27 Waine Street, Freshwater – DA Acoustic Assessment

Pyco at Greenslopes Pty Ltd
C/o Fuse Architects

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1 INTRODUCTION

Pulse White Noise Acoustics Pty Ltd (PWNA) has been engaged Pyco at Greenslopes Pty Ltd to undertake a acoustic assessment for the proposed residential redevelopment of 27 Waine Street, Freshwater.

This report has been prepared to form part of the Development Application (DA) package to be submitted to Council.

A list of acoustic terminology used in this report is included in Appendix A of this report.

1.1 Relevant Guidelines

Acoustic criteria which have been adopted in this assessment include requirements from the local and state authorities as well as Australian and International Standards, which will be adopted in the absence of any relevant requirements.

Noise intrusion into the development will be controlled by the requirements of former Warringah Council Development Control Plan (DCP) 2011 and the objectives of Australian New Zealand Standard AS/NZS 2107:2016 Acoustics–Recommended design sound levels and reverberation times for building interiors has been adopted.

Internal construction requirements are governed by the requirements of Section F5 of the Building Code of Australia (BCA) component of the National Construction Code (NCC).

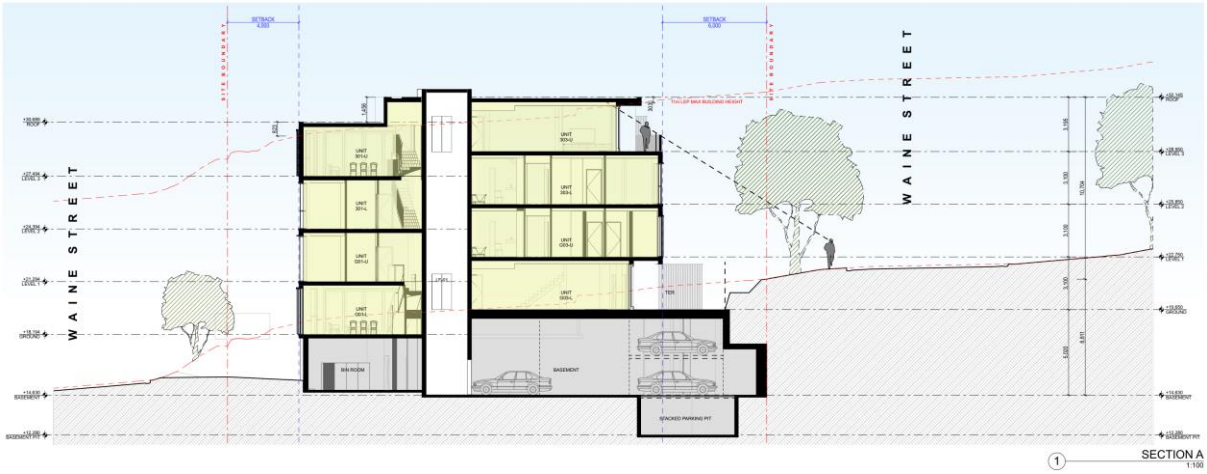
Furthermore, the noise emission impacts from the proposed development on the adjacent receivers are regulated by the Warringah Council Development Control Plan (DCP) 2011 and the NSW EPA Noise Policy for Industry (NPI) 2017.

1.2 Proposed Development

The proposed redevelopment will result in a development which includes the following:

- Single level basement with automatic vehicle parking systems, storage, building services and lift lobby. The basement will be accessed via Waine Street along the southern boundary of the site.
- Ground level will include pedestrian access from Waine Street as well as three double storey apartments.
- Level one will accommodate the upper level of the double storey apartment from ground level. through six are residential apartments.
- Levels two and three will accommodate a further three double storey apartments with access to these apartments via level 3.

Figure 1 Architectural Plan –Section A – DA 301



Architectural drawings for the proposed development, which have been used in our assessment, are from Fuse Architects.

1.3 Site Description

The project site is located at 27 Waine Street, Freshwater which is defined as a R3 zoning based on NSW ePlanning website.

Situated along the northern, western and southern side of the site is Waine Street as it wraps around the site.

Located to the north of the site across Waine Street is low density single/two storey residential dwellings. Along the western and southern sides of the site across Waine Street are medium density residential apartment buildings.

Beyond the developments along the southern and western side of Waine Street is Pittwater Road which carries a high volume of traffic.

Along the eastern boundary of the site is an existing medium density residential apartment building.

The nearest sensitive receivers to the site have been identified below.

Receiver 1: Multi-storey residences within the residential apartment building along the eastern boundary of the site, situated at 25-31 Waine Street, Freshwater.

Receiver 2: Single/two storey residential dwellings located to the north of the site across Waine Street, situated at 44-46 Waine Street, Freshwater.

Receiver 3: Multi-storey residential buildings to the northeast, east and south of the site across Waine Street, situated at 26-42 Waine Street, Freshwater.

A map showing the site location and all measurement locations as well as nearest receivers is provided in Figure 2 below.

Figure 2 Site Map, Measurement Locations and Surrounding Receivers – Sourced from SixMaps NSW

2 ACOUSTIC NOISE AND VIBRATION SURVEY

2.1 Onsite Noise Measurements

Measured noise levels from both the unattended and attended noise surveys are outlined below. In addition, measured vibration levels are also outlined below

2.1.1 Unattended Noise Monitoring

An unattended noise survey was conducted between Thursday 21st July 2022 and Friday 29th August 2022in the rear of the property as shown in Figure 2 above.

Instrumentation for the survey comprised one Rion NL-42 sound level meter (serial number 00998079). Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. The charts present each 24-hour period and show the L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15-minute periods. This data has been filtered to remove periods affected by adverse weather conditions based on weather information.

Figure 3 Noise Monitor Install Photo – 27 Waine Street, Freshwater

Based on the unattended noise measurements outlined above, the results for the survey are presented in each relevant period and parameter below.

2.1.1.1 Results in accordance with the NSW *EPA Noise Policy for Industry (NPI) 2017* (RBL's)

To assess the acoustical implications of the development at nearby noise sensitive receivers, the measured background noise data of the logger was processed in accordance with the NSW EPA's *Noise Policy for Industry* (NPI, 2017).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially-affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. RBL L_{A90} (15minute) and L_{Aeq} noise levels are presented in the table below

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria. Meteorological information has been obtained from the Sydney Observatory Hill weather station (ID 66214).

Table 1 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)
27 Waine Street, Freshwater. See Figure 2.	39	59	39	46	33	49

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

2.1.1.2 Results in accordance with the NSW Road Noise Policy (RNP)

In determining the required façade construction for the proposed building, in accordance with the internal noise level requirements of as listed in section 3 below, reference to the time periods listed in the NSW Road Noise Policy (RNP) has been conducted below.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria.

Table 2 Measured Ambient Noise Levels corresponding to the RNP Time Periods

Measurement Location	Daytime [1] 7:00 am to 10:00 pm	Night-time [1] 10:00 pm to 7:00 am
	L_{Aeq} (whole period) [2] (dBA)	L_{Aeq} (whole period) [2] (dBA)
27 Waine Street, Freshwater. See Figure 2.	58	46

Note 1: For Monday to Sunday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am.

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

2.1.2 Attended Noise Measurements

In addition to the unattended noise survey, an attended noise survey was carried out to establish levels at key locations within and surrounding the site. These are summarised below.

The attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter (serial number 2709757). Calibration of the sound level meter was checked prior to and following the measurements using a Brüel & Kjær Type 4231 sound calibrator (serial number 1275644). The calibrator emitted a calibration tone of 94 dB at 1 KHz. The drift in calibration did not exceed ±0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

Attended noise measurements were undertaken on Friday 29th July 2022 between 9:00am and 9:30am.

Results of the attended noise measurements are outlined in Table 3 below.

Table 3 Measured Results of the Attended Noise Survey

Measurement Location	Date and Time	Measured Noise Level (dBA)		Comments
		$L_{A90\ (15\text{-}min)}$[1]	$L_{Aeq\ (15\text{-}min)}$[2]	
Location 1: Waine Street (See Figure 2)	Friday 29th July 2022 ,9:00am to 9:30am	57	48	Distant traffic noise from Pittwater Road and occasional vehicle pass-by.

Note 1: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

3 ACOUSTIC CRITERIA

The acoustic criteria which have been adopted for this assessment are outlined below. All criteria have been separated into the relevant assessment type. These are: *Noise Intrusion Criteria* (Assessment of building envelope), Noise *Emission Criteria* (Assessment of noise to surrounding receivers) and *Acoustic Separation Criteria* (Assessment of acoustic privacy within the building).

