Traffic Impact Assessment

Werrington Subdivision

89914069

Prepared for

Lendlease

25 March 2020

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1 Introduction

Cardno has been invited by Lendlease to prepare a Traffic Impact Assessment (TIA) to supplement a Development Application (DA) for the residential and industrial subdivision located at 16 Chapman Street, Werrington. The subject site is within the Penrith City Council and the development seeks to create 265 Residential Lots together with 14 light industrial lots. The light industrial lots have a combined Land Area of 31,000 m^2.

The development also creates several super lots which create the potential for a further 91 Residential Lots and 33 apartments.

The staging of the development is per the table below:

Table 1-1 Development staging

Stages	RESIDENTIAL LOTS (No)		APARTMENTS (No)		LIGHT INDUSTRIAL GROSS AREA (m^2)	
	This DA	Future DA	This DA	Future DA	This DA	Future DA
Stage 1A	64	0	0	0	0	0
Stage 1B	60	16	0	0	0	0
Stage 1C	5	14	0	0	0	0
Stage 2A	44	16	0	0	0	0
Stage 2B	63	45	0	0	0	0
Stage 3	30	0	0	33	0	0
Stage 4A	0	0	0	0	10,982.3 m^2	0
Stage 4B	0	0	0	0	20,017.7 m^2	0
TOTAL	**266**	**91**	**0**	**33**	**31,000 m^2**	**0**

This assessment has been undertaken to demonstrate the compliance of the development with relevant standards and Council controls as well as identifying the relevant traffic impacts (if any) associated with the development.

Cardno has previously submitted a TIA (October, 2019) as part of the original Development Application. This amended TIA (version 2, March 2020) includes updates that account for submissions made by Penrith Council and Transport for NSW (TfNSW) and seeks to resolve those request for information. Submissions made by the two organisations are contained in **Appendix G**.

1.1 Scope of Works

The main objective of this report is to evaluate the traffic impacts that are generated by the subdivision together with its associated impact on the surrounding road network. Cardno's scope of works for this study includes the following tasks:

- Review background information and collate supplied information from previous Cardno Tech Memo;
- Review the current transport context, including pedestrian, cycling and public transport networks and the integration of these transport modes with the wider transport network;
- Assess the traffic impact associated with the development using RMS guidelines; and
- Review the access arrangements of the proposed Lots in accordance with the relevant standards and guidelines.
- Review Penrith Council and TfNSW request for information which includes amended trip generation rates, extended locations of traffic surveys and intersection modelling.

1.2 Reference Documents

In preparing this report, reference has been made to a number of background documents, including:

- Lendlease Werrington Subdivision Traffic Investigation (Cardno, 2019);
- South Werrington Urban Village – Traffic Impact Assessment (Traffix, 2014);
- 25 Rance Road, Werrington – Traffic Impact Assessment (Mott MacDonald, 2015);

- 16 Chapman Street, Werrington (Proposed Residential Development) – Traffic Impact Assessment (Varga Traffic Planning, 2016);
- 16 Chapman Street, Werrington (Proposed Mixed Use Residential & Light Industrial Subdivision) – Traffic Impact Assessment (Varga Traffic Planning, 2016);
- Guide to Traffic Generating Developments (Roads and Maritime, 2002); and
- Technical Direction (Roads and Maritime, TDT 2013/04a).

2 Strategic Context

2.1 South Werrington Urban Village (SWUV) Precinct

The South Werrington Urban Village (SWUV) consists of approximately 48 hectares of land between the Great Western Highway and Werrington Railway Station. Penrith Council has a Development Control Plan (DCP) specific to the SWUV and is applicable to the land shown in **Figure 2-1**.

Figure 2-1 SWUV area

The SWUV structure plan provided within the DCP shows the high level land-use and road hierarchy strategy and broadly informs the future development of land within SWUV. The structure plan is depicted in **Figure 2-2**, with the DCP citing the following access measures:

- The structure plan envisages the construction of the proposed Werrington Arterial Road. A new major collector road is proposed to link the Werrington Arterial Road to the future employment development to the west. This new link road also provides a separation between the employment and residential land uses. A roundabout at the intersection of the new link road with the Werrington Arterial Road has been proposed as part of the development and can be constructed in stages if required. The location of the new link road is as shown on the Structure Plan, and is located on the residential zoned land;
- A minor north south road is proposed linking Werrington Station with the Great Western Highway and forming an edge between the employment precinct and the land that forms part of the Wollemi School;
- The arterial and collector road system are proposed to be designed to accommodate buses and articulated vehicles;
- Local streets are proposed to be generally inter-connective and to link with existing streets in South Werrington; and
- A cycle system is proposed to provide movement through the area, linking with surrounding areas including the recreational areas to the east and St Marys. The system links with the proposed cycleway along the western side of the Werrington Arterial Road with the potential to extend northwards.

Figure 2-2 SWUV structure plan

The SWUV DCP also nominates the minimum level of residential development across the precinct. The total minimum development is shown as 414 dwellings. This is shown in **Figure 2-3**.

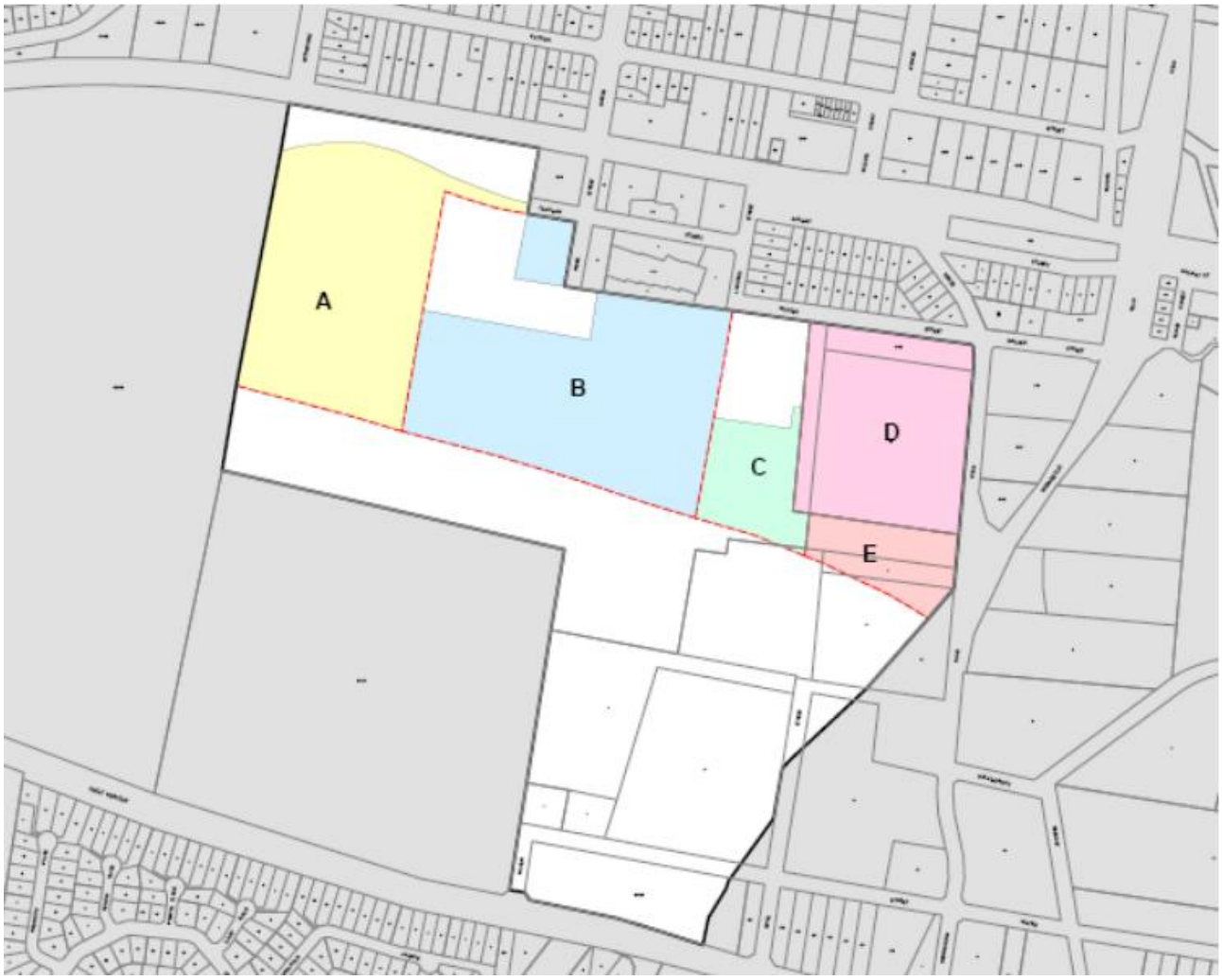


Figure 2-3 SUWV DCP yield

Sub-Precinct	Minimum dwelling yield
A	78
B	154
C	30
D	122
E	30
Totals	**414**

Traffix has previously undertaken a TIA for the SWUVP development. The SWUVP Concept Plan envisaged a proposed development of some 2,000 units of high and medium density with a mix of employment and industrial land as well.

Cardno's review of the document identified that with no development, the Rance Road / Werrington Road intersection performs at LoS B & F during the AM and PM peak hour respectively. The Traffix report states that provision of the new East-West link between the subject site and the future signalised intersection with Werrington Road should be considered a priority for redevelopment of the South Werrington Urban Village as a result of the poor performance identified at Rance Road. The proposed signalised intersection along Werrington Road with the proposed East-West link (at the south of Rance Road) would provide additional capacity and ensure an acceptable level of service of intersection performance to cope with future developmental traffic.

The provision of the signalised intersection is likely to be warranted when some 950 residential units are developed to achieve 200veh/hr on the minor roads, as required under the warrant criteria at the time of the assessment.

Cardno has undertaken a high level review of relevant documents and studies associated with the site (or nearby developments). They are summarised as follows:

- South Werrington Urban Village TIA
  - Traffic report prepared by Traffix (6 February 2014)
  - Identified that with no development, Rance Road / Werrington Road performs at LoS B & F during the AM and PM peak hour respectively. The Traffix report states that provision of the new east-west connection between the subject site and the future signalised intersection with Werrington Road should be considered a priority for redevelopment of the South Werrington Urban Village as a result of the poor performance identified at Rance Road.
  - Provision of signalised intersection likely to be warranted when some 950 residential units are developed to achieve 200veh/hr on the minor road required under the warrant criteria at the time of the assessment.
- DA 14-0627 for 85 residential allotments and 2 residue lots
  - Consent details cross section requirements for the east-west road, being a 24m road reserve width with a 14m carriageway.
- DA 15-0207 for 83 residential allotments (known as the Statewide site)
  - Traffic report prepared by Mott McDonald (February 2015). The report identifies a reduced trip generation rate based on surveys of the existing dwellings in Werrington. A trip rate of 0.44 to 0.54 was estimated based on the survey results, with a rate of 0.40 applied to the development application. Assessment was based originally on 156 Lots.
  - This February 2015 report identified that the intersection delay of Rance Road / Werrington Road was not adversely affected and proposed an upgrade to a Seagull intersection for safety reasons.
  - Peer review undertaken by Lyle Marshall & Associates (July 2015) identified capacity issues at the Rance Road / Werrington Road intersection and recommended a roundabout upgrade.
- DA 16-1148 for 94 residential allotments and 1 superlot
  - Trip generation of 0.99 trips/dwelling (per peak period) and 10 trips/light industrial lot (per peak hour) adopted as mentioned in the TIA report
- DA 16-0789 for 95 apartments (L&EC Approved)
- DA 17-0982 for 751 apartments
  - Application withdrawn
  - Traffic report prepared by Traffix (August 2017)
  - Assessment did not identify an upgrade of Rance Road / Werrington Road intersection under the future traffic loading of the site (Stages 1 to 4 and the Statewide site). LoS B/C was reported for the priority controlled intersection
  - Recommendation to upgrade the roundabout intersection of Werrington Road / The Kingsway with a short northbound lane.
- DA 17/1204 for Place of Public Worship containing 89 place Child Care Centre (refused)
  - Site access via Water Street, directly onto Great Western Highway
  - Land provision for the proposed Lander Street Extension which would travel north towards the Lendlease site (north-south collector road within the DCP Structure Plan)
  - Peak traffic generation appears to be Friday evening (6:00-7:00pm) and Sundays (9:00am – 11:30am).
  - Traffic generation in weekday morning in the order of 71 trips whilst the evening would see some 62 trips
  - Peak Friday evening traffic generation is in the order of 105 trips.
  - Peak Sunday morning traffic generation in the order of 676 coinciding with the changeover between two different services.
  - Application refusal appears to be, amongst other things, is due to concurrence with RMS not being achieved regarding access to / from Great Western Highway.

Based on the review, it is understood that there are 262 residential lots, inclusive of the Statewide site, and a further 95 residential apartments approved within the SWUV precinct.

3 Existing Conditions

3.1 Subject Site

The proposed development is located at the west of Werrington Road (approximately 400m south of Werrington Station) and is bounded to the east by Werrington Road / Rance Road. It is located approximately 50 km west of Sydney CBD. The site is primarily vacant, with surrounding rural land and residential dwellings. The location of the proposed site is shown in **Figure 3-1.**

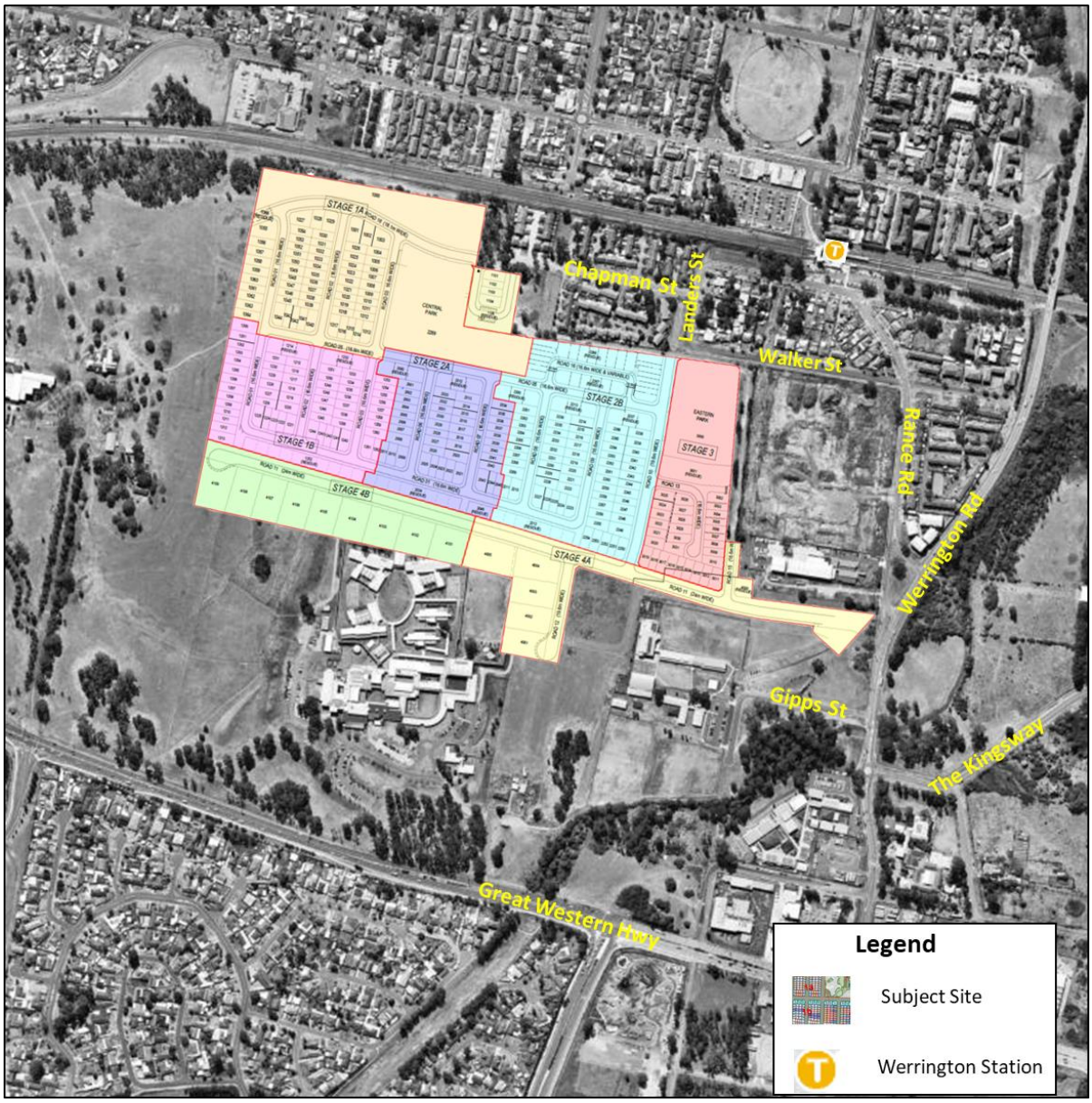


Figure 3-1 Subject site

3.2 Existing Road Network

3.2.1 Schedule of Road Classification

Transport for New South Wales (TfNSW) in partnership with local government established an administrative framework of State, Regional and Local Road categories to help manage the extensive network of roads.

State roads are managed and financed by TfNSW, and Regional / Local Roads are managed and financed by Councils. Notwithstanding, Regional Roads perform an intermediate function between the main arterial network of State Roads and Council controlled Local Roads and therefore received financial assistance from TfNSW.

