

# JUBILEE PLACE ROOFTOP BAR & RESTAURANT

## Noise Assessment Report

### Prepared for:

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## BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with JGL Properties Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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## DOCUMENT CONTROL

| Reference          | Date             | Prepared       | Checked           | Authorised        |
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# 1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by JGL Pty Ltd (JGL) (c/o Bennett & Associates) to undertake a noise assessment to support the potential bar use and restaurant of a rooftop terrace located at Jubilee Place, at 470 St Pauls Terrace, Fortitude Valley (the Project). There are specific requirements within the Bowen Hills Priority Development Area (PDA) Decision Notice DEV2017/891/3 in relation to the noise emission from amplified entertainment. On 4<sup>th</sup> July 2019, the Minister for Economic Development Queensland (MEDQ) decided to grant the amendment application for the site subject to comply with these conditions.

The purpose of this report is to address the operational noise impacts from the roof top bar and restaurant to be located on Level 14 of the new building at the site, including patron noise, amplified music and mechanical plant emissions pertaining the Terrace only.

The noise assessment has been conducted in accordance with the specific acoustic requirements outlined in PDA Decision Notice DEV2017/891/3 and contained in the Brisbane City Council (BCC) Noise Impact Assessment Planning Scheme Policy, where applicable.

This report details the results of predictions of potential noise emissions onto sensitive receptors external to the Project and the assessment of these against applicable noise criterion levels.

A glossary of terms used in this report is provided in **Appendix A**.

## 2 Project Overview

### 2.1 Project Description and Site Location

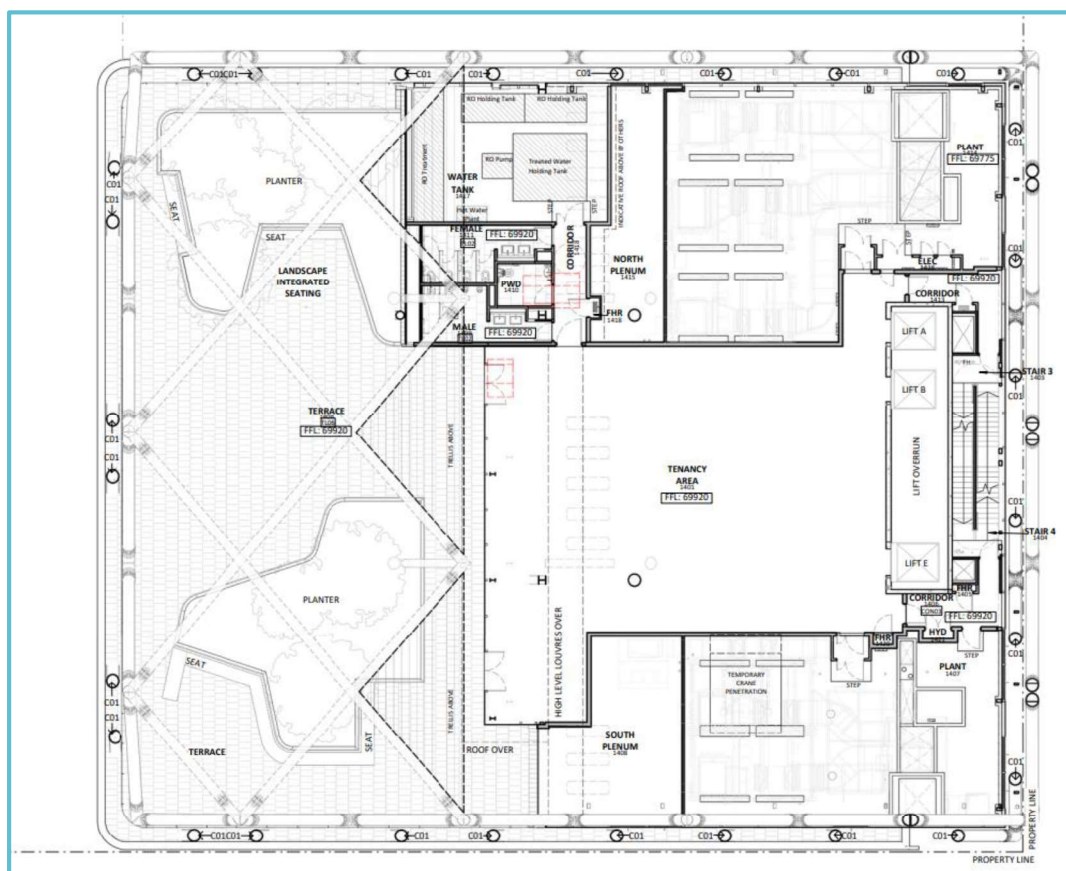
The Project is to be located on the building rooftop at 470 St Pauls Terrace Fortitude Valley at an area described as a Mixed-Use Zone of the Bowen Hills Priority Development Area (PDA). In addition, the building site is identified as Special Entertainment Area (SEA) Core B within the BCC City Plan mapping.

The site is located within a zone which is intended to provide a wide range and intensity of land use activity. It is intended that the rooftop area will cater for beverages and food during the day, transitioning to a restaurant/bar in the evening and night. The maximum number of patrons will be 300, as determined by access and egress restrictions under the BCA. The proposed hours of operation for the restaurant/bar are 8:00 am to 2:00 am.

At this stage, it is not proposed that the venue will incorporate amplified entertainment. However, an assessment of amplified entertainment has been conducted to determine the feasibility of this use if this eventuates in the future.

For context, a plan of the rooftop is shown in **Figure 1**.

**Figure 1** Proposed rooftop



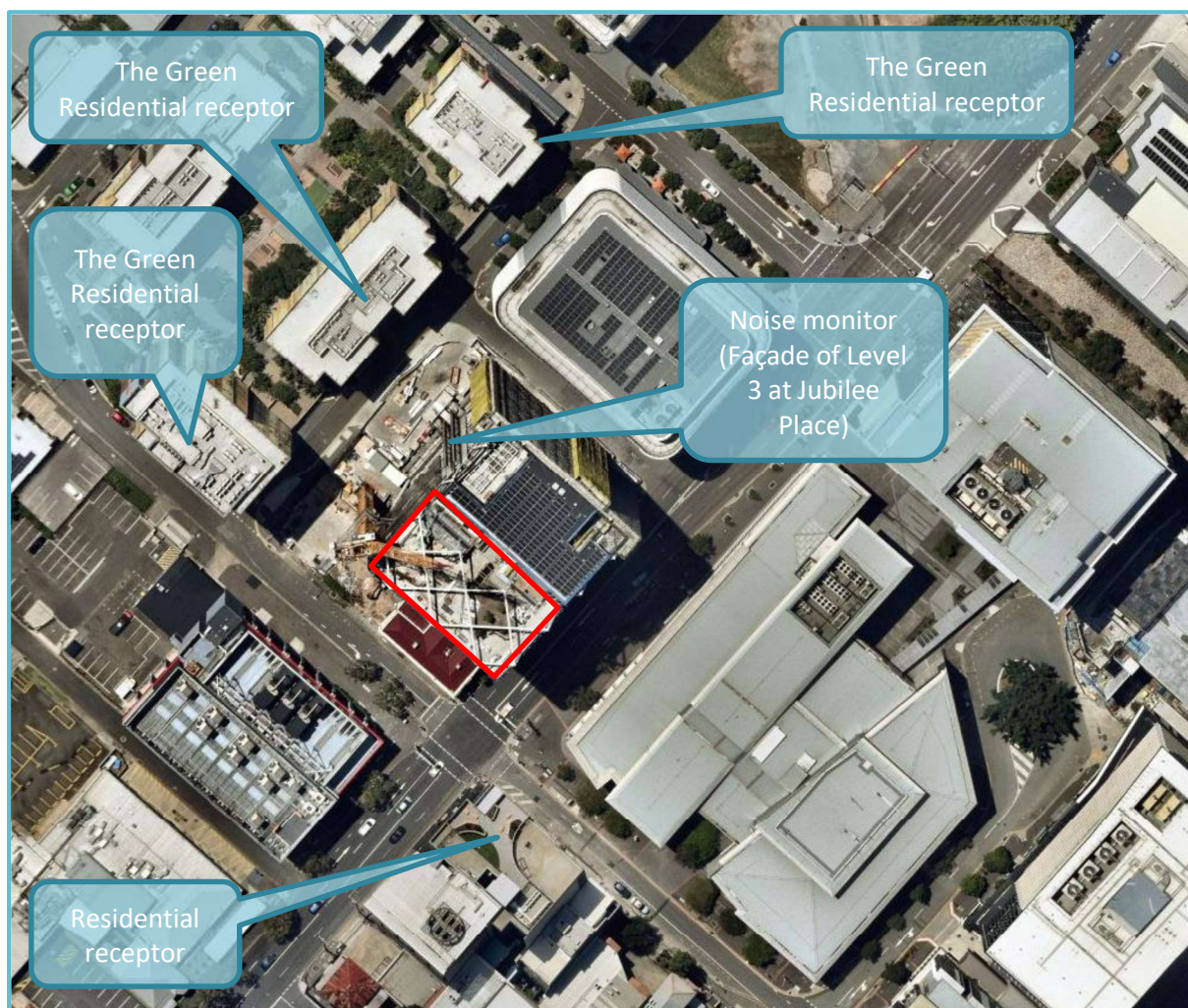
Sourced from Appendix C – Amended Architectural Plans

