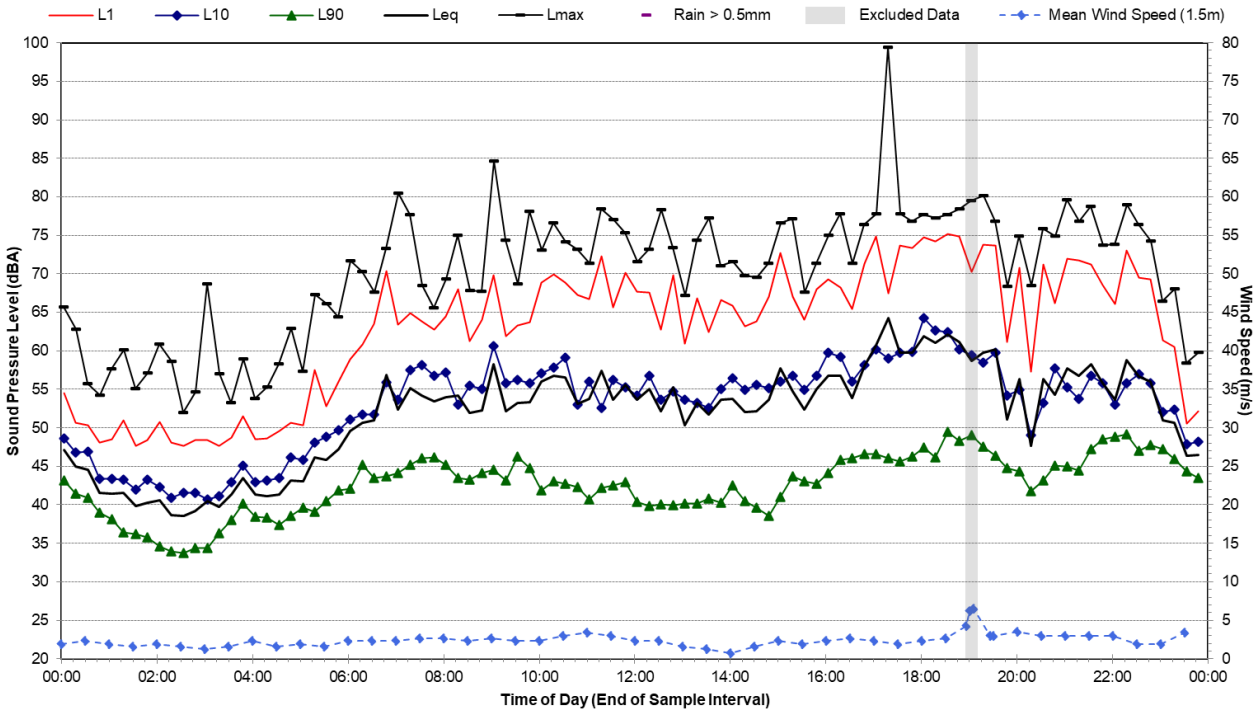
Statistical Ambient Noise Levels

8 Silver St, St Peters - Monday, 20 June 2022



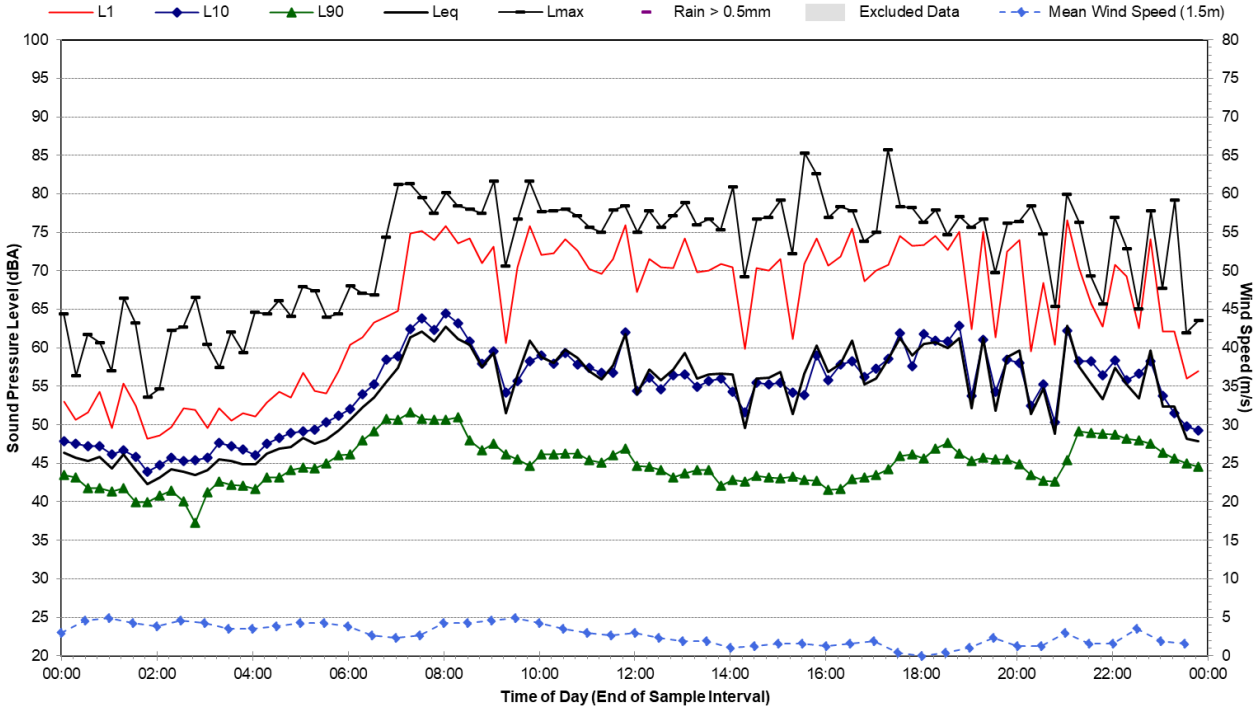
Statistical Ambient Noise Levels

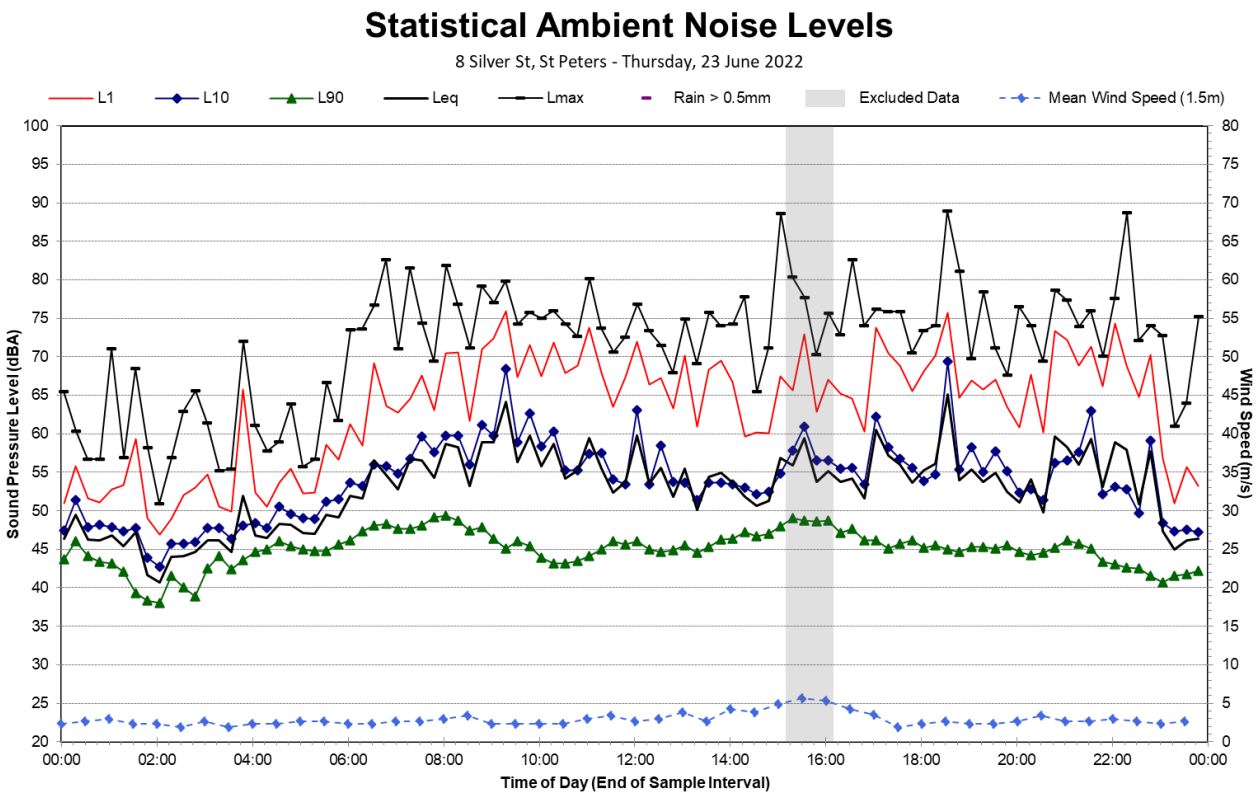
8 Silver St, St Peters - Tuesday, 21 June 2022

