Paradigm 42

Brisbane
Canberra

# Noise Management Plan for DA

# Phillip Hellenic Woden Village

Reference: 1068 R01 3

## On behalf of

## Hellenic Property Investment 2 Pty Ltd ATF The Hellenic Property Trust No 2

5 March 2026

Paradigm 42


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# 1 Introduction

## 1.1 Background

Paradigm 42 has been engaged by Hellenic Property Investment 2 Pty Ltd ATF The Hellenic Property Trust No 2, to prepare a noise management plan as part of the development application for a proposed mixed use including a residential component, currently part of Blocks 4, Section 7 Phillip.

## 1.2 Summary

In this report we have:

1. Determined the criteria for noise intrusion into the apartments;
2. Established noise emissions for the commercial uses;
3. Established noise emissions for any plant;
4. Shown how the criteria could be met in the recommendations;

## 1.3 References


1. Australian Capital Territory, 'Planning (Residential Zones) Technical Specifications 2024 (No 3), Notifiable instrument NI2024-539' made under the *Planning Act 2023*, s 51 (Technical specifications);
2. Australian/New Zealand Standard *AS 2107-2000 Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS 2107);
3. Australian/New Zealand Standard *AS/NZS 3671 - Acoustics – Road Traffic Noise Intrusion Building Siting and Design*, (AS 3671);
4. *Environmental Protection Regulation 2005* (SL2005-38), version effective 16 , August 2024 (*EPR*);
5. *Guidelines for the preparation of Noise Management Plans for development applications*, Environment Protection Authority, February 2014, (Guide for NMP);
6. *Noise Measurement Manual*, Environment Protection Authority, ACT, September 2009
7. *Commercial Waste Collection Code*;
8. Smith, Peters and Owen, *Acoustics and Noise Control*, Second Edition, Edinburgh, 1996;
9. Bies D.A., and Hanson C.H., *Engineering Noise Control, Theory and Practice*, Third Edition, 2003, Spon Press, NY, especially p. 342, formula (8.16);
10. Drawings from Metier3 Pty Ltd Achitects, Project 24031, issued 27/08/25 as below:

| | |
|---|---|
| DA0109 | PROPOSED SITE PLAN |
| DA0110 | ESTATE DEVELOPMENT PLAN |
| DA0111 | PROPOSED STAGING PLAN |
| DA0112 | PROPOSED PARKING PLAN |
| DA0113 | ACTIVE TRAVEL PLAN |
| DA1096 | FLOOR PLAN - BASEMENT 4 |
| DA1097 | FLOOR PLAN - BASEMENT 3 |
| DA1098 | FLOOR PLAN - BASEMENT 2 |
| DA1099 | FLOOR PLAN - BASEMENT 1 |
| DA1100 | FLOOR PLAN - GROUND LEVEL |
| DA1101 | FLOOR PLAN - OVERALL - LEVEL 1 |
| DA1102 | FLOOR PLAN - OVERALL - LEVEL 2 |
| DA1103 | FLOOR PLAN - OVERALL - LEVEL 3 |
| DA1104 | FLOOR PLAN - OVERALL - LEVEL 4 |
| DA1105 | FLOOR PLAN - OVERALL - LEVEL 5 |
| DA1106 | FLOOR PLAN - OVERALL - LEVEL 6 |
| DA1107 | FLOOR PLAN - OVERALL - LEVEL 7 |
| DA1108 | FLOOR PLAN - OVERALL - LEVEL 8 |
| DA1109 | FLOOR PLAN - OVERALL - LEVEL 9 |
| DA1110 | FLOOR PLAN - OVERALL - LEVEL 10 |
| DA1111 | FLOOR PLAN - OVERALL - LEVEL 11 |
| DA1112 | FLOOR PLAN - OVERALL - LEVEL 12 |
| DA1113 | FLOOR PLAN - OVERALL - LEVEL 13 |
| DA1114 | FLOOR PLAN - OVERALL - LEVEL 14 |
| DA1115 | FLOOR PLAN - OVERALL - LEVEL 15 |
| DA1116 | FLOOR PLAN - OVERALL - LEVEL 16 |
| DA1117 | ROOF PLAN - OVERALL |
| DA2001 | STREETSCAPE ELEVATION - MATILDA STREET AND BUILDING NORTH ELEVATION |
| DA2002 | STREETSCAPE ELEVATION - CALLAM STREET AND BUILDING EAST ELEVATION |
| DA2003 | STREETSCAPE ELEVATION - BOWES STEET AND BUILDING SOUTH ELEVATION |
| DA2004 | STREETSCAPE ELEVATION - BOWES STREET AND BUILDING WEST ELEVATION |

