



Operational Noise Emission Assessment

15 Jubilee Ave, Warriewood, NSW

Client:
15 Jubilee Pty Ltd
ATF 15 Jubilee Trust



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GLOSSARY

NOISE

Noise is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined below.

NOISE DESCRIPTORS

dB – Decibels. The fundamental unit of sound, a Bel is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bel. Probably the most common usage of the Decibel in reference to sound loudness is dB sound pressure level (SPL), referenced to the nominal threshold of human hearing. For sound in air and other gases, dB(SPL) is relative to 20 micropascals (μPa) = 2×10^{-5} Pa, the quietest sound a human can hear.

L_{Aeq} – The A-weighted sound pressure level averaged over the measurement period. It can be considered as the equivalent continuous steady-state sound pressure level, which would have the same total acoustic energy as the real fluctuating noise over the same time period. Measured in dB.

L_{Amax} – The maximum or peak A-weighted noise level that occurs over the measurement period. Measured in dB.

Indoor Design Level – The recommended maximum level in dB(A) inside a building from external noise sources.

A-WEIGHTING

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements in order to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. The A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

NOISE CHARACTER, NOISE LEVEL AND ANNOYANCE

The perception of a given sound to be deemed annoying or acceptable is greatly influenced by the character of the sound and how it contrasts with the character of the background noise. A noise source may be measured to have only a marginal difference to the background noise level, but may be perceived as annoying due to the character of the noise.

Acoustic Dynamics' analysis of noise considers both the noise level and sound character in the assessment of annoyance and impact on amenity.

1 INTRODUCTION

1.1 SUMMARY & BACKGROUND INFORMATION

Acoustic Dynamics has been engaged by **15 Jubilee Pty Ltd ATF 15 Jubilee Trust** to assess noise emission at nearby receiver locations resulting from the use and operation of the light industrial premises located at 15 Jubilee Avenue, Warriewood NSW.

This assessment is based on the inspections, attended noise measurements, and unattended noise monitoring undertaken by Acoustic Dynamics at the subject site.

This document provides an assessment of the measured noise emission associated with the use and operation of the site when assessed at nearby receivers and is prepared in accordance with the acoustic requirements of Northern Beaches Council, the NSW Environment Protection Authority (EPA), and other relevant Australian Standards.

1.2 LOCATION & DESCRIPTION OF PROPOSED COMMERCIAL PREMISES

The proposal is for a multi-unit commercial/industrial complex at 15 Jubilee Avenue, Warriewood in the Northern Beaches Council area of NSW. Acoustic Dynamics understands that the subject site is zoned B7: Business Park.

The site is proposed to contain 24 commercial/industrial units, each with a first-floor warehouse area, and a small mezzanine (office) area, as well as strata storage on the ground floor. The development includes an access for the ground floor and the carpark area on the first floor with 38 parking spaces (9 on ground floor, 29 on first floor) provided for the site. The site shares boundaries with commercial & industrial sites to the west and south, Jubilee Avenue to the north, and a residential property located on IN2: Light Industrial zoned land to the east. The nearest receivers have been identified as:

- Commercial Receiver, 20 Jubilee Avenue (B7 zoning);
- Commercial Receiver, 6-10 Apollo Street (IN2 zoning);
- Commercial Receivers, 5 Ponderosa Parade (IN2 zoning);
- Residential receiver, known as 19 Jubilee Avenue (IN2 zoning); and
- Residential receiver, 185 Warriewood Road (IN2 zoning).

Acoustic Dynamics understands that tenancies within the proposed development will operate during normal day-time hours, being 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm on Sundays. Light industrial activities in all units have been assessed for the subject site, including regular vehicle ingress/egress, the use of forklifts and loading/unloading activities in the common car park, as well as mechanical noise sources (including air-conditioning units).

Additionally, Acoustic Dynamics understands the storage facility is proposed to be accessible 24 hours a day, 7 days a week. Activities associated with the storage facility may include car and removal truck ingress and egress, reverse beeping from removal trucks, and the impulsive noise of car/truck doors closing.

The site is shown on the location map, aerial photo and drawings presented within **Appendix A**.

1.3 SCOPE

Acoustic Dynamics has been engaged to provide a noise assessment of the proposed development. A summary of the scope is provided below;

- Review of Council, NSW EPA, and other relevant documents relating to acoustics;
- Use unattended noise monitoring previously collected at the subject site to determine existing ambient noise levels;
- Establish relevant project specific noise emission and external noise intrusion criteria;
- Determine the noise emission levels at nearby receiver locations, resulting from the operation of the premises; and
- Assess predicted noise emission at nearby receiver locations, and provide recommendations where appropriate.

2 RELEVANT ACOUSTIC CRITERIA AND STANDARDS

Acoustic Dynamics has conducted a review of local council, state government and federal legislation that is applicable to noise assessment for the subject development. The relevant sections of the legislation are presented below.

2.1 NORTHERN BEACHES COUNCIL CRITERIA

2.1.1 LOCAL ENVIRONMENT PLAN

A review of the Pittwater Council Local Environment Plan (LEP) 2014 was conducted. No relevant acoustic requirements and relevant noise criteria were presented within the LEP.

2.1.2 DEVELOPMENT CONTROL PLANS

A review of the Pittwater 21 Development Control Plan (DCP) 2014 was conducted. No relevant acoustic requirements and relevant noise criteria were presented within the DCP.

2.1.3 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT

In accordance with the noise emission requirements of Northern Beaches Council, we advise that noise emission from the proposed gym must also comply with the requirements of the

relevant legislation, being the *Protection of the Environment Operations (POEO) Act 1997*. The POEO Act 1997 requires that the subject plant and equipment must not generate “offensive noise”. Offensive noise is defined as follows:

“offensive noise” means noise:

- (a) *that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*
 - (i) *is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
 - (ii) *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
- (b) *that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.”*

Council can enforce the above planning controls under the Environmental Planning and Assessment Act of 1979.

2.2 PROTECTION OF THE ENVIRONMENT OPERATION (POEO) ACT

We advise that noise emission from the development must also comply with the requirements of the relevant legislation, being the *Protection of the Environment Operations (POEO) Act 1997*. The POEO Act 1997 requires that the subject plant and equipment must not generate “offensive noise”. Offensive noise is defined as follows:

“offensive noise” means noise:

- (a) *that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*
 - (i) *is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
 - (ii) *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
- (b) *that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.”*

2.3 NSW ENVIRONMENT PROTECTION AUTHORITY (EPA)

2.3.1 NOISE POLICY FOR INDUSTRY (NPFI)

Acoustic Dynamics advises that noise emission assessment at nearby and adjacent noise sensitive receivers has been conducted with reference to the EPA’s Noise Policy for Industry (NPFI, 2017).

Project Intrusiveness Noise Level

The intrusiveness noise level is determined as follows:

$L_{Aeq, 15min} = \text{rating background noise level} + 5 \text{ dB}$	
where:	
$L_{Aeq, 15min}$	represents the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes.
and	
Rating background noise level	represents the background level to be used for assessment purposes, as determined by the method outlined in Fact Sheets A and B.

Project Amenity Noise Level

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **project amenity noise level** represents the objective for a noise from a **single** industrial development at a receiver location.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)
--

The **Project Noise Trigger Level** is the lower noise level of the Project Intrusiveness Noise Level and the Project Amenity Noise Level.

