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Stage 1 DA Acoustic Assessment

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DOCUMENT CONTROL REGISTER

| | |
|---------------------------|----------------------------------|
| Project Number | 20171369.2 |
| Project Name | Ivanhoe Estate, Macquarie Park |
| Document Title | Stage 1 DA Acoustic Assessment |
| Document Reference | 20171369.2/1510A/R6/SN |
| Issue Type | Email |
| Attention To | Frasers Property Ivanhoe Pty Ltd |

| Revision | Date | Document Reference | Prepared By | Checked By | Approved By |
|----------|------------|------------------------|-------------|------------|-------------|
| 0 | 6/11/2017 | 20171369.2/0611A/R0/SN | SN | | |
| 1 | 6/11/2017 | 20171369.2/0611A/R1/SN | SN | | GW |
| 2 | 6/11/2017 | 20171369.2/0611A/R2/SN | SN | | GW |
| 3 | 6/11/2017 | 20171369.2/0611A/R3/SN | SN | | |
| 4 | 6/11/2017 | 20171369.2/0611A/R4/SN | SN | | GW |
| 5 | 1/10/2019 | 20171369.2/0110A/R5/SN | GW | | GW |
| 6 | 15/10/2019 | 20171369.2/1510A/R6/SN | GW | | GW |
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1 INTRODUCTION

This report supports a Development Application for Stage 1 of the Ivanhoe Estate redevelopment, a State Significant Development (SSD) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It has been prepared for Aspire Consortium on behalf of NSW Land and Housing Corporation.

This document addresses noise impacts associated with the following:

- Traffic noise intrusion into project site from Herring Road and Epping Road, Macquarie Park.
- External noise emission from operation of project site including Child Care Centre, Mechanical Plant and Loading Dock.
- Noise and vibration emissions from the construction of project site.

ALC have utilised the following documents and regulations in the noise assessment of the development:

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – *'Developments near Rail Corridors or Busy Roads – Interim Guideline'*;
- Australian and New Zealand AS/NZS 3671:1989 *'Acoustics—Road traffic noise intrusion—Building siting and construction'*;
- Australian and New Zealand AS/NZS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*;
- NSW Planning Noise Policy for Industry 2017;
- Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013;
- Australian Standards AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites; and
- NSW Environmental Protection Agency Interim Construction Noise Guideline German Standard DIN 4150.

This assessment has been conducted using the Bates Smart Architects Pty Ltd and Candalepas Associates architectural drawings for D.A Submission, see details below.

Table 1 – Architectural Drawing List

| Architect | Building | Drawing Number | Drawing Title | Date | Rev | | |
|--------------------------------|-------------------------|-----------------------|---|------------|-----------------------|------------|----|
| Bates Smart Architects Pty Ltd | A1 | DA02.MP.102 | Masterplan Envelope Control Plan | 30/10/2017 | A | | |
| | | DA01.A1.001 | Site Plan | 21/12/2017 | X | | |
| | | DA03.A1.000L | Lower Ground Plan | | | | |
| | | DA03.A1.000U | Upper Ground Plan | | | | |
| | | DA03.A1.001 | Level 01 Plan | 20/12/2017 | | | |
| | | DA03.A1.002 | Level 02 Plan | | | | |
| | | DA03.A1.003 | Level 03, 05 & 07 Plan | | | | |
| | | DA03.A1.004 | Level 04 & 06 Plan | | | | |
| | | DA03.A1.008 | Level 08, 10, 12 & 14 | | | | |
| | | DA03.A1.009 | Level 09, 11, 13 & 15 | | | | |
| | | DA03.A1.016 | Level 16, 18 & 20 Plan | | | | |
| | | DA03.A1.017 | Level 17, 19 & 21 Plan | | | | |
| | | DA03.A1.022 | Level 22 Plan | | | | |
| | | DA03.A1.023 | Level 23 Plan | | | | |
| | | DA03.A1.024 | Roof Plan | | | | |
| | | DA03.A1.B1 | Basement 01: Loading Dock/Childcare Parking | | | | |
| | | DA03.A1.B2 | Basement 02 – Typical Carpark | | | | |
| | | DA.03.A1.B3 | Basement 03 - Carpark | | | | |
| | | DA.03.A1.B4 | Basement 04 - Carpark | | | | |
| | | DA08.A1.001 | Section AA | | | | |
| | | DA08.A1.002 | Section BB | | | | |
| | | CANDALEPAS ASSOCIATES | C1 | DA 1050 | Site Plan | 25/09/2018 | P7 |
| | | | | DA 1102 | Basement 3 Floor Plan | | |
| DA 1103 | Basement 2 Floor Plan | | | | | | |
| DA 1104 | Basement 1 Floor Plan | | | | | | |
| DA 1105 | Lower Ground Floor Plan | | | | | | |
| DA 1106 | Upper Ground Floor Plan | | | | | | |
| DA 1107 | Level 1 Floor Plan | | | | | | |
| DA 1108 | Level 2 Floor Plan | | | | | | |
| DA 1109 | Level 3 – 4 Floor Plan | | | | | | |
| DA 1110 | Level 5 – 12 Floor Plan | | | | | | |

Table 2 – Architectural Drawing List (Cont.)

| Architect | Building | Drawing Number | Drawing Title | Date | Rev |
|-----------------------|-----------------|-----------------------|-------------------------------|-------------|------------|
| CANDALEPAS ASSOCIATES | C1 | DA 1111 | Level 13 Floor Plan | 25/09/2018 | P7 |
| | | DA 1112 | Level 14 – 19 Floor Plan | | |
| | | DA 1113 | Roof Plan | | |
| | | DA 1150 | Adaptable Unit Floor Plans | | |
| | | DA1200 | Section A | | |
| | | DA 1201 | Section B | | |
| | | DA 1202 | Section C | | |
| | | DA 1300 | North East Elevation | | |
| | | DA 1301 | North West Elevation | | |
| | | DA 1302 | North West Internal Elevation | | |
| | | DA 1303 | South East Elevation | | |
| | | DA 1304 | South East Internal Elevation | | |
| | | DA 1305 | South West Elevation | | |

2 SITE DESCRIPTION

The Ivanhoe Estate site is located in Macquarie Park near the corner of Epping Road and Herring Road within the Ryde Local Government Area (LGA). The site is approximately 8.2 hectares and currently accommodates 259 social housing dwellings, comprising a mix of townhouse and four storey apartment buildings set around a cul-de-sac street layout. An aerial photo of the site is provided at **Figure 1** below.