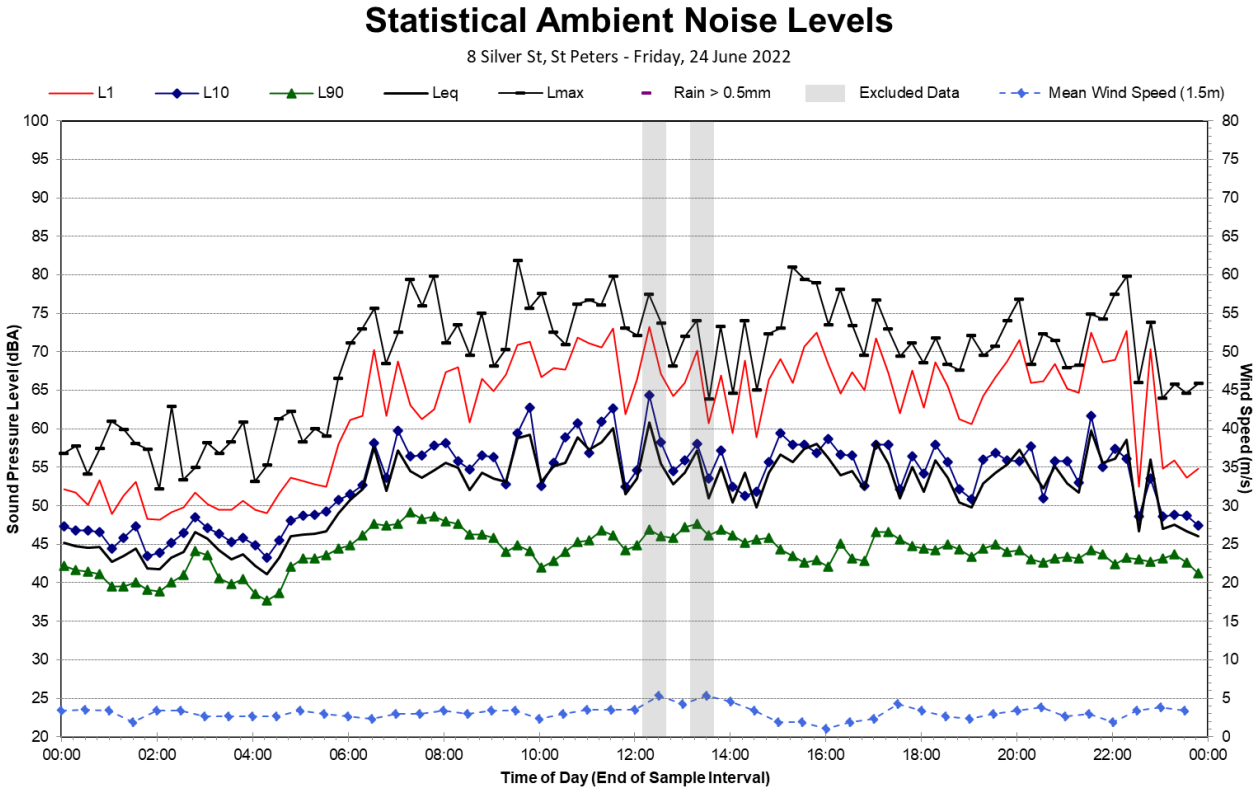


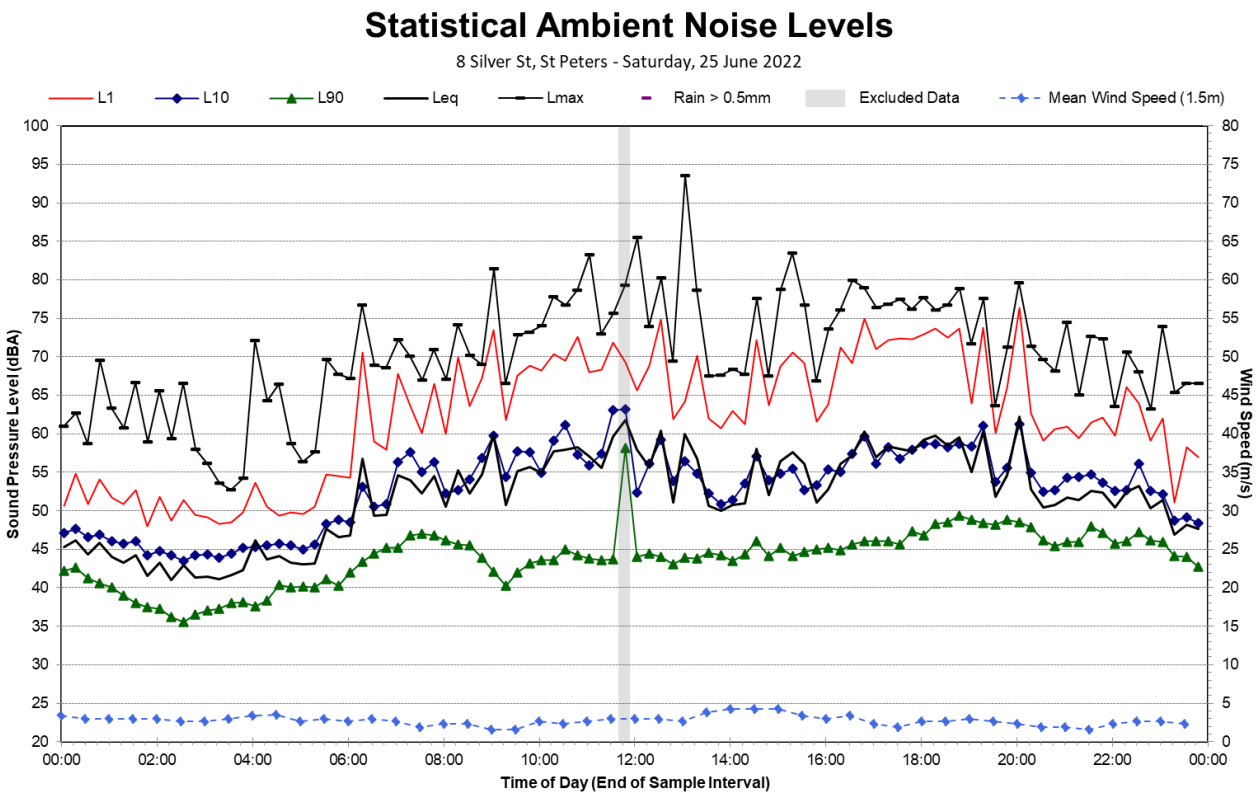
Statistical Ambient Noise Levels

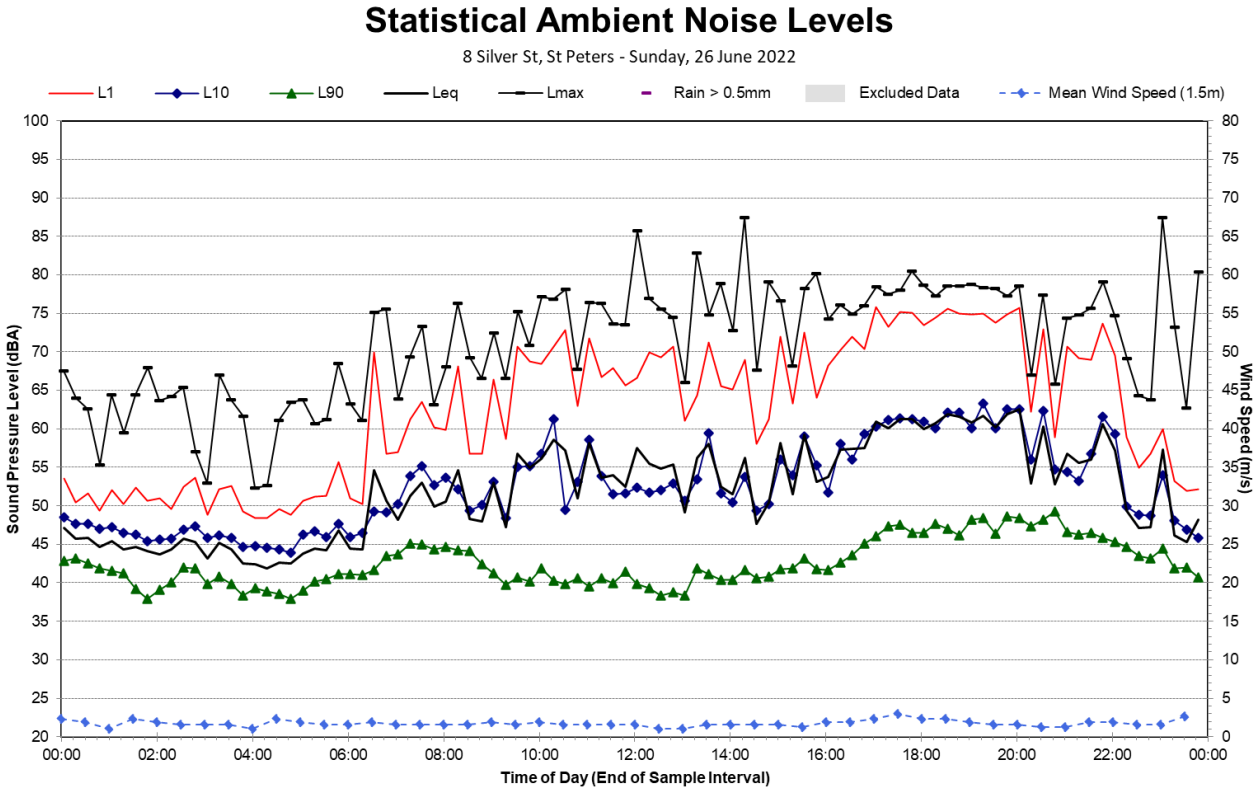
8 Silver St, St Peters - Wednesday, 22 June 2022




Statistical Ambient Noise Levels
8 Silver St, St Peters - Thursday, 23 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

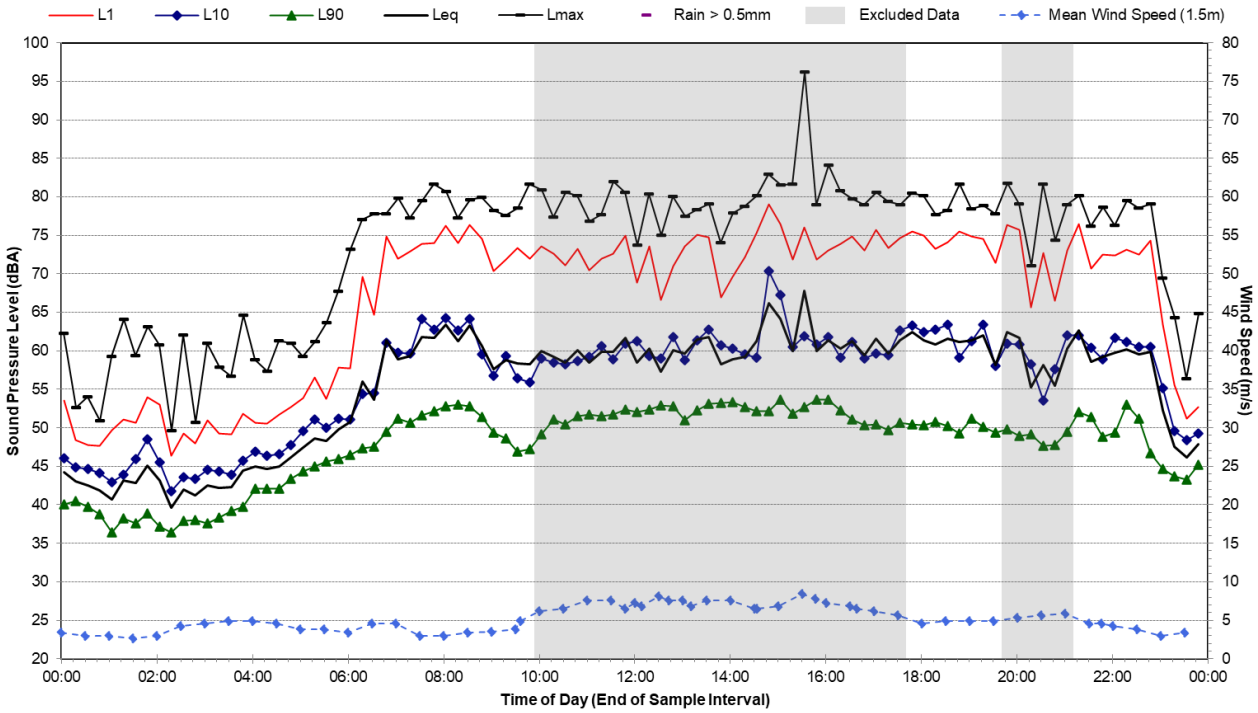

Statistical Ambient Noise Levels
8 Silver St, St Peters - Friday, 24 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Silver St, St Peters - Saturday, 25 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Silver St, St Peters - Sunday, 26 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