## 2.2 Noise Sensitive Receptors

As minimum, the project is expected to incorporate noise emissions from mechanical plant (ie kitchen/toilet exhausts and air conditioning) and patron noise. **Figure 2** shows the site location in context of surrounding land uses and noise logging locations conducted as part of this assessment. The following noise sensitive receptors have been identified:

- Northwest: The Green apartments residential tower across Constance Street. This building comprises a tall tower with enclosed balconies, and a shorter building, with balconies at a lower level than the Jubilee rooftop bar;
- Northeast: Commercial building. This is a non-sensitive receptor;
- Southeast: Commercial building. This is a non-sensitive receptor;
- South: 7 level storey residential apartment tower on 465 St Pauls Terrace, Fortitude. This building comprises balconies that are positioned adjacent to the Jubilee Place Tower; however, the total building height is approximately 25m below the proposed Jubilee rooftop.
- Southwest: Commercial building. This is a non-sensitive receptor.

**Figure 2 Project site and noise monitoring location**



### 3 Existing Acoustic Environment

Noise monitoring was conducted by SLR to identify and quantify the existing noise environment at the site.

Continuous unattended noise logging was conducted at the monitoring location shown in **Figure 2**, between Tuesday 19<sup>th</sup> and Wednesday 27<sup>th</sup> October 2021, located on the Level 3, 470 St Pauls Terrace, which is considered a representative measurement location for quantify existing ambient noise levels at nearby noise sensitive receptors.

Noise monitoring was conducted with the purpose of determining the existing ambient noise levels as well as to derive assessment criterion levels. It is noted that, whilst measurements were conducted 24 x 7 including during construction of Jubilee Place, only the noise data obtained outside construction hours is presented as this coincides with the proposed use hours of the assessed rooftop for bar use.

The unattended noise monitoring was carried out using one Acoustic Research Laboratories (ARL) Ngara sound level meter and a SVAN 977 sound level meter. The sound level meters were configured to record a range of A-weighted fast-response statistical noise levels, including the  $L_{Amax}$ ,  $L_{A10}$ ,  $L_{A90}$  and  $L_{Aeq}$  noise levels at 15-minute intervals.

The sound level meter calibration was checked for calibration before and after the monitoring, using a G.R.A.S 42AG Sound Level Calibrator. The instruments showed a drift less than  $\pm 0.5$  dB; therefore, the measurements are considered valid according to AS1055:2018 - *Acoustics - Description and measurement of environmental noise*.

The noise logger was located at the façade of the building on Level 3 with a microphone height of 1.5 m above the existing ground level. It is noted that at the time of monitoring, the Building façade at the monitoring location was not yet installed.

The instrumentation utilised for the noise monitoring is outlined in **Table 1**.

**Table 1 Acoustic instrumentation**

| Location ID | Equipment type    | Manufacturer model | Serial number |
|-------------|-------------------|--------------------|---------------|
| 1           | Sound Level Meter | ARL Ngara Type 1   | 8781B1        |
| 1           | Calibrator        | SV30A              | 24513         |

A summary of relevant ambient noise levels used in this assessment is presented in **Table 2**.

**Table 2 Summary of measured ambient noise levels**

| Parameter                    | Period                 | Average of 15-minute Measured Noise Levels (dBA) |
|------------------------------|------------------------|--------------------------------------------------|
| Rating Background Level, RBL | Evening (6 pm - 10 pm) | 50                                               |
|                              | Night (10 pm - 7 am)   | 47                                               |
| $L_{Aeq}$                    | Evening (6 pm - 10 pm) | 55                                               |
|                              | Night (10 pm - 7 am)   | 58                                               |

## 4 Noise Criteria

### 4.1 Bowen Hills Priority Development Area Development Scheme

The Bowen Hills Priority Development Area (PDA) Development Scheme June 2019 provides requirements for acoustic assessment of developments within the Bowen Hills PDA.

In relation to noise from entertainment venues, the requirements in Section 2.5.9.3 of this document are reproduced below:

*“Reduce the exposure of residential uses to noise impacts from lawfully operating entertainment venues. A building is designed and constructed to achieve a minimum reduction in sound pressure level between the exterior of the building and the bedroom or living room, of  $L_{Leq,T}$  20dB at 63Hz where near a lawfully operating entertainment venue. Residents living near lawfully operating entertainment venues also need to be aware that noise levels will be relatively higher both inside and outside of residences”*

The above criteria apply to future residential uses nearby entertainment areas. No criteria are defined in the Bowen Hills PDA for new entertainment venues located nearby existing residential receptors. In the absence of specific acoustic requirements within the PDA, reference has been made to the acoustic conditions in the PDA development approval and the Brisbane City Council (BCC) City Plan 2014, where applicable.

### 4.2 PDA Development Approval

On 4 July 2019 the Minister for Economic Development Queensland (MEDQ) granted the amendment application for the proposed Jubilee rooftop terrace, subject to PDA development conditions set out in PDA decision notice DEV2017/891/3.

Condition 33 of the decision notice refers to the noise emission from the redeveloped ground floor entertainment and food premises, as reproduced in **Table 3**.

**Table 3 PDA Development Acoustic Conditions**

| Condition | Compliance assessment - Acoustics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Timing                                 |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 33        | <p>a) Submit to EDQ Development Assessment, DSDMIP, for compliance assessment, an acoustic report demonstrating that the redeveloped Indoor Entertainment and Food Premises (“beer garden”) use has been designed to achieve an amplified music noise level that complies with the current Amplified Music Venue Permit in existence, or if no Amplified Music Venue Permit exists then designed to achieve an amplified music noise level at 1m external to any point of the premises of not greater than <math>L_{Ceq,T}</math> 88dB for approved activities before 11.30pm on Sundays to Thursdays, or to midnight on Fridays and Saturdays, and <math>L_{Ceq,T}</math> 65dB and <math>L_{Leq,T}</math> 55dB in any one-third octave band between and including 31.5Hz and 125Hz, for approved activities after 11.30pm on Sundays to Thursdays, or after midnight on Fridays and Saturdays.</p> <p>b) Carry out the development in accordance with the endorsed document required under part a) of this condition</p> | Prior to the commencement of the works |

Notwithstanding the conditions listed in **Table 3** which applies to the existing approved uses, this development application for additional uses on the rooftop seeks to apply an alternative amplified entertainment noise criteria for the rooftop food and beverage outlet/bar to be no greater than  $L_{Ceq,T}$  88dB until 1:00 am on Fridays and Saturday's (noise limits on Sunday to Thursday to remain consistent with the current condition).

