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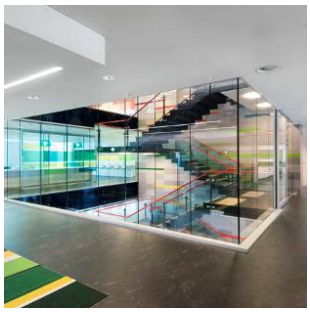

Rudds acoustics

**Noise Assessment Report**

# The Riverina Clinic

336-344 Edward Street Wagga Wagga NSW 2650

Report Number: R320057AC R1 20-04-09

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| Rev No | Reason for Issue | Author | | Approver for Issue | |
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| | | Name | Date | Name | Date |
| 00 | For Information | Jerremy Lofts | 10 March 2020 | Jerremy Lofts | 10 March 2020 |
| 01 | For Information | Jerremy Lofts | 9 April 2020 | Jerremy Lofts | 9 April 2020 |

**Qualifications of Report Writers**

This report has been prepared by Mr Jerremy Lofts, BSc. Grad Cert (env), M.A.A.S.

Mr Lofts is a senior acoustic consultant with approximately 20 years of his career specifically dedicated to acoustics. Mr Lofts has worked as an acoustic consultant since 2000 and is a member of the Australian Acoustical Society. His training includes environmental noise, architectural and building acoustics, occupational noise, road and rail noise, mine and quarry noise and blasting.

This report has been prepared in accordance with the scope of services described in the contract or agreement between Rudds Consulting Engineers Pty Ltd ABN 16 054 221 162 (Rudds) or Rudds Acoustics Pty Ltd ABN 41 147 203 610 and the client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the client. Furthermore, the report has been prepared solely for use by the client and Rudds accepts no responsibility for its use by other parties.

# Contents

# Section 1 - Introduction

The proposal is to construct a medical facility over five blocks, including 336, 338, 340, 342 and 344 Edwards Street Wagga Wagga. The purpose of this assessment is to determine ambient background noise levels and noise limits for the site for the Development Application stage of the project and to undertake a road traffic noise intrusion assessment to determine appropriate façade design.

Rudds is pleased to provide a Demolition and Construction Noise Impact Assessment and road traffic noise intrusion assessment for the project This assessment has been undertaken with reference to:

- The NSW Noise Policy for Industry (NPI, 2017).
- The NSW Interim Construction Noise Guideline.
- The Wagga Wagga Local Environmental Plan.
- The Wagga Wagga city Council Development Application and Preparation guide.
- The NSW Road Noise Policy.
- AS/NZS 2107:2016.

Figure 1 shows a proposed site plan, provided by the proponent, detailing the redevelopment. The proposal is to demolish the housing currently present on the sites and to builded a new medical facility.

**FIGURE 1 PROPOSED SITE PLAN**

Source: Provided by client.

# Section 2 - Location

The site is located on the southern side of the Sturt Highway, which is named Edward Street in this location. It is zoned R3 medium density residential and there is R1 general residential to the south. Across Edward Street to the north is land zoned B6 – Enterprise corridor, and to the west across Cullen Road the nearest land is zoned RE1 public recreation.

Therefore, the nearest, most potentially affected residential receivers are located in the R1 zoned land in Gormly Avenue to the south of the proposed site and 334 Edward Street Wagga Wagga to the east. These residential receivers all share a common boundary with the site.

# Section 3 - Noise Trigger Levels

## 3.1 General

There is a comprehensive noise control framework in NSW, with several government departments and local authorities able to regulate noise. The primary legal framework is provided by the Protection of the Environment Operations Act 1997 (POEO Act) and the Protection of the Environment Operations (Noise Control) Regulation 2008 (Noise Control Regulation).

The POEO Act identifies the authority responsible for regulating noise, defines the meaning of offensive noise and provides a range of regulatory tools to manage noise.

Section 6 of the POEO Act makes local councils responsible for regulating noise in their local government areas, unless the activities carried out on the premises are scheduled activities listed in Schedule 1 of the POEO Act, are the subject of an environment protection licence for the purpose of regulating water pollution, or are activities conducted by state or public authorities, in which case DECCW is the regulating authority. DECCW are also the regulating authority for certain non-scheduled activities, none of which are relevant to this project.

In this case, Rudds understands the local council is the responsible party for the assessment because this is a relatively small local redevelopment whose activities are not listed in Schedule 1 of the POEO Act.

Where a premises is licensed under the Liquor Act 2007, the NSW Office of Liquor, Gaming and Racing (OLGR) has regulatory powers and complaints can be made directly to the OLGR. Such complaints are typically due to unruly behaviour of patrons, or due to noise (including music) emitted from within the premises. It is generally recognised that the local council rather than the OLGR handle any complaints relating to mechanical equipment noise from licensed premises.

## 3.2 NSW Noise Policy for Industry

There have been recent changes to NSW Environmental Noise Legislation with the NSW Industrial Noise Policy (INP) being replaced by the Noise Policy for Industry (NPI) in 2017. The process for determining noise compliance limits under the NPI is very similar to the INP, with both intrusiveness and amenity noise limits still being applicable. However, minimum assumed rating background noise levels (RBL's) have increased for daytime operation to reflect the fact that receivers are likely to be more sensitive to noise being received of a night-time.

It is important to understand that the amenity noise limit is a noise limit for the cumulative impact of ALL industrial-type noise sources in the area, not just the noise emissions of one site. Where there is a significant existing industrial noise contribution, any new noise sources need to achieve lower levels of emissions so that the overall noise level of the area does not exceed these limits.

Environmental noise can be assessed according to its intrusiveness and offensiveness. The intrusiveness of noise is a quantitative measure relating to the level of noise against a pre-determined target or compliance noise level. The offensiveness of noise is a qualitative assessment based upon the level, character, time and duration of the noise, whether it is in character with the area, how often it occurs and the number of people affected. Also within the NPI and following on from the intrusiveness noise criteria is an amenity noise criteria which is essentially a recommended maximum $L_{eq}$ level for the cumulative impact of several industrial noise sources in the one area.

### 3.2.1 Project Noise Trigger Levels

The NPI, Page 7 states the following:

> *"The project noise trigger level provides a benchmark or objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures."*

The project noise trigger level is determined by determining an project intrusiveness noise level and a project amenity noise level then taking the lowest of these levels to determine an overall project noise trigger level, which is determined to be a $L_{Aeq(15\ minute)}$ dBA trigger level.

#### *3.2.1.1 Determination of Intrusiveness Trigger Levels*

Intrusiveness is assessed at residential receiver locations. The NPI states that a noise is intrusive if the $L_{Aeq}$ noise level of that noise, as measured over a 15 minute period, exceeds the $L_{A90}$ RBL, in the absence of the noise source to be assessed, by more than 5 dBA. There are two ways to determine the background noise level:

1. Measure the ambient noise level of the area and undertake an assessment of at least 7 days of valid data (wind speeds less than 5 m/s and no rainfall). Use the measured $L_{A90,\ 15\ minute}$ noise levels to determine a $L_{A90}$ RBL.
2. Assume a minimum allowable RBL as determined by the NPI.

Table 1 contains the minimum assumed rating background levels and intrusiveness noise levels as defined by the NPI.

**TABLE 1 NPI MINIMUM ASSUMED RBL'S AND INTRUSIVENESS NOISE LEVELS**

| Time of Day | Minimum assumed rating background noise level (dB[A]) | Minimum project intrusiveness noise level (dB[A]) |
|---|---|---|
| Day | 35 | 40 |
| Evening | 30 | 35 |
| Night | 30 | 35 |

Notes:

1. Day is 7 am to 6 pm
2. Evening is 6 pm to 10 pm
3. Night is 10 pm to 7 am

In this particular case, long-term noise logging was used to determine RBL's and the project intrusiveness noise levels.

### 3.2.2 Determination of Amenity Noise Trigger Levels

It is important to understand that this is a noise limit for the cumulative impact of ALL industrial-type noise sources in the area, not just the noise emissions of one site. Table 2 is a re-production of the NSW INP Table 2.1. Where there is a significant existing industrial noise contribution, any new noise sources need to achieve lower levels of emissions so that the overall noise level of the area does not exceed these limits. This adjustment factor can be found in the NSW INP Table 2.2 and is re-produced in Table 2.

**TABLE 2 AMENITY CRITERIA LEVELS**

| Type of Receiver | Indicative Noise Amenity Area | Time of Day | Recommended $L_{Aeq}$ Noise level (dBA) |
|---|---|---|---|
| **Residential** | Rural | Day | 50 |
| | | Evening | 45 |
| | | Night | 40 |
| | **Suburban** | **Day** | **55** |
| | | **Evening** | **45** |
| | | **Night** | **40** |
| | Urban | Day | 60 |
| | | Evening | 50 |
| | | Night | 45 |
| Hotels, motels, caretakers quarters, holiday accommodation, permanent resident caravan parks | See column 4 | See column 4 | 5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day |
| School classrooms – internal | All | Noisiest 1-hour period when in use | 35 (see notes for table) |
| Hospital ward | | | |
| – internal | All | Noisiest 1-hour period | 35 |
| – external | All | Noisiest 1-hour period | 50 |
| Place of worship – internal | All | When in use | 40 |
| Area specifically reserved for passive recreation (e.g. National Park) | All | When in use | 50 |

| Type of Receiver | Indicative Noise Amenity Area | Time of Day | Recommended $L_{Aeq}$ Noise level (dBA) |
|---|---|---|---|
| Active recreation area (e.g. school playground, golf course) | All | When in use | 55 |
| Commercial premises | All | When in use | 65 |
| Industrial premises | All | When in use | 70 |
| Industrial interface (applicable only to residential noise amenity areas) | All | All | Add 5 dB(A) to recommended noise amenity area |

Notes:

1. Day is 7 am to 6 pm
2. Evening is 6 pm to 10 pm
3. Night is 10 pm to 7 am

In addition, in areas where high traffic noise may mask noise from an industrial source, effectively making the industrial nose inaudible, the project amenity noise level may be derived from the traffic noise level using the following methodology, described on page 13 of the NPI:

*High traffic project amenity noise level for industrial developments = $L_{Aeq,period(traffic)}$ minus 15 dBA.*

### 3.2.3 Maximum Noise Level Event Assessment

There is also a maximum noise event assessment for sleep disturbance. This is only relevant for night-time operations and is as follows for residential locations:

- $L_{Aeq,15minute}$ 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 15dB, whichever is greater.

