Hills Marketplace, 287 Mona Vale Rd Terrey Hills

Noise Impact Assessment

1/06/2023

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Revision

Revision	Date	Comment	Prepared By	Approved By
001	26/10/2022	Draft Issue	James Ashpole	Mathew McGrory
002	25/11/2022	Updates to restaurant operation	James Ashpole	Mathew McGrory
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1. Introduction

This Acoustic Report has been prepared by Stantec (Australia) Pty Ltd to accompany the Development Application (DA) for the proposed upgrades of the existing garden centre located at 287 Mona Vale Rd, Terrey Hills, NSW 2084.

The main objectives of this acoustic assessment are:

- Identify the noise and vibration sources that will potentially affect the noise sensitive receivers surrounding the proposed development.
- Carry out noise surveys to determine the existing ambient and background noise levels on the site as well as any external noise sources that will potentially impact the proposed development.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation for the following items:
    - Noise emissions from mechanical plant from the development to the surrounding receivers.
    - Noise emissions from traffic generated by the proposed development.
    - Noise and vibration impacts during construction
- Carry out an acoustic assessment to determine whether the relevant criteria can be achieved and, where applicable, comment on noise control measures required to achieve compliance with the relevant noise level criteria.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed use development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.
- Recommendations for noise and vibration criteria and best practices during construction phase.

The following information has been used for the preparation of this report:

- Architectural Drawings Issued for Development Application provided by BN Group dated 24th May 2023.
- Mechanical Services Drawings of the proposed development provided by Climatech dated 28th February 2022
- Noise data collected on site through the use of a noise logger and a hand held spectrum analyser.

This document and related work has been prepared following Stantec's Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001:2015 and ISO 14001:2015 respectively.

2. Project Overview

The proposed redevelopment is located at 287 Mona Vale Road, Terrey Hills. It includes upgrades of the existing garden centre which has a number of various retail and commercial tenancies. The works will include the demolition of several retail tenancies to allow for an extension to the garden centre, proposed restaurant and other retail tenancies. The redevelopment will also include the relocation and construction of additional carparking. The works will include upgrade to the existing mechanical services to provide fresh air to the development.

The site is bound by Commercial Properties in the form of a Café and the Miramare Gardens (wedding/event venue) to the West. The land adjacent to the north is currently empty rural land, with the Kuan Yin Buddhist Temple located approximately 80 meters from the site boundary. To the South East is Mona Vale road which carries over 40,000 Annual Average Traffic Volume (AADT) according to the Transport for NSW Traffic volume maps for Infrastructure SEPP, and is noted to generate the highest impact regarding the existing background noise in the vicinity of the proposed redevelopment. Beyond Mona Vale Road the land is noted as Public Recreation.

The nearest, most-affected residential receiver is located directly to the north at 285 Mona Vale Road and has been identified in the Figure below (R1) and have been considered the most affected noise-sensitive receivers for the acoustic impact assessment.

2.1 Site Description

The site location of the proposed development at 287 Mona Vale Road is shown in Figure 1. Also included is the identification of sensitive receivers and their classification as well as both attended and unattended noise monitoring locations.