Immediately to the north of the site are a series of four storey residential apartment buildings. On the north-western boundary, the site fronts Herring Road and a lot that is currently occupied by four former student accommodation buildings and is likely to be subject to redevelopment. Epping Road runs along the south-western boundary of the site and Shrimptons Creek, an area of public open space, runs along the south-eastern boundary. Vehicle access to the site is via Herring Road.

Ivanhoe Estate comprised of 17 individual lots owned and managed by the NSW Land and Housing Corporation. The Masterplan site also incorporates adjoining land, being a portion of Shrimptons Creek and part of the commercial site at 2-4 Lyon park Road. This land is included to facilitate a bridge crossing and road connection to Lyon park Road.



Figure 1: Ivanhoe Estate Site

The proposed Stage 1 Development Application seeks consent for the first stage of detailed works within the Ivanhoe Estate, pursuant to the Ivanhoe Estate Masterplan under Section 4.22 of the EP&A Act. The Masterplan establishes the planning and development framework against which this Stage 1 Development Application will be assessed.

The Stage 1 Development Application seeks approval for:

- Site preparation works, including services, and earthworks across the Ivanhoe Estate;
- The provision and augmentation of utilities and services infrastructure across the Ivanhoe Estate;
- The construction of all internal roads including public domain within the road reserves, and the bridge crossing and road connection to Lyonpark Road;
- The consolidation of existing lots and subdivision of the Ivanhoe Estate to reflect the revised road layout, open space, and provide superblocks corresponding to the Masterplan;
- The construction and use of Buildings A1 and C1 comprising residential uses (including social housing), a childcare centre, and retail / community spaces.

An image of the Masterplan, identifying Buildings A1 and C1 and illustrating the road network, is provided at **Figure 2** below.

Acoustic investigation has been carried out by this office in regards to the developments surrounding the Stage 1 Ivanhoe Estate development, which has been detailed below:

- Western facade faces Herring Road which is the six lane road with heavy traffic volume including buses at certain time of a day;
- Southern facade faces future residential development;
- Northern facade faces the existing multi storey residential buildings;
- Remaining facades will be bounded by the future development of whole project site.
- The proposed childcare centre will be located on ground floor of Building A1 which will care 75 kids and operation hours are 7am to 6pm.

The nearest residential noise receivers around the project site include:

- Receiver 1 - Residential buildings located at 112 – 120 Herring Road situated to the North, residential receivers are multi storey;
- Receiver 2 - Residential buildings located at 155 – 159 Herring Road and 5-11 Windsor Drive situated to the North-West, residential receivers are multi storey.
- Receiver 3- Residential apartments within project site.
- Receiver 4- multi storey residential building located at 137-143 Herring Rd which is under construction.
- Receiver 5- Commercial building within Morling College. Macquarie Baptist Church is located further west at back of this College. Noise compliance to Morling College will automatically satisfy Baptist Church.

A site map with noise measurement locations and surrounding receivers is presented in Figure 3 below.



Figure 2: Site Map of Ivanhoe Estate

Proposed A1 & C1 Buildings





-  Unattended Noise Monitor
-  Attended Noise Measurements

Figure 3: Site Survey and Monitoring Positions
Sourced from Six Maps NSW

 Residential Receiver

3 EXISTING ACOUSTIC ENVIRONMENT

The acoustic environment is categorised by High background noise levels during the day and evening due to traffic movements along Herring Road and Epping Road. Medium background noise levels during the night as most of the volume of traffic has finished for the day.

Acoustic monitoring was conducted at the site to establish the background noise levels which will be used as basis for this assessment.

3.1 ENVIRONMENTAL NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10} , L_{90} and L_{eq} .

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

3.2 BACKGROUND NOISE LEVELS

Background noise measurements have been carried out by the six noise monitors setup around project site with locations detailed below:



Figure 3: Background Noise Monitor Locations

● — Noise Monitor Locations

Monitor Locations: It is noted that no access to the nearest noise receivers and six background noise monitors were setup around project boundary and the lowest background noise levels (Location 5) during each time period is adopted to setup noise emission criteria.

3.2.1 equipment used

Background noise were recorded using six Acoustic Research Laboratories Pty Ltd noise loggers. The loggers were programmed to store 15-minute statistical noise levels throughout the unmanned monitoring period. The equipment was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

3.2.2 Measurement time period

Unmanned measurements at location 1/3/4/6 were conducted between 25th and 31st October 2017 and at location 2/5 were conducted between 11th and 19th September 2017. Figure 3 details the measurement positions.

3.2.3 Measured Rating Background Noise Level

The measured background noise levels dB(A)_{L₉₀} for day, evening and night time periods are shown in the table below.

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm; and
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Table 3 – Rating Background Noise Levels

