Richmond Agricultural Centre (RAC)

REF Acoustic Assessment

Richard Crookes Constructions
Level 14, 558 Pacific Highway,
St Leonards NSW 2065

Report Reference: 240558 – REF Acoustic Assessment – R2.1

Date: 8 May 2025

Revision: R2.1

Project Number: 240588

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

DOCUMENT CONTROL

Project Name:	Richmond Agricultural Centre (RAC)
Project Number:	240558
Report Reference:	240558 – REF Acoustic Assessment – R2
Client:	Richard Crookes Constructions

Revision	Description	Reference	Date	Prepared	Checked	Authorised
R0	For Review	240558 – REF Acoustic Assessment – R0	17/04/2025	Matthew Furlong	Matthew Furlong	Matthew Furlong
R1	Comments Updated	240558 – REF Acoustic Assessment – R1	08/05/2025	Matthew Furlong	Matthew Furlong	Matthew Furlong
R2	Comments Updated	240558 – REF Acoustic Assessment – R2	08/05/2025	Matthew Furlong	Matthew Furlong	Matthew Furlong

PREPARED BY:

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

CONTENTS

Figures

Tables

1 INTRODUCTION

This Acoustic Assessment has been prepared by Pulse White Noise Acoustics on behalf of the Department of Education (DoE) (the Proponent) to assess the potential environmental impacts that could arise from the activities associated with the Richmond Agricultural Centre development at 2 College Street Richmond (Part Lot 2 DP1051798) (the site).

The report has been prepared to undertake a review of the potential noise and vibration impacts associated with the proposal and determine all relevant acoustic mitigation measures to ensure the existing acoustic amenity of the surrounding community is maintained.

This report accompanies a Review of Environmental Factors (REF) that seeks approval for the construction and operation of the agricultural centre which will provide facilities for a specialist agricultural curriculum at the site. The activities associated with establishing the Richmond Agricultural Centre involves the following works:

- The removal of trees and fencing
- Construction of a general learning hub
- Construction of a science hub
- Construction of a multipurpose hall
- Construction of an administration building
- Construction of canteen and amenities building
- Construction of a new parking area (including accessible spaces) driveway and kiss and drop facilities
- The provision of outdoor agricultural learning areas comprising:
    - Agricultural plots
    - Aboriginal enterprise
    - Agricultural shed and greenhouse
    - Animal plots with associated stock yard, animal shelters, troughs and stock lane
    - Gravel access road with wash bay
- Landscaping including new trees, entry forecourt, village green and kitchen garden
- Ancillary services and infrastructure upgrades including new substation and HV Works, sewer pump station, water booster, dual carriage vehicle access and pedestrian paths
- Wayfinding and school identification signage

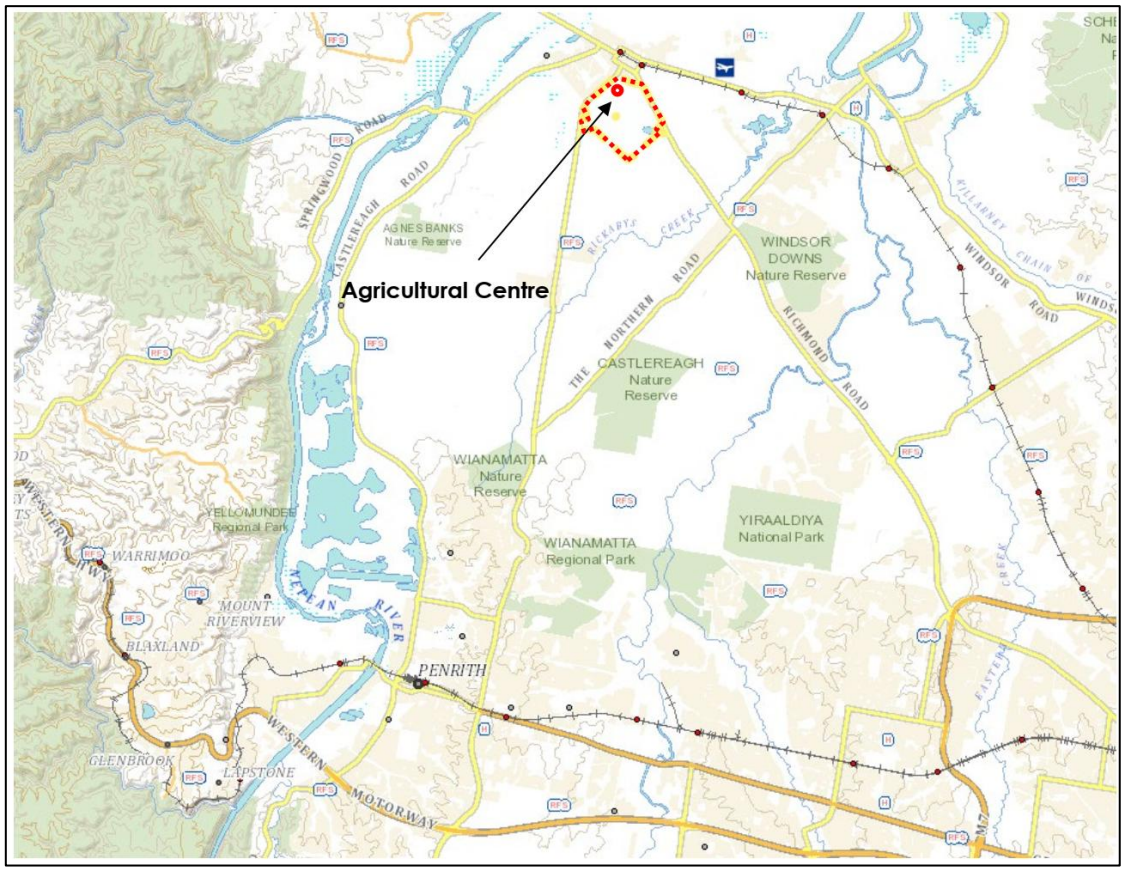
For a detailed project description, please refer to the Review of Environmental Factors (REF) prepared by EPM Projects.

1.1 Site Description and Surrounding Receivers

The Site is located on 2 College Street, Richmond (Part Lot 2 DP 1051798). The site is located within the Hawkesbury City Council area and is zoned SP1 Special Activities (the SP1 zone) by the Hawkesbury Local Environmental Plan 2012 (the LEP).

Figure 1 is a site plan showing the location of the proposed Richmond Agricultural Centre within its regional context. Figure 2 is an aerial image of the site and its immediate surrounds.

Figure 1 Location of the proposed Richmond Agricultural Centre



The nearest sensitive noise receivers to the site are identified below.

Receiver 1: Existing residential dwellings situated along the northern side of College Street. These dwellings include a combination of single and two storey dwellings.

Receiver 2: Existing residential dwellings situated western side of Londonderry Road. These dwellings include a combination of single and two storey dwellings.

Figure 2 Site Aerial Map – Map Sourced NearMap

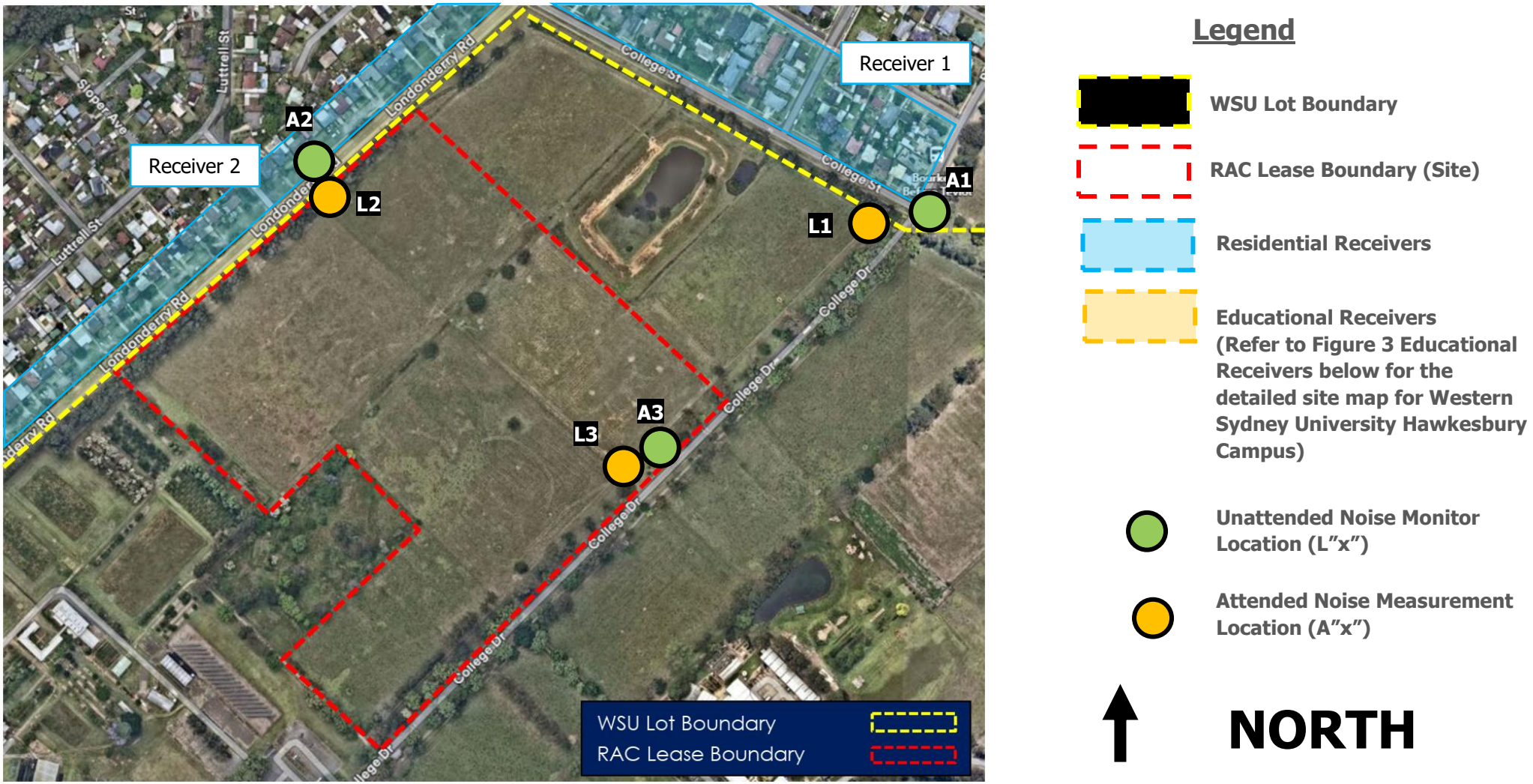
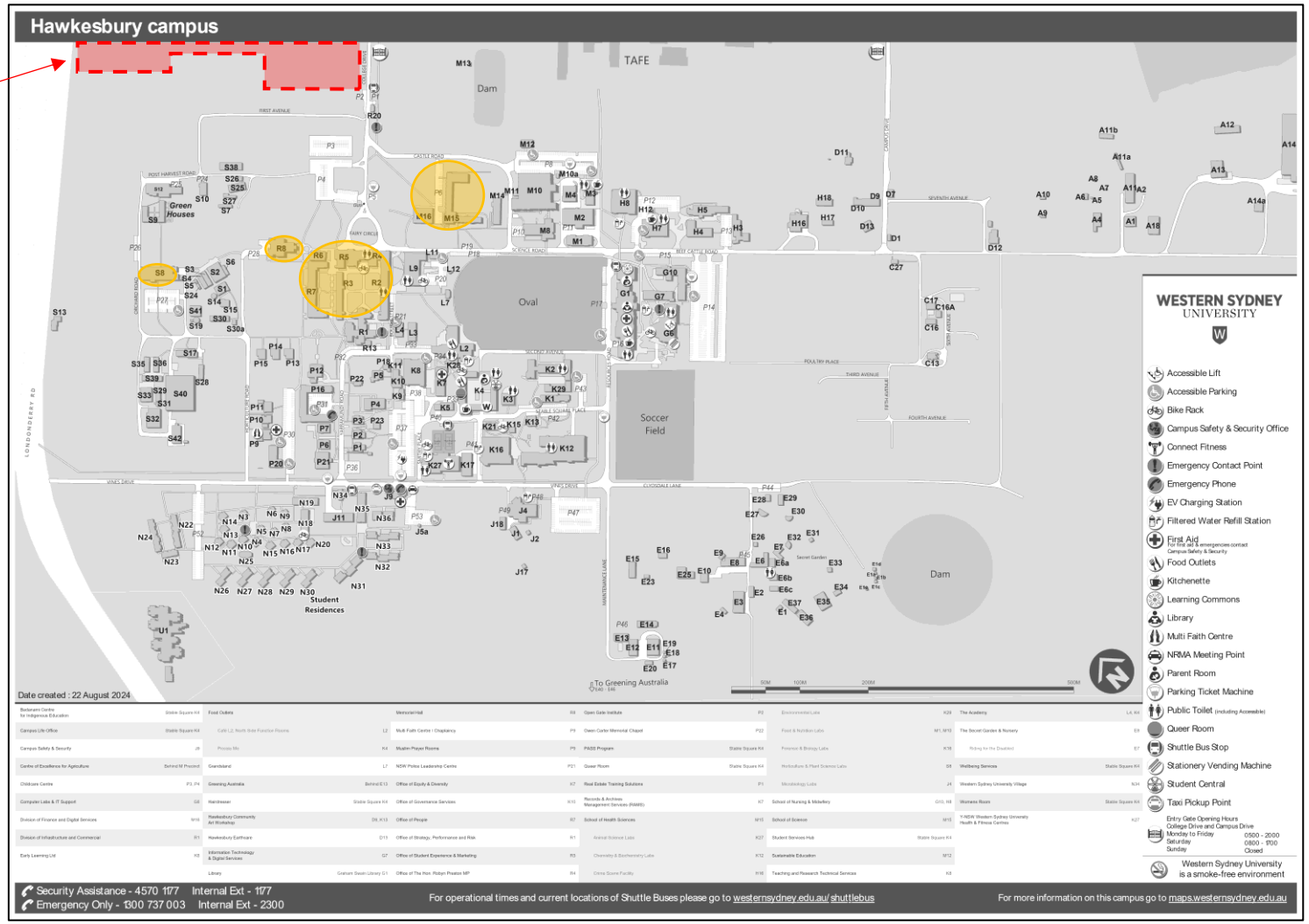