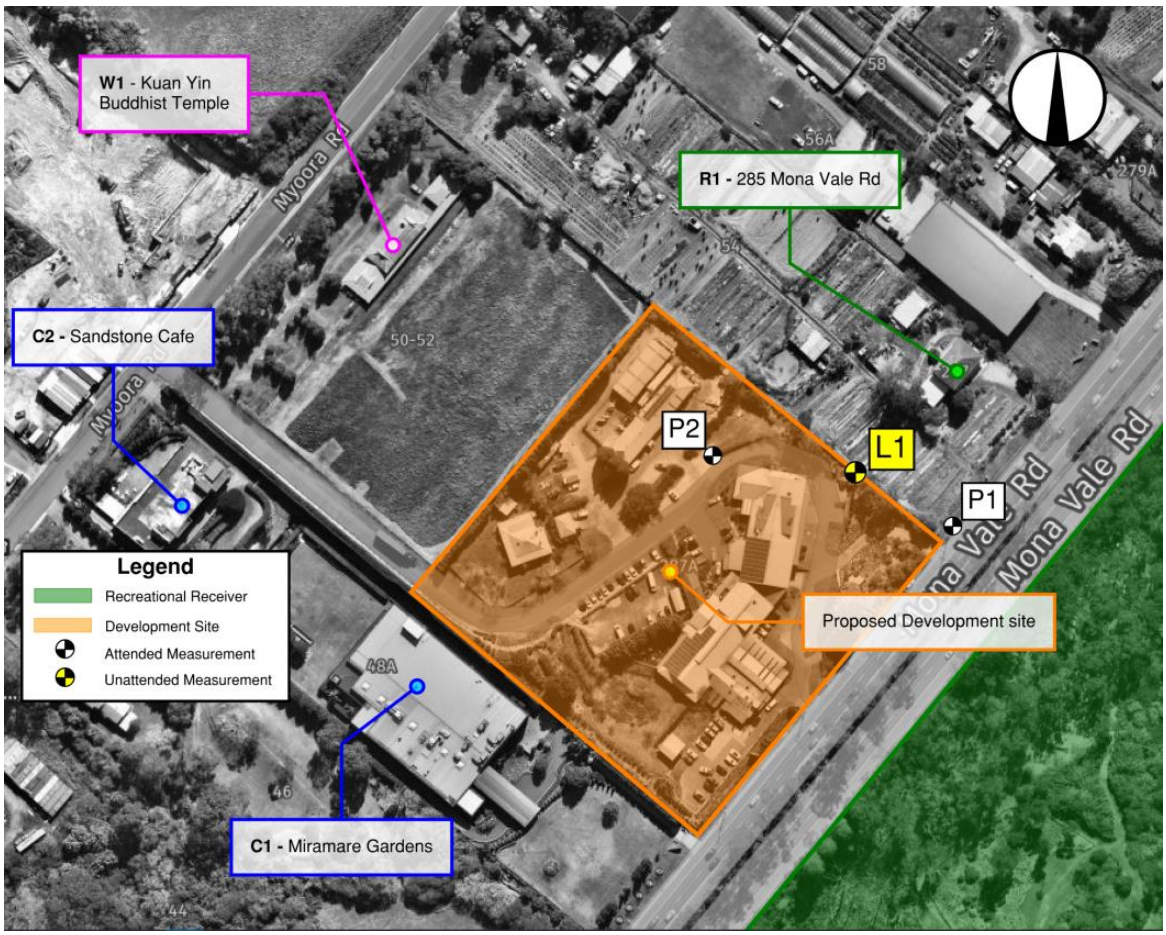


Figure 1: Aerial Photo showing an Overview of the Site, sensitive receivers, and measurement locations

2.1.1 Acoustic Considerations

Noise Impact from the Development on the Environment

The proposed development will generate noise which may adversely impact the surrounding environment, such as the nearby residential and commercial receivers.

The main noise sources generated by the development that may impact the local community and environment include:

- Noise emissions from the operation of mechanical plant servicing the proposed development to the surrounding noise-sensitive receivers.
- Traffic generated by the development, including, vehicle movements entering and exiting the carparking spaces provided.
- Noise emissions from the operation of the licensed restaurant which is proposed to operate up to 12:00am.

3. Noise Survey

3.1 Overview

Attended and unattended noise surveys were conducted in the locations shown in Figure 1 to establish the ambient and background noise levels of the site and surrounds. Noise surveys have been carried out in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'*.

Due to the proposed redevelopment remaining consistent with the current use, the existing high noise environment due to traffic movements along Mona Vale Road, and the distances from the proposed works to the surrounding noise sensitive receivers, the redevelopment has been identified as low risk as per the EPA Noise Policy for Industry. As such, the measurement period for determining existing industrial noise levels will consist of one full day, covering the day, evening and night-time periods.

Unattended Monitoring has been conducted over a full 24 hour period on the 18th to the 19th of October 2022 to understand the local noise environment and to establish the noise criteria to the nearest noise sensitive receivers surrounding the site. Refer to Figure 1 for locations of monitoring on site. In addition to the monitoring conducted, the background and ambient noise results obtained where benchmarked against the attended noise monitoring and the Australian Standard – AS 1005 *Acoustic – Description and measurements of environmental noise'*.

3.1.1 Instrumentation

The following equipment was used for the noise surveys conducted by Stantec:

- Brüel & Kjær Environmental Noise Logger, Type 2250, S/N 3011814
- Type 1 Hand-held sound spectrum analyzer Casella CEL-63X, S/N 4257387
- Sound Calibrator Svan SV30A, S/N 17556;

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

3.2 Unattended Noise Survey Results

Unattended noise surveys were conducted in on-site, refer to Figure 1 for the locations of loggers on-site. Results of the monitoring are presented in the following subsections and graphs of these logged results provided in Appendix A.

3.2.1 Background & Ambient Noise Monitoring

A noise monitor was placed at position L1 as shown in Figure 1 to measure the background and ambient noise that is representative of the surrounding noise-sensitive receivers. Noise monitor L1 was installed from the 18th to the 19th October 2022. The results of the unattended background and ambient noise survey is shown in Table 1 below (for the day, evening and night periods). The local ambient noise environment is dominated by noise from vehicle movements along Mona Vale Road and local wildlife noise throughout the majority of the day periods. Note that any rain affected data during the period of logging has been excluded from the calculations.

Table 1: Long-term noise survey summary – Background noise

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)			Background Noise Level RBL - dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	58	55	52	51	44	31

3.3 Attended Noise Survey Results

Attended noise measurements were conducted on site to characterise the traffic noise intruding into the development and to validate the results of the unattended noise monitoring. The locations of the attended noise measurements close to the proposed development site are shown in Figure 1.

The SLM microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free-field – i.e. more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the attended noise monitoring. Table 2 below shows the summary of the attended noise measurements.

Table 2: Short-term (Attended) Traffic Noise Survey Results

Measurement Location	Measurement Time	$L_{Aeq, period}$ dB(A)	$L_{A90, period}$ dB(A)	Comments
P1	19/10/2022 2:11pm	77	66	Measurement conducted along Mona Vale Road with High Traffic in both directions. The environmental noise is dominated by traffic movements. A high number of heavy vehicles (Trucks and Construction Vehicles) travelling along Mona Vale Road.
P2	19/10/2022 2:26pm	54	51	Measurement conducted towards boundary near the North Eastern existing carpark on site. The environmental noise is dominated by ambient traffic movements from Mona Vale Road. Occasional vehicle movements within the site carpark are present and Loading activities within the externally located loading dock. Wildlife noise (birds) are notable contributor to the background noise level.

4. Noise & Vibration Criteria

4.1 External Noise Emissions

4.1.1 Warringah Development Control Plans (DCP) 2011

The Warringah DCP does not have any specific requirements related to noise emissions from the proposed redevelopment. As such the criteria outlined in the NSW EPA Noise Policy for Industry 2017 presented in 4.1.3 will satisfy the requirement outlined by Warringah DCP with regard to external noise emissions.