| Location | Date | ABL | | |
|----------|------------|-----------|-----------|-----------|
| | | Day | Evening | Night |
| #1 | 25.10.2017 | - | 56 | 35 |
| | 26.10.2017 | 59 | 58 | - |
| | 27.10.2017 | 60 | 56 | 39 |
| | 28.10.2017 | 57 | 56 | 41 |
| | 29.10.2017 | 53 | 55 | 38 |
| | 30.10.2017 | - | - | 39 |
| | 31.10.2017 | - | - | 37 |
| | RBL | 58 | 56 | 38 |
| #2 | 11.09.2017 | - | 55 | 38 |
| | 12.09.2017 | 57 | 56 | 38 |
| | 13.09.2017 | - | 55 | 41 |
| | 14.09.2017 | - | 56 | 39 |
| | 15.09.2017 | 58 | 55 | 39 |
| | 16.09.2017 | - | 54 | 40 |
| | 17.09.2017 | 52 | 53 | 37 |
| | 18.09.2017 | 56 | 55 | 38 |
| | RBL | 56 | 55 | 39 |
| #3 | 25.10.2017 | - | - | 37 |
| | 26.10.2017 | 57 | 55 | - |
| | 27.10.2017 | - | 53 | 38 |
| | 28.10.2017 | 54 | 52 | 39 |
| | 29.10.2017 | 51 | 51 | 38 |
| | 30.10.2017 | - | - | 41 |
| | 31.10.2017 | - | - | 39 |
| | RBL | 54 | 53 | 38 |
| #4 | 25.10.2017 | - | 50 | 35 |
| | 26.10.2017 | 56 | 53 | - |
| | 27.10.2017 | - | 51 | 36 |
| | 28.10.2017 | 53 | 48 | 38 |
| | 29.10.2017 | 46 | 46 | 38 |
| | 30.10.2017 | - | - | 38 |
| | 31.10.2017 | - | - | 36 |
| | RBL | 53 | 50 | 37 |

| | | | | |
|----|-------------|-----------|-----------|-----------|
| #5 | 11.09.2017 | | 39 | 35.5 |
| | 12.09.2017 | 41 | 43 | 35 |
| | 13.09.2017 | 45 | 38 | 34 |
| | 14.09.2017 | 46 | 39 | 34 |
| | 15.09.2017 | 42 | 38 | 33 |
| | 16.09.2017 | 40 | 41 | 34 |
| | 17.09.2017 | 38 | 38 | 35 |
| | 18.09.2017 | 42 | 39 | |
| | RBL* | 42 | 39 | 34 |
| #6 | 25.10.2017 | | 45 | 42.4 |
| | 26.10.2017 | 46 | 46 | 47 |
| | 27.10.2017 | 50 | 47 | 43 |
| | 28.10.2017 | 44 | 45 | 45 |
| | 29.10.2017 | 44 | 46 | 46 |
| | 30.10.2017 | 47 | 48 | 43 |
| | 31.10.2017 | 46 | 43 | 41 |
| | RBL | 46 | 46 | 43 |

Note: The lowest RBL (location #5) has been adopted in DA report for setting up noise emission criteria.

4 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigation indicates that the major external noise sources around project site are below:

- Traffic noise impacts from Herring Road, Macquarie Park;
- Traffic noise impacts from Epping Road, Macquarie Park and;

4.1 INTERNAL NOISE CRITERIA

A traffic noise intrusion assessment has been conducted based off the requirements of the following acoustic noise criteria/standards;

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline*';
- NSW Department of Planning and Environment's document – '*State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*';
- Australian and New Zealand AS/NZS 3671:1989 '*Acoustics—Road traffic noise intrusion—Building siting and construction*' and;
- Australian and New Zealand AS/NZS 2107:2016 '*Recommended design sound levels and reverberation times for building interiors*'.

4.1.1 City of Ryde Development Control Plan 2014 (Traffic Noise Intrusion)

The City of Ryde Development Control Plan 2014 does not state traffic noise criteria, therefore; the following documents and their criteria are recommended.

4.1.2 NSW Department of Planning and Environment's Document – 'Developments near Rail Corridors or Busy Roads – Interim Guideline'

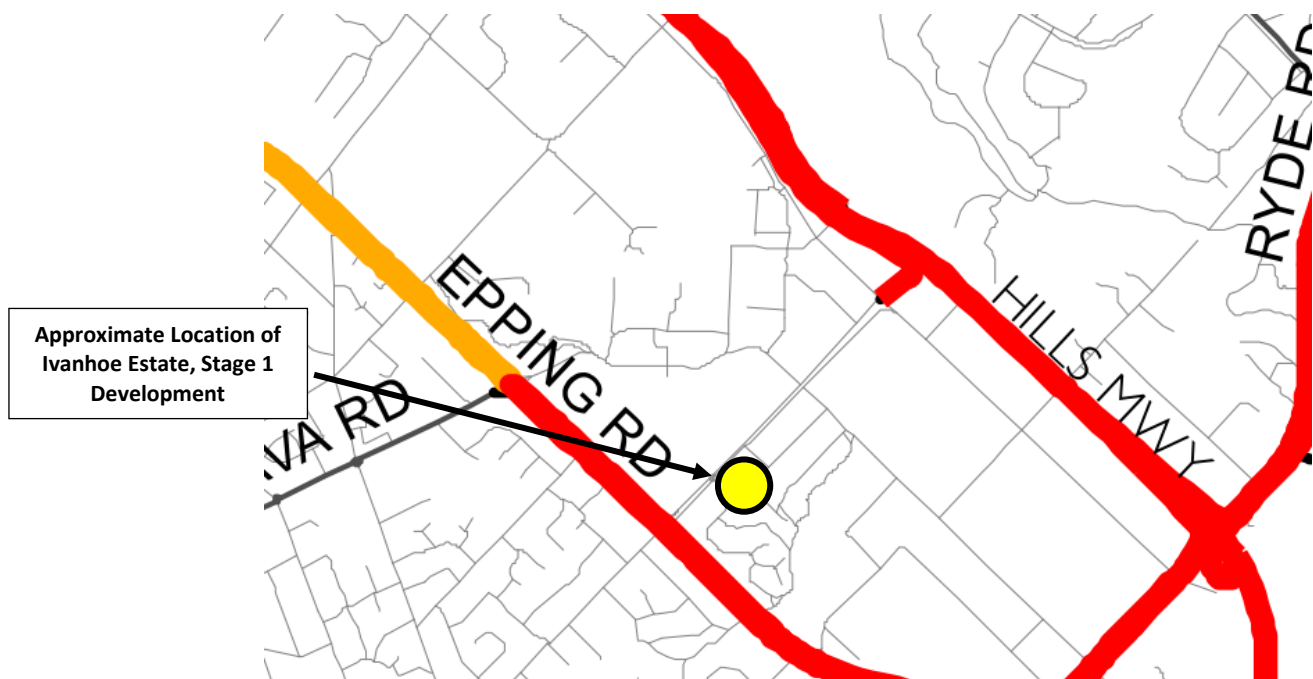
Section 3.5 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail."

