Noise Assessment

Serviced Apartments Development
6-8 Grant Street
Maitland, NSW

Prepared for: Brown Commercial Building Pty Ltd
March 2024
MAC231943-01RP1V1

Muller Acoustic Consulting

Document Information

Noise Assessment

Serviced Apartments Development

6-8 Grant Street

Maitland, NSW

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Brown Commercial Building Pty Ltd (BCB), to prepare a Noise Assessment (NA) to quantify potential noise impacts associated with the proposed Serviced Apartments Development to be located at 6-8 Grant Street, Maitland, NSW (the project).

The NA has quantified potential noise intrusion into the habitable spaces of the development as well as construction noise emissions from the project site to the surrounding environment. The NA recommends reasonable and feasible noise controls where required.

This assessment has been undertaken in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017;
- NSW Department of Environment and Climate Change (DECC) – NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Department of Environment, Climate Change and Water (DECCW) – NSW Road Noise Policy (RNP), March 2011;
- NSW Department of Planning – Development Near Rail Corridors and Busy Roads – Interim Guideline (RRIG), 2008;
- Standards Australia AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures; and
- Standards Australia AS/NZS 2107:2016 (AS2107) – Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors.

A glossary of terms, definitions and abbreviations used in this report is provided in Appendix A.

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2 Project Description

2.1 Background

The project site is to be located at 6-8 Grant Street, Maitland, NSW, which is on land zoned MU1 for mixed-use. The area surrounding the project site comprises of residential lots to the southwest, educational receivers to the northwest and north with passive recreation receivers to the northeast and east of the project site. Several commercial receivers are also located further to the north, beyond the passive recreation receivers, with the upper levels of the commercial having direct line of sight to the project site. Site plans are provided in Appendix B.

The ambient noise environment surrounding the project site is expected to be dominated by passing local traffic and noise from the surrounding educational receivers.

2.1.1 Receiver Review

A review of residential receivers in proximity to the project has been completed and are summarised in Table 1. Figure 1 provides a locality plan showing the position of these receivers in relation to the project.

Table 1 Receiver Locations

Receiver	Receiver Type	Receiver Height	Coordinates (MGA56)	
			Easting	Northing
R01	Residential	2.5m	365005	6376824
R02	Residential	2.5m	365009	6376816
R03	Residential	2.5m	365022	6376810
R04	Residential	2.5m	365026	6376796
R05	Residential	2.5m	365049	6376773
R06	Residential	2.5m	365068	6376748
R07	Residential	2.5m	365083	6376766
R08	Residential	2.5m	365105	6376777
ED01	Educational	1.5/4.5/7.5m	365029	6376915
ED02	Educational	1.5/4.5/7.5m	365008	6376898
ED03	Educational	1.5/4.5m	364981	6376875
ED04	Educational	1.5m	364995	6376857
PR01	Passive Recreational	1.5m	365080	6376839
PR02	Passive Recreational	1.5m	365069	6376818
C01	Commercial	1.5/4.5m	365139	6376853
C02	Commercial	1.5/4.5m	365089	6376887
C03	Commercial	1.5/4.5m	365076	6376920

FIGURE 1

Locality Plan

MAC231943-01

6-8 Grant Street,

Maitland, NSW

KEY

Receiver	●
Site Boundary	

0 10 20 30 40 50 m

N

MAC
Muller Acoustic Consulting

3 Noise Policy and Guidelines

3.1 Development Near Rail Corridors and Busy Roads – Interim Guidelines

Guidance for the specification of internal noise levels of habitable rooms is prescribed in Department of Planning's (DoP) Development near Rail Corridors and Busy Roads – Interim Guidelines (2008) (the guideline).

3.1.1 Road Noise Screening Test

Section 5.3.2 of the guideline provides screening tests for flat building dwellings. The screening tests provide various categories of noise control treatments for dwellings taking into consideration distance to the road and amount of traffic. The guideline presents two screen tests for a 60/70km/hr zone and 100/110km/hr zone that are reproduced in Figure 2 and Figure 3 respectively. The screening tests have been adopted in this assessment to provide guidance on building categories for the project.

As the near point of the project site is greater than 300m from the New England Highway (which carries approximately 43,000 vehicles per day) and with intervening buildings and vegetation blocking line of sight to the roadway, a detailed assessment is not required to determine the appropriate acoustic treatments required for the development prior to construction.

As a conservative approach to protect the amenity of the internal spaces of the development, it is recommended that Category 2 treatments, which is consistent with 6mm monolithic glazing and construction materials, are anticipated to be adequate to attenuate road traffic noise associated with main roads in the area.

It is understood that 6.38mm laminated glazing, which is consistent with Category 3 treatments will be installed in the development which exceeds the recommendation for Category 2 treatments. Category treatments are reproduced in Appendix C.

Figure 2 Screen test for habitable areas of single/dual occupancy dwellings adjacent to 60/70km/hr zones.

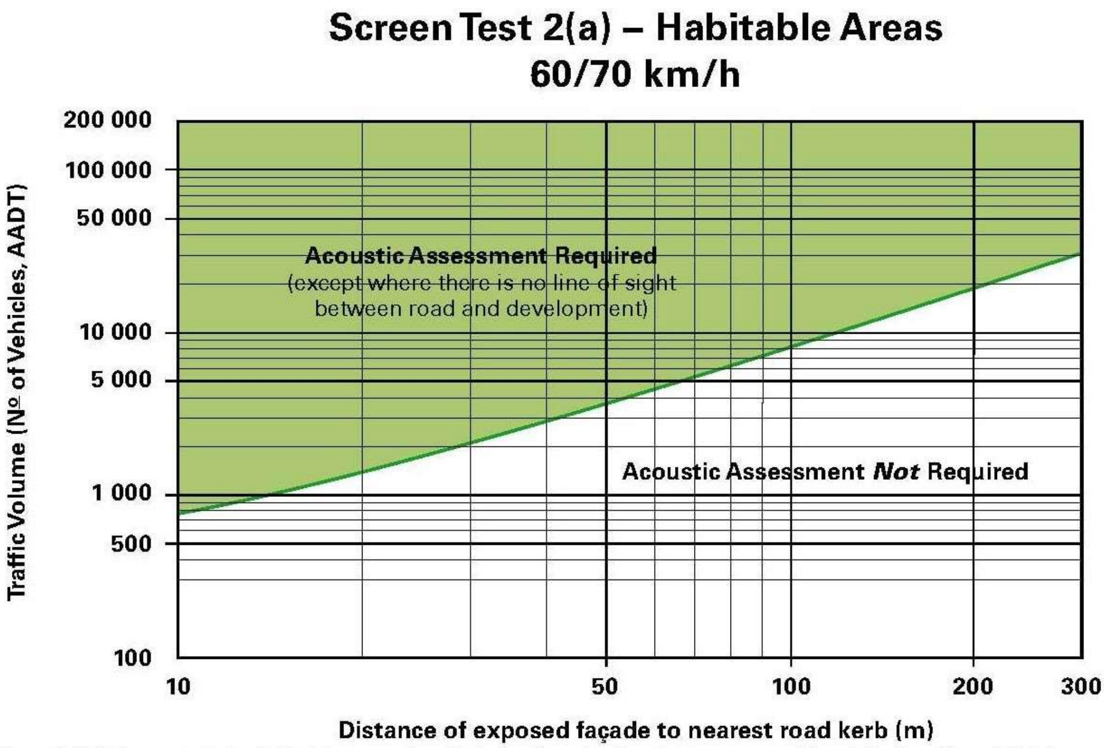


Figure 3.4(a): Screen tests for habitable areas of multiple dwellings (noting that any exposed façade is direct line-of-sight)

Figure 3 Screen test for habitable areas of single/dual occupancy dwellings adjacent to 100/110km/hr zones.

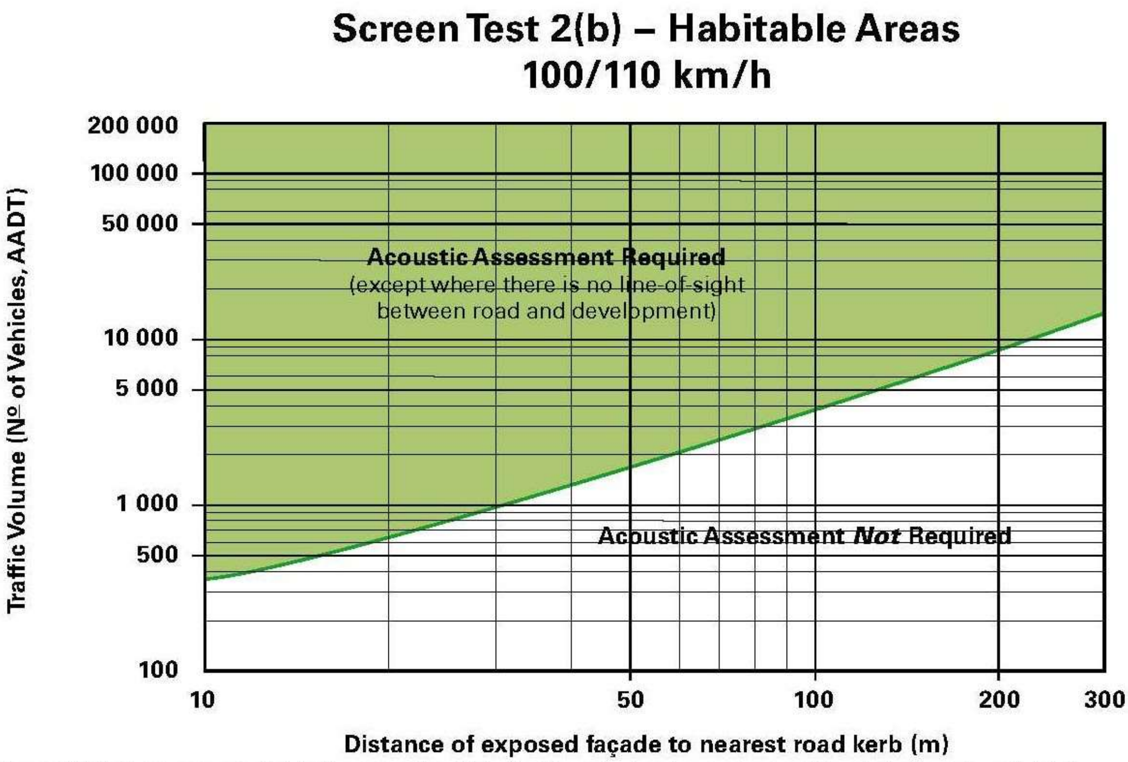


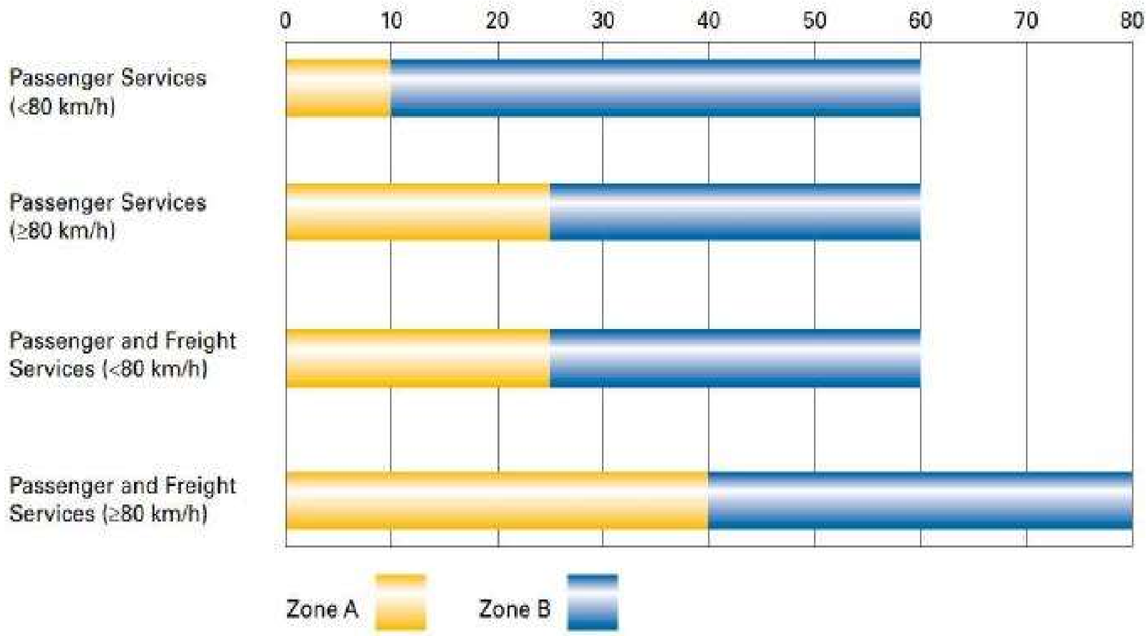
Figure 3.4(b): Screen tests for habitable areas of multiple dwellings (noting that any exposed façade is direct line-of-sight)

3.1.2 Rail Noise Screening Tests

Section 3.5.1 of the guideline provides a screening test to determine the level of assessment required when noise sensitive receivers are located close to existing railway lines. Figure 4 identifies indicative acoustic assessment zones, based on distance (in metres), for developments from an operational rail track.

