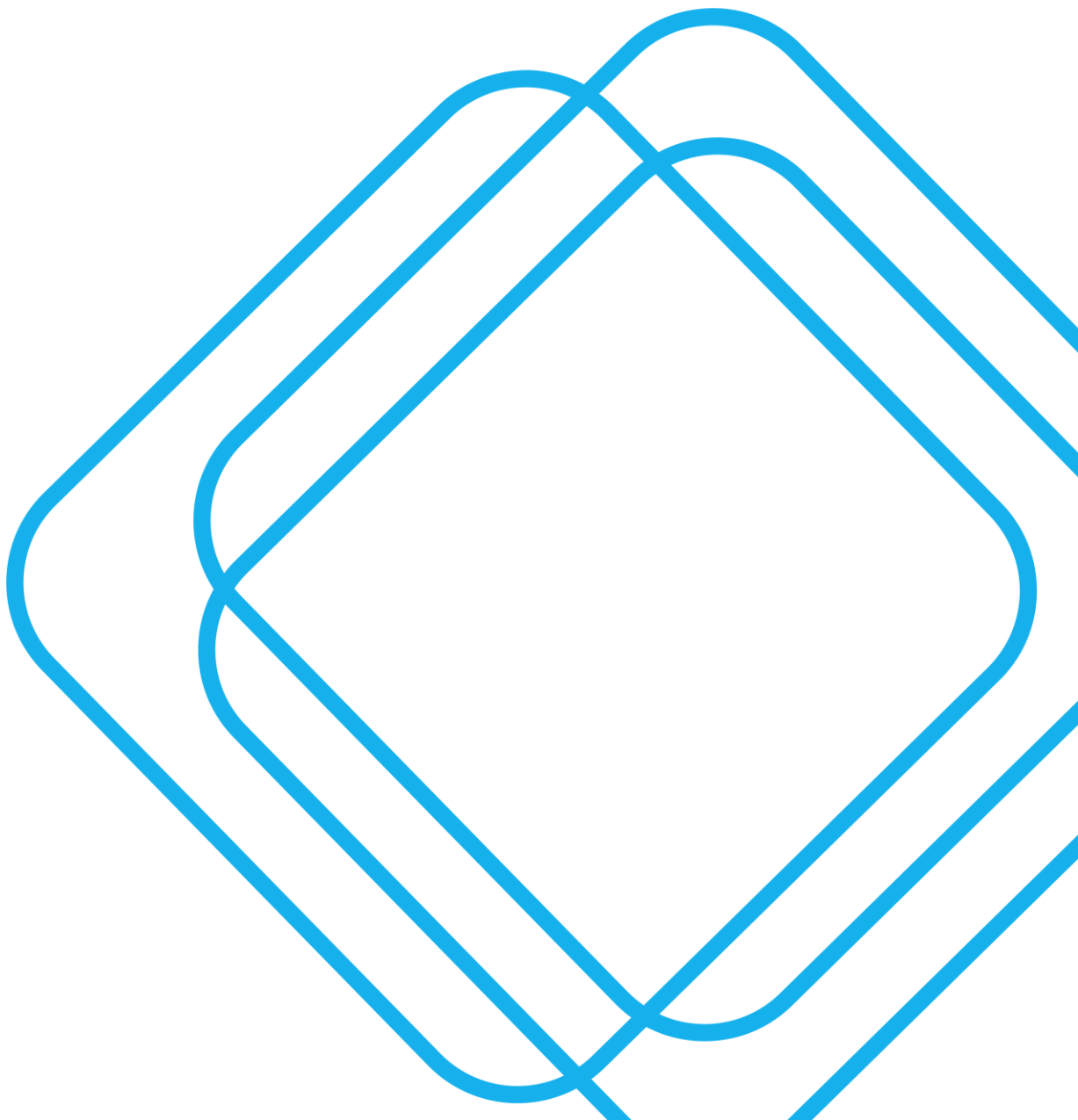


# TRANSPORT IMPACT ASSESSMENT




Wyndella Road Lochinvar  
Development Application

3 MAY 2023



## Quality Assurance

<b>Project Name:</b>	Wyndella Road Lochinvar Development Application		
<b>Project Number:</b>	SCT_00390		
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<b>Client:</b>	Lochinvar Developments Pty Ltd c/o ADW Johnson Pty Ltd	<b>ABN:</b>	46 731 467 966
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1.1	4 April 2023	Updated inconsistent lot release rates
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3.0	3 May 2023	Updated based on AWD Johnson comments

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## Executive Summary

### The proposed development

ADW Johnson on behalf of CPG estates engaged SCT Consulting to conduct a transport impact assessment for a proposed development of 262 dwellings, located at north of the New England Highway along Wyndella Road in Lochinvar.

The site comprises Lots 2, 3, 4, 5, 6 and 9 DP 747391, and Lots 12 and 13 DP1219648. The site is zoned R1 General Residential and covers an area of approximately 22ha. The site is proposed to be subdivided for residential development, with associated roads and services.

The subdivision would deliver 262 residential lots (an increase of 253 lots compared to the current 8 lots). Lots would be opening indicatively in 2025 and approximately 50 lots per year would be released.

### Previous planning

The site is part of the Lochinvar Urban Renewal area and sits at one of the key connection points of the Anambah Precinct (Wyndella Road). Previous studies have developed a long term intersection layout and contribution plan that apply to this site.

TfNSW has recently upgraded Wyndella Road / New England Highway / Springfield Drive to accommodate future growth in the area.

### Impact assessment

Traffic modelling using SIDRA 9 software was used to assess the future impacts of this development on traffic conditions at the intersection of Wyndella Road, New England Highway and Springfield Drive. The Wyndella Road / New England Highway / Springfield Drive intersection performs at a satisfactory level with background traffic growth and the traffic from the 262 additional lots.

The intersection has a DOS of 0.85 in the future background growth and development scenario, indicating some spare capacity. The intersection operates at Level of Service B and C in the AM and PM peak, respectively, indicating that no upgrade would be required due to this proposal.

No upgrade is therefore required for Wyndella Road / New England Highway / Springfield Drive for the development to proceed. The development would still contribute to the long-term upgrade of Wyndella Road / New England Highway / Springfield Drive at the rates outlined in the relevant contribution plan.

## 1.0 Introduction

### 1.1 Purpose of this report

CPG estates (the development arm of Clarendon Holmes) is the proponent of a residential subdivision at 898 New England Highway, Lochinvar, NSW (the site), as shown in **Figure 1-1**.

The site comprises Lots 2, 3, 4, 5, 6 and 9 DP 747391, and Lots 12 and 13 DP1219648. The site is zoned R1 General Residential and covers an area of approximately 22ha. The site is proposed to be subdivided for residential development, with associated roads and services.

The subdivision would deliver 262 residential lots (an increase of 253 lots compared to the current 8 lots). Lots would be opening indicatively in 2025 and approximately 50 lots per year would be released.

**Figure 1-1 Wyndella Road subdivision**



Source: Nearmap & ADW Johnson, 2023

This Transport Impact Assessment accompanies the development application and provides Maitland City Council with an understanding of the transport impacts of the proposal.

### 1.2 Report structure

This report contains the following sections:

- **Section 1.0 Introduction:** an overview of the purpose of the report
- **Section 2.0 Strategic context:** a description of the strategic documents that apply to the site
- **Section 3.0 Existing conditions:** the existing transport context for the development
- **Section 4.0 Proposed development:** a description of the development proposal and how it complies with site-based controls
- **Section 5.0 Impact assessment:** details of the impacts of the development and proposed mitigations
- **Section 6.0 Conclusion:** summarises the key outcomes of the study.

## 2.0 Context

### 2.1 NSW Government

#### 2.1.1 Future Transport Strategy

Future Transport Strategy is a 40-year strategy developed by Transport for NSW (TfNSW) which outlines the directions and principles for mobility and transport investment as a guiding document. Future Transport 2056 builds on the achievements of the Long-Term Transport Master Plan, which has delivered local and international investment in the NSW transport network and placed a focus on customer-oriented planning.

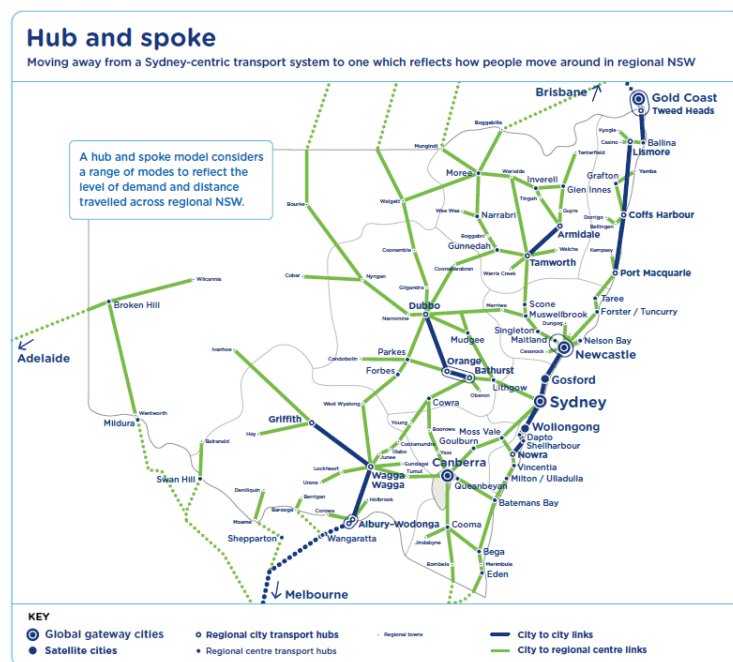
The strategy covers three aspects of vision, which are replicated in **Figure 2-1**.

**Figure 2-1 Future Transport Strategy vision elements**



The intended network functionality is explained in **Figure 2-2**. The concept is that there are key city to city links and city to regional centre links, which provide a lower order of connectivity. The plan puts forward a centre hierarchy with global gateway cities -Gold Coast, Newcastle, Sydney, and Canberra.

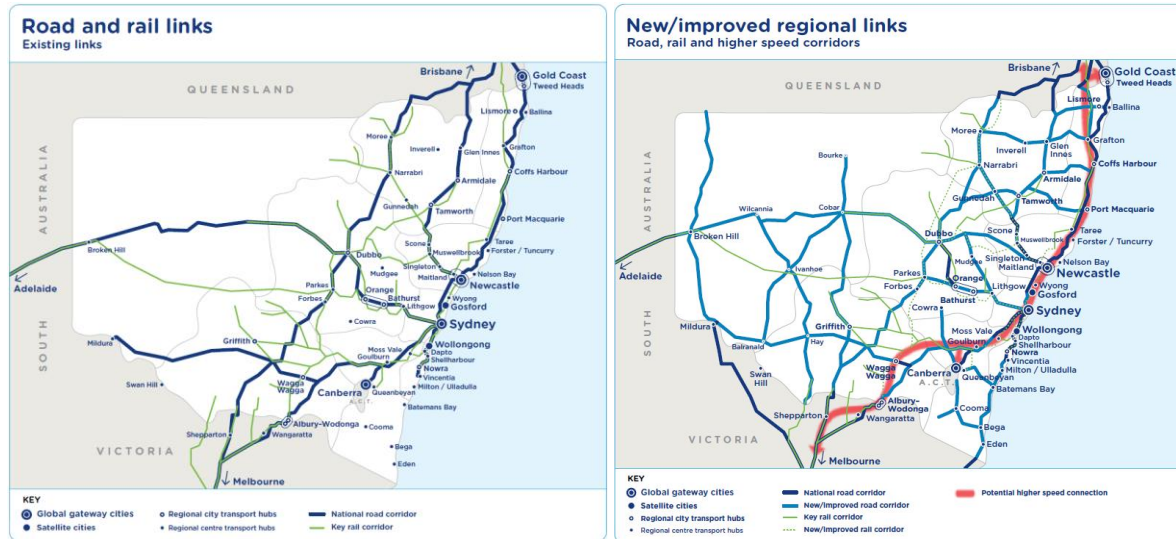
**Figure 2-2 Hub and spoke network in Regional NSW**



Source: Transport for NSW, 2018

Sydney is connected to the broader transport landscape of regional NSW as shown in **Figure 2-3**. The left side of the figure shows the existing links and the right side shows the future links.

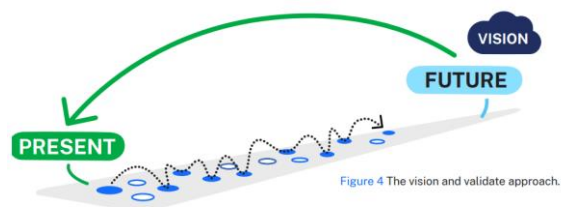
**Figure 2-3 Regional NSW strategic transport corridors**



Source: Transport for NSW, 2018

The strategy takes a vision and validate approach (**Figure 2-4**), which is about determining the desired end state and developing a plan to achieve the vision rather than taking predict and provide planning (which takes a forecast of the future as the end state objective).

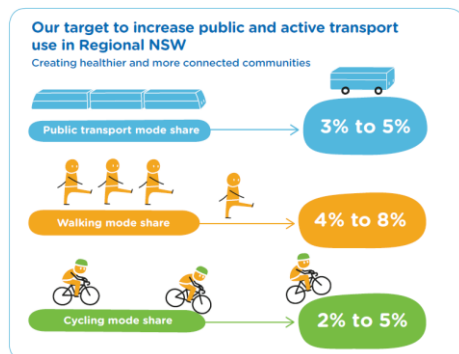
**Figure 2-4 Vision and validate methodology**



Source: Transport for NSW, 2022

The plan sets bold targets for walking, cycling and public transport (**Figure 2-5**).

**Figure 2-5 Targets for walking, cycling and public transport**



Source: Transport for NSW, 2018

**Implications for this site:** Future Transport outlines a visionary approach to planning, which incorporates not only connectivity objectives but also placemaking objectives. This site needs to consider the broader context that it sits in as part of the planning.



## 2.2 Lochinvar precinct

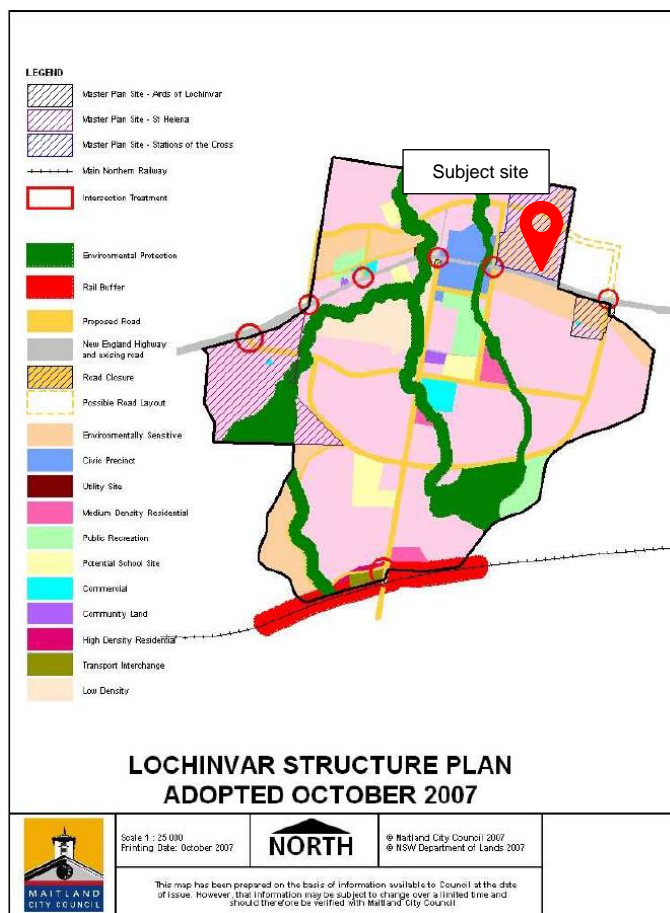
### 2.2.1 Lochinvar Structure Plan (Maitland Council, 2007)

Lochinvar is identified in the Lower Hunter Regional Strategy as a priority area to accommodate regional population growth. In October 2007, the Lochinvar Structure Plan (LSP) was approved by Maitland City Council. The LSP provides a logical framework for the development and planning of the area with consideration of its natural elements, the needs of the community, and infrastructure requirements. The LSP aims to achieve an urban structure based on a walkable, mixed-use town, with a capacity for up to 5,000 residential dwellings. The subject site is located at the eastern end of the Structure Plan area.