This report demonstrates that compliance will still be achieved by extending the noise limit by 1-hour.

### 4.3 Brisbane City Plan 2014

The PDA condition presented in Section 4.2 has been reproduced from Table 7.2.6.4.3.A – *Performance outcomes and acceptable outcomes* of the Fortitude Valley neighbourhood plan code. It is then assumed that, as stated in PO22 of the code, Operating noise levels for the above activities will be determined by the Amplified Music Venue Permit in accordance with the Amplified Music Venues Local Law 2006, which defines:

- $L_{Ceq,T}$  is the C-weighted equivalent continuous sound pressure level during measurement time T, where T equals 3 minutes; and
- $L_{Leq,T}$  is the un-weighted equivalent continuous sound pressure level during measurement time T, where T equals 3 minutes.

The latter document further states:

*“Compliance with a noise level specified in a permit condition will be determined by noise measurements carried out by an authorised person inside the amplified music venue at the measurement point specified in the permit.”*

In the absence of noise limits in the PDA Development Scheme, the noise (planning) criteria in Table 9.3.3.3.F, low frequency noise criteria in Table 9.3.3.3.G and night-time noise criteria in Table 9.3.3.3.H of the BCC City Plan 2014 Centre or Mixed-Use (MU) Code have been applied for the assessment of mechanical plant and patron noise.

The criteria are reproduced in **Table 4**.

**Table 4 BBC noise (planning) criteria**

| Period               | Criteria                                          | Criteria at MU Zone, $L_{eq}$ |
|----------------------|---------------------------------------------------|-------------------------------|
|                      |                                                   | Residential criteria          |
| Daytime (7 am-6 pm)  | Intrusive noise criteria $L_{Aeq,adj,11h}$ , dBA  | Background (RBL) + 5dBA       |
|                      | Amenity criteria<br>$L_{Aeq,adj,11h}$ , dBA       | 60dBA                         |
|                      | Low frequency criteria<br>$L_{Ceq,adj,11h}$ , dBC | 75dBC                         |
| Evening (6 pm-10 pm) | Intrusive noise criteria $L_{Aeq,adj,4h}$ , dBA   | Background (RBL) + 5dBA       |
|                      | Amenity criteria<br>$L_{Aeq,adj,4h}$ , dBA        | 55dBA                         |
|                      | Low frequency criteria<br>$L_{Ceq,adj,4h}$ , dBC  | 75dBC                         |
| Night (10 pm-7 am)   | Intrusive noise criteria $L_{Aeq,adj,9h}$ , dBA   | Background (RBL) + 5dBA       |

| Period | Criteria                                                                                        | Criteria at MU Zone, Leq |
|--------|-------------------------------------------------------------------------------------------------|--------------------------|
|        | Amenity criteria<br>LAeq,adj,9h, dBA                                                            | 50dBA                    |
|        | Low frequency criteria<br>LCeq,adj,9h, dBC                                                      | 70dBC                    |
|        | Night-time noise criteria, average of highest 15 single<br>LAmax, dBA events over a given night | 65dBA                    |
|        | Night-time noise criteria, absolute single event LAmax, dBA<br>over a given night               | 70dBA                    |

Based on the measured background noise levels (refer **Section 4.3**), noise limits have been defined following the criteria above. The limits are summarised in **Table 5**.

**Table 5 Project specific noise (planning) criteria**

| Noise source                                       | Assessed noise criteria | Project specific noise criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                     |             |                                                                                |
|----------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------|-------------|--------------------------------------------------------------------------------|
|                                                    |                         | Evening (6pm to 10pm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             | Night (10pm to 7am) |             |                                                                                |
|                                                    |                         | LAeq,adj,4h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | LCeq,adj,4h | LAeq,adj,9h         | LCeq,adj,9h | LAmax                                                                          |
| Patron noise, amplified music and mechanical plant | BBC                     | 55 dBA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 75 dBC      | 50dBA               | 70dBC       | 65 dBA average 15 loudest events, but no greater than 70 dBA on a single event |
| Amplified entertainment noise                      | PDA                     | Sound system is designed to achieve an amplified music noise level at 1m external to any point of the premises of not greater than L <sub>Ceq,T</sub> 88dB for approved activities before 11.30 pm on Sundays to Thursdays, or to 1:00 am on Fridays and Saturdays, and L <sub>Ceq,T</sub> 65dB and L <sub>Leq,T</sub> 55dB in any one-third octave band between and including 31.5Hz and 125Hz, for approved activities after 11.30pm on Sundays to Thursdays, or after 1:00 am on Fridays and Saturdays. |             |                     |             |                                                                                |

## 5 Noise Emission Assessment

### 5.1 Noise Modelling Inputs and Assumptions

Topographical information for the study area was sourced from SLR's database comprising of Light Detection And Ranging (LiDAR) data and digital elevation data used to create a detailed terrain map of the proposed site and surrounding areas.

With this terrain survey as a base, SLR developed a 3D SoundPLAN software noise model of the study area to predict noise levels at nearby sensitive receptors. SoundPLAN is a software package which enables compilation of a sophisticated computer model to develop a 3D ground map containing ground contours, road contours (including gradients) and existing building locations.

The algorithms detailed in ISO 9613-2:1996 Acoustics — *Attenuation of sound during propagation outdoors — Part 2: General method of calculation*, as implemented within SoundPLAN were used to predict the potential noise intrusion levels.

Summary of the noise modelling inputs are detailed below:

- Buildings – All building locations, footprints, heights and zoning (example residential, commercial, industrial, etc), was sourced from PSMA Geoscape product which provides building outlines from high resolution satellite imagery and heights from LiDAR. This information was current as of April 2020.
- 3D topography data for the terrain within the study area was sourced from Queensland Department of Natural Resources, Mines and Energy as was captured in 2019.
- Proposed Jubilee place and rooftop was developed within SoundPLAN, referencing to the *Jubilee Place Appendix C – Amended Architectural Plans*.
- Transparent 1.5m glass noise barrier as per the design specifications outlined in drawing *7180 BAL Concept 1 ASSY Rev A* (modelled up to 1.2m high to account for gaps between glass panes above this height).