For developments located within Zone A, a detailed Noise Impact Assessment is required. For single dwellings in Zone B, standard mitigation measures consistent with Nosie Control Treatment Category 2 (Appendix C of the guideline), for development will normally provide adequate attenuation to achieve the acceptable internal noise levels. The rail noise screening test identifies that internal design sound levels should be achieved for dwellings within approximately 60m of the railway line (freight service <80km/h) with Category 2 treatments implemented. For dwellings within 25m of the railway line, a detailed assessment would be required.

Figure 4 Acoustic Assessment Zones for Rail noise assessment near dwellings.



The nearest rail line to the project site is part of the Main Northen Line which carries both passenger and heavy freight trains. The rail line is located approximately 260m south of the project site. Accordingly, as the project site is located outside both Zone A and Zone B, no additional treatments are required.

Notwithstanding, as outlined in Section 3.1.1 of this report, mitigation measures consistent with Noise Control Treatment Category 2 (Appendix C of the guideline) for development will provide adequate attenuation to achieve the acceptable internal noise levels from both road and rail noise. It is reiterated that 6.38mm laminated glazing will be installed in the development, which exceeds the requirement of Category 2 treatments.

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

3.2.1 Rating Background Level (RBL)

The Rating Background Level (RBL) is a parameter determined from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period. For low-risk projects, such as construction assessment, minimum assumed RBLs apply within the NPI can be adopted in lieu of completing background noise measurements. This is considered the most conservative method for establishing noise criteria for a project. The minimum assumed RBLs are as follows:

- Minimum Day RBL = 35dBA;
- Minimum Evening RBL = 30dBA; and
- Minimum Night RBL = 30dBA.

3.3 Interim Construction Noise Guideline

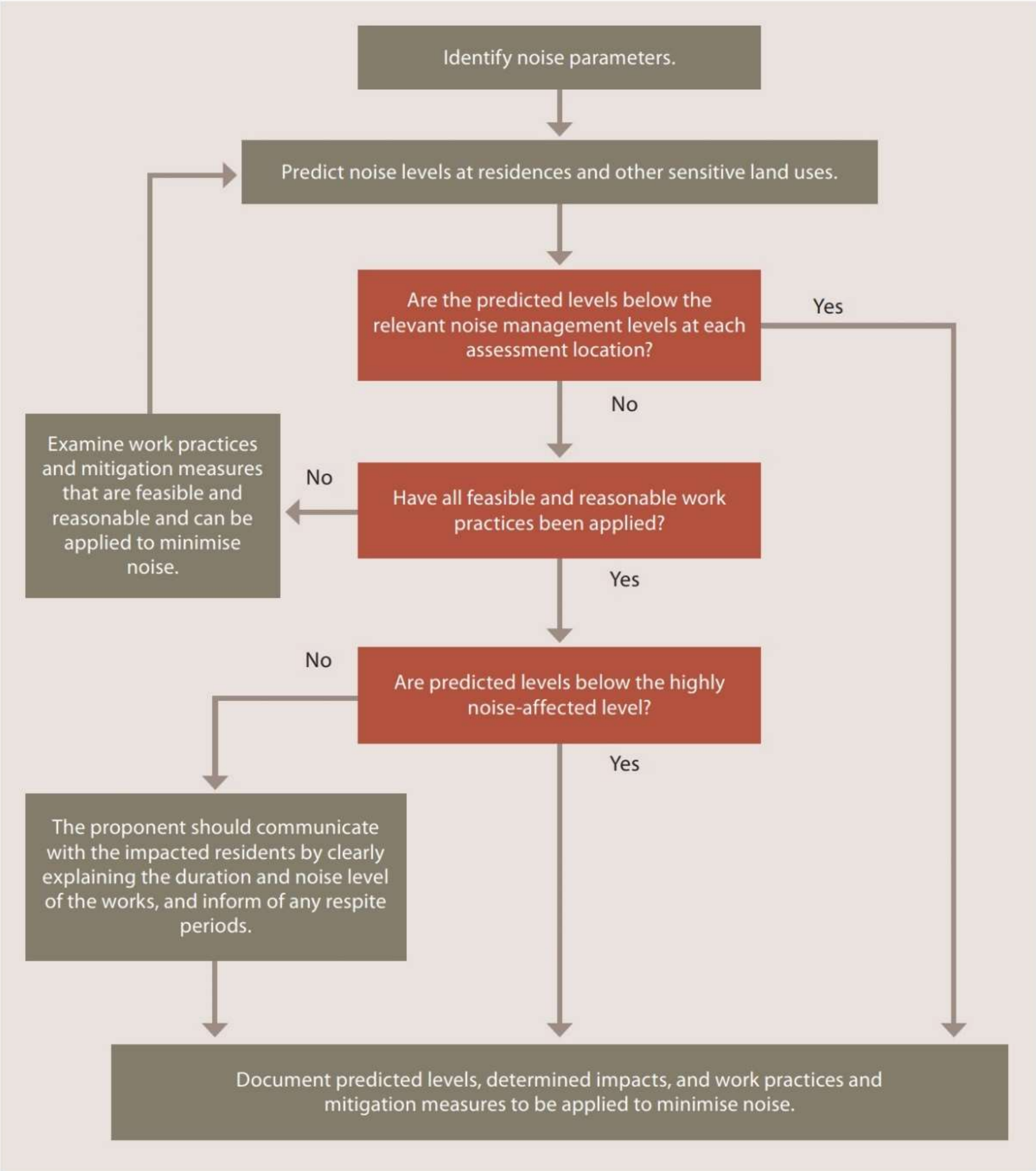
The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This NA has adopted a quantitative assessment approach which is summarised in Figure 5. The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

Figure 5 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.3.1 Standard Hours for Construction

Table 2 presents the ICNG recommended standard hours for construction works.

Table 2 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Construction activities are anticipated to be undertaken during standard construction hours.

3.3.2 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. Table 3 reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB for Out of Hours (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 3 Noise Management Levels		
Time of Day	Management Level LAeq(15min)[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75dBA (HNA)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

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4 Construction Noise Management Levels

4.1 Background Noise levels

The assessment has adopted the minimum assumed Rating Background Noise Levels (RBLs) outlined in Section 2.3 of the Noise Policy for Industry (NPI, 2017), which are reproduced in **Table 4**.

Table 4 Default RBLs

Period[1]	Adopted RBL, dB LA90
Day	35
Evening	30
Night	30

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Construction Noise Management Levels

The relevant NMLs for standard construction hours are presented in **Table 5**.

Table 5 Construction Noise Management Levels

Catchment (No) Receiver ID	Assessment Period[1]	Adopted RBL dB LA90	NML dB LAeq(15min)
Residential	Standard Hours	35	45 (RBL+10dBA)
Educational	When in use	N/A	45 (internal) 55 (external)[2]
Passive Recreation Areas	When in use	N/A	60 (external)
Commercial Premises	When in use	N/A	70 (external)

Note 1: Refer to **Table 2** for Standard Recommended Hours for Construction.

Note 2: External level based on 10dB with windows open for adequate ventilation (ICNG).

4.3 Construction Vibration

The Construction Noise & Vibration Strategy (V4.2 Transport for NSW, 2019) sets out safe working distances to achieve the cosmetic damage and human response criteria for vibration.

Table 6 provides the minimum working distances for the use of various vibration intensive sources to nearby receivers. The minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions.

Table 6 Minimum Working Distances or Vibratory Plant (m)

Plant item	Rating / Description	Minimum working distance	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5m	15m to 20m
	< 100 kN (Typically 2-4 tonnes)	6m	20m
	< 200 kN (Typically 4-6 tonnes)	12m	40m
	< 300 kN (Typically 7-13 tonnes)	15m	100m
	> 300 kN (Typically 13-18 tonnes)	20m	100m
	> 300 kN (> 18 tonnes)	25m	100m
Small Hydraulic Hammer	300kg – 5 to 12t excavator	2m	7m
Medium Hydraulic Hammer	900kg – 12 to 18t excavator	7m	23m
Large Hydraulic Hammer	1600kg – 18 to 34t excavator	22m	73m
Vibratory Pile Driver	Sheet Piles	2m to 20m	20m
Pile Boring	≤800 mm	2m (nominal)	4m
Jackhammer	Handheld	1m (nominal)	2m

Note: Source, CNVS (Transport for NSW, 2019)

5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2024) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613:1 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standards are the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

5.1 Construction Assessment Methodology

Construction activities are proposed to be progressive and will be undertaken in three stages. The scenarios of these work stages are identified as below:

- Scenario 1: Demolition and Required Preparation Works;
- Scenario2: Pouring Concrete Sections and General Construction; and
- Scenario 3: Internal fit out.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

Noise emission data and assumptions used in this assessment are summarised in Table 7.

Table 7 Construction Equipment Sound Power Levels, Lw dBA (re 10^{-12} Watts)

Scenario Description	Items	Number of	Lw
Scenario1 – Demolition and Required Preparation Works			
Demolition of required sections and required preparation works.	Compressor	1	109
	6 tonne Excavator with hydraulic hammer	1	115
	Truck – Medium rigid (20 tonne)	2	106
	Hand tools	1	103
Total Scenario Sound Power			117
Scenario 2 – Pouring Concrete Sections and General Construction			
Install reo formation work pour concrete slabs	Compressor	1	109
	Generator – diesel/petrol (6kW)	1	103
	Truck – Concrete	2	112
	Vibrator – Concrete	2	116
	Hand tools	1	103
Total Scenario Sound Power			119
Scenario 3 – Internal Fit out			
Internal fit out and install final equipment.	Crane – Franna (20 tonne)	1	98
	Elevated work platform – scissor lift	1	98
	Truck – Medium rigid (20 tonne)	2	106
	Hand tools	1	103
Total Scenario Sound Power			109

Sound Power Levels (SWLs) range from 109dBA to 119dBA which is representative of the combined noise level for specific construction activities. It should be noted that some items may be interchanged within each activity and would have no influence on the overall noise level of each activity or predicted noise levels.

6 Construction Noise Assessment Results

6.1 Construction Noise Assessment

Table 8 summarises the predicted noise level for each of the construction scenario at identified receivers. Where a construction scenario exceeds the NML at an assessed receiver, it is highlighted in Bold.

Table 8 Construction Nosie Predictions – All Receivers

Rec	Predicted Noise Level dB $L_{Aeq(15min)}$			NML
	Sc1	Sc2	Sc3	dB $L_{Aeq(15min)}$
R01	73	76	65	45
R02	74	76	65	45
R03	77	79	69	45
R04	75	78	67	45
R05	71	76	65	45
R06	58	60	53	45
R07	59	62	52	45
R08	56	65	47	45
ED01	67	70	59	55
ED02	69	70	59	55
ED03	55	57	47	55
ED04	69	72	62	55
PR01	74	77	65	60
PR02	81	83	71	60
C01	58	60	50	70
C02	68	71	60	70
C03	64	68	57	70

Predictions identify that emissions from all construction scenarios are above the noise management levels at several of the assessed receivers. Accordingly, recommendations to reduce the impact of construction noise emissions on surrounding receivers are provided in Section 7 of this report.

6.2 Construction Vibration Assessment

The key vibration generating source proposed to be used is a small hydraulic hammer mounted on a tracked excavator (up to 12 tonnes) used for demolition of the existing structures on the site or during excavation works. Table 6 in Section 4.3 provides the minimum working distances for the use of various vibration intensive sources. As previously stated, the minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions.

Building works have the potential to occur within a minimum offset distance of 5m from the nearest receiver, PR01, during demolition and ground works. A minimum offset distance to receptors of greater than 7m is required to satisfy the minimum offset criteria specified in the CNVS for human comfort for the largest vibration generating equipment likely to be used for the project.

Therefore, once the final construction plant is selected, consideration should be given to where possible utilising smaller plant, with a lower minimum working distance, when construction is conducted in close proximity to neighbouring receivers to limit the potential impact. Alternatively, where possible, planning to undertake vibration intensive construction when the adjacent passive recreational receiver is not occupied and not in use, may be also considered to limit the potential impact on human comfort.

7 Construction Recommendations

The results of the Noise Assessment demonstrate that levels during standard construction hours have the potential to be above the applicable ICNG Noise Management Levels at several of the nearest receivers in proximity to the operation. Accordingly, it is recommended that noise management and mitigation measures be adopted during noise intensive construction activities to limit impact on surrounding receivers.

