



NOISE MEASUREMENT SERVICES

**Noise Assessment Report**  
Proposed Integrated Health Care Facility  
97- 99 Cornwall Street,  
and 275-281 Ipswich Road, Annerley, QLD 4103

Lot(s) 72-73 and 1-4 on RP37992

**Report No 6682\_0 10<sup>th</sup> March 2023**



Noise Measurement Services Pty Ltd  
18 Lade Street, Gaythorne QLD 4051  
PO Box 2127, Brookside Centre QLD 4053

Ph: (07) 3355 9707  
Fax: (07) 3355 7210  
Email: info@noisemeasurement.com.au

## Document Control Page

**NOISE MEASUREMENT SERVICES PTY LTD**

18 Lade Street, Gaythorne, QLD 4051  
PO Box 2127  
Brookside Centre, QLD 4053

Telephone: (07) 3355 9707  
Facsimile: (07) 3355 7210  
E-mail: [info@noisemeasurement.com.au](mailto:info@noisemeasurement.com.au)

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**REPORT FOR**

*CHP Projects on behalf of Cornerstone Development Management Pty Ltd*

**CONTACT**

**Joshua Peacock**

Signed



**Joshua Dyer**

*Grad Dip. Noise Management, CertIV Work Health and Safety, B. Environmental Technology, M.A.A.S  
(Senior Acoustician of Noise Measurement Services)*

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## Executive Summary

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This Report is in response to a request from CHP Projects for a noise impact assessment for a proposed Integrated Health Care Facility located 97-99 Cornwall Street and 275-281 Ipswich Road, Annerley, QLD 4103, including Lot 72-73 and 1-4 on RP37992. The proposal is to remove an existing commercial building and four dwellings and construct a multi story integrated Health Care building with vehicle entrance located on Cornwall Street.

The proposed development is a Ministerial Infrastructure Designation and has been referred to the State Development Infrastructure Local Government and Planning criteria. The development site, located in Brisbane City Council area, is Zoned Low Medium Residential and Character, and is adjacent to Community Facilities, District Centre, Character and Low Medium Residential Zones. The proposed Health Care Facility is subject to Brisbane City Council Zone Code Criteria.

The proposed hours of operation are for 24 hours, 7 days per week. Operating hours for patients are between 7:00 AM and 6:00 PM Monday to Friday.

The proposed tenancies and activities include the following:

- General practice clinic;
- Outpatient consultant office rooms;
- Pharmacy;
- Pathology;
- Radiology;
- Overnight hospital beds, and;
- Acute Surgical Theatres.

The purpose of this report is to assess road traffic noise impacts onto the development and assess potential noise impacts from the proposed use of the facility onto adjacent residential commercial zone boundaries.

## Conclusions

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It is concluded that-

- Subject to the considerations and recommendations as set out in this Report, it is the opinion of this consultancy that the proposed development can meet the requirements of the Department of State Development, Infrastructure, Local Government and Planning, the Department of Transport and Main Roads and Brisbane City Plant 2014, and be otherwise compliant with relevant regulatory requirements with proposed attenuation measures as discussed in this assessment and summarised following.
- The development site and locality are exposed to substantial levels of road traffic noise from the Ipswich Road and Cornwall Street, which is identified as the dominant noise source in the area.
- The external façade transport noise levels cannot meet the DTMR primary (external) façade criteria. However, amenity for the occupants of the Health Care facility can be protected by achieving the *Secondary (internal) noise criteria for new sensitive development*.
- Amenity for the occupants of the Health Care facility can be protected by achieving the DTMR *Secondary (internal) noise criteria for new sensitive development*. The minimum  $R_w$  for building components are presented in **Section 4.2** and summarised in **Table ES1** following.

- Under the design calculations external doors and windows are closed for noise mitigation. There is a need for alternative ventilation to sensitive (such as patient care) areas, most commonly mechanical ventilation or air-conditioning.
- The communal open (outdoor terrace and gardens) area on Level 5 can meet the DTMR environment criteria for passive recreation. Solid Balustrades are recommended. The location of the solid balustrade is illustrated in **Section 4.3** and **Plate ES1** following.
- Screening is required to protect adjacent residential zone boundaries from noise emissions from vehicle movement areas and commercial vehicle and emergency vehicle parking areas near the vehicle entrance on Cornwall Street. With proposed enclosure of the vehicle movement areas, vehicle movements, including regular deliveries, are forecast to comply with day evening and night time criteria at noise sensitive zone boundaries. The proposed acoustic treatments are presented in **Section 5.2** and **Plate ES2** following.
- Noise emissions from the proposed Multi Use Service Centre, can be reduced at the boundary of the existing noise sensitive commercial uses by construction an acoustic fence or barrier. The proposed location of the acoustic fence is shown in Plate ES1 below and is included in the following assessment.
- Cumulative noise emissions from all proposed activities are forecast to meet criteria at residential and commercial zone boundaries, with proposed acoustic treatments.
- On this basis, it is concluded that the development can meet the residential Noise Emissions Standards for 24 hour operation for care services, and daytime operation hours for patients.

## Recommendations

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It is recommended that-

- A solid balustrade be provided around the outdoor terrace and gardens on Level 05. The solid balustrade reduces road traffic noise in these areas and lowers the  $R_w$  requirements for building façade components. The location of the proposed solid balustrade is shown in **Plate 4.7** and **Plate ES1** below.
- Acoustic treatments to the vehicle entrance and carpark access to the building on Level 01, be considered. The proposed design is to create a height wall in the location illustrated in **Plate 5.2** and **Plate ES2** following. This will screen the adjected residential zone boundaries and upper floor occupants of the dwellings on these Lots from delivery area, rubbish collection area and vehicle movements areas, protecting the amenity. At least 15 dB(A) reduction is required from this proposed acoustic screen or wall. This also allows for night-time operations. To be fully effective the screen or wall must extend the full height of the opening being screened. Landscaping of the wall or screen is recommended, associated with changes in design or style to reduce the visual effect of the facade.
- The precise type and siting of mechanical plant is not known at this stage. Detailed plant noise assessment can be conducted – if required – at the Building Approval stage, although ready compliance with criteria is expected without additional acoustic treatment.
- With the acoustic treatments implemented above, the proposed hours of operation for 24 hours, 7 days per week and operating hours for patients are between 7:00 AM and 6:00 PM Monday to Friday be approved.

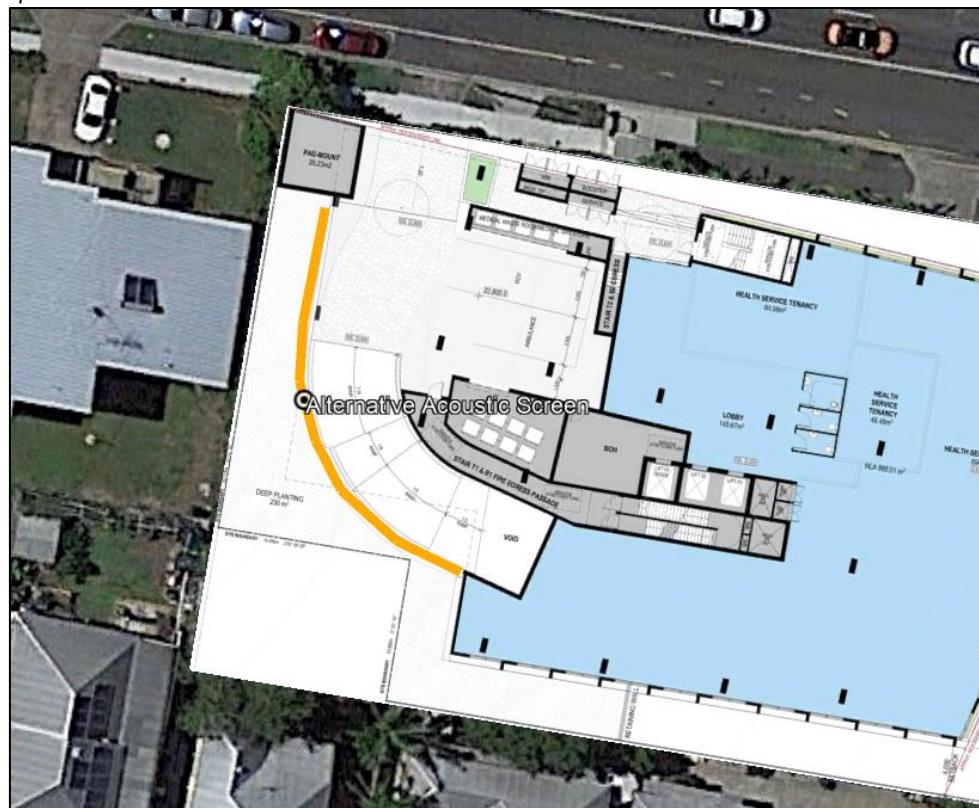
**Table ES1:** Indicative *Rw* values for various construction elements.

Floor	Room	Element	Facing	Ext Leq dB(A)	AS2107 criteria	TNR	Element (Sc) area	Floor (Sf) area	Height (m)	RT60 (s)	C	TNAC	Calc STC/Rw
LG	Health Service Tenancy	All glass façade	N,E	74	35	39	139.7	255.0	3.6	1.0	2	42	48
L01	Lobby	Glass Sliding Door	N	71	35	36	12.6	145.0	3.0	1.0	2	31	37
L01	Health Service Tenancy	Window	N	75	35	40	7.2	85.0	3.0	1.0	2	35	41
L01	Health Service Tenancy	All glass façade	N,E	77	35	42	156.0	604.0	3.0	1.0	2	42	48
L01	Health Service Tenancy	All glass façade	S	70	35	35	108.0	604.0	3.0	1.0	2	34	40
L02	Tennancy	All glass façade	N1	75	35	40	117.0	260.0	4.5	1.0	2	41	47
L02	Tennancy	All glass façade	N2	75	35	40	117.0	260.0	4.5	1.0	2	41	47
L02	Tennancy	All glass façade	E	77	35	42	243.0	604.0	4.5	1.0	2	42	48
L02	Tennancy	All glass façade	S1	73	35	38	166.5	260.0	4.5	1.0	2	40	46
L02	Tennancy	All glass façade	W1	43	35	8	45.0	260.0	4.5	1.0	2	5	11
L02	Tennancy	All glass façade	S2	53	35	18	63.0	260.0	4.5	1.0	2	16	22
L02	Tennancy	All glass façade	W2	68	35	33	117.0	260.0	4.5	1.0	2	34	40
L03	Tennancy	All glass façade	N1	75	35	40	98.8	260.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	N2	75	35	40	98.8	260.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	E	76	35	41	205.2	604.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	S1	73	35	38	140.6	260.0	3.8	1.0	2	40	46
L03	Tennancy	All glass façade	W1	44	35	9	38.0	260.0	3.8	1.0	2	6	12
L03	Tennancy	All glass façade	S2	60	35	25	53.2	260.0	3.8	1.0	2	23	29
L03	Tennancy	All glass façade	W2	68	35	33	98.8	260.0	3.8	1.0	2	34	40
L04	Tennancy	All glass façade	N1	74	35	39	98.8	260.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	N2	74	35	39	98.8	260.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	E	75	35	40	205.2	604.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	S1	72	35	37	140.6	260.0	3.8	1.0	2	39	45
L04	Tennancy	All glass façade	W1	46	35	11	38.0	260.0	3.8	1.0	2	8	14
L04	Tennancy	All glass façade	S2	61	35	26	53.2	260.0	3.8	1.0	2	24	30
L04	Tennancy	All glass façade	W2	69	35	34	98.8	260.0	3.8	1.0	2	35	41
L05	Tennancy	All glass façade	N1	74	35	39	72.2	260.0	3.8	1.0	2	38	44
L05	Tennancy	All glass façade	N2	74	35	39	64.6	260.0	3.8	1.0	2	38	44
L05	Tennancy	All glass façade/Glass	E	57	35	22	83.6	260.0	3.8	1.0	2	22	28
L05	Tennancy	All glass façade / Mechanical Plant Deck	S1	75	35	40	140.6	260.0	3.8	1.0	2	42	48
L05	Tennancy	All glass façade/Near Theatre Plant	S2	70	35	35	38.0	260.0	3.8	1.0	2	32	38
L05	Tennancy	All glass façade	W	69	35	34	91.2	260.0	3.8	1.0	2	34	40
All	Tennancy	External Wall	W	77	35	42	91.2	260.0	3.8	1.0	2	42	48

**Plate ES1:** Showing the location of the proposed solid balustrade in red.



**Plate ES2:** Showing proposed location of alternative acoustic screen or wall (in orange) allows night time operations.



## 1. Introduction

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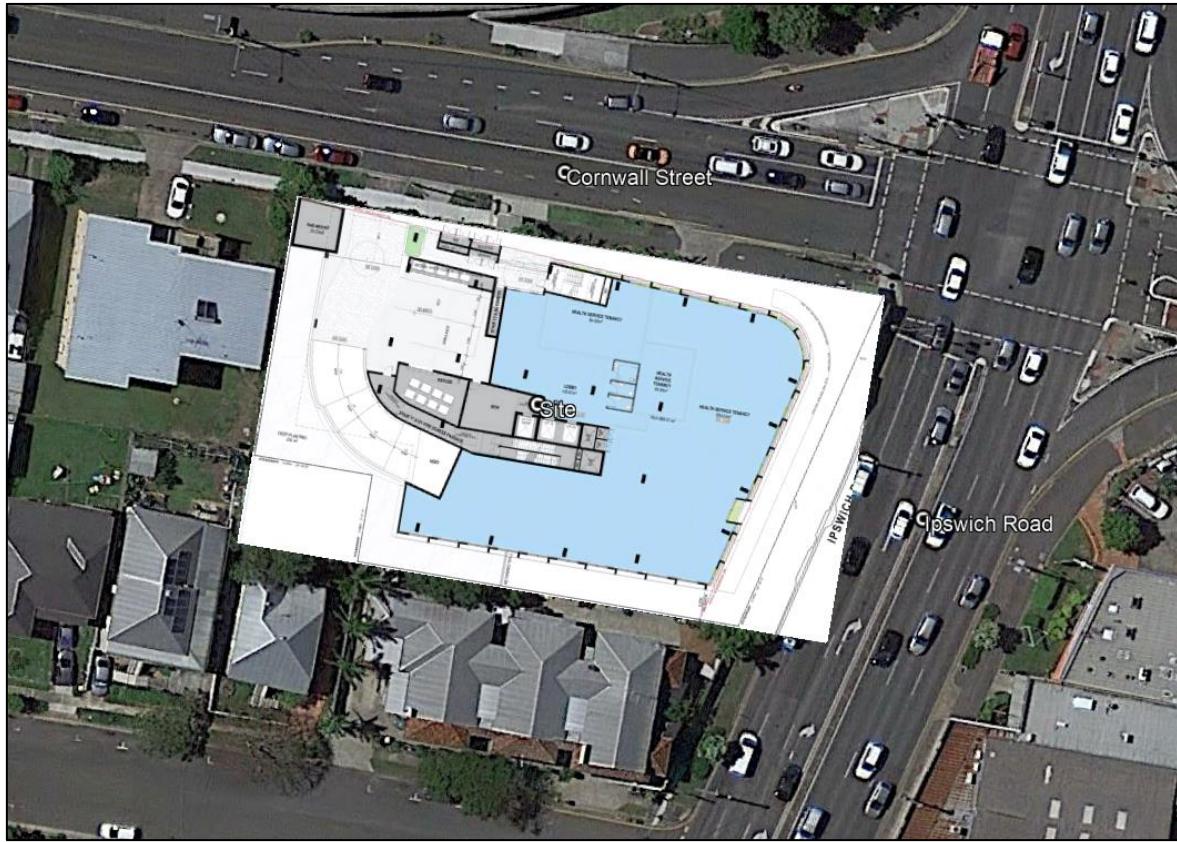
The purpose of this report is to assess road traffic noise impacts onto the development and assess potential noise impacts from the proposed use of the facility onto adjacent residential commercial zone boundaries.

The following standards and policy documents are referenced:

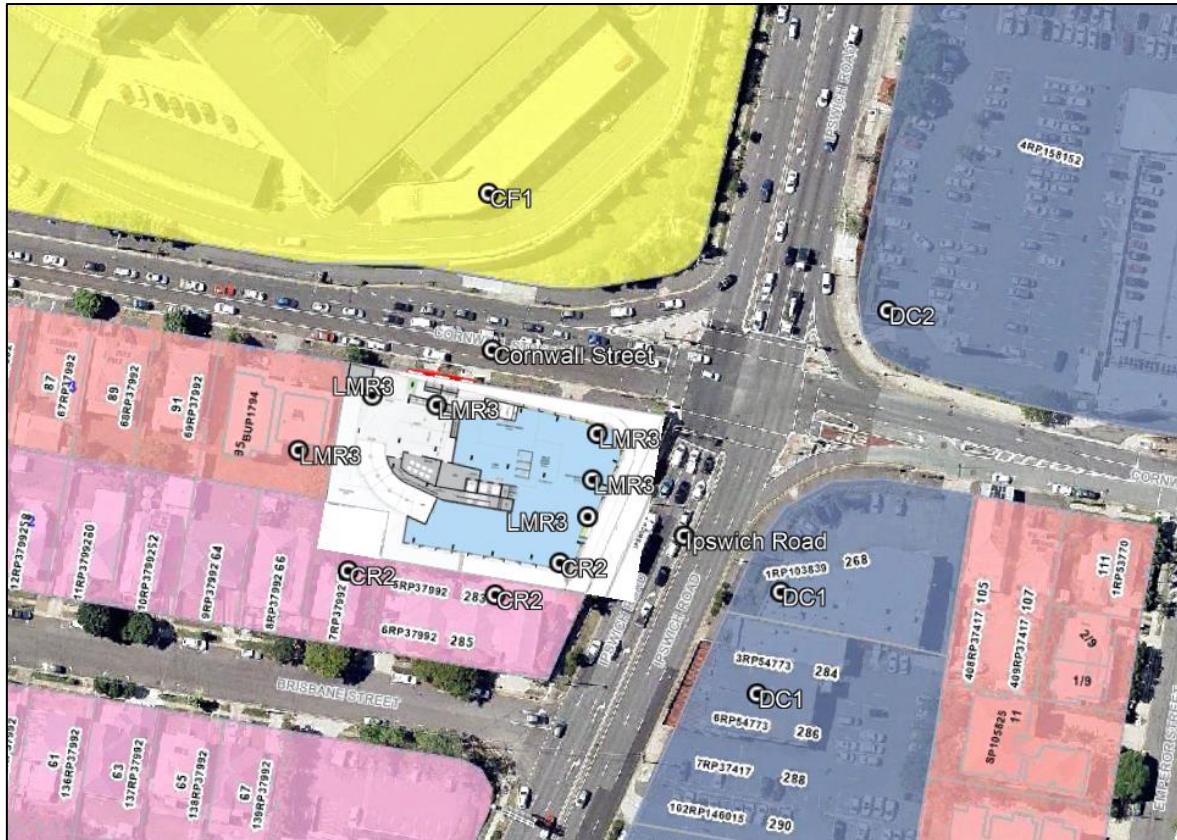
- Queensland Government *Department of Transport and Main Roads - Development Affected by Environmental Emissions from Transport Policy*;
- Brisbane City Plan 2014 Use Code Criteria;
- Environmental Protection (Noise) Policy 2019
- Environmental Protection Act 1994;
- Australian Standard AS1055:2018 *Acoustics – Description and measurement of environmental noise*
- Environmental Protection Agency – *Noise Measurement Manual 2000*.

The locality and development design is presented in the following **plates, plan and photos**. Plans for the proposed are presented in **Appendix A**. Environmental noise calculations are presented in **Appendix B**. Terms and definitions used in this Report are found in **Appendix C**.

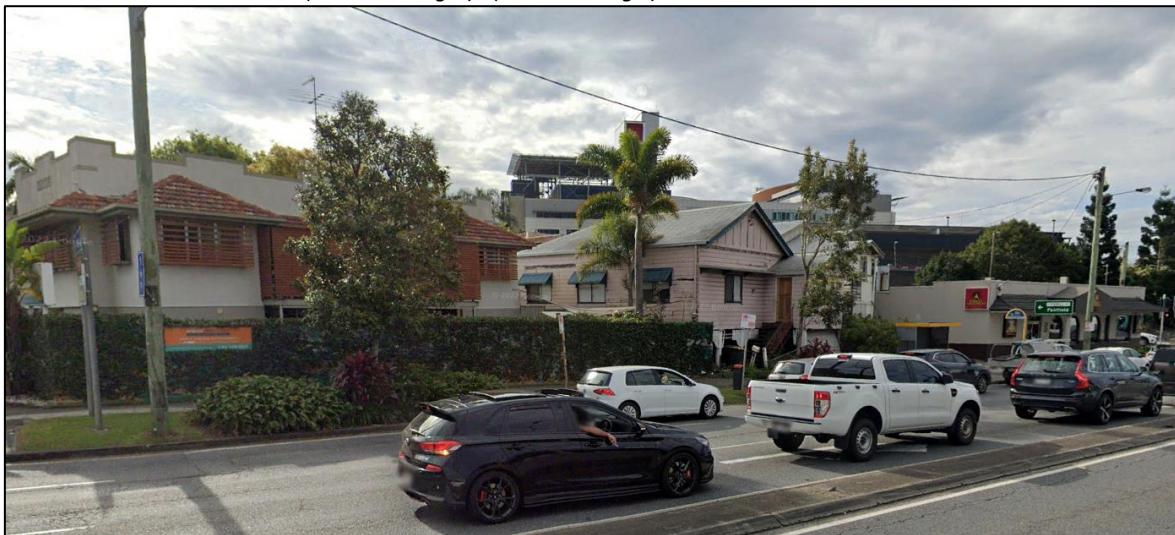
**Plate 1.1:** Showing the site and locality. (Source: Google; Queensland Government).



**Plate 2.2:** The site is zoned Low medium residential and Character residential and is adjacent to Community Facilities, District Centre, Character residential and Low medium residential zones. (Source: Brisbane City Council).



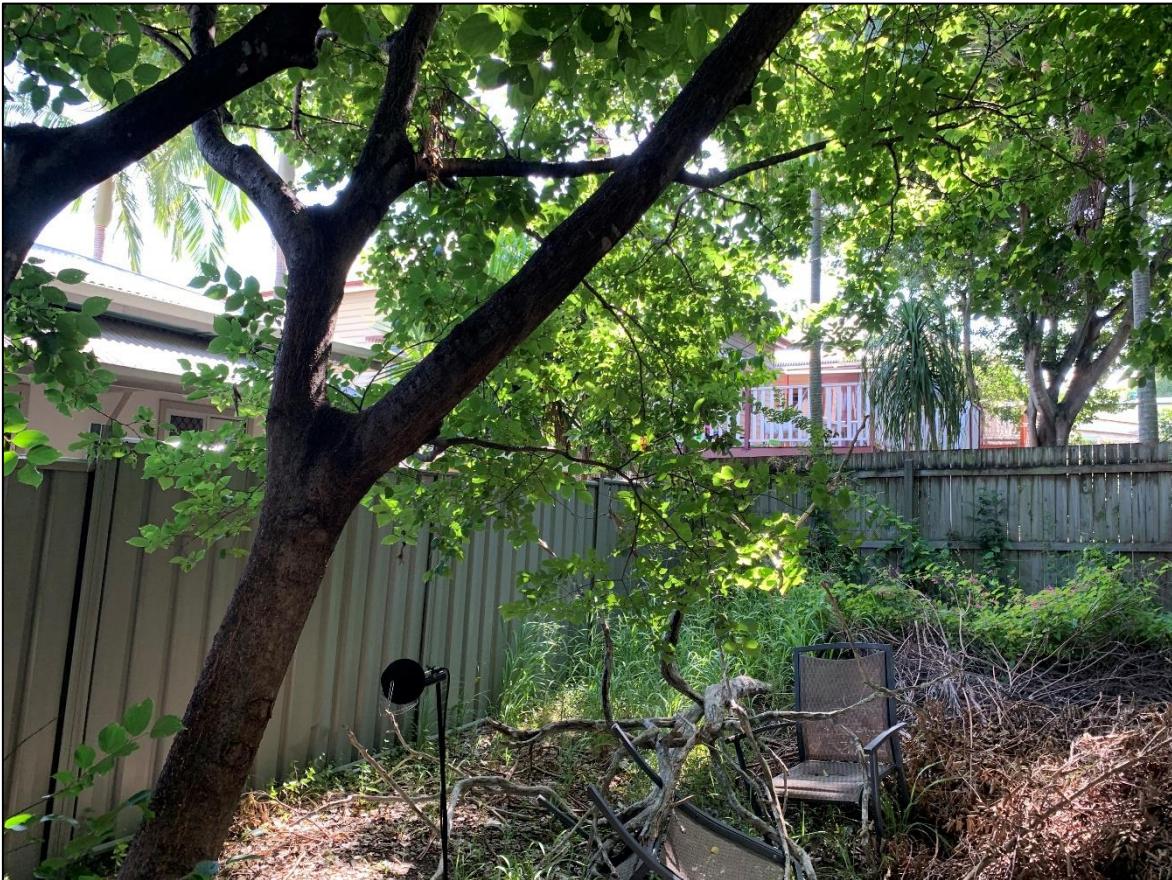
**Photo 1.1:** View from Ipswich Road showing the Character residential interface (left) and existing dwellings and commercial use to be removed (centre and right). (Source: Google).



**Photo 1.2:** View from Cornwall Street showing the existing commercial use and dwellings to be removed (left) and the Low medium residential interface (right). (Source: Google).



