President Private Hospital, 369-381 President Avenue, Kirrawee 10320

Construction Noise and Vibration Management Sub Plan (CNVMSP)

President Property Company Pty Limited
301 Catherine Street,
Leichhardt NSW 2060

Report Reference: 240532-1 - President Private Hospital - CNVMSP - R0

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1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) has been engaged by President Property Company Pty Limited to prepare a site-specific Construction Noise and Vibration Management Sub-Plan (CNVMSP) for the redevelopment of the existing President Private Hospital located at 369-381 President Avenue and 2 & 3 Bidurgal Avenue, Kirrawee NSW and 61 & 65 Hotham Road, Gymea NSW.

This CNVMSP has been prepared to address a number of noise and vibration related conditions as outlined in Annexure A from the NSW Land and Environment proceedings LEC 2023/51612, dated 16th April 2024. Refer to section 3.1.

Onsite unattended noise levels have previously been determined for the project by Acoustic Directions in the sites *Noise and Vibration Impact Assessment* submitted for as part of the SSD Application, report reference: *Noise and Vibration Assessment for Proposed Alterations and Additions to President Private Hospital*, dated 29th June 2020. These will be adopted for the purpose of establishing residential Noise Management Levels (NMLs).

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

1.1 Development Overview

The proposed development comprising:

- Demolition of three single storey dwellings on the site and areas of the existing hospital affected by the redevelopment.
- Demolition of a listed local heritage item, Hotham House.
- Construction of a new three-storey building with two basement car park levels, providing inpatient accommodation, therapy and rehabilitation facilities, and support services.
- An increase in the number of surgical and rehabilitation beds from 45 to 110, and a new mental health facility with 72 beds bringing total patient beds to 182.
- Refurbishment of the wellness centre, comprising a rehabilitation gym, change rooms, and hydrotherapy pool.
- A new site linkage between the wellness centre and hospital; and
- Upgrade of the existing three operating theatre suites and the construction of a fourth operating theatre and new recovery and sterilising facilities.

1.2 Project Construction

To ensure the successful delivery of the project whilst maintaining a semi-operational hospital, the project will be delivered in phases. The three (3) phases are described below.

- Phase 1:
    - Demolition of 65 and 61 Hotham.
    - Road, 53 and 54 Bidurgal Avenue.

- Demolition of existing staff carpark.
- Excavation for northern carpark.
- Construction of the northern wing.
- Construction of main entry.
- Construction of vertical circulation.
- Construction of northern carpark, surface carpark and vehicular access to main entry.
- Fit-out of CSSD.
- Possible temporary staff parking in west car park.

- Phase 2:
  - Demolition of existing eastern ward.
  - Demolition of existing southern easter carpark.
  - Excavation for south eastern carpark.
  - Construction of eastern wing.
  - Refurbishment of existing areas amongst CSSD and Patient recovery.
  - Construction of south eastern carpark.
  - Temporary ground floor linkage from new north wing to existing east wing.
  - Decanting of east and west wing patients to north wing. Use of one floor of mental health inpatient rooms as surgical and rehabilitation inpatient rooms.
  - Day surgery patients to continue in west wing.
- Phase 2:
  - Demolition of therapy and therapy gym buildings.
  - Demolition of west wing.
  - Refurbishment of hydrotherapy area.
  - Construction of new west wing and recovery.
  - Construction of vertical circulation to provide access to Hydrotherapy areas.
  - Construction of swale drainage.
  - Decanting of north wing surgical and rehabilitation patients to new east wing.
  - Day surgery patients enter via east wing.
  - Construction of operating theatre 4 and new recovery.
  - Patients to be transported to hydrotherapy via bus during construction of west wing.

1.3 Site Layout

The proposed development is located at 369 – 381 President Ave in the suburb of Kirrawee.

The formal description of the site is as follows: Lot 1 DP 841502; Lot 24A DP26995, Lot 23 DP26995, Lot 53 DP29493 and lot 54 DP29493. The subject site consists of one large site made up of Lots 1, 24A and three smaller sites which will be amalgamated into the larger site as part of this development proposal.

The site is bound by residential sites to the north. The main train line to Sydney is located to the far north of the site. To the south the site is bound by President Avenue, a four-lane road providing vehicles an alternative access to Cronulla and Sydney rather than continuing along the Princes Highway. Residential home sites line to southern end of President Avenue. To the west the site, are neighbours to more residential sites.

Figure below outlines the concept approval area, the project site and the driveway.

1.4 Surrounding Receivers

The nearest sensitive receivers to the site are identified below.

Receiver 1: A combination of single and multi-storey residential dwellings to the north of the site across Bidurgal Avenue. Receivers are situated at 55-57 Hotham Road and 1-5 Bidurgal Avenue.

Receiver 2: Multi-storey residential dwellings located along part of the northern boundary of site, situated along the southern side of Bidurgal Avenue. The receivers are situated at 59 Hotham Road and 2A Bidurgal Avenue.

Receiver 3: Single storey residential dwellings located to the north-east of the site across Hotham Avenue. The receivers are situated at 72-76 Hotham Road.

Receiver 4: Multi-storey residential dwellings located to the east of the site across Hotham Avenue. The receivers are situated at 80-82 Hotham Road.

Receiver 5: Multi-storey residential building located to the east of the site across Hotham Avenue and to the rear of Gymea Skin Care Centre situated at 367 President Avenue. The receiver is situated at 365 President Avenue.

Receiver 6: Single and multi-storey residential dwellings located to the south-east of the site across President Avenue within the 2 N W Arm Road complex.

Receiver 7: Single and multi-storey residential dwellings located to the south of the site across President Avenue. The receivers are situated at 384-392 President Avenue.

Receiver 8: Single storey residential dwelling located to the south-west of the site across President Avenue. The receiver is situated at 394 President Avenue.

Receiver 9: Single storey residential dwelling located along part of the western boundary of the site, situated along the northern side of President Avenue. The receiver is situated at 383 President Avenue.

Receiver 10: A combination of single and multi-storey residential dwellings located along part of the northern boundary of the site, situated along the southern side of Bidurgal Avenue. Receivers are located at 6-12 Bidurgal Avenue.

Receiver 11: Gymea Skin Cancer Clinic which is located to the east of the site across Hotham Avenue, situated at 367 President Avenue.

Based on the topography of the site, receivers located to the north (generally) of the site are situated higher than the receivers located to the south.

