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Acoustics
Vibration
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11 GIBBONS STREET, REDFERN

Acoustic Assessment for Development Application

14 February 2019

St George Community House (SGCH)

TK332-01F02 Acoustic report for DA (r5)

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Prepared for:	St George Community House (SGCH)
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Attention:	Kim Gray

Document control

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03.07.2018	Prepare draft report	0		TWo		
18.07.2018	Update report & issue		1	TW		TW
29.08.2018	Review final DA drawings & update report		2	TW		TW
05.09.2018	Minor of update Figures in APPENDIX E		3	TW/TWo		TW
26.09.2018	Update criteria, predicted noise levels and include assessment with future buildings		4	TW		TW
10.12.2018	Update Section 9 and add APPENDIX G		5	TW		TW
14.02.2019	Updated report as per comments and APPENDIX F glazing figures		6	TWo		TW

Contents

List of tables

List of figures

1 Introduction

Renzo Tonin & Associates was commissioned by St George Community Housing (SGCH) to undertake an environmental noise assessment of the proposed mixed-use development at 11 Gibbons Street, Redfern to accompany Development Application.

From our assessment of site location, the following potential acoustic and vibration issues were identified:

- Road traffic noise associated with Gibbons and Regent Streets
- Rail vibration associated with the commuter trains on the Eastern Suburbs & Illawarra Line (T4) located in an underground tunnel adjacent to the site western boundary

Renzo Tonin & Associates attended the site on 27/06/18 from 11:00am to 5:00pm to measure the existing levels of rail vibration potentially affecting the site. A long-term noise monitor was installed on site at facing Gibbons Street from 19/06/18 to 27/06/18 to establish the existing levels of ambient noise surrounding the site. In addition, a short-term traffic noise survey was also carried out on 27/06/18 at corner of Regent and Marian Street. The results of the noise and vibration surveys were used to predict noise and vibration levels within the dwellings, and then assessed against the recommended internal noise and vibration criteria for the project. Recommendations are made where necessary for noise and vibration mitigation.

External facade treatments are recommended in Section 5 of this report to comply with the relevant acoustic criteria. All windows and exterior doors shall incorporate full perimeter acoustic seals.

The following architectural drawings prepared by DKO Architecture were reviewed during the assessment;

Table 1: Schedule of Architectural Drawings Reviewed

Drawing No.	Date	Revision	Title
DA2000	September 2018	P2	Ground Level
DA2001	September 2018	P2	Level 1
DA2002	September 2018	P2	Level 2
DA2003	September 2018	P2	Level 3
DA2004	September 2018	P2	Level 4
DA2005	September 2018	P2	Levels 5-16 Typical
DA2006	September 2018	P2	Level 17
DA2007	September 2018	P2	Roof Level
DA3000	September 2018	P2	West & North Elevations
DA3001	September 2018	P2	East & South Elevations

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Acoustic Criteria

Renzo Tonin & Associates attended the site on 27/06/18 from 11:00am to 5:00pm to measure the existing levels of rail vibration from an underground rail tunnel. Unattended long-term noise survey was also conducted on site from 19/06/18 to 27/06/18 to determine the existing level of ambient and background noise surrounding the site. The results of the noise and vibration surveys were used to calculate noise and vibration levels within the residential spaces and assessed against the relevant internal noise and vibration criteria describe below.

2.1 Noise and Vibration Criteria

The airborne noise criteria for this development are based on the following documents:

1. Apartment Design Guide (June 2015)
2. State Environmental Planning Policy 65 – Design Quality of Residential Apartment Development (SEPP65)
3. State Environment Planning Policy (Infrastructure) 2007
4. Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008
5. Australian Standard AS/NZS 2107:2016 "Acoustics – Recommended design sound pressure levels and reverberation times for building interior"

The Roads and Maritime Services (RMS) has identified Gibbons and Regent Streets as roads that are mandatory for acoustic assessment in accordance with the State Environment Planning Policy (Infrastructure) 2007, meaning that the average annual daily traffic (AADT) volumes are greater than 40,000 vehicles per day - refer to RMS ISEPP Map 16 attached in APPENDIX B. Therefore, an acoustic assessment in accordance with the ISEPP 2007 is mandatory for the subject development.

2.1.1 Road Traffic and Airborne Rail Noise Criteria

The internal noise criteria for this development as per ISEPP 2007 is presented in Table 2 below and defined in APPENDIX A of this report. Criteria for occupancies not covered under ISEPP 2007 such as offices are adopted from the Australian Standard AS/NZS 2107:2016.

Table 2: Maximum Internal Noise Criteria for Road Traffic Noise and Airborne Rail Noise

Type of Occupancy	Windows & Doors Condition	Design Noise Level	
		Day, L_{Aeq} (15hour)	Night, L_{Aeq} (9hour)
Sleeping areas	Closed	-	35dB(A)
	Open	-	45dB(A)
Other habitable rooms (excluding garages, kitchens, bathrooms and hallways)	Closed	40dB(A)	40dB(A)
	Open	50dB(A)	50dB(A)

Type of Occupancy	Windows & Doors Condition	Design Noise Level	
		Day, L_{Aeq} (15hour)	Night, L_{Aeq} (9hour)
Bathrooms	Closed	45dB(A)[1]	45dB(A)[1]
Residential lobbies & communal internal areas	Closed	50dB(A)[1]	50dB(A)[1]
Retail / Commercial	Closed	50dB(A)[1]	-
General offices	Closed	45dB(A)[1]	-

Notes:

1. Based on Australia Standard AS2107 "Acoustics – Recommended design sound pressure levels and reverberation times for building interior"

2.1.2 Ground-borne Rail Noise Criteria

The Department of Planning publication "Development near Rail Corridors & Busy Roads – Interim Guideline" 2008 provides recommended criteria for ground-borne or regenerated rail noise. Table 3 summaries these noise limits for sleeping and living spaces.

Table 3: Recommended Internal Noise Criteria for Regenerated Rail Noise

Occupancy	Period	L_{Amax} Noise Limit [1]
Sleeping areas (Bedrooms)	10pm – 7am	35 dB(A)
Other habitable rooms (excluding garages, kitchens, bathrooms and hallways)	7am – 10pm	40 dB(A)

Notes: 1. L_{Amax} – is a-weighted maximum sound pressure level measures using "Slow" response time

2.1.3 Rail Tactile Vibration Criteria

In addition to regenerated rail noise, Section 3.6.3 of the Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline", also provides recommended vibration criteria documents to refer to when establishing train vibration criteria for residential buildings.

1. Assessing Vibration: A technical guideline (DECC 2006)
2. German Standard DIN 4150, Part 3 - 1999
3. British Standard BS 7385 - 1992
4. Australian Standard AS 2670.2 - 1990

The above documents have been reviewed and the criterion for assessment of tactile vibration from train pass-bys affecting the proposed development is quantified using:

- Assessing Vibration: A technical guideline (DECC 2006)
- British Standard BS6472: 1992 "*Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*"

It is noted that DECC guideline "Assessing Vibration: A technical guideline (DECC 2006)" is based on the British Standard BS6472:1992. The criteria curves presented in BS6472:1992 are identical to those in Australian Standard AS2670.2 1990 and the International Standard 2631-2:1989.

Criteria for continuous vibration from the British Standard BS6472:1992 for residential spaces, offices and commercial workshop environments are shown in Figure 1 below.

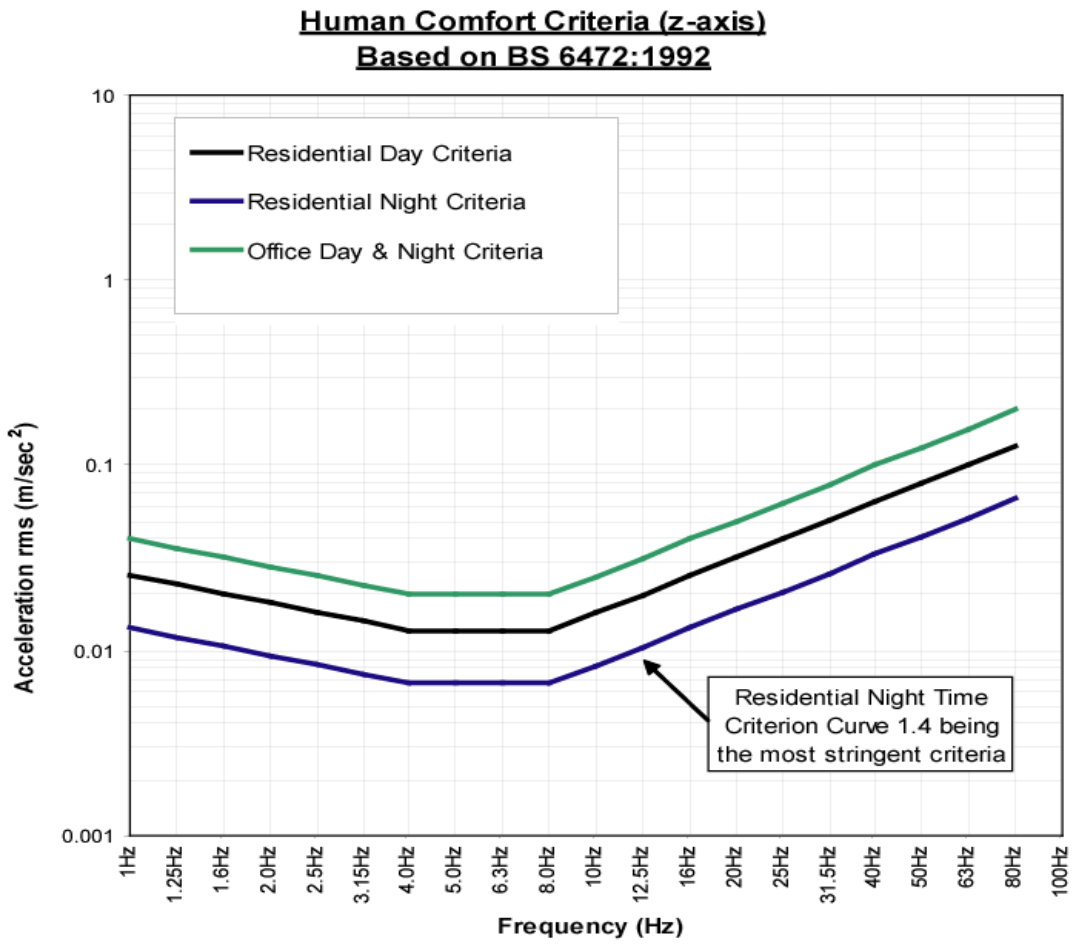

Figure 1: Tactile Vibration Criteria for Residential Buildings

Table 2.4 of the Department of Environment Climate Change's document "Assessing Vibration: A technical guideline (DECC 2006)" presents acceptable vibration dose values for intermittent vibration. Table 4 below outlines DECC's requirements.

Table 4: Acceptable VDVs for intermittent vibration in residential buildings m/s1.75

Location	Period	Preferred VDV m/s1.75
Residence	Day time (7am – 10pm)	0.20
	Night time (10pm – 7am)	0.13

3 Noise & Vibration Survey

3.1 Project Description

The subject site is located at the corner of Gibbons Street and Marian Street, Redfern and is approximately 100m southeast of the above ground station platforms at Redfern station. The rail corridor nearest to subject site consists of two operational tracks in an underground tunnel located approximately 17m west of the site boundary and 12m below the ground. The two tracks services commuter trains on the Eastern Suburbs & Illawarra Line (T4) between Redfern and Sydenham station.

The proposed mixed-use development comprises of the following:

- Retail/commercial, community hub and office tenancies on the Ground floor
- Apartments on Levels 1 & 2
- Mixed of apartments and community spaces on Level 3
- Apartments on Levels 4 to 16
- Apartments and communal open space on level 17

3.2 Train Noise and Vibration Monitoring Locations

An operator-attended rail vibration survey was conducted inside the existing 2-storey building on site at the corner of Gibbons and Marian Street on 27/06/18 from 11:00am to 5:00pm. Refer to Figure 2 and APPENDIX H for details of monitoring location. The monitoring location was representative of the nearest proposed facade to the underground rail corridor. The survey captured passenger train pass-bys between Redfern and Sydenham Station.

Figure 2: Site Boundary and Noise and Vibration Monitoring Locations

3.3 Instrumentation

Train vibration levels were measured using the Sinus SoundBook multi-channel analyser and PCB accelerometers on the ground floor of the 2-storey building on site (Location 2) as shown in figure above. Three accelerometers (x, y & z) were magnetically fixed to a steel bracket that has been glue fixed to bare concrete slab.

Intermittent rain was observed during the first hour of the operator-attended train vibration survey, however it did not affect the measured results. The weather condition during remaining of noise & vibration survey was fine. All instruments were calibrated before and after measurement. No significant drift in calibration was observed.

The recorded ground vibration levels of train pass-bys are shown in Section 3.6 below together with the vibration criteria from British Standard BS6472-1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80 Hz)" and DECC intermittent vibration dosage criterion.

3.4 Long-term Ambient and Background Noise Survey

The proposed development is potentially affected by road traffic noise from Gibbons Street on western boundary and Regent Street to approximately 40m to the east. An environmental noise monitor was installed 1.2m inside the site boundary facing Gibbons Street indicated in Figure 2 above for the ambient and background noise survey from 19/06/18 to 27/06/18. A short-term noise survey was also conducted on Regent Street on 27/06/18.

The noise logger records noise levels on a continuous basis and stores data every fifteen minutes. The noise logger was calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as Type 2 instruments suitable for field use.

The results of the background and ambient noise monitoring conducted on site are presented in APPENDIX H.

3.5 Measured Road Traffic Noise

The design traffic noise levels are taken from the representative L_{Aeq} for the week for both the day time (7am to 10pm) and night time (10pm-7am) periods. The design external traffic noise levels are presented Table 5 below.

Table 5: Representative Day and Night Road Traffic Noise Levels

Monitoring Location	Survey Period	Measured Traffic Noise Levels	
		$L_{Aeq,15hours}$ [1,2]	$L_{Aeq,9\ hours}$ [1,2]
Location 1 – Gibbons Street at 1.2m from site west boundary	Day time (7am to 10pm) 19/06/18 to 27/06/18	71 dB(A)	-
	Night time (10pm to 7am) 19/06/18 to 27/06/18	-	68 dB(A)

Notes:

1. Noise levels presented are facade values.
2. Representative external noise levels in measured L_{Aeq} over 15 hour and 9 hour day and night period respectively (ISEPP 2007)

Table 6 below presents results of the short-term traffic noise survey conducted at corner of Regent and Marian Street.

Table 6: Representative Day and Night Road Traffic Noise Levels

Monitoring Location	Survey Period	Measured Traffic and Background Noise Levels	
		$L_{Aeq, 15minute}$	$L_{A90, 15minute}$
Location 2 – Corner of Regent & Marian Street at 2.5m from building façade and 0.5m from road kerb	3:15pm to 3:30pm on Wednesday 27/06/18	72 dB(A)	59dB(A)

Notes:

1. Noise levels presented are facade values.

3.6 Measured Tactile Train Vibration & Assessment to BS6472 and DECC

Results of the train vibration survey were plotted against night and day criterion of British Standard BS6472-1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)" as show in Figure 3 and Figure 6 below. In addition, the measured train vibration levels were used to calculate the vibration dosage values (VDV) and then compared to the acceptable levels from the Table 2.4 of DECC guideline.

The graphs below demonstrate that the floor induced vibration within the proposed building from each of the measured train pass-bys were in compliance with the British Standard BS6472:1997 for human comfort in a residential environment during the day and night. Similarly, the calculated vibration dosage values (VDV) from our measurements complied with the preferred day and night VDV criterion as defined in the DECC guideline.

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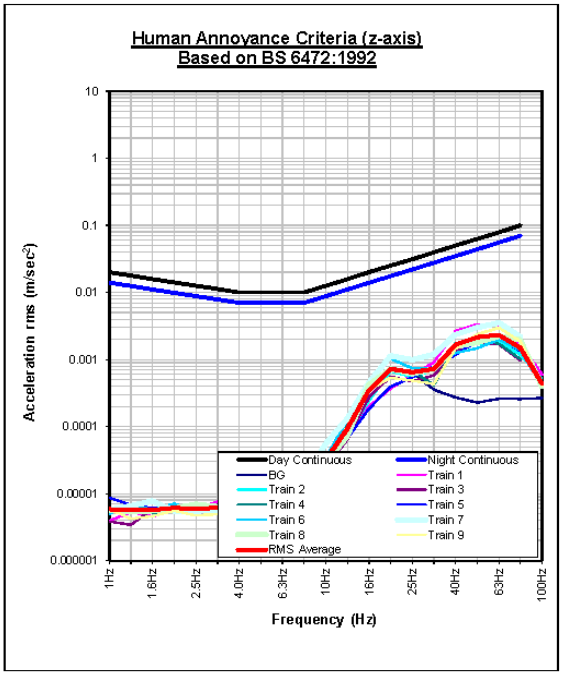
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	Project TK332-01				
Location:	11 Gibbons Street, Redfern				
Source:	Trains				
Assessment Location:	Residential	Axis	Z	Total secs of Vib per Day (t):	3,810
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	840



Legend														
Measurement		BG	Train 1	Train 2	Train 3	Train 4	Train 5	Train 6	Train 7	Train 8	Train 9	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec^2)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000		
	12.5Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	16Hz	0.0004	0.0002	0.0002	0.0003	0.0004	0.0002	0.0005	0.0004	0.0004	0.0004	0.0003		
	20Hz	0.0007	0.0004	0.0007	0.0006	0.0007	0.0004	0.0010	0.0011	0.0007	0.0005	0.0007		
	25Hz	0.0006	0.0006	0.0005	0.0005	0.0007	0.0005	0.0007	0.0010	0.0006	0.0005	0.0006		
	31.5Hz	0.0004	0.0009	0.0007	0.0006	0.0004	0.0008	0.0004	0.0012	0.0007	0.0004	0.0007		
	40Hz	0.0003	0.0027	0.0018	0.0013	0.0016	0.0012	0.0013	0.0023	0.0016	0.0015	0.0017		
	50Hz	0.0002	0.0033	0.0017	0.0018	0.0023	0.0019	0.0015	0.0030	0.0018	0.0024	0.0022		
	63Hz	0.0003	0.0031	0.0018	0.0017	0.0017	0.0021	0.0020	0.0035	0.0022	0.0030	0.0023		
	80Hz	0.0003	0.0017	0.0012	0.0010	0.0010	0.0013	0.0014	0.0022	0.0020	0.0019	0.0015		
	100Hz	0.0003	0.0006	0.0005	0.0004	0.0003	0.0005	0.0004	0.0005	0.0004	0.0004	0.0004		
Weighted rms	Day	0.0004	0.0009	0.0006	0.0006	0.0007	0.0006	0.0007	0.0011	0.0007	0.0007	0.0007	0.0100	0.0200
	Night	0.0004	0.0009	0.0006	0.0006	0.0007	0.0006	0.0007	0.0011	0.0007	0.0007	0.0007	0.0070	0.0140
eVDV	Day	0.0045	0.0103	0.0071	0.0063	0.0076	0.0064	0.0080	0.0118	0.0078	0.0080	0.0080	0.20	0.40
	Night	0.0031	0.0071	0.0049	0.0043	0.0052	0.0044	0.0055	0.0081	0.0053	0.0055	0.0055	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 3: Vibration Assessment (Survey 1) for Human Annoyance BS6472 in Horizontal Plane

