Noise Assessment

The Store Residential Towers
854 Hunter Street
Newcastle, NSW.

Prepared for: SLR Consulting Australia Pty Ltd
September 2021
MAC180790-03RP1V1

Muller Acoustic Consulting

Document Information

Noise Assessment

The Store Residential Towers

854 Hunter Street, Newcastle, NSW

Prepared for: SLR Consulting Australia Pty Ltd

Suite 2B, 125 Bull Street

Newcastle West NSW 2302

Prepared by: Muller Acoustic Consulting Pty Ltd

PO Box 678, Kotara NSW 2289

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by SLR Consulting Australia Pty Ltd (SLR) to conduct a Noise Assessment (NA) for the proposed Residential Towers development at 854 Hunter Street, Newcastle, NSW (the 'project'). This report presents the results, findings and recommendations of the NA and has been prepared to accompany the project's Development Application (DA) being prepared for submission to The City of Newcastle Council (TCON).

Key acoustic elements addressed as part of this assessment include:

- Road/transportation noise intrusion (impacts to internal spaces within apartments);
- Rooftop emissions, including mechanical plant from the project to neighbouring receivers; and
- Carpark noise emissions (including potential emissions from proposed Store car park).

Given the acoustic aspects considered in this assessment, the following policies and guidelines have been adopted:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Department of Planning (DPI), Development Near Rail Corridors and Busy Roads - Interim Guideline, 2008;
- NSW Environment Protection Authority (EPA), Road Noise Policy (RNP) 2011;
- NSW EPA's Noise Guide for Local Government (NGFLG) (2013);
- The Independent Liquor and Gaming Authority (ILGA) criteria related to licensed premises;
- Australian Standard AS 1055:2018 Acoustics - Description and measurement of environmental noise - General Procedures;
- Australian Standard AS 3671-1989, Acoustics - road traffic noise intrusion - building site and construction; and
- Australian Standard AS 2107:2016 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. Figure 1 presents the project site and nearest surrounding receivers that have been considered in this assessment.

FIGURE 1

LOCALITY PLAN

REF: MAC180790

0 70m

KEY	
R1	RECEIVER LOCATION
L1	LOGGER LOCATION
	SITE LOCATION

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*Imagery Source: nearmap

2 Noise Policy and Guidelines

2.1 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').

The guideline outlines internal noise criteria for Clause 102 (Road) of the State Environmental Planning Policy (SEPP) for Infrastructure (Infrastructure SEPP):

> *"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
>
> - *in any bedroom in the building: 35dBA at any time 10pm–7am; and*
> - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dBA at any time."*

Table 3.1 of the guideline clarifies that the above noise criteria are to be determined as an $LA_{eq(15hr)}$ for the daytime and $LA_{eq(9hr)}$ for the night time period.

The guideline assists in the planning, design and assessment of developments in, or adjacent to, rail corridors and busy roads and supports the Infrastructure SEPP. The guidelines are mandatory for residential developments proposed adjacent to busy roads with an Annual Average Daily Traffic (AADT) of greater than 40,000 vehicles or for projects where traffic noise impacts are anticipated.

Traffic flows for Hunter Street were referenced from Table 2-2 of the Newcastle Light Rail, Technical Paper 1- Traffic, Transport and Access Assessment (GHD, 2016). The estimated AADT flow for this section of Hunter Street were 18,300 vehicles for 2015 and were projected to 2021 assuming 2% traffic growth per annum. The traffic volumes were adopted to calibrate the predictive road traffic noise model.

2.1.1 Road Noise Screening Test

Section 5.3.2 of the guideline provides screening tests for single and dual occupancy 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 60/70 km/hr zone and 100/110 km/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.

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

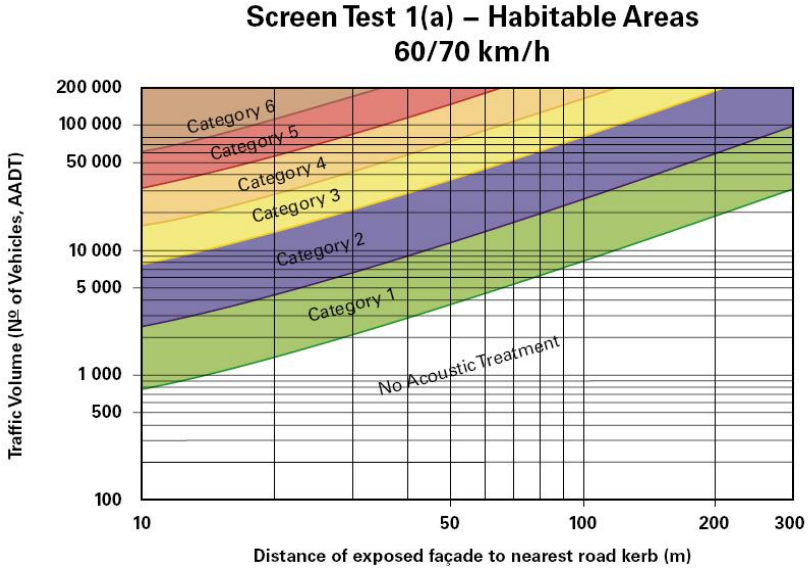
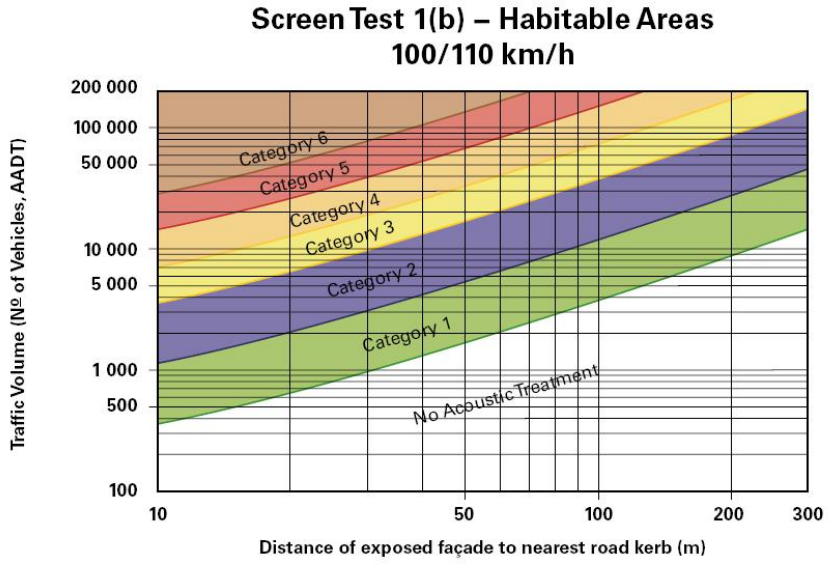


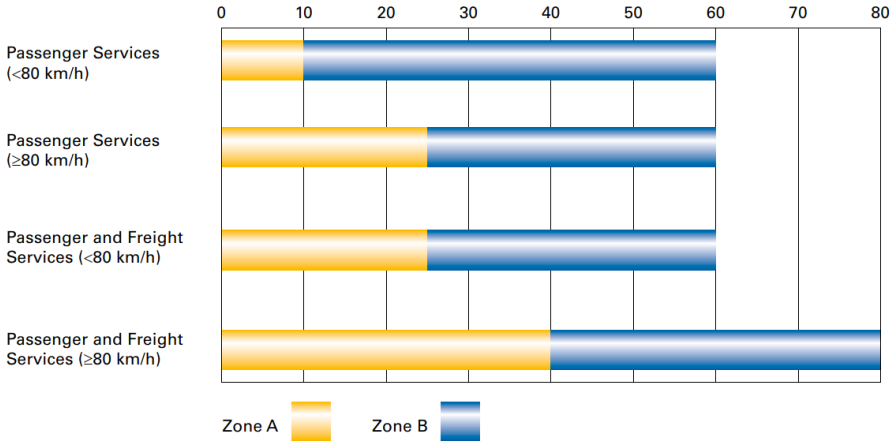
Figure 3 Screen test for habitable areas of single/dual occupancy dwellings adjacent to 100/110 km/hr zones.



2.1.1 Rail Noise Screening Test

Section 5.3.1 of the guideline provides Acoustic Assessment Zones for rail corridors. The Assessment Zones provide offset distances for developments from an operational rail track where a detailed noise impact assessment is required. **Figure 4** reproduces the Acoustic Assessment Zones as presented in the guideline.

Figure 4 Acoustic Assessment Zones.



The section of rail adjacent to the project accommodates passenger trains to the Newcastle Interchange. The distance to the nearest rail track to the project site is approximately 60m, and rail traffic would be slowing and be at speeds of less than 80km/hr. It is noted that the project is outside the buffer zone required for a detailed acoustic assessment, hence, rail noise has not been considered further in this assessment.

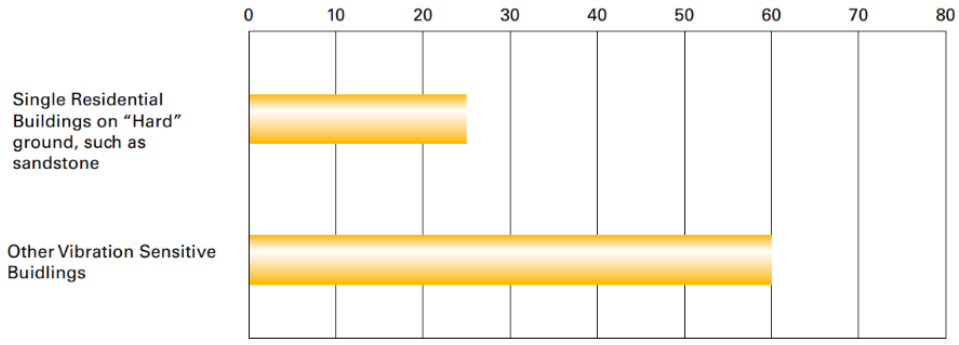
2.1.2 Light Rail Noise

Attended measurements of light rail passbys at Bolton Street Station, identified a L_{Amax} sound power level (Lw) of 99dBA for the light rail vehicle. Taking into account the 55m setback from the Newcastle Interchange to the project, emissions from the light rail movements are expected to be <50dBA at the project façade (excluding intervening buildings that are proposed to be constructed. These levels are negligible compared to road or heavy rail traffic noise.

2.1.3 Rail Vibration Screening Test

Section 5.3.1 of the guideline provides guidance on the Vibration Assessment Zone for development sites adjacent to rail corridors. As per **Figure 5** reproduced below (from the guideline), the project site is outside the 25m from the existing rail track, hence an assessment of light and heavy rail vibration is not required.

Figure 5 Rail Vibration Assessment Zone (distance (m) to operational track)



2.2 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).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.

2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.

3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.

4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

2.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

2.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter 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. The measured RBLs relevant to the project are contained in **Section 3**.

2.2.3 Project Intrusiveness Noise Level (PINL)

The PINL ($LA_{eq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

Background noise levels need to be determined before intrusive noise can be assessed. The NPI states that background noise levels to be measured are those that are present at the time of the noise assessment and without the subject development operating. For the assessment of modifications to existing premises, the noise from the existing premises should be excluded from background noise measurements. It is note that the exception is where the premises has been operating for a significant period of time and is considered a normal part of the acoustic environment; it may be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and,
- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

Where a project intrusiveness noise level has been derived in this way, the derived level applies for a period of 10 years to avoid continuous incremental increases in intrusiveness noise levels. This approach is consistent with the purpose of the intrusiveness noise level to limit significant change in the acoustic environment. The purpose of the project amenity noise level is to moderate against background noise creep.

2.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: “to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows”:

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 1**.

Table 1 Amenity Noise Levels			
Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: 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.

2.2.5 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq(15min)}$ 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- L_{Amax} 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

2.3 Independent Liquor and Gaming Authority (ILGA)

2.3.1 ILGA from the project

There is the potential for the ground floor tenancies of the project to consist of licenced premises (ie restaurants or cafes). Therefore, the NSW EPA's Noise Guide for Local Government (NGFLG) (2013) has been adopted to quantify potential noise emissions from the ground floor tenancies. The ILGA criteria are reproduced from NGFLG below and have been adopted for this assessment:

'The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) by more than 5dB between 7:00am and 12:00midnight at the boundary of any affected residence.

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) between 12:00midnight and 7:00am at the boundary of any affected residence. Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00midnight and 7:00am.'

2.3.2 ILGA to the project

A review of licenced premises in the vicinity of the project has been completed. The closest licenced premises is the Cambridge Hotel 25m from the project building. Attended measurements of the premises (EMM, 2013) identifies that the noise contribution from the premises is 55dBA at 20m which are similar to night road noise levels for the area. Notwithstanding, recommendations in this report are anticipated to adequately attenuate residual noise from surrounding licenced premises. Hence, noise emissions from licenced premises have not been considered further in this assessment.

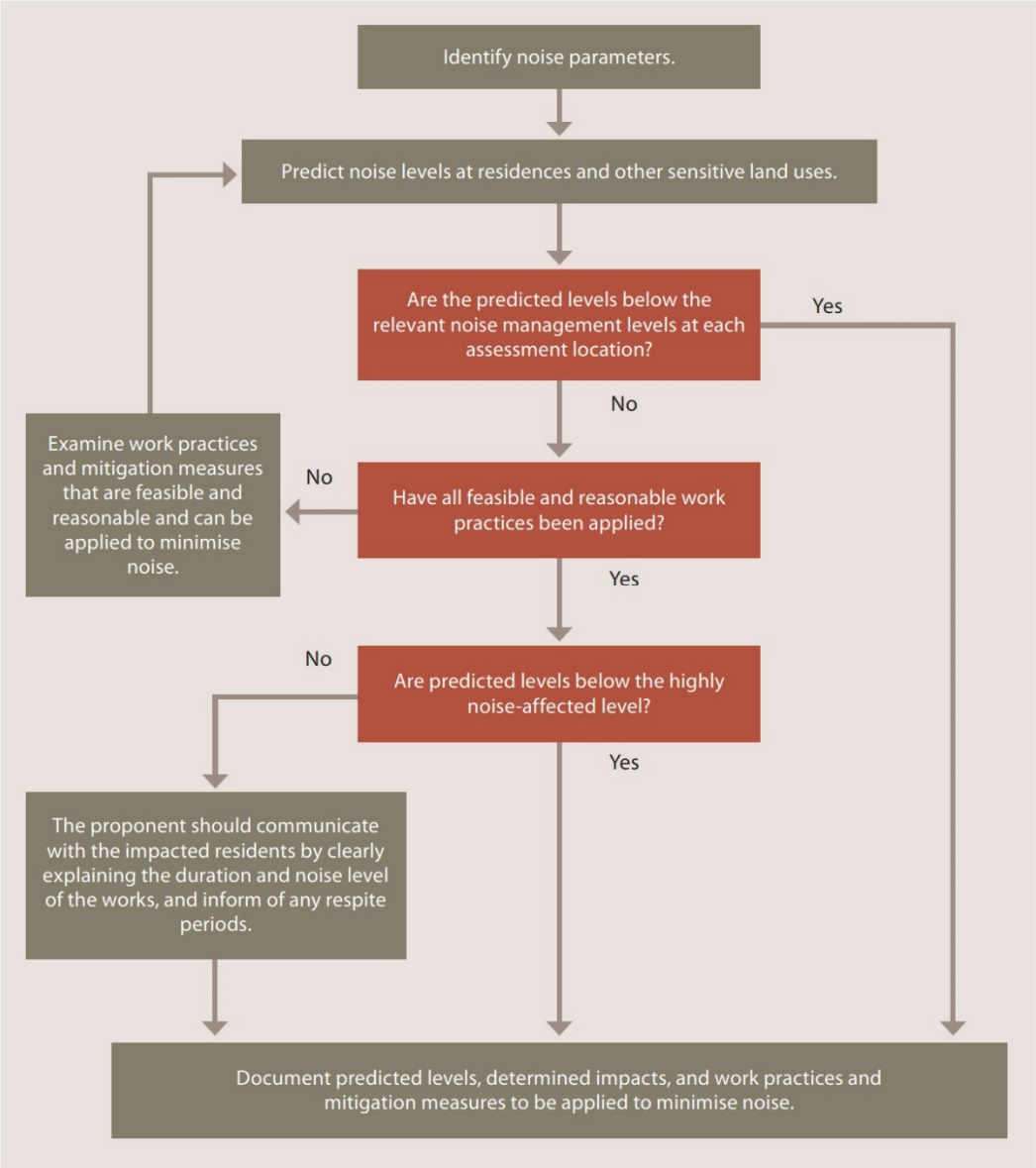
2.4 Interim Construction Noise Guideline

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 study has adopted a quantitative assessment approach which is summarised in Figure 6. 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 6 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

2.4.1 Standard Hours for Construction

Table 2 summaries 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.

2.4.2 Construction Noise Management Levels

Section 4 of the ICNG (DECC, 2009) 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 (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	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.

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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3 Existing Environment

3.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at one location representative of the ambient environment surrounding the project site. The selected monitoring location is shown in **Figure 1** and is considered representative of surrounding residential receivers as per Fact Sheet B1.1 of the NPI.

The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics – Description and Measurement of Environmental Noise".

The measurements were carried out using one Svantek 977 noise analyser from Tuesday 13 July 2021 to Wednesday 21 July 2021 The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Observations on-site identified the surrounding locality was typical of an urban environment, with traffic noise from Hunter Street and urban hum from the surrounding commercial and residential buildings audible.

Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI. Residential receivers situated in the surrounding area have been classified under the EPA's urban amenity category. This criteria is used in conjunction with the intrusiveness criteria to determine the limiting criteria. The results of long-term unattended noise monitoring are provided in **Table 4**. The noise monitoring charts for the background monitoring assessment are provided in **Appendix B** of this report.

Table 4 Background Noise Monitoring Summary

Location	Measured Background Noise Level (L_{A90}) dB ABL[1]			Measured dB $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
L1	57	52	47	64	60	58

Note: Excludes periods of wind or rain affected data. Meteorological data obtained from the Bureau of Meteorology weather station Newcastle Nobbys Signal Station AWS 32.9S 151.8°E 33m AMSL.

Note: 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.

Note 1: Assessment background level (ABL) – the single-figure background level representing each assessment period day, evening and night as per NPI Fact Sheet A.

