270 Pacific Highway, Crows Nest, NSW

SSD Acoustic Assessment Report

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1 INTRODUCTION

Pulse White Noise Acoustics (PWNA) has been engaged to undertake a noise and vibration assessment for proposed mixed-use residential/commercial development at 270 Pacific Highway, Crows Nest, NSW. This assessment is undertaken in response to the acoustic conditions issued as part of the Secretary's Environmental Assessment Requirements (SEARs) related to this development.

Therefore, this report addresses the findings of the noise and vibration assessment undertaken for operational conditions; as well as for construction activities.

A list of acoustic terminology used in this report is included in Appendix A of this report

1.1 Project Description

The application seeks development consent for the development of a 16 storey mixed use development at 270 Pacific Highway Crows Nest, comprising 168 build to rent units and non-residential uses in the podium. Specifically, the SSDA seeks development consent for:

- Demolition of two existing 5 storey commercial buildings
- Construction of a maximum 16 storey building, including:
  - 2 basement parking levels (with 82 carparks, 8 motorbike spaces and 230 bicycle spaces)
  - 3 podium levels comprising non-residential uses such as medical centre, retail, and residential uses (build to rent units and residential amenity facilities such as a gym and sauna, steam room, outdoor pool, class space, cinema room, co-working space)
  - 13 storeys of residential uses in the tower, comprising build-to-rent units
  - Communal open space
  - Landscaping on ground, Level 2 – Level 15
  - Rooftop solar panels
  - Internal and external residential amenities space on roof top
- Streetscape upgrades
- Office and substation along the northwestern boundary

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 31 January 2025 and issued for the SSDA (SSD-79658964). Specifically, this report has been prepared to respond to the SEARs requirement discussed in Section 1.3.

1.2 Site Layout

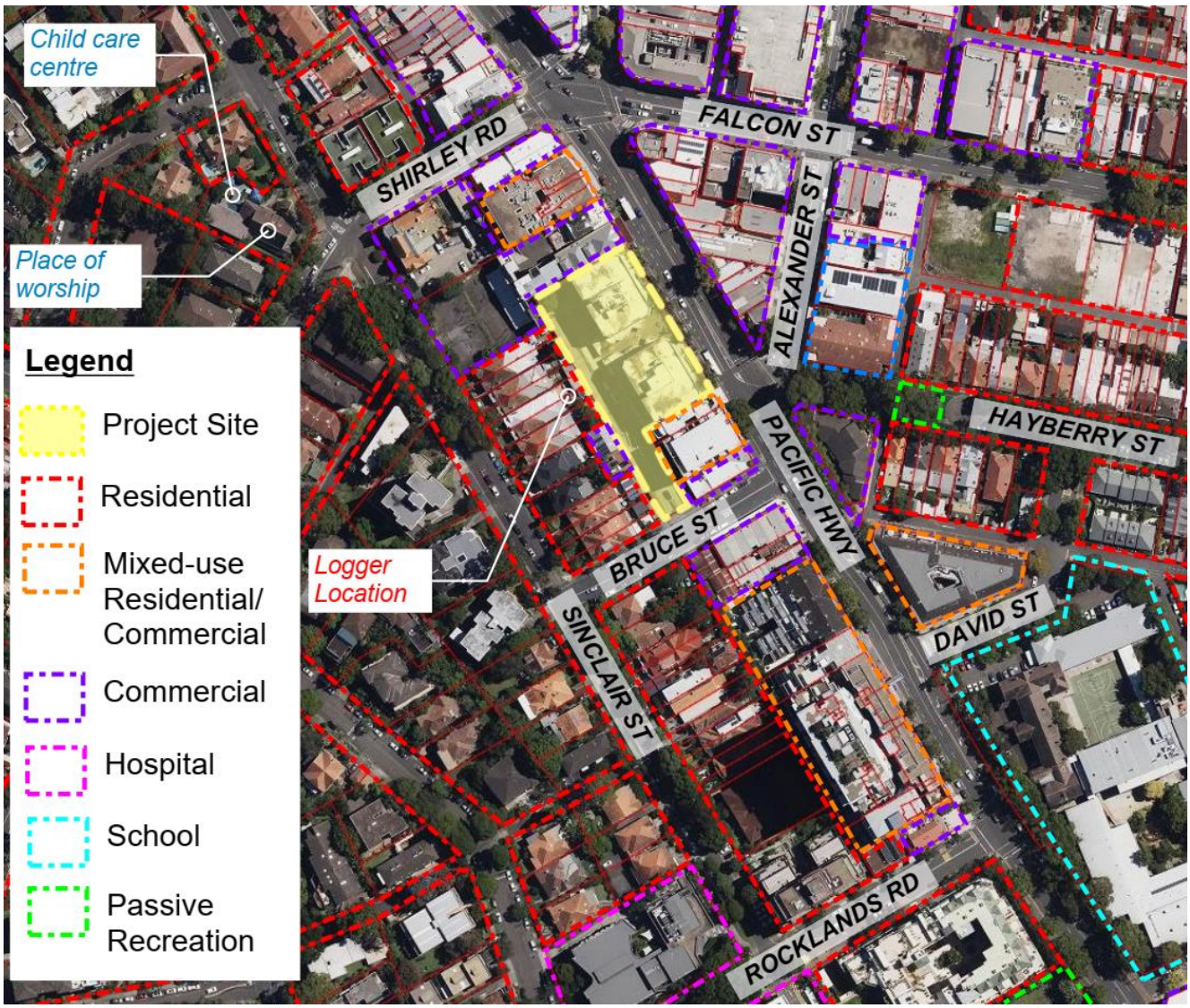
The proposed development is located at 270 Pacific Highway, Crows Nest, NSW. This is surrounded by the following nearest impacted receivers (refer to Figure 1):

- Mixed-use residential/commercial buildings located along the Pacific Highway. These are situated north, south and east from the project site. The nearest impacted buildings are located at:
  - No. 250 & 258 Pacific Highway, along south-eastern property boundary.
  - No. 12 Hayberry Street, at approximately 40-45m east from the project site.
  - No. 300 Pacific Highway, at approximately 20-25m north-west from the project site.
- Residential buildings. These are generally situated behind commercial and mixed-use buildings which are located along the Pacific Highway. The nearest impacted residential buildings are found at:
  - No. 51 to 77 Sinclair Street, located along the western property boundary.
  - No. 49 Sinclair Street, located at approximately 20m from the southern property boundary, across Bruce Street.
- Commercial buildings. The nearest impacted commercial buildings are located at following locations (mostly along Pacific Highway):
  - No. 286 Pacific Highway, located along the northern property boundary.
  - No. 391 to 423 Pacific Highway, located at approximately 25m from the eastern property boundary, across the Pacific Highway.
  - No. 385-389 Pacific Highway, located at approximately 35m from the eastern property boundary, across the Pacific Highway.
  - No. 246 Pacific Highway, along south-eastern property boundary.
  - No. 2A Sinclair Street, along western property boundary.
- Educational premises (namely North Sydney Girls High School), located at approximately 125m from the southern property boundary. Its address is No. 365 Pacific Highway, Crows Nest.
- Hospital premises (namely Mater Hospital), located at approximately 150m from the southern property boundary.
- Place of worship (namely Crows Nest Uniting Church), located at approximately 100m from the northern property boundary. The address is No. 122 Shirley Road, Wollstonecraft.
- Childcare centre (namely Gowrie NSW Shirley Road), located at approximately 125m from the northern property boundary. This is situated in the corner of Shirley Road and Nicholson Place, Crows Nest.
- Passive recreation area (namely Hayberry Street Road Reserve), located at approximately 80m from the eastern property boundary. This is between Alexander Lane and Hayberry Street.

Finally, it is noted that the proposed commercial building is located near the underground rail corridor which is part of the Sydney Metro – Chatswood to Sydenham development (refer to Figure 8). Near the proposed building, the underground rail tunnel is situated at approximately 30-35m below ground level. Also, the project site is located approximately 55m horizontally from the underground rail corridor.

Additionally, we note that near the project site, the underground rail corridor approaches the new Crows Nest Rail Station (also part of Sydney Metro). The Crows Nest Rail Station is situated at approximately 220m north-west from the project site, along the Pacific Highway.

Figure 1 Site layout



1.3 Planning Secretary's Environmental Assessment Requirements (SEARs)

The Planning Secretary's Environmental Assessment Requirements (SEARs) for the new LSPS, were issued on 31 January 2025, under application number SSD-79658964.

The sections of the SEARs which are relevant to the acoustic assessment are the following:

10. Noise and Vibration

Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.

These requirements are addressed as follows in this report:

- For typical operational activities, the assessment criteria are summarised in Section 3. These criteria are obtained according to the NSW Noise Policy for Industry, and other relevant statutory requirements.
- The assessment of typical operational activities and relevant outcomes are discussed in Section 5.
- The criteria utilised for the assessment of noise and vibration impact during construction stages, are discussed in Section 4. The findings from this assessment are addressed in Section 6.

2 EXISTING ACOUSTIC ENVIRONMENT

2.1 Noise Surveys

To determine the existing ambient noise levels on site, the following noise surveys were conducted:

- Unattended noise survey undertaken between Tuesday 14 November and Wednesday 22 November 2023. To conduct this survey a NL-42 noise logger (serial number 00396931) was deployed at 67 Sinclair Street, Wollstonecraft. Figure 1 shows the logger location.
- Attended noise survey conducted on Wednesday 22 November 2023, at the following times: 9:00am (during morning period), 6:15pm (during evening period); 10:00pm (during night-time period). The survey was conducted at 3m from the northbound kerb of Pacific Highway, along the eastern property boundary. This attended survey was performed using a Bruel & Kjaer Type 2260 sound level meter (serial number 1823768).

Calibration of the noise logger and sound level meter was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

For the unattended noise survey, charts presenting summaries of the measured daily noise data are attached in Appendix B. The charts present each 24 hour period and show the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15 minute periods. This data has been filtered to remove periods affected during adverse weather conditions based on weather information obtained from Sydney Observatory Hill weather station (ID 066214).

2.2 Noise Descriptors & Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure environmental noise in terms of quantifiable time periods and statistical descriptors. Typically, environmental noise is measured over 15 minutes periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' arithmetic does not apply, e.g. adding two sound sources of equal values result in an increase of 3 dB (i.e. 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels. The L_{Aeq} noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included as Appendix A.

2.3 Noise Monitoring Results

The noise levels measured at the nominated logger location (shown in Figure 1) have been used to assess the noise impact of the development onto the nearest noise affected residential buildings. These residences are generally located behind commercial and mixed-use buildings along the Pacific Highway.

The time periods used in the analysis are in accordance with those recommended in the NSW Noise Policy for Industry (NSW NPI). The measurement results are presented in Table 1 below.

Table 1 Unattended noise survey - Measured ambient noise levels in accordance with the NSW NPI

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Logger Location: 67 Sinclair Street, Wollstonecraft	40	48	37	46	33	42

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Noise measurements obtained during the attended noise survey are used to determine the façade incident noise levels for the proposed commercial development; as well as to assess the noise impact of the development onto commercial and mixed-use buildings located along the Pacific Highway. The measured noise levels are summarised in Table 2.

Table 2 Attended noise survey (along Pacific Highway) - Measured ambient noise levels

Measurement Location	During Daytime 9:00 am to 9:15 am		During Evening 6:15 pm to 6:30 pm		During Night-time 10:00 pm to 10:15 pm	
	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Attended Noise Survey: 270 Pacific Highway, 3m from NB Pacific Hwy kerb	60	72	57	72	56	71

Note 1: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

These attended measurements are validated with those undertaken for mixed-use developments near the project site (refer to discussion in Section 2.4). From comparison with these measurement results, the following is determined:

- Existing ambient noise levels for receivers facing the Pacific Highway (refer to Table 8). From these noise levels, the criteria for external noise emissions are derived (refer to discussion in Section 3.1).
- Façade incident noise levels influenced by local road traffic along Pacific Highway (refer to Table 9).

2.4 Noise Monitoring Results From Near-By Developments

To validate our attended noise measurements along the Pacific Highway, we refer to the following noise surveys conducted for future mixed-use developments in the vicinity of the project site:

- Development at 378-398 Pacific Highway, Crows Nest, NSW. Measurements are discussed in report titled *"378-398 Pacific Highway, Crows Nest, NSW, SSD Acoustic Assessment Report"* (revision 6.0, dated 4 March 2025, issued by PWNA). Measurement results are summarised in Table 3 and Table 4 below.

Table 3 378-398 Pacific Hwy, measured ambient noise levels

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Measurement Location: Facing Pacific Highway	59	72	55	70	47	66

Table 4 378-398 Pacific Hwy, measured façade incident noise levels

Logger	Period	Measured Noise Levels (dBA)	
		Daytime/Night Time Periods	Max. 1 Hour Levels
Measurement Location: Facing Pacific Highway	**Daytime: 7:00 am – 10:00 pm**	71 L_{Aeq} (15 hrs)	74 L_{Aeq} (1 hr)
	Night time: 10:00pm – 7:00 am	66 L_{Aeq} (9 hrs)	69 L_{Aeq} (1 hr)

- Development at 286-294 Pacific Highway, Crows Nest, NSW. Measurements are discussed in report titled *"Environmental Noise Assessment, Proposed Mixed-Use Development at 286-294 Pacific Highway, Crows Nest"* (revision 3.0, dated 6 June 2024, issued by TTM Consulting). Measurement results are summarised in Table 5 below.

Table 5 286-294 Pacific Hwy, measured façade incident noise levels

Logger	Period	Measured Noise Levels (dBA)	
		Daytime/Night Time Periods	Max. 1 Hour Levels
Measurement Location: Facing Pacific Highway	**Daytime: 7:00 am – 10:00 pm**	70 L_{Aeq} (15 hrs)	72 L_{Aeq} (1 hr)
	Night time: 10:00pm – 7:00 am	65 L_{Aeq} (9 hrs)	66 L_{Aeq} (1 hr)

- Development at 391-423 Pacific Highway, Crows Nest, NSW. Measurements are discussed in report titled *"391-423 Pacific Highway, Crows Nest, NSW, DA Acoustic Assessment"* (revision 3.0, dated 12 March 2025, issued by Acoustic Logic Consultancy). Measurement results are summarised in Table 6 and Table 7 below

Table 6 391-423 Pacific Hwy, measured ambient noise levels

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Measurement Location: Facing Pacific Highway	59	-	55	-	44	-

Table 7 391-423 Pacific Hwy, measured façade incident noise levels

Logger	Period	Measured Noise Levels (dBA)	
		Daytime/Night Time Periods	Max. 1 Hour Levels
Measurement Location: Facing Pacific Highway	**Daytime: 7:00 am – 10:00 pm**	68 L_{Aeq} (15 hrs)	69 L_{Aeq} (1 hr)
	Night time: 10:00pm – 7:00 am	63 L_{Aeq} (9 hrs)	68 L_{Aeq} (1 hr)

Therefore, based on the information presented above, as well as attended noise measurements summarised in Table 2, we define the following parameters:

- Table 8: Existing ambient noise levels which are representative for receivers facing directly onto the Pacific Highway.

Table 8 270 Pacific Hwy (facing Pacific Hwy), existing ambient noise levels

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Location: Facing Pacific Highway	60	70	57	70	44	65

- Table 9: Façade incident noise levels influenced by local road traffic along Pacific Highway

Table 9 270 Pacific Hwy (facing Pacific Hwy), façade incident noise levels

Logger	Period	Measured Noise Levels (dBA)	
		Daytime/Night Time Periods	Max. 1 Hour Levels
Location: Facing Pacific Highway	**Daytime: 7:00 am – 10:00 pm**	70 L_{Aeq} (15 hrs)	72 L_{Aeq} (1 hr)
	Night time: 10:00pm – 7:00 am	65 L_{Aeq} (9 hrs)	68 L_{Aeq} (1 hr)

3 OPERATIONAL ACOUSTIC CRITERIA

3.1 NSW Noise Policy For Industry

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

Consequently, the NSW EPA has prepared a document titled Noise Policy for Industry (NSW NPI) which provides a framework and process for determining external noise criteria and subsequent assessments. The NSW NPI criteria for industrial noise sources have two components:

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

3.1.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minutes period, does not exceed the background noise level measured in the absence of the source by more than 5 dBA. This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

3.1.3 Area Classification

Table 2.3 of the NSW NPI defines "urban" and "suburban" residential areas as summarised in Table 10 below. By comparing the measured L_{A90} noise levels listed in Table 1 and Table 2, and the defined RBL values in Table 10; we note the following:

- Mixed-use residential/commercial buildings located along Pacific Highway, can be considered as "urban" residential receivers. These are located within zone MU1 shown in Figure 2. Figure 2 is an extract obtained from the NSW Planning Portal Spatial Viewer.
- Residences located behind commercial buildings and mixed-use residential/commercial buildings along Pacific Highway, can be considered as "suburban" residential receivers. This coincides with the designated zoning shown in Figure 2. (i.e. R2 and R3 residential zoning areas).

Based on the information discussed above, the amenity criteria for the identified receiver types are summarised in Table 11. The criteria are obtained from Table 2.2 of the NSW NPI.

Table 10 Definition for residential receiver categories

Receiver Category	Typical Planning Zoning – Standard Instrument	Typical Existing Background Noise Levels	Description
Suburban	RU5 – village RU6 – transition R2 – low density residential R3 - medium density residential E2 – environmental conservation E3 – environmental management	Daytime RBL< 45 dBA Evening RBL < 40 dBA Night RBL < 35 dBA	An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity
Urban	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL> 45 dBA Evening RBL > 40 dBA Night RBL > 35 dBA	An area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above

Figure 2 Land zoning around project site

Table 11 NSW NPI – Recommended L_{Aeq} noise levels from industrial noise sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residences: Mixed-use buildings located along Pacific Hwy	Urban	Day	60
		Evening	50
		Night	45
Residences: Residences located behind commercial & mixed-use buildings along Pacific Hwy	Suburban	Day	55
		Evening	45
		Night	40
Commercial premises: Along Pacific Hwy	All	When in use	65
School classrooms – internal: North Sydney Girls High School Gowrie NSW Shirley Road (childcare centre)	All	Noisiest 1-hour period when in use	35
Place of worship – internal: Crows Nest Uniting Church	All	When in use	40

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Hospital ward – external: Mater Hospital	All	Noisiest 1 hour	50
Passive recreation area: Hayberry Street Road Reserve	All	When in use	50

Note 1. For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2. The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

3.1.4 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in Table 12. These criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the commercial components of the development to potentially affected noise sensitive receivers.

For each assessment period, the lower (i.e. the more stringent) of the amenity criteria, intrusive criteria, are adopted. These are shown in bold text in Table 12.

Table 12 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [6]	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [4]
Residences (Urban): Mixed-use buildings located along Pacific Hwy	Day	55 [7]	60	70	65	**58** [9]
	Evening	45 [7]	57	70	62	**58** [9]
	Night	40 [7]	44	65	**49**	53 [9]
Residences (Suburban): Residences located behind commercial & mixed-use buildings along Pacific Hwy	Day	50 [7]	40	48	**45**	53
	Evening	40 [7]	37	46	**42**	43
	Night	35 [7]	33	42	**38**	**38**
Commercial premises: Along Pacific Hwy	When in use	60	N/A	70	N/A	**63**
School classrooms – external: North Sydney Girls High School Gowrie NSW Shirley Road (childcare centre)	Noisiest 1-hour period when in use	55 [1]	N/A	70	N/A	**63**

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [6]	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [4]
Place of worship – external: Crows Nest Uniting Church	When in use	60 [1]	N/A	48	N/A	**63**
Hospital wards, external Mater Hospital	Noisiest 1 hour	45	N/A	48	N/A	**48**
Passive recreation area: Hayberry Street Road Reserve	When in use	45	N/A	48	N/A	**48**

Note 1: Amenity external noise level criteria obtained from assuming a noise reduction of 25 dB for non-openable windows; and - 5 dB to convert from Recommended Amenity Noise Level to Project Amenity Noise Level.

Note 2: L_{A90} Background Noise or Rating Background Level (RBL).

Note 3: Project Noise Trigger Levels are shown in bold. This is the lower of the amenity and the intrusiveness level, typically used as the applicable overall noise criterion for the day, evening and night periods.

Note 4: This is based on the assumption that the existing noise levels are unlikely to decrease in the future.

Note 5: As per Section 2.3 of the NSW Noise Policy for Industry, the evening RBL is set to no greater than the daytime RBL.

Note 6: Intrusive criterion is equal to the RBL + 5 dB.

Note 7: Amenity Criterion corresponding to residential areas, equivalent to the Recommended Amenity Noise Levels (Section 3.1.2) minus 5 dBA + 3 dB to convert from the measurement "period" to a 15 minute criteria.

Note 8: Where the measured L_{Aeq} noise levels are more than 10 dB higher than the Project Amenity Criterion, then the 15 minute Amenity Noise Criteria is equal to the measured $L_{Aeq,period}$ noise levels minus 10 dBA + 3 dB to convert from the measurement "period" to a 15 minute criteria.

Note 9: Existing L_{Aeq} noise levels impacted by road traffic noise from Pacific Highway. Therefore, high traffic amenity criteria $L_{Aeq\ (15\ minutes)}$ = $L_{Aeq, period\ (traffic)}$ -15 dB + 3 dB

3.1.5 Sleep Disturbance

In accordance with the NSW NPI, sleep disturbance is to be assesses in two stages addressing the likelihood of sleep disturbance and sleep awakening.

For the criterion addressing the likelihood of sleep disturbance, the NSW NPI recommends that the maximum noise level event should not exceed the following:

- 40 dB $L_{Aeq,\ 15\ minutes}$ or the prevailing RBL plus 5 dB, whichever is the greater; and / or
- 52 dB L_{AFmax} or the prevailing RBL plus 15 dB, whichever is the greater

As a result, the criteria for the likelihood of sleep disturbance are adopted as summarised in Table 13.

Table 13 Criteria for the likelihood of sleep disturbance

Receiver	Criteria for the Likelihood of Sleep Disturbance
Urban Residences Mixed-use residential/commercial buildings along Pacific Highway	49 dB $L_{Aeq,\ 15\ minutes}$ 59 dB L_{AFmax} (i.e. RBL + 15 dB)
Suburban Residences Residences located behind commercial & mixed-use buildings along Pacific Hwy	38 dB $L_{Aeq,\ 15\ minutes}$ 52 dB L_{AFmax}

Regarding sleep awakening, ongoing research is still being undertaken to quantify an appropriate criterion. The NSW Road Noise Policy (NSW RNP) provides guidelines and a summary of current research being undertaken on this topic. According to the NSW RNP, an accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or $L_{A1(1\ minute)}$, and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during early morning shoulder periods).

Currently the information relating to sleep disturbance impacts indicates that:

- Maximum internal noise levels below 50–55 dBA are unlikely to cause an awakening from a sleep state.
- One or two noise events per night with maximum internal noise levels of 65–70 dBA are not likely to affect health and wellbeing significantly.

As a result, the adopted sleep awakening criterion for the project is an internal noise level of 50 - 55 dB L_{AFmax}. This criterion is applicable for noise emissions generated by short term events occurring during the night time period. Therefore, allowing for a 10 dB noise reduction for open windows, it is proposed that the noise screening criterion for sleep awakening should be 60 - 65 dB L_{AFmax} external noise level at residential properties.

3.1.6 Emergency Plant / Infrequent Operations

For emergency plant (such as stand-by generators) or activities which are conducted infrequently, such as waste collection; the NSW NPI allows for modifying factors that can be subtracted from the predicted noise levels. These modifying factors should be applied prior to assessing against the external noise level criteria. These duration modifying factors are summarised in Table 14 below.

Under the assumption that each waste collection event has a duration of between 15 minutes to 1 hour, and there is only one such event in a 24 hour period, then a modifying factor of 5 dB can be applied to the predicted noise levels. Alternatively, the modifying factor can be added to the relevant criterion (as a leniency factor) prior to the assessment.

Table 14 Modifying factors for duration

Allowable Duration of Noise (one event in any 24 hour period)	Allowable Exceedance at Receiver for the Period of Noise Event	
	Daytime and Evening (7am – 10pm)	Night-time (10pm – 7am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
Less than 1.5 minutes	20	10

Note: Where the duration of the noise event is smaller than the duration of the project trigger noise level (PNTL), that is, less than 15 minutes, the allowable adjusted project noise trigger level (APNTL) is derived as follows:

$$APNTL = 10\log((10^{\frac{PNTL}{10}}\ x\ (\frac{900 - duration}{900})) + (10^{\frac{PNTL+allowable\ exceedance\ in\ table\ above}{10}}\ x\ duration))$$

3.2 Internal Noise Level Criteria

3.2.1 State Environmental Planning Policy (Transport & Infrastructure) 2021

The State Environmental Planning Policy (Transport & Infrastructure) 2021 (referred herein as the SEPP 2021) was introduced to assist the delivery of necessary infrastructure by improving regulatory certainty and efficiency. The Transport & Infrastructure SEPP has specific planning provisions and development controls for various types of infrastructure, and also for development located adjacent to infrastructure. To provide guidelines for this type of assessment (noise intrusion from road and rail traffic noise), the Department of Planning of the NSW Government has prepared a document titled "Developments Near Rail Corridors and Busy Roads – Interim Guideline" (DNRC & BR-IG).

The DNRC & BR-IG applies to development adjacent to rail corridors and busy roads. It can also provide a useful guide for all development that may be impacted by, or may impact on, rail corridors or busy roads.

Sections 2.119 and 2.120 of the SEPP 2021, state the following regarding traffic noise or vehicle noise emissions:

2.119 Development with frontage to classified road

(2) The consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that -

(c) The development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.

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

(1) This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

(a) In any bedroom in the residential accommodation—35 dBA at any time between 10 pm and 7 am,

(b) Anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dBA at any time.

We understand that the Pacific Highway is categorised as a classified road (indicated as a SP2 Classified Road in Figure 2). Therefore, the proposed development faces a classified road. Furthermore, based on Map 12D of the *"Traffic Volume Maps for Transport and Infrastructure SEPP"*, Pacific Highway has a traffic volume which is more than 20,000 AADT. As previously mentioned, the proposed development is located along this road corridor.

In accordance with Clause 2.120 of the Transport & Infrastructure SEPP, for residential areas, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded (with windows and doors closed):

- In any bedroom in the building – 35 dB $L_{Aeq\ (9\ hour)}$ between 10:00 pm and 7:00 am
- Anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB L_{Aeq} at any time (i.e. $L_{Aeq\ (15\ hour)}$ and $L_{Aeq\ (9\ hour)}$).

If internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also meet the ventilation requirements of the National Construction Code (NCC).

Where windows must be kept closed, the adopted ventilation systems must meet the requirements of the national Construction Code and Australian Standard 1668 titled *"The use of ventilation and air conditioning in buildings"*.

As such, the SEPP 2021 requires that the proposed development incorporates treatments that mitigate against traffic noise or vehicle noise emissions. In our opinion, these treatments should aim at mitigating overall internal noise levels to comply with the design noise levels discussed in Section 3.2.2. Overall internal noise levels are the aggregate result of internal noise emissions by building services, and noise intrusion from external noise sources such as vehicular traffic.

Therefore, the criteria discussed in this section (i.e. Section 3.2.1) are used for the assessment external noise intrusion only. These criteria are summarised in Table 15.

Table 15 Summary of noise intrusion criteria

Scenario	Noise Intrusion Criteria	
	Daytime, dB $L_{Aeq(15hour)}$	Night-time, dB $L_{Aeq(9hour)}$
Windows closed	40 dBA (elsewhere)	35 dBA (bedrooms) 40 dBA (elsewhere)
Windows open	50 dBA (elsewhere)	45 dBA (bedrooms) 50 dBA (elsewhere)

3.2.2 Standard AS/NZS 2107:2016

Standard AS/NZS 2107:2016 provides guidelines for internal noise levels within commercial buildings. However, these are considered to be non-mandatory or non-enforced by statutory conditions or local authorities (such as NSW EPA or local council). However, if ESD schemes such as Green Star are adopted at later design stages, then the internal noise level criteria will be defined as part of the project specific quality requirements.

As a general guideline, the recommendations summarised in standard AS/NZS 2107:2016 are discussed in this section; since these are typically recommended as minimum requirements. Standard AS/NZS 2107:2016 recommends a range with lower and upper levels for building interiors based on room designation and location of the development relative to external noise sources.

The levels for areas relevant to this development are given in Table 16 below. In this report we will confine our recommendations to dBA levels, however, where the background noise appears to be unbalanced, AS/NZS 2107:2016 provides direction in terms of suitable diagnostic tools that can be used to assess the spectrum distribution of the background noise.

Section 6.18 of standard AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

If tonal components are significant characteristics of the sound within a measurement time interval, an adjustment shall be applied for that time interval to the measured A-weighted sound pressure level to allow for the additional annoyance. If the background sounds include spectral imbalance, then the RC (Mark II) levels indicated in Table 16 should be referenced (see also Appendix D of standard AS/NZ 2107:2016 for additional guidance).

Generally, where the final noise levels are within +/- 2 dB of the specified level given above, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied especially where privacy is important or where noise intrusion to be avoided.

Table 16 Recommended design internal noise levels as per standard AS/NZS 2107:2016

Type of Occupancy/Activity	Design sound level range ($L_{Aeq,t}$)	Project Design Noise Level dBA
Houses and apartments in inner city areas, entertainment districts or near major roads		
Apartment common areas (e.g. foyer, lift lobby)	45 - 50	50
Living areas	35 - 45	45
Sleeping areas (night-time, 10pm to 7am)	35 - 40	40
Work areas	35 - 45	40
Non-residential areas		
General office areas Open plan office	40 - 45	45
Consulting Rooms Dental clinics Patient lounge Surgery, treatment, procedure rooms	40 – 45	45
Kitchen, sterilising and service areas	< 55	55
Reception areas	40 – 50	45
MRI, CT scan, X-ray, ultra-sound rooms	45 – 50	50
Retail stores (general)	< 50	50

Type of Occupancy/Activity	Design sound level range ($L_{Aeq,t}$)	Project Design Noise Level dBA
Undercover carparks, loading docks	< 65	65
Dining rooms	40 - 45	45
Corridors and lobbies	45 - 50	50
Toilets, EoT facilities	45 - 55	55

3.2.3 Internal Noise Emissions From Smoke Control Systems

According to standard AS/NZS 1668.1:2015, internal noise levels generated by smoke control systems should comply with the following:

The noise level in occupied spaces during operation of the smoke control systems (including smoke exhaust fans and air pressurization fans) shall not exceed 65 dBA. Where the internal occupied ambient noise levels exceed 60 dBA, the smoke control systems shall not exceed 5 dBA above the internal occupied ambient noise levels, to a maximum level of 80 dBA.

Noise levels in fire-isolated exits and car parks, as well as and smoke control zones served by hot layer smoke control systems shall not exceed 80 dBA.

3.3 Sound Insulation Requirements – Residential Areas

The residential accommodation areas (including those which include hotel units in Level 3 to 8, and apartments in Levels 10 to 41) are subject to the sound insulation requirements stated in the National Construction Code 2022 (NCC 2022) for class 2 or 3 accommodation. These requirements are summarised in Table 17 below.

Table 17 NCC 2022, sound insulation requirements (Class 2 and 3)

Construction	NCC 2022	
	Laboratory Performance Requirements	Verification Method
Walls between sole occupancy units	$R_w + C_{tr}$ not < 50	$D_{nT,w} + C_{tr}$ not < 45
Walls between a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit and a habitable room (other than a kitchen) in an adjoining unit	$R_w + C_{tr}$ not < 50 and Must have a minimum 20 mm cavity between two separate leaves	$D_{nT,w} + C_{tr}$ not < 45 "Expert Judgment" Comparison to the "Deemed to satisfy" Provisions
Walls between sole occupancy units and a plant room or lift shaft	R_w not < 50 and Must have a minimum 20 mm cavity between two separate leaves[1]	$D_{nT,w}$ not < 45
Walls between sole occupancy units and a stairway, public corridor, public lobby or the like, or parts of a different classification	R_w not < 50	$D_{nT,w}$ not < 45
Door assemblies located in a wall between a sole-occupancy unit and a stairway, public corridor, public lobby or the like	R_w not < 30 [2]	$D_{nT,w}$ not < 25

Construction	NCC 2022	
	Laboratory Performance Requirements	Verification Method
Floors between sole-occupancy units or between a sole-occupancy unit and a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	$R_w + C_{tr}$ not < 50 $L_{n,w}$ not > 62	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w}$ not > 62
Soil, waste, water supply and stormwater pipes and ductwork to habitable rooms	$R_w + C_{tr}$ not < 40	N/A
Soil, waste, water supply and stormwater pipes and ductwork to kitchens and other rooms	$R_w + C_{tr}$ not < 25	N/A
Intra-tenancy Walls	There is no statutory requirement for airborne isolation via intra-tenancy walls.	

3.4 Noise Emissions From Carpark

It is likely that all traffic activity related to the carpark will be produced by light vehicles. Hence, it is considered feasible to assess car park noise impacts with reference to the NSW NPI.

3.5 Outdoor Noise Emissions From Patrons

No mandatory legislation is available which addresses noise emission from outdoor gatherings (generally caused by participants talking, playing, etc). In our opinion, noise emissions from outdoor areas are different in both character and duration to that of industrial, commercial, or even machinery noise. For example, noise generated by outdoor activities is intermittent in character, as noise from mechanical services is typically constant. Therefore, the project trigger noise levels derived in accordance with the NSW NPI (i.e. Section 3.1.4), are not considered adequate for the assessment of outdoor noise emissions by patrons.

Furthermore, we note that the outdoor areas in the proposed development, are not intended to be used as licensed premises. Therefore, the criteria established in accordance with guidelines dictated by Liquor & Gaming NSW, are also not applicable.

Based on previous project experience, we consider the intrusiveness criteria (i.e. RBL + 5 dB) to be more adequate to assess such noise emissions. Therefore, the noise targets summarised in Table 18 are adopted for the assessment of patron noise emissions from communal outdoor areas.

We assume the operational times for these outdoor spaces only include the daytime and evening periods. Therefore, the noise targets have been defined accordingly.

Table 18 Noise targets for assessment of outdoor patron noise emissions

Type of Receiver	Daytime Period 7:00 am – 6:00 pm (dB $L_{Aeq,\ 15\ minutes}$)	Evening Period 6:00 pm – 10:00 pm (dB $L_{Aeq,\ 15\ minutes}$)
Urban Residences Mixed-use buildings along Pacific Highway	65	62
Suburban Residences Residences located behind commercial & mixed-use buildings along Pacific Highway	45	42

3.6 Noise Impact On Local Roads

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

Also, the NSW RNP recommends the criteria summarised in Table 19 which is applicable to residential land uses.

Table 19 Road traffic noise assessment criteria for residential land uses according to the NSW RNP

Road Category	Type of project/land use	Assessment Criteria	
		Day (7:00 am – 10:00 pm)	Night (10:00 pm – 7:00 am)
Local roads	Existing residences affected by noise from new local road corridors Existing residences affected by noise from redevelopment of existing local roads Existing residences affected by additional traffic on existing local roads generated by land use developments	55 dB $L_{Aeq,\ 1\ hour}$ (external)	50 dB $L_{Aeq,\ 1\ hour}$ (external)

3.7 Vibration Criteria

3.7.1 Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"* (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration - from uninterrupted sources (refer to Table 20).
- Impulsive vibration - up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 21).
- Intermittent vibration - such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 22).

Table 20 Continuous vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions, and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 21 Impulsive vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions, and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 22 Intermittent vibration impacts criteria (m/s$^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

3.7.2 Scientific Instrumentation

Some vibration sensitive equipment can require more stringent objectives than those applicable to human comfort. This equipment can comprise scientific instrumentation which might be installed within the medical centre tenancies. These tenancies are located at Ground Level, Level 1 and Level 2.

Where it has been identified that vibration sensitive equipment is likely to be operational at the medical centre tenancy, objectives for the satisfactory operation of the instrument should be sourced from manufacturer's data.

Where manufacturer's data is not available, generic vibration criterion (VC) curves may be adopted as vibration goals. These generic VC curves are presented below in Table 23 and Figure 4.

According to Table 3.2 of book titled *"A Design Guide for Footfall Induced Vibration of Structures"* (shown in Figure 3 below), vibration criterion for computer equipment is more suited to the "Residential Day" curve shown in Figure 4.

Table 23 Criteria for vibration sensitive equipment

Equipment	Curve
Bench microscopes up to 100× magnification; laboratory robots	0.102 mm/s
Bench microscopes up to 400× magnification; optical and other precision balances; coordinate measuring machines; metrology laboratories; optical comparators; microelectronics manufacturing equipment; proximity and projection aligners, etc.	0.051 mm/s VC-A
Microsurgery, eye surgery, neurosurgery; bench microscopes at magnification greater than 400×; optical equipment on isolation tables; microelectronic manufacturing equipment, such as inspection and lithography equipment (including steppers) to 3 mm line widths	0.025 mm/s VC-B
Electron microscopes up to 30 000× magnification; microtomes; magnetic resonance imagers; microelectronics manufacturing equipment, such as lithography and inspection equipment to 1 mm detail size	0.013 mm/s VC-C
Electron microscopes at magnification greater than 30 000×; mass spectrometers; cell implant equipment; microelectronics manufacturing equipment, such as aligners, steppers, and other critical equipment for photolithography with line widths of 1/2 µm; includes electron beam systems	0.0054 mm/s VC-D
Non-isolated laser and optical research systems; microelectronics manufacturing equipment, such as aligners, steppers, and other critical equipment for photolithography with line widths of 1/4 µm; includes electron beam systems	0.0032 mm/s VC-E

Figure 3 Criteria for vibration sensitive equipment (ASHRAE 2007, HVAC Applications, Chapter 47 "Sound and Vibration Control")

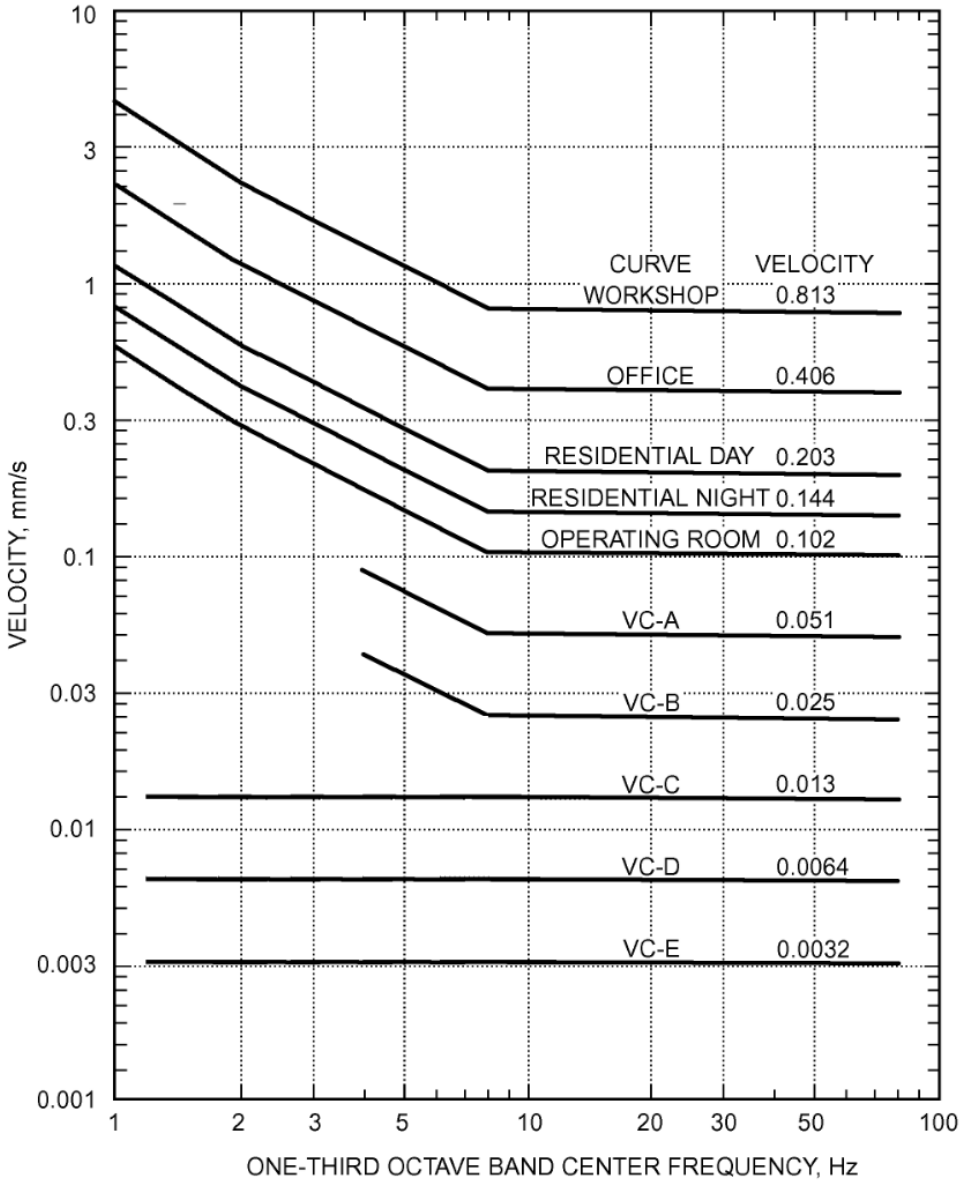


Figure 4 Vibration criteria for sensitive equipment (obtained from book titled "A Design Guide for Footfall Induced Vibration of Structures")

Criterion curve	Max. velocity level* µm/sec (RMS)	Detail size** microns	Description of use
Workshop (ISO2631 and BS6472) *R* = 8, ASHRAE J	800	N/A	Distinctly perciptible vibration. Appropriate to workshops and non-sensitive areas.
Office (ISO2631 and BS6472) *R* = 4, ASHRAE I	400	N/A	Perceptible vibration. Appropriate to offices and non-sensitive areas.
Residential day (ISO2631 and BS6472) *R* = 2, ASHRAE H	200	75	Barely perceptible vibration. Appropriate to sleep areas in most instances. Probably adequate for computer equipment, probe test equipment and low-power (to 20X) microscopes.
Operating theatre (ISO2631 and BS6472) *R* = 1, ASHRAE F	100	25	Threshold of perception. Suitable for sensitive sleep areas. Suitable in most instances for microscopes to 100X and for other equipment of low sensitivity.
VC-A (BBN-A or ASHRAE E) *R* = 0.5	50	8	Adequate in most instances for optical microscopes to 100X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B (BBN-B or ASHRAE D) *R* = 0.25	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C (BBN-C or ASHRAE C) *R* = 0.125	12.5	1	A good standard for most lithography and inspection equipment to 1-micron detail size.
VC-D (BBN-D or ASHRAE B) *R* = 0.0625	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.
VC-E (BBN-E or ASHRAE A) *R* = 0.03125	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

Notes
* As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz.
** The detail size refers to the line widths for microelectronics fabrication, the particle(cell) size for medical and pharmaceutical research, etc. the values given take into account the observation that the vibration requirements of many items depend upon the detail size of the process.

3.8 Ground-Borne Noise Criteria

According to Section 3.6.2 of the DNRC & BR-IG, the ground-borne noise level criteria are defined as follows for residential areas:

- Daytime (7:00 am to 10:00 pm): Internal noise level not to exceed 40 dB L_{ASmax}
- Night-time (10:00 pm to 7:00 am): Internal noise level not to exceed 35 dB L_{ASmax}

The L_{ASmax} noise level should be representative of 95th percentile of train pass-bys.

4 CONSTRUCTION NOISE & VIBRATION CRITERIA

4.1 Construction Noise Criteria

4.1.1 Interim Construction Noise Guideline

Noise criteria for construction and demolition activities are discussed in the Interim Construction Noise Guideline (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in Table 24 below.

Specific non-residential receivers in the vicinity of the proposed construction site, and their recommended 'management levels', are presented in Table 25.

Based on the measured background noise levels summarised in Section 2.3, the NMLs to be used in this assessment are listed in Table 26.

It is our understanding that construction works will be conducted under typical standard construction hours.

Table 24 NMLs for quantitative assessment at residences (from ICNG)

Time of Day	Noise Management Level LAeq(15 minute)[1,2]	How to Apply
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	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: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. 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 + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

Table 25 NMLs for quantitative assessment at non-residential receivers

Land Use	$L_{Aeq(15minute)}$ Construction NML
Commercial premises: Along Pacific Highway	70 (external)
School classrooms – external: [1] North Sydney Girls High School	70 (external)
Place of worship – external: Crows Nest Uniting Church	70 (external)
Hospital wards, external: [1] Mater Hospital	70 (external)
Child care centre: [1] Gowrie NSW Shirley Road	65 (external)
Passive recreation area: Hayberry Street Road Reserve	60 (external)
Note 1: External noise level criterion estimated from internal noise level criterion assuming a 25 dB noise level difference for non-openable facade windows	

Table 26 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB $L_{Aeq(15minute)}$	
	Standard Hours **Monday to Friday:** **7 am to 6 pm** **Saturday:** **8 am to 1 pm**	**Outside Standard Hours**
Residences (urban zones) Mixed-use buildings located along Pacific Hwy	70	N/A
Residences (suburban zones) Residences located behind commercial & mixed-use buildings along Pacific Hwy	50	N/A
Commercial premises: Along Pacific Highway	70	N/A
School classrooms – external: [1] North Sydney Girls High School	70	N/A
Place of worship – external: Crows Nest Uniting Church	70	N/A
Hospital wards, external: [1] Mater Hospital	70	N/A
Childcare centre: [1] Gowrie NSW Shirley Road	65	N/A
Passive recreation area: Hayberry Street Road Reserve	60	N/A
Note 1: External noise level criterion estimated from internal noise level criterion assuming a 25 dB noise level difference for non-openable facade windows Note 2: External noise level criterion estimated from internal noise management level of 45 dB $L_{Aeq,\ 15\ minutes}$ for construction activities within private enclosed offices		

4.1.2 Sleep Disturbance

It is noted that construction works will be undertaken during standard construction hours. These standard hours are only part of the daytime period. Therefore, a sleep disturbance assessment is not required.

4.2 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.3 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 3.8.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 4.3.1.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 4.3.1.

4.3.1 Vibration Criteria – Building Contents & Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration"* (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 *"Effects of Vibration on Structure"* (DIN 1999).

4.3.1.1 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 27 and illustrated in Figure 5.

Table 27 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in Figure 5	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 27 relate to transient vibration which does not cause resonant responses in buildings.

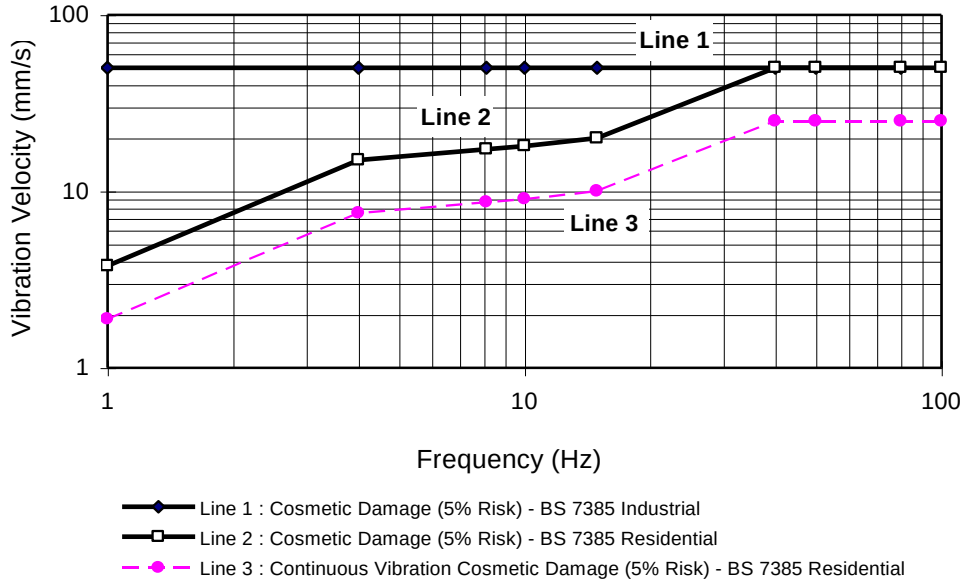
Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 27 may need to be reduced by up to 50% (refer to Line 3 in Figure 5). Rock breaking/hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures (e.g. residences) and it may therefore be appropriate to reduce the transient values by 50%.

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 27, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 27 should not be reduced for fatigue considerations.

Figure 5 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



Therefore, for most construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receiver type is given below:

- Reinforced or framed structures: 25 mm/s
- Unreinforced or light framed structures: 7.5 mm/s

4.3.1.2 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 28. The criteria are frequency dependent and specific to particular categories of structures.

Table 28 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.				

4.3.1.3 Buried Pipework & Services

British Standard BS 7385-2:1993 notes that structures below ground are known to sustain higher levels of vibration and are very resistant to damage unless in very poor condition. Further guidance is taken from the German Standard DIN 4150: Part 3-1999.02. Section 5.3 of DIN 4150: Part 3 sets out guideline values for short term vibration velocity to be used when evaluating the effects of vibration on buried pipework. These values are reproduced and presented in Table 29.

Table 29 DIN 4150-3, Recommended vibration velocity values for assessment of short-term vibration on buried pipework

Pipe Material	Vibration Velocity Measured on Pipe
Steel (including welded pipes)	100 mm/s
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s
Masonry, plastic	50 mm/s

4.4 Ground-Borne / Structure-Borne Noise Criteria - Residences

Ground-borne noise targets at which management actions should be implemented, are obtained from the following documents:

- Section 4.2 of the ICNG.
- Section A.2 of the "Construction Noise and Vibration Strategy" (referred herein as the CN&VS, authored by NSW Transport for NSW).

The recommended ground-borne noise targets are summarised in Table 30. Ground-borne noise levels should be assessed internally within residential buildings, at the centre of the most habitable room. The assessment of ground borne noise levels should only be undertaken when these are higher than airborne noise levels. If ground borne noise levels are found to be higher than airborne noise levels during the daytime period, then ground borne noise levels should be assessed against the evening criterion.

Table 30 Ground-borne NML targets

Time Period	Ground-Borne Noise Level Target
Daytime, 7:00 am to 6:00 pm	Human comfort vibration objectives only (refer to Section 3.7.1) [2]
Evening, 6:00 pm to 10:00 pm	40 dB $L_{Aeq,\ 15\ min}$ [1, 3]
Night-time, 10:00 pm to 7:00 am	35 dB $L_{Aeq,\ 15\ min}$ [1]

Notes:
1. Obtained from Section 4.2 of the ICNG
2. Obtained from Section A.2 of the CN&VS
3. If ground-borne noise levels are higher than airborne noise levels during the daytime period, then ground-borne noise levels should be assessed against the evening criterion.

5 OPERATIONAL ACOUSTIC ASSESSMENT

5.1 External Noise Emissions – Building Services

At this stage, no detailed design has been developed for mechanical services. Therefore, no detailed acoustic assessment has been conducted.

Nevertheless, it is advised the mechanical plant design and equipment selection should be made so that the aggregate noise level from all external emissions, comply with the external noise level criteria discussed in Section 3.1.

This should be conducted as part of the detailed assessment of mechanical noise emissions which is required to be undertaken during the later design stages.

The following design measures could be considered as part of the detailed design stage in order to achieve compliance:

- Mechanical plant installation locations and the positioning of external air duct paths (such as inlets and outlets) near the property boundary should be limited, as far as practicable.
- Plant room walls should achieve a minimum airborne sound insulation performance of Rw 45 -50. Whenever possible, the plant rooms should only be accessible from inside the building.
- If airflow paths are required to/from outside (such as outside air, exhaust air, relief air, etc) these paths should be fully ducted and include minimum 50 mm thick internal insulation; and / or include acoustic louvres. When the extent of ductwork is not sufficient for treatment, then rectangular silencers may be required (this especially applies to fans and AHUs).
- Ornamental louvres should generally only be considered if they are blanked off with FC sheeting or plant room external walls (subject to further Detailed Design acoustic assessment).
- All plant room walls and roof / ceiling to be internally lined with insulation, which in combination with insulation facing, should achieve a minimum noise reduction coefficient (NRC) rating of 0.8.
- AHUs and FCUs should include return air / outside air plenums which are in internally lined with minimum 50 mm thick insulation.
- Variable speed drives should be implemented whenever possible.
- Reduce the number of operational plant items between 6:00 pm and 7:00 am (i.e. especially during the evening and night-time periods).
- Outdoor units and other plant items to be screened from direct line of sight to the affected residences (depending on their locations).
- Stand-by generators should be acoustically treated to achieve the external noise level criteria discussed in Section 3.1, by accounting the modifying factors listed in Section 3.1.6 for maintenance operations. The treatment is likely to comprise an acoustic enclosure, rectangular silencers / louvres for air intakes and air discharge paths; and mufflers on the exhaust. Maintenance operations are likely to be only conducted during the daytime period.

The above recommendations should be considered as in-principle, best practice acoustic treatment that will need to be confirmed during detailed design stages.

5.2 Internal Noise Emissions – Building Services

As discussed in Section 5.1, the mechanical ventilation design has not been developed. Nevertheless, it is advised that this should be designed so the overall internal noise level achieves the internal noise level criteria discussed in Section 3.2. Please note the overall internal noise level is the aggregate noise level estimated from internal noise emissions by mechanical services, and noise intrusion levels by external noise sources (such as local road traffic).

Furthermore, emergency plant (such stair pressurisation fans, smoke exhaust fans, smoke relief air fans, mechanical services serving the fire pump room, etc), should achieve compliance with the criteria discussed in Section 3.1.6. Therefore, it is likely these plant items will comprise rectangular silencers as part of the room side ductwork.

Mechanical plant should be resiliently mounted. Vibration isolation mounts and supports should be designed to achieve compliance with vibration criteria discussed in Section 3.7.

5.3 Building Envelope

To achieve compliance with the noise intrusion criteria discussed in Section 3.2.1, Appendix C summarises the recommended sound insulation requirements for façade elements. For examples of glazed constructions, based on required sound insulation performances, refer to Table 31 for non-residential areas, and Table 32 for residential areas.

Table 31 Example of glazed constructions, non-residential areas

Legend Colour	Occupancy	Overall Performance Rw (C; Ctr)	Example of Glazed Constructions
	Open office area	36 (-1; -3)	10.38mm laminated glass
	Enclosed private office Meeting room	44 (-1; -6)	11.38mm laminated glass / 12mm air gap / 12.38mm laminated glass
	Retail tenancy	35 (-1; -3)	8.38mm laminated glass

Table 32 Example of glazed constructions, residential areas

Legend Colour	Overall Performance Rw (C; Ctr)	Example of Glazed Constructions
	42 (-2; -5)	8mm monolithic glass / 12mm air gap / 12.38mm laminated glass
	37 (-1; -3)	12.38mm laminated glass
	36 (-1; -3)	10.38mm laminated glass

Additionally, for residential apartments, all external doors (such as balcony sliding doors) and windows should achieve a minimum sound insulation performance of Rw 35. Please note this performance is not indicated in Appendix C.

Therefore, we note that for external windows and doors, the recommended performances are likely to require the following:

- Solid non-hollow frames: Either metal frames fully packed with insulation or grout; or solid timber frames.
- Rubber acoustic seals implemented to window/door frames (such as Q-Lon seals), or fin rubber seals with deep C channels as part of the window track.

For non-glazed façade elements, these could comprise masonry elements. If a lightweight construction is opted, this should comprise a non rigid, open and porous insulation such as rockwool (rigid insulation panels such as Kingspan Kooltherm are not acceptable). Number of wall cavities should also be reduced to one which is to be filled with the aforementioned insulation.

The roof construction should comprise a 200mm concrete slab (with 2400 kg/m^3 minimum density).

Regarding internal noise levels for slightly open external doors and windows to allow for natural ventilation, a 6-10 dB noise reduction has been assumed for such open condition. Therefore, intrusion noise levels are estimated as summarised in Table 33.

Table 33 Predicted noise intrusion levels for open windows/doors

Location	Period	Noise Intrusion Criteria	Predicted Noise Level, dBA	Assessment Outcome
Residential apartments facing Pacific Hwy	Daytime	Elsewhere: 50 dB LAeq (15 hrs)	60-64 dB LAeq (15 hrs)	Non-compliance
	Night-time	Bedrooms: 45 dB LAeq (9 hrs) Elsewhere: 50 dB LAeq (9 hrs)	55-59 dB LAeq (9 hrs)	Non-compliance
Residential apartments facing Sinclair St	Daytime	Elsewhere: 50 dB LAeq (15 hrs)	50-54 dB LAeq (15 hrs)	Non-compliance
	Night-time	Bedrooms: 45 dB LAeq (9 hrs) Elsewhere: 40 dB LAeq (9 hrs)	45-49 dB LAeq (9 hrs)	Non-compliance in bedrooms. Compliance is achieved elsewhere

From Table 33, we note estimated internal noise levels for open doors or windows exceed the noise intrusion criteria listed in Table 15. Therefore, we advise that provisions for mechanical ventilation should be implemented in the residential apartments. This mechanical ventilation system should meet the requirements of the NCC 2022.

5.4 Internal Building Elements

Internal building elements which are subject to the sound insulation requirements discussed in Section 3.3 (generally in accordance with Part F7 of the NCC 2022), should be designed and constructed so compliance is achieved with these requirements. Architectural elements which are subject to these requirements, are listed in Table 17; along with their respective requirements.

These architectural elements include inter-tenancy partitions and floors between single occupancy units (SOUs), partitions separating SOUs and wet areas, partitions separating SOUs and plant rooms or lift shafts, apartment doors accessing common corridors, building separation between habitable spaces and building services.

5.5 Patron Noise Emissions

Noise emissions from patrons are predicted based on site assumptions summarised in Table 34. These noise emissions are predicted at nearest impacted residential receivers (i.e. residences facing Sinclair Street). These predicted noise levels are listed in Table 35.

Table 34 Site assumptions for patron noise calculations

Outdoor Communal Area	Area, m^2	Max. Patron Capacity
Level 2 Outdoor Terrace (including outdoor pool)	100	36
Level 12, Tower 1, Roof Terrace	250	100
Level 14, Tower 12, Roof Terrace	250	100

Table 35 Patron noise emissions predicted at residential buildings facing Sinclair Street

Outdoor Communal Area	Predicted Noise Level dB $L_{Aeq, 15\ min}$	Noise Emission Targets		Assessment Outcomes
		Daytime Period 7:00 am – 6:00 pm (dB $L_{Aeq, 15\ minutes}$)	Evening Period 6:00 pm – 10:00 pm (dB $L_{Aeq, 15\ minutes}$)	
Level 2, Outdoor Terrace (including outdoor pool)	42 - 44	45	42	Compliance (including marginal compliance) is achieved provided that: • Level 2 outdoor terrace only operates between 7:00 am and 10:00 pm • Solid screen is implemented as discussed in Section 5.5
Level 12, Tower 1, Roof Terrace	36 - 40	45	42	Compliance
Level 14, Tower 12, Roof Terrace	36 - 40	45	42	Compliance

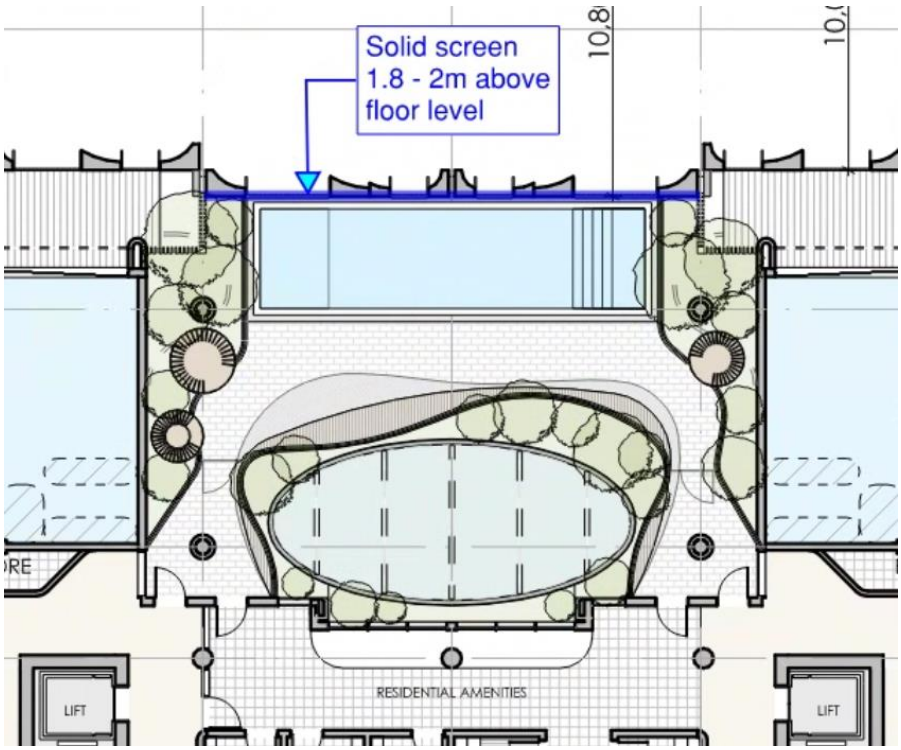
From assessment outcomes summarised in Table 35, we note that compliance is achieved provided the following measures are implemented:

- For Level 2 outdoor terrace, a solid screen is implemented as shown in Figure 6. This screen can comprise 10.38mm laminated glass or non-glazed material that achieves 14 kg/m^2 minimum mass density (such as 9mm FC sheet).

Finally, the following is recommended for all outdoor terrace areas in Levels 2, 12 and 14:

- Terrace areas should not exceed the patron capacity listed in Table 34.
- Terrace areas should only operate between 7:00 and 10:00pm
- If background music is to be played, a noise limiter should be installed as part of the PA system, so noise levels within the terrace do not exceed 60 dB L_{Aeq}.

Figure 6 Recommended screen layout for Level 2 outdoor terrace



5.6 Ground-Borne Vibration Assessment

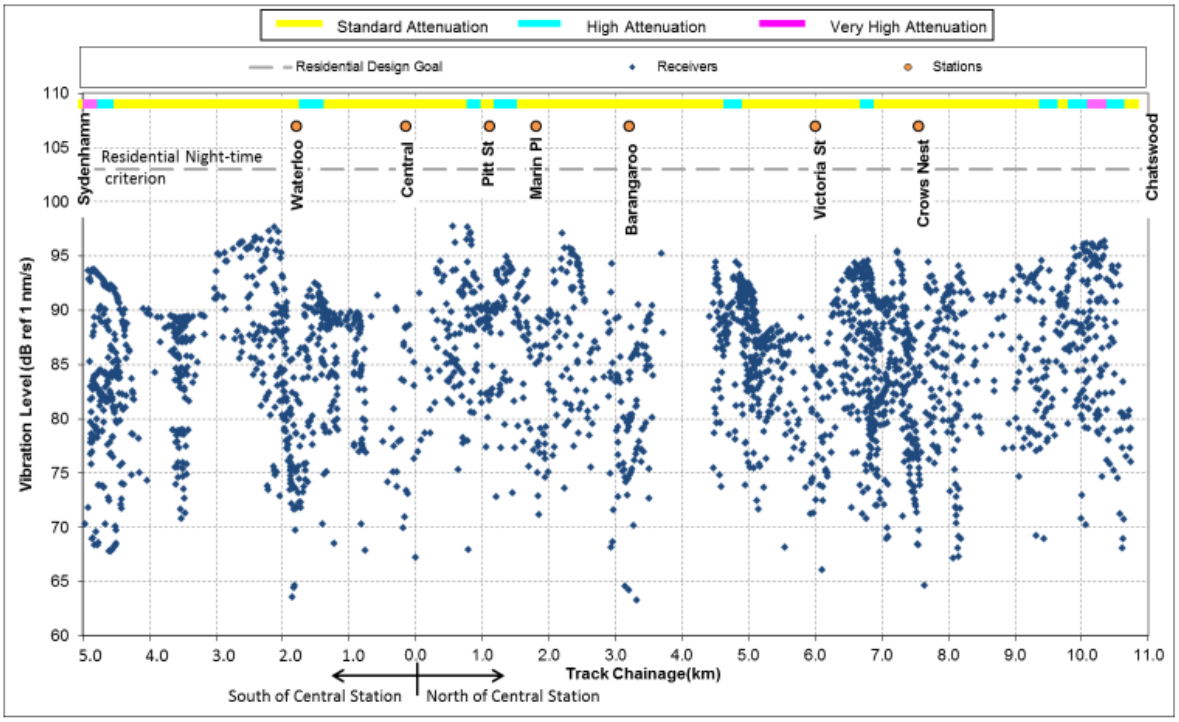
The proposed development is in the vicinity of the new Sydney Metro rail network. As part of the Environmental Impact Statement (EIS) required for the Sydney Metro project, a technical report was issued which addresses the environmental acoustic impacts of this rail project. This report is titled *"Sydney Metro Chatswood to Sydenham, Technical Report 2: Noise and Vibration"* (authored by SLR Consulting, dated 28 April 2016, referred herein as the *EIS Technical Paper 2*).

Section 4.1.5 of the EIS Technical Paper 2 discusses the predictions for ground-borne vibration. These predicted levels are summarised in Figure 34 of the EIS Technical Paper 2; this figure is reproduced in Figure 7 below.

From this figure, we note that the residential night-time criterion is defined as a vibration level of 103 dB. This vibration level corresponds to a VDV value of 0.13 m/s $^{1.75}$. This VDV value corresponds to the preferred night-time vibration criterion for residences regarding intermittent vibration events, such as train pass-bys (refer to Table 22). In Figure 7 we note that this night-time criterion is not exceeded for receivers near the project site (i.e. approximately at chainage 7000, towards Crows Nest station).

Therefore, we conclude that the vibration criteria for human comfort is likely to be achieved for the proposed development.

Figure 7 EIS Technical Paper 2 - Predicted operational ground-borne vibration levels



5.7 Ground-Borne Noise Assessment

The EIS Technical Paper 2 discusses the prediction and assessment of ground-borne noise levels in the vicinity of the project site. The predicted ground-borne noise levels are illustrated in Appendix H2 of the EIS Technical Paper 2. Figure 8 shows an extract of the predicted noise levels at and around the project site. Therefore, the predicted ground-borne noise levels at the project site range between 16 - 25 dB L_{ASmax}. These predicted levels are found to be compliant with the criteria discussed in Section 3.8.

The EIS Technical Paper 2 states that these ground-borne noise levels are predicted at Ground Level. However, from Section 1.1 we note that the proposed development comprises 2 basement levels. Therefore, it is likely that the development will be exposed to ground-borne noise levels which are higher than those predicted.

To predict the ground-borne noise levels, we have requested the source vibration levels to Transport for NSW regarding rail corridor segment closest to the project site, however we received no response.

Therefore, either of the following two options are advised to be undertaken during detailed design stages:

- Option 1: Project manager to liaise with Transport for NSW to obtain source vibration levels from underground rail corridor, and latest rail corridor alignments (both vertical and horizontal alignments). This information is required so ground-borne noise levels can be predicted; or
- Option 2: Conduct vibration measurements on site once excavation works have been completed. From these vibration measurements undertake prediction of ground-borne noise levels.

Figure 8 EIS Technical Paper 2 - Predicted operational ground-borne noise levels

5.8 Carpark Noise Emissions

5.8.1 Methodology

It is noted that the carpark spaces are located within basement levels and fully enclosed spaces. As result, these will be served by a mechanical ventilation system.

Therefore, the impact from carpark noise emissions are considered to be negligible, and an assessment of such noise emissions is not required. However, external noise emissions by mechanical plant should be assessed based on the external noise level criteria discussed in Section 4.1.

However, the entry and exit routes, to and from the carpark, laid out at Ground Level and within the project site, are exposed to residential receivers along the western property boundary. Therefore, noise emissions from these routes are assessed.

To predict these noise emissions, vehicle movements are modelled as line sources with sound power levels corrected for length, assessment time (i.e. 15 minutes), and number of movements:

$SWL_{\text{line source}} = SWL_{\text{base sound power level}} + 10 \log (t_{\text{event}} / t_{\text{assessment period}}) + 10 \log (N)$

Where:

$SWL_{\text{line source}}$:	Sound power level of line source
$SWL_{\text{base sound power level}}$:	Base sound power levels. For light vehicle pass-bys, this is 91 dB L_{Amax}
t_{event}:	Duration of individual event in seconds
$t_{\text{assessment period}}$:	Assessment period in seconds (900 seconds which corresponds to 15 minutes)
N:	Number of events. Based on information provided by traffic consultant, a maximum of 20 vehicle movements are expected at AM and PM peak hour traffic, during a

15 minute period. AM and PM peak hour traffic periods occur during the daytime period.

Also, it is noted that for light vehicle movements, engine noise was modelled at an elevation of 1m above ground level.

5.8.2 Predicted Noise Levels

Based on the information discussed in Section 5.8.1, we predict the following noise levels at nearest residential receivers by considering the existing solid screen shown in Figure 9:

- During AM and PM peak hour traffic: 45 – 47 dB $L_{Aeq\ (15\ min)}$
- During night-time period: 50-58 dB L_{Amax}

From these predicted noise levels, we note the following:

- Compliance is achieved with the nominated noise target of 45 dB $L_{Aeq\ (15\ min)}$, provided that the existing screen shown in Figure 9 is retained.
  Note that a marginal exceedance of 2 dB over the noise criterion is considered as compliance since a 2 dB difference is subjectively difficult to perceive.
- Sleep disturbance is unlikely to occur just for certain residences along the western property boundary. However, sleep awakening is unlikely to occur at any of these residences. Please note this outcome also requires for the existing screen shown in Figure 9 to be retained.

Figure 9 Existing solid screen along western property boundary

5.9 Waste Collection & Use Of Loading Dock

At the time of issuing this report, a traffic report has not been fully developed. Therefore, we cannot confirm the operational times and frequency of use for the loading dock. A more detailed acoustic assessment of the loading dock should be undertaken when the relevant information becomes available.

Nevertheless, it is anticipated that as an operational measure, use of the loading, including commercial and residential waste collection, should only be conducted between 7:00 am and 10:00 pm. This is recommended to minimise noise impact to local residences at the most sensitive time period (i.e. night-time period)

5.10 Noise Impact On Local Roads

To predict the noise impact along Bruce Street due to traffic increase influenced by the proposed development, the methodology discussed in Section 5.8.1 is used, except the following parameters are changed:

- Assessment period is redefined as 1 hour
- Number of vehicles during AM and PM peak hour traffic. Residences along Bruce Street are located west of the site access. Therefore, based on information provided by traffic consultant, the number of vehicles during AM peak hour traffic, along relevant section of Bruce Street, is 61, and 72 during PM peak hour traffic.

Therefore, based on information above, we predict a traffic noise level of 50 dB $L_{Aeq,\ 1\ hr}$ along Bruce Street. This complies with the target noise level listed in Table 19.

The traffic generated by the development, compared to existing traffic flows along the Pacific Highway, is considered to be insufficient in order to increase traffic noise levels by 2 dB. Therefore, the noise impact along the Pacific Highway is believed to be negligible.

6 CONSTRUCTION NOISE & VIBRATION ASSESSMENT

6.1 Construction Noise Assessment

At this stage, no construction program is available for the project. Therefore, it is assumed that construction works will extend for 18-19 months, starting in middle of 2024, with project completion at the end of 2026. Based on this timeline, typical construction activities have been assumed, these are summarised in Table 36. This table also lists the construction equipment used for each activity.

Table 36 Summary of sound power levels

Tasks	Equipment	Max. Sound Power Levels (dBA re 1pW)	Aggregate Sound Power Level per Task (dBA re 1pW)
Site establishment	Excavator (approx. 20 tonne)	107	114
	Mobile crane	110	
	Power hand tool (electric)	103	
	Forklift	106	
	Semi - trailer (idle)	102	
Site clearance, demolition & bulk earthworks	Dump truck	109	124
	Skid steer	110	
	Compactor	107	
	Forklift	106	
	Hand-held jackhammer (for pile trimming)	116	
	Concrete pump	103	
	Concrete truck	107	
	Piling rig	113	
	Mini grader	108	
	Rock hammer (mounted to excavator)	122	
	Excavator (approx. 20 tonne)	107	
Structure	Concrete pump	103	115
	Concrete truck	107	
	Delivery truck (idle)	106	
	Concrete vibrator	103	
	Mobile crane	110	
	Power hand tool (electric)	103	
	Forklift	106	
	Elevating work platform	105	
	Welder	101	

Tasks	Equipment	Max. Sound Power Levels (dBA re 1pW)	Aggregate Sound Power Level per Task (dBA re 1pW)
Façade & fitout	Delivery truck (idle)	106	121
	Mobile crane	110	
	Power hand tool (electric)	103	
	Forklift	106	
	Elevating work platform	105	
	Angle grinder	102	
	Core drill	113	
	Concrete saw	119	
	Welder	101	
	Nail gun	103	
External works	Welder	101	120
	Concrete saw	119	
	Delivery truck (idle)	106	
	Mobile crane	110	
	Power hand tool (electric)	103	
	Elevating work platform	105	
	Forklift	106	
	Blower	98	

For this assessment, the nearest affected receivers on which our assessment is conducted, are listed in Table 37 below. Based on the equipment sound power levels given in Table 36, noise levels have been predicted at these nearest affected properties for each construction scenario (where each construction scenario comprises two or more construction tasks). These predicted noise levels are summarised in Table 38.

These predicted noise levels have been assessed against the construction noise criteria discussed in Section 4.1. The outcomes of this assessment are summarised in Table 39.

Table 37 Receiver IDs for assessment purposes

Receiver ID	Noise Sensitive Locations	Type
RE01	No. 258 Pacific Highway	Residential
RE02	No. 67 Sinclair Street	Residential
RE03	No. 300 Pacific Highway	Mixed-use residential/commercial building
RE04	No. 12 Hayberry Street	Mixed-use residential/commercial building
CM01	No. 286 Pacific Highway	Commercial
CM02	No. 401 Pacific Highway	Commercial
ED01	North Sydney Girls High School	Educational
ME01	Mater Hospital	Hospital
POW	Crows Nest Uniting Church	Place of worship
CCC	Gowrie NSW Shirley Road	Childcare centre
PRA	Hayberry Street Road Reserve	Passive recreation area

Table 38 Predicted external $L_{Aeq\ (15\ minutes)}$ noise levels at residential receivers

Scenario	Tasks	Aggregate Sound Power Level per Scenario (dBA re 1pW)	Predicted $L_{Aeq,\ 15min}$ Noise Levels, dBA										
			RE01	RE02	RE03	RE04	CM01	CM02	ED01	ME01	POW	CCC	PRA
1	Site establishment	114	≥ 85	70 - ≥ 85	70 - 75	65 - 70	80 - ≥ 85	70 - 75	50 - 60	55 - 60	60 - 65	55 - 60	60 - 65
2	Site clearance & bulk earthworks	124	≥ 85	≥ 85	80 - 85	75 - 80	≥ 85	80 - 85	65 - 70	65 - 70	70 - 75	65 - 70	70 - 75
3	Structure	115	≥ 85	70 - ≥ 85	70 - 80	65 - 75	≥ 85	70 - 80	55 - 65	60 - 65	60 - 65	60 - 65	65 - 70
4	Façade & fitout	125	≥ 85	75 - ≥ 85	80 - 85	75 - 80	≥ 85	75 - 85	60 - 70	65 - 70	70 - 75	65 - 70	70 - 75
5	External works	125	≥ 85	75 - ≥ 85	75 - 85	70 - 80	≥ 85	75 - 85	60 - 70	65 - 70	65 - 70	65 - 70	70 - 75

Table 39 Summary of assessment outcomes and exceedances based on the ICNG criteria

Scenario	Parameter	Assessment Outcomes										
		RE01	RE02	RE03	RE04	CM01	CM02	ED01	ME01	POW	CCC	PRA
1	*Predicted Noise Levels, dBA*	*≥ 85*	*70 - ≥ 85*	*70 - 75*	*65 - 70*	*80 - ≥ 85*	*70 - 75*	*50 - 60*	*55 - 60*	*60 - 65*	*55 - 60*	*60 - 65*
	Within standard construction hours Exceedance over NML, dB	≥ 35	≥ 20	20 – 25	15 – 20	≥ 10	0 - 5	0	0	0	0	0 – 5
2	*Predicted Noise Levels, dBA*	*≥ 85*	*≥ 85*	*80 - 85*	*75 - 80*	*≥ 85*	*80 - 85*	*65 - 70*	*65 - 70*	*70 - 75*	*65 - 70*	*70 - 75*
	Within standard construction hours Exceedance over NML, dB	≥ 35	≥ 35	30 - 35	25 - 30	≥ 15	10 - 15	0	0	0 - 5	0 – 5	10 – 15
3	*Predicted Noise Levels, dBA*	*≥ 85*	*70 - ≥ 85*	*70 - 80*	*65 - 75*	*≥ 85*	*70 - 80*	*55 - 65*	*60 - 65*	*60 - 65*	*60 - 65*	*65 – 70*
	Within standard construction hours Exceedance over NML, dB	≥ 35	≥ 20	20 - 30	15 - 25	≥ 15	0 - 10	0	0	0	0	5 – 10
4	*Predicted Noise Levels, dBA*	*≥ 85*	*75 - ≥ 85*	*80 - 85*	*75 - 80*	*≥ 85*	*75 - 85*	*60 - 70*	*65 - 70*	*70 - 75*	*65 - 70*	*70 - 75*
	Within standard construction hours Exceedance over NML, dB	≥ 35	≥ 25	30 - 35	25 - 30	≥ 15	5 - 15	0	0	0 – 5	0 – 5	10 – 15
5	*Predicted Noise Levels, dBA*	*≥ 85*	*75 - ≥ 85*	*75 - 85*	*70 - 80*	*≥ 85*	*75 - 85*	*60 - 70*	*65 - 70*	*65 - 70*	*65 - 70*	*70 – 75*
	Within standard construction hours Exceedance over NML, dB	≥ 35	≥ 25	25 -35	20 - 30	≥ 15	5 - 15	0	0	0	0 – 5	10 – 15

Note 1: Nil exceedances (i.e. 0 dB shown with **green** font) indicate compliance. Exceedances shown with **orange** font indicate noise affected receivers. Exceedances shown with **red** font indicate highly noise affected receivers

Consequently, from the assessment outcomes summarised in Table 39, the following is noted:

- Nearest residential premises and commercial buildings are likely to be highly noise affected.
- Nearest educational and hospital buildings (i.e. North Sydney Girls High School and Mater Hospital respectively); are not likely to be impacted.
- Place of worship (i.e. Crows Nest Uniting Church) and childcare centre (i.e. Gowrie NSW Shirley Road) are likely to be noise affected by construction activities.
- Nearest passive recreation area (i.e. Hayberry Street Road Reserve) is likely to be noise affected by construction works.

Therefore, based on these findings, the conceptual management procedures discussed in Section 6.4 are recommended.

6.2 Construction Traffic Noise Assessment

No information regarding vehicular traffic movements related to construction activities; is available at this stage. Nevertheless, it is noted that vehicle numbers on surrounding roads would need to increase by around 60% from existing traffic flows, for a 2 dB increase in road traffic noise to occur.

6.3 Vibration Assessment

To maintain compliance with the human comfort vibration criteria discussed in Section 4.3, it is recommended that the indicative safe distances listed in Table 40 should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site. These measurements should especially be undertaken within nearest impacted residences and commercial buildings. The validation acoustic survey should also include measurements of ground-borne / structure-borne noise levels.

It is recommended that these validating measurements should be conducted prior to undertaking vibration intensive activities (such as demolition of building components, excavation, piling, etc.)

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 4.3. This information should also be included as part of the construction noise and vibration management plan (CNVMP).

Table 40 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20
Piling rig – Bored	≤ 800mm	2	N/A

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Piling rig – Hammer	12 Tonne force	15	50
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

As discussed in Section 1.2, the project site is located at approximately 55m from the underground rail corridor. Based on the recommended safe distances summarised in Table 40, it is found unlikely that the excavation works will have a vibration impact onto the rail infrastructure.

6.4 Noise & Vibration Management Procedures

The contractor should develop a construction noise and vibration management plan (CNVMP) in order to implement mitigation measures to manage the noise and vibration impact onto the potentially affected receivers.

The following sub-sections discuss the issues and measures that can be considered as part of this CNVMP.

6.4.1 Noise Mitigation Measures

A detailed construction program should be provided which should include the following:

- Schedule of construction activities (classified into scenarios if applicable)
- List of construction equipment per activity
- Location of construction equipment
- Duration of construction activities, as well as proposed construction hours

This construction program should be issued to assist on the prediction of the noise impact and to develop mitigation measures that can ameliorate this impact. A 3D computer noise model can be produced to conduct the noise level predictions and undertake the relevant assessment. The outcomes of this assessment should be discussed in the CNVMP.

The contractor should, where reasonable and feasible, apply best practice noise mitigation measures. These measures include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

To minimise noise impacts during the works, the contractor should take all reasonable and feasible measures to attenuate the noise impact. Hence it is advised that on-site monitoring be conducted to attest this impact and propose mitigation measures as construction activities develop.

The contractor should also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

A potential approach would be to schedule a respite period after continuous construction activity, or undertaking high noise generating works to less sensitive times.

Finally, undertake an assessment of road traffic noise generated by light and heavy vehicle movements which are associated with the development construction. For this purpose, request a traffic study report to determine the relevant traffic flows and assess the predicted road traffic noise levels in accordance with the criteria discussed in Section 4.2.

6.4.2 Vibration Mitigation Measures

The following vibration mitigation measures are recommended to be considered as part of a CNVMP:

- Any vibration generating plant and equipment is to be located in areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Identify of other vibration sensitive structures such as tunnels, gas pipelines, fibre optic cables, Sydney Water retention basins. Specific vibration goals should be determined on a case-by-case basis by an acoustic consultant which is to be engaged by the construction contractor.
- Identify heritage structures as well as vibration sensitive premises (such as those containing scientific instrumentation, surgery equipment, etc). Safe working distances from vibration generating equipment should be established to achieve compliance with the criteria discussed in Sections 4.3 and 4.4.
  Hence, it is advised to conduct attended measurements of vibration generating plant at commencement of works to confirm compliance with vibration criteria discussed in Sections 4.3 and 4.4. Measurements should be conducted at the nearest affected property boundary. If possible, measurements will also be used to validate the safe working distances advised in Table 40 and to establish safe working distances suitable to the project. Trial measurements should be considered at the following premises:
  - Residential apartments at No. 258 & No. 250 Pacific Highway.
  - Residential buildings between No. 51 and No. 77 Sinclair Street.
  - Commercial building at No. 286 Pacific Highway.

- Use lower vibration generating items of construction plant and equipment, that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Schedule a minimum respite period prior to long continuous activities.
- Use only dampened rock breakers and/or "city" rock breakers to minimise the impacts associated with rock breaking works.

6.4.3 Miscellaneous Measures

Deliveries should be undertaken, where possible, during standard construction hours.

Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles on site; and monitor the profiles in use.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. Broadband "quacker" reversing alarms should be used in preference to tonal alarms. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site.

A complaint response procedure should be implemented. Information to be gathered as part of this process should include location of complainant, time/s of occurrence of alleged noise or vibration impacts (including nature of impact particularly with respect to vibration), perceived source, prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint. All resident complaints will be responded to in the required timeframe and action taken recorded.

7 CONCLUSIONS

Pulse White Noise Acoustics has undertaken a noise and vibration assessment for proposed mixed-use development at 270 Pacific Highway, Crows Nest, NSW.

From the operational assessment, the following has been found:

- Mechanical plant design and equipment selection should be made so that the aggregate noise level from all external emissions, comply with the external noise level criteria discussed in Section 3.1. Additionally, plant selection and mechanical design should be undertaken so aggregate internal noise level complies with the criteria discussed in Section 3.2. Mechanical plant should be resiliently mounted. Vibration isolation mounts and supports should be designed to achieve compliance with vibration criteria discussed in Section 3.7.
- Building envelope constructions should include treatments aimed at mitigating noise intrusion from external noise sources (mainly local road traffic), so the aggregate internal noise level does not exceed the internal noise level criteria discussed in Section 3.2. These constructions should be recommended when floor layouts are finalised. In the interim, conceptual sound insulation performances are provided in Section 5.3 and Appendix C.
- Internal building elements which are subject to the sound insulation requirements discussed in Section 3.3 (generally in accordance with Part F7 of the NCC 2022), should be designed and constructed so compliance is achieved with these requirements. Generally, these building items correspond to residential apartments, and comprise inter-tenancy partitions, floors/ceiling constructions, apartment doors, risers.
- As mentioned in Section 3.5, the outdoor terrace areas are no intended to be used as licensed premises. As such, the following is recommended for all outdoor terrace areas:
  - Terrace areas should not exceed patron capacity listed in Table 34.
  - Terrace areas are only allowed to operate between 7:00 am and 10:00 pm.
  - If background music is to be used in any terrace area, a noise limiter should be installed as part of the PA system, so noise levels within the terrace do not exceed 60 dB L_{Aeq}.
  - For Level 2 outdoor terrace, a solid screen should be installed as discussed in Section 5.5.
- Ground-borne vibration generated by the Sydney Metro rail network, is unlikely to impact the proposed development. However, we advise that ground-borne noise related to the Sydney Metro underground rail corridor, should be further assessed during detailed design stages. Refer to discussion in Section 5.7.
- Since the carpark will be fully enclosed and mechanically ventilated, it is expected that noise impact from the carpark will be negligible. Furthermore, noise emissions from the entry and exit routes, to and from the carpark, are expected to achieve compliance provided that the existing screen shown in Figure 9 is retained.
- Waste collection and use of loading dock should be conducted between 7:00 am and 10:00 pm.
- Noise impact on local roads is expected to be negligible (refer to discussion in Section 5.10).

Additionally, it is advised that a construction noise and vibration management plan (CNVMP) should be developed for the construction works related to the development. This CNVMP should consider the operational procedures and mitigation measures summarised in Section 6.4.

Based on the findings from the acoustic assessment, it is our opinion that the proposed development can achieve compliance with the operational and construction acoustic criteria required by local authorities, provided the conceptual recommendations discussed herein are implemented, further developed at the later detailed design stages; and the CNVMP is submitted to local authorities.

APPENDIX A. ACOUSTIC TERMINOLOGY

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] *(Sound Transmission Loss)*	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.
Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.

Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Sound Pressure Level, LP dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, Lw dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Noise Reduction	The difference in sound pressure level between any two areas. The term "noise reduction" does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the LA90 value
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.
L1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.

APPENDIX B. UNATTENDED NOISE MEASUREMENTS

270 Pacific Hwy, Crows Nest

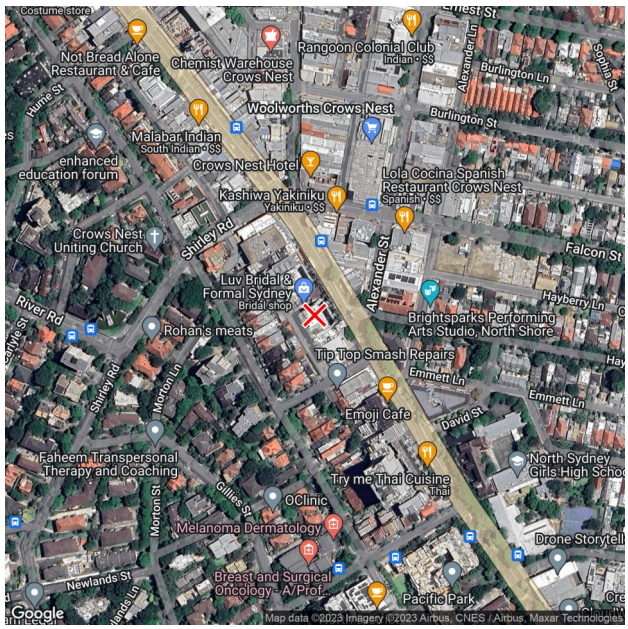
Ambient noise monitoring report

Item	Information
Logger Type	NL-42
Serial number	00396931
Address	270 Pacific Hwy, Crows Nest
Location	270 Pacific Hwy, Crows Nest
Facade / free field	Free field
Environment	

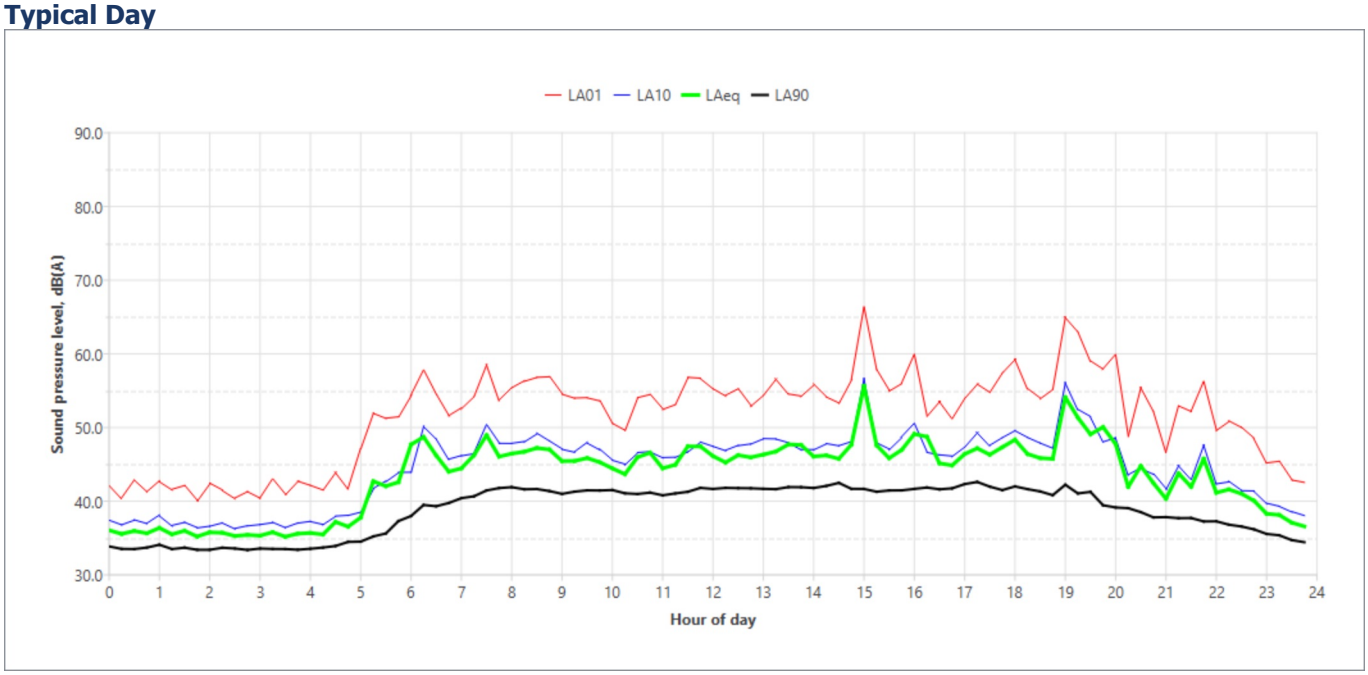
Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Tue 14 Nov 2023	-	36	22	42	44	33
Wed 15 Nov 2023	40	36	32	46	43	41
Thu 16 Nov 2023	40	-	-	47	47	40
Fri 17 Nov 2023	42	-	-	48	47	44
Sat 18 Nov 2023	-	41	-	51	46	47
Sun 19 Nov 2023	37	40	33	53	49	40
Mon 20 Nov 2023	40	37	33	48	47	39
Tue 21 Nov 2023	-	-	33	45	44	39
Wed 22 Nov 2023	-	-	-	47	-	41
Summary	**40**	**37**	**33**	**48**	**46**	**42**

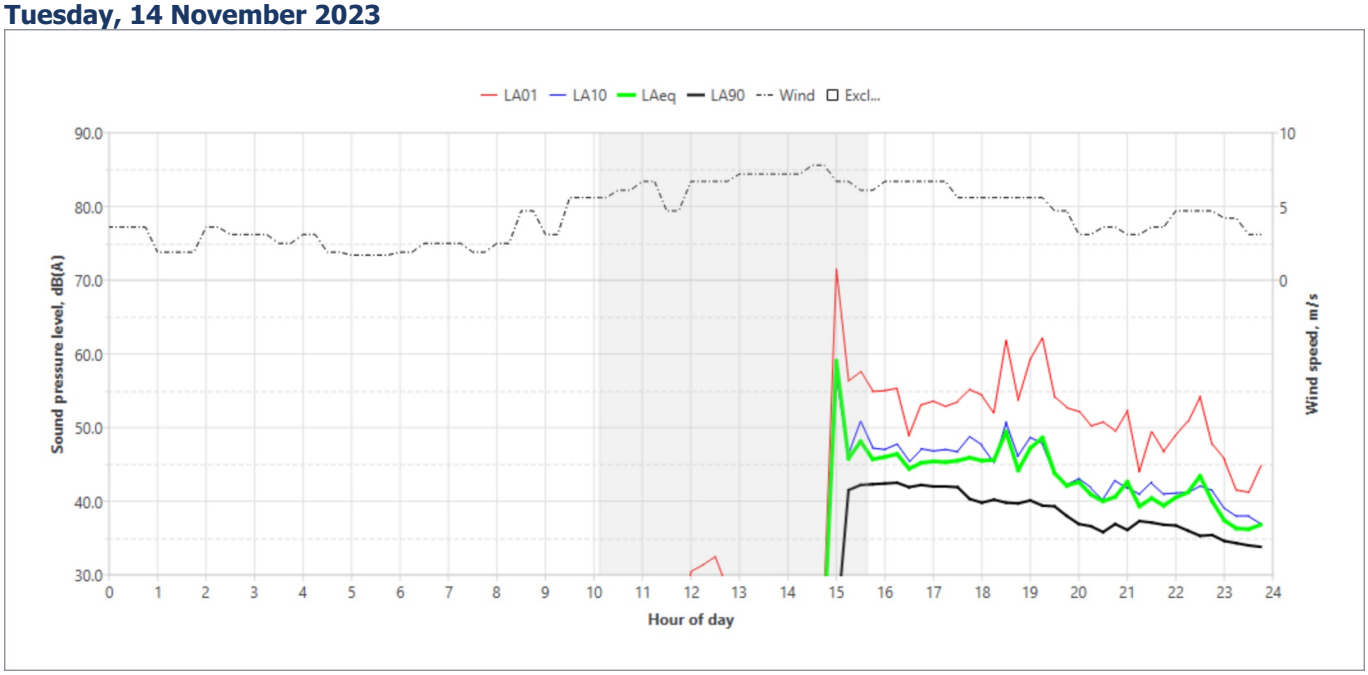
Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location	Logger deployment photo
	

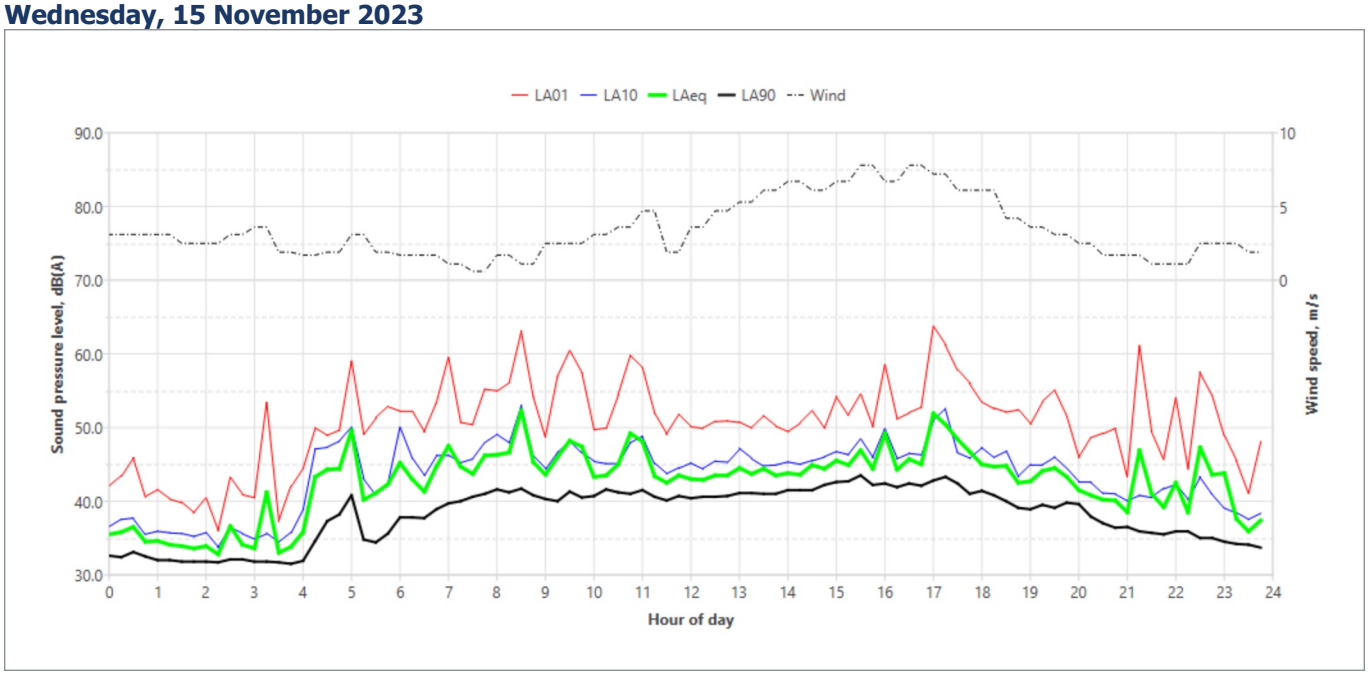
Typical Day



Tuesday, 14 November 2023



Wednesday, 15 November 2023



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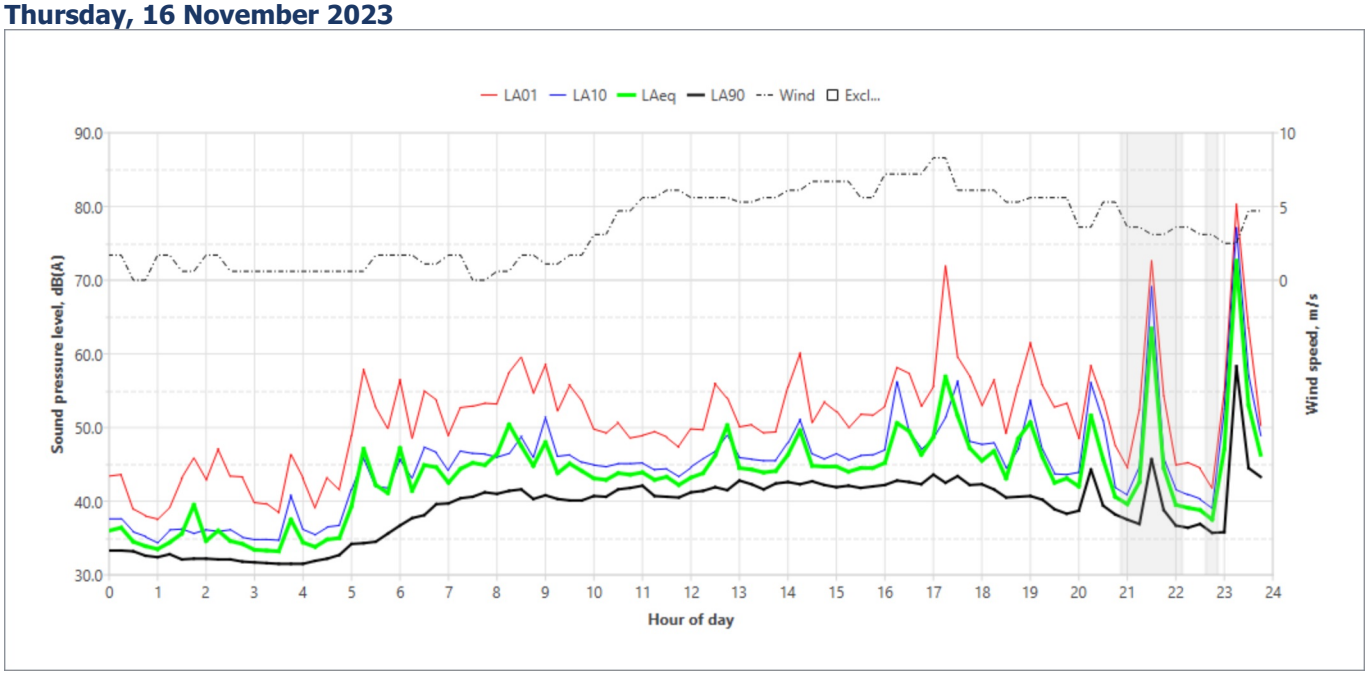

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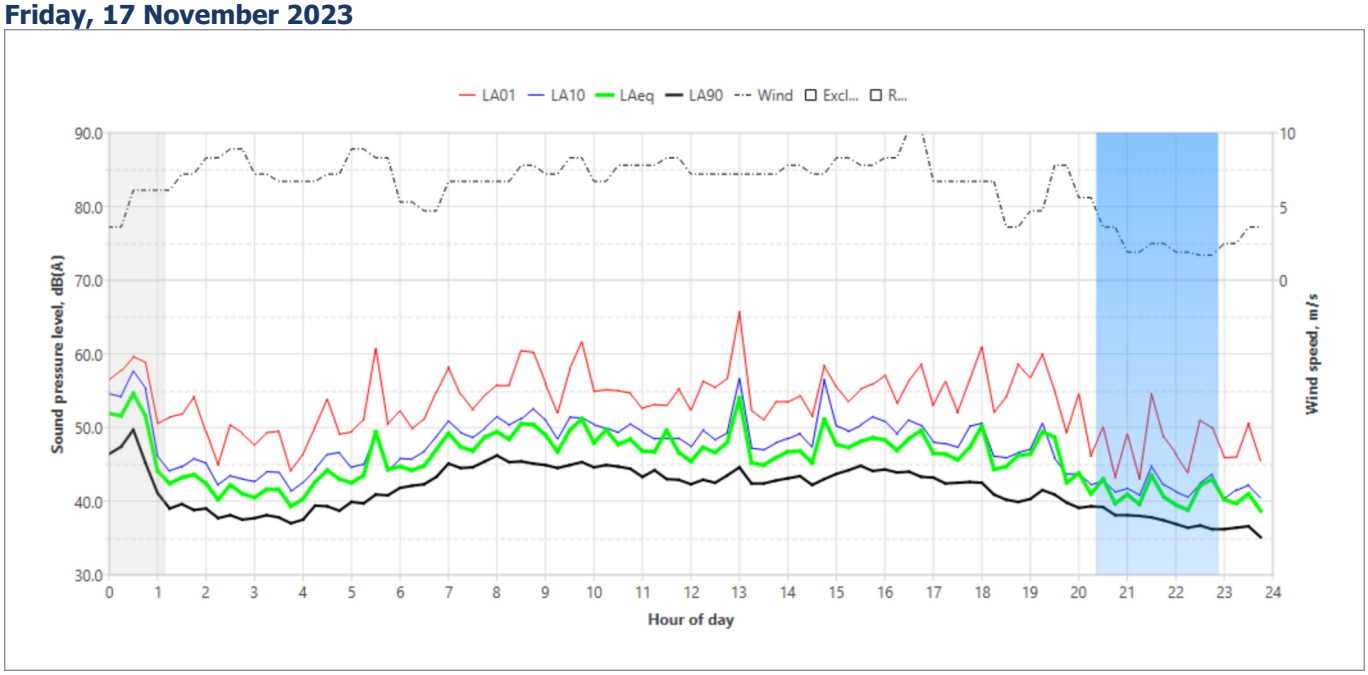

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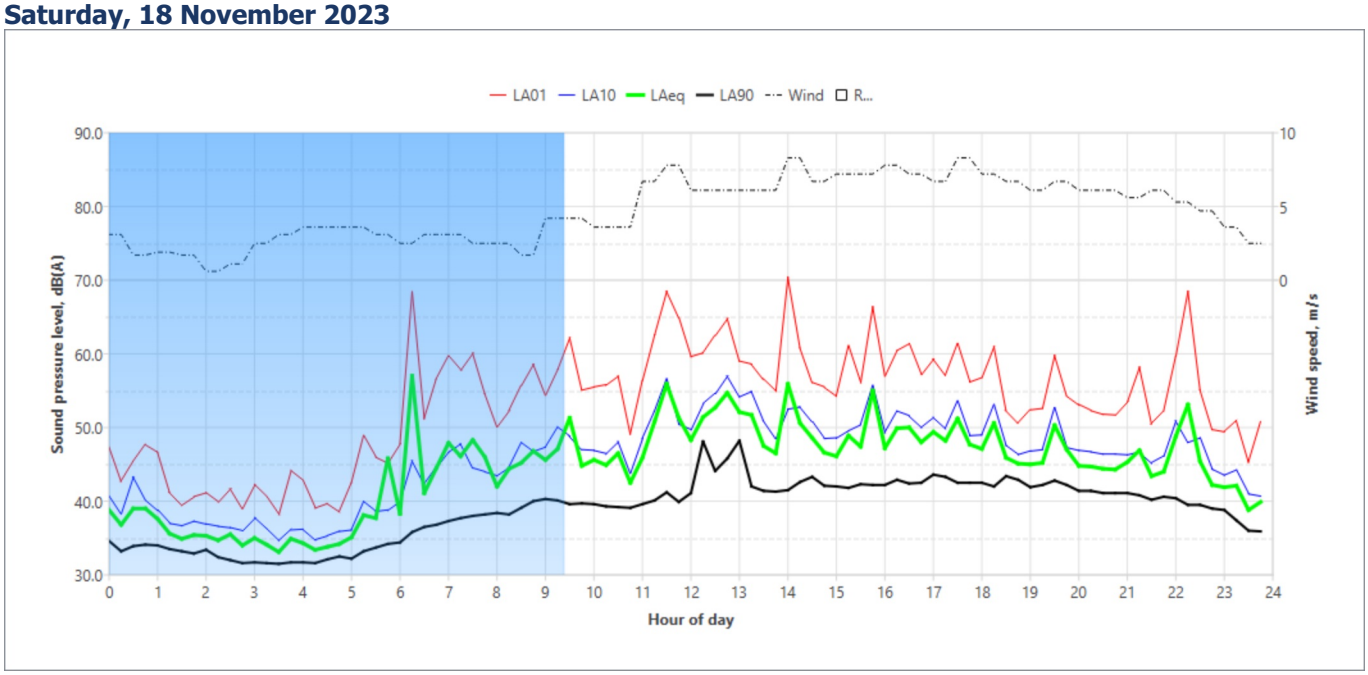
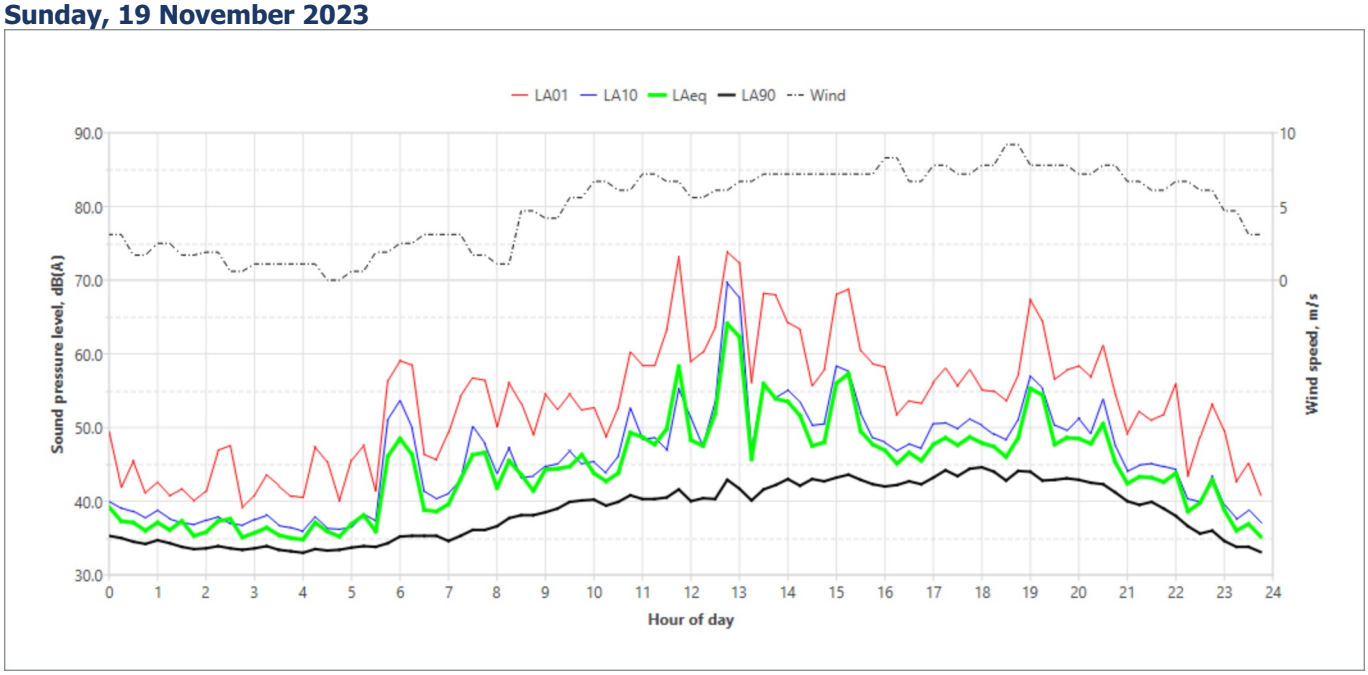
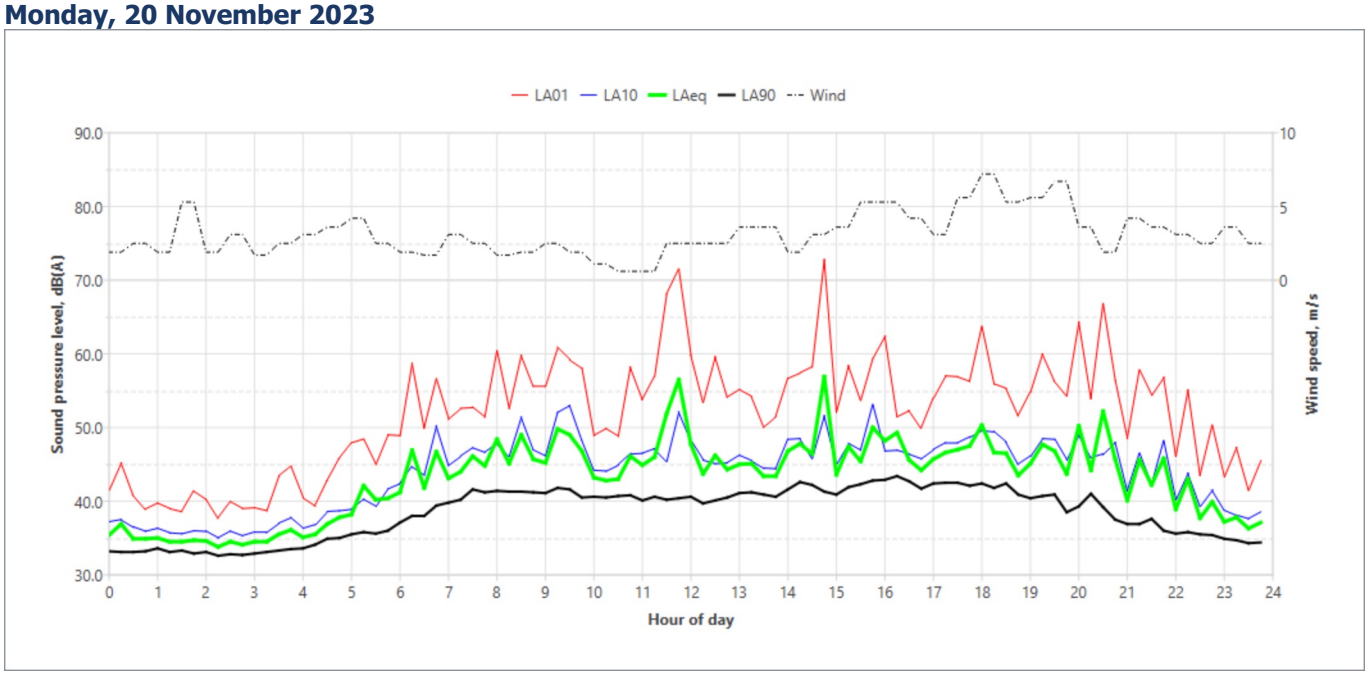


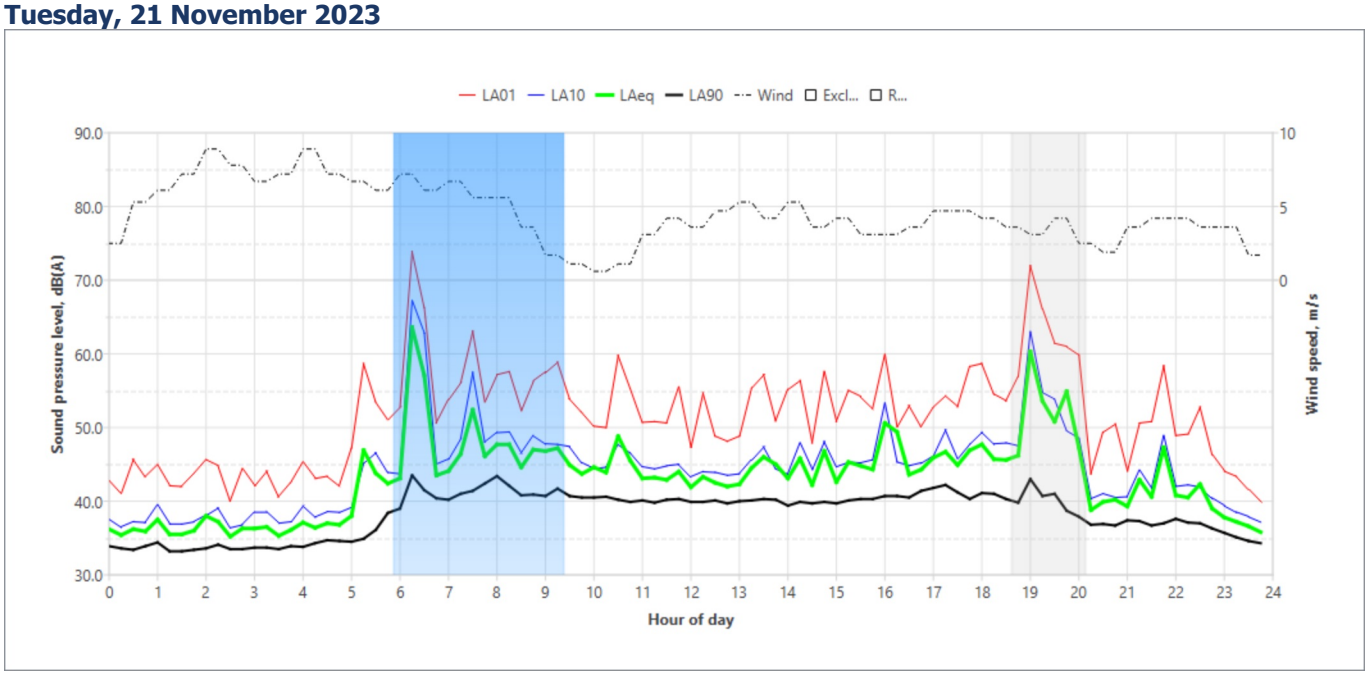
Sunday, 19 November 2023



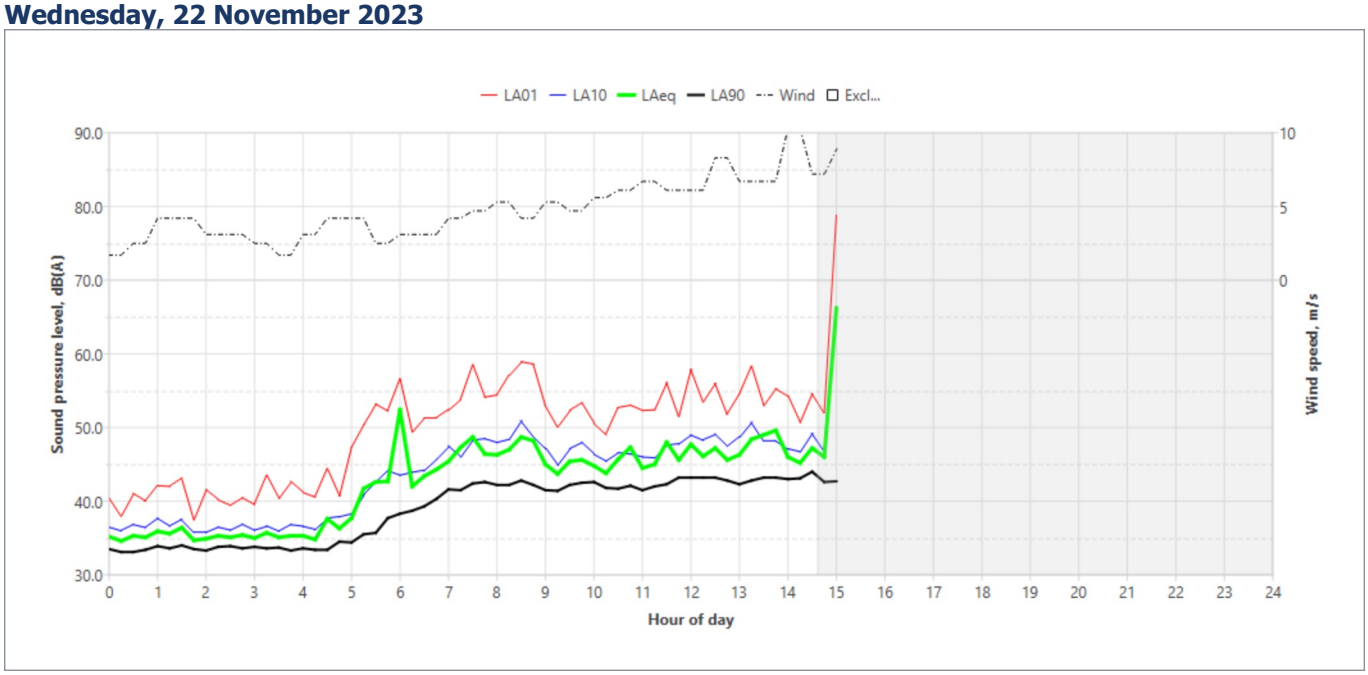
Monday, 20 November 2023



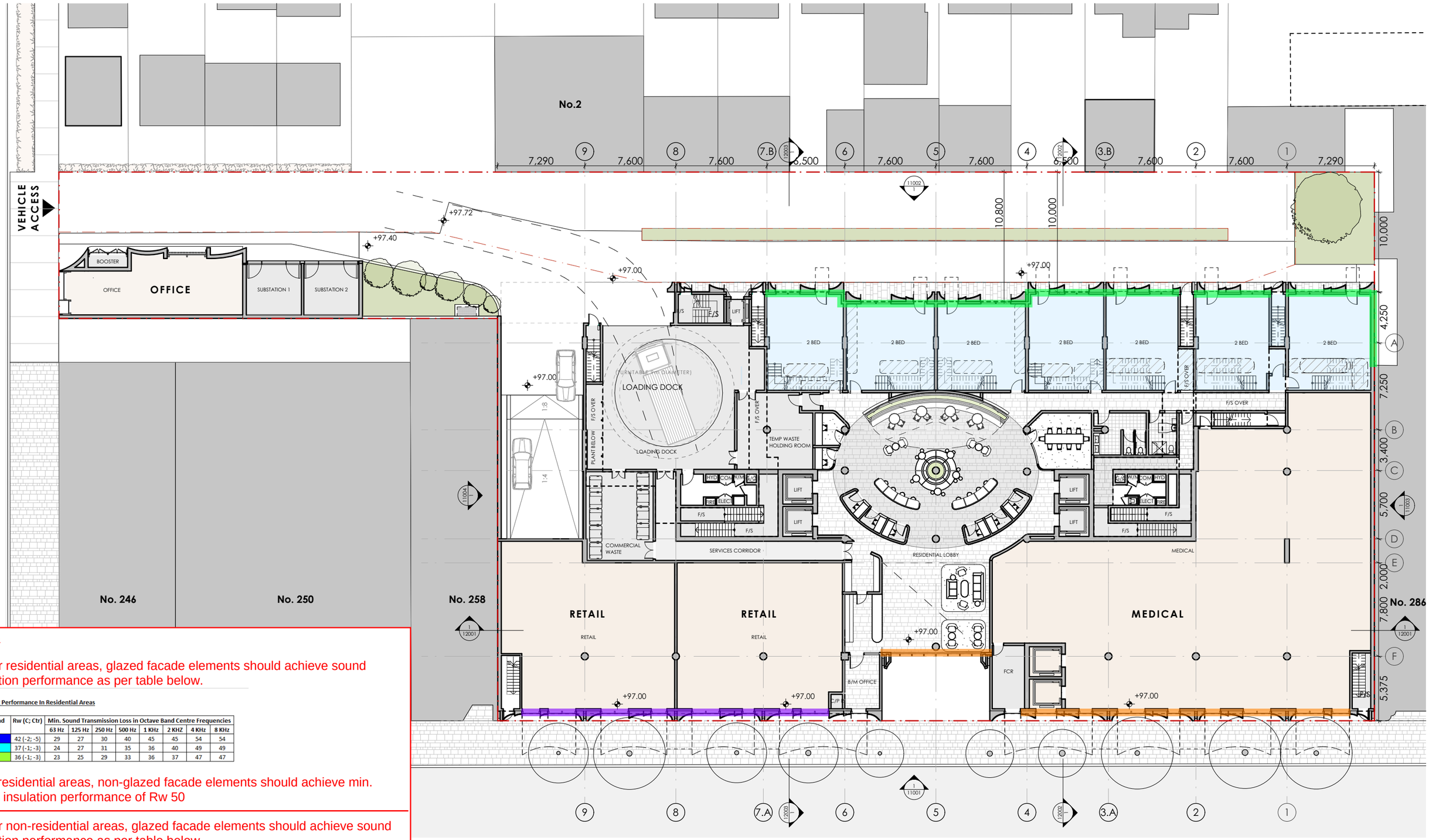
Tuesday, 21 November 2023



Wednesday, 22 November 2023



APPENDIX C. FAÇADE – SOUND INSULATION MARK-UP, RESIDENTIAL AREAS



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
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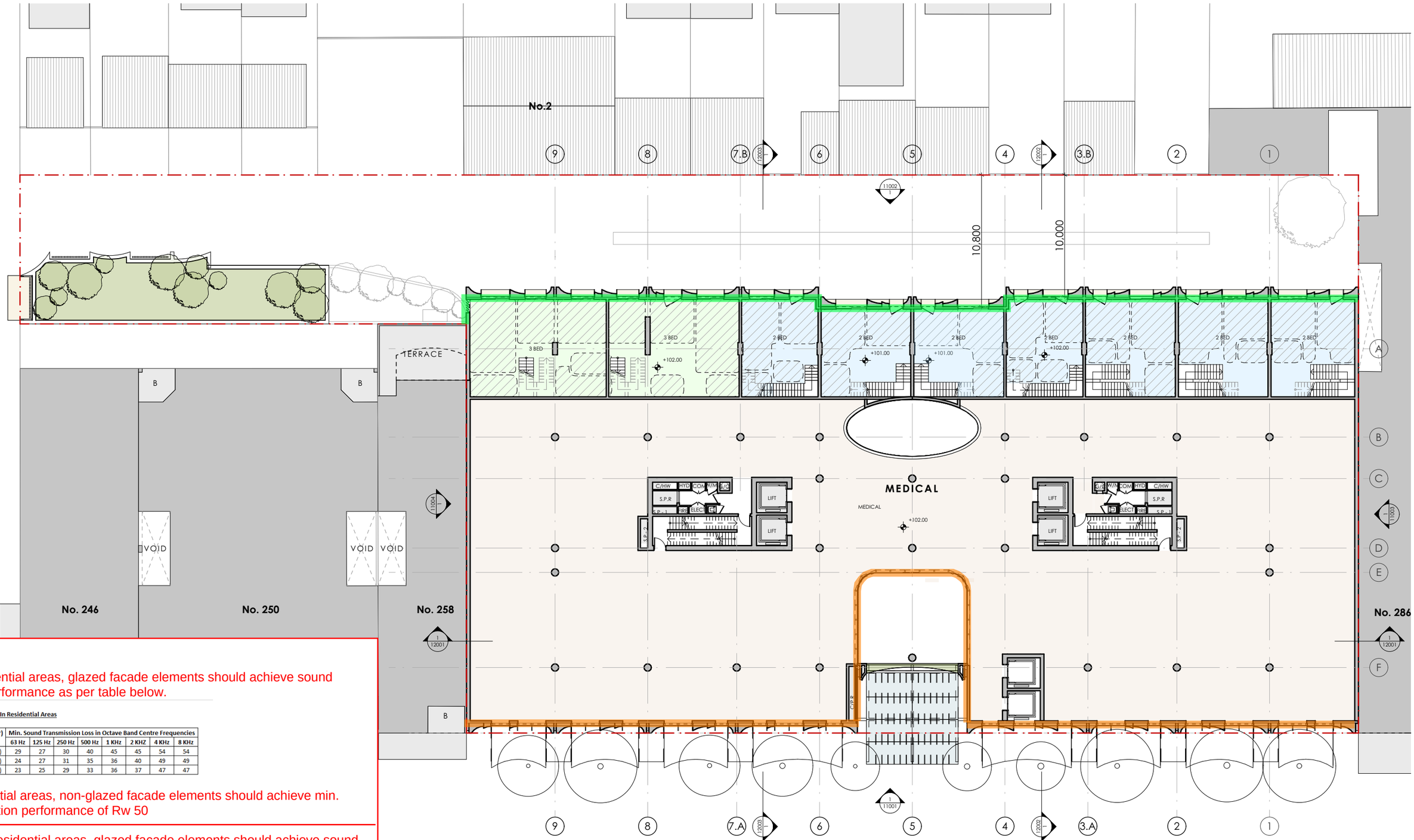
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
GROUND FLOOR

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10001**	**01**



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4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

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30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
LEVEL 01 - NON-RESIDENTIAL

PROJECT NUMBER	DRAWING NUMBER	ISSUE
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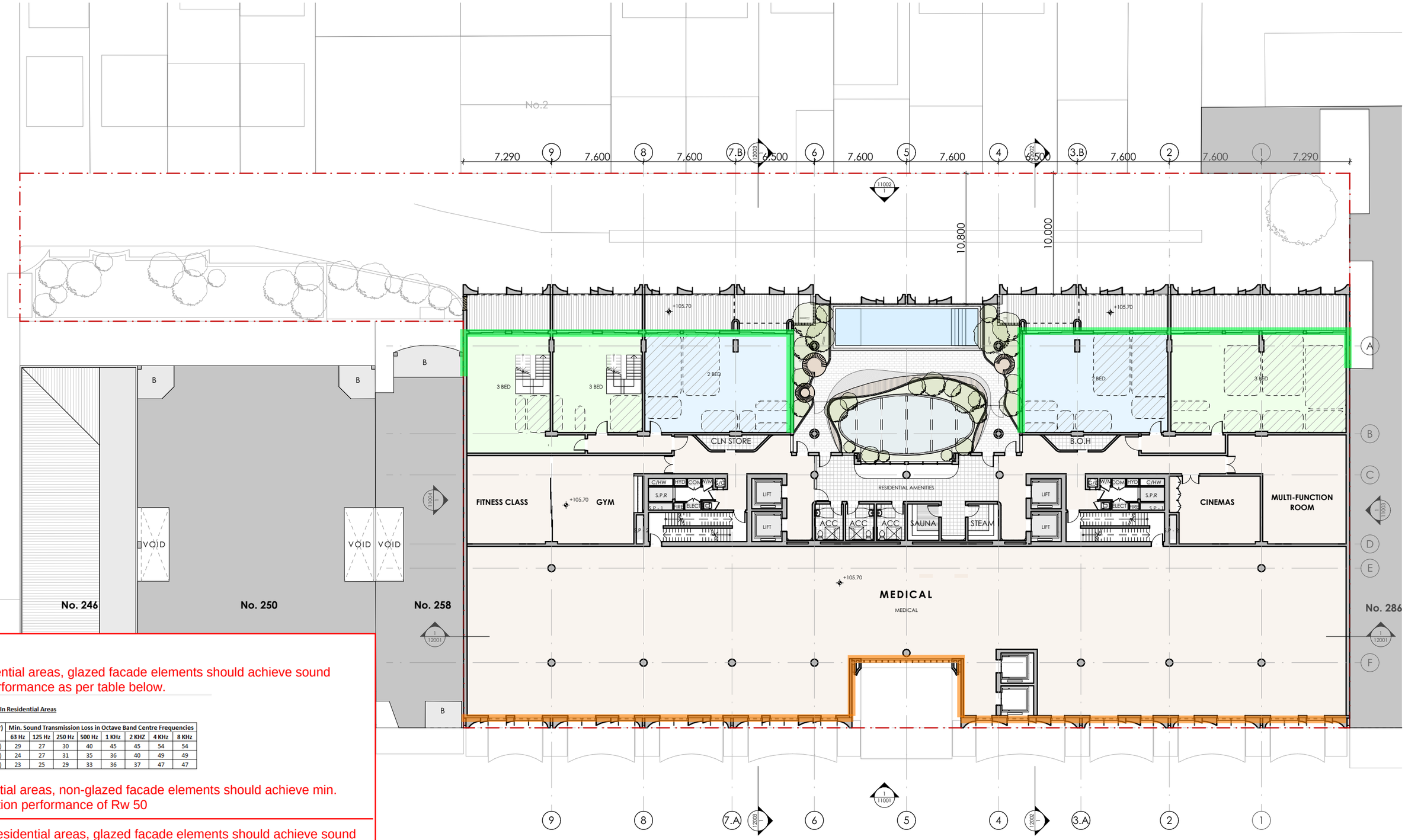

Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
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AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
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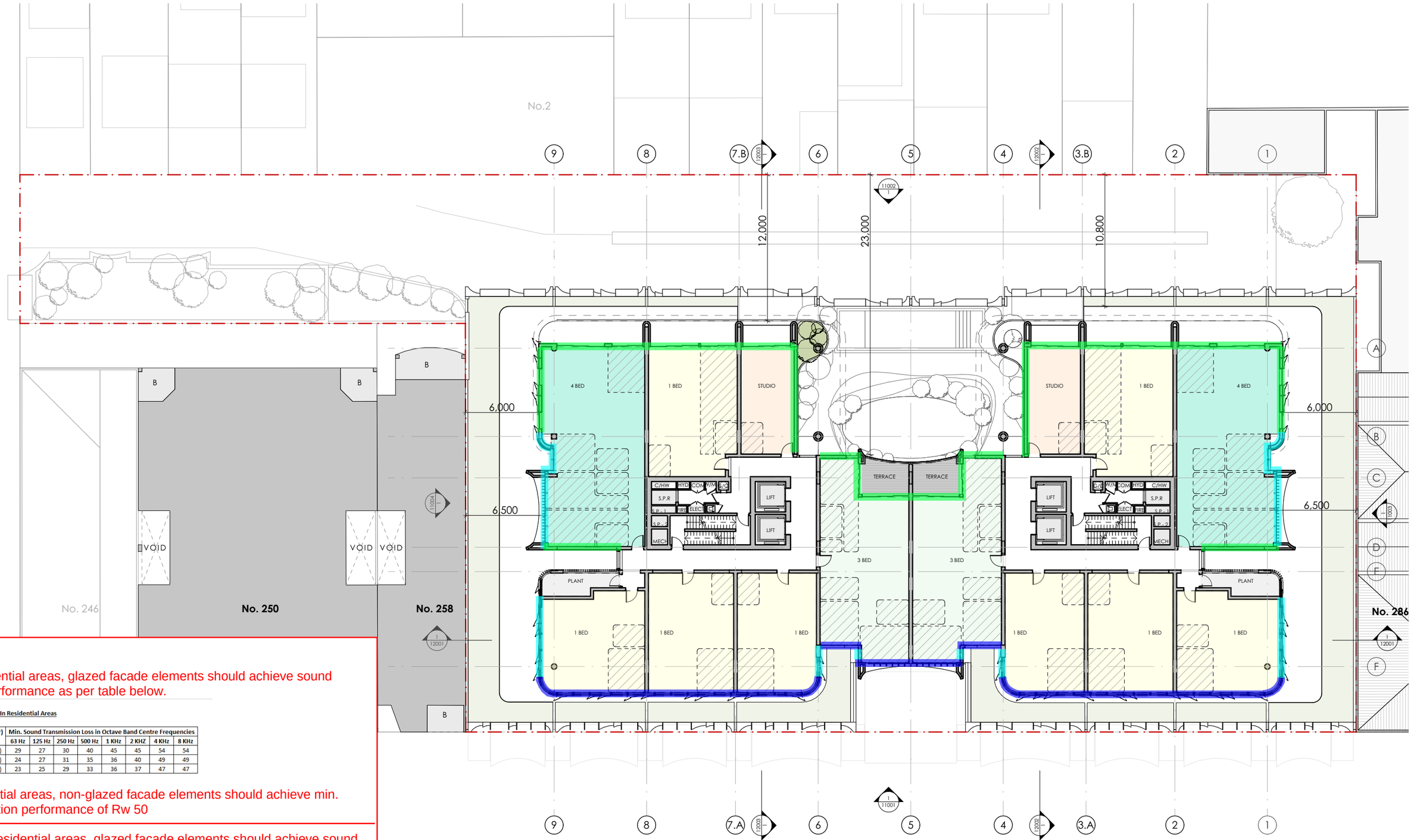
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
LEVEL 02 - RESIDENTIAL AMENITIES

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10005**	**01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE
1:300 @A3

DRAWN BY

APPROVED BY

30mm ON ORIGINAL

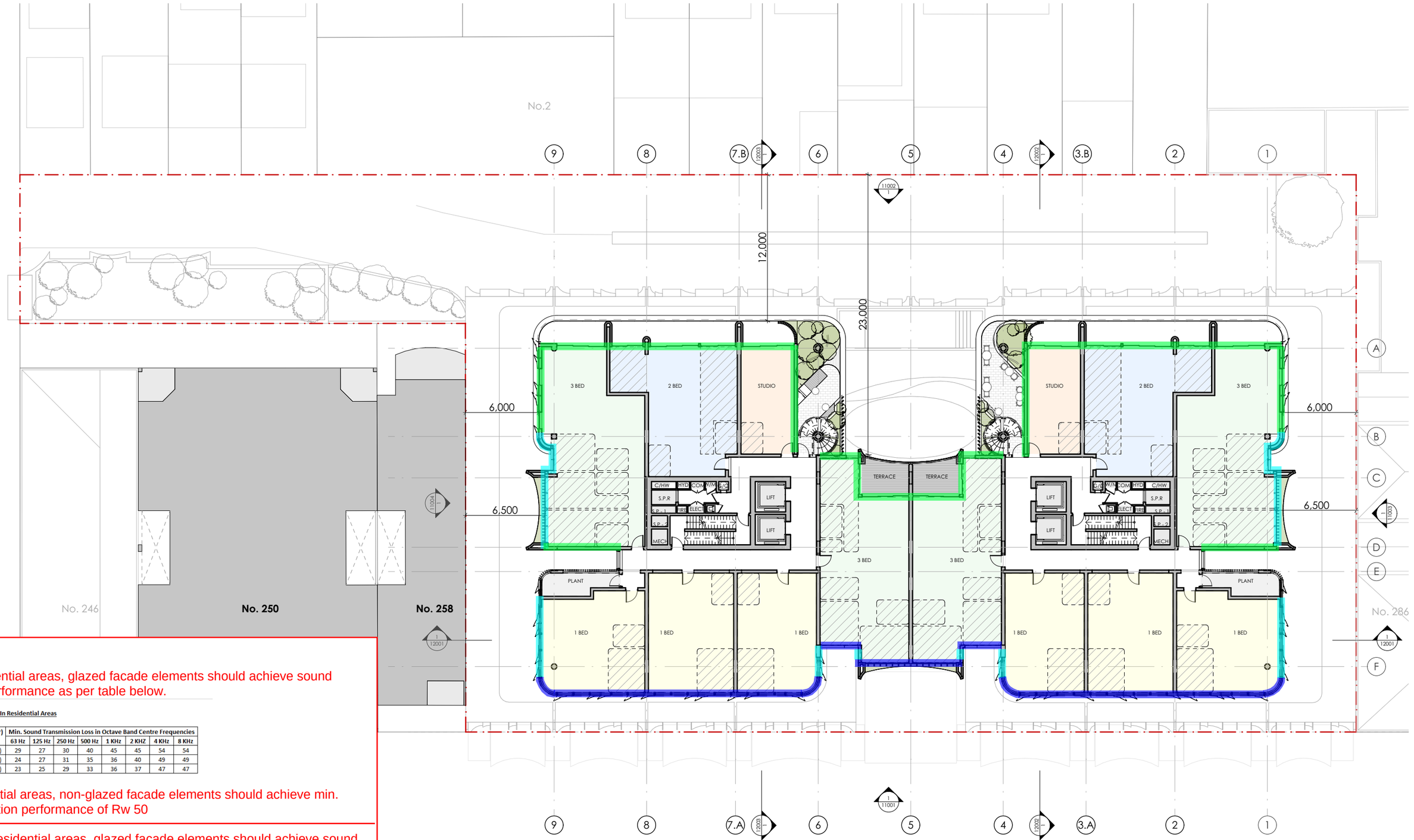
PRINT DATE
19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
LEVEL 3 TERRACE

PROJECT NUMBER
22501

DRAWING NUMBER
DA-10006

ISSUE
01



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

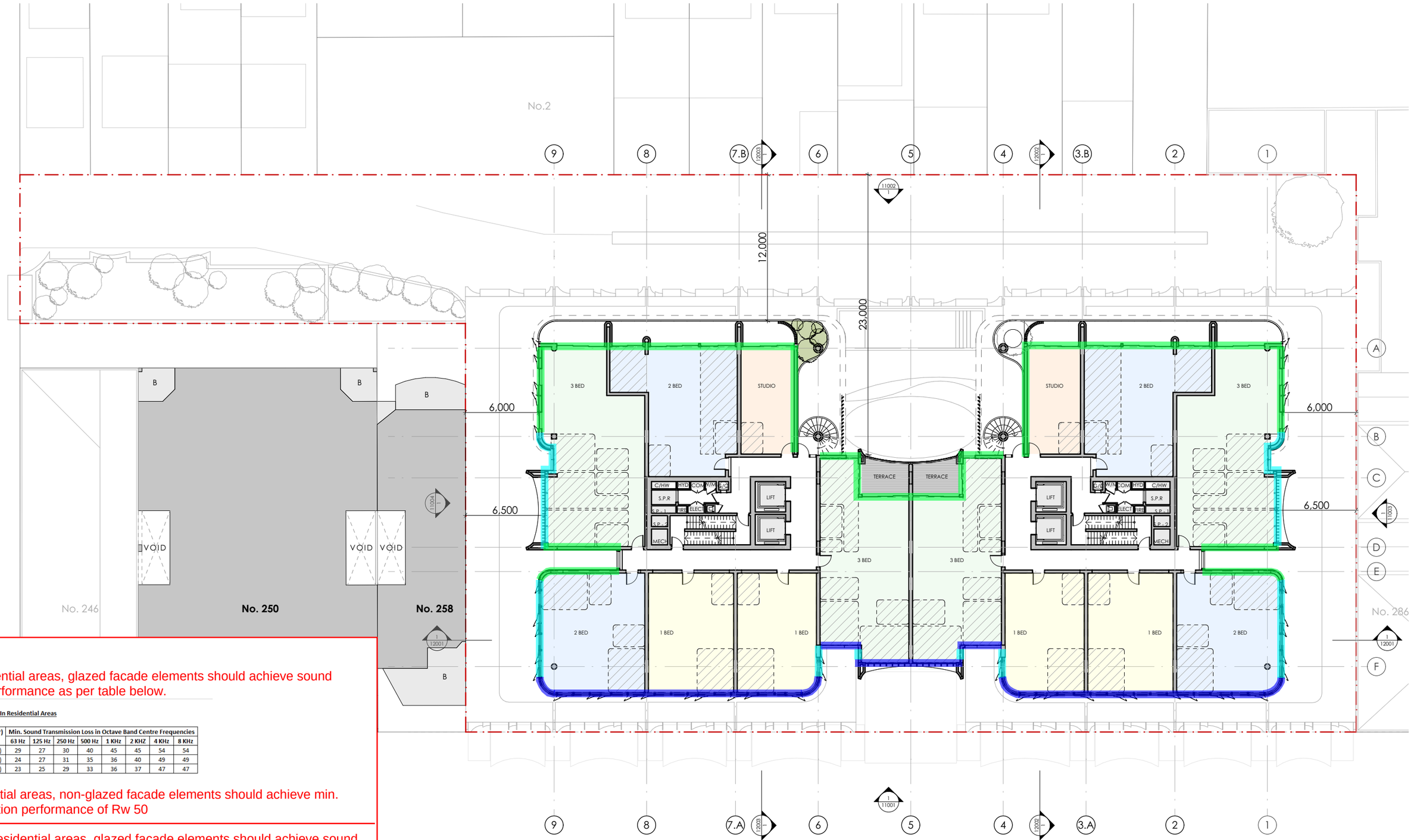
PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE 1:300 @A3
DRAWN BY
APPROVED BY
30mm ON ORIGINAL
PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
LEVEL 4

PROJECT NUMBER **22501**
DRAWING NUMBER **DA-10007**
ISSUE **01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

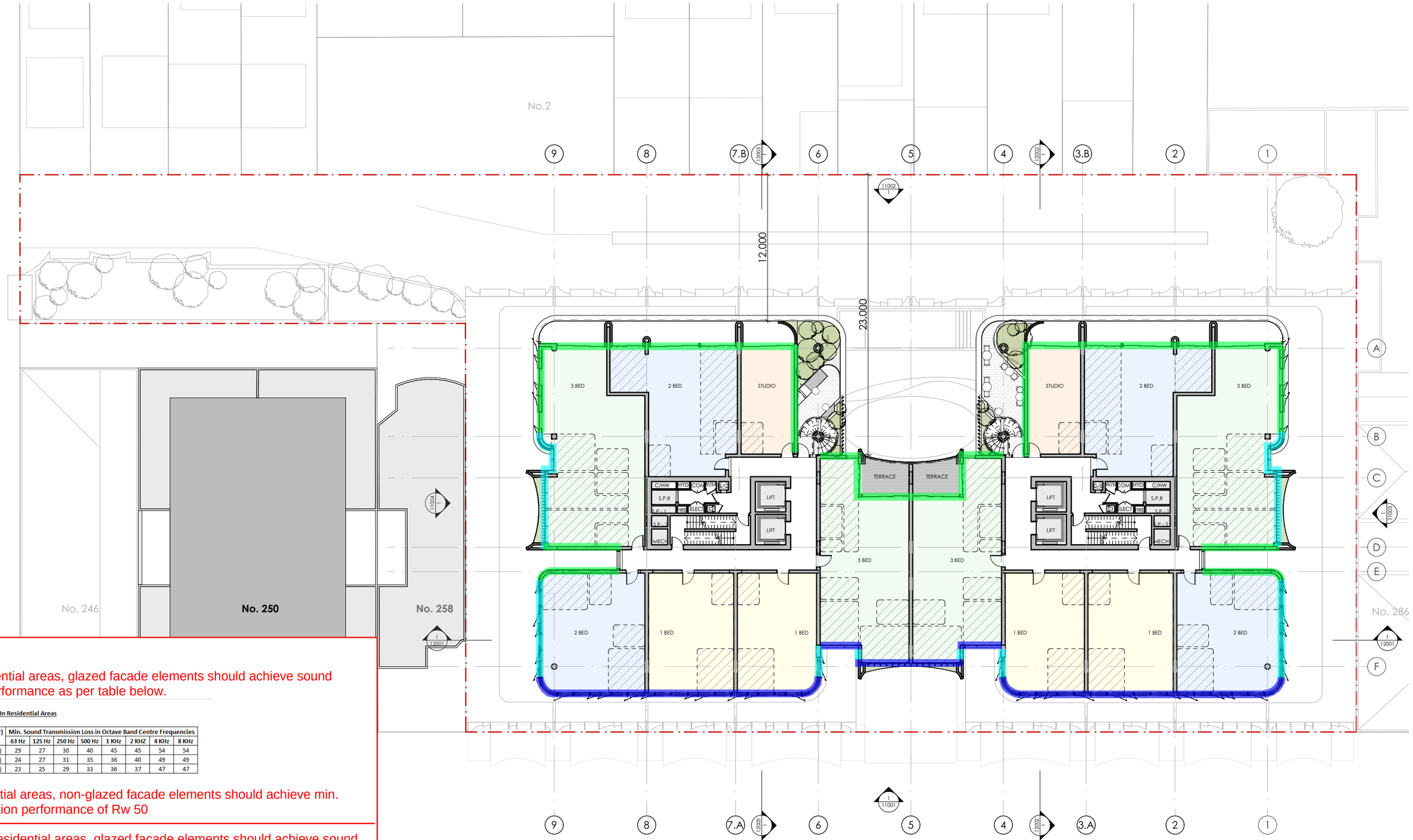
PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE 1:300 @A3
DRAWN BY
APPROVED BY
30mm ON ORIGINAL
PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L5,L7,L9,L11 TYP. RESI FLOOR - WITHOUT TERRACE

PROJECT NUMBER **22501**
DRAWING NUMBER **DA-10008**
ISSUE **01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE 1:300 @A3
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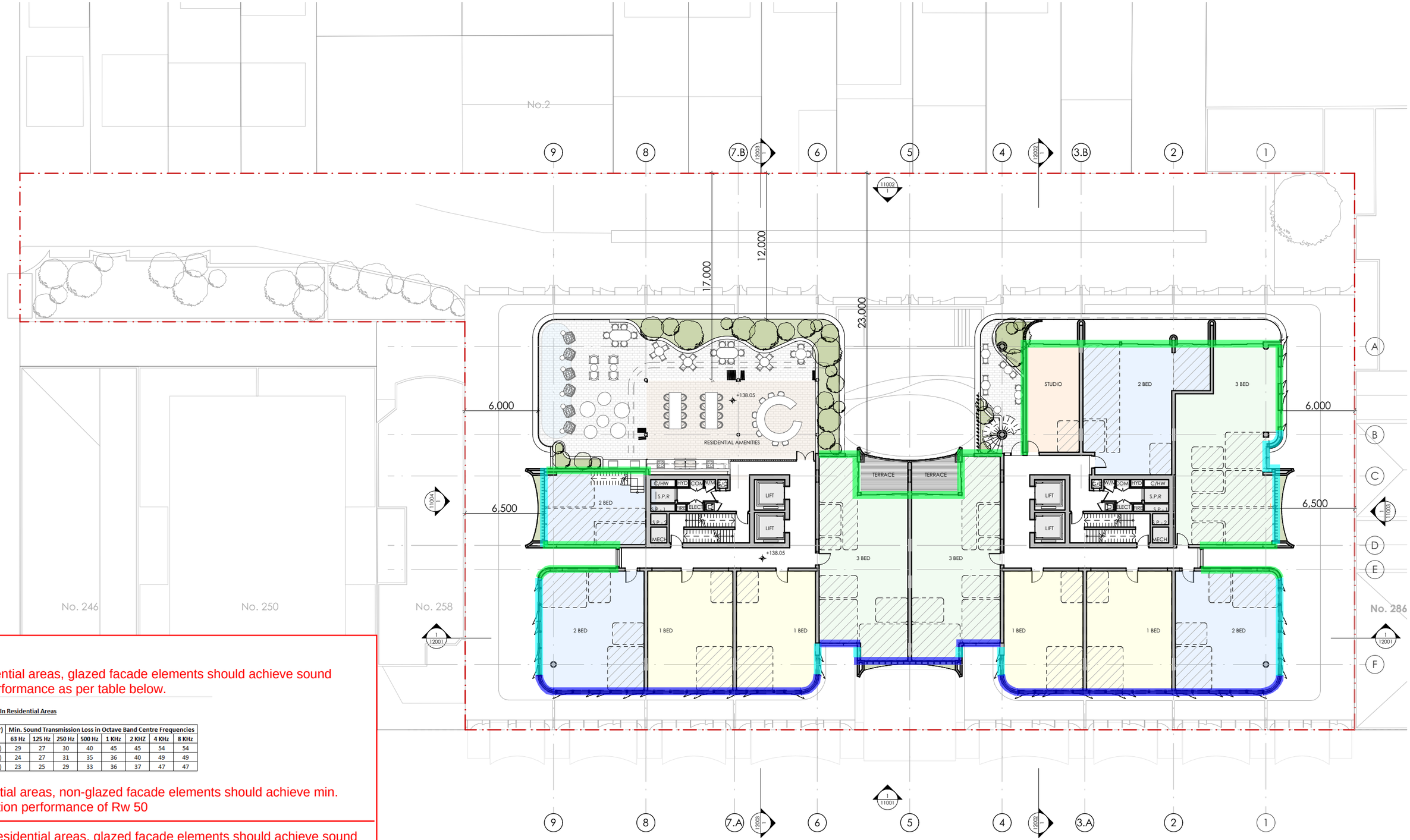
APPROVED BY
30mm ON ORIGINAL
PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L6,L8,L10 TYP. RESI FLOOR - WITH TERRACE

PROJECT NUMBER **22501**
DRAWING NUMBER **DA-10009**
ISSUE **01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
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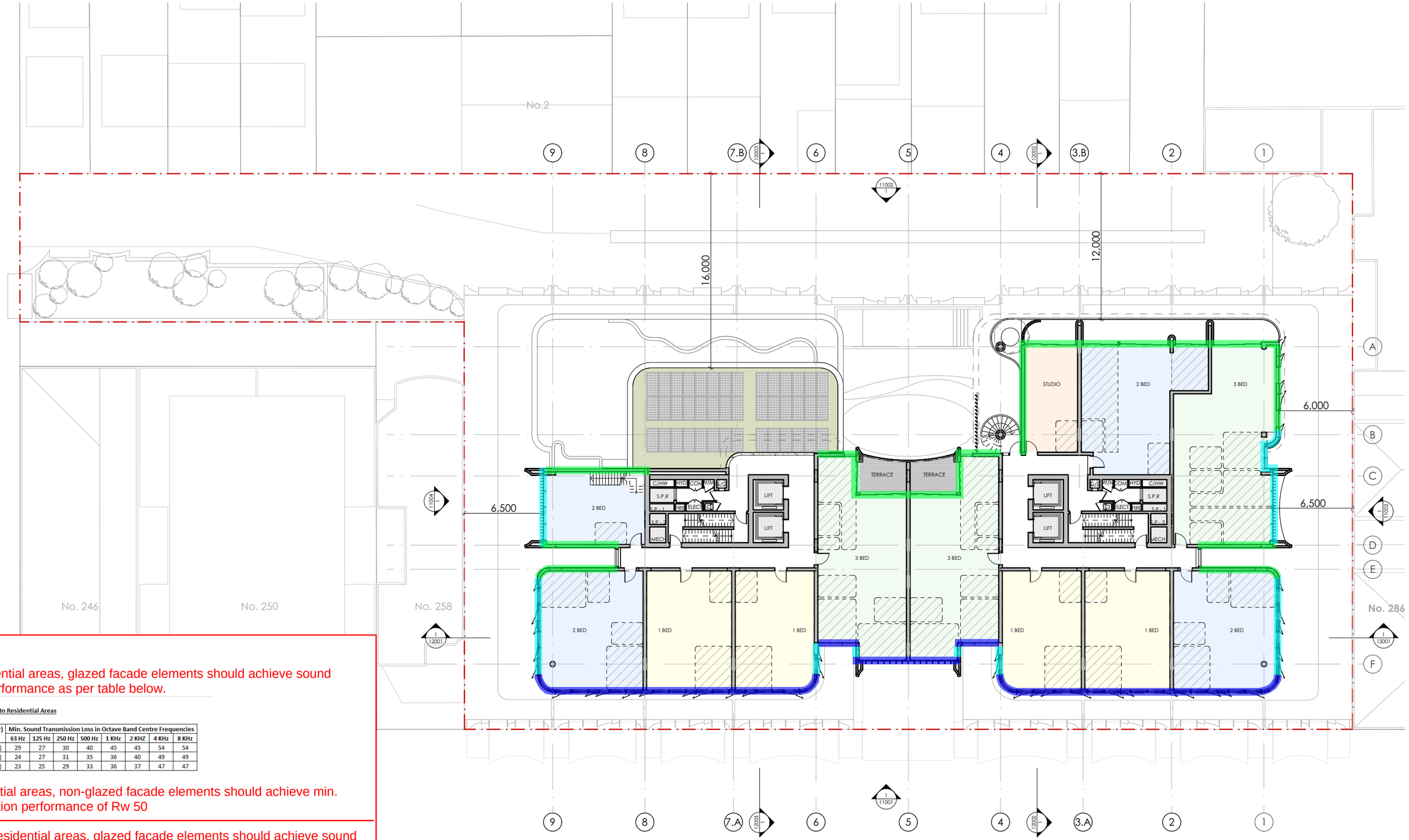
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L12 TOWER 1 ROOF TERRACE

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10010**	**01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
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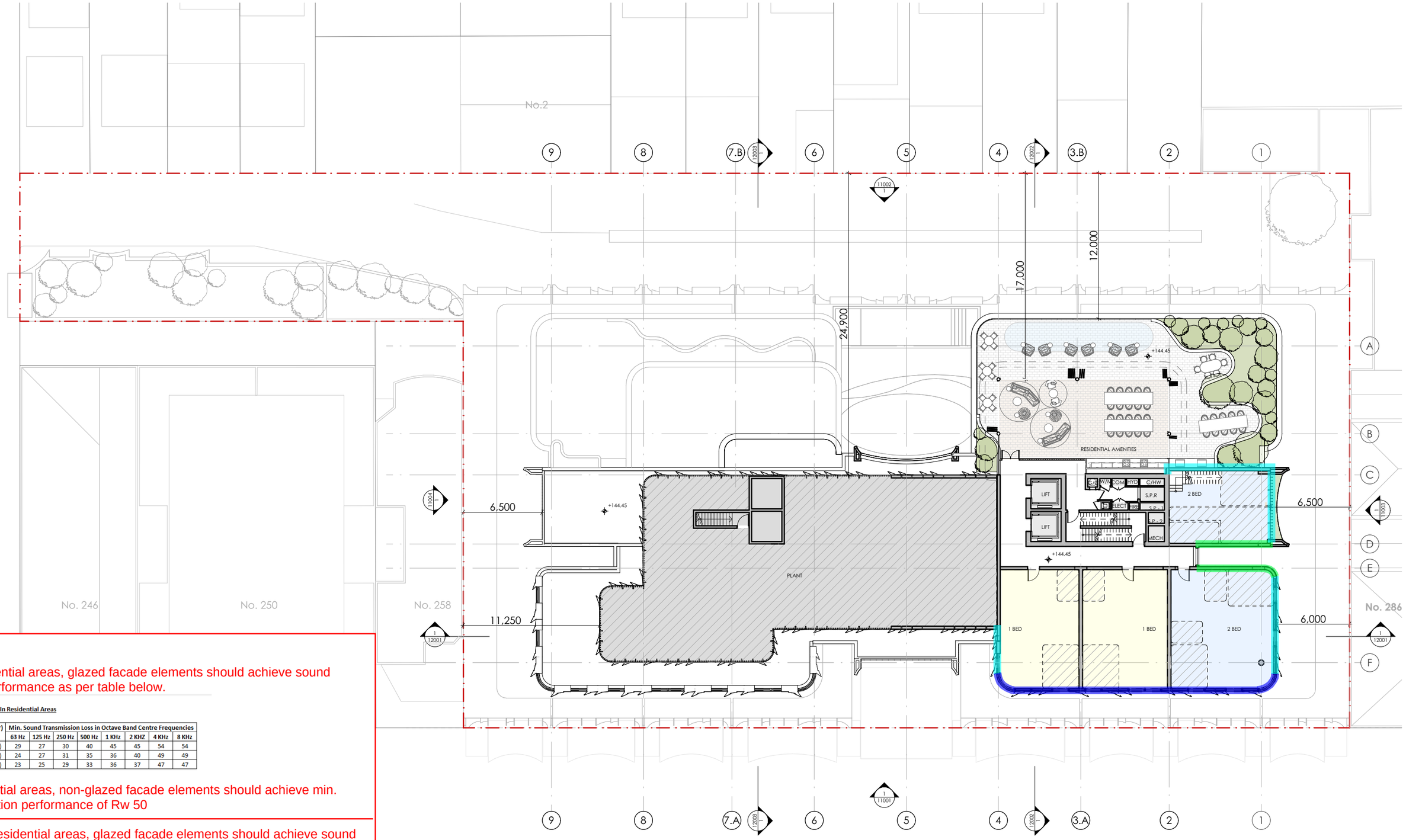
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L13

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10011**	**01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
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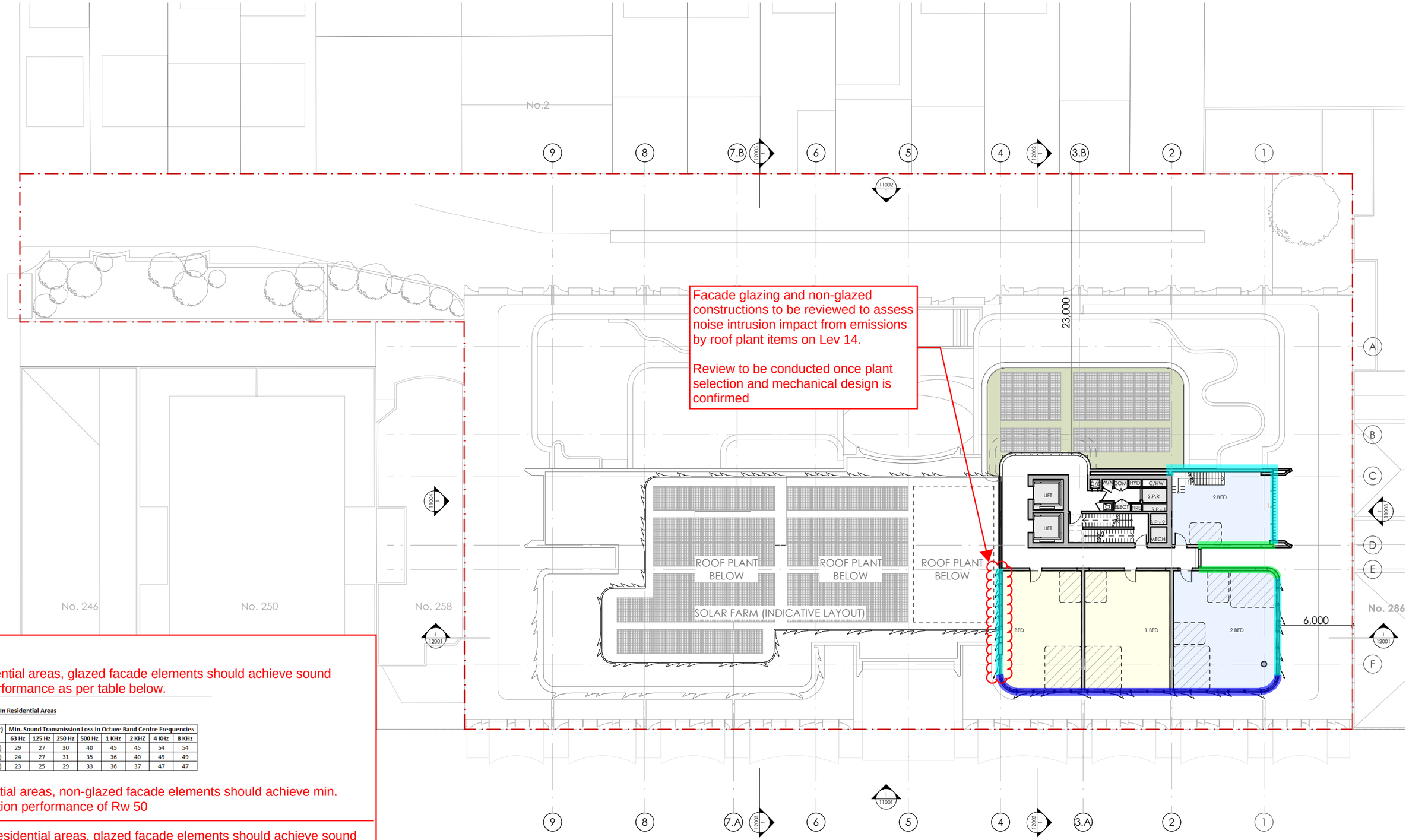
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L14 TOWER 2 ROOF TERRACE/ROOF PLANT

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10012**	**01**



Notes

1.- For residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Residential Areas

Legend	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
		63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	42 (-2; -5)	29	27	30	40	45	45	54	54
	37 (-1; -3)	24	27	31	35	36	40	49	49
	36 (-1; -3)	23	25	29	33	36	37	47	47

2.- In residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 50

3.- For non-residential areas, glazed facade elements should achieve sound insulation performance as per table below.

Glazing Performance In Non-Residential Areas

Legend	Occupancy	Rw (C; Ctr)	Min. Sound Transmission Loss in Octave Band Centre Frequencies							
			63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHZ	4 KHz	8 KHz
	Open office areas	36 (-1; -3)	23	25	29	33	36	37	47	47
	Enclosed private office Meeting room	44 (-1; -6)	30	27	33	43	47	50	62	62
	Retail tenancy	35 (-1; -3)	21	23	27	32	35	36	44	44

4.- In non-residential areas, non-glazed facade elements should achieve min. sound insulation performance of Rw 45

AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

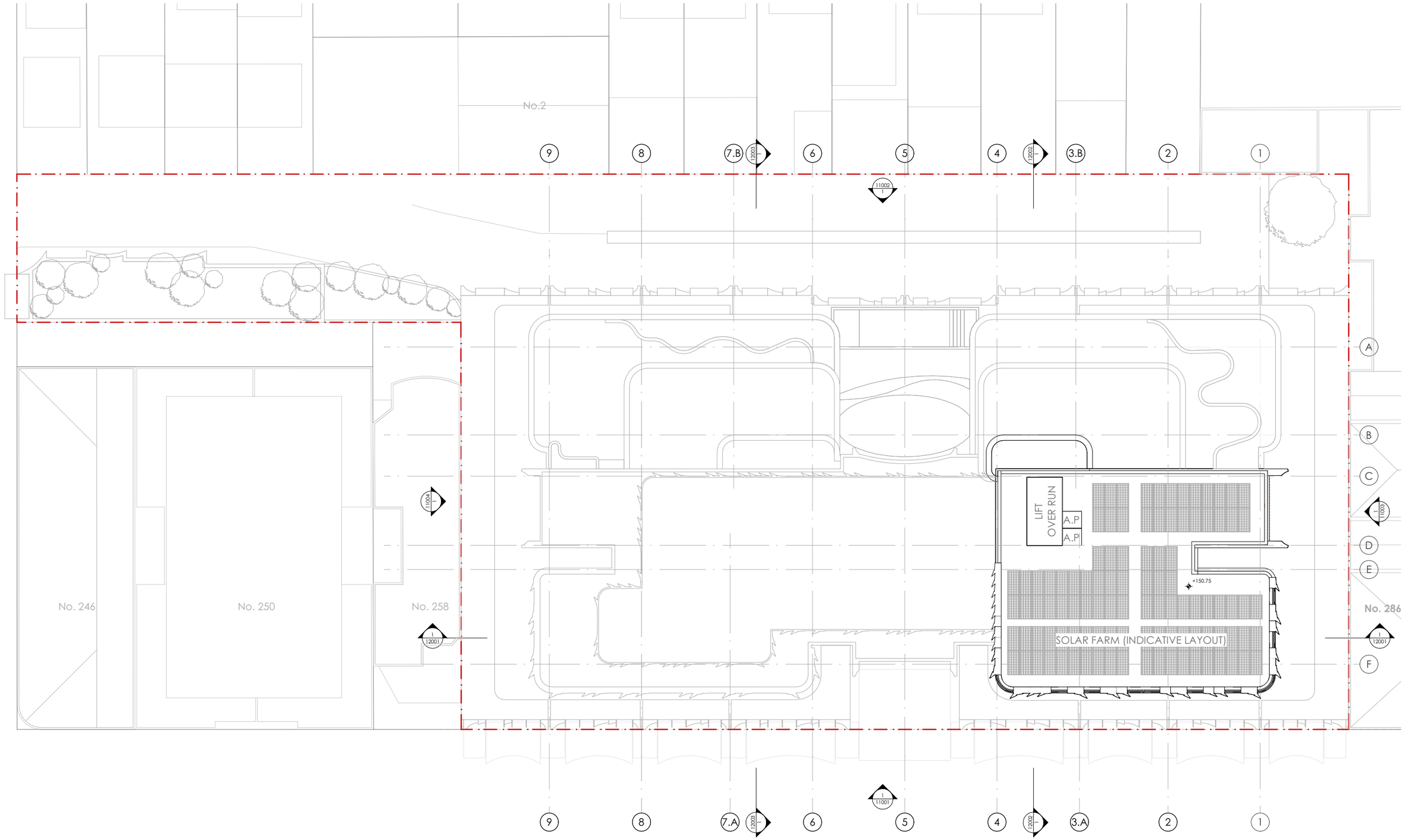
PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
1:300 @A3		
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L15

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10013**	**01**



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AMENDMENTS

REV.	DATE	DESCRIPTION	CHK
01	19/03/2025		

PROJECT
270 PACIFIC HWY BTR
270 PACIFIC HIGHWAY
CROWS NEST NSW 2064
AUSTRALIA

PHASE: DEVELOPMENT APPLICATION

PROJECT NORTH

CLIENT
SILVERNIGHT
#Client Full Address

SCALE	DRAWN BY	APPROVED BY
1:300 @A3		
30mm ON ORIGINAL		PRINT DATE 19/03/2025

DRAWING
GENERAL ARRANGEMENT PLANS
L16 TOWER 2 ROOF

PROJECT NUMBER	DRAWING NUMBER	ISSUE
22501	**DA-10014**	**01**