16 Thompson Street, Bowen Hills Tower 1 and Masterplan

Noise Impact Assessment

Prepared for: Mewing Planning Consultants Pty. Ltd.

Attention: Leo Mewing

Date: 20 April 2020

Prepared by: Rodrigo Olavarria

Ref: 45289

Stantec Australia Pty. Ltd.
232 St Paul's Terrace, Fortitude Valley QLD 4006
Tel: +61 7 3811 4500 Email: brisbane@wge.com.au www.wge.com.au

\\WGE-BRI-FS-01\PROJECTS\45289\PROJECT DOCUMENTATION\ACOUSTICS\DESIGN\REPORTS\ISSUE\45289-AC-RE-001_002 - 16 THOMPSON STREET TOWER 1 AND MASTERPLAN NOISE IMPACT ASSESSMENT REPORT.DOCX

Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	25-03-2020	Initial Issue	RO	MLL
002	20-04-2020	Final	RO	MLL

Contents

Contents

1. Introduction

1.1 Overview

Stantec Australia Pty. Ltd. (Stantec) have been engaged by Gansons Pty Ltd, Ganboys Pty Ltd and Ganbros Pty Ltd to provide an acoustic report in support a material change application of use for Tower 1 and PDA preliminary approval for the Masterplan pertaining a development to be located at 16 Thompson Street, Bowen Hills.

The application is being made to Economic Development Queensland (EDQ) within the Bowen Hills Priority Development Approval (PDA) Development permit for Material Change for Office, Research and Technology Industry, Health Care Service, Hospital, Childcare Centre (Tower 1), Food and Drink Outlet, Shop and Parking Station, and Showroom and masterplan / plan of development comprising four buildings (including Tower 1), containing of mix use including health care, food and drink outlet, retail, and office.

This report has been prepared to address the requirements for operational noise impacts in the Bowen Hills Priority Development Area (PDA). Assessment against the requirements of the Development Scheme, last amended on 21 June 2019.

This report addresses the noise impacts from the development onto noise sensitive receptors external to the project, as well as transportation noise impacts onto childcare and healthcare uses within the development.

The acoustic assessment contained in this report is based on a noise survey that was conducted during February 2020, our understanding of the proposed development, the application of the relevant guidelines and professional experience within the acoustic field.

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

The recommendations made in this report are based on available information at the date of issue of this report and are subject to change during the Project design. Where changes to the design occur, further advice should be sought to ensure that the acoustic outcomes presented in this report are achieved.

This report relates to this specific project and must not be applied to any other project without consultation with WGE. Designs and conditions can vary between projects causing significant variations in acoustic performance and relevant subsequent advice to one project may not apply to another.

This report shall not be relied upon as providing any warranties or guarantees of construction quality with regards to acoustics.

2. Referenced documentation

The following documents and standards are referenced throughout this report:

- Bowen Hills Priority Development Area (PDA) Development Scheme, last amended on 21 June 2019;
- Brisbane City Council Planning Scheme Policy 2014;
- Queensland Government Development Assessment mapping system and the State Development Assessment Provisions – State Code 2: Development in a railway environment v2.6;
- Environmental Protection Act 1994, current as at 9 December 2019;
- AS/NZS 2107:2016 – Acoustics – Recommended indoor design sound levels and reverberation times for building interiors;
- Australian Association of Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment; and
- AS 1055.2018 – Acoustics – Description and measurement of environmental noise.

3. Project overview

3.1 Project description

The Project is to be located at 16 Thompson Street, Bowen Hills, as shown in **Figure 1**. The development comprises:

- **Tower 1:** A 14 storey tower which facilitates retail, services and end of trip facilities on the ground floor, three levels of podium carparking, and commercial office space within the tower (including childcare on Level 6). There is a roof terrace with services, amenities, meeting rooms and green roof landscape. A PDA Development Permit is sought for Material Change for Office, Research and Technology Industry, Health Care Service, Hospital, Childcare Centre, Food and Drink Outlet, Shop and Parking Station; and
- **Masterplan:** Supporting tower 1 development is a masterplan / plan of development comprising four buildings (including tower 1), containing of mix use including health care, food and drink outlet, retail, and office. Throughout the development is public and open green spaces. Access to the masterplan is via Thompson Street, Murray Street and Abbotsford Road. A PDA Preliminary Approval for master plan / plan of development is sought.

The project will be located within a Mixed Industry and Business Zone within the Bowen Hills Priority Development Area (PDA).

