DK ACOUSTICS PTY LTD
Building and Environmental Acoustics

Road Traffic Noise Assessment and Environmental Noise Impact Assessment

Proposed Mixed-Use Development

1129 – 1131 Pittwater Road, Collaroy

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SECTION 1 INTRODUCTION

A new mixed-use development is proposed to be built at 1129 – 1131 Pittwater Road, Collaroy, refer to Figure 1 below. The development will comprise commercial space on the ground floor and a boarding house with 23 occupancy rooms and a manager office on levels 1 to 3.

The ambient noise at the development site is affected by road traffic on Pittwater Road and activities associated with the nearby commercial and residential premises. The nearest potentially affected residences by the development are the residences located along the southern and western boundaries of the development site. Commercial premises are located along the northern and southern boundaries of the development site.

Road traffic noise affecting the proposal was measured at the development site and noise control recommendations to reduce the noise inside the development to comply with Council requirements and Clause 102 of the State Environment Planning Policy (Infrastructure) 2007) are detailed in Section 5 of this report.

The noise emission from the development is assessed in Section 4 of this report. Noise controls are recommended in Section 5 to reduce noise emission from the development to comply with the requirements of Council and the NSW Environmental Protection Authority (EPA) environmental noise guidelines. Construction noise is considered in Section 6.

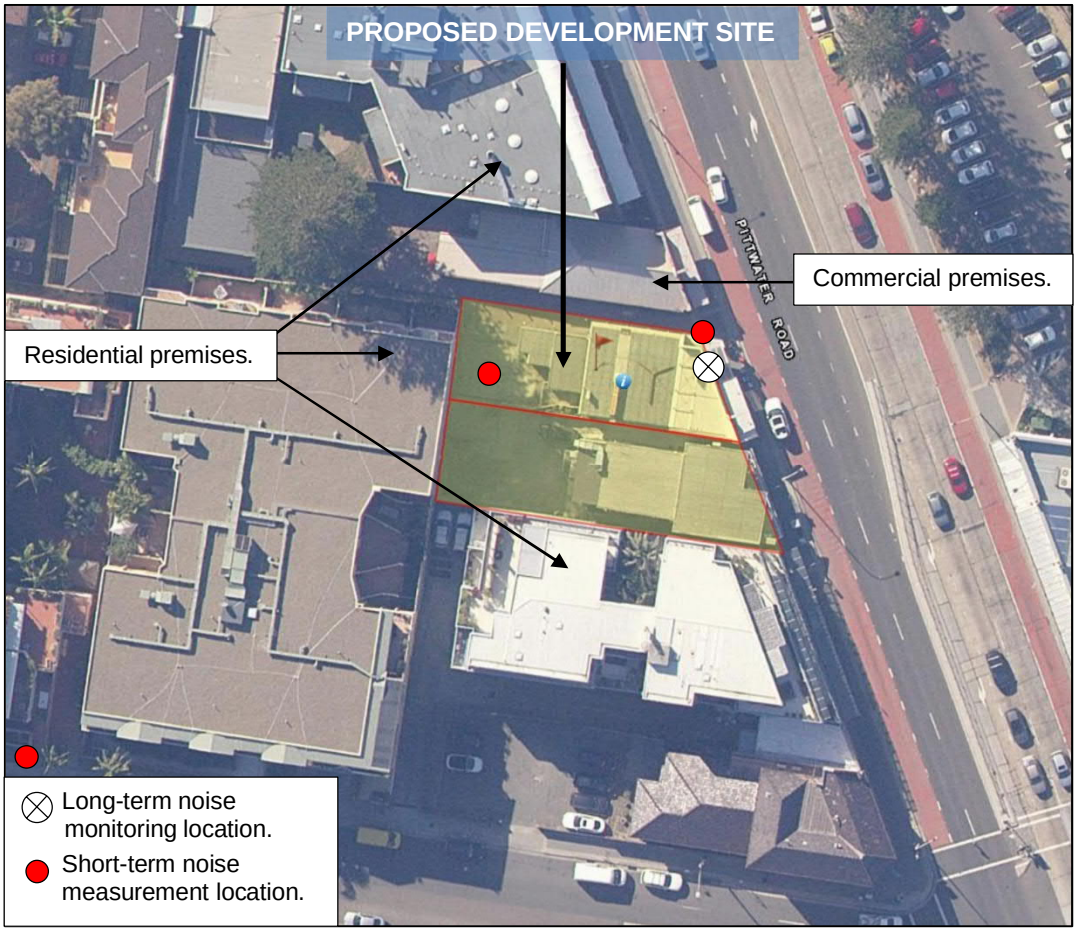


FIGURE 1 – Site Location

SECTION 2 AMBIENT NOISE MEASUREMENTS

2.1 Measured Background Noise Levels

The proposed development will be located at 1129 – 1131 Pittwater Road, Collaroy, refer to Figure 1 in Section 1 of this report. The ambient noise at the development site is affected by road traffic on Pittwater Road and activities associated with the nearby commercial and residential premises with a regular daily pattern of noise.

Long-term unattended background noise measurements were carried out at the development site at the height of approximately 5 metres above the ground on the eastern boundary, above the roof of the existing building, refer to Figure 1 in Section 1 of this report.

The EPA uses the Rating Background Level (RBL) to determine the background noise level, to account for the temporal variation of background noise levels. The results of the noise survey are presented in Appendix A and summarized in TABLE 1 below.

TABLE 1 – Measured Rating Background Noise Levels

Location: 1129 – 1131 Pittwater Road, Collaroy			
Time Period	Rating Background Level (RBL)		
	Day, dB(A) (7 am – 6 pm)	Evening, dB(A) (6 pm – 10 pm)	Night, dB(A) (10 pm– 7 am)
Monday (3/02/20)	61	59	56
Tuesday (4/02/20)	61	59	51
Wednesday (5/02/20)	61	59	52
Thursday (6/02/20)	62	60	62
Friday (7/02/20)	68	69	63
Saturday (8/02/20)	64	65	62
Sunday (9/02/20)	69	48	55
Monday (10/02/20)	63	-	-
Median RBL	**62**	**59**	**57**

Short-term background noise levels in Octave Band Centre Frequencies were measured 1.5 metres above the ground, near the western boundary of the development site and in Collaroy Street. The measured levels are shown in TABLE 2 below.

TABLE 2 – Measured Background Noise Levels in Octave Band Centre Frequencies

Location, Date & Time	L_{90} Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
Back of the premises, near the western boundary of the development site, (3 – 4 pm, Monday 3/02/2020)	59	56	53	53	49	42	37	33	**54**
Outside the nearby residences at 7 – 9 Collaroy Street, Collaroy (3 – 4 pm, Monday 3/02/2020)	56	52	46	44	41	38	35	48	**50**

The background noise levels are representative of the background noise levels at the nearest residences in the absence of noise from the subject development, as required by the EPA in Section B2.1 of the Noise Policy for Industry.

Meteorological conditions during the measurements consisted of clear and cloudy skies and periods of rain and high wind, as shown in Appendix A. Recorded data during the periods of rain/high wind was excluded from the background noise levels. Atmospheric conditions at all other times were ideal for noise monitoring.

2.2 Calculated Rating Background Levels

The short-term L_{90} background noise levels were found to be up to 11 dB lower at the back of the premises than the L_{90} levels at the long-term noise monitoring location, at the front of the premises.

The Rating Background Levels are calculated at the nearby residences, based on the measured background noise levels in Section 2.1 of this report, as shown in TABLE 3 below.

TABLE 3 – Rating Background Levels at Nearby Residences

Location	Time Period	Rating Background Level (RBL)
Outside the adjoining residences fronting Pittwater Road	Day (7 am – 6 pm)	62 dB(A)
	Evening (6 pm – 10 pm)	59 dB(A)
	Night (10 pm – 7 am)	57 dB(A)
Outside the adjoining residences to the west of the development	Day (7 am – 6 pm)	51 dB(A)
	Evening (6 pm – 10 pm)	48 dB(A)
	Night (10 pm – 7 am)	46 dB(A)

2.3 Measured Road Traffic Noise Levels

Measurements of road traffic noise affecting the proposed development were carried out at the same location as the long term ambient noise monitoring location in Section 2.1 of this report. The results of the noise survey are presented in Appendix A and summarized in TABLE 4 below. The measured noise levels in TABLE 4 exclude a façade reflection.

The measured levels of noise are representative of the road traffic noise levels at the development site.

TABLE 4 – Measured Long-Term Road Traffic Noise

Location: 1129 – 1131 Pittwater Road, Collaroy		
Measurement Period	External Daytime (7am – 10pm) $L_{eq,\ 15\text{-}hour}$ Noise Level, dB(A)	External Night-time (10pm – 7am) $L_{eq,\ 9\text{-}hour}$ Noise Level, dB(A)
Monday (3/02/20)	70	66
Tuesday (4/02/20)	70	66
Wednesday (5/02/20)	70	68
Thursday (6/02/20)	70	70
Friday (7/02/20)	82*	77*
Saturday (8/02/20)	72	69
Sunday (9/02/20)	91*	79*
Monday (10/02/20)	72	
Highest 10th percentile	**72**	**69**

* The noise level was affected by rain and high wind and was excluded from the calculated overall L_{eq} noise levels.