The key road network surrounding the subject site consists of:

- Great Western Highway;
- Werrington Road;
- Rance Road;
- Chapman Street / Landers Street / Walker Street;
- Gipps Street; and
- Christie Street

3.2.2 Great Western Highway

Great Western Highway is classified as a State Road (Road No 5) under the care and maintenance of Roads and Maritime. The road is typically configured with a six-lane carriageway with three-lane in each direction. The posted speed limit is 80km/hr.

3.2.3 Werrington Road

Werrington Road is classified as a Regional Road (Road No 7485) under the care and maintenance of the local Council. The road is typically configured with a two-lane carriageway with one lane in each direction. The posted speed limit is 70km/hr.

3.2.4 Rance Road

Rance Road is a local, unclassified road under the care and maintenance of the local Council, and runs in a north-south direction. Rance Road borders the development site to the east. The road is typically configured with a two-lane carriageway with a posted speed limit of 50 km/hr.

3.2.5 Chapman Street/Landers Street/Walker Street

Chapman St, Landers St, and Walker St are local, unclassified roads under the care and maintenance of the local Council with a two-lane undivided carriageway. There is no posted speed limit hence a default speed of 50km/hr applies.

3.2.6 Gipp Street

Gipps St is a local, unclassified road under the care and maintenance of the local Council with a two-lane undivided carriageway. There is no posted speed limit hence a default speed of 50km/hr applies.

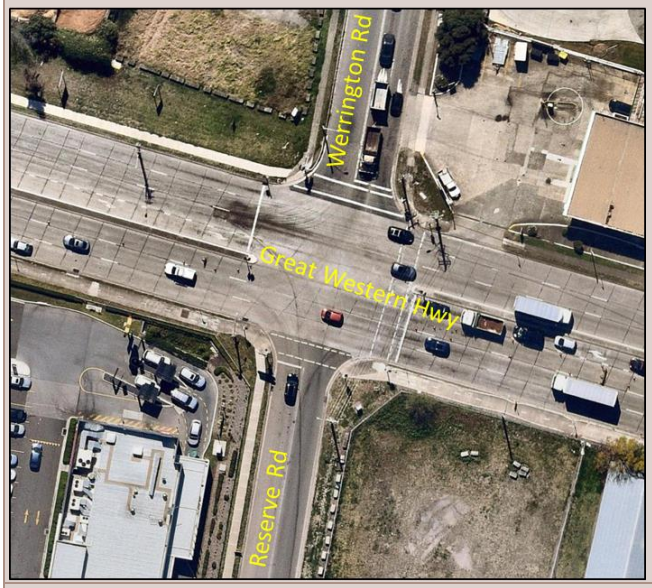
3.2.7 Christie Street

Christie Street is classified as a Regional Road (Road No 7485) under the care and maintenance of the local Council. The road is configured as a two-lane carriageway with a posted speed limit of 70km/hr.

3.3 Traffic Control

The description of the intersection in the close proximity of the subject site and their restrictions are given below:

Intersection Layout	Description
Werrington Road / Rance Road 	Werrington Road / Rance Road intersection is a priority control intersection with a 'Give Way' sign at Rance Road to control the traffic. All vehicles approaching the intersection from Rance Road to turn left or right must give way to all vehicles approaching from Werrington Road.
Werrington Road / The Kingsway 	Werrington Road / The Kingsway intersection is a roundabout that manages the traffic flow with a single lane. The rules and restrictions for giving way when approaching and exiting this roundabout are the same as for any single-lane roundabout.

Werrington Road / Great Western Highway 	Werrington Road / Great Western Highway is an intersection that manages traffic flow with traffic signals in all approaches. There are signalized pedestrian crossings also provided in the northern, eastern and southern approaches.
Werrington Road / Christie Street 	Werrington Road / The Kingsway intersection is a roundabout that manages traffic flow with two circulating lanes. The rules and restrictions for giving way when approaching and exiting this roundabout are the same as for any roundabout.

3.4 Crash Data

Crash data for the period 2014 to 2019 for the study area was accessed through TfNSW Centre for Road Safety. **Figure 3-2** shows the location of crashes within the study area.

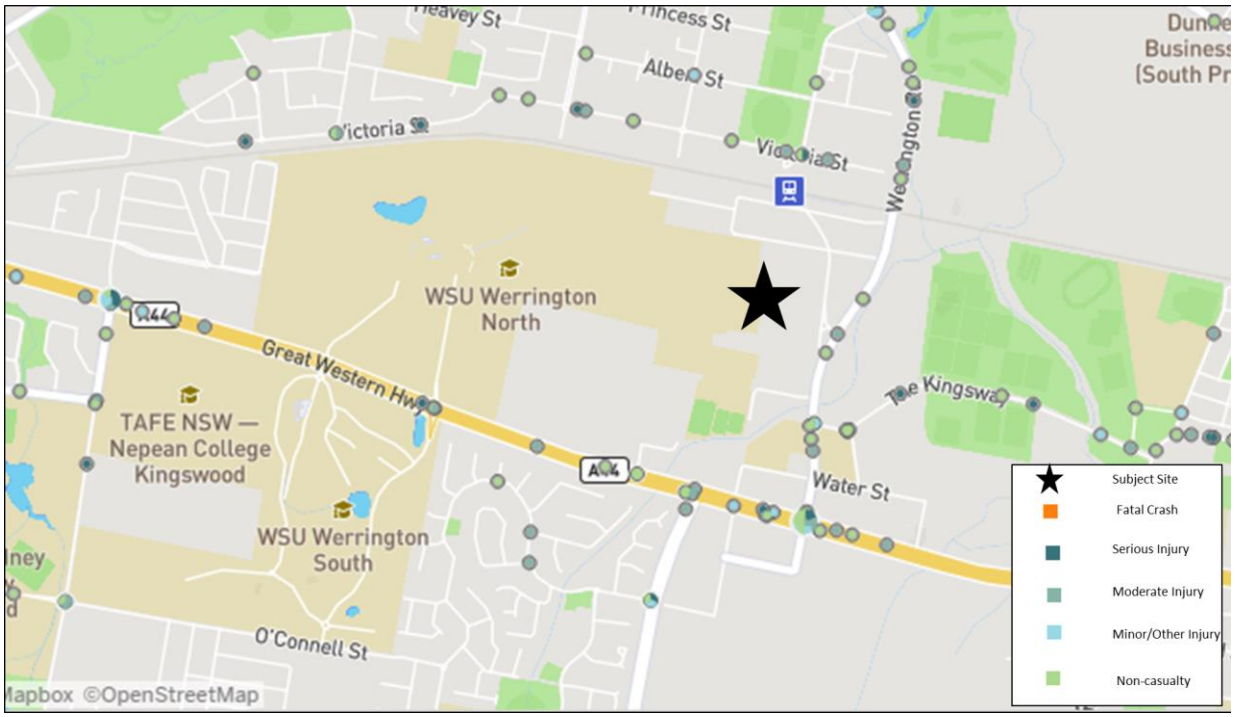


Figure 3-2 Crash locations by injury severity within study area between 2014-2018

The following key findings were identified from the analysis of the crash data:

- No fatalities were recorded in the study area.
- There was a total of two crashes at the Werrington Road / Rance Road Intersection (moderate injury and non-casual (tow-away)).
- There was a total of 20 crashes along Werrington Road which extends from Christie Street to Great Western Highway. Most of the crashes along Werrington Road were non-casual. The details of the crash types are described below:
  - Total of 4 (four) Moderate injury crashes;
  - Total of 12 non-casualties (tow-away) type of crashes;
  - 2 (two) serious injury crashes; and
  - 2 (two) minor injury crashes.

3.5 Existing Traffic Volumes (2019 & 2020)

An indication of the existing traffic volumes in the vicinity of the subject site is provided by peak hour traffic surveys, undertaken by Trans Traffic Survey (TTS), on Tuesday 27 August 2019 at the following locations:

- Werrington Road / The Kingsway;
- Werrington Road / Rance Road; and
- Rance Road / Walker Street.

In addition to the classified intersection counts, Cardno commissioned TTS to undertake a vehicle delay survey for the right turn onto Werrington Road from Rance Road.

Following consultation with Council and TfNSW, additional classified intersection counts were conducted on Tuesday 18 February 2020 by TTS at the following locations:

- Werrington Road / Christie Road; and
- Werrington Road / Great Western Highway.

24-hour automatic tube count traffic surveys were also conducted at four (4) sites between Monday 15 February 2020 and Friday 21 February 2020 by TTS at the following locations:

- Isabella Street (north of Heavey Street);
- Malcolm Avenue (west of John Oxley Avenue);
- Cygnus Close (north of Kildare Road); and
- Perigee Close (north of Kildare Road).

A summarised version of the surveys conducted on Tuesday 27 August 2019 is provided in **Figure 3-3** to **Figure 3-5**. The surveys conducted on Monday 17 February 2020 are summarised in **Figure 3-6** to **Figure 3-7.**

The identified peak periods across all surveyed intersections was 8:00am-9:00 and 4:45pm-5:45pm.

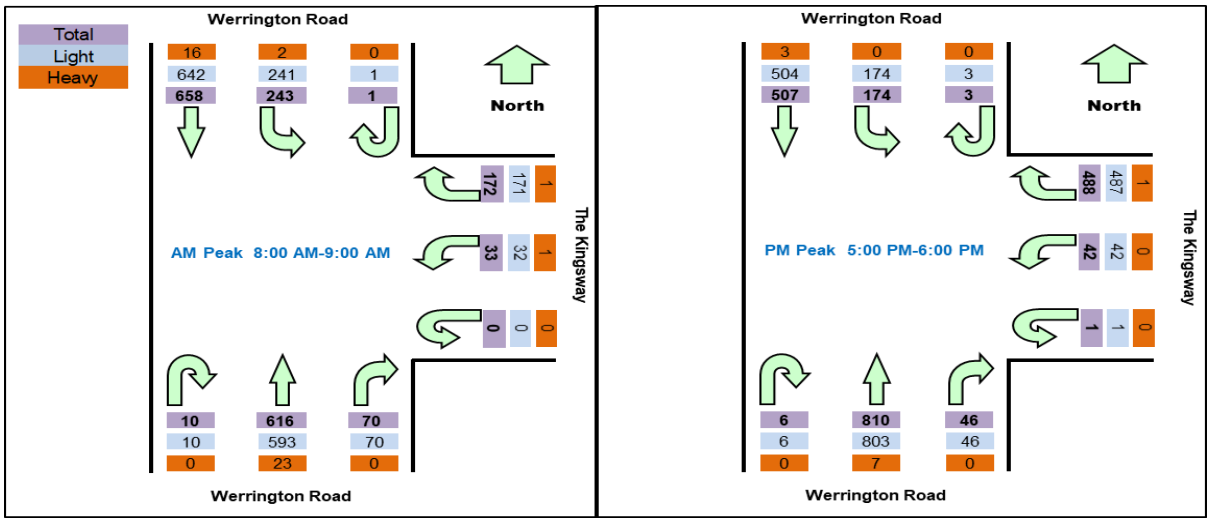


Figure 3-3 Werrington Road / The Kingsway intersection

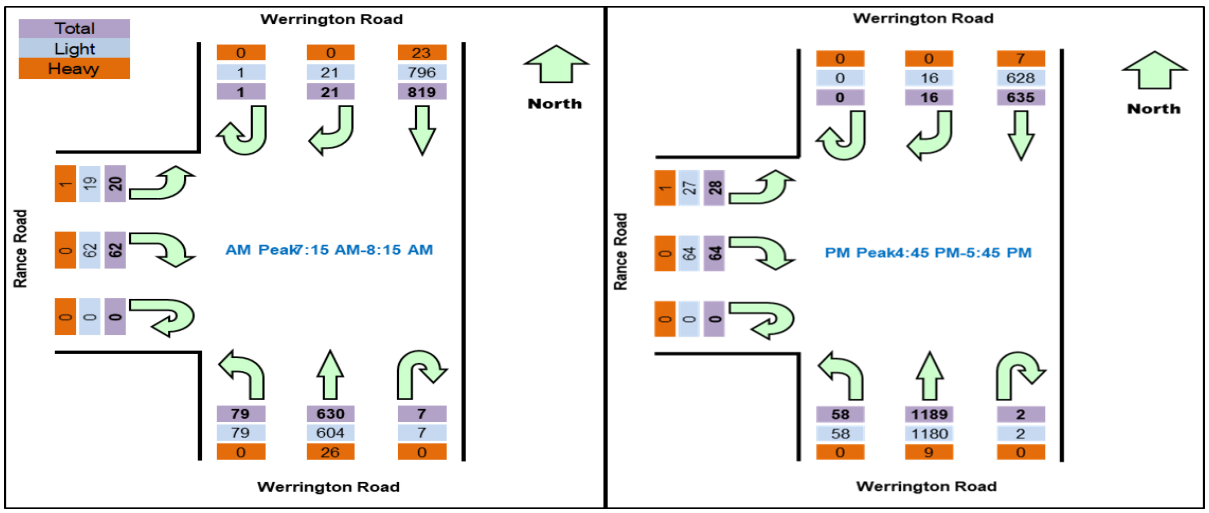


Figure 3-4 Werrington Road / Rance Road intersection

Raw traffic survey data are presented in **Appendix A** and **B**.