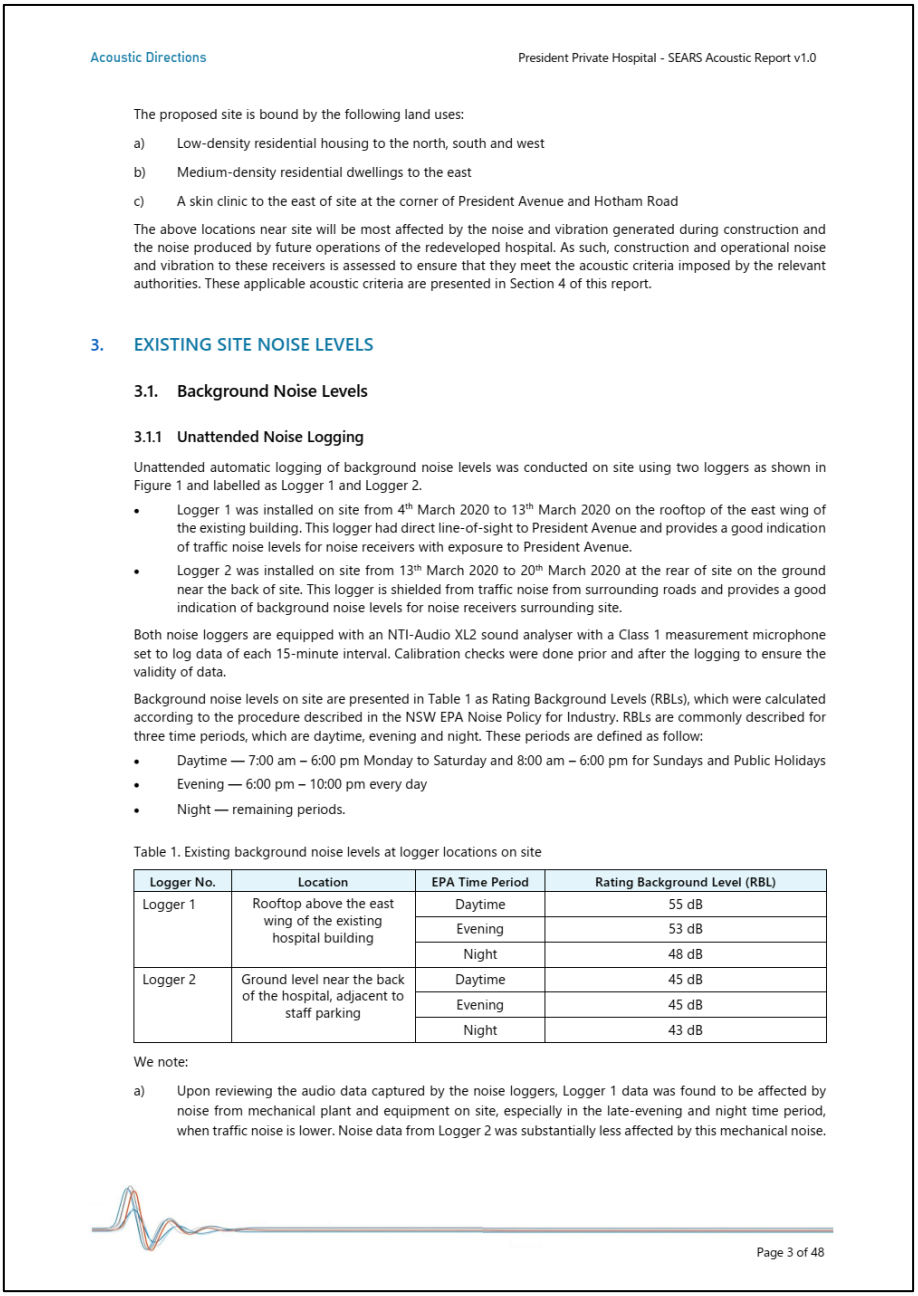
A map showing the site location as well as nearest receivers is provided in Figure 1 below. This figure also shows the location of the assumed noise measurements (Acoustic Directions measurements) that form part of this assessment.

Figure 1 Site Map, Measurement Locations (Acoustc Directions) and Surrounding Receivers

2 EXISTING ACOUSTIC ENVIRONMENT

As mentioned above, the onsite establishment of existing acoustic environment will be adopted from the Acoustic Directions in the sites *Noise and Vibration Impact Assessment* submitted for as part of the SSD Application, report reference: *Noise and Vibration Assessment for Proposed Alterations and Additions to President Private Hospital*, dated 29th June 2020. Section 3 below is extracted from the Acoustic Directions report mentioned afore.

Figure 2 Extract of Acoustic Directions Report – Planning Submission -Section 3



The proposed site is bound by the following land uses:

a) Low-density residential housing to the north, south and west

b) Medium-density residential dwellings to the east

c) A skin clinic to the east of site at the corner of President Avenue and Hotham Road

The above locations near site will be most affected by the noise and vibration generated during construction and the noise produced by future operations of the redeveloped hospital. As such, construction and operational noise and vibration to these receivers is assessed to ensure that they meet the acoustic criteria imposed by the relevant authorities. These applicable acoustic criteria are presented in Section 4 of this report.

3. EXISTING SITE NOISE LEVELS

3.1. Background Noise Levels

3.1.1 Unattended Noise Logging

Unattended automatic logging of background noise levels was conducted on site using two loggers as shown in Figure 1 and labelled as Logger 1 and Logger 2.

- Logger 1 was installed on site from 4th March 2020 to 13th March 2020 on the rooftop of the east wing of the existing building. This logger had direct line-of-sight to President Avenue and provides a good indication of traffic noise levels for noise receivers with exposure to President Avenue.
- Logger 2 was installed on site from 13th March 2020 to 20th March 2020 at the rear of site on the ground near the back of site. This logger is shielded from traffic noise from surrounding roads and provides a good indication of background noise levels for noise receivers surrounding site.

Both noise loggers are equipped with an NTI-Audio XL2 sound analyser with a Class 1 measurement microphone set to log data of each 15-minute interval. Calibration checks were done prior and after the logging to ensure the validity of data.

Background noise levels on site are presented in Table 1 as Rating Background Levels (RBLs), which were calculated according to the procedure described in the NSW EPA Noise Policy for Industry. RBLs are commonly described for three time periods, which are daytime, evening and night. These periods are defined as follow:

- Daytime — 7:00 am – 6:00 pm Monday to Saturday and 8:00 am – 6:00 pm for Sundays and Public Holidays
- Evening — 6:00 pm – 10:00 pm every day
- Night — remaining periods.

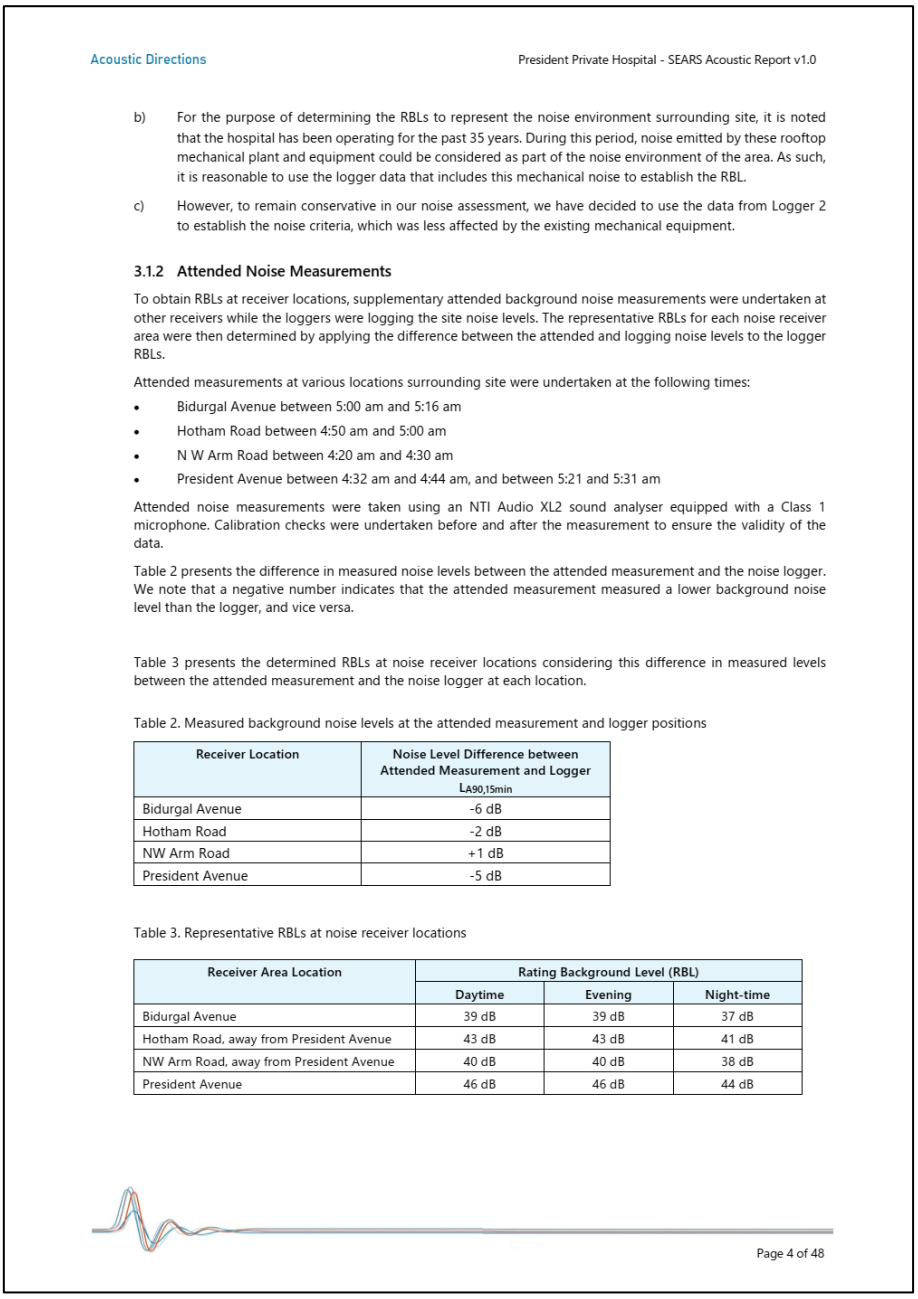
Table 1. Existing background noise levels at logger locations on site

