Darcy Road Public School

Construction Noise and Vibration Management Sub Plan (CNVMSP)

Taylor Construction

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1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) has been engaged to prepare a Construction Noise and Vibration Management Sub Plan (CNVMSP) for the construction works associated with the proposed alterations and additions to Darcy Road Public School located at 98A Darcy Road, Wentworthville, NSW.

Onsite unattended and attended noise levels have previously been determined for the project and included in the NDY *Acoustic Report, School Infrastructure NSW, Darcy Road Public School, State Significant Development Application (SSDA) – Noise and Vibration Impact Assessment* revision 8.0 – SSDA DPE Update and dated 25 August 2023 and included in the proposed SSD documentation. The details of the acoustic survey included in the NDY report have been used in this assessment.

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

The author of this report is a director of Pulse White Noise Acoustics who is a member of the Australian Acoustic Society, details including Ben's CV and membership of the AAS are included in Appendix C.

1.1 Site Layout and Development Overview

This report has been prepared on behalf of the NSW Department of Education (DoE) and School Infrastructure NSW (SINSW) to support the State Significant Development Application (SSD-49073460) for the upgrade of Darcy Road Public School.

Darcy Road Public School is located at 98A Darcy Road, Wentworthville within the Parramatta Local Government Area. Darcy Road Public School comprises 11 separate allotments, which have a combined area of 23,531m2, forming an irregular and consolidated development parcel.

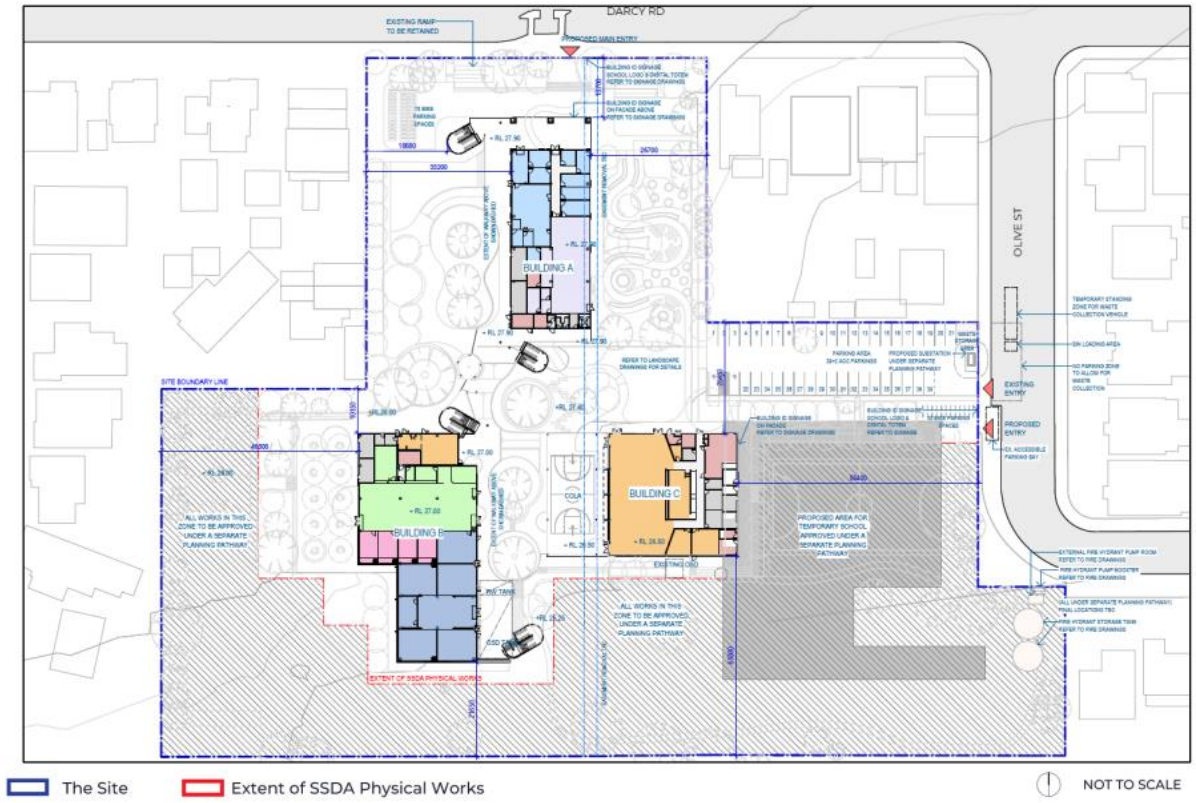
The legal description is outlined below:

- Lot 6-7 in DP 10955;
- Lot 1 in DP 782155;
- Lot A in DP 383734;
- Lot 1 in DP 122893;
- Lot 1 in DP 160134; and
- Lots 12-16 in DP 16811.

Darcy Road Public School is the subject site of this SSDA, however the extent of physical works is limited and is not located across the entire site. The subject site, and the extent of SSDA physical works are shown in Figure 1 below.

There is a separate planning approval for a temporary school and associated infrastructure to be located on/near the existing oval on the southeast of the site. Indicative location of the temporary school and associated infrastructure is shown below in Figure 1.

Figure 1 Site Plan and the extent of SSDA physical works



The development application pathway for the project consists of an SSDA pursuant to section 4.36 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The project involves the upgrade of Darcy Road Public School to accommodate 1,000 students and 25 new permanent staff. The proposal includes the following:

- Demolition of all buildings associated with the existing school, except for the existing hall which will be retained and refurbished;
- Construction of a new school comprising two new interconnected buildings up to four storeys,
- Construction of new open spaces and landscaping;
- Refurbishment of the existing hall including demolition of existing ancillary features to the eastern side of the building and extension of the hall into the existing covered outdoor learning area; and
- Extension of the existing car park.

