ADP
Consulting : Engineering

SummitCare Casula

Noise Impact Assessment

Prepared for: Centurion Group

Project No: SYD1026
Date: 9 July 2020
Revision: [02]

ADP Consulting : Engineering

Creating great environments with great people

Project:	SummitCare Casula
Location:	18 Randwick Close Casula, NSW, 2170
Prepared by:	ADP Consulting Pty Ltd Level 3, 8 Spring Street Sydney NSW 2000
Project No:	SYD1026
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Rev	Date	Comment	Author	Signature	Technical Review	Signature	Authorisa-tion & QA	Signature
01	4/10/19	Council issue	JW		TC		GW	
02	9/7/20	Respond to Council's RFI	CI		TC		CR	

Project Team	
Client / Principal	Centurion Group
Architect	Jackson Teece

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1. Introduction

1.1 Document purpose

ADP Consulting Pty Ltd has been retained on behalf of Centurion Group to undertake acoustics engineering services for the proposed aged care facility located at 18 Randwick Close, Casula.

This report is prepared to provide acoustic design advice for documentation by others and addresses the following:

- Noise emission criteria and recommendations at the nearby sensitive receivers
- Recommended internal noise levels of the development
- Noise separation between sensitive spaces and separate tenancies

The design criteria and acoustic treatment concepts in this report demonstrate the pathways by which these shall be addressed by ADP Consulting and the project team through further analysis, recommendations and coordination as the design progresses.

It is anticipated that this report will be issued to the City of Liverpool in support of a Development Application.

1.2 Referenced drawings, codes and standards

The followings drawings, conditions and other project-specific information has been referenced in preparing this report:

- Jackson Teece's Development Application Architectural Drawings (Architectural Drawings)
- ADP Consulting's building services mark-up (Building Services Mark-up)

The following guidelines, standards and regulatory requirements have been used to define the site-specific acoustic criteria for the development:

- AS/NZS 1668.1:2015 The use of ventilation and air conditioning in buildings Part 1: Fire and smoke control in buildings (AS/NZS 1668.1)
- AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (AS/NZS 2107)
- AS 2670.2:1990 Evaluation of human exposure to whole body vibration Part 2: Continuous and shock-induced vibration in buildings (1 to 80Hz) (AS 2670.2)
- BS 6472:1992 Evaluation of human exposure to vibration in buildings (1 to 80 Hz) (BS 6472)
- Assessing Vibration: A Technical Guideline – NSW Department of Environment and Conservation, February 2006 (AVTG)
- National Construction Code 2019 – Volume one, Building Code of Australia class 2 to 9 buildings (NCC)
- NSW EPA's Noise Policy for Industry, dated October 2017 (NPfI)
- State Environment Planning Policy (Infrastructure) 2007 (SEPP)
- Department of Environment, Climate Change and Water's NSW Road Noise Policy, dated March 2011 (RNP)
- United Kingdom Department of the Environment's Calculation of Road Traffic Noise, dated 1988 (CoRTN)

1.3 Project summary

The SummitCare Casula development comprises construction of a new aged care facility. The Architectural Drawings show that the proposed development will consist three buildings:

- Basement (shared between three buildings):
  - Carpark spaces
  - Pump / plant rooms
  - Waste loading dock
  - Maintenance room
  - Commercial kitchen and laundry
  - Theatre
  - Staff rooms
  - Toilets
- Building A to the west, comprising of:
  - Ground level:
    - Residential Aged Care rooms
    - Lounge and dining rooms
    - Administration, and meeting rooms
    - Toilets
    - Physiotherapy room
    - Cafeteria
    - Retail, including hairdresser
  - Level 1 to Level 3:
    - Residential Aged Care rooms
    - Assisted Care Units
    - Lobby area
    - Lounge and dining rooms
    - Toilets
    - Terrace areas
  - Level 4:
    - Assisted Care Units
    - Lobby area
    - Rooftop outdoor terrace
  - Level 5:
    - Rooftop plant
    - Function room
    - Toilets
  - Roof / Level 6: Rooftop plant
- Building B to the east, comprising of:
  - Ground level:
    - Residential apartments
    - Retail
  - Level 1 to Level 3: Residential apartments
  - Level 4:
    - Residential apartments
    - Rooftop terrace
    - Rooftop plant
  - Level 5 to Roof/Level 6: Rooftop plant
- Building C to the south, comprising of:
  - Ground level to Level 2: Residential apartments

Figure 1 provides a site map of the proposed development and its surrounds.