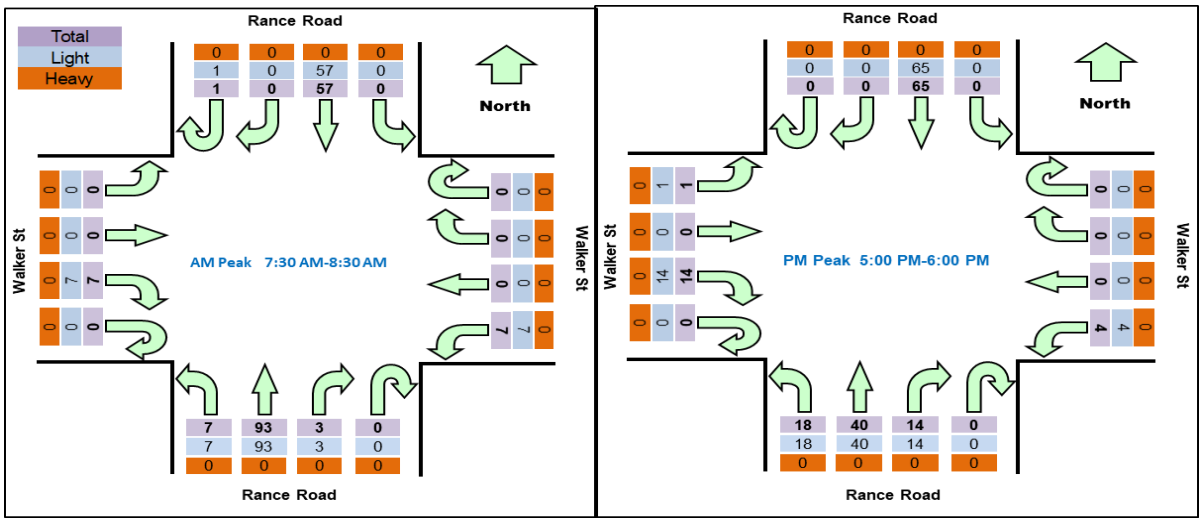


Figure 3-5 Rance Road / Walker Street intersection

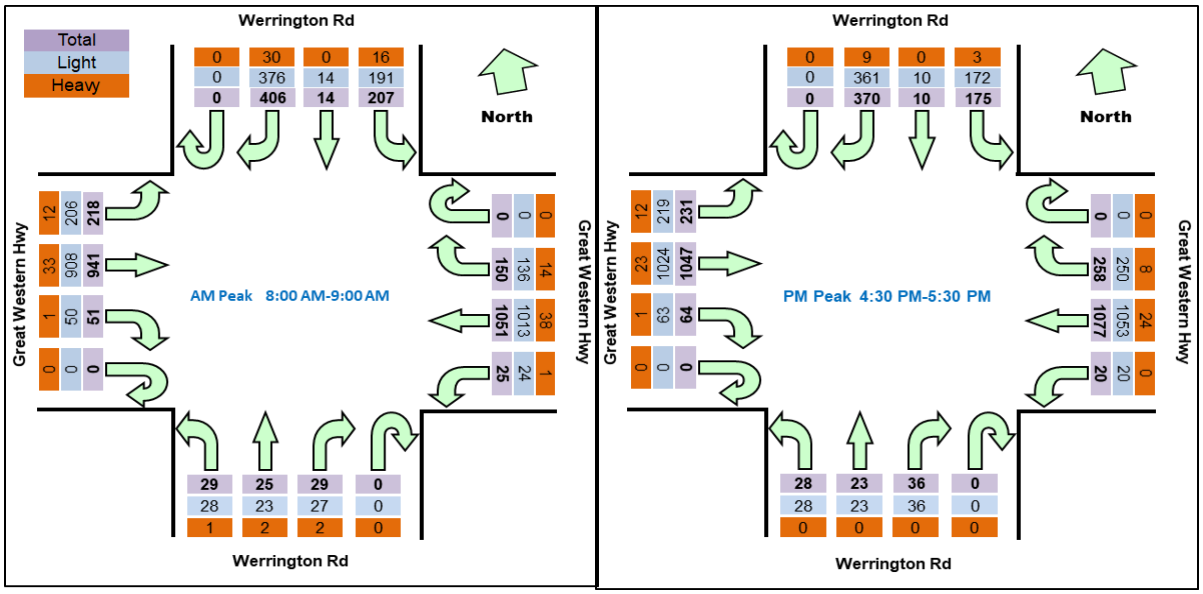


Figure 3-6 Werrington Road / Great Western Highway intersection

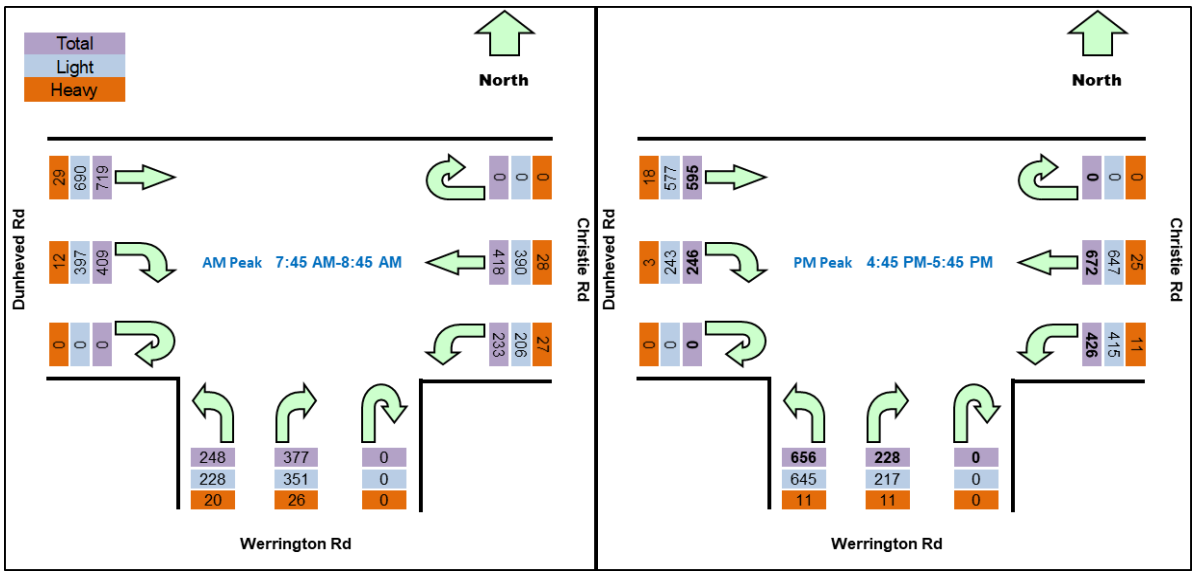


Figure 3-7 Werrington Road / Christie Road intersection

3.6 Existing Public Transport Services

3.6.1 Train

The proposed location of the subject site is currently well served by public transport services as it is located within 500 metres walk from Werrington Station, which is served by Sydney Trains T1 Western line services.

Table 3-1 provides a guide of the frequency of the existing train services.

Table 3-1 Train service frequency

Line	Weekday Peak Frequency	Weekend Peak Frequency
T1 (Towards Chatswood)	1 Service every 10 minutes	1 Service every 15 minutes
T1 (Towards Emu Plains)	1 Service every 15 minutes	1 Service every 15 minutes

3.6.2 Buses

Busways operates two routes via Werrington station: Route 782 (Penrith station to St Mary's station) and Route 785 (to Penrith station). A public transport map showcasing the bus routes and train services serving the development and nearby suburbs is shown in **Figure 3-8**.

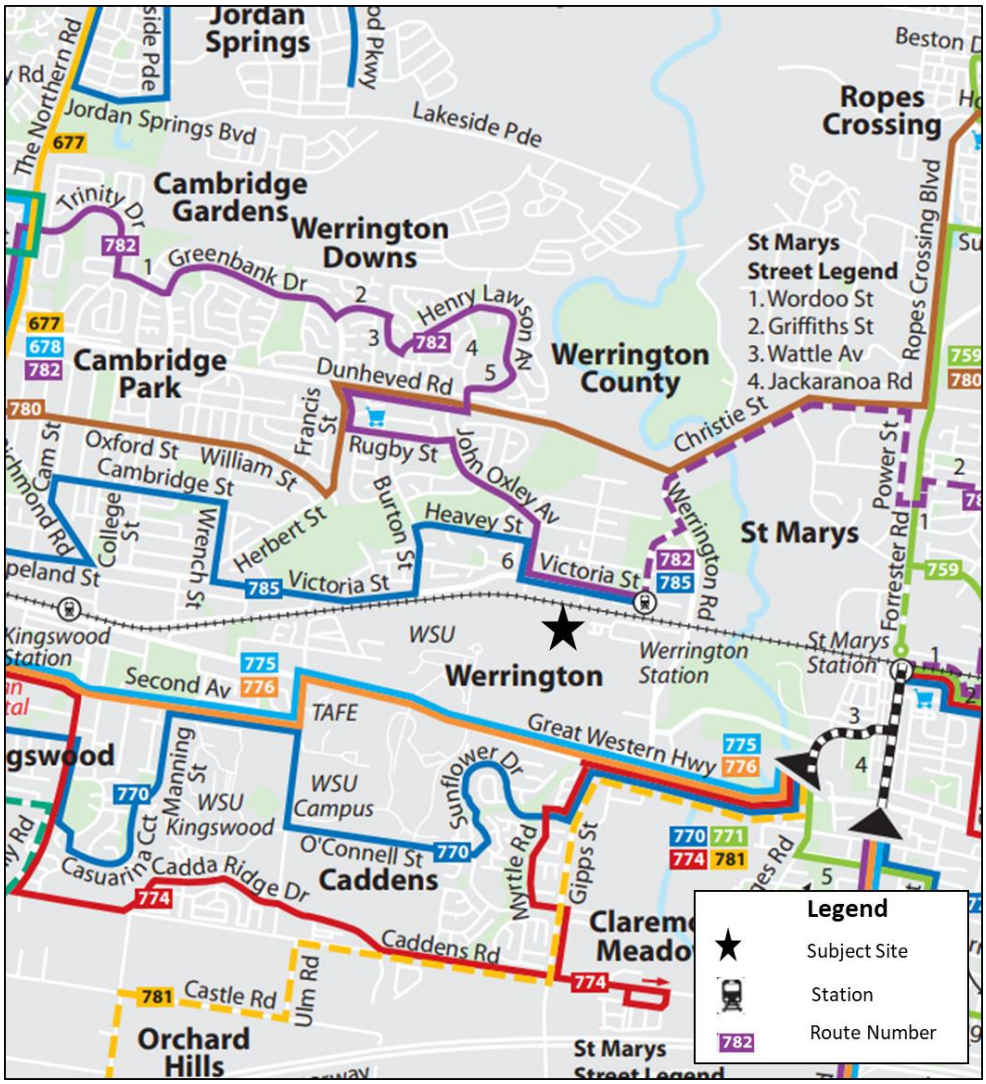


Figure 3-8 Public transport map

Source: Transport for NSW

Table 3-2 provides a guide of the frequency of the existing bus services.

Table 3-2 Bus service frequency

Route	Weekdays Peak Frequency	Weekend Frequency
782 (To St Marys)	1 Service every 30 minutes	1 service Every Hour
782 (To Penrith)	1 Service every 30 minutes	1 service Every Hour
785 (To Penrith Station)	3 Services Daily	1 service Every Hour

The proposed development site is conveniently located to take advantage of the connectivity of existing public transport services and encourage the greater use of sustainable modes of transport, therefore reducing reliance on private vehicles.

3.7 Walking and Cycling

A desktop review using NearMaps showed that the site is surrounded by footpaths. A figure showing the surrounding footpath is given below in **Figure 3-9**.

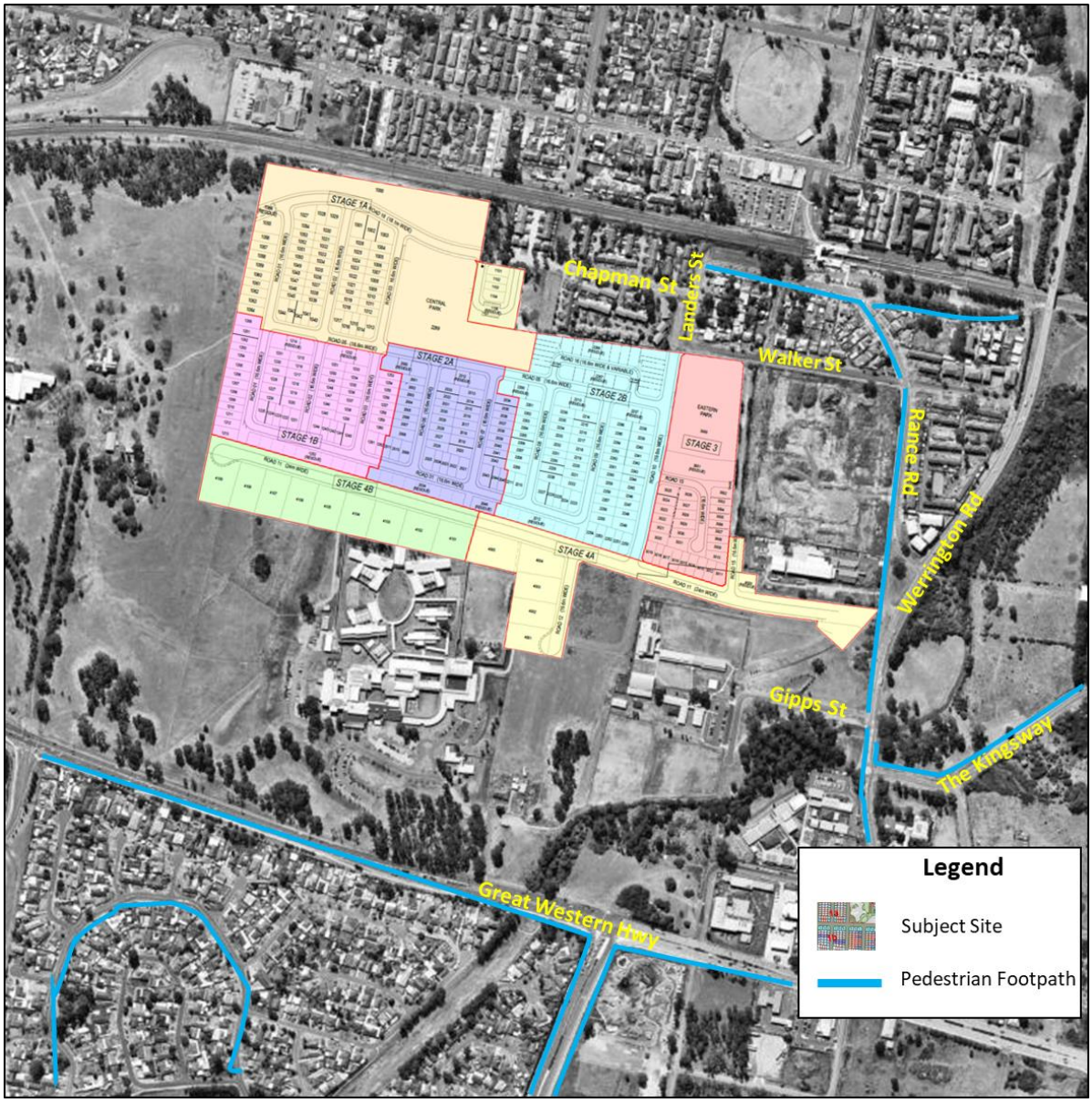


Figure 3-9 Pedestrian footpath

On the above basis, it can be seen that on the areas surrounding the subject site footpaths are provided on the western side of Werrington Road, which links to Rance Road and ultimately connects to Werrington station. From the latest NearMap aerial image, the width of the footpath is calculated at approximately 1.2 m,

which is considered narrow as Sydney Streets Design Code (2013) recommends a minimum width of 2 m footpath to allow two pairs of people to comfortably pass each other.

In addition, RMS Cycle Way finder was accessed and reviewed and the cycleway network in the close vicinity of the subject site is shown in **Figure 3-10**.

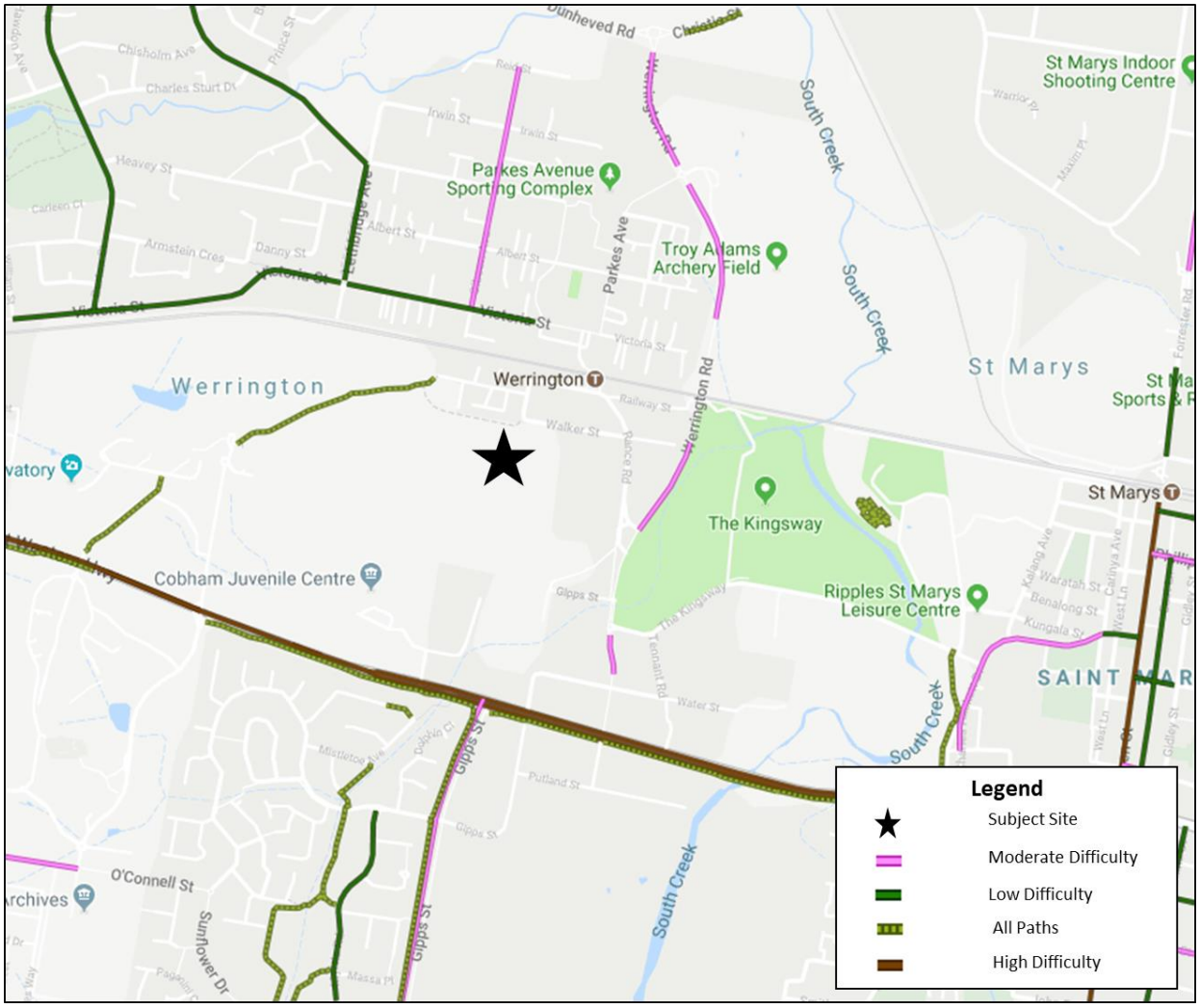


Figure 3-10 Existing cycleway network

Source: RMS Cycleway Finder (Accessed: 10/09/2019)

4 Development Details

4.1 Approved development under SWUV

Development details and associated trip generation rates were extracted from the TIA reports prepared for each corresponding DA. The yield summarised in **Table 4-1** is reflective of the approved yield according to jurisdictional consents.

Table 4-1 Approved development details under SWUV

Development Site (DA Number)	Residential Lots (No)	Apartments (No of units)		Industrial Gross Area (m^2)	Trip Generation Rate (trips/dwelling)
16 Chapman Street (DA14/0627)	85	-		2 residue lots	0.40 (residential) 10 veh/h (industrial)
25 Rance Road (Statewide) (DA15/0207)	83 (medium density)	-		-	0.40
16 Chapman Street (DA16/1148)	94 (low density)	-		1 industrial lot	0.99 (residential) 10 veh/h (industrial)
16 Chapman Street (DA16/0789)	-	95	23 x 1 bd 55 x 2 bd 17 x 3 Bd	-	0.19 AM 0.15 PM
Total	**262**	**95**		**3**	**-**

A total of 262 residential lots, 95 apartments and 3 residue lots have been approved for development at the study area. Anecdotally, these developments are either referred to the Bathla sites (16 Chapman Street) or Statewide site (25 Rance Road)

4.2 Proposed development description

The proposed subdivision development is located at 16 Chapman Street, Werrington and the development seeks to create 266 Residential Lots together with 14 light industrial lots. The light industrial lots have a combined Land Area of 31,000 m^2. The development also creates several super lots which create the potential for a further 91 Residential Lots and 33 apartments.

The proposed development has the following components shown in **Table 4-2**.

Followong consultation with Penrith Council, it was requested that Stage 1 is to be assessed assessed for the years 2022 and 2030 whilst the remaining stages (2-4) which is under the ultimate scenario are to be assessed for year 2030.