To establish the acoustic environment at the subject site in accordance with the guidelines of the NSW EPA's NPfI, Acoustic Dynamics has used unattended noise logger data previously collected at the subject development site between Monday 5 November 2018 and Tuesday 13 November 2018 for the specific purposes of *Blackmores Group*. The noise logger was placed in a location considered to be representative of the noise environment of the most-affected residential receivers within the area. Further, *Blackmores Group* advises that they shall not be liable for any legalities relating to this new Development Application.

Following the general procedures outlined in the EPA's NPfI, a summary of the established noise environment, and relevant environmental noise criteria is presented in **Table 2.1**.

Acoustic Dynamics advises that the assessment has been based on the **lowest** background noise levels in the area during typical **maximum** operations of the proposed residential development. Acoustic Dynamics advises that such an assessment is conservative and will ensure no loss of amenity to the nearby residential receivers.

Table 2.1 Summary of External Noise Level & Most Stringent Criteria

Location	Time of Day	L _{A90} Rating Background Noise Level (RBL) [dB]	Measured L _{Aeq} [dB]	Project Intrusive Noise Level [dB]	Project Amenity Noise Level ² L _{Aeq} [dB]	Project Noise Trigger Level L _{Aeq} [dB]
Nearest residential receiver(s)	Day 7:00am-6:00pm ¹	47	57	52	53	52
	Evening 6:00pm-10:00pm	40	55	45	48	45
	Night 10:00pm-7:00am ¹	38	58	43	43	43

- Note:
- 1) Day-time period starts at 8am on Sundays and public holidays.
 - 2) Amenity adjustment based on "Industrial interface - Urban" receiver type (Table 2.3 of the NPfI). The noise emission objective has been modified in accordance with the recommendations detailed within the NPfI Section 2.2, for time period standardising of the intrusiveness and amenity noise levels (L_{Aeq,15min}) will be taken to be equal to the L_{Aeq, (period)} + 3 decibels (dB).

For premises to which it applies, the NPfI noise criteria for the assessment of noise emission from industrial noise sources at the boundaries of nearby commercial premises are reproduced from Table 2.2 from the NPfI and presented here as **Table 2.2**.

Table 2.2 Summary of External Project Noise Trigger Level – Commercial

Type of Receiver	Time of Day	Project Noise Trigger Level L _{Aeq} [dB] ¹
Commercial Premises	When in use	63
Industrial Premises	When in use	68

- Note:
- 1) The noise emission objective has been modified in accordance with the recommendations detailed within the NPfI Section 2.2, for time period standardising of the intrusiveness and amenity noise levels (L_{Aeq,15min}) will be taken to be equal to the L_{Aeq, (period)} + 3 decibels (dB).

The EPA's NPfI specifies additional noise emission level corrections that should be applied when a noise source is determined to include "modifying factors" that can vary the perceived

intrusiveness of a noise source. Such modifying factors include tonal, low frequency, impulsive, or intermittent noise.

2.3.2 THE EPA'S SLEEP DISTURBANCE CRITERION

Acoustic Dynamics advises that sleep disturbance is a complex issue and the potential for sleep disturbance to occur depends on both the level of noise at a residential receiver and the number of events that occur.

The EPA has in the past investigated overseas and Australian research on sleep disturbance. The method of assessing noise for sleep disturbance EPA relies on the application of a screening that indicates the potential for this to occur. The EPA's Noise Guide for Local Government, provides the following guidance for such a screening test:

“Currently, there is no definitive guideline to indicate a noise level that causes sleep disturbance and more research is needed to better define this relationship. Where likely disturbance to sleep is being assessed, a screening test can be applied that indicates the potential for this to occur. For example, this could be where the subject noise exceeds the background noise level by more than 15 dB(A). The most appropriate descriptors for a source relating to sleep disturbance would be $L_{A1(1\text{ minute})}$ (the level exceeded for 1% of the specified time period of 1 minute) or L_{Amax} (the maximum level during the specified time period) with measurement outside the bedroom window.”

Additionally, the guidelines of the NSW EPA's NPfl provide the following additional information:

“Where the subject development/premises night-time noise levels at a residential location exceed:

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

Further to the above information, the following summarizes the sleep disturbance criterion:

$$L_{Amax} \text{ or } L_{A1(1\text{ minute})} < L_{A90} + 15 \text{ dB or } 52 \text{ dB(A), whichever is greater}$$

In addition to the above, the EPA has published the following additional information relating to findings of significant research carried out for sleep disturbance:

“Maximum internal noise levels below 50-55 dBA are unlikely to cause awakening reactions... One or more noise events per night, with maximum internal noise levels of 65-70 dBA, are not likely to affect health and wellbeing significantly.”

Conservatively based on an assumed minimum ambient background noise level, the following sleep disturbance screening criterion was determined for the residential receivers with windows open:

Sleep Disturbance Criterion = 53 dB(A)

2.3.3 THE EPA'S ROAD NOISE POLICY

The NSW Environmental Protection Authority ("EPA") presents guidelines for assessment of road traffic noise in its Road Noise Policy ("RNP"). The document provides road traffic noise criteria for proposed road as well as other developments with the potential to have an impact in relation to traffic noise generation. **Table 2.3** presents the relevant RNP noise criteria for the subject site.

Table 2.3 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project / land use	Assessment Criteria [dB]	
		Day (7am – 10pm)	Night (10pm – 7am)
Local roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments	L _{Aeq, (1 hour)} 55 (external)	L _{Aeq, (1 hour)} 50 (external)

2.4 AUSTRALIAN STANDARDS

Acoustic Dynamics has conducted a review of relevant Australian Standards in relation to the subject development. The following details this review.

2.4.1 AS2107:2016 "ACOUSTICS – RECOMMENDED DESIGN SOUND LEVELS"

Australian Standard 2107:2016 recommends a design sound level range for various types of occupancy within buildings. AS 2107 recommends the following design sound level range for the various types of occupancies and areas within the development.

Table 2.4 Recommended Design Sound Level Range (Extract from Australian Standard 2107 Table 1)

Type of occupancy / activity	Design Sound Level (L _{Aeq,t}) range
7 RESIDENTIAL BUILDINGS	
Houses and apartments in suburban areas or near minor roads –	
Apartment common areas (e.g. foyer, lift lobby)	45 to 50
Living areas	35 to 45
Sleeping areas (night time)	35 to 40
Work areas	35 to 45
3 INDUSTRIAL BUILDINGS	
Assembly lines – Packaging and Delivery	< 60
Foreman's offices	45 to 50

Note: 1) Reverberation time should be minimised for noise control.

2.5 SUMMARY OF APPLICABLE ASSESSMENT CRITERIA

Acoustic Dynamics advises that assessment of noise emission associated with the light industrial premises must comply with the various relevant noise criteria detailed above.

Assessment of the noise emission from the use of the light industrial premises against the most stringent applicable criteria will ensure compliance with the various other relevant criteria.

Accordingly, **Table 2.5** provides a summary of the noise emission criteria applicable to the light industrial premises, which are based on long term unattended background noise measurements.