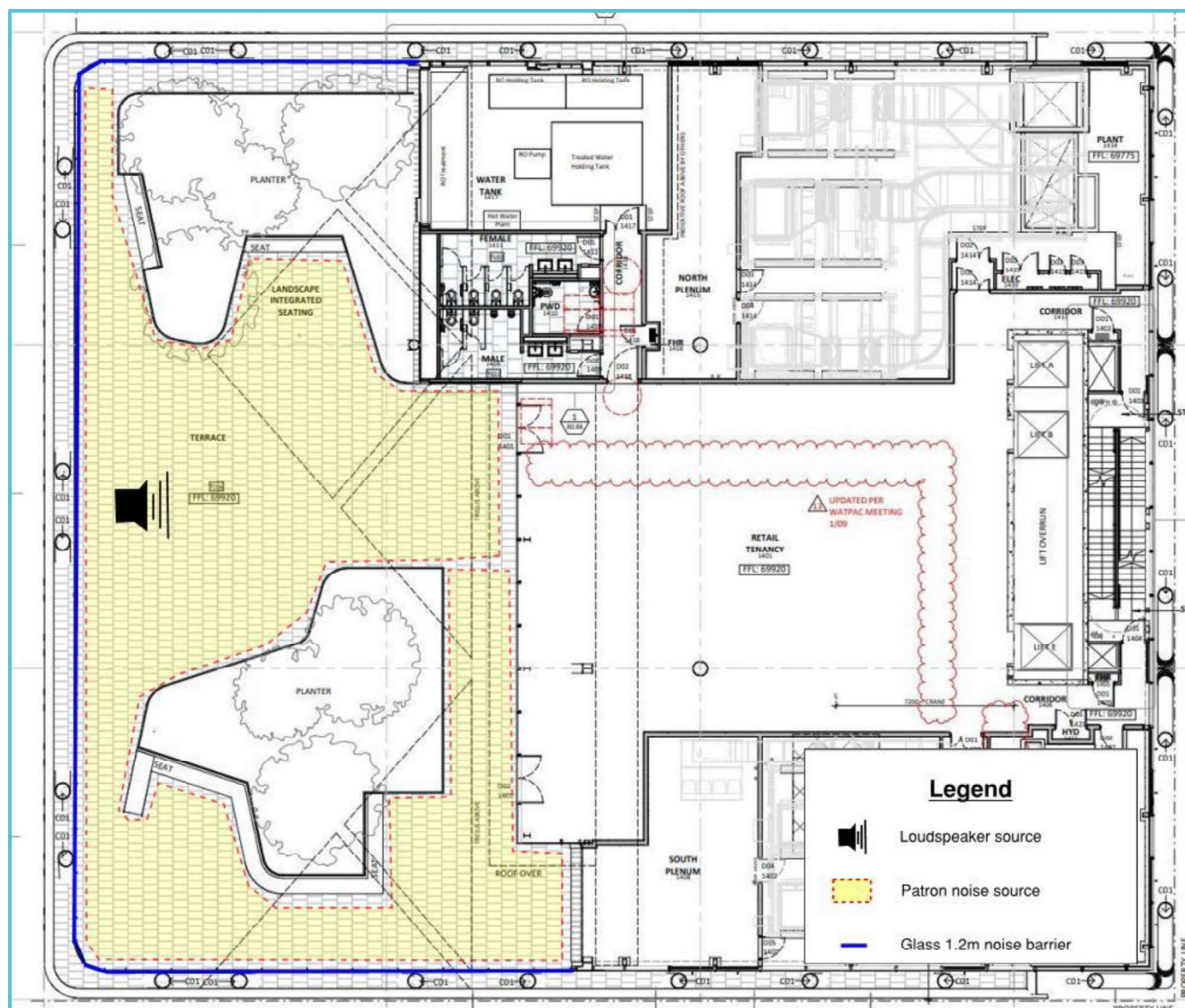
The following assumptions were made to complete the impact noise assessment:

- Patron noise:
  - Up to 300 patrons to occupy the space.
  - Crowds are distributed within the space and half the crowd is talking and the other half listening at any single time. This is conservative as it does not assume larger groups will also occupy the space.
  - The rooftop café/bar will open at 8:00am and will close at 1:00am;
- Amplified entertainment noise:
  - Amplified entertainment may be provided by a DJ using portable loudspeakers (worst-case) or incidental music by a distributed loudspeaker system.
  - A typical music spectrum of recorded electronic music from SLR's noise data base has been used for the reference sound emitted and was adjusted to comply with PDA noise limit at the bar boundary.

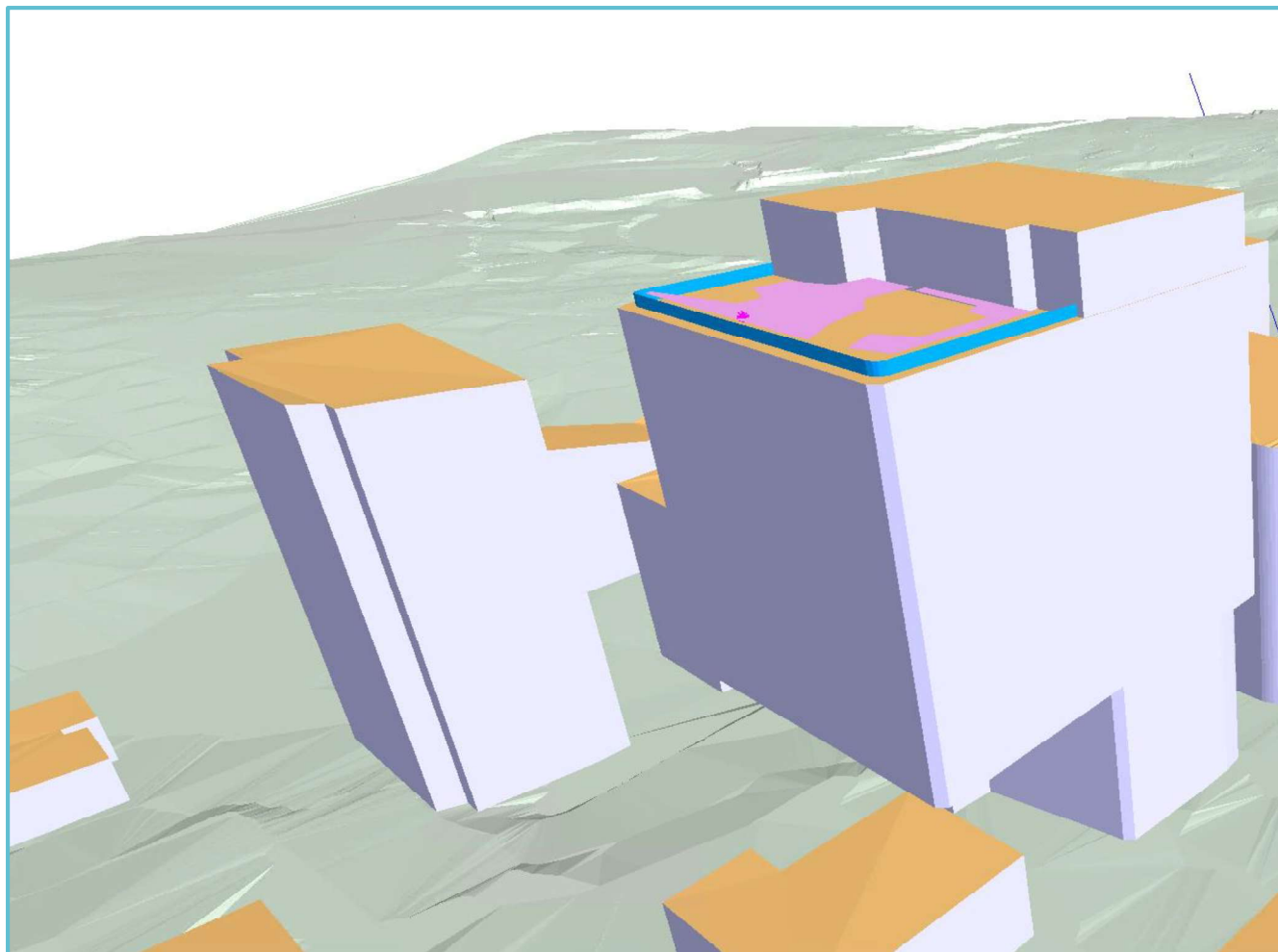
- The amplified entertainment was modelled conservatively as a point source loudspeaker at 1.8m above the roof top floor level, as the location shown in **Figure 2**.
- Ground absorption coefficient for different ground surfaces utilised within the noise model are defined below:
  - For all the development trafficable areas, a 'hard surface' absorption coefficient of 0 has been used.
  - For all other areas, the model has assumed a ground absorption of 1 since the remaining areas are predominately 'soft ground'.

Refer to **Figure 3** and **Figure 4** for the modelled noise source locations/configuration.

**Figure 3 Modelled noise source configuration**



**Figure 4 3D SoundPLAN Model**



## 5.2 Patron Noise

Noise from crowds consists of the following two components:

- The steady noise of the crowd talking with one another, and
- The occasional increase of noise levels when a group of individuals laugh or call-out. The noise generated by laughter and exclamations becomes more swamped as the number of individuals increases.

Based on Australian published<sup>1</sup> research on crowd noise, it is anticipated that the noise emission levels from laughs and exclamations will only be marginally above the steady hubbub of the crowd. Given that this is a venue where alcohol will be served, it is assumed that all patrons are likely to be talking with a raised voice (rather than a normal level voice) and each generates a raised noise level of 69 dBA at 1 metre.