### 3.2.4 Determination of Offensiveness

The NPI contains modifying factors that are to be used to assess the offensiveness of noise. These modifying factors include adjustments for the character and duration of noise events. The primary modifying factors, as written in Fact Sheet C, pages 57-58 of the NPI are shown in Table 3.

**TABLE 3 MODIFYING FACTOR CORRECTIONS**

| Factor | Assessment/ Measurement | When to apply | Correction[1] | Comments |
|---|---|---|---|---|
| Tonal Noise | One-third octave or narrow band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2- | Level of one-third octave band exceeds the level of the adjacent bands on both sides by:<br>- 5 dB or more if the centre frequency of the band containing the tone is above 400 Hz<br>- 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive | 5 dB[2,3] | Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it |

| Factor | Assessment/ Measurement | When to apply | Correction[1] | Comments |
|---|---|---|---|---|
| | 2007-Annex D) | - 15 dB or more if the centre frequency of the band containing the tone is below 160 Hz | | appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands. |
| Low frequency noise | Measurement of C-weighted and A-weighted level and one-third octave measurements in the range 10-160 Hz | Measure/assess C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more and:<br>• where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2- dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period<br>• where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2- dB(A) positive adjustment applies for the daytime period. | 5 dB[2] | A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations. |
| Intermittent noise | Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level. | The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible. | 5 dB | Adjustment to be applied for **night-time only**. |
| Duration | Single-event noise duration may range from 1.5 min to 2.5 h | One event in any 24-hour period | 0 to – 20 dB(A) | The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3). |

| Factor | Assessment/ Measurement | When to apply | Correction[1] | Comments |
|---|---|---|---|---|
| Maximum adjustment | Refer to individual modifying factors | Where two or more modifying factors are indicated | Maximum of correction of 10 dB(A)[2] (excluding duration correction) | |

Notes:

1. Corrections to be added to the measured or predicted levels.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range.
3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

## 3.3 NSW Interim Construction Noise Guideline

### 3.3.1 Airborne Noise

While the interim construction noise guideline is specifically aimed at managing noise from construction works regulated by the DECC, meaning it is not specifically required in this instance, it still forms an excellent basis for best practice assessment and will be used to provide an indication of the likely noise exposure of residents surrounding this particular construction site.

Recommend standard hours for normal construction:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays.

If it is necessary for work to occur outside these hours, clear justification should be provided.

Both quantitative and qualitative assessments are allowable. Undertaking an assessment using the quantitative method, an operating only within the recommended standard construction hours, the following noise management levels are recommended:

- Premises are not considered noise affected if the $L_{Aeq(15\ minute)}$ noise level received is lower than the RBL plus 10 dBA.
- Premises are considered noise affected when the $L_{Aeq(15\ minute)}$ noise level received is higher than the RBL plus 10 dBA, but less than $L_{Aeq(15\ minute)}$ 75 dB(A).

  The noise affected level is the level above which there may be some community reaction to noise. Where this level is exceeded, the proponent should apply all reasonable and feasible work practices to meet the noise affected level. The proponent should also inform potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
- Premises are considered highly noise affected when the $L_{Aeq(15\ minute)}$ noise level received is 75 dB(A) or higher

  The highly noise affected level is the level above which there may be strong community reaction to noise. Where noise is above this level, respite periods may be required, by restricting the hours that the very noisy activities can occur, taking into account the times identified by the community when they are less sensitive to noise and /or whether the community is willing to accept a longer construction period in exchange for restrictions on construction times.

In all cases, any operation outside the standard hours for normal construction should achieve a $L_{Aeq(15\ minute)}$ noise level not exceeding the RBL plus 5 dBA.

#### *3.3.1.1 AS2436 – 2010 Noise from Construction Work*

AS2436 – 2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* provides a series of recommendations to minimise noise and vibration from construction activities. The engineering principles commonly used to control noise fall into the following broad categories:

1. Controlling noise at the source. This includes selecting quiet equipment where possible and maintaining the equipment in accordance with manufacturers specifications.
2. Controlling the spread of noise. This includes siting potentially noisy equipment in a location that minimises noise spill to adjoining sites and providing shielding, where necessary, to further reduce noise from equipment.
3. Controlling noise at the receiver. This includes providing acoustic shielding near the residences. Where this is insufficient, further noise mitigation may be necessary to achieve a satisfactory outcome for the residents.

The principle control measure should always be to control the noise at the source, followed by controlling the spread of noise and then finally controlling noise at the receiver should be the last option chosen of all other options are not sufficient to reduce noise to within acceptable levels.

### 3.3.2 Ground Borne Noise

Ground-borne noise is generated by vibration transmitted through the ground into a structure. It is most commonly associated with underground works such as tunnelling. No underground works are expected at this site, so ground-borne noise should not pose an issue.

## 3.4 Road Traffic Noise Intrusion

### 3.4.1 NSW Road Noise Policy

Based on the NSW Road Noise Policy, the target noise level for existing roads not subject to redevelopment are as shown in Table 4. Where these noise levels are not met, consideration should be given to reasonable and feasible noise mitigation measures to reduce noise.

**TABLE 4 TARGET NOISE LEVEL FOR EXISTING ROADS**

| **Existing Road Category** | **Target Noise Level (dBA)** | |
|---|---|---|
| | **Day (7 am to 10 pm)** | **Night (10 pm to 7 am)** |
| Freeway/Arterial/Sub-arterial Road | LAeq(15 hour) 60 (external) | LAeq(9 hour) 55 (external) |
| Local Road | LAeq(1 hour) 55 (external) | LAeq(1 hour) 50 (external) |

One method of noise reduction is to design the façade of the development to meet suitable internal noise levels. In the case of a health facility development like this project, the following internal noise levels are acceptable:

- Hospital Wards $L_{Aeq}$(1hour) 35 internal, day or night.
- Other areas in a health care facility to AS/NZS 2107.

### 3.4.2 AS / NZS 2107:2016

The relevant standard for steady-state or quasi-steady-state noise within the building is Australian/New Zealand Standard AS/NZS 2107:2016 *Acoustics-Recommended design sound levels and reverberation times for building interiors*.

Recommended noise levels are $L_{Aeq,\ T}$ values for the building unoccupied but ready for occupancy and the recommended reverberation times are for the occupied building.

The recommended goals for this building are based upon equivalent spaces within appropriate buildings. Our recommended project goals are summarised in Table 5.

**TABLE 5 AS/NZS 2107:2016 RECOMMENDED NOISE LEVELS AND REVERBERATION TIMES**

| Type of Occupancy | Recommended Design Sound Level Range $L_{Aeq}$, dB(A) | Recommended Reverberation Time (T), seconds |
|---|---|---|
| **Health Buildings** | | |
| Corridors and lobbies | <50 | See Note 1 |
| Consulting rooms | 40 to 45 | 0.6 to 0.8 |
| Dining areas | 40 to 45 | See Note 1 |
| Kitchens, sterilizing and service areas | <55 | See Note 1 |
| Nurses stations | 40 to 45 | 0.4 to 0.7 |
| Office areas | 35 to 45 | 0.4 to 0.7 |
| Patient lounge | 40 to 45 | 0.4 to 0.6 |
| Post-op, pre-op, recovery rooms | 40 to 45 | 0.4 to 0.6 |
| Staff rooms | 40 to 45 | 0.4 to 0.6 |
| Surgeries, treatment, procedure rooms | 40 to 45 | 0.4 to 0.7 |
| Utility rooms | 50 to 60 | - |
| Ward bedrooms – single occupancy | 35 to 40 | 0.4 to 0.7 |
| Waiting rooms, reception areas | 40 to 50 | <0.7 |

Note 1: Reverberation time should be minimised for nose control.

It should be noted that the recommended noise level range provides a recommended minimum noise level to provide acoustic masking that will help to improve speech privacy. When designing building services systems, it is highly unlikely to be possible to design to such a tight tolerance. This is primarily because of the variable nature of modern air handling systems. Therefore, it is likely that there will be some areas within the building that will have internal noise levels below the minimum values recommended in Table 5, especially when building services are running at low speed and/or are in night mode and/or when supplementary systems are not operating. In these areas, if the user requires the minimum values to be achieved, a sound masking system is likely to be required.