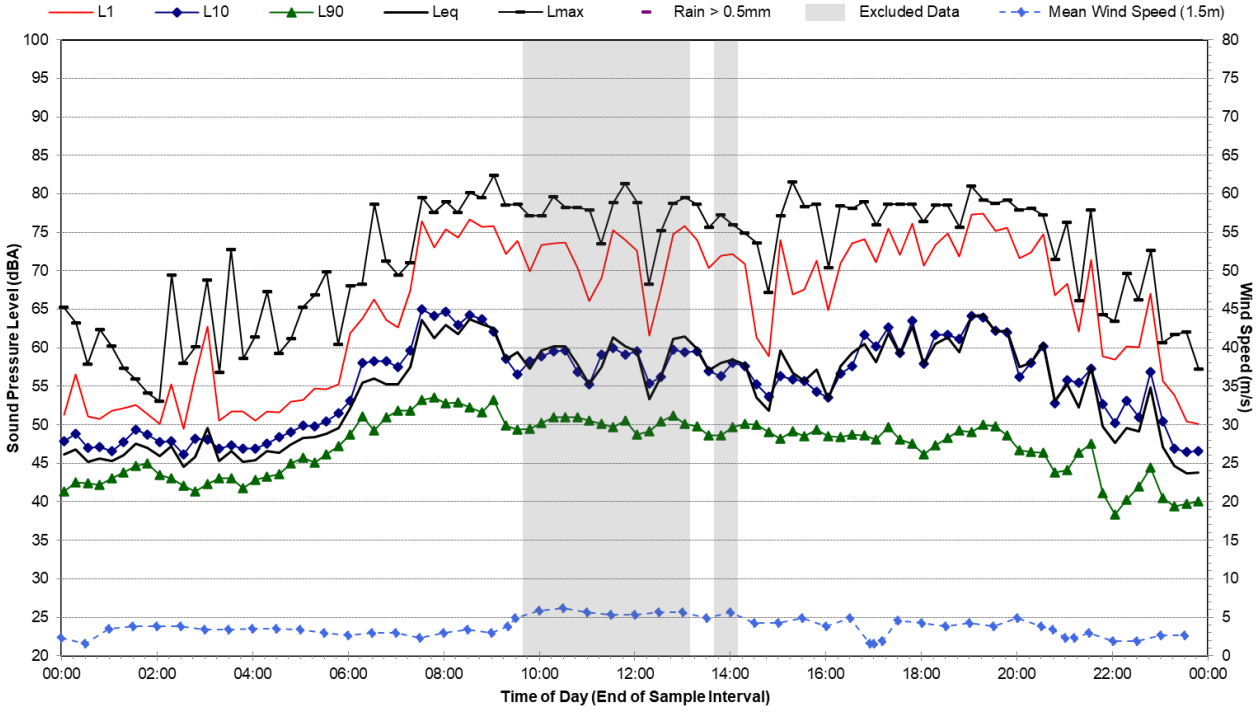
Statistical Ambient Noise Levels

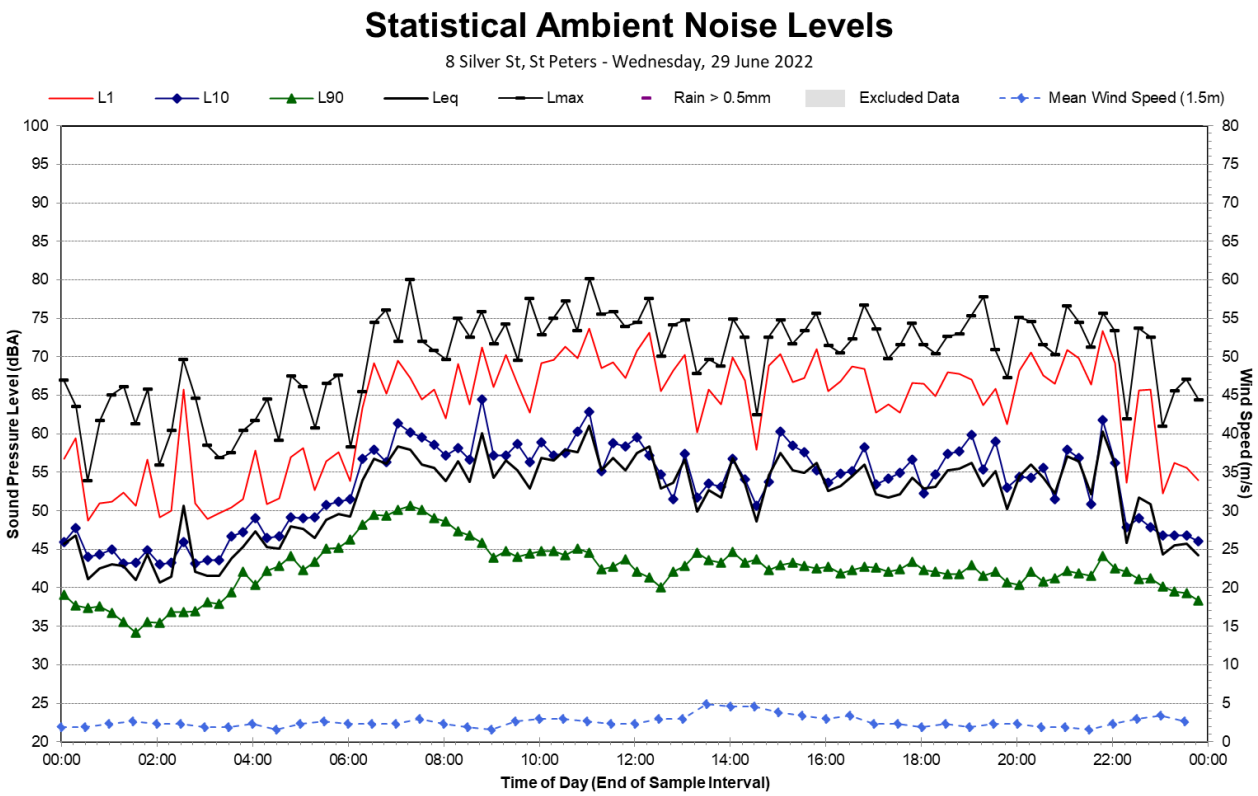
8 Silver St, St Peters - Monday, 27 June 2022



Statistical Ambient Noise Levels

8 Silver St, St Peters - Tuesday, 28 June 2022




Statistical Ambient Noise Levels
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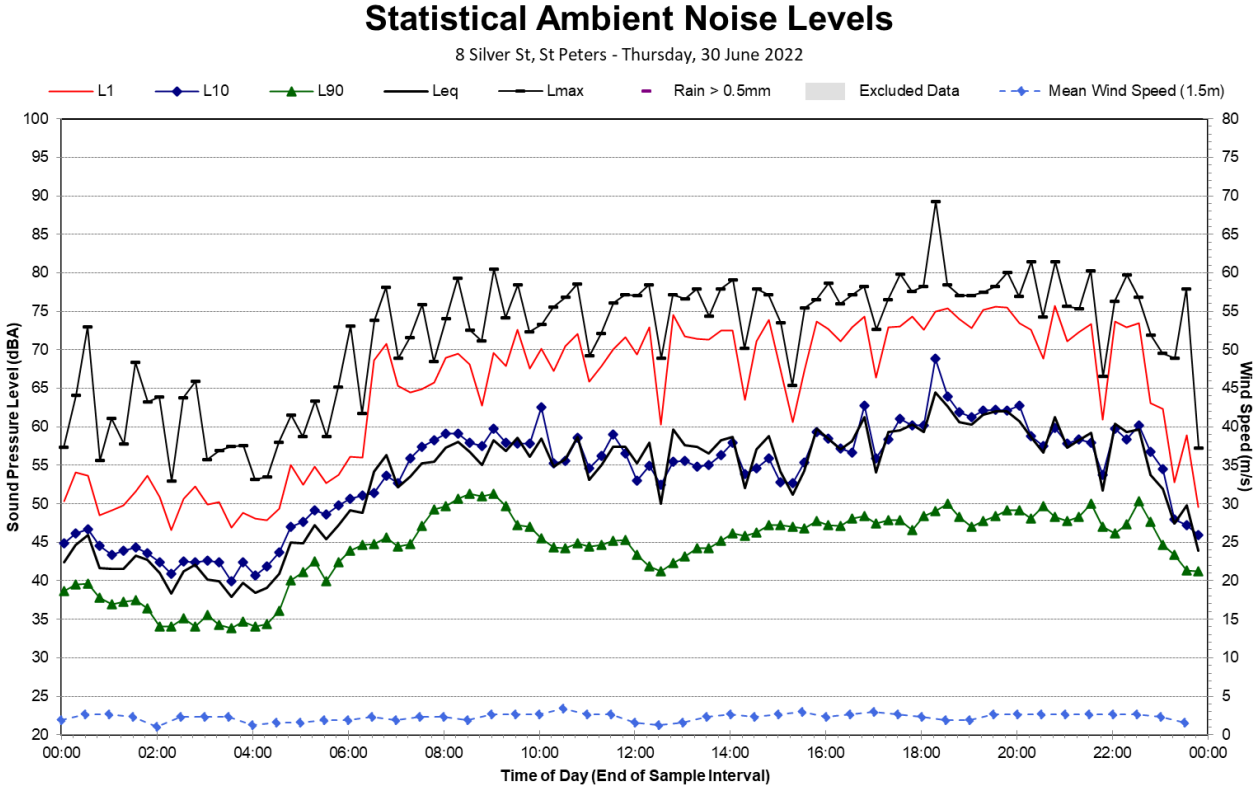
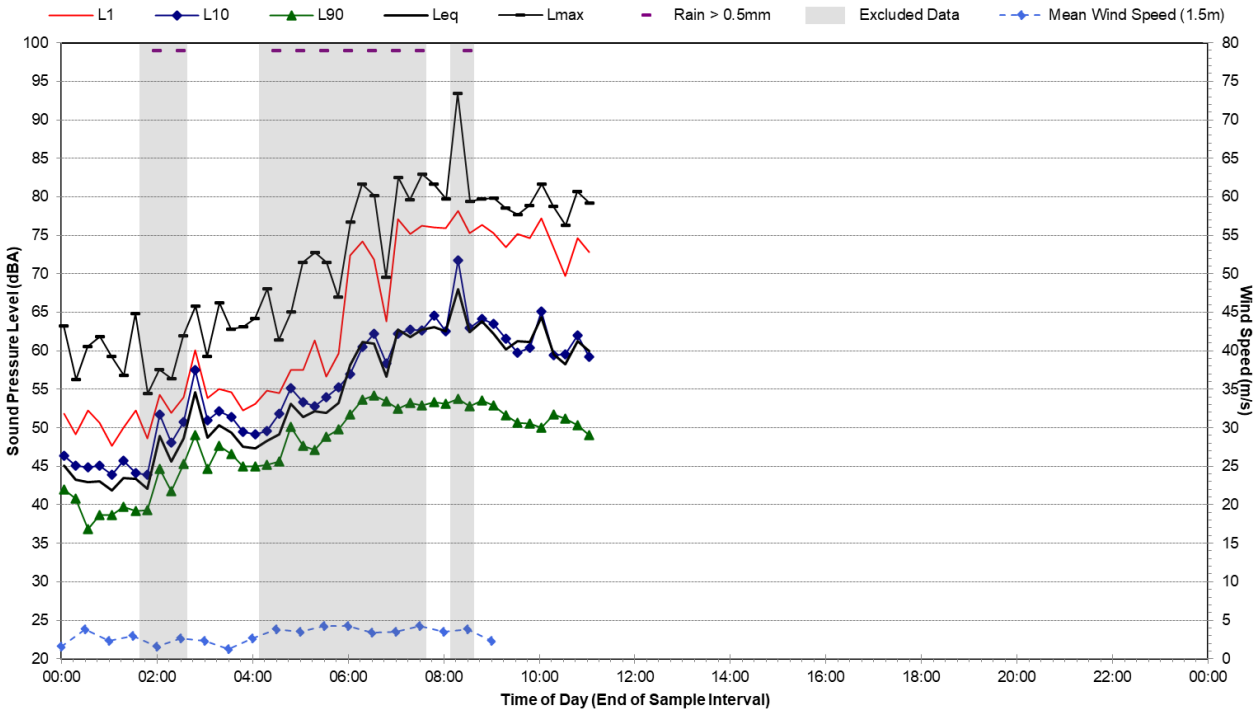
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
8 Silver St, St Peters - Thursday, 30 June 2022
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels

8 Silver St, St Peters - Friday, 1 July 2022



Noise Monitoring Location	L03	Map of Noise Monitoring Location
Noise Monitoring Address	**14 Campbell Road, Alexandria**	

Logger Device Type: Svantek 977, Logger Serial No: 980694
Sound Level Meter Device Type: Brüel and Kjær 2250L, Sound Level Meter Serial No: 3004636

Ambient noise logger deployed at residential address 14 Campbell Road, Alexandria. Logger located with view of Campbell Road to the south and Euston Road and the M8 Motorway to the east.

Attended noise measurements indicate the ambient noise environment at this location is dominated by road traffic noise from Campbell Road and aircraft flyovers to and from Sydney Airport.

Recorded Noise Levels (LAmax) 29/07/2022:

Light vehicle traffic Campbell Road: 65-79 dBA, Heavy vehicle traffic Campbell Road: 70-80 dBA, Aircraft flyover: 74-80 dBA, Construction: 55-64 dBA

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	56	67	70	75
Evening	55	65	68	74
Night-time	47	62	63	68

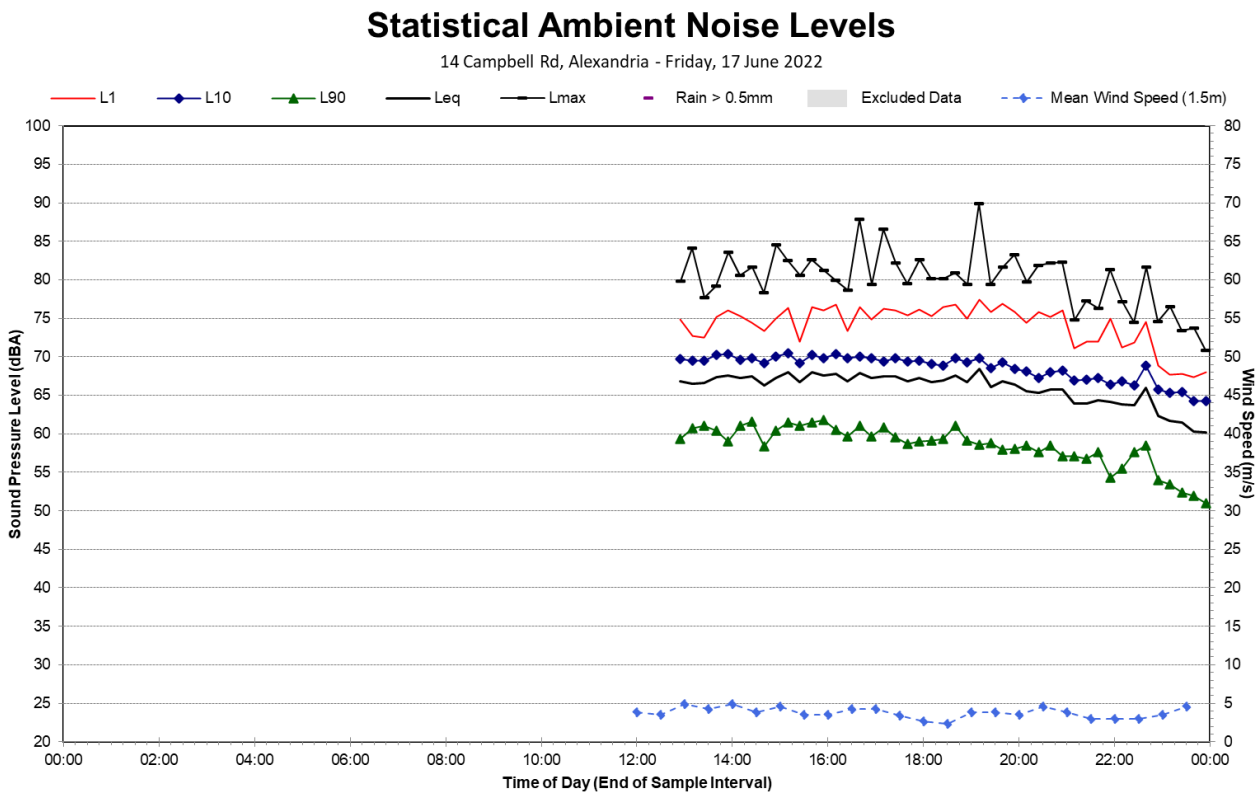
Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	67	68
Night-time (10pm-7am)	62	64