The existing hard courts and oval within the broader Darcy Road Public School are outside of the extent of SSDA physical works.

During the construction period, the majority of the school will be relocated to a temporary area using demountable buildings in accordance with a separate planning approval outside of the SSDA boundary.

Upon completion of the SSDA works, Darcy Road Public School proposes to accommodate 1,000 students, assisting in alleviating current enrolment pressures within the Parramatta LGA. Darcy Road Public School will contain high quality collaborative learning spaces and associated facilities, creating future focused education through new and sustainable buildings.

The completed Darcy Road Public School will offer:

- facilities that are readily accessible and flexible to meet the demands of an evolving curriculum in line with future-focused learning principles
- flexible and well-connected teaching and learning spaces that enable a variety of teaching and learning practices
- spaces that are engaging and supportive for students and teachers
- technology-rich settings with an emphasis on mobility and flexibility
- a healthy and environmentally sustainable environment
- innovative, connected outdoor spaces that enable play and collaborative learning
- connected open space, creating a welcoming and accessible school with indoor and outdoor teaching and learning opportunities

New teaching spaces will incorporate principles of energy efficiency and ecologically sustainable development (ESD) including:

- passive design principles
- thermal performance and comfort
- natural lighting
- water and recycling management

Pending approval, works are programmed to commence in late-2023, with completion of the Main Works programmed for late-2025.

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

Receiver 1: Residential receivers neighbouring the site to the north west, including the dwelling at 100A Darcy Road.

Receiver 2: Residential receivers located opposite the site to the north of Darcy Road, including the dwelling at 119 Darcy Road.

Receiver 3: Residential receivers neighbouring the site to the west, including the dwelling at 10 Pioneer Street.

Receiver 4: Residential receivers neighbouring the site to the south, including the dwelling at 16 Graham Avenue.

Receiver 5: Residential receivers neighbouring the site to the north east, including the dwelling at 98 Darcy Road.

Receiver 6: Residential receivers located to the east of the site on Olive Street including the dwelling at 7 Olive Street.

Receiver 7: Residential receivers located to the south east of the site on Fyall Avenue including the dwelling at 12 Fyall Avenue.

Receiver 8: Residential receivers located to the east of the site on Olive Street, including the dwelling at 4 Olive Street.

Receiver 9: Residential receivers located to the west of the site on Pioneer Street, including the dwelling at 10 Pioneer Street.

Figure 2 Site Map, Measurement Locations and Surrounding Receivers

1.2 SSD Compliance

This report has been undertaken in accordance with the requirements of Item B15 of the project's SSD conditions of consent.

Details of conditions of consent and sections of the report which include the required items required by the consent are included in the table below.

Table 1 SSD Compliance Table

SSD Condition number	Requirement	Report Reference for Satisfaction
B15	*B15. The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following:*	-
(a)	*be prepared by a suitably qualified and experienced noise expert;*	Ben white is a director of Pulse White Noise Acoustics, Ben's CV and membership of the Australian Acoustic Society is included in Appendix C.
(b)	*describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);*	Section 4.1
(c)	*describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;*	Section 6.1 and 6.2
(d)	*include strategies that have been developed with the community for managing high noise generating works;*	Section 6.2 and Section 6.8
(e)	*describe the community consultation undertaken to develop the strategies in condition B15(d);*	Section 6.5.5 and Appendix B
(f)	*include a complaints management system that would be implemented for the duration of the construction; and*	Section 6.5
(g)	*include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B1*	Section 6.2.2 and Section 6.3.2

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

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

2 EXISTING ACOUSTIC ENVIRONMENT

Measured noise levels from the attended noise survey undertaken as part of the NDY *Acoustic Report, School Infrastructure NSW, Darcy Road Public School, State Significant Development Application (SSDA) – Noise and Vibration Impact Assessment* revision 8.0 – SSDA DPE Update and dated 25 August 2023 and included in the proposed SSD documentation have been used in this assessment.

As part of the NDY *Acoustic Report, School Infrastructure NSW, Darcy Road Public School, State Significant Development Application (SSDA) – Noise and Vibration Impact Assessment* background noise levels within the vicinity of the site has been undertaken including locations of noise logging (including the locations detailed in Figure 2 above). The NDY *Acoustic Report, School Infrastructure NSW, Darcy Road Public School, State Significant Development Application (SSDA) – Noise and Vibration Impact Assessment* includes an assessment which has been stated to be in accordance with the NSW EPA's *Noise Policy for Industry* (NPI, 2017).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes and includes the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. The RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels presented within the *Darcy Road Public School, State Significant Development Application (SSDA) – Noise and Vibration Impact Assessment* are summarised in Table 2.

Table 2 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)	L_{A90}[2] (dBA)	L_{Aeq}[3] (dBA)
Monitor Location: Including Locations to the north of the site						
Logger 1 – To the north portion of the school	46	61	44	58	37	53
Monitor Location: Including Locations to the east of the site						
Logger 2 – To the eastern portion of the school	43	69	39	52	35	46
Monitor Location: Including Locations to the south and west of the site						
Logger 3 – To the southwestern portion of the school	44	61	41	55	36	50

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

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

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

3 PROJECTS CONDITIONS OF CONSENT

Relevant noise and vibration criteria for construction activities includes item B15 of the SSD which includes the following:

> Construction Noise and Vibration Management Sub-Plan (see condition B15 for required inclusions).
>
> *B15. The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following:*
>
> *(a) be prepared by a suitably qualified and experienced noise expert;*
> *(b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);*
> *(c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;*
> *(d) include strategies that have been developed with the community for managing high noise generating works;*
> *(e) describe the community consultation undertaken to develop the strategies in condition B15(d);*
> *(f) include a complaints management system that would be implemented for the duration of the construction; and*
> *(g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B13.*

The project has included a *Community Communication* Strategy as require in the consent, Details of the Community Communication Strategy are to be provided as part of the project submissions as required.