## 1.4 Personnel Qualifications

This report was prepared by Alan Subkey MAAS. Alan has been practicing as an acoustical consultant since 2002 and been a full member of the Australian Acoustical Society since 2005. He has practised acoustics in the ACT since January 2005. A fuller CV is available on request.

## 1.5 Disclaimer:

This report has been prepared for DA. It is not intended 'For Construction'. We take no responsibility for any 'indicative recommendations' as set out in this report. The requirements should be checked for Building Approval and any consultant should verify the requirements. A prospective occupant is required to seek their own advice. Any information in this report that is used past DA, the user will take responsibility for the information including its appropriateness and accuracy.

# 2 Background

## 2.1 Permissible Uses under the Crown Lease

We understand that this development application does not include any Lease variations and therefore all of the current permissible uses will require assessing. An excerpt from the Crown Lease is below that shows the permissible uses:

(5) The permitted uses for the Land will be consistent with the zoning under the CZ2 Business Zone and related development controls under the Territory Plan. Subject to approval by the Planning and Land Authority, the Deed of Agreement will provide for the issuing of Consequent Leases that allow for permissible uses that include:

(a) multi-unit housing of not less than 30 dwellings and not more than 200 dwellings;

(b) car park containing not less than 370 spaces available for uses by the public; and

(c) In addition, the Land may also be used for one or more of the following purposes:

(1) caretaker's residence;

(2) civic administration;

(3) club;

(4) co-housing;

(5) commercial accommodation use (however guest house will not be permitted;

(6) communications facility;

(7) community use;

(8) craft workshop;

(9) drink establishment;

(10) indoor entertainment facility;

(11) non-retail commercial use;

(12) outdoor recreation facility;

(13) parkland;

(14) place of assembly;

(15) restaurant;

(16) residential care accommodation;

(17) retirement village;

(18) secondary residence;

(19) shop (provided that the gross floor area for a shop does not exceed 200 square metres); and

(20) supportive housing;

Provided that the maximum combined number of dwellings is 200 across all of the land (regardless of the number of Consequent Leases).

The following uses **will not be** provided under any Consequent Lease:

(a) emergency services facility;

(b) indoor recreation facility (within any residential dwelling building);

(c) public transport facility;

(d) recyclable materials collection; and

(e) tourist facility

## 2.2 Noisy Uses

Several of the permissible uses are considered noisy. The worst of these is 'drink establishment'. The assessable noise level for 'drink establishment' is 105 dB(A). The Carpark Building has an 'indoor recreation facility' on the ground floor and is assessed at 95 dB(A).

## 2.3 Vibration

'Indoor recreation facilities' are assessed for vibration, but in this case the potential gym is in a carpark, and will not be assessed for vibration as occupation by any individual of the carpark is for a very limited time.

