40-76 William Street, Leichhardt

SSD Application

Noise and Vibration Impact Assessment

Anprisa

Report number: 250459 - 40-76 William St, Leichhardt - SSD Noise and Vibration Impact Assessment-R1
Date: 16 October 2025
Version: For Information

PULSE WHITE NOISE ACOUSTICS Suite 601, L6, 32 Walker St, North Sydney NSW 2060
P 1800 4 PULSE (1800 478 573) **E** info@pwna.com.au **pwna.com.au** ABN 95 642 886 306

DOCUMENT CONTROL

Project Name	40-76 William Street, Leichhardt
Project Number	240474
Report Reference	250459 - 40-76 William St, Leichhardt - SSD Noise and Vibration Impact Assessment-R1
Client:	Anprisa

Revision	Description	Reference	Date	Prepared	Checked	Authorised
0	For Information	250459 - 40-76 William St, Leichhardt - SSD Noise and Vibration Impact Assessment-R0	17 July 2025	Ben White	Matt Furlong	Ben White
1	For Information	250459 - 40-76 William St, Leichhardt - SSD Noise and Vibration Impact Assessment-R0	16 October 2025	Ben White	Matt Furlong	Ben White

PREPARED BY:

Pulse White Noise Acoustics Pty Ltd
ABN 95 642 886 306
Suite 601, Level 6, 32 Walker Street, North Sydney, 2060
1800 4 PULSE

TABLE OF CONTENTS

TABLES

FIGURES

1 INTRODUCTION

Pulse White Noise Acoustics Pty Ltd (PWNA) has been engaged by Anprisa to undertake an acoustic assessment for the proposed residential development located at 40-76 William Street, Leichhardt as part of the SSD-119545240 submission of the project.

This assessment will address the following:

- Potential surrounding environmental noise intrusion impacts on the development (i.e., traffic and other noise external noise sources).
- Noise emissions on nearby receivers from operation of the base building services (i.e., electrical, hydraulic and mechanical plant).
- Construction noise and vibration impact during the construction stage of the project.

This report will discuss the relevant acoustic criteria which have been adopted as well as the outcome of the assessment.

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

The proposed project to be included in the site includes the following:

1. Construction of a residential flat building including 203 units, inclusive of 5% affordable housing
2. Two basement levels
3. Public domain works

This assessment includes the acoustic investigation into the potential for noise impacts from the operation of the completed project as well as potential noise impacts from existing noise sources within the vicinity of the site which predominantly includes traffic noise from surrounding roadways within proximity of the site as well as aircraft noise from aircraft using Sydney International airport.

1.1 Relevant Guidelines

Acoustic criteria which have been adopted in this assessment include requirements from the local and state authorities and in the absence of any applicable criteria from these bodies, Australian and International Standards will be utilised, including those required to comply with the Industry SEARs which include the following:

10. Noise and Vibration • Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (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.	Noise and Vibration Impact Assessment

2 PROJECT DETAILS

2.1 Site Location

The proposed development is located at 40-76 William Street, Leichhardt. The surrounding receivers to the site include the following:

1. Existing residential dwellings to the east of the site on Francis Steet.
2. Existing residential dwellings to the west of the site on North Street.

The site location is detailed in Figure 2-1 below, including the location of the noise survey completed at the site.

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

Receiver 1: Residential receivers to the north of the site opposite on William Street.

Receiver 2: Residential receivers to the north east of the site opposite on William Street.

Receiver 3: Residential receivers to the east of the site opposite on William Street.

Receiver 4: Residential receivers to the south east of the site opposite on William Street.

Receiver 5: Residential receivers to the south of the site opposite on William Street.

Receiver 6: Residential receivers to the south west of the site opposite on William Street.

Receiver 7: Residential receivers to the west of the site opposite on North Street.

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

Figure 2-1 Site location and Noise Measurement Locations

2.2 Project Description

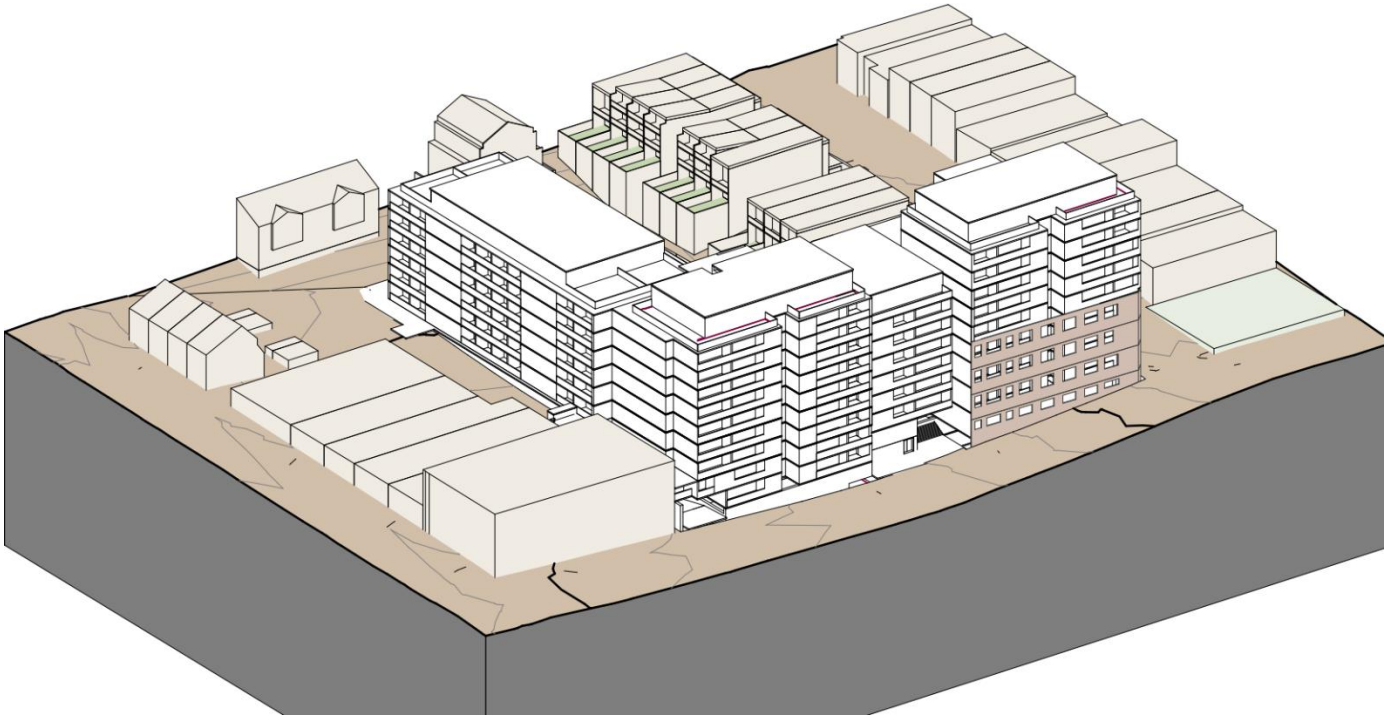
The proposed residential project is to be located at 40-76 William Street, Leichhardt and is located within an area defined for acoustics as suburban of the Inner West Council local government area.

The proposed project includes the following:

1. Construction of a residential flat building including 203 units, inclusive of 5% affordable housing
2. Two basement levels
3. Public domain works

The proposed development is detailed in the Woods Bagot Architectural drawings, including as part of the SSD submission. The proposed development is detailed in the figure below including the 3D Image.

Figure 2-2 Proposed Development Details, 3D Image



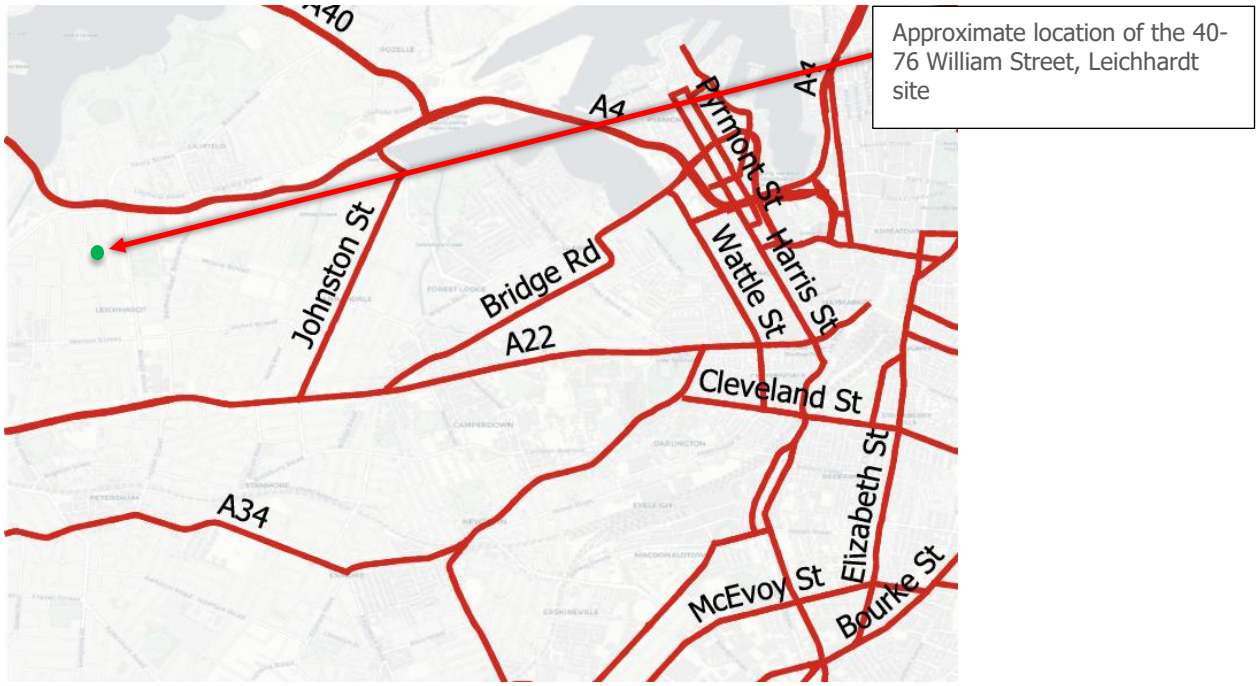
3 EXISTING ACOUSTIC ENVIRONMENT

The 40-76 William Street, Leichhardt site is located with an area which is classified as Suburban residential area as defined by the NSW EPA *Noise Policy for Industry*. The exiting noise levels at the site are predominantly as a result from traffic noise within the vicinity of the site on surrounding roadways including William Street to the north of the site.

The site is located in an area where all surrounding Roadways are not defined as busy roads which carry over 20,000 Annual Average Daily Traffic (AADT) number as defined in Map 12D of the RTA's *Traffic Volume Maps for Noise Assessment for Buildings on Land Adjacent to Busy Roads*.

See the Figure below which includes the site location included on Map 12D of the RTA.

Figure 3-1 Site Location of Map 12D of the RTA's *Traffic Volume Maps for Noise Assessment for Buildings on Land Adjacent to Busy Roads*



The 40-76 William Street, Leichhardt site is located to the southern side of William Street which would be classified as a Suburban area. The exiting noise levels at the site are predominantly as a result from traffic noise within the vicinity of the site and aircraft fly overs from landing and take offs from Sydney International Airport. Existing receivers within the vicinity of the site include residential receivers.

3.1 Noise Descriptors and Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure noise in terms of quantifiable time periods with statistical descriptors. Typically environmental noise is measured over 15 minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' linear arithmetic does not apply, e.g. adding two sound sources of equal values result in an increase of 3 dB (i.e. 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels. The L_{Aeq} noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included in Appendix A.

3.2 Noise Survey Results

As part of this assessment an acoustic survey has been undertaken at the site which include both long term unattended noise monitoring as well as short term attended measurements. The details of the noise survey conducted at the site are detailed in this section of the report.