Recommendations for consideration during construction activities for this operation may include:

- implement boundary fences/retaining walls as early as possible to maximise their attenuation benefits to surrounding receivers;
- toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to the community;
- where possible use mobile screens or construction hording to act as barriers between construction works and receivers;
- all plant should be shut down when not in use. Plant to be parked/started at farthest point from relevant assessment locations;
- operating plant in a conservative manner (no over-revving);
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimisation of metallic impact noise;
- all plant are to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm; and
- undertake letter box drops to notify receivers of potential works.

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8 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment to quantify and manage (if required) associated with the proposed Serviced Apartments Development to be located at 6- 8 Grant Street, Maitland, NSW.

A semi-quantitative screening test of noise intrusion from road traffic travelling on the nearby New England Highway has been completed. The findings of the screening test demonstrate that Category 2 treatments, which is consistent with 6mm monolithic glazing standard construction materials, are expected to be able to provide suitable attenuation from road traffic associated with busy roads in the area. It is understood that 6.38mm laminated glazing, which is consistent with Category 3 treatments will be installed in the development which exceeds the recommendation for Category 2 treatments.

Additionally, a rail noise screening test found the project site is located outside both Zone A and Zone B, with no additional treatments required to attenuate rail noise intrusion into the dwelling.

Modelled noise emissions from construction activities identify that predicted noise emissions are above the applicable construction management levels at all assessed receivers. Therefore, noise management measures are provided in this report to reduce potential impacts on surrounding receivers.

A review potential vibration levels found that the nearest receivers may experience vibration levels above the recommended level for human comfort when works are conducted in close proximity to the receivers. Therefore, should be given to where possible utilising smaller plant, with a lower minimum working distance, when construction is conducted in close proximity to neighbouring receivers to limit the potential impact. Alternatively, where possible, planning to undertake vibration intensive construction when the adjacent passive recreational receiver is not occupied and not in use, may be also considered to limit the potential impact on human comfort.

In summary, the Noise Assessment supports the Development Application for the project incorporating the recommendations and controls outlined in this report.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in Table A1.

Table A1 Glossary of Acoustical Terms

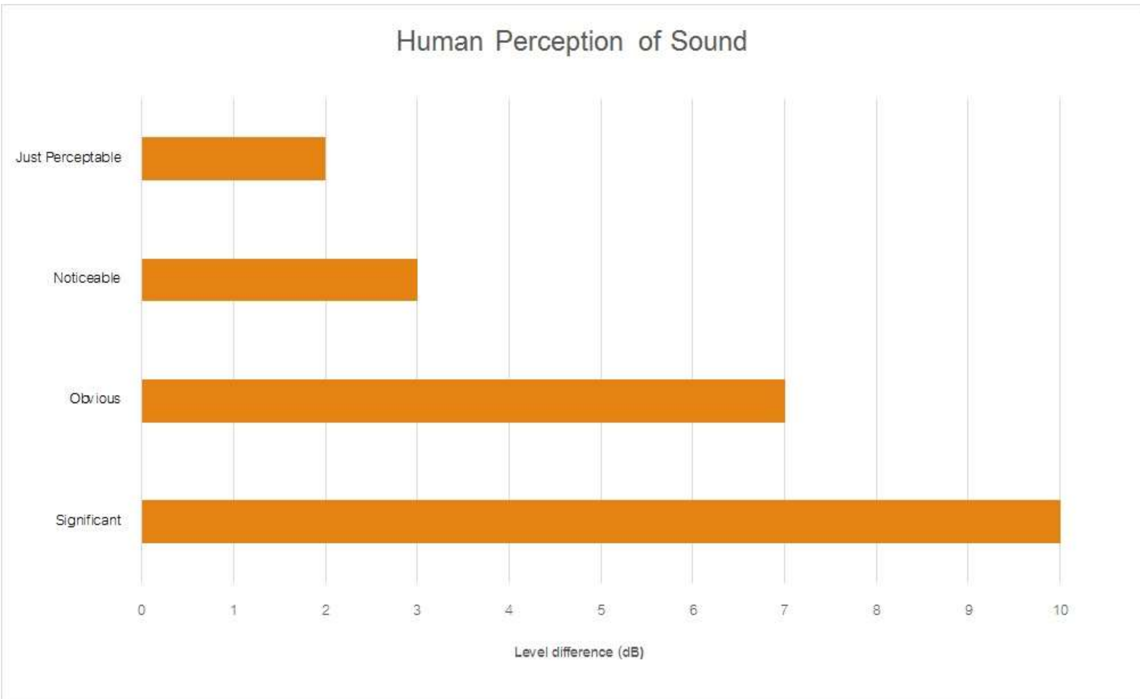
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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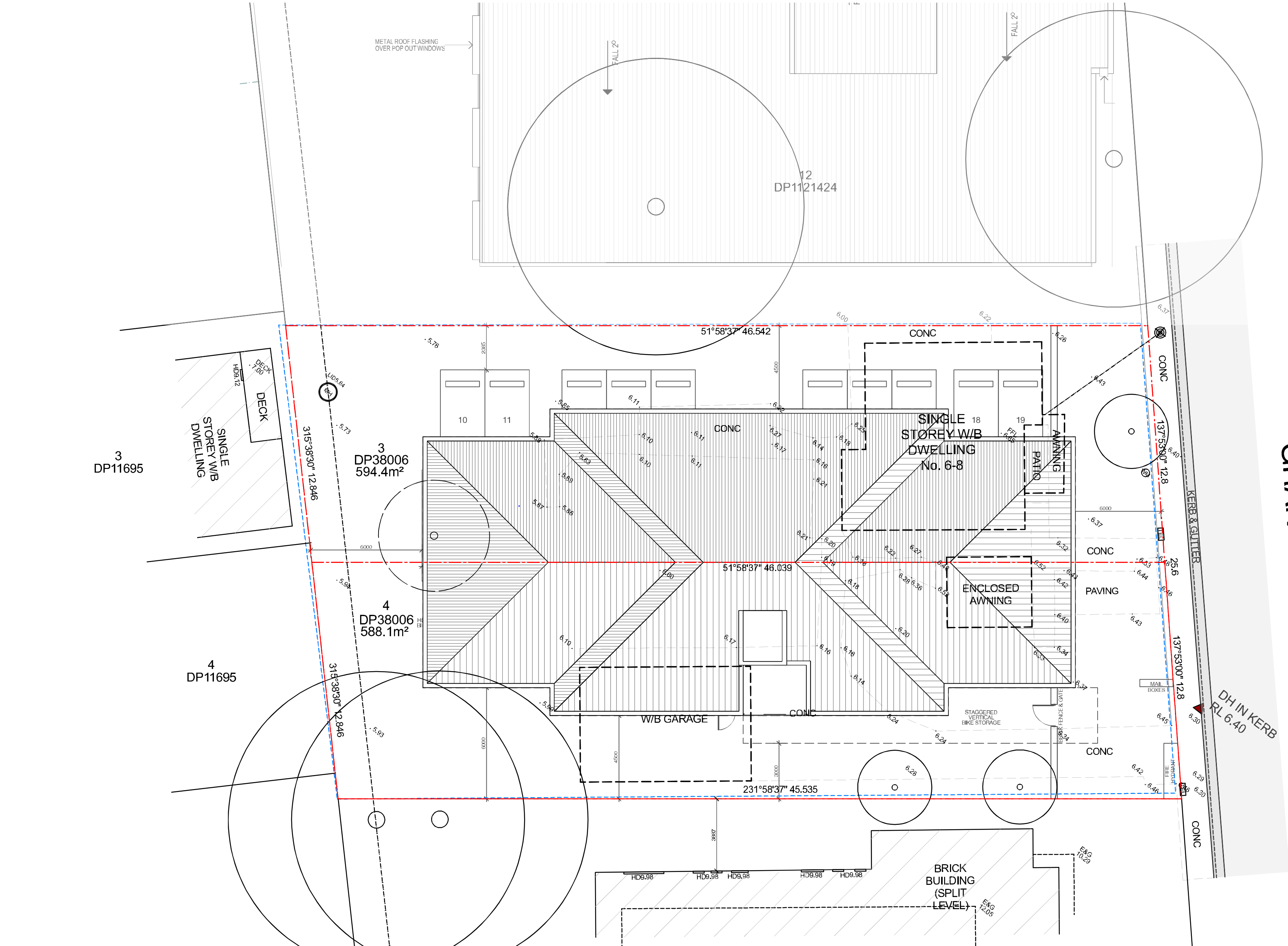
Appendix B – Site Plans



Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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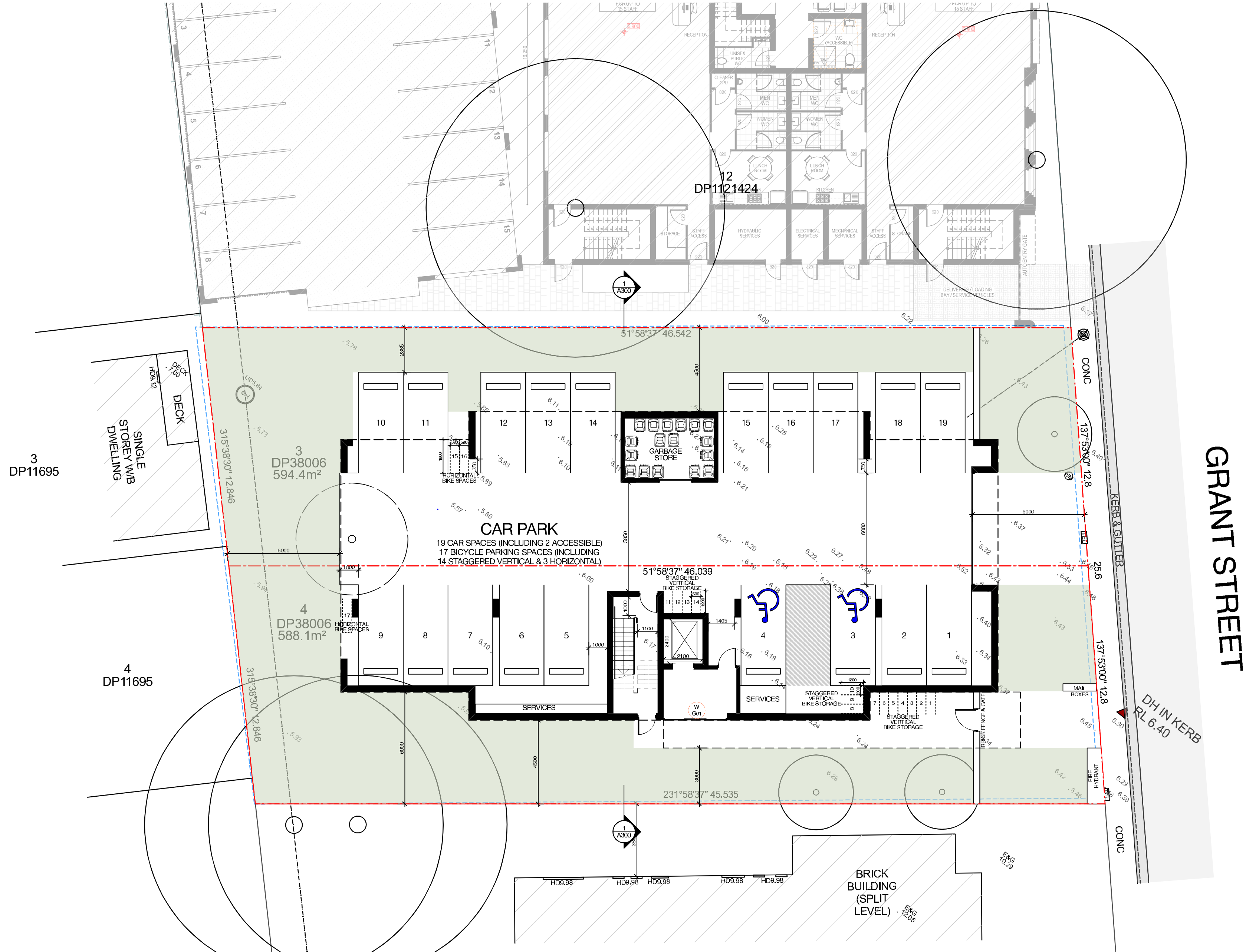
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By RL	Dwg Date: Oct 2023	Project No. 2350
Client	BROWN COMMERCIAL	Checked By AB	Scale 1:200@A3	Drawing No. A101 / Rev A
Title	SITE PLAN / ROOF PLAN			