Figure 1 – Site plan

2. Site investigations and noise measurements

2.1 Site investigations

Based on our site survey and investigations we have identified the following sensitive receivers as being the nearest noise sensitive premises to the proposed development:

- Commercial premises within Casula Mall, approximately 170m to the east
- Residences, including:
  - 40 Ironbark Ave, located approximately 45m to the north
  - 9, 11, 13 and 15 Sandown Cl, located directly to the southwest
  - 16 and 27 Randwick Cl, located directly to the south
  - 7 Robinson Cl, located approximately 110m to the northwest
- Daruk Park, approximately 20m to the east
- Casula library and preschool at 39 Ingham Dr, located approximately 90m to the south
- The development itself that includes:
  - Services requiring noise attenuation and vibration isolation to ensure low indoor noise levels in occupied areas and compliance with noise emission regulations
  - An expected standard of amenity compliant with all applicable codes, regulatory requirements, client brief and/or other standards

2.2 Noise measurement equipment

The following instrumentation was used for noise measurements and analysis:

- Bruel and Kjaer 2250 Integrating Sound Level Meter (S/N: 3011318)
- Bruel and Kjaer type 1 microphone – comprising of:
  - ZC 0032 preamplifier (S/N: 25754)
  - 4189 capsule (S/N: 3087045)
- Bruel and Kjaer Sound Calibrator Type 4231 (S/N: 3018299)
- Infobyte iM4 Integrating-Averaging Sound Level Meter – noise logger (S/N: 101)

All instrument systems are laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.2dB during measurements. No adjustments for instrument drift during the measurement period were warranted.

2.3 Attended noise measurements

Attended noise measurements were conducted on Monday 9 September 2019 at locations A1 to A3, and Monday 23 September 2019 at locations A4 and A5. These noise measurements were used to qualify and quantify the noise levels for the area.

Table 1 presents the noise levels of the attended measurements at the locations shown in Figure 1.

Table 1 Attended noise measurements, dB(A)

Location	Start Time	Location and Comments	L_{Aeq}	L_{A90}
Monday 9 September 2019				
A1	12.47pm	**Centre of proposed site** – 25m from the northern boundary and 95m from the eastern boundary. The character of noise comprised of: > Rustling of leaves > Droning noise from M5 dominant > Noise from Kurrajong Rd audible	55	52
A2	1.15pm	**35m south of proposed site** – 5m from curb of Kurrajong Rd. The character of noise comprised of: > Local traffic along Kurrajong Rd dominant, including buses and cars > Truck pass-bys, at approximately 77 dB(A) > Traffic noise from M5 audible	67	56
A3	1.32pm	**On Kurrajong Rd overpass, 7m above M5** – 2m from curb Kurrajong Rd, 5m to side of M5 curb. The character of noise comprised of: > Dominant sound of M5 traffic, including articulated trucks	76	71
Monday 23 September 2019				
A4	2.54pm	**Midway along north-western boundary** – 5m inside boundary fence inside site. The character of noise comprised of: > Rustling of leaves > Droning noise from M5 dominant > Noise from Kurrajong Rd audible	59	57
A5	3.11pm	**Along northern boundary, 30m from eastern boundary** – 20m from Kurrajong Rd. The character of noise comprised of: > Local traffic along Kurrajong Rd dominant, including buses and cars > Traffic noise from M5 audible	62	58

2.4 Unattended noise measurements

Unattended noise measurements were conducted at Location L1 (shown in Figure 1) between Monday 2 September 2019 and Monday 9 September 2019.

The long-term logger was chosen to collect background noise in the area to set noise emission criteria for the development. These criteria have been presented in Section 3.4 of this report.

Background and equivalent continuous sound levels at location L1 are summarised in Table 2.

Table 2 Unattended noise measurements at location L1, dB(A)

Noise Measurement	**Daytime** (07:00-18:00)	**Evening** (18:00-22:00)	**Night-time** (22:00-07:00)
Repeatable – L_{Aeq}	55	54	51
Rating Background Level (RBL) – L_{A90}	49	48	43

2.5 Traffic noise levels

Based on site surveys and noise measurements, traffic noise levels (L_{Aeq}) at the building façade for both daytime and night-time have been determined and scheduled in Table 3.

Table 3 schedules a summary of the external traffic noise measurements. The external L_{Amax} values were determined to assess the development in accordance with the NPfI and the RNP which are outlined in Sections 3.5 and 4.2.

Table 3 Traffic noise measurements, dB(A)

Time	**Noise descriptor**	**Traffic noise**
Day (7am to 10pm)	$L_{Aeq, (15\ hour)}$	74
Night (10pm to 7am)	$L_{Aeq, (9\ hour)}$	71
	1st highest L_{Amax}[1]	96
	3rd highest L_{Amax}[2]	88

[1] Note that the RNP states that one or two noise events (L_{Amax}) over 65-70dB(A) per night are unlikely to affect health and wellbeing significantly (Section 4.2).
[2] The third highest maximum noise level has been identified to determine traffic noise levels at night in accordance with the RNP where awakenings will not occur for any number of events (Section 4.2).