Table 2.5 Measured Noise Levels and Applicable Criteria – All Receivers

Location	Time of Day	Maximum Noise Emission L _{Aeq} (15-min) [dB]
Nearest Residential Receivers	Night-time	43
Nearest Residential Receivers	Day-time	52
Nearest Commercial Receivers		63
Nearest Industrial Receivers		68

3 NOISE MEASUREMENT EQUIPMENT & STANDARDS

All measurements were conducted in general accordance with Australian Standard 1055.1-1997, *“Acoustics - Description and Measurement of Environmental Noise Part 1: General Procedures”*. Acoustic Dynamics’ sound measurements were carried out using precision sound level meters conforming to the requirements of IEC 61672-2002 *“Electroacoustics: Sound Level Meters – Part 1: Specifications”*. The survey instrumentation used during the survey is set out in **Table 3.1**.

Table 3.1 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2270	2664115	Brüel & Kjaer Modular Precision Sound Level Meter
4189	2650956	Brüel & Kjaer 12.5 mm Prepolarised Condenser Microphone
4230	623588	Brüel & Kjaer Acoustic Calibrator
XL2	A2A-05090-E0	NTi Audio XL2 Environmental Noise logger

The reference sound pressure level was checked prior to and after the measurements, using the acoustic calibrator, and remained within acceptable limits.

4 NOISE EMISSION LEVELS & ASSESSMENT

The following section provides an assessment of the noise emission from the use and operation of the light industrial premises located at 15 Jubilee Avenue, Warriewood, against the various noise emission criteria and objectives outlined in **Section 2** above.

Acoustic Dynamics has utilised attended noise measurements of relevant noise-generating activities from previously collected data at commercial and industrial sites, to inform our assessment of the maximum L_{Aeq} noise emission levels at the nearest receiver locations for the proposed development.

Acoustic Dynamics advises that the noise emission levels presented below are based on operations at maximum capacity during the quietest hours. The maximum capacity operations have been summarised below:

Daytime

- Maximum capacity internal operations of the 24 tenancies including presumed light industrial equipment such as processing and packing machinery;
- Operation of 24 individual air-conditioning systems (beneath the office of each tenancy) each with an assumed **Sound Power Level of 70 dB(A)**;
- A total of 10 staff in each tenancy;
- 10 carpark movements of staff and customers in a 15-minute period;
- 1 removal truck arriving, unloading/loading and leaving within a 15-minute period; and
- 4 carpark movements of delivery vans in a 15-minute period, including loading and unloading of these vehicles using forklifts.

Evening/Night-time

- 1 removal truck arriving, unloading/loading and leaving within a 15-minute period; and
- 4 carpark movements of storage unit owners within the ground floor carpark within a 15-minute period.

It is noted that given the layout of the storage facility driveway, Acoustic Dynamics does not believe delivery vans will be required to reverse to enter or exit the site. Regardless, removal truck reverse alarms have also been modelled and assessed

Given the use of each tenancy is yet to be determined, Acoustic Dynamics advises that the above assumptions present a worst-case (conservative) scenario for the average operations of a light industrial facility such as is proposed. As the use of each tenancy is determined, Acoustic Dynamics recommends business-specific noise emission assessments be conducted to ensure each tenancy can operate without impacting the amenity of the nearest receivers.

4.1 NOISE EMISSION TO EXTERNAL RECEIVERS

The calculated maximum external noise emission levels at the nearest residential and commercial receiver locations are presented in **Table 4.1** below, assessed against the criteria presented within **Section 2** of this report. It is advised that by achieving compliance with the nearest receiver locations, compliance will also be achieved at those further away.

The predicted noise emission levels presented below in **Table 4.1** include allowances for relevant distance, direction and shielding losses. Additionally, the noise levels presented below include incorporation of the recommendations outlined in **Section 5** of this report.

Table 4.1 External Predicted Noise Emission Levels & Relevant Criteria – Nearest Receivers (Daytime)

Receiver Location	Activity / Noise Source	Calculated Maximum L _{Aeq} Noise Level [dB]	L _{Aeq} Noise Emission Objective [dB]	Complies?
Residential Receivers at 19 Jubilee Ave (East)	Internal Activities (Processing and Handling)	< 30	52 (Daytime)	Yes
	Vehicle movements	40		
	Removal Truck Reverse Alarms	25		
	Forklift loading/unloading	40		
	Mechanical Plant	34		
	Cumulative Total	44		
Residential Receivers at 185 Warriewood Rd (East)	Internal Activities (Processing and Handling)	<20	52 (Daytime)	Yes
	Vehicle movements	27		
	Removal Truck Reverse Alarms	19		
	Forklift loading/unloading	21		
	Mechanical Plant	22		
	Cumulative Total	29		
Commercial Receiver at 5 Ponderosa Pde (west)	Internal Activities (Processing and Handling)	< 30	63 (When in use)	Yes
	Vehicle movements	43		
	Removal Truck Reverse Alarms	37		
	Forklift loading/unloading	15		
	Mechanical Plant	11		
	Cumulative Total	44		
Commercial Tenancy at 6-10 Apollo St (south)	Internal Activities (Processing and Handling)	< 30	63 (When in use)	Yes
	Vehicle movements	43		
	Removal Truck Reverse Alarms	5		
	Forklift loading/unloading	15		
	Mechanical Plant	40		
	Cumulative Total	22		

Receiver Location	Activity / Noise Source	Calculated Maximum L _{Aeq} Noise Level [dB]	L _{Aeq} Noise Emission Objective [dB]	Complies?
Commercial Tenancy at 20 Jubilee Ave (North)	Internal Activities (Processing and Handling)	<20	63 (When in use)	Yes
	Vehicle movements	39		
	Removal Truck Reverse Alarms	34		
	Forklift loading/unloading	12		
	Mechanical Plant	15		
	Cumulative Total	40		

Note: 1) Compliance at the nearest receiver locations will demonstrate compliance at all other sensitive receivers.

Table 4.1 External Predicted Noise Emission Levels & Relevant Criteria – Nearest Receivers (Night-time)

Receiver Location	Activity / Noise Source	Calculated Maximum L _{Aeq} Noise Level [dB]	L _{Aeq} Noise Emission Objective [dB]	Complies?
Residential Receivers at 19 Jubilee Ave (East)	Internal Activities	< 20	43	Yes
	Vehicle movements	36		
	Removal Truck Reverse Alarms	25		
	Cumulative Total	37		
Residential Receivers at 185 Warriewood Rd (East)	Internal Activities	<14	43	Yes
	Vehicle movements	30		
	Removal Truck Reverse Alarms	19		
	Cumulative Total	30		

Note: 1) Compliance at the nearest receiver locations will demonstrate compliance at all other receivers.

Acoustic Dynamics has also determined the potential maximum L_{A1(60 Sec)} noise emission from the storage facility to be **<20 dB** from the activities from within the facility and **15 dB** from the closing of car doors within the ground floor carpark of the proposed site, at the nearest potential residential receivers on the surrounding streets, during night-time hours. We advise that the calculated L_{AMax} noise emission from all activities achieves compliance with the EPA's sleep disturbance screening criterion during night-time hours of **L_{A1(60sec)} ≤ 53 dB**. It is advised that by noise from gym activities achieving compliance with the nearest residential receiver locations, compliance will also be achieved at all other residential receiver locations further away.

The determined noise levels outlined above indicate that the noise from the light industrial premises and storage facility will comply with the applicable criterion established in **Section 2**, provided the management plans and measures outlined in **Section 5** are implemented.