3.2.1 Unattended Acoustic Monitoring

To determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at the site. The location of the noise monitoring is detailed in Figure 2-1 above. As per Table A1 of the Noise Policy for Industry, the noise logger was placed in the vicinity of the reasonably most or potentially most affected residence.

3.2.1.1 Monitoring Instrumentation

Instrumentation used for the noise survey comprised a Rion NL-42 sound level meter / analysers (serial number 00409024 fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. 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. These charts, representing each 24 hour period, show the L_{A10}, L_{Aeq} and L_{A90} noise levels measured over 15 minute time periods.

Logging was conducted continuously between the 11th and the 21st July 2024. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology weather station at Sydney Airport. Detailed noise logging results are shown in Appendix B.

The measured background noise data of the logger was processed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry* (NPI).

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 the night. The RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 1 for the unattended logging. The measured noise levels are considered to be representative of the levels to be expected at the nearest and most affected residence to the proposed development.

Table 1 Measured ambient noise levels in accordance with the NSW NPI

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]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Logger Location	36	60	35	57	31	50

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.

3.2.2 Attended Noise Measurements

Attended noise testing was conducted at the site to supplement the noise logging completed at the site and detailed in the sections above. Attended noise level testing was undertaken using a Bruel and Kjaer 2236C type meter. The meter was calibrated before and after testing and no significant drift was recorded.

The attended and unattended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ($L_{90\ (t)}$) as well as the impact from traffic movements ($Leq_{(t)}$).

Attended noise level measurements were undertaken at the site on the 21st July 2024 during the afternoon period of 4.30pm to 5.40pm. The results of the attended noise level measurements are detailed in the table below.

Table 2 Attended Noise Level Survey

Measurement Location	Time of measurement	Measured $L_{Aeq,\ 15min}$ dB(A)	Measured $L_{A90,\ 15min}$ dB(A)	Comments
Facing William Street – West	4.30pm to 4.45pm	67	56	Noise levels resulting from natural noise sources and traffic noise from roadways within vicinity of the site.
	4.45pm to 5.00pm	64	52	
Facing North Street	5.05pm to 5.20pm	61	49	
Facing Francis Street	5.25pm to 5.40pm	62	48	

4 INTERNAL NOISE LEVEL ASSESSMENT

Internal noise levels within the future residential occupancies have been based on the relevant noise levels as detailed in this section of the report.

4.1 Australian and New Zealand Standard AS/NZS 2107:2016

Since the *State Environmental Planning Policy (Infrastructure) 2007* does not provide a criteria for all occupancies possible within a residential apartment, the *Australian and New Zealand Standard AS/NZS 2107:2016 Acoustics– Recommended design sound levels and reverberation times for building interiors* is adopted as a supplement.

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 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.

Table 3 AS2107:2016 Design Sound Levels

Type of Occupancy/Activity	Design sound level maximum ($L_{Aeq,t}$)
Common areas (e.g. foyer, lift lobby)	55 $L_{Aeq\ 24\ min}$
Residential - Living areas	40 $L_{Aeq\ 24\ hour}$
Residential[1] - Sleeping areas (night time)	35 $L_{Aeq\ 9\ hour}$[1]
Retail/Commercial Tenancies	45 $L_{Aeq\ 24\ hour}$
Toilets	55 $L_{Aeq\ 24\ min}$

Note 1: Night time noise levels include the period of 10pm to 7am.

4.2 Project Airborne Noise Requirements

Based on the details included in the section above, the project internal noise levels requirements are summarised in the table below.

Table 4 Project Airborne Internal Noise Level Requirements

Day of Week	Activity
Residential - Living areas	40 $L_{Aeq\ 15\ hour}$[2]
Residential - Sleeping areas (night-time)	35 $L_{Aeq\ 9\ hour}$[1]
Common areas (e.g. foyer, lift lobby)	55 $L_{Aeq\ 24\ min}$
Toilets	55 $L_{Aeq\ 15\ hour}$[2]
Note 1: The relevant time period for night-time periods included 10pm to 7am. *Note 2: The relevant time for daytime periods includes 7am to 10pm.*	

5 AIRCRAFT NOISE IMPACT

This section of the report includes the acoustic assessment of the potential noise impact from aircraft flyovers based on the Australian Standard AS2021:2015 *Acoustics – Aircraft noise intrusion – Building siting and construction.*

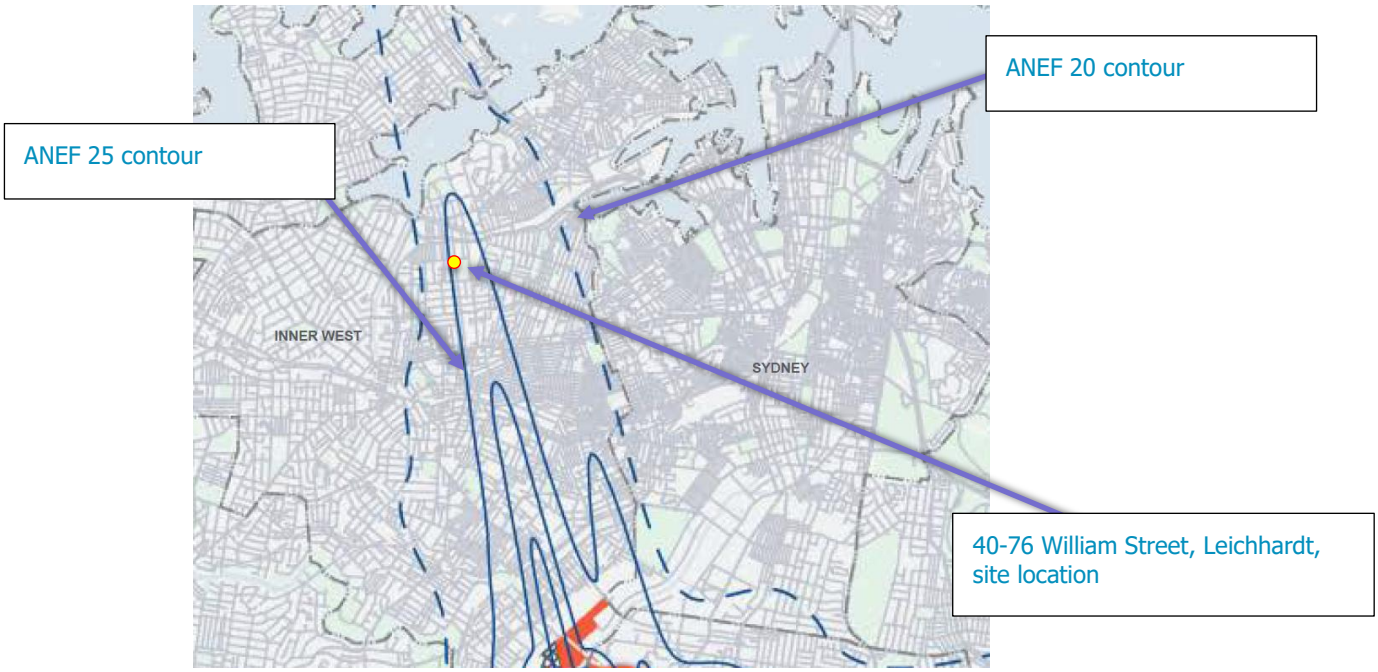
AS2021:2015 'Acoustics – Aircraft noise intrusion – Building siting and construction' provides guidance for the assessment and design of project with the potential for noise impact generated from aircraft flyovers.

AS2021:2015 concludes that sites can be '*unacceptable', 'conditionally acceptable'* or *'acceptable'* based on the site location relative to the contours of the ANEF (Australian Noise Exposure Forecast) maps. Sites located between the ANEF 25 and ANEF 30 contours are classified *conditionally acceptable* conditional on the being designed to control noise from aircraft for the internal areas of the project.

The assessment of potential aircraft noise exposure at a given site is based on the Australian Noise Exposure Forecast (ANEF) system, which requires assessments to be undertaken for development sites which are located within ANEF 20 contours or greater.

The location of the 40-76 William Street, Leichhardt site is detailed in the figure below, including the relevant ANEF 2039 chart.

Figure 5-1 Site Location based on ANEF 2039 Chart



Based on the location of the site is on or about the ANEF 25 contour and therefore the site is '*conditionally acceptable'* and a detailed assessment of aircraft noise is required to be undertaken which is detailed in this section of the report.

5.1 Internal Noise Level Criteria

The Australian Standard AS2021:2015 *Acoustics – Aircraft noise intrusion – Building siting and construction* provides internal noise levels requirements for the design of residential buildings. The required internal noise level requirements of the standard are detailed in the table below.

Table 5 AS2021 Aircraft Internal Noise Level Criteria

Occupancy Type	Space Type	Indoor Design sound level maximum ($L_{Amax, slow}$)
Residential	Residential - Living areas	55
	Residential - Sleeping areas (night time)	50
	Retail Areas	75
	Toilets	60

5.2 Aircraft Movement

Based on the location of the site and the movement of aircraft to and from Sydney International airport the potential movements impacting site include take off and landings on the main runway. Based on the required assessment of noise from aircraft in the Australian Standard AS2021:2015 the relevant DS, DT and DL's have been measured to calculate the resulting aircraft noise impacts on the site stipulated by the Australian Standard. The table below details the measured distances of the site from the main runway.

Table 6 AS2021 Aircraft Distances from the site

Site Location	Sydney International Airport Runway	Measurement Type	Measured Distance (m)
40-76 Willima Street, Leichhardt	Main Runway North South	DS	260
		DT	9960
		DL	6130
Note: Take off DS based on the flight paths detailed within the Sydney Airport Master Plan 2039			

Based on the distances detailed above the noise impact on the site as a result of a Boeing 747-400 is calculated to be 83 dB(A) $_{slow}$, this noise level has been used in the assessment of air craft noise intrusion into the project.

6 ENVIRONMENTAL NOISE INTRUSION ASSESSMENT

This section of the report details the assessment of environmental noise intrusion into the proposed development and the recommended acoustic treatments to ensure the recommended internal noise levels detailed in the Sections above (including environmental noise and aircraft noise intrusion) are achieved.

Internal noise levels within the future areas of the development will result from the noise intrusion into the building through the external façade including glass, masonry and other façade elements. Typically, the acoustic performance of building elements including the relatively light weight elements of the building façade, including glass and/or plasterboard constructions, will be the determining factors in the resulting internal noise levels.

Calculations of internal noise levels have been undertaken based on the measured traffic and calculated environmental noise levels at the site and the characteristics of the building, including window openings, buildings constructions and the like.

6.1.1 External Glass Elements

The recommended acoustic constructions to the buildings external façade glass elements are detailed in the table below to ensure the recommended internal noise levels detailed above are achieved, with the façade building openings closed.

Table 7 External Glass Acoustic Requirements

Façade Orientation	Room Type	Recommended Glass Construction	Minimum Façade Acoustic Performance[1]
All Façade Orientations All Levels	Bedrooms	6.38mm Laminated	Rw 30
	Living Rooms	6.38mm Laminated	Rw 30
	Wet areas	6.38mm Laminated	Rw 30
	Common Areas	6.38mm Laminated	Rw 30

Note 1: The acoustic performance of the external façade includes the installed glazing and frame including (but not limited to) the façade systems seals and frame. All external glazing systems are required to be installed using acoustic bulb seals.

The recommended glass constructions detailed in the table above include those required to ensure the acoustic requirements of the project are achieved. Thicker glazing may be required to achieve other project requirements such as structural, thermal, safety or other requirements and is to be advised by others.

6.2 External Building Elements

The proposed external building elements including masonry or concrete external walls and roof are acoustically acceptable without additional acoustic treatment.

Any lightweight external pasteboard walls should be constructed from a construction with a minimum acoustic performance of Rw 45.