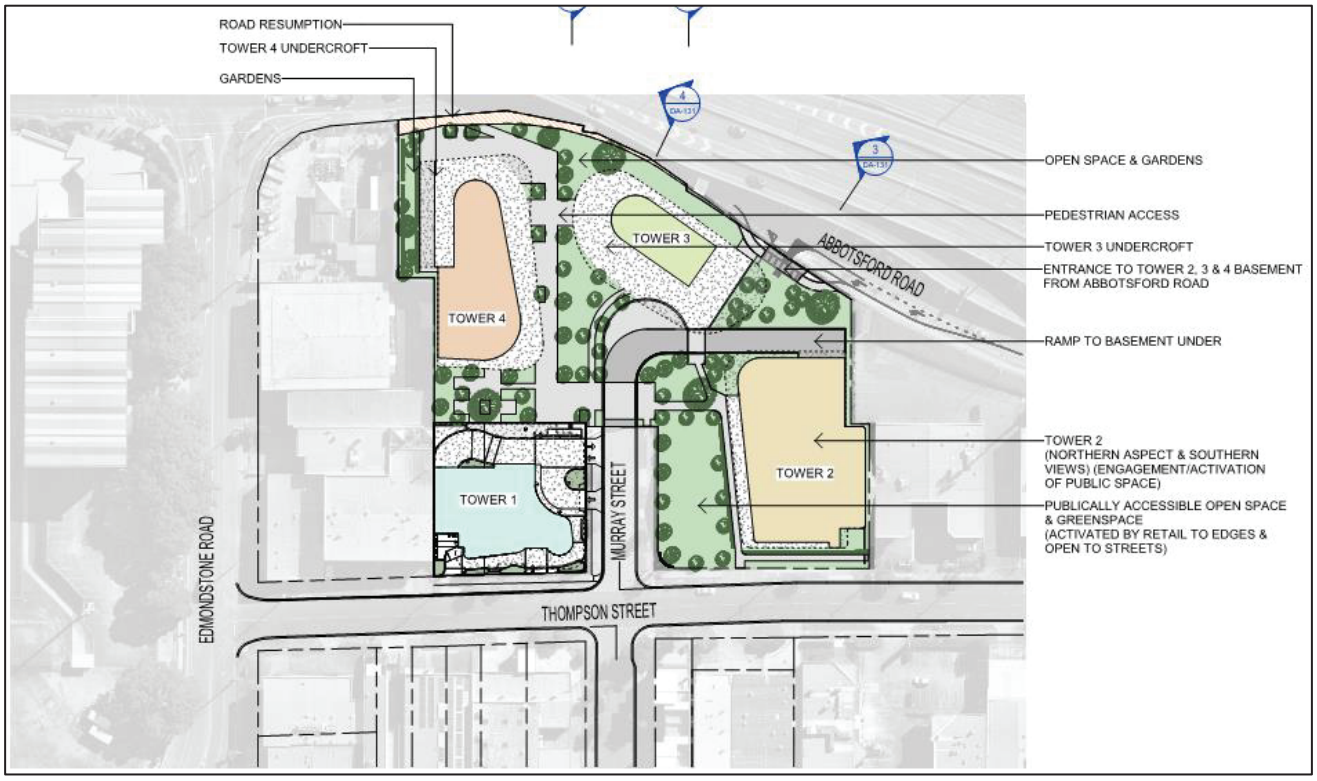

Figure 1 Masterplan

3.2 Noise sensitive receptors

The closest external sensitive (dwelling) receptors are located at 170m to the East of the site. At this distance, these receptors are unlikely to be impacted by noise emissions from the project.

Existing external commercial receptors will be located adjoining the project, or across Thompson Street and across Murray Street. These receptors will have low sensitivity to the noise emitted from the site and are unlikely to be impacted.

Internally, Tower 1 will comprise offices, childcare centre and a health care service. Road traffic noise from Inner City Bypass (ICB) will be largely screened by Towers 2-4 and the existing adjoining commercial buildings, and the resulting residual noise from the ICB and the road traffic noise from Thompson Street will be managed by the design of the building facades.

Towers 2-4 will be exposed to higher levels of road traffic noise from ICB, which will be controllable mostly via acoustic treatment of the building facades, but also with the location of sensitive spaces facing away from this road.

3.3 Acoustic environment

Unattended noise monitoring (noise logging) was conducted to quantify the existing noise environment on site and specify applicable noise limits. Monitoring was conducted between Thursday 20th February and Friday 28th February 2020 at the locations shown in **Figure 2**.

Figure 2 Noise monitoring locations

Noise measurements were conducted in accordance with Australian Standard AS 1055.2018 – *Acoustics – Description and measurement of environmental noise*, and the instrument was configured as follows:

- A-weighting frequency response;
- FAST time response; and
- 15 minute intervals.

The sound level meters were calibrated before and checked at the end of the measurement period. The instrument showed a drift less than ±1 dB during monitoring; therefore, measurements are considered valid according to AS1055:2018.

For further details and full measured results, refer to **Appendix C**. A summary of relevant noise descriptors used in this assessment to determine applicable noise emission limits is presented in **Table 1**.

Table 1: Summary of relevant noise descriptors used to determine noise emission limits (based on measured noise levels by Noise Monitor 1)

LA90, dB(A)		
Day (7am-6pm)	**Evening (6 PM – 10 PM)**	**Night (10 PM – 7 AM)**
57	54	49
RBL, dB(A)		
Day (7am-6pm)	**Evening (6 PM – 10 PM)**	**Night (10 PM – 7 AM)**
56	53	44

4. Environmental noise criteria

The project will be located within the Bowen Hills Priority Development Area (PDA); therefore, the requirements from the Bowen Hills Priority Development Area (PDA) Development Scheme June 2019 apply.

The requirements under the Development Scheme only apply to noise intrusion onto the project from some transportation sources, not from the likely noise emissions from the project (i.e. mechanical plant), car parks and childcare centre. However, the following is noted with regards to the noise emissions from the project:

- Car movements to and the car parks will produce the highest noise levels during peak hour traffic, when users of the adjoining commercial buildings will also be travelling to and from their place of work; therefore, no adverse impacts are expected. Thus, this noise source is not assessed further;
- A childcare centre will be located on Level 6 of Tower 1, at a higher elevation than existing adjoining buildings, where receptors are exposed to road traffic noise, the dominant noise source on site. The building structures would provide acoustic screening in this case, and further screening required to reduce road traffic noise intrusion at outdoor play areas will further reduce noise levels at external sensitive receptors to the project, although this is not expected to be required to meet environmental noise emission limits. In summary, no adverse noise impacts from the childcare centre to receptors external to the project are expected.

In the absence of applicable noise emission criteria in the Bowen Hills PDA, it is proposed that the environmental Noise emissions are assessed using the most conservative noise limits between the QLD Environmental Protection Act 1997 and the Brisbane City Plan 2014. Whilst the criteria apply to all the noise sources, this will typically be applied to mechanical plant only, for the reasons explained above.

Similarly, where noise intrusion criteria applicable to the likely uses pertaining the Masterplan is not provided in the PDA, reference has been made to recommended levels in Australian standards and guidelines.

4.1 Bowen Hills Priority Development Area Development Scheme requirements

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 the impacts from railways, Section 2.5.9.1 of the Development Scheme PDA states:

> *"Development ensures that the community is protected from significant adverse impacts resulting from environmental emissions generated by a railway (refer to the Queensland Government Development Assessment mapping system and the State Development Assessment Provisions – State Code 2: Development in a railway environment)."*

In relation to noise from transportation sources, the requirements in Section 2.5.9.3 of the Development Scheme are reproduced below:

> *"Development is oriented, designed and constructed to:*
>
> *reduce the exposure to noise impacts from designated transport noise corridors (refer to the Brisbane City Plan Transport Noise overlay map); and*
>
> *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 adjoining a law fully 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.*

Following the above, the following would apply:

- **Rail traffic:** Queensland Government Development Assessment mapping system and the State Development Assessment Provisions – State Code 2: Development in a railway environment;
- **Road traffic:** The project site is not located inside a State designated noise corridor (i.e. state controlled road). Whilst located within a Brisbane Noise corridor, BCC requirements only apply for the protection of residential buildings against Queensland Development Code MP4.4. Residential uses are not proposed for the master plan; therefore, a road traffic impact assessment is not a mandatory requirement. In the absence of assessable criteria, road traffic noise intrusion has been assessed against the applicable criteria presented in the following documents
  - AS/NZS 2107:2016 – Acoustics: Recommended indoor design sound levels and reverberation times for building interiors; and
  - Australian Association of Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment.

It is not proposed that the project will incorporate a licensed venue; therefore, noise emissions from noise sources pertaining this use are not addressed further.

4.1.1 Rail noise criteria

For assessment of rail noise intrusion, the PDA Development Scheme refers to the Queensland Government Development Assessment mapping system and the State Development Assessment Provisions – State Code 2: Development in a railway environment.