# Section 4 - Determination of Project Trigger Levels

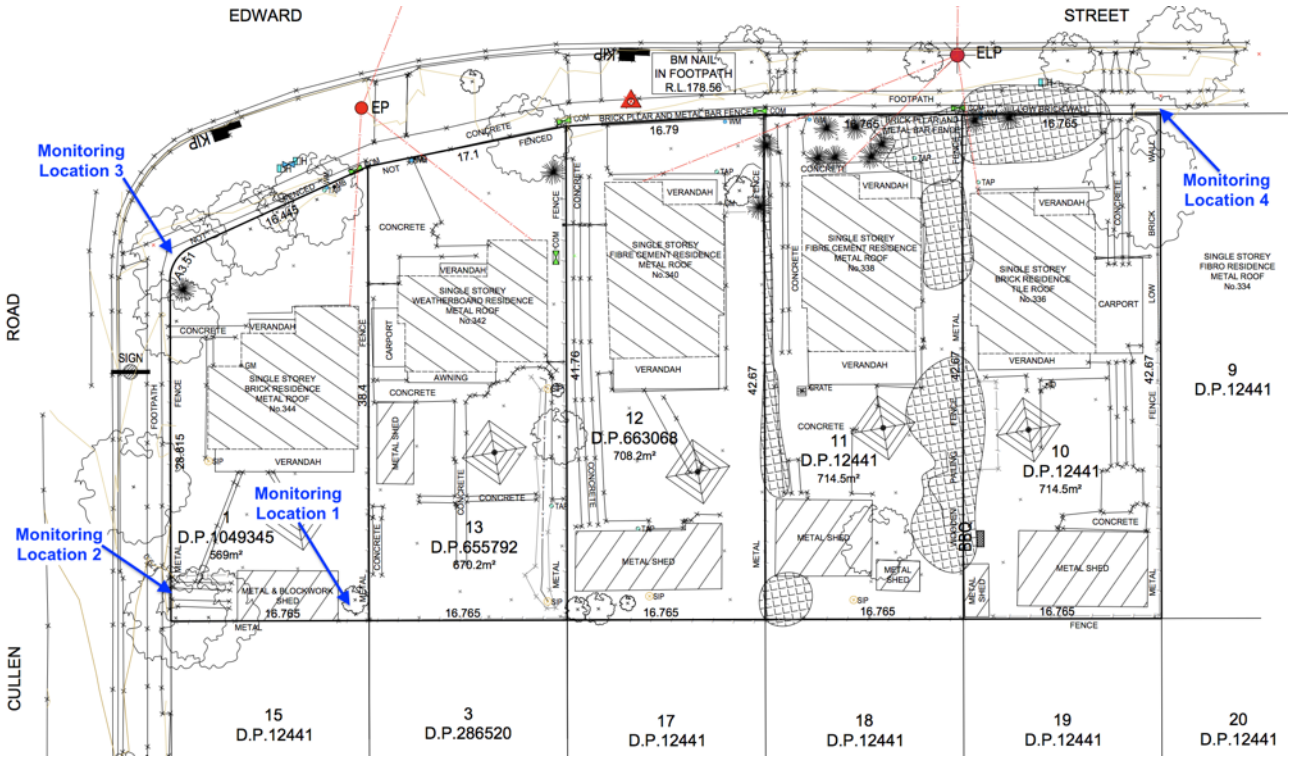
## 4.1 Background Noise Monitoring

### 4.1.1 Noise Logging

Rudds undertook background noise monitoring using an ARL EI316 environmental noise logger near the southern (rear) boundary of No.344 from Monday 3 February to Friday 14 February 2020. This location was chosen to minimise disturbance to neighbouring residents while providing a secure and representative location for determination of the background noise of the area. This effectively gave 11 full 24 hour periods of noise monitoring to use to determine the RBL's and associated intrusiveness noise trigger levels.

The noise monitoring locations are shown in Figure 2. Noise Monitoring Location 1 was where the noise logger was places, and noise monitoring locations 2, 3 and 4 were where operator attended short-term noise measurements were undertaken to determine the ambient noise conditions present at the site.

**FIGURE 2 NOISE MONITORING LOCATIONS**




Source: Base survey map provided by client.

The results of background noise measurements are shown in Table 6 with daily graphs for both noise monitoring locations provided in Appendix A.

**TABLE 6 NOISE LOGGER 1 - MEASURED BACKGROUND NOISE LEVELS**

| Date | LAeq | | | LA90 | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| Monday, 3 February 2020 | - | 49 | 46 | - | 38 | 29 |
| Tuesday, 4 February 2020 | 51 | 50 | 49 | 44 | 41 | 33 |
| Wednesday, 5 February 2020 | 51 | 50 | 48 | 44 | 39 | 34 |
| Thursday, 6 February 2020 | 53 | 56 | 48 | 47 | 44 | 33 |
| Friday, 7 February 2020 | 53 | 53 | 47 | 47 | 44 | 35 |
| Saturday, 8 February 2020 | 53 | 52 | 48 | 42 | 44 | 34 |
| Sunday, 9 February 2020 | 52 | 50 | 48 | 39 | 41 | 33 |
| Monday, 10 February 2020 | 53 | 52 | 46 | 46 | 42 | 35 |
| Tuesday, 11 February 2020 | 52 | 49 | 48 | 44 | 39 | 36 |
| Wednesday, 12 February 2020 | 52 | 49 | 47 | 45 | 41 | 39 |
| Thursday, 13 February 2020 | 52 | 53 | 49 | 46 | 45 | 38 |
| | | | | | | |
| **Overall** | 52 | 52 | 48 | 44 | 41 | 34 |

### 4.1.2 Operator Attended Noise Monitoring

Operator attended noise measurements were undertaken at the site. The measurement locations were logger location number 1 (as shown in Figure 2), and locations 2,3 and 4. These locations were primarily used to determine short-term road traffic noise intrusion levels for assessment of the proposed building façade. The results of these measurements, rounded to the nearest 15 minute period, are contained in Table 7.

**TABLE 7 OPERATOR ATTENDED NOISE MEASUREMENT RESULTS**

| Location 3<br>3:50 pm<br>3/2/2020 | LAmax | LA10 | LAeq | LA90 | LAmin |
|---|---|---|---|---|---|
| | 80 | 70 | 67 | 58 | 52 |
| **Comments / Noise Sources**<br>Constant road traffic, including significant heavy vehicle content, occasional dog barking | | | | | |
| Location 2<br>4:10 pm<br>3/2/2020 | LAmax | LA10 | LAeq | LA90 | LAmin |
| | 77 | 63 | 60 | 55 | 52 |
| **Comments / Noise Sources**<br>Constant road traffic off Edward Street. Occasional wind in trees. | | | | | |
| Location 1<br>4:300 pm<br>3/2/2020 | LAmax | LA10 | LAeq | LA90 | LAmin |
| | 77 | 58 | 56 | 50 | 46 |
| **Comments / Noise Sources**<br>This site was relatively well shielded from road traffic noise, but road traffic noise was still the dominant noise source. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Location 3<br>5:05 pm<br>3/2/2020 | **LAmax** | **LA10** | **LAeq** | **LA90** | **LAmin** |
| | 78 | 70 | 67 | 59 | 54 |
| **Comments / Noise Sources**<br>Primarily road traffic off Edwards Street. | | | | | |
| Location 1<br>10:30 am<br>14/2/2020 | **LAmax** | **LA10** | **LAeq** | **LA90** | **LAmin** |
| | 74 | 56 | 53 | 47 | 41 |
| **Comments / Noise Sources**<br>Primarily road traffic off Edward Street. Occasional birds. | | | | | |
| Location 2<br>10:45 am<br>14/2/2020 | **LAmax** | **LA10** | **LAeq** | **LA90** | **LAmin** |
| | 75 | 61 | 59 | 52 | 48 |
| **Comments / Noise Sources**<br>Primarily road traffic off Edward Street. Occasional birds. | | | | | |
| Location 3<br>11:00 am<br>14/2/2020 | **LAmax** | **LA10** | **LAeq** | **LA90** | **LAmin** |
| | 79 | 70 | 67 | 58 | 50 |
| **Comments / Noise Sources**<br>Primarily road traffic off Edward Street. | | | | | |
| Location 4<br>11:20 am<br>14/2/2020 | **LAmax** | **LA10** | **LAeq** | **LA90** | **LAmin** |
| | 82 | 73 | 69 | 60 | 52 |
| **Comments / Noise Sources**<br>Road traffic off Edward Street. | | | | | |

These measurements indicate a very busy road and significant road traffic noise across the northern boundary of the site, reducing the further south the measurements are taken (with increasing distance from Edward Street). It is clear that road traffic dominates the ambient noise environment of the area. While there are commercial and industrial areas to the north and west, noise from these areas was minimal and did not contribute significantly to the measured noise levels.

There were occasional cars travelling along Cullen Road, but the low traffic speed at this intersection combined with very low traffic flow numbers in Cullen Street mean it was not a significant contributor to noise at the site.

## 4.2 Project Operational Noise Trigger Levels

Based on the noise measurements undertaken at the site and the determination that the site is in a suburban area, the project noise trigger levels are shown in Table 8. The project noise trigger levels are the lowest of the intrusiveness and amenity levels.

**TABLE 8 NPI NOISE TRIGGER LEVELS**

| Time of Day | Measured rating background noise level (dB[A]) | Project intrusiveness noise level (dB[A]) | Project amenity noise level (dB[A]) | Project trigger noise level ($L_{Aeq,\ 15\ minute}$, dBA) |
|---|---|---|---|---|
| Day<br>7 am to 6 pm | 44 | 49 | 55 | **49** |
| Evening<br>6 pm to 10 pm | 41 | 46 | 45 | **45** |
| Night<br>10 pm to 7 am | 34 | 39 | 40 | **39** |

Notes:

1. Day is 7 am to 6 pm
2. Evening is 6 pm to 10 pm
3. Night is 10 pm to 7 am
4. The project trigger noise level is the lowest of the intrusiveness and amenity noise levels, adjusted to an $L_{Aeq(15\ minute)}$ noise level.

Based on this assessment, the allowable $L_{Aeq\ (15\ minute)}$ noise trigger levels will be 49 dBA daytime, 45 dBA evening and 39 dBA night-time at all residences surrounding the subject site.

There is also a maximum noise event assessment for sleep disturbance. This is only relevant for night-time operations and is as follows for residential locations:

- $L_{Aeq,15minute}$ 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 greater.

This makes the sleep disturbance assessment level $L_{Aeq,15minute}$ 40 dB(A) and/or $L_{AFmax}$ 52 dB(A).

## 4.3 Project Construction Noise Management Levels

Based on the noise measurements undertaken at the site the project construction noise management levels are shown in Table 9.

**TABLE 9 CONSTRUCTION NOISE MANAGEMENT LEVELS**

| Time of Day | Measured rating background noise level (dB[A]) | Project Management noise level ($L_{Aeq,\ 15\ minute}$, dBA) |
|---|---|---|
| 7 am to 6 pm Monday to Friday, 8 am to 1 pm Saturday | 44 | **54**<br>**(Noise affected level)** |
| All Other Times | 41 | **46**<br>**(Noise affected level)** |
| Highly Noise Affected | N/A | **75**<br>**(Highly Noise Affected Level)** |
| Commercial Receivers | N/A | **70**<br>**(Noise affected level)** |

# Section 5 - Construction Noise Modelling and Assessment

## 5.1 Demolition and Construction

The first phase is expected to be demolition of the existing residential dwellings and site preparation for the new development. The site will then be established and site sheds installed.

