ROSALIND PARK PLANNING PROPOSAL, MENANGLE PARK

TRAFFIC IMPACT ASSESSMENT

PREPARED FOR LEDA HOLDINGS PTY LTD | FINAL DRAFT JULY 2022
300303568

Stantec

Revision	Description	Date	Author	Quality Check	Approver
A-Dr	Draft	1//07/2022	Connor Hoang	Carla Bradley	Steve Manton
B-Dr	Updated Draft	25/07/2022	Connor Hoang	Carla Bradley	Steve Manton
C-Dr	Final Draft	29/07/2022	Connor Hoang	Carla Bradley	Steve Manton

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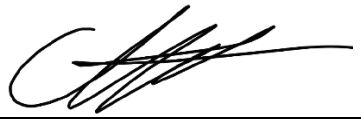
Prepared by: 

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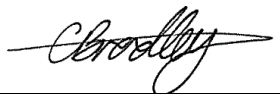
Reviewed by: 

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1 Introduction

1.1 Background

The Rosalind Park planning proposal is being lodged with Campbelltown City Council (Council) for the rezoning of land located at 33 Medhurst Road and 101 and 111 Menangle Road, Menangle Park.

Stantec has been engaged by Leda Holdings Pty Ltd to complete a Transport Impact Assessment (TIA) for the proposal.

1.2 Proposal

The planning proposal involves rezoning of land located at Medhurst Road and Menangle Road, Menangle Park to allow for residential, retail, community and educational uses. The site would include between 1,346 to 1,648 residential dwellings with a target yield of 1,450 dwellings, a primary school with capacity for 1,000 students and 70 full time equivalent (FTE) staff, and associated sporting fields. Given the size of the development, construction works will be staged with approximately 200 dwellings being constructed per year over a six-to-eight-year period, with the first lot release commencing in 2024 and full completion targeted for 2032 (assuming an eight year construction period). The school would be completed following completion of the final residential lot, opening in 2034 at 50% capacity and ramping up to full capacity by 2039. The school would primarily serve residents of the estate.

1.3 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposed development, including consideration of the following:

- existing traffic and parking conditions surrounding the site
- suitability of the proposed parking in terms of supply (quantum) and layout
- service vehicle requirements
- pedestrian and bicycle requirements
- the traffic generating characteristics of the proposed development
- suitability of the proposed access arrangements for the site
- the transport impact of the development proposal on the surrounding road network.

1.4 References

In preparing this report, reference has been made to the following:

- Campbelltown (Sustainable City) Development Control Plan (DCP) 2015

- Campbelltown Local Environmental Plan (LEP) 2015
- Australian Standard/ New Zealand Standard, Parking Facilities, Part 1: Off-Street Car Parking AS/NZS 2890.1:2004
- Australian Standard, Parking Facilities, Part 2: Off-Street Commercial Vehicle Facilities AS 2890.2:2018
- Australian Standard / New Zealand Standard, Parking Facilities, Part 6: Off-Street Parking for People with Disabilities AS/NZS 2890.6:2009
- plans for the proposal prepared by LEDA (drawing no. LEDME-13-001-1, rev H).
- other documents and data as referenced in this report.

2 Strategic Context

2.1 State and Regional Policies and Strategic Context

State and regional policies provide future direction for the development of NSW and, in this case, Greater Sydney. This includes policies for how infrastructure, housing and employment will be planned and implemented throughout Greater Sydney, and the local South-west Sydney region which in-turn have informed the transport planning and assumptions for the subject site. Policies and plans that would apply and be relevant to the subject site include:

- Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018)
- Western City District Plan (Greater Sydney Commission, 2018)
- Future Transport 2056 (Transport for NSW, 2018)
- Greater Macarthur Investigation Area (Department of Planning and Environment, 2015-2017).

In addition to the above, several infrastructure works packages have been planned by Campbelltown City Council and TfNSW, which have also been considered.

2.1.1 GREATER SYDNEY REGION PLAN

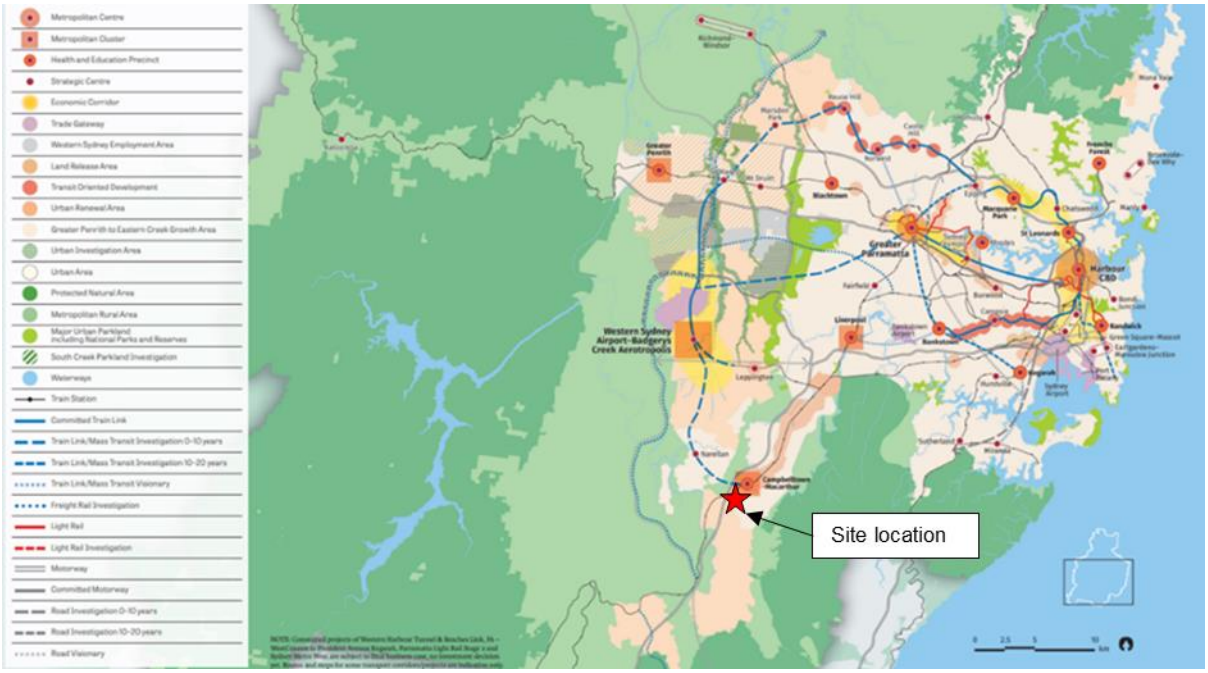
The Greater Sydney Region Plan, published in March 2018 by the Greater Sydney Commission, provides a 40-year vision and a 20-year plan to 2036. Within the document, the Greater Sydney Region is split into the three following cities:

- The Western Parklands City encompassing Campbelltown and Macarthur, Liverpool and Penrith as well as the to-be-built Western Sydney Airport Aerotropolis and Employment area.
- The Central River City encompassing Greater Parramatta and surrounding regions including the North-west Growth Area.
- The Eastern Harbour City encompassing Sydney CBD, eastern, northern and southern suburbs.

The 20-year plan as proposed within the Greater Sydney Region Plan outlines a range of transport and infrastructure initiatives to support already established and yet-to-be developed precincts, centres and clusters. This includes mass transit investigations, committed train links, urban area investigations and protected natural areas. These initiatives and investigations are a result of directions within the plan to increase and diversify housing supply within Greater Sydney as well as provide efficient and connected places with a key direction being a 30-minute commute between home and work for most residents.

The Greater Sydney Structure Plan 2056 is shown indicatively in Figure 1.

Figure 1: Greater Sydney Structure Plan 2056 – The Three Cities



Source: Greater Sydney Commission

In South West Sydney, the plan identifies the need to grow the Campbelltown-Macarthur and Liverpool strategic centres by providing continued employment and housing growth to support their surrounding communities.

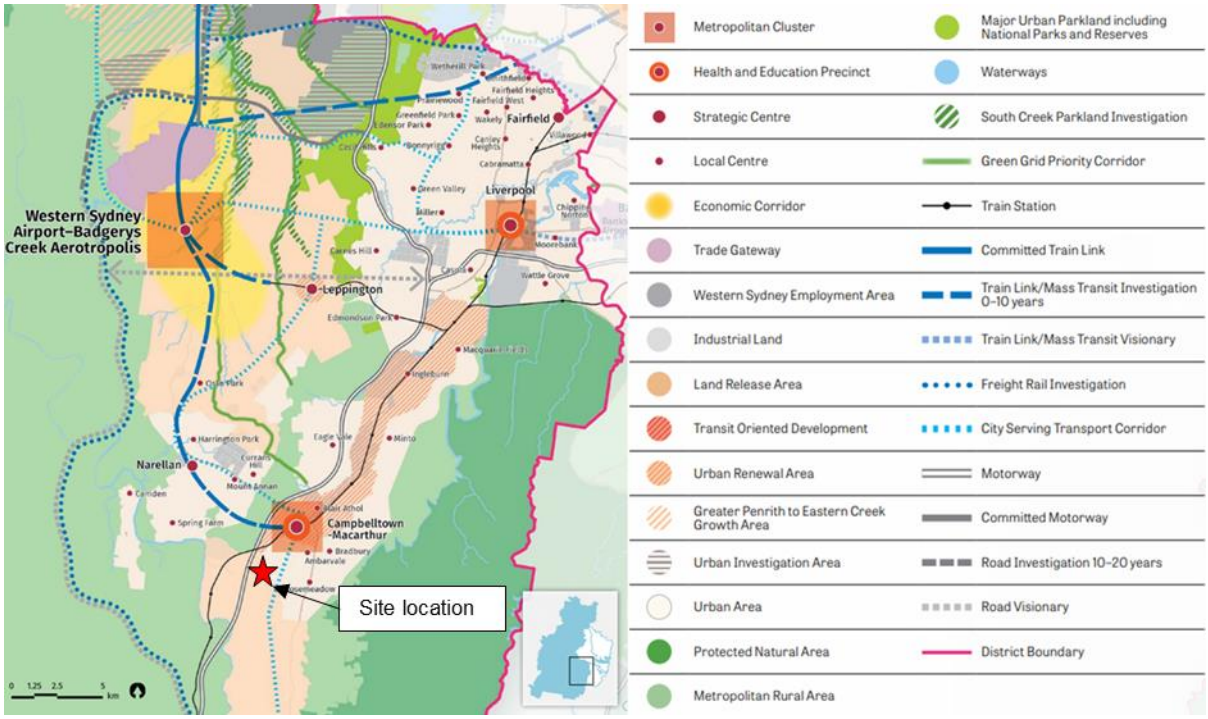
The potential for a new priority growth area comprising greenfield sites located south and south-west of Campbelltown-Macarthur, known as the Macarthur South Investigation Area, was identified to support regional housing targets. The subject development site forms one such component of that area. Likewise, in achieving the goal of locating workplaces closer to homes, key employment areas are proposed throughout the Western Sydney region. These include the Western Sydney Employment Area and Badgerys Creek Airport Precinct.

2.1.2 WESTERN CITY DISTRICT PLAN

The Western City District Plan is a continuation of the Greater Sydney Region Plan and focusses on the Western Parklands City and district. The Western City District Plan proposes a package of priority growth areas, urban investigations, transport and infrastructure to support growth in a number of strategic centres and metropolitan city clusters such as Campbelltown-Macarthur, Greater Penrith, Liverpool and Western Sydney Airport by 2036. Activities in these four locations will be influenced by a significant population growth, diversification of jobs in Western Sydney and bringing jobs closer to homes. Estimates of between 6,300 and 10,600 new jobs are proposed for Campbelltown-Macarthur by 2036.

The infrastructure plan as part of the Western City District Plan is shown in Figure 2.

Figure 2: Western City District infrastructure plan



Source: Greater Sydney Region Plan (2018) Greater Sydney Commission

The subject site forms part of the south-western area of land release within the Western City District which includes boosting housing supply and diversity, as well as jobs.

2.1.3 FUTURE TRANSPORT 2056

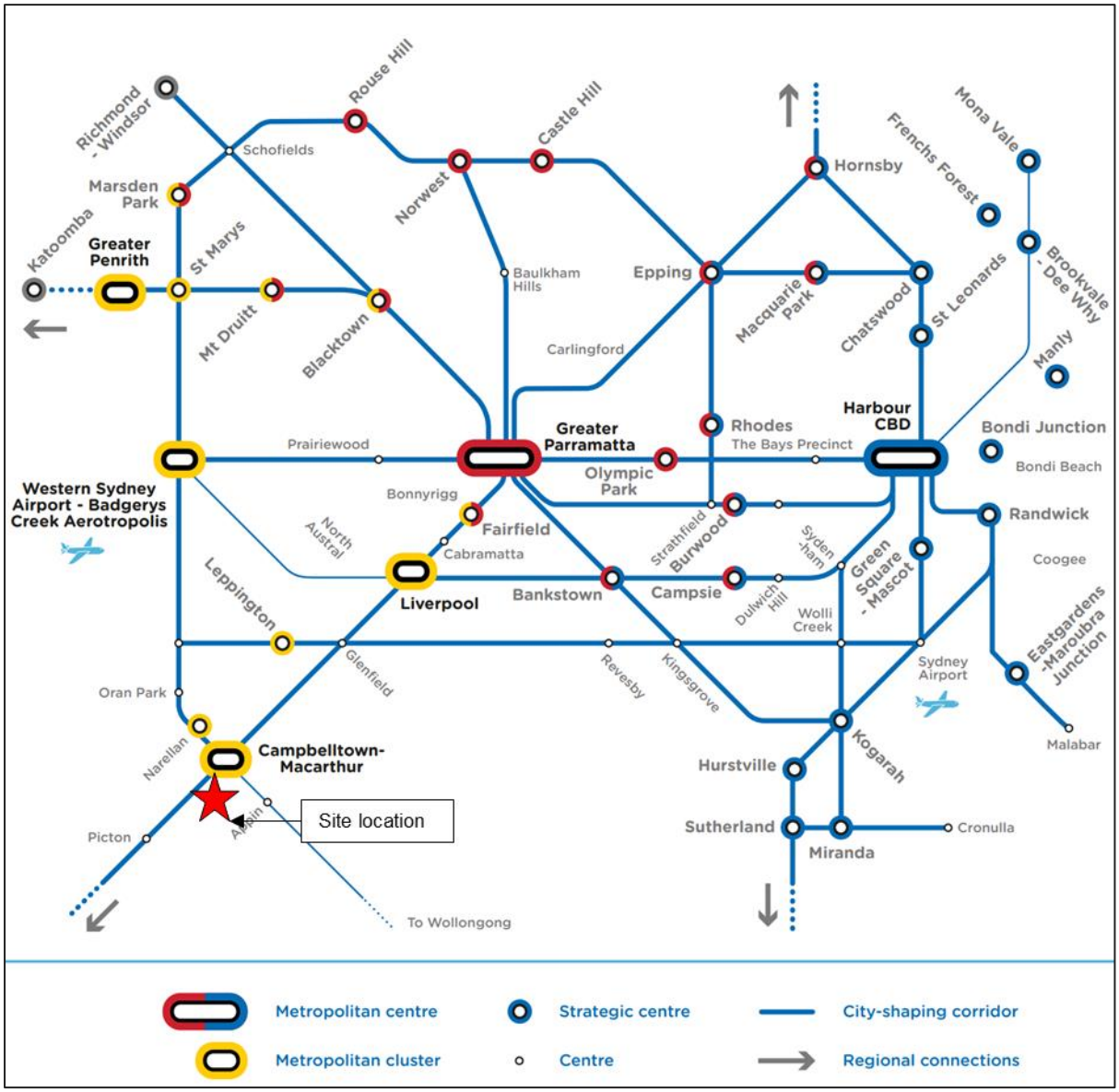
Future Transport 2056 provides a 40-year strategy for how transport will be planned, amended and forecasted within NSW, both regional and metropolitan, for the expected 12 million residents within the state. Future Transport 2056 follows on from the 2012 Long Term Transport Master Plan which listed over 700 transport projects, the majority of which are completed or in progress. It also ties in with the Greater Sydney Region Plan and the subsequent district plans to support the three cities metropolis vision.

Future Transport 2056 is supported by two key documents, the Greater Sydney Services and Infrastructure Plan and the Regional NSW Services and Infrastructure Plan, which provide guidance and planning for these areas.

From a metropolitan view, Future Transport 2056 and associated plans support the 30-minute city where jobs and services are within 30 minutes of residents in Greater Sydney. Strategic transport corridors to move people and goods are outlined between metropolitan and strategic centres, clusters and surrounds. The Movement and Place framework is also emphasised to support liveability, productivity and sustainability.

For the Campbelltown and Macarthur Region, a city-shaping corridor is planned which can take the form of road or rail. The 2056 network vision for Greater Sydney is shown in Figure 3.

Figure 3: Future Transport 2056 network vision



Source: *Future Transport 2056* (2018) NSW Government

The initiatives, projects and investigations as outlined within Future Transport 2056 that are relevant to the site are listed in Table 1.

Table 1: Transport Initiatives and Investigations

Timeframe	Mode	Initiative/ Investigation
0-10 years committed	Road	Western Sydney Infrastructure Plan including the Northern Road Upgrade from Peter Brock Drive to Jamison Road
0-10 years investigation	Rail	North-South Rail Link extension from WSA-Badgerys Creek Aerotropolis to Campbelltown-Macarthur
0-10 years investigation	Bus	Infrastructure to support rapid bus connections between WSA-Badgerys Creek Aerotropolis and Greater Penrith, Liverpool, Blacktown and Campbelltown-Macarthur.

Timeframe	Mode	Initiative/ Investigation
0-10 years investigation	Rail	Passenger train improvements to support growth at Wilton.
0-10 years investigation	Bus	Improved bus connections between South-west Sydney and Illawarra
0-10 years investigation	Road	Appin and Picton Road improvements.
0-10 years investigation	Rail	Completion of Maldon to Dombarton railway line
20+ years investigation	Road	Outer Sydney Orbital from Western Sydney Airport – Badgerys Creek Aerotropolis to Hume Motorway.
20+ years investigation	Road	Outer Sydney Orbital from Hume Motorway to Illawarra

2.1.4 GREATER MACARTHUR LAND RELEASE INVESTIGATION – PRELIMINARY STRATEGY & ACTION PLAN (2015)

The Greater Macarthur Land Release Investigation - Preliminary Strategy & Action Plan has been issued by the NSW Department of Planning and Environment to guide land release within the Greater Macarthur area.

The Greater Macarthur Land Release Investigation proposes urban development within two distinct Priority Precincts along the Hume Highway: the Menangle Park/ Mount Gilead Precinct and the Wilton Precinct.

Both Menangle Park and Mount Gilead are proposed to include town centres thereby being somewhat self-sustaining but with additional services and employment opportunities available in Campbelltown, Camden and the broader Western Sydney region.

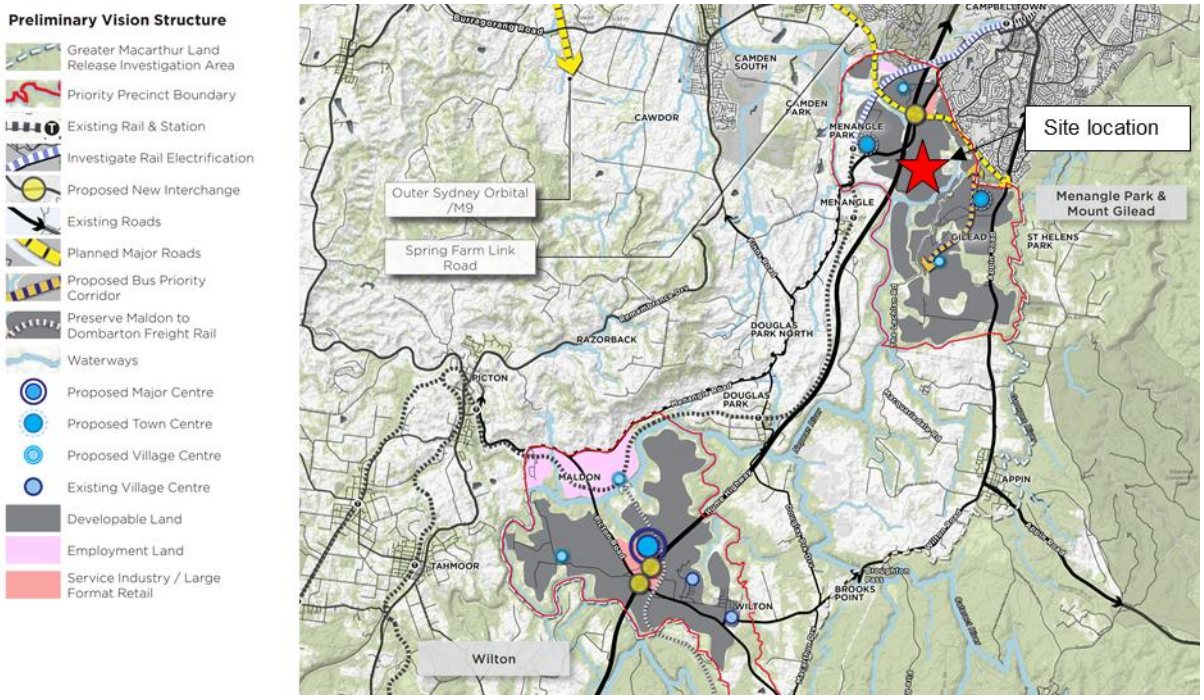
Wilton would present a new major centre with associated employment, retail, health and other services for the region. Wilton would cater for a growing population within Wollondilly Shire including housing and employment and services.