6.3 External Roof

The required external roof and ceiling constructions for the project are required to include the following:

- Concrete external roof construction – no additional acoustic treatments required.

6.4 External Opening and Penetrations

All openings and penetrations are required to be acoustically treated such that the performance of the building construction is not compromised. This may require lining of duck work behind mechanical service openings/grills, treatments to ventilation opening and the like.

6.5 Alternative Ventilation Requirements

The internal design sound levels detailed above are achieved with the external building openings closed to the façade elements for compliance with aircraft noise to other façade orientations.

Based on the requirements of the Australian Standard AS2021:2015 (aircraft noise levels) the trigger for the requirement of an alternative outside air source on this project, is required for all residential façade elements of the project based on internal noise levels with the windows open.

The method of providing an alternative method of outside air ventilation is required to be provided in accordance with relevant regulations including the Building Code of Australia and AS1668.

As part of the proposed development the provision for an alternative outside air source to all residential dwellings is required. The options for the proposed alternative source of ventilation are discussed below:

1. The acoustic design of the building includes performance of glass and solid façade elements which will ensure internal noise levels with operable windows closed will achieve internal noise level requirements and ensure a suitable acoustic amenity for future residence.
    a. The use of the operable windows and doors could be used to provide ventilation/cross ventilation to the units. This can be undertaken by opening the operable elements of the façade at the discretion of the future occupants.
2. In the event occupants choose to keep the windows closed, an alternative source of outside air will be provided to the residential dwellings. The method of providing an alternative outside air will include a design which is in accordance with AS1668 and does not reduce the acoustic performance of the building's external façade. Possible methods of providing an alternative outside air source include one of the following:
    a. The use of a mechanical system to provide outside air such as a dedicated fan or the use of the fan within a units FCU including an outside air source (which would not be required to condition air to provide outside air to the unit).
    b. Provision of an outside air source to the intake air side of the Fan Coil Units (FCU) located in the ceiling space of each apartment. The outside air is mixed with the return air in the return air plenum and provided to the dwelling using the fan of the FCU which can operate with or without air conditioning being functional.
    c. Provision of outside air via a dedicated supply air fan which can be operated at the discretion of future occupants.
    d. The use of a positively charged corridor air plenum to common corridors with supply air accessing units via fir dampers within the above ceiling voids to residential units. The design of such as system is to be undertaken such that the minimum requirements for the separation of corridor walls is not less than Rw 50 as required by Part F5 of the BCA.
    e. Other methods of outside air supply which are compliant with the requirements of the Australian Standard AS1668.2.

7 EXTERNAL NOISE EMISSION ASSESSMENT

This section of the report details the relevant noise level criteria for noise emissions generated on the site once completed.

The relevant authority which provides the required noise level criteria for noise levels generated on the site includes the NSW Environmental Protection Authority's (EPA) Noise Policy for Industry (NPI).

This section contains noise criteria on the operational criteria, construction criteria and vibration criteria.

The following criteria are relevant for the assessment of noise and vibration emissions from the proposed training centre:

- For the assessment of the predicted operational noise emissions by the training facility: The criteria have been derived in accordance with the *Noise Policy for Industry* (EPA, 2017), details are included in the following sections of this report.

7.1 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Government and the NSW Environment Protection Authority (NSW EPA). In October 2017, the NSW EPA released the *Noise Policy for Industry* (NSW NPI). The purpose of the policy is to ensure that noise impacts associated with particular industrial developments are evaluated and managed in a consistent and transparent manner. The policy aims to ensure that noise is kept to acceptable levels in balance with the social and economic value of industry in NSW.

The NSW NPI criteria for industrial noise sources have two components:

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

The project noise trigger level is derived from the more stringent value out of the project intrusiveness noise level and the project amenity noise level.

7.1.1 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.

7.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increases 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.

7.1.3 Area Classification

The NSW NPI characterises the "Suburban Residential" as 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.

For the considered receptors in the rural area, the recommended amenity noise level is shown in Table 8 below. When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

Table 8 NSW NPI – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residence	Suburban	Day	55
		Evening	45
		Night	40
Commercial Receiver	-	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.

7.1.4 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in the table below. The amenity and intrusive criterion are nominated for the purpose of determining the operational noise limits for noise sources associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the project trigger noise levels are the lower (i.e. the more stringent) of the amenity or intrusive criteria. The project trigger noise levels are shown in bold text in Table 9

Table 9 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Representative Background Noise level $L_{A90, 15\ min}$ (RBL) [1] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) 2	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [2, 3]
Residence (Suburban)	Day	50	36	60	**41**	53
	Evening	40	35	57	**40**	43
	Night	35	31	50	**36**	38
Commercial Receiver	When in Use	60	-	-	**-**	**63**

Note 1: L_{A90} Background Noise or Rating Background Level, including L_{A90} Background Noise or Rating Background Level based on the assumed minimum rating of the EPA NPfI.

Note 2: Project Noise Trigger Levels are shown in bold

Note 3: According to Section 2.2 of the NSW NPI, the LAeq, 15 minutes is equal to the LAeq, period + 3 dB

Note 4: Noise from the operation of residential condensers are to be inaudible within a neighbouring residential premises during night time hours

8 OPERATIONAL ACOUSTIC ASSESSMENT

This section of the report details the assessment of potential noise generated as part of the proposed development.

The assessment of potential noise impacts from various sources of noise on the site are detailed in the following sections.

8.1 Mechanical Services Equipment

Detailed selections of the proposed mechanical plant and equipment to be used on the site are not available at this time. All future plant and equipment are to be acoustically treated to ensure the noise levels at all surrounding receivers comply with noise emission criteria detailed within this report. Experience with similar projects indicated that it is both possible and practical to treat all mechanical equipment such that the relevant noise levels are achieved. Examples of the possible acoustic treatments to mechanical equipment includes the following:

- Supply and Exhaust Fans – location of fans within the building and treated using internally lined ductwork or acoustic silencers.
- General supply and exhaust fans – general exhaust and supply fans such as toilet, kitchen, lobby and other small mechanical fans can be acoustically treated using acoustic flex ducting or internal lined ducting.
- Residential Condensers – The project may include external residential condenser units which will be located within the basement or on the roof top of the project. Providing condenser equipment is selected using suitable noise level data then acoustic treatments can be included such as screening and treatment to exhaust are as required to ensure that the relevant noise emission criteria will be achieved.
- Roof top equipment – Roof top plant and equipment may be proposed. Treatment to roof top pant and equipment is both possible and practical using acoustic mitigations such as silencers and internally lined ductwork to supply and discharge ductwork.

Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

Experience with similar projects indicates that the acoustic treatment of the proposed mechanical equipment to be installed on the project is both possible and practical.

8.2 Waste and Garbage Collections

Noise resulting from the removal of waste and garbage from the site, including garbage trucks and the like will be undertaken in accordance with council's waste management requirements.

Noise resulting from the collection of waste from the site will include intermittent collection using approved waste collection vehicles. The resulting noise impact resulting from the site will be similar to noise levels currently experienced by exiting receivers from exiting waste collection services, train noise and vehicle movements on surrounding roadways.

Noise resulting from the collection of waste from the site will include intermittent collection using approved waste collection vehicles using the access to the site will be acoustically acceptable.

9 CONSTRUCTION NOISE AND VIBRATION IMPACTS

Relevant construction noise and vibration criteria for construction activities are detailed below.

9.1 Construction Noise Criteria

9.1.1 NSW EPA Interim Construction Noise Guideline (ICNG) – DECC 2009

Noise criteria for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in the table below.

Table 10 NMLs for quantitative assessment at residences.

Time of Day	Noise Management Level $L_{Aeq(15minute)}$[1,2]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	***"Noise Affected Level"*** RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ 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.
Outside recommended standard 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 practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.
	"Highly Noise Affected Level" 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

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

Note 2 *The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Noise Policy for Industry (EPA 2017).*

The ICNG also provides NMLs for non-residential land uses. Unlike residential receivers, these criteria are fixed levels, independent of local background noise levels. Presented in Table 11 below are the NMLs for non-residential land uses.

Table 11 Construction noise management levels – other receivers.

Land use	Location applied	Noise management level, $L_{Aeq,15min}$
Classrooms at school and other educations institutions	Internal noise level	45 dB(A)
Hospital wards and operating theatres	Internal noise level	45 dB(A)
Places of worship	Internal noise level	45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level	65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level	60 dB(A)
Community centres	Refer to the recommended "maximum" internal levels in AS2107 for specific uses	
Industrial premises	External noise level	75 dB(A)
Offices, retail outlets	External noise level	70 dB(A)

Based on the measured background noise levels summarised in Section 3.2, and the NMLs outlined above the construction noise criteria to be used in this assessment are listed in Table 12 below.

Table 12 NMLs as basis for the acoustic assessment.

Receiver Types	NML, dB $L_{Aeq(15minute)}$		
	Standard Hours Monday to Friday: 7:00am to 6:00pm Saturday: 8:00am to 1:00pm	Outside Standard Hours 6:00pm to 10:00pm	Outside Standard Hours 10:00pm to 7:00am
Receiver 1 – Residential Receiver Location 1	46 / HNAL = 75	39	36
Receiver 2 – Residential Receiver Location 2	46 / HNAL = 75	39	36
Receiver 3 – Residential Receiver Location 3	46 / HNAL = 75	39	36
Receiver 4 – Residential Receiver Location 4	46 / HNAL = 75	39	36
Receiver 5 – Residential Receiver Location 5	46 / HNAL = 75	39	36
Receiver 6 – Residential Receiver Location 6	46 / HNAL = 75	39	36
Receiver 7 – Residential Receiver Location 7	46 / HNAL = 75	39	36

Note 1: The LAeq and LA90 levels from the daytime period have not been used to determine any noise level criteria due to the presence of construction noise occurring across the road.

9.1.2 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW *Road Noise Policy (RNP)* states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

9.2 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 9.2.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 9.2.2.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 9.2.2.

9.2.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"*. (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (refer to Table 13).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 14).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 15 below).

Table 13 Continuous vibration acceleration criteria (m/s^2) 1 Hz-80 Hz.

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 14 Impulsive vibration acceleration criteria (m/s^2) 1 Hz-80 Hz.

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 15 Intermittent vibration impacts criteria ($m/s^{1.75}$) 1 Hz-80 Hz.

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

9.2.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 *"Effects of Vibration on Structure"* (DIN 1999).

9.2.2.1 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 16 and illustrated in Figure 9-1 below.

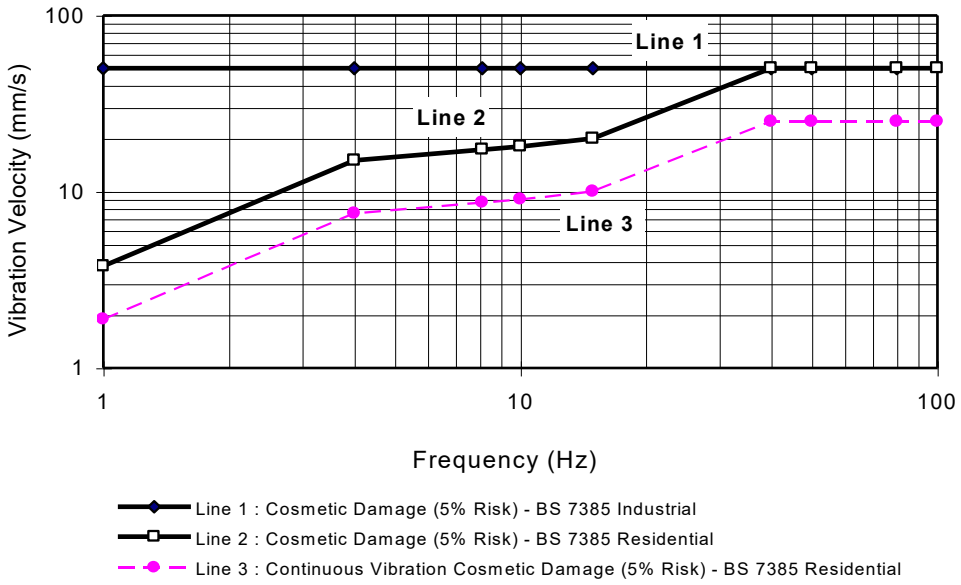
Table 16 Transient vibration criteria as per standard BS 7385 Part 2 – 1993.