2.4 Measurement Equipment

The background and road traffic noise level measurements were made with Svantek 979 Sound Analyser, Type 1 precision environmental sound and vibration analyser, and Infobyte Noise Monitor iM4-102, Type 2 precision environmental noise monitor, meeting all applicable requirements of Australian Standard AS1259, set to Fast Response.

The measurement systems were field calibrated with CEL-284/2 Class 1L calibrator prior to the noise survey. Calibration check was performed at the start and end of the noise survey, and the calibration drift was found to be less than 0.5 dB and was therefore acceptable.

2.5 Noise Level Descriptors

L_{Aeq} noise level descriptor is defined as "the value of the A-weighted sound pressure level of a continuous steady sound that, within the measurement time interval, has the same sound pressure as a sound under consideration whose level varies with time" [AS2107-2000].

The L_{Aeq} is an average noise level, where the averaging is based on the sound energy. Studies have shown that human reaction to time-varying noise is quite accurately represented by the L_{Aeq} level [Marshall Long, "Architectural Acoustics", 2006].

$L_{Aeq\ (15\text{-}hour)}$ noise level descriptor refers to the L_{Aeq} noise level evaluated over fifteen hours between 7 am and 10 pm and is used to assess road traffic noise inside living areas.

$L_{Aeq\ (9\text{-}hour)}$ noise level descriptor refers to the L_{Aeq} noise level evaluated over nine hours between 10 pm and 7 am and is used to assess road traffic noise inside sleeping areas.

L_{A90} noise level descriptor is defined as the exceeded A-weighted sound pressure level that occurred for 90 percent of the time in a measurement period (the lowest 10 percentile of the measured noise levels). The L_{90} noise level is considered as the background noise level.

SECTION 3 NOISE CRITERIA

3.1 State Environment Planning Policy (Infrastructure) 2007 (SEPP 2007)

Clause 102 of the State Environment Planning Policy (Infrastructure) 2007 (SEPP 2007) requires the following:

102 Impact of road noise or vibration on non-road development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of RMS) and that the consent authority considers is likely to be adversely affected by road noise or vibration—

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, 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 LAeq levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

(4) In this clause, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.

3.2 Development Near Rail Corridors and Busy Roads – Interim Guidelines

The NSW Department of Planning published the "Development Near Rail Corridors and Busy Roads – Interim Guidelines" in 2008. The Guidelines refer to Clause 102 of the State Environment Planning Policy (Infrastructure) 2007 for the noise criteria for developments affected by traffic noise.

The Guidelines use the $L_{Aeq(9h)}$ noise descriptor to assess the noise level between 10 pm and 7 am, and the $L_{Aeq(15h)}$ noise descriptor to assess the noise level in the daytime between 7 am and 10 pm. In addition, the Guidelines also state that:

"*if internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*".

3.3 EPA Project Noise Trigger Levels

The NSW Environmental Protection Authority (EPA) published the Noise Guide for Local Government in 2013 and the Noise Policy for Industry (NPI) in 2017 to provide guidelines to assess the potential impact of noise from new and existing developments and includes a framework for considering feasible and reasonable noise mitigation measures.

The Guide refers to the NSW Industrial Noise Policy (EPA 2000), which has now been superseded by the NPI, for a definition of intrusive noise [Section 2.2.1 “Intrusive noise”, Noise Guide for Local Government].

The NPI specifically applies to industrial noise sources from activities listed in Schedule 1 of the POEO Act and regulated by the EPA. In the absence of Council noise criteria, the NPI is used in this report as a guide to assess the potential noise impact from the subject premises.

The NPI sets out a procedure to determine ‘project noise trigger levels’ relevant to a particular development. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community. The project noise trigger level provides a benchmark or objective for assessing a proposal or site and is not intended for use as a mandatory requirement [Section 2.1 of the NPI].

The project noise trigger level is the lower (that is, the more stringent) value of the project *intrusiveness noise level* and project *amenity noise level* determined in this report.

The intrusiveness of a noise source may generally be considered acceptable if the 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 by more than 5 dB when beyond a minimum threshold.

The noise levels are assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most-affected point within 30 metres of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2–1.5 metres above ground level [Section 2.6 of the NPI].

The measured rating background levels are given in Section 2 of this report. Table 2.2 “Amenity noise levels” of the Policy provides recommended amenity noise levels to protect commercial and residential premises in an Urban noise amenity area. The project noise trigger levels are summarised in TABLE 5 below.

The Project Intrusiveness Noise Level also meets the recommendations in the ‘Noise Guide for Local Government’.

TABLE 5 – EPA Project Noise Trigger Levels

Location	Period	$L_{eq\ (15\ MINUTE)}$ Project Amenity Noise Level	$L_{eq\ (15\ MINUTE)}$ Project Intrusiveness Noise Level	$L_{eq\ (15\ MINUTE)}$ Project Noise Trigger Level
Outside the adjoining residences fronting Pittwater Road	Day (7 am – 6 pm)	59 dB(A) (= 71 – 15 + 3)	67 dB(A)	59 dB(A)
	Evening (6 pm – 10 pm)	58 dB(A) (= 70 – 15 + 3)	64 dB(A)	58 dB(A)
	Night (10 pm – 7 am)	56 dB(A) (= 68 – 15 +3)	62 dB(A)	56 dB(A)
Outside the adjoining residences to the west of the development	Day (7 am – 6 pm)	58 dB(A) (= 60 – 5 + 3)	56 dB(A)	56 dB(A)
	Evening (6 pm – 10 pm)	48 dB(A) (= 50 – 5 + 3)	53 dB(A)	48 dB(A)
	Night (10 pm – 7 am)	43 dB(A) (= 45 – 5 +3)	51 dB(A)	43 dB(A)
Nearby commercial premises	When in use	63 dB(A) (= 65 – 5 + 3)	-	63 dB(A)

(1) The area is affected by high road traffic noise, and the project amenity noise level is determined as recommended in Section 2.4.1 of NPI. The measured median L_{eq} road traffic noise level was 71 dB(A) during the day, 70 dB(A) in the evening and 68 dB(A) at night, at the ambient noise monitoring location. The L_{eq} road traffic noise levels are approximately 15 dB lower at the residences to the west of the development site.

The cumulative noise impact of activities within the proposed development should comply with the noise trigger levels.

The NPI states that "*where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level*" [Section C.1 of the NPI].

Correction factors are to be added to the measured or predicted noise levels at the receiver before comparison with the noise trigger levels. The level of noise from mechanical plant and air-conditioning plant is typical without the above characteristics, and modifying factors are therefore usually not applicable.

Provided the noise emission from the development complies with the EPA noise trigger levels in TABLE 5 above, the noise emission will also comply with Council requirements.

3.4 Protection of the Environment Operations (Noise Control) Regulation 2017

Clause 45 of the Protection of the Environment Operations (Noise Control) Regulation 2017 provides the following controls for domestic air conditioners:

45 Use of air conditioners on residential premises

A person is guilty of an offence if:

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

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

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

(b) within 7 days of doing so, the person is warned by an authorised officer or enforcement officer not to cause or permit an air conditioner to be used on residential premises in that manner, and

(c) the person again causes or permits an air conditioner to be used on residential premises in the manner referred to in paragraph (a) within 28 days after the warning has been given.

To comply with the audibility criterion, it is recommend that the $L_{Aeq,\ 15\text{-}minute}$ noise level from domestic air conditioners not exceed 10 dB below the measured night-time RBL level of 46 dB(A) in Section 2.1 of this report, or 30 to 35 dB(A), whichever is higher, at night outside the habitable rooms of the nearby residences.

In this case, the $L_{Aeq,\ 15\text{-}minute}$ noise level from domestic air conditioners should not exceed **36 dB(A)** outside the nearby residences.

3.5 Internal Noise Criteria

Based on the noise criteria in Section 3.1 of this report for the proposed development, the required traffic noise reduction from outside to inside with the windows/doors closed is summarised in TABLE 6 below.

The required noise reduction at night was found to be higher than the required noise reduction during the day. TABLE 6 below, therefore, only shows the night-time recommended noise reduction for the occupancy rooms.

TABLE 6 – Internal Noise Criteria and Recommended Noise Reduction

Location	External Noise Level	Indoor Design Sound Level	Recommended Noise Reduction
Rooms 1 - 6	72 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	35 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	37 dB(A)
Rooms 13 - 17	67 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	35 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	32 dB(A)
Rooms 7 - 12, 18 - 23	52 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	35 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	17 dB(A)
Common room 1	72 dB(A) $L_{eq,\ 15\ hour}$ Day (7 am – 10 pm)	40 dB(A) $L_{eq,\ 15\ hour}$ Day (7 am – 10 pm)	32 dB(A)
Common room 2	70 dB(A) $L_{eq,\ 15\ hour}$ Day (7 am – 10 pm)	40 dB(A) $L_{eq,\ 15\ hour}$ Day (7 am – 10 pm)	30 dB(A)
Manager Unit Living room	65 dB(A) $L_{eq,\ 15\ hour}$ Day (7 am – 10 pm)	40 dB(A) $L_{eq,\ 15\ hour}$ Day (7 am – 10 pm)	25 dB(A)
Manager Unit Bedrooms 1 and 3	62 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	35 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	27 dB(A)
Manage Unit Bedroom 2	52 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	35 dB(A) $L_{eq,\ 9\ hour}$ Night (10 pm – 7 am)	17 dB(A)

3.6 Mechanical Ventilation

For natural ventilation, with 20% of the windows and external doors open, the level of noise inside the rooms from road traffic should not exceed 10 dB above the internal noise criteria, refer to TABLE 7 below.