This overall aim of this assessment is to ensure that the development master plan Lendlease is proposing has merit and can be achieved considering the traffic impacts.

Table 4-2 Development components

Stages	Residential Lots (No)		Apartments(No)		Light Industrial Gross Area (m^2)	
	This DA	Future DA	This DA	Future DA	This DA	Future DA
Stage 1A	64	0	0	0	0	0
Stage 1B	60	16	0	0	0	0
Stage 1C	5	14	0	0	0	0
Stage 2A	44	16	0	0	0	0
Stage 2B	63	45	0	0	0	0
Stage 3	30	0	0	33	0	0
Stage 4A	0	0	0	0	10,982.3 m^2	0
Stage 4B	0	0	0	0	20,017.7 m^2	0
TOTAL	**266**	**91**	**0**	**33**	**31,000 m^2**	**0**

4.3 Proposed Site Access

Vehicular access into and out of the proposed development will be through the existing connections to the development via Walker Street / Chapman Street and a new link road (East-West link) passing through the southern side of the development, which will connect to Werrington Road.

The general arrangement of the proposed development is illustrated in **Figure 4-1**. A larger version of the layout is provided in **Appendix D**.

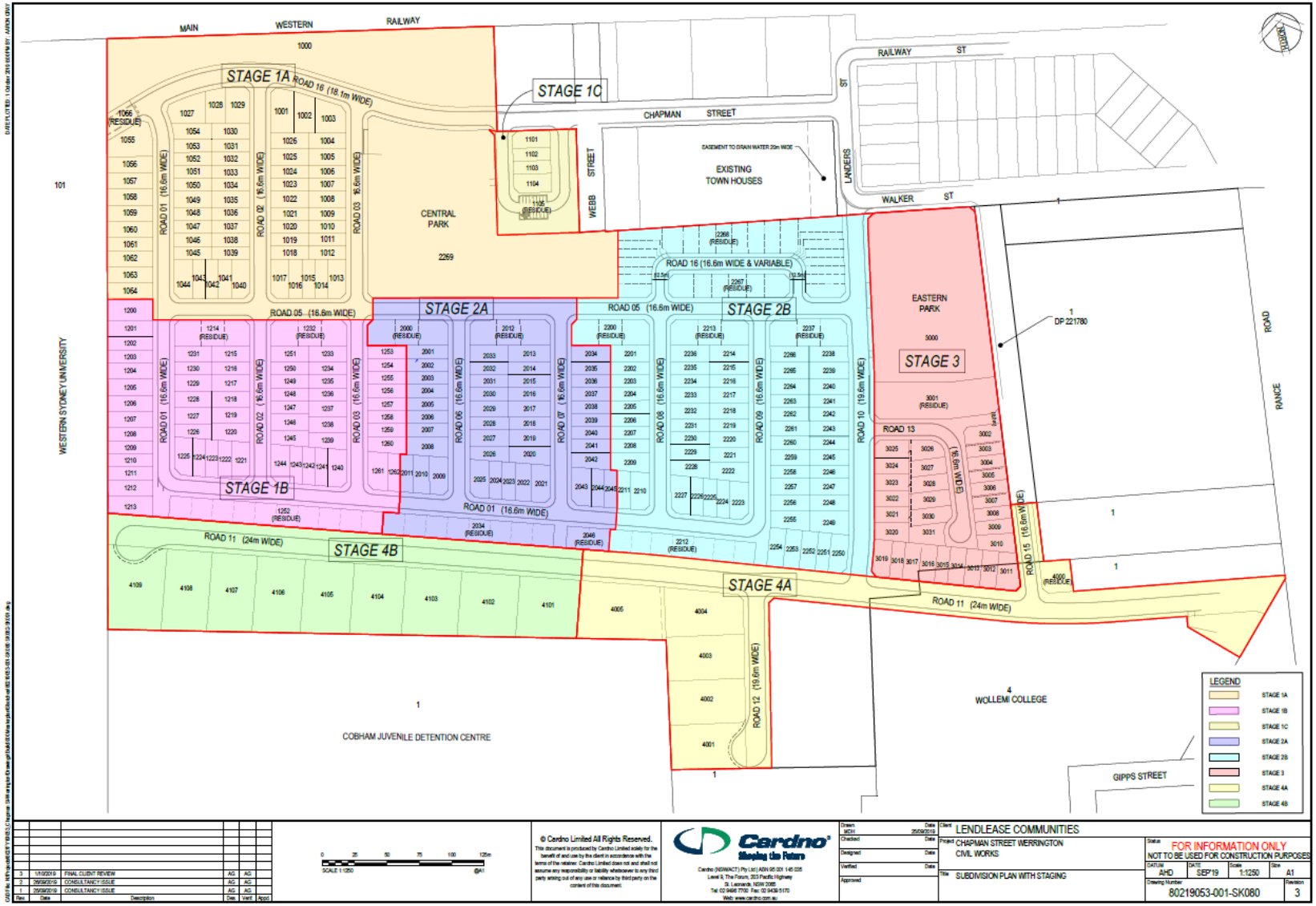


Figure 4-1 Development layout

Source: Lendlease (dated 28 August 2019)

5 Traffic Assessment

5.1 Assessment Years

As part of this study there is a need to assess intersection performance for key intersections at different design horizon years. This is done to identify capacity issues and propose mitigation measures (if any) that would ensure satisfactory performance in all design years. This assessment focuses on two design years and is in line with the proposed staging development as outlined in **Section 4.2** and **Table 4-2**.

- Assessing interim requirements at opening year of Stage 1 only (year 2022); and
- Assessing Stage 1 as well as ultimate requirements (year 2030).

5.2 Development Traffic Generation

5.2.1 Trip Generation Rate Calculation (Low Density)

Penrith City Council provided comments in regards to the TIA component for the proposed 16 Chapman Street development located in Werrington (DA19/0704). More specifically Council is concerned with the trip generation rate adopted by Cardno for this analysis:

"The development traffic generation rate for the 265 residential lot at the rate of 0.4 trips /dwelling lot is not appropriate (that being a rate for medium density) and rate should be the dwelling lot rate of 0.85 trips / residential lot in AM and PM peak hour."

Furthermore, previous assessments have considered low density residential development as generating 0.95-0.99 trips per dwelling. This was highlighted in Council's email as per below.

Cardno believes that the development site is unique to those sites whih underpin the 0.85 and 0.95-0.99 trips per dwelling which has been derived by the RMS. That is, those sites are not within reasonable walking distance to a train station. This is shown in the most recent RMS survey data, which underpins the 0.95-0.99 trip rate and followed the same survey methodology that was adopted to derive the 0.85 trips rate. The survey sites selected are not in close proximity to a train station and the transport mode share for train is 0% across all surveyed sites. This is because residents will drive to the neares train station outside of the survey area and are therefore counted as a car driver and associated vehicle trip.

APPENDIX A - LOW DENSITY RESIDENTIAL – SURVEY DETAILS

Source: Trip Generation Surveys, Low Density Residential, TEF Consulting, in association with Gennaoui Consulting Pty Ltd, for the NSW Roads and Traffic Authority, June 2010, p6

	Survey area ID										
	LDR1	LDR2	LDR3	LDR4	LDR5	LDR6	LDR7	LDR8	LDR9	LDR10	LDR11
rea Characteristics:											
Suburb	Beaumont Hills	Longueville	North Epping	Werrington Downs	West Hoxton	Westleigh	Coffs Harbour	Goonellabah	Calare	Glenfield Park	Farmborough Heights
Local Government Area	Baulkham Hills	Lane Cove	Hornsby	Penrith	Liverpool	Hornsby	Coffs Harbour	Lismore	Orange	Wagga Wagga	Wollongong
Typical housing type	two-storey	two-storey	one - & two-storey	one-storey	large two-storey	one-storey	one-storey	one - & two-storey	one-storey	one-storey	one - & two-storey
Indicative Public Transport Accessibility Score	6	30	11	8	5	6	3	2	2	3	2
Traffic generating developments within the area	1 School, 2 Childcare centres	1 Private Hospital	1 School, 2 Childcare centres, 1 Shopping Village, 1 Local shop, 1 Retirement Village	1 Childcare centre	1 School, 3 Childcares, 1 Medical Centre	1 School, 1 Childcare, 1 Shopping centre	None	1 Function Centre	2 Childcare centres, 1 Aged Care facility	None	None
No. of dwellings	956	676	1495	669	1235	1335	509	556	697	554	905
Population	3,346	2,084	4,295	2,095	4,552	4,024	1,250	1,378	2,037	1,391	2,685
	4	3	3	3	4	3	2	2	3	3	3
Date of survey	04-May-10	28-Apr-10	28-Apr-10	04-May-10	06-May-10	28-Apr-10	13-May-10	12-May-10	06-May-10	05-May-10	06-May-10
Day of survey	Tuesday	Wednesday	Wednesday	Tuesday	Thursday	Wednesday	Thursday	Wednesday	Thursday	Wednesday	Thursday
Duration of survey	06:00-19:00 (13 hours) - All survey areas										
Weather	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Overcast, light morning showers	Fine
Surrounding roads- AM peak period	08:00-09:00	08:00-09:00	06:00-07:00	08:00-09:00	08:00-09:00	07:00-08:00	08:00-09:00	08:00-09:00	08:00-09:00	08:00-09:00	08:00-09:00
Surrounding roads - PM peak period	17:00-18:00	17:00-18:00	15:00-16:00	15:30-16:30	17:00-18:00	16:00-17:00	15:00-16:00	17:00-18:00	16:00-17:00	16:00-17:00	15:00-16:00
erson Trips:											
o Peak 1-hour person-trips	2170	1083	1390	1286	2807	1207	735	631	1018	733	892
o Time of peak 1-hour person-trips	15:00-16:00	07:15-08:15	07:30-08:30	16:30-17:30	08:00-09:00	17:00-18:00	15:15-16:15	15:30-16:30	08:00-09:00	15:30-16:30	07:45-08:45
o Peak person-trips per dwelling	2.27	1.60	0.93	1.92	2.27	0.90	1.44	1.13	1.46	1.32	0.99
o Peak person-trips per resident	0.65	0.52	0.32	0.61	0.62	0.30	0.59	0.46	0.50	0.53	0.33
o Total daily person-trips	14389	9699	11276	9753	17668	11489	4955	5099	7356	4878	6672
o Total daily person-trips per dwelling	15.05	14.35	7.54	14.58	14.31	8.61	9.73	9.17	10.55	8.81	7.37
o Total daily person-trips per resident	4.30	4.65	2.63	4.65	3.88	2.86	3.96	3.70	3.61	3.51	2.49
o Person-trips in network AM peak	1880	917	401	1046	2807	1042	639	629	1018	569	851
o Person-trips in network PM peak	1517	939	1169	1068	1732	1085	675	557	896	655	854
ehicle Trips:											
o Peak 1-hour vehicle-trips	1170	710	875	932	1625	944	384	448	627	480	555
o Time of peak 1-hour vehicle-trips	08:00-09:00	17:30-18:30	07:30-08:30	17:00-18:00	08:00-09:00	17:00-18:00	08:00-09:00	17:00-18:00	16:45-17:45	17:15-18:15	07:45-08:45
o Peak vehicle-trips per dwelling	1.22	1.05	0.59	1.39	1.32	0.71	0.75	0.80	0.90	0.87	0.61
o Peak vehicle-trips per resident	0.35	0.34	0.20	0.44	0.36	0.23	0.31	0.32	0.31	0.35	0.21
o Total daily vehicle-trips	9237	6962	7816	6914	11983	8888	3325	3635	4962	3521	4670
o Total daily vehicle-trips per dwelling	9.66	10.30	5.23	10.33	9.70	6.66	6.53	6.54	7.12	6.36	5.16
o Total daily vehicle-trips per resident	2.76	3.34	1.82	3.30	2.63	2.21	2.66	2.64	2.44	2.53	1.74
o Vehicle-trips in network AM peak	1170	598	297	649	1625	790	384	368	591	372	543
o Vehicle-trips in network PM peak	1070	709	653	744	1271	808	334	446	552	460	485
o Car Occupancy (average over survey period)	1.25	1.24	1.30	1.28	1.38	1.21	1.35	1.28	1.42	1.32	1.33
of total trips by mode:											
o % Car (as driver)	61.2%	68.7%	67.7%	68.6%	65.3%	75.2%	65.6%	68.2%	66.7%	70.2%	67.1%
o % Car (as passenger)	15.2%	18.0%	20.5%	18.0%	25.0%	18.1%	23.2%	19.0%	27.0%	23.1%	24.0%
o % Train	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
o % Bus	16.9%	4.5%	5.2%	5.6%	4.0%	3.5%	4.3%	7.0%	2.9%	5.9%	6.2%
o % Cycle	0.3%	0.4%	0.7%	0.7%	0.2%	0.3%	1.3%	0.5%	0.3%	0.1%	0.3%
o % On foot	5.4%	6.8%	4.3%	4.9%	3.5%	3.0%	4.4%	3.6%	1.8%	1.0%	2.6%
o % Other	1.0%	2.9%	1.6%	1.3%	2.0%	1.8%	1.3%	1.7%	0.4%	0.6%	1.8%

Cardno commissioned for Automatic Tube Count (ATC) traffic surveys to be undertaken in areas with similar nature to the existing development residences enclosed by Chapman Street / Walker Street / Rance Road. The ATC counts captured inbound/outbound traffic volumes for a 4-day period between Monday 17 February and Friday 21 February 2020 for two (2) sites shown in **Figure 5-1** and **Figure 5-2**. Site 1 is located approximately 1km away from Werrington station whereas Site 2 is located 700m away from Doonside station. Both sites comprise low residential type of dwellings.

Figure 5-1 Site 1 - Malcolm Avenue / Isabell Street Precinct

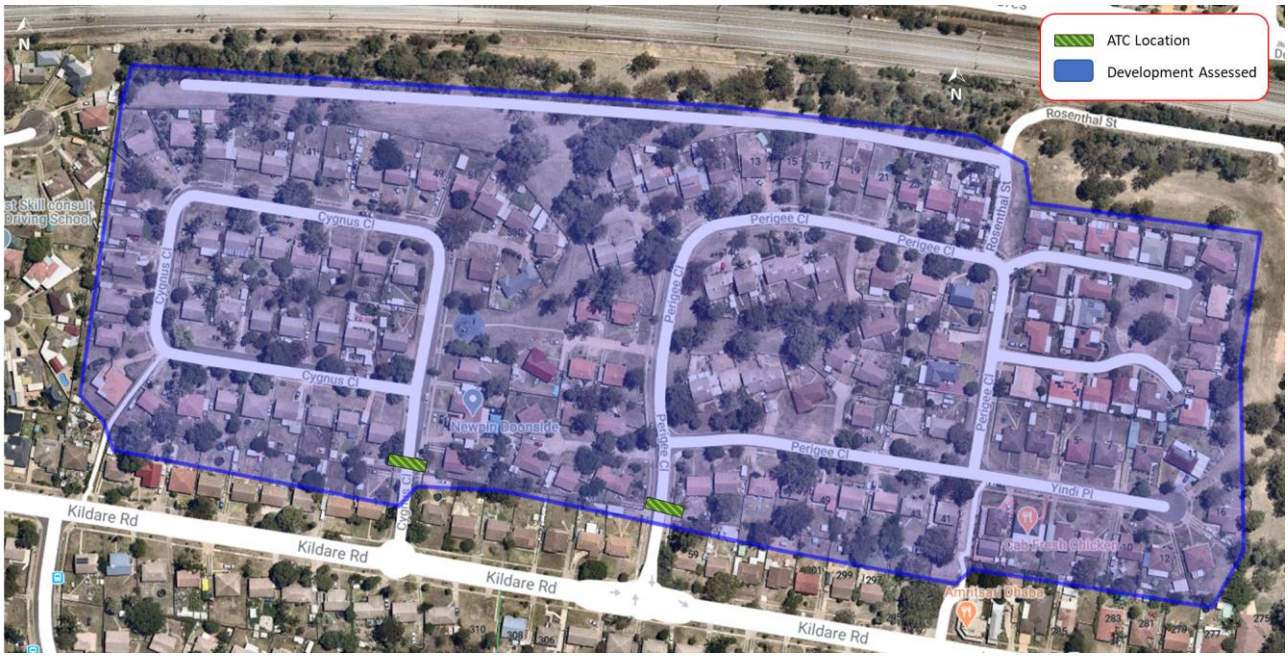


Figure 5-2 Site 2 – Cygnus Close / Perigee Close Precinct

Only the number of dwellings that were directly accessing/exiting Isabell Street / Malcolm Avenue and Cygnus Close / Perigee Close were considered in this calculation as there were a number of dwellings with driveways/access on the main road network. Traffic volumes reflected an average of Tuesday, Wednesday and Thursday volumes as these are considered the typical busiest weekdays. **Table 5-1** summarises the trip generation rate calculations.

The peak hour assessed is based on the peak hours recorded along Werrington Road, which was 8:00-9:00am and 5:00-6:00pm. The weighted average of the survey was used to derive the trip generation rate.