Figure 3 Western Sydney University – Campus Map – 22nd August 2024



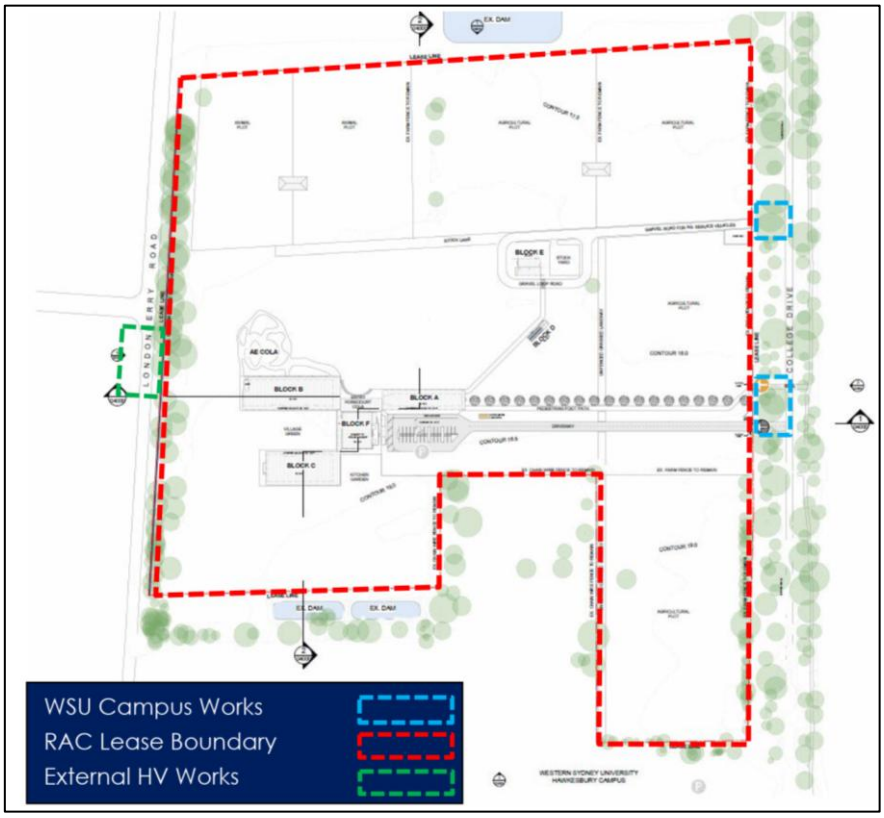
As shown in the figure adjacent, the nearest buildings to the site (i.e. S7, S9, S10, S12, S25, S26, S27 and S28) are not learning spaces, rather maintenance and greenhouses. The sensitive education type buildings are located further within the site as indicated by the **orange circles** on the figure and beyond. The distance from the nearest point of the RAC Lease Area to the nearest building is >~150m.

The boundary of the REF works is shown in **Figure 3** and comprises:

- **Leased area:** This is the area of land leased by the Department of Education from Western Sydney University (WSU) for the proposed Richmond Agricultural Centre. This area comprises 14.25 ha of land with frontage to College Drive of 480 meters. The future school site comprises existing agricultural land within the WSU campus bound by College Drive to the east, Londonderry Road to the west, WSU facilities to the south and vacant WSU agricultural land to the north.

- **WSU Campus:** This the area of land between the leased area and College Drive

Figure 4 Extent of proposed works at Richmond Agricultural Centre



1.2 Relevant Guidelines

Acoustic criteria that have been adopted in this assessment include requirements from the following guidelines or legislative documents:

- Hawkesbury City Council LEP and DCP
- NSW EPA Noise Policy for Industry (*NPI*) 2017.
- NSW EPA Road Noise Policy (*RNP*) 2011.
- NSW EPA Interim Construction Noise Guideline (*ICNG*) 2009.
- NSW EPA (formerly, Department of Environment and Climate Change) *Assessing Vibration: a technical guideline 2006 (AV-TG)*.

- Australian Standard AS 2670.2 1990 - *Evaluation of Human Exposure to Whole Body Vibration - Part 2: Continuous and Shock Induced Vibration in Buildings (1 Hz to 80 Hz).*
- British Standard BS 6472 - 2008 - *Evaluation of Human Exposure Vibration in Buildings (1 Hz to 80 Hz).*
- German DIN 4150: Part 3 – 1999 "*Effects of Vibration on Structure*" (DIN 1999).
- NSW Education Educational Facilities Standards and Guidelines (*EFSG*); and
- Association of Australasian Acoustical Consultants *Guide for Child Care Centre Acoustic Assessment (V3).*

2 ACOUSTIC NOISE SURVEY

Measured noise levels from the onsite noise survey are outlined below.

2.1 Unattended Noise Monitoring

Three unattended noise monitors were deployed to the site to survey existing background noise levels as well as ambient L_{Aeq} noise levels.

The first monitoring location was situated along the northern boundary of the WSU campus adjacent to College Street, known as location **"L1"** in Figure 2 above. This location was used for determining existing acoustic environment for the receivers across College Street.

The second location was along the western boundary adjacent to Londonderry Road, known as location **"L2"** in Figure 2 above. This location was used for determining existing acoustic environment for the receivers across Londonderry.

The third location was along the eastern boundary of the RAC boundary adjacent to College Drive, known as location **"L3"** in Figure 2 above. This location was used for determining existing acoustic environment for the receivers across College Street.

Onsite acoustic noise survey was conducted from Monday 2nd September 2024 and Tuesday 10th September 2024. All data in the graphs presented in Appendix B (L1), Appendix C (L2) and Appendix D (L3) have not been corrected (i.e., raw data is presented). The charts present each 24-hour period and show the L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15-minute periods. This data has been filtered to remove periods affected by adverse weather conditions based on weather information.

Unfortunately due to an equipment malfunction at location L3, data was only recorded until Tuesday 3rd September 2024. As this location is not being used for the determination of rating background noise levels, this is considered non-critical.

Instrumentation for the survey comprised one SvanTek 971 sound level meter at location L1, one (1) Acoustic Research Laboratories (ARL) nGara noise monitor at location L2 and one (1) Rion NL-42 sound level meter at location L3. Calibration of the monitors were checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Based on the unattended noise measurements, the results of the survey have been presented below.

2.1.1 Results in accordance with the NSW EPA Noise Policy for Industry (NPI) 2017 (RBL's)

In order to assess the acoustical implications of the development at nearby noise sensitive receivers, the measured background noise data of the logger was processed 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 at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 1

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria. Meteorological information has been obtained from the Richmond Observation (ID 067105) which is located within 30km. Levels presented below are processed results with extraneous weather events removed.

Table 1 Measured Ambient Noise Levels corresponding to the NPI's Assessment Time Periods

Measurement Location [4]	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)
Location 1 **(L1)** – College Street (see Figure 2)	38	57	39	50	29	46
Location 2 **(L2)** – Londonderry Drive (see Figure 2)	42	64	40	61	30	57
Location 3 **(L3)** – College Drive (see Figure 2)	N/A [4]	N/A [4]	N/A [4]	N/A [4]	N/A [4]	N/A [4]

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 LA90 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 LAeq 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.

Note 4 Due to an equipment malfunction ambient and background noise levels cannot be accurately determine at this location.

Based on analysis of the measured noise levels and onsite observations we note:

- Measured L_{A90} noise levels during the evening period along College Street are 1dB above the measured noise level during the day period at the same location. As such, in accordance with the procedures outlined in the NPI the resulting intrusiveness criteria will match the day period.
- Measured L_{A90} noise levels during the night period along College Street are 1dB below the minimum noise levels for the period (10:00pm to 7:00am). As such the background noise levels in this location will be adjusted to match the minimum for the night period in accordance with the procedures of the NSW EPA NPI (i.e. 30dBA $L_{A90\ (10:00pm\ to\ 7:00am)}$).

2.1.2 Results in accordance with the NSW Department of Planning "Road Noise Policy"

In determining the required façade construction for the proposed building in accordance with the internal noise level requirements of NSW Department of Planning "Road Noise Policy", measured noise levels are shown based on the time periods defined by the SEPP below.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events have been excluded from the results, and also excluded from the data used to determine the noise emission criteria.

Table 2 Measured Ambient Noise Levels corresponding to the "Road Noise Policy" Assessment Time Periods

Measurement Location	Daytime [1] 7:00 am to 10:00 pm $L_{Aeq\ (whole\ period)}$ [2] (dBA)	Night-time [1] 10:00 pm to 7:00 am $L_{Aeq\ (whole\ period)}$ [2] (dBA)
Location 1 **(L1)** – College Street (see Figure 2)	57	46
Location 2 **(L2)** – Londonderry Drive (see Figure 2)	64	57
Location 3 **(L3)** – College Drive (see Figure 2)	59	41

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

Note 2 The LAeq 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.

2.2 Attended Noise Survey

In addition to the unattended noise surveys detailed above, an onsite attended noise surveys have being undertaken around the site to support the measurements above.

Locations of the attended noise measurements are detailed in the Figure 2 above . Noise measurements have been undertaken along all boundaries adjacent to existing and future residential receivers.

Attended noise level testing was undertaken using a Bruel and Kjaer 2270 Class 1 Type 1 Sound Level Meter (SLM). The meter was calibrated before and after testing and no significant drift was recorded. The attended and unattended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ($L_{90\ (t)}$) as well as the impact from traffic movements ($Leq_{(t)}$). All noise measurements were conducted on Monday 2nd September 2024 after the deployment of the noise monitors detailed above.

Table 3 Measured Attended Noise Level Measurements

Measurement Location	Measured Noise Level (dBA)	
	$L_{A90\ (15\text{-}minutes)}$ [1] (dBA)	$L_{Aeq\ (15\text{-}minutes)}$ [2] (dBA)
Location 1 **(A1)** – College Street (see Figure 2)	43	58
Location 2 **(A2)** – Londonderry Drive (see Figure 2)	46	65
Location 3 **(A3)** – College Drive (see Figure 2)	38	60

Note 1 The LA90 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 2 The LAeq 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 NOISE AND VIBRATION CRITERIA

All relevant noise and vibration criteria for the project is presented below. It has been separated in to four main components: external noise emission criteria, building envelope criteria (façade), vibration criteria and construction noise/vibration criteria. Each are discussed in detail below.

3.1 External Noise Emission Criteria

3.1.1 Hawkesbury City Council Local Environmental Plan (LEP) 2012 & Development Control Plan (DCP) 2023

Acoustic requirements relevant to noise emitted from the development are not provided in the Hawkesbury City Council LEP or DCP documents. Therefore, requirements of the NSW EPA NPI 2017, RNP 2011 and NSW Education EFSG will be adopted. Each is discussed in detail below.

3.1.2 NSW Educational Facilities Services Guidelines (EFSGs)

Section DG11 Acoustics of the EFSGs states the following:

> Noise emission considerations include:
>
> - Noise emission from school activity (e.g.: music performance, sporting activity)
> - Noise emission from a mechanical service (such as air conditioning unit or fan)
>
> The extent to which noise emission will have to be considered and the extent of acoustic treatment required will depend upon:
>
> - Whether noisy activities take place in a room or space
> - Whether the room or space is naturally ventilated and therefore windows and/or doors are expected to be open when noisy activities are taking place
> - Room facade construction and orientation of 'acoustically weak' facades relative to noise-sensitive receivers
> - Distance to noise-sensitive receivers
> - Whether mandatory noise emission criteria are required to be satisfied at nearby boundaries and land uses.

Note: In addressing the above, the following is proposed:

- In the assessment of noise emissions from plant items, the NSW EPA NPI 2017 will be adopted.
- In the assessment of vehicles on the site, guidance from the NSW EPA NPI 2017 will be adopted.
- In the assessment of vehicles on public roads, the NSW RNP 2011 will be adopted.

All are discussed below.