Logger No.	Location	EPA Time Period	Rating Background Level (RBL)
Logger 1	Rooftop above the east wing of the existing hospital building	Daytime	55 dB
		Evening	53 dB
		Night	48 dB
Logger 2	Ground level near the back of the hospital, adjacent to staff parking	Daytime	45 dB
		Evening	45 dB
		Night	43 dB

We note:

a) Upon reviewing the audio data captured by the noise loggers, Logger 1 data was found to be affected by noise from mechanical plant and equipment on site, especially in the late-evening and night time period, when traffic noise is lower. Noise data from Logger 2 was substantially less affected by this mechanical noise.

Figure 2 Extract of Acoustic Directions Report – Planning Submission -Section 3 (Cont.)



b) For the purpose of determining the RBLs to represent the noise environment surrounding site, it is noted that the hospital has been operating for the past 35 years. During this period, noise emitted by these rooftop mechanical plant and equipment could be considered as part of the noise environment of the area. As such, it is reasonable to use the logger data that includes this mechanical noise to establish the RBL.

c) However, to remain conservative in our noise assessment, we have decided to use the data from Logger 2 to establish the noise criteria, which was less affected by the existing mechanical equipment.

3.1.2 Attended Noise Measurements

To obtain RBLs at receiver locations, supplementary attended background noise measurements were undertaken at other receivers while the loggers were logging the site noise levels. The representative RBLs for each noise receiver area were then determined by applying the difference between the attended and logging noise levels to the logger RBLs.

Attended measurements at various locations surrounding site were undertaken at the following times:

- Bidurgal Avenue between 5:00 am and 5:16 am
- Hotham Road between 4:50 am and 5:00 am
- N W Arm Road between 4:20 am and 4:30 am
- President Avenue between 4:32 am and 4:44 am, and between 5:21 and 5:31 am

Attended noise measurements were taken using an NTI Audio XL2 sound analyser equipped with a Class 1 microphone. Calibration checks were undertaken before and after the measurement to ensure the validity of the data.

Table 2 presents the difference in measured noise levels between the attended measurement and the noise logger. We note that a negative number indicates that the attended measurement measured a lower background noise level than the logger, and vice versa.

Table 3 presents the determined RBLs at noise receiver locations considering this difference in measured levels between the attended measurement and the noise logger at each location.

Table 2. Measured background noise levels at the attended measurement and logger positions

Receiver Location	Noise Level Difference between Attended Measurement and Logger $L_{A90,15min}$
Bidurgal Avenue	-6 dB
Hotham Road	-2 dB
NW Arm Road	+1 dB
President Avenue	-5 dB

Table 3. Representative RBLs at noise receiver locations

Receiver Area Location	Rating Background Level (RBL)		
	Daytime	Evening	Night-time
Bidurgal Avenue	39 dB	39 dB	37 dB
Hotham Road, away from President Avenue	43 dB	43 dB	41 dB
NW Arm Road, away from President Avenue	40 dB	40 dB	38 dB
President Avenue	46 dB	46 dB	44 dB

Based on the resulting RBL's detailed above, the following RBL's have been assumed for each of the surrounding receivers as part of the Acoustic Directions report (corresponding to the receivers identified in this report, see Figure 1 above).

Table 1 Project RBL's vs. Receiver

Receiver Location (See Figure 1)	Measured Rating Background Noise Level (dBA $L_{A90\ Period}$)		
	Daytime (7:00am to 6:00pm)	**Evening Time** (6:00pm to 10:00pm)	**Nighttime** (10:00pm to 7:00am)
Receiver 1	39	39	37
Receiver 2	43	43	41
Receiver 3	43	43	41
Receiver 4	43	43	41
Receiver 5	46	46	44
Receiver 6	40	40	38
Receiver 7	46	46	44
Receiver 8	46	46	44
Receiver 9	46	46	44
Receiver 10	39	39	37
Receiver 11	N/A (Commercial)		

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 L_{A90} Background Noise or Rating Background Level.

3 NOISE AND VIBRATION CRITERIA

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

3.1 Annexure A, NSW Land and Environment proceedings LEC 2023/51612

Relevant conditions of the consent require the following in relation to construction noise and vibration impacts from the site.

Noise and Vibration Monitoring Program

C28 Prior to the commencement of construction, the Applicant must submit a Construction Noise and Vibration Monitoring Program to the satisfaction of the Planning Secretary. The program must include, but not be limited to:

(a) consideration of the recommendations described in the Noise and Vibration Assessment for Proposed Alterations and Additions to President Private Hospital dated 29 June 2020 and prepared by Acoustic Directions Pty Ltd, and be consistent with the Plan for the Management of Noise and Vibration During Construction dated 14 July 2023 and prepared by Acoustic Directions Pty Ltd;

(b) noise and vibration monitoring at representative residential and other locations (including at the worst-affected residences), subject to property owner approval, to confirm construction noise and vibration levels;

(c) noise monitoring during the day, evening and night time periods throughout the construction period, covering the range of activities (including worst-case construction noise levels) being undertaken;

(d) method and frequency for reporting monitoring results;

(e) procedures to identify and implement additional mitigation measures where monitoring indicates noise and/or vibration levels in excess in excess of noise and vibration criteria; and

(f) consideration of the requirements set out in condition D16.

Construction Noise Limits

D12 The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures identified in the approved Construction Noise and Vibration Management Plan.

D13 The Applicant must ensure construction vehicles (including concrete agitator trucks) do not arrive at the site or surrounding residential precincts outside of the construction hours of work outlined under condition D4.

