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ACOUSTICAL REPORT – CONSTRUCTION STAGE

MIXED-USE DEVELOPMENT

PEMULWUY PROJECT, REDFERN NSW

(PRECINCT 1 AND 2)

Date: Monday, 29 June 2020

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ACOUSTICAL REPORT – CONSTRUCTION STAGE
MIXED-USE DEVELOPMENT
PEMULWUY PROJECT, REDFERN NSW
(PRECINCT 1 AND 2)

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1.0 INTRODUCTION

Koikas Acoustics Pty Ltd (KA) was engaged by Deicorp to prepare a Construction Stage acoustical report for Precinct 1 and 2 of the mixed-use development at Pemulwuy Project, Redfern NSW. The report will form part of the Construction Certificate documentation required for sign-off by the Principal Certifying Authority (PCA) prior to construction commencing on the development.

Koikas Acoustics has been requested to review the construction documentation and address the following acoustical related concerns:

- Determine construction details of partitions to achieve nominated acoustic ratings;
- Determine the type and extent of mechanical plant treatments;
- Discuss the type and extent of materials likely to be required for the Gymnasium to reduce noise and vibration transmission to adjoining noise sensitive premises;
- Determine the type and extent of noise and vibration treatment from duct work located adjacent/adjoining noise sensitive premises;
- Determine the magnitude of noise and vibration transmissions from rail activities from P1 and P2 buildings;
- Confirm the type and extent of building materials required for the external building envelope to meet the nominated acoustic criteria for rail noise and vibration intrusion, and
- Preliminary child care center noise impact assessment to determine reasonable noise mitigation measures to be adopted into the design.

This report presents the results and findings of an acoustic assessment for the subject development. Recommended acoustic treatments and noise controls that are detailed within this report are deemed necessary for the development to comply with the relevant conditions of consent.

This report should be read with the approved DA acoustic report prepared by Koikas Acoustics, details are provided below:

Project Title: *Acoustic Assessment: Pemulwuy Project
Mixed-use Retail Commercial Residential Development*
File Reference: *R031111as2075.docx*
Revision: *V1*
Dated: *Tuesday, 13th December 2011*

Hereafter referred to as the 'Previous Acoustic Report'.

KOIKAS ACOUSTICS PTY LTD

Date: Monday, 29 June 2020

File Reference: 2075R20181126jtPemulwuyPrecinct1&2_CC_V9.docx

Prepared For: Deicorp

Acoustic Report: Construction stage – Mixed-use development, Pemulwuy Project, Redfern NSW (Precinct 1 and 2)

2.0 CONDITIONS OF CONSENT

The relevant conditions for the CC stage from the Minister for Planning (Application No.: MP11_0093) is provided below.

B3 Acoustic Treatments The following details as recommended in the Koikas Consultants Pty Ltd Acoustics Assessment dated 13 December 2011 are required to be submitted with the Construction Certification application: a) The maximum vibration limit is to be specified by a consulting geotechnical engineer prior to commencement of excavation; b) The specifications shall include reference to building materials capable of achieving the recommended acoustic attenuation in accordance with Section 6.5 of the Koikas assessment. c) Compliance with the recommendations of Section 10.1 of the Koikas assessment in relation to BCA requirements.

Condition (a) refers to a vibration limit to be nominated by a geotechnical engineer.

Conditions (b) and (c) was be reviewed by Koikas Acoustics in this report:

- Condition (b) refers to a review of the building materials used to attenuate external noise intrusion.
- Condition (c) refers to a review of the building materials used to attenuate inter-tenancy noise.

3.0 THE DEVELOPMENT

The Pemulwuy Project development is located in Redfern in close proximity to Redfern Train Station, off Lawson Street.

- **Precinct 1** is located on the block that is enclosed by Eveleigh Street to the east, Louis Street to the west, Vine Street to the north and Caroline Street to the south.
- **Precinct 2** occupies the block of land that adjoins Caroline Street to the north, Eveleigh Street to the east and Lawson Street to the south.

Due to the proximity of the rail corridor and vehicular traffic along Lawson Street, there is the potential for intrusive noise and vibrations to be experienced within premises associated with the proposed development. Similarly, there is the potential for noise from the use of premises within the proposed development generating intrusive noise to residents surrounding the Pemulwuy Project site.

As the surrounding area is predominantly for residential use, care must be taken to ensure there is no unreasonable loss of acoustic amenity as a result of the new development.

As a consequence of the size of the development site, the existing ambient noise varies markedly.

In the vicinity of Precinct 2 the ambient noise is mostly that of vehicles and pedestrian traversing along Lawson Street.

This site area is dominated by distant traffic movements (road and rail) and noise from surrounding commerce and industrial sources. With the inclusion of the two buildings proposed for Precinct 2 and 3 there will likely be a reduction to the existing ambient noise profile as these buildings will provide significant noise shielding of road and rail activities.

Particular noise sensitive receiver sites are located in Caroline Street, Lawson Street, Louis Street and to a lesser extent, Hugo Street. The subject sites and surrounding properties are identified on the aerial photograph included as Figure 1.

Set-back from both the road and rail corridors will have the effect of lower ambient noise levels. The proposed new buildings will provide shielding to most of the new Precinct 1 and 2 apartments. The level of ambient noise will however increase marginally for the higher floor levels.

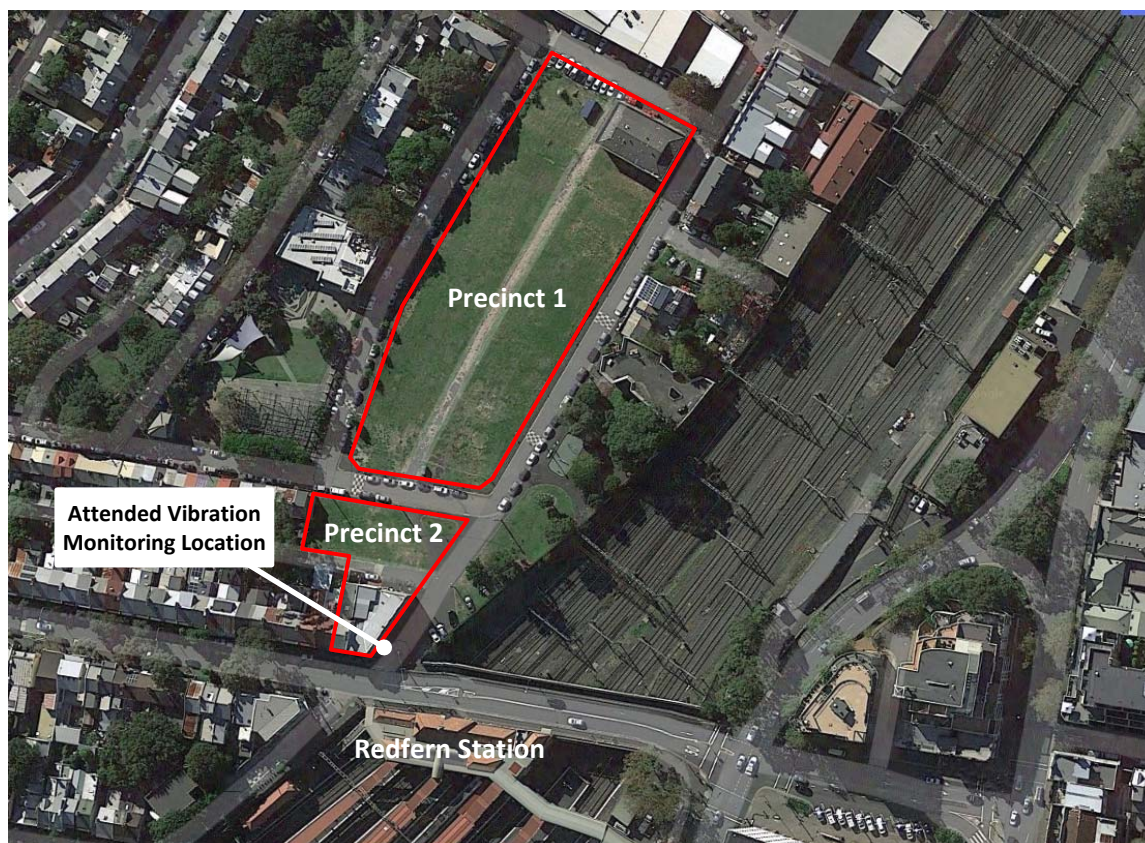


Figure 1. Aerial photo of subject site and surrounds – Image is taken from Google Maps

Precinct 1 will include 36 townhouses over two floor levels and 26 apartments over six floor levels.

Precinct 2 will include a child care centre with playground on the ground floor, 4 retail premises on second floor, and office premises on third and fourth floors.

The current building design can be seen in the architectural drawings of the site as prepared by Nordon Jago Architects, detailed in Table 1. All calculations/noise modelled scenarios conducted for this assessment are referenced to these architectural drawings.

Table 1. Drawings used in the assessment					
Architectural Drawing		Drawing No.	Revision	Date	Job No.
Precinct 1		1CD----	-	19.05.19	DEI00210
Precinct 2		2CD----	-	29.06.20	DEI00210
Notes	1.	Detailed above are the plans and drawings available at the time of assessment. Where design changes are made without the prior knowledge of Koikas Acoustics, our assessment results and conclusions published within this report may be incorrect.			

4.0 RAIL VIBRATION ASSESSMENT

4.1 SITE LOCATION OF ATTENDED VIBRATION MONITORING

The vibration survey was conducted around 1300 hours on Friday 27th November, 2018.

The vibration loggers were placed in the front of Precinct 2, approximately 15 metres from the railway corridor (nearest location to railway corridor/station). The vibration transducer was mounted on top of the concrete sidewalk. This site was considered appropriate for the purpose of quantifying the magnitude of ground induced vibration levels likely to be experienced along the front façades of Precinct 2 and to a lesser extent to Precinct 1.

Refer to **Figure 1** for an aerial photo showing the unattended noise monitoring locations.

4.2 METEOROLOGICAL CONDITIONS DURING VIBRATION SURVEY

The meteorological conditions pertaining over the monitoring period did not adversely affect the noise and vibration results.

4.2.1 Vibration Monitoring Instrumentation

The vibration survey for this site utilised one Vibrock V901 vibration logger. The vibration logger was connected to one vibration transducers and the vibration transducers was secured on a solid concrete floor surface.

All equipment used for taking noise level measurements currently carry NATA certification or traceable to NATA calibration certification.

4.3 RAIL VIBRATION SURVEY RESULTS

During the attended rail vibration survey, at least 10 trains were seen to pass through Redfern station and no vibration levels were measured during each pass-by. The railway tracks/corridor is at least 10 meters beneath the ground (at Precinct 2), therefore propagation path of vibrations to Precinct 2 is much greater than the horizontal distance of 15 meters. As no vibration levels were recorded at the ground floor level, vibration controls are therefore not required for this development.

5.0 REVIEW EXTERNAL NOISE INTRUSION ASSESSMENT

Calculating the level of noise that is transmitted from outside to inside a building through a façade is dependent upon the external façade noise level, the sound insulation performance of the building façade (inclusive of all building components), and the level of acoustic absorption that is present within the subject room.

5.1 TRAFFIC NOISE CRITERIA

The traffic noise criteria adopted for each internal space has been extracted from the previous acoustic report and provided below.

Table 8. Traffic noise criteria to each internal space		
Location	Windows Closed	Windows Open
Residential: Bedrooms	35dB(A), LAeq, 9 hrs	45dB(A), LAeq, 9 hrs
Residential: Living areas	40dB(A), LAeq, 15 hrs	50dB(A), LAeq, 15 hrs
Retail spaces	45dB(A), LAeq, 15 hrs	55dB(A), LAeq, 15 hrs
Commercial spaces	40dB(A), LAeq, 15 hrs	50dB(A), LAeq, 15 hrs
Gallery	40dB(A), LAeq, 15 hrs	50dB(A), LAeq, 15 hrs
Child Care Centre	40dB(A), LAeq, 15 hrs	50dB(A), LAeq, 15 hrs
Gym	45dB(A), LAeq, 15 hrs	55dB(A), LAeq, 15 hrs

The City of Sydney Council Sydney DCP 2012 has since been introduced and provides guidance on acceptable indoor noise levels when considering external sources of noise. The City's guidelines adopt a LAeq 1 hour noise metric that applies during daytime (7am to 10pm) and night-time (10pm to 7am) hours. They are summarised as follows:

- For closed windows and doors
 - LAeq 1 hour 35dB for bedrooms (10pm-7am)
 - LAeq 1 hour 45dB for living areas (24 hours)
- For open windows and doors
 - LAeq 1 hour 45dB for bedrooms (10pm-7am)
 - LAeq 1 hour 55dB for living areas (24 hours)

5.2 FAÇADE TRAFFIC NOISE LEVELS

The calculated maximum $L_{Aeq, Period}$ noise levels to each building has been extracted from the previous acoustic report and shown in the table below.