3.1.3 NSW EPA Noise Policy for Industry (NPI) 2017

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

The NSW EPA has recently released a document titled Noise Policy for Industry (NSW NPI) which provides a framework and process for determining external noise criteria for the assessment of noise emission from industrial developments. The NSW NPI criteria for industrial noise sources have two components:

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

3.1.3.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.1.3.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient LAeq noise level should not exceed the level appropriate for the locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPI) minus 5 dB(A). To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the LAeq,15min will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

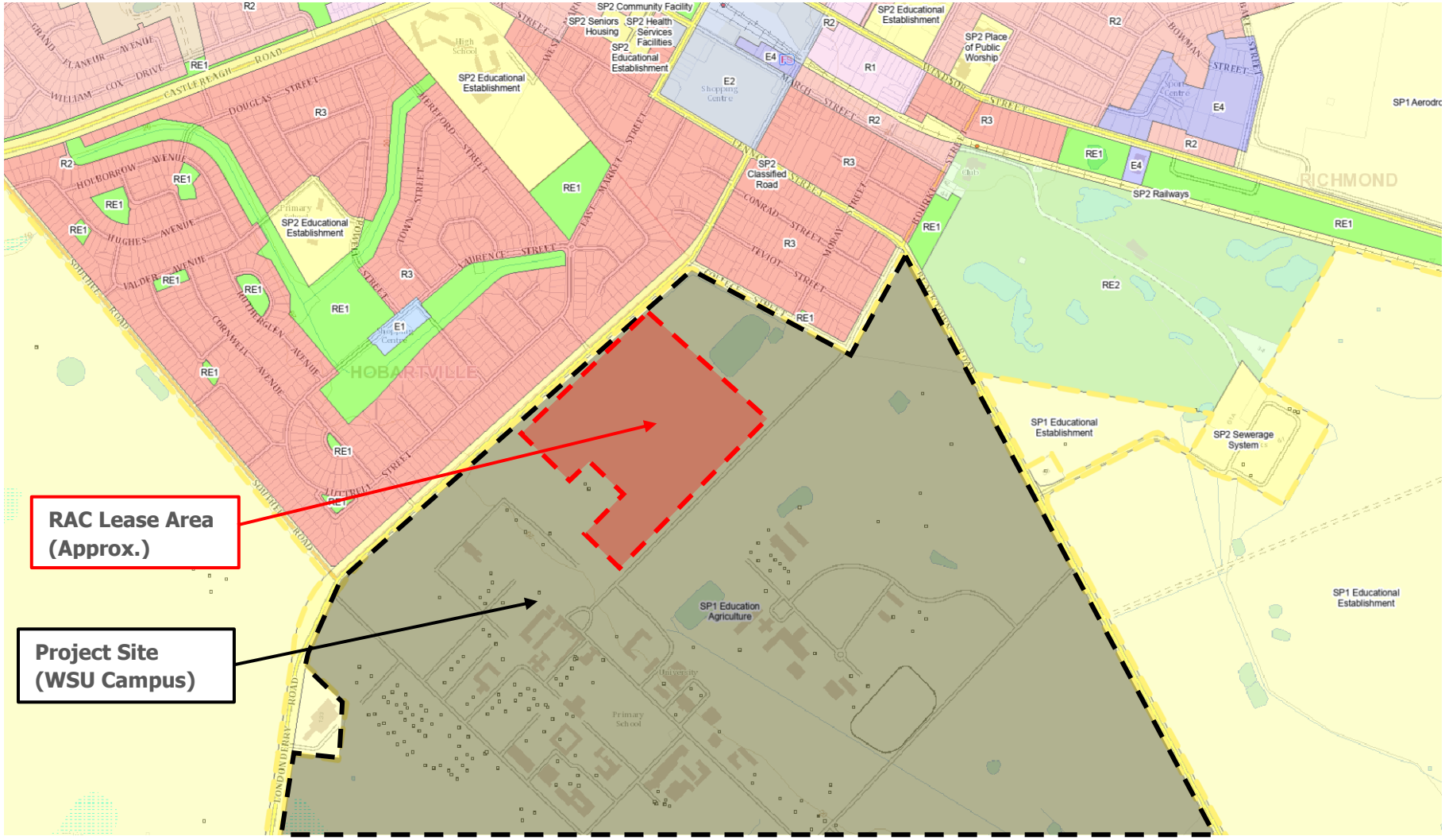
Where the resultant project amenity noise level is 10 dB or more lower than the existing traffic noise level, the project amenity noise levels can be set at 15 dB below existing traffic noise levels (i.e. $L_{Aeq,period(traffic)}$ *minus 15 dBA*).

3.1.3.3 Residential Receivers – Area Classification

The NSW NPI characteristics the "Suburban Residential" noise environment as an area that has the following characteristics:

- An acoustical environment that:
    - An area that has local traffic with characteristically intermittent traffic flows or with some limited commercial industry.
    - This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.

Figure 5 – NSW ePlanning Spatial Viewer



As shown above, the site and its surrounding receivers are within an area made up of R3 type developments (Medium Density Residential). Based on classification of R3, using table 2.3 of the NPI (see below), we believe that the most appropriate classification for the development site is suburban.

Figure 6 - NPI Extract - Table 2.3 Determining which of the residential receiver categories applies

Table 2.3: Determining which of the residential receiver categories applies.

Receiver category	Typical planning zoning – standard instrument*	Typical existing background noise levels	Description
Rural residential	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime RBL <40 dB(A) Evening RBL <35 dB(A) Night RBL <30 dB(A)	**Rural** – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition	Daytime RBL<45 dB(A) Evening RBL<40 dB(A)	**Suburban** – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the
	R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Night RBL <35dB(A)	following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL> 45 dB(A) Evening RBL> 40 dB(A) Night RBL >35 dB(A)	**Urban** – an area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above.

Notes: *As cited in Standard Instrument – Principal Local Environmental Plan, New South Wales Government, Version 15 August 2014. RBL = rating background noise level.

Resultant amenity levels for suburban receivers are shown below.

Table 4 NSW NPI – Recommended L_{Aeq} Noise Levels from Noise Sources

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

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

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

3.1.3.4 Maximum Noise Level Event (Sleeping Disturbance)

Section 2.5 of the NPI states the following:

> The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.
>
> Where the subject development/premises night-time noise levels at a residential location exceed:
>
> - $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
> - L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,
>
> a detailed maximum noise level event assessment should be undertaken.

As outlined in section 2.1 above, the measured rating background noise level during the night hours (10:00pm to 7:00am) is 30 dBA L_{A90}. Therefore, the resultant RBL + 15 dB is 45 dBA which is below the minimum 52dBA L_{AFmax}. As such the 52 dBA will be adopted for this assessment. Additionally, the resulting RBL + 5dBA is 35dBA, again below the minimum 40dBA $L_{Aeq,15min}$. As such the 40dBA will be adopted.

3.1.3.5 Project Specific External Noise Emission Criteria

The intrusive, amenity and maximum noise event criteria for noise emissions, derived from the measured data, are presented in Table 5. These criteria are nominated for the purpose of determining the operational noise limits for building services associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the lower (i.e., the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 5.

Table 5 External noise level criteria in accordance with the NSW NPI

Receiver Type	Time of Day [1]	Project Amenity Noise Level, $L_{Aeq, period}$ [2 4] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [3] (dBA)	Measured $L_{Aeq, period}$ Noise Level [4] (dBA)	Intrusive $L_{Aeq, 15\ min\ Criterion}$ [4] for New Sources (dBA)	Amenity $L_{Aeq, 15\ min\ Criterion}$ [4 5] for New Sources (dBA)
Receiver 1	Day	50	38	57	**43**	53
	Evening	40	39	50	**43** [6]	**43**
	Night	35	~~29~~ 30 [7]	46	**35**	38
Receiver 2	Day	50	42	64	**47**	53
	Evening	40	40	61	45	**43**
	Night	35	30	57	**35**	38

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 Project Amenity Noise Levels corresponding to "Suburban" areas, equivalent to the Recommended Amenity Noise Levels minus 5 dBA.

Note 3 LA90 Background Noise or Rating Background Level.

Note 4 The LAeq 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

Note 5 According to Section 2.2 of the NSW NPI, the LAeq, 15 minutes is equal to the LAeq, period + 3 dB.

Note 6 According to Section 2.2 of the NSW NPI, rating background noise levels for the evening period should not be set greater than the daytime period.

Note 7 According to Section 2.2 of the NSW NPI, a minimum assumed noise level for the night period of 30dBA apply. As such, this is adjusted to the minimum from the policy.

Note 8 Project Noise Trigger Levels are shown in bold.

In addition, a maximum noise level criterion of **52dBA L_{AFmax}** during the night period (10:00pm to 7:00am) at residential receivers also applies.

3.1.4 NSW EPA (Formerly DECCW) NSW Road Noise Policy (RNP) 2011

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy 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.

3.1.5 School Activity Noise

Noise associated with school activities (i.e., playgrounds, school halls, outdoor learning spaces etc.) is not well addressed in NSW. Hawkesbury City Council LEP/DCP and the NSW EPA NPI are not intended for the application of noise associated with these types of areas. School activity noise is also not listed under Schedule 1 of the Protection of the Environmental Operations Act (POEO) of 1997.

In the absence of any applicable acoustic requirements related to the noise associated with the use of the school we believe guidance from the Association of Australasian Acoustical Consultants (AAAC) document Guideline for Child Care Centre Acoustic Assessment should be sought.

The Child Care Centre Guideline was first prepared in 2008 as a guide for AAAC members in conducting assessments of these type of facilities due to the absence of acoustic criteria. In the current revision of the guideline, the AAAC recommends the following criteria be adopted for residential receivers:

External Play Areas

> ***Up to 4 hours (total) per day*** *– If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq, 15minute noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*

A typical structure of a public-school day will include use of the outdoor play areas before school (typically 8:00am to 9:00am), a short break mid-morning (typically 11:00am to 11:30am) and finally an hour in the middle/early afternoon (typically 12:30pm to 1:30pm). This would result in approximately 2.5 hours of outdoor play with a buffer of 1.5 hours for additional activities.

For this assessment, it is proposed that the Background + 10dBA $L_{Aeq(15\text{-}minute)}$ level outlined in the AAAC guideline for outdoor play will be adopted as a Noise Management Level (NML) for this assessment.

Indoor Play (i.e. Classroom + Hall Noise

> *…. with the exception of noise emission from outdoor play discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above. This includes the noise emission resulting from:*
>
> - *Indoor play;*
> - *Mechanical plant;*

- *Drop off and pick up;*
- *Other activities/operations (not including outdoor play).*

For this assessment, it is proposed that the Background + 5dBA $L_{Aeq(15\text{-}minute)}$ level outlined in the AAAC guideline for indoor activities will be adopted as a Noise Management Level (NML) for this assessment.

In relation to the NML's outlined above, it's important to note that these are intended/proposed as limits (i.e., like those established above for mechanical plant and the like). The NML's are established to provide a framework to enable the management of noise from these areas areas.

In many cases across NSW school playgrounds are located directly adjacent to surrounding residential receivers. During the initial site planning phase, the project team considered several elements before determining the proposed layout being most suitable, including noise emissions, noise intrusion, bulk and scale, security, visual impacts etc. As a result, the current site planning provided the best possible outcome for the community and future school occupants.

Additionally, we do note that in an NSW Land and Environment Court (LEC) proceeding (Meriden School v Pedavoli) on the 22nd of October 2009 case NSW LEC 183, the court noted "All noise that emanates from the normal activities at a school is not offensive".

3.2 Noise Intrusion Criteria

3.2.1 Hawkesbury City Council Local Environmental Plan (LEP) 2012 & Development Control Plan (DCP) 2023

Acoustic requirements relevant to noise into the building are not provided in the Hawkesbury City Council LEP or DCP documents. Therefore, requirements of the NSW EPA NPI 2017, RNP 2011 and NSW Education EFSG will be adopted. Each is discussed in detail below.

3.2.2 EFSG Section DG11 – Internal Noise Levels

Section DG11 **Acoustics** of the EFSGs states the following:

> *An internal noise level assessment must be carried out for all new buildings to ensure comfortable acoustic conditions for the spaces occupied.*
>
> *The internal noise levels within the space must meet the limits stipulated in Table 11.06.1 of Section 11.6 Acoustic Performance Guidelines or be within the range stipulated in Table 1 of the AS/NZS 2107:2016 standard. The more stringent of the two should be met.*
>
> *Noise measurements conducted for at least 10% of the spaces will be required to demonstrate compliance with the noise levels criteria. The spaces considered for onsite testing shall be the ones most susceptible to internal and external noise sources as a conservative measure.*
>
> ***Sound Sources Description***
>
> - *Steady-state(consistent) noise intrusion from external sources:*
>   - *Road (and in some cases, rail) traffic noise*
>   - *Industry*

- *General environmental noise including external school activity*

- *Intermittent (occasional) noise intrusion from external sources:*
  - *Individual rail pass-bys*
  - *Aircraft flyovers*
  - *Rain noise*
- *Steady-state (consistent) noise contribution of internal sources:*
  - *Mechanical equipment*
  - *Air conditioning*

- *Intermittent (occasional) noise intrusion from internal sources:*
  - *Hydraulic services*
- *The potential impact of the noise and the extent of acoustic treatment will depend upon:*
  - *Required internal noise levels*
  - *The sensitivity of a room or space to a particular intermittent or intrusive noise source*
  - *The proximity of the room or space to external noise sources and the external noise level incident upon the facade (principally the glazing, ventilation openings or lightweight facade or roof construction)*
  - *Whether mechanical ventilation or air conditioning is present*
  - *Rainfall conditions in the region*

Table 11.06.1 from the EFSGs provides the following Acoustic Performance Guidelines; see below.