4 NOISE AND VIBRATION CRITERIA

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

4.1 Construction Noise Objectives

Relevant construction noise objectives applicable to this project are outlined below.

4.1.1 NSW EPA (Former DECC) Interim Construction Noise Guideline (ICNG) 2009

Noise objective 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 3 NMLs for quantitative assessment at residences

Time of Day	Noise Management Level $L_{Aeq(15minute)}$ [1,2]	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected 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 LAeq(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.
	Highly noise affected 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.
Outside the recommended standard hours above	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 notify 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 Industrial Noise Policy (EPA 2000).

Construction noise levels at other noise receivers are outlined below:

- Construction noise levels within classrooms other educational institutions is not recommended to exceed 45dBA $L_{Aeq,15minute}$, when measured internally.
- Construction noise levels at offices and retail outlets are not recommended to exceed 70dBA LAeq,15minute, when measured externally.

Based on the measured background noise levels summarised in section 0, and the NMLs outlined above, the construction noise criteria to be used in this assessment are listed in Table 4.

Table 4 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB $L_{Aeq(15minute)}$		
	Standard Hours **Monday to Friday: 7:00am to 6:00pm** **Saturday: 8:00am to 1:00pm**		**Outside Standard Hours** **All hours not listed in the adjacent column.**
Residential receivers located to the north of the site, including locations 1, 2 , 3 and 5	**NAFL: 56** (RBL (46) + 10dB)	**HNAL: 75**	RBL + 5dB
Residential receivers located to the east of the site, including locations 6, 7, and 8	**NAFL: 53** (RBL (43) + 10dB)		
Residential receivers located to the south and west of the site, including locations 4 and 9	**NAFL: 54** (RBL (44) + 10dB)		

4.2 Vibration Criteria

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

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

4.2.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from AV-TG. This type of impact can be further categorised and assessed using the appropriate criterion as follows:

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

Table 5 Continuous vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or night-time	0.0050	0.010	0.10	0.20
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 6 Impulsive vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or night-time	0.0050	0.010	0.10	0.20
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 7 Intermittent vibration impacts criteria (m/s$^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Critical working areas (e.g. hospital operating theatres, precision laboratories)	0.10	0.20	0.10	0.20
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

4.2.2 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).

4.2.3 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 below.

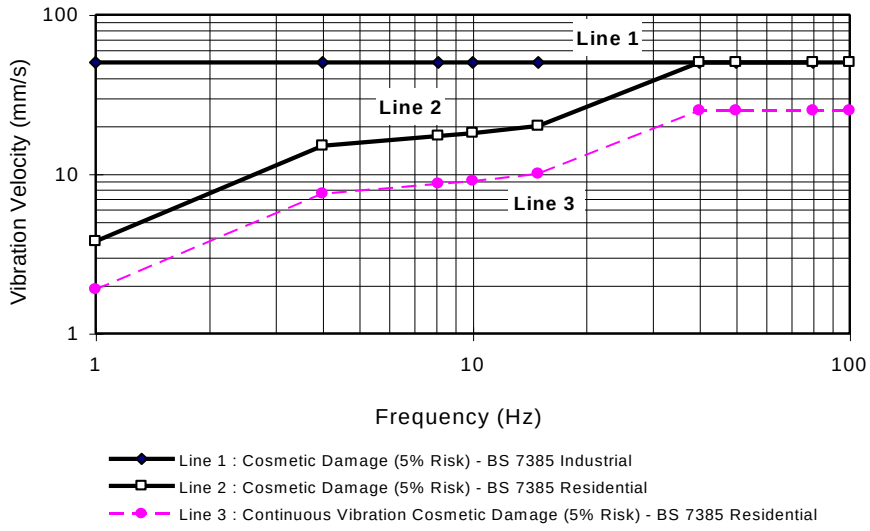
Table 8 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

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 8 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 8 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 8, 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 the 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 8 should not be reduced for fatigue considerations.

4.2.4 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 9. The criteria are frequency dependent and specific to particular categories of structures.

Table 9 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

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

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

4.3 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.

5 NOISE AND VIBRATION ASSESSMENT

5.1 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 10 below.

Table 10 Summary of predicted sound power levels

Tasks	Equipment	Sound Power Levels (dBA re 1pW)	Aggregate Sound Power Level per Task (dBA re 1pW)
Site Establishment Works	Mobile crane	110	113
	Power hand tools	109	
	Semi Rigid Vehicle [1]	105	
Ground Works and Demolition	Excavator	112	119
	Hand held jack hammer [1]	111	
	Dump truck [1]	104	
	Concrete saw [1]	114	
	Skid steer	110	
	Power hand tools	109	
Structure	Hand held jack hammer [1]	106	117
	Concrete saw [1]	114	
	Power hand tools	109	
	Welder	101	
	Concrete pump truck	110	
	Concrete agitator truck	108	
Internal Works	Power hand tools	109	109
Common and External Works	Concrete agitator truck	108	117
	Saw cutter [1]	104	
	Dump truck [1]	104	
	Concrete saw [1]	114	
	Power hand tools	109	

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

5.2 Predicted Construction Noise Levels

Predicted construction noise levels are presented below for each of the surrounding receivers in accordance with the NSW EPA ICNG.

Note:

- Predicted noise levels presented below are given in a range, this includes the expected minimums as well as the maximums.
- With regards to the maximum noise levels in the range, these are typically experienced when plant/works are within close proximity to a boundary. In our experience whilst these levels above NML's and considered intrusive they will only occur for a short time and is not a representation of noise levels during the entire construction period.