Table 2. Maximum predicted facade noise levels [dB]				
Precinct	Location	Period	Noise level	Required noise reduction
Precinct 1	Townhouses: TH 33	$L_{Aeq, Daytime}$	58	18
		$L_{Aeq, Night-time}$	54	19
		Max L_{Aeq} 1 hour (Daytime)	60 ¹	20
		Max L_{Aeq} 1 hour (Night-time)	57 ¹	22
	Units: Floor level 5	$L_{Aeq, Daytime}$	58	18
		$L_{Aeq, Night-time}$	53	18
		Max L_{Aeq} 1 hour (Daytime)	60 ¹	20
		Max L_{Aeq} 1 hour (Night-time)	56 ¹	21
Precinct 2	Commercial: Floor level 3	$L_{Aeq, Daytime}$	66	26
		$L_{Aeq, Night-time}$	n/a	n/a
Notes:	1.	Maximum $L_{Aeq, 1hour}$ was based off the unattended noise survey conducted at Precinct 1(Vine Street) and noise modelling conduct in the previous acoustic report.		

To achieve the indoor noise criteria, the following maximum noise reductions are required:

- 22 dB for Townhouses (TH 33);
- 21 dB for Units (Level 5), and
- 26 dB for Commercial (Level 3)

5.3 RECOMMENDED CONSTRUCTION MATERIALS

5.3.1 External Walls

Table 3. External wall construction requirements	
Construction	Areas this applies
- Double brick and cavity (minimum cavity width 20mm) - 1 layer of 13mm cement render applied to either external or internal wall face	All external wall areas, all Precincts

5.3.2 Ceiling/Roof

Table 4. Ceiling / Roof construction requirements	
Construction	Areas this applies
PRECINCT 1: Townhouses - 0.45mm metal roofing; - Roof framing structure; - 250mm air gap (purlins) between the metal roof over and fibre cement ceiling under; - 100mm insulation (24kg/m³) between the purlins, and - 1 layer of 6mm fibre cement sheet ceiling material (<i>fibre cement sheet ceiling to butt up against walls and be sealed with cornice</i>) PRECINCT 1: Units/Apartments - 150mm concrete slab roof/ceiling will be satisfactory	This type of construction applies to all roof areas over habitable spaces in Precinct 1.
PRECINCT 2: Commercial tenancies - 150mm concrete slab roof/ceiling will be satisfactory	This type of construction applies to all roof areas in Precinct 2.

5.3.3 Glass Windows And Doors

Table 5. Glazing Recommendations			
Precinct	Location description	Glazing recommendation	Mechanical ventilation required
Precinct 1	Bedrooms – TH 32 & 33 and Unit 54 & 60.	6.38mm laminated glass	Yes
Precinct 1	Bedrooms – fronting Caroline St & Eveleigh St	6.38mm laminated glass	No
Precinct 1	All other areas	Minimum 4mm float glass (windows) Minimum 4mm toughened glass (Sliding door)	No
Precinct 2	Child Care Centre	4mm float glass	No
	Retail	4mm float glass	No
	Offices (fronting Caroline St)	6.38mm laminated	Yes
	All other offices	4mm float glass	No

The installed window/glazed door systems (inclusive of framing and seals) must achieve a minimum acoustic rating of:

- Rw 27 for 4mm thick toughened glass;
- Rw 29 for 4mm thick float glass, and
- Rw 31 for 6.38 laminated glass,

and comply with Notes 1 to 5 below.

Notes

1. Recommendation based on typical aluminium framed sliding windows/doors with no weep holes in the frame.
2. Window frames should be tightly fitted to the external wall minimising any air gaps. Any air gaps present should be packed with timber and appropriate acrylic sealant such as Knauf Bindex (or approved equivalent).
3. All open-able windows and glazed door systems should be air tight when closed.
4. Q-lon type seals or the equivalent should be fitted along the perimeter of all glazing systems to minimise air gaps. For sliding glass systems that cannot incorporate Q-lon seals, heavy duty fin-type seals such as Schlegel SilentFin could be used. If the windows/doors are not designed to be air-tight when closed, the reduced performance of the windows/doors could compromise the acoustic integrity of the building facade.
5. Recommended glass systems have been calculated based on current architectural drawings as established within this report.

Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing predicted to achieve satisfactory acoustic performance. Design factors such as safety, thermal or energy efficiency are outside the scope of this report and should be assessed accordingly. It is the Client's responsibility to ensure all glazed windows and sliding doors installed on-site to meet all building design requirements.

5.3.4 Ventilation

In the event of high external traffic noise levels, naturally ventilating rooms through the opening of windows and/or doors may not be suitable. This is due to the level of traffic noise being transmitted through the open doors resulting in a breach of the applied noise criterion.

As a general rule, where windows or doors opened sufficiently to provide natural ventilation to a room, the indoor noise level is 10dB below the outside noise level. Therefore, a window or sliding door to a room may be opened to provide natural ventilation where the outdoor noise level does not exceed 10dB above the “Windows open” criteria as detailed within this report.

The spaces where mechanical ventilation is required are nominated in the glazing schedule.

See **Appendix B** for mechanical ventilation details.

For rooms requiring an alternate source of ‘mechanical’ ventilation, suitable options could be to incorporate a component of fresh air into a ducted air conditioning system or to install a small wall-mounted ventilator such as the Acoustica Aeropac. Other options may be considered through consultation with suitably qualified ventilation and acoustic consultants.

6.0 MECHANICAL PLANT NOISE ASSESSMENT

Mechanical plant noise emission has been assessed in accordance with the specification of plant and equipment and installation locations as detailed on the project mechanical services plans prepared by Dynatech Industries shown in Table 6.

Table 6. Drawings used in the assessment				
Mechanical Services Drawing	Drawing No.	Revision	Date	Job No.
B2 & L0 Townhouse Part 1	M1101.1	7	26.11.19	DT-18-151
B2 & L0 Townhouse Part 2	M1101.2	6	26.11.19	DT-18-151
B2 Sections	M1101.3	3	26.11.19	DT-18-151
B1 & L1 Townhouse Part 1	M1102.1	5	21.11.19	DT-18-151
B1 & L1 Townhouse Part 2	M1102.2	5	21.11.19	DT-18-151
L0 & L2 Townhouse Part 1	M1103.1	5	21.11.19	DT-18-151
L0 & L2 Townhouse Part 2	M1103.2	5	21.11.19	DT-18-151
Level 1	M1104	5	21.11.19	DT-18-151
Level 2	M1105	5	21.11.19	DT-18-151
Level 3	M1106	5	21.11.19	DT-18-151
Level 4	M1107	4	21.11.19	DT-18-151
Level 5	M1108	4	21.11.19	DT-18-151
Level 6	M1109	5	05.12.19	DT-18-151
Roof	M1110	3	20.08.19	DT-18-151
Level 1	M2101	01	12.06.19	DT-18-151
Level 2	M2102	01	12.06.19	DT-18-151
Level 3	M2103	01	12.06.19	DT-18-151
Level 4	M2104	01	12.06.19	DT-18-151
Roof	M2105	01	17.06.19	DT-18-151
Notes	1.	Detailed above are the plans and drawings available at the time of assessment. Where design changes are made without the prior knowledge of Koikas Acoustics, our assessment results and conclusions published within this report may be incorrect.		

6.1 PROJECT NOISE CRITERIA

Mechanical plant noise is assessed in accordance with the planning levels contained within the NPfL. Acoustic planning levels are largely determined in relation to the existing environmental noise levels as shown in the previous acoustic report. The following NPfL planning levels apply for this project:

Table 7. NPfL planning levels								
Period, T (Note 1)	Precinct 1 – Vine Street							
	Intrusive		Amenity					Project noise trigger level
	RBL	RBL + 5	Area classification	Recommended amenity noise level	High traffic area	Project amenity noise level	+3dB correction	
Day	43	48	Urban	65	No	60	63	48
Evening	42	47	Urban	55	No	50	53	47
Night	38	43	Urban	50	No	45	48	43
Period, T (Note 1)	Precinct 2 – Lawson Street							
	Intrusive		Amenity					Project noise trigger level
	RBL	RBL + 5	Area classification	Recommended amenity noise level	High traffic area	Project amenity noise level	+3dB correction	
Day	55	60	Urban	65	No	60	63	60
Evening	51	56	Urban	55	Yes	56	59	56
Night	43	48	Urban	50	Yes	51	54	48
Notes								
1. The NSW EPA Industrial Noise Policy refers to the following time periods, Day – 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays, Evening – 6pm to 10pm Monday to Sunday, Night – 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.								
2. The amenity criterion is based on the area classification of the site as being ‘urban’ and has been corrected for an assessment in areas of high traffic and for existing industrial noise where applicable.								
3. Project noise amenity level = recommended noise amenity level – 5dB, except where specific circumstances are met, such as high traffic.								

Mechanical plant noise levels are not to exceed the recommended project amenity noise level of $L_{Aeq,15min}$ 63 dB for commercial properties during business hours and $L_{Aeq,15min}$ 58 dB for active recreational areas.

6.2 EQUIPMENT AND ASSOCIATED SOUND LEVELS

The mechanical services plans identify the following plant and equipment to be installed in the development. Associated noise data is included.

Table 8. Schedule of equipment and noise levels

	Equipment selection	ID	Descriptor	Noise level, [dBA]	Location
Precinct 1	Car park exhaust fan	CPEF-P1-B2.1	Lw @ 3m	65	Basement 2
	Car park supply fan	CPSF-P1-B2.1	Lw @ 3m	71	Basement 2
	Pump room exhaust fan	PREF-P1-B1.1	Lw @ 3m	62	Basement 1
	Pump room supply fan	PRSF-P1-B1.1	Lw @ 3m	62	Basement 1
	-	OAF-P1-L6.1	Lw @ 3m	58	Level 6
	Garbage exhaust fan	GEF-P1-R.1	Lw @ 3m	53	Roof
	Residential AC	Fujistu - AOTG09LVCC	Lp at 1m	47	Balcony/Courtyard
	Residential AC	Fujistu – AOTG12LVCC	Lp at 1m	48	Balcony/Courtyard
	Residential AC	Fujistu – AOTG18LVCC	Lp at 1m	52	Balcony/Courtyard
	Residential AC	Fujistu – AOTG22LVCC	Lp at 1m	55	Balcony/Courtyard
Precinct 2	Kitchen exhaust fan	KEF-P2-L1.1	Lw @ 3m	50	Roof
	Supply fan	SF-P2-L2.1	Lw @ 3m	44	Level 2
	Lobby supply fan	LSF-P2-L4.1	Lw @ 3m	46	Level 4
	Garbage exhaust fan	GEF-P2-R.1	Lw @ 3m	56	Roof
	Toilet exhaust fan	TEF-P2-R.4	Lw @ 3m	56	Roof
	Toilet exhaust fan	TEF-P2-R.2	Lw @ 3m	56	Roof
	Toilet exhaust fan	TEF-P2-R.3	Lw @ 3m	52	Roof
	Toilet exhaust fan	TEF-P2-R.41	Lw @ 3m	47	Roof

An attenuator schedule is also included in the mechanical services plans. The following attenuators are recommended to be included in the mechanical equipment installation unless otherwise noted in this report. Alternate attenuators may be used where they are shown to have comparable or better insertion loss values to those nominated below.

Table 9. Schedule of attenuators

ID	Attenuator serving	Octave band centre frequency insertion loss, [dB]							
		63	125	250	500	1000	2000	4000	8000
CPEF-P1-B2.1	CPEF inlet and outlet (Fantech C1-100)	3	4	9	14	12	8	7	6

Smaller toilet/lobby fans have not been included in the calculations due to their low inherent noise level and limited acoustic impact related to their intermittent nature of use.

6.3 CALCULATED RECEIVER LEVELS

Mechanical plant noise levels have been predicted to nearby residential and commercial receivers by way of preparing an acoustic model and conducting point-to-point calculations based on standard sound propagation algorithms. All calculations consider the equipment as selected in the mechanical services plans, the associated sound levels and corresponding attenuators.

Reference should also be made to additional noise control recommendations included within Section 6.4 of this report, which also govern the calculated receiver noise levels.

Predicted mechanical plant and equipment noise levels from Precinct 1 and Precinct 2, inclusive of all identified fans and air conditioning condensers are shown in Table 10 and Table 11 respectively.