The applicable assessment criteria is reproduced in **Table 2**, which will apply to the childcare centre and health care uses within the masterplan assessed as a hospital. It is noted that, according to SDAP State Code 2, hospital is defined as:

the use of the premises for:

1. *The medical or surgical care or treatment of patients, whether or not the care or treatment requires overnight accommodation; or*
2. *Providing accommodation for patients; or*
3. *Providing accommodation for employees, or any other use, if the use is ancillary to the use in paragraphs 1 or 2.*

It is further noted that Tower 1-2 will be located at a distance greater than 50 metres from the centreline of the nearest railway track. This is greater than the 25m distance required in SDAP State Code 2 for the assessment of rail induced vibration; therefore, this pollutant is not considered further.

Table 2: Applicable railway noise criteria (Reproduced from Table 2.2.1 of SDAP State Code 2, v2.6)

Performance Outcomes	Acceptable Outcomes
Noise at a childcare centre and educational establishment	
PO27 Development involving a: 1. Childcare centre; or 2. Educational establishment minimises noise intrusion from a railway or type 2 multi-modal corridor in indoor education areas and indoor play areas.	**AO27.1** A noise barrier or earth mound is provided which is designed, sited and constructed: 1. To meet the following external noise criteria at all facades of the building envelope: a) 65 dB(A) Leq (1 hour) façade corrected (maximum hour during opening hours) b) ≤87dB(A) (single event maximum sound pressure level) façade corrected. 2. In accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011.

Performance Outcomes	Acceptable Outcomes
	Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report be provided. If the building envelope is unknown, the deemed-to-comply setback distances for buildings stipulated by the local planning instrument or relevant building regulations should be used. OR all of the following apply: **AO27.2** Buildings which include an indoor education area, indoor play area or sleeping room are setback furthest from a railway or type 2 multi-modal corridor as possible. AND **AO27.3** Buildings are designed and oriented so that indoor education areas, indoor play areas or sleeping rooms are located furthest from a railway or type 2 multi-modal corridor. AND AO27.4 Buildings are designed and constructed using materials which ensure indoor education areas and indoor play areas meet the following internal noise criteria: • ≤50 dB(A) single event maximum sound pressure level. AND **AO27.5** Buildings are designed and constructed using material which ensure sleeping rooms in a childcare centre meet the following internal noise criteria: • ≤45 dB(A) single event maximum sound pressure level. Note: Noise levels from railways or type 2 multi-modal corridors are measured in accordance with AS1055.1–1997 Acoustics –Description and measurement of environmental noise. To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report be provided.
PO28 Development involving a: 1. Childcare centre; or 2. Educational establishment minimises noise intrusion from a railway or type 2 multi-modal corridor in outdoor education areas and indoor play areas.	**AO28.1** A noise barrier or earth mound is provided which is designed, sited and constructed: 1. To meet the following external noise criteria in each outdoor education area or outdoor play area: a) ≤62 dB(A) Leq (24 hour) free field (between 6am and 6pm) b) ≤84 dB(A) (single event maximum sound pressure level) free field 2. In accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011. Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report be provided. OR AO28.2 Each outdoor education area and outdoor play area is shielded from noise generated from a railway or type 2 multi-modal corridor by a building, a solid gap-free fence, or other solid gap-free structure.

Performance Outcomes	Acceptable Outcomes
Hospital	
PO29 Development involving a hospital minimises noise intrusion from a railway or a type 2 multi-modal corridor in patient care areas.	**AO29.1** Hospitals are designed and constructed using materials which ensure ward areas meet the following internal noise criteria: • ≤45 dB(A) single event maximum sound pressure level AND **AO29.2** Hospitals are designed and constructed using materials which ensure patient care areas (other than ward areas) meet the following internal noise criteria: • ≤50 dB(A) single event maximum sound pressure level. Note: Noise levels from railways or type 2 multi-modal corridors are measured in accordance with AS1055.1–1997 Acoustics –Description and measurement of environmental noise. To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report be provided.
PO30 Development involving a hospital located within 25metres of the centreline of the nearest railway track minimises vibration impacts from a railway or type 2 multi-modal corridor in patient care areas.	**AO30.1** Hospitals are designed and constructed to ensure vibration in the treatment area of a patient care area does not exceed a vibration dose value of 0.1m/s$^{1.75}$. AND **AO30.2** Hospitals are designed and constructed to ensure vibration in the ward area of a patient care area does not exceed a vibration dose value of 0.4m/s1.75. Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified vibration assessment report be provided.

4.1.2 Road traffic noise

To satisfy the intent of the PDA to "*ensure that the community is protected from significant adverse impacts resulting from environmental emission"* and "*reduce the exposure to noise impacts from designated transport noise corridors*", criteria for assessment has been extracted from the following documents:

- AS/NZS 2107:2016 – Acoustics: Recommended indoor design sound levels and reverberation times for building interiors; and
- Australian Association of Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment.

Assessment criteria is presented in **Table 3**.

Table 3: Proposed road traffic noise intrusion criteria

Performance Outcomes	Acceptable Outcomes
Childcare centre	
Outdoor play area	$L_{Aeq,1hr}$ 55 dBA
Indoor play or sleeping area	$L_{Aeq,1hr}$ 40 dBA
Hospital	
Internal noise levels	$L_{Aeq,1hr}$ 40-45 dBA, typical for the use defined in AS/NZS2107:2016.

4.2 Environmental Protection Act 1994

Section 440U of the Environmental Protection Act 1994 applies to premises at or for which there is air conditioning equipment.

An occupier of the premises must not use, or permit the use of, the equipment on any day:

- before 7am, if it makes a noise of more than 3dB(A) above the background level; or
- from 7am to 10pm, if it makes a noise of more than 5dB(A) above the background level; or
- after 10pm, if it makes a noise of more than 3dB(A) above the background level.

According to the EPA Act 94:

- Background level means the background A-weighted sound pressure level under the prescribed standard measured as $L_{A90,T}$.
- $L_{A90,T}$ means the A-weighted sound pressure level obtained using time weighting 'F' that is exceeded for 90% of the measuring period (T).

According to the Environmental Protection Regulation, source noise for noise standard 440U may be measured as $L_{A90,T}$.

Based on the noise data collected by Noise Monitor 1 and summarised in **Table 1**, the applicable EPA Act 1994 noise limits are presented in **Table 4**. It is understood that the noise limits apply at any 15min within the indicated day periods.

