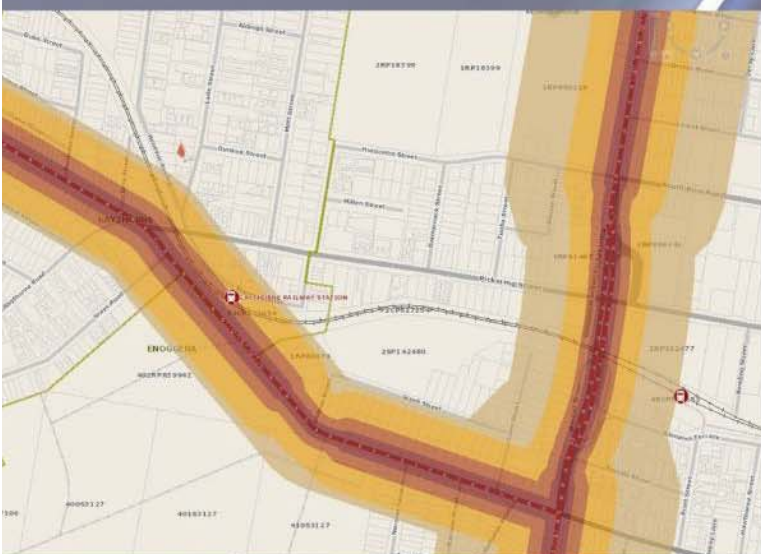


PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2018/942
Date: 1 February 2019



Document Control Page

NOISE MEASUREMENT SERVICES PTY LTD

18 Lade Street, Gaythorne, QLD 4051

PO Box 2127

Brookside Centre, QLD 4053

Telephone: (07) 3355 9707

Facsimile: (07) 3355 7210

E-mail: info@noisemeasurement.com.au

Copy No _____

Revision No	Issue Date	Revision Description	Author	Review
0	21/11/2018	Report	GR	MT

Copy No(s)	Rev No	Destination
1 pdf	0	HAL Architects
2	0	Noise Measurement Services
3 pdf	0	Teddy Bear Pty Ltd

REPORT FOR **HAL Architects on behalf of Teddy Bear Pty Ltd**
CONTACTS **Adam Lockhart, Jesse Govender (HAL) on behalf**

Signed


Max Thorne
(Director)
DISCLAIMER

This Report by Noise Measurement Services Pty Ltd is prepared for a particular Client and is based on the agreed objective, scope, conditions and limitations as may be stated in the Executive summary. The Report presents only the information that Noise Measurement Services Pty Ltd believes, in its professional opinion, is relevant and necessary to describe the issues involved. The Report should not be used for anything other than the intended purpose and should not be reproduced, presented or reviewed except in full. The intellectual property of this Report remains with Noise Measurement Services Pty Ltd. The Client is authorised, upon payment to Noise Measurement Services Pty Ltd of the agreed Report preparation fee, to provide this Report in full to any third party.

Contents

Executive Summary	4
Conclusions	4
Recommendations	4
1. Introduction	5
2. Noise Level Measurements	7
2.1 Measurement Procedures – Ambient Noise Survey	7
2.2 Measurement Results – Ambient Noise Survey	8
2.3 Measurement Procedures – Attended Noise Measurements	10
2.4 Measurement Results – Attended Noise Measurements	11
3. Noise Criteria and Limits	12
3.1 Bowen Hills Urban Development Area Development Scheme	12
3.2 Brisbane City Council City Plan 2014	14
4. Noise Impact Assessment	16
4.1 Noise Breakout	16
4.2 Sensitive Receptors	17
4.3 Noise Emission Forecasts	18
Appendix A: Plans	19
Appendix B: Noise Breakout Calculations	22
Appendix C: Glossary	24

Executive Summary

This report is in response to a request from HAL Architects for a noise impact assessment report for proposed extended operating hours for existing dog day care activities at 22 Brookes Street, Bowen Hills (Lot 3 on RP9985). The site is located within an EC Emerging Community zone, and is within the Bowen Hills Priority Development Area (PDA). The proposal is to extend the hours of operation to include overnight boarding. The purpose of this report is to assess potential noise impacts onto nearby sensitive uses with regards to the following standards and policy documents:

- *Bowen Hills Urban Development Area Development Scheme*
- *Brisbane City Plan 2014 – Centre or Mixed Use Code*
- *Brisbane City Plan 2014 – Noise Impact Assessment Planning Scheme Policy*
- *Environmental Protection Act 1994*
- *Environmental Protection (Noise) Policy 2008*
- Australian Standard AS1055:1 – *Acoustics: Description and measurement of environmental noise*

Conclusions

It is concluded that:

- Subject to the considerations as presented in this report, it is the opinion of this consultancy that the proposes night time operations can comply with the requirements of *Bowen Hills Urban Development Area Development Scheme*, and be otherwise compliant with relevant regulatory obligations
- Forecast emissions from noise breakout are within criteria at all nearby sensitive uses. Calculations assume highly excited barking events, although significantly lower emissions are expected during the night period.

Recommendations

It is recommended that:

- The extended hours of operation be approved, as activities are forecast to be within the *Brisbane City Plan 2014* night time noise criteria.

1. Introduction

This report is in response to a request from HAL Architects for a noise impact assessment report for proposed extended operating hours for existing dog day care activities at 22 Brookes Street, Bowen Hills (Lot 3 on RP9985). The site is located within an EC Emerging Community zone, and is within the Bowen Hills Priority Development Area (PDA). The proposal is to extend the hours of operation to include overnight boarding. The purpose of this report is to assess potential noise impacts onto nearby sensitive uses with regards to the following standards and policy documents:

- *Bowen Hills Urban Development Area Development Scheme*
- *Brisbane City Plan 2014 – Centre or Mixed Use Code*
- *Brisbane City Plan 2014 – Noise Impact Assessment Planning Scheme Policy*
- *Environmental Protection Act 1994*
- *Environmental Protection (Noise) Policy 2008*
- *Australian Standard AS1055:1 – Acoustics: Description and measurement of environmental noise*

Proposed hours of operation are 24hr, although only boarding activities are envisioned during the night period. The development site and locality are presented in the following **plates**. Further development plans are shown in **Appendix A**, while terms and definitions used in this report are presented in **Appendix C**.