4.1.2 Warringah Local Environment Plan (LEP) 2011

Relevant Planning Documents of Warringah Council Legislation have been reviewed for any noise requirement or criteria.

The Warringah-LEP 2011 sets the Land Zoning as shown in Figure 2 as per information extracted from the maps provided by The Warringah LEP 2011 and the NSW Government legislation web service. The proposed site and surrounding developments is categorised as Primary Production Small Lots (RU4) and Public Recreation Land (RE1).

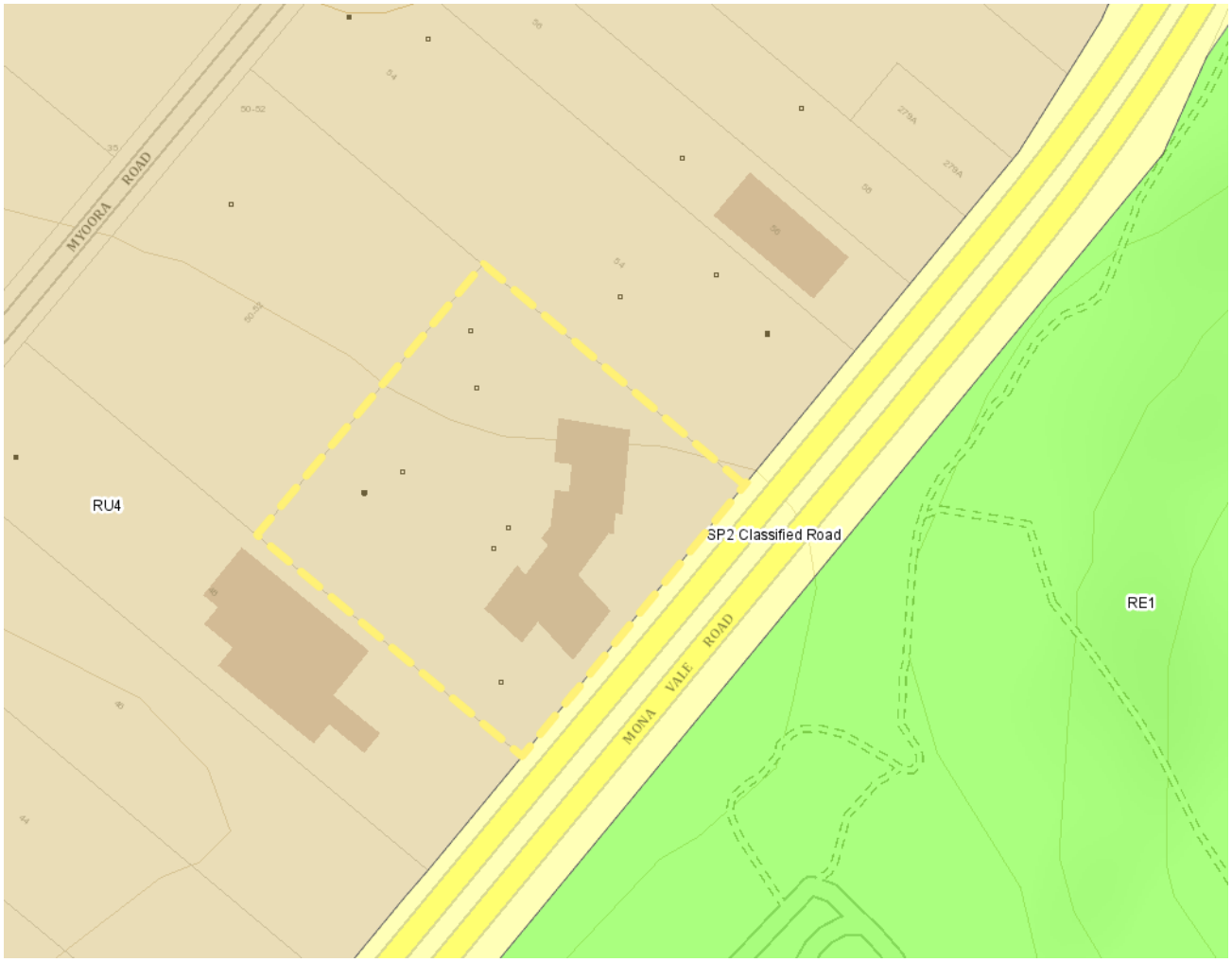


Figure 2: Land Zoning of the site and surroundings.

4.1.3 NSW EPA Noise Policy for Industry (2017)

The *NSW Noise Policy for Industry* has been applied to address the noise emissions from the development to the surrounding noise-sensitive receivers. The NSW NPI sets out noise criteria to control the noise emission from industrial noise sources generated by the proposed development. Operational noise emissions from the development shall be addressed following the guideline in the NSW NPI.

The calculation is based on the results of the unattended ambient and background noise monitoring in conjunction with AS 1055.3-1997, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established, the most stringent for each considered assessment period (day, evening, night) is adopted as the Project Noise Trigger Level (PNTL).

4.1.4 Intrusiveness Criteria

The NSW EPA NPI states the following:

> *"The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), 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)."*

The intrusiveness criterion can be summarised as follows:

$L_{Aeq,\ 15\ minute} \leq$ RBL background noise level + 5 dB(A)

The intrusiveness criterion for the closest residential receivers is presented in Table 3 below.