3. Noise emission criteria

Noise emission restrictions apply to future tenant activity and mechanical plant and equipment systems. These must be planned, designed and installed to include suitable sound attenuation, vibration isolation, and other necessary acoustic treatments.

The NPfI requires that trigger levels be calculated from the intrusiveness and amenity criteria. The NPfI also includes the application of modifying factors for undesirable noise characteristics, up to a maximum of 10dB.

3.1 Noise intrusiveness

The NPfI states that the intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5dB.

Table 4 schedules the noise intrusion level criteria in accordance with the NPfI, calculated with the background noise levels presented in Section 2.3 and Section 2.4.

3.2 Noise amenity

The NPfI describes methodology to limit the increases in noise levels from the introduction of new noise sources in an area. The NPfI recommends that the maximum ambient noise should not exceed the levels in Table 2.2 of the NPfI.

Table 4 summarises the project amenity noise levels (as described in Table 2.2 of the NPfI).

3.3 Modifying factors

For noise emissions from the proposed development with undesirable characteristics such as; tonality, low frequency, impulsiveness and intermittency, adjustments (as per Fact Sheet C of the NPfI) need to be included. These modifying factors include a 5dB penalty for each undesirable characteristic. A maximum penalty of 10dB for 2 or more undesirable characteristics is to be applied.

It should be noted that during the detailed design / construction phase of the project, if the design team / contractor makes selections of equipment which include one or more of these undesirable noise characteristics, a modifying factor will be applied.

3.4 Noise emission criteria - NPfI

The project specific trigger levels have been derived using the methodology presented in the NPfI and are scheduled in Table 4 and Table 5. We note that these trigger levels have been derived from the background noise levels measured at Location L1.

Table 4 Noise emission criteria – Residential

Time of operation	Site specific noise limits				
	Intrusive, $L_{Aeq,15min}$	**Recommended amenity, $L_{Aeq, Period}$**	**Project amenity, $L_{Aeq, Period}$**	**Project amenity, $L_{Aeq, 15min}$**	**Project trigger levels, $L_{Aeq, 15min}$**
Day (7am to 6pm)	54	60	55	58	**54**
Evening (6pm to 10pm)	53	50	45	48	**48**
Night (10pm to 7am)	48	45	40	43	**43**

Section 2.4.1 of the NPfI stipulates that noise emission criteria may be adjusted if the existing traffic noise level is 10 dB or more above the recommended amenity noise level for the area, which in this case is 60 dB(A), If this is the case, the emissions criteria will be taken as 15 dB less than the L_{Aeq} level of the traffic. As the calculated and verified traffic noise level of 72 dB(A) during the day is within this range, the amended Day time noise emissions criteria is taken as 57 dB(A). As such the following emissions criteria to residential receivers will apply for this project:

- Day (7am to 6pm): 57 dB(A) $L_{Aeq\ 15min}$
- Evening (6pm to 10pm): 48 dB(A) $L_{Aeq\ 15min}$
- Night (10pm to 7am): 43 dB(A) $L_{Aeq\ 15min}$

Table 5 Noise emission criteria – Commercial and other

Type of receiver	Time of operation	Site specific noise limits			
		Recommended amenity, $L_{Aeq, Period}$	**Project amenity, $L_{Aeq, Period}$**	**Project amenity, $L_{Aeq, 15min}$**	**Project trigger levels, $L_{Aeq, 15min}$**
Commercial	When in use	65	60	63	**63**
Active recreation area (e.g. school playground, golf course)	When in use	55	50	53	**53**
School classroom – internal (external)	Noisiest 1-hour period when in use	35	30	33	**33** (43)

As the NPfI does not refer to noise emission criteria to libraries, AS/NZS 2107 stipulates an indoor limit of 45 dB(A). Applying the generally accepted 10dB conversion for noise through an open window, a noise emission criterion of 55 dB(A) will be applied at the library façade.

It should be noted that the cumulative noise emission from the operations of the proposed development are to meet the project trigger levels presented in Table 4 and Table 5. Careful planning and coordination with the project design team should be undertaken so that these criteria are complied with.

3.5 Transient noise events – sleep disturbance – NPfI

Night-time noises, which occur infrequently and for short durations of time, have a potential to cause sleep disturbances. Such noise sources may include traffic-related noise, refuse collection and other activities.

Table 6 presents the recommended sleep disturbance criteria based on the NPfI and the measured background noise levels presented in Section 2.4. Noise emission from such short duration noise events should be controlled to meet these criteria to reduce the risk of sleep disturbance to residences at night.

Table 6 NPfI noise emission criteria – transient noise events

Activity	**Noise descriptor**	**Internal noise criterion L_{Amax}, dB(A)**
Traffic-related noise, etc.	$L_{Aeq,15min}$	48
	L_{AFmax}	58

It should be noted that the RNP (Section 4.2) also presents sleep disturbance criteria. We recommend that both are assessed for this development when addressing sleep disturbance.