Table 10. Calculated receiver noise levels for Precinct 1 [dB]					
Receiver location	Project noise criteria L_{Aeq} 15 mins				Predicted receiver noise level
	Residential Day	Residential Evening	Residential Night	Non-residential	L_{Aeq} 15 mins Day / Evening / Night
R1 – Residential	48	47	43	n/a	30
R2 – Residential	48	47	43	n/a	39
R3 – Residential	48	47	43	n/a	35
R4 – Residential	48	47	43	n/a	40
R5 – Residential	48	47	43	n/a	42
R6 – Residential	48	47	43	n/a	40
R7 – Residential	48	47	43	n/a	35
R8 – Residential	48	47	43	n/a	32
R9 – Residential	48	47	43	n/a	38
R10 – Residential	n/a	n/a	n/a	58	31
R11 – Residential	n/a	n/a	n/a	58	34
R12 – Residential	48	47	43	n/a	39
R13 – Residential	48	47	43	n/a	39
R14 – Residential	48	47	43	n/a	39
R15 – Residential	n/a	n/a	n/a	63	35
Notes 1.	Intrusive noise levels consider that all fans and AC condensers may be operating simultaneously over a 15 minutes assessment period during the day, evening, or night period. It is highly unlikely that this scenario would ever occur, therefore actual noise levels may be lower than predicted.				

Table 11. Calculated receiver noise levels for Precinct 2 [dB]					
Receiver location	Project noise criteria L_{Aeq} 15 mins				Predicted receiver noise level
	Residential Day	Residential Evening	Residential Night	Non-residential	L_{Aeq} 15 mins Day / Evening / Night
R1 – Residential	60	56	48	n/a	34
R2 – Residential	60	56	48	n/a	20
R3 – Residential	48	47	43	n/a	38
R4 – Residential	48	47	43	n/a	37
R5 – Residential	48	47	43	n/a	39
R6 – Residential	48	47	43	n/a	32
R7 – Residential	48	47	43	n/a	36
R8 – Residential	48	47	43	n/a	36
Notes	1. Intrusive noise levels consider that all fans may be operating simultaneously over a 15 minutes assessment period during the day, evening, or night period. It is highly unlikely that this scenario would ever occur, therefore actual noise levels may be lower than predicted.				

Mechanical plant noise levels have been assessed to comply with the limiting NPfl criteria, pending the inclusion of noise control measures as detailed in Section 6.4 Recommendations of this report. Refer to **Appendix C** for the mechanical plant Cadna noise contour maps.

6.4 RECOMMENDATIONS

In order to achieve compliance with the nominated mechanical plant noise criteria at the adjoining/surrounding residential and commercial premises as shown in Section 6.3 of this report, noise mitigation measures are required to attenuate the noise levels generated by the mechanical plant. The following noise mitigation measures are required:

Table 12. Recommended Noise Mitigation Measures to Mechanical Plant in Precinct 1	
MECHANICAL PLANT	NOISE MITIGATION MEASURES
Car park exhaust air fan CPEF-P1-B2.1 Fantech AP1004GA6/22	- Line the inside ductwork with 50 mm thick rigid grade fibreglass 32 kg/m³ over a minimum length of 3 meters between the outlet end of the ductwork and the exhaust fan. - An acoustic silencer/attenuator with insertion loss specified in Table 9 of this report is also required to be incorporated for the air-extraction ductwork on both sides of the fan.
Car park supply air fan CPSF-P1-B2.1 Fantech AP0804GP6/24	Line the inside ductwork with 50 mm thick rigid grade fibreglass 32 kg/m³ over a minimum length of 4 meters between the inlet end of the ductwork and the supply fan.
Pump room exhaust air fan PREF-P1-B1.1 Fantech AP0312AP5/22	No addition recommendations beyond the mechanical services drawings.
Pump room supply air fan PRSF-P1-B1.1 Fantech AP0312AP5/22	Line the inside ductwork with 25 mm thick rigid grade fibreglass 32 kg/m³ over a minimum length of 3 meters between the outlet end of the ductwork and the exhaust fan.
OAF-P1-L6.1 Fantech AP0564GP6/21	Line the inside ductwork with 25 mm thick rigid grade fibreglass 32 kg/m³ over a minimum length of 2 meters between the outlet end of the ductwork and the exhaust fan.
Garbage exhaust air fan GEF-P1-R.1 Fantech PCD354DD	Line the inside ductwork with 25 mm thick rigid grade fibreglass 32 kg/m³ over a minimum length of 2 meters between the outlet end of the ductwork and the exhaust fan.
Residential Outdoor AC units Fujitsu - AOTG09LVCC Fujitsu – AOTG12LVCC Fujitsu – AOTG18LVCC Fujitsu – AOTG22LVCC	- AC condenser units are to be located as per the mechanical services drawings in Table 6. - Alternative AC units could be considered provided that the acoustic performance is equal to or better than the Fujitsu - AOTG09LVCC, AOTG12LVCC, AOTG18LVCC and AOTG22LVCC. Recommended brands include Daikin/Mitsubishi/Fujitsu/Actron. - The AC unit must be mounted on the floor of the balcony with the top of the AC unit not higher than the balustrade.

Table 13. Recommended Noise Mitigation Measures to Mechanical Plant in Precinct 2	
MECHANICAL PLANT	NOISE MITIGATION MEASURES
Kitchen exhaust fan KEF-P2-L1.1 Fantech RIL-200SW (high speed)	No addition recommendations beyond the mechanical services drawings.
Supply fan SF-P2-L2.1 Fantech RIL-200SW (low speed)	Line the inside ductwork with 50 mm thick rigid grade fibreglass 32 kg/m³ over a minimum length of 1 meters between the inlet end of the ductwork and the supply fan.
Lobby supply fan LSF-P2-L4.1 Fantech PUE314ER	No addition recommendations beyond the mechanical services drawings.
Garbage exhaust fan GEF-P2-R.1 Fantech CE252V	No addition recommendations beyond the mechanical services drawings.
Toilet exhaust fan TEF-P2-R.4 Fantech CD404V	No addition recommendations beyond the mechanical services drawings.
Toilet exhaust fan TEF-P2-R.2 Fantech CE252V	No addition recommendations beyond the mechanical services drawings.
Toilet exhaust fan TEF-P2-R.3 Fantech GUE354V	No addition recommendations beyond the mechanical services drawings.
Toilet exhaust fan TEF-P2-R.1 Fantech CE314V	No addition recommendations beyond the mechanical services drawings.

It is recommended that the lining material begin one duct length away from the actual fan.

Further, ductworks in risers and AC units on balconies, basement fans and ductwork must be vibration isolated from the building structure to minimise structure-borne vibrations transmitting into floor slabs/walls which will manifest as airborne noise in adjoining spaces. Embleton rubber mounts (Refer to Figure 2 below) or spring-mounted hangers (Refer to Figure 3 below) could be considered.

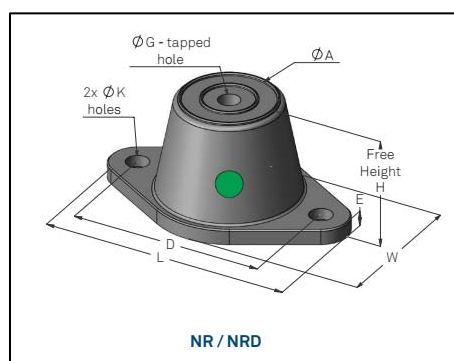


Figure 2. Embleton Rubber Mount NR/NRD



Figure 3. Embelton Isolation Hangers

Expert advice regarding vibration isolation details is to be sought from Embelton, Elephants Foot (relating to the garbage chute, if any) or other similar suppliers/manufacturers based on the detailed design specifications available at a later stage.

Furthermore, it is reasonable to expect that not all plant and equipment will be operating at full capacity at the same time, especially the car park exhaust fans which will generally be set on CO₂ sensor and only operate as necessary. Receiver noise levels are anticipated to be lower than predicted in this report.

7.0 INTERTENANCY NOISE ASSESSMENT

The proposed partitions separating adjacent units, and units from common areas in the development have been assessed for acoustic compliance with the current sound insulation provisions of the BCA and Councils Conditions. Where necessary, KA has noted recommended changes to the standard design to ensure they are compatible with the BCA design standards and Councils Conditions.

7.1.1 National Construction Code – Building Code Of Australia

A wall or floor partition is considered to satisfy BCA Performance Requirements where it is shown to:

- Have a laboratory tested acoustic rating that meets or exceeds the Deemed-to-Satisfy provisions of F5.4 to F5.7, or
- Complies with Specification F5.2, or
- Is tested on-site to achieve the minimum acoustic performance as defined within *Verification Methods* FV5.1 and FV5.2.

The Deemed-to-Satisfy provisions applying to this specific development are summarised below:

Table 14. BCA acoustic design requirements			
Partition	Detail	Airborne sound	Impact sound
Floor	Separating SOU's, or an SOU from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or part of a different classification	$R_w + C_{tr} \geq 50$	$L_{n,w} \leq 62$
Wall <i>See notes 1 and 2</i>	Separating SOU's	$R_w + C_{tr} \geq 50$	Not applicable
	Separating a habitable room (other than a kitchen) in one SOU from a bathroom, sanitary compartment, laundry, kitchen in another SOU	$R_w + C_{tr} \geq 50$	Discontinuous construction
	Separating an SOU from a plant room or lift shaft	$R_w \geq 50$	Discontinuous construction
	Separating an SOU from a stairway, public corridor, public lobby or the like, or part of a different classification	$R_w \geq 50$	Not applicable
Door	Located in a wall separating an SOU from a stairway, public corridor, public lobby or the like	$R_w \geq 30$	Not applicable
Services	Duct, soil, waste or water supply pipes located in a wall or floor cavity and serves or passes through more than one SOU (including a stormwater pipe)	$R_w + C_{tr} \geq 40$ (habitable) $R_w + C_{tr} \geq 25$ (other)	Not applicable
Pumps	A flexible coupling must be used at the point of connection between the service's pipes in a building and any circulating or another pump.		
Notes	- Where a wall is to achieve a sound insulation rating and has a floor above, the wall must continue to either the underside of the floor or to the ceiling which has a comparable sound insulation rating to the wall. - Where a wall is to achieve a sound insulation rating and has a roof above, the wall must continue to either the underside of the roof or to the ceiling which has a comparable sound insulation rating to the wall.		

7.2 RECOMMENDED PARTITION WALLS

Refer to **Appendix A** for comments regarding the proposed partition wall systems for Precinct 1. The acoustic ratings of the proposed partition walls were calculated using *Insul V9.0.19* and found to comply with the minimum noise requirements of the BCA.

Koikas Acoustics has reviewed the Wall systems for Precinct 2 (Dwg No.: 2CD960E & 2CD962D) and has identified Wall Type 7A (200mm AFS Rediwall) is used in conjunction with various stud walls between the *lift/staircase/garbage room/mechanical room/mechanical riser* and the adjoining *commercial/retail/office/CCC*.

There are no acoustical requirements between these spaces, although the proposed 200 mm AFS Rediwall will achieve the airborne criteria ($R_w + C_{tr} 50$) of the BCA. In order to minimise structure-borne vibration noise from the *lift* to the *commercial/retail/office/CCC* spaces, we recommend isolating the AFS Rediwall from the stud system.

Furthermore, there are no acoustical requirements between the *commercial/retail/office/CCC* spaces therefore we have not considered these wall types.

7.3 RECOMMENDED PARTITION FLOOR/CEILING

The following floor/ceiling assemblies are recommended to achieve the BCA minimum acoustic rating requirements and Council's requirements.

Table 15. Floor system recommendations	
System 1	
Floor covering	Selected tiles + 30mm screed
Underlay	Regupol 4515 (4.5mm), OR Uniroll RF700 5mm / RFC750 4.5mm, OR A1 Rubber Acoustamat 3mm, OR Damtec Standard 4mm, OR other approved products.
Floor slab	200mm concrete
Ceiling cavity	None
Cavity insulation	None
Ceiling material	None
System 2	
Floor covering	Engineered timber or laminate timber
Underlay	Regupol 4515 (5mm), OR Uniroll RF700 5mm / RFC750 4.5mm, OR A1 Rubber Acoustamat 3mm, OR Damtec Standard 4mm, OR other approved products.
Floor slab	200mm concrete
Ceiling cavity	None
Cavity insulation	None
Ceiling material	None
System 3	
Floor covering	Carpet
Underlay	Carpet underlay
Floor slab	200mm concrete
Ceiling cavity	None
Cavity insulation	None
Ceiling material	None

Notes: The recommended ceiling/floor systems above are based on impact noise test conducted in a NATA certified lab and the acoustic predicting software (Insul V9.0.17). Koikas Acoustics recommend that in-situ testing is conducted on representative and fully installed partition assemblies to ensure adequate acoustic insulation and isolation is achieved prior to installation throughout the development.