It is our current understanding that the new building will be a single storey slab on ground, so construction will be similar to a domestic build. This, and the relatively flat nature of the site means there will be little excavation, with most excavation works being for drainage and other in-ground services. This will be followed by preparation and pouring of the concrete slab, the structure, the façade and roof. Building services installation will occur concurrently with structural, façade and roof construction. Given the size of the site, access by small trade utilities an the like will be limited, so Rudds has concentrated on the larger (and noisier) equipment expected to be used at the site. It is understood that no rock breaking, impact piling or the like will be involved.

Therefore, Rudds has broken the demolition/construction stage into the following phases and equipment:

- Demolition – which is likely to be of short duration.
    - 25 tonne excavator with bucket or claw.
    - Concrete breaker (impact hammer on excavator).
    - Waste removal trucks (Dump trucks).
- Excavation and in-ground services reticulation.
    - Small tracked excavator.
    - Small bucket loader or similar.
- Structural slab preparation and pouring.
    - Telescopic handler.
    - Delivery trucks.
    - Concrete trucks.
    - Concrete pumper.
    - Grinders and small had tools.
    - Diesel generator
- Structure, Services, Façade and roofing.
    - Delivery trucks.
    - Small wheeled backhoe loader or similar.
    - Telescopic handler (Manitou or similar).
    - Hand tools, including drop saws, grinders, etc.
    - Waste removal trucks – skip bin collection.
    - Diesel generator
    - Mobile telescopic Crane (100 tonne)

Rudds has referred to the NSW Interim Construction Noise Guideline and the UK Department for Environment, Food and Rural Affairs (Defra) Update of *Noise Database for Prediction of Noise on Construction and Open Sites* for determination of equipment noise levels. Where equipment was not in this database it has been sourced from a Rudds database of similar equipment.

The noise levels of the equipment proposed for the construction activities are shown in Table 10.

**TABLE 10 CONSTRUCTION EQUIPMENT SOUND POWER LEVELS**

| Equipment | Octave Frequency Band Sound Power Levels, dB, Hz | | | | | | | | Total dBA |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | |
| 25 tonne excavator | 123 | 112 | 107 | 101 | 98 | 96 | 92 | 85 | 105 |
| Concrete Breaker on excavator | 116 | 116 | 114 | 117 | 111 | 111 | 108 | 104 | 118 |
| Excavator loading dump truck | 110 | 106 | 110 | 109 | 109 | 106 | 100 | 92 | 113 |
| Articulated semi-trailer for deliveries | 101 | 106 | 106 | 106 | 102 | 101 | 96 | 94 | 108 |
| Concrete mixer truck | 100 | 101 | 107 | 100 | 97 | 95 | 91 | 88 | 104 |
| Concrete pumper | 111 | 109 | 106 | 107 | 105 | 102 | 99 | 94 | 110 |
| Telescopic handler | 107 | 101 | 94 | 93 | 106 | 94 | 82 | 75 | 107 |
| Waste truck – skip collection | 110 | 112 | 106 | 103 | 99 | 98 | 93 | 87 | 109 |
| Grinder grinding steel | 85 | 79 | 80 | 88 | 98 | 105 | 101 | 101 | 106 |
| Drop saw | 73 | 74 | 71 | 84 | 93 | 91 | 97 | 96 | 102 |
| Diesel Generator - 150 kVA | 107 | 102 | 95 | 92 | 83 | 79 | 73 | 68 | 93 |
| 100 tonne telescopic crane | 101 | 99 | 96 | 98 | 94 | 91 | 82 | 77 | 99 |
| wheeled backhoe loader (8 tonne) | 102 | 94 | 92 | 92 | 91 | 88 | 87 | 78 | 96 |
| mini tracked excavator (5 tonne) | 99 | 99 | 96 | 87 | 87 | 86 | 82 | 76 | 93 |

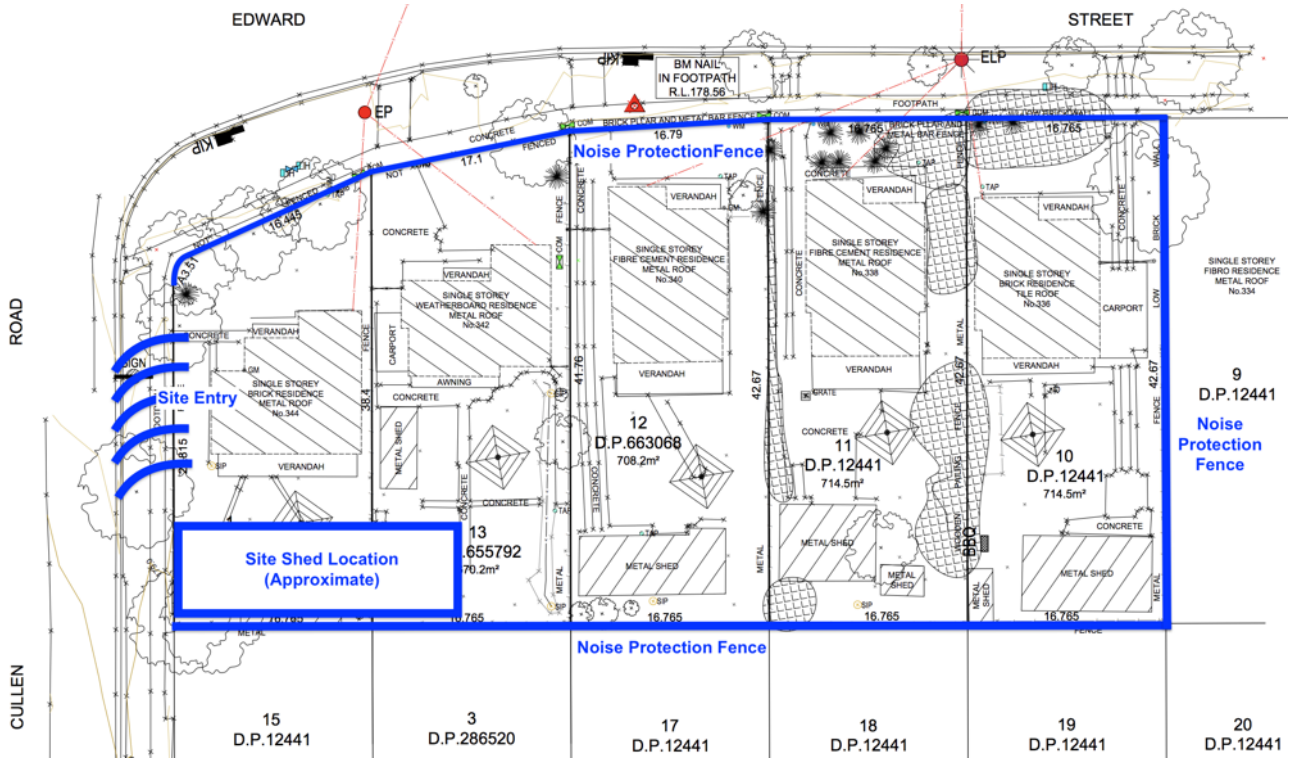
The site is expected to be accessed off Cullen Road. It is recommended that the entry be as far north on the site as possible, constructing the site sheds on the south western corner of the site, if this is a viable construction option and does not significantly impact upon the construction sequencing. This moves any potential vehicle deliveries further from the nearest residence behind and uses the site sheds as an acoustic barrier to the nearest residence at the south western corner the site.

If a site generator is required, it needs to be shielded from nearby residences as it is likely to be operating continuously. A generator should also be chosen for quiet operation to minimise the likelihood of excessive noise at adjoining properties.

As noise mitigation measures are expected to be required, Rudds has included an acoustic barrier fence in the calculation. This barrier fence is to be at least 2.4 metres high and is to be constructed along the entire northern, southern and eastern boundaries of the site, leaving site access to the west. A plywood barrier or similar is acceptable. It must be solid, have no gaps or cracks, and it must be continuous. The only opening should be for site access at the western end of the site. Consideration should be given to increasing the height of this fence to 3.5 metres on the southern and eastern sides to help protect the nearest residences, as discussed later in this report.

The proposed location of the site sheds and the acoustic barriers is shown in Figure 3.

**FIGURE 3 SITE NOISE MITIGATION MEASURES**




Based on these noise levels, and assuming all equipment operating at full power simultaneously (i.e. potential worst case situation) Rudds has predicted the noise level at the adjoining residential properties.

The predicted noise levels due to the various construction stages are shown in Table 11.

**TABLE 11 PREDICTED CONSTRUCITON NOISE LEVELS**

| Construction Stage | Predicted $L_{Aeq(15\ minute)}$ Noise Level (dBA) | | Management Noise Level $L_{Aeq(15\ minute)}$ (dBA) |
|---|---|---|---|
| | Nearest Residences in Gormly Avenue & 334 Edward Street | Properties across Edward Street | |
| Demolition with concrete breaking activities | Up to 75 | Up to 64 | Noise Affected: 54<br>Highly Noise Affected: 75<br>Commercial 70 |
| General Demolition and waste removal | Up to 64 | Up to 53 | |
| Excavation and site preparation | Up to 54 | Up to 54 | |
| Structural Slab preparation – formwork and reinforcing steel | Up to 67 | Up to 52 | |
| Structural slab pour | Up to 67 | Up to 52 | |
| Building structure, services, façade and roofing | Up to 68 | Up to 57 | |

As is to be expected, the demolition phase is likely to be the loudest phase, but is also likely to be the shortest phase, with most noisy works to demolish and remove the existing buildings only expected to last a few days to a week.

The noise management level of 70 dBA is achieved at all commercial receivers to the north, across Edward Street.

In all cases, the management noise level is expected to be exceeded at the nearest residential receivers when activity at the site is high. During most phases, the management noise level will be exceeded, with general building works typically less than 64 dBA to 68 dBA. This is roughly the same as the existing road traffic noise level that the Edward Street properties experience of a daytime.

Increasing the height of the barrier can improve the acoustic attenuation afforded. Increasing the height from 2.4 to 3.5 metres results in an additional 4 dBA to 6 dBA of attenuation, and could be considered if necessary to further reduce noise levels closer to the noise affected management level.

During the demolition stage, there will be periods where the nearby residences are likely to be considered highly noise affected. Therefore, when demolition occurs, respite periods are likely to be required, by restricting the hours that the very noisy activities can occur, taking into account the times identified by the community when they are less sensitive to noise and scheduling louder activities to occur at these times.