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*
 - *in any bedroom in the building: 35dB(A) at any time 10pm-7am*
 - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

4.1.3 NSW Department of Planning and Environment's document – 'State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007' (Traffic Noise Intrusion)

RTA Map No. 11 of the traffic volume maps referenced by the SEPP (INFRASTRUCTURE) on the RTA website (see below), classifies the section of Epping Road where the development is located adjacent to as a road where a noise intrusion assessment is mandatory under clause 102 of the SEPP Infrastructure 2007. See RTA average annual daily road traffic volume map number 11 and the approximate location of the site below.



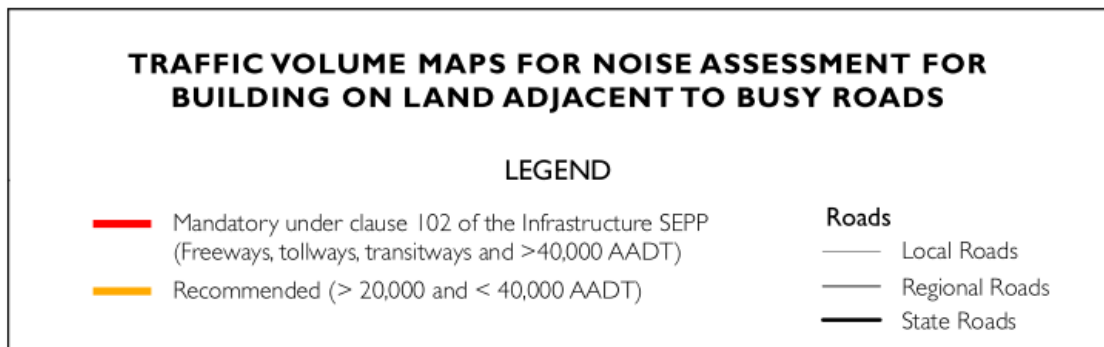


Figure 2 – RTA Map No. 11 and Approximate Location of Proposed Development

Clause 87 - Impact of rail noise or vibration on non-rail development

(1) This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:

- (a) a building for residential use,
- (b) a place of public worship,
- (c) a hospital,
- (d) an educational establishment or child care centre.

(3) 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.

Clause 102

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*

- *in any bedroom in the building: 35dB(A) at any time 10pm-7am*
- *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

4.1.4 Australian and New Zealand AS/NZS 3671:1989 'Acoustics—Road traffic noise intrusion—Building siting and construction'

Australian Standard AS 3671-1989 notes the following in relation to traffic noise:

- Internal noise levels should be determined in accordance with the relevant standard.
- Australian Standard AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors', is the industry adopted standard.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the L_{eq} descriptor, ALC shall also use this descriptor.
- AS3671 does not specifically recommend a time interval. On this basis, ALC have adopted the interval used by the EPA Road Noise Policy for main/arterial roads, that being:
 - Day – 7am to 10pm (15 hour); and
 - Night – 10pm to 7am (9 hour).

Internal noise levels have been selected in accordance with AS 2107:2016.

4.1.5 Australian and New Zealand AS/NZS 2107:2016 'Recommended design sound levels and reverberation times for building interiors'

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table 1, in Section 5 of AS 2107-2016, gives the following maximum internal noise levels for commercial buildings and residential buildings near major roads.

Table 4 – Recommended Design Sound Level

| Space /Activity Type | Recommended Maximum Design Sound Level dB(A) L_{eq} |
|------------------------------|---|
| Living Areas | 30-40 dB(A) L_{eq} , 24 hours |
| Sleeping Areas | 30-35 dB(A) L_{eq} (night time) |
| Bathrooms, Ensuites, Laundry | 45 dB(A) L_{eq} |

4.1.6 To Child Care Centre

4.1.6.1 Indoor Play Area Noise Levels

The internal noise levels of the childcare centre shall comply with the requirements of Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013 which has been detailed below.

Table 5 – Childcare Centre- Internal Noise Criteria

| Space | Internal Noise |
|----------------|----------------------------|
| Sleeping Rooms | 40 dB(A) L_{eq} , 1 hour |
| Other rooms | 40 dB(A) L_{eq} , 1 hour |

4.1.6.2 Outdoor Play Area Noise Levels

External ambient noise levels shall comply with the requirements of Association of Australian Acoustical Consultants “Technical Guideline Child Care Centre Noise Assessment” 2013 which has been detailed below.

Table 6 - Childcare Centre- Outdoor Noise Criteria

| Space | External Noise |
|--|----------------------------|
| Outdoor Playgrounds and Activity Areas | 55 dB(A) L_{eq} , 1 hour |

4.1.7 Summary of Criteria

The governing project criteria is presented in the Table below.

Table 7 - Summary of Internal Noise Level Criteria

| Space | Internal Traffic Noise Criteria dB(A)L_{eq} |
|-------------------------|---|
| Bedroom | 35dB(A) L_{eq} (9hour); 40dB(A) L_{eq} (15hour) |
| Living Space | 40dB(A) L_{eq} (24hour) |
| Bathroom | 45dB(A) L_{eq} (When in use) |
| Child Care Indoor Area | 40 dB(A) L_{eq} , 1 hour |
| Child Care Outdoor Area | 55 dB(A) L_{eq} , 1 hour |

4.2 EXTERNAL NOISE MEASUREMENTS

This section of the report details noise measurements conducted at the site to establish traffic and surrounding environmental noise levels impacting the development.

4.2.1 Noise Measurements

4.2.2 Measurement Equipment

Attended short term measurements of traffic noise which were undertaken by this office, to supplement the unattended noise monitoring. Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

Unattended noise monitoring was conducting using one Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

4.2.3 Measurement Location

Attended Traffic Noise Measurements: These were conducted along Epping Road and Herring Road, See Figure 1 for measurement location. All noise measurements had a 180° view of the road.

4.2.4 Measurement Period

Unattended noise monitoring was conducted from Wednesday, 25th October, 2017 to Wednesday, 1st November, 2017.