The Association of Australian Acoustical Consultant Draft Licensed Premises - Noise Assessment Technical Guideline recommends raised voice levels of 67 dBA @ 1m for Males and 64 at 1m for Females. The adopted levels are therefore considered conservative.

An assumed  $L_{Amax}$  sound power level of 79 dBA has been used.

## 5.3 Amplified Entertainment

A 'typical' music spectrum was referenced from SLR's acoustic data base for an amplified speaker. The reference source spectrum level was used for the proposed DJ speaker noise source. The referenced noise spectrum is populated in **Table** , in **Appendix D**.

It should be noted that the below nominated spectrum is considered conservative and unlikely that the rooftop terrace would be commissioned to play audio at these noise levels.

Summary of the overall assessed speaker sound power level is summarised below:

- $L_{Aeq}$  for the speaker has nominated a sound power level of 101 dBA.
- $L_{Amax}$  for the speaker has been assumed to be a sound power level of 107 dBA.

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<sup>1</sup> Prediction of Noise from Small to Medium Sized Crowds, M.J. Hayne et al. Proceedings of ACOUSTICS 2011

## 6 Predicted Noise Emission Levels

The proposed rooftop terrace is to be used as a restaurant and bar. The maximum number of patrons will be 200 and will operate until 1:00 am. The individual and combined noise emissions emanating from the premise due to patron and amplified entertainment noise have been assessed against the criteria specified in **Table 5**.

The nearest impacted noise sensitive receivers are outlined below:

- Residential Building A – The Green apartments residential tower across Constance Street
- Residential Building B – 7 level storey residential apartment tower on 465 St Pauls Terrace, Fortitude

### 6.1 Bar and Restaurant Noise Level Predictions

Noise levels were predicted at the façade of each of the above-mentioned receptors. Results are summarised in **Table 6**, noting that only the highest predicted noise level at each receptor has been reported. The noise predictions include the proposed 1.2m transparent glass noise fence (with a minimum surface area of 12 kg/m<sup>2</sup>) around the rooftop area. Receptors that are positioned behind the modelled noise compliant receptors (ie further away from the Jubilee rooftop) are also expected to be complaint.

A list of noise predictions at all the above sensitive receptors is presented in **Appendix C**.

**Table 6 Predicted noise emissions at nearby sensitive receptors, assessed against BBC noise criteria**

| Assessed Noise Criteria                                                                                             | Highest predicted noise level, dBA                                               |                     |                                      |                     |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------|--------------------------------------|---------------------|
|                                                                                                                     | Modelled scenario, combination of patron noise and Amplified entertainment noise |                     | Modelled scenario, patron noise only |                     |
|                                                                                                                     | Residential Group A                                                              | Residential Group B | Residential Group A                  | Residential Group B |
| Evening (6pm – 10pm)<br>Noise Limit at identified receptor,<br>55 dBA $L_{Aeq,Adj,4hr}$                             | 39                                                                               | 40                  | 19                                   | 21                  |
| Night (10pm – 7am)<br>Noise Limit at identified receiver,<br>50 dBA $L_{Aeq,Adj,9hr}$                               | 35                                                                               | 36                  | 16                                   | 19                  |
| Night (10pm – 7am)<br>Noise limit at identified receptor,<br>average of the 15 loudest events, 65 dBA<br>$L_{Amax}$ | 49                                                                               | 51                  | 29                                   | 31                  |
| Night (10pm – 7am)<br>Noise limit at identified receptor,<br>Absolute 70 $L_{Amax}$                                 |                                                                                  |                     |                                      |                     |

| Assessed Noise Criteria                                                                                                                          | Highest predicted noise level, dBA |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Complies with evening criterion of 55 dBA</b><br>$L_{Aeq,Adj,4hr}$ ?                                                                          | Yes, at all nearby receptors       |
| <b>Complies with night criterion 50 dBA</b><br>$L_{Aeq,Adj,9hr}$ ?                                                                               | Yes, at all nearby receptors       |
| <b>Complies with BCC night-time criterion, average of 15 loudest events, 65 dBA <math>L_{Amax}</math> and Absolute 70 <math>L_{Amax}</math>?</b> | Yes, at all nearby receptors       |

**Table 7** below presents the maximum amplified entertainment noise levels predicted at 1m from the external perimeter of the Jubilee rooftop for activities before 11:30pm on Sundays to Thursdays, or to 1:00 am on Fridays and Saturdays for the noise levels specified in the PDA Acoustic Condition.

**Table 7 Predicted noise levels 1m from the external rooftop perimeter, assessed against the PDA noise criteria**

| Assessed Amplified entertainment noise criteria                                                                                                                                                   | Maximum amplified noise level 1m from the rooftop boundary                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Before 11:30pm on Sundays to Thursdays,<br>No greater than $L_{Ceq,T}$ 88 dBC                                                                                                                     | 72 dBC, $L_{Ceq,T}$                                                                          |
| Up to 1:00 am Fridays and Saturdays,<br>No greater than $L_{Ceq,T}$ 88 dBC                                                                                                                        | 72 dBC, $L_{Ceq,T}$                                                                          |
| After 11:30pm on Sundays to Thursdays, or after 1:00 am on Fridays and Saturdays,<br>$L_{Ceq,T}$ 65 dBC and $L_{Leq,T}$ 55 dB in any one-third octave band between and including 31.5Hz and 125Hz | 54 dBC, $L_{Ceq,T}$ and 54 dBL, $L_{Leq,T}$ (maximum predicted in any one-third octave band) |

A summary of the findings is outlined below:

- A sound system (e.g. DJ speaker) that generates a total sound level of 80 dBA/ 86 dBC at 3m from a loudspeaker system may be permitted where the speaker is position as shown in **Figure 3** with the proposed layout (which includes the glass screen as shown in the architectural drawings with no gaps up to 1.2m high, except for drainage at bottom).
- The above loudspeaker noise level is considered conservative and more likely to be in the range of 74 dBA / 84 dBC 3m from a loudspeaker to enable reasonable levels of ambient music during conversations.

- The combined noise emission from patron noise and amplified entertainment is predicted to comply with the noise criteria outlined in **Table 5**.

Based on the results presented above, it is expected that the introduction of amplified entertainment noise at the Jubilee Place rooftop terrace can be implemented whilst achieving the noise criteria requirements.

## 6.2 Mechanical Plant Noise

Potential sources of noise emission from mechanical plant pertaining the rooftop may include equipment associated with the following items (the corresponding assumptions are described below):

- Air-conditioning plant - The restaurant/bar air conditioning plant will be independent to other building plant, as it would be operated outside office hours; therefore, it will be of reduced size and noise emission.
- Toilet exhaust fans - These sources will operate continuously during bar hours. Standard commercial fans are not expected to result in adverse noise intrusion at sensitive receptors due to the separation distances involved and the existing ambient noise levels.
- Kitchen exhaust fan – Standard commercial fans not expected to result in adverse noise emissions due to the separation distances involved and the existing ambient noise levels.

Noise emission levels have been estimated for the combined mechanical plant associated with the bar with reference to the criteria specified in **Table 5**. The limiting sound power level (SWLs) specified below identifies the maximum mechanical plant noise emission resulting in noise levels complaint at the closest noise sensitive receptors:

- The maximum allowable sound power level per total number of plant (i.e. toilet exhausts, kitchen exhausts and AC plant) that achieves the proposed noise limit is estimated to 93 dBA.

Reasonable and feasible noise mitigation measures can be implemented to meet the noise limits. These are discussed in **Section 7**.

## 7 Recommendations

Based on the assessment conducted, the proposed restaurant/bar use is considered feasible whereby amplified entertainment can be implemented to provide reasonable sound levels within the rooftop terrace area whilst still compliant with the PDA and BBC noise limits. The following is recommended:

- Where a portable sound system is used, noise levels should not exceed the following levels at 3m in front of the loudspeaker system (sum of sound produced by all loudspeakers) located and aimed as shown in **Figure 3**:
  - Overall sound level must not exceed 80 dBA and 86 dBC.
  - $L_{Ceq, T}$  77dB and  $L_{Leq, T}$  78dB in any one-third octave band between and including 31.5Hz and 125Hz.
- Where a permanent installation is introduced, a distributed sound system is recommended, which is to be designed and commissioned to meet the applicable criteria summarised in **Table 5**.
- Loudspeakers must be positioned to direct the sound towards the terrace and retail/tenancy area.