Table 4: Mechanical plant noise limits, based on noise measurements conducted on site by Noise Monitor 1

Period	Criteria	Noise Limit, $L_{A90,T}$ dBA
7.00am – 6.00pm	<5 dBA above background	62
6.00pm – 10.00pm	<5 dBA above background	59
10.00pm – 7.00am	<3 dBA above background	52

4.3 Brisbane City Council Planning Scheme Policy 2014

According to the BCC City Plan mapping tool, Tower 1 and the Masterplan will be located within a II Industry Investigation Zone and EC Emergency Community zone, and it will be surrounded by II and EC zones. No Performance Outcomes (PO) nor Acceptable Outcomes (AO) are defined within the respective zone codes. Given the application is for a material change of use and the masterplan contemplates a mix of uses, the BBC City Plan 2014 Centre or Mixed Use Zone Code has been referred to for assessment, as the most applicable.

4.3.1 Centre or Mixed Use Code

The Centre or Mixed Use Code contains performance outcomes and acceptable outcomes that are the assessment criteria for the development. The relevant performance outcomes and acceptable outcomes are presented in **Table 5**.

The applicable criteria are presented in **Table 6** to **Table 8**, where the night time criteria is provided for information as the noise emissions within this period will be negligible due to the main uses of the building being closed at this time.

Table 5: Acoustic Criteria from Centre or Mixed Use Code (Table 9.3.3.3.A of City Plan 2014)

Performance Outcomes	Acceptable Outcomes
Section A—If for accepted development subject to compliance with identified requirements (acceptable outcomes only) or assessable development	
PO1 Development: (a) has hours of operation which are controlled so that the use does not detrimentally impact on the amenity of adjoining residents; (b) does not result in noise emissions that exceed 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 in a sensitive zone or a nearby sensitive use, except music noise where located in a Special Entertainment Precinct identified in a neighbourhood plan. Note—A noise impact assessment report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.	**AO1.1** Development: (a) for accommodation activities, dwelling unit or emergency services has unlimited hours of operation; (b) for a club, if licensed, function facility, hotel or nightclub entertainment facility does not generate noise which is clearly audible and detectable, or impacts on the amenity of a resident, in a dwelling or other sensitive use; Note—Development for a club, if licensed, function facility, hotel or nightclub entertainment facility is not expected to achieve this outcome. (c) for any other use: (i) where in the Principal centre zone or Major centre zone has unlimited hours of operation; (ii) where in the District centre zone, Neighbourhood centre zone or Mixed use zone: (A) has hours of operation, including for deliveries, which are limited to 6am to 10pm; or (B) does not generate noise which is clearly audible and disturbing in a dwelling or other sensitive use; (iii) where in any other zone: (A) has hours of operation, including for deliveries, which are limited to 6am to 8pm; or (B) does not generate noise which is clearly audible and disturbing in a dwelling or other sensitive use. AO1.2 Development ensures mechanical plant or equipment is acoustically screened from an adjoining sensitive use. Note—Mechanical plant includes generators, motors, compressors and pumps e.g. air-conditioning, refrigeration or cold room motors
Additional criteria for development if for a food and drink outlet	
PO7 Development mitigates impacts on residential amenity in or adjoining the building through: (a) providing an outdoor dining area that is appropriately located; (b) ensuring external dining and entertainment areas are visually and acoustically screened from an adjoining dwelling.	**AO7** Development provides for external dining or entertainment areas to be: (a) located in or directly adjacent to the public realm; (b) visually and acoustically screened from an adjoining dwelling.

Table 6: BCC Centre or Mixed Use Code Noise (planning) criteria (source: BCC City Plan 2014 Table 9.3.3.3.F)

Criteria location	Intrusive noise criteria Day, evening and night $L_{Aeq,adj,T}$ are not greater than the RBL plus the value in this column for the relevant criteria location, where T equals: day – 11hr (7am-6pm) evening – 4hr (6pm-10pm) night – 9hr (10pm-7am)	Acoustic Amenity Criteria Day, evening and night $L_{Aeq,adj,T}$ are not greater than the values in the columns below for the relevant criteria location, where T equals: day – 11hr evening – 4hr night – 9hr		
		Day	Evening	Night
Emerging Community Zone boundary	5 dBA	55 dBA	50 dBA	45 dBA

Table 7: BCC Centre or Mixed Use Code low frequency criteria (source: BCC City Plan 2014 Table 9.3.3.3.G)

Criteria location	Day (7am-6pm) $L_{Ceq,adj,11hr}$ is not greater than the following values at the relevant criteria location	Evening (6pm-10pm) $L_{Ceq,adj,4hr}$ is not greater than the following values at the relevant criteria location	Night (10pm-7am) $L_{Ceq,adj,9hr}$ is not greater than the following values at the relevant criteria location
Emerging Community Zone boundary	65 dBC	65 dBC	60 dBC

Table 8: Night-time noise criteria (source: BCC City Plan 2014 Table 9.3.3.3.H)

Criteria location	Where the existing LAeq,9hr(night) at the criteria location is:	Average of the highest 15 single LAmax events over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location	The absolute highest single LAmax event over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location
At the zone boundary of a Emerging Community Zone	<45 dBA	50 dBA	55 dBA
	45 to 60 dBA	$L_{Aeq,9hr}$ + 5 dBA	$L_{Aeq,9hr}$ + 10 dBA
	>60 dBA	65 dBA	70 dBA

4.4 Environmental noise emission limits

When the strictest noise criteria defined in **Section 4.2** and **Section 4.3** are applied in combination with the noise levels in **Table 1**, the noise limits in **Table 9** result.

Table 9: Environmental noise emission limits

Day (7am-6pm)		Evening (6pm-10pm)		Night (10pm-7am)		
$L_{Aeq,adj,11hr}$	$L_{Ceq,adj,11hr}$	$L_{Aeq,4adj,hr}$	$L_{Ceq,4adj,hr}$	$L_{Aeq,4adj,hr}$	$L_{Ceq,4adj,hr}$	L_{Amax}
61 dBA	65 dBC	50 dBA	65 dBC	45 dBA	60 dBC	61 dBA average of highest 15 events 66 dBA absolute highest single event

$L_{Ceq,Tadj}$ noise limits apply to mechanical plant only. $L_{Aeq,T}$ noise limits apply to all other noise sources in combination.

5. Noise impact assessment

5.1 Noise emissions from mechanical plant

Continuous noise sources pertaining Tower 1 and the Masterplan will include air conditioning equipment, car park exhaust fans and other exhaust systems (e.g. kitchens/toilets). Details of plant pertaining the buildings is not available for assessment at this stage; therefore, the noise limits in **Table 4** are provided for assessment during the following design stages. Given the low sensitivity of existing commercial receptors external to the project, no adverse impacts are expected where the noise emissions of plant are controlled to meet these noise limits, which may only typically require the installation of standard noise control systems.