3.2 Attended Noise Monitoring

To validate background noise levels, an attended noise monitoring measurement was completed at the development site.

Observations during the survey noted that road traffic from Hunter Street was the dominant contributor to background noise levels. The monitored noise level contributions and observed meteorological conditions for each measurement are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results

Location	Date & Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
A1	13/07/2021 15:24	76	61	57	WD: S WS: <0.5m/s Rain: Nil	Passing Traffic 50-76 Urban Hum 52-65

Note: 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 Assessment Criteria

4.1 Operational Noise Criteria

4.1.1 Intrusiveness Noise Levels

The PINL for the project are presented in **Table 6** and have been determined based on the RBL +5dBA and only apply to residential receivers.

Table 6 Project Intrusiveness Noise Levels

Location	Receiver Type	Period[1]	Measured RBL dB LA_{90}	PINL dB $LA_{eq(15min)}$
L1	Residential	Day	57	62
		Evening	52	57
		Night	47	52

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.

4.1.2 Amenity Noise Levels and Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 7.**

Table 7 Amenity Noise Levels and Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	NPI Recommended ANL dB $LA_{eq(period)}$	ANL dB $LA_{eq(period)}$	PANL dB $LA_{eq(15min)}$[4]
Residential	Urban	Day	60	55[2]	58
		Evening	50	45[3]	48
		Night	45	43[3]	46
Hotels Motels	Urban	Day	65	60[2]	63
		Evening	55	50[2]	53
		Night	50	45[2]	48
Commercial	All	When in use	65	60[2]	63

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.

Note 2: Project Amenity Noise Level equals the Amenity Noise Level -5dB as there is other industry in the area.

Note 3: $LA_{eq,period}$ (traffic) as per section 2.4.1 of the NPI (i.e. existing $LA_{eq\ Traffic}$ -15dB).

Note 4: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.

4.1.3 Project Noise Trigger Levels

The PNTL are the lower of either the PINL or the PANL. **Table 8** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI.

Table 8 Project Noise Trigger Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	PINL dB $L_{Aeq(15min)}$	PANL dB $L_{Aeq(15min)}$	PNTL dB $L_{Aeq(15min)}$
Residential	Urban	Day	62	58	58
		Evening	57	48	48
		Night	52	46	46
Hotels Motels	Urban	Day	N/A	63	63
		Evening	N/A	53	53
		Night	N/A	48	48
Commercial	All	When in Use	N/A	63	63

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.

4.1.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 9** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 9 Maximum Noise Trigger Level

Residential Receivers			
$L_{Aeq(15min)}$		L_{Amax}	
40dB $L_{Aeq(15min)}$ or RBL + 5dB		52dB L_{Amax} or RBL + 15dB	
Trigger	40	Trigger	52
RBL 47+5dB	52	RBL 47+15dB	62
Highest	**52**	**Highest**	**62**

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note: NPI identifies that maximum of the two values is to be adopted which is shown in bold font.

4.1.5 ILGA Criteria

The relevant ILGA criteria for the period up to midnight has been derived by analysing seven days of single octave LA90 statistical levels from the historic noise monitoring data for the period between 6pm and midnight. This period is representative of peak operating hours for (potential licensed) ground floor tenancies of the proposal that may be situated on the north east facade. **Table 10** reproduces the adopted ILGA noise criteria.

Table 10 ILGA Criteria

	LA_{10} Noise Criteria, Octave Band Centre Frequency (Hz), dBA								
	31.5	63	125	250	500	1 k	2 k	4 k	8 k
Octave Background (LA_{90})	23	30	35	39	42	47	43	35	27
LA_{10} criteria (background +5dB)	28	35	40	44	47	52	48	40	32

4.2 Construction Noise Criteria

The relevant Noise Management Levels (NMLs) for standard construction hours are presented in **Table 11**.

Table 11 Construction Noise Management Levels

Receivers	Assessment Period[1]	Daytime RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
Residential[2]	Standard Hours	57	67 (RBL+10dBA)
Commercial Premises	When in use	N/A	70 (external)

Note 1: See Table 2 for Standard Recommended Hours for Construction.

Note 2: Hotels/Motels adopt the residential criteria for construction noise assessments.

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5 Modelling Methodology

5.1 Calculation of Road Traffic Noise

A theoretical assessment of road traffic noise was carried out to predict levels at the proposed façades of the project using the Calculation of Road Traffic Noise (CORTN) algorithm, as developed by the UK Department of Transport. This method incorporates flow volumes, average speed, percentage of heavy vehicles, and road gradient and includes attenuation via spherical spreading (or cylindrical in the case of a line source such as a road), soft ground, atmospheric absorption and screening from buildings or barriers. AADT distributions for Hunter Street have been included in the noise model. Hunter Street road traffic volumes were referenced from Report for Transport for NSW- Newcastle Light Rail, (GHD, 2016).

The calculation parameters, assumptions and traffic flows used for the modelling assessment are summarised in **Table 12**.

Table 12 Calculation Parameters

Assessment Period	Traffic Volume[1]	% Heavy Vehicles	Speed Limit (km/hr)
Modelled Traffic Flows – Hunter Street, 2021			
Day	16487	10	50
Night	4122	10	50

Note 1: Report for Transport for NSW- Newcastle Light Rail, 22/17478 (GHD).

5.2 Indicative Attenuation Levels

The Environmental Noise Management Manual (ENMM) (2001) provides a summary of indicative attenuation from standard building types. The indicative attenuation levels are summarised in **Table 13**, which provides typical performance of buildings with respect to noise reduction. A masonry residence with single 3mm glazing would be expected to provide a reduction of approximately 25dB from external to internal with windows closed. Where windows are closed, the fresh air requirements outlined in the Building Code of Australia are to be satisfied.

Table 13 Indicative Building Noise Attenuation

Building Type	Windows	Internal noise reduction, dBA
All	Open	10
Light frame	Single glazed (closed)	20
Masonry	Single glazed (closed)	25
	Double glazed (closed)	30

5.3 Operational and Construction Noise Modelling Methodology

An assessment of potential operational noise emissions from the project has been completed. The assessment has identified several noise sources that may generate acoustic impacts at surrounding residences, such as amplified music and speech/conversation from residents and patrons on the podium communal open space and hypothetical ground floor café/bar tenancies. Additionally, operational noise from the rooftop mechanical plant, and car park emissions from the store car park and buses entering and leaving the Newcastle Interchange have been assessed against relevant NPI criteria. **Table 14** presents the sound power levels for each source assessed in this report.

Table 14 Sound Power Levels[1]

Item	Octave Band Sound Power Level									Total dBA[3]
	31.5	63	125	250	500	1000	2000	4000	8000	
Operational Assessment (dB $LA_{eq(15min)}$)										
Conversation noise (x80) and low-level amplified music	36	48	53	59	64	64	63	58	51	70
Air Conditioning Condensers (x300)	40	48	51	57	66	62	64	64	49	71
Kitchen Exhaust/Commercial Plant (x30)	35	42	44	70	73	68	61	51	31	76
Onsite buses (x3 day, x2 evening and 1xnight)	76	86	92	87	86	90	94	89	82	99
Car idle and start up and drive off (x6)	45	52	62	59	67	66	68	61	54	73
Car passby (ie via entry ramp (x170)	45	52	62	59	57	66	68	61	54	73
ILGA/NCC Technical Guideline Assessment (dB LA_{10})[2]										
Talking/Conversations and amplified music	47	59	64	72	76	75	73	66	69	81
Sleep Disturbance Assessment (dB LA_{max})										
Conversation noise (yelling)	45	62	73	80	85	87	84	78	87	92
Car door slam (interchange car park)	40	57	68	75	80	82	79	73	82	87

Note 1: Source - MAC database.

Note 2: As per the ILGA policy, the LA_{10} sound power is required rather than the LA_{eq}.

Note 3: Total dBA is sound power level per item.

Brüel and Kjær Predictor Type 7810 (Version 11.10) noise modelling software was used to assess potential noise impacts associated with the project. A three-dimensional digital terrain map providing all relevant topographic information was 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. Patron noise of up to 80 individuals (assuming 50% of which are talking simultaneously) at the ground floor commercial external spaces on the eastern façade of each building which is representative of potential usage of the café/bars. Tenant noise from the Level 5 podium recreational area included 62 individuals (assuming 50% of which are talking simultaneously). Mechanical plant (ie 150 units per building) noise was modelled on the rooftop of the development (see Site Plans in **Appendix C**). It is noted that the project may have several kitchen exhausts, hence 15 have been modelled on each building as a direct discharge on the roof. Deliveries for the project are assumed to occur at the ground floor and will be enclosed within the building envelope and hence are not anticipated to be audible at surrounding receivers.

The noise model assumed 677 vehicles (100% car park utilisation) entering the project site within a one-hour peak period, this equates to 170 vehicles in fifteen minutes. Additionally, sources were modelled at the south-western entry ramp of the project site, this is the closest and most exposed position of vehicles to the assessment locations. Therefore, results should be considered a worst case.

The sound power levels have been adjusted to account for duration over a fifteen-minute period. It is noted that the potential for maximum noise level events to occur simultaneously is unlikely for this project as the majority of vehicles in any fifteen-minute period would be parked and not operational.

For construction, a fleet sound power level of 108dB $LA_{eq(15min)}$ was adopted to quantify construction emissions to surrounding receivers. This sound power level is considered generally representative of average emissions from a variety of construction tasks for residential developments.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'.

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6 Noise Assessment Results

6.1 Road Noise Prediction Results

Road noise predictions for the project based on estimated 2021 traffic flows were compared to measured levels at an unattended noise monitoring location at 787 Hunter Street, Newcastle, NSW. This is considered a good practice technique to validate the assumptions made in the assessment. Results of the validation demonstrate a consistent correlation (±<2dB tolerance) when compared against measured levels.

A review of floor plans (Bates Smart Pty Ltd, 2021) (**Appendix C**) for the project have been completed as part of the assessment. The assessment includes potential road noise emissions for both towers (Tower 1 – West and Tower 2 – East) with results presented in separate tables for each.

Ground to fourth floor are either retail or commercial, contain no residential receivers, and hence, have not been included in this assessment.

Table 15 presents a comparison of predicted road traffic noise for units exposed to Hunter Street against the respective day and night internal criteria for Tower 1 (West).

Table 15 Noise Prediction Results – The Store, Tower 1 (West)

Level	Receptor Room Category[1]	Predicted level, dB LA_{eq}[2] (internal)		Internal Criteria, dB LA_{eq}	
		Day	Night	Day	Night
Apartment 1					
5	Bedrooms	25-43	21-39	40	35
	Living Room	25-43	**21-39**	40	40
6-18	Bedrooms	35-44	31-40	40	35
	Living Room	35-44	31-40	40	40
Apartment 2					
5	Bedrooms	30-43	26-39	40	35
	Living Room	30-43	26-39	40	40
6-18	Bedrooms	32-44	29-40	40	35
	Living Room	32-44	29-40	40	40
19-22	Bedrooms	31-40	27-36	40	35
	Living Room	31-40	27-36	40	40
Apartment 3					
5	Bedrooms	43-44	39-40	40	35
	Living Room	43-44	39-40	40	40
6-18	Bedrooms	40-44	36-40	40	35
	Living Room	40-44	36-40	40	40
19-22	Bedrooms	39-40	35-36	40	35
	Living Room	39-40	35-36	40	40
Apartment 4					
5	Bedrooms	39-40	35-36	40	35
	Living Room	39-40	35-36	40	40
6-18	Bedrooms	34-40	30-36	40	35
	Living Room	34-40	30-36	40	40

Note 1: Determined from proposed site drawing plans (Bates Smart, 2021).

Note 2: Internally predicted to habitable rooms. Adjustments made assuming attenuation (25dB) for a masonry structure with windows closed and includes +2.5dB façade correction.

Table 16 presents a comparison of predicted road traffic noise for units exposed to Hunter Street against the respective day and night internal criteria for Tower 2 (East).

Table 16 Noise Prediction Results – The Store, Tower 2 (East)

Level	Receptor Room Category[1]	Predicted level, dB LA_{eq}[2] (internal)		Internal Criteria, dB LA_{eq}	
		Day	Night	Day	Night
		Apartment 2			
5	Bedrooms	43-43	39-40	40	35
	Living Room	43-43	39-40	40	40
		Apartment 3			
5	Bedrooms	36-43	32-39	40	35
	Living Room	36-43	32-39	40	40
		Apartment 6			
6-15	Bedrooms	40-44	37-40	40	35
	Living Room	40-44	37-40	40	40
19-26	Bedrooms	39-40	35-36	40	35
	Living Room	39-40	35-36	40	40
		Apartment 7			
6-15	Bedrooms	37-44	33-40	40	35
	Living Room	37-44	33-40	40	40
19-24	Bedrooms	39-40	35-36	40	35
	Living Room	39-40	35-36	40	40

Note 1: Determined from proposed site drawing plans (Bates Smart, 2021).

Note 2: Internally predicted to habitable rooms. Adjustments made assuming attenuation (25dB) for a masonry structure with windows closed and includes +2.5dB façade correction.

Results of the noise assessment demonstrate that internal noise criteria for the project would require additional glazing upgrades to some elements of the building facades.

6.2 Operational Noise Prediction Results (NPI Assessment)

Operational noise levels from the project (mechanical plant, customer/patron noise from the ground floor café/bar noise, on-site cars and buses), have been predicted to the nearest residential receivers adjacent to the project and other surrounding receivers.

Table 17 presents the single point calculation results and demonstrate that operational noise emissions from the project remain below the relevant PNTL for all assessed receivers.

Table 17 Predicted Operational Noise Levels

Location[1]	Period	Predicted Noise Level dB $LA_{eq(15min)}$	PNTL dB $LA_{eq(15min)}$
R1	Day	38	58
	Evening	37	48
	Night	36	46
R2	Day	47	58
	Evening	46	48
	Night	44	46
R3	Day	<35	58
	Evening	<35	48
	Night	<35	46
Tower 1	Day	48	58
	Evening	47	48
	Night	45	46
Tower 2	Day	43	58
	Evening	43	48
	Night	43	46
C1	When in use	43	63
C2	When in use	<35	63
C3	When in use	<35	63
C4	When in use	<35	63
M1	Day	43	63
	Evening	42	53
	Night	40	48
M2	Day	<35	63
	Evening	<35	53
	Night	<35	48

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.

Note 1: Assessed to the most exposed tenancy/unit.

6.3 ILGA Noise Assessment

Noise calculations have been completed and compared with the ILGA requirements for ground floor café/bars to above residential tenancies for the nearest units in Tower 1 and Tower 2. Results of the calculations are presented in **Table 18** and **Table 19** for the nearest potentially most affected residential receivers on the east façade of Tower 1 and Tower 2.

Table 18 ILGA Noise Assessment Results – Tower 1 (Level 5 East Façade)

	L_{A10} Noise Criteria, Octave Band Centre Frequency (Hz), dBA								
	31.5	63	125	250	500	1 k	2 k	4 k	8 k
Received level Tower 1, Level 5	1	13	18	26	30	29	27	20	23
Criteria	28	35	40	44	47	52	48	40	32
Exceedance	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**

Table 19 ILGA Noise Assessment Results – Tower 2 (Level 5 East Façade)

	L_{A10} Noise Criteria, Octave Band Centre Frequency (Hz), dBA								
	31.5	63	125	250	500	1 k	2 k	4 k	8 k
Received level Tower 1, Level 5	2	11	16	24	28	27	25	18	21
Criteria	28	35	40	44	47	52	48	40	32
Exceedance	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**	**Nil**

Calculations of noise emissions from the project to the nearest residential receiver for the project are expected to satisfy the ILGA noise criteria. It is noted that receivers external to the project are also anticipated to satisfy the ILGA noise criteria due to their greater distance to the project.

6.4 Maximum Assessment

A comparison of L_{Amax} noise emissions associated with the project have been assessed against the EPA maximum noise trigger level to the nearest residential tenancies for Tower 1 and Tower 2. **Table 20** presents the results of the maximum noise level assessment for each Tower, along with receiver location and key maximum noise source for that receiver. Results identify that the maximum noise events trigger level will be satisfied for all assessed receivers.

Table 20 Maximum Noise Levels Assessment (Night)[1]

Receiver	Maximum source	Predicted Noise Level		Trigger Level	
		dB $L_{Aeq(15min)}$	dB L_{Amax}	dB $L_{Aeq(15min)}$	dB L_{Amax}
Tower 1 - West					
Level 6 Apartment 1	Yelling (Recreational Podium)	45	62	52	62
Level 6 Apartment 6	Yelling (Ground level Cafe)	45	56	52	62
Level 6 Apartment 9	Car Door Slam (Interchange car park)	45	47	52	62
Tower 2 - East					
Level 6 Apartment 5	Yelling (Recreational Podium)	43	61	52	62
Level 5 Apartment 8	Yelling (Ground level Cafe)	43	56	52	62

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.

Results of the sleep disturbance calculations are identified to remain below maximum noise trigger levels for all receivers with the exception of northern façade receivers adjacent to the recreational podium. Noise levels from yelling in this area at night have the potential to be above the trigger level, hence noise controls are recommended and provided in **Section 7**.

6.5 Construction Noise Results

Predicted $LA_{eq(15min)}$ noise emissions for modelled construction are presented in **Table 21**. Noise modelling identifies that construction activities will be below relevant NMLs at assessed receivers. Notwithstanding, management measures should be considered during the construction phase of the project to minimise impact to the surrounding community.

Table 21 Construction Noise Emissions

Location	Period[1]	Predicted Noise Level dB $LA_{eq(15min)}$	NML dB $LA_{eq(15min)}$
R1	Day	52	67
R2	Day	60	67
R3	Day	53	67
C3	When in use	60	70
C4	When in use	52	70
M1	Day	55	67
M2	Day	55	67

Note 1: Standard Hours for Construction for Day are Monday to Friday 7am to 6pm, Saturday 8am to 1pm.

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7 Discussion and Summary of Recommendations

7.1 Road Noise Recommendations

Standard domestic glass is usually acoustically inadequate and can reduce the attenuation performance of the overall building facade. Glazing improvement options include thicker laminated glass or double-glazed laminated windows with an air gap between panels. The frames and air gaps should be adequately sealed to optimise noise reduction.