In terms of transport infrastructure, the Preliminary Strategy and Action Plan for the Greater Macarthur Priority Growth Area outlines the following for Greater Macarthur, which has been considered in the context of this Proposal:

- Construction of Spring Farm Parkway, linking the Menangle Park subdivision area to Menangle Road, Appin Road, Hume Highway and Camden Bypass, and new access ramps to the Hume Highway
- Upgrades to Menangle Road, Appin Road and Picton Road
- Upgrade of the Hume Highway between Picton Road and Raby Road and upgrade of Picton Road/ Hume Highway interchange including the provision of new northern access ramps
- Construction of a bus priority corridor and further corridor protection
- Further investigation of the feasibility of the electrification of the Southern Highland Rail Line to Menangle Park.

The Greater Macarthur Priority Growth Area and the subject site are shown in Figure 4.

Figure 4: Greater Macarthur Priority Growth Area



Source: Greater Macarthur Land Release Investigation – Preliminary Strategy and Action Plan (2015) Department of Planning & Environment

2.1.5 GREATER MACARTHUR INVESTIGATION AREA – STRATEGIC TRANSPORT INFRASTRUCTURE STUDY (2017)

The Strategic Transport Infrastructure Study prepared by Jacobs in 2017 for the Department of Planning & Environment proposes a new structure plan for the Greater Macarthur Investigation Area (GMIA) for the 2051 long-term vision. It is understood that the preferred structure plan has not yet been endorsed by the Government and is currently being revised.

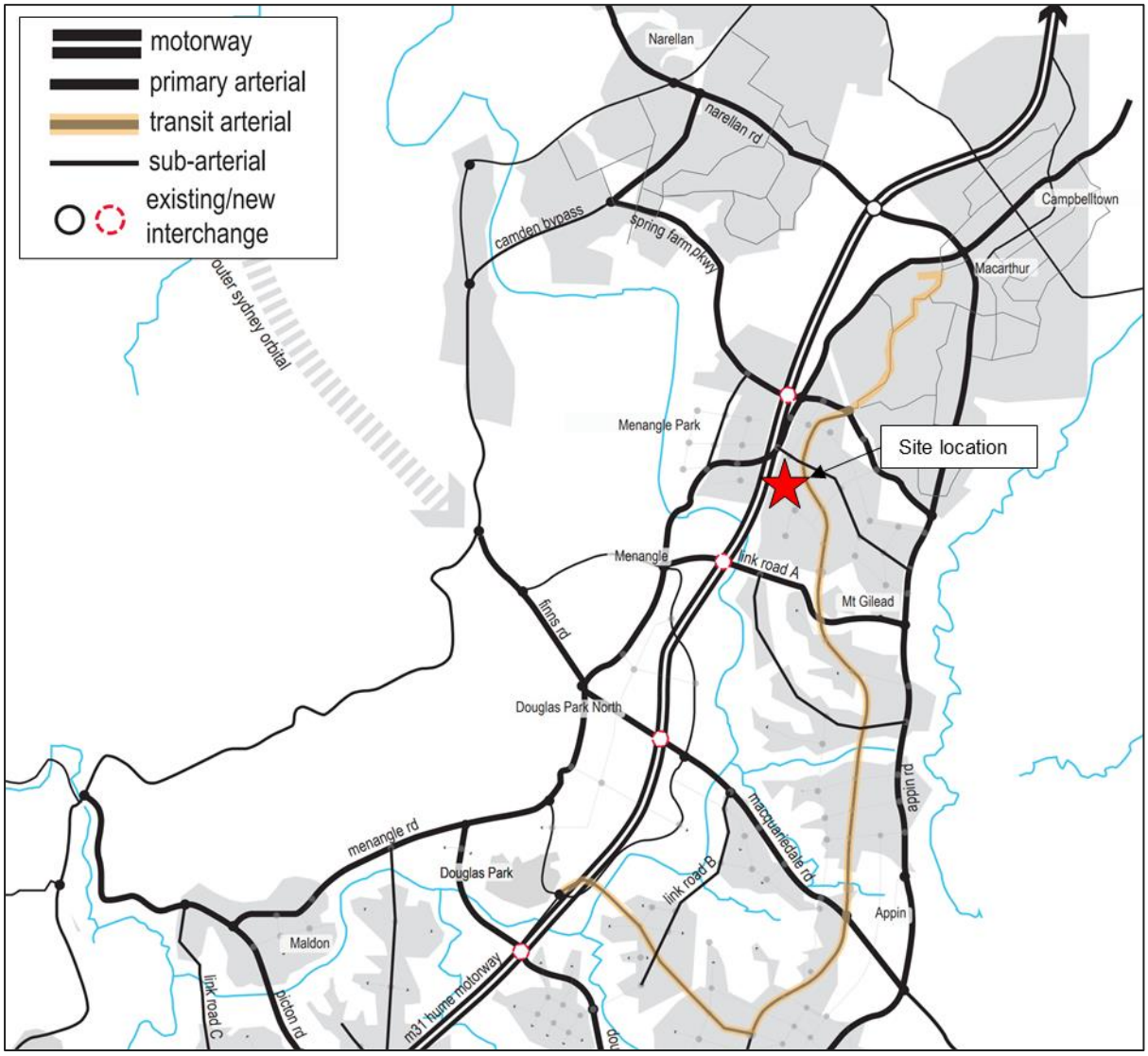
The study considers the following long-term land use scenario for the year 2051 (Table 2). It includes new developments in West Appin in addition to already identified precincts in Mt Gilead, Menangle Park and Wilton.

Table 2: Population and employment projections 2051

Precinct	Population	Jobs
Mt Gilead & Menangle Park	60,000	10,000
West Appin	60,000	9,000
Wilton	40,000	11,000
Total	160,000	30,000

The future strategic road transport network proposed in the study is presented in Figure 5.

Figure 5: Strategic road network



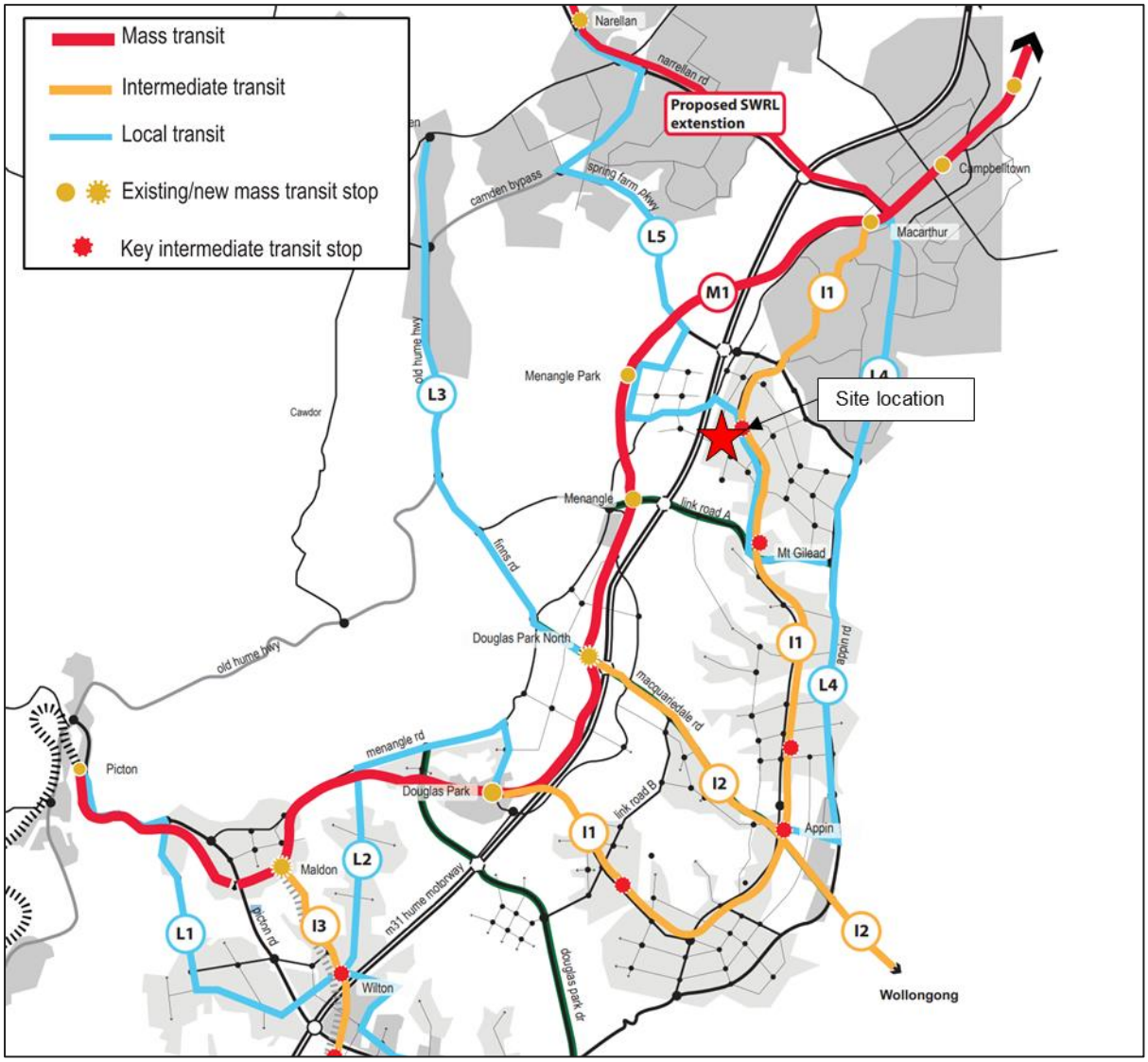
Source: Greater Macarthur Investigation Area – Strategic Transport Infrastructure Study (2017), Department of Planning & Environment

Additional road infrastructure proposed in this study in relation to the previous plan includes:

- New Southeast-Northwest oriented connections across the Macarthur Area, including new links between Menangle/ Menangle Park and Gilead
- Upgrades to the Hume Highway and additional new interchanges.

The future public transport network proposed in the study is presented in Figure 6.

Figure 6: Strategic public transport network



Source: Greater Macarthur Investigation Area – Strategic Transport Infrastructure Study (2017), Department of Planning & Environment

Additional public transport infrastructure proposed in this study in relation to the previous plan includes:

- Long-term electrification and quadruplication of the Southern Highlands rail line (South of Macarthur to Picton)
- Additional train stations along the Southern Highland Line at Douglas Park North and Maldon
- New Southeast-Northwest oriented intermediate transit connections to link new developments to the Southern Highland Line train stations
- New propositions on local transit links, including a route from Appin to Narellan via Menangle Park.

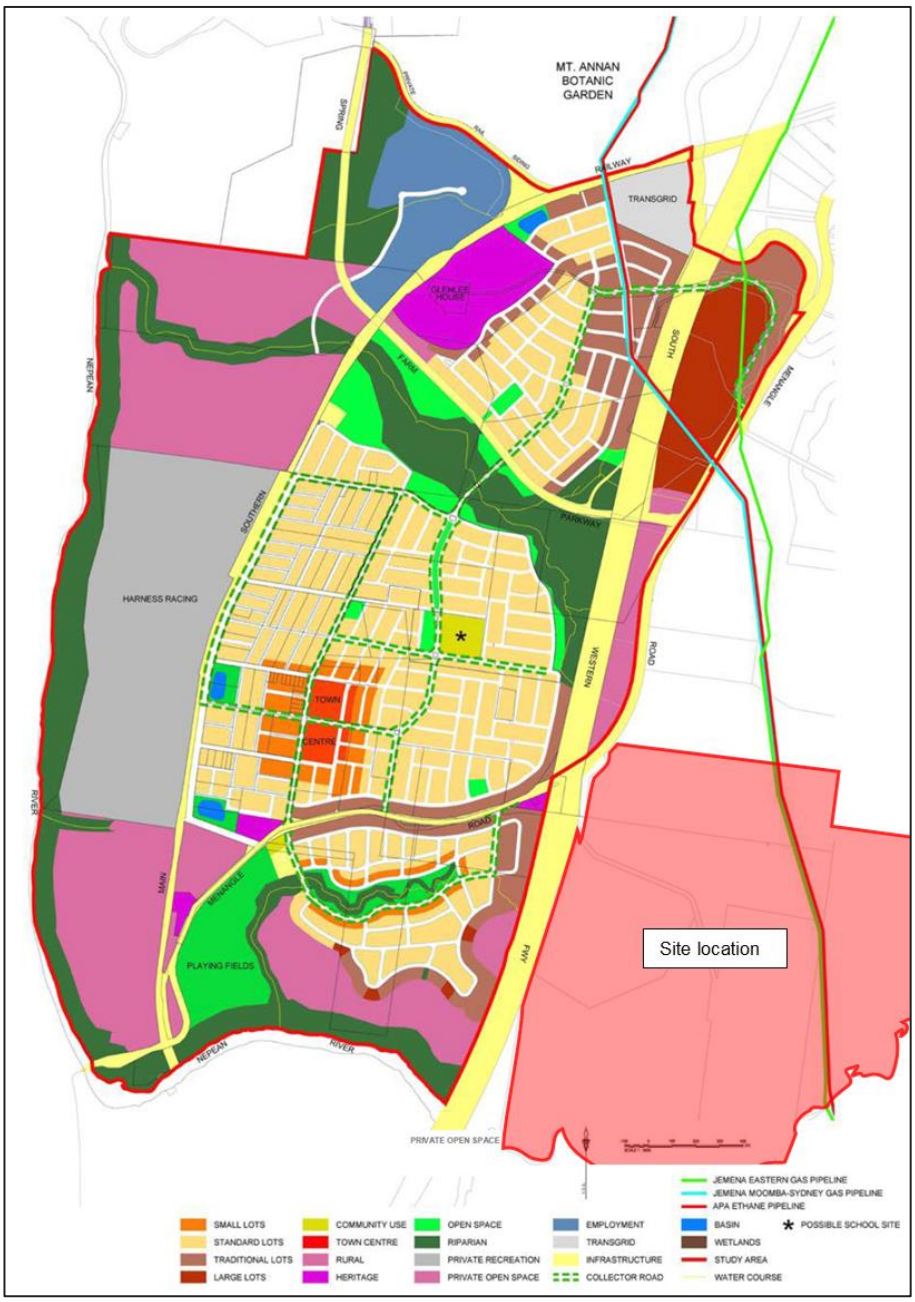
2.2 Surrounding Developments

2.2.1 MENANGLE PARK URBAN RELEASE AREA

The Menangle Park URA is 958 hectares in area and will accommodate about 3,500 residential allotments (varying in densities, lot sizes and dwelling types), as well as a large town centre comprising retail/ employment uses.

The existing urban structure from DCP 2016 is shown in Figure 7.

Figure 7: Menangle Park URA urban structure plan



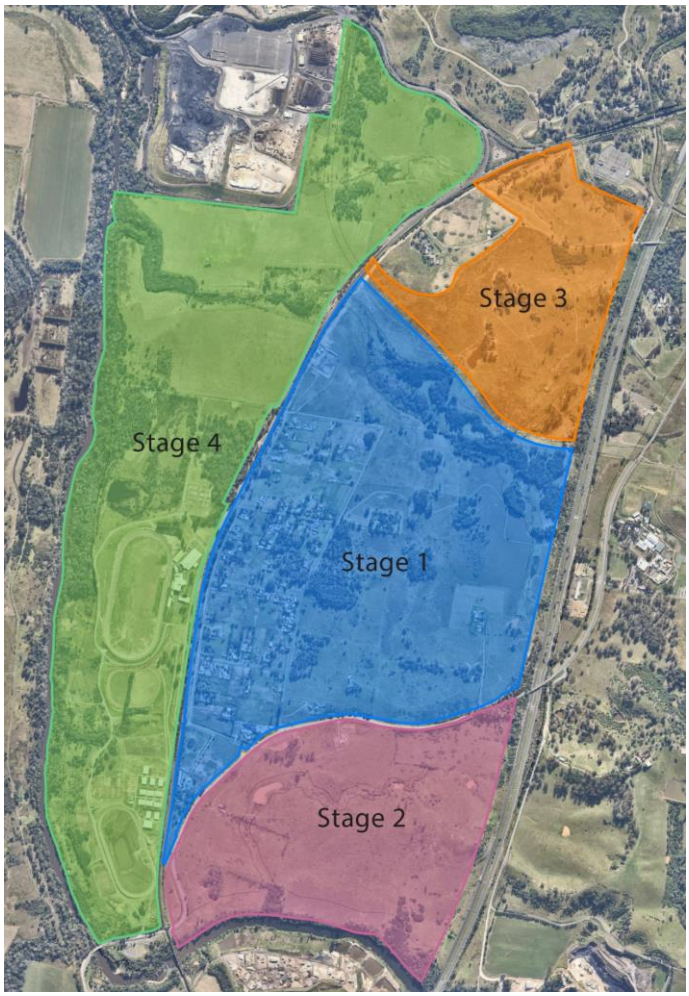
Source: DCP 2016, Campbelltown City Council

The development is aimed to be constructed in four stages as illustrated in Figure 8 and summarised below:

- Stage 1 – Menangle Park Central and Village
- Stage 2 – Menangle Park South
- Stage 3 – Menangle Park North
- Stage 4 – Paceway, Employment and Environmental.

Construction has been impacted due to the COVID-19 pandemic and currently only the residential allotments for Stage 1 and 2A have been completed. However, these areas are still largely undeveloped lots with limited dwellings completed and occupied. Development, planning and approval of Stage 4 is currently unknown and not expected to begin construction until well into the future.

Figure 8: Menangle Park URA staging plan



Source: Campbelltown City Council Part 8A Menangle Park Precinct Development Control Plan October 2021

2.2.2 MOUNT GILEAD ESTATE

The Mount Gilead site is a greenfield site located south-east of the Rosalind Park site. A new residential estate is proposed at the site which it is understood would comprise approximately 1,700 lots varying in size from 375 to 700 square metres. The proposal would also include a new town centre and community hub.

Although located in close proximity to the Rosalind Park site, access would be via Appin Road only and thus its development traffic is unlikely to impact the operation of intersections surrounding the Rosalind Park site.

2.3 Transport Infrastructure Upgrades

As identified in Section 2.1.4 of this report, there are several actions stemming from the Greater Macarthur Priority Growth Area. This includes the construction of Spring Farm Parkway, widening of Menangle Road and new access ramps to the Hume Motorway.

2.3.1 SPRING FARM PARKWAY

The upgrade of Spring Farm Parkway is proposed to be completed in two stages with Stage 1 in the final phase of design and Stage 2 undergoing design option development.