**Photo 1.3:** Showing the noise logger for ambient background noise monitoring.



**Photo 1.4:** Showing the noise logger for Ipswich Road noise monitoring.



**Photo 1.5:** Showing the noise logger for Cornwall Street noise monitoring.



**Plan 1.1:** Perspective plan. (Source: CotteeParker).



## 2. Measurement of Ambient Noise Levels

### 2.1 Measurement Procedures

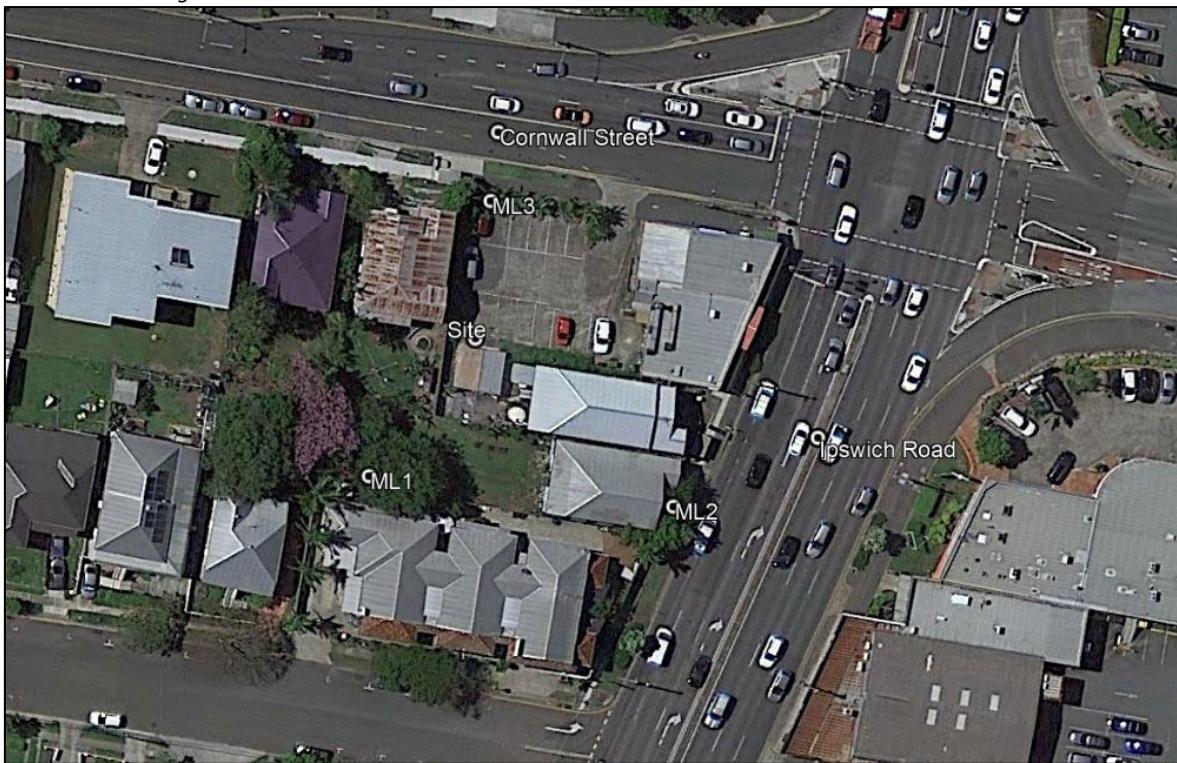
To assess the existing acoustic environment, ambient noise measurements were undertaken on site in January 2023.

Three noise monitoring locations (ML) were chosen:

- ML1 – Located at the rear of the property 281 Ipswich Road, 1.4 metres above ground in a free field location, for ambient background noise monitoring over seven days;
- ML2 – Located front of the property 281 Ipswich Road, approximately 2.5 metres from the road edge, and 1.4 metres above ground in a free field location, for road traffic noise monitoring over 48 hours;
- ML3 – Located in the existing commercial carpark on 101 Cornwall Street, approximately 5 metres from the road edge and 1.4 metres above ground in a free-field location, for road traffic noise monitoring.

The approximate measurement locations are presented in **Plate 2.1** and **Photo 1.3-1.5** in the **Introduction** of this Report.

**Plate 2.1:** Showing measurement location ML1.



The instruments were calibrated before and after the measurement session, and were found to match the reference signa. All instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels -

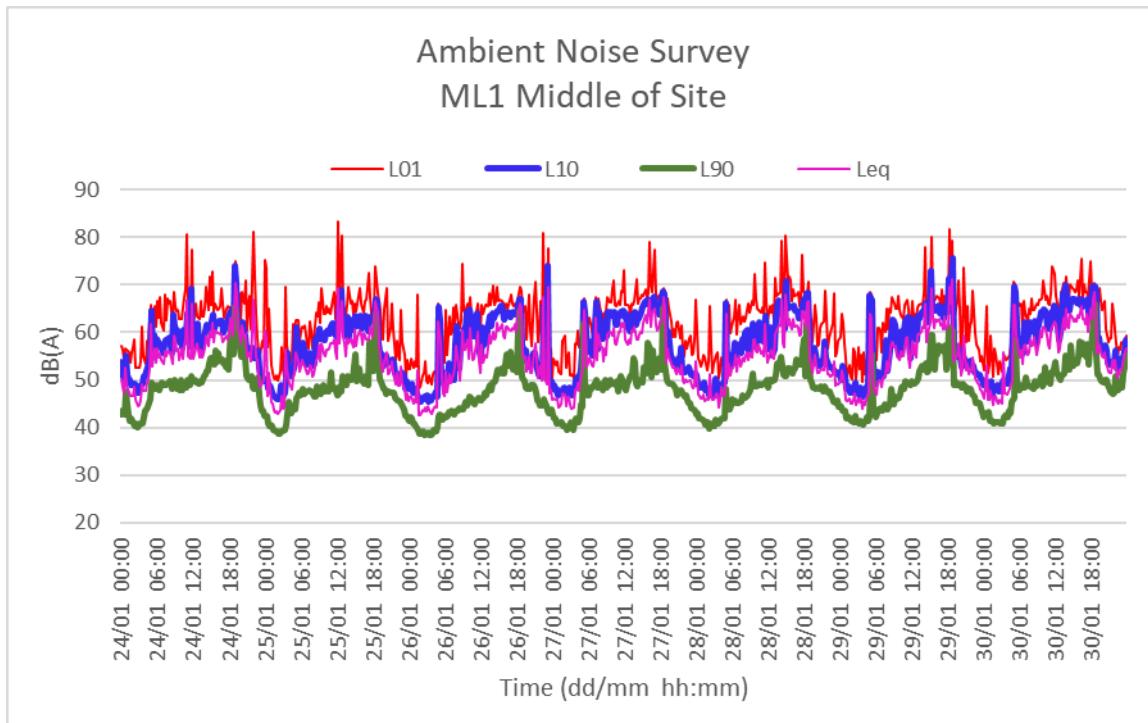
- 3x Larson Davis LxT Class 2 environmental noise logger;
- Larson Davis CAL200 Class 1 acoustic calibrator.

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055:2018 - *Acoustics - Description and measurement of environmental noise*, and the Department of Environment and Science *Noise Measurement Manual 2020*.

## 2.2 ML1 – Ambient Background Sound Levels

Measurement location 1 (ML1) was located at the rear of the property 281 Ipswich Road, 1.4 metres above ground in a free field location, for ambient background noise monitoring over seven days from the 23<sup>rd</sup> January to the 31<sup>st</sup> of January 2023.

Measured levels are presented graphically in **Figure 2.1** below, and in tabular format in **Table 2.1** following.



**Figure 2.1:** Ambient noise levels at ML1. Levels are in dB(A), free-field.

**Table 2.1:** Average ambient noise levels at ML1. Levels are in dB(A), free-field

Day	Date	Time of Day	Time Period	L <sub>01</sub>	L <sub>10</sub>	ABL L <sub>90</sub>	L <sub>eq</sub>
Tuesday	24 <sup>th</sup> January	Night	10:00pm – 7:00am	66	53	41	55
		Day	7:00am – 6:00pm	69	60	49	59
		Evening	6:00pm – 10:00pm	68	61	52	59
Wednesday	25 <sup>th</sup> January	Night	10:00pm – 7:00am	71	52	40	55
		Day	7:00am – 6:00pm	69	60	48	59
		Evening	6:00pm – 10:00pm	69	57	47	59
Thursday	26 <sup>th</sup> January	Night	10:00pm – 7:00am	64	49	39	51
		Day	7:00am – 6:00pm	68	61	44	58
		Evening	6:00pm – 10:00pm	69	57	47	59
Friday	27 <sup>th</sup> January	Night	10:00pm – 7:00am	66	52	40	58
		Day	7:00am – 6:00pm	71	63	49	61
		Evening	6:00pm – 10:00pm	69	58	48	60
Saturday	28 <sup>th</sup> January	Night	10:00pm – 7:00am	66	51	41	52
		Day	7:00am – 6:00pm	72	61	47	60
		Evening	6:00pm – 10:00pm	69	58	48	60
Sunday	29 <sup>th</sup> January	Night	10:00pm – 7:00am	65	52	41	53
		Day	7:00am – 6:00pm	68	62	48	61
		Evening	6:00pm – 10:00pm	77	58	48	63
Monday	30 <sup>th</sup> January	Night	10:00pm – 7:00am	67	52	41	56
		Day	7:00am – 6:00pm	71	64	49	61
		Evening	6:00pm – 10:00pm	70	59	48	61

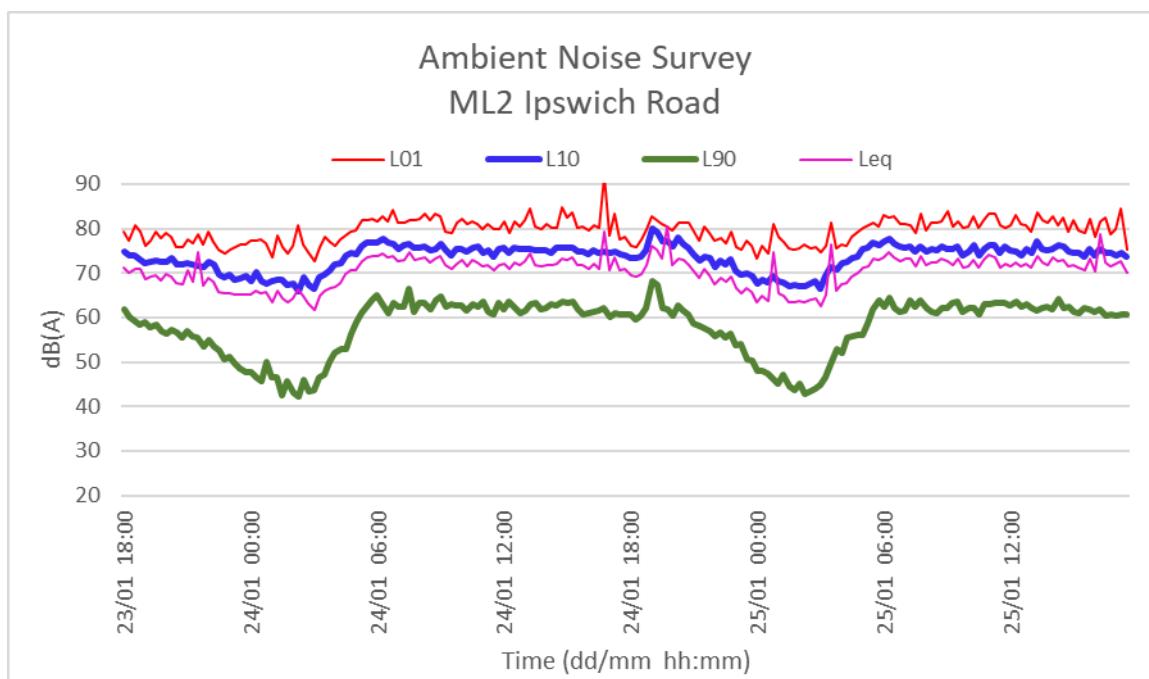
(Note: Significant rain was recorded 24<sup>th</sup> January between 6:45pm and 7:45pm, and this time period has been excluded from the calculations.)

Rating Background Sound Level (RBL)			RBL (L <sub>90</sub> )	L <sub>Aeq</sub>
Median	Night	10:00pm – 7:00am	41	55
	Day	7:00am – 6:00pm	48	59
	Evening	6:00pm – 10:00pm	48	60

## 2.3 ML2 – Road Traffic Noise – Ipswich Road

Measurement location 2 (ML2) was located front of the property 281 Ipswich Road, approximately 2.5 metres from the road edge, and 1.4 metres above ground in a free field location, for road traffic noise monitoring over 48 hours from the 23<sup>rd</sup> January to the 25<sup>th</sup> of January 2023.

Measured levels are presented graphically in **Figure 2.2**, and in tabular format in **Table 2.2** below.



**Figure 2.2:** Ambient noise levels at ML2. Levels are in dB(A), free-field.

**Table 2.2:** Average ambient noise levels at ML2 24<sup>th</sup> January 203 (levels in dB(A), free field, weather affected data removed).

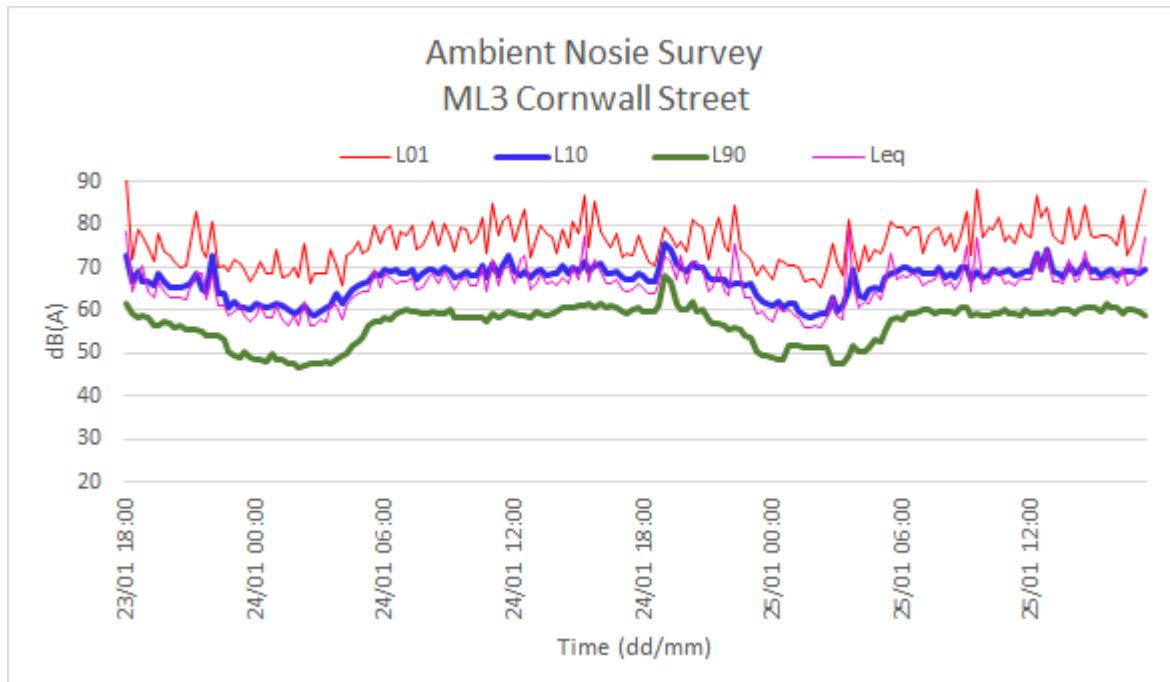
Time	L <sub>A01</sub>	L <sub>A10</sub>	L <sub>A90</sub>	L <sub>Aeq</sub>
Day 6am to 6pm	83.3	75.2	62.4	72.7
Evening 6pm to 10pm	79.4	72.7	57.5	70.0
Night 10pm to 6am	81.9	71.0	51.5	69.1
Day max 1-hr		83.0		75.2
Night max 1-hr (night to 6am)		82.6		73.9
CoRTN 6am to 12pm		74.1	60.0	
24 hour	82.6			71.2

The measured noise levels include noise from all sources, including road traffic, residential, wildlife and other local sources of noise. Road traffic noise was observed to be the dominant noise source in the environment, and the levels presented are considered to be consistent with an acoustic environment generally controlled by road traffic noise. As a conservative assumption, the measured L<sub>10, 18hr</sub> from all sources is considered representative of road traffic noise intrusion. The measured L<sub>10, 18hr</sub> at ML2 was 76.6 dB(A) L<sub>10, 18hr</sub> with a façade adjustment.

## 2.4 ML3 – Road Traffic Noise – Cornwall Street

Measurement location 3 (ML3) was in the existing commercial carpark on 101 Cornwall Street, approximately 5 metres from the road edge and 1.4 metres above ground in a free-field location, for road traffic noise monitoring over 48 hours from the 23<sup>rd</sup> January to the 25<sup>th</sup> of January 2023.

Measured levels are presented graphically in **Figure 2.3**, and in tabular format in **Table 2.3** below.



**Figure 2.3:** Ambient noise levels at ML3. Levels are in dB(A), free-field.

**Table 2.3:** Average ambient noise levels at ML3 24<sup>th</sup> January 2023 (levels in dB(A), free field, weather affected data removed).

Time	L <sub>A01</sub>	L <sub>A10</sub>	L <sub>A90</sub>	L <sub>Aeq</sub>
Day 6am to 6pm	81.9	69.0	59.6	68.7
Evening 6pm to 10pm	80.7	69.4	60.5	69.1
Night 10pm to 6am	78.5	63.3	51.1	63.1
Day max 1-hr		77.0		73.4
Night max 1-hr (night to 6am)		74.5		68.1
CoRTN 6am to 12pm		68.6	59.0	
24 hour	80.8			67.4

The measured noise levels include noise from all sources, including road traffic, residential, wildlife and other local sources of noise. Road traffic noise was observed to be the dominant noise source in the environment, and the levels presented are considered to be consistent with an acoustic environment generally controlled by road traffic noise. As a conservative assumption, the measured L<sub>10, 18hr</sub> from all sources is considered representative of road traffic noise intrusion. The measured L<sub>10, 18hr</sub> at ML2 was 71.1 dB(A) L<sub>10, 18hr</sub> with a façade adjustment.

## 3. Noise Criteria and Limits

### 3.1 Department of State Development, Infrastructure, Local Government and Planning

The proposed development has been referred to the *Department of State Development, Infrastructure, Local Government and Planning (DSDILGP)* being designated Ministerial Infrastructure. The following item was raised during pre-lodgement advice meetings (Reference MPL-1122-03814) and dated 16<sup>th</sup> December 2022.

Amenity	
4.	<p>The MID proposal should consider potential amenity impacts at adjoining sensitive receptors, including noise, lighting, visual and privacy.</p> <p>Elevations/perspectives, building materials and finishes and landscape plans should be provided.</p> <p>An acoustic report should be provided as part of the MID proposal that address noise impacts from the surrounding road network and commercial activities.</p>

The noise impacts from the surrounding road network have been assessed in accordance with the Queensland Government, *Department of Transport and Main Roads - Development Affected by Environmental Emissions from Transport Policy*.

### 3.2 Department of Transport and Main Roads

The Queensland Government, *Department of Transport and Main Roads - Development Affected by Environmental Emissions from Transport Policy* contains the primary external and secondary internal noise criteria for a new sensitive development affected by transport noise.

The noise criteria and limits are presented (in part) in **Table 3.1** and **3.2** following.

**Table 3.1:** Primary (external) noise criteria for new sensitive development.

State transport corridor	Development type	Location within development	Environmental criteria
<b>State-controlled road OR Multi-modal corridor which does not include a railway or includes &lt;15 single railway events</b>	Accommodation activities	All facades	≤ 60 dB(A) L <sub>10</sub> (18hr) facade corrected (measured L <sub>90</sub> (8hr) free field between 10pm and 6am ≤ 40dB(A))
			≤ 63 dB(A) L <sub>10</sub> (18hr) facade corrected (measured L <sub>90</sub> (8hr) free field between 10pm and 6am > 40dB(A))
		Private and communal open space	≤ 57 dB(A) L <sub>10</sub> (18hr) free field (measured L <sub>90</sub> (18hr) free field between 6am and midnight ≤ 45dB(A))
			≤ 60 dB(A) L <sub>10</sub> (18hr) free field (measured L <sub>90</sub> (18hr) free field between 6am and midnight > 45dB(A))
	Educational establishments Child care centres	Public open space	≤ 63 dB(A) L <sub>10</sub> (12hr) free field (between 6am and 6pm)
		All facades	≤ 58 dB(A) L <sub>10</sub> (1hr) façade corrected (maximum hour during normal opening hours)
	Health care services Hospitals Community uses Places of worship Offices	Outdoor education areas Outdoor play areas	≤ 63 dB(A) L <sub>10</sub> (12hr) free field (between 6am and 6pm)
		All facades	≤ 58 dB(A) L <sub>10</sub> (1hr) façade corrected (maximum hour during normal opening hours)
		Outdoor spaces for passive recreation	≤ 63 dB(A) L <sub>10</sub> (12hr) free field (between 6am and 6pm)

**Table 3.2:** Secondary (internal) noise criteria for new sensitive development.

<b>State-controlled road OR Busway OR Light rail OR Multi-modal corridor which does not include a railway or includes &lt;15 single railway events</b>	Accommodation activities	Habitable rooms all times	≤ 35 dB(A) L <sub>eq</sub> (1hr) (maximum hour over 24 hours)
	Child care centres	Indoor education areas Indoor play areas	≤ 35 dB(A) L <sub>eq</sub> (1hr) (maximum hour during normal opening hours)
	Health care services Hospitals	Patient care areas	≤ 35 dB(A) L <sub>eq</sub> (1hr) (maximum hour during normal opening hours)
	Educational establishments	Indoor education areas	≤ 35 dB(A) L <sub>eq</sub> (1hr) (maximum hour during normal opening hours)
	Community uses (library only) Places of worship		≤ 35 dB(A) L <sub>eq</sub> (1hr) (maximum hour during normal opening hours)
	Community uses (except libraries) Offices		≤ 45 dB(A) L <sub>eq</sub> (1hr) (maximum hour during normal opening hours)
	It is noted that the Environmental Protection (Noise) Policy 2008 includes more stringent noise criteria for sleeping areas and/or during night-time periods. However, since the Queensland Development Code does not currently differentiate sleeping areas from other habitable rooms TMR has chosen not to implement these criteria at this time.		

### 3.3 Brisbane City Plan 2014

The proposed Integrated Health Care Facility is located on land zoned Low medium density and Character residential and is impact assessable. The Use Code Assessment and Noise Impact Assessment Planning Scheme Policy applies.

#### 3.3.1 Use Code Assessment Criteria

The following noise emissions limits from on-site activities are to be achieved. These limits have been used in this assessment to protect the amenity of sensitive uses at the zone boundary. The sensitive adjacent Lots are zoned Low medium density, Character residential and District centre.

**Table 3.3:** Brisbane City Plan 2014 Code Assessment Criteria (in part).

Table 9.3.5.3.B: Noise (planning) criteria				
Criteria Location	Intrusive Noise Criteria Day, evening and night LAeq,adj,T are not greater than the RBL plus the value in column 1 for the relevant criteria location, where T equals: • Day: 11hr • Evening: 4hr • Night: 9hr	Acoustic Amenity Criteria Day, evening and night LAeq,adj,T are not greater than the values in column 2 for the relevant criteria location, where T equals: • Day: 11hr • Evening: 4hr • Night: 9hr		
Low medium density residential zone boundary	RBL + 3 dB(A)	55 dB(A)	45 dB(A)	40 dB(A)
Character residential zone boundary	RBL + 3 dB(A)	50 dB(A)	45 dB(A)	40 dB(A)
District centre zone boundary	RBL + 5 dB(A)	60 dB(A)	55 dB(A)	50 dB(A)

**Table 9.3.5.3.C Night-time noise criteria**

Criteria Location	Where the existing LAeq,9hr night at the criteria location is:	Average of the highest 15 single LAmax events over a given night (10pm-7am) period is not greater than the following values at the relevant criteria location	The absolute highest single LAmax event over a given night (10pm-7am) period is not greater than the following values at the relevant criteria location
Low-medium density residential zone and Character residential zone boundary	< 45dB(A)	50 dB(A)	55dB(A)
	45 to 60dB(A)	Leq,9hr night + 5dB(A)	Leq,9hr night + 10dB(A)
	> 60dB(A)	65 dB(A)	70 dB(A)
District centre zone boundary	Not applicable	65 dB(A)	70 dB(A)

The Mixed Use Zone Code contains guidance as to the assessment of acoustic amenity, and is reproduced (in part).

### 3.4 Summary of Noise Emission Assessment Criteria

Relevant criteria for noise assessment are derived from the noise criteria and limits presented in **Section 3** of this report and the measured ambient sound levels in **Section 2.2** of this report. The noise limits applied by Council (i.e not including the Environmental Protection (Noise) Policy 2019 criteria) are summarised in **Table 3.4** below.

**Table 3.4:** Summary of relevant Council assessment criteria. Levels are in dB(A), free-field.

Descriptor	Descriptor	Day	Evening	Night
<b>Brisbane City Council Code Criteria</b>				
Intrusive Noise Criteria (Low medium density residential zone boundary)	$L_{eq}$	<b>51</b>	51	44
Acoustic Amenity Criteria (Low medium density residential zone boundary)	$L_{eq}$	55	<b>45</b>	<b>40</b>
Intrusive Noise Criteria (Character residential zone boundary)	$L_{eq}$	51	51	44
Acoustic Amenity Criteria (Character residential zone boundary)	$L_{eq}$	<b>50</b>	<b>45</b>	<b>40</b>
Intrusive Noise Criteria (District centre zone boundary)	$L_{eq}$	<b>53</b>	<b>53</b>	<b>46</b>
Acoustic Amenity Criteria (District centre zone boundary)	$L_{eq}$	60	55	50
Night-time Noise Criteria (Low medium density and Character residential zone boundary)	$L_{max}(\text{average})$	-	-	<b>60</b>
	$L_{max}(\text{absolute})$	-	-	<b>65</b>
Night-time Noise Criteria (District centre zone boundary)	$L_{max}(\text{average})$	-	-	<b>65</b>
	$L_{max}(\text{absolute})$	-	-	<b>70</b>

Definition of terms used in this report are presented in **Appendix C**.