As windows must remain closed for effective noise reduction, alternative means of internal ventilation (eg air conditioning or wall ventilator) is to be considered to allow windows to remain fully closed (refer to BCA ventilation requirements).

Table 22 provides the recommended minimal building categories as per the guideline (see Appendix D) for the unit dwellings. The western façade glazing has been improved to provide for an increased internal acoustic amenity due to the proximity of the car park.

Table 22 Noise Attenuation Recommendations		
Apartment	Levels	Minimum Guideline Category for Glazing Treatments[1,2,3,4]
Tower 1 - West		
1	Level 5 to Level 18	Category 3
1	Level 19 to Level 27	Category 1
2	Level 5 to Level 18	Category 3
2	Level 24 to Level 27	Category 1
3	Level 5to Level18	Category 3
3	Level 19 to Level 22	Category 2
3	Level 23 to Level 27	Category 1
4	Level 5 to Level 18	Category 2
4	Level 19 to Level 27	Category 1
5	Level 6 to Level 27	Category 1
6	Level 6 to Level 25	Category 1
7	Level 6 to Level 24	Category 1
8	Level 6 to Level 23	Category 1
9	Level 6 to Level 18	Category 1
Tower 2		
1	Level 5 to Level 29	Category 1
2	Level 5	Category 3
2	Level 6 to Level 29	Category 1
3	Level 5	Category 3
3	Level 6 to Level 28	Category 1
4	Level 5 to Level 28	Category 1
5	Level 6 to Level 27	Category 1
6	Level 6 to Level 15	Category 3
6	Level 16 to Level 24	Category 2
6	Level 25 to Level 26	Category 1
7	Level 6 to Level 15	Category 3
7	Level 16 to Level 24	Category 2
8	Level 6 to Level 15	Category 1

Note 1: Category 1 glazing requirements include – Windows/Sliding Doors: Openable with minimum 4mm monolithic glass and standard weather seals.

Note 2: Category 2 glazing requirements include – Windows/Sliding Doors: Openable with minimum 6mm monolithic glass and full perimeter acoustic seals.

Note 3: Category 3 glazing requirements include – Windows/Sliding Doors: Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals.

7.2 Operational Noise Recommendations

Recommendations to reduce operational emissions to the surrounding community for this project may include:

- Enclosing rooftop mechanical plant and/or installation of an impervious barriers around rooftop plant; and
- Limiting use of the recreational podium to day and evening hours (ie 7am to 10pm) to minimise the potential impacts of maximum noise emissions to receivers.

7.3 Construction Noise Recommendations

Recommendations for consideration during construction and demolition activities to reduce emissions to the surrounding community for this project may include:

- implement any boundary fencing/hoarding as early as possible to maximise their attenuation benefits;
- toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to the community;
- all plant should be shutdown when not in use. Plant to be parked/started at farthest point from relevant assessment locations (ie northern boundary);
- 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.

7.3.1 Complaints Handling

- Provide a readily accessible contact point, for example, through a 24-hour toll-free information and complaints line and give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
- Records of all community complaints will be maintained on an up-to-date complaints register. The records will include:
    - date and time of the complaint;
    - the means by which the complaint was made (telephone, mail or email);
    - any personal details of the complainant that were provided, or if no details are provided, a note to that effect;
    - the nature of the complaint;
    - any actions taken by the site supervisor/construction contractor in relation to the complaint, including any follow up contact with the complainant and the timing for implementing action; and
    - if no action was taken by site supervisor/construction contractor in relation to the complaint, the reason why no action was taken.

- Community complaints will be allocated to a responsible contractors representative immediately to facilitate the implementation of corrective actions. The details of the complaint will also be circulated to the applicable construction personnel for action, where required.

8 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed an assessment of potential noise impacts associated with the proposed Residential Towers development at 854 Hunter Street, Newcastle, NSW.

The assessment has quantified noise intrusion to the proposed development from transportation noise, and emissions from the development to surrounding receivers.

With respect to road noise attenuation and to protect the internal acoustic amenity of the development it is recommended that the glazing component for the project be reviewed to contain minimum specifications outlined in Section 7.1.

Noise emission from the project including patrons from the ground floor tenancies, rooftop mechanical plant and vehicles associated with the Newcastle Interchange car park, are demonstrated to remain below relevant criteria for all assessed receivers. Notwithstanding, it is recommended that the rooftop mechanic plant be situated within an acoustic screen or enclosure to reduce emission to residential tenancies below.

Maximum noise emissions satisfy relevant criteria with the exception of the recreational podium. Tenant noise from this area (in particular yelling) are likely to be above the maximum trigger level. Hence, management of tenants using this space, particularly during the night-time is recommended.

Construction noise emissions have the potential to be above the relevant noise management levels, therefore, to minimise impacts recommendations have been provided in Section 7.3 for consideration.

Following the findings of the Noise Assessment, it is recommended Council approve the development based on noise control assumptions/recommendations and referenced architectural plans provided 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

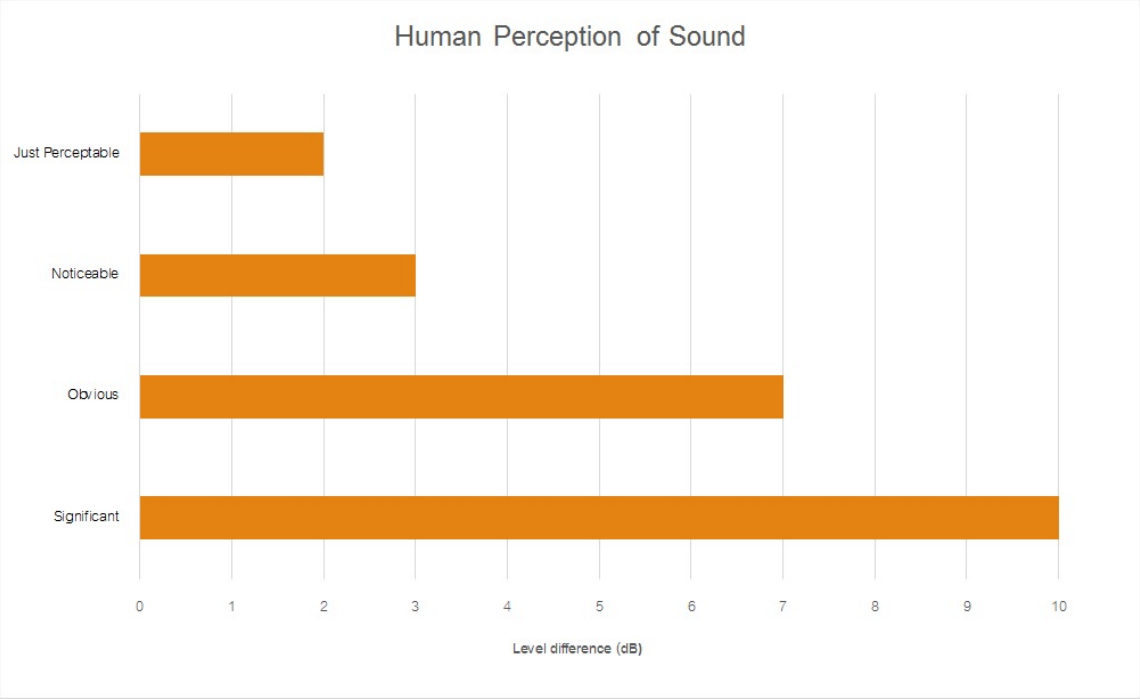
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for 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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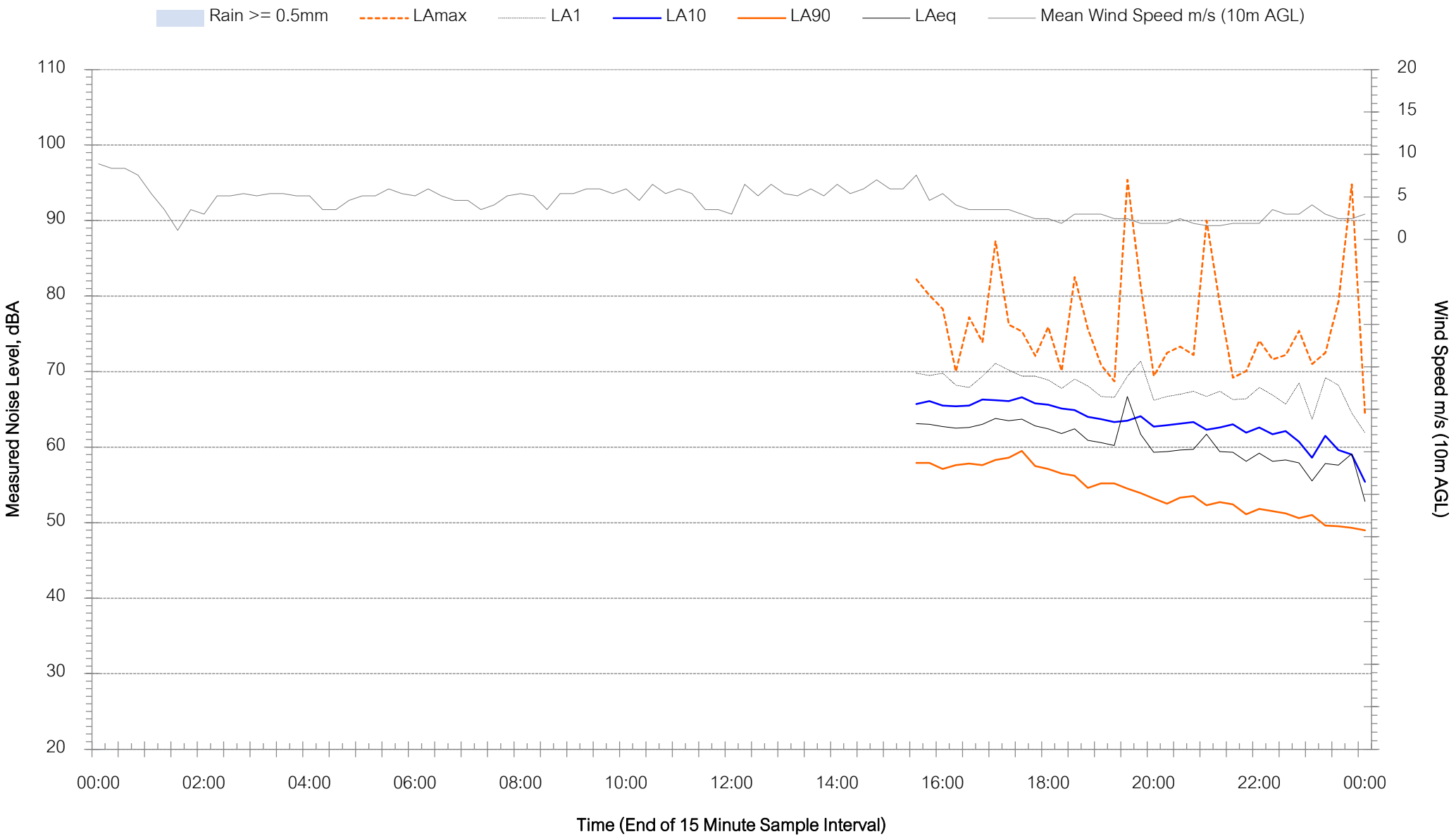
Appendix B – Noise Monitoring Charts