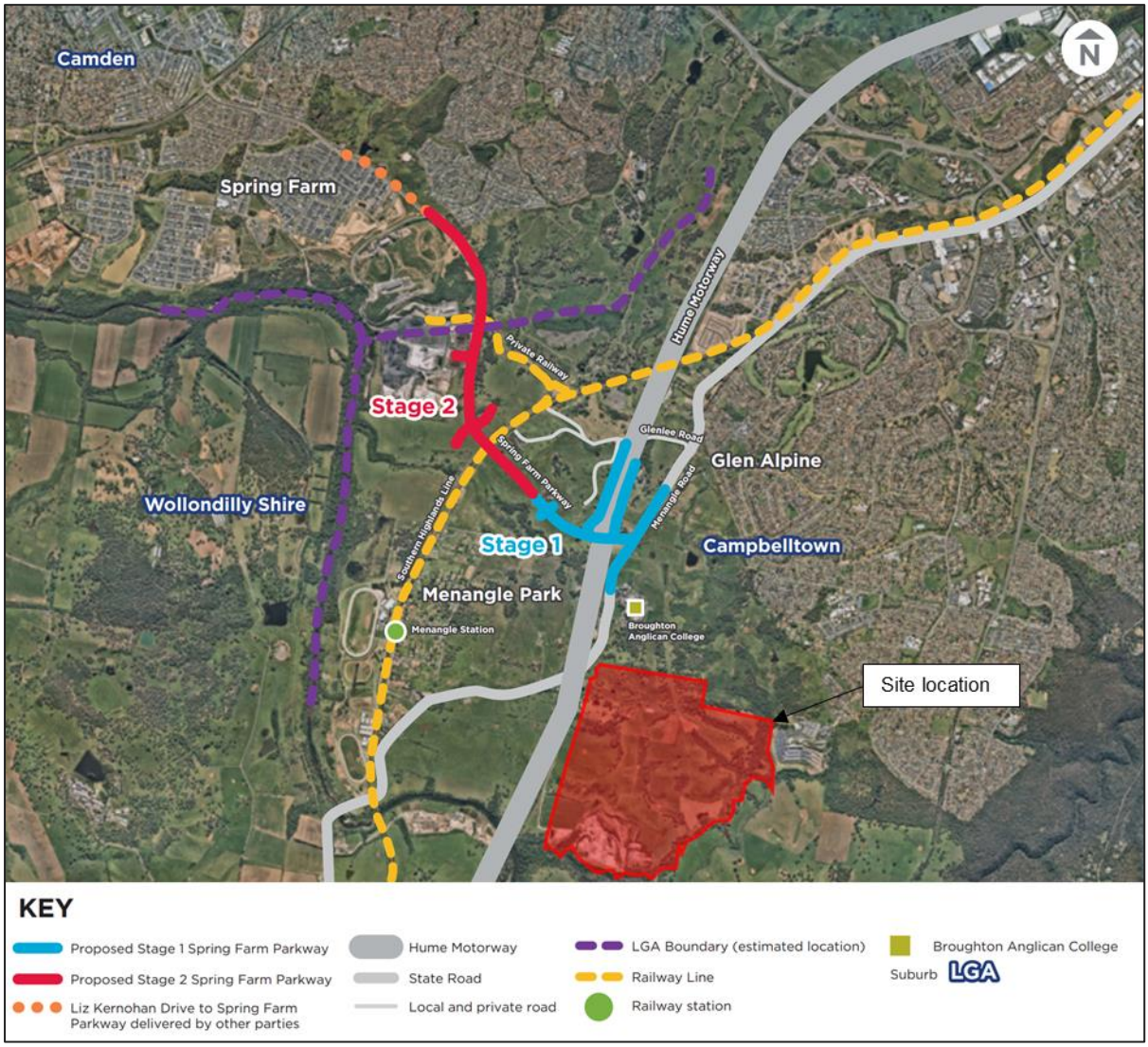
Stage 1 will include 2.5 kilometres of road linking Menangle Park with the Hume Motorway via north facing entry and exit-ramps. Stage 2 will complete the east-west link between Spring Farm and Menangle Park.

Once complete, Spring Farm Parkway will provide the key access to the Hume Motorway for land release areas in Menangle Park and Spring Farm, thereby reducing traffic volumes on Menangle Road, Camden Bypass and Narellan Road to the north.

Furthermore, Spring Farm Parkway would provide a key connection between Menangle Park and key employment hubs including Narellan and destinations further to the west via The Northern Road. This connection would operate as an alternative to the congested Narellan Road, which would otherwise accommodate these trips.

The Spring Farm Parkway upgrade is shown in Figure 9.

Figure 9: Spring Farm Parkway upgrade



Source: TfNSW

2.3.2 MENANGLE ROAD

As outlined in the Greater Macarthur Land Use and Infrastructure Plan and the Greater Macarthur Investigation Area Strategic Transport Infrastructure Study, Menangle Road is expected to be upgraded to a four-lane divided carriageway (two lanes in each direction) with active transport. The proposed upgrades are understood to extend between Tindall Street in the north and Cummins Road to the south, with the strategic business case currently underway.

The road would intersect with Spring Farm Parkway Stage 1 providing access to the north facing ramps onto the Hume Motorway.

3 Existing Conditions

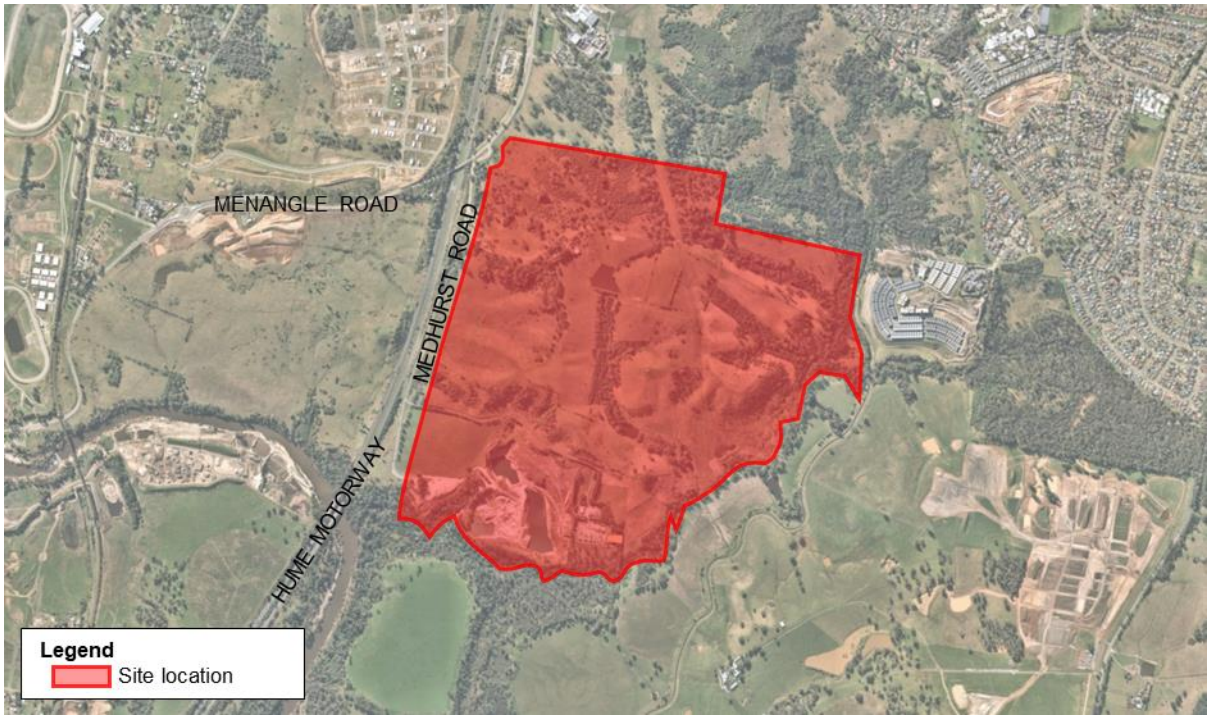
3.1 Site Overview

The subject site is located at 33 Medhurst Road and 101 and 111 Menangle Road, Menangle Park, about seven kilometres south west of Campbelltown. It is legally described as Lot 1/ DP58924, Lot 35/ DP230946, Lot 58/ DP632328, and Lots 1, 2 and 3/ DP622362. The site occupies a 265.5 hectare parcel of land and is accessed via Medhurst Road, which connects to Menangle Road in the north.

The site currently has a land use classification of RU2 Rural Landscape and largely comprises undeveloped land. An existing quarry is located at the southern extent of the site. The surrounding land uses are similarly undeveloped. It is noted that the Greater Macarthur Land Release Investigation – Preliminary Strategy and Action Plan identified the proposed land as 'developable land'.

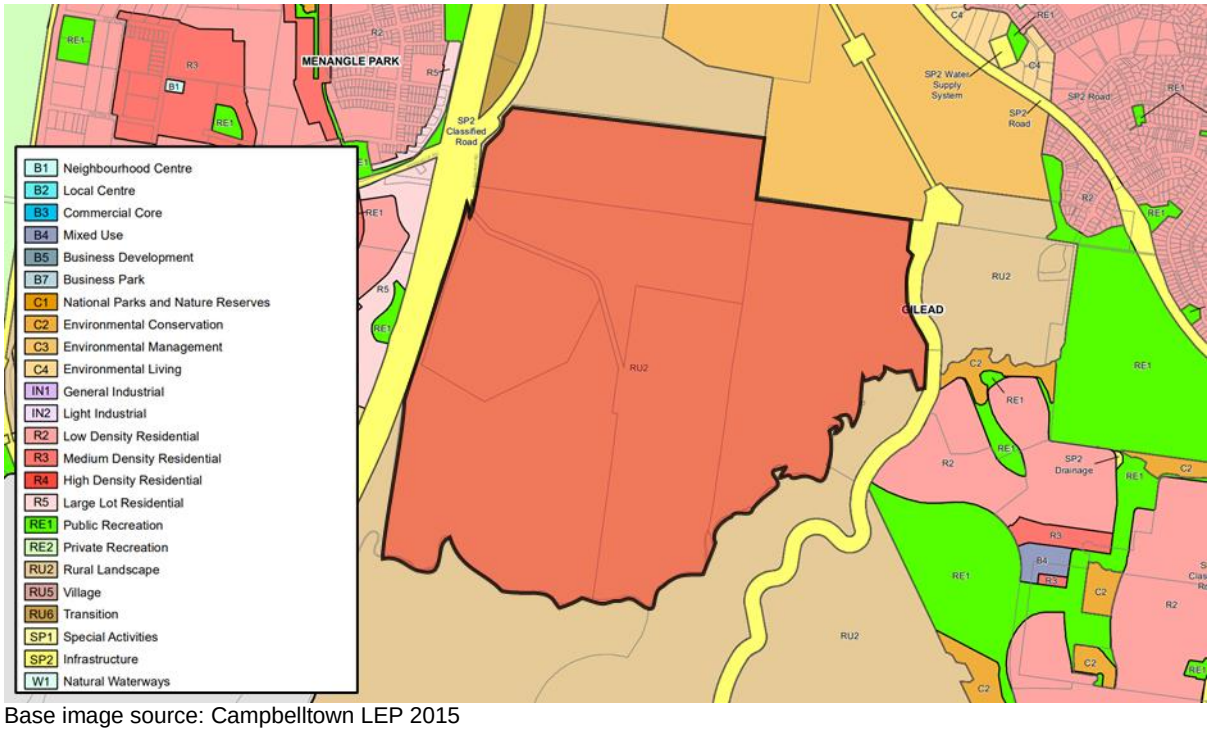
The location of the subject site and its surrounding environs is shown via the aerial view provided in Figure 10, while the Land Use Map is shown in Figure 11.

Figure 10: Aerial view of the subject site



Base image source: Nearmap

Figure 11: Land Use Map



Base image source: Campbelltown LEP 2015

3.2 Transport Network

3.2.1 ROAD HIERARCHY

Roads are classified according to the functions they perform. The main purpose of defining a road's functional class is to provide a basis for establishing the policies which guide the management of the road according to their intended service or qualities.

In terms of functional road classification, State roads are strategically important as they form the primary network used for the movement of people and goods between regions, and throughout the State. Transport for NSW (TfNSW) is responsible for funding, prioritising and carrying out works on State roads. State roads generally include roads classified as freeways, state highways, and main roads under the Roads Act 1993, and the regulation to manage the road system is stated in the Australian Road Rules.

TfNSW defines four levels in a typical functional road hierarchy, ranked from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- Arterial Roads – Controlled by TfNSW, typically no limit in flow and designed to carry vehicles long distances between regional centres.
- Sub-Arterial Roads – Managed by either Council or TfNSW under a joint agreement. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region or provide connectivity from arterial road routes (regional links).

- Collector Roads – Provide connectivity between local sites and the sub-arterial road network, and typically carry between 2,000 and 10,000 vehicles per day.
- Local Roads – Provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

3.2.2 SURROUNDING ROAD NETWORK

The surrounding road network is characterised by Menangle Road and Medhurst Road, which are summarised in Table 3.

Table 3: Surrounding road network

Road	Classification	Description
Menangle Road	State Road (Arterial Road)	• North-south connector between Campbelltown centre and Picton Road at Maldon. • Undivided carriageway configured with one travel lane in each direction set within a 13-metre-wide carriageway. • 80km/h speed zoning, however, a 40km/h school zone begins about 300m north of the Medhurst Road intersection. • Kerbside parking is not permitted.
Medhurst Road	Local Road	• Local road orientated in a general north-south direction providing access to the quarry and other lots. • Undivided carriageway permitting two-way movements set within a 7-metre-wide carriageway. • Parts of the road (particularly near Menangle Road) exhibit potholes and show signs of deterioration. There is also no centreline or edge line pavement marking near Menangle Road. • Default speed zone limit applies. • Kerbside parking is not permitted. • At southern extents it becomes a private road with a 40km/h posted speed limit.

Menangle Road and Medhurst Road are shown in Figure 12 to Figure 15.

Figure 12: Menangle Road (looking north)

Figure 13: Menangle Road (looking south towards intersection of Medhurst Road)

Figure 14: Medhurst Road private road (looking south)

Figure 15: Medhurst Road (near Menangle Road) showing lack of shoulder and linemarking

3.3 Existing Volumes

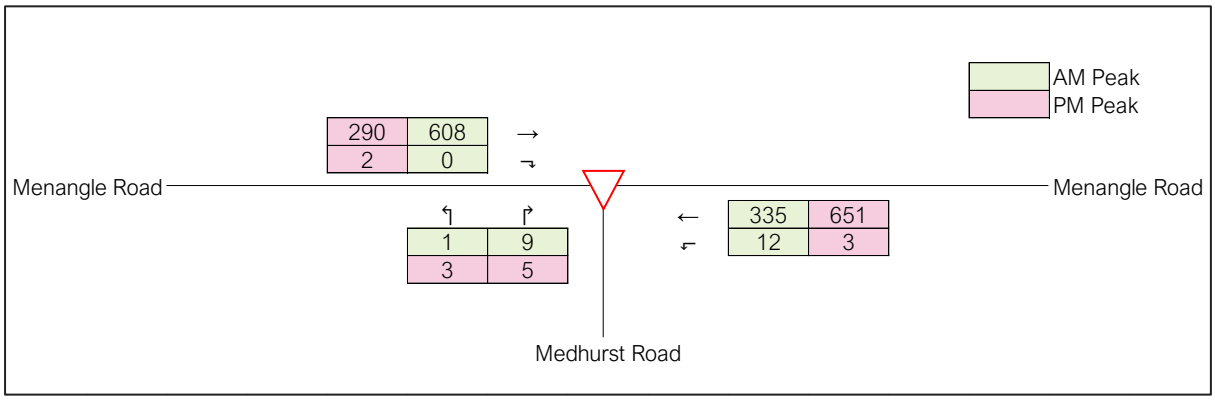
3.3.1 INTERSECTION VOLUMES

Stantec commissioned traffic movement counts at the Menangle Road/ Medhurst Road intersection on 9 June 2022 during the following peak periods:

- 7:00am to 10:00am
- 3:00pm to 6:00pm.

The AM and PM peak hours were found to occur from 7:45am to 8:45am and 4:30pm to 5:30pm respectively, with traffic volumes summarised in Figure 16. Full survey results are contained in Appendix A.

Figure 16: Existing peak hour traffic volumes



3.3.2 AVERAGE DAILY TRAFFIC VOLUMES

To supplement the intersection surveys, Stantec commissioned automatic tube counts (ATC) on Menangle Road approximately 200 metres north of the Medhurst Road intersection from 9 June to 22 June 2022. Data from the first week (9 June to 15 June) has been excluded given it contained a public holiday.

The ATC data indicates that traffic volumes on the day of the intersection survey (9 June 2022) were representative of normal conditions. Therefore, no adjustments have been made to the intersection survey volumes presented above.

The key findings are summarised below:

- Volumes are generally consistent throughout the weekdays, and it is evident that the dominant direction of travel is northbound during the AM period and southbound during the PM period.
- The weekday road network peak periods along Menangle Road occur at approximately 7:00am to 9:00am and 4:00pm to 6:00pm (noting that ATC's report data hourly and therefore differ slightly from the peak hour observed from the intersection survey).

- The weekday average daily traffic volumes (in both directions) along Menangle Road were approximately 7,800 vehicles.
- During the ATC recorded peak hour period the following directional splits were observed:
    - 65 percent northbound and 35 percent southbound during the AM peak hour
    - 66 percent southbound and 34 percent northbound during the PM peak hour.
- A heavy vehicle percentage of approximately six percent was recorded.

The results of the traffic counts along Menangle Road between 16 June to 22 June 2022 for the northbound and southbound traffic are summarised in Figure 17 and Figure 18 respectively, with the survey data included in Appendix A.

Figure 17: Northbound traffic flows

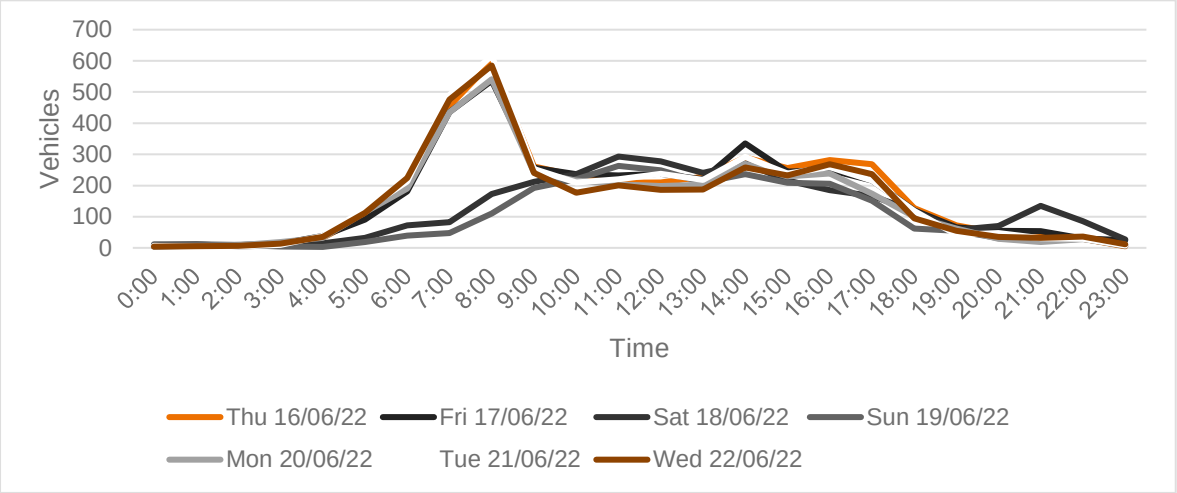
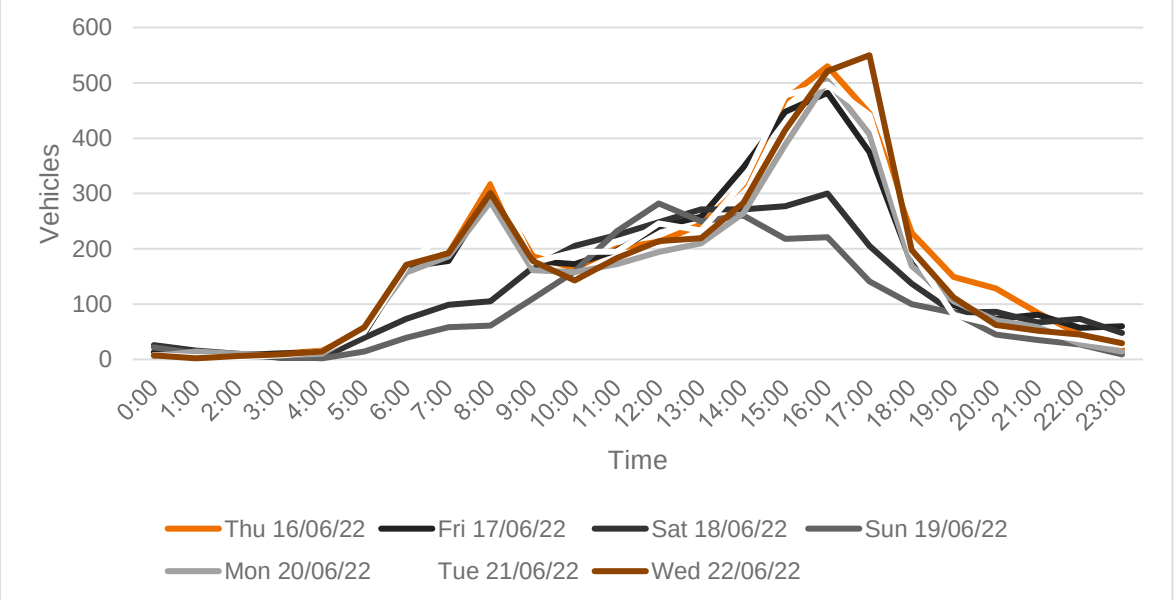


Figure 18: Southbound traffic flows



3.4 Intersection Operation

The operation of the key intersections within the study area has been assessed using SIDRA INTERSECTION (SIDRA), a computer-based modelling package which calculates intersection performance.