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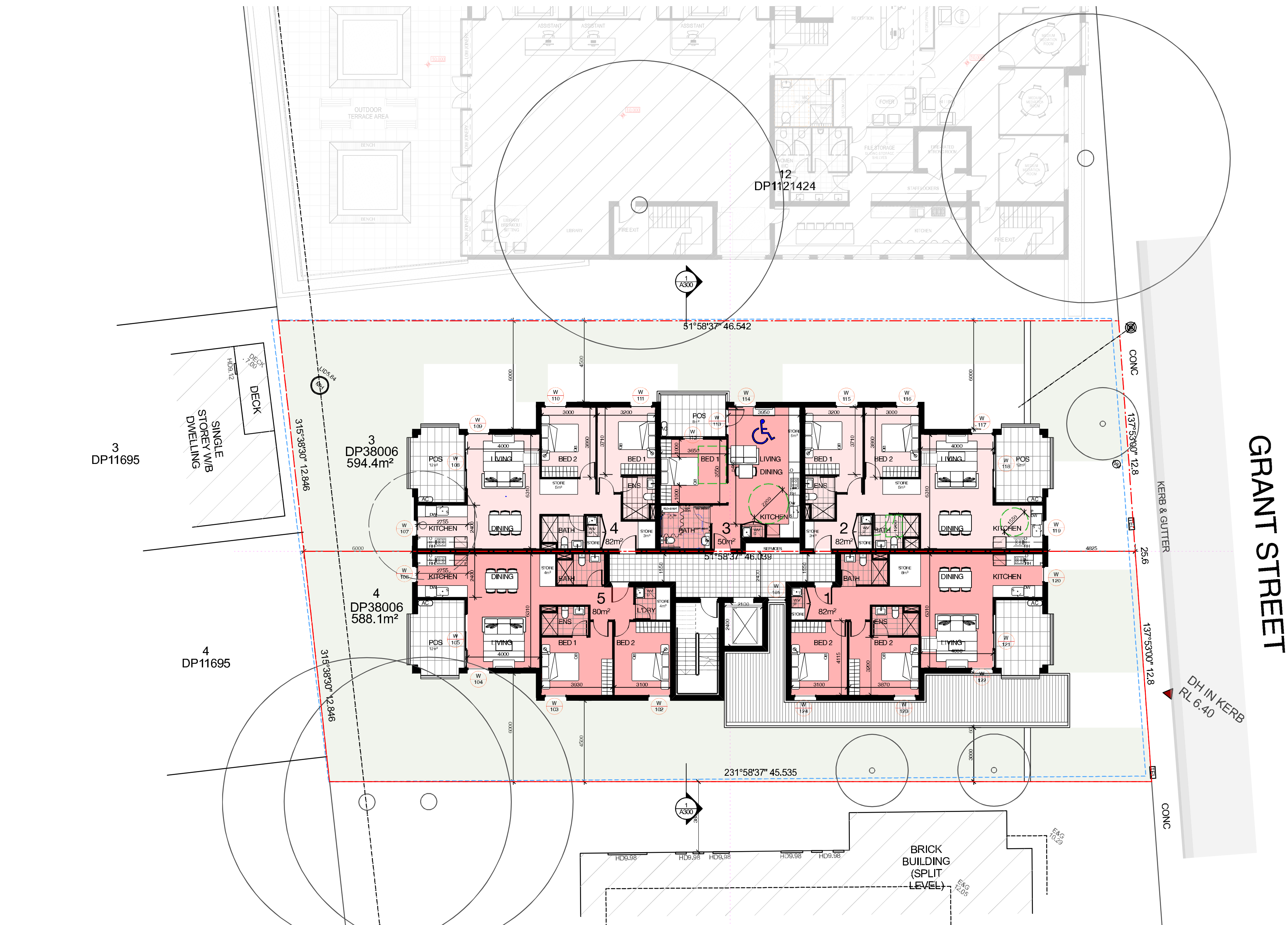
Registered Architect 5387
ABN 87 123 916 807

Project	NEW RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By RL	Dwg Date: Oct 2023	Project No. 2350
Client	BROWN COMMERCIAL	Checked By AB	Scale 1:200@A3	Drawing No. A102 Rev A
Title	GROUND FLOOR PLAN			



When measuring the building separation between commercial and residential uses, consider office windows and balconies as habitable space and service and plant areas as non-habitable.

Where applying separation to buildings on adjoining sites, apply half the minimum separation distance measured to the boundary. This distributes the building separation equally between sites (consider relationship with section 3F Visual privacy).

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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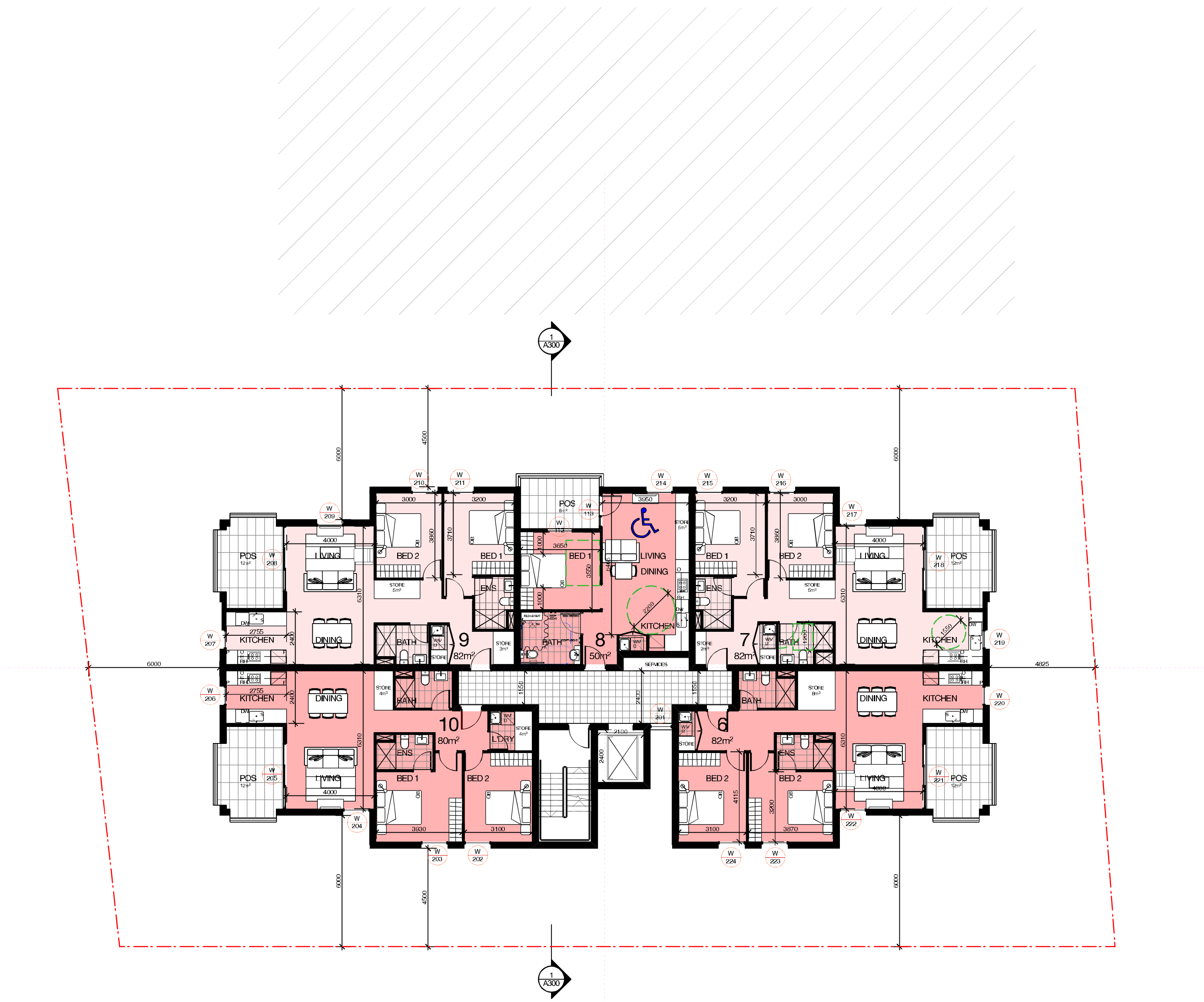
Client	BROWN COMMERCIAL	Checked By AB	Scale 1:200@A3	Drawing No. A103 Rev A
Title	LEVEL 1 FLOOR PLAN			



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Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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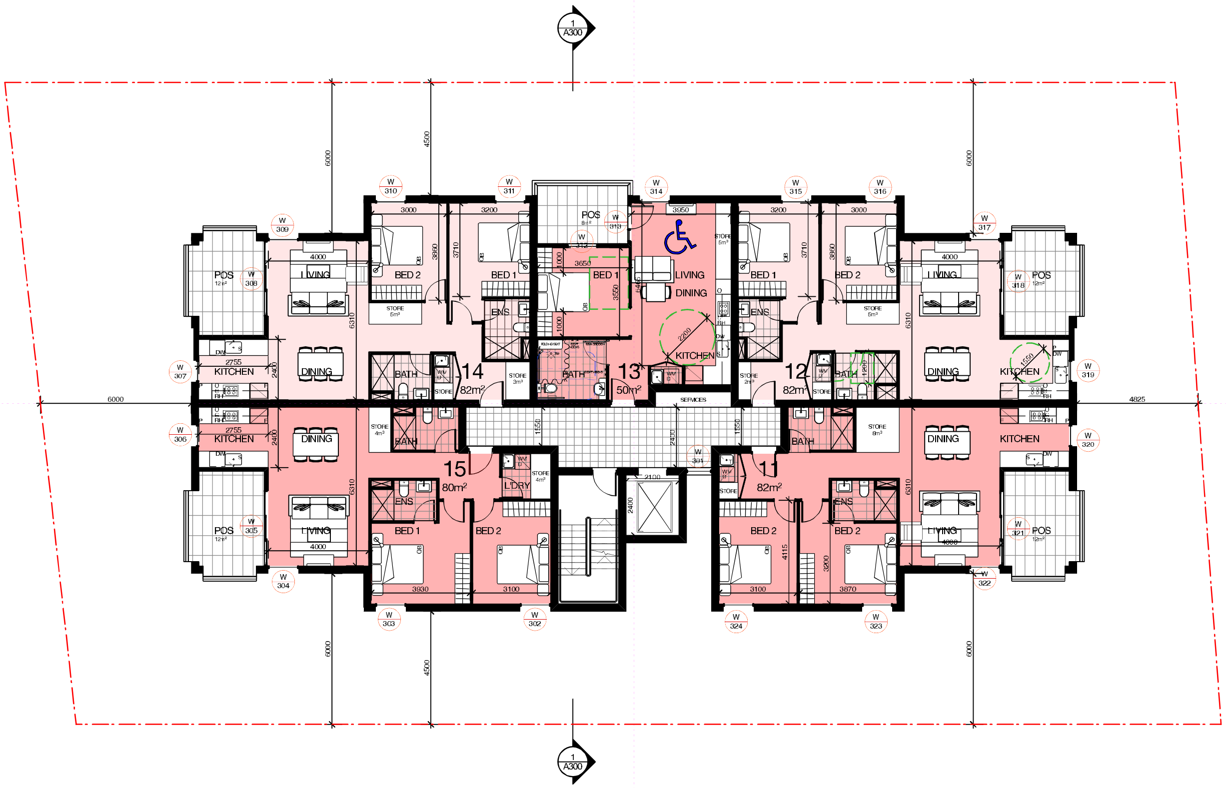
Project: NEW RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By: RL	Dwg Date: Oct 2023	Project No.: 2350
Client: BROWN COMMERCIAL BUILDING	Checked By: AB	Scale: 1:200@A3	Drawing No.: A104 Rev: A
Title: LEVEL 2 FLOOR PLAN			



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Where applying separation to buildings on adjoining sites, apply half the minimum separation distance measured to the boundary. This distributes the building separation equally between sites (consider relationship with section 3F Visual privacy).