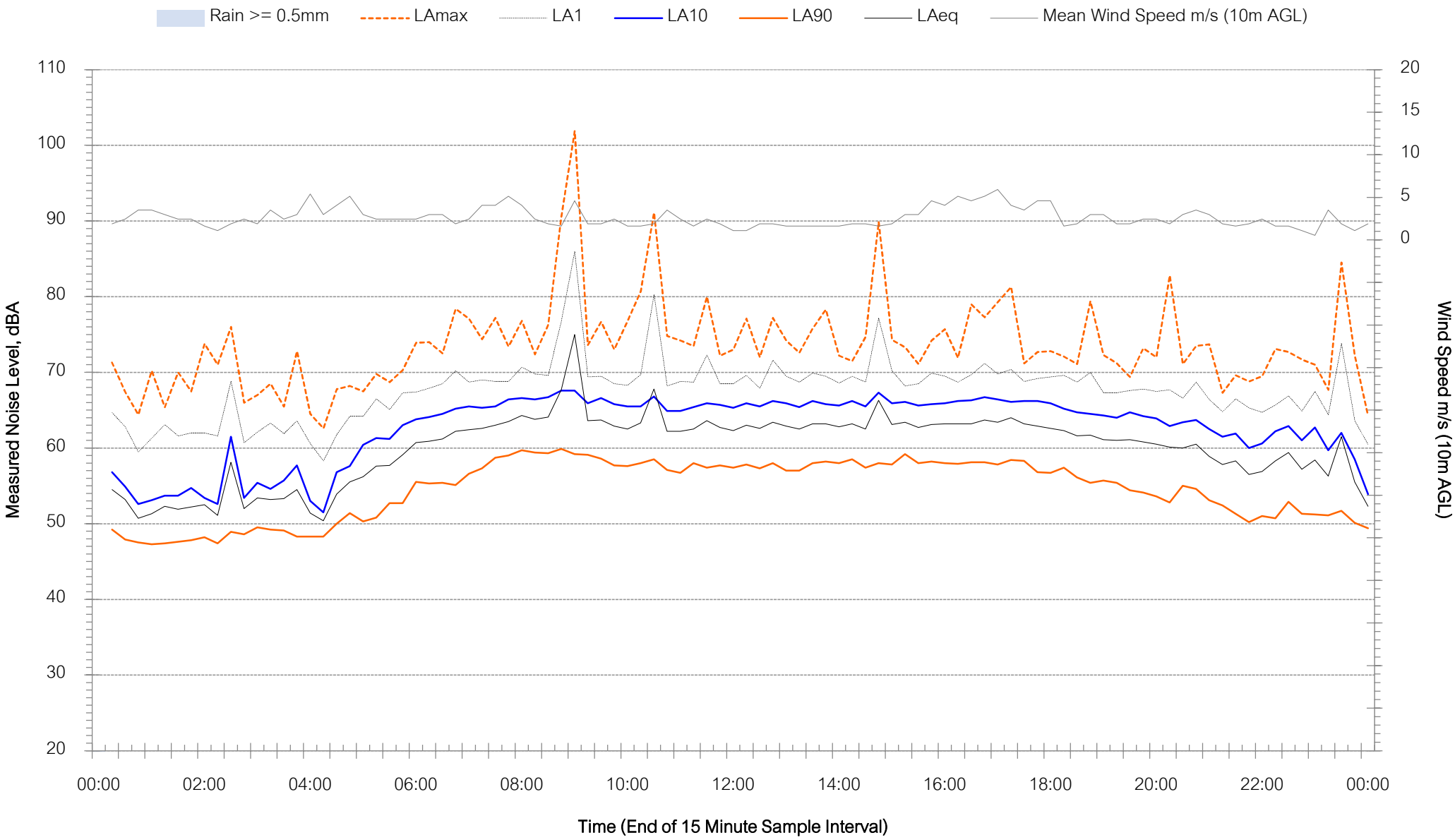
Background Noise Levels

787 Hunter St, Newcastle West - Tuesday 13 July 2021



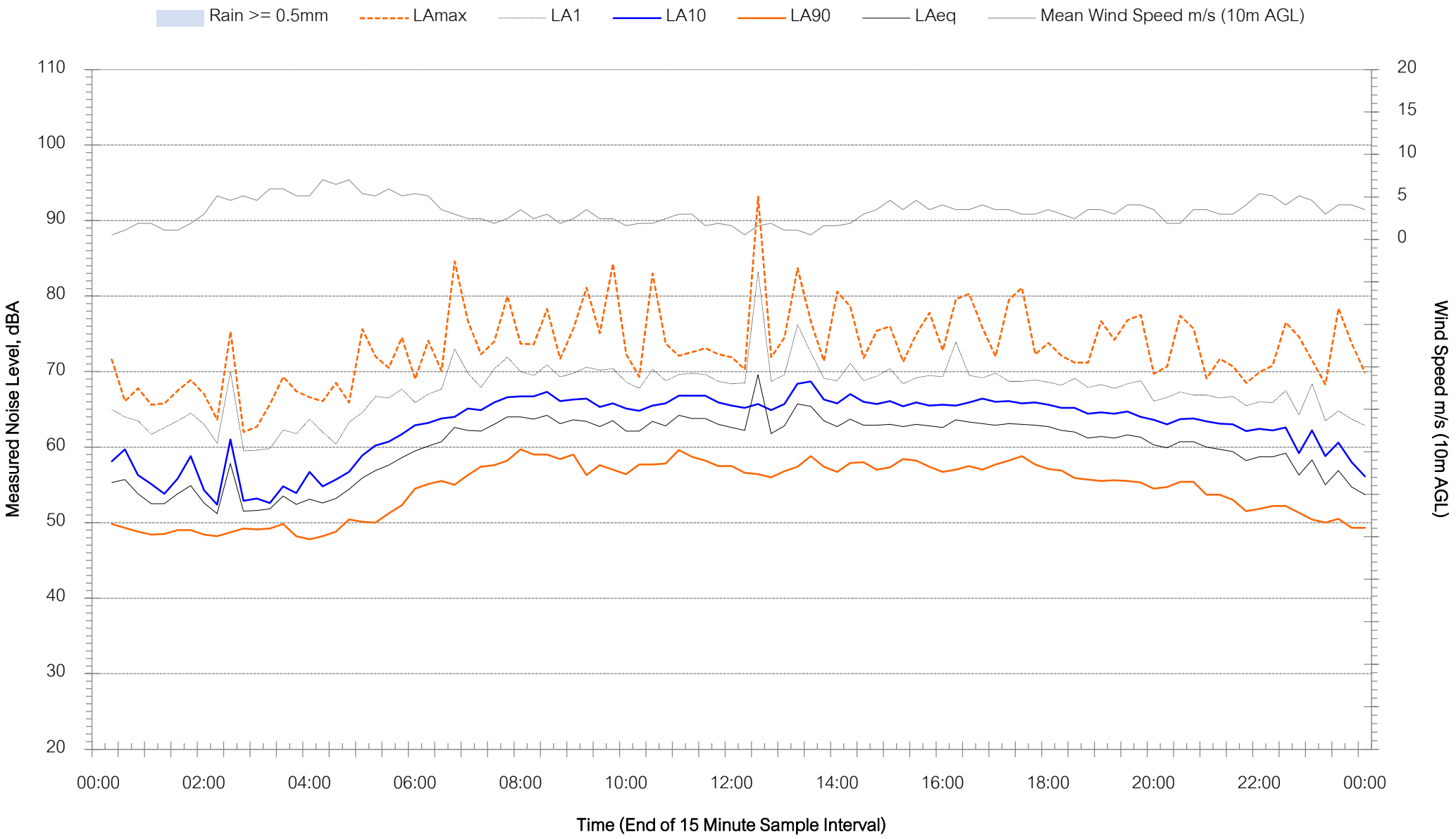
Background Noise Levels

787 Hunter St, Newcastle West - Wednesday 14 July 2021



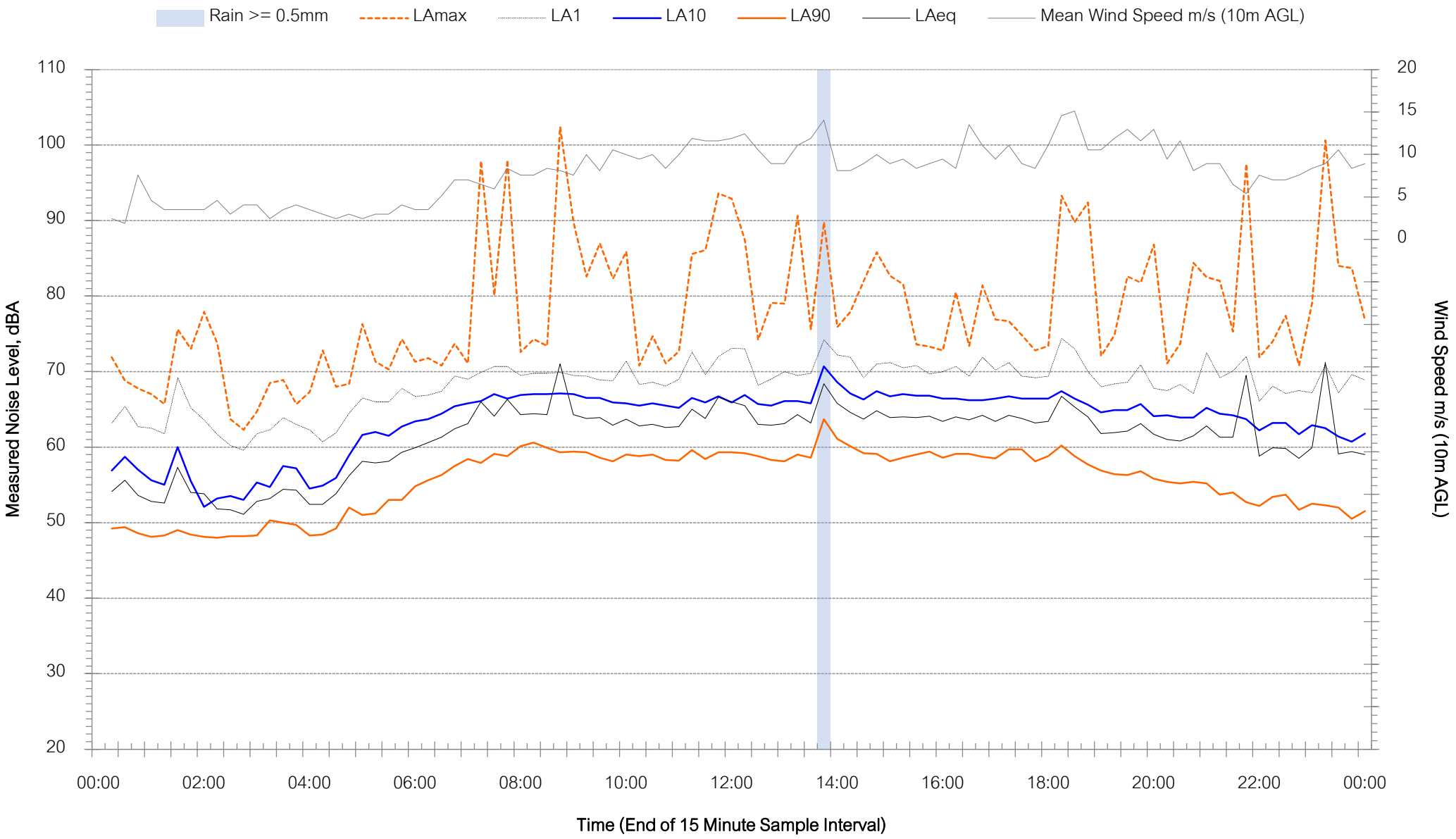
Background Noise Levels

787 Hunter St, Newcastle West - Thursday 15 July 2021



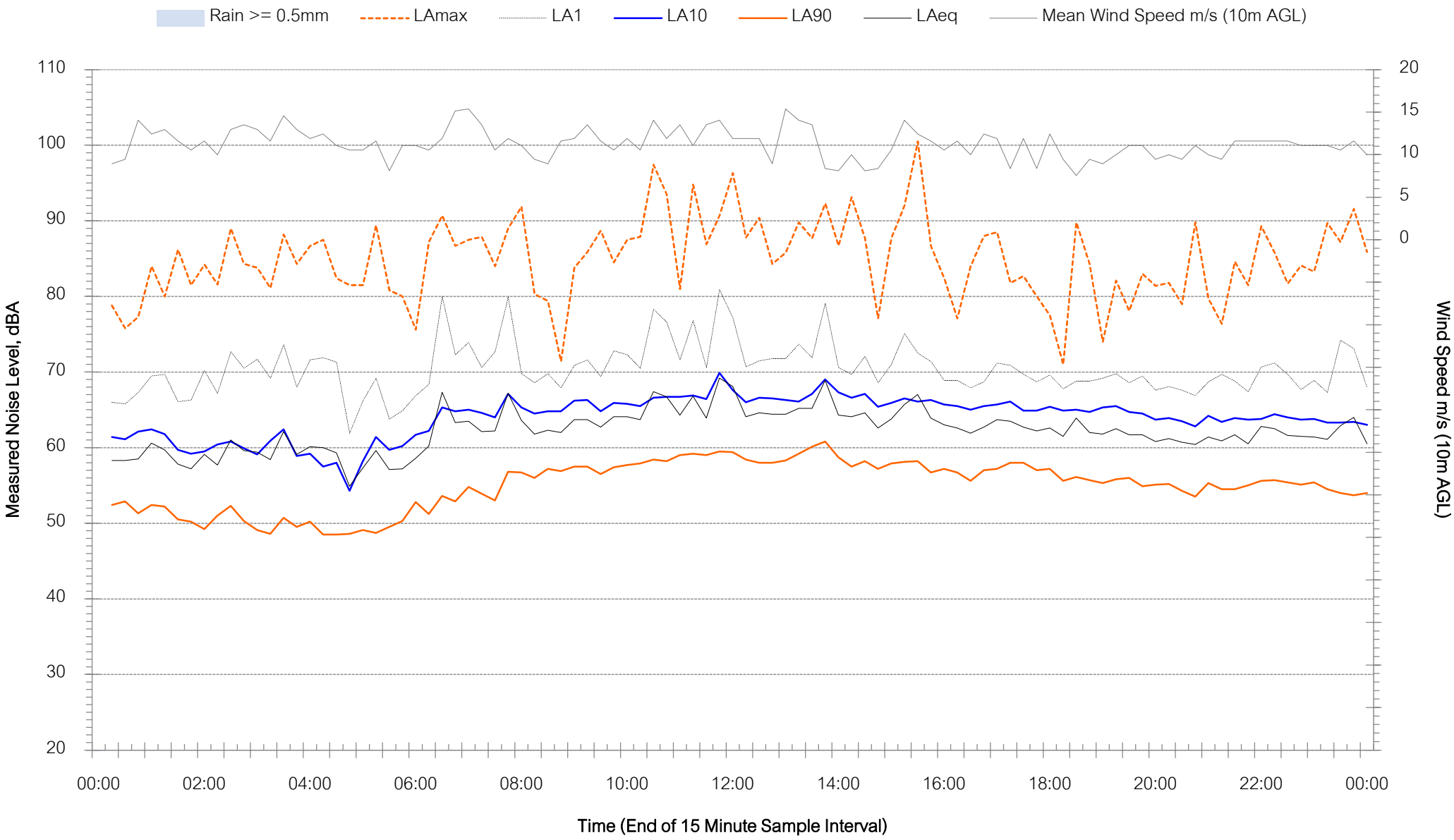
Background Noise Levels

787 Hunter St, Newcastle West - Friday 16 July 2021



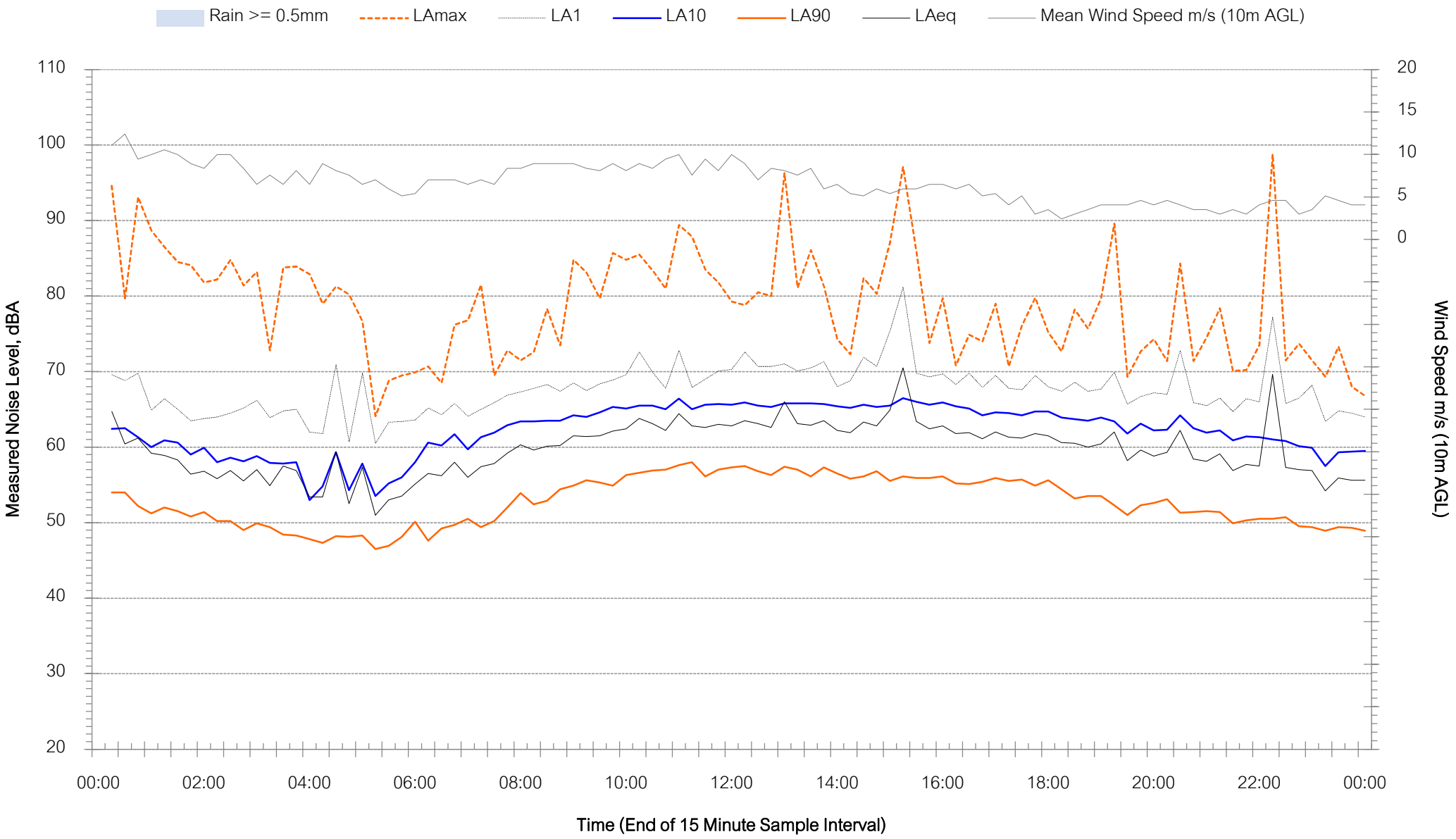
Background Noise Levels

787 Hunter St, Newcastle West - Saturday 17 July 2021



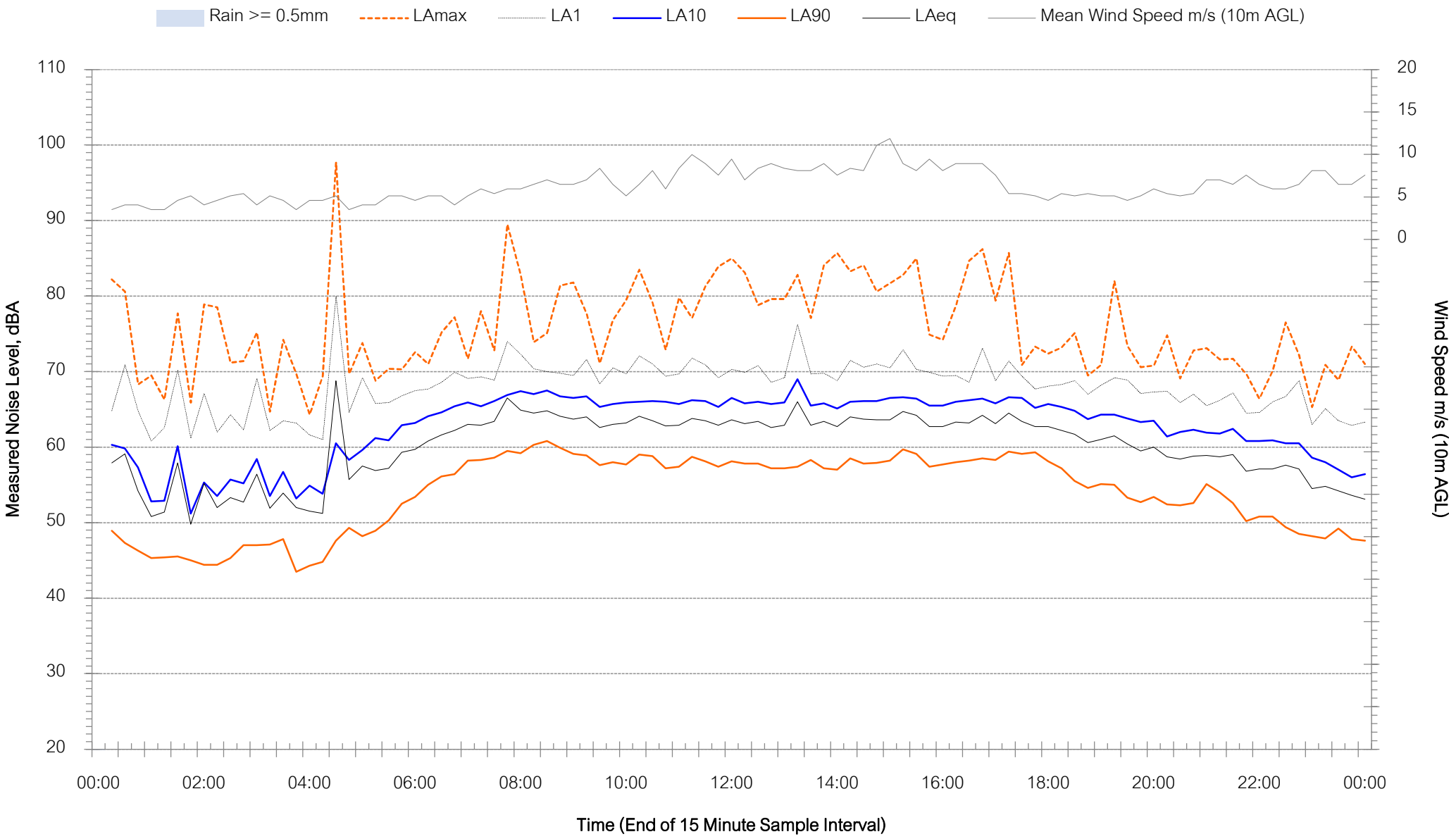
Background Noise Levels

787 Hunter St, Newcastle West - Sunday 18 July 2021



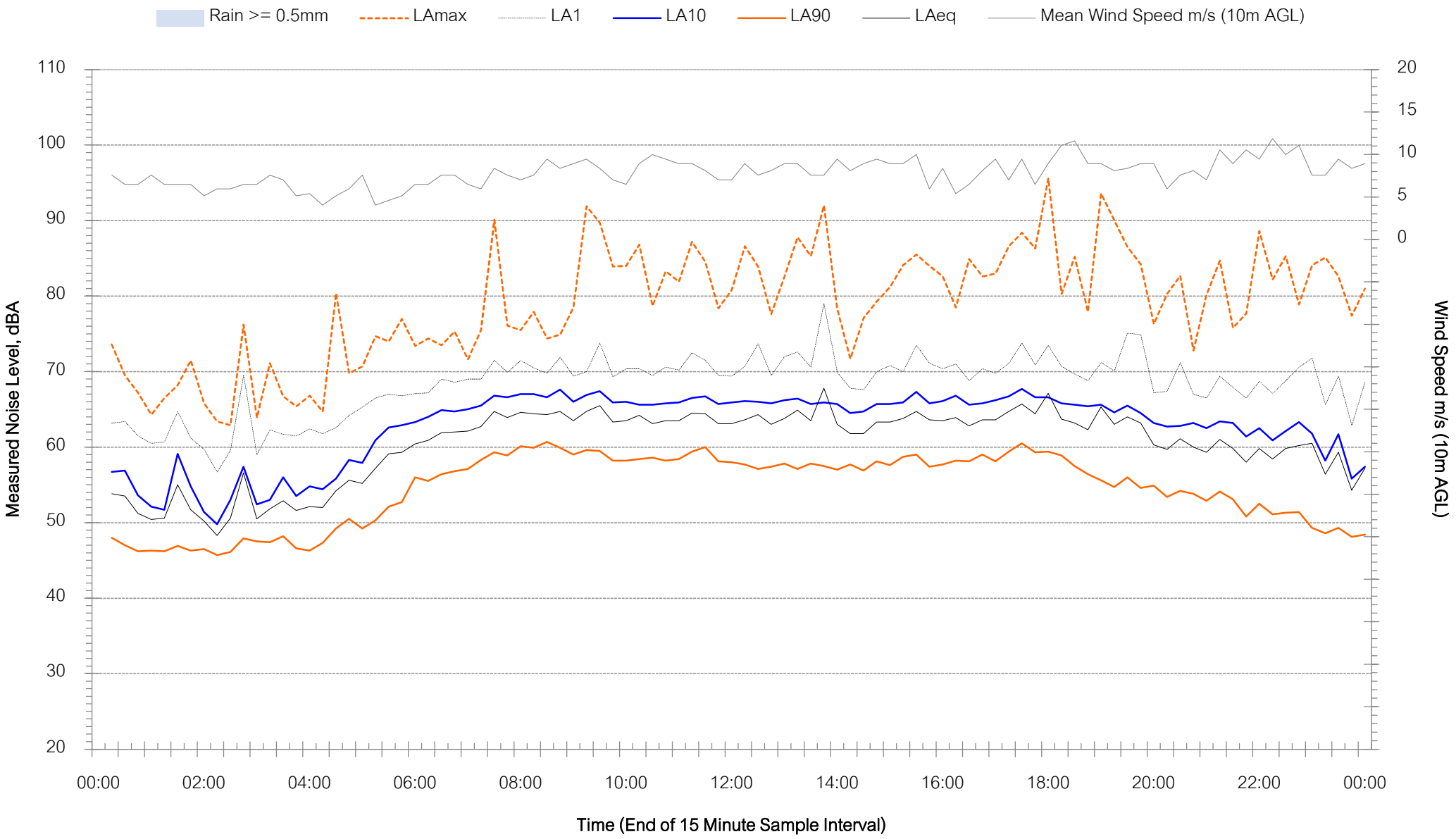
Background Noise Levels

787 Hunter St, Newcastle West - Monday 19 July 2021



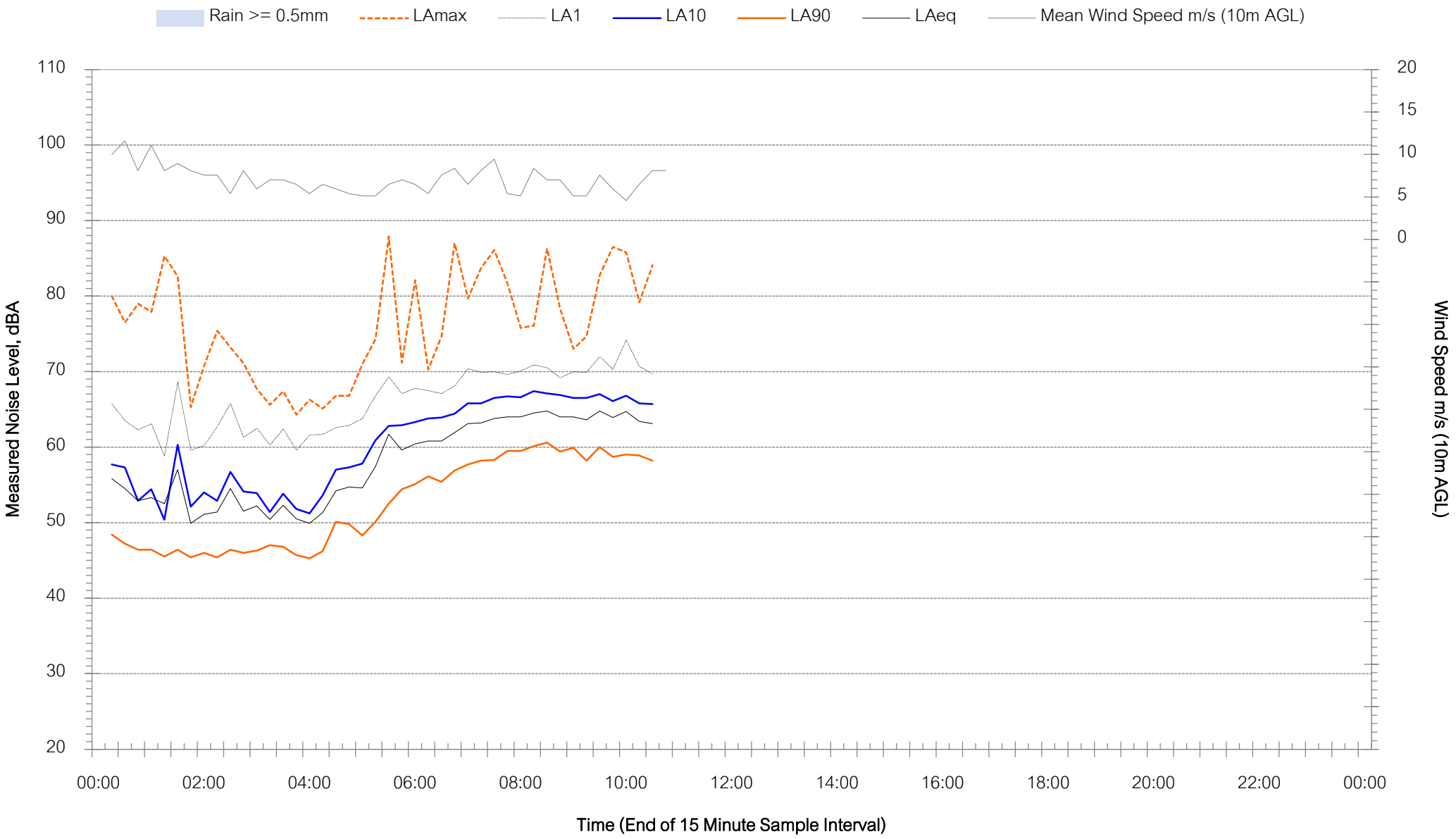
Background Noise Levels

787 Hunter St, Newcastle West - Tuesday 20 July 2021

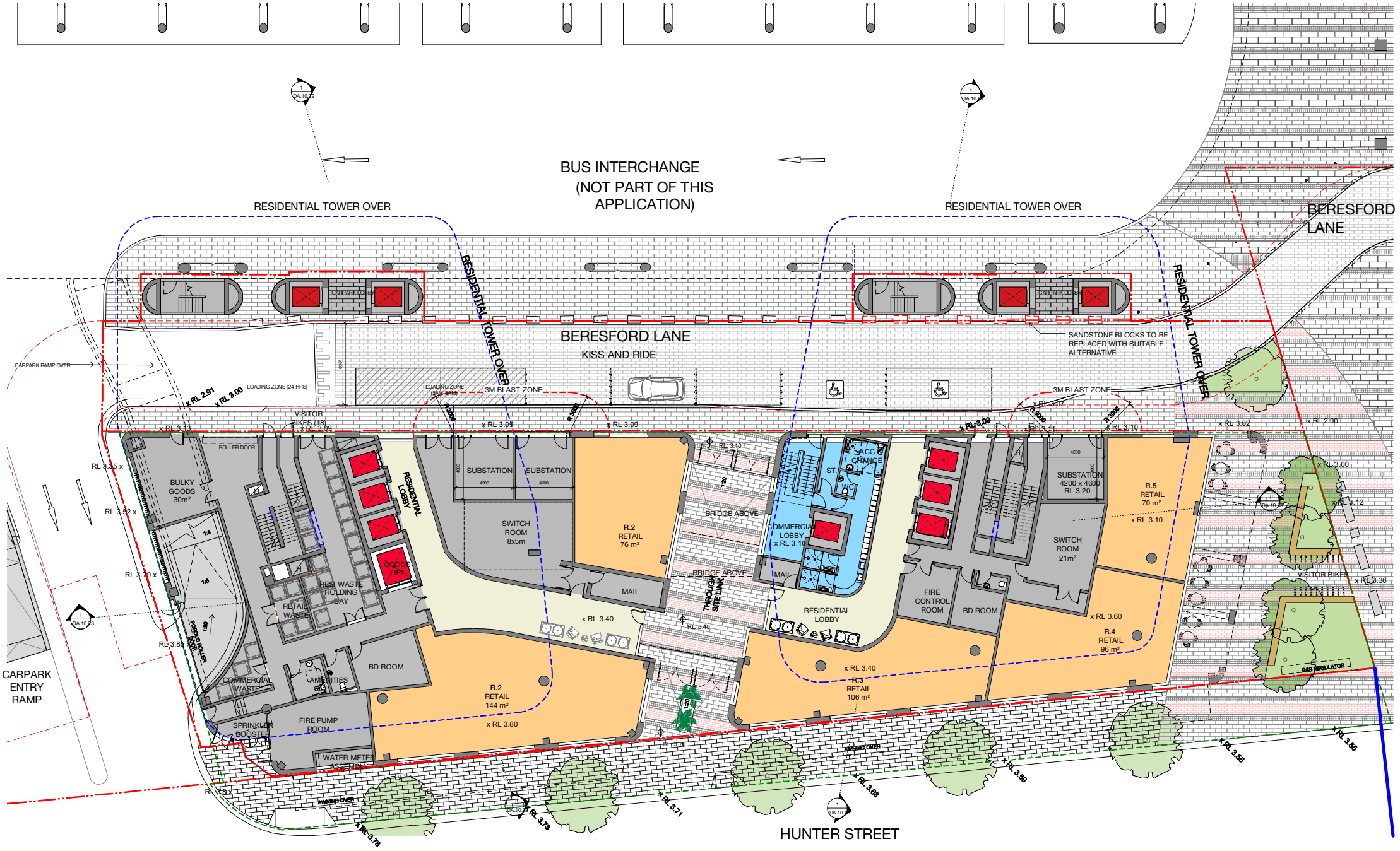


Background Noise Levels

787 Hunter St, Newcastle West - Wednesday 21 July 2021



Appendix C – Site Plans



PROPOSED TREE (REFER LANDSCAPE DWG FOR DETAIL)

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3	06.07.21	FOR COORDINATION	MT	