Table 11 Receiver 1 – Summary of preliminary predicted construction noise levels – Residence to the north

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	60 to 76	63 to 79	**Standard Construction Hours** 39 + 10 = **49** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		59 to 75			
	Semi Rigid Vehicle		55 to 71			
Ground Works and Demolition	Excavator	119	62 to 78	68 to 84		
	Handheld jack hammer		56 to 72			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Skid steer		60 to 76			
	Power hand tools		59 to 75			
Structure	Handheld jack hammer	117	56 to 72	67 to 83		
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			
	Welder		51 to 67			
	Concrete pump truck		60 to 76			
	Concrete agitator truck		58 to 74			
Internal Works	Power hand tools	109	59 to 75	59 to 75		
Common and External Works	Concrete agitator truck	117	58 to 74	66 to 83		
	Saw cutter		54 to 70			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			

Table 12 Receiver 2 – Summary of predicted construction noise levels – Residence to the north of the site opposite on Darcy Road

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	57 to 72	60 to 76	**Standard Construction Hours** 38 + 10 = **48** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		56 to 71			
	Semi Rigid Vehicle		52 to 68			
Ground Works and Demolition	Excavator	119	59 to 74	65 to 81		
	Handheld jack hammer		53 to 69			
	Dump truck		51 to 67			
	Concrete saw		61 to 77			
	Skid steer		57 to 72			
	Power hand tools		56 to 71			
Structure	Handheld jack hammer	117	53 to 69	64 to 80		
	Concrete saw		61 to 77			
	Power hand tools		56 to 71			
	Welder		48 to 63			
	Concrete pump truck		57 to 72			
	Concrete agitator truck		55 to 70			
Internal Works	Power hand tools	109	56 to 71	56 to 71		
Common and External Works	Concrete agitator truck	117	55 to 70	64 to 79		
	Saw cutter		51 to 67			
	Dump truck		51 to 67			
	Concrete saw		61 to 77			
	Power hand tools		56 to 71			

Table 13 Receiver 3 - Summary of predicted construction noise levels – Residence located to the west of the site on Pioneer Street

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	60 to 76	63 to 79	**Standard Construction Hours** 39 + 10 = **49** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		59 to 75			
	Semi Rigid Vehicle		55 to 71			
Ground Works and Demolition	Excavator	119	62 to 78	68 to 84		
	Handheld jack hammer		56 to 72			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Skid steer		60 to 76			
	Power hand tools		59 to 75			
Structure	Handheld jack hammer	117	56 to 72	67 to 83		
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			
	Welder		51 to 67			
	Concrete pump truck		60 to 76			
	Concrete agitator truck		58 to 74			
Internal Works	Power hand tools	109	59 to 75	59 to 75		
Common and External Works	Concrete agitator truck	117	58 to 74	66 to 83		
	Saw cutter		54 to 70			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			

Table 14 Receiver 4 - Summary of predicted construction noise levels – Residence located to the south of the site on Graham Avenue

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	60 to 76	63 to 79	**Standard Construction Hours** 39 + 10 = **49** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		59 to 75			
	Semi Rigid Vehicle		55 to 71			
Ground Works and Demolition	Excavator	119	62 to 78	68 to 84		
	Handheld jack hammer		56 to 72			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Skid steer		60 to 76			
	Power hand tools		59 to 75			
Structure	Handheld jack hammer	117	56 to 72	67 to 83		
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			
	Welder		51 to 67			
	Concrete pump truck		60 to 76			
	Concrete agitator truck		58 to 74			
Internal Works	Power hand tools	109	59 to 75	59 to 75		
Common and External Works	Concrete agitator truck	117	58 to 74	66 to 83		
	Saw cutter		54 to 70			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			

Table 15 Receiver 5 - Summary of predicted construction noise levels – Residence located to the north east on Darcy Road

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	60 to 76	63 to 79	**Standard Construction Hours** 39 + 10 = **49** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		59 to 75			
	Semi Rigid Vehicle		55 to 71			
Ground Works and Demolition	Excavator	119	62 to 78	68 to 84		
	Handheld jack hammer		56 to 72			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Skid steer		60 to 76			
	Power hand tools		59 to 75			
Structure	Handheld jack hammer	117	56 to 72	67 to 83		
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			
	Welder		51 to 67			
	Concrete pump truck		60 to 76			
	Concrete agitator truck		58 to 74			
Internal Works	Power hand tools	109	59 to 75	59 to 75		
Common and External Works	Concrete agitator truck	117	58 to 74	66 to 83		
	Saw cutter		54 to 70			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			

Table 16 Receiver 6 - Summary of predicted construction noise levels – Residence located to the east on Olive Street

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	57 to 72	60 to 76	**Standard Construction Hours** 38 + 10 = **48** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		56 to 71			
	Semi Rigid Vehicle		52 to 68			
Ground Works and Demolition	Excavator	119	59 to 74	65 to 81		
	Handheld jack hammer		53 to 69			
	Dump truck		51 to 67			
	Concrete saw		61 to 77			
	Skid steer		57 to 72			
	Power hand tools		56 to 71			
Structure	Handheld jack hammer	117	53 to 69	64 to 80		
	Concrete saw		61 to 77			
	Power hand tools		56 to 71			
	Welder		48 to 63			
	Concrete pump truck		57 to 72			
	Concrete agitator truck		55 to 70			
Internal Works	Power hand tools	109	56 to 71	56 to 71		
Common and External Works	Concrete agitator truck	117	55 to 70	64 to 79		
	Saw cutter		51 to 67			
	Dump truck		51 to 67			
	Concrete saw		61 to 77			
	Power hand tools		56 to 71			

Table 17 Receiver 7 - Summary of predicted construction noise levels – Residence located to the south east on Fyall Avenue