Table 6 Table 11.06.1 from DG11 - EFSGs

Type of Occupancy / Activity	Internal Noise Level (dB L_{Aeq})
Art/Craft Studios	40
Assembly halls up to 250 seats	40 [6]
Assembly halls over 250 seats	40 [6]
Audio-Visual areas	40 [6]
Computer rooms – Teaching	40
Computer rooms – Laboratories	45
Conference Room	35
Corridors and lobbies	45
Dance Studios	40

Dining Rooms	45
Drama Studios	40 [6]
Duplicating rooms/stores	50
Engineering workshops	45
Gymnasiums	45 [6]
Interview/counselling rooms	35
Kitchens	50
Laboratories – Teaching	40
Laboratories – Working	45
Lecture Theatres – without speech reinforcement and < 50 seats	35
Lecture Theatres – with speech reinforcement	40 [6]
Libraries – General areas	45 [6]
Libraries – Reading Areas	40
Libraries – Stack Areas	40 [6]
Manual art workshops	40
Medical Rooms (First Aid)	40
Music Practice Rooms	40 [6]
Music Studios	35 [6]
Office Areas	40
Open Plan Teaching Areas	40
Professional and Administrative offices	40 [6]
Staff Common Rooms	45 [6]
Study Rooms	40 [6]
Teaching Spaces – students who are deaf or hard of hearing	30
Teaching Spaces – Primary schools	40 [6]
Teaching Spaces – secondary schools	40 [6]
Toilet/change/showers	50

Notes:

Note 1 All noise levels are to be free of tonal or annoying characteristics.

Note 2 Internal noise levels to include the combined noise from environmental noise intrusion as well as building services operations.

Note 3 Rain noise is to be assessed only for general learning areas, music, drama, movement studios and halls or as otherwise directed. Rain is to be assessed using the one-year annual recurrence, one-hour event for the region as reported by the Bureau of Meteorology.

Note 4 Assuming departure item one (1) as detailed above is approved.

Note 5 Internal noise levels detailed above comply with the requirements of the Green Star Buildings v1 tool.

Note 6 This project has revised project requirements based on the EFSG and these have been reflected above for consistency.

3.2.3 NSW EPA Road Noise Policy (RNP) 2011

External noise impacts also include noise targets for outdoor passive and active areas of a School Playground. Table 4 of the NSW EPA RNP 2011 recommends that a school playground (deemed a passive area) should have traffic noise levels which are below 55dBAL$_{Aeq\ (15hour)}$ when in use.

3.3 Vibration Criteria

3.3.1 Hawkesbury City Council Local Environmental Plan (LEP) 2012 & Development Control Plan (DCP) 2023

Vibration requirements emitted from the building are not provided in the Hawkesbury City Council LEP or DCP documents. Therefore, requirements of the NSW EPA NPI 2017, RNP 2011 and NSW Education EFSG will be adopted. Each is discussed in detail below.

3.3.2 NSW EPA (formerly, Department of Environment and Climate Change) *Assessing Vibration: a technical guideline 2006* - 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*". (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 7 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

Table 8 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

Table 9 Continuous vibration velocity criteria (mm/s and dB re 10-9 m/s) 1 Hz-80 Hz, Z axis

Location	Assessment period	Z axis	
		Preferred Values	Maximum Values
Residences	Daytime	0.20 mm/s 106 dB	0.40 mm/s 112 dB
	Night-time	0.14 mm/s 103 dB	0.28 mm/s 109 dB

Table 10 Impulsive vibration velocity criteria (mm/s and dB re 10-9 m/s) 1 Hz-80 Hz, Z axis

Location	Assessment period	Z axis	
		Preferred Values	Maximum Values
Residences	Daytime	6 mm/s 136 dB	12 mm/s 142 dB
	Night-time	2 mm/s 126 dB	4 mm/s 132 dB

Table 11 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

3.3.3 British Standard BS 7385: Part 2-1993 AND German DIN 4150: Part 3 – 1999 – Building Damage

It is expected that the human comfort criteria discussed in Section 2.2 will be more stringent than that corresponding to building damage.

Table 12 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.

3.4 Construction Noise and Vibration Criteria

3.4.1 Hawkesbury City Council Local Environmental Plan (LEP) 2012 & Development Control Plan (DCP) 2023

Construction noise and vibration requirements relevant to the construction of the buildings are not provided in the Hawkesbury City Council LEP or DCP documents. Therefore, requirements of the NSW EPA NPI 2017, RNP 2011 and NSW Education EFSG will be adopted. Each is discussed in detail below.

3.4.2 Construction Noise Criteria

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

3.4.2.1 NSW EPA (Former DECC) Interim Construction Noise Guideline (ICNG) 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 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 13 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 $L_{Aeq(15minute)}$ 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.
	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).

Based on the measured background noise levels summarised in section 2.1, and the NMLs outlined above, the construction noise criteria to be used in this assessment are listed in section 2.2.

Table 14 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.**
Residences (Measured externally)	Receiver 1	**NAFL:** **48** (RBL (38) + 10dB) **HNAL** **75**	RBL + 5dB
	Receiver 2	**NAFL:** **52** (RBL (42) + 10dB) **HNAL** **75**	RBL + 5dB

Note 1 The LAeq 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.

3.4.2.2 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.

3.4.3 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.
- 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.

3.4.3.1 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 15 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

Table 16 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

Table 17 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

3.4.3.2 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).

3.4.3.2.1 British 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 18 and illustrated in Figure 7.

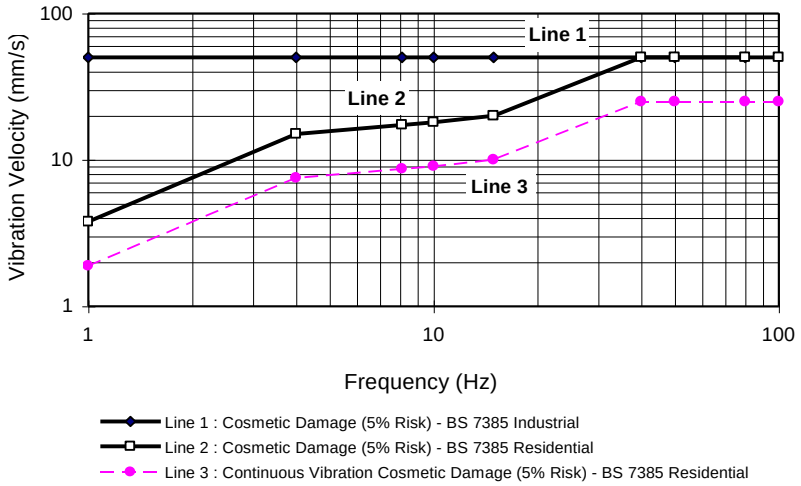
Table 18 Transient vibration criteria as per standard BS 7385 Part 2 – 1993

Line in Figure 7	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 18 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 18 may need to be reduced by up to 50% (refer to Line 3 in Figure 7).

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

3.4.3.2.2 German 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 19. The criteria are frequency dependent and specific to particular categories of structures.

Table 19 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

4 EXTERNAL NOISE INTRUSION ASSESSMENT

4.1 Façade Acoustic Treatments

Preliminary façade acoustic treatments based on the external levels measured above from surrounding roads and other environmental sources as discussed in section 2.1 above are provided below.

4.1.1 Glazing Recommendations

The recommended sound transmission loss requirement required to satisfy the specified internal noise level criteria outlined above are summarised in the table below.

Please note for windows, this performance is not only subject to the glazing selection but also to the construction of the window frame and the frame seal selection. Therefore, it is recommended that the window manufacturer should confirm that the required sound insulation can be achieved. It is anticipated that the window system should comprise Q-Lon (or equivalent) or fin seals with deep C channels as part of the window track **(i.e., Performance levels outlined above need to be achieved with glazed panels + frame + seals).**

Table 20 Recommended Glazing Construction

Spaces	Façade	Indicative Construction	Minimum Glazing System Rating Requirements
All spaces	All facades	6.38mm Laminated Glazing	**Rw** (C, Ctr): **31** (-1,-3)

4.1.2 External Wall Construction

External wall constructions which are constructed from a concrete or masonry construction will be acoustically sufficient and no further acoustic upgrading is required. However, for wall systems constructed from a lightweight cladding system, the following construction is recommended.

Table 21 Recommended Light Weight External Wall Construction

Location	Occupancy Area 1	Minimum External Wall Rating Requirements [1]
All buildings	All Spaces	**Rw** (C, Ctr): **40** (-4,-10)
Note 1 Recommended performances are identical for each level.		

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

4.1.3 External Roof Construction

External roofs will be constructed from a lightweight sheet metal cladding. It is recommended the following minimum construction is installed.

Table 22 Recommended Light Weight Roof Construction

Building	Occupancy Area [1]	Minimum External Roof Rating Requirements [1]
All buildings	All Spaces	**Rw** (C, Ctr): **40** (-4,-10)

Note 1 These are preliminary selections will be confirmed in the detailed design stage once the layouts and façade orientations are finalised.
Note 2 Recommended system does not address rain noise criteria. Further detailing is required for compliance with rain noise criteria.

If penetrations through any external skin are required, all gaps remaining in the penetration are to be filled with an acoustic grade sealant which provides an equal or better performance to the system being penetrated.

4.2 External Noise Level within Playground

As outlined in section 4.2.3 above, the NSW EPA RNP recommends open passive open spaces to have a 55 dBA $L_{Aeq(15\text{-}hour)}$ noise level exposure. Measured onsite noise levels indicate compliance with the 55 dBA objective will be achieved without the need for acoustic screens to control noise into the playground.

5 OPERATIONAL NOISE EMISSION ASSESSMENT

Assessment of the potential noise emissions from the operation of the school impacts on the adjacent land users are outlined below. Noise emissions expected from the operation of the building are mainly from any base building services (mechanical, electrical, hydraulic), vehicle movements around and activity noise.

Each major component is discussed in detail below.

5.1 Noise from Engineering Services

Noise associated with the operation of all engineering services whilst onsite must comply with the requirements listed in section 3.1 above. This includes (however not limited to) all mechanical plant (including ventilation systems and air conditioning plant) and hydraulic plant (including hot water systems).

At this stage of the project, the location of plant area and the likely size of the associated systems including the number of units are known. However, the final selections of plant and the associated noise levels are not known as such a detailed assessment cannot be undertaken.

However, to ensure the site can achieve compliance with the relevant noise emission criteria established above, we have conducted a preliminary assessment based on plant selections from a previous completed project.

In our experience, for this type of development the following mechanical systems would be installed, and their associated sound power levels are outlined below.

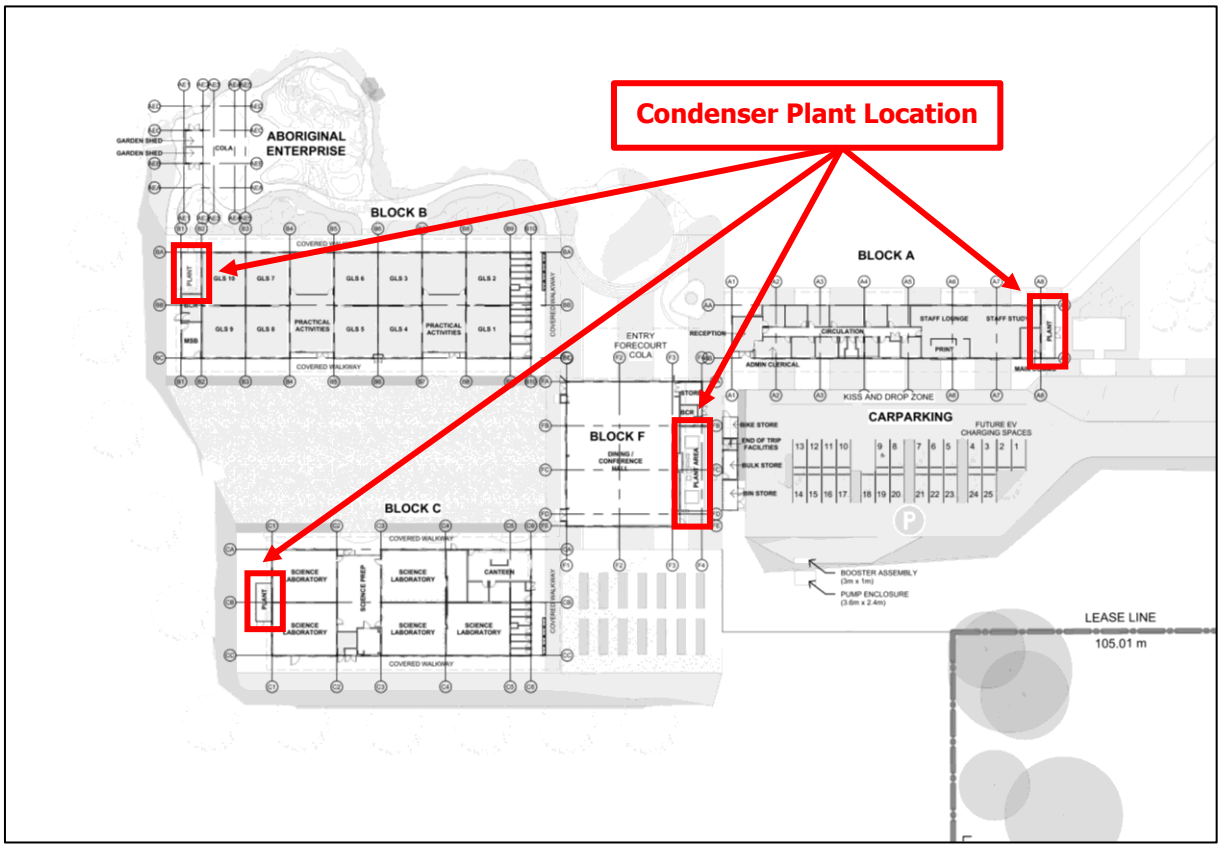
- Kitchen Exhaust Fan (KEF) - Canteen – 65dBA (Lw) per unit.
- Air Conditioning Condensers – Office Areas, Learning Areas, Library etc. – 70dBA (Lw) per unit.
- Toilet Exhaust Fans (TEF) – Bathrooms – 55dBA (Lw)

It is anticipated that KEF serving the canteen will vertically discharge through the external roof. From our modelling to achieve compliance at neighbouring properties acoustic treatment to a fan on the discharge (external) side will be required. Further details of the acoustic treatment will be formulated during the detailed design phase.