Attended noise measurements were undertaken between the hours of 3:30pm and 5:30pm on Wednesday, 25th October 2017.

4.2.5 Measured Traffic Noise Levels

4.2.5.1 Attended Noise Measurement Results

Table 8 – Manned Traffic Noise Measurement Results

| Location | Measured Noise Level dB(A) _{Leq} |
|---|---|
| Epping Road- at 7m distance from kerb (Figure 1) | 69 |
| Herring Road- at 5m distance from kerb (Figure 1) | 71 |

4.2.5.2 Unattended Noise Measurement Results

Table 9 -Unattended Noise Measurement Results

| Location | Measured Noise Level Day | |
|--------------------------------------|-----------------------------|-------------------------------|
| | Day dB(A) _{Leq, T} | Night dB(A) _{Leq, T} |
| 13m distance from kerb of Epping Rd | 69 | 66 |
| 18m distance from kerb of Herring Rd | 63 | 56 |

4.2.6 Summarised External Noise Levels

The existing traffic noise levels listed in the table below were determined based on the unattended noise monitoring and attended noise measurements.

Table 10 – Measured Existing Traffic Noise Levels

| Location | Summary of Measured Existing Traffic Noise Levels* | |
|---|--|--|
| | Daytime (7am-10pm) dB(A) L _{Aeq} | Night time (10pm-7am) dB(A) L _{Aeq} |
| Herring Road 5m from kerb 180° view of the road | 72dB(A) | 65dB(A) |
| Epping Road 7m from kerb 180° view of the road | 69dB(A) | 62dB(A) |

*Adjusted based off unattended noise monitoring

4.3 NOISE INTRUSION ANALYSIS

Traffic noise intrusion into the proposed development was assessed using the measured and predicted noise levels above.

Calculations were undertaken taking into account the orientation of windows, barrier effects (*where applicable*), the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way, the likely interior noise levels can be predicted.

5 NOISE EMISSION ASSESSMENT

The noise emission from the project site shall comply with the requirements of the following documents;

- City of Ryde Development Control Plan 2014 and;
- NSW Planning Noise Policy for Industry 2017.

5.1 NOISE EMISSION CRITERIA

5.1.1 City of Ryde Development Control Plan 2014

3.10 Acoustic Privacy Controls

f. *“The operating noise level of air conditioners, swimming pool pumps and other mechanical services must not exceed the background noise level by more than 5dB(A).”*

5.1.2 Requirements by EPA

The Industrial Noise Policy has been superseded by Noise Policy for Industry 2017.

The NPfI 2017 provides guidelines for assessing noise impacts from industrial developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPfI has two requirements which both have to be complied with, namely project amenity criterion and an intrusiveness criterion.

5.1.2.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A).

Intrusive criteria based on the lowest RBL recorded around project site by this office and detailed in table below.

Table 11 – INP Intrusiveness Criteria

| Time of day | Background Noise Level dB(A) L_{90} | Intrusiveness Criteria (Background+5dB(A)) dB(A) L_{eq} |
|-------------|--|---|
| Day | 42 | 47 |
| Evening | 39 | 44 |
| Night | 34 | 39 |

5.1.2.2 Project Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The NPfI requires Project Amenity Noise Levels to be calculated below:

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

Pursuant to the NPfI, the residential receivers in the vicinity would be considered Urban. Corresponding Project Amenity Criteria noise emission goals are presented below.

Table 12 –NPfI Project Amenity Criteria

| Type of Receiver | Time of day | Recommended Amenity Noise Level dB(A) L_{eq} | Project Amenity Noise Level dB(A) $L_{eq, 15min}$ |
|----------------------|-------------|--|--|
| Residential (Urban)* | Day | 60 | 58 |
| | Evening | 50 | 48 |
| | Night | 45 | 43 |

*Note: 1) residents along Epping Rd “has through traffic with characteristically heavy and continuous traffic flow during peak periods”

2) residents along northern boundary and western boundary: high density residential, partially dominated by “urban hum”/traffic sound sources.

5.1.2.3 Sleep Arousal Criteria

Section 2.5 of NPfI 2017 recommended the following noise limit to mitigate sleeping disturbance:

Where the subject development/ premises night -time noise levels at a residential location exceed:

- $L_{Aeq, 15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
 - L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,
- A detailed maximum noise level even assessment should be undertaken.

Table 13 - Sleep Arousal Emergence Criteria (Night)

| Location | Rating Background Noise Level (Night) - dB(A) L_{90} | Emergence Level |
|---|--|--|
| All Potentially Affected Residential Properties | 34 | 40dB(A) $L_{eq, 15min}$; 52 dB(A) $L_{max, F}$ |

5.1.2.4 Summary of Noise Emission Criteria

The noise emission criteria for the proposed Stage 1 have been summarised below.

Table 14 – Summary of External Noise Emission Criteria

| Location | Time | Noise Emission Criteria |
|---|---------|--|
| All potentially affected residential boundaries | Day | 47 dB(A) $L_{eq, 15 min}$ |
| | Evening | 44 dB(A) $L_{eq, 15 min}$ |
| | Night | 39 dB(A) $L_{eq, 15 min}$ 52 dB(A) $L_{max, F}$ |

5.2 NOISE EMISSION ASSESSMENT

The major noise sources generated by the proposed development are below:

- Plant service project buildings.
- Loading dock operation
- Child Care Centre.

5.2.1 Mechanical Plant Noise

Detailed plant selection has not been undertaken at this stage, as plant selections have not been determined. Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels. Satisfactory levels will be achievable through appropriate plant selection and location and, if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Noise emissions from all mechanical services to the closest residential receiver should comply with the requirements of section 5.1.

5.2.2 Noise generated by loading dock and carpark

Loading dock and carpark are fully enclosed therefore the noise emissions shall not have any adverse impact to the noise receivers around the project site.

5.2.3 Proposed Child Care Centre

5.2.3.1 Noise Emission Criteria

Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013 states:

Up to 2 hours (total) per day- The $L_{eq, 15min}$ noise level emitted from outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location;

More than 2 hours per day- The $L_{eq, 15min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.