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	60 to 76	63 to 79	**Standard Construction Hours** 39 + 10 = **49** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		59 to 75			
	Semi Rigid Vehicle		55 to 71			
Ground Works and Demolition	Excavator	119	62 to 78	68 to 84		
	Handheld jack hammer		56 to 72			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Skid steer		60 to 76			
	Power hand tools		59 to 75			
Structure	Handheld jack hammer	117	56 to 72	67 to 83		
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			
	Welder		51 to 67			
	Concrete pump truck		60 to 76			
	Concrete agitator truck		58 to 74			
Internal Works	Power hand tools	109	59 to 75	59 to 75		
Common and External Works	Concrete agitator truck	117	58 to 74	66 to 83		
	Saw cutter		54 to 70			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			

Table 18 Receiver 8 - Summary of predicted construction noise levels – Residence located to the east on Olive Street

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	60 to 76	63 to 79	**Standard Construction Hours** 39 + 10 = **49** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		59 to 75			
	Semi Rigid Vehicle		55 to 71			
Ground Works and Demolition	Excavator	119	62 to 78	68 to 84		
	Handheld jack hammer		56 to 72			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Skid steer		60 to 76			
	Power hand tools		59 to 75			
Structure	Handheld jack hammer	117	56 to 72	67 to 83		
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			
	Welder		51 to 67			
	Concrete pump truck		60 to 76			
	Concrete agitator truck		58 to 74			
Internal Works	Power hand tools	109	59 to 75	59 to 75		
Common and External Works	Concrete agitator truck	117	58 to 74	66 to 83		
	Saw cutter		54 to 70			
	Dump truck		54 to 70			
	Concrete saw		64 to 80			
	Power hand tools		59 to 75			

Table 19 Receiver 9 - Summary of predicted construction noise levels – Residence located to the west of the site on Pioneer Street

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	57 to 72	60 to 76	**Standard Construction Hours** 38 + 10 = **48** **Highly Noise Affected Level** Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the noise management level when working near a receiver. Mitigations of construction noise required to be undertaken including measures detailed in this report.
	Power hand tools		56 to 71			
	Semi Rigid Vehicle		52 to 68			
Ground Works and Demolition	Excavator	119	59 to 74	65 to 81		
	Handheld jack hammer		53 to 69			
	Dump truck		51 to 67			
	Concrete saw		61 to 77			
	Skid steer		57 to 72			
	Power hand tools		56 to 71			
Structure	Handheld jack hammer	117	53 to 69	64 to 80		
	Concrete saw		61 to 77			
	Power hand tools		56 to 71			
	Welder		48 to 63			
	Concrete pump truck		57 to 72			
	Concrete agitator truck		55 to 70			
Internal Works	Power hand tools	109	56 to 71	56 to 71		
Common and External Works	Concrete agitator truck	117	55 to 70	64 to 79		
	Saw cutter		51 to 67			
	Dump truck		51 to 67			
	Concrete saw		61 to 77			
	Power hand tools		56 to 71			

5.3 Construction Traffic Noise Assessment

It is proposed that the construction traffic would access the site via Darcy Road to the north of the site. All construction traffic will access the site and use the surrounding roadways in accordance with the site Construction Management plan.

5.4 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 4.2, it is recommended that the indicative safe distances listed in table below should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site.

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

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 4.2.

Table 20 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
Vibratory pile driver	Sheet piles	2 – 20	20
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

Based on the required construction activities to be undertaken as part of the project as well as the proximity of the surrounding receivers to the site the resulting construction vibration is unlikely to negatively impact on any of the surrounding receivers.

6 NOISE AND VIBRATION MANAGEMENT PLAN

6.1 Acoustic Management Procedures

Table 21 below summarises the management procedures recommended for airborne noise and vibration impact. These procedures are also further discussed in the report. Hence, where applicable, links to further references are provided in Table 21.

Table 21 Summary of mitigation procedures

Procedure	Abbreviation	Description	Further Reference
General Management Measures	GMM	Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.	Refer to Section 5 For noise impact, also refer to Section 6.2.1 For vibration impact, also refer to Section 6.3.1
Project Notification	PN	Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included. Content and length to be determined on a project-by-project basis.	Refer to Section 6.5.4 and 6.5.5
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 6.2.2. For vibration impact, refer to Section 6.3.2
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders	Refer to Section 0
Specific Notification	SN	Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives. Alternatively, contractor could visit stakeholders individually in order to brief them in regards to the noise impact and the mitigation measures that will be implemented.	Refer to Section 6.5.4 and 6.5.5
Respite Offer	RO	Offer provided to stakeholders subjected to an ongoing impact.	-
Alternative Construction Methodology	AC	Contractor to consider alternative construction options that achieve compliance with relevant criteria. Alternative option to be determined on a case-by-case basis.	-

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 6.1.1

For vibration, the criteria either correspond to human comfort, building damage or scientific and medical equipment. The application of these procedures is discussed in Section 6.1.2.

6.1.1 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 4.1). 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: 8:00 am to 7:00 pm Sat: 8:00 am – 5:00 pm	0 - 3	GMM
	4 - 10	GMM, PN, V [1], CMS, AC
	> 10	GMM, PN, V, CMS, SN, AC
Outside Standard Hours Mon – Fri: 7:00 am to 8:00 am Sat: 7:00 am to 8:00 am	0 - 10	GMM, AC
	11 - 20	GMM, PN, V [1], CMS, AC
	> 20	GMM, PN, V, CMS, SN, RO, AC

Notes

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 5.1.
- The allocation of procedures is based on the assumptions used for noise level predictions (refer to Section 5.1). Consequently, these allocations can be further refined once additional details of the construction program become available.

For non-residential receivers (such as commercial), management measures are provided in Section 6.2.3.