Plate 1: Showing the development site and locality (source: Google)

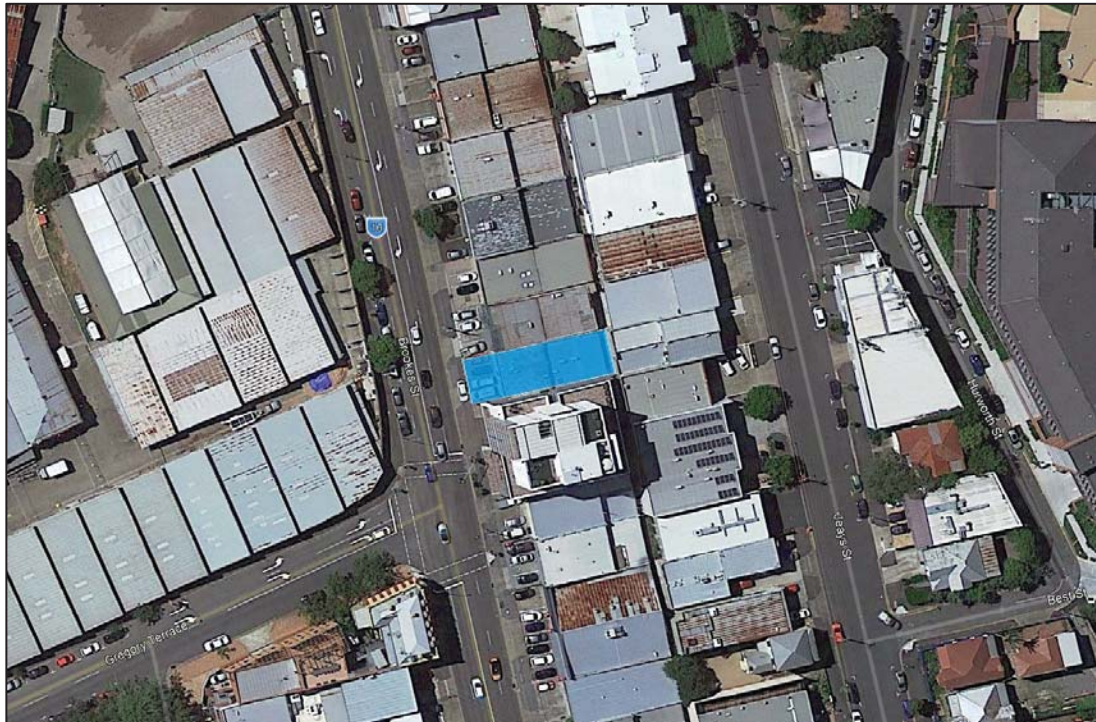


Plate 2: Showing the site and locality within an EC Emerging Community zone (source: BCC)

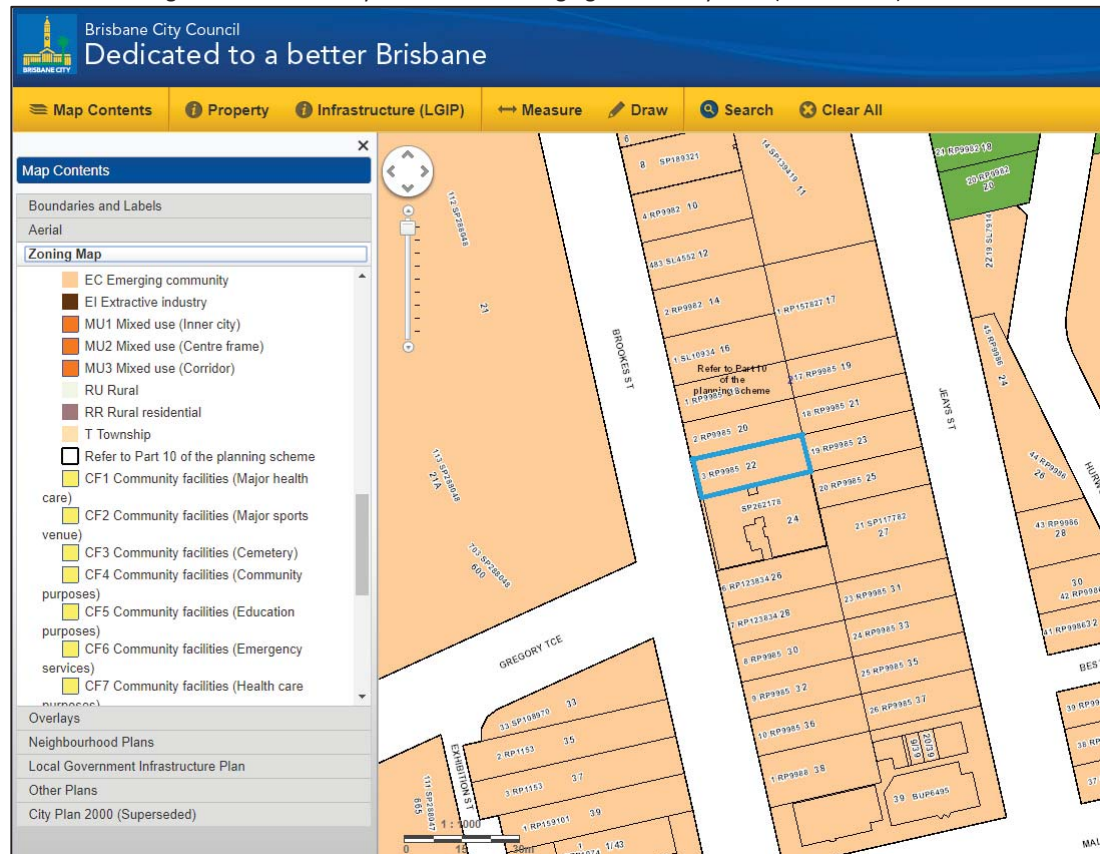
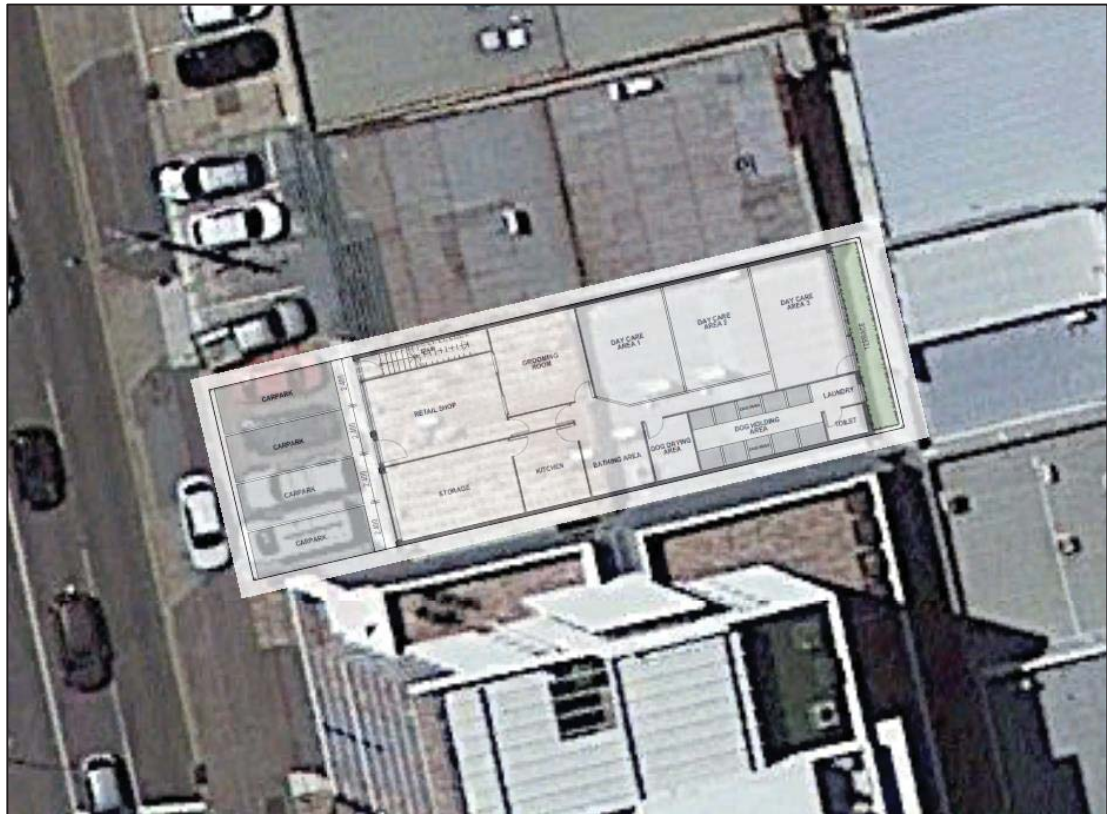