For the rest of the construction period, the proponent should apply all reasonable and feasible work practices to meet the noise affected level. The proponent should also inform potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

A complaints register is to be kept on-site at all times.

# Section 6 - Noise Intrusion Assessment

It is understood that a road noise barrier or the like externally is not the preferred option and that building measures are preferred to minimise noise intrusion into occupied areas of the building. To this end, Rudds has undertaken an assessment of noise levels to determine the level of noise intrusion into the building based on the selected facade system and site layout.

Based upon analysis of noise logging f=data and operator attended noise measurements, Rudds expects the following noise levels at the northern façade of the property:

- $L_{eq(15\ hour)}$ day 66 dBA
- $L_{eq(9\ hour)}$ night 62 dBA

This will reduce by approximately 3 dBA at the façade of the wards toward the rear of the site.

On the understanding that wards are also required to meet the requirements of a daytime, the night-time noise level is irrelevant. Meeting daytime noise limits will also result in night-time levels being met.

Therefore, Rudds assessment of noise intrusion requirements is presented in Table 12, based on a façade noise level of 66 dBA at the northern façade and 63 dBA at the ward bedrooms.

**TABLE 12 FAÇADE REDUCTION ASSESSMENT**

| Type of Occupancy | Recommended Design Sound Level Upper Limit $L_{Aeq}$, dB(A) | Recommended Noise Reduction |
|---|---|---|
| **Health Buildings** | | |
| Corridors and lobbies | <50 | 16 |
| Consulting rooms | 45 | 21 |
| Dining areas | 45 | 21 |
| Kitchens, sterilizing and service areas | 55 | 11 |
| Nurses stations | 45 | 21 |
| Office areas | 45 | 21 |
| Patient lounge | 45 | 21 |
| Post-op, pre-op, recovery rooms | 45 | 21 |
| Staff rooms | 45 | 21 |
| Surgeries, treatment, procedure rooms | 45 | 21 |
| Utility rooms | 60 | 6 |
| Ward bedrooms – single occupancy | 40 (AS/NZS 2107)<br>35 (NSW Road Noise Policy) | At least 28 to meet 35 dBA from 63 dBA external. |
| Waiting rooms, reception areas | 50 | 16 |

Rudds has also received the following information from the cloent:

- Minimum glazing will be 6 mm glass externally, then 12 mm argon filled cavity to 6.38 mm laminated safety glass internally.
- Corridor and public area minimum glazing will be 6 mm glass externally, then 12 mm argon filled cavity to 10.38 mm laminated safety glass internally.

Based on this assessment, the following minimum construction is proposed:

- External walls with an acoustic rating of at least Rw 45.
- Window framing system capable of providing a positive seal when closed. Awning windows or fixed windows are excellent for this purpose. Sliding windows can be used, but must be provided with acoustic seals and should be supported by manufacturer data proving they meet the acoustic requirements.
- Window frames must be sealed into the façade. Where packing is provided between windows and frames, these gaps must be fully sealed prior to fitting architraves.
- Glazing to all areas except north facing ward bedroom windows s to be minimum 6 mm glass externally, then 12 mm argon filled cavity to 6.38 mm laminated (or 10.38 mm laminated in the case or corridors and public areas) safety glass internally.
- Glazing to north facing ward bedrooms (with exposure to the road) to be minimum 10 mm glass externally, then 12 mm argon filled cavity to 6.38 mm laminated safety glass internally, or 6 mm glass externally, then 12 mm argon filled cavity to 10.38 mm laminated safety glass internally. Ward bedroom windows facing south can be 6 mm glass externally, then 12 mm argon filled cavity to 6.38 mm laminated safety glass internally.
- The egress door at the eastern end of the ward bedroom corridor is to be fitted with acoustic seals and is to be fully acoustically sealed. This is to minimise noise intrusion into the ward bedrooms through the corridor, expecting that internal bedroom doors are likely to remain open much of the time.

# Section 7 - Conclusion

Rudds has undertaken background noise measurements to determine rating background noise levels for the construction of a medical facility over five blocks, including 336, 338, 340, 342 and 344 Edwards Street Wagga Wagga. The purpose of this assessment was to determine noise limits and noise intrusion treatments for the site for the Development Application stage of the project, and to prepare a Demolition and Construction Noise Impact Assessment for the project This assessment has been undertaken with reference to:

- The NSW Noise Policy for Industry (NPI, 2017).
- The NSW Interim Construction Noise Guideline.
- The Wagga Wagga Local Environmental Plan.
- The Wagga Wagga city Council Development Application and Preparation guide.
- The NSW Road Noise Policy.
- AS/NZS 2107:2016.

This assessment finds that the project management levels can be achieved at the commercial receivers to the north across Edward Street, but due to the close proximity of residential receivers to the east and south of the site, there will be periods during construction that will exceed the construction noise management levels at these nearby residences.

In order to mitigate these exceedances, an acoustic barrier is proposed for the site, and it is also recommended that noisy activities be undertaken at periods where the local community is least sensitive to noise. This should be planned in consultation with the community.

For the rest of the construction period, the proponent should apply all reasonable and feasible work practices to meet the noise affected level. The proponent should also inform potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

A complaints register is to be kept on-site at all times.

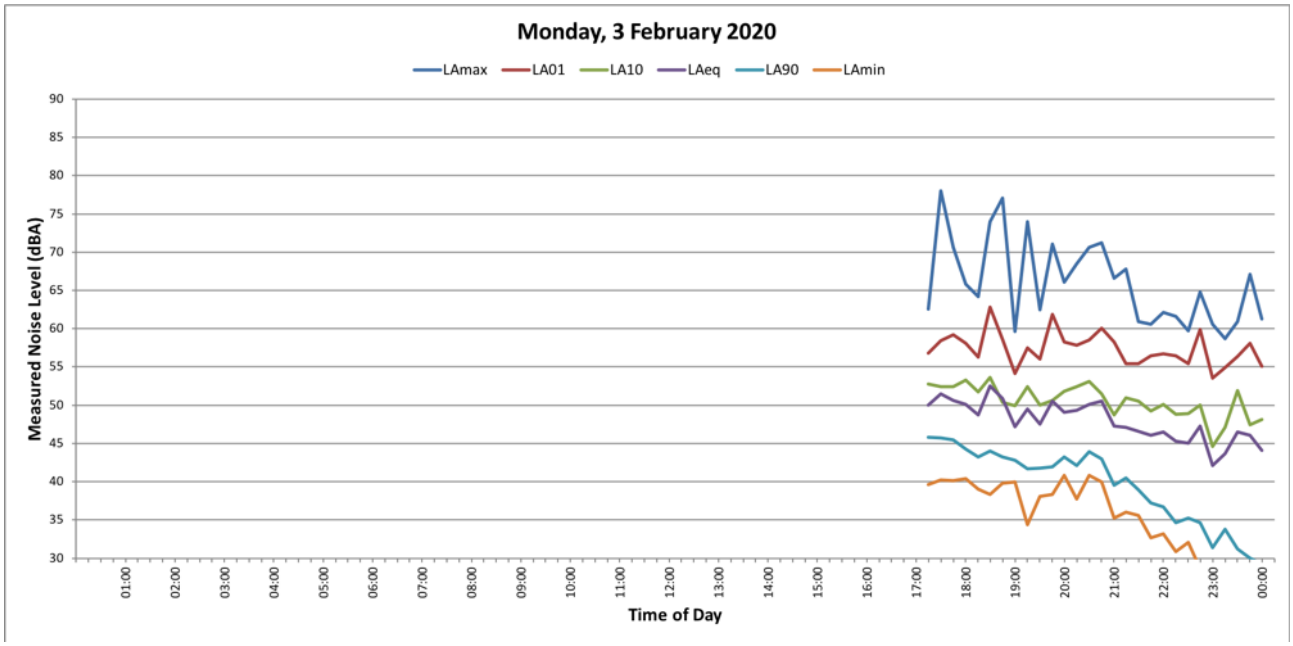
Noise intrusion into the development can be addressed through appropriate construction of façade elements, with advice on suitable construction being provided in this report.

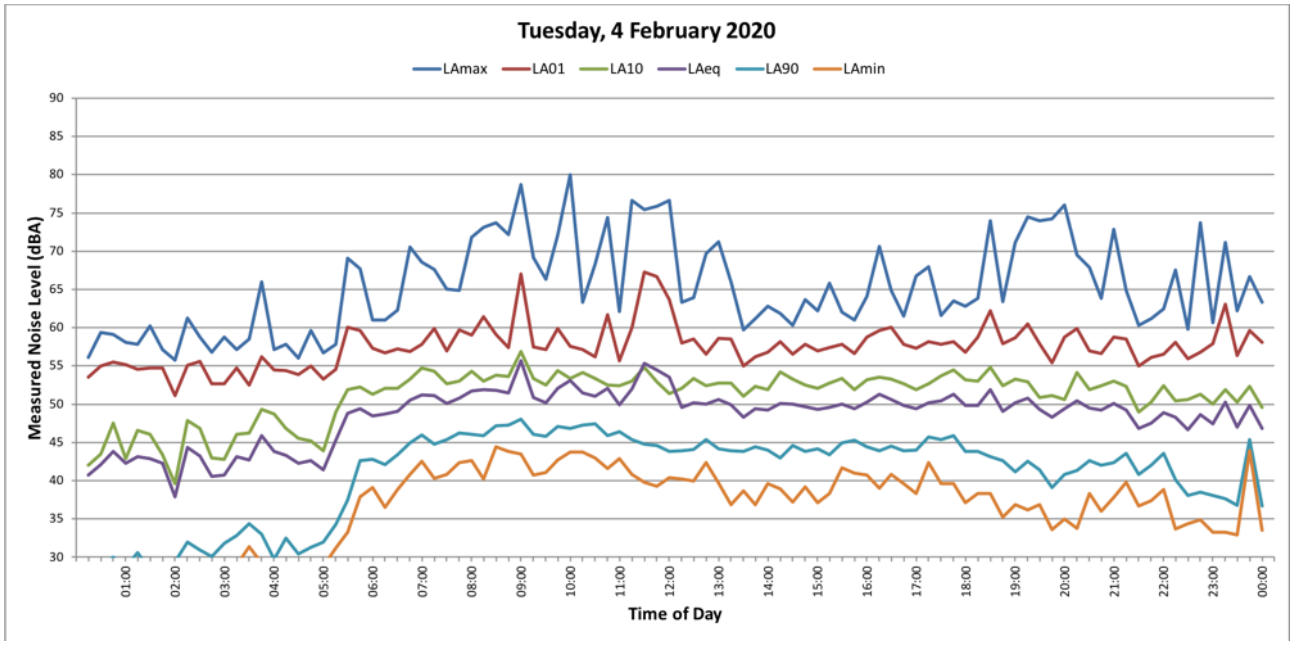
Rudds trusts this information meets your current requirements. For any questions or comments, please do not hesitate to contact Rudds on 02 6240 2900.