6.1.2 Allocation of Vibration Management Procedures

Table 23 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: 8:00 am to 7:00 pm Sat: 8:00 am – 5:00 pm	Over human comfort criteria (refer to Section 4.2)	GMM, PN, V, RO
	Over building damage criteria (refer to Section 4.2)	GMM, V, AC
Outside Standard Hours Mon – Fri: 7:00 am to 8:00 am Sat: 7:00 am to 8:00 am	Over human comfort criteria (refer to Section 4.2)	GMM, SN, V, RO, CMS
	Over building damage criteria (refer to Section 4.2)	GMM, V, AC

6.2 Site Specific Noise Mitigation Measures – High Noise Affected Appliances

Predicted noise levels outlined in section 5.1 indicate exceedances above the Noise Management Levels (NMLs) as well as the Highly Noise Affected Level (HNAL) when in proximity to a boundary. To militate against any exceedances, the site will need to introduce periods of respite for activities which are creating noise levels above the HNAL only (i.e. greater than 75dBA). See below.

Table 24 Recommended Respite Periods

Monday to Friday	Saturday
7:00am to 8:00am – No noisy works (Respite Period)	8:00am to 9:00am – No noisy works (Respite Period)
8:00am to 11:30am – Works	9:00am to 12:00pm – Works
11:30am to 12:30pm – No noisy works (Respite Period)	12:00pm to 1:00pm – No noisy works (Respite Period)
12:30pm to 3:30pm – Works	
3:30pm to 4:30pm – No noisy works (Respite Period)	
4:30pm to 6:00pm – Works	

6.2.1 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.

6.2.2 Noise Monitoring

Noise monitoring, if required, will be performed by an acoustical consultant directly engaged by the contractor.

Noise monitoring is recommended to be undertaken by attended noise measurements at the start of any new phase of works (i.e. demolition, excavation or remediation works etc.). The statistical parameters to be measured should include the following noise descriptors: L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq}. Unattended noise measurements should be conducted over consecutive 15 minute periods.

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

- Differentiate between construction noise sources and other extraneous noise events (such as road traffic and aircraft noise)
- Note and identify any excessive noise emitting machinery or operation.

Noise monitoring and measurements on the site will include the following:

- Noise monitoring during the required demolition to be completed on the site.
- Periodic attended noise measurements during the bulk earthworks to be completed on the site, typically monthly.

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

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

6.2.3 Noise Mitigation Measures for Non-Residential Receivers

Where exceedances have been identified in Section 0, the following mitigation measures are recommended:

- Undertake general mitigation measures as discussed in Section 6
- Issue project updates to tenants in affected premises. The updates can include overview of current and upcoming works, as well as advanced warning of potential disruptions. These updates can also be issued through an email distribution list or via social media.
- Signage to be posted in order to provide stakeholders information regarding project details, emergency contacts and enquiry contact information.

6.2.4 Alternate Equipment or Process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

6.2.5 Acoustic Enclosures/Screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant i.e. (diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

6.2.6 Required Piling

Works on the site are not required to include piling of any type.

6.3 Vibration Mitigation Measures

6.3.1 General Comments

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).
- Schedule a minimum respite period of at least 30 minutes before activities commence which are to be undertaken for a continuous 4-hour period.
- 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 25 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 should be defined by considering the vibration criteria discussed in Section 1.2 (i.e., criteria for structural damage, human comfort and impact to scientific or medical equipment).

6.3.2 Vibration Monitoring

Vibration monitoring will be undertaken at the nearest most affected structures and include the following:

1. Attended vibration surveys resulting from high vibration generating activities which are within the recommended safe working distances detailed in Table 20 above. Vibration assessments should include attended vibration measurements of proposed activities to be undertaken on the site.

The vibration monitoring equipment would be operated 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.

6.4 Noise and Vibration Monitoring

As part of the management of noise from the proposed construction activities to be undertaken on the site the following noise and vibration monitoring is to be undertaken:

1. Noise Monitoring– Attended noise monitoring of excavation and construction activities is to be undertaken during the following periods:
    a. Commencement of any rock breaking or sawing on the site.
    b. In response to any ongoing complaints received from neighbours.

2. Vibration – Based on the proximity of the surrounding receivers to the works magnitudes of vibration resulting from construction activities required to be undertaken on the site are not expected to approach vibration limits detailed in Section 4.2 of this report, therefore permanent continuous vibration monitoring is not recommended.

    Attended vibration monitoring is to be undertaken at the following periods:
    a. Commencement of any high vibration generating activities including hydrail hammering, rock breaking or vibration rolling on the site.
    b. receiver location in the event complaints resulting from construction activities resulting from the perception of vibration are experienced by the occupants of buildings within the vicinity of the site.

The noise and vibration monitoring will be undertaken in accordance with the project requirements including item B13 of the SSD, including the project *Environmental Management Plan Guideline: Guideline for Infrastructure Project (DPIE April 202).*

6.5 SINSW Complaints management process as outlined in the Community Communication Report (CCR)

6.5.1 Enquiries and complaints management

SINSW manages enquiries, and complaints in a timely and responsive manner and detailed in the projects Community Consolation Summary report.

Prior to project delivery, a complaint could be related to lack of community consultation, design of the project, lack of project progress, etc.

During project delivery, a complaint is defined as in regard to construction impacts – such as – safety, dust, noise, traffic, congestion, loss of parking, contamination, loss of amenity, hours of work, property damage, property access, service disruption, conduct or behaviour of construction workers, other environmental impacts, unplanned or uncommunicated disruption to the school.

As per our planning approval conditions, a complaints register is updated monthly and is publicly available on the project's website page on the SINSW website. The complaints register will record the number of complaints received, the nature of the complaints and how the complaint was resolved.

6.5.2 Complaints management process

All complaints will be conducted in accordance with the projects Community Communication Strategy. Any face to face complaints will be directed to the hotline as detailed in the Community Communication Strategy.