7.3.1 Additional Recommendations/Information

Although the above systems are predicted to achieve compliance for transmission to rooms directly below, offset transmission to a nearby living area may result in impact noise levels that do not achieve the BCA standards. Koikas Acoustics advises that in-situ testing be completed on a completed sample or model unit prior to construction and installation throughout the entire development.

The impact isolation requirements and floor system recommendations are applicable to external balconies that are situated above internal areas of another SOU below. The BCA also does not distinguish between habitable or non-habitable spaces, therefore, the above recommendations also apply to wet areas such as bathrooms etc.

Hard floor coverings such as tiles/timber must not make contact with any walls or joinery such as kitchen benches, cupboards etc. During installation of hard floor coverings, temporary spacers of 5-10mm should be used to isolate the floor covering from walls and/or joinery with the resulting gaps filled with a suitable mastic type sealant or off-cut of rubber underlay material.

Alternative floor/ceiling systems could be considered provided that the acoustic performance is tested or assessed by a consulting acoustical engineer to be compliant with the sound insulation performance requirements of the BCA.

The above floor systems have been assessed to comply with the BCA airborne and impact sound insulation requirements. Verification of the installed acoustic performance is recommended as per Section 7.6 of this report prior to full installation throughout the development.

7.4 SOIL, WASTE, WATER SUPPLY PIPES

Where a duct, soil, waste or water supply pipe is located within a wall or ceiling cavity and serves or passes through one or more SOU's, the following separation details may be used to comply with the required acoustic rating:

Table 16. Services in cavity wall or ceiling			
Option	Rating	Documented source	System detail
1	Rw + Ctr 25	CSR Red Book, KA opinion	2 layers of 10mm plasterboard, or 1 layer of 9mm compressed fibre cement (density $\geq 2100 \text{ kg/m}^3$).
2	Rw + Ctr 25	CSR Red Book, KA opinion	- Acoustilag 45, and 13mm plasterboard, or 6mm fibre cement sheet (density $\geq 1560 \text{ kg/m}^3$).
3	Rw + Ctr 25	CSR Red Book, KA opinion	- Unlagged pipes, and 13mm Soundchek wall/ceiling lining, or 2 layers of 16mm Fychek may be used as wall/ceiling lining, or 1 layer of 9mm compressed fibre cement (density $\geq 2100 \text{ kg/m}^3$).
4	Rw + Ctr 40	CSR Red Book, KA opinion	- Acoustilag 45, and 13mm Soundchek as wall/ceiling lining, or 2 layers of 16mm Fychek as wall/ceiling lining, or 1 layer of 9mm compressed fibre cement (density $\geq 2100 \text{ kg/m}^3$).
5	Rw + Ctr 40	Pyrotech Soundlag 4525C brochure, KA opinion	- Soundlag 4525C, and - Minimum 10mm plasterboard, or - minimum 6mm fibre cement (density $\geq 1560 \text{ kg/m}^3$).
Notes: - The acoustic lagging material may be excluded by using Rehau Raupiano Plus pipe system. - All installations are to be in accordance with relevant manufacturers' specifications and requirements. - Incorporating downlights into ceilings will impact on the acoustic rating of the partition system. Consultation should be made with an acoustic consultant in the event of downlights being proposed in the ceiling. The CSR Red Book provides some guidance on downlights being installed in a services partition system.			

The BCA further qualifies the acoustic requirements of services partitions with the following:

- Services must not be chased into concrete or masonry elements,
- An access door or panel must be firmly fixed so as to overlap the frame or rebate the frame by not less than 10mm and be fitted with proper sealing gasket along all edges and constructed of:
 - Wood, particle board or block board not less than 38mm thick; or
 - Compressed fibre reinforced cement sheeting not less than 9mm thick; or
 - Other suitable material with a mass per unit area not less than 24kg/m^2 .

- A water supply pipe must only be installed in the cavity of discontinuous construction, and in the case of a pipe that serves only one SOU, must not be fixed to the wall leaf on the side adjoining any other SOU and have a clearance not less than 10mm to the other wall leaf.

7.5 SOUND ISOLATION OF PUMPS

A flexible coupling must be used at the point of connection between the service's pipes in a building and any circulation or another pump.

7.6 UNIT ENTRY DOORS

Where an entry door is incorporated into a wall that separates a tenancy from a common area such as a Lobby/Foyer, that door must achieve an acoustic rating of no less than R_w 30. A suitable door system to achieve this would be a 40mm solid core timber door with Raven type RP10/RP10si door frame/perimeter seals and RP8si door bottom seals.

Alternate systems could be considered pending approval from a consulting acoustical engineer.

7.7 VERIFICATION OF ACOUSTIC PERFORMANCE

The recommendations for partition construction details included in this report are not a certification of acoustic compliance. The recommendations are based on our professional opinion of acoustic performance ratings. Due to the number of variables that can exist between development sites, it is not possible to confirm acoustical compliance without conducting in-situ tests.

Koikas Acoustics recommend that in-situ testing is conducted on representative and fully installed partition assemblies to ensure adequate acoustic insulation and isolation is achieved prior to installation throughout the development.

8.0 NOISE AND VIBRATION IMPACT FROM GYMNASIUM, MECHANICAL PLANT AND DUCTS

Koikas Acoustics Pty Ltd was requested to address concerns of structure-borne noise and vibration to surrounding residents from the gymnasium, mechanical plant and ducts for Precinct 1 and Precinct 2.

Recommendations provided in this report are based on achieving inaudibility to residents in the surrounding units from the normal use of plant and equipment associated with the gymnasium, mechanical plant and ducts. As details regarding these areas are not available at this stage, preliminary recommendations have been provided below regarding critical components to be considered.

Koikas Acoustics has liaised with vibration isolation suppliers regarding the isolation of plant and equipment typically associated with these areas. Wandel is a supplier and installer of vibration isolation for plant/equipment/pipes. Important parameters that will have a bearing on the type of isolation required is the static and dynamic forces of the plant used. In order to determine the acoustical parameter of the vibration isolation, details of all plant and equipment will be required. Wandel's contact detail are provided below.

Christian

Mobile: 0450 609 588

Email: christian@wandel.com.au

8.1 GYMNASIUM

Details regarding the gymnasium are not available at this stage. An assessment is normally undertaken once the foundation of the gymnasium has been constructed so that real-world testing can be undertaken to determine the extent (if required) of any noise and vibration mitigation measures.

8.1.1 Recommendations For Free-Weights Area

The use of the spring mounted platform system are normally required to minimise noise and vibration impacts to achieve inaudibility to surrounding residential/commercial premises. The spring mounted platform system may consist of two layers of 18 mm plywood (glued together) and fitted with Gym Floor Damped Springs.

The following is noted:

- The free weights area must be located at the furthest distance away from the sleeping areas above and adjacent.
- The information provided in this report relates to acoustic matters only. Supplementary advice should be sought for other matters relating to flooring installation, construction, design, structural, fire-rating, water proofing, and the likes.
- Product installation details, methodologies and bonding or adhesive product (if any) must be sought from product supplier, installer or other experts.
- All flooring is to be vibration isolated off the structural walls and columns.
- Pipe lagging on ductworks and fabric lining to the underside of the ceiling can further reduce the airborne noise transmission.

8.1.2 Recommendations For Pin Loaded Weight Machine

Pin loaded weight machines, may require a spring mount is to be placed on the bottom of the weights to achieve vibration isolation. Refer to the figures below.

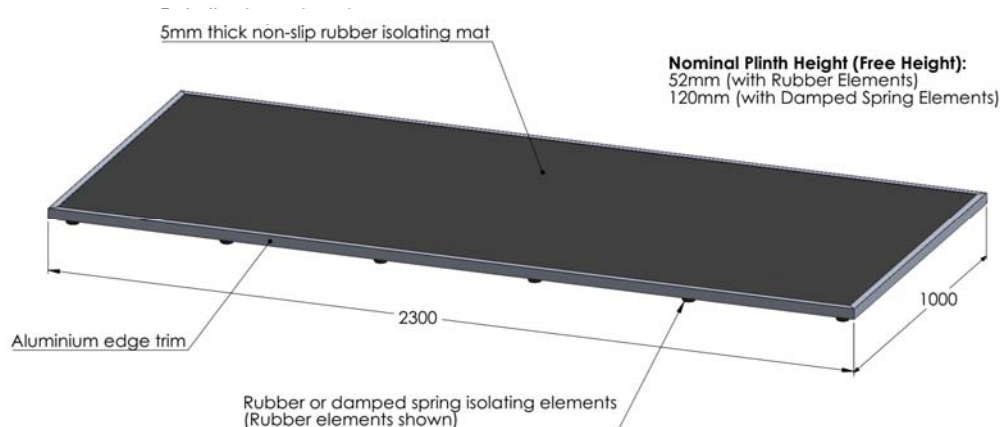


Product installation details and methodologies must be sought from a reputable products supplier/installer. Alternatively, spring mounts can be used provided that an on-site testing is conducted and showing favourable results.

8.1.3 Recommendations For Cardio Machines

Treadmills and cardio apparatus areas may be required to be covered with minimum one layer of 15 mm over one layer of 20 mm 750 kg/m³.

In addition to the above, a plinth consisting of 5 mm thick 850kg/m³ rubber held by aluminium framing and rubber or damped spring isolating elements could be placed beneath all cardio machines/apparatus. In particular, the treadmills. Refer to the extracted figure below.



8.2 ISOLATING MECHANICAL PLANT

Refrigeration racks should be installed on 50 mm deflection springs mounts and pumps should be installed on 25 mm deflection springs mounts. An example of deflection springs installed is shown below.



Condenser units should be installed on double deflection rubber mounts as shown in the image below.



Springs Mounts



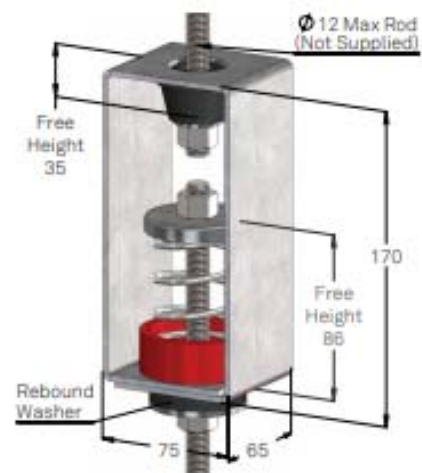
Rubber Mounts

8.3 ISOLATING DUCT/PIPE WORK

Duct/pipe work should be contained with spring hangers, and subsequent pipe work can be held with rubber hangers in order to isolate any vibrations from propagating into the concrete flooring. An example of the spring hangers installed is presented below.



Rubber hangers



Spring hangers

9.0 CHILDCARE CENTRE OPERATIONAL NOISE ASSESSMENT

The proposed childcare centre can accommodate a total of 60 children and is located on the ground floor of Precinct 2. The architectural plans indicate the following number of children per age bracket:

- 9 children aged 0-1 years;
- 12 children aged 1-2 years;
- 18 children aged 2-3 years, and
- 21 children aged 3-5 years.

Note: This acoustic report and any associated recommendations are based solely on the architectural design and drawings as referenced Table 1. Any changes to the above-referenced plans and plan of management may require a new assessment and recommendations.

The childcare centre is proposed to operate from Monday to Friday between the hours of 7 am and 6 pm.

9.1 ACOUSTICAL REQUIREMENTS

9.1.1 Outdoor play areas

The Association of Australian Acoustical Consultants (AAAC) recommended noise emission guidelines covering the use of outdoor play areas are:

- $L_{Aeq,15 \text{ minutes}}$ not exceeding background + 10 dB where outdoor play areas are in use for up to 2 hours per day.
- $L_{Aeq,15 \text{ minutes}}$ not exceeding background + 5 dB where outdoor play areas are in use for more than 2 hours per day.

The above criteria would apply to the residential premises to the 1st floor level directly above and to the south of the subject site.

9.1.2 Indoor play area, mechanical plant, pick-up and drop-off

The noise that is generated as a result of indoor activities, mechanical plant and equipment, and site pick-up/drop-off zones must not exceed the L_{A90} background noise level by more than 5 dB when assessed at the most affected point within any residential property. Childcare centre noise is assessed as $L_{Aeq,15\text{-minutes}}$.

9.1.3 Commercial receptors

Noise emitted from a childcare centre must not result in a $L_{Aeq,15\text{-minutes}}$ level that exceeds 65 dB on or within any commercial property boundary.

