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St Peter's Anglican College Broulee – Community Hub and Sport & Recreation Centre

Acoustic Report for Development Application

Prepared for: Anglican Diocesan Services

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Revisions

Revision	Description	Date	Prepared by	Approved by
04	Acoustic Design Report for Development Application	29/07/22	Joseph Iaconis Mahbub Sheikh	Mahbub Sheikh
04A	Acoustic Design Report for Development Application	15/12/22	Joseph Iaconis Mahbub Sheikh	Mahbub Sheikh

Review Panel

Division/ office	Name
NSW/Sydney	Mahbub Sheikh
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1 Introduction

ACOR Consultants Pty Ltd have been engaged by Colliers to provide acoustic consulting services in relation to the proposed new Community Hub, Sport & Recreation Centre and Specialist Music Areas at St Peter's Anglican College, Broulee. The site is located at 61 Train Street, Broulee NSW 2537. The proposed development site masterplan is shown in Figure 1.

This acoustic report reviews the preliminary issued architectural drawings and the mechanical design documentation to assess the noise impact at the nearby noise sensitive receivers and provide design recommendations to achieve the relevant acoustic design requirements.

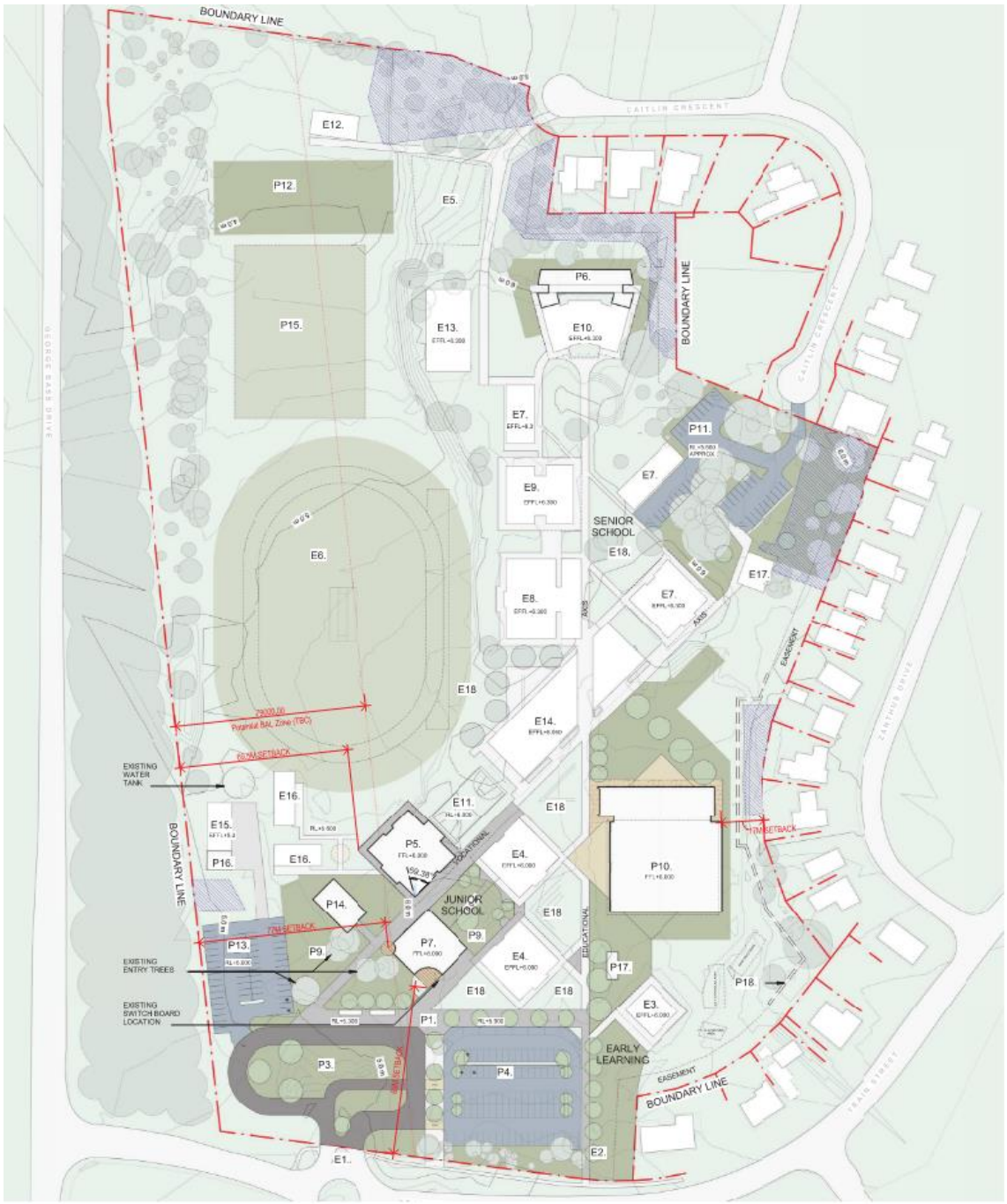


Figure 1 Project site masterplan

2 Project Description

The project scope and staging of the project are detailed below:

1) Construction of three (3) new buildings:
    a. Admin Building
    b. Sport and Recreation Centre (Gymnasium)
    c. New Junior School
2) Extension to culture and performing centre.
3) Construction of new permanent staff car park

A site plan of the new buildings is shown in Figure 2 below. Preliminary details of the buildings are shown in Figure 3 to Figure 5.

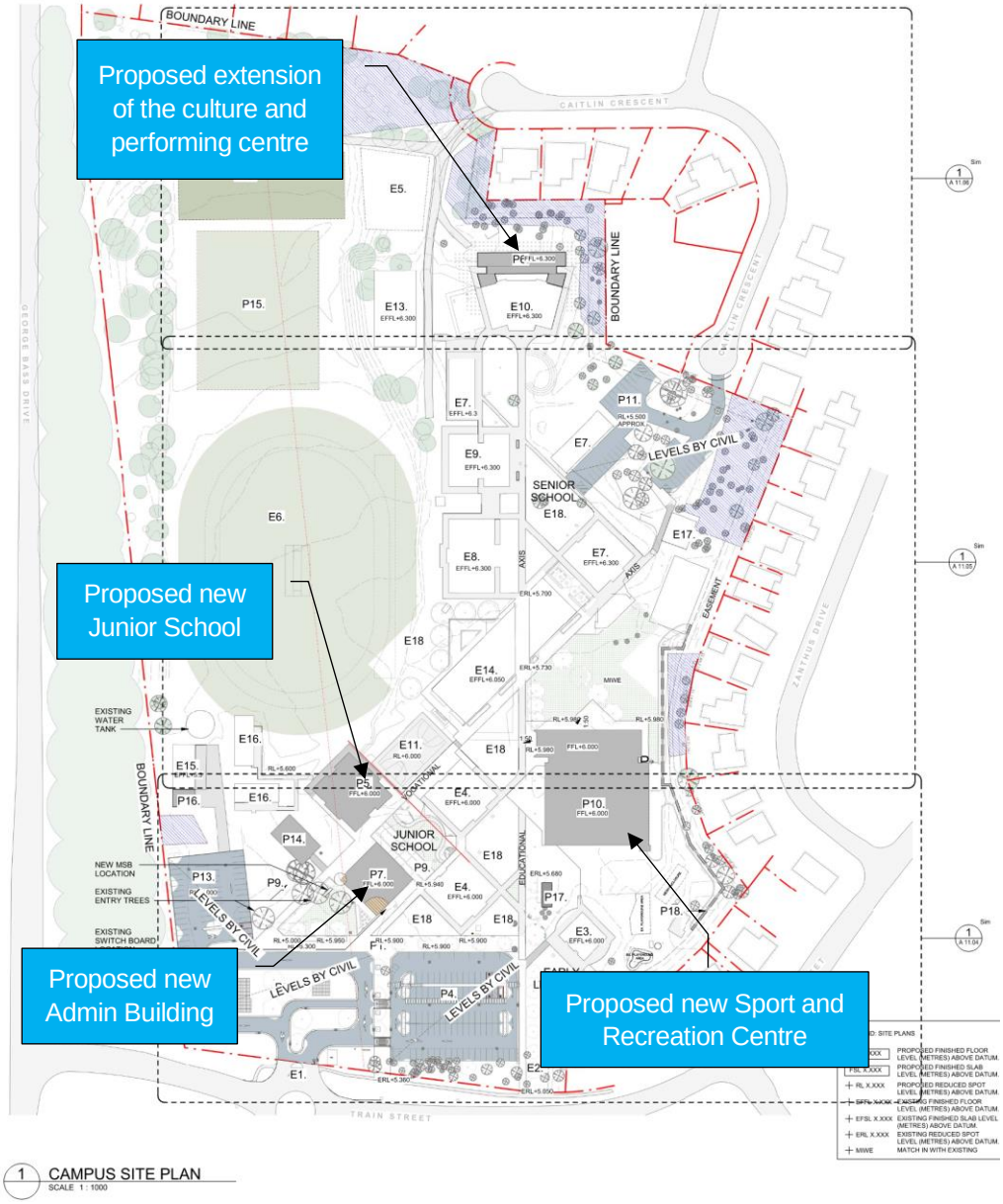


Figure 2 Detailed site plan for the proposed development

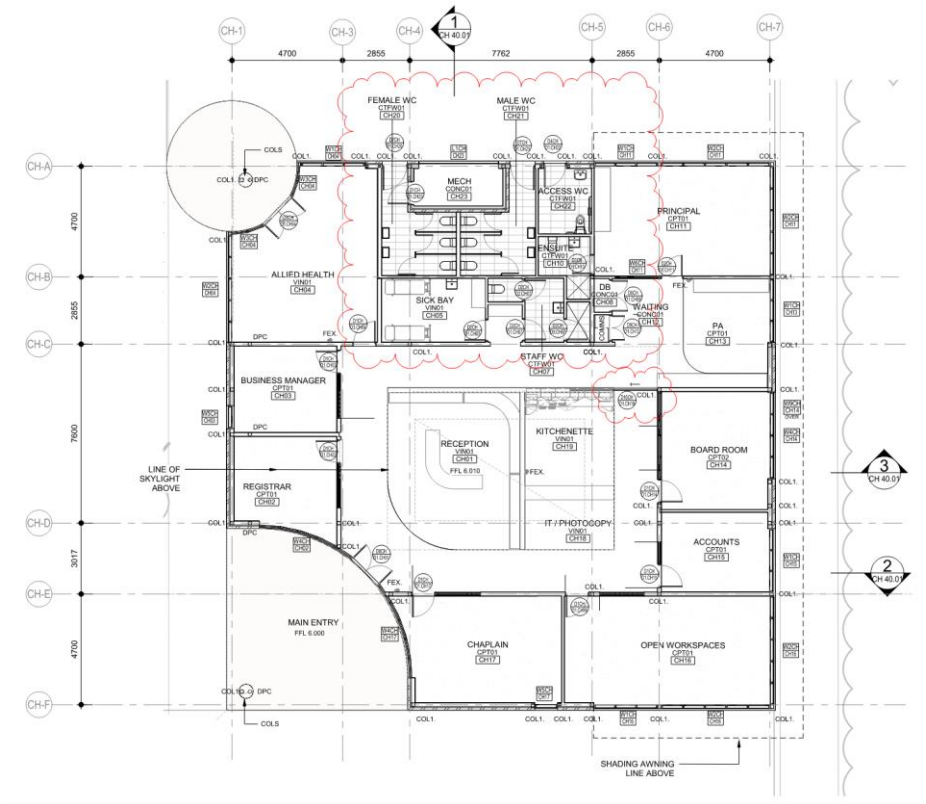


Figure 3 Proposed Admin Building layout

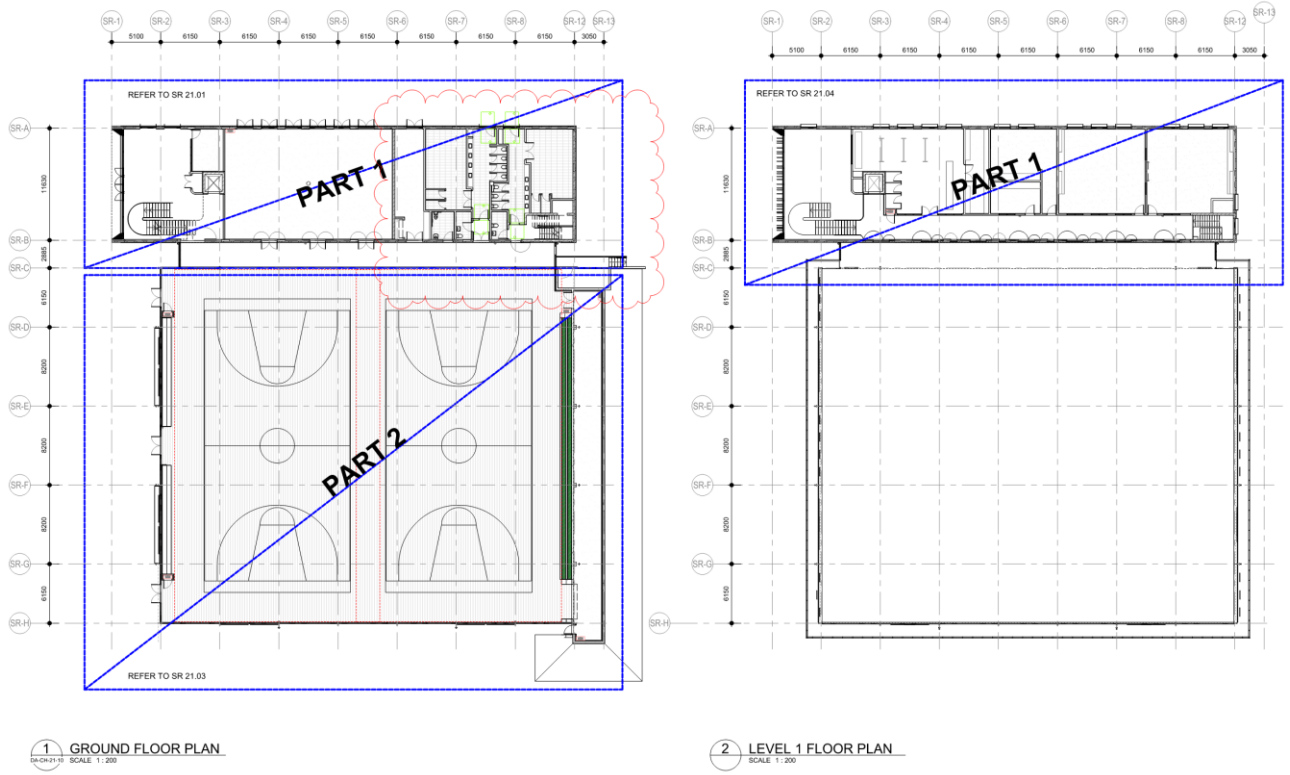


Figure 4 Proposed Sports and Recreation Centre

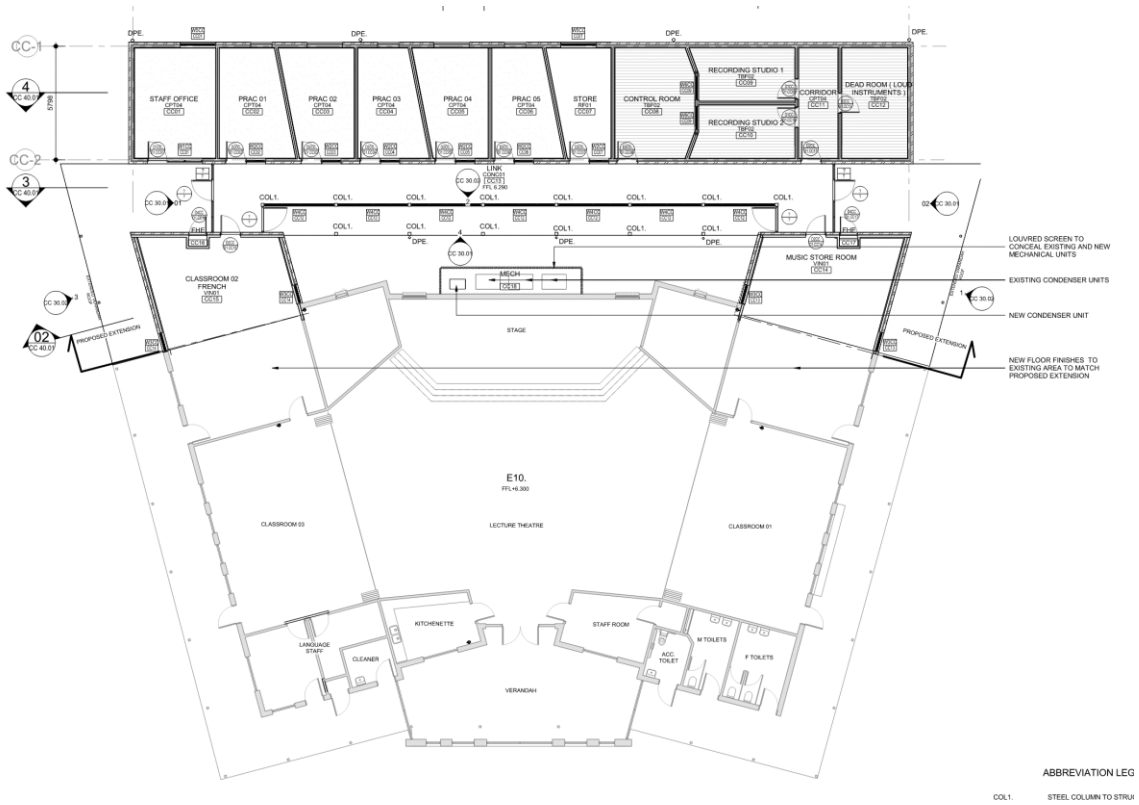


Figure 5 Proposed layout of the extension to culture and performing centre

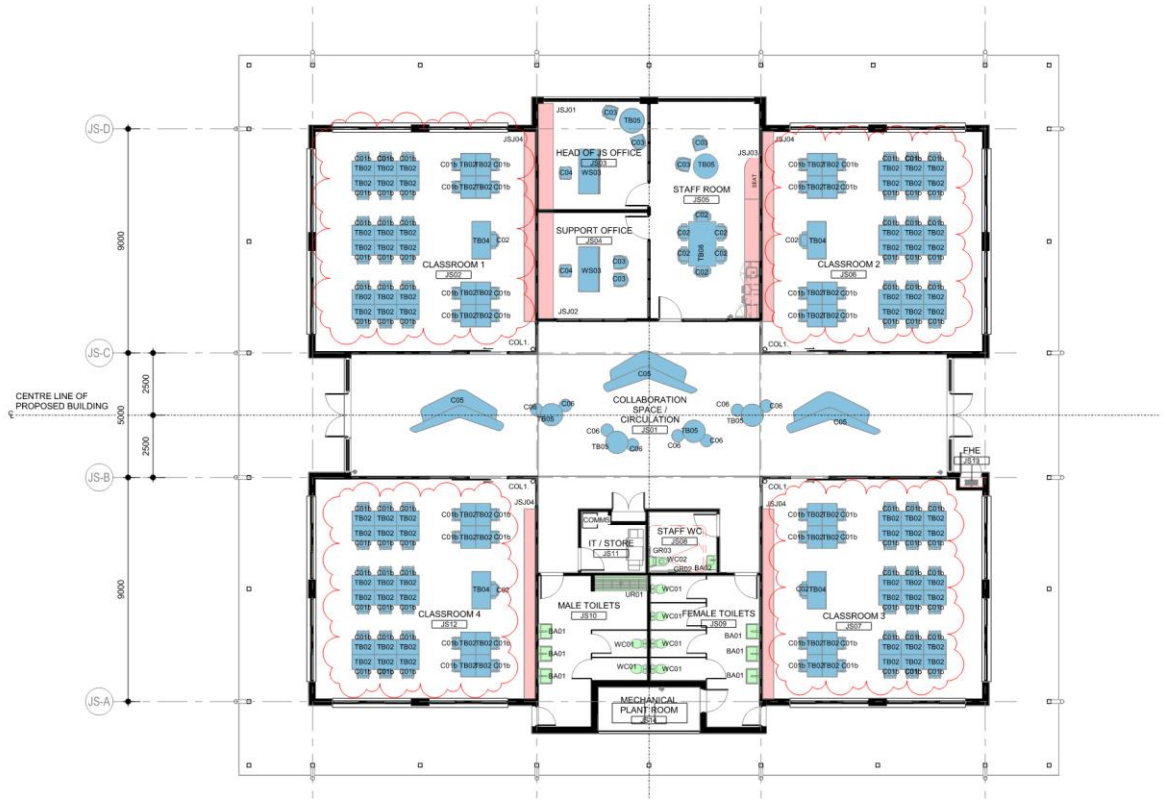


Figure 6 Proposed layout of the new Junior School

3 Reference Documents

The following documents, listed in Table 1, have been reviewed in relation to this acoustic assessment.

Table 1 Reference documents

Document Description	Discipline	Prepared by	Project No	Date
DA Drawing Set	Architecture	COX Architecture	922038	25/10/22
Mechanical Design Drawings	Mechanical	ACOR	ACT220140	07/10/22
Statement of Environmental Effects	Traffic	Rygate & West	U19767_SEE_A	12/07/22

4 Regulations, Standards and Guidelines

The following regulations, standards and guidelines have been referred / considered in relation to acoustic assessment of the subject development, in this report.

- NSW EPA Noise Policy for Industry (NPfI) 2017.
- EPA NSW Interim Construction Noise Guidelines (ICNG)
- NSW DEC Assessing Vibration: A Technical Guideline 2006 (AVTG)
- Australian/New Zealand Standard AS/NZS 2107: 2016 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors (AS 2107).
- Protection of the Environmental Operations (Noise Control) Regulations 2017 (POEO)
- NSW Department of Education Design Guideline for Acoustics (DG11)

5 Noise Sensitive Receivers

The proposed development site is located in R2 Low density residential zone, as shown in Figure 7. The proposed development is located within the St Peter's Anglican College. Noise sensitive receivers (residential dwellings) are located to the northern and eastern sides of the proposed buildings. A site map is shown in Figure 8.

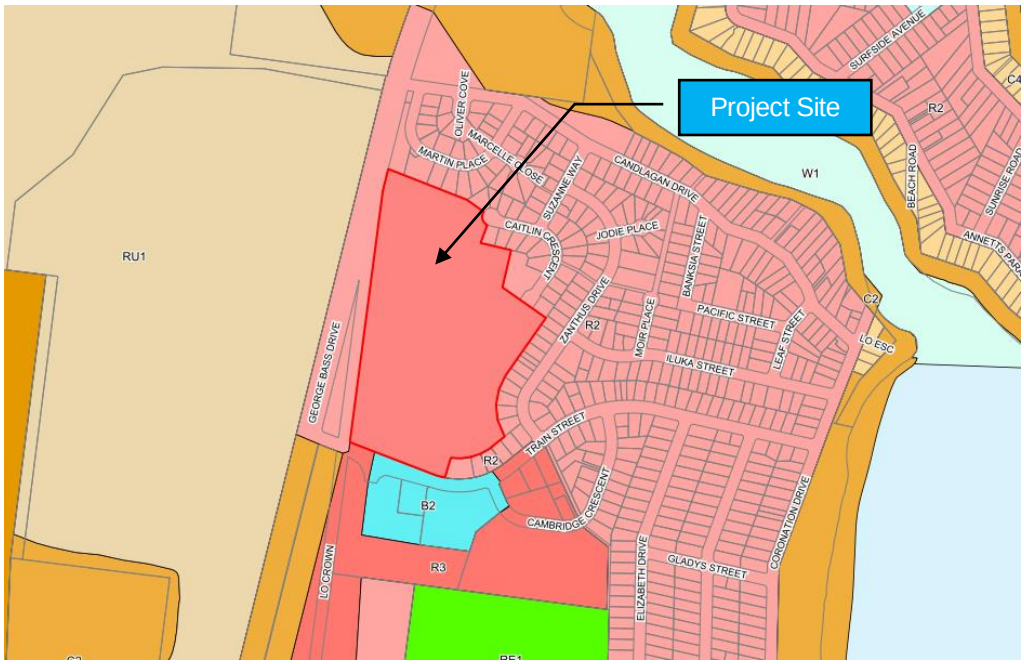


Figure 7 Location of proposed development and land zoning (Source: Eurobodalla Shire Council Interactive Maps)

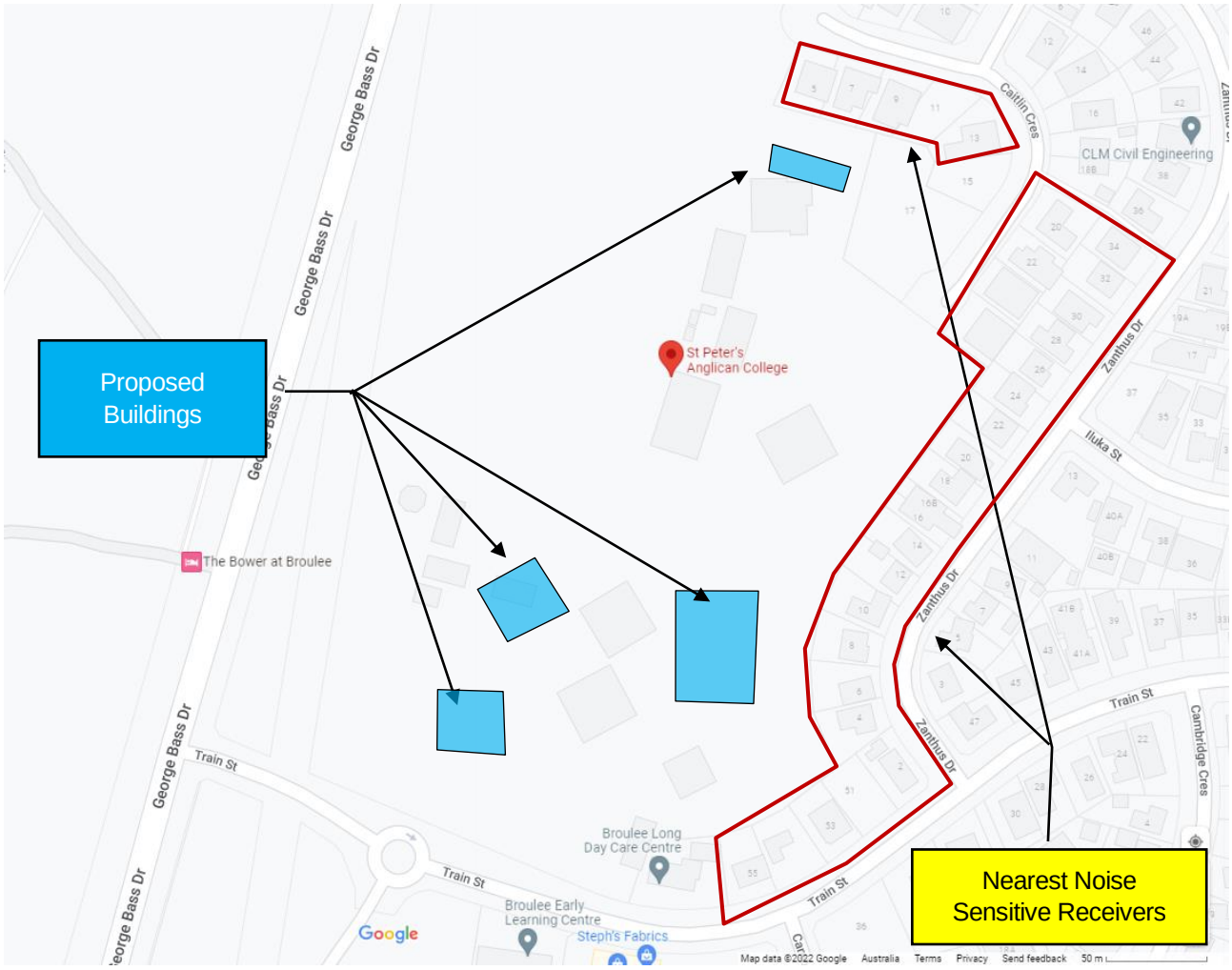


Figure 8 Site Map showing Noise sensitive receivers around the proposed development site

The nearby noise sensitive receivers are listed in Table 2

Table 2 Noise sensitive receivers

Noise Sensitive Receiver	Direction from Site
51 Train St	South
53 Train St	South
55 Train St	South
4 Zanthus Dr	East
6 Zanthus Dr	East
8 Zanthus Dr	East
10 Zanthus Dr	East
12 Zanthus Dr	East
14 Zanthus Dr	East
16 Zanthus Dr	East

Noise Sensitive Receiver	Direction from Site
18 Zanthus Dr	East
20 Zanthus Dr	East
22 Zanthus Dr	East
24 Zanthus Dr	East
5 Caitlin Cres	North
7 Caitlin Cres	North
9 Caitlin Cres	North
11 Caitlin Cres	North
13 Caitlin Cres	North
18 Caitlin Cres	East
20 Caitlin Cres	East
22 Caitlin Cres	East
24 Caitlin Cres	East
26 Caitlin Cres	East

6 Existing Noise Environment

The current noise environment at the project site and surrounds is predominantly dominated by road traffic noise from George Bass Drive, Train Street and Zanthus Drive. Based on a Traffic Impact Assessment Report available online for a site close to this project site, the AADT traffic volume along George Bass Drive (north of Train Street) would be approximately 6,515 vehicles/day.

The project site and nearby noise sensitive receivers are considered to be located in an area similar to suburban residential environment, which is characterised by intermittent local traffic flows during day period and by the noise from natural environment (i.e. nearby beach) and human activities during the evening period.

6.1 Attended and Unattended Noise Monitoring

Attended noise measurements were taken in eight different locations and unattended noise monitoring was undertaken at two locations. These are shown in Figure 9 below.

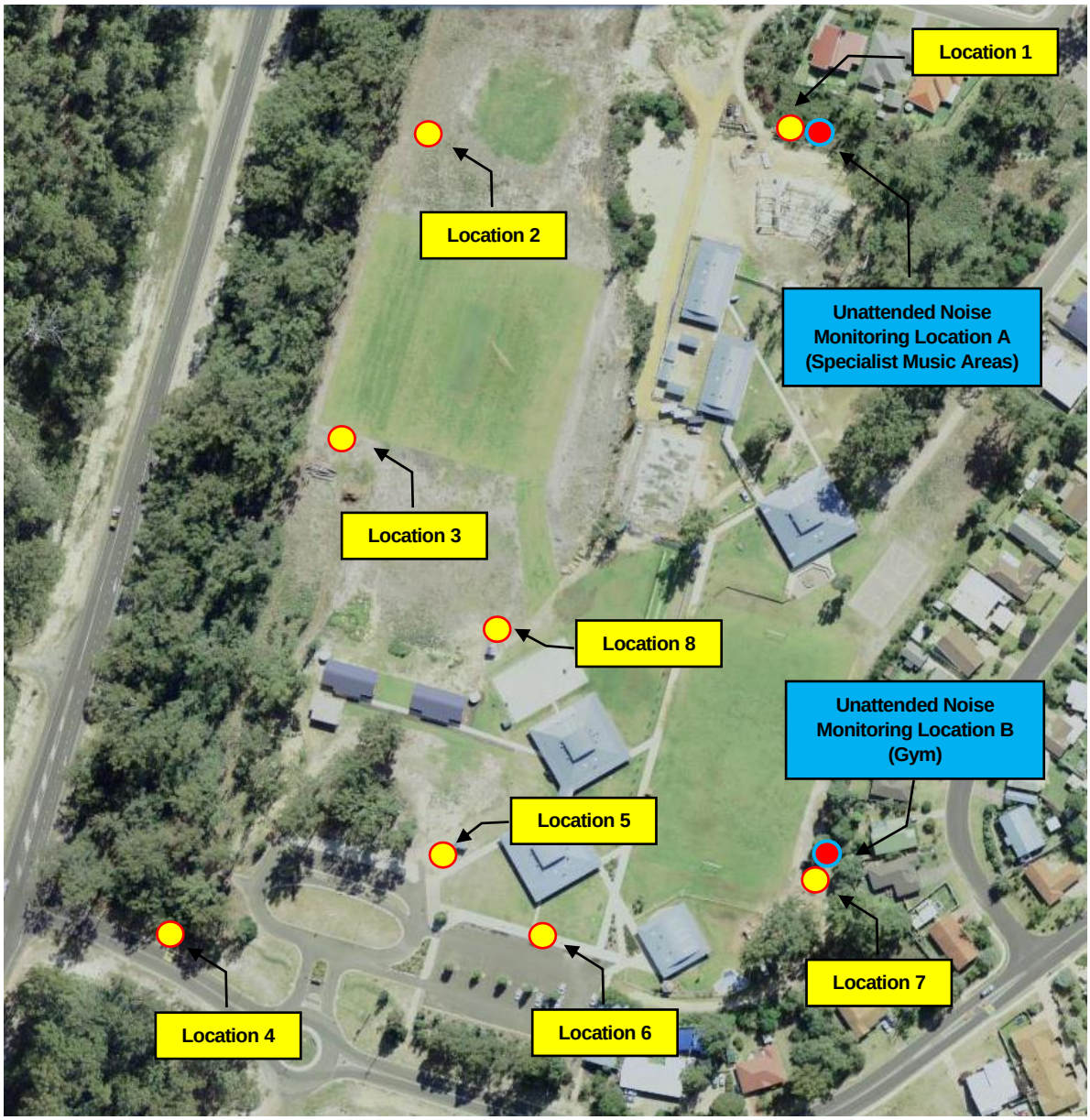


Figure 9 Location of attended measurements and unattended monitoring (noise logger)

Table 3 Location of noise loggers and measurement period

Noise Logger Location	Location of Measurement	Measurement Period	Measured Background Representative at the Noise Sensitive Receivers
Location A	School grounds, north of proposed buildings	21/06/2022 – 25/06/2022	Dwellings along Caitlin Crescent
Location B	School grounds, west of proposed buildings	21/06/2022 – 28/06/2022	Dwellings along Train Street Dwellings along Zanthus Drive

6.1.1 Methodology

The noise loggers were configured to record continuous sound pressure levels over a recurring logging period of 15-minutes during the whole period of noise logging. Measured data were stored for the measurement parameters L_{A10}, L_{A90}, L_{Aeq} and L_{Amax} during each 15-minute logging period. All measurements were taken on A-weighted fast response mode.