The effective noise reduction required from outside to the inside of the habitable rooms with the windows/doors open is therefore up to 27 dB (equal to the external noise level minus the indoor design sound level with windows open), refer to TABLE 7 below.

Up to 10 dB noise reduction can be achieved with the windows/doors open. The level of road traffic noise will exceed the noise criteria inside the rooms, with open windows/doors, and mechanical ventilation will therefore be required to provide ventilation while the windows and doors are closed.

TABLE 7 – Required Noise Reduction with Windows Open

Location	External Noise Level	Indoor Design Sound Level (*windows closed*)	Indoor Design Sound Level (*windows open*)	Required Noise Reduction (windows open)	Required Mechanical Ventilation (Yes/No)
Rooms 1 - 6	72 dB(A) $L_{eq,\ 9\ hour}$	35 dB(A) $L_{eq,\ 9\ hour}$	45 dB(A) $L_{eq,\ 9\ hour}$	27 dB(A)	Yes
Rooms 13 - 17	67 dB(A) $L_{eq,\ 9\ hour}$	35 dB(A) $L_{eq,\ 9\ hour}$	45 dB(A) $L_{eq,\ 9\ hour}$	22 dB(A)	Yes
Rooms 7 - 12, 18 - 23	52 dB(A) $L_{eq,\ 9\ hour}$	35 dB(A) $L_{eq,\ 9\ hour}$	45 dB(A) $L_{eq,\ 9\ hour}$	7 dB(A)	No
Common room 1	72 dB(A) $L_{eq,\ 15\ hour}$	40 dB(A) $L_{eq,\ 15\ hour}$	50 dB(A) $L_{eq,\ 15\ hour}$	22 dB(A)	Yes
Common room 2	70 dB(A) $L_{eq,\ 15\ hour}$	40 dB(A) $L_{eq,\ 15\ hour}$	50 dB(A) $L_{eq,\ 15\ hour}$	20 dB(A)	Yes
Manager Unit Living room	65 dB(A) $L_{eq,\ 15\ hour}$	40 dB(A) $L_{eq,\ 15\ hour}$	50 dB(A) $L_{eq,\ 15\ hour}$	15 dB(A)	Yes
Manager Unit Bedrooms 1 and 3	62 dB(A) $L_{eq,\ 9\ hour}$	35 dB(A) $L_{eq,\ 9\ hour}$	45 dB(A) $L_{eq,\ 9\ hour}$	17 dB(A)	Yes
Manager Unit Bedroom 2	52 dB(A) $L_{eq,\ 9\ hour}$	35 dB(A) $L_{eq,\ 9\ hour}$	45 dB(A) $L_{eq,\ 9\ hour}$	7 dB(A)	No

SECTION 4 NOISE EMISSION

The noise measurements and assessment in this report were carried out in accordance with the Australian Standard AS1055.1-1997 “Acoustics - Description and Measurement of Environmental Noise”.

The sound pressure level at the receiver location is calculated using the following formula, based on International Standard ISO 9613-2:1996 “Acoustics – Attenuation of sound during propagation outdoor – Part 2: General method of calculation”:

$$L_p = L_w – 20 \times \text{Log}_{10}(D) – 8 – A_{barrier}$$

where: L_p is the sound pressure level at the receiver location (dB);

L_w is the sound power level of the noise source (dB);

D is the distance between the noise source and the receiver location (m);

$A_{barrier}$ is the attenuation due to the sound barrier between the noise source and the receiver.

The overall sound pressure level inside the common rooms was calculated using a room correction with an average sound absorption coefficient of 0.1.

4.1 Description of the Proposed Development

The proposed development will be located at 1129 – 1131 Pittwater Road, Collaroy. The development will comprise commercial space on the ground floor and a boarding house with 23 occupancy rooms and a manager unit on levels 1 to 3. The rooms are proposed to be air-conditioned.

The ambient noise at the development site is affected by road traffic on Pittwater Road and activities associated with the nearby commercial and residential premises.

The following noise sources have been identified as part of this development that may potentially affect the neighbouring properties:

- ❑ Air-conditioning plant
- ❑ People talking in communal areas
- ❑ Cars/motorbikes entering and leaving the carpark

The noise emission is assessed at the following nearest potentially affected receptor locations:

- ❑ Receptor location 1: outside the adjoining residences, located along the western boundary of the development site. The noise is assessed outside the windows on the first floor of the residential building.
- ❑ Receptor location 2: outside the adjoining residences, located along the southern boundary of the development site. The noise is assessed outside the windows on the first floor of the residential building.

Provided the noise emission from the development complies with the noise criteria at the above receptor locations, the noise emission will also be acceptable at all other nearby properties.

4.2 Air-Conditioning Plant

It is proposed to provide air-conditioning for the commercial premises and the boarding house. The air-conditioning plant has however not yet been selected for this development.

The following is assumed in this report to calculate a typical level of noise at the receptor locations:

- The outdoor condensing units serving the boarding house will be installed on the balcony of each occupancy unit.
- The outdoor condensing units serving the commercial premises will be installed inside the basement.
- 50% of the condensing units will operate simultaneously any time during the day and evening and 25% at night.
- A typical domestic outdoor condensing unit has a sound power level of 60 dB(A).
- A typical commercial outdoor condensing unit has a sound power level of 75 dB(A).

The predicted (calculated) cumulative L_{eq} levels of noise from the condensers at the nearest receptor locations are shown in Section 4.5 below.

4.3 Communal Areas

A communal room will be located on Levels 1 and 2 on the north-eastern corner of the building. A communal outdoor area will be located outside each communal room, refer to the architectural plans in Appendix B.

For assessing the typical highest noise emission from people talking in the communal areas, the following number of people were assumed to be talking in the common rooms and the outdoor areas, at any one time:

- Five people inside each communal room;
- Five people in each communal outdoor area;
- People will talk **at any one time** as follows: 30% will talk with a raised voice, 20% will talk normally, and the rest will listen or not talk[1].

Based on the level of sound from a person talking at various levels provided in Harris[2], the sound power levels for people talking are shown in TABLE 8 below.

[1] When 2 people talk, one person normally talks and the other listens i.e. 50% talk at the same time. In a group of 4 people, one or two people talk and the rest listen i.e. 25-50% talk at the same time. In this case, the assumption that 50% of the people talk at the same time is conservative since it is likely that less people will talk at the same time. The various percentages that describe the level at which people talk is the result of previous observations and noise measurements in hotels and restaurants in Sydney.

[2] Handbook of Acoustical Measurements and Noise Control, Cyril M. Harris, McGraw-Hill Inc., New York, 1997, Page 16.2.

TABLE 8 – Sound Power Levels of People Talking

Description	L_{eq} Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
5 people inside the communal room on Levels 1 and 2; 5 people in the outdoor area on Levels 1 and 2	63	64	70	74	70	65	60	54	**75**

Based on the sound power levels in TABLE 8 above, the predicted (calculated) cumulative L_{eq} levels of noise at the nearest receptor locations are shown in Section 4.5 below.

A detailed sample calculation of the noise emission from people talking in the common outdoor area is shown in Appendix C.

4.4 Carpark

The proposed development will have space for 22 cars and 3 motorbikes in the basement carpark and 1 car space outside the building on the western side of the building. The cars and motorbikes will enter and leave the carpark via a driveway on the eastern boundary.

The NSW Roads and Maritime Services in their "Guide to Traffic Generating Developments - Updated traffic surveys" estimates a traffic generation rate for high density residential flat buildings (a multi-level building containing 20 or more dwellings) in Sydney of up to 0.53 vehicle trips per unit in the morning peak hour. Based on 24 residential units in the proposed development, 13 vehicle trips per hour will occur during the peak hour (equivalent to 3 cars / 15 minutes).

Based on previous noise measurements of various carparks in Sydney, the sound power levels of cars and motorbikes are shown in TABLE 9 below.

TABLE 9 – Sound Power Levels of Cars/Motorbike entering and leaving the premises

Description	L_{eq} Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
3 car trips and 1 motorbike trip in 15 minutes entering/ leaving the carpark (1)	81	75	73	71	71	66	63	59	**75**

(1) The time-corrected $L_{eq,\ 15\ minute}$ sound power level of 75 dB(A) is calculated based on cars and motorbikes travelling along the driveway. The level of noise from cars/ motorbikes travelling along the driveway is based on an overall sound power level of 85 dB(A) for a car and 90 dB(A) for a motorbike. The overall sound power levels of 85 and 90 dB(A) are estimated based on the average of mean energy emission levels taken in various locations in the U.S. and Europe, consisting of over 6000 pass by events [Handbook of Noise and Vibration Control, Malcolm J. Crocker, John Wiley & Sons Inc., New Jersey, 2007, p.1429].