2	17.06.21	FOR COORDINATION		
1	04.05.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 00 Plan

Scale	As indicated @ A1	1:250	@ A3
Drawn	MT	Checked	BD
Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:26:39 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.00	Revision	4

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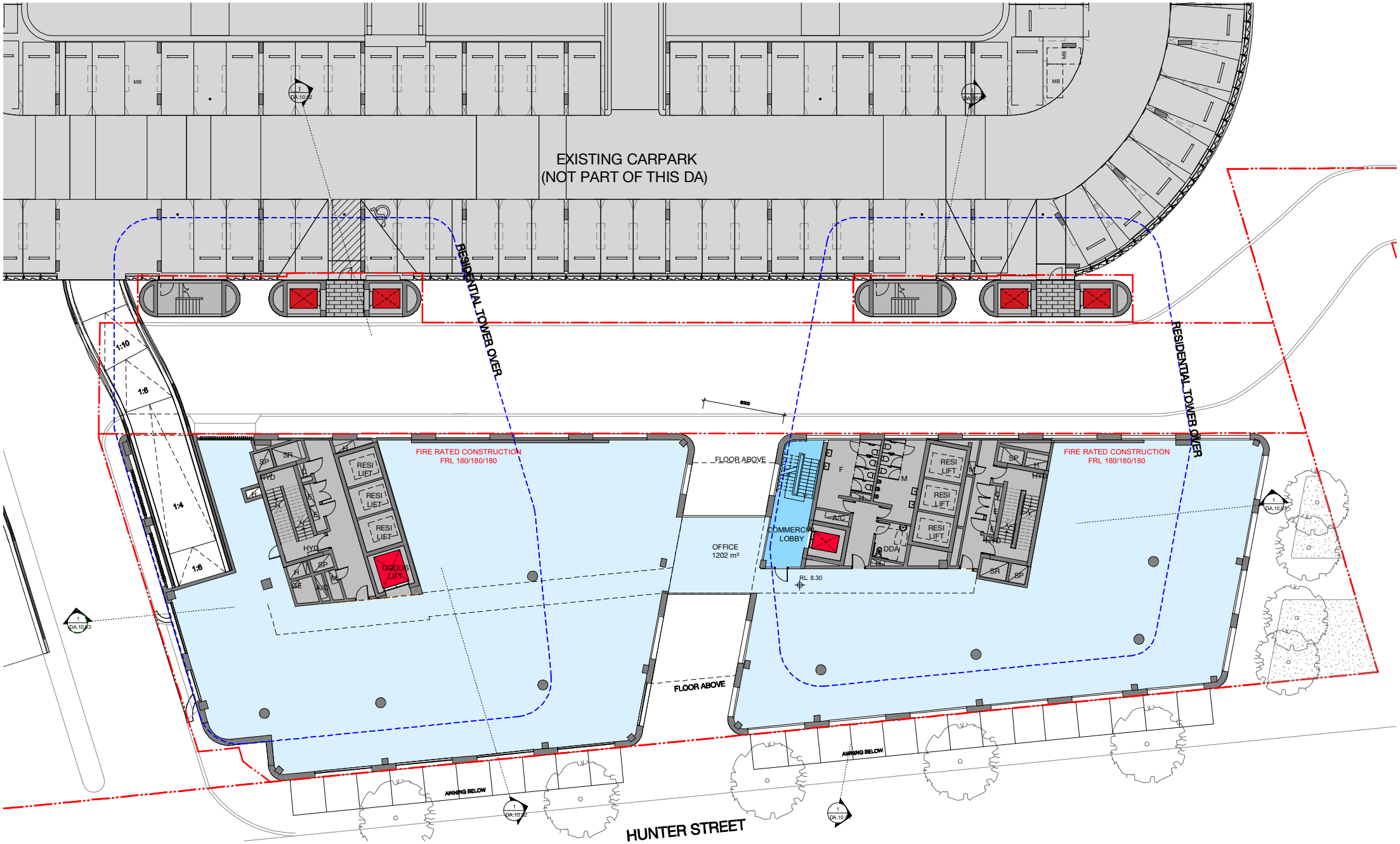

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3	06.07.21	FOR COORDINATION		MT
2	17.06.21	FOR COORDINATION		
1	04.06.21	FOR COORDINATION		

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854 HUNTER STREET, NEWCASTLE

Level 01 Plan

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Drawing no.	DA.03.01	Revision	4

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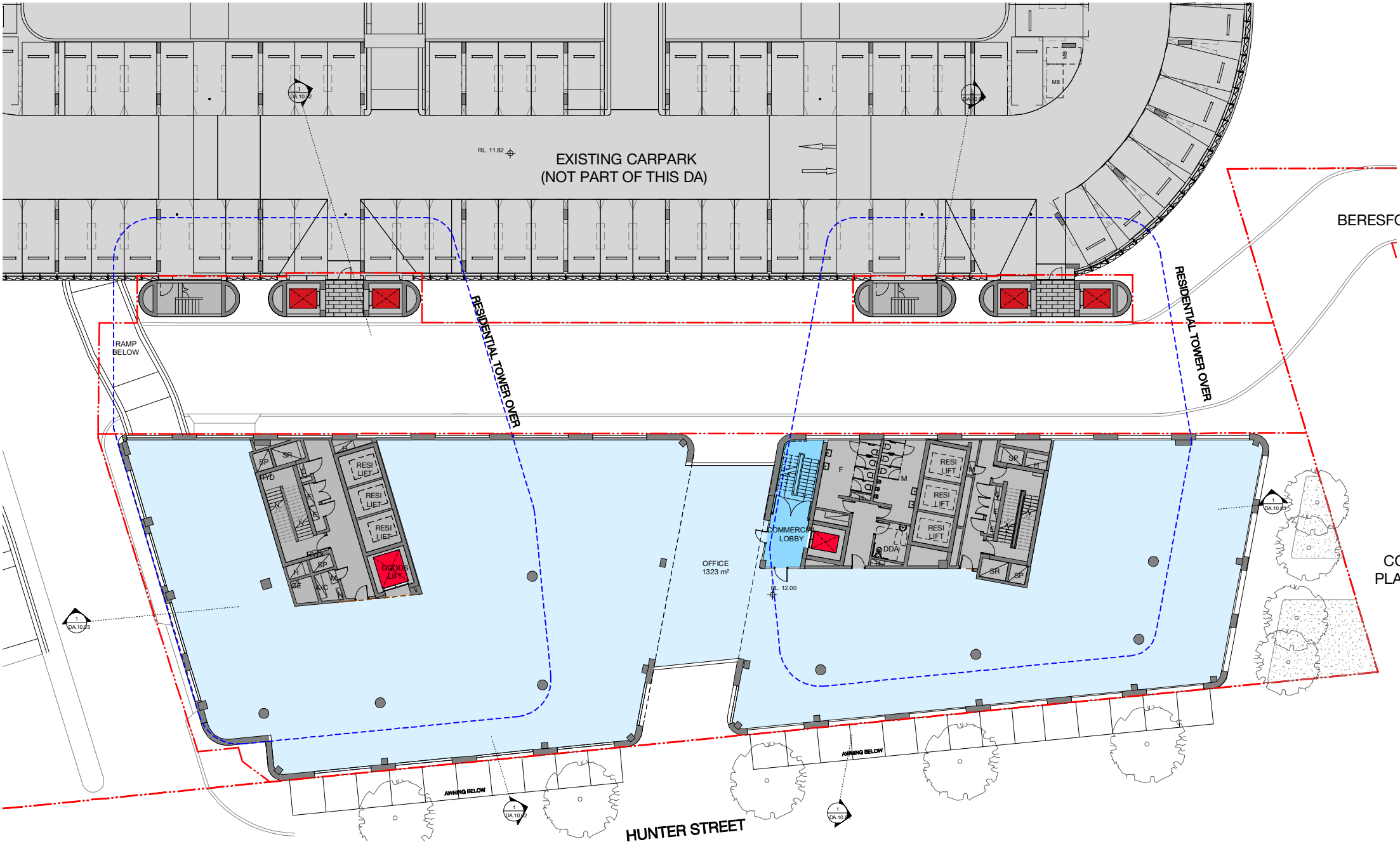

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2	17.06.21	FOR COORDINATION		
1	04.05.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 02 Plan

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Drawn	MT	Checked	BD	
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Status	Development Application			
Plot Date	21/09/2021 7:26:45 PM			
BIM	RESIDENTIAL ARCH			
Drawing no.	DA.03.02	Revision	4	