D14 The Applicant must implement, where practicable and without compromising the safety of construction staff or members of the public, the use of 'quackers' to ensure noise impacts on surrounding noise sensitive receivers are minimised.

Noise and Vibration

D15 The Applicant must implement the Construction Noise and Vibration Monitoring Program in accordance with condition C28.

D16 During the early stages of rock breaking, rock hammering, sheet piling, pile driving and similar activities, the Applicant must:

(a) monitor the vibration level at the worst-affected residence, subject to property owner approval, to confirm construction vibration levels;
(b) immediately stop work if the vibration exceeds the limits in Section 8.1 of, and be consistent with, the Plan for the Management of Noise and Vibration During Construction dated 14 July 2023 and prepared by Acoustic Directions Pty Ltd;
(c) identify and implement alternative construction practices to mitigate the vibration levels to achieve the vibration criteria specified in in condition D17;
(d) prepare a vibration monitoring report to submit to the Principal Certifying Authority within 30 days of the vibration monitoring.

Vibration Criteria

D17 Vibration caused by construction at any residence or structure outside the site must be limited to:

(a) for structural damage, the latest version of DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures (German Institute for Standardisation, 1999); and
(b) for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: a technical guideline (DEC, 2006) (as may be updated or replaced from time to time).

D18 Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition D17.

D19 The limits in conditions D17 and D18 apply unless otherwise outlined in a Construction Noise and Vibration Management Plan, approved as part of the CEMP required by condition C14 of this consent.

3.2 Construction Noise Criteria

3.2.1 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 2 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: 7:00 am to 6:00 pm Saturday: 8:00 am to 1:00 pm	"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.
No work on Sundays or public holidays	"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.

Table 2 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$ [1,2]	How to Apply
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.

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).

Note 3 Requirements listed in the table above are in accordance with the Construction Hours listed in Condition D4, D5, and D7.

Construction noise levels at other noise receivers are outlined below:

- Construction noise levels at offices, retail outlets is not to exceed 70dB $L_{Aeq,15minute}$, when measured externally.
- Community centres is to not exceed the maximum noise level of AS2107:2016, i.e. 45dBA $L_{Aeq,15minute}$, when measured internally.

Based on the measured background noise levels summarised in section 2, and the NMLs outlined above the construction noise criteria to be used in this assessment are listed above.

Table 3 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**
Residences (Measured externally)	Receiver 1	NAFL: 49 HNAL: 75
	Receiver 2	NAFL: 53 HNAL: 75
	Receiver 3	NAFL: 53 HNAL: 75
	Receiver 4	NAFL: 53 HNAL: 75
	Receiver 5	NAFL: 56 HNAL: 75
	Receiver 6	NAFL: 50 HNAL: 75
	Receiver 7	NAFL: 56

		HNAL: 75
	Receiver 8	NAFL: 56 HNAL: 75
	Receiver 9	NAFL: 56 HNAL: 75
	Receiver 10	NAFL: 49 HNAL: 75
	Receiver 11	70

3.2.2 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.

3.3 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 3.3.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 3.3.2.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 3.3.2.

3.3.1 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 4).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 5).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 6).

Table 4 Continuous vibration acceleration criteria (m/s2) 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

Table 5 Impulsive vibration acceleration criteria (m/s2) 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

Table 6 Intermittent vibration impacts criteria (m/s1.75) 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

3.3.2 Vibration Criteria – Building Contents and Structure

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

- For transient vibration: British Standard BS 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "Effects of Vibration on Structure" (DIN 1999).

3.3.2.1 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 7 and illustrated in Figure 3.

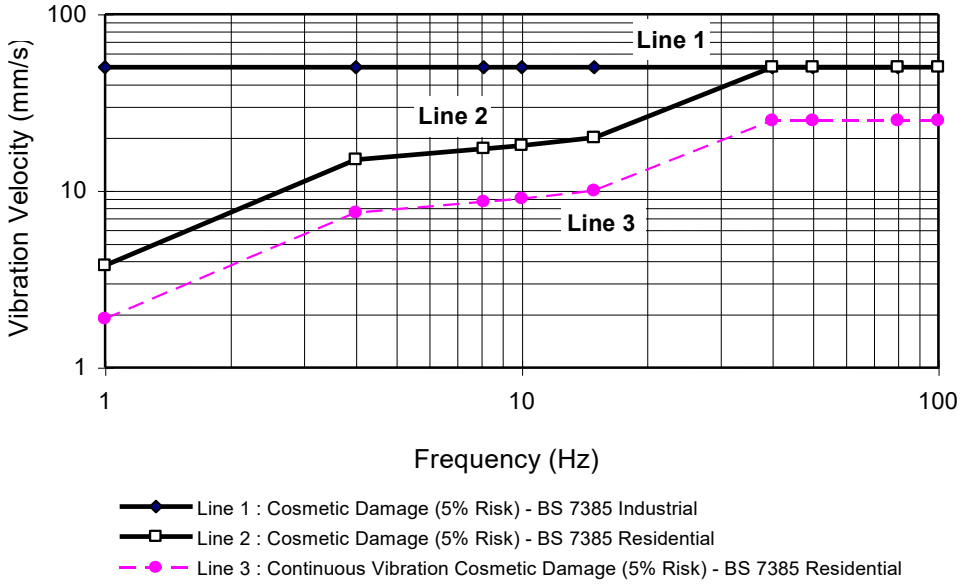
Table 7 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in Figure 3	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 7 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 7 may need to be reduced by up to 50% (refer to Line 3 in Figure 3).

Figure 3 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 7, 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 7 should not be reduced for fatigue considerations.

3.3.2.2 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 8. The criteria are frequency dependent and specific to particular categories of structures.

Table 8 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 Hz1	
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 100Hz, at least the values specified in this column shall be applied.				

3.4 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.

4 NOISE ASSESSMENT

4.1 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 9 below.

Table 9 Summary of predicted sound power levels

Tasks	Equipment	Sound Power Levels (dBA re 1pW)
Site Establishment Works	Mobile crane	103
	Power hand tools	102
	Semi Rigid Vehicle	106
Demolition & Ground Works Structure	Excavator	106
	Hydraulic Hammer	121
	Piling Rig	111
	Dump truck	105
	Concrete saw	120
	Skid steer	110
	Power hand tools	102
	Handheld jack hammer	115
Structure Internal Works	Concrete saw	114
	Power hand tools	102
	Welder	101
	Concrete pump truck	110
	Concrete agitator truck	108
	Power hand tools	102
Common and External Works	Concrete agitator truck	108
Common and External Works	Concrete Saw	120
	Dump truck	105
	Concrete saw	120
	Power hand tools	102
	Mobile crane	103

Table 10 Receiver 1 – Summary of preliminary predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	49 to 64	**Monday to Friday** 07.00-18.00 45 + 10 = **49** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **49** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	48 to 63		
	Semi Rigid Vehicle	106	52 to 67		
Demolition & Ground Works	Excavator	106	57 to 72		
	Hydraulic Hammer	121	69 to 84		
	Piling Rig	111	60 to 75		
	Dump truck	105	51 to 66		
	Concrete saw	120	66 to 81		
	Skid steer	110	61 to 76		
	Power hand tools	102	53 to 68		
Structure	Handheld jack hammer	115	61 to 76		
	Concrete saw	114	60 to 75		
	Power hand tools	102	53 to 68		
	Welder	101	52 to 67		
	Concrete pump truck	110	61 to 76		
	Concrete agitator truck	108	56 to 71		
Internal Works	Power hand tools	102	33 to 48		
Common and External Works	Concrete agitator truck	108	56 to 71		
	Concrete Saw	120	66 to 81		
	Dump truck	105	51 to 66		
	Concrete saw	120	66 to 81		
	Power hand tools	102	53 to 68		