Based on the sound power levels in TABLE 9 above, the predicted (calculated) cumulative noise L_{eq} levels from cars and motorbikes entering and leaving the carpark, outside the nearest receptor locations are shown in Section 4.5 below.

4.5 Predicted Cumulative Noise Levels

The predicted cumulative L_{Aeq} levels of noise at the nearest residences from the proposed development, with the noise controls recommended in Section 5 of this report implemented, are summarised in TABLES 10 to 13 below.

The predicted noise levels comply with the noise criteria in Section 3 of this report at the nearest residences.

TABLE 10 – Predicted Cumulative Noise Levels at Receptor 1

Description	L_{eq} Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
Receptor location 1: outside the adjoining residences, located along the western boundary of the development site									
DAY & EVENING (7 am – 10 pm)									
People talking inside the communal room on Level 1, noise transmitted through an open balcony door	11	<10	10	11	<10	<10	<10	<10	**10**
People talking inside the communal room on Level 2, noise transmitted through an open balcony door	14	12	15	16	<10	<10	<10	<10	**14**
People talking on the communal balcony on Level 1	20	20	24	26	18	11	<10	<10	**25**
People talking on the communal balcony on Level 2 (1)	21	21	27	30	23	16	<10	<10	**29**
AC unit on the balcony of Unit 7, closest unit to receptor location	42	37	33	30	27	22	14	<10	**32**
AC units on all other balconies (50% of the units operating at the same time)	41	36	31	26	21	14	<10	<10	**28**
AC Units located inside the basement, serving commercial space	36	30	24	19	13	<10	<10	<10	**21**
Cars/motorbikes entering/leaving the carpark	43	35	31	26	23	15	<10	<10	**29**
TOTAL	47	41	37	35	30	24	16	<10	**36**
Noise Trigger Level (Evening)	48 dB(A)								
Complies (Yes/No)	YES								

(1) A sample calculation is shown in Appendix C.

TABLE 11 – Predicted Cumulative Noise Levels at Receptor 1

Description	L_{eq} Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
Receptor location 1: outside the adjoining residences, located along the western boundary of the development site									
NIGHT (10 pm – 7 am)									
People talking inside the communal room on Level 1, noise transmitted through an open balcony door	11	<10	10	11	<10	<10	<10	<10	**10**
People talking inside the communal room on Level 2, noise transmitted through an open balcony door	14	12	15	16	<10	<10	<10	<10	**14**
People talking on the communal balcony on Level 1	20	20	24	26	18	11	<10	<10	**25**
People talking on the communal balcony on Level 2	21	21	27	30	23	16	<10	<10	**29**
AC unit on the balcony of Unit 7, closest unit to receptor location	42	37	33	30	27	22	14	<10	**32**
AC units on all other balconies (25% of the units operating at the same time)	39	34	29	25	20	12	<10	<10	**26**
A car and motorbike entering/leaving the carpark at night	38	30	26	21	18	10	<10	<10	**24**
TOTAL	45	39	35	32	28	23	15	<10	**34**
Noise Trigger Level (Night)	43 dB(A)								
Complies (Yes/No)	YES								

TABLE 12 – Predicted Cumulative Noise Levels at Receptor 2

Description	L_{eq} Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
Receptor location 2: outside the adjoining residences, located along the southern boundary of the development site									
DAY & EVENING (7 am – 10 pm)									
People talking inside the communal room on Level 1, noise transmitted through an open balcony door	10	<10	10	11	<10	<10	<10	<10	**9**
People talking inside the communal room on Level 2, noise transmitted through an open balcony door	10	<10	10	11	<10	<10	<10	<10	**9**
People talking on the communal balcony on Level 1	20	20	24	26	18	11	<10	<10	**25**
People talking on the communal balcony on Level 2	20	20	24	26	18	11	<10	<10	**25**
AC unit on the balcony of Unit 23, closest unit to receptor location	45	39	34	29	23	15	<10	<10	**31**
AC units on all other balconies (50% of the units operating at the same time)	46	41	36	31	26	19	<10	<10	**33**
AC Units located inside the basement, serving commercial space	53	48	44	40	37	30	21	11	**42**
Cars/motorbikes entering/leaving the carpark	50	43	38	34	31	23	17	11	**36**
TOTAL	56	50	46	42	38	32	22	14	**44**
Noise Trigger Level (Evening)	48 dB(A)								
Complies (Yes/No)	YES								

TABLE 13 – Predicted Cumulative Noise Levels at Receptor 2

Description	L_{eq} Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	**dB(A)**
Receptor location 2: outside the adjoining residences, located along the southern boundary of the development site									
NIGHT (10 pm – 7 am)									
People talking inside the communal room on Level 1, noise transmitted through an open balcony door	10	<10	10	11	<10	<10	<10	<10	**9**
People talking inside the communal room on Level 2, noise transmitted through an open balcony door	10	<10	10	11	<10	<10	<10	<10	**9**
People talking on the communal balcony on Level 1	20	20	24	26	18	11	<10	<10	**25**
People talking on the communal balcony on Level 2	20	20	24	26	18	11	<10	<10	**25**
AC unit on the balcony of Unit 23, closest unit to receptor location	45	39	34	29	23	15	<10	<10	**31**
AC units on all other balconies (25% of the units operating at the same time)	44	39	34	30	25	17	<10	<10	**31**
A car or motorbike entering/leaving the carpark at night	48	41	37	32	29	21	15	<10	**35**
TOTAL	51	44	40	35	31	23	16	<10	**37**
Noise Trigger Level (Night)	43 dB(A)								
Complies (Yes/No)	YES								

SECTION 5 NOISE CONTROL RECOMMENDATIONS

It is recommended that the following noise control and management plan be implemented to reduce the noise emission from the development and to provide the required external noise reduction to comply with the noise criteria in Section 3 of this report.

The noise assessment is based on the noise criteria in Section 3 of this report and the architectural drawings by Barry Rush & Associates Pty Ltd, dated 19/03/2020. The floor plans are shown in Appendix B.

5.1 External Walls

Standard double brick external wall or brick veneer wall construction such as the following will be acoustically acceptable. Refer to the acoustic details in TABLE 14 below.

- ❑ 110 mm brick masonry; and
- ❑ One layer of 13 mm thick plasterboard fixed to 90 mm timber studs (or 92 mm steel studs) built 20 mm from the brick masonry, on the inside of habitable rooms; and
- ❑ 90 mm thick glasswool or polyester insulation or similar such as R2.5 type thermal insulation, installed between the studs.

The following external wall construction using Hebel Powerpanels will also be acoustically acceptable:

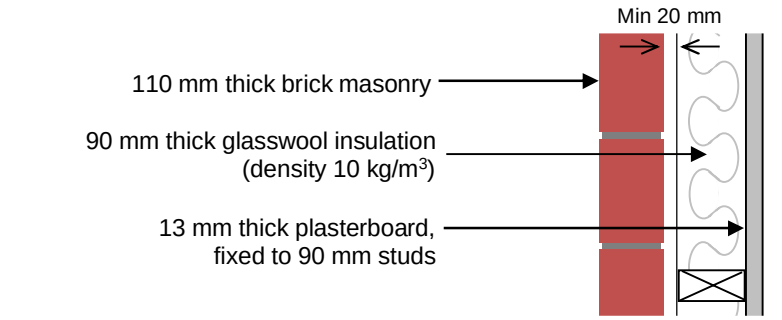
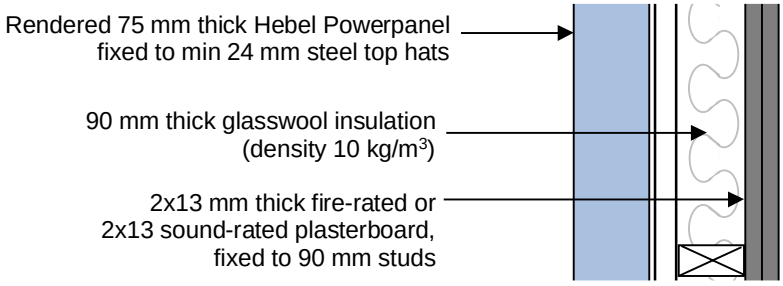
- ❑ 75 mm Hebel Powerpanel with 5 mm Acrylic render; and
- ❑ Two layers of 13 mm thick sound-rated or fire-rated plasterboard fixed to 92 mm steel studs built 50 mm from the Hebel panels; and
- ❑ 90 mm thick glasswool or polyester insulation or similar such as R2.5 type thermal insulation, installed between the studs.

A minimum 150 mm thick concrete for external walls will also be acoustically acceptable.

Standard external wall construction is sufficient for all non-habitable rooms and for the external walls of the rooms on the western side of the building.

The total wall thickness should be such that the external wall will allow the installation of the double glazing assembly, recommended in Section 5.4 of this report.