5.2 Transportation Noise intrusion

This section provides an assessment of rail noise intrusion against the requirements detailed in **Section 4.1.1** and **Section 4.1.2**. The assessment was conducted based on the measured noise levels registered by the noise monitors at the site.

5.2.1 Tower 1 Childcare centre

Rail traffic noise intrusion

A conservative assessment of rail noise levels at the Childcare centre is presented in **Table 10**, which is based on direct assessment of the measured noise levels by Noise Monitor 1 against the noise limits. The assessment is conservative for the following reasons:

- The noise levels were measured at a closer distance to the rail line than the nearest actual Tower 1 façade;
- The measured noise levels were captured by an instrument with its microphone in direct line of sight to the rail line. When constructed, the Masterplan buildings will provide significant screening to this location;
- The limits were assessed against the combined contribution of rail and road traffic, the latter is the dominant noise source, where train pass-by occur they are barely audible above road traffic;
- Assessment of maximum noise levels was conducted using the L_{Amax} noise descriptor, not the Single Event Maximum (SEM) noise descriptor which is also conservative as the SEM is the average of the 15 loudest trains in any day.

Table 10: State Code 2 rail noise intrusion assessment at childcare centre

Noise descriptor	Noise limit, dBA (SEM)	Noise Monitor 1 Measured noise level, dBA	Comment
$L_{Aeq,1hr}$ (maximum during operation hours)	65	65	Noise level below limit
L_{Amax}	87 (Façade) 84 (External)	88	The measured noise level is only 1 dB above the façade limit and 4 dB above external limit. Noise levels at the building will be well below the criteria for the following reasons: • Measurements were made using the L_{Amax}, which is a much more conservative noise descriptor than the SEM measured in the free field; • Measurements were made at a closer distance than the actual Tower 1 façade (a further 3-6 dB reduction due to the additional increase in distance); and • Tower 1 will have screening provided by masterplan buildings, which will be located between the railway and Tower 1 (3-6 dB expected conservatively); • The childcare centre will be required to incorporate acoustic screening around the perimeter to reduce traffic noise. This measure will further reduce rail noise; Based on these conservative assumptions, the SEM would be greater than 10 dBA below the noise limits.
$L_{Aeq,24hr}$	59	62	Noise level below limit

Based on the assessment above, the applicable noise limits from rail noise will be met at the Tower 1 childcare centre and no further mitigation measures are required to protect the use against the impacts of rail traffic noise.

Road traffic noise intrusion

Table 11 provides an indication of road traffic noise impacts at the childcare centre, and the minimum road traffic noise attenuation and options that may be required.

Table 11: Road traffic noise intrusion assessment at childcare centre

Noise descriptor	Noise limit at typical use, dBA[1]	Noise Monitor 2 measured noise level, dBA	Comment
Max $L_{Aeq,1hr}$	55 at outdoor play area	65	Maximum 10 dB road traffic noise attenuation required. This is achievable with combination of acoustic screening around outdoor play area and sound absorption to soffit. (This is par
	40 at indoor play and sleeping area		< 25 dB road traffic attenuation required after acoustic screening applied to outdoor play area.

5.2.2 Masterplan Healthcare

Rail traffic noise intrusion

Rail traffic noise criteria is presented in **Table 12.** The noise limits are largely exceeded by the existing road traffic noise levels, making the rail noise levels barely inconsequential where road traffic noise is the dominant noise source, and the loudest; therefore, where the building as are designed to control the noise from road traffic noise, no adverse impacts from rail traffic are expected. Thus, rail noise levels are not addressed further.

Road traffic noise intrusion

The exact location of heath care uses within the master plan is not known at this stage; therefore, **Table 12** is presented to provide an indication of the minimum requirements of road traffic noise attenuation that will be required to be provided by the building facades facing ICB.

Table 12: Road traffic noise intrusion assessment at Health uses facing ICB

Noise descriptor	Noise limit at typical use, dBA[1]	Noise Monitor 2 measured noise level, dBA	Comment
Max $L_{Aeq,1hr}$	35-45 Office areas 40-45 Consulting room patient lounge, Dental clinic, geriatric rehabilitation, Staff room, procedure room	74	Minimum road traffic noise attenuation of façade 32 dB to allow for air conditioning noise intrusion

[1] Noise levels assessed against recommended indoor design sound levels from AS/NZS 2107:2016 from typical uses.

Based on the assessment above, where health care uses are located at facades facing the ICB, these will be required to provide a road traffic noise attenuation up to 32 dBA. This will require high performance acoustic systems. Whilst this is may be achievable, it is recommended that these be located facing away from the ICB, given the sensitivity of the use. Alternatively, the health spaces may be incorporate corridors around the perimeter to achieve noise limits inside patient care and other areas using buffer zones.

6. Recommendations

A noise impact assessment has been conducted in support of an application to Economic Development Queensland (EDQ) for a Priority Development Approval (PDA) Development permit for material change of use for Tower 1 and PDA preliminary approval for the Masterplan pertaining a development to be located at 16 Thompson Street, Bowen Hills.

Noise monitoring was conducted to determine representative ambient noise levels at representative locations of the worst-case exposure of the future Tower 1 and Masterplan buildings, and of the noise levels at the closest external receptors to the project. The data collected was used to specify noise limits for mechanical plant noise emissions, and to assess the potential impact from transportation noise onto the sensitive uses pertaining the project.

The noise assessment presented in **Section 5** showed that acoustic treatments may be required to ensure that noise emissions at or below the noise limits are achieved. These are summarised as follows:

6.1 Mechanical plant noise

Noise limits are presented in this report that will apply the Tower 1 and Masterplan plant equipment. The noise emission of the various plant items is to be reviewed during the following and suitable noise controls are to be implemented, where noise levels are found to exceed the noise limits in **Table 9**.

No specific recommendations are made currently as the project is at an early stage of design.

6.2 Childcare centre

The assessment presented showed that rail traffic would not result in adverse noise impacts at the centre. However, road traffic noise may result in adverse impacts and is to be manage further. Further assessment will be required during the following design stages to confirm the following:

- Combination of acoustic screen surrounding the outdoor play and learning areas (all perimeter) and sound absorption to the soffit to meet the noise limits at outdoor play areas;
- Acoustic performance of glazing systems, which, in combination to the recommendation above, will result in noise levels that meet the noise limits for internal play and sleeping areas.

6.3 Healthcare areas

Analysis of the noise data showed that acoustic treatment will be required to be applied to Building 2-4 facades, where healthcare uses are introduced facing the ICB. Road traffic noise intrusion up to 32 dBA will be required. Alternative options to manage the noise levels include:

- Placement of heath care uses facing away from the ICB;
- High performance façade glazing systems;
- corridors around the perimeter of health areas to achieve noise limits inside patient care and other areas using glazing systems with a lower acoustic performance.