Table 5-1 Trip generation rate calculation (low density development)

Site 1	AM Peak (veh/h) - In/Out	PM Peak (veh/h) - In/Out
Malcom Avenue	11	7
Isabella Street	16	12
Total Traffic Volume (veh/h)	**27**	**19**
Number of Dwellings	31	31
Trip Generation Rate (trips/dwelling)	0.88 (rounding up)	0.61
Site 2	**AM Peak (veh/h) - In/Out**	**PM Peak (veh/h) - In/Out**
Cygnus Close	27	28
Total Traffic Volume (veh/h)	27	28
Number of Dwellings	**48**	**48**
Trip Generation Rate (trips/dwelling)	0.57	0.58
Perigee Close	36	37
Total Traffic Volume (veh/h)	36	37
Number of Dwellings	**92**	**92**
Trip Generation Rate (trips/dwelling)	0.39	0.41 (rounding up)
Weighted Average*	**AM Peak - In/Out**	**PM Peak - In/Out**
Trip Generation Rate (trips/dwelling)	**0.53**	**0.49**

*Weighted average takes into account the different contributions of sites based on the quantity of dwellings in each site rather than assuming an equal weight for each site

A total of 171 dwellings were captured in this comparative survey and is therefore considered to be a satisfactory sample size to be applied to the proposed Lendlease development. Based on the numbers above, the average trip generation rate for low density development for these particular conditions is **0.53** and **0.49** trips/dwelling in the morning and evening peak respectively.

Detailed analysis is shown in **Appendix C**.

5.2.2 Other Trip Generation Rates

An indication of the traffic generation potential of the proposed development is sourced from the "*25 Rance Road Werrington Traffic Assessment Report*" prepared by Mott Macdonald (February 2015). The report adopted a lower trip rate of 0.4 trips per dwelling considering the mixture of low and medium density residential dwellings and the potential for easy access to rail and bus services from the site.

RMS trip generation rates for medium density housing is between 0.4 and 0.65 trips per dwelling. Hence it was deemed reasonable to adopt a trip rate of 0.4 trips per dwelling for the mixture of medium density given the current public transport usage for residential commuter trips was around 30%.

Cardno have compared 2019 aerial photography to 2014 to confirm that the number of lots has remained unchanged between 2014 (Mott MacDonald Report traffic survey period) and the current year (2019). Classified intersection counts that were recently undertaken by Cardno (August 2019) were compared against previous assessments (Mott MacDonald, December 2014) relating to the Werrington Road / Rance Road Intersection and showed negligible turning volume differences (except for the northbound through approach) as seen in **Table 5-2**.

Table 5-2 Traffic survey comparison Werrington Rd / Rance Rd intersection (Cardno 2019 vs Mott MacDonald 2014)

		Cardno (August 2019)		Mott MacDonald (December 2014)	
Approach	**Movement**	**AM (7:45-8:45)**	**PM (16:45-17:45)**	**AM (7:45-8:45)**	**PM (16:45-17:45)**
North	T	819	635	860	645
	R	21	16	11	10
South	L	79	58	56	66
	T	630	1,189	517	1,174
West	L	20	28	25	26
	R	62	64	51	63
Total (vehs/h)		**1,631**	**1,990**	**1,520**	**1,984**

Therefore, a trip generation rate of 0.4 for both AM and PM peaks for medium density residential dwellings has been applied for this assessment.

For High-Density Residential (apartments) the trip generation rates provided by the RMS Technical Direction is 0.19 per dwelling for the AM Peak and 0.15 per dwelling for the PM Peak. The rate for similar high density development which based on the RMS Guide (2002) is 0.29 trips per dwelling. Cardno's previous assessment (Octoebr 2019) adopted the higher rate of 0.29 trips per dwelling, which was higher than previous assessments to date.

Following consultation with Council, Cardno was provided with the Council agreed trip rates for high density development within their LGA. This is attached in **Appendix G** for reference. The recommended trip rate of 0.33 trips per dwelling, as per Council's comments, has been adopted for high density development in the application.

5.2.3 Trip Generation Rate Summary

The adopted traffic generation rates for this assessment is given below:

Low Density Residential

AM Peak: 0.53 trips per lot

PM Peak: 0.49 trips per lot

Medium Density Residential

AM Peak: 0.4 trips per lot

PM Peak: 0.4 trips per lot

High Density Residential (Apartments)

AM Peak: 0.33 trips per dwelling

PM Peak: 0.33 trips per dwelling

Industrial

AM Peak: 0.52 per 100 m^2 of GFA

PM Peak: 0.56 per 100 m^2 of GFA

The resulting traffic generation is summarised in **Table 5-3**.

Table 5-3 Traffic generation estimate (Lendlease subdivision)

Stage	Lots/Dwellings/GFA	Traffic Generation (veh/h)	
		AM Peak	PM Peak
Stage 1A	64 Lots	34	31
Stage 1B	76 Lots	40	37
Stage 1C	19 Lots	10	9
Stage 2A	60 Lots	32	29
Stage 2B	108 Lots	57	53
Stage 3	30 Lots	16	15
Stage 3	33 Apartments	11	11
Stage 4A	109,82.3 m^2 GFA*	57	62
Stage 4B	200,17.7 m^2 GFA*	104	112
Total (veh/h)		**361**	**359**

** Car/truck split for industrial traffic was estimated to calculate AADT daily volumes for the noise design assessment. The analysis determined a 72%/28% (car/truck) split using survey data collected from Site 3 Wonderland Business Park, Eastern Creek (Roads and Maritime Services – Trip Generation Surveys: Business Parks and Industrial Estaets Data Report 2012). This split was applied to the above industrial development.*

The proposed development is therefore expected to generate 361 vehicular trips during the 1-hour morning peak and 359 vehicular trips during the evening peak period.

As far as the traffic generation of the approved development under SWUV is concerned, it was estimated that 208 and 205 vehicular trips during the morning and evening peaks respectively will be generated as seen in **Table 5-4**. This is in accordance to the assumptions summarised in **Table 4-1** which have been sourced from the respective applications' supporting traffic impact assessment.

Table 5-4 Traffic generation estimate (approved development under SWUV)

Development Site (DA Number)	Residential Lots (No)	Apartments (No of units)		Industrial Gross Area (m^2)	Trip Generation Rate (trips/dwelling)	Traffic Generation (veh/h)	
						AM Peak	PM Peak
16 Chapman Street (DA14/0627)	85	-		2 residue lots	0.40 (residential) 10 veh/h (industrial)	54	54
25 Rance Road (Statewide) (DA15/0207)	83 (medium density)	-		-	0.40	33	33
16 Chapman Street (DA16/1148)	94 (low density)	-		1 industrial lot	0.99 (residential) 10 veh/h (industrial)	103	103
16 Chapman Street (DA16/0789)	-	95	23 x 1 bd	-	0.19 AM 0.15 PM	18	14
			55 x 2 bd				
			17 x 3 Bd				
Total	**262**	**95**		**3**	**-**	**208**	**205**

In addition to the traffic generated by the new development, a background traffic growth rate of **2% per annum** was applied to the existing road network. Traffic background growth refers to the traffic volume increase experienced across corridors between different years, which are not impacted by the proposed developments within the study precinct. To calculate this traffic growth, historical traffic background data at the same locations are compared to most recent traffic surveyed data. A growth rate is then determined for the compared time period and a linear annual percentage growth is derived.

5.3 Trip Distribution

- The ratio of the inbound and outbound traffic movements for the Stewide residential development is assumed to be 10:90 in the AM peak hour and 90:10 in the PM peak hour respectively (in line with previous TIA report prepared by Mott MacDonald);
- The ratio of the inbound and outbound traffic movements for residential developments is assumed to be 20:80 in the AM peak hour and 80:20 in the PM peak hour respectively;
- The ratio of the inbound and outbound traffic movements for industrial developments is assumed to be 50:50 in the AM and PM peak hour respectively;
- Traffic generation from Stage 1A, 1B and 1C is assumed to access Werrington Road / Rance Road under the 2022 design year;
- Cardno adopted the shortest distance calculation approach for the 2030 design year in order to derive the number of lots that are expected to use the two site accesses (new East-West link and Rance Road):
  - It is assumed that traffic from development Stages 1A and 1C will divert to Chapman Street / Railway Street / Rance Road; and
  - The remaining development stages (1B, 2A, 2B, 3, 4A and 4B) are expected to use the new East-West link upon construction completion.
- The 2019 surveyed turning count proportions were adopted to distribute the North/South trips going in/out of the development. The North/South trip assignment obtained from survey turning counts is shown in **Figure 5-3**.

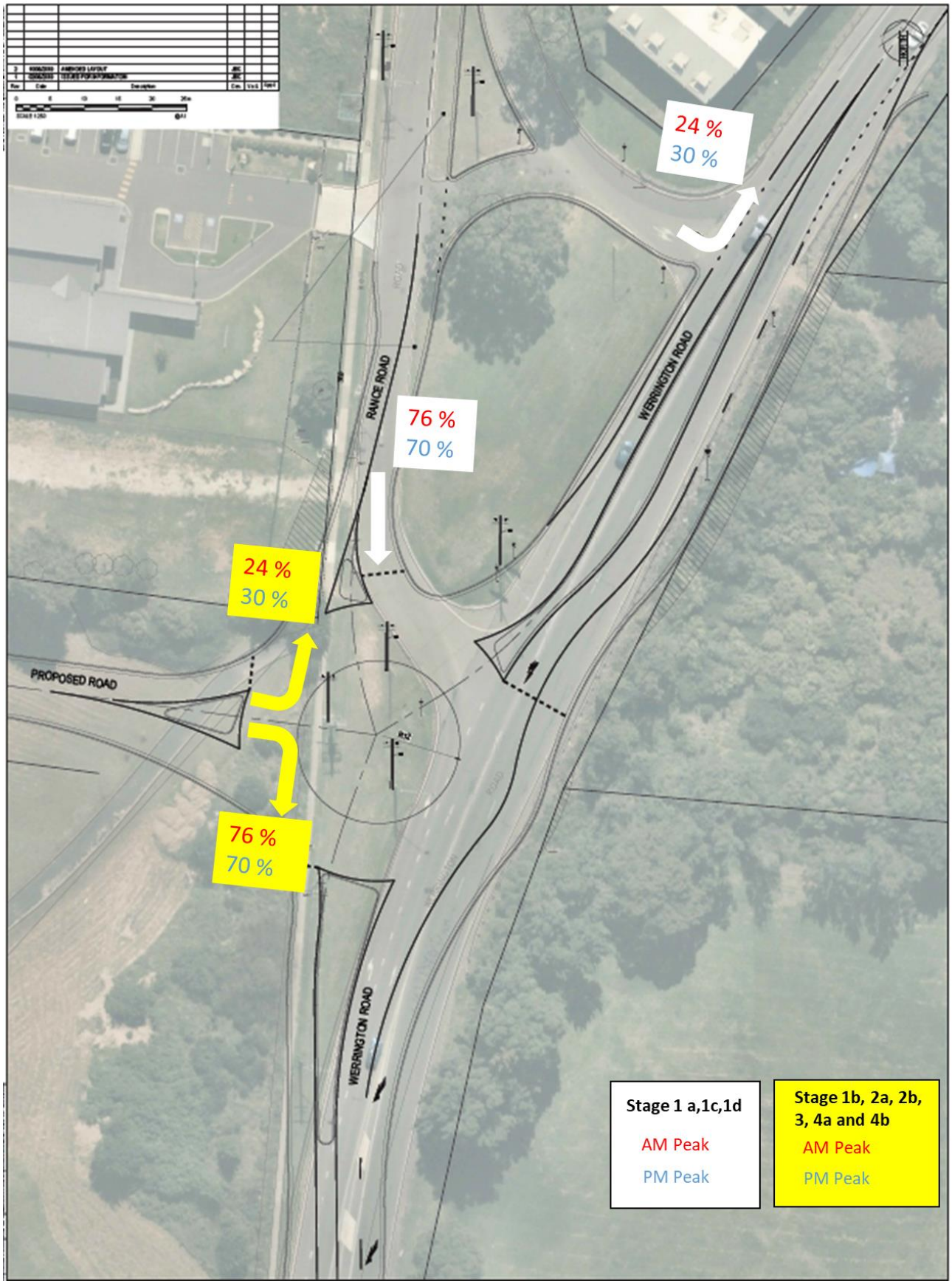


Figure 5-3 North/South trip assignment

6 Public and Active Travel

6.1 Proposed Internal Road Network

The road hierarchy proposed by the SWUV structure plan provided within the DCP of Penrith Development Control Plan 2014 is shown in **Figure 6-1**.

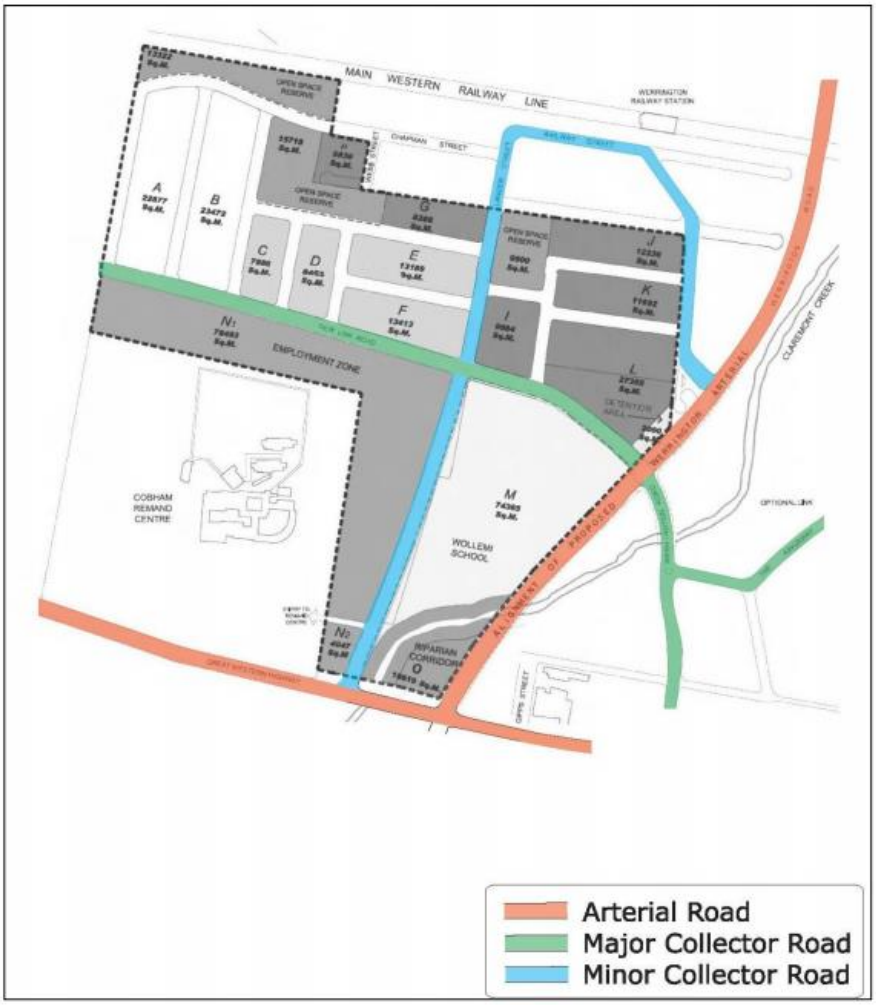


Figure 6-1 Proposed road hierarchy

As seen from **Figure 6-1,** the structure plan envisages a major and minor collector road (East-West New Link Road, North-South Road) to run through the subject site. The subdivision layout provided by Lendlease as seen in **Figure 4-1** shows an internal road in the east-west direction which runs in the same alignment envisioned by the structure plan. The North-South road has been segmented into two straights which are linked by the East-West New Link Road.

The indicative sections of East-West New Link Road, North-South Road and Local Road envisioned by the structure plan are illustrated in **Figure 6-2**, **Figure 6-3** and **Figure 6-4** respectively.

The structure plan envisions the width of the East-West link road for the carriageway (including pavement and kerbside lane only) to be 14 m whereas the proposed layout also shows an approximate width of 12 m for the carriageway. The overall road reserve width is unchanged and it is understood that some additional width has been provided to the footpath verges.

The North-South which runs north of the East-West Road is 19.6m wide and has a 12m wide carriageway (including pavement and kerbside lane only) in accordance with the structure plan.