The noise emission criteria have been summarised below base on the requirements above and measured rating background noise data on site.

Table 15 –Noise Emission Criteria for the Child Care Centre

| Total Outdoor Play Hours | Noise Receiver | Criteria dB(A) L_{eq} 15min |
|--------------------------|-----------------------------|-------------------------------|
| ≤ 2 hours | 1m from the receiver façade | 52 |

5.2.4 Noise Source Data

5.2.4.1 Outdoor Play Area Noise Measurements

Outdoor play area noise measurements were undertaken at Child Care Centre, 8 Central Avenue Mosman by this office. Details of the measurements are presented below. Noise measurements were taken of the 3 to 6 year age group (8 kids) at play. This group represents the most active of the age groups and hence are likely to generate the maximum noise levels. Although noise measurements have not been conducted for the 0-2 year age group, it would be expected that they would be likely to generate lower levels of sound than the older age group

5.2.4.2 Measurement Location

Measurements were taken during the morning play session within the outdoor play area with 8 children present.

The measurements were taken at noted distances to the children playing with the measured levels presented below.

5.2.4.3 Measurement Equipment

Noise measurements were obtained using a CEL-593 Type 1 Sound Level Analyser, set to A-weighted fast response. The sound level meter was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

5.2.4.4 Measured Noise Levels

The measured activity noise levels from the 8 children playing are listed below in table below.

Table 16 - Measured Children Activity Noise Levels dB(A) LA₁₀

| Location | Activity | Distance | Noise Level L ₁₀ * |
|-------------------|--------------------------------|----------|-------------------------------|
| Outdoor Play Area | Bikes + Sandpit play | 3m | 66 |
| | Blocks + Sandpit play | 4m | 64 |
| | Stepping Blocks + Sandpit play | 4m | 57 |
| | Play gym + Sand pit play | 3m | 65 |

*Note: dB(A)L₁₀ is used as L_{eq} for noise emission calculations.

5.2.5 Predicted Noise Levels

The nearest noise receivers are apartments with openable windows located directly above. The noise level at the nearest residents upstairs was predicted using the above data and by taking into account any expected noise reduction provided by the building fabric, distance losses, directivity, barrier effects, number of children playing etc. The EPA INP now uses the L_{eq} descriptor in place of L₁₀. An approximate relationship would be a difference of 2dB less for the L_{eq} descriptor. Table below shows the predicted noise levels from the children with the recommended acoustic barrier. It is noted that analysis was based on a maximum of 40 children use the afternoon outplay area at any one time. The recommended noise controls in Section 8 has been taken account in the noise prediction.

Table below presents the predicted noise levels dB(A) L_{eq} at the subject sensitive receivers.

5.2.5.1 To the Nearest Noise Receiver

The noise emission calculations detailed below to the noise receiver is below.

Table 17 –Predicted Outdoor Play Area to facade of Receiver - dB(A) L_{eq}

| Noise Source | 8 Kids Sound Power Level: 82.8 dB(A) |
|---------------------------|--------------------------------------|
| Adjust the Number of Kids | 40 Kids playing outdoor areas: +7 dB |
| Result | 52dB(A) |
| Criteria | ≤ 52 dB(A) L _{eq} 1 hour |
| Comply | Yes |

6 CONSTRUCTION NOISE AND VIBRATION IMPACT

6.1 SENSITIVE RECEIVERS

The nearest sensitive receivers in the vicinity of the site are as follows:

- Receiver 1 - Residential buildings located at 112 – 120 Herring Road situated to the North, residential receivers are multi storey;
- Receiver 2 - Residential buildings located at 155 – 159 Herring Road and 5-11 Windsor Drive situated to the North-West, residential receivers are multi storey.

- Receiver 3- Residential apartments within project site.
- Receiver 4- multi storey residential building located at 137-143 Herring Rd which is under construction.
- Receiver 5- Commercial building within Morling College. Macquarie Baptist Church is located further west at back of this College. Noise compliance to Morling College will automatically satisfy Baptist Church.

6.2 NOISE MANAGEMENT LEVEL

Establishment of criteria for construction noise requirements will be in accordance with the following documents.

- Ryde Council Development Control Plan 2014
- Australian Standards AS2436:2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*
- NSW Environmental Protection Agency Interim Construction Noise Guideline

6.2.1 Ryde Council Development Control Plan 2014

6.2.1.1 Part 8.1 – Construction Activities

Section 2.6.1 a) of the Ryde DCP 2014 states:

All works shall be carried out in accordance with the requirements of AS2601 – 1991 The Demolition of Structures.

Section 1.7.2.3 – Noise Control of AS2601 states:

Noise shall be minimised, as far as practicable, by the selection of appropriate methods and equipment, and by the use of silencing devices. Attention is drawn to the recommendations contained in AS2436

6.2.1.1.1 Section 4.6 – Hours of Operation

Section 4.6 a) of the Ryde DCP 2014 states:

All demolition and/or construction and associated work is to be restricted to between the hours of 7am and 7pm Mondays to Fridays and between 8am and 4pm on Saturday. No work is to be carried out on Sundays or public holidays

6.2.2 Australian Standard AS2436:2010 “Guide to noise control on construction, maintenance and demolition sites

Australian Standard AS2436 provides guidance on noise and vibration control in respect to construction and demolition sites, and the preparation of noise and vibration management plans, work method statements and impact studies. The Standard states that:

- “Some construction and demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration.”

- Construction, demolition and maintenance works pose different problems of noise and vibration control when compared with most other types of industrial activity, since
 - (a) they are mainly carried on in the open;
 - (b) they are often temporary in nature although they may cause considerable disturbance whilst they last;
 - (c) the noise and vibration arise from many different activities and kinds of plant, and their intensity and character may vary greatly during different phases of the work, and;
 - (d) the sites cannot be separated by planning control, from areas that are sensitive to noise and vibration.

The Standard provides advice and guidelines for the prediction of impacts and the methods available to manage impacts. It guideline promulgates feasible and reasonable mitigation strategies and controls, and stakeholder liaison, in the effort to reach a realistic compromise between site activities and impacts on neighbouring properties.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Develop a suitable noise criterion based on the NSW Environmental Protection Agencies Interim Construction Noise Guideline.
- Adopt management conditions as per AS 2436 in the event of a non-compliance.