Line in Figure 9-1	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

Standard BS 7385 Part 2 – 1993 states that the values in Table 16 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 16 may need to be reduced by up to 50% (refer to Line 3 in Figure 4 below).

Figure 9-1 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage.



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 16, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 16 should not be reduced for fatigue considerations.

9.2.2.2 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 17. The criteria are frequency dependent and specific to particular categories of structures.

Table 17 Structural damage criteria as per standard DIN 4150 Part 3 – 1999.

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: For frequencies above 100 Hz, at least the values specified in this column shall be applied.

9.3 Ground-Borne Noise Criteria

According to the NSW EPA *Interim Construction Noise Guideline* (ICNG) 2009, the criteria for ground-borne noise at residences is defined as follows:

- Maximum internal noise levels of 40 dB $L_{Aeq(15mins)}$ between 6:00pm and 10:00pm.

It is noted that the ground borne criteria will apply for construction works undertaken outside of standard hours.

9.4 Project Vibration Criteria

Based on the details included in the points above, the project specific construction vibration criteria is recommended to include the following:

1. Neighbouring buildings – 8 mm/s.

9.5 Noise and vibration assessment

9.6 Construction Noise Assessment

Sound power levels have been predicted for the construction tasks identified in the project program. The equipment anticipated for use in each task is based on previous project experience. The sound power levels for the equipment likely to be used for each of the listed tasks are provided in Table 18 below.

Table 18 Summary of predicted sound power levels.

Tasks	Equipment	Sound Power Levels (dBA re 1pW)	Aggregate Sound Power Level per Task (dBA re 1pW)
Site Establishment Works	Mobile crane	110	113
	Power hand tools	109	
	Semi Rigid Vehicle [1]	105	
Ground Works	Excavator	112	121
	Hydraulic Hammer	118	
	Piling Rig	110	
	Handheld jack hammer [1]	111	
	Dump truck [1]	104	
	Concrete saw [1]	114	
	Skid steer	110	
	Power hand tools	109	
Structure	Handheld jack hammer [1]	106	115
	Concrete saw [1]	114	
	Power hand tools	109	
	Welder	101	
	Concrete pump truck	110	
	Concrete agitator truck	108	
Internal Works	Power hand tools	109	104
Common and External Works	Concrete agitator truck	108	114
	Saw cutter [1]	104	
	Dump truck [1]	104	
	Concrete saw [1]	114	
	Power hand tools	109	

Note 1: An assumed time correction has been applied, this being 5 minutes of operation in any 15-minute interval.

Table 19 Receiver – 01 – Residential– Summary of preliminary predicted construction noise levels.

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	65 to 76	68 to 78	Standard Construction Hours: **Noise Management Level** **46** **Highly Noise Affected Level** **75**	Works indicatively predicted to be non-compliant with the Noise Management Level (BG + 10 dB(A)), and above the Highly Noise Affected Level of 75 dB(A) during peak standard construction hours.
	Power hand tools		64 to 75			
	Semi Rigid Vehicle		55 to 66			
Ground Works and Demolition	Excavator	121	67 to 78	72 to 82		
	Hydraulic Hammer		73 to 84			
	Piling Rid		65 to 76			
	Handheld jack hammer		61 to 72			
	Dump truck		54 to 65			
	Concrete saw		64 to 75			
	Skid steer		65 to 76			
	Power hand tools		64 to 75			
Structure	Handheld jack hammer	115	56 to 67	70 to 81		
	Concrete saw		64 to 75			
	Power hand tools		64 to 75			
	Welder		56 to 67			
	Concrete pump truck		65 to 76			
	Concrete agitator truck		63 to 74			
Internal Works	Power hand tools	104	59 to 70	59 to 70		
Common and External Works	Concrete agitator truck	114	63 to 74	69 to 79		
	Saw cutter		54 to 65			
	Dump truck		54 to 65			
	Concrete saw		64 to 75			
	Power hand tools		64 to 75			

Table 20 Receiver – 02 – Residential – Summary of preliminary predicted construction noise levels.

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	65 to 76	68 to 78	Standard Construction Hours: **Noise Management Level** **46** **Highly Noise Affected Level** **75**	Works indicatively predicted to be non-compliant with the Noise Management Level (BG + 10 dB(A)), and above the Highly Noise Affected Level of 75 dB(A) during peak standard construction hours.
	Power hand tools		64 to 75			
	Semi Rigid Vehicle		55 to 66			
Ground Works and Demolition	Excavator	121	67 to 78	72 to 82		
	Hydraulic Hammer		73 to 84			
	Piling Rid		65 to 76			
	Handheld jack hammer		61 to 72			
	Dump truck		54 to 65			
	Concrete saw		64 to 75			
	Skid steer		65 to 76			
	Power hand tools		64 to 75			
Structure	Handheld jack hammer	115	56 to 67	70 to 81		
	Concrete saw		64 to 75			
	Power hand tools		64 to 75			
	Welder		56 to 67			
	Concrete pump truck		65 to 76			
	Concrete agitator truck		63 to 74			
Internal Works	Power hand tools	104	59 to 70	59 to 70		
Common and External Works	Concrete agitator truck	114	63 to 74	69 to 79		
	Saw cutter		54 to 65			
	Dump truck		54 to 65			
	Concrete saw		64 to 75			
	Power hand tools		64 to 75			

Table 21 Receiver – 03 – Residential – Summary of preliminary predicted construction noise levels.

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	67 to 88	70 to 91	Standard Construction Hours: **Noise Management Level** **46** **Highly Noise Affected Level** **75**	Works indicatively predicted to be non-compliant with the Noise Management Level (BG + 10 dB(A)), and above the Highly Noise Affected Level of 75 dB(A) during peak standard construction hours.
	Power hand tools		66 to 87			
	Semi Rigid Vehicle		58 to 78			
Ground Works and Demolition	Excavator	121	69 to 90	74 to 95		
	Hydraulic Hammer		75 to 96			
	Piling Rid		67 to 88			
	Handheld jack hammer		64 to 84			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Skid steer		67 to 88			
	Power hand tools		66 to 87			
Structure	Handheld jack hammer	115	59 to 79	73 to 93		
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			
	Welder		58 to 79			
	Concrete pump truck		67 to 88			
	Concrete agitator truck		65 to 86			
Internal Works	Power hand tools	104	61 to 82	61 to 82		
Common and External Works	Concrete agitator truck	114	65 to 86	71 to 92		
	Saw cutter		57 to 77			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			

Table 22 Receiver – 04 – Residential – Summary of preliminary predicted construction noise levels.

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	67 to 88	70 to 91	Standard Construction Hours: **Noise Management Level** **46** **Highly Noise Affected Level** **75**	Works indicatively predicted to be non-compliant with the Noise Management Level (BG + 10 dB(A)), and above the Highly Noise Affected Level of 75 dB(A) during peak standard construction hours.
	Power hand tools		66 to 87			
	Semi Rigid Vehicle		58 to 78			
Ground Works and Demolition	Excavator	121	69 to 90	74 to 95		
	Hydraulic Hammer		75 to 96			
	Piling Rid		67 to 88			
	Handheld jack hammer		64 to 84			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Skid steer		67 to 88			
	Power hand tools		66 to 87			
Structure	Handheld jack hammer	115	59 to 79	73 to 93		
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			
	Welder		58 to 79			
	Concrete pump truck		67 to 88			
	Concrete agitator truck		65 to 86			
Internal Works	Power hand tools	104	61 to 82	61 to 82		
Common and External Works	Concrete agitator truck	114	65 to 86	71 to 92		
	Saw cutter		57 to 77			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			

Table 23 Receiver – 05 – Residential – Summary of preliminary predicted construction noise levels.

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	67 to 88	70 to 91	Standard Construction Hours: **Noise Management Level** **46** **Highly Noise Affected Level** **75**	Works indicatively predicted to be non-compliant with the Noise Management Level (BG + 10 dB(A)), and above the Highly Noise Affected Level of 75 dB(A) during peak standard construction hours.
	Power hand tools		66 to 87			
	Semi Rigid Vehicle		58 to 78			
Ground Works and Demolition	Excavator	121	69 to 90	74 to 95		
	Hydraulic Hammer		75 to 96			
	Piling Rid		67 to 88			
	Handheld jack hammer		64 to 84			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Skid steer		67 to 88			
	Power hand tools		66 to 87			
Structure	Handheld jack hammer	115	59 to 79	73 to 93		
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			
	Welder		58 to 79			
	Concrete pump truck		67 to 88			
	Concrete agitator truck		65 to 86			
Internal Works	Power hand tools	104	61 to 82	61 to 82		
Common and External Works	Concrete agitator truck	114	65 to 86	71 to 92		
	Saw cutter		57 to 77			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			

Table 24 Receiver – 06 – Residential – Summary of preliminary predicted construction noise levels.

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	67 to 88	70 to 91	Standard Construction Hours: **Noise Management Level** **46** **Highly Noise Affected Level** **75**	Works indicatively predicted to be non-compliant with the Noise Management Level (BG + 10 dB(A)), and above the Highly Noise Affected Level of 75 dB(A) during peak standard construction hours.
	Power hand tools		66 to 87			
	Semi Rigid Vehicle		58 to 78			
Ground Works and Demolition	Excavator	121	69 to 90	74 to 95		
	Hydraulic Hammer		75 to 96			
	Piling Rid		67 to 88			
	Handheld jack hammer		64 to 84			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Skid steer		67 to 88			
	Power hand tools		66 to 87			
Structure	Handheld jack hammer	115	59 to 79	73 to 93		
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			
	Welder		58 to 79			
	Concrete pump truck		67 to 88			
	Concrete agitator truck		65 to 86			
Internal Works	Power hand tools	104	61 to 82	61 to 82		
Common and External Works	Concrete agitator truck	114	65 to 86	71 to 92		
	Saw cutter		57 to 77			
	Dump truck		57 to 77			
	Concrete saw		67 to 87			
	Power hand tools		66 to 87			

9.7 Construction Traffic Noise Assessment

It is proposed that the construction traffic would access the site on Atchinson Street and Mitchell Street.

It is noted that vehicle numbers on surrounding roads would need to increase by around 60% from existing traffic flows, for a 2 dB increase in road traffic noise to occur. As noted previously, a 2 dB increase in road traffic noise is not considered to be noticeable.

Based on the likely number of vehicles projected over each of the phases, it is concluded that noise impacts from construction traffic is unlikely to have an impact at the nearest affected properties. As a result, no further assessment is required.

9.8 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 9.2, it is recommended that the indicative safe distances listed in Table 25 should be maintained. These indicative safe distances should be validated at the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site if required to be used within the distances detailed in the table below.

If applicable, the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort. Vibration validating measurements should be conducted at each site to determine the vibration level and potential impact to this sensitive equipment.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 9.2. This information should also be included as part of the CNVMSP.

Table 25 Recommended indicative safe working distances for vibration intensive plant.

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller[1]	< 50 kN (Typically 1 – 2 tonnes)	5[1]	15 – 20[1]
	< 100 kN (Typically 2 – 4 tonnes)	6[1]	20[1]
	< 200 kN (Typically 4 – 6 tonnes)	12[1]	40[1]
	< 300 kN (Typically 7 – 13 tonnes)	15[1]	100[1]
	> 300 kN (Typically more than 13 tonnes)	20[1]	100[1]
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

9.9 Noise Monitoring

Noise monitoring, if required, will be performed by an acoustical consultant directly engaged by the contractor in accordance with the Conditions of Consent.