4. Internal noise and vibration requirements

4.1 State Environmental Planning Policy (Infrastructure) 2007

Clause 102 of the State Environmental Planning Policy (Infrastructure) 2007 (SEPP), specifies indoor noise level requirements for non-road developments that are for residential use. The SEPP also states for a road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles, that:

> *If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*
>
> *a) in any bedroom in the building – 35 dB(A) at any time between 10.00 pm and 7.00 am,*
>
> *b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.*

4.2 NSW Road Noise Policy Sleep Disturbance Criteria

Section 5.4 of the NSW Road Noise Policy (RNP) outlines the policy for sleep disturbance and internal noise levels due to traffic-related noise. The RNP states 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*

We recommend that the sleep disturbance criteria above is used in conjunction with the criteria defined in Section 3.5 (based on the methodology presented in the NPfI) for this development.

4.3 AS/NZS 2107:2016

Indoor background noise levels in terms of Sound Pressure Level (SPL) and reverberation times (seconds) deemed acceptable to the majority of reasonable occupants are published in AS/NZS 2107. For areas that are not sleeping areas nor habitable rooms, we have summarised the recommended indoor noise levels and reverberation times for the proposed development in Table 7.

These limits apply to continuous sources of noise internal to the proposed development such as plant equipment, lifts, etc.

Please note that this section would apply for:

- the external traffic noise intrusion from M5 South Western Motorway and Kurrajong Road
- mechanical plant and equipment for all spaces including sleeping and habitable spaces

Furthermore, the façade should be designed so that the noise levels presented in Table 7 in areas other than habitable (including sleeping) spaces are complied with.

Table 7 Internal design sound pressure levels and reverberation time recommendations

Type of occupancy	Design SPL, L_{Aeq}, dB(A)	Reverberation Time, seconds
Meeting rooms / staff rooms	40 to 45	< 0.6
Small retail stores (general)	< 50	Minimise
Cafeterias	45 to 50	< 1.0
Enclosed car parks	< 65	–
Apartment common areas (foyer, lift lobby)	45 to 50	–
Cinema	30 to 35	< 0.6
Toilets	< 50	–
Kitchen, laundry and maintenance areas	< 55	–

4.4 Fire mode noise conditions

Some building systems only operate in fire mode and during periodic testing, so they do not add to background noise under typical conditions. According to AS/NZS 1668.1:2015, these systems are subject to noise limits, presented in Table 8, relating not to occupant comfort but rather to occupant distress and the intelligibility of emergency commands. Here, the 65 dB(A) limit supports the audibility of fire alarms (min. 75 dB(A) at bedheads per AS 1670.1).

Table 8 Fire mode maximum sound pressure levels

Area type	Maximum SPL, L_{Aeq}, dB(A)
Occupied Area	65
Fire-isolated exit (e.g. fire stair)	80

4.5 Construction requirements (NCC)

The development comprises of the following classifications that require acoustic consideration in accordance with the NCC:

> Class 2: Independent Living Units (ILUs)

> Class 9c: Aged care facility

The NCC specifies minimum sound insulation ratings between various occupancies, defined in terms of a weighted standardized level difference $D_{nT,w}$ and a weighted standardized level difference with adapted spectrum $D_{nT,w}+C_{tr}$. These ratings are determined by field testing conducted in accordance to AS/NZS 1276.1 or ISO 717.1 standards.

The NCC also offers deemed-to-satisfy provisions based on wall sound insulation ratings determined by laboratory testing in accordance to AS/NZS 1276.1 or ISO 717.1 standards. Table 9 and Table 10 schedules field-tested sound insulation ratings needed to achieve compliance, along with corresponding deemed-to-satisfy provisions.

Table 9 Internal NCC requirements (Class 2)

Element	Description	Performance	
		Deemed to satisfy	**Field testing rating**
Class 2 Requirements			
Walls	Airborne Sound		
	Separating any two sole occupancy units	R_w+C_{tr} > 50	$D_{nT,w}+C_{tr}$ > 45
	Separating a sole occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like	R_w > 50	$D_{nT,w}$ > 45
	Separating habitable room in one dwelling and a bathroom, sanitary compartment, laundry or kitchen in another dwelling	R_w+C_{tr} > 50 + impact	$D_{nT,w}+C_{tr}$ > 45 + impact
	Impact sound		
	Walls between sole occupancy units shall comply with the impact sound resistance standards specified in the NCC which means discontinuous construction		
Doors	Door that separates a sole occupancy unit from a stairway, public corridor, public lobby or the like	R_w > 30	$D_{nT,w}$ > 25
Floors	Airborne Sound		
	Separating sole occupancy units	R_w+C_{tr} > 50	$D_{nT,w}+C_{tr}$ > 45
	Separating a sole occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like	R_w+C_{tr} > 50	$D_{nT,w}+C_{tr}$ > 45
	Impact Sound		
	Separating sole occupancy units	$L_{n,w}$ < 62	$L_{nT,w}$ < 62
	Separating a sole occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like	$L_{n,w}$ < 62	$L_{nT,w}$ < 62
Services	If the adjacent room is a habitable room (other than a kitchen)	R_w+C_{tr} > 40	-
	If the adjacent room is a kitchen or non-habitable room.	R_w+C_{tr} > 25	-
	If a storm water pipe passes through a sole-occupancy unit it must be separated as stated above		
	Access panel in acoustical walls and acoustical barrier ceilings	R_w+C_{tr} > 25	-

