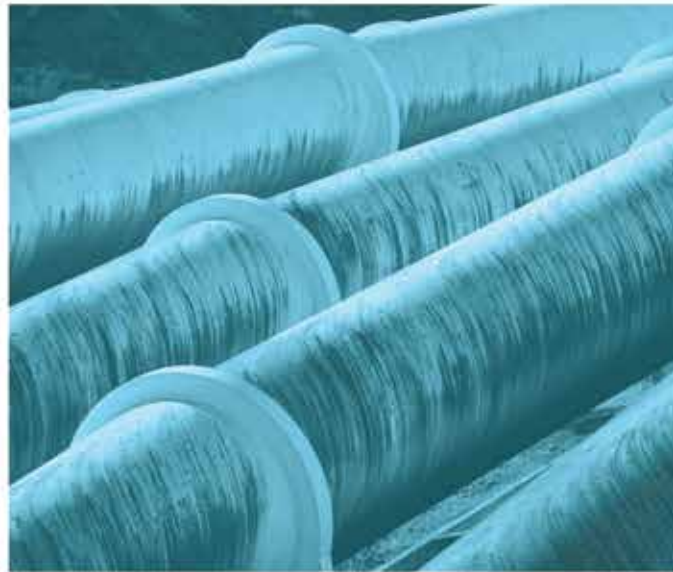




Tuggerah Gateway

Planning proposal noise constraints and opportunities

Prepared for Scentre Group
September 2021 (revised March 2024)





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Tuggerah Gateway

Planning proposal noise constraints and opportunities

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Prepared by

Approved by



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16 September 2021



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8 March 2024

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Executive Summary

This report has been commissioned by Scentre Group Limited to address potential noise implications associated with the proposed Tuggerah Gateway Precinct ('the Project') to be located at 60 Wyong Road and 58 Tonkiss Street, Tuggerah, NSW ('the subject site'). The proposal will include the rezoning of the existing greenfield site to include residential and mixed-use development.

The scope of this assessment is to undertake a review of noise intrusion into the development from surrounding major sources (eg roadways) and address potential noise generated by future uses of the site identified as part of the concept plan. This assessment has been prepared in support of the planning proposal.

The purpose of this assessment is to determine whether:

- road traffic noise intrusion into the development can meet the acoustic requirements for road traffic noise intrusion dictated by the State Environmental Planning Policy (Infrastructure) ('Infrastructure SEPP'); and
- noise generated by the Project is capable of meeting relevant Environmental Protection Authority (EPA) noise emission requirements.

Road traffic noise intrusion has been assessed in accordance with the Infrastructure SEPP and the Department of Planning (DoP) 2008, *Development near Rail Corridors and Busy Roads – Interim Guideline* ('the guideline').

Noise from commercial and retail uses within the mixed-use development areas of the Project has been discussed with consideration to the EPA 2017, *Noise Policy for Industry* (NPfI).

The potential project related road traffic noise generation on Tonkiss Street and Wyong Road has been assessed using the guidance provided in the NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP).

Given the early stages of development planning, only high level commentary has been provided in relation to achieving the objectives of the NSW Department of Environment and Climate Change (DECC) 2009, *Interim Construction Noise Guideline* (ICNG). No specific assessment of construction noise has been undertaken at this stage given the many unknowns as would be expected at this stage.

The outcomes from the assessment of noise from the concept plan indicates the following:

- road traffic noise intrusion (from the Pacific Motorway and Wyong Road) into the development can be suitably treated using best practice building placement and orientation of residential structures, internal spatial planning and acoustically treating the building façades as relevant to meet internal noise targets;
- noise generating commercial uses (eg bulky goods and future retail food and beverage) has been discussed. Given the early stages of the project planning, specific uses are yet to be determined to inform this assessment. Potential limitations on the location and orientation of such uses have been discussed and in-principle recommendations have been provided to minimise potential noise impacts from these uses; and
- additional road traffic noise on Tonkiss Street and Wyong Road is expected to comply with road traffic noise targets. It is further noted that increased road traffic noise would be realised over a number of years and should be considered in the planned growth of the area.

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1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged by Scentre Group Limited to assess potential noise impacts associated with the proposed Tuggerah Gateway Precinct ('the Project') at 60 Wyong Road and 58 Tonkiss Street, Tuggerah NSW ('the subject site').

On behalf of Scentre Group, this review of noise constraints report supports a planning proposal and structure plan prepared by Urbis. The Planning Proposal facilitates the proposed amendment to the Local Environmental Plan at the Tuggerah Gateway Site, known as Lot 2 DP1056960 and Lot 3 DP1084221, which will enable residential, mixed-use and recreational land uses.

The planning application is being submitted for the re-zoning of the subject site and no actual physical works are proposed. It is understood that should the planning proposal be successful, the proposed works will include vegetation clearance, construction of low set dwellings, low-medium and medium-high rise residential buildings, mixed-use buildings, landscaping and earthworks and construction of roads and services.

1.1 Location of site

The subject site is located at 60 Wyong Road and 58 Tonkiss Street, Tuggerah NSW and is legally referred to as Lot 3 in DP 1084221 and Lot 2 in DP 1056960 within the Central Coast Local Government Area (LGA), approximately 14.5 kilometres (km) northeast of Gosford CBD and 65 km north of the Sydney CBD (refer to Figure 1.1).

The subject site is currently greenfield and is bounded by Pacific Motorway to the west, Wyong Road to the north, Tonkiss Street to the east and environmental conservation bushland to the south.

1.2 Proponent

The proponent is Scentre Group Limited who is the owner and operator of Westfield shopping centres in Australia and New Zealand.

1.3 Purpose of this report

This noise review supports the planning proposal. It documents the existing noise environment, applicable impact assessment criteria, sources of noise, modelling of traffic noise impact and discussion of operational activities including traffic.

This report consists of the following sections:

- A description of the local setting and surrounds of the site.
- A description of the existing environment, specifically:
 - existing noise environment including road traffic noise; and
 - existing industrial noise from Westfield Tuggerah.
- Identification of noise criteria applicable to the site, including:
 - noise intrusion criteria to address road traffic impacts from the Pacific Motorway to the west and Wyong Road to the north;

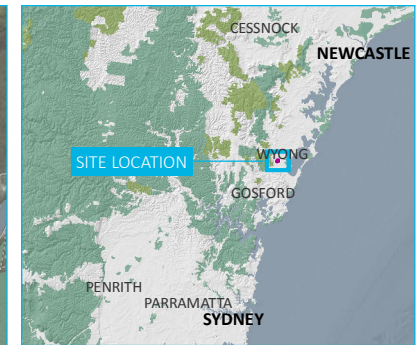
- noise emission criteria to govern:
 - construction noise generated by the site;
 - operational noise associated with commercial development within the site; and
 - the potential for road traffic noise increases on surrounding roadways due to site generated road traffic.
- The assessment of road traffic noise impacting future uses as part of the site and mitigation measures which may be incorporated to satisfy road traffic noise criteria. This includes:
 - identification of best practice site and spatial planning to reduce traffic noise impacts using the built form; and
 - identification of suitable mitigation measures to reduce road traffic noise intrusion such that internal design targets may be met.
- The assessment of operational noise in-principle for the currently zoned B4 mixed use area located along Wyong Road in the northeast of the site.
- Assessment of road traffic noise as a result of project related vehicles on public roads.

Commentary has also been provided regarding potential construction noise impacts on surrounding land uses. Given the early stages of the application process, this commentary is provided in principle.

1.4 Referenced guidelines and policies

The assessment has been prepared considering the guidance in:

- NSW Department of Environment Climate Change (DECC) 2009, The Interim Construction Noise Guideline (ICNG);
- NSW Environment Protection Authority (EPA) 2017, NSW Noise Policy for Industry (NPfI);
- NSW Department of Environment Climate Change and Water (DECCW) 2011, Road Noise Policy (RNP);
- Department of Environment and Conservation (DEC) NSW 2006, Assessing Vibration: a technical guideline;
- NSW State Environmental Planning Policy (Infrastructure) 2007 ('infrastructure SEPP'); and
- NSW Department of Planning (DoP) 2008, Development near Rail Corridors and Busy Roads – Interim Guideline.



- KEY**
- Project site
 - Rail line
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Named waterbody
 - NPWS reserve
 - State forest

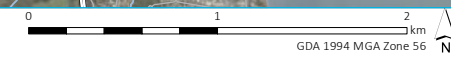
Site locality

Tuggerah Gateway
Noise and vibration impact assessment
Figure 1.1



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Source: EMM (2021); MetroMap (2021); DFSI (2017); GA (2011); ASGC (2006)



2 Project description

The Tuggerah Gateway Precinct will include a mixture of residential, mixed-use development and retention of E2 environmental conservation zoning.

The site is approximately 41.6 hectares and is currently zoned RU6 Transition, B4 Mixed Use and E2 Environmental Conservation.

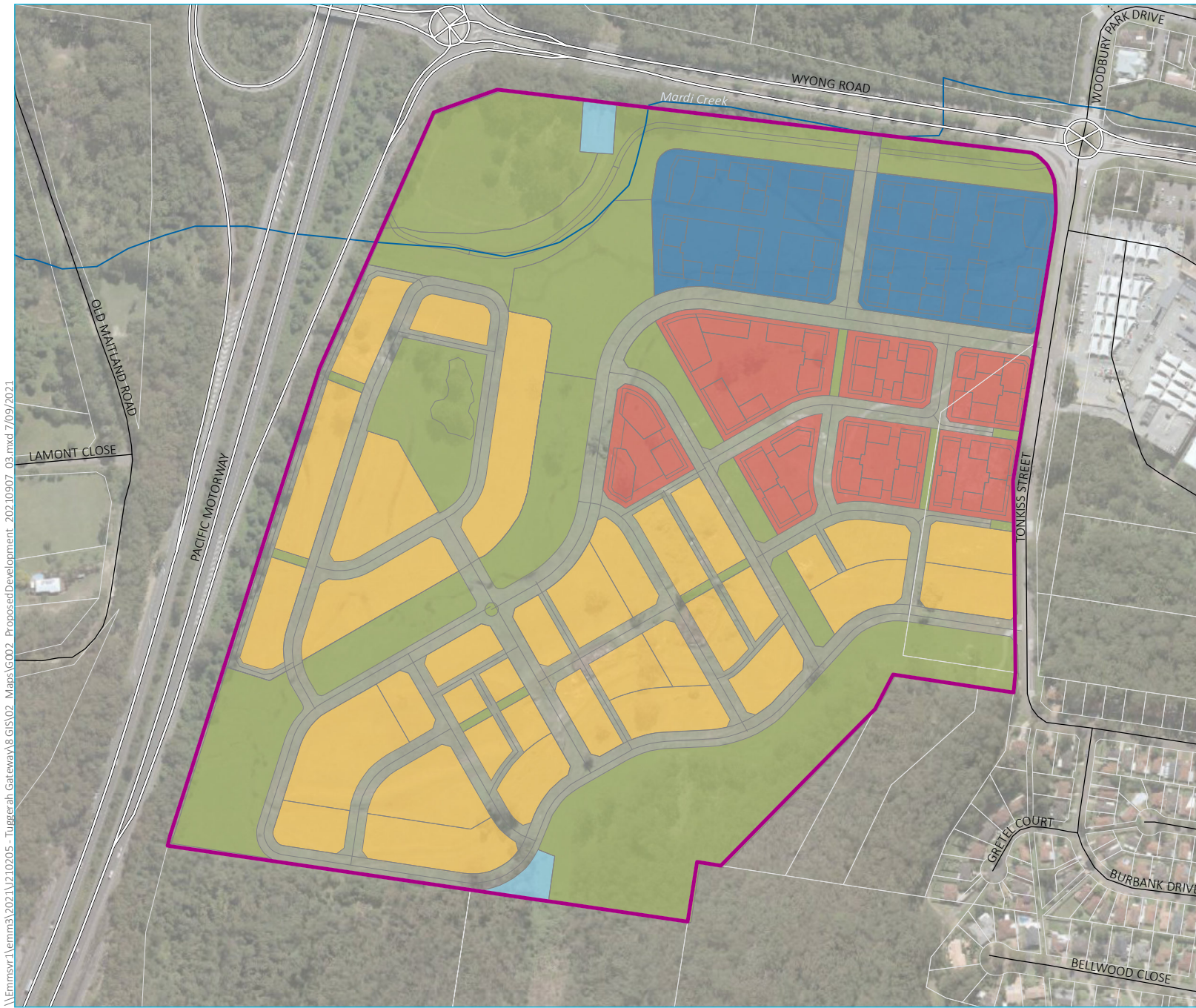
The planning proposal seeks to rezone land comprising (part) Lot 2 in DP 1056960 and Lot 3 in DP 1084221 from RU6 Transition to R1 General Residential. The MU1 zone in the north-east of the site and C2 Environmental Conservation zone in the south-east is to be retained.

The long-term development yield capable of being accommodated on the site comprises of 2,112 dwellings including mix detached housing lots, medium density townhouses/terraces, apartments and seniors living. Consistent with the structure plan, the future development of the site is to be staged in accordance with market demand and infrastructure requirements. In the short-term employment uses in the form of bulky goods / large format retailing will be prioritised in part of the MU1 zone. In the longer term this area is envisaged as a mixed-use precinct.

The structure plan is summarised by the following (refer to Figure 2.1):

- A natural lowland corridor runs from the southwest corner to the northwest corner of the subject site joining into Mardi Creek. There is an environmental conservation zone in the southeast corner of the site.
- Residential terraces are proposed along the western boundary facing the Pacific Motorway with detached residential standard lots to the east across internal roadways and designated active open space.
- Detached homes (standard and large lot) are located along the southern boundary, which follows through to higher density terrace homes, townhouses and duplexes through the development centre and onto Tonkiss Street frontages facing Westfield Tuggerah.
- Mid rise apartments, independent living and mixed use up to twelve stories is proposed in the northeast quadrant.
- Additional open space and public domain are provided via a linear park running from the conservation zone in the southeast, through active open space in the northwest and onto the rocky outcrop landscape landmark in the northwest corner of the subject site.

Vehicle access to the development will be via Wyong Road to the north and Tonkiss Street to the east. A left in left out arrangement is proposed for Wyong Road, with development traffic distribution through to Tuggerah via the Tonkiss Street/Wyong Road intersection.



- KEY**
- Project site
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Cadastral boundary
 - Proposed site layout
 - Detail
 - Detached/townhouse/terrace homes (2 storey)
 - High rise apartment/unit (3+ storey)
 - Mixed use (3+ storey)
 - Utilities
 - Open space and public domain

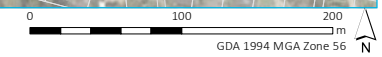
Proposed development and local context

Tuggerah Gateway
Noise and vibration impact assessment
Figure 2.1



\\Emmsvr1\emms3\2021\1\210205 - Tuggerah Gateway\18 GIS\02 Maps\G002 ProposedDevelopment_20210907_03.mxd 7/09/2021

Source: EMM (2021); MetroMap (2021); Urbis (2021); DFSI (2017)



3 Existing environment

3.1 Existing surrounding land uses

The site is generally surrounded by the following land uses:

- to the north of the site across Wyong Road:
 - environmental conservation areas to the north and northwest; and
 - residential zoning and public recreation areas to the northeast;
- to the east across Tonkiss Street:
 - Westfield Tuggerah;
 - public recreation and environmental conservation areas; and
 - dwellings within the residential zoning to the south east;
- to the south, public recreation and environmental conservation areas; and
- to the west, the Pacific Motorway with residential and environmental conservation areas beyond.

3.2 Site characteristics

The topography across the site is described as follows:

- the subject site is a gully formation from the southwest through to the northeast of the site;
- the Pacific Motorway to the west is elevated above the western portion of the site via steep embankment; and
- there is a large fill mound in the northeast corner of the site.

The embankment to the Pacific Motorway provides acoustic screening from road traffic noise for ground level areas of the subject site boundary. This screening effect would not be realised for multi-storey buildings and is evident in noise contour plots prepared for the subject site.

3.3 Existing acoustic environment

The acoustic environment across the site is categorised by high to moderate road traffic noise from the Pacific Motorway to the west and Wyong Road to the north.

The northern section of the eastern boundary of the site is directly across from the Westfield Tuggerah carpark. It is noted that a portion of the shopping centre's mechanical plant is also located within the carpark, approximately 120 metres (m) from the eastern boundary. Accordingly, some level of impact is expected due to existing industrial and commercial noise associated with the Westfield Tuggerah carpark and mechanical plant. It is expected that noise from the Westfield carpark will be largely masked by road traffic noise along Tonkiss Street.

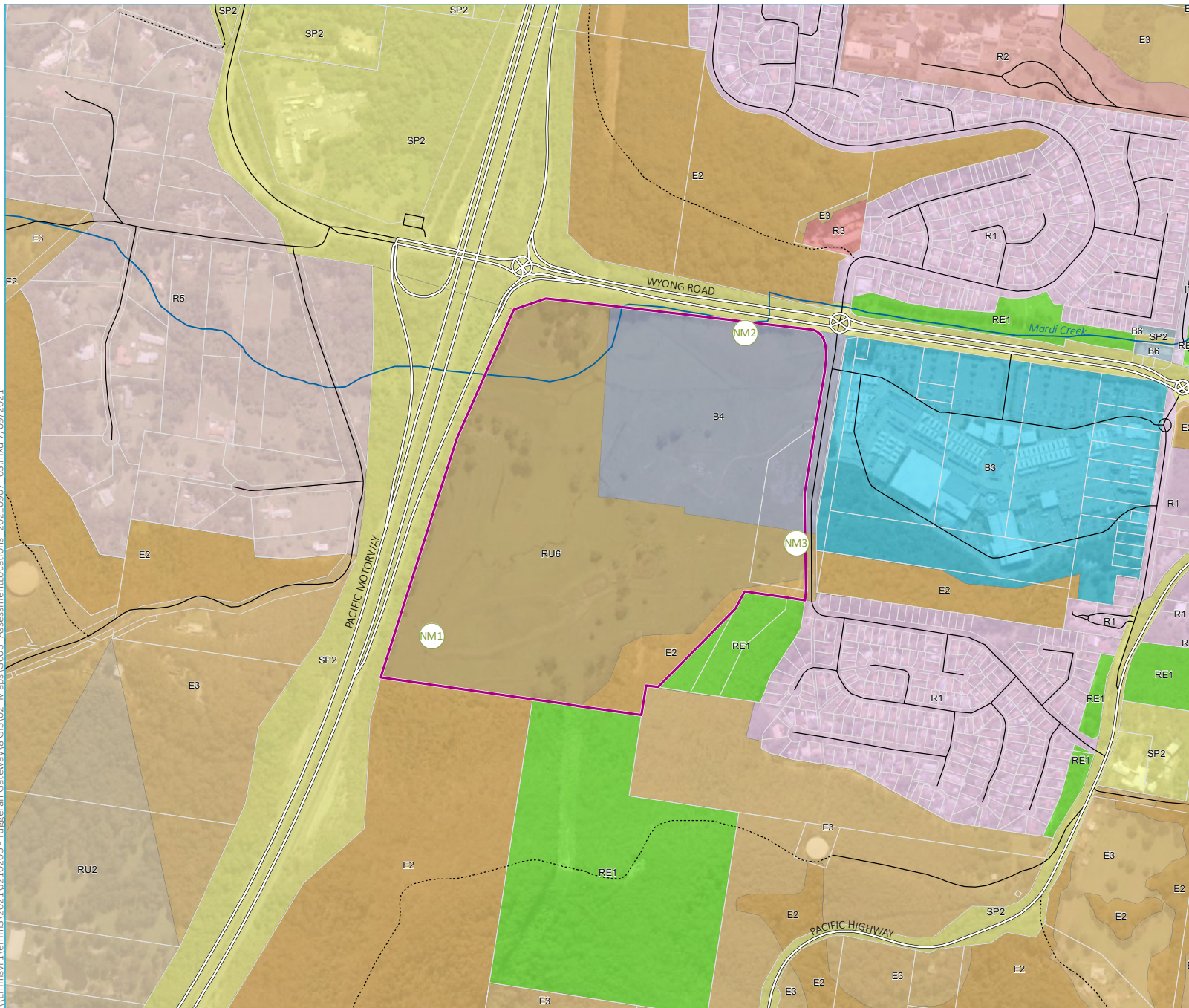
It is noted that the proponent has the capability as owner and operator of the Westfield Tuggerah to mitigate mechanical plant noise emanating from the Westfield car park should this be required.

3.4 Noise sensitive uses potentially impacted by the Project

The Project primarily consists of residential uses and as such direct noise impacts from such uses will be relatively minimal. Some mixed-use development has been allocated in the northeast quadrant of the subject site which may incorporate retail uses in the longer term, or bulky goods in the short to medium term. The details of such uses are unknown given the early stages of the Project planning.

Noise sensitive receivers which may be potentially impacted by these mixed-use zones would include the residential dwellings across Wyong Road to the north. It is noted that Wyong Road carries significant road traffic volumes, and these receivers would be subject to high road traffic noise levels. As such, noise impact from any reasonable retail uses will be unlikely to have any significant impact on these dwellings. Notwithstanding, the residential dwellings in this area would be subject of assessment in the event that noise producing tenancies (eg food and beverage) were to be proposed for the mixed use zone.

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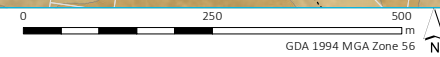


- KEY**
- NM# Noise monitoring location - unattended
 - Project site
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Cadastral boundary
- Land zone**
- Commercial core (B3)
 - Mixed use (formerly B4)
 - Enterprise corridor (B6)
 - Environmental conservation (formerly E2)
 - Environmental management (E3)
 - Light industrial (IN2)
 - General residential (R1)
 - Low density residential (R2)
 - Medium density residential (R3)
 - Large lot residential (R5)
 - Public recreation (RE1)
 - Rural landscape (RU2)
 - Transition (RU6)
 - Infrastructure (SP2)

Surrounding uses and noise monitoring positions

Tuggerah Gateway
Noise and vibration impact assessment
Figure 3.1

Source: EMM (2021); MetroMap (2021); DFSI (2017); DPE (2017)



3.5 Ambient noise survey

To establish the existing ambient noise environment of the area, unattended noise surveys and operator-attended aural observations were conducted at monitoring locations as guided by the procedures described in Australian Standard AS 1055-1997 - Acoustics - Description and Measurement of Environmental Noise.

Noise monitoring was conducted at two locations on the site to establish road traffic noise levels impacting the development. Additional noise monitoring was conducted in the southeast quadrant of the site to establish background noise levels in the vicinity of the nearest noise sensitive receivers to the development along Tonkiss Street, Tuggerah.

The monitoring locations selected are presented in Table 3.1 and shown in Figure 3.1.

Table 3.1 Noise monitoring locations

Monitor ID	Equipment type and serial number	Period of measurement	Monitor location	GDA Coordinates MGA 56 ¹	
			Address	Easting	Northing
NM1	ARL NGARA, 878007	27 April to 3 May 2021	Southwest quadrant of the development site, approximately 60 m from western boundary	351731	6313646
NM2	ARL NGARA, 87802E	27 April to 3 May 2021	Northeast quadrant of the development site, approximately 16 m from the northern boundary	351173	6313107
NM3	Svantek 977A, 59681	27 May to 9 September 2021	Southeast quadrant of the site, approximately 17 m from the eastern boundary	351823	6313272

Notes: 1. Geocentric Datum of Australia (GDA) 94 - Map Grid of Australia (MGA) Zone 56

The noise loggers were programmed to record statistical noise level indices continuously in 15-minute intervals, including the L_{Amax} , L_{A1} , L_{A10} , L_{A50} , L_{A90} , L_{A99} , L_{Amin} and the L_{Aeq} . Calibration of all instrumentation was checked prior to and following monitoring. All equipment carried appropriate and current National Association of Testing Authorities (NATA) (or manufacturer) calibration certificates.

A summary of existing background and ambient noise levels is given in Table 3.2. Results are provided for each day in Table 3.2.

Table 3.2 Summary of existing background and ambient noise

Monitoring location	Period ¹	Rating background level (RBL) ² , dBA	Measured L _{Aeq, period} noise level ³ , dBA
NM1 Southwest quadrant ⁴	Day	53	62
	Evening	47	54
	Night	41	53
NM2 Northeast quadrant ⁴	Day	57	66
	Evening	50	60
	Night	39	58
NM3 Southeast quadrant	Day	51	55
	Evening	49	54
	Night	43	53

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am, Sunday to Friday and 10 pm to 8 am Saturday and public holidays.
 2. The RBL is an NPfI term and is used to represent the background noise level.
 3. The energy averaged noise level over the measurement period and representative of general ambient noise.
 4. Noise monitoring location selected for measuring road traffic noise.

For the review and assessment of road traffic noise levels, Table 3.3 provides a summary of the measured day L_{Aeq,15hr} and night L_{Aeq,9hr} noise levels for measurement locations NM1 and NM2.

Table 3.3 Summary of existing traffic noise levels

Monitoring location	Measured L _{Aeq,15hr} Noise Level, dB	Measured L _{Aeq,9hr} Noise Level, dB
NM1	57	55
NM2	64	60

Note: Road traffic noise levels have been taken as the logarithmic average during weekdays.

4 Assessment criteria

4.1 Road traffic noise intrusion

There are no specific requirements for traffic noise contained within the Wyong Development Control Plan 2013 (WDCP). As such, traffic noise has been addressed against the Infrastructure SEPP.

4.1.1 Infrastructure SEPP

Clause 102 of the Infrastructure SEPP details specific noise requirements for traffic noise intrusion into sensitive noise receivers. The requirements of Clause 102 are provided as follows:

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

- (1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of RMS) 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.
- (2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this clause and published in the Gazette
- (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 dB(A) 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 dB(A) at any time.

4.1.2 Development near Rail Corridors and Busy Roads – Interim Guidelines

The guideline issued by the secretary for the purposes of Clause 102 is the Department of Planning (DoP) 2008, *Development near Rail Corridors and Busy Roads – Interim Guideline* ('the guideline').

The guideline assists in the planning, design and assessment of development in or adjacent to, rail corridors and busy roads and supports the Infrastructure SEPP. The guidelines are mandatory for residential developments proposed adjacent to busy roads with an Annual Average Daily Traffic (AADT) of greater than 20,000 vehicles.

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

The guideline includes specific provisions to address internal noise levels under naturally ventilated conditions and nominates the following:

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

This equates to a noise target of 45 dB, $L_{Aeq,9hr}$ for bedrooms at night and 50 dB, $L_{Aeq,15hr}$ for other habitable spaces during the daytime.

Section 3.8 of the guideline provides guidance on best practice planning, orientation and design measures which may be employed to minimise road noise impact.

It is noted that there are no specific requirements which would preclude residential development adjacent to busy road corridors on the proviso that internal noise level requirements can be met.

4.1.3 Road traffic noise objectives

Road traffic noise impacts from the Pacific Motorway and Wyong Road have been assessed against the requirements of infrastructure (SEPP) and the guideline. Road traffic noise objectives for the project are summarised in Table 4.1.

Table 4.1 Road traffic noise objectives

Development use	Internal use	Internal noise objective, dB (windows closed)		Internal noise objective (naturally ventilated conditions)	
		$L_{Aeq,15hour}$	$L_{Aeq,9hour}$	$L_{Aeq,15hour}$	$L_{Aeq,9hour}$
Residential	Bedroom	40	35	50	45
	Other habitable rooms ¹	40	40	50	50

Notes: 1. Excluding garages, kitchens, bathrooms and hallways

Internal noise objectives with windows closed can be achieved with the acoustic design of the building envelope (ie façade, roof and openings).

Internal noise objectives under naturally ventilated conditions requires consideration to noise ingress through open windows. A 10 dB reduction will typically be afforded across a window open sufficient to satisfy naturally ventilated conditions as per the BCA.

Accordingly, an external road traffic noise target 10dB higher than the internal noise objectives provided in Table 4.1 under naturally ventilated conditions would apply (ie 60 dB $L_{Aeq,15hour}$ and 55 dB $L_{Aeq,9hour}$). Where this noise level cannot be satisfied due to high external noise levels, alternative means of ventilation should be provided such that windows can be closed.

4.2 Construction noise and vibration

The Interim Construction Noise Guideline (ICNG) (DECC 2009) has been jointly developed by NSW Government agencies including the EPA and Department of Planning, Industry and Environment (DPIE). The objectives of the guideline relevant to the planning process are to promote a clear understanding of ways to identify and minimise noise from construction and to identify ‘feasible’ and ‘reasonable’ work practices.

The guideline recommends standard construction hours where noise from construction activities is audible at residential premises (ie assessment locations):

- Monday to Friday 7.00 am to 6.00 pm;
- Saturday 8.00 am to 1.00 pm; and
- no construction work is to take place on Sundays or public holidays.

The ICNG acknowledges that works outside standard hours may be necessary, however, justification should be provided to the relevant authorities.

The ICNG provides two methodologies to assess construction noise emissions. The first is a quantitative approach, which is suited to major construction projects with typical durations of more than three weeks. This method requires noise emission predictions from construction activities at the nearest assessment locations and assessment against ICNG recommended noise levels.

The second is a qualitative approach, which is a simplified assessment process that relies more on noise management strategies. This method is suited to short-term infrastructure and maintenance projects of less than three weeks.

Given there is no proposed construction as part of this application, only construction noise objectives for the development have been outlined as per the ICNG. It is expected that a quantitative approach to assessing construction noise as part of future development applications would be undertaken.

Table 2 of the ICNG provides guidance on establishing noise management levels (NML) for residential receivers during standard hours and has been reproduced in Table 4.2.

Table 4.2 ICNG residential NMLs

Time of day	NML $L_{Aeq,15min}$	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 $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
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	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Source: ICNG (DECC, 2009).

Table 4.3 summarises noise management levels for non-residential land uses as defined in the ICNG.

Table 4.3 ICNG noise management levels at other land uses

Land use	Management level, $L_{Aeq,15\text{ minute}}$
Active recreation	65
Passive recreation	60
Offices and retail outlets	70

Source: ICNG (DECC, 2009).

4.3 Operational noise

Operational noise as part of the development will typically be associated with commercial and retail uses in the mixed use zone within the subject site northeast quadrant. The specific uses within this mixed-use zone is unknown at this stage, however potential limitations on typical noise generating uses is discussed in Section 6.2. Noise emission criteria which would typically apply to such uses is discussed in this section.

Acoustic requirements pertaining to potential road traffic noise generation due to the development generated traffic are provided in this section.

4.3.1 Noise from commercial and retail uses within the development

Noise from commercial and retail uses or processes in NSW is regulated by the local council, DPIE and/or the EPA, through a licence and/or development consent conditions stipulating noise limits. These limits are typically derived from project specific trigger or operational noise levels predicted at assessment locations. They are based on EPA guidelines (ie NPfl) or noise levels that can be achieved by a specific site following the application of all feasible and reasonable noise mitigation.

The objectives of noise trigger levels for commercial or industrial use established in accordance with the NPfl are to protect the community from excessive intrusive noise and preserve amenity for specific land uses. It should be noted that the audibility of a noise source does not necessarily equate to disturbance at an assessment location.

To ensure these objectives are met, the EPA provides project specific noise trigger levels, namely intrusiveness and amenity.

i Intrusiveness noise levels

The intrusiveness noise levels require that $L_{Aeq,15min}$ noise levels from the site during the relevant operational periods do not exceed the RBL by more than 5 dB. It is noted that intrusiveness noise levels are only applicable at residential assessment locations.

ii Amenity noise levels

The assessment of amenity is based on noise levels specific to the land use. In the context of the site, noise levels relate only to commercial sources and exclude road or rail traffic noise. Where the measured existing commercial/industrial noise approaches recommended amenity noise levels, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise such that amenity noise levels are exceeded.

To ensure that commercial/industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level for a new commercial development is the recommended amenity noise level (outlined in Table 2.2 of the NPfl) minus 5 dB. It is noted that this approach is based on a receiver being impacted by multiple commercial or industrial sites (or noise sources).

Residential assessment locations in the vicinity of the site would be categorised as follows:

- dwellings along Tonkiss Street to the southeast of the subject site would be considered suburban; and
- dwellings fronting Wyong Road to the north of the subject site would be considered urban given proximity to a major roadway with continuously heavy and continuous traffic flows during peak periods.

Existing commercial use in the vicinity of the dwellings along Tonkiss Street would include Westfield Tuggerah. Being the only source of existing industrial/commercial noise in the vicinity of these dwellings, a 3 dB correction to amenity noise levels to account for existing industrial/commercial noise sources would be reasonable. This is the case also for dwellings across Wyong Road. Accordingly, a -3dB correction has been made to the amenity noise levels.

The amenity noise level for residential assessment locations are presented in Table 4.4.

Table 4.4 Project amenity noise levels

Residential assessment location	Time period ¹	Indicative area	Project amenity noise level ² dB, L _{Aeq,period}
Tonkiss Street residences	Day	Suburban	52
	Evening		42
	Night		37
Wyong Road residences	Day	Urban	57
	Evening		47
	Night		42

Source: NPfl (EPA 2017)

- Notes:
1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am Monday to Saturday; 10 pm to 8 am Sundays and public holidays.
 2. Project amenity noise level is Amenity noise level (Table 2.2 of NPfl) -3dB in accordance with NPfl Section ii.

4.3.2 Development generated road traffic noise

Potential noise impacts resulting from development generated road traffic on public roads is assessed against criteria defined in the NSW Road Noise Policy (RNP). The application of appropriate road traffic noise criteria for the planning proposal has followed the two-step process identifying the assessment and relative increase criteria as outlined in Section 3.4.1 of the RNP.

The RNP requires that the traffic generated by the development be addressed in accordance with the relative increase criteria provided in Table 6 of the RNP and reproduced in Table 4.5 below.

Table 4.5 RNP relative increase criterion

Road category	Type of project/development	Total traffic noise level increase – dB(A)	
		Day (7 am–10 pm)	Night (10 pm–7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic LAeq, (15 hour) + 12 dB (external)	Existing traffic LAeq, (9 hour) + 12 dB (external)

For the relative increase assessment, the total traffic noise impact on residential receivers is assessed against the traffic generating development criterion provided in Table 3 of the RNP reproduced in Table 4.6 below.

Table 4.6 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB	
		Day (7 am–10 pm)	Night (10 pm–7 am)
Freeway/arterial/sub-arterial roads	1. Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	L _{Aeq,15hour} 60 (external)	L _{Aeq,9hour} 55 (external)

Table 4.6 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB	
		Day (7 am–10 pm)	Night (10 pm–7 am)
Local roads	6. Existing residences affected by additional traffic on existing local roads generated by land use developments.	L _{Aeq,1hour} 55 (external)	L _{Aeq,1hour} 50 (external)

Table 4.7 was reproduced from Table 4 of the RNP and provides relevant noise management levels for non-residential land uses that have been identified in the area.

Table 4.7 Road traffic noise assessment criteria for non-residential land uses

Existing sensitive land use	Assessment criteria, dB		Additional considerations
	Day (7 am–10 pm)	Night (10 pm–7 am)	
Open space (active use)	L _{Aeq,15hour} 60 (external)	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg playing chess, reading).
Open space (passive use)	L _{Aeq,15hour} 55 (external)	-	In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, eg school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB where all feasible and reasonable noise mitigation is considered.

5 Road traffic noise impacting potential site uses

This section addresses potential road traffic noise impacts associated with the future developed Project. Road traffic noise impacts from the Pacific Motorway to the west and Wyong Road to the north on future uses within the subject site are discussed in this section.

5.1 Assessment under the Infrastructure SEPP

Traffic volumes for roads exceeding 20,000 vehicles per day are provided on the RMS website. The section of Wyong Road and the Pacific Motorway adjoining the site is provided on Map 5 of the TMS data and has been included in Appendix B herein.

Traffic volumes along the Pacific Motorway and Wyong Road are 20,000 AADT or greater and as such require assessment.

5.2 Method

Road traffic noise has been calibrated using noise measurements conducted at the site and a SoundPlan™ noise model incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithm, developed by the UK Department of Transport.

The CoRTN algorithm incorporates consideration of traffic flow volume, average speed, percentage of heavy vehicles, and road gradient to establish noise source strength, and includes attenuation via spherical spreading (or cylindrical in the case of a line source such as a road), soft ground, atmospheric absorption and screening from buildings or barriers.

SoundPlan noise modelling software was used to develop a noise calculation model based on the above method for existing traffic conditions. Road traffic noise levels were predicted for day (7.00 am to 10.00 pm) and night (10.00 pm to 7.00 am) periods.

The road traffic noise model was calibrated to the road traffic noise levels measured at NM1 and NM2 and therefore provides a valid representation of existing road traffic noise levels across the development.

The concept plan includes multi-storey development along the western boundary of the subject site. The topography at this location falls away from the Pacific Motorway which provides screening affects to ground level receiver locations. Dwellings located on upper floors of the development will have a direct line of sight to the Pacific Motorway and as such road traffic noise levels are expected to be higher. Accordingly, road noise contours have been provided at 1.5 m above ground and 7.5 m above ground representing ground level receivers and second level (ie two levels above ground) receivers.

5.3 Traffic volumes

Road traffic volumes have been adopted from the following sources:

- TfNSW counting station F3WFY006 for the Pacific Motorway located 20 m east of Reeves Street, Somersby;
- TfNSW counting station 05007 for the Pacific Motorway located 300 m south of Yarramalong Road, Wyong;
- TfNSW counting station 05161 for Wyong Road located 170 m west of Gavenlock Road, Tuggerah; and

- Ason Group 2021, *Tuggerah Gateway Precinct Rezoning Pre-Gateway - Transport Assessment* prepared for Scentre Group Limited.

The traffic counter at Somersby includes heavy vehicle counts and as such has been used to estimate heavy vehicle percentages along the Pacific Motorway adjacent to the subject site. The traffic counter at Wyong includes counts between 2006 and 2016 which have been used for road traffic volumes within the road noise model. The growth during this period has been used to determine approximate 2021 traffic volumes for the Pacific Motorway.

Road traffic volumes for Wyong Road have been adopted from the peak hour counts provided in the Ason Group (2021) report. The AADT has been approximated by using the industry accepted estimate of ten times the peak hour count. The $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ volumes have been approximated using the 24-hour data logging during the 2010 count at the TfNSW Wyong Road counting station 05161.

Traffic volumes modelled in the traffic noise assessment are provided in Table 5.1.

Table 5.1 Modelled road traffic volumes and assumptions

Road	Direction	2021 traffic volumes		Speed limit (km/h)
		AADT	%HV	
Pacific Motorway	Northbound	37531	15.9	110
	Southbound	39875	15.7	110
Wyong Road	Eastbound	15560	3.6	70
	Westbound	15560	3.6	70

5.4 Noise modelling results

Noise modelling has been conducted based on the volumes presented in Table 5.1 for day and night periods. Noise contour plots are provided in Appendix A.

Modelled road traffic noise levels have been compared to measurements conducted at noise monitoring locations NM1 and NM2 and are presented in Table 5.2.

Table 5.2 Calculated road traffic noise levels

Location	Roadway	Traffic noise level, dB $L_{Aeq\ 15\ hour}$			Traffic noise level, dB $L_{Aeq\ 9\ hour}$		
		Noise model	Measured	Difference	Noise model	Measured	Difference
NM1	Pacific Motorway	59.4	56.6	2.8	55.4	54.8	0.6
NM2	Wyong Road	65.7	63.6	2.1	59.8	59.7	0.1

A cursory review of road traffic volumes for the Pacific Motorway indicates a significant proportion of vehicle traffic during the day time period which is to be expected. Calculations of road traffic noise indicates a difference between the day ($L_{Aeq\ 15\ hour}$) and night ($L_{Aeq\ 9\ hour}$) traffic noise level of 4 dB.

However, the measured road traffic noise levels at NM1 (Pacific Motorway) indicates a difference between the $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ of 2 dB. This is significant in the fact that the difference between the modelled $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ levels do not correlate well with the difference between the measured $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ recorded on site. This discrepancy is not easily identifiable given the following:

- In other circumstances this could be attributed to other external extraneous noise sources (eg other contributing road ways, industrial noise, insects). However, observations on site indicated that there were no other obvious contributing noise sources which would generate levels in the order of those recorded at NM1 which may influence road traffic noise levels.
- Corrections for road surfacing or sound propagation would apply to both night and day and as such would not explain the identified difference between the day and night calculated noise levels (ie road noise propagation is the same for the day as it is for night).
- Whilst heavy vehicle traffic percentages are significantly higher during the night time period, this has been accounted for in the model.

It is noted that predicted noise levels during the night-time period calibrate well with measured noise levels, whilst modelled daytime levels appear to be overpredicted. For the purposes of this planning assessment, the conservative modelled noise levels have been adopted as a demonstration of compliance under a worst-case prediction.

It is noted that further noise measurements would be expected to be conducted as part of each individual development application for residences adjoining the Pacific Motorway and Wyong Road.

5.5 Assessment of noise impacts

An assessment of potential road traffic noise impacts on noise sensitive receptors within the development has been undertaken to demonstrate attainment of the internal noise level requirements of the Infrastructure SEPP.

Of note is the terrace housing zoned along the western boundary adjacent the Pacific Motorway. Given the proximity of this zone to the Pacific Motorway, proof of concept at this location will be representative of the site as whole.

To aid in this, a hypothetical 2-storey block has been incorporated into the noise model to identify likely façade noise levels impacting this location. This model will be used to discuss potential mitigation measures which may be employed to meet road traffic noise targets.

Two storey terraces along the western boundary will act as acoustic barriers to the residential dwellings within the site. The extent such incidental screening effects has not been specifically addressed but will inevitably occur where buildings provide a line-of-sight barrier between roadways and other residential dwellings. This is discussed in terms of 'barrier blocks' in Section 5.5.4.

5.5.1 Noise model

An example terrace block has been incorporated into the model for the two storey terraces along the western boundary as indicated in Figure 5.1. The building block has been set back 12 m from the boundary consistent with planning advice from Urbis.

The terraces will be separated from the western boundary via a laneway which will provide access to the terrace dwellings and as emergency fire access. The building block does not consider best practice internal spatial planning (ie locating habitable spaces toward quieter facades screened from the road way; in this instance the eastern façade). It is noted however that given the access laneway, driveways and garages are likely to be located on the western façade exposed to traffic. Discussion to this effect and other best practice spatial planning is provided in Section 6.

A façade noise model has been prepared which illustrates road traffic noise levels along the building façade. Road traffic noise levels for the $L_{Aeq\ 15hour}$ and $L_{Aeq\ 9\ hour}$ have been presented in Figure 5.2 to Figure 5.5.



Figure 5.1 Proof of concept - example terrace block

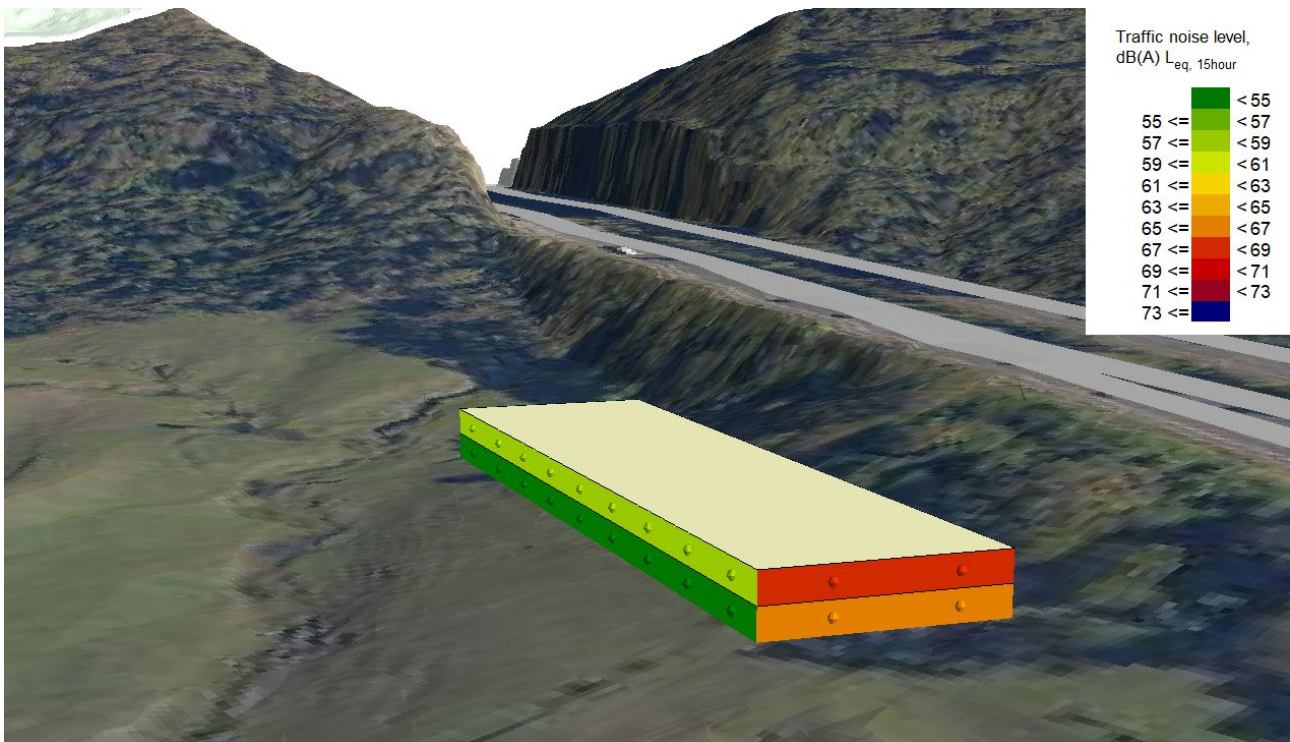


Figure 5.2 Road noise – façade noise levels (day) north and eastern facades

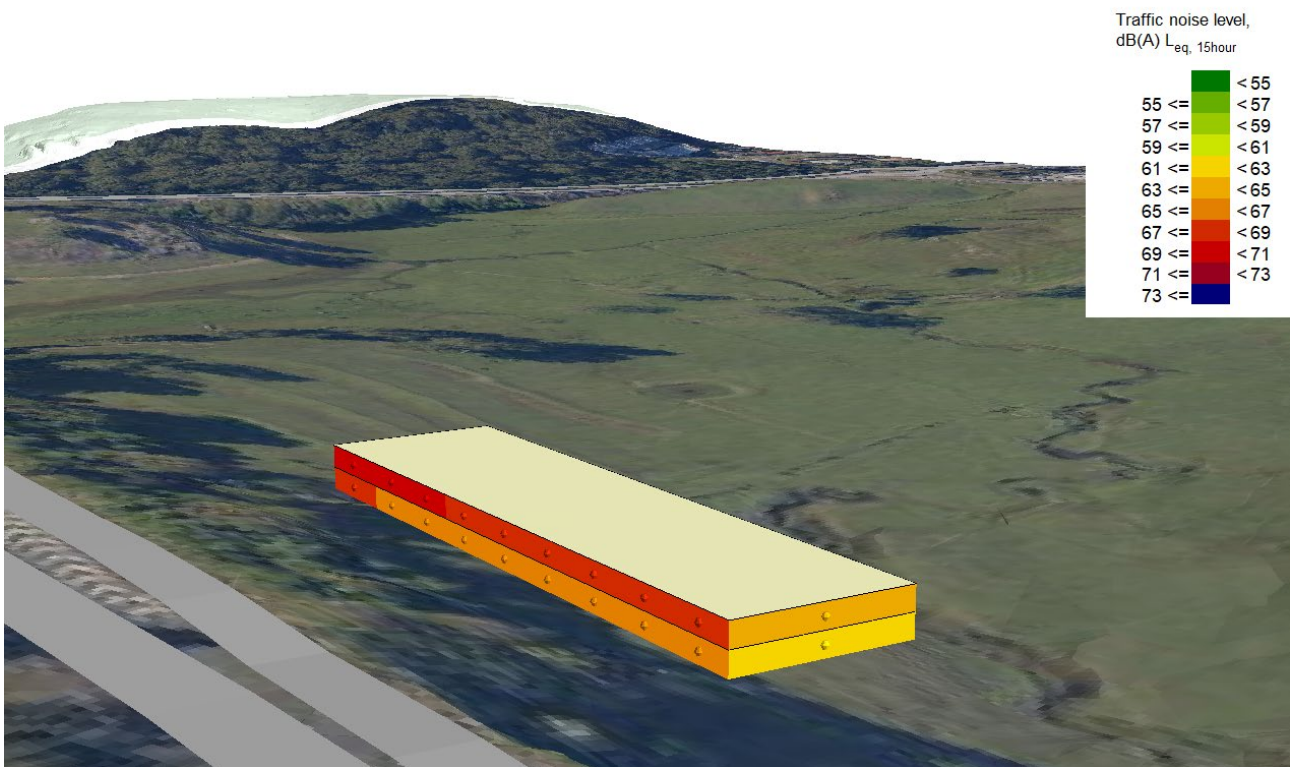


Figure 5.3 Road noise – façade noise levels (day) south and western facades

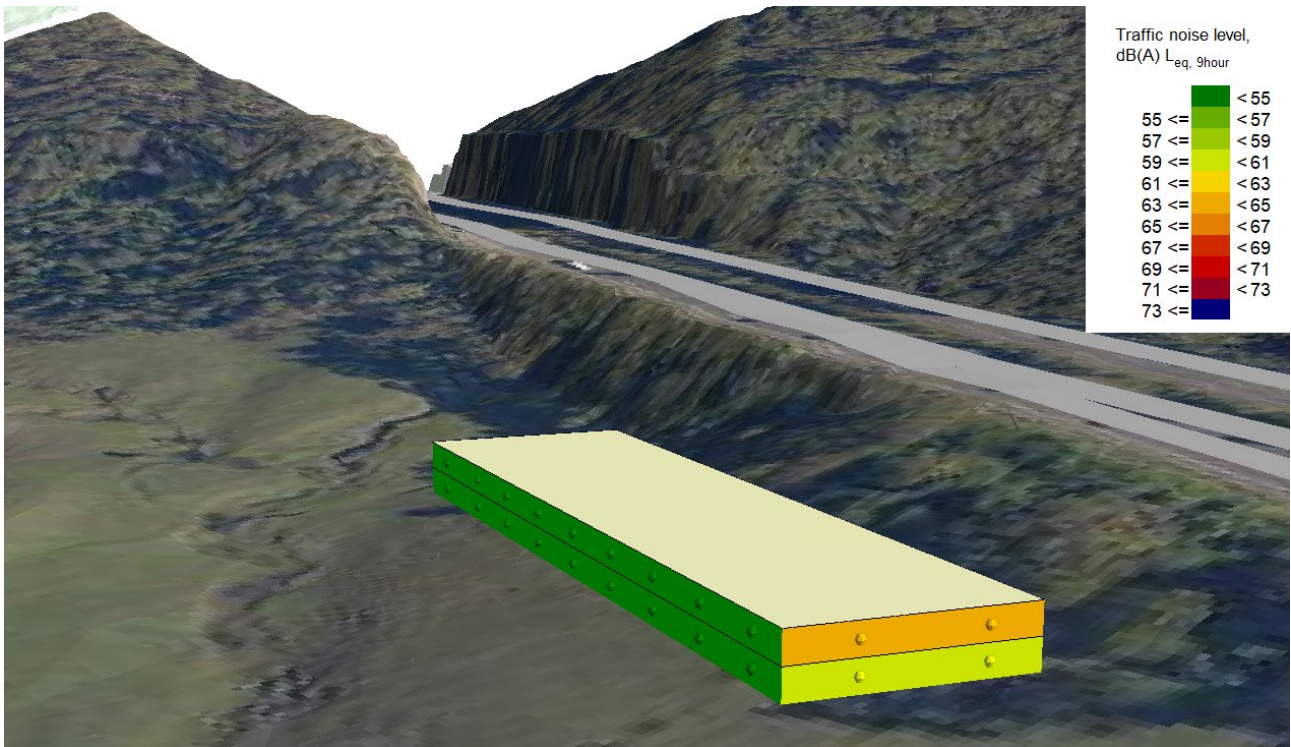


Figure 5.4 Road noise – façade noise levels (night) north and eastern facades

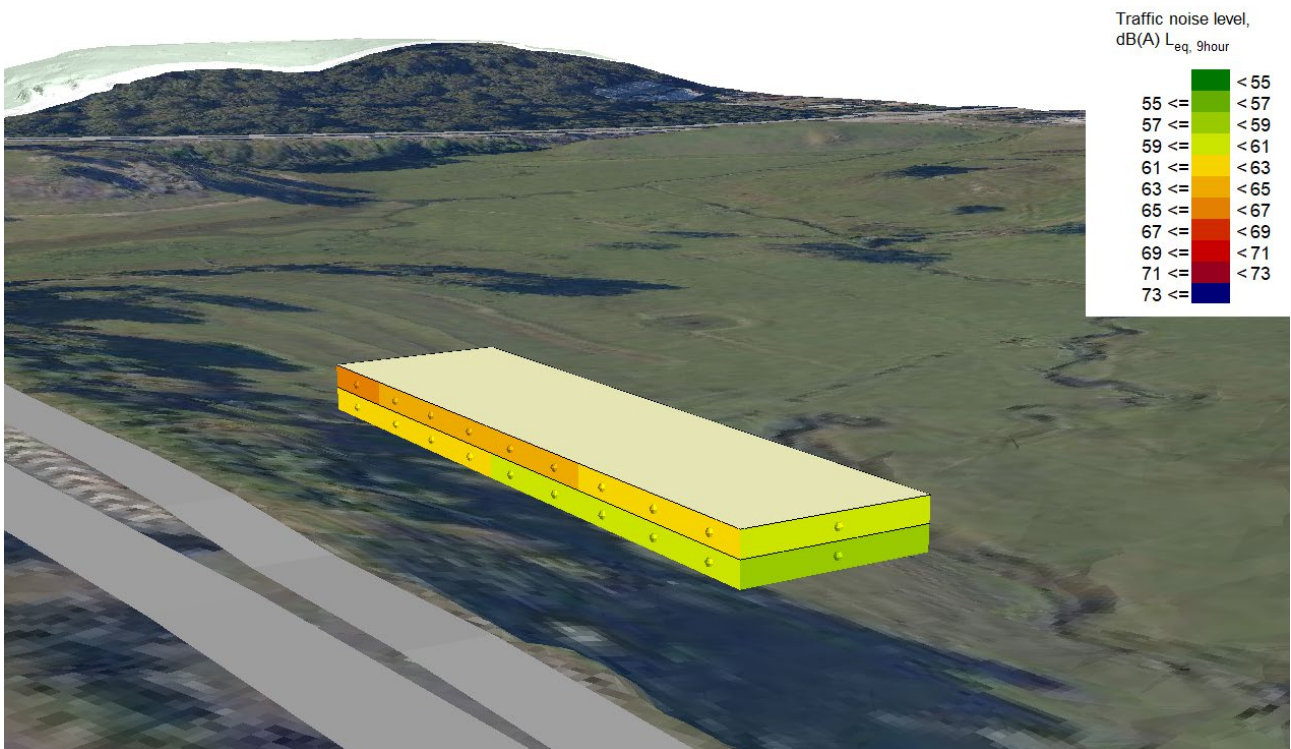


Figure 5.5 Road noise – façade noise levels (night) south and western facades

5.5.2 Worst case façade noise levels

The worst-case noise level on each façade has been summarised in Table 5.3. The required noise reduction to meet the internal traffic noise targets has also been provided for each façade based on the highest calculated noise level.

Table 5.3 Worst case required façade noise reduction

Façade	Worst case façade noise level, dB	Internal noise objective, dB	Worst case façade noise level, dB	Internal noise objective, dB	Required traffic noise reduction (TNR) ¹
	L _{Aeq} 15hour	L _{Aeq} 15hour	L _{Aeq} 9hour	L _{Aeq} 9hour	
West	70	40	66	35	31
North	68	40	64	35	29
East	58 ²	40	54 ²	35	19
South	64	40	60	35	25

Notes: 1. Required TNR to satisfy both day and night time criteria.
2. Noise levels would be substantially less with the incorporation of an eave.

To satisfy natural ventilation requirements, the external noise level should not exceed 60 dB L_{Aeq} 15hour and 55 dB L_{Aeq} 9hour. Calculated noise levels on the eastern façade of the building will satisfy this requirement.

The assessment of the example apartment block along the western boundary indicates the following:

- the west, north and south facades would require additional acoustic treatment to satisfy internal noise targets. Acoustic treatments to satisfy this are discussed in Section 5.5.3;
- habitable rooms on the west, north and south facades would require an alternative means of ventilation given that windows would be required to be closed to satisfy internal noise requirements; and
- standard building constructions could be adopted for the eastern façade. Windows could be kept open to satisfy the natural ventilation requirements provided in the DoP guideline.

5.5.3 In-principle treatments

The following treatments would be recommended in principle to satisfy the internal noise requirements.

i Walls

Walls could be constructed of a brick, concrete or masonry construction. Light weight walls and in-fills would require additional acoustic treatment.

ii Roof / ceiling

A concrete roof would satisfy internal noise requirements. A light-weight sheet metal roof or similar would require additional acoustic treatment to the ceiling beneath and the introduction of acoustic insulation within the ceiling cavity.

iii Glazing

Typical glazing constructions needed to satisfy internal noise requirements are provided in Table 5.4.

Table 5.4 In-principle glazing construction

Facade	Room	Glazed area	Recommended glazing construction ¹
West	Bedroom (10m ²)	< 1.6m ²	8.38mm laminate (Rw 33)
		1.6m ² to 3.2m ²	10.38mm laminate (Rw 35)
	Living (50m ²)	< 7m ²	8.38mm laminate (Rw 33)
		7m ² to 12m ²	10.38mm laminated (Rw 35)
North	Bedroom (10m ²)	< 1.6m ²	6.38mm laminate (Rw 31)
		1.6m ² to 3.2m ²	10.38mm laminate (Rw 35)
	Living (50m ²)	< 7m ²	6.38mm laminate (Rw 31)
		7m ² to 12m ²	8.38mm laminate (Rw 33)
South	Bedroom (10m ²)	< 1.6m ²	5mm float (Rw 28)
		1.6m ² to 3.2m ²	5mm float (Rw 28)
	Living (50m ²)	< 7m ²	5mm float (Rw 28)
		7m ² to 12m ²	5mm float (Rw 28)

Notes: 1. Glazing constructions are indicative only and have been provided for proof-of-concept purposes.

5.5.4 Discussion

An assessment of calculated road traffic noise levels at the development façade indicates that the building fabric can be suitably treated to mitigate road traffic noise impacts for all internal uses (ie bedrooms and living spaces) based on the worst case façade facing the Pacific Motorway. Further best practice design principles are provided in Section 5.6 to further mitigate road traffic noise levels.

5.6 Options for consideration

Best practice planning for residential development adjacent busy roads and rail corridors is provided in Section 3.8 of the DoP guideline. The recommendations of the guideline with regard to best practice acoustic design and planning is summarised as follows:

- where multiple structures are proposed on a development site, ‘barrier blocks’ may be utilised which may consist of multi-level residential buildings to screen low set residential dwellings. In the context of the proposal, this has been instituted as the terrace homes along the western boundary which provides screening to the detached homes, townhouses and terraces to the east. It is noted that the noise contours appended herein ignore screening benefits of possible buildings on the western boundary to simulate worst case (eg due to gaps) implications for proposed uses to the east;
- locating non-sensitive rooms ‘service rooms’ such as garages, kitchens, corridors, laundries and bathrooms along facades directly impacted by high external noise levels. In context with the subject site, this could entail incorporating garages and entry ways to the laneway, with balconies and backyards facing out to the east; and
- incorporating winter gardens. This may not be required in this instance given the eastern façade of the development (which may incorporate balconies and backyards) is sufficiently screened from the Pacific Motorway. However, balconies may be included for mixed use developments along Wyong Road which will also be impacted by road traffic noise.

6 Assessment of operational noise impacts

6.1 Operational noise sources

Operational noise impacts have been addressed in principle for potential commercial and retail uses in the northeast quadrant of the site adjoining Tonkiss Street and Wyong Road (refer Figure 6.1). Given the early planning stages of the development, commentary has been provided for these uses to inform the design and highlight any potential limitations on specific retail uses. This has been addressed for bulky goods in the short to medium term and entertainment and food and beverage tenancies as a worst case for the long term.

Potential increases in road traffic noise on surrounding streets due to site generated traffic has also been addressed.

6.2 Commercial and retail uses

The mixed-use zones in the northeast quadrant of the subject site will likely include bulky goods in the short term and retail uses in the long term. With regard to potential noise impact, we note:

- noise from bulky goods (short term planning) will typically be associated with carparking and loading dock areas which should be considered in context with noise sensitive uses; and
- entertainment (ie licensed venues) and food and beverage tenancies (long term planning) will typically include some form of outdoor seating which should be considered in the planning of these developments.

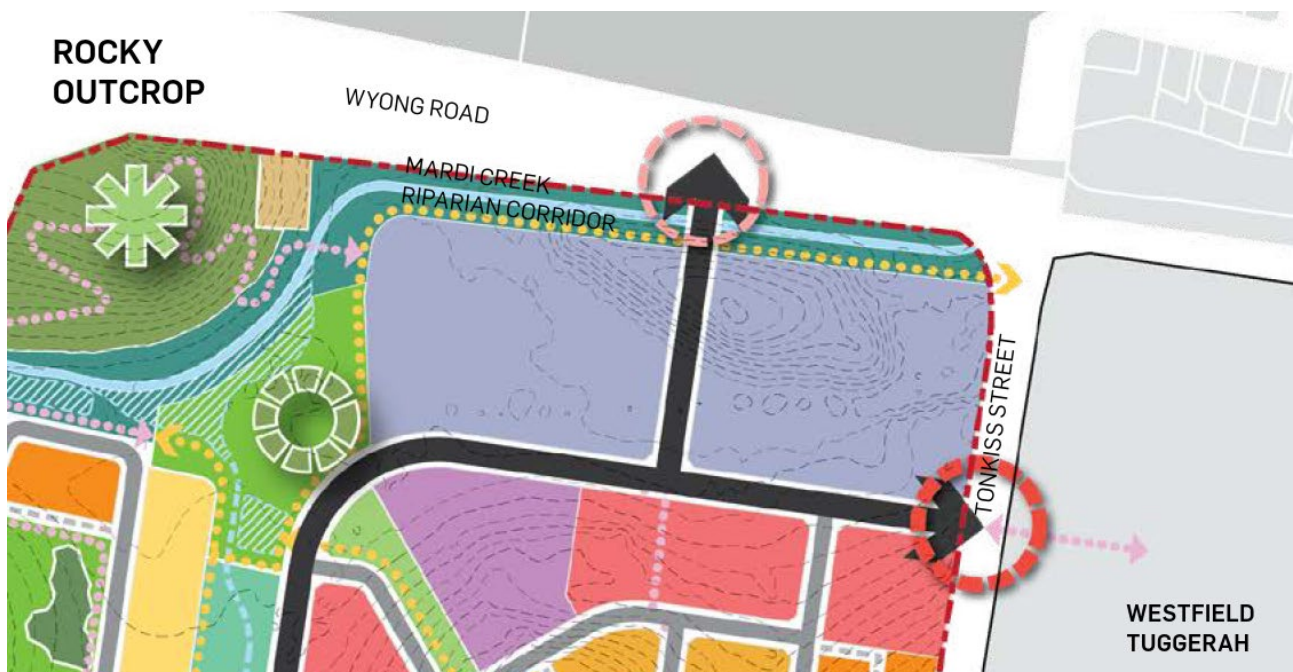


Figure 6.1 Commercial and retail development within mixed use zones

In the short term, bulky goods uses are likely to be incorporated. In this regard we note the following:

- parking lots should be located to minimise potential noise impacts to residential uses. In the context of the site, this would be toward the north facing Wyong Road which would be screened from the medium rise buildings to the south;
- the location of loading docks should also be considered. It may not be desirable to have loading docks to street frontages and as such could be incorporated to the west facing the active open space and the central roadway between the two mixed use blocks; and
- mechanical plant, particularly roof mounted types, would likely be visible from the medium rise apartments to the south. As such, mechanical plant should be located as far to the north as practical to maximise distance to apartment blocks which may overlook the roof.

In the long term, ground floor retail may be considered. In this regard we note the following:

- activation of street frontages to Wyong Road may be a desired outcome. Given the high noise environment, outdoor seating in this location would be plausible. It is noted that additional screening may be desirable (although not necessary) to reduce road traffic noise impacts on outdoor seating and dining areas in these locations;
- the western side of the mixed-use zone faces out into public greenspace and conservation areas which would be minimally affected by entertainment, food and beverage uses particularly during the evening and night time period;
- the southern side of the mixed-use zone faces onto mid rise apartment and independent living units which may be affected by patron noise from outdoor seating areas. This should be considered when planning retail uses for this area;
- the eastern side faces onto Tonkiss Street and Westfield Tuggerah beyond which, like the western aspect, would be minimally affected by entertainment, food and beverage uses; and
- a main roadway through to Wyong Road will split the two mixed use zones. Outdoor seating in these locations may be problematic due to residential dwellings in the opposing mixed-use building.

Dwellings will likely be incorporated above such uses with balconies which may face out over outdoor seating areas. In this regard, solid awnings (eg glazed awnings) should be considered where such seating areas are employed.

6.3 Road traffic noise generated by the Site

This section addresses potential road traffic noise from the proposed development of the Site impacting other land uses.

The proposed development will generate additional traffic movements which will increase the level of traffic noise emanating from Tonkiss Street and Wyong Road. An increase in road traffic noise due to the development has been assessed against the requirements of the RNP as discussed in Section 4.3.2. It should be noted that the changes in road traffic volumes and possible related effects are likely to be gradual as the Site is developed over time.

The RNP addresses traffic noise generated by a development in two ways discussed as follows:

- cumulative traffic noise levels from existing traffic volumes and that generated by the development are compared against the relative increase and planning noise levels provided in Table 3 and Table 4 of the RNP

(Table 4.6 Road traffic noise assessment criteria for residential land uses and Table 4.7 Road traffic noise assessment criteria for non-residential land uses of this report); and

- where existing traffic noise levels exceed the relative increase criteria or planning noise levels of the RNP, any additional increase in total traffic noise level should be limited to 2 dB where all feasible and reasonable noise mitigation is considered.

Consideration of road traffic noise was considered for future traffic volumes potentially impacting residential dwellings along Wyong Road to the northeast of the site

The potential for increased road traffic noise due to development generated traffic has been addressed for future traffic volumes in the absence of the development (no-build) and with the development (build) as required by NSW EPA policy. Increases in road traffic noise level are to meet the maximum allowable increase criterion of 2dB as per the RNP.

Road traffic volumes have been adopted from the movement summaries provided in Appendix A of the Ason Group (2021) report. The peak hour projections have been utilised to approximate future increases in road traffic noise levels. Projected future road traffic volumes and associated increases in road traffic noise level due to development generated traffic are presented in Table 6.1.

Table 6.1 Projected increase in road traffic noise level

Road section	Time of day	Projected 2036 peak hour road traffic volumes (no-build)	Projected 2036 peak hour road traffic volumes (build)	Relative increase in road traffic noise level, dB L _{Aeq}
Wyong Road West	AM	1210	1310	+0.34
	PM	1841	2137	+0.65
Wyong Road East	AM	2335	2439	+0.19
	PM	1983	2292	+0.63

Projected increases in road traffic noise level along Wyong Road is expected to be below the maximum permissible increase of 2dB as per the RNP.

The main access to the site will be via Tonkiss Street along the eastern boundary. EMM has been advised by Ason Group that the distribution to and from the site is expected to be primarily from this access point. There are no existing or proposed noise sensitive uses along the section of Tonkiss Street between Wyong Road and the main access point to the gateway development.

There is a secondary access point towards the south of the development, which incorporates a left in / left out arrangement to/from Tonkiss Street. Road traffic could approach the site from the south via this access point, which would pass by residential dwellings along Tonkiss Street to the southeast. However, EMM has been advised by Ason Group that incoming volumes from this route would be negligible based on projected distribution. As such, road traffic noise generation along Tonkiss Street to the southeast of the site is expected to have negligible impacts on these residential dwellings.

7 Construction noise

At this stage, a detailed construction methodology has not been undertaken. However, a development of this nature is not atypical and can be suitably managed to minimise noise impacts on surrounding noise sensitive receivers.

Noise mitigation strategies which would be considered as part of the masterplan construction noise and vibration assessment may include the following.

7.1 Construction noise mitigation

Mitigation measures which may be employed to minimise noise impacts from the construction of the project are discussed in this section. These can include physical measures, such as acoustic screens or shrouds, or noise management measures such as scheduling, community consultation and the like.

7.1.1 Community consultation

Community consultation and complaints handling procedures should be developed such that noise affected receivers may be kept apprised of:

- construction timeline;
- expected noisy works particularly concrete pours which may extend into the evening; and
- readily available avenues to address noise complaint.

7.1.2 Acoustically rated site hoarding

Acoustically rated site hoarding may be employed between the site and surrounding receiver locations. The use of imperforate materials such as plywood (a typically standard hoarding material) can provide realistic noise reductions in the order of 10-15 dB assuming that the barrier inhibits line of sight to receptor locations.

7.1.3 Temporary noise barriers

Temporary noise barriers may be incorporated around particularly noisy static equipment to minimise noise being transmitted to surrounding noise sensitive locations.

7.1.4 Scheduling of works

Noisy works may be scheduled to times which are more mutually agreeable to surrounding noise receptors. This can also include scheduling works such that multiple pieces of noisy plant equipment are not being utilised in close proximity to a particular noise receptor.

7.1.5 Plant and equipment

Additional measures for plant and equipment include:

- where possible, choose quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks;

- operate plant and equipment in the quietest and most efficient manner; and
- regularly inspect and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.

7.1.6 Work practices

Work practice methods include:

- regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration;
- regular identification of noisy activities and adoption of improvement techniques;
- avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby residents;
- locating vehicles to minimise noise;
- where possible, avoid the use of equipment that generates impulsive noise (ie hammering);
- minimise the movement of materials and plant and unnecessary metal-on-metal contact; and
- minimise truck movements.

8 Conclusion

EMM has completed a review of potential noise impacts associated with the proposed Tuggerah Gateway Precinct development to be located at 60 Wyong Road and 58 Tonkiss Street, Tuggerah NSW. This assessment has been conducted to support the land rezoning application and inform strategic planning of the future masterplan application of the site.

The assessment addressed potential road traffic noise impacts in accordance with the Infrastructure SEPP due to the Project's proximity to the Pacific Motorway and Wyong Road.

Noise emission criteria for construction and operations applicable to the Project has been developed based on the requirements of the ICNG and NPfI respectively. Specific noise targets for each allotment would be determined as part of the masterplan application, and the more rigorous DA stages for each separate development.

Operational activities which may have the potential to impact surrounding noise sensitive land uses have been discussed in principle and would be further explored as part of future development applications.

Findings of the assessment are summarised as follows:

- Potential road traffic noise impacts from the Pacific Motorway and Wyong Road can be suitably managed by incorporating:
 - best practice site and spatial planning to reduce traffic noise impacts using the built form; and
 - suitable treatments to the building envelope (ie façade, roof and entry/egress points) to reduce road traffic noise intrusion such that internal design targets are met.
- The potential for noise generating commercial uses (ie retail food and beverage) has been considered. Given the early stages of the project planning, specific uses are yet to be determined to inform this assessment. Potential limitations on the location of retail food and beverage uses which may incorporate outdoor seating have been identified in context to future noise sensitive dwellings. In-principle recommendations have been provided to minimise potential noise impacts from these uses.
- The project will result in additional road traffic movements during the project operation. The outcomes from this assessment are as follows:
 - additional road traffic generation along Wyong Road will not exceed the maximum permissible 2dB increase in road traffic noise as required by the NSW EPA's RNP; and
 - potential increases in road traffic noise for residents adjoining Tonkiss Street to the southeast of the site will be negligible based on projected future traffic distribution.

References

NSW Environment Protection Authority (EPA) 2017, *NSW Noise Policy for Industry* (NPfI)

NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP)

NSW Environmental Protection Authority (EPA) 2009, *The Interim Construction Noise Guideline* (ICNG)

NSW State Environmental Planning Policy (Infrastructure) 2007 ('infrastructure SEPP')

NSW Department of Planning (DoP) 2008, *Development near Rail Corridors and Busy Roads – Interim Guideline*

Glossary

Project and technical terms

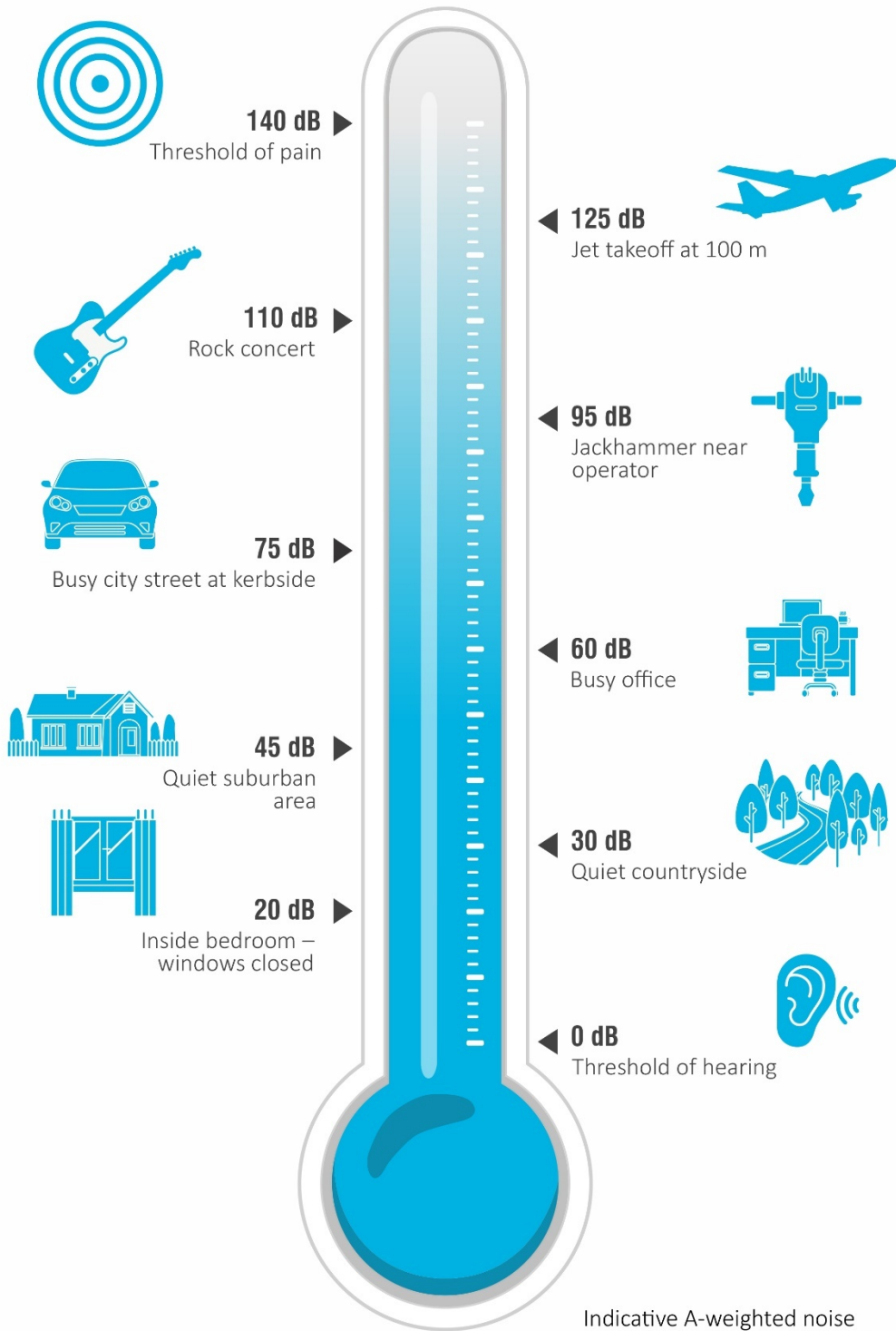
Term	Meaning
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Amenity noise criteria	The amenity noise criteria relate to existing industrial noise. Where industrial noise approaches base amenity noise criteria, then noise levels from new industries need to demonstrate that they will not be an additional contributor to existing industrial noise. See Section 3.1 for more detail.
Day period	Monday-Saturday: 7 am to 6 pm, on Sundays and public holidays: 8 am to 6 pm.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dBC	Noise is measured in units called decibels (dB). There are several scales for describing noise, with the 'C-weighted' scale typically used to assess low frequency noise.
Evening period	Monday-Sunday: 6 pm to 10 pm EIS Environmental impact statement FGJV Future Generation Joint Venture Intrusive noise criteria. The intrusive noise criteria refers to noise that intrudes above the background level by more than 5 dB. The intrusiveness criterion is described in detail in Section 3.1.
L1	The noise level exceeded for 1% of the time.
L10	The noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L90	The noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
Leq	The energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The Leq(15min) descriptor refers to a Leq noise level measured over a 15-minute period.
Linear peak	The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.
Lmax	The maximum sound pressure level received during a measuring interval.
NEM	National Electricity Market Night period Monday-Saturday: 10 pm to 7 am, on Sundays and public holidays: 10 pm to 8 am.
NPfi	Noise Policy for Industry NVIA Noise and vibration impact assessment.
Project area	The area required to access and build project infrastructure, operation of precast segment factory.
PNTL	The project-noise trigger level (PNTL) is criteria for a particular industrial noise source or industry. The PSNL is the lower of either the intrusive noise criteria or amenity noise criteria.
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
Sound power level (Lw)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.

Common noise levels

The table below gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels encountered on a daily basis are provided in the figure below.

Perceived change in noise

Change in sound level (dB)	Perceived change in noise
up to 2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times as loud (or quarter) as loud.



Common sources of noise with levels

Abbreviations

Abbreviation	Term
ARL	Acoustic Research Laboratories
AGL	above ground level
ANZEC	Australian and New Zealand Environment Council
ABL	Assessment background level
BoM	Bureau of Meteorology
CSSI	critical State significant infrastructure
CEMP	Construction Environmental Management Plan
DECC	Department of Environment and Climate Change
DEC	Department of Environment and Conservation
DEFRA	Department of Environment, Food and Rural Affairs (United Kingdom)
D&B	drill and blast
DP&E	Department of Planning and Environment
EPA	Environmental Protection Authority
EIS	environmental impact statement
EMM	EMM Consulting Pty Limited
FGJV	Future Generation Joint Venture
FHWA	US EPA Federal Highways
GWh	gigawatt hours
HV	heavy vehicle
ICNG	Interim Construction Noise Guideline
LGAs	local government areas
LV	light vehicle
MAT	Main Access Tunnel
MW	megawatts
NATA	National Association of Testing Authorities
NPfi	Noise Policy for Industry
NML	noise management level
NVIA	Noise and vibration impact assessment
OOH	out of hours
PHES	Pumped Hydro-Electric Storage
PPV	peak particle velocity
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
PNTL	project noise trigger level
RBL	rating background level
RNP	Road Noise Policy
RMS	root mean square
SHL	Snowy Hydro Limited
SEARs	Secretary's environmental assessment requirements
SSI	State significant infrastructure
VDV	vibration dose value

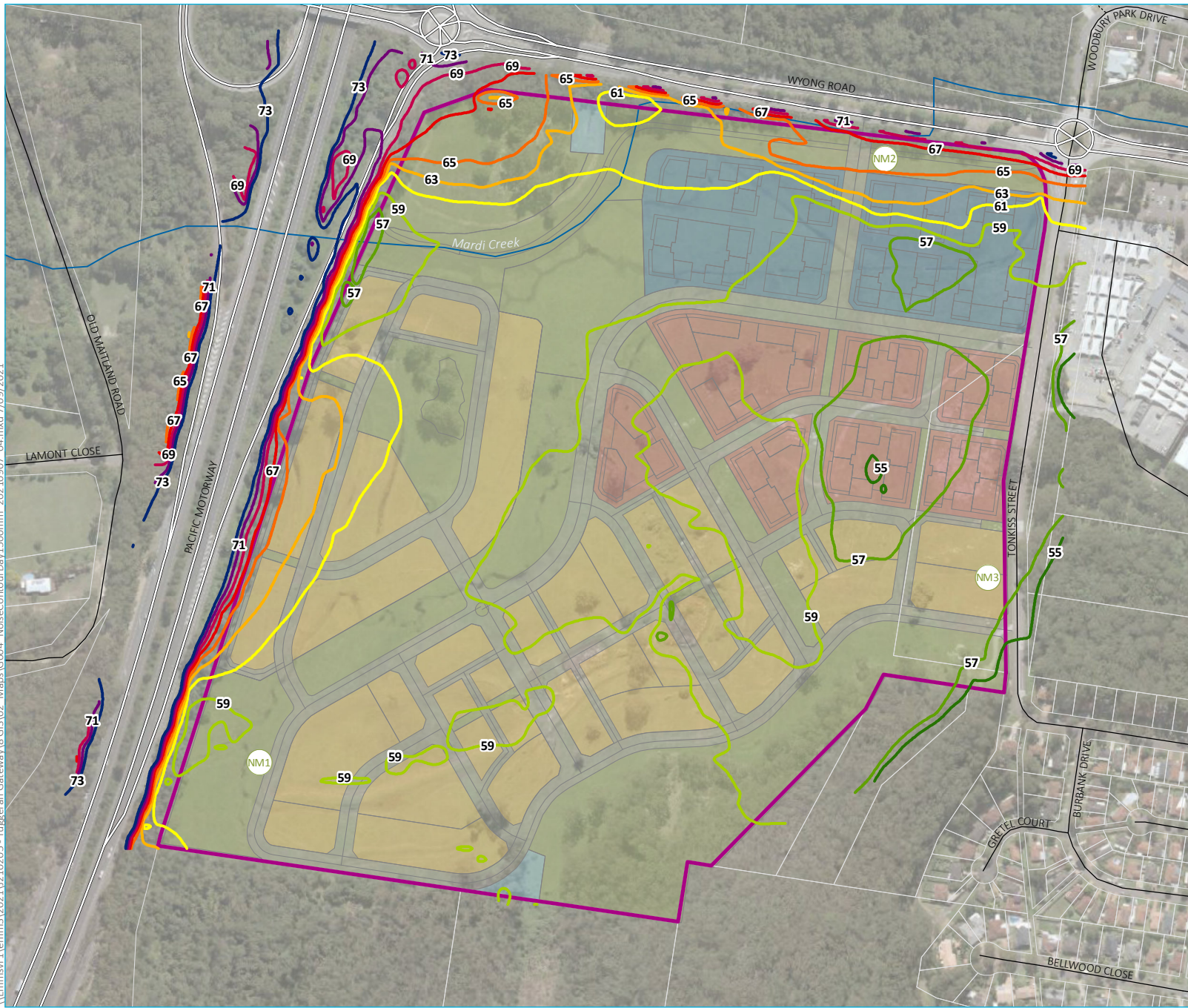


Appendix A

Road traffic noise contours



\\Emmsvr1\emms3\2021\210205 - Tuggerah Gateway\8 GIS\02 Maps\G004 NoiseContourDay1500mm 20210907 04.mxd 7/09/2021



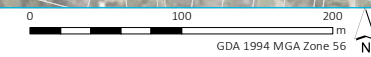
- KEY**
- Project site
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Cadastral boundary
 - Proposed site layout
 - Detail
 - Detached/townhouse/terrace homes (2 storey)
 - High rise apartment/unit (3+ storey)
 - Mixed use (3+ storey)
 - Utilities
 - Open space and public domain
 - Noise contours (dB_LAeq,15hour)
 - 55
 - 57
 - 59
 - 61
 - 63
 - 65
 - 67
 - 69
 - 71
 - 73

Road noise contour (day)
LAeq 15 hour - 1.5 m above ground

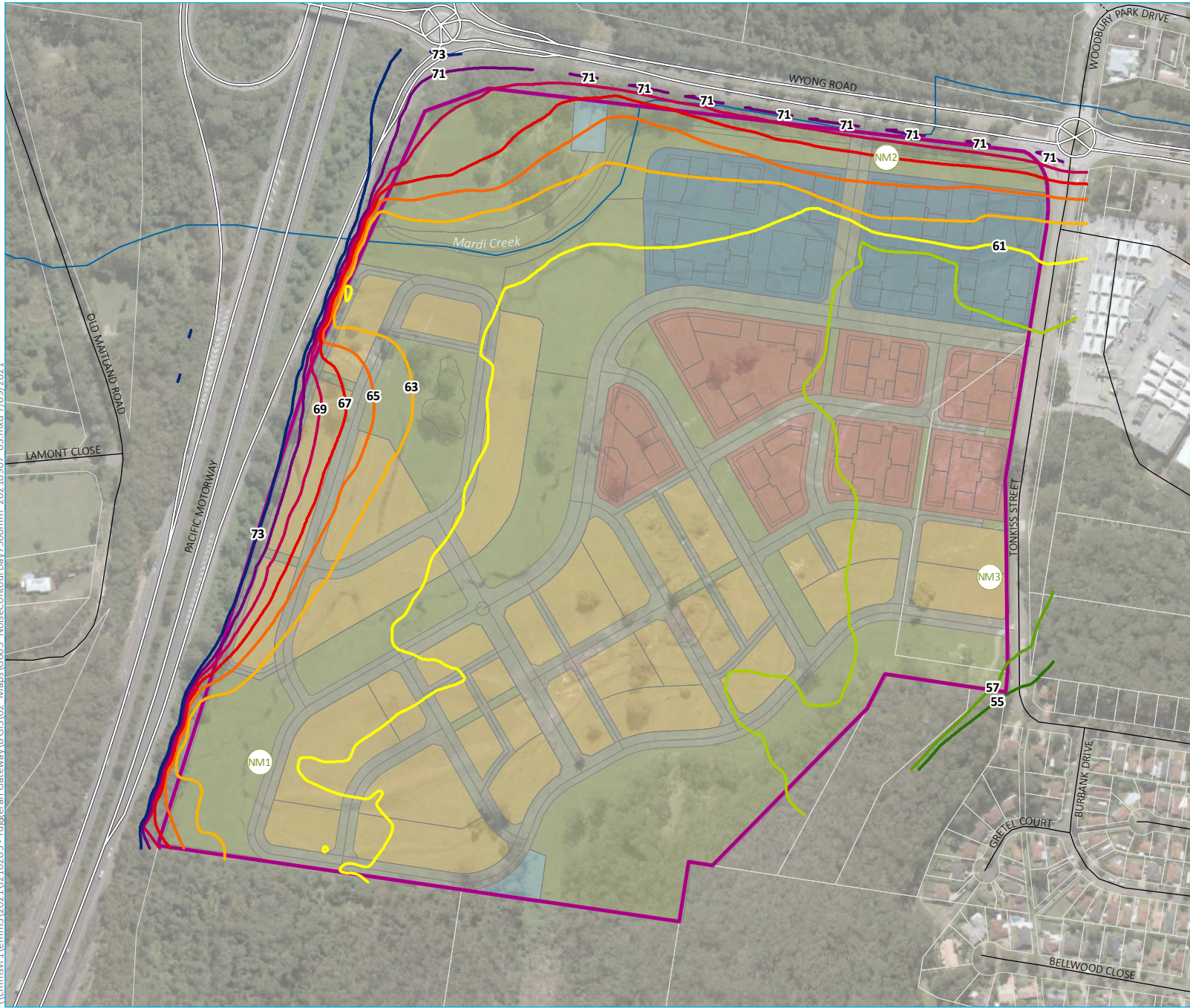
Tuggerah Gateway
Noise and vibration impact assessment
Figure A.1



Source: EMM (2021); MetroMap (2021); Urbis (2021); DFSI (2017)



\\Emmsvr1\emms3\2021\210205 - Tuggerah Gateway\18 GIS\02 Maps\G005 Noise\ContourDay7500mm 20210907 03.mxd 7/09/2021



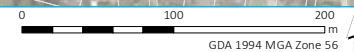
- KEY**
- Project site
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Cadastral boundary
 - Proposed site layout
 - Detail
 - Detached/townhouse/terrace homes (2 storey)
 - High rise apartment/unit (3+ storey)
 - Mixed use (3+ storey)
 - Utilities
 - Open space and public domain
 - Noise contours (dB_{L_{Aeq,15hour}})
 - 55
 - 57
 - 59
 - 61
 - 63
 - 65
 - 67
 - 69
 - 71
 - 73

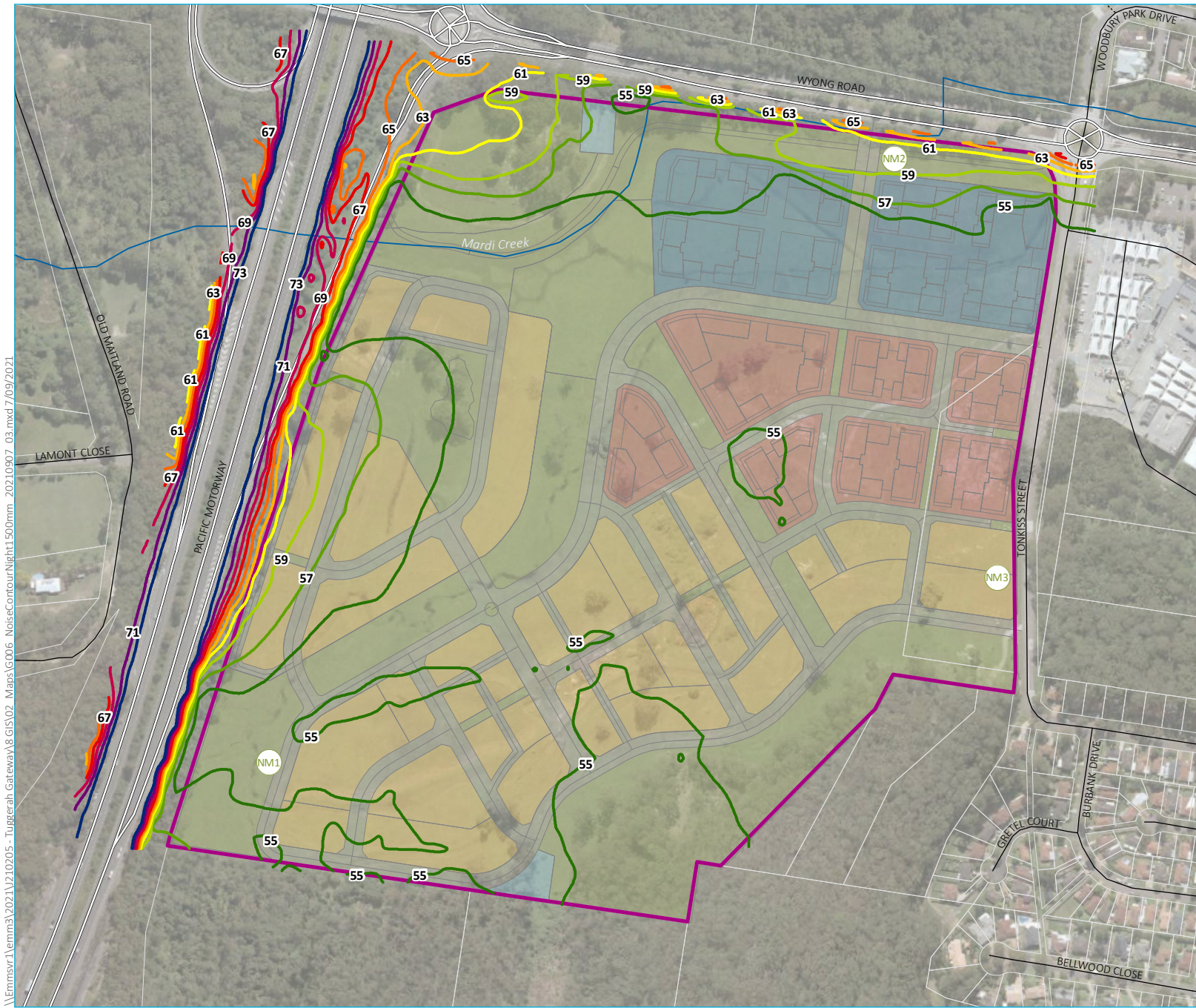
Road noise contour (day)
LAeq 15 hour - 7.5 m above ground

Tuggerah Gateway
Noise and vibration impact assessment
Figure A.2



Source: EMM (2021); MetroMap (2021); Urbis (2021); DFSI (2017)





- KEY**
- Project site
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Cadastral boundary
 - Proposed site layout
 - Detail
 - Detached/townhouse/terrace homes (2 storey)
 - High rise apartment/unit (3+ storey)
 - Mixed use (3+ storey)
 - Utilities
 - Open space and public domain
 - Noise contours (dB_{LAeq,9hour})
 - 55
 - 57
 - 59
 - 61
 - 63
 - 65
 - 67
 - 69
 - 71
 - 73

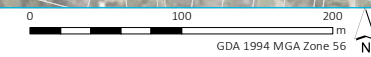
Road noise contour (night)
LAeq 9 hour - 1.5 m above ground

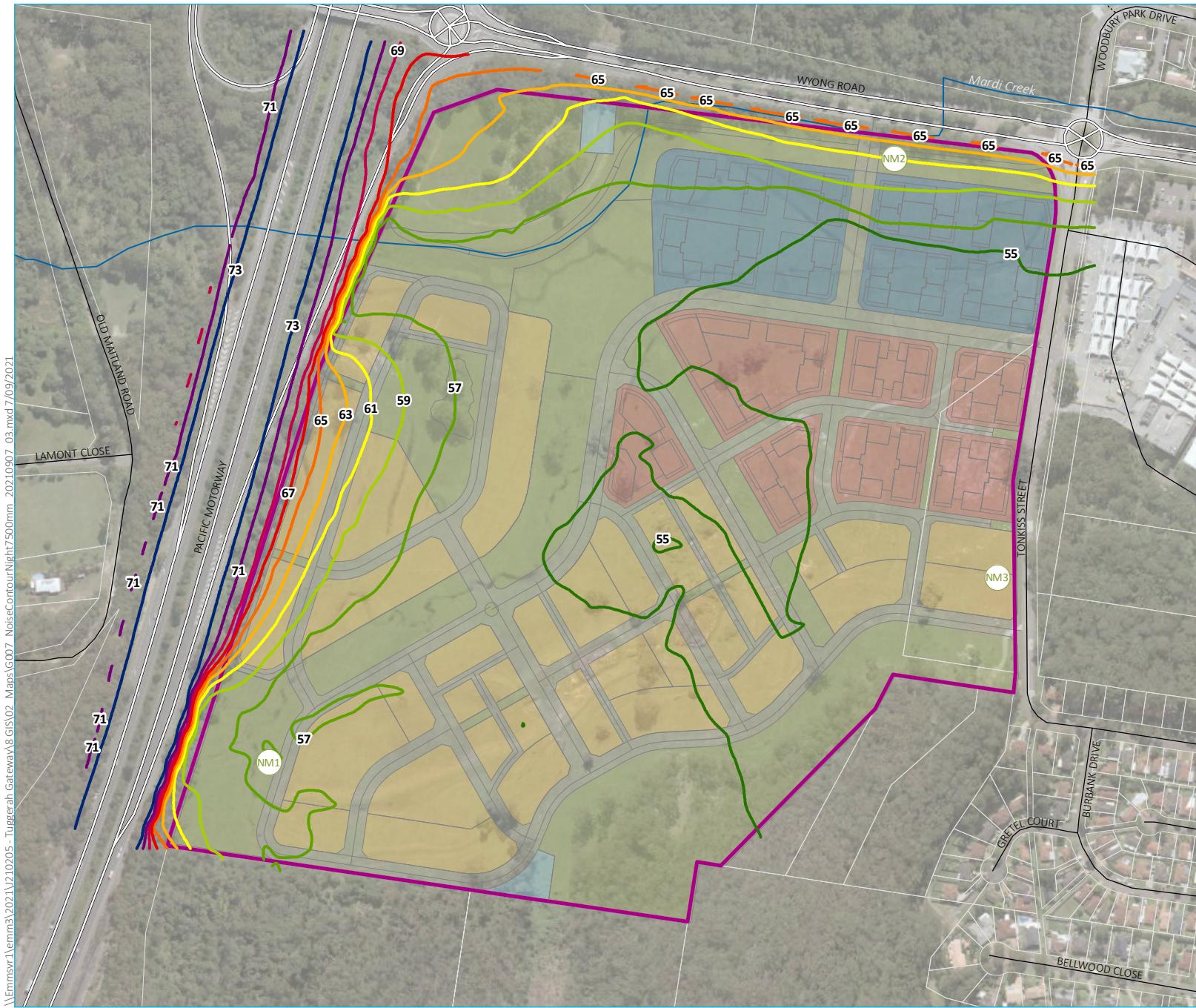
Tuggerah Gateway
Noise and vibration impact assessment
Figure A.3



\\Emmsvr1\emms3\2021\21020205 - Tuggerah Gateway\18 GIS\02 Maps\G006 NoiseContourNight1500mm 20210907 03.mxd 7/09/2021

Source: EMM (2021); MetroMap (2021); Urbis (2021); DFSI (2017)





- KEY**
- Project site
 - Major road
 - Minor road
 - Vehicular track
 - Named watercourse
 - Cadastral boundary
 - Proposed site layout
 - Detail
 - Detached/townhouse/terrace homes (2 storey)
 - High rise apartment/unit (3+ storey)
 - Mixed use (3+ storey)
 - Utilities
 - Open space and public domain
 - Noise contours (dB_{L_{Aeq,9hour}})
 - 55
 - 57
 - 59
 - 61
 - 63
 - 65
 - 67
 - 69
 - 71
 - 73

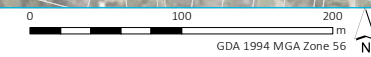
Road noise contour (night)
 LAeq 9 hour - 7.5 m above ground

Tuggerah Gateway
 Noise and vibration impact assessment
 Figure A.4



\\Emmsvr1\emms3\2021\1\210205 - Tuggerah Gateway\18 GIS\02 Maps\G007 NoiseContourNight7500mm 20210907 03.mxd 7/09/2021

Source: EMM (2021); MetroMap (2021); Urbis (2021); DFSI (2017)

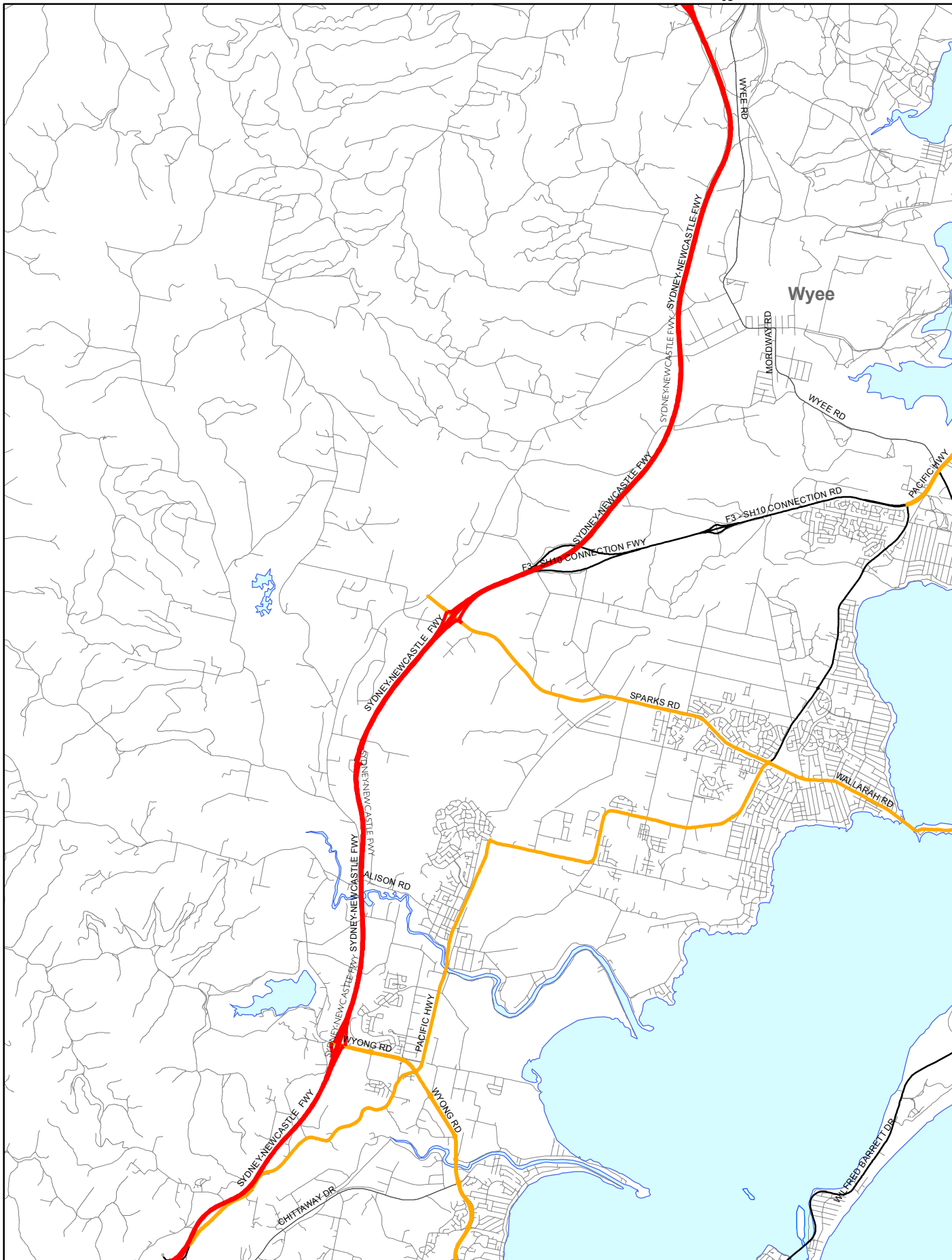




Appendix B

RMS traffic volumes - Map 5





07

08

Scale 1:100,000



TRAFFIC VOLUME MAPS FOR NOISE ASSESSMENT FOR BUILDING ON LAND ADJACENT TO BUSY ROADS

LEGEND

- Mandatory under clause 102 of the Infrastructure SEPP (Freeways, tollways, transitways and >40,000 AADT)
- Recommended (> 20,000 and < 40,000 AADT)

Roads

- Local Roads
- Regional Roads
- State Roads

Map: 05





Appendix C

Noise monitoring results



C.1 NM1 – Southwest quadrant of subject site

Table C.1 Summary of daily noise logging results – NM1

Date	ABL Day ¹	ABL Evening ¹	ABL Night ¹	L _{Aeq,11 hour} Day	L _{Aeq,4 hour} Evening	L _{Aeq,9 hour} Night
Tuesday, 27/04/21	53	48	42	-	55	55
Wednesday, 28/04/21	53	47	44	57	54	55
Thursday, 29/04/21	53	48	42	57	55	55
Friday, 30/04/21	53	47	38	57	53	51
Saturday, 01/05/21	52	47	38	56	52	49
Sunday, 02/05/21	52	47	40	56	53	53
Monday, 03/05/21	53	51		57	55	
Summary Values	53	47	41	57	54	53

Notes: 1. A "0" indicates insufficient data samples due to adverse weather or other extraneous effects.

C.2 NM2 – Northeast quadrant of subject site

Table C.2 Summary of daily noise logging results – NM2

Date	ABL Day ¹	ABL Evening ¹	ABL Night ¹	L _{Aeq,11 hour} Day	L _{Aeq,4 hour} Evening	L _{Aeq,9 hour} Night
Tuesday, 27/04/21	58	49	39	-	60	60
Wednesday, 28/04/21	56	49	41	64	60	59
Thursday, 29/04/21	57	52	40	64	62	60
Friday, 30/04/21	57	51	39	65	62	57
Saturday, 01/05/21	55	50	37	63	59	56
Sunday, 02/05/21	52	47	37	63	59	55
Summary Values	57	50	39	64	60	58

Notes: 1. A "0" indicates insufficient data samples due to adverse weather or other extraneous effects.

C.3 NM3 – Southeast quadrant of subject site

Table C.3 Summary of daily noise logging results – NM3

Date	ABL Day ¹	ABL Evening ¹	ABL Night ¹	L _{Aeq,11 hour} Day	L _{Aeq,4 hour} Evening	L _{Aeq,9 hour} Night
Thursday, 27/05/21	52	49	42	56	54	52
Friday, 28/05/21	51	46	40	54	51	49
Saturday, 29/05/21	50	43	39	55	49	47
Sunday, 30/05/21	49	44	38	53	50	50
Monday, 31/05/21	48	49	45	54	54	55
Tuesday, 01/06/21	51	50	44	56	54	54
Wednesday, 02/06/21	48	49	45	54	54	54
Thursday, 03/06/21	52	50	44	57	57	55
Friday, 04/06/21	53	47	39	56	53	49
Saturday, 05/06/21	51	48	37	54	53	48
Sunday, 06/06/21	48	49	43	53	54	54
Monday, 07/06/21	51	50	45	56	55	55
Tuesday, 08/06/21	52	49	45	57	59	54
Wednesday, 09/06/21	55			58		
Summary Values	51	49	43	55	54	53

Notes: 1. A "0" indicates insufficient data samples due to adverse weather or other extraneous effects.