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
29/07/2022	10:05	60	68	80

Photo of Noise Monitoring Location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L90
Leq
Lmax
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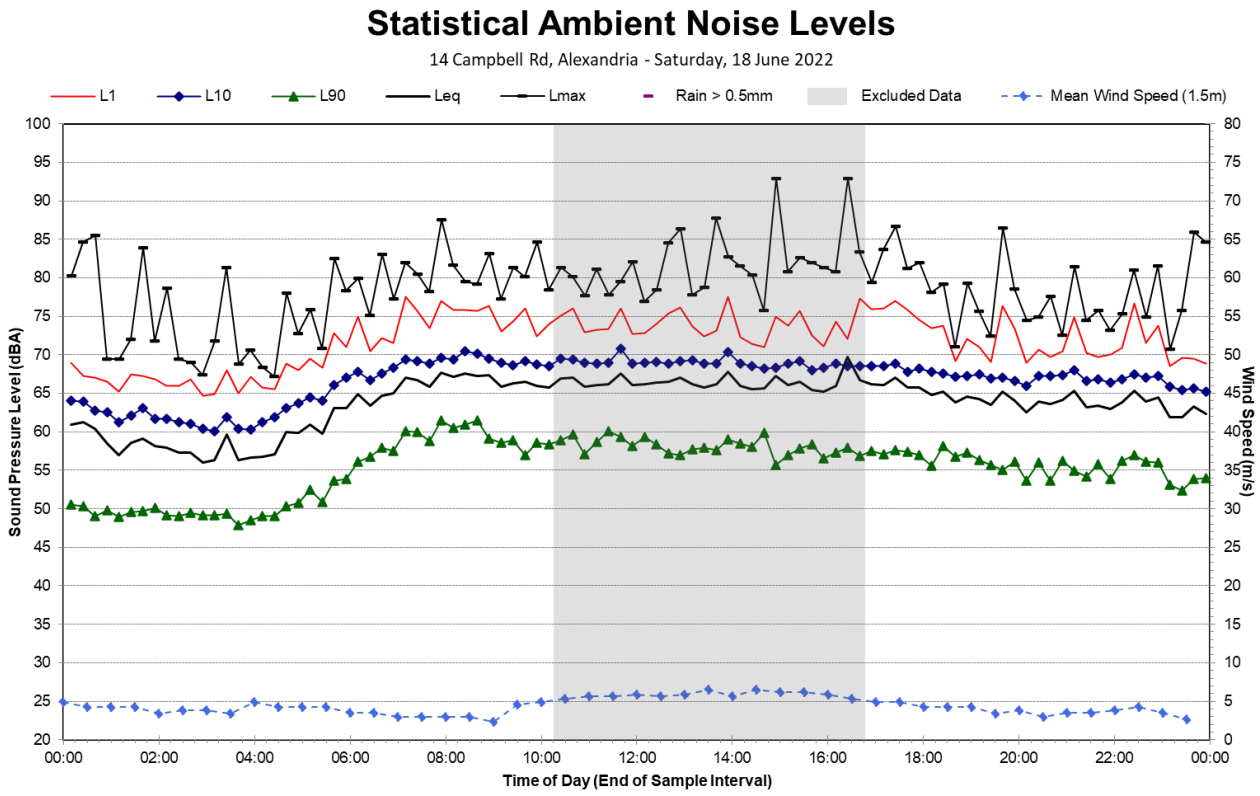
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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L90
Leq
Lmax
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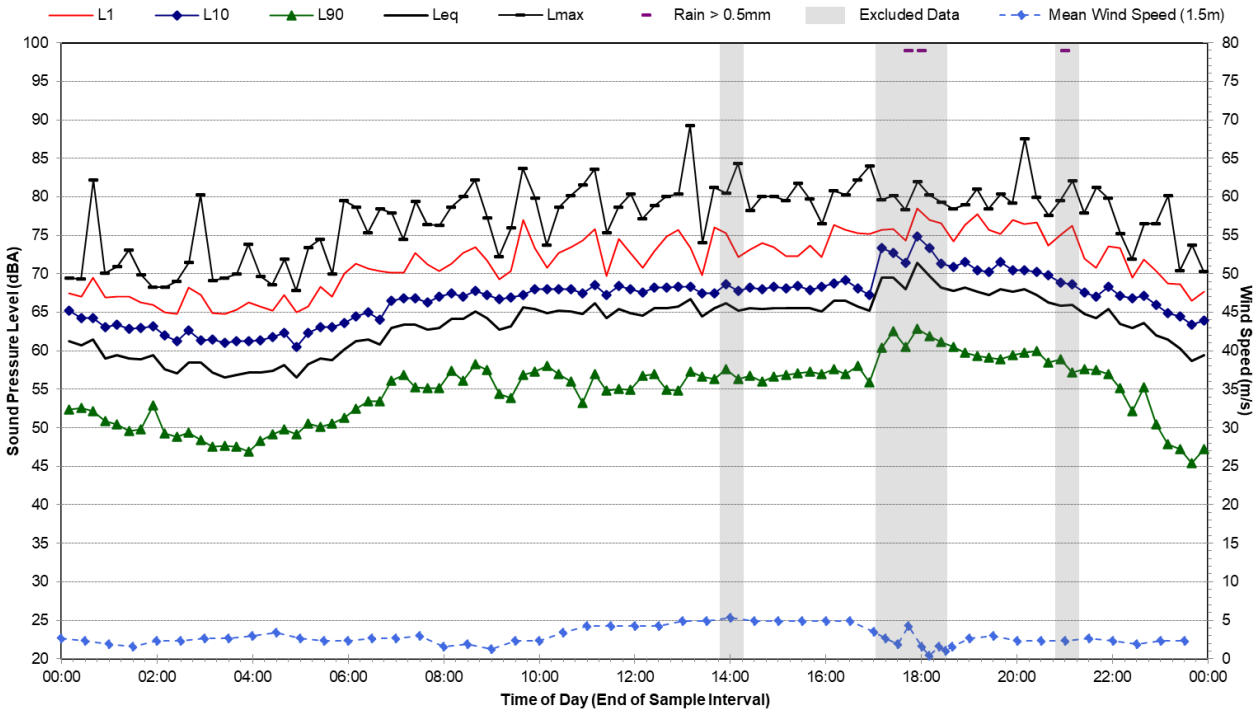
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels

14 Campbell Rd, Alexandria - Sunday, 19 June 2022



Statistical Ambient Noise Levels

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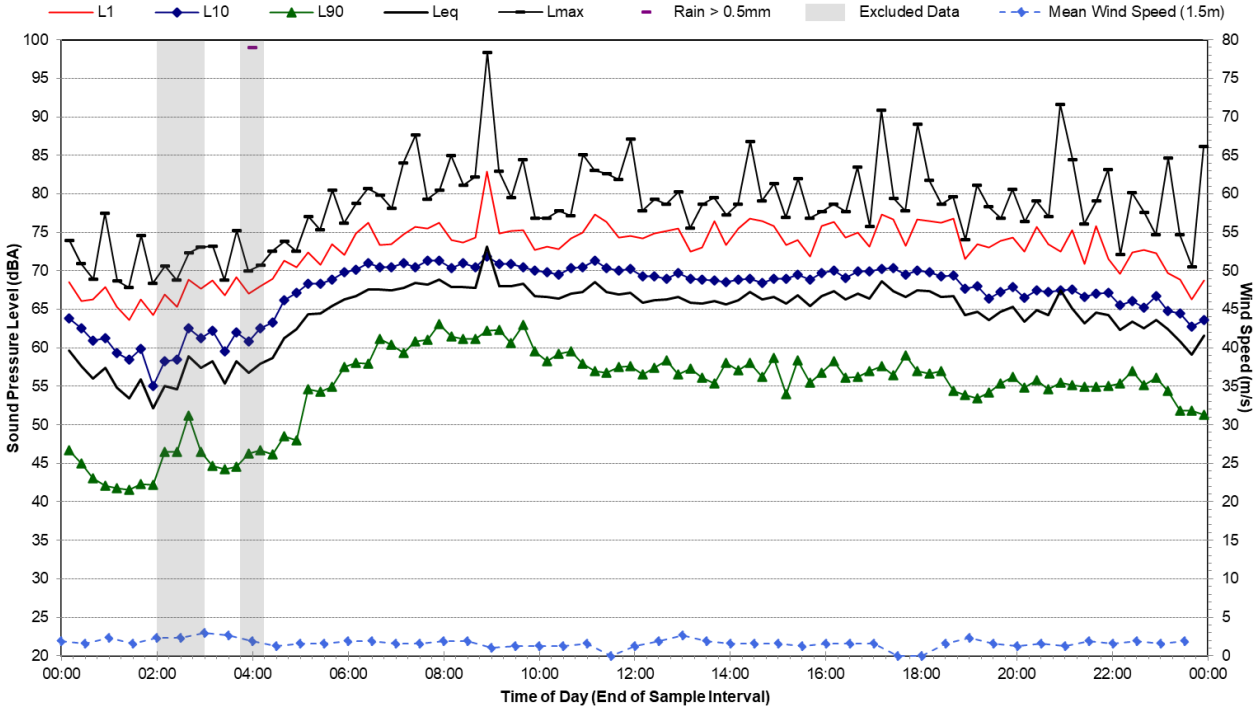
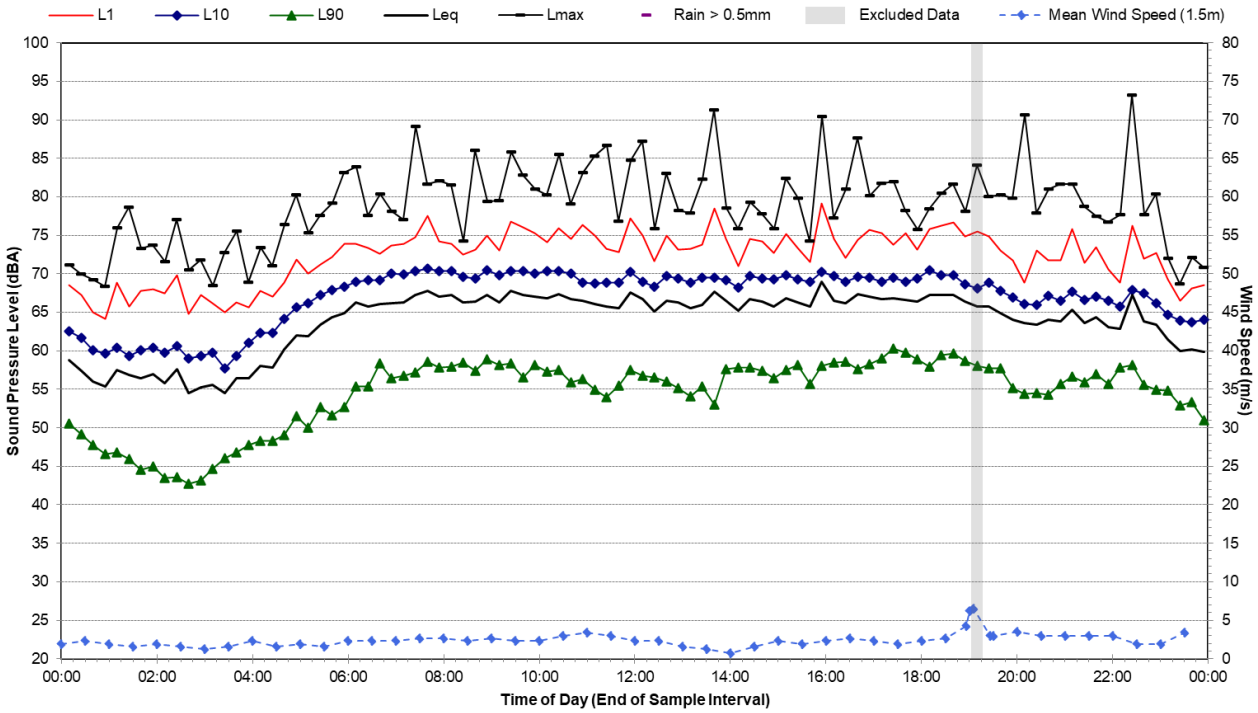