Table 10 Internal NCC requirements (Class 9c)

Element	Description	Performance	
		Deemed to satisfy	**Field testing rating**
Class 9c Requirements			
Walls	Airborne Sound		
	Separating any two sole occupancy units	R_w > 45	$D_{nT,w}$ > 40
	Separating a sole occupancy unit from a bathroom, sanitary compartment (not being an associated ensuite), plant room or utilities room	R_w > 45	$D_{nT,w}$ > 40
	Separating a sole occupancy unit from a kitchen or laundry	R_w > 45 + impact	$D_{nT,w}$ > 40 + impact
	Impact sound		
	Walls between sole occupancy units shall comply with the impact sound resistance standards specified in the NCC which means discontinuous construction		
Floors	Airborne Sound		
	Separating any two sole occupancy units	R_w > 45	$D_{nT,w}$ > 40
	Impact Sound		
	Separating any two sole occupancy units	-	$L_{n,w}$ < 62
Services	If the adjacent room is a habitable room (other than a kitchen)	R_w+C_{tr} > 40	-
	If the adjacent room is a kitchen or non-habitable room.	R_w+C_{tr} > 25	-
	If a storm water pipe passes through a sole-occupancy unit it must be separated as stated above		
	Access panel in acoustical walls and acoustical barrier ceilings	R_w+C_{tr} > 25	-

Where there is an identified risk of structure-borne sound transmission, the NCC requires a discontinuous construction, as scheduled in Table 11.

Table 11 NCC Specified constructions for wall impact sound insulation

Wall or door type	Discontinuous construction
Wall separating a wet area in one unit from a habitable room in adjacent unit; OR Wall separating a unit from a plant room or a lift shaft	**For Class 2 buildings:** Discontinuous construction means a wall having a minimum 20mm cavity between 2 separate leaves; and For masonry walls where ties are required between leaves, they are to be of the resilient type, and For walls other than masonry, no mechanical linkage between the leaves, except at the perimeter. **For Class 9c buildings:** For masonry walls, be identical with a prototype that is no less resistant to the transmission of impact sound when tested in accordance with Specification F5.5 than a wall listed in Table 2 of Specification F5.2 (NCC). For walls other than masonry, be two or more separate leaves without rigid mechanical connection except at the periphery.

It should be noted that open kitchens are considered wet source rooms but habitable receiver rooms.

In addition to codified ratings, specific higher-performing constructions may be required in some areas (e.g. plant rooms) to reduce noise to the adjacent tenancies. Similarly, specific detailed constructions and treatments may be needed to maintain the specified sound insulation rating even across wall elements beyond typical wall types, such as at the junction of internal walls and the façade.

Notwithstanding deemed-to-satisfy provisions based on lab tests, field performance is critically dependent on good workmanship and installation quality, which is also a requirement of the acoustic design.

4.6 Internal vibration requirements

Vibration is the oscillation of an object, structure, or surface at frequencies typically below 20 Hz, which is inaudible but instead can be "felt". **Structure-borne sound** means oscillation at frequencies higher than 20Hz, resulting in audible noise, which is transmitted through rigid building elements and radiated by surfaces.

Human response to building vibration is a complex phenomenon. There is great variability in the vibration tolerance of humans, and as a result, human comfort criteria cannot robustly be defined and quantified. Acceptable values of human exposure to vibration depend on human activity and the character of the vibration, and they are further influenced by individual attitudes, expectations, and perceptibility.

Limits for vibration of the building structure potentially affecting human comfort have been derived from AS 2670.2 and BS 6472, both of which are referenced and discussed practically in the AVTG. These standards propose maximum vibration levels in terms of baseline curves and multiplication factors. For the purpose of minimising the disturbing perceptibility of vibration within the occupied areas of this development, Table 12 specifies appropriate limits for floor vibration in a simplified form.