### 3.5 Environmental Protection (Noise) Policy 2019 (2008)

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The *Environmental Protection (Noise) Policy 2019* establishes acoustic quality objectives (AQO) to protect or enhance stated environmental values. The environmental values to be enhanced or protected under the policy are the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and the qualities of the acoustic environment that are conducive to human health and well-being, including ensuring a suitable acoustic environment for individual's to sleep, study and learn, to be involved in recreation including relaxation and conversation; and the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

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

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

Noise management strategies are required to the extent it is reasonable to do so. It is therefore concluded that the AQO are not intended to be necessarily limiting criteria, as reasonableness and equity are fundamental precepts of the policy.

It is furthermore noted that the AQO are specifically not applicable to noise from ordinary use of public roads, and that the *Department of Transport and Main Roads* provides Noise Emissions Standards for the assessment of noise emissions from transport activities and Council's Zone Code for the assessment of noise emissions onto sensitive zone boundaries. It is therefore concluded that the policy intent of the Environmental Protection (Noise) Policy 2019 is met through application of Council's Noise Emission Standards.

### 3.6 Environmental Protection Act 1994

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The proposed development contains a theatre plant deck and mechanical plant deck located on Level 5. State requirements are set out under the *Environmental Protection Act 1994*; in that Act noise from air conditioning (and similar plant) must not exceed the following noise levels when measured as the  $L_{A90}$  dB(A) level over a period of 15 minutes at an affected building:

- Between 10pm and 7am: 3 dB(A) above the background level
- From 7am to 10pm: 5 dB(A) above the background level

It is recommended that mechanical plant be appropriately sited and maintained to ensure compliance with EPA criteria at all times.

Detailed plant noise assessment can be conducted – if required – at the Building Approval stage once plant specifications can be determined.

## 4. Noise Impact Assessment – Noise Immission (Road Traffic Noise)

### 4.1 Department of Transport and Main Roads – Primary (External) Noise Assessment

The proposed development has been referred to the *Department of State Development, Infrastructure, Local Government and Planning (DSDLGP)* being designated Ministerial Infrastructure. The noise impacts from the surrounding road network have been assessed in accordance with the Queensland Government, *Department of Transport and Main Roads (DTMR) - Development Affected by Environmental Emissions from Transport Policy*.

The primary (external) noise criteria for new sensitive developments are assessed in **Table 4.1** below against the measured sound levels presented in **Section 2** of this Report.

The proposed outdoor space for passive recreation is located on the fifth floor. The calculated sound level, derived from measured levels, are presented in **Appendix B**.

**Table 4.1:** Primary (external) noise criteria for new development assessed.

Development Type	Location	Environment Criteria	Measured Year 2023	Calculated Year 2032	Compliance
Health Care Services	External Facade Ipswich Road	58 dB(A) L10 (1hr)	86 dB(A) L10 (1hr)	86 dB(A) L10 (1hr)	+ 28 dB(A)
Health Care Services	External Facade Cornwall Street	58 dB(A) L10 (1hr)	80 dB(A) L10 (1hr)	80 dB(A) L10 (1hr)	+22 dB(A)
Health Care Services	Passive Recreation NE	≤63 dB(A) L10 (12hr) (free field) between 6am and 6pm	-	56 dB(A) L10 (12hr)	Yes
Health Care Services	Passive Recreation E	≤63 dB(A) L10 (12hr) (free field) between 6am and 6pm	-	56 dB(A) L10 (12hr)	Yes
Health Care Services	Passive Recreation SE	≤63 dB(A) L10 (12hr) (free field) between 6am and 6pm	-	58 dB(A) L10 (12hr)	Yes

It is concluded that the external façade transport noise levels cannot meet the primary (external) façade criteria. Amenity for the occupants of the Health Care facility can be protected by achieving the *Secondary (internal) noise criteria for new sensitive development*.

The communal open (outdoor terrace and gardens) area on Level 5 can meet the environment criteria for passive recreation. Solid Balustrades are recommended and included in the calculations above. The location of the solid balustrade is illustrated in **Section 4.3**.

## 4.2 Department of Transport and Main Roads – Secondary (Internal) Noise Assessment

### 4.2.1 Traffic Noise Reduction

The nearest major road is Ipswich Road located adjacent east of the site, is a designated Council arterial route. Cornwall Street, a designated Council suburban route, is adjacent north of the site.

Predicted levels for this report have been calculated using CRTN prediction models PEN3D2000 and are façade-adjusted. Existing and future traffic volumes have been interpreted from data provided by the Brisbane City Council Key Corridors. Topographic data was obtained from Geoscience Australia (0.5m contours). The road traffic volumes (AADT) and assumptions are presented **Table 4.2** below. Additional noise modelling data is presented in **Appendix B**.

**Table 4.2:** Road traffic volume AADT used in this assessment. (Source: Brisbane City Council Key Corridors).

Road	Vehicles per 24hr			Growth (%p.a.)	HV %	Speed (km/hr)	Source Height (m)				
	(18hr volume is 94% of 24hr)										
	2018	2023	2033								
Ipswich Road (bi-directional)	51,255	53,870	59,505	1.00%	5.00%	50	0.5				
Cornwall Street (bi-directional)	17,085	17,957	19,835	1.00%	5.00%	40	0.5				

Traffic noise predictions are presented in **Appendix B**. Road traffic is observed as being the main element for building design. The building design elements are presented in the following section and include the traffic noise reductions necessary to achieve the interior noise amenity indicated by DTMR and DSDILGP.

### 4.2.2 Building Design for Road Traffic Noise Reduction

AS3671-1989 Acoustics-Road traffic noise intrusion-Building siting and construction provides guidance on the location and construction of new buildings near major roads. The exterior design noise levels are calculated from the relationships between the L10(18hr) levels and the Leq (day / night) levels. The residential levels are referenced to the 1-hour maximum Leq levels (day / night) as presented in the ambient sound survey in **Table 2.2**:

$$\text{Daytime Leq maximum 1hr} = \text{L10}(18\text{hr}) + 1.1 \text{ dB(A)}$$

$$\text{Night-time Leq maximum 1hr} = \text{L10}(18\text{hr}) - 0.2 \text{ dB(A)}$$

The required traffic noise reduction levels (TNR) for the building design to achieve required interior noise amenity levels, and indicative Rw ratings for building components, are presented in **Table 4.3** following. Detailed calculations to AS3671 are required as the traffic noise reductions (TNR) are generally above 25 dB(A) and construction to Category 2, 3 and 4 under AS3671 is permitted-

- Category 2: TNR of approximately 25 dB(A) is expected. Standard construction is acceptable, except for some light-weight elements such as fibrous cement or metal cladding or all-glass facades. Windows, doors and other openings must be closed.
- Category 3: TNR of approximately 25 and 35 dB(A) is expected. Special construction, chosen in accordance with Clause 3.4. Windows, doors, and other openings must be closed.
- Category 4: TNR of approximately greater than 35 dB(A) is expected. Special acoustic advice should be sought.

**Table 4.3:** Indicative  $R_w$  values for various construction elements.

Floor	Room	Element	Facing	Ext Leq dB(A)	AS2107 criteria	TNR	Element (Sc) area	Floor (Sf) area	Height (m)	RT60 (s)	C	TNAC	Calc STC/Rw
LG	Health Service Tenancy	All glass façade	N,E	74	35	39	139.7	255.0	3.6	1.0	2	42	48
L01	Lobby	Glass Sliding Door	N	71	35	36	12.6	145.0	3.0	1.0	2	31	37
L01	Health Service Tenancy	Window	N	75	35	40	7.2	85.0	3.0	1.0	2	35	41
L01	Health Service Tenancy	All glass façade	N,E	77	35	42	156.0	604.0	3.0	1.0	2	42	48
L01	Health Service Tenancy	All glass façade	S	70	35	35	108.0	604.0	3.0	1.0	2	34	40
L02	Tennancy	All glass façade	N1	75	35	40	117.0	260.0	4.5	1.0	2	41	47
L02	Tennancy	All glass façade	N2	75	35	40	117.0	260.0	4.5	1.0	2	41	47
L02	Tennancy	All glass façade	E	77	35	42	243.0	604.0	4.5	1.0	2	42	48
L02	Tennancy	All glass façade	S1	73	35	38	166.5	260.0	4.5	1.0	2	40	46
L02	Tennancy	All glass façade	W1	43	35	8	45.0	260.0	4.5	1.0	2	5	11
L02	Tennancy	All glass façade	S2	53	35	18	63.0	260.0	4.5	1.0	2	16	22
L02	Tennancy	All glass façade	W2	68	35	33	117.0	260.0	4.5	1.0	2	34	40
L03	Tennancy	All glass façade	N1	75	35	40	98.8	260.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	N2	75	35	40	98.8	260.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	E	76	35	41	205.2	604.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	S1	73	35	38	140.6	260.0	3.8	1.0	2	40	46
L03	Tennancy	All glass façade	W1	44	35	9	38.0	260.0	3.8	1.0	2	6	12
L03	Tennancy	All glass façade	S2	60	35	25	53.2	260.0	3.8	1.0	2	23	29
L03	Tennancy	All glass façade	W2	68	35	33	98.8	260.0	3.8	1.0	2	34	40
L04	Tennancy	All glass façade	N1	74	35	39	98.8	260.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	N2	74	35	39	98.8	260.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	E	75	35	40	205.2	604.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	S1	72	35	37	140.6	260.0	3.8	1.0	2	39	45
L04	Tennancy	All glass façade	W1	46	35	11	38.0	260.0	3.8	1.0	2	8	14
L04	Tennancy	All glass façade	S2	61	35	26	53.2	260.0	3.8	1.0	2	24	30
L04	Tennancy	All glass façade	W2	69	35	34	98.8	260.0	3.8	1.0	2	35	41
L05	Tennancy	All glass façade	N1	74	35	39	72.2	260.0	3.8	1.0	2	38	44
L05	Tennancy	All glass façade	N2	74	35	39	64.6	260.0	3.8	1.0	2	38	44
L05	Tennancy	All glass façade/Glass	E	57	35	22	83.6	260.0	3.8	1.0	2	22	28
L05	Tennancy	All glass façade / Mechanical Plant Deck	S1	75	35	40	140.6	260.0	3.8	1.0	2	42	48
L05	Tennancy	All glass façade/Near Theatre Plant	S2	70	35	35	38.0	260.0	3.8	1.0	2	32	38
L05	Tennancy	All glass façade	W	69	35	34	91.2	260.0	3.8	1.0	2	34	40
All	Tennancy	External Wall	W	77	35	42	91.2	260.0	3.8	1.0	2	42	48

The  $R_w$  for external walls should be 48  $R_w$  or higher. The reverberation (RT60) time is set at 1.0 seconds for assessment purposes. The reverberation time can be higher or lower depending on the size of the room, carpeting, ceiling and final fit out. Lower RT60 will also lower the  $R_w$  requirements for building elements.

Floor plans for the L01 mezzanine were not included in the plans provided.

Solid balustrades are recommended for the communal open (outdoor terrace and gardens) area on Level 5 and are included in the calculations above. The location of the solid balustrade is illustrated in **Section 4.3**.

It is not possible to determine the floor area for individual tenancies. A floor area of 260m<sup>2</sup> has been used for assessment purposes where an individual tenancy or room is not specified. Windows on Level 5 near or adjacent to the mechanical plant deck should have higher ratings to minimise plant noise intrusion. An external sound level of 70-75 dB(A) at the façade has been used for assessment purposes from plant noise and included in **Table 4.3** above .

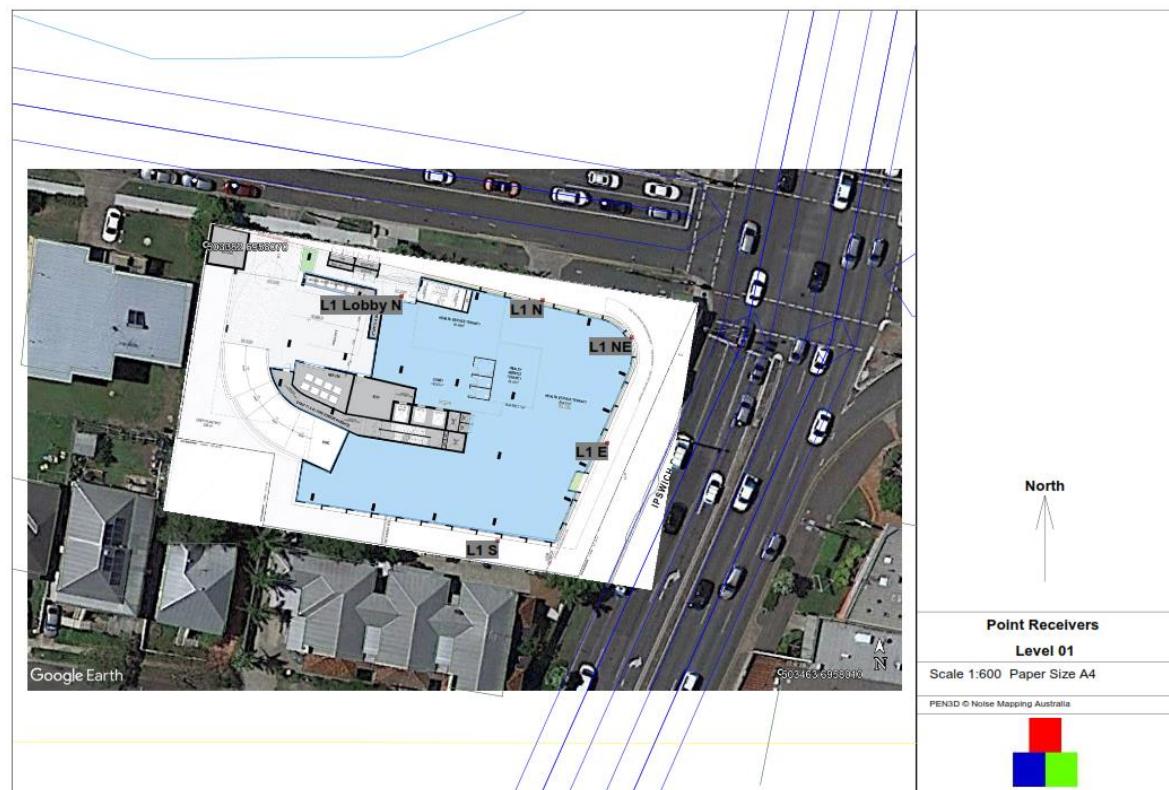
It is recommended that the  $R_w$  calculations be confirmed at building approval stage with the final design plans. Consequently, we do not recommend any specific choice of building material or construction as the various components must be fit for their purpose and can only be determined by the building designer and relevant manufacturer. Australian Standard AS 3671 offers a description of construction and  $R_w$  range for building components.

The point receiver locations (façade facing) are presented in the following **Plates**.

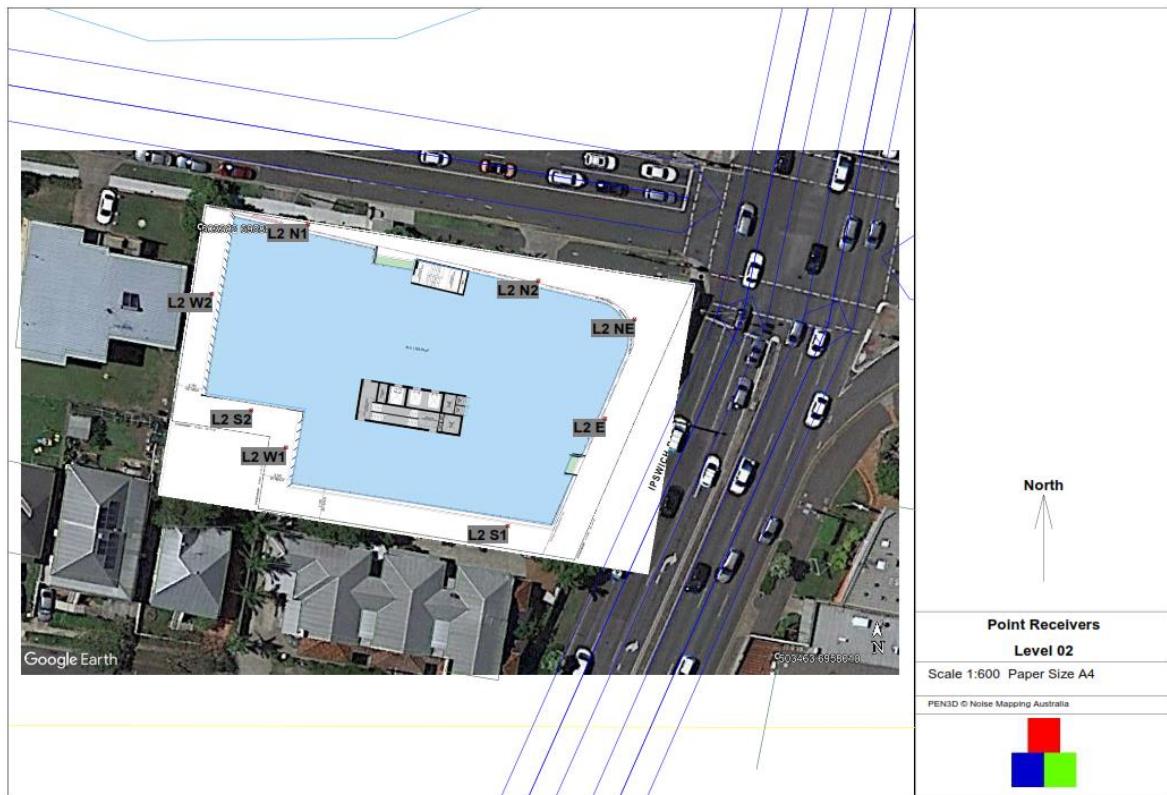
**Plate 4.1:** Point receivers Level Ground.



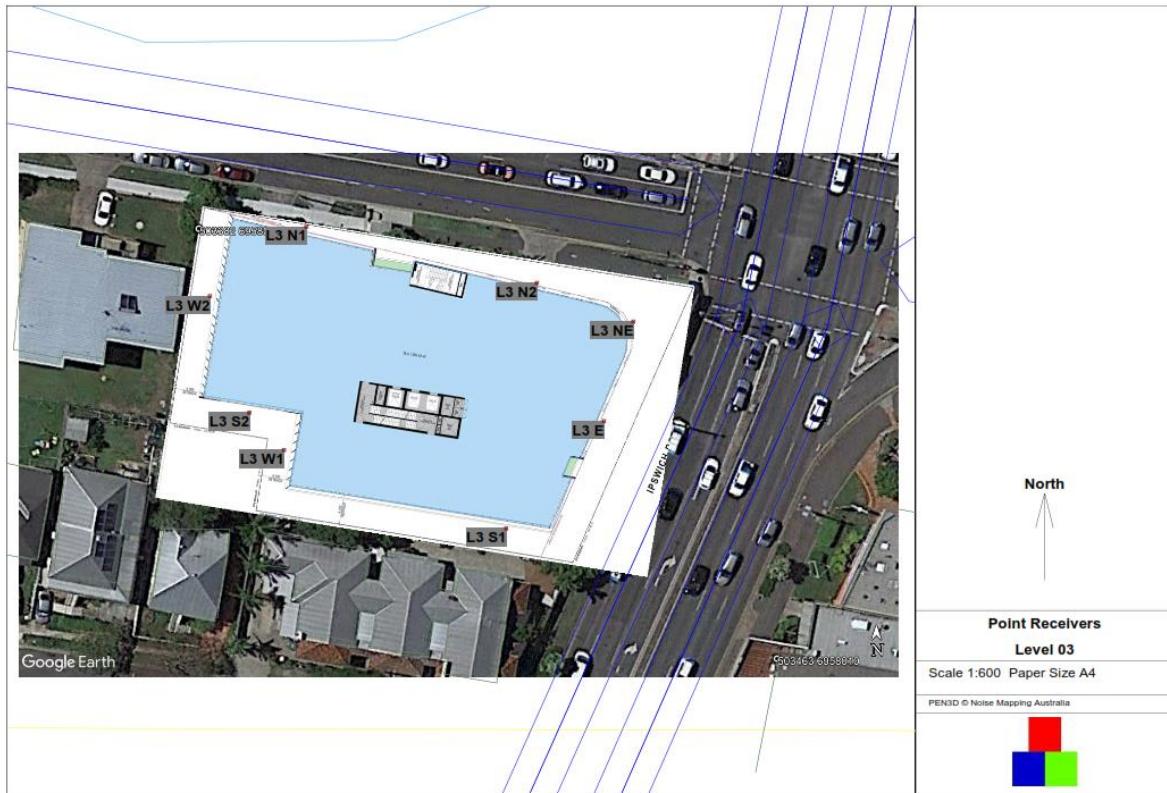
**Plate 4.2:** Point receivers Level 01.



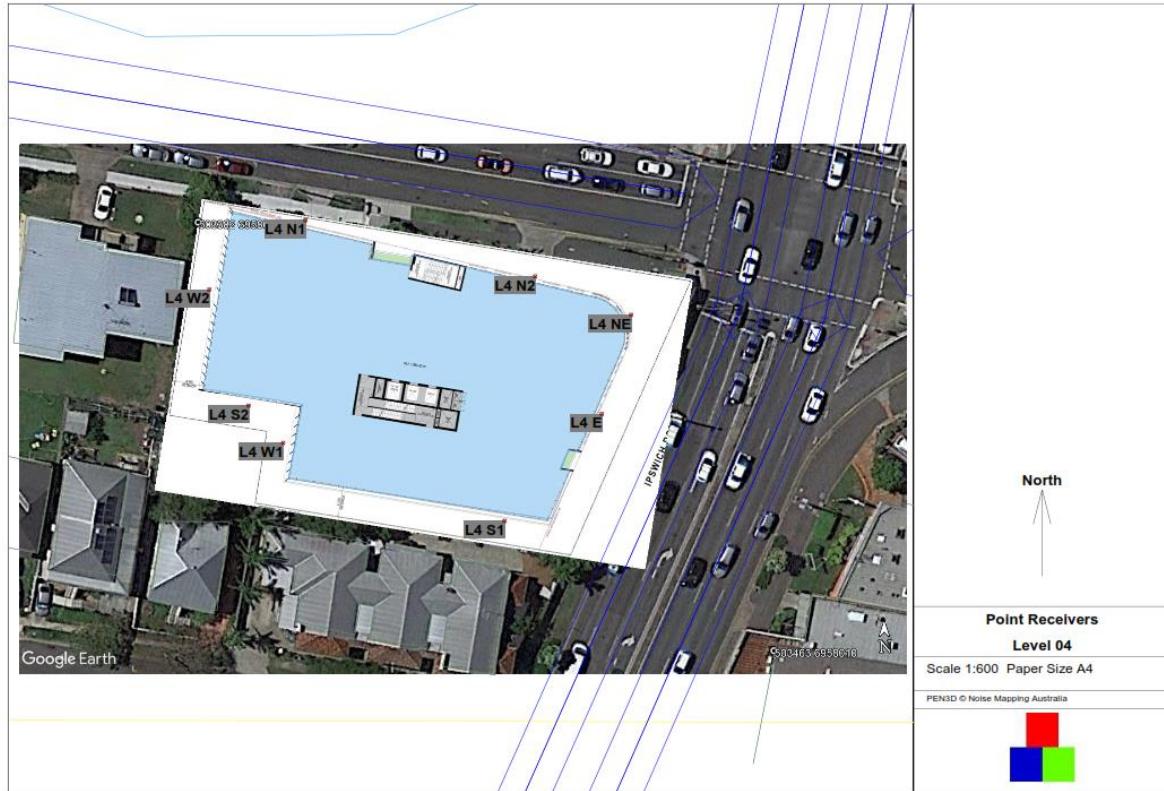
**Plate 4.3:** Point receivers Level 02.



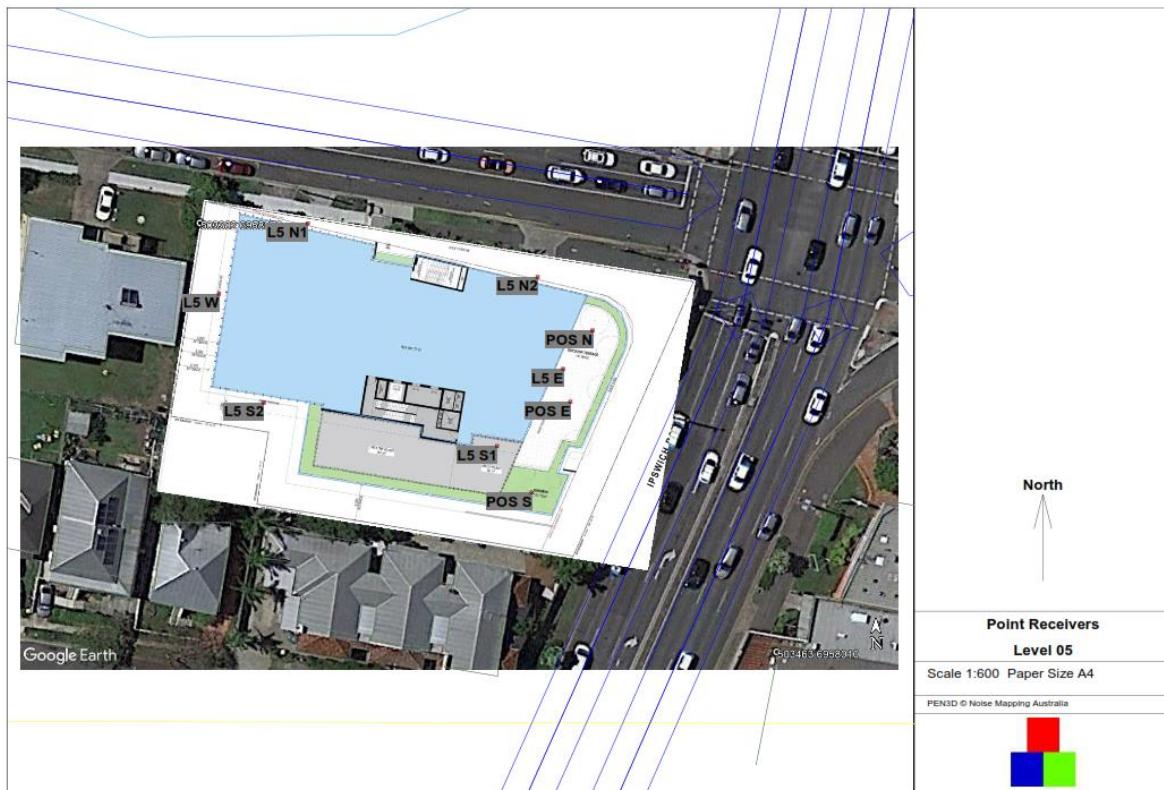
**Plate 4.4:** Point receivers Level 03.