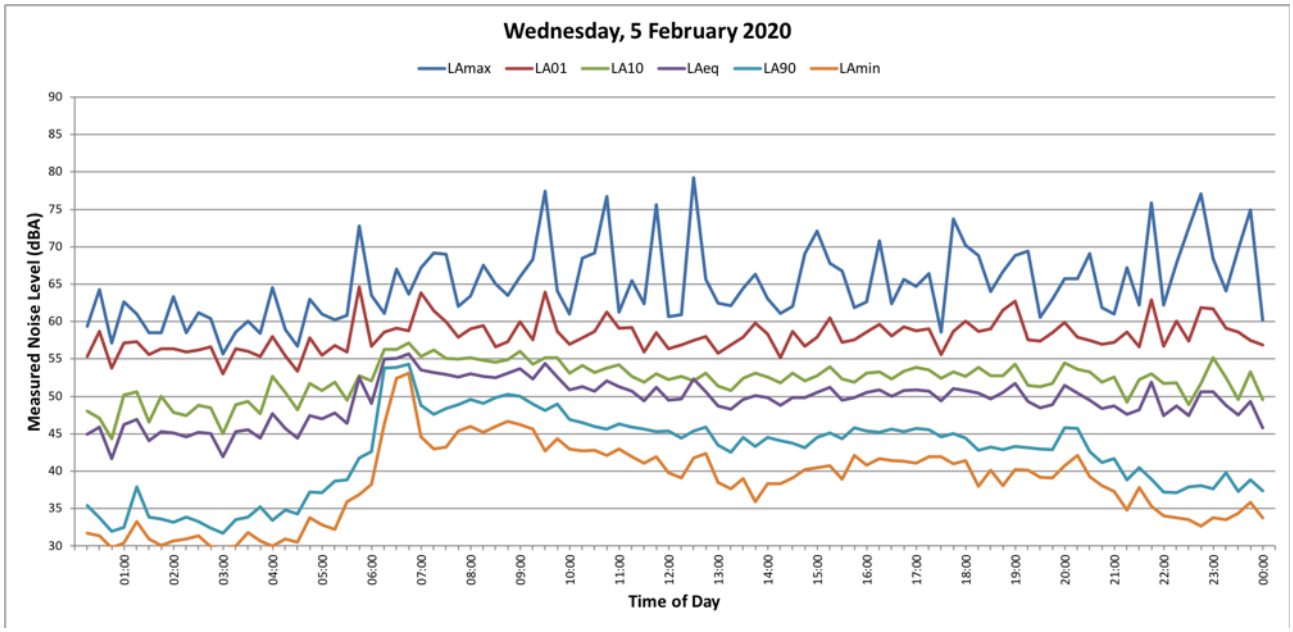
Jerremy Lofts BSc. Grad Cert(Env.) M.A.A.S.