Statistical Ambient Noise Levels

14 Campbell Rd, Alexandria - Tuesday, 21 June 2022



Statistical Ambient Noise Levels

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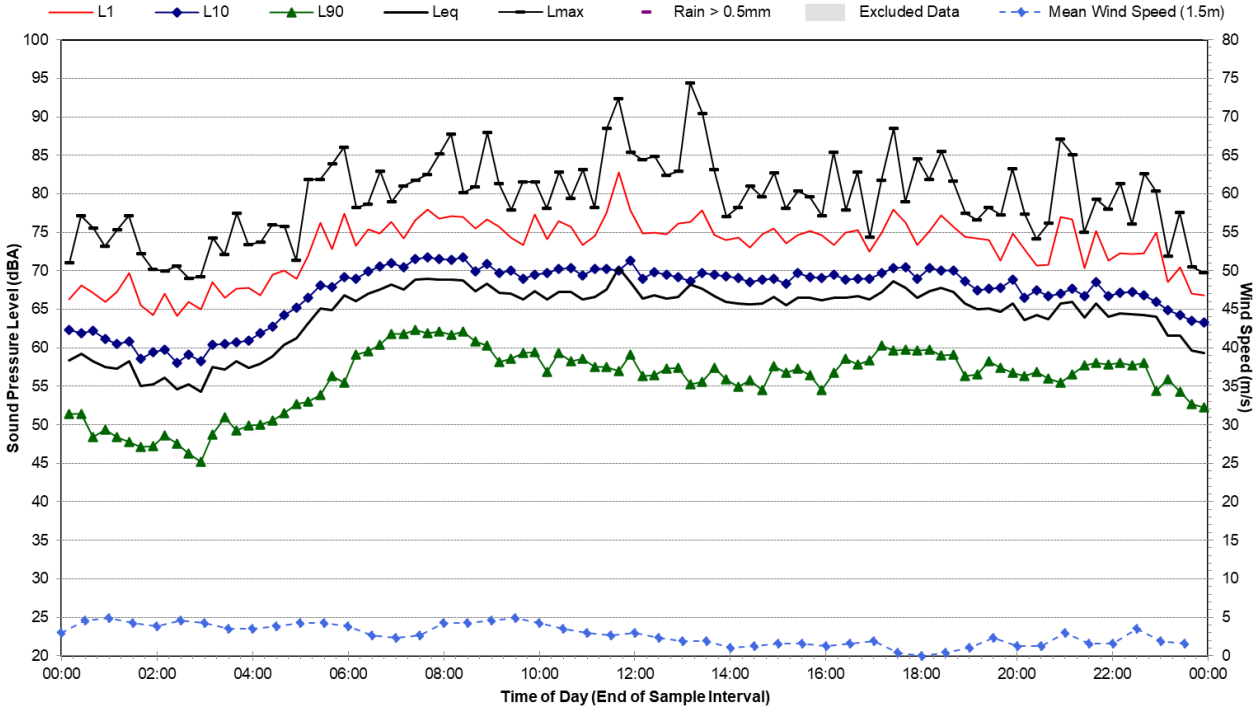
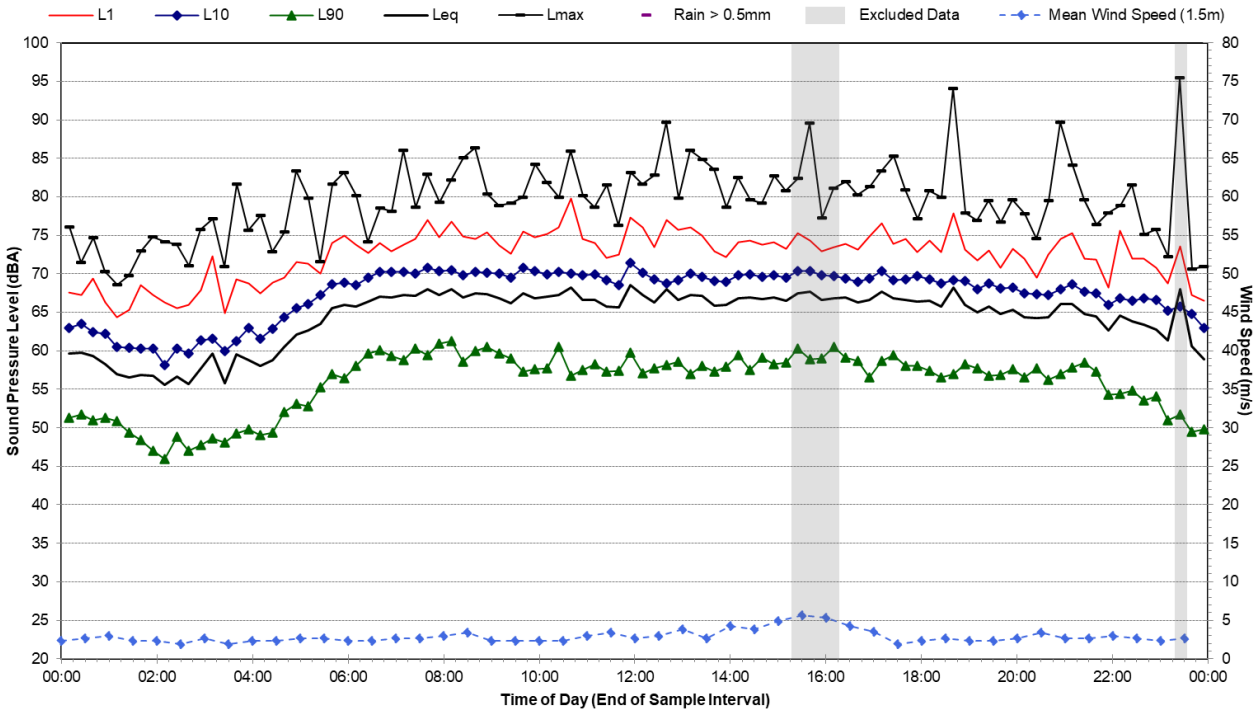


Statistical Ambient Noise Levels

14 Campbell Rd, Alexandria - Thursday, 23 June 2022



Statistical Ambient Noise Levels

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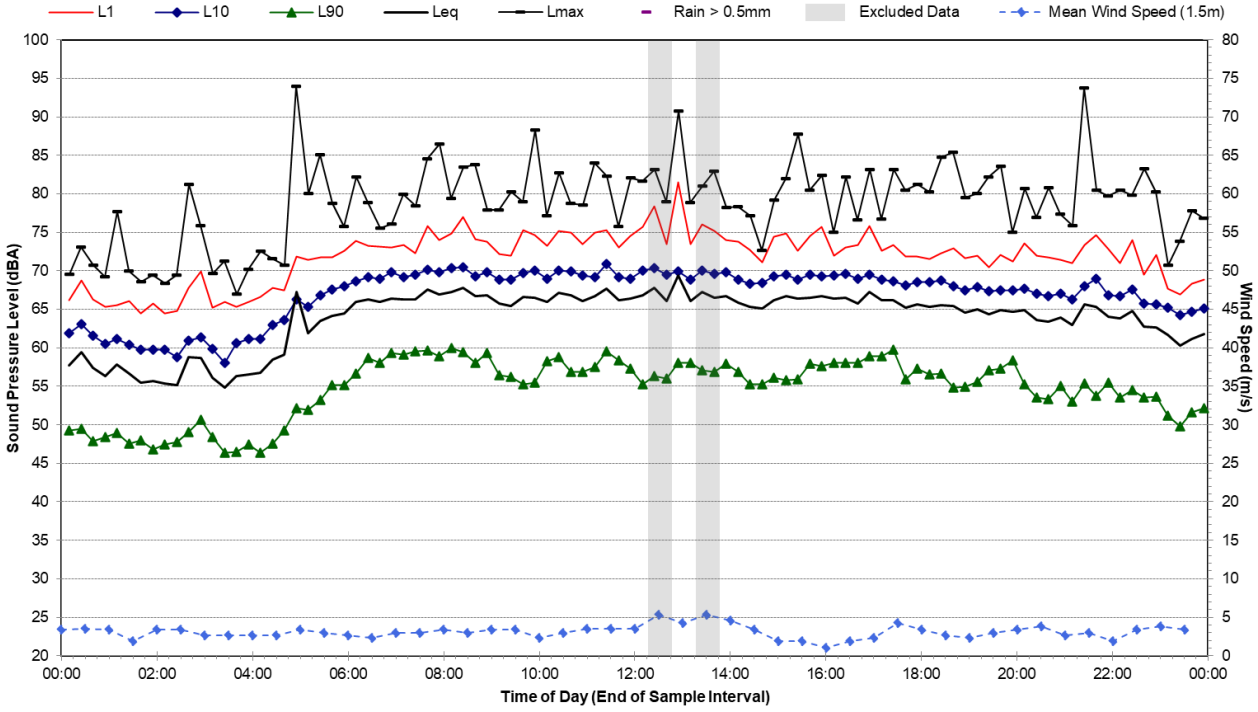

Statistical Ambient Noise Levels

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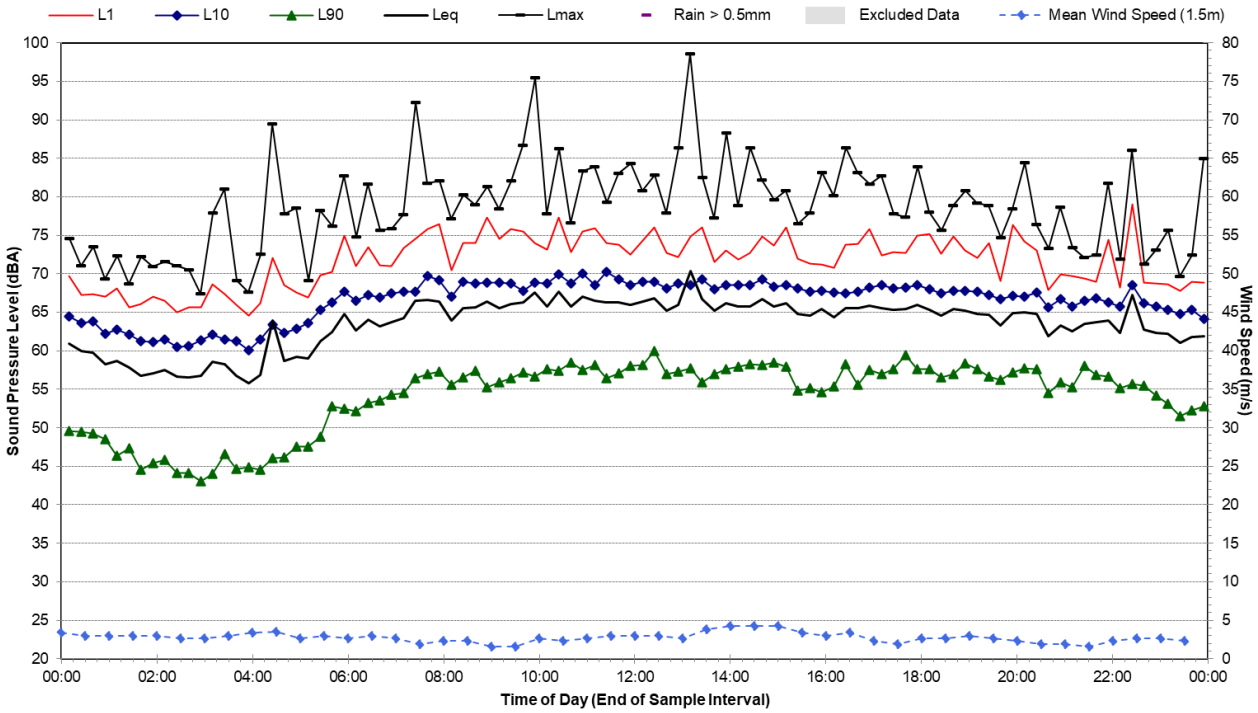