Table 11 Receiver 2 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	49 to 70	**Monday to Friday** 07.00-18.00 45 + 10 = **53** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **53** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	48 to 69		
	Semi Rigid Vehicle	106	52 to 73		
Demolition & Ground Works	Excavator	106	57 to 78		
	Hydraulic Hammer	121	69 to 90		
	Piling Rig	111	60 to 81		
	Dump truck	105	51 to 72		
	Concrete saw	120	66 to 87		
	Skid steer	110	61 to 82		
	Power hand tools	102	53 to 74		
Structure	Handheld jack hammer	115	61 to 82		
	Concrete saw	114	60 to 81		
	Power hand tools	102	53 to 74		
	Welder	101	52 to 73		
	Concrete pump truck	110	61 to 82		
	Concrete agitator truck	108	56 to 77		
Internal Works	Power hand tools	102	33 to 54		
Common and External Works	Concrete agitator truck	108	56 to 77		
	Concrete Saw	120	66 to 87		
	Dump truck	105	51 to 72		
	Concrete saw	120	66 to 87		
	Power hand tools	102	53 to 74		

Table 12 Receiver 3 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	47 to 61	**Monday to Friday** 07.00-18.00 45 + 10 = **53** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **53** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	46 to 60		
	Semi Rigid Vehicle	106	50 to 64		
Demolition & Ground Works	Excavator	106	54 to 68		
	Hydraulic Hammer	121	66 to 80		
	Piling Rig	111	58 to 72		
	Dump truck	105	49 to 63		
	Concrete saw	120	64 to 78		
	Skid steer	110	58 to 72		
	Power hand tools	102	50 to 64		
Structure	Handheld jack hammer	115	59 to 73		
	Concrete saw	114	58 to 72		
	Power hand tools	102	50 to 64		
	Welder	101	49 to 63		
	Concrete pump truck	110	58 to 72		
	Concrete agitator truck	108	53 to 67		
Internal Works	Power hand tools	102	30 to 44		
Common and External Works	Concrete agitator truck	108	53 to 67		
	Concrete Saw	120	64 to 78		
	Dump truck	105	49 to 63		
	Concrete saw	120	64 to 78		
	Power hand tools	102	50 to 64		

Table 13 Receiver 4 - Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	48 to 62	**Monday to Friday** 07.00-18.00 45 + 10 = **53** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **53** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	47 to 61		
	Semi Rigid Vehicle	106	51 to 65		
Demolition & Ground Works	Excavator	106	56 to 70		
	Hydraulic Hammer	121	68 to 82		
	Piling Rig	111	59 to 73		
	Dump truck	105	50 to 64		
	Concrete saw	120	65 to 79		
	Skid steer	110	60 to 74		
	Power hand tools	102	52 to 66		
Structure	Handheld jack hammer	115	60 to 74		
	Concrete saw	114	59 to 73		
	Power hand tools	102	52 to 66		
	Welder	101	51 to 65		
	Concrete pump truck	110	60 to 74		
	Concrete agitator truck	108	55 to 69		
Internal Works	Power hand tools	102	32 to 46		
Common and External Works	Concrete agitator truck	108	55 to 69		
	Concrete Saw	120	65 to 79		
	Dump truck	105	50 to 64		
	Concrete saw	120	65 to 79		
	Power hand tools	102	52 to 66		

Table 14 Receiver 5 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	37 to 46	**Monday to Friday** 07.00-18.00 45 + 10 = **56** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **56** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	36 to 45		
	Semi Rigid Vehicle	106	40 to 49		
Demolition & Ground Works	Excavator	106	44 to 54		
	Hydraulic Hammer	121	56 to 66		
	Piling Rig	111	48 to 57		
	Dump truck	105	39 to 48		
	Concrete saw	120	54 to 63		
	Skid steer	110	48 to 58		
	Power hand tools	102	40 to 50		
Structure	Handheld jack hammer	115	49 to 58		
	Concrete saw	114	48 to 57		
	Power hand tools	102	40 to 50		
	Welder	101	39 to 49		
	Concrete pump truck	110	48 to 58		
	Concrete agitator truck	108	43 to 53		
Internal Works	Power hand tools	102	40 to 50		
Common and External Works	Concrete agitator truck	108	43 to 53		
	Concrete Saw	120	54 to 63		
	Dump truck	105	39 to 48		
	Concrete saw	120	54 to 63		
	Power hand tools	102	40 to 50		

Table 15 Receiver 6 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	47 to 58	**Monday to Friday** 07.00-18.00 45 + 10 = **50** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **50** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	46 to 57		
	Semi Rigid Vehicle	106	50 to 61		
Demolition & Ground Works	Excavator	106	54 to 66		
	Hydraulic Hammer	121	66 to 78		
	Piling Rig	111	58 to 69		
	Dump truck	105	49 to 60		
	Concrete saw	120	64 to 75		
	Skid steer	110	58 to 70		
	Power hand tools	102	50 to 62		
Structure	Handheld jack hammer	115	59 to 70		
	Concrete saw	114	58 to 69		
	Power hand tools	102	50 to 62		
	Welder	101	49 to 61		
	Concrete pump truck	110	58 to 70		
	Concrete agitator truck	108	53 to 65		
Internal Works	Power hand tools	102	40 to 52		
Common and External Works	Concrete agitator truck	108	53 to 65		
	Concrete Saw	120	64 to 75		
	Dump truck	105	49 to 60		
	Concrete saw	120	64 to 75		
	Power hand tools	102	50 to 62		

Table 16 Receiver 7 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	48 to 62	**Monday to Friday** 07.00-18.00 45 + 10 = **56** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **56** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	47 to 61		
	Semi Rigid Vehicle	106	51 to 65		
Demolition & Ground Works	Excavator	106	56 to 70		
	Hydraulic Hammer	121	68 to 82		
	Piling Rig	111	59 to 73		
	Dump truck	105	50 to 64		
	Concrete saw	120	65 to 79		
	Skid steer	110	60 to 74		
	Power hand tools	102	52 to 66		
Structure	Handheld jack hammer	115	60 to 74		
	Concrete saw	114	59 to 73		
	Power hand tools	102	52 to 66		
	Welder	101	51 to 65		
	Concrete pump truck	110	60 to 74		
	Concrete agitator truck	108	55 to 69		
Internal Works	Power hand tools	102	42 to 56		
Common and External Works	Concrete agitator truck	108	55 to 69		
	Concrete Saw	120	65 to 79		
	Dump truck	105	50 to 64		
	Concrete saw	120	65 to 79		
	Power hand tools	102	52 to 66		

Table 17 Receiver 8 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	48 to 62	**Monday to Friday** 07.00-18.00 45 + 10 = **56** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **56** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	47 to 61		
	Semi Rigid Vehicle	106	51 to 65		
Demolition & Ground Works	Excavator	106	56 to 70		
	Hydraulic Hammer	121	68 to 82		
	Piling Rig	111	59 to 73		
	Dump truck	105	50 to 64		
	Concrete saw	120	65 to 79		
	Skid steer	110	60 to 74		
	Power hand tools	102	52 to 66		
Structure	Handheld jack hammer	115	60 to 74		
	Concrete saw	114	59 to 73		
	Power hand tools	102	52 to 66		
	Welder	101	51 to 65		
	Concrete pump truck	110	60 to 74		
	Concrete agitator truck	108	55 to 69		
Internal Works	Power hand tools	102	42 to 56		
Common and External Works	Concrete agitator truck	108	55 to 69		
	Concrete Saw	120	65 to 79		
	Dump truck	105	50 to 64		
	Concrete saw	120	65 to 79		
	Power hand tools	102	52 to 66		

