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GLENMORE PARK EAST

Desktop Traffic Noise Assessment

14 September 2023

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TN505-01F02 Desktop Acoustic Assessment (r2).docx

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Contents

List of tables

List of figures

1 Introduction

Renzo Tonin & Associates was engaged to undertake a desktop road traffic noise assessment of the proposed Glenmore Park East precinct located within the Penrith Local Government Area (LGA), in accordance with the relevant noise criteria set out in the Penrith City Council's Development Control Plan 2014 (DCP), NSW Road Noise Policy' (RNP) and the NSW State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP).

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

The Planning Proposal (PP) seeks to rezone a 47.95 hectare (ha) parcel of land bounded by the recently upgraded The Northern Road to the east, Glenmore Parkway to the north, Bradley Street to the south and the existing Glenmore Park neighbourhood to the west. The precinct is within the Penrith Local Government Area (LGA) and the land subject to this PP is described as Glenmore Park East.

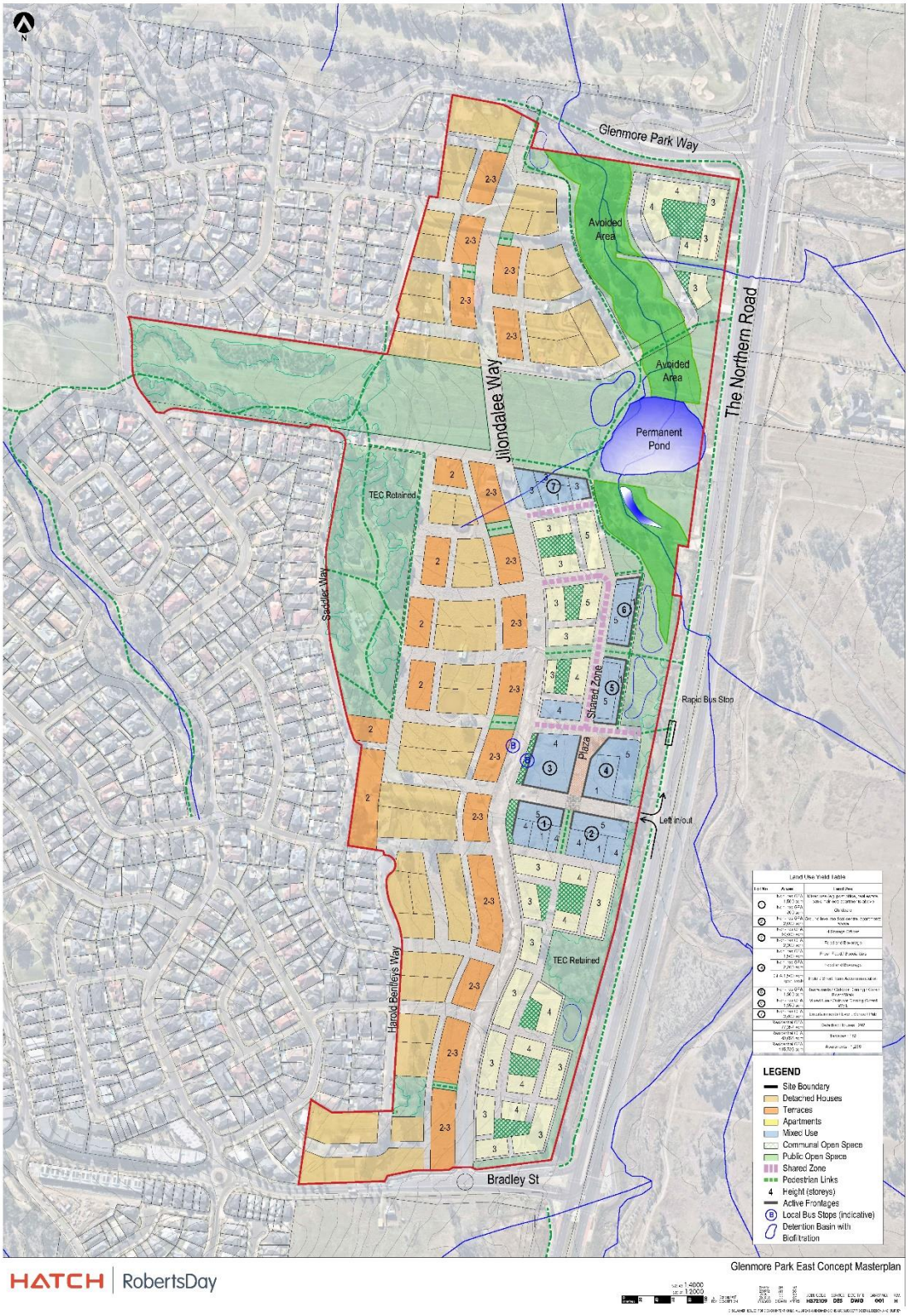
The precinct is currently zoned C4 Environmental Living (44.93 hectares), R2 Low Density Residential (225 square metres), SP2 Infrastructure (113 square metres) and RE1 Public Recreation (2.98 hectares) under the PLEP 2010. Land within the precinct is currently utilised for rural residential lifestyle properties, with part of the precinct having been approved for a 17-lot rural residential subdivision in 2005.

The proposed Masterplan provides for approximately 1,710 new homes, offering a diverse range of housing options to meet the needs of a changing community. These new homes include approximately 242 traditional detached homes (with an average site area of 320 square metres), 182 smaller attached terraces (with an average site area of 240 square metres), and 1,286 (1, 2 and 3 bedroom) apartments (with an average size of 90 square metres). The proposal also commits to providing a minimum of 5% affordable housing on the site, in collaboration with a Community Housing Provider, surpassing Penrith City Council's target of 3% affordable housing applied in other locations.

Furthermore, the proposed Masterplan accommodates a range of non-residential uses in the precinct, including mixed-use retail spaces, childcare facilities, medical services, food and beverage establishments, a fresh food market, specialty shops, restaurants and cafes, entertainment venues, offices, and a hotel for short-term accommodation supporting visitors and the requirements of nearby defence industry partners. This diverse range of services and amenities aims to meet the needs of both residents and visitors to the precinct.

The Concept Masterplan for the Glenmore Park East precinct is shown in Figure 1.

Figure 1 – Concept Masterplan



3 Road Traffic Noise Criteria

3.1 Penrith Development Control Plan 2014

Section 12.1 of Chapter C12 *Noise and Vibration* of the Penrith Development Control Plan 2014 (DCP) sets out the following with respect to road traffic noise:

"***12.1. Road Traffic Noise***

A. Background

Currently, road traffic is the most widespread source of environmental noise. The controls below seek to minimise the impact of road traffic noise.

This Section of the DCP applies to all development that generates a significant level of traffic noise (as determined by Council) that has potential to impact upon residential and other sensitive land uses.

This Section is also applicable to any residential development, subdivision or other sensitive land uses, which propose to locate near existing areas of significant road traffic noise.

B. Objectives

a) To ensure that the amenity of all residential development and other sensitive land uses is not significantly affected by road traffic noise;

b) To ensure that the traffic associated with development does not significantly impact upon the amenity of surrounding land uses;

c) To ensure that the traffic associated with development does not have a significant noise impact on the existing road network; and

d) To ensure that any subdivisions are designed to minimise the impact of road traffic noise on any residential development or other sensitive land uses.

C. Controls

1) Road traffic noise criteria including sensitive land uses

a) Council will not grant consent to development, particularly residential development, including subdivisions, unless the impact of traffic noise from freeway, arterial, designated or collector roads complies with the standards and guidelines for road traffic noise prepared by the relevant State Government authorities or agencies, as well as relevant Australian Standards.

b) Council will not grant consent to development for sensitive land uses unless it complies with the provisions and standards for road traffic noise prepared by the relevant State Government authorities or agencies, as well as relevant Australian Standards.

c) Sensitive land uses subject to road traffic noise criteria referred to in b) above include educational establishments (including schools), places of public worship, hospitals, and passive and active recreation areas.

Noise Impact Statements - Specific Requirements

a) Where a site is likely to be affected by unacceptable levels of road traffic noise, the applicant is required to provide a Noise Impact Statement prepared by a qualified acoustic consultant in accordance with the requirements set out in the DA Submission Requirements Appendix of this DCP.

b) The Noise Impact Statement should demonstrate acoustic protection measures necessary to achieve an indoor environment meeting residential standards, in accordance with EPA and Department of Planning Criteria, as well as relevant Australian Standards.

***NOTE:** To determine whether your site is likely to be exposed to levels of road traffic noise that exceed residential standards:*

a) Contact Council regarding main road frontages known to exceed residential noise standards; and

b) Obtain detailed advice from a qualified acoustic consultant regarding appropriate planning and design measures."

3.2 NSW Road Noise Policy (RNP)

Table 3 of the NSW 'Road Noise Policy' *(*RNP) outlines criteria to be applied to particular types of road developments and land uses. The criteria apply when assessing noise impact and determining mitigation measures for existing developments that are potentially affected by road traffic noise, with the aim of preserving the amenity appropriate to the land use.

However, the RNP does not stipulate noise criteria for new land use developments potentially impacted by road traffic noise. Noise criteria for new developments affected by existing roads are addressed through the NSW 'State Environmental Planning Policy (Transport and Infrastructure)' 2021 (SEPP) and the associated NSW Department of Planning 'Development Near Rail Corridors and Busy Roads – Interim Guideline'.

3.3 State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW 'State Environmental Planning Policy (Transport and Infrastructure)' 2021 (SEPP) is used to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes

identifying the environmental assessment category into which different types of infrastructure and service developments fall under and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessments, the SEPP includes the following section:

> *"**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.*
>
> *(2) Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this section 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 10pm and 7am,*
>
> *(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) – **40 dB(A)** at any time.*
>
> *(3A) Subsection (3) does not apply to a building to which State Environmental Planning Policy (Housing) 2021, Chapter 3, Part 7 applies.*
>
> *(4) In this section, **freeway**, **tollway** and **transitway** have the same meanings as they have in the Roads Act 1993."*

The NSW Department of Planning 'Development Near Rail Corridors and Busy Roads – Interim Guideline' (December 2008 – Guideline) is supplementary to the SEPP and assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the SEPP applies only to roads with an Annual Average Daily Traffic (AADT) greater than 20,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that the noise assessment is based over the following time periods:

- **Daytime:** 7am – 10pm $L_{Aeq,15\ hour}$
- **Night-time:** 10pm – 7am $L_{Aeq,9\ hour}$

The noise criteria nominated in the SEPP apply to internal noise levels with windows and doors closed. However, as the preliminary noise assessment is based on predictions at external locations, equivalent external noise criteria have been established. The equivalent external noise criteria are used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the SEPP. The equivalent external criteria have been determined on the following basis:

- The Guideline states:

  "*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 to meet the ventilation requirements of the Building Code of Australia*."

  The internal criteria with windows open are therefore 10 dB(A) above the criteria and should be applied when using the SEPP.

- The generally accepted noise reduction through an open window from a free-field external position is 10 dB(A). Windows / doors are assumed to be open no more than 5 % of the room's floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Based on the above, Table 3.1 presents the SEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 3.1 – SEPP Noise Criteria for New Residential Developments

Room	Location	$L_{Aeq,15\ hour}$ Day 7am – 10pm	$L_{Aeq,9\ hour}$ Night 10pm – 7am
Living rooms	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)[1]	60	60
Bedrooms	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)[1]	60	55

Notes: 1. External goals have been calculated on the basis of nominal 10 dB(A) reduction through an open window to a free-field position. Windows open to 5 % of floor area in accordance with the BCA 2011 requirements.

2. SEPP Guideline states that where internal noise criteria are exceeded by more than 10 dB(A) with windows open mechanical ventilation is required.

Based on the above table, the most stringent criteria for the day and night time periods will be used for the assessment of road traffic noise impacting the subject site. That is, for the day period the external free-field noise criterion will be **$L_{Aeq,15\ hour}$ 60 dB(A)** and for the night period the external free-field noise criterion will be **$L_{Aeq,9\ hour}$ 55 dB(A).**

4 Road Traffic Noise Sources

The proposed development will potentially be affected by traffic noise along The Northern Road, Glenmore Parkway and Bradley Street. Traffic volumes for the year 2021 and 2031 are taken from the report 'The Northern Road Upgrade – Mersey Road to Glenmore Parkway – Noise and Vibration Assessment' prepared by Jacobs (ref. IA086100-RP-EN-0129 Version J, dated 15 May 2017). The relevant traffic volumes used for this assessment is presented in Table 4.1.

Table 4.1 – Year 2021 and 2031 Traffic Volumes and Composition Data (two-way)

Road	Direction	Posted speed (km/h)	Daytime (hourly average)		Night time (hourly average)	
			Vehicles	% Heavy Vehicle	Vehicles	% Heavy Vehicle
Year 2021[1]						
The Northern Road	Northbound	90	1,432	5.1	296	5.1
	Southbound	90	1,242	6.2	226	5.4
Glenmore Parkway	Westbound	50	1,125	4.0	228	3.8
	Eastbound	50	482	2.7	132	2.1
Bradley Street	Westbound	50	599	2.1	96	3.7
	Eastbound	50	1,154	3.2	307	2.0
Year 2031[2]						
The Northern Road	Northbound	90	1,809	5.1	370	5.1
	Southbound	90	1,837	6.2	336	5.4
Glenmore Parkway	Westbound	50	1,204	4.0	240	3.8
	Eastbound	50	512	2.7	141	2.1
Bradley Street	Westbound	50	653	2.1	108	3.7
	Eastbound	50	1,213	3.2	305	2.0

Notes:
1. Traffic volume data from Table F.3 of 'The Northern Road Upgrade – Mersey Road to Glenmore Parkway – Noise and Vibration Assessment' prepared by Jacobs (ref. IA086100-RP-EN-0129 Version J, dated 15 May 2017)
2. Traffic volume data from Table F.4 of 'The Northern Road Upgrade – Mersey Road to Glenmore Parkway – Noise and Vibration Assessment' prepared by Jacobs (ref. IA086100-RP-EN-0129 Version J, dated 15 May 2017).

It is expected that the Glenmore Park East precinct will be fully completed by the year 2041. Based on the traffic volumes data from Table 4.1, the ten year percentage increase from years 2021 and 2031 was determined and this increase was applied to the year 2031 traffic volumes in order to determine the year 2041 traffic volumes. The calculated year 2041 traffic volumes used for the road traffic noise modelling is presented in Table 4.2.

Table 4.2 – Year 2041 Traffic Volumes and Composition Data (two-way)

Road	Direction	Posted speed (km/h)	Daytime (hourly average)		Night time (hourly average)	
			Vehicles	% Heavy Vehicle	Vehicles	% Heavy Vehicle
The Northern Road	Northbound	90	2,285	5.1	467	5.1
	Southbound	90	2,717	6.2	497	5.4
Glenmore Parkway	Westbound	50	1,289	4.0	257	3.8
	Eastbound	50	544	2.7	150	2.1
Bradley Street	Westbound	50	712	2.1	118	3.7
	Eastbound	50	1,275	3.2	321	2.0

5 Road Traffic Noise Modelling

The noise prediction model used to predict traffic noise levels for the project are contained within the calculation algorithms of the noise model developed by the United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)" known as the CoRTN88 method. This method has been adapted to Australian conditions and extensively tested by the Australian Road Research Board.

The model predicts noise levels for free flowing traffic and a modified method has been developed which enables an accurate prediction of noise from high truck exhausts to be taken into account. The method predicts the $L_{10(1hour)}$ noise levels within the daytime 15 hour (7am to 10pm) and night-time 9 hour (10pm to 7am) periods and a correction of -3dB(A) is applied to obtain the $L_{eq(1hour)}$ noise levels for each period. The $L_{eq(1hour)}$ noise level for the time period 7am to 10pm is then equated to the daily $L_{eq(15hour)}$ noise level. Similarly, the $L_{eq(1hour)}$ noise level for the time period 10pm to 7am is then equated to the night time $L_{eq(9hour)}$ noise level.

The noise prediction model takes into account the following modelling inputs.

Table 5.1 – Summary of Modelling Inputs

Input Parameters	Data Acquired From
Traffic volumes and mix	As presented in Table 4.2
Vehicle speed	As presented in Table 4.2
Gradient of roadway	Land contours from NSW Department of Lands
Source height	0.5m for car exhaust, 1.5m for car and truck engines and 3.6m for truck exhaust and detailed within CoRTN88
Ground topography at receiver and road	Land contours provided by client
Angles of view from receiver	160 degrees for all receivers
Reflections from existing barriers, structures and cuttings on opposite side of road	Determined from Google Streetview and review of concept design. No structures or cuttings identified.
Air and ground absorption	Detailed within CoRTN88, ground absorption varied along route. Numeric values varied between 0 (hard surface) to 1 (100% absorptive). A value of 0.75 was used in the model
Receiver Heights	1.5m above ground level for ground floor 4.5m above ground level for first floor
Free Field Noise Levels	Free field noise levels were used in this assessment as it is directly relevant to the assessment against the SEPP traffic noise requirements
Australian conditions correction	-0.7dB(A) correction to represent free field conditions
Acoustic properties of road surfaces	Assumed dense graded asphalt
Roadside barriers	Assumes no existing noise barriers

6 Road Traffic Noise Assessment

Road traffic noise levels are predicted across the Glenmore Park East precinct using noise contour maps, where the predicted noise contour levels have been overlayed on the subject site to identify areas of exceedances.

Figure 2 and Figure 3 present the day time noise contours representing road traffic noise generated by the surrounding road network for the year 2041 impacting the ground and first floor levels, respectively, of future residential dwellings within the precinct.

Figure 4 and Figure 5 present the night time traffic noise contours for the year 2041 at the ground and first floor levels, respectively, of future residential dwellings within the precinct.

It is noted that the predicted noise contours are for the year 2041 and would be higher than both the measured noise levels and 2031 predicted noise levels presented by TfNSW in The Northern Road Upgrade noise assessments.

Figure 2 – Design Year 2041 Day Time $L_{Aeq\ (15hr)}$ Noise Contours (Ground Floor)

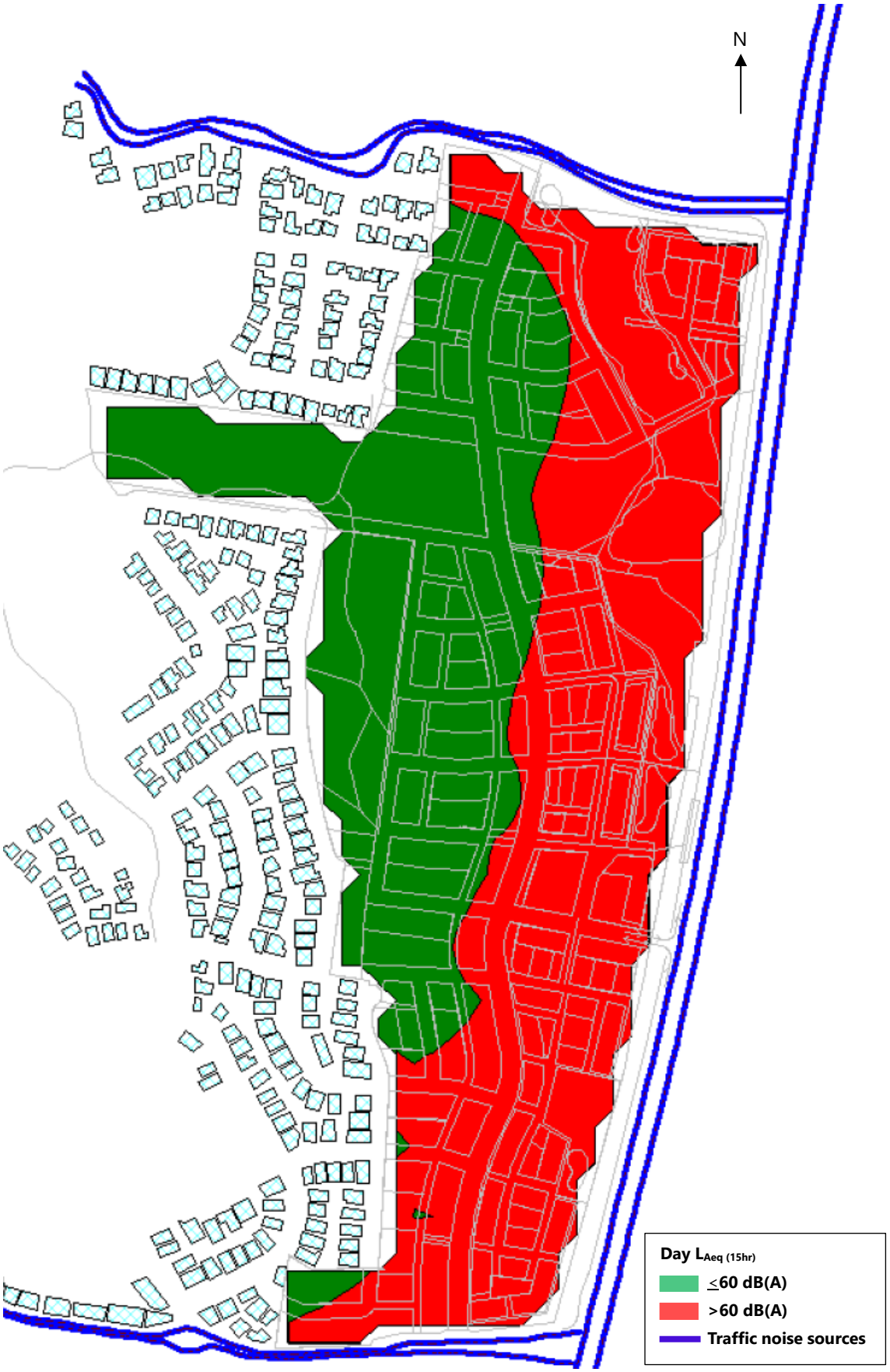


Figure 3 – Design Year 2041 Day Time $L_{Aeq\ (15hr)}$ Noise Contours (First Floor)

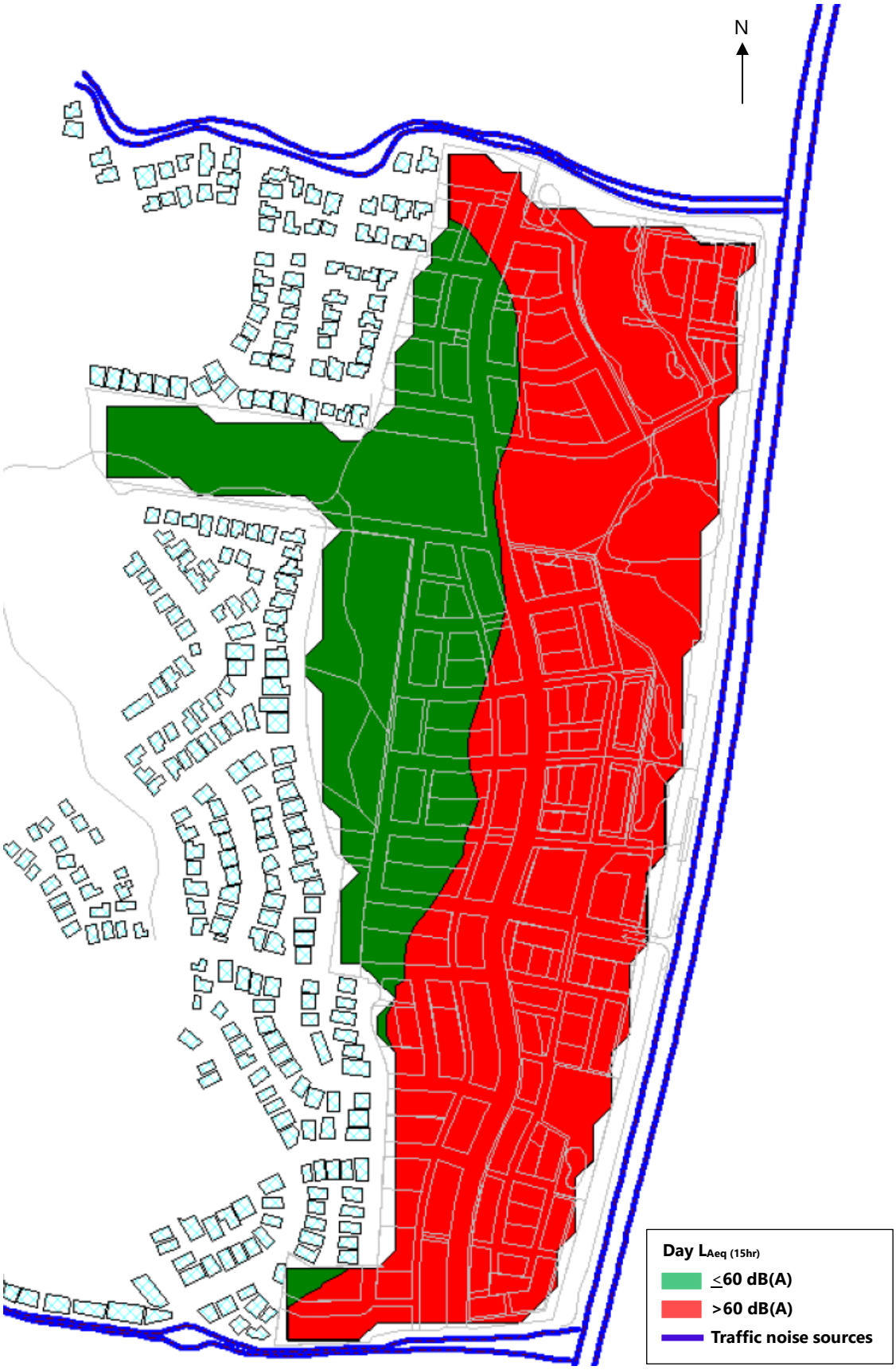


Figure 4 – Design Year 2041 Night Time $L_{Aeq\ (9hr)}$ Noise Contours (Ground Floor)

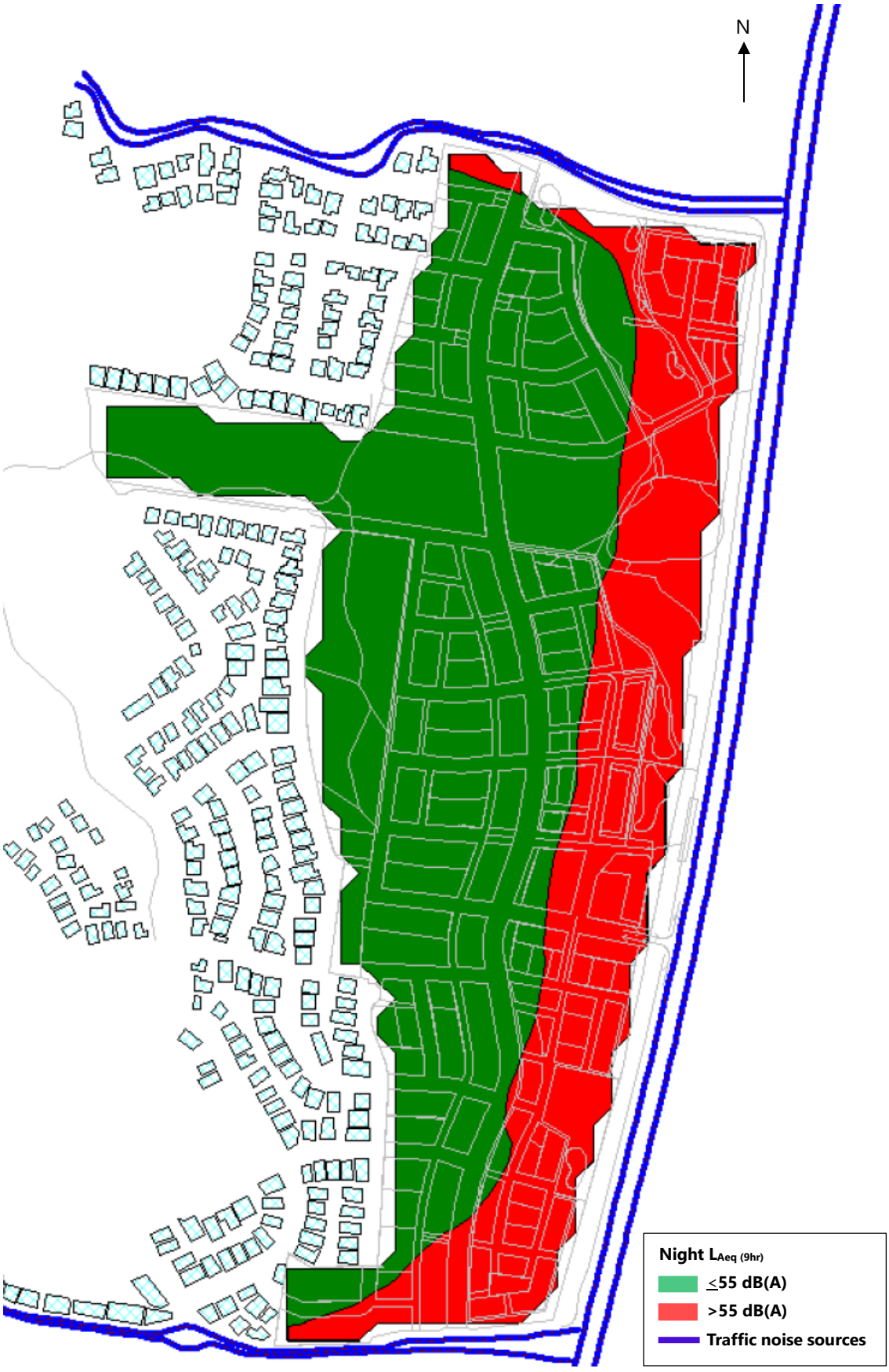
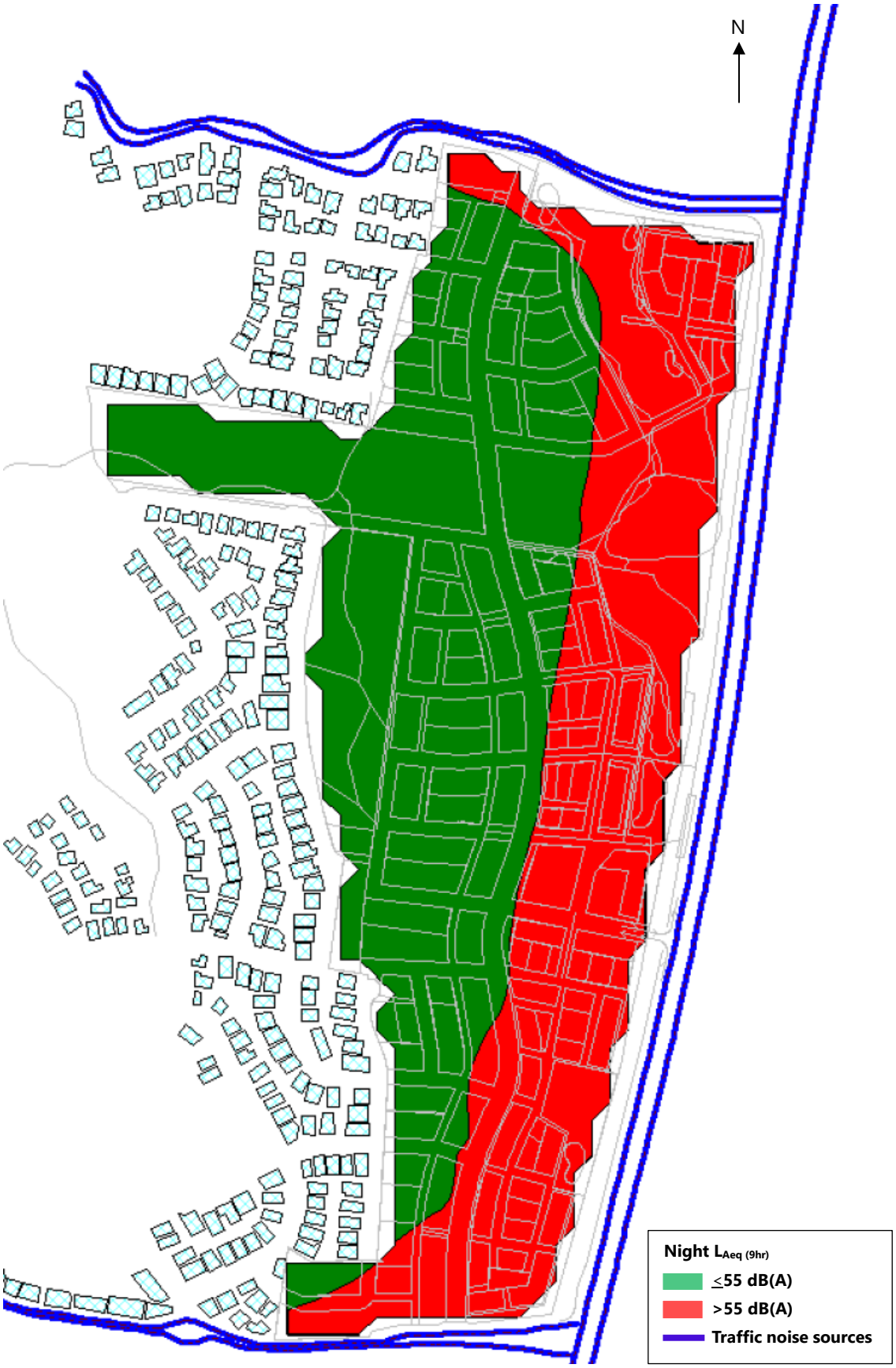


Figure 5 – Design Year 2041 Night Time $L_{Aeq\ (9hr)}$ Noise Contours (First Floor)



The red shaded contour areas shown in Figure 2 and Figure 3 for the day period indicate the locations within the Glenmore Park East precinct where road traffic noise levels from the surrounding road network, for the year 2041, would exceed the SEPP road traffic noise criterion for the day period [i.e. > $L_{Aeq,15hr}$ 60dB(A)]. Therefore, it is recommended that for future residential lots located within the red shaded areas, appropriate acoustic mitigation measures should be incorporated in the design of the residential lots (see Section 7 following).

Similarly, the red shaded areas shown in Figure 4 and Figure 5 for the night period indicate the locations within the Glenmore Park East precinct where road traffic noise levels from the surrounding road network, for the year 2041, would exceed the SEPP road traffic noise criteria for the night period [i.e. > $L_{Aeq,9hr}$ 55dB(A)]. Therefore, it is recommended that for residential lots located within the red shaded areas, appropriate acoustic mitigation measures should be incorporated in the design of the residential lots (see Section 7 following).

7 Recommendations

The following recommendations provide typical noise control solutions commonly used to reduce noise impacts to residential buildings that may be developed along The Northern Road, Glenmore Parkway and Bradley Street within the development. This information is presented for the purpose of development assessment only and shall not be used in more detailed design unless otherwise approved in writing by the acoustic consultant.

7.1 Noise Barriers

Whilst the use of acoustic barriers is unlikely to be consistent with the aesthetics of the precinct, for residential properties constructed within the $L_{Aeq(15hr)}$ 60dB(A) and/or $L_{Aeq(9hr)}$ 55dB(A) contours (i.e. red shaded areas shown in the above figures), the use of noise barriers can be considered to reduce traffic noise impacts. Noise barriers can usually reduce noise levels by at least 5dB(A) when they are high enough to break line-of-sight and 10-15dB(A) in the acoustic 'shadow zone', with a maximum total noise reduction of 20dB(A).

Noise barriers can be effective for mitigating traffic noise where residences are closely grouped and there are no breaks / gaps in the barrier. Where the proposed dwellings are of double storey or multi-storey construction, high noise barriers (> 5m) would be required to mitigate noise to the upper levels and may not be a feasible option given the structural requirements for high barriers.

Furthermore, noise barriers are only feasible where the barriers do not cause access difficulties to properties and where they are visually acceptable. Where driveway access is required for residential properties it is preferred not to use noise barriers as the overall noise reduction provided by the barrier is compromised by the need to install an access gate.

The effectiveness and location of any noise barriers will need to be investigated during the detailed design stage when final property layout, building footprints and density distribution have been determined. The use of acoustic barriers is not mandatory and other design solutions in the following sections can be utilised to address the SEPP.

7.2 Building Treatment

Residential properties constructed within the $L_{Aeq(15hr)}$ 60dB(A) and/or $L_{Aeq(9hr)}$ 55dB(A) contours (i.e. red shaded areas shown in the above figures) should be designed to satisfy the internal noise requirements of the SEPP.

Examples of building treatment options that may be considered in order to achieve the SEPP requirements may include, but not limited to, the following:

- Provide glazing with sufficient acoustic performance for windows facing the traffic noise source including the installation of acoustic seals for operable windows.

- Provide doors with sufficient acoustic performance for doors facing the traffic noise source including the installation of acoustic seals.
- Facades facing the traffic noise source be of masonry construction.
- If the SEPP internal noise levels can only be achieved with windows and doors closed, then mechanical ventilation (eg. acoustic wall ventilators, air conditioners that provide fresh air circulation or the like) should be provided to ensure fresh airflow inside the dwellings when windows and doors are closed, so to meet the requirements of the Building Code of Australia (BCA).

Depending on the noise reductions required in order to achieve the internal noise requirements of the SEPP, various types of building treatment options are available to mitigate noise. The associated cost implications will depend upon the required noise controls options shown below. It is noted that cost estimates are only provided as a guide and should not be used for cost planning.

- **Option 1** **Mechanical ventilation only**

  1-10 dB(A) reduction

  Where external noise levels are less than 10dB(A) above the nominated external criteria, the internal noise goals may be achieved with windows and doors closed. A light framed building with single glazed windows will provide a minimum noise reduction of up to 20dB(A) from outside to inside when windows and doors are closed. If the SEPP internal noise goals can only be achieved with windows and doors closed, then mechanical ventilation must be provided to ensure fresh airflow inside the dwelling so to meet the requirements of the Building Code of Australia.

  It is important to ensure that mechanical ventilation does not provide a new noise leakage path into the dwelling and does not create a noise nuisance to neighbouring residential premises.

- **Option 2** **Upgraded seals for windows and doors**

  10-12dB(A) reduction

  Where external noise levels are only slightly greater than 10dB(A) above the nominated external criteria, then in addition to installing mechanical ventilation systems (Option 1), special acoustic grade seals should also be installed on windows and perimeter doors exposed to road traffic noise to enable the internal noise criteria to be achieved with windows and doors shut.

- **Option 3** **Upgraded windows, glazing and doors**

  >12 dB(A) reduction

  Where the predicted external noise level exceeds the nominated external criteria by significantly more than 10dB(A), then upgraded windows and glazing and the provision of solid core doors will be required on the facades exposed to the road noise source, in addition to the mechanical ventilation described in Option 1 and the acoustic seals in Option 2. Note that these upgrades are only suitable for masonry buildings. It is unlikely that this degree of upgrade would provide

significant benefits to light framed structures should there be no acoustic insulation in the walls.

Other community (e.g. libraries), commercial and industrial buildings should also be constructed to achieve the recommended internal noise levels presented in Australian Standard AS2107:2000 'Acoustics – Recommended design sound levels and reverberation times for building interiors'.

The table below provides a summary of typical recommended indoor design sound levels from AS2107:2000. It is noted that this summary is for guidance only and is by no means exhaustive.

Table 7.1 – Recommended Internal Sound Levels Based on AS2107:2000

Type of Occupancy	Activity	Recommended Design Sound Level, L_{Aeq} dB(A)	
		Satisfactory	Maximum
Child Care Centre	Teaching Areas	35	45
	Outdoor Play Areas[1]	$L_{Aeq(1hr)}$ 55[1]	-
Libraries	Office Spaces	40	45
	Reading Areas	40	45
	Stack Areas	45	50
	Workshop Areas	45	55
Shop Building	Small retail store (general)	45	50
	Supermarkets	50	55

Notes: 1. External noise level, taken from RNP (p13) Table 4 – Outdoor play areas

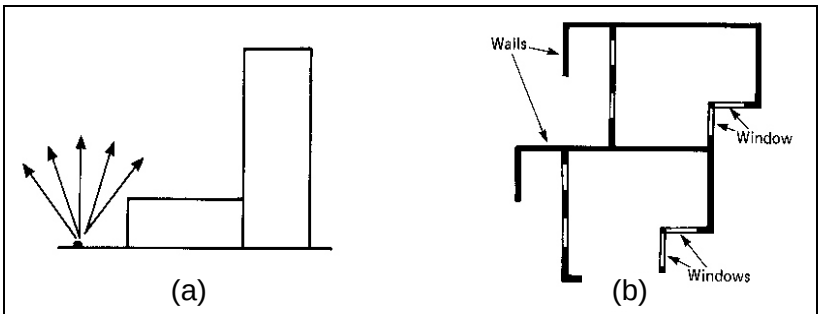
7.3 Building Design

Buildings to be constructed in areas affected by road traffic noise, as discussed above, should consider building layout design at the design stage to aid in achieving compliance with SEPP requirements for internal noise levels.

Courtyards and open space areas can be located away from the road, using the building as a buffer to obtain a quiet outdoor environment. Within the building itself, locate less sensitive rooms (eg. kitchens, bathrooms, laundry, etc) closest to the road, so that these essentially form a barrier between the road and noise sensitive rooms such as bedrooms. Where possible, locate the building further away from the road, thereby reducing road traffic noise at the facade.

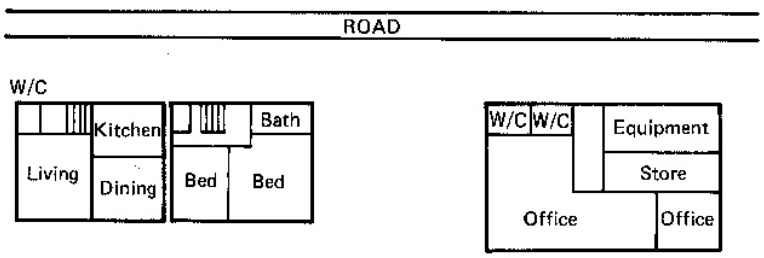
Figure 6 below provides examples of 'self-protecting' building design.

Figure 6 – Examples of 'Self-Protecting' Buildings



(a) Podium provides shielding for most of the tower block

(b) Building shape provides shielding for the windows and the solid wing wall provides a quiet courtyard



(c) Arrangement of rooms to minimise traffic noise problems

(Nelson P 1987 p11/16)

8 Conclusion

Renzo Tonin & Associates has completed an investigation of traffic noise impacts for the proposed Glenmore Park East precinct. Traffic noise impacts have been quantified and compared to the noise guidelines set by the RNP and SEPP, in accordance with Penrith City Council's DCP.

Any noise mitigation recommendations included in this report are in-principle only. The assistance of an acoustic consultant must be sought at the detailed design phase of the project to provide more accurate design advice when there is more detailed information available about building type, lot arrangement and traffic on the surrounding road network.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	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).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.