3.1 Noise Intrusion Criteria

External noise intrusion into the building will generally be via the building envelope (External wall, glazing or external roof). The design of the building envelope should be such that the requirements listed below are achieved.

3.1.1 Warringah Council Development Control Plan (DCP) 2011

Warringah Council Development Control Plan (DCP) 2011 does not provide any site specific numerical objectives, in the absence of any requirements guidance from the Australian / New Zealand Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors - (AS/NZS 2107:2016), see below.

3.1.2 Australian / New Zealand Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors - (AS/NZS 2107:2016)

Recommended ambient noise levels and reverberation times for internal spaces are given in a number of publications including Table 1 of Australian / New Zealand Standard 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors"*. Unlike the previous version of this Standard, this latest edition recommends a range with lower and upper levels (rather than "satisfactory" and "maximum" internal noise levels) for building interiors based on room designation and location of the development relative to external noise sources. This change has occurred due to the fact that sound levels below 'satisfactory' could be interpreted as desirable, but the opposite may in fact be the case. Levels below those which were listed as 'satisfactory' can lead to inadequate acoustic masking resulting in loss of acoustic isolation and speech privacy.

Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this Standard. The levels for areas relevant to this development are given in Table 4 below. The mid to maximum points of the internal noise level ranges are generally adopted as the internal design noise criteria for the combined effect of mechanical services and external noise intrusion. In this report we will confine our recommendations to dBA levels, however, where the background noise appears to be unbalanced, AS/NZS 2107:2016 provides direction in terms of suitable diagnostic tools that can be used to assess the spectrum distribution of the background noise.

Table 4 Recommended Design Sound Levels

Type of Occupancy/Activity	Design sound level range dBA ($L_{Aeq,t}$)	Project Design Noise Level [1] dBA ($L_{Aeq,t}$)
Residential Buildings—		
Houses and apartments in suburban areas or near minor roads —		
Sleeping areas (nighttime)	30 to 35	**35**
Living areas (anytime)	30 to 40	**40**
Washrooms and toilets (anytime)	45 to 55	**50**
Note 1: Overall recommended level for mechanical services noise and intrusive noise, combined.		

Section 6.18 of AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

If tonal components are significant characteristics of the sound within a measurement time interval, an adjustment shall be applied for that time interval to the measured A-weighted sound pressure level to allow for the additional annoyance. If the background sounds include spectral imbalance, then the RC (Mark II) levels indicated in the Standard should be referenced (see also Appendix D of AS/NZ 2107:2016 for additional guidance).

Generally, where the final noise levels are within +/- 2 dB of the specified level given above, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied especially where privacy is important or where noise intrusion is to be avoided.

3.2 Noise Emission Criteria (Operational Criteria)

Noise emissions from the operation of the site impacting on the adjacent land users are outlined below.

3.2.1 Warringah Council Development Control Plan (DCP) 2011

External noise emission criteria are not provided in the Warringah Council Development Control Plan, as such the NSW EPA NPI outlined below will be adopted for this assessment.

3.2.2 NSW EPA Noise Policy for Industry (NPI) 2017

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled *Noise Policy for Industry* (NSW NPI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

3.2.2.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.2.2.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPI) minus 5 dB(A). To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the $L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

Where the resultant project amenity noise level is 10 dB or more lower than the existing traffic noise level, the project amenity noise levels can be set at 15 dB below existing traffic noise levels (i.e. *LAeq,period(traffic) minus 15 dBA*).

3.2.2.2.1 Area Classification

The NSW NPI characterises the "Urban Residential" noise environment as an area that has the following characteristics:

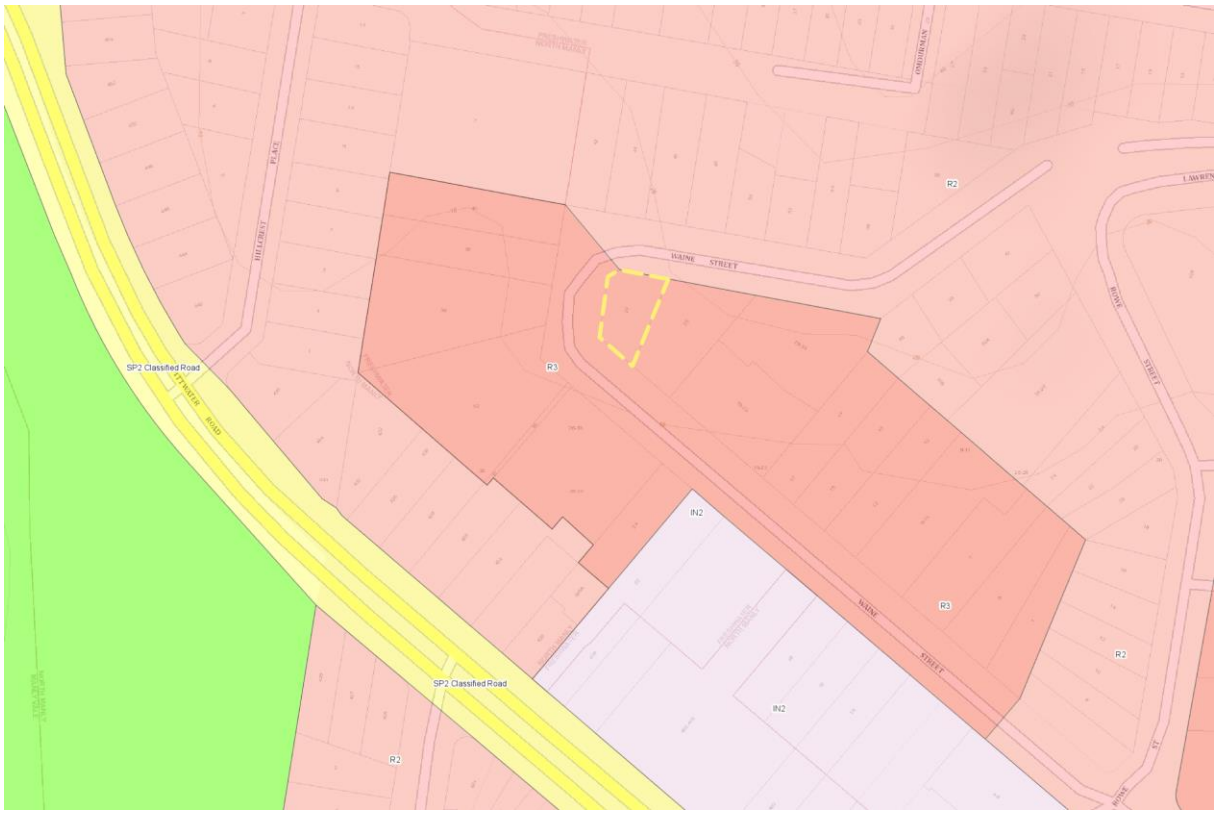
- An acoustical environment that:

  Urban –

  - *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.*

Figure 4 is obtained from the NSW Planning Portal and shows the land zoning map of the proposed development and the nearest sensitive receivers.

Figure 4 NSW Planning Portal – 27 Waine Street, Freshwater and Surrounds



As shown above, the site and its surrounding receivers are within are a mix of R2, R4 and IN2 zoning. Based on the acoustical characteristics measured and observed onsite as well as the description above, the surrounding residences are deemed Urban Residential.

For residential and non-residential receivers in an urban residential area, the recommended amenity criteria are shown in Table 5 below.

Table 5 NSW NPI – Recommended L_{Aeq} Noise Levels from Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2] (dBA)
Residence	Urban Residential	Day	60
		Evening	50
		Night	45
Commercial		When in use	65

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am.

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

3.2.3 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions, derived from the measured data, are presented in Table 6. These criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the development which can potentially affect noise-sensitive receivers.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted, which are shown in bold text in Table 6.

Table 6 External noise level criteria in accordance with the NSW NPI

Location	Time of Day [1]	Project Amenity Noise Level, $L_{Aeq, period}$ [2] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [3] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA)	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA)
Suburban Residences	Day	55	39	59	**44**	58
	Evening	45	39	46	**44**	48
	Night	40	33	49	**38**	43
Commercial	When in use	60	N/A	N/A	N/A	**63**

Note 1: For Monday to Saturday, Daytime 7:00 am – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 10:00 pm; Night-time 10:00 pm – 8:00 am.