Table 18 Receiver 9 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	38 to 54	**Monday to Friday** 07.00-18.00 45 + 10 = **56** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **56** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	37 to 53		
	Semi Rigid Vehicle	106	41 to 57		
Demolition & Ground Works	Excavator	106	46 to 62		
	Hydraulic Hammer	121	58 to 74		
	Piling Rig	111	49 to 65		
	Dump truck	105	40 to 56		
	Concrete saw	120	55 to 71		
	Skid steer	110	50 to 66		
	Power hand tools	102	42 to 58		
Structure	Handheld jack hammer	115	50 to 66		
	Concrete saw	114	49 to 65		
	Power hand tools	102	42 to 58		
	Welder	101	41 to 57		
	Concrete pump truck	110	50 to 66		
	Concrete agitator truck	108	45 to 61		
Internal Works	Power hand tools	102	22 to 38		
Common and External Works	Concrete agitator truck	108	45 to 61		
	Concrete Saw	120	55 to 71		
	Dump truck	105	40 to 56		
	Concrete saw	120	55 to 71		
	Power hand tools	102	42 to 58		

Table 19 Receiver 10 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	52 to 70	**Monday to Friday** 07.00-18.00 45 + 10 = **49** HNAL: **75** **Saturday** 08.00-13.00 45 + 10 = **49** HNAL: **75**	Works indicatively predicted to have the potential to exceed the BG+10 dBA and could have the potential to be above the Highly Noise Affected Level when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	51 to 69		
	Semi Rigid Vehicle	106	55 to 73		
Demolition & Ground Works	Excavator	106	60 to 78		
	Hydraulic Hammer	121	72 to 90		
	Piling Rig	111	63 to 81		
	Dump truck	105	54 to 72		
	Concrete saw	120	69 to 87		
	Skid steer	110	64 to 82		
	Power hand tools	102	56 to 74		
Structure	Handheld jack hammer	115	64 to 82		
	Concrete saw	114	63 to 81		
	Power hand tools	102	56 to 74		
	Welder	101	55 to 73		
	Concrete pump truck	110	64 to 82		
	Concrete agitator truck	108	59 to 77		
Internal Works	Power hand tools	102	46 to 64		
Common and External Works	Concrete agitator truck	108	59 to 77		
	Concrete Saw	120	69 to 87		
	Dump truck	105	54 to 72		
	Concrete saw	120	69 to 87		
	Power hand tools	102	56 to 74		

Table 20 Receiver 11 – Summary of predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	103	51 to 61	**When in use: 70**	Works indicatively predicted to have the potential to exceed the 70 dBA when working near a receiver. It is recommended that the noise and vibration mitigation measures detailed below be implemented.
	Power hand tools	102	50 to 60		
	Semi Rigid Vehicle	106	54 to 64		
Demolition & Ground Works	Excavator	106	59 to 68		
	Hydraulic Hammer	121	71 to 80		
	Piling Rig	111	62 to 72		
	Dump truck	105	53 to 63		
	Concrete saw	120	68 to 78		
	Skid steer	110	63 to 72		
	Power hand tools	102	55 to 64		
Structure	Handheld jack hammer	115	63 to 73		
	Concrete saw	114	62 to 72		
	Power hand tools	102	55 to 64		
	Welder	101	54 to 63		
	Concrete pump truck	110	63 to 72		
	Concrete agitator truck	108	58 to 67		
Internal Works	Power hand tools	102	45 to 54		
Common and External Works	Concrete agitator truck	108	58 to 67		
	Concrete Saw	120	68 to 78		
	Dump truck	105	53 to 63		
	Concrete saw	120	68 to 78		
	Power hand tools	102	55 to 64		

5 NOISE AND VIBRATION MANAGEMENT PLAN

5.1 Acoustic Management Procedures

5.1.1 Summary of Management Procedures

The table below summarises potential management procedures recommended for airborne noise and vibration impact. Sections 5.1.2 and 5.1.3 sets out the general principles used to apply those management procedures to this site.

Section 5.2 and 5.3 presents the noise and vibration management procedures that will be adopted for this development.

Sections 5.4, 5.5 and 5.6 set out notification, community consultation and complaints handling recommendations.

Table 21 Summary of mitigation procedures

Procedure	Abbreviation	Description	Further Reference
General Management Measures	GMM	Introduce best-practice general mitigation measures on site which are aimed at reducing the acoustic impact onto the nearest affected receivers.	For noise management, refer to Section 5.1. For vibration management refer to Section 5.3.2.
Project Notification	PN	Undertake project notification in accordance with the recommendations contained in section 5.4.	Refer to Section 5.4
Verification Monitoring	V	Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers. If the measured levels are higher than those predicted, then the measures will need to be reviewed, and the management plan will need to be amended.	For noise impact, refer to Section 5.2.3. For vibration impact, refer to Section 0
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders	Refer to Section 5.5 and 5.6.
Specific Notification	SN	Undertake specific notification for receivers impacted in accordance with section 5.4.	Refer to Section 5.4
Respite Offer	RO	Offer provided to stakeholders subjected to an ongoing impact (i.e. when noise levels exceed 75dBA)	Refer to section 5.2.2.
Alternative Construction Methodology	AC	Contractor to consider/investigate if alternative construction options that achieve compliance with relevant criteria are feasible and reasonable (with consideration of time, cost, benefit etc.)	Refer to section 5.6.

The above procedures are applied when it is anticipated that there will be exceedance of the Noise Management Levels (set out in table 3).

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 5.1.2

5.1.2 Allocation of Noise Management Procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs (refer to Section 3). The allocation of these procedures is summarised in Table 22 below.

Table 22 Allocation of noise management procedures – residential receivers

Construction Hours	Exceedance over NML (dB)	Management Procedures (see definition above)
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	0 - 3	GMM
	4 - 10	GMM, V [1], CMS,
	> 10	GMM, PN, V [1], CMS, SN, AC
	≥ 75dBA	GMM, PN, V, CMS, SN, AC, RO

Note 1 Verification monitoring to be undertaken upon complaints received from affected receivers

Please note the following regarding the allocation of these procedures:

- The exceedances have been estimated as part of the acoustic assessment, and these are summarised in Section **Error! Reference source not found.**.
- The allocation of procedures is based on the assumptions used for noise level predictions (refer to Section **Error! Reference source not found.**). Consequently, these allocations can be further refined once additional details of the construction program become available.

5.1.3 Allocation of Vibration Management Procedures

Error! Not a valid bookmark self-reference. below summarises the vibration management procedures to be adopted based on exceedance scenarios (i.e., whether the exceedance occurs over human comfort criteria, building damage criteria, or criteria for scientific and medical equipment). Please note these management procedures apply for any type of affected receiver (i.e., for residences as well as non-residential receivers).