For toilet exhaust fans exhausting air from bathrooms, it is likely the fan will be installed within the ceiling cavity of the bathrooms and discharge air to the roof via a roof/plant area above the bathrooms. The use of internal acoustic lining and fan vibration isolation will result in compliance. Further details of the acoustic treatment will be formulated during the detailed design phase.

Regarding Air Conditioning condensers, four (4) dedicated plant areas are provided adjacent to each of the proposed four (4) buildings. See locations below.

Figure 8 Ground Floor Architectural Drawing – Condenser Plant Locations (Ground)



On the proviso the air conditioning systems are installed with a vibration isolation system we can confirm compliance will be achieved with no further acoustic treatments required.

5.2 Vehicle Movements

Vehicle movements in/out of the site will be via College Drive and subsequently College Street and Bourke Street. Three different vehicle movements have being assessed below, these include:

- Vehicles associated with the on-grade carpark and driveway.
- Vehicle movements associated with the kiss and drop facilities within the driveway/carpark.
- Waste collection/deliveries from within the on-grade carpark.
- Movements associated with the agricultural operations from the gravel service road within the plots.

Assessment of each noise impacts is addressed below.

5.2.1 Vehicle Noise Data

To quantify the noise level likely to take place with regards to vehicle movements, the noise levels of the relevant vehicles are obtained from previous project experience. Therefore, the sound power levels used in the noise impact assessment are listed in Table 23 below.

Table 23 Sound power levels for vehicular events

Parameter	Octave Band Centre Frequency, Hz								Overall dBA
	63	125	250	500	1k	2k	4k	8k	
Noise Events									
Car movement at 40km/hr	88	86	83	82	83	82	75	70	**88**
Car movement at 10 km/hr	79	77	74	73	74	73	66	61	**79**
Truck movement at 10 km/hr	98	100	98	100	96	91	87	80	**101**

5.2.2 Kiss & Drop Activities on Surrounding Roadways

Noise impacts from the increase in vehicle movements during Kiss & Drop activities in the morning and afternoon along the two roadways are to be assessed in accordance with the NSW EPA Road Noise Policy (RNP) 2011.

In undertaking our noise modelling below, we have assumed the following from the information:

- A combined six (6) Kiss & Drop spaces are provided along the northern portion of the carpark adjacent Block A.
- Kiss & Drop activities are assessed as 30-minute peak period.
- Speed of vehicles is assumed as 40km/hour in accordance with speed limits around schools during peak periods.
- Vehicle movements associated with the Kiss & Drop have been adopted from the Metafora *Transport Impact and Accessibility Impact Assessment (dated 05/05/2025)* see below.

Figure 9 Extract – Metafora Report – Modelling

7.1.1 Trip generation

Based on the travel mode analysis discussed in Section 5, Table 17 summarises the estimated number of cars arriving and departing the site, while Table 18 provides a summary of the estimated development trip generation during the AM and PM peak hours. The following comments are made:

- The student-per-car ratio is based on the target of 60% of students that travel by car doing so in a car-pool arrangement (refer to Table 6 and Section 5 in general for travel mode share target assumptions). The same ratio has been assumed for student drivers.
- It is assumed that those staff who would travel by car (based on the travel mode share targets), will travel at a 1 staff-per-car ratio.

Table 17: Estimated number of cars arriving and departing the site

User & travel mode	# of users	Users per car	# of cars per user	# of cars per travel mode
Students – pick-up & drop-off	65	1.4	46	48
Staff – pick-up & drop-off	2	1	2	
Students – driving	16	1.4	11	34
Staff – driving	23	1	23	
Total:	106		82	

Table 18: Estimated development trip generation

Travel mode	# cars	# of trips			
		AM		PM	
		Inbound	Outbound	Inbound	Outbound
Pick-up & drop-off	48	48	48	48	48
Driving	34	34	0	0	34
Total:	82	82	48	48	82

In the assessment of noise from the use of the Kiss & Drop areas onto nearby residential receivers has been undertaken using the EPA's Road Noise Policy as a Local Road for existing and the future roadways, see highlighted yellow in the table below.

Table 24 Table 3 of RNP "Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m. – 7 a.m.)
Local Roads	Existing residences affected by noise from new local road corridors. Existing residences affected by noise from redevelopment of existing local roads. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (External)	$L_{Aeq,\ (1\ hour)}$ 50 (External)

The results of the acoustic assessment because of Kiss & Drop are detailed in the table below.

Table 25 Result of the Acoustic Assessment of Kiss & Drop

Receiver Location (Refer to Figure 2)	Time of Day	Calculated Noise Level dBA $L_{Aeq(15\text{-}minute)}$	EPA's Road Noise Policy dBA $L_{Aeq\ 1hour}$	Comments
Receiver 1 (College Street)	AM Peak	<55	55	**Compliance achieved.**
	PM Peak	<55	55	**Compliance achieved.**
Receiver 2 (Londonderry Road)	AM Peak	<55	55	**Compliance achieved.**
	PM Peak	<55	55	**Compliance achieved.**

Note 1 The LAeq 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.

5.2.3 Staff Carpark

As discussed above, located adjacent to Block A is the proposed school staff carpark. As this carpark will only be for the use of staff, peak vehicle movements will be associated with staff arriving for the day between 7:30am and 8:30am and departing at the end of the day between 4:00pm and 5:00pm. An assessment of peak movements is provided below.

Table 26 Predicted Peak AM/PM Noise Levels from Carpark – $L_{Aeq(15\text{-}minute)}$

Receiver Location (Refer to Figure 2)	Predicted Noise Level dBA $L_{Aeq\ (15\text{-}minute)}$	Criteria dBA $L_{Aeq\ (15\text{-}minute)}$	Compliance?
Receiver 1 (College Street)	<43	43 (day criteria)	**Yes**
Receiver 2 (Londonderry Road)	<47	47 (day criteria)	**Yes**

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 – 1:00 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 – 1:00 am.

Note 2 The LAeq 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.

5.3 Activity Noise

Noise levels associated with the operation of the school are outlined below. It has been separated into three sections: outdoor play areas, internal areas classrooms and community hall; see below.

5.3.1 Noise from Outdoor Play Areas

Assessment of the use of the proposed external outdoor play areas is detailed below. Outlined below is an assessment of both school use between typical daytime school hours and out of hours community use.

5.3.1.1 Assessment of School Outdoor Play Area

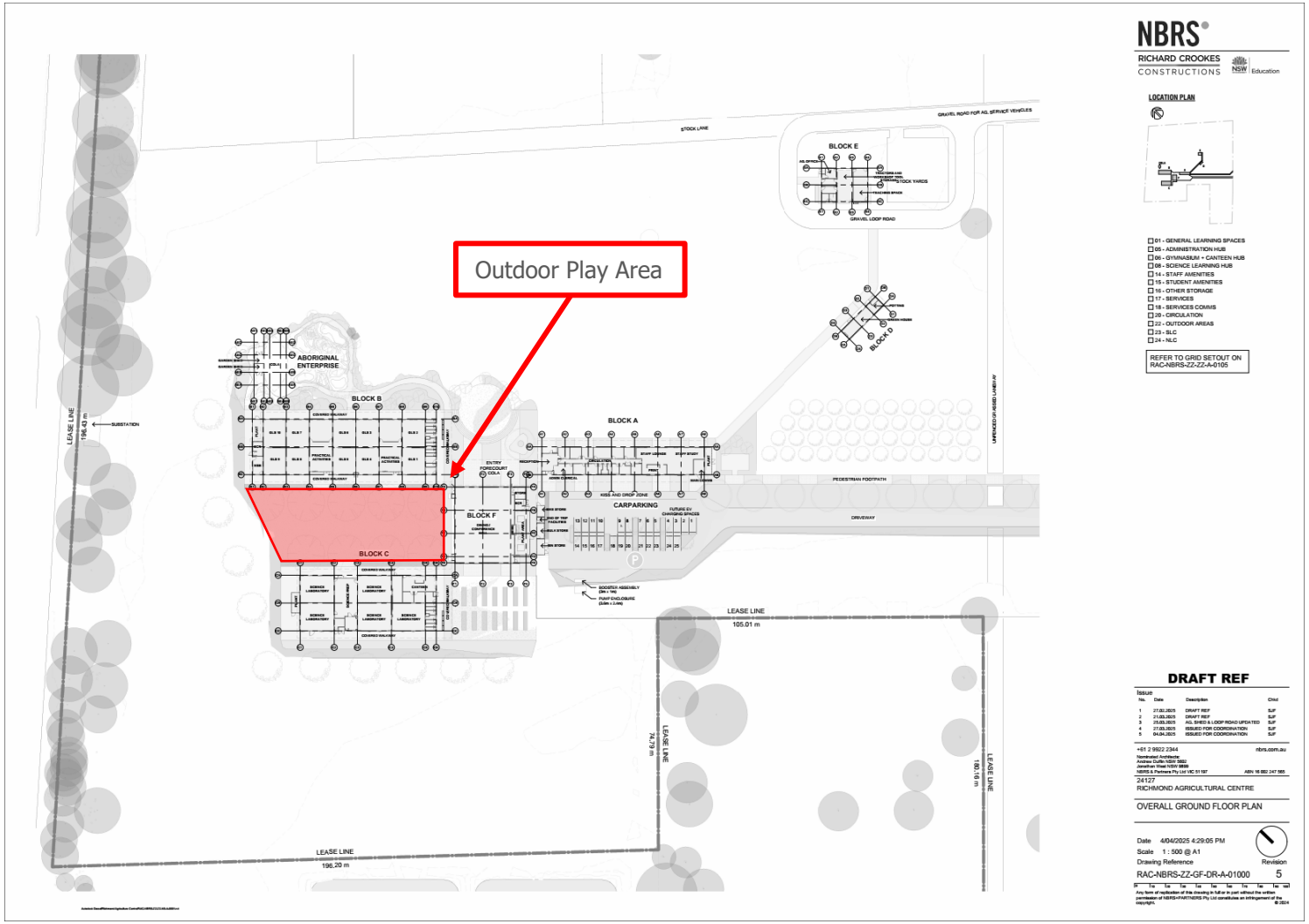
The school is proposed to accommodate up to 325 students, as such a worst-case scenario of all students out during a recess or lunch period is detailed below. Regarding the modelling of student's coverage across the site, Figure 10 below indicates the area used in the modelling.

Noise levels of students playing in outdoor areas which have been adopted in this assessment are provided below. These are determined based on PWNA professional experience and noise measurements undertaken at other school playgrounds during break periods (i.e., recess/lunch) for other School Infrastructure projects.

Table 27 Sound power levels for outdoor play activities

Parameter	Octave Band Centre Frequency, Hz								Overall dBA
	63	125	250	500	1000	2000	4000	8000	
Active Sports Play (60%)	77	83	88	94	96	93	89	85	**100**
Passive Play (40%)	69	75	80	86	88	85	81	77	**92**

Figure 10 Outdoor Play Modelling – Student Coverage



Based on the assumptions outlined above, predicted noise levels during outdoor play times are presented below.

Table 28 Predicted Outdoor Play Noise Levels – $L_{Aeq(15\text{-minute})}$

Receiver Location (Refer to Figure 2)	Predicted Noise Level dBA $L_{Aeq\ (15\text{-minute})}$	Noise Management Level (NML) dBA $L_{Aeq\ (15\text{-minute})}$	Result
Receiver 1 (College Street)	Up to 55dBA	Day: 48 (Background + 10)	Refer to management controls below.
Receiver 2 (Londonderry Road)	Up to 60dBA	Day: 52 (Background + 10)	Refer to management controls below.