Instruments used for the noise measurements are listed in Table 4. The sound level meters were calibrated before and after all measurements, with no significant drift (not exceeding more than ± 0.5 dB(A)) in the calibration levels. All instruments are calibrated in NATA accredited laboratory and hold current traceable NATA certification.

Table 4 Instruments used for noise measurements

Instrument Description	Brand/ Model	Serial No.	Equipment Used for
Sound Level Meter (Type 1)	NTI XL2	A2A-18956-E0	Attended measurements – traffic
Noise Logger (Type 1)	NTI XL2	A2A-18927-E0	Noise logging – Location B
Noise Logger (Type 1)	RION NL-52	00810542	Noise logging – Location A
Calibrator	Larson Davis Cal 200	18644	Calibration

Noise data were excluded from calculations to account for any prevailing adverse meteorological conditions (wind speed greater than 5 m/sec and/or rain), as required by the NPI 2017. Meteorological data during the measurement period was collected from the Bureau of Meteorology website for Moruya Heads Weather Station and is provided in Appendix B .

6.1.2 Attended Noise Measurements – Traffic and Ambient Noise Levels

A summary of the attended noise measurements is provided in Table 5. Refer to Figure 9 for location of the attended noise measurements. Each measurement was carried out for a 15-minute period.

Table 5 Summary of attended noise measurements

Measurement Location	Measurement Start Time (Duration 15-min)	Measurement Description	Noise Levels, dB(A)				Site Notes
			L_{Aeq}	L_{A90}	L_{Amax}	L_{A10}	
1	8:13 am	Background measurement in same location as Noise Logger A	56	52	70	58	▪ Bird calls audible throughout measurement ▪ Traffic from George Bass Drive audible – approx. 210m from road side
2	8:33 am	Traffic measurement for George Bass Drive, approx. 70m from roadside and 15m from tree line	63	59	71	65	▪ Bird calls audible throughout measurement ▪ Trees fairly sparse between measurement position and the road

Measurement Location	Measurement Start Time (Duration 15-min)	Measurement Description	Noise Levels, dB(A)				Site Notes
			L_{Aeq}	L_{A90}	L_{Amax}	L_{A10}	
3	8:50 am	Traffic measurement for George Bass Drive, approx. 70m from roadside and 15m from tree line	61	54	67	64	▪ Bird calls audible throughout measurement ▪ Dense bush between the measurement position and the road ▪ Much less road traffic than in Measurement Location 1
4	9:15 am	Traffic measurement for Train Street, approx. 5m from roadside and 50m from George Bass Drive	62	51	83	64	▪ Cars, trucks and utes passing by throughout measurement
5	3:00 pm	Traffic measurement for buses entering and leaving	63	53	79	67	▪ Cars constantly entering main driveway 75m south-west ▪ Buses idling nearby 15m south-west, then leaving ▪ Children/parents arriving, leaving and chatting in carpark 30m south-east ▪ Children walking past and chatting 5-10m away
6	2:25 pm	Traffic measurement for parents arriving for pickup	55	48	77	58	▪ Young children playing throughout measurement approx. 40m east ▪ Cars arriving in carpark and idling consistently throughout measurement
7	9:35 am	Background measurement in same location as Noise Logger B	50	46	68	52	▪ Bird calls audible throughout measurement
8	9:57 am	Background measurement for children playing on sports field	60	50	78	63	▪ 15 children playing soccer approx. 30m north-west ▪ 25 children with teacher practicing running races approx. 20m north-east ▪ 15 children with skipping ropes near classroom approx. 40m west

6.1.3 Measured Background and Ambient Noise Levels

Measured noise data was processed in accordance with the Noise Policy for Industry 2017 to establish the Rating Background Level (RBL). Table 6 and Table 7 provide the measured background noise levels (L_{A90}) and the ambient noise levels (L_{Aeq}) at the noise monitoring locations. Refer to Figure 9 for the location of unattended noise monitoring (noise logger location).

Table 6 Measured background noise levels at unattended noise monitoring Location A

Date	**Day of the Week**	**Background Noise Level, L_{A90} dB(A)**			**Ambient Noise Level, L_{Aeq} dB(A)**		
		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
21/06/2022	Tuesday	43	34	37	47	48	46
22/06/2022	Wednesday	42	41	37	51	47	45
23/06/2022	Thursday	44	29	28	52	47	43
24/06/2022	Friday	41	29	31	51	44	42
25/06/2022	Saturday	37	-	-	49	-	-
Rating Background Level (RBL)		**42**	**32**	**34**			
Average Ambient Noise Level					**50**	**47**	**44**

Table 7 Measured background levels at unattended noise monitoring Location B

Date	**Day of the Week**	**Background Noise Level, L_{A90} dB(A)**			**Ambient Noise Level, L_{Aeq} dB(A)**		
		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
21/06/2022	Tuesday	45	38	39	49	50	48
22/06/2022	Wednesday	44	40	36	44	46	44
23/06/2022	Thursday	42	32	29	47	43	44
24/06/2022	Friday	42	32	31	55	43	41
25/06/2022	Saturday	36	33	30	50	44	41
26/06/2022	Sunday	35	30	31	48	42	42
27/06/2022	Monday	40	39	37	45	45	46
28/06/2022	Tuesday	40	39	35	53	47	46
29/06/2022	Wednesday	42	-	-	47	-	-
Rating Background Level (RBL)		**41**	**36**	**33**			
Average Ambient Noise Level					**50**	**46**	**45**

Detailed noise monitoring results are graphically presented in Appendix C .

6.1.4 Measured Traffic Noise Levels

Measured road traffic noise levels are provided in Table 8 below. Traffic noise measurements have been carried out at noise logger Location A (approx. 210m from George Bass Drive). Please refer to Figure 9 for location of the unattended noise monitoring (noise logger location). The measured traffic noise levels are at free field condition.

Table 8 Measured Road Traffic Noise Levels at noise monitoring Location A

Date	**Day of the Week**	**Traffic Noise Levels, dB(A)**				
		$L_{A10(18h)}$ (6am to 12am)	$L_{Aeq(15h)}$ (7am to 10pm)	$L_{Aeq(9h)}$ (10m to 7am)	$L_{Aeq(1h)}$ 7am – 10pm	$L_{Aeq(1h)}$ 10pm – 7am
21/06/2022	Tuesday	-	47	46	53	51
22/06/2022	Wednesday	49	50	45	56	52
23/06/2022	Thursday	50	51	43	56	50
24/06/2022	Friday	50	50	42	54	48
Overall Traffic Noise Level		**50**	**49**	**44**	**56**	**52**

Detailed noise monitoring results are graphically presented in Appendix C

The measured traffic noise spectrum is provided in Table 9.

Table 9 Measured traffic noise spectrum (Logger location A)

Parameter	**Octave – Band Centre Frequencies (Hz) Sound Power Level, dB**								**Total, dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
$L_{Aeq(15h)}$ 7am – 10pm	49	47	44	41	47	40	33	22	49
$L_{Aeq(9h)}$ 10pm – 7am	44	42	39	36	42	35	28	17	44
$L_{Aeq(1h)}$ 7am – 10pm	56	54	51	48	54	47	40	29	56
$L_{Aeq(1h)}$ 10pm – 7am	52	50	47	44	50	43	36	25	52

Based on the measured traffic noise levels, the calculated façade noise levels at the proposed development would be as per levels provided in Table 10:

Table 10 Traffic noise level at proposed building façades

Façade of the Building	**Octave – Band Centre Frequencies (Hz) Sound Power Level, dB $L_{Aeq(1h)}$ Daytime**								**Total, dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Admin Building	59	59	59	59	59	59	59	59	66
Sport and Recreation Centre (Gymnasium)	56	56	56	56	56	56	56	56	63
New Junior School	59	59	59	59	59	59	59	59	66
Extension to culture and performing centre	57	57	57	57	57	57	57	57	64

It is noted that children's outdoor activities and noise from parking movements will also have a noise impact at nearby facades of the proposed buildings such as the Admin Building, Junior School and Sports and Recreational Centre. Based on the measured noise levels, it is predicted that the façade noise levels at these buildings would be $L_{Aeq,15min}$ 63 to 66 dB(A) (excluding façade reflection).

7 Acoustic and Vibration Criteria

7.1 NSW EPA Noise Policy for Industry (NPI) 2017

Industrial noise can have a significant effect on noise-sensitive receivers surrounding the premises. Both the increase in noise level above background levels (that is, intrusiveness of a source), as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources. The project "Noise Trigger Level" established in NPI addresses each of these components of noise impact. The project noise trigger level applies to existing noise-sensitive receivers; however, it may also be used in strategic planning processes for proposed land uses.

Note that in NPI, time of the day is defined as follows:

- Day: 7am to 6pm Monday to Saturday and 8am to 6pm on Sundays and public holidays.
- Evening: 6pm to 10pm every day.
- Night: 10pm to 7am Monday to Saturday and 10pm to 8 am on Sundays and public holidays.

7.1.1 Project Intrusiveness Noise Level

The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source ($L_{Aeq,15min}$) does not exceed the Rating Background Level (RBL) by more than 5 dB, when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment. The outcome of this approach aims to ensure that the intrusiveness noise level is being met for at least 90% of the time-periods over which annoyance reactions can occur (taken to be periods of 15 minutes). Project intrusiveness noise level is defined as follows:

- $Project\ Intrusiveness\ Noise\ Level\ (L_{Aeq,15min}) = Rating\ Background\ Level\ (RBL) + 5\ dB$

Intrusive noise levels are only applied to residential receivers (residences). For other receiver types identified in Table 2.2 of the NPI, only the amenity levels apply.

Based on the minimum assumed Rating Background Level (RBL), presented in Table 6 and Table 7, the minimum project intrusiveness noise level for this project is established in Table 11.

Table 11 Minimum Project Intrusiveness Noise Levels (as per Noise Policy for Industry)

Noise Sensitive Receiver	**Rating Background Level RBL, dB(A)**			**Minimum Project Intrusiveness Noise Levels, $L_{Aeq,15min}$ dB(A)**		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)
5-24 Caitlin Crescent (North)	42	32	34	47	37	39
51-55 Train Street (East) 2-26 Zanthus Drive (South)	41	36	33	46	41	38

7.1.2 Project Amenity Noise Level

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

The recommended amenity noise levels (Table 2.2 of the NPI) represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. To ensure that industrial noise levels (existing plus new) remain within the

recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows.

- $Project\ Amenity\ Noise\ Level, L_{Aeq,15min} = Recommended\ Amenity\ Noise\ Level - 5\ dB(A) + 3\ dB(A)$

Recommended amenity noise level should be established from Table 2.2 of the NPI based on the noise sensitive receivers category, determined based on Table 2.3 of the NPI.

As the NPI states, the approach of deriving the project amenity noise level from the recommended amenity noise level minus 5 dB is based on a receiver not being impacted by more than three to four individual industrial noise sources. To standardise the time periods for the intrusiveness and amenity noise levels, NPI assumes that the Amenity $L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

Considering that the residential noise sensitive receivers are located in R2 low density residential zone, and the surrounding environmental character is similar to a suburban residential, the NPI recommended Amenity Noise Level and Project Amenity Noise Level for this project are presented in Table 12.

Table 12 Project Amenity Noise Levels, $L_{Aeq,15min}$ dB(A)

Noise Sensitive Receiver	**Recommended Amenity Noise Level, L_{Aeq} dB(A)**			**Project Amenity Noise Levels, $L_{Aeq,15min}$ dB(A)**		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)
5-26 Caitlin Crescent (North)	55	45	40	53	43	38
51-55 Train Street (East) 2-26 Zanthus Drive (South)	55	45	40	53	43	38

7.1.3 Project Noise Trigger Level

The “Project Noise Trigger Level” is the lower (that is, the more stringent) value of the “Project Intrusiveness Noise Level” and “Project Amenity Noise Level” determined in accordance with the Noise Policy for Industry 2017. The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited, and amenity is protected and that no single industry can unacceptably change the noise level of an area. It is noted that Intrusive noise levels are only applied to residential receivers (residences). For other receiver types identified in Table 2.2 of the NPI, only the amenity levels apply.

Project Noise Trigger Levels for this project are established in accordance with the NPI 2017 and provided in Table 13.

Table 13 Project Noise Trigger Levels

Noise Sensitive Receiver	**Project Intrusiveness Noise Level, $L_{Aeq,15min}$ dB(A)**			**Project Amenity Noise Level, $L_{Aeq,15min}$ dB(A)**			**Project Noise Trigger Level, $L_{Aeq,15min}$ dB(A)**		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)
5-26 Caitlin Crescent (North)	47	37	39	53	43	38	47	37	38

Noise Sensitive Receiver	Project Intrusiveness Noise Level, $L_{Aeq,15min}$ dB(A)			Project Amenity Noise Level, $L_{Aeq,15min}$ dB(A)			Project Noise Trigger Level, $L_{Aeq,15min}$ dB(A)		
51-55 Train Street (East) 2-26 Zanthus Drive (South)	46	41	38	53	43	38	46	41	38

7.1.4 Correction For Modifying Factors

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, a correction should be applied as per the Noise Policy for Industry, to the measured or predicted noise levels at the receiver before comparison with the project noise trigger levels. The maximum correction of 10 dB(A) to be applied to the predicted or the measured level where two or more modifying factors are present. NPI recommended correction factors (Table C1 of the NPI) are shown in Table 14.

Table 14 Modifying factor corrections for noise characteristics.

Factors	Corrections[1]	Notes
Tonal Noise	5 dB[2,3]	[1.] Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion. [2.] Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz. [3.] Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard
Low-Frequency Noise	2 or 5 dB[2]	
Intermittent Noise	5 dB	
Duration	0 to 20 dB(A)	
Maximum Adjustment	Maximum correction of 10 dB(A)[2] (excluding duration correction).	

As per the NPI, correction for duration is applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aeq,15min}$ equivalent noise criterion is provided in Table C3 of the NPI for the duration of the event. This adjustment is designed to account for unusual and one-off events and does not apply to regular and/or routine high-noise level events. The adjustments for duration are to be applied to the criterion.

7.1.5 Sleep Disturbance Criteria

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. NPI recommends, 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,

That a detailed maximum noise level event assessment should be undertaken. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Based on the NPI, the sleep disturbance criteria for the proposed development are determined as shown in Table 15.

Table 15 Sleep disturbance criteria for the proposed development

Noise Sensitive Receiver	Rating Background Level (RBL) at Night, L_{A90} dB(A)	NPI Recommended Sleep Disturbance Criteria, dB(A)	
		$L_{Aeq,15min}$ (40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater)	L_{AFmax} (52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater)
5-26 Caitlin Crescent (North)	34	40	52
51-55 Train Street (East) 2-26 Zanthus Drive (South)	33	40	52

In addition to the above, NSW Road Noise Policy (RNP) noted that the research on sleep disturbance to date concluded that:

- Maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep
- One or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.

7.1.6 Protection of the Environmental Operations (POEO) Act 1997

The Protection of the Environment Operations (POEO) Act 1997 aims to protect, restore and enhance the quality of the noise environment in New South Wales. 'Offensive noise' in the POEO Act 1997 is defined as the noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances—

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

For control of noise from Air Conditioners, Pumps and Heat Pump Water Heaters, POEO Act 1997 defines the following in regards to its use on residential premises:

A person is guilty of an offence if -

(a) the person causes or permits an air conditioner / pump to be used on residential premises in such a manner that it emits noise that can be heard within any room in any other residential premises (that is not a garage, storage area, bathroom, laundry, toilet or pantry) whether or not any door or window to that room is open -

(i) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or

(ii) before 7 am or after 10 pm on any other day,

7.2 Construction Noise Criteria - DECC Interim Construction Noise Guideline (ICNG) 2009

While the interim construction noise guideline is specifically aimed at managing noise from construction works regulated by the DECC, it forms an excellent basis for best practice assessment and will be used to provide an indication of the likely noise exposure of residents surrounding the particular construction site.

Recommend standard hours for normal construction:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays.

If it is necessary for work to occur outside these hours, clear justification should be provided.

However, ICNG also acknowledges that the following five categories of work might be undertaken outside the recommended standard hours provided all reasonable and feasible noise mitigation measures are implemented to minimise the noise impact.

- the delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- public infrastructure works that shorten the length of the project and are supported by the affected community
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

Both quantitative and qualitative assessments are allowable. Undertaking an assessment using the quantitative method, an operating only within the recommended standard construction hours, the following noise management levels provided in Table 16 are recommended:

Table 16 Recommended construction noise management levels (extract of ICNG)

Time of Day	**Management Level, $L_{Aeq(15minute)}$ dB(A)**	**How to Apply**
Standard Construction 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 $L_{Aeq\ (15\ min)}$ 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 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory)

Time of Day	Management Level, $L_{Aeq(15minute)}$ dB(A)	How to Apply
		may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: – times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences – if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL+ 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(A) above the noise affected level, the proponent should negotiate with the community. ▪ For guidance on negotiating agreements refer to section 7.2.2 of the ICNG.

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.

Based on the adopted RBL for this project, the project construction noise management levels are shown in Table 17.

Table 17 Construction noise management levels - Residential

Noise Sensitive Receiver	Rating Background Level RBL, dB(A)			Construction Noise Management Level, $L_{Aeq(15minute)}$ dB(A)				
				Standard Construction Hours (RBL+10) (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm)		Outside recommended standard hours (RBL+5)		
				Noise Affected Level	Highly Noise Affected Level	Noise affected level		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)	Day (7am-6pm)		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm – 7am)
5-26 Caitlin Crescent (North)	42	32	34	52	75	47	37	39
51-55 Train Street (East) 2-26 Zanthus Drive (South)	41	36	33	51	75	46	41	38

Other sensitive land uses, such as schools, typically consider noise from construction to be disruptive when the properties are being used (such as during school times). Table 18 presents management levels for noise at other sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed. The proponent should consult with noise sensitive land use occupants likely to be affected by noise from the works to schedule the project's work hours to achieve a reasonable noise outcome.

Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most affected point within 50 m of the area boundary. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences. Some buildings may achieve greater performance, such as where windows are fixed (that is, cannot be opened).

Table 18 Construction noise management levels - School

Noise Sensitive Receiver	**Construction Noise Management Level, $L_{Aeq(15minute)}$ dB(A) (Applies when properties are being used)**
Classroom at school and other educational institutions	Internal noise level, 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level, 65 dB(A)

7.3 NSW Department of Education Standards and Guideline (DG11)

7.3.1 Internal Noise Levels (Noise Intrusion Criteria)

The NSW Department of Education Design Guideline for Acoustics states that road noise for general learning areas, music, drama, movement studios and halls shall be assessed consistent with the requirements of State Environmental Planning Policy (Infrastructure) 2007 - Regulation 102. An assessment should be undertaken where directed for any site impacted by traffic noise. Generally, it is recommended for all sites impacted by noise from roads with greater than 20,000 vehicles AADT and required for all sites impacted by noise from roads with greater than 40,000 vehicles AADT. The guideline internal noise levels presented in Acoustic Performance Guidelines (section11.06) is to be used in the assessment.

NSW Department of Education Design Guideline for Acoustics (DG11) specifies the following indoor noise levels, relevant to the proposed classrooms, provided in Table 19.

Table 19 Recommended internal noise levels

Room	**Internal Noise Level, L_{Aeq} dB(A)**	**Recommended Reverberation Time (RT), Sec**
Professional and administrative offices	35	<0.8
Staff common rooms	40	<0.6
Office Areas	40	<0.8
Corridors and Lobbies	45	Minimise
Open plan teaching areas	40	<0.8
Teaching spaces - Primary Schools	35	<0.5
Teaching spaces - Secondary Schools	35	<0.6
Gymnasium	40	<1.5
Music practice rooms	35	See note 1

Room	Internal Noise Level, L_{Aeq} dB(A)	Recommended Reverberation Time (RT), Sec
Music Studios	30	See note 1
Note 1: The appropriate reverberation time shall be influenced by the internal volume and intended use of the space. Guidance from an acoustical engineer shall be sought. Also refer to AS /NZS 2107:2000 Figure A1 for guidance values.		

7.3.2 Noise Emission Criteria

DG11 also states that noise emission to the environment from mechanical services noise sources (such as air conditioners) are the subject of a development consent conditions. In NSW the development consent conditions will refer to the Industrial Noise Policy (INP – currently known as NPI) or Local Council requirement. Where no condition regarding noise sources exists for a school development, noise emission from such sources should be designed, in-principle, to satisfy the requirements of the NPI.

Noise associated with school activity (such as music or sport within a hall) are not a stationary noise source and is not subject to the INP requirements. Where a condition of consent exists for the control of activity related noise, an acoustic engineer is to assess the noise emission.

7.4 AS/NZS 2107:2016 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors

Internal noise and reverberation time criteria have been nominated to target appropriate noise levels for the building with respect to speech privacy, occupant comfort and the functional purpose of the space. These targets are from Australian Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors. Table 20 presents the internal noise and reverberation time criteria nominated for the building.

Table 20 AS 2107 – Internal Noise and Reverberation Time Criteria

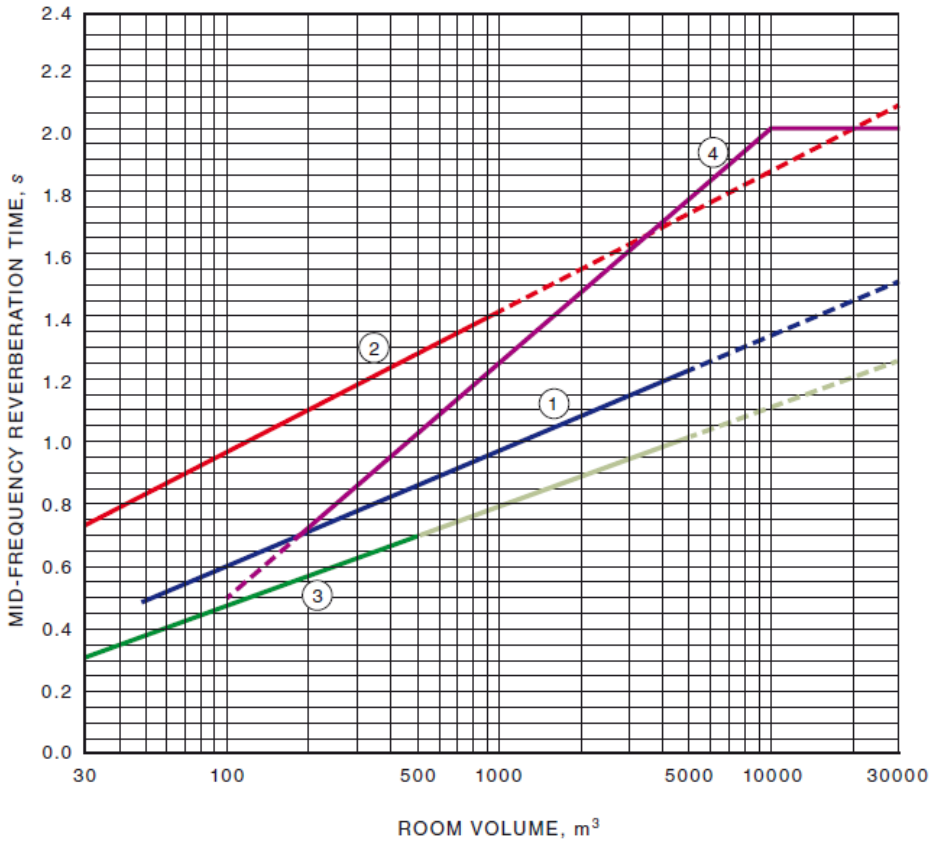
Room Type	Internal Noise Level (L_{eq} dB[A])	Reverberation Time, Seconds
Professional and administrative offices	35 - 40	0.6 - 0.8
Staff common room	40 - 45	<0.6
Toilet	<55	N/A
Corridor and Lobbies	<50	<0.8
Office Area	40 - 45	0.4 - 0.7
Conference Rooms	35 - 40	0.6 – 0.7
Teaching spaces/single classroom – Open plan teaching spaces	35 to 45	Curve 3 of the AS2107 (refer to Figure 10). RT should be minimised for noise control
Teaching spaces/single classroom – Primary schools	35 to 45	Curve 3 of the AS2107 (refer to Figure 10). RT may be considered at lower end of the range depending on the classroom requirements
Teaching spaces/single classroom – Secondary schools	35 to 45	Curve 3 of the AS2107 (refer to Figure 10)
Music practice rooms	40 – 45	0.7 – 0.9
Music studios	30 – 35	Curve 2 of the AS2107 (refer to Figure 10). Acoustic consultant to recommend.
Weight training/Fitness Room	<50	<1.0

Room Type	Internal Noise Level (L_{eq} dB[A])	Reverberation Time, Seconds
Sports Hall	<50	Curve 4 of the AS2107 (refer to Figure 10)
Assembly halls upto 250 seats	30 to 40	0.6 – 0.8
Assembly halls over 250 seats	30 to 35	Curve 1 of the AS2107 (refer to Figure 10).
Toilet/change/showers	<55	-

REVERBERATION TIMES FOR SELECTED SPACES

(Informative)

The curves in Figure A1 represent mean reverberation times of spaces which are considered to possess good acoustic qualities. They are intended only as guides since the scatter about these mean curves is large.



LEGEND:
Curve 1 = Speech/Lecture
Curve 2 = Music
Curve 3 = Teaching/Communication
Curve 4 = Sport

NOTE: The graphic in Figure A1 is based on DIN 18041.

Figure 10 Recommended reverberations time for selected space (extract from AS2107:2016)

7.5 Noise Emission Criteria – Indoor Activities and Outdoor Play Noise

DG11 states that noise associated with school activity (such as music or sports within a hall) are not a stationary noise source and is not subject to the NPI requirements. Where a condition of consent exists for the control of activity related noise, an acoustic engineer is required to assess the noise emission.

It is a common that school developments include playgrounds and classrooms that may be in close proximity to residential dwellings. Noise in schools from such areas are often not considered as offensive noise as they are part of school activities. It is understood that there is no regulated noise criteria in NSW for assessing such noise from schools.

However, for managing noise within the school and providing a conducive amenity at the surrounding residential areas, ACOR considers that the following guideline criteria at the nearby residential receivers can be adopted.

- Noise from outdoor play areas (≤ 2 hours outdoor play), $L_{Aeq,15min}$: Background + 10 dB(A)
- Noise from outdoor play areas (≥ 2 hours outdoor play), $L_{Aeq,15min}$: Background + 5 dB(A)
- Noise from Internal Activities (Speech or Music), $L_{Aeq,15min}$:Background+5 dB(A) and/or NPI recommended Project Amenity Noise (this is the recommended range).

The above recommendations are based on the Association of Australasian Acoustic Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment and best practices for acoustic design. Although the AAAC guideline is applicable for childcare centres, the noise characteristics of children playing either in schools or childcare centres are very similar, and are hence considered relevant for noise assessment of outdoor playground noise for schools.

AAAC States that:

- 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,15 minute noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.

- More than 4 hours (total) per day – If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed Leq,15 minute noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

In addition to the above, on several occasions the NSW Land & Environment Court (NSWLEC) determined that a Background + 10 dB(A) noise criteria is considered acceptable in assessing playground noise, that is limited to 2 hours period. However, it is also noted from NSWLEC in its decision for Meriden School v Pedavoli (2009) that all noise that emanates from the normal activities at a school is not offensive.

ACOR recommends that internal school activities associated with music or speech should be assessed for $L_{Aeq,15min}$: Background+5 dB(A) or NPI recommended Project Amenity Noise level. This essentially would target to keep the activities noise within the school to match the amenity noise levels in the surrounding environment. Keeping the amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.

Based on the discussion above, the acceptable activity noise emission levels from school are provided in Table 21.

Table 21 Adopted noise emission criteria for indoor activities and outdoor play noise

Noise Sensitive Receiver	**Rating Background Level RBL, dB(A)**			**Acceptable Noise Levels, $L_{Aeq,15min}$**							
				Outdoor Play		**Indoor Activities***					
				≤ 2 hours	≥ 2 hours						
				Background + 10 dB(A)	Background + 5 dB(A)	Background + 5 dB(A)			NPI Recommended Project Amenity Noise Level		
	Day	Evening	Night	Day	Day	Day	Evening	Night	Day	Evening	Night
5-26 Caitlin Crescent (North)	42	32	34	52	47	47	37	-	53	43	-
51-55 Train Street (East) 2-26 Zanthus Drive (South)	41	36	33	51	46	46	41	-	53	43	-

*Note: The school operates only during the day period. Indoor communal activities would typically occur during the day and evening period during the weekends and during the evening period on weekdays.

The time period referred here is:

- Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and Public Holidays
- Evening: 6pm to 10pm
- Night: 10pm to 7am.

7.6 Emergency Noise Levels

7.6.1 Fire and smoke control equipment

Fire and smoke control equipment must meet the noise provisions of AS 1668 Set-2016 – the use of ventilation and air conditioning in buildings set for plant operating in an emergency operation mode including (but not limited to):

- The noise level during operation of the smoke control systems (including smoke-spill fans and air pressurization fans) shall not exceed 65dBA in occupied spaces or 5dB above ambient noise levels to a maximum level of 80dBA.
- Noise levels in fire-isolated exits shall not exceed 80dBA.

7.6.2 Fire control room

NCC Section Specification E1.8 requires the ambient sound level within the Fire Control Rooms (FCRs) as measured when all fire safety equipment is operating in the way it operates in an emergency, to not exceed 65 dBA $L_{eq;1\ minute}$.

7.6.3 Emergency back-up generators

There is no guidance in Australian Standards for prescribing set limits or recommendations in relation to internal noise from emergency generators.

The AAAC Guideline recommends that internal noise levels during emergency and testing operation should be limited to no more than 5dB above the maximum recommended internal noise criteria, which are outlined in Table 20.

7.7 Hydraulic Services

For hydraulic services, the noise will most likely be intermittent and, as such, the AAAC Guideline recommends that the $L_{ASmax,avg}$ be used with a minimum of 5 samples in critical spaces. Acceptable criteria would be 5 dB

higher than the maximum recommended design sound level of Table 20. If the noise is considered to be more of a continuous source, then the design levels of Table 20, measured as a L_{Aeq}, shall be used.

7.8 Rain Noise

Given the nature of this development, levels up to 5dB above the recommended criteria are likely to be acceptable in terms of rain noise impact, i.e., the maximum recommended design sound level given in Table 20.

7.9 Building Vibration Criteria

7.9.1 Human Comfort

Vibration can potentially impact on the quality of life or working efficiency. Individuals can detect building vibration values that are well below those that can cause any risk of damage to the building or its contents. The level of vibration that affects amenity is lower than that associated with building damage. To protect the health and wellbeing of the community, NSW DEC has developed a guideline to aid in protecting people from values of vibration above preferred and maximum values felt inside buildings.

The recommended vibration criteria for Human Comfort are based on the NSW DEC Assessing Vibration: A Technical Guideline (2006). The criteria for continuous and impulsive vibration are summarized in Table 22.

Continuous vibration is defined as the vibration that continues uninterrupted for a defined period (usually throughout daytime and/or night-time). This type of vibration is assessed on the basis of weighted RMS acceleration values presented in Table 22.

Impulsive vibration is a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds. Impulsive vibration (no more than three occurrences in an assessment period) is assessed on the basis of acceleration and the recommended criteria is provided in Table 22.

Table 22 Vibration criteria for Human Comfort – Continuous and Impulsive Vibration

Location	**Assessment Period***	**Preferred weighted RMS values (m/s^2)**		**Maximum weighted RMS values (m/s^2)**	
Continuous Vibration					
		z-axis	x and y axes	z-axis	x and y axes
Residences	Daytime (7am to 10pm)	0.010	0.0071	0.020	0.014
	Night-time (10pm to 7am)	0.007	0.005	0.014	0.010
Offices, Schools, Educational Institutions and Places of Worship	Day or Night-time	0.020	0.014	0.040	0.028
Impulsive Vibration					
Residences	Daytime (7am to 10pm)	0.30	0.21	0.60	0.42
	Night-time (10pm to 7am)	0.10	0.071	0.20	0.14
Offices, Schools, Educational Institutions and Places of Worship	Day or Night-time	0.64	0.46	1.28	0.92
* Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am					

Perception of vibration will depend on the vibration magnitude and its duration of exposure. In addition to the continuous and impulsive vibration, people can be subjected to Intermittent vibration. It is defined as interrupted periods of continuous (e.g. a drill) or repeated periods of impulsive vibration (e.g. a pile driver), or continuous

vibration that varies significantly in magnitude. It may originate from impulse sources (e.g. pile drivers and forging presses) or repetitive sources (e.g. pavement breakers), or sources which operate intermittently, but which would produce continuous vibration if operated continuously (for example, intermittent machinery, railway trains and traffic passing by). This type of vibration is assessed on the basis of Vibration Dose Values (VDV) which is used to evaluate the cumulative effects of intermittent vibration. As per the recommendations of the NSW DEC Assessing Vibration: A Technical Guideline (2006), the recommended criteria for intermittent vibration are summarized in Table 23.