9.1.4 Noise Criteria

In addition to the AAAC guidelines, the EPA's Noise Policy for Industry also applies to the mechanical plant/vehicular noise. A summary of site-specific planning levels relevant to both the AAAC and NPfI guidelines is included for reference below:

Table 17. Acoustic planning limits – outdoor play [dB]			
Receiver type	Daytime background level L_{A90} Period	AAAC guideline L_{Aeq} 15 minutes	NSW EPA NPfI L_{Aeq} 15 minutes
Residential	43 ^{Note 1}	53 – outdoor play limit 2 hours 48 – outdoor play no limits	48
Commercial	n/a	65	63

Note 1: Background noise levels are based on the unattended noise logging survey conducted at the Vine Street location (lowest).

9.1.5 Source sound levels

Sound power levels attributed to children playing in outdoor areas have been found to be age-dependent. Koikas Acoustics has surveyed noise associated with children playing in outdoor areas of childcare centre facilities. Sound power levels attributed to children within outdoor play areas of childcare centres are:

Table 18. Calculated sound power levels of Children Outdoor Play											
Description	Noise Metric	Sound Power Level, [dB]									
	Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Total
Children aged 0 - 2 (Free play)	L _{Aeq}	27	43	53	61	64	67	67	60	50	72
Children aged 2 - 3 (Free play)		29	45	55	63	66	69	69	62	52	74
Children aged 3 - 5 (Free play)		34	50	60	68	71	74	74	67	57	79
Educational Activities* (all ages)		-	42	49	56	56	59	57	52	42	64

*educational activities refer to controlled activities such as storytelling or other activities where only few children or staff are talking at once.

For each group of children, a conservative estimate is that 50% of children will be making noise at the same time. Therefore, the total sound power level attributed to the proposed children grouped per aged bracket is as follows:

- LA_{weq} 80 dB for 9 children aged 0-1 years (50 % of children making noise);
- LA_{weq} 80 dB for 12 children aged 1-2 years (50 % of children making noise);
- LA_{weq} 83 dB for 18 children aged 2-3 years (50 % of children making noise), and
- LA_{weq} 89 dB for 21 children aged 3-4 years (50 % of children making noise).

9.1.6 Predicted receiver levels – Noise model CCC

Noise emission from the outdoor play area has been calculated to neighbouring and onsite commercial and residential premises. In accordance with AAAC guidelines, receiver levels have been predicted at the most affected point within any affected property, this includes upper floor windows and balconies.

The most noise-sensitive receiver locations are summarised below.

R1	Commercial premises	Precinct 2
R2	Residential dwelling (ground floor)	108 Lawson Street
R3	Residential dwelling (upper floor window)	108 Lawson Street
R4	Residential dwelling (ground floor)	112 Lawson Street
R5	Residential dwelling (ground floor)	17 Caroline Street
R6	Residential dwelling (upper floor window)	17 Caroline Street
R7	Residential dwelling (ground floor)	17 Caroline Street
R8	Residential apartments (Level 2)	Precinct 1

Predicted operational noise levels are shown in Table 19.

Table 19. CCC calculated receiver noise levels [dB]					
Receiver location	Project noise criteria $L_{Aeq\ 15\ mins}$				Predicted receiver noise level
	Residential Day	Residential Evening	Residential Night	Non-residential	$L_{Aeq\ 15\ mins}$ Day / Evening / Night
R1 – Commercial	n/a	n/a	n/a	65	61
R2 – Residential	53	n/a	n/a	n/a	47
R3 – Residential	53	n/a	n/a	n/a	53 ²
R4 – Residential	53	n/a	n/a	n/a	44
R5 – Residential	53	n/a	n/a	n/a	43
R6 – Residential	53	n/a	n/a	n/a	53 ²
R7 – Residential	53	n/a	n/a	n/a	43
R8 – Residential	53	n/a	n/a	n/a	47
Notes					
1.	Calculated noise levels are based on all children occupying the outdoor area operating simultaneously over a 15 minutes assessment period during the daytime period. It is highly unlikely that this scenario would ever occur, therefore actual noise levels may be lower than predicted.				
2.	Receiver locations are outside windows and not accessible areas, as such a 5-10 dB noise reduction is expected through an open window.				

Receiver noise level at the surrounding premises is predicted to achieve the nominated noise criteria, provided the recommendations in Section 9.2 of this report are implemented into the building design.

Refer to noise model attached as **Appendix D**.

9.2 RECOMMENDATIONS & OPERATING CONDITIONS/RESTRICTIONS

To achieve compliance with the nominated noise criteria to surrounding residential premises, the following operating restrictions and requirements are to apply to the outdoor play areas.

Noise barriers of **2.1 m** are required to be constructed along the boundaries of the play area for the childcare centre. Details are discussed above.

Details on the heights of the barrier is dependent on the operating conditions, as discussed below. The following construction materials will be adequate for the proposed noise barrier.

- o Double lapped 15mm thick timber fence palings offset so that there are no air gaps. This equates to a total barrier thickness of 30 mm;
OR
- o 15mm compressed fibre cement panels with no air gaps at the joints;
OR
- o 6mm compressed fibre cement panels either side of a 50mm steel frame with fibreglass insulation batts (14kg/m²) to the cavity.

The barrier above 1.8 meters high can be built with the same building materials or with solid 15 mm thick plexiglass.

It is to be noted that gaps between the panels and the posts or the ground will significantly reduce the effectiveness of the noise barrier and may lead to non-compliant noise levels at the adjoining premises.

Koikas Acoustics also recommends that the outdoor areas include absorptive ground such as synthetic grass and sand pits.

No children can occupy the outdoor area for more than 2 hours per day. Additional acoustic requirements are outlined in the noise management plan.

9.2.1 Noise Management Plan

This noise management plan is indicative and a more specific noise management plan should be prepared once a detailed acoustic assessment has been conducted.

Koikas Acoustics has prepared a noise management plan regarding the acoustical related issues arising from the operation of the proposed child care centre. This noise management plan should be supplemented with an Operational Management Plan considering other non-acoustical related components such as child to staff ratio and training procedures, as requested by council.

Detailed child rotation timetable and how children will be monitored to meet the specific child to staff ratio required by the governing body.

During the first two hours of outdoor play

- A maximum of XX children can occupy the outdoor area at any one time for free play.

Remaining hours of outdoor play

- For the remaining hours, all XX children at any one time could occupy the outdoor areas provided that this is for educational activities* only, or
- For free play activities, no more than X children at any one time would be allowed to occupy the outdoor area.

**educational activities refer to controlled activities such as storytelling or other activities where only few children or staff are talking at 'normal' vocal effort.*

Approaches for promoting noise awareness by patrons and staff;

- Signs can be installed around the CCC to remind patrons and staff to consider the peaceful amenity of surrounding residents.
- Parents should be notified during the sign up of their children to the CCC to ensure the children and themselves do not raise their voices during pick up/drop off and when in the outdoor areas.
- Staff should be advised that when a child is crying or yelling, that they be taken inside immediately until the child calms down.
- No noisy activities should be organised in outdoor areas, such as games that include yelling.

A more detailed assessment should be conducted of the childcare center once more details are available.

10.0 CONCLUSION

Koikas Acoustics Pty Ltd was requested to prepare an acoustic report that assesses the 'for construction' design of Precinct 1 and 2 of the mixed-use development at Pemulwuy Project, Redfern NSW, to the applied acoustical design standards adopted for the development.

Approval of the development is subject to conditions of consent imposed by Council/Certifier to ensure the development complies with all relevant statutory requirements and is consistent with the development standards required in the respective Local Government Area.

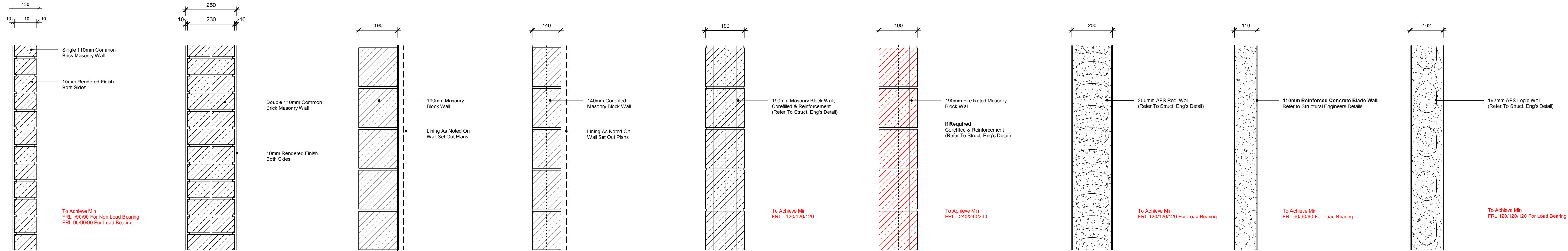
To conduct the assessment and formulate reliable conclusions, reference is made to the construction stage architectural drawings and mechanical services drawings as detailed in Table 1 and Table 6 of this report respectively.

Our assessment concludes the following in relation to the assessed components of noise:

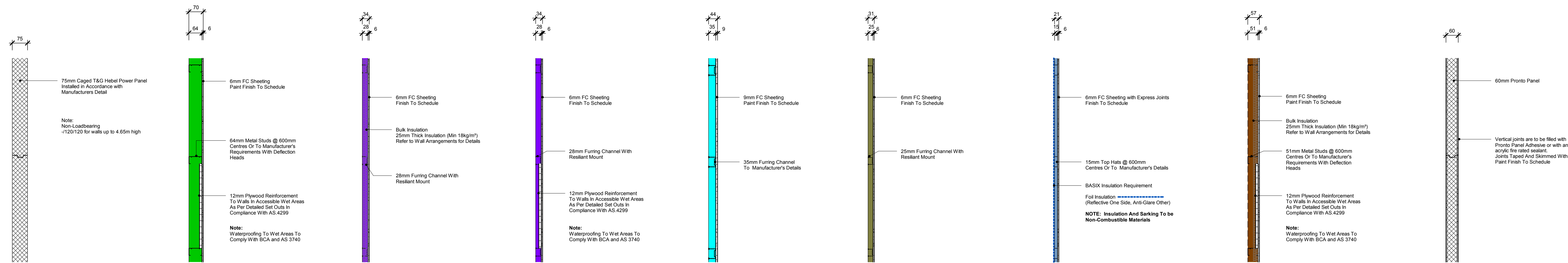
1. Standard construction materials (shown in Section 5.3) will provide sufficient insulation against external noise.
2. Identified wall and floor/ceiling systems can achieve the acoustic performance requirements of the BCA and Council's conditions. Where additional or upgraded materials are recommended in this report, construction drawings should be amended to suit.
3. A detailed mechanical plant noise impact assessment has been conducted for Precinct 1 and Precinct 2 with associated recommendations provided in Section 6.4. No assessment has been conducted for Precinct 2 as mechanical services plans are not complete at this stage.
4. Preliminary recommendation have been provided regarding the type and extent of materials likely to be required for the Gymnasium, mechanical plant and ductwork to reduce noise and vibration transmission to adjoining noise-sensitive premises;
5. As no rail vibration levels were recorded at the ground floor level, no vibration controls are required for this development.
6. A preliminary child care center assessment has been conducted to determine reasonable noise mitigation measures to be adopted into the design. A more detailed assessment should be conducted of the child care center when more details are available.

It is the professional opinion of Koikas Acoustics that the development as detailed in the construction documentation will comply with the adopted acoustical design standards.

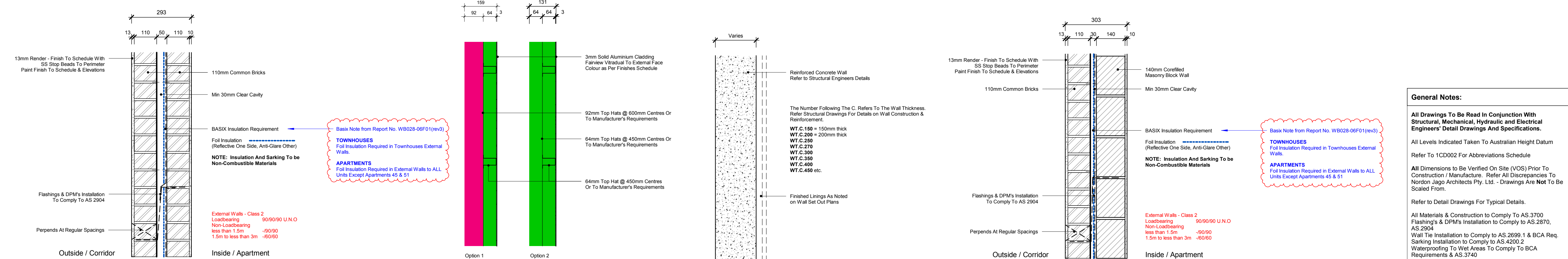
The green tick (✓) shows the wall systems Koikas Acoustics recommends



Wall Type 01 1:10
Wall Type 02 1:10
Wall Type 05A 1:10
Wall Type 05B 1:10
Wall Type 06A 1:10
Wall Type 06B 1:10
Wall Type 07A 1:10
Wall Type 07C 1:10
Wall Type 08 1:10



Wall Type 09A 1:10
Wall Type 10A 1:10
Wall Type 14A 1:10
Wall Type 14B 1:10
Wall Type 14C 1:10
Wall Type 14D 1:10
Wall Type 15 1:10
Wall Type 16A 1:10
Wall Type 18 1:10



Wall Type 20A 1:10
Wall Type 21 1:10
Wall Type 35x 1:10
Wall Type 22 1:10

General Notes:

All Drawings To Be Read In Conjunction With Structural, Mechanical, Hydraulic and Electrical Engineers' Detail Drawings And Specifications.