The commonly used measure of intersection performance, as defined by TfNSW, is vehicle delay. SIDRA determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 4 shows the criteria that SIDRA adopts in assessing the level of service.

Table 4: SIDRA level of service criteria

Level of service (LOS)	Average delay per vehicle (secs/veh)	Traffic signals, roundabout	Give way & stop sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Table 5 presents a summary of the existing operation of the intersection, with full results presented in Appendix B of this report.

Table 5: Existing Menangle Road/ Medhurst Road intersection operating conditions

Peak	Leg	Degree of saturation (DOS)	Average delay (sec)	95th percentile queue (m)	Level of service (LOS)
AM	South (Medhurst)	0.02	11	0.3	A
	East (Menangle)	0.19	4	0	A
	West (Menangle)	0.34	9	0.1	A
	Overall	**0.34**	**3**	**0.3**	**-**
PM	South (Medhurst)	0.02	11	0.4	A
	East (Menangle)	0.36	7	0	A
	West (Menangle)	0.16	11	0.2	A
	Overall	**0.36**	**0.2**	**0.4**	**-**

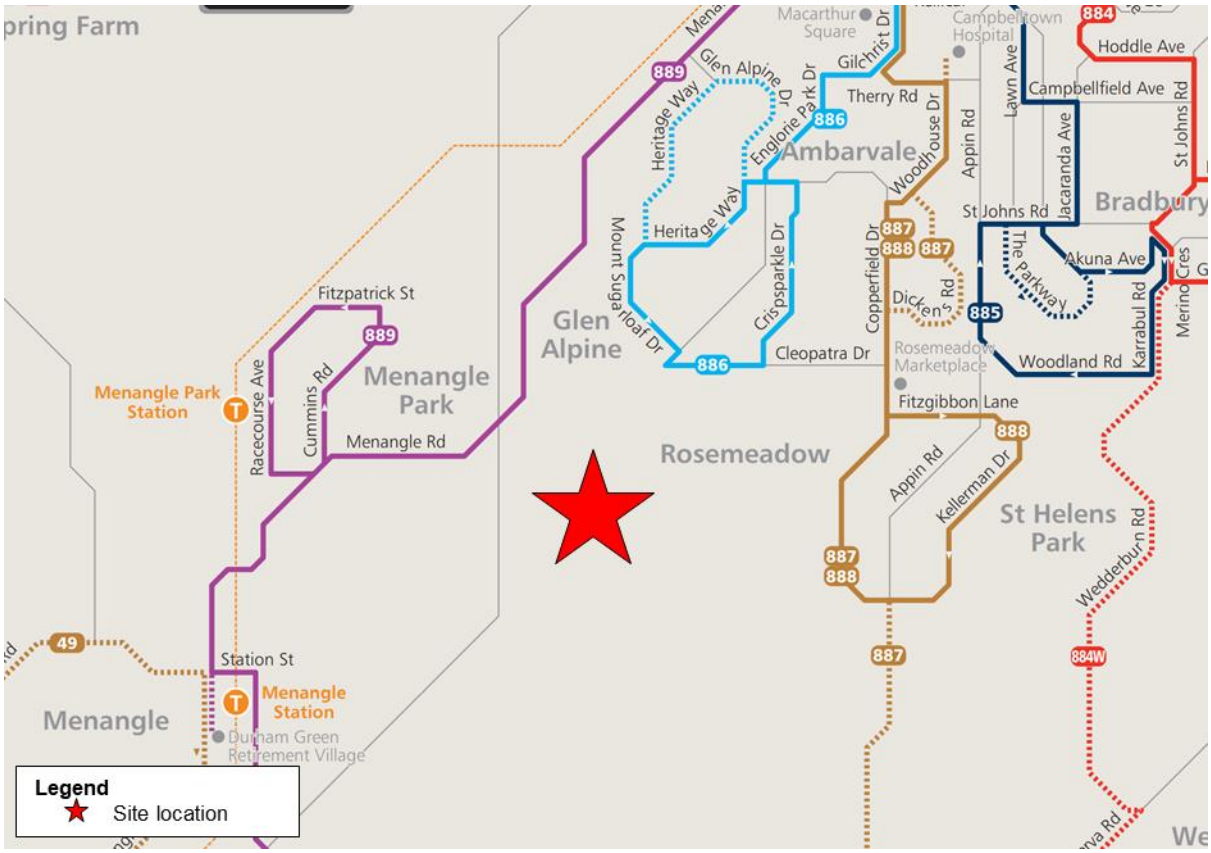
3.5 Public Transport

The site has limited access to public transport, with a single bus stop on Menangle Road about 350 metres north of the Medhurst Road intersection which services the 889 bus route.

The 889 bus route travels from Menangle to Campbelltown via Menangle Park providing access to Campbelltown Train Station and has six services per day.

The surrounding bus network is shown indicatively in Figure 19.

Figure 19: Surrounding bus network



Base image source: Busabout south western map https://www.busabout.com.au/wp-content/uploads/network_map.pdf

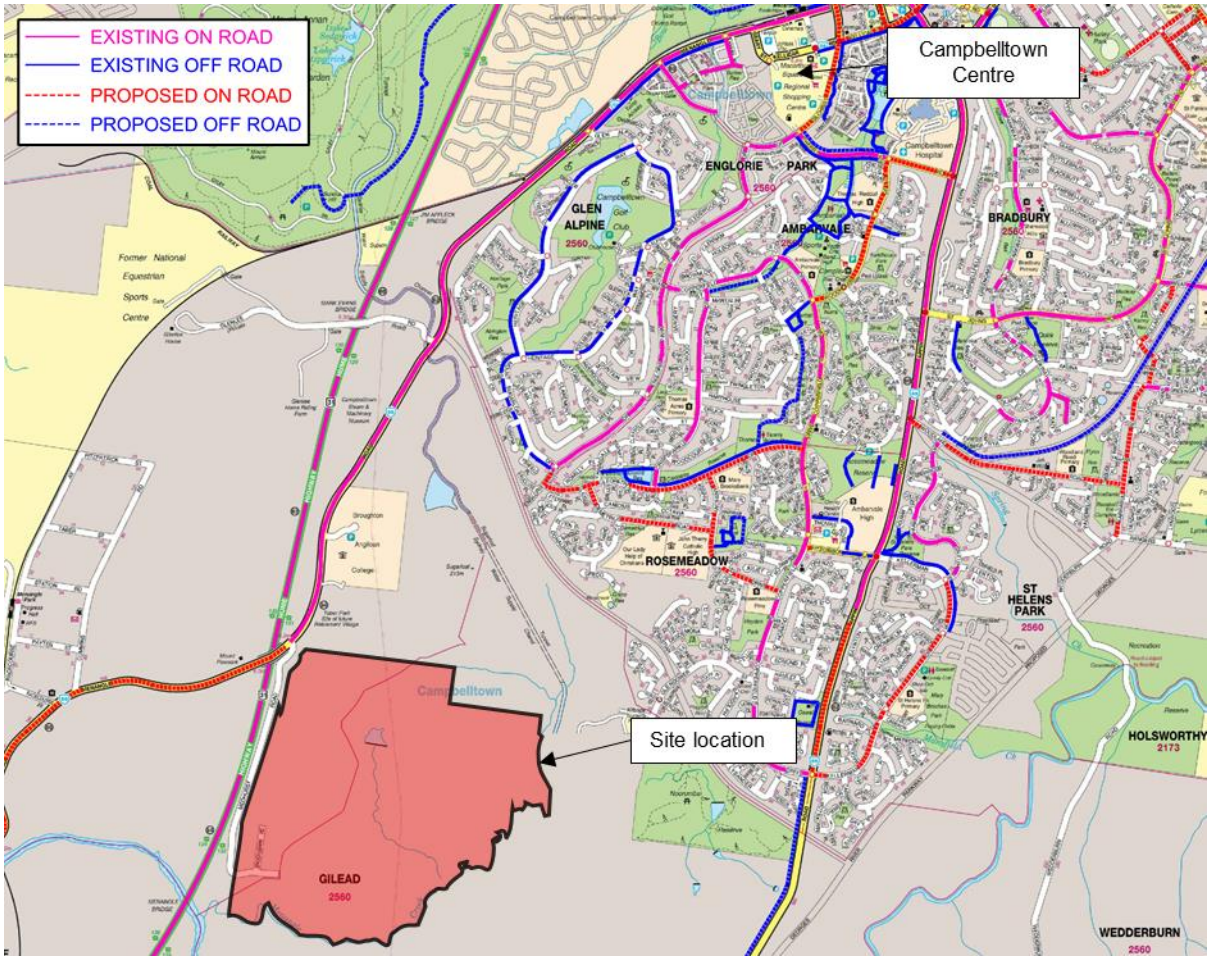
3.6 Walking and Cycling Infrastructure

The site has limited pedestrian infrastructure in the vicinity of the site with no formal footpaths provided on any of the surrounding roads.

Campbelltown City Council cycling map indicates that an on-road cycle path is provided on Menangle Road, starting just south of Medhurst Road and connecting to Campbelltown centre to the north. Extension of this on-road cycle path is proposed to the south.

The bicycle network surrounding the site is shown in Figure 20.

Figure 20: Surrounding bicycle routes



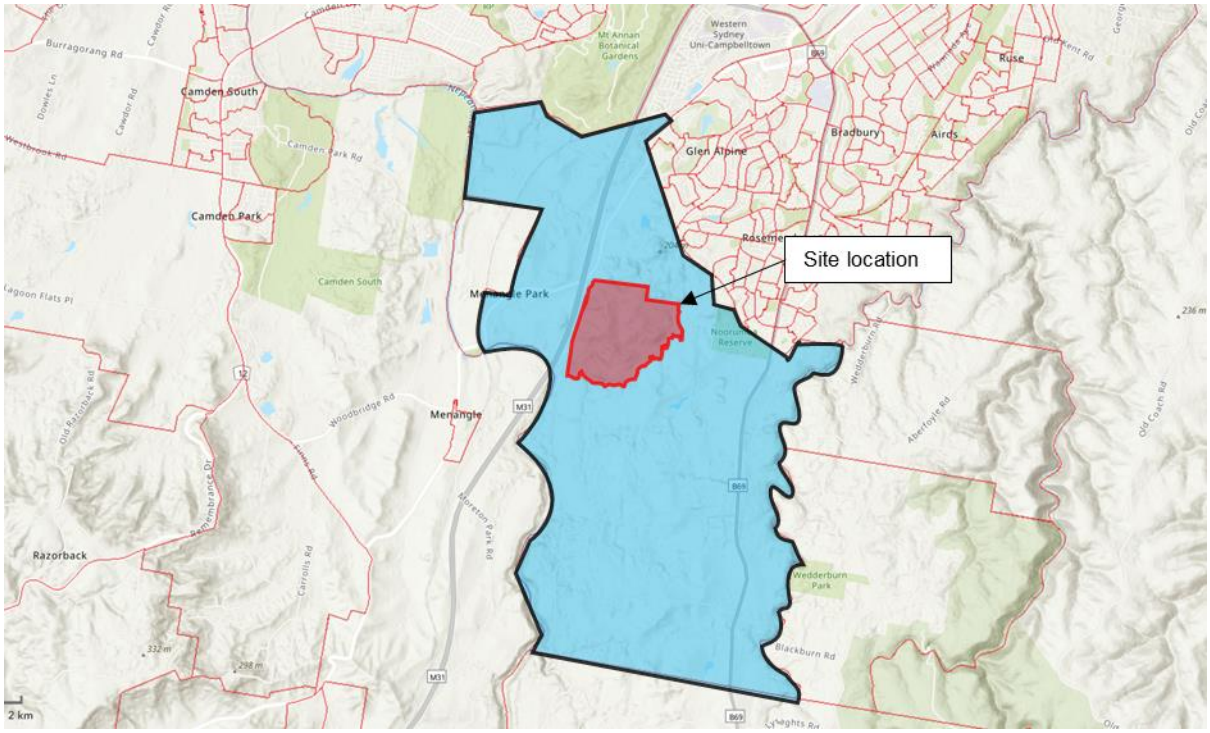
Base image source: Campbelltown City Council Bicycle Plan

3.7 Existing Travel Behaviour

Journey to Work (JTW) data has been sourced from the Australian Bureau of Statistics (ABS) 2016 census and provides an idea of existing travel patterns to/ from the relevant statistical area.

Figure 21 details the catchment of census data analysed which corresponds to the ABS 2016 Statistical Area 1 (SA1) 12302144409.

Figure 21: Analysed SA1 zones (12302144409)



Source: ABS 2016 Census

The JTW data indicates that approximately 500 people reside and 350 people work in the statistical area. The Journey to Work data indicates that the residents within the statistical area commute to the following top destinations:

- 25 percent to Rosemeadow/ Glen Alpine
- 21 percent to Campbelltown
- 10 percent to Parramatta
- 8 percent to Mino/ St Andrews
- 8 percent to Minchinbury/ Rooty Hill
- 7 percent to Picton/ Tahmoor/ Buxton
- 6 percent to Prospect/ Reservoir
- 6 percent to Liverpool
- 5 percent to Sydney CBD
- 4 percent to Douglas Park/ Appin.

As such, there is a large amount of travel to the Rosemeadow, Campbelltown, and Parramatta areas for employment (north of the subject site). Of those travellers surveyed on the day, approximately 90

percent travelled to work by private vehicle (either as the driver or passenger) and 10 percent utilised public transport. The JTW data for the statistical area is presented in Table 6.

Table 6: JTW travel mode splits for the statistical area

Mode of travel	Residents living in the statistical area	Employees working in the statistical area
Car driver	83%	92%
Car passenger	7%	6%
Train	10%	2%

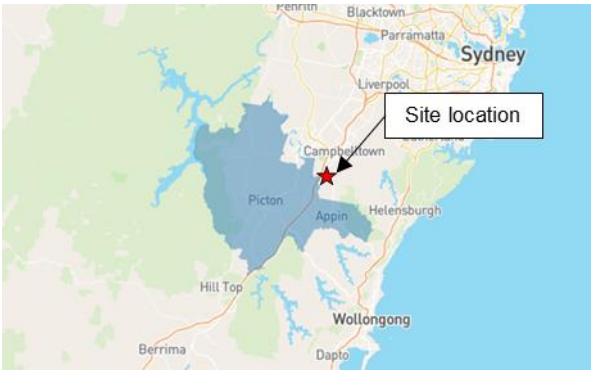
Source: ABS 2016 Census data

The 2016 JTW mode splits indicate a high reliance on private car (either as driver or passenger) for the statistical area for both residents (90 percent) as well as employees (98 percent).

The NSW Household Travel Survey (HTS) was also analysed to understand travel patterns for all trips made during the day (and not only the journey to work). HTS data is compiled based on Statistical Area Level 3 (SA3) which consists of a number of suburbs. The Campbelltown and Wollondilly SA3s were considered in understanding HTS travel behaviour for the Menangle Park URA (which is assumed to be representative for the Rosalind Park site). The SA3s are shown in Figure 22 and Figure 23, with a summary of travel modes within each presented in Table 7.

Figure 22: Campbelltown SA3

Figure 23: Wollondilly SA3



Source: Transport for NSW

Table 7: HTS modes of travel for Campbelltown and Wollondilly SA3s in 2019/20

Mode of Travel	Campbelltown SA3	Wollondilly SA3
Vehicle Driver	48%	58%
Vehicle Passenger	28%	27%
Train	9%	4%
Bus	4%	4%
Walk Only	10%	6%
Other	1%	1%

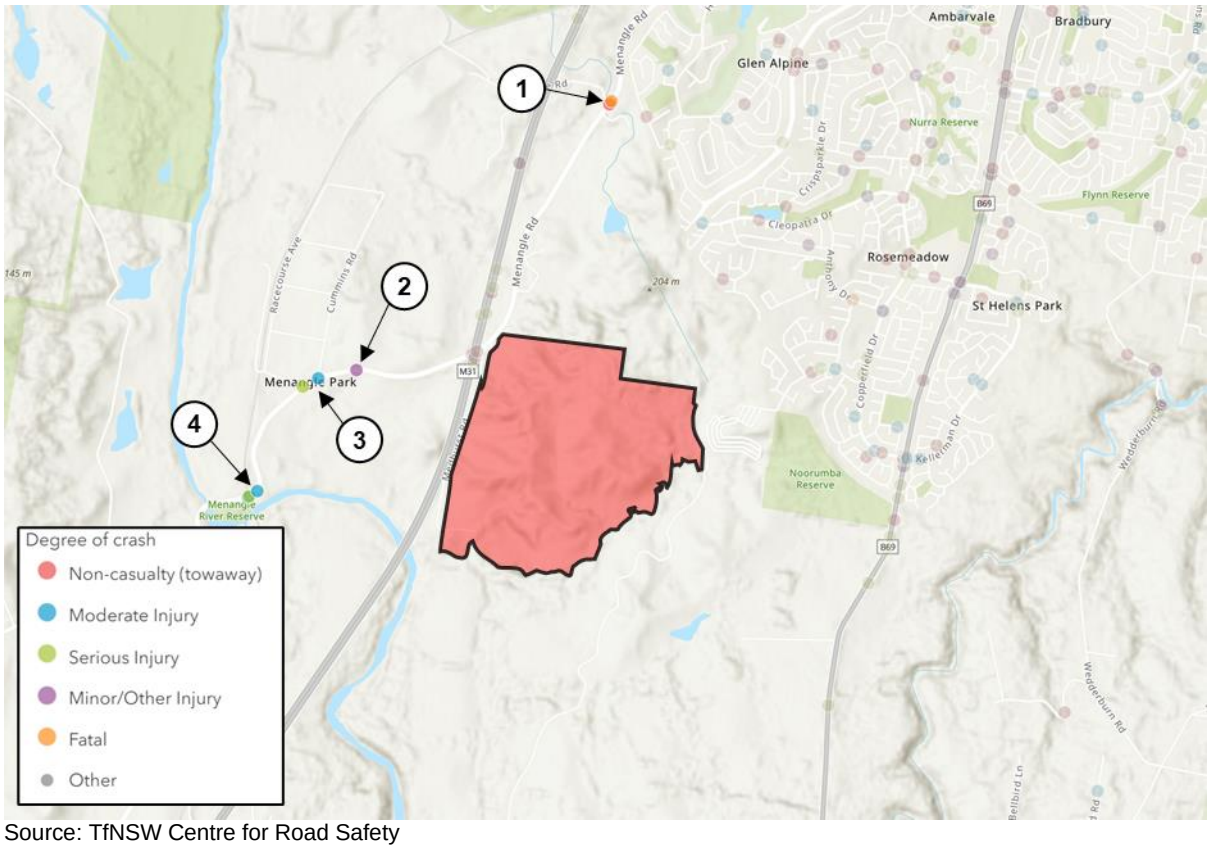
Source: Transport for NSW

The proportion of trips made by private vehicle, as a driver or a passenger, is 76 percent for Campbelltown SA3 and 85 percent for Wollondilly SA3. The share of private vehicle usage for all trips made during the day remains high but overall is slightly lower than for the journey to work. The occupancy of private cars is also higher when all trip purposes are considered, compared to only the JTW data.

3.8 Crash History

An analysis of the most recent five-year period of available crash data (1 January 2016 to 31 December 2020) has been undertaken based on crash data provided by TfNSW for the roads surrounding the site. The locations and severity of the crash data for the five-year period is shown in Figure 24 and detailed in Table 8.

Figure 24: Crash map from 1 January 2016 to 31 December 2020



Source: TfNSW Centre for Road Safety

Table 8: Recorded crashes from 1 January 2016 to 31 December 2020

Location	ID	Rum Code(s)	Number of crashes	Number of Injuries	Number of Fatalities
Menangle Road	1	2, 30	2	2	1
	2	81	1	1	0
	3	32 (2)	2	4	0
	4	20, 80, 81	3	4	0
		Total	**8**	**11**	**1**

The following key statistics can be drawn from the crash data:

- In total eight incidents occurred during the five-year period, resulting in 11 injuries and one fatality.
- One fatal crash and two serious injury crashes were recorded, with the remaining five crashes ranging from non-casualty to moderate injury crashes.
- There were no incidents at or surrounding the Menangle Road/ Medhurst Road intersection.
- The one fatality was pedestrian-related, associated with a pedestrian crossing from the far side of Menangle Road near the intersection with Glenlee Road and not necessarily due to any safety concerns with the road itself.
- The two most common crash types were run-off road crashes and rear-end crashes. The rear-end crashes occurred near side road intersections where no auxiliary turn lanes are provided.