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 LAeq 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.

In relation to above, we note:

- Predicted noise levels during periods of the day when the entire student faculty is utilising the outdoor play areas (i.e., recess and lunch) are likely to intermittently exceed the formulated NML in a worst-case scenario assessment.
- However, in our experience the noise levels emitted are like those typically emitted from a community's usage of a public park and therefore could be considered typical of a large open space of this nature.
- Noise levels during periods where the outdoor areas are used for structured learning activities to be significantly lower and are more frequent.
- As discussed in section 3.1, in NSW there is no defined acoustic criteria for the operational use of a school. As such we developed a Noise Management Level (NML) based on similar guidelines.
- Therefore, in our professional opinion we believe the outdoor play area of the school is acoustically acceptable and justified.

5.3.2 Noise from Internal Areas (Classrooms and Library)

In the assessment of noise from the homebases and associated support areas (including Library) has been conducted on the assumption of a highly noise activity being undertaken with a sound pressure level within the classroom of 70dBA sound pressure level and windows open for natural ventilation purposes which would be considered a worst-case scenario. Predicted noise levels at surrounding receivers is provided below.

Table 29 Predicted Internal Homebases Noise Levels – $L_{Aeq(15\text{-}minute)}$

Receiver Location (Refer to Figure 2)	Predicted Noise Level dBA $L_{Aeq\ (15\text{-}minute)}$		Noise Management Level (NML) dBA $L_{Aeq\ (15\text{-}minute)}$	Result
	Windows Open	Windows Closed		
Receiver 1 (College Street)	<40	<25	Day: 43 (Background + 5)	**Compliance**
Receiver 2 (Londonderry Road)	<40	<25	Day: 47 (Background + 5)	**Compliance**

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 – 1:00 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 – 1:00 am.

Note 2 The LAeq 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.

To ensure compliance, the following operational parameters must be incorporated into the School Noise Management Plan (NMP):

- School homebases and associated support areas (including Library) is limited to 7:00am to 10:00pm.
- Use of the homebases and associated support areas (including Library) after 6:00pm is recommended to have the doors closed.

5.3.3 Noise from School Hall

The school hall is proposed to be used for regular school activities during typical school hours as well as occasional use after school. Additionally, from time-to-time use of the school hall will be used for out of hours community use.

As such an assessment of the hall is undertaken for both during daytime representing use by the school between 9:00am and 3:00pm and the evening time representing use from the external community of Richmond. For both assessments amplified speech and music will be assessed. Regarding internal noise levels the following is assumed:

- Sound pressure level within the hall during amplified music or speech is 90dBA (sound pressure).

During events which create these type of noise levels, all windows and doors will be required to remain closed and is reflected in the modelling below.

Predicted noise levels from the day and evening time use of the community hall is presented below.

Table 30 Predicted Hall Noise Levels – $L_{Aeq(15\text{-}minute)}$

Receiver Location (Refer to Figure 2)	Predicted Noise Level dBA $L_{Aeq\ (15\text{-}minute)}$		Noise Management Level (NML) dBA $L_{Aeq\ (15\text{-}minute)}$	Result
	Windows Open	Windows Closed		
Receiver 1 (College Street)	<40	<25	Day: 43 (Background + 5)	**Compliance**
Receiver 2 (Londonderry Road)	45	<25	Day: 47 (Background + 5)	**Compliance**

Note 1 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 – 1:00 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 – 7:00 am.

Note 2 Note 2: The LAeq 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.

To ensure compliance, the following operational parameters must be incorporated into the School Noise Management Plan (NMP):

- School hall is limited to 7:00am to 10:00pm.
- Noise levels within the school must not exceed 90 dBA L_{Aeq} (sound pressure level) unless the doors are closed.
- It's recommended the school hall audio system be limited to 90 dBA L_{Aeq} (sound pressure level).

5.4 Public Address Systems

The location and design of the Public Address/Bell system has not been undertaken at this stage, however, will be required from an operation perspective. As such we provide the following acoustic design advice which must be incorporated during the design phase:

Noise levels at surrounding residents should not exceed the RBL + 5 dBA criteria established above.

A detailed review should be undertaken during the detailed design phase to ensure compliance with the RBL + 5dBA criteria.

5.5 Summary of Acoustic Treatments (Operational Noise)

Based on the modelling outlined above the following acoustic treatments and or management controls are required to be implemented:

- Recommended building envelope treatments as outlined in section 4.1 should be implemented.
- A detailed acoustic review of all building services is required prior to installation once final selections are made to ensure compliance.
- A review of the proposed Public Address/bell system is recommended once locations of speakers are known to ensure compliance.
- Use of the hall the following management controls are to be implemented:
    - School hall is limited to 7:00am to 10:00pm.
    - Noise levels within the school must not exceed 90dBA L_{Aeq} (sound pressure level).
    - It's recommended the school hall audio system be limited to 90 dBA L_{Aeq} (sound pressure level).
- Recommended traffic management controls associated with the southern kiss and drop should be implemented (refer to TIA/associated management plan).

6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

A preliminary acoustic assessment of the noise and vibrations impact during the construction of the school has been undertaken below.

6.1 Construction Activities Sound Power Levels (Lw)

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 the listed tasks are provided in the table below.

Table 31 Summary of predicted sound power levels

Tasks	Equipment	Sound Power Levels (dBA re 1pW)	Aggregate Sound Power Level per Task (dBA re 1pW)
Site Establishment Works	Mobile crane	110	113
	Power hand tools	109	
	Semi Rigid Vehicle [1]	105	
Ground Works	Excavator	112	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.

6.2 Predicted Construction Noise Levels

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

Table 32 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 $L_{Aeq\ 15\ minutes}$	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	49 to 60	52 to 64	Monday to Friday 07.00-18.00 38 + 10 = **48** Saturday 08.00-13.00 38 + 10 = **48** Highly Noise Affected Level Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the internal noise management level when working near a receiver.
	Power hand tools		48 to 59			
	Semi Rigid Vehicle		44 to 56			
Ground Works	Excavator	119	51 to 62	57 to 69		
	Handheld jack hammer		45 to 57			
	Dump truck		43 to 55			
	Concrete saw		53 to 65			
	Skid steer		49 to 60			
	Power hand tools		48 to 59			
Structure	Handheld jack hammer	117	45 to 57	56 to 68		
	Concrete saw		53 to 65			
	Power hand tools		48 to 59			
	Welder		40 to 51			
	Concrete pump truck		47 to 58			
	Concrete agitator truck		47 to 58			
Internal Works	Power hand tools	109	33 to 44	33 to 44		
Common and External Works	Concrete agitator truck	117	43 to 54	51 to 63		
	Saw cutter		43 to 55			
	Dump truck		43 to 55			
	Concrete saw		44 to 56			
	Power hand tools		47 to 58			

Table 33 Receiver 2 – Summary of preliminary predicted construction noise levels

Phase	Activity	Aggregate Sound Power Level (dBA re 1pW)	Predicted Individual Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Predicted Combined Noise Level at Receiver dBA $L_{Aeq\ 15\ minutes}$	Criteria dBA $L_{Aeq\ 15\ minutes}$	Summary of Result
Site Establishment Works	Mobile crane	113	46 to 54	49 to 57	Monday to Friday 07.00-18.00 42 + 10 = **52** Saturday 08.00-13.00 42 + 10 = **52** Highly Noise Affected Level Standard Construction Hours **75**	Works indicatively predicted to have the potential to exceed the internal noise management level when working near a receiver.
	Power hand tools		45 to 53			
	Semi Rigid Vehicle		41 to 49			
Ground Works	Excavator	119	48 to 56	54 to 6		
	Handheld jack hammer		42 to 50			
	Dump truck		40 to 48			
	Concrete saw		50 to 58			
	Skid steer		46 to 54			
	Power hand tools		45 to 53			
Structure	Handheld jack hammer	117	42 to 50	53 to 61		
	Concrete saw		50 to 58			
	Power hand tools		45 to 53			
	Welder		37 to 45			
	Concrete pump truck		44 to 52			
	Concrete agitator truck		44 to 52			
Internal Works	Power hand tools	109	30 to 38	30 to 38		
Common and External Works	Concrete agitator truck	117	40 to 48	48 to 56		
	Saw cutter		40 to 48			
	Dump truck		40 to 48			
	Concrete saw		41 to 49			
	Power hand tools		44 to 52			

6.3 Construction Traffic Noise Assessment

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

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

6.4 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 3.4, it is recommended that the indicative safe distances listed in Table 34 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 3.4.2.2. This information should also be included as part of a Construction Noise Vibration Management Plan (CNVMP).

Table 34 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

6.5 Acoustic Management Procedures

6.5.1 Summary of Management Procedures

Table 35 below summarises the management procedures recommended for airborne noise and vibration impact. These procedures are also further discussed in the report.

Table 35 Summary of mitigation procedures

Procedure	Abbreviation	Description
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.
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.
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.
Complaints Management System	CMS	Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders
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 regard to the noise impact and the mitigation measures that will be implemented.
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. It is recommended that the selection of the alternative option should also be determined by considering the assessment of on-site measurements (refer to Verification Monitoring above).

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 6.5.2.

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 6.5.3.

6.5.2 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 6.2 for list of NMLs used in the acoustic assessment). The allocation of these procedures is summarised in Table 35 below.

Table 36 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, CMS, AC
	4 - 10	GMM, CMS, AC, V [1]
	11 - 20	GMM, CMS, PN, AC, V [1]
	≥ 21	GMM, CMS, PN, AC, SN, V [1]
	≥ 75dBA	GMM, CMS, PN, AC, SN, RO, V [1]
Outside Standard Hours (If applicable)	Specific NMP will be undertaken should this be required.	

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

6.5.3 Allocation of Vibration Management Procedures

Table 37 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 37 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 6.4)	GMM, CMS, AC, SN, V [1]
	Over building damage criteria (refer to Section 6.4)	GMM, CMS, AC, SN, VM, RO, V [1]
Outside Standard Hours (If applicable)	Specific VMP will be undertaken should this be required.	

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

6.6 Site Specific Noise Mitigation Measures

6.6.1 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.

6.6.2 Noise Monitoring

Noise monitoring will not be regularly required, unless significant noise complaints are received. In the event of significant complaints, the contractor will undertake noise monitoring by a suitably qualified acoustical consultant.

Noise monitoring for the excavation, compaction and construction works should be undertaken using statistical noise loggers. The statistical parameters to be measured should include the following noise descriptors: LA90, LA10 and LAeq. Noise measurements should be conducted over consecutive 15-minute periods.

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

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

In the event of any complaints, the noise impact at the affected location should be confirmed by conducting attended noise measurements.

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

6.6.3 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.

6.6.4 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).

6.7 Vibration Mitigation Measures

6.7.1 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 to validate the indicative safe working distances advised in Table 34 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 3.4.2.2 (i.e., criteria for structural damage and human comfort).

6.7.2 Vibration Monitoring

Vibration monitoring, if required, should be undertaken continuously at the nearest most affected structures.

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 audible/visual 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.

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.

6.8 Community Consultation

6.8.1 Stakeholder Engagement

The overarching Communications and Stakeholder Engagement Strategy for the project, as well as the Communications and Engagement plans to support each stage of the development, including the Project, have been developed in line with Schools Infrastructure guiding principles for capital projects, which centre on:

- Proactive stakeholder engagement.
- Proactive and transparent communications.
- Coordinated information.
- Collaboration.

6.8.2 Stakeholders

The Project's stakeholder environment is complex and extensive. The Project team has developed a deep understanding of stakeholders and the engagement environment which has informed the timing, method, and level of engagement across all stages of the redevelopment. Key engagement methods include:

- Formal and information briefings and meetings
- Workshops.
- Door Knocks.
- Letterbox Drops.
- Email Notifications.

6.9 Complaints Management System

The Contractor is to establish a communication register for recording incoming complaints. The registration of a particular item will remain open until the complaint has been appropriately dealt with.

All complaints should be investigated by the Contractor in accordance with the procedures outlined in Australia Standard 2436-2010. In addition, the following procedures are an example of the procedures that are to be specifically adopted for complaints relating to noise.

Upon receipt of a complaint the Contractor is to:

- Try to ascertain from the complaint which appliance is causing the problem i.e., inside or outside the site and in what position.
- Establish from the monitoring equipment if the allowable noise levels have been complied with.

- Establish if the appliance positioning has previously been highlighted as a problem area. If not and the noise levels are above the allowable limit, then the equipment and its position shall be noted.
- Move machinery if the allowable levels have been exceeded or take other acoustic remedial action.
- The Site Supervisor is to ensure that a report of any incident is provided to the Project Manager.
- The Project Manager is to provide a report on the incident to the relevant stakeholders.
- The Contractor is to provide a 24-hour telephone contact number and this number is to be prominently displayed on the site.

6.10 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 could 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.

6.11 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.

6.11.1 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 elevated work platforms used on site.

- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

6.11.2 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.

6.11.3 On Site Noise Mitigation

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

6.11.4 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.

6.11.5 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.