All Levels Indicated Taken To Australian Height Datum

Refer To 1CD002 For Abbreviations Schedule

All Dimensions to Be Verified On Site (VOS) Prior To Construction / Manufacture. Refer All Discrepancies To Nordon Jago Architects Pty. Ltd. - Drawings Are Not To Be Scaled From.

Refer to Detail Drawings For Typical Details.

All Materials & Construction to Comply To AS.3700 Flashing's & DPM's Installation to Comply to AS.2870, AS.2904

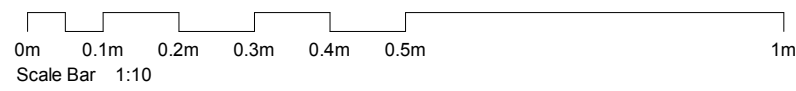
Wall Tie Installation to Comply to AS.2699.1 & BCA Req.

Sarking Installation to Comply to AS.4200.2

Waterproofing To Wet Areas To Comply To BCA Requirements & AS.3740

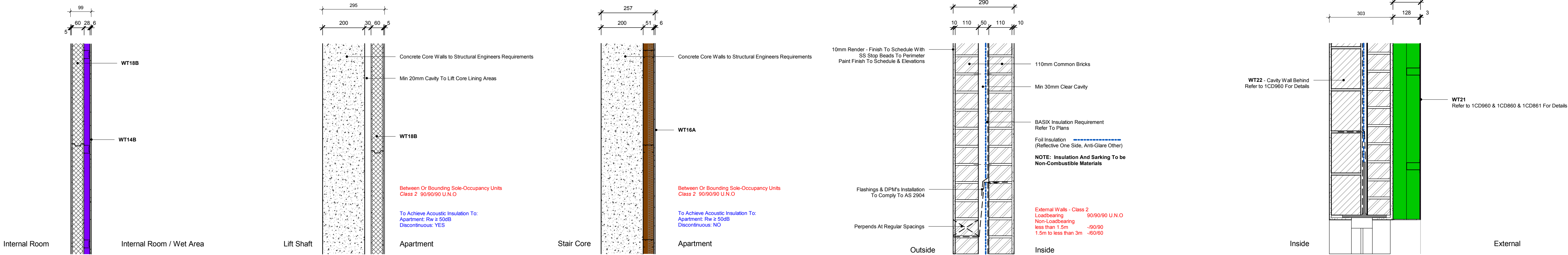
Survey by Lockleys Land Title Solutions (LTS)
Ref No. 50426 002DT

Rev	Description	Date
D	General Updates as Clouded	22.07.19
E	Revisions as Clouded	24.10.19
F	Issued For Construction	08.11.19
G	Revised Roof Structure, Gutters and Feature Window Cladding, Added New Wall Linings for Electrical Backing and New Cladding System for Exposed Facades as Clouded	12.12.19
H	Added Linings To Kitchens In Apartments From Levels 2 To 5	19.02.20
I	Updated Basix Requirements Notes	27.02.20



JOB No.	DEI00210
DATE	Mar 2019
SCALE	A1 @ As indicated
DWG No.	