Noise monitoring is recommended to be undertaken by attended noise measurements including the following periods:

1. at the start of any new phase of works (i.e. demolition, excavation or construction etc.).

2. In response to ongoing complaints from the neighbouring receivers.

The statistical parameters to be measured should include the following noise descriptors: L_{Amin}, L_{A90}, L_{A10}, L_{A01}, L_{Amax} and L_{Aeq}. Unattended noise measurements should be conducted over consecutive 15-minute periods.

This monitoring should also be complemented by undertaking attended noise measurements in order to:

- Differentiate between construction noise sources and other extraneous noise events (such as road traffic and aircraft noise)

- Note and identify any excessive noise emitting machinery or operation.

In addition to the above detailed measurements, should any complaints be received which have not been determined previously, it should be confirmed by conducting additional attended noise measurements.

The survey methodology and any equipment should comply with the requirements discussed in Standard AS 1055.1-1997.

9.9.1 Vibration Monitoring

Vibration monitoring, if required, should be undertaken continuously at the nearest most affected structures in accordance with the conditions of the consent.

The monitoring location would be on a stiff part of the structure (at the foundation) on the side of the structure adjacent to the subject demolition and construction works.

The vibration monitoring system will be configured to record the peak vibration levels and to trigger an alarm when predetermined vibration thresholds are exceeded. The thresholds correspond to an "Operator Warning Level" and an "Operator Halt Level", where the Warning Level is 75% of the Halt Level. The Halt Level should be determined based on the vibration criteria for building contents and structure (refer to Section 9.4).

Exceedance of the "Operator Warning Level" would not require excavation or demolition work to cease, but rather, alerts the site manager to proceed with caution at a reduced force or load.

An exceedance of the "Operator Halt Level" would require the contractor to implement an alternative excavation technique pending further analysis of the vibration frequency content in order to determine any potential exceedance of the criteria.

The vibration monitoring equipment would be downloaded and analysed by the acoustical consultant.

Reports of the measured vibration levels and their likely impacts would be prepared by the acoustical consultant and issued to the contractor.

Based on the proposed works to be completed as part of the project attended noise surveys would be considered to be acoustically including surveys undertaken at the commencement of high vibration generating activities being undertaken such as hydraulic hammering, rock breaking, concrete hammering, vibration roiling or the like.

10 CONCLUSION

Pulse White Noise Acoustics Consultancy Pty Ltd (Pulse White Noise Acoustics) has been engaged to undertake the Noise Impact Assessment of the proposed residential development located at 40-76 William Street Leichhardt.

As part of this assessment, we have undertaken a review of the building envelope and noise emissions from the use of the site. From this assessment we note the following:

- Minimum acoustic performances and associated indicative constructions for the building envelope have been provided in section 4.2 of this report. The recommended treatments have been provided to ensure compliance with the objectives presented in 4.1.

- To control noise impacts at external receivers, recommended indicative treatments for major engineering services have been provided in section 7. From our review we have formulated the following opinion:

    - 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 in each type of plant room.

    - From this review we recommend the selection of high-performance acoustic treatment to ensure that the operation of the plant items comply with the project criteria. Therefore, it is recommended that prior to the issue of a Construction Certificate (CC) a detailed acoustic assessment is undertaken to ensure all cumulative noise from engineering services (including the roof plant room) comply with the requirements as listed in section 8.1.

- An assessment of the impacts associated with number of vehicles on surrounding public roads around the site and the impact is less than 2dBA and therefore is compliant with the NSW EPA RNP.

- An assessment of construction noise and vibration has been undertaken and details, including recommended management and community consultation are included in Section 9 of this report.

Based on the acoustic assessment of the proposed development to the proposed residential provided will be acoustically acceptable.

Regards

Ben White
Director

Pulse White Noise Acoustics

11 APPENDIX A: ACOUSTIC TERMINOLOGY

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

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

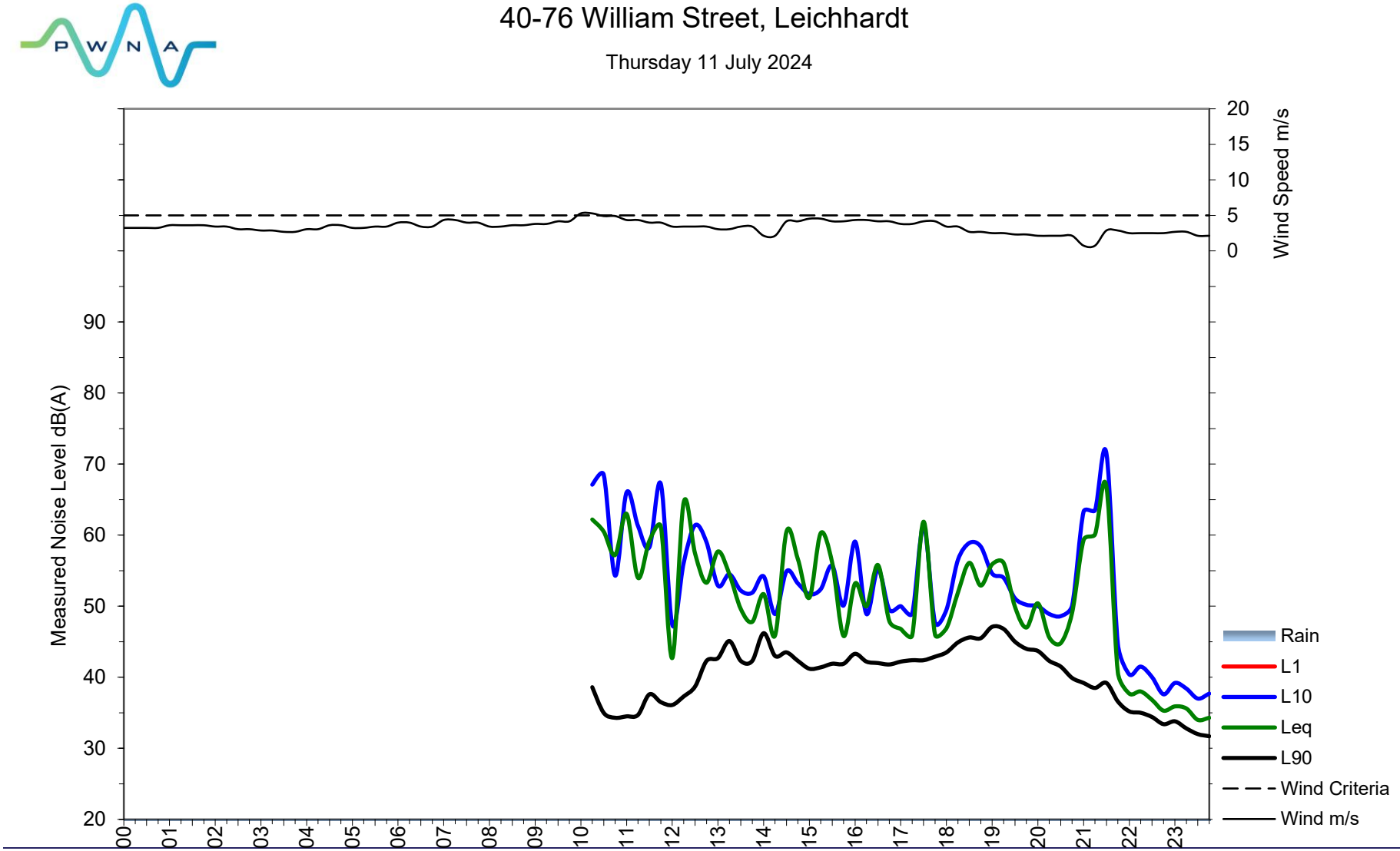
0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry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

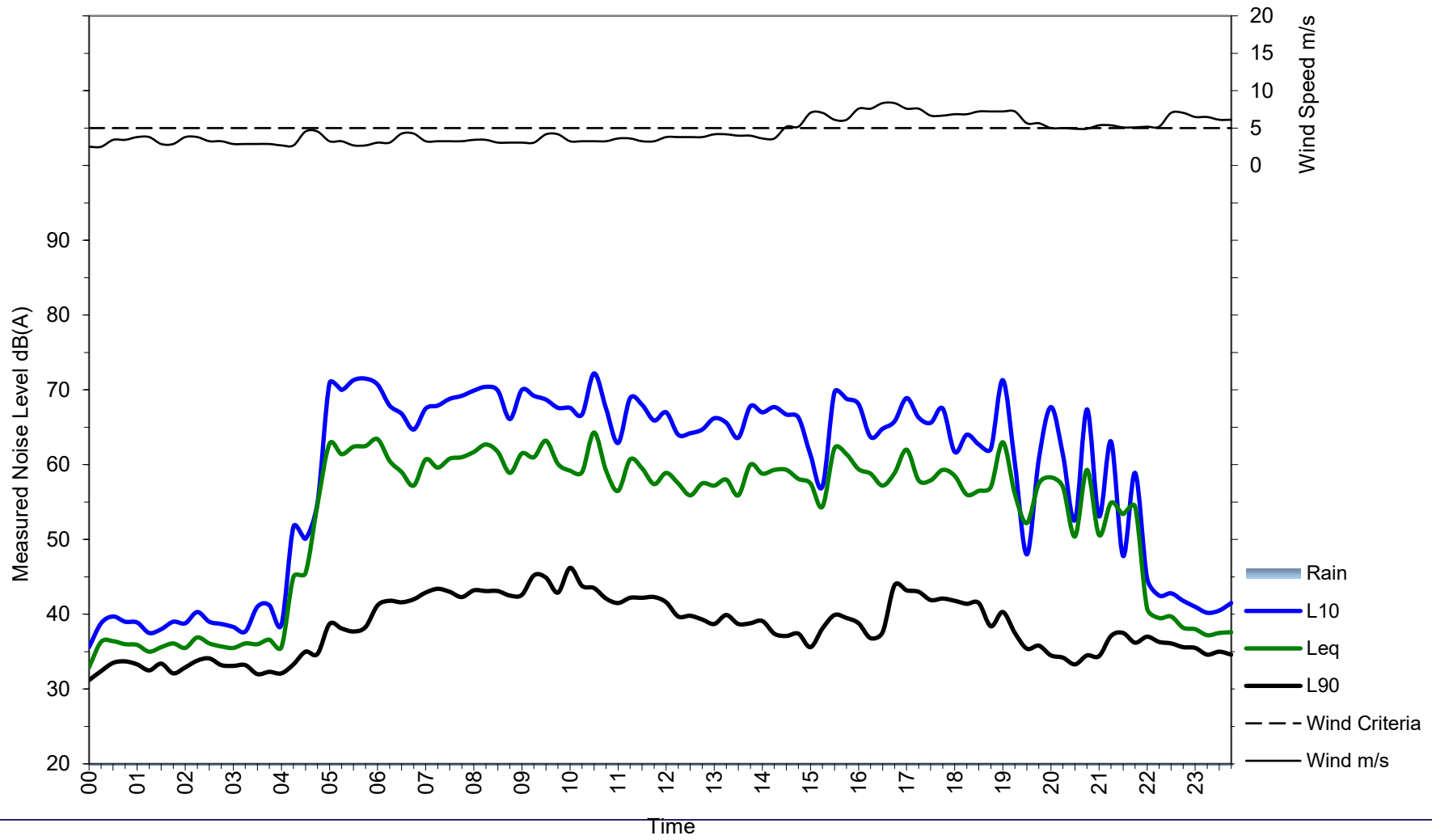
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] (Sound Transmission Loss)	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