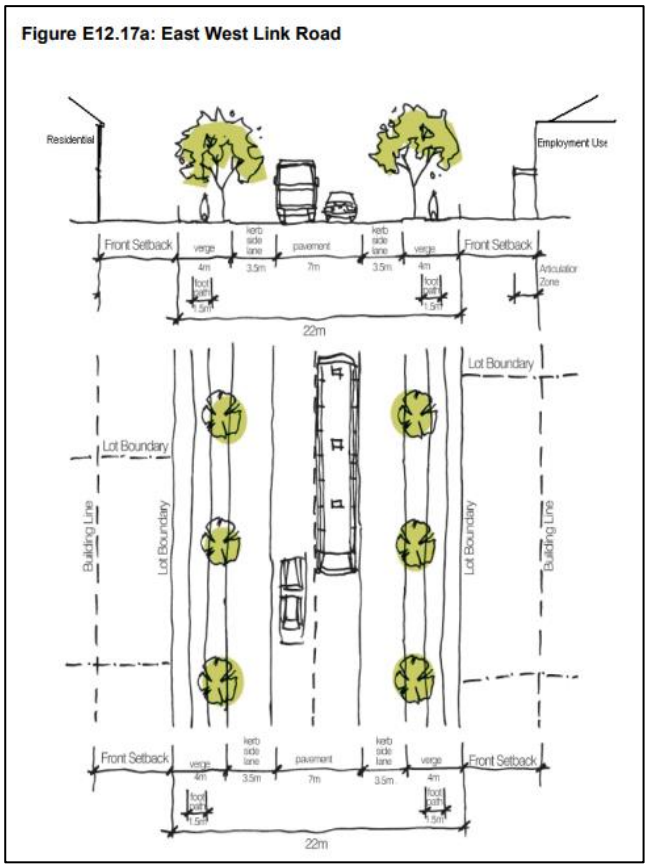


Figure 6-2 Indicative section East-West Link Road

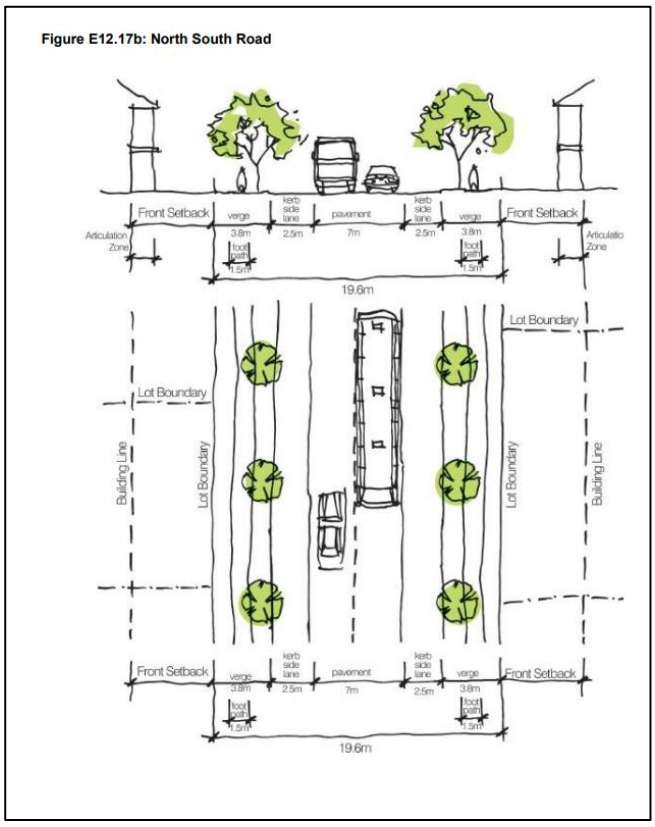


Figure 6-3 Indicative section North-South Road

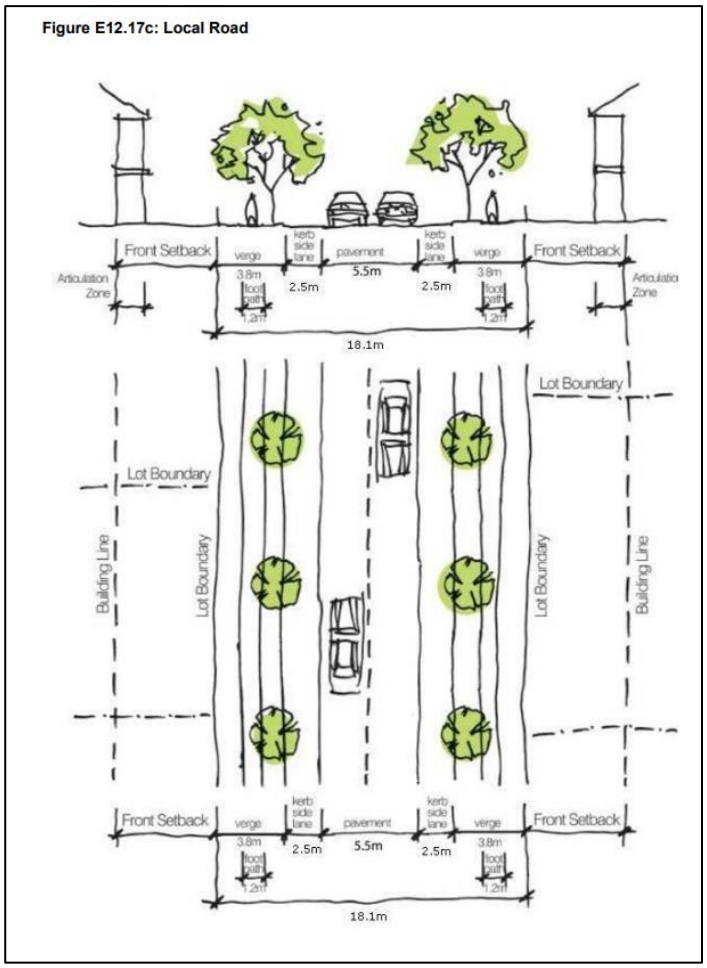


Figure 6-4 Indicative section Local Road

Cardno recommends providing internal intersection controls where the internal roads intersect (for example New Link Road /Local Road intersections). Also, as the East West New Link Road is aligned as long straights, traffic calming measures like speed humps are recommended to control the speed. Also, pedestrian refuges are recommended to be provided to improve pedestrian permeability.

Stopping Sight Distance (SSD) for the individual lot access driveways is assessed based on the guidelines provided in relevant Australian Standard (AS 2890.1:2004). The SSD determines the minimum sight distance, which should be provided on a major road at an intersection and is dependent on several factors including the major road speed limit of frontage road and type of vehicle traveling on the road.

At the DA stage for each individual dwelling, the lot driveways need to be located and constructed so that there is adequate entering stopping sight distance (SSD), which is most likely adequately offset from corners and bends. It is understood that all corner Lots have been sized so to allow for a driveway to be placed a minimum of 6m from the tangent points of all kerb returns.

6.2 Public transport Accessibility

The public transport proposed by the SWUV structure plan provided within the DCP of Penrith Development Control Plan 2014 is shown in **Figure 6-5**.

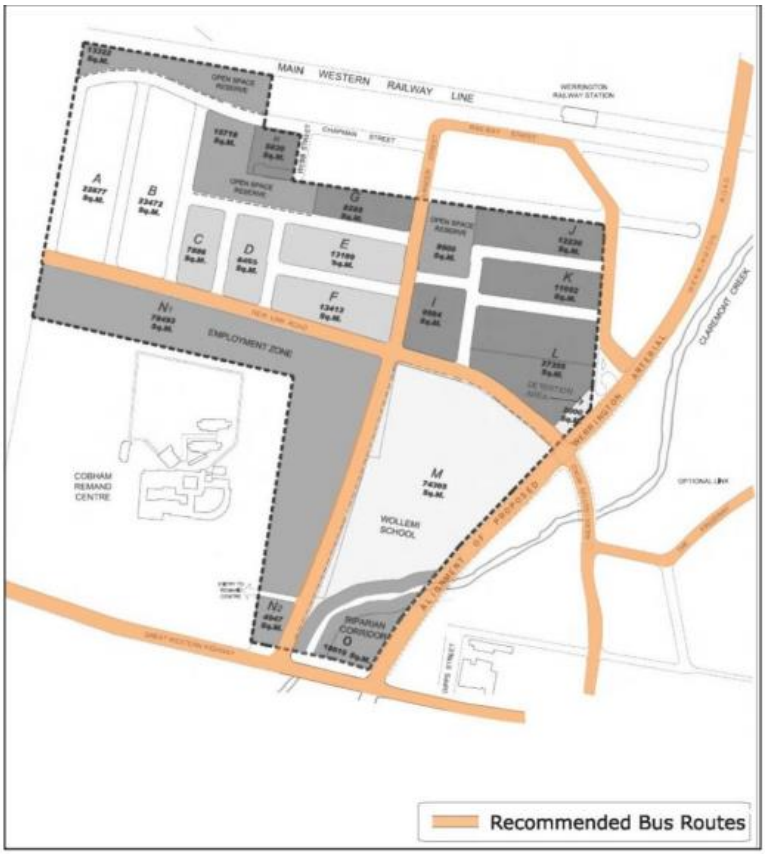


Figure 6-5 Proposed bus routes

As seen from **Figure 6-5,** the structure plan envisions bus routes to run along the arterial roads (Great Western Highway and Werrington Road) and to enter the site through the proposed East-West link road and North-South link Roads.

The proposed subdivision layout as seen in **Figure 4-1** shows an internal road in the east-west direction that has the potential to run the bus in the same route as envisioned by the structure plan. The location of the proposed North-South link road is slightly different to the structure plan however affords the the same connectivity through the site.

6.3 Pedestrian / Cycle Connectivity

The pedestrian/cycle connectivity proposed by the SWUV structure plan provided within the DCP of Penrith Development Control Plan 2014 is shown in **Figure 6-6**.

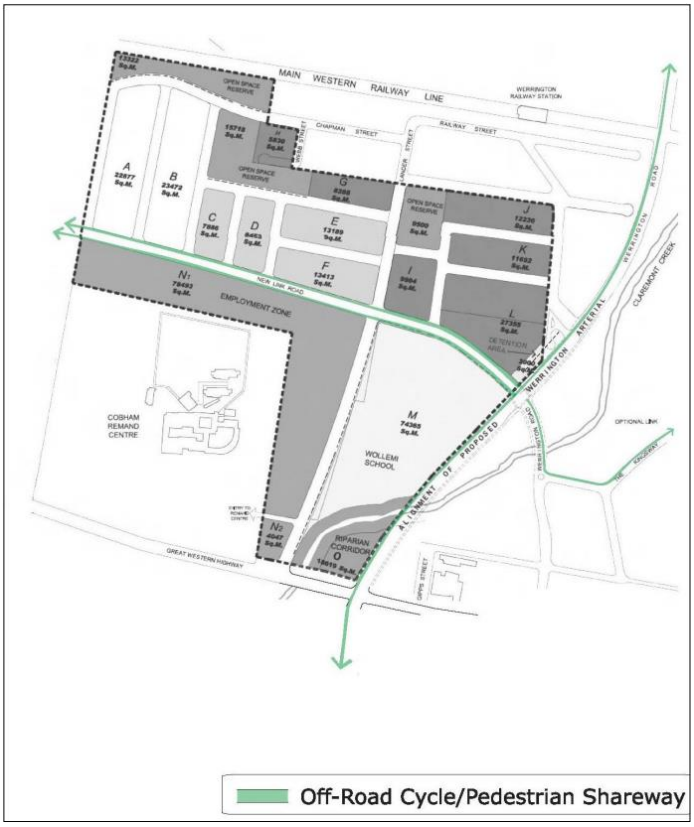


Figure 6-6 Proposed pedestrian/cycling links

As seen from **Figure 6-6,** the structure plans envisions an off-road cycle/pedestrian share way to run along the East-West Road.

It should be noted that DCP requires pedestrian and cycle pathway to have a minimum width of 1.5 m which should be provided along both sides of the road. The subdivision layout at **Figure 4-1** proposes a share way width of 3.6m. This greatly improves the safety of the users of this share way.

7 Key Intersections Operations and Performance

7.1 Modelling Scenarios

The modelling investigations were carried out for the current year (2020), and two future years being 2022 and 2030 as requested by Council.

The design years and options assessed are set out in **Table 7-1**. The Werrington Road / East-West Link roundabout design is shown in **Appendix E**.

Table 7-1 Summary of assessment scenarios

Year	Scenario	Infrastructure geometry (Werrington Rd / Rance Rd / EW link)	Land use development
2019/2020	Base Case (Without Development)	Priority control (as per existing conditions)	No development
2022	Base Case (Without Development)	Priority control (as per existing conditions)	No development
	Approved Development*	3-leg roundabout	Approved development under SWUV (262 residential lots inclusive of Statewide site + 95 apartments)
	Stage 1**	3-leg roundabout	Lendlease development (357 residential lots + 33 apartments + Statewide site + other approved developments within Werrington)
2030	Base Case (Without Development)	Priority control (as per existing conditions)	No development
	Approved Development*	3-leg roundabout	Approved development under SWUV (262 residential lots inclusive of Statewide site + 95 apartments)
	Stage 1**	3-leg roundabout	Lendlease development (357 residential lots + 33 apartments + Statewide site + other approved developments within Werrington)
	Ultimate Development (Stage 1-4)***	4-leg roundabout (including EW link connection)	Lendlease development (357 residential lots + 33 apartments + Statewide site + other approved developments within Werrington)

***Approved Development** assumes scenario with development yield as per the approved development under SWUV (summarised in Table 4-1)

****Stage 1** assumes scenario with construction of 159 dwellings (Stage 1a, 1b and 1c only) in addition to the Statewide site (83 medium density)

*****Ulitmate Development (Stage 1-4)** assumes scenario with construction of complete development (357 dwellings + 33 apartments + industrial estate) in addition to the Statewide site (83 medium density)

As part of this investigation the following intersections were assessed in detail for the above scenarios:

- Werrington Road / Rance Road;
- Werrington Road / East-West Link;
- Werrington Road / The Kingsway;
- Werrington Road / Great Western Highway; and
- Werrington Road / Christie Road / Dunheved Road.

7.2 Level of service criteria threshold

The existing intersection operation performance was assessed using the SIDRA Intersection 8.0 software package. The key indicator of intersection performance is typically the Level of Service (LoS), where results are placed on a scale from 'A' to 'F', outlined in **Table 7-2**.

Table 7-2 Level of Service criteria for intersections

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals, Roundabout	Giveway & Stop Signs
A	< 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	Operating near capacity	Near Capacity & accident study required
E	57 to 70	At Capacity, at signals incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires additional capacity.

Source: Guide to Traffic Generating Developments (RMS, 2002)

The Average Vehicle Delay (AVD) provides a measure of the operational performance of an intersection and determines the LoS when applying the RMS method. It should be noted that the AVD's should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route). For traffic signals, the weighted average delay over all movements should be utilised. For roundabouts and priority control intersections (sign control) the critical movement for assessing LoS should be the movement with the highest average delay.

The Degree of Saturation (DoS) is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals, both queue length and delay increase rapidly as DOS approaches 1.0. It is usual to attempt to keep DOS to less than 0.9. Degrees of Saturation in the order of 0.7 generally represent satisfactory intersection operation. When DOS exceed 0.9 queues can be anticipated.

7.2.1 SIDRA Model Calibration (Werrington Road / Rance Road)

The Werrington Road / Rance Road intersection was assessed as an initial step using SIDRA and based on the updated 2019 traffic surveys. SIDRA outputs (under default parameters) showed LoS B in the AM peak with 26.8 seconds of average delay and LoS F in the PM peak with 152.7 seconds of average vehicle delay for the worst movement (right turn onto Werrington Road).

Delay surveys for the right turn from Rance Road onto Werrington Road were analysed and showed that average vehicle delay during the morning 1-hour peak was 17 seconds and for the afternoon 1-hour peak 40 seconds. This suggests a discrepancy between SIDRA outputs and surveyed vehicle delay.

The "critical gap" parameter was adjusted to calibrate the SIDRA model to the observed average vehicle delay for the right turn (for both AM and PM peaks). Critical gap for the Rance Road right turn was adjusted from the default value of 7.0 seconds to 6.35 seconds in the AM peak and 6.70 seconds in the PM peak. The actual critical gap acceptance calculated by SIDRA through the Two Way Sign Control Calibration (TWSC) is actually 3.65 and 4.0 seconds in the AM and PM peak respectively which is aggressive behaviour. Updated LoS for the 2019 base AM peak remains at LoS B with average delay of 16.6 seconds and improves to LoS C with average delay of 43.1 seconds in the PM peak.

This parameter was carried forward for the future base modelling of 2022 and 2030.

7.3 Intersection LoS Perfromance Results

7.3.1 2019 Base Year

The Werrington Road / Rance Road geometry for 2019 base is illustrated in **Figure 7-1**.The intersection assessment has been undertaken using SIDRA v8 network input parameters. This is to enable the model to see the impact of queue propagation which occurs in reality.

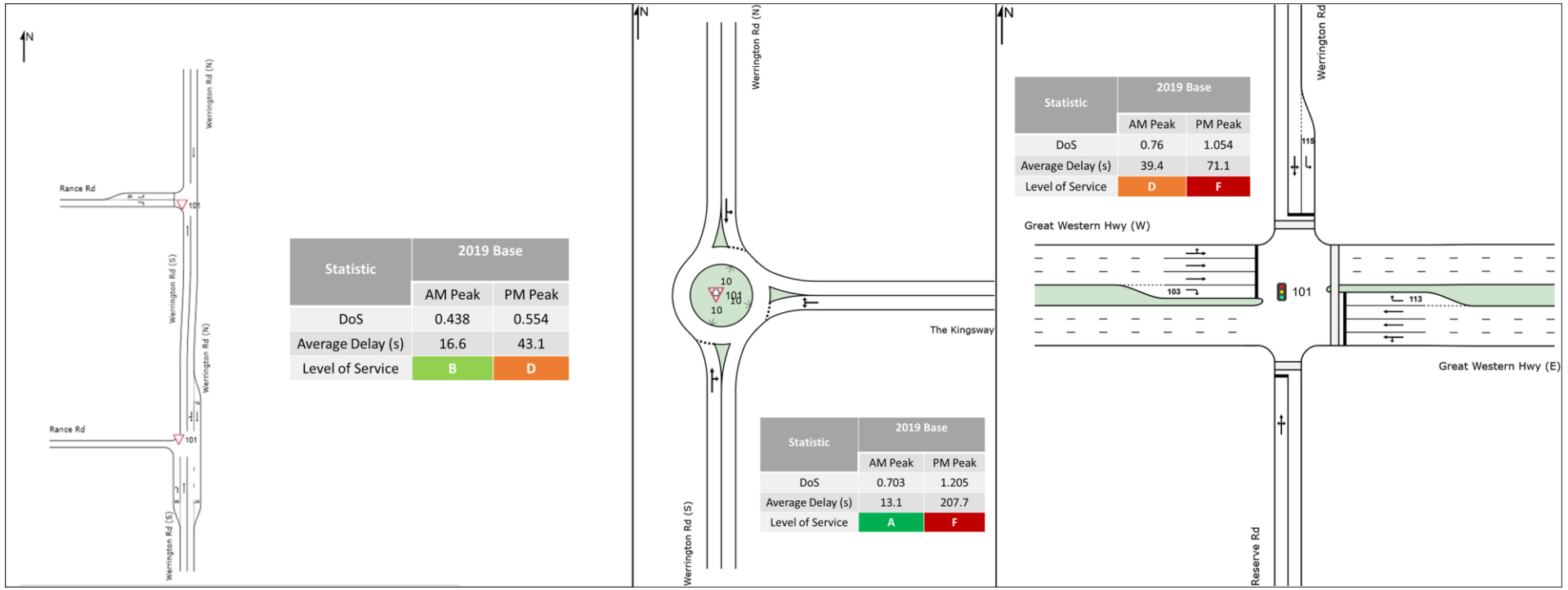


Figure 7-1 2019/2020 intersection performance summary

The intersection of Werrington Road / Rance Road is currently operating at satisfactory LoS B during the AM and LoS D during PM peak hour. The LoS is based on the worst movement which is the right turn movement from Rance Road. Werrington Road / The Kingsway operates at LoS A in the AM peak and fails at LoS F in the PM peak under current conditions. Finally, the intersection of Werrington Road / Great Western Highway already experiences capacity issues with LoS D in the AM peak and fails at LoS F in the PM peak.