6.4 Other areas

The development will also incorporate ground level retail and office spaces on levels above. Applicable noise limits inside office spaces will be like those applied in this report to healthcare areas, in the order of 35-45 dBA. The recommendations to treat noise intrusion to healthcare areas may also be considered to provide suitable noise levels inside office spaces.

7. Conclusion

Based on the noise assessment conducted, it is advised that Tower 1 and the Masterplan can be designed to mitigate its noise impacts onto the community and meet applicable internal noise limits from transportation noise sources; therefore, the project is considered feasible from a noise perspective.

7.1 Recommended Conditions

We recommend the following conditions with the following intent be included in the project approval:

- Acoustic treatment to meet the proposed noise limit of 55 dBA at outdoor play and learning areas for road traffic. This may be in the form of acoustic screening around the perimeter (primary measure) and acoustic treatment to the soffit (complementary measure);
- Acoustic treatment to the façade which, in combination to the above measures, will result in a noise level at or below $L_{Aeq,1hr}$ 40 dBA at indoor play and/or sleep areas;
- Acoustic treatment to the façade, and/or fit out considerations to achieve AS/NZS2107:2016 indoor design sound levels as applicable to the various uses within the healthcare facilities;
- Design mechanical plant to meet the outdoor noise limits in **Table 9** of this report.

Should you have any queries regarding this report, please do not hesitate to contact the undersigned on (07) 3811 4500.

Yours faithfully

Rodrigo Olavarria (Author)

Senior Acoustics Engineer for
Stantec Australia Pty Ltd

Michael Lanchester (Reviewer)

Acoustics Section Manager (QLD) for
Stantec Australia Pty Ltd

Appendix A Glossary of Acoustic Terms

Acceptable Noise Level:	The acceptable L_{Aeq} noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{A90} noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A-filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
L_{Amax}	The maximum A-weighted sound pressure level measured over a period.
L_{Amin}	The minimum A-weighted sound pressure level measured over a period.
L_{A1}	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
L_{A10}	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
L_{A90}	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{A90} noise level expressed in units of dB(A).
L_{Aeq}	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.

$L_{Aeq,T}$	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R_w:	The Sound Insulation Rating R_w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L_{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

Appendix C Noise Monitoring Details

Unattended noise monitoring (noise logging) was conducted between Thursday 20th February and Friday 28th February 2020. The indicative location of the noise monitors is shown in **Figure 1**. The noise monitoring was undertaken in accordance with AS 1055:2018 A*coustics – Description and measurement of environmental noise*.

The following instrumentation was used:

- NTi XL2 Class 1 sound level meter (Serial A2A-12892-E0), and Pulsar 105 Class 1 acoustic calibrator (serial number 72913). The instruments had a current calibration certificate by a certified National Association of Testing Authorities (NATA) acoustics laboratory at the time of measurements.

Noise measurements were conducted in accordance with Australian Standard AS 1055:2018 – *Acoustics – Description and measurement of environmental noise*, and the instruments were configured as follows:

- A-weighting frequency response;
- FAST time response;
- 15-minute intervals;

The sound level meter was calibrated before and checked at the end of each measurement period, at each location. The instrument showed a drift less than ±1dB during the course of monitoring; therefore, measurements are considered valid according to AS1055:2018.

Noise monitoring results

The raw sound level meter files were post-processed to determine relevant long-tern noise descriptors, some of which were used to determine the applicable noise limits.

Results and plots of relevant noise descriptors captured by Noise Monitor 1 are provided in **Table 13** and **Figure 3**. Results and plots of relevant noise descriptors captured by Noise Monitor 2 are provided in **Table 14** and **Figure 4**. Where data was not measured for a full period (i.e. at the start and end of measurement), the cells are shown dashed in the table. In addition, the noise descriptor averages are presented.

A summary of weather observations by the Bureau of Meteorology (BoM) during the monitoring period is shown in **Table 15**. Up to 4.4mm of rain were recorded at the closest weather station at Brisbane Airport. With reference to the Department of Transport and Main Roads Code of Practice 2013: Volume 1: Road Traffic Noise, for traffic noise measurements conducted over a 24-hour period, the maximum acceptable a maximum of 0.3 mm/hr. Whilst from the time trace plots it appears that the data has been largely unaffected, noise levels recorded between 23rd and 25th March when total daily rain fall was between 1.4mm and 4.4 mm has been excluded from the averages presented in the tables.

Noise data captured on weekends has also been excluded from the averages.

Table 13: Summary of measured noise levels (rounded) – Noise Monitor 1

Noise descriptor	Measured Noise Level, dB(A)					Average, dB(A)
	Thu 20/02/20	Fri 21/02/20	Sat 22/02/20	Sun 23/02/20	Mon 24/02/20	
$L_{A10(18hr),6am-12am}$	-	61	60	59	61	61
$L_{Aeq,7am-6pm}$	-	60	59	58	61	60
$L_{Aeq,6pm-10pm}$	58	58	57	56	58	58
$L_{Aeq,10pm-7am}$	57	55	55	57	57	56
$L_{A90,7am-6pm}$	-	57	55	55	58	57
$L_{A90,6pm-10pm}$	54	54	54	53	54	54
$L_{A90,10pm-7am}$	49	49	50	50	50	49
$RBL_{,Day(7am\ to\ 6pm)}$	-	56	54	53	56	56
$RBL_{,Evening(6pm\ to\ 10pm)}$	52	53	53	52	52	53
$RBL_{,Night\ (10pm\ to\ 7am)}$	44	45	47	44	44	44