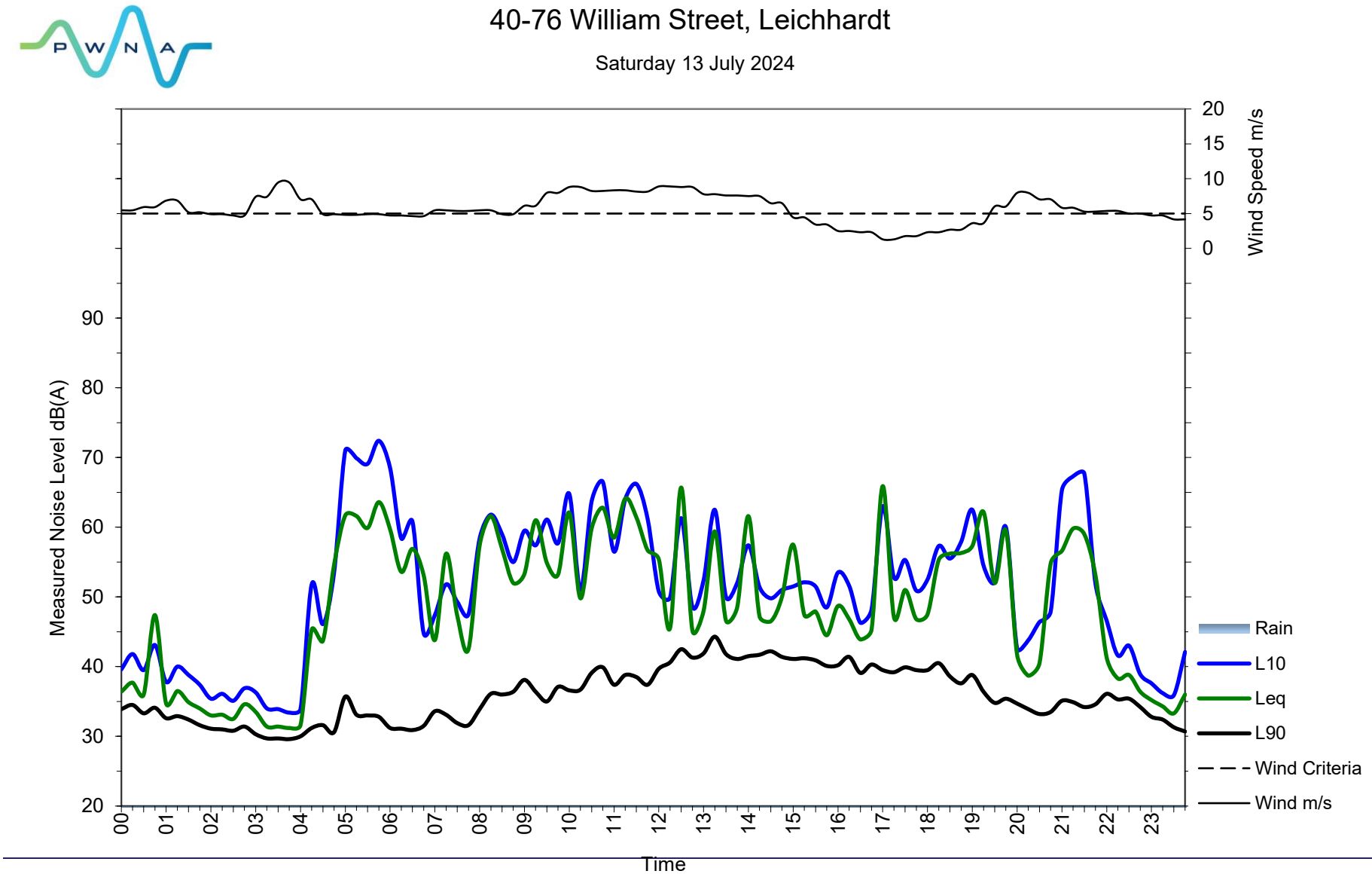
Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

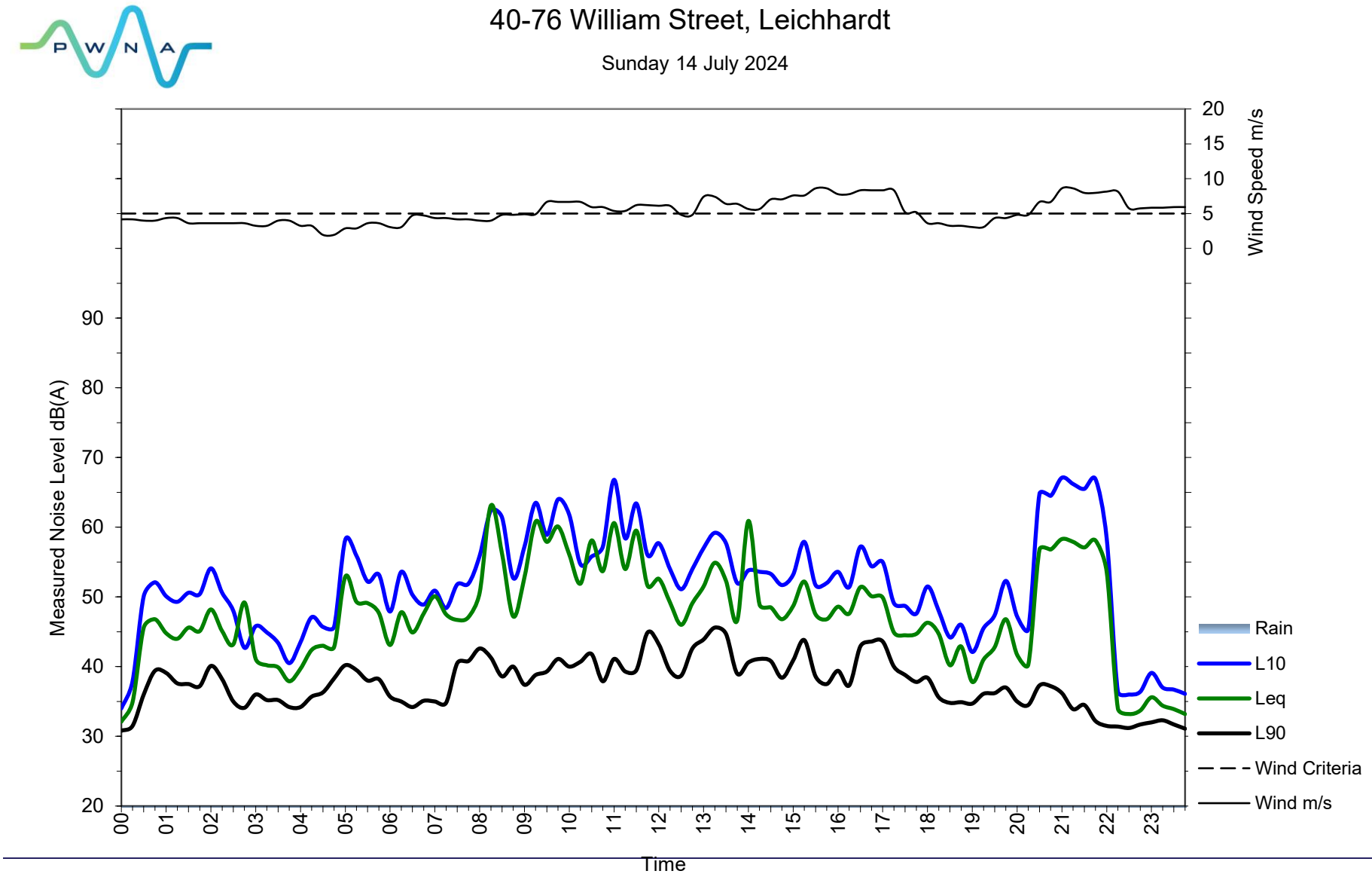
*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