The town centre precinct serves to provide a hub for the future town linking the existing established village with the new urban development fronts. Based on an expected population of around 12,000 people, the town centre will comprise a mix of uses including community, retail, commercial, and residential uses. There will be a wide range of retail outlets including a supermarket, speciality shops, a newsagent, a medical centre, and a service station. Sufficient car parking areas will be provided to encourage local shopping. It is envisaged that an area of at least 5-10 hectares is to be provided to cater for the provision of sufficient retail/commercial facilities within the central town precinct. An additional commercial area will be required to accommodate support services and business offices associated with such precincts. (URaP – TTW, 2012)

The structure plan is shown in **Figure 2-6**.

**Figure 2-6 Lochinvar Structure Plan**



Source: Maitland Council, 2007

The structure plan shows the site as the Master Plan site – Stations of the Cross.

The land use areas of the structure plan are outlined in **Table 2-1**.

**Table 2-1 Lochinvar Structure Plan development areas**

Land Use	Area (ha)
Commercial	6.4
Recreation	20.6
Medium Density	8.8
High Density	1.0
Transport Interchange	2.1
Community Land	1.6
Civic Precinct	17.3
Low Density	18.8
Environmentally Sensitive	72.6
Potential School Sites	16.6
Residential (single dwellings)	480.0
<b>Total</b>	<b>645.8</b>

Source: URap – TTW, 2012

The proposed road network is shown in **Figure 2-7**.

**Figure 2-7 Lochinvar Structure Plan road network**



Source: Maitland Council, 2007

The original road network concept shows a new southern link road that connects from a new intersection west of Windermere Road (now Terriere Drive) to a new intersection east of Wyndella Road (“Aird’s intersection upgrade”). Road upgrades are proposed at:

- New England Highway / Terriere Drive
- New England Highway / Windemere Road
- New England Highway / Cartwell Road
- New England Highway / Wyndella Road
- New England Highway / Airds intersection
- New England Highway / St Helena Close.

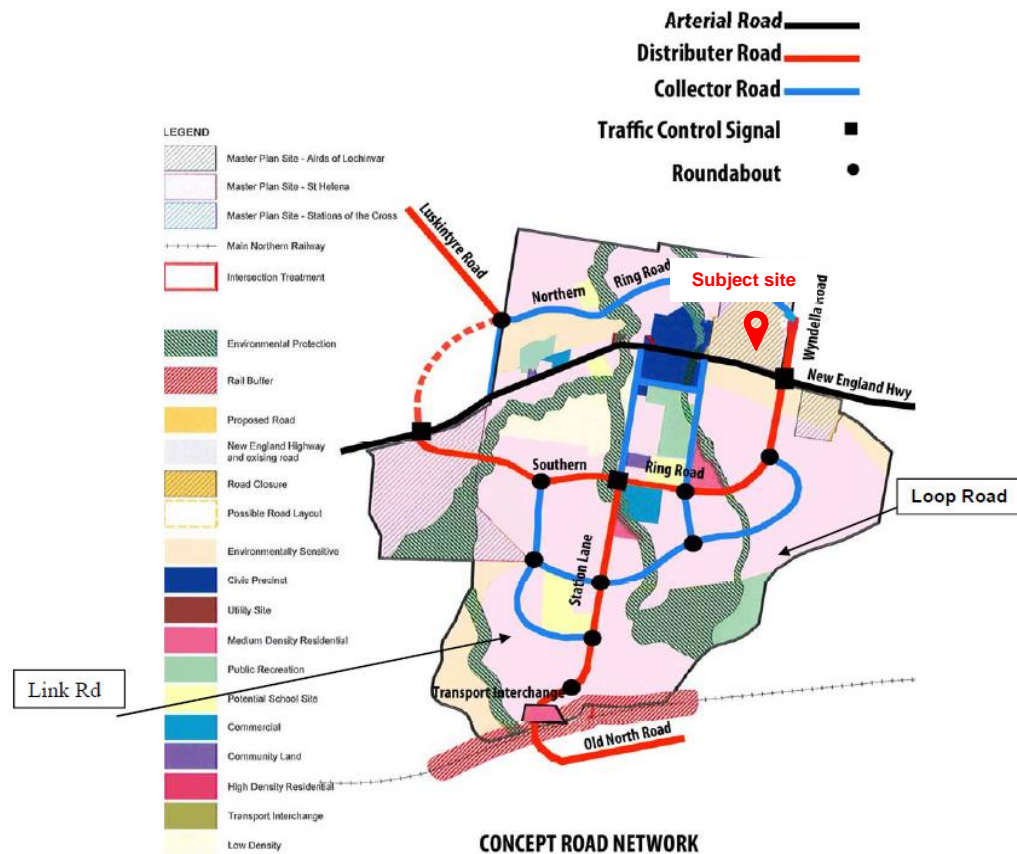
**2.2.2 Lochinvar Urban Release Area traffic and transport study (URaP – TTW, 2012)**

The study assumes a yield of 5,000 lots for the Lochinvar Urban Release Area, distributed as follows:

- **The area between New England Highway and the southern ring road:** 2,976 lots
- **The area north of New England Highway:** 1,239 lots
- **The area north of the railway line and south of the southern ring road:** 785 lots

The traffic and transport study reviews the road network proposed under the structure plan and provides several refinements. The modified road network is shown in **Figure 2-8**.

**Figure 2-8 Lochinvar Urban Release Area – updated road network**



Source: URaP – TTW, 2012

The road network is based on the treatments identified in **Table 2-2**.

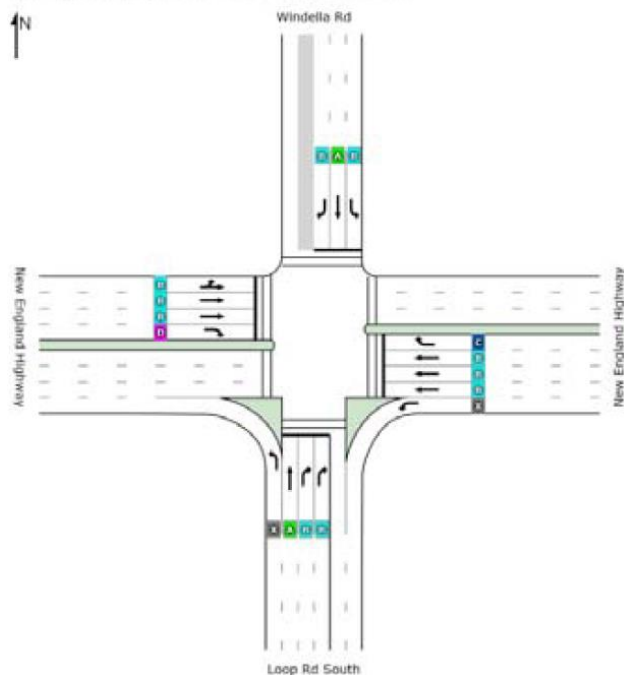
**Table 2-2 Updated road network intersection treatments**

Road	Intersection treatments
<b>New England Highway</b>	<ul style="list-style-type: none"> <li>– Traffic control signals at the east intersection with Northern Ring Road (Wyndella Road) and Southern Ring Road.</li> <li>– Traffic control signals at the west intersection with Northern Ring Road and Southern Ring Road (St Helena Close).</li> </ul>
<b>Southern Ring Road</b>	<ul style="list-style-type: none"> <li>– Traffic control signals at the intersection with Station Lane.</li> <li>– Three roundabout intersections with un-named collector roads.</li> </ul>
<b>Station Lane</b>	<ul style="list-style-type: none"> <li>– Two roundabout intersections with un-named collector roads and a roundabout intersection at the east access to Lochinvar transport interchange/railway station.</li> </ul>
<b>Northern Ring Road</b>	<ul style="list-style-type: none"> <li>– Roundabout intersection at Luskintyre Road and Windermere Road.</li> </ul>

Source: URaP – TTW, 2012

Traffic and transport study identifies that Wyndella Road (the section just north of New England Highway) is part of the Distributor Road network and it will form a signalised intersection with the New England Highway at the eastern end of the LSP area. **Wyndella Road becomes a road that no longer carries local traffic but also strategic traffic.** The layout of New England Highway / Wyndella Road is shown in **Figure 2-9**.

**Figure 2-9 Lochinvar Urban Release Area Wyndella Road layout**



Source: URaP – TTW, 2014

### 2.2.3 Lochinvar Urban Release Area Traffic Modelling (Hyder, 2014)

Roads and Maritime Services commissioned a study of the Lochinvar Urban Release Area in 2014. The study assumed a total of 4,700 dwellings would be delivered, with a traffic generation rate of 0.66 peak hour trips per dwelling (Table 2-3).

Table 2-3 Lochinvar Urban Release Area

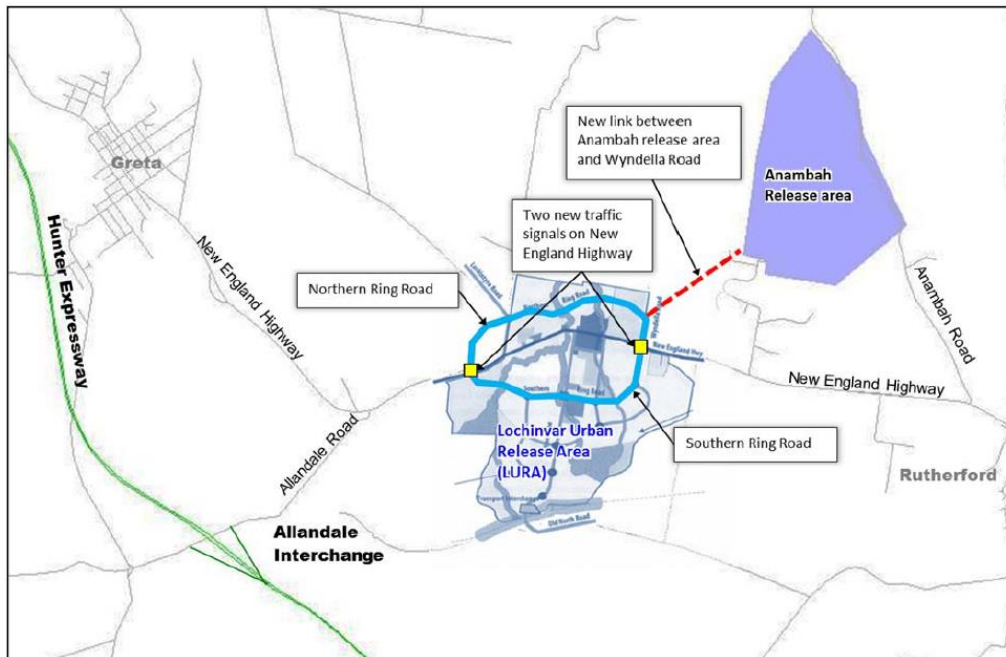
	Daily	AM Peak One Hour	PM Peak One Hour
Trip generation rates (vehicles per dwelling)	6.8	0.66	0.66
Total additional vehicle trips from LURA	31,800	3,100	3,100

Source: Hyder, 2014

The figure assumed of 4,700 dwellings is a reduction of 300 from the original 5,000 dwelling uplift forecast in the Lochinvar Structure Plan.

The future network in the vicinity of the Lochinvar Urban Release Area assumed is shown in Figure 2-10.

Figure 2-10 Broader network assumptions



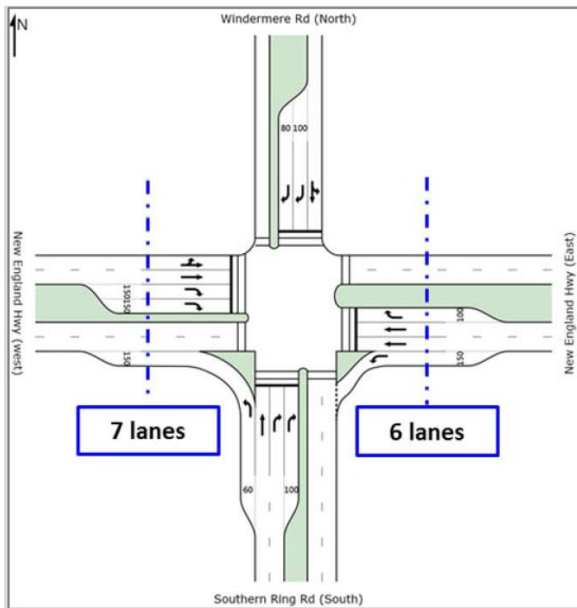
Source: Hyder, 2014

In addition to the function of Wyndella Road being a northern ring road, it also provides connectivity to the Anambah Release Area. This area was identified as having the potential for 3,300 dwellings uplift. Volume from Anambah Release Area on Wyndella Road was forecast to be approximately 440 vehicles per hour. This is an increase from approximately 1,000 vehicles per day as originally forecast in the 2012 Council traffic study (without this connection with the Anambah Release Area).

The forecasting undertaken in 2014 was before the introduction of Hunter Expressway (HEX). As a result, there are two different forecasts for the amount of traffic on New England Highway – one with a 60% reduction of traffic on New England Highway and one with a forecast reduction of 30%.

The proposed intersection layout for the intersection is shown in **Figure 2-11**.

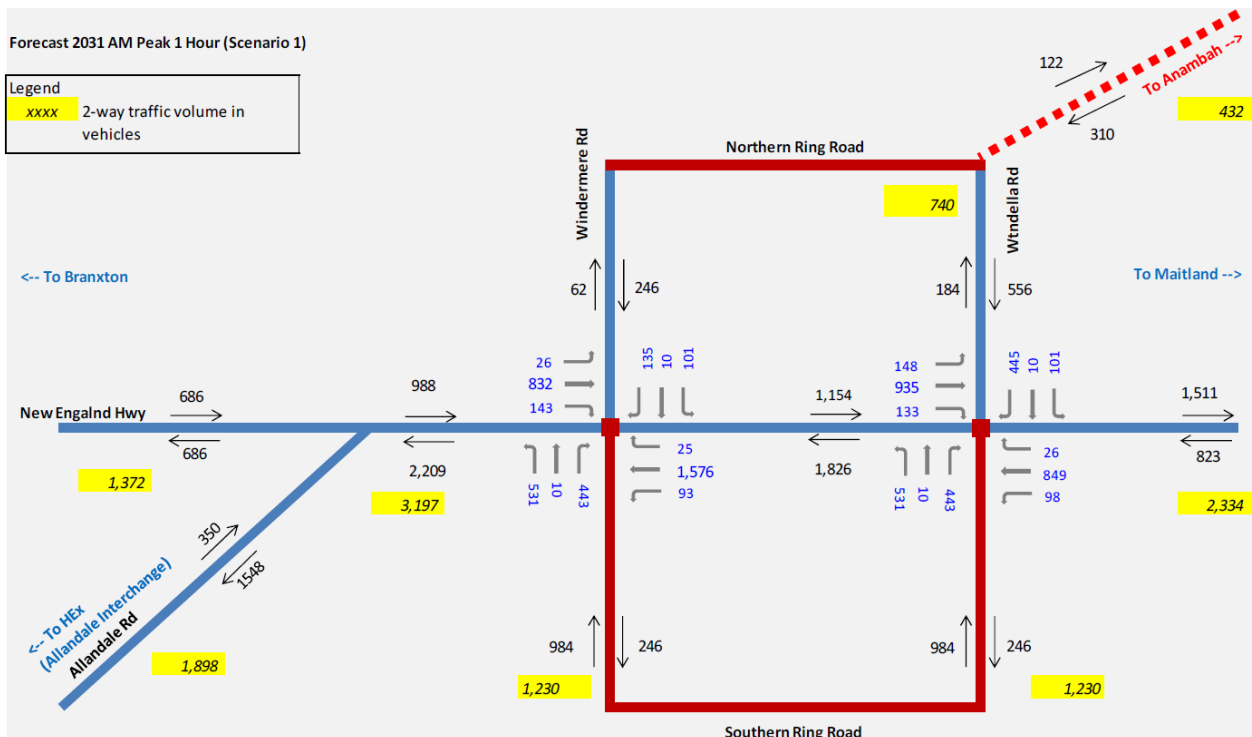
**Figure 2-11 Layout of New England Highway / Wyndella Road**



Source: Hyder, 2014

The study also included a network flow diagram, which is shown in **Figure 2-12**.