Note 2: Project Amenity Noise Levels corresponding to the discussion in Section 3.2.2 (i.e. existing L_{Aeq} noise level -15dBA).

Note 3: L_{A90} Background Noise or Rating Background Level.

Note 4: Project Noise Trigger Levels are shown in bold and underline.

Note 5: Calculated based on the attended and unattended noise surveys.

Note 6: Adjusted based on the traffic affected level outlined in section 3.2.2.2 (i.e. LAeq,period(traffic) minus 15 dBA).

3.3 Acoustic Separation Criteria

Acoustic separation between apartments/dwellings within the development must comply with the requirements listed below.

3.3.1 National Construction Code (NCC) & Building Code of Australia (BCA) 2019

The Building Code of Australia (BCA) is a uniform set of technical provisions for the design and construction of buildings and other structures throughout Australia. The BCA is produced and maintained by the Australian Building Codes Board (ABCB) and given legal effect through the Building Act 1975. The National Construction Code (NCC) comprises the Building Code of Australia and the Plumbing Code of Australia (the Plumbing Code of Australia is given legal effect through the Plumbing and Drainage Act 2002 (Qld)) and is published in three volumes. Volumes one and two relate to the BCA.

Part F5 of Volume One of the BCA / NCC provides the Sound Transmission and Insulation requirements for Class 2 or 3 buildings. These requirements are identified below:

3.3.1.1 Inter-Tenancy Walls (Sole Occupancy Unit to Sole Occupancy Unit (SOU-SOU))

Section FP5.2 of the BCA requires:

Walls separating sole-occupancy units or a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification, must provide insulation against the transmission of -

a) airborne sound; and

b) impact generated sound, if the wall is separating a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit,

Sufficient to prevent illness or loss of amenity to the occupants.

F5.5 of the BCA provides the sound insulation performance rating of walls as follows:

a) A wall in a Class 2 or 3 building must –

i. have an Rw + Ctr (airborne) not less than 50, if it separates sole-occupancy units; and

ii. have an Rw (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

iii. comply with F5.3(b) if it separates—

a) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

b) a sole-occupancy unit from a plant room or lift shaft.

b) A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an Rw not less than 30.

c) A wall in a Class 9c building must have an Rw not less than 45 if it separates—

i. sole-occupancy units; or

ii. a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room.

d) In addition to (c), a wall separating a sole-occupancy unit in a Class 9c building from a kitchen or laundry must comply with F5.3 (b).

e) Where a wall required to have sound insulation has a floor above, the wall must continue to -

i. the underside of the floor above; or

ii. a ceiling that provides the sound insulation required for the wall.

f) Where a wall required to have sound insulation has a roof above, the wall must continue to-

i. the underside of the roof above; or

ii. a ceiling that provides the sound insulation required for the wall.

FV5.2 states that compliance with FP5.2(a) to avoid the transmission of airborne sound through walls is verified when it is measured in-situ that –

a) a wall separating sole-occupancy units has a weighted standardised level difference with spectrum adaptation term (DnT,w + Ctr) not less than 45 when determined under AS/NZS 1276.1 or ISO 717.1; or

b) a wall separating a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification, has a weighted standardised level difference (DnT,w) not less than 45 when determined under AS/NZS 1276.1 or ISO 717.1; or

c) any door assembly located in a wall that separates a sole-occupancy unit from a stairway, public corridor, public lobby, or the like, has a weighted standardised level difference (DnT,w) not less than 25 when determined under AS/NZS 1276.1 or ISO 717.1.

F5.3 (b) states the following:

a) A floor in a building required to have an impact sound insulation rating must -

i. have the required value for weighted normalised impact sound pressure level (Ln,w) determined in accordance with AS ISO 717.2 using results from laboratory measurements; or

ii. comply with Specification F5.2.

b) A wall in a building required to have an impact sound insulation rating must -

i. for a Class 2 or 3 building be of discontinuous construction; and

ii. for a Class 9c building, must—

a) for other than masonry, be two or more separate leaves without rigid mechanical connection except at the periphery; or

b) be identical with a prototype that is no less resistant to the transmission of impact sound when tested in accordance with Specification F5.5 than a wall listed in Table 2 of Specification F5.2.

c) For the purposes of this Part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

i. for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

ii. for other than masonry, there is no mechanical linkage between leaves except at the periphery.

3.3.1.2 Inter-Tenancy Floors (Sole Occupancy Unit to Sole Occupancy Unit (SOU-SOU))

Section FP5.1 of the BCA states that for Class 2 or 3 buildings:

Floors separating -

a) sole-occupancy units; or

b) sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or a part of a different classification,

must provide insulation against the transmission of airborne and impact generated sound sufficient to prevent illness or loss of amenity to the occupants.

F5.4 provides the sound insulation performance rating of floors as follows:

a) A floor in a Class 2 or 3 building must have an Rw+Ctr (airborne) not less than 50 and an Ln,w (impact) not more than 62 if it separates—

(i) sole-occupancy units; or

(ii) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

b) A floor in a Class 9c building separating sole-occupancy units must have an Rw not less than 45.

FV5.1 states that compliance with FP5.1 is verified when it is measured in-situ that the separating floor has -

a) airborne: a weighted standardised level difference with spectrum adaptation term (DnT,w + Ctr) not less than 45 when determined under AS/NZS 1276.1 or ISO 717.1; and

b) impact: a weighted standardised impact sound pressure level with (LnT,w) not more than 62 when determined under AS ISO 717.2.

3.3.1.3 Summary of BCA Acoustic Requirements

A summary of the acoustic requirements of the NCC 2019 for Class 2 or 3 buildings is given in Table 7 below.

Table 7 NCC 2019 Sound Insulation Requirements

Construction	2019 NCC	
	Laboratory performance requirements	**Verification method**
Walls between sole occupancy units	$R_w + C_{tr}$ not < 50	$D_{nT,w} + C_{tr}$ not < 45
Walls between a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit and a habitable room (other than a kitchen) in an adjoining unit	$R_w + C_{tr}$ not < 50 and Must have a minimum 20 mm cavity between two separate leaves	$D_{nT,w} + C_{tr}$ not < 45 "Expert Judgment" Comparison to the "Deemed to satisfy" Provisions
Walls between sole occupancy units and a plant room or lift shaft	R_w not < 50 and Must have a minimum 20 mm cavity between two separate leaves[1]	$D_{nT,w}$ not < 45
Walls between sole occupancy units and a stairway, public corridor, public lobby or the like, or parts of a different classification	R_w not < 50	$D_{nT,w}$ not < 45
Door assemblies located in a wall between a sole-occupancy unit and a stairway, public corridor, public lobby or the like	R_w not < 30 [2]	$D_{nT,w}$ not < 25
Floors between sole-occupancy units or between a sole-occupancy unit and a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	$R_w + C_{tr}$ not < 50 $L_{n,w}$ not > 62	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w}$ not > 62
Soil, waste, water supply and stormwater pipes and ductwork to habitable rooms	$R_w + C_{tr}$ not < 40	n/a

Soil, waste, water supply and stormwater pipes and ductwork to kitchens and other rooms	$R_w + C_{tr}$ not < 25	n/a
Intra-tenancy Walls	There is no statutory requirement for airborne isolation via intra-tenancy walls.	

Note 1: A wall must be of "discontinuous construction" if it separates a sole occupancy unit from a plant room or lift shaft. Clause F5.3(c) defines "discontinuous construction" as a wall having a minimum 20mm cavity between two separate leaves with no mechanical linkage except at the periphery.

Note 2: Clause FP5.3(b) in the 2016 BCA states that the required insulation of a floor or wall must not be compromised by a door assembly.

Note 3: Masonry walls must be laid with all joints filled solid, including those between the masonry and any adjoining construction

4 ACOUSTIC ASSESSMENT

In addressing the noise and vibration criteria which are established above, each component of the development is assessed and presented below.

4.1 Noise Intrusion – Building Envelope

4.1.1 Glazing Recommendations

The recommended sound transmission loss requirement required to satisfy the specified internal noise level criteria outlined above are summarised in Table 8 below.

Please note these recommendations are also based on the floor details shown in the architectural drawings included in Appendix C.