6.2.3 NSW EPA Interim Construction Noise Guideline

Given the scale of the proposed works, the “quantitative” assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used (as opposed to the more simple “qualitative” assessment method outlined in the guidelines). The quantitative assessment method requires:

- Determination of noise generation goals (based on background noise levels on site).
- Prediction of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

6.2.3.1 At Residential Receivers

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *“Noise affected” level.* Where construction noise is predicted to exceed the “noise affected” level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the “noise affected level”. For residential properties, the “noise affected” level occurs when construction noise exceeds ambient levels by more than 10dB(A)_{L_{eq}(15min)}.

- “Highly noise affected level”. Where noise emissions are such that nearby properties are “highly noise affected”, noise controls such as respite periods should be considered. For residential properties, the “highly noise affected” level occurs when construction noise exceeds 75dB(A)_{Leq(15min)} at nearby residences.

6.2.3.2 Construction Noise Management Levels

Construction noise management levels applicable to the development have been determined based on the minimum background noise level recorded and the construction noise management level detailed in of this report. Noise management Level for the construction period of the site are detailed in table below.

Table 18 – Construction Noise Management Levels

| Receiver | Category | Time of Day | Background Noise Level dB(A) L ₉₀ | Construction Noise Management Level dB(A) L _{eq(15min)} | “Highly Noise Affected” Level dB(A) L _{eq(15min)} |
|-----------------------|----------------------|-------------|---|---|---|
| Residential Receivers | Monday to Friday | 0700 - 1800 | 42 | 52 | 75 |
| Receiver 5 | Classroom (Internal) | | | 45 | |

6.3 NOISE EMISSION ASSESSMENT

Detailed demolition, excavation and construction methodology are not available at this stage, acoustic analysis will be carried out at CC stage based on requirements above to work out noise mitigation solutions.

7 CONSTRUCTION VIBRATION CRITERIA

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For amenity criterion, the NSW Environmental Protection Authorities document *Assessing Vibration: A technical guideline*
- For structure borne damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*

The criteria and the application of these standards are discussed in separate sections below.

7.1.1 Human Comfort Vibration Limits

Table 2.2 of DECCW “Assessing Vibration: A technical guideline” specified the following vibration goal for human comfort:

Table 19 –Preferred and Maximum Weighted rms values Vibration Acceleration (m/s²) 1-80 Hz

| Location | Assessment Period | Preferred Values Z-axis | Preferred Values X & Y-axis | Maximum Values Z-axis | Maximum Values X & Y-axis |
|----------------------|-------------------|----------------------------|--------------------------------|--------------------------|------------------------------|
| Continuous Vibration | | | | | |
| Residences | Day time | 0.010 | 0.0071 | 0.020 | 0.014 |
| Impulsive Vibration | | | | | |
| Residence | Day Time | 0.3 | 0.21 | 0.6 | 0.42 |

Acceptable values for intermittent vibration shall comply with the requirements in Table 2.4 of DECCW “Assessing Vibration: A technical guideline” detailed as below.

Table 20 – Acceptable Vibration Dose Values for Intermittent Vibration (m/s^{1.75})

| Location | Day time preferred value | Day time maximum value |
|------------|--------------------------|------------------------|
| Residences | 0.20 | 0.40 |

Vibration is assessed in terms of “continuous” or “intermittent/ impulsive” vibration criteria. Continuous vibration is vibration that is present at a reasonable steady level for long periods of time. Intermittent or impulsive vibration results from sources such as piling. Continuous vibration limits are generally more stringent than the intermittent/ impulsive vibration limits.

Section 2.5 of DECCW “Assessing Vibration: A technical guideline” also states:

When short term works such as piling, demolition and construction give rise to impulsive vibrations, undue restriction on vibration values may significantly prolong these operations and results in greater annoyance. Short term works are works that occur for duration of approximately one week. This office has been advised that the most vibration inducing works such as piling and hydraulic hammering will be less than one week.

In circumstance where work is short term, feasible and reasonable mitigation measures have been applied, and the project has a demonstrated high level of social worth and broad community benefits, then higher vibration values (above the maximum) may apply. In these cases, best management practices should be used to reduce values as far as practicable.

7.1.2 Structure Borne Vibration (Damage Criteria)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table .

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 21 - DIN 4150-3 (1999-02) Safe Limits for Building Vibration

| TYPE OF STRUCTURE | | PEAK PARTICLE VELOCITY (mms^{-1}) | | | |
|-------------------|---|--|--------------|---------------|------------------------------------|
| | | At Foundation at a Frequency of | | | Plane of Floor of Uppermost Storey |
| | | < 10Hz | 10Hz to 50Hz | 50Hz to 100Hz | All Frequencies |
| 1 | Buildings used in commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| 2 | Dwellings and buildings of similar design and/or use | 5 | 5 to 15 | 15 to 20 | 15 |
| 3 | Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order) | 3 | 3 to 8 | 8 to 10 | 8 |

7.1.3 Recommended Vibration Limits

The table below presents the recommended vibration limit at the nearest vibration sensitive receivers.

Table 22 – Recommended Vibration Limit

| Vibration Receiver | Recommended Vibration Limits PPV (mm/s) |
|-----------------------|---|
| Residential Receivers | $\leq 5\text{mm/s PPV}$ |

7.2 VIBRATION MONITORING AND SAFEGUARD SYSTEM

Vibration monitoring system shall be determined at CC stage once the detailed piling /excavation methodology available. The buildings adjacent to the project site shall be vibration safeguarded by monitors and ensure that the construction of project site will not result any adverse vibration impact on neighbouring buildings.

8 RECOMMENDATIONS

The following acoustic treatments are recommended for the proposed redevelopment.

8.1 GLAZED WINDOWS AND DOORS

The following constructions are recommended to comply with the project noise objectives. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria. All external windows and doors listed are required to be fitted with Q-Ion type acoustic seals. **(Mohair Seals are unacceptable)**.