**Figure 2-12 Network flow diagram – 2031 AM peak with 60% New England Highway demand reduction**

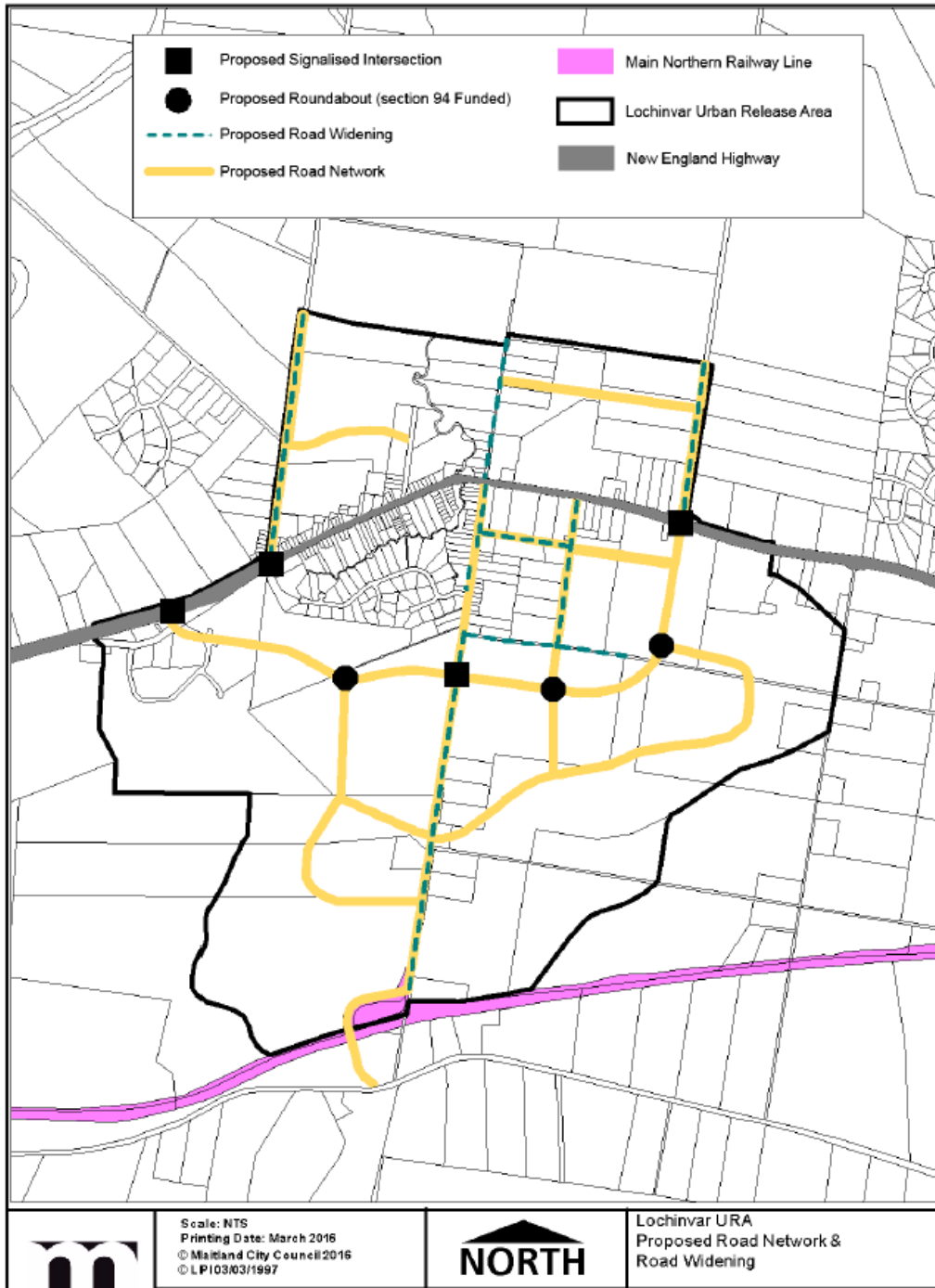


Source: Hyder, 2014

### 2.2.4 Maitland Development Control Plan updates (2016)

After the publication of the Lochinvar studies, Maitland City Council produced an update to their Development Control Plan with a proposed road network layout (Figure 2-13).

Figure 2-13 Lochinvar Urban Renewal Area Proposed Road Network and Road Widening



Source: Maitland Council, 2016

This plan shows that the northern road would no longer be a full bypass but only connect to Cantwell Road.

**Further observations:** The change in the northern bypass route to no longer provide a full connection would lower the amount of strategic traffic using this route compared with previous modelling.

### 2.2.5 SIDRA Report: Wyndella Stage 1 (TfNSW, 2017)

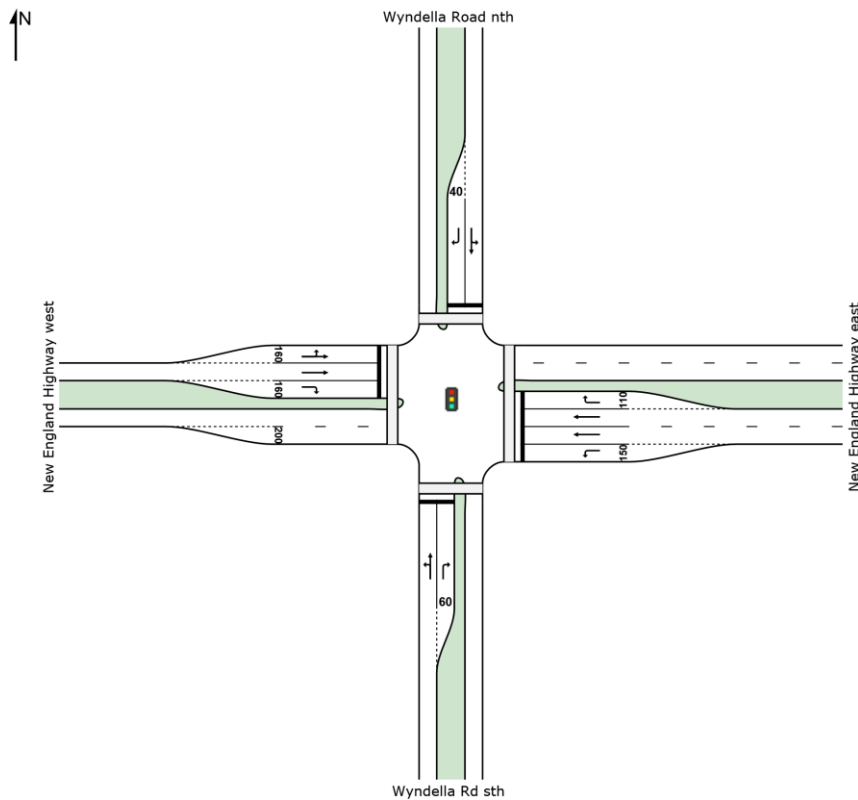
TfNSW separately prepared a standalone SIDRA study on the intersection form of New England Highway / Wyndella Road. The key assumptions were:

- Development to the south and north split 80%/20% respectively
- Growth on the highway is assumed to be a 1.9% p.a.
- Growth on the southern leg is assumed to be either 60 or 100 lots per year, with trip generation either 50% to the east or 70% to the east
- Cycle time is 100 sec.

The modelling work included two scenarios:

- **Scenario 1:** a test of a smaller intersection layout
- **Scenario 2:** sensitivity tests of various growth rates and the end of life with a larger intersection size.

Figure 2-14 Scenario 1 intersection layout

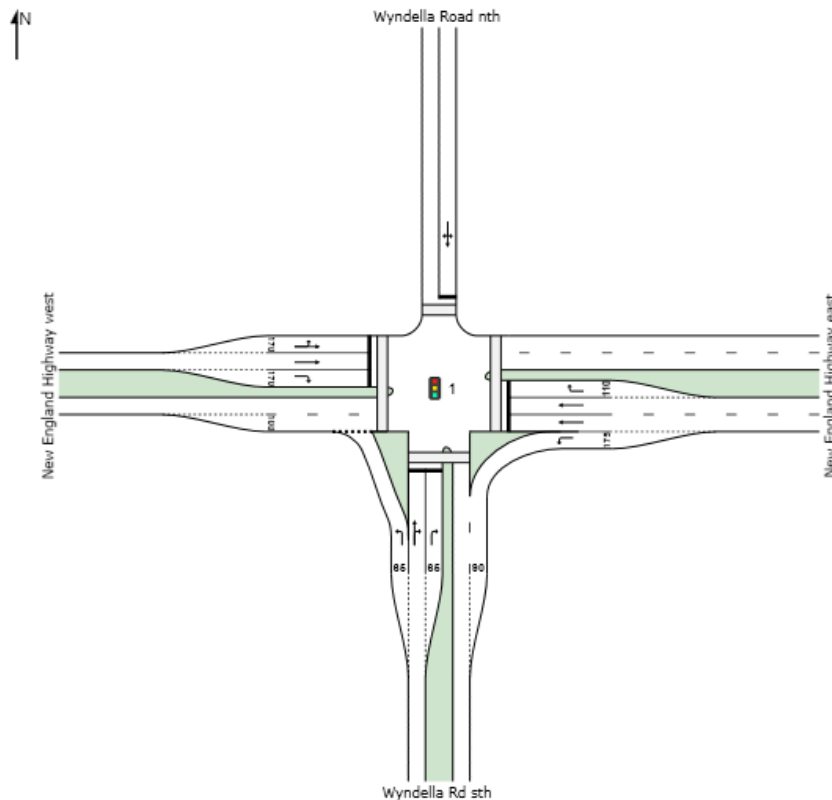


Source: Transport for NSW, 2017

The intersection performed at Level of Service C in 2028 in Scenario 1.



Figure 2-15 Scenario 2 intersection layout



Source: Transport for NSW, 2017

The performance of the signal in various scenarios is shown in **Table 2-4** and **Table 2-5**.

Table 2-4 Scenario 2 differing lot release rates and trip distributions

Scenario 2 up to target year (2028)	DOS	Intersection delay	Worst Delay
AM Year 2028 - 60 lots per year - 70% trips to the east	0.735	23.6	41.9
AM Year 2028 - 60 lots per year - 50% trips to the east	0.657	21.8	42.0
AM Year 2028 - 100 lots per year - 70% trips to the east	0.821	28.1	42.0
AM Year 2028 - 100 lots per year - 50% trips to the east	0.747	24.4	43.2
PM Year 2028 - 60 lots per year - 70% trips to the east	0.793	22.1	43.7
PM Year 2028 - 60 lots per year - 50% trips to the east	0.901	28.0	44.2
PM Year 2028 - 100 lots per year - 70% trips to the east	0.901	26.1	44.2
PM Year 2028 - 100 lots per year - 50% trips to the east	0.828	29.3	52.3

Source: Transport for NSW, 2017

Table 2-5 Scenario 2 end of life

Scenario 2 up to end of life	DOS	Intersection delay	Worst Delay
PM Year 2033 - 100 lots per year - 50% trips to the east	0.965	40.0	69.3
PM Year 2034 - 100 lots per year - 50% trips to the east	0.996	44.4	77.7
PM Year 2035 - 100 lots per year - 50% trips to the east	1.034	49.2	85.5

Source: Transport for NSW, 2017

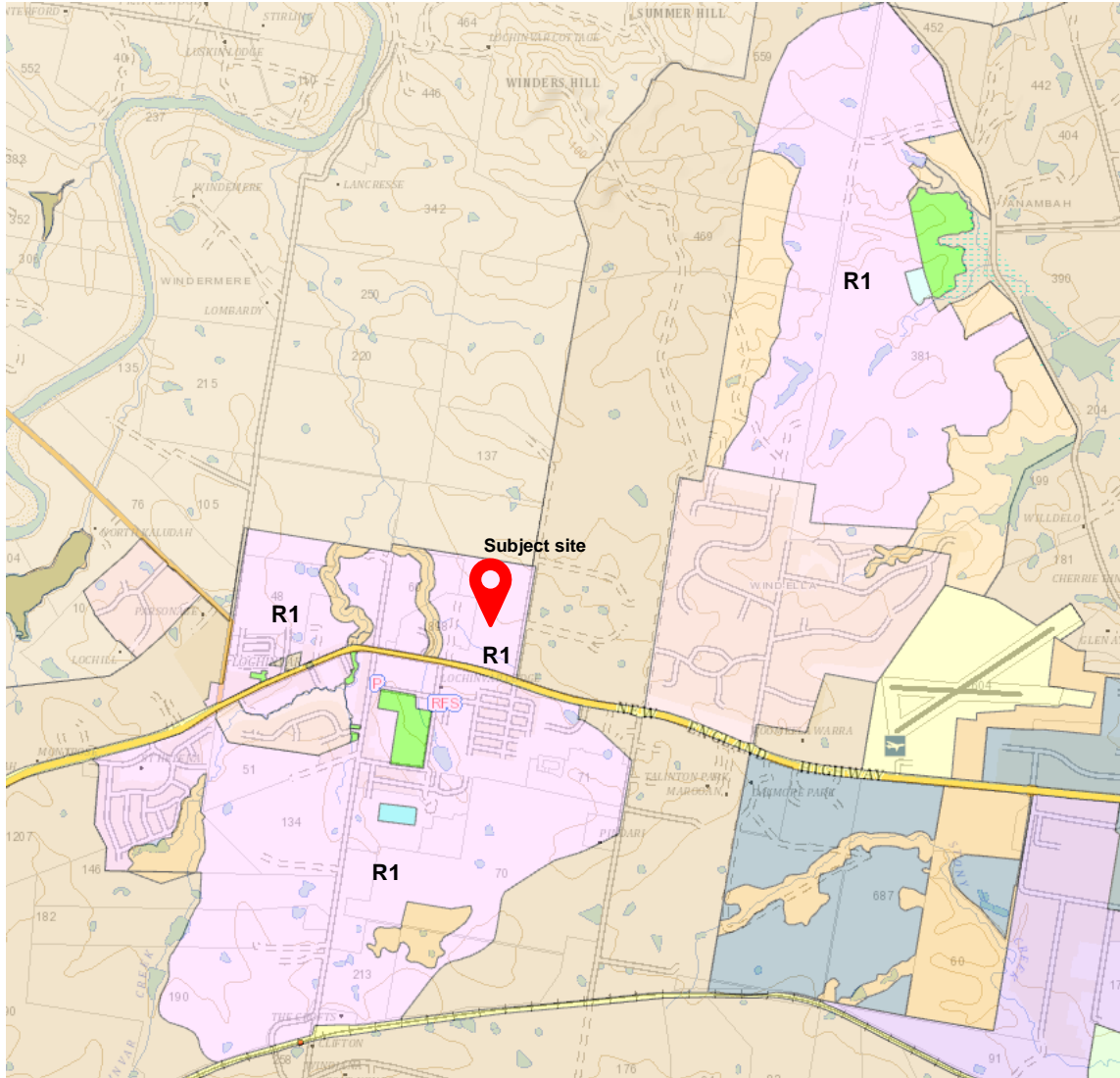
**Further observations:** the following conclusions were not stated in the report, but inferred from analysis of the contents:

- The base year model was 2017. No calibration data is provided
- There is no assumption about strategic traffic using the link beyond the traffic
- Growth to 2028 at 60 lots per year is 660 lots
- Growth to 2028 at 100 lots per year is 1,100 lots
- Growth to 2033 at 100 lots per year is 1,600 lots
- Based on the 2033 design year, the number of lots to the north is greater than the Wyndella Road subdivision application, but less than could come from Anamabah and Wyndella Road precincts combined.