Table 23 Acceptable vibration dose values for Intermittent Vibration

Location	**Assessment Period***	**Preferred weighted RMS values ($m/s^{1.75}$)**	**Maximum weighted RMS values ($m/s^{1.75}$)**
Intermittent Vibration			
Residences	Daytime (7am to 10pm)	0.20	0.40
	Night-time (10pm to 7am)	0.13	0.26
Offices, Schools, Educational Institutions and Places of Worship	Day or Night-time	0.40	0.80

7.9.2 Structural Damage

Currently there are no Australian Standards specifying the acceptable level of vibration limits for structural integrity due to ground vibration.

7.9.2.1 Cosmetic Damage

Recommended vibration criteria for cosmetic damage are based on the British Standard BS 7385-2:1993 “Evaluation and measurement for vibration in buildings. Guide to damage levels from ground borne vibration” BS 7385-2:1993 recommends the lower value of vibration limits, above which cosmetic damage could occur, presented in Table 24.

Table 24 Recommended transient vibration values for cosmetic damage

Type of Building	**Peak component particle velocity (PPV) in frequency range of predominant pulse**	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial	50mm/s at 4 Hz and above	50mm/s at 4 Hz and above
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20mm/sec at 15 Hz	20mm/s at 15 Hz increasing to 50mm/sec at 40 Hz and above.

The recommended values relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the recommended values in Table 24 may need to be reduced by up to 50 %.

7.9.2.2 Structural Damage

Vibration criteria for structural damage, as recommended in German Standard DIN 4150-Part 3 Effects on Structures, is adopted and recommended for vibration assessment for structural integrity. The DIN 4150 Part 3 prescribes maximum allowable vibration velocities measured at the foundation of the buildings, which do not affect the structural integrity of the buildings. Based on the Standard, the maximum allowable ground vibration velocity deemed acceptable for different types of buildings is shown in Table 25.

Table 25 Guideline values for vibration velocity for evaluating the effects of short-term vibration on structures (DIN 4150)

Type of Structure	Guideline values for $v_{i,max}$ in mm/s				
	Foundation, all directions (i=x,y,z) at a frequency of			Topmost floor, horizontal direction (i=x,y)	Floor Slabs, vertical direction (i=z)
	1 Hz to 10 Hz	10 to 50Hz	50 to 100Hz	All frequencies	All frequencies
Buildings used for commercial purposes, industrial buildings and buildings of similar design (Industrial)	20	20 to 40	40 to 50	40	20
Dwellings and buildings of similar design and/or occupancy (Residential)	5	5 to 15	15 to 20	15	20
Structures that, because of their particular sensitivity to vibration, cannot be classified under the above two classifications and are of great intrinsic value (e.g. listed buildings under preservation order). (Heritage)	3	3 to 8	8 to 10	8	20

8 Acoustic Review and Recommendations

8.1 Operational Noise Assessment – Noise from Indoor Areas

An acoustic assessment is performed in this section to evaluate the indoor activities and determine its impact at nearby noise sensitive receivers. An acoustic model is developed in SoundPLAN 8.2 Noise Modelling Software to assess the noise at nearby noise sensitive receivers which is described in the following sections. CONCAWE Noise Propagation Algorithm in the SoundPLAN was used to perform the noise prediction, with the noise-enhancing meteorological conditions specified in Table D1 of the Noise Policy for Industry (NPI). This is further discussed in the following section.

8.1.1.1 Meteorological Conditions

Certain meteorological/weather conditions may increase noise levels by focusing sound-wave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level), and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receiver. Meteorological conditions need to be considered for both the impact assessment phase (pre-operation) and compliance assessment phase (post-operation) for an industrial activity.

NSW NPI specifies the following two options to consider meteorological effects:

Option 1:

"Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night", OR

Option 2:

"Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment".

Acoustic modelling in this assessment adopted 'Option 1' of the NPI recommended meteorological conditions, which is the Noise-enhancing meteorological conditions, provided in Table 26. This assessment is limited to daytime only as the school operates from 8am to 4pm on Monday to Friday.

Table 26 Noise-enhancing meteorological conditions

Meteorological Conditions	Meteorological Parameters
Noise-enhancing meteorological conditions	▪ Daytime/evening: stability categories A-D with light winds (up to 3m/s at 10m above ground level). ▪ Night-time: stability categories A-D with light winds (up to 3m/s at 10m above ground level) and/or stability category F with winds up to 2m/s at 10m above ground level.

8.1.1.2 Modelling Parameters

Key modelling parameters in SoundPLAN and assumptions relevant to this project are provided in Table 27.

Table 27 SoundPLAN Modelling parameters and assumptions

Modelling Parameters	Modelling Details/Specifications
Ground Absorption	▪ 0.6
Elevation Data	▪ Terrain at the project site is considered to be flat
Meteorological Conditions	▪ Daytime/evening: stability categories A-D with light winds (up to 3m/s at 10m above ground level).
Noise Sensitive Receivers	▪ As described in Section 5
Sound Power Level (L_w of the Noise Sources)	▪ As per Section 8.1.2
Operating Hours	▪ School : 8am to 5pm, Monday to Friday ▪ Sports and Recreation Centre: 7am to 9pm (7 days) ▪ Cultural Centre: 8am to 9pm (7 days)
Height of Receiver	▪ 1.5m above ground level.
Duration of Assessment	▪ 15 min

8.1.2 Sound Power Level of Noise Sources – Indoor Activities

Based on the architectural drawings and discussion with the clients, it is considered that the following activities will be performed (only the noisiest activities are listed) in the proposed buildings. Typical sound power levels of the activities are provided in the table below which are adopted for noise assessment at nearby noise sensitive receivers. All these noise sources listed in the table are included in the SoundPLAN modelling.

Table 28 Proposed activities and sound power levels

Building/Area	Description of Activity	Operating Hours	Days of Operations	Typical Sound Power Level, dB(A)
Admin Building				
The admin building comprises of Principle's office, staff office space, allied health area, meeting rooms, board rooms and uniform store. There is no classroom within this building. Hence, it is considered that the noise within the building would be minimal and impact at nearby residential receivers would be insignificant.				
New Junior School				
Learning Area (Indoor) – Each Classroom	Students (26 Persons) 50% talking simultaneously at normal voice	8am-5pm	Weekdays	77
Collaborative Learning Area (Indoor)	Students (20 Persons) 50% talking simultaneously at normal voice	8am-5pm	Weekdays	76
Sport and Recreation Centre				
Indoor sports (Basketball)	Indoor Sports / Basketball Games (2 games simultaneously)	7am-9pm	Weekdays Afterhours Weekends	99
	240 Spectators (50% cheering)	7am-9pm	Weekdays Afterhours Weekends	95
School Assembly	546 People (500 Students attending assembly with	8am-5pm	Weekdays	103

Building/Area	Description of Activity	Operating Hours	Days of Operations	Typical Sound Power Level, dB(A)
	raised voice) and amplified music			
Fitness Activity (class with amplified music)	Fitness class with 25 Persons raised voice and amplified music	7am-9pm	Afterhours Weekends	94
Cardio and Weights with Music	4 Persons raised voice with amplified music	7am-9pm	Afterhours Weekends	90
Extension to culture and performing centre				
Music Practice	Students performing band music, playing percussion in music practice rooms	8am-9pm	Weekdays Afterhours Weekends	108-113

Octave band spectra of the adopted sound power levels of the above noise sources are provided in Table 29.

Table 29 Octave band spectra of the sound power levels

Activity/ Equipment	Octave Band Frequency (Hz) Sound Power Level, dB								Overall Sound Power Level dB(A)
	63	125	250	500	1000	2000	4000	8000	
Students (26 nos.) – 50% Talking	66	76	77	71	67	63	58	66	77
Students (20 nos.) – 50% Talking	65	74	76	70	66	62	57	65	76
Indoor Sports / Basketball Games (2 games)	79	80	88	94	96	92	87	80	99
240 Spectators (50% Cheering)	85	85	91	94	91	86	81	75	95
546 People (500 Students attending assembly with raised voice) and amplified music	90	89	96	100	99	95	91	88	103
Fitness class with 25 Persons and amplified music	87	86	90	91	89	84	83	82	94
Cardio and Weights with Amplified Music	80	84	86	87	86	81	81	80	90
Drum/Percussions	97	110	109	107	106	103	103	84	113
Music Practice	102	104	104	104	99	99	98	98	108

8.1.3 Predicted Operational Noise Levels – Indoor Activities

A desktop acoustic assessment in SoundPLAN has been performed to predict the sound level of the indoor activities at the nearest noise sensitive receivers. For control of noise emission to the environment, recommendations are provided in Section 9. This assessment has considered the recommended noise control measures in the acoustic modelling.

Two scenarios are modelled in SoundPLAN:

- **Scenario 1: Weekdays School Activities (Indoor)**
  - This scenario includes noise from all indoor activities in the Junior School (P5), Admin Building (P7) and Extension of Music Building (P6).
  - In addition to the above, indoor noise from the Sport and Recreation Centre (P10) has been considered as Basketball Games or School Assembly.
- **Scenario 2: After Hours or Weekend Communal Activities (Indoor)**
  - This scenario excludes all the school activities from other buildings (P5, P6 and P7).
  - This scenario includes indoor activity noise from the Sports and Recreation Centre (P10), either Basketball Games, Gym or Community Fitness Sessions.

The following assumptions were made for assessment of activity noise:

- Junior School (P5)
  - It is understood that the classrooms may be naturally ventilated, with the provision of awning windows at the facade. Considering that the opening area in a typical awning window around the perimeter is generally very small, it is assumed for this acoustic model that 8 sqm of the window areas are open only.
- Admin Building (P7)
  - All doors and windows closed.
- Extension of Music Building (P6)
  - It is assumed that all doors and windows in this building are closed.
  - All the music practice rooms and recording studios within the building are in operation simultaneously.
  - All the music practice rooms and recording studios were modelled as per the design layout.
- Sports and Recreation Centre
  - It was modelled that 3 doors on the western façade were open for ventilation.

Noise from all indoor operational activities within the proposed classrooms, music building and multi-purpose hall are modelled in SoundPLAN. It is considered in the modelling that all the proposed activities listed in Table 28 are performed simultaneously during the whole period of the assessment. For control of noise emission to the environment, recommendations are provided in Section 9. *This modelling has implemented the recommended noise control measures.* The predicted noise levels, with the recommendations implemented, at the nearby noise sensitive receivers are provided in Table 30 to Table 33.

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Table 30 Predicted noise level – School Indoor Activities + Basketball Games + Gym Activities (Weekdays)

Noise Sensitive Receiver	**Predicted Noise Levels, LAeq,15min dB(A)**		**Noise Criteria, $L_{Aeq,15min}$ dB(A)**				**Criteria Satisfied?**	
	School Activities + Basketball Games in the Sports Bldg.		Background + 5 dB(A), $L_{Aeq,15min}$ dB(A)		Project Amenity Noise Level, $L_{Aeq,15min}$ dB(A)		Criteria Satisfied?	
	Day	Eve	Day	Eve	Day	Eve	Day	Eve
R1- Caitlin Cres #5	30	26	47	37	53	43	✓	✓
R2- Caitlin Cres #7	31	25	47	37	53	43	✓	✓
R3- Caitlin Cres #9	37	31	47	37	53	43	✓	✓
R4- Caitlin Cres #11	35	31	47	37	53	43	✓	✓
R5- Caitlin Cres #13	35	28	47	37	53	43	✓	✓
R6- Caitlin Cres #18	32	27	47	37	53	43	✓	✓
R7- Caitlin Cres #20	32	28	47	37	53	43	✓	✓
R8- Caitlin Cres #22	33	29	47	37	53	43	✓	✓
R9- Caitlin Cres #24	33	30	47	37	53	43	✓	✓
R10- Caitlin Cres #26	35	30	47	37	53	43	✓	✓
R11 - Zanthus Dr #24	33	30	46	41	53	43	✓	✓
R12- Zanthus Dr #22	34	31	46	41	53	43	✓	✓
R13- Zanthus Dr #20	37	33	46	41	53	43	✓	✓
R14- Zanthus Dr #18	37	34	46	41	53	43	✓	✓
R15- Zanthus Dr #16	38	34	46	41	53	43	✓	✓
R16- Zanthus Dr #14	43	38	46	41	53	43	✓	✓
R17- Zanthus Dr #12	47	43	46	41	53	43	✓*	✓*
R18- Zanthus Dr #10	44	43	46	41	53	43	✓	✓*
R19- Zanthus Dr #8	40	37	46	41	53	43	✓	✓
R20- Zanthus Dr #6	33	24	46	41	53	43	✓	✓
R21- Zanthus Dr #4	27	24	46	41	53	43	✓	✓
R22- Train St #51	28	24	46	41	53	43	✓	✓
R23- Train St #53	30	27	46	41	53	43	✓	✓
R24- Train St #55	27	24	46	41	53	43	✓	✓

Note:

✓ Predicted noise level is within the Background + 5 dB(A) noise criteria.

✓* Predicted noise level exceeds the Background + 5 dB(A), but it is within the project amenity noise criteria and is considered acceptable.

As per the Noise Policy for Industry, the time period referred here is:

Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and Public Holidays

Evening: 6pm to 10pm

Night: 10pm to 7am.

Table 31 Predicted noise level – School Indoor Activities + School Assembly + Gym Activities (Weekdays)

Noise Sensitive Receiver	**Predicted Noise Levels, LAeq,15min dB(A)**		**Noise Criteria, $L_{Aeq,15min}$ dB(A)**				**Criteria Satisfied?**	
	School Activities + Assembly in the Sports Bldg.		Background + 5 dB(A), $L_{Aeq,15min}$ dB(A)		Project Amenity Noise Level, $L_{Aeq,15min}$ dB(A)		Criteria Satisfied?	
	Day	Eve	Day	Eve	Day	Eve	Day	Eve
R1- Caitlin Cres #5	31	19	47	37	53	43	✓	✓
R2- Caitlin Cres #7	31	19	47	37	53	43	✓	✓
R3- Caitlin Cres #9	37	17	47	37	53	43	✓	✓
R4- Caitlin Cres #11	34	13	47	37	53	43	✓	✓
R5- Caitlin Cres #13	34	12	47	37	53	43	✓	✓
R6- Caitlin Cres #18	30	7	47	37	53	43	✓	✓
R7- Caitlin Cres #20	29	9	47	37	53	43	✓	✓
R8- Caitlin Cres #22	30	9	47	37	53	43	✓	✓
R9- Caitlin Cres #24	29	8	47	37	53	43	✓	✓
R10- Caitlin Cres #26	32	8	47	37	53	43	✓	✓
R11 - Zanthus Dr #24	30	6	46	41	53	43	✓	✓
R12- Zanthus Dr #22	30	7	46	41	53	43	✓	✓
R13- Zanthus Dr #20	34	10	46	41	53	43	✓	✓
R14- Zanthus Dr #18	33	9	46	41	53	43	✓	✓
R15- Zanthus Dr #16	35	12	46	41	53	43	✓	✓
R16- Zanthus Dr #14	41	16	46	41	53	43	✓	✓
R17- Zanthus Dr #12	44	16	46	41	53	43	✓	✓
R18- Zanthus Dr #10	38	13	46	41	53	43	✓	✓
R19- Zanthus Dr #8	39	9	46	41	53	43	✓	✓
R20- Zanthus Dr #6	37	7	46	41	53	43	✓	✓
R21- Zanthus Dr #4	34	5	46	41	53	43	✓	✓
R22- Train St #51	35	5	46	41	53	43	✓	✓
R23- Train St #53	38	5	46	41	53	43	✓	✓
R24- Train St #55	35	5	46	41	53	43	✓	✓

Note:

✓ Predicted noise level is within the Background + 5 dB(A) noise criteria.

✓* Predicted noise level exceeds the Background + 5 dB(A), but it is within the project amenity noise criteria and is considered acceptable.

As per the Noise Policy for Industry, the time period referred here is:

Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and Public Holidays

Evening: 6pm to 10pm

Night: 10pm to 7am.

Table 32 Predicted noise level – Community Activities – Basketball Games (Weekends and Afterhours)

Noise Sensitive Receiver	**Predicted Noise Levels, LAeq,15min dB(A)**		**Noise Criteria, $L_{Aeq,15min}$ dB(A)**				**Criteria Satisfied?**	
	Basketball Games		Background + 5 dB(A), $L_{Aeq,15min}$ dB(A)		Project Amenity Noise Level, $L_{Aeq,15min}$ dB(A)		Criteria Satisfied?	
	Day	Eve	Day	Eve	Day	Eve	Day	Eve
R1- Caitlin Cres #5	17	13	47	37	53	43	✓	✓
R2- Caitlin Cres #7	16	11	47	37	53	43	✓	✓
R3- Caitlin Cres #9	23	22	47	37	53	43	✓	✓
R4- Caitlin Cres #11	22	18	47	37	53	43	✓	✓
R5- Caitlin Cres #13	20	13	47	37	53	43	✓	✓
R6- Caitlin Cres #18	18	9	47	37	53	43	✓	✓
R7- Caitlin Cres #20	18	9	47	37	53	43	✓	✓
R8- Caitlin Cres #22	19	10	47	37	53	43	✓	✓
R9- Caitlin Cres #24	19	11	47	37	53	43	✓	✓
R10- Caitlin Cres #26	20	11	47	37	53	43	✓	✓
R11 - Zanthus Dr #24	17	11	46	41	53	43	✓	✓
R12- Zanthus Dr #22	17	12	46	41	53	43	✓	✓
R13- Zanthus Dr #20	19	13	46	41	53	43	✓	✓
R14- Zanthus Dr #18	19	13	46	41	53	43	✓	✓
R15- Zanthus Dr #16	21	16	46	41	53	43	✓	✓
R16- Zanthus Dr #14	27	23	46	41	53	43	✓	✓
R17- Zanthus Dr #12	29	27	46	41	53	43	✓	✓
R18- Zanthus Dr #10	26	24	46	41	53	43	✓	✓
R19- Zanthus Dr #8	27	25	46	41	53	43	✓	✓
R20- Zanthus Dr #6	25	23	46	41	53	43	✓	✓
R21- Zanthus Dr #4	24	22	46	41	53	43	✓	✓
R22- Train St #51	25	23	46	41	53	43	✓	✓
R23- Train St #53	30	27	46	41	53	43	✓	✓
R24- Train St #55	28	23	46	41	53	43	✓	✓

Note:

✓ Predicted noise level is within the Background + 5 dB(A) noise criteria.

✓* Predicted noise level exceeds the Background + 5 dB(A), but it is within the project amenity noise criteria and is considered acceptable.

As per the Noise Policy for Industry, the time period referred here is:

Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and Public Holidays

Evening: 6pm to 10pm

Night: 10pm to 7am.

Table 33 Predicted noise level – Community Activities – Community Fitness + Gym (Weekends and Afterhours)

Noise Sensitive Receiver	**Predicted Noise Levels, LAeq,15min dB(A)**		**Noise Criteria, $L_{Aeq,15min}$ dB(A)**				**Criteria Satisfied?**	
	Basketball Games		Background + 5 dB(A), $L_{Aeq,15min}$ dB(A)		Project Amenity Noise Level, $L_{Aeq,15min}$ dB(A)		Criteria Satisfied?	
	Day	Eve	Day	Eve	Day	Eve	Day	Eve
R1- Caitlin Cres #5	22	21	47	37	53	43	✓	✓
R2- Caitlin Cres #7	23	21	47	37	53	43	✓	✓
R3- Caitlin Cres #9	32	30	47	37	53	43	✓	✓
R4- Caitlin Cres #11	32	30	47	37	53	43	✓	✓
R5- Caitlin Cres #13	29	28	47	37	53	43	✓	✓
R6- Caitlin Cres #18	28	27	47	37	53	43	✓	✓
R7- Caitlin Cres #20	30	28	47	37	53	43	✓	✓
R8- Caitlin Cres #22	30	29	47	37	53	43	✓	✓
R9- Caitlin Cres #24	31	30	47	37	53	43	✓	✓
R10- Caitlin Cres #26	32	30	47	37	53	43	✓	✓
R11 - Zanthus Dr #24	31	30	46	41	53	43	✓	✓
R12- Zanthus Dr #22	33	31	46	41	53	43	✓	✓
R13- Zanthus Dr #20	34	33	46	41	53	43	✓	✓
R14- Zanthus Dr #18	36	34	46	41	53	43	✓	✓
R15- Zanthus Dr #16	36	34	46	41	53	43	✓	✓
R16- Zanthus Dr #14	39	38	46	41	53	43	✓	✓
R17- Zanthus Dr #12	44	43	46	41	53	43	✓	✓*
R18- Zanthus Dr #10	44	43	46	41	53	43	✓	✓*
R19- Zanthus Dr #8	38	37	46	41	53	43	✓	✓
R20- Zanthus Dr #6	23	21	46	41	53	43	✓	✓
R21- Zanthus Dr #4	24	22	46	41	53	43	✓	✓
R22- Train St #51	21	18	46	41	53	43	✓	✓
R23- Train St #53	26	20	46	41	53	43	✓	✓
R24- Train St #55	26	17	46	41	53	43	✓	✓

Note:

✓ Predicted noise level is within the Background + 5 dB(A) noise criteria.

✓* Predicted noise level exceeds the Background + 5 dB(A), but it is within the project amenity noise criteria and is considered acceptable.

As per the Noise Policy for Industry, the time period referred here is:

Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and Public Holidays

Evening: 6pm to 10pm

Night: 10pm to 7am.

From review of the predicted noise levels, provided in Table 30 and Table 31, at nearby noise sensitive receivers it can be concluded that the predicted school activity noise levels (indoor, daytime weekdays) are all well within the recommended noise criteria. However, it is understood that the acoustic prediction considered all sources of noise were active simultaneously during the assessment which results in worst-case noise scenario prediction. In reality it may not be the case, provided the design recommendations are adopted and an appropriate noise management plan is in place to manage noise in the school. The predicted results are therefore considered to be conservative.

In addition, it is also found from Table 32 and Table 33 that the communal noise levels are also within the recommended criteria during the weekends and after hours. However, it is advised that care must be taken during the afterhours and weekends to keep the noise to a minimum at indoor and surrounds. Therefore, with the recommendations provided in Section 9 being implemented, it is predicted that the project would satisfy the environmental noise requirements.

8.1.4 Sleep Disturbance – Classroom and Outdoor Learning Areas Activities

As the proposed operating hours of the school facility is from 8am to 5pm on Monday to Friday, it is considered that the indoor school activities at the proposed building would not cause any sleep disturbance to the residents at nearby noise sensitive receivers.

In additional, community activities may occur during after-hours (up to 9pm) on all days. Provided the recommendations are implemented, it is predicted that the communal activities at the proposed buildings would not cause any sleep disturbance to the residents at nearby noise sensitive receivers. As noted earlier, it is advised that care must be taken during the afterhours and weekends to keep the noise to a minimum at indoor and surrounds. In addition, school should have an appropriate noise management plan in place to manage noise due to activities within the school premises.

8.2 Mechanical Equipment Noise Emission (to Outdoor) Assessment

An acoustic assessment is performed in this section to evaluate the mechanical plant and equipment noise associated with the proposed development and assess its impact at nearby noise sensitive receivers. An acoustic model is developed in SoundPLAN to assess the noise at nearby noise sensitive receivers which is described in the following sections.

8.2.1 Sound Power Level of Noise Sources – Mechanical Equipment

The following mechanical plant and equipment, listed in Table 34, are proposed for the development. The assessment is based on the following information provided by ACOR Mechanical Design Team involved in the project.

Table 34 Sound power levels of the proposed mechanical plant/equipment

Equipment	Model Number	Octave – Band Centre Frequencies (Hz) Sound Power Level, dB								Overall Sound Power Level, L_w, dB(A)
		63	125	250	500	1000	2000	4000	8000	
Outdoor AC Unit – Cultural Centre	REYQ12BYM	83	84	78	79	73	71	68	62	80
Outdoor AC Unit – Junior School	REYQ34BYM (REYQ20BYM + REYQ14BYM)	97	98	93	87	83	77	71	64	90
Outdoor AC Unit – Community Hub	REYQ22BYM	85	86	82	81	75	72	69	62	82
Outdoor AC Unit – Gym	REYQ40BYM (REYQ20BYM + REYQ20BYM)	99	100	96	89	85	79	73	66	92

Number of mechanical equipment and its location at the different buildings are shown in the mechanical design drawings. These are included in Appendix D

8.2.2 Acoustic Modelling – Mechanical Equipment Noise Emission

An acoustic model was developed using SoundPLAN 8.2 Noise Modelling Software to predict the mechanical equipment noise associated with the proposed development to the noise sensitive areas. CONCAWE Noise Propagation Algorithm in the SoundPLAN was used to perform the noise prediction, with the noise-enhancing meteorological conditions specified in Table D1 of the Noise Policy for Industry (NPI). This is further discussed in the following section.

8.2.2.1 Meteorological Conditions

Meteorological conditions as described in Section 8.1.1.1 are also adopted for this modelling.

8.2.2.2 Modelling Parameters

Key modelling parameters in SoundPLAN and assumptions relevant to this project are provided in Table 35.

Table 35 SoundPLAN Modelling parameters and assumptions

Modelling Parameters	Modelling Details/Specifications
Ground Absorption	▪ 0.6
Elevation Data	▪ Terrain at the project site is considered to be flat
Meteorological Conditions	▪ Daytime/evening: stability categories A-D with light winds (up to 3m/s at 10m above ground level).
Noise Sensitive Receivers	▪ As described in Section 5
Sound Power Level (L_w of the Noise Sources)	▪ As per Section 8.2.1
Operating Hours	▪ School : 8am to 5pm, Monday to Friday ▪ Communal Activities: up to 9pm (7 days) ▪ No mechanical plant/equipment running after 9pm on any day.
Height of Receiver	▪ 1.5m above ground level.
Duration of Assessment	▪ 15 min

8.2.3 Predicted Operational Noise Levels – Mechanical Equipment Noise Emission

Noise from all mechanical equipment associated with the proposed development are modelled in SoundPLAN. It is considered in the modelling that all the mechanical equipment is operating at full capacity simultaneously during the whole assessment period. For control of noise emission to the environment, recommendations are provided in Section 9. This modelling has implemented the recommended noise control measures. The predicted noise levels, with the recommendations implemented, at the nearby noise sensitive receivers are provided in Table 36.

Table 36 Predicted noise from mechanical equipment associated with the project

Noise Sensitive Receiver	**Predicted Noise Levels, LAeq,15min dB(A)**		**Noise Criteria, LAeq,15min dB(A)**		**Criteria Satisfied?**	
	Noise from Mechanical Plant and Equipment		Project Noise Trigger Level dB(A), LAeq,15min dB(A)		Criteria Satisfied?	
	Day	Eve	Day	Eve	Day	Eve
R1- Caitlin Cres #5	37	33	47	37	✓	✓
R2- Caitlin Cres #7	37	33	47	37	✓	✓
R3- Caitlin Cres #9	39	33	47	37	✓	✓
R4- Caitlin Cres #11	40	30	47	37	✓	✓
R5- Caitlin Cres #13	40	31	47	37	✓	✓
R6- Caitlin Cres #18	41	27	47	37	✓	✓
R7- Caitlin Cres #20	40	28	47	37	✓	✓
R8- Caitlin Cres #22	41	27	47	37	✓	✓
R9- Caitlin Cres #24	42	26	47	37	✓	✓
R10- Caitlin Cres #26	42	28	47	37	✓	✓
R11 - Zanthus Dr #24	39	22	46	41	✓	✓
R12- Zanthus Dr #22	37	24	46	41	✓	✓
R13- Zanthus Dr #20	39	25	46	41	✓	✓
R14- Zanthus Dr #18	38	25	46	41	✓	✓
R15- Zanthus Dr #16	37	26	46	41	✓	✓
R16- Zanthus Dr #14	39	27	46	41	✓	✓
R17- Zanthus Dr #12	37	29	46	41	✓	✓
R18- Zanthus Dr #10	37	32	46	41	✓	✓
R19- Zanthus Dr #8	39	38	46	41	✓	✓
R20- Zanthus Dr #6	36	33	46	41	✓	✓
R21- Zanthus Dr #4	34	27	46	41	✓	✓
R22- Train St #51	34	24	46	41	✓	✓
R23- Train St #53	33	24	46	41	✓	✓
R24- Train St #55	32	20	46	41	✓	✓
Note: ✓ Predicted noise level is within the noise criteria.						
As per the Noise Policy for Industry, the time period referred here is: Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and Public Holidays						

Noise Sensitive Receiver	Predicted Noise Levels, LAeq,15min dB(A)		Noise Criteria, LAeq,15min dB(A)		Criteria Satisfied?	
	Noise from Mechanical Plant and Equipment		Project Noise Trigger Level dB(A), LAeq,15min dB(A)		Criteria Satisfied?	
	Day	Eve	Day	Eve	Day	Eve
Evening: 6pm to 10pm Night: 10pm to 7am.						

It is noted from Table 36 that the mechanical plant/equipment predicted noise levels at the nearby noise sensitive receivers comply with the NPI recommended noise trigger levels. Noted that the above predictions are considering that all equipment are running in full operations simultaneously, which may not be the case in reality. Therefore, it is considered that the predicted noise levels at all nearby noise sensitive receivers are likely to satisfy the Project Noise trigger Levels, provided the recommendations in Section 9 are implemented.

8.2.4 Sleep Disturbance

As the proposed operating hours of the school facilities are from 8am to 5pm on Monday to Friday, the operation of the proposed facility is considered not to cause any sleep disturbance to nearby noise sensitive receivers. The proposed cultural centre would be operating between 8am and 9pm (7 days) and the proposed sports centre and Gym would be operating between 7am and 9pm (7 days). The predicted noise levels are also found to be within the noise criteria during the after hours, both in terms of the project noise trigger level and the sleep disturbance criteria. Therefore, provided that the noise control recommendations in Section 9 are implemented, it is predicted that the noise from the proposed development is unlikely to cause any sleep disturbance to residents at nearby dwellings.

However, it is advised that care must be taken during the afterhours and weekends to keep the noise to a minimum at indoor and surrounds. An appropriate noise management plan should be in place to manage noise associated with the operation of the mechanical plant within the school premises.

8.3 Noise from Outdoor Play Areas

Additional school students due to the proposed development will typically use the school's current outdoor playground. This is unlikely to influence/increase the current ambient noise environment of the school during outdoor activities hours (i.e. lunch, recess or outdoor games). Hence, it is considered that noise from outdoor play areas due to additional students is unlikely to cause any significant noise impact at the nearby noise sensitive receivers.

8.4 Noise from Carpark Activities and Traffic Generation by the Proposed Development

Based on the information provided in the traffic report, high-level SoundPLAN assessment of existing and proposed carparks was performed to determine the acoustic impact of the carpark additions to the campus. Peak traffic hours of 8:15-9:15am and 2:30-3:30pm were used in the assessment, as per the Statement of Environmental Effects Report.

Carpark P13 and P4: The proposed new permanent staff carpark (P13) would be located at the western boundary of the school, which would be accessed by the current main entrance of the school. Currently, the staff parking area accommodates approximately 30 cars. The proposed carpark would accommodate 55 cars. Therefore, there is only an addition of 26 parking bays. Noted that this is for staff only and be operated during school hours.

The visitor carpark (P4) on the southern boundary currently accommodates 76 cars, and the proposed extension to P4 would accommodate an extra 19 cars, for a total of 95. The carpark would be operating during the typical school hours. In addition, it would also be used for the Sports Building during weekends and afterhours.

Based on the SoundPLAN model of the existing parking movements and proposed parking movements as per above during the peak hours, it is predicted that the increase in noise levels at nearby noise sensitive receiver would be a maximum of 1.6 dB(A). This is considered not a significant increase and would be considered acceptable as an increase of noise level of 2 dB(A) would be hardly perceived by a typical healthy person.

In addition to the above, the proposed new parking area P13 will be accessed by the existing main entrance area which is located near the corner of George Bass Drive and Train Street, therefore no considerable traffic would be generated at the local roads due to the proposed developments. On this basis, it is considered that traffic noise generation from the development is unlikely to increase the existing noise levels considerably. Therefore, it is considered to meet the NSW Road Noise Policy (RNP) criteria of a development not increasing existing traffic noise levels by more than 2 dB(A).

Carpark P11: The proposed new carpark at the northern end of the campus (P11) would hold 26 cars and would be operated during typical school hours. Based on the SoundPLAN model of the proposed parking movements during the peak hours, it is predicted that the noise level at nearby noise sensitive receiver would range from 32 dB(A) to 45 dB(A) at locations ranging from 5 Caitlin Crescent to 14 Zanthrus Drive, which are within the NPI recommended Project Noise Trigger Level. Noted that this carpark would be used for students only and will be operated between 8am to 5pm (daytime). Therefore, it is considered that the predicted noise levels at the nearby noise sensitive receivers are acceptable.

8.5 Indoor Noise Level – Department of Education Guideline (DG11)

The NSW Department of Education Design Guideline for Acoustics states that road noise for general learning areas, music, drama, movement studios and halls shall be assessed consistently with the requirements of State Environmental Planning Policy (Infrastructure) 2007 (SEPP) - regulation 102. An assessment should be undertaken where directed for any site impacted by traffic noise. Generally, it is recommended for all sites impacted by noise from roads with greater than 20,000 vehicles AADT and required for all sites impacted by noise from roads with greater than 40,000 vehicles AADT. The guideline internal noise levels presented in Acoustic Performance Guidelines (section11.06) is to be used in the assessment.

Clause 102 of SEPP applies to an educational establishment or centre-based childcare facility development that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW).

It is understood that the project site is located approximately 180m to the east of George Bass Drive, which carries approximately 6,500 Vehicle/day. The speed limit at George Bass Drive is 80km/hr. As the traffic volume is considerably lower than what is specified in the SEPP, a noise intrusion assessment is not required for the proposed development.