TABLE 14 – Recommended External Wall Constructions

Location	Wall Construction
Habitable rooms	
	

5.2 Floors

Standard floor construction will be acoustically acceptable[3] to reduce road traffic noise.

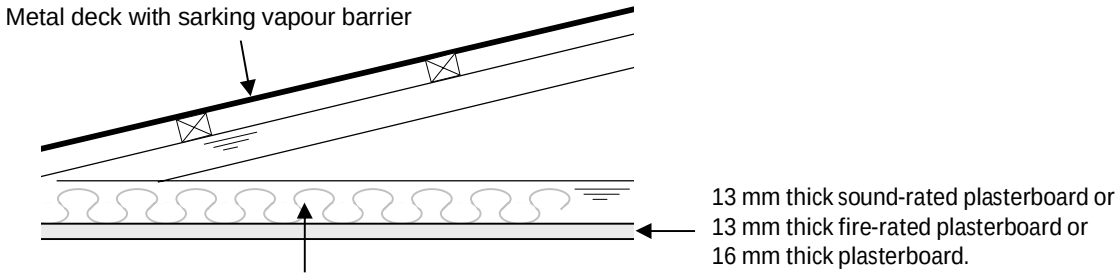
[3] This report provides recommendations to reduce external traffic noise and does not consider the sound insulation requirements of Part F5 of the Building Code of Australia (BCA). The floors and ceilings are required to be sound insulated to meet the requirements of the BCA and may therefore require a heavier construction than recommended in this report.

5.3 Roof/Ceiling

Concrete slab roof over the occupancy units will be acoustically acceptable. It is recommended that a metal deck roof and ceiling be constructed using the following, refer to the detail in TABLE 15 below:

- ❑ Standard metal deck roof with sarking vapour barrier; and
- ❑ Minimum 100 mm thick glasswool insulation (min density 10 kg/m^3) or similar[4] installed inside the roof cavity between the ceiling joists or rafters; and
- ❑ One layer of 13 mm thick sound-rated or 13 mm thick fire-rated plasterboard or 16 mm thick plasterboard for the ceiling under the roof in habitable rooms; and
- ❑ One layer of standard 10 mm thick plasterboard for the ceiling under the roof in other areas; and
- ❑ A minimum air gap of 250 mm between the roof and the ceiling (the insulation recommended above, is installed inside the air gap).

TABLE 15 – Recommended Roof/Ceiling Construction

Roof and Ceiling Construction


5.4 Windows and External Glazed Doors

The recommended glazing assemblies are given in TABLE 16 below and marked up in Appendix B. Alternative glazing assembly may be used provided the R_w rating and the glass thickness are achieved or exceeded.

It is recommended that the glazing supplier provide a confirmation, supported by acoustical laboratory test reports, that the glazing will meet the specifications. The design of the glazing assembly including the frames, perimeter seals, and the installation in the building openings should not reduce the R_w rating of the glazing assembly below the specified values and should be built and acoustically sealed as per the acoustical laboratory test reports.

The gap between the window frames and the building opening should be acoustically sealed with silicone or polyurethane mastic and backing rods behind, such as open-cell polyurethane backing rods.

[4] Minimum 100 mm thick glasswool insulation (minimum density 10 kg/m^3) or similar such as 175 mm thick 'Knauf Earthwool' or 185 mm thick 'CSR Bradford' R3.5 type thermal insulation.

TABLE 16 – Recommended Glazing Constructions

Window / Door	Minimum R_w	Glazing Construction
Rooms 1 – 6	48*	Double glazing: 10.38 mm thick laminated glass / 100 mm airgap / 6.38 mm thick laminated glass with Schlegel Q-Lon acoustic seals (R_w 48); OR Single glazing: doors/windows comprising 10.38 mm thick laminated glass with Schlegel Q-Lon acoustic seals (R_w 34), and the terrace completely enclosed using louvre windows with 6 mm thick glass (R_w 30)
Manager Unit Living room	48*	Double glazing: 10.38 mm thick laminated glass / 100 mm airgap / 6.38 mm thick laminated glass with Schlegel Q-Lon acoustic seals
Rooms 13 – 17; Common rooms 1 and 2 Manager Unit Bedroom 1 north window/door; Manager Unit Kitchen south window	38 – 45*	Single glazing: 12.5 mm thick Vlaminated HUSH glass with Schlegel Q-Lon acoustic seals (R_w 38); OR Double glazing: 6.38 mm thick laminated glass / 120 mm airgap / 5 mm thick glass with Schlegel Q-Lon acoustic seals (R_w 45) OR Double glazing: 10.38 mm thick laminated glass / 70 mm airgap / 5 mm thick glass with Schlegel Q-Lon acoustic seals (R_w 45)
Manager Unit Bedroom 3 south window	30	Single glazing: 6.38 mm thick laminated glass with Schlegel Q-Lon acoustic seals
Rooms 7 – 12, 18 – 23; Manager Unit Bedrooms 1 - 3 west windows	25	Single glazing: 5 mm thick toughened glass with Schlegel Q-Lon acoustic seals
Other windows and doors	-	Standard window/door construction

* The R_w (Weighted Sound Reduction Index) rating is estimated for the double glazed system based on the single glazed panels tested in a laboratory, i.e. a window/door with 5 mm thick glass and acoustic seals rated at R_w 25, 6.38 mm thick laminated glass rated at R_w 30 and 10.38 mm thick laminated glass rated at R_w 34. Provided the double glazed system will comprise the recommended construction; the overall R_w rating will also be considered acceptable.

5.5 Mechanical Services Plant

The mechanical plant, including the air-conditioning plant, has not yet been selected for this development. It is recommended that the noise emission from the mechanical plant be assessed at the Construction Certificate stage and/or once the plant selection is finalised.

The outdoor air-conditioning condensing units, installed on the balconies and with a sound power level of up to 60 dB(A), will be acoustically acceptable.

It is feasible to reduce the noise emission from the mechanical plant, such as the carpark ventilation plant, using internally lined ductwork and/or silencers. Notwithstanding this, the mechanical plant should be acoustically treated, if required, to reduce the noise emission level at the nearby residences to levels complying with the noise criteria in Section 3 of this report.

It is recommended that all mechanical plant, including the air conditioning condensing units, be vibration isolated from the building structure.

5.6 Mechanical Ventilation

The windows and external glazed doors in the rooms fronting Pittwater Road need to be closed and be fitted with acoustic seals to reduce the internal noise level to within the noise criteria in Section 3 of this report.

These rooms are to be mechanically ventilated to comply with Section F4.5 of the Building Code of Australia and Australian Standard AS1668.2-1991. An air-conditioning system or mechanical ventilation with fresh air supply will be acceptable.

5.7 Managing a Noise Complaint

It is recommended that attended noise monitoring be carried out should there be a noise complaint and appropriate measures be taken to reduce the noise to comply with the noise criteria.

Contact phone number should be displayed at the front of the premises, and the management should nominate a representative to manage noise complaints. Complainants should be informed that their complaints are being addressed and that action is being taken to reduce the noise emission.

SECTION 6 CONSTRUCTION NOISE

6.1 EPA Construction Noise Guideline

The Interim Construction Noise Guideline, published by the NSW Environment Protection Authority (EPA) in 2009, is specifically aimed at managing noise from construction works regulated by EPA. The Guideline is a useful tool for assessing the noise from non-scheduled construction activities.

The Guideline aims to provide guidance on managing construction works to minimise noise and focuses on applying all 'feasible' and 'reasonable' work practices to minimise noise impact.

The Guideline recommends the following standard hours for construction work:

- ❑ 7.00 am to 6.00 pm, Monday to Friday;
- ❑ 8.00 am to 1.00 pm, Saturday; and
- ❑ No work on Sunday or Public Holiday.

The Guideline provides 'quantitative' and 'qualitative' assessment methods. A 'quantitative' assessment method is for major construction projects that are licensed by the EPA such as new public infrastructure or major commercial or industrial developments. A 'qualitative' method is used for smaller scale construction or maintenance projects.

While the 'quantitative' method is not strictly applicable to this site, as the proposed development is not scheduled, the 'quantitative' method is used in this report to establish management noise levels at potentially affected residential and commercial receptors and how they are to be applied during normal construction hours.

Based on the daytime RBL level of 51 dB(A) in Section 2.1 of this report, the recommended noise management levels at the nearby affected residential premises and commercial premises are summarised in TABLE 17 below.

During construction, the Guideline states that the proponent should regularly update the occupants of the nearby premises regarding noise levels and hours of work.

The 'qualitative' assessment method recommends that a Noise Management Plan include the following:

- identification of nearby residences and other sensitive land uses;
- description of approved hours of work and what work will be undertaken;
- description of what work practices will be applied to minimise noise;
- description of the complaints handling process.

TABLE 17 – Noise Management Levels from Construction Activities

Time of Day	Management Level $L_{Aeq\ (15\ Min)}$	How to Apply
Residential Receptor: **Recommended standard hours:** Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	**61 dB(A)*** (= 51 + 10)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)*	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Commercial Receptor: (**offices, retail outlets)**	**70 dB(A)**	

* Noise levels apply at the residential property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. Noise levels may be higher at the upper floors of the noise affected residence.