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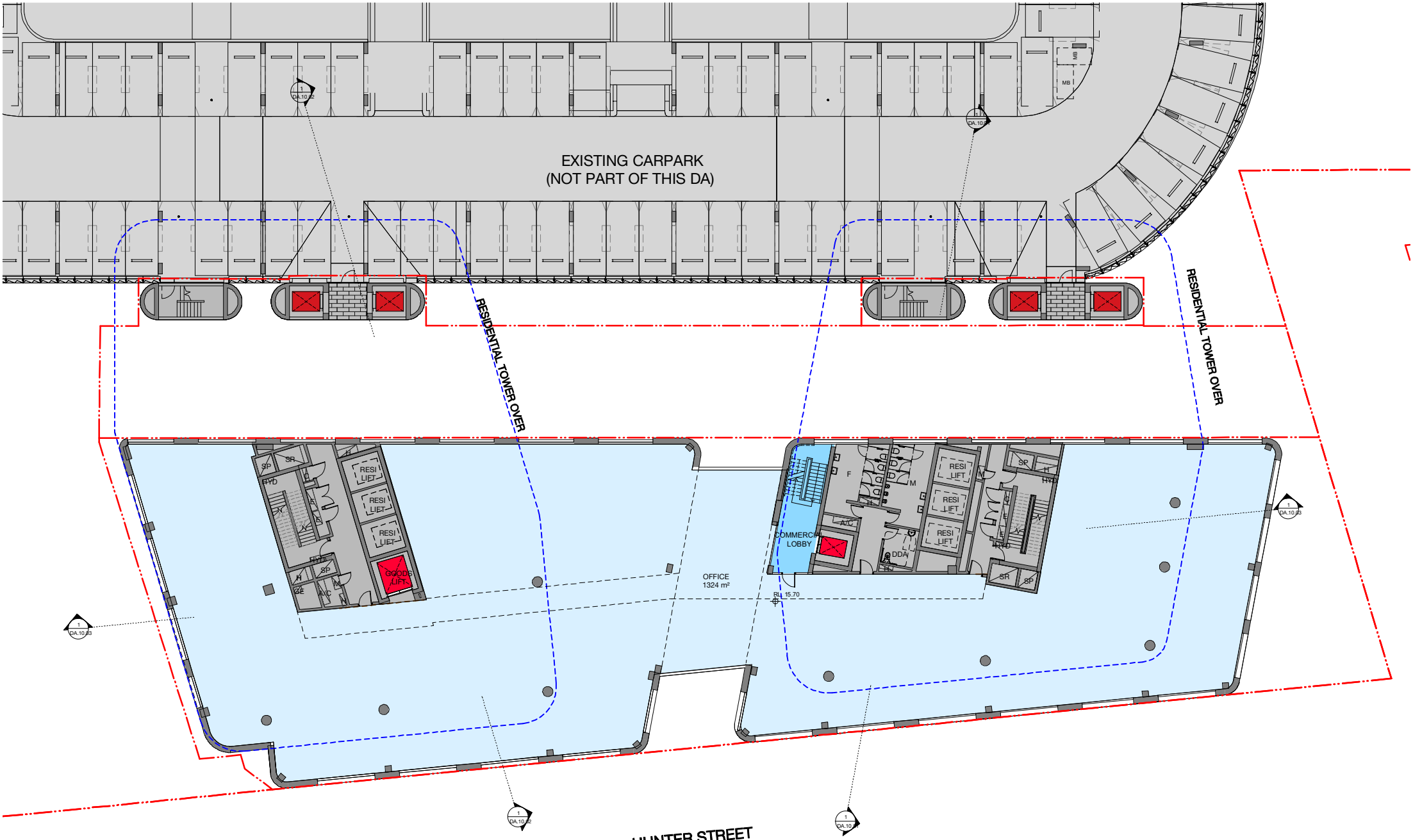

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2	17.06.21	FOR COORDINATION		
1	04.06.21	FOR COORDINATION		

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Level 03 Plan

Scale	1 : 125 @ A1 1:250 @ A3
Drawn	MT
Checked	BD
Project no.	S12133
Status	Development Application
Plot Date	21/09/2021 7:26:48 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.03
Revision	4

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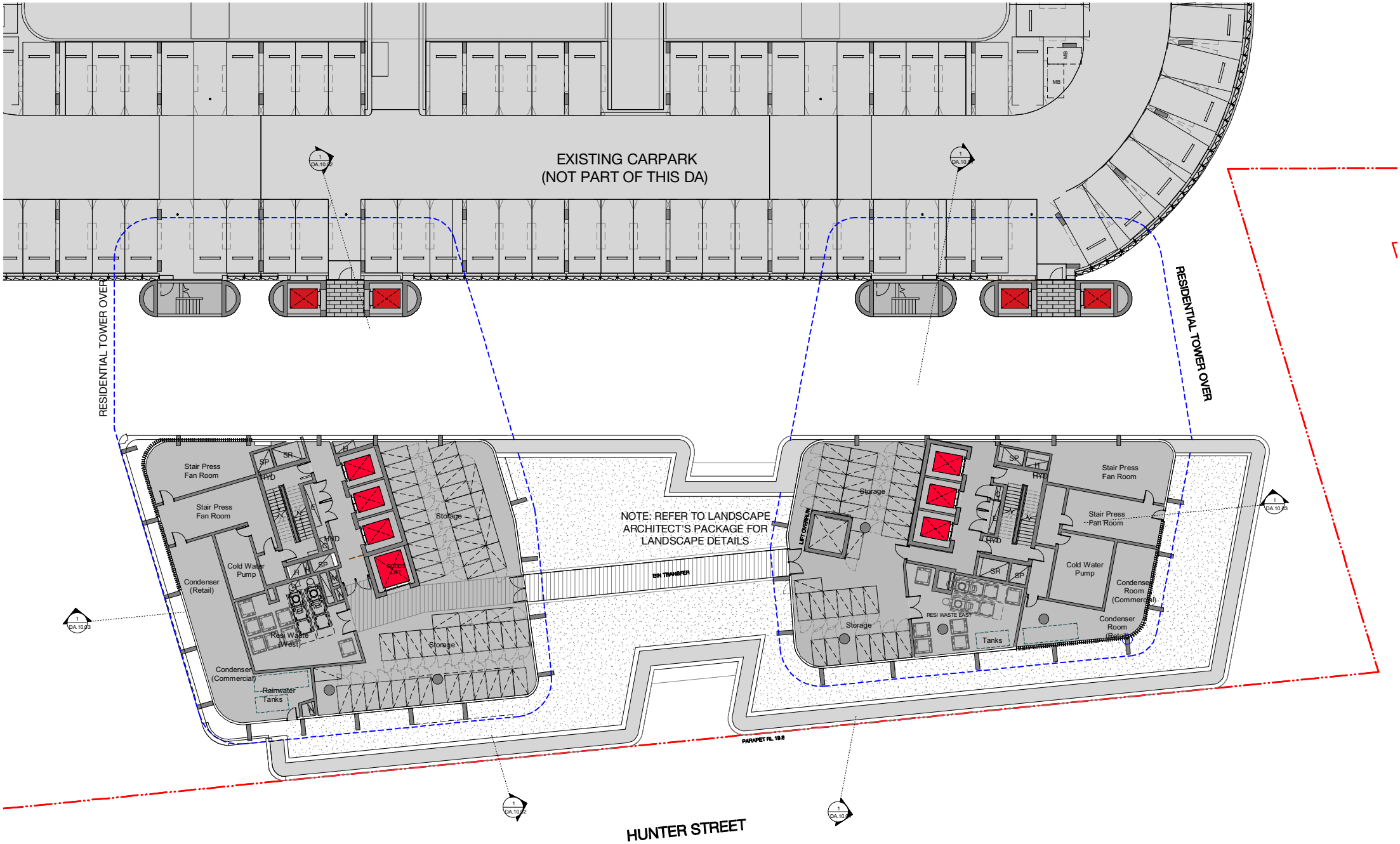

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3	06.07.21	FOR COORDINATION	MT	
2	17.06.21	FOR COORDINATION		
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 04 Plan

Scale	1 : 125 @ A1	1:250 @ A3	
Drawn	MT	Checked	BD
Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:26:49 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.04	Revision	4

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http://www.batessmart.com.au

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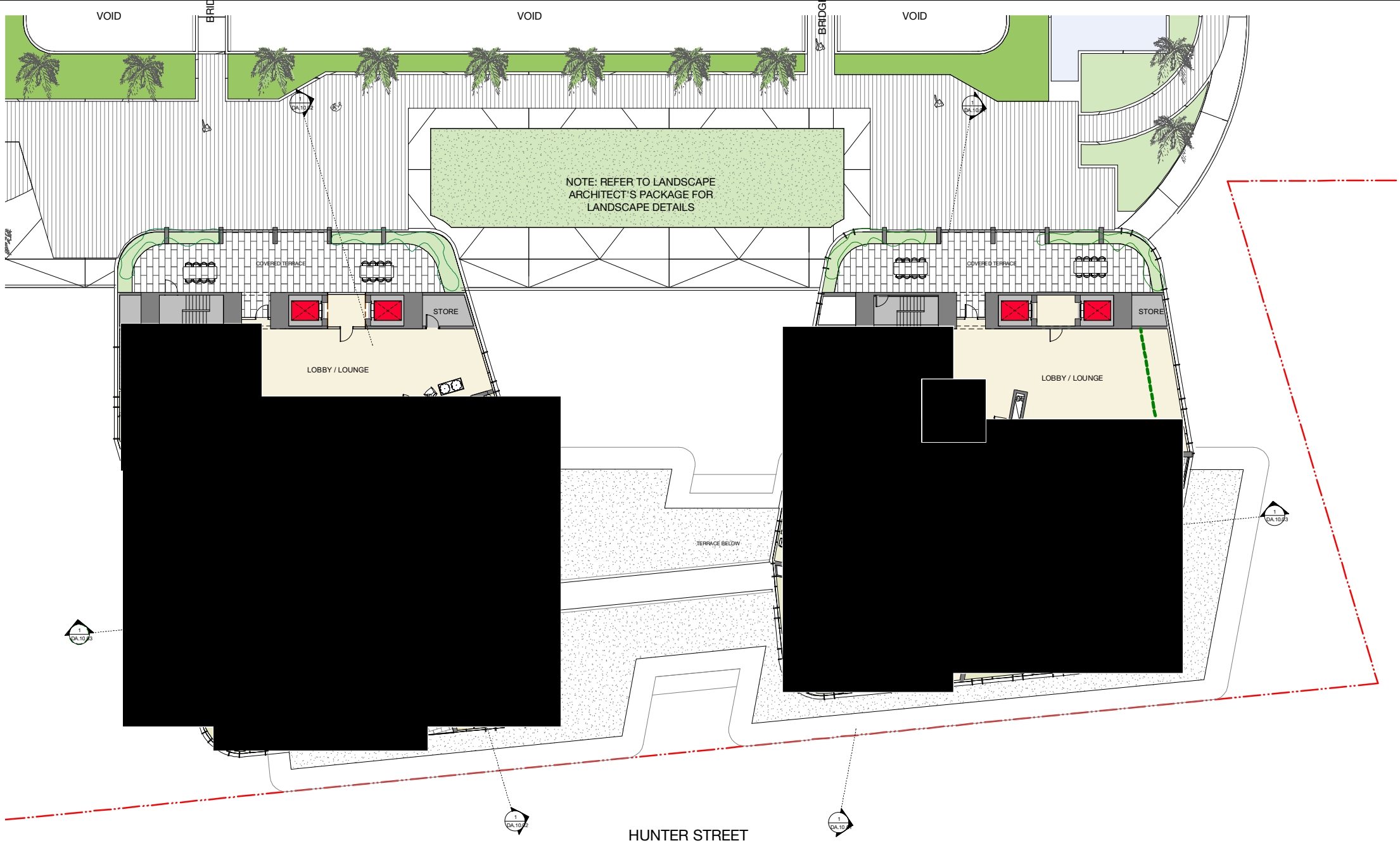

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2	17.06.21	FOR COORDINATION		
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 05 Plan

Scale	1 : 125 @ A1	1:250 @ A3	
Drawn	MT	Checked	BD
Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:26:52 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.05	Revision	4

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http://www.batessmart.com.au

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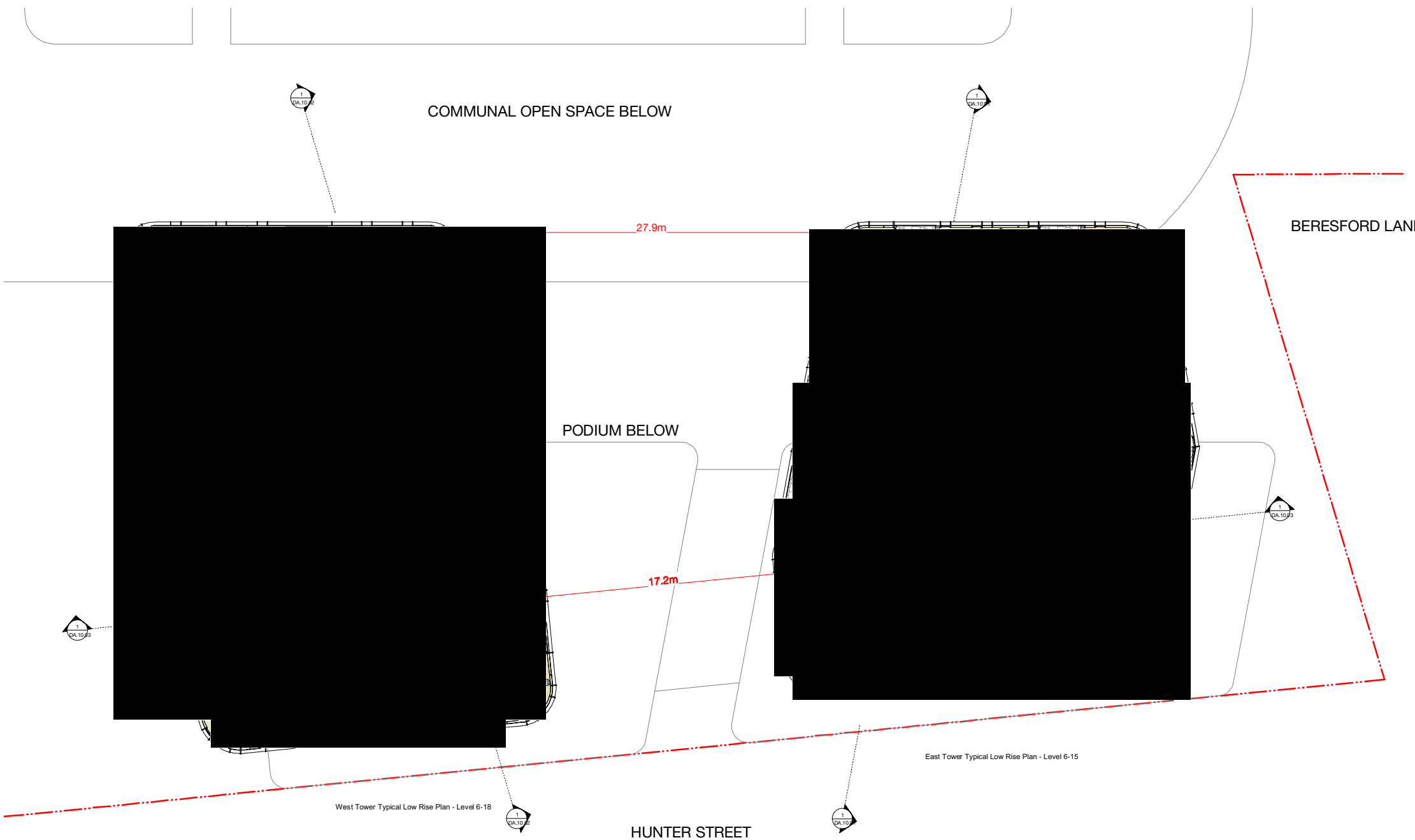

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Typical Low Rise Plan

Scale	1 : 125 @ A1 1:250 @ A3
Drawn	MT
Checked	BD
Project no.	S12133
Status	Development Application
Plot Date	21/09/2021 7:26:56 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.06
Revision	3

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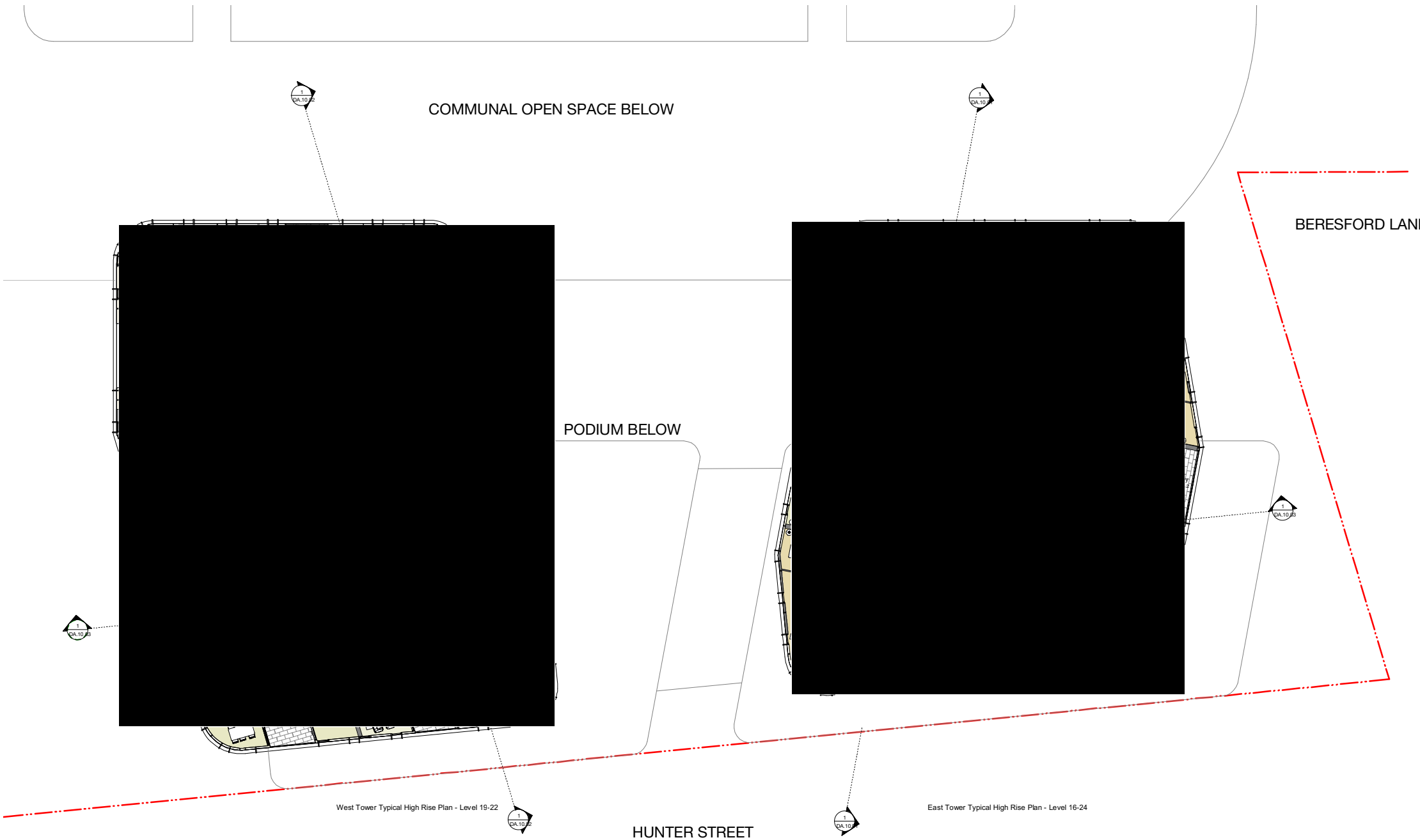