Plate 3: Showing the existing site plan (source: HAL Architects)



2. Noise Level Measurements

2.1 Measurement Procedures – Ambient Noise Survey

In order to assess the existing acoustic environment, an ambient noise survey was conducted on the neighbouring site. The environmental noise logger was installed at the fourth floor, representing the most potentially affected residential dwellings. The microphone was at a height of 1.4m relative to floor level and is considered free-field. The location is referred to as ML1 in this report, and is presented below.

Plate 4: Showing location ML1

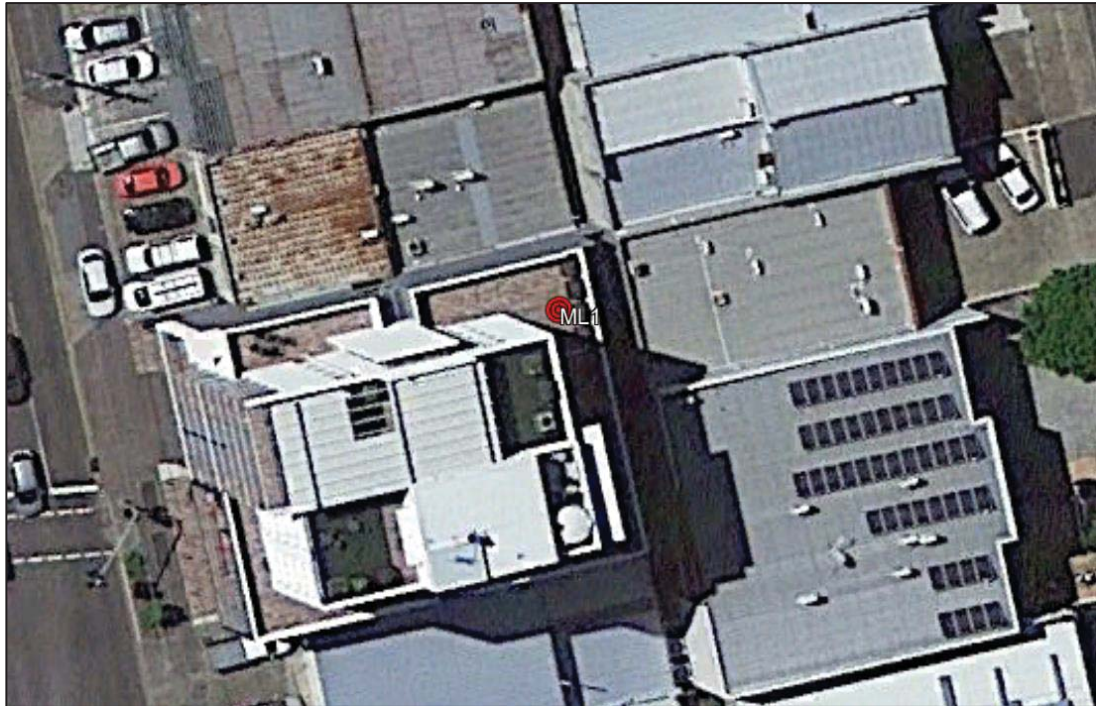


Photo 1: Showing location ML1 (source: NMS)



The operation of the sound level measuring equipment was field calibrated before and after each measurement session, and no significant drift from the reference signal was observed. All instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- 1 x Rion NL21 type 2 environmental noise logger
- 1 x Quest CA-22 calibrator

2.2 Measurement Results – Ambient Noise Survey

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 - *Acoustics-Description and measurement of environmental noise - Part 1: General procedures*. Ambient noise levels were recorded at 15 minute intervals between the 12th and the 19th of November 2018. Levels are presented graphically in **Figure 1** below, and in tabular format in **Table 1** following