Revision	Amendment	By	Date
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Client	BROWN COMMERCIAL	Checked By AB	Scale 1:200@A3	Drawing No. A105 Rev A
Title	LEVEL 3 FLOOR PLAN			

S O U T H   E L E V A T I O N

N O R T H   E L E V A T I O N   -   G R A N T   S T R E E T

FINISHES LEGEND

1FB	FACE BRICK DARK BRICK
2FB	FACE BRICK LIGHT BRICK
CL	FC CLADDING
RP	RENDER + PAINT FINISH
RP1	RENDER + PAINT FINISH
MR	METAL ROOFING

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By: PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By: AB	Scale: 1:200@A3	Drawing No. A201 Rev A
Title	NORTH & SOUTH ELEVATIONS			

W E S T   E L E V A T I O N

E A S T   E L E V A T I O N

FINISHES LEGEND

1FB	FACE BRICK DARK BRICK
2FB	FACE BRICK LIGHT BRICK
CL	FC CLADDING
RP	RENDER + PAINT FINISH
RP1	RENDER + PAINT FINISH
MR	METAL ROOFING

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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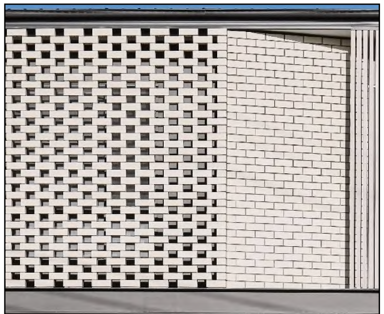
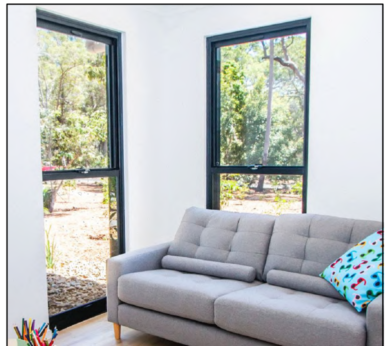
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By AB	Scale 1:200@A3	Drawing No. A202 Rev A
Title	EAST & WEST ELEVATIONS			

FINISHES LEGEND	
1FB	FACE BRICK DARK BRICK
2FB	FACE BRICK LIGHT BRICK
CL	FC CLADDING
RP	RENDER + PAINT FINISH
RP1	RENDER + PAINT FINISH
MR	METAL ROOFING



HIT MISS BRICK PATTERN TO CARPARK

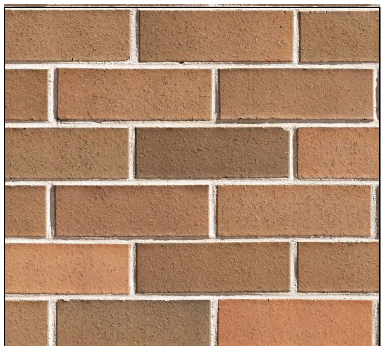
BALUSTRADES
COLOUR DULUX BASALT



ALUMINIUM WINDOW FRAMES
COLOUR DULUX BASALT

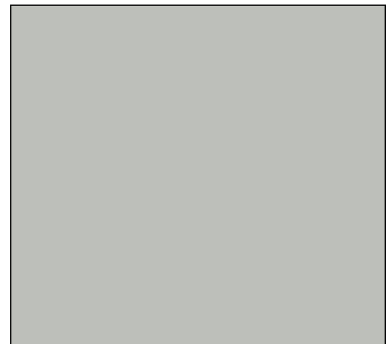
MR METAL ROOF
LYSAGHT KLIP-LOK COLORBOND

1FB FACE BRICK
AUSTRAL PARK LANE CHESTERFIELD

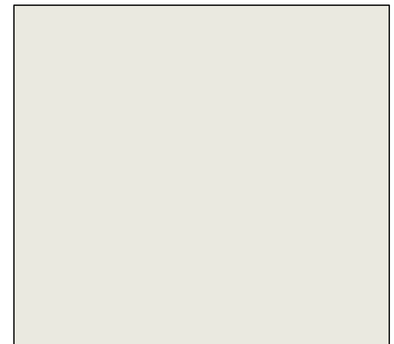


2FB FACE BRICK
AUSTRAL PARK LANE WESTMINSTER

CL CLADDING PAINTED FIBRE CEMENT
COLOUR DULUX BASALT



RP RENDER + PAINT
COLOUR COLORBOND SHALE GREY



MR METAL ROOF & RENDER + PAINT
RP1 COLOUR COLORBOND SURF MIST

S O U T H E L E V A T I O N - E N T R A N C E

N O R T H E L E V A T I O N - G R A N T S T R E E T

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Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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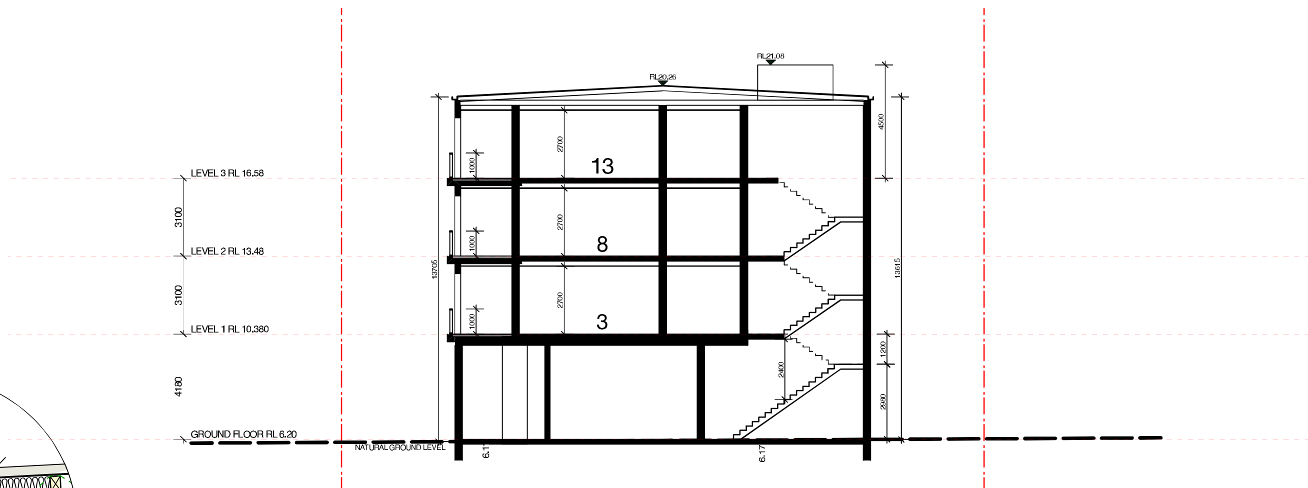
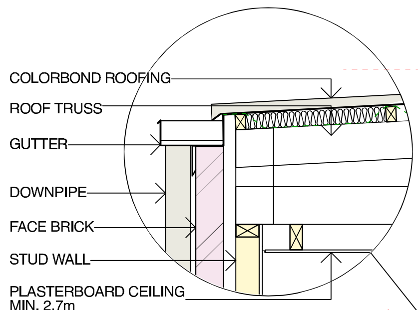
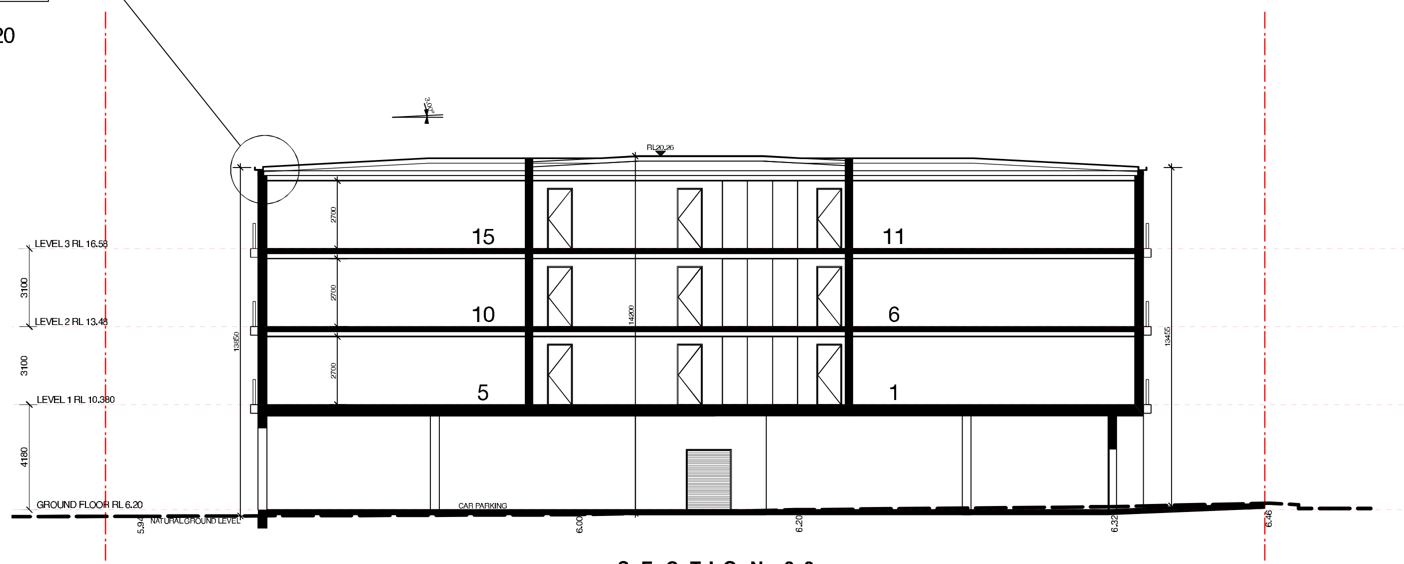
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By AB	Scale 1:200@A3	Drawing No. A203 Rev A
Title	MATERIALS & FINISHES			



SECTION 01



GUTTER DETAIL SCALE 1:20



SECTION 02

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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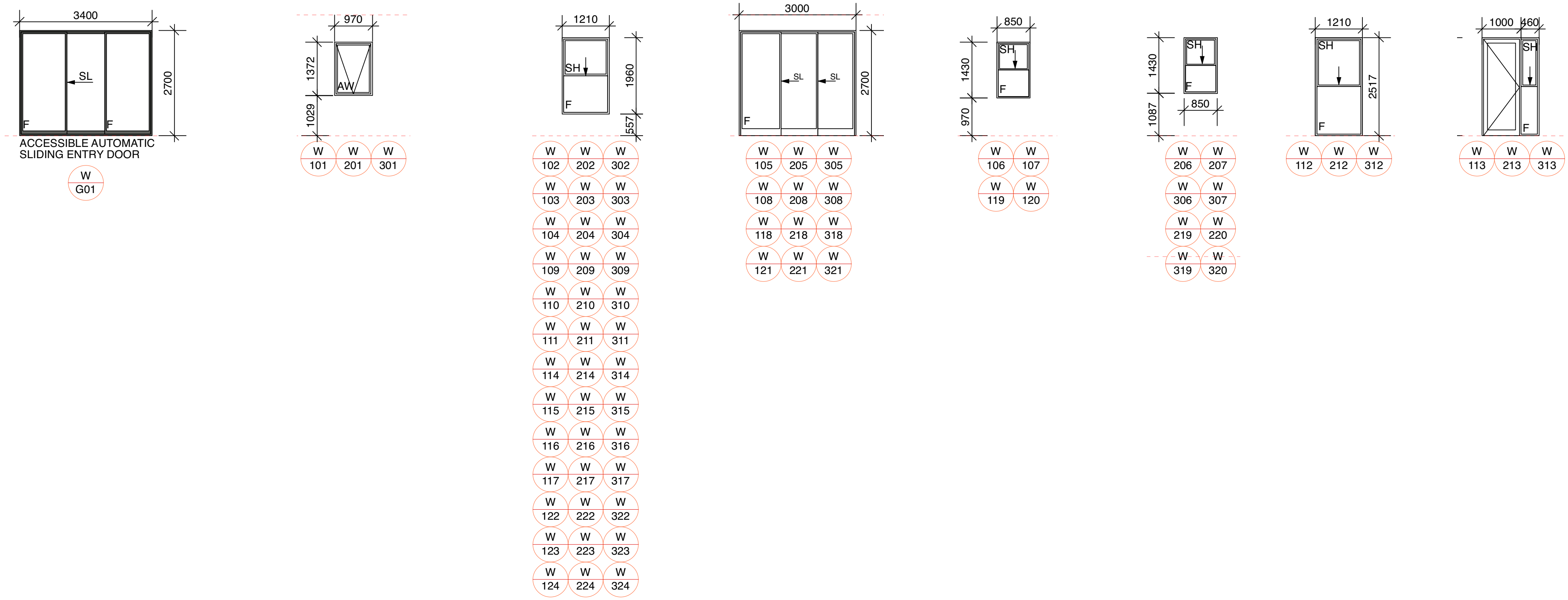
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By: PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By	Scale: 1:200@A3	Drawing No. A300, Rev A
Title	SECTION 1 & 2			



Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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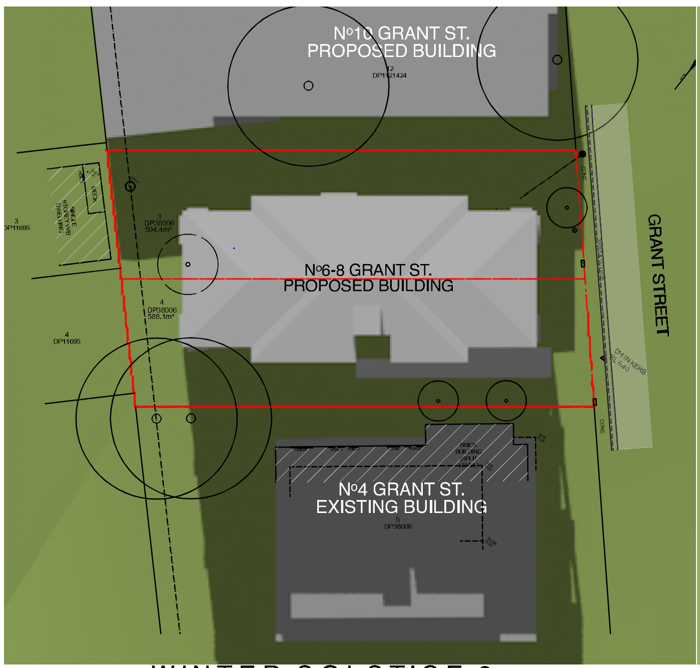
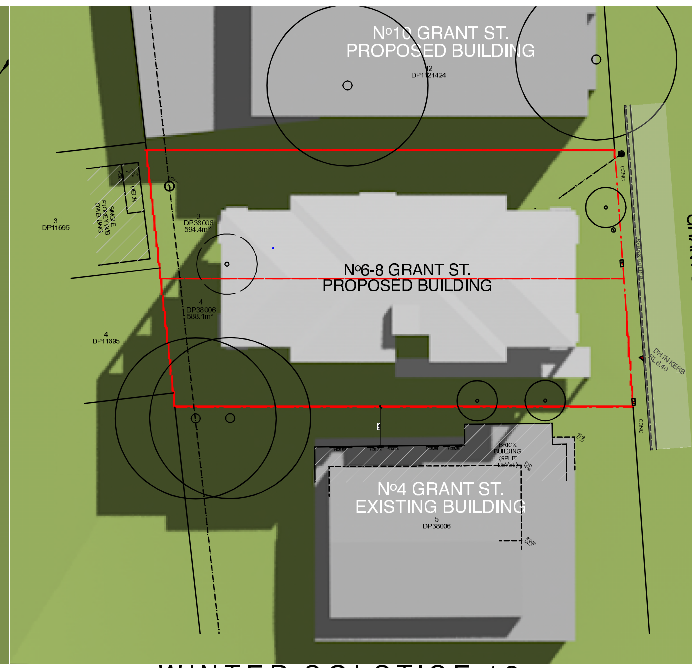
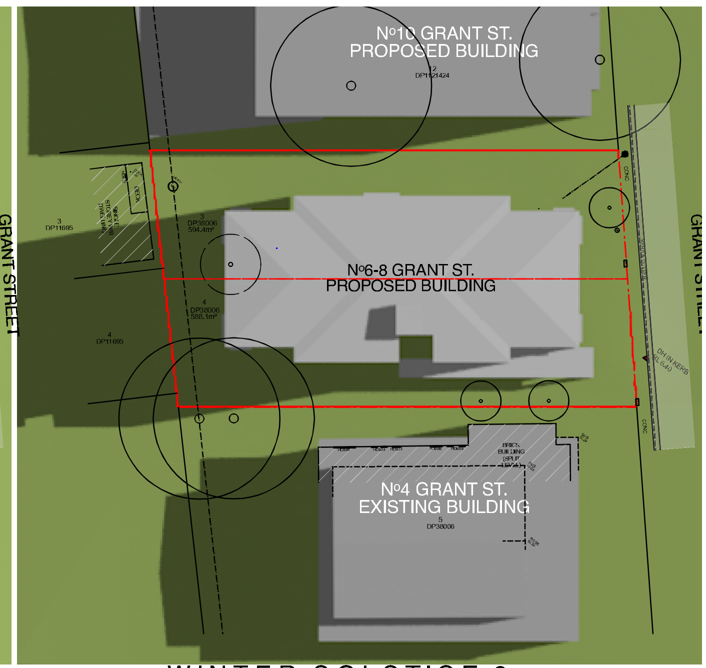
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By AB	Scale 1:100@A3	Drawing No. A400 Rev A
Title	WINDOW SCHEDULE			



WINTER SOLSTICE 3pm



WINTER SOLSTICE 12 noon



WINTER SOLSTICE 9am

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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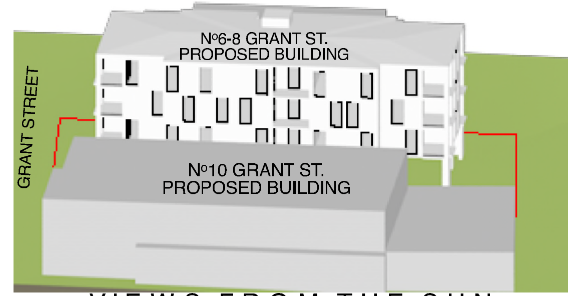
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By	Scale 1:500@A3	Drawing No. A820 Rev A
Title	SHADOW DIAGRAMS			

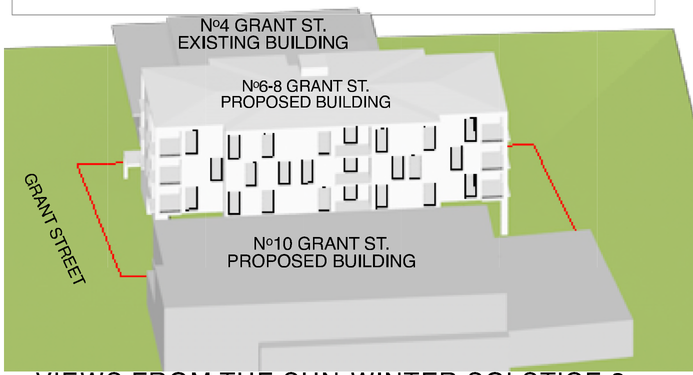
SOLAR ACCESS DURING THE WINTER SOLSTICE

		9am	10am	11am	12pm	1pm	2pm	3pm	TOTAL
LEVEL 1	UNIT 1	√	√	√	√				3hours
	UNIT 2	√	√	√	√	√	√	√	6hours
	UNIT 3		√	√	√	√	√	√	5hours
	UNIT 4			√	√	√	√	√	4hours
	UNIT 5								0hours
LEVEL 2	UNIT 6	√	√	√	√				3hours
	UNIT 7	√	√	√	√	√	√	√	6hours
	UNIT 8		√	√	√	√	√	√	5hours
	UNIT 9			√	√	√	√	√	4hours
	UNIT 10								0hours
LEVEL 3	UNIT 11	√	√	√	√				3hours
	UNIT 12	√	√	√	√	√	√	√	6hours
	UNIT 13		√	√	√	√	√	√	5hours
	UNIT 14			√	√	√	√	√	4hours
	UNIT 15								0hours

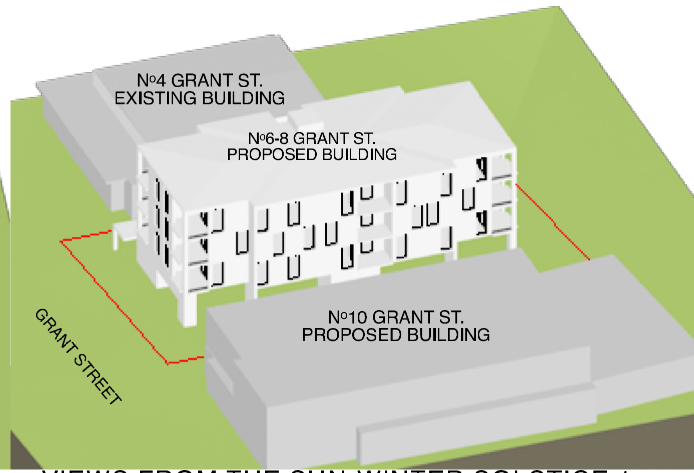
12 of the 15 units receive a minimum of 3hours of solar access to the living area & private open space during the winter solstice.This meets ADG requirements as it EQUATES TO 80%.



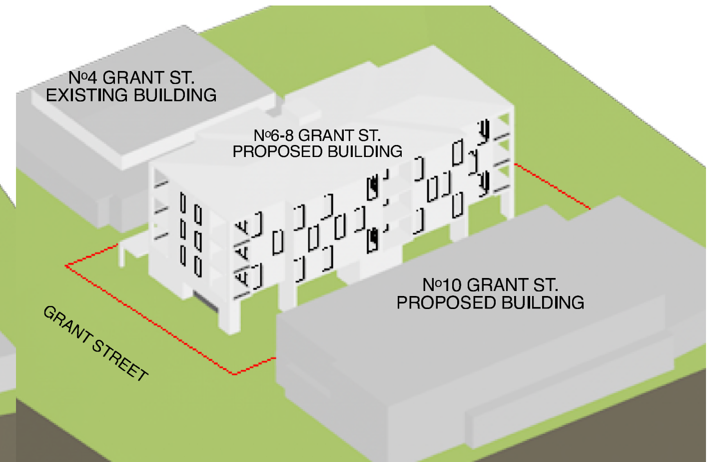
VIEWS FROM THE SUN
WINTER SOLSTICE 3pm



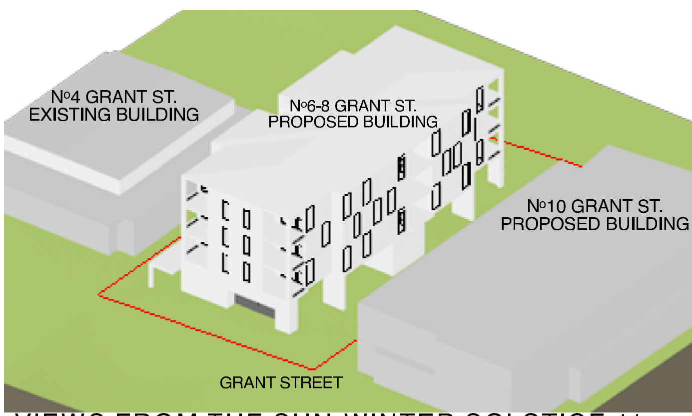
VIEWS FROM THE SUN-WINTER SOLSTICE 2pm



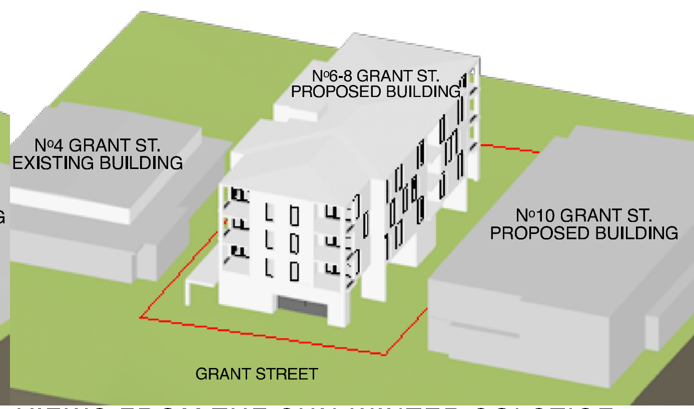
VIEWS FROM THE SUN-WINTER SOLSTICE 1pm



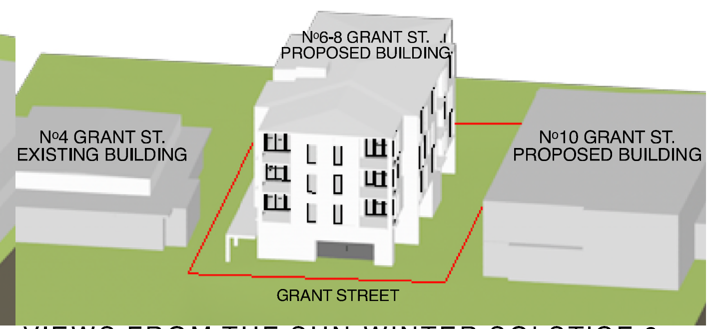
VIEWS FROM THE SUN-WINTER SOLSTICE 12noon