### 2.3 Current planning status

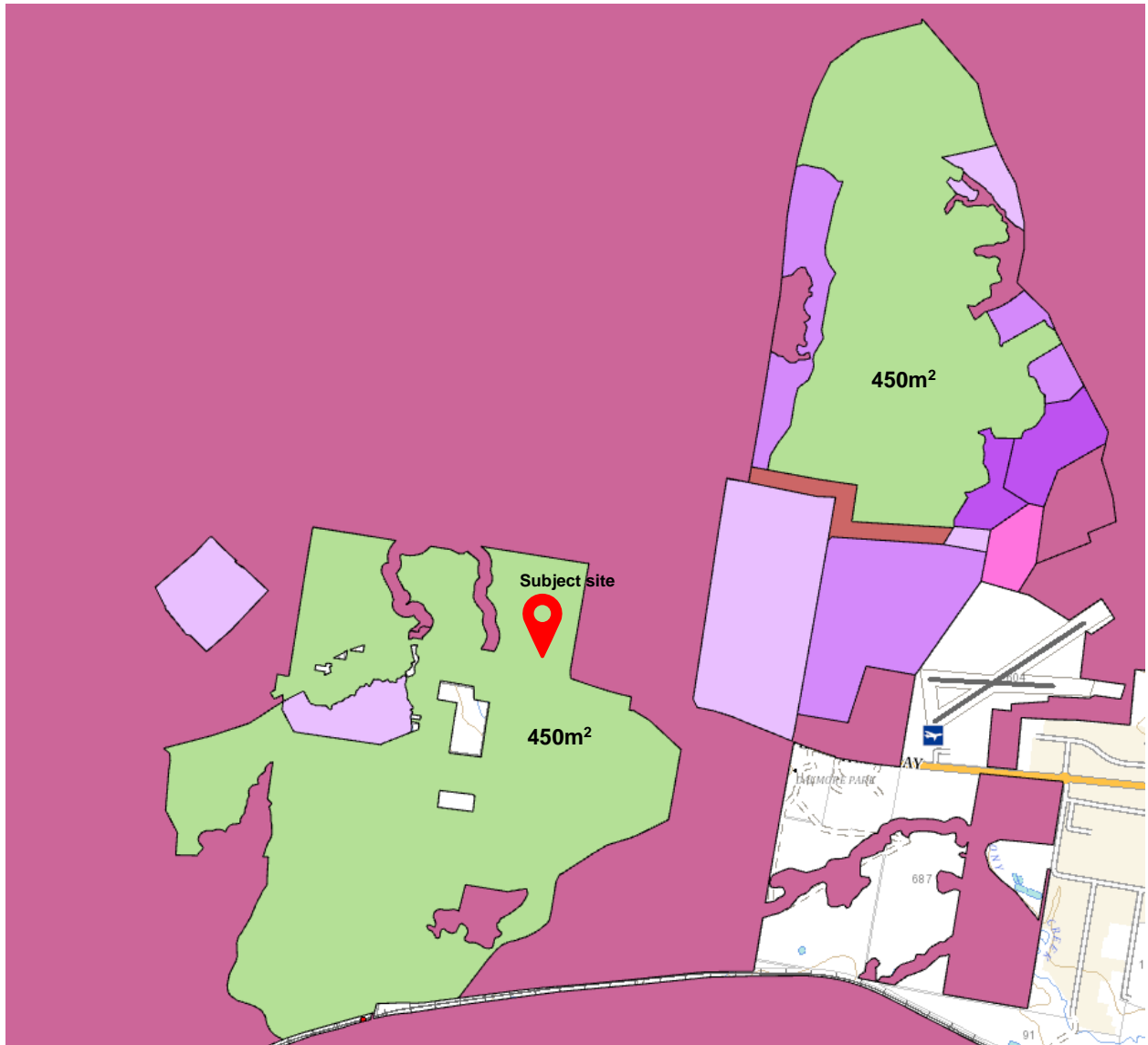
The land zoning and the minimum lot size have been updated to reflect the land uses previously proposed in the Lochinvar Structure Plan and the Anambah Release Area (**Figure 2-16** and **Figure 2-17**).

**Figure 2-16 Local Environment Plan zoning**



Source: Department of Planning & Environment, 2023

Figure 2-17 Lot size map



Source: Department of Planning & Environment, 2023

## 3.0 Existing conditions

### 3.1 Site

The site is bounded by New England Highway to the south, Wyndella Road to the east, residential lots to the north and St Joseph’s College Lochinvar/residential lots to the west (**Figure 3-1**).

**Figure 3-1 Wyndella Road subdivision**

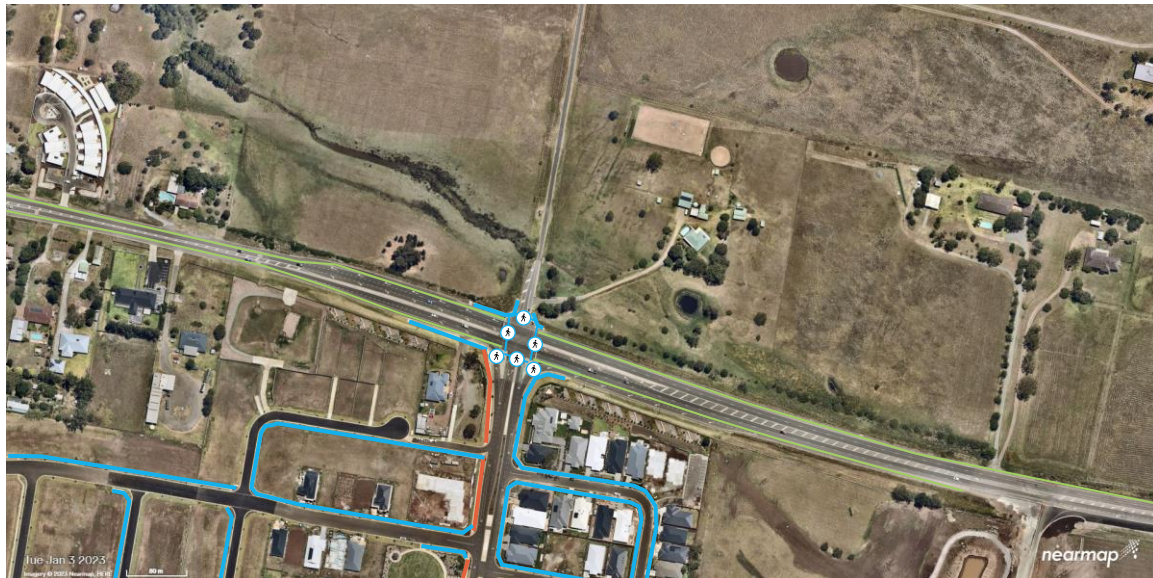


Source: Nearmap & ADW Johnson, 2023

### 3.2 Walking and cycling infrastructure

The walking and cycling infrastructure around the site is shown in **Figure 3-2**.

**Figure 3-2 Walking and cycling infrastructure**



- Pedestrian facility (footpath, signalised crossing, zebra)
- Cyclist facility (on road cycle lane/wide shoulder)
- Shared path



Source: Nearmap, SCT Consulting, 2023

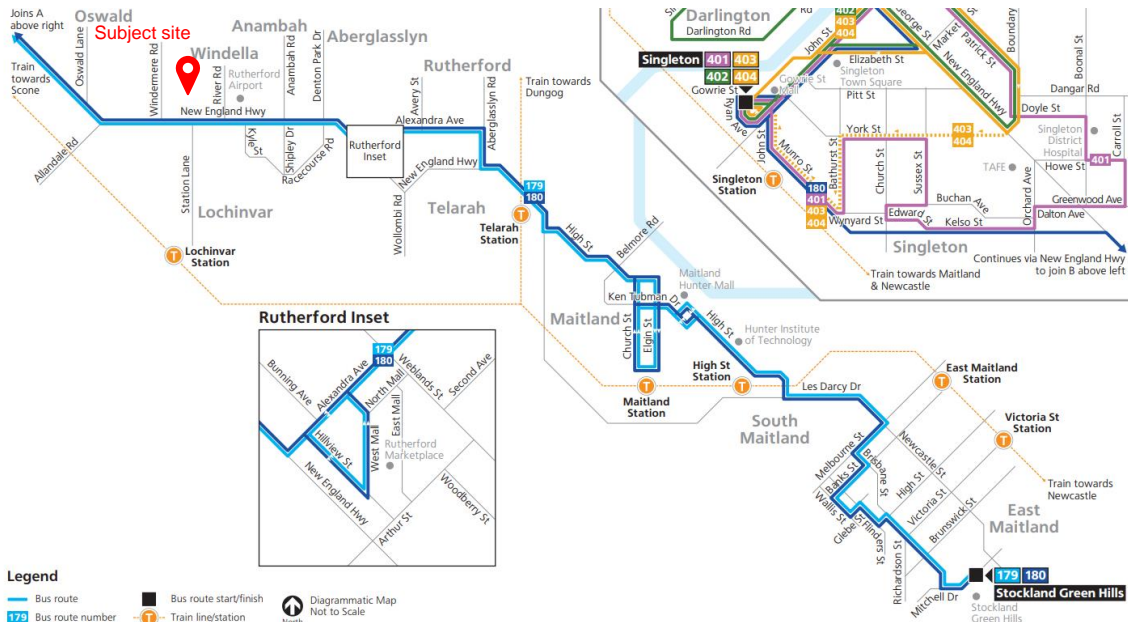
There is a footpath within the subdivision area to the south of the New England Highway with crossings on all legs of New England Highway / Wyndella Road.

There are on-road cycle lanes on the eastern, western and southern approaches to New England Highway / Wyndella Road. There are wide shoulders along New England Highway that would be suitable for experienced cyclists. A shared path runs along the western side of Springfield Drive south of New England Highway.

### 3.3 Public transport network

The site is located north of New England Highway, which carries bus services to Maitland and Stockland Green Hills, as shown in **Figure 3-3**. Bus routes 179 and 180 follow a similar route towards Maitland.

**Figure 3-3 Public transport network**



Source: Transport for NSW, 2023

The closest bus stops are 600m to the west of Wyndella Road outside St Joseph’s College (eastbound & westbound) and 400m to the east of Wyndella Road (westbound). The frequency of these services is approximately hourly from 8 am to 6 pm.

Lochinvar Station is 4.8km to the southwest of the intersection of New England Highway / Wyndella Road. There are no feeder bus routes to this station. Lochinvar Station is served by the Hunter Line, which has an approximately hourly frequency from 7am to 10pm. The Hunter Line connects Lochinvar to Newcastle Interchange and Scome.

### 3.4 Road network

The site sits west of Wyndella Road and north of New England Highway. New England Highway is classified as a state road (per the Roads Act), shown in **Figure 3-4**, and connects to Maitland and through onto Newcastle to the east. To the west, it connects to Branxton. There are interchanges with M15 Hunter Expressway via Lovedale Road at Allandale.

Figure 3-4 Classified state and regional road network



Source: Transport for NSW, 2023

#### 3.4.1 Traffic surveys

Intersection turning counts and queue length surveys were conducted for New England Highway / Wyndella Road / Springfield Drive on 8/03/2023 during 7am to 9am and 2.30pm to 5.30pm. These are typical periods as they cover the typical morning and evening peak in most contexts. The date of the survey was during the school term. The current intersection layout is shown in **Figure 3-5**.

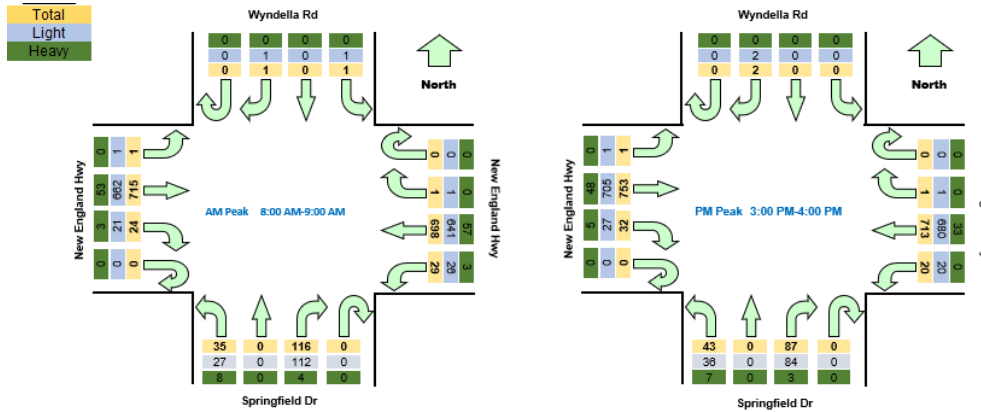
Figure 3-5 New England Highway / Wyndella Road / Springfield Drive intersection layout



Source: Nearmap, 2023

Intersection turning counts were collected in fifteen-minute intervals with classifications of light vehicles, heavy vehicles. Queue lengths were also collected during the same time period to inform the validation of the traffic models. The peak period traffic counts are shown for both peak periods in **Figure 3-6**.

**Figure 3-6 Intersection turning counts for the AM and PM peak periods**



Source: Trans Traffic Survey, 2023

Raw outputs of the traffic surveys are attached in **Appendix A**.

### 3.4.2 Intersection modelling

The traffic modelling methodology was developed with TfNSW prior to the preparation of the development application.

The intersections were modelled in SIDRA 9.1, which is the most recent version of the software at the time of writing. SIDRA models the delays to road users (cars, trucks, buses, pedestrians, cyclists) based on the demands and geometry of intersections. It is a typical software used for a development application of this scale.

SIDRA is considered an appropriate tool for the following reasons:

- The actual potential bypass traffic will be derived from survey data and wholly reassigned to the bypass rather than using an assignment model. This takes a conservative view of the maximum traffic that could use the bypass.
- SIDRA provides an accurate estimation of capacity at the intersection level, which is typically the most constrained part of the traffic network in urban areas.

### 3.4.3 SIDRA supports rapid turnaround of sensitivity tests, enabling stakeholders to evaluate alternatives quickly. Calibration and validation

Signal timings were adjusted slightly to match the queue lengths observed on site.

SIDRA models are mainly calibrated based on queue comparisons of maximum observed approach queues and the modelled 95<sup>th</sup> percentile queues. However, as identified in the TfNSW Modelling Guidelines, observations / surveys of queues are subjective:

*Counting or calculating queue lengths is a subjective exercise since queued vehicles will often still be moving slowly and it will not always be clear what criteria should be used to constitute a queue. Also, since data is likely to be collected by a number of surveyors it is unlikely that consistent and accurate reporting will be possible across the study area. Additionally, software packages will each calculate queue lengths using different criteria and methodologies which add a further level of complexity. For this reason, RMS does not have mandatory statistical guideline criteria for queue length comparison.*

As such, precise exact replication of queues between observed and modelled are impractical, as the models would no longer represent the reported signal timings.



Queue length calibration results are shown in **Table 3-1**.

**Table 3-1 Queue length calibration results**

Approach	SIDRA 9 queue length AM	Observed queue length AM	SIDRA 9 queue length PM	Observed queue length PM	AM Difference	PM Difference
North	1	1	1	1	0	0
South	3	3	2	3	0	1
East	9	8	8	9	1	1
West	4	5	7	6	1	1

The queue lengths show a good degree of matching for a traffic model and are therefore appropriate to be used for this traffic impact assessment.