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Typical High Rise Plan

Scale	1 : 125 @ A1 1:250 @ A3
Drawn	MT
Checked	BD
Project no.	S12133
Status	Development Application
Plot Date	21/09/2021 7:27:02 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.19
Revision	3

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 23 Plan

Scale	1 : 125 @ A1, 1 : 250 @ A3
Drawn	MT
Checked	BD
Project no.	S12133
Status	Development Application
Plot Date	21/09/2021 7:27:08 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.23
Revision	3

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http://www.batessmart.com.au

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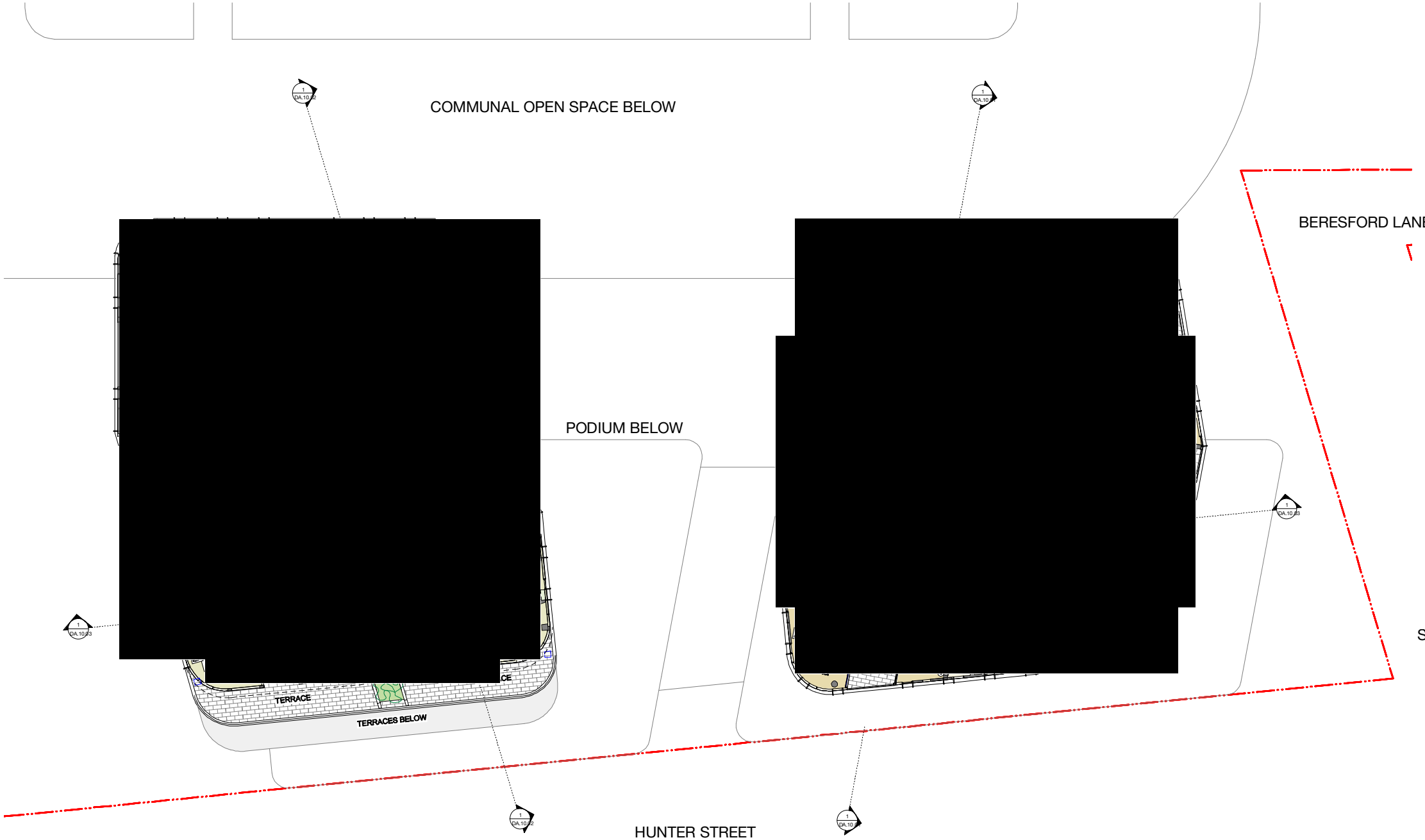

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

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Level 24 Plan

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Drawn	MT
Checked	BD
Project no.	S12133
Status	Development Application
Plot Date	21/09/2021 7:27:13 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.24
Revision	3

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http://www.batessmart.com.au

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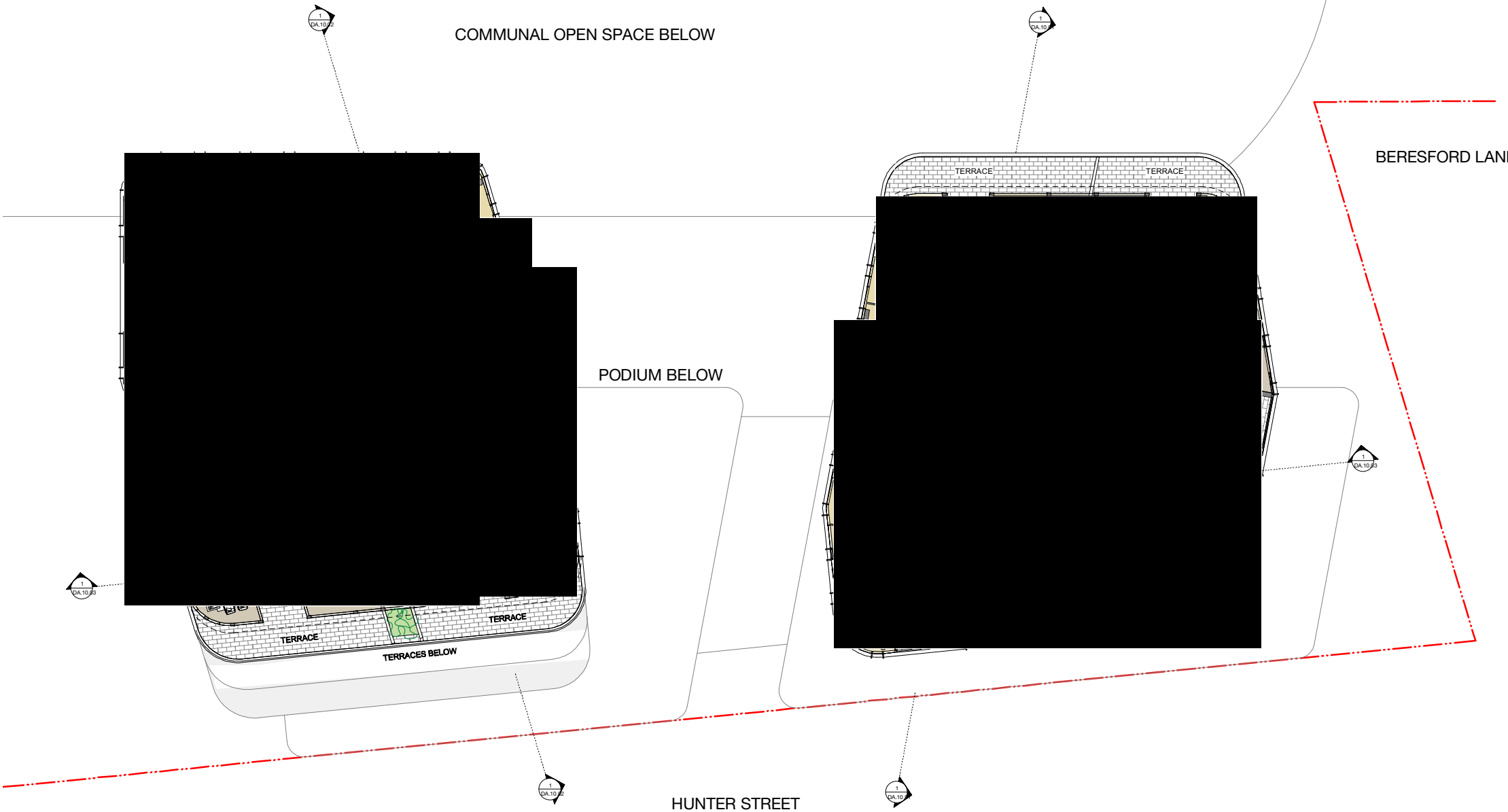

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 25 Plan

Scale	1 : 125 @ A1, 1 : 250 @ A3
Drawn	MT
Checked	BD
Project no.	S12133
Status	Development Application
Plot Date	21/09/2021 7:27:18 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.25
Revision	3

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T 03 8664 6200 F 03 8664 6300
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http://www.batessmart.com.au

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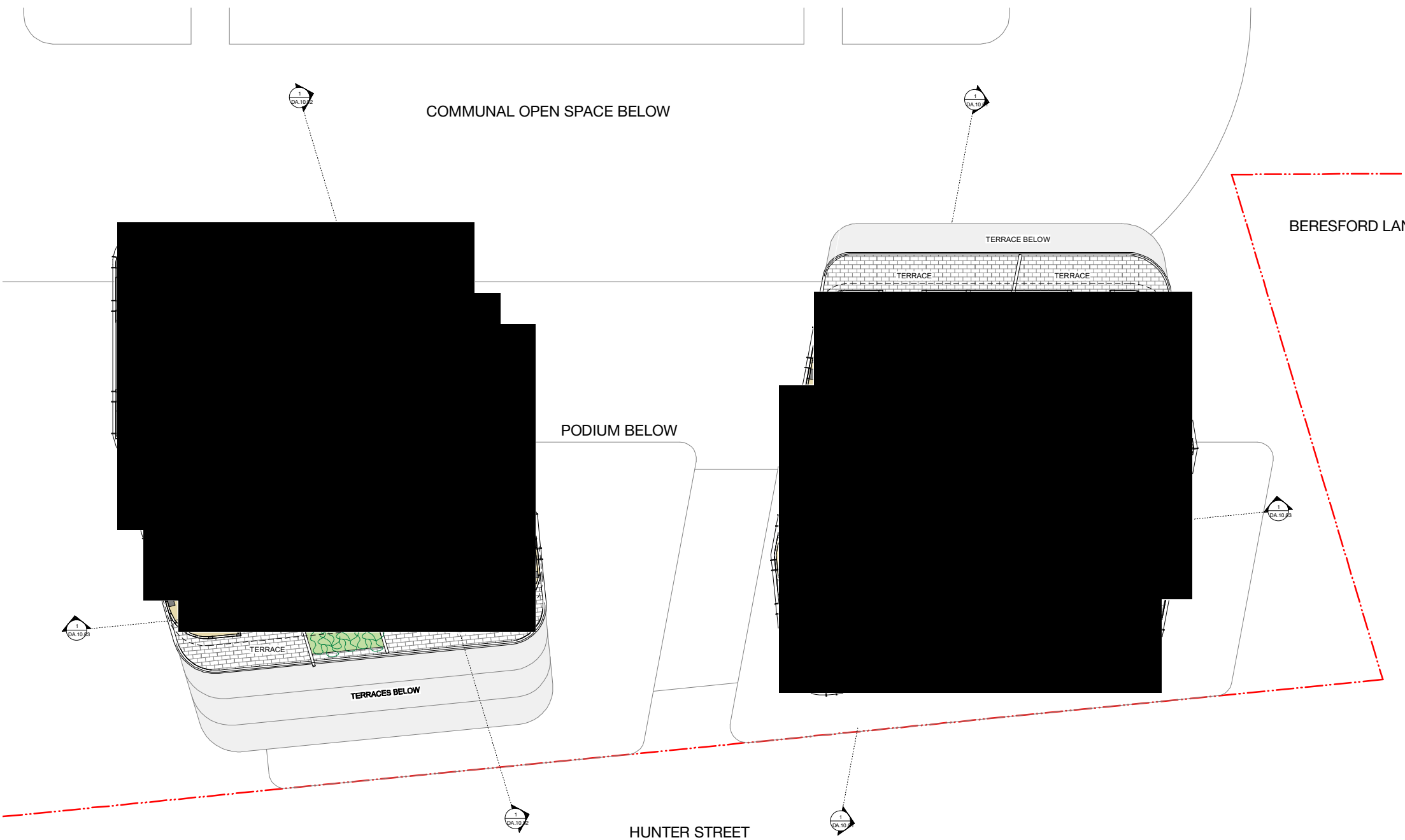

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 26 Plan

Scale	1 : 125 @ A1 — 1 : 250 @ A3
Drawn	MT
Checked	BD
Project no.	S12133
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Plot Date	21/09/2021 7:27:23 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.26
Revision	3

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T 03 8664 6200 F 03 8664 6300
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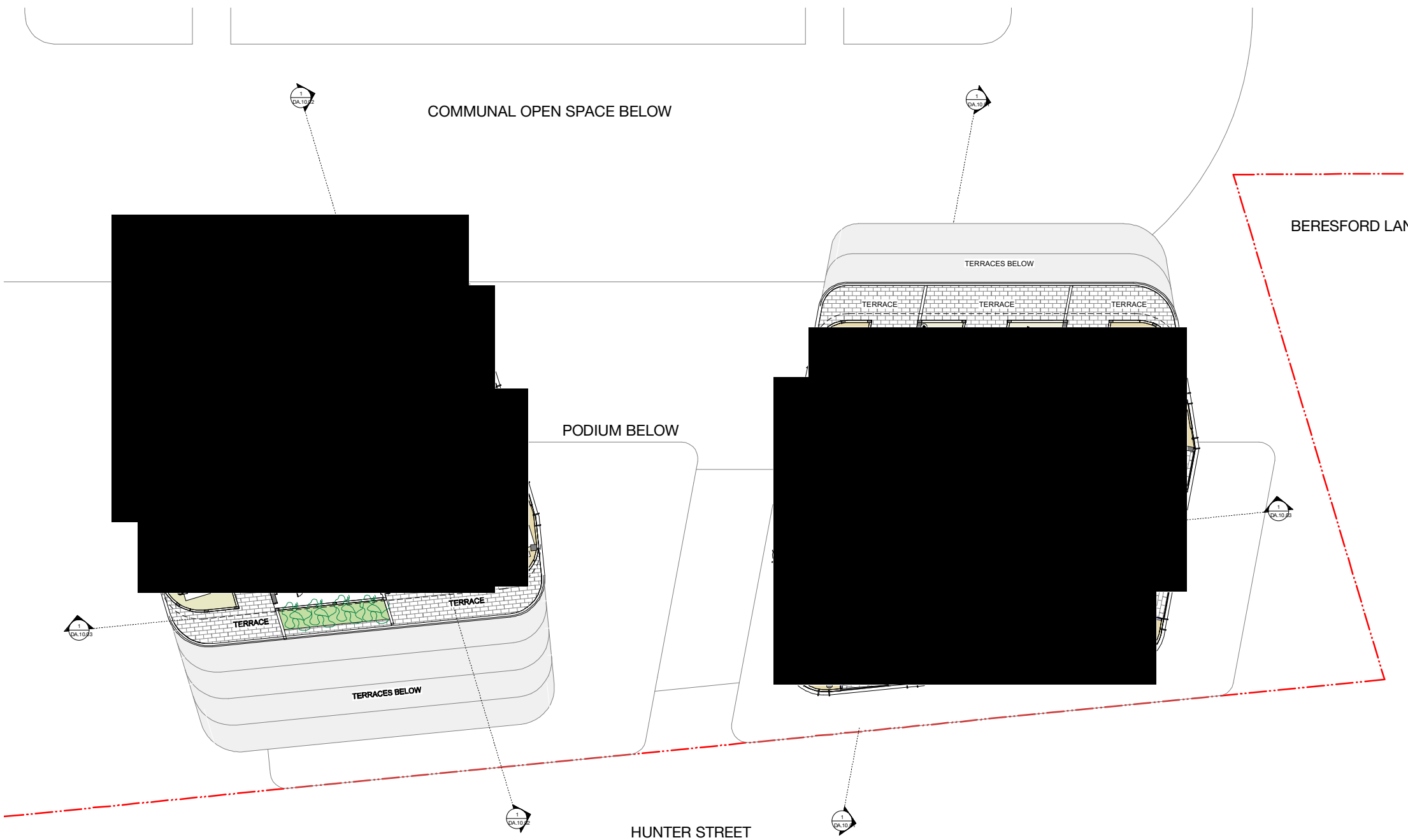