Table 12 Vibration limits

Type of occupancy	**Time**	**Continuous vibration limits:** **r.m.s. acceleration (m/s^2)** **Preferred / maximum**	**Impulsive vibration limits:** **r.m.s. acceleration (m/s^2)** **Preferred / maximum**	**Intermittent vibration limits:** **Vibration Dose Value VDV ($m/s^{1.75}$)** **Preferred / maximum**
Offices, retail, circulation / other occupied ventilated space	Day or night	0.020 / 0.040	0.640 / 1.280	0.40 / 0.80
Residences	Day	0.010 / 0.020	0.300 / 0.600	0.20 / 0.40
	Night	0.007 / 0.014	0.100 / 0.200	0.13 / 0.26

5. Noise assessment and recommendations

5.1 Noise intrusion

5.1.1 Glazing

The site is impacted by road traffic along the M5, approximately 30m to the northwest, and along Kurrajong Rd, approximately 20m to the north. These are the main sources of external noise that will affect the façade of the proposed site. External noise measurements scheduled in Section 2.3 and Section 2.4 have been used to determine the façade glazing treatment presented in this section.

We have calibrated our noise model using noise measurements in Section 2.3 and Section 2.4 and CoRTN and determined the external noise levels (particularly at higher levels) along the M5. Section 3.5 also outlines the criteria for internal noise level criteria due to traffic-related noise at night, concerning sleep disturbance.

The sleep disturbance criteria for both the NPfI and RNP have been assessed and the recommended glazing presented in Table 13 and Appendix B meets the criteria for both.

Indicative glazing requirements are presented in Table 13, with a mark-up of façade treatment locations is provided in Appendix B.

Table 13 Minimum glazing performance requirements

Indicative glazing construction	**Minimum glazing octave band insertion loss – dB, Hz**								
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**R_w**
13.52mm laminated / 90mm airgap / 6mm monolithic glass	23	28	38	45	50	52	57	58	**48**
10.38mm laminated / 90mm airgap / 6mm monolithic glass	21	26	36	40	44	45	47	44	**43**
13.52mm laminated / 13mm airgap / 6mm monolithic glass	20	24	29	37	40	42	53	47	**39**
10.38mm laminated / 8mm airgap / 6mm monolithic glass	19	24	26	34	33	34	37	34	**34**
6mm monolithic / 12mm airgap / 6mm monolithic glass	21	23	22	32	34	32	36	34	**33**

We understand that these glazing recommendations will be refined at a later stage and the following considerations will need to be accounted for. These include:

- Selection of glazing supplier (framing systems and ultimately acoustic performance of the glazing system as a whole)
- If required, reassess noise intrusion based on glazing sizes and any changes made
- Structural requirements

> Thermal requirements

5.1.2 External walls

To assist in reducing noise intrusion, the wall / floor construction will need to be made up of concrete slab or brick veneer with a minimum acoustic performance of R_w 50.

5.2 Mechanical plant and equipment noise emission

Preliminary plant and equipment specifications have been provided by the mechanical engineer. Based on the Architectural Drawings and Building Services Mark-up, we understand that external plant (cooling towers) will be located on the roof of Building A. Our calculations have made provisions for noise emissions from these locations to nearby sensitive receivers.

Based on information provided by the mechanical engineer, there will be 2 cooling towers with the following sound power levels located on Building A:

> Cooling Tower 1:
  - 100% capacity: 93dB(A)
  - 75% capacity: 85dB(A)

> Cooling Tower 2:
  - 100% capacity: 90dB(A)
  - 75% capacity: 83dB(A)

> We understand that the cooling towers will be operating under the following operating conditions:
  - Daytime and evening (7am to 10pm): 100% capacity
  - Night-time (10pm to 7am): 75% capacity

The calculated noise levels at the most sensitive receivers have been provided in Table 14. The assumptions made above, comply with the most stringent noise emission criteria of Section 3.4. We note that compliance at these locations would mean compliance at other locations described in Section 2.1.

Table 14 Noise emission levels at closest sensitive receivers

Receiver location	Time of day	Receiver noise levels, dB(A)	Criteria, dB(A)	Compliance
40 Ironbark Ave	Day	48	54	Yes
	Evening	48	48	Yes
	Night	40	43	Yes
Daruk Park	Day	50	53	Yes
	Evening	50	53	Yes
	Night	50	53	Yes
Liverpool City Council Library	Day	39	55	Yes
	Evening	39	55	Yes
	Night	-	-	Yes
Preschool – internal (external)	Day	29 (39)	33 (43)	Yes
	Evening	-	-	Yes
	Night	-	-	Yes

Table 14 presents noise levels at the worst affected locations of different use.

5.3 Mechanical plant and equipment preliminary recommendations

Commercial noise emissions, including plant noise emissions, from any base-building systems and commercial tenancies within the subject development are required to comply with the NPfI noise emission trigger levels (presented in Section 3.4 of this report).