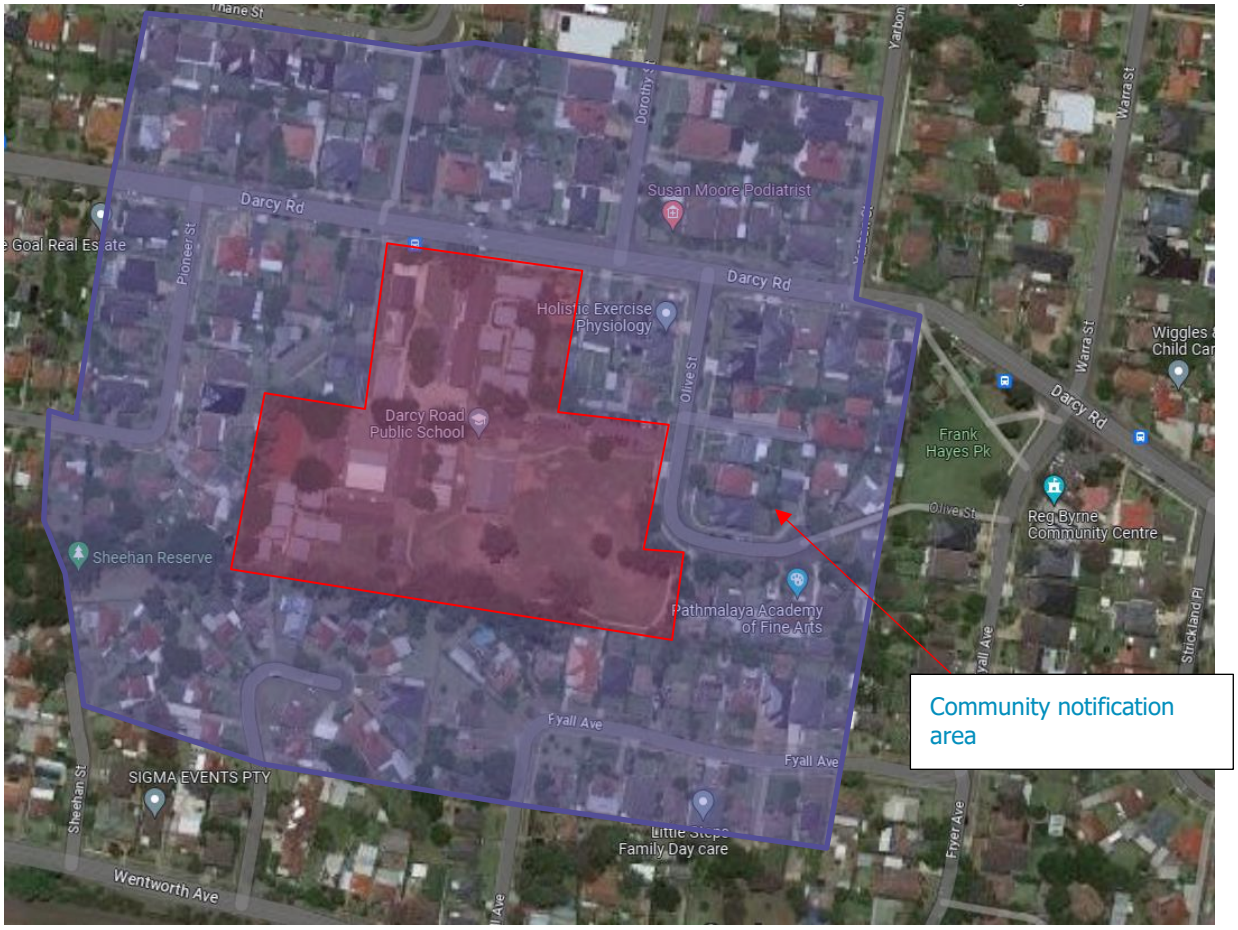
6.5.3 Complaints in common community languages

Complaints can be made in common community languages using the Translating and Interpreting Service (TIS), managed by the Department of Home Affairs. Community members can be connected to an interpreter by calling TIS on 131 450. TIS contact details are included on all project communications. Once TIS has the interpreter on the line, the interpreter and community member are connected to School Infrastructure and phone interpretation can begin. School Infrastructure NSW receives the complaint via the translator and begins the complaints management process as outlined above.

6.5.4 Community Notifications

Prior to the works onsite being undertaken, it is recommended that community consultation with the neighbouring affected parties be undertaken. These include the locations detailed in the figure below.

Figure 4 Required Community Notification Area



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

- Project website.
- Email notifications; and
- Letterbox drops.

6.5.5 Community Engagement

It is proposed that throughout the duration of the project, continued meetings with both the school principals will be undertaken on a regular basis to monitor and mitigate any impacts of construction noise and vibration on the school community.

Community engagement has included notifications and information, including the details included in Appendix B of this report.

It is noted that as of the 15th March, 2024 no feedback from the community has been received by School Infrastructure NSW.

6.6 Complaints Management System

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

6.7 Contingency Plans

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; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

The Superintendent shall have access to view the Contractor's noise measurement records on request. The Superintendent may undertake noise monitoring if and when required.

6.8 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.

6.8.1 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.

6.8.2 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.
- Operating plant and equipment in the quietest and most efficient manner.

6.8.3 On Site Noise Mitigation

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

6.8.4 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.

6.8.5 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.

6.8.6 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.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site (except for emergency purposes).

7 CONCLUSION

This report details the Construction Noise and Vibration Management Sub Plan for the construction of the proposed alterations and additions to Darcy Road Public School located at 98A Darcy Road, Wentworthville, NSW.

An assessment of noise and vibration impacts from the required processes to be undertaken during the construction period of the project (including ground works 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* and the projects *Consent* will be achieved.

Based on the required construction activities to be undertaken on the site and the distance separation to the neighbouring receivers, compliance with the relevant vibration criteria is expected to be achieved without additional mitigations. Conformation of compliance with the relevant criteria will be undertaken using attended vibration monitoring.