6.12 Summary of Acoustic Treatments (Construction)

It is recommended that a site-specific *Construction Noise and Vibration Management Sub-Plan (CNVMSP)* be prepared for the site once exact construction methodologies are known. The plan should be developed based on the formulated Noise and Vibration construction objectives and management levels detailed in this report. Also consideration should be given to the preliminary mitigation measures outlined in this report.

7 SUMMARY OF ACOUSTIC MITIGATION MEASURES

Detailed below is a summary of the relevant acoustic mitigation measures required to be implemented.

Table 38 Summary of Acoustic Mitigation Measures

Project Stage	Mitigation Measures	Relevant Section of Report
Design (D)	Design of building envelope (i.e. Glazing Construction, External Wall Construction and Roof Construction) should meet the minimum acoustic design requirements.	Section 4.1.
	A detailed acoustic review of all proposed building services is required to be undertaken prior to installation once final selections are made to ensure compliance with the relevant PTNLs.	Section 5.1.
	A review of the proposed Public Address/bell system is required once locations of speakers are known to ensure compliance with the relevant PTNLs.	Section 5.4.
Construction (C)	A dedicated site-specific *Construction Nosie and Vibration Sub-Plan (CNVMSP)* must be prepared for the site outlining the relevant noise and vibration mitigation measures required.	Section 6.12.
	All onsite works must be undertaken in accordance with the *Construction Nosie and Vibration Sub-Plan (CNVMSP)* – Once prepared.	Section 6.
Operation (O)	Use of the hall the following management controls are to be implemented: • School hall is limited to 7:00am to 10:00pm. • Noise levels within the school must not exceed 90dBA L_{Aeq} (sound pressure level). • It's recommended the school hall audio system be limited to 90 dBA LAeq (sound pressure level).	Section 5.3.3.
	Recommended traffic management controls associated with the kiss and drop should be implemented (refer to TIA/associated management plan).	Section 5.2.

8 CONCLUSION

This Acoustic Assessment has been prepared by Pulse White Noise Acoustics on behalf of the Department of Education (DoE) (the Proponent) to assess the potential environmental impacts that could arise from the activities associated with the Richmond Agricultural Centre development at 2 College Street Richmond (Part Lot 2 DP1051798) (the site).

The report has been prepared to undertake a review of the potential noise and vibration impacts associated with the proposal and determine all relevant acoustic mitigation measures to ensure the existing acoustic amenity of the surrounding community is maintained.

This report accompanies a Review of Environmental Factors (REF) that seeks approval for the construction and operation of a secondary school with a specialist agricultural curriculum at the site.

A review of the existing onsite noise levels from the nearby roadways has resulted in recommended acoustic treatments to the future buildings facades to ensure internal noise levels are within permissible limits.

Analysis of noise from internal areas such as homebases as well as the noise associated with from vehicle movements in and out of the site including the use of the public address system indicates the site is capable of achieving the sites applicable noise emission goals.

Noise emissions from the use of the school play areas during periods where maximum capacities are achieved (i.e. recess and lunch) is likely to exceed the formulated criteria outlined above. However as cited above, "All noise that emanates from the normal activities at a school is not offensive" and therefore is deemed acceptable.

Overall we can confirm the proposed development will comply with the relevant planning requirements as formulated above and not have a negative acoustic impact to the existing environment.

If you have any additional questions, please contact us should you have any further queries.

Regards,

Matthew Furlong
Principal Acoustic Engineer
PULSE WHITE NOISE ACOUSTICS PTY LTD
AAS Member and AAAC Member Firm

APPENDIX A. APPENDIX TERMINOLOGY

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] *(Sound Transmission Loss)*	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.
Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.

Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
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
Noise Reduction	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
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.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value
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.
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 L90 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.

APPENDIX B. UNATTENDED NOISE MONITORING – LOCATION 1 – COLLEGE STREET

College Street, Richmond

Ambient noise monitoring report

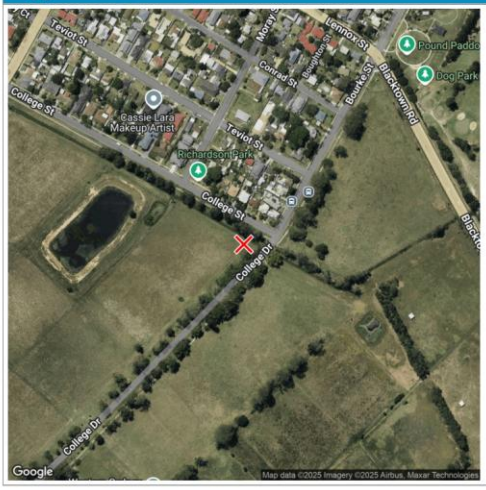
Item	Information
Logger Type	SVAN 971
Serial number	61521
Address	College Street, Richmond
Location	College Street, Richmond
Facade / free field	Free field
Environment	

Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Mon 02 Sep 2024	-	42	-	61	57	45
Tue 03 Sep 2024	38	37	26	52	49	46
Wed 04 Sep 2024	41	40	29	61	49	46
Thu 05 Sep 2024	40	40	29	58	48	47
Fri 06 Sep 2024	42	39	31	54	48	48
Sat 07 Sep 2024	38	39	28	50	46	45
Sun 08 Sep 2024	37	39	27	52	46	46
Mon 09 Sep 2024	38	37	30	52	48	46
Tue 10 Sep 2024	-	-	-	57	-	47
Summary	**38**	**39**	**29**	**57**	**50**	**46**

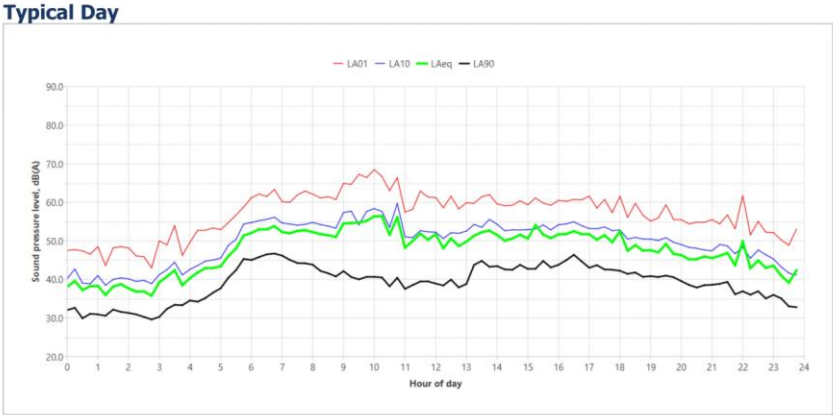
Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location

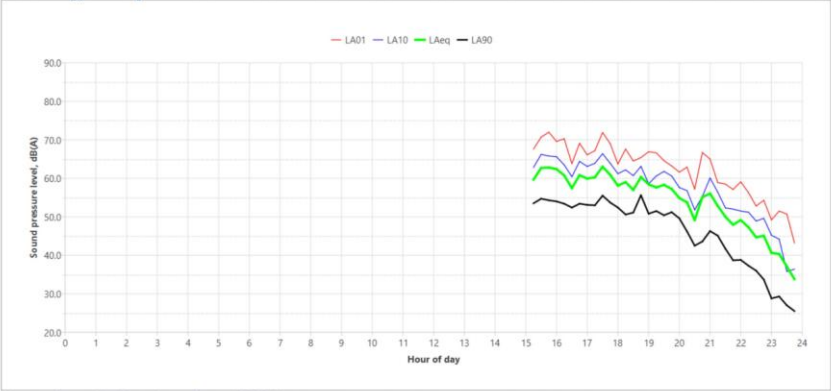


Logger deployment photo

Typical Day



Monday, 2 September 2024

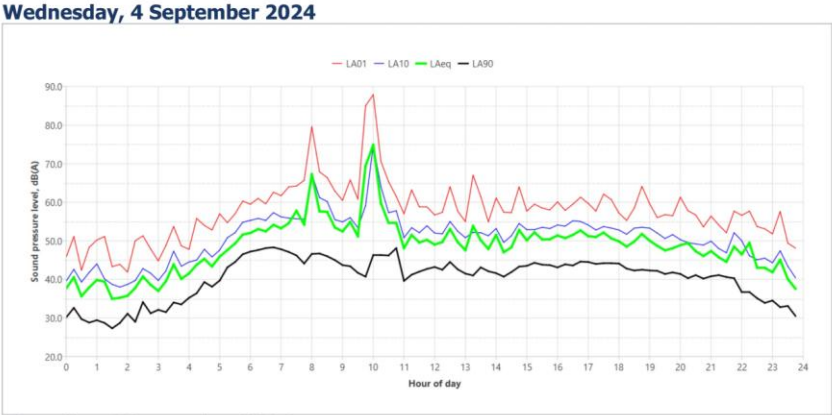


Tuesday, 3 September 2024

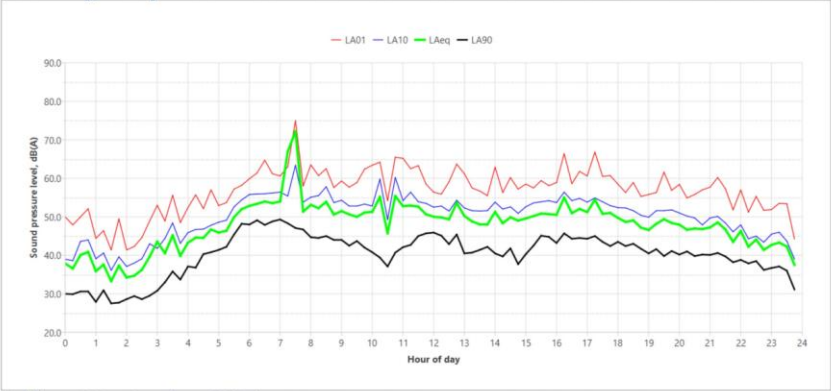
College Street, Richmond

Page 2

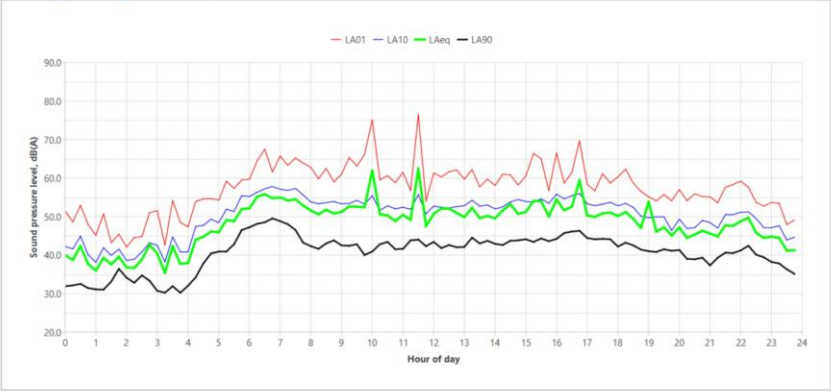
Wednesday, 4 September 2024



Thursday, 5 September 2024



Friday, 6 September 2024

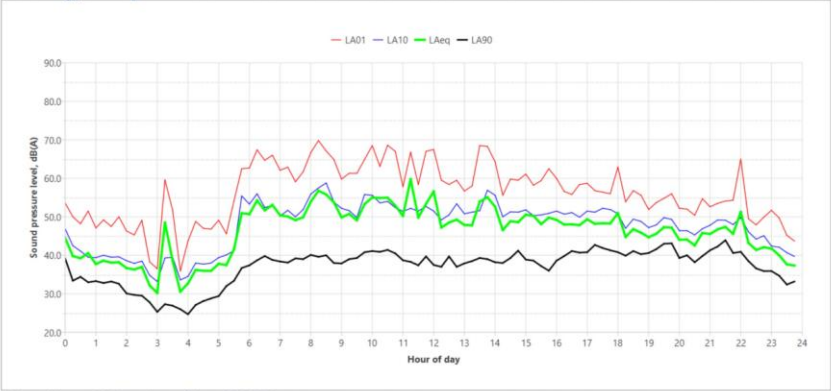


College Street, Richmond

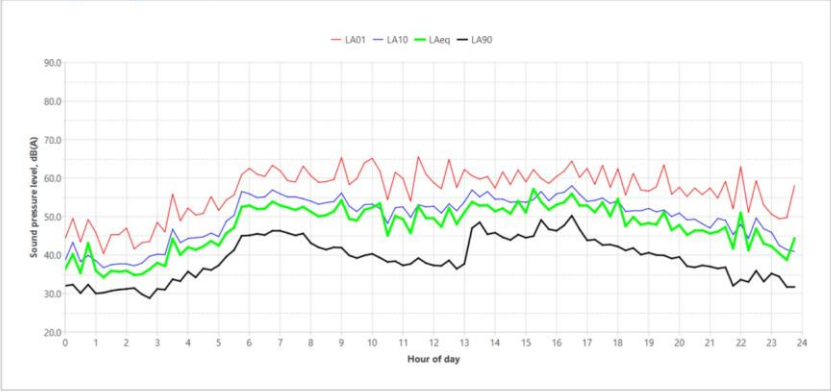
Page 3

Saturday, 7 September 2024

Sunday, 8 September 2024



Monday, 9 September 2024



College Street, Richmond

Page 4

Tuesday, 10 September 2024

College Street, Richmond

Page 5

APPENDIX C. UNATTENDED NOISE MONITORING – LOCATION 2 – LONDONDERRY ROAD

Londonderry Road, Richmond

Ambient noise monitoring report

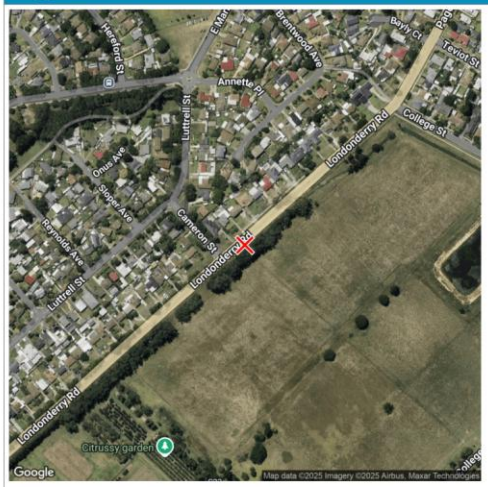
Item	Information
Logger Type	NGARA
Serial number	87826B
Address	Londonderry Road, Richmond
Location	Londonderry Road, Richmond
Facade / free field	Free field
Environment	

Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Mon 02 Sep 2024	-	38	-	65	61	53
Tue 03 Sep 2024	40	38	28	63	62	58
Wed 04 Sep 2024	45	41	31	64	61	58
Thu 05 Sep 2024	42	39	30	64	61	57
Fri 06 Sep 2024	45	41	30	64	62	58
Sat 07 Sep 2024	42	42	28	62	61	56
Sun 08 Sep 2024	-	-	-	62	-	55
Summary	**42**	**40**	**30**	**64**	**61**	**57**

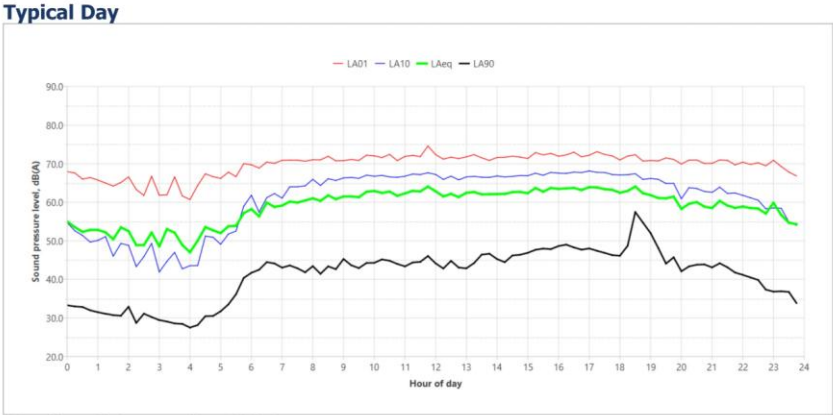
Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location

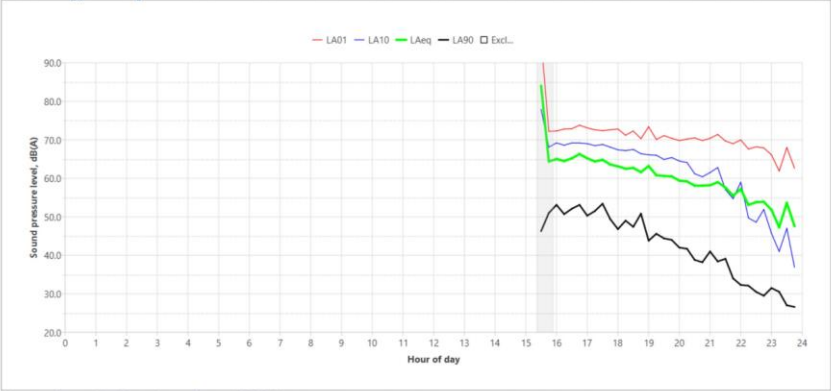


Logger deployment photo

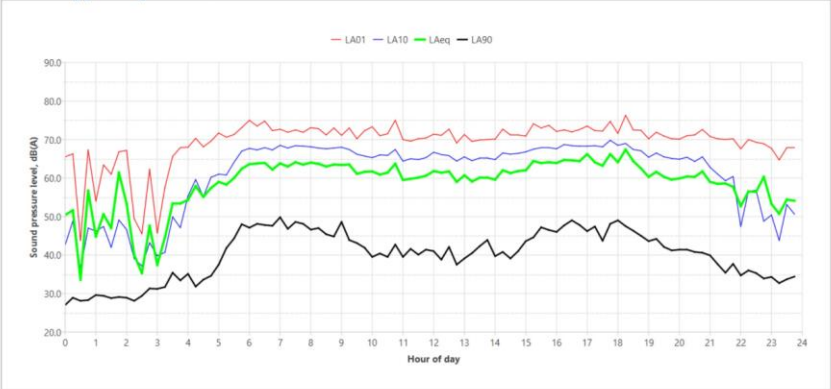
Typical Day



Monday, 2 September 2024



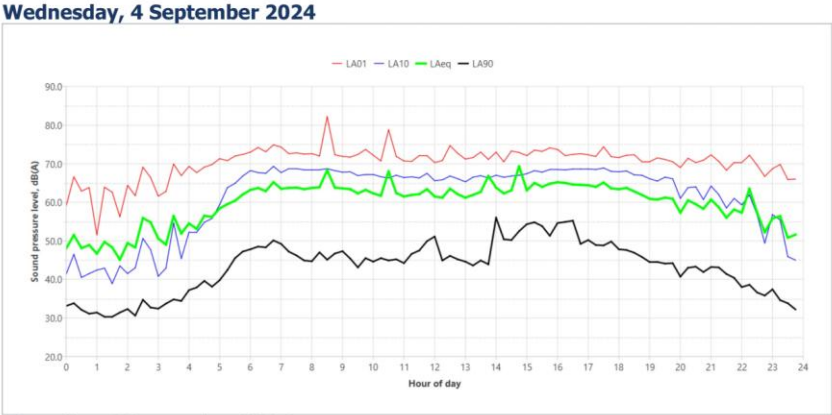
Tuesday, 3 September 2024



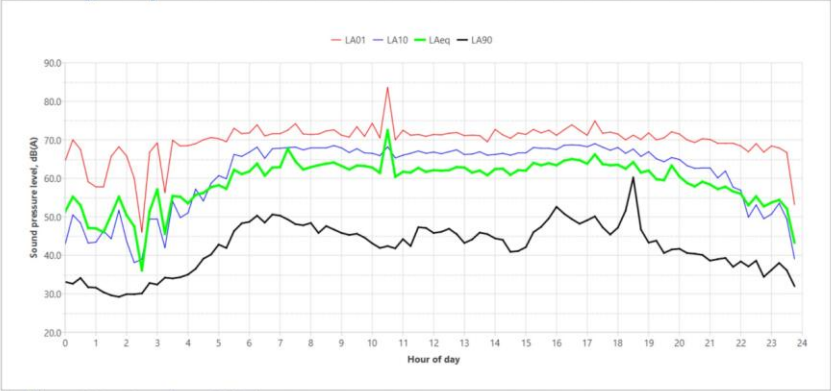
Londonderry Road, Richmond

Page 2

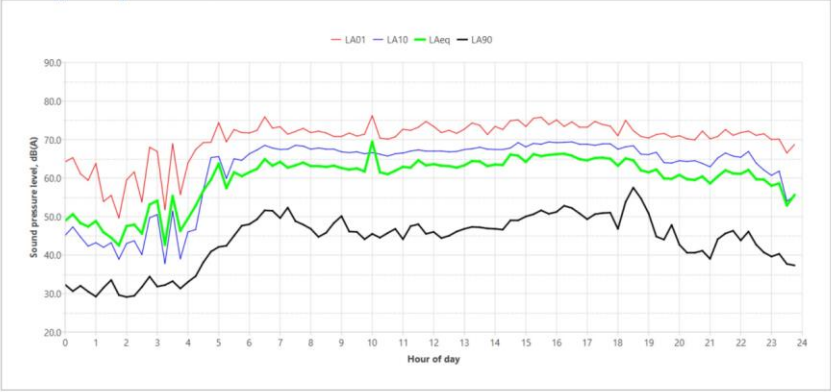
Wednesday, 4 September 2024



Thursday, 5 September 2024



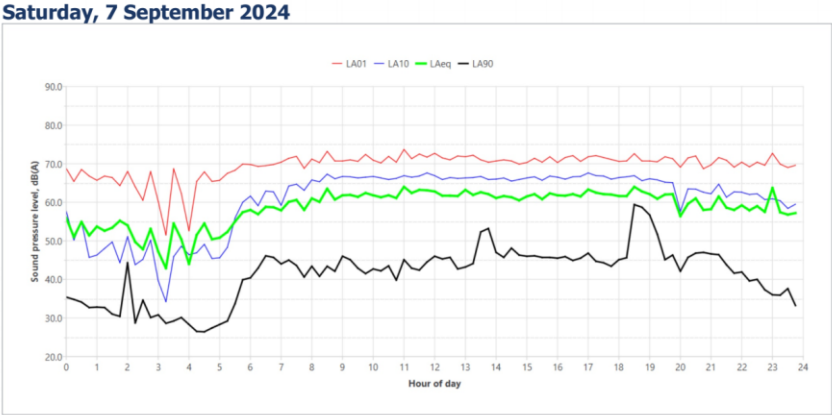
Friday, 6 September 2024



Londonderry Road, Richmond

Page 3

Saturday, 7 September 2024



Sunday, 8 September 2024

APPENDIX D. UNATTENDED NOISE MONITORING – LOCATION 3 – COLLEGE DRIVE

College Drive, Richmond

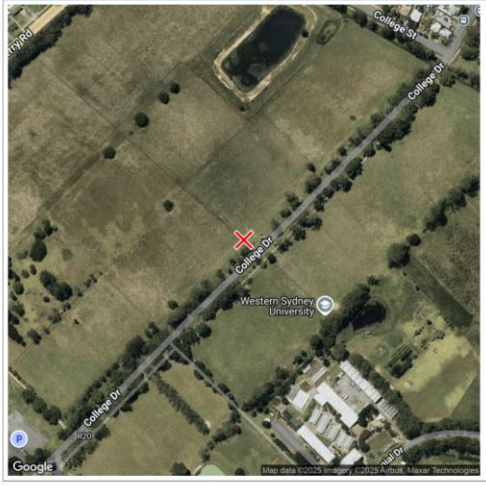
Ambient noise monitoring report

Item	Information
Logger Type	NL-42
Serial number	00998079
Address	College Drive, Richmond
Location	College Drive, Richmond
Facade / free field	Free field
Environment	

Measured noise levels

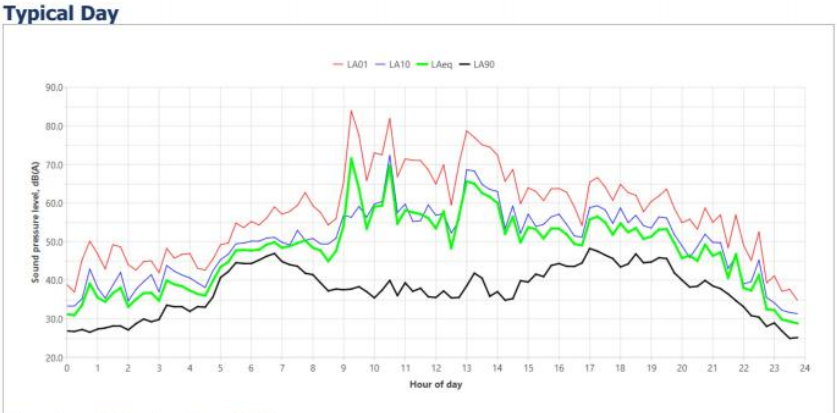
Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Mon 02 Sep 2024	-	36	-	56	51	36
Tue 03 Sep 2024	35	-	-	60	-	43
Summary	**35**	**36**	-	**59**	**51**	**41**

Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

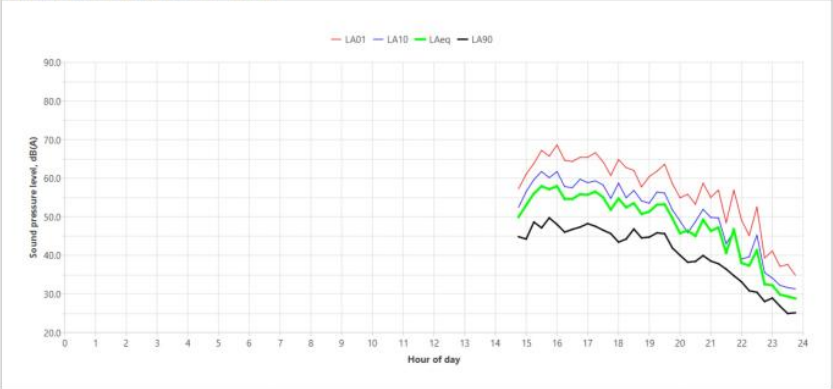
Logger location	Logger deployment photo
	

College Drive, Richmond Page 1

Typical Day



Monday, 2 September 2024



Tuesday, 3 September 2024

College Drive, Richmond

Page 2