# 3 Location

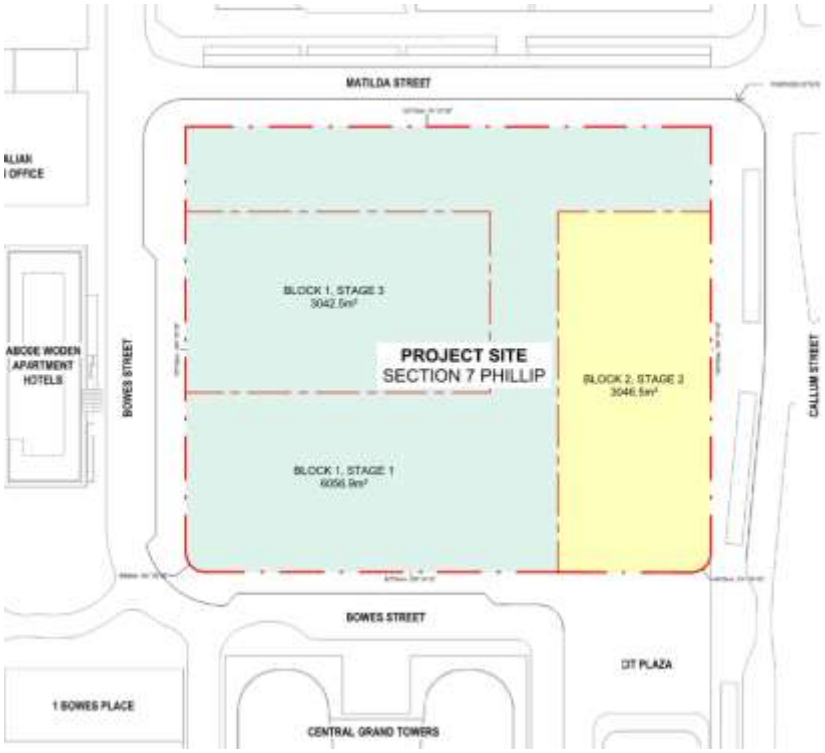
The location is shown below in Figure 1.

**Figure 1: Woden Village development Block 4, Section 7, Phillip, Source: Metier DA 0101.**


## 3.1 Subdivision

The site is to be subdivided as per the plan below. The future boundaries are shown in red.

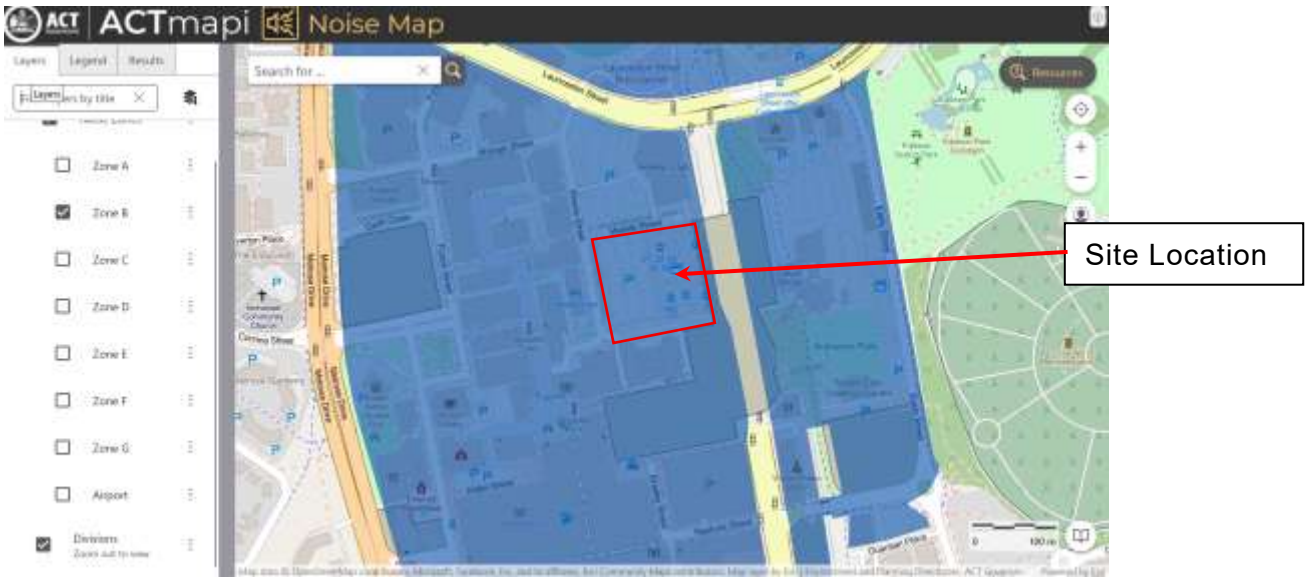
**Figure 2: Future subdivision, Source: Metier DA 0104**



# 4 Site Description

This development is zoned noise zone B as shown below.

**Figure 3: Site Location from *ACTMAPi* accessed 7 July 2025**




## 4.1 Description of Proposed Development

The proposal is to develop the site containing the following:

Stage 1 – Carpark Building

1. Two stories of basement car parking;
2. Ground level with end of trip facilities and indoor recreation facility;
3. 7 levels of above ground car parking.