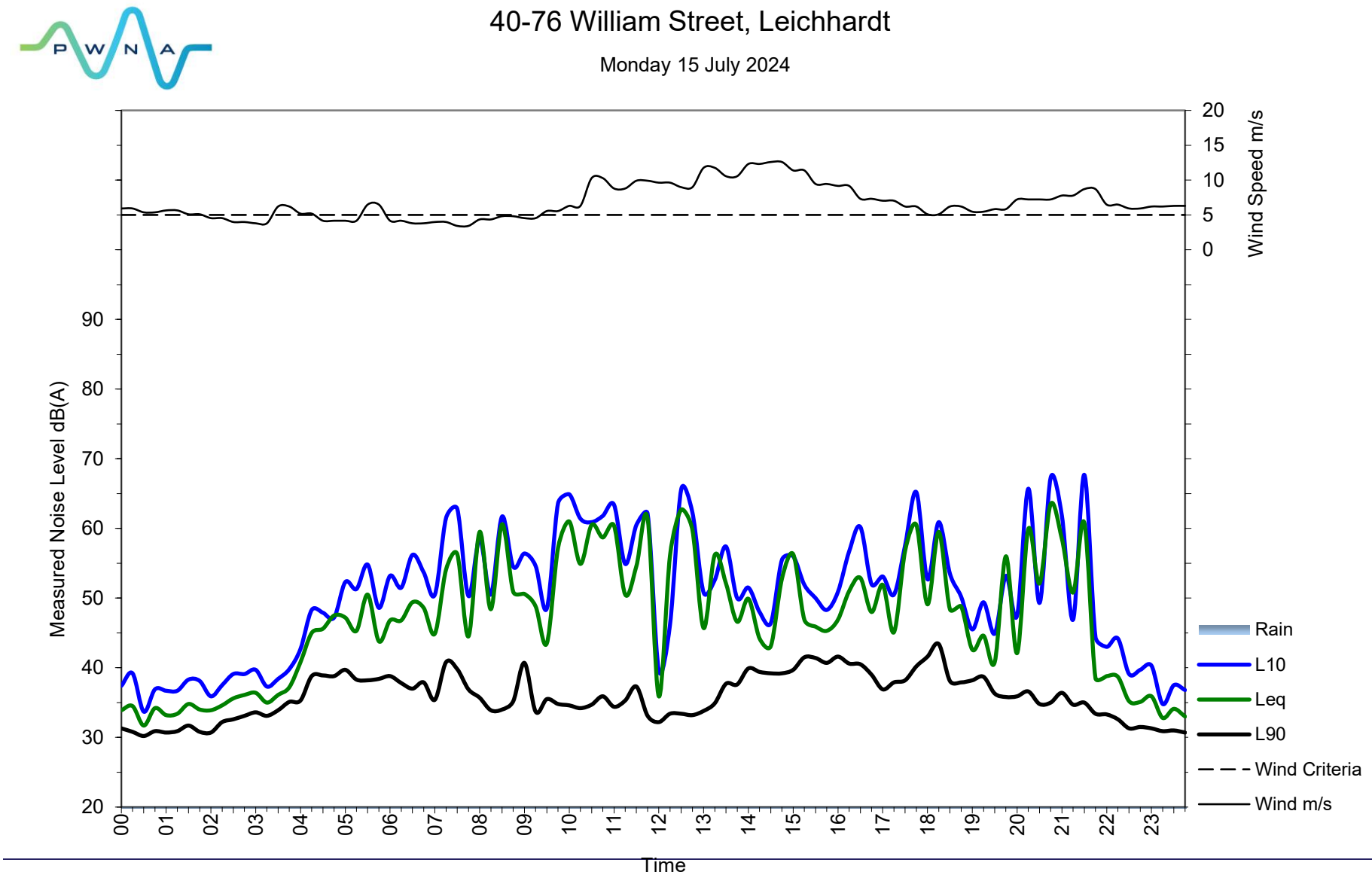
12 APPENDIX B: UNATTENDED NOISE LOGGING

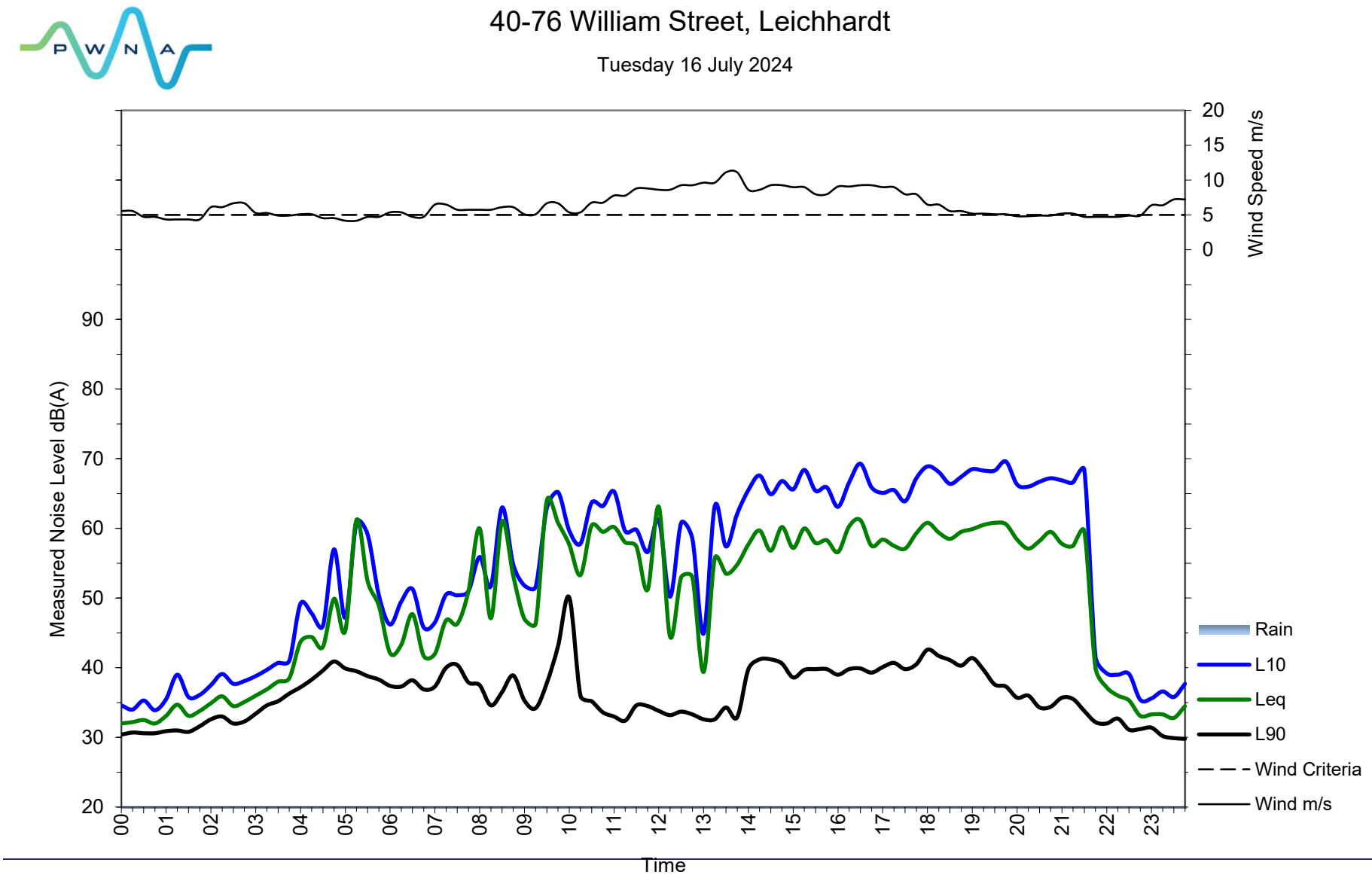

40-76 William Street, Leichhardt
Thursday 11 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

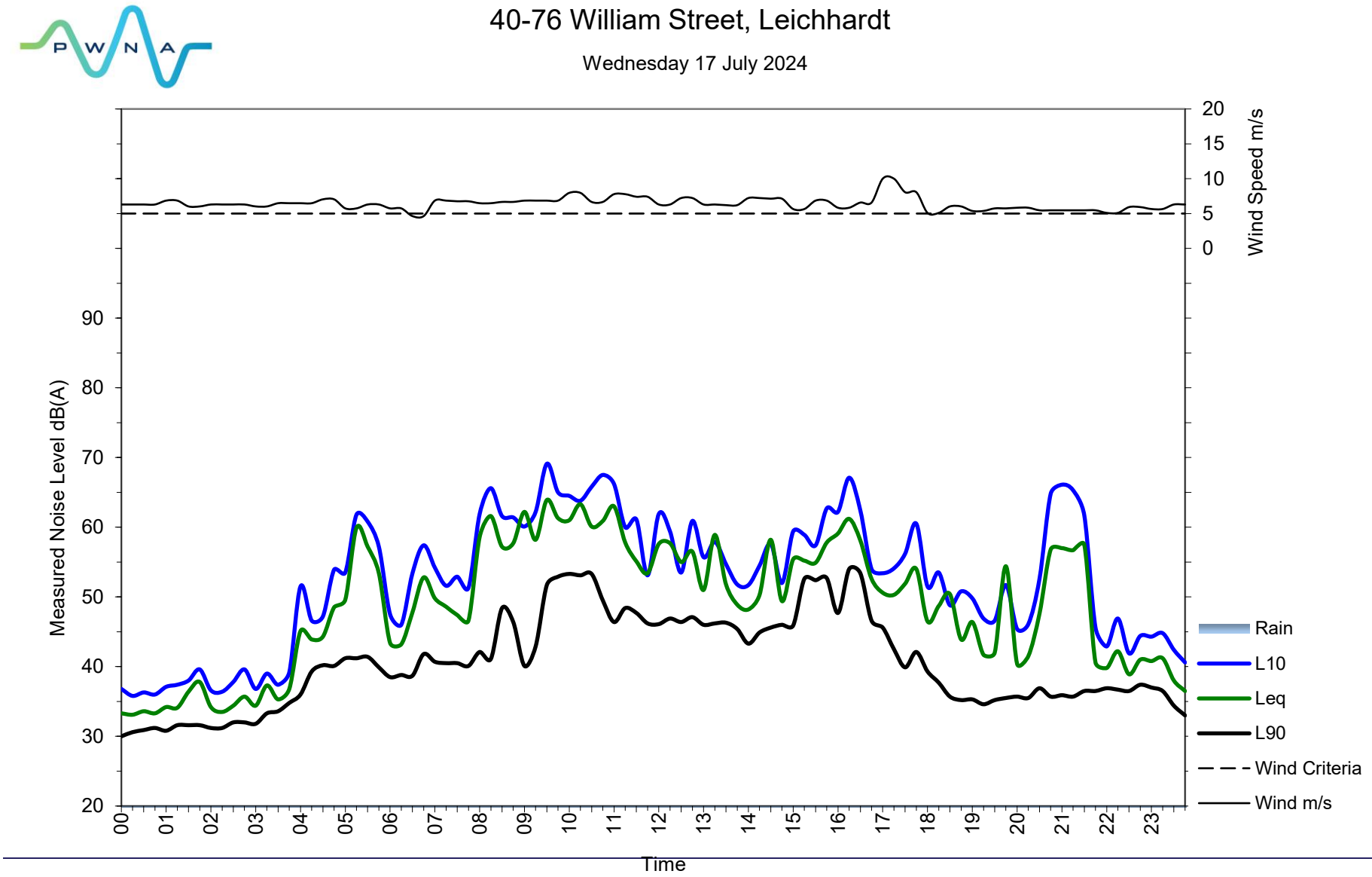

40-76 William Street, Leichhardt
Friday 12 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

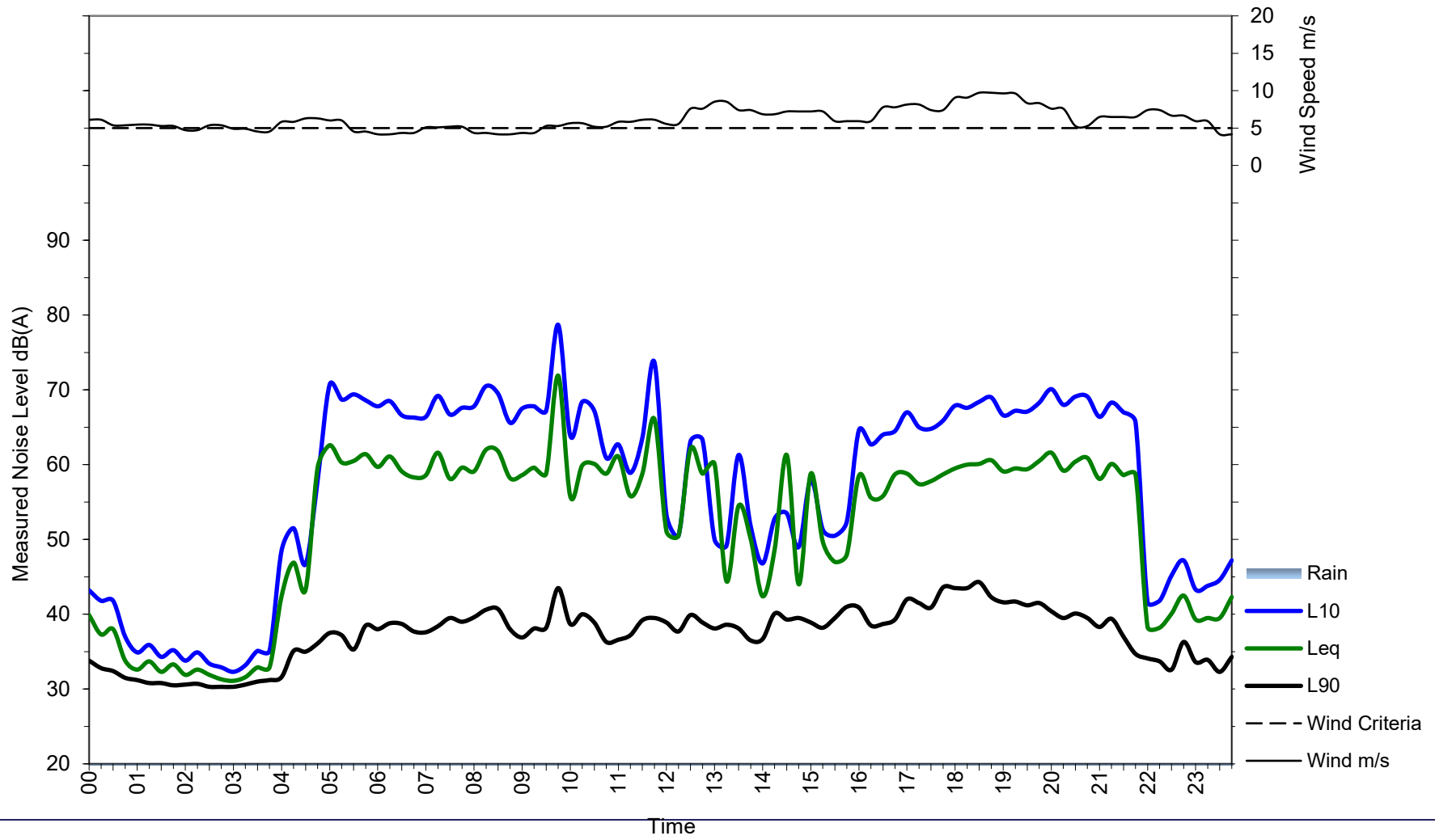

40-76 William Street, Leichhardt
Saturday 13 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s


40-76 William Street, Leichhardt
Sunday 14 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s


40-76 William Street, Leichhardt
Monday 15 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