Table 8 In-principle Glazing Recommendations

Location	Level	Space	Minimum Glazing System Rating Requirements [1]	Indicative Construction [1]
Future Northern Façade	All levels	Sleeping areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
		Living areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
		Washrooms, laundry & toilets	Rw (C;Ctr): 27 (0;-3)	Doors and windows with 4mm float glass and acoustic rated seals, see description below.
Future Eastern Façade (25 Waine Street)	All levels	Sleeping areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
		Living areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
		Washrooms, laundry & toilets	Rw (C;Ctr): 27 (0;-3)	Doors and windows with 4mm float glass and acoustic rated seals, see description below.
Future Southern Façade	All levels	Sleeping areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
		Living areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
Future Western Façade	All levels	Sleeping areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.
		Living areas	Rw (C;Ctr): 31 (0;-3)	Doors and windows with 6.38mm laminate glass and acoustic rated seals, see description below.

Please note for windows, this performance is not only subject to the glazing selection but also to the construction of the window frame and the frame seal selection. Therefore, it is recommended that the window manufacturer should confirm that the required sound insulation can be achieved. It is anticipated that the window system should comprise Q-Lon (or equivalent) or fin seals with deep C channels as part of the window track **(i.e. Performance levels outlined above need to be achieved with glazed panels + frame + seals).**

4.1.2 External Wall Construction

External wall constructions will be constructed from either a solid dense construction (i.e. like a masonry or concrete) or light weight cladding systems. In the event the external wall is constructed from a solid dense construction as summarised above, no further acoustic upgrading is required.

However, in the event the external walls are constructed from a lightweight cladding system, the following construction is recommended.

Table 9 Recommended Light Weight External Wall Construction

Location	Occupancy Area [1]	External Lining	Studwork System	Internal Lining
All Facades	Sleeping areas	Proposed Architectural Cladding	Minimum 92mm Steel Studwork + 75mm thick 14kg/m^3 glasswool insulation	1 x 13mm layers of Standard Plasterboard.
	Living areas			
	Washrooms, laundry & toilets			1 x 13mm layers of Standard Plasterboard **OR** 1 x 6mm Fibre Cement Sheeting

Note 1: Recommended constructions are identical for each level.

Note 2: These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are approved.

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

4.1.3 External Roof Construction

External roofing system will be a concrete construction. As such, no further acoustic treatments are required. If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

4.2 Noise from Engineering Services

At this stage of the project, the exact location of key plant items has not been selected, and or the selection of items to be installed. As such a detailed assessment of noise associated from engineering services cannot be undertaken.

However, to ensure that future selections of plant items meet external noise levels at neighbouring properties a proof of concept approach has been considered.

In our experience, for this type of development the following mechanical systems would be installed, and their associated sound power levels are outlined below.

- Residential toilet exhaust fans – 45dBA (Lw)
- Air conditioning condensers – 75dBA (Lw)
- Basement Ventilation Systems – 85dBA (Lw)

It is anticipated apartment toilet exhaust fans for the units will individually discharge along the façade utilising a façade louvre above the glazed elements. It is recommended that 1m with acoustic flexible ducting is used on the intake and discharge side of the fan. On this assumption, compliance would be achieved.

Air conditioning condensers could be located on the balconies of each dwelling along the external wall or on the roof. Based on a typical sound power level of a condenser unit, the following acoustic treatments are recommended to be installed.

- Condenser plant are to be isolated from the base building structure with a rubber pad.
- Night operation mode must be in operation between 9:00pm and 7:00am and provided a minimum of 4-5dBA.
- High performing acoustic louvres which will provide a high level of noise reduction whilst maintaining the required airflow may be required. However, this is subject to final selections and should be reviewed prior to installation.

For the basement ventilation systems, it is anticipated that the physical fans would be installed within the basement level with mechanical risers moving air to above ground level or to the roof or ground level. A dedicated plant room has been provided in the centre of the ground floor plate. On the assumption of the Sound Power Level above and the ductwork that is installed is acoustically treated with 50mm internal lining or attenuators (depending on the exact location), compliance would be achieved. A detailed review should be undertaken prior to the issue of the Construction Certificate once selections and locations are finalised.

4.3 Driveway Entry System (i.e. Roller Shutter or Gates)

At this stage of the project, the exact model or design for the carpark entry system (i.e. roller shutter or gate systems) has not been selected. As such a detailed assessment of noise associated from the system cannot be undertaken.

However, to ensure that future selections and design meet external noise levels at neighbouring properties the following indicative principle recommendations are included.

All motorised carpark access doors are required to be vibration isolated from the building structure such that internal noise levels within any habitable areas does not exceed 30 dB(A).

Where access doors are fixed to the building structure the access door frame should also be vibration isolated from the building structure using an appropriately selected mounting system. The doors mechanical motor should be supported off the isolated door frame.

4.4 Additional Traffic on Public Roads

Noise impacts from the increase in vehicle movements along Waine Street are to be assessed in accordance with the NSW EPA *Road Noise Policy (RNP) 2011*.

A review of the project traffic assessment results in a minor increase in traffic along Waine Street and will not exceed a 2dBA increase as summarised in the NSW EPA RNP *to be barely perceptible to the average person* and therefore considered acoustically acceptable.

4.5 Acoustic Separation

As this project is still within the development approval phase, information regarding the proposed constructions that will be separating units within the development is not known at this stage. As such, a detailed review of the constructions for compliance with the airborne and impact ratings from the National Construction Code cannot be undertaken. It is usual for such work to be conducted at the Construction Certificate (CC) stage of the development. The required airborne and impact ratings have been presented in section 3.3.1 of this report.

5 CONCLUSION

Pulse White Noise Acoustics (PWNA) has been engaged to undertake an acoustic assessment of the proposed redevelopment of 27 Waine Street, Freshwater. As part of this assessment, we have undertaken a review of the building envelope, noise emissions from the use of the site as well as establish the applicable acoustic separation requirements. From this assessment we note the following:

- Minimum acoustic performances and associated indicative constructions for the building envelope have been provided in section 4.1 of this report. The recommended treatments have been provided to ensure compliance with the objectives presented in 3.1.

- To control noise impacts at external receivers, recommended indicative treatments for major engineering services have been provided in section 4.2. From our review we have formulated the following opinion that at this stage of the project the exact selections/locations of plant items are not known. A preliminary assessment however has been carried out using our experience with similar types of developments and the typical plant items installed.

- Noise associated with the operation of the basement entry system has been reviewed and will comply on the proviso the recommended treatments above are installed.

- Noise associated with additional traffic on Public Roads has been reviewed and determined to not exceed the existing conditions by 2dBA, therefore compliance with the NSW Road Noise Policy is achieved.

- Establishment of the acoustic requirements for the separation between units within the development has been formulated in accordance with the National Construction Code (NCC). Details of the constructions are not known at this stage of the project. It is recommended that a detailed review is undertaken at the Construction Certificate (CC) stage to ensure all requirements are achieved.

For any additional information please do not hesitate to contact the person below.