Stage 2 – Residential Building

4. 4 floors of basement car parking;
5. Ground floor with back of house facilities and some non-retail commercial and retail;
6. Level 1 with amenity and storage facilities;
7. Two (southern) towers with 10 levels of residential apartments;
8. One tower (northern) with 15 levels of residential.

Stage 3 – Commercial Building

9. Two stories of basement car parking;
10. Ground floor across two buildings with back of house facilities and some non-retail commercial and retail;
11. One building (eastern) with two floors of community spaces, and 3 levels of office, and rooftop amenity;
12. One building with 11 floors of office and roof top terrace.

## 4.2 Noise Sources

Noise sources are:

1. Plant noise from internal sources as well as future adjacent buildings. This may include refuse compactors, pumps, air-conditioning condensors, garage roller doors;
2. Commercial uses within the development;
3. Noise from the bus interchange.

# 5 NOISE ASSESSMENT CRITERIA

## 5.1 Planning (Residential Zones) Technical Specifications (RZTS)

The internal criteria are found under the 'Planning (Residential Zones) Technical Specifications (RZTS) 2024 (No 3), Notifiable instrument NI2024-539' made under the *Planning Act 2023*, s 51 (Technical specifications)

The RZTS states that if a block has one of the following:

| **Specification** | |
|---|---|
| Noise management and acoustic treatment - dwellings | 24.1.<br>a) Where a block is located adjacent to a road carrying or forecast to carry traffic volumes greater than 12,000 vehicles per day:<br>i) Dwellings are designed and constructed to comply with *AS/NZS 3671 - Acoustics – Road Traffic Noise Intrusion Building Siting and Design;* and<br>ii) A noise management plan, prepared by a suitably qualified person, is endorsed by the government department responsible for road transport planning.<br>b) Where a block is identified as being potentially noise affected in a district policy/specification:<br>i) Dwellings are designed and constructed to comply with the relevant sections of *AS/NZS 2107:2000 - Acoustics – Recommended design sound levels and reverberation times for building interiors (the relevant satisfactory recommended interior design sound level);* and<br>ii) A noise management plan, prepared by a suitably qualified person, is endorsed by the EPA. |
| Noise management – community activity centre | 24.2. For a community centre, the design is in accordance with a noise management plan, prepared by a suitably qualified person, endorsed by Environment Protection Authority. |

Previously the superseded 'Multi Unit Housing Development Code' has stated:

> For other than road traffic noise, the noise level immediately adjacent to the dwelling is assumed to be the relevant noise zone standard specified in the ACT Environment Protection Regulation 2005.

MUHDC R 67 page 29.

This still applies as the adjacent properties are required to observe the Noise Zone limits at their boundaries. Therefore as noisy uses within the development must comply with the proposed new boundaries and the noise zone limits, 'the noise level immediately adjacent to the dwelling' will be applied as per the 'relevant noise zone standard specified in the ACT Environment Protection Regulation 2005'.

## 5.2 AS 2107

The internal noise limits are the recommended design sound levels from Australian/New Zealand Standard *AS 2107-2000 Acoustics – Recommended design sound levels and reverberation times for building interiors* (*AS 2107*) and the relevant noise levels for apartments are presented in Table 1

AS 2107 recommends that assessment in a space should be conducted when it is utilised.

**Table 1: Design Sound Levels From AS 2107:2000 Table 1**

| Type of occupancy/activity | Recommended design sound level, $L_{Aeq}$, dB(A) | |
|---|---|---|
| | Satisfactory | Maximum |
| 7 RESIDENTIAL BUILDINGS (see Note 7 and Clause 5.2) | | |
| Houses and apartments near major roads— | | |
| Living areas | 35 | 45 |
| Sleeping areas | 30 | 40 |
| Work areas | 35 | 45 |

The satisfactory level should be met during the times of use (as per AS 2107) for living areas during the day and evening period, and for bedrooms during the night time period.