Table 3: Intrusiveness Criteria

Receiver	Period	Measured Rating Background Level L_{A90} dB(A)	Intrusiveness Criteria L_{Aeq} dB(A)
Residential	Day	51	56
	Evening	44	49
	Night	31	36

4.1.5 Amenity Criteria

The NSW NPI states the following:

> *"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance*

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), +3 dB(A) to convert from a period level to a 15-minute level".

The applicable parts of Table 2.2: Amenity noise levels from Industrial Noise Sources – L_{Aeq}, dB(A) which are relevant to the project are reproduced below:

Table 4: NSW NPI Table 2.2 amenity criteria for external noise levels

Receiver	Noise Amenity Area	Time of Day	L_{Aeq}, dB(A) **Recommended amenity noise level**	$L_{Aeq, period}$ dB(A) **Project amenity noise level**
Residential (R1)	Rural*	Day	50	48
		Evening	45	43
		Night	40	38
Commercial Premises (C1 & C2)	All	When in use	65	63
Place of Worship (Internal)	All	When in use	40	38
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50	48

Note: * Rural area as defined in EPA NSW NPI Table 2.3

Note that where the resultant project amenity noise level is 10dB or more lower than the existing industrial noise level the project amenity noise levels can be set at 10dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

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

Note 3: Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

4.1.6 Project Noise Trigger Levels

The project noise trigger levels for industrial noise sources such as mechanical plant etc. are provided in Table 5. These noise levels have been derived from the Noise Policy for Industry 2017 and AS 1055.3-1997.

Table 5: Project noise trigger levels for industrial noise emissions

Receiver	Period	Descriptor	Project Noise Trigger Levels dB(A)
Residential	Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	**48**
	Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	**43**
	Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	**36**
Commercial	When in Use	$L_{Aeq,15min}$	**63**
Place of Worship (Internal)	When in Use	$L_{Aeq,15min}$	**38**
Public Recreation	When in use	$L_{Aeq,15min}$	**48**

4.1.7 Traffic Generation Noise Criteria

The noise impacts from traffic generation are assessed in accordance with the NSW Road Noise Policy. The criterion (Table 3 – Road Traffic Noise Assessment Criteria for Residential Land Uses) divides land use developments into different categories and lists the respective criteria for each case. The category that is relevant to the proposed use of the site is shown below in Table 6.

Table 6: NSW Road Noise Policy – Traffic noise assessment criteria

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

If the traffic noise at the site is already in excess of the criteria noted above, the NSW RNP states that the primary objective is to reduce the existing level through feasible and reasonable measures to meet the criteria above.

If this is not achievable, Section 3.4.1 Process for applying the criteria – Step 4 states that for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise should be limited to 2 dB above that of the corresponding 'no build option'.

4.2 NSW Liquor Act 2007

The noise criteria set out by the Office of Liquor Gaming and Racing. As part of the Development Application, noise control reports are to be submitted outlining the management of patron noise as well as other offensive noise such as amplified music. The Liquor Administration Board (LAB), and is summarized below:

> *"The LA10 noise level emitted from the licensed premises must not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8 kHz inclusive) by more than 5 dB between 7am and 12 midnight at the boundary of any affected residence."*
>
> *"The LA10 noise level emitted from the licensed premises must not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8 kHz inclusive) between 12 midnight and 7am at the boundary of any affected residence.*
>
> *"Notwithstanding compliance with the above, the noise level from the licensed premises must not be audible within any habitable room in any residential premises between the hours of 12 midnight and 7am or as otherwise required under conditions of development consent."*
>
> *"Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Liquor Administration Board."*

For the purposes of condition, the LA10 can be taken as the average maximum deflection of noise emission from licensed premises. Using the octave band noise data collected, the project specific criteria for the licensed premises is summarized in Table 7. These values have been adopted as criteria for the noise emissions of the licensed premises.

The Liquor Act 2007 criteria is summarised below in Table 7.

Table 7: NSW Liquor Act 2007 Noise Criteria

Period	Octave Band Centred Frequencies (Hz)	Noise Descriptor dB(A)
7:00am – 12:00am	From 31.5Hz to 8000Hz	$L_{A10,\ Oct} \leq L_{A90,\ Oct} + 5$
12:00am – 7:00am	From 31.5Hz to 8000Hz	$L_{A10,\ Oct} \leq L_{A90,\ Oct} + 0$

The project specific noise criteria have been derived from the Logger located at L1 as it is representative of the noise environment of the nearest most affected residential receiver. The project specific noise criteria for licenced premises have been summarised in Table 8 below. The criterion established is based off the measured L_{A90} daily averages which are also shown in Table 8.

Table 8: Project specific noise criteria – NSW Liquor Act 2007

Time Period	Noise Metric	Octave Band Centre Frequency								
		31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Daytime	Minimum Measured L_{A90} (daily average) 7:00am – 12:00am dB(A)	53	56	47	42	42	46	42	33	20
	Criterion L_{A10} 7:00am – 12:00am dB(A)	**57**	**61**	**53**	**47**	**47**	**51**	**47**	**38**	**25**
Night-Time	Minimum Measured L_{A90} (daily average) 12:00am – 7:00am dB(A)	45	45	40	33	31	31	27	25	16
	Criterion L_{A10} 12:00am – 7:00am dB(A)	**45**	**45**	**40**	**33**	**31**	**31**	**27**	**25**	**16**

4.3 Internal Noise Levels

4.3.1 AS/NZS 2017:2016

Australian Standard AS/NZS 2107:2016 – *'Acoustics- Recommended design sound levels and reverberation times for building interiors'* will be used to specifies target noise levels for internal spaces to the development for noise sources and particular spaces that are not covered in the other standards. Traffic noise intrusion AS 3671 refers to internal noise compliance with AS/NZS2107:2016. Refer to Table 9 for the values corresponding to Commercial and Retail spaces.