The low number and nature of incidents occurring over the five-year period does not indicate a safety concern with the surrounding road network.

4 Rosalind Park Planning Proposal

4.1 Land Uses

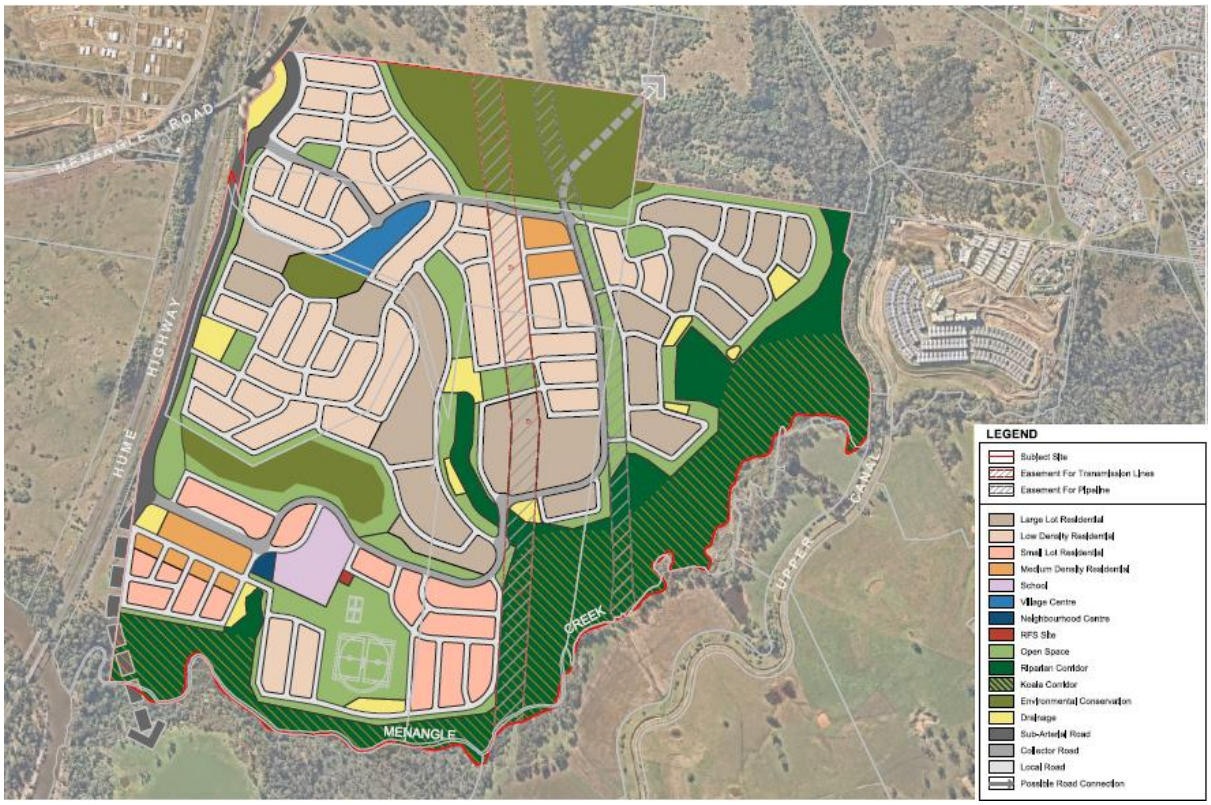
The Rosalind Park planning proposal involves rezoning of land located at Medhurst Road and Menangle Road, Menangle Park to allow for residential, retail, community and educational uses. The site would include between 1,346 to 1,648 dwellings with a target yield of 1,450 dwellings, a primary school with capacity for 1,000 students and 70 full time equivalent (FTE) staff, and associated sporting fields. Given the size of the development, construction works will be staged with approximately 200 dwellings being constructed per year over a six-to-eight-year period, with the first lot release commencing in 2024 and full completion targeted for 2032 (assuming an eight year construction period). The school would be completed following completion of the final residential lot, opening in 2034 at 50% capacity and ramping up to full capacity by 2039. The school would primarily serve residents of the estate.

The proposal anticipates the realignment of Medhurst Road towards the northern end of the site to improve road safety given that this section is not currently line marked. This will also allow for better alignment with the future lot boundaries. The works would also involve shifting the Menangle Road/ Medhurst Road intersection just north of the existing location.

Two roundabouts are proposed on Medhurst Road to connect into the proposed internal Collector road network which will circulate through the site. The internal Collector road network also provides the possibility of future connections to the Office of State Revenue Lands (OSL) located to the north of the site (Sugarloaf Farm) and any developments to the south through Medhurst Road.

The indicative site layout is shown in Figure 25.

Figure 25: Indicative Structure Plan



Source: LEDA, drawing no. LEDME-13-001-1, rev. H

5 Parking Assessment

5.1 Car Parking

The car parking provision for low and medium density dwellings is outlined in *Part 3: Low and Medium Density Residential Development and Ancillary Residential Structures* of the Campbelltown DCP 2015. The DCP specifies that low and medium density dwellings should provide a minimum of one single garage per dwelling.

In accordance with Part 3, dwelling houses shall be provided with an undercover car parking area which is restricted to:

- 18 square metres for one-to-two-bedroom dwellings
- 36 square metres for three or more-bedroom dwellings.

Any additional undercover car parking areas would be included in gross floor area calculations when determining floor space ratios permitted on the site.

6 Traffic Assessment

6.1 Preliminary Considerations

The following provides a preliminary assessment of the development in 2032 (anticipated year of full completion for the residential development) and 2042 (10-year design horizon). The assessment also considers the impacts of the Menangle Park URA accessed via Menangle Road.

The following assumptions have been made for this assessment:

- The target development yield of 1,450 residential lots has been adopted for the proposal.
- Menangle Park URA would deliver approximately 350 dwellings per year. Although Stages 1 and 2A have been completed these are largely still undeveloped and unoccupied lots as discussed in Section 2.2.1. Hence, no traffic from the URA is assumed to currently be on the road network, which is a worst-case scenario. Commencing this year, the development would be completed in 2032 coinciding with completion of the subject site.
- It is assumed that the full upgrade of Menangle Road would be complete by 2032 and therefore the four-lane design has been considered in both the opening year (2032) and 10-year horizon (2042) scenarios.
- An average background growth rate of 2.5 percent per annum between 2022 and 2042 has been applied to traffic on Menangle Road. This is a conservative assessment and is estimated to capture background growth in the region due to the surrounding developments (excluding the 3,500 dwellings approved for the Menangle Park URA). It is noted that the growth rate may initially be higher, but is anticipated to reduce towards the end of the 20-year period when much of the currently undeveloped land would be largely populated.
- For residential development traffic a split of 20 percent inbound and 80 percent outbound has been adopted for the weekday AM peak hour and vice versa for the PM peak hour, consistent with the typical weekday in/out splits for residential developments.
- Limited details of the proposed village centre facilities are available, notwithstanding it is expected these will generally be used by the local community attracting internal trips only and therefore would not impact Menangle Road or the Menangle Road/ Medhurst Road intersection.
- Sports fields within the development site would generate traffic outside of the road network peaks (i.e. weekends or later in the evening). Therefore, they have not been included in the assessment scenarios.
- All future access would be via the Menangle Road/ Medhurst Road intersection. Potential future access through the OSL site to the north (Sugarloaf Farm), and to the south of the development via Medhurst Road have not been considered. Any additional access points would reduce the impact on the Menangle Road intersection.

- Based on details provided by the proponent and Stantec's surveys of other comparable schools, the school is expected to have the following characteristics:
    - accommodate 1,000 students at full capacity and 70 FTE staff
    - be operational by 2034 after completion of all residential lots, with 50% capacity initially ramping up to full capacity by 2039
    - 25 percent of students and 90 percent of staff to reside at locations external to the estate
    - vehicle occupancy of 1.8 for students and 1.1 for staff
    - student mode share of 65 percent private vehicle use during the AM peak hour and 50 percent during the PM peak hour
    - staff mode share of 95 percent private vehicle use during the AM and PM peak hours
    - 95 percent of students arriving during the AM peak hour and 90 percent departing during the PM peak hour
    - 55 percent of staff arriving during the AM peak hour and 25 percent departing during the PM peak hour.

6.2 Future Traffic Generation

6.2.1 ROSALIND PARK

Residential

Traffic generation estimates for the proposal have been sourced from the TfNSW G*uide to Traffic Generating Developments* (2002) and the Technical Direction Updated Traffic Surveys (TDT 2013/04a). The TDT 2013/04a outlines generation rates for low density residential dwellings of 0.99 and 0.95 vehicle trips during the AM and PM peak hours respectively.

The estimated traffic volumes are summarised in Table 9.

Table 9: Residential – Estimated traffic volumes for Rosalind Park

Size	Traffic Generation Rate (veh trips)		Traffic Volumes (veh)			
	AM	PM	AM		PM	
			IN	OUT	IN	OUT
1,450 dwellings	0.99	0.95	287	1,148	1,102	276
		TOTAL	**1,435**		**1,378**	

School

The traffic generation estimates for the school have been determined based on a comparable assessment using the assumptions outlined above. School bell times are likely to be between 8:15am to 8:45am and 2:30pm to 3:00pm. As such, the PM volumes would occur outside the PM road

network peak hour and therefore are not included in the completed traffic modelling. As stated, 25 percent of students and 90 percent of staff would reside at locations external to the estate. Therefore, a discount has been applied to consider the external traffic volumes related to the school. The estimated total traffic volumes (internal and external trips) are summarised in Table 10, with only the external trips summarised in Table 11.

Table 10: School – Estimated total traffic volumes (internal & external trips) for Rosalind Park

Staff/ Student	Size	Traffic Volumes (Total)			
		AM		PM (outside road network peak)	
		IN	OUT	IN	OUT
Student	1000	343	343	250	250
Staff	70	33	0	0	15
TOTAL		**719**		**515**	

Table 11: School – Estimated external traffic volumes for Rosalind Park

Staff/ Student	Size	Traffic Volumes (External only)			
		AM		PM (outside road network peak)	
		IN	OUT	IN	OUT
Student	1000	86	86	63	63
Staff	70	30	0	0	14
TOTAL		**202**		**140**	

Summary

As shown the proposed development is anticipated to generate up to 2,154 and 1,893 total vehicle trips in the AM and PM peak hours respectively (although the school PM peak traffic volumes would occur outside the road network peak hour). Considering only external trips (i.e. not travelling within the site) and discounting the school trips in the PM peak hour, the proposed development would generate 1,637 and 1,378 vehicle trips in the AM and PM peaks respectively. All development traffic is anticipated to use the Menangle Road/ Medhurst Road intersection, at least until such time that alternative routes are available.

6.2.2 MENANGLE PARK URA

The Menangle Park URA is anticipated to provide 3,500 dwellings including low, medium and high-density options. The adopted density mix and traffic generation rates for the AM/ PM peak hours are set out in Table 12.

Table 12: Traffic generation rates for Menangle Park URA

Land use	Dwellings	Traffic generation rate (vehicle-trips)		Source
		AM	PM	
Low density residential (<30 dwellings/ha)	2,450 dwellings (70%)	0.99	0.95	TDT 2013/04a (average metropolitan Sydney for site peak) TfNSW recommendation
Medium density residential (30-60 dwellings/ha)	525 dwellings (15%)	0.65	0.65	Guide to Traffic Generating Developments (2002) – highest range First-principles trip generation and mode share
High density residential (>60 dwellings/ha)	525 dwellings (15%)	0.5	0.5	First-principles trip generation and mode share

The following assumptions have been made when estimating future traffic volumes for the Menangle Park URA through the Medhurst Road intersection:

- The exact GFA's and uses of the community, recreational, employment and educational uses are unknown. Residential traffic volumes have been increased by 10 percent to account for trips associated with the other land uses.
- A dwelling mix of 70 percent low-density, 15 percent medium-density and 15 percent high-density has been assumed for this assessment which is consistent with the *Menangle Park Planning Proposal Transport Impact Assessment* (2018) completed by Stantec (formerly GTA Consultants) in 2018 for the Menangle Park Urban Release Area (URA).
- Based on the land area of each stage it is assumed that 45 percent of the dwellings would be constructed in Stage 1, 30 percent in Stage 2 and 25 percent in Stage 3.

As such, the estimated traffic volumes for the overall Menangle Park URA are summarised in Table 13.

Table 13: Estimated traffic volumes for Menangle Park URA

Stage	Dwellings	Traffic Volumes incl. 10% buffer (veh trips)			
		AM		PM	
		IN	OUT	IN	OUT
1	1,575	300	1,200	1,161	290
2	1,050	200	800	774	193
3	875	167	666	645	161
Total		**3,333**		**3,224**	

As shown the Menangle Park URA is anticipated to generate up to 3,333 and 3,224 vehicle trips in the AM and PM peak periods respectively.

Only a portion of the total Menangle Park URA traffic is anticipated to travel through the study intersection of Medhurst Road/ Menangle Road; however, this is dependent on the access points to

the URA and connections into the surrounding road network. The following traffic from each stage is anticipated to use Menangle Road and travel past its intersection with Medhurst Road:

- 25 percent of Stage 1 traffic (i.e. the southern quarter of Stage 1) travelling to/ from the north – vehicles anticipated to access Menangle Road at Cummins Road to continue heading north along Menangle Road or access the Hume Motorway. The remaining 75 percent would utilise the internal development roads and access Spring Farm Parkway.
- All Stage 2 traffic travelling to/ from the north – vehicles anticipated to access Menangle Road at Cummins Road to continue heading north along Menangle Road or access the Hume Motorway.
- All Stage 3 traffic travelling to/from the south – vehicles anticipated to use Spring Farm Parkway to access Menangle Road and continue south.

6.3 Trip Distribution and Assignment

6.3.1 OVERVIEW

The directional distribution and assignment of traffic generated by the Menangle Park URA and Rosalind Park site would be influenced by several factors, including the following:

- Configuration and connectivity of the arterial road network including connections to Hume Motorway M31 and to the Spring Farm Parkway.
- Configuration of planned and any future access points to the area. It is assumed that Menangle Road would provide sole access to the proposed Rosalind Park site.
- Location of surrounding employment centres, retail centres and schools in relation to the site.

Considering these factors, as well as the JTW data analysed in Section 3.7, the assumed directional distributions for the Rosalind Park site are shown in Figure 26 and Figure 27 for the AM and PM peaks respectively, and similarly for the Menangle Park URA in Figure 28 and Figure 29 (extracted from the *Menangle Park Planning Proposal Transport Impact Assessment,* 2018).

Figure 26: AM peak distribution – Rosalind Park

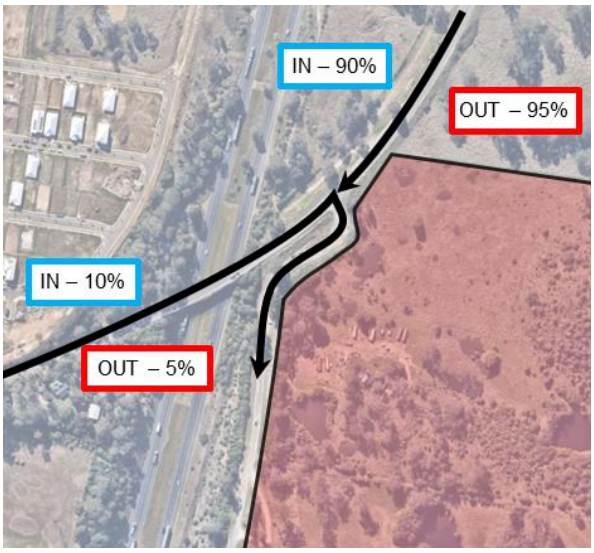


Figure 27: PM peak distribution – Rosalind Park

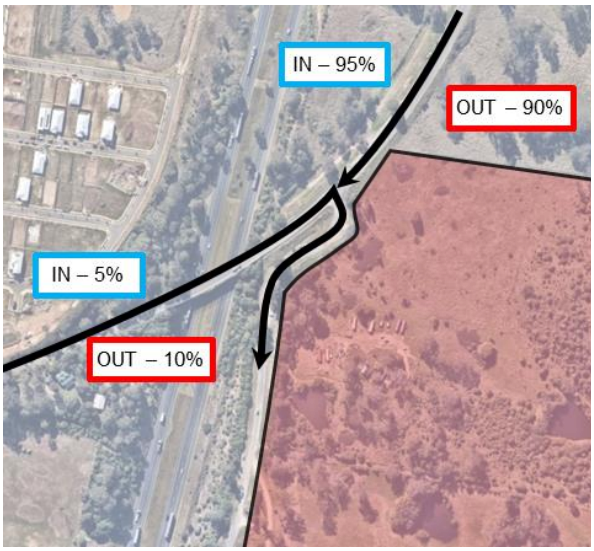


Figure 28: AM peak distribution – Menangle Park URA

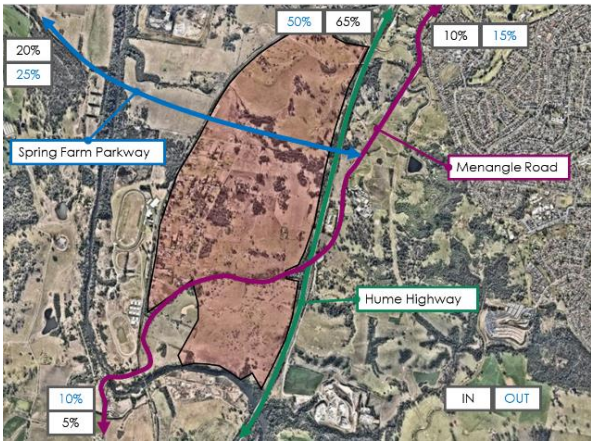
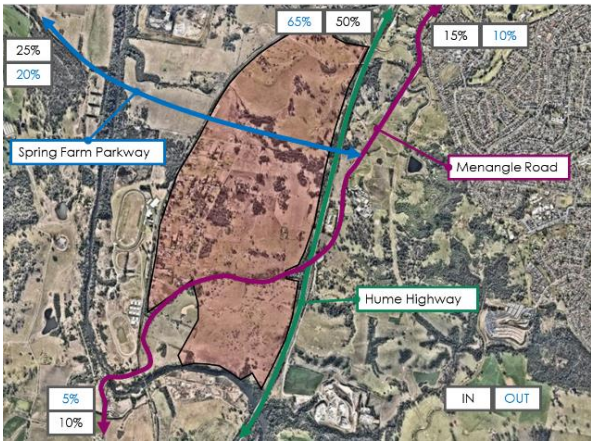


Figure 29: PM peak distribution – Menangle Park URA



Base image source: Nearmap

6.4 Intersection Operation

6.4.1 OVERVIEW

The future operation of the Medhurst Road/ Menangle Road intersection and the two internal roundabouts proposed on Medhurst Road to provide access to the Rosalind Park estate have been assessed for the year of completion of the proposed residential development (2032) and for a 10-year design horizon (2042) as summarised below:

- Scenario 1: Year of Opening (2032) – Rosalind Park site at full completion including 1,450 dwellings and Menangle Park URA at full completion including 3,500 dwellings. In this

scenario Menangle Road has been upgraded to a four-lane divided carriageway and an average background growth rate of 2.5 percent per annum has been applied.

- Scenario 2: 10-Year Design Horizon (2042) – Scenario 1 plus an additional 10-years background growth at an average rate of 2.5 percent per annum applied, and proposed school at full capacity.

6.4.2 YEAR OF OPENING (2032)

An initial assessment was conducted with the existing priority-controlled intersection at Medhurst Road/ Menangle Road retained and two single lane roundabouts provided internal to the site. It was assumed that Menangle Road would have been upgraded to a four-lane divided carriageway by 2032. To cater for the development traffic a 50 metre left turning lane on the Medhurst Road approach was included.

Under this arrangement the Menangle Road/ Medhurst Road intersection was predicted to fail, with a level of service, LOS F and a degree of saturation exceeding 1 during both the AM and PM peak hours. Therefore, as a result of the anticipated growth in the area, Menangle Park URA traffic and the development traffic an upgraded intersection design at this location is required.