**Plate 4.5:** Point receivers Level 04.



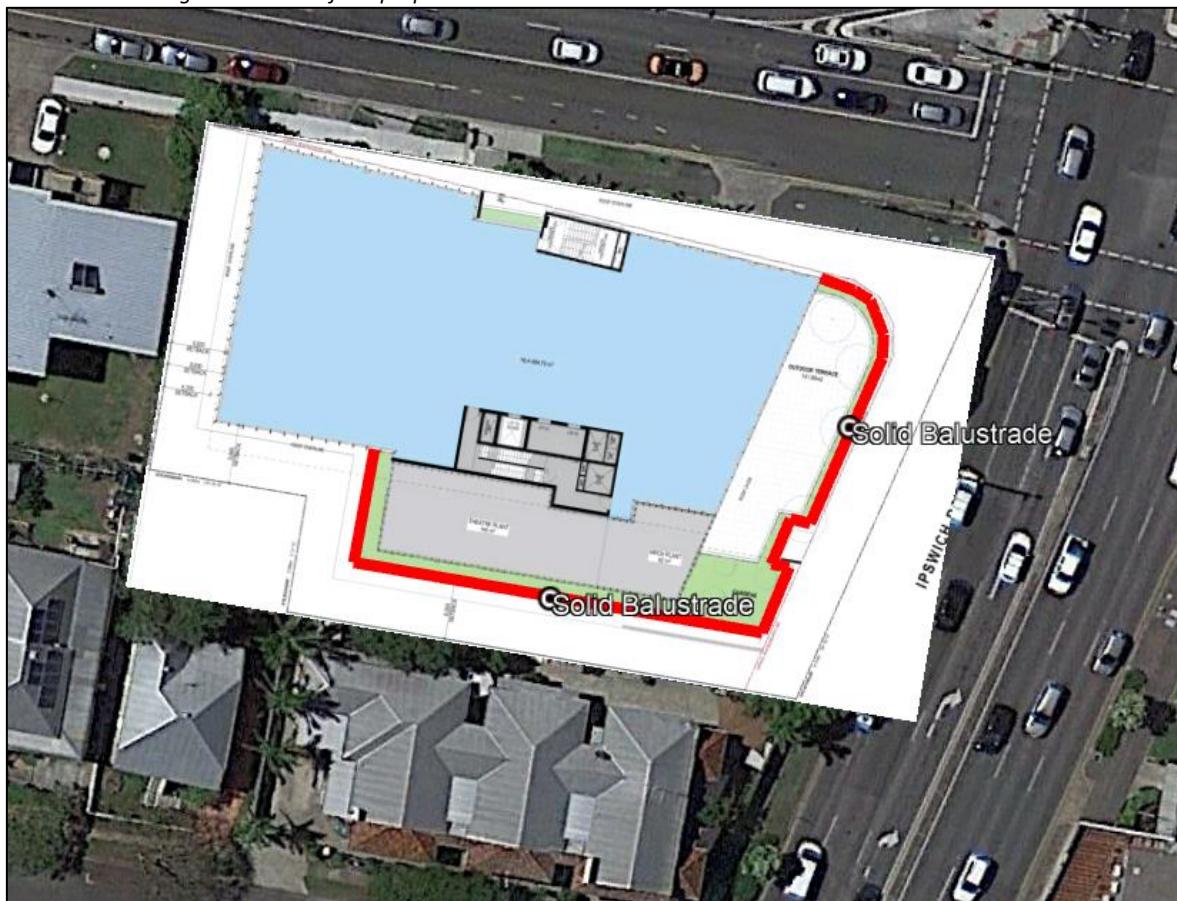
**Plate 4.6:** Point receivers Level 05.



#### 4.3 Proposed Noise Attenuation – Solid Balustrade

It is recommended that a solid balustrade be provided around the outdoor terrace and gardens on Level 05. The solid balustrade reduces road traffic noise in these areas and lowers the  $R_w$  requirements for building façade components. The location of the proposed solid balustrade is shown in **Plate 4.7** below.

**Plate 4.7:** Showing the location of the proposed solid balustrade in red.



#### 4.4 Ventilation to Occupied Areas

Under the design calculations external doors and windows are closed for noise mitigation. There is a need for alternative ventilation to sensitive (such as patient care) areas, most commonly mechanical ventilation or air-conditioning.

## 5. Noise Impact Assessment – Noise Emissions

### 5.1 Noise Sources

The proposed development consists of a Level 01 commercial vehicle parking and passenger basement parking, mechanical services, mechanical plant deck, theatre plant deck and an outdoor terrace and garden on Level 05. Potential noise emissions from proposed activities have been forecast to residential and commercial receivers using the environmental noise model presented in **Appendix D**. Design sound power levels – as modelled – are presented in **Table 5.1** below for the LAeq descriptor and **Table 5.2** for the LMax descriptor. Sound power levels have been sourced from the SoundPlan database, AAAC Guideline for the Child Care Centre Acoustic Assessment, M.J. Hayne et al. Prediction of Noise from Small to Medium Sized Crowds, Harwood, M, “Carrying out noise assessments for proposed supermarket developments”, ACOUSTICS 2008, Geelong and the NMS database. Further details of the modelling and assessment scenarios are presented in the **Sections** following.

**Table 5.1:** Design Leq sound power levels, as modelled.

Source	Descriptor	Sound Power Levels in dB(Z)								Total in dB(Z)	Total in dB(A)
		63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz		
Car Idle	Leq	74	81	75	72	75	76	72	69	85	81
Rubbish collection	Leq,15min	93	87	88	87	88	90	88	77	98	95
Deliveries	Leq	79	86	80	77	80	81	77	74	90	86
Crowd 10	Leq	54	59	65	69	73	74	73	64	79	79
Mechanical Plant	Leq	79	75	77	81	82	85	86	82	92	91

**Table 5.2:** Design Lmax sound power levels, as modelled.

Source	Descriptor	Sound Power Levels in dB(Z)								Total in dB(Z)	Total in dB(A)
		63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz		
Car Door Slam	Lmax	88	92	88	89	93	87	85	83	98	95
Truck Tone Alarm	Lmax	75	82	76	73	76	102	73	70	102	103

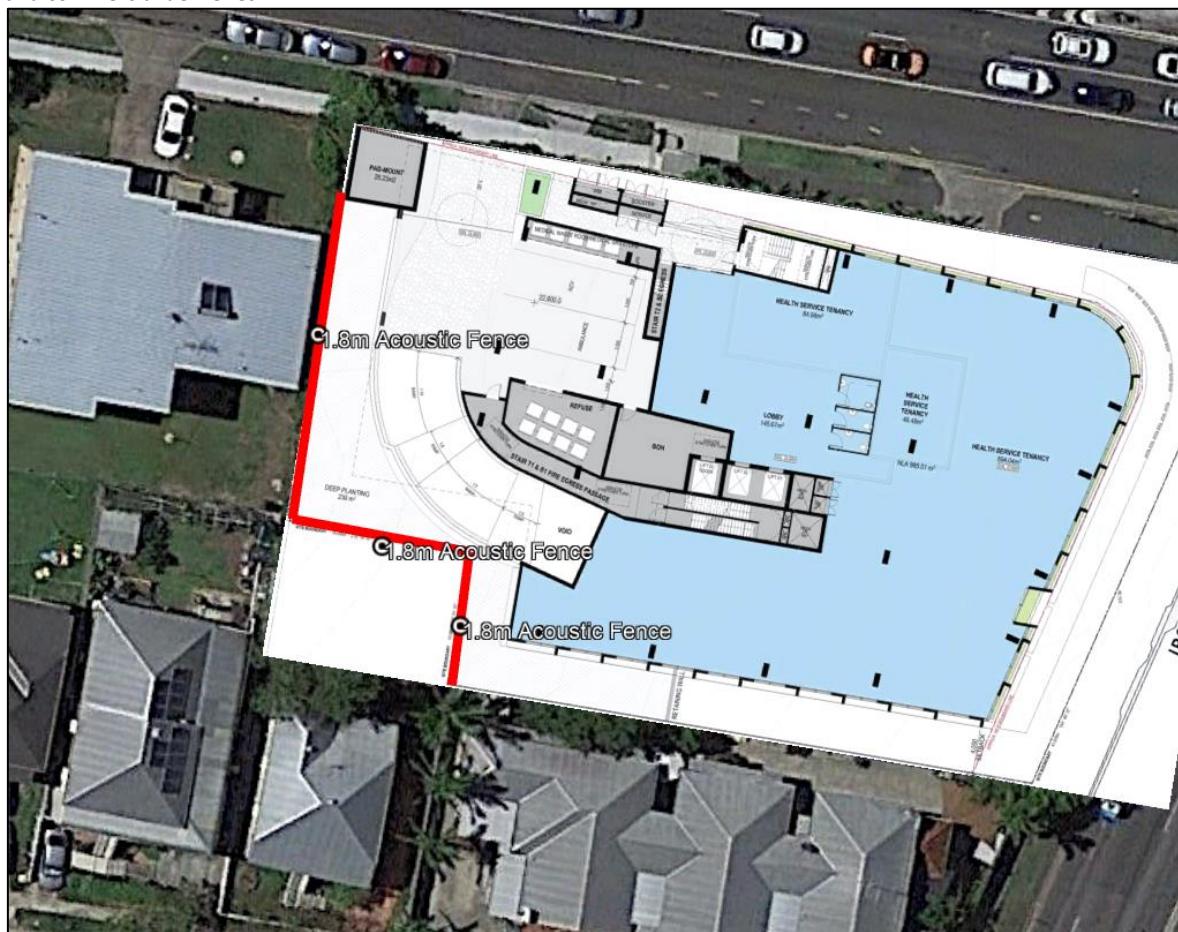
## 5.2 Proposed Noise Attenuation – Acoustic Screen

The vehicle movement areas are located adjacent to residential zone boundaries and multi-story dwellings. Screening of the vehicle movement areas would usually require acoustic fences be constructed along the residential zone boundaries, however this will not protect the amenity of the occupants in the upper floors of the adjacent dwellings.

Rather, this assessment includes alternative acoustic treatments to the vehicle entrance and carpark access to the building, creating a full height wall. This screens the delivery area, rubbish collection area and vehicle movements areas completely, protecting the amenity of upper floor occupants in the adjacent residential building(s). At least 15 dB(A) reduction is required from this proposed acoustic screen. This also allows for night-time operations.

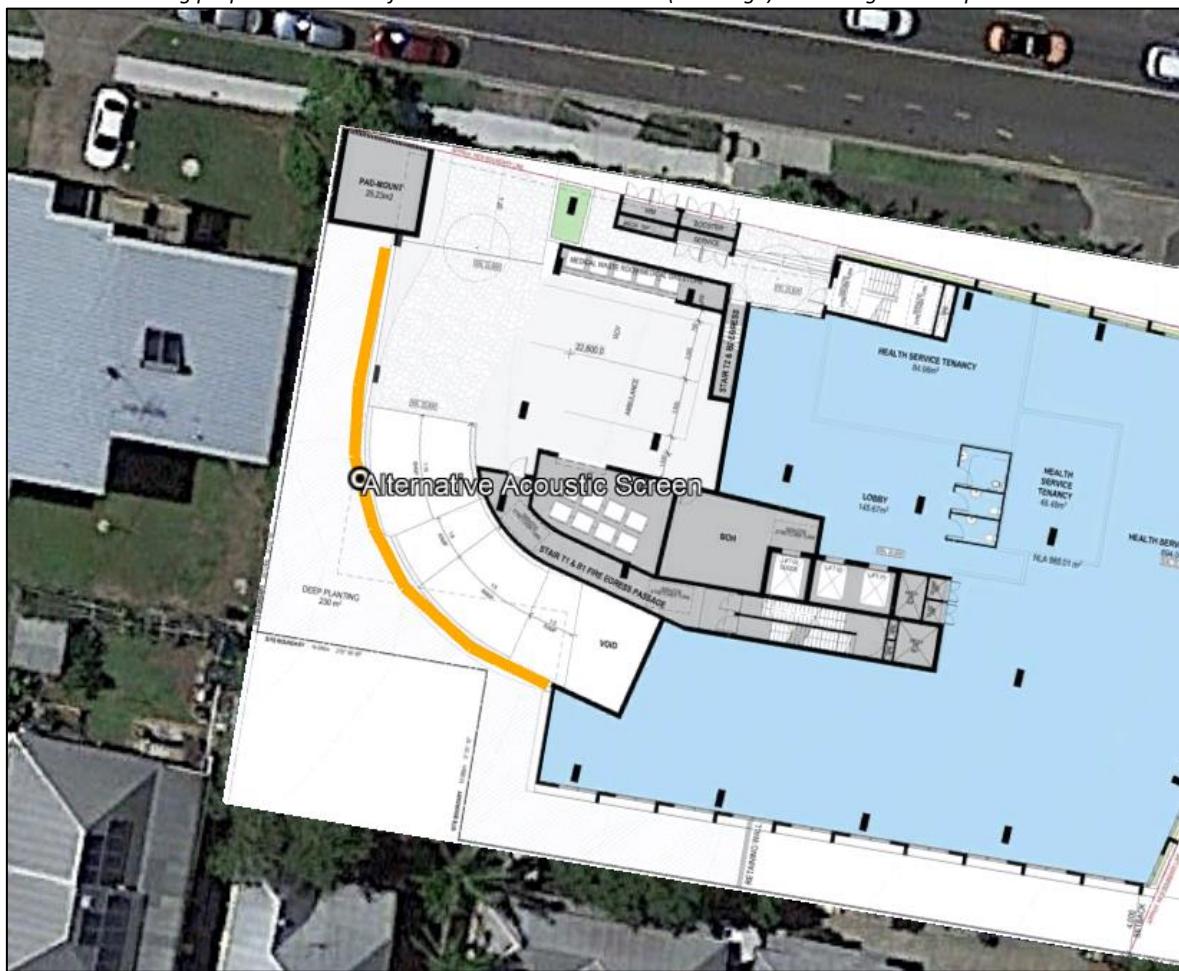
To be fully effective the screen or wall must extend the full height of the opening being screened. Landscaping of the wall or screen is recommended, associated with changes in design or style to reduce the visual effect of the facade.

**Plate 5.1:** Showing proposed location of acoustic fence (in red), however upper floors are not protected from vehicle noise and commercial deliveries.



The alternative proposed acoustic screen is shown in **Plate 5.2** following and is used in the following assessment.

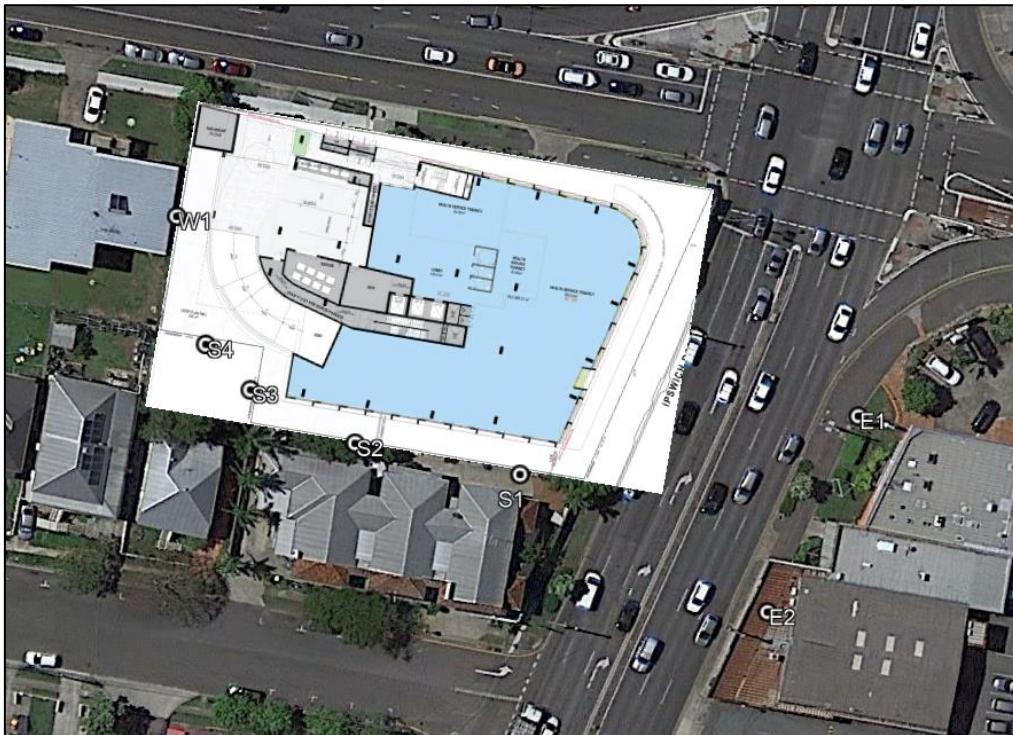
**Plate 5.2:** Showing proposed location of alternative acoustic screen (in orange) allows night time operations.



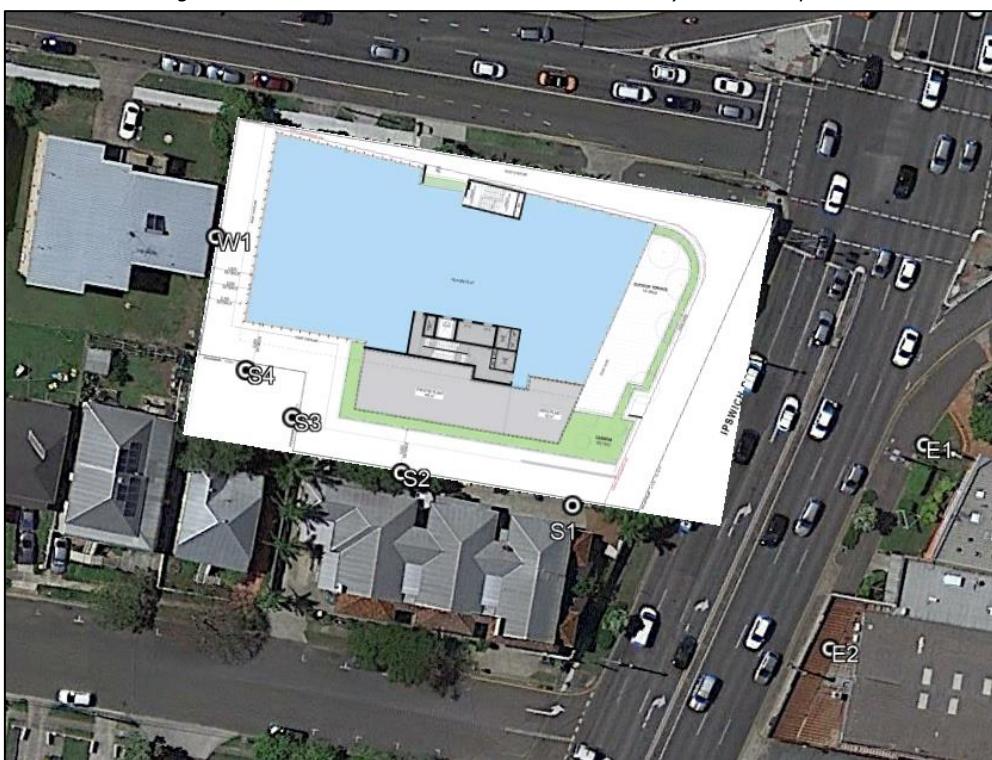
### 5.3 Point Receiver Locations

Noise impacts have been calculated to the nearest noise sensitive zone boundary shown below in **Plate 5.3** with the Level 01 plan shown and in **Plate 5.4** with the Level 05 plan shown. The receiver height is considered upper floor level for assessment purposes at 4.6 metres above ground level, and lower floor for the commercial buildings across Ipswich Road.

**Plate 5.3:** Showing the site and nearest noise sensitive zone boundary calculation points with Level 01 plan showing.



**Plate 5.4:** Showing the site and nearest noise sensitive zone boundary calculation points with Level 05 plan showing.



## 5.4 Environmental Noise Emissions

### 5.4.1 Noise Assessment Level 01 Vehicle Movements Daytime Leq Descriptor

For assessment purposes, typical noise emissions during the daytime include the following:

- 4 x Vehicles;
- 3 x Delivery or commercial vehicles.

The alternative acoustic screen enclosing the vehicle movement areas has been included in this assessment. Further information is presented in **Section 5.2**.

Rubbish collections are periodic and are considered separately.

The location of the point sources for noise modelling are presented in **Plate 5.5** below and an assessment to daytime criteria are presented in **Table 5.3** following and **Plate 5.6** following. Further noise model details are presented in **Appendix D**.

*Plate 5.5: Showing the Leq noise source locations for typical daytime operations.*



**Table 5.3a:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
DC E1	Cumulative	Daytime, Leq	14	0	53	Yes
DC E1	Car 1	Daytime, Leq	1	0	53	Yes
DC E1	Car 2	Daytime, Leq	3	0	53	Yes
DC E1	Car 3	Daytime, Leq	1	0	53	Yes
DC E1	Car 4	Daytime, Leq	2	0	53	Yes
DC E1	Delivery Vehicle 1	Daytime, Leq	7	0	53	Yes
DC E1	Delivery Vehicle 2	Daytime, Leq	8	0	53	Yes
DC E1	Delivery Vehicle 3	Daytime, Leq	8	0	53	Yes

**Table 5.3b:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
DC E2	Cumulative	Daytime, Leq	13	0	53	Yes
DC E2	Car 1	Daytime, Leq	2	0	53	Yes
DC E2	Car 2	Daytime, Leq	2	0	53	Yes
DC E2	Car 3	Daytime, Leq	3	0	53	Yes
DC E2	Car 4	Daytime, Leq	2	0	53	Yes
DC E2	Delivery Vehicle 1	Daytime, Leq	7	0	53	Yes
DC E2	Delivery Vehicle 2	Daytime, Leq	7	0	53	Yes
DC E2	Delivery Vehicle 3	Daytime, Leq	7	0	53	Yes

**Table 5.4.3c:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
S1 CR2	Cumulative	Daytime, Leq	18	3	50	Yes
S1 CR2	Car 1	Daytime, Leq	5	0	50	Yes
S1 CR2	Car 2	Daytime, Leq	6	0	50	Yes
S1 CR2	Car 3	Daytime, Leq	7	0	50	Yes
S1 CR2	Car 4	Daytime, Leq	8	0	50	Yes
S1 CR2	Delivery Vehicle 1	Daytime, Leq	11	0	50	Yes
S1 CR2	Delivery Vehicle 2	Daytime, Leq	12	0	50	Yes
S1 CR2	Delivery Vehicle 3	Daytime, Leq	12	0	50	Yes

**Table 5.3d:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
S2 CR2	Cumulative	Daytime, Leq	21	6	50	Yes
S2 CR2	Car 1	Daytime, Leq	7	0	50	Yes
S2 CR2	Car 2	Daytime, Leq	8	0	50	Yes
S2 CR2	Car 3	Daytime, Leq	10	0	50	Yes
S2 CR2	Car 4	Daytime, Leq	13	0	50	Yes
S2 CR2	Delivery Vehicle 1	Daytime, Leq	14	0	50	Yes
S2 CR2	Delivery Vehicle 2	Daytime, Leq	14	0	50	Yes
S2 CR2	Delivery Vehicle 3	Daytime, Leq	15	0	50	Yes

**Table 5.3e:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
S3 CR2	Cumulative	Daytime, Leq	53	38	50	Yes
S3 CR2	Car 1	Daytime, Leq	40	25	50	Yes
S3 CR2	Car 2	Daytime, Leq	42	27	50	Yes
S3 CR2	Car 3	Daytime, Leq	47	32	50	Yes
S3 CR2	Car 4	Daytime, Leq	50	35	50	Yes
S3 CR2	Delivery Vehicle 1	Daytime, Leq	15	0	50	Yes
S3 CR2	Delivery Vehicle 2	Daytime, Leq	16	1	50	Yes
S3 CR2	Delivery Vehicle 3	Daytime, Leq	17	2	50	Yes

**Table 5.3f:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
S4 CR2	Cumulative	Daytime, Leq	54	39	50	Yes
S4 CR2	Car 1	Daytime, Leq	42	27	50	Yes
S4 CR2	Car 2	Daytime, Leq	45	30	50	Yes
S4 CR2	Car 3	Daytime, Leq	51	36	50	Yes
S4 CR2	Car 4	Daytime, Leq	48	33	50	Yes
S4 CR2	Delivery Vehicle 1	Daytime, Leq	16	1	50	Yes
S4 CR2	Delivery Vehicle 2	Daytime, Leq	17	2	50	Yes
S4 CR2	Delivery Vehicle 3	Daytime, Leq	18	3	50	Yes

**Table 5.3g:** Forecast noise emissions for typical daytime noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
W1 LMR3	Cumulative	Daytime, Leq	48	43	51	Yes
W1 LMR3	Car 1	Daytime, Leq	51	33	51	Yes
W1 LMR3	Car 2	Daytime, Leq	47	36	51	Yes
W1 LMR3	Car 3	Daytime, Leq	43	32	51	Yes
W1 LMR3	Car 4	Daytime, Leq	50	28	51	Yes
W1 LMR3	Delivery Vehicle 1	Daytime, Leq	50	35	51	Yes
W1 LMR3	Delivery Vehicle 2	Daytime, Leq	50	35	51	Yes
W1 LMR3	Delivery Vehicle 3	Daytime, Leq	48	35	51	Yes

With proposed enclosure of the vehicle movement areas (See **Plate 5.2**), vehicle movements, including regular deliveries, are forecast to comply with daytime criteria at noise sensitive zone boundaries.