4.2 ROAD TRAFFIC NOISE ASSESSMENT

The calculated maximum noise emission levels due to the delivery, staff & customer vehicle access to/from the site are presented in **Table 4.2** below. It is advised that by achieving compliance with the nearest residential locations, compliance will also be achieved at all other residential and receiver locations further away. Note that the below assessment assumes 10 ingress/egress manoeuvres of staff and customers and 4 ingress/egress manoeuvres of delivery vans in any 15-minute period, whereas the likely number of ingress/egress manoeuvres is likely to be significantly less in a worst-case 15-minute period.

Table 4.2 Maximum LAeq Road Traffic Noise Emission Levels & Criteria for Residential Receivers

All Residential Receivers	Noise Source	Period	Calculated Maximum L _{Aeq} (1 hour) Noise Level [dB]	Relevant Criterion Daytime L _{Aeq} (1 hour) [dB]	Complies With Criteria?
Residential Receivers at 19 Jubilee Ave	Vehicular access from Jubilee Ave	Day-time (7:00am to 10:00pm) ¹	43	55	Yes
		Night-time (10:00pm to 7:00am) ¹	36	50	Yes

Note 1) Day-time period commences at 8am on Sundays and Public Holidays.

We advise that noise emission associated with the use and operation of the subject development, following the incorporation of the management plans and measures in **Section 5** below, will achieve compliance with the relevant noise emission criteria and requirements of the NPfI.

5 RECOMMENDATIONS

Acoustic Dynamics' analysis and prediction calculations indicate that predicted noise emission associated with the subject development requires implementation of the following recommendations, to ensure the amenity of the surrounding area is protected.

5.1 ACOUSTIC BARRIERS

The determined noise levels in **Section 4** are the result of calculations which include modelling of an acoustic barrier that extends along the eastern edge of the subject development (nearest 19 Jubilee Avenue). This barrier must be constructed to a height of **2.4 metres above the finished floor height of the first floor**, to the extent as shown in **Appendix A** and to the following specifications:

- ❑ The acoustic barriers/screens must contain **no gaps** along the surface area of the screen, and be **close fitting (i.e. within 100mm) to the ground** (to prevent the transmission of noise below the barrier, and allow overland flow); and
- ❑ The acoustic barrier(s) must provide a minimum surface density of **15 kg/m²**, and contain **no gaps** along the surface of the barrier(s). All gaps are to be adequately sealed using a flexible mastic sealant. Acoustic Dynamics advises that the acoustic barrier(s) could be constructed to be:
 - A double layer Colorbond™ (or equivalent) barrier(s); or
 - Masonry (brick or concrete) construction; or
 - A minimum 9mm thick compressed fibros-cement sheeting on a timber or steel stud; or
 - A lapped and capped timber fence, with a minimum surface density of **15 kg/m²**; or
 - Other suitable material (minimum surface density of **15 kg/m²**) such as Perspex or equivalent; and
- ❑ Design of the barrier supports of the acoustic barrier(s) must be verified by a suitably qualified contractor to ensure sufficient structural and wind loading support is provided.

5.2 MANAGEMENT PLAN

We recommend establishment of a management plan incorporating measures to ensure the acoustic amenity of the surrounding area. Such a management plan should outline policies and procedures to ensure noise emission from activities associated with the proposed operations are kept to a minimum, including:

- The training of delivery and waste collection vehicles drivers as follows:
 - Ensuring that delivery drivers do not pass-through residential areas unnecessarily, to minimise any potential loss of amenity to residents; and
 - Instructing drivers to switch off the engine at the point of arrival.

6 CONCLUSION AND ACOUSTIC OPINION

Acoustic Dynamics has conducted an acoustic assessment of the noise emission resulting from the use & operation of the light industrial premises located at 15 Jubilee Avenue, Warriewood, NSW.

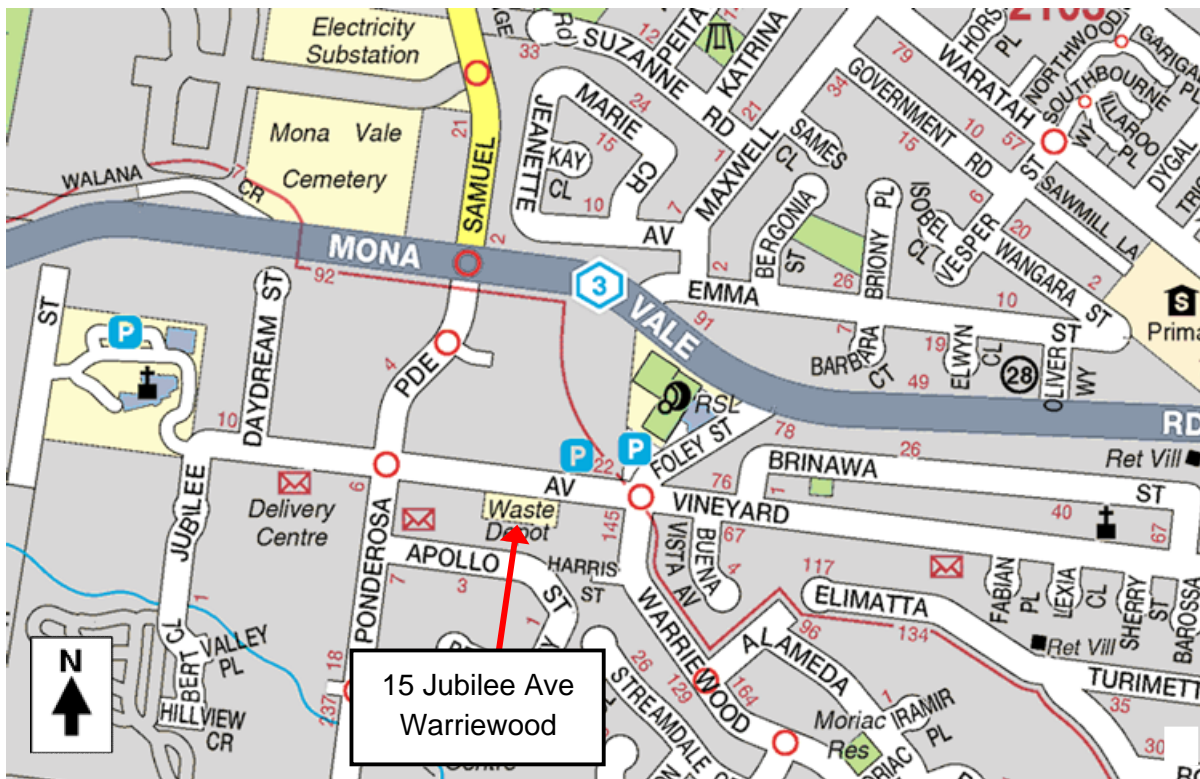
Acoustic Opinion

Further to the noise monitoring and measurements conducted, our review of the relevant acoustic criteria, requirements and our calculations, the proposed operation will likely comply with relevant noise emission criteria of Northern Beaches Council, NSW guidelines and Australian Standards, following the incorporation of our recommendations outlined in Section 5.