## 5.3 Noise Emissions

Noise emissions should comply with the noise zone limits at the boundaries. These will be from commercial uses and plant. Commercial uses will be determined by the permissible uses on each of the Crown Leases, and plant will be selected during the design process.

# 6 Noise Zones

This proposed site is in land use Zone B. As it is outside the CCEP (City Centre Entertainment Precint) it must be in B1 in Table 2: which means that allowable noise emissions would be 60/50 day/night (times are defined below).

For residential premises on the site the *Guide for NMP* states:

> Where a residential development is proposed in an area with a noise standard higher than zone G, the development must meet the 'satisfactory' recommended design sound levels for residential buildings of AS/NZS 2107. Commercial accommodation developments should meet AS/NZS 2107 for sleeping areas.

**Table 2: From Environmental Protection Regulation 2005, version effective 16 August 2024, Schedule 2 Tables 2.1, 2.2 and 2.2A combined**

| **Table 2.1** | | | **Table 2.2** | |
|---|---|---|---|---|
| Noise Zone | ACT Land | NSW Land | **noise standard (dB(A))** Mon-Sat 7am-10pm, Sun & public holiday 8am-10pm | **noise standard (dB(A))** Mon-Sat 10pm-7am, Sun & public holiday 10pm-8am |
| A | land in an industrial zone | land in the Queanbeyan city industrial zone | 65 | 55 |
| B2 | land in the Central National Area (City Hill Precinct), other than land in the CCEP frame | land in the Queanbeyan city business zone | 60 | 50 |
| B3 | land in the CCEP core | | See below | |
| B4 | land in the CCEP frame | | See below | |
| C2 | land in a corridor sites or an office site | | 55 | 45 |
| D | land (other than land in the city centre, town centres and group centres) in a commercial CZ4 zone | | 50 | 35 |
| E | land (other than land in the city centre, town centres and group centres) in—<br>• restricted access recreation zone<br>• broadacre zone | | 50 | 40 |
| F | land (other than land in the city centre, town centres and group centres) in—<br>• a commercial CZ3 zone<br>• a commercial CZ5 zone (other than land in zone FA)<br>• a TSZ2 services zone<br>• a Community facility zone<br>• a leisure and accommodation zone | land in the Queanbeyan city special uses zone | same as the noise standard for the adjoining noise zone with the loudest noise standard for the time period | |

| Table 2.1 | | | Table 2.2 | |
|---|---|---|---|---|
| FA | land (other than land in the city centre, town centres and group centres) in a commercial CZ5 zone adjoining—<br>• the CCEP frame and<br>• zone G | | 60 | 50 |
| G | all other land, other than land in the Central National Area (Fairbairn) | all other NSW land | 45 | 35 |
| B1 | land in the city centre or a town centre, other than land in the CCEP core and CCEP frame<br>**From Table 2.2A** | | Monday-Thursday 7 am–10 pm<br>Friday and Saturday 7 am–12 am<br>Sunday and public holiday 8 am–10 pm | any other time not mentioned in column in adjacent column |
| | | | 60 | 50 |
| C1 | land in group centres, | | 55 | 45 |

**Table 3: From Table 2.2AA, Noise zones B3 and B4—entertainment noise from place other than dwelling**

| **column 2**<br>**noise zone** | **column 3**<br>**noise standard (dB(A))**<br>Sunday-Wednesday and public holiday 10 am–11 pm<br>Thursday-Saturday 10 am–1 am | **column 4**<br>**noise standard (dB(A))**<br>any other time not mentioned in column 3 | **column 5**<br>**noise standard (dB(C))**<br>Sunday-Wednesday and public holiday 10 am–11 pm<br>Thursday-Saturday 10 am–1 am | **column 6**<br>**noise standard (dB(C))**<br>any other time not mentioned in column 5 |
|---|---|---|---|---|
| zone B3 | 75 | 60 | 90 | 75 |
| zone B4 | 65 | 55 | 80 | 70 |

## 6.1 Summary of Criteria

Below is a summary of the criteria discussed above:

**Table 4: Summary of Criteria**

| **Location where assessed** | **Criteria** | **Time Applicable** | |
|---|---|---|---|
| | | Monday-Thursday 7 am–10 pm<br>Friday and Saturday 7 am–12 am<br>Sunday and public holiday 8 am–10 pm | any other time not mentioned in column in adjacent column |

| | | | |
|---|---|---|---|
| **External to development at each boundary** | All directions | 60 | 50 |
| **Residential within the development from commercial within the development** | Internal AS2107 | 35 | 30 |

# 7 ASSESSMENT – Transport Noise

The Territory Planning Authority has required that the following be addressed, p.27.