**Plate 5.6:** Daytime Leq noise contours Level 01, with acoustic screen. Levels are in Leq, dB(A), free field.



#### 5.4.2 Noise Assessment Level 01 Vehicle Movements Evening / Night Leq Descriptor

For assessment purposes, typical noise emissions during the daytime include the following:

- 2 x Vehicles;
- 1 x Commercial or emergency vehicle.

The alternative acoustic screen enclosing the vehicle movement areas has been included in this assessment. Further information is presented in **Section 5.2**.

Rubbish collections should not be conducted during the evening or night time periods.

The location of the point sources for noise modelling are presented in **Plate 5.7** below and an assessment to daytime criteria are presented in **Table 5.4** following and **Plate 5.8** following. Further noise model details are presented in **Appendix D**.

**Plate 5.7:** Showing the Leq noise source locations for vehicle movement during the evening or night time hours.



**Table 5.4a:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
DC E1	Cumulative	Even/Night, Leq	9	0	53/46	Yes Yes
DC E1	Car 2	Even/Night, Leq	3	0	53/46	Yes Yes
DC E1	Car 3	Even/Night, Leq	1	0	53/46	Yes Yes
DC E1	Delivery Vehicle 1	Even/Night, Leq	8	0	53/46	Yes Yes

**Table 5.4b:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
DC E2	Cumulative	Even/Night, Leq	9	0	53/46	Yes Yes
DC E2	Car 2	Even/Night, Leq	2	0	53/46	Yes Yes
DC E2	Car 3	Even/Night, Leq	3	0	53/46	Yes Yes
DC E2	Delivery Vehicle 1	Even/Night, Leq	7	0	53/46	Yes Yes

**Table 5.4c:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
S1 CR2	Cumulative	Even/Night, Leq	13	0	45/40	Yes Yes
S1 CR2	Car 2	Even/Night, Leq	5	0	45/40	Yes Yes
S1 CR2	Car 3	Even/Night, Leq	6	0	45/40	Yes Yes
S1 CR2	Delivery Vehicle 1	Even/Night, Leq	12	0	45/40	Yes Yes

**Table 5.4d:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
S2 CR2	Cumulative	Even/Night, Leq	16	1	45/40	Yes Yes
S2 CR2	Car 2	Even/Night, Leq	8	0	45/40	Yes Yes
S2 CR2	Car 3	Even/Night, Leq	10	0	45/40	Yes Yes
S2 CR2	Delivery Vehicle 1	Even/Night, Leq	14	0	45/40	Yes Yes

**Table 5.4e:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
S3 CR2	Cumulative	Even/Night, Leq	49	34	45/40	Yes No
S3 CR2	Car 2	Even/Night, Leq	43	28	45/40	Yes Yes
S3 CR2	Car 3	Even/Night, Leq	47	32	45/40	Yes Yes
S3 CR2	Delivery Vehicle 1	Even/Night, Leq	16	1	45/40	Yes Yes

**Table 5.4f:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
S4 CR2	Cumulative	Even/Night, Leq	53	38	45/40	Yes Yes
S4 CR2	Car 2	Even/Night, Leq	45	30	45/40	Yes Yes
S4 CR2	Car 3	Even/Night, Leq	52	37	45/40	Yes No
S4 CR2	Delivery Vehicle 1	Even/Night, Leq	17	2	45/40	Yes Yes

**Table 5.4g:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Even/Night Leq	Compliance Even/Night
W1 LMR3	Cumulative	Even/Night, Leq	55	40	45/40	Yes Yes
W1 LMR3	Car 2	Even/Night, Leq	52	37	45/40	Yes Yes
W1 LMR3	Car 3	Even/Night, Leq	48	33	45/40	Yes Yes
W1 LMR3	Delivery Vehicle 1	Even/Night, Leq	50	35	45/40	Yes Yes

With proposed enclosure of the vehicle movement areas (See **Plate 5.2**), vehicle movements, including regular deliveries, are forecast to comply with evening and night time criteria at noise sensitive zone boundaries.

**Plate 5.8:** Evening and Night-time Leq noise contours, with acoustic screen. Levels are in Leq, dB(A), free field.



### 5.4.3 Noise Assessment Level 01 Daytime Rubbish Collection Leq Descriptor

For assessment purposes, typical noise emissions during rubbish collection include the following:

- 1 x Rubbish collection truck.

The alternative acoustic screen enclosing the vehicle movement areas has been included in this assessment. Further information is presented in **Section 5.2**.

Rubbish collections are avoided during evening and night-time hours.

The location of the point sources for noise modelling are presented in **Plate 5.9** below and an assessment to daytime criteria are presented in **Table 5.5** following and **Plate 5.10** following. Further noise model details are presented in **Appendix D**.

**Plate 5.9:** Showing the Leq noise source locations for rubbish collection.



**Table 5.5a:** Forecast noise emissions for typical night-time noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Day Leq	Daytime Compliance
DC E1	Rubbish Truck	Leq (15m)	16	1	53	Yes
E2 DC	Rubbish Truck	Leq (15m)	15	0	53	Yes
S1 CR2	Rubbish Truck	Leq (15m)	19	4	50	Yes
S2 CR2	Rubbish Truck	Leq (15m)	21	6	50	Yes
S3 CR2	Rubbish Truck	Leq (15m)	24	9	50	Yes
S4 CR2	Rubbish Truck	Leq (15m)	58	43	50	Yes
W1 LMR3	Rubbish Truck	Leq (15m)	62	47	51	Yes

With proposed enclosure of the vehicle movement areas (See **Plate 5.2**), rubbish collection is forecast to comply with daytime criteria at noise sensitive zone boundaries.

**Plate 5.10:** Rubbish collection noise contours with acoustic treatment. Levels are in Leq, dB(A), free field.

#### 5.4.4 Noise Assessment Level 01 Vehicle Movements Night Max Descriptor

For assessment purposes, typical noise emissions during the daytime include the following:

- 2 x Vehicle door slams;
- 1 x Commercial or emergency vehicle reversing.

The alternative acoustic screen enclosing the vehicle movement areas has been included in this assessment. Further information is presented in **Section 5.2**.

Rubbish collections should not be conducted during the evening or night time periods.

The location of the point sources for noise modelling are presented in **Plate 5.11** below and an assessment to daytime criteria are presented in **Table 5.6** following and **Plate 5.12** following. Further noise model details are presented in **Appendix D**.

**Plate 5.11:** Showing the L<sub>eq</sub> noise source locations for vehicle movement during the evening or night time hours.



**Table 5.6a:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Night-time Compliance
DC E1	Cumulative	Night, Lmax	20	5	65	Yes
DC E1	Door Slam 1	Night, Lmax	18	3	65	Yes
DC E1	Door Slam 2	Night, Lmax	18	3	65	Yes
DC E1	Reverse Beeper	Night, Lmax	20	5	65	Yes

**Table 5.6b:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Night-time Compliance
DC E2	Cumulative	Night, Lmax	20	5	65	Yes
DC E2	Door Slam 1	Night, Lmax	17	2	65	Yes
DC E2	Door Slam 2	Night, Lmax	17	2	65	Yes
DC E2	Reverse Beeper	Night, Lmax	20	5	65	Yes

**Table 5.6c:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Night-time Compliance
S1 CR2	Cumulative	Night, Lmax	22	7	60	Yes
S1 CR2	Door Slam 1	Night, Lmax	22	7	60	Yes
S1 CR2	Door Slam 2	Night, Lmax	22	7	60	Yes
S1 CR2	Reverse Beeper	Night, Lmax	22	7	60	Yes

**Table 5.6d:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Night-time Compliance
S2 CR2	Cumulative	Night, Lmax	25	10	60	Yes
S2 CR2	Door Slam 1	Night, Lmax	24	9	60	Yes
S2 CR2	Door Slam 2	Night, Lmax	25	10	60	Yes
S2 CR2	Reverse Beeper	Night, Lmax	24	9	60	Yes

**Table 5.6e:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Night-time Compliance
S3 CR2	Cumulative	Night, Lmax	27	12	60	Yes
S3 CR2	Door Slam 1	Night, Lmax	26	11	60	Yes
S3 CR2	Door Slam 2	Night, Lmax	27	12	60	Yes
S3 CR2	Reverse Beeper	Night, Lmax	26	11	60	Yes

**Table 5.6f:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

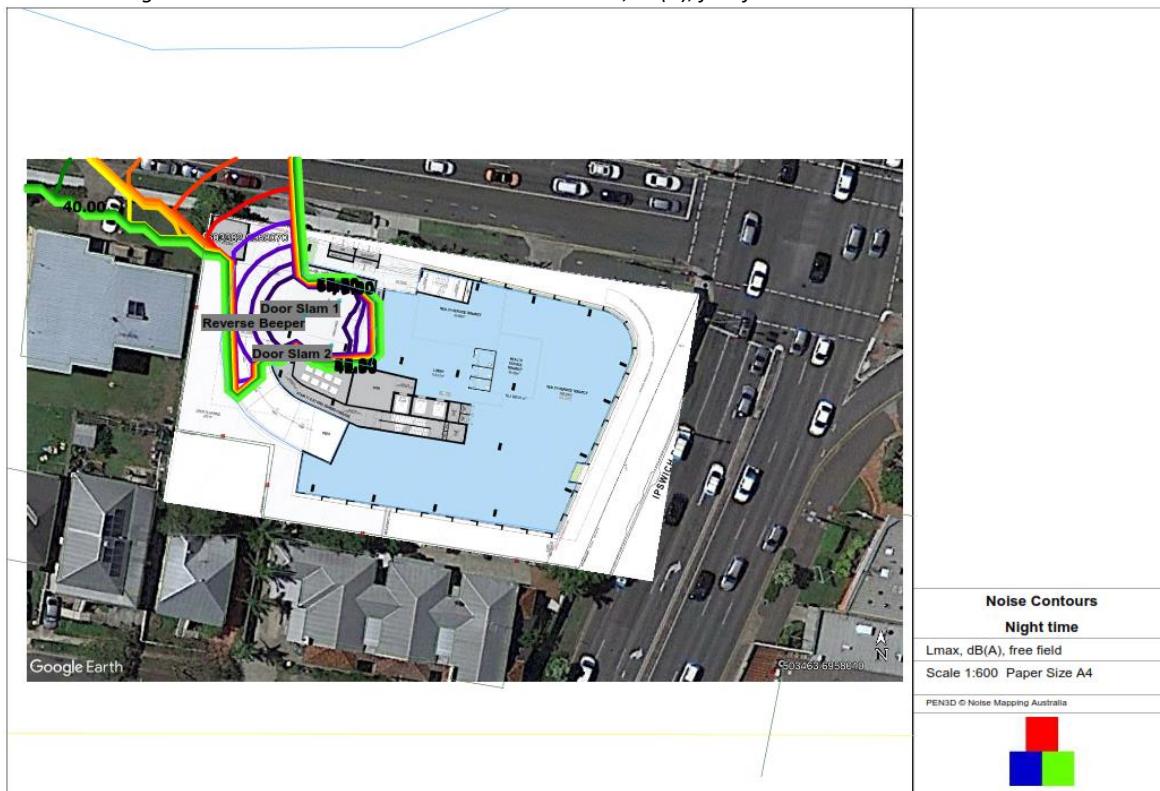
Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Daytime Compliance Even/Night
S4 CR2	Cumulative	Night, Lmax	27	12	60	Yes
S4 CR2	Door Slam 1	Night, Lmax	27	12	60	Yes
S4 CR2	Door Slam 2	Night, Lmax	27	12	60	Yes
S4 CR2	Reverse Beeper	Night, Lmax	27	12	60	Yes

**Table 5.6g:** Forecast noise emissions for typical night noise emissions and criteria. Levels are in Lmax, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted -15dB(A) Acoustic Screen	Criteria Night Lmax	Daytime Compliance Even/Night
W1 LMR3	Cumulative	Night, Lmax	69	54	60	Yes
W1 LMR3	Door Slam 1	Night, Lmax	59	44	60	Yes
W1 LMR3	Door Slam 2	Night, Lmax	59	44	60	Yes
W1 LMR3	Reverse Beeper	Night, Lmax	69	54	60	Yes

With proposed enclosure of the vehicle movement areas (See **Plate 5.2**), maximum sound levels from vehicle movements, including regular deliveries, are forecast to comply with night time criteria at noise sensitive zone boundaries.

**Plate 5.12:** Night-time Lmax noise contours. Levels are in Lmax, dB(A), free field.



#### 5.4.5 Noise Assessment Level 05 Plant Deck and Open Terrace Day and Night Leq Descriptor

For assessment purposes, typical noise emissions during the daytime include the following:

- 6 x Theatre plant;
- 6 x Mechanical plant;
- 4 x Group of 10 people in open terrace and garden.

A solid balustrade is recommended around the outdoor terrace and gardens on Level 05. The solid balustrade reduces road traffic noise in these areas and can reduce plant noise at lower levels at noise sensitive boundaries. The location of the proposed solid balustrade is shown in **Plate 4.7** in **Section 4.3** of this report.

The receiver height is considered upper floor level for assessment purposes at 4.6 metres above ground level, and lower floor for the commercial buildings across Ipswich Road.

The location of the point sources for noise modelling are presented in **Plate 5.13** below and an assessment to daytime criteria are presented in **Table 5.7** following and **Plate 5.14** following. Further noise model details are presented in **Appendix D**.

**Plate 5.7:** Showing the Leq noise source locations for vehicle movement during the evening or night time hours.



**Table 5.7a:** Forecast noise emissions for typical day/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
DC E1	Cumulative	Day/Night, Leq	34	-	53/46	Yes Yes
DC E1	Theatre Plant	Day/Night, Leq	21	-	53/46	Yes Yes
DC E1	Mechanical Plant	Day/Night, Leq	25	-	53/46	Yes Yes
DC E1	Crowd of 10	Day/Night, Leq	19	-	53/46	Yes Yes

**Table 5.7b:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
DC E2	Cumulative	Day/Night, Leq	35	-	53/46	Yes Yes
DC E2	Theatre Plant	Day/Night, Leq	24	-	53/46	Yes Yes
DC E2	Mechanical Plant	Day/Night, Leq	25	-	53/46	Yes Yes
DC E2	Crowd of 10	Day/Night, Leq	20	-	53/46	Yes Yes

**Table 5.7c:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
S1 CR2	Cumulative	Day/Night, Leq	38	-	50/40	Yes Yes
S1 CR2	Theatre Plant	Day/Night, Leq	27	-	50/40	Yes Yes
S1 CR2	Mechanical Plant	Day/Night, Leq	30	-	50/40	Yes Yes
S1 CR2	Crowd of 10	Day/Night, Leq	21	-	50/40	Yes Yes

**Table 5.7d:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
S2 CR2	Cumulative	Day/Night, Leq	39	-	50/40	Yes Yes
S2 CR2	Theatre Plant	Day/Night, Leq	31	-	50/40	Yes Yes
S2 CR2	Mechanical Plant	Day/Night, Leq	28	-	50/40	Yes Yes
S2 CR2	Crowd of 10	Day/Night, Leq	17	-	50/40	Yes Yes

**Table 5.7e:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
S3 CR2	Cumulative	Day/Night, Leq	36	-	50/40	Yes No
S3 CR2	Theatre Plant	Day/Night, Leq	30	-	50/40	Yes Yes
S3 CR2	Mechanical Plant	Day/Night, Leq	21	-	50/40	Yes Yes
S3 CR2	Crowd of 10	Day/Night, Leq	9	-	50/40	Yes Yes

**Table 5.7f:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
S4 CR2	Cumulative	Day/Night, Leq	37	-	50/40	Yes Yes
S4 CR2	Theatre Plant	Day/Night, Leq	31	-	50/40	Yes Yes
S4 CR2	Mechanical Plant	Day/Night, Leq	22	-	50/40	Yes No
S4 CR2	Crowd of 10	Day/Night, Leq	9	-	50/40	Yes Yes

**Table 5.7g:** Forecast noise emissions for typical evening/night noise emissions and criteria. Levels are in Leq, dB(A), free field.

Zone Boundary Receiver	Noise Source	Descriptor	Forecast (or Highest Component)	Adjusted	Criteria Day/Night Leq	Compliance Day/Night
W1 LMR3	Cumulative	Day/Night, Leq	23	-	51/40	Yes Yes
W1 LMR3	Theatre Plant	Day/Night, Leq	14	-	51/40	Yes Yes
W1 LMR3	Mechanical Plant	Day/Night, Leq	11	-	51/40	Yes Yes
W1 LMR3	Crowd of 10	Day/Night, Leq	0	-	51/40	Yes Yes

With the proposed solid balustrades, forecast sound levels from plant and equipment are forecast to comply with the daytime (and evening) and night-time criteria and noise sensitive zone boundaries, at upper floor level (4.6m) on the boundary. It is not known the type of mechanical plant at this stage, and it is recommended that the detailed assessment be conducted at the Building Approval stage. See **Section 5.5** following for discussion.

**Plate 5.14:** Plant and crowd noise Leq noise contours, (at 4.6m above ground), anytime. Levels are in Leq, dB(A), free field.

## 5.5 Mechanical Plant and Air Conditioning

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It is expected that the development will incorporate many types of mechanical plant for the medical theatre and for air conditioning, although the precise equipment and siting is not known at this stage. The development design provides numerous locations where plant would be fully screened or substantially setback from nearby sensitive uses, and the applicable criteria area considered to be readily achievable through appropriate plant siting. Detailed assessment of plant can be conducted – if required – at the Building Approval stage once the specific model and installation of plant can be determined.

## 6. Conclusions and Recommendations

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### 6.1 Conclusions

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It is concluded that-

- Subject to the considerations and recommendations as set out in this Report, it is the opinion of this consultancy that the proposed development can meet the requirements of the Department of State Development, Infrastructure, Local Government and Planning, the Department of Transport and Main Roads and Brisbane City Plant 2014, and be otherwise compliant with relevant regulatory requirements with proposed attenuation measures as discussed in this assessment and summarised following.
- The development site and locality are exposed to substantial levels of road traffic noise from the Ipswich Road and Cornwall Street, which is identified as the dominant noise source in the area.
- The external façade transport noise levels cannot meet the DTMR primary (external) façade criteria. Amenity for the occupants of the Health Care facility can be protected by achieving the *Secondary (internal) noise criteria for new sensitive development*.
- Amenity for the occupants of the Health Care facility can be protected by achieving the DTMR *Secondary (internal) noise criteria for new sensitive development*. The minimum  $R_w$  for building components are presented in **Section 4.2** and summarised in **Table 6.1** following.
- Under the design calculations external doors and windows are closed for noise mitigation. There is a need for alternative ventilation to sensitive (such as patient care) areas, most commonly mechanical ventilation or air-conditioning.
- The communal open (outdoor terrace and gardens) area on Level 5 can meet the DTMR environment criteria for passive recreation. Solid Balustrades are recommended. The location of the solid balustrade is illustrated in **Section 4.3** and **Plate 6.1** following.
- Screening is required to protect adjacent residential zone boundaries from noise emissions from vehicle movement areas and commercial vehicle and emergency vehicle parking areas near the vehicle entrance on Cornwall Street. With proposed enclosure of the vehicle movement areas, vehicle movements, including regular deliveries, are forecast to comply with day evening and night time criteria at noise sensitive zone boundaries. The proposed acoustic treatments are presented in **Section 5.2** and **Plate 6.2** following.
- Noise emissions from the proposed Multi Use Service Centre, can be reduced at the boundary of the existing noise sensitive commercial uses by construction an acoustic fence or barrier. The proposed location of the acoustic fence is shown in Plate ES1 below and is included in the following assessment.
- Cumulative noise emissions from all proposed activities are forecast to meet criteria at residential and commercial zone boundaries, with proposed acoustic treatments.
- On this basis, it is concluded that the development can meet the residential Noise Emissions Standards for 24 hour operation for care services, and daytime operation hours for patients.

## 6.2 Recommendations

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It is recommended that-

- A solid balustrade be provided around the outdoor terrace and gardens on Level 05. The solid balustrade reduces road traffic noise in these areas and lowers the  $R_w$  requirements for building façade components. The location of the proposed solid balustrade is shown in **Plate 4.7** and **Plate ES1** below.
- Acoustic treatments to the vehicle entrance and carpark access to the building on Level 01, be considered. The proposed design is to create a height wall in the location illustrated in **Plate 5.2** and **Plate ES2** following. This will screen the adjected residential zone boundaries and upper floor occupants of the dwellings on these Lots from delivery area, rubbish collection area and vehicle movements areas, protecting the amenity. At least 15 dB(A) reduction is required from this proposed acoustic screen or wall. This also allows for night-time operations. To be fully effective the screen or wall must extend the full height of the opening being screened. Landscaping of the wall or screen is recommended, associated with changes in design or style to reduce the visual effect of the facade.
- The precise type and siting of mechanical plant is not known at this stage. Detailed plant noise assessment can be conducted – if required – at the Building Approval stage, although ready compliance with criteria is expected without additional acoustic treatment.
- With the acoustic treatments implemented above, the proposed hours of operation for 24 hours, 7 days per week and operating hours for patients are between 7:00 AM and 6:00 PM Monday to Friday be approved.

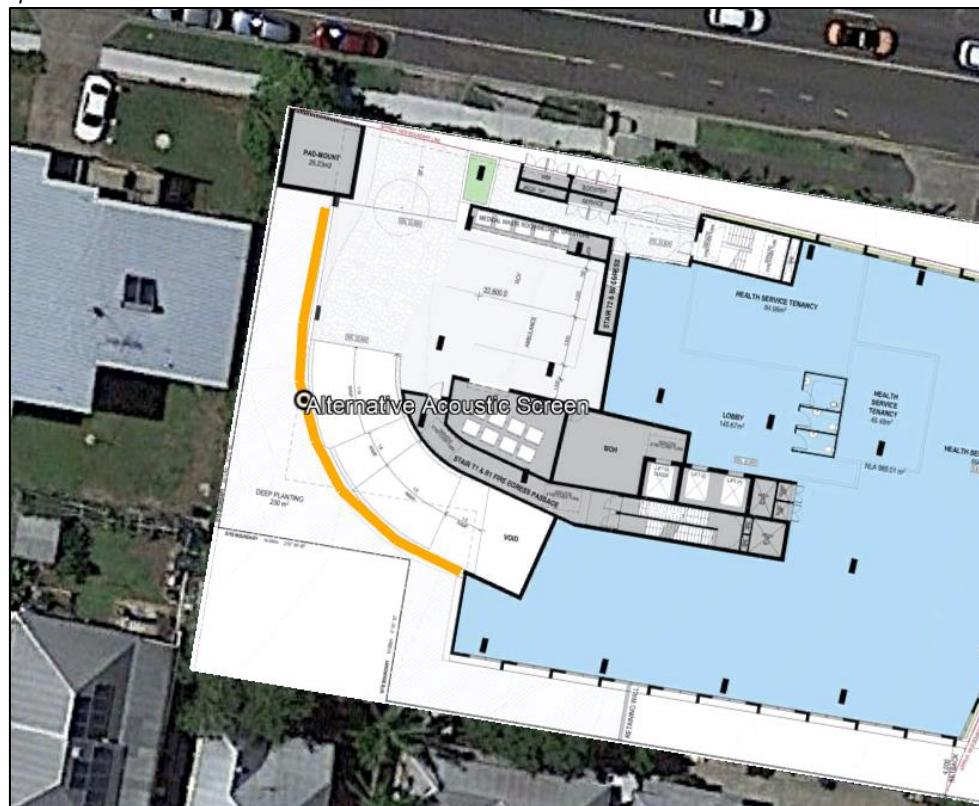
**Table 6.1:** Indicative  $R_w$  values for various construction elements.