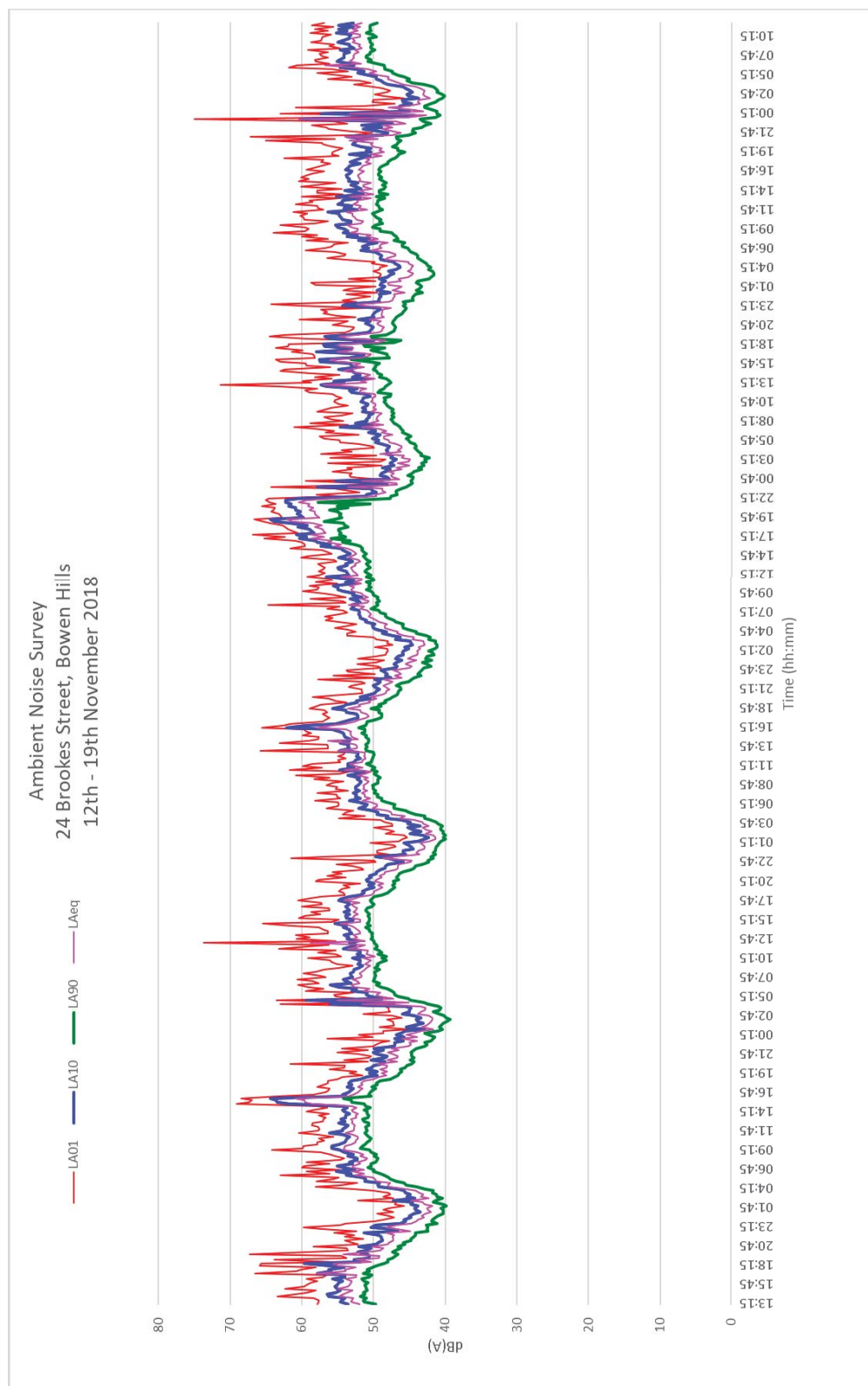


Figure 1: Ambient noise levels at ML1, 12th – 19th November 2018. Levels are in dB(A), free-field

Table 1: Ambient noise levels at ML1, 12th – 19th November 2018. Levels are in dB(A), free-field

Day	Date	Period	L ₀₁	L ₁₀	L ₉₀	L _{eq}
Monday	12 th / 19 th November	7:00am – 6:00pm	60.7	54.5	50.7	52.8
		6:00pm – 10:00pm	65.8	51.8	47.1	51.3
		10:00pm – 7:00am	60.8	48.7	43.5	49.9
Tuesday	13 th November	7:00am – 6:00pm	63.8	54.8	50.8	54.0
		6:00pm – 10:00pm	56.4	50.3	46.1	48.9
		10:00pm – 7:00am	58.1	47.7	43.3	47.2
Wednesday	14 th November	7:00am – 6:00pm	60.8	53.2	50.0	52.5
		6:00pm – 10:00pm	57.9	50.9	47.4	49.7
		10:00pm – 7:00am	59.3	47.9	43.0	47.7
Thursday	15 th November	7:00am – 6:00pm	61.7	53.4	50.2	52.7
		6:00pm – 10:00pm	58.3	51.9	47.9	50.5
		10:00pm – 7:00am	55.9	46.9	42.6	46.1
Friday	16 th November	7:00am – 6:00pm	61.4	54.4	51.0	53.6
		6:00pm – 10:00pm	65.5	61.0	54.7	58.9
		10:00pm – 7:00am	55.7	47.8	43.7	46.6
Saturday	17 th November	7:00am – 6:00pm	63.0	52.6	48.3	51.7
		6:00pm – 10:00pm	62.2	52.3	48.0	51.4
		10:00pm – 7:00am	58.8	49.8	44.9	49.7
Sunday	18 th November	7:00am – 6:00pm	60.3	53.6	49.1	52.0
		6:00pm – 10:00pm	63.8	51.5	46.5	50.4
		10:00pm – 7:00am	58.4	49.0	43.9	48.4
Arithmetic Average		Day	62	54	50	53
		Evening	61	53	48	52
		Night	58	48	44	48

The levels presented above include measured noise from all sources in the locality, including road traffic, residential activity, commercial activity and meteorology.

The Rating Background Levels (RBL) at ML1 have been calculated in accordance with the BCC *Noise Impact Assessment Planning Scheme Policy*, and are presented in **Table 2** below.

Table 2: Rating Background Levels (RBL) at ML1

Location	Day (7am – 6pm)	Evening (6pm – 10pm)	Night (10pm – 7am)
ML1	49	46	41

2.3 Measurement Procedures – Attended Noise Measurements

To assess dog barking noise emissions from existing activities, attended noise measurements were undertaken on-site on the 19th of November 2018. Measurements were taken internally at a distance of 1m, and externally in the middle of the terrace area, representing breakout through the building envelope. These attended measurement locations are referred to as AL1 and AL2 respectively.

The operation of the sound level measuring equipment was field calibrated before and after each measurement session, and no significant drift from the reference signal was observed. All instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- 1 x Larson Davis 831 type 1 environmental noise logger
- 1 x Quest CA-22 calibrator

Measurements were undertaken at 1 second intervals using both the Fast and Impulse response times. The microphone was at a height of 1.5m, and external measurements are considered façade-affected. The locations of AL1 and AL2 are presented below.