However, attended and unattended traffic noise measurements were performed at the site, and the results are provided in Section 6. Based on the measured noise levels, it was determined that the façade noise levels at the subject buildings ranges between 63 and 66 dB(A). Façade construction for each of the proposed buildings are provided in Section 9. It is predicted that the design indoor sound level would be achieved provided that the recommendations in Section 9 are implemented.

9 Acoustic Design Review and Noise Control Recommendations

The acoustic assessment (sound insulation rating) of the internal and external walls are based on the manufacturer's specification, test data, available literature and acoustic predictions. Noted that accuracy of software prediction for air-borne sound insulation performance of wall is typically ±3 dB.

9.1 Junior School (P5)

9.1.1 External Walls

Proposed external Façade walls are shown in Figure 11.

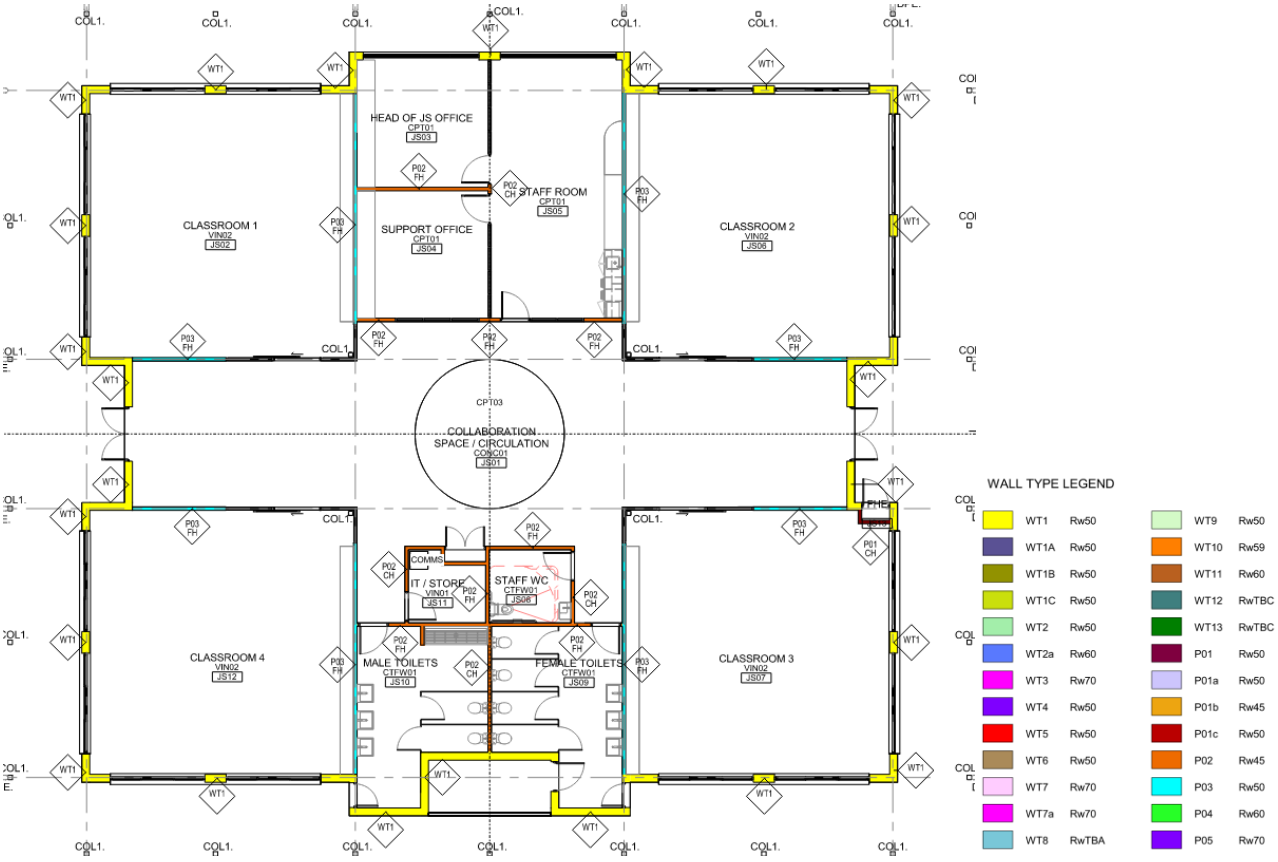
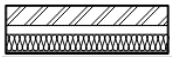
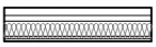
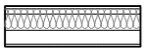


Figure 11 Proposed exterior wall construction for Junior School Building

Acoustic review of the external wall is completed, a summary of recommendations and findings in relation to compliance with design criteria is provided in Table 37 below.

Table 37 Acoustic review of proposed external wall for Junior School Building

Wall Type	Plan View	Description of Wall Construction	Acoustic Criteria	Satisfy Criteria?	Notes/ Comments / Upgrades Recommended
WT1		EXTERNAL FACE BRICK VENEER WALL 110mm FACE BRICK 50mm CAVITY 92mm STEEL STUD WORK WITH 90mm THICK 14kg/m³ FIBREGLASS R2.5 INSULATION 13mm PLASTERBOARD LINING *AQUACHEK PLASTERBOARD REQUIRED TO WET AREAS	R_w 50	Yes	
WT5 / WT5a		EXTERNAL WALL WITH VERTICAL METAL CLADDING 48mm METAL CLADDING 35mm 35 x 35mm BATTENS 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 2 x 16mm FIRE RATED PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER) *CHANGE TO 150mm SHS STEEL WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 AND 77mm SUB-FRAME/PACKER TO SUIT OVERALL WIDTH	R_w 50	Yes	Not shown on the wall set-out plan, however, included in the wall schedule

Wall Type	Plan View	Description of Wall Construction	Acoustic Criteria	Satisfy Criteria?	Notes/ Comments / Upgrades Recommended
WT9		EXTERNAL WALL WITH FC CLADDING 18mm COMPRESSED FC CLADDING (SURFACE DENSITY 33kg/m³) 35mm 35 x 35mm BATTENS 107mm SUB FRAME / PACKER TO ALIGN 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 16mm FYRECHECK PLASTERBOARD LINING	R_w 50	Yes	Not shown on the wall set-out plan, however, included in the wall schedule

9.1.2 External Glazing

Façade glazing schedule was not available in the architectural design documentation. However, based on the measured noise levels on site, façade glazing criteria and recommended construction are provided in Table 38. The following glazing recommendations should be adopted for external glazed façade construction.

Table 38 Recommended Façade Glazing

Description of Façade	Acoustic Requirement	Recommended Glazing Construction
All Facade	R_w (C, Ctr) 38 (-2,-5)	Viridian 6mm VFloat, 12mm air gap and 6.5mm Viridian Hush

All glazing should be installed with appropriate acoustic seals. Mohair Seals are not considered suitable where acoustic glazing is recommended. Recommended acoustic seals are as follows:

- Schlegel Q-Lon
- Raven

9.1.3 External Door

External door schedule was not available in the architectural design documentation. However, based on the measured noise levels on site, recommended construction for the external doors are provided in Table 39.

Table 39 Recommended External Door Construction

R_w Rating	Door Type	Door Seals
R_w 38-40	▪ Proprietary Acoustic Door ▪ 48mm thick Single Leaf proprietary acoustic door ▪ Recommended door is Pyropanel AS-Special-A1 ▪ Doors are supplied as a set including frame, hardware and seals. The system is tested to R_w 42	▪ Acoustic doors rated no less than Rw42 based on laboratory test. Doors are supplied as a set including door, frame, hardware and seals. Example of suitable door would be Pyropanel AS-Special-A1
	▪ 12.5mm Laminated Glazed Door	▪ As per manufacturer's specification

All doors that are incorporated into partitions that have been assigned a sound insulation rating will need to be fitted with acoustic seals to all sides of the frame and the bottom of the door to ensure that the door provides a suitable level of sound insulation.

- Transfer grilles or undercuts must not be supplied to any sound insulating door set;
- The door sets must meet all necessary fire precaution requirements without compromising the sound insulation performance. All fittings (e.g. physical security, acoustics, fire, smoke) must be fully coordinated before procurement;

- Timber doors should be specified as solid-core doors.
- Where frames for sound insulating door sets are built into the wall, resilient acoustic sealant must be used to seal all joints between the wall and frame;
- Door frames must be structurally designed and reinforced as required to accommodate the heavy weight of acoustically rated doors;
- Door wall frames for ≥R_w 40 doors should be appropriately filled with mass or acoustic insulation. It is our recommendation to use steel frames rather than timber, as they are more reliable to achieve acoustic ratings within door sets.
- Double leaf doors must have seals installed to the meeting stile of the doors.
- Bottom seals should always be specified as drop down seals to ensure that the seal is not subjected to fatigue by rubbing against the floor when opening/closing.
- Doors must not be undercut nor have air relief door grilles in them, as this will severely compromise the acoustic integrity of the door assembly.

9.1.4 Roof

Proposed roof ceiling construction for this building is provided in the image below.

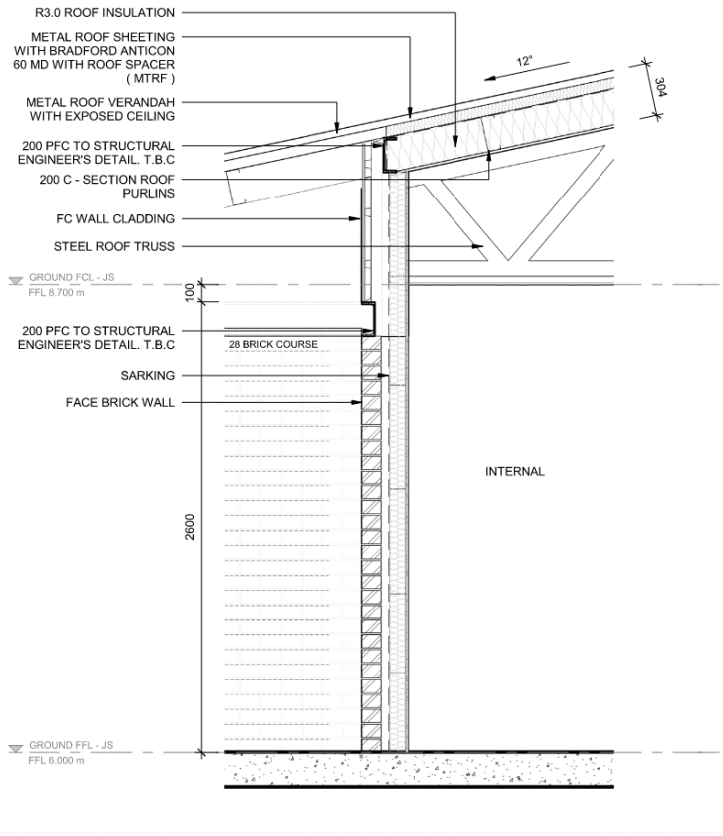


Figure 12 Proposed roof construction

Based on the review, it is recommended that the following should be incorporated into the section details:

- Insulation in the ceiling cavity (above ceiling) should be minimum 120mm thick, 30kg/m^3 glasswool or fibreglass acoustic insulation in the ceiling cavity.

- Ceiling should comprise of 1 layer of 19mm Mineral fibre ceiling tile (NRC 0.7 and CAC 39/40) to underside of the truss using resilient furring channel (e.g. Rondo 581 or equivalent).
- Where acoustic ceiling is not used/applicable, it is recommended to use 13mm Standard Plasterboard.

9.2 Cultural Centre Extension (P6)

9.2.1 External Walls

Proposed external Façade walls are shown in Figure 13.

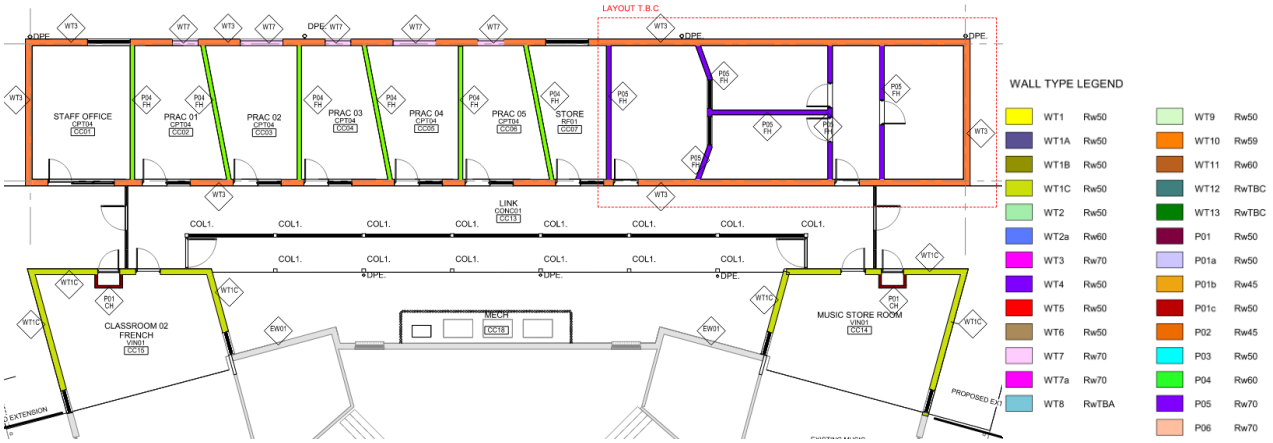
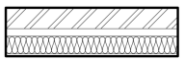
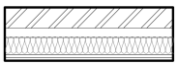
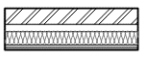
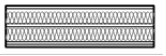
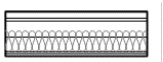


Figure 13 Proposed exterior wall construction for Cultural Centre Extension Building

Acoustic review of the external wall is completed, a summary of recommendations and findings in relation to compliance with design criteria is provided in Table 40 below.

Table 40 Acoustic review of proposed external wall for cultural centre extension building

Wall Type	Plan View	Description of Wall Construction	Acoustic Criteria	Satisfy Criteria?	Notes/ Comments / Upgrades Recommended
WT1C		EXTERNAL FACE BRICK VENEER WALL TO MATCH EXISITNG WALL STRUCTURE THICKNESS 110mm FACE BRICK 40mm CAVITY COS (MATCH EXISTING ADJACENT WALL) 92mm STEEL STUD WORK WITH 75mm THICK 14kg/m³ FIBREGLASS INSULATION 13mm PLASTERBOARD LINING *AQUACHEK PLASTERBOARD REQUIRED TO WET AREAS	R_w 50	Yes	-
WT3		EXTERNAL FACE BRICK VENEER WALL 110mm FACE BRICK 50 mm CAVITY 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 2 x 16mm FIRE RATED PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER)	R_w 70 $R_w + C_{tr}$ 65	Yes	
WT3A		110mm FACE BRICK 50 mm CAVITY 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 2 x 16mm SOUNDCHECK PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER)	R_w 70 $R_w + C_{tr}$ 65	Yes	
WT7		EXTERNAL WALL WITH FC CLADDING 18mm COMPRESSED FC CLADDING (SURFACE DENSITY 33kg/m³) 92mm STEEL STUD (bmt 0.55) WITH 75mm THICK 14kg/m³ FIBREGLASS R2.5 INSULATION 20mm AIRGAP 92mm STEEL STUD (bmt 0.55) WITH 75mm THICK 14kg/m³ FIBREGLASS R2.5 INSULATION 16mm FC CLADDING (SURFACE DENSITY 33.8 kg/m3 16mm PLASTERBOARD LINING (MIN 12.kg/m²)	R_w 70 $R_w + C_{tr}$ 65	Yes	Note that 16mm PB should be 16mm Fire-rated PB.
WT7A		EXTERNAL WALL WITH FC CLADDING 41mm METAL CLADDING 18mm COMPRESSED FC CLADDING (SURFACE DENSITY 33kg/m³) 101mm CAVITY 92mm STEEL STUD (bmt 0.55) WITH 130mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 16mm CFC CLADDING (SURFACE DENSITY 22.6 kg/m3 16mm FYRECHECK PLASTERBOARD LINING (MIN 12.5kg/m²)	R_w 70 $R_w + C_{tr}$ 65	Yes	

9.2.2 External Glazing

Façade glazing schedule was not available in the architectural design documentation. However, based on the measured noise levels on site, façade glazing criteria and recommended construction are provided in Table 41. The following glazing recommendations should be adopted for external glazed façade construction.

Table 41 Recommended Façade Glazing

Description of Façade	Acoustic Requirement	Recommended Glazing Construction
All Façade – Practice Rooms	$R_w + C_{tr}$ 44	Oceania 12.5mm Hush-12mm Gap-16.5mm Hush double glazing unit
Corridor Glazed Wall – Facing the Mechanical Plant Area	R_w 40 or better	▪ Single Glazing: Viridian 12.5mm Hush laminated glass, OR ▪ Double Glazing System (DGU): 8mm Vfloat, 16mm Gap and 10.5mm Hush

All glazing should be installed with appropriate acoustic seals. Mohair Seals are not considered suitable where acoustic glazing is recommended. Recommended acoustic seals are as follows:

- Schlegel Q-Lon
- Raven

It is recommended that glazing should be minimised, possibly avoided, on the northern façade wall. This is firstly, due to the close proximity of the noise sensitive receivers to the proposed building and secondly, to avoid sound reflection which may impact the sound quality within the music rooms and recording studios.

9.2.3 External Door (Corridor Only)

External door schedule was not available in the architectural design documentation. However, based on the measured noise levels on site, recommended construction for the external doors are provided in Table 42.

Table 42 Recommended External Door Construction

R_w Rating	Door Type	Door Seals
R_w 38-40	48mm Acoustic Door	▪ Acoustic doors rated no less than R_w 44 based on laboratory test. Doors are supplied as a set including door, frame, hardware and seals. Example of suitable door would be Pyropanel AS-Special-A1
	12.5mm Vlam Hush laminated glass (by Viridian)	▪ As per manufacturer's specification

All doors that are incorporated into partitions that have been assigned a sound insulation rating will need to be fitted with acoustic seals to all sides of the frame and the bottom of the door to ensure that the door provides a suitable level of sound insulation.

- Timber doors should be specified as solid-core doors.
- Double leaf doors must have seals installed to the meeting stile of the doors.
- Bottom seals should always be specified as drop down seals to ensure that the seal is not subjected to fatigue by rubbing against the floor when opening/closing.

- Doors must not be undercut nor have air relief door grilles in them, as this will severely compromise the acoustic integrity of the door assembly.
- Sliding doors should be avoided where a high level of sound isolation is required.

9.2.4 Roof

Proposed roof construction is provided in Figure 14 below.

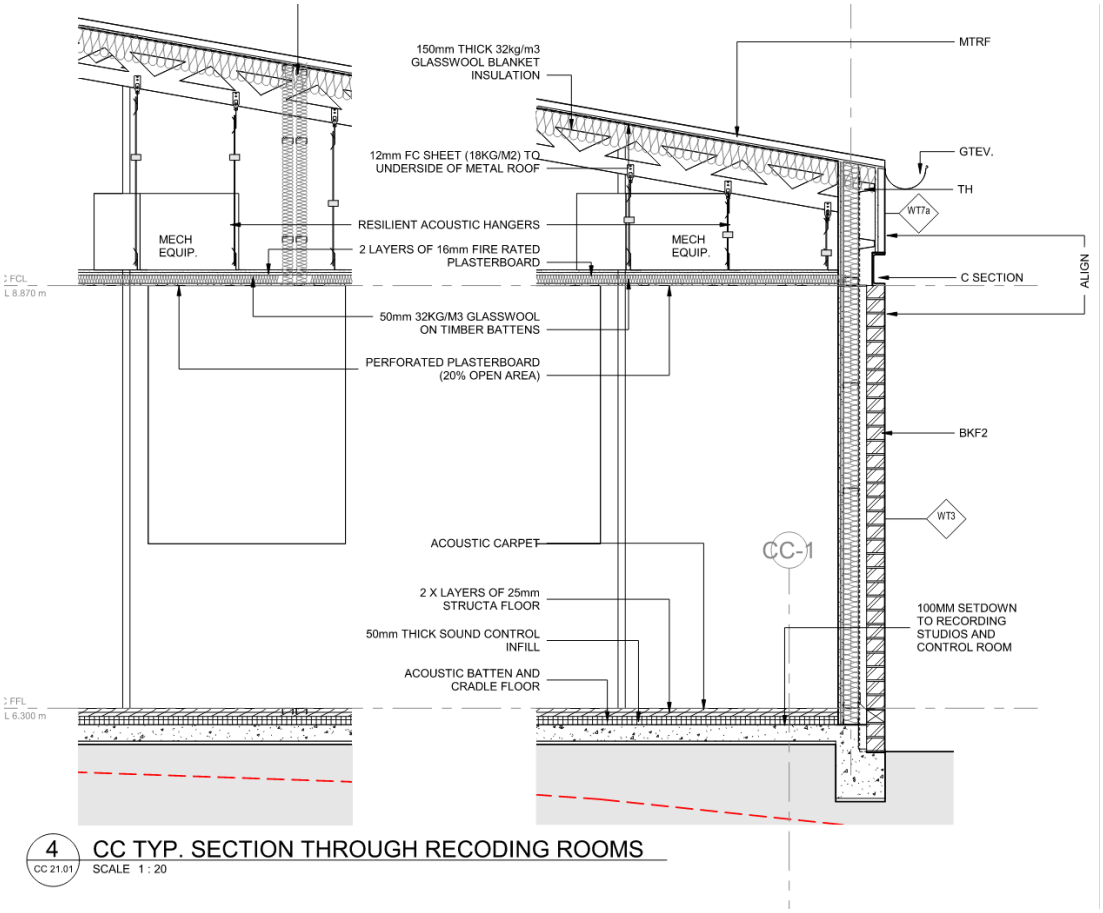


Figure 14 Proposed roof construction

Following recommendations are provided to update the roof-ceiling section:

- 2 x 16mm fire rated flush plasterboard should be fixed to the underside of the purlins using resilient rail (i.e. Rondo 581) or Acoustic Hangers.
- Refer to internal finishes recommendations for recommendations on the internal ceiling types.

Note – Mechanical services must be located within the ceiling space, therefore the height may vary based on building service requirements.

9.3 Admin Building / Community Hub (P7)

9.3.1 External Walls

Proposed external Façade walls are shown in Figure 15.

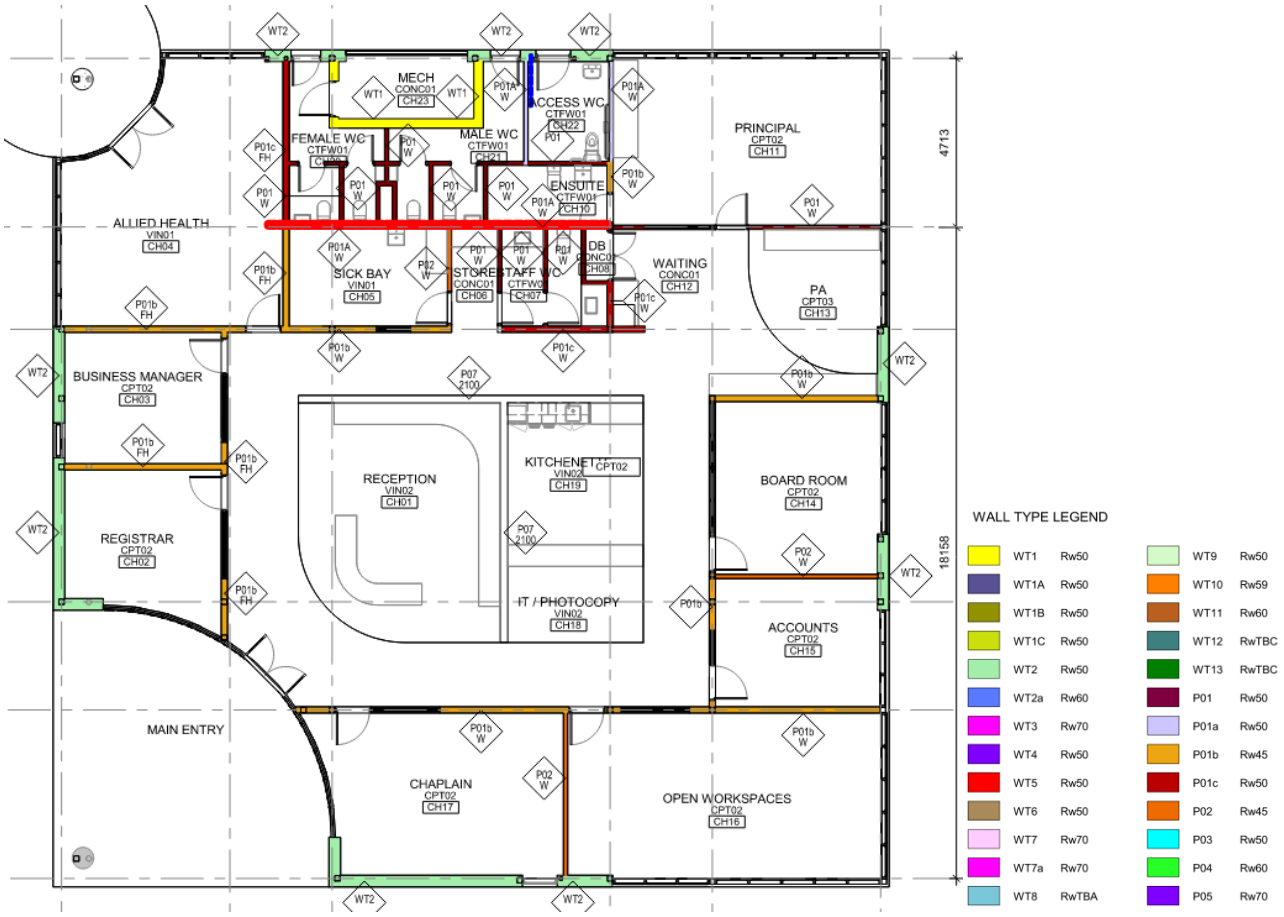
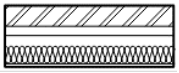
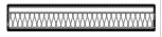
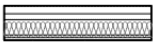


Figure 15 Proposed exterior wall construction for Admin Building

Acoustic review of the external wall is completed, a summary of recommendations and findings in relation to compliance with design criteria is provided in Table 43 below.

Table 43 Acoustic review of proposed external wall for admin building

Wall Type	Plan View	Description of Wall Construction	Acoustic Criteria	Satisfy Criteria?	Notes/ Comments / Upgrades Recommended
WT2		EXTERNAL FACE BRICK VENEER WALL (150 STUDS) 110mm FACE BRICK 50mm CAVITY 150mm STEEL STUD WORK WITH 90mm THICK 14kg/m3 FIBREGLASS R2.5 INSULATION 16mm FIRE RATED PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER)	R_w 50	Yes	
WT6		EXTERNAL WALL WITH FC CLADDING 18mm COMPRESSED FC CLADDING (SURFACE DENSITY 33kg/m³) 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 16mm FIRE RATED PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER)	R_w 50	Yes	Not shown on the wall set-out plan, however, included in the wall schedule
WT5 / WT5a		EXTERNAL WALL WITH VERTICAL METAL CLADDING 48mm METAL CLADDING 35mm 35 x 35mm BATTENS 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 2 x 16mm FIRE RATED PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER) *CHANGE TO 150mm SHS STEEL WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 AND 77mm SUB-FRAME/PACKER TO SUIT OVERALL WIDTH	R_w 50	Yes	Not shown on the wall set-out plan, however, included in the wall schedule

9.3.2 External Glazing

Façade glazing schedule was not available in the architectural design documentation. However, based on the measured noise levels on site, façade glazing criteria and recommended construction are provided in Table 44. The following glazing recommendations should be adopted for external glazed façade construction.

Table 44 Recommended Façade Glazing

Description of Façade	Acoustic Requirement	Recommended Glazing Construction
All Facade	R_w (C, Ctr) 38 (-2,-5)	Viridian 6mm Vfloat, 12mm air gap and 6.5mm Viridian Hush

All glazing should be installed with appropriate acoustic seals. Mohair Seals are not considered suitable where acoustic glazing is recommended. Recommended acoustic seals are as follows:

- Schlegel Q-Lon
- Raven

9.3.3 External Door

External door schedule was not available in the architectural design documentation. However, based on the measured noise levels on site, recommended construction for the external doors are provided in Table 45.

Table 45 Recommended External Door Construction

R_w Rating	Door Type	Door Seals
R_w 38-40	▪ Proprietary Acoustic Door ▪ 48mm thick Single Leaf proprietary acoustic door ▪ Recommended door is Pyropanel AS-Special-A1 ▪ Doors are supplied as a set including frame, hardware and seals. The system is tested to R_w 42	▪ Acoustic doors rated no less than Rw42 based on laboratory test. Doors are supplied as a set including door, frame, hardware and seals. Example of suitable door would be Pyropanel AS-Special-A1
	▪ 12.5mm Laminated Glazed door	▪ As per manufacturer's specification

All doors that are incorporated into partitions that have been assigned a sound insulation rating will need to be fitted with acoustic seals to all sides of the frame and the bottom of the door to ensure that the door provides a suitable level of sound insulation.

- Transfer grilles or undercuts must not be supplied to any sound insulating door set.
- The door sets must meet all necessary fire precaution requirements without compromising the sound insulation performance. All fittings (e.g., physical security, acoustics, fire, smoke) must be fully coordinated before procurement.
- Timber doors should be specified as solid-core doors.
- Where frames for sound insulating door sets are built into the wall, resilient acoustic sealant must be used to seal all joints between the wall and frame.
- Door frames must be structurally designed and reinforced as required to accommodate the heavy weight of acoustically rated doors.

- Door wall frames for ≥R_w 40 doors should be appropriately filled with mass or acoustic insulation. It is our recommendation to use steel frames rather than timber, as they are more reliable to achieve acoustic ratings within door sets.
- Double leaf doors must have seals installed to the meeting stile of the doors.
- Bottom seals should always be specified as drop down seals to ensure that the seal is not subjected to fatigue by rubbing against the floor when opening/closing.
- Doors must not be undercut nor have air relief door grilles in them, as this will severely compromise the acoustic integrity of the door assembly.

9.3.4 Roof

Recommended roof-ceiling constructions to achieve the nominated internal noise criteria are provided below.

Table 46 Recommended roof-ceiling construction

Roof Type	Roof Construction	Recommended Acoustic Rating, R_w
Metal Roof	▪ Profiled steel sheet (0.6mm) roofing ▪ Minimum 200mm Timber or Steel Purlin or metal truss. ▪ Bradform Anticon 60 MD or similar over the roof purlin. ▪ Minimum 120mm thick, 30kg/m^3 glasswool or fibreglass acoustic insulation in the ceiling cavity. ▪ Install 1 layer of 19mm Mineral fibre ceiling tile (NRC 0.7 and CAC 40) to underside of the truss using resilient furring channel (e.g. Rondo 581 or equivalent).	44

9.4 Multipurpose Hall / Gymnasium (P10)

It is noted that all activities within the Multipurpose Hall/Gymnasium will contain within the building and there would be no windows/door open that may cause flanking noise transmission to the neighbouring residents.

9.4.1 External Walls

Proposed external Façade walls are shown in Figure 16 and Figure 17.