Table 9: Recommended internal noise levels extracted from AS/NZS 2107:2016

Type of occupancy / activity	Design sound level L_{Aeq}, dB(A) range
Shop Buildings	
Enclosed carpark	< 65
Small retail stores (general)	< 50
Speciality shops	< 45
Supermarkets	< 55
Public Buildings	
Cafeterias	40 to 50
Food courts	45 to 55
Coffee shops	40 to 50
Restaurants	40 to 50

4.4 Construction Noise and Vibration Criteria

4.4.1 Construction Noise

Noise criteria for construction sites are established in accordance with the Interim Construction Noise Guideline (ICNG July 2009) by the NSW Environment Protection Authority (EPA). It is important to note that the recommended criteria are for planning purposes only. Numerous other factors need to be considered when assessing potential noise impacts from construction works.

However, in undertaking the assessment of potential noise intrusion associated with the proposed construction activities, *Chapter 4 of the NSW EPA ICNG (July 2009)* were specifically referenced. The limits presented in Table 10 apply.

Table 10: NSW EPA ICNG Construction Noise Criteria

Time of Day	Management Level $L_{Aeq,15min}$ *	How to Apply
Recommended Standard Hours: Mon – Fri (7am – 6pm) Sat (8am – 1pm) No work on Sunday & Public Holidays	Noise Affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ 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 residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise Affected RBL + 5dB(A)	• 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(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2.

Note: 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 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Source: Chapter 4 (Table 2 Sec 4.1.1) of NSW DECCW ICNG

4.4.2 Construction Vibration

The NSW Environment Protection Authority (EPA) developed a document, "Assessing vibration: A technical Guideline" in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. The guideline does not however address vibration induced damage to structures or structureborne noise effects. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent.

4.4.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. The likelihood of complaints from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 11. It should be noted that the human comfort levels for vibration are more stringent than the building damage criteria.

Table 11: RMS values for continuous and impulsive vibration acceleration (m/s^2) 1-80Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
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	0.02	0.014	0.040	0.028
Workshops	Day or night time	0.04	0.029	0.080	0.058
Impulsive vibration					
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

4.4.2 Human Comfort – Intermittent Vibration Criteria

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Various studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude. The VDV is often used to measure the vibration impact associated with train passbys throughout the day or night.

Table 12: Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime (7:00am to 10:00pm)		Night-time (10:00pm to 7:00am)	
	Preferred value	Maximum value	Preferred value	Maximum value
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

4.4.3 Structural Damage – Vibration Criteria

Ground vibration criteria is defined in terms of the levels of vibration emission from the construction activities which will avoid the risk of damaging surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity.

Most commonly specified structural vibration criteria are defined to minimise the risk of cosmetic surface cracks and are set below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in German Standard DIN4150-Part 3 “Structural vibration in buildings – Effects on structures” and British Standard BS7385-Part 2: 1993 “Evaluation and Measurement for Vibration in Buildings”. Table 13 shows the vibration limits presented in DIN4150-Part 3 to minimise the risk structural damage doesn’t occur.

Table 13: Guideline value of vibration velocity, vi, for evaluating the effects of short-term vibration

Line	Type of Structure	Vibration velocity, vi, in mm/s			
		Foundation			Plane of floor of uppermost full storey
		At a frequency of			
		Less than 10Hz	10 to 50Hz	50 to 100*Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular 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
*For frequencies above 100Hz, at least the values specified in this column shall be applied					

Table 14 presents guide values for building vibration, based on the lowest vibration levels above which cosmetic damage has been demonstrated as per BS7385-Part 2:1993.

Table 14: Transient vibration guide values for cosmetic damage

Type of Building	Peak Particle Velocity in frequency range of predominant pulse (PPV)	
Residential or light commercial type buildings	4 Hz to 15 Hz	15 Hz and above
	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

4.4.4 Construction Vibration Objectives

Table 15 indicates the construction vibration criteria applicable to the residential properties located adjacent to the development.

Table 15: Construction vibration criteria summary

Location	Period	Human Comfort Vibration Objectives			Building damage Objectives – Velocity (mm/s)
		Continuous mm/s^2 (RMS)		Intermittent m/s$^{1.75}$ (VDV)	
		z-axis	x- and y-axis		
Residential	Day time	10 - 20	7 - 14	0.20 - 0.40	5
	Night-time	7 - 14	5 - 10	0.13 - 0.26	5
Offices, schools, educational institutions and places of worship	Day time or Night time	20 – 40	14 – 28	0.4 – 0.8	20
Workshops	Day time or Night time	40 - 80	29 – 58	0.8 – 1.6	20

5. Operational Noise & Vibration Assessment

The proposed development will provide customers with tenancies for both recreational/entertainment use (restaurant with ancillary brewery) and retail purposes. The way in which customer behave in each environment is expected to vary and will have differing impacts on the surrounding local noise environment.

The retail land use is expected to have lower impact from customer generated noise, with the mechanical equipment expected to generate a higher contribution on the surrounding noise sensitive receivers, whilst the restaurant tenancies of the proposed development are expected to have a higher contribution from patron generated noise. It should be noted, the restaurant tenancies are located on the South-western side of the development site and has greater distance and shielding (from other tenancies) to assist in mitigating the higher noise levels from patrons to the nearby residential noise sensitive receivers.