> Noise Management
> The Noise Management Plan must consider potential noise intrusion from future light rail operations, including platform public address systems and general operational noise at the adjacent Woden Interchange, in combination with existing bus traffic noise.

This and the following section addresses the requirement to consider light rail and bus interchange noise.

## 7.1 Light Rail

From previous occasions where measurements of traffic on Northbourne Avenue have been conducted, the following observations have been made:

1. Rail carriages are almost silent when stopped;
2. Road traffic noise, stationary or moving is considerably louder than light rail when moving;
3. Diesel engines such as those that power busses are (very) noisy.

Due to these facts an assessment of the light rail is considered unnecessary as the busses at the interchange will dominate the ‘noise scape’.

# 8 Assesment - BUS TRAFFIC NOISE

## 8.1 Ligh

The site is adjacent the bus interchange. As there are changes proposed to the interchange, noise measurements undertaken should reflect the future noise levels as measurements were conducted at similar distances as those shown in the plans.

## 8.2 MEASUREMENT METHODOLOGY

Attended noise measurements were conducted at 16 metres from the curb at the interchange. The measured noise levels are presented below. The average was $L_{Aeq}$ 60 dB(A) which was used for this assessment.

**Table 5: Summary of measurements**

| Project Name | Start Time | Elapsed Time | $L_{(Aeq)}$ |
|---|---|---|---|
| Project 002 | 20/01/2026 15:44 | 00:15:01 | 60.62 |
| Project 003 | 20/01/2026 16:02 | 00:15:00 | 59.98 |
| Project 004 | 20/01/2026 16:21 | 00:15:03 | 59.66 |

$L_{Aeq}$ is the parameter utilised in AS 2107 (which is the criteria in the MUHDC) and therefore the parameter reported here.

### 8.2.1 Equipment

The following equipment was used to measure road traffic and ambient noise levels surrounding the site:

4. Hand held sound level meter Bruel and Kjaer type 2250, SN 3006332;
5. Field calibrator Bruel and Kjaer type 2453, SN 3009148.

## 8.3 Noise Intrusion from Bus Interchange ANALYSIS AND RESULTS

The nearest residences to the bus interchange are those located on ground level in the northern most building. These are 16 metres away from the curb. Measurements were conducted of the current interchange at 16 m from the curb. The residences that are further from the buses will be less affected.

Noise emissions from busses are from the diesel engine. In the future we expect noise levels to drop with the ACT Government's intention to introduce electric buses, and potentially any extension of the light rail.

Based on floor plans and elevations, glazing and building treatments were determined using an inside to outside calculation method as published in Smith, Peters and Owen, *Acoustics and Noise Control*, Second Edition, Edinburgh, 1996, p. 155, and Bies D.A., and Hanson C.H., *Engineering Noise Control, Theory and Practice*, Third Edition, 2003, Spon Press, NY, p. 342, formula (8.16).

$SPL_{in} = SPL_{out} - R + 10 \log_{10} S - 10 \log_{10} A + K$.

This formula takes into account the Reduction, the area of absorbent material in the room based on RT time, volume of room, area of material under consideration, adjusts for angles of incidence and façade reflection.

The most affected rooms are on the eastern elevation on levels 2 - 3, simply because of proximity. Glazing should be as below.

**Table 6: Glazing for the Development to address Bus Interchange Noise**

| Levels | Rooms | Location | Rating (Indicative Glazing) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 2-5 | Living and Bedrooms | East Facing | $R_W$ 36 (6.38 lam/12/6 DG) |
| Rest of Development | All | North, South and West facing | $R_W$ 32 |

We have assumed that double glazing will be used throughout the development for energy reasons. Ratings above are for the entire window system including frames.

## 8.4 Other External Noise Sources

These include plant noise from adjacent buildings. These other buildings should have been designed to meet the noise zone standards, (60/50 day/night respectively).