In addition, the following general principles can be implemented to control the noise emission from mechanical plant which will run during the bar operating hours:

- Fans should preferentially be mounted in-duct, rather than rooftop/façade mounted.
- The design should aim at producing no direct line of sight between major plant items and the nearest noise sensitive receptors, eg ventilation and extraction systems inlets and outlets should preferably point in a direction at least 90 degrees away from the nearest residences.
- Acoustic attenuators can be introduced as required to specific items of plant to meet the noise limits specified in **Table 5**.

---

## 8 Conclusion

SLR has been commissioned to undertake a noise assessment of the potential restaurant/bar use of a rooftop terrace located at Jubilee Place, at 470 St Pauls Terrace, Fortitude Valley.

Noise generated by the bar use (including amplified entertainment) within the rooftop terrace has been assessed with regards to the Brisbane City Council City Plan 2014 requirements and the PDA noise conditions summarised in **Table 5** of this report.

The noise assessment has determined that noise resulting from a restaurant/bar use (i.e. patron noise and amplified entertainment) can be introduced whilst complying with the noise criterion at nearby noise sensitive receptors for the current architectural design (which includes a glass screen as shown in the architectural drawings with no gaps up to 1.2m high, except for drainage at bottom). Sound system setup recommendations are provided in this report to result in sound levels compliant with the noise limits.

Mechanical plant associated with the rooftop terrace can be designed to comply with all relevant noise criteria. The applicable noise limits at the sensitive receptors are provided in **Table 5** of this report.

# APPENDIX A

## Acoustic Glossary

### 1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is  $2 \times 10^{-5}$  Pa.

### 2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

| Sound Pressure Level (dBA) | Typical Source                             | Subjective Evaluation |
|----------------------------|--------------------------------------------|-----------------------|
| 130                        | Threshold of pain                          | Intolerable           |
| 120                        | Heavy rock concert                         | Extremely noisy       |
| 110                        | Grinding on steel                          |                       |
| 100                        | Loud car horn at 3 m                       | Very noisy            |
| 90                         | Construction site with pneumatic hammering |                       |
| 80                         | Kerbside of busy street                    | Loud                  |
| 70                         | Loud radio or television                   |                       |
| 60                         | Department store                           | Moderate to quiet     |
| 50                         | General Office                             |                       |
| 40                         | Inside private office                      | Quiet to very quiet   |
| 30                         | Inside bedroom                             |                       |
| 20                         | Recording studio                           | Almost silent         |

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

### 3. Sound Power Level

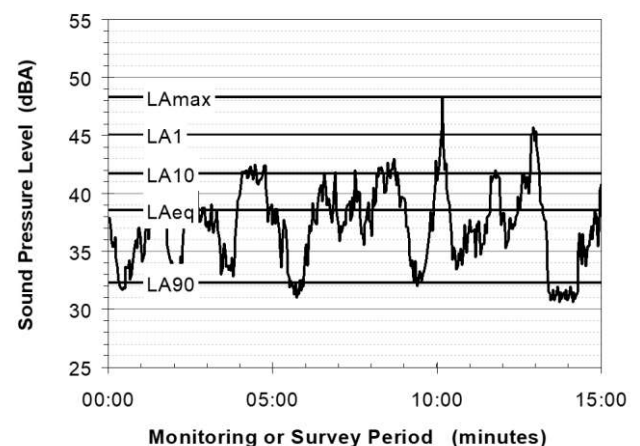
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit  $10^{-12}$  W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

### 4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

### 5. Frequency Analysis

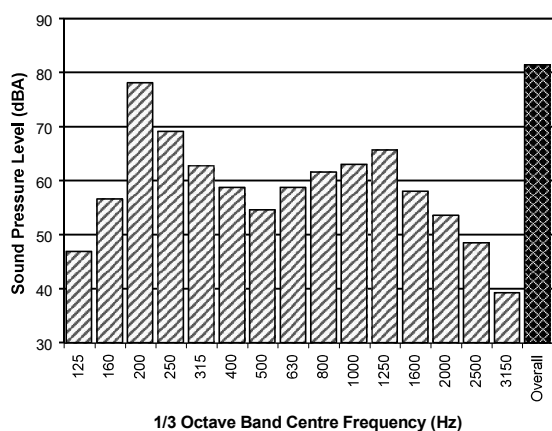
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



## 6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

## 7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level  $V$ , expressed in mm/s can be converted to decibels by the formula  $20 \log (V/V_0)$ , where  $V_0$  is the reference level ( $10^{-9}$  m/s). Care is required in this regard, as other reference levels may be used.

## 8. Human Perception of Vibration

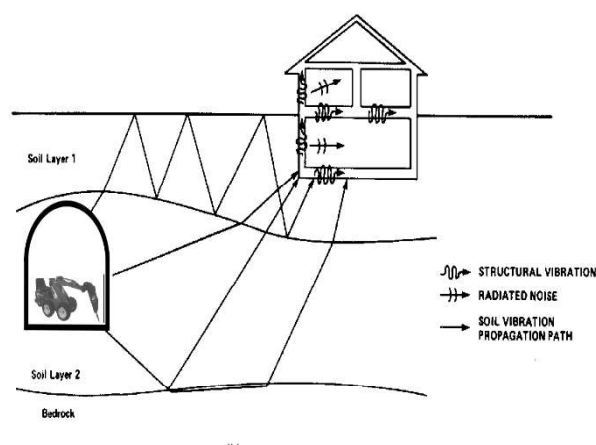
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

## 9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

# APPENDIX B

## Noise Monitoring Results

**Table B-1 Summary of measured noise levels (rounded)**

| Descriptor                           | Average | Tue 19 Oct | Wed 20 Oct | Thu 21 Oct | Fri 22 Oct | Sat 23 Oct | Sun 24 Oct | Mon 25 Oct | Tue 26 Oct |
|--------------------------------------|---------|------------|------------|------------|------------|------------|------------|------------|------------|
| L <sub>Aeq</sub> ,Day (7am-6pm)      | 70      | 73         | 72         | 72         | 73         | 59         | 56         | 75         | 79         |
| L <sub>Aeq</sub> ,Evening (6pm-10pm) | 55      | 55         | 55         | 54         | 56         | 56         | 54         | 55         | 58         |
| L <sub>Aeq</sub> ,Night (10pm-7am)   | 57      | 59         | 56         | 59         | 53         | 53         | 59         | 60         | 60         |
| L <sub>A90</sub> ,Day (7am-6pm)      | 58      | 59         | 60         | 60         | 59         | 53         | 51         | 61         | 61         |
| L <sub>A90</sub> ,Evening (6pm-10pm) | 52      | 51         | 51         | 50         | 52         | 52         | 50         | 52         | 56         |
| L <sub>A90</sub> ,Night (10pm-7am)   | 49      | 48         | 47         | 48         | 49         | 49         | 48         | 50         | 56         |
| RBL, Day (7am-6pm)                   | 54      | 54         | 55         | 55         | 54         | 52         | 50         | 54         | 58         |
| RBL, Evening (6pm-10pm)              | 50      | 50         | 50         | 50         | 51         | 51         | 50         | 51         | 56         |
| RBL, Night (10pm-7am)                | 47      | 46         | 45         | 46         | 47         | 48         | 47         | 49         | 55         |

Figure B-1 Noise monitor time traces (Start 19 October 2021)