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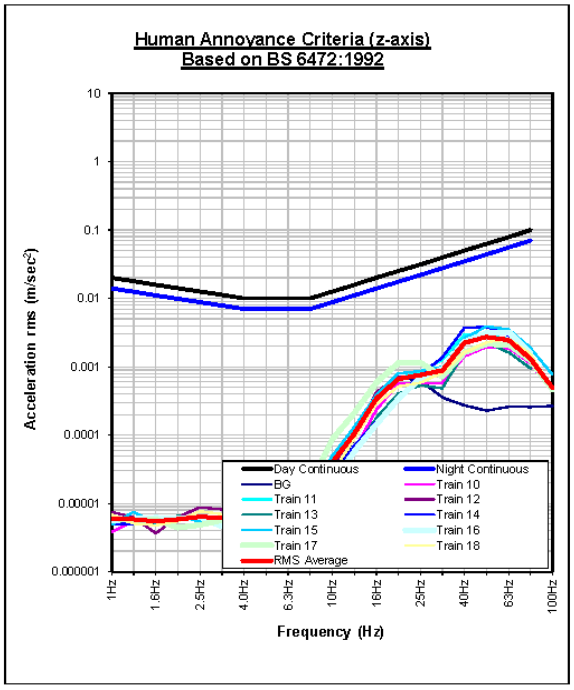
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	Project TK332-01				
Location:	11 Gibbons Street, Redfern				
Source:	Trains				
Assessment Location:	Residential	Axis	Z	Total secs of Vib per Day (t):	3,810
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	840



Legend														
Measurement		BG	Train 10	Train 11	Train 12	Train 13	Train 14	Train 15	Train 16	Train 17	Train 18	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	10Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000		
	12.5Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001		
	16Hz	0.0004	0.0002	0.0004	0.0004	0.0002	0.0002	0.0004	0.0001	0.0006	0.0003	0.0003		
	20Hz	0.0007	0.0006	0.0007	0.0007	0.0004	0.0004	0.0008	0.0003	0.0011	0.0005	0.0007		
	25Hz	0.0006	0.0006	0.0009	0.0007	0.0005	0.0008	0.0009	0.0007	0.0011	0.0006	0.0008		
	31.5Hz	0.0004	0.0006	0.0013	0.0007	0.0005	0.0014	0.0010	0.0009	0.0007	0.0008	0.0009		
	40Hz	0.0003	0.0014	0.0029	0.0023	0.0016	0.0037	0.0026	0.0023	0.0016	0.0016	0.0022		
	50Hz	0.0002	0.0019	0.0029	0.0028	0.0023	0.0038	0.0039	0.0031	0.0021	0.0023	0.0027		
	63Hz	0.0003	0.0019	0.0025	0.0025	0.0016	0.0029	0.0035	0.0032	0.0021	0.0026	0.0025		
	80Hz	0.0003	0.0011	0.0012	0.0012	0.0009	0.0016	0.0019	0.0016	0.0012	0.0015	0.0013		
	100Hz	0.0003	0.0004	0.0004	0.0004	0.0003	0.0006	0.0008	0.0006	0.0005	0.0005	0.0005		
Weighted rms	Day	0.0004	0.0006	0.0010	0.0009	0.0006	0.0011	0.0011	0.0009	0.0009	0.0007	0.0008	0.0100	0.0200
	Night	0.0004	0.0006	0.0010	0.0009	0.0006	0.0011	0.0011	0.0009	0.0009	0.0007	0.0008	0.0070	0.0140
eVDV	Day	0.0045	0.0067	0.0108	0.0094	0.0067	0.0125	0.0120	0.0097	0.0098	0.0079	0.0093	0.20	0.40
	Night	0.0031	0.0046	0.0074	0.0065	0.0046	0.0086	0.0082	0.0066	0.0067	0.0054	0.0064	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 4: Vibration Assessment (Survey 2) for Human Annoyance BS6472 in Horizontal Plane

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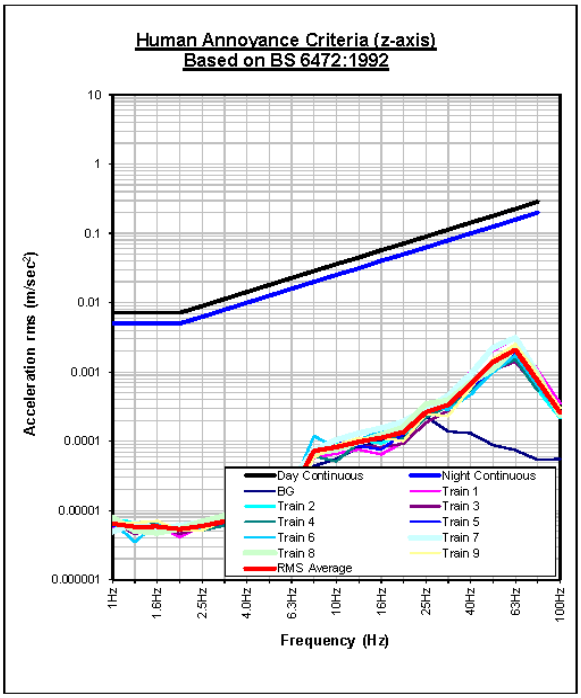
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	Project TK332-01				
Location:	11 Gibbons Street, Redfern				
Source:	Trains				
Assessment Location:	Residential	Axis	X&Y	Total secs of Vib per Day (t):	3,810
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	840



Legend														
Measurement		BG	Train 1	Train 2	Train 3	Train 4	Train 5	Train 6	Train 7	Train 8	Train 9	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	10Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	12.5Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	16Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001		
	20Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001		
	25Hz	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003		
	31.5Hz	0.0001	0.0005	0.0004	0.0003	0.0003	0.0003	0.0003	0.0005	0.0004	0.0002	0.0003		
	40Hz	0.0001	0.0010	0.0006	0.0006	0.0005	0.0006	0.0005	0.0009	0.0007	0.0006	0.0007		
	50Hz	0.0001	0.0020	0.0013	0.0011	0.0011	0.0011	0.0010	0.0022	0.0011	0.0015	0.0014		
	63Hz	0.0001	0.0031	0.0015	0.0014	0.0015	0.0019	0.0017	0.0031	0.0022	0.0025	0.0021		
	80Hz	0.0001	0.0011	0.0005	0.0006	0.0005	0.0008	0.0006	0.0009	0.0009	0.0009	0.0008		
	100Hz	0.0001	0.0004	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003	0.0002	0.0003	0.0003		
Weighted rms	Day	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0071	0.0140
	Night	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0050	0.0100
eVDV	Day	0.0004	0.0016	0.0010	0.0009	0.0009	0.0011	0.0010	0.0017	0.0012	0.0013	0.0012	0.20	0.40
	Night	0.0003	0.0011	0.0007	0.0006	0.0006	0.0007	0.0007	0.0012	0.0008	0.0009	0.0008	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 5: Vibration Assessment (Survey 1) for Human Annoyance BS6472 in Vertical Plane

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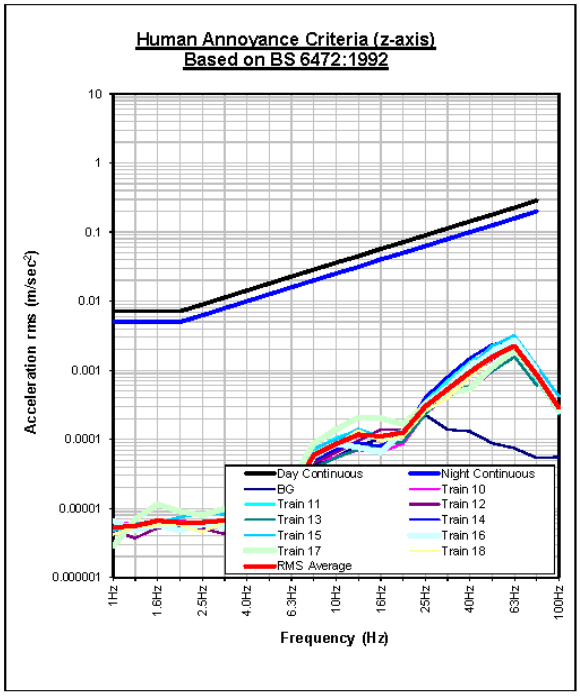
Vibration Survey Results

Vibration Assessment for Human Annoyance BS6472-1992 & DECCW

Project No.:	Project TK332-01				
Location:	11 Gibbons Street, Redfern				
Source:	Trains				
Assessment Location:	Residential	Axis	X&Y	Total secs of Vib per Day (t):	3,810
Type of Vibration:	Intermittent			Total secs of Vib per Night (t):	840



Legend														
Measurement		BG	Train 10	Train 11	Train 12	Train 13	Train 14	Train 15	Train 16	Train 17	Train 18	RMS Ave	Preferred DECCW Criterion	Maximum DECCW Criterion
Acceleration rms (m/sec²)	1Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.25Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	1.6Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	2.5Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	3.15Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	4.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	5.0Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	6.3Hz	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
	8.0Hz	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	10Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		
	12.5Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001		
	16Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001		
	20Hz	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001		
	25Hz	0.0002	0.0002	0.0004	0.0003	0.0002	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003		
	31.5Hz	0.0001	0.0004	0.0007	0.0006	0.0005	0.0008	0.0005	0.0005	0.0005	0.0004	0.0005		
	40Hz	0.0001	0.0005	0.0014	0.0008	0.0006	0.0015	0.0011	0.0011	0.0005	0.0008	0.0009		
	50Hz	0.0001	0.0010	0.0017	0.0014	0.0010	0.0024	0.0023	0.0018	0.0011	0.0015	0.0016		
	63Hz	0.0001	0.0020	0.0021	0.0024	0.0016	0.0027	0.0032	0.0027	0.0020	0.0022	0.0022		
	80Hz	0.0001	0.0008	0.0007	0.0010	0.0006	0.0010	0.0012	0.0010	0.0008	0.0009	0.0009		
	100Hz	0.0001	0.0003	0.0002	0.0003	0.0002	0.0003	0.0004	0.0003	0.0003	0.0003	0.0003		
Weighted rms	Day	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0071	0.0140
	Night	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0050	0.0100
eVDV	Day	0.0004	0.0010	0.0015	0.0013	0.0009	0.0018	0.0018	0.0015	0.0012	0.0012	0.0013	0.20	0.40
	Night	0.0003	0.0007	0.0010	0.0009	0.0006	0.0012	0.0012	0.0010	0.0008	0.0009	0.0009	0.13	0.26

NOTE: Red indicates exceedence of Preferred DECCW Criterion
NOTE: Gray indicates continous vibration levels and criteria if intermittent criteria is selected

QTS-01 (rev 12) Human Annoyance Vibration Assessment BS6472-DEC - z axis

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Figure 6: Vibration Assessment (Survey 2) for Human Annoyance BS6472 in Vertical Plane

4 Predicted Noise Levels

4.1 Predicted Ground-borne Rail Noise Inside Proposed Building

Regenerated or ground-borne rail noise is the low rumble heard inside buildings with vicinity of railway tunnels or railway tracks due to ground vibration generated by passing trains which propagate through soil and rock up into building elements such as foundation, wall and floors which re-radiates as audible sound.

Train vibration levels measured on site on 27/06/18 were used to predict the regenerated rail noise inside the proposed building from train pass-bys in underground rail tunnel adjacent to site. These calculated noise levels inside apartments are summarised in Table 7 below and compared to ground-borne noise criteria defined in Table 3.

Table 7: Predicted Ground-borne Rail Noise Levels

Floor Level	Proposed Occupancy	Calculated [1] Ground-borne Rail Noise L_{Amax} (Slow) inside Apartments for 95% of rail pass-by events	DOP Criteria for Ground-borne Rail Noise L_{Amax} (Slow)	Comply? (Yes/No)
Levels 6 to 17	Living, dining and kitchen	Equal to or less than 30 dB(A)	40 dB(A)	Yes
	Sleeping areas	Equal to or less than 30 dB(A)	35 dB(A)	Yes
Levels 4 & 5	Living, dining and kitchen	31-33 dB(A)	40 dB(A)	Yes
	Sleeping areas		35 dB(A)	Yes
Level 3	Living, dining and kitchen	36 [2]dB(A)	40 dB(A)	Yes
	Sleeping areas		35 dB(A)	Yes [2]
	Commercial		N/A	N/A
Level 2	Living, dining and kitchen	38 dB(A)	40 dB(A)	Yes
	Sleeping areas		35 dB(A)	No. Exceed by 3dB
	Commercial/community room		N/A	N/A
Level 1	Living, dining and kitchen	40 dB(A)	40 dB(A)	Yes
	Sleeping areas		35 dB(A)	No. Exceed by 5dB
	Commercial/community room		N/A	N/A
Ground	Retail/commercial, offices & community hub	34 dB(A)	N/A	N/A

Notes:

1. Ground-borne noise calculations were based upon the measured L_{AMax} (Slow) of 95% of train pass-events as per DOP Guideline 2008
2. Exceedance of 1dB is insignificant and not discernible.

The above assessment demonstrates ground-borne rail noise level inside habitable rooms of the development due train pass-bys on the adjacent rail tunnel (Eastern Suburbs & Illawarra Line) to exceed the L_{Amax} (Slow) criteria stipulated in the DOP Guideline 2008 by **3dB to 5dB**.

4.2 Predicated Traffic Noise Levels at Building Facades

The major sources of external noise intrusion for the proposed development has been identified as traffic on Gibbons Street and Regent Street.

The level of road traffic noise impacting on the each of the proposed building façades were predicted by modelling road noise sources, existing surrounding buildings, intervening structures and ground topography using the internationally recognised environmental noise prediction computer program CadnaA (version 4.5). Results of the long-term and short-term traffic noise surveys were used to calibrate and fine tune the acoustic model.

In addition, acoustic modelling has also been conducted to demonstrate the sound-shielding effects of future 18-storey towers to the south, east and north-east of subject site. Table 8 below is summary of predicted façade traffic noise levels with current and future surrounding buildings.

Graphical representation of the predicated noise levels on the proposed building facades are shown in APPENDIX E.

Table 8: Predicted Existing and Future Traffic Noise Levels

Facade	Floor	Day Traffic Noise Level [1,2] $L_{Aeq,\ 15\ Hour}$	Night Traffic Noise Level [1,2] $L_{Aeq,\ 9\ Hour}$
Façade Traffic Noise Levels with Existing Surrounding Buildings			
Gibbons Street (West)	Ground to Level 10	69 to 72dB(A)	66 to 69dB(A)
	Levels 11 to 17	66 to 68dB(A)	63 to 65dB(A)
William Lane (East)	Ground to Level 10	50 to 62dB(A)	47 to 59dB(A)
	Levels 11 to 17	63 to 65dB(A)	60 to 62dB(A)
Façade Traffic Noise Levels with Future Surrounding Buildings			
Gibbons Street (West)	Ground to Level 10	69 to 72dB(A)	66 to 69dB(A)
	Levels 11 to 17	66 to 68dB(A)	63 to 65dB(A)
William Lane (East)	Ground to Level 10	47 to 59dB(A)	44 to 56dB(A)
	Levels 11 to 17	60 to 62dB(A)	57 to 59dB(A)

Notes:

1. $L_{Aeq,15hour}$ is traffic noise level over 15-hour period from 7am to 10pm and $L_{Aeq,9hour}$ is traffic noise level over 9-hour period from 10pm to 7am next day as defined in ISEPP 2007 and DoP Guideline.
2. Predicted façade noise levels are 1m from façade or window.
3. Predicted traffic noise with future buildings is based on current traffic volume

The predicted traffic noise levels from the acoustic model with existing surrounding buildings were then used to calculate internal noise levels within the proposed residential and non-residential spaces to determine façade and glazing requirements to comply noise goals defined in Table 2 above. Internal noise calculations and predications were conducted using the Outside-In Glazing Spreadsheet developed in this office which takes into account façade noise levels, glazing and facade transmission loss and room sound absorption characteristics.

External facade and glazing constructions required to comply with the project noise criteria outlined in Table 2 above are presented in Section 5 below.

In addition to sound proofing of facades, a number of noise mitigation measures has been incorporated into the building design which are as follows;

- Winter gardens proposed for Levels 1 & 2 apartments where units are worst-affected by traffic noise from Gibbons Street
- Alcoves on Gibbons Street façade to create quiet zones for bedroom windows
- Double glazing proposed for bedrooms located at building corners overlooking Gibbon Street
- Size of bedroom windows overlooking the main noise source has been kept to a minimum to reduce ingress of external noise.

5 Recommendations

5.1 Glazing Design Requirements

Table 9 below presents recommended glazing treatment for the building facades to achieve compliance with the maximum noise levels nominated in Table 2 above.