Regards,

Matthew Furlong
Principal Acoustic Engineer
PULSE WHITE NOISE ACOUSTICS PTY LTD

APPENDIX A – ACOUSTIC GLOSSARY

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

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value

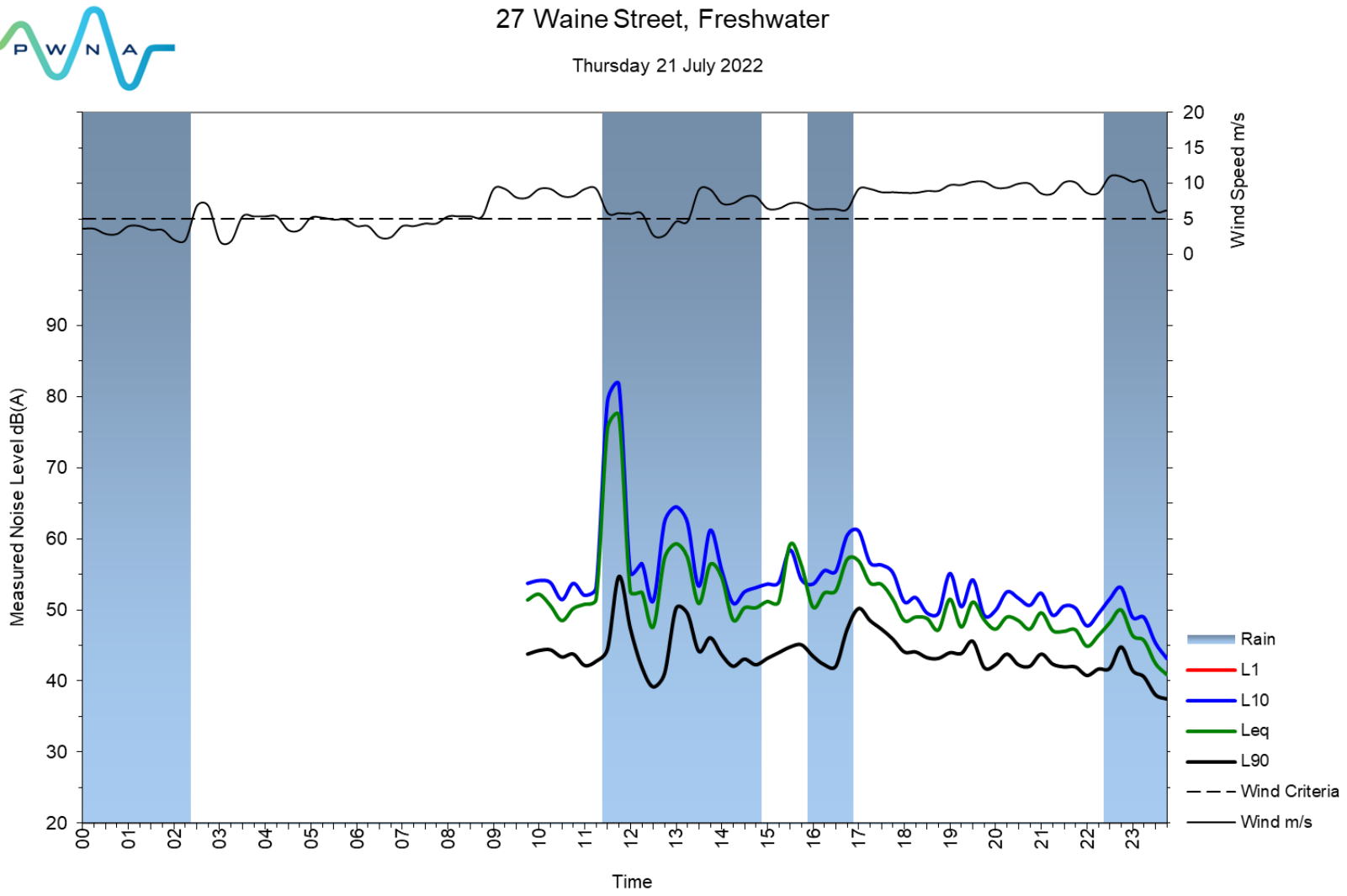
Ctr	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
dB (A)	'A' Weighted overall sound pressure level
Noise Reduction	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
NR Noise Rating	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the "A" weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
Rw	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for Rw are defined in ISO 140-2:1991 "Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data".
R'w	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
Sound Isolation	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term "sound isolation" does not specify any grade or performance quality and requires the units to be specified for any contractual condition
Sound Pressure Level, LP dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Transmission Loss	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.