VIEWS FROM THE SUN-WINTER SOLSTICE 11am



VIEWS FROM THE SUN-WINTER SOLSTICE 10am



VIEWS FROM THE SUN-WINTER SOLSTICE 9am

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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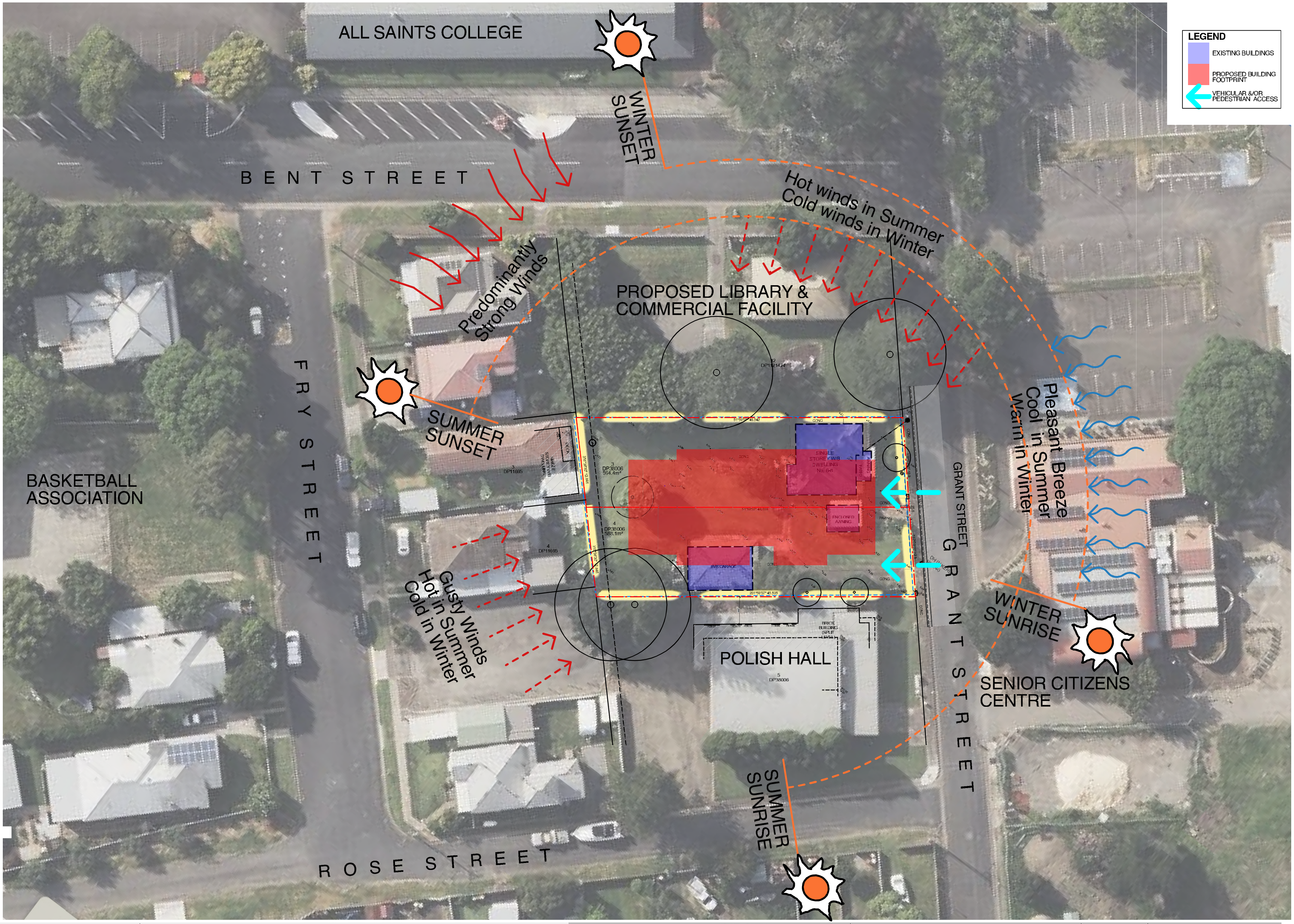
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By: PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By	Scale: 1:500@A3	Drawing No. A821 / Rev A
Title	VIEWS FROM THE SUN			



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Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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Client	BROWN COMMERCIAL	Checked By	AB	Scale 1:500@A3	Drawing No. A822 / Rev A
Title	SITE ANALYSIS PLAN				

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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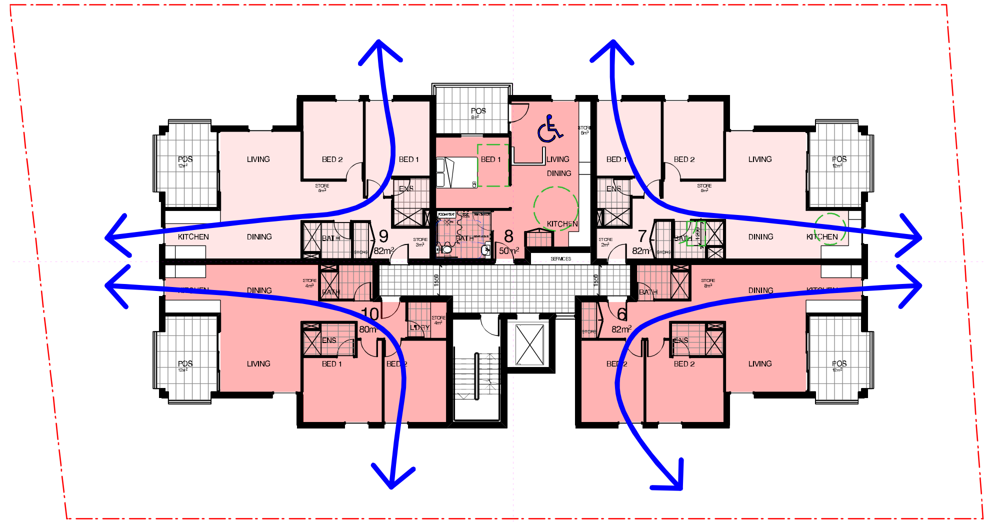
Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By PB	Dwg Date: Feb 2024	Project No. 2350
Client	BROWN COMMERCIAL	Checked By AB	Scale nts@A3	Drawing No. A823 Rev A
Title	MASSING MODEL			

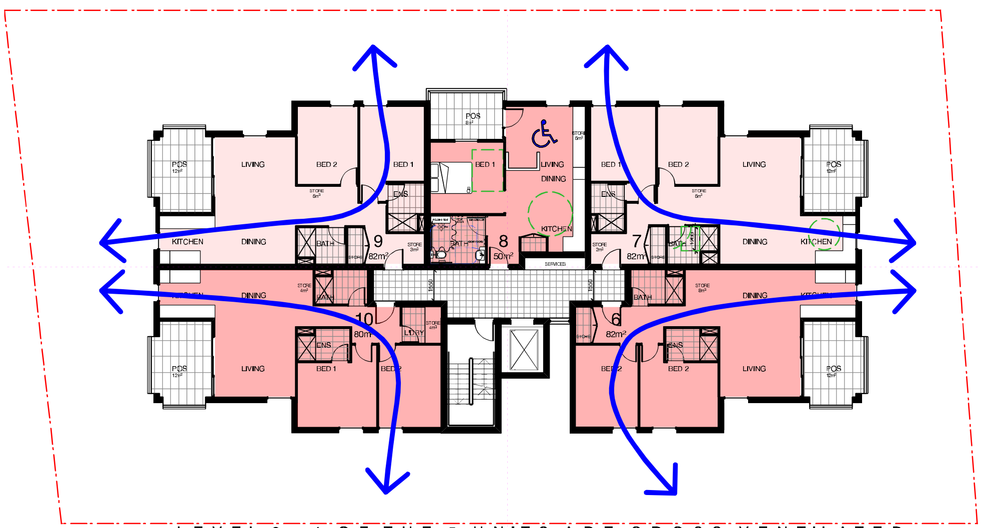
NATURAL CROSS VENTILATION		
LEVEL 1	UNIT 1	√
	UNIT 2	√
	UNIT 3	
	UNIT 4	√
	UNIT 5	√
LEVEL 2	UNIT 6	√
	UNIT 7	√
	UNIT 8	
	UNIT 9	√
	UNIT 10	√
LEVEL 3	UNIT 11	√
	UNIT 12	√
	UNIT 13	
	UNIT 14	√
	UNIT 15	√
	TOTAL	12

Natural cross ventilation to a min. of 60% of units in the development this equates to 9 units.

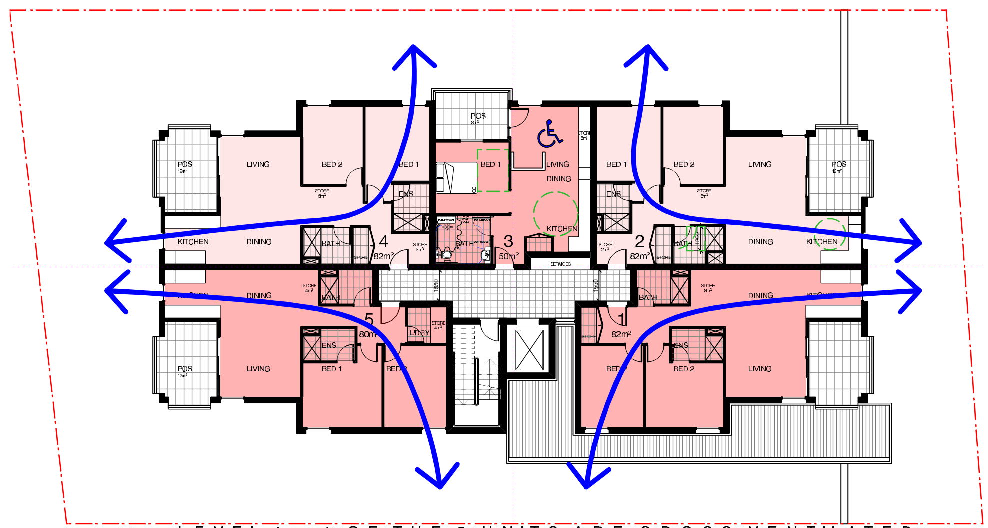
12 of the 15 units achieve natural cross ventilation. This meets ADG requirements as it EQUATES TO 80%.



L E V E L 3 - 4 O F T H E 5 U N I T S A R E C R O S S V E N T I L A T E D



L E V E L 2 - 4 O F T H E 5 U N I T S A R E C R O S S V E N T I L A T E D



L E V E L 1 - 4 O F T H E 5 U N I T S A R E C R O S S V E N T I L A T E D

A	Issued for DA approval	PB	15/3/24
Revision	Amendment	By	Date

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Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By: PB	Dwg Date: March 2024
Client	BROWN COMMERCIAL	Checked By	Scale: 1:250@A3
Title	NATURAL CROSS VENTILATION		

Project No. 2350

Drawing No. A113 Rev A

SOLAR ACCESS DURING THE WINTER SOLSTICE									
		9am	10am	11am	12pm	1pm	2pm	3pm	TOTAL
LEVEL 1	UNIT 1	√	√	√	√				3hours
	UNIT 2	√	√	√	√	√	√	√	6hours
	UNIT 3		√	√	√	√	√	√	5hours
	UNIT 4			√	√	√	√	√	4hours
	UNIT 5								0hours
LEVEL 2	UNIT 6	√	√	√	√				3hours
	UNIT 7	√	√	√	√	√	√	√	6hours
	UNIT 8		√	√	√	√	√	√	5hours
	UNIT 9			√	√	√	√	√	4hours
	UNIT 10								0hours
LEVEL 3	UNIT 11	√	√	√	√				3hours
	UNIT 12	√	√	√	√	√	√	√	6hours
	UNIT 13		√	√	√	√	√	√	5hours
	UNIT 14			√	√	√	√	√	4hours
	UNIT 15								0hours

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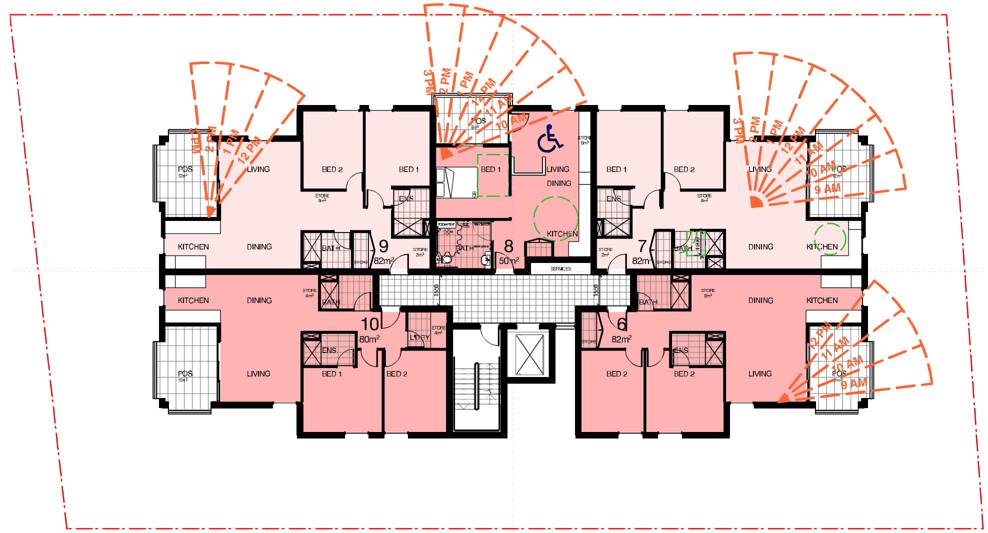
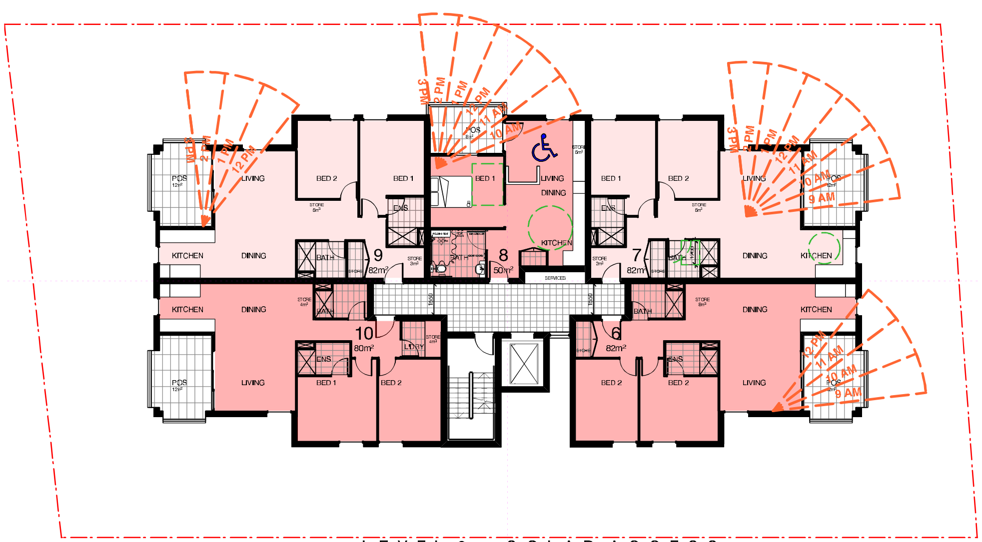
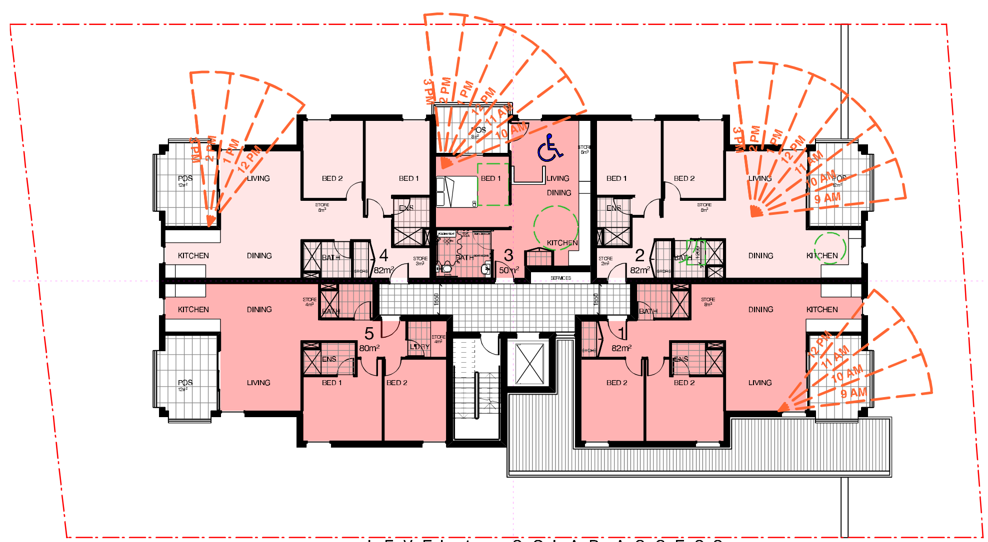