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

The recommended constructions are listed in the table below.

Table 23 – Recommended Glazing Construction

| Building | Level | Façade | Room | Glazing Thickness | Acoustic Seals |
|----------|-------------------|-------------------|--|-------------------|----------------|
| A1 | Level 1- Level 12 | Herring Road | Bedroom (total glazed area of room $\leq 8\text{m}^2$) | 12.38mm Laminated | Yes |
| | | | Living Room (total glazed area of room $\leq 10\text{m}^2$) | 10.38mm Laminated | |
| | | Remaining Façades | Bedroom (total glazed area of room $< 8\text{m}^2$) | 10.38mm Laminated | |
| | | | Living Room (total glazed area of room $< 10\text{m}^2$) | 10.38mm Laminated | |
| | | Child Care Centre | All | 10.38mm Laminated | |

Table 24 – Recommended Glazing Construction (Cont.)

| Building | Level | Façade | Room | Glazing Thickness | Acoustic Seals |
|--------------|-----------------|-------------------|--|-------------------|----------------|
| A1 | Level 12 And Up | Herring Road | Bedroom (total glazed area of room $\leq 8\text{m}^2$) | 10.38mm Laminated | |
| | | | Living Room (total glazed area of room $\leq 10\text{m}^2$) | 10.38mm Laminated | |
| | | Remaining Façades | Bedroom (total glazed area of room $< 8\text{m}^2$) | 10.38mm Laminated | |
| | | | Living Room (total glazed area of room $< 10\text{m}^2$) | 10.38mm Laminated | |
| C1.1 to C1.5 | | All | Bedroom | 6.38mm Laminated | |
| | | | Living Room | 6.38mm Laminated | |

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

In addition to complying with the minimum scheduled glazing thickness, the R_w rating of the glazing fitted into open-able frames and fixed into the building opening will require the use of acoustic seals around the full perimeter of open-able frames and the frame will need to be sealed into the building opening using a flexible sealant.

Table 25 - Minimum R_w of Glazing (with Acoustic Seals)

| Glazing Assembly | Minimum R_w of Installed Window | Acoustic Seals |
|-------------------|-----------------------------------|----------------|
| 6.38mm Laminated | 31 | Yes |
| 10.38mm Laminate | 35 | Yes |
| 12.38mm Laminated | 37 | Yes |

8.2 EXTERNAL ROOF/CEILING

External roof construction will be constructed from concrete or masonry elements, this proposed structure will not require any further acoustic upgrading. In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

8.3 EXTERNAL WALLS

External wall construction will be constructed from concrete and masonry elements, this proposed structure will not require any further acoustic upgrading. In the event that any penetrations are required through the external skin, an acoustic grade sealant should be used to minimise all gaps.

8.4 ENTRY DOORS

External opening entry doors shall have glazing thicknesses equal to those recommended in section 4.4.1 Recommended Glazing Construction, and are to have Raven RP10 to the top and sides, and Raven RP38 to the underside of the door.

8.5 MECHANICAL VENTILATION

With respect to natural ventilation of the dwelling, the NSW Department of Planning document “Development near Busy Roads and Rail Corridors - Interim Guideline” dictates that:

- *“If internal noise levels with windows or doors open exceed the criteria by more than 10dB(A), 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.”*

With windows open, the allowable internal noise goal is permitted to be 10dB(A) higher than when the windows are closed (ie – allowable level in bedrooms becomes 45dB(A), and 50dB(A) in living rooms).

The northern facade and western facade of Building A1 cannot achieve the noise criteria above with doors/ windows open. The ventilation for those rooms shall be provided to make sure that occupants can leave windows / doors closed.

Remaining facades will satisfy the requirements above with windows / doors open.

8.6 LOADING DOCK

- Loading dock - truck movements shall be day time only: 7am to 10pm Monday to Saturday; 8am to 10pm Sunday and public holidays.

8.7 PLANT

- Plant noise emission criteria has been setup in this report, detailed mechanical noise assessment shall be carried out at CC stage.

8.8 CHILD CARE CENTRE

Recommendations subject to future Development Application by Child Care Operator:

- Consider no more than 2 hours total outdoor play time per childcare ages group every day. The exact amount of time allowance will be subject to a future DA by the childcare operator.

- Consider maximum number of children outside at one time are below

Table 26 – Number of Children Outside Once a Time

| Location | Number of Children |
|----------------------|--------------------|
| Morning play space | 20 |
| Afternoon play space | 40 |

- Consider external doors /windows to remain closed except people in/out.
- Consider installation of 1Kg/m² acoustic treatment to cover the outdoor play area, or other equivalent acoustic treatments, or engineered solutions.

Note: Detailed acoustic treatment design is subject to a future Development Application by the childcare operator.



9 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with the proposed residential development to be constructed at Stage 1 Ivanhoe Estate, Macquarie Park.

Provided that the treatments set out in section 8 of this report are employed, internal noise levels shall comply with the requirements below:

- City of Ryde Development Control Plan 2014;
- NSW Department of Planning and Environment's Document – '*Developments near Rail Corridors or Busy Roads – Interim Guideline*';
- NSW Department of Planning and Environment's document – '*State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007*';
- Australian and New Zealand AS/NZS 3671:1989 '*Acoustics—Road traffic noise intrusion—Building siting and construction*'; and
- Australian and New Zealand AS/NZS 2107:2016 '*Recommended design sound levels and reverberation times for building interiors*'.

External noise emissions criteria have been setup in this report to satisfy the requirements from the following documents;

- City of Ryde Development Control Plan 2014;
- NSW Planning Noise Policy for Industry 2017; and
- Association of Australian Acoustical Consultants "Technical Guideline Child Care Centre Noise Assessment" 2013.

Construction noise emission management level have been setup based on requirements of NSW Interim Construction Noise Guideline and detailed noise controls will be determined at CC stage.

Construction vibration limit has been setup in in Section 10 based on requirements of DIN 4150 and EPA document Assessing Vibration: A technical guideline. Detailed vibration safeguard system will be determined at CC of each stage.

Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Consultancy Pty Ltd
Shane Nichols