The green tick (✓) shows the wall systems Koikas Acoustics recommends



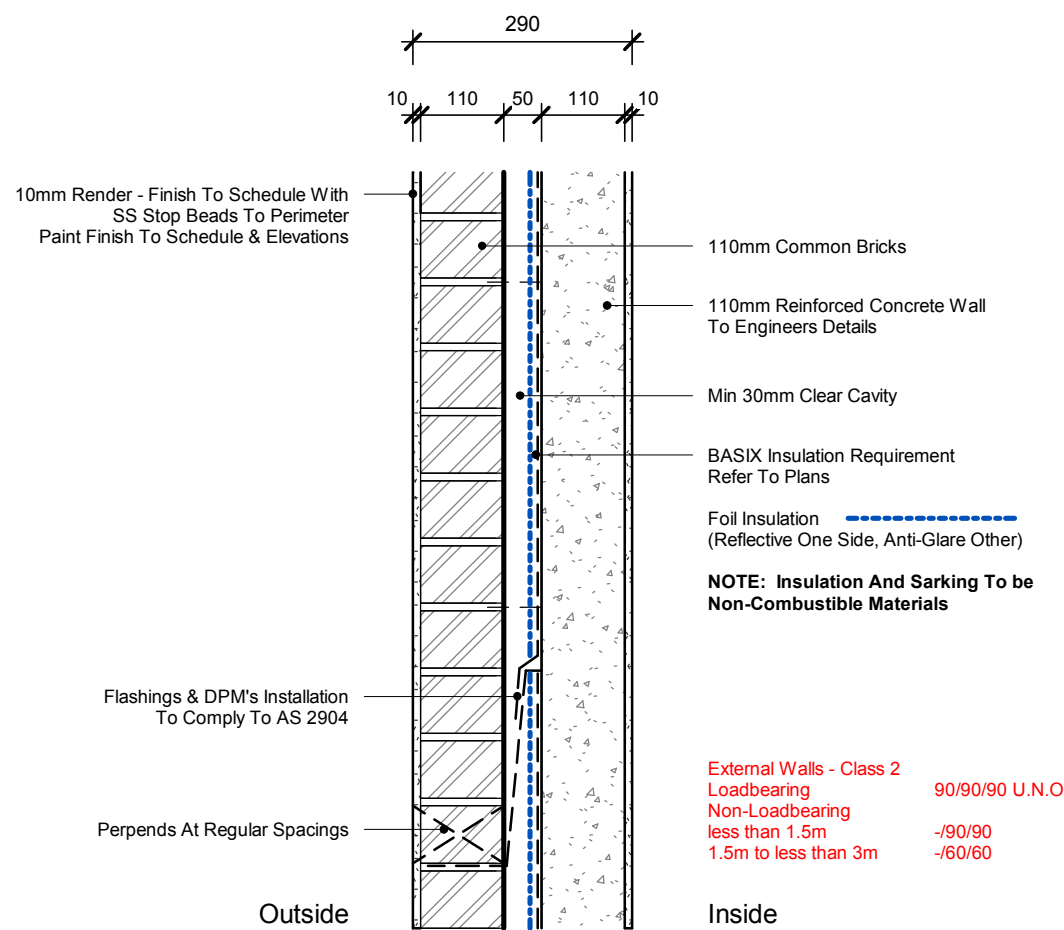
Typical Internal Walls & Wet Areas

Typical Lift Shaft Build-Up

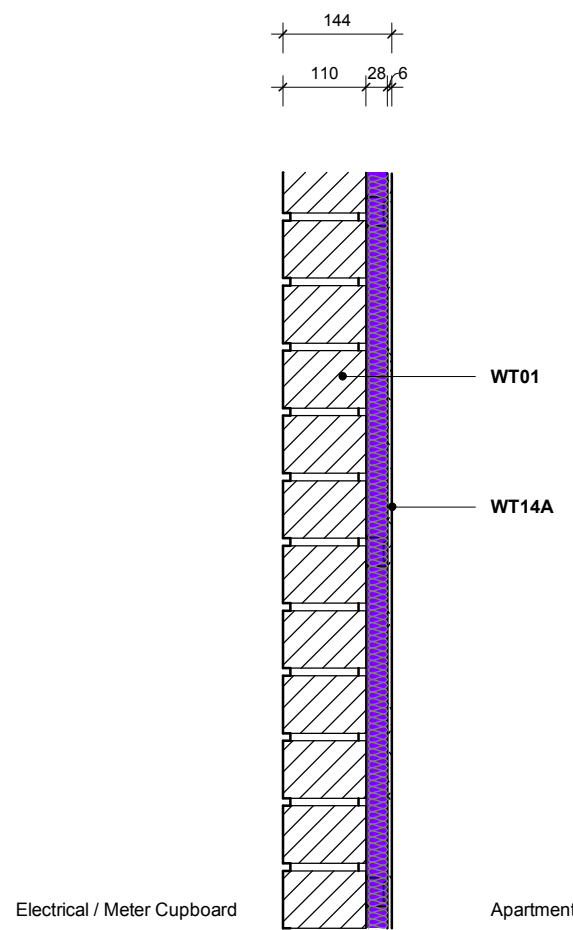
Typical Stair Core Build-Up

Typical External Wall Type With Internal Render

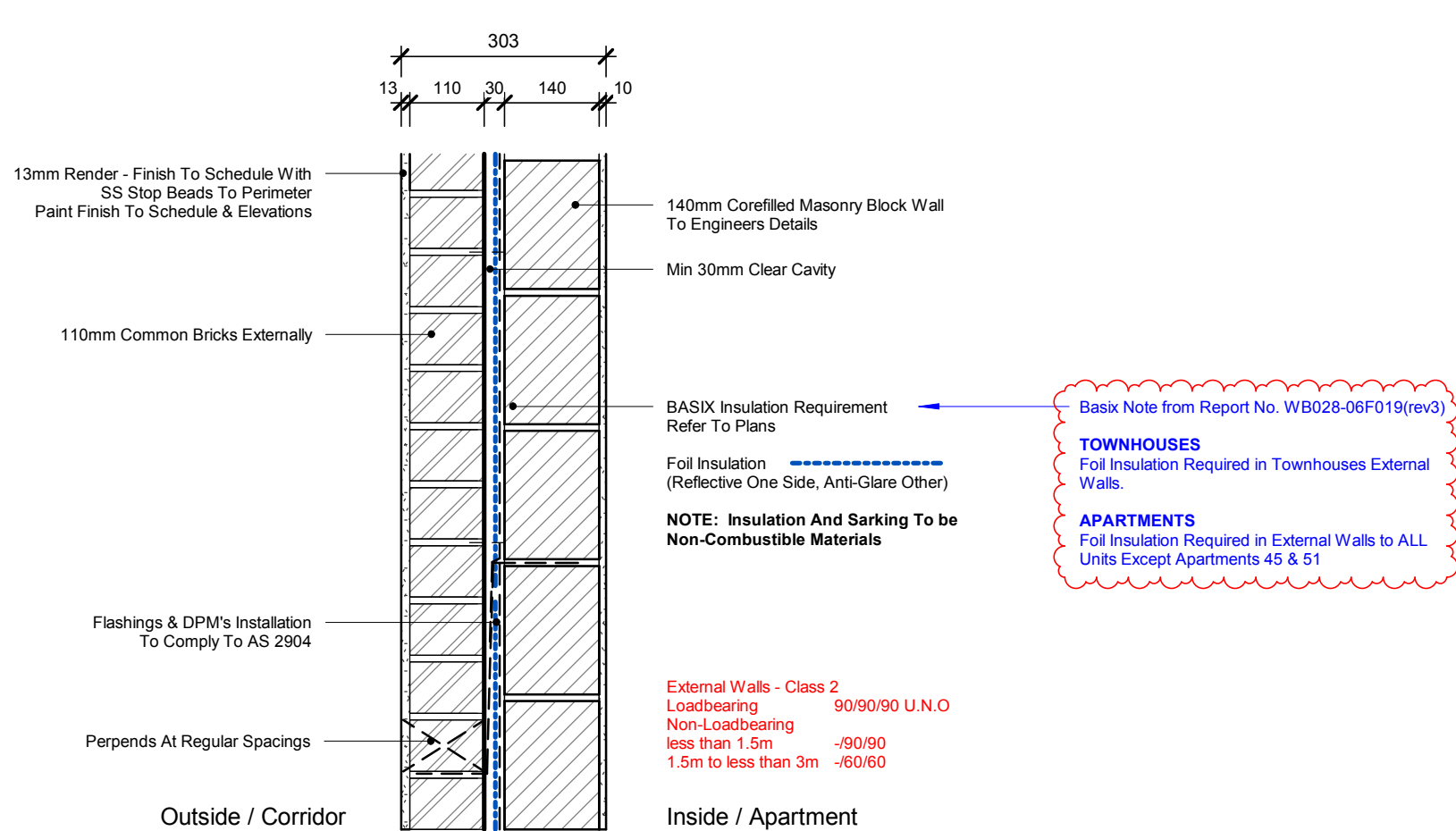
Typical External Feature Wall Cladding



Typical External Wall Type With Concrete Blade



Typical Electrical / Meter Cupboard & Apartment



Typical External Wall Type With Internal Render

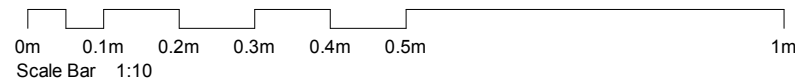
Acoustic Requirements:			
Partition	Detail	Airborne Sound	Impact Sound
Floor	Separating SOUs or an SOU from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or part of a different classification	$R_w + C_{tr} \geq 50$	$L_n, w \leq 62$
Wall <i>(Note 1 & 2)</i>	Separating SOUs	$R_w + C_{tr} \geq 50$	Not Applicable
	Separating a habitable room (other than kitchen) in one SOU from a bathroom, sanitary compartment, laundry, kitchen in another SOU	$R_w + C_{tr} \geq 50$	Discontinuous
	Separating an SOU from a plantroom of lift shaft	$R_w \geq 50$	Discontinuous
	Separating an SOU from a stairway, public corridor, public lobby or the like, or part of a different classification	$R_w \geq 50$	Discontinuous
Door	Located in a wall separating an SOU from a stairway, public corridor, public lobby or the like	$R_w \geq 30$	Not Applicable
Services	Duct, soil, waste or water supply pipes located in a wall or floor cavity and serves or passes through more than one SOU (including stormwater pipe)	$R_w + C_{tr} \geq 40$ (habitable) $R_w + C_{tr} \geq 2$ (other)	Not Applicable
Pumps	A flexible coupling must be used at a point of connection between the services pipes in a building and any circulating or another pump		
Note	1. Where a wall is to achieve a sound insulation rating and has a floor above, the wall must continue to either the underside of the floor or to the ceiling which has a comparable sound insulation rating to the wall.		
	2. Where a wall is to achieve a sound insulation rating and has a roof above, the wall must continue to either the underside of the roof or to the ceiling which has a comparable sound insulation rating to the wall.		

General Notes:	
All Drawings To Be Read In Conjunction With Structural, Mechanical, Hydraulic and Electrical Engineers' Detail Drawings And Specifications.	
All Levels Indicated Taken To Australian Height Datum	
Refer To 1CD002 For Abbreviations Schedule	
All Dimensions to Be Verified On Site (VOS) Prior To Construction / Manufacture. Refer All Discrepancies To Nordon Jago Architects Pty. Ltd. - Drawings Are Not To Be Scaled From.	
Refer To Detail Drawings For Typical Details.	
All Materials & Construction to Comply To AS.3700 Flashing's & DPM's Installation to Comply to AS.2870, AS.2904	
Wall Tie Installation to Comply to AS.2699.1 & BCA Req. Sarking Installation to Comply to AS.4200.2	
Waterproofing To Wet Areas To Comply To BCA Requirements & AS.3740	
Survey by Lockleys Land Title Solutions (LTS) Ref No. 50426 002DT	

Working Drawings

Rev	Description	Date
B	Wall Type Change as Per Deicorps Request	09.07.19
C	General Updates as Clouded	22.07.19
D	Revisions as Clouded	24.10.19
E	Issued For Construction	08.11.19
F	Revised Roof Structure, Gutters and Feature Window Cladding, Added New Wall Linings for Electrical Backing and New Cladding System for Exposed Facades as Clouded	12.12.19
G	Updated Basix Requirements Notes	27.02.20

Issued For Construction



Precinct 1 - Pemulwuy Project, Mixed Use Development, REDFERN

Wall Arrangements

JOB No.	DEI00210
DATE	Mar 2019
SCALE	A1 @ As indicated
DWG No.	1CD961 G

APPENDIX

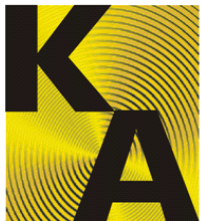
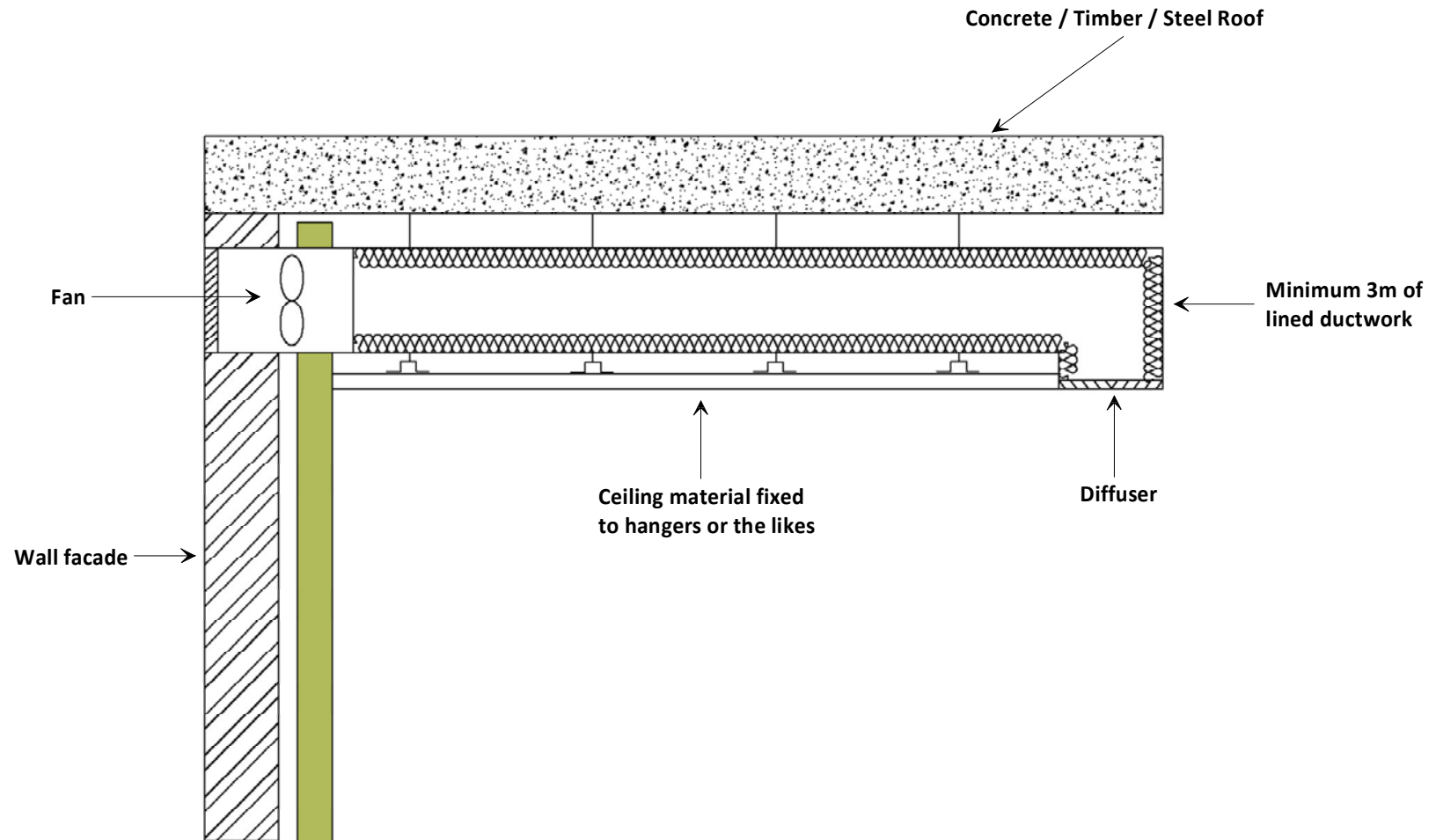
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APPENDIX

B



KOIKAS ACOUSTICS PTY LTD

CONSULTANTS IN NOISE & VIBRATION

Commercial 1 (Unit 27)

637 - 645 Forest Road

BEXLEY NSW 2207

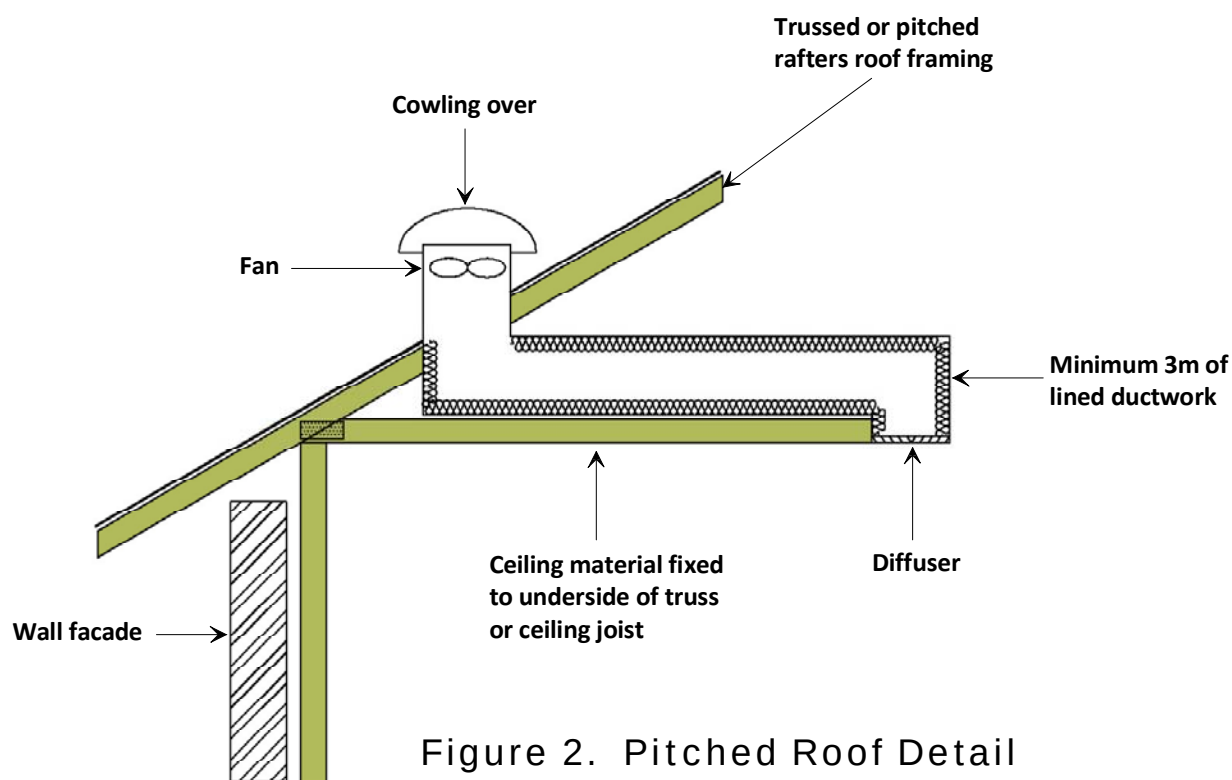
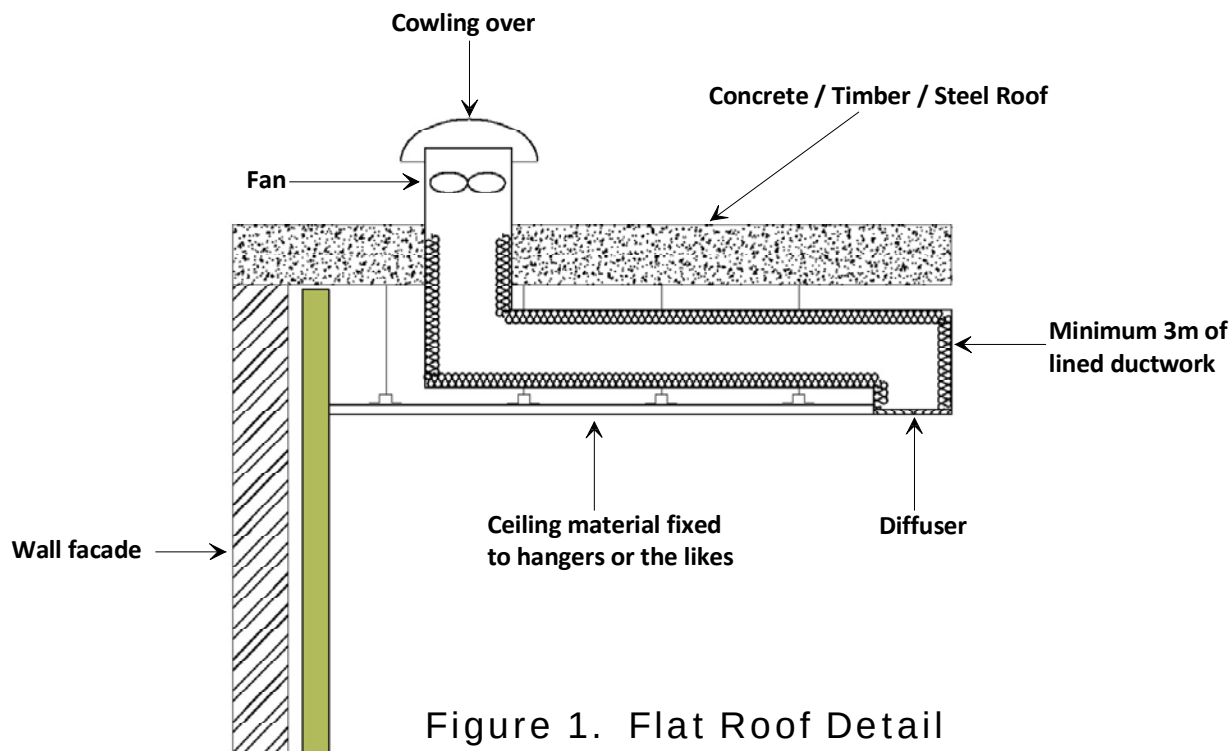
ABN 12 058 524 771