The Operational noise assessment of the proposed development is addressed in the following subsections.

5.1 Mechanical Plant and Equipment Assessment

Noise sources from general operation of the development site will typically include mechanical services noise from proposed upgrades to air-conditioning equipment and inclusion of any new equipment to serve any new spaces as part of the redevelopment. These noise sources have been used to predict the noise impact at on-site residential noise sensitive receivers. These noise-sensitive receivers include the following:

- Noise sensitive receivers (R1, C1, C2 and W1) as identified in Figure 1

The following noise sources are considered the most likely to cause an adverse noise impact to noise sensitive receivers if not treated effectively:

- Fan Coil Units (FCU's) serving the internal spaces of the proposed development, with outside air intake ducted to the External envelope of the development.
- External Condenser units located on the ground floor serving individual tenancies of the proposed development.
- Exhaust Fans with discharges located at roof level for the proposed restaurant and Ancillary Brewery and Garden Centre extension.

The proposed development has proposed the following hours of operation:

- The café is proposed to operate between the hours of 7:00am – 10:00pm (7 days a week).
- The proposed restaurant with ancillary brewing facilities on the south-western boundary will operate between 7:00am – 10:00pm (Sunday – Wednesday) and will extend its operation hours on Thursday – Saturday to midnight (12:00am).
- All other retail tenancies have their own specific trading hours, but will operate at any point between the hours of 7:00am – 8:30pm (7 days a week)

In order to assess the worst-case scenario, it is assumed that the air conditioning units associated with the proposed development are running at any time throughout the day-time and evening periods (7:00am – 10:00pm), with the exception of the restaurant with ancillary brewery, which will be assessed up to the night-time period (up to 12:00am).

With all, the evening and night periods are the most stringent period for the noise generated by the operation of the mechanical plant, therefore this criterion was used as the noise target at the boundary of the nearest sensitive receivers for the project.

5.1.1 Proposed Equipment Noise Levels

Table 16 presents the proposed maximum sound power levels for individual mechanical units to achieve the noise criteria shown at the nearest sensitive receiver of the site. Mechanical plant Sound Power Levels for the Outdoor condenser units have been provided by the Mechanical Services Consultant. This information has been extrapolated into noise spectrums, based on typical condenser units, which has been implemented into the acoustic modelling. Further to this, no noise data for the Exhaust Fans associated with the redevelopment has been provided, as such, typical spectra has been implemented at this stage. However, the assessment will need to be amended if there are any changes to the provided equipment schedule, when specific units are selected for the exhaust fans, and when the locations of equipment has been finalised.

Table 16: Proposed acoustic power for individual mechanical units

Item	Number of Units	Sound Power Level SWL dB(A)								
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Overall dB(A)
Condenser Unit (Restaurant with Ancillary Brewery)	x2	74	74	71	68	64	61	58	50	70
Condenser Unit (Garden Centre)	x1	66	66	63	60	56	53	50	42	62
Condenser Unit (Weber BBQ)	x2	73	73	70	67	63	60	57	49	69
Condenser Unit (Pittwater Mowers)	x3	71	71	68	65	61	58	55	47	67
Condenser Unit (Horseland)	x4	66	66	63	60	56	53	50	42	62
Condenser Unit (Garden Centre Office)	x1	73	73	70	67	63	60	57	49	69
Condenser Unit (Hills Flower Market Office)	x1	71	71	68	65	61	58	55	47	67
Condenser Unit (Garden Centre)	1	66	66	63	60	56	53	50	42	62
Toilet Exhaust (Typical Spectra)	X2	66	63	63	64	63	59	51	43	67
Kitchen Exhaust (Typical Spectra)	X2	67	69	73	71	66	65	59	59	73

5.1.2 General Mechanical Equipment – Noise Mitigation Measures

Noise generation by mechanical equipment in association with the proposed development is to be managed to ensure external noise emissions are not intrusive and do not impact the amenity of the nearest sensitive receivers.

To meet the external noise emissions requirements for noise generated by the mechanical plant and equipment the following are some typical practices to mitigate noise from operation of mechanical plant and equipment on rooftop plantrooms.

- Where possible, locate plant as far away from possible noise sensitive receivers as practical to minimise the aggregate noise level.
- Select low noise mechanical equipment.
- Where possible, locate noisy plant within an enclosed plant space.
- Carpark Exhaust should allow for sufficient ductwork to allow for acoustic internal lining (minimum 50mm thick) on the discharge side to reduce the extent of noise to the environment.
- Outside air intake ductwork reticulation on Fan Coil Units should be internally lined to reduce the extent of noise transmission to the environment.

5.1.3 Predicted Noise Levels

Table 17 presents the predicted noise levels anticipated from operation of the mechanical equipment to the nearest noise sensitive receivers. The assessment has been based on the equipment provided in Table 16 in addition to the assumptions and mitigation measures outlined above.

Table 17: Predicted noise level at noise sensitive receivers – Mechanical Equipment

Receiver	Criteria Period	Predicted Noise Level (worst case) $L_{Aeq, 15min}$ – dB(A)	Evening-time criteria NSW NPI $L_{Aeq, 15min}$ – dB(A)	Evening Time Background Noise Level RBL dB(A)	Compliance (Yes/No)
285 Mona Vale Road (Residential - R1)	Evening (6:00pm - 10:00pm)	39	43	44	Yes
	Night 10:00pm – 7:00am)	31	36	31	Yes
Miramare Gardens (Commercial – C1)	When in use	38	63	44	Yes
Sandstone Café (Commercial – C1)	When in use	31	63	44	Yes
Kuan Yin Buddhist Temple (Place of Worship – W1)	When in use	31	38	44	Yes
Public Recreational Area	When in use	36	48	44	Yes

5.2 Licensed Premises Noise Impact Assessment

The operational noise assessment considers the noise associated with activities within the restaurant located on the ground floor level of the newly proposed building on the south-western boundary of the site. The noise breaking out from the dining areas has been assessed based on the expected maximum number of patrons occupying the areas at a given time.