Floor	Room	Element	Facing	Ext Leq dB(A)	AS2107 criteria	TNR	Element (Sc) area	Floor (Sf) area	Height (m)	RT60 (s)	C	TNAC	Calc STC/Rw
LG	Health Service Tenancy	All glass façade	N,E	74	35	39	139.7	255.0	3.6	1.0	2	42	48
L01	Lobby	Glass Sliding Door	N	71	35	36	12.6	145.0	3.0	1.0	2	31	37
L01	Health Service Tenancy	Window	N	75	35	40	7.2	85.0	3.0	1.0	2	35	41
L01	Health Service Tenancy	All glass façade	N,E	77	35	42	156.0	604.0	3.0	1.0	2	42	48
L01	Health Service Tenancy	All glass façade	S	70	35	35	108.0	604.0	3.0	1.0	2	34	40
L02	Tennancy	All glass façade	N1	75	35	40	117.0	260.0	4.5	1.0	2	41	47
L02	Tennancy	All glass façade	N2	75	35	40	117.0	260.0	4.5	1.0	2	41	47
L02	Tennancy	All glass façade	E	77	35	42	243.0	604.0	4.5	1.0	2	42	48
L02	Tennancy	All glass façade	S1	73	35	38	166.5	260.0	4.5	1.0	2	40	46
L02	Tennancy	All glass façade	W1	43	35	8	45.0	260.0	4.5	1.0	2	5	11
L02	Tennancy	All glass façade	S2	53	35	18	63.0	260.0	4.5	1.0	2	16	22
L02	Tennancy	All glass façade	W2	68	35	33	117.0	260.0	4.5	1.0	2	34	40
L03	Tennancy	All glass façade	N1	75	35	40	98.8	260.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	N2	75	35	40	98.8	260.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	E	76	35	41	205.2	604.0	3.8	1.0	2	41	47
L03	Tennancy	All glass façade	S1	73	35	38	140.6	260.0	3.8	1.0	2	40	46
L03	Tennancy	All glass façade	W1	44	35	9	38.0	260.0	3.8	1.0	2	6	12
L03	Tennancy	All glass façade	S2	60	35	25	53.2	260.0	3.8	1.0	2	23	29
L03	Tennancy	All glass façade	W2	68	35	33	98.8	260.0	3.8	1.0	2	34	40
L04	Tennancy	All glass façade	N1	74	35	39	98.8	260.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	N2	74	35	39	98.8	260.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	E	75	35	40	205.2	604.0	3.8	1.0	2	40	46
L04	Tennancy	All glass façade	S1	72	35	37	140.6	260.0	3.8	1.0	2	39	45
L04	Tennancy	All glass façade	W1	46	35	11	38.0	260.0	3.8	1.0	2	8	14
L04	Tennancy	All glass façade	S2	61	35	26	53.2	260.0	3.8	1.0	2	24	30
L04	Tennancy	All glass façade	W2	69	35	34	98.8	260.0	3.8	1.0	2	35	41
L05	Tennancy	All glass façade	N1	74	35	39	72.2	260.0	3.8	1.0	2	38	44
L05	Tennancy	All glass façade	N2	74	35	39	64.6	260.0	3.8	1.0	2	38	44
L05	Tennancy	All glass façade/Glass	E	57	35	22	83.6	260.0	3.8	1.0	2	22	28
L05	Tennancy	All glass façade / Mechanical Plant Deck	S1	75	35	40	140.6	260.0	3.8	1.0	2	42	48
L05	Tennancy	All glass façade/Near Theatre Plant	S2	70	35	35	38.0	260.0	3.8	1.0	2	32	38
L05	Tennancy	All glass façade	W	69	35	34	91.2	260.0	3.8	1.0	2	34	40
All	Tennancy	External Wall	W	77	35	42	91.2	260.0	3.8	1.0	2	42	48

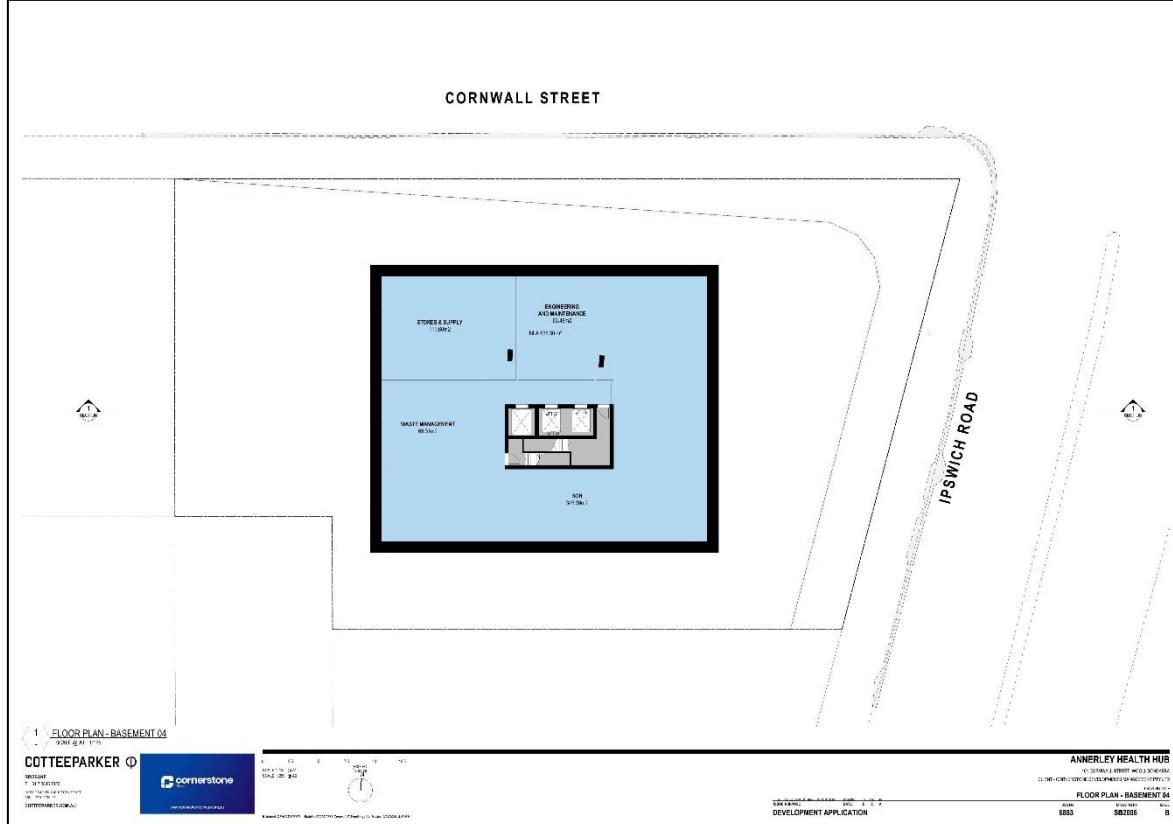
**Plate 6.1:** Showing the location of the proposed solid balustrade in red.

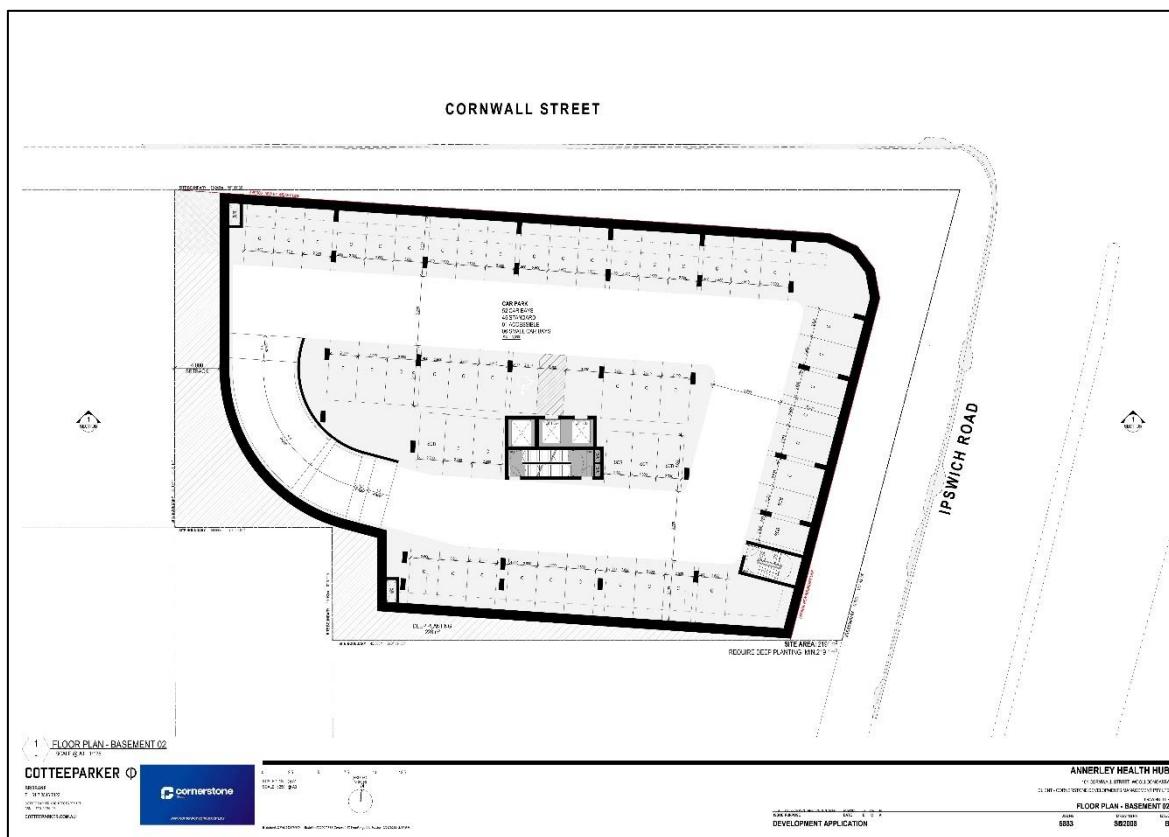
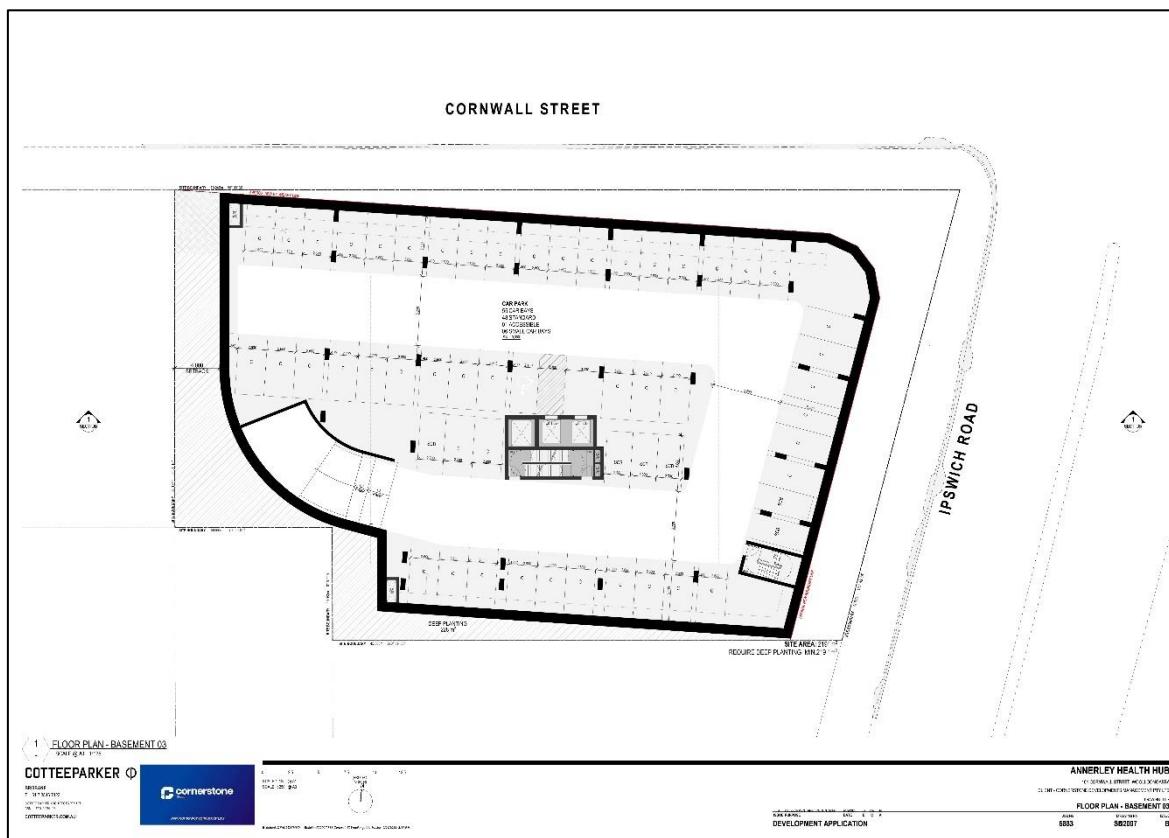


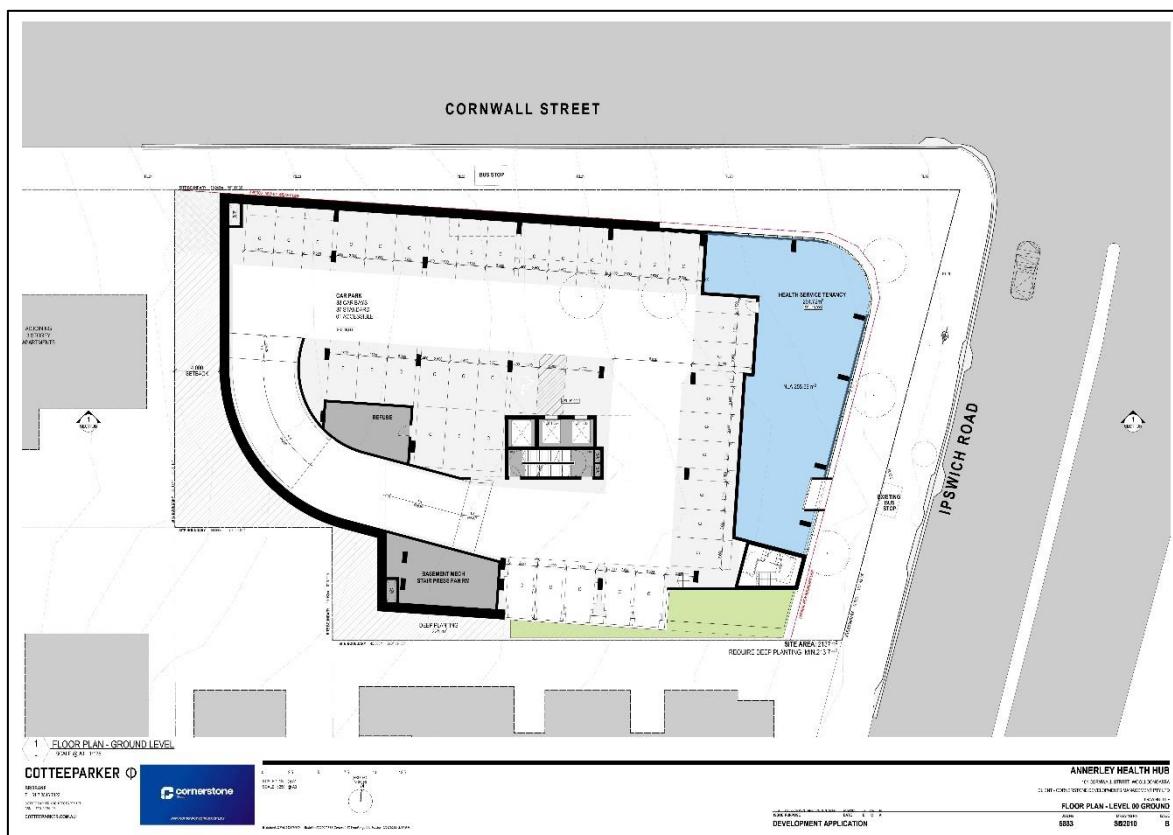
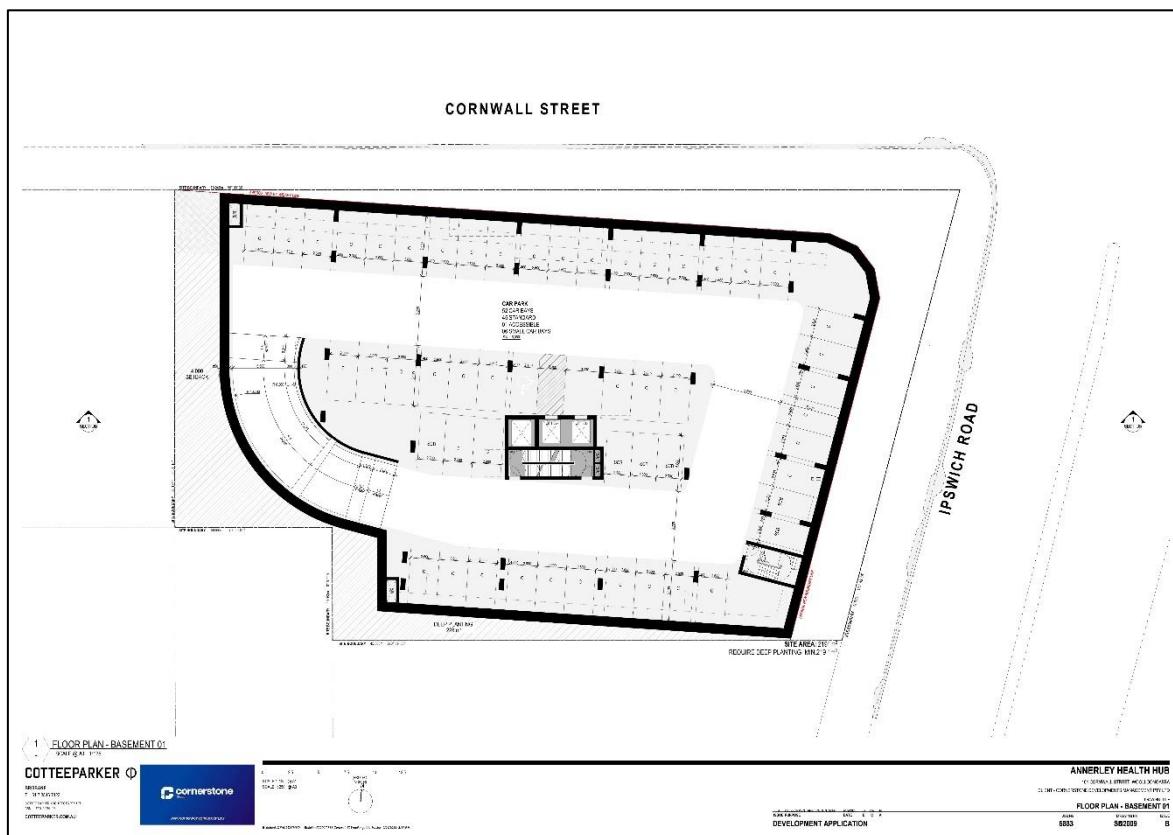
**Plate 6.2:** Showing proposed location of alternative acoustic screen or wall (in orange) allows night time operations.

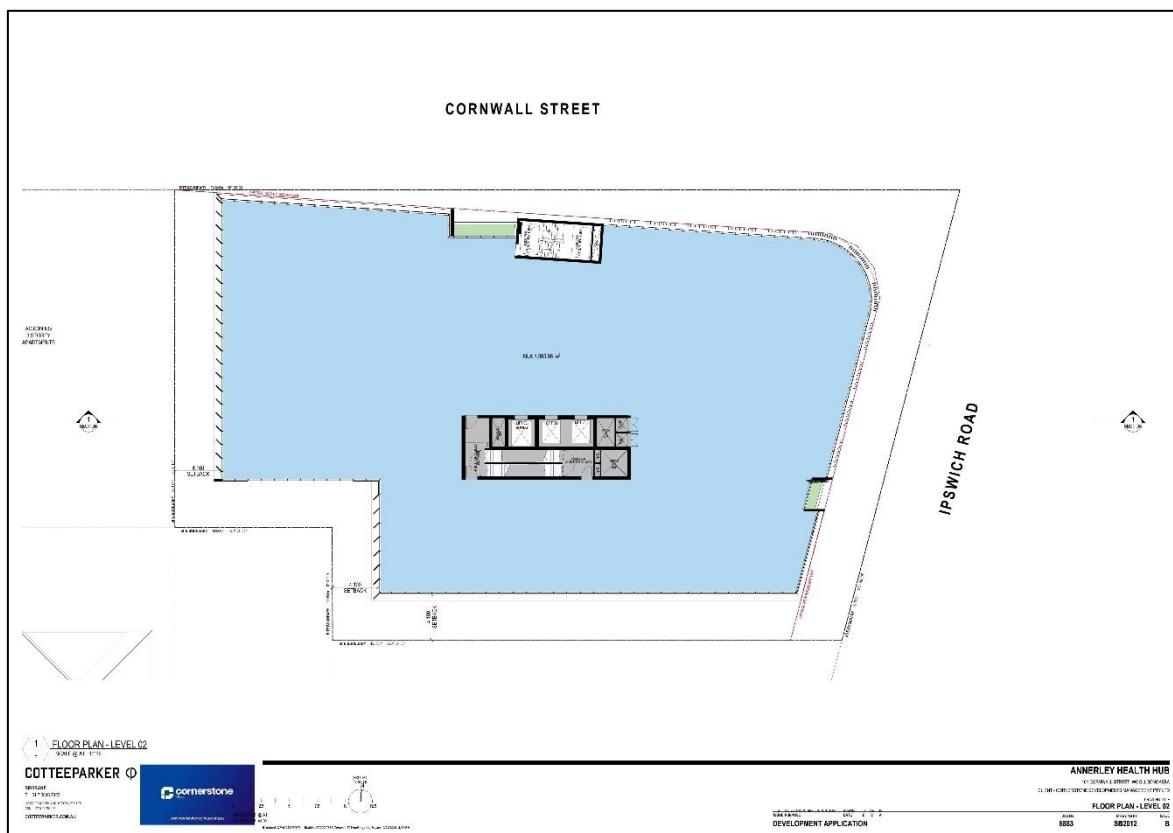
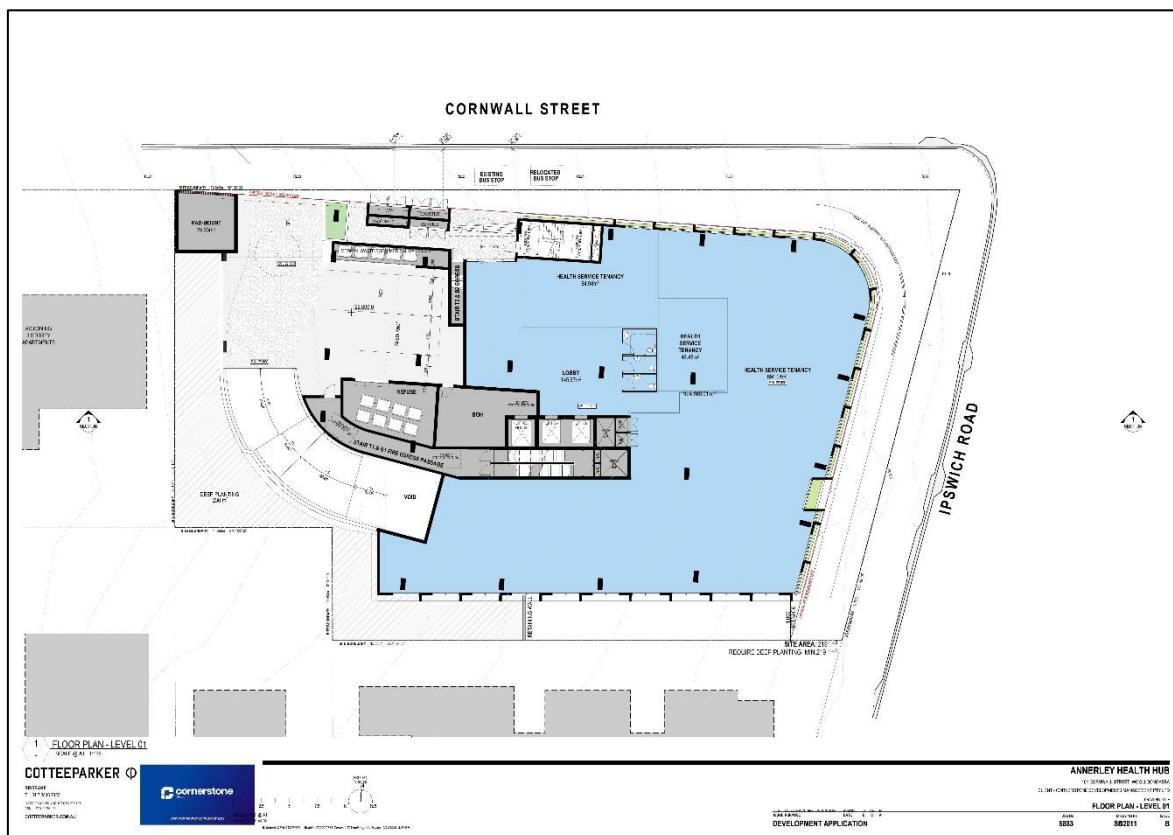


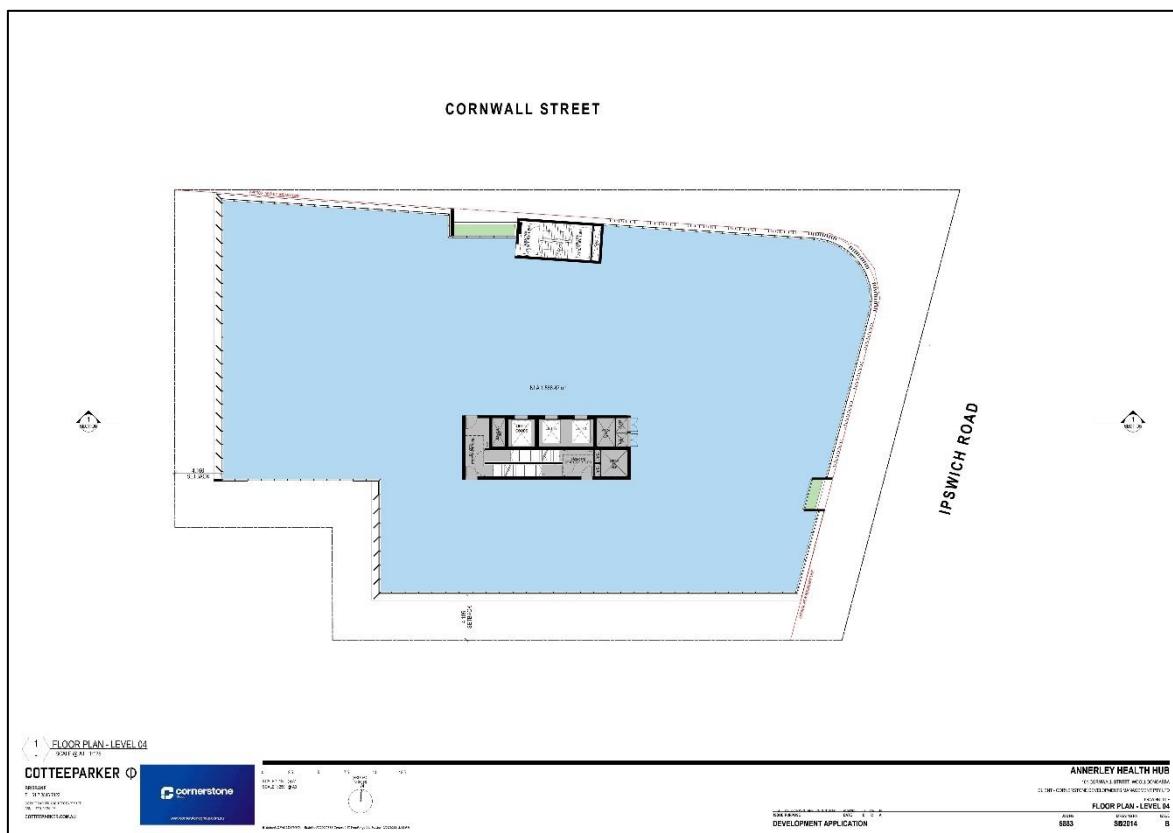
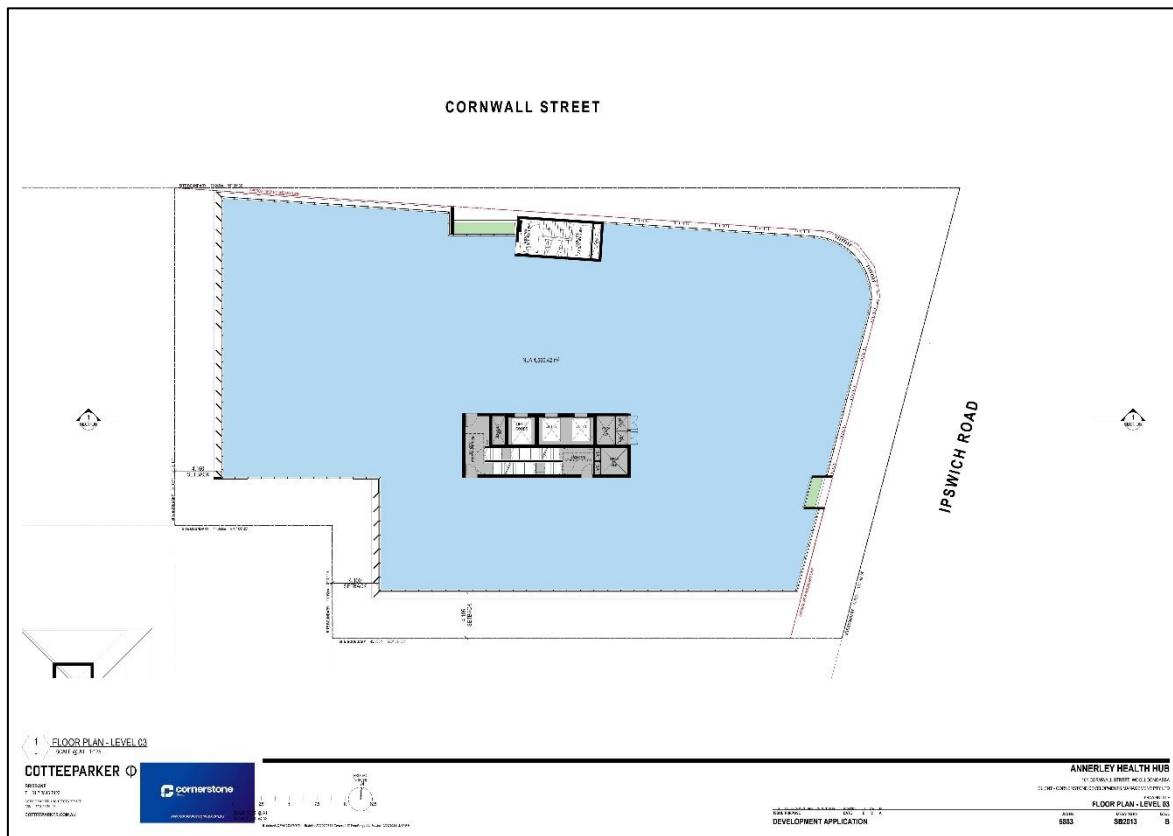
## Appendix A: Development Plans