6.2 Australian Standard AS2436

The Australian Standard AS2436–2010 "Guide to noise and vibration control on construction, demolition and maintenance sites" provides guidance in noise and vibration control on construction sites affecting people working on the sites and also those living and working in the neighbourhood.

AS2436–2010 recommends that a Noise and Vibration Management Plan be prepared and show the following:

- ❑ Describe the approaches that will be applied in consulting with, and notifying, the community.
- ❑ Show a commitment to work practices, such as scheduling of activities and selection of equipment and procedures that will be implemented to minimize noise impact.
- ❑ Describe how noise complaints will be managed.

AS2436–2010 also states that the monitoring of noise and vibration is an essential part of assessing impacts and determining compliance with approval conditions and community concerns.

6.3 EPA Construction Vibration Guideline

"Assessing Vibration: a technical guideline", published by the NSW Environment Protection Authority (EPA) in 2006, is based on the British Standard BS 6472:1992 "Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)."

The Guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The vibration from construction activities is considered as 'intermittent' vibration. Table 2.4 of the Guideline sets out acceptable vibration dose values (VDV) to assess intermittent vibration at residences, extracted in TABLE 18 below.

TABLE 18 – Acceptable Vibration Dose Values (VDV) from Construction Activities

Location	Daytime	
	Preferred Value ($m/s^{1.75}$)	Maximum Value ($m/s^{1.75}$)
Residences	0.20	0.40

The British Standard BS 7385-2:1993 "Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration" provides limits for transient vibration above which cosmetic damage in buildings could occur, extracted in TABLE 19 below for residential buildings.

TABLE 19 – Transient vibration guide values for cosmetic damage

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

6.4 Recommendations

A Construction Noise Management Plan (CNMP) may be prepared prior to works commencing to limit the impact on nearby residences. The CNMP should be prepared in accordance with the guidance provided in AS2436-2010 and the Interim Construction Noise Guideline.

The Interim Construction Noise Guideline focuses on achieving desired environmental outcomes – "*there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts. This approach gives construction site managers and construction workers the greatest flexibility to manage noise*".

The CNMP may be prepared at the Construction Certificate stage if required, once the construction programme, proposed work practices, equipment to be used and methodology is determined.

SECTION 7 CONCLUSION

Acoustical investigation of the noise emission from the proposed boarding house to be built at 1129 – 1131 Pittwater Road, Collaroy was carried out to assess the impact on the nearby residences in Section 4 of this report.

Provided the recommended noise controls in Section 5 of this report are implemented, noise emission from the development will comply with the noise limits required by Council and the NSW Environmental Protection Authority (EPA) noise guidelines, detailed in Section 3.3 of this report.

Road traffic noise affecting the proposed boarding house has been assessed in Sections 2.3, 3.5 and 3.6 of this report. Provided the noise control recommendations in Section 5 of this report are implemented, road traffic noise inside the habitable rooms will be reduced to comply with the noise criteria in Clause 102 of the State Environment Planning Policy (Infrastructure) 2007.

Report prepared by
DK Acoustics Pty Ltd

Danny Kastak, BE, MEngSc., MIEAust., MAAS
Senior Acoustical Engineer

MEMBERSHIPS

Member of the Australian Acoustical Society and the Institute of Engineers, Australia and a consulting acoustical engineer since 1997. The work in this reported has been performed in accordance with the terms of these memberships.

QUALIFICATIONS

Bachelor of Engineering, The University of New South Wales, 1993.
Master of Engineering Science, The University of New South Wales, 1996.

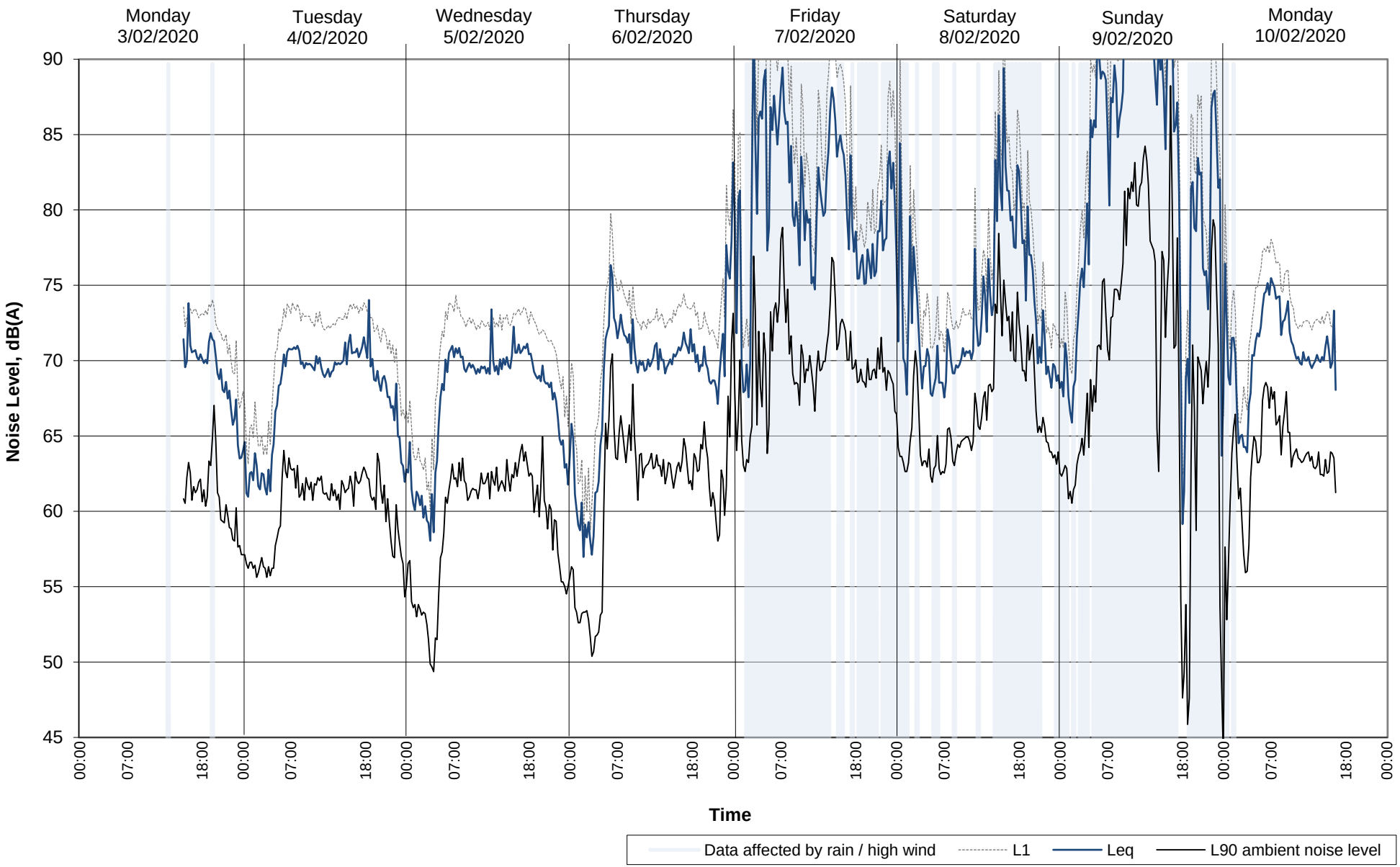
Attachments:

Appendix A – Ambient noise survey
Appendix B – Architectural floor plans and marked up glazing constructions
Appendix C – Sample calculation of the predicted noise level