The glazing above will meet the noise intrusion at 60/50 day/night respectively.

# 9 Assessment – Commercial Premises

Assessment has been conducted to various locations of noisy uses, and where compliance is not achieved, recommendation have been provided so for each commercial usage that compliance is achieved.

General recommendations that cover the entire development are in the next section.

## 9.1 Indoor Recreation Facility in Caparpark Building (stage 1)

**Table 7: Calculations from Building A commercial to receiver directly above commercial premises**

| Condition | Formula / notes | Values in formulae | dB |
|---|---|---|---|
| Internal SPL | as required by EPA | Indoor Recreation Facility | 95.0 |
| Convert to SWL | 10*log(S)<br>S = Area of glazing | S = 89.1 | 19.5 |
| Attenuation through façade glazing | $SPL_{outside} = SPL_{inside} - R - 6$ | R = 36 | -42.0 |
| Attenuation through Distance | 10*log(2/(4*pi()*r^2)) | r = 1 | -8.0 |
| Total | simple addition | | 64.5 |

### 9.1.1 Recommendations to achieve compliance

1. $R_W$ 35-36 rated glazing is to be fitted to all commercial facades.
2. The non-glazed or solid portions of the commercial units are to rate $R_W$ 45 or higher.
3. If an 'indoor recreation facility' is to operate with a sound system above background levels a noise limiter is to be fitted and calibrated at the boundaries.
4. Air locks should be fitted to all entry points. This could incorporate the reception area, which for communication purposes would not be noisy.

## 9.1 Drinking Establishment in Commercial and Community Buildings (stage 3)

While this assessment below is specifically for the non-retail commercial in the commercial building on the western side, the recommendations apply to all noisy uses in non residential buildings.

| Condition | Formula / notes | Values in formulae | dB |
|---|---|---|---|
| Internal SPL | as required by EPA | Drinking Establishment | 105.0 |
| Convert to SWL | 10*log(S)<br>S = Area of glazing | S = 35.1 | 15.5 |
| Attenuation through façade glazing | $SPL_{outside} = SPL_{inside} - R - 6$ | R = 36 | -42.0 |
| Attenuation through Distance | 10*log(2/(4*pi()*r^2)) | r = 1 | -8.0 |
| Total | simple addition | | 70.5 |

This shows a non compliance. Our recommendations will provide guidance on complying with the criteria.

### 9.1.1 Recommendations to achieve compliance

5. $R_W$ 35-36 rated glazing is to be fitted to all commercial facades.
6. The non-glazed or solid portions of the commercial units are to rate $R_W$ 45 or higher.
7. If an 'drinking establishment' or other noisy use is to operate with a sound system above background levels a noise limiter is to be fitted and calibrated at the boundaries.
8. Air locks to be considered at entry points. However compliance can be achieved using a noise limiter, with reduced sound levels inside.

## 9.2 Drinking Establishment in Residential Buildings (stage 2) to Boundary

While this assessment below is specifically for the non-retail commercial in the commercial building on the western side, the recommendations apply to all noisy uses in non residential buildings.

| Condition | Formula / notes | Values in formulae | dB |
|---|---|---|---|
| Internal SPL | as required by EPA | Drinking Establishment | 105.0 |
| Convert to SWL | 10*log(S)<br>S = Area of glazing | S = 20.25 | 13.1 |
| Attenuation through façade glazing | $SPL_{outside} = SPL_{inside}$ - R - 6 | R = 36 | -42.0 |
| Attenuation through Distance | 10*log(2/(4*pi()*r^2)) | r = 2.5 | -12.9 |
| Total | simple addition | | 63.1 |

This shows a non compliance. Our recommendations will provide guidance on complying with the criteria.

### 9.2.1 Recommendations to achieve compliance

9. $R_W$ 35-36 rated glazing is to be fitted to all commercial facades.
10. The non-glazed or solid portions of the commercial units are to rate $R_W$ 45 or higher.
11. If an 'drinking establishment' or other noisy use is to operate with a sound system above background levels a noise limiter is to be fitted and calibrated at the boundaries.
12. Air locks to be considered at entry points. However compliance can be achieved using a noise limiter, with reduced sound levels inside.