The proposed restaurant will operate during any period of time during the day-time and evening periods between the hours of 7:00am and 10:00pm. The restaurant is proposed to extend operation to 12:00am on Thursdays – Saturday, and will therefore be assessed to the relevant criteria established in the Liquor Act 2007 for this time interval.

5.2.1 Restaurant Noise Assumptions

The assessment was made considering the architectural drawings provided by BN Architecture. The nearest most-affected residential receiver is considered to be R1. The worst-case scenario investigated in the assessment, regarding the operational activities of the proposed development, is considered to be the following:

- The restaurant will accommodate a maximum of 250 patrons at any given time. From this, 100 patrons are assumed to be in the outdoor areas (Alfresco dining setting on the ground floor, as well as additional patrons locations on the lawn area on ground floor). The remaining patrons are expected to be located within the internal portions of the restaurant. See Figure 3 below for the extent of areas used in the acoustic assessment.
- The doors separating the restaurant to the external undercover walkway is assumed to be open at any time throughout the operation hours.
- 50% of the patrons are speaking continuously at any given time.
- The restaurant will operate in a worst case scenario (Thursdays to Saturdays) at any time between 7:00am and 12:00am.
- The restaurant and bar is at capacity across its entire operating hours.
- The noise levels used have been based on typical speech noise levels for various vocal efforts as per the Olsen Method and measurements conducted. The Sound Power Levels are presented in Table 18.
- Raised vocal effort has been assumed for the purposes of the assessment. Typically, individuals will raise their voice to be heard in a lively environment.

Table 18: Acoustic power for single person, SWL re 1pW

Item	Frequency (Hz) dB							Overall dB(A)
	125	250	500	1000	2000	4000	8000	
1 person raised voice	66	70	75	69	65	60	55	75

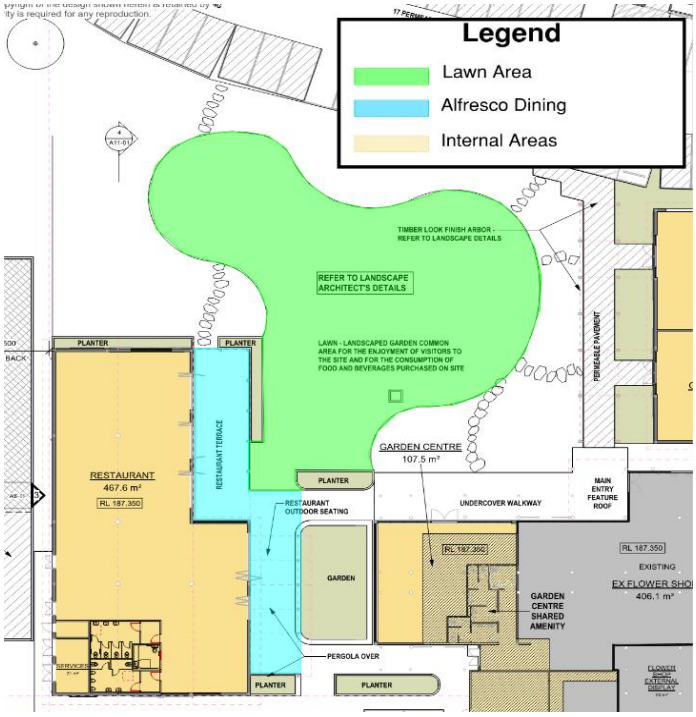


Figure 3: Outdoor areas for restaurant operation – Ground Floor

5.2.2 Predicted Noise Levels – Without Mitigation Measures

The predicted noise levels at the boundary of the nearest noise sensitive residential receiver (R1) are given in Table 19. The noise levels have been compared to the criteria established in line with the Liquor Act 2007 as per Section 4.2. It has been noted that R1 is likely to be the most affected receiver from operations of the dining areas due to the more direct line of sight without shielding provided by the surrounding retail buildings.

Table 19: Predicted Noise Levels at Residential Receiver (R3) – Day time – without mitigation measures

	Frequency (Hz)								
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Criteria 7:00am–12:00am $L_{A10, Oct}$ dB(A)	**57**	**61**	**53**	**47**	**47**	**51**	**47**	**38**	**25**
Predicted Noise Level (R3) $L_{A10, Oct}$ dB(A)	-	-	26	30	33	26	21	14	8
Compliance (Yes/No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Based on the maximum number of occupants proposed being restricted to as detailed above, the noise emissions are expected to meet the requirements of the NSW Liquor Act at the most affected residential receivers without additional mitigation measures.

Regardless, the following management measures should be adopted to reduce any potential impact on surrounding receivers:

- Occupants should be aware of the noise emissions and not create excessive noise.
- Signage to encourage patrons to be mindful when leaving the restaurant so as to not impact the nearby noise sensitive receivers.

5.3 Traffic Generation Noise

A traffic generation noise assessment has been undertaken in order to determine the potential noise impact of traffic generated by the proposed development.