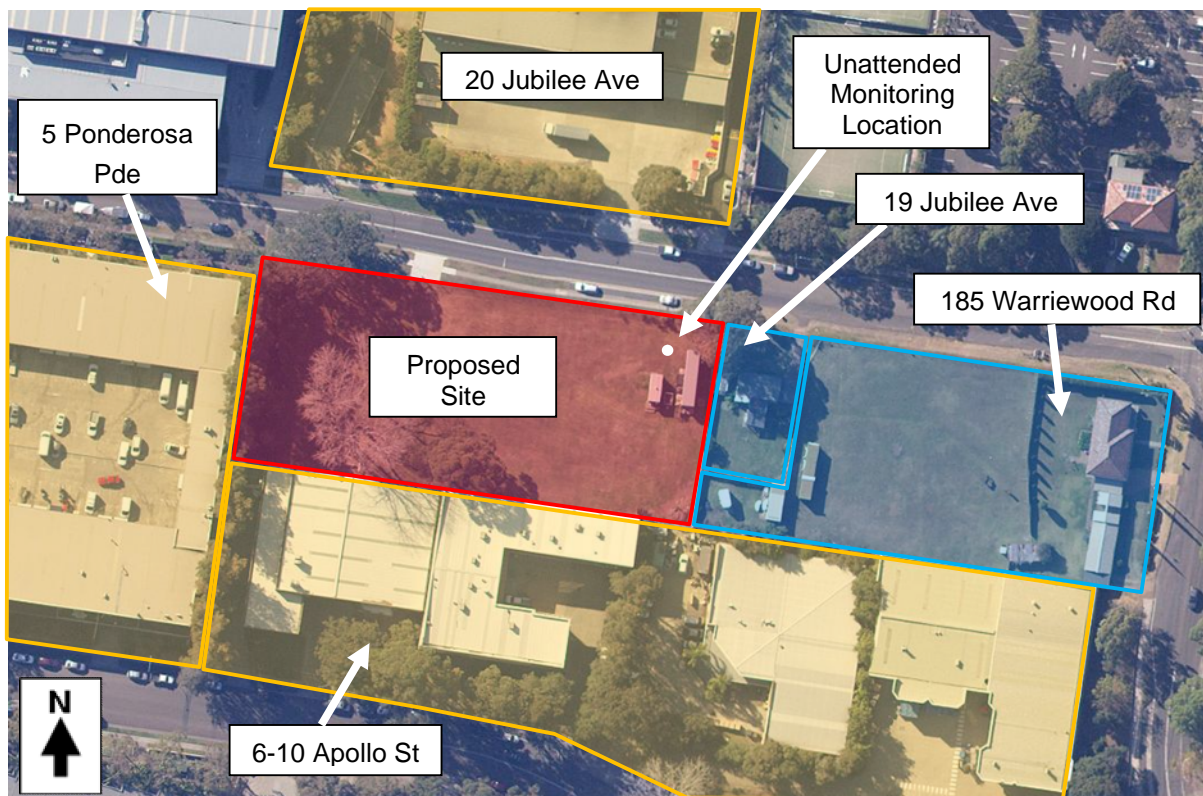
We trust that the above information meets with your requirements and expectations. Please do not hesitate to contact us on 02 9908 1270 should you require more information.