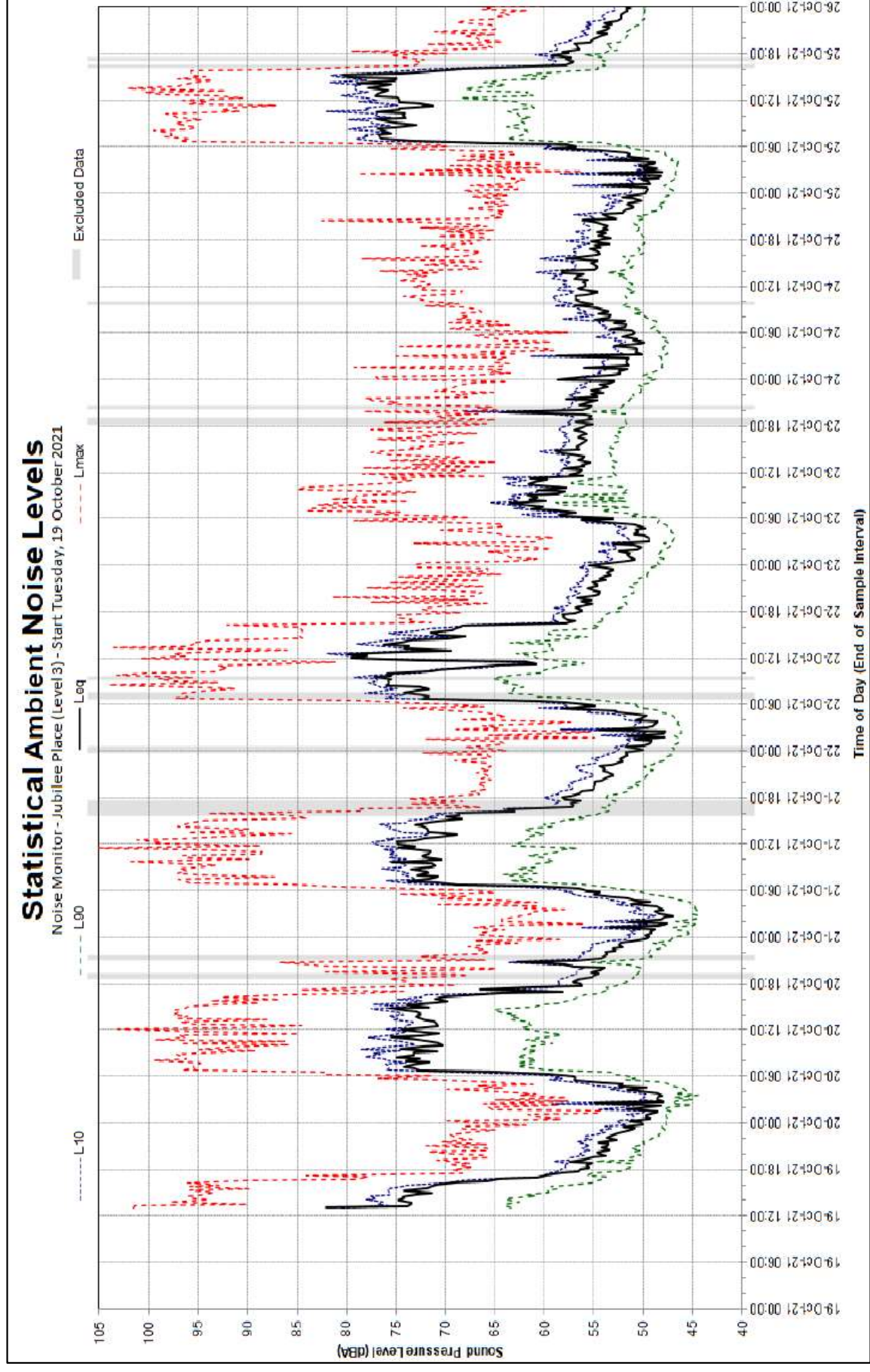
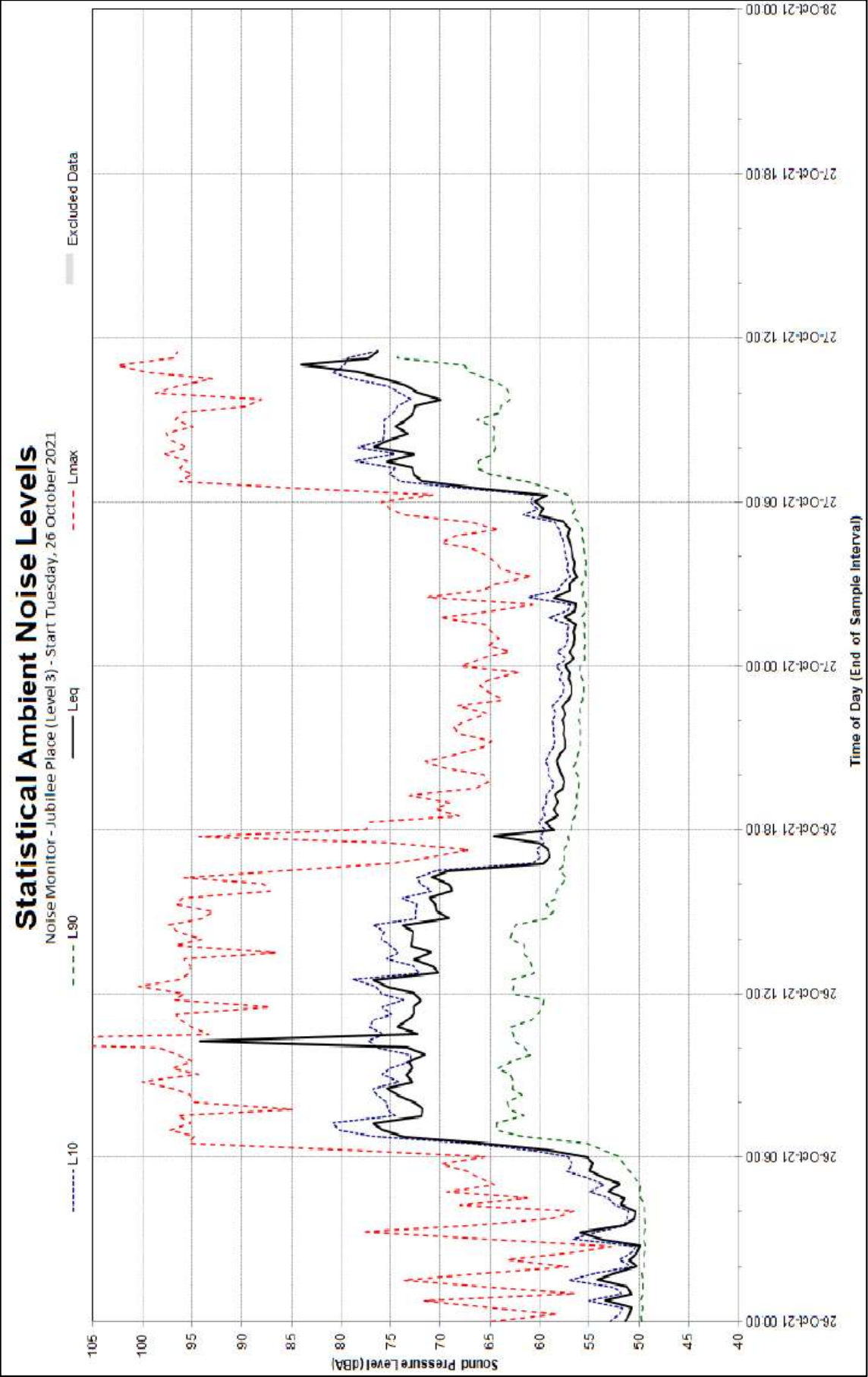


Figure B-2 Noise monitor time traces (Start 26 October 2021)