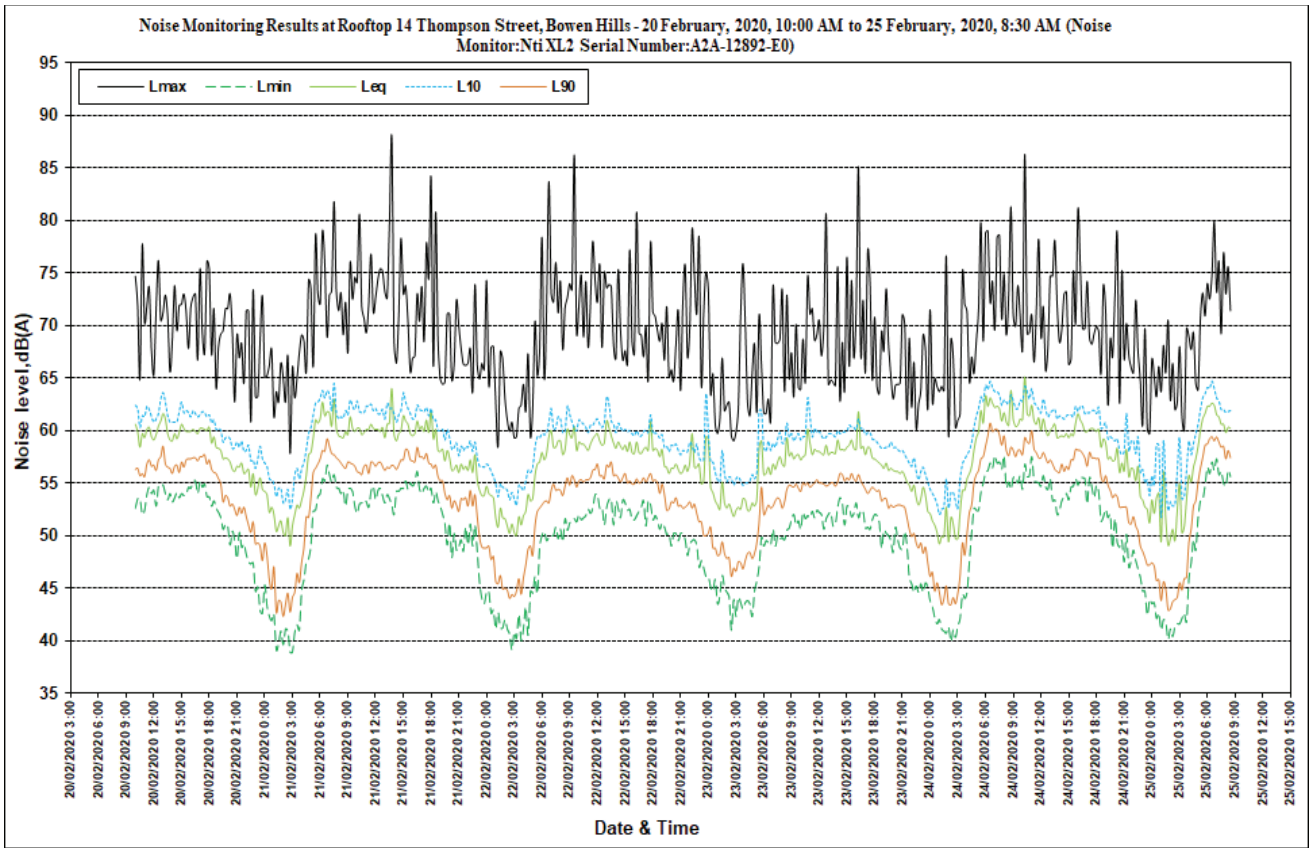

Figure 3: Time trace of relevant noise descriptors, Noise Monitor 1

Table 14: Summary of measured noise levels (rounded) – Noise Monitor 2

Noise descriptor	Measured Noise Level, dB(A)			Average, dB(A)
	Tue 25/02/20	Wed 26/02/20	Thu 27/02/20	
$L_{A10(18hr),6am-12am}$	-	73	73	73
$L_{Aeq,7am-6pm}$	-	72	72	72
$L_{Aeq,6pm-10pm}$	70	70	70	70
$L_{Aeq,10pm-7am}$	68	67	68	68
$L_{A90,7am-6pm}$	-	67	67	67
$L_{A90,6pm-10pm}$	64	64	65	64
$L_{A90,10pm-7am}$	57	56	57	57
$RBL_{,Day(7am\ to\ 6pm)}$	-	65	66	68
$RBL_{,Evening(6pm\ to\ 10pm)}$	62	62	62	62
$RBL_{,Night\ (10pm\ to\ 7am)}$	51	48	50	49