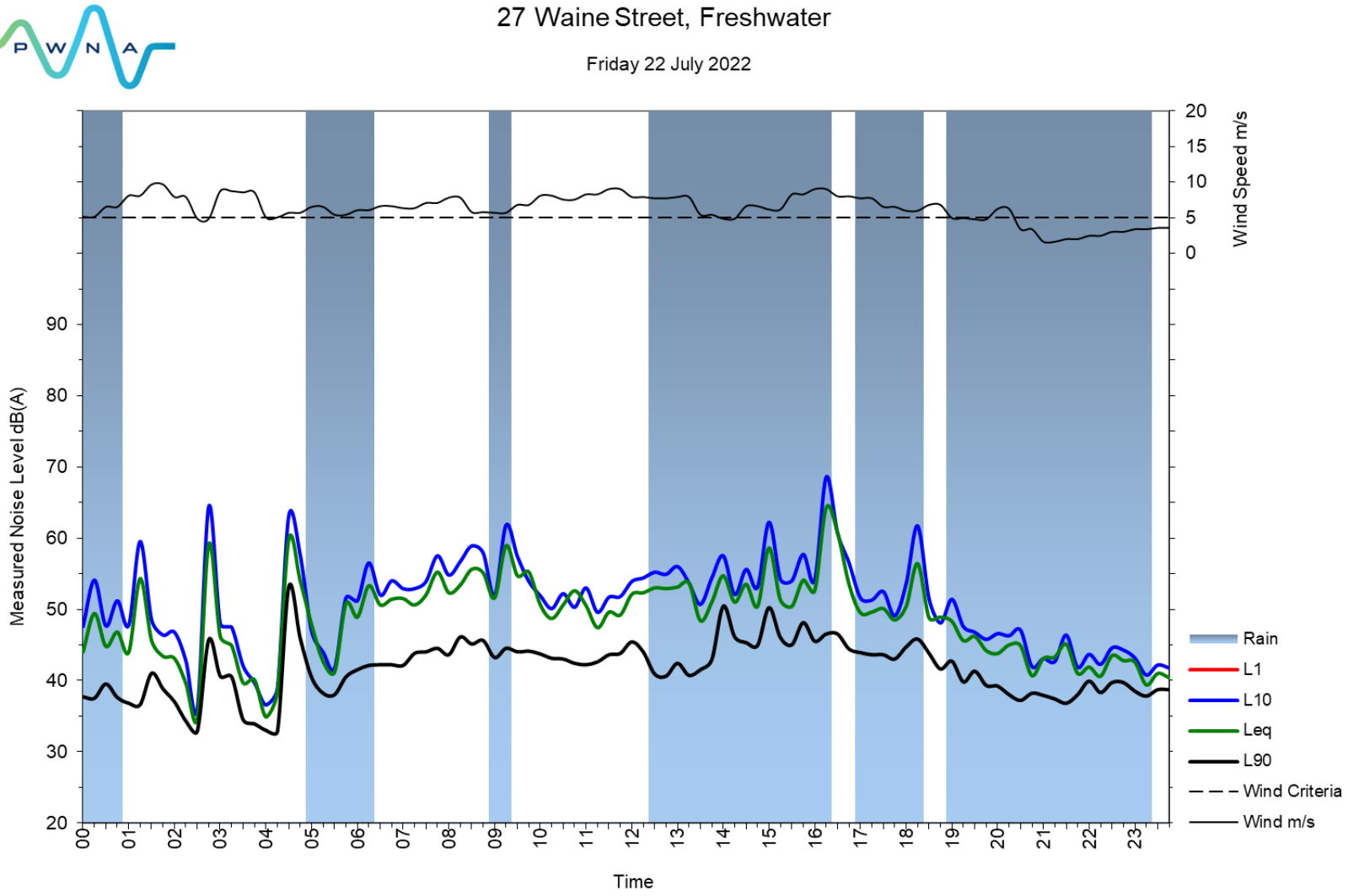
APPENDIX B – UNATTENDED NOISE MONITORING RESULTS

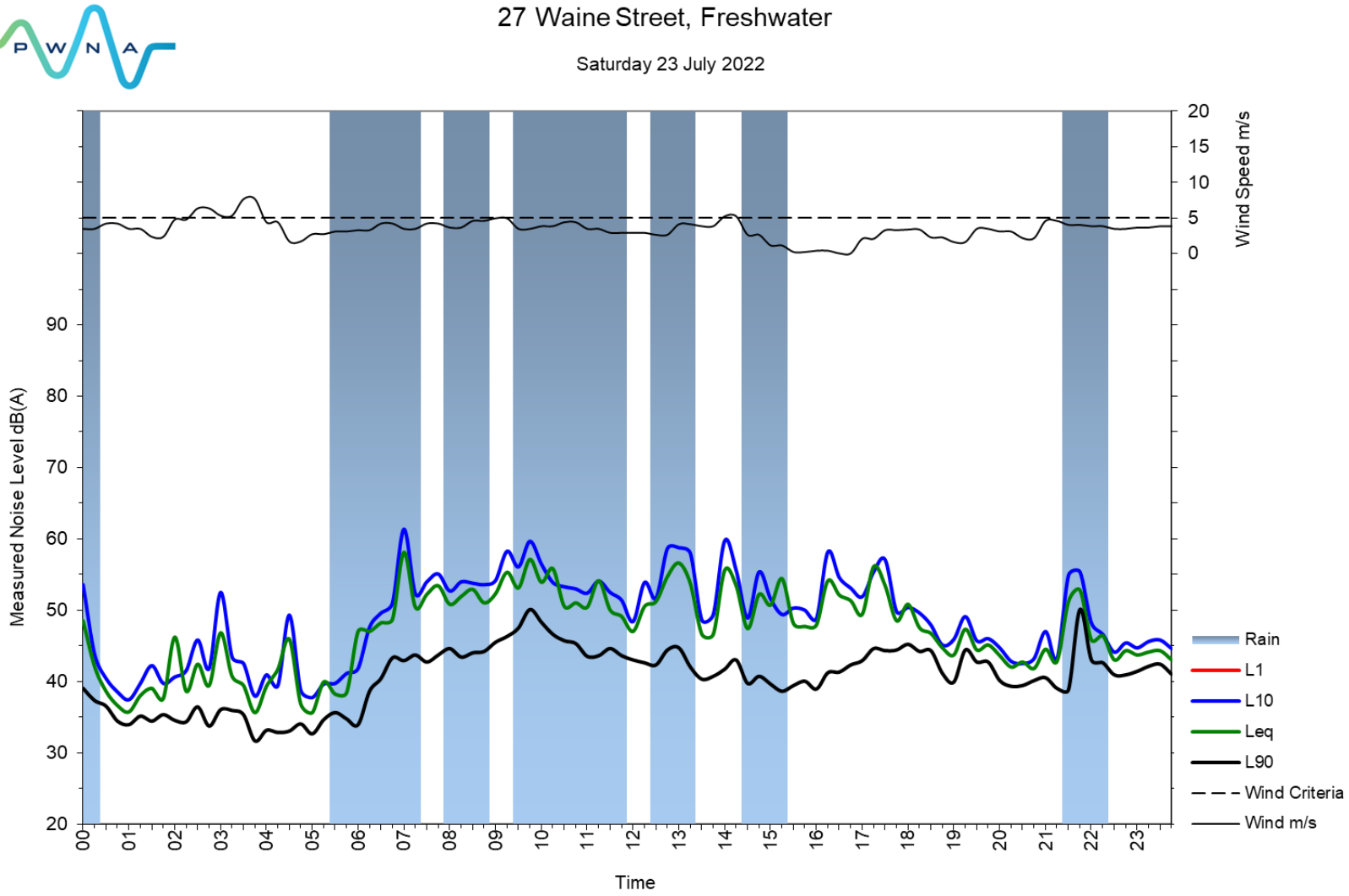
Weather Station: Sydney Observatory Hill AWS (ID: 66214)

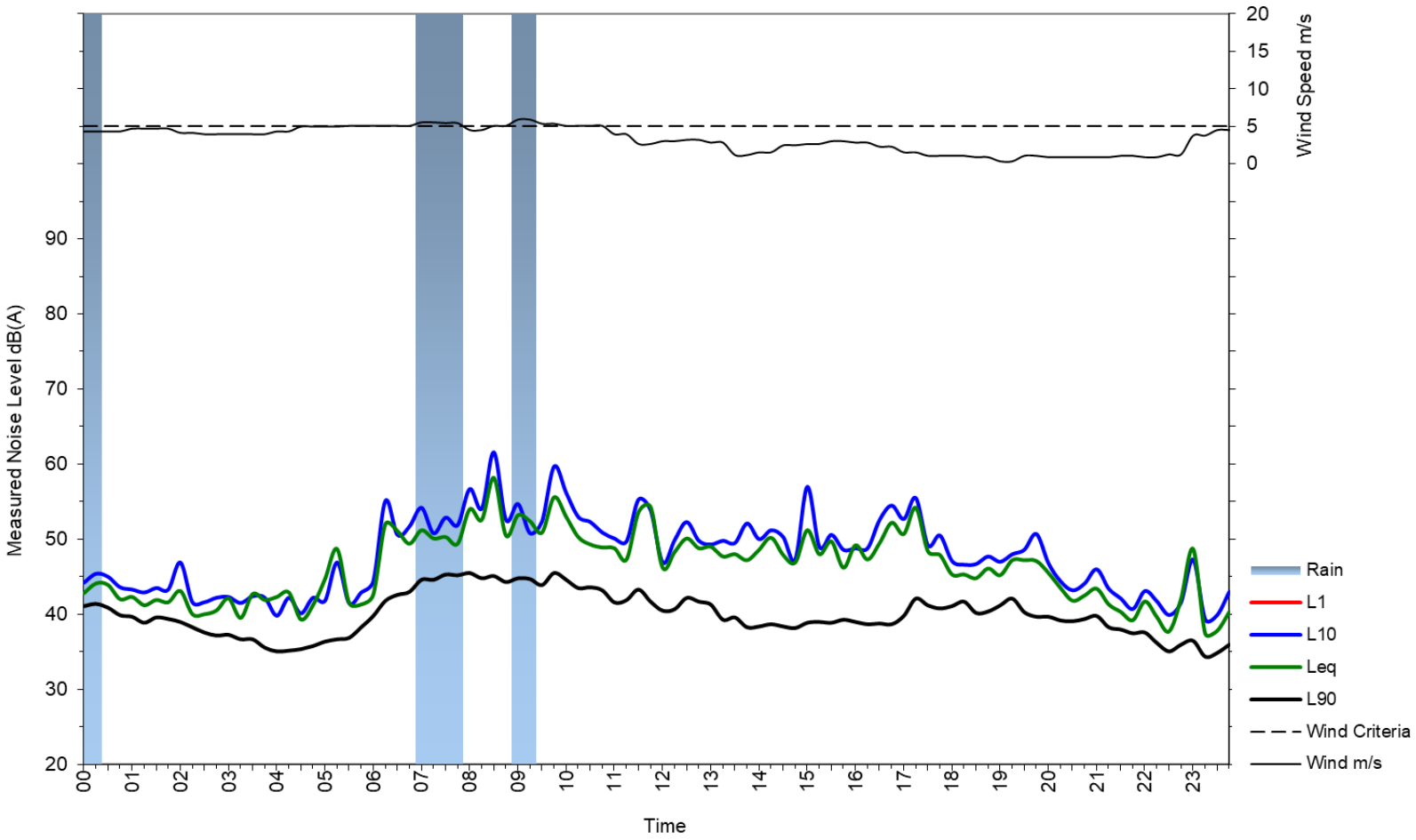
Weather Station ID: 066214

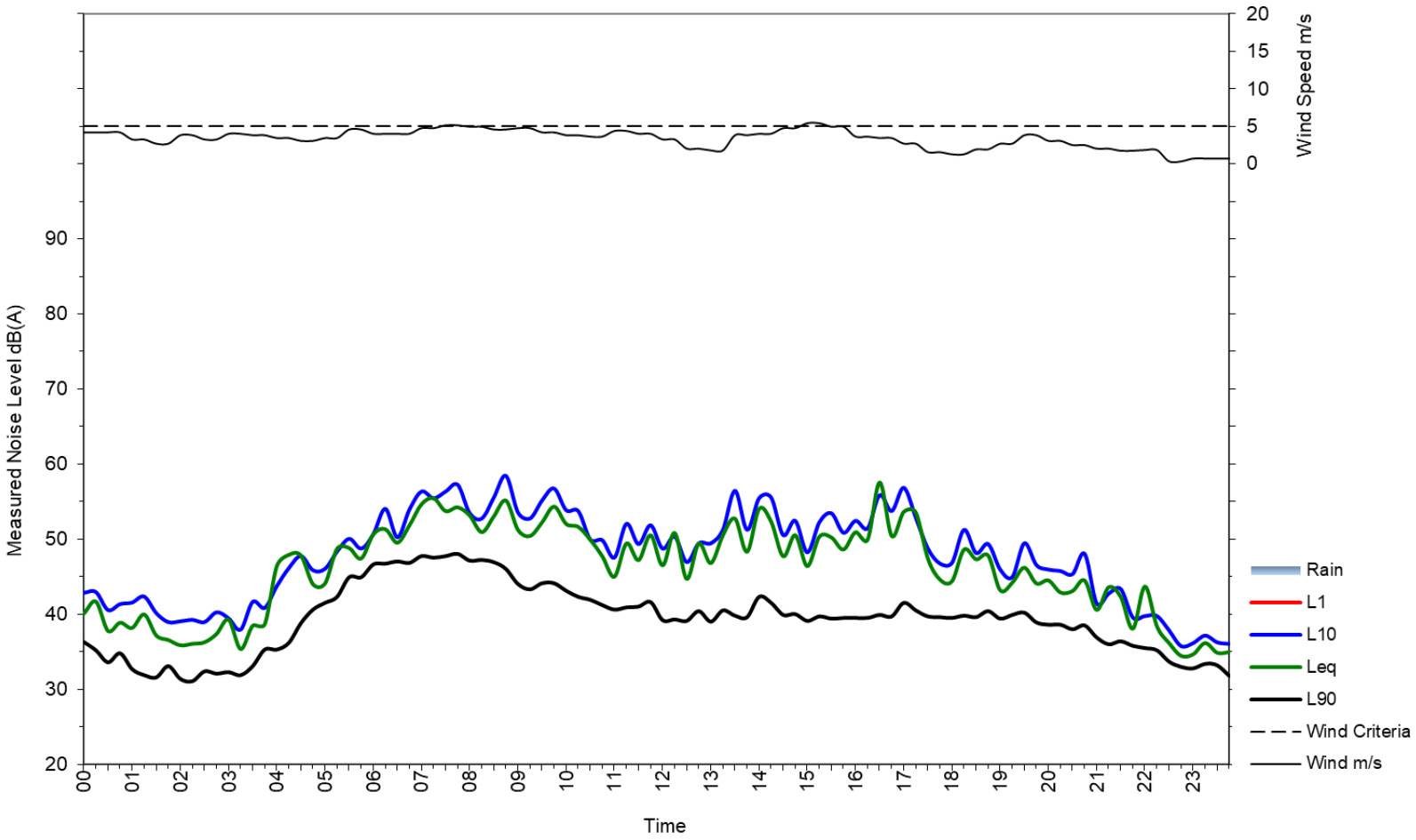
Co-ordinates: Lat: -33.8593°S, Lon: 151.2048°E, Height: 44.0 m