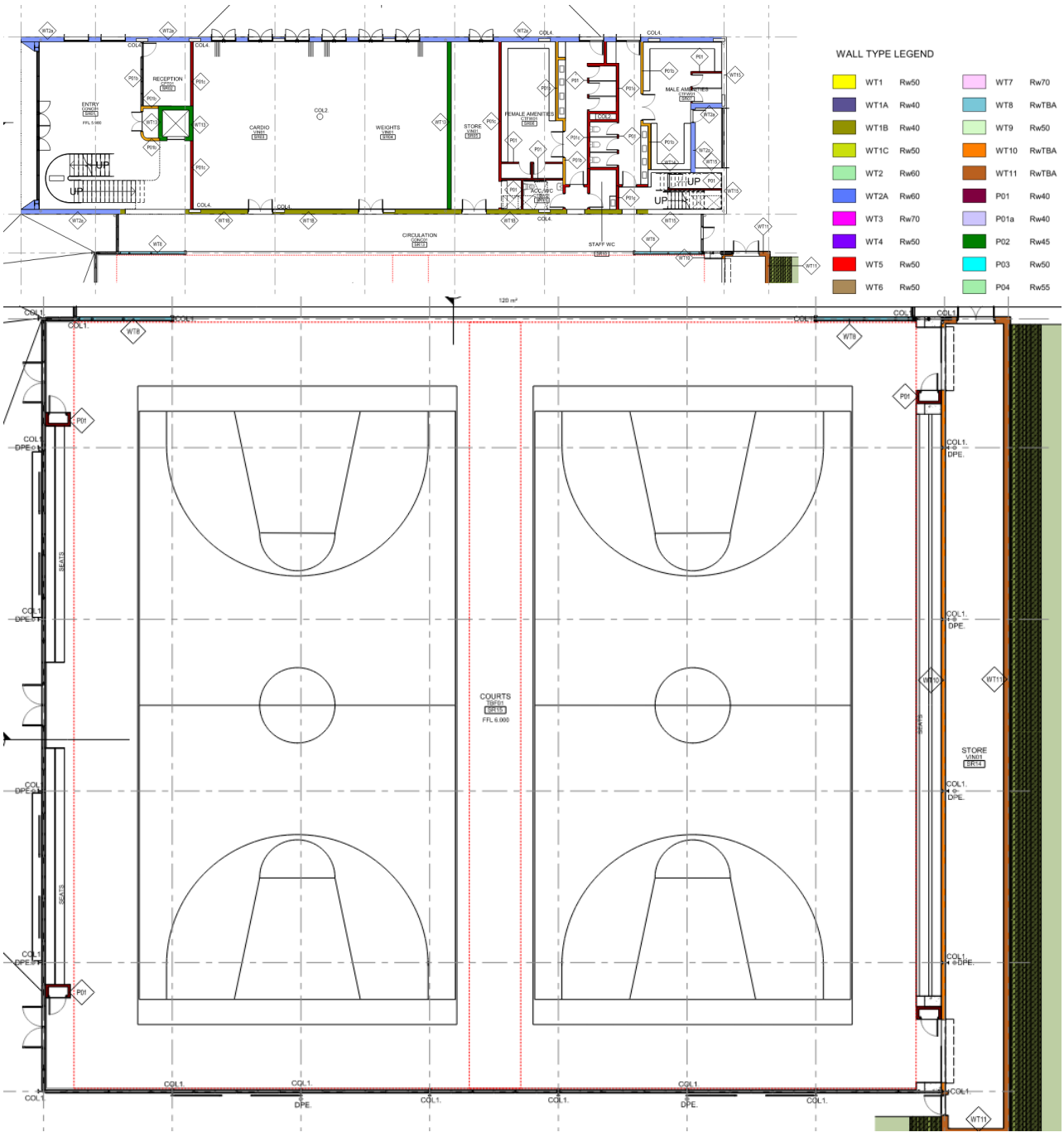


Figure 16 Proposed exterior wall construction for Multipurpose Hall / Gymnasium – Ground Floor

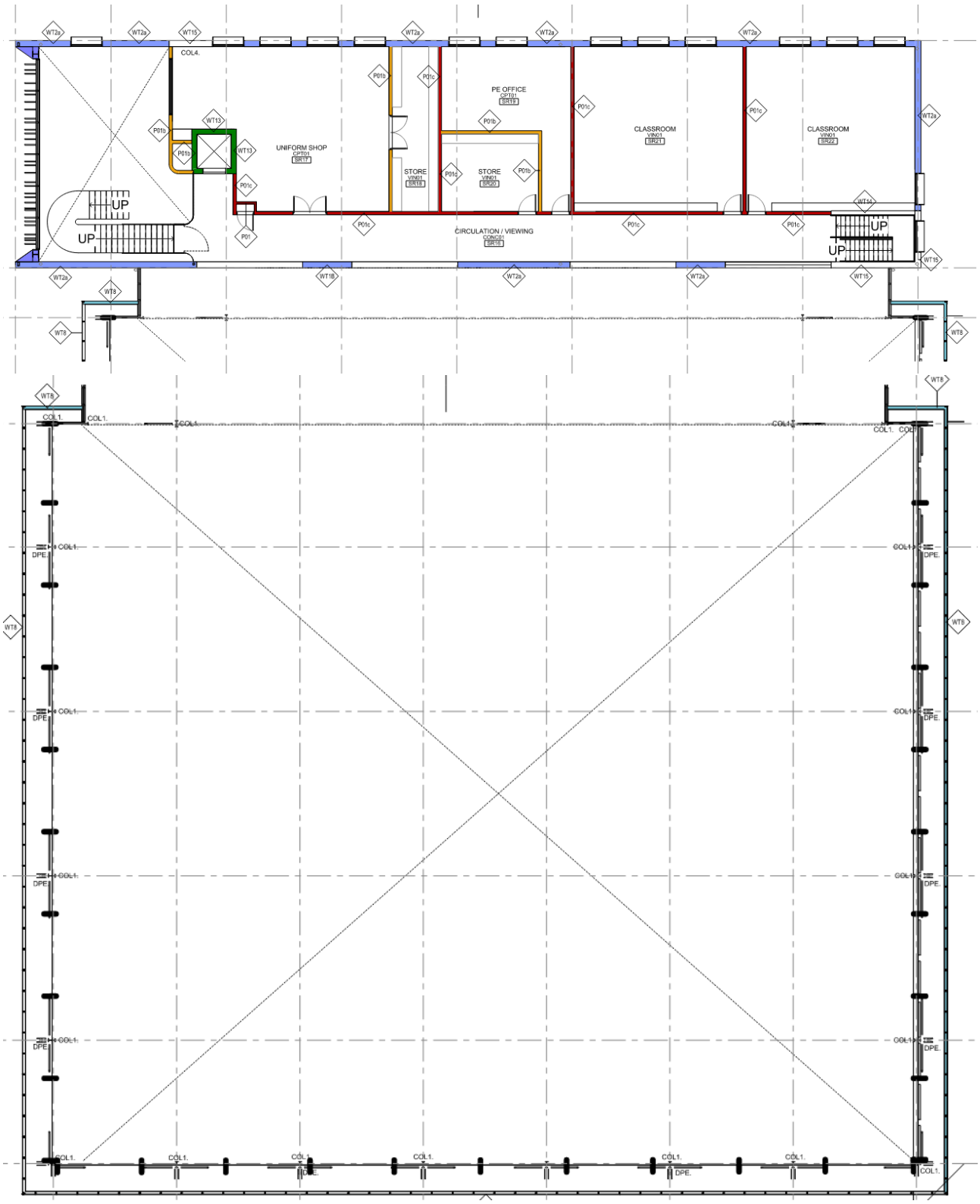
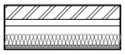
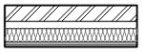
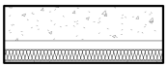
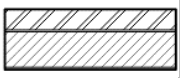


Figure 17 Proposed exterior wall construction for Multipurpose Hall / Gymnasium – First Floor

Acoustic review of the external wall is completed, a summary of recommendations and findings in relation to compliance with design criteria is provided in Table 47 below.

Table 47 Acoustic review of proposed external wall for gymnasium building

Wall Type	Plan View	Description of Wall Construction	Acoustic Criteria	Satisfy Criteria?	Notes/ Comments / Upgrades Recommended
WT2a		EXTERNAL FACE BRICK VENEER WALL (150 STUDS) 110mm FACE BRICK 50mm CAVITY 150mm STEEL STUD WORK WITH 90mm THICK 32kg/m3 FIBREGLASS R2.5 INSULATION 2 x 16mm FIRE RATED PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER)	R_w 60	Yes	Note that 1 layer of fire rated plasterboard should be sufficient.
WT3A		110mm FACE BRICK 50 mm CAVITY 92mm STEEL STUD WITH 90mm THICK 32kg/m³ FIBREGLASS R2.5 INSULATION 2 x 16mm SOUNDCHECK PLASTERBOARD LINING (MIN 12.5kg/m² PER LAYER)	R_w 60	Yes	
WT8		EXTERNAL WALL DANPALON 16mm 104 TBC 16mm	-	-	Danpalon has an acoustic rating of R_w 21 and would be used on external façade. All the façade glazing/window to remain closed.
WT10		CONCRETE WALL 200mm CONCRETE, OFF-FORM	R_w 60	Marginally`	
WT11		EXTERNAL CONCRETE WALL 200mm CONCRETE, OFF-FORM 50mm CAVITY 64mm 64 STEEL STUD WORK WITH INSULATION TBC 13mm PLASTERBOARD LINING	R_w 60	Yes	
WT15		EXTERNAL BLOCKWORK WALL 110mm FACE BRICK 10mm AIRGAP 190mm BLOCKWORK 13mm SOUNDCHECK PLASTERBOARD LINING *AQUACHEK PLASTERBOARD REQUIRED TO WET AREAS	R_w 60	Yes	

In addition to the above, it is recommended that the Danpatherm K12 Façade System with acoustic insulation added (R_w 41) should be used on the eastern and southern façade as shown in Figure 18.

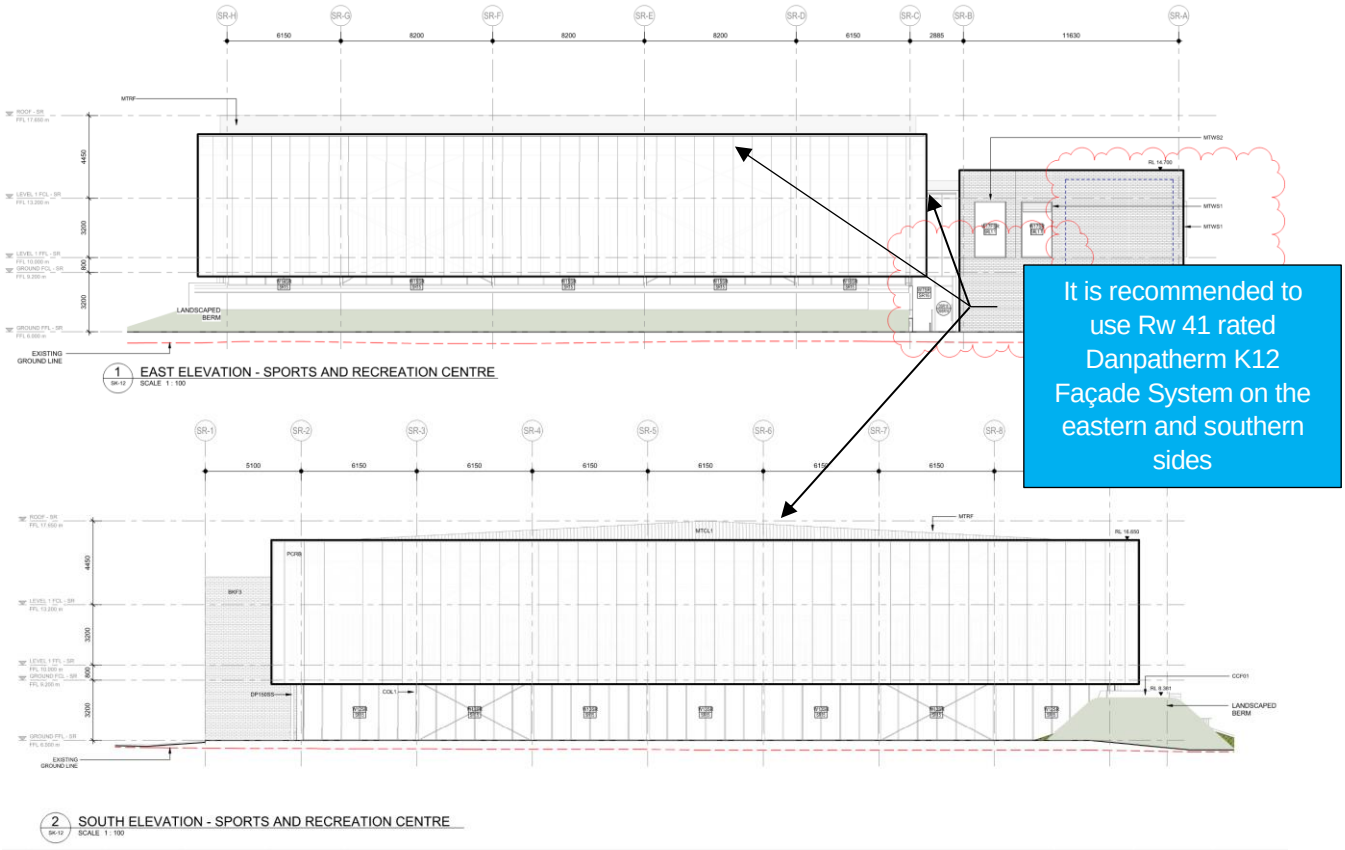


Figure 18 Proposed Multipurpose Hall/Gymnasium (Building P10)

9.4.2 External Door

It is recommended that an air-lock corridor is established for entry to the proposed building. This can be achieve implementing the recommended doors in a pair in an airlock corridor, having the doors separated by at least 1.5m.

All doors that are incorporated into partitions that have been assigned a sound insulation rating will need to be fitted with acoustic seals to all sides of the frame and the bottom of the door, to ensure that the door provides a suitable level of sound insulation.

- Timber doors should be specified as solid-core doors.
- Double leaf doors must have seals installed to the meeting stile of the doors.
- Bottom seals should always be specified as drop down seals to ensure that the seal is not subjected to fatigue by rubbing against the floor when opening/closing.
- Doors must not be undercut nor have air relief door grilles in them, as this will severely compromise the acoustic integrity of the door assembly.
- Sliding doors should be avoided where a high level of sound isolation is required.
- Sliding doors will need to incorporate seals on the leading edge, trailing edge and top and bottom of the door.

Table 48 provides examples of hinged door constructions that will achieve the sound insulation requirements for doors to each of the spaces within the building. Options have been provided for both solid timber and glazed doors.

Table 48 Examples of Door Assemblies

R_W Rating	Door Type	Door Seals
R_w 38-40	48mm Acoustic Door	▪ Acoustic doors rated no less than Rw38 based on laboratory test. Doors are supplied as a set including door, frame, hardware and seals. ▪ Example of suitable door would be Pyropanel AS-38-PAC
	12.5mm VLam Hush laminated glass (by Viridian) doors	▪ Perimeter and bottom acoustic seals required. Note that threshold plate is required to the door, with the door seals adjusted to ensure an air-tight fit when the doors are closed. ▪ Frame: RP 24 ▪ Bottom: RP 70 ▪ Threshold plate: RP 96/ RP66

9.4.3 Roof

A section of the proposed roof-ceiling system is shown in the image below.

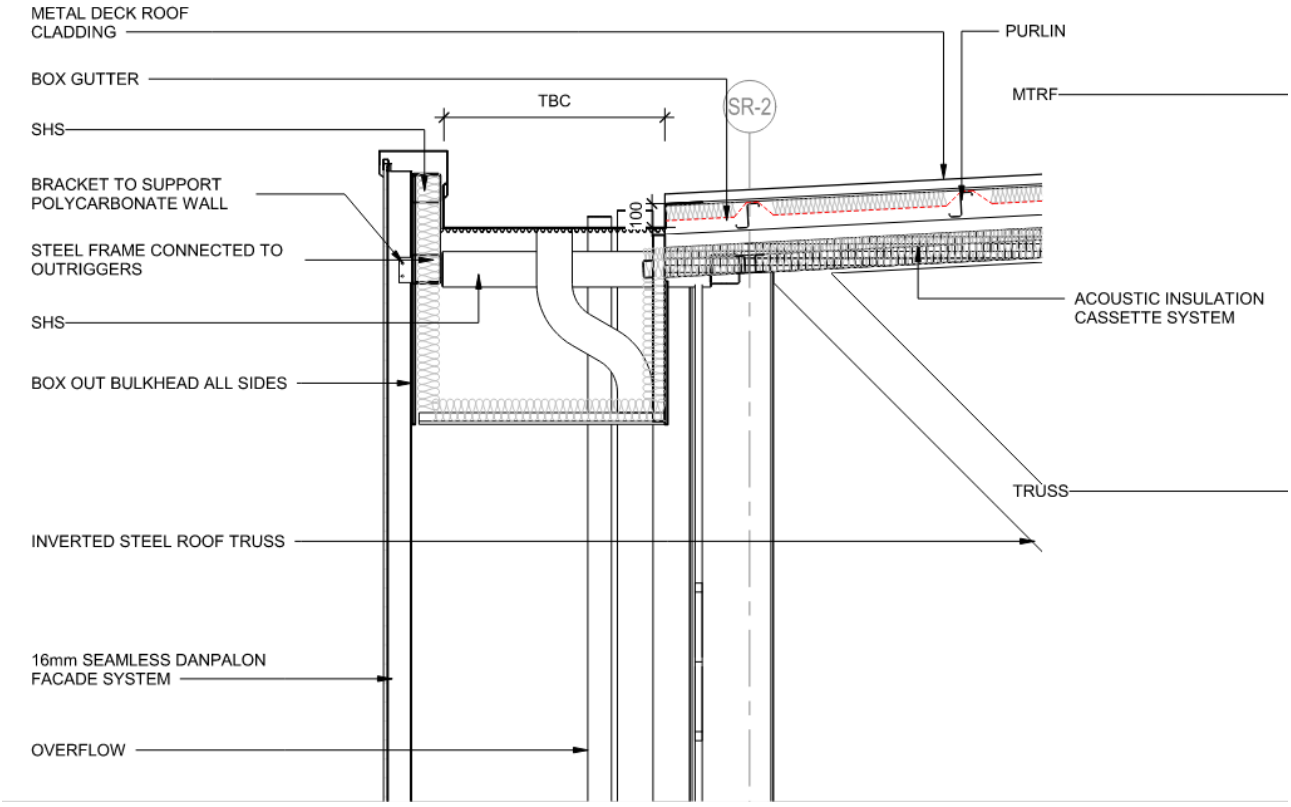


Figure 19 Proposed roof construction – Gymnasium

It is recommended that the architectural section should be updated as per recommendations below:

Table 49 Recommended roof-ceiling construction

Roof Type	Roof Construction	Recommended Acoustic Rating,
Metal Roof (Courts)	▪ Minimum 0.48mm profiled steel sheet roofing. ▪ 6mm thick Fibre Cement Sheet (surface mass 9 kg/m^2) to underside of the metal roof. ▪ 75mm thick, 14 kg/m^3 fibreglass insulation hard under the roof sheeting ▪ 350mm I-beam with suspended ceiling of S50Durra Panel 50mm faced with 75mm x 48kg/m^3 fibreglass and 11% perforated corrugated Colorbond Soundsorb finish. ▪ NRC 0.85 and R_w 52 Or any other suitable roof construction that would achieve the recommended acoustic rating.	R_w 52
Metal Roof (Classroom areas)	▪ Profiled steel sheet (0.6mm) roofing ▪ Minimum 200mm Timber or Steel Purlin or metal truss. ▪ Bradform Anticon 60 MD or similar over the roof purlin. ▪ Minimum 120mm thick, 30kg/m^3 glasswool or fibreglass acoustic insulation in the ceiling cavity. ▪ Internal finishes per recommendations provided in detail design.	R_w 44

Example of recommended roof construction for gymnasium and courts area are shown below:

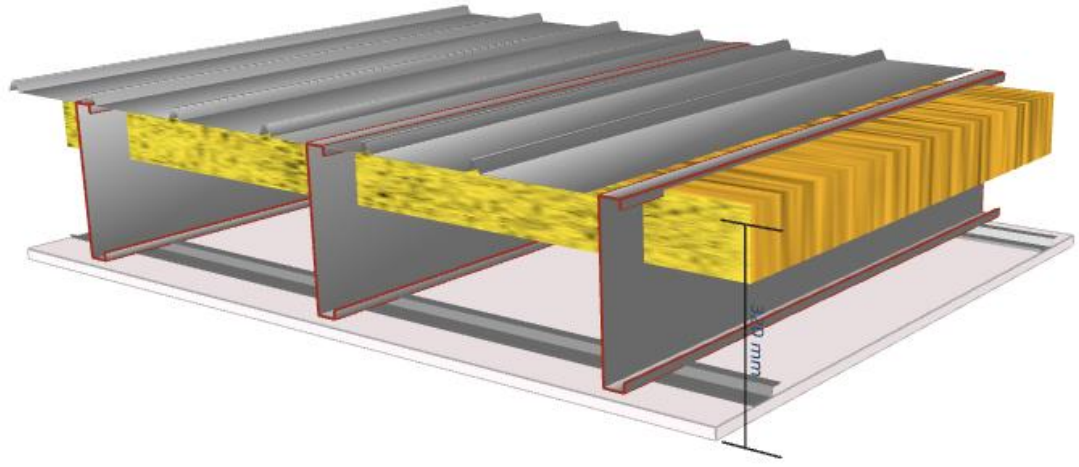


Figure 20 Example of recommended roof construction – Class areas

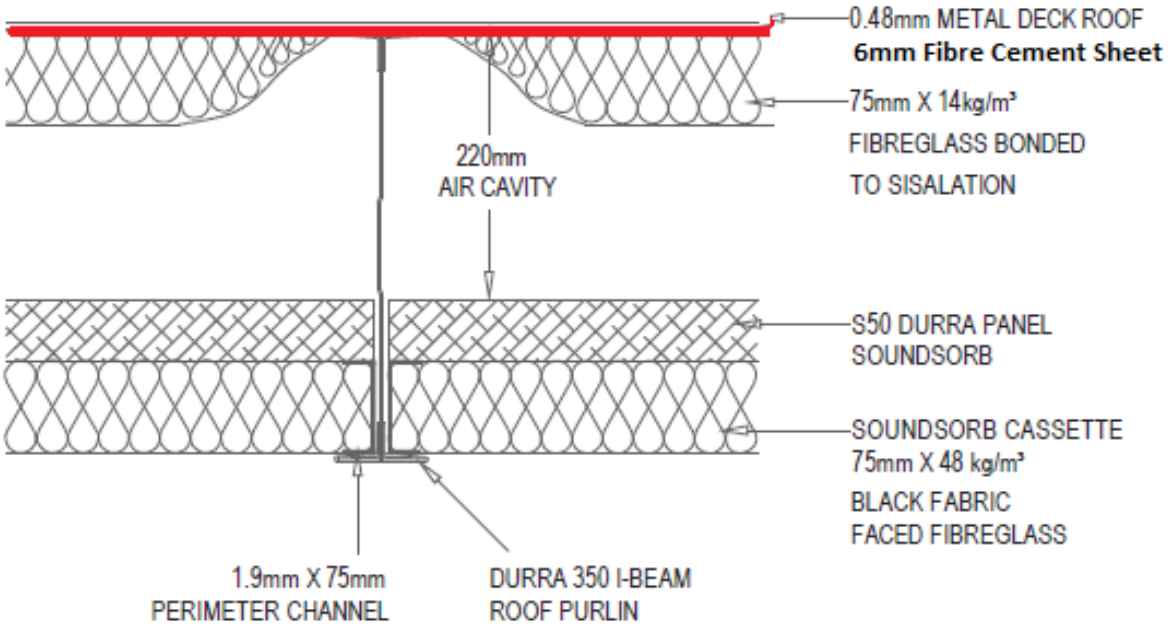


Figure 21 Example of recommended roof construction – Courts

9.5 Recommendations for Mechanical Plant and Equipment

9.5.1 Sound Power Level of Equipment

The sound power level of the mechanical ventilation equipment is provided in Table 50. If the specific model as provided below or the sound power level of the equipment is changed, a further acoustic assessment would be required to ensure compliance with the noise requirements. The following recommendations are provided to achieve NPI recommended noise criteria at the nearby noise sensitive receivers.

Table 50 Sound power levels of the proposed mechanical plant/equipment

Equipment	Model Number	Octave – Band Centre Frequencies (Hz) Sound Power Level, dB								Overall Sound Power Level, L_w, dB(A)
		63	125	250	500	1000	2000	4000	8000	
Outdoor AC Unit – Cultural Centre	REYQ12BYM	83	84	78	79	73	71	68	62	80
Outdoor AC Unit – Junior School	REYQ34BYM (REYQ20BYM + REYQ14BYM)	97	98	93	87	83	77	71	64	90
Outdoor AC Unit – Community Hub	REYQ22BYM	85	86	82	81	75	72	69	62	82
Outdoor AC Unit – Gym	REYQ40BYM (REYQ20BYM + REYQ20BYM)	99	100	96	89	85	79	73	66	92

Noise control recommendations for the mechanical ventilation equipment are as follows:

9.5.2 Acoustic Treatment for AC Condensers – Sports Building

It is recommended that an acoustic screen or louvre is installed on the northern face of the plant room housing the condensers, for control of noise emission at nearby noise sensitive receivers. Refer to Figure 22 for location of the acoustic louvre. Specification of the acoustic louvre is provided in Table 51.

Table 51 Acoustic louvres minimum insertion loss

Acoustic Louvres	**Minimum Noise Reduction in Octave Band Frequency (Hz)**							
	63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
ACRAN 200mm Deep Acoustic Louvre or equivalent	-	14	13	17	27	30	22	-

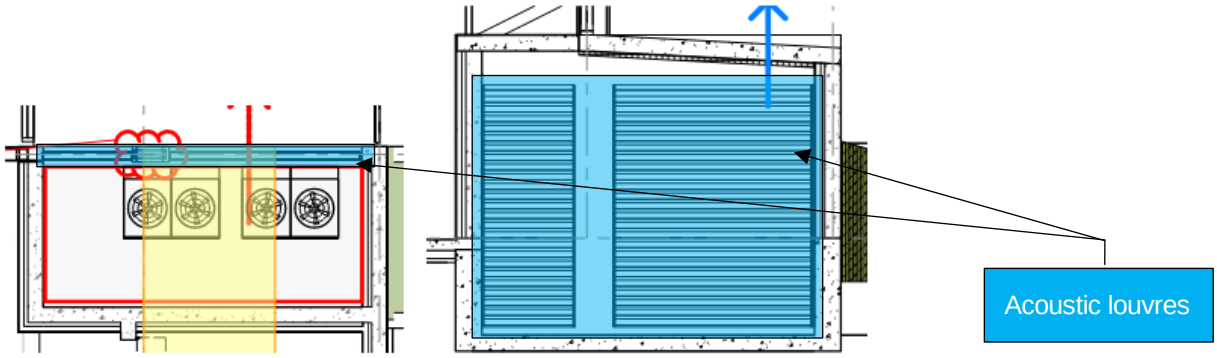


Figure 22 Acoustic louvre locations for AC condensers

A section view of the condensers with discharge ductwork and acoustic louvre is shown in Figure 23. Note that acoustic attenuators are recommended at the outlet of the condensers to reduce noise emission to the environment. The recommended specification for the attenuators is shown in Table 52.

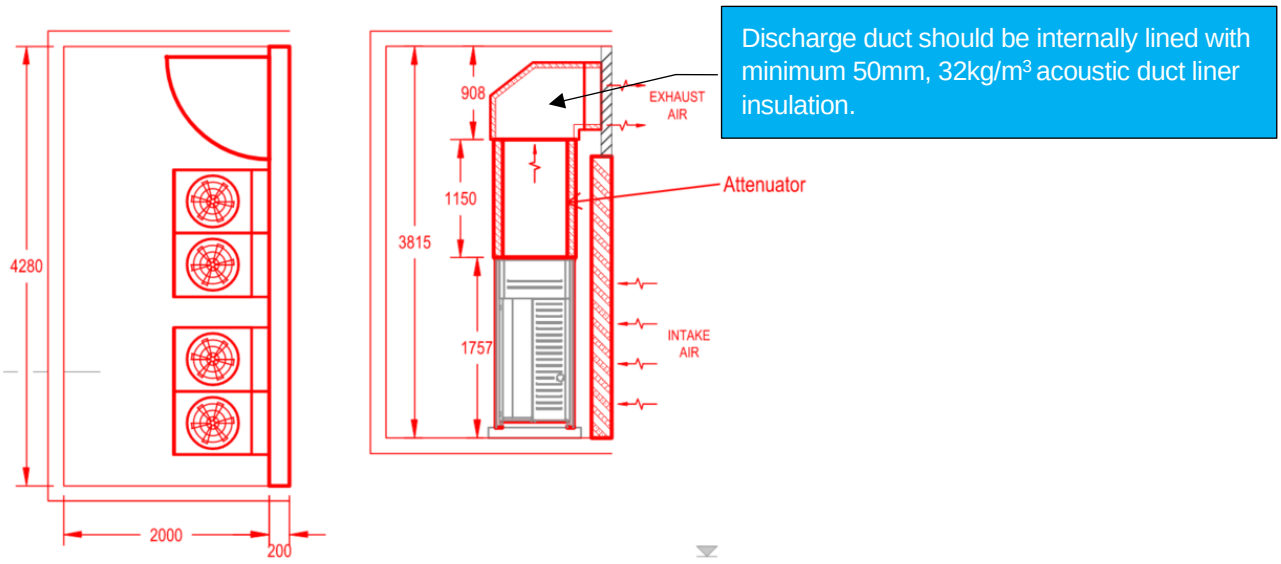


Figure 23 Recommended acoustic treatment for the AC condensers

Table 52 Recommended acoustic attenuators for outdoor AC condensers

Acoustic Attenuators	Minimum Noise Reduction in Octave Band Frequency (Hz)							
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Fantech C2-056 or equivalent	5	7	11	18	21	17	15	12

Vibration Isolation:

- To reduce potential structure borne noise generated by the units, vibration at the operational frequency must be reduced. To provide a minimum of 95% vibration isolation efficiency (i.e. 5% of transmissibility), spring isolators with static deflection of 25mm are required (i.e. Getzner, Mason or Embelton). The spring mounts shall be sized to adequately support the weight of the unit to provide a minimum of 95% vibration isolation efficiency.
- It is recommended that the units be installed on a 100-200mm thick concrete slab. The units should be installed on a spring vibration isolation system to achieve 95% vibration isolation efficiency.

9.5.3 Acoustic Treatment for the Outdoor AC Unit at Admin Building and Junior School Building

It is recommended that the following recommendations should also be adopted:

- To reduce potential structure borne noise generated by the units, vibration at the operational frequency must be reduced. To provide a minimum of 95% vibration isolation efficiency (i.e. 5% of transmissibility), spring isolators with static deflection of 25mm are required (i.e. Getzner, Mason or Embelton). The spring mounts shall be sized to adequately support the weight of the unit to provide a minimum of 95% vibration isolation efficiency.
- Outdoor AC units should be installed behind solid external walls (without any structural connections or bridging) and not exposed to any nearby windows.
- Acoustic louvre should be installed as per Figure 24 and Figure 25.
- Specification of the acoustic louvre is provided in Table 53.

Table 53 Acoustic louvres minimum insertion loss

Acoustic Louvres	Minimum Noise Reduction in Octave Band Frequency (Hz)							
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
ACRAN 200mm Deep Acoustic Louvre or equivalent	-	14	13	17	27	30	22	-

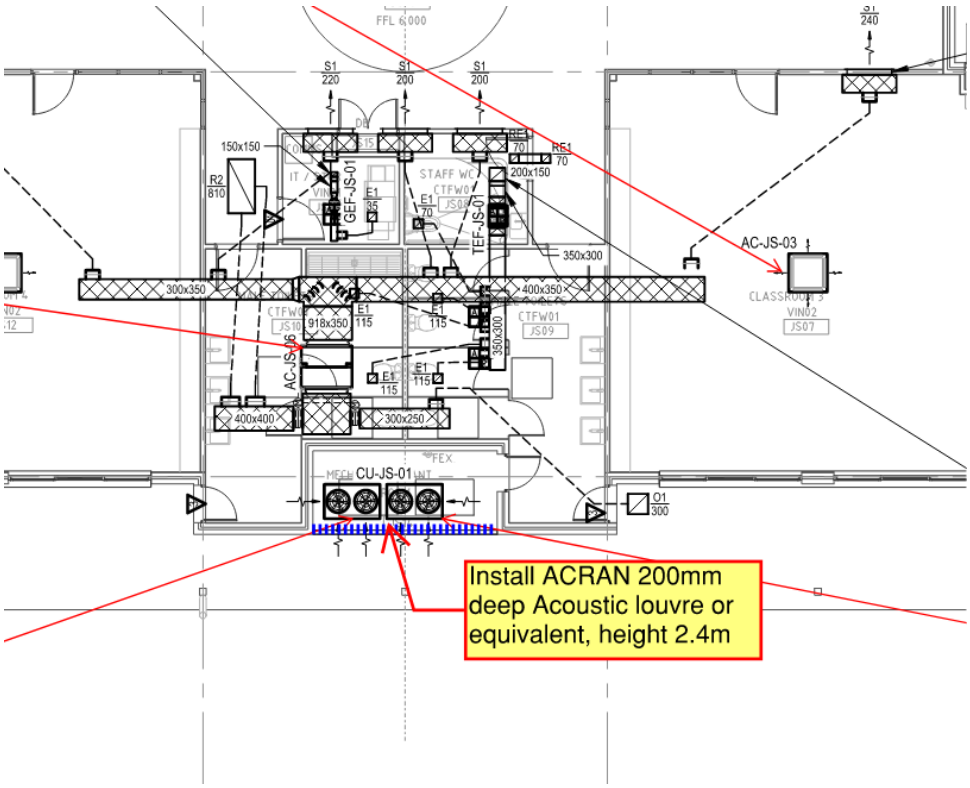


Figure 24 Extent of acoustic louvre proposed, plant detail. Junior School

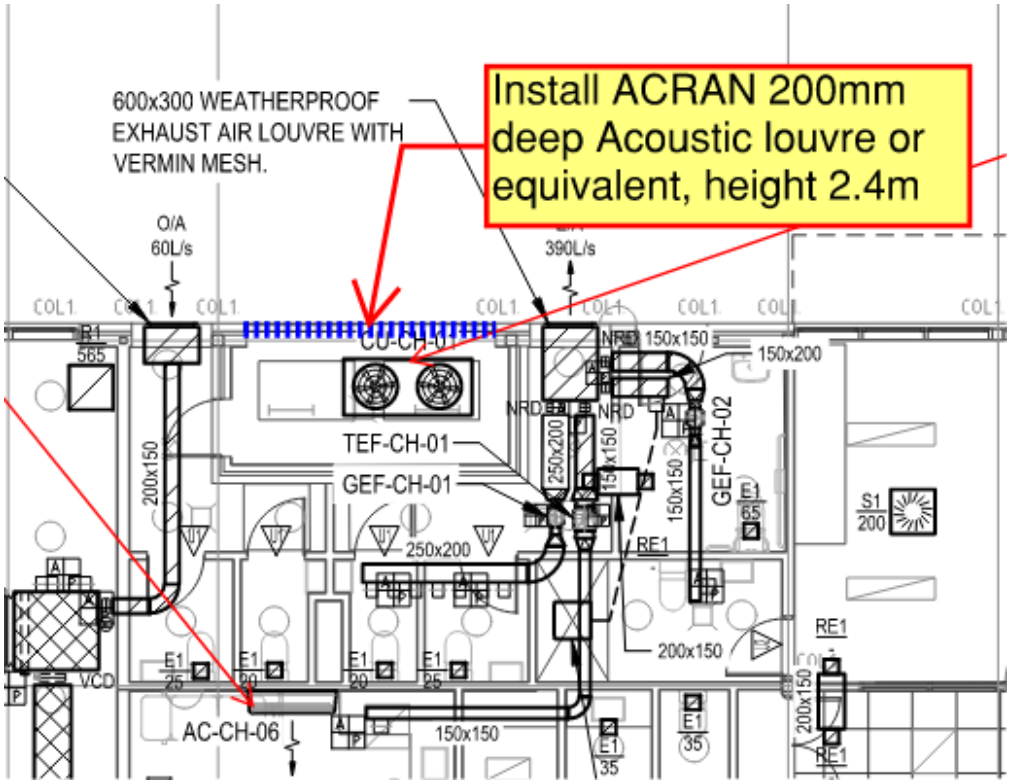


Figure 25 Extent of acoustic barrier proposed, plant detail. Admin building.