# Appendices

## APPENDIX A NOISE LOGGER RESULTS

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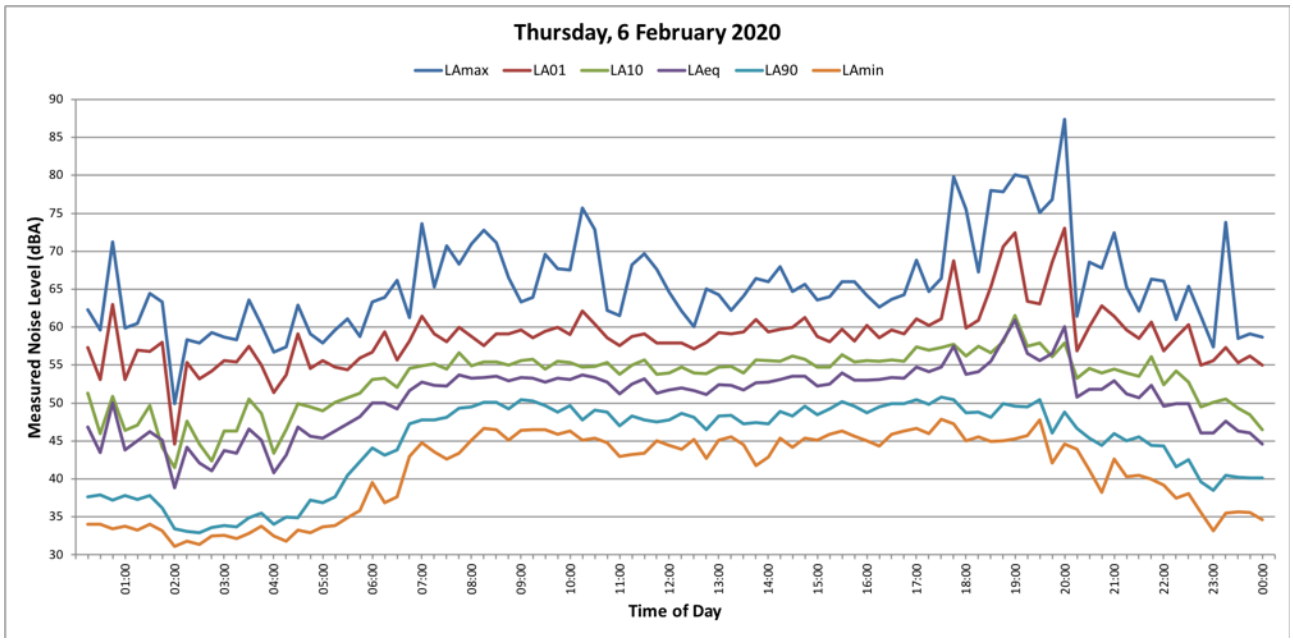
LA01
LA10
LAeq
LA90
LAmin
Measured Noise Level (dBA)
Time of Day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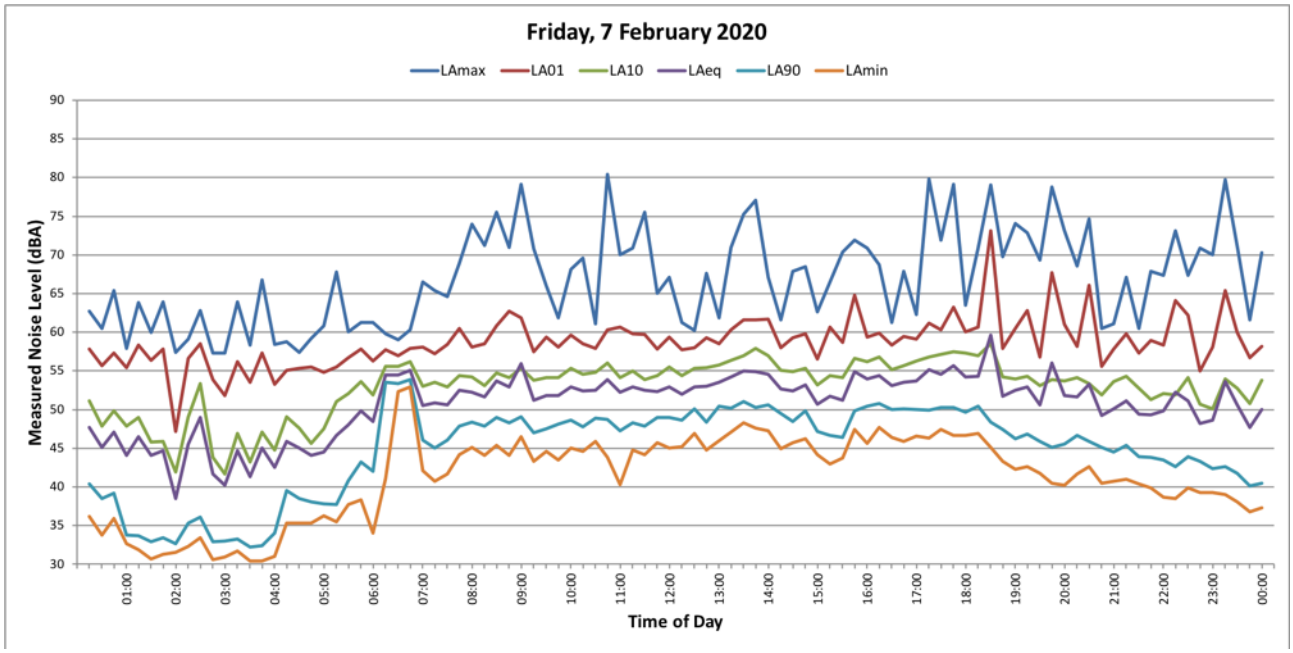
Time of Day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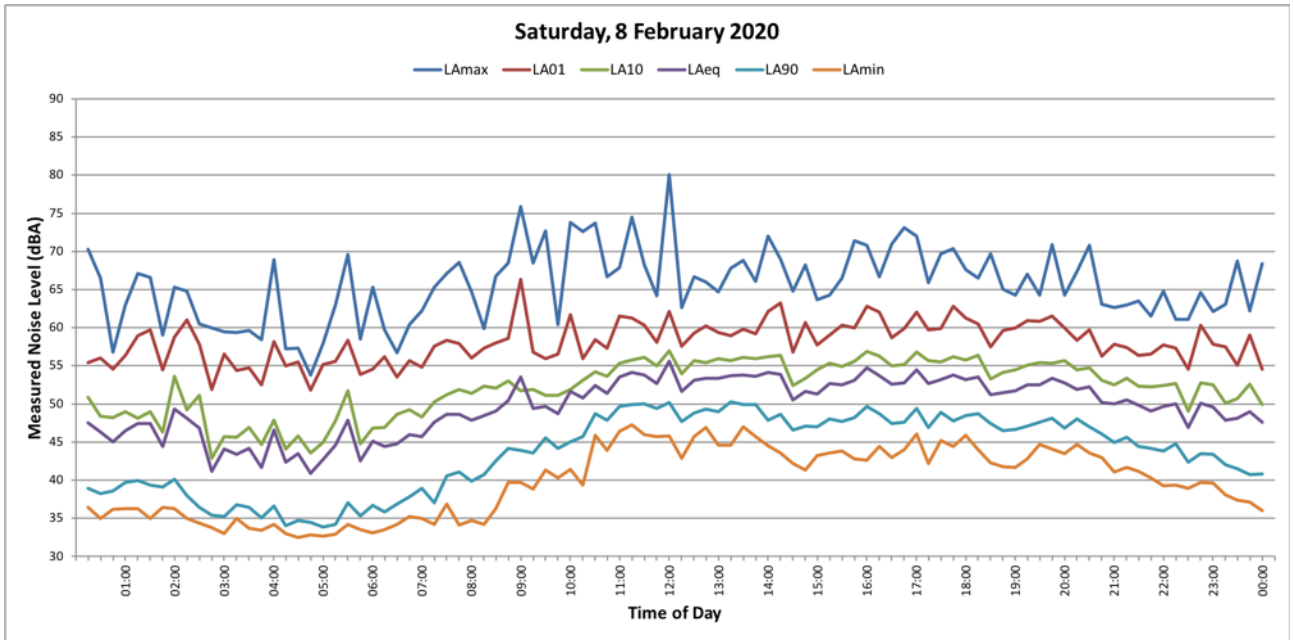
Measured Noise Level (dBA)
Time of Day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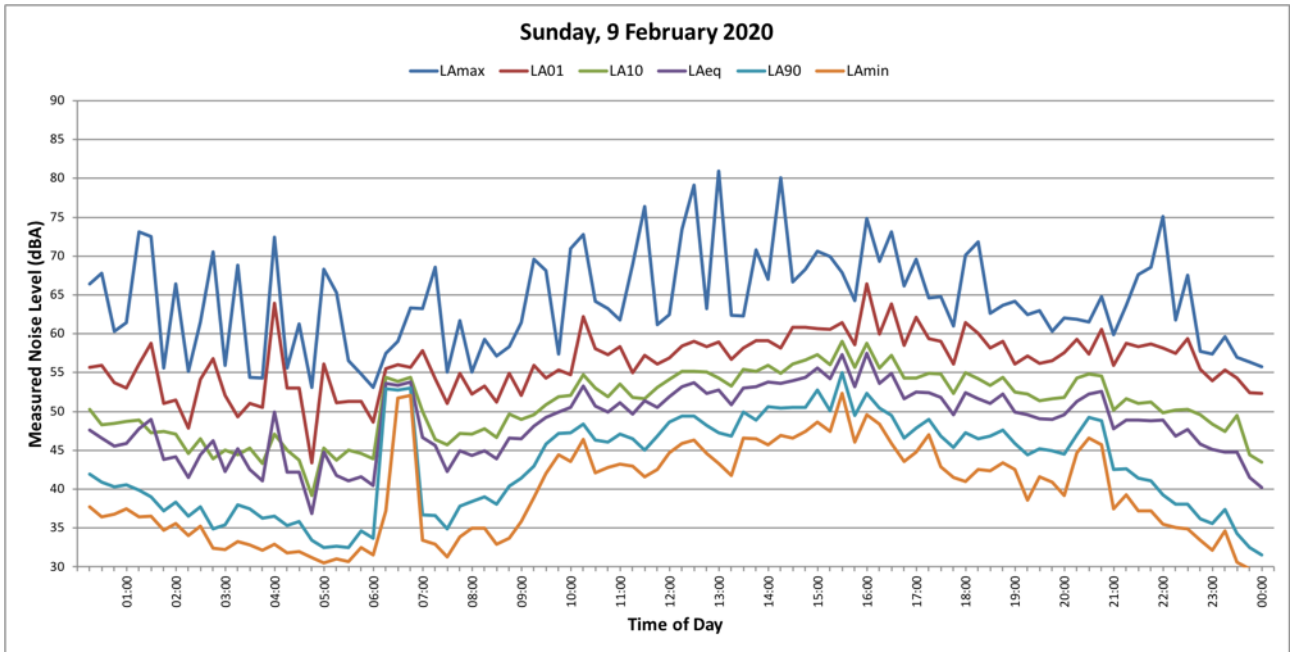
Time of Day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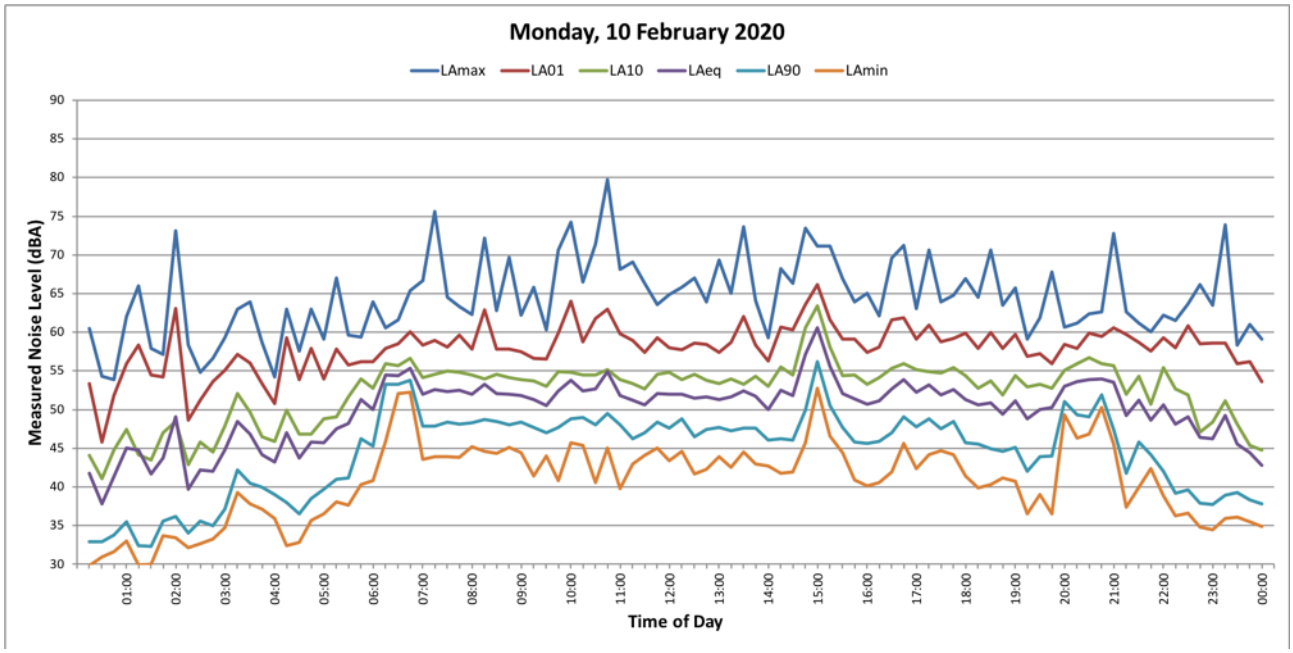
Measured Noise Level (dBA)
Time of Day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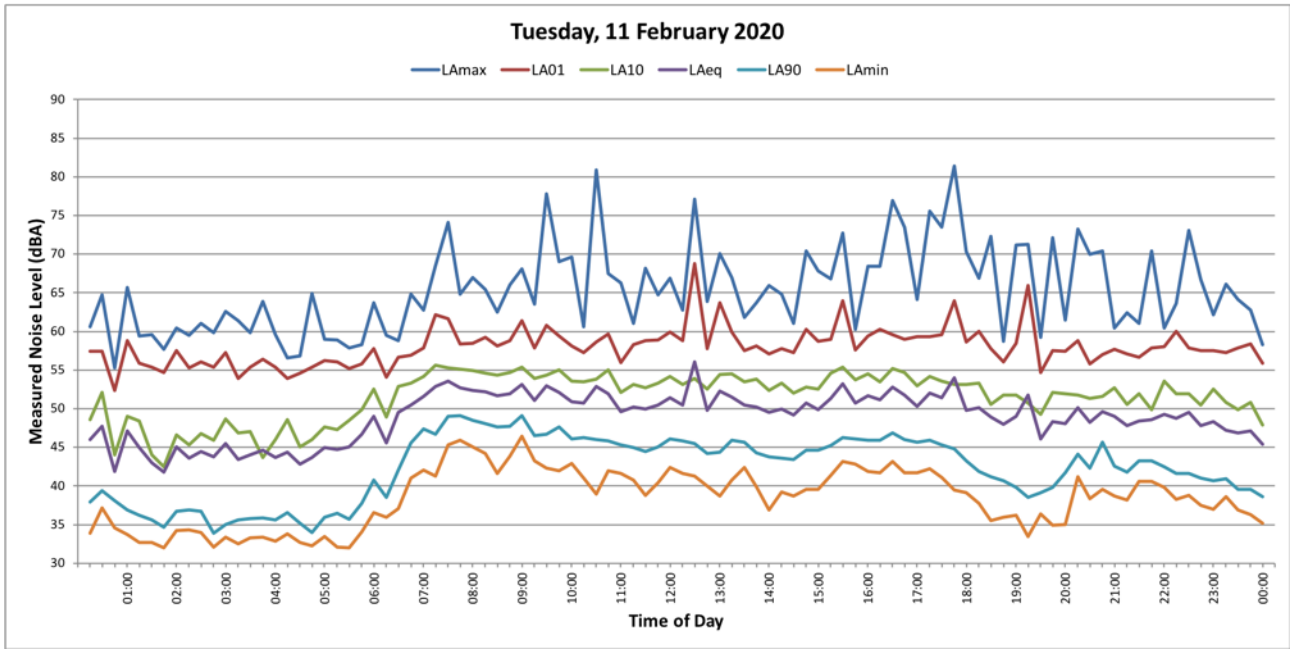
Measured Noise Level (dBA)
Time of Day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LA90
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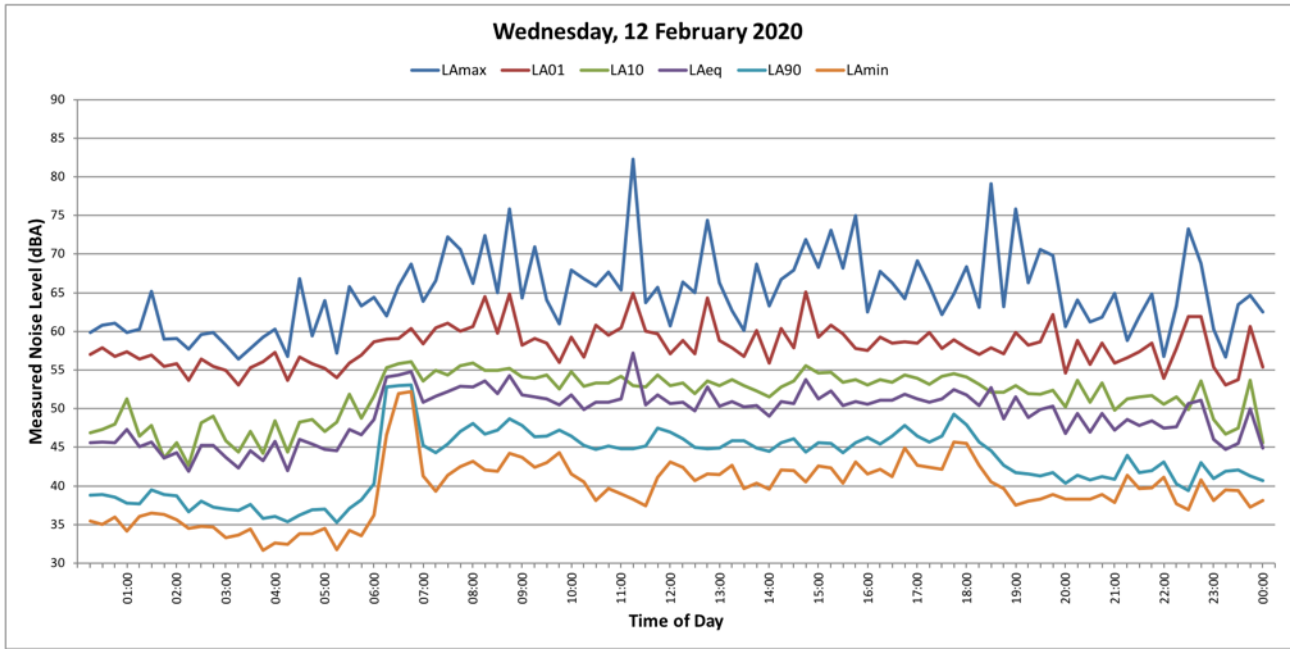
Measured Noise Level (dBA)
Time of Day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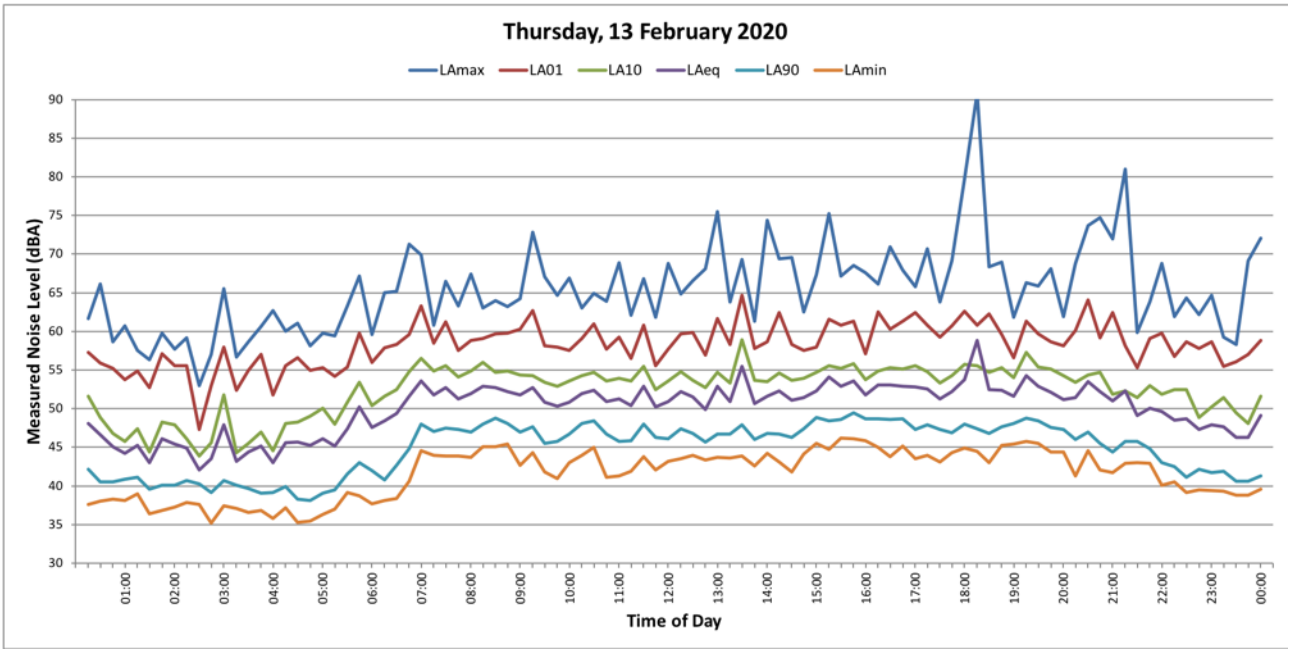
Time of Day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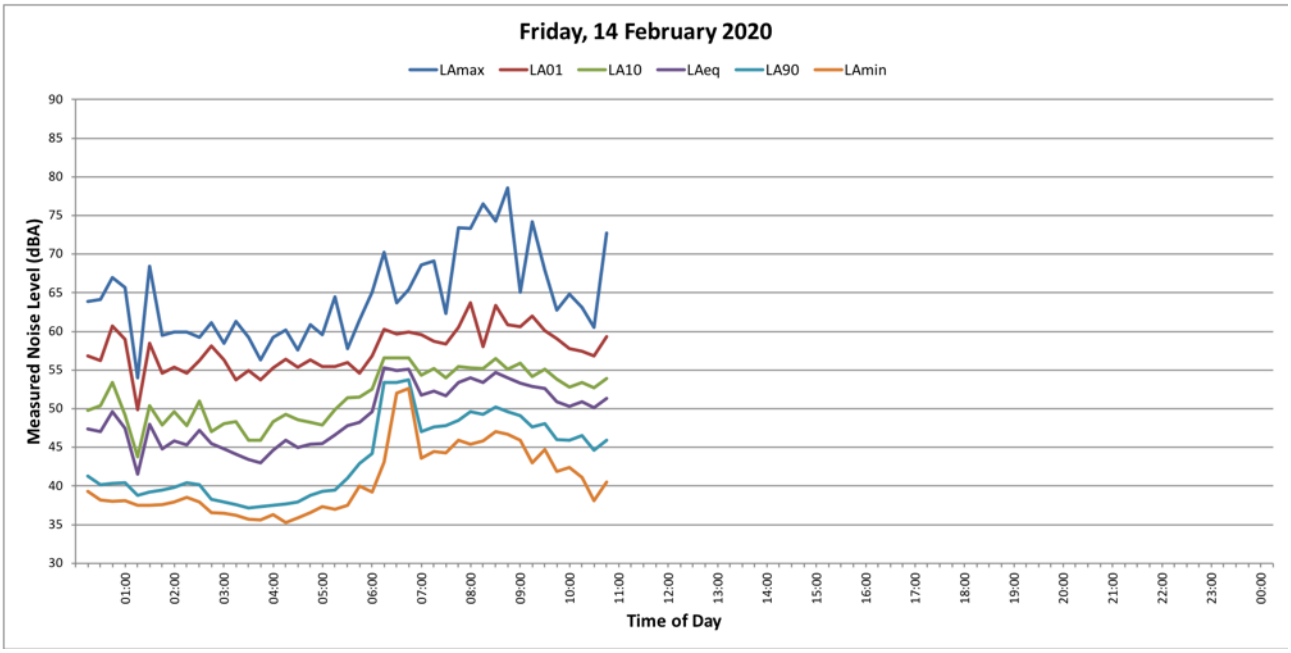
Time of Day