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

Regards

Ben White
Director

Pulse White Noise Acoustics

APPENDIX A: ACOUSTIC GLOSSARY

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

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

From: SchoolInfrastructure <schoolinfrastructure@det.nsw.edu.au>
Sent: Friday, 15 March 2024 4:21 PM
To: Katherine Barrionuevo; Kate Burgess; Pete Krause; Fred Sedighi; Matthew Spooner; Kimaya Yeola; Mathew Wood; Greg Smith (Greg Smith); Kendal Caynes; Miriam Waters (Miriam Waters)
Subject: Darcy Road Public School Upgrade - consultation on CNVMSP
Attachments: Darcy_Road_PS_consultation_project_update_24_January_2024.pdf

To whom it may concern,

In January 2024, a letter was issued to neighbouring residents of Darcy Road Public School requesting feedback on the planned management of construction impacts. See attached.

To date, no feedback has been received by School Infrastructure NSW in relation to this.

Kindly,
Kate

Community Engagement Team | School Infrastructure NSW
1300 482 651 | schoolinfrastructure@det.nsw.edu.au | schoolinfrastructure.nsw.gov.au
[Please note our community phone and email are staffed from Monday to Friday between 9 am and 5 pm]

NSW GOVERNMENT Education

I acknowledge the homelands of all Aboriginal people and pay my respect to Country.

Confidentiality: This email is from the NSW Department of Education. The contents are confidential and may be protected by legal professional privilege. The contents are intended only for the named recipient of this email. If the reader of this email is not the intended recipient you are hereby notified that any use, reproduction, disclosure or distribution of the information contained in the email is prohibited. If you have received this email in error, please reply to us immediately and delete the document.

Darcy Road Public School

Project update | 24 January 2024

The upgrade of Darcy Road Public School will provide new permanent classrooms and core facilities to support the growing population in Western Sydney.

The project is a State Significant Development (SSD-49073460) and the Department of Planning, Housing and Infrastructure (DPHI) is currently assessing the application for the project.

Feedback on managing construction impacts

DPHI has issued draft conditions of consent for the project which require a Construction Noise and Vibration Management Sub-Plan (CNVMSP) to be prepared by a suitably qualified and experienced noise expert. The CNVMSP needs to include strategies that have been developed with the community for managing high noise generating works.

There are noise mitigation strategies that are already planned as part of the construction works, such as:

- noise monitoring, to ensure compliance with the noise and vibration management criteria outlined in the SSD application consent
- compliance with the 'Construction Hours' included in the SSD application consent conditions to minimise noise and vibration impacts of the development
- acoustic shielding where practical, to minimise noise from the site
- organising and scheduling works to limit the noisiest machines operating simultaneously
- maximising the distance between plant items and nearby noise sensitive receivers.

Under the conditions of approval, all work, including building/demolition and excavation work, and activities in the vicinity of the site generating noise, must only be carried out between 7 am and 6 pm, Mondays to Fridays inclusive and between 8 am and 1 pm, Saturdays. No work may be carried out on Sundays or public holidays.

Provided noise levels do not exceed the existing background noise level plus 5 decibels, works may also be undertaken between 6 pm and 7 pm, Mondays to Fridays and between 1 pm and 4 pm, Saturdays.

If you would like to provide any feedback on these measures or contribute any recommendations, that you feel would be beneficial and feasible for the project to implement, please contact School Infrastructure NSW by emailing schoolinfrastructure@det.nsw.edu.au or calling 1300 482 651 by Wednesday 31 January 2024.

To learn more about this project, visit the dedicated project webpage edu.nsw.link/DarcyRdPS.

For a **Translation and Interpreting Service** call **131 450** and ask them to call the Department of Education - School Infrastructure NSW on **1300 482 651**.

School Infrastructure NSW
Email: schoolinfrastructure@det.nsw.edu.au
Phone: 1300 482 651
www.schoolinfrastructure.nsw.gov.au

NSW GOVERNMENT

APPENDIX C - BEN WHITE CV AND AAS MEMBERSHIP

Curriculum Vitae – Benjamin White

Employment Experience:

Director – Pule White Noise Acoustics November 2020 – Present

Director - White Noise Acoustics: March 2019 – Present

Director/Engineer - Acoustic Logic Consultancy: March 2001 – July 2018

Experience:

Ben White the Director of White Noise has over 17 years of experience in acoustic.

Ben has significant experience in providing acoustic services and expert advice in the following areas:

- Residential acoustic reports including aircraft noise (AS2021) assessments, traffic noise, train noise and vibration assessments.
- Noise emission assessments for various projects including assessments with planning requirements using EPA, Department of Planning, Council DCP's and similar regulatory requirements.
- Planning approvals including Development Applications for multi dwelling residential developments, commercial developments, hotels and boarding houses, places of entertainment, carparks, mixed use developments, shopping centres and the like.
- Expert court witness including Land and Environment Court and other expert witness work.
- Project planning and specifications for types of projects including residential, commercial, retail, hotel accommodation, warehouses and industrial developments and mixed-use projects.
- Project delivery for all types of projects including, design advice and project delivery requirements at all stages of projects during design and construction.
- Certification works including on site testing for the provision of certification of all types of projects including items required to comply with Part F5 of the BCA as well as project specific acoustic requirements.
- Mechanical design and advice for the treatments of mechanical services with project requirements.
- External façade design and specification.
- Specialised acoustic design advice including areas of projects.
- Issues with existing building include site surveys and audits as well as advice regarding rectification if required.

AUSTRALIAN ACOUSTICAL SOCIETY

This is to certify that

BENJAMIN WHITE

was admitted to the grade of

MEMBER

of the Australian Acoustical Society

on 27th October 2020

and is entitled to use the letters

M.A.A.S.

issued on 26th November 2020

S. Moore

President

General Secretary

AUSTRALIAN ACOUSTICAL SOCIETY A.C.N. 000 712 658 The Common Seal Of

This certificate remains the property of the Australian Acoustical Society