APPENDIX A – SITE LOCATION MAP, AERIAL IMAGE & ACOUSTIC MARKUP

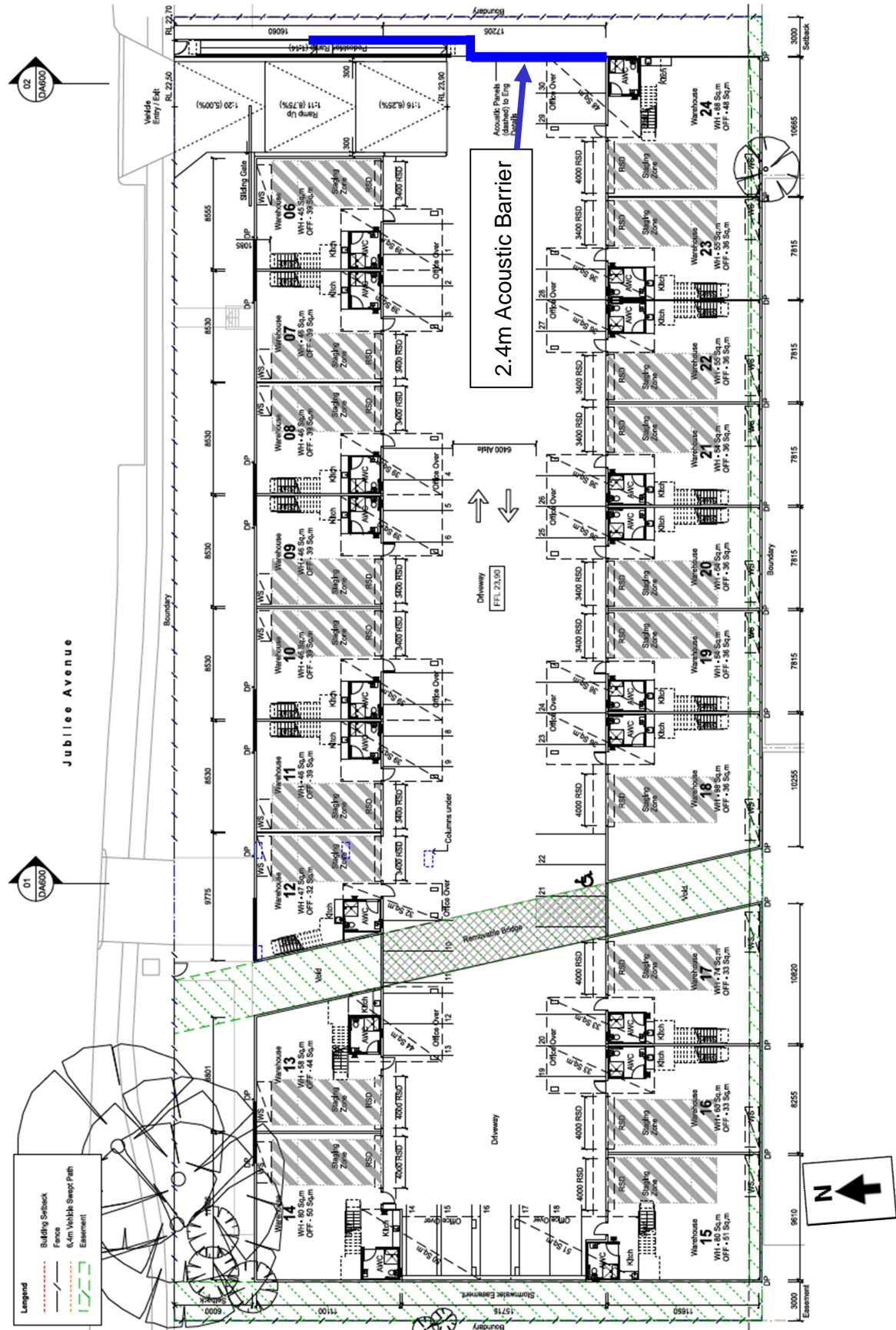
A.1 SITE LOCATION MAP



A.2 AERIAL IMAGE



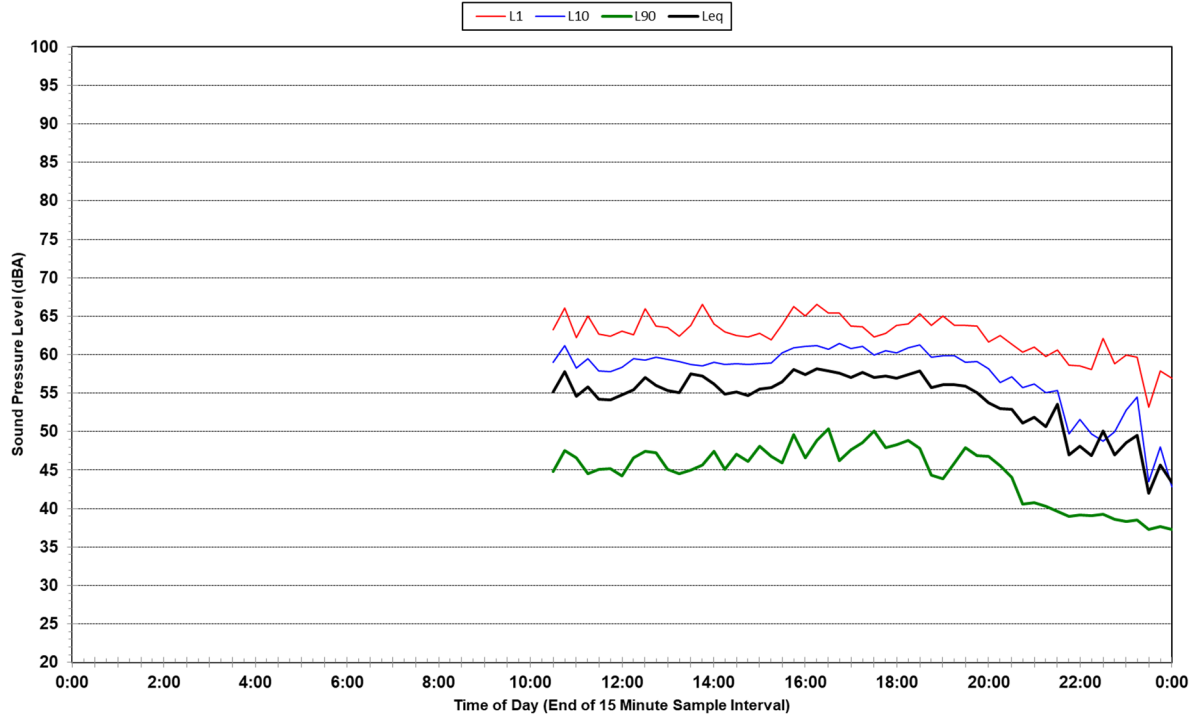
A.3 ACOUSTIC MARKUP



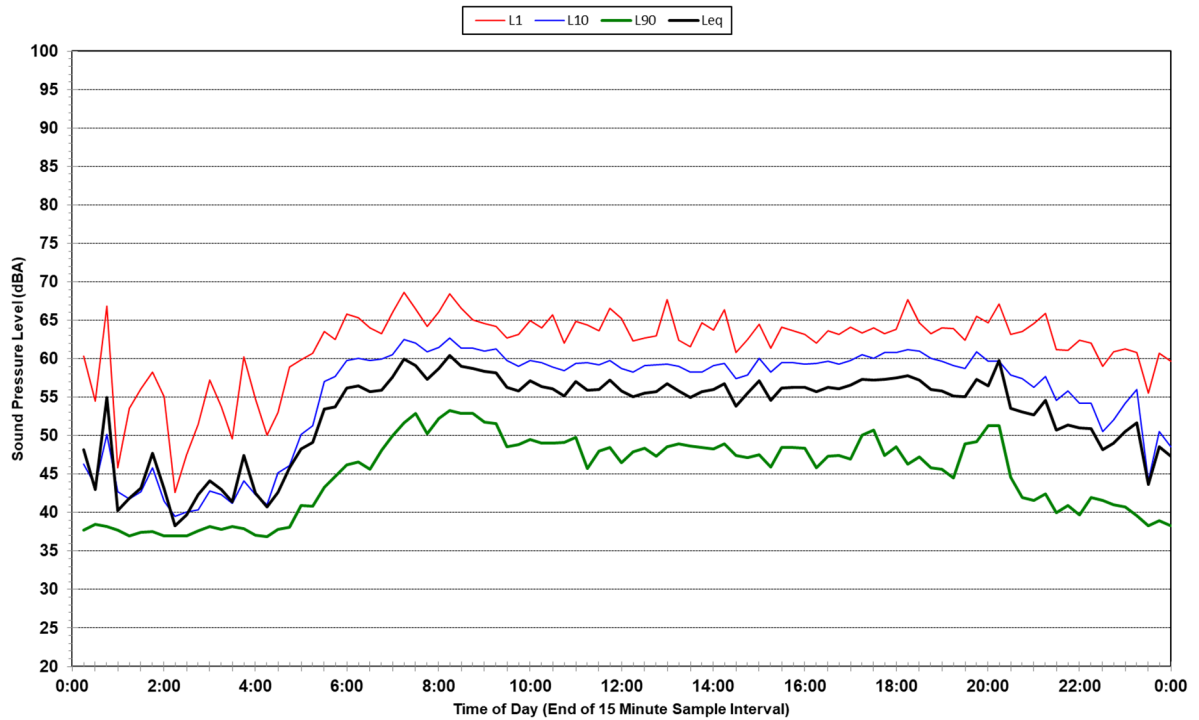
APPENDIX B – NOISE LOGGER DATA

B.1 LOGGER DATA

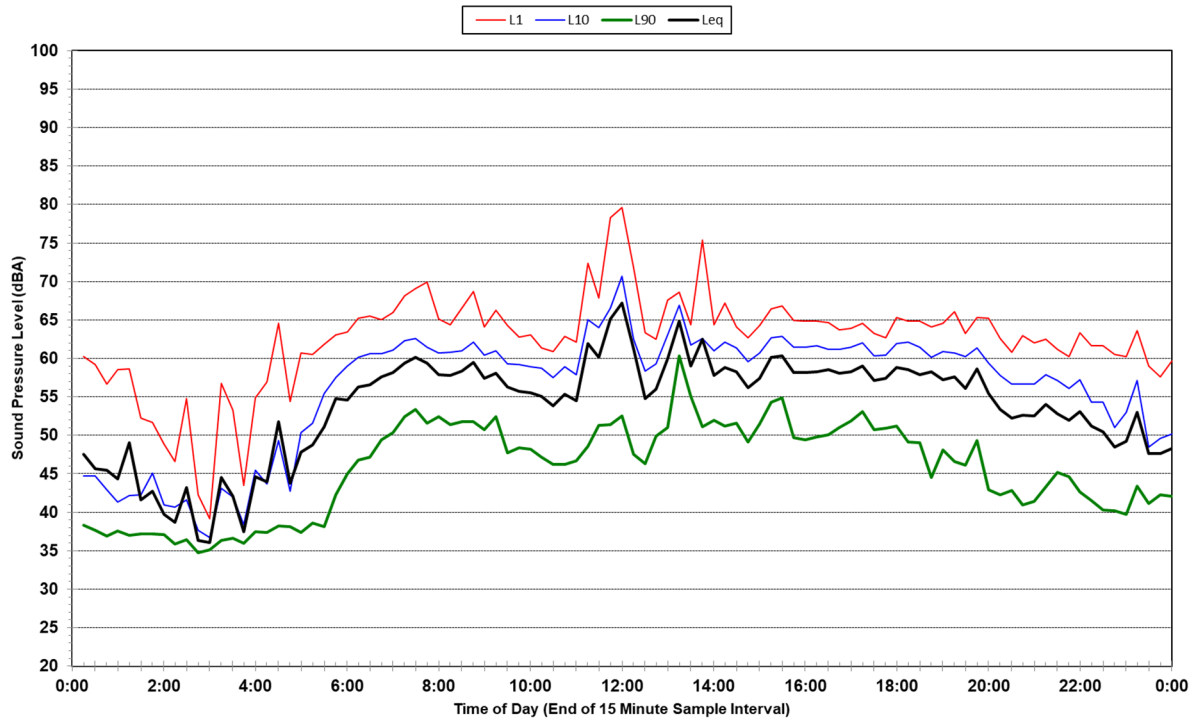
Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Monday 5 November 2018