### 3.4.4 Intersection performance

Intersection Level of Service (LOS) is a tool to measure the level of congestion at an intersection as well as to identify locations requiring further investigations. The LOS as defined in the Traffic Modelling Guidelines is summarised in **Table 3-2**.

**Table 3-2 Level of Service definitions**

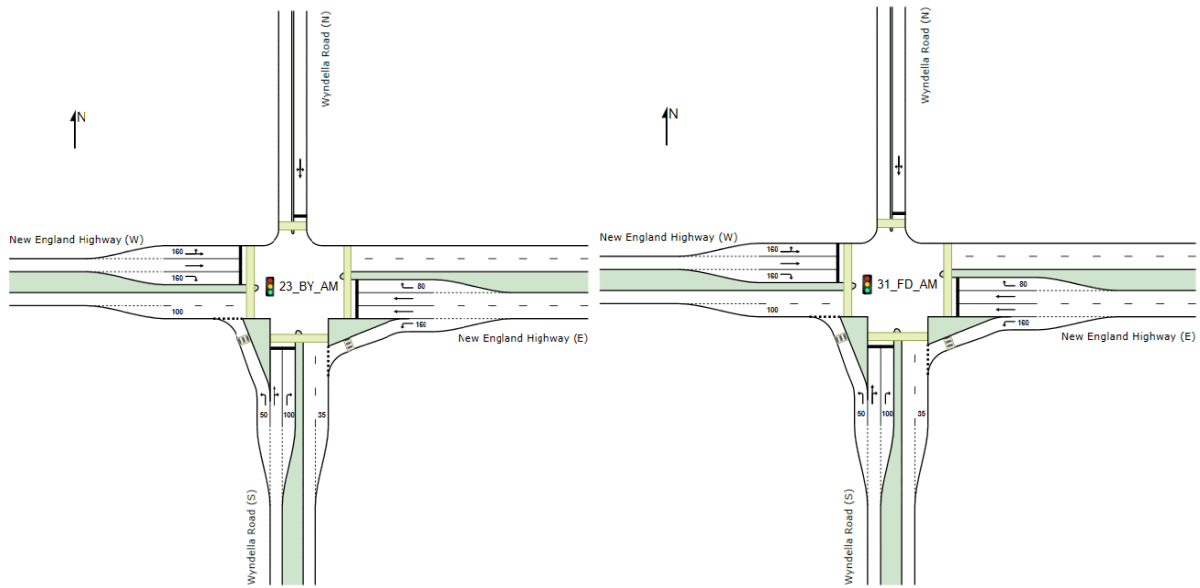
Level of Service (LOS)	Average Delay per Vehicles (sec/h)	Performance explanation
<b>A</b>	Less than 14.5	Good operation
<b>B</b>	14.5 to 28.4	Good with acceptable delays and spare capacity
<b>C</b>	28.5 to 42.4	Satisfactory
<b>D</b>	42.5 to 56.4	Operating near capacity
<b>E</b>	56.5 to 70.4	At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method.
<b>F</b>	70.5 or greater	At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method.

Source: Roads and Maritime Services, 2002

Intersection Degree of Saturation (DOS) is another metric to measure the performance of isolated intersections and approaches. DS is a ratio of traffic demand to capacity. For intersections controlled by traffic signals, both queue length and delays typically increase rapidly as DOS approaches 1.0. The Traffic Modelling Guidelines identified an upper limit of 0.9 for signalised intersections.

Traffic modelling was undertaken using SIDRA 9.1 for the intersection of New England Highway, Wyndella Road and Springfield Drive using the traffic volumes collected on 8/03/2023. The current intersection geometry and configuration was used for base and future year analysis. The SIDRA 9.1 intersection layout for future year and base are shown in **Figure 3-7**.

Figure 3-7: SIDRA 9.1 Base year and future year layout



Source: SCT Consulting, 2023

Table 3-3 Base AM peak performance

Approach	Movement	Volume	Degree of Saturation (DOS)	Average Delay (seconds)	Level of Service (LOS)	95 <sup>th</sup> Percentile Queue veh (metres)
Wyndella Road (north)	Left	1	0.1	53.2	D	1
	Through	1	0.1	53.2	D	1
	Right	1	0.10	53.2	D	1
New England Highway (east)	Left	29	0.02	7.9	A	1
	Through	698	0.40	6.6	A	61
	Right	1	0.05	56.9	E	1
Springfield Drive (south)	Left	35	0.05	8.6	A	2
	Through	1	0.25	35.1	C	17
	Right	116	0.25	40.7	C	17
New England Highway (west)	Left	1	0.28	10.3	A	38
	Through	715	0.28	4.2	A	39
	Right	24	0.40	53.9	D	9
<b>Intersection</b>		<b>1,623</b>	<b>0.40</b>	<b>8.9</b>	<b>A</b>	<b>61</b>

Table 3-4 Base PM peak performance

Approach	Movement	Volume	Degree of Saturation (DOS)	Average Delay (seconds)	Level of Service (LOS)	95 <sup>th</sup> Percentile Queue veh (metres)
Wyndella Road (north)	Left	43	0.07	47.2	D	2
	Through	1	0.07	45.1	D	2
	Right	87	0.07	50.6	D	2
New England Highway (east)	Left	20	0.01	7.8	A	1
	Through	713	0.37	6.2	A	58
	Right	1	0.05	56.2	D	1
Springfield Drive (south)	Left	43	0.06	8.7	A	3
	Through	1	0.41	42.4	C	14
	Right	87	0.41	48.0	D	14
New England Highway (west)	Left	1	0.29	10.5	A	46
	Through	753	0.29	4.9	A	46
	Right	32	0.40	51.6	D	12
<b>Intersection</b>		<b>1655</b>	<b>0.41</b>	<b>8.9</b>	<b>A</b>	<b>58</b>

The intersection is performing at a LOS of A during both peaks. Results are similar, with an average delay of 8.9 seconds, DOS of 0.40 and 0.41 and 95<sup>th</sup> percentile queue lengths of 61m and 58m for the AM and PM peaks respectively. These results show additional intersection capacity.

## 4.0 Proposed development

### 4.1 Proposal

The site comprises Lots 2, 3, 4, 5, 6 and 9 DP 747391, and Lots 12 and 13 DP1219648. The site is zoned R1 General Residential and covers an area of approximately 22ha. The site is proposed to be subdivided for residential development, with associated roads and services.

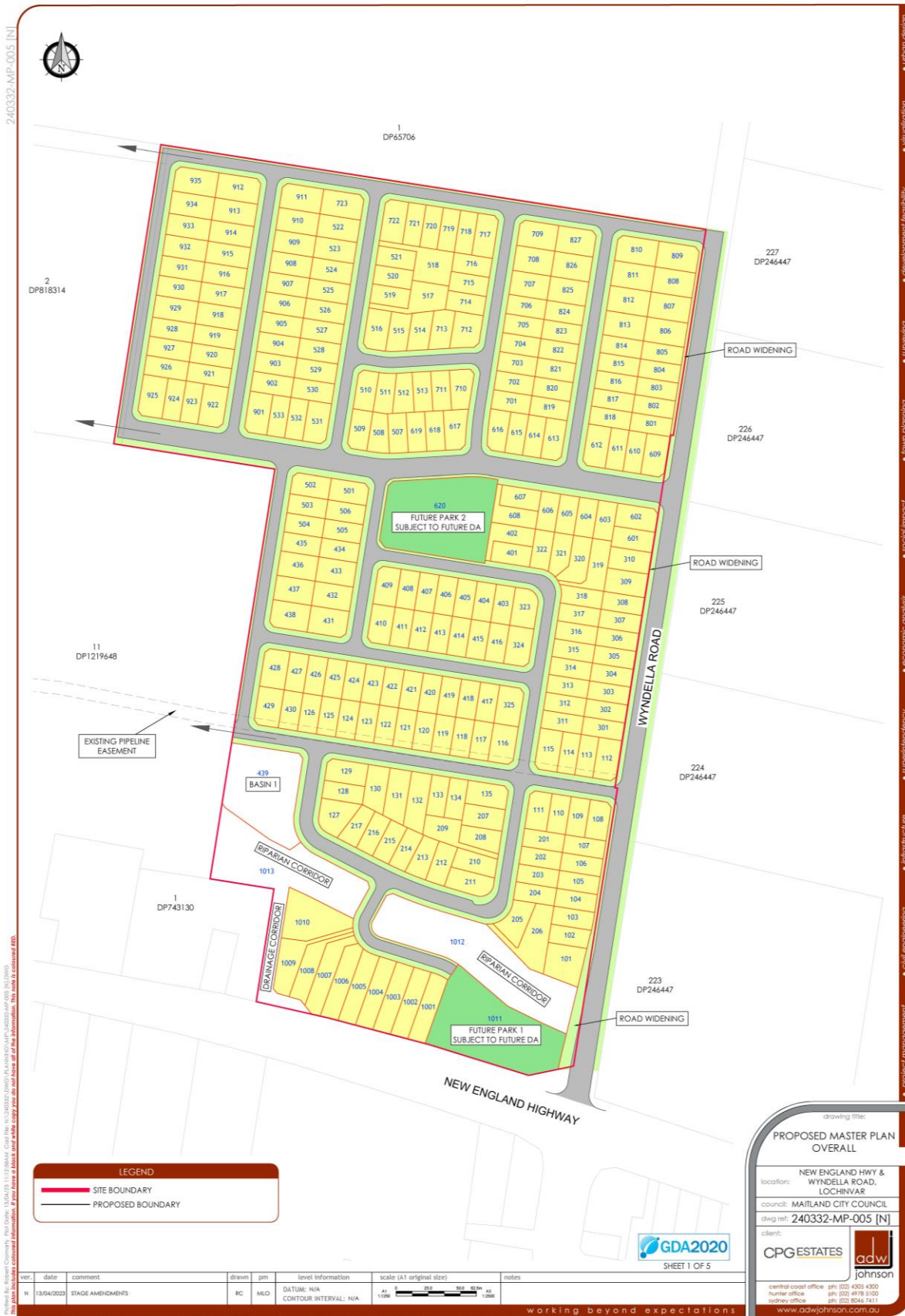
The subdivision would deliver 262 residential lots (an increase of 253 lots compared to the current 8 lots). Lots would be opening indicatively in 2025 and approximately 50 lots per year would be released.

The layout plan is based on a grid road network. Wyndella Road and a new east-west link form the higher order roads in the subdivision.

Access to the state road network would be via Wyndella Road to New England Highway, which permits all movements in and out.

The subdivision layout plan is provided overleaf in **Figure 4-1**.

Figure 4-1 Subdivision plan layout



Source: ADW Johnson, 2023

## 4.2 Street cross section requirements

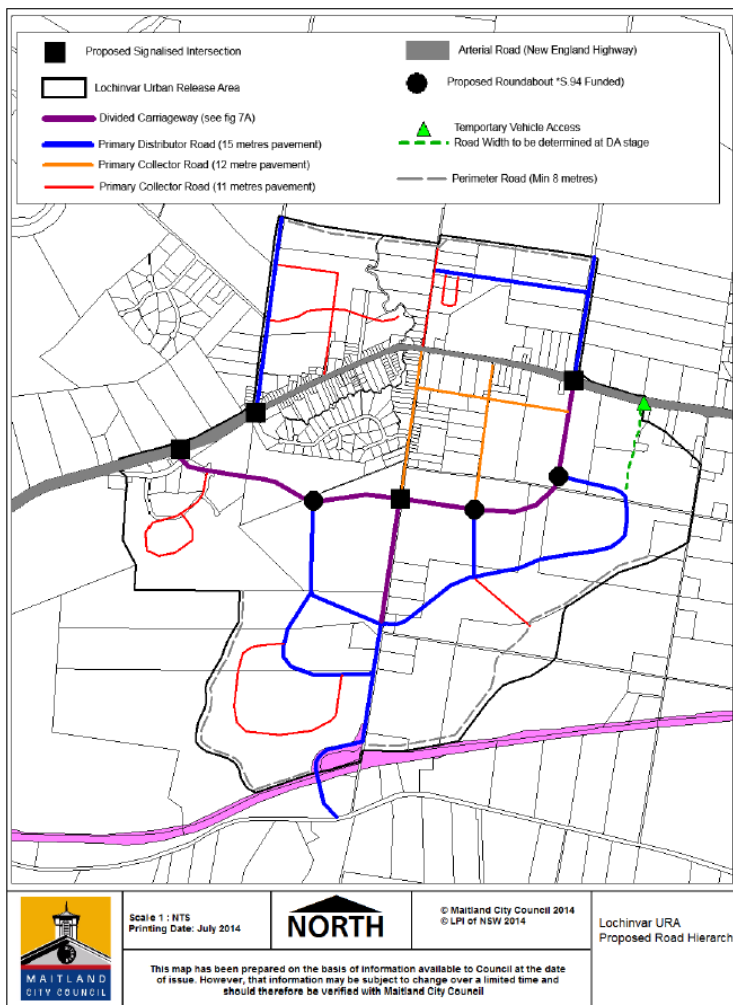
The Maitland City Council | Manual of Engineering Standards – Road Design defines the requirements for street cross sections (**Figure 4-2**). The higher order roads are defined by **Figure 4-3**. Lochinvar URA Proposed Road Hierarchy and Bus Routes of Part F – Urban Release Areas ..

**Figure 4-2 Street cross sections for different road types**

ROAD TYPE	MAX NO. LOTS	RESERVE WIDTH (m) <sup>a</sup>	CARRIAGEWAY / KERB-KERB (m) <sup>b</sup>	ON-ROAD BICYCLE FACILITY	FOOTWAY VERGE (m) <sup>c</sup>	KERB <sup>d</sup>	FOOTPATH (1.5m WIDE) <sup>e</sup>	DESIGN ESA <sup>f</sup>
Local – Place <sup>i</sup>	10	17	8	Mixed	4.5	Rolled	As Required	1 x10 <sup>5</sup>
Local – Access <sup>i</sup>	20	17	8	Mixed	4.5	Rolled	One side	1 x10 <sup>5</sup>
Local – Secondary <sup>i</sup>	50	17	8	Mixed	4.5	Rolled	One side	2 x10 <sup>5</sup>
Local - Primary <sup>i</sup>	100	17	8	Mixed	4.5	Rolled	One side	5 x10 <sup>5</sup>
Collector - Secondary <sup>i</sup>	200	17	8	Mixed (Parking)	4.5	Upright	One side	1 x10 <sup>6</sup>
Collector - Primary <sup>iv</sup>	300	20	11	Mixed (Parking) <sup>p</sup>	4.5	Upright	One side	1.5 x10 <sup>6</sup>
Distributor –Secondary <sup>v</sup>	400	23	14	Mixed (Parking) <sup>p</sup>	4.5	Upright	Both sides	2 x10 <sup>6</sup>
Distributor - Primary <sup>m, v</sup>	500	24	15 <sup>q</sup>	1.5m Lane	4.5	Upright	Both sides	5 x10 <sup>6</sup>
Sub-Arterial <sup>n</sup>	3500	24.4	15.4 <sup>r</sup>	1.7m Lane <sup>s</sup>	4.5	Upright	Both sides	1 x10 <sup>7</sup> min
Industrial - Secondary	10 <sup>b</sup>	22	13	Mixed	4.5	Upright	As Required	5 x10 <sup>6</sup>
Industrial - Primary	> 10	22	13	Mixed	4.5	Upright	As Required	1x10 <sup>7</sup>
School Bus/Public Route <sup>o</sup>			9min / 12min					2/5 x10 <sup>6</sup> min
Business / School Precinct			15.4	1.7m Lane	5.5 min <sup>h</sup>	Upright		1 x10 <sup>7</sup> min

Source: Maitland City Council

**Figure 4-3 Cross section requirements**



Source: Maitland City Council, 2014

The above documents indicate that the following street cross-sections are required for the following key roads:

- Wyndella Road is a Primary Distributor Road, which needs to have a kerb – kerb carriageway width of 15 metres and a reserve width of 24m.
- A new northern bypass road runs east-west through the subdivision area, which is also classified as a Primary Distributor Road, and needs to have a kerb – kerb carriageway width 15 metres and a reserve width of 24m.
- The northern road along the edge of the development needs to have a kerb – kerb carriageway width of at least 8m.