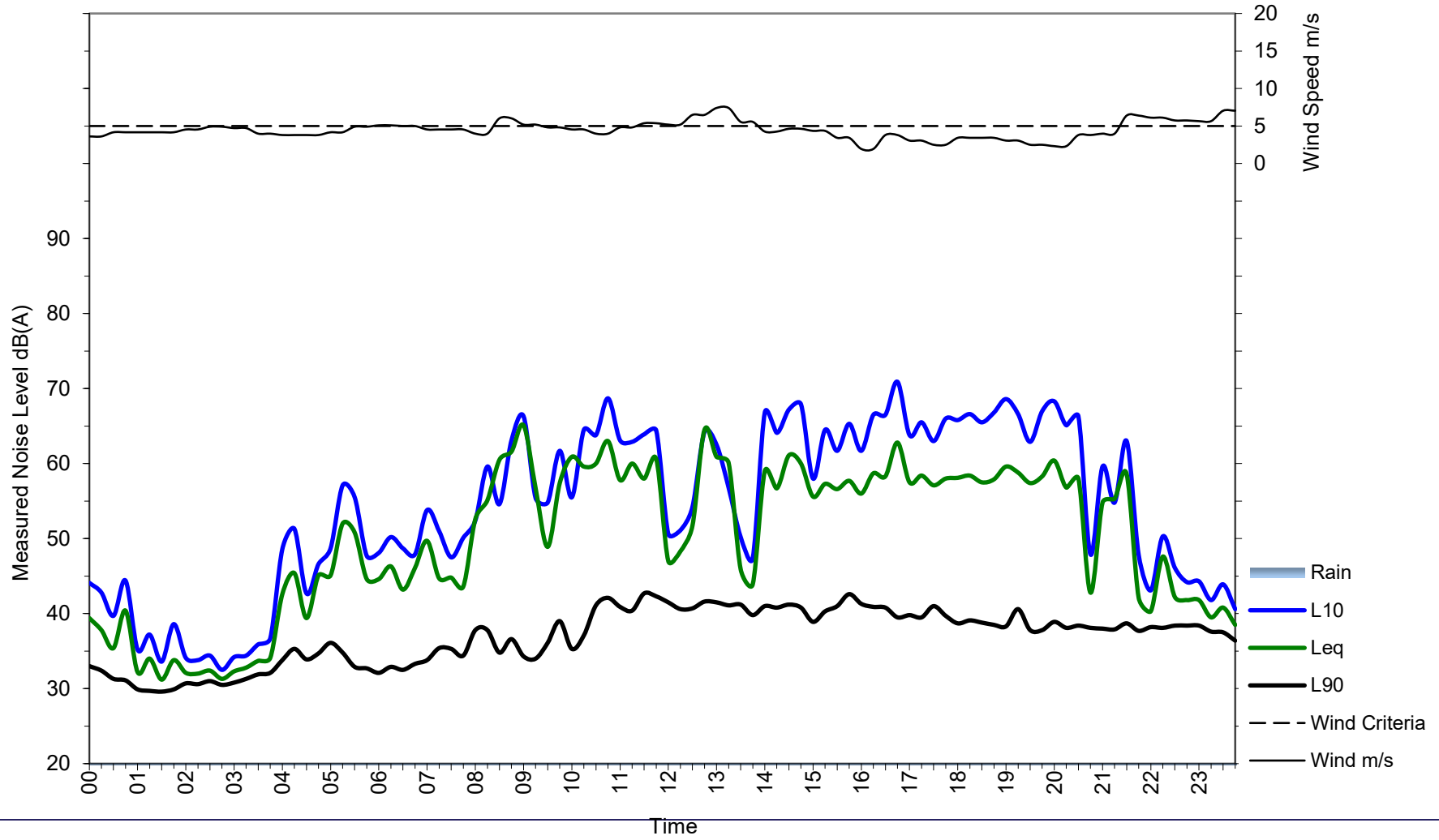

40-76 William Street, Leichhardt
Tuesday 16 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

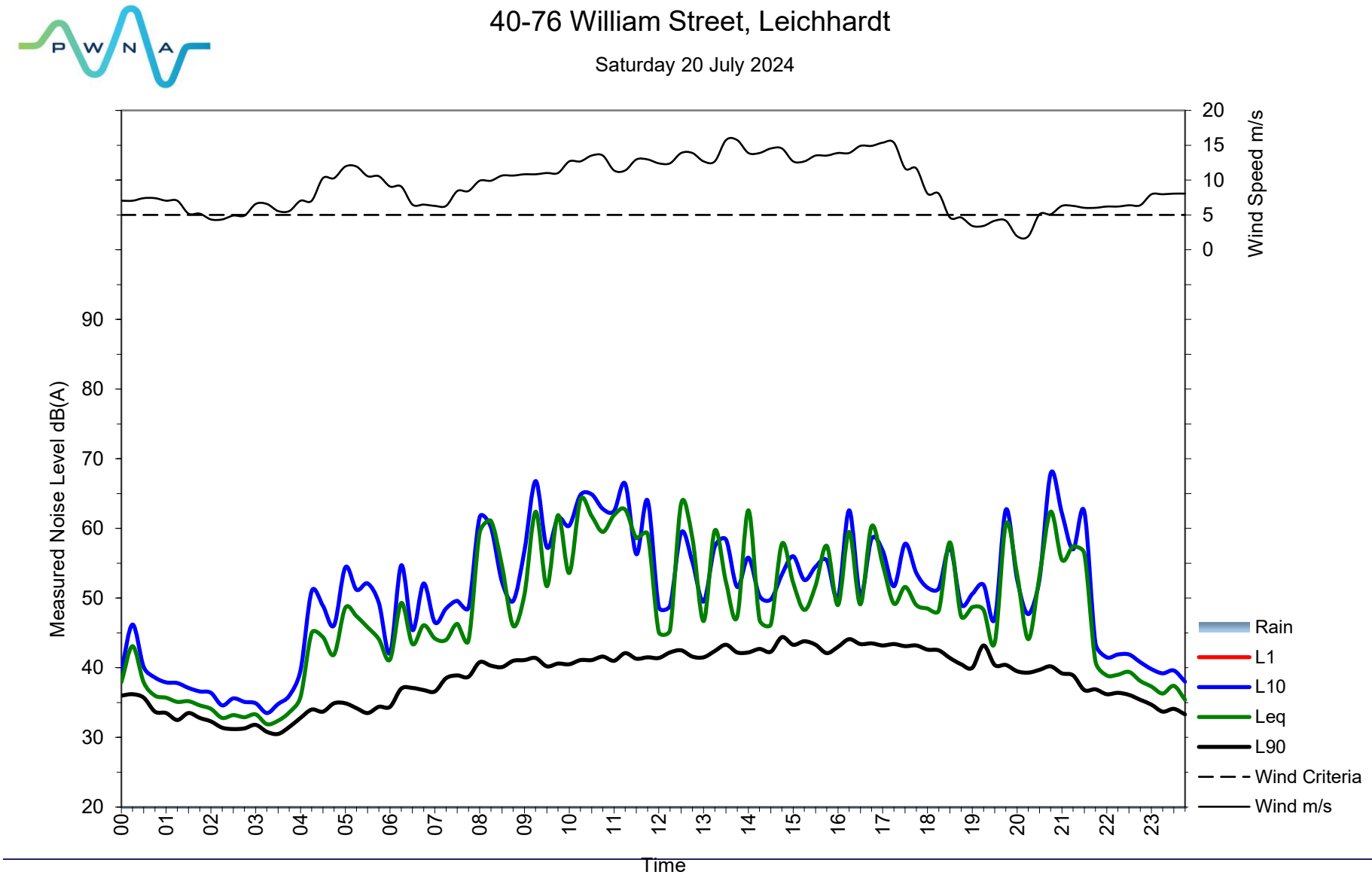

40-76 William Street, Leichhardt
Wednesday 17 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

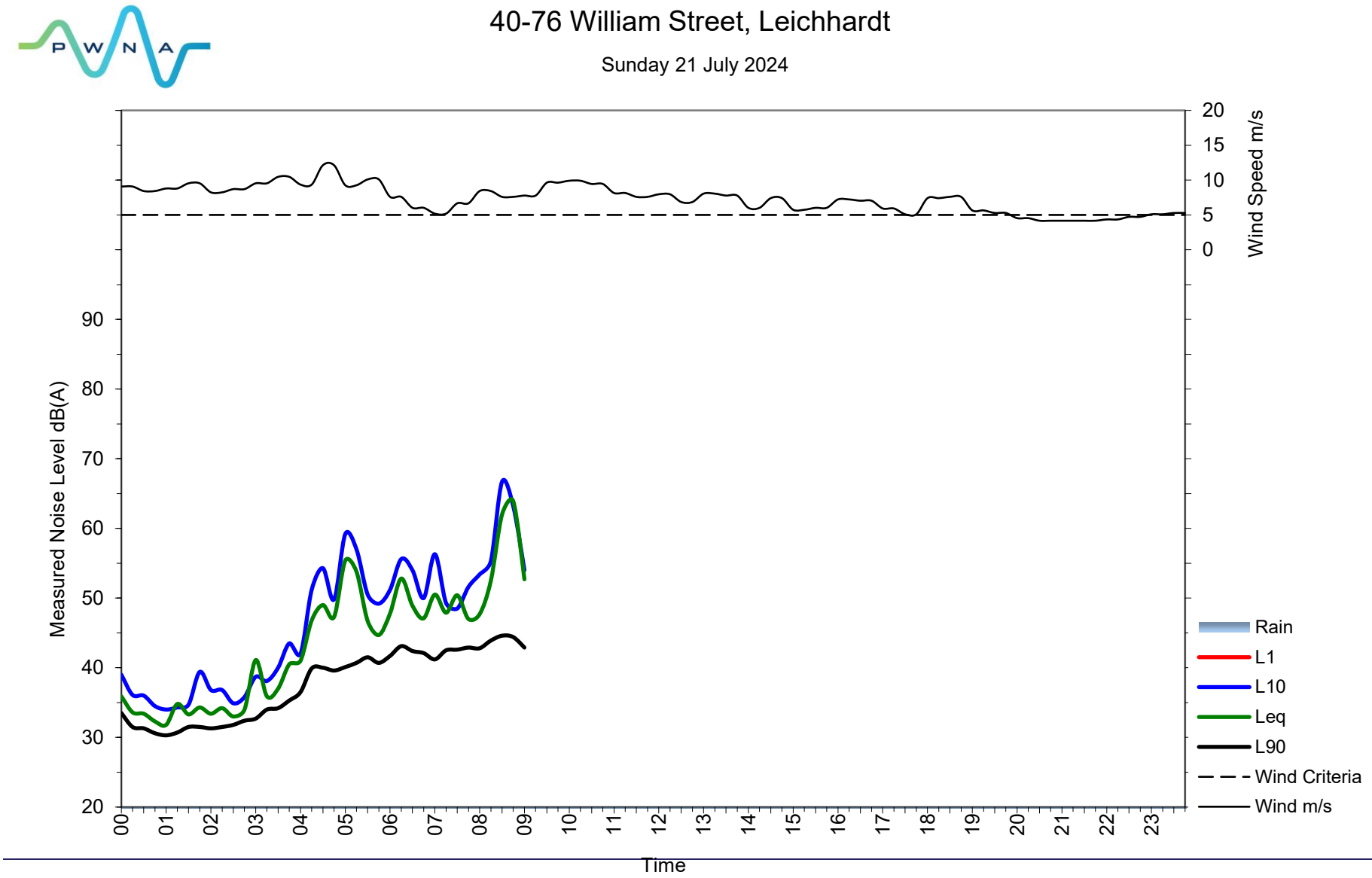

40-76 William Street, Leichhardt
Thursday 18 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L10
Leq
L90
Wind Criteria
Wind m/s

40-76 William Street, Leichhardt

Friday 19 July 2024




40-76 William Street, Leichhardt
Saturday 20 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


40-76 William Street, Leichhardt
Sunday 21 July 2024
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s