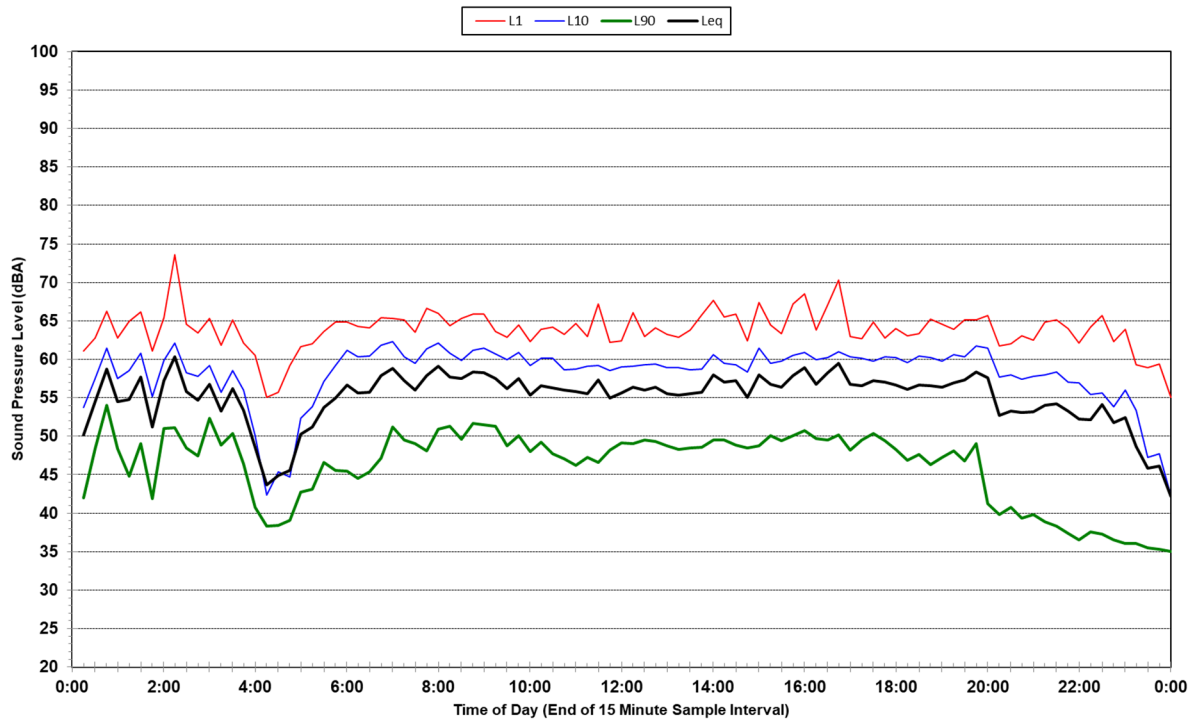
Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Tuesday 6 November 2018



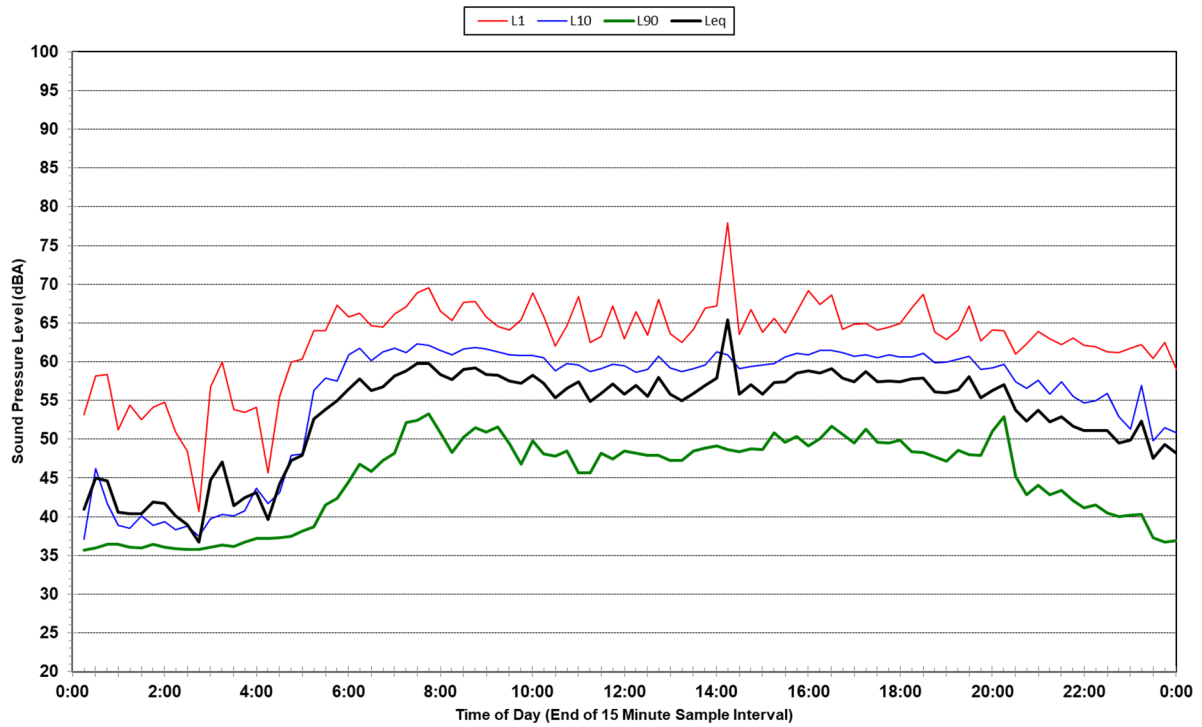
**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Wednesday 7 November 2018**