Friday, 14 February 2020
LAmax
LA01
LA10
LAeq
LA90
LAmin
Measured Noise Level (dBA)
Time of Day

## APPENDIX B NOISE DESCRIPTORS

| | |
|---|---|
| dB | Decibel. This is the unit measurement of sound. |
| dBA | A weighted decibel is the most commonly used descriptor. The A weighting is an adjustment to the raw sound level to approximate what the average human ear can hear, which is less sensitive at very low and very high frequencies. |
| Lw or SWL | Sound power level. This is the total radiated sound energy. |
| Lp or SPL | Sound pressure level. This is the measurable sound level at a given distance from an item. |
| $L_{max}$ | The RMS maximum noise level of a measurement |
| $L_{10}$ | $90^{th}$ percentile sound level of a measurement. Often called the average maximum noise level |
| $L_{eq}$ | The energy average noise level of a measurement. |
| $L_{90}$ | $10^{th}$ percentile sound level of a measurement. Often called the average background noise level |
| $L_{min}$ | The minimum noise level of a measurement |
| $L_{eq(T)}$ | The time (T) equivalent energy noise level. The time interval is often in blocks of 10 or 15 minutes for short term measurements, or hours for long-term measurements. Common increments for long term measurements are 1 hour, day, night, 18 hours and 24 hours. |
| $L_{eq(8h)}$ | The 8 hour equivalent energy noise level. Primarily used for occupational noise assessments |
| $LC_{peak}$ | The C weighted peak noise level. Primarily used for occupational noise assessments |