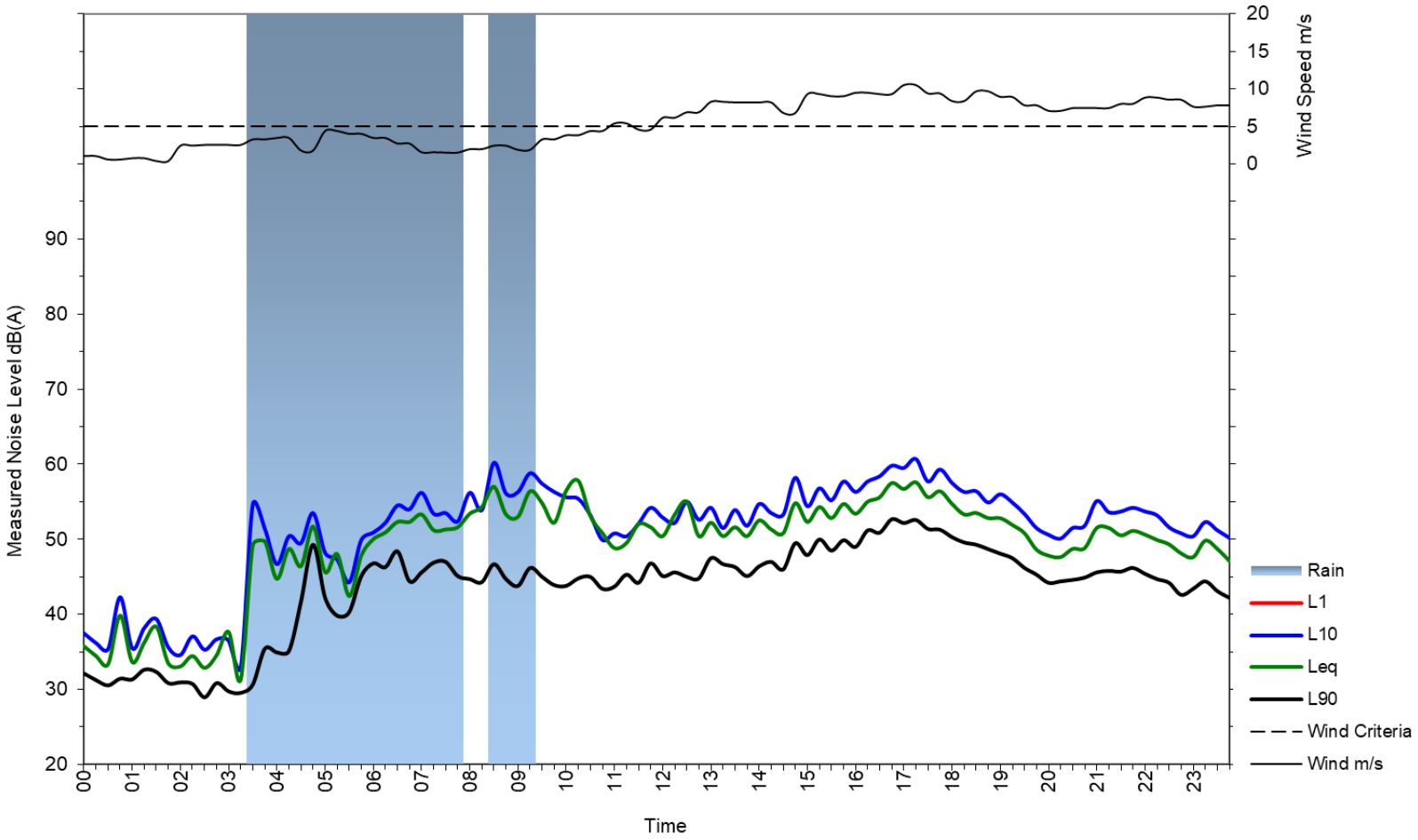

27 Waine Street, Freshwater
Thursday 21 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

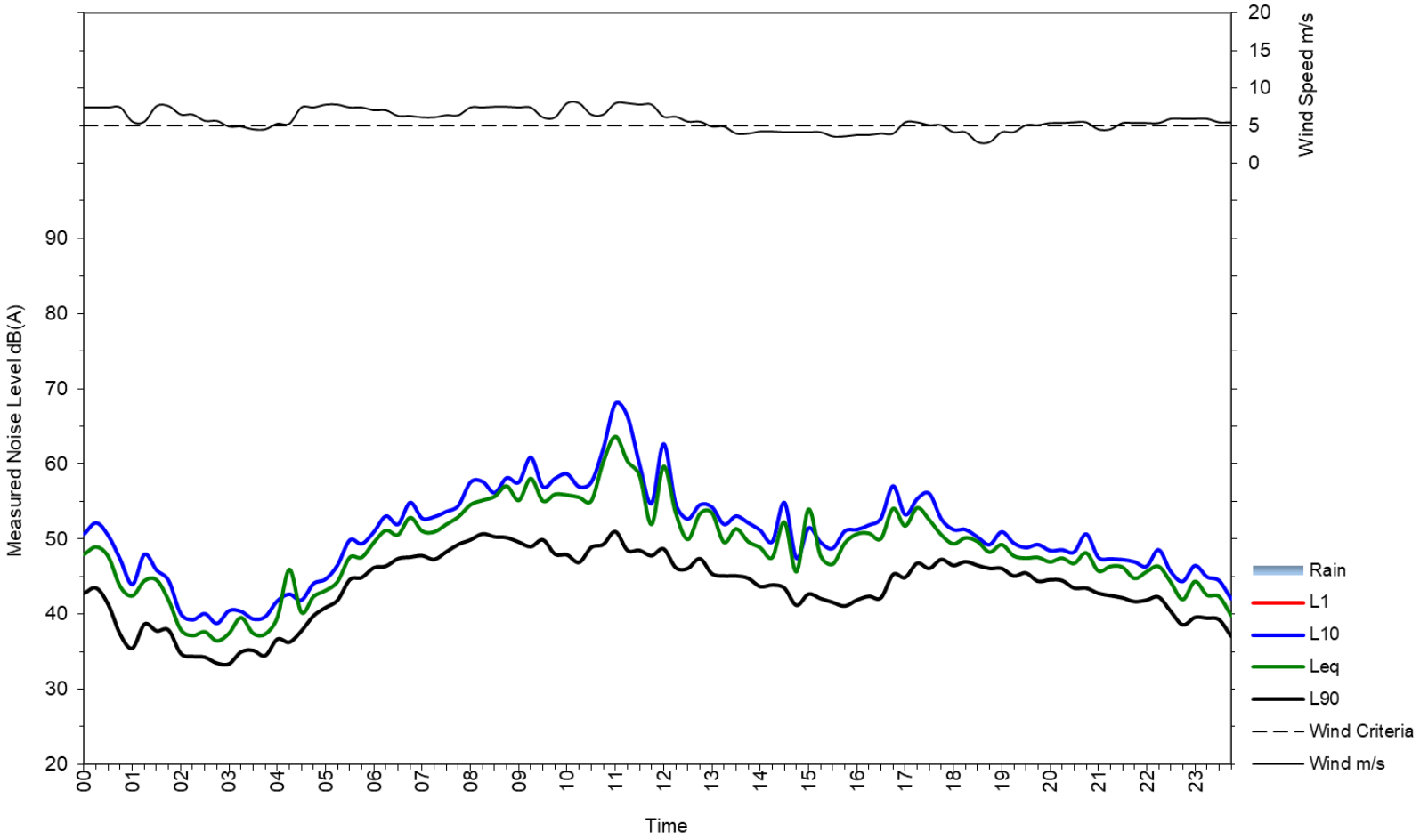

27 Waine Street, Freshwater
Friday 22 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

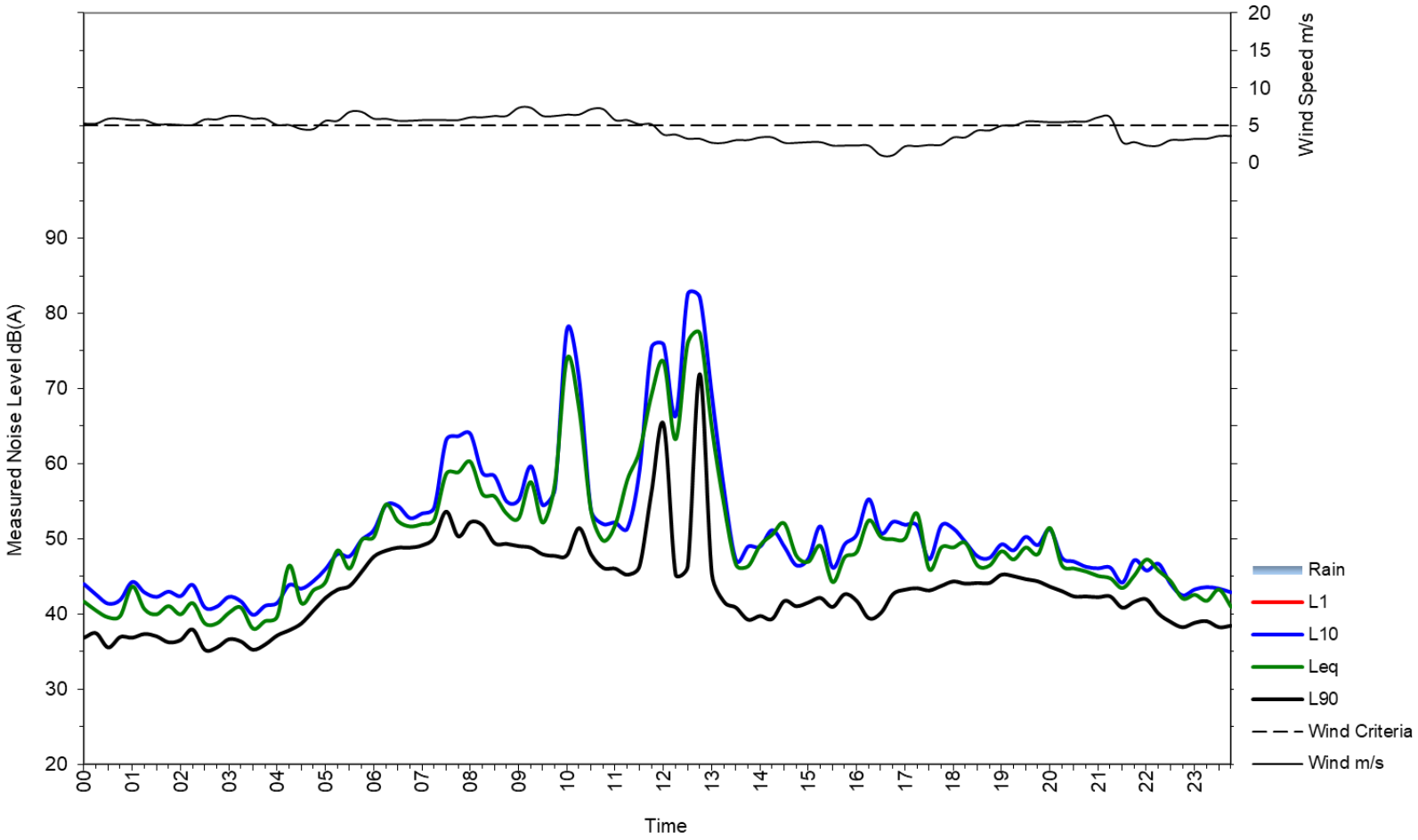

27 Waine Street, Freshwater
Saturday 23 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


27 Waine Street, Freshwater
Sunday 24 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


27 Waine Street, Freshwater