7.3.2 2022 Design Horizon Year

The 2022 design horizon year assumes that Stage 1A, 1B and 1C (including the development of the super lots through subsequent development application) will have been fully constructed without the East-West link in place.

As such, the proposed 4-leg roundabout would be constructed to operate as a 3-leg roundabout until Stage 2 of the development.

Werrington Road / Christie Street

Figure 7-2 illustrate the SIDRA layouts for the assessed scenarios along with the operation performance results summarised in **Table 7-3**.

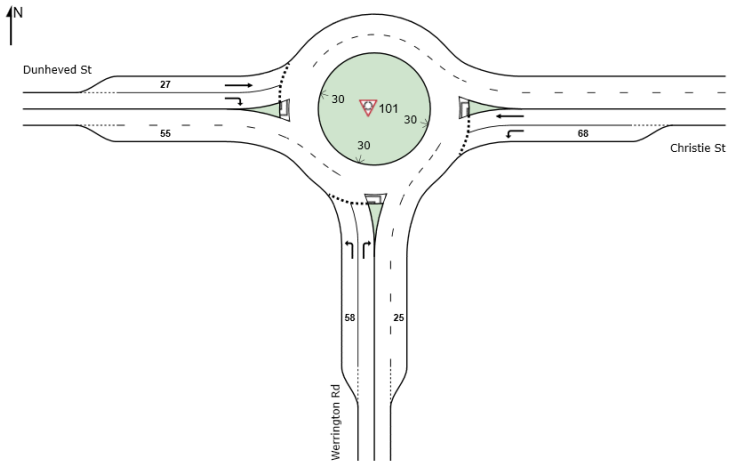


Figure 7-2 Werrington Road / Christie Street intersection year 2022

Table 7-3 Level of Service summary results (2022) – Werrington Road / Christie Street

Scenario	Approach	AM Peak DoS	AM Peak Average Delay (secs)	AM Peak LoS	PM Peak DoS	PM Peak Average Delay (secs)	PM Peak LoS
2022 Base	South	0.368	12.8	A	0.909	29.5	C
	East	0.415	7.1	A	0.521	5.3	A
	North	n/a					
	West	0.617	13.9	A	0.467	12.1	A
	Total	0.617	13.9	A	0.909	29.5	C
2022 Approved Development	South	0.398	12.8	A	0.926	32.9	C
	East	0.422	7.1	A	0.528	5.5	A
	North	n/a					
	West	0.637	14.5	B	0.469	12.1	A
	Total	**0.637**	**14.5**	B	0.926	32.9	C
2022 Stage 1	South	0.384	12.8	A	0.917	31	C
	East	0.419	7.1	A	0.525	5.4	A
	North	n/a					
	West	0.628	14.2	A	0.468	12.1	A
	Total	0.628	14.2	A	0.917	31	C

> Intersection performance shows that under the 2022 scenarios, the performance is LoS C or better. This demonstrates acceptable performance during both peak hours.

Werrington Road / Rance Road

Figure 7-3 illustrates the SIDRA layouts for the assessed scenarios along with the operational performance results summarised in **Table 7-4** and **0**.

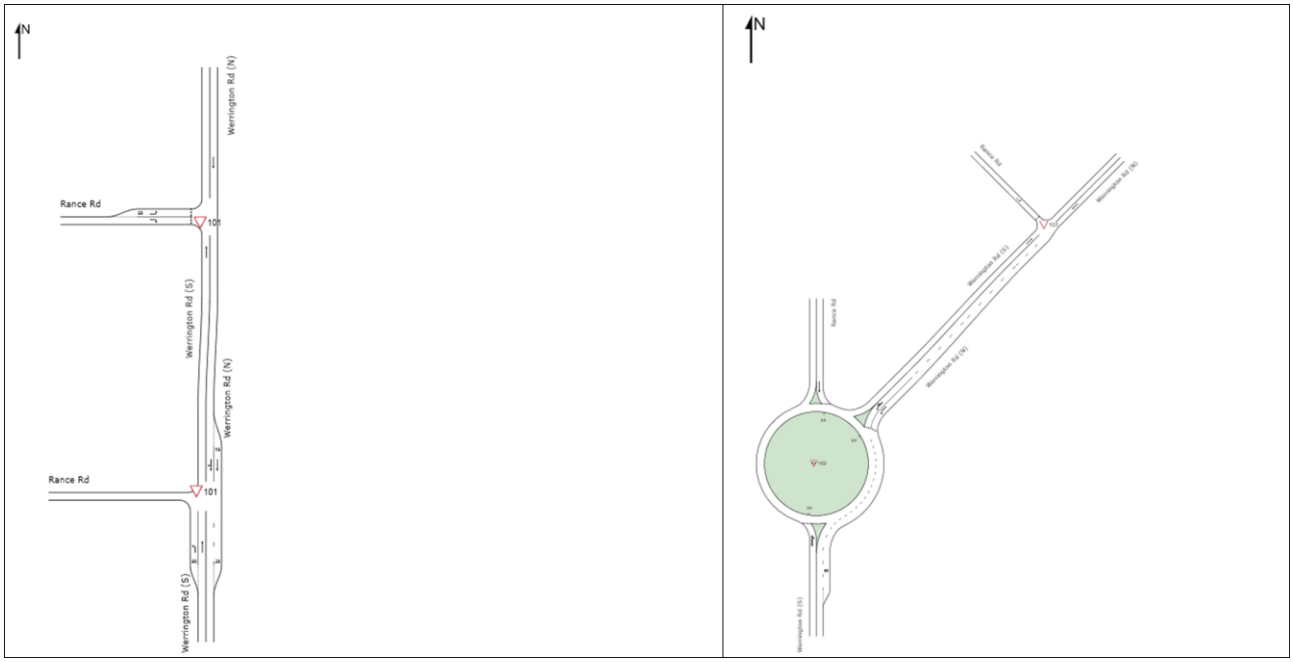


Figure 7-3 Werrington Road / Rance Road 2022 design layout (Base-left, Approved Development & Stage 1-right)

Table 7-4 Level of Service summary results (2022) – Werrington Road / Rance Road

Scenario	Approach	AM Peak			PM Peak		
		DoS	Average Delay (secs)	LoS	DoS	Average Delay (secs)	LoS
2022 Base	South	0.352	0	A	0.556	0	A
	East	n/a			n/a		
	North	0.464	0.1	A	0.356	0	A
	West	0.2265	19.2	B	0.567	46.7	D
	Total	**0.464**	**19.2**	**B**	**0.567**	**46.7**	**D**
2022 Approved Development	South	n/a			n/a		
	East	0.493	0.1	A	0.395	0.1	A
	North	0.092	8.2	A	0.108	12.7	A
	West	0.37	0	A	0.531	0	A
	Total	**0.493**	**8.2**	**A**	**0.531**	**12.7**	**A**
2022 Stage 1	South	n/a			n/a		
	East	0.49	0.1	A	0.385	0.1	A
	North	0.064	8.2	A	0.101	13.9	A
	West	0.37	0	A	0.556	0	A
	Total	**0.49**	**8.2**	**A**	**0.556**	**13.9**	**A**

Table 7-5 Level of Service summary results (2022) – Werrington Road / EW Link

Scenario	Approach	AM Peak			PM Peak		
		DoS	Average Delay (secs)	LoS	DoS	Average Delay (secs)	LoS
2022 Base	South	0.352	5.5	A	0.556	5.5	A
	East	n/a			n/a		
	North	0.399	12.3	A	0.332	23.2	B
	West	n/a			n/a		
	Total	**0.399**	**12.3**	**A**	**0.556**	**23.2**	**B**
2022 Approved Development	South	0.519	8	A	0.769	8.5	A
	East	0.511	10.2	A	0.373	9.5	A
	North	0.257	7.3	A	0.186	11	A
	West	n/a			n/a		
	Total	**0.519**	**10.2**	**A**	**0.77**	**11**	**A**
2022 Stage 1	South	0.501	7.9	A	0.738	8.2	A
	East	0.476	9.8	A	0.356	9.4	A
	North	0.173	7.1	A	0.155	11.9	A
	West	n/a			n/a		
	Total	**0.501**	**9.8**	**A**	**0.738**	**11.9**	**A**

- Intersection of Werrington Road / Rance Road under the 2022 Base, shows an operation of LoS B and D in the AM and PM peaks respectively. Improvement are shown under the Approved Development and Stage 1 as the new roundabout is introduced (LoS A for both peak periods and options);
- The proposed 3-approach roundabout will operate satisfactorily in both Approved Development and Stage 1 at LoS A in both peak periods.

Werrington Road / The Kingsway

Figure 7-4 illustrates the SIDRA layouts for the assessed scenarios along with the operational performance results summarised in **Table 7-6**.

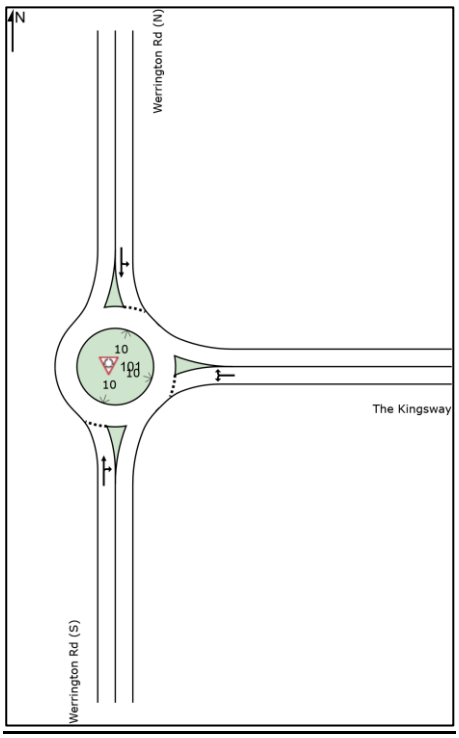


Figure 7-4 Werrington Road / The Kingsway 2022 design layout (same layout for all 2022 scenarios)

Table 7-6 Level of Service summary results (2022) – Werrington Road / The Kingsway

Scenario	Approach	AM Peak			PM Peak		
		DoS	Average Delay (secs)	LoS	DoS	Average Delay (secs)	LoS
2022 Base	South	0.632	9.8	A	1.257	253.3	F
	East	0.328	13.6	A	0.809	23.5	B
	North	0.747	5.8	A	0.633	5	A
	West	n/a			n/a		
	Total	**0.747**	**13.6**	**A**	**1.257**	**253.3**	**F**
2022 Approved Development	South	0.665	9.9	A	1.341	327	F
	East	0.429	16.8	B	0.917	37	C
	North	0.85	6.2	A	0.992	13.7	A
	West	n/a			n/a		
	Total	**0.85**	**16.8**	**B**	**1.341**	**327**	**F**
2022 Stage 1	South	0.648	9.8	A	1.297	288	F
	East	0.372	14.7	B	0.861	28.2	B
	North	0.801	6	A	0.819	5	A
	West	n/a			n/a		
	Total	**0.801**	**14.7**	**B**	**1.297**	**288**	**F**

> Under the 2022 Base scenario, the intersection of Werrington Road / The Kingsway operates at LoS A in the AM peak and fails at LoS F in the PM peak. The intersection will deteriorate further in terms of average vehicle delay in the PM peak when compared to the Base due to the additional developmental traffic under the two scenarios.

Werrington Road / Great Western Highway

Figure 7-5 illustrates the SIDRA layouts for the assessed scenarios along with the operational performance results summarised in **Table 7-7**.

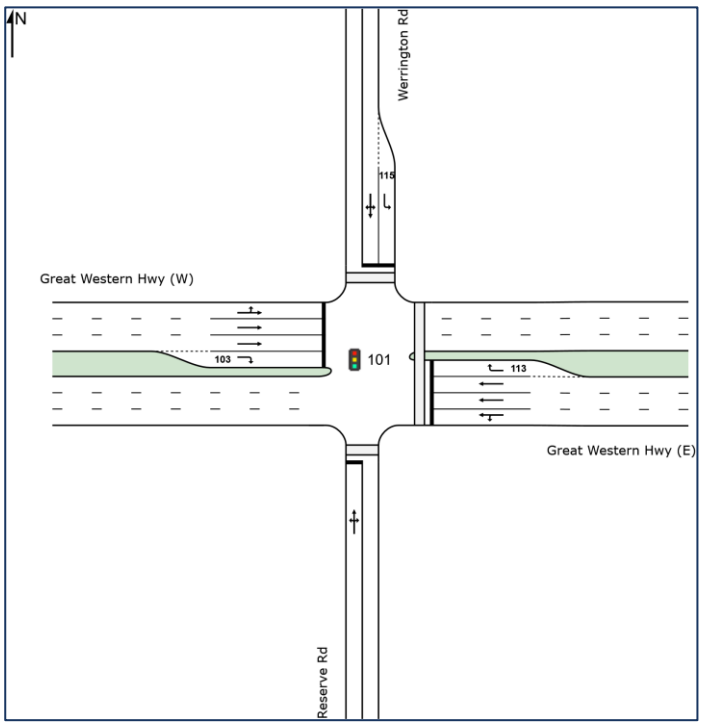


Figure 7-5 2022 design horizon intersection performance summary (same layout for all 2022 scenarios)

Table 7-7 Level of Service summary results (2022) – Werrington Road / Great Western Highway

Scenario	Approach	AM Peak			PM Peak		
		DoS	Average Delay (secs)	LoS	DoS	Average Delay (secs)	LoS
2022 Base	South	0.147	27.1	B	0.296	43.3	D
	East	0.756	37.6	C	1.094	51.1	D
	North	0.789	34.8	C	1.073	113.3	F
	West	0.784	47.2	D	1.089	138.6	F
	Total	**0.789**	**40.4**	**C**	**1.094**	**96.5**	**F**
2022 Approved Development	South	0.141	25.1	B	0.352	48.2	D
	East	0.868	41.2	C	1.29	91.2	F
	North	0.896	43.2	D	1.264	220	F
	West	0.873	57.5	E	1.266	141.5	F
	Total	**0.896**	**47.3**	**D**	**1.29**	**131.9**	**F**
2022 Stage 1	South	0.141	25.7	B	0.32	45.3	D
	East	0.839	54	D	1.195	69.4	E
	North	0.839	37.5	C	1.168	165.1	F
	West	0.814	48.7	D	1.183	137.7	F
	Total	**0.839**	**47.7**	**D**	**1.195**	**112.2**	**F**

> Under the 2022 Base scenario, the intersection of Werrington Road / Great Western Highway operates at capacity with LoS C in the AM peak and fails at LoS F in the PM peak. The intersection will deteriorate to LoS D under Approved Development and Stage 1 scenarios in the AM peak. The PM peak remains at LoS F with increased average vehicle delay compared to Base in both scenarios.

7.3.3 2030 Design Horizon Year

The 2030 design horizon year assumes that all stages will have been constructed and the East-West link will be in place tying in with the already proposed 3-approach roundabout at Werrington Road to convert it into a 4-approach.

Werrington Road / Christie Street

Figure 7-6 illustrate the SIDRA layouts for the assessed scenarios along with the operation performance results summarised in **Table 7-8**. The layout reflects no change from the assessed 2022 year.