Table 23 Allocation of vibration management procedures

Construction Hours	Exceedance Scenario	Management Procedures
Standard Hours Mon – Fri: 7:00 am to 6:00 pm Sat: 8:00 am – 1:00 pm	Over human comfort criteria (refer to Section 3)	GMM, PN, V, RO
	Over building damage criteria (refer to Section 3)	GMM, V, AC, RO

5.2 Site Specific Noise Mitigation Measures

5.2.1 General Comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.

- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

5.2.2 Respite Periods

Predicted noise levels outlined in Section 4.1 indicate that in some cases when works are being undertaken within proximity of receiver boundaries, exceedances above the Noise Management Levels (NMLs) may occur. In addition, in accordance with Condition D7 respite periods are recommended for noisy activities (as defined below). As such the following respite conditions are recommended in accordance with D7 or when works extended periods of noisy works are affecting a surrounding receiver above the HNAL of 75dBA. See below.

Table 24 Recommended Respite Periods

Monday to Friday [1]	Saturday [1]
7:00am to 9:00am – *"No rock breaking, rock hammering, sheet piling, pile driving and similar activities"* (Respite Period).	**8:00am to 9:00am – *"No rock breaking, rock hammering, sheet piling, pile driving and similar activities"* (Respite Period).**
9:30am to 12:00pm – Works	9:00am to 12:00pm – Works
12:00pm to 2:00pm – *"No rock breaking, rock hammering, sheet piling, pile driving and similar activities"* (Respite Period).	**12:00pm to 1:00pm – *"No rock breaking, rock hammering, sheet piling, pile driving and similar activities"* (Respite Period).**
2:00pm to 5:00pm – Works	
5:00pm to 6:00pm – *"No rock breaking, rock hammering, sheet piling, pile driving and similar activities"* (Respite Period).	

Note 1: In accordance with Condition D4, approved construction hours are limited to the hour shown above. Notwithstanding this, Condition D5 does permit works outside these hours in the case of specific exceptions.

5.2.3 Noise Monitoring

It is recommended that during the demolition, excavation and structure phases of the project, onsite noise monitoring is undertaken to provide real time feedback to the construction team regarding their acoustic impact.

Noise monitoring should be conducted (at a minimum) at:

- The site boundary along Hotham Road (~opposite Receiver R2/R3/R4).

- Along the northern site boundary adjacent to R10.

Noise monitoring should be performed by an acoustical consultant directly engaged by the contractor.

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

5.2.4 Site Permanent Cranes

A review of the proposed crane to be installed has been undertaken. We have been advised the proposed crane will be located in the centre of the site (exact selection still pending). However, it is known that the crane will be electric and will be served by onsite power, temporary power generation is unlikely required. Based on this, we can confirm the proposed crane location will be acoustically acceptable to work during Standard Construction hours in accordance with the NSW EPA ICNG.

5.3 Vibration Mitigation Measures

5.3.1 General Comments

Proposed piling method (bored piles) emits lower levels of vibration compared to other pilling methods.

Excavation of rock using pneumatic/hydraulic hammers will be unavoidable. Vibration monitoring to ensure adequate protection of the adjacent receivers is discussed below.

As part of the CNVMP, the following vibration mitigation measures should be implemented:

- Any vibration generating plant and equipment is to be in areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of construction plant and equipment; that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Use only dampened rock breakers and/or "city" rock breakers to minimise the impacts associated with rock breaking works.
- Conduct attended measurements of vibration generating plant at commencement of works in order to validate the indicative safe working distances advised in Table 35 and, consequently, to establish safe working distances suitable to the project. Measurements should be conducted at the nearest affected property boundary. These safe working distances (in conjunction with Table 25 below) should be defined by considering the vibration criteria discussed in Section 3 (i.e., criteria for structural damage, human comfort and impact to scientific or medical equipment).

5.3.2 Vibration Monitoring

In order to maintain compliance with the human comfort vibration criteria and cosmetic building damage discussed in Section 3.3 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.

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	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
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
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

Recommendation - Given the separation distance between the site and Receiver 2, Receiver 9 and Receiver 10 (being adjacent to the property), vibration monitoring is recommended at the commencement of demolition (limited to removal of base slabs and footings, assuming hydraulic hammers are required) and bulk excavation (if hydraulic hammers are required) and during vibratory compaction (if proposed).

With respect to the monitor:

- 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 3).
- 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.

5.4 Community Consultation / Notification

Condition of consent D1 requires erection of a sign detailing contact details of the Principal Contractor.

Active community consultation and the maintenance of positive relations with local residents and businesses would assist in alleviating concerns and thereby minimising complaint. It is common for construction projects to provide community consultation if an exceedance of noise goals has been predicted. This communication is commonly conducted in the form of a letter box drop or more active engagement with more highly impacted receivers.

This form of notification should provide specific notification of the duration and timing of the construction activities so that residents are informed about the proposed works ahead of time. The letter should also provide the community with a telephone number for the Principal Contactor.

Ideally the hotline number should provide concerned locals an opportunity to raise any concerns with the project proponent and provide an opportunity to determine the best method to satisfy all requirements.

Prior to the works onsite being undertaken, it is recommended that notification of neighbouring affected parties be undertaken. Notification should be provided to:

- Receiver 1: 55-57 Hotham Road and 1-5 Bidurgal Avenue.
- Receiver 2: 59 Hotham Road and 2A Bidurgal Avenue.
- Receiver 3: 72-76 Hotham Road.
- Receiver 4: 80-82 Hotham Road.
- Receiver 9: 383 President Avenue.
- Receiver 10: 6-12 Bidurgal Avenue.
- Receiver 11: 367 President Avenue.

The communication however should not be limited to the beginning of the onsite works but throughout providing the community with constant updates to the progress and upcoming works. In our experience these could include:

- Site noticeboard. and
- Letterbox drops.

5.5 Complaints Management System

Should complaints arise they must be delt with in a responsible and uniform manner, therefore a management system to deal with complaints is detailed above.

In response to a complaint, the following should be recorded by the Principal Contractor:

- Name/address of complainant.
- Date and time of activity in question.
- Equipment item/activity being undertaken.
- Record of steps taken/to be taken in response.

5.6 Contingency Plans / Complaint Response

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers.
- Determine if noise emission exceed those anticipated in this CNVMP.
- If so, review the identified equipment and determine if an alternate piece of equipment can be used, the process can be altered or if noise screening is feasible.
- Works to recommence following evaluation of the noise level and introduction on any further recommended mitigation.

5.7 General Mitigation Measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 "Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.

5.7.1 Adoption of Universal Work Practices

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevating work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

5.7.2 Plant and Equipment

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics, where feasible.
- Operating plant and equipment in the quietest and most efficient manner.

5.7.3 On Site Noise Mitigation

- Maximising the distance between noise activities and noise sensitive land uses.
- Installing purpose-built noise barriers, acoustic sheds and enclosures around static plant.

5.7.4 Work Scheduling

- Providing respite periods which could include restricting very noisy activities to time periods that least affect the nearby noise sensitive locations, restricting the number of nights that after-hours work is conducted near residences or by determining any specific requirements.
- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

5.7.5 Source Noise Control Strategies

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Regular and effective maintenance.

5.7.6 Miscellaneous Comments

- Deliveries should be undertaken, where possible, during standard construction hours.
- Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site and monitor the profiles in use.
- The use of "quackers" could be used to ensure noise impacts on surrounding noise sensitive receivers are minimised. This will not be implemented where it is deemed the use of quackers (as opposed to standard vehicle notification devices) would compromise the safety of construction staff or members of the public.
- No public address system should be used on site (except for emergency purposes).