Ph: (02) 9587 9702

Fax: (02) 9587 5337

E-mail: Office@KoikasAcoustics.com

Project ACOUSTIC DESIGN DETAIL	Drawn by AS	Checked N/A	File Mech Vent Detail Wall.srf
Title Mechanical Ventilation Wall penetration	Drawing Number 1 of 1	Revision V1	Scale NOT TO SCALE
			Date 19th April 2011



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E-mail: Office@KoikasAcoustics.com

MECHANICAL VENTILATION DETAILS

Figure 1. Flat Roof

Figure 2. Pitched Roof

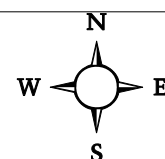
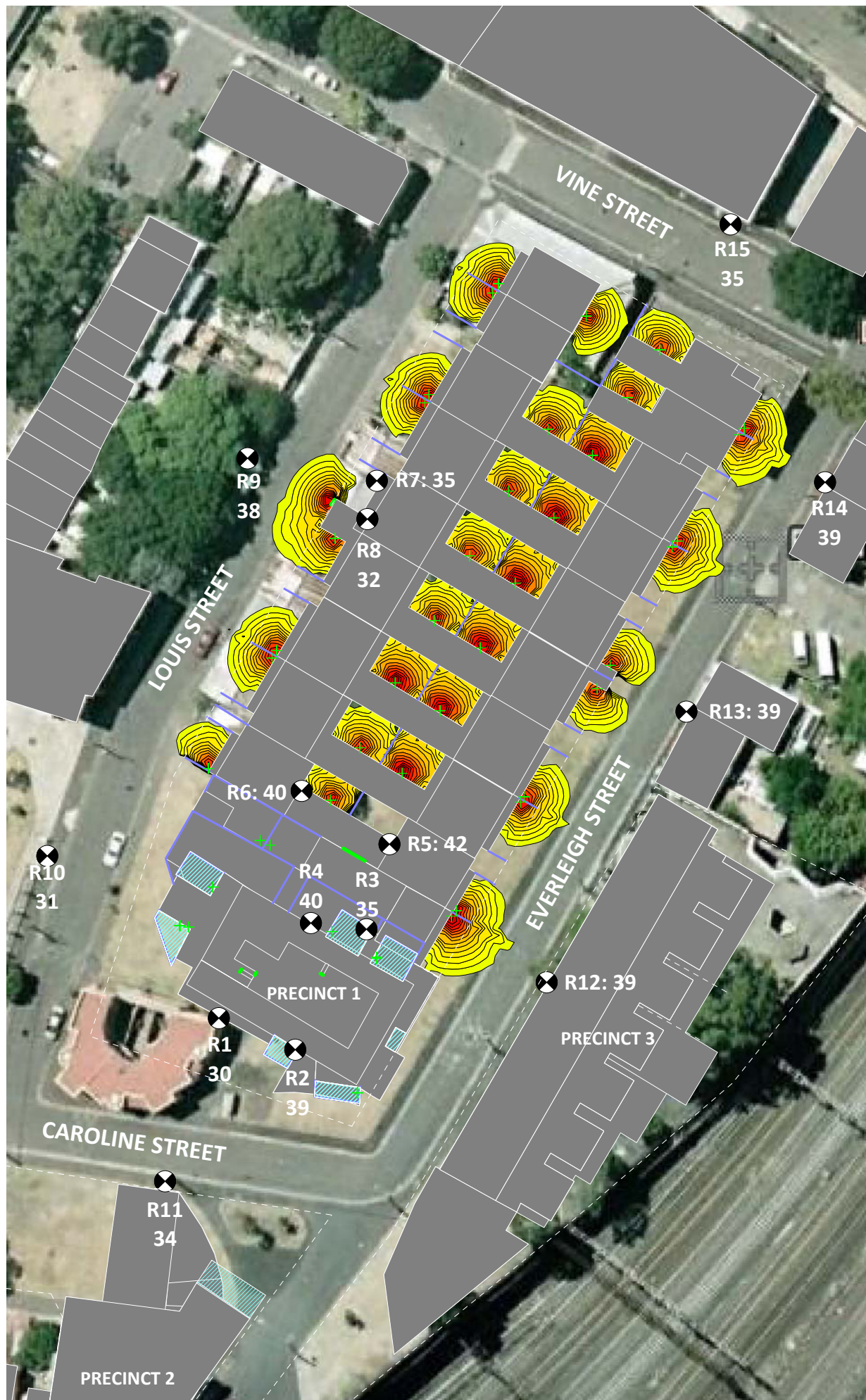
** NOISE SOURCES **

~ Carpark exhaust fan
~ Carpark supply fan
~ Pump room exhaust fan
~ Pump room supply fan
~ OAF-P1-L6.1
~ Garbage exhaust fan
~ 63 x AC condenser units

Note:

- LAeq,15mins noise contours are at a height of 1.5m above the natural ground level and end at the limiting criteria of 43 dB.
- Receiver points are 1.5m above the respective floor level.
- The maximum calculated noise level to the nearest resident is 42 dB.

PRINT DATE: 09/01/2019



- + Point Source
- vert. Area Source
- Building
- Barrier
- ▨ 3D-Reflector
- Bridge
- Contour Line
- Receiver
- Calculation Area

- ≥ 45.0
- ≥ 50.0
- ≥ 55.0
- ≥ 60.0
- ≥ 65.0
- ≥ 70.0
- ≥ 75.0
- ≥ 80.0

JOB NUMBER: 2075

CLIENT: Deicorp

SITE ADDRESS: Pemulwuy Project, Redfern NSW (Precinct 1)

ASSESSED TO: EPA's Noise Policy for Industry

LIMITING CRITERIA: 43 dB(A) - Residential (night)

58/63 dB(A) - recreational/commercial (anytime)

Mechanical Plant (Precinct 2)

** NOISE SOURCES **

- ~ 1 x Kitchen exhaust fan
- ~ 1 x Supply fan
- ~ 1 x Lobby supply fan
- ~ 1 x Garbage exhaust fan
- ~ 4 x Toilet exhaust fan

Note:

- LAeq,15minutes noise contours are at a height of 1.5 m above ground level and end at 43 dB

- Receiver points are 13.5 m above the ground, except R2, R3 & R5 are 4.5m and R4 & R6 are 1.5m.

- The maximum reading at the nearest resident is 39 dB.

PRINT DATE: 26/06/20



- Area Source
- vert. Area Source
- Building
- Barrier
- 3D-Reflector
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

- > 40.0 dB
- > 50.0 dB
- > 60.0 dB
- > 70.0 dB

JOB NUMBER: 2950

CLIENT: Deicorp

SITE ADDRESS: Pemulwuy Project, Redfern (Precinct 2)

ASSESSED TO: EPA's Noise Policy for Industry

LIMITING CRITERIA: 43/48 dB(A) - Residential (Night)

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APPENDIX

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APPENDIX

D

Childcare Center

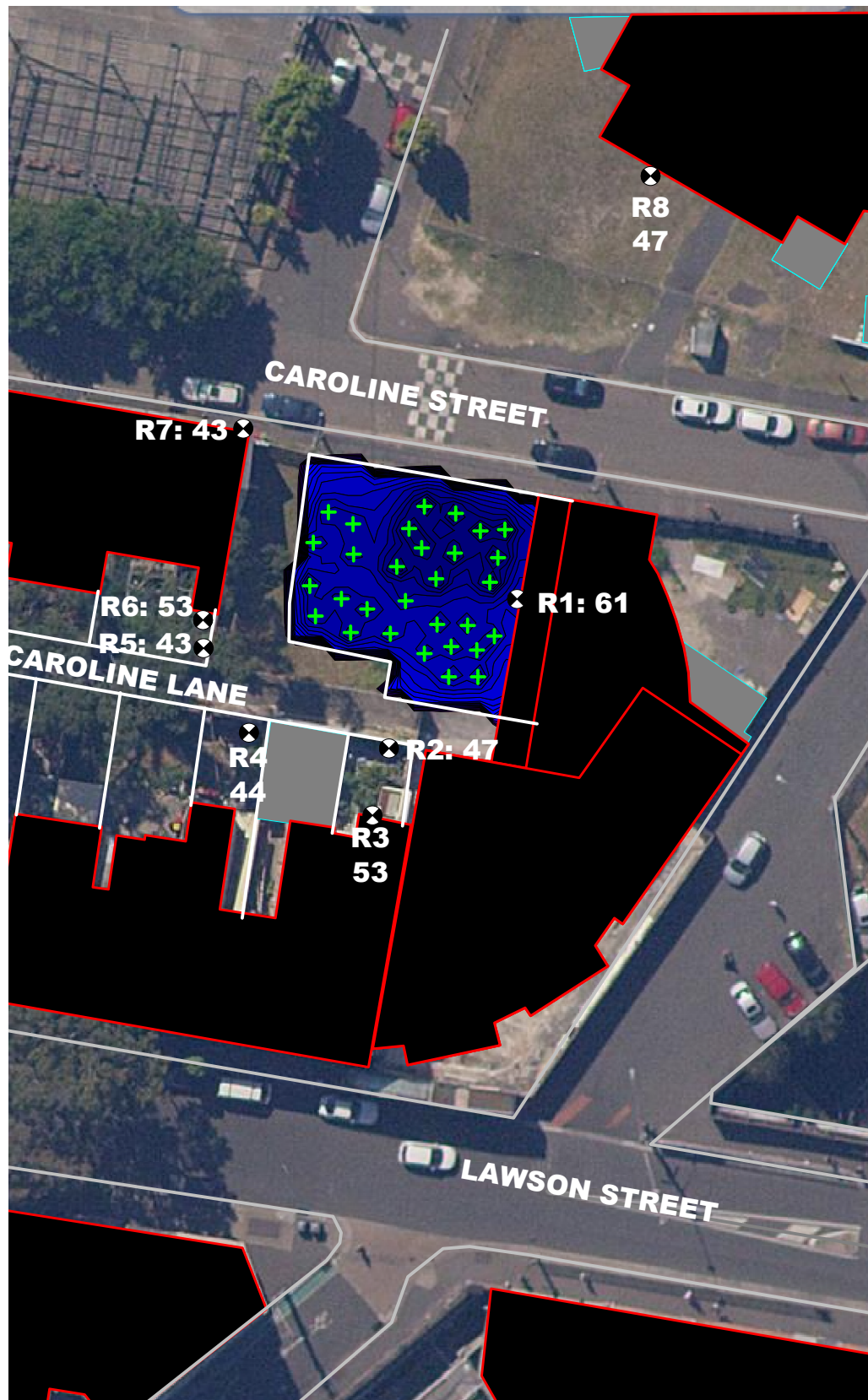
** NOISE SOURCES **

~ 10 x 0-2yo kids
~ 9 x 2-3yo kids
~ 11 x 3-5yo kids

Note:

- LAeq,15minutes noise contours are at a height of 1.5 m above ground level and end at 53 dB
- Receiver points are 1.5 m above the ground, except R1 & R5 are 7.5m and R3 & R6 are 4.5m.
- The maximum reading at the nearest resident is 53 dB.

PRINT DATE: 23/06/20



- + Point Source
- Building
- Barrier
- 3D-Reflector
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

- > 50.0 dB
- > 60.0 dB
- > 70.0 dB

JOB NUMBER: 2950

CLIENT: Deicorp

SITE ADDRESS: Pemulwuy Project, Redfern NSW (Precin

ASSESSED TO: AAAC guidelines

LIMITING CRITERIA: 53 dB(A) - Residential (Daytime)

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