Statistical Ambient Noise Levels

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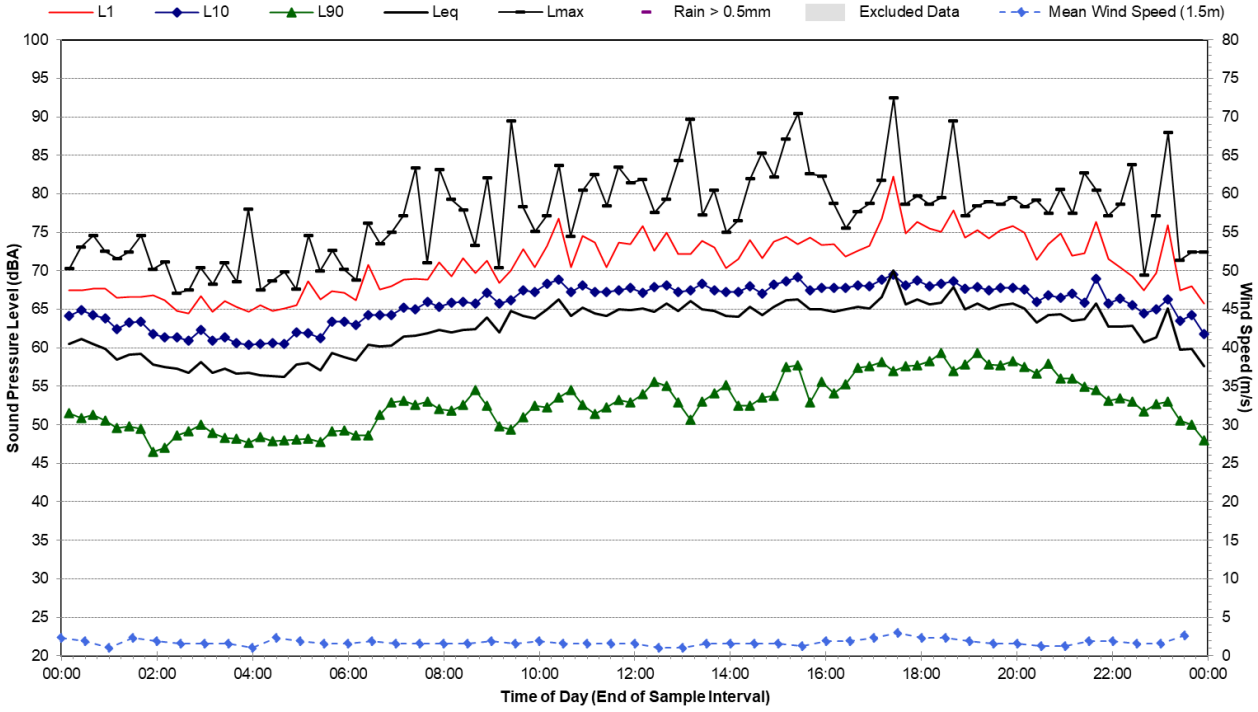

Statistical Ambient Noise Levels

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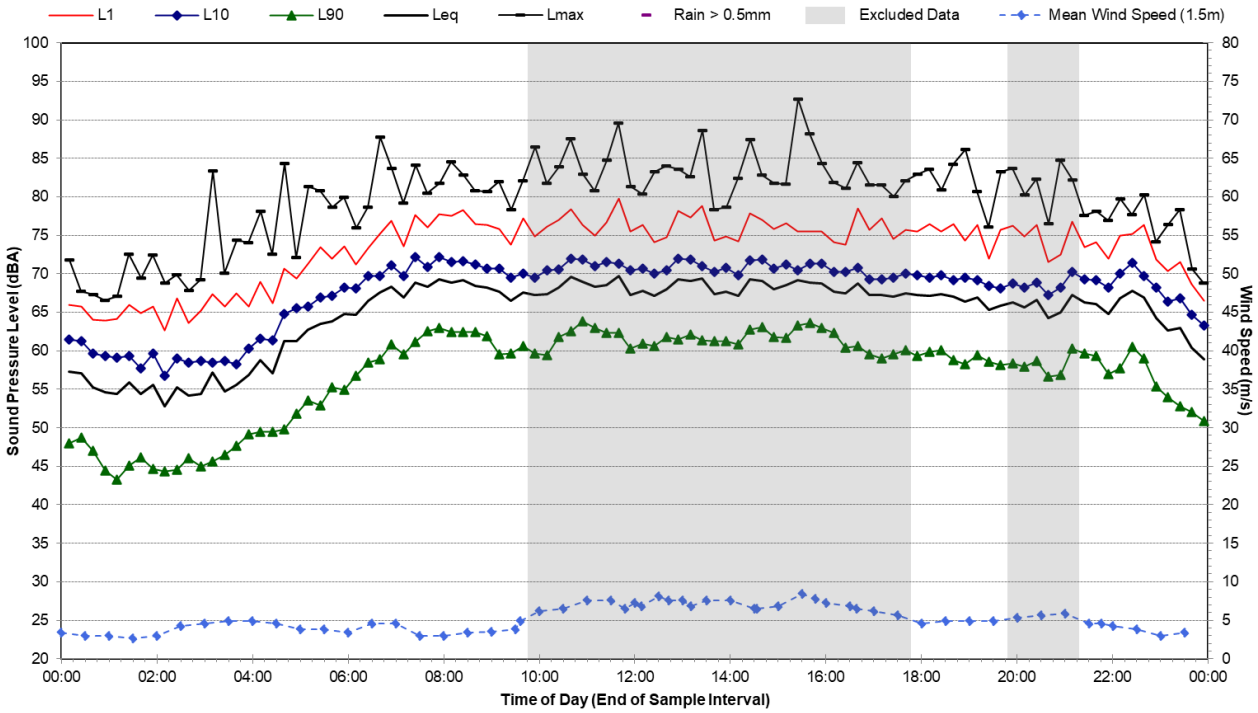

Statistical Ambient Noise Levels

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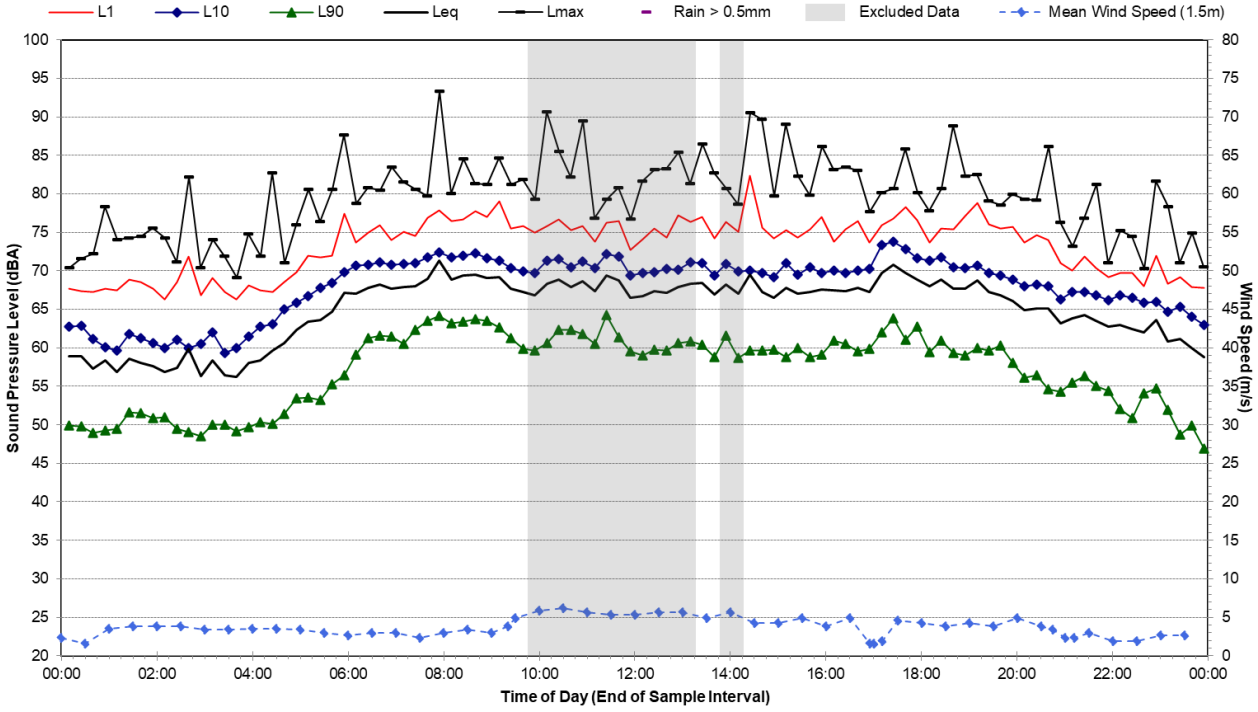
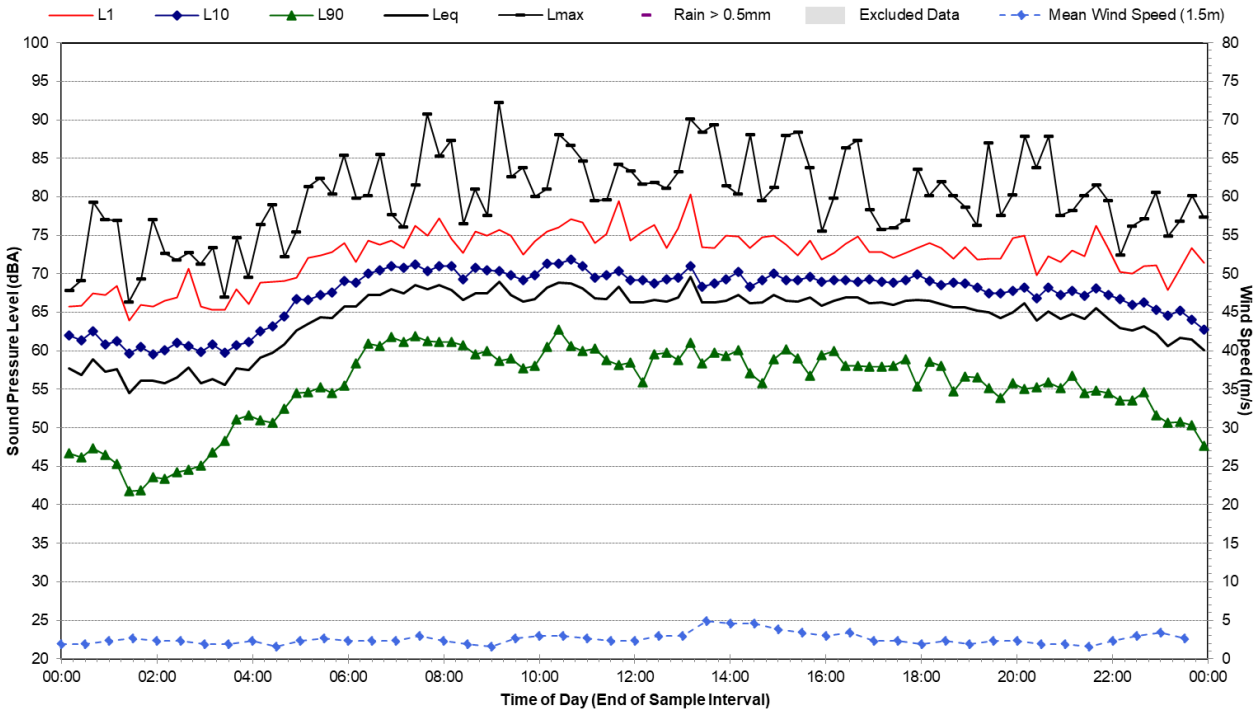