9.5.4 Acoustic Treatment for the Outdoor AC Unit at Cultural Centre Building

It is recommended that the following recommendations should also be adopted:

- One layer of sound absorbing material should be installed onto the wall, as shown in Figure 26. Insulation should have a minimum NRC 0.8 such as 50mm SealdAir Stratocell Whisper. Discharge ductwork should be internally lined with 25mm, 32kg/m^3 Glasswool insulation or equivalent.
- It is recommended that the condensers be installed on a 100mm thick reinforced concrete slab. To reduce potential structure borne noise generated by the units, vibration at the operational frequency must be reduced. To provide a minimum of 95% vibration isolation efficiency (i.e., 5% of transmissibility), spring isolators with static deflection of 25mm are required (i.e. Getzner, Mason or Embelton). The spring mounts shall be sized to adequately support the weight of the unit and provide a minimum of 95% vibration isolation efficiency.

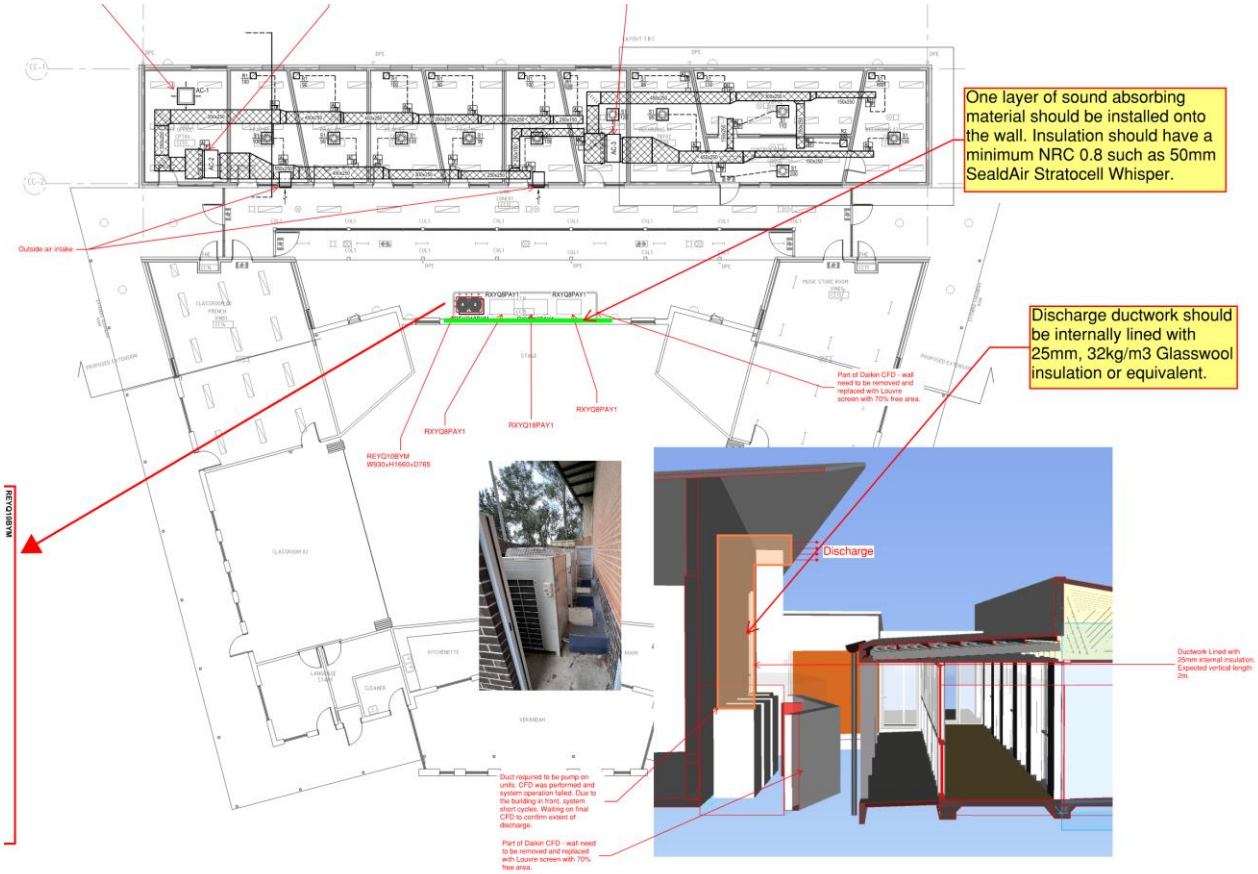


Figure 26 Recommended acoustic treatment for the Mech Plant at the Cultural Centre

9.6 Vibration Associated with the Gymnasium

The cardio and weights areas in the Gymnasium are about 20m from the boundary of nearest noise sensitive receivers, including teaching spaces just immediately above on Level 1.

9.6.1 Gym Floor Construction

Floor isolation should be provided at the specified area as shown in Figure 27.

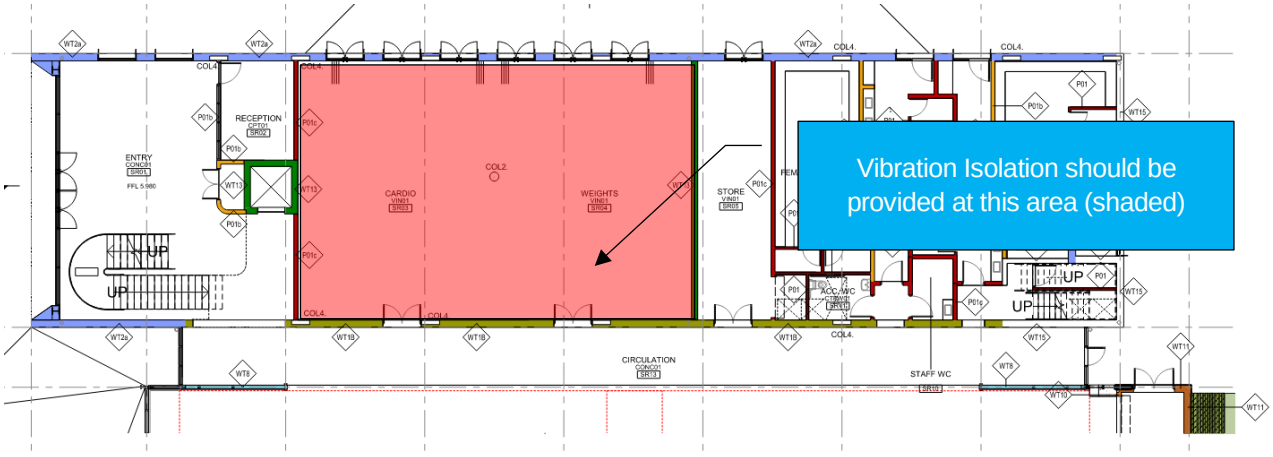


Figure 27 Extent of the Gym Floor System in red. Ground Level

Floor isolation system for the Cardio and Weights should be as per below:

9.6.1.1 Cardio Area:

Proposed floor isolation system is presented in Figure 28.

- 8mm Regupol Floor Finish
- 2 layers of 25mm thick Blue tongue particle board.
- 16/9mm AFM33 corrugate profile Getzner with a sound reduction (Delta impact isolation) of ≥ ΔL 33 dBA
- Perimeter isolation strip: 12.5mm Sylomer SR11 Getzner.

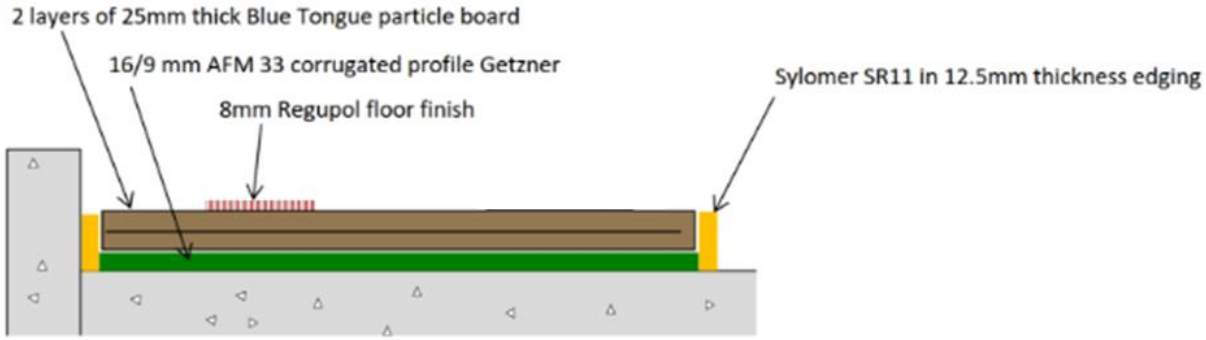


Figure 28 Gym Floating Floor System. Section detail – Cardio Area Only

It is to be noted that the columns (connection between the column and the concrete slab) should be decoupled (not rigid connection) from the structural slab using Sylomer edge strips, as per Figure 30.

9.6.1.2 Weights Area and Cross Fit Workout Zones:

Proposed floor isolation system is presented in Figure 29.

- G-FIT shock absorber 75mm + Floor Finishes
- 2 layers of 25mm thick Blue tongue particle board.
- 16/9mm AFM33 corrugate profile Getzner with a sound reduction (Delta impact isolation) of ≥ ΔL 33 dBA
- Perimeter isolation strip: 12.5mm Sylomer SR11 Getzner.

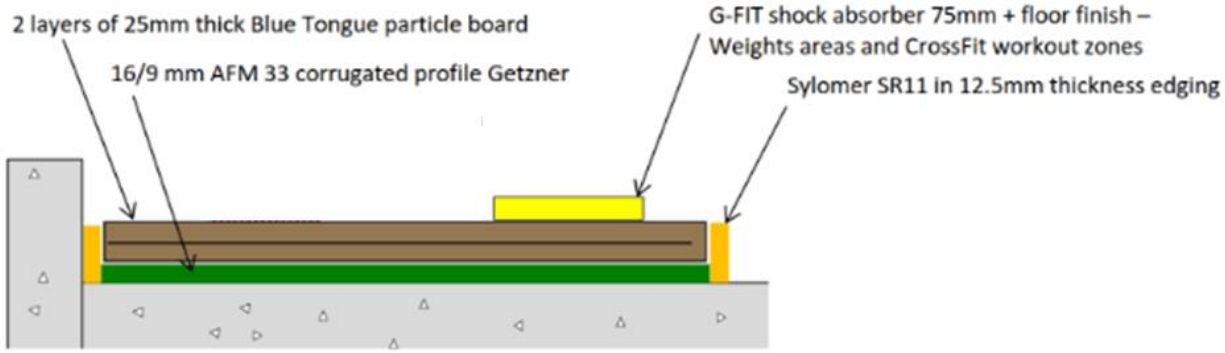


Figure 29 Gym Floating Floor System. Section detail – Weights Area and Cross Fit Workout Zones

It is to be noted that the columns (connection between the column and the concrete slab) should be decoupled (not rigid connection) from the structural slab using Sylomer edge strips, as per Figure 30.

It is preferred (not a requirement) that a structural discontinuity or decoupling (gap between slabs) is provided at the gymnasium floor area, as per image below (marked in GREEN).

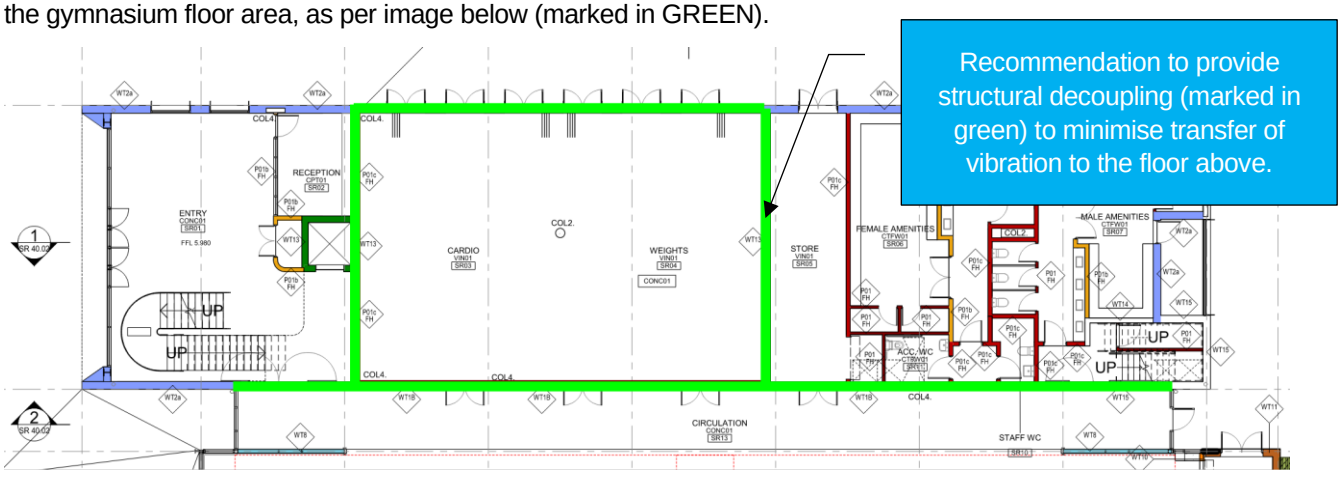


Figure 30 Structural floor slab decoupling (marked in blue) recommended – Gym Area

9.6.2 Sports Floor Construction

It is preferred (not a requirement) that the sports courts concrete floor should be decoupled from remaining building to minimise noise and vibration transmission to the classrooms on Level 1. This is shown in Figure 31.

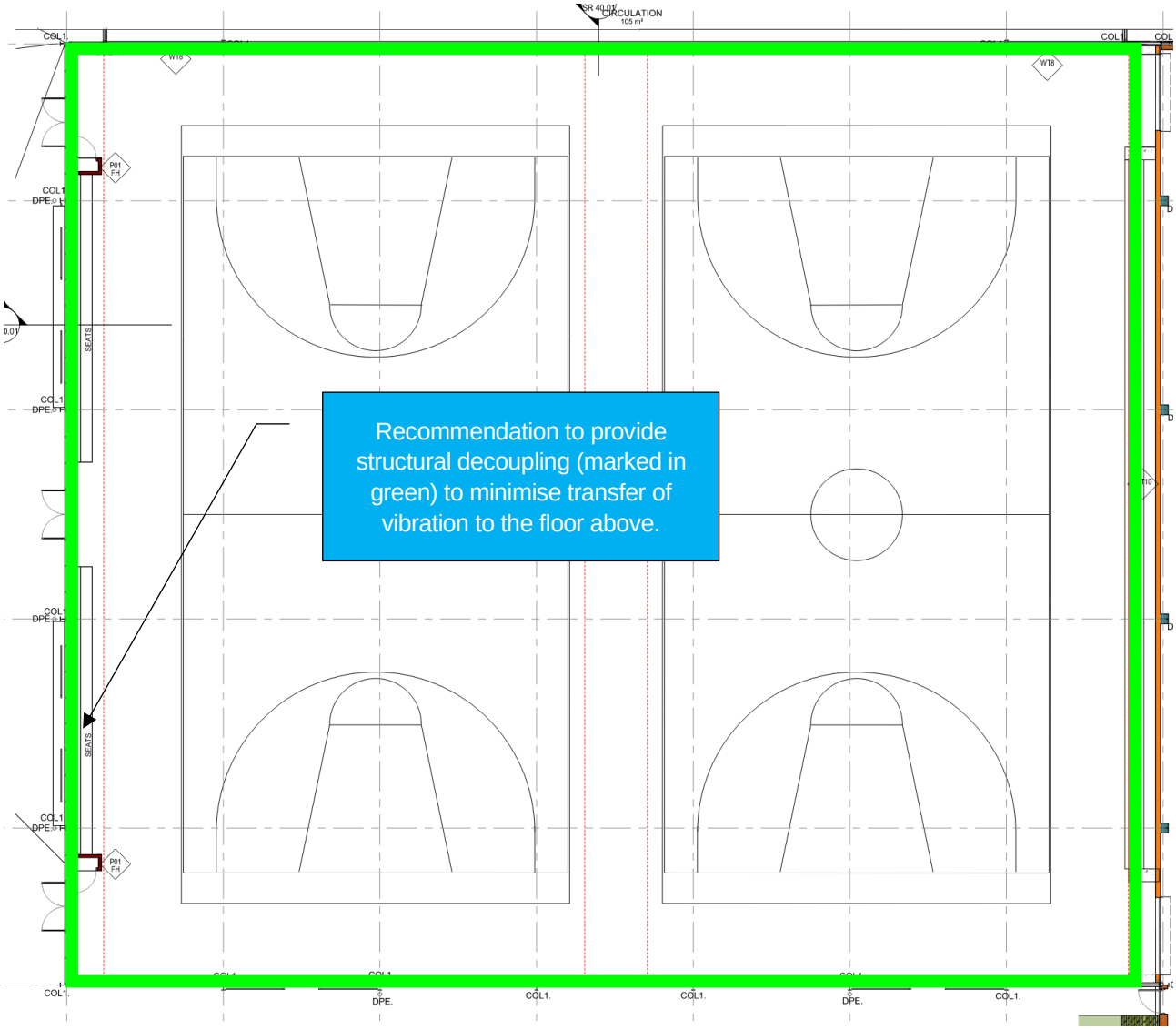


Figure 31 Structural floor slab decoupling (marked in blue) recommended – Sports Court Area

9.7 Acoustic Treatment at Boundary

It is recommended that a 2.4m high acoustic fence should be installed near the eastern boundary, adjacent to the Sports and Recreation Centre, to minimise HVAC equipment noise from nearby plant room to nearby residential properties. Location, extent, and height of the recommended acoustic treatment are shown in Figure 32.

On 25/07/2022 the design team was notified of an Aboriginal Object Due Diligence Assessment performed at the project site. This assessment revealed exclusion zones where works cannot be performed. One such area is shown below where the recommended acoustic treatment would be located. As such, the acoustic fence would be set around the exclusion zone to avoid disturbing it.

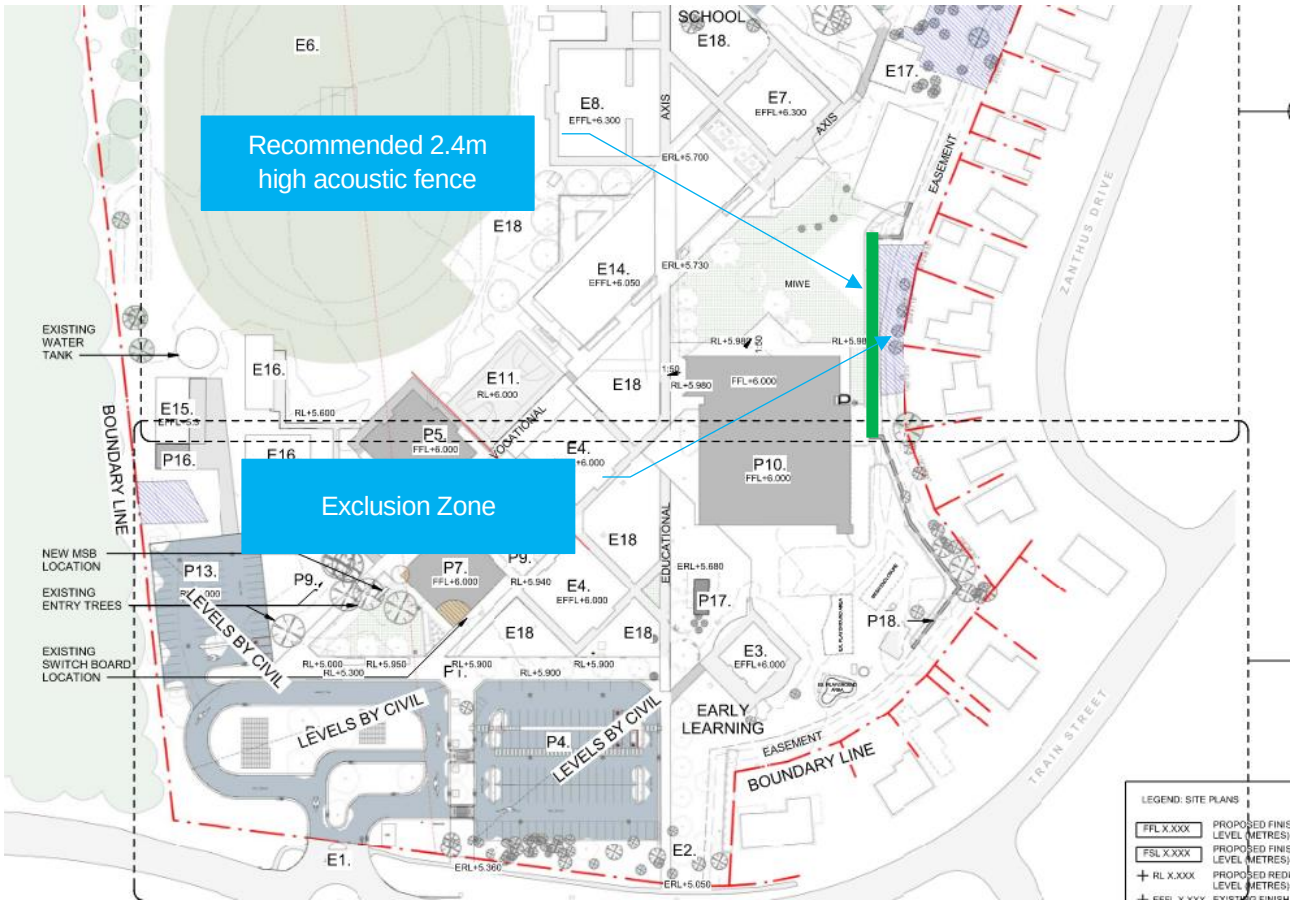


Figure 32 Recommended Acoustic Fence

Example of recommended construction of the Acoustic Fence is provided in Table 54.

Table 54 Recommended acoustic barrier/screen construction

Acoustic Barrier/Screen Type	Recommended Construction
2.4m Acoustic Fence	12mm Compressed Fibre Cement (CFC), or 100mm thick Aerated Concrete Panel, or Masonry/Brick Wall Construction, or Minimum 22mm thick timber paling fence. Planks should have minimum 50% overlap (surface mass of 20 kg/m^2), or 15mm Palsun Polycarbonate Sheet Any other material with minimum surface mass of 20 kg/m^2.

10 Acoustic Detailing

10.1 General

Small gaps and cracks, or incorrect corner detailing and setting of walls can significantly compromise the acoustic rating of the partitions. It is vital to understand that workmanship must be excellent. All gaps and cracks must be sealed with a resilient, non-hardening mastic that can withstand any movement likely throughout the life of the rooms. Generally, a polyurethane mastic or fire mastic that allows for minimum 15% joint movement will be acceptable. The top, bottom, and sides of all plasterboard walls, as well as all services penetrations must be fully mastic sealed and inspected, prior to any finishing detailing (skirting, architraves, and the like) being provided.

P50 shadowline edging and the like can compromise the acoustic rating of the partitions and it is recommended that such edging not be used unless a suitable detail is provided to minimise leakage.

Door seals are to be installed and adjusted correctly to minimise noise leakage. The manufacturer's instructions for best acoustic practice installation should be followed.

Wall penetration details assume ductwork is above an acoustic ceiling or below a data floor. If the duct is exposed within the space, additional treatment may be required and will be determined on an individual basis.

Architectural documentation should show mastic sealing at the base and the head of the of D_w 40 ($\geq R_w$45) walls, so this is not missed by the contractor. For the acoustic integrity of building elements to be maintained, all gaps and interfaces along the junctions and joints of linings must be sealed with an appropriate acoustic grade sealant. Penetrations for mechanical or electrical services must be properly blocked and sealed around the ductwork/cabling to ensure the intended acoustic rating of the partition is retained. Appropriate acoustic caulking products include:

- Bostik Firemastic
- Bostik Seal-n-flex 1
- Pyropanel Multiflex
- Boral Fyreflex
- Dow-Corning 790 Silicone
- Dow-Corning 795 Silicone
- Sika Sikaflex-11 FC

10.2 Vibration Isolation

All mechanical services plant, equipment and associated ancillaries, and hydraulic services, should be mounted or supported using vibration isolating elements to minimise the transmission of structure borne noise throughout the building. This includes all building services, such as ductwork and pipework.

There should be a flexible coupling or connection installed between each item of plant, such as a fan, FCU unit or pump, and the associated ductwork and pipework.

Rigid contact between ductwork or pipework and the building structure should be avoided by mounting the duct or pipe such that contact does not occur, or by installing a 6mm thick neoprene strip between the duct or pipe and the building structure for cases where space constraints are an issue.

All pipework should be isolated at support points. Main riser and dropper pipes should be supported from the floor slabs only, and mounting points on lightweight walls between the slabs should not be used. All branch and main riser pipes must be supported by rubber lined clips or vibration-isolated hangers.

Pipework should only be located in dividing walls if the dividing walls are of a discontinuous construction. Pipes in dividing walls should be supported by resilient clamps and only be mounted to the wall leaf adjacent to the room served by the pipe, or the wall leaf adjacent to the least noise sensitive space in the case of common pipework. If

a pipe is required to be installed in single framed stud wall, the pipe should be connected to the stud frame using vibration isolating elements, for e.g., rubber lined clips or resilient mounts.

11 Conclusion

ACOR Consultants Pty Ltd (ACOR) has undertaken an acoustic review of the proposed St Peter's Anglican College Community Hub Admin Building, Junior School, Music Room Extension and Gymnasium.

This report details our architectural and mechanical recommendations and provide construction recommendations to achieve the acoustic design requirements. Following design standard, guideline and regulations were adopted for acoustic design of the proposed development.

- NSW EPA Noise Policy for Industry (NPfI) 2017.
- NSW DEC Assessing Vibration: A Technical Guideline 2006 (AVTG).

It is predicted that the proposed development would achieve the relevant design criteria with the implementation of the recommendations provided in this report. It should be noted that all the material specified in this report are in relation to acoustics and vibration and do not consider its implication on other discipline, such as fire, mechanical and structural. It is important that the client should consult with the relevant engineer to ensure that these products are suitable for this development.

We trust this information meets your requirements. If you have any questions, please do not hesitate to contact ACOR on 02 9438 5098.

ACOR Consultants Pty Ltd

Mahbub Sheikh (Dr)
M.A.A.S., FIEAust, CPEng, NER, RPEQ,
Senior Acoustics Engineer

Appendix A Glossary of Acoustic Terminology

A-weighting	Frequency weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).
C_{tr}	The spectrum adaptation term C_{tr} adjustment factor takes account of low frequency noise.
CAC	Ceiling Attenuation Class. The CAC determines how much cross-talk will occur between one room and another through the ceiling cavity where both rooms have the tested ceiling tile. This is an ideal situation, with no wall head leaks and no services penetrations in the ceiling. Therefore, it defines the ideal, best possible result as tested in a laboratory
dB	Decibel. This is the unit measurement of sound.
dBA	A weighted decibel is the most commonly used descriptor. The A weighting is an adjustment to the raw sound level to approximate what the average human ear can hear, which is less sensitive at very low and very high frequencies.
D_w	The Weighted Level Difference as defined in AS/NZS ISO 717.1:2004. This is the single number rating describing the ability of a partition to reduce noise as measured in the field with no standardisation or normalisation.
D_nT_w	The Weighted standardised level difference as defined in AS/NZS ISO 717.1:2004. This is the single number rating describing the ability of a partition to reduce noise as measured in the field. The higher the D_nT_w rating, the better is the acoustic performance of the wall or floor.
$D_nT_w + C_{tr}$	$D_nT_w + C_{tr}$ is D_nT_w with the addition of a low frequency sound correction factor Ctr (always a negative number remember). Rw + Ctr is used because of the increase in low frequency sound sources such as surround sound systems, drums or bass guitars, and of course traffic or aircraft noise. Two walls can have the same D_nT_w rating, but have different resistance to low frequency sound, thus a different $D_nT_w + C_{tr}$.
L_w or SWL	Sound power level. This is the total radiated sound energy.
L_p or SPL	Sound pressure level. This is the measurable sound level at a given distance from an item.
L_{max}	The RMS maximum noise level of a measurement
L_{10}	90^{th} percentile sound level of a measurement. Often called the average maximum noise level
L_{eq}	The energy average noise level of a measurement.
L_{90}	10^{th} percentile sound level of a measurement. Often called the average background noise level
L_{min}	The minimum noise level of a measurement
$L_{eq(T)}$	The time (T) equivalent energy noise level. The time interval is often in blocks of 10 or 15 minutes for short term measurements, or hours for long-term measurements. Common increments for long term measurements are 1 hour, day, night, 18 hours and 24 hours.
$L_{eq(8h)}$	The 8 hour equivalent energy noise level. Primarily used for occupational noise assessments
LC_{peak}	The C weighted peak noise level. Primarily used for occupational noise assessments
$L_{n,w}$	The Weighted Normalized Impact Sound Pressure Level. This is a single number rating describing the impact sound performance of a floor ceiling assembly as measured in a laboratory. Assessed in accordance with AS/NZS ISO 717.2. The lower the $L_{n,w}$ rating, the better is the impact sound isolation performance of a floor-ceiling assembly
$L'_{n'Tw}$	The weighted standardized impact sound pressure level. This is a single number rating describing the impact sound performance of a floor ceiling assembly as measured in a filed. Assessed in accordance with AS/NZS ISO 717.2. The lower the $L'_{nT,w}$ rating, the better is the impact sound isolation performance of a floor-ceiling assembly
NRC	Noise Reduction Coefficient. The NRC defines how much sound is absorbed by a surface. An NRC of 0 means it absorbs no sound while an NRC of 1 means it will absorb most sound.

R_w	The Weighted Sound Reduction Index. This is the single number rating describing the ability of a building element to reduce noise as measured in a laboratory. Assessed in accordance with AS/NZS ISO 717.1. The higher the R_w rating, the better is the acoustic performance of the wall or floor.
$R_w + C_{tr}$	$R_w + C_{tr}$ is R_w with the addition of a low frequency sound correction factor Ctr (always a negative number remember). Rw + Ctr is used because of the increase in low frequency sound sources such as surround sound systems, drums or bass guitars, and of course traffic or aircraft noise. Two walls can have the same Rw rating, but have different resistance to low frequency sound, thus a different Rw + Ctr.

Appendix B Weather Data

Moruya, New South Wales
June 2022 Daily Weather Observations

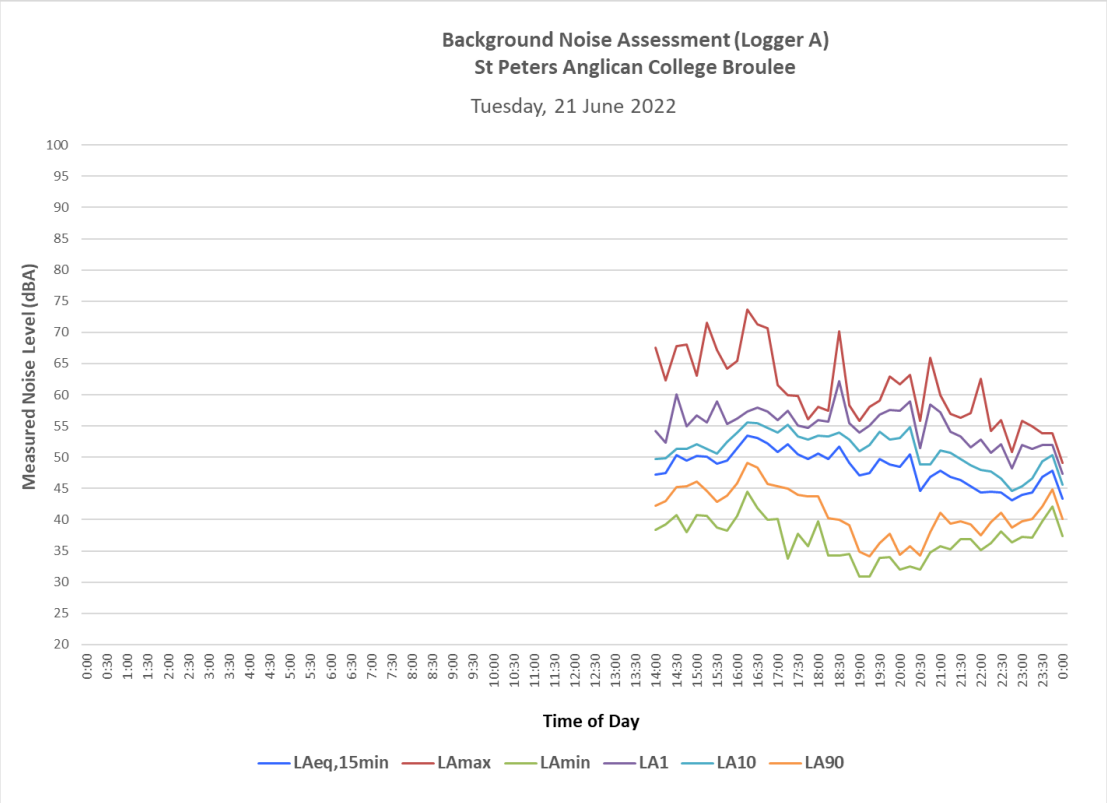
Most observations from Moruya Heads Pilot Station, but some from Moruya Airport.