Furthermore, although the locations of other plant and equipment, such as fans and internal VRF units has been provided in the mechanical markups, at time of writing, selections are yet to be made. Provision has been included in the current scheme to incorporate standard acoustic treatment, such as silencers, barriers, acoustically lined ductwork, acoustic louvres, etc. to meet the noise emission requirements of the NPfI (Section 3.4).

Building fabric recommendations (including façade glazing) have been presented in Section 5.1. These recommendations will ensure that the noise intrusion and sleep disturbance criteria have been complied with as per Sections 3.5 and 4.1 respectively.

As the design progresses through the detailed design phase, acoustic measures will need to be incorporated in the design so that the noise emission criteria presented in Section 3.4 will be complied with.

Furthermore, as the proposed commercial tenants are not known, it is the responsibility of the tenant to ensure compliance with the internal and noise emission criteria set out in this report (Section 3 and Section 4).

6. Conclusion

A site investigation of the proposed site and surrounds at 18 Randwick Close, Casula has been completed to determine existing noise levels for the environment and surrounds for a proposed development of the site.

Mechanical plant used on the site will need to be designed to comply with the noise emission and noise intrusion criteria in the design development stage of the project. Controlling noise from plant and equipment would include a combination of enclosed plant rooms, silencers, lined ductwork, acoustic barriers, acoustic louvers and the selection of quiet plant where required.

The preliminary road traffic noise intrusion assessment shows that the upgraded glazing will be required for affected residential spaces, with recommendations shown in Table 13 and Appendix B, in order to meet the internal acoustic requirements presented in this report. These include the criteria for sleep disturbance at night-time for both the NPfI and the RNP.

Current standards associated with the development have been reviewed and assessed in accordance with existing site constraints. Preliminary construction standards have been reviewed to ensure that Liverpool City Council's and other guidelines are satisfied.

ADP Consulting believes that there are no site conditions that would preclude this development from complying with the criteria defined in this report.

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Appendix A
Glossary of acoustic terms

Air-borne sound

The sound emitted directly from a source into the surrounding air, such as speech, television or music.

Ambient sound

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far. This is normally taken to be the L_{Aeq} value.

Background noise level

The average of the lowest levels of the noise levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources. Usually the L_{A90} value represents the background noise level.

dB(A)

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Decibel scale

The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. Therefore, a 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. It is generally accepted that a 10 dB increase in the sound pressure level corresponds to a perceived doubling in loudness.

Examples of decibel levels of common sounds are as follows:

- 0 dB(A) Threshold of human hearing
- 30 dB(A) A quiet country park
- 40 dB(A) Whisper in a library
- 50 dB(A) Open office space
- 70 dB(A) Inside a car on a freeway
- 80 dB(A) Outboard motor
- 90 dB(A) Heavy truck pass-by
- 100 dB(A) Jackhammer / Subway train
- 110 dB(A) Rock Concert
- 115 dB(A) Limit of sound permitted in industry
- 120 dB(A) 747 take off at 250 metres

Frequency

The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low-pitched sound.

L_{90}, L_{10}, etc

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of a measurement period (i.e. L_{90} is the level which is exceeded for 90 percent of a measurement period). L_{90} is commonly referred to as a basis for measuring the background sound level.

$L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

L_{Amax}

The maximum sound pressure level measured over the measurement period.

L_{Amin}

The minimum sound pressure level measured over the measurement period.

Day

Referred to as the period between 7am and 6pm for Monday to Saturday and 8am to 6pm for Sundays and Public Holidays.

Evening

Referred to as the period between 6pm and 10pm for Monday to Sunday and Public Holidays.

Night

Referred to as the period between 10pm and 7am for Monday to Saturday and 10pm to 8am for Sundays and Public Holidays.

Assessment background level (ABL)

The overall background noise level on each day, evening and night periods for each day of the noise monitoring.

Rating background level (RBL)

The overall background level on each day, evening and night periods for the entire length of noise monitoring.

Reverberation

The persistence, after emission by the source has stopped, of a sound field in an enclosure.

Sound isolation

A reference to the degree of acoustical separation between two spaces. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term 'sound isolation' does not specify any grade or performance quality and requires the units to be specified for any contractual condition.