Table 9: Recommended Glazing Treatment

Level	Facade	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Configuration	Laboratory Test Reference
Ground Refer to glazing mark-up floor plans in APPENDIX F for further details	All facades	Retail/commercial/ lobby/community hub	R_W 32	6.38mm laminated glass or equivalent	ESTIMATE
	North	SGCH Offices	R_W 32	6.38mm laminated glass or equivalent	ESTIMATE
	East		R_W 27	6mm standard float glass or equivalent	ESTIMATE
Levels 1 & 2 Refer to glazing mark-up floor plans in APPENDIX F for further details	West facing Gibbons St	Open plan living/dining/kitchen	Rw38	Winter garden consisting of 6mm standard float glass and 6.38mm laminated	ESTIMATE
		Bedrooms	Rw40	12.5mm Viridian VLam Hush laminated glass or Double glazing consisting of 5mm standard float glass/16mm air gap/8.5mm Viridian VLam Hush laminated glass or equivalent	ESTIMATE
			Rw40	Winter garden consisting of 6mm standard float glass and 6.38mm laminated	ESTIMATE
			Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
	North	Bedrooms	Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
			Rw32	6.38mm laminated glass or equivalent	ESTIMATE
	South	Bedrooms	Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
			Rw35	10.38mm laminated glass or equivalent	ESTIMATE
			Rw32	6.38mm laminated glass or equivalent	ESTIMATE
		Bathroom	Rw27	6mm standard float glass	ESTIMATE

Level	Facade	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Configuration	Laboratory Test Reference
	East	Open plan living/dining/kitchen	Rw27	6mm standard float glass or equivalent	ESTIMATE
		Bedrooms	Rw32	6.38mm laminated glass or equivalent	ESTIMATE
Level 3 Refer to glazing mark-up floor plans in APPENDIX F for further details	West & north	Community room	Rw32	6.38mm laminated glass or equivalent	ESTIMATE
	West facing Gibbons St	Open plan living/dining/kitchen	Rw35	10.38 laminated glass or equivalent	ESTIMATE
		Bedrooms	Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
	North	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
	South	Bedrooms	Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
			Rw35	10.38 laminated glass or equivalent	ESTIMATE
		Bathroom	Rw27	6mm standard float glass or equivalent	ESTIMATE
	East	Open plan living/dining/kitchen	Rw27	6mm standard float glass or equivalent	ESTIMATE
		Bedrooms	Rw32	6.38mm laminated glass or equivalent	ESTIMATE
Levels 4 Refer to glazing mark-up floor plans in APPENDIX F for further details	West facing Gibbons St	Open plan living/dining/kitchen	Rw35	10.38mm laminated glass or equivalent	ESTIMATE
		Bedrooms	Rw40	12.5mm Viridian VLam Hush laminated glass or Double glazing consisting of 5mm standard float glass/16mm air gap/8.5mm Viridian VLam Hush laminated glass or equivalent	ESTIMATE
			Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
	North	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
	South	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
			Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
		Bathroom	Rw27	6mm standard float glass or equivalent	ESTIMATE
	East	Open plan living/dining/kitchen	Rw27	6mm standard float glass or equivalent	ESTIMATE
		Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE

Level	Facade	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Configuration	Laboratory Test Reference
Levels 5 to 10 Refer to glazing mark-up floor plans in APPENDIX F for further details	West facing Gibbons St	Open plan living/dining/kitchen	Rw35	10.38mm laminated glass or equivalent	ESTIMATE
		Bedrooms	Rw40	12.5mm Viridian VLam Hush laminated glass or Double glazing consisting of 5mm standard float glass/16mm air gap/8.5mm Viridian VLam Hush laminated glass or equivalent	ESTIMATE
			Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
	North	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
	South	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
			Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
		Bathroom	Rw27	6mm standard float glass or equivalent	ESTIMATE
	East	Open plan living/dining/kitchen	Rw27	6mm standard float glass or equivalent	ESTIMATE
		Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
Levels 11 to 17 Refer to glazing mark-up floor plans in APPENDIX F for further details	West facing Gibbons St	Open plan living/dining/kitchen	Rw32	6.38mm laminated glass or equivalent	ESTIMATE
		Bedrooms	Rw38	10.5mm Viridian VLam Hush laminated glass	ESTIMATE
	North	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
	South	Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE
		Bathroom	Rw27	6mm standard float glass or equivalent	ESTIMATE
	East	Open plan living/dining/kitchen	Rw27	6mm standard float glass or equivalent	ESTIMATE
		Bedrooms	Rw35	10.38 laminated glass or equivalent	ESTIMATE

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the partition, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

Level	Facade	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Configuration	Laboratory Test Reference

LEGEND where no appropriate test certificate exists:

1. ESTIMATE: The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.
2. ESTIMATE – APPROVED FOR CONSTRUCTION: Use of the form of construction is approved prior to laboratory certification. To complete the quality control of the design process and confirm the acoustical performance of the construction, we recommend testing in a laboratory to confirm the Rw rating as soon as practicable. In the case of impact rating for floor systems, no particular impact rating is guaranteed to comply with either the Building Code of Australia or Strata Scheme Management Act and hence carpet runners may still be required.
3. ESTIMATE – TEST NOT REQUIRED: Use of the form of construction is approved without laboratory certification. The STC/Rw of the form of construction exceeds the project requirements.
4. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

NOTES FOR GLAZING CONSTRUCTIONS:

5. The information in this table is provided for the purpose of development approval process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
6. The design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.
7. Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction where only an "estimate" is available for the sound insulation properties of recommended materials.
8. The glazing supplier shall ensure that installation techniques will not diminish the Rw performance of the glazing when installed on site.
9. All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced.
10. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

GENERAL

11. The sealing of all gaps in partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
12. Check design of all junction details with acoustic consultant prior to construction.
13. Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
14. The information provided in this table is subject to modification and review without notice.
15. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

5.2 Building Ventilation

Table 10 and Table 11 below shows the assessment of external noise intrusion to the "Windows Open" noise criteria nominated in Table 2 for living and bedrooms. Predicted façade noise levels with and without future surrounding building are summarised in Table 8 above.

Table 10: Noise Assessment to Windows Open Criteria for Living Areas (Day Time Traffic)

Façade	Occupancy	Floor	Predicted Noise Level $L_{Aeq,\ 15hours}$ in dB(A)		ISEPP Windows Open Internal Noise Criteria $L_{Aeq,}$ in dB(A)	Compliance (Yes/No)
			At facade[1]	Inside Apartment with Windows Open[2,3]		
Assessment of window open criteria with existing surrounding buildings						
Gibbons Street (West)	Open-plan Living/Dining/ Kitchen	Levels 1 to 10	69 to 72	57 to 60	50 or less	No
		Levels 11 to 17	66 to 68	54 to 56	50 or less	No

Façade	Occupancy	Floor	Predicted Noise Level $L_{Aeq, 15hours}$ in dB(A)		ISEPP Windows Open Internal Noise Criteria $L_{Aeq,}$ in dB(A)	Compliance (Yes/No)
			At facade[1]	Inside Apartment with Windows Open[2,3]		
William Lane (East)	Open-plan Living/Dining/ Kitchen	Levels 1 to 10	50 to 62	38 to 40	50 or less	Yes
		Levels 11 to 17	63 to 65	51 to 53	50 or less	No
Assessment of window open criteria with consideration of future surrounding buildings						
Gibbons Street (West)	Proposed future neighbouring buildings does not provide noise shielding to Gibbons Street apartments					
William Lane (East)	Open-plan Living/Dining/ Kitchen	Levels 1 to 10	47 to 59	35 to 47	50 or less	Yes
		Levels 11 to 17	60 to 62	48 to 50	50 or less	Yes

Notes:

1. Predicted façade noise levels are 1m from window or sliding door
2. Assumes open-plan living/dining/kitchen has timber floor finish and furnished providing typical reverberation time of no greater than 0.7seconds.
3. Opening area of window or sliding door is no greater than 5% of floor area

Table 11: Noise Assessment to Windows Open Criteria for Bedrooms (Night Time Traffic)

Façade	Occupancy	Floor	Predicted Noise Level $L_{Aeq, 9hours}$ in dB(A)		ISEPP Windows Open Internal Noise Criteria $L_{Aeq,}$ in dB(A)	Compliance (Yes/No)
			At facade[1]	Inside Apartment with Windows Open[2,3]		
Assessment of window open criteria with existing surrounding buildings						
Gibbons Street (West)	Bedrooms	Levels 1 to 10	66 to 69	52 to 55	45 or less	No
		Levels 11 to 17	63 to 65	49 to 51	45 or less	No
William Lane (East)	Bedrooms	Levels 1 to 10	47 to 59	33 to 45	45 or less	Yes
		Levels 11 to 17	60 to 62	46 to 48	45 or less	No
Assessment of window open criteria with consideration of future surrounding buildings						
Gibbons Street (West)	Proposed future neighbouring buildings does not provide noise shielding to Gibbons Street apartments					
William Lane (East)	Bedrooms	Levels 1 to 10	44 to 56	30 to 45	45 or less	Yes
		Levels 11 to 17	57 to 59	43 to 45	45 or less	Yes

Notes:

1. Predicted façade noise levels are 1m from window or sliding door
2. Assumes bedrooms are carpeted and furnished providing typical reverberation time of no greater than 0.4seconds
3. Opening area of window or sliding door is no greater than 5% of floor area

The above assessment has shown once the future neighbouring multi-storey buildings are built all apartments within the proposed development that faces William Lane can be naturally ventilated and achieve compliance with ISEPP internal noise criteria outlined Table 2.

5.3 Facade & Roof Sound Insulation

In principle advice is provided below for the acoustic requirements of the roof and external walls for this proposed development.

5.3.1 External Walls

The dominate path of external noise ingress into building interior is via window and doors. Assessment and recommendations in regard to external noise intrusion has accordingly been made with respect to the windows and doors. It is therefore recommended that the external walls have a sound isolation rating (R_w) at least 15dB higher than that of the glazing specified in Table 9 above, to maintain the acoustic integrity of the overall facade system.

5.3.2 Roof and Ceiling

Similar to the external wall design, the roof/ceiling construction can generally provide acoustic performances well in excess of glazing or doors. The roof construction should have a sound isolation rating (R_w) at least 10dB higher than that of the glazing on its facade.

5.3.3 Glazing Assembly Requirements

The following acoustic measures should also be incorporated into the building design:

s1. All operable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the R_w rating performance of the glazing to not be reduced.

s2. The glazing thicknesses outlined in Table 9 should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

s3. The glazing supplier shall ensure that installation techniques will not diminish the R_w performance of the glazing when installed on site. Sliding door meeting stiles should form an airtight seal when closed and locked.

s4. The perimeter of all window and door frames are to be sealed airtight in the external facade using the following methods:

- For gaps less than 10mm - Fill all gaps around the window perimeter with an acoustic mastic sealer (minimum specific gravity 1.6sg) equivalent to Promat Promaseal. The depth of sealer shall be at least equal to the width of the gap.
- If the gap is greater than 10mm, fill the cavity with polyester insulation and a backing rod. Seal the gap airtight an acoustic mastic sealer (min specific gravity 1.6sg) equivalent to Promat Promaseal. The depth of sealer shall be at least equal to the width

of the gap. The gaps between frames shall also be sealed using aluminium angle brackets (approximately 25 x 25 x 3mm).

6 Operational Noise Emission from Development

6.1 Existing Noise Environment at Development Site

The results of the long-term noise monitoring have been summarised in accordance with Industrial Noise Policy requirements published by the NSW Environmental Protection Authority (EPA) and are presented in Table 12 below.

Table 12: Measured Site Ambient & Background Noise Levels

Noise Monitoring Location	Representative Ambient & Background Noise Levels in dB(A)	Day[1]	Evening[2]	Night[3]
Location 1 – 1.2m from site boundary facing Gibbons St, Redfern	Background Noise Level L_{A90}	56	52	43
	Ambient Noise Level L_{Aeq}	69	67	64

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW EPA's Industrial Noise Policy as follows.

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. As results were affected by construction noise weekend day and Saturday morning, Sunday results have been presented for the Day time period
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

The representative background noise levels (L_{A90}) are used in defining external noise emission from the development such as mechanical ventilation and air-conditioning systems in accordance to Office of Environment and Heritage (formally Department of Department of Environment, Climate Change and Water).

6.2 EPA Requirements

The NPfI sets project noise trigger level to protect noise amenity for residential receivers. The project noise trigger level is set as the lower value of the following two assessment components:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for particular land uses for residences and other land uses.

Noise intrusiveness ensures that industrial noise does not exceed the background noise level by an excessive margin, preventing significant changes in the noise characteristic pertinent to the development site and surrounds. This is commonly referred to as the 'background plus 5' criterion. That is, the noise level from new industrial development, assessed in periods of 15 minutes, should not exceed the existing background noise level (measured in the absence of that development) by more than 5dB(A).

Noise amenity ensures that industrial noise levels do not increase without limit, for if a number of industrial noise sources are permitted to increase the background noise level by 5dB(A), in turn there would be a point where the ultimate noise level is unacceptable. A limit on the ultimate acceptable noise level is therefore included in the NPfI as a way of ensuring that cumulative noise impact from industrial growth is curtailed. This limit is referred to as the project amenity noise level. The appropriate

limit in any circumstance relates to the land use category, for example, there are different limits for rural, suburban and urban areas.

The table below presents the recommended amenity noise level relevant to the receivers surrounding the proposed development site. The project amenity noise level is defined as the recommended amenity noise level minus 5dB(A).

Table 13: NPfI Amenity Noise Levels - Recommended L_{Aeq} Amenity Noise Levels from Industrial Noise Sources [EPA NPfI Table 2.1]

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A) Recommended amenity noise level
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See Column 4	5dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom - internal	All	Noisiest 1-hour period when in use	35
Hospital ward - internal	All	Noisiest 1-hour	35
Hospital ward - external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5dB(A) to recommended noise amenity

Notes:

- Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
- On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
- The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

In accordance with Section 2.4 of the NPfI, the following **exceptions** to the above method to derive the project amenity noise level apply:

1. In areas with high traffic noise levels (see Section 2.4.1 of the NPfI).
2. In proposed developments in major industrial clusters (see Section 2.4.2 of the NPfI).
3. Where the resultant project amenity noise level is 10dB, or more, lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
4. Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

The following table presents the site-specific noise production criteria from industrial noise sources, namely mechanical plant.

Table 14: L_{Aeq} design criterion for noise production from mechanical plant (EPA NPfI)

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Time of Day	**Rating Background Level (RBL) L_{A90}**	**Intrusiveness Criterion (RBL+5)**	**Project Amenity Noise Level (PANL)**	**Measured L_{Aeq} Ambient Noise Levels**	**Is PANL 10dB, or more, lower than measured L_{Aeq}?**	**Existing noise level likely to decrease in future?**	**Exceptions to PANL? ^**	**Project Noise Trigger Level $L_{Aeq, period}$ dB(A)**
Day (7am to 6pm)	56	61	55	69	Yes	No	Existing L_{Aeq} minus 15dB	54
Evening (6pm to 10pm)	52	57	45	67	Yes	No	Existing L_{Aeq} minus 15dB	52
Night (10pm to 7am)	43	48	40	64	Yes	No	Existing L_{Aeq} minus 15dB	49

Explanatory notes:

Column 1 – RBL measured in accordance with the NPfI and outlined in Table 4 above

Column 3 – Project Amenity Noise Level determined based on 'Residential - urban' area in Table 2.2 (Amenity noise levels) of the EPA's NPfI minus 5dB

Column 4 – Measured in accordance with the NPfI and outlined in Table 5 above

Column 7 - Determined in accordance with Section 2.4 of the NPfI.

Column 8 – Project Noise Trigger Level is the lower value of project intrusiveness noise level and project amenity noise level

^ - In accordance with Section 2.4.1 of the NPfI, the project amenity noise level is derived from measured LAeq where measured traffic noise is 10dB or more above the recommended amenity noise level for the area

Where necessary, noise amelioration treatment will be incorporated in the design to ensure that noise levels comply with the recommended EPA's INP noise emission criteria noted above.

6.3 Recommended Noise Control Measures for Mechanical Plant

Mechanical plant such as exhaust systems, air-conditioning, mechanical ventilation and refrigeration associated with the development has the potential to impact on nearby residential and commercial properties. As details of mechanical plant are not available at this stage of the development the following in principle noise control advice are provided.

- Acoustic assessment of mechanical services equipment will be required to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in established in Table 9.
- Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following;
  - procurement of 'quiet' plant
  - strategic positioning of roof and balcony plant equipment away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises
  - installation of commercially available silencers or acoustic attenuators for air discharge and air intakes of plant
  - acoustically lined and lagged ductwork
  - provide acoustic screens and/or acoustic louvres between plant and sensitive neighbouring premises
  - provide partially enclosed or fully enclosed acoustic enclosure over plant
  - Mechanical plant shall have their noise specifications and proposed locations checked prior to installation
  - Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 "Rotating and Reciprocating Machinery - Mechanical Vibration"

7 Internal Sound Insulation between Tenancies

Internal walls and floors shall comply with the National Construction Code of Australia 2016 (formally Building Code of Australia). All services and doors shall comply with the requirements of the NCC 2016.

APPENDIX B presents a summary of acoustic provisions outlined in Part F5 of the NCC 2016.

8 Construction Noise

The nature of the construction processes proposed for the development does not present difficulties in ensuring that the associated noise limits at surrounding properties are achieved. The major construction activities proposed on this site are demolition works, excavation works, concrete pours and general building works.

Construction and building work will be adequately managed so as to minimise disruption to the local community and the environment.

The NSW Interim Construction Noise Guideline sets out management noise levels and time restrictions for construction activities. The aims of the guideline are to control and manage noise on all building sites within the local area.

Since detail of the construction equipment such as exact type, size, number and operating time are not know at this stage, in-principle noise control measures are provided in Section 8.1 below which may be implemented to minimise any noise exceedances to the noise sensitive receptors where that may occur.

8.1 General Engineering Noise Control

Implementation of noise control measures, such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-1981, Appendix E, Table E1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table E2 in Appendix E presents typical examples of noise reductions achievable after treatment of various noise sources. Table E3 in Appendix E presents the relative effectiveness of various forms of noise control treatment.

Table 15 below present noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 15: Relative Effectiveness of Various Forms of Noise Control, dBA

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	7 to 10	5 to 10	15	15
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 30	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Substitution by alternative process	Use electric motors in preference to diesel or petrol	15 to 25	15 to 25	60	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this assessment.

Table 16 below identifies possible noise control measures which are applicable on the construction plant likely to be used on site.

Table 16: Noise Control Measures for Likely Construction Plant

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Concrete Saw	✔	✔	x	x
Jack hammers	✔	x	✔	x
Mobile Crane	✔	✔	✔	x
Front End Loader	✔	x	✔	x
Pneumatic Hand Tools (general)	✔	✔	✔	✔
Bulldozer	✔	x	✔	x
Tracked Excavator	✔	x	✔	x
Concrete Trucks	✔	x	✔	x
Delivery Trucks	✔	x	✔	x
Dump Trucks	✔	x	✔	x
Truck (> 20 tonne)	✔	x	✔	x
Welders	✔	✔	x	x
Cherry Picker	✔	x	✔	x
Concrete Pump	✔	✔	✔	✔
Power Generator	✔	✔	✔	x
Light commercial vehicles	✔	x	✔	x
Silenced Air Compressor	✔	✔	✔	✔

To ensure efficient noise attenuation performance is achieved using any of the methods listed above, it is recommended acoustic engineers work closely with the construction contractors and carry out preliminary testing prior to commencement of works.