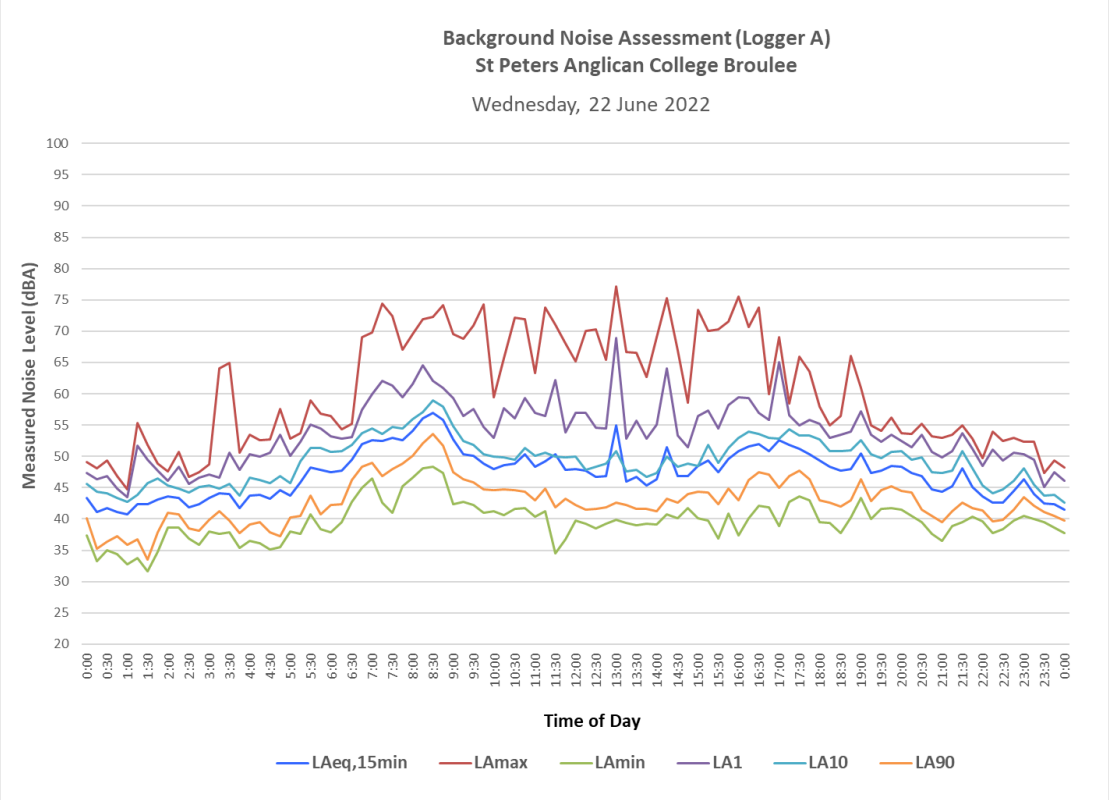
Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9 am						3 pm					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
1	We	6.9	16.3	0			W	41	11:34	11.0	57	1	NNW	9		14.1	41	7	WSW	19	
2	Th	7.2	17.0	0			WNW	24	04:26	10.0	61	7	WSW	11		16.5	52	6	ESE	7	
3	Fr	6.4	14.0	0			W	24	20:59	8.5	79	7	NW	4	1016.4	13.5	67	7	N	7	1010.2
4	Sa	6.0	17.9	0.4			NNW	35	15:04	8.3	93	0	W	7	1010.0	16.9	50	1	NNW	11	1007.0
5	Su	8.3	18.9	0			N	54	12:20	15.6	53	7	N	13	1006.7	17.5	49	3	NNW	13	1002.6
6	Mo	7.8	16.9	0			NW	59	01:33	12.3	56	1	NNW	11	999.9	16.0	41	1	NNW	15	1002.3
7	Tu	9.0	16.5	0			WNW	44	15:24	12.5	58	1	N	7	1002.5	14.9	43	8	WNW	24	
8	We	4.6	15.3	0			SW	48	12:40	8.9	87	1	WSW	7	1012.9	15.1	47	1	SW	28	1012.2
9	Th	7.1	18.5	0			W	24	12:14	11.8	67	2	NNW	9		18.3	43	5	WNW	9	
10	Fr	5.5	18.0	0			WNW	20	19:45	8.2	89	0	Calm		1012.1	17.5	47	1	NNE	13	1010.5
11	Sa	4.5	17.2	0			WNW	31	21:28	6.2	95	1	WSW	2	1014.4	16.7	53	0	NW	6	1008.9
12	Su	4.5	18.5	0			SW	41	11:38	13.3	62	1	WNW	9	1010.1	17.5	43	2	SW	22	1010.2
13	Mo	6.1	14.3	0			SSW	17	10:37	7.9	91	1	SW	9	1022.5	13.6	55	1	E	11	1020.6
14	Tu	4.7	14.5	0			ENE	22	14:12	6.7	94	5	SW	7	1024.2				NE	17	
15	We	4.7	16.3	0			SW	24	07:28	10.4	62	3	WSW	9	1018.7	15.8	50	1	NE	15	1015.0
16	Th	10.3	20.1	0			WNW	26	17:24	14.4	63	2	WNW	11	1015.1	18.8	49	1	NNW	9	1012.5
17	Fr	8.6	17.9	0			SSW	39	11:26	11.1	89	0	Calm		1019.3	16.4	60	1	S	17	1019.4
18	Sa	6.6	17.2	0			S	30	11:51	8.2	91	1	SW	9	1027.0	16.7	61	1	SSE	17	1025.8
19	Su	6.5	17.8	0			SW	22	11:38	8.8	89	1	SW	13		17.3	64	5	S	11	1026.6
20	Mo	8.8	15.4	2.4			NE	24	14:40	11.5	96	7	WSW	6	1025.7	15.0	83	7	ENE	17	1022.5
21	Tu	8.6	15.4	0			S	19	20:37	10.1	92	7	NW	7	1018.3	13.2	89	7	N	9	1016.3
22	We	5.2	16.2	1.8			ENE	17	14:44	7.5	94	3	Calm			15.9	53	1	NE	13	1022.0
23	Th	7.3	17.9	0			NE	20	14:51	9.0	93	7	Calm		1022.8	17.2	68	7	NNE	17	1018.5
24	Fr	9.0	18.2	0			WNW	35	04:07	14.6	69	7	NNW	15	1017.1	17.9	67	3	NNE	19	1013.1
25	Sa	8.5	18.1	0			WNW	19	09:43	9.6	96	0	SW	9	1020.0	16.8	70	0	ENE	13	1018.5
26	Su	5.2	17.3	0			SW	24	21:55	7.1	97	0	Calm		1023.1	16.5	47	1	NE	11	1021.4
27	Mo	5.1	15.1	0			SW	43	13:35	7.4	90	1	WSW	6	1028.0	14.5	39	1	S	22	1028.1
28	Tu	3.6	14.8	0			W	20	04:03	6.0	78	1	W	11	1032.8	14.3	60	1	ESE	9	1029.7
29	We	3.7	14.2	0			SE	19	14:06	6.0	97	7	Calm		1024.8				ESE	9	
30	Th	6.0		0						8.9	92	7	SW	6	1023.9						
Statistics for the first 30 days of June 2022																					
Mean		6.5	16.7							9.7	81	2		6	1017.9	16.1	55	2		14	1016.3
Lowest		3.6	14.0	0						6.0	53	0	Calm		999.9	13.2	39	0	NW	6	1002.3
Highest		10.3	20.1	2.4			NW	59		15.6	97	7	NNW	15	1032.8	18.8	89	8	SW	28	1029.7
Total				4.6																	

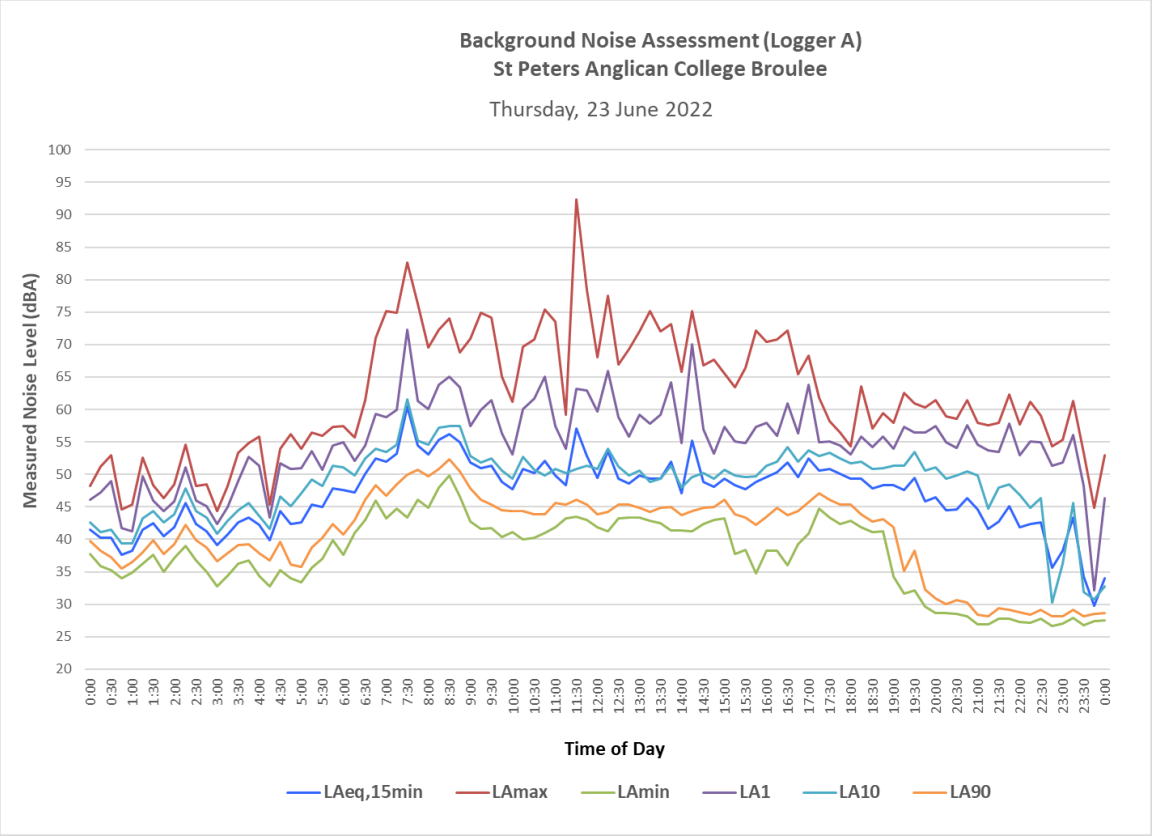
IDCJDW2085.202206 Prepared at 00:36 UTC on Thursday 30 June 2022

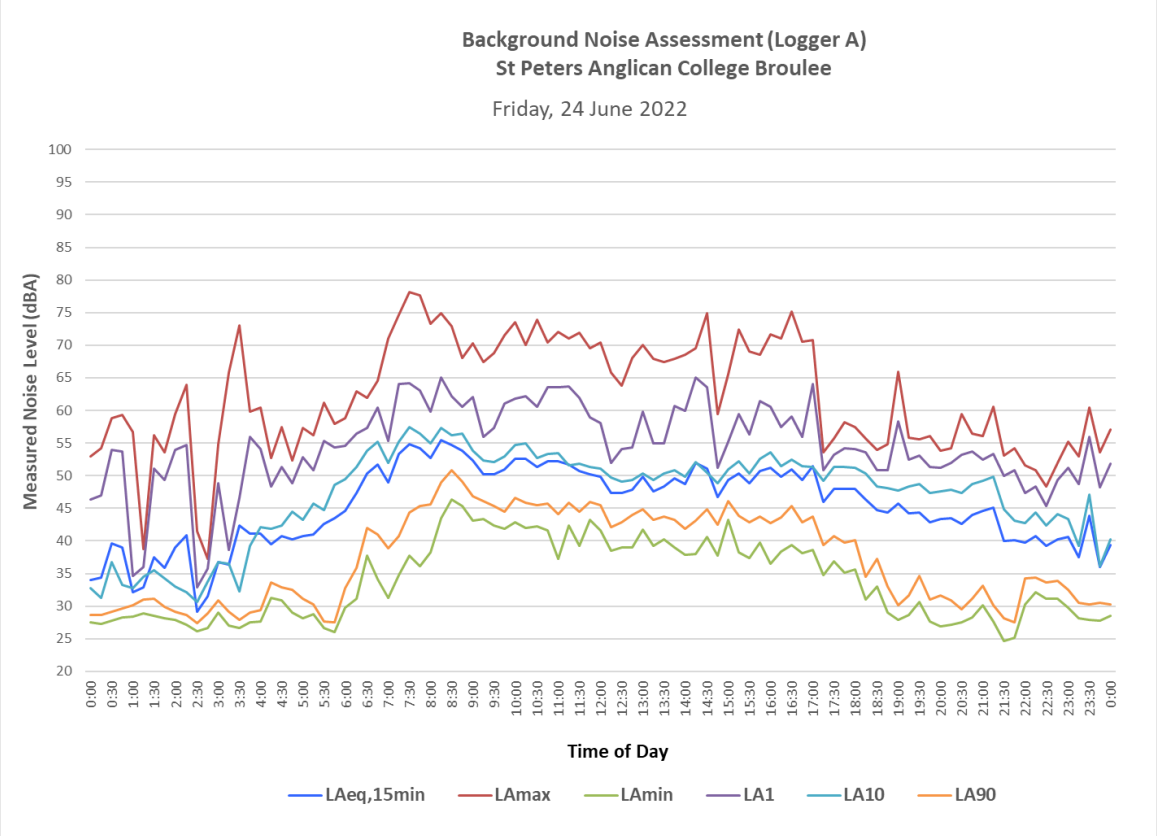
Appendix C Noise Charts

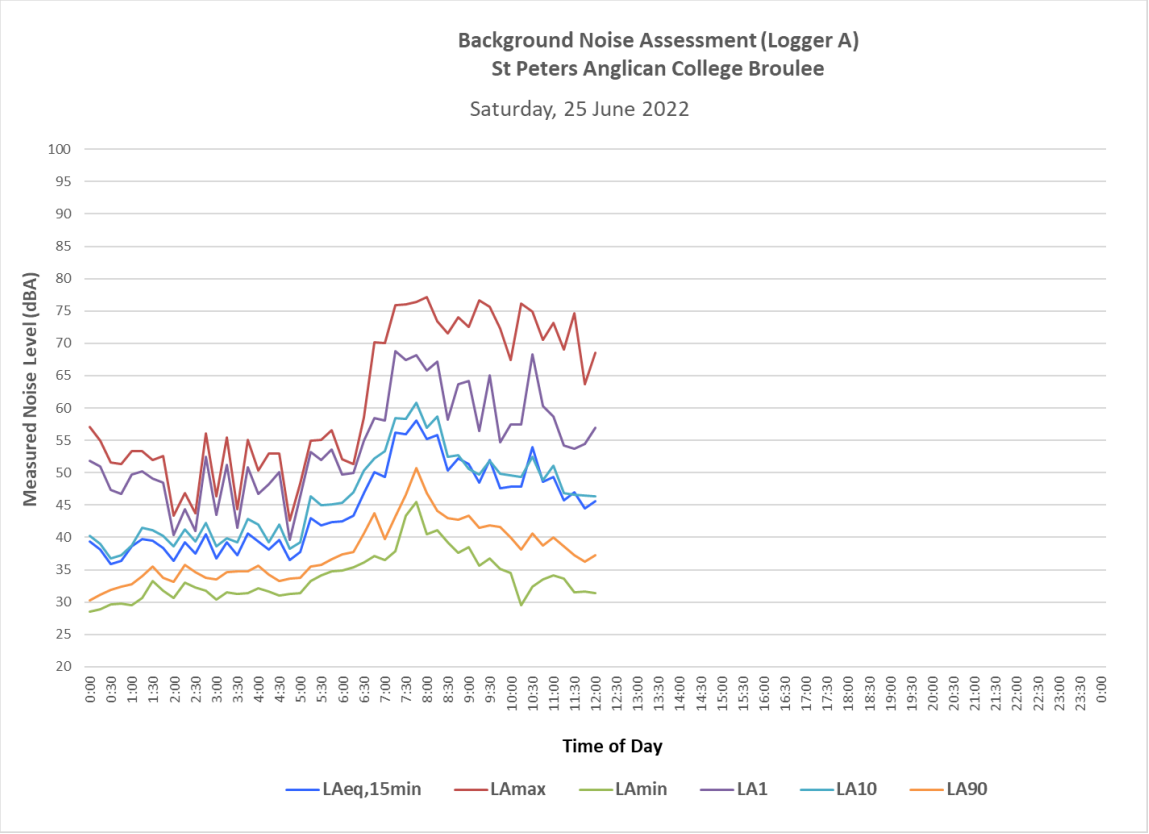
Noise Logger A (Refer to Figure 9 for logger location)






Background Noise Assessment (Logger A)
St Peters Anglican College Broulee
Thursday, 23 June 2022
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger A)
St Peters Anglican College Broulee
Friday, 24 June 2022
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger A)
St Peters Anglican College Broulee
Saturday, 25 June 2022
Measured Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
0:30
1:00
1:30
2:00
2:30
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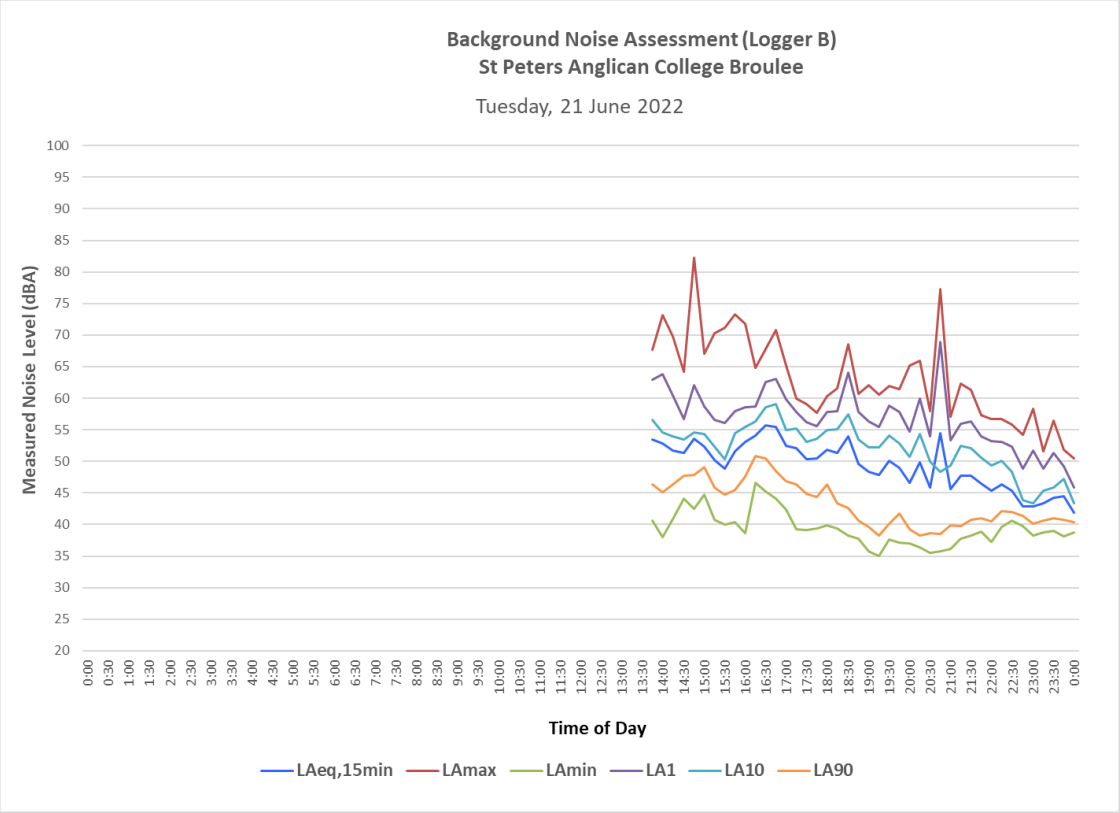
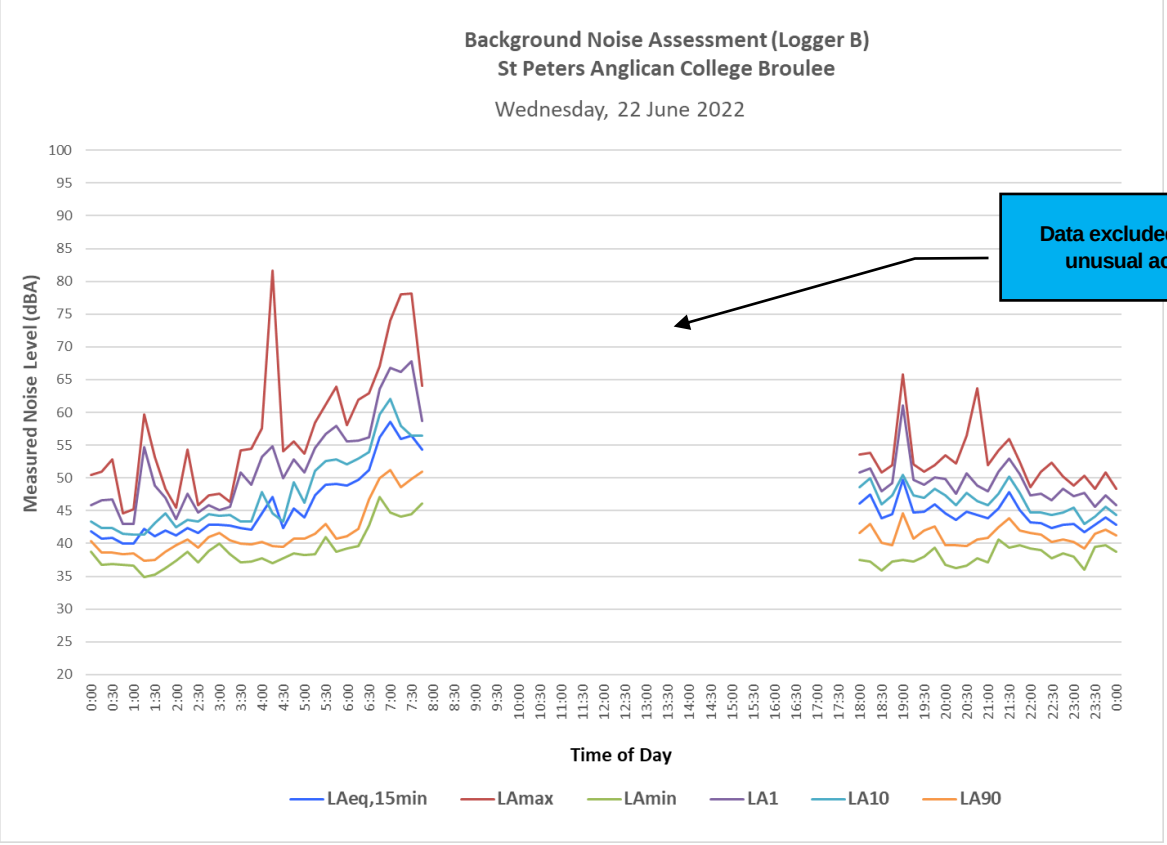
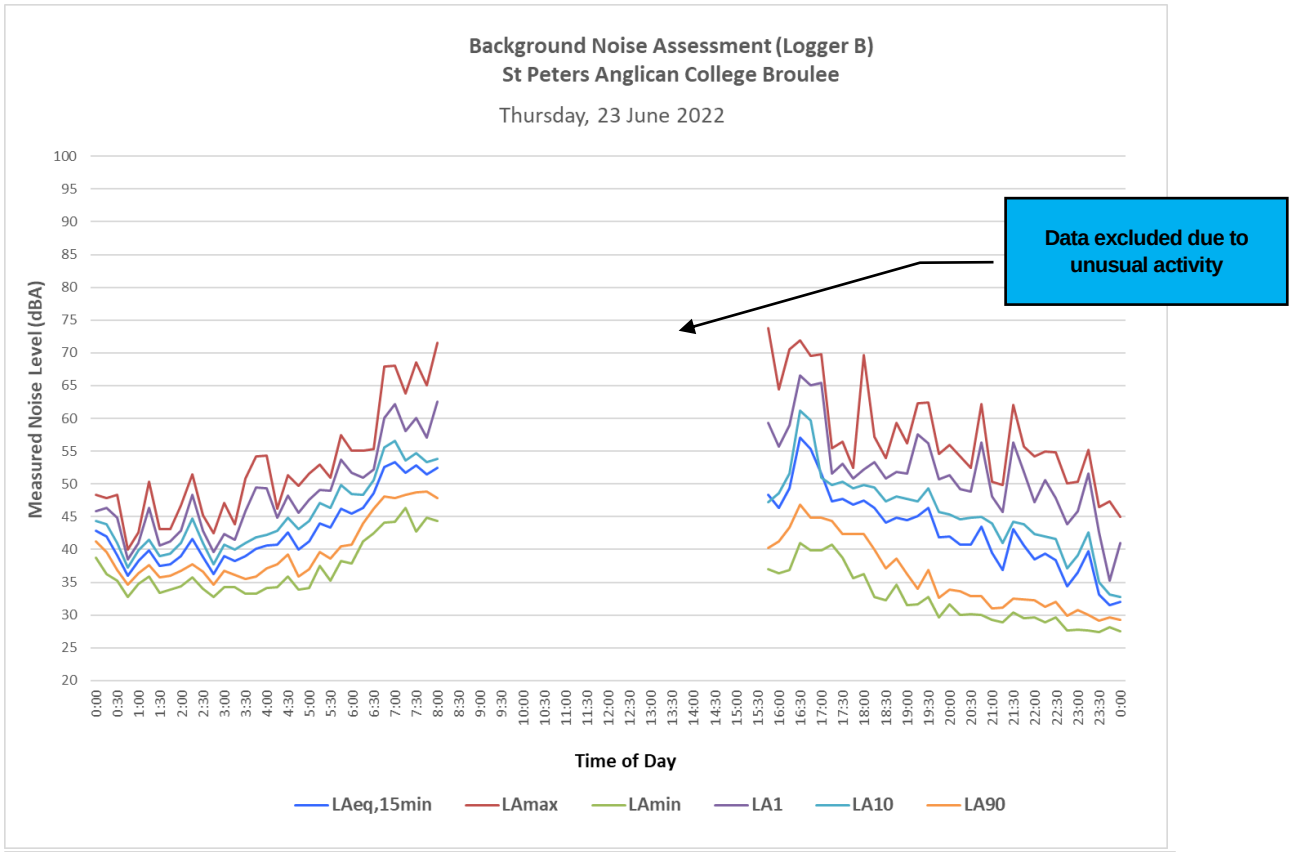
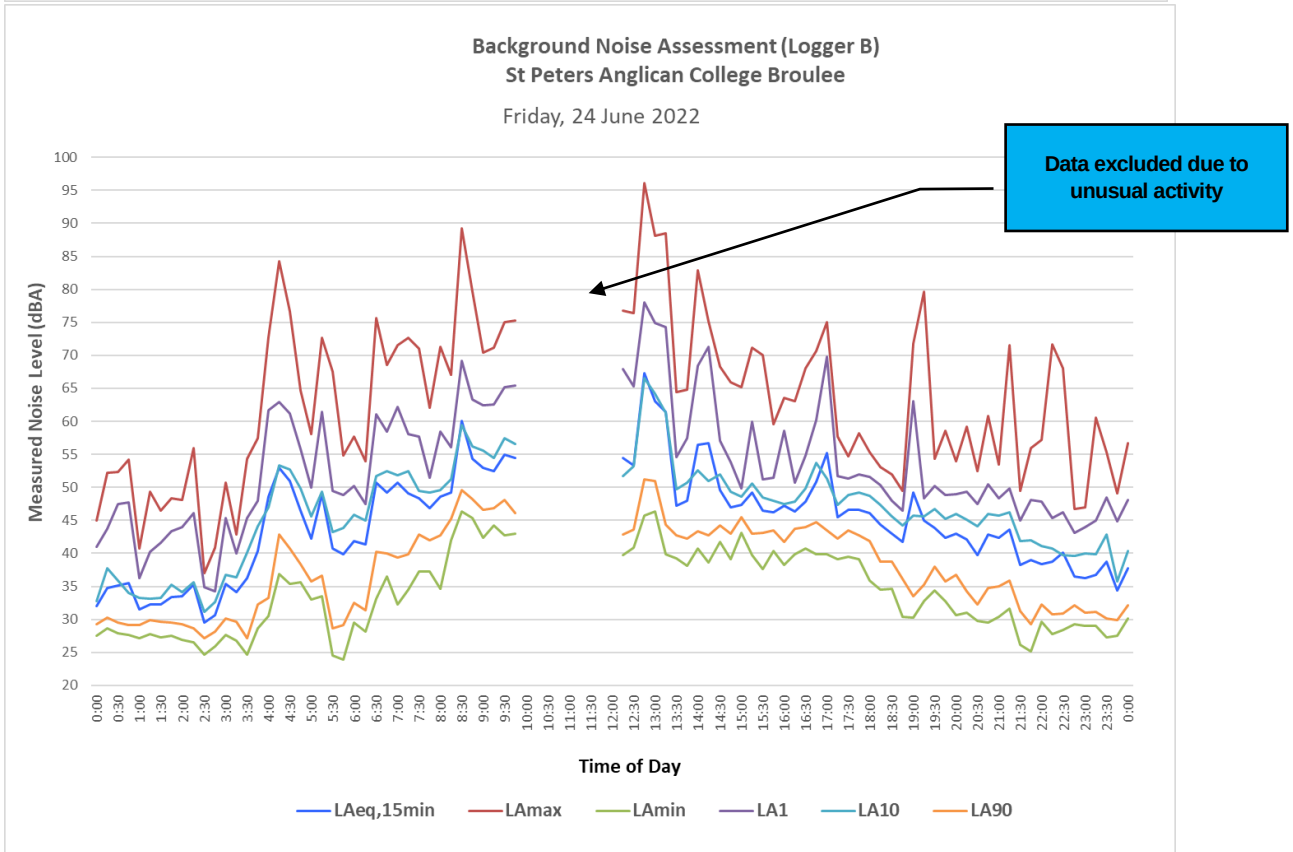
19:30
20:00
20:30
21:00
21:30
22:00
22:30
23:00
23:30
0:00
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90

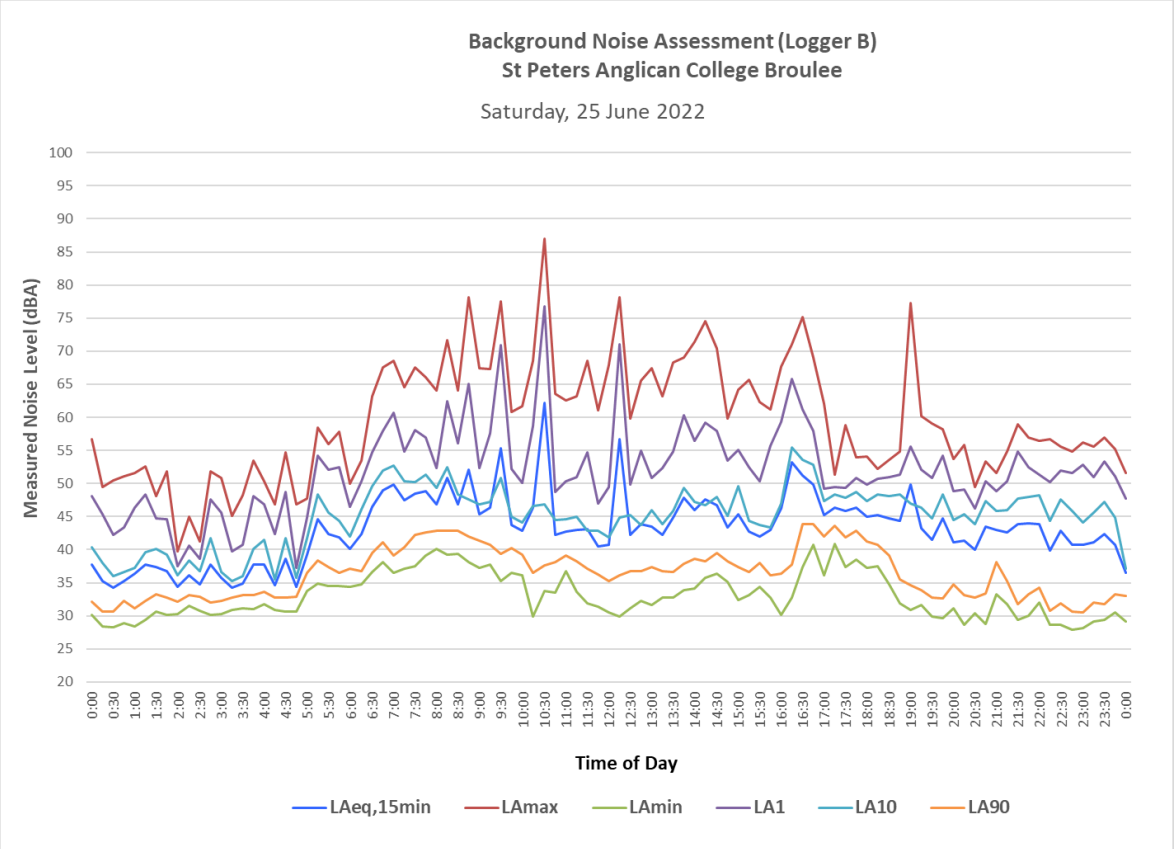
Noise Logger B (Refer to Figure 9 **for logger location)**