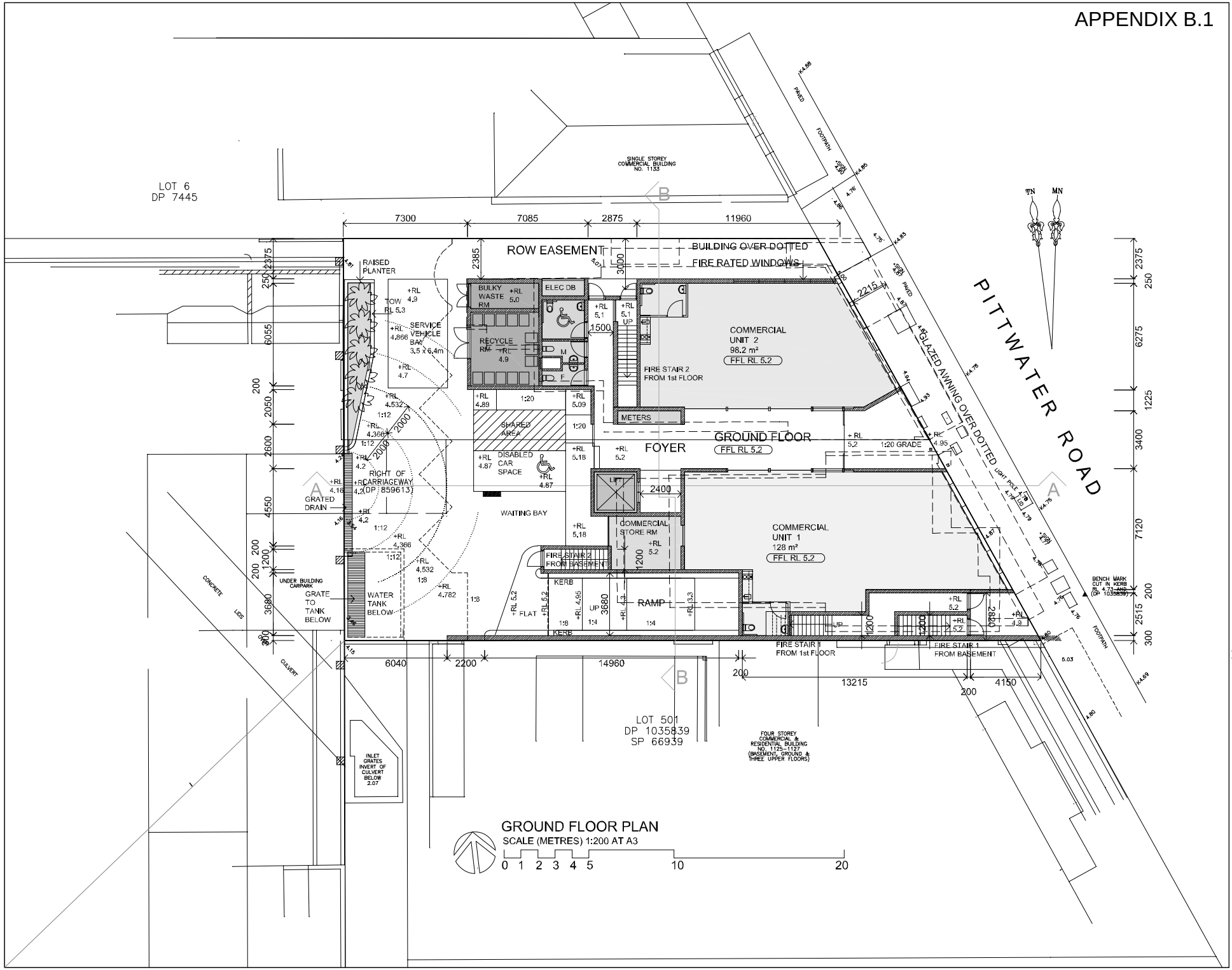
APPENDIX A

AMBIENT NOISE SURVEY

1129 – 1131 Pittwater Road, Collaroy



APPENDIX B.1



LEGEND

ISSUE DATE AMENDMENTS

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Client
LOTUS PROJECTS

Project
1129-1131 PITTWATER ROAD COLLAROY

LOT 4 IN DP 7445 &
LOT 1 IN DP 859613

Drawing
GROUND FLOOR PLAN

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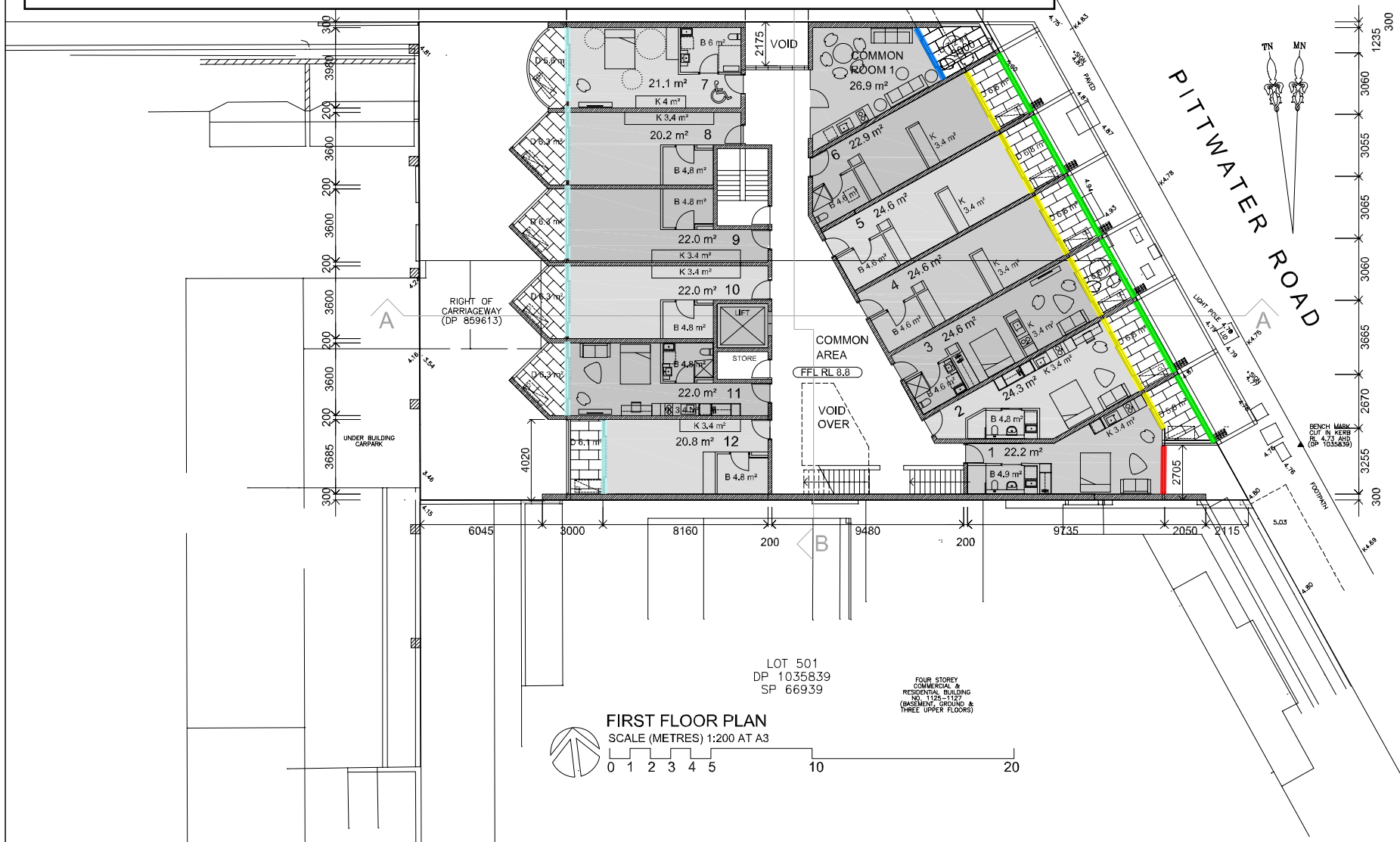
Job No 1812	
Version DA	Drawing No: **A03**

APPENDIX B.2

Recommended Glazing Constructions (Section 5.4)

- Double glazing, Rw 48
- 12.5 mm thick Vlaminated HUSH glass with acoustic seals, Rw 38, or double glazing
- 10.38 mm thick laminated glass with acoustic seals, Rw 34, or double glazing
- 6.38 mm thick laminated glass with acoustic seals, Rw 30
- 5 mm thick glass with acoustic seals, Rw 25