In addition to physical noise controls, the following general noise management measures should be followed:

- Plant and equipment should be properly maintained

- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel
- Avoid unnecessary noise when carrying out manual operations and when operating plant
- Any equipment not in use for extended periods during construction work should be switched off
- Noise compliance monitoring for all major equipment and activities on site should be undertaken prior to their commencement of work on site.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided, then consideration should be given to implementing time restrictions and/or providing periods of repose for neighbouring receptors.

9 Conclusion

Renzo Tonin & Associates have completed an assessment of the road traffic and rail vibration impacts on the proposed mixed-use development at 11 Gibbons Street, Redfern.

Our assessment has shown floor induced vibration within the proposed residential spaces due to train pass-bys to comply with British Standard BS6472:1992 *"Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)* and day and night VDV values to be within the acceptable values set by the DECC guideline as required by the Department of Planning Interim Guideline 2008.

Based on the measured rail vibration levels on site, our acoustic modelling anticipates ground-borne rail noise to exceed the Department of Planning Guideline by 3 to 5dB for bedrooms on Levels 1 & 2. For bedrooms facing Gibbons Street which are dominated by constant traffic noise, this exceedance would not be an issue. However, for bedrooms facing William Lane which are shielded from surrounding traffic noise, this exceedance may be an issue. Although this exceedance is of a low degree, we recommend the affected rooms to be vibration isolated off the building structure as per detail in APPENDIX G to attenuate ingress of structure-borne noise and minimise this potential noise risk for the occupants. Alternately, undertaking rail vibration measurements after concrete slab floor construction may reveal that regenerated rail noise levels is not an issue.

To control the ingress of traffic noise into the proposed development and to comply with the nominated noise criteria recommendations have been provided in Section 5 of the report.

APPENDIX A Assessment and Design Methodology

A.1 Apartment Design Guide (June 2015)

The Apartment Design Guide is a support document to the State Environmental Planning Policy 65 – Design Quality of Residential Apartment Development (SEPP65). Relevant section of the guide is re-iterated below.

"4J Noise and pollution

…

Development near rail corridors and busy roads

The NSW Government's Development near Rail Corridors and Busy Roads - Interim Guideline as called up by State Environmental Planning Policy (Infrastructure) 2007 assists in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads. SEPP 65 development in these locations must have regard to this Guideline.

"

It is noted that the ADG recommends developments near busy roads and rail corridors to undertake assessment in accordance with the "Development near Rail Corridors and Busy Roads – Interim Guideline" published by Department of Planning and discussed in sections below.

A.2 State Environmental Planning Policy (Infrastructure) 2007

The NSW State Environmental Planning Policy (Infrastructure) 2007 (known as 'ISEPP') came into force in NSW on 1 January 2008 to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessment, the ISEPP includes the following clauses:

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

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

a. a building for residential use,

b. a place of public worship,

c. a hospital,

d. an educational establishment or child care centre.

6. Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

7. If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

e. in any bedroom in the building - 35 dB(A) at any time between 10 pm and 7am,

f. anywhere else in the building (other than a garage, kitchen, bathroom or hallway) - 40 dB(A) at any time.

102 Impact of road noise or vibration on non-road development

8. This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

g. a building for residential use,

h. a place of public worship,

i. a hospital,

j. an educational establishment or child care centre.

9. Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

10. If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

k. in any bedroom in the building - 35 dB(A) at any time between 10 pm and 7am,

l. anywhere else in the building (other than a garage, kitchen, bathroom or hallway) - 40 dB(A) at any time.

11. In this clause, "freeway", "tollway" and "transitway" have the same meanings as they have in the Roads Act 1993

A.2.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

To support the Infrastructure SEPP, the NSW Department of Planning released the *Development in Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise,

vibration and air quality. While the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

A.2.2 Clarification of ISEPP noise limits

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the ISEPP apply to internal noise levels with windows and doors closed. However, as the preliminary noise assessment is based on measurements/predictions at external locations, equivalent external noise criteria has been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the ISEPP. The equivalent external goals have been determined on the following basis:

- The ISEPP states: "*If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*." The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the ISEPP.
- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Table 17 presents the ISEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 17: ISEPP noise criteria for new residential development

Room	Location	$L_{Aeq,\ 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 40,000AADT Roads only under ISEPP 2007.

^ ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

A.3 Australian/New Zealand Standard AS/NZS 2107:2016

As traffic noise levels are not constant, the L_{eq} noise level descriptor is used when assessing this type of noise source. The L_{eq} is the mean energy level of the noise being measured and has been found to accurately describe the level of annoyance caused by traffic noise.

This standard provides recommended noise levels for steady state such as noise from building services and quasi-steady state sounds, such as traffic and industrial noise. The noise levels recommended in AS/NZS 2107:2016 take into account the function of the area and apply to the sound level measured within the space unoccupied although ready for occupancy.

This standard recommends the following noise levels for residential buildings.

Table 18: Recommended design sound levels for different areas of occupancy in buildings

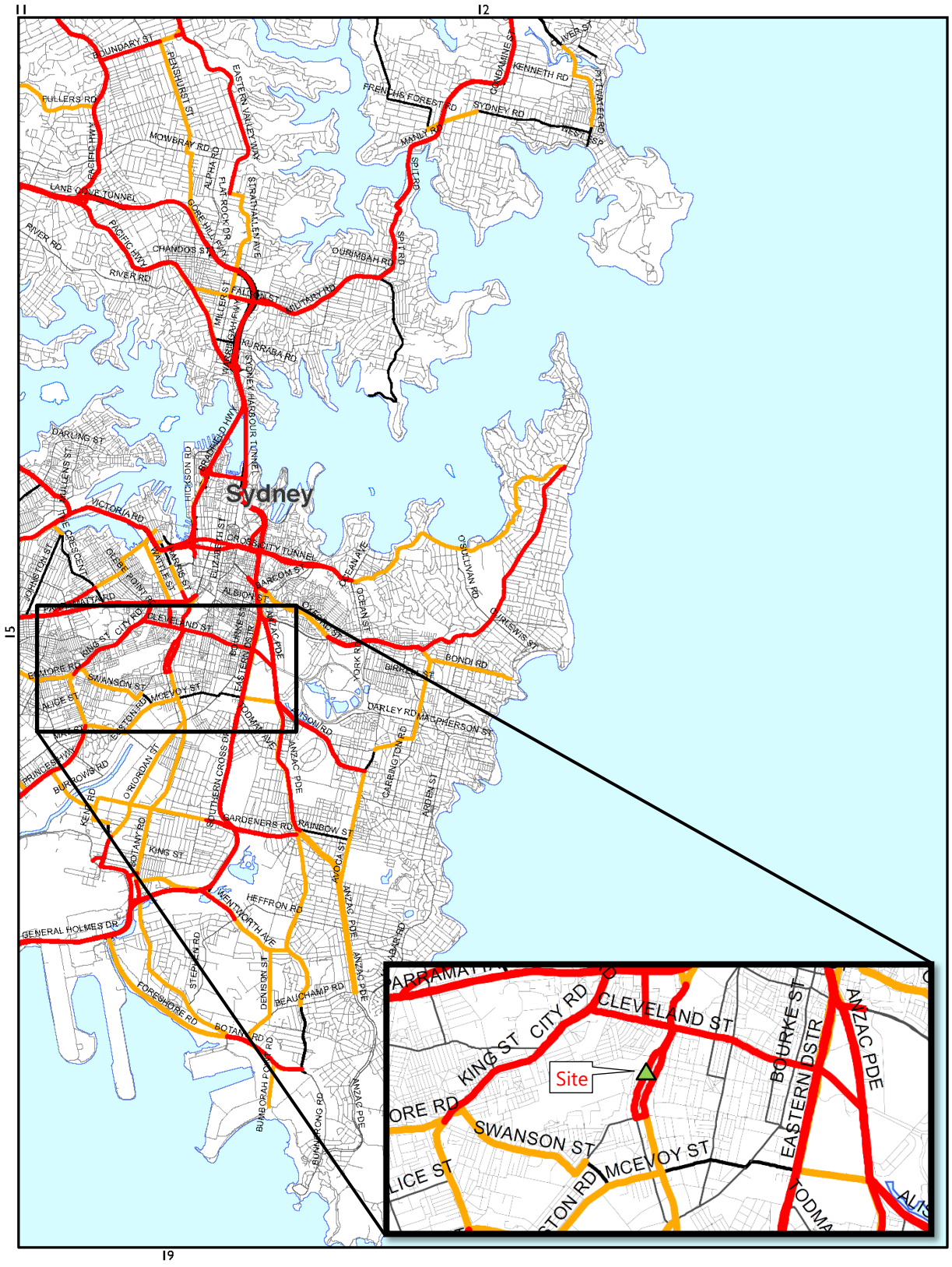
Type of occupancy/ activity	Recommended design sound level, L_{Aeq}, dB(A)		Recommended reverberation time (T),s
	Satisfactory	Maximum	
5 OFFICE BUILDINGS			
General office areas	40	45	0.4 to 0.6
Private offices	35	40	0.6 to 0.8
Public spaces	40	50	0.5 to 1.0
Reception areas	40	45	0.6 to 0.8
Rest rooms and break-out spaces	40	45	0.4 to 0.6
Toilets	45	55	-
Undercover carparks	-	<65	-
7 RESIDENTIAL BUILDINGS (see Note 7 and Clause 5.2)			
Houses in areas with negligible transportation -			
Sleeping areas	25	30	-
Houses and apartments near minor roads -			
Living areas	30	40	-
Sleeping areas	30	35	-
Work areas	35	40	-
Apartment common areas (e.g. foyer, lift lobby)	45	50	-
Houses and apartments near major roads -			
Living areas	35	45	-
Sleeping areas	35	40	-
Work areas	35	45	-
Apartment common areas (e.g. foyer, lift lobby)	45	50	-
8 SHOP BUILDINGS			
Enclosed carparks	-	<65	-
Show rooms	-	<50	See Note 3

Type of occupancy/ activity	Recommended design sound level, L_{Aeq}, dB(A)		Recommended reverberation time (T),s
	Satisfactory	Maximum	
Small retails stores (general)	-	<50	See Note 3
Specialty Shops (where detailed discussion is necessary in transactions)	-	<45	See Note 3

NOTES:

1. The recommended design sound levels are for a fully fitted out and completed building. Attention is drawn to the additive noise effect of many machines within the same area and adjacent areas. Allowance for the total number and type of noise sources should therefore be made in the selection of equipment and in the design of building spaces. A building owner or developer may consider an allowance of 3-5 dB(A) to be appropriate.
2. Recommended reverberation time is 10 percent to 20 percent higher than Curve 1 of Appendix A.
3. Reverberation time should be minimized as far as practicable for noise control.
4. Certain teaching spaces, including those intended for students with learning difficulties and students with English as a second language, should have reverberation times at the lower end of the specified range.
5. Specialist advice should be sought for these spaces.
6. A very wide range of noise levels can occur in the occupied state in spaces housing manufacturing processes, and the levels are primarily subject to control as part of a noise management program (see AS/NZS 1269.2). The possibilities for segregating very noisy processes from quieter ones by partitioning vary between particular industries and plants. For reasons such as these, it is difficult to make generalized recommendations for desirable, or even maximum, design levels for the unoccupied state, but one guiding principle may still be observed - when the activity in one area of a manufacturing plant is halted, it is desirable that the local level should if possible drop to 70 dB(A) or lower to permit speech communication without undue effort.
7. In situations where traffic noise levels may vary widely over a 24-hour period, measurements to assess compliance with this Standard should be taken at the relevant time and for an appropriate measurement period according to the area of occupancy or activity in the building. Where traffic noise fluctuates rapidly with the passage of individual vehicles, the community reaction may not correlate well with the equivalent continuous noise level as measured.
8. The overall sound pressure level in dB(A) should conform to the recommended design sound level given in Table 1. In these spaces, a balanced sound pressure level across the full frequency range is essential. These spaces should therefore be evaluated in octave bands across the full frequency spectrum. The recommended maximum sound pressure levels for the individual octave bands corresponding to the overall dB(A) value are given in Appendix C.
9. In spaces in which high quality sound recordings are to be made, the levels set for low frequency octave bands should not be exceeded (see Appendix C). Subsequent replay of the recordings may cause an amplification of the ambient sound resulting in an overemphasis of its low-frequency components. Specialist advice should always be sought when these spaces are being designed. In some circumstances, for purposes of very high quality recording, lower levels than those specified in Table 1 may be required.

APPENDIX B Traffic Volume Map for Noise Assessment



APPENDIX C Internal Sound Insulation

C.1 National Construction Code of Australia 2016

The National Construction Code of Australia (NCC) outlines minimum requirements for inter-tenancy (party) walls and ceiling/ floors to maintain privacy. This includes the incorporation of penetration of a service through a floor or through more than one sole-occupancy unit.

NCC nominates required Weighted Sound Reduction Indexes (R_w) and spectrum adaptation factor (C_{tr}) for partition constructions, of different space/ activity types in adjoining units. The R_w and $R_w + C_{tr}$ are single number descriptors for quantifying the attenuating performance of partitions for typical intrusive noises produced inside residences. The higher the rating, the greater the isolation provided by the partition.

Spectrum adaptation factors are commonly used to compensate for the fact that certain kinds of sounds are more readily transmitted through insulating materials than others insulate.

The adaptation factor C_{tr} has now been introduced for most building elements which require an airborne sound insulation rating. The only exception is a wall which separates a dwelling from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification. Therefore, both the C_{tr} factor and the R_w of the building element will need to be considered in most cases.

The C_{tr} factor takes into account lower frequency level sounds, and has been chosen in large part, in recognition of the problem of the high bass frequency outputs of modern home theatre systems and music reproduction equipment.

The Deemed-to-Satisfy Provisions also have impact sound insulation requirements for floors. The terms to describe the impact sound insulation of the floor is the weighted normalised impact sound pressure level ($L_{n,w}$). The lower the $L_{n,w}$ of the floor, the better the performance of the floor in terms of impact sound insulation.

The following section represents a summary of acoustic provisions outlined in the Part F5 of the NCC.

C.2 Sound Insultion Provision of NCC of Australia 2016

The acoustic provisions for inter-tenancy walls and floors in Class 2 and 3 buildings are outlined in the National Construction Code of Australia and the following is an extract from the NCC:

> *"F5.2 Determination of airborne sound insulation ratings*
>
> *A form of construction required to have an airborne sound insulation rating must –*

a. have the required value for weighted sound reduction index (R_w) or weighted sound reduction index with spectrum adaptation term ($R_w + C_{tr}$) determined in accordance with AS/NZS 1276.1 or ISO 717.1 using results from laboratory measurements; or

b. comply with Specification F5.2.

F5.3 Determination of impact sound insulation ratings

a. A floor in a building required to have an impact sound insulation rating must –

i. have the required value for weighted normalised impact sound pressure level with spectrum adaptation term ($L_{n,w}$) determined in accordance with AS/ISO 717.2 using results from laboratory measurements; or

ii. comply with Specification F5.2.

b. A wall in a building required to have an impact sound insulation rating must –

i. for a Class 2 or 3 building be of discontinuous construction;

c. For the purposes of this part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

i. for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

ii. for other than masonry, there is no mechanical linkage between leaves except at the periphery.

F5.4 Sound insulation rating of floors

a. A floor in a Class 2 or 3 building must have an $R_w + C_{tr}$ (airborne) not less than 50 and an $L_{n,w}$ (impact) not more than 62 if it separates –

i. sole-occupancy units; or

ii. a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

F5.5 Sound insulation rating of walls

a. A wall in a Class 2 or 3 building must –

i. have an $R_w + C_{tr}$ (airborne) not less than 50, if it separates sole-occupancy units; and

ii. have an R_w (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

iii. comply with F5.3(b) if it separates:

(A) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

(B) a sole-occupancy unit from a plant room or lift shaft.

b. A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an R_w not less than 30.

c. Where a wall required to have sound insulation has a floor above, the wall must continue to –

i. the underside of the floor above; or

ii. a ceiling that provides the sound insulation required for the wall.

F5.6 Sound insulation rating of services

a. If a duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an $R_w + C_{tr}$ (airborne) not less than –

i. 40 if the adjacent room is a habitable room (other than a kitchen); or

ii. 25 if the adjacent room is a kitchen or non-habitable room.

b. If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (a)(i) and (ii).

F5.7 Sound insulation of pumps

A flexible coupling must be used at the point of connection between the services pipes in a building and any circulating or other pumps."

APPENDIX D Construction Noise

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.