# APPENDIX C

## Noise Prediction Results

**Table C-1 Summary of measured noise levels (rounded)**

| Receiver                          | Floor level | Façade direction | Predicted noise levels, dBA |               |                  |               |                  |
|-----------------------------------|-------------|------------------|-----------------------------|---------------|------------------|---------------|------------------|
|                                   |             |                  | Daytime, LAeq               | Evening, LAeq | Night-time, LAeq | Evening, LAmx | Night-time, LAmx |
| 16 BREWERS ST, BOWEN HILLS QLD    | GF          | SE               | 25                          | 27            | 23               | 37            | 37               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 1         | SE               | 25                          | 27            | 24               | 38            | 38               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 2         | SE               | 26                          | 28            | 24               | 38            | 38               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 3         | SE               | 26                          | 28            | 24               | 39            | 39               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 4         | SE               | 26                          | 28            | 25               | 39            | 39               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 5         | SE               | 26                          | 28            | 25               | 39            | 39               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 6         | SE               | 27                          | 28            | 25               | 39            | 39               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 7         | SE               | 27                          | 29            | 25               | 39            | 39               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 8         | SE               | 27                          | 29            | 25               | 40            | 40               |
| 16 BREWERS ST, BOWEN HILLS QLD    | GF          | SW               | 30                          | 32            | 28               | 43            | 43               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 1         | SW               | 30                          | 32            | 29               | 43            | 43               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 2         | SW               | 31                          | 33            | 29               | 43            | 43               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 3         | SW               | 31                          | 33            | 29               | 44            | 44               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 4         | SW               | 31                          | 33            | 30               | 44            | 44               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 5         | SW               | 32                          | 34            | 30               | 44            | 44               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 6         | SW               | 32                          | 34            | 31               | 45            | 45               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 7         | SW               | 33                          | 34            | 31               | 45            | 45               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 8         | SW               | 34                          | 36            | 32               | 46            | 46               |
| 16 BREWERS ST, BOWEN HILLS QLD    | GF          | SE               | 28                          | 30            | 27               | 41            | 41               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 1         | SE               | 29                          | 31            | 27               | 41            | 41               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 2         | SE               | 29                          | 31            | 28               | 42            | 42               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 3         | SE               | 29                          | 31            | 28               | 42            | 42               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 4         | SE               | 30                          | 32            | 28               | 42            | 42               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 5         | SE               | 30                          | 32            | 29               | 43            | 43               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 6         | SE               | 30                          | 32            | 29               | 43            | 43               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 7         | SE               | 31                          | 33            | 29               | 44            | 44               |
| 16 BREWERS ST, BOWEN HILLS QLD    | F 8         | SE               | 31                          | 33            | 30               | 44            | 44               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | GF          | SE               | 29                          | 31            | 28               | 42            | 42               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 1         | SE               | 30                          | 32            | 28               | 42            | 42               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 2         | SE               | 30                          | 32            | 29               | 43            | 43               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 3         | SE               | 31                          | 33            | 29               | 43            | 43               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 4         | SE               | 31                          | 33            | 29               | 44            | 44               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 5         | SE               | 31                          | 33            | 30               | 44            | 44               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 6         | SE               | 32                          | 34            | 30               | 44            | 44               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 7         | SE               | 32                          | 34            | 30               | 45            | 45               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 8         | SE               | 32                          | 34            | 31               | 45            | 45               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 9         | SE               | 33                          | 35            | 31               | 45            | 45               |
| 191 CONSTANCE ST, BOWEN HILLS QLD | F 10        | SE               | 33                          | 35            | 32               | 46            | 46               |

| Receiver                               | Floor level | Façade direction | Predicted noise levels, dBA |               |                  |                |                   |
|----------------------------------------|-------------|------------------|-----------------------------|---------------|------------------|----------------|-------------------|
|                                        |             |                  | Daytime, LAeq               | Evening, LAeq | Night-time, LAeq | Evening, LAmix | Night-time, LAmix |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 11        | SE               | 34                          | 36            | 32               | 46             | 46                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 12        | SE               | 34                          | 36            | 33               | 47             | 47                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 13        | SE               | 35                          | 37            | 34               | 48             | 48                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 14        | SE               | 36                          | 38            | 34               | 49             | 49                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 15        | SE               | 37                          | 39            | 36               | 50             | 50                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | GF          | SE               | 29                          | 31            | 27               | 41             | 41                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 1         | SE               | 29                          | 31            | 28               | 42             | 42                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 2         | SE               | 29                          | 31            | 28               | 42             | 42                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 3         | SE               | 30                          | 32            | 28               | 43             | 43                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 4         | SE               | 30                          | 32            | 29               | 43             | 43                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 5         | SE               | 31                          | 33            | 29               | 43             | 43                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 6         | SE               | 31                          | 33            | 29               | 44             | 44                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 7         | SE               | 31                          | 33            | 30               | 44             | 44                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 8         | SE               | 32                          | 34            | 30               | 45             | 45                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 9         | SE               | 32                          | 34            | 31               | 45             | 45                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 10        | SE               | 33                          | 35            | 31               | 46             | 46                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 11        | SE               | 33                          | 35            | 32               | 46             | 46                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 12        | SE               | 34                          | 36            | 32               | 47             | 47                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 13        | SE               | 35                          | 37            | 33               | 47             | 47                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 14        | SE               | 36                          | 38            | 34               | 48             | 48                |
| 191 CONSTANCE ST, BOWEN HILLS QLD      | F 15        | SE               | 37                          | 39            | 35               | 49             | 49                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | GF          | NW               | 35                          | 37            | 33               | 47             | 47                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 1         | NW               | 35                          | 37            | 34               | 48             | 48                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 2         | NW               | 36                          | 38            | 34               | 49             | 49                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 3         | NW               | 36                          | 38            | 35               | 49             | 49                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 4         | NW               | 37                          | 39            | 35               | 50             | 50                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 5         | NW               | 37                          | 38            | 35               | 49             | 49                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 6         | NW               | 37                          | 39            | 35               | 50             | 50                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 7         | NW               | 38                          | 40            | 37               | 51             | 51                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 8         | NW               | 39                          | 41            | 37               | 51             | 51                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | GF          | NE               | 34                          | 36            | 33               | 47             | 47                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 1         | NE               | 35                          | 37            | 33               | 47             | 47                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 2         | NE               | 35                          | 37            | 34               | 48             | 48                |

| Receiver                               | Floor level | Façade direction | Predicted noise levels, dBA |               |                  |                |                   |
|----------------------------------------|-------------|------------------|-----------------------------|---------------|------------------|----------------|-------------------|
|                                        |             |                  | Daytime, LAeq               | Evening, LAeq | Night-time, LAeq | Evening, LAmax | Night-time, LAmax |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 3         | NE               | 36                          | 38            | 34               | 48             | 48                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 4         | NE               | 35                          | 37            | 34               | 48             | 48                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 5         | NE               | 36                          | 38            | 34               | 49             | 49                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 6         | NE               | 36                          | 38            | 35               | 49             | 49                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 7         | NE               | 37                          | 39            | 36               | 50             | 50                |
| 465 ST PAULS TCE, FORTITUDE VALLEY QLD | F 8         | NE               | 38                          | 40            | 36               | 51             | 51                |

## APPENDIX D

### Amplified Entertainment Reference Noise Spectrum

Table D-1 Referenced amplified speaker noise emission spectrum

| Noise Source | 1/3 Octave band noise levels, Sound Power, dB |    |    |    |    |     |     |     |     |     |     |     |     |     |      |      |      | Overall<br>dBA | Overall<br>dB |      |
|--------------|-----------------------------------------------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|----------------|---------------|------|
|              | 31.5                                          | 40 | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 500 | 630 | 800 | 1000 | 1250 | 1600 |                |               | 2000 |
|              | Hz                                            | Hz | Hz | Hz | Hz | Hz  | Hz  | Hz  | Hz  | Hz  | Hz  | Hz  | Hz  | Hz  | Hz   | Hz   | Hz   |                |               | Hz   |
| Loudspeaker  | 50                                            | 61 | 71 | 84 | 96 | 95  | 98  | 96  | 92  | 97  | 92  | 93  | 91  | 91  | 93   | 91   | 87   | 86             | 99            | 105  |

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