Upgraded Signalised Intersection

A signalised layout has been considered at the Menangle Road/ Medhurst Road intersection to improve the future operating conditions of this intersection, with the proposed concept design layout shown in Figure 30. The northernmost internal roundabout has also been upgraded to include additional short turning lanes on each approach and two lanes on the northbound departure leg (to tie into the two lanes proposed at the Menangle Road/ Medhurst Road traffic signals) as shown in Figure 31. The southernmost roundabout would remain as single lane approaches, as shown in Figure 32.

Figure 30: Medhurst Road/ Menangle Road concept layout (signalised intersection)

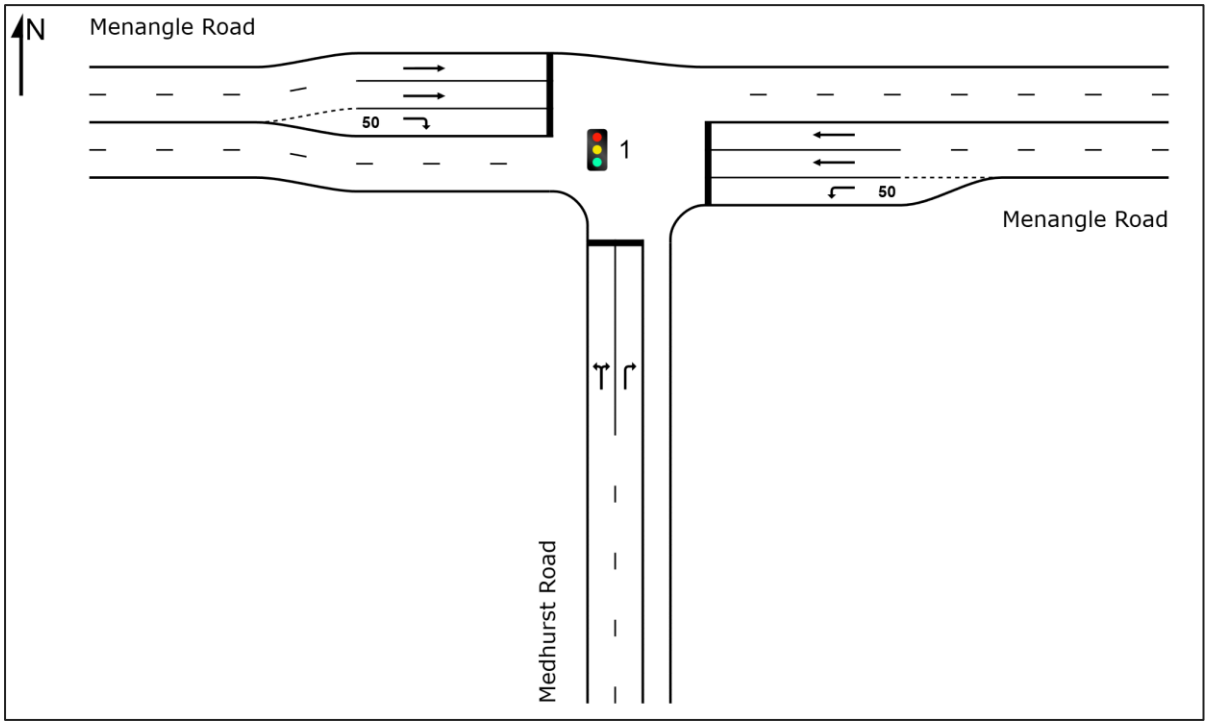


Figure 31: Northern internal roundabout concept layout

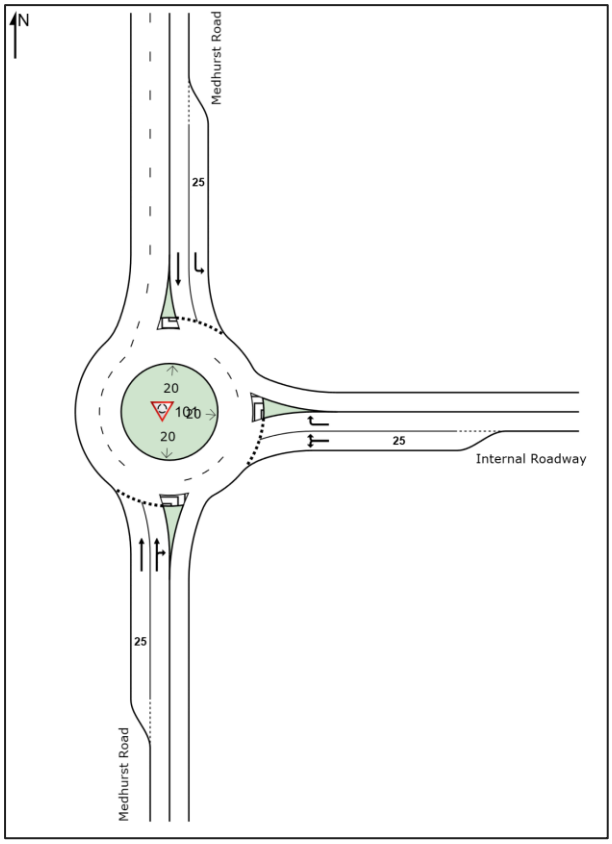


Figure 32: Southern internal roundabout concept layout

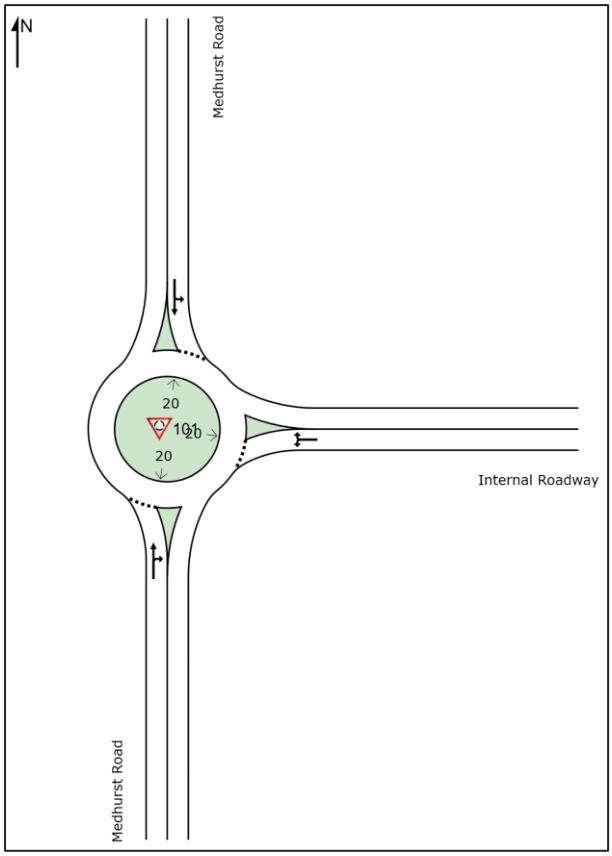


Table 14 presents a summary of the future predicted operation of each of the intersections at the year of opening (2032) under the concept layouts, based on an analysis using the SIDRA software and its optimum cycle times for the signalised intersection calculated for the AM and PM peaks. Full results of the analysis are presented in Appendix B of this report.

Table 14: Opening year (2032) intersection operating conditions

Peak	Intersection	Leg	Degree of saturation (DOS)	Average delay (sec)	95th percentile queue (m)	Level of service (LOS)
AM	Menangle Road/ Medhurst Road	South (Medhurst)	0.89	43	201	D
		East (Menangle)	0.71	23	103	B
		West (Menangle)	0.90	38	269	C
		Overall	**0.90**	**36**	**269**	**C**
	Northern Internal Roundabout	South	0.23	15	10	B
		East	0.28	9	12	A
		North	0.11	4	5	A
		Overall	**0.28**	**8**	**12**	**A**
	Southern Internal Roundabout	South	0.01	10	0	A
		East	0.21	9	8	A
		North	0.05	4	2	A
		Overall	**0.21**	**8**	**8**	**A**
PM	Menangle Road/ Medhurst Road	South (Medhurst)	0.82	84	83	F
		East (Menangle)	0.96	25	385	B
		West (Menangle)	0.48	7	38	A
		Overall	**0.96**	**26**	**385**	**B**
	Northern Internal Roundabout	South	0.01	9	0	A
		East	0.03	9	1	A
		North	0.19	4	7	A
		Overall	**0.19**	**5**	**7**	**A**
	Southern Internal Roundabout	South	0.01	9	0	A
		East	0.05	9	2	A
		North	0.20	4	8	A
		Overall	**0.20**	**5**	**8**	**A**

Table 14 indicates that under the proposed intersection arrangements all of the intersections would operate at a LOS C or better during the AM and PM peak hours respectively. However, it should be noted that the Menangle Road/ Medhurst Road intersection is expected to operate near capacity based on the degree of saturation predicted in both peak periods (and in particular the PM peak).

In the PM peak hour the Medhurst Road approach LOS falls to F at the Menangle Road/ Medhurst Road intersection, with an average delay on this approach of 84 seconds. SIDRA has determined a 150 second cycle time is required to appropriately cater for future traffic volumes through the intersection. While operating at capacity, the relatively high delays are typical for minor approaches to high demand arterial roads which support broader regional movement patterns. With a 150 second

cycle time, Medhurst Road vehicles must wait at least 135 seconds between signal phases, hence contributing to higher average delays on this approach. It should be noted that the average delay of 84 seconds indicates that all Medhurst Road traffic is generally cleared each phase.

Both internal roundabouts are predicted to operate well at an overall LOS A during both the AM and PM peak hours.

6.4.3 10-YEAR DESIGN HORIZON (2042)

Table 15 presents a summary of the future predicted operation of the intersections at the 10-year design horizon (2042) under the concept layouts, based on an analysis using the SIDRA software and its optimum cycle times for the signalised intersection calculated for the AM and PM peaks. Full results of the analysis are presented in Appendix B of this report.

Table 15: 10-year design horizon (2042) intersection operating conditions

Peak	Intersection	Leg	Degree of saturation (DOS)	Average delay (sec)	95th percentile queue (m)	Level of service (LOS)
AM	Menangle Road/ Medhurst Road	South (Medhurst)	0.94	73	413	F
		East (Menangle)	0.71	28	240	B
		West (Menangle)	0.93	57	545	E
		Overall	**0.94**	**53**	**545**	**D**
	Northern Internal Roundabout	South	0.44	16	15	B
		East	0.48	10	15	A
		North	0.14	4	6	A
		Overall	**0.48**	**9**	**17**	**A**
	Southern Internal Roundabout	South	0.01	11	0	A
		East	0.27	9	11	A
		North	0.14	4	6	A
		Overall	**0.27**	**7**	**11**	**A**
PM	Menangle Road/ Medhurst Road	South (Medhurst)	0.98	115	105	F
		East (Menangle)	0.98	43	710	D
		West (Menangle)	0.49	8	43	A
		Overall	**0.98**	**41**	**710**	**C**
	Northern Internal Roundabout	South	0.03	10	1	A
		East	0.08	10	3	A
		North	0.44	4	24	A
		Overall	**0.44**	**5**	**24**	**A**
	Southern Internal Roundabout	South	0.01	9	0	A
		East	0.05	9	2	A
		North	0.20	4	8	A
		Overall	**0.20**	**5**	**8**	**A**

Table 15 indicates that all of the intersections would operate at a LOS D or better during the AM and PM peak hours respectively, with the two internal roundabouts continuing to operate at LOS A. However, the Menangle Road/ Medhurst Road intersection is expected to operate near capacity based on the degree of saturation predicted in both peak periods. The 95th percentile queue lengths for the Menangle Road/ Medhurst Road intersection are estimated at 545 metres (west approach) during the AM peak hour and 710 metres (east approach) during the PM peak hour. A queue of approx. 410 metres is also estimated on the Medhurst Road approach to this intersection during the AM peak hour which would therefore queue back to the northern internal roundabout.

At 2042 in both peak periods the Medhurst Road approach LOS falls to F, with an average delay on this approach of 73 seconds and 115 seconds in the AM and PM peaks respectively. SIDRA has determined cycle times of 150 seconds are required to appropriately cater for future traffic volumes through the intersection. While operating at capacity, the relatively high delays are typical for minor approaches to high demand arterial roads which support broader regional movement patterns.

In the AM peak, Medhurst Road vehicles must wait at least 85 seconds between signal phases, hence contributing to higher average delays on this approach. It should be noted that the average delay of 73 seconds indicates that all traffic on Medhurst Road is generally cleared each phase.

The PM peak results in Medhurst Road vehicles waiting at least 131 seconds between signal phases, hence contributing to higher average delays on this approach. It should be noted that the average delay of 115 seconds indicates that all traffic on Medhurst Road approach traffic is generally cleared each phase.

As detailed in previous sections of this report, with the forecast growth in the Greater Macarthur area various road network changes and additional public transport infrastructure are currently planned or being explored. It is anticipated that the implementation of these measures will likely result in a reduction in the volume of traffic predicted to occur along Menangle Road, and in turn the intersection performance would be expected to be better in practice than what has been estimated in this report. This is particularly the case given the average background growth rate of 2.5 percent per annum adopted over a 20 year timeframe for this assessment which is considered to be conservatively high.

7 Design Review

7.1 References

In recommending road hierarchy and cross-sectional requirements for the subdivision, the following documents have been referenced:

- Campbelltown (Sustainable City) Development Control Plan (DCP) 2009, Volume 2, Engineering Design for Development.
- Street Design Guidelines, Landcom, 2008
- Bus Infrastructure Guide, Issue 2, State Transit, July 2011

7.2 Campbelltown DCP 2009 – Engineering Design for Development

All new rural residential roads within the site should be designed and constructed to comply with Campbelltown Council Standard Drawings. Council's cross-sectional requirements for applicable roads in residential areas are reproduced in Figure 33.

Figure 33: Subdivision road network design

Road Category and Type	Maximum Number of Dwellings	Maximum Speed (km/h)	Road Reserve Width (m)	Carriageway Width (m)		Verge Width Left/Right (m/m)	Kerb Type	Concrete Foot paving/ Cycle path	Design Equiv. Standard Axles (ESA's)
Cat. A Accessway	7	10	9 plus parking provision (1)	4.0		1.5/3.5 plus parking (1)	Flush or roll	No	2×10^4
Cat B Minor Cul-de-sac	15	30	13	6.0		3.5/3.5	Roll	No	2×10^4
Cat. C Cul-de-sac	30	40	15	8.0		3.5/3.5	Roll	No	6×10^4
Cat. D Local Street	N/A	50	15	8.0		3.5/3.5	Roll	Yes (3)	3×10^5
Cat. E (i) Collector	N/A	60	18 (2&3)	11.0		3.5/3.5 (2)	Standard K&G	Yes (3)	1×10^6
Cat E (ii) Distributor	N/A	60	18 (2&3)	11.0		3.5/3.5 (2)	Standard K&G	Yes (3)	2×10^6
Cat. F Commercial/ Industrial	N/A	60	20 (2&3)	13.0		3.5/3.5 (2)	Standard K&G	Yes (3)	5×10^6 (heavy ind. 1×10^7)
Cat. G Rural Residential Cul-de-sac (Minor)	25	60	16 (4)	5.5 +	1.2 shoulder x 2	As required	N/A	No	2×10^4
Cat. H Rural Residential (Secondary)	N/A	60	20 (4)	6.0 +	1.5 shoulder x 2	As required	N/A	No	3×10^5
Cat. I Rural Residential (Main)	N/A	80	20 (4)	7.5 +	2.5 shoulder x 2	As required	N/A	No	1×10^6

(1) Additional width/area required for provision of minimum 1 parking space per 2 dwellings
(2) Footpath may need to be widened to 4.5 metres to accommodate a 2.0m wide cycle path
(3) If required by Council or if shown on Council's Foot paving or Cycleway Strategy Plans
(4) Plus provision for batters/berms, catch drains and clearance where required.

Source: Campbelltown (Sustainable City) Development Control Plan (DCP) 2009, Volume 2, Engineering Design for Development

Figure 33 indicates that the transit sub-arterial road (Medhurst Road) could be designed to Cat E (ii) – Distributor specifications with the internal roadway designed as Cat. E (i) – Collector. Any other roads of lower hierarchy within the site would be designed per Cat D – Local Street specifications.

7.3 Street Design Guidelines, Landcom, 2008

The Street Design Guidelines developed for the Landcom Projects publication (Landcom, 2008) contain guidelines for the design of streets in urban and suburban Landcom developments. While the document was specifically prepared to outline guidelines for Landcom specific developments, the guidance within the document can be applied to most precinct-like developments, particularly those involving residential development. Landcom is committed to best practice urban design, noting that:

"These guidelines have been prepared to help us design streets that people like: streets that make the most of the natural environment and help to create a sense of place, while also meeting their functional requirements."

Road hierarchy requirements identified within the publication are reproduced as Figure 34, with the collector road specifications similar to those outlined in the Campbelltown DCP 2009.

Figure 34: Model street types and street hierarchy (Landcom)

STREET TYPE	INDICATIVE TRAFFIC VOLUME RANGE (VPD)	TARGET DESIGN SPEED (KM/HR)	STREET RESERVE WIDTH (M)	CARRIAGEWAY WIDTH (M)	APPROPRIATE USE
Major Road (with slip road)	6000	60	Slip road – 10.1m Main carriageway varies depending on the swale width.	Slip road – 5.6m Main carriageway – 8.2m in each direction.	Major roads are generally used to link and pass through major town or suburban regional/sub regional centres. They will normally have a major bus route along them but are subordinate to the primary distributor roads.
Collector Street	3000-6000	60	20.4m	11.6m	Collector Streets link neighbourhoods together. They usually carry bus routes within as well as between neighbourhoods. Neighbourhood and local centres are usually located along these routes at intersections.
Local Streets - : with trees in the verge : with trees in the carriageway + verge : with parking bays : with trees in the carriageway and swales	Up to 3000	50	17.4m unless the verge contains a swale in which case the reserve width will increase depending on the required swale width.	9.6m 9.6m 10.4m 9.6m	Local streets are the predominant street type within a neighbourhood. They provide access to the dwellings, parks and neighbourhood edges. The type of local street used should relate to the local context, lot widths and WSUD strategy.
Minor Local Street	1000	40	14.8m	7.6m	Minor local streets have a limited use. Use only where: : traffic volumes are low, : there is low parking demand and : where the lot width is 15m or more.
Lanes and access ways/mews	300	15	8.0m	6.0m	Lanes or access ways are used to provide rear vehicle access to dwellings. They should be designed as shared zones with good passive surveillance. They should be a maximum of 100m and have a straight alignment.

Source: Street Design Guidelines, Landcom, 2008

7.4 Bus Infrastructure Guide, Issue 2, State Transit, July 2011

The objective of the State Transit Bus Infrastructure Guide is to assist State Transit, state and local government agencies in providing consistent, safe and effective bus infrastructure. The aim is to provide a comfortable, convenient, reliable and safe service that is accessible to all users. A summary of the key requirements is as follows:

- The minimum kerb lane widths to accommodate bus stops in accordance with the State Transit Bus Infrastructure Guide (BI Guide) are as follows:
    - Kerb lane operates as a parking lane only: minimum of 3.0 metres.

  - Kerb lane operates as a traffic lane: minimum of 3.5 metres.

- The minimum desirable lane width to accommodate bus routes is 3.2 metres, however, 3.5 metres is to be provided for one lane or one-way sections of road.
- It is noted that additional kerb and/ or travel lane widths may be required for bus stops/ routes on curved sections of road.

8 Conclusion

Based on the analysis presented in this report the following conclusions are made:

- The Rosalind Park planning proposal is being lodged with Campbelltown City Council (Council) for the rezoning of land located at Medhurst Road and Menangle Road, Menangle Park to allow for residential, retail, community and educational uses. The site would include between 1,346 to 1,648 residential dwellings with a target yield of 1,450 dwellings, a primary school with capacity for 1,000 students and 70 full time equivalent (FTE) staff, and associated sporting fields.

- Based on the target yield the Rosalind Park site is estimated to generate 2,154 vehicle trips during the AM peak hour and 1,893 vehicle trips during the PM peak hour. Considering only external trips (i.e. not travelling within the site) and discounting the school trips in the PM peak hour (since the school PM peak traffic volumes would occur outside the road network peak hour), the proposed development would generate 1,637 and 1,378 vehicle trips in the AM and PM peaks respectively.

- The site is located near the Menangle Park Urban Release Area (URA) which is predicted to provide 3,500 dwellings and other community, recreational, educational and employment uses. Based on stated assumptions the development at full completion (Stage 1, 2 and 3) is estimated to generate 3,333 vehicle trips during the AM peak hour and 3,224 vehicle trips during the PM peak hour. Only a portion of this traffic will utilise Menangle Road to access their destinations and travel through the Medhurst Road/ Menangle Road intersection.