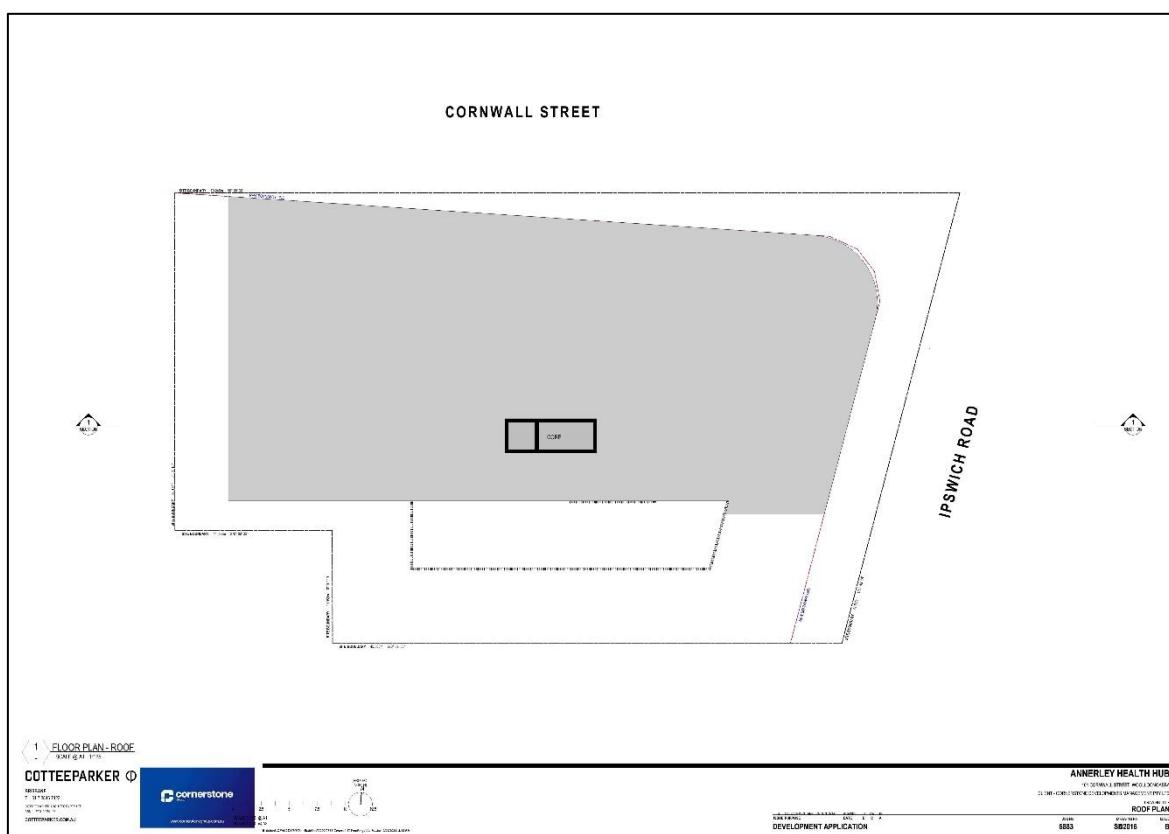
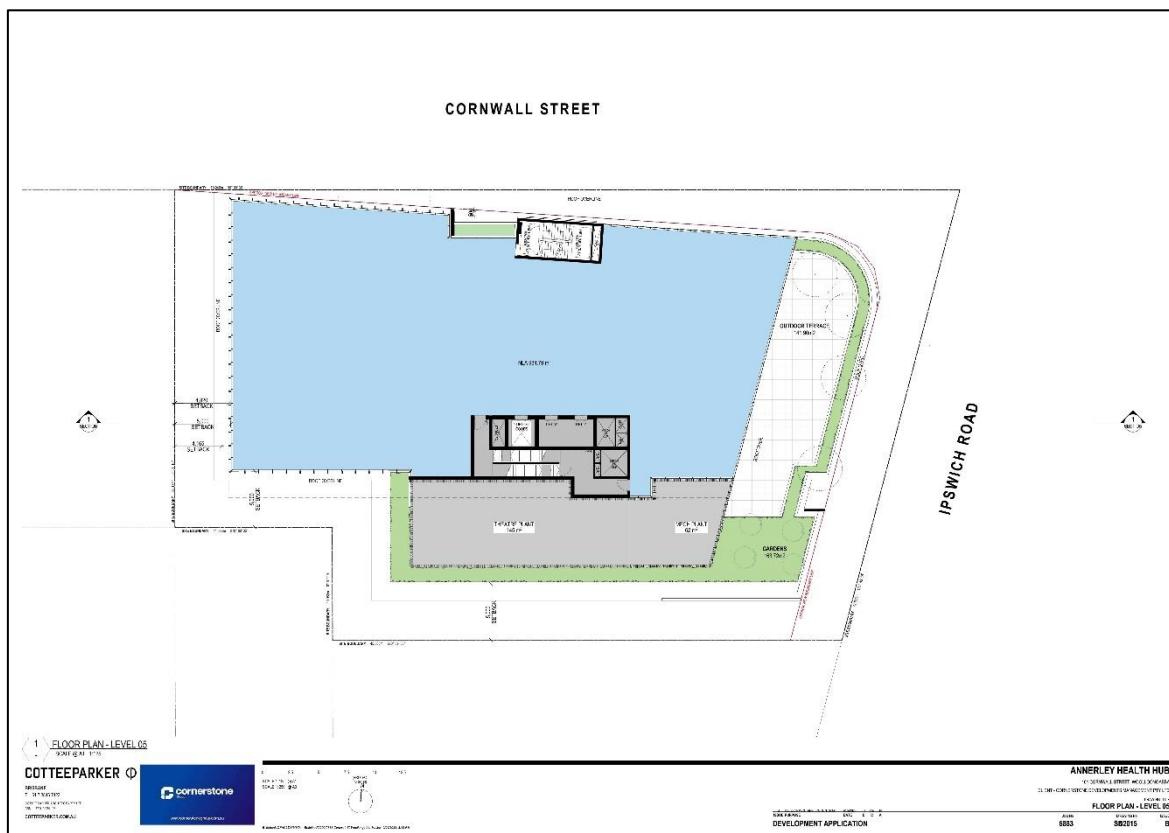


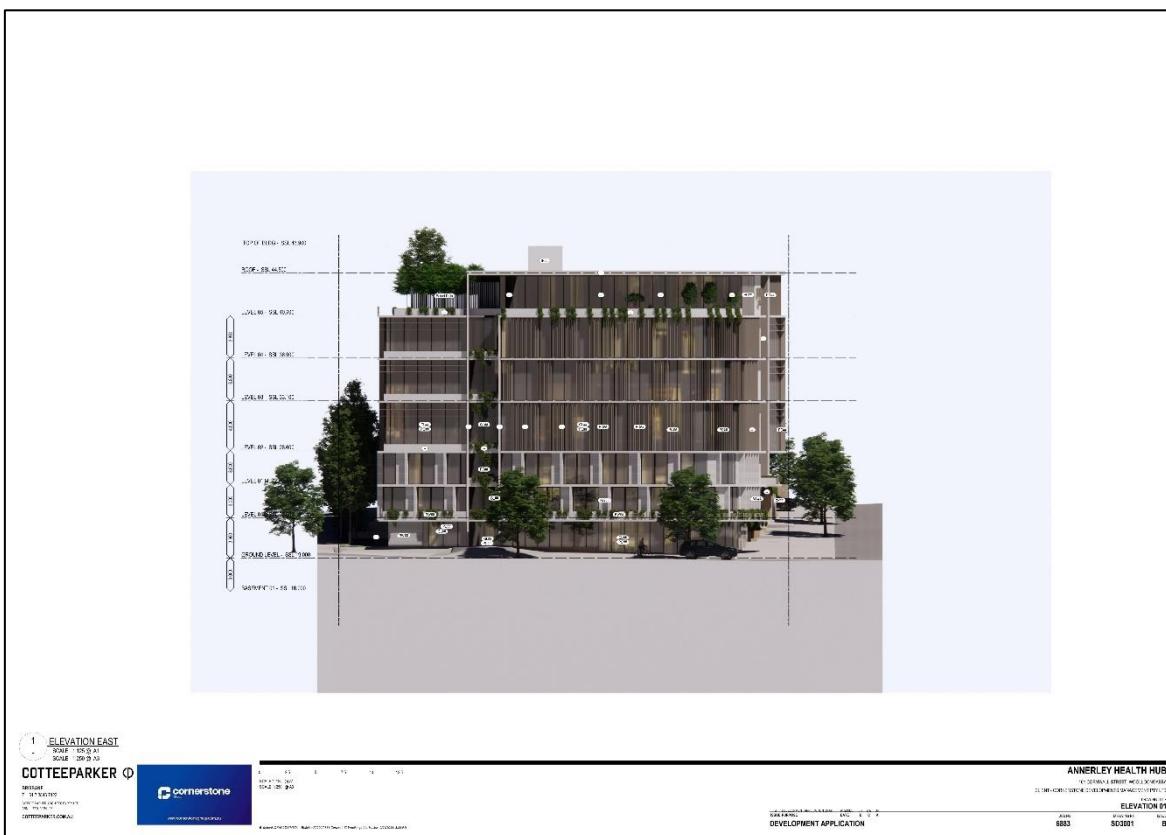














## Appendix B: Traffic Noise Calculations

The 10-year design levels for traffic noise are calculated for the proposed development. Calculations are performed in accordance with Australian Standard AS2702-1984 *Acoustics-Methods for the measurement of road traffic noise* and 'Calculation of Road Traffic Noise', 1975-1988.

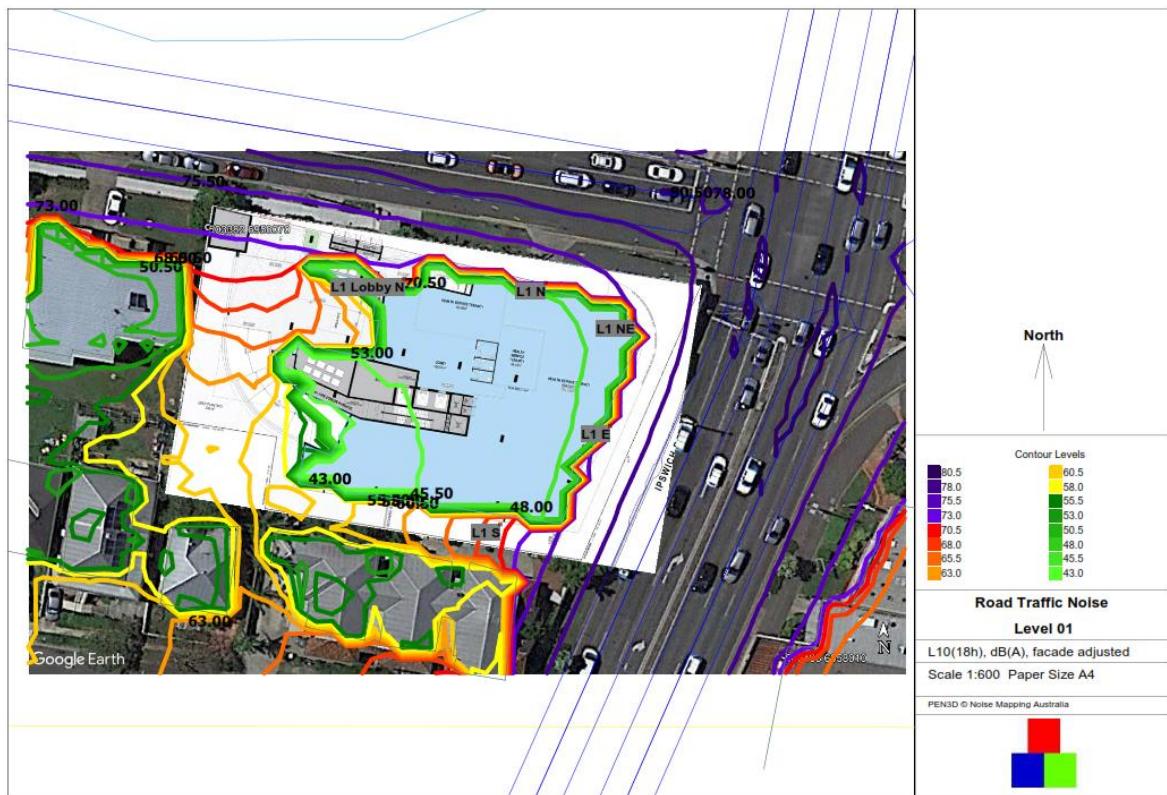
Predicted levels for this report have been calculated using CRTN prediction models PEN3D2000 and are façade-adjusted. Existing and future traffic volumes have been interpreted from data provided by the Brisbane City Council Key Corridors. Topographic data was obtained from Geoscience Australia (0.5m contours). The assumptions that were made for the calculations included:

Road	Vehicles per 24hr			Growth (%p.a.)	HV %	Speed (km/hr)	Source Height (m)				
	(18hr volume is 94% of 24hr)										
	2018	2023	2033								
Ipswich Road (bi-directional)	51,255	53,870	59,505	1.00%	5.00%	50	0.5				
Cornwall Street (bi-directional)	17,085	17,957	19,835	1.00%	5.00%	40	0.5				

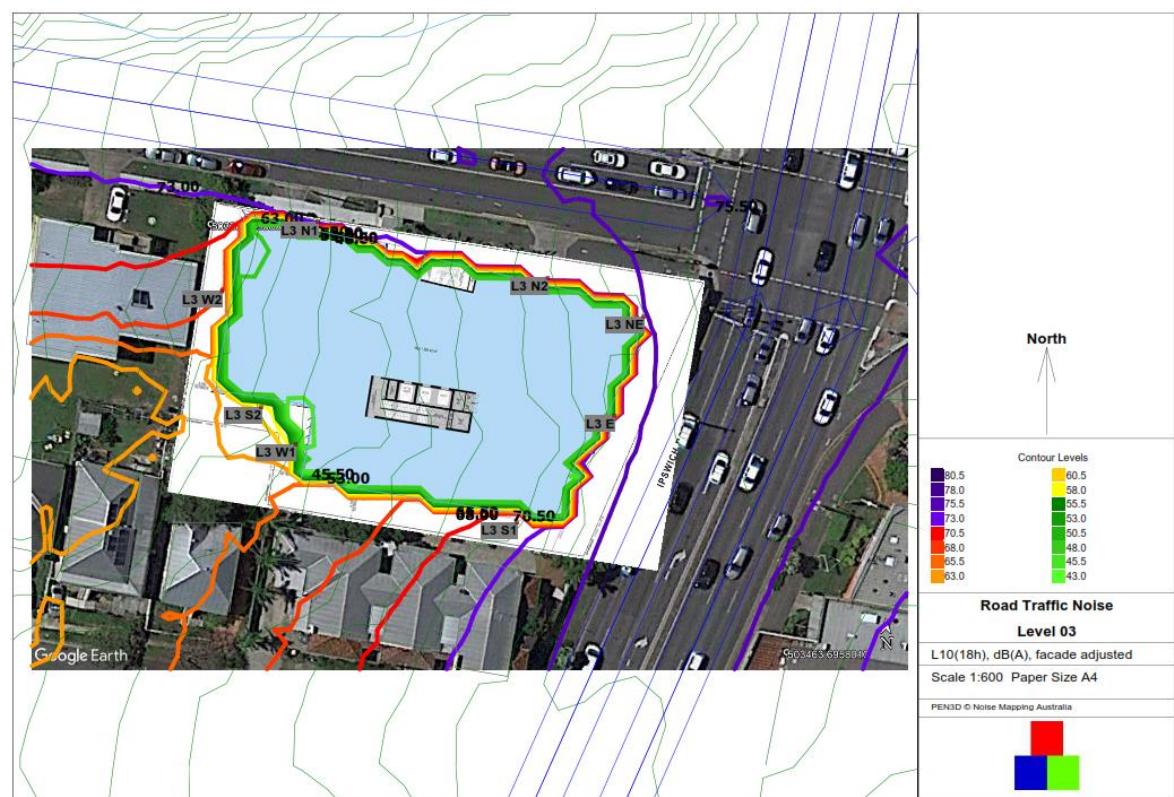
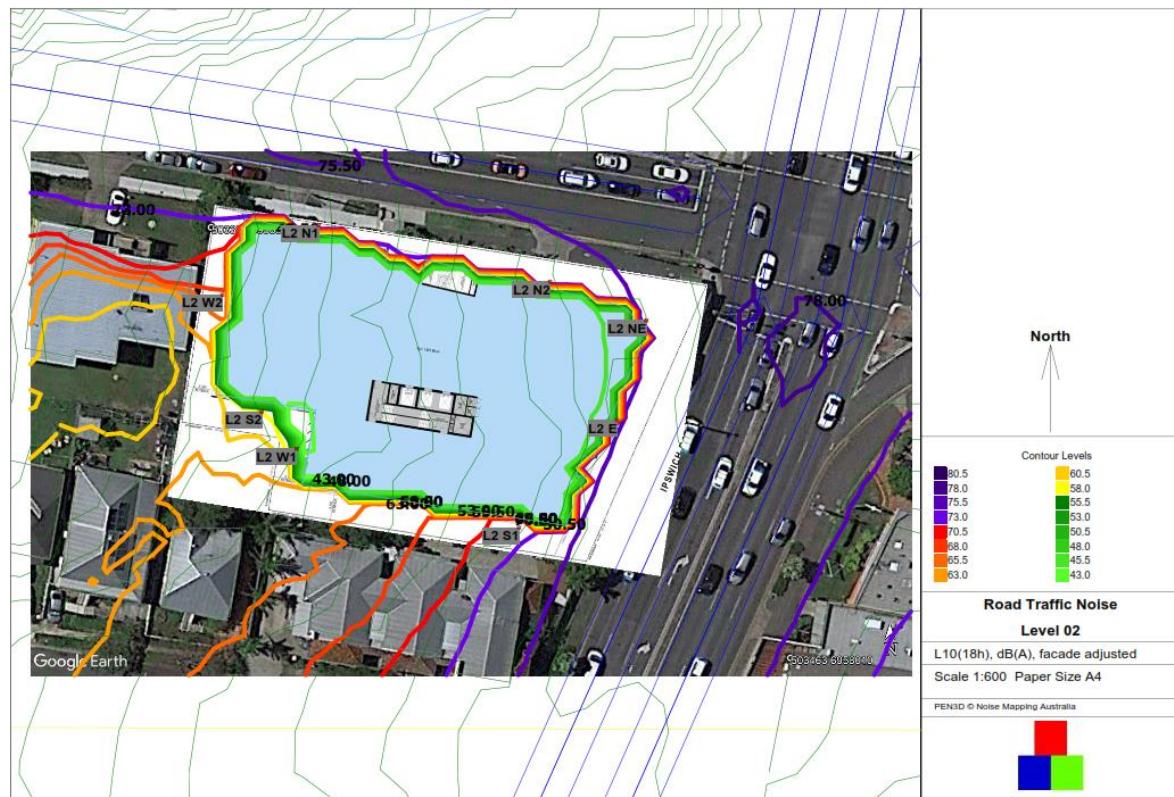
- Source height 0.5m;
- Measured noise level year 2023 for ML2 (Ipswich Road), 76.7 dB(A) L10, 18hr façade adjusted;
- Calculated noise level year 2023 for ML2 (Ipswich Road), 76.6 dB(A) L10, 18hr façade adjusted (within 0.1dB);
- Predicted design level year 2032 for ML2 (Ipswich Road), 77.1 dB(A) L10, 18hr façade adjusted;
- Predicted increase in road traffic noise from Ipswich Road over the ten year design horizon is +0.4 dB(A);
- Measured noise level year 2023 for ML3 (Cornwall Street), 70.4 dB(A) L10, 18hr façade adjusted;
- Calculated noise level year 2023 for ML3 (Cornwall Street), 71.6 dB(A) L10, 18hr façade adjusted (within 1.2dB);
- Predicted design level year 2032 for ML3 (Cornwall Street), 72.1 dB(A) L10, 18hr façade adjusted;
- Predicted increase in road traffic noise from Ipswich Road over the ten year design horizon is +0.4 dB(A);
- Calculation points at 1.5m above finished floor level as indicated on plans;
- Level 5 outdoor terrace and gardens include solid balustrades.

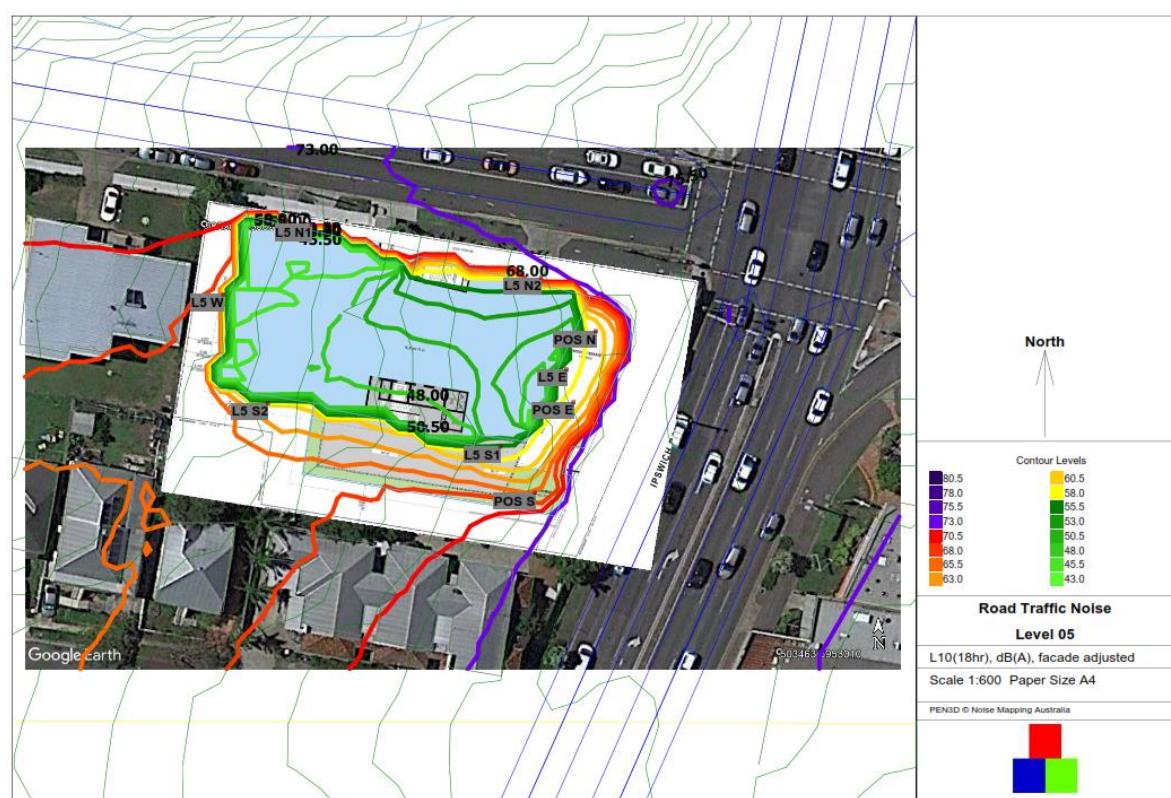
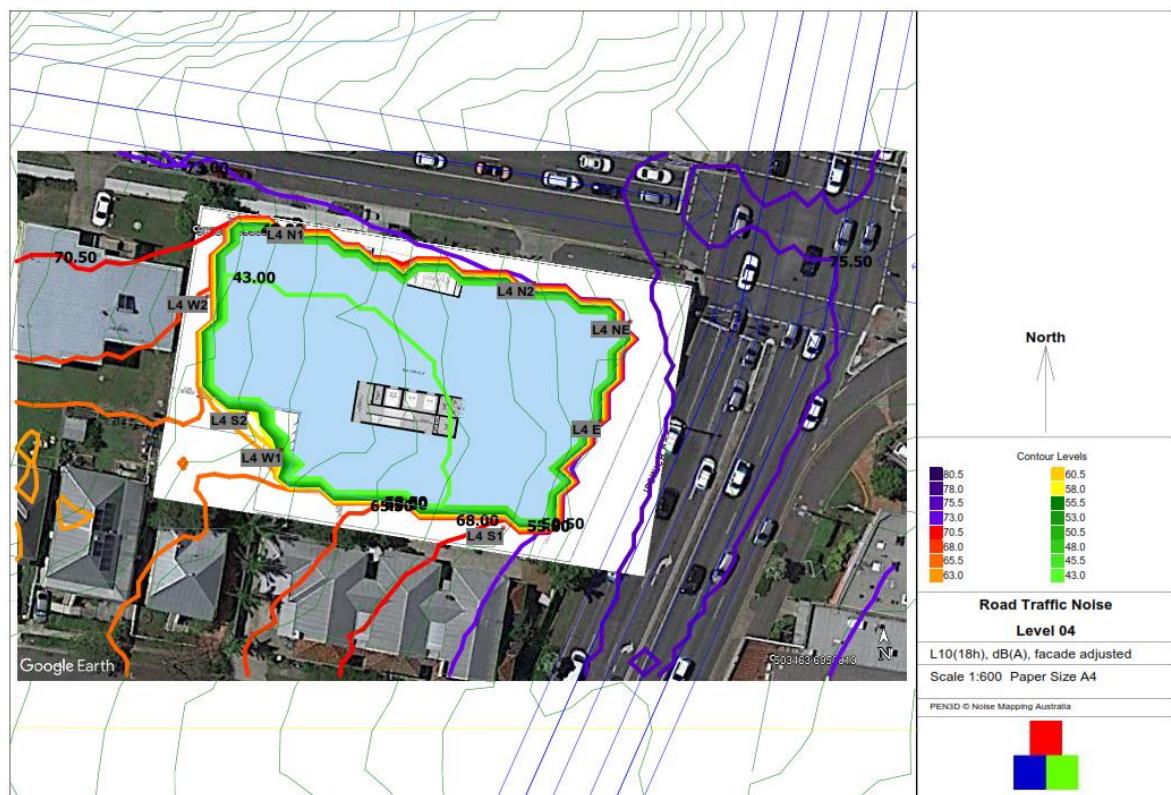
Results from the road traffic noise model are presented in the following **Plates** and **Table**.