6 CONCLUSION

Pulse White Noise Acoustics (PWNA) has been engaged by President Property Company Pty Limited to prepare a site-specific Construction Noise and Vibration Management Sub-Plan (CNVMSP) for the redevelopment of the existing President Private Hospital located at 369-381 President Avenue and 2 & 3 Bidurgal Avenue, Kirrawee NSW and 61 & 65 Hotham Road, Gymea NSW.

This CNVMSP has been prepared to address a number of noise and vibration related conditions as outlined in Annexure A from the NSW Land and Environment proceedings LEC 2023/51612, dated 16th April 2024. Refer to section 3.1.

An assessment of noise and vibration impacts from the required processes to be undertaken during the demolition and construction phases of the project (including excavation and construction) has been undertaken and suitable treatments, management controls, perioding measurements and community engagement has been detailed in this report.

Providing the recommendations in this report are included in the construction of the site, compliance with the relevant EPA's Interim Construction Noise Guideline Objectives can be achieved.

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

Regards

Matthew Furlong
Principal Acoustic Engineer
Pulse White Noise Acoustics
AAS Member and AAAC Member Firm

APPENDIX A. APPENDIX A. ACOUSTIC TERMINOLOGY

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

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

Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt

APPENDIX B. AUTHOR CURRICLULUM VITAE (CV)

MATTHEW FURLONG

Principal Acoustic Engineer

Qualifications

Bachelor of Creative Technology (Audio Engineering and Sound Production)

Member of the Australian Acoustical Society (AAS)

Matthew Furlong has 10 years' experience in delivering acoustic design on architectural, environmental and infrastructure projects, including conceptual, detailed design, construction, and post-construction stages.

He has consulted for mixed use of education, health commercial and residential developments, developing in-principal recommendations for the client, and managing contractor providing detailed design advice as well as full construction services.

Selected Project Experience

Commercial

- Development Application, Acoustic Design and Construction Services Winston Hills Mall Enabling Works.
- Development Application and Acoustic Design 210-220 George Street Sydney.
- Acoustic Design and Construction Services 151 Clarence Street, Sydney.
- Development Application for 390-396 Pitt Street, Haymarket.
- Acoustic Design and Construction Services Chifley Plaza Internal Works.
- Development Application 371-375 Pitt Street, Sydney.
- Construction Services Fitout of the Department of Premier and Cabinets.
- Noise Investigations for Transport NSW (Chatswood and Burwood).
- Schematic Design for Western Sydney Airport – Nancy Warbird (WSA).
- Schematic Design, Detailed Design, Tender, IFC, Construction Johnson Winter Slattery (JWS) Sydney Office Fitout.
- Schematic Design, Detailed Design, Tender, IFC, Construction UHY Haines Norton Sydney Office Fitout.

Residential

- Acoustic Design for Crown Casino Sydney.
- Acoustic Design and Construction Services 130 Elizabeth Street, Sydney (One30Hyde).
- Acoustic Design and Construction Services Trinity Terraces Rosebery.
- Construction Services 1a Coulson Street, Erskinville.
- Construction Services for the Erko Apartments Erskinville.
- Construction Services for the Eve Apartments Erskinville.
- Acoustic Design 54-56 Riley Street and 1 Crown Lane, Darlinghurst.
- Development Application, Acoustic Design and Construction Services New Life Darling Harbour, 495 Harris Street, Ultimo.

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- Development Application, Acoustic Design and Construction Services Meriton Developments (Mascot, Rosebery, Epping, Parramatta, Pagewood, Bondi, Dee Why, Zetland, Waterloo, North Sydney, Sydney, Macquarie Park).
- Development Application, Acoustic Design and Construction Services Summer Hill Flourmill Stages 1, 2, 3 and 4.
- Acoustic Design and Construction Services Macquarie Park Village.
- Acoustic Design and Construction Services Ryde Gardens.
- Acoustic Design and Construction Services Tempo Apartments Victoria Road Drummoyne.
- Development Application, Acoustic Design and Construction Services Winston Hills Mall Residential.
- Construction Services Presbyterian Aged Care Paddington.
- Acoustic Design and Construction Services Wahroonga Nursing Home.
- Acoustic Design and Construction Anglicare Castle Hill (ARV).
- Acoustic Design and Construction Cardinal Freeman Village, Ashfield.

Education

- Schematic, SSDA, Detailed Design, IFC, Construction Carlingford West Public School
- Masterplan, Concept, Schematic and SSDA Tallawong Station Public School.
- Masterplan, Concept, Schematic and SSDA Tallawong Public School.
- Schematic and SSDA Macquarie Park Public School.
- Detailed Design Neutral Bay Public School.
- SSDA, Acoustic Design, Construction and Commissioning Meadowbank Education Precinct (School + TAFE – certain elements)
- Schematic, SSDA, Detailed Design, IFC, Construction and Commissioning New Primary School in Murrumbateman
- Schematic, SSDA, Detailed Design, IFC, Construction and Commissioning New Primary School in Googong.
- Design Finalisation, IFC, Construction and Commissioning Chatswood High School.
- Design Finalisation, IFC, Construction and Commissioning Chatswood Public School.
- Schematic, Planning Pathway Hurlstone Agricultural High School.
- Schematic, Planning Pathway Yanco Agricultural High School.
- CNVMP and Construction Services Anzac Park Public School.
- CNVMP and Construction Services Alexandria Park Public School.
- Planning Pathway, Detailed Design, Tender, Design Finalisation, Commissioning Aspect Autism Schools Australia.
    - Cardiff Heights School.
    - The Gables School.
    - Corrimal School.
    - Central Coast Primary School.
    - Central Coast Secondary School.
    - Vern Barnett School.

Health Facilities

- Master Planning, Feasibility, Schematic, SSDA, Detailed Design and IFC for Sydney Children's Hospital Stage 1 & Children's Comprehensive Cancer Centre (SCH1/CCCC), Randwick.
- Formulation of the new Victorian Health Engineering Guidelines (Acoustics).
- Construction Services for Wagga Wagga Base Hospital Stage 2.
- SSDA and Acoustic Design for Concord Repatriation General Hospital.
- SSDA and Acoustic Design Nepean Public Hospital.
- CNVMP, Design Finalisation, IFC, Construction Campbelltown Hospital Redevelopment Works

Licensed Premises

- Development Application for The Cauliflower Hotel, Waterloo
- Development Application for Christopher Hanna Salon and Bar, 13-15a Bridge Street, Sydney
- Development Application for the Tilbury Hotel Woolloomooloo.
- Development Application for the Exchange Hotel, Balmain.
- Development Application for the Town Hall Hotel, Balmain.
- Development Application for the Exchange Hotel, Darlinghurst.
- Development Application for 388 George Street, Sydney.
- Development Application for 88 Pitt Street, Sydney.
- Development Application for 92 Pitt Street, Sydney.
- Development Application for Pilu Freshwater.
- Development Applications for the Redevelopment of Ibis Hotels:
    - Enfield NSW.
    - Liverpool NSW.
    - Wentworthville NSW.
    - Sydney Airport NSW.
    - St Peters NSW.
    - Olympic Park NSW.
    - Thornleigh NSW.

Industrial

- Acoustic design Erskine Park Industrial Area.
- CNVMP, Acoustic Design, IFC and Construction Snackbrands Orchard Hills.
- CNVMP, Acoustic Design, IFC and Construction Logos Moorebank (Warehouse 6 & 7).