- Exact staging of the Rosalind Park proposal is still to be confirmed, however, based on an eight year roll-out it is assumed that full completion of the target yield would occur in 2032, coinciding with completion of the Menangle Park URA. The school would open following completion of the residential lots in 2034.

- The Medhurst Road/ Menangle Road intersection has been considered under two scenarios:

    - Scenario 1: Year of Opening (2032) – Rosalind Park site and Menangle Park URA at full completion with Menangle Road upgraded to a four-lane divided carriageway and average background growth rate of 2.5 percent per annum.

    - Scenario 2: 10-Year Design Horizon (2042) – Scenario 1 with additional background growth of 2.5 percent per annum for a 10-year period and school fully operational.

- Under a priority-controlled layout (with four-lane carriageway on Menangle Road) the intersection of Medhurst Road/ Menangle Road would operate at LOS F during both the AM and PM peak hours, with significant queues and delays. Therefore, intersection upgrades are required to cater for the anticipated future traffic volumes.

- A signlised intersection option, with auxiliary turn lanes on Menangle road and a dual lane approach on Medhurst Road has been considered.

- The proposed signalised layout is estimated to operate at LOS C and B during the AM and PM peak hours respectively in 2032 under Scenario 1.

- At the 10-year horizon in 2042 the signalised layout is estimated to operate at LOS D and C during the AM and PM peak hours respectively under Scenario 2.

- Under the signalised layout in both scenarios the intersection is expected to operate near capacity given the high degree of saturation. However, the assessment has adopted a number of conservative assumptions and the intersection operation is expected to be better in practice due to other road network changes and public transport infrastructure improvements in the pipeline that will be implemented over the next 20 years.

- Concept layouts for the two internal site roundabouts have also been considered. The analysis indicates that both intersections would operate at LOS A during the AM and PM peak hours under the 2032 and 2042 scenarios.

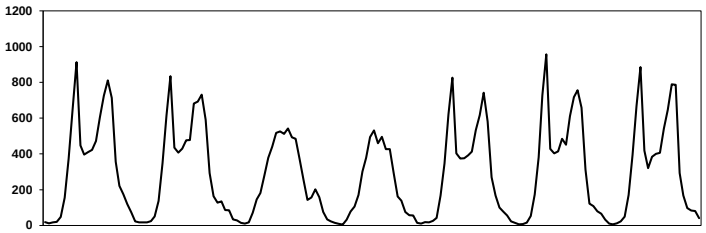
Overall, the proposal can be supported from a traffic and transport perspective.

Appendix A Survey Data

Hourly Volume By Day (Speed and Classification)

Menangle Road
200m north of Medhurst Road
Menangle Park
Northbound and Southbound - Two Way Traffic

Site Number:	1
Client:	Stantec
LGA:	Wollondilly Shire
Count Type:	Volume/Class/Speed
Coordinates:	-34.1047476, 150.7645521



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Posted Speed Limit

Day	Thu	Fri	Sat	Sun	Mon	Tue	Wed	7 day Average	Weekday Average
Time	16/06/22	17/06/22	18/06/22	19/06/22	20/06/22	21/06/22	22/06/22		
0:00	19	18	34	34	10	14	11	20	14
1:00	12	18	28	23	19	7	7	16	13
2:00	17	17	15	15	18	8	12	15	14
3:00	20	25	10	9	26	16	23	18	22
4:00	48	51	18	5	42	53	49	38	49
5:00	155	138	71	33	168	173	170	130	161
6:00	373	348	145	78	347	381	395	295	369
7:00	647	614	181	105	621	727	668	509	655
8:00	913	835	278	171	826	957	886	695	883
9:00	448	435	378	302	403	428	419	402	427
10:00	396	408	441	379	374	404	320	389	380
11:00	410	429	518	495	376	415	384	432	403
12:00	423	477	526	531	392	484	400	462	435
13:00	472	478	512	460	413	451	406	456	444
14:00	606	682	542	496	533	612	541	573	595
15:00	726	693	493	427	617	717	647	617	680
16:00	812	732	485	427	743	756	789	678	766
17:00	713	591	372	292	581	658	786	570	666
18:00	357	293	255	162	269	312	293	277	305
19:00	221	164	143	139	167	122	167	160	168
20:00	175	128	156	76	100	109	97	120	122
21:00	120	135	202	58	77	79	84	108	99
22:00	74	87	158	56	56	65	81	82	73
23:00	23	85	75	15	23	33	41	42	41
7am-7pm	6923	6667	4981	4247	6148	6921	6539	6061	6640
24hr Total	8180	7881	6036	4788	7201	7981	7676	7106	7784
Cars	7452	7116	5816	4637	6732	7287	7154	6599	72
Trucks	484	413	194	150	412	499	451	372	4
Articulated	244	267	36	5	105	218	71	135	1

SITE DETAILS
Two Way Traffic

Speed Distribution	
> 40 km/hr	97.6%
> 50 km/hr	88.9%
> 60 km/hr	80.0%
> 70 km/hr	68.3%
> 80 km/hr	21.7%
> 90 km/hr	2.3%
> 100 km/hr	0.4%

Peak Survey Results		
AM	8:00	957
PM	16:00	812
24hr Volume		8180
Cars		7452
Trucks		499
Articulated		267
7am to 7pm Volume		6923

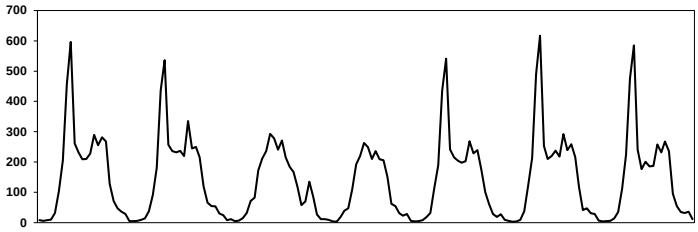
Avg Traffic Composition	
Cars	92.9%
Trucks	5.2%
Articulated	1.9%

Avg Speed Data (kph)	
85th Percentile	83.0
Mean	70.9
Minimum	14.0
Maximum	150.0
Std. Deviation	13.0

Hourly Volume By Day (Speed and Classification)

Menangle Road
200m north of Medhurst Road
Menangle Park
Northbound - One Way Traffic

Site Number:	1
Client:	Stantec
LGA:	Wollondilly Shire
Count Type:	Volume/Class/Speed
Coordinates:	-34.1047476, 150.7645521



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Posted Speed Limit

Day	Thu	Fri	Sat	Sun	Mon	Tue	Wed	7 day Average	Weekday Average
Time	16/06/22	17/06/22	18/06/22	19/06/22	20/06/22	21/06/22	22/06/22		
0:00	8	5	8	12	4	6	4	7	5
1:00	6	6	12	12	5	3	5	7	5
2:00	8	9	5	9	8	4	6	7	7
3:00	10	14	7	4	19	9	14	11	13
4:00	32	38	15	3	32	38	35	28	35
5:00	104	91	32	19	114	123	112	85	109
6:00	205	181	72	39	190	213	224	161	203
7:00	455	436	82	47	435	490	476	346	458
8:00	596	536	173	110	541	617	585	451	575
9:00	261	257	212	192	242	253	241	237	251
10:00	231	236	236	220	216	210	177	218	214
11:00	209	232	293	263	204	220	201	232	213
12:00	210	237	278	249	198	238	186	228	214
13:00	228	220	241	210	203	218	187	215	211
14:00	290	335	271	236	269	292	258	279	289
15:00	256	245	216	209	229	239	232	232	240
16:00	282	250	185	206	239	259	268	241	260
17:00	268	216	167	151	174	216	236	204	222
18:00	128	120	118	62	100	118	95	106	112
19:00	72	66	58	55	62	42	55	59	59
20:00	47	55	70	31	29	47	35	45	43
21:00	36	54	135	23	19	31	32	47	34
22:00	29	30	85	29	28	29	36	38	30
23:00	5	25	27	6	9	7	12	13	12
7am-7pm	3414	3320	2472	2155	3050	3370	3142	2989	3259
24hr Total	3976	3894	2998	2397	3569	3922	3712	3495	3815
Cars	3625	3550	2899	2330	3348	3578	3457	3255	36
Trucks	234	194	81	56	193	250	213	174	2
Artic.	117	125	16	3	54	103	42	66	1

SITE DETAILS
One Way Traffic

Speed Distribution	
> 40 km/hr	96.3%
> 50 km/hr	86.4%
> 60 km/hr	78.8%
> 70 km/hr	68.4%
> 80 km/hr	24.9%
> 90 km/hr	2.8%
> 100 km/hr	0.4%

Peak Survey Results		
AM	8:00	617
PM	14:00	335
24hr Volume		3976
Cars		3625
Trucks		250
Articulated		125
7am to 7pm Volume		3414

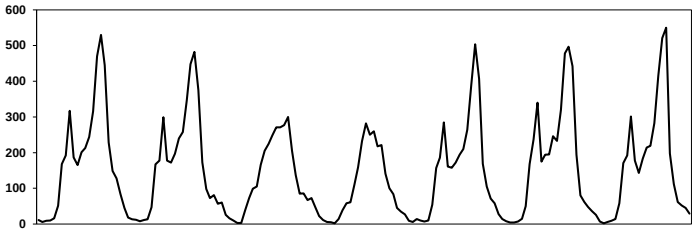
Avg Traffic Composition	
Cars	93.1%
Trucks	5.0%
Articulated	1.9%

Avg Speed Data (kph)	
85th Percentile	83.7
Mean	70.9
Minimum	23.0
Maximum	150.0
Std. Deviation	14.0

Hourly Volume By Day (Speed and Classification)

Menangle Road
200m north of Medhurst Road
Menangle Park
Southbound - One Way Traffic

Site Number:	1
Client:	Stantec
LGA:	Wollondilly Shire
Count Type:	Volume/Class/Speed
Coordinates:	-34.1047476, 150.7645521



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Posted Speed Limit

Day	Thu	Fri	Sat	Sun	Mon	Tue	Wed	7 day Average	Weekday Average
Time	16/06/22	17/06/22	18/06/22	19/06/22	20/06/22	21/06/22	22/06/22		
0:00	11	13	26	22	6	8	7	13	9
1:00	6	12	16	11	14	4	2	9	8
2:00	9	8	10	6	10	4	6	8	7
3:00	10	11	3	5	7	7	9	7	9
4:00	16	13	3	2	10	15	14	10	14
5:00	51	47	39	14	54	50	58	45	52
6:00	168	167	73	39	157	168	171	135	166
7:00	192	178	99	58	186	237	192	163	197
8:00	317	299	105	61	285	340	301	244	308
9:00	187	178	166	110	161	175	178	165	176
10:00	165	172	205	159	158	194	143	171	166
11:00	201	197	225	232	172	195	183	201	190
12:00	213	240	248	282	194	246	214	234	221
13:00	244	258	271	250	210	233	219	241	233
14:00	316	347	271	260	264	320	283	294	306
15:00	470	448	277	218	388	478	415	385	440
16:00	530	482	300	221	504	497	521	436	507
17:00	445	375	205	141	407	442	550	366	444
18:00	229	173	137	100	169	194	198	171	193
19:00	149	98	85	84	105	80	112	102	109
20:00	128	73	86	45	71	62	62	75	79
21:00	84	81	67	35	58	48	52	61	65
22:00	45	57	73	27	28	36	45	44	42
23:00	18	60	48	9	14	26	29	29	29
7am-7pm	3509	3347	2509	2092	3098	3551	3397	3072	3380
24hr Total	4204	3987	3038	2391	3632	4059	3964	3611	3969
Cars	3827	3566	2917	2307	3384	3709	3697	3344	37
Trucks	250	219	113	94	219	249	238	197	2
Artic.	127	142	20	2	51	115	29	69	1

SITE DETAILS
One Way Traffic

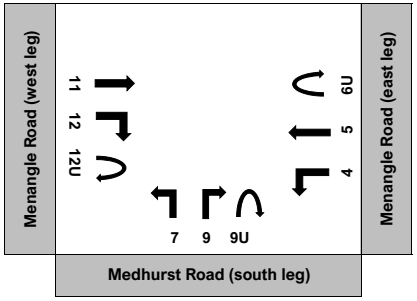
Speed Distribution	
> 40 km/hr	98.9%
> 50 km/hr	91.4%
> 60 km/hr	81.2%
> 70 km/hr	68.2%
> 80 km/hr	18.6%
> 90 km/hr	1.9%
> 100 km/hr	0.3%

Peak Survey Results		
AM	8:00	340
PM	17:00	550
24hr Volume		4204
Cars		3827
Trucks		250
Articulated		142
7am to 7pm Volume		3551

Avg Traffic Composition	
Cars	92.6%
Trucks	5.5%
Articulated	1.9%

Avg Speed Data (kph)	
85th Percentile	81.9
Mean	70.9
Minimum	14.0
Maximum	148.0
Std. Deviation	12.0

Report Type:	Classified Intersection Data - **60min**
Geocounts Job ID:	1652913908991
Client Job Number:	300303568
Client Name:	Stantec
Location:	Menangle Park
Survey Site:	IC01 - Menangle Road / Medhurst Road
Survey Date:	**Thursday, 9th June 2022**
Site Coordinates:	-34.1062178, 150.7633129



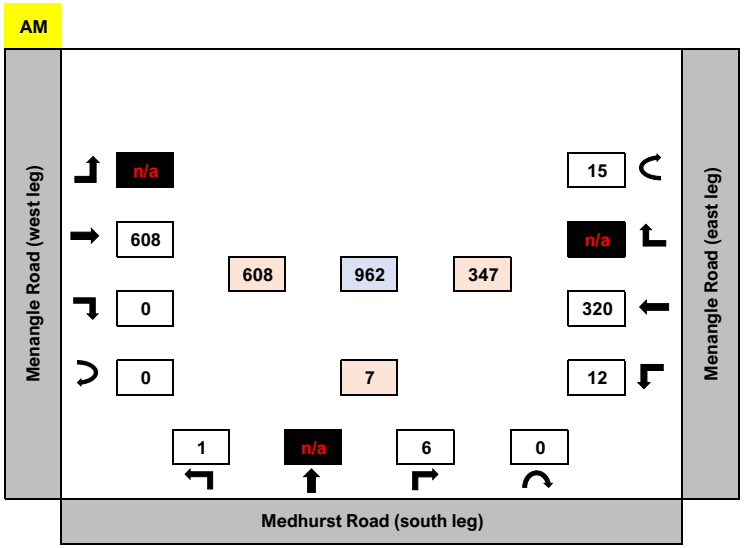
AM Peak Hour:	**7:45 to 8:45**
PM Peak Hour:	**16:30 to 17:30**
AM Peak Hour Volume:	**962**
PM Peak Hour Volume:	**954**

Approach	**Menangle Road (east leg)**									**Medhurst Road (south leg)**									**Menangle Road (west leg)**								
Movement	Movement 4 (Left Turn)			Movement 5 (Through)			Movement 6U (U Turn)			Movement 7 (Left Turn)			Movement 9 (Right Turn)			Movement 9U (U Turn)			Movement 11 (Through)			Movement 12 (Right Turn)			Movement 12U (U Turn)		
Time Interval	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**	Light	Heavy	**Total**
7:00 to 8:00	4	0	**4**	185	23	**208**	0	0	**0**	1	0	**1**	2	0	**2**	0	0	**0**	446	15	**461**	1	0	**1**	0	0	**0**
7:15 to 8:15	4	0	**4**	230	21	**251**	1	0	**1**	1	0	**1**	2	0	**2**	0	0	**0**	534	23	**557**	1	0	**1**	0	0	**0**
7:30 to 8:30	7	0	**7**	283	18	**301**	9	0	**9**	2	0	**2**	2	0	**2**	0	0	**0**	606	29	**635**	1	0	**1**	0	0	**0**
7:45 to 8:45	12	0	**12**	308	12	**320**	15	0	**15**	1	0	**1**	6	0	**6**	0	0	**0**	577	31	**608**	0	0	**0**	0	0	**0**
8:00 to 9:00	15	0	**15**	301	22	**323**	15	0	**15**	1	0	**1**	6	0	**6**	0	0	**0**	484	23	**507**	1	0	**1**	0	0	**0**
8:15 to 9:15	16	0	**16**	279	28	**307**	14	0	**14**	4	0	**4**	9	0	**9**	0	0	**0**	400	14	**414**	1	0	**1**	0	0	**0**
8:30 to 9:30	12	0	**12**	238	34	**272**	6	0	**6**	3	0	**3**	8	0	**8**	0	0	**0**	303	11	**314**	1	1	**2**	0	0	**0**
8:45 to 9:45	5	0	**5**	195	37	**232**	0	0	**0**	3	0	**3**	3	0	**3**	0	0	**0**	271	12	**283**	1	1	**2**	0	0	**0**
9:00 to 10:00	4	1	**5**	185	25	**210**	0	0	**0**	4	0	**4**	6	1	**7**	0	0	**0**	243	13	**256**	0	1	**1**	0	0	**0**
15:00 to 16:00	6	0	**6**	396	25	**421**	1	0	**1**	2	1	**3**	11	1	**12**	0	0	**0**	256	13	**269**	1	2	**3**	0	0	**0**
15:15 to 16:15	1	0	**1**	411	19	**430**	0	0	**0**	2	1	**3**	4	1	**5**	0	0	**0**	259	14	**273**	0	0	**0**	0	0	**0**
15:30 to 16:30	1	0	**1**	450	14	**464**	0	0	**0**	2	1	**3**	3	0	**3**	0	0	**0**	255	16	**271**	0	0	**0**	0	0	**0**
15:45 to 16:45	0	0	**0**	491	12	**503**	0	0	**0**	3	1	**4**	2	0	**2**	0	0	**0**	258	17	**275**	1	0	**1**	0	0	**0**
16:00 to 17:00	2	0	**2**	573	10	**583**	0	0	**0**	3	0	**3**	2	0	**2**	0	0	**0**	245	13	**258**	1	0	**1**	0	0	**0**
16:15 to 17:15	2	0	**2**	619	8	**627**	0	0	**0**	2	0	**2**	4	0	**4**	0	0	**0**	261	12	**273**	1	0	**1**	0	0	**0**
16:30 to 17:30	3	0	**3**	641	10	**651**	0	0	**0**	3	0	**3**	5	0	**5**	0	0	**0**	284	6	**290**	2	0	**2**	0	0	**0**
16:45 to 17:45	3	0	**3**	605	7	**612**	1	0	**1**	2	0	**2**	6	0	**6**	0	0	**0**	288	9	**297**	2	0	**2**	0	0	**0**
17:00 to 18:00	1	0	**1**	524	6	**530**	1	0	**1**	1	0	**1**	4	0	**4**	0	0	**0**	279	6	**285**	2	0	**2**	0	0	**0**

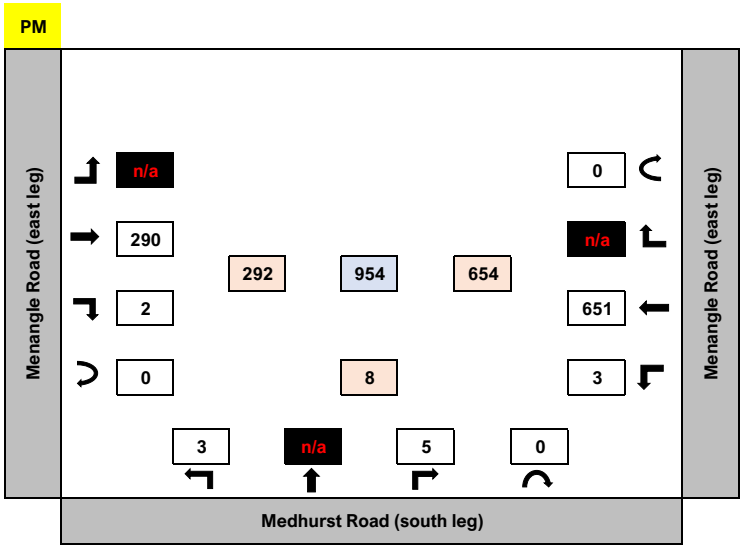
Report Type:	Peak Hour Volume Diagram
Geocounts Job ID:	1652913908991
Client Job Number:	300303568
Client Name:	Stantec
Location:	Menangle Park
Survey Site:	IC01 - Menangle Road / Medhurst Road
Survey Date:	**Thursday, 9th June 2022**
Site Coordinates:	-34.1062178, 150.7633129