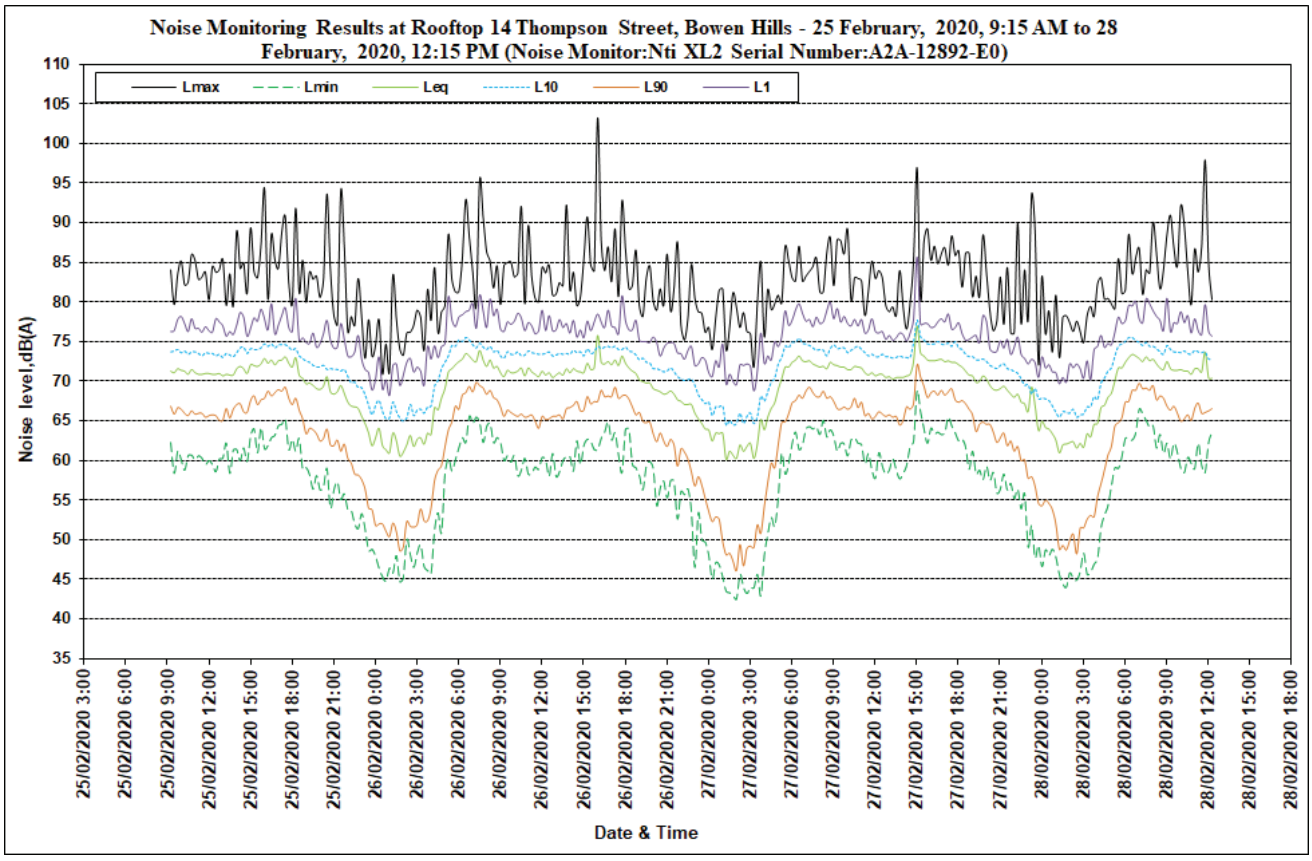

Figure 4: Time trace of relevant noise descriptors, Noise Monitor 2

Brisbane Airport, Queensland
February 2020 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	oktas		km/h	hPa	°C	%	oktas		km/h	hPa
1	Sa	24.1	30.4	0		11.3	NNE	35	17:20	28.2	65	4	NE	13	1018.2	29.7	58	1	NE	20	1014.5
2	Su	21.4	31.7	0		12.7	NNE	50	21:02	29.0	56	1	NNE	17	1014.0	29.9	60	1	NNE	31	1009.6
3	Mo	23.1	33.1	0		12.6	NNE	57	17:17	29.9	58	1	NNE	17	1009.4	30.9	63	1	NNE	33	1005.2
4	Tu	24.1	27.0	24.2		0.3	SSE	54	12:41	26.0	72	8	SSE	24	1013.6	24.1	74	7	SSE	28	1014.8
5	We	20.7	25.1	0		0.0	SSE	39	14:41	23.2	73	8	SSE	15	1017.4	24.6	68	8	SE	22	1014.9
6	Th	19.8	26.0	84.6		0.0	SSE	31	17:25	20.4	97	8	SSW	13	1015.9	23.5	95	8	S	11	1012.7
7	Fr	20.4	28.5	76.2		5.5	SE	31	17:48	24.9	82	8	E	13	1014.6	28.2	70	7	N	15	1011.7
8	Sa	23.2	28.3	1.6		4.6	ESE	35	13:40	25.5	79	7	E	11	1011.7	23.6	96	7	E	15	1008.3
9	Su	22.4	27.4	53.8		3.3	NE	37	00:27	26.4	83	7	N	11	1007.3	25.2	83	8	SE	9	1005.6
10	Mo	21.7	28.9	38.2		4.5	ENE	31	14:21	26.1	81	7	ENE	9	1010.0	28.1	74	6	ENE	20	1007.1
11	Tu	21.8	29.2	15.4		3.5	NE	30	22:02	26.4	80	6	WSW	7	1009.3	27.6	79	7	ENE	15	1006.1
12	We	22.7	25.1	4.6		0.2	SE	39	22:32	24.1	94	7	ENE	13	1007.1	24.6	90	7	SE	7	1005.1
13	Th	21.8	26.9	119.6		0.0	SSW	30	15:41	23.6	93	8	SSW	15	1005.6	24.6	91	7	SSW	13	1003.4
14	Fr	21.6	29.4	45.4		9.5	NE	33	15:12	26.4	74	1	SW	13	1006.2	28.4	65	2	NE	24	1003.5
15	Sa	22.8	30.5	0		10.1	NNE	33	15:41	28.3	73	3	N	11	1007.8	29.5	69	3	NNE	24	1005.4
16	Su	24.4	30.6	0		12.2	ENE	30	12:49	28.8	74	3	SE	11	1011.2	30.2	64	2	E	17	1010.0
17	Mo	23.6	30.3	0		12.3	ENE	30	16:02	28.4	66	3	ESE	13	1013.6	29.5	64	2	ENE	15	1011.4
18	Tu	22.5	31.1	0		12.7	NNE	31	21:13	28.0	74	3	S	11	1012.3	30.5	63	2	ENE	17	1008.7
19	We	24.6	31.2	0		10.3	NNE	44	16:12	29.2	63	7	N	15	1007.9	30.0	73	7	NNE	31	1004.0
20	Th	22.0	30.4	0.4		11.4	SE	31	16:00	28.1	62	1	SSE	9	1008.2	29.7	57	1	E	13	1006.9
21	Fr	22.8	29.3	0		10.6	E	33	15:16	27.9	65	3	SSE	13	1014.5	28.3	59	1	ENE	22	1012.9
22	Sa	24.0	28.8	0		7.3	SE	43	13:42	27.2	64	6	SSE	13	1019.5	27.1	49	6	SE	22	1018.2
23	Su	21.1	26.4	1.4		0.3	E	41	01:07	24.7	75	7	S	13	1020.7	24.0	70	7	SSE	19	1018.1
24	Mo	20.5	27.7	4.4		1.7	SW	31	08:54	23.6	82	7	SW	24	1018.0	26.6	71	7	SE	13	1015.2
25	Tu	20.9	28.4	2.2		4.5	SE	35	13:24	26.5	71	4	S	13	1015.4	24.9	88	7	SE	11	1012.9
26	We	21.1	29.9	0.4		7.5	N	30	19:38	27.4	71	6	SSE	9	1011.6	28.7	72	6	ENE	15	1007.5
27	Th	23.8	28.9	0		4.6	E	33	14:40	27.6	78	7	ENE	9	1008.1	24.9	80	8	ENE	17	1007.2
28	Fr	20.8	30.5	0.4		9.8	E	30	15:43	27.1	72	3	SSW	9	1008.7	29.3	61	4	ENE	19	1006.5
29	Sa	23.8	29.2	0		10.8	ESE	37	14:23	26.9	67	6	SE	17	1014.2	28.4	60	3	SE	19	1011.8
Statistics for February 2020																					
	Mean	22.3	29.0			6.7				26.5	73	5		13	1012.1	27.4	71	4		18	1009.8
	Lowest	19.8	25.1			0.0				20.4	56	1	WSW	7	1005.6	23.5	49	1	SE	7	1003.4
	Highest	24.6	33.1	119.6		12.7	NNE	57		29.9	97	8	#	24	1020.7	30.9	96	8	NNE	33	1018.2
	Total			472.8		194.1															

Observations were drawn from Brisbane Aero (station 040842)

IDCJDW4020.202002 Prepared at 13:01 UTC on 21 Mar 2020

Table 15: Summary of BoM weather observations during unattended monitoring (monitored days circled)

Design with
community in mind

232 St Paul's Terrace

Fortitude Valley QLD 4006
Tel +61 +61 7 3811 4500
E enquiries.ap@stantec.com

For more information please visit
www.stantec.com

WOOD & GRIEVE ENGINEERS

NOW PART OF

Stantec