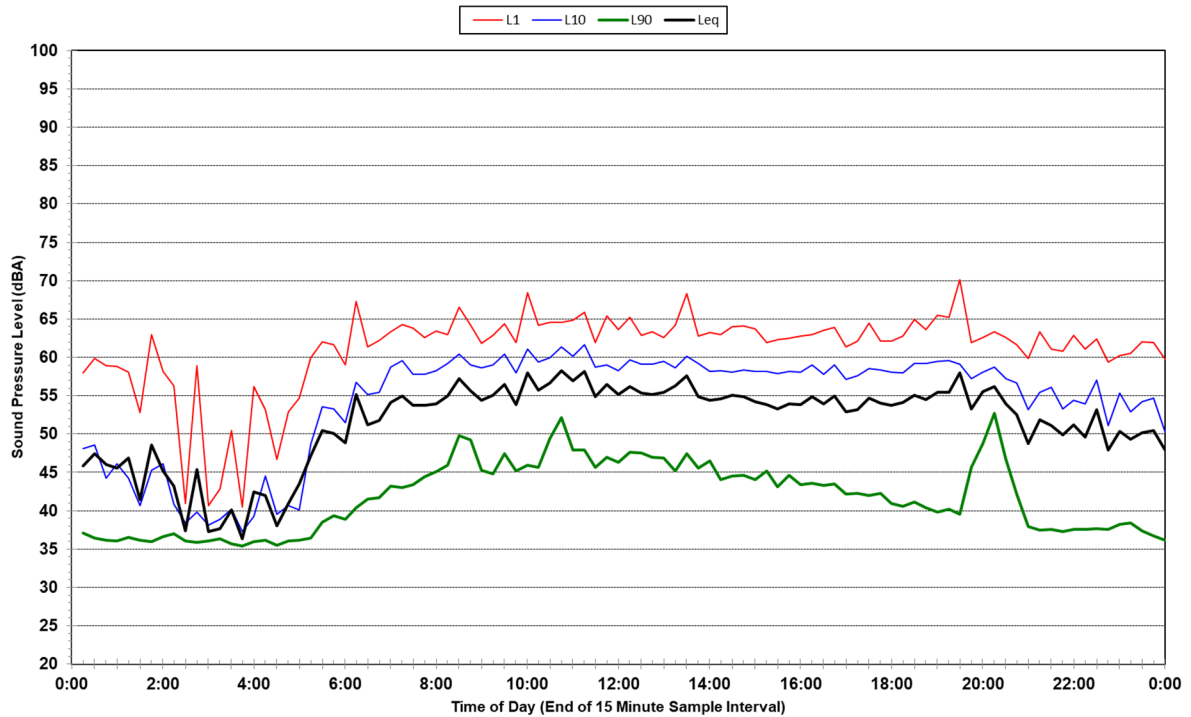
**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Thursday 8 November 2018**



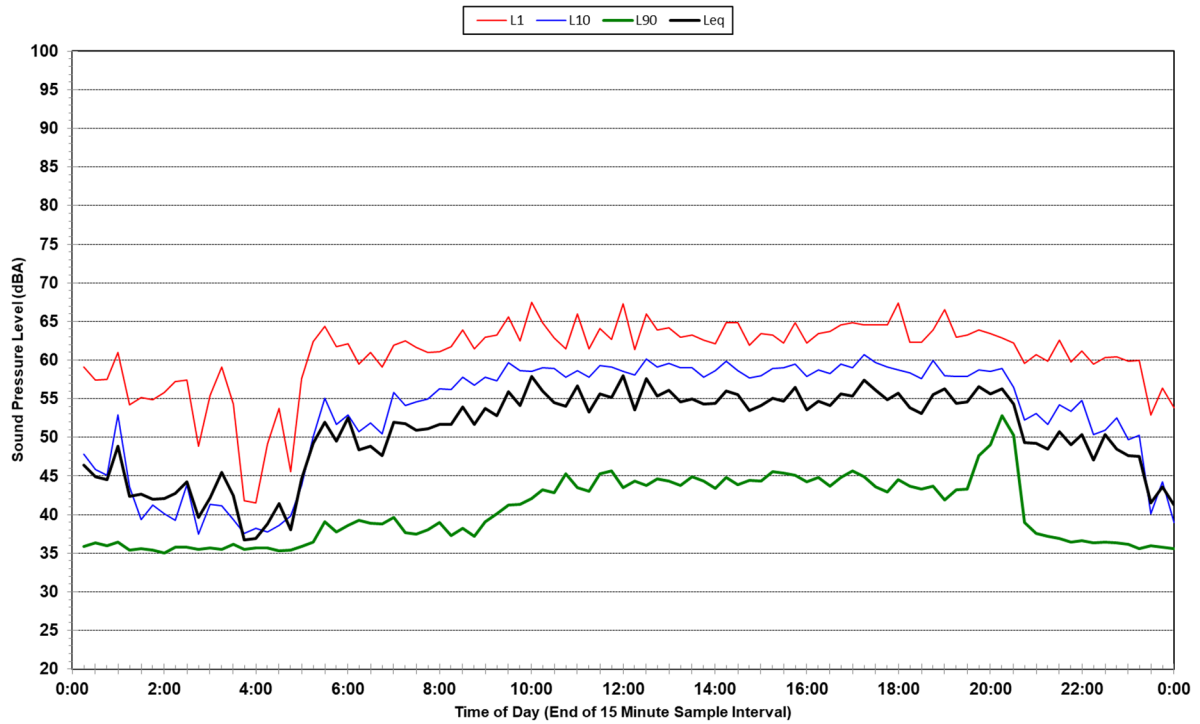
**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Friday 9 November 2018**



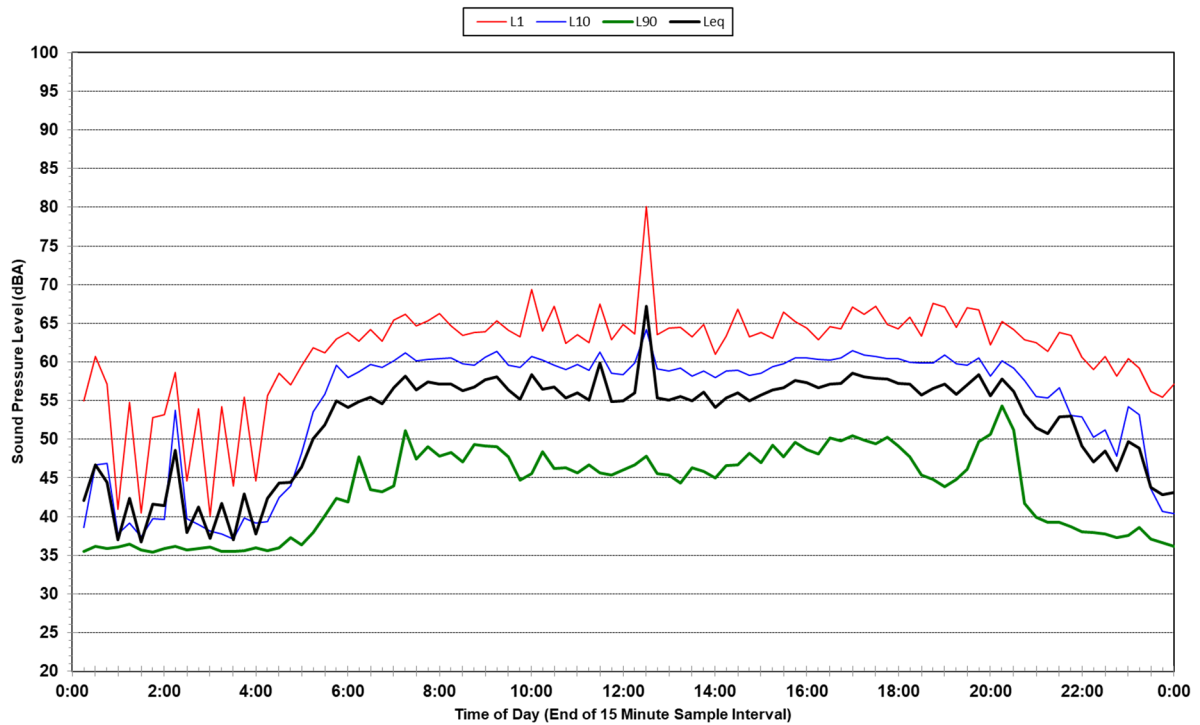
**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Saturday 10 November 2018**



**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Sunday 11 November 2018**



**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Monday 12 November 2018**



**Statistical Ambient Noise Levels
15 Jubilee Ave Warriewood - Tuesday 13 November 2018**