Plate 5: Showing attended measurement locations AL1 and AL2



Photo 2: Showing attended measurement locations AL1 and AL2 (source: NMS)

2.4 Measurement Results – Attended Noise Measurements

Results from the attended noise measurements are presented below. Measurements were undertaken during a 1 minute period of highly excited dog activity, and are considered representative of a 'reasonable worst-case' scenario.

Table 3: Attended noise measurements. Levels are in dB(A), façade-affected

Location	L _{AFeq}	L _{AFmax}	L _{AImax}
AL1	95.0	105.9	108.5
AL2	60.6	75.5	77.2
Difference	34.4	30.4	31.3

As shown above, a difference of 30 – 34 dB(A) between internal and external levels were measured, amounting to an approximate Noise Reduction (NR) of 30 dB(A) from the building envelope at the Day Care areas. While this does not necessarily correlate with the acoustic performance of Dog Holding Area, this value is generally indicative of overall performance of the building envelope.

Barking dogs are considered a potentially impulsive noise source, and adjustments for impulsiveness have been calculated as per the *Brisbane City Plan 2014 – Noise Impact Assessment Planning Scheme Policy*. The difference between the measured L_{AImax} and L_{AFmax} was 2.6 dB(A) internally and 1.7 dB(A) externally. As a conservative methodology, internal measurements have been used to calculate the impulsive adjustment, and 2.6 dB(A) has been added to source levels during noise emission calculations.

Based upon the measurements presented above, emissions as represented by the L_{Amax} descriptor are considered the most intrusive. The 1/1 Octave spectra for the measured L_{AFmax} are presented below. L_{eq} calculations assume the same spectral relationship, adjusted to meet the lower noise levels.

Table 4: Measured 1/1 Octave spectra, L_{AFmax}. Levels are in dB(Z)

Location	Frequency (dB(Z))								
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
AL1	63.1	69.6	65.8	69.0	87.5	103.9	93.5	85.3	73.0

3. Noise Criteria and Limits

3.1 Bowen Hills Urban Development Area Development Scheme

The site is within the Bowen Hills Priority Development Area (PDA), and the proposed development is therefore subject to considerations under the *Bowen Hills Urban Development Area Development Scheme*. Relevant acoustic guidance under the scheme is reproduced below:

“ General noise requirements

The design, siting and layout of development must address noise impacts and where necessary incorporate appropriate noise mitigation measures.

Development is to achieve acceptable noise levels for noise sensitive uses in affected areas⁸

Where determined necessary by the ULDA, an acoustic report will be required to evaluate and address potential noise impacts and recommend appropriate noise mitigation measures.

⁸ Refer to the *Environmental Protection (Noise) Policy 2008*. “

It is noted that the scheme does not mandate specific assessment criteria, and instead references the *Environmental Protection (Noise) Policy 2008*.

The *Environmental Protection (Noise) Policy 2008* (EPP Noise 2008) establishes acoustic quality objectives (AQO) to protect or enhance stated environmental values. The environmental values to be enhanced or protected under the policy are the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and the qualities of the acoustic environment that are conducive to human health and well-being, including ensuring a suitable acoustic environment for individual's to sleep, study and learn, to be involved in recreation including relaxation and conversation; and the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Table 5: Environmental Protection (Noise) Policy 2008 Acoustic Quality Objectives (in part)

Type of Occupancy / Activity	Recommended Acoustic Quality Objective		
	LAeq,adj,1hr	LA10,adj,1hr	LA01,adj,1hr
Dwelling, outdoors, daytime & evening	50	55	65
Dwelling, indoors, daytime & evening	35	40	45
Dwelling, indoors, night-time	30	35	40

The policy also sets recommended criteria for the control of background creep. To the extent that it is reasonable to do so, noise from an activity must not be—

- for noise that is continuous noise measured by LA90,T—more than nil dB(A) greater than the existing acoustic environment measured by LA90,T; or
- for noise that varies over time measured by LAeq,adj,T—more than 5dB(A) greater than the existing acoustic environment measured by LA90,T

It is noted that the Acoustic Quality Objectives (AQO) are to be progressively achieved over the long term, to meet the stated purpose of the Noise Policy:

- (a) identifying environmental values to be enhanced or protected; and
- (b) stating acoustic quality objectives for enhancing or protecting the environmental values; and
- (c) providing a framework for making consistent, equitable and informed decisions about the acoustic environment.

Noise management strategies – including background creep criteria – are required to the extent it is reasonable to do so. It is therefore concluded that the AQO are not intended to be necessarily limiting criteria, as reasonableness and equity are fundamental precepts of the policy. As the existing acoustic environment is in substantial excess of the internal AQO assuming transmission through a fully open window, the application of internal AQO as limiting criteria is not considered reasonable in this case. It is noted that the proposed extension of activities is to occur solely during the night period, when the outdoor AQO specifically do not apply.

It is furthermore understood that the policy is not intended to override specific Council noise policies, and that application of relevant Council noise criteria (where formally established) are considered to satisfy the policy intent of protecting environmental values within a consistent and equitable framework. Council's criteria (discussed in **Section 3.2** below) are more stringent during the night period than background creep criteria, and include $L_{\max}$ sleep disturbance criteria, which are a relevant descriptor for dog barking noise emissions. It is therefore concluded that application of Brisbane City Council noise emission criteria represents the 'best fit' methodology for assessment of potential noise impacts, and meets the general noise requirements of the *Bowen Hills Urban Development Area Development Scheme*.

3.2 Brisbane City Council City Plan 2014

The City Plan 2014 Centre or Mixed Use Code provides guidance to assess the suitability of proposed centre use activities, and is summarized (in part) in **Table 6** below. Proposed uses do not include significant amplified music or other identified sources of low-frequency noise emissions, and the low-frequency noise emission criteria have therefore not been assessed.

