Woodville Corridor Planning Framework

Acoustic and air quality study

Cumberland City Council

26 June 2023

→ The Power of Commitment

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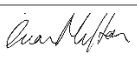
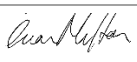
S4	1	M.Velasco	E.Milton		E.Milton		26/06/23

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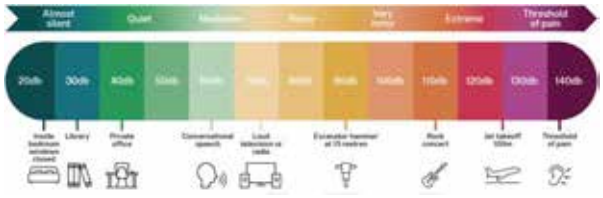
Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

Glossary of terms

Item	Description
$\mu g/m^3$	Micrograms per cubic metre
A-frequency weighting (dBA)	An adjustment made to sound level measurement, by means of an electronic filter, in line with international standards. This approximates the response of the human ear at lower sound pressure levels.
AADT	Annual average daily traffic or total volume of traffic passing a roadside observation point over the period of a calendar year, divided by the number of days in that year
AQMS	Air Quality Monitoring Station
BoM	Bureau of Meteorology
Buffer	An area of land between a roadway or rail corridor and a noise-sensitive land use, used as open space or for some other noise-tolerant land use.
Busy road	A busy road is defined as: – Roads specified in Clause 102 of the Infrastructure SEPP: a freeway, tollway or a transitway or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA). – Any other road – with an average annual daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of the RTA) – Any other road – with a high level of truck movements or bus traffic..
CLPP	Cumberland Local Planning Panel
CO	Carbon Monoxide
Council	Refers to Cumblerland City Council
dB	Decibel, which is 20 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a measure of sound.
dBA	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
DCP	Development Control Plan
Habitable room	Any room other than a garage, storage area, bathroom, laundry, toilet or pantry
Heavy vehicle	A truck, transport or other vehicle with a gross vehicle weight greater than 4.5 tonnes.
$L_{Aeq(period)}$	Equivalent sound pressure level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. Typical sound pressure levels are provided below for reference: 
$L_{Aeq(15hour)}$	The L_{Aeq} noise level for 7 am to 10 pm or the 'day period'
$L_{Aeq(9hour)}$	The L_{Aeq} noise level for 10 pm to 7 am or the 'night period'
$L_{Aeq(1hour)}$	The noise level representing the 'average maximum' one-hour noise level to the AM / PM peak
Local road	A road handling local traffic and characteristically having low or intermittent traffic flows.
LEP	Local Environmental Plan
NO_2	Nitrogen Dioxide
PM_{10}	Particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less
$PM_{2.5}$	Particulate matter with an equivalent aerodynamic diameter of 2.5 micrometres or less

Item	Description
Rail corridor	as defined in the SEPP (Transport and Infrastructure): – Land that is owned, leased managed or controlled by a public authority for the purpose of a railway or rail infrastructure facilities, or – Land that is zoned under an environmental planning instrument predominantly or solely for the development for purpose of a railway or rail infrastructure facilities, or – Land in respect of which the Minister has granted approval under Part 3A or (before its repeal) Division 4 of Part 5 of the Act for the carrying out of development (or for a concept plan for a project comprising or including development) for the purpose of a railway or rail infrastructure facilities.
Road corridor	as defined in the SEPP (Transport and Infrastructure): – land that is used for the purposes of a road or road infrastructure facilities and owned or managed by a public authority, or – any land in respect of which the Minister has granted approval under Part 3A or Division 5.2 or (before its repeal) Division 4 of Part 5 of the Act, or consent under Part 4 of the Act, for the carrying out of development for the purpose of a road or road infrastructure facilities
Setback	The distance between the building alignment or face and the corresponding land boundaries of a property, which are controlled through planning regulation
Sensitive development	Development for any of the following purposes that is on land that is in or immediately adjacent to a rail corridor or busy road and the consent authority considers development is likely to be adversely affected by rail noise or vibration: i.e. a building for residential use, a place of public worship, a hospital or an educational establishment or childcare centre
SEPP	State Environmental Planning Policy

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Existing Low Density Housing Within The Study Area

Introduction and policy context

Purpose of the report and a summary of the relevant legislation, policies and guidelines pertaining to air quality and noise amenity

1. Introduction

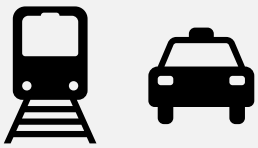
1.1 Project background

The Woodville Road Corridor (WRC) Planning Proposal (PP) is currently being updated by Cumberland City Council in accordance with a new Local Environmental Plan Making Guideline adopted by the NSW Department of Planning and Environment (DPE) in 2021. The history of the Woodville Corridor Planning Framework is summarised below.

2015 - 2016	• Former Parramatta City Council exhibited the Draft Woodville Road Corridor Strategy
2019	• Council endorsed a staged apprach for future land use planning of the Woodville Road Corridor
2021	• Draft planning proposal, DCP and public domain plan were considered by Cumberland Local Planning Panel (CLPP). • The revised draft Planning Proposal (PP) was endorsed by Council
2021 to 2022	• New LEP Making Guideline, Ministerial Directions and Consolidated SEPPs • Additional supporting technical studies required and updates to the planning proposal to align with DPE
Now	• Additional studies being prepared to consider the acoustic and air quality amenity impacts of the WRC Planning Framework and to inform the planning controls for the Woodville Road DCP

1.2 Woodville Road Corridor Planning Framework

Cumberland City Council's WRC Planning Framework (the 'proposal') provides a new approach to guide development along the Woodville Road corridor. It proposes to focus growth at three precincts along the corridor that can take advantage of existing and planned infrastructure and facilities. Where no changes are proposed, the existing planning controls will continue to apply in these areas. The framework will also inform the preparation of detailed planning controls for the corridor in the future, including a Planning Proposal and Development Control Plan. The Planning Framework has identified three main precincts within the WRC. The three precincts and the key sources of pollution are shown below and have been allocated a Precinct ID for reference within this report.

A	**Woodville North Precinct**	**State Roads**: Woodville Road **Other busy roads**: Merrylands Road, Randle Street and William Street **Railway corridor**: T2 Line between Merrylands and Granville	
B	**Merrylands East Precinct**	**State Roads**: Woodville Road **Other busy roads**: Oxford Street	
C	**Woodville South Precinct**	**State Roads**: Woodville Road **Other busy roads**: Rawson Road and Guildford Road	

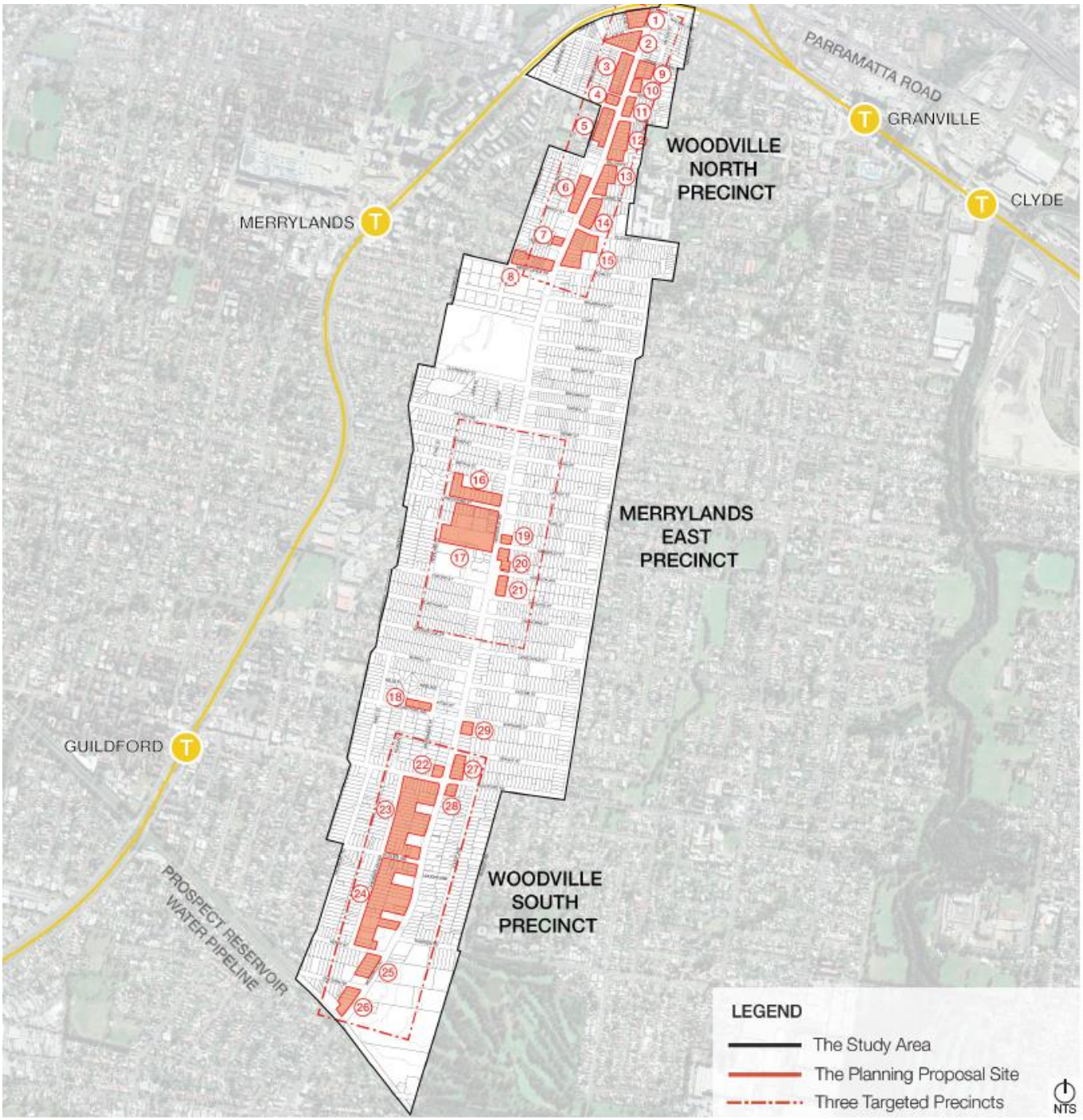


Figure 1.1 *Woodville Road Corridor – Proposed Planning Framework (Image source: CM+ Urban Design Report – Stage 1+2 Report, June 2023)*

1.3 Purpose of this report

GHD has prepared this acoustic and air quality assessment to assess the potential for amenity impacts associated with the proposal and to identify opportunities to provide outcomes that protect the amenity of the community whilst enabling future development. Excessive noise from nearby industrial noise sources or from transport noise including road, rail and aircraft can disrupt daily activities, sleep disturbances, and result in other health issues. Air quality from nearby sources can affect health and quality of life.

The key outcome is to ensure potential amenity issues associated with a proposal package are identified and appropriate and achievable design controls are implemented in planning controls and instruments. This is to ensure the amenity of the community and the environment is protected in line with the relevant legislation, applicable guidelines and policies.

The aim of the study is:

– To identify the existing noise sources and any key acoustic and air quality impacts generated from both the railway corridor and Woodville Road to the proposed Woodville Road Corridor Planning Framework area
– To assess and recommend air quality and noise mitigation design considerations in accordance with the SEPP (Transport and Infrastructure) 2021 and the Development Near Rail Corridors and Busy Roads –Interim Guidelines (2008)
– To provide comments, where necessary, regarding state planning legislation and policies and Council planning controls for the DCP, recommending changes that addresses any impacts as a result of the proposed planning framework

1.4 Scope and limitations

This report: has been prepared by GHD for Cumberland City Council and may only be used and relied on by Cumberland City Council for the purpose agreed between GHD and Cumberland City Council as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Cumberland City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.5 of this report and the assumptions made throughout). GHD disclaims liability arising from any of the assumptions being incorrect.

1.5 Key assumptions

This report relies on the following information provided to GHD:

– Traffic count and traffic volume information provided by Bitzios as detailed in Appendix C-1
– The Built Form Masterplan provided by Conynear Morrison (Appendix B)

The noise modelling assumptions, inputs and parameters to predict road traffic noise levels are detailed in Appendix C-2. Using the existing traffic volumes, the noise model has been validated with existing noise levels as detailed in Appendix C-3.

The air quality modelling assumptions, inputs and parameters to predict air quality concentration are detailed in Appendix G.

Assumptions have been made to forecast traffic volumes 10 years in the future. These assumptions are described in detail in Appendix C-1. The forecast traffic volumes have been used to predict future road traffic noise levels at the planning proposal sites within the Woodville Road Corridor Planning Framework.

2. Planning and regulatory framework

The Environmental Planning and Assessment Act 1979 (EPA Act) and associated Regulation establishes the planning and environmental assessment system for NSW. It establishes the legislative framework for the bulk of the planning system. The EPA Act is followed closely by State Environmental Planning Policies (SEPP), which establish planning controls for specific areas or types of development. The State Government prepares the EPA Act and SEPP and Councils prepare Local Environmental Plans (LEP) and Development Control Plans (DCP) to regulate development and land use within a particular local government area. The relevant objectives and controls within Part B of the Cumberland DCP 2021 are reproduced in Appendix A.

A Development Control Plan would be developed for the Woodville Road Corridor and the planning controls relevant to amenity (noise and air quality) would be informed by the outcomes of this study.

2.1 State Environmental Planning Policies

State Environment Planning Policies (SEPPs) address matters of state and regional environmental planning significance. The key SEPP instruments that apply to the Woodville Road Corridor Planning Framework are presented in Table 2.1 along with the key requirements pertaining to acoustics and air quality.

Table 2.1 State Environmental Planning Policies

SEPP	Relevant requirements	Relevant Guideline
State Environmental Planning Policy (Transport and Infrastructure) 2021	The State Environmental Planning Policy (Transport and Infrastructure) 2021 provides a consistent planning regime for infrastructure and the provision of services across NSW. If the consent authority considers that land that is in or adjacent to a rail corridor or a busy road is likely to be adversely affected by noise or vibration, the consent authority must not consent to a residential development unless it is satisfied that appropriate measures will be taken to ensure that the internal L_{Aeq} noise levels prescribed in the SEPP can be achieved (see Table 2.2)	The Development near Rail Corridors and Busy Roads Interim Guideline (DoP 2008) provides guidance for the planning, design, and assessment of development in or adjacent to rail corridors and busy roads to support the Transport and Infrastructure SEPP
State Environmental Planning Policy No 65 - Design Quality of Residential Apartment Development (SEPP 65).	The NSW Government promotes better apartment design across NSW through the SEPP 65 – Design Quality of Residential Flat Apartment Development policy. This policy aims to deliver a better living environment for the residents now choosing this form of housing, and enhance our streetscapes and our neighbourhoods across the State. It does this by establishing a consistent approach to the design and assessment of apartments and the way they are assessed by councils.	The Apartment Design Guide (DPE 2015) explains how to apply SEPP 65's design principles to the design of new apartments, including natural ventilation design objectives (4B) and design objectives to reduce noise and pollution for development near busy roads, rail lines and beneath flight paths.

2.1.1 SEPP (Transport and Infrastructure) 2021

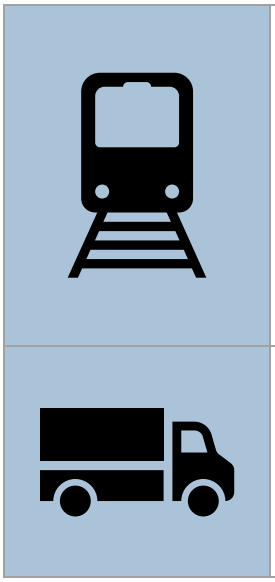
The State Environmental Planning Policy (Transport and Infrastructure) 2021 provides a consistent planning regime for infrastructure and the provision of services across NSW. If the consent authority considers that land that is in or adjacent to a rail corridor or a busy road is likely to be adversely affected by noise, vibration or vehicle emissions, the consent authority must not consent to a residential development unless it is satisfied that appropriate measures will be taken to ensure that the internal L_{Aeq}

noise levels prescribed in the SEPP can be achieved (see Table 2.2) and that vehicle emissions can be adequately controlled .

The construction of sensitive developments such as residential dwellings, churches, hospitals, and schools on land in or immediately adjacent to a rail corridor or busy road triggers the requirement to consider air and noise pollution under the Transport and Infrastructure SEPP.

Clause 2.119 notes that proposed developments with frontage to classified roads must not be sensitive to traffic noise or vehicle emissions or must be located and adequately designed to ameliorate potential traffic noise and vehicle emissions from adjacent classified roads.

The definition of a 'rail corridor' and a 'busy road' as defined in the Transport and Infrastructure SEPP are provided below.



Clause 2.100

Rail corridor: as defined by clause 2.100 of the Infrastructure SEPP.

- Land that is owned, leased managed or controlled by a public authority for the purpose of a railway or rail infrastructure facilities, or
- Land that is zoned under an environmental planning instrument predominantly or solely for the development for purpose of a railway or rail infrastructure facilities, or
- Land in respect of which the Minister has granted approval under Part 3A or (before its repeal) Division 4 of Part 5 of the Act for the carrying out of development (or for a concept plan for a project comprising or including development) for the purpose of a railway or rail infrastructure facilities.

Clause 2.120

A busy road is defined as:

- 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)

Development near busy roads and corridors

The *Development near rail corridors and busy roads Interim Guideline* is a document prepared by the Department of Planning to reduce the health impacts of rail and road noise and emissions to air on sensitive adjacent developments. The Transport and Infrastructure SEPP refers to the guidelines that must be considered where development is proposed in, or adjacent to, specific roads and railway corridors under clauses 2.100 (rail) and 2.120 (road). The internal noise levels from the Interim Guideline to be achieved are provided in Table 2.2.

Table 2.2 Transport and Infrastructure SEPP internal noise levels

Development type	Room type	Internal noise level	Time period
Residential	Bedrooms	35 dBA	Night
	Other habitable rooms	40 dBA	Day / 24 hours
Hospitals	Wards	35 dBA	When in use
	Other noise sensitive areas	45 dBA	When in use
Place of worship	Internal areas (learning spaces)	40 dBA	When in use

Development type	Room type	Internal noise level	Time period
Educational institutes and child care centres	Internal areas (learning spaces)	40 dBA	When in use

2.1.2 SEPP 65 – Design Quality of Residential Development (2002)

Principle 6: Amenity

Residential apartment developments also need to meet the requirements set out in SEPP 65. SEPP 65 establishes nine design quality principles to be applied in the design and assessment of residential apartment development, including Principle 6: Amenity. This Policy aims to improve the design quality of residential apartment development in New South Wales.

Apartment Design Guide

The NSW Apartment Design Guide (Department of Planning and Environment, 2005) details how residential development proposals can meet these principles (including acoustic amenity) through good design and planning practice. This Apartment Design Guide is a resource to improve the planning and design of residential apartment development in NSW. The Apartment Design Guide is to be used in conjunction with State Environmental Planning Policy No 65 – Design Quality of Residential Apartment Development (SEPP 65) which sets out the NSW Government's policy direction for residential apartment development in NSW.

The relevant objectives of the Apartment Design Guide are reproduced in Table 2.3. For each objective the ADG, provides design guidance and design criteria (where relevant).

Table 2.3 Apartment Design Guide objectives (natural ventilation and noise and pollution)

Development type	Objective no.	Objectives
Natural ventilation	4B-1	All habitable rooms are naturally ventilated
	4B-2	The layout and design of single aspect apartments maximises natural ventilation
	4B-3	The number of apartments with natural cross ventilation is maximised to create a comfortable indoor environment for residents
Noise and pollution	4J-1	In noisy or hostile environments the impacts of external noise and pollution are minimised through the careful siting and layout of buildings
	4J-2	Appropriate noise shielding or attenuation techniques for the building design, construction and choice of materials are used to mitigate noise transmission

SEPP 65 development in locations adjacent to rail corridors and busy roads must have regard to the *Development near rail corridors and busy roads Interim Guideline*.

Woodville Road Corridor Planning Framework

A summary of the planning framework relevant to acoustic and air quality amenity

3. Woodville Road Corridor Planning Framework

3.1 Masterplan

Conybeare Morrison has prepared a Built Form Masterplan (Appendix B) including an Urban Design Strategy where R4 High Density Residential Zoning is proposed along the first row of properties along Woodville Road and R3 Medium Density zoning beyond. Employment Zones are concentrated at the key Woodville Road and East-West side street intersections, with 3 key Employment Zones proposed, one for each precinct. The John Cootes site is zoned E1 Local Centre.

The Overall Masterplan Zoning Map (indicative) is shown in Figure 3.1 along with the key planning proposal sites. The masterplan identified three key precincts as shown in Figure 3.2 (Woodville Road North), Figure 3.3 (Merrylands East) and Figure 3.4 (Woodville Road South). They key sources of air and noise pollution are shown graphically in these figures.

3.2 Air and noise pollutions sources

Clause 2.120 of the Transport and Infrastructure SEPP requires that sensitive development near busy roads be designed to protect the acoustic and air quality amenity of future occupants. A noise impact assessment (NIA) should be prepared and accompany a Development Application (DA) where development is proposed adjacent to a 'busy road' or 'rail corridor' as defined in the SEPP. Air quality should be a design consideration for all developments near Woodville Road.

New development along road corridors with an annual average daily traffic (AADT) volume greater than 20,000 vehicles would require the need for a NIA and an air quality assessment (AQA) (mandatory) under the Transport and Infrastructure SEPP.

Development along the other regional and local roads within the Woodville Road Corridor Planning Framework would not trigger a requirement for a NIA to achieve the requirements of the Transport and Infrastructure SEPP unless the proposed development is also adjacent to a 'busy road'.

Table 3.1 Air and noise pollutions sources

Estimated ADT	Assessment required	Roads within the Woodville Road Corridor Planning Framework
<2000	Not required unless the development is also adjacent to a 'busy road' or rail corridor	Earl St, Union St, Brady St, Claremont St, Farnell St, Park St, Bertha St, Bursill St, Mountford St, Wynyard St, Rhodes St, Henry St
2,000 to 5,000		Lansdowne St
5,000 to 10,000		Randle St
10,000 to 15,000		Guildford St (West of Woodville Road)
15,000 to 20,000		Merrylands St, Louis St, William St, Guildford St (East of Woodville Road)
20,000 to 25,000	Yes (mandatory) A busy road specified under Clause 102 of the SEPP	Oxford St, Rawson Rd
>40,000	Yes (mandatory) A busy road specified under Clause 102 of the SEPP	A - Woodville Road North Precinct
		B – Merrylands East Precinct
		C - Woodville Road South Precinct

Other side streets not listed in Table 3.1 would have relatively low traffic volumes and would not trigger a requirement for a NIA to achieve the requirements of the Transport and Infrastructure SEPP unless the proposed development is also adjacent to a ‘busy road’.Air and noise pollutions sources

Note should be made that new developments on the corner of Wallace Street and Woodville Road would be exposed to both rail and traffic movements. The most-affected facades on the eastern, northern and southern sides would be predominantly exposed to the road traffic and the most-affected facades on the western side would be predominantly exposed to commuter rail traffic movements. The T2 rail line can be seen in Figure 3.2 (Woodville North).

For rail corridors with passenger services with movements less than 80 km/hr, the *Development near rail corridors and busy roads Interim Guideline recommends* a full noise assessment should be mandatory for sensitive development within 10 m of the nearest track and should be considered for sensitive development within 60 metres of the nearest track (see Figure 3.2).

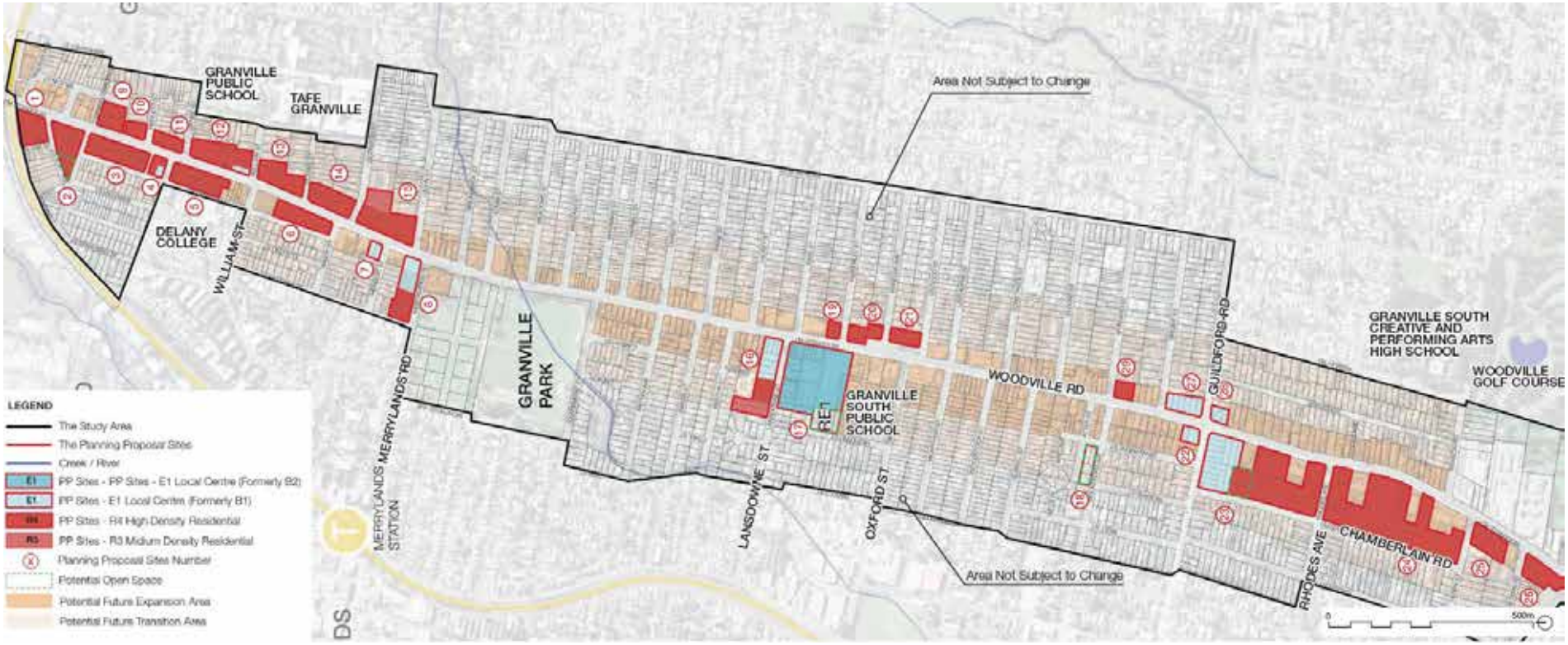
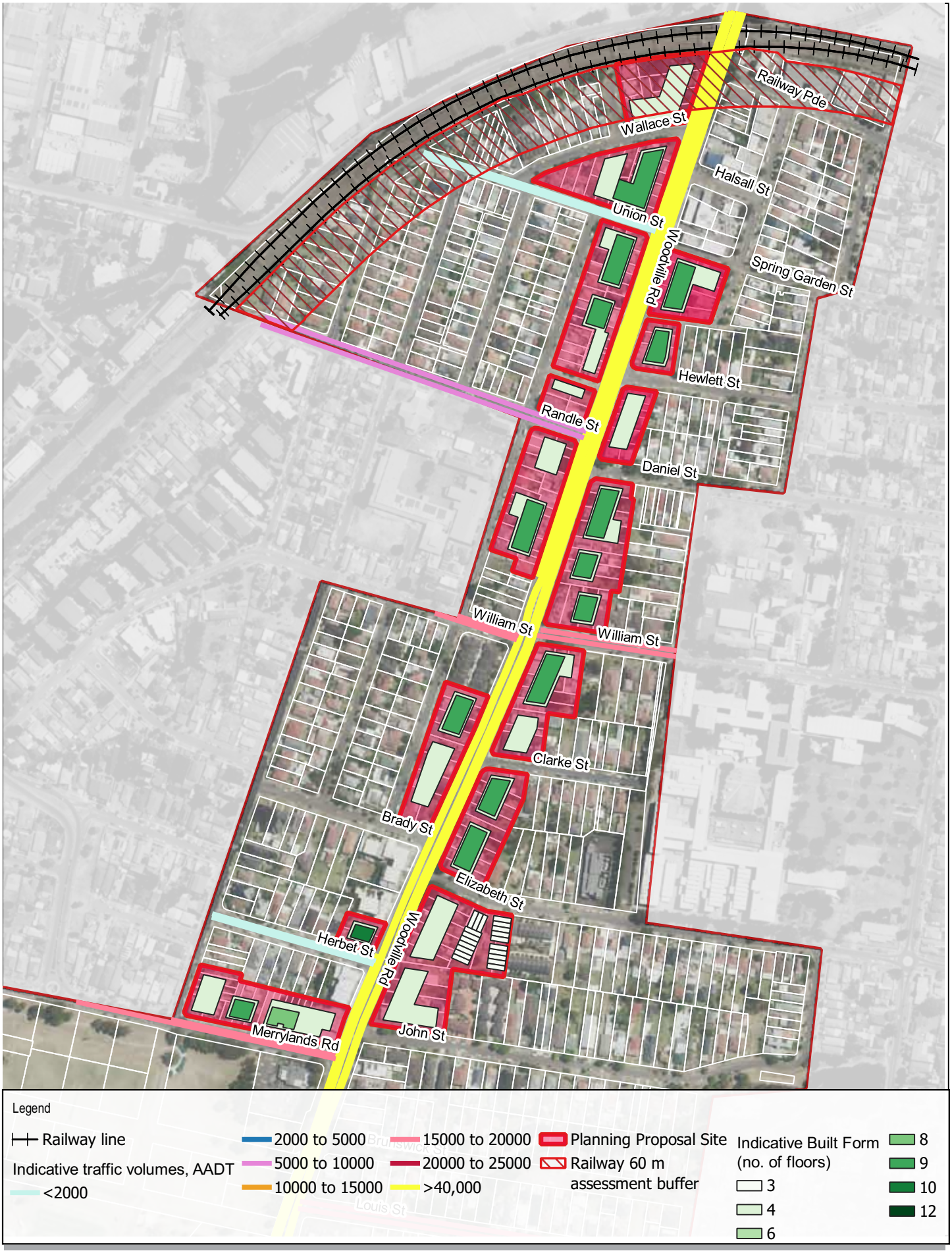


Figure 3.1 Masterplan zoning plan



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Woodvill Road Corridor Planning Framework

Acoustic and air quality study - Woodville North Precinct

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FIGURE 3.2

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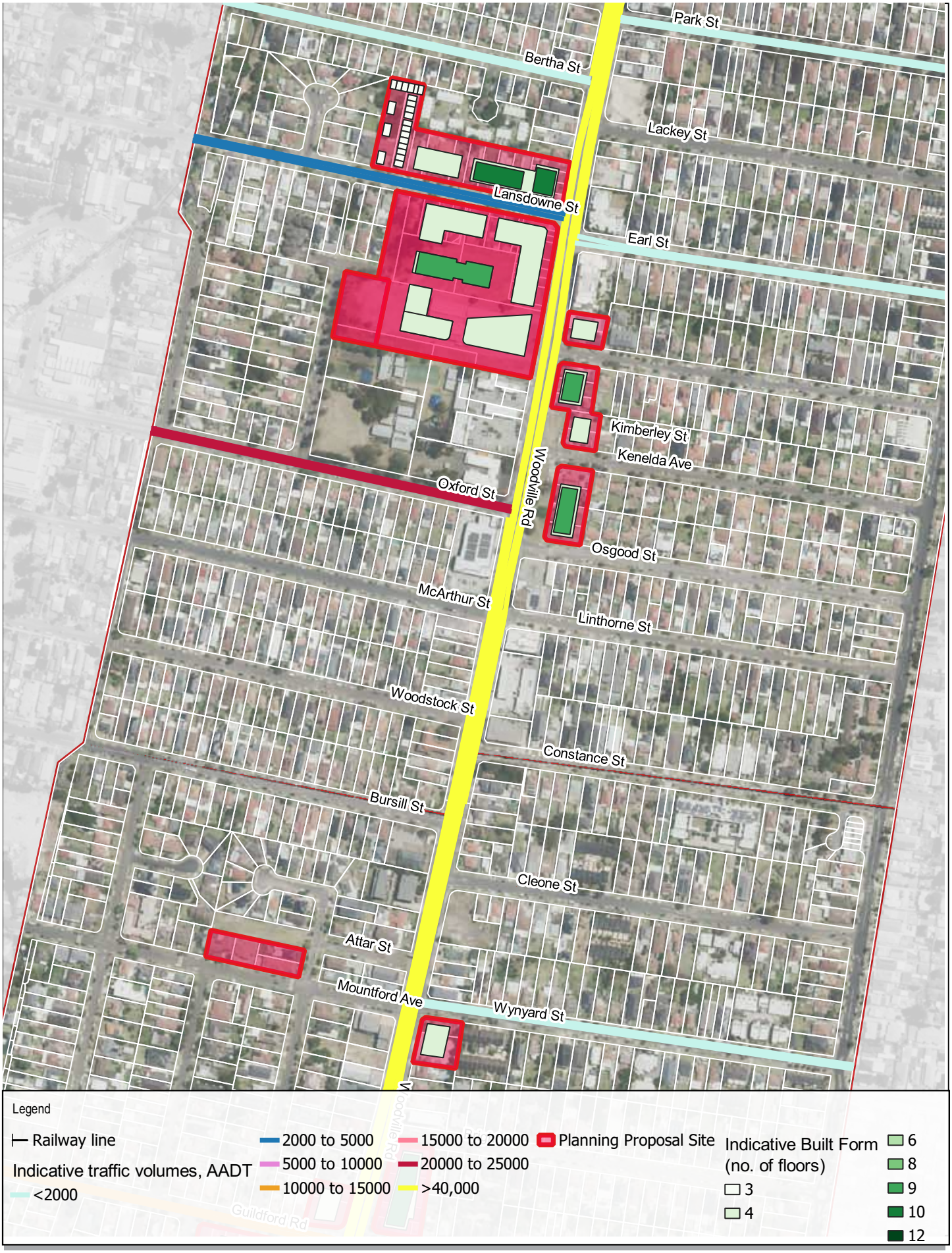

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Cumberland City Council
Woodvill Road Corridor
Planning Framework

Acoustic and air quality study - Merrylands East Precinct

Project No. **12587867**
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FIGURE 3.3

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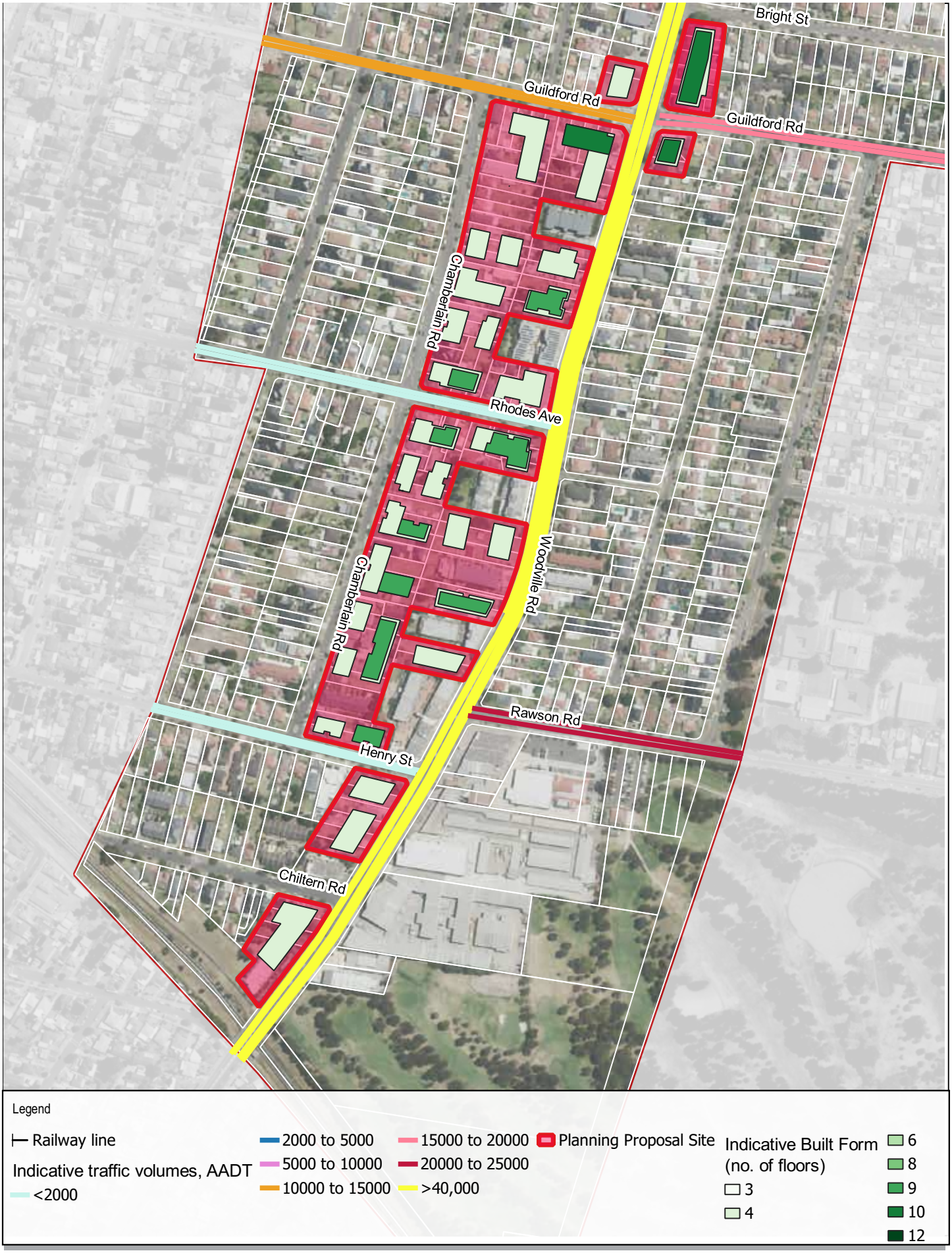

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Planning Framework

Acoustic and air quality study - Woodville South Precinct

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FIGURE 3.4

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A Local Shop along Guildford Road

Impact assessment

A summary of the identified noise and air pollutions sources along Woodville Road Corridor, potential impacts and mitigation options

4. Acoustic impact assessment

4.1 Noise modelling

Noise modelling was undertaken using the SoundPLAN 8.2 software package to predict façade noise levels based on the proposed built form for new developments along the Woodville Road Corridor (Appendix B) as well as buildings set back from the main road.

The noise modelling methodology is detailed in Appendix C and façade noise maps are also shown in Appendix E showing:

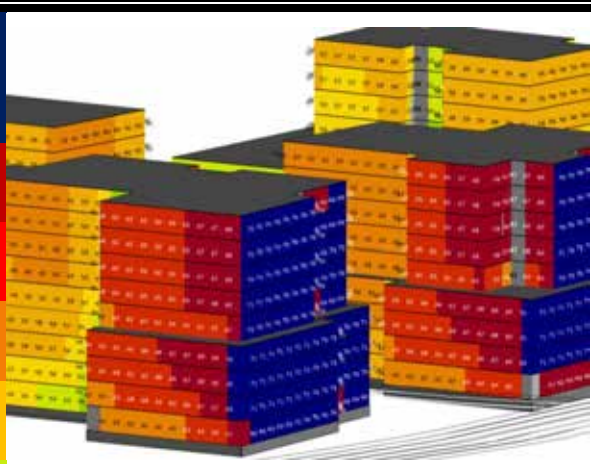
– $L_{Aeq(9hour)}$ night time noise levels; and
– $L_{Aeq(15hour)}$ day time noise levels

4.2 Summary of the results

The results of the noise modelling indicate that mitigation treatments would be required for residential developments fronting the Woodville Road corridor in all three precincts. A summary of the typical noise levels during the most-sensitive time period (night) at residential flat buildings fronting Woodville Road are shown in Table 4.1. The reduction in noise levels for various facades are also provided compared to the noise level at 10 metres from Woodville Road.

Table 4.1 Typical noise levels at Residential Flat Buildings fronting Woodville Road (based on 10 m setback) (night period)

70 dBA	**Average night-time noise level at 10m from the road (ground level)**
No reduction	**Facades parallel to Woodville Road**
1-3 dBA reduction	**Facades perpendicular to Woodville Road (no setback)**
3 dBA reduction	**Facades that at 2x the setback distance from Woodville Road**
3 - 6 dBA reduction	**Facades perpendicular to Woodville Road (setback)**
>12 dBA reduction	**Buildings behind the buildings fronting Woodville Road**
>15 dBA reduction	**Facades on the opposite side of the building**



Cross-section noise maps (night time noise levels) are shown in Figure 4.1 and Figure 4.2 for each precinct. These maps are based on the cross-section views shown in the Built Form Masterplan for the Woodville North Precinct (ref: Section 2), Merrylands East Precinct (ref: Section 4) and the Woodville South Precinct (ref: Section 5). Noise levels predicted to the façade include a +2.5 dB correction to account for the effects of noise being reflected from the façade of the building (at 1 metre from the façade).

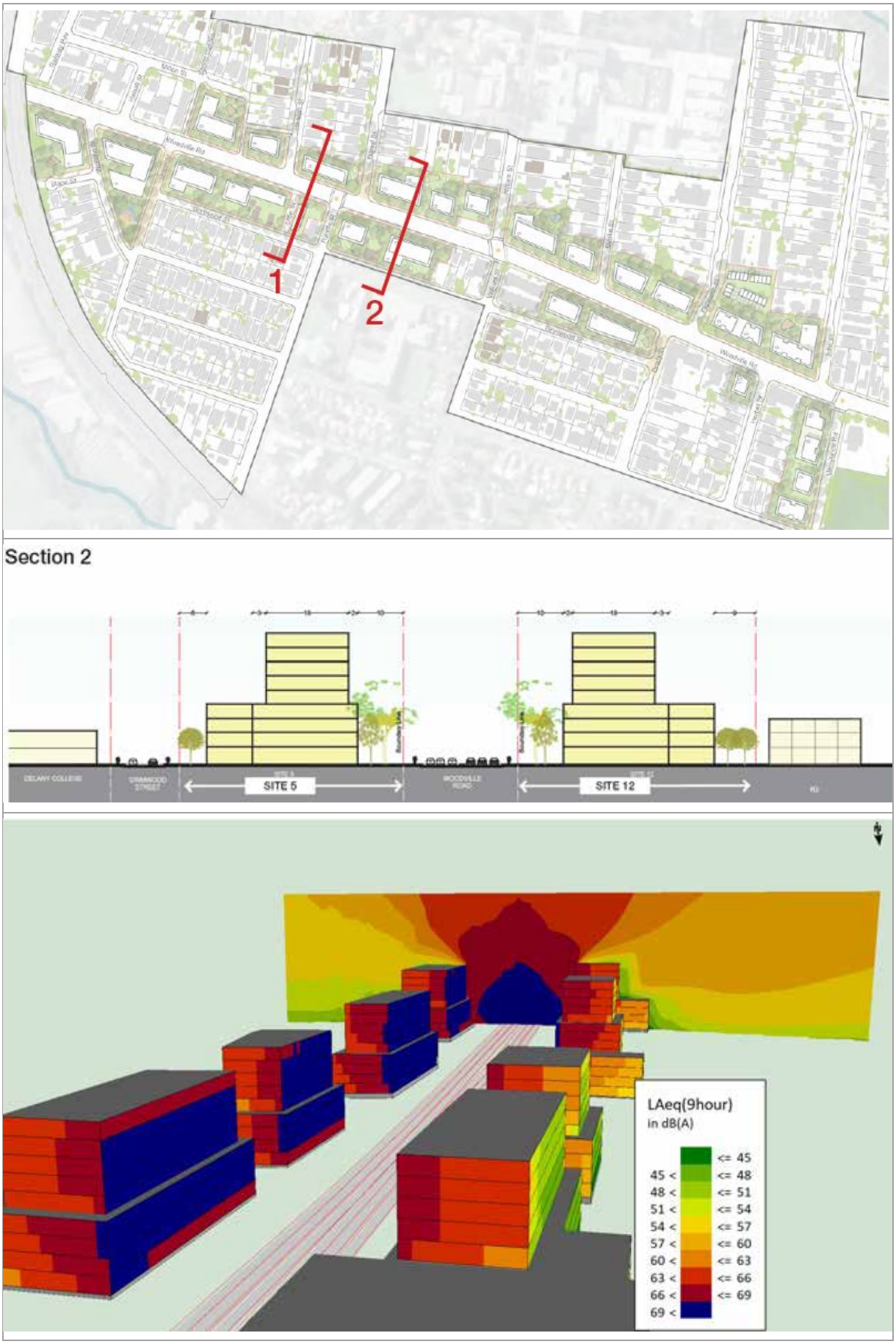


Figure 4.1 ***Woodville Road North Precinct cross section view and indicative noise levels, $L_{Aeq(9hour)}$ dBA***

Figure 4.2 *Merrylands East Precinct cross section view and indicative noise levels, $L_{Aeq(9hour)}$ dBA*

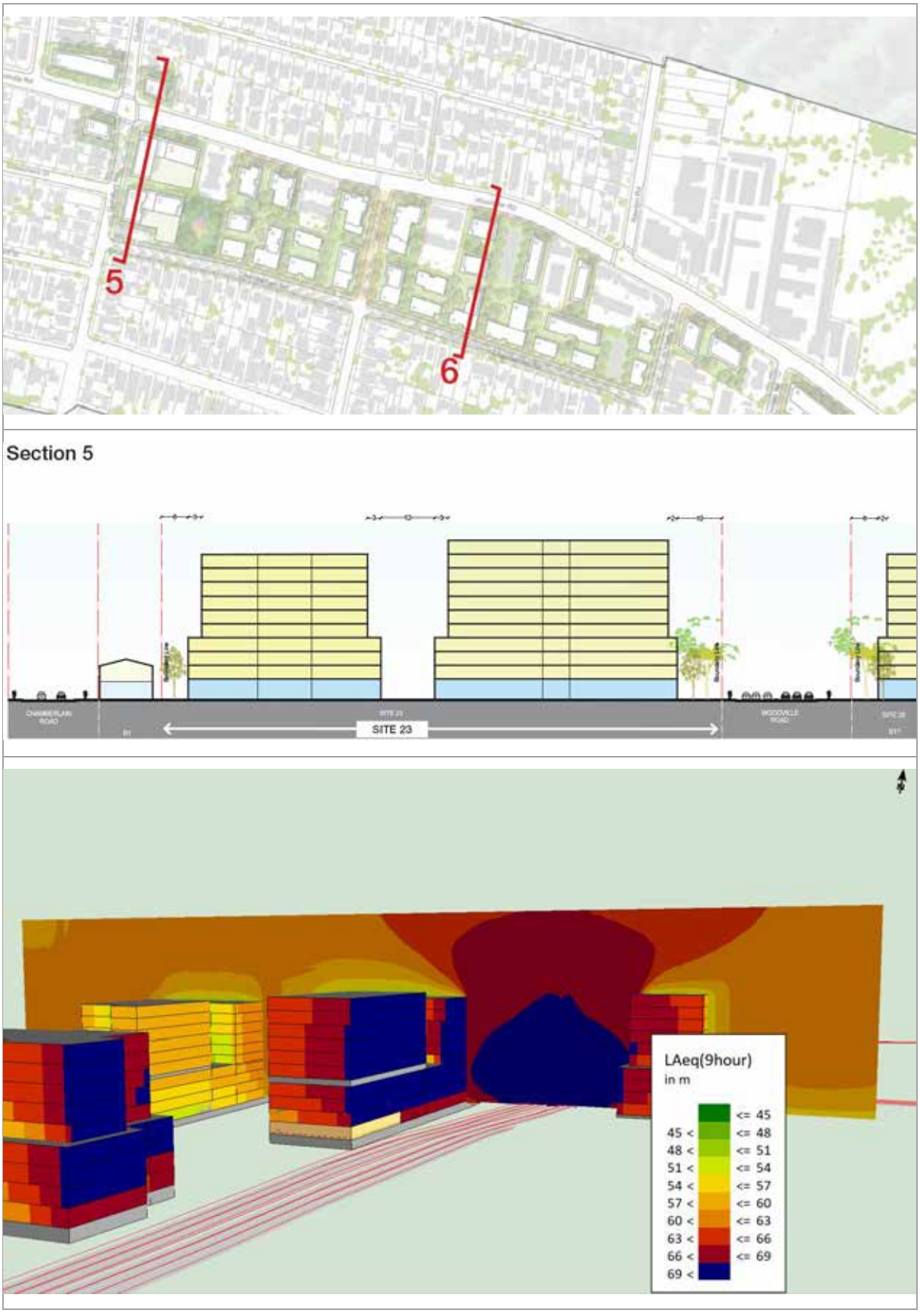


Figure 4.3 *Woodville South Precinct cross section view and indicative noise levels, $L_{Aeq(9hour)}$ dBA*

4.3 Summary of design considerations

The intent of the noise modelling is to help inform future planners, urban designers, architects, consultants and the relevant consent authorities of the design considerations for future development to ensure the following can be achieved:

– Internal noise levels for sleeping areas and other habitable rooms as prescribed in the Development near rail corridors and busy roads (Transport and Infrastructure SEPP)
– The natural ventilation objectives described in the NSW Apartment Design Guideline are considered (SEPP 65 – Design Quality of Residential Apartment Development)

There are various mitigation options available to ensure noise pollution can be minimised within sleeping and habitable rooms of residential apartments and dwellings. Section 3.8 of the *Development near Rail Corridors and Busy Roads Interim Guideline* provides useful information to avoid adverse airborne noise impacts from busy roads through good design practices. These design considerations are summarised in Table 4.2 and in Figure 4.4.

Note should be made that noise barriers are not considered a reasonable or feasible option to reduce noise levels for developments fronting Woodville Road as a barrier would have to be impractically high to block the line-of-sight to receivers overlooking the road.

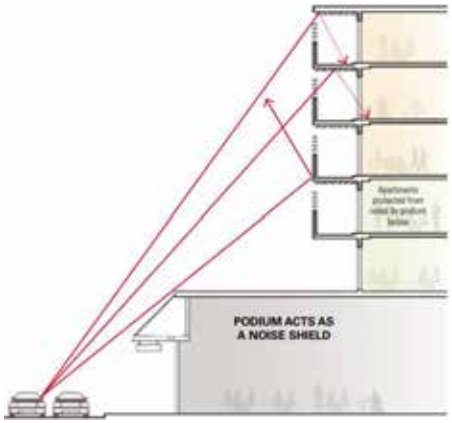
Table 4.2 Design considerations to reduce internal noise levels at residences

Consideration type	Design considerations
Built form design and land use type, internal layout considerations	– Building location and design orientation – Using non-sensitive or less-sensitive buildings/structures as noise shields for sensitive development – The use of lower-level podiums with commercial land uses to act as a noise shield to residential towers above. Residential towers should be setback from the podium edge to provide further noise reduction – Internal room layout to use less-sensitive rooms (e.g. laundries or bathrooms) as a buffer between noise sources and noise sensitive rooms (e.g. bedrooms)
Building treatment and internal room layout	– The use of either open balconies or enclosed balconies to reduce internal noise levels; and/or – Building façade treatments, with special consideration given to doors and glazing, to reduce internal noise levels

The Woodville Road Corridor Planning Framework also has some similarities with the Parramatta Road Corridor Urban Transformation Strategy (PRCUTS). The PRCUTS Planning and Design Guidelines Implementation Tool Kit (UrbanGrowth NSW, 2016) includes noise control and air quality design considerations that would also be considered appropriate for the Woodville Road Corridor Planning Framework. These design considerations are reproduced in Appendix F.

» Upper level setbacks / balconies«

- Lower floors podiums can act as a noise shield to residential apartments above
- This can provide both vertical separation to noise and pollution sources and horizontal separation when residential uses are set back from the source of noise or pollution
- Solid balustrades on balconies can act as a noise shield to reduce internal noise levels. However, the underside of the balcony above should be lined with sound absorptive material to reduce the reflection of noise to the facade

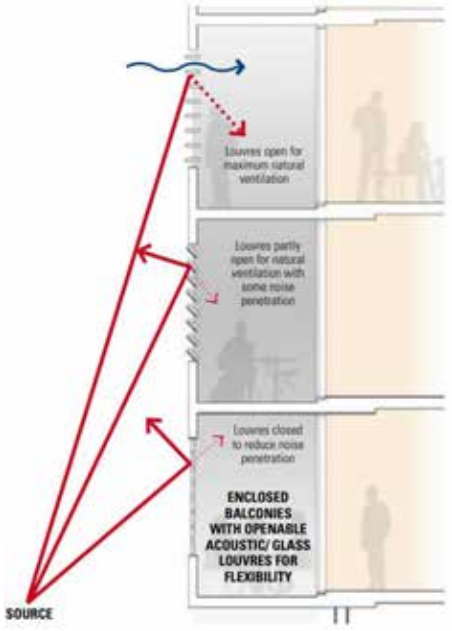


»Noise-residential uses as a buffer«

- The podium levels fronting the noise source would be exposed to the highest noise levels. Non-residential-land uses (e.g. commercial) should be encouraged at lower floors
- Orientating private open space and windows that provide natural ventilation to habitable rooms away from the busy road or rail corridor

»Enclosed balconies / wintergardens«

- Balconies can be designed as acoustically sealed wintergardens with retractable glazed acoustic screens or openable acoustic/glass louvres to both reduce noise levels at the facade and allow for natural ventilation to habitable spaces
- Engineering solutions can be designed where:
  - The air/noise path from the road source is screened by a solid balcony/balustrade; and
  - A low-level hinged window opening provides open area to the habitable space; and
  - The underside of the soffit above is lined with absorption



»Internal room layout«

- A key element of good acoustic planning and design is to increase the separation between sources of noise and pollution and a noise sensitive area
- Sleeping areas and other habitable areas should be placed on the side of the building furthest away from the source of noise and pollution, where possible
- Rooms that are less sensitive (e.g. laundries, bathrooms, stairwells, corridors etc.) should be located on the façade facing the noise or pollution source to act as a buffer

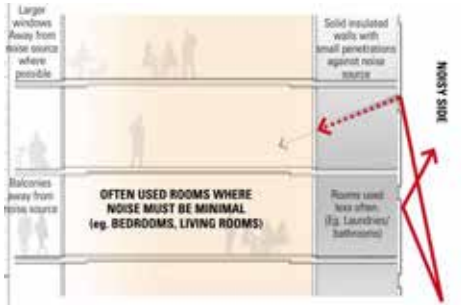


Figure 4.4 Building design considerations to reduce noise levels within sensitive spaces

4.4 Building design measures

For residential apartments fronting a busy road (e.g., Woodville Road), the following measures should be considered to maximise the distance between the road and bedrooms and other habitable rooms:

1. Vertically and horizontally separating habitable spaces and busy roads, considering lower-level podiums with non-residential land uses (e.g. commercial/retail)
2. Designing the internal layout of apartments to use non-noise sensitive spaces such as laundries, bathrooms and storage areas as noise buffers between the impacted façade and habitable spaces (see indicative floors plans provided in Appendix F-3)

Should habitable spaces be proposed to front a busy road, indicative façade noise maps are provided in Appendix C and have been colour-coded to reflect the design considerations in the tables below. Day and night road traffic noise levels are shown at the facades of buildings based on the proposed built form (Appendix B). For noise-affected facades, various architectural design considerations have been provided in Table 4.3 and Table 4.4 to achieve the internal noise levels (Table 2.2).

Table 4.3 Indicative architectural design considerations for other habitable rooms

Noise level range, dBA external		Architectural design category	Required façade reduction, dB		Indicative façade requirements to allow for natural ventilation	Indicative glazing requirements (closed windows)	
			Natural ventilation	Closed windows		Glazed doors / Large windows	Small windows
50	53	E	3	13	Considered marginally acceptable	Std. glazing	Std. glazing
53	56	D	6	16	Balcony with solid balustrade and acoustically lined soffit	Std. glazing	Std. glazing
56	59	D	9	19		Std. glazing	Std. glazing
59	62	C	12	22	Enclosed balcony with acoustically lined soffit / acoustically sealed louvres	6.38 mm lam	5 mm float
62	65	C	15	25		6.38 mm lam	5 mm float
65	68	B	18	28	Enclosed balcony with attenuated ventilation	10.38 mm lam	6.38 mm lam
68	71	B	21	31		10.38 mm lam	6.38 mm lam
71	74	A	24	34	Mechanical ventilation required to close windows	Dbl. glazing	12.5 Vlam Hush
74	77	A	27	37		Dbl. glazing	12.5 Vlam Hush

Table 4.4 Indicative architectural design considerations for bedrooms

Noise level range, dBA external		Architectural design category	Required façade reduction, dB		Indicative façade requirements to allow for natural ventilation	Indicative glazing requirements (closed windows)	
			Natural ventilation	Closed windows		Glazed doors / Large windows	Small windows
45	48	E	3	13	Considered marginally acceptable	Std. glazing	Std. glazing
48	51	D	6	16	Balcony with solid balustrade / acoustically lined soffit	Std. glazing	Std. glazing
51	54	D	9	19		Std. glazing	Std. glazing
54	57	C	12	22	Enclosed balcony with acoustically lined soffit and acoustically sealed louvres	6.38 mm lam	5 mm float
57	60	C	15	25		6.38 mm lam	5 mm float
60	63	B	18	28	Enclosed balcony with attenuated ventilation	10.38 mm lam	6.38 mm lam
63	66	B	21	31		10.38 mm lam	6.38 mm lam
66	69	A	24	34	Mechanical ventilation required to close windows	Dbl. glazing	12.5 Vlam Hush
69	72	A	27	37		Dbl. glazing	12.5 Vlam Hush

Façade design measures to reduce internal noise levels within habitable spaces are detailed in Table 4.5 for bedrooms and other habitable rooms.

Table 4.5 Design considerations to reduce internal noise levels

Consideration type	Design considerations
Habitable rooms (other than bedrooms)	– Where other habitable rooms (besides bedrooms), are proposed at facades facing or adjacent to Woodville Road: – indicative façade requirements are provided in Figure 4.3 to allow for natural ventilation and a reasonable level of acoustic amenity – indicative glazing requirements are provided in Figure 4.3 to ensure the internal noise levels are at or below 40 dBA with windows closed. Where a noise reduction of 34 dBA or more is required for closed windows, double glazing would likely be required for glazed doors and large windows (e.g. 10.5 Vlam Hush / 8 mm air gap / 6 mm glass) along with acoustic seals.
Bedrooms	Where sleeping areas are proposed at facades facing or adjacent to Woodville Road: – indicative façade requirements are provided in Figure 4.4 to allow for natural ventilation and a reasonable level of acoustic amenity with windows open – indicative glazing requirements are provided in Figure 4.4 to ensure the internal noise levels are at or below 35 dBA with windows closed. Where a noise reduction of 34 dBA or more is required for closed windows, double glazing would likely be required for glazed doors and large windows (e.g. 10.5 Vlam Hush / 8 mm air gap / 6 mm glass) along with acoustic seals).
Windows and doors	As windows and doors are generally the weakest component of the façade with regards to noise reduction performance, minimising the proportion of surface area to be glazed or have operable openings (e.g. hinged doors, sliding doors, openable windows etc.) would improve the sound reduction performance of the façade.
Attenuated ventilation path / mechanical ventilation	For facades that require 15 dBA or more of attenuation for natural ventilation (i.e. to day time noise levels of 65 dBA and above for habitable rooms or night time levels of 60 dBA and above at bedrooms), the following design measures should be considered: – An enclosed balcony with a ventilation path from the habitable space to an external area that is acoustically treated (may require mechanical assistance); or – Mechanical ventilation should be provided to allow for windows to be closed Alternatively, a less-noise sensitive space (e.g. laundry, bathroom, storage room etc.) can act as a buffer between a noise source and the sensitive space

5. Air quality impact assessment

5.1 Air quality modelling

Screening level pollutant dispersion modelling was undertaken using the Roads and Maritime developed Tool for Roadside Air Quality (TRAQ). TRAQ was used to predict air quality impacts from road vehicle emissions along the Woodville Road Corridor on the proposed built form of new developments. TRAQ is a first pass screening assessment tool to estimate pollutant emission rates due to road traffic and subsequently, pollutant ground level concentrations at a selected distance from the road. Ambient air quality data is added to predicted concentrations in order to understand potential cumulative impacts

It should be noted that TRAQ is considered high level assessment tool which is likely to output conservative results. Use of more sophisticated models (which are significantly more intensive to set up) may result in lower model predictions due to less layers of conservatism.

The TRAQ modelling methodology is detailed in Appendix G.

5.2 Summary of the results

TRAQ modelling was undertaken for three scenarios, existing traffic volumes and future traffic volumes for Woodville Road as it was identified as the worst case roadway with respect to traffic volumes and potential emissions to air and worst case future traffic volumes on a worst case side street.

Modelling results, presented as the predicted pollutant concentration expressed as a function of distance from the kerb, are provided for six scenarios summarised in:

– Predicted incremental air quality concentrations (i.e. predicted air quality concentration from Woodville Road Corridor or a side street only):
  - Table 5.1 – Existing traffic volumes (Woodville Road Corridor only)
  - Table 5.2 – Future traffic volumes (Woodville Road Corridor only)
  - Table 5.3 – Future traffic volumes (side street only)
– Total impact (predicted Woodville Road Corridor contribution plus background concentrations):
  - Table 5.4 – Existing traffic volumes (Woodville Road Corridor total impact)
  - Table 5.5 – Future traffic volumes (Woodville Road Corridor total impact)
  - Table 5.6 – Future traffic volumes (side street total impact)

For all scenarios, predicted air quality concentrations were compared against the current air quality assessment criteria (sourced from *The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2022)) and the anticipated future criteria (which applies only to $PM_{2.5}$ sourced from the goals in the National Environment Protection Measures for Ambient Air Quality (the 'Air NEPM') proposed to commence from 2025). The Air NEPM $PM_{2.5}$ goals proposed to commence in 2025 are shown in parenthesis in the results tables Table 5.1 to Table 5.5.

No exceedances of the air quality assessment criteria were predicted for modelling of the Woodville Road Corridor or a worst case side street in isolation or for the worst case side street total impact scenario.

For the Woodville Road Corridor total impact scenarios, exceedance of the Air NEPM 2025 goal for annual $PM_{2.5}$ was predicted up to 20 metres from the kerb (exceedances highlighted in Table 5.4 and Table 5.5).

The results indicate that:

– There is potential for the annual $PM_{2.5}$ criteria to be exceeded at ground level within 20 metres from the kerb of Woodville Road. As the criteria is exceeded on an annually averaged basis, the result applies to sensitive land uses (primarily residential dwellings) which are likely to be occupied continuously over a given year and would not apply to commercial or industrial uses as it is expected that they would only be occupied for limited time during business hours and therefore occupants would not be continuous exposed to air quality concentrations at the location.
– Appropriate design consideration should be implemented at sensitive land uses that are proposed within 20 metres from the kerb of Woodville Road which have natural ventilation pathways (i.e. pollutant emissions from vehicles can enter a sensitive land use via a window or unfiltered air intake).
– Appropriate design consideration should take into account the strengthening (i.e. becoming more stringent) of air quality goals over time. No exceedances of the current air quality assessment criteria were predicted, however exceedances of the Air NEPM 2025 goal for annual $PM_{2.5}$ was predicted. As the development of Woodville Road Corridor is anticipated to take many years, the Development Control Plan for the Woodville Road Corridor should acknowledge planned changes in legislation and ensure future development can comply with more stringent criteria.

Table 5.1 Predicted pollutant concentration for existing traffic volumes (Woodville Road Corridor only)

Receptor location	Predicted pollutant concentration (µg/m^3) (existing traffic volumes, Woodville Road Corridor only)							
Pollutant	**CO**		**NO_2**		**PM_{10}**		**$PM_{2.5}$**	
Averaging period	**1 hour**	**8 hour**	**1 hour**	**Annual**	**24 hour**	**Annual**	**24 hour**	**Annual**
Criteria[1]	**30,000**	**10,000**	**164**	**31**	**50**	**25**	**25 (20)**	**8 (7)**
10 m from kerb	200	200	19.5	3.9	12.0	4.8	6.0	2.4
20 m from kerb	200	100	19.9	4.0	9.2	3.7	4.6	1.9
30 m from kerb	200	100	16.7	3.3	7.7	3.1	3.9	1.6
40 m from kerb	100	100	14.7	2.9	6.8	2.7	3.4	1.4
50 m from kerb	100	100	13.2	2.6	6.1	2.4	3.1	1.2
75 m from kerb	100	100	10.8	2.2	5.0	2.0	2.5	1.0
100 m from kerb	100	100	9.3	1.9	4.3	1.7	2.2	0.9
150 m from kerb	100	0	7.3	1.5	3.4	1.3	1.7	0.7
200 m from kerb	100	0	6.1	1.2	2.8	1.1	1.4	0.6

Table 5.2 Predicted pollutant concentration for future traffic volumes (Woodville Road Corridor only)

Receptor location	Predicted pollutant concentration (µg/m^3) (future volumes, Woodville Road Corridor only))							
Pollutant	**CO**		**NO_2**		**PM_{10}**		**$PM_{2.5}$**	
Averaging period	**1 hour**	**8 hour**	**1 hour**	**Annual**	**24 hour**	**Annual**	**24 hour**	**Annual**
Criteria[1]	**30,000**	**10,000**	**164**	**31**	**50**	**25**	**25 (20)**	**8 (7)**
10 m from kerb	200	100	13.9	2.8	13.6	5.4	6.8	2.7
20 m from kerb	100	100	14.2	2.8	10.4	4.1	5.2	2.1
30 m from kerb	100	100	12.0	2.4	8.7	3.5	4.4	1.8
40 m from kerb	100	100	10.5	2.1	7.7	3.1	3.9	1.6
50 m from kerb	100	100	9.5	1.9	6.9	2.8	3.5	1.4
75 m from kerb	100	0	7.8	1.6	5.7	2.3	2.9	1.2
100 m from kerb	100	0	6.7	1.3	4.9	1.9	2.5	1.0
150 m from kerb	0	0	5.3	1.1	3.9	1.5	2.0	0.8
200 m from kerb	0	0	4.4	0.9	3.2	1.3	1.6	0.7

[1] Assessment criteria was sourced from *The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2022) and the National Environment Protection Measures for Ambient Air Quality (the 'Air NEPM'). The Air NEPM proposes more stringent air quality goals to be implemented from 2025 onwards for 24 hour $PM_{2.5}$ (20 µg/m^3) and annual $PM_{2.5}$ (7 µg/m^3). These 2025 goals are shown in parenthesis.

Table 5.3 Predicted pollutant concentration for future traffic volumes (side street only)

Receptor location	Predicted pollutant concentration (µg/m³) (future volumes, side street only))							
Pollutant	CO		NO_2		PM_{10}		$PM_{2.5}$	
Averaging period	1 hour	8 hour	1 hour	Annual	24 hour	Annual	24 hour	Annual
Criteria[1]	30,000	10,000	164	31	50	25	25 (20)	8 (7)
10 m from kerb	100	100	8.8	1.8	6.7	2.7	3.4	1.4
20 m from kerb	100	100	8.2	1.6	4.7	1.9	2.4	1.0
30 m from kerb	100	100	6.7	1.3	3.8	1.5	1.9	0.8
40 m from kerb	100	0	5.7	1.1	3.3	1.3	1.7	0.7
50 m from kerb	100	0	5.1	1	3	1.2	1.5	0.6
75 m from kerb	0	0	4.2	0.8	2.4	1	1.2	0.5
100 m from kerb	0	0	3.6	0.7	2.1	0.8	1.1	0.4
150 m from kerb	0	0	2.8	0.6	1.6	0.7	0.8	0.4
200 m from kerb	0	0	2.4	0.5	1.4	0.5	0.7	0.3

Table 5.4 Predicted pollutant concentration for existing traffic volumes (Woodville Road Corridor total impact)

Receptor location	Predicted pollutant concentration (µg/m³) (existing traffic volumes, Woodville Road Corridor total impact)							
Pollutant	CO		NO_2		PM_{10}		$PM_{2.5}$	
Averaging period	1 hour	8 hour	1 hour	Annual	24 hour	Annual	24 hour	Annual
Criteria[1]	30,000	10,000	164	31	50	25	25 (20)	8 (7)
Background	3,375	1,125	92.3	19.5	20.1	14.1	8.5	5.2
10 m from kerb	3,575	1,325	112	23	32	18.9	14.5	7.6
20 m from kerb	3,575	1,225	112	24	29	17.8	13.1	7.1
30 m from kerb	3,575	1,225	109	23	28	17.2	12.4	6.8
40 m from kerb	3,475	1,225	107	22	27	16.8	11.9	6.6
50 m from kerb	3,475	1,225	106	22	26	16.5	11.6	6.4
75 m from kerb	3,475	1,225	103	22	25	16.1	11.0	6.2
100 m from kerb	3,475	1,225	102	21	24	15.8	10.7	6.1
150 m from kerb	3,475	1,125	100	21	24	15.4	10.2	5.9
200 m from kerb	3,475	1,125	98	21	23	15.2	9.9	5.8

Table 5.5 Predicted pollutant concentration for future traffic volumes (Woodville Road Corridor total impact)

Receptor location	Predicted pollutant concentration (µg/m^3) (future traffic volumes, Woodville Road Corridor total impact)							
Pollutant	**CO**		**NO_2**		**PM_{10}**		**$PM_{2.5}$**	
Averaging period	**1 hour**	**8 hour**	**1 hour**	**Annual**	**24 hour**	**Annual**	**24 hour**	**Annual**
Criteria[1]	**30,000**	**10,000**	**164**	**31**	**50**	**25**	**25 (20)**	**8 (7)**
Background	**3,375**	**1,125**	**92.3**	**19.5**	**20.1**	**14.1**	**8.5**	**5.2**
10 m from kerb	3,575	1,225	106	22	34	19.5	15.3	7.9
20 m from kerb	3,475	1,225	107	22	31	18.2	13.7	7.3
30 m from kerb	3,475	1,225	104	22	29	17.6	12.9	7.0[2]
40 m from kerb	3,475	1,225	103	22	28	17.2	12.4	6.8
50 m from kerb	3,475	1,225	102	21	27	16.9	12.0	6.6
75 m from kerb	3,475	1,125	100	21	26	16.4	11.4	6.4
100 m from kerb	3,475	1,125	99	21	25	16.0	11.0	6.2
150 m from kerb	3,375	1,125	98	21	24	15.6	10.5	6.0
200 m from kerb	3,375	1,125	97	20	23	15.4	10.1	5.9

Table 5.6 Predicted pollutant concentration for future traffic volumes (side street total impact)

Receptor location	Predicted pollutant concentration (µg/m^3) (future traffic volumes, side street total impact)							
Pollutant	**CO**		**NO_2**		**PM_{10}**		**$PM_{2.5}$**	
Averaging period	**1 hour**	**8 hour**	**1 hour**	**Annual**	**24 hour**	**Annual**	**24 hour**	**Annual**
Criteria[1]	**30,000**	**10,000**	**164**	**31**	**50**	**25**	**25 (20)**	**8 (7)**
Background	**3,375**	**1,125**	**92.3**	**19.5**	**20.1**	**14.1**	**8.5**	**5.2**
10 m from kerb	3,475	1,225	101	21	27	16.8	11.9	6.6
20 m from kerb	3,475	1,225	101	21	25	16.0	10.9	6.2
30 m from kerb	3,475	1,225	99	21	24	15.6	10.4	6.0
40 m from kerb	3,475	1,125	98	21	23	15.4	10.2	5.9
50 m from kerb	3,475	1,125	97	21	23	15.3	10.0	5.8
75 m from kerb	3,375	1,125	97	20	23	15.1	9.7	5.7
100 m from kerb	3,375	1,125	96	20	22	14.9	9.6	5.6
150 m from kerb	3,375	1,125	95	20	22	14.8	9.3	5.6
200 m from kerb	3,375	1,125	95	20	22	14.6	9.2	5.5

Whilst interpreting the above results, it is important to note that the TRAQ assessment methodology assumes that worst-case daily traffic emissions and meteorological conditions occur for all days of the

[2] The predicted annual $PM_{2.5}$ concentration 30 metres from the kerb was 6.95 µg/m^3 which has been rounded to one decimal place (7.0 µg/m^3). It is therefore not considered an exceedance of the assessment criteria.

year which is considered to lead to a highly conservative estimate of air quality impacts from traffic impacts, particularly when assessing pollutants on an annual basis. It is noted that TRAQ does not predict $PM_{2.5}$ concentrations, therefore an indicative assessment has been provided using conservative assumptions. In addition, background $PM_{2.5}$ concentrations were considered high in the region as the annual $PM_{2.5}$ criteria was exceeded at the nearest three Department of Planning and Environment (DPE) air quality monitoring stations (AQMS) for 2018, 2019 and 2020, and were near the criteria in 2021. The decrease in annual $PM_{2.5}$ concentrations recorded in 2022 is likely attributed to high rainfall recorded in the year. Rainfall acts as dust suppression, reducing windblown dust emissions and lowering ambient concentrations. Use of background data that exceeds the assessment criteria is not considered to provide meaningful analysis.

Nonetheless, based on the results of the modelling and review of contemporary guidance, the findings as listed above apply such that suitable design requirements should be implemented (refer to Section 5.3) or additional assessment (using a more sophisticated air quality impact assessment methodology) are warranted for any sensitive land uses proposed within 20 metres of Woodville Road. The 20 metre separation distance aims to minimise potential exposure of sensitive land uses to adverse air quality outcomes near Woodville Road.

5.3 Summary of design considerations

The intent of the air quality modelling was to help inform future planners, urban designers, architects, consultants and the relevant consent authorities of the design considerations for future development to minimise air quality impacts from Woodville Road Corridor as much as practicable.

The Development near rail corridors and busy roads guideline states that air quality should be considered in the design of future development when they are located:

> *"Within 20 metres of a freeway or main road (with more than 2500 vehicles per hour, moderate congestions levels of less than 5% idle time and average speeds of greater than 40 km/hr)"*

Woodville Road is considered a busy road with peak hour traffic loads greater than 3,500 vehicles per hour based on traffic tube counts. Both contemporary guidance and modelling indicate potential for air quality impacts within 20 metres of the road. Therefore the Development Control Plan for the Woodville Road Corridor should include design consideration to minimise air quality impacts.

There are various mitigation options available, however at a minimum development applications should demonstrate that the design of any development makes appropriate consideration of the following design principles:

– Careful siting and orientation of buildings to ensure appropriate separation distances between sensitive uses and the Woodville Road Corridor
  - It is recommended that no sensitive land uses such as residential dwellings are positioned on the ground floor and first floor within 20 metres of the kerb along Woodville Road unless suitable design requirements are implemented. The need for air quality design considerations is summarised in Table 5.7.
  - It is understood that the proposed building setbacks are approximately 15 metres from the kerb for majority of developments (5 metre setback from kerb to lot boundary plus a 10 metre setback from lot boundary to building footprint) and approximately 11 metres from the kerb for the developments which are closest to the kerb (5 metre setback from kerb to lot boundary plus a 6 metre setback from lot boundary to building footprint). Therefore suitable design requirements should be applied to natural ventilation pathways located within 5 metres of the building façade facing Woodville Road (for development with a 15 metre setback) and within 9 metres of the building façade facing Woodville Road (for development with a 11 metre setback).
  - Alternatively, additional air quality assessment (including detailed dispersion modelling) should be undertaken at the development application stage to demonstrate that compliance with the air quality criteria can be achieved for a proposed development if located within the recommended 20 metre buffer distance.
  - To summarise Table 5.7 and the above, where the minimum separation distance of 20 metres from kerb to natural ventilation pathway is not proposed/achievable, suitable design requirements should be implemented (e.g. enclosed façade with mechanical ventilation) or additional air quality assessment should be undertaken to demonstrate that compliance with the air quality criteria can be achieved.

Table 5.7 Need for air quality design considerations and further assessment for sensitive land uses

Distance from kerb (m)	Air quality compliance level	Indicative design requirements to allow for natural ventilation	Need for additional air quality assessment
50	Compliance achieved	No specific requirements needed to achieve air quality compliance, best	No further assessment considered necessary
40			

Distance from kerb (m)	Air quality compliance level	Indicative design requirements to allow for natural ventilation	Need for additional air quality assessment
30		practice design recommended.	
20	Potential exceedance of annual $PM_{2.5}$ criteria within the recommended 20 m buffer	Enclosed façade with mechanical ventilation required for sensitive land uses. Ventilation intakes are to be located as far as practicable from the roadway and incorporate adequate filtration if within 20 metres from the kerb of Woodville Road. **Corresponds to acoustic Architectural design category A**	If design requirements are not proposed to be met (refer column to the left), additional air quality assessment should be undertaken to demonstrate that compliance with the air quality criteria can be achieved for a proposed development if located within the recommended 20 metre buffer distance
10			
0			

– Minimising the formation of urban canyons (to the greatest extent feasible) which can lead to poor dispersion of air emissions away from receptors and increase the probability of air quality impacts
  - This could include use of differential height buildings such as lower height developments near the road corridor with taller developments further away to minimise urban canyoning.
– Taking into account microclimates to help support the sustainable design of buildings that capitalises on natural ventilation and minimise the risk of canyoning
– Siting mechanical ventilation air inlet ports and natural ventilation operable doors/windows to maximise the distance from road and industry to reduce inflows of air pollutants and use external air filtering systems to treat air prior to entering a building where deemed necessary (e.g. mechanical ventilation with use of carbon filters)
– Use of landscaping and vegetative screens to act as shielding between road and sensitive land uses
– Considering exemplar approaches set out in the Parramatta Road Corridor Urban Transformation Strategy Planning and Design Guidelines (2016), refer Appendix F
– The measures in the NSW Child Care Planning Guideline (2017) to protect children from adverse air quality impacts are to be adopted for new child care centres which include:
  - Use of appropriate separation distances between child care centres and pollution source
  - Use of landscaping to act as a shield or filter for air pollution
  - Incorporating suitable ventilation design
– Design considerations from the Development near rail corridors and busy roads guideline to minimise air quality impacts, refer Figure 5.1.

Where development applications are proposed within 20 metres (i.e. within the exceeding separation distance predicted by the screening air quality modelling in Section 5) of the Woodville Road Corridor, **and** suitable design requirements (i.e. enclosed façade with mechanical ventilation) are not proposed, it is recommended that an Air Quality Impact Assessment is prepared to accompany future sensitive land use development applications. Sensitive land uses are considered to be residential dwellings and other premises that are likely to be occupied for the entire year with a natural ventilation pathway such as an operable windows or balcony where users of the proposed development are to be exposed to emissions from Woodville Road. The air quality assessment is to:

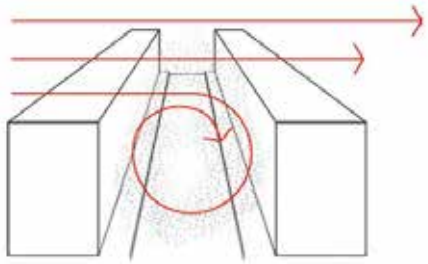
– be prepared by a suitably qualified person in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, published by New South Wales Environment Protection Authority in 2022

- including the collection of or reference to available site-specific baseline air quality data (including but not limited to particulate matter (PM_{10} and $PM_{2.5}$))
- make predictions of air quality at sensitive receptor locations. For the purposes of developments within the corridor, sensitive receptors should include:
  - locations where people are likely to work or reside and may include a dwelling, school, childcare centre, hospital, office or public recreational area
  - only those locations (as above) where people are likely to be exposed to ambient air (i.e. fully enclosed developments with air conditioning are not considered sensitive)
  - locations of any mechanical ventilation air inlet ports
  - locations as above which are existing, approved and proposed
- Where the Air Quality Impact Assessment predicts that exceedances of the relevant air quality standards may occur, the following design measures are to be considered to mitigate potential impacts:
  - modifying the design so that affected sensitive receptors are replaced by those receptors whose use is more consistent with mechanical ventilation (e.g., commercial, retail)
  - reducing the number of apartments facing Woodville Road
  - providing mechanical ventilation for apartments facing Woodville Road with fixed glazing on the impacted façade and operable windows to non-impacted façade
  - where windows must be kept closed, the adopted ventilation systems must meet the requirements of the Building Code of Australia and Australian Standard 1668 – The use of ventilation and air conditioning in buildings.
  - where exceedances are predicted at public outdoor areas, these areas should be designed to minimise exposure time of users (e.g., thoroughfares or garden paths rather than seating areas).

»Urban canyons«

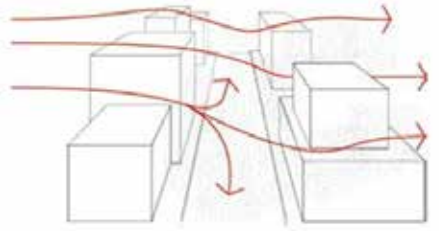
– Design should aim to minimise the creation of urban canyons.
– Urban canyons consist of similarly height buildings that are tightly packed in a uniform structure.

  Urban canyoning effects can 'trap' air quality pollutants within the canyon resulting in poor dispersion and



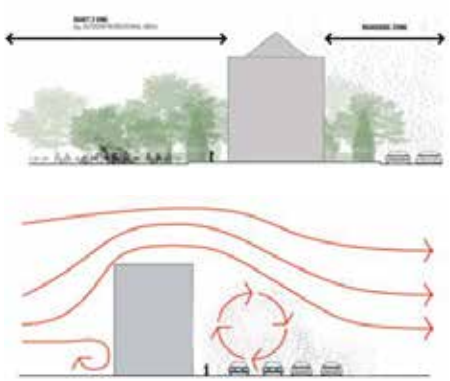
»Air flow around buildings«

– Building spacing and use of differentiate buildings heights should be encouraged to promote air flow between buildings and minimise urban canyoning.
– This enables air pollutants to be quickly dispersed to minimise pollutant concentrations.



»Use of buildings to shield«

– Buildings, landscaping and vegetation can be used to shield sensitive areas from high emissions zones.
– Sensitive land uses should be positioned behind buildings such that they are shielded from emissions from Woodville Road Corridor



»Emissions levels intensity«

– Generally, highest air pollutant concentrations exist adjacent to the road (at the kerb) and decrease with distance.
– Set back distances should be implemented to maximise the distance between the road and sensitive land uses.

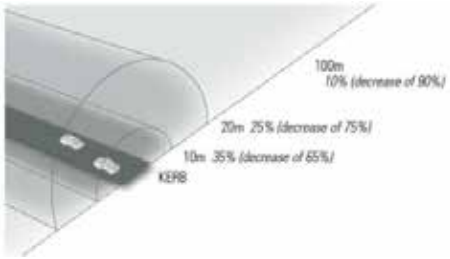


Figure 5.1 Building design considerations to minimise air quality impacts

Example design recommendations

Example design considerations and building treatments to achieve amenity (noise and air quality) outcomes.

6. Example design considerations

6.1 Recommended design considerations

A consolidated summary of example acoustic and air quality design considerations are provided in Table 6.1 based on the proposed Built Form Masterplan. These are not mandatory requirements, however, can provide guidance on how the Transport and Infrastructure SEPP and SEPP 65 requirements can be achieved through architectural design considerations.

These would be considered in the Development Application stage for new development at the Planning Proposal sites.

Table 6.1 Consolidated summary of acoustic and air quality design considerations

Design considerations			Acoustic requirements	Air quality requirements
Indicative façade requirements to allow for natural ventilation	Indicative glazing requirements (closed windows) (Applies to acoustic requirements only)			
	Glazed doors / Large windows	Small windows		
N/A	Std. glazing	Std. glazing	Architectural design category E	N/A
Balcony with solid balustrade and acoustically lined soffit	Std. glazing	Std. glazing	Architectural design category D	N/A
Enclosed balcony with acoustically lined soffit and acoustically sealed louvres	6.38 mm lam	5 mm float	Architectural design category C	N/A
Enclosed balcony with an attenuated ventilation path	10.38 mm lam	6.38 mm lam	Architectural design category B	N/A
Mechanical ventilation required to close windows (air filter on the intake side of the fan)	Dbl. glazing	12.5 mm Vlam Hush	Architectural design category A	Applies to sensitive land uses with natural ventilation pathways within 20 metres from the kerb of Woodville Road

6.2 Façade design examples

Examples of the architectural design categories (see Table 4.3 and Table 4.4) are shown in Figure 6.1 (Category D – low impact), Figure 6.2 (Category C – moderate impact), and Figure 6.3 (Category B and Category A – moderate to high impact) using guidance from the *Development Near Rail Corridors and Busy Roads Interim Guideline* and the NSW *Apartment Design Guide*.

For reference, plan view maps are shown in Appendix D and 3D façade noise maps are shown in Appendix E for the Woodville Road Corridor planning proposal sites.

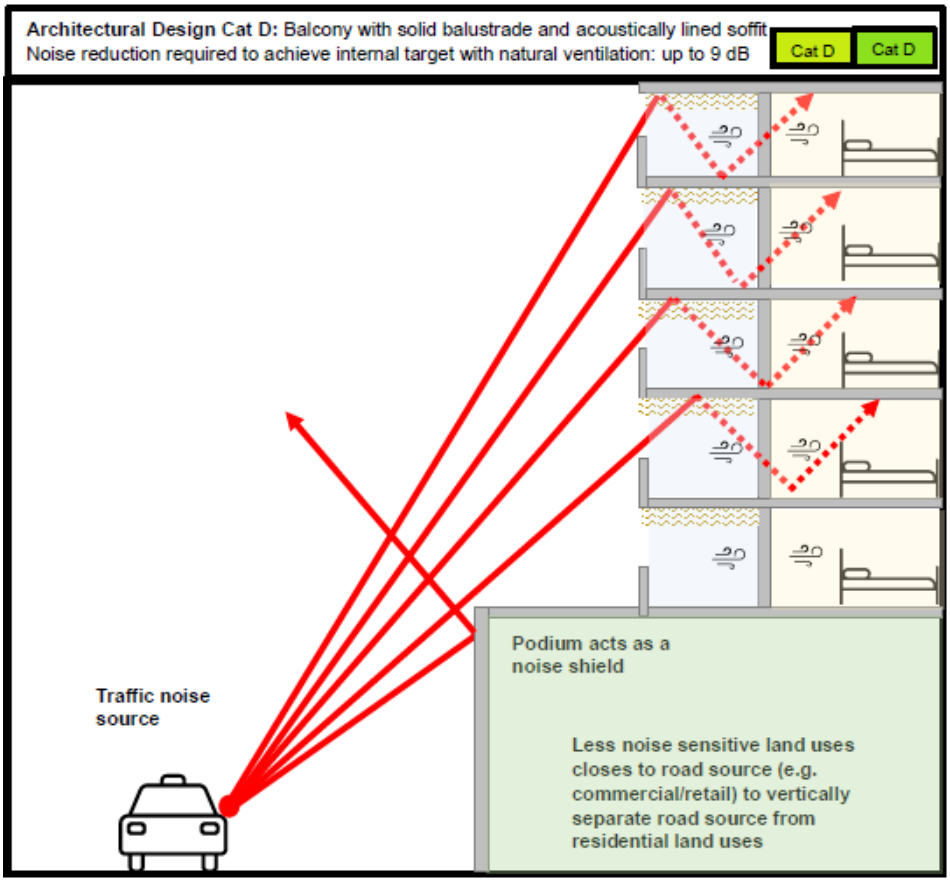


Figure 6.1 Façade design example for Architectural design category D

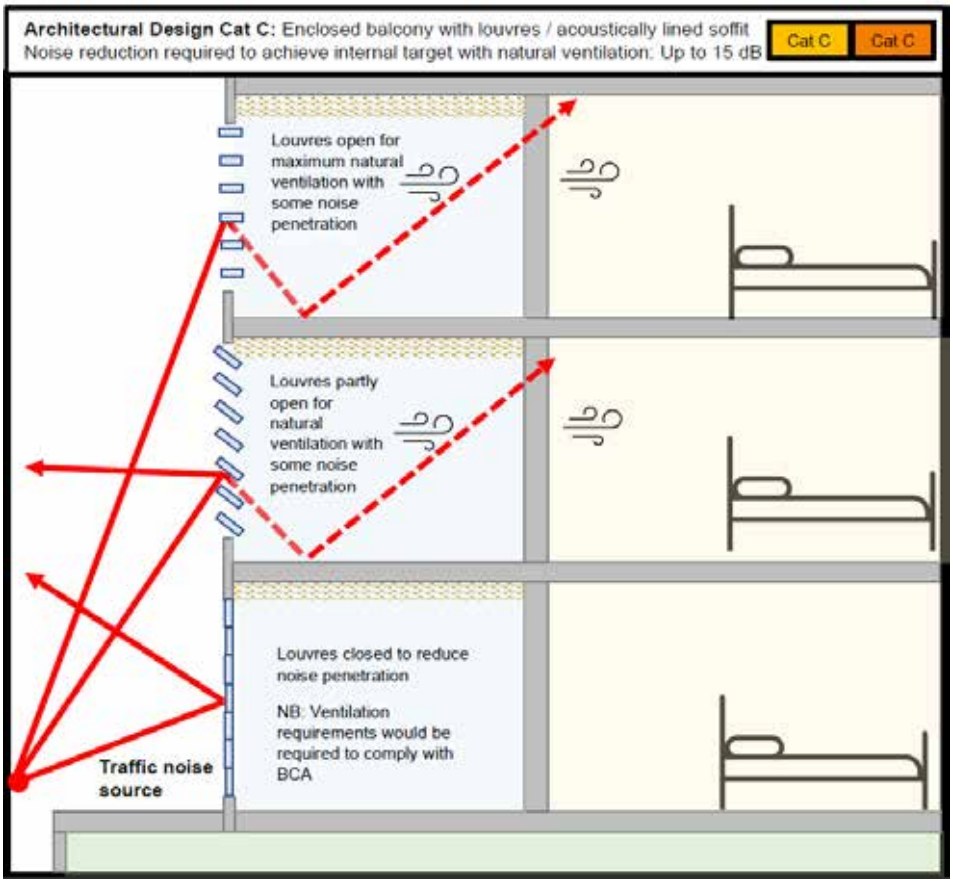


Figure 6.2 Façade design example for Architectural design category C

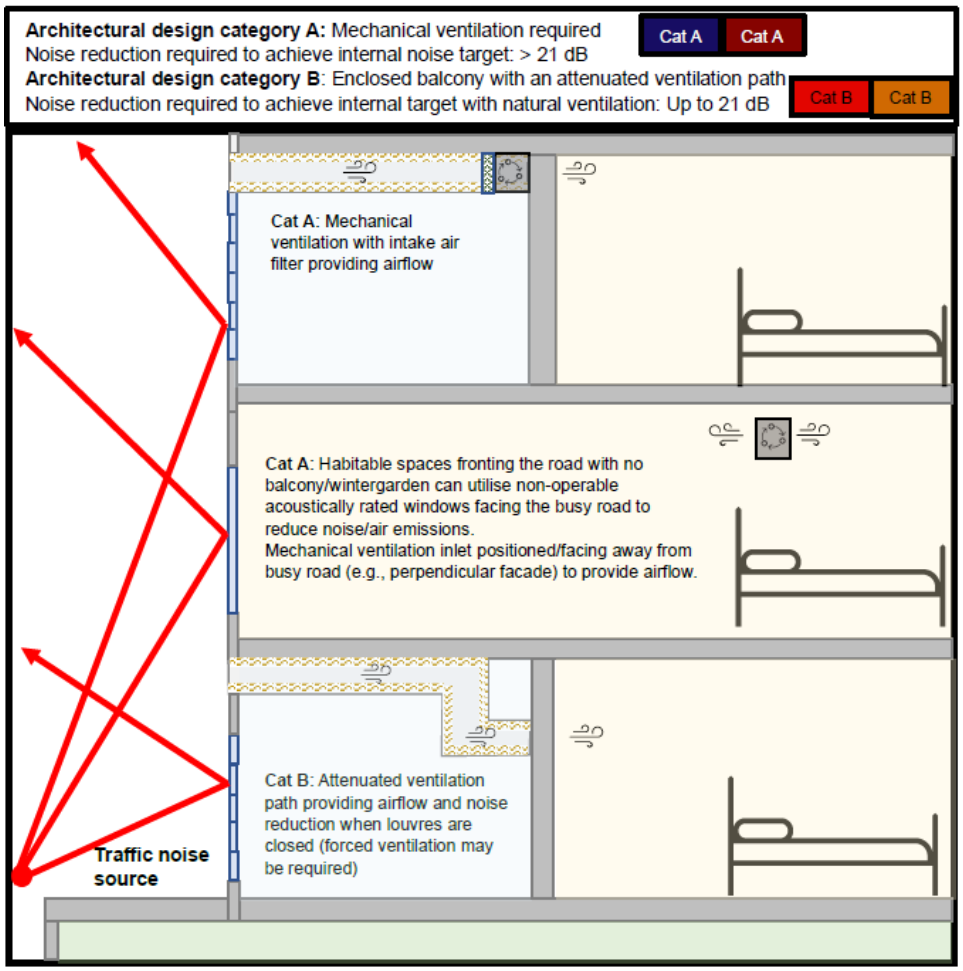


Figure 6.3 *Façade design example for Architectural design category B and category A*

Recommendations and conclusion

The recommended planning controls for inclusion in the Woodville Corridor DCP and the key outcomes of the study

7. Recommended planning controls

The recommended planning controls for the Woodville Road Corridor are provided in the tables below.

	Amenity (noise)	
Objectives	Amenity	Ensure that land uses within the Woodville Road Corridor Planning Framework, particularly sensitive uses such as residential, child care centres and health facilities, are appropriately sited and designed to mitigate noise impacts from vehicle and other emissions
Controls	DA Noise Impact Assessment for new developments near busy roads	A noise impact assessment is to accompany development applications for any new sensitive development adjacent to a busy road or the rail corridor. The development should consider the provisions of the following (or as updated or superseded): – State Environmental Planning Policy (Transport and Infrastructure) 2021 – Development Near Rail Corridors and Busy Roads Interim Guideline – NSW Apartment Design Guide This applies to development that fronts a road with an annual average daily traffic (AADT) volume of more than 20,000 vehicles) and/or development within 60 m of a rail corridor.
	Land use separation	– Where possible, non-residential land uses should be located at lower levels vertically separating the residential components of the development from the noise or pollution source at ground level. – The setback distance for the upper level residential component should be maximised to increase the acoustic shielding effects of the lower level building
	Natural ventilation considerations	– Internal habitable rooms of residential dwellings (other than bedrooms) are to be designed to achieve noise levels of no greater than 50 dBA with windows open during any time of the day. – Bedrooms of residential dwellings are to be designed to achieve noise levels of no greater than 45 dBA with windows open during the night period. *Note: Where noise criteria cannot be achieved concurrently with natural ventilation via open windows, alternative ventilation shall be provided complying with the Building Code of Australia ventilation requirements as a minimum. Noise from background ventilation systems shall be at least 5 dB below the relevant internal noise criteria. Notwithstanding the provision of alternative ventilation, measures to reduce noise to external areas and via open windows shall be incorporated in the overall design and layout of noise sensitive development.* – Residential flat buildings are to carefully consider the internal layout and configuration of residential dwellings to ensure that the natural ventilation requirements detailed in Section 4B of the Apartment Design Guide can be achieved.
	Building design considerations	Other appropriate measures to mitigate noise and provide suitable internal acoustic amenity are to be incorporated into the design of future residential developments, where required. These may include (but are not limited to): – Setting the façade at oblique or perpendicular angles to the primary noise source, with shielded ventilation opening – Reorienting and reducing the number of habitable spaces (particularly bedrooms) facing the Woodville Road Corridor – Using non-sensitive spaces such as laundries, bathrooms and storage areas as a noise buffer between a noise-impacted façade and a habitable space – Increased glazing specifications and/or reducing the glazed areas for noise-affected facades – Locating ventilation intakes (where required) along a non-noise impacted façade – Incorporating attenuated natural ventilation measures such as partially or fully enclosed balconies with solid balustrades and acoustic absorption, offset window openings or acoustic plenums for habitable spaces – The exemplar approaches set out in the Parramatta Road Corridor Urban Transformation Strategy Planning and Design Guidelines (2016)

Amenity (air quality)

Objectives	Amenity	Ensure that land uses within the Woodville Road Corridor Planning Framework, particularly sensitive uses such as residential, child care centres and health facilities, are appropriately sited and designed to mitigate air impacts from vehicle and other emissions
Controls	DA Air Quality Impact Assessment for new developments near busy roads	An air quality impact assessment is to accompany development applications for any new sensitive development with natural ventilation pathways adjacent (within 20 metre) to a busy road. The development should consider the provisions of the following (or as updated or superseded): – State Environmental Planning Policy (Transport and Infrastructure) 2022 – Development Near Rail Corridors and Busy Roads Interim Guideline – Parramatta Road Corridor Urban Transformation - Planning and Design Guidelines - Amenity
	Land use separation	– Where possible, non-sensitive land uses (such as enclosed commercial premises with mechanical ventilation) should be located at lower levels (ground floor and where possible the first floor) and on the Woodville Road side façade to vertically separating and shield sensitive land uses from vehicle air quality emissions. – The setback distance for the upper level sensitive land uses should be maximised to increase the dispersion of air pollutant and consequently minimise air pollutant concentrations. – Sensitive land uses should not be positioned within 20 metres of the kerb. This separation distance should be maintained for all sensitive land uses including those on the ground floor or first floor.
	Building design considerations	Other appropriate measures to mitigate the potential impact of emissions to air are to be incorporated into the design of future residential developments, where required. These may include (but are not limited to): – Careful siting and orientation of buildings to ensure appropriate separation distances between sensitive uses and the Woodville Road Corridor – Minimising the formation of urban canyons (to the greatest extent feasible) – Siting mechanical ventilation air inlet ports and natural ventilation operable doors/windows to maximise the distance from road and industry to reduce inflows of air pollutants and use external air filtering systems to treat air prior to entering a building where deemed necessary (e.g. mechanical ventilation with use of carbon filters) – Use of landscaping and vegetative screens to act as shielding between road and sensitive land uses

8. Conclusion

Purpose of the report

An air quality and noise impact assessment was prepared to accompany Cumberland City Council's proposed planning framework for the Woodville Road Corridor. A review was undertaken to understand the planning and regulatory framework relevant to air quality and noise pollution, including SEPP (Transport and Infrastructure) 2021 and SEPP 65. The potential for air quality and noise amenity impacts was considered with reference to the Development near rail corridors and busy roads– interim guideline and the Apartment Design Guide.

Planning framework, pollution sources and the built form masterplan

The key sources of noise and pollution within the Woodville Road Corridor Planning Framework was identified to be the high number of light and heavy vehicle movements along Woodville Road. Other busy roads identified, including Oxford Street and Rawson Road, which are located perpendicular to Woodville Road.

The proposed Built Form Masterplan includes R4 High Density Residential planning zones along the Woodville Road Corridor, located within three key precincts, being the Woodville Road North Precinct, Merrylands East Precinct and Woodville Road South. As these areas are directly adjacent to Woodville Road, development within these areas would require assessment to ensure the SEPP (Transport and Infrastructure) internal noise levels can be achieved and the SEPP 65 natural ventilation objectives are considered.

The northernmost planning proposal site within the Woodville Road North Precinct would also be exposed to the rail movements on the T2 commuter rail line.

Acoustic impact assessment

Noise modelling was undertaken using SoundPLAN software to predict future road traffic noise levels at development adjacent to Woodville Road and various associated side streets. Traffic volumes were forecasted to 10 years in the future based on existing traffic volumes and an assumed growth rate of 2.0% p.a. for light vehicles and 1.0% p.a. for heavy vehicles. The projected growth for light vehicles and trip generation is information provided in the Traffic and Transport Study (Bitzios, 2023)

The results of the noise modelling indicate that facades fronting Woodville Road would be exposed to the highest noise levels and other facades of the building would be experience lower noise levels depending on:

– the horizontal and vertical separation distance from the road as well as intervening; and
– intervening structures blocking the line-of-sight from the source to the façade

Various mitigation measures were provided based on guidance from the Development near rail corridors and busy roads guideline, the Apartment Design Guide and the design considerations promoted in the Parramatta Road Corridor Urban Transformation (PRCUT) Planning and Design Guidelines. Architectural treatment considerations were also provided to allow natural ventilation whilst achieving a reasonable level of acoustic amenity with windows open. Additionally, indicative glazing requirements were provided to ensure the SEPP (Transport and Infrastructure) internal noise levels can be achieved with windows closed.

Air quality impact assessment

Screening level pollutant dispersion modelling was undertaken using TRAQ to predict existing and future air quality concentrations at developments adjacent to Woodville Road. The modelling was based on traffic tube counts and assumed growth rates to forecast future traffic volumes.

The results of the air quality modelling indicate that there is potential for air quality impacts to occur at sensitive land uses located up to 20 metres from the kerb of Woodville Road for both existing and future scenarios.

Predicted cumulative results are highly dependent on ambient air quality meaning that it may or may not comply with the air quality criteria depending which year background dataset is used. Regardless of modelling results, both guidance and modelling indicate potential for air quality impacts is greater within 20 metres of the road.

Various mitigation measures were provided based on guidance to minimise potential air quality impacts on future development from Woodville Road Corridor as much as practicable

Recommended planning controls

Based on the outcomes of the study, planning controls have been recommended for inclusion in the Woodville Road Corridor Development Control Plan, including:

– A requirement for a noise impact assessment to be prepared for a new development proposed near the Woodville Road Corridor, other busy roads and the rail line
– A requirement for an air quality impact assessment to be prepared for all new developments that propose sensitive land uses with natural ventilation pathways within 20 metres of the Woodville Road Corridor.
– Land use separation controls to vertically and horizontally separate noise and air pollution sources from proposed sensitive developments
– Design considerations to allow for natural ventilation whilst achieving a reasonable level acoustic amenity with windows open and protection against vehicle emissions to air
– Other building design considerations to reduce internal noise levels and minimise air pollutant concentrations within habitable spaces, with reference to the exemplar approaches set out in the PRCUT Planning and Design Guidelines

9. References

NSW Department of Planning (2008), *Development Near Busy Roads and Guidelines*

NSW Department of Planning and Environment (2015), *Apartment Design Guide*

NSW Legislation (2021), *State Environmental Planning Policy (Transport and Infrastructure)*

NSW Legislation (2002), *State Environmental Planning Policy No 65 – Design Quality of Residential Apartment Development*

Conybeare Morrison (2023), *Urban Design Report – Stages 1 + 2 Report*

Marchese Partners *(2021), Merrylands East Neighbourhood Centre DA Application Rev C Architectural Plans*

Urban Growth NSW (2016), *Parramatta Road Corridor Urban Transformation Planning and Design Guidelines*

Bitzios (April 2023), *Woodville Road Corridor Traffic and Transport Study*

Appendices

Appendix A

Cumberland Development Control Plan Part B

Acoustic

A-1 Part B1 - Development within land zoned 'Residential'

Part B1 applies to development types detailed within this Part within land zoned Residential under *Cumberland Local Environmental Plan 2021*. This Part is intended to guide the assessment of the development of a dwelling house, secondary dwelling and associated outbuildings. The relevant objectives and controls pertaining to acoustic privacy and natural ventilation are reproduced below.

Table A.1 Cumberland City Council Development Control Plan Part B – Development in Residential Zones

Section	Reference	Description
2.10 Visual and acoustic privacy		
Objectives	01	Ensure the siting and design of buildings/dwelling house provides visual and acoustic privacy for residents and neighbours in their dwellings and private open spaces.
Controls	C11	Where dwellings or dwelling house additions are proposed within close proximity to busy roads and rail corridors, non-habitable rooms should be located on the noise affected side of each dwelling house and should be able to be sealed off by doors from living areas and bedrooms where practicable, whilst maintaining good housing design and building appearance. Alternative design solutions incorporating noise attenuation measures may be considered in these circumstances.
	C12	Air conditioners, swimming pool pumps and the like are not to exceed 5dba above background noise levels and should not be audible from habitable rooms of neighbouring dwellings.
	C13	For development adjacent to a rail corridor, or major road corridor with an annual average daily traffic volume of more than 40,000 vehicles, applicants must consult *State Environmental Planning Policy (Infrastructure) 2007* and the relevant NSW guidelines. Where acoustic reports are required by the SEPP and Guidelines, the building is to be designed and detailed to comply with the recommendations of that report.
2.12 Cross ventilation		
Objectives	O1	The design of development is to utilise natural breezes for cooling and fresh air during summer and to avoid unfavourable winter winds.
	O2	All dwelling houses are designed to maximise natural ventilation.
Controls	C1	Rooms with high fixed ventilation openings such as bathrooms and laundries shall be situated on the southern side to act as buffers to insulate the dwelling house from winter winds. Garages may also useful as buffers on the southern and western sides.
	C2	Dwelling houses shall be designed with bathrooms, laundries and kitchens sited in a position that allows natural ventilation of the room through an openable window.

A-2 Part B2 - Low rise dual occupancy development

This Part applies to low rise dual occupancy development under the *Cumberland Local Environment Plan 2021.* The relevant objectives and controls pertaining to acoustic privacy and natural ventilation are reproduced in below.

Table A.2 Low rise dual occupancy developments within R2 and R3 zones

Section	Reference	Description
2.1Q Noise and pollution		
Objective	2.1Q-1	Ensure outside noise levels are controlled to acceptable levels in living and bedrooms of dwellings.
Controls	57	Any development within the 20 ANEF contour is to be constructed to comply with AS 2021:2015 Acoustics – Aircraft Noise Intrusion.

Section	Reference	Description
Controls	C11	Dwellings that are within 100m of a classifed road or 80m from a rail corridor are to have LAeq measures not exceeding: – In any bedroom: 35dB(A) between 10pm-7am. – Anywhere else in the building (other than a kitchen, garage, bathroom or hallway): 40dB(A) at any time. This is achieved by: – Providing a full noise assessment prepared by a qualified acoustic engineer; and • Complying with relevant noise control treatment for sleeping areas and other habitable rooms in Appendix C of RMS Development Near Rail Corridors and Busy Roads - Interim Guideline

A-3 Part B3 - Residential flat buildings

This Part applies to residential flat building development under the *Cumberland Local Environment Plan 2021*. *State Environmental Planning Policy 65 Design Quality of Residential Apartment Development* (SEPP 65) provides a state-wide framework for detailed planning guidance of residential apartments in NSW. SEPP 65 is supported by the objectives, design criteria and design guidance set out in the *Apartment Design Guide* (ADG), which guide the siting, design and amenity of residential flat building development.

All residential flat building development in the Cumberland City are to be assessed in accordance with SEPP 65 and the ADG and must be consistent with the design quality principles outlined in SEPP 65 and the objectives, design criteria and design guidance outlines in the ADG (or equivalent). The ADG takes precedence over a DCP. Therefore, the DCP provisions do not repeat or seek to vary any controls under the ADG. Where there are inconsistencies between the controls set out in this DCP and the ADG, the ADG shall prevail. In some cases, Council has chosen to provide additional objectives and controls for criteria such as setbacks, basements, site area and site frontage. These objectives and controls are to be considered in addition to the SEPP 65 and ADG requirements. The relevant objectives and controls for SEPP 65 development are discussed in Section 2.1.2. SEPP 65 development in locations adjacent to rail corridors and busy roads must also have regard to the *Development near rail corridors and busy roads Interim Guideline* to satisfy the requirements of the Transport and Infrastructure SEPP.

A-4 Part B4 - Boarding houses

This Part applies to development of land for the purposes of a boarding house under the *Cumberland Local Environmental Plan 2021.* The relevant objectives and controls pertaining to acoustic privacy and natural ventilation are reproduced below.

Table A.3 Cumberland City Council Development Control Plan Part B – Development in Residential Zones

Section	Reference	Description
2.6 Acoustics		
Objectives	O1	Ensure an acceptable level of amenity in boarding house premises to meet the needs of residents whilst minimising potential noise adverse impacts to surrounding development
Controls	C1	Boarding house design should attempt to locate bedrooms away from significant internal and external noise sources.
	C2	During the design of a boarding house consideration must be given to the potential acoustic impact upon adjoining neighbours. The following noise minimisation measures should be considered at the design stage: – offsetting the location of windows in respect to the location of windows on neighbouring properties; – appropriate building separation and setbacks to neighbouring properties; – sensitive location of communal outdoor areas away from main living areas or bedroom windows of any adjoining dwelling; – the use of screen fencing or acoustic barriers as a noise buffer to external noise sources; – incorporation of double glazing for windows; and – locate similar building uses (such as bedrooms or bathrooms) back to back internally within the building, to minimise internal noise transmission.

Appendix B

CM+ Urban Design Report – Stages 1+2 Report - Section 9.0 Masterplan (June 2023)

9.0 Master Plan

9.7 Precinct Master Plans

Precinct master plans are provided for each of the three precincts, Woodville North Precinct, Merrylands East Precinct and Woodville South Precinct.

These precinct master plans provide further information regarding future public open space, communal open space locations, desired built form envelopes and preferred amalgamation patterns for the 29 Planning Proposal sites. They should be read in conjunction with the recommended controls in this report and the proposed Draft Woodville Road Corridor Development Control Plan.

Woodville North Precinct Master Plan

Key design outcomes includes:

- Introduce a new mixed use zone fronting Granville Park providing job opportunities close to living and amenity. The mixed use zone enjoys higher development potential than other land use zones.
- Introduce a four-storey street wall height (podium) along Woodville Road and local streets, with up to six-storey buildings set back from the podium to create a human scaled streetscape.
- Transition higher built form along Woodville Road down to the lower scale surroundings. This will also bolster housing choice.
- Provide landscape setbacks along Woodville Road and local streets to create green links and mitigate acoustic and air quality issues.
- To meet the need in the northern part of the precinct, locate the future local open space at the triangular site along Union Street,

The 3D images overleaf compare the existing context with the proposed master plan building envelopes in the Woodville North Precinct. The 3D models illustrate indicative building envelopes and do not include full building articulation.

Woodville North Precinct Proposed Yield (PP Sites Only) *	
Site Area (m^2)	**80,724**
Residential GFA (m^2)	**138,813**
Non-Residential GFA (m^2)	**1,776**
Total GFA (m^2)	**140,589**
Proposed Dwellings (units)	**1,384**
Population Projection (Proposed)	**3,875**

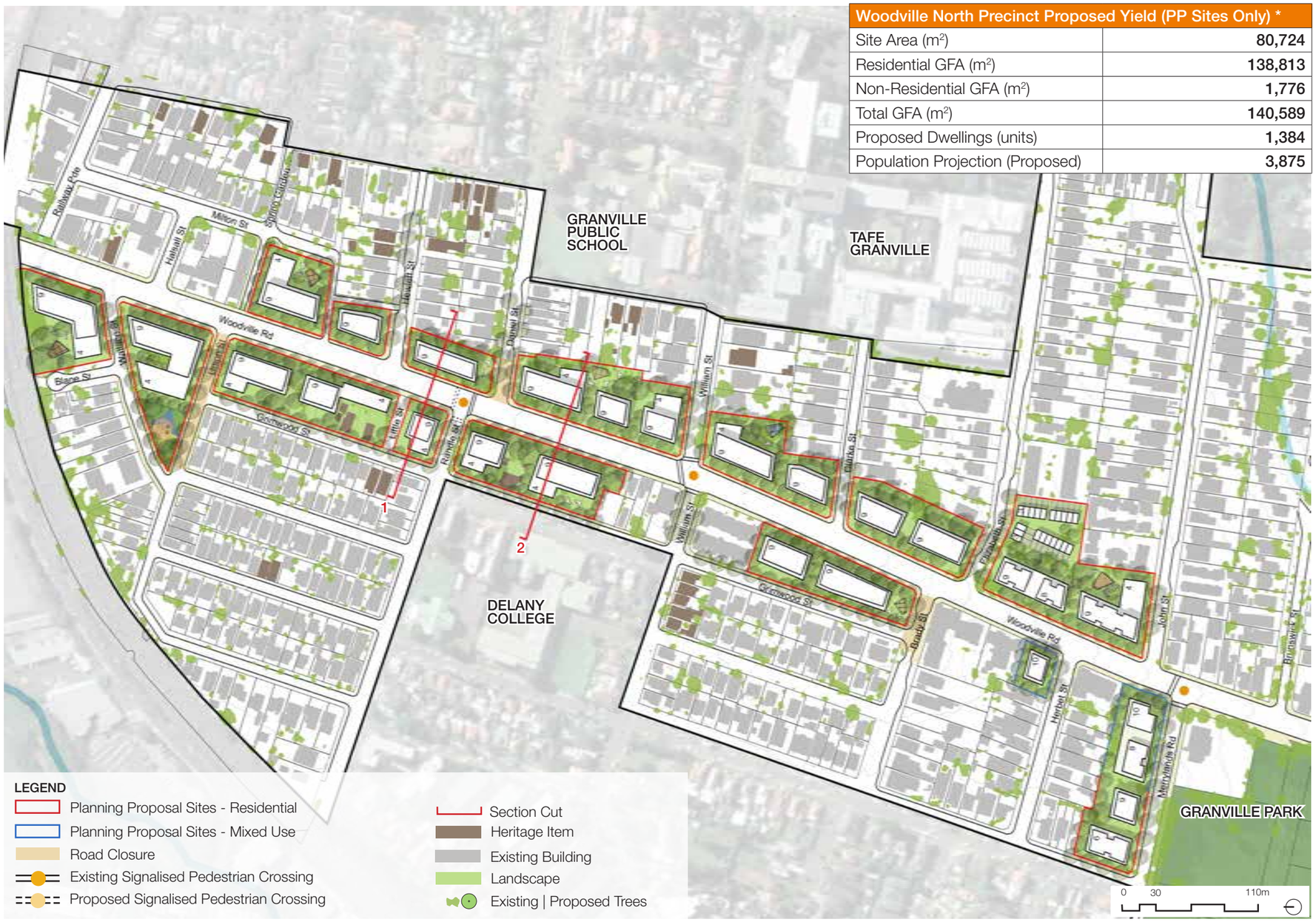
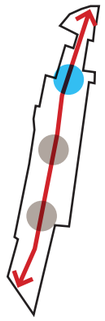


Figure 38: Illustrative Master Plan, Woodville North Precinct

** Based on design parameters outlined in Chapter 8.1 of this report*

9.0 Master Plan

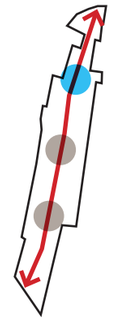


Existing 3D

Proposed 3D

Figure 39: 3D Aerial Views, Woodville North Precinct - Existing (Left) and Master Plan (Right)

9.0 Master Plan



Woodville North Precinct Sections

The sections illustrate the following:

1. Four-storey street wall height datum.
2. Secondary setback (upper-level setback) above the four-storey street wall height.
3. Increased setback to a lower density zone interface.
4. Generous landscape setback along Woodville Road.

Note:
Built form outside of the Planning Proposal sites is indicative only.

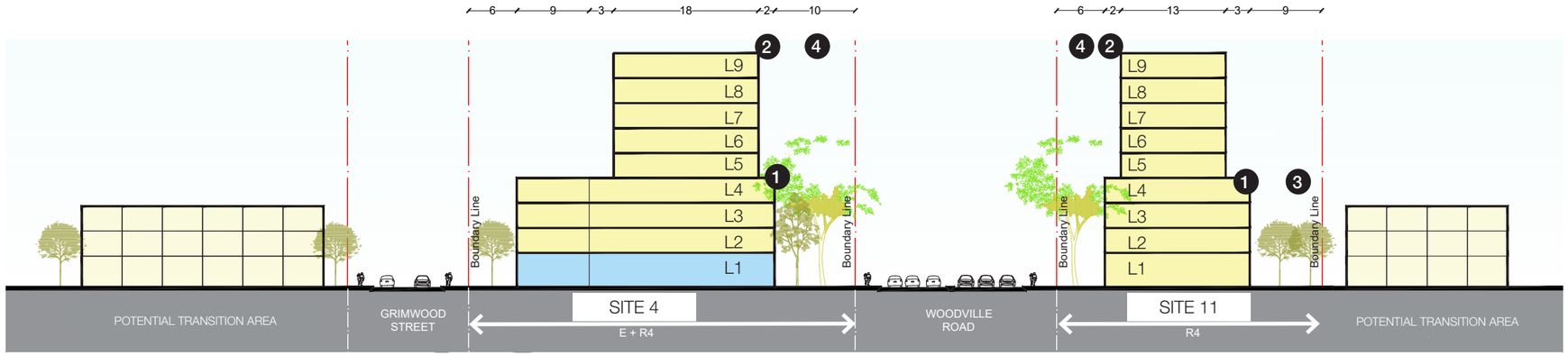


Figure 40: Section 1-1

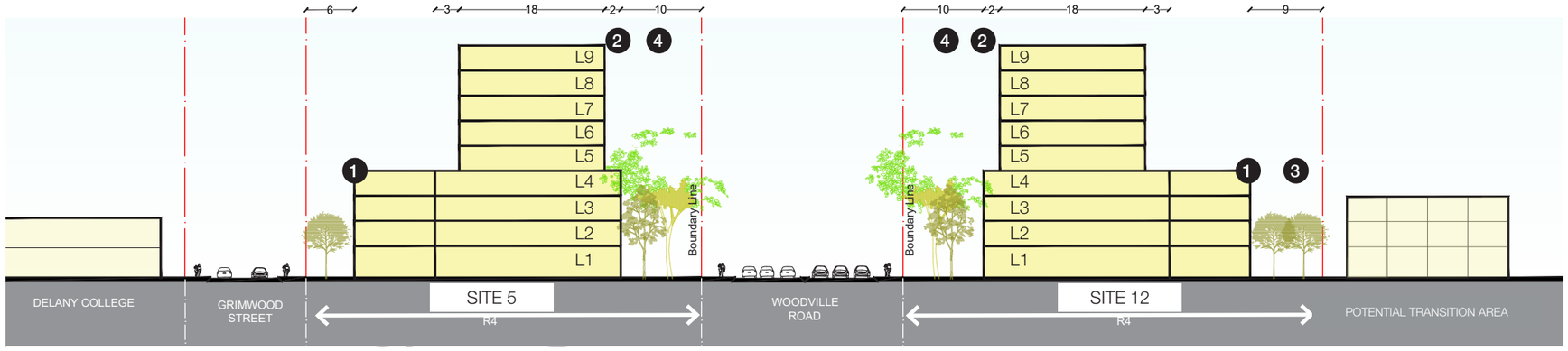
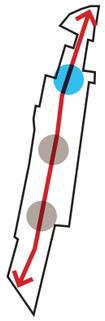


Figure 41: Section 2-2

LEGEND

- Item Number
- Site Boundary
- Proposed Building Envelope (Residential)
- Proposed Building Envelope (Non-Residential)
- Section Cut

9.0 Master Plan



Woodville North Precinct Street Views

The street views compare the existing streetscape to the future streetscape and demonstrate the following:

- The view along Woodville Road (View 1) showcasing the four-storey street wall and increased landscaping.
- The view along Union Street looking at the future local open space (View 2). This shows the built form stepped down from nine-storeys along Woodville Road to four-storeys facing the future park.

The diagrams on this page are computer generated images (CGI) only.

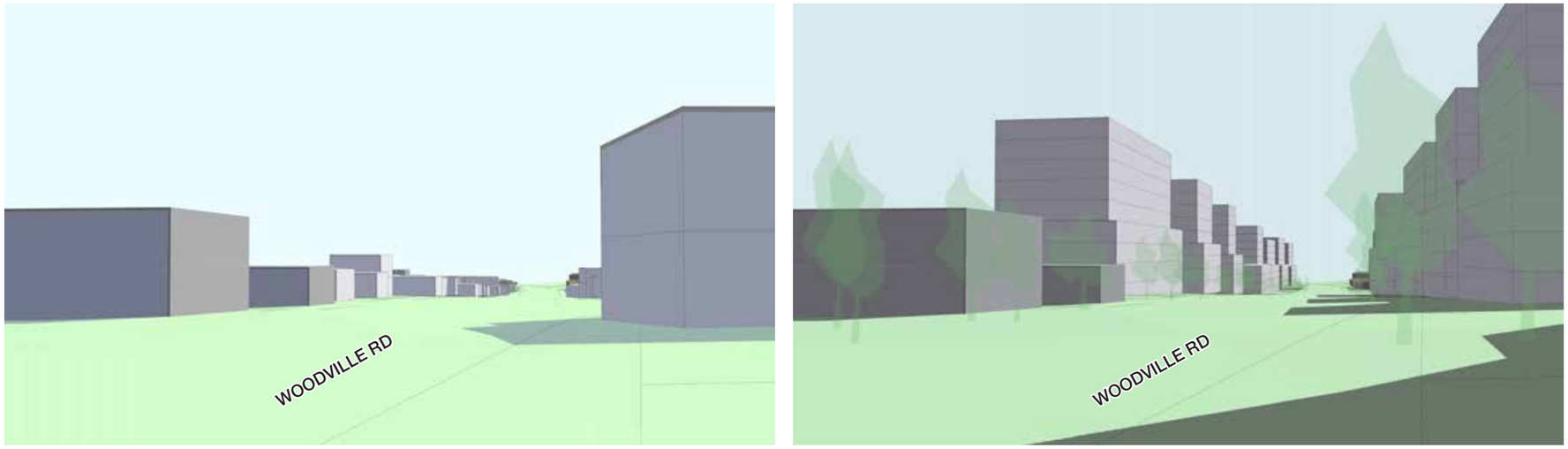


Figure 42: Street View 1 - Existing (left) and Proposed (right)

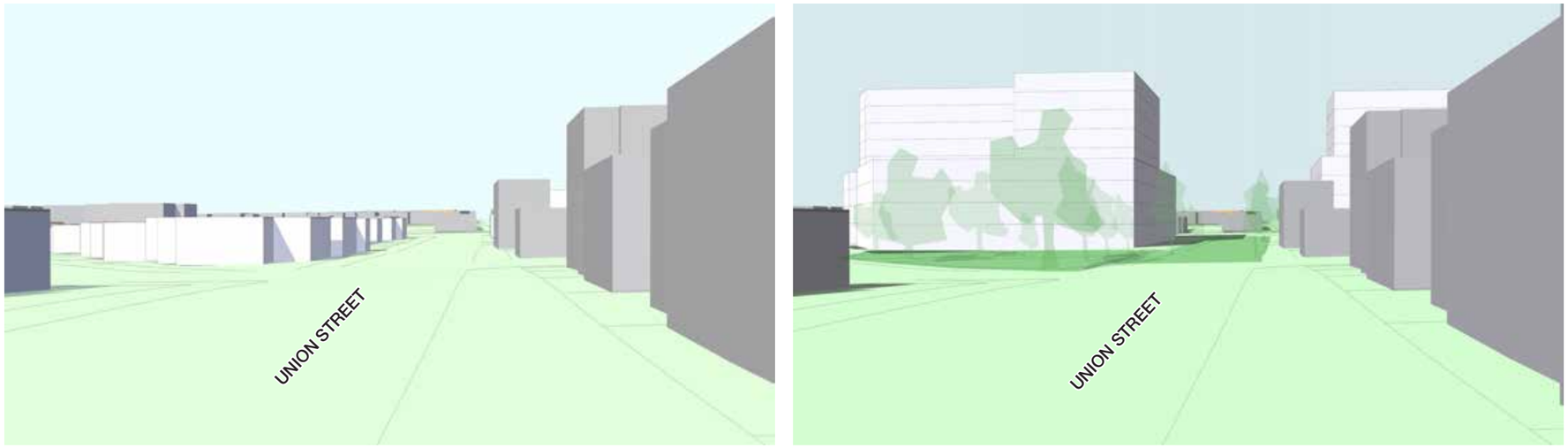
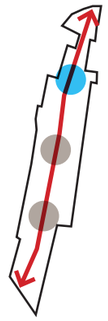


Figure 43: Street View 2 - Existing (left) and Proposed (right)

9.0 Master Plan



Woodville North Precinct Shadow Diagrams - Winter Solstice

Future development should achieve adequate solar access to comply with ADG requirements. Achieving decent solar access in the future public domain and communal open space is also important to living amenity in the study area. The shadow diagrams illustrate that:

- Proposed building envelopes for the 29 Planning Proposal sites are able to achieve the required solar access in mid-winter, in the later detailed design stage (refer to the SEPP 65 Design Quality Principles Statement in the Appendix for detailed information).
- At least 50% of the area of proposed communal open space, on the ground, structure or a combination of both, can receive two hours or more solar access in mid-winter (refer to the SEPP 65 Design Quality Principles Statement in the Appendix for detailed information).

LEGEND

- Planning Proposal Sites
- COS - Ground Level
- COS - On Structure

9AM Winter Solstice

10AM Winter Solstice

11AM Winter Solstice

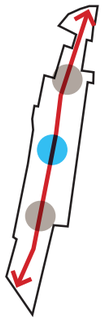
12PM Winter Solstice

1PM Winter Solstice

2PM Winter Solstice

3PM Winter Solstice

9.0 Master Plan



Merrylands East Precinct Master Plan

Key design outcome includes:

- Create a 'village' feel for the precinct by introducing an urban plaza, recreational facilities, ground floor activation and mix of uses in the precinct.
- Echo Council's LSPS by introducing the highest development potential within the Merrylands East Precinct on the development ready John Cootes site.
- Introduce a new mixed use zone to the north of Lansdowne Street, providing job opportunities close to the emerging Local Centre.
- Increase the precinct's permeability by introducing through site links and road access on the John Cootes site.
- Introduce a four-storey street wall height (podium) along Woodville Road and local streets, with up to eight-storey buildings set back from the podium, to create a human scale streetscape
- Transition down the higher built form along Woodville Road to the lower scale surrounds.
- Provide landscape setbacks along Woodville Road and local streets to create green links and mitigate acoustic and air quality issues.
- Increase the size of public open space within the John Cootes site to a minimum 3,000m^2.
- Utilise the land near the Kenelda Avenue / Woodville Road intersection to create an adequate local open space.

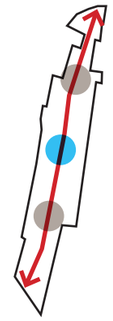
The 3D images overleaf compare the existing context with the proposed master plan building envelopes in the Woodville North Precinct. The 3D models illustrate indicative building envelopes and do not include full building articulation.

Figure 44: Illustrative Master Plan, Merrylands East Precinct

Merrylands East Precinct Proposed Yield (PP Sites Only) *	
Site Area (m^2)	**48,759**
Residential GFA (m^2)	**82,699**
Non-Residential GFA (m^2)	**11,871**
Total GFA (m^2)	**94,570**
Proposed Dwellings (units)	**823**
Population Projection (Proposed)	**2,306**

** Based on design parameters outlined in Chapter 8.1 of this report*

9.0 Master Plan

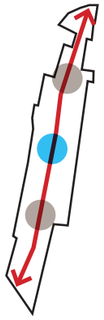


Existing 3D

Proposed 3D

Figure 45: 3D Aerial Views, Merrylands East Precinct - Existing (Left) and Master Plan (Right)

9.0 Master Plan



Merrylands East Precinct Sections

The sections illustrate the following:

1. Four-storey street wall height datum.
2. Secondary setback (upper-level setback) above the four-storey street wall height.
3. Urban plaza and through site links with non-residential active edges fronting links.
4. Generous landscape setback along Woodville Road.
5. New vehicular connection and future public open space.

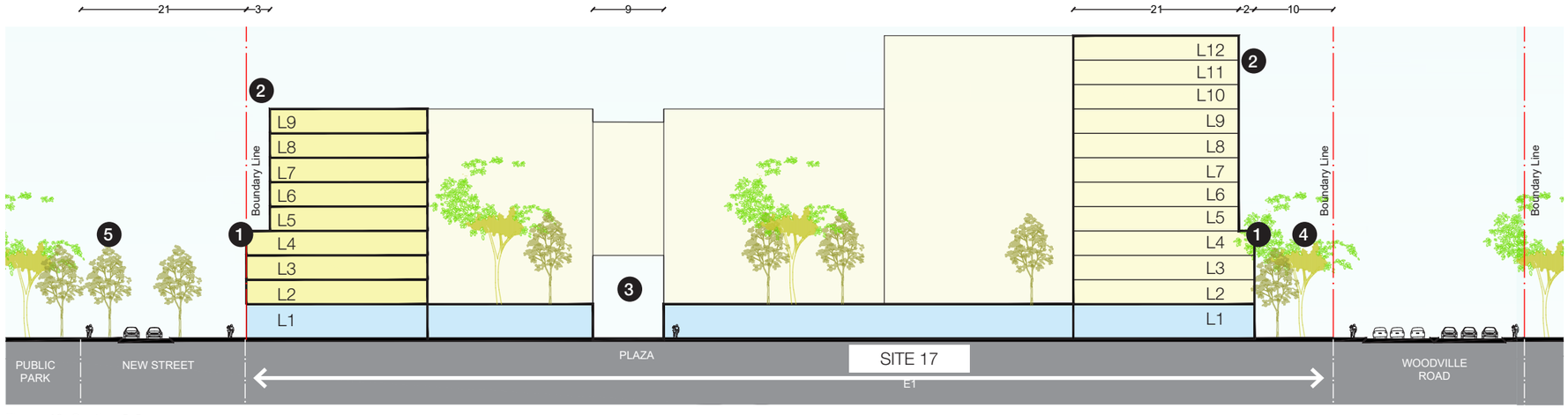


Figure 46: Section 3-3

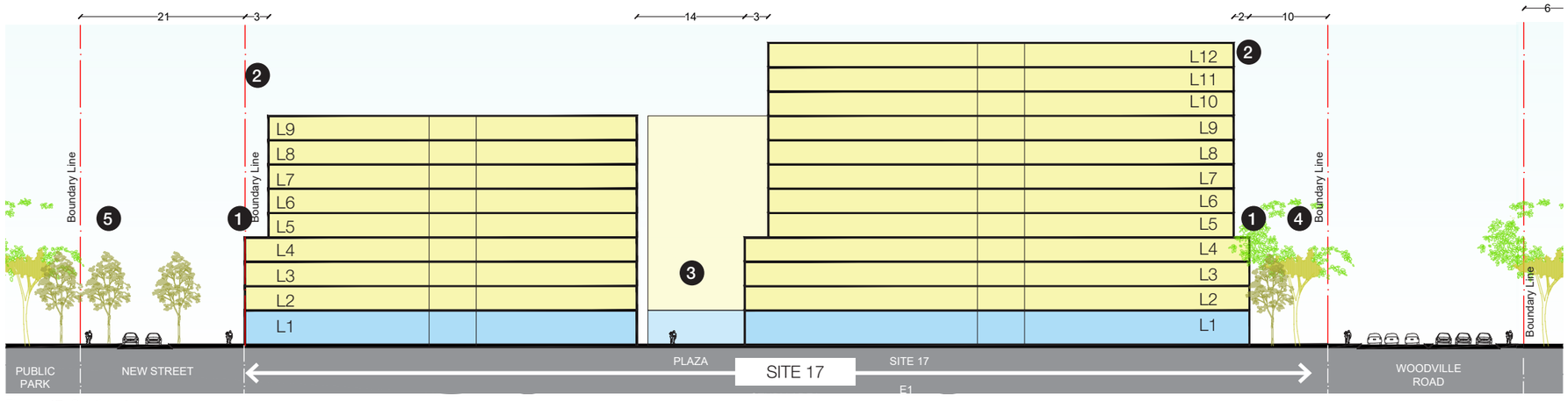
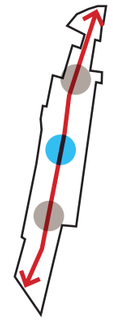


Figure 47: Section 4-4

LEGEND

- X Item Number
- Site Boundary
- Proposed Building Envelope (Residential)
- Proposed Building Envelope (Non-Residential)
- Section Cut

9.0 Master Plan



Merrylands East Precinct Street Views

The street views compare the existing streetscape to the future streetscape and demonstrate the following:

- The view along Woodville Road looking south showcasing the four-storey street wall and increased landscaping.

The diagrams on this page are computer generated images (CGI) only.

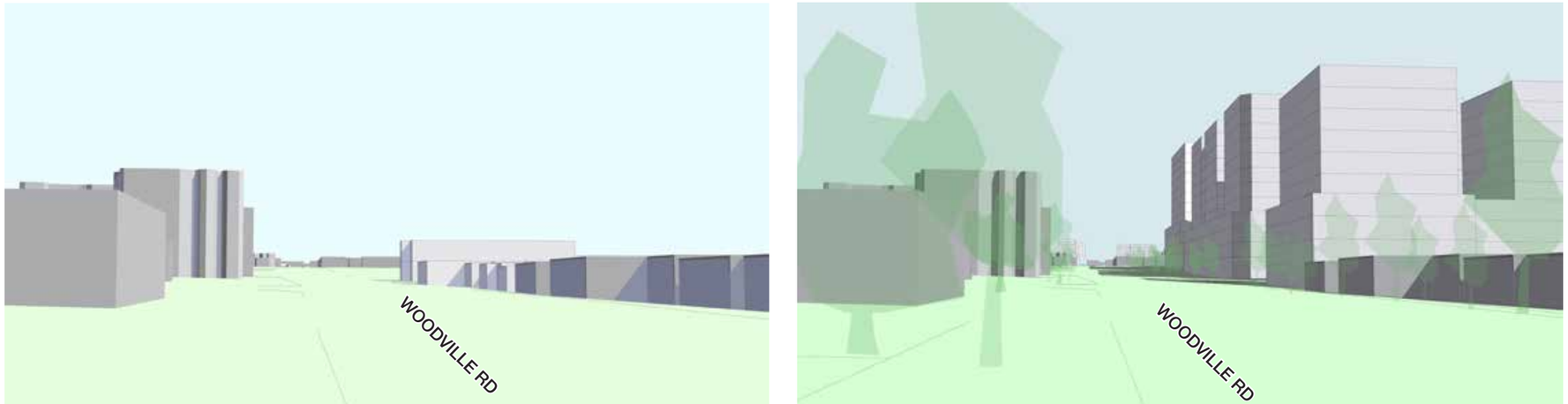
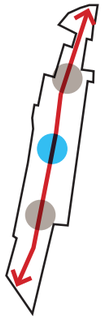


Figure 48: Street View 3 - Existing (left) and Proposed (right)

9.0 Master Plan



Merrylands East Precinct Shadow Diagrams - Winter Solstice

Future development should achieve adequate solar access to comply with the ADG requirements. Achieving appropriate solar access in the future public domain and communal open space is also important to the living amenity in the study area. The shadow diagrams illustrate that:

- Proposed building envelopes in the 29 Planning Proposal sites are able to achieve the required solar access in mid-winter, in the later detailed design stage (refer to the SEPP 65 Design Quality Principles Statement in the Appendix for detailed information).
- At least 50% of the area of proposed communal open space, on the ground, structure or a combination of both can receive two or more hours solar access in mid-winter (refer to the SEPP 65 Design Quality Principles Statement in the Appendix for detailed information).

LEGEND

- Planning Proposal Sites
- COS - Ground Level
- COS - On Structure

9AM Winter Solstice

10AM Winter Solstice

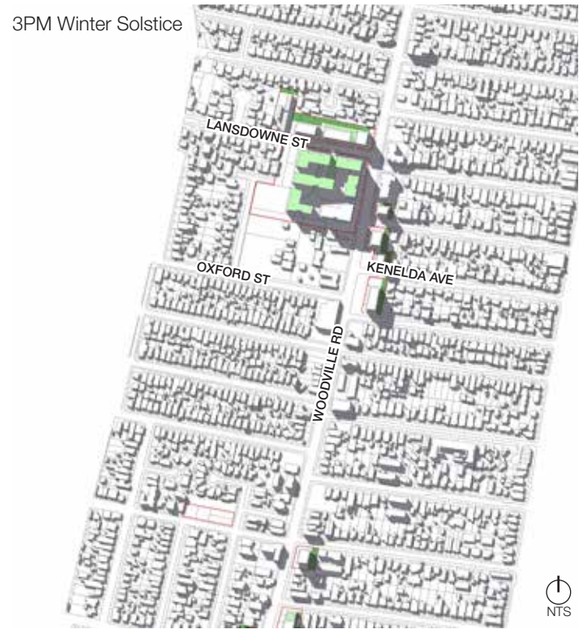
11AM Winter Solstice

12PM Winter Solstice

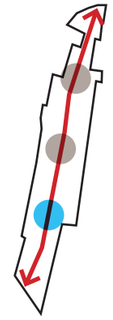
1PM Winter Solstice

2PM Winter Solstice

3PM Winter Solstice



9.0 Master Plan



Woodville South Precinct Master Plan

Key design outcome include:

- Encourage site amalgamation between Woodville Road and Chamberlain Road to facilitate vehicular access from a local street rather than Woodville Road.
- Introduce a new mixed use zone at Guildford Road / Woodville Road intersection, providing employment and living opportunities.
- Introduce four-storey street wall height (podium) along Woodville Road and local streets, with up to six-storey buildings set back from the podium to create a human scale streetscape.
- Transition higher built form along Woodville Road down to the lower scale surrounds.
- Limit the building height along Chamberlain Road to four storeys reflecting adjacent low density to the west.
- Provide landscape setbacks along Woodville Road and local streets to create green links and mitigate acoustic and air quality issues.
- Provide new public open space close to the future mixed use area and transfer Rhodes Avenue to a new local open space.

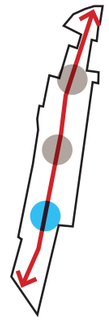
The 3D images overleaf compare the existing context and the proposed master plan scenario building envelopes in the Woodville North Precinct. The 3D models illustrate indicative building envelopes and do not include full building articulation.

Woodville South Precinct Proposed Yield (PP Sites Only) *	
Site Area (m^2)	**89,991**
Residential GFA (m^2)	**148,851**
Non-Residential GFA (m^2)	**7,141**
Total GFA (m^2)	**155,992**
Proposed Dwellings (units)	**1,489**
Population Projection (Proposed)	**4,168**

Figure 49: Illustrative Master Plan, Woodville South Precinct

** Based on design parameters outlined in Chapter 8.2 of this report*

9.0 Master Plan

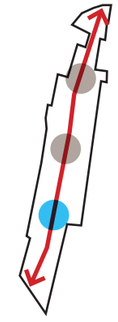


Existing 3D

Proposed 3D

Figure 50: 3D Aerial Views, Woodville South Precinct - Existing (Left) and Master Plan (Right)

9.0 Master Plan



Woodville South Precinct Sections

The sections illustrate following items:

1. Four-storey street wall height datum.
2. Secondary setback (upper-level setback) above the four-storey street wall height.
3. Built form transition from Woodville Road to Chamberlain Road.
4. Adequate building separations, complying with the ADG.
5. Generous landscape setback along Woodville Road.
6. Ground level communal open space.

Note:
Built form outside of the PP sites is indicative only.

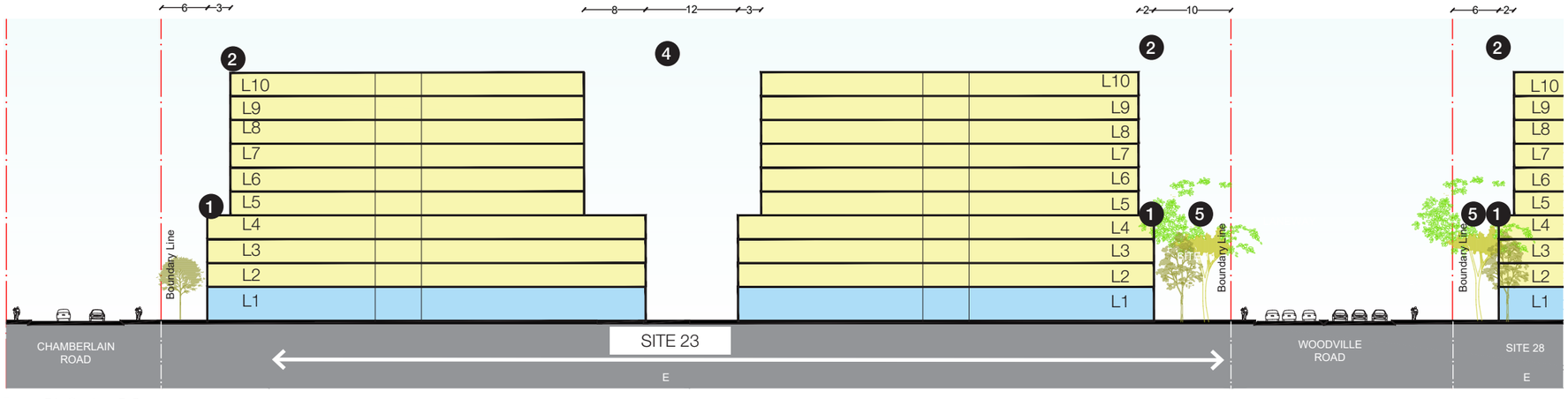


Figure 51: Section 5-5

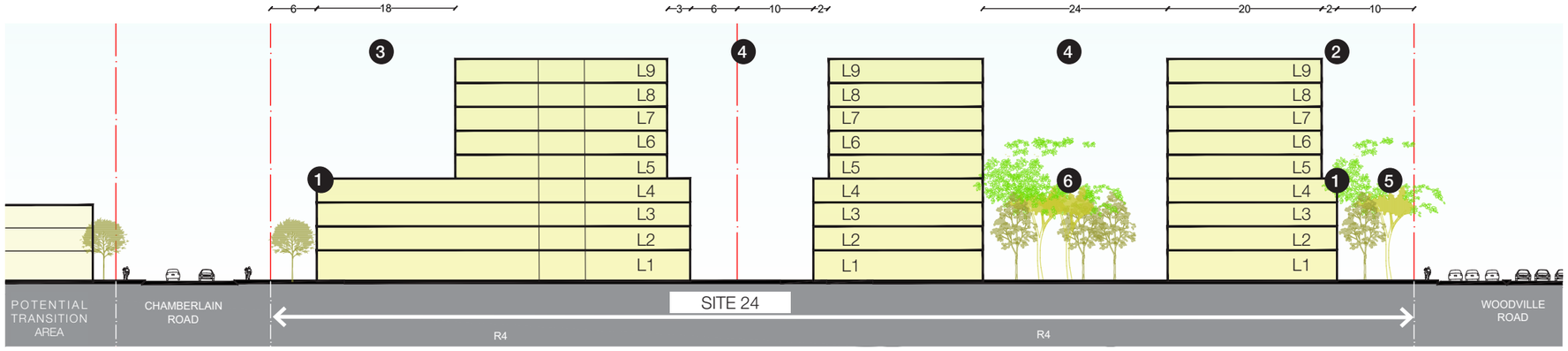
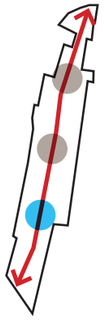


Figure 52: Section 6-6

LEGEND

- X Item Number
- Site Boundary
- Proposed Building Envelope (Residential)
- Proposed Building Envelope (Non-Residential)
- Section Cut

9.0 Master Plan



Woodville South Precinct Street Views

The street views compare the existing streetscape to the future streetscape and demonstrate the following:

- This view illustrates the building height transition from nine storeys along Woodville Road to four storeys along Chamberlain Road.

The diagrams on this page are computer generated images (CGI) only.

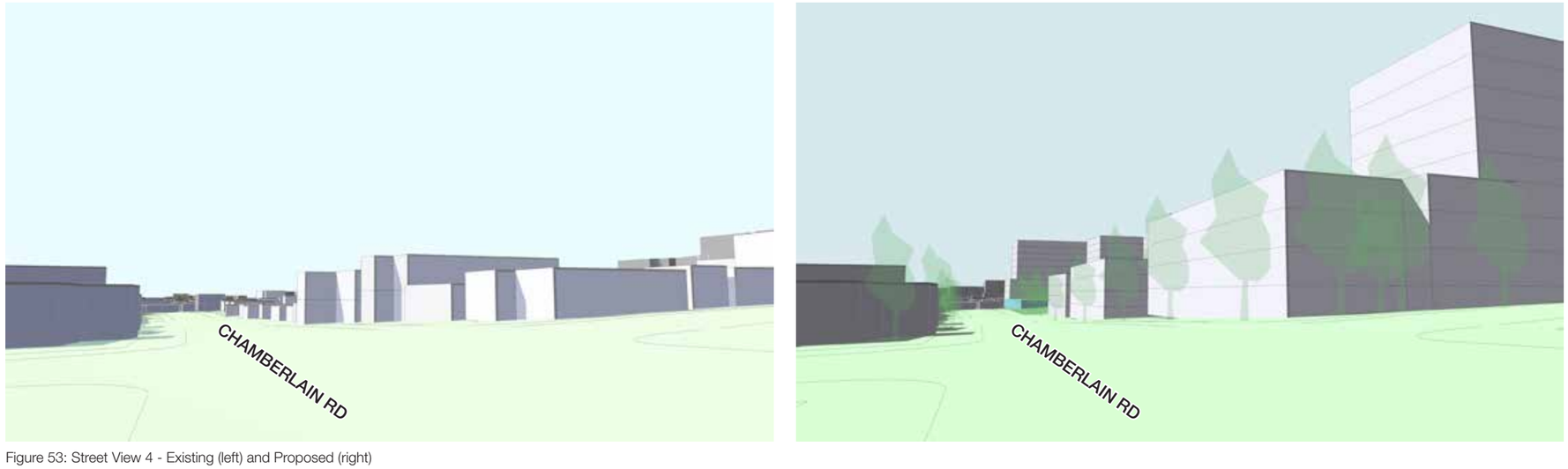
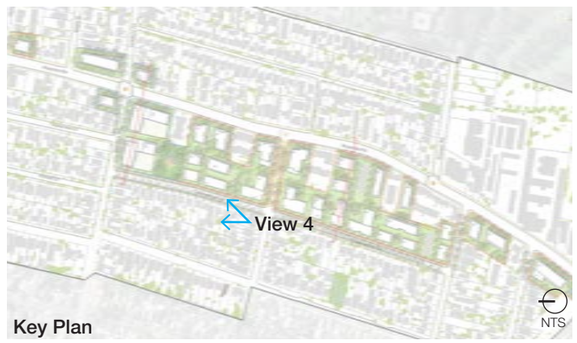
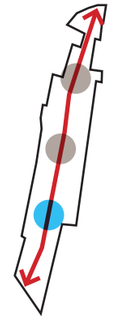


Figure 53: Street View 4 - Existing (left) and Proposed (right)



9.0 Master Plan



Woodville South Precinct Shadow Diagrams - Winter Solstice

Future development should achieve adequate solar access to comply with the ADG requirements. Achieving appropriate solar access in future public domain and communal open space is also important to living amenity in the study area. The shadow diagrams illustrate that:

- The proposed building envelopes in the 29 Planning Proposal sites are able to achieve the required solar access in mid-winter in the later detailed design stage (refer to the SEPP 65 Design Quality Principles Statement in the Appendix for detailed information).
- At least 50% area of proposed communal open space, either on ground, structure or a combination of both can receive two or more hours solar access in mid-winter (refer to the SEPP 65 Design Quality Principles Statement in the appendix for detailed information).

LEGEND

- Planning Proposal Sites
- COS - Ground Level
- COS - On Structure

9AM Winter Solstice

10AM Winter Solstice

11AM Winter Solstice

12PM Winter Solstice

1PM Winter Solstice

2PM Winter Solstice

3PM Winter Solstice

9.0 Master Plan

9.8 Control Recommendations

The control changes proposed, apply to the 29 Planning Proposal Sites only. Controls for other potential future expansion / transition areas within the WRC, are indicative only. The proposed changes align with the envisaged urban design strategies, overarching parameters, and the indicative master plan.

Proposed Land Zoning

The key features are:

- Provide a new employment zone (E1) at key intersections, including Merrylands Road / Woodville Road, Lansdowne Street / Woodville Road and Guildford Road / Woodville Road intersections.
- Align with Cumberland LSPS centre hierarchy by differentiating E1 Local Centre zone on John Cootes site (Site 17) from other E1 zone within the study area.
- Introduce a high density residential (R4) zone along Woodville Road outside the employment zone.
- Introduce a medium density residential (R3) zone moving away from Woodville Road.
- Deliver the needed open space through amalgamation incentives (refer to proposed height and density controls).

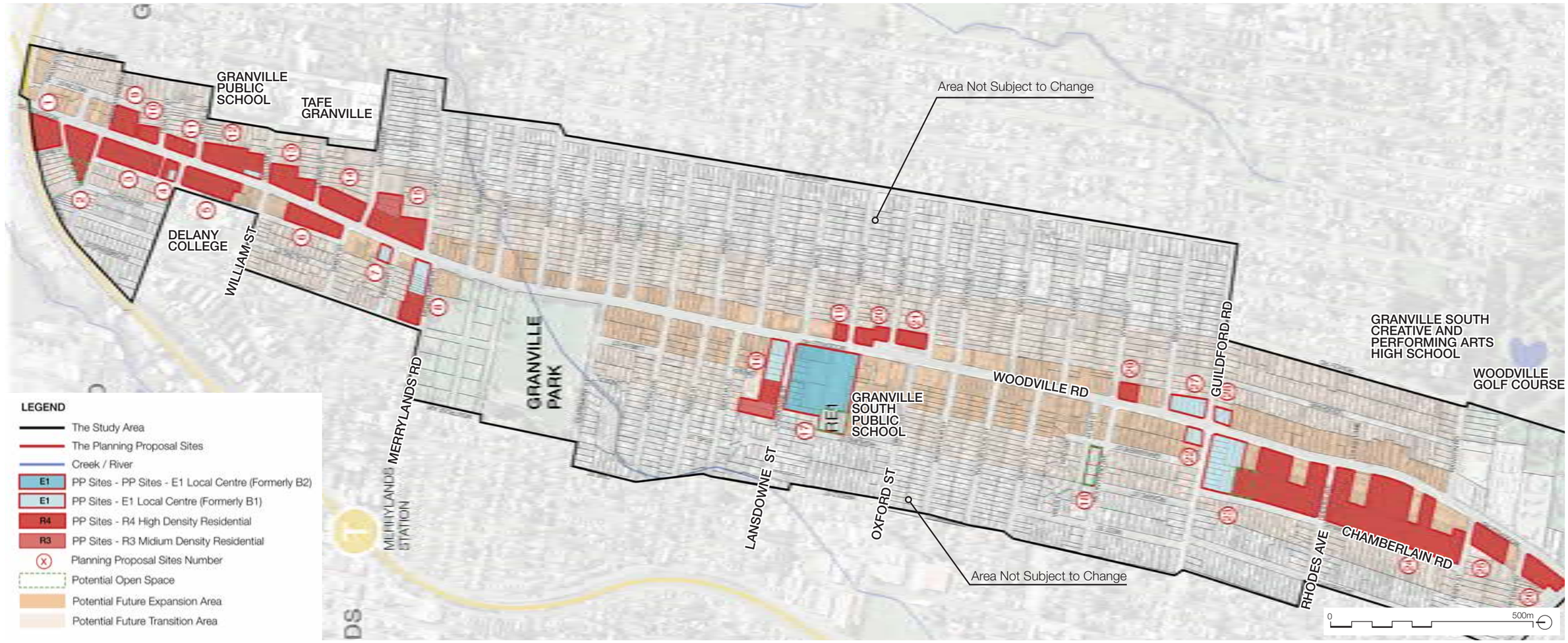
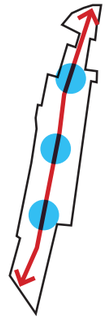


Figure 54: Proposed Land Use

9.0 Master Plan



Proposed Building Height

The key features are:

- The maximum 12 storeys on John Cootes site (Site 17) in Merrylands East Precinct.
- Maximum nine storeys along Woodville Road future R4 zone and two E1 zones at Randle Street and William Street.
- Maximum 10 storeys along Woodville Road employment zone, except for John Cootes site and two E1 zones at Randle Street and William Street.
- Three to four storeys maximum building height moving away from Woodville Road to provide transition
- The properties along Union Street and Chamberlain Road away from Woodville Road to have a maximum height control of four storeys (Sites 2, 23 and 24)
- Amalgamation height incentives of nine storeys with a four-storey transition zone apply to the following sites if:
  - Site 2: Identified lots are used as open space, combining with the Union Street closure to form a 3,000m^2 open space.
  - Site 23 (N1 Lots): Access is provided to lots facing Woodville Road and identified lots are used to form a 3,000m^2 open space.
  - Site 24 (N1 Lots) : Access is provided to lots facing Woodville Road and land dedications to the open space.
- The above incentives should be read in conjunction with the proposed density control.

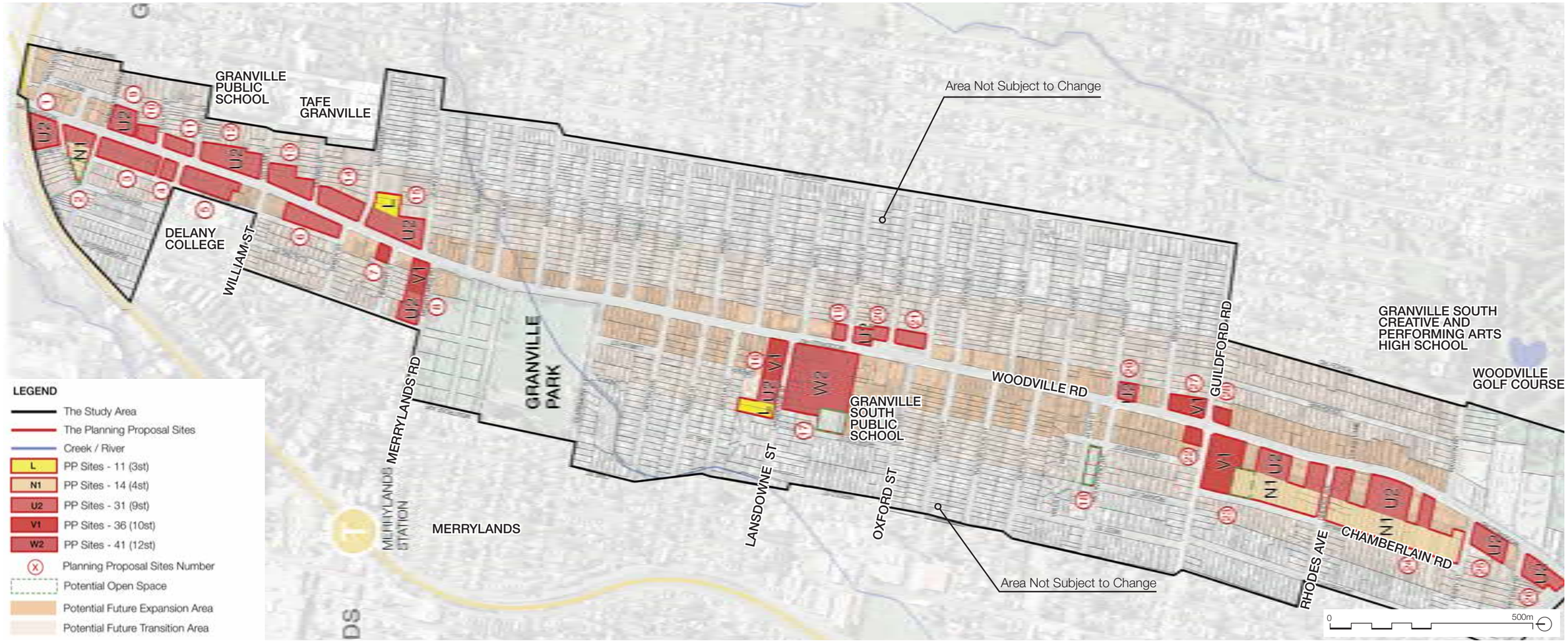
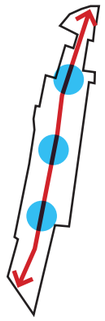


Figure 55: Proposed Building Height

9.0 Master Plan



Proposed Density

The key features are:

- The maximum FSR is 2.5:1 on John Cootes site in Merrylands East precinct.
- Maximum 1.8:1 FSR along Woodville Road future R4 zone and two E1 zones at Randle Street and William Street.
- Maximum 2.0:1 FSR along Woodville Road employment zone, except for John Cootes site (Site 17) and two E1 zones at Randle Street and William Street.
- Generally an 0.75:1 and 1:1 FSR moving away from Woodville Road to encourage housing diversity.
- The properties along Union Street and Chamberlain Road away from Woodville Road to have a maximum FSR of 1.0:1 (Sites 2, 23 and 24).
- Amalgamation density incentives apply to these sites resulting in a 1.8:1 FSR if:
  - Site 2: Identified lots are used as open space, combined with the Union Street closure to form a 3,000m^2 open space.
  - Site 23 (N Lots): Access is provided to lots facing Woodville Road and identified lots are used to form a 3,000m^2 open space.
  - Site 24 (N Lots): Access is provided to lots facing Woodville Road and land dedications to open space.
- The above incentives should be read in conjunction with the proposed height control.

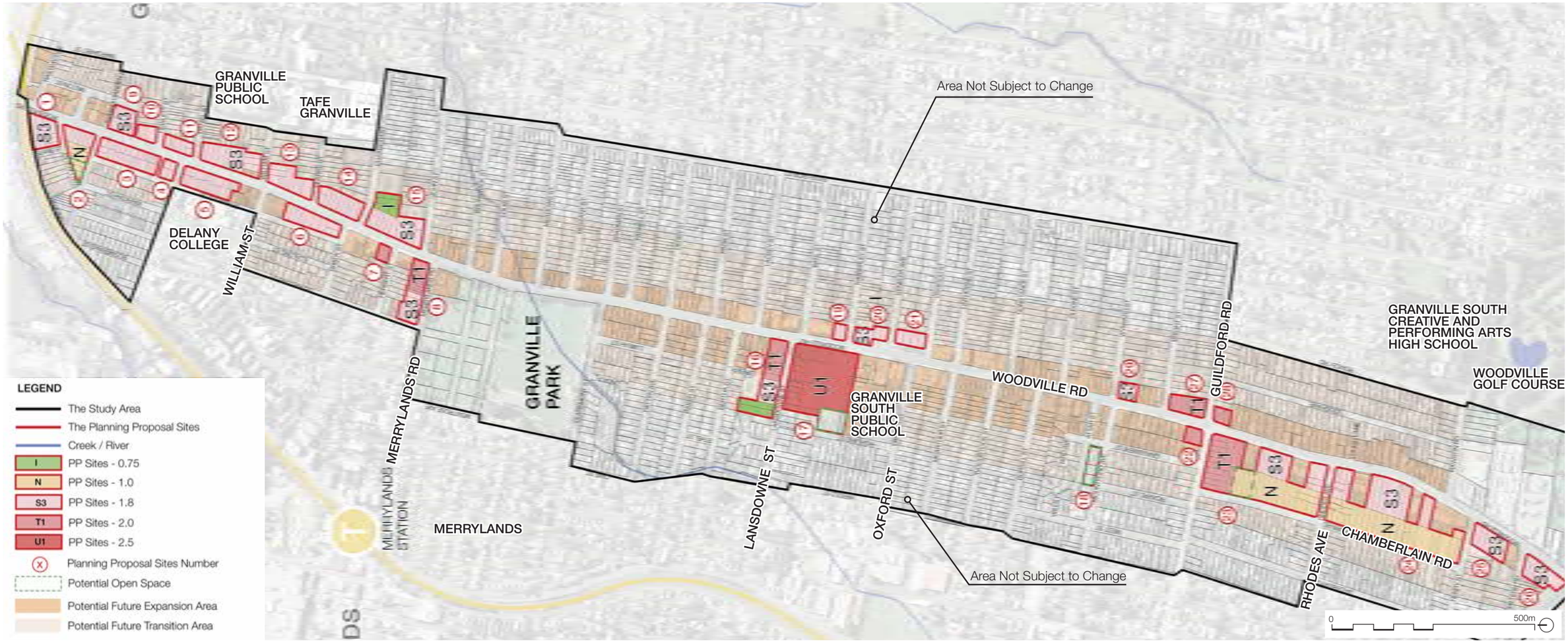
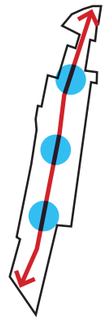


Figure 56: Proposed Density

9.0 Master Plan



Preferred Amalgamation Pattern

The key features are:

- The amalgamated sites to have a frontage of at least 30m.
- The preferred amalgamation pattern to create a reasonable interface with the constrained sites.
- The number of lots to be amalgamated should generally be less than eight owners; however, for the ones delivering public open space or through site access, more than eight owners may be appropriate.
- The preferred amalgamation pattern in the diagram below is a recommendation only. The final site amalgamation may be different than the recommended; however the above principles should apply.

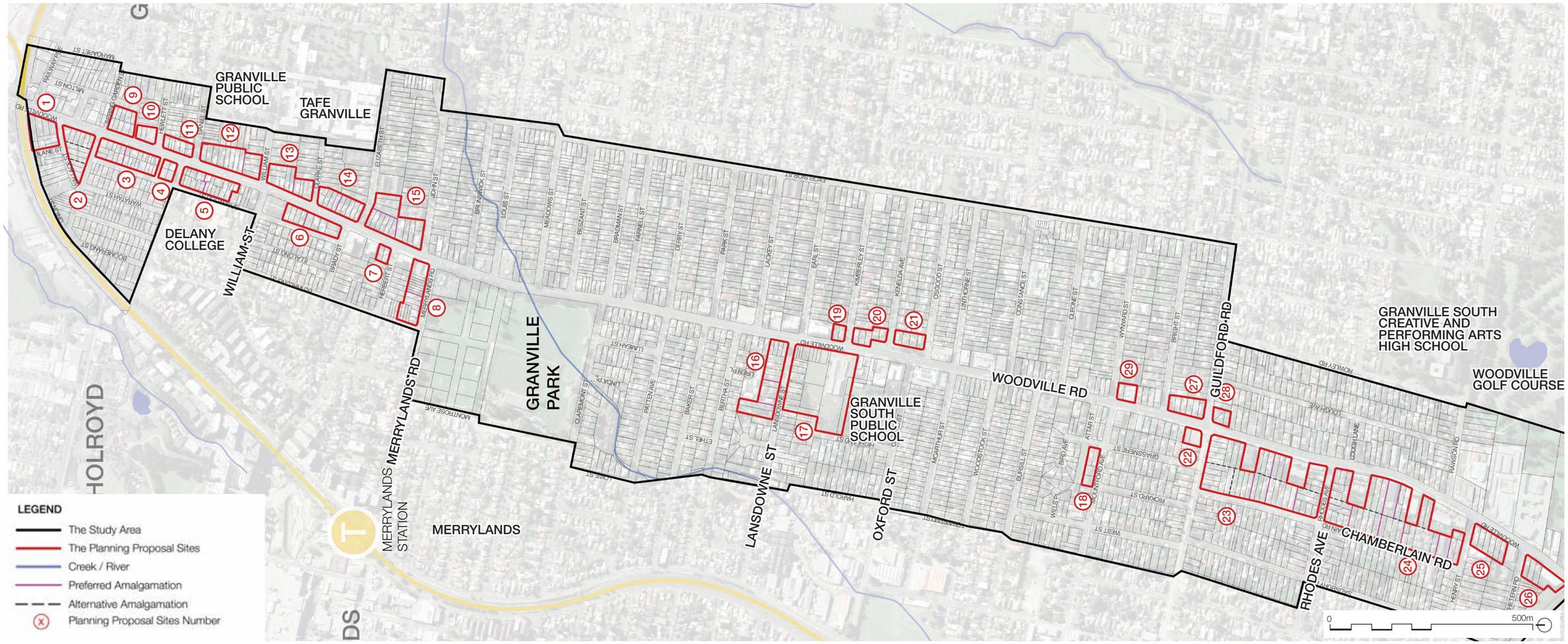
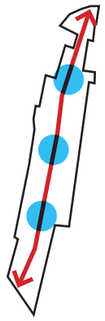


Figure 57: Preferred Amalgamation Pattern

9.0 Master Plan



Proposed Setbacks / Separation

The key features are:

- Woodville Road Setback - 10m on both sides to create a green corridor, where practicable.
- 6m is used where the 10m setback may result in undevelopable built form or against the prevailing setback established by the recent residential flat building developments.
- Local / Secondary Street Setback - 6m to allow decent ground floor garden / landscaping.
- Increased setback (11m) along the nominated part of Rhodes Avenue to accommodate future open space.
- Setbacks to the common boundary should also reference the ADG building separation controls.
- Additional 3m setback to the common boundary should apply if interfacing with a lower density zone.

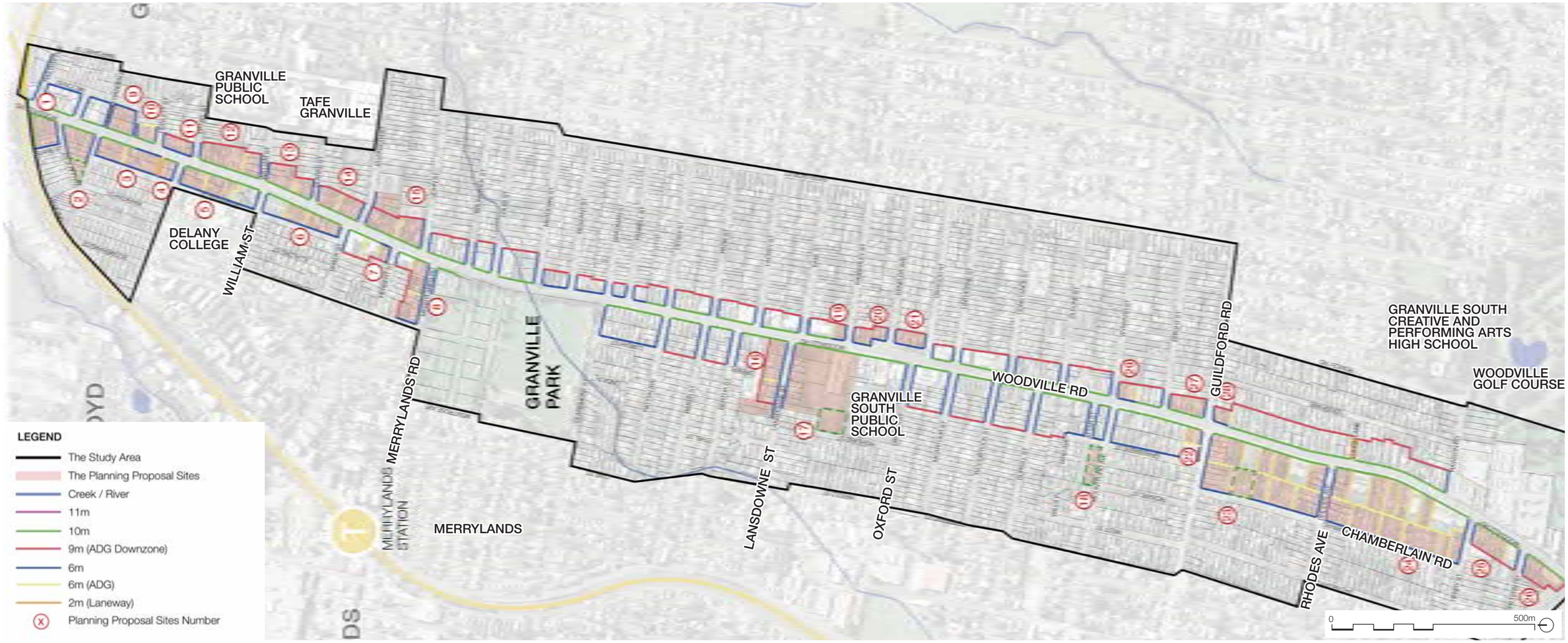
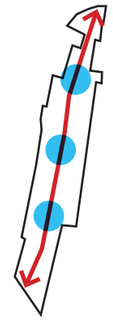


Figure 58: Proposed Setbacks / Separation

9.0 Master Plan



Proposed Active Frontages

The key features are:

- There should generally be an actived, mixed use zone at ground level according to the diagram below.
- Residential ground level should be activated by providing direct access to these units.
- Required Active frontage applies to:
  - Mixed use on all streets
  - Residential use on local streets
- Preferred Active frontage applies to
  - Residential use along the WRC

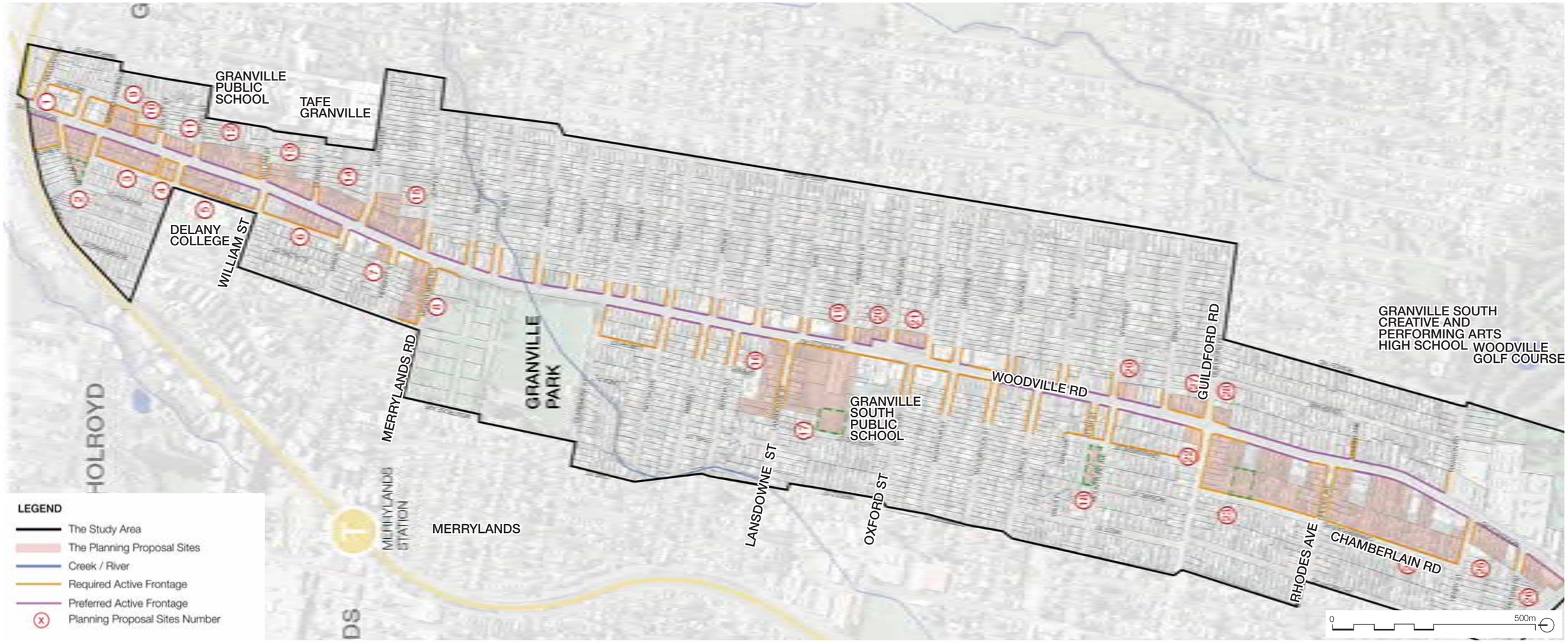


Figure 59: Active Street Frontages

Appendix C

Noise modelling methodology

C-1 Traffic volume assumptions used in the modelling

Table C.1 Existing traffic volumes along Woodville Road (2022)

ID	AADT			HV%		NB hourly volumes				SB hourly volumes			
						Day (15hr)		Night (9hr)		Day (15hr)		Night (9hr)	
	Both	NB	SB	NB	SB	LV	HV	LV	HV	LV	HV	LV	HV
A	39410	22784	16626	10%	16%	1133	125	391	43	754	145	293	56
B	46583	21780	24803	8%	8%	1102	94	393	33	1272	118	403	37
C	55169	27585	27585	10%	11%	1373	151	472	52	1354	171	466	59

Table C.2 Estimated existing and future traffic volumes used for modelling

Scenario	Road	AADT	HV percentage	Data source / assumption
Existing traffic volumes				
	Woodville Road	A - 39,410	10% NB, 16% SB	A – Woodville Road, Merrylands (Matrix ATC, Sept 2022)
		B - 46,583	8% NB, 8% SB	B – Woodville Road, Granville (Matrix ATC, Sept 2022)
		C - 55,169	10% NB, 11% SB	C- Woodville Road, Chester Hill (Matrix ATC, Sept 2022)
	Earl St, Union St, Brady St etc.	<2000	Assumed 2.6% for all side streets	– AADT volumes based on 24 hour Automatic Tube Counts, where available (Matrix, Sept 2022) – Where 24 hour data was not available (peak hour only), conversion factors were used to estimate AADT,15 hour and 9 hour volumes: • AM or PM peak hour to AADT (24 hour) – 14.7x • peak hour to 15 hour (7 am to 10 pm)– 13.2x • peak to 9 hour (10 pm to 7am) – 1.5x (SCT Report Extract 2021, Matrix Intersection counts, Sep 2022) – HV% based on an average of measured heavy vehicles across side streets
	Lansdowne St	2,000 to 5,000		
	Randle St	5,000 to 10,000		
	Guildford Str West	10,000 to 15,000		
	Merrylands St, Louis St, William St etc.	15,000 to 20,000		
	Oxford St, Rawson St	20,000 to 25,000		
Future traffic volumes				
	Woodville Road	A – 48,708	Same as existing	Conservative estimation undertaken by GHD: – 2.0% growth p.a for LV (10 year projection) – 1.0% growth p.a for HV (10 year projection) – Plus a total of 1199 • AM peak LV movements and 1462 PM peak LV movements to account for additional residency. • B: 435 AM peak, 671 PM peak • C: 450 AM peak , 489 PM peak (Woodville Road Corridor Traffic and Transport Study, Bitzios April 2023)
		B – 58,560		
		C – 68,463		
	Side streets	Upper limit of AADT category in Table 3.2	Assumed 2.6% for all side streets	Conservative assumption made by GHD

Table C.3 Forecasted traffic volumes along Woodville Road (10 years)

ID	AADT			HV%		NB hourly volumes				SB hourly volumes			
						Day (15hr)		Night (9hr)		Day (15hr)		Night (9hr)	
	Both	NB	SB	NB	SB	LV	HV	LV	HV	LV	HV	LV	HV
A	48708	28131	20576	10%	16%	1423	138	477	48	960	160	357	62
B	58560	27460	31100	8%	8%	1417	104	480	37	1624	130	491	41
C	68463	34252	34212	10%	11%	1737	167	576	57	1713	188	567	65

Table C.4 Forecasted traffic volumes along sides streets (10 years)

AADT Category	AADT	HV%		NB hourly volumes				SB hourly volumes			
				Day (15hr)		Night (9hr)		Day (15hr)		Night (9hr)	
		NB	SB	LV	HV	LV	HV	LV	HV	LV	HV
<2000	2000	2.6%	2.6%	58.5	1.5	10.8	0.3	58.5	1.5	10.8	0.3
2,000 to 5,000	5000	2.6%	2.6%	146.2	3.8	27.1	0.7	146.2	3.8	27.1	0.7
5,000 to 10,000	10000	2.6%	2.6%	292.3	7.7	54.1	1.4	292.3	7.7	54.1	1.4
10,000 to 15,000	15000	2.6%	2.6%	438.5	11.5	81.2	2.1	438.5	11.5	81.2	2.1
15,000 to 20,000	20000	2.6%	2.6%	584.6	15.4	108.3	2.8	584.6	15.4	108.3	2.8
20,000 to 25,000	25000	2.6%	2.6%	730.8	19.2	135.3	3.6	730.8	19.2	135.3	3.6

C-2 Road traffic noise modelling methodology

To predict road traffic noise levels at the facades at future development within each precinct, the CoRTN road traffic noise modelling method has been used and is considered the industry standard prediction method in NSW. The modelling parameters and assumptions for the CoRTN model are detailed in Table C.5.

Table C.5 Noise modelling parameters – CoRTN noise model

Variable	Parameter used
Software	SoundPLAN 8.2
Calculation method	Calculation of Road traffic Noise Levels (CoRTN) method Vehicle heights split into 3 being: – Cars at 0.5 metres – 0 dB correction – HV engines at 1.5 metres - -0.6 dB correction – HV exhausts at 3.6 metres - -8.6 dB correction
Topography	2 metre LiDAR elevation data was sourced from NSW Government – Spatial Services
Receiver heights	1.5 m above the ground floor and +3.0 metres for every storey above on the eastern façade of each building (most-affected)
Ground absorption	– G = 0.5 for all areas Where G = 0 represents hard non-porous ground (road, pedestrian paths) and g= 1 represents porous ground such as grass
Building footprints and heights	Provided by CM+ based on Built Form Masterplan
Temperature	20 deg Celsius
Humidity	80%
Number of reflections	3 number of reflections
Traffic volumes	See Table A.3 for Woodville Road See Table A.4 and Section 3.2 of side streets

C-3 Existing noise levels and model validation

Attended noise monitoring was undertaken at various locations to quantify existing noise levels along Woodville Road and near the rail corridor 1-hour L_{A1}, L_{Aeq}, L_{A10} and L_{A90} noise levels were measured during AM peak monitoring period.

The results of the noise monitoring along Woodville Road indicate that the measured vs. modelled noise levels are within +/- 2 dBA and therefore the noise model is validated and representative of existing noise conditions (see Table C.6) The results of the noise monitoring near the rail corridor indicate that noise levels from passenger rail movements contribute to the noise environment but is not considered to be a significant impact as noise levels at 5 metres from the rail corridor were measured to be approximately L_{Aeq} 62 dBA.

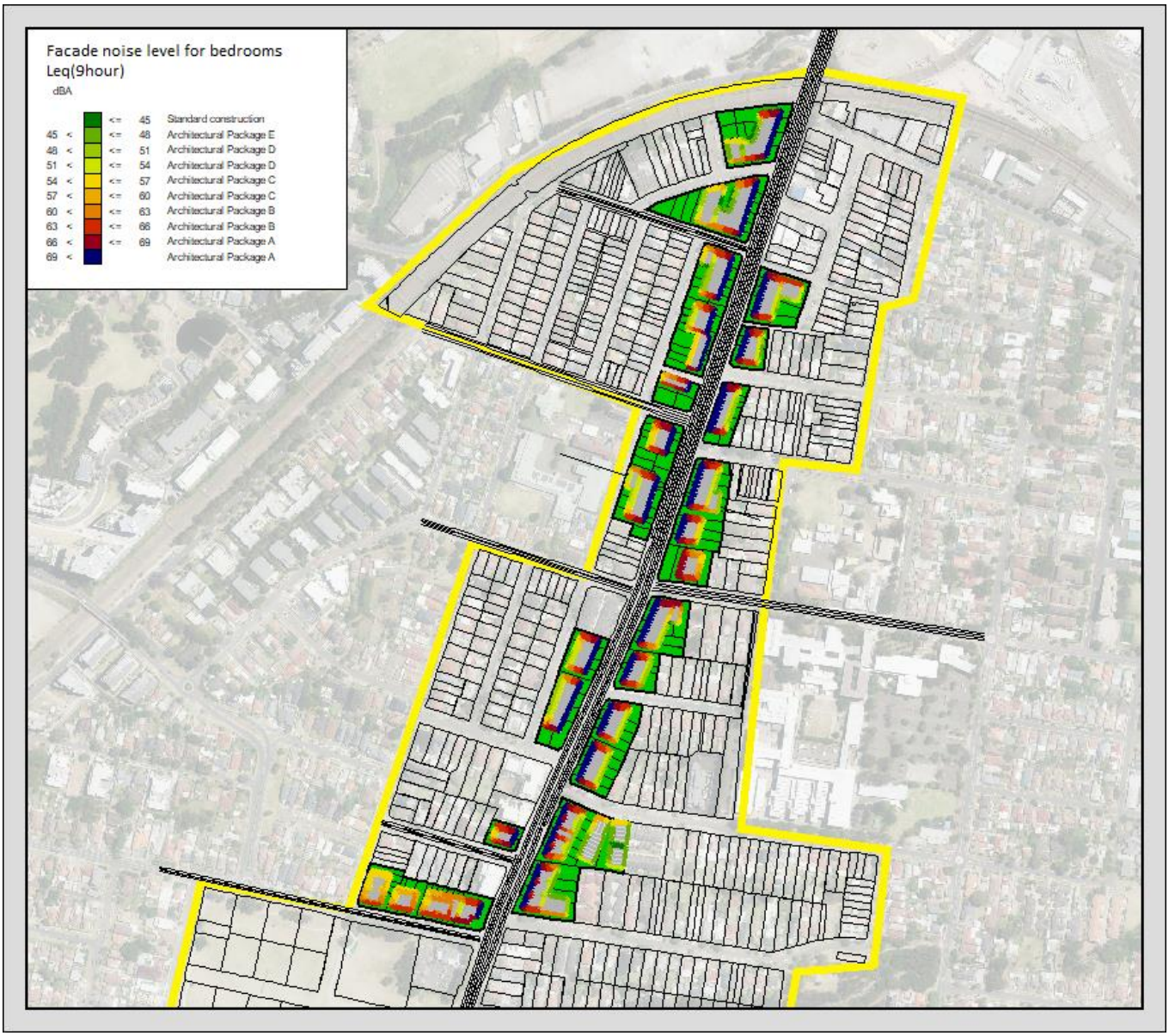
Table C.6 Measured 1 hour noise levels (Tuesday 11/10/2022 AM peak hours)

Measurement / validation point	Setback distance, m	$L_{Aeq(1hour)}$ noise level, dBA		
		Measured	Modelled	Difference
Road noise levels along Woodville Road				
A – between Halsall St and Wallace St	6 metres	74.0	73.3	-0.7
B - between Earl St and Kimberley St	8 metres	69.9	71.7	+1.8
C - between Barbers Road and Springfield St	8 metres	71.2	72.3	+1.1
Average difference in measured vs – modelled noise level, dBA				**+0.7**
Rail traffic noise levels (T2 Line)				
A – near Boomerang St	5 metres	61.7	N/A	N/A

Appendix D

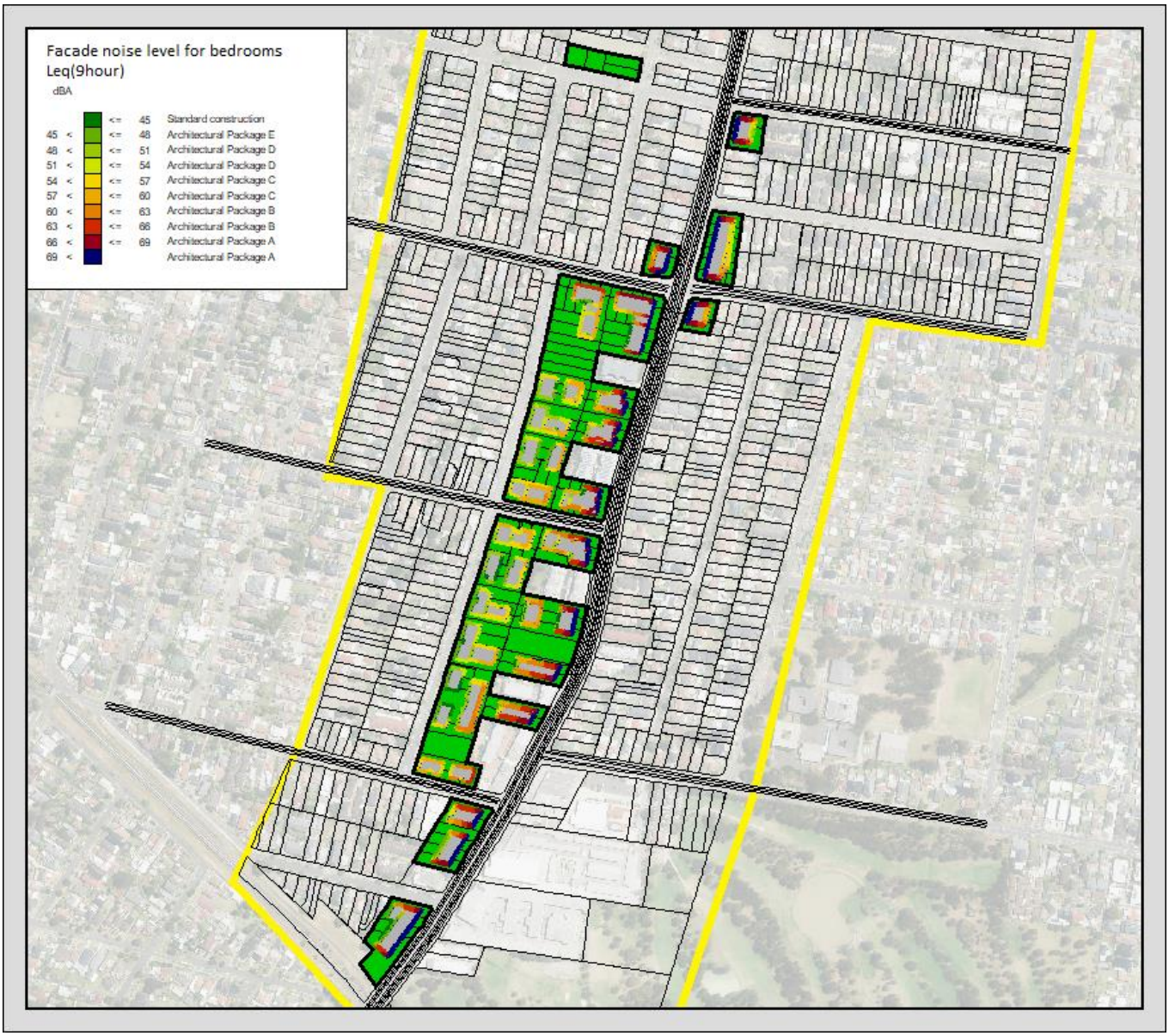
Plan view maps

D-1 Woodville Rd North - façade noise levels (night)



D-2 Merrylands E Precinct –façade noise levels (night)

D-3 Woodville Rd South - façade noise levels (night)



Appendix E

Façade noise maps

E-1 Woodville North Precinct

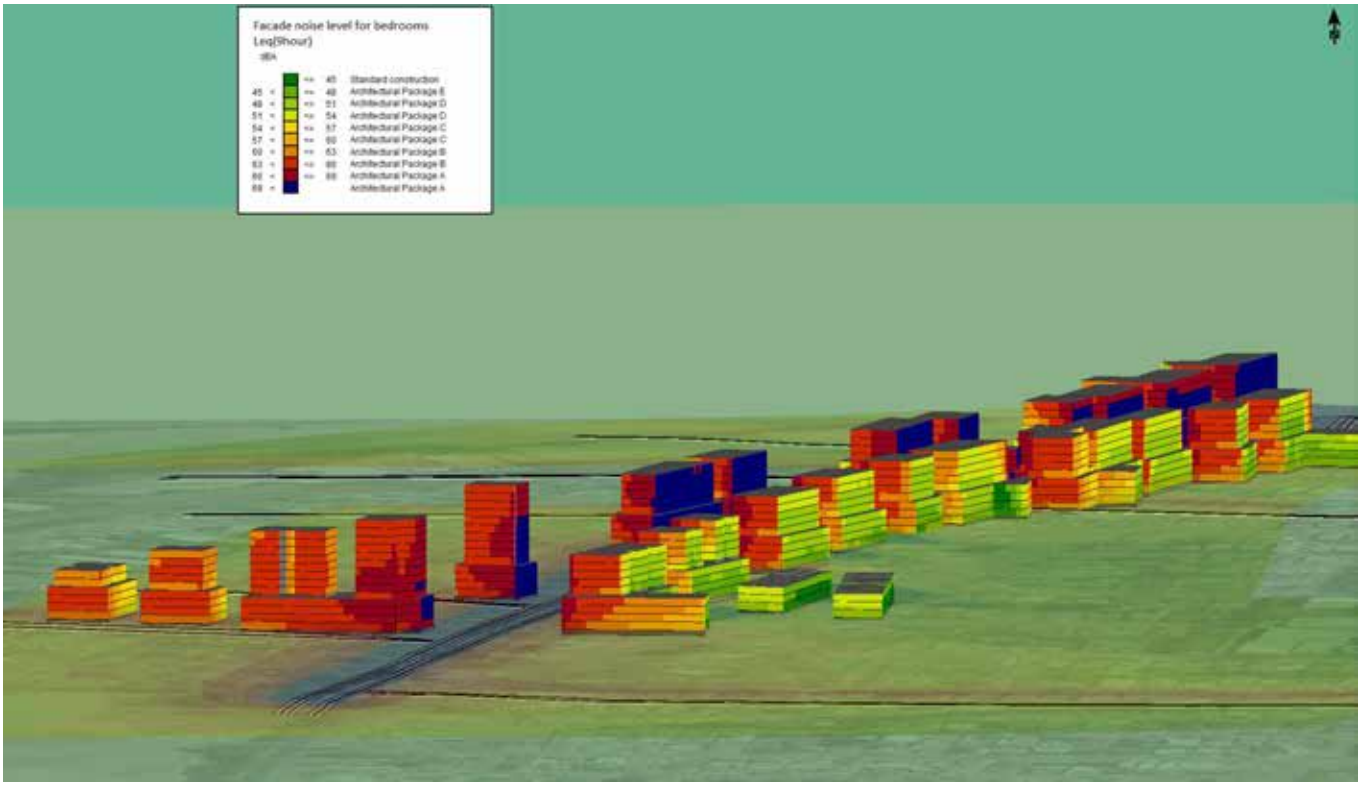


Figure E.1 Façade noise map, $L_{Aeq(9hour)}$ noise level dBA (southeast elevation)

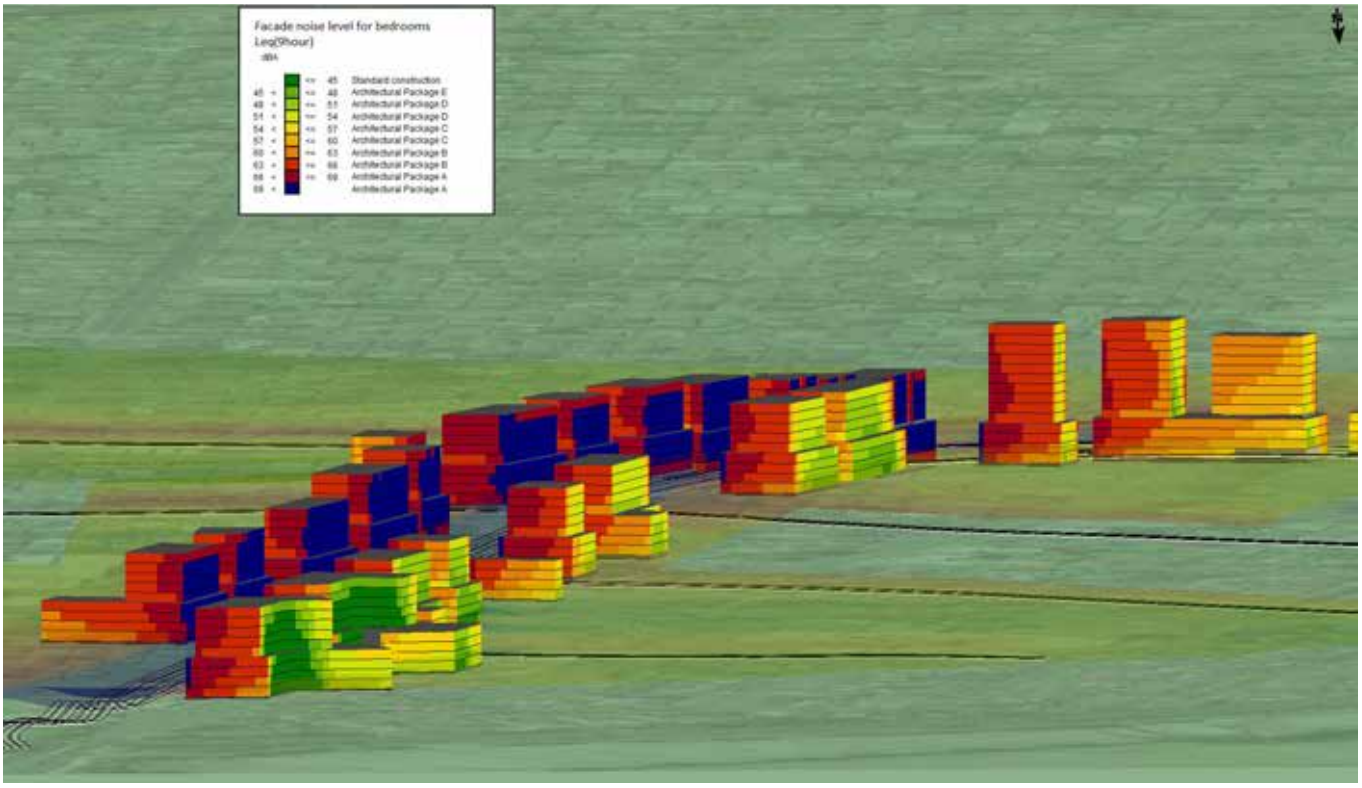


Figure E.2 Façade noise map, $L_{Aeq(9hour)}$ noise level dBA (northwest elevation)

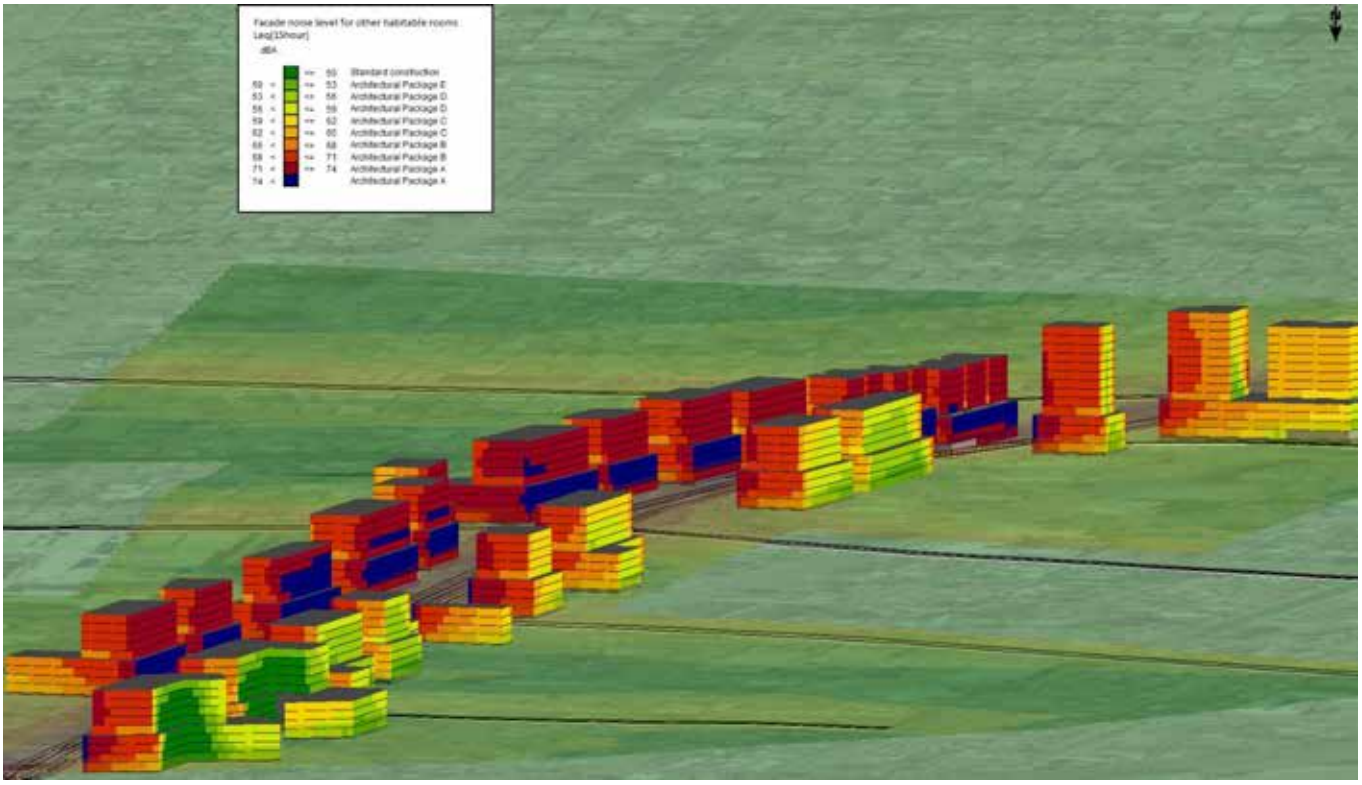


Figure E.3 Façade noise map, $L_{Aeq(15hour)}$ noise level dBA (northwest elevation)

E-2 Merrylands East Precinct

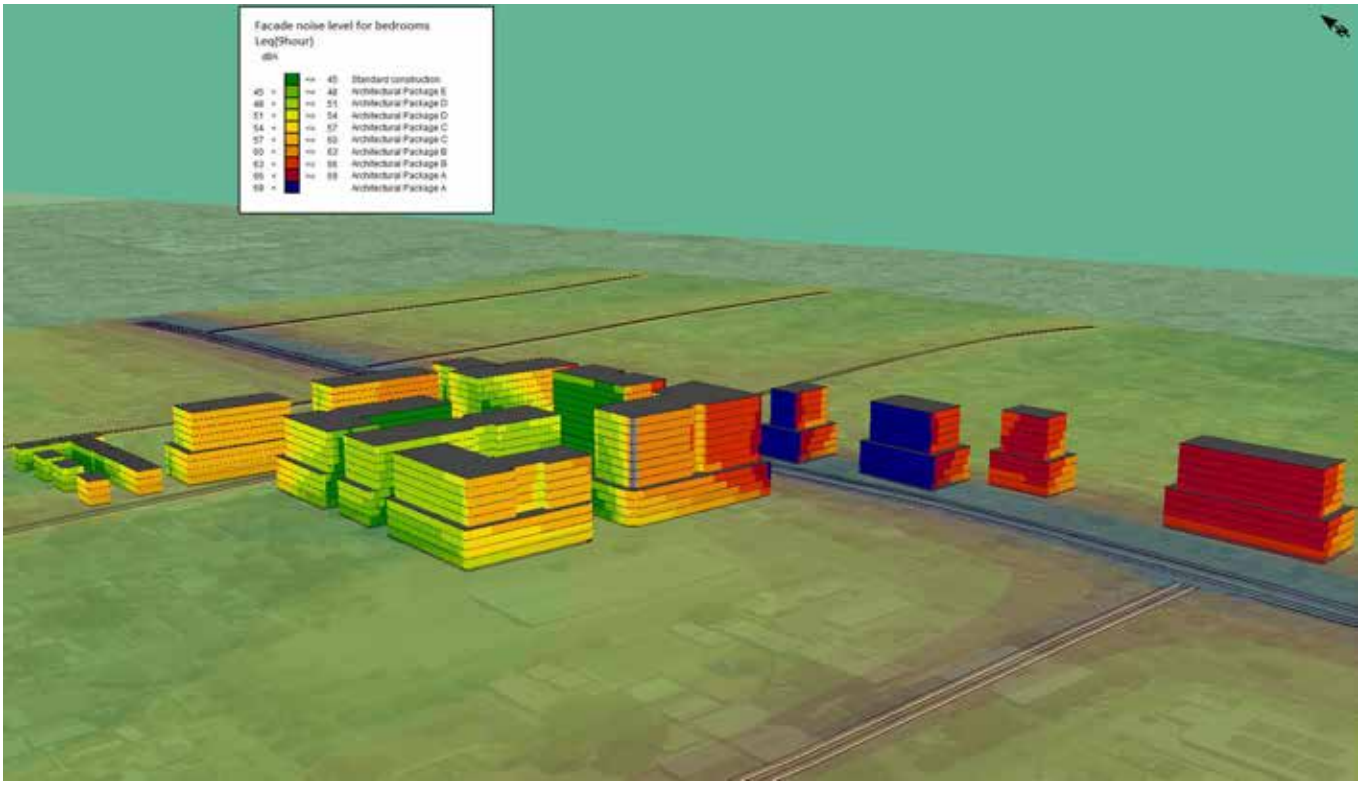


Figure E.4 Façade noise map, $L_{Aeq(9hour)}$ noise level dBA (southwest elevation)

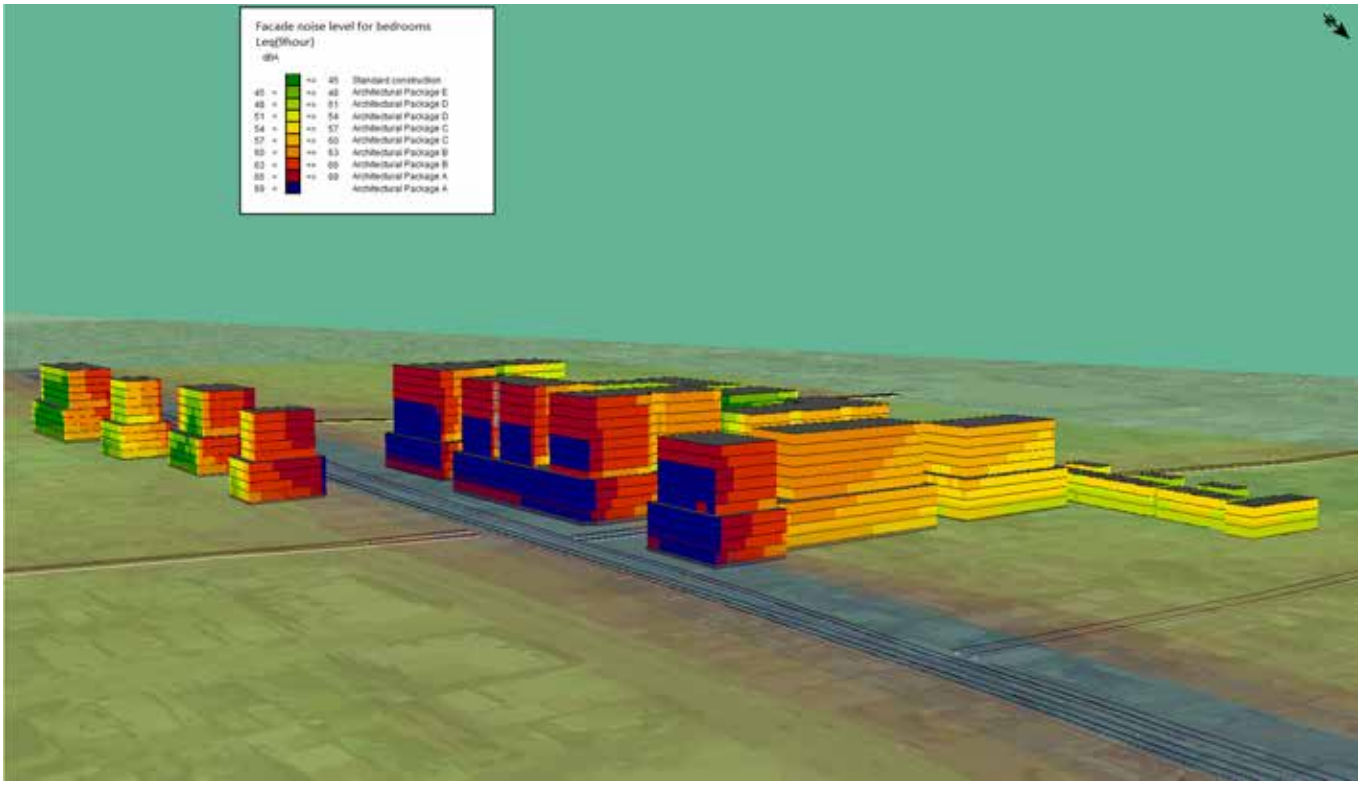


Figure E.5 ***Façade noise map, $L_{Aeq(9hour)}$ noise level dBA (northeast elevation)***

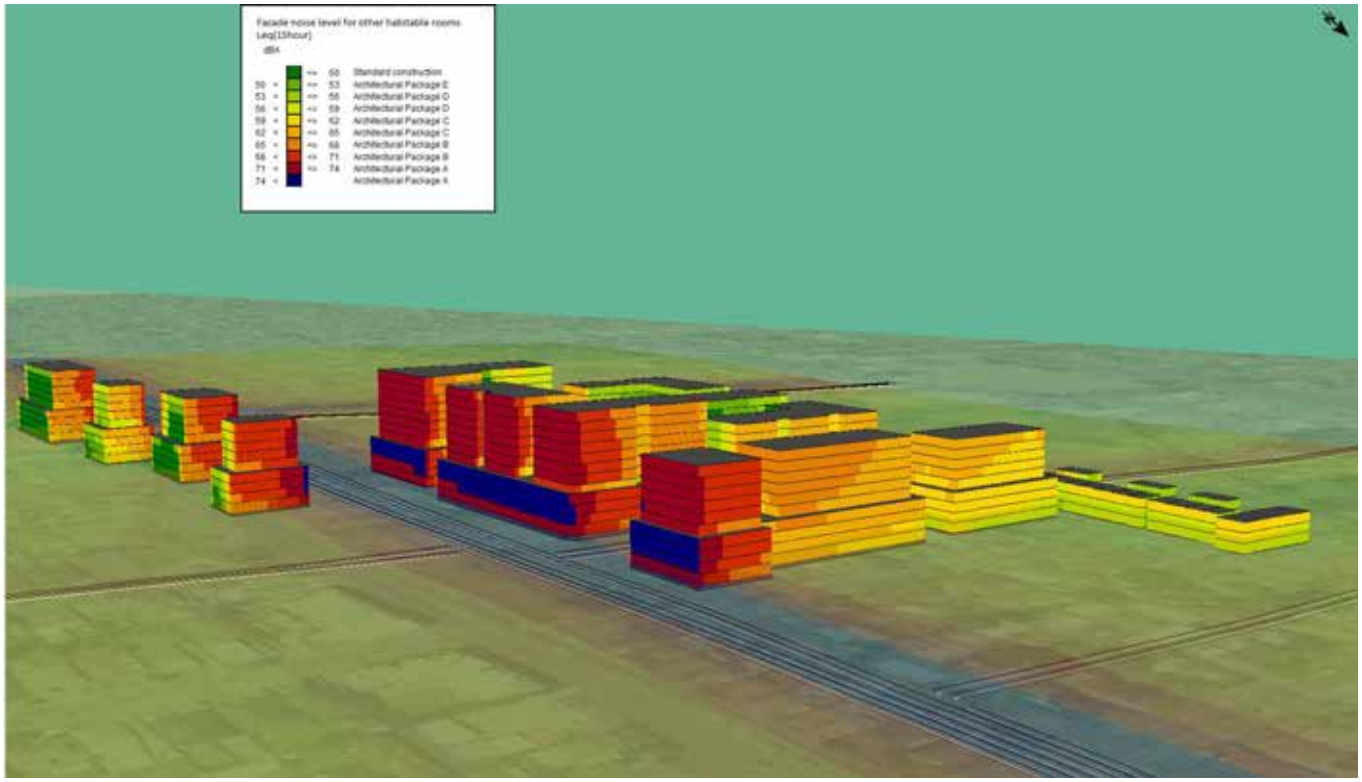


Figure E.6 ***Façade noise map, $L_{Aeq(15hour)}$ noise level dBA (northwest elevation)***

E-3 Woodville South Precinct

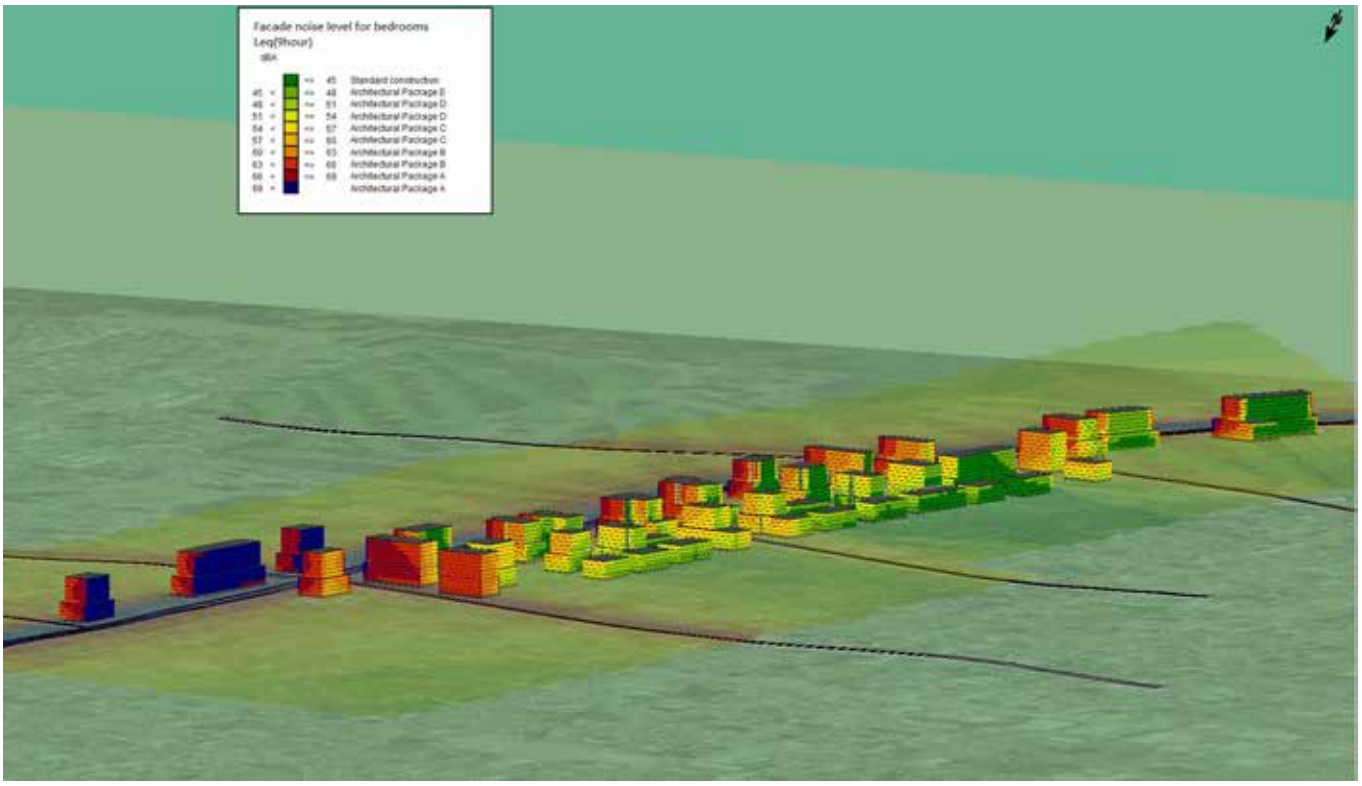


Figure E.7 *Façade noise map, $L_{Aeq(9hour)}$ noise level dBA (northeast elevation)*

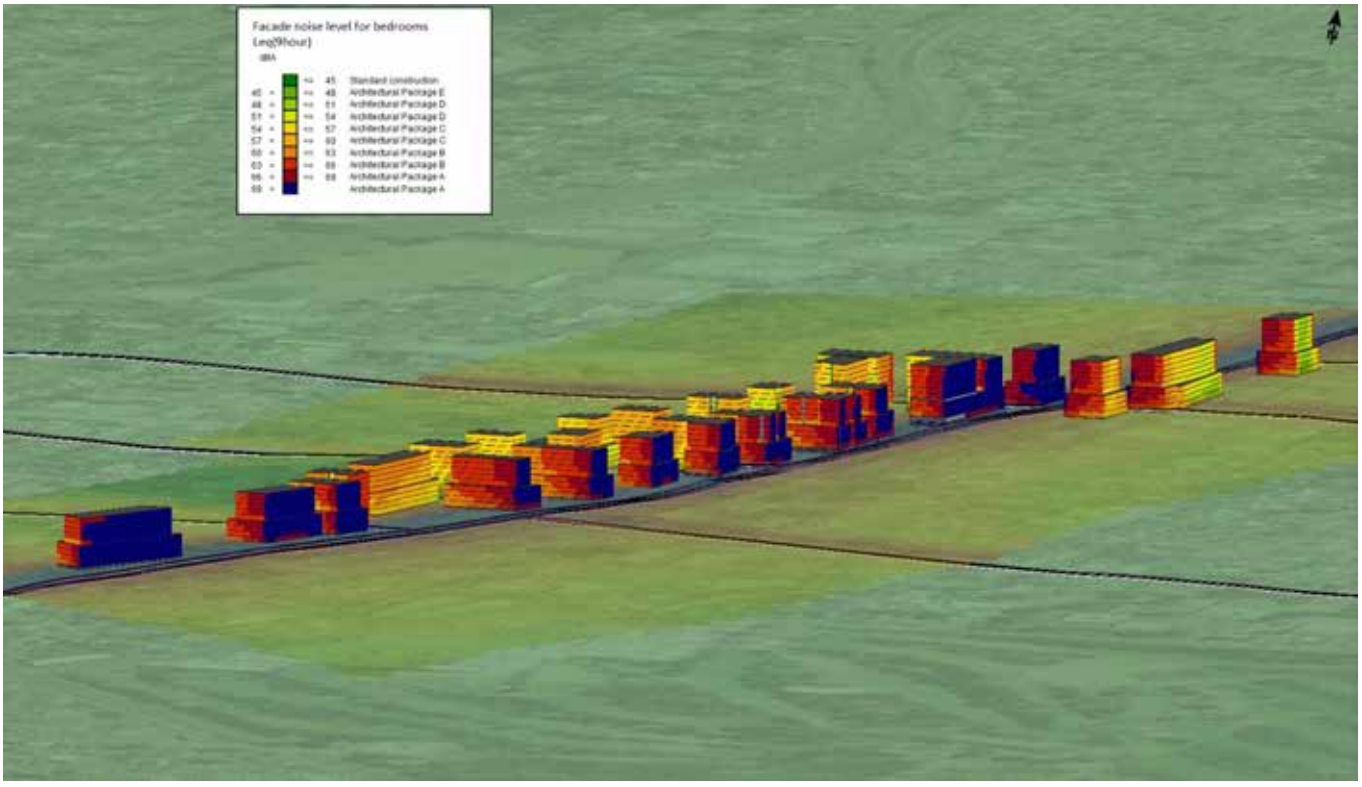


Figure E.8 *Façade noise map, $L_{Aeq(9hour)}$ noise level dBA (southwest elevation)*

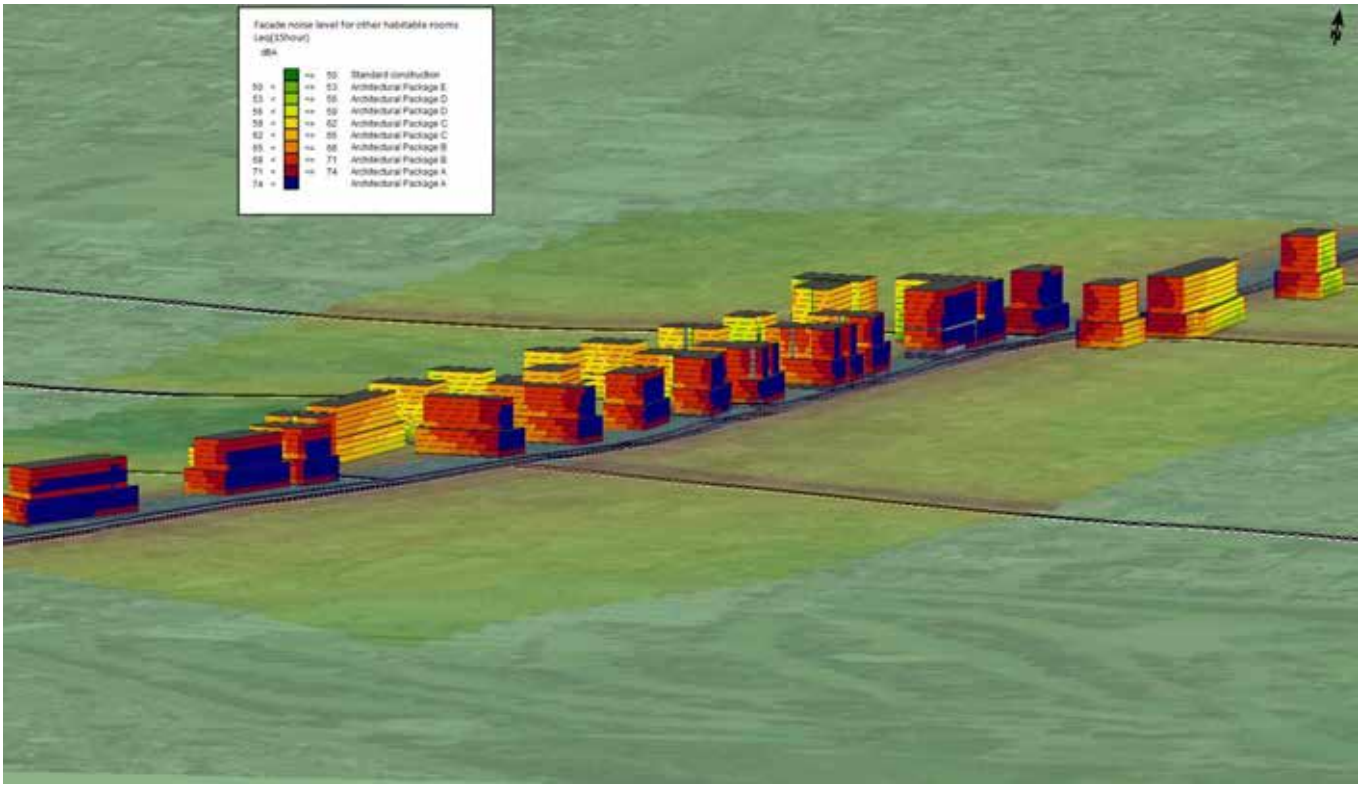


Figure E.9 Façade noise map, $L_{Aeq(15hour)}$ noise level dBA (southwest elevation)

Appendix F

Parramatta Road Corridor Urban Transformation - Planning and Design Guidelines - Amenity

F-1 Amenity (controls)

4.8 Amenity

New development should contribute to improved experiences along the Corridor, and ensure that new housing and employment uses deliver a high level of amenity for residents and users. Views to important features should be preserved. Views from residential units are desirable to occupants but also provide an important passive surveillance function. The amenity of open spaces (both public and private) should be protected in terms of solar access, and visual, acoustic, air and noise quality.

Residential development should comply with the Apartment Design Guide. Non-residential or other development that is not captured by the Apartment Design Guide should demonstrate:

- response and contribution to the public domain or communal spaces
- design initiatives to maintain daylight access to adjoining residential dwellings and land that is zoned (but undeveloped) for residential purposes
- consideration of land use interfaces, planting, fences and architectural features.

A. View Requirements

a. Protect significant views to and from public places.
b. Configure built form to enhance or frame views to significant places or elements, or support legibility of the area.
c. Buildings should not to impede key views from the public domain to important public places, parks, heritage buildings and monuments.

B. Shadowing and Solar Access Requirements

a. Orientate taller elements north-south to minimise overshadowing.
b. Manage height of east-west buildings to allow solar access to courtyard spaces and adjoining open space and roads.
c. Maximise direct solar access to adjoining properties.
d. Minimise shadowing of public and private open space.

C. Visual and Acoustic Amenity Requirements

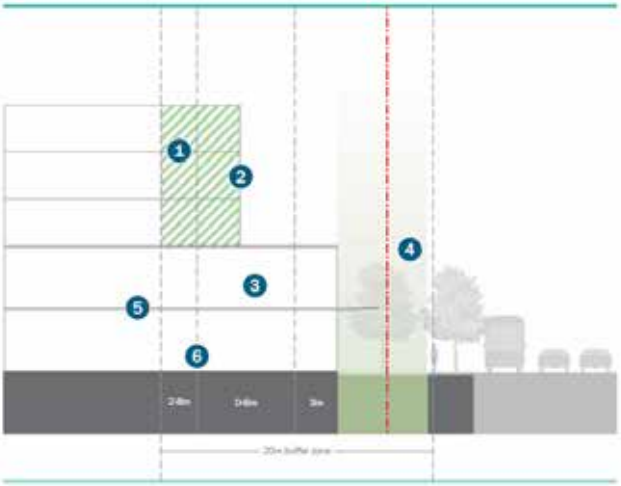
a. Orient and design development to optimise visual and acoustic privacy between buildings.
b. Configure and landscape internal courtyards to optimise visual privacy whilst also allowing passive surveillance opportunities.
c. Attenuate noise impacts between residential and non-residential components of mixed use development.
d. Employ design measures to minimize loss of privacy.

D. Air and Noise Quality Requirements

a. Development on busy roads (an annual average daily traffic volume of more than 40,000 vehicles) is to consider the provisions of the State Environmental Planning Policy (Infrastructure) 2007 and Development Near Rail Corridors and Busy Roads Interim Guidelines.
b. Internal habitable rooms of dwellings are to be designed to achieve internal noise levels of no greater than 50dBA.
c. Adopt the planning and design approaches and architectural treatments outlined in Figure 4.14 - 4.21 to minimise noise and air quality impacts from abutting busy roads, rail corridors and other noise-generating land uses.
d. Consider the Indicative Floor Plans at Appendix A when designing development on busy roads.

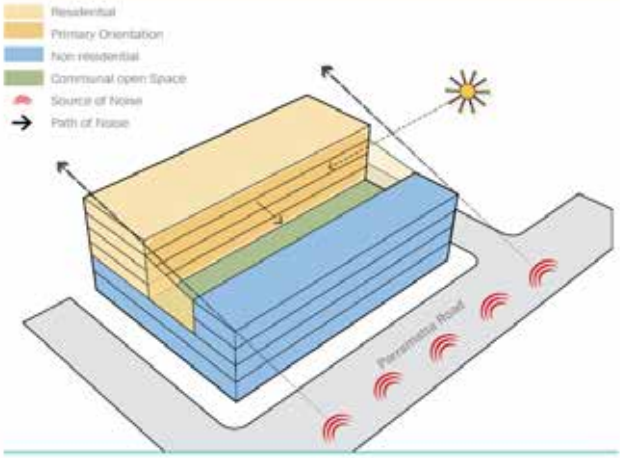
F-2 Planning and design approaches

Figure 4.14: Air Quality Setback Control



1. Air intake away from road (balconies and winter-gardens)
2. Residential dwellings setback
3. Landscape upper buffer
4. Trees and landscape between road and development
5. Non-residential uses at the ground & upper floors
6. Creation of a podium to raise sensitive uses above road

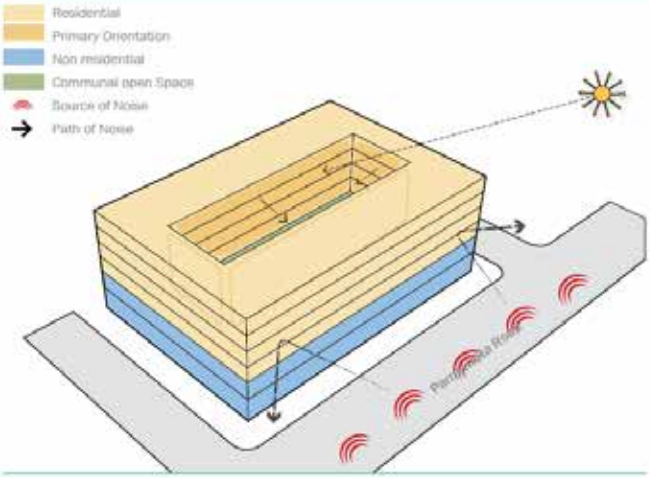
Figure 4.15: Noise Control Setback - Shield



1. Shield

- Conventional residential building to the rear of the site away from the noise source
- Non-residential building only to road edge at a height to create an acoustic shadow for the residential behind
- Residential building must sit within visual and acoustic shadow of front building
- Utilise a fixed solid glazed element that encloses the courtyard, screen noise from primary and secondary street.

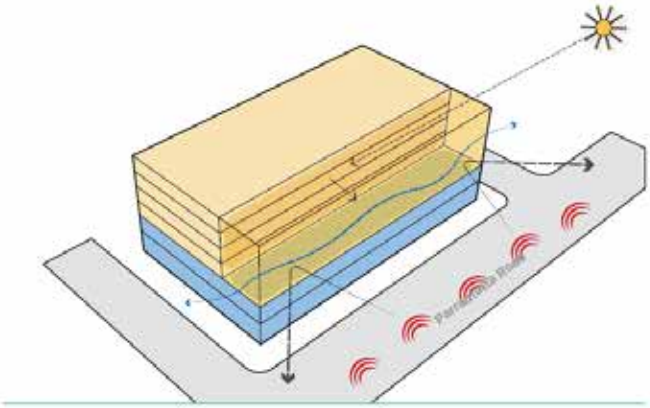
Figure 4.16: Noise Control Setback - Barrier (Courtyard)



2. Barrier (Courtyard)

- All openings required for ventilation open from a protected courtyard
- Courtyard dimension defined by separation requirements outlined in the AGD.

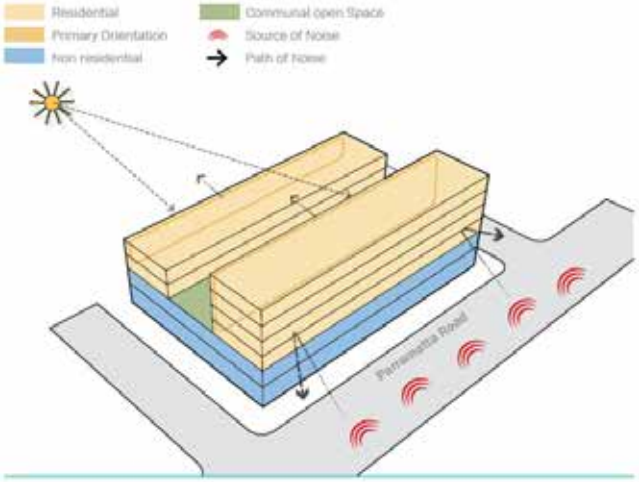
Figure 4.17: Noise Control Setback - Barrier (Screen)



3. Barrier (Screen)

- A fixed solid glazed edge to provide a protected courtyard space for ventilation
- The glazed courtyard will be open to the sky to allow for natural ventilation.

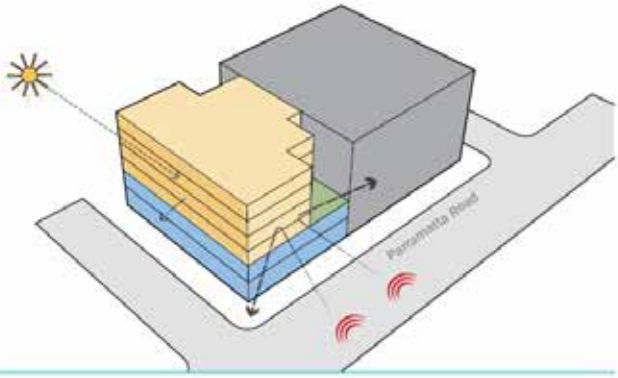
Figure 4.18: Noise Control Setback - Facing Away



4. Facing away

- Habitable rooms to be orientated away from the source of noise
- Locate secondary uses such as cores and walkways along the source of noise.

Figure 4.19: Noise Control Setback - Corner



5. Corner

- Turning away primary orientation of living space from noise source
- Articulate facade to create an acoustic shadow away from the source of the noise, orientate openings within the acoustic shadow.

Figure 4.20: Noise Control Setback - Upper Level Setbacks

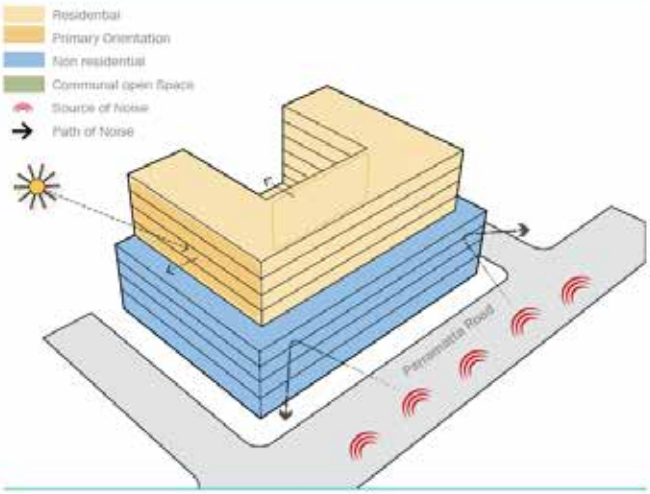
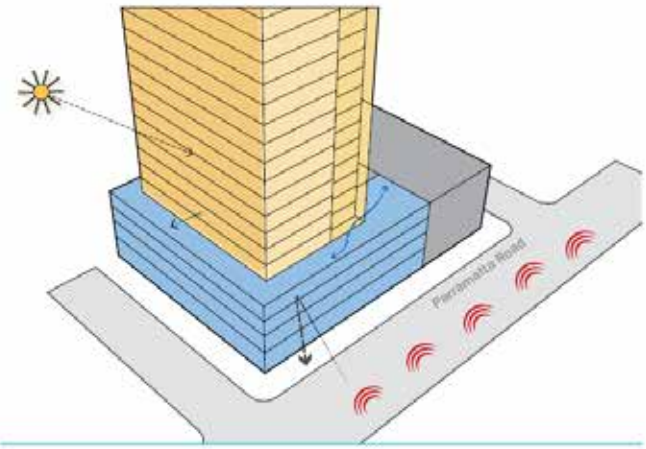


Figure 4.21: Noise Control Setback - Above Podium Towers



6. Upper Level Setbacks

- All openings required for ventilation open from a protected courtyard
- Turning away from noise source.

7. Above Podium Towers

- Turning away habitable spaces from the noise source
- Utilised fixed solid glazed edge to provide an enclosed space for ventilation.

Angled Walls

Angled solid walls with windows facing away from the source of the noise.

Winter Gardens

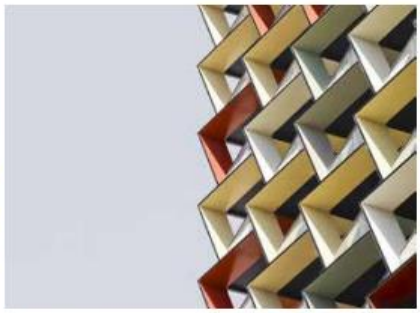
Create winter gardens to protect balconies from noise, hopper windows to be located within an acoustic shadow.

Corner

Orientate operable windows away from the source of the noise.

Screen

Glazed screen that protect an internal courtyard used for ventilation.



Building Form

Use building form to create an acoustic shadow for low hopper windows.

Solid Balconies

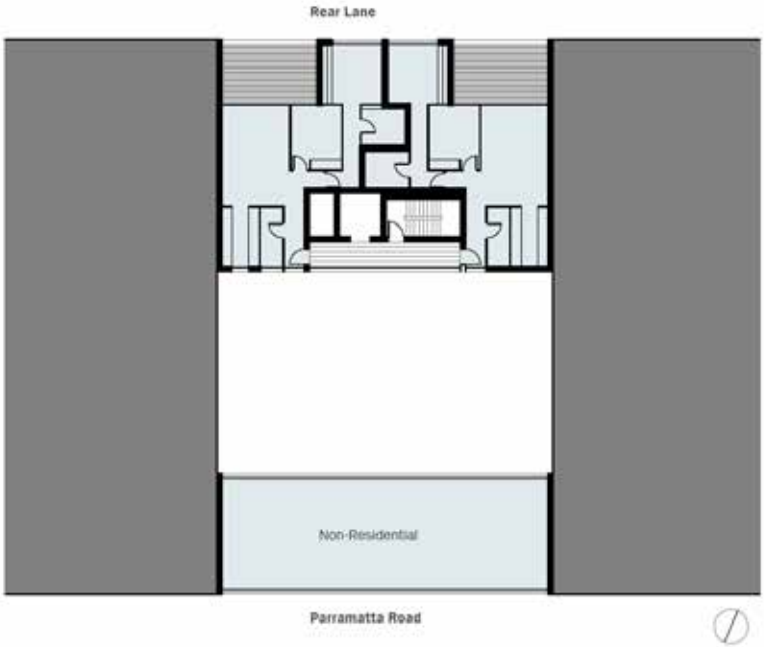
Concrete up-stand with hopper windows located below balustrade line.

F-3 Indicative floor plans

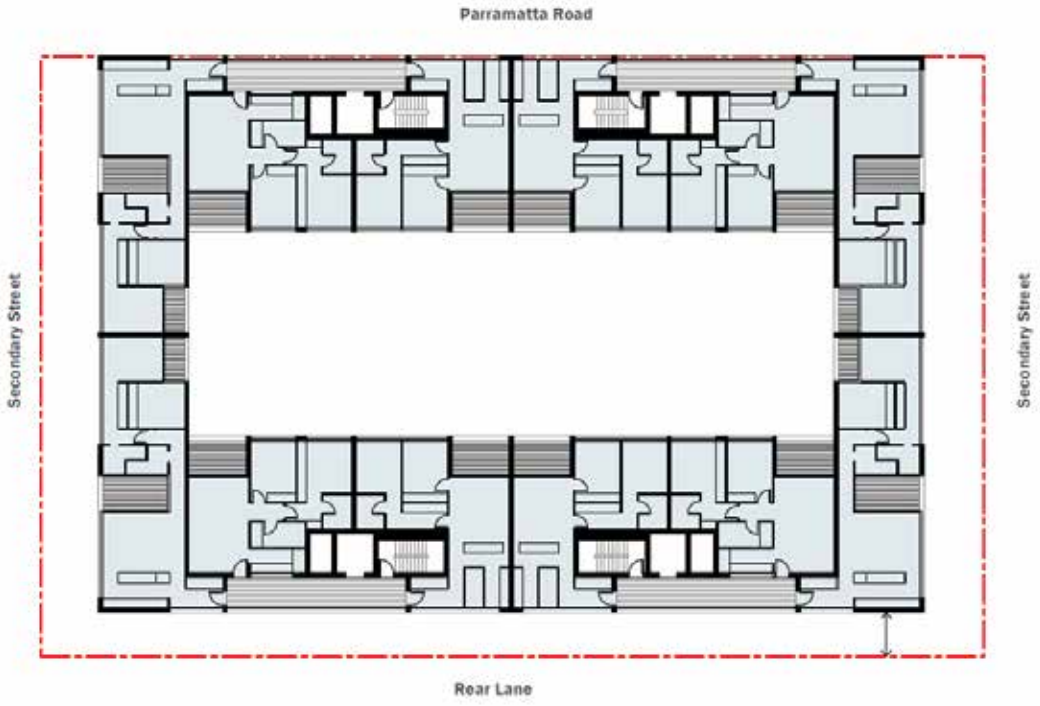
1. Example of a Shield

Indicative Floor Plans

The following are examples of indicative floor plans that should be considered when designing buildings along busy roads.

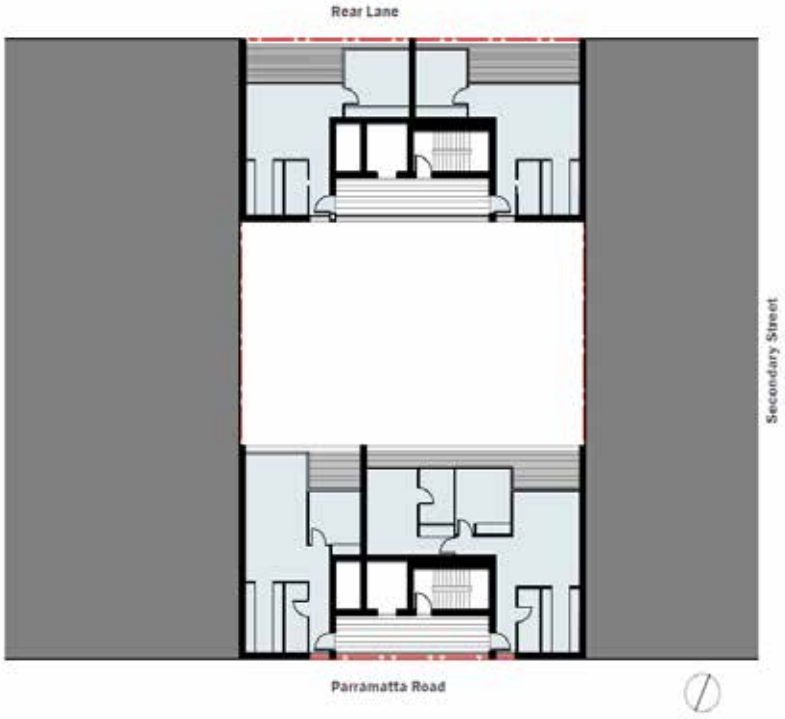


2. Example of a Barrier



3. Example of a Corner

3. Example of a Facing Away



Appendix G

Air quality modelling methodology

G-1 Air modelling approach

The following air quality dispersion modelling approach was adopted:

– The Roads and Maritime developed Tool for Roadside Air Quality (TRAQ) was used to predicted ground level pollutant concentrations as a function of distance from the roadside kerb. TRAQ modelling inputs are summarised in Section G-4

– Background air quality data was sourced from nearby Department of Planning and Environment (DPE) air quality monitoring stations (AQMS). A summary of the data is provided in Section G-3

– A cumulative assessment of air quality concentrations was undertaken whereby pollutant emissions from vehicle movements on the Woodville Road Corridor (predictions from the TRAQ model) were added to background air quality data (ambient pollutant concentrations recorded for DPE AQMS) to calculate total pollutant concentrations. Predicted total pollutant concentrations were assessed against the air quality assessment criteria outlined in Section G-2. Due to modelling limitations, $PM_{2.5}$ was not individually modelled, instead a $PM_{2.5}/PM_{10}$ ratio of 0.5 was adopted to scale TRAQ predictions.

G-2 Air quality criteria

The National Environment Protection Council (NEPC) made Australia's first national ambient air quality standards as part of the National Environment Protection Measures for Ambient Air Quality (the 'Air NEPM'). The Air NEPM sets national standards for the six key air pollutants to which most Australians are exposed: Carbon monoxide (CO), Ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead and particulates. Under the Air NEPM, all Australians have the same level of air quality protection.

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2022) ('Approved Methods') outlines impact assessment criteria which are concentration levels to be met at all 'existing' or 'future' off-site sensitive receptors. Air quality impact assessment criteria in the Approved Methods are based on the Air NEPM goals. The criteria are shown in Table G.1 , and relate to total impacts (project plus background).

More stringent air quality concentrations are proposed for $PM_{2.5}$ to commence from 2025 under the Air NEPM. The Air NEPM 2025 goals were adopted into the adopted air quality impact assessment criteria as it is expected that the developments along Woodville Road corridor would be in use from 2025 onwards.

Table G.1 Air quality impact assessment criteria

Pollutant	Averaging period	Criteria/goals (µg/m^3)		Adopted air quality impact assessment criterion (µg/m^3)
		Approved Methods	Air NEPM[1]	
PM_{10}	24 hours	50	50	50
	Annual	25	25	25
$PM_{2.5}$*	24 hours	25	20	25 (20)
	Annual	8	7	8 (7)
Nitrogen dioxide (NO_2)	1 hour	164	164	164
	Annual	31	31	31
Carbon monoxide (CO)	1 hours	30,000	-	30,000
	8 hour	10,000	10,000	10,000
Note 1: NEPM AAQ goals for $PM_{2.5}$ are those presented in Table 2 'Goal for Particles as $PM_{2.5}$ from 2025'				

G-3 Background air quality

An assessment of the total impact, which includes the project impact as well as the background concentrations, is required for all pollutants (PM_{10}, $PM_{2.5}$, NO_2, CO). To assess the total impact, representative background levels of each pollutant must be established.

DPE operates air quality monitoring stations (AQMS) in many locations across NSW. The nearest DPE AQMS that was considered suitable for use in this assessment were:

– Parramatta North AQMS located approximately 3.5 km to the north of the Woodville Road corridor
– Chullora AQMS located approximately 6 km to the southeast of the Woodville Road corridor
– Prospect AQMS located approximately 9 km to the northwest of the Woodville Road corridor

A summary of the ambient air quality data recorded at the DPE AQMS's over the last five years (2018 – 2022) is provided in Table G.2 .

Table G.2 Summary of recorded air quality data at nearby DPE AQMS (2018 – 2022)

Pollutant	Averaging period	Recorded background concentration by year (µg/m^3)				
		2018	2019	2020	2021	2022
Parramatta North DPE AQMS						
PM_{10}	24 hour maximum	107.4	195.3	188.9	42.5	42.7
	Maximum 24 hour below assessment criteria (50 µg/m^3)	43.7	49.9	49.9	42.5	42.7
	90th percentile of 24 hour average data	32.9	40.4	30.3	26.8	20.1
	Annual average	21.6	25.5	19.3	17.1	14.1
	Number of days above assessment criteria (number of days > 50 µg/m^3)	8	23	9	0	0
$PM_{2.5}$	24 hour maximum	42.1	130.1	72.9	27.4	16.9
	Maximum 24 hour below assessment criteria (25 µg/m^3)	23.5	24.3	24.6	23.0	16.9
	90th percentile of 24 hour average data	14.4	17.4	14.7	12.1	8.5
	Annual average	9.2	10.5	8.2	6.6	5.2
	Number of days above assessment criteria (number of days > 25 µg/m^3)	5	21	10	3	0
Nitrogen dioxide (NO_2)	1 hour	131.2	143.5	75.9	96.4	69.7
	Annual average	22.0	21.1	15.3	15.2	13.4
Carbon monoxide (CO)	1 hour	1,625	7,125	3,500	1,375	3,375
	8 hours	1,375	4,000	2,500	1,125	1,000
Chullora DPE AQMS						
PM_{10}	24 hour maximum	90.7	140.4	167.9	40.3	29.6
	Maximum 24 hour below assessment criteria (50 µg/m^3)	49.7	48.4	47.8	40.3	29.6
	90th percentile of 24 hour average data	32.4	39.4	31.8	24.1	19.1
	Annual average	21.9	24.6	20.5	16.5	13.6

Pollutant	Averaging period	Recorded background concentration by year (µg/m^3)				
		2018	2019	2020	2021	2022
	Number of days above assessment criteria (number of days > 50 µg/m^3)	7	20	8	0	0
$PM_{2.5}$	24 hour maximum	29.1	97.6	86.2	33.7	13.1
	Maximum 24 hour below assessment criteria (25 µg/m^3)	23.1	24.9	24.6	19.9	13.1
	90th percentile of 24 hour average data	13.5	18.4	15.3	11.3	8.4
	Annual average	8.6	11.7	8.8	7.2	5.6
	Number of days above assessment criteria (number of days > 25 µg/m^3)	3	18	9	6	0
Nitrogen dioxide (NO_2)	1 hour	116.9	143.5	106.6	114.8	92.3
	Annual average	24.1	23.5	19.5	18.7	19.5
Carbon monoxide (CO)	1 hour	4,500	5,750	2,875	3,000	1,750
	8 hours	4,250	1,750	2,375	1,000	1,125
Prospect DPE AQMS						
PM_{10}	24 hour maximum	113.3	182.8	245.8	44.6	29.2
	Maximum 24 hour below assessment criteria (50 µg/m^3)	47.9	49.1	48.7	44.6	29.2
	90th percentile of 24 hour average data	33.3	40.8	31.6	27.9	19.9
	Annual average	21.9	26.0	20.2	17.2	13.4
	Number of days above assessment criteria (number of days > 50 µg/m^3)	8	25	10	0	0
$PM_{2.5}$	24 hour maximum	47.5	134.1	70.8	37.3	18.2
	Maximum 24 hour below assessment criteria (25 µg/m^3)	23.1	24.6	24.9	24.9	18.2
	90th percentile of 24 hour average data	13.8	19.1	15.1	11.8	8.3
	Annual average	8.5	11.9	8.6	6.9	5.3
	Number of days above assessment criteria (number of days > 25 µg/m^3)	4	25	13	2	0
Nitrogen dioxide (NO_2)	1 hour	104.6	100.5	88.2	88.2	86.1
	Annual average	18.7	17.7	15.1	14.9	13.1
Carbon monoxide (CO)	1 hour	1,625	6,875	2,625	1,625	1,625
	8 hours	1,375	3,500	2,250	1,250	1,125

The background data adopted for use in this assessment is provided in Table G.3 . Background data was adopted from the nearest DPE AQMS (Parramatta North DPE AQMS) for the most recent full calendar year of data (2022). 90th percentile 24 hour PM_{10} and 24 hour $PM_{2.5}$ concentrations were used as background concentration to calculate total 24 hour concentrations.

It is noted that the background $PM_{2.5}$ was low across all DPE AMQS in the most recent year 2022. The decrease in annual $PM_{2.5}$ concentrations recorded in 2022 is likely attributed to high rainfall recorded in the year. Rainfall acts as dust suppression watering, reducing windblown dust emissions and lowering ambient concentrations.

Table G.3 Adopted background air quality data

Pollutant	Averaging period	Adopted background concentration (µg/m³)
PM_{10}	24 hour maximum	20.1
	Annual average	14.1
$PM_{2.5}$	24 hour maximum	8.5
	Annual average	5.2
NO_2	1 hour	92.3
	Annual average	19.5
CO	1 hour	3,375
	8 hours	1,125

G-4 Model inputs

TRAQ modelling inputs for two scenarios are summarised in:

– Table G.4 - Existing traffic volumes – Woodville Road Corridor
– Table G.5 - Future traffic volumes – Woodville Road Corridor
– Table G.6 - Future traffic volumes – worst case side street

Table G.4 TRAQ input for existing traffic volumes scenario – Woodville Road Corridor

Parameter	Value	Units	Notes
Daily traffic	55,169	Vehicles/day	Based on the maximum traffic volume location C - Woodville Road, Chester Hill (Matrix ATC, Sept 2022), refer Section C-1 of Appendix C
Number of lanes	6	Lanes	As per current number of lanes
Daily traffic per lane	9,195	Vehicles/day/lane	
Peak hour speed	50	km/h	Assumed based on findings of the traffic count survey (Matrix ATC, Sept 2022)
Grade	0%	%	Assumed
Peak hour traffic as a percentage of daily traffic	10%	%	Assumed and considered conservative. Traffic volume counts (Matrix ATC, Sept 2022) suggest a peak hour traffic values of ~7% of daily traffic.
Traffic mix	Light vehicles = ~93% Heavy vehicles = ~7%		Default values for residential road type used as it was the closest values that aligned with traffic counts (Matrix ATC, Sept 2022).
Traffic fleet year	2021		

Table G.5 TRAQ input for future traffic volumes scenario – Woodville Road Corridor

Parameter	Value	Units	Notes
Daily traffic	68,463	Vehicles/day	Based on the maximum forecast future traffic volumes, refer Section C-1 of Appendix C
Number of lanes	6	Lanes	As per current number of lanes
Daily traffic per lane	11,411	Vehicles/day/lane	
Peak hour speed	50	km/h	Assumed based on findings of the traffic count survey (Matrix ATC, Sept 2022)
Grade	0%	%	Assumed
Peak hour traffic as a percentage of daily traffic	10%	%	Assumed and considered conservative. Traffic volume counts (Matrix ATC, Sept 2022) suggest a peak hour traffic values of ~7% of daily traffic.
Traffic mix	Light vehicles = ~93% Heavy vehicles = ~7%		Default values for residential road type used as it was the closest values that aligned with traffic counts (Matrix ATC, Sept 2022).
Traffic fleet year	2031		

Table G.6 TRAQ input for future traffic volumes scenario – worst case side street

Parameter	Value	Units	Notes
Daily traffic	25,000	Vehicles/day	Based on the expected maximum forecast future traffic volumes, refer Section C-1 of Appendix C
Number of lanes	2	Lanes	As per current number of lanes
Daily traffic per lane	12,500	Vehicles/day/lane	
Peak hour speed	25	km/h	Assumed
Grade	0%	%	Assumed
Peak hour traffic as a percentage of daily traffic	10%	%	Assumed and considered conservative. Traffic volume counts (Matrix ATC, Sept 2022) suggest a peak hour traffic values of ~7% of daily traffic.
Traffic mix	Light vehicles = ~93% Heavy vehicles = ~7%		Default values for residential road type used as it was the closest values that aligned with traffic counts (Matrix ATC, Sept 2022).
Traffic fleet year	2031		

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