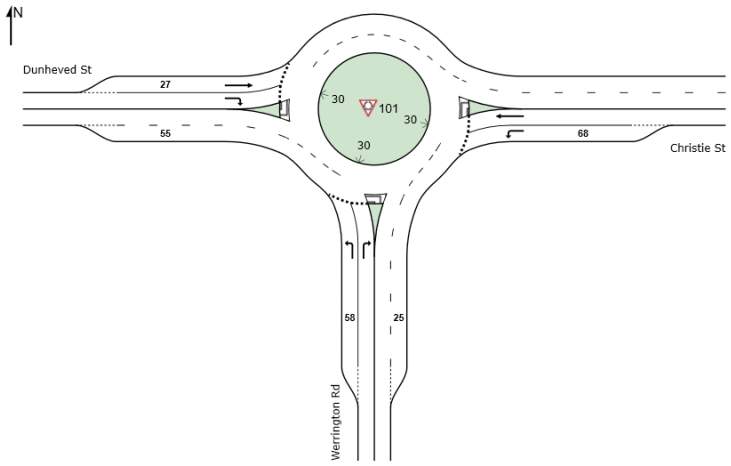


Figure 7-6 Werrington Road / Christie Street intersection year 2030

Table 7-8 Level of Service summary results (2030) – Werrington Road / Christie

Scenario	Approach	AM Peak			PM Peak		
		DoS	Average Delay (secs)	LoS	DoS	Average Delay (secs)	LoS
2030 Base	South	0.446	13.4	A	1.042	90.4	F
	East	0.486	7.2	A	0.626	5.8	A
	North	n/a					
	West	0.759	15	B	0.542	12.1	A
	Total	0.759	15	B	1.042	90.4	F
2030 Approved Development	South	0.499	13.6	A	1.29	285.3	F
	East	0.548	8.9	A	0.638	6	A
	North	n/a					
	West	0.798	18.1	B	0.572	12.6	A
	Total	0.798	18.1	B	1.29	285.3	F
2030 Stage 1	South	0.485	13.4	A	1.276	273.1	F
	East	0.544	8.8	A	0.633	5.9	A
	North	n/a					
	West	0.787	17.5	B	0.571	12.5	A
	Total	0.787	17.5	B	1.276	273.1	F
2030 Ultimate Development	South	0.514	13.8	A	1.29	285.3	F
	East	0.56	9.4	A	0.638	5.7	A
	North	n/a					

	West	0.81	19.2	B	0.572	12.5	A
	Total	0.81	19.2	B	1.29	285.3	F

- During the morning period, the intersection performs satisfactorily at LoS B or better. This represent good performance and spare capacity
- During the evening peak hour, the intersection performs at LoS F under the 2030 Base scenario (i.e. no development). The average delays under the Stage 1, Approved and Ultimate development scenarios increases vastly however the delays are very comparable to each other. Adopting the Approved development scenario delay (285 seconds) is generally worse than Stage 1 development and little difference to the Ultimate scenario.

Werrington Road / Rance Road

Figure 7-7 illustrates the SIDRA layouts for the assessed scenarios along with the operational performance results summarised in **Table 7-9** and **Table 7-10**.

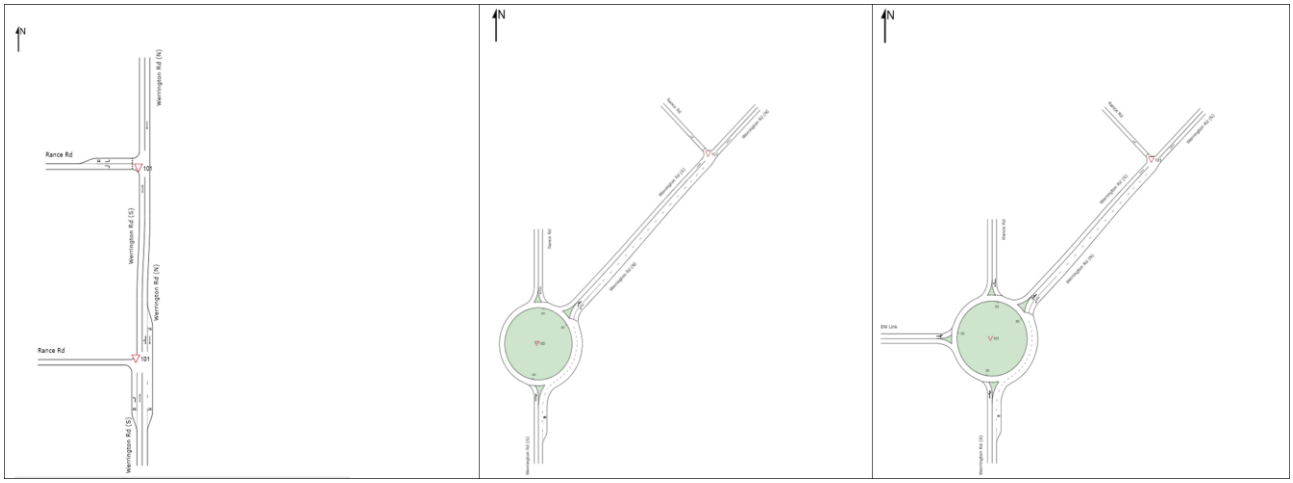


Figure 7-7 Werrington Road / Rance Road 2030 design layout (Base-left, Approved Development & Stage 1-middle, Ultimate Development & With Mitigation-right)

Table 7-9 Level of Service summary results (2030) – Werrington Road / Rance Road

Scenario	Approach	AM Peak DoS	AM Peak Average Delay (secs)	AM Peak LoS	PM Peak DoS	PM Peak Average Delay (secs)	PM Peak LoS
2030 Base	South	0.408	0	A	0.554	0	A
	East	n/a			n/a		
	North	0.537	0.1	A	0.412	0.1	A
	West	0.431	32	C	1.362	400.6	F
	Total	**0.537**	**32**	**C**	**1.362**	**400.6**	**F**
2030 Approved Development	South	n/a			n/a		
	East	0.57	0.1	A	0.455	0.1	A
	North	0.111	9.4		0.11	12.9	
	West	0.43	0	A	0.535	0	A
	Total	**0.57**	**9.4**	**A**	**0.535**	**12.9**	**A**
2030 Stage 1	South	n/a			n/a		
	East	0.567	0.1	A	0.444	0.1	A
	North	0.077	9.4	A	0.101	14	A
	West	0.43	0	A	0.557	0	A
	Total	**0.567**	**9.4**	**A**	**0.557**	**14**	**A**
2030 Ultimate Development	South	n/a			n/a		
	East	0.581	0.1	A	0.466	0.1	A
	North	0.07	10.1	A	0.089	12.9	A
	West	0.459	0	A	0.535	0	A
	Total	**0.581**	**10.1**	**A**	**0.535**	**12.9**	**A**
2030 Ultimate Development	South	n/a			n/a		
	East	0.581	0.1		0.466	0.1	A
	North	0.07	10.1	A	0.151	19.6	B

(With Mitigation)	West	0.459	0	A	0.637	0	A
	Total	**0.581**	**10.1**	**A**	**638**	**19.6**	**B**

Table 7-10 Level of Service summary results (2030) – Werrington Road / EW Link

Scenario	Approach	AM Peak DoS	AM Peak Average Delay (secs)	AM Peak LoS	PM Peak DoS	PM Peak Average Delay (secs)	PM Peak LoS
2030 Base	South	0.408	5.5	A	0.553	5.5	A
	East	n/a			n/a		
	North	0.464	16.1	B	0.372	24	B
	West	n/a			n/a		
	Total	**0.464**	**16.1**	**B**	**0.553**	**24**	**B**
2030 Approved Development	South	0.587	8	A	0.761	8.4	A
	East	0.903	15.3	B	0.637	9.5	A
	North	0.288	8.6	A	0.187	11.2	A
	West	n/a			n/a		
	Total	**0.903**	**15.3**	**B**	**0.761**	**11.2**	**A**
2030 Stage 1	South	0.568	8	A	0.731	8.2	A
	East	0.841	9.7	A	0.615	9.4	A
	North	0.193	8.3	A	0.154	12	A
	West	n/a			n/a		
	Total	**0.841**	**9.7**	**A**	**0.731**	**12**	**A**
2030 Ultimate Development	South	0.664	8.3	A	0.789	8.8	A
	East	0.966	29.7	C	0.688	9.8	A
	North	0.214	16.3	B	0.177	17.6	B
	West	0.674	26.2	B	0.528	25.9	B
	Total	**0.966**	**29.7**	**C**	**0.787**	**25.9**	**B**
2030 Ultimate Development (with mitigation)	South	0.664	8.3	A	0.939	9.8	A
	East	0.966	29.7	C	0.687	9.8	A
	North	0.214	16.3	B	0.331	25.1	B
	West	0.674	26.2	B	1.039	188.9	F
	Total	**0.966**	**29.7**	**C**	**1.039**	**188.9**	**F**

- Intersection of Werrington Road / Rance Road under the 2030 Base, shows an operation of LoS C and F in the AM and PM peaks respectively. Improvements are shown under all other assessed scenarios as the new roundabout is introduced (LoS A for both peak periods and options except PM peak of Ultimate Development With Mitigation which operates at LoS B);
- The proposed 3-approach roundabout under the Approved Development and Stage 1 will operate satisfactorily in both scenarios at LoS B or better in both peak periods. Under the 2030 Ultimate Development with the introduction of the additional traffic generation and fourth approach of the EW link, the roundabout is expected to operate at LoS C or better. Under the 2030 Ultimate Development With Mitigation, the roundabout will operate at LoS C in the AM and fail at LoS F in the PM. This is a result of the Kingsway mitigation, which improves traffic flow across the corridor at the downstream intersections and southbound queueing at The Kingsway spills back to the roundabout.

Werrington Road / The Kingsway

Figure 7-8 illustrates the SIDRA layouts for the assessed scenarios along with the operational performance results summarised in **Table 7-11**.

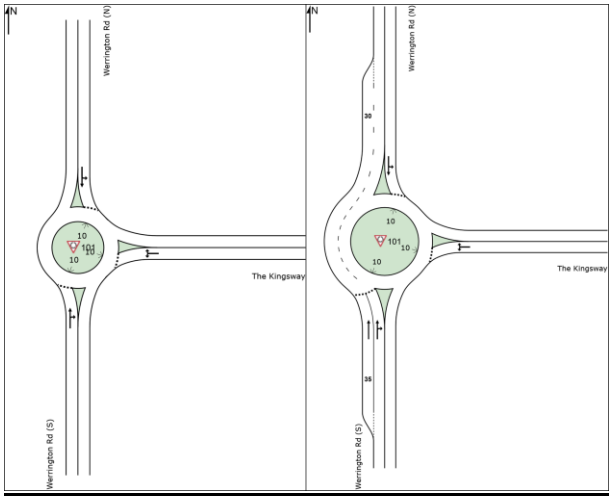


Figure 7-8 Werrington Road / The Kingsway 2030 design layout (all scenarios-left, Ultimate Development & With Mitigation-right)

Table 7-11 Level of Service summary results (2030) – Werrington Road / The Kingsway

Scenario	Approach	AM Peak DoS	AM Peak Average Delay (secs)	AM Peak LoS	PM Peak DoS	PM Peak Average Delay (secs)	PM Peak LoS
2030 Base	South	0.747	11.3	A	1.335	321.1	F
	East	0.487	17.5	B	1.195	205.3	F
	North	0.906	6.5	A	1.08	84.9	F
	West	n/a			n/a		
	Total	**0.906**	**17.6**	**B**	**1.335**	**205.3**	**F**
2030 Approved Development	South	0.781	12	A	1.38	360.7	F
	East	0.558	20.1	B	1.227	232.8	F
	North	1.121	119.9	F	1.138	135.9	F
	West	n/a			n/a		
	Total	**1.121**	**119.9**	**F**	**1.38**	**360.7**	**F**
2030 Stage 1	South	0.763	11.6	A	1.365	347.6	F
	East	0.542	19.5	B	1.204	212.8	F
	North	1.057	63.6	E	1.123	122.9	F
	West	n/a			n/a		
	Total	**1.057**	**63.6**	**E**	**1.365**	**347.6**	**F**
2030 Ultimate Development	South	0.85	14.1	A	1.394	373.4	F
	East	0.557	19.4	B	1.256	257.8	F
	North	1.258	242.3	F	1.231	219.1	F
	West	n/a			n/a		
	Total	**1.258**	**242.3**	**F**	**1.394**	**373.4**	**F**
2030 Ultimate Development (with mitigations)	South	0.637	9.7	A	1.121	134.3	F
	East	0.504	16.4	B	1.297	292.5	F
	North	1.404	373.6	F	1.268	251.3	F
	West	n/a			n/a		
	Total	**1.404**	**373.6**	**F**	**1.297**	**292.5**	**F**

> Intersection of Werrington Road / The Kingsway fails at LoS F across all scenarios in the PM peak period. Under the AM peak of 2030 Base, the intersection is operating satisfactorily at LoS B and further deteriorates as a result of the additional development traffic to LoS F (Approved Development, Ultimate Development and Ultimate Development With Mitigation). It is important to note that the mitigation implementation will reduce the intersection delay in the PM peak to 361 seconds compared to 293 seconds under the Approved Development.

Werrington Road / Great Western Highway

Figure 7-9 illustrates the SIDRA layouts for the assessed scenarios along with the operational performance results summarised in **Table 7-12**.

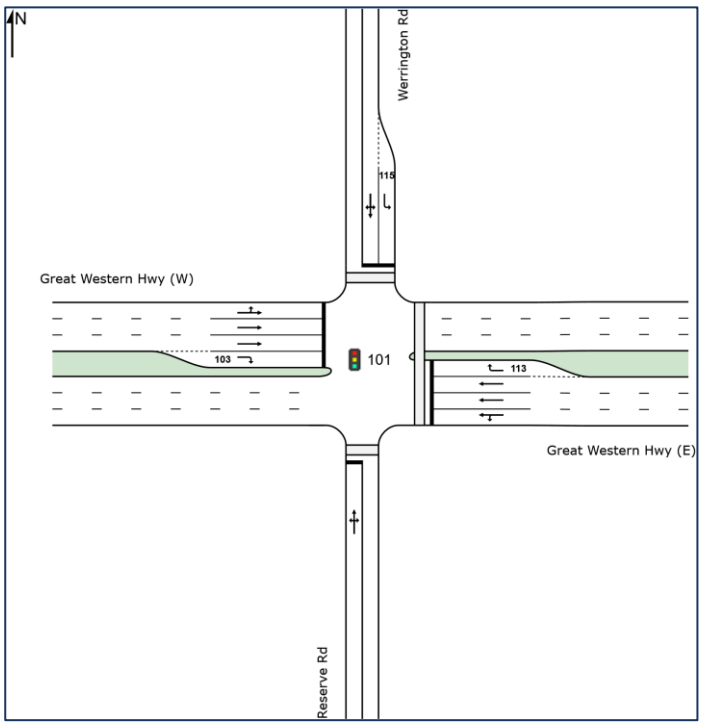


Figure 7-9 2022 design horizon intersection performance summary (same layout for all 2030 scenarios)

Table 7-12 Level of Service summary results (2030) – Werrington Road / Great Western Highway

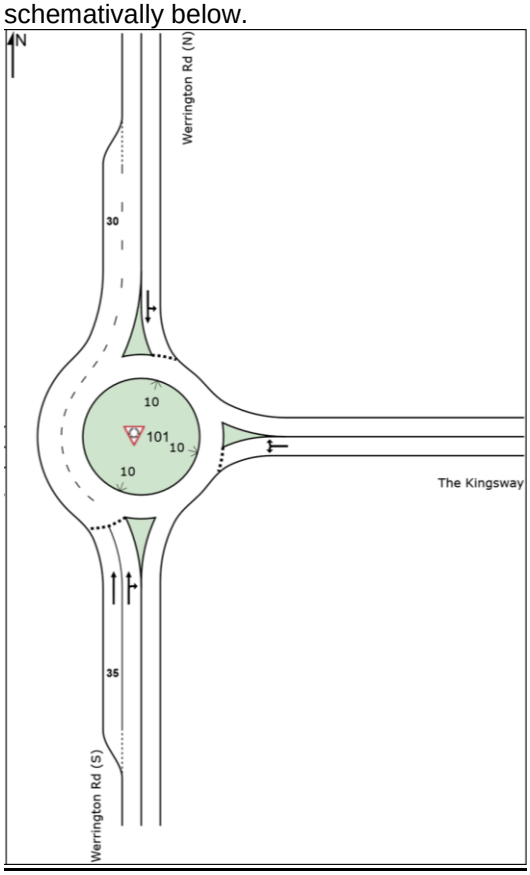
Scenario	Approach	AM Peak DoS	AM Peak Average Delay (secs)	AM Peak LoS	PM Peak DoS	PM Peak Average Delay (secs)	PM Peak LoS
2030 Base	South	0.15	27.1	B	0.329	46.2	D
	East	0.938	41.1	C	1.239	72.3	F
	North	0.922	50	D	1.206	186.4	F
	West	0.918	63.5	E	1.223	240.7	F
	Total	**0.938**	**51.2**	**D**	**1.239**	**158.2**	**F**
2030 Approved Development	South	0.152	27.8	B	0.385	50.3	D
	East	0.93	41.2	C	1.418	113.6	F
	North	0.959	59.3	E	1.385	291.6	F
	West	0.957	75.9	F	1.391	231.7	F
	Total	**0.959**	**57.9**	**E**	**1.418**	**187.6**	**F**
2030 Stage 1	South	0.149	27.1	B	0.36	49.1	D
	East	0.967	43.3	D	1.297	90.4	F
	North	0.953	57.1	E	1.328	258.4	F
	West	0.95	73.5	F	1.309	233.2	F
	Total	**0.967**	**57.3**	**E**	**1.328**	**173.6**	**F**
2030 Ultimate Development	South	0.155	28.5	C	0.44	53.6	D
	East	0.988	43.9	D	1.505	140.3	F
	North	0.978	66.2	E	1.505	364.8	F
	West	0.988	90	F	1.474	232	F
	Total	**0.988**	**65.9**	**E**	**1.505**	**210**	**F**
2030 Ultimate Development (with mitigations)	South	0.156	28.5	C	0