Table 6: Centre or Mixed Use Code (in part)

Performance Outcome	Acceptable Outcome
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) where not located in a Special entertainment precinct identified in a neighbourhood plan, does not result in noise emissions that exceed the noise (planning) criteria in Table 9.3.3.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. 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: (c) for any other 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

Table 9.3.3.3.F—Noise (planning) criteria

Criteria location	Intrusive noise criteria	Acoustic amenity 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 • evening – 4hr • night – 9hr	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	5dB(A)	55dB(A)	50dB(A)	45dB(A)

Table 9.3.3.3.H—Night-time noise criteria

Criteria location	Where the existing $L_{Aeq,9hr\ night}$ at the criteria location is:	Average of the highest 15 single L_{Amax} events over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location	The absolute highest single L_{Amax} 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 dB(A)	50 dB(A)	55 dB(A)
	45- 60 dB(A)	$L_{Aeq,9hr\ night} + 5\ dB(A)$	$L_{Aeq,9hr\ night} + 10\ dB(A)$
	>60 dB(A)	65 dB(A)	70 dB(A)

The intrusive noise criteria have been calculated with reference to the Rating Background Levels (RBL) at ML1, as presented in **Section 2.2**. Night-time noise criteria have been calculated with reference to the 48 dB(A) $L_{eq,9hr}$ measured at ML1 and presented in **Section 2.2**. A summary of criteria is presented in **Table 7** below.

Table 7: Summary of assessment criteria

Policy	Descriptor	Day	Evening	Night
Intrusive Noise Criteria (RBL + 5)	$L_{eq,adj,T}$	54	51	46
Acoustic Amenity Criteria	$L_{eq,adj,T}$	55	50	45
Night-time Noise Criteria ($L_{eq,9hr} + 5$ dB(A))	L_{max} (average of 15 highest)	-	-	53
Night-time Noise Criteria ($L_{eq,9hr} + 10$ dB(A))	L_{max} (highest single event)	-	-	58

As shown above, the Acoustic Amenity Criteria are more stringent than the Intrusive Noise Criteria. The Intrusive Noise Criteria have therefore not been applied. Similarly, the proposed extended hours of operation relate solely to the night period, and the daytime and evening criteria have not been further considered as they relate to an existing lawful use.

4. Noise Impact Assessment

4.1 Noise Breakout

The proposed extended operating hours relate to the boarding of dogs overnight at the Dog Holding Area shown on development plans. External activity is not proposed during the night period, and noise breakout from internal barking activity will be the substantive acoustic issue. The Dog Holding Area is shown in **Photo 3** below.

Photo 3: Showing the Dog Holding Area



The Dog Holding Area is located on the Ground Floor of the premises. Consequently, the Upper Floor and roof of the building will combine to provide a high level of noise attenuation, and breakout through the roof is predicted to be minor. Lateral noise breakout through eastern building envelope is considered the design driver for noise containment.

The external walls of the Dog Holding Area are of brick construction, which provides a high level of noise attenuation. The critical transmission pathways are therefore through openings on the eastern façade. The laundry and toilet areas adjacent to the Dog Holding Area include louvres on the eastern façade which have been sealed off with fibrous cement cladding, as shown in **Photo 4** below.

Photo 4: Showing the acoustic treatment applied to seal off the existing louvres



Noise breakout from 'reasonable worst-case' internal activities have been calculated at 81.4 dB(A) L_{max} SWL, and 70.5 dB(A) L_{eq} SWL. Details of breakout calculations are presented in **Appendix B**. The acoustic performance of building materials has been sourced from Soundplan 9.0.

4.2 Sensitive Receptors

The site is adjacent to commercial premises to the north and east, which are not considered to be noise sensitive receptors, particularly during the night period. The most potentially affect noise sensitive receivers are therefore considered to be the residential units located to the immediate south of the site. It is noted that an existing blade wall on the boundary will screen a majority of the neighbouring units, with only the upper two floors (Level 7 and Level 8) being fully exposed to lateral noise breakout. The transmission path from the eastern façade to the most exposed units are shown in **Photo 5** below.

Photo 5: Showing the residential facades most exposed to potential noise breakout



The distance from the top of the blade wall (at Level 4 of the residential building) to ground level at the terrace was measured by rangefinder to be 15m. The distance to Level 7 (the closest exposed façade) is calculated as 21m (assuming 2.7m between floors and a 1.8m source height). Noise propagation calculations have been conducted from breakout at the terraced area to this most exposed façade (referred to as R1 in this report). Other noise sensitive uses in the area are either at further setback or screened from noise breakout, and are considered to be less affected.

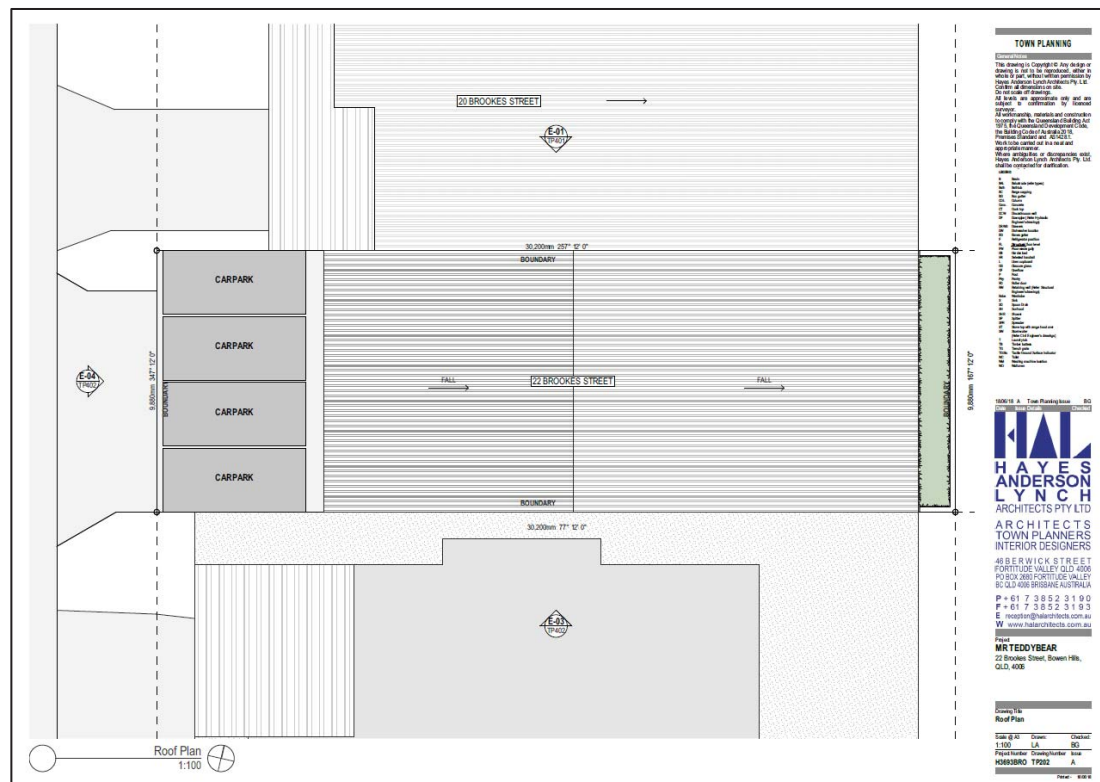
4.3 Noise Emission Forecasts

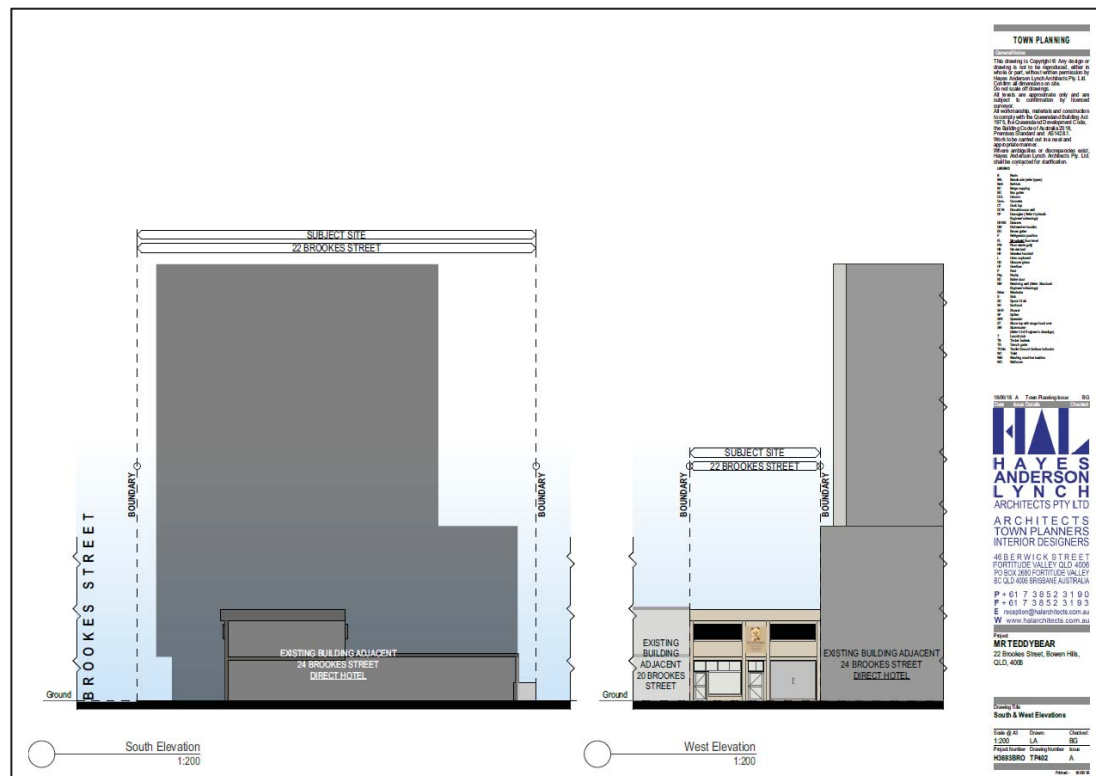
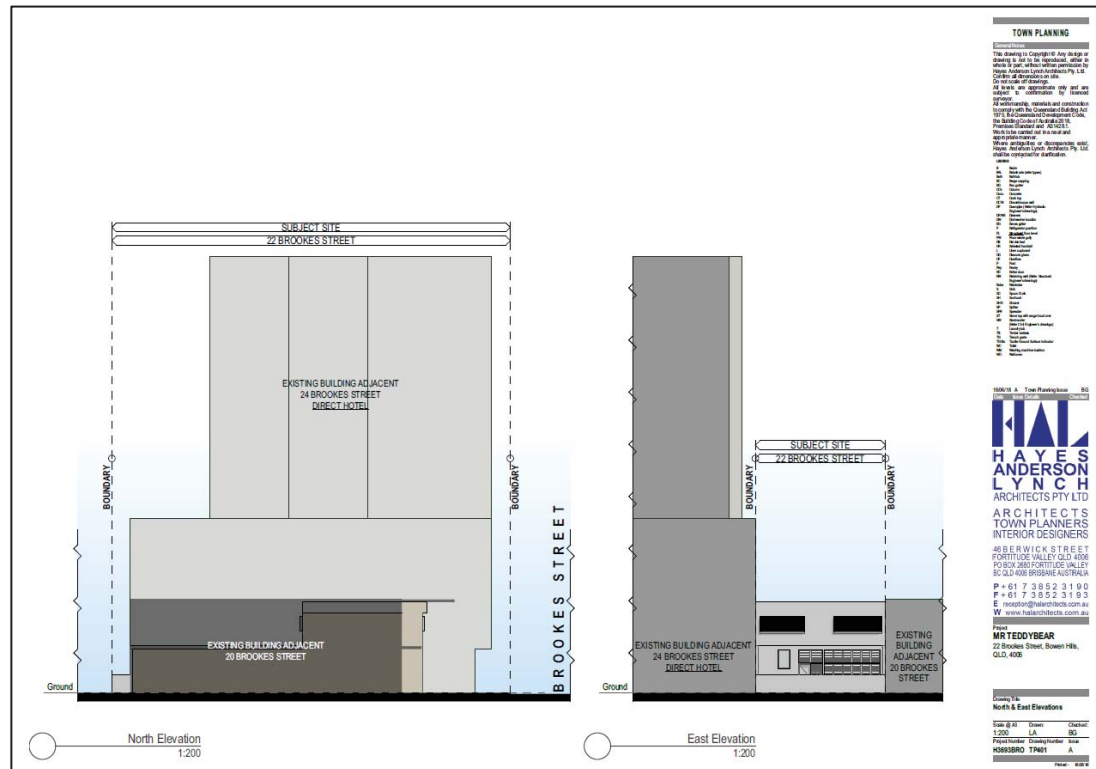
Noise emission calculations are presented in **Table 8** below, based upon the general environmental propagation model as presented in “Engineering Noise Control – Theory and Practice” by Bies & Hansen. Source levels represent ‘reasonable worst-case’ periods of highly excited dog barking activity. Actual emissions during the night period – when dogs are individually penned and human activity has ceased – are expected to be significantly lower in general.

Table 8: Showing noise propagation calculations

Project 4768 22 Brookes Street, Bowen Hills		
Receiver	R1	R1
Source and Criteria Descriptor	L _{Amax,adj}	L _{Aeq,adj}
Sound power level (SWL)	81	71
Sound pressure level at 1m (Dl=6)	77	66
Distance (m)	21	21
Distance Attenuation	-26	-26
Impulsive Adjustment	3	3
Level dB(A)	50	42
Criteria	52	45
Pass	Yes	Yes

As shown above, potential noise breakout during the night period is predicted to meet criteria at the most affected noise sensitive use. On this basis, it is concluded that the extended hours of operation can meet the requirements of the *Brisbane City Plan 2014*, and be otherwise compliant with relevant regulatory obligations.





Appendix B: Noise Breakout Calculations



Project: 4768
22 Brookes Street, Bowen Hills
21st November 2018
Lmax Noise Breakout

SPL (sound level) inside room (dBZ)	dBZ	Octave Band Centre Frequencies - Hz							
		32	63	125	250	500	1000	2000	4000 8000
	104.4	63	70	66	69	88	104	94	85 73

Façade Element 1 Nominal Roof Sound Transmission Loss = Equivalent Sound Power Level of Element (dBZ) =	Dimensions: 6.0 m, 3.7 m Area = 21.9 m ²									
	dBZ	32	63	125	250	500	1000	2000	4000	8000
		48	51	54	54	51	47	45		
	80.6	70	29	22	22	41	60	54	47	80

Façade Element 2 Hollow Concrete Block Sound Transmission Loss = Equivalent Sound Power Level of Element (dBZ) =	Dimensions: 3.0 m, 2.7 m Area = 8.1 m ²									
	dBZ	32	63	125	250	500	1000	2000	4000	8000
		40	43	42	47	54	60	66		
	76.3	66	32	26	30	43	53	36	22	76

Façade Element 3 Compressed Fibre Boards Sound Transmission Loss = Equivalent Sound Power Level of Element (dBZ) =	Dimensions: 2.4 m, 0.9 m Area = 2.2 m ²									
	dBZ	32	63	125	250	500	1000	2000	4000	8000
		12	15	19	24	29	34	31		
	74.7	60	55	48	47	61	72	57	51	70

COMBINED L_w of Façade Elements = Z-Weighted A-Weighted	Octave Band Centre Frequencies - Hz									
	dB	32	63	125	250	500	1000	2000	4000	8000
	82.7	72.0	54.8	48.0	47.2	60.8	72.3	58.4	52.9	81.8
	81.4	32.6	28.6	31.9	38.6	57.6	72.3	59.6	53.9	80.7



Project: 4768
22 Brookes Street, Bowen Hills
21st November 2018
Leq Noise Breakout

SPL (sound level) inside room (dBZ)		Octave Band Centre Frequencies - Hz									
		dBZ	32	63	125	250	500	1000	2000	4000	8000
		93.5	52	59	55	58	77	93	83	74	62

Façade Element 1 Nominal Roof	Dimensions: 6.0 m, 3.7 m									
	Area = 21.9 m ²									
	dBZ	32	63	125	250	500	1000	2000	4000	8000
			48	51	54	54	51	47	45	
Sound Transmission Loss =										
Equivalent Sound Power Level of Element (dBZ) =	69.7	59	18	11	11	30	49	43	37	69

Façade Element 2 Hollow Concrete Block	Dimensions: 3.0 m, 2.7 m									
	Area = 8.1 m ²									
	dBZ	32	63	125	250	500	1000	2000	4000	8000
			40	43	42	47	54	60	66	
Sound Transmission Loss =										
Equivalent Sound Power Level of Element (dBZ) =	65.4	55	22	15	19	32	42	25	11	65

Façade Element 3 Compressed Fibre Boards	Dimensions: 2.4 m, 0.9 m									
	Area = 2.2 m ²									
	dBZ	32	63	125	250	500	1000	2000	4000	8000
			12	15	19	24	29	34	31	
Sound Transmission Loss =										
Equivalent Sound Power Level of Element (dBZ) =	63.8	49	44	37	36	50	61	46	41	59

COMBINED L _w of Façade Elements =	dB	Octave Band Centre Frequencies - Hz								
		32	63	125	250	500	1000	2000	4000	8000
Z-Weighted	71.8	61.1	43.9	37.1	36.3	49.9	61.4	47.5	42.0	70.9
A-Weighted	70.5	21.7	17.7	21.0	27.7	46.7	61.4	48.7	43.0	69.8

Appendix C: Glossary

“Peak” maximum level ($L_{Amax,T}$).

The peak maximum level is the absolute highest (1 second or less) sound level within the whole of the measurement time.

Event maximum sound pressure level ($L_{A\%,adj,T}$), L_{01}

The L_{01} level is calculated as the noise level equalled and exceeded for 1% of the measurement time, for example 9 seconds in any 15 minute interval. L_{01} is an appropriate level to characterise single events, such as from train bypass.

In this Report, the measured L_{01} levels for day/evening/night are not averaged but are arranged from low to high in the relevant day/evening/night interval and the value that is found at the 90th percentile (L_{10} of L_{01} sample) in the interval is recorded as its “ L_{01} ” level.

Average maximum sound pressure level ($L_{A\%,adj,T}$), L_{10}

The “ L_{10} ” level is an indicator of “steady-state” noise or intrusive noise conditions from traffic, music and other relatively non-impulsive noise sources. The L_{10} level is calculated as the noise level equalled and exceeded for 10% the measurement time, for example 90 seconds in any 15 minute interval. The measured L_{10} time-intervals for day/evening/night are arithmetically averaged to present the “average maximum” levels of the environment for day/evening/night. The level can be adjusted for tonality or impulsiveness.

Background sound pressure level ($L_{A90,T}$), L_{90}

Commonly called the “ L_{90} ” or “background” level and is an indicator of the quietest times of day, evening or night. The L_{90} level is calculated as the noise level equalled and exceeded for 90% the measurement time. The measured L_{90} time-intervals are arithmetically averaged to present the “average background” levels of the environment for day/evening/night. The level is recorded in the absence of any noise under investigation. The level is not adjusted for tonality or impulsiveness.

Equivalent Continuous or time average sound pressure level ($L_{Aeq,T}$), L_{eq}

Commonly called the “ L_{eq} ” level it is the logarithmic average noise level from all sources far and near. The maximum 1-hour levels within the day/evening/night time intervals are referenced for building design. The level can be adjusted for tonality.

Façade-adjusted level

A sound level that is measured at a distance of 1.0 metre from a wall or facade. The level is nominally 2.5 dB higher than the free-field level.

Free-field level

A sound level that is measured at a distance of more than 3.5 metres from a wall or facade.