AM Peak Hour:	**7:45 to 8:45**
PM Peak Hour:	**16:30 to 17:30**
AM Peak Hour Volume:	**962**
PM Peak Hour Volume:	**954**

AM



PM



Appendix B SIDRA Modelling Outputs

MOVEMENT SUMMARY

Site: 1 [Menangle Rd/Medhurst Rd_Existing_AM (Site Folder: Existing - FINAL)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
1	L2	1	0	1	0.0	0.017	5.7	LOS A	0.0	0.3	0.63	0.77	0.63	49.8
3	R2	6	0	6	0.0	0.017	11.3	LOS A	0.0	0.3	0.63	0.77	0.63	39.3
Approach		7	0	7	0.0	0.017	10.5	LOS A	0.0	0.3	0.63	0.77	0.63	40.5
East: Menangle Road														
4	L2	12	0	13	0.0	0.192	3.5	LOS A	0.0	0.0	0.00	0.02	0.00	40.0
5	T1	335	12	353	3.6	0.192	0.1	LOS A	0.0	0.0	0.00	0.02	0.00	39.9
Approach		347	12	365	3.5	0.192	0.2	NA	0.0	0.0	0.00	0.02	0.00	39.9
West: Menangle Road														
11	T1	608	31	640	5.1	0.340	4.2	LOS A	0.0	0.1	0.00	0.51	0.00	50.5
12	R2	1	0	1	0.0	0.340	8.6	LOS A	0.0	0.1	0.00	0.51	0.00	56.4
Approach		609	31	641	5.1	0.340	4.2	NA	0.0	0.1	0.00	0.51	0.00	50.5
All Vehicles		963	43	1014	4.5	0.340	2.8	NA	0.0	0.3	0.01	0.33	0.01	46.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Menangle Rd/Medhurst Rd_Existing_PM (Site Folder: Existing - FINAL)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
1	L2	3	0	3	0.0	0.017	7.6	LOS A	0.1	0.4	0.64	0.76	0.64	50.3
3	R2	5	0	5	0.0	0.017	11.2	LOS A	0.1	0.4	0.64	0.76	0.64	50.0
Approach		8	0	8	0.0	0.017	9.8	LOS A	0.1	0.4	0.64	0.76	0.64	50.1
East: Menangle Road														
4	L2	3	0	3	0.0	0.357	7.0	LOS A	0.0	0.0	0.00	0.00	0.00	74.4
5	T1	651	10	685	1.5	0.357	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		654	10	688	1.5	0.357	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.6
West: Menangle Road														
11	T1	290	6	305	2.1	0.161	0.1	LOS A	0.0	0.2	0.01	0.00	0.01	79.8
12	R2	2	0	2	0.0	0.161	10.6	LOS A	0.0	0.2	0.01	0.00	0.01	60.1
Approach		292	6	307	2.1	0.161	0.1	NA	0.0	0.2	0.01	0.00	0.01	79.6
All Vehicles		954	16	1004	1.7	0.357	0.2	NA	0.1	0.4	0.01	0.01	0.01	79.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Menangle Rd/Medhurst Rd_2032_AM (Site Folder: Opening Year (2032) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2032_AM (Network Folder: 2032)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
1	L2	62	2.0	62	2.0	0.891	42.5	LOS C	27.4	195.2	0.98	1.00	1.26	33.5
3	R2	1161	2.0	1161	2.0	* 0.891	42.9	LOS D	28.2	200.5	0.99	1.00	1.27	27.6
Approach		1223	2.0	1223	2.0	0.891	42.9	LOS D	28.2	200.5	0.99	1.00	1.27	27.8
East: Menangle Road														
4	L2	288	6.0	288	6.0	0.220	6.9	LOS A	3.5	25.6	0.33	0.59	0.33	34.8
5	T1	739	6.0	739	6.0	0.711	28.8	LOS C	14.0	103.1	0.95	0.85	0.99	36.4
Approach		1027	6.0	1027	6.0	0.711	22.6	LOS B	14.0	103.1	0.77	0.77	0.81	36.1
West: Menangle Road														
11	T1	1580	6.0	1580	6.0	* 0.898	38.1	LOS C	36.6	269.0	0.98	1.04	1.22	34.4
12	R2	31	6.0	31	6.0	0.094	30.8	LOS C	0.9	6.8	0.83	0.72	0.83	34.4
Approach		1611	6.0	1611	6.0	0.898	38.0	LOS C	36.6	269.0	0.98	1.03	1.22	34.4
All Vehicles		3861	4.7	3861	4.7	0.898	35.5	LOS C	36.6	269.0	0.93	0.95	1.12	32.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Northern Roundabout_2032_AM (Site Folder: Opening Year (2032) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2032_AM (Network Folder: 2032)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	363	0.0	363	0.0	0.225	9.4	LOS A	1.6	10.9	0.78	0.77	0.78	46.3
3	R2	1	0.0	1	0.0	0.225	14.7	LOS B	1.4	9.9	0.78	0.79	0.78	52.1
Approach		364	0.0	364	0.0	0.225	9.4	LOS A	1.6	10.9	0.78	0.77	0.78	46.4
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.282	4.5	LOS A	1.7	12.1	0.25	0.61	0.25	46.3
6	R2	846	0.0	846	0.0	0.282	9.1	LOS A	1.7	12.1	0.25	0.61	0.25	46.3
Approach		847	0.0	847	0.0	0.282	9.1	LOS A	1.7	12.1	0.25	0.61	0.25	46.3
North: Medhurst Road														
7	L2	212	0.0	212	0.0	0.114	4.2	LOS A	0.7	5.0	0.02	0.49	0.02	54.2
8	T1	91	0.0	91	0.0	0.062	4.1	LOS A	0.4	2.5	0.02	0.40	0.02	49.6
Approach		302	0.0	302	0.0	0.114	4.1	LOS A	0.7	5.0	0.02	0.46	0.02	53.4
All Vehicles		1514	0.0	1514	0.0	0.282	8.2	LOS A	1.7	12.1	0.33	0.62	0.33	47.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Southern Roundabout_2032_AM (Site Folder: Opening Year (2032) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2032_AM (Network Folder: 2032)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	1	0.0	1	0.0	0.002	5.6	LOS A	0.0	0.1	0.44	0.52	0.44	47.6
3	R2	1	0.0	1	0.0	0.002	10.2	LOS A	0.0	0.1	0.44	0.52	0.44	53.4
Approach		2	0.0	2	0.0	0.002	7.9	LOS A	0.0	0.1	0.44	0.52	0.44	51.3
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.209	3.9	LOS A	1.1	7.8	0.02	0.65	0.02	52.0
6	R2	363	0.0	363	0.0	0.209	8.7	LOS A	1.1	7.8	0.02	0.65	0.02	47.4
Approach		364	0.0	364	0.0	0.209	8.7	LOS A	1.1	7.8	0.02	0.65	0.02	47.4
North: Medhurst Road														
7	L2	91	0.0	91	0.0	0.053	3.9	LOS A	0.3	2.0	0.02	0.47	0.02	55.6
8	T1	1	0.0	1	0.0	0.053	4.1	LOS A	0.3	2.0	0.02	0.47	0.02	57.0
Approach		92	0.0	92	0.0	0.053	3.9	LOS A	0.3	2.0	0.02	0.47	0.02	55.6
All Vehicles		458	0.0	458	0.0	0.209	7.7	LOS A	1.1	7.8	0.02	0.62	0.02	49.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Menangle Rd/Medhurst Rd_2032_PM (Site Folder: Opening Year (2032) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2032_PM (Network Folder: 2032)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
1	L2	33	2.0	33	2.0	0.819	83.3	LOS F	11.6	82.3	1.00	0.89	1.21	22.8
3	R2	267	2.0	267	2.0	0.819	83.7	LOS F	11.7	83.0	1.00	0.89	1.21	22.8
Approach		300	2.0	300	2.0	0.819	83.6	LOS F	11.7	83.0	1.00	0.89	1.21	22.8
East: Menangle Road														
4	L2	1106	6.0	1106	6.0	* 0.959	41.9	LOS C	49.4	363.6	0.35	0.80	0.52	28.6
5	T1	1614	6.0	1614	6.0	0.811	13.2	LOS A	52.4	385.4	0.61	0.58	0.63	62.1
Approach		2720	6.0	2720	6.0	0.959	24.9	LOS B	52.4	385.4	0.50	0.67	0.58	47.6
West: Menangle Road														
11	T1	668	6.0	668	6.0	0.217	3.1	LOS A	5.2	38.2	0.24	0.21	0.24	74.9
12	R2	61	6.0	61	6.0	* 0.484	54.0	LOS D	4.7	34.9	1.00	0.87	1.00	24.1
Approach		729	6.0	729	6.0	0.484	7.3	LOS A	5.2	38.2	0.30	0.26	0.30	68.5
All Vehicles		3749	5.7	3749	5.7	0.959	26.2	LOS B	52.4	385.4	0.50	0.61	0.58	46.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Northern Roundabout_2032_PM (Site Folder: Opening Year (2032) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2032_PM (Network Folder: 2032)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	1	0.0	1	0.0	0.001	4.3	LOS A	0.0	0.0	0.19	0.38	0.19	51.6
3	R2	1	0.0	1	0.0	0.001	9.0	LOS A	0.0	0.0	0.20	0.58	0.20	52.6
Approach		2	0.0	2	0.0	0.001	6.7	LOS A	0.0	0.0	0.20	0.48	0.20	52.2
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.026	4.2	LOS A	0.1	0.9	0.01	0.65	0.01	47.5
6	R2	87	0.0	87	0.0	0.026	8.7	LOS A	0.1	0.9	0.01	0.65	0.01	47.5
Approach		88	0.0	88	0.0	0.026	8.7	LOS A	0.1	0.9	0.01	0.65	0.01	47.5
North: Medhurst Road														
7	L2	348	0.0	348	0.0	0.188	4.2	LOS A	1.0	7.1	0.02	0.49	0.02	54.2
8	T1	1	0.0	1	0.0	0.001	4.1	LOS A	0.0	0.0	0.02	0.40	0.02	49.6
Approach		349	0.0	349	0.0	0.188	4.2	LOS A	1.0	7.1	0.02	0.49	0.02	54.2
All Vehicles		440	0.0	440	0.0	0.188	5.1	LOS A	1.0	7.1	0.02	0.52	0.02	53.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Southern Roundabout_2032_PM (Site Folder: Opening Year (2032) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2032_PM (Network Folder: 2032)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	1	0.0	1	0.0	0.002	4.4	LOS A	0.0	0.1	0.21	0.51	0.21	48.9
3	R2	1	0.0	1	0.0	0.002	9.1	LOS A	0.0	0.1	0.21	0.51	0.21	54.2
Approach		2	0.0	2	0.0	0.002	6.7	LOS A	0.0	0.1	0.21	0.51	0.21	52.3
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.052	3.9	LOS A	0.2	1.7	0.01	0.65	0.01	52.1
6	R2	87	0.0	87	0.0	0.052	8.7	LOS A	0.2	1.7	0.01	0.65	0.01	47.5
Approach		88	0.0	88	0.0	0.052	8.7	LOS A	0.2	1.7	0.01	0.65	0.01	47.6
North: Medhurst Road														
7	L2	348	0.0	348	0.0	0.200	3.9	LOS A	1.2	8.1	0.02	0.47	0.02	55.6
8	T1	1	0.0	1	0.0	0.200	4.1	LOS A	1.2	8.1	0.02	0.47	0.02	57.0
Approach		349	0.0	349	0.0	0.200	3.9	LOS A	1.2	8.1	0.02	0.47	0.02	55.6
All Vehicles		440	0.0	440	0.0	0.200	4.9	LOS A	1.2	8.1	0.02	0.51	0.02	54.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Menangle Rd/Medhurst Rd_2042_AM (Site Folder: 10-Year Horizon (2042) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2042_AM (Network Folder: 2042)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
1	L2	66	5.6	66	5.6	0.937	72.2	LOS F	54.0	396.0	0.99	0.99	1.20	24.7
3	R2	1249	5.6	1249	5.6	* 0.937	73.5	LOS F	56.3	412.7	0.99	0.99	1.21	21.7
Approach		1316	5.6	1316	5.6	0.937	73.4	LOS F	56.3	412.7	0.99	0.99	1.21	21.8
East: Menangle Road														
4	L2	406	4.3	406	4.3	0.268	6.7	LOS A	6.0	43.2	0.22	0.59	0.22	39.2
5	T1	865	6.0	865	6.0	0.709	37.3	LOS C	32.6	239.8	0.85	0.75	0.85	33.5
Approach		1272	5.5	1272	5.5	0.709	27.5	LOS B	32.6	239.8	0.65	0.70	0.65	34.5
West: Menangle Road														
11	T1	1809	6.0	1809	6.0	* 0.934	56.7	LOS E	74.0	544.8	0.99	1.00	1.13	29.3
12	R2	43	4.2	43	4.2	0.181	54.6	LOS D	2.6	19.0	0.85	0.77	0.85	23.3
Approach		1853	6.0	1853	6.0	0.934	56.6	LOS E	74.0	544.8	0.98	1.00	1.12	29.2
All Vehicles		4440	5.7	4440	5.7	0.937	53.3	LOS D	74.0	544.8	0.89	0.91	1.01	27.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Northern Roundabout_2042_AM (Site Folder: 10-Year Horizon (2042) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2042_AM (Network Folder: 2042)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	454	0.0	454	0.0	0.441	10.3	LOS A	2.4	16.5	0.83	0.87	0.90	45.2
3	R2	19	0.0	19	0.0	0.441	16.1	LOS B	2.1	15.0	0.82	0.91	0.93	50.8
Approach		473	0.0	473	0.0	0.441	10.6	LOS A	2.4	16.5	0.83	0.87	0.90	45.6
East: Internal Roadway														
4	L2	19	0.0	19	0.0	0.475	5.1	LOS A	2.2	15.2	0.42	0.65	0.42	45.6
6	R2	846	0.0	846	0.0	0.475	9.8	LOS A	2.2	15.2	0.43	0.66	0.43	45.5
Approach		865	0.0	865	0.0	0.475	9.7	LOS A	2.2	15.2	0.43	0.66	0.43	45.5
North: Medhurst Road														
7	L2	212	0.0	212	0.0	0.140	4.2	LOS A	0.9	6.3	0.12	0.47	0.12	53.8
8	T1	217	0.0	217	0.0	0.126	4.2	LOS A	0.8	5.7	0.11	0.39	0.11	48.5
Approach		428	0.0	428	0.0	0.140	4.2	LOS A	0.9	6.3	0.11	0.43	0.11	52.1
All Vehicles		1766	0.0	1766	0.0	0.475	8.6	LOS A	2.4	16.5	0.46	0.66	0.48	47.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Southern Roundabout_2042_AM (Site Folder: 10-Year Horizon (2042) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2042_AM (Network Folder: 2042)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	1	0.0	1	0.0	0.002	6.1	LOS A	0.0	0.1	0.50	0.53	0.50	47.1
3	R2	1	0.0	1	0.0	0.002	10.8	LOS A	0.0	0.1	0.50	0.53	0.50	53.0
Approach		2	0.0	2	0.0	0.002	8.4	LOS A	0.0	0.1	0.50	0.53	0.50	50.8
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.271	3.9	LOS A	1.5	10.8	0.02	0.65	0.02	52.0
6	R2	472	0.0	472	0.0	0.271	8.7	LOS A	1.5	10.8	0.02	0.65	0.02	47.4
Approach		473	0.0	473	0.0	0.271	8.7	LOS A	1.5	10.8	0.02	0.65	0.02	47.4
North: Medhurst Road														
7	L2	235	0.0	235	0.0	0.136	3.9	LOS A	0.8	5.7	0.02	0.47	0.02	55.6
8	T1	1	0.0	1	0.0	0.136	4.1	LOS A	0.8	5.7	0.02	0.47	0.02	57.0
Approach		236	0.0	236	0.0	0.136	3.9	LOS A	0.8	5.7	0.02	0.47	0.02	55.6
All Vehicles		711	0.0	711	0.0	0.271	7.1	LOS A	1.5	10.8	0.02	0.59	0.02	51.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Menangle Rd/Medhurst Rd_2042_PM (Site Folder: 10-Year Horizon (2042) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2042_PM (Network Folder: 2042)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
1	L2	34	6.0	34	6.0	* 0.982	114.0	LOS F	14.1	103.7	1.00	1.06	1.61	18.3
3	R2	269	6.0	269	6.0	0.982	114.6	LOS F	14.3	104.9	1.00	1.06	1.61	18.3
Approach		303	6.0	303	6.0	0.982	114.6	LOS F	14.3	104.9	1.00	1.06	1.61	18.3
East: Menangle Road														
4	L2	1107	6.0	1107	6.0	0.977	52.7	LOS D	55.8	410.6	0.35	0.81	0.58	24.5
5	T1	1859	6.0	1859	6.0	* 0.947	37.5	LOS C	96.4	709.3	0.78	0.85	0.93	43.9
Approach		2966	6.0	2966	6.0	0.977	43.2	LOS D	96.4	709.3	0.62	0.84	0.80	37.1
West: Menangle Road														
11	T1	778	6.0	778	6.0	0.249	2.7	LOS A	5.8	42.7	0.23	0.20	0.23	75.5
12	R2	61	6.0	61	6.0	0.494	73.9	LOS F	4.7	34.5	1.00	0.83	1.00	19.1
Approach		839	6.0	839	6.0	0.494	7.9	LOS A	5.8	42.7	0.28	0.25	0.28	67.8
All Vehicles		4108	6.0	4108	6.0	0.982	41.2	LOS C	96.4	709.3	0.58	0.73	0.75	38.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Northern Roundabout_2042_PM (Site Folder: 10-Year Horizon (2042) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2042_PM (Network Folder: 2042)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	87	0.0	87	0.0	0.034	4.8	LOS A	0.2	1.3	0.36	0.44	0.36	50.2
3	R2	1	0.0	1	0.0	0.034	9.5	LOS A	0.2	1.2	0.36	0.45	0.36	55.0
Approach		88	0.0	88	0.0	0.034	4.9	LOS A	0.2	1.3	0.36	0.44	0.36	50.3
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.084	5.5	LOS A	0.5	3.2	0.44	0.64	0.44	45.4
6	R2	203	0.0	203	0.0	0.084	10.2	LOS A	0.5	3.2	0.44	0.64	0.44	45.4
Approach		204	0.0	204	0.0	0.084	10.1	LOS A	0.5	3.2	0.44	0.64	0.44	45.4
North: Medhurst Road														
7	L2	812	0.0	812	0.0	0.436	4.2	LOS A	3.4	23.6	0.02	0.49	0.02	54.1
8	T1	348	0.0	348	0.0	0.235	4.1	LOS A	1.4	9.8	0.02	0.40	0.02	49.6
Approach		1160	0.0	1160	0.0	0.436	4.1	LOS A	3.4	23.6	0.02	0.46	0.02	53.4
All Vehicles		1453	0.0	1453	0.0	0.436	5.0	LOS A	3.4	23.6	0.10	0.49	0.10	52.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Southern Roundabout_2042_PM (Site Folder: 10-Year Horizon (2042) - Signal Two Lane Upgraded Intersection - FINAL)]

Network: N101 [2042_PM (Network Folder: 2042)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Medhurst Road														
2	T1	1	0.0	1	0.0	0.002	4.4	LOS A	0.0	0.1	0.21	0.51	0.21	48.9
3	R2	1	0.0	1	0.0	0.002	9.1	LOS A	0.0	0.1	0.21	0.51	0.21	54.2
Approach		2	0.0	2	0.0	0.002	6.7	LOS A	0.0	0.1	0.21	0.51	0.21	52.3
East: Internal Roadway														
4	L2	1	0.0	1	0.0	0.052	3.9	LOS A	0.2	1.7	0.01	0.65	0.01	52.1
6	R2	87	0.0	87	0.0	0.052	8.7	LOS A	0.2	1.7	0.01	0.65	0.01	47.5
Approach		88	0.0	88	0.0	0.052	8.7	LOS A	0.2	1.7	0.01	0.65	0.01	47.6
North: Medhurst Road														
7	L2	348	0.0	348	0.0	0.200	3.9	LOS A	1.2	8.1	0.02	0.47	0.02	55.6
8	T1	1	0.0	1	0.0	0.200	4.1	LOS A	1.2	8.1	0.02	0.47	0.02	57.0
Approach		349	0.0	349	0.0	0.200	3.9	LOS A	1.2	8.1	0.02	0.47	0.02	55.6
All Vehicles		440	0.0	440	0.0	0.200	4.9	LOS A	1.2	8.1	0.02	0.51	0.02	54.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network 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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.