Sound pressure level, L_p, dB of a sound

A measurement obtained directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the R.M.S. sound pressure to the reference sound pressure of 20 micro Pascals

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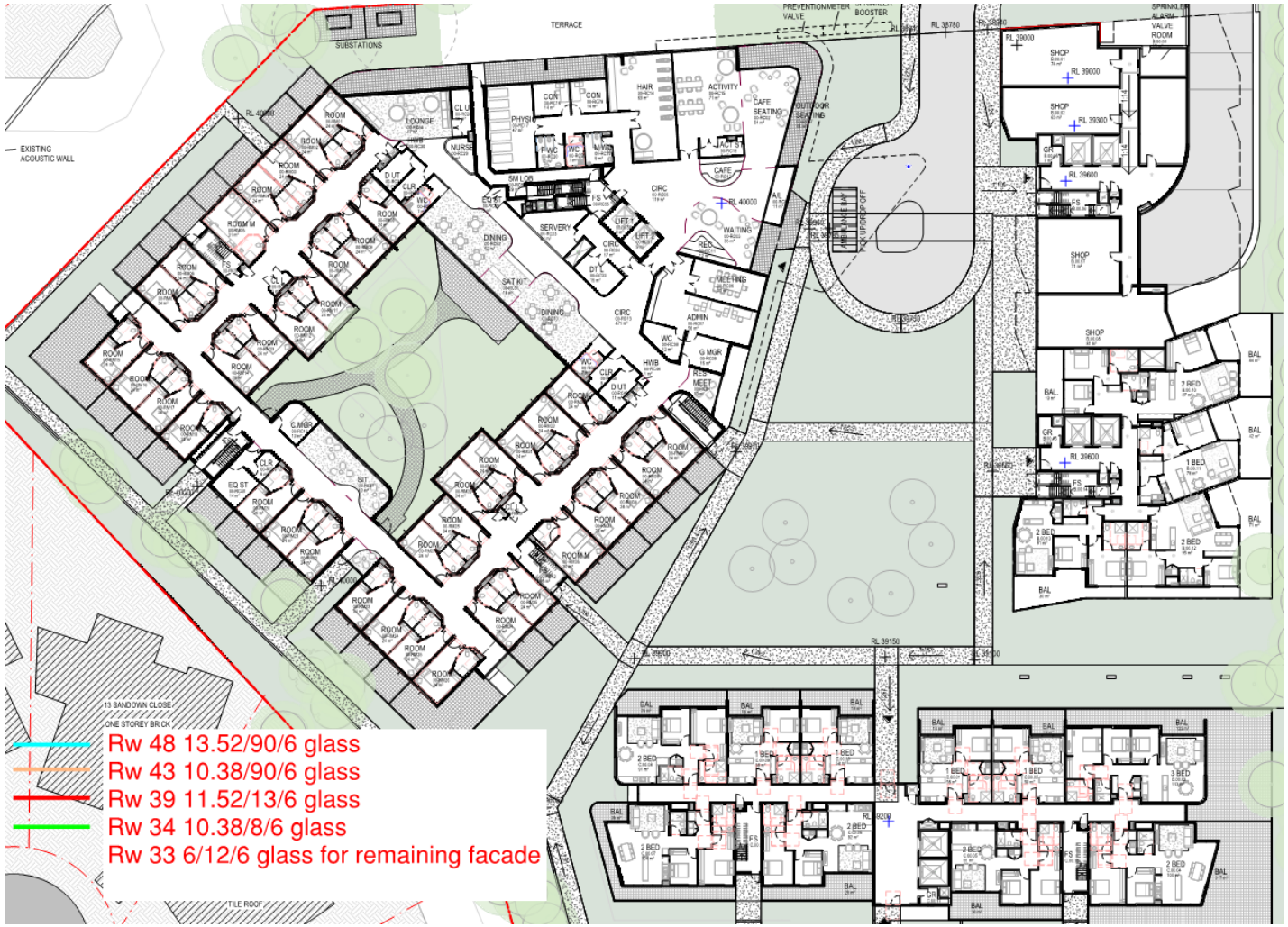
Appendix B
Façade treatment mark-up

Ground Level



Level 1


13 SANDOWN CLOSE
ONE STOREY BRICK
Rw 48 13.52/90/6 glass
Rw 43 10.38/90/6 glass
Rw 39 11.52/13/6 glass
Rw 34 10.38/8/6 glass
Rw 33 6/12/6 glass for remaining facade
TILE ROOF

Level 2


Rw 48 13.52/90/6 glass
Rw 43 10.38/90/6 glass
Rw 39 11.52/13/6 glass
Rw 34 10.38/8/6 glass
Rw 33 6/12/6 glass for remaining facade

Level 3


Rw 48 13.52/90/6 glass
Rw 43 10.38/90/6 glass
Rw 39 11.52/13/6 glass
Rw 34 10.38/8/6 glass
Rw 33 6/12/6 glass for remaining facade

Level 4


OUTDOOR
TERRACE
LOBBY
AIR
COOLED
VRF
PLANT
COMMUNAL
TERRACE
BUILDING C
Rw 48 13.52/90/6 glass
Rw 43 10.38/90/6 glass
Rw 39 11.52/13/6 glass
Rw 34 10.38/8/6 glass
Rw 33 6/12/6 glass for remaining facade

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