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 27 Plan

Scale	1 : 125	@ A1	1:250	@ A3
Drawn	MT		Checked	BD
Project no.	S12133			
Status	Development Application			
Plot Date	21/09/2021 7:27:28 PM			
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Drawing no.	DA.03.27		Revision	3

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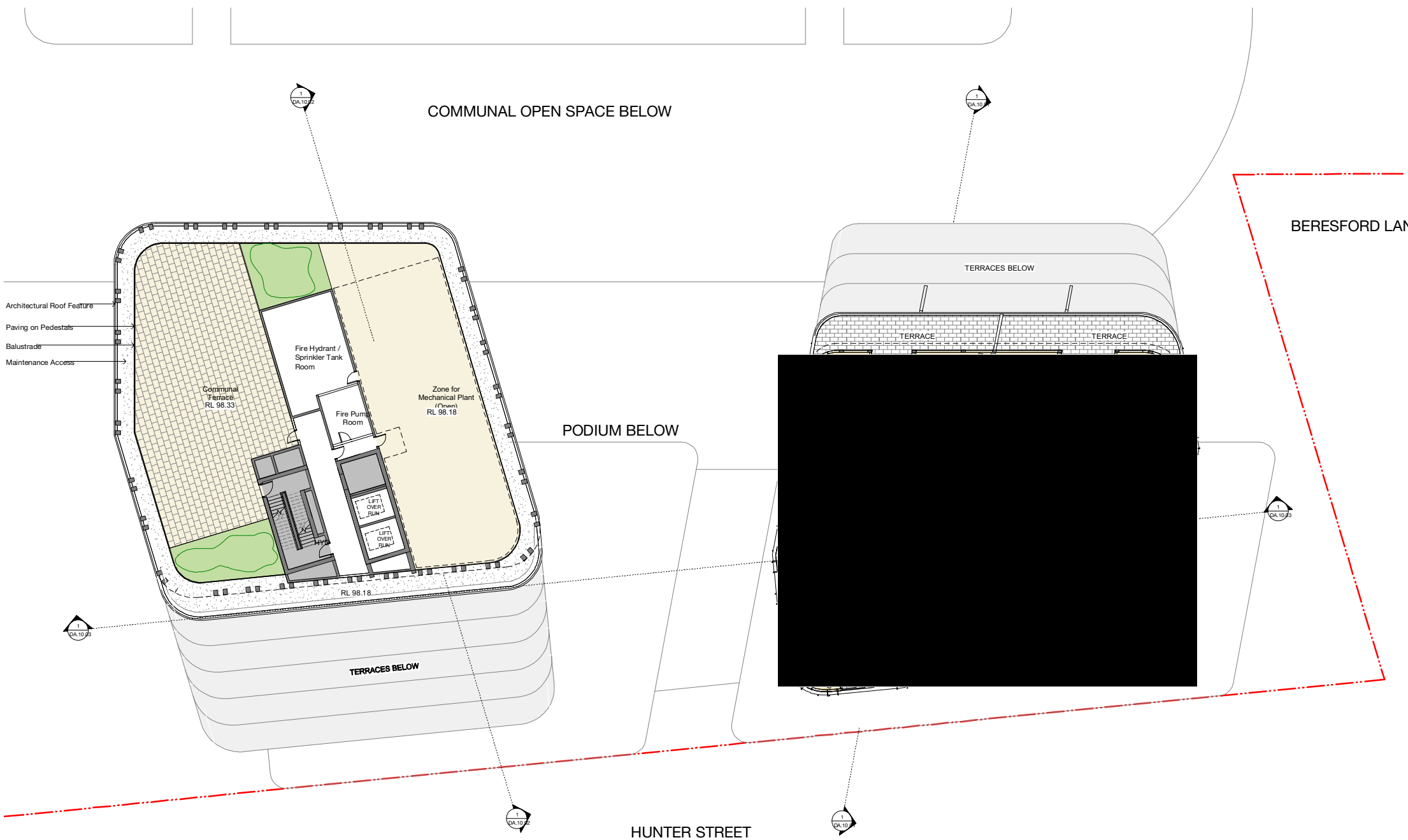

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 28 Plan

Scale	1 : 125 @ A1	1:250 @ A3	
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Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:27:32 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.28	Revision	3

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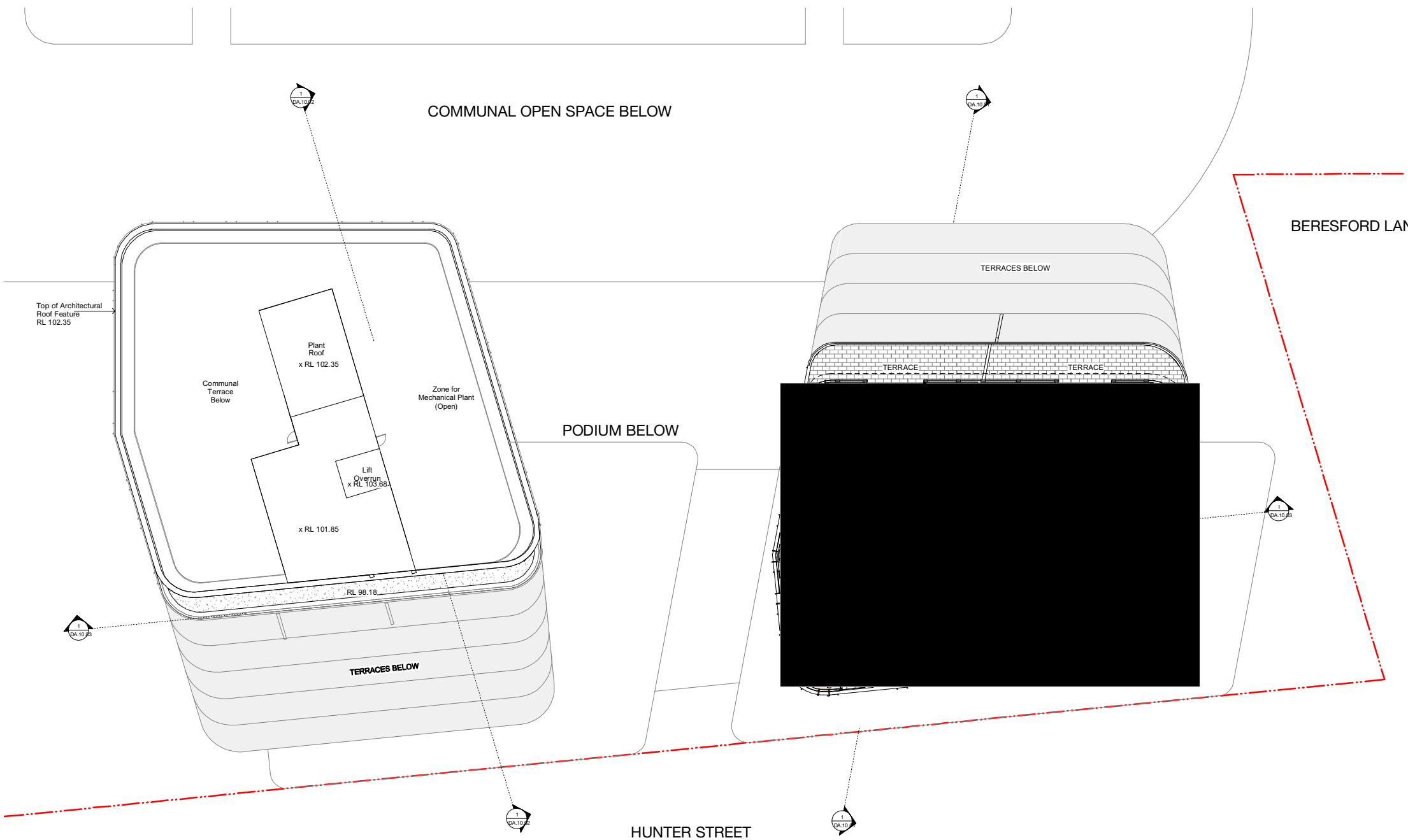

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 29 Plan

Scale	1 : 125 @ A1	1:250	@ A3
Drawn	MT	Checked	BD
Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:27:36 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.29	Revision	3

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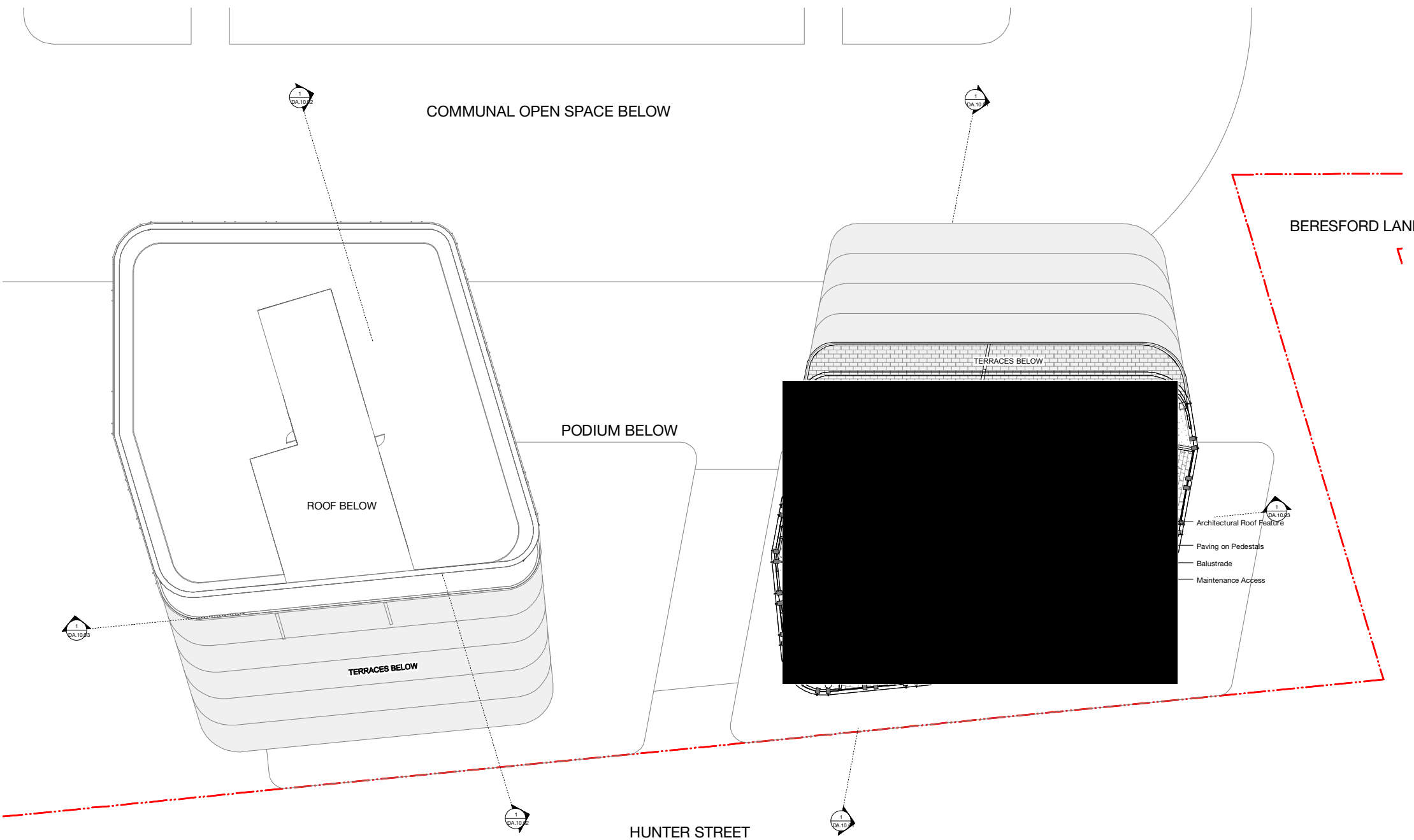

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2	06.07.21	FOR COORDINATION		MT
1	04.06.21	FOR COORDINATION		

THE STORE
854 HUNTER STREET, NEWCASTLE

Level 30 Plan

Scale	1 : 125 @ A1	1:250 @ A3	
Drawn	MT	Checked	BD
Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:27:39 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.30	Revision	3

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Revision	Date	Description	Initial	Checked
1	06.07.21	FOR COORDINATION	MT	

THE STORE
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Roof Plan

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Status	Development Application
Plot Date	21/09/2021 7:27:42 PM
BIM	RESIDENTIAL ARCH
Drawing no.	DA.03.31
Revision	1

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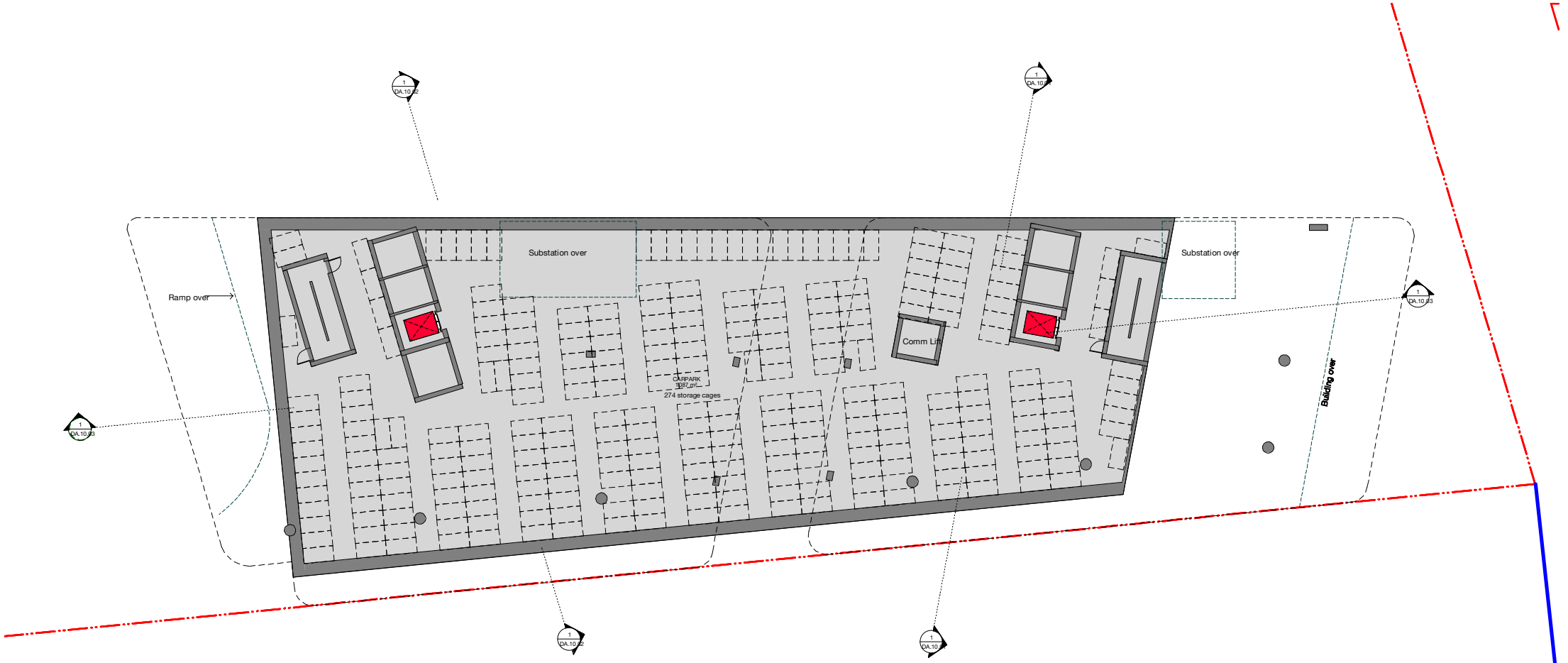

THE STORE
854 HUNTER STREET, NEWCASTLE

Level B1 Plan

Rev	Date	Description	Initial	Checked
1	21.09.21	FOR COORDINATION		JW

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Scale	1 : 125 @ A1	1:250	@ A3
Drawn	Author	Checked	Checker
Project no.	S12133		
Status	Development Application		
Plot Date	21/09/2021 7:27:44 PM		
BIM	RESIDENTIAL ARCH		
Drawing no.	DA.03.B1	Revision	1

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Appendix D – Construction Material Categories

Appendix C – Acoustic Treatment of Residences

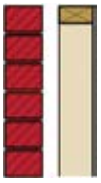
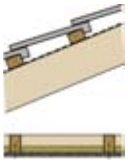
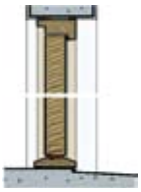
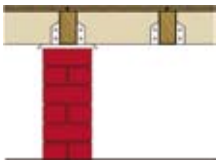
The following table sets out standard (or deemed-to-satisfy) constructions for each category of noise control treatment for the sleeping areas and other habitable areas of single / dual occupancy residential developments only. The assumptions made in the noise modelling are as follows:

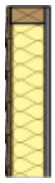
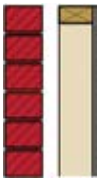
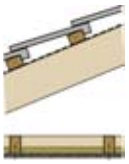
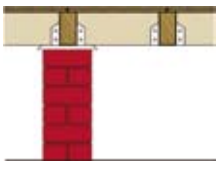
- Typical layout of a modern dwelling taken from a recent large residential development in an outer Sydney suburb
- Bedrooms and other habitable rooms are exposed to road noise

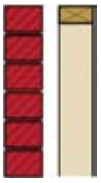
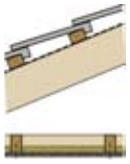
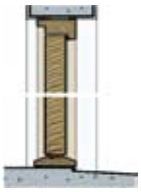
ACOUSTIC PERFORMANCE OF BUILDING ELEMENTS

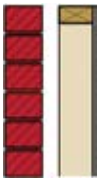
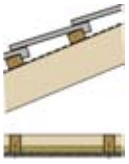
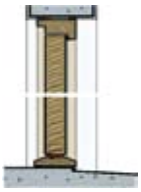
The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (Rw) values, which can be used to find alternatives to the standard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

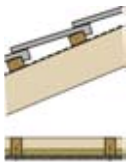
Category of Noise Control Treatment	R_w of Building Elements (minimum assumed)				
	Windows/Sliding Doors	Frontage Facade	Roof	Entry Door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

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	

Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
Ph: +61 2 4920 1833
www.mulleracoustic.com

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Muller Acoustic Consulting