**Table 4-1** below summarises the road width requirements outlined above, and the road widths proposed under this development application.

**Table 4-1 Road requirements and widths**

Road	Required carriageway width (kerb – kerb)	Provided carriageway width (kerb – kerb)	Required reserve width	Provided reserve width
Wyndella Road	15m	8.5m	24m	22.56m
New east-west link	15m	15m	24m	25m
Northern perimeter road	8m	8m	17m	14.5m
Typical street	8m	8m	17m	17m

Source: Maitland City Council, SCT Consulting, ADW Johnson, 2023

As demonstrated in **Table 4-1** the carriageway and road reserve widths for the new east-west link and typical streets have been met.

A lower road reserve width is proposed for the northern perimeter road. That is, 14.5m rather than 17m. The proposed carriageway complies with the minimum requirement of 8m. This variation is considered appropriate as the northern perimeter road does not require a footpath on the northern side nor a setback from the adjoining property to the north.

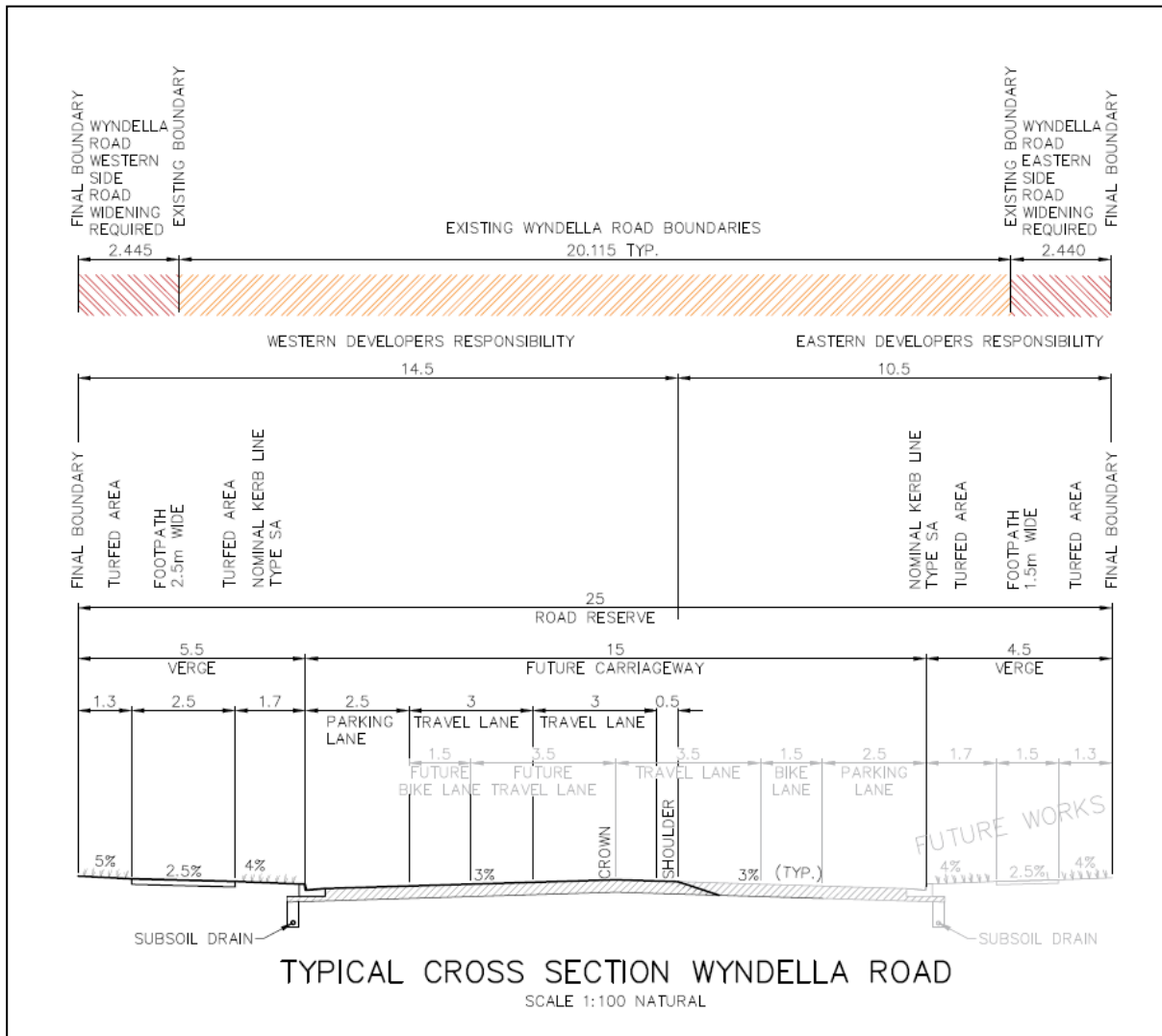
It is also noted that the works associated with Wyndella Road do not comply with the requirements outlined in **Figure 4-2** and **Figure 4-3**, which nominate Wyndella Road as a Distributor Primary Road.

This development application proposes to upgrade Wyndella Road to a Collector Primary Road. This road type is proposed on the basis that a Collector Primary Road is sufficient to cater for the additional traffic generated by the proposed development. That is, a Collector Primary Road can cater for up to 300 lots, and the proposed development will deliver 262 lots.

The proposed configuration is shown in **Figure 4-4**. It is noted that the proposed road does not include provision of a parking lane on the eastern side of Wyndella Road, as there is no nexus for parking on the side of the road abutting the rural zoned land.

Notwithstanding the above, SCT Consulting is advised that the proposed arrangement for Wyndella Road has been designed having regard to the fact that it will ultimately be constructed as a Distributor Primary Road, if and when surrounding development proceeds.

**Figure 4-4 Typical cross section of Wyndella Road**



Source: ADW Johnson, 2023



## 5.0 Impact assessment

### 5.1 Walking and cycling

All lots are set back by 4.5m, which is sufficient for future walking and cycling infrastructure – including any shared paths.

The delivery of a park at the north-west corner of the intersection of New England Highway / Wyndella Road provides a prominent and accessible location that can be reached by the subdivision as well as dwellings to the south of New England Highway on foot.

The intersection of New England Highway / Wyndella Road has crossings on all approaches, which supports pedestrian and cyclist accessibility.

### 5.2 Public transport

The site is within a walkable distance of the bus stops on New England Highway, which provides connectivity to Maitland and Stockland Green Hills as well as other centres along the New England Highway.

Lochinvar Station has parking which enables residents to park and ride to Newcastle CBD.

### 5.3 Road

#### 5.3.1 Traffic generation

The traffic generation of the new use is provided in **Table 5-1**. Traffic generation rates were adopted for the 'Low Density' category, despite the mix of housing typologies on the site as the low-density traffic generation rates are highest in the residential category. The traffic generation rates adopted are consistent with previous studies.

Table 5-1 Parking requirements

Yield	Traffic generation rate		Total traffic	
	Day	Peak hours (both)	Day	Peak hour
262 dwellings	6.8 veh/ dwg	0.66 veh/dwg	1,782 veh / day	173 veh / h

#### 5.3.2 Scenarios

The following scenarios were tested:

- **Future 2031 with background growth only:** using historical Annual Average Daily Traffic data, growth will be applied to the network. Known lot release rates on Springfield Drive to the south of New England Highway will be taken as additional to the general background traffic growth.
- **Future 2031 with background growth and development traffic:** development traffic will be added to the network without any mitigations to determine the upper limit of the impacts of the subject development application.

The year 2031 is considered appropriate because it allows for the full completion of the site. With the relatively small yield of 262 dwellings, this is considered feasible.

#### 5.3.3 Traffic modelling assumptions

Assumptions used as part of this assessment are outlined as follows:

- A 3% annual growth rate was applied for traffic on the New England Highway as per advice from Regional Planning.
- Based on turn counts collected as part of this study from Springfield Drive, a split of 72% of trips to/from the east and 28% of trips to/from the west was used to inform future development trip distribution.
- A 20/80 Inbound and outbound directional split was used for the AM peak period which was reversed for the PM peak. A trip rate of 0.66 was applied to both peak periods (Hyder, 2014).

### 5.3.4 Future 2031 with background growth only

Results for the 2031 future background growth scenarios are presented in **Table 5-2** and **Table 5-3**.

**Table 5-2 Future 2031 with background growth only – AM peak performance**

Approach	Movement	Volume	Degree of Saturation (DOS)	Average Delay (seconds)	Level of Service (LOS)	95 <sup>th</sup> Percentile Queue (metres)
Wyndella Road (north)	Left	1	0.10	53.2	D	1
	Through	1	0.10	48.8	D	1
	Right	1	0.10	54.4	D	1
New England Highway (east)	Left	72	0.04	7.8	A	2
	Through	865	0.45	7.2	A	77
	Right	1	0.05	56.9	E	1
Springfield Drive (south)	Left	102	0.60	9.5	A	6.0
	Through	1	0.60	37.4	C	42
	Right	287	0.14	43.1	D	42
New England Highway (west)	Left	41	0.34	10.5	A	47
	Through	887	0.34	4.4	A	49
	Right	1	0.63	54.6	D	14
<b>Intersection</b>		<b>2,260</b>	<b>0.63</b>	<b>11.7</b>	<b>A</b>	<b>77</b>

**Table 5-3 Future 2031 with background growth only – PM peak performance**

Approach	Movement	Volume	Degree of Saturation (DOS)	Average Delay (seconds)	Level of Service (LOS)	95 <sup>th</sup> Percentile Queue (metres)
Wyndella Road (north)	Left	1	0.02	33.9	C	1
	Through	2	0.02	37.0	C	1
	Right	1	0.02	42.6	D	1
New England Highway (east)	Left	191	0.11	8.0	A	6
	Through	884	0.68	18.5	B	131
	Right	1	0.01	43.6	D	1
Springfield Drive (south)	Left	60	0.08	12.1	A	6
	Through	1	0.20	30.3	C	17
	Right	130	0.20	35.9	C	17
New England Highway (west)	Left	1	0.57	16.0	B	102
	Through	934	0.57	19.6	B	102
	Right	99	0.64	48.7	D	30
<b>Intersection</b>		<b>2,305</b>	<b>0.68</b>	<b>20.2</b>	<b>B</b>	<b>131</b>

LOS for both peaks remains at A and B for the AM and PM peaks, respectively. AM peak delays increased by 2.8 seconds and PM peak by 8.5 seconds. Queue lengths along the eastern approach increased by approximately 72m.

### 5.3.5 Future 2031 with background growth and development traffic

Results for the future 2031 AM and PM peaks scenarios, including background growth and additional traffic generated from the development are shown in **Table 5-4** and **Table 5-5**.

**Table 5-4 Future 2031 with background growth + development – AM peak performance**

Approach	Movement	Volume	Degree of Saturation (DOS)	Average Delay (seconds)	Level of Service (LOS)	95 <sup>th</sup> Percentile Queue veh (metres)
Wyndella Road (north)	Left	99	0.36	28.3	B	32
	Through	1	0.36	33.9	C	32
	Right	40	0.36	39.4	C	32
New England Highway (east)	Left	72	0.05	8.1	A	2
	Through	865	0.81	24.5	B	146
	Right	26	0.18	42.8	D	7
Springfield Drive (south)	Left	102	0.13	12.5	A	10
	Through	1	0.85	42.9	D	44
	Right	287	0.85	48.5	D	44
New England Highway (west)	Left	11	0.66	13.2	A	102
	Through	887	0.66	21.9	B	102
	Right	41	0.28	43.6	D	11
<b>Intersection</b>		<b>2432</b>	<b>0.85</b>	<b>26.3</b>	<b>B</b>	<b>146</b>

**Table 5-5 Future 2031 with background growth + development – PM peak performance**

Approach	Movement	Volume	Degree of Saturation (DOS)	Average Delay (seconds)	Level of Service (LOS)	95 <sup>th</sup> Percentile Queue veh (metres)
Wyndella Road (north)	Left	25	0.14	30.4	C	8.5
	Through	1	0.14	33.9	C	8.5
	Right	12	0.14	39.4	C	8.5
New England Highway (east)	Left	191	0.12	8.2	A	6
	Through	884	0.64	14.9	B	110
	Right	100	0.67	44.7	D	28
Springfield Drive (south)	Left	60	0.08	10.5	A	5
	Through	1	0.53	37.7	C	18
	Right	130	0.53	43.3	D	18
New England Highway (east)	Left	40	0.56	51.4	D	89
	Through	934	0.56	54.6	D	91
	Right	99	0.66	44.9	D	28
<b>Intersection</b>		<b>2,477</b>	<b>0.67</b>	<b>34.0</b>	<b>C</b>	<b>110</b>

LoS for the AM and PM peaks are B and C respectively. Average delays increase by 17.4 and 25.1 seconds respectively for these periods. DOS increased by 0.45 and 0.26 for the AM and PM peaks. This is likely due to greater phase time allocated to Wyndella Road.

The current configuration of the intersection of Wyndella Road, New England Highway and Springfield Drive performs at a satisfactory level with the additional development traffic with some spare capacity.

No upgrade is therefore required for Wyndella Road / New England Highway / Springfield Drive for the development to proceed. The development would still contribute to the long-term upgrade of Wyndella Road / New England Highway / Springfield Drive at the rates outlined in the relevant contribution plan.

## 6.0 Conclusion

This transport impact assessment shows:

- The cross-section requirements per Maitland Development Control Plan *Lochinvar URA Proposed Road Hierarchy and Bus Routes of Part F – Urban Release Areas* are all met
- The intersection of Wyndella Road / New England Highway / Springfield Drive intersection performs at a satisfactory level with background traffic growth and the traffic from the 262 additional lots
- The intersection has a DOS of 0.85 in the future background growth and development scenario, indicating some spare capacity
- The intersection operates at Level of Service B and C in the AM and PM peak, respectively, indicating that no upgrade would be required due to this proposal.
- No upgrade is therefore required for Wyndella Road / New England Highway / Springfield Drive for the development to proceed. The development would still contribute to the long-term upgrade of Wyndella Road / New England Highway / Springfield Drive at the rates outlined in the relevant contribution plan.

## APPENDIX A

# Raw traffic surveys

APPENDIX B

# SIDRA movement summaries

# QUEUE ANALYSIS

Site: 23\_BY\_AM [NEH\_WYN\_23\_BY\_AM (Site Folder: Base Year)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New England Highway and Wyndella Road  
TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 81 seconds (Site User-Given Phase Times)

Lane Queues (Distance)															
Lane Number	Contin. Lane	Deg. Satn	Prog. Factor (Queue)	Overflow Queue (m)	Back of Queue (m)		Queue at Start of Green (m)		Cycle-Average Queue (m)		Queue Storage Ratio		Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
					Av.	95%	Av.	95%	Av.	95%	Av.	95%			
South: Wyndella Road (S)															
Lane 1		0.050	1.000	0.0	1.2	1.9	1.1	1.8	0.1	0.2	0.02	0.04	NA	0.0	2
Lane 2		0.250	1.000	0.0	10.0	16.3	9.7	15.8	4.3	9.0	0.02	0.03	0.0	NA	NA
Lane 3		0.250	1.000	0.0	10.0	16.3	9.7	15.8	4.3	9.0	0.10	0.16	NA	0.0	2
Approach		0.250			10.0	16.3	9.7	15.8	4.3	9.0	0.02	0.03			
East: New England Highway (E)															
Lane 1		0.019	1.000	0.0	0.5	0.8	0.5	0.8	0.0	0.0	0.00	0.01	NA	0.0	2
Lane 2		0.219	1.000	0.0	18.9	30.8	16.1	26.3	3.1	6.6	0.04	0.06	0.0	NA	NA
Lane 3		0.376	1.000	0.0	37.1	60.6	27.8	45.4	6.2	12.9	0.07	0.12	0.0	NA	NA
Lane 4		0.046	1.000	0.0	0.2	0.3	0.2	0.3	0.1	0.2	0.00	0.00	NA	0.0	3
Approach		0.376			37.1	60.6	27.8	45.4	6.2	12.9	0.07	0.12			
North: Wyndella Road (N)															
Lane 1		0.096	1.000	0.0	0.6	1.0	0.6	1.0	0.3	0.6	0.00	0.00	0.0	NA	NA
Approach		0.096			0.6	1.0	0.6	1.0	0.3	0.6	0.00	0.00			
West: New England Highway (W)															
Lane 1		0.283	1.000	0.0	22.9	37.4	18.2	29.7	3.1	6.5	0.14	0.23	NA	0.0	2
Lane 2		0.283	1.000	0.0	23.9	39.0	19.0	31.1	3.4	7.1	0.05	0.08	0.0	NA	NA
Lane 3		0.400	1.000	0.0	5.3	8.6	5.2	8.4	2.5	5.3	0.03	0.05	NA	0.0	2
Approach		0.400			23.9	39.0	19.0	31.1	3.4	7.1	0.05	0.08			
Intersection		0.400			37.1	60.6	27.8	45.4	6.2	12.9	0.07	0.12			

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

Short Lanes are not included in determining Queue Storage Ratios.