**Plate B2:** Noise Contours at 1.8m, year 2032. Levels in dB(A)  $L_{10, 18hr}$ , façade-adjusted.



**Plate B3:** Noise Contours at 1.8m, year 2032 with 2.0 to 1.8m high acoustic barrier. Levels in dB(A)  $L_{10, 18hr}$ , façade-adjusted.





**Table B1:** Point calculations year 2032. Levels in dB(A)  $L_{10, 18hr}$ , façade-adjusted.

POINT CALCULATIONS				Calc On Ground			
Pen3D2000 V 1.9.32							
Project Code:6682							
Project Description:							
File:Z:\Projects 6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Road Traffic Year 2023 Validation.PEN							
Tuesday 07 Mar, 2023 at 08:55:47							
CoRTN Calculations							
All road segments included. Segmentation angle: 10degrees. Road elevations apply.							
Receptor	X Posn (m)	Y Posn (m)	Height (m)	$L_{10(18hour)}$ (dB(A))			
ML2	503437.3	6958027	1.4	76.7	76.6		
ML3	503413.5	6958067	1.4	71.6	70.4		
					1.2		
POINT CALCULATIONS							
Pen3D2000 V 1.9.32							
Project Code:6682							
Project Description:							
File:Z:\Projects 6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Road Traffic Year 2033 Future Validation.PEN							
File Description:6682 Year 2033 Future Validation							
Tuesday 07 Mar, 2023 at 09:00:53							
CoRTN Calculations							
All road segments included. Segmentation angle: 10degrees. Road elevations apply.							
Receptor	X Posn (m)	Y Posn (m)	Height (m)	$L_{10(18hour)}$ (dB(A))			
ML2	503437.3	6958027	1.4	77.1	0.4		
ML3	503413.5	6958067	1.4	72.1	0.5		
POINT CALCULATIONS							
Pen3D2000 V 1.9.32							
Project Code:6682							
Project Description:							
File:Z:\Projects 6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Road Traffic Year 2033 Ground 2023-02-09.PEN							
File Description:6682 Road Traffic Year 2033 Ground 2023-02-09							
Tuesday 07 Mar, 2023 at 09:19:51							
CoRTN Calculations							
All road segments included. Segmentation angle: 10degrees. Road elevations apply.							
Receptor	X Posn (m)	Y Posn (m)	Height (m)	$L_{10(18hour)}$ (dB(A))			
LG N	503436.7	6958061	20.5	71.3	72.4		
LG NE	503442.4	6958057	20.5	73.4	74.5		
LG E	503438.4	6958043	20.5	73.2	74.3		
POINT CALCULATIONS							
Pen3D2000 V 1.9.32							
Project Code:6682							
Project Description:							
File:Z:\Projects 6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Road Traffic Year 2033 Level 1 2023-02-09.PEN							
File Description:6682 Road Traffic Year 2033 Level 1 2023-02-09							
Tuesday 07 Mar, 2023 at 09:42:09							
CoRTN Calculations							
All road segments included. Segmentation angle: 10degrees. Road elevations apply.							
Receptor	X Posn (m)	Y Posn (m)	Height (m)	$L_{10(18hour)}$ (dB(A))			
L1 Lobby N	503409.5	6958063	24.1	69.6	70.7		
L1 N	503429.4	6958062	24.1	73.5	74.6		
L1 NE	503441.9	6958057	24.1	75.6	76.7		
L1 E	503438.4	6958042	24.1	75.8	76.9		
L1 S	503423.1	6958028	24.1	69	70.1		

**Table B1** continued on following page...



## Appendix C: Rw Calculations for Building Elements

**Table C1:** minimum Rw requirements for building elements.

STC Multi Unit			TNR is Leq façade corrected maximum 1-hr Leq vs indoor maximum AS2107 TNAC is the traffic noise attenuation required of the component "6" is the approximate allowance for the traffic noise spectrum TNAC = TNR + 10Log10[(Sc/Sf) x (3/H) x 2T60 xC] STC = TNAC + 6 Allowance for building construction to Design STC = Calculated STC + 6										
Floor	Room	Element	Facing	Ext Leq dB(A)	AS2107 criteria	TNR	area	area	Height (m)	RT60 (s)	C	TNAC	Calc STC/Rw
LG	Health Service Tenancy	All glass façade	N,E	74	35	39	139.7	255.0	3.6	1.0	2	42	<b>48</b>
L01	Lobby	Glass Sliding Door	N	71	35	36	12.6	145.0	3.0	1.0	2	31	<b>37</b>
L01	Health Service Tenancy	Window	N	75	35	40	7.2	85.0	3.0	1.0	2	35	<b>41</b>
L01	Health Service Tenancy	All glass façade	N,E	77	35	42	156.0	604.0	3.0	1.0	2	42	<b>48</b>
L01	Health Service Tenancy	All glass façade	S	70	35	35	108.0	604.0	3.0	1.0	2	34	<b>40</b>
L02	Tennancy	All glass façade	N1	75	35	40	117.0	260.0	4.5	1.0	2	41	<b>47</b>
L02	Tennancy	All glass façade	N2	75	35	40	117.0	260.0	4.5	1.0	2	41	<b>47</b>
L02	Tennancy	All glass façade	E	77	35	42	243.0	604.0	4.5	1.0	2	42	<b>48</b>
L02	Tennancy	All glass façade	S1	73	35	38	166.5	260.0	4.5	1.0	2	40	<b>46</b>
L02	Tennancy	All glass façade	W1	43	35	8	45.0	260.0	4.5	1.0	2	5	<b>11</b>
L02	Tennancy	All glass façade	S2	53	35	18	63.0	260.0	4.5	1.0	2	16	<b>22</b>
L02	Tennancy	All glass façade	W2	68	35	33	117.0	260.0	4.5	1.0	2	34	<b>40</b>
L03	Tennancy	All glass façade	N1	75	35	40	98.8	260.0	3.8	1.0	2	41	<b>47</b>
L03	Tennancy	All glass façade	N2	75	35	40	98.8	260.0	3.8	1.0	2	41	<b>47</b>
L03	Tennancy	All glass façade	E	76	35	41	205.2	604.0	3.8	1.0	2	41	<b>47</b>
L03	Tennancy	All glass façade	S1	73	35	38	140.6	260.0	3.8	1.0	2	40	<b>46</b>
L03	Tennancy	All glass façade	W1	44	35	9	38.0	260.0	3.8	1.0	2	6	<b>12</b>
L03	Tennancy	All glass façade	S2	60	35	25	53.2	260.0	3.8	1.0	2	23	<b>29</b>
L03	Tennancy	All glass façade	W2	68	35	33	98.8	260.0	3.8	1.0	2	34	<b>40</b>
L04	Tennancy	All glass façade	N1	74	35	39	98.8	260.0	3.8	1.0	2	40	<b>46</b>
L04	Tennancy	All glass façade	N2	74	35	39	98.8	260.0	3.8	1.0	2	40	<b>46</b>
L04	Tennancy	All glass façade	E	75	35	40	205.2	604.0	3.8	1.0	2	40	<b>46</b>
L04	Tennancy	All glass façade	S1	72	35	37	140.6	260.0	3.8	1.0	2	39	<b>45</b>
L04	Tennancy	All glass façade	W1	46	35	11	38.0	260.0	3.8	1.0	2	8	<b>14</b>
L04	Tennancy	All glass façade	S2	61	35	26	53.2	260.0	3.8	1.0	2	24	<b>30</b>
L04	Tennancy	All glass façade	W2	69	35	34	98.8	260.0	3.8	1.0	2	35	<b>41</b>
L05	Tennancy	All glass façade	N1	74	35	39	72.2	260.0	3.8	1.0	2	38	<b>44</b>
L05	Tennancy	All glass façade	N2	74	35	39	64.6	260.0	3.8	1.0	2	38	<b>44</b>
L05	Tennancy	All glass façade/Glass Door	E	57	35	22	83.6	260.0	3.8	1.0	2	22	<b>28</b>
L05	Tennancy	All glass façade / Mechanical Plant Deck	S1	75	35	40	140.6	260.0	3.8	1.0	2	42	<b>48</b>
L05	Tennancy	All glass façade/Near Theatre Plant	S2	70	35	35	38.0	260.0	3.8	1.0	2	32	<b>38</b>
L05	Tennancy	All glass façade	W	69	35	34	91.2	260.0	3.8	1.0	2	34	<b>40</b>
All	Tennancy	External Wall	W	77	35	42	91.2	260.0	3.8	1.0	2	42	<b>48</b>

The Rw for external walls should be 48 Rw or higher. The reverberation (RT60) time is set at 1.0 seconds for assessment purposes. The reverberation time can be higher or lower depending on the size of the room, carpeting, ceiling and final fit-out. Lower RT60 will also lower the Rw requirements for building elements. For further details see Section 4.2.2.

Floor plans for the L01 mezzanine were not included in the plans provided.

Solid balustrades are recommended for the communal open (outdoor terrace and gardens) area on Level 5 and are included in the calculations above. The location of the solid balustrade is illustrated in Section 4.3.

It is not possible to determine the floor area for individual tenancies. A floor area of 260m<sup>2</sup> has been used for assessment purposes where an individual tenancy or room is not specified. Windows on Level 5 near or adjacent to the mechanical plant deck should have higher ratings to minimise plant noise intrusion. An external sound level of 70-75 dB(A) at the façade has been used for assessment purposes from plant noise and included in Table C1 above .

## Appendix D: Environmental Noise Calculations

Forecasts noise emissions from expected activities at the proposed development have been calculated with PEN3D2000, a software program implementing a prediction model based on the method described in Bies & Hansen, *ISO 9613-2 (1996) Acoustics – Attenuation of sound propagation outdoors Part 2: General Method of Calculation* and CONCAWE. The basic equation adopted is-

$$L_p = L_w - 20 \log_{10}(r) - 10\log_{10}(4\pi) + AE$$

Where

- $L_p$  is the sound pressure level at an observer
- $L_w$  is the sound power level of the source
- $20 \log_{10}r - 10\log_{10}(4\pi)$  is the Distance attenuation (spherical)
- $AE$  is the excess attenuation factors and is determined as the sum of the contributions

All prediction models have limits to their accuracy of prediction. This is due to the inherent nature of the calculation algorithms that go into the design of the models, the assumptions made in the implementation of the model, and the availability of good source sound power data. ISO 9613-2 has an estimated accuracy for broadband noise of  $\pm 3$  dB at 1000 metres. Neutral atmospheric and meteorological conditions have been assumed. Noise source design sound power levels (SWL) of activities considered representative of those at the development have been used, as presented in **Section 5**. Topographic data was sourced from the Queensland Government, and from development plans.

The noise source sound power levels are presented in **Table B1** and **B2** following.

**Table B1:** Design Leq sound power levels, as modelled.

Source	Descriptor	Sound Power Levels in dB(Z)								Total in dB(Z)	Total in dB(A)
		63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz		
Car Idle	Leq	74	81	75	72	75	76	72	69	85	81
Rubbish collection	Leq,15min	93	87	88	87	88	90	88	77	98	95
Deliveries	Leq	79	86	80	77	80	81	77	74	90	86
Crowd 10	Leq	54	59	65	69	73	74	73	64	79	79
Mechanical Plant	Leq	79	75	77	81	82	85	86	82	92	91

**Table B2:** Design Lmax sound power levels, as modelled.

Source	Descriptor	Sound Power Levels in dB(Z)								Total in dB(Z)	Total in dB(A)
		63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz		
Car Door Slam	Lmax	88	92	88	89	93	87	85	83	98	95
Truck Tone Alarm	Lmax	75	82	76	73	76	102	73	70	102	103

Noise contours from the environmental noise calculations are presented in **Figures B1 to B5** following.

Point calculations from the environmental noise calculations are presented untitled in the tables following where:

Green = Typical daytime Leq noise emissions Level 01;

Blue = Typical evening and night-time Leq noise emissions Level 01;

Yellow = Periodic (rubbish collection) daytime Leq noise emissions;

Grey = Typical anytime Lmax noise emissions;

Red = Typical plant and crowd Leq noise emissions.

**Plate B1:** Daytime L<sub>eq</sub> noise contours Level 01, with acoustic screen. Levels are in L<sub>eq</sub>, dB(A), free field.



**Plate B2:** Evening and Night-time L<sub>eq</sub> noise contours, with acoustic screen. Levels are in L<sub>eq</sub>, dB(A), free field.



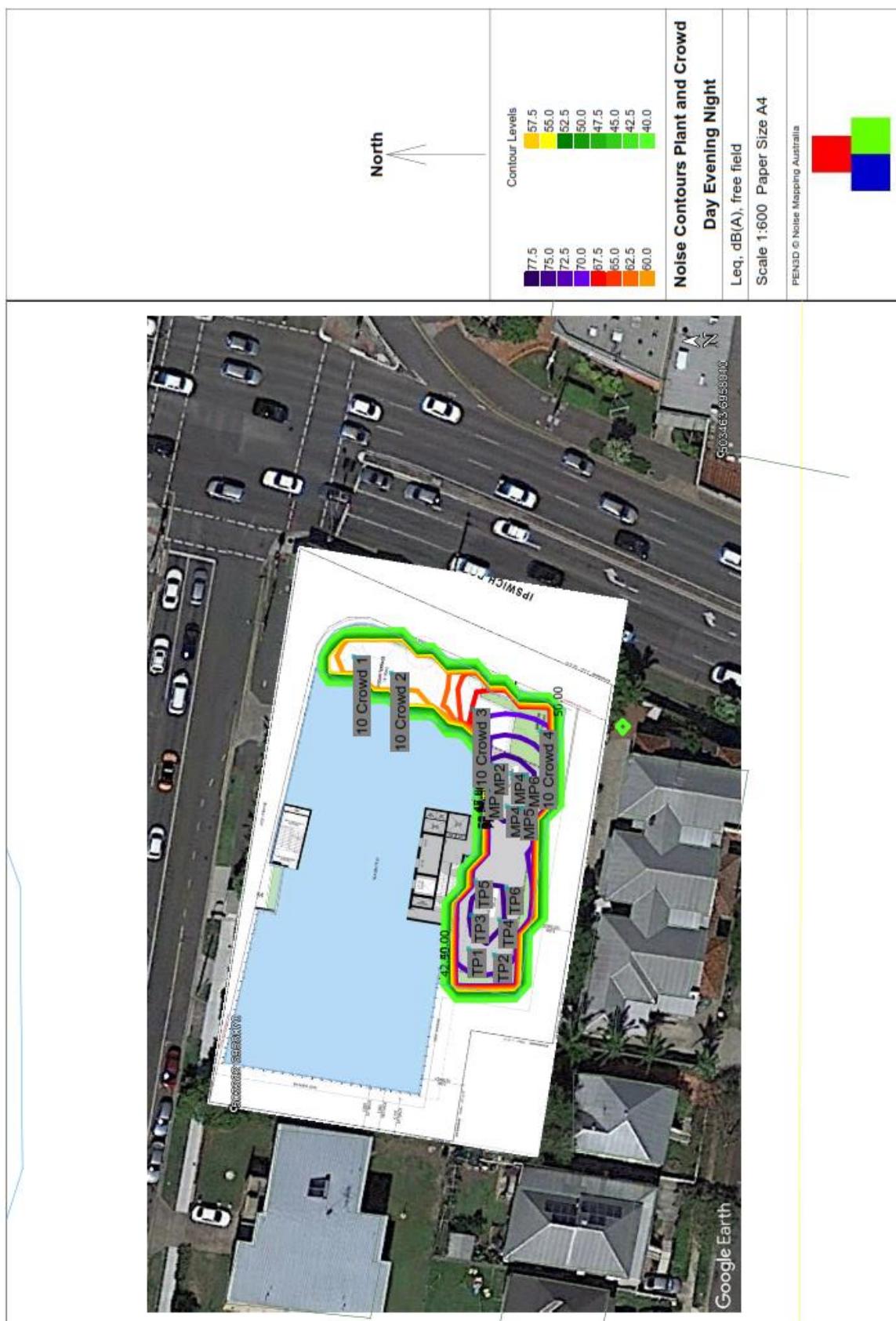
**Plate B3:** Rubbish collection noise contours with acoustic treatment. Levels are in L<sub>eq</sub>, dB(A), free field.



**Plate B4:** Night-time Lmax noise contours. Levels are in Lmax, dB(A), free field.



**Plate B5:** Plant and crowd noise Leq noise contours, (at 4.6m above ground), anytime. Levels are in Leq, dB(A), free field.





**POINT CALCULATIONS**

Pen3D2000 V 1.9.32

Project Code:6682

Project Description:

File:Z:\Projects\6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Environmental Leq Evening Night Level 1 2023-02-09  
File Description:6682 Environmental Leq Evening Night Level 1 2023-02-09

Thursday 09 Mar, 2023 at 11:17:58

Environmental Calculations

All point and line sources included. Line source segmentation angle: 1 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology:

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
DC E1	503470.4	6958031.7	1.8	19	9	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		3	-12
Car 3	503388.7	6958049.1	0.5		1	-14
Delivery Vehicle 1	503398.8	6958058.3	1		8	-8
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
E2 DC	503461.6	6958008.8	1.8	19.1	9	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		2	-13
Car 3	503388.7	6958049.1	0.5		3	-13
Delivery Vehicle 1	503398.8	6958058.3	1		7	-8
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S1 CR2	503425.7	6958024.4	1.8	20.3	13	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		5	-10
Car 3	503388.7	6958049.1	0.5		6	-9
Delivery Vehicle 1	503398.8	6958058.3	1		12	-4
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S2 CR2	503404.1	6958028.2	1.8	21.6	16	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		8	-7
Car 3	503388.7	6958049.1	0.5		10	-5
Delivery Vehicle 1	503398.8	6958058.3	1		14	-1
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S3 CR2	503390.7	6958035	1.8	22.5	49	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		43	28
Car 3	503388.7	6958049.1	0.5		47	32
Delivery Vehicle 1	503398.8	6958058.3	1		16	1
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S4 CR2	503384.4	6958041.8	1.8	23	53	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		45	30
Car 3	503388.7	6958049.1	0.5		52	37
Delivery Vehicle 1	503398.8	6958058.3	1		17	2
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
W1 LMR3	503380.6	6958059.9	1.8	23.8	55	
Source	X Posn (m)	Y Posn (m)	Height (m)		Noise Level (dB(A))	Acoustic Wall
Car 2	503388.6	6958060.2	0.5		52	37
Car 3	503388.7	6958049.1	0.5		48	33
Delivery Vehicle 1	503398.8	6958058.3	1		50	35

**POINT CALCULATIONS**

Pen3D2000 V 1.9.32

Project Code:6682

Project Description:

File:Z:\Projects 6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Environmental Leq Rubbish Colle

File Description:6682 Environmental Leq Rubbish Collection Level 1 2023-02-09

Thursday 09 Mar, 2023 at 12:33:17

Environmental Calculations

All point and line sources included. Line source segmentation angle: 1 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology:

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	Acoustic Screen
DC E1	503470.4	6958031.7	1.8	19	<b>16</b>	<b>1</b>
E2 DC	503461.6	6958008.8	1.8	19.1	<b>15</b>	<b>0</b>
S1 CR2	503425.7	6958024.4	1.8	20.3	<b>19</b>	<b>4</b>
S2 CR2	503404.1	6958028.2	1.8	21.6	<b>21</b>	<b>6</b>
S3 CR2	503390.7	6958035	1.8	22.5	<b>24</b>	<b>9</b>
S4 CR2	503384.4	6958041.8	1.8	23	<b>58</b>	<b>43</b>
W1 LMR3	503380.6	6958059.9	1.8	23.8	<b>62</b>	<b>47</b>

POINT CALCULATIONS

Pen3D2000 V 1.9.32

Project Code:6682

Project Description:

File:Z:\Projects\6650 - 6699\6682 Cnr Ipswich Road and Cornwall Street, Annerley - Intergrated Health Care Facility\Model\6682 Environmental Lmax Night Level 1 2023-02-09.PEN  
File Description:6682 Environmental Lmax Night Level 1 2023-02-09

Thursday 09 Mar, 2023 at 15:39:09

Environmental Calculations

All point and line sources included. Line source segmentation angle: 1 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology:

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
DC E1	503470.4	6958031.7	1.8	19	20	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		18	3
Door Slam	503399.6	6958054.6	1		18	3
Reverse Beep	503395.9	6958058.8	1		20	5
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
E2 DC	503461.6	6958008.8	1.8	19.1	20	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		17	2
Door Slam	503399.6	6958054.6	1		17	2
Reverse Beep	503395.9	6958058.8	1		20	5
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S1 CR2	503425.7	6958024.4	1.8	20.3	22	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		22	7
Door Slam	503399.6	6958054.6	1		22	7
Reverse Beep	503395.9	6958058.8	1		22	7
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S2 CR2	503404.1	6958028.2	1.8	21.6	25	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		24	9
Door Slam	503399.6	6958054.6	1		25	10
Reverse Beep	503395.9	6958058.8	1		24	9
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S3 CR2	503390.7	6958035	1.8	22.5	27	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		26	11
Door Slam	503399.6	6958054.6	1		27	12
Reverse Beep	503395.9	6958058.8	1		26	11
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
S4 CR2	503384.4	6958041.8	1.8	23	27	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		27	12
Door Slam	503399.6	6958054.6	1		27	12
Reverse Beep	503395.9	6958058.8	1		27	12
Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))	
W1 LMR3	503380.6	6958059.9	1.8	23.8	69	
Source	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))	Tunnel	
Door Slam	503400.7	6958060.9	1		59	44
Door Slam	503399.6	6958054.6	1		59	44
Reverse Beep	503395.9	6958058.8	1		69	54



## Appendix E: Glossary

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### ***Event maximum sound pressure level ( $LA\%,adj,T$ ), L01***

The L01 level is calculated as the noise level equalled and exceeded for 1% of the measurement time, for example 9 seconds in any 15 minute interval. L01 is an appropriate level to characterise single events, such as from train bypass.

In this Report, the measured L01 levels for day/evening/night are not averaged but are arranged from low to high in the relevant day/evening/night interval and the value that is found at the 90th percentile (L10 of L01 sample) in the interval is recorded as its "L01" level.

### ***Average maximum sound pressure level ( $LA\%,adj,T$ ), L10***

The "L10" level is an indicator of "steady-state" noise or intrusive noise conditions from traffic, music and other relatively non-impulsive noise sources. The L10 level is calculated as the noise level equalled and exceeded for 10% the measurement time, for example 90 seconds in any 15 minute interval. The measured L10 time-intervals for day/evening/night are arithmetically averaged to present the "average maximum" levels of the environment for day/evening/night. The level can be adjusted for tonality or impulsiveness.

### ***Background sound pressure level ( $LA90,T$ ), L90***

Commonly called the "L90" or "background" level and is an indicator of the quietest times of day, evening or night. The L90 level is calculated as the noise level equalled and exceeded for 90% the measurement time. The measured L90 time-intervals are arithmetically averaged to present the "average background" levels of the environment for day/evening/night. The level is recorded in the absence of any noise under investigation. The level is not adjusted for tonality or impulsiveness.

### ***Equivalent Continuous or time average sound pressure level ( $LAeq,T$ ), Leq***

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

### ***Façade-adjusted level***

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

### ***Free-field level***

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