## 9.3 Drinking Establishment in Residential Buildings (stage 2) to Residential

While this assessment below is specifically for the non-retail commercial in the residential buildings on the north eastern corner, the recommendations apply to all noisy uses in the residential buildings.

| Condition | Formula / notes | Values in formulae | dB |
|---|---|---|---|
| Internal SPL | as required by EPA | Drinking Establishment | 105.0 |
| Convert to SWL | 10*log(S)<br>S = Area of glazing | S = 20.25 | 13.1 |
| Directionality | Already adjusted | = 3 | -3.0 |
| Attenuation through façade glazing | $SPL_{outside} = SPL_{inside}$ - R - 6 | R = 35 | -41.0 |

| | | | | |
|---|---|---|---|---|
| Attenuation through Distance | 10*log(2/(4*pi()*r^2)) | r = | 4 | -17.0 |
| Barrier calculation | Makeawa method $E_b$=10log(3+40$\delta/\lambda$)dB | $\delta$ = | sum of path lengths | 0.0 |
| | | $\lambda$ = | wavelength (500 Hz) | |
| Attenuation through the receiver's façade with windows or doors shut as per *AS2107* | $SPL_{in} = SPL_{out} - R + 10 \log_{10} S - 10 \log_{10} A + K$. S= Surface Area A=0.16*V/RT | R = | 32 | -29.3 |
| | | S = | 8.1 | |
| | | A = | 8.736 | |
| | | K = | 3 | |
| Total | simple addition | | | 27.7 |

This shows compliance at bedrooms during the night time. Note that this is conservative because to comply at the boundary, noise levels outside the commercial premises attenuation will be required, reducing noise levels to the apartments above even further.

## 9.4 Onsite Activity Noise - Plant

At this stage because equipment has not been chosen we cannot say definitively what treatments will be required. The criteria in all directions should be determined for each building.

# 10 Recommendations

The recommended acoustic treatments are required to ensure compliance with the relevant criteria.

## 10.1 Commercial Components

### 10.1.1 Facade Treatments – Commercial

$R_W$ 35-36 rated glazing is to be fitted to all commercial facades.

The non-glazed or solid portions of the commercial units are to rate $R_W$ 45 or higher.

### 10.1.2 Sound Systems

If a 'drinking establishment', an 'indoor recreation facility' or 'restaurant' is to operate with a sound system above background levels a noise limiter is to be fitted and calibrated at the receivers, both the residential components as well as at the boundaries.

Noise levels should be assessed through in the apartments directly above the commercial unit through the floor and the noise limiter calibrated at these locations as well.

### 10.1.1 Air locks

If music is to be played loudly necessitating a noise limiter, air locks should be fitted to all external entry points. This is because the criteria cannot be met for loud music without both of these items, ie noise limiters and air locks.

### 10.1.2 Noise from Commercial Waste

Commercial waste collection including hours of collection should comply with the *Commercial Waste Code*.

## 10.2 Facade Treatments - Residential

It is understood that the residential parts of the development will be double glazed. These should have a minimum $R_W$ of 36 to the first four floors of residential including the frames and hardware to the eastern facade. The remainder of the eastern facing glazing can be rated to $R_W$ 35. All other residential glazing may be rated to $R_W$ of 32.

## 10.3 Other Treatments - Residential

Treatments to the apartments on level 1 will require further treatments. The floor of level 1 apartments are to be rated at $R_W$ 60. This may necessitate a false ceiling of plasterboard in the commercial with a cavity of 100mm with 50mm fibrous insulation in the cavity. No penetrations should be made in the plasterboard with building services below this. Hydraulic services to the apartments on level 1 should double lagged. Risers should be treated so that the floor rating is preserved.

## 10.4 Plant

Plant is to emit no more noise than the criteria at the boundaries. As the site is to subdivided, noise zones may change, and therefore compliance levels should be ascertained for each building.

## 10.5 Other Plant

Other plant and building services such as garage doors are to comply with the internal noise levels are to be minimised.

## 10.6 Vibration

We understand that 'indoor recreation facility' is not allowed in the residential buildings as per the Crown Lease, therefore this has not been addressed.