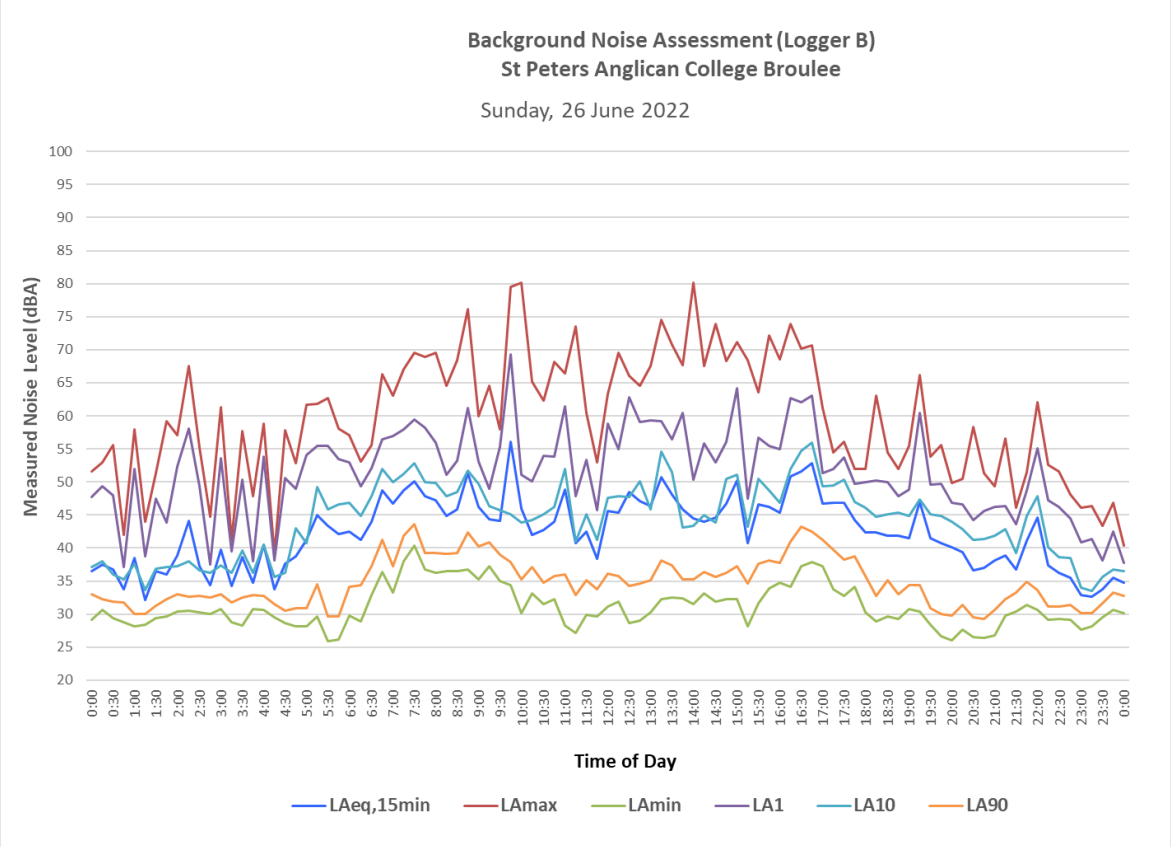


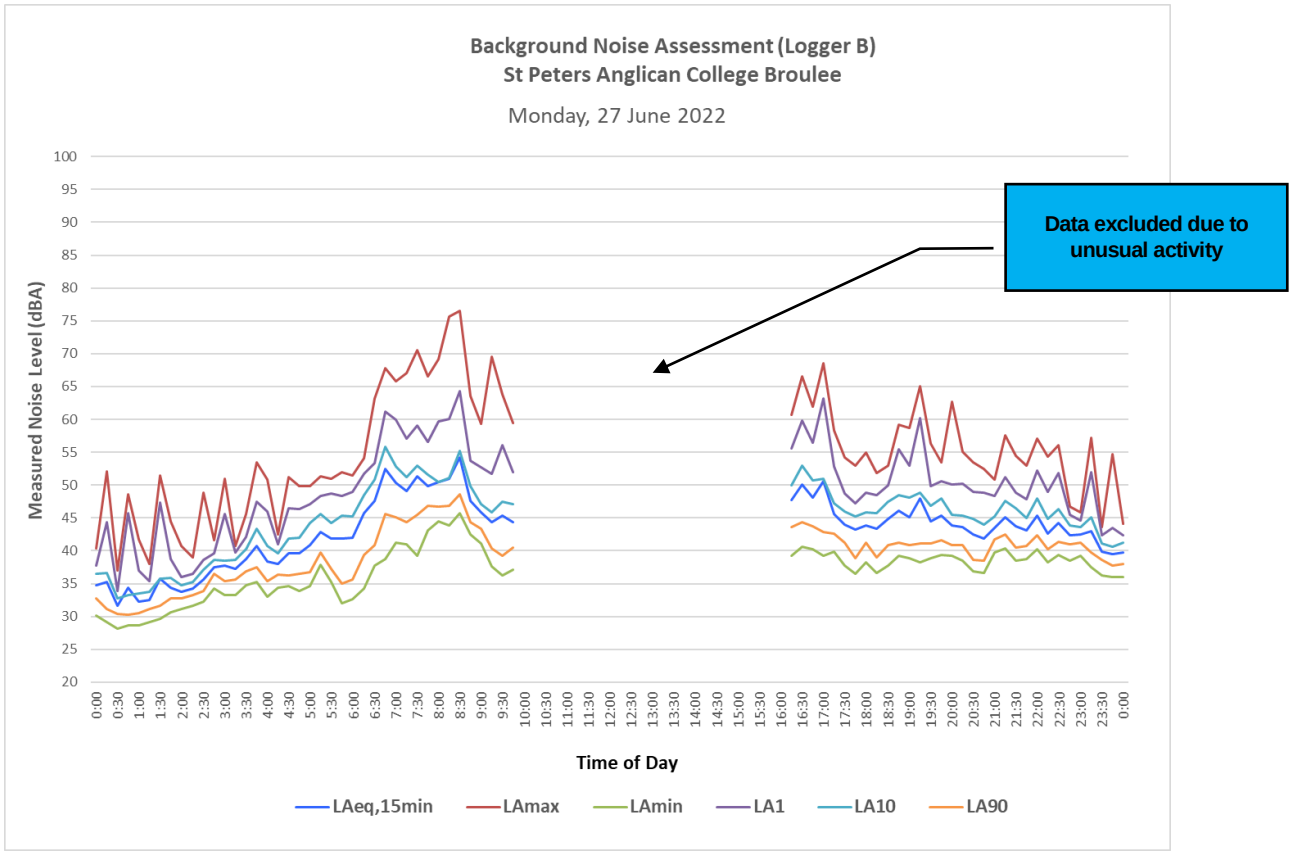


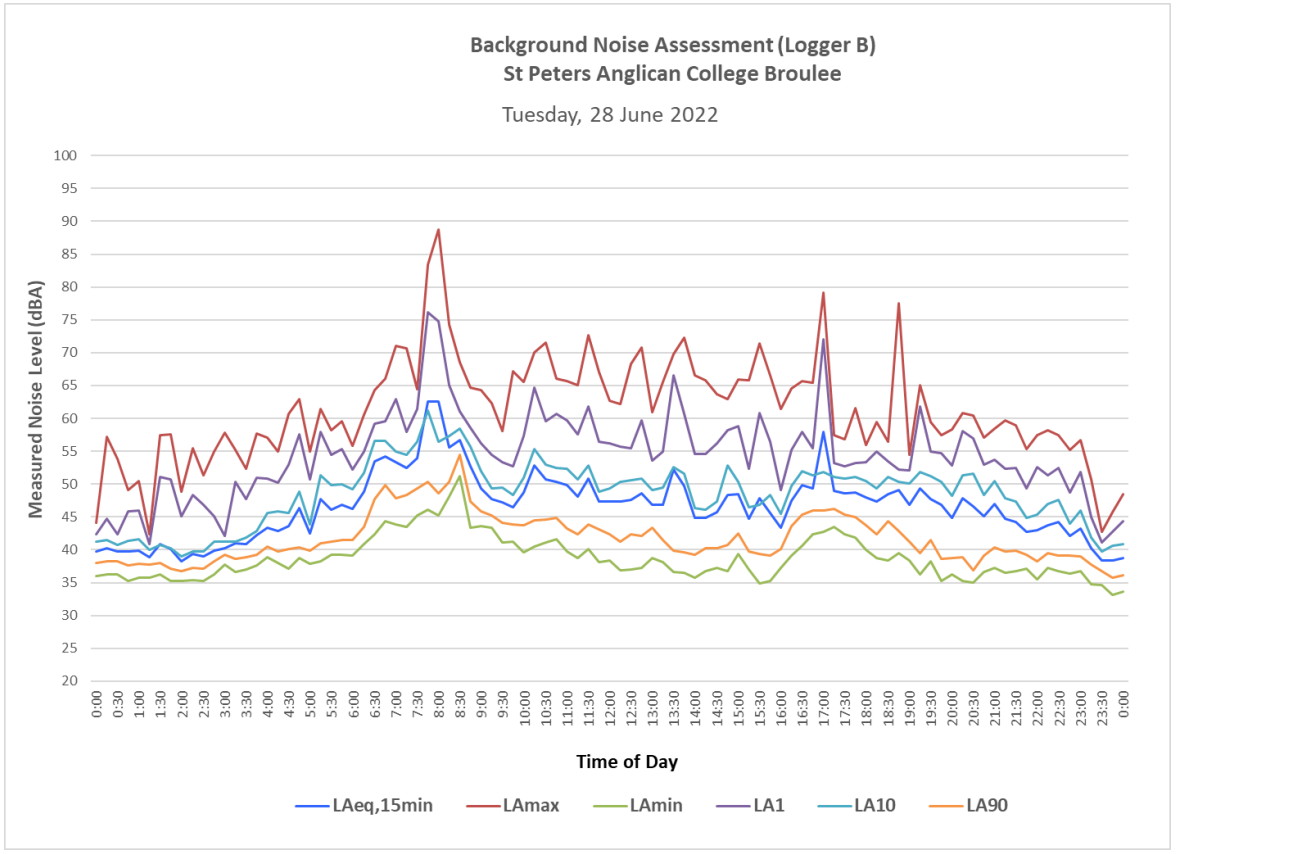

Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Thursday, 23 June 2022
Data excluded due to unusual activity
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90

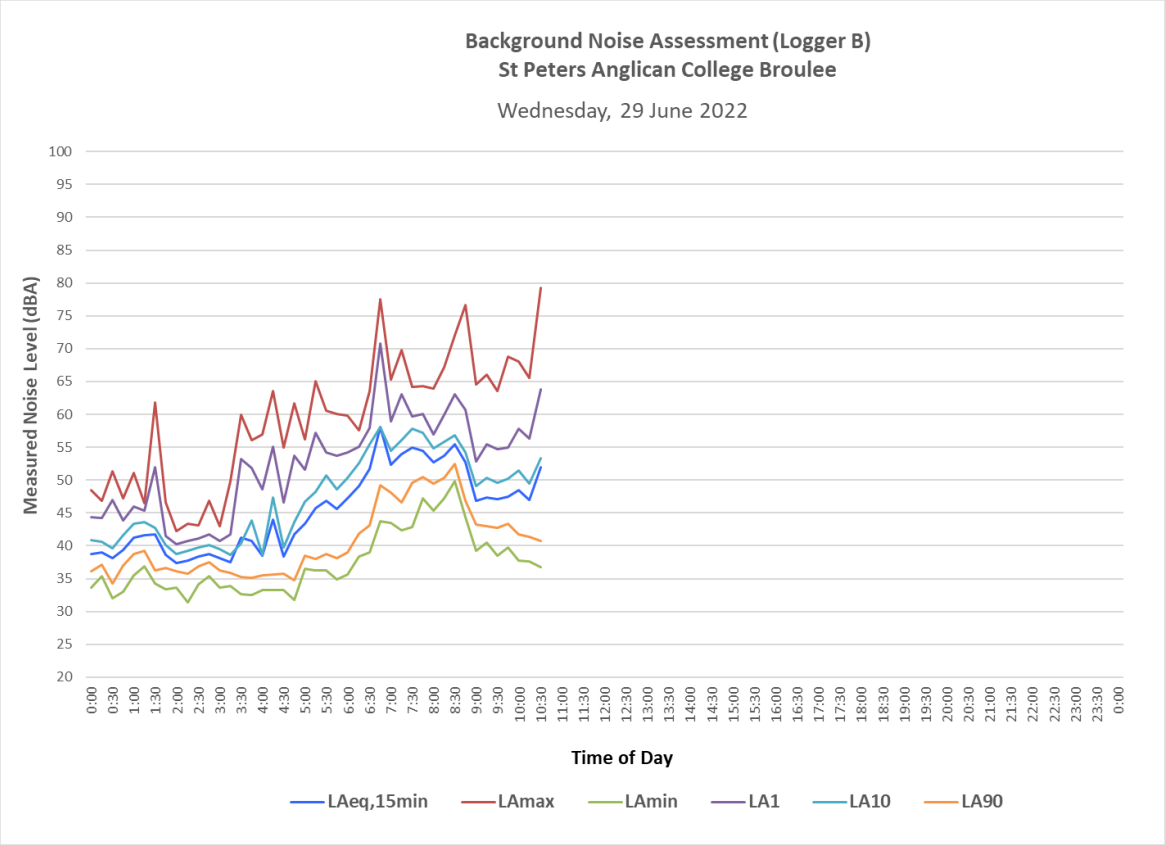

Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Friday, 24 June 2022
Data excluded due to unusual activity
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Saturday, 25 June 2022
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Sunday, 26 June 2022
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Monday, 27 June 2022
Data excluded due to unusual activity
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Tuesday, 28 June 2022
Measured Noise Level (dBA)
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90


Background Noise Assessment (Logger B)
St Peters Anglican College Broulee
Wednesday, 29 June 2022
Measured Noise Level (dBA)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
0:30
1:00
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21:00
21:30
22:00
22:30
23:00
23:30
0:00
Time of Day
LAeq,15min
LAmax
LAmin
LA1
LA10
LA90

Appendix D Mechanical Equipment Specifications and Drawings

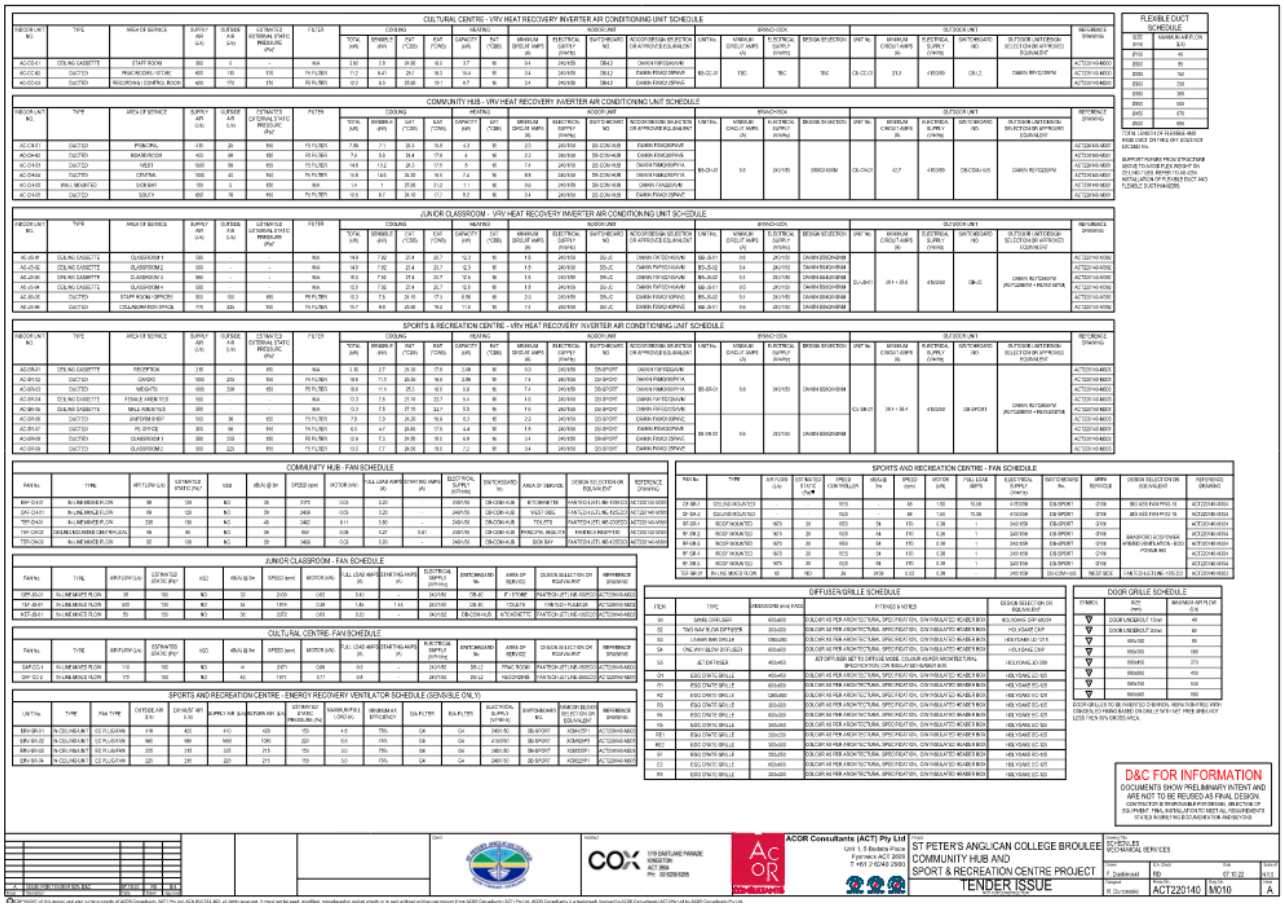

Figure 33 Equipment schedule

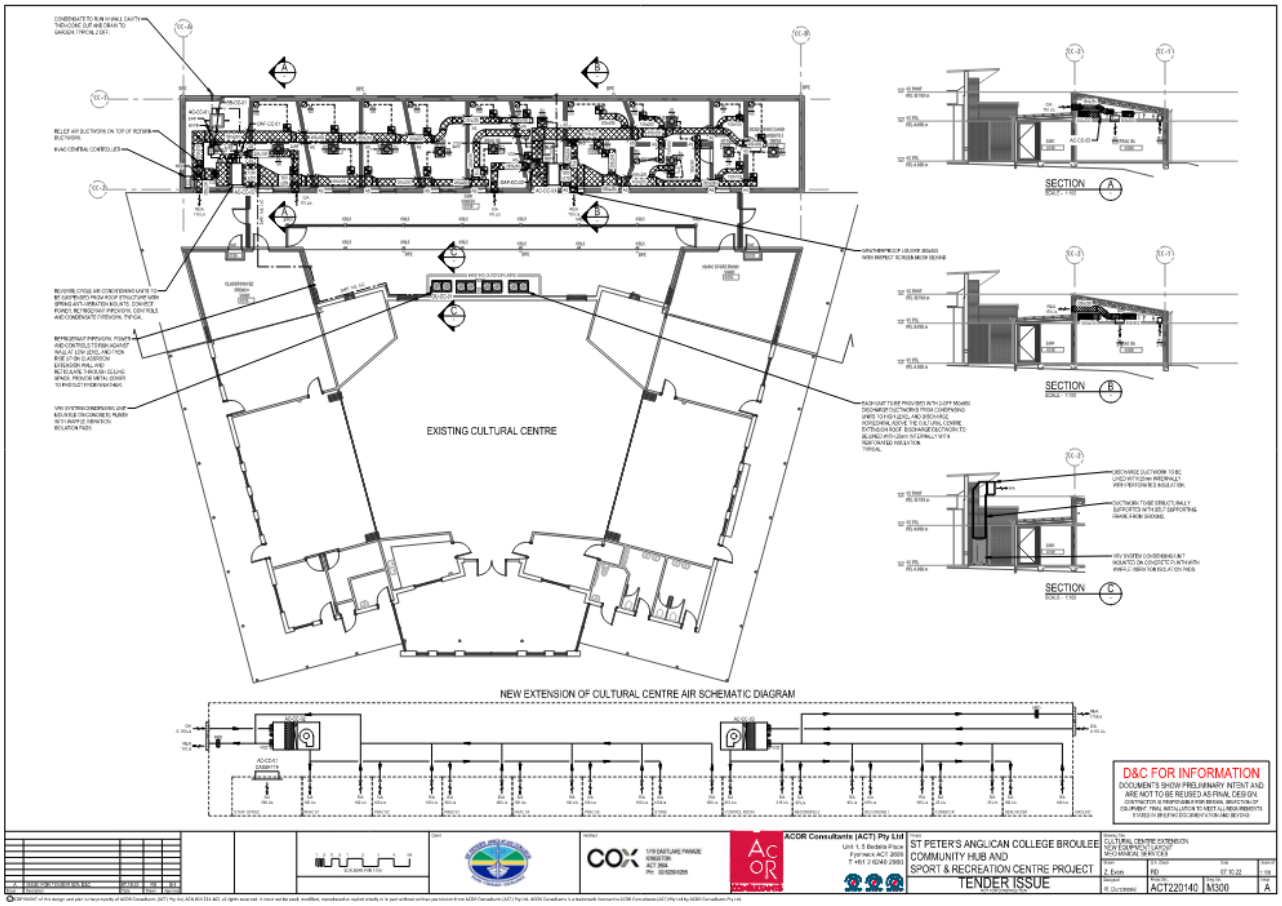

Figure 34 Mechanical ventilation design for the cultural centre (P6)

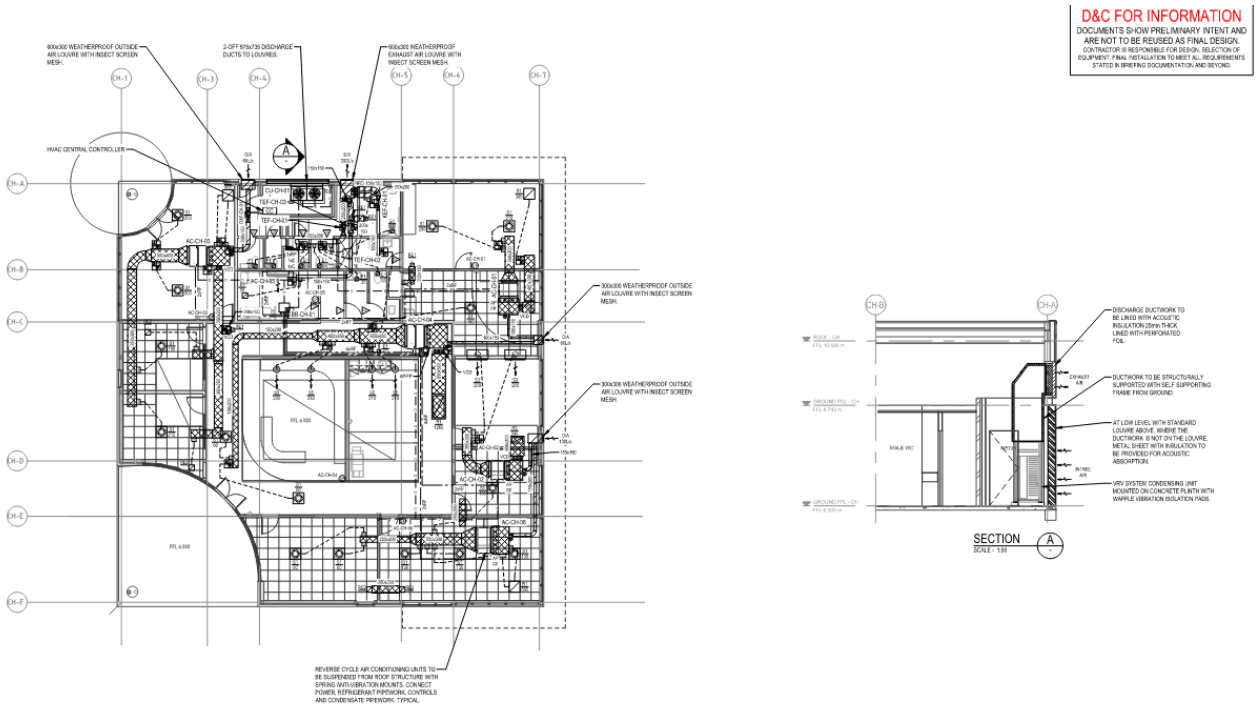

Figure 35 Mechanical ventilation design for the admin (community hub) building (P7)

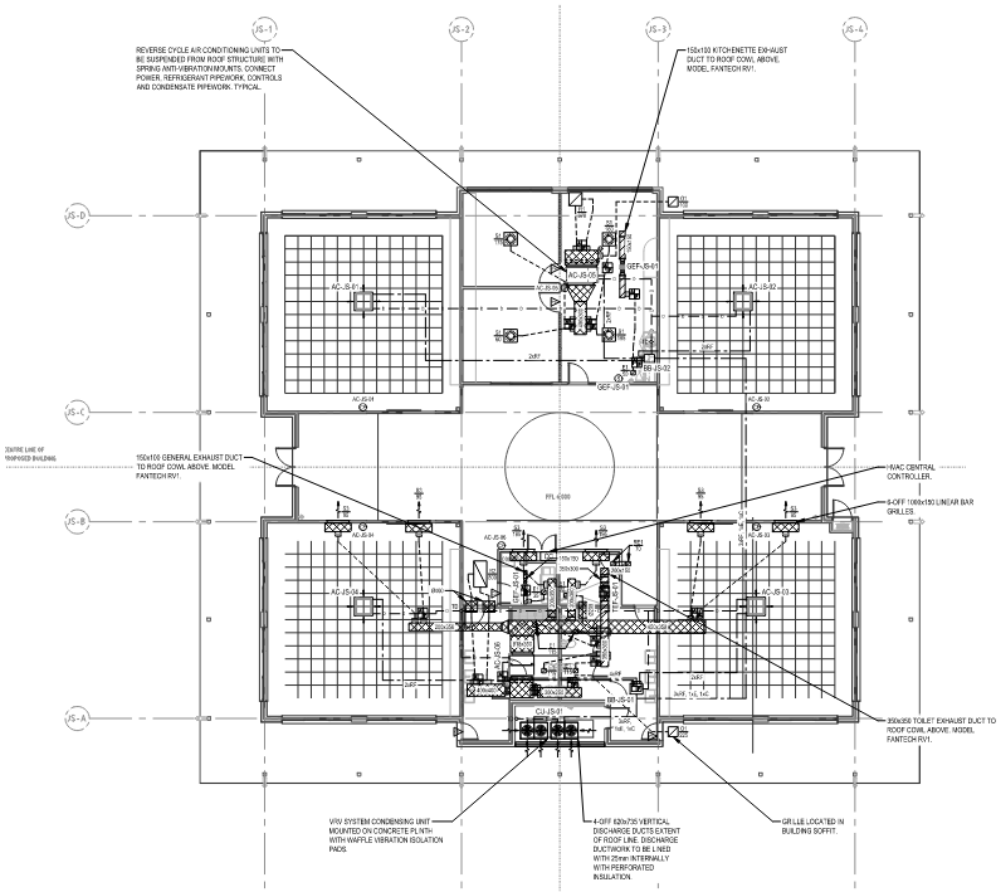

Figure 36 Mechanical ventilation design for the Junior School Building (P5)

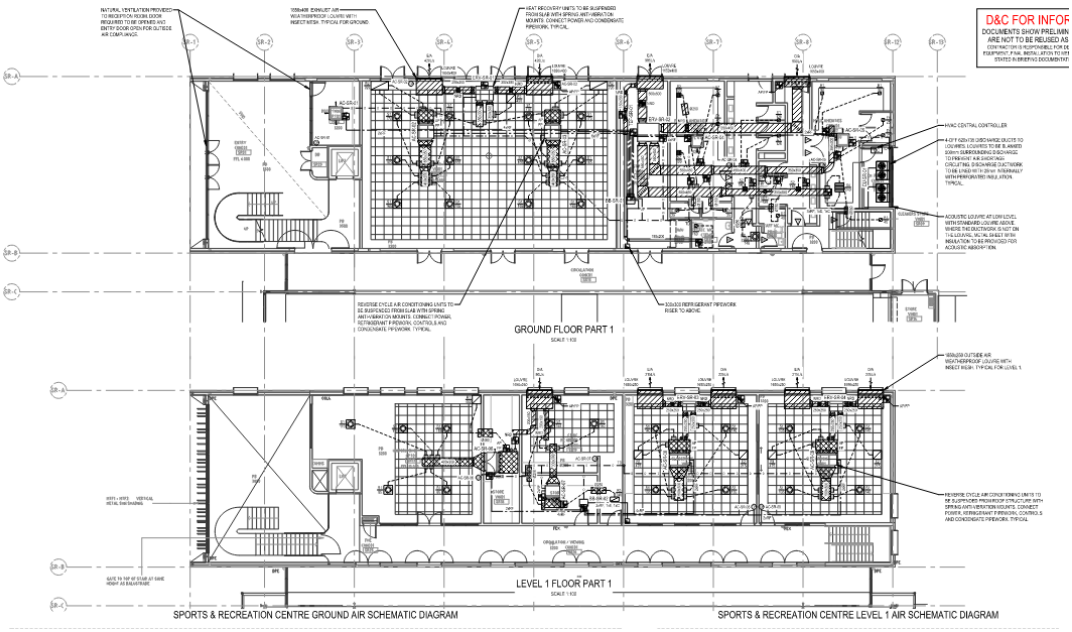

Figure 37 Mechanical ventilation design for gym area of the sports building (P10)

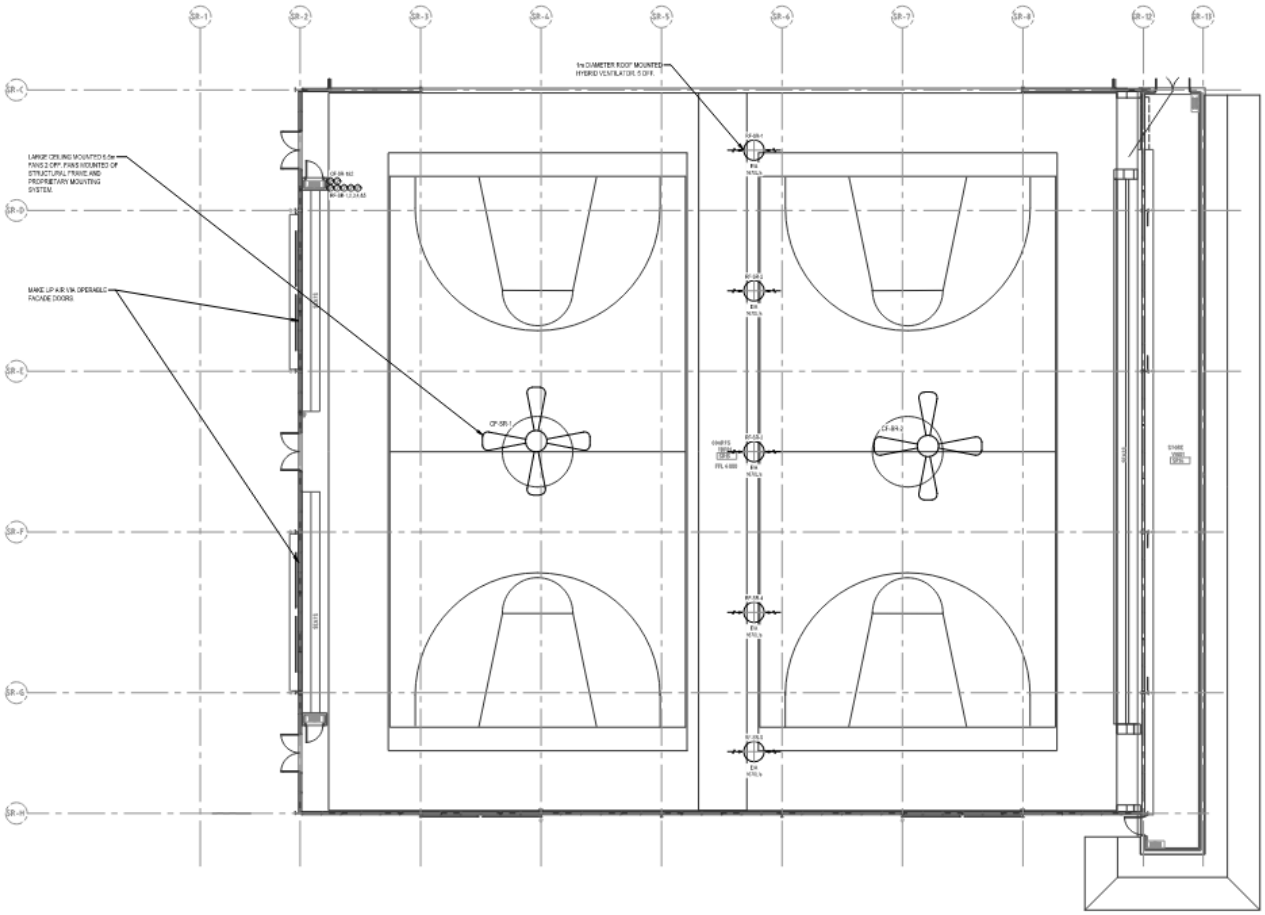

Figure 38 Mechanical ventilation design for the sports building (P10)