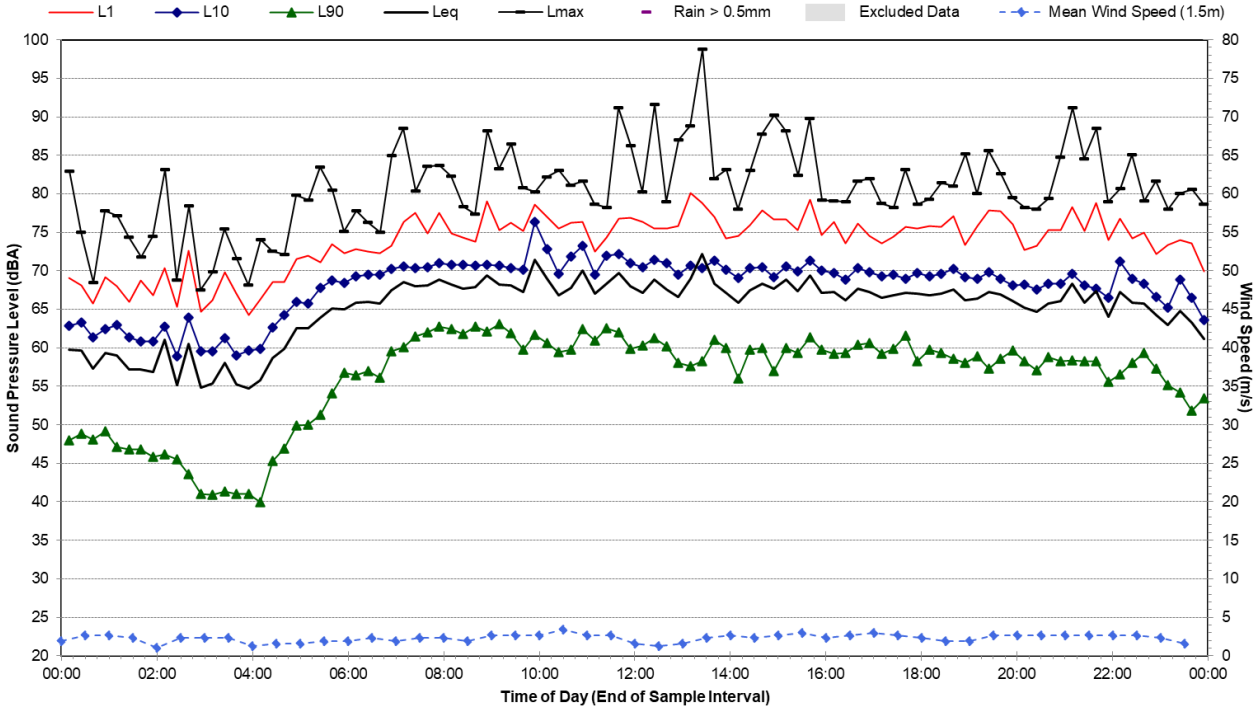
Statistical Ambient Noise Levels

14 Campbell Rd, Alexandria - Wednesday, 29 June 2022



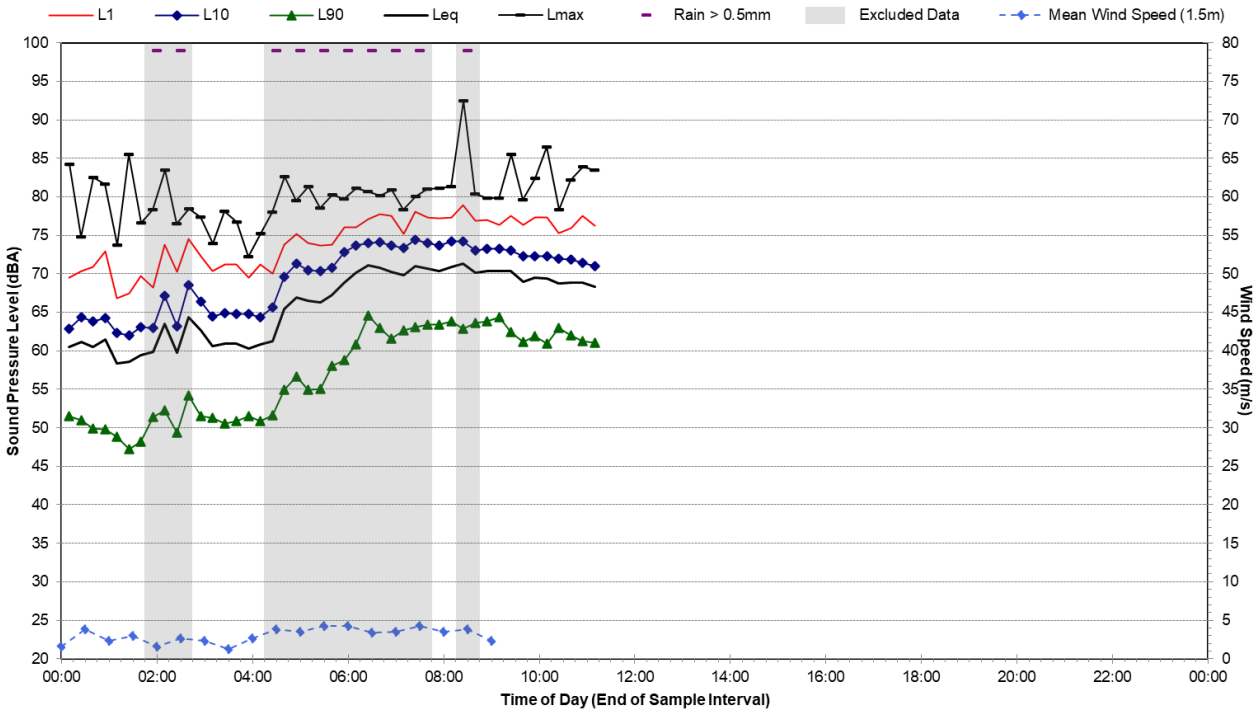
Statistical Ambient Noise Levels

14 Campbell Rd, Alexandria - Thursday, 30 June 2022



Statistical Ambient Noise Levels

14 Campbell Rd, Alexandria - Friday, 1 July 2022



Appendix C:

Construction Noise Sources

Equipment	Total SWL	Asphalt Truck & Sprayer	Chainsaw[1]	Chipper	Concrete Pump	Concrete Truck	Concrete Vibrator	Crane - Mobile (100t)	Dozer	Elevated Working Platform	Excavator (20t)	Excavator (30t) + Hydraulic Hammer[1]	Front End Loader	Hand Tools	Line Marking Truck	Paving Machine	Roller - Vibratory[1]	Truck - Dump	Truck - Flatbed	Water Cart
Sound Power Level[2]		106	119	120	109	109	113	113	116	97	105	127	112	104	108	108	114	110	103	107
Estimated on-time in any 15 minutes		15	5	15	10	15	5	15	10	15	10	5	10	15	15	15	15	10	10	10
Scenario																				
Vegetation Clearing	122		X	X							X		X					X		X
Demolition	123								X			X	X							X
Earthwork	117								X		X		X					X		X
Construction of Roads	116	X													X	X	X			
Construction of Pads and Hardstands	113				X	X	X													
Construction of Structures	114							X		X				X					X	

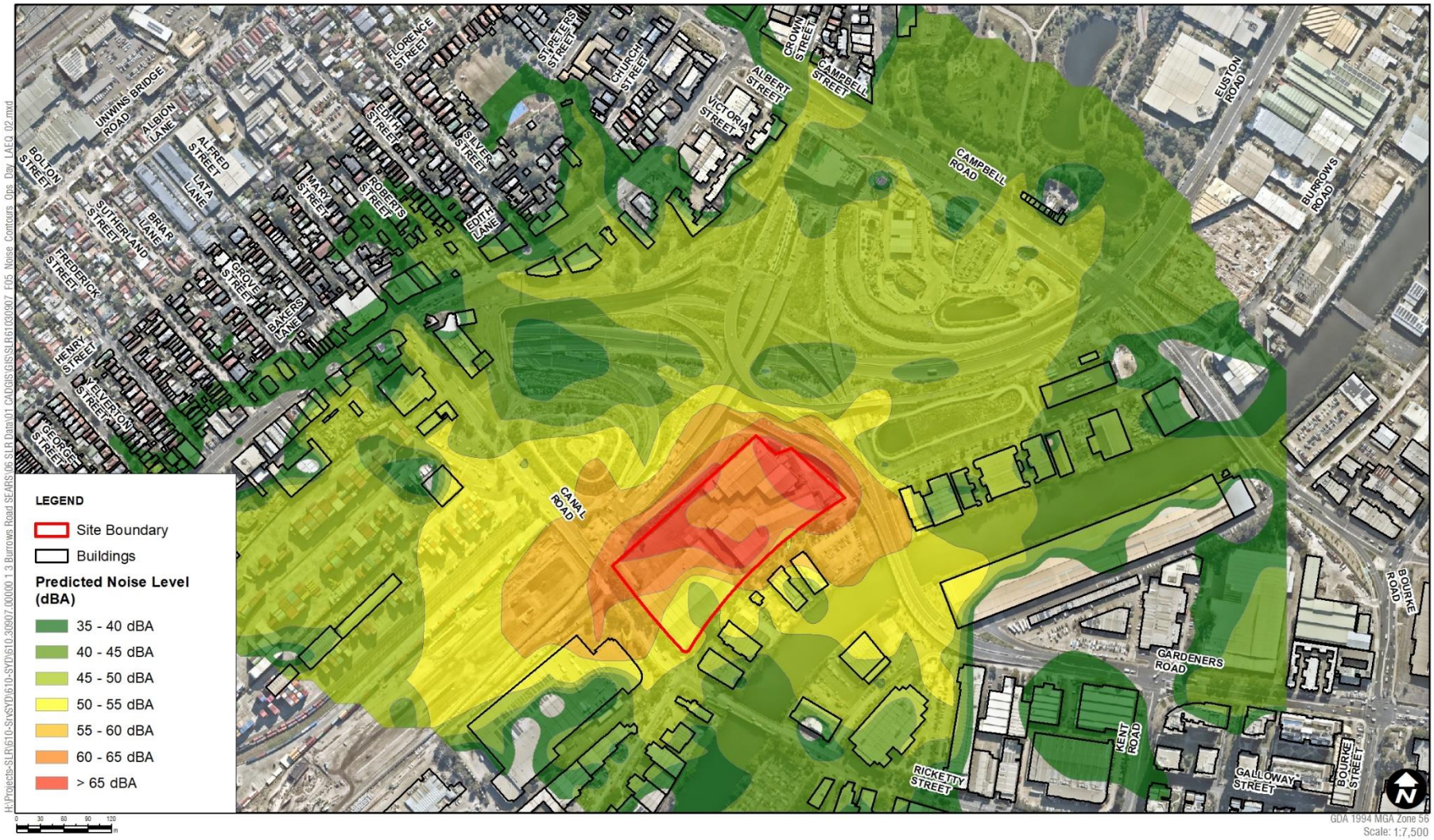
Note 1: Equipment classed as 'annoying' in the ICNG and requires a 5 dB correction.

Note 2: Sound power level data is taken from the DEFRA Noise Database, RMS Construction and Vibration Guideline and TfNSW Construction Noise and Vibration Strategy.

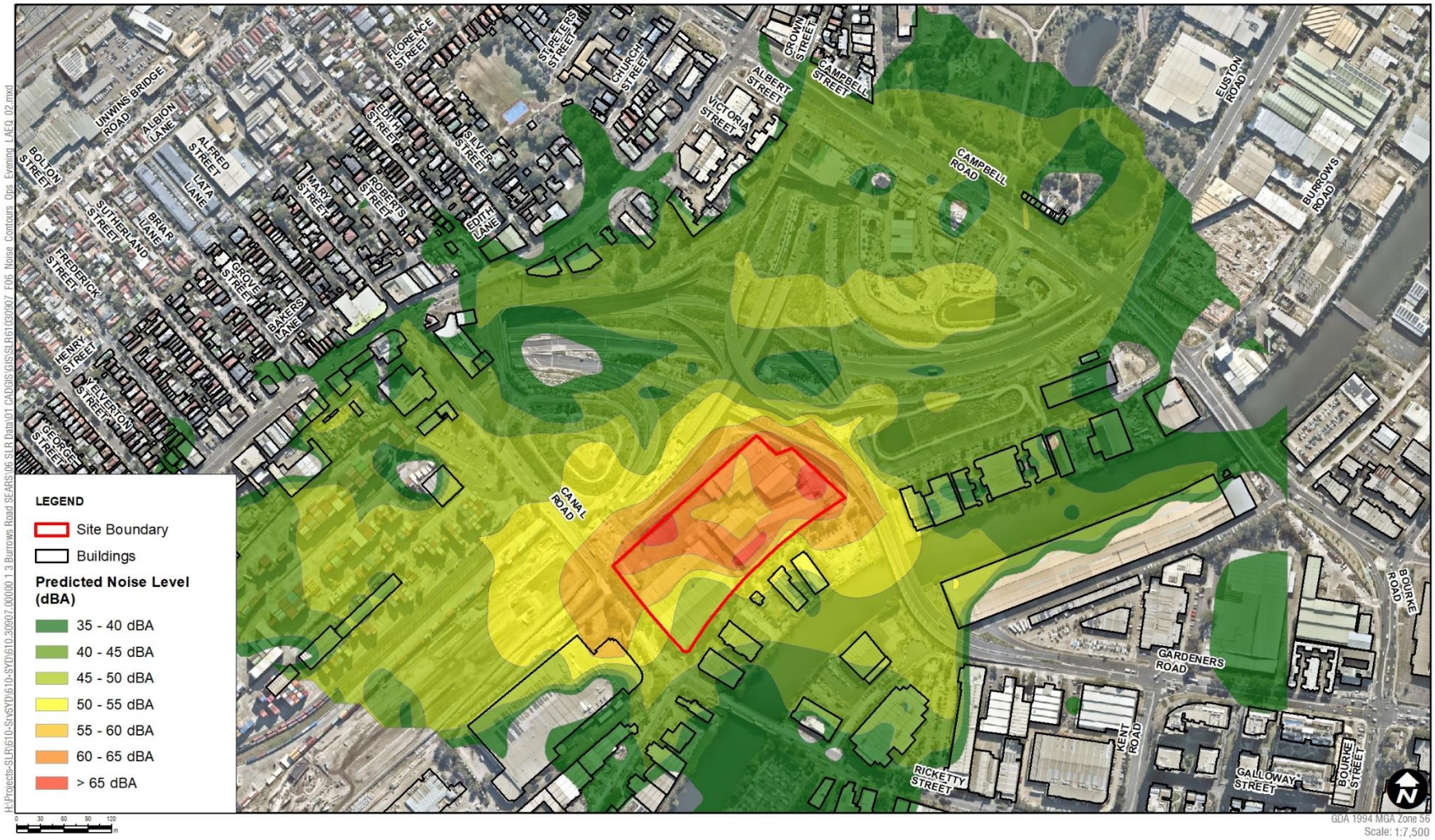
Appendix D:

Operational Noise Contours

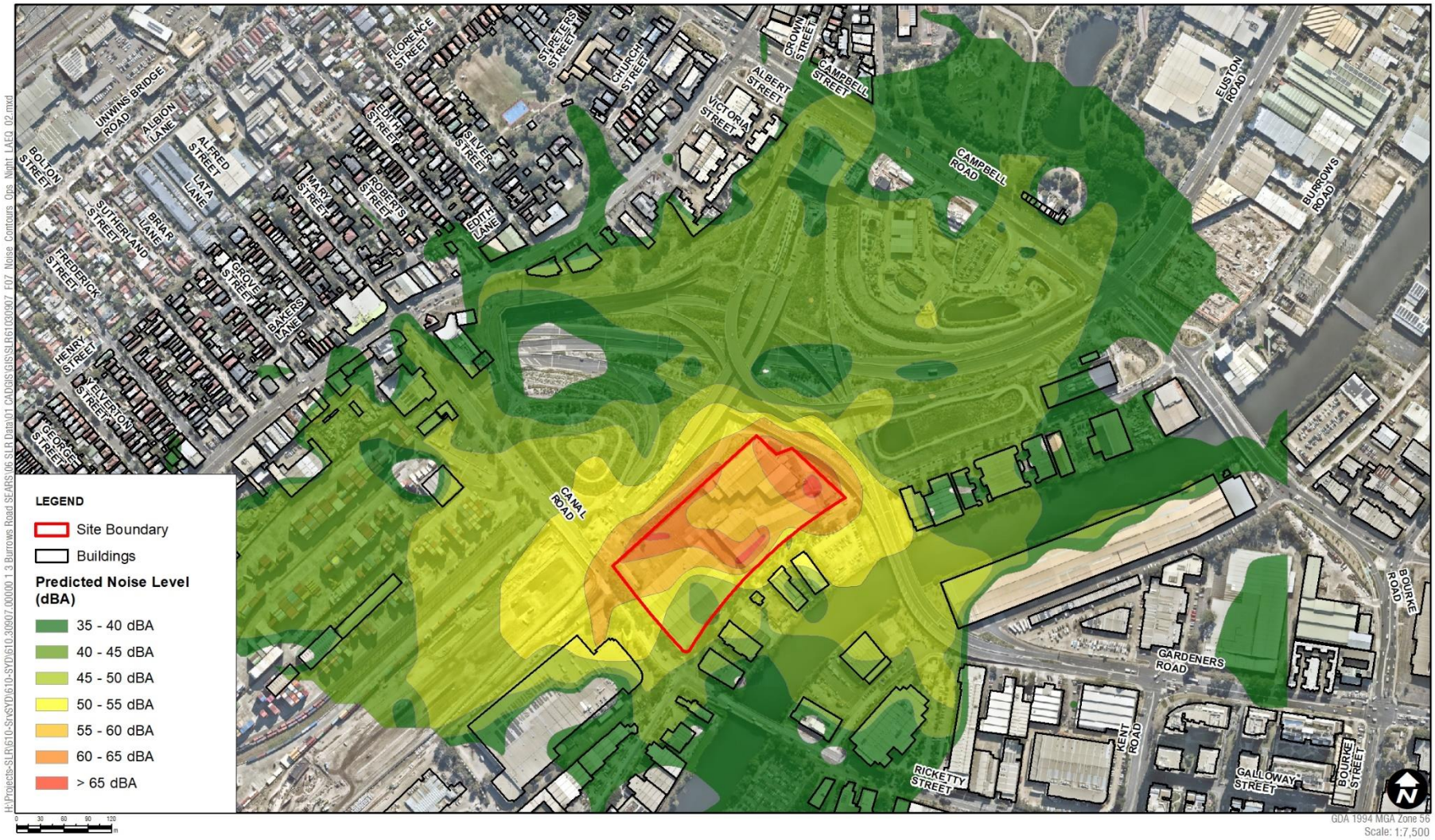
Site Operation – Day



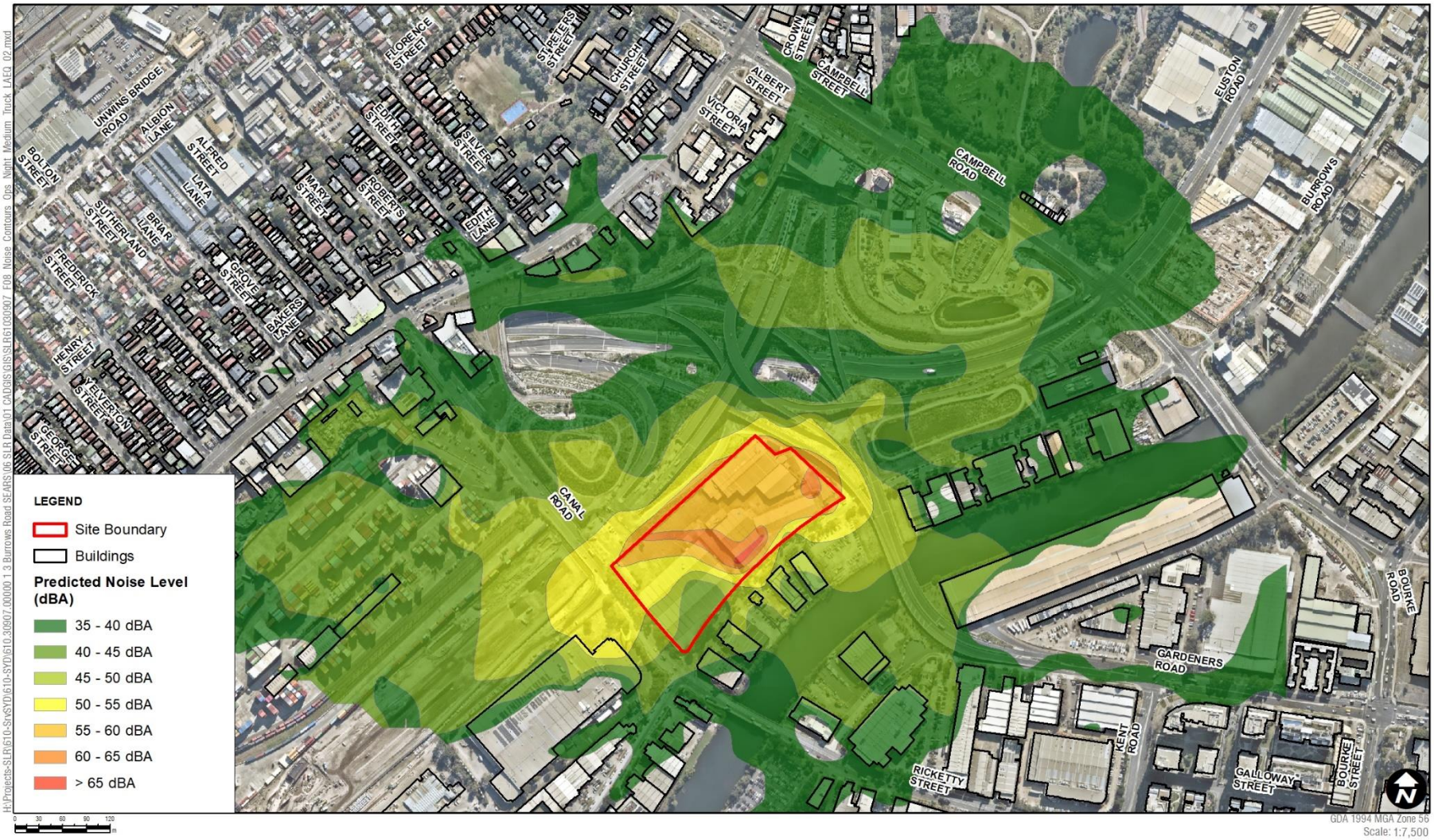
Site Operation – Evening



Site Operation – Night (Heavy Trucks)



Site Operation – Night (Medium Trucks)



Appendix E:

CNVG Mitigation Measures

CNVG Standard Mitigation and Management Measures

Action Required	Applies To	Details
Management measures		
Implementation of any project specific mitigation measures required.	Airborne noise	Implementation of any project specific mitigation measures required.
Implement community consultation or notification measures.	Airborne noise Ground-borne noise & vibration	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night-time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required. Please contact Roads and Maritime Communication and Stakeholder Engagement for guidance. Website (If required) Contact telephone number for community Email distribution list (if required) Community drop-in session (if required by approval conditions).
Site inductions	Airborne noise Ground-borne noise & vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • 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	Airborne noise	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.
Verification	Airborne noise Ground-borne noise & vibration	Where specified under Appendix C of the CNVG a noise verification program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	Airborne noise Ground-borne noise & vibration	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.

Action Required	Applies To	Details
Building condition surveys	Vibration Blasting	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to commencement of activities with the potential to cause property damage
Source controls		
Construction hours and scheduling	Airborne noise Ground-borne noise & vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period during normal hours and out-of-hours work	Ground-borne noise & vibration Airborne noise	See Appendix C of the CNVG for more details on the following respite measures: • Respite Offers (RO) • Respite Period 1 (R1) • Respite Period 2 (R2) • Duration Respite (DR)
Equipment selection.	Airborne noise Ground-borne noise & vibration	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits. Ensure plant including the silencer is well maintained.
Plant noise levels.	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the CNVG. Implement a noise monitoring audit program to ensure equipment remains within the more stringent of the manufacturers specifications or Appendix H of the CNVG.
Rental plant and equipment.	Airborne-noise	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 criteria in Table 2 of the CNVG.
Use and siting of plant.	Airborne-noise	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. Only have necessary equipment on site.
Plan worksites and activities to minimise noise and vibration.	Airborne noise Ground-borne vibration	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters. If programmed night work is postponed the work should be re-programmed and the approaches in this guideline apply again.

Action Required	Applies To	Details
Reduced equipment power	Airborne noise Ground-borne vibration	Use only the necessary size and power.
Non-tonal and ambient sensitive reversing alarms	Airborne noise	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. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction sites.	Airborne noise	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. Avoid or minimise these out of hours movements where possible.
Engine compression brakes	Construction vehicles	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
Path controls		
Shield stationary noise sources such as pumps, compressors, fans etc.	Airborne noise	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities.	Airborne noise	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.
Receptor control		
Structural surveys and vibration monitoring	Ground-borne vibration	Pre-construction surveys of the structural integrity of vibration sensitive buildings may be warranted. At locations where there are high-risk receptors, vibration monitoring should be conducted during the activities causing vibration.
See Appendix C of the CNVG for additional measures	Airborne noise Ground-borne vibration	In some instances, additional mitigation measures may be required.

Appendix F:

NPfI Mitigation Measures

Best Management Practice (BMP)

Best management practice (BMP) is the application of particular operational procedures that minimise noise while retaining productive efficiency.

Where applied, these measures and practices are often documented in a noise management plan so that operational practices and undertakings are clearly understood and applied at all levels of an industrial operation. Application of BMP can include the following types of practice:

- Using the quietest plant that can do the job
- Scheduling the use of noisy equipment at the least-sensitive time of day
- Not operating, or reducing operations at night
- Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise
- Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently
- Keeping equipment well-maintained and operating it in a proper and efficient manner
- Using 'quiet' practices when operating equipment, for example, positioning idling trucks in appropriate areas
- Running staff-education programs and regular tool box talks on the effects of noise and the use of quiet work practices.

Best Available Technology Economically Achievable (BATEA)

With 'Best available technology economically achievable' (BATEA), equipment, plant and machinery that produce noise incorporate the most advanced and affordable technology to minimise noise output. Affordability is not necessarily determined by the price of the technology alone. Increased productivity may also result from using more advanced equipment, offsetting the initial outlay, for example, using 'quieter' equipment that can be operated over extended hours. Old or badly-designed equipment can often be a major source of noise.

Where BMP fails to achieve the required noise reduction by itself, the BATEA approach should then be considered. Examples of uses of BATEA include:

- Considering alternatives to tonal reversing alarms (where work health and safety is appropriately considered)
- Using equipment with efficient muffler design
- Using quieter engines, such as electric instead of internal combustion
- Fitting and maintaining noise reduction packages on plant and equipment
- Using efficient enclosures for noise sources
- Damping or lining metal trays or bins
- Active noise control.

For many industries there are a wide range of factors that can restrict the feasibility and reasonableness of applying BMP or BATEA measures on a particular site. Work health and safety considerations must also be taken into account as well as any other regulatory and process requirements.

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