LEVEL 3 - SOLAR ACCESS



LEVEL 2 - SOLAR ACCESS



LEVEL 1 - SOLAR ACCESS

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

DIAL BEFORE YOU DIG www.1100.com.au
Prior to any commencement of works, ensure enquiry to dial before you dig is made.

0 5 10 M

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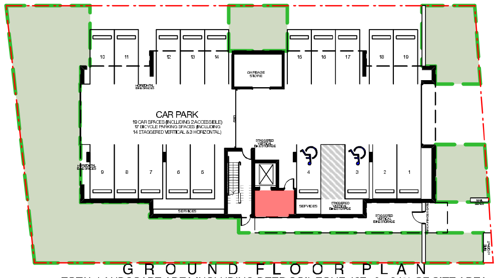
Project: RESIDENTIAL DEVELOPMENT, 6-8 GRANT ST MAITLAND
Client: BROWN COMMERCIAL
Title: WINTER SOLSTICE SOLAR ACCESS
Drawn By: PB
Checked By:
Dwg Date: March 2024
Scale: 1:250@A3
Project No. 2350
Drawing No. A114
Rev A



GROUND FLOOR PLAN

TOTAL LANDSCAPE AREA INCLUDING DEEP SOIL ZONE 407m² = 34% OF SITE AREA

GROSS FLOOR AREA 10m²

DEVELOPMENT STANDARDS CHECKLIST	STANDARD REQUIRED	PROPOSED	COMPLIES
ZONING	MU1 Mixed use		
SITE AREA		1182.5m2	
HEIGHT OF BUILDING	Not applicable	14m	
NUMBER OF STOREYS	Not applicable	4	
GROSS FLOOR AREA	Not applicable	1282 m2	
FSR	Not applicable	1 : 1.08	
MINIMUM LANDSCAPE AREA 25% OF SITE AREA	296m2	(407m2) 34%	√
DEEP SOIL ZONE 7% OF SITE AREA & 3m MIN. DIMENSION	83m2	(407m2) 34%	√
PROPORTION OF AREA FORWARD OF BUILDING LINE THAT CONTAINS LANDSCAPED AREA MINIMUM 25%		53% (71m2)	√
PRIMARY ROAD SETBACK	Average of adjoining	4825m	√
REAR SETBACK	6m	6m	√
MINIMUM PRINCIPAL PRIVATE OPEN SPACE	1 bed	8m2	√
	2 bed	12m2	√
COMMUNAL OPEN SPACE 25% OF SITE AREA	296m2	320m2 27%	√
ACID SULPHATE	CLASS 4		√

NOTE : All measurements have been rounded up or down to the nearest whole number

UNIT SCHEDULE	1 BED	2 BED	AREA
LEVEL 1		UNIT 1	82
		UNIT 2	82
Adaptable/Livable Housing	UNIT 3		50
		UNIT 4	82
		UNIT 5	80
LEVEL 2		UNIT 6	82
		UNIT 7	82
Adaptable/Livable Housing	UNIT 8		50
		UNIT 9	82
		UNIT 10	80
LEVEL 3		UNIT 11	82
		UNIT 12	82
Adaptable/Livable Housing	UNIT 13		50
		UNIT 14	82
		UNIT 15	80
Car spaces 1 per dwelling			15
(Including 2 accessible)			
Visitor			4
		TOTAL	19
Bicycle parking 1 per dwelling			15
Visitor			2
		TOTAL	17

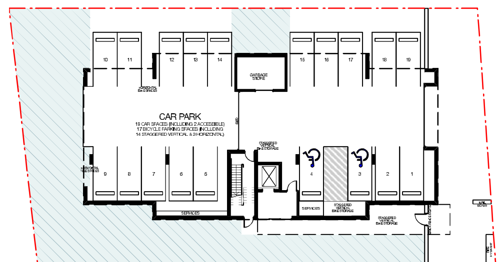
Note Areas are approximate & rounded to the nearest whole number

LEVEL 1 GROSS FLOOR AREA

AREA 424m²

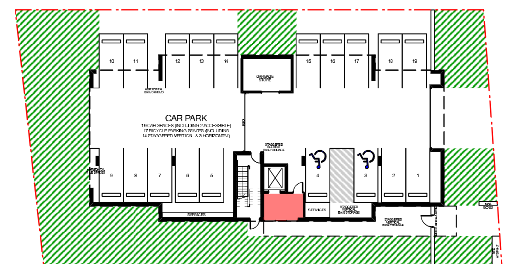
LEVEL 2 GROSS FLOOR AREA

AREA 424m²



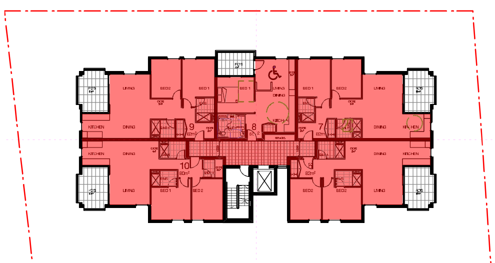
GROUND FLOOR PLAN

COMMUNAL OPEN SPACE 320m² = 27% OF SITE AREA



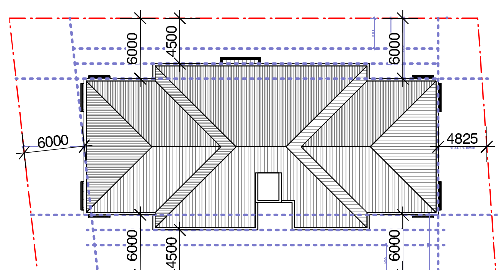
GROUND FLOOR PLAN

DEEP SOIL ZONE 7% OF THE SITE AREA & MIN. 3m (83m²) PROPOSED 407m² = 34% OF SITE AREA



LEVEL 3 GROSS FLOOR AREA

AREA 424m²



SETBACKS

Revision	Amendment	By	Date
A	Issued for DA approval	PB	15/3/24

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Project	RESIDENTIAL DEVELOPMENT 6-8 GRANT ST MAITLAND	Drawn By: PB	Dwg Date: Feb 2024
Client	BROWN COMMERCIAL	Checked By	Scale: 1:500@A3
Title	AREA CALCULATIONS	Project No.: 2350	Drawing No.: A810 Rev: A

Appendix C – Treatment Categories

Appendix C – Acoustic Treatment of Residences

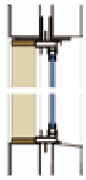
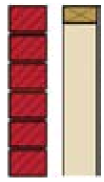
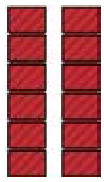
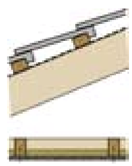
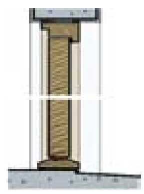
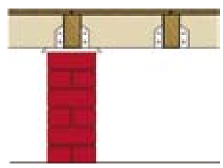
The following table sets out standard (or deemed-to-satisfy) constructions for each category of noise control treatment for the sleeping areas and other habitable areas of single / dual occupancy residential developments only. The assumptions made in the noise modelling are as follows:

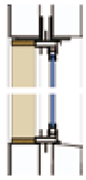
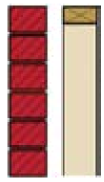
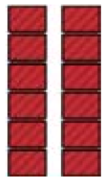
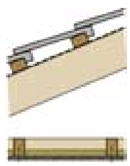
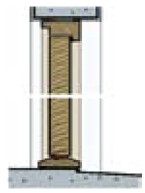
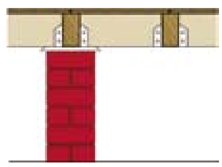
- Typical layout of a modern dwelling taken from a recent large residential development in an outer Sydney suburb
- Bedrooms and other habitable rooms are exposed to road noise

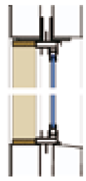
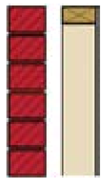
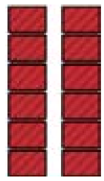
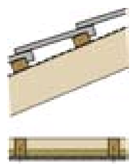
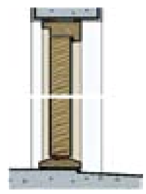
ACOUSTIC PERFORMANCE OF BUILDING ELEMENTS

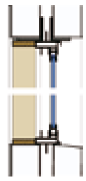
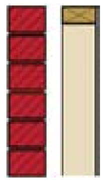
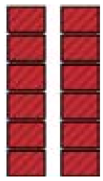
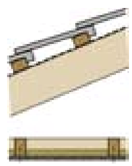
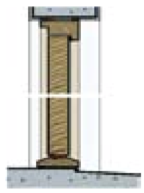
The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (Rw) values, which can be used to find alternatives to the standard constructions presented in this Appendix:

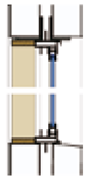
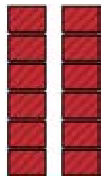
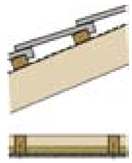
Category of Noise Control Treatment	R_w of Building Elements (minimum assumed)				
	Windows/Sliding Doors	Frontage Facade	Roof	Entry Door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

Category No.	Building Element	Standard Constructions	sample
1	**Windows/Sliding Doors**	Openable with minimum 4mm monolithic glass and standard weather seals	
	Frontage Facade	**Timber Frame or Cladding:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		Brick Veneer: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		Double Brick Cavity: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	Entry Door	35mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
2	**Windows/Sliding Doors**	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Frontage Facade	**Timber Frame or Cladding Construction:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity.	
		Brick Veneer Construction: 110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	40mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
3	**Windows/Sliding Doors**	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
4	**Windows/Sliding Doors**	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
5	**Windows/Sliding Doors**	Openable Double Glazing with separate panes: 5mm monolithic glass, 100mm air gap, 5mm monolithic glass with full perimeter acoustic seals.	
	Frontage Facade	**Double Brick Cavity Construction:** 2 leaves of 110mm brickwork separated by 50mm gap with cement render to the external face of the wall and cement render or 13mm plasterboard direct fixed to internal faces of the wall.	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joist using resilient mounts, R2 insulation batts in roof cavity	
	Entry Door	Special high performance acoustic door required - Consult an Acoustic Engineer	*Door to acoustic consultant's specifications*
	Floor	Concrete slab floor on ground	
6	**All**	Consult an Acoustic Engineer	

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