LEGEND

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Client
LOTUS PROJECTS

Project
1129-1131 PITTWATER ROAD COLLAROY

LOT 4 IN DP 7445 &
LOT 1 IN DP 859613

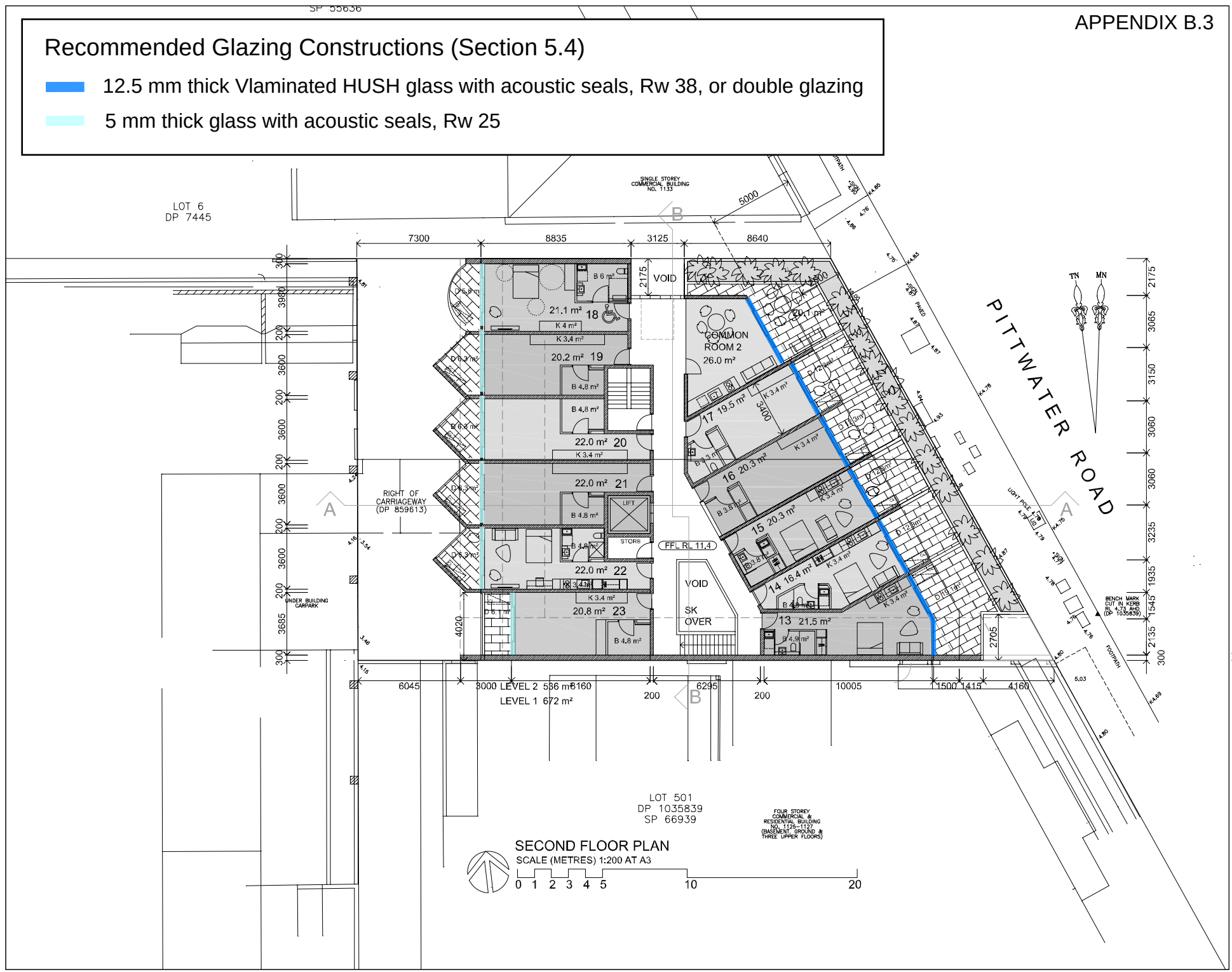
Drawing
FIRST FLOOR PLAN

Scale 1:100 Drawn BR
File DA\PITTWATER RD COLLAROY.dwg
Plotted 19/03/2020 3:17 PM
Job No 1812
Version DA Drawing No: **A04**

APPENDIX B.3

Recommended Glazing Constructions (Section 5.4)

- 12.5 mm thick Vlaminated HUSH glass with acoustic seals, Rw 38, or double glazing
- 5 mm thick glass with acoustic seals, Rw 25



SECOND FLOOR PLAN

SCALE (METRES) 1:200 AT A3

0 1 2 3 4 5 10 20

LEGEND

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Client
LOTUS PROJECTS

Project
1129-1131 PITTWATER ROAD COLLAROY

LOT 4 IN DP 7445 &
LOT 1 IN DP 859613

Drawing
SECOND FLOOR PLAN

Scale	1:100
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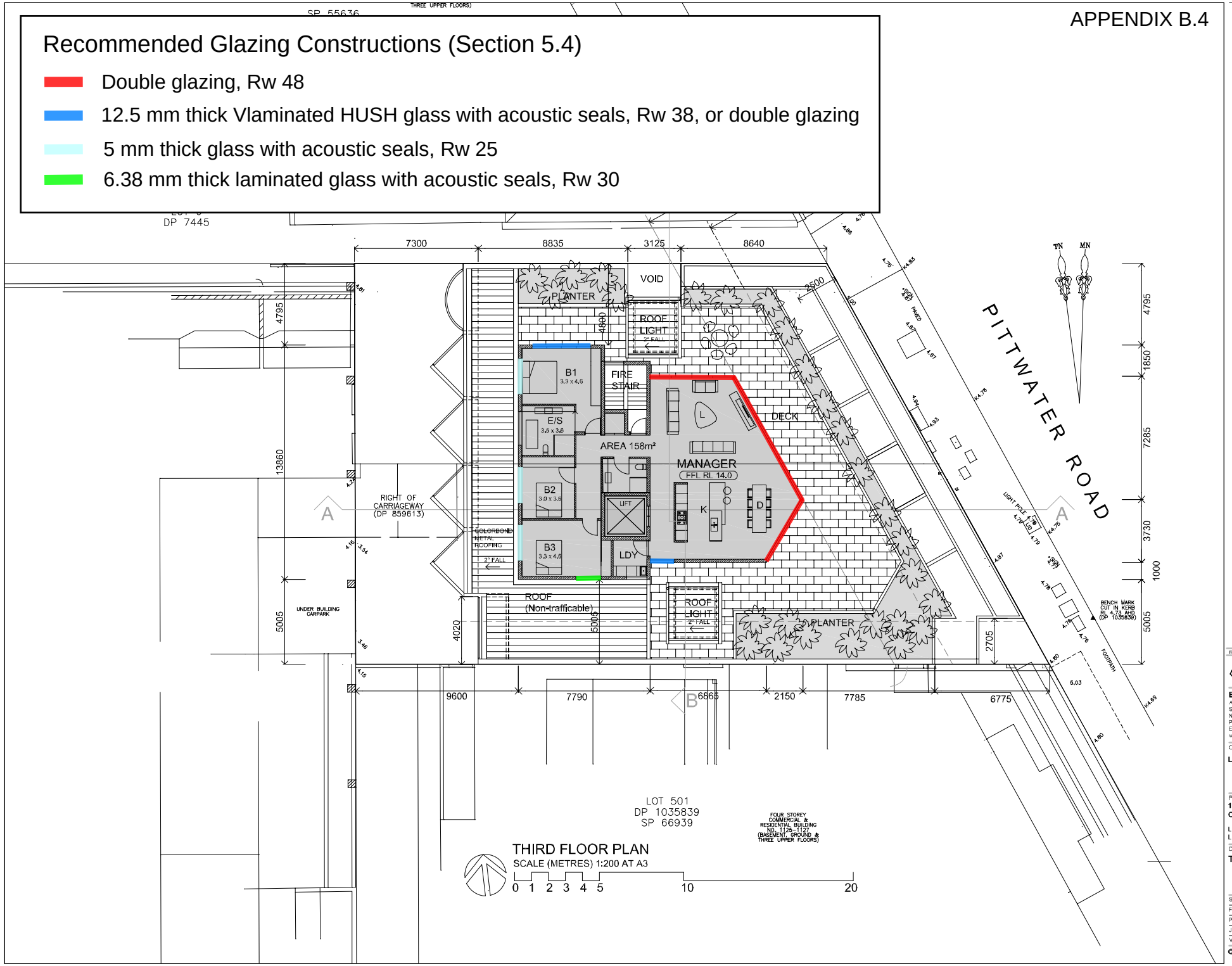
Plotted	19/03/2020 3:17 PM
Job No	1812
Version	DA
Drawing No:	A05

APPENDIX B.4

Recommended Glazing Constructions (Section 5.4)

- Double glazing, Rw 48
- 12.5 mm thick Vlaminated HUSH glass with acoustic seals, Rw 38, or double glazing
- 5 mm thick glass with acoustic seals, Rw 25
- 6.38 mm thick laminated glass with acoustic seals, Rw 30



LEGEND

ISSUE | DATE | AMENDMENTS

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Client
LOTUS PROJECTS

Project
1129-1131 PITTWATER ROAD COLLAROY

LOT 4 IN DP 7445 &
LOT 1 IN DP 859613

Drawing
THIRD FLOOR PLAN

Scale	1:100	Drawn	BR
File	DA\PITTWATER RD COLLAROY.dwg		
Plotted	19/03/2020 3:17 PM		
Job No	1812		
Version	DA	Drawing No:	A06

Project: 1129 – 1131 Pittwater Road, Collaroy ***SAMPLE CALCULATION***
Project Number: 200131
Noise Assessment Location: Receptor location 1: outside the adjoining residences, located along the western boundary of the development site.

Operation: People talking on the communal balcony on Level 2

Description	Octave Band Centre Frequencies (Hz)									
	31.5	63	125	250	500	1k	2k	4k	8k	dB(A)
Total sound power level of noise source, Lw	53	60	61	67	71	67	62	57	51	72
Distance between noise source and receptor, d1 (m) =	27.0									
Distance between noise source and sound barrier (m) =	9.0									
Noise source height above floor level (m) =	1.5									
Receptor height above floor level (m) =	1.5									
Effective height of sound barrier wall (m) =	1.0									
Distance attenuation of source to receptor, Ad=20Log(d1)+8	37	37	37	37	37	37	37	37	37	
Barrier attenuation (between the source and receiver), B	3	6	6	7	8	10	13	16	19	
Reflection, Rfl=10Log(Q/2)	3	3	3	3	3	3	3	3	3	
Barrier directivity, D	0	0	0	0	0	0	0	0	0	
Air sound absorption, A(air)	0	0	0	0	0	0	0	0	1	
Sound pressure level at receptor location*, Lw-(Ad+D+A(air)+B)+Rfl	17	21	21	27	30	23	16	7	-3	29

* Calculation based on International Standard ISO 9613-2:1996 “Acoustics – Attenuation of sound during propagation outdoor – Part 2: General method of calculation”.