  NSW noise policies, including the INP, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- Application of reasonable and feasible noise mitigation measures

- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Table 19 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied for residential receivers. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 19: Noise management levels at residential receivers

Time of day	Management level $L_{Aeq\ (15\ min)}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Sensitive Land Use

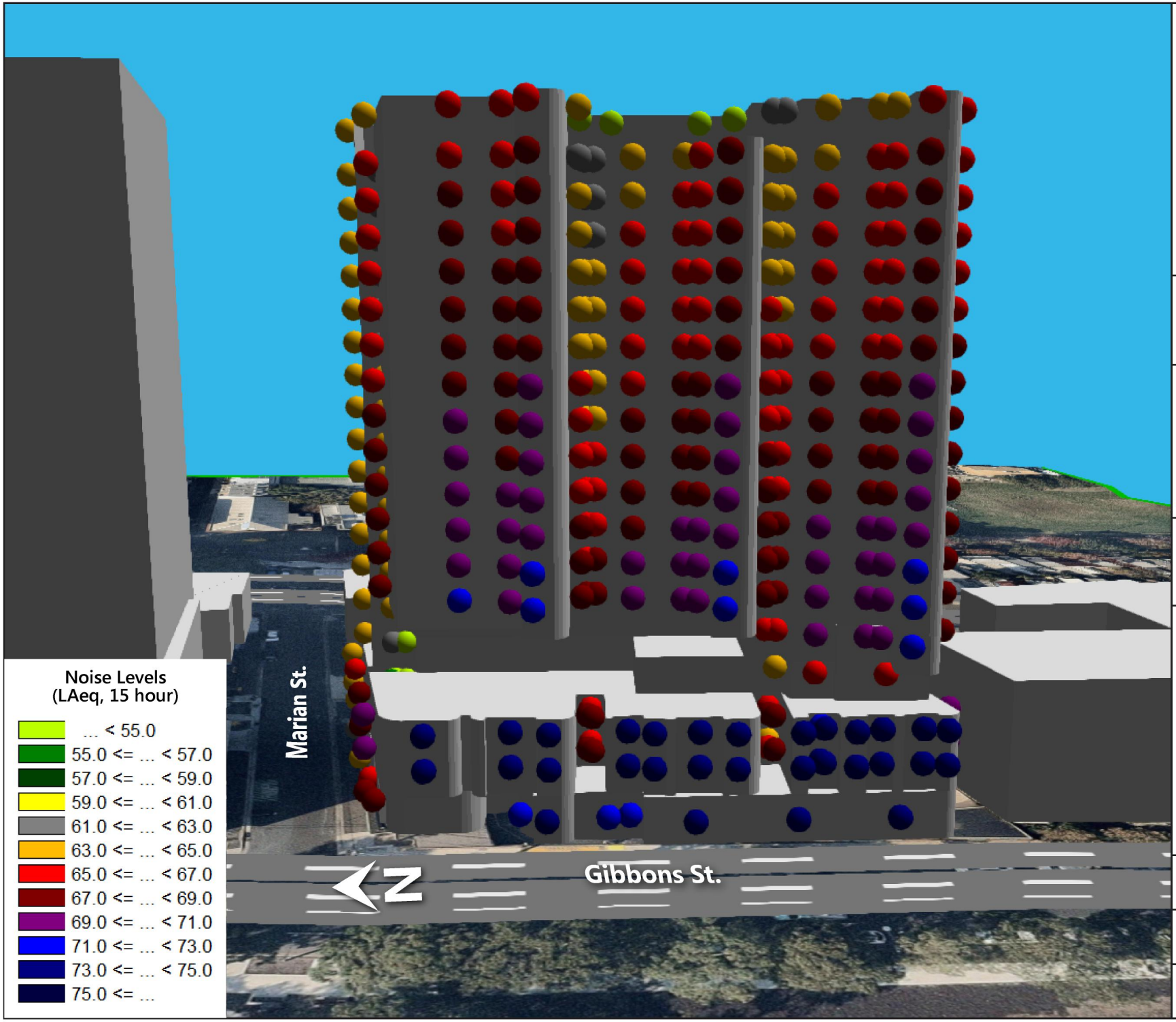
Table 20 below (reproduced from Table 3 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 20: Noise management levels at other noise sensitive land uses

Land use	Where objective applies	Management level $L_{Aeq\ (15\ min)}$
Classrooms at schools and other educational institutions	Internal noise level	45 dB(A)
Hospital wards and operating theatres	Internal noise level	45 dB(A)
Places of worship	Internal noise level	45 dB(A)
Active recreation areas	External noise level	65 dB(A)
Passive recreation areas	External noise level	60 dB(A)
Community centres	Depends on the intended use of the centre.	Refer to the 'maximum' internal levels in AS2107 for specific uses.
Commercial premises	External noise level	70 dB(A)
Industrial premises	External noise level	75 dB(A)

Notes: Noise management levels apply when receiver areas are in use only.

APPENDIX E Predicted Traffic Noise Levels ($L_{Aeq,\ 15hour}$ Day)



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Ph: (02) 8218 0500 Fax: (02) 8218 0501

Project :

11 Gibbons St., Redfern

Title :

Predicted traffic noise levels on proposed building facades during day time without future buildings

Ref :

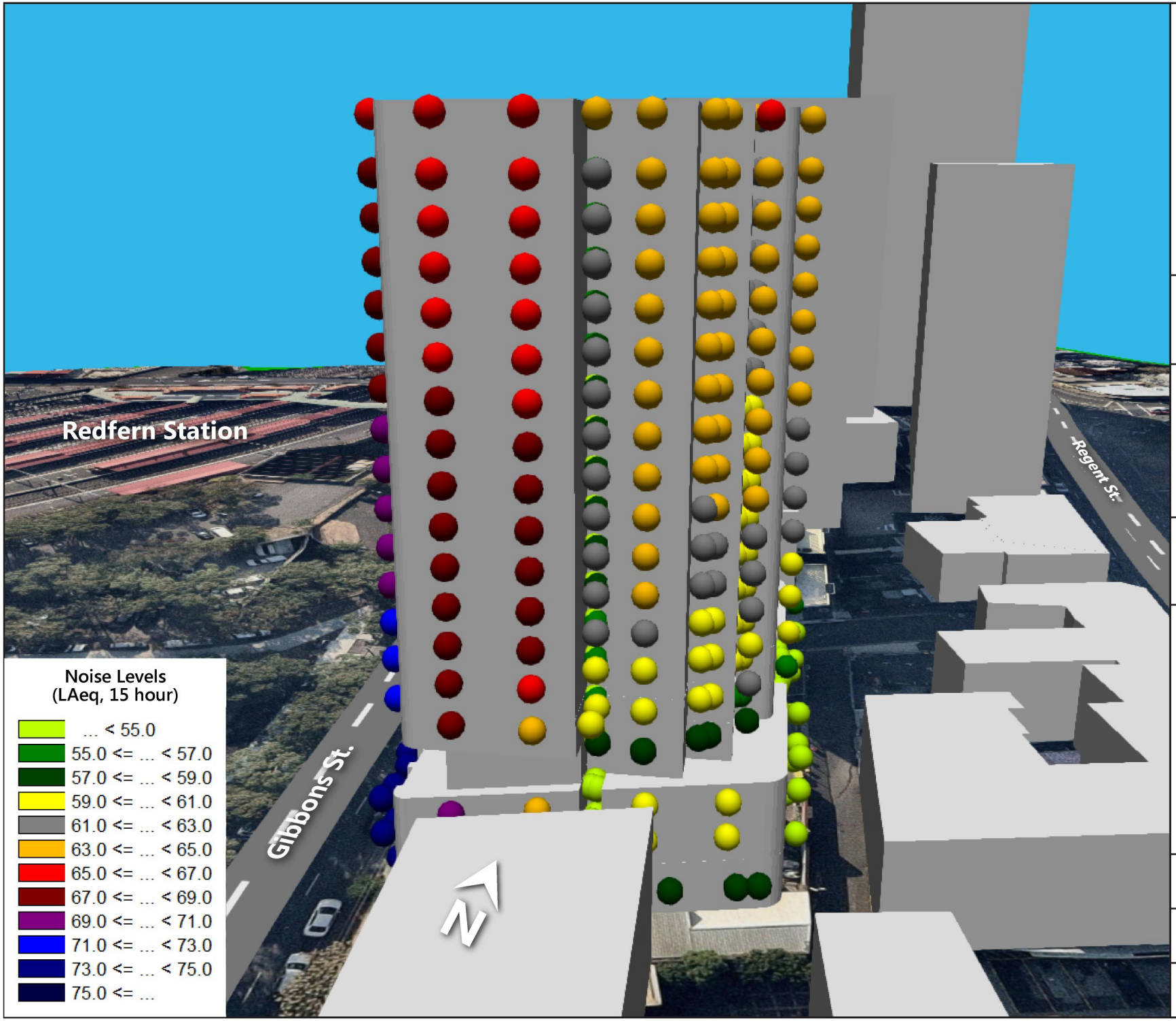
West Facade

Note :

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05A



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Project :

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Title :

Predicted traffic noise levels on proposed building facades during day time without future buildings

Ref :

South Facade

Note :

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05B

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Project :

11 Gibbons St., Redfern

Title :

Predicted traffic noise levels on proposed building facades during day time without future buildings

Ref :

East Facade

Note :

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05C

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Project :

11 Gibbons St., Redfern

Title :

Predicted traffic noise levels on proposed building facades during day time without future buildings

Ref :

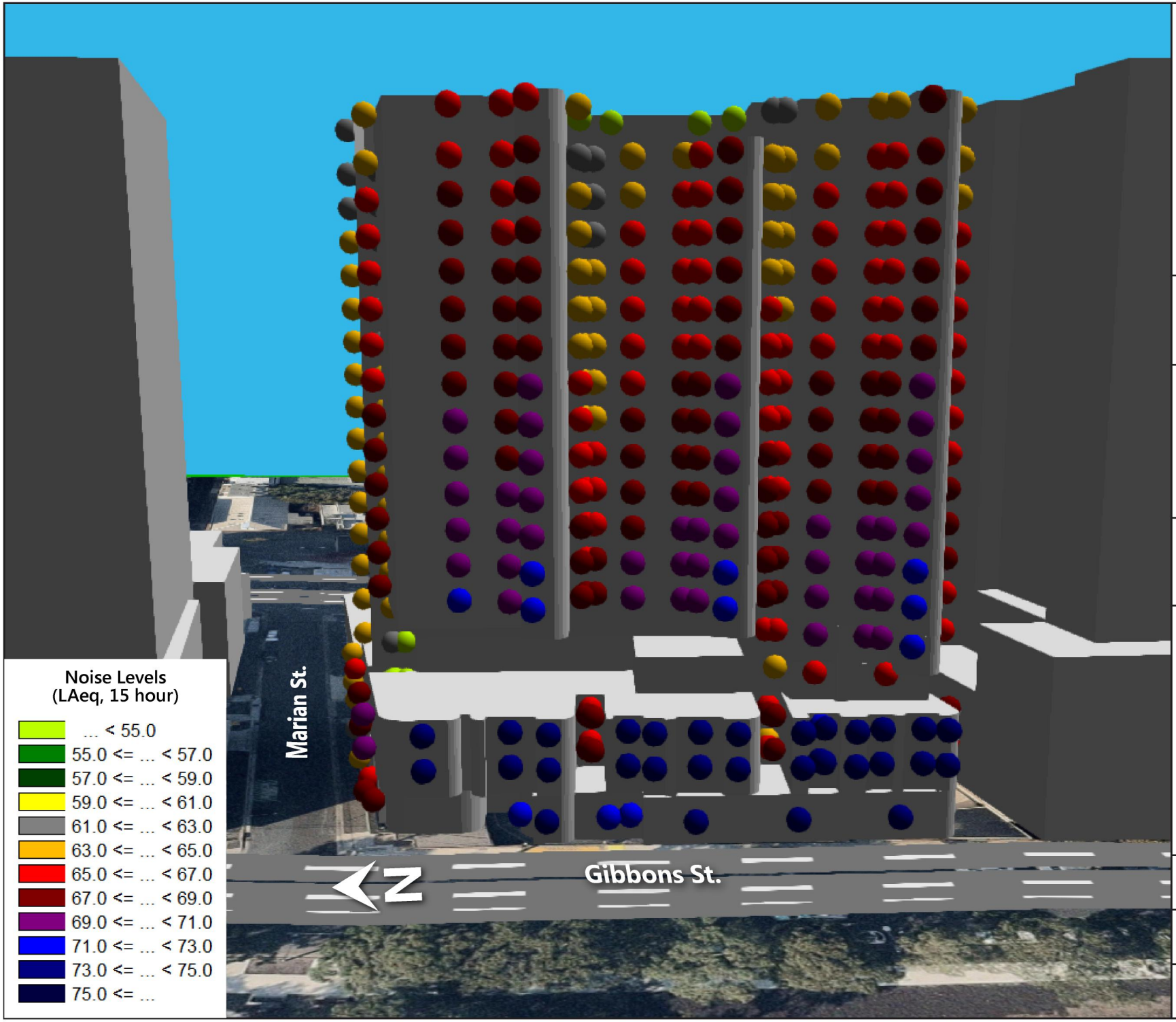
North East Perspective

Note :

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05D



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Project :

11 Gibbons St., Redfern

Title :

Predicted traffic noise levels on proposed building facades during day time with future buildings

Ref :

West Facade

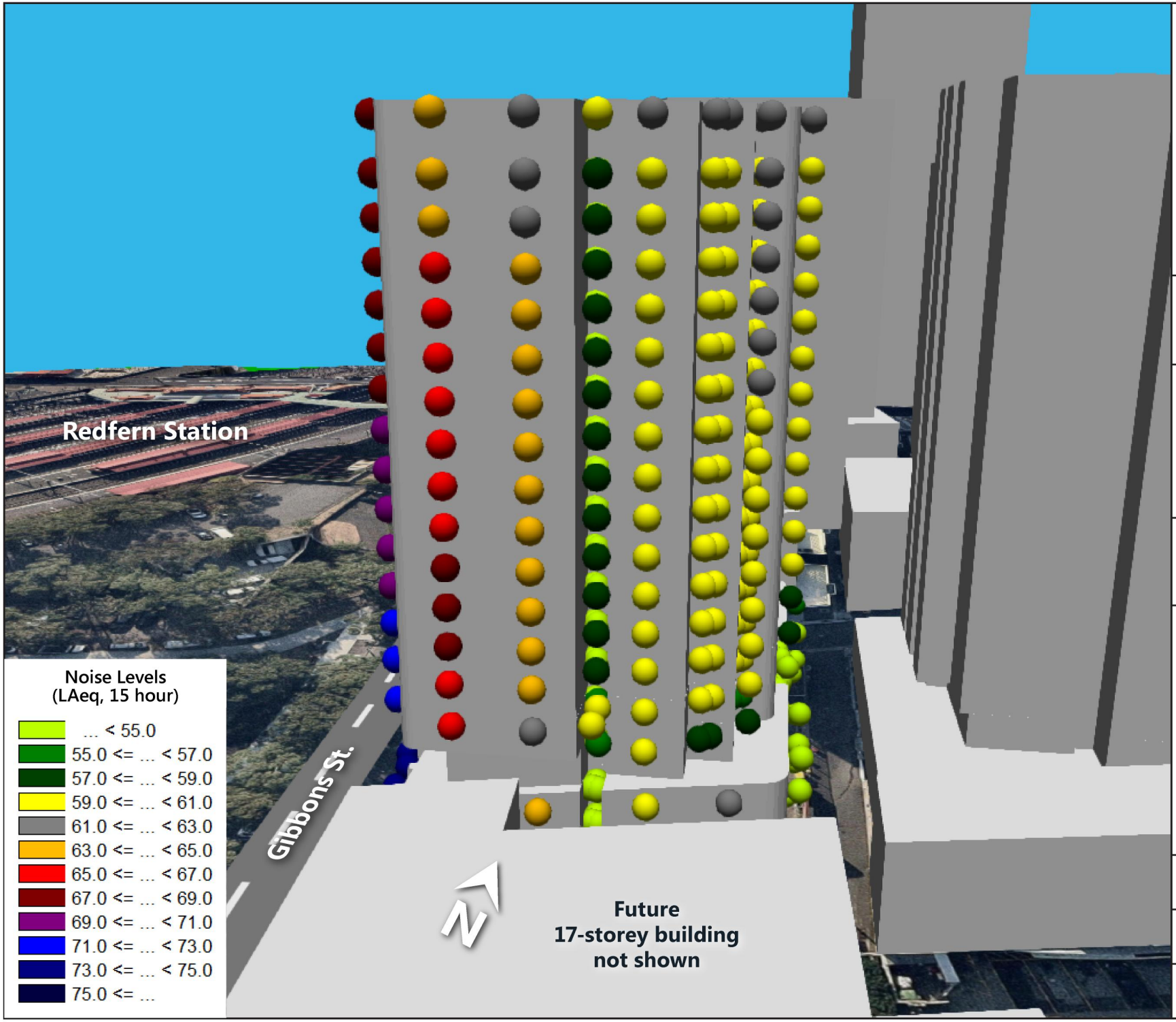
Note :

Based on current total traffic volumes and includes shielding effect of proposed 17-18 storey building to the East, South and North East of development.

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05E



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Project :

11 Gibbons St., Redfern

Title :

Predicted traffic noise levels on proposed building facades during day time with future buildings

Ref :

South Facade

Note :

Based on current total traffic volumes and includes shielding effect of proposed 17-18 storey building to the East, South and North East of development.

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05F

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Project :

11 Gibbons St., Redfern

Title :

Predicted traffic noise levels on proposed building facades during day time with future buildings

Ref :

East Facade

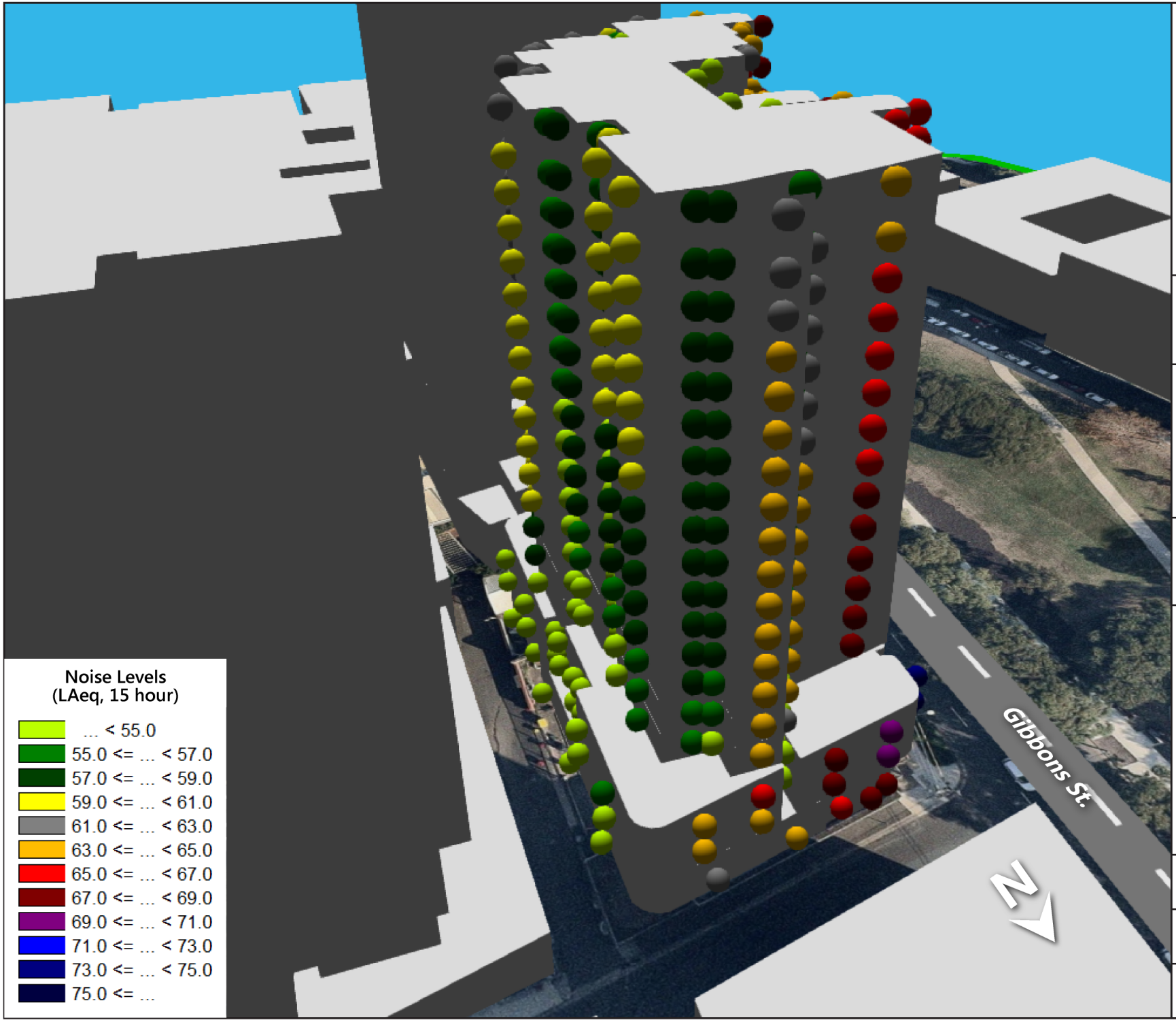
Note :

Based on current total traffic volumes and includes shielding effect of proposed 17-18 storey building to the East, South and North East of development.