Monday 25 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


27 Waine Street, Freshwater
Tuesday 26 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


27 Waine Street, Freshwater
Wednesday 27 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


27 Waine Street, Freshwater
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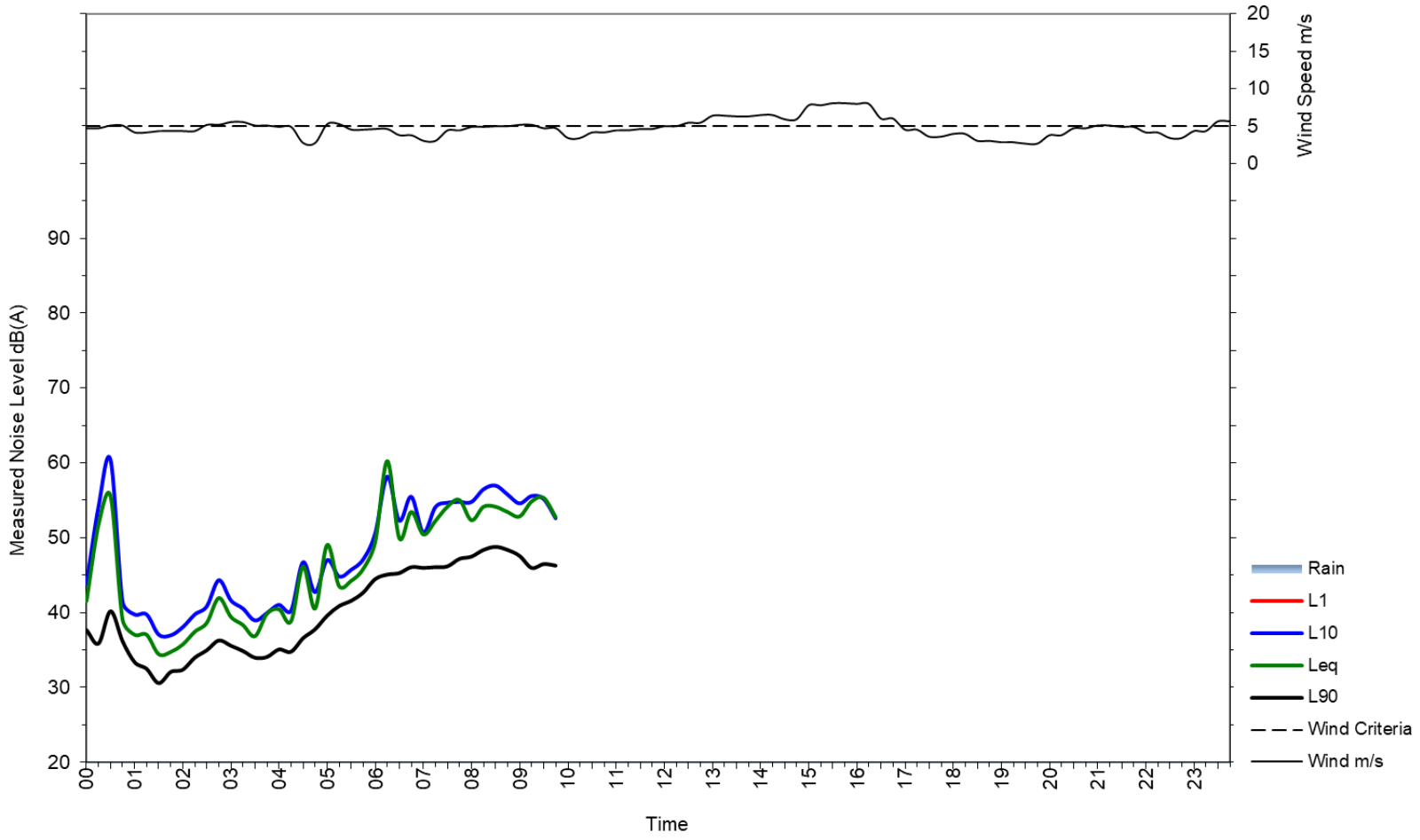
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


27 Waine Street, Freshwater
Friday 29 July 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s