As noted in Section 4.1.7, when considering land use development and the impact on sensitive land uses, the NSW RNP states that an increase up to 2.0dB in relation to existing noise levels is anticipated to be insignificant. The existing conditions on site demonstrate that the noise in association with local traffic is above the criteria for each respective period (daytime and night-time).

Based on the Attended and Unattended Monitoring conducted in addition to the information provided by Transport for NSW Traffic volume maps for Infrastructure SEPP, the existing Annual Average Traffic Volume is above 40,000 vehicles with a high percentage of heavy vehicles. Based on the GFA, the available parking spaces of the proposed redevelopment areas of the site, and the existing conditions (high existing traffic along Mona Vale Road) there is not expected any discernible or adverse noise impacts to the nearby noise sensitive receivers and is compliance with the criteria outlined in Section 4.1.7. As an indication, a 3dB increase in noise levels would be resultant of a doubling of total traffic in the area.

6. Conclusion

The existing and predicted noise environment has been assessed for the redevelopment of the existing Hills Marketplace, located at 287 Mona Vale Road, Terrey Hills and its nearby surroundings. This document forms part of the documentation package to be submitted to authorities as part of the development application (DA), based on design updates and additional noise monitoring.

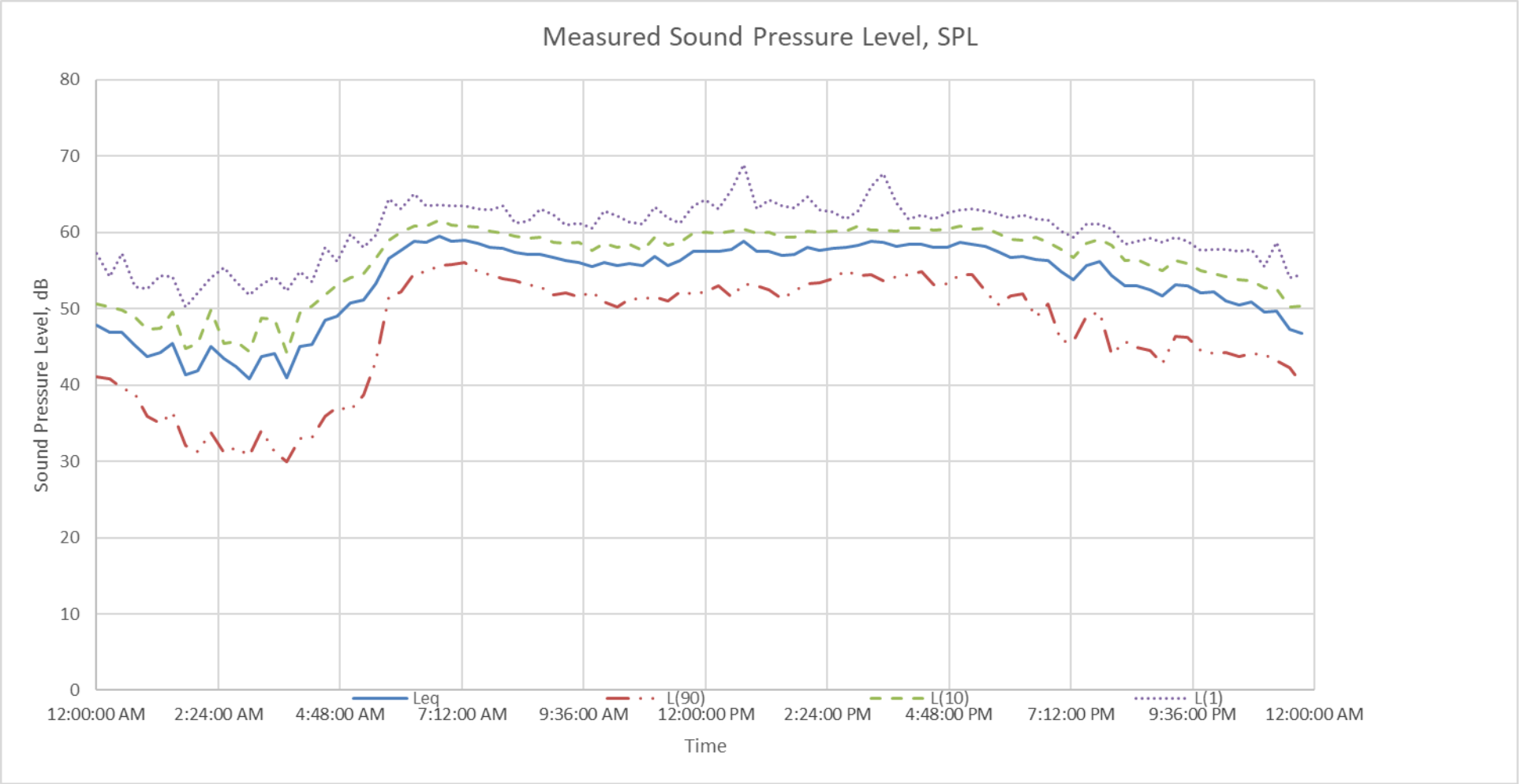
This report has provided criteria, in-principle treatment, and design requirements, which aim to achieve the statutory criteria discussed in Section 4. The criteria aim to provide acoustic amenity to the future occupants of the proposed development and maintain the surrounding noise environment.

It is the opinion of Stantec that the development and its proposed site are not expected to generate or be exposed to excessive noise or vibration.

Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, having given regard to the above listed conclusions, it is the finding of this assessment that the development application should be granted on acoustic grounds.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of air-conditioning units, layout of equipment, modifications to the building and introduction of any additional noise sources.

Appendix A Noise Logger Graph



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