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05G



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Project :

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Title :

Predicted traffic noise levels on proposed building facades during day time with future buildings

Ref :

North East Perspective

Note :

Based on current total traffic volumes and includes shielding effect of proposed 17-18 storey building to the East, South and North East of development.

Date : 26/09/2018

Scale : NTS

Ref : TK332-01P05H

APPENDIX F Recommend Glazing Requirments (Rw)

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float

Gibbons Street

Extent of Cafe Tenancy indicative only

Chamfer to SW corner to podium corner

Building line above

3m high 50% porosity gate to private driveway

PIT RL24.66 INV RL23.46

POWER POLE 24.92

RL 24.76

RL 24.81

RL 24.86

Site Boundary

Water M

Paving Patt… Refer to Art… for further …

TELSTRA PIT 25.39

Continuous awning to Marion Street

RL 24.68

Gate to Private Driveway

RL 24.68

Louvred Recess for Condensers

Cond.

Cond.

Retail/Commercial
195 m²
RL 25.00

Cafe
67 m²
RL 25.40

Community Hub
63 m²
RL 25.60

Kitchenette

Male

Female

DDA

Hyd Booster

1:14

1:14

RL 25.29

1:14

RL 24.60

RL 24.49

Commercial Bin Storage

RL 24.49 6,000 to boundary

Bulky Goods

Residential Bin Storage
RL 25.00

10m

R R R

R R R

W W W W W W

W W W W W W

W

W

W

Lift lobby
RL 25.40

Mailboxes

Total Bicycle Spaces
96 Spaces

Res. Bicycle Spaces
80 Spaces

Comm. Bicycle Spaces
16 Spaces

1:20

RL 25.10

Bike Workshop

RL 25.40

RL 26.60

RL 26.60

RL 26.60

Kitchenette

Female

DDA WC

Lockers

Male

SGCH Office
221 m²
RL 25.60

3,000

OSD

RWT

RW Re-use Tank

Comms Room

Main Switch Rm

RL 24.50

Gas Cupboard

RL 24.32

Pump Room
RL 24.50

RWT / CW Pump
RL 24.50

Fire Control Room
RL 24.50

Cleaner' Room / Store
RL 24.50

RL 24.90

RL 24.90

Chamber Substation
RL 24.901

2,000

2m Blast Zone

5,577

1,140

Cond.

Cond.

SEWER INSPECTION OPENING
25.14

Gate to Private Driveway

RL 24.17

RL 24.27

POWER POLE 24.19

SEWER MANHOLE 24.11

PIT RL24.17 INV RL22.55

Kerb

PIT RL24.39 INV RL23.61

Site Boundary

William Lane

STORMWATER MANHOLE 24.05

Fence

Marian Street

7-9 Gibbons Street
Residential Tower
Existing 19 Storey

13-23 Gibbons Street
Proposed 18 Storeys

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Title :

Facade Acoustic Glazing Requirements Ground Level

Project :

11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01A

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
Red	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
Orange	Rw 38	10.5 Viridian VLam Hush laminated
Blue	Rw 35	10.38mm laminated or 6.5mm laminated
Green	Rw 32	6.38mm laminated
Yellow	Rw 27	6mm float

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Title : Facade Acoustic Glazing Requirements L1

Project : 11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01B

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float

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Kuwait
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Title :

Facade Acoustic Glazing Requirements L2

Project :

11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01C

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float

Gibbons Street

Retention of proposed densely foliating evergreen planting

Horizontal canopy/ awning over COS

Refer to Landscape Plans for further details

Building Over Shown Dashed

Site Boundary

22 m²

HWU

HWU 16 m²

6m ADG setback H/H - Up to four storeys

1I
A: 57 m²

1A
A: 50 m²

3.01

3.02

DDA WC

Resident **Community Rm** 48 m²

Residential Communal Open Space 289 m²

4m Street Setback

3m Street Setback

Impermeable High Wind Screen to NE corner of COS. Framed clear glass 3m height

Retention of evergreen landscaping and timber teepee

RL 36.00

RL 36.10

Opaque Glass

Opaque Glass (Cross Ventilation)

13-23 Gibbons Street
Future 18 Storeys

MTR

Elec

NSW

C

3.06

3.05

3.04

3.03

2D adpt
A: 71 m²

1D
A: 51 m²

2D
A: 71 m²

2F
A: 78 m²

HWU

14 m²

57 m²

12 m²

37 m²

51 m²

6m ADG setback H/H - Up to four storeys

Site Boundary

William Lane

Marian Street

7-9 Gibbons Street
Residential Tower
Existing 19 Storey

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Ph: +0011 965 653 1520

Title :

Facade Acoustic Glazing Requirements L3

Project :

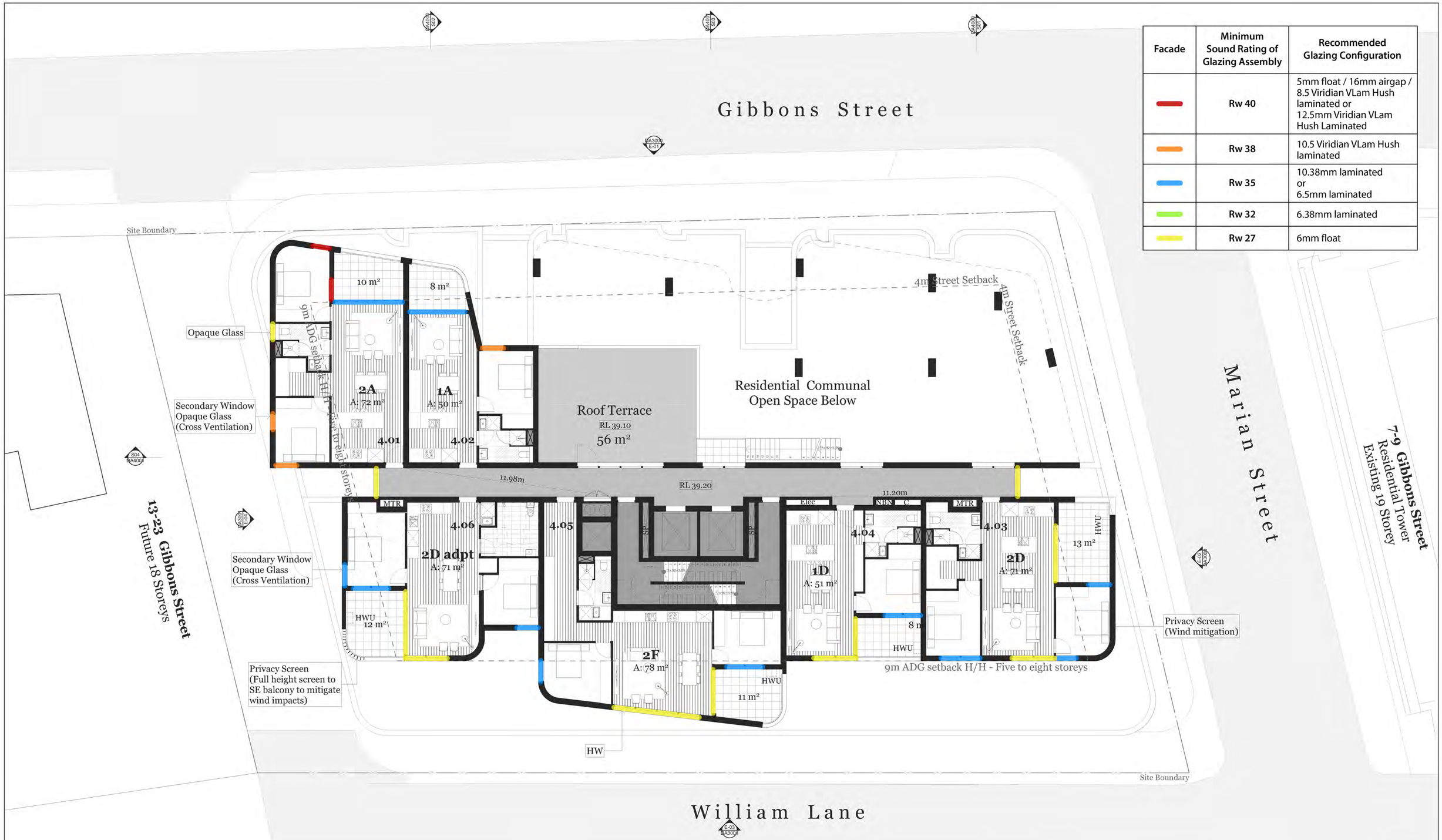
11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01D

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float



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Ph: +0011 965 653 1520

Title : Facade Acoustic Glazing Requirements L4

Project : 11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01E

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float

Gibbons Street

Roof Over Communal Open Space below (Applies to Level 5 Only)

Site Boundary

Opaque Glass

Secondary Window Opaque Glass (Cross Ventilation)

9m ADG setback H/H - Five to eight storeys

4m Street Setback

4m Street Setback

HWU 10 m²

HWU 8 m²

HWU 10 m²

HWU 8 m²

HWU 10 m²

HWU 8 m²

2A A: 72 m² 5.01

1A A: 50 m² 5.02

2B A: 72 m² 5.03

1A A: 50 m² 5.04

2B A: 72 m² 5.05

1E adpt A: 60 m² 5.06

11.98m

11.90m

11.20m

MTR

Elec

NBN

C

MTR

5.10 2D adpt A: 71 m²

5.09

5.08 1D A: 51 m²

5.07 2D A: 71 m²

HWU 13 m²

Secondary Window Opaque Glass (Cross Ventilation)

HWU 12 m²

2F A: 78 m²

HWU 11 m²

8 m² HWU

9m ADG setback H/H - Five to eight storeys

Privacy Screen (Full height screen to SE balcony to mitigate wind impacts)

HW

Site Boundary

13-23 Gibbons Street Future 18 Storeys

Marian Street

7-9 Gibbons Street Residential Tower Existing 19 Storey

William Lane

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Title : Facade Acoustic Glazing Requirements L5 to L10

Project : 11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01F

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float

Gibbons Street

Roof Over Communal Open Space below (Applies to Level 5 Only)

Site Boundary

Opaque Glass

Secondary Window Opaque Glass (Cross Ventilation)

9m ADG setback H/H - Five to eight storeys

4m Street Setback

4m Street Setback

HWU 10 m²

HWU 8 m²

HWU 10 m²

HWU 8 m²

HWU 10 m²

HWU 8 m²

2A A: 72 m²

1A A: 50 m²

2B A: 72 m²

1A A: 50 m²

2B A: 72 m²

1E adpt A: 60 m²

5.01

5.02

5.03

5.04

5.05

5.06

11.98m

11.90m

11.20m

MTR

Elec

NBN

C

MTR

5.10

2D adpt A: 71 m²

5.09

5.08

5.07

1D A: 51 m²

2D A: 71 m²

HWU 13 m²

Secondary Window Opaque Glass (Cross Ventilation)

HWU 12 m²

2F A: 78 m²

HWU 11 m²

HWU 8 m²

9m ADG setback H/H - Five to eight storeys

Privacy Screen (Full height screen to SE balcony to mitigate wind impacts)

HW

Site Boundary

13-23 Gibbons Street
Future 18 Storeys

Marian Street

7-9 Gibbons Street
Residential Tower
Existing 19 Storey

William Lane

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Brisbane Ph: (07) 3211 9155 Fax: (07) 3211 9188
Gold Coast Ph: (07) 5593 5633 Fax: (07) 5593 5635
Kuwait Ph: +0011 965 653 1520

Title :

Facade Acoustic Glazing Requirements L11 to L16

Project :

11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01G

Facade	Minimum Sound Rating of Glazing Assembly	Recommended Glazing Configuration
	Rw 40	5mm float / 16mm airgap / 8.5 Viridian VLam Hush laminated or 12.5mm Viridian VLam Hush Laminated
	Rw 38	10.5 Viridian VLam Hush laminated
	Rw 35	10.38mm laminated or 6.5mm laminated
	Rw 32	6.38mm laminated
	Rw 27	6mm float

Gibbons Street

Refer to Landscape Plans for further details

Site Boundary

Opaque Glass

Secondary Window Opaque Glass (Cross Ventilation)

Residential Communal Open Space

RL 79.40

HWU 10 m²

HWU 8 m²

HWU 410 m²

HWU 8 m²

2A A: 72 m²

1A A: 50 m²

2B A: 72 m²

1E A: 59 m²

17.01

17.02

17.03

17.04

12m ADG setback H/H - Five to eight storeys

11.98m

RL 79.50

11.30m

11.20m

MTR

Elec

NBN

C

MTR

17.08

17.07

17.06

17.05

2D adpt A: 71 m²

1D A: 51 m²

2D A: 71 m²

HWU 13 m²

HWU 12 m²

2F A: 78 m²

HWU 11 m²

HWU 8 m²

Secondary Window Opaque Glass (Cross Ventilation)

Privacy Screen (Full height screen to SE balcony to mitigate wind impacts)

HW

13-23 Gibbons Street
Future 18 Storeys

Marian Street

7-9 Gibbons Street
Residential Tower
Existing 19 Storey

Site Boundary

William Lane

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Gold Coast
Ph: (07) 5593 5633 Fax: (07) 5593 5635
Kuwait
Ph: +0011 965 653 1520

Title :

Facade Acoustic Glazing Requirements L17

Project :

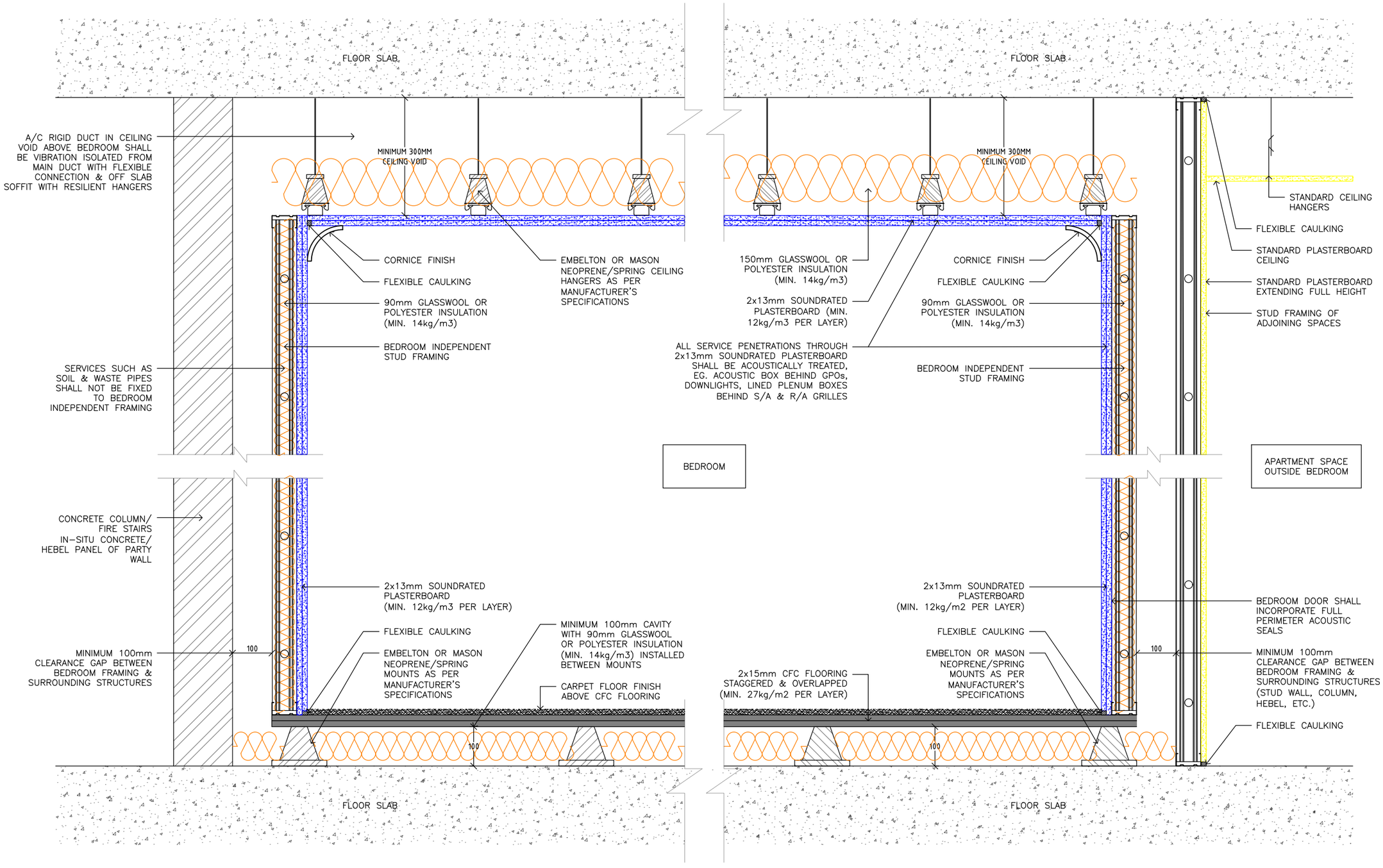
11 Gibbons Street

Date: 14/02/19

Scale: NTS

Ref: TK332-01P01H

APPENDIX G Vibration Isolation of L1 & L2 Bedrooms facing William Lane



ACOUSTIC CONSULTANT
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SYDNEY OFFICE
1/418A Elizabeth St., SURRY HILLS, NSW 2000
Ph (02) 8218 0500 Fax (02) 8218 0501

PROJECT
11 GIBBONS STREET, REDFERN

CLIENT
ST. GEORGE COMMUNITY HOUSE (SGCH)

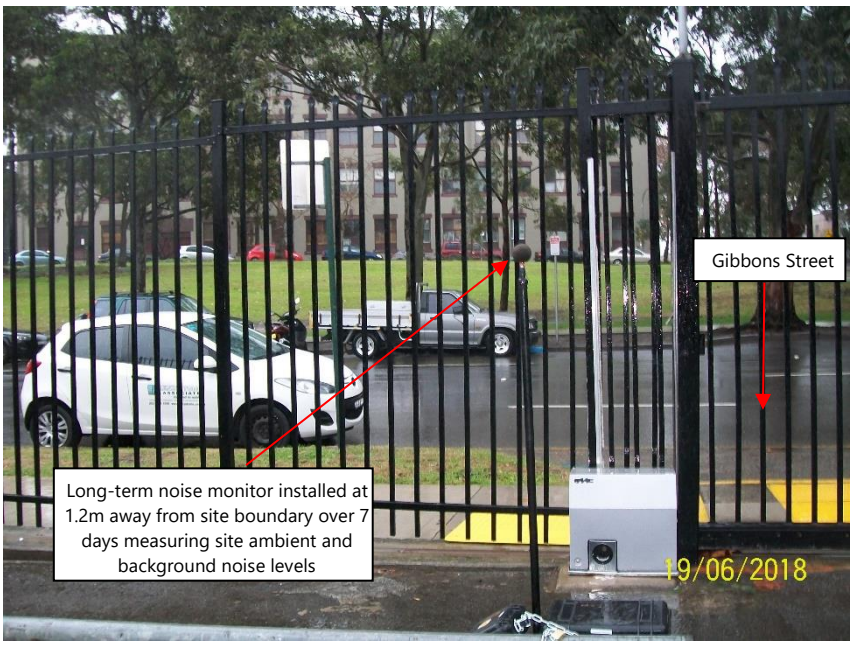
DRAWING TITLE
ACOUSTIC ISOLATION OF BEDROOMS ON L1 & L2 FACING WILLIAM LANE

DATE	SHEET SIZE	SCALE
07-12-2018	A3	-
DRAWN	DESIGNED	APPROVED
RV	TW	NT
PROJECT NO.	DRAWING NO.	REVISION
TK332-01	006	01

APPENDIX H Locations & Results of Long-term Noise Survey

H.1 Noise & Vibration Monitoring Locations

Location 1: Unattended road traffic noise monitoring at 1.2m away from site boundary facing Gibbons Street.
Survey Period: Friday 19/06/2018 to Thursday 27/06/2018



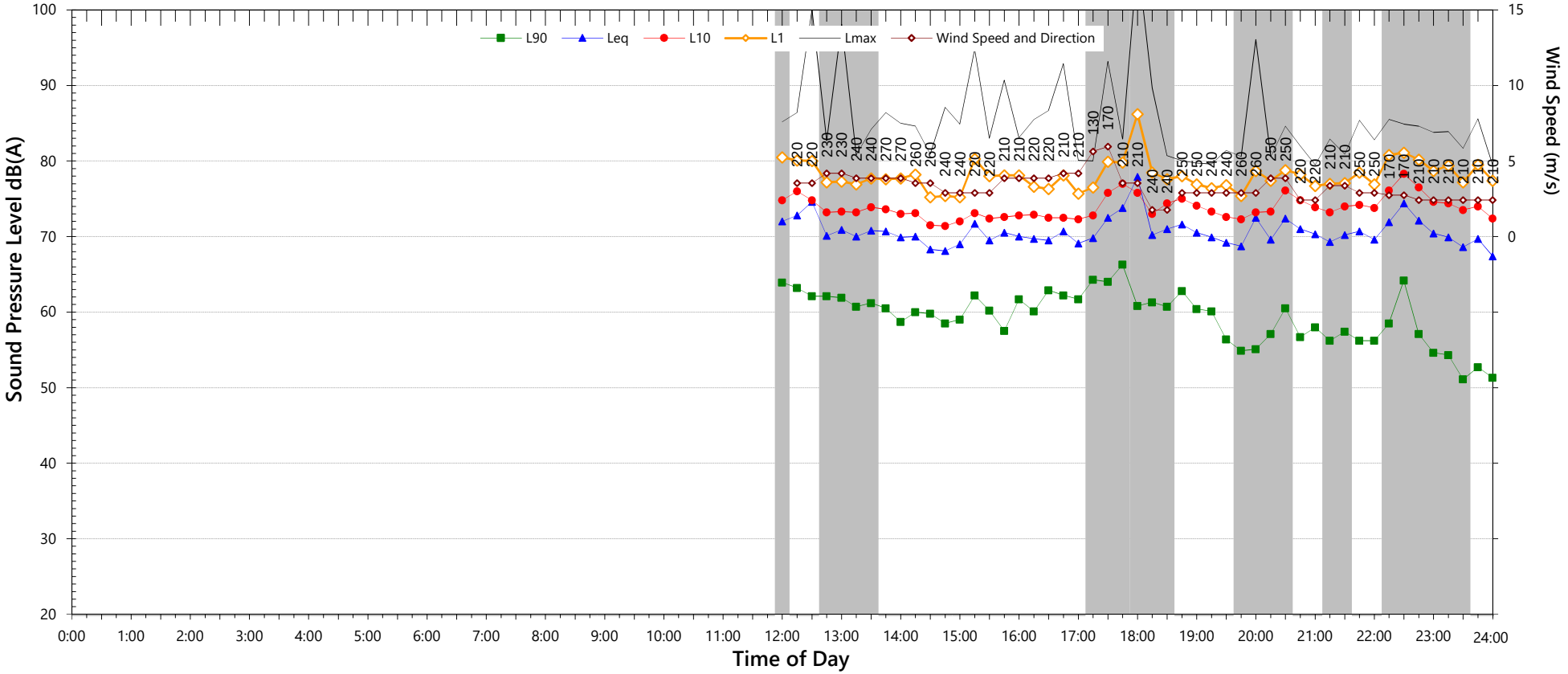
Location 2: Operator-attended rail vibration survey conducted at on existing concrete slab at corner of Gibbons Street and Marian Street, Redfern.
Survey Period: 11:00am to 5:00pm on Wednesday 27/06/2018

Location 3: Operator-attended traffic noise survey conducted at corner of Regent and Marian Street, Redfern.
Survey Period: 3:15am to 3:30pm on Wednesday 27/06/2018

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Tuesday, 19 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	73.0	73.0
$L_{eq\ 1hr}$ upper 10 percentile	76.3	75.7
$L_{eq\ 1hr}$ lower 10 percentile	71.4	66.8

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	81.7	to	89.2
L_{Max} - L_{eq} (Range)	16.0	to	20.3

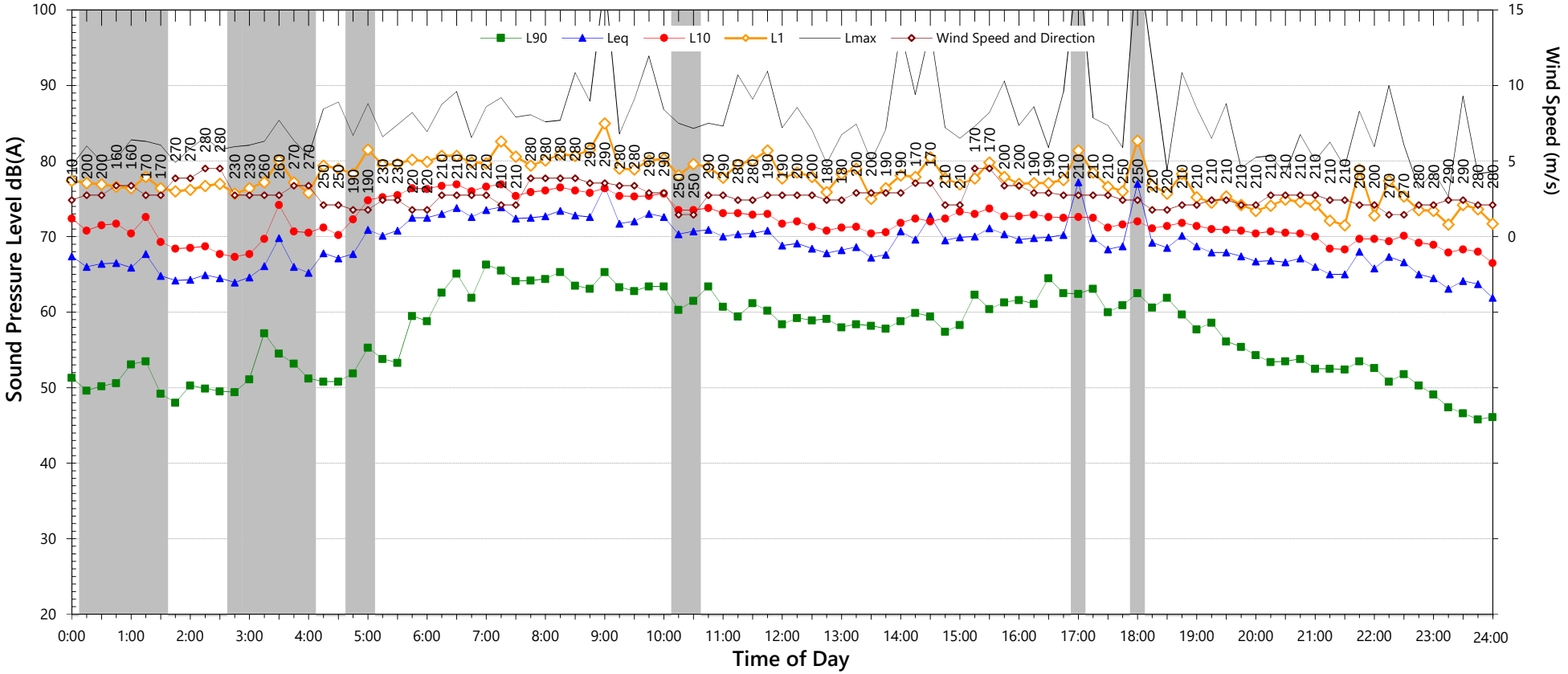
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Wednesday, 20 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	58.3	52.5	-
LAeq	71.1	67.5	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	79.4	to	90.0
L_{Max} - L_{eq} (Range)	17.9	to	25.3

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	72.8	65.2
$L_{eq\ 1hr}$ upper 10 percentile	76.1	68.5
$L_{eq\ 1hr}$ lower 10 percentile	68.9	62.4

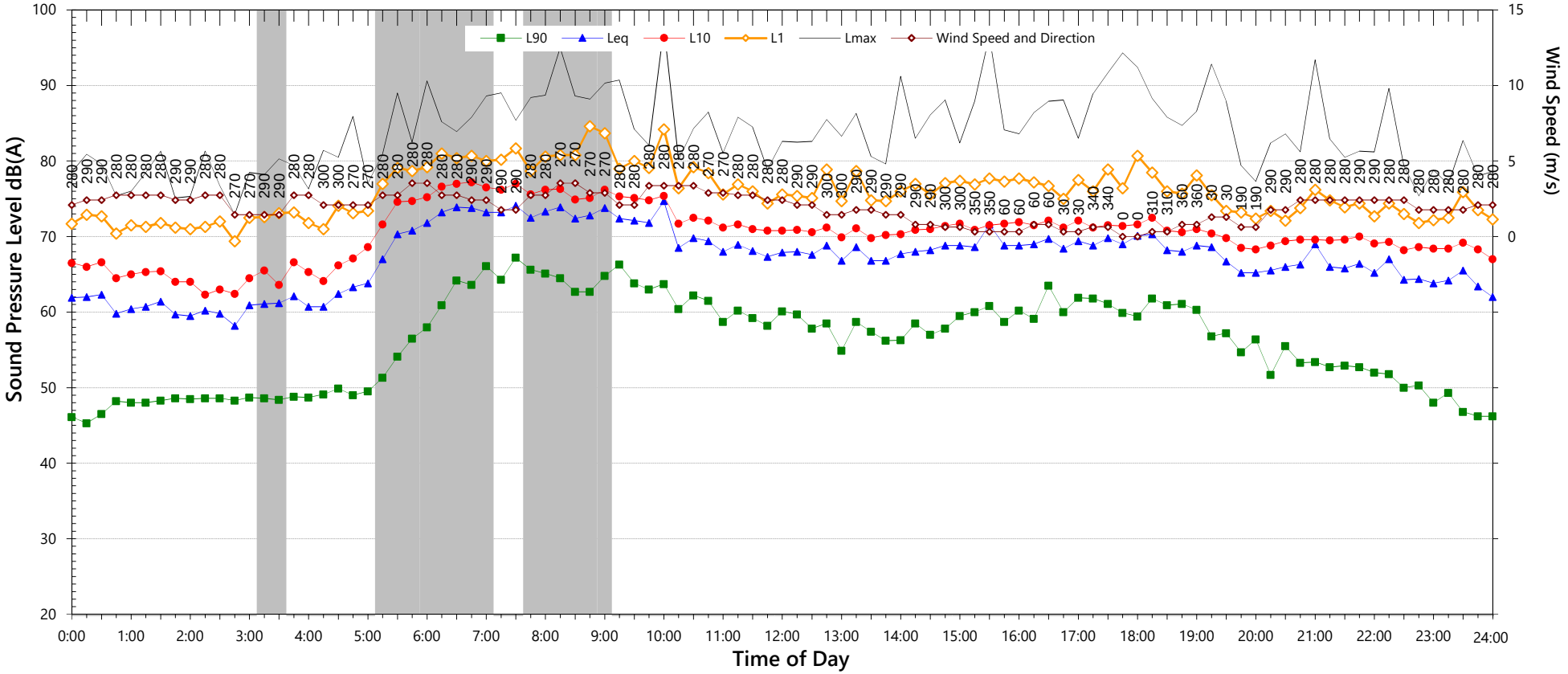
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Thursday, 21 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	57.0	52.0	43.8
LAeq	69.8	67.3	65.1

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	78.3	to	101.6
L_{Max} - L_{eq} (Range)	18.6	to	30.9

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	71.7	67.6
$L_{eq\ 1hr}$ upper 10 percentile	75.9	73.2
$L_{eq\ 1hr}$ lower 10 percentile	68.7	61.9

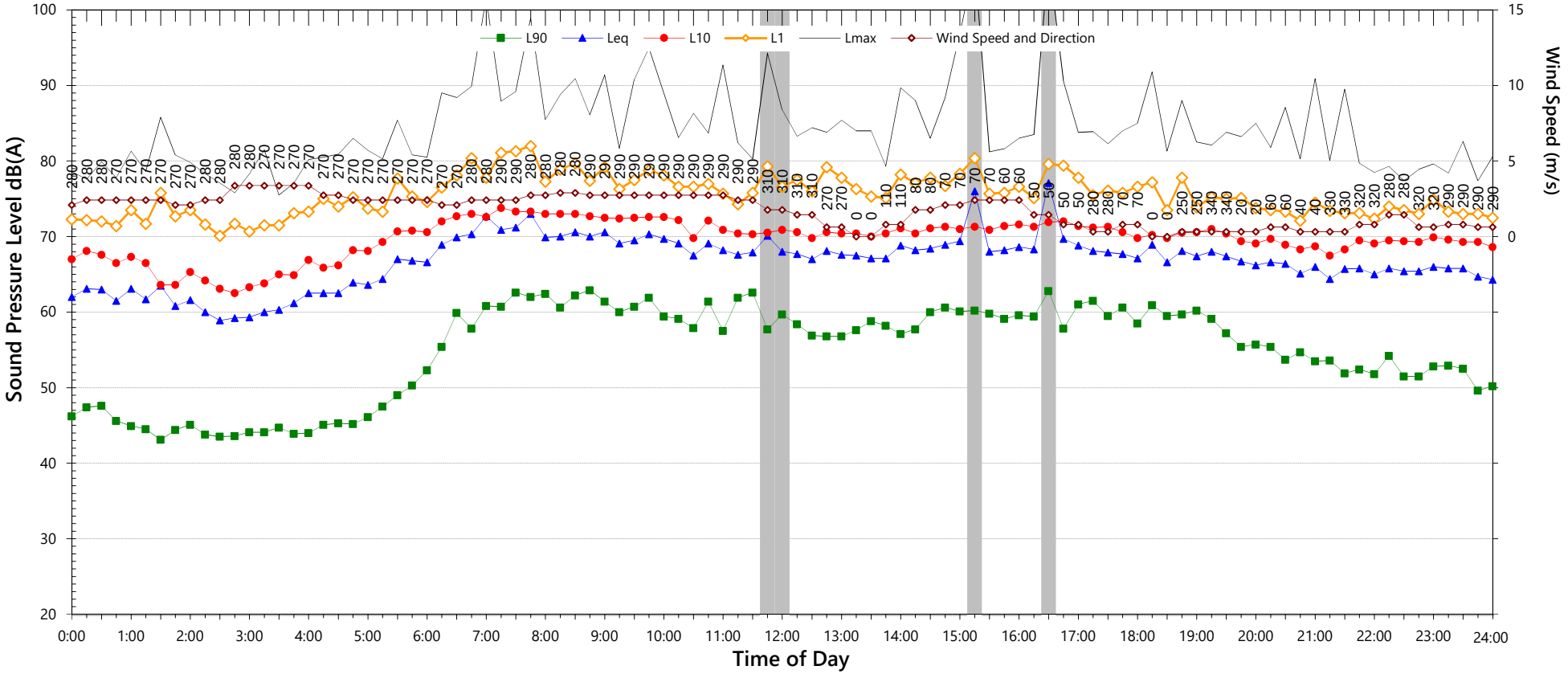
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Friday, 22 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	57.3	51.9	45.9
LAeq	69.0	66.7	63.5

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	77.1	to	84.2
L_{Max} - L_{eq} (Range)	16.7	to	24.1

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	71.0	66.0
$L_{eq\ 1hr}$ upper 10 percentile	73.4	68.8
$L_{eq\ 1hr}$ lower 10 percentile	68.2	62.6

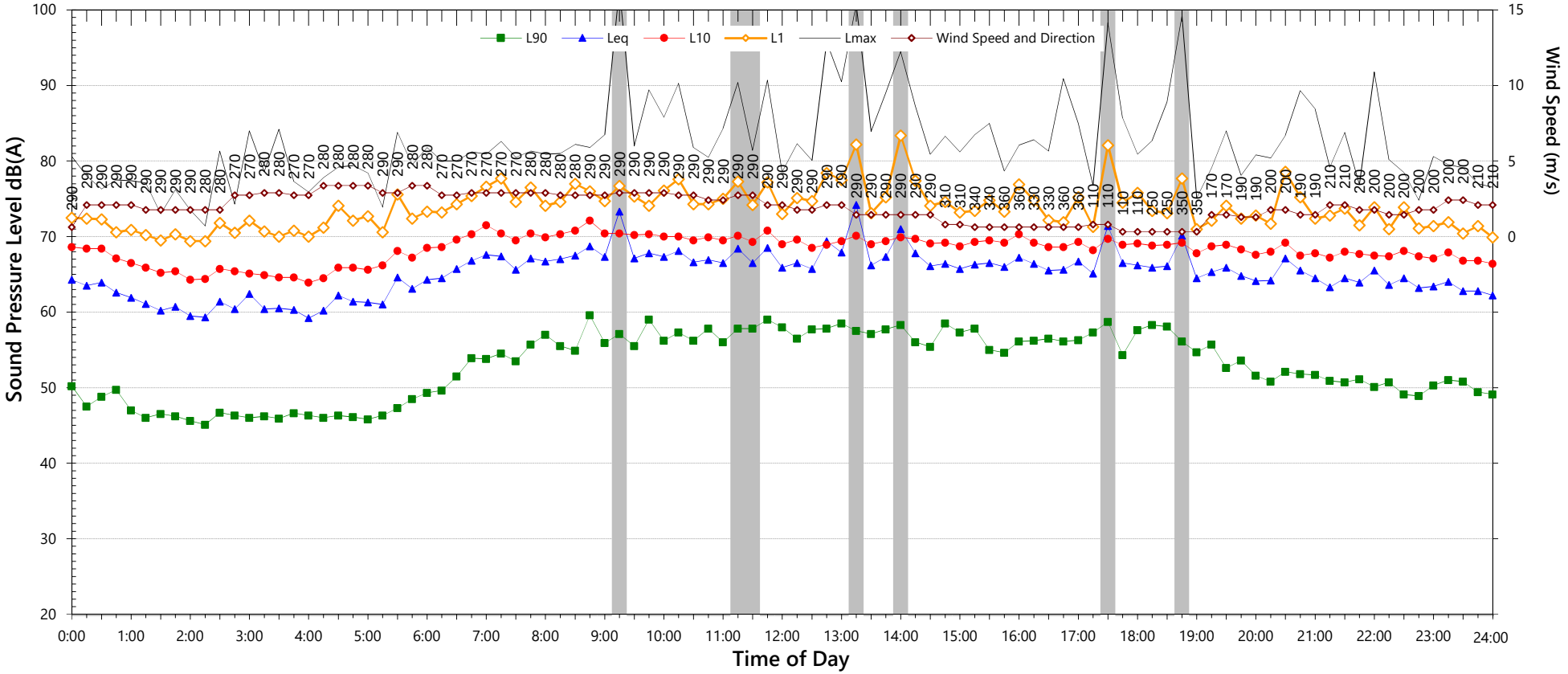
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Saturday, 23 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	54.6	50.7	44.5
LAeq	66.9	65.1	61.7

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	75.1	to	93.5
L_{Max} - L_{eq} (Range)	15.3	to	31.8

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	69.0	64.0
$L_{eq\ 1hr}$ upper 10 percentile	70.1	66.2
$L_{eq\ 1hr}$ lower 10 percentile	67.2	61.0

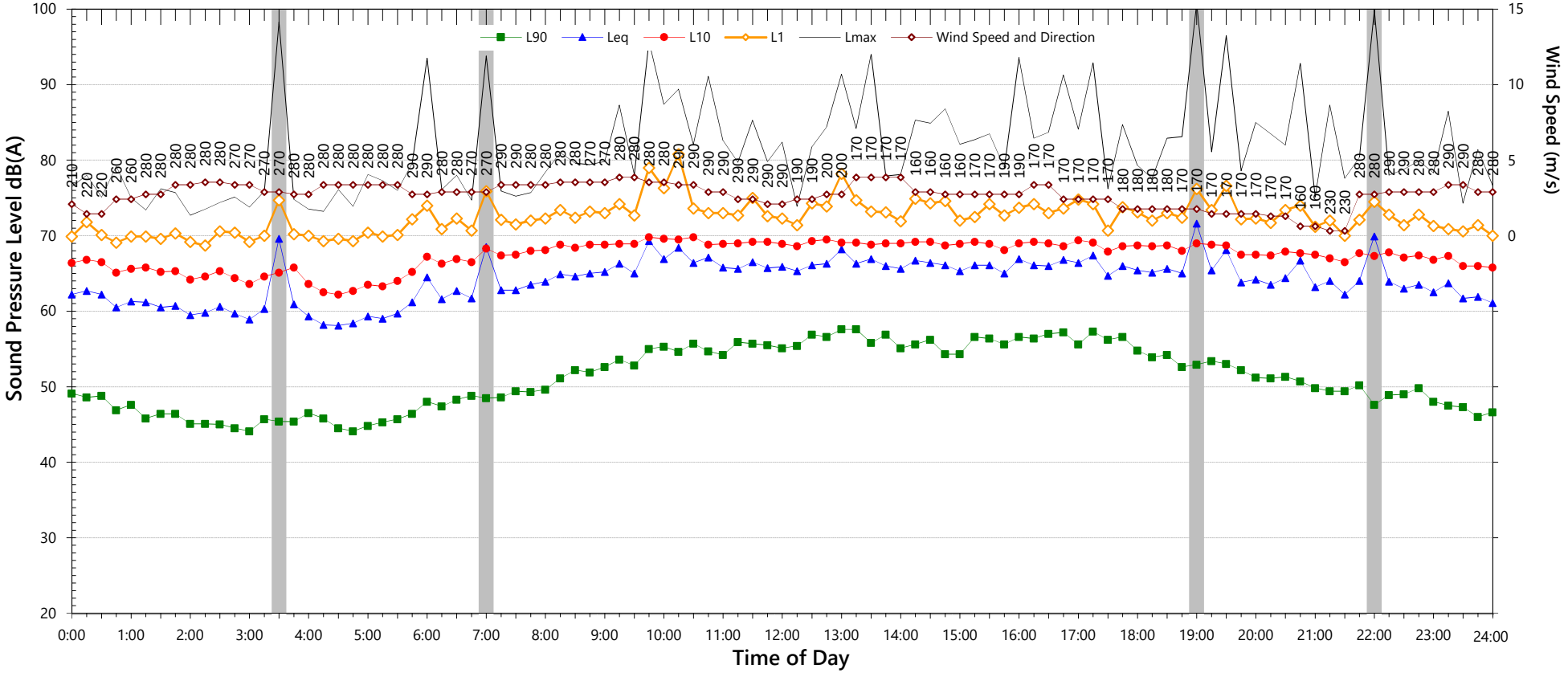
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Sunday, 24 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	52.7	49.4	43.3
LAeq	66.3	64.9	64.0

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	79.3	to	89.5
L_{Max} - L_{eq} (Range)	16.6	to	24.3

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68.3	66.5
$L_{eq\ 1hr}$ upper 10 percentile	69.6	71.8
$L_{eq\ 1hr}$ lower 10 percentile	65.9	61.0

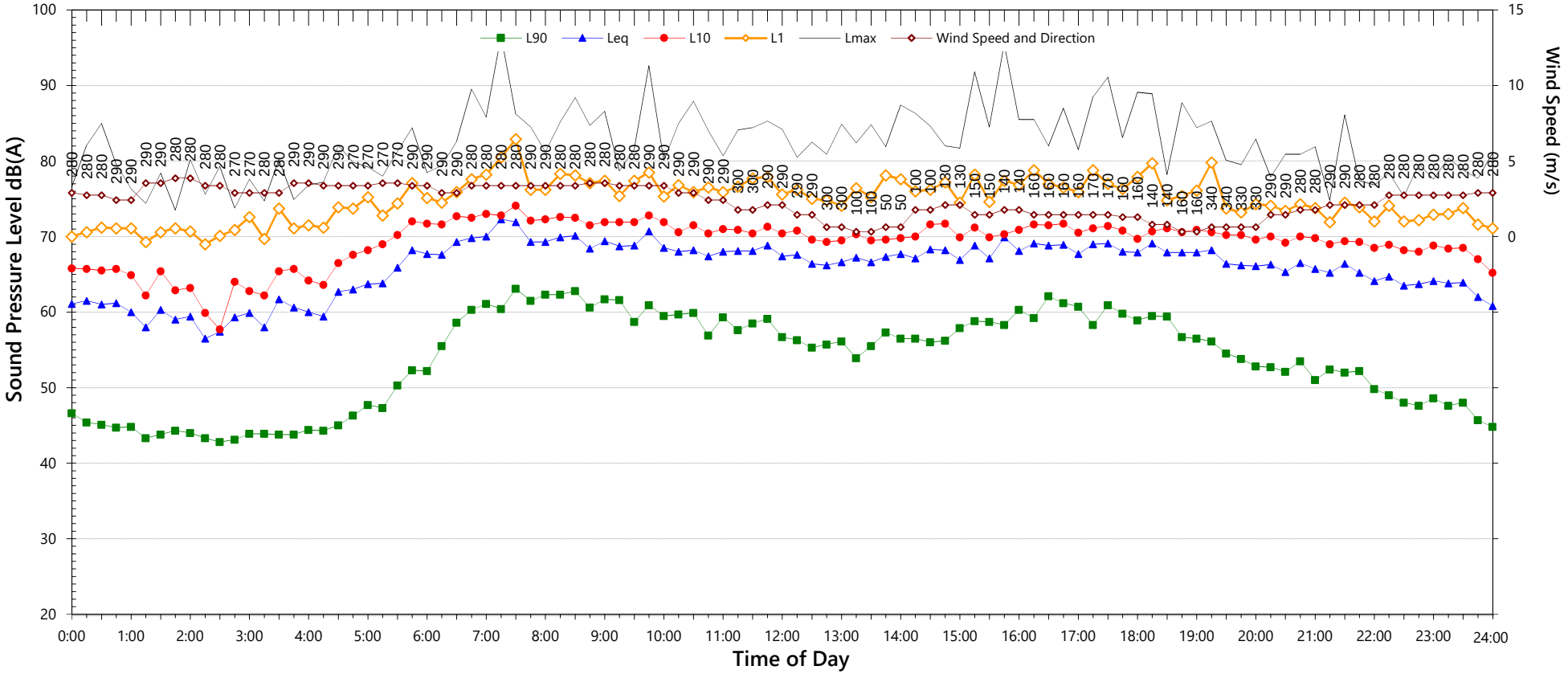
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Monday, 25 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	56.0	51.0	43.7
LAeq	68.6	66.7	64.0

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	78.9	to	86.3
L_{Max} - L_{eq} (Range)	15.6	to	25.6

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	70.7	66.5
$L_{eq\ 1hr}$ upper 10 percentile	72.8	71.9
$L_{eq\ 1hr}$ lower 10 percentile	68.2	61.6

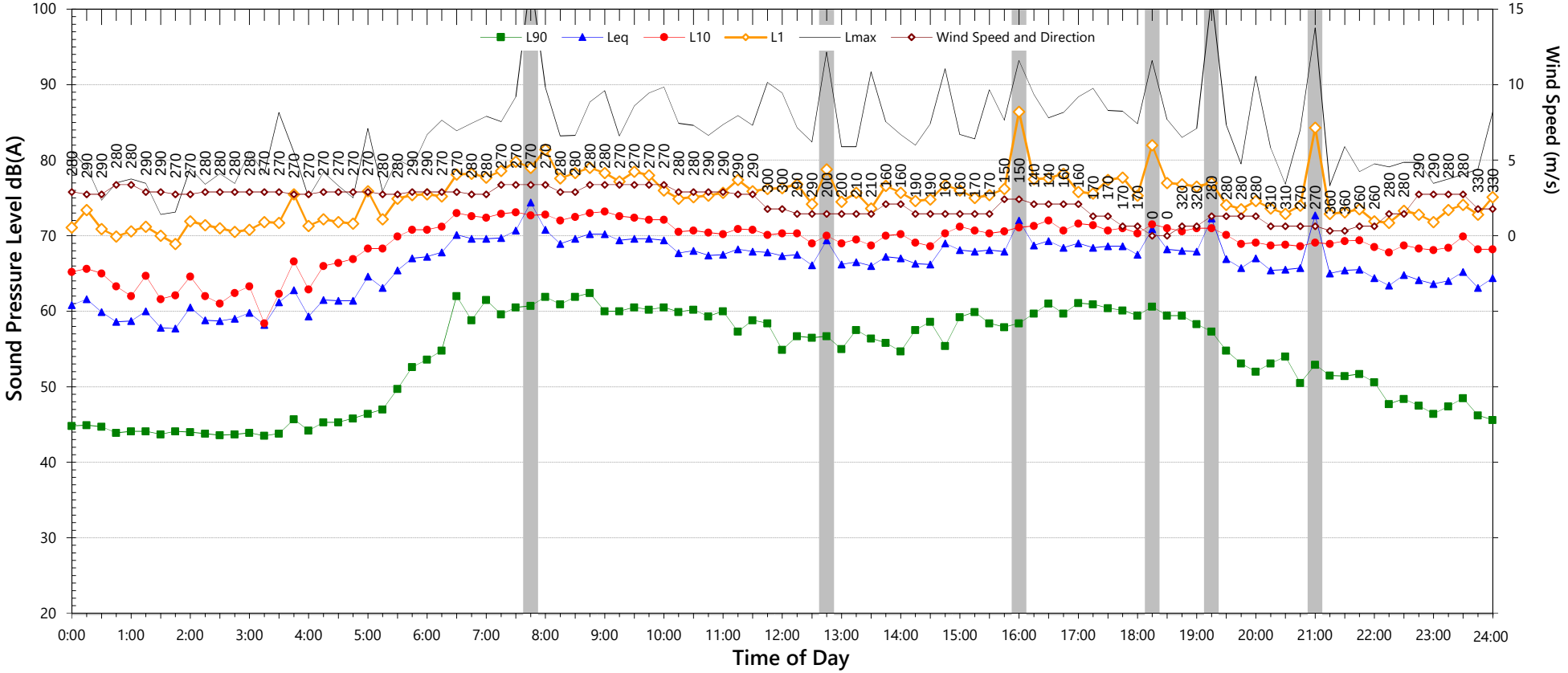
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Tuesday, 26 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	55.8	-	43.3
LAeq	68.4	-	64.9

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	79.7	to	86.4
L_{Max} - L_{eq} (Range)	15.7	to	23.7

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	70.5	67.4
$L_{eq\ 1hr}$ upper 10 percentile	72.6	72.5
$L_{eq\ 1hr}$ lower 10 percentile	67.8	64.2

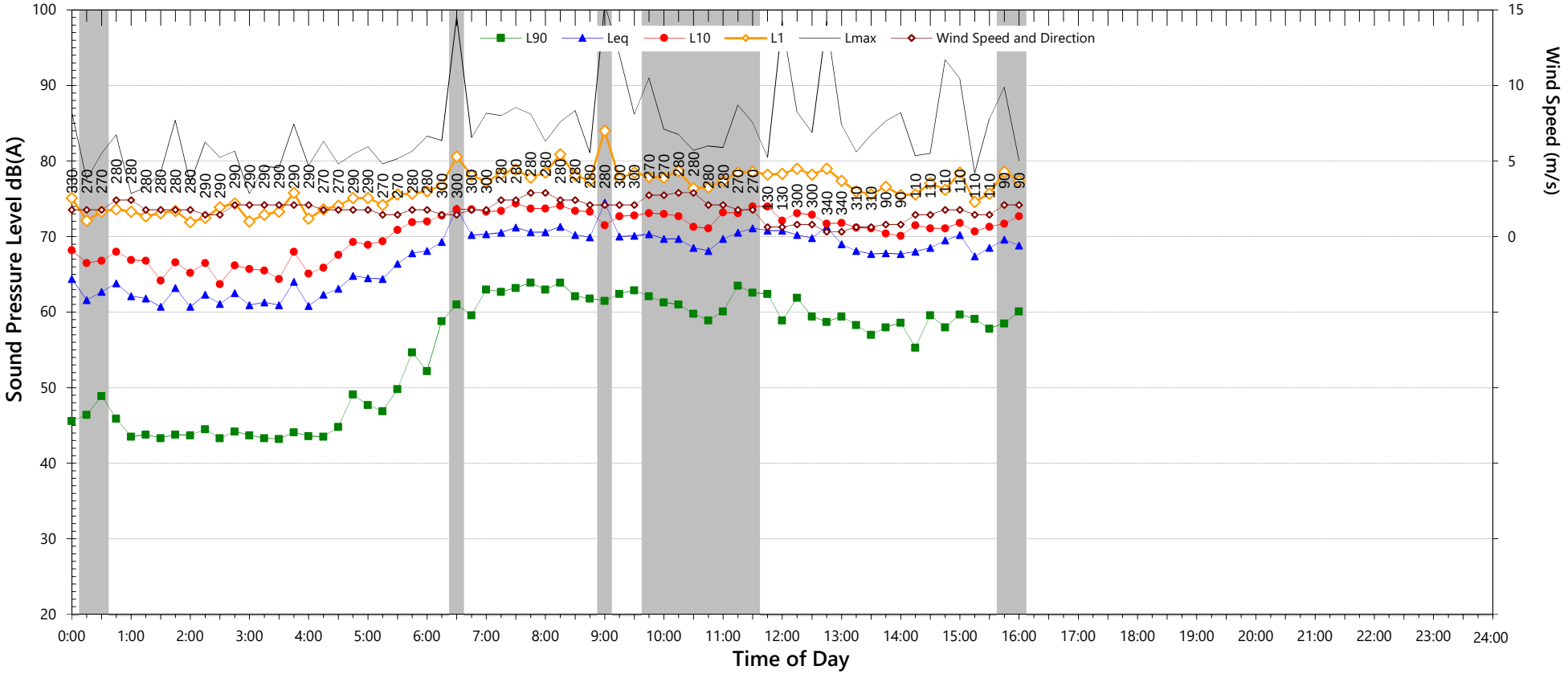
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

1.2m from site boundary facing Gibbons St, Redfern

Wednesday, 27 June 2018



NSW Industrial Noise Policy (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	72.3	-
$L_{eq\ 1hr}$ upper 10 percentile	73.3	-
$L_{eq\ 1hr}$ lower 10 percentile	70.3	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)