Lane Queues (Vehicles)															
Lane Number	Contin. Lane	Deg. Satn	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh)		Queue at Start of Green (veh)		Cycle-Average Queue (veh)		Queue Storage Ratio		Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
					Av.	95%	Av.	95%	Av.	95%	Av.	95%			
South: Wyndella Road (S)															
Lane 1		0.050	1.000	0.0	0.1	0.2	0.1	0.2	0.0	0.0	0.02	0.04	NA	0.0	2
Lane 2		0.250	1.000	0.0	1.4	2.3	1.3	2.2	0.6	1.3	0.02	0.03	0.0	NA	NA
Lane 3		0.250	1.000	0.0	1.4	2.3	1.3	2.2	0.6	1.3	0.10	0.16	NA	0.0	2
Approach		0.250			1.4	2.3	1.3	2.2	0.6	1.3	0.02	0.03			
East: New England Highway (E)															
Lane 1		0.019	1.000	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.00	0.01	NA	0.0	2
Lane 2		0.219	1.000	0.0	2.5	4.1	2.2	3.5	0.4	0.9	0.04	0.06	0.0	NA	NA
Lane 3		0.376	1.000	0.0	5.0	8.1	3.7	6.1	0.8	1.7	0.07	0.12	0.0	NA	NA



Lane 4	0.046	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	NA	0.0	3
Approach	0.376			5.0	8.1	3.7	6.1	0.8	1.7	0.07	0.12			
North: Wyndella Road (N)														
Lane 1	0.096	1.000	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.00	0.00	0.0	NA	NA
Approach	0.096			0.1	0.1	0.1	0.1	0.0	0.1	0.00	0.00			
West: New England Highway (W)														
Lane 1	0.283	1.000	0.0	3.1	5.0	2.4	4.0	0.4	0.9	0.14	0.23	NA	0.0	2
Lane 2	0.283	1.000	0.0	3.2	5.2	2.6	4.2	0.5	1.0	0.05	0.08	0.0	NA	NA
Lane 3	0.400	1.000	0.0	0.7	1.1	0.7	1.1	0.3	0.7	0.03	0.05	NA	0.0	2
Approach	0.400			3.2	5.2	2.6	4.2	0.5	1.0	0.05	0.08			
Intersection	0.400			5.0	8.1	3.7	6.1	0.8	1.7	0.07	0.12			

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

Short Lanes are not included in determining Queue Storage Ratios.

Continuous Lane Performance												
Lane Number	Deg. Satn	Unint. Speed	Unint. Travel Delay	Hdwy Spacing	Aver. Vehicle Length	Occup. Time	Space Time	Space Occup. Ratio	Time Occup. Ratio	Density	LOS (Density Method)	
	v/c	km/h	sec	sec	m	sec	sec	%	%	veh/km	pc/km	
There are no Continuous Lanes at this Site.												

Pedestrian Queues				
Mov ID	Description	Dem. Flow	AVERAGE BACK OF QUEUE [ Ped ]	Dist ]
		ped/h	ped	m
South: Wyndella Road (S)				
P1	Full	11	0.0	0.0
East: New England Highway (E)				
P2	Full	11	0.0	0.0
North: Wyndella Road (N)				
P3	Full	11	0.0	0.0
West: New England Highway (W)				
P4	Full	11	0.0	0.0
All Pedestrians		42	0.0	0.0

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Project: S:\Projects\SCT\_00390 Wyndella Rd Lochinvar\3. Technical Work Area\1. Network Optimisation\New England Highway & Wyndella Rd-72pct\_v0.2.sip9

# QUEUE ANALYSIS

Site: 23\_BY\_PM [NEH\_WYN\_23\_BY\_PM (Site Folder: Base Year)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New England Highway and Wyndella Road  
TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Phase Times)

Lane Queues (Distance)															
Lane Number	Contin. Lane	Deg. Satn	Prog. Factor (Queue)	Overflow Queue (m)	Back of Queue (m)		Queue at Start of Green (m)		Cycle-Average Queue (m)		Queue Storage Ratio		Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
					Av.	95%	Av.	95%	Av.	95%	Av.	95%			
South: Wyndella Road (S)															
Lane 1		0.062	1.000	0.0	1.5	2.4	1.4	2.3	0.2	0.3	0.03	0.05	NA	0.0	2
Lane 2		0.409	1.000	0.0	8.4	13.7	8.2	13.3	3.9	8.2	0.02	0.03	0.0	NA	NA
Lane 3		0.409	1.000	0.0	8.4	13.7	8.2	13.3	3.9	8.2	0.08	0.14	NA	0.0	2
Approach		0.409			8.4	13.7	8.2	13.3	3.9	8.2	0.02	0.03			
East: New England Highway (E)															
Lane 1		0.012	1.000	0.0	0.3	0.6	0.3	0.6	0.0	0.0	0.00	0.00	NA	0.0	2
Lane 2		0.216	1.000	0.0	18.0	29.4	15.4	25.1	2.9	6.1	0.04	0.06	0.0	NA	NA
Lane 3		0.371	1.000	0.0	35.5	57.9	26.6	43.4	5.8	12.0	0.07	0.12	0.0	NA	NA
Lane 4		0.045	1.000	0.0	0.2	0.3	0.2	0.3	0.1	0.2	0.00	0.00	NA	0.0	3
Approach		0.371			35.5	57.9	26.6	43.4	5.8	12.0	0.07	0.12			
North: Wyndella Road (N)															
Lane 1		0.069	1.000	0.0	0.8	1.2	0.8	1.2	0.4	0.8	0.00	0.00	0.0	NA	NA
Approach		0.069			0.8	1.2	0.8	1.2	0.4	0.8	0.00	0.00			
West: New England Highway (W)															
Lane 1		0.292	1.000	0.0	27.7	45.2	26.2	42.7	4.7	9.8	0.17	0.28	NA	0.0	2
Lane 2		0.292	1.000	0.0	24.1	39.4	19.0	31.0	3.3	6.9	0.05	0.08	0.0	NA	NA
Lane 3		0.403	1.000	0.0	6.9	11.3	6.8	11.0	3.3	6.9	0.04	0.07	NA	0.0	2
Approach		0.403			27.7	45.2	26.2	42.7	4.7	9.8	0.05	0.08			
Intersection		0.409			35.5	57.9	26.6	43.4	5.8	12.0	0.07	0.12			

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

Short Lanes are not included in determining Queue Storage Ratios.

Lane Queues (Vehicles)															
Lane Number	Contin. Lane	Deg. Satn	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh)		Queue at Start of Green (veh)		Cycle-Average Queue (veh)		Queue Storage Ratio		Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
					Av.	95%	Av.	95%	Av.	95%	Av.	95%			
South: Wyndella Road (S)															
Lane 1		0.062	1.000	0.0	0.2	0.3	0.2	0.3	0.0	0.0	0.03	0.05	NA	0.0	2
Lane 2		0.409	1.000	0.0	1.2	1.9	1.1	1.9	0.5	1.1	0.02	0.03	0.0	NA	NA
Lane 3		0.409	1.000	0.0	1.2	1.9	1.1	1.8	0.5	1.1	0.08	0.14	NA	0.0	2
Approach		0.409			1.2	1.9	1.1	1.9	0.5	1.1	0.02	0.03			
East: New England Highway (E)															
Lane 1		0.012	1.000	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.00	0.00	NA	0.0	2
Lane 2		0.216	1.000	0.0	2.5	4.0	2.1	3.5	0.4	0.8	0.04	0.06	0.0	NA	NA
Lane 3		0.371	1.000	0.0	4.9	7.9	3.7	6.0	0.8	1.7	0.07	0.12	0.0	NA	NA

Lane 4	0.045	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	NA	0.0	3
Approach	0.371			4.9	7.9	3.7	6.0	0.8	1.7	0.07	0.12			
North: Wyndella Road (N)														
Lane 1	0.069	1.000	0.0	0.1	0.2	0.1	0.2	0.1	0.1	0.00	0.00	0.0	NA	NA
Approach	0.069			0.1	0.2	0.1	0.2	0.1	0.1	0.00	0.00			
West: New England Highway (W)														
Lane 1	0.292	1.000	0.0	3.8	6.1	3.5	5.8	0.6	1.3	0.17	0.28	NA	0.0	2
Lane 2	0.292	1.000	0.0	3.3	5.3	2.6	4.2	0.4	0.9	0.05	0.08	0.0	NA	NA
Lane 3	0.403	1.000	0.0	0.9	1.4	0.9	1.4	0.4	0.9	0.04	0.07	NA	0.0	2
Approach	0.403			3.8	6.1	3.5	5.8	0.6	1.3	0.05	0.08			
Intersection	0.409			4.9	7.9	3.7	6.0	0.8	1.7	0.07	0.12			

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

Short Lanes are not included in determining Queue Storage Ratios.

Continuous Lane Performance												
Lane Number	Deg. Satn	Unint. Speed	Unint. Travel Delay	Hdwy Spacing	Aver. Vehicle Length	Occup. Time	Space Time	Space Occup. Ratio	Time Occup. Ratio	Density	LOS (Density Method)	
	v/c	km/h	sec	sec	m	sec	sec	%	%	veh/km	pc/km	
There are no Continuous Lanes at this Site.												

Pedestrian Queues				
Mov ID	Description	Dem. Flow	AVERAGE BACK OF QUEUE [ Ped ]	Dist ]
		ped/h	ped	m
South: Wyndella Road (S)				
P1	Full	11	0.0	0.0
East: New England Highway (E)				
P2	Full	11	0.0	0.0
North: Wyndella Road (N)				
P3	Full	11	0.0	0.0
West: New England Highway (W)				
P4	Full	11	0.0	0.0
All Pedestrians		42	0.0	0.0

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# MOVEMENT SUMMARY

**Site: 23\_BY\_AM [NEH\_WYN\_23\_BY\_AM (Site Folder: Base Year)]**

**Output produced by SIDRA INTERSECTION Version: 9.1.2.202**

New England Highway and Wyndella Road

TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 81 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [ Total HV ]		Arrival Flows [ Total HV ]		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [ Veh. Dist ]		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Wyndella Road (S)															
1	L2	All MCs	37	22.9	37	22.9	0.050	8.6	LOS A	0.2	1.9	0.25	0.60	0.25	51.8
2	T1	All MCs	1	0.0	1	0.0	*0.250	35.1	LOS C	2.3	16.3	0.93	0.75	0.93	36.1
3	R2	All MCs	122	3.4	122	3.4	0.250	40.7	LOS C	2.3	16.3	0.93	0.75	0.93	37.1
Approach			160	7.9	160	7.9	0.250	33.3	LOS C	2.3	16.3	0.78	0.71	0.78	39.7
East: New England Highway (E)															
4	L2	All MCs	31	10.3	31	10.3	0.019	7.9	LOS A	0.1	0.8	0.12	0.62	0.12	57.4
5	T1	All MCs	735	8.2	735	8.2	*0.376	6.6	LOS A	8.1	60.6	0.46	0.40	0.46	70.6
6	R2	All MCs	1	0.0	1	0.0	0.046	56.9	LOS E	0.0	0.3	1.00	0.57	1.00	32.4
Approach			766	8.2	766	8.2	0.376	6.7	LOS A	8.1	60.6	0.44	0.41	0.44	69.9
North: Wyndella Road (N)															
7	L2	All MCs	1	0.0	1	0.0	0.096	53.2	LOS D	0.1	1.0	1.00	0.62	1.00	33.4
8	T1	All MCs	1	0.0	1	0.0	*0.096	48.8	LOS D	0.1	1.0	1.00	0.62	1.00	32.4
9	R2	All MCs	1	0.0	1	0.0	0.096	54.4	LOS D	0.1	1.0	1.00	0.62	1.00	33.5
Approach			3	0.0	3	0.0	0.096	52.1	LOS D	0.1	1.0	1.00	0.62	1.00	33.1
West: New England Highway (W)															
10	L2	All MCs	1	0.0	1	0.0	0.283	10.3	LOS A	5.0	37.4	0.37	0.32	0.37	61.2
11	T1	All MCs	753	7.4	753	7.4	0.283	4.2	LOS A	5.2	39.0	0.37	0.33	0.37	73.3
12	R2	All MCs	25	12.5	25	12.5	*0.400	53.9	LOS D	1.1	8.6	1.00	0.71	1.00	33.4
Approach			779	7.6	779	7.6	0.400	5.8	LOS A	5.2	39.0	0.39	0.34	0.39	70.6
All Vehicles			1708	7.9	1708	7.9	0.400	8.9	LOS A	8.1	60.6	0.45	0.41	0.45	65.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

\* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [ Ped Dist ]		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed	
	ped/h	ped/h	sec		ped	m			sec	m	m/sec	
South: Wyndella Road (S)												
P1	Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06

East: New England Highway (E)												
P2	Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
North: Wyndella Road (N)												
P3	Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
West: New England Highway (W)												
P4	Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
All	Pedestrians	40	42	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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# MOVEMENT SUMMARY

Site: 23\_BY\_PM [NEH\_WYN\_23\_BY\_PM (Site Folder: Base Year)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New England Highway and Wyndella Road  
TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[ Total HV ]	[ Total HV ]	[ Total HV ]	[ Total HV ]				[ Veh. ]	[ Dist ]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Wyndella Road (S)															
1	L2	All MCs	45	16.3	45	16.3	0.062	8.7	LOS A	0.3	2.4	0.27	0.61	0.27	53.0
2	T1	All MCs	1	0.0	1	0.0	*0.409	42.4	LOS C	1.9	13.7	1.00	0.74	1.00	33.7
3	R2	All MCs	92	3.4	92	3.4	0.409	48.0	LOS D	1.9	13.7	1.00	0.74	1.00	34.6
Approach			138	7.6	138	7.6	0.409	35.1	LOS C	1.9	13.7	0.76	0.69	0.76	39.0
East: New England Highway (E)															
4	L2	All MCs	21	0.0	21	0.0	0.012	7.8	LOS A	0.1	0.6	0.11	0.63	0.11	57.9
5	T1	All MCs	751	4.6	751	4.6	*0.371	6.2	LOS A	7.9	57.9	0.44	0.39	0.44	71.1
6	R2	All MCs	1	0.0	1	0.0	0.045	56.2	LOS D	0.0	0.3	1.00	0.57	1.00	32.6
Approach			773	4.5	773	4.5	0.371	6.3	LOS A	7.9	57.9	0.44	0.40	0.44	70.6
North: Wyndella Road (N)															
7	L2	All MCs	1	0.0	1	0.0	0.069	47.2	LOS D	0.2	1.2	0.99	0.63	0.99	35.1
8	T1	All MCs	2	0.0	2	0.0	0.069	45.1	LOS D	0.2	1.2	0.99	0.63	0.99	34.0
9	R2	All MCs	1	0.0	1	0.0	0.069	50.6	LOS D	0.2	1.2	0.99	0.63	0.99	35.1
Approach			4	0.0	4	0.0	0.069	47.0	LOS D	0.2	1.2	0.99	0.63	0.99	34.5
West: New England Highway (W)															
10	L2	All MCs	1	0.0	1	0.0	*0.292	10.5	LOS A	6.1	45.2	0.37	0.33	0.37	59.4
11	T1	All MCs	793	6.4	793	6.4	0.292	4.9	LOS A	6.1	45.2	0.37	0.33	0.37	72.2
12	R2	All MCs	34	15.6	34	15.6	*0.403	51.6	LOS D	1.4	11.3	1.00	0.72	1.00	34.0
Approach			827	6.7	827	6.7	0.403	6.8	LOS A	6.1	45.2	0.40	0.35	0.40	69.1
All Vehicles			1742	5.8	1742	5.8	0.409	8.9	LOS A	7.9	57.9	0.45	0.40	0.45	65.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

\* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[ Ped ]	[ Dist ]					
			ped/h	ped/h	sec	ped	m			sec	m	m/sec
South: Wyndella Road (S)												
P1	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06

East: New England Highway (E)												
P2	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06
North: Wyndella Road (N)												
P3	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06
West: New England Highway (W)												
P4	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06
All	Pedestrians	40	42	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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# MOVEMENT SUMMARY

**Site: 31\_FB\_AM [31\_FB\_AM (Site Folder: Base Year)]**

**Output produced by SIDRA INTERSECTION Version: 9.1.2.202**

New England Highway and Wyndella Road

TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 81 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[ Total HV ]	%	[ Total HV ]	%	v/c	sec		[ Veh. ]	[ Dist ]				km/h
			veh/h		veh/h					veh	m				
South: Wyndella Road (S)															
1	L2	All MCs	107	0.0	107	0.0	0.141	9.5	LOS A	0.9	6.0	0.31	0.63	0.31	56.5
2	T1	All MCs	1	0.0	1	0.0	*0.601	37.4	LOS C	6.0	41.7	0.99	0.81	1.01	35.3
3	R2	All MCs	302	0.0	302	0.0	0.601	43.1	LOS D	6.0	41.7	0.99	0.81	1.01	36.6
Approach			411	0.0	411	0.0	0.601	34.3	LOS C	6.0	41.7	0.81	0.76	0.83	40.3
East: New England Highway (E)															
4	L2	All MCs	76	0.0	76	0.0	0.044	7.8	LOS A	0.3	1.9	0.12	0.63	0.12	57.9
5	T1	All MCs	911	2.0	911	2.0	*0.448	7.2	LOS A	10.7	76.2	0.48	0.43	0.48	70.2
6	R2	All MCs	1	0.0	1	0.0	0.046	56.9	LOS E	0.0	0.3	1.00	0.57	1.00	32.4
Approach			987	1.8	987	1.8	0.448	7.3	LOS A	10.7	76.2	0.46	0.44	0.46	68.9
North: Wyndella Road (N)															
7	L2	All MCs	1	0.0	1	0.0	0.096	53.2	LOS D	0.1	1.0	1.00	0.62	1.00	33.4
8	T1	All MCs	1	0.0	1	0.0	*0.096	48.8	LOS D	0.1	1.0	1.00	0.62	1.00	32.4
9	R2	All MCs	1	0.0	1	0.0	0.096	54.4	LOS D	0.1	1.0	1.00	0.62	1.00	33.5
Approach			3	0.0	3	0.0	0.096	52.1	LOS D	0.1	1.0	1.00	0.62	1.00	33.1
West: New England Highway (W)															
10	L2	All MCs	1	0.0	1	0.0	0.339	10.5	LOS A	6.6	46.8	0.39	0.34	0.39	60.9
11	T1	All MCs	934	2.0	934	2.0	0.339	4.4	LOS A	6.8	48.7	0.40	0.35	0.40	73.0
12	R2	All MCs	43	0.0	43	0.0	*0.627	54.6	LOS D	1.9	13.5	1.00	0.78	1.18	33.3
Approach			978	1.9	978	1.9	0.627	6.6	LOS A	6.8	48.7	0.42	0.37	0.43	69.3
All Vehicles			2379	1.5	2379	1.5	0.627	11.7	LOS A	10.7	76.2	0.50	0.47	0.51	61.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

\* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed	
		ped/h	sec		[ Ped ]	[ Dist ]			sec	m	m/sec	
		ped/h	ped/h	sec	ped	m			sec	m	m/sec	
South: Wyndella Road (S)												
P1	Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
East: New England Highway (E)												



P2 Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
North: Wyndella Road (N)											
P3 Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
West: New England Highway (W)											
P4 Full	10	11	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06
All Pedestrians	40	42	34.7	LOS D	0.0	0.0	0.93	0.93	188.6	200.0	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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# MOVEMENT SUMMARY

**Site: 31\_FB\_PM [31\_FB\_PM (Site Folder: Base Year)]**

**Output produced by SIDRA INTERSECTION Version: 9.1.2.202**

New England Highway and Wyndella Road

TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [ Total HV ]		Arrival Flows [ Total HV ]		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [ Veh. Dist ]		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Wyndella Road (S)															
1	L2	All MCs	63	0.0	63	0.0	0.078	12.1	LOS A	0.8	5.6	0.43	0.65	0.43	54.3
2	T1	All MCs	1	0.0	1	0.0	*0.198	30.3	LOS C	2.3	16.3	0.88	0.74	0.88	37.9
3	R2	All MCs	137	0.0	137	0.0	0.198	35.9	LOS C	2.3	16.3	0.88	0.74	0.88	39.4
Approach			201	0.0	201	0.0	0.198	28.4	LOS B	2.3	16.3	0.74	0.71	0.74	43.1
East: New England Highway (E)															
4	L2	All MCs	201	0.0	201	0.0	0.114	8.0	LOS A	0.9	6.0	0.12	0.64	0.12	57.9
5	T1	All MCs	931	2.0	931	2.0	*0.679	18.5	LOS B	18.3	130.1	0.80	0.70	0.80	57.7
6	R2	All MCs	1	0.0	1	0.0	0.006	43.6	LOS D	0.0	0.3	0.93	0.59	0.93	36.8
Approach			1133	1.7	1133	1.7	0.679	16.6	LOS B	18.3	130.1	0.68	0.69	0.68	57.7
North: Wyndella Road (N)															
7	L2	All MCs	1	0.0	1	0.0	0.021	33.9	LOS C	0.1	1.0	0.91	0.63	0.91	38.0
8	T1	All MCs	1	0.0	1	0.0	0.021	37.0	LOS C	0.1	1.0	0.91	0.63	0.91	36.6
9	R2	All MCs	2	0.0	2	0.0	0.021	42.6	LOS D	0.1	1.0	0.91	0.63	0.91	38.0
Approach			4	0.0	4	0.0	0.021	39.0	LOS C	0.1	1.0	0.91	0.63	0.91	37.6
West: New England Highway (W)															
10	L2	All MCs	1	0.0	1	0.0	*0.568	16.0	LOS B	14.2	101.4	0.79	0.70	0.79	47.4
11	T1	All MCs	983	2.0	983	2.0	0.568	19.6	LOS B	14.2	101.4	0.79	0.70	0.79	56.1
12	R2	All MCs	104	0.0	104	0.0	*0.641	48.7	LOS D	4.3	30.0	1.00	0.82	1.10	35.2
Approach			1088	1.8	1088	1.8	0.641	22.3	LOS B	14.2	101.4	0.81	0.71	0.82	53.1
All Vehicles			2426	1.6	2426	1.6	0.679	20.2	LOS B	18.3	130.1	0.74	0.70	0.75	54.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

\* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE [ Ped Dist ]		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Wyndella Road (S)												
P1	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06

East: New England Highway (E)												
P2	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06
North: Wyndella Road (N)												
P3	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06
West: New England Highway (W)												
P4	Full	10	11	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06
All	Pedestrians	40	42	34.2	LOS D	0.0	0.0	0.93	0.93	188.1	200.0	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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# MOVEMENT SUMMARY

**Site: 31\_FD\_AM [31\_FD\_AM (Site Folder: Future Development)]**

**Output produced by SIDRA INTERSECTION Version: 9.1.2.202**

New England Highway and Wyndella Road

TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 73 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[ Total HV ]	[ Total HV ]	[ Total HV ]	[ Total HV ]	v/c	sec		[ Veh. ]	[ Dist ]				km/h
			veh/h	%	veh/h	%				veh	m				
South: Wyndella Road (S)															
1	L2	All MCs	107	0.0	107	0.0	0.128	12.5	LOS A	1.3	9.3	0.47	0.67	0.47	54.1
2	T1	All MCs	1	0.0	1	0.0	*0.851	42.9	LOS D	6.2	43.7	1.00	0.99	1.43	33.6
3	R2	All MCs	302	0.0	302	0.0	0.851	48.5	LOS D	6.2	43.7	1.00	0.99	1.43	34.7
Approach			411	0.0	411	0.0	0.851	39.1	LOS C	6.2	43.7	0.86	0.91	1.18	38.3
East: New England Highway (E)															
4	L2	All MCs	76	0.0	76	0.0	0.048	8.1	LOS A	0.3	1.9	0.21	0.65	0.21	57.5
5	T1	All MCs	911	2.0	911	2.0	*0.808	24.5	LOS B	20.5	146.0	0.91	0.84	0.98	52.8
6	R2	All MCs	27	0.0	27	0.0	0.179	42.8	LOS D	1.0	6.8	0.96	0.71	0.96	37.1
Approach			1014	1.8	1014	1.8	0.808	23.8	LOS B	20.5	146.0	0.86	0.82	0.92	52.5
North: Wyndella Road (N)															
7	L2	All MCs	104	0.0	104	0.0	0.361	28.3	LOS B	4.5	31.7	0.88	0.78	0.88	41.1
8	T1	All MCs	1	0.0	1	0.0	0.361	33.9	LOS C	4.5	31.7	0.88	0.78	0.88	39.6
9	R2	All MCs	42	0.0	42	0.0	0.361	39.4	LOS C	4.5	31.7	0.88	0.78	0.88	41.2
Approach			147	0.0	147	0.0	0.361	31.5	LOS C	4.5	31.7	0.88	0.78	0.88	41.1
West: New England Highway (W)															
10	L2	All MCs	12	0.0	12	0.0	*0.664	13.2	LOS A	14.2	101.2	0.89	0.79	0.89	46.7
11	T1	All MCs	934	2.0	934	2.0	0.664	21.9	LOS B	14.3	101.5	0.89	0.78	0.89	54.3
12	R2	All MCs	43	0.0	43	0.0	*0.283	43.6	LOS D	1.6	10.9	0.97	0.73	0.97	37.0
Approach			988	1.9	988	1.9	0.664	22.7	LOS B	14.3	101.5	0.90	0.78	0.90	53.1
All Vehicles			2560	1.4	2560	1.4	0.851	26.3	LOS B	20.5	146.0	0.87	0.82	0.95	49.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

\* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[ Ped ]	[ Dist ]			sec	m	m/sec
					ped	m					
South: Wyndella Road (S)											
P1	Full	10	30.8	LOS D	0.0	0.0	0.92	0.92	184.6	200.0	1.08

East: New England Highway (E)												
P2	Full	10	11	30.8	LOS D	0.0	0.0	0.92	0.92	184.6	200.0	1.08
North: Wyndella Road (N)												
P3	Full	10	11	30.8	LOS D	0.0	0.0	0.92	0.92	184.6	200.0	1.08
West: New England Highway (W)												
P4	Full	10	11	30.8	LOS D	0.0	0.0	0.92	0.92	184.6	200.0	1.08
All	Pedestrians	40	42	30.8	LOS D	0.0	0.0	0.92	0.92	184.6	200.0	1.08

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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# MOVEMENT SUMMARY

**Site: 31\_FD\_PM [31\_FD\_PM (Site Folder: Future Development)]**

**Output produced by SIDRA INTERSECTION Version: 9.1.2.202**

New England Highway and Wyndella Road  
TCS 4907

Site Category: Base Year

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 71 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[ Total HV ]	[ Total HV ]	[ Total HV ]	[ Total HV ]	v/c	sec		[ Veh. ]	[ Dist ]				km/h
			veh/h	%	veh/h	%				veh	m				
South: Wyndella Road (S)															
1	L2	All MCs	63	0.0	63	0.0	0.075	10.5	LOS A	0.6	4.1	0.37	0.64	0.37	55.6
2	T1	All MCs	1	0.0	1	0.0	* 0.527	37.7	LOS C	2.5	17.7	1.00	0.77	1.04	35.2
3	R2	All MCs	137	0.0	137	0.0	0.527	43.3	LOS D	2.5	17.7	1.00	0.77	1.04	36.5
Approach			201	0.0	201	0.0	0.527	33.0	LOS C	2.5	17.7	0.80	0.73	0.83	40.9
East: New England Highway (E)															
4	L2	All MCs	201	0.0	201	0.0	0.125	8.2	LOS A	0.8	5.4	0.22	0.66	0.22	57.5
5	T1	All MCs	931	2.0	931	2.0	* 0.638	14.9	LOS B	15.4	109.6	0.76	0.67	0.76	61.2
6	R2	All MCs	105	0.0	105	0.0	* 0.671	44.7	LOS D	3.9	27.4	1.00	0.83	1.15	36.3
Approach			1237	1.5	1237	1.5	0.671	16.4	LOS B	15.4	109.6	0.69	0.68	0.70	57.3
North: Wyndella Road (N)															
7	L2	All MCs	26	0.0	26	0.0	0.136	30.4	LOS C	1.2	8.5	0.88	0.72	0.88	40.3
8	T1	All MCs	1	0.0	1	0.0	0.136	33.9	LOS C	1.2	8.5	0.88	0.72	0.88	38.8
9	R2	All MCs	13	0.0	13	0.0	0.136	39.4	LOS C	1.2	8.5	0.88	0.72	0.88	40.3
Approach			40	0.0	40	0.0	0.136	33.4	LOS C	1.2	8.5	0.88	0.72	0.88	40.3
West: New England Highway (W)															
10	L2	All MCs	42	0.0	42	0.0	* 0.556	51.4	LOS D	12.5	88.9	0.76	0.69	0.76	51.2
11	T1	All MCs	983	2.0	983	2.0	0.556	54.6	LOS D	12.7	90.2	0.76	0.68	0.76	60.4
12	R2	All MCs	104	0.0	104	0.0	0.664	44.9	LOS D	3.9	27.1	1.00	0.83	1.15	36.5
Approach			1129	1.8	1129	1.8	0.664	53.6	LOS D	12.7	90.2	0.78	0.70	0.80	56.6
All Vehicles			2607	1.5	2607	1.5	0.671	34.0	LOS C	15.4	109.6	0.74	0.69	0.76	54.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

\* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed	
		ped/h	ped/h	sec	[ Ped ]	[ Dist ]			sec	m	m/sec	
					ped	m						
South: Wyndella Road (S)												
P1	Full	10	11	29.8	LOS C	0.0	0.0	0.92	0.92	183.6	200.0	1.09

East: New England Highway (E)												
P2	Full	10	11	29.8	LOS C	0.0	0.0	0.92	0.92	183.6	200.0	1.09
North: Wyndella Road (N)												
P3	Full	10	11	29.8	LOS C	0.0	0.0	0.92	0.92	183.6	200.0	1.09
West: New England Highway (W)												
P4	Full	10	11	29.8	LOS C	0.0	0.0	0.92	0.92	183.6	200.0	1.09
All	Pedestrians	40	42	29.8	LOS C	0.0	0.0	0.92	0.92	183.6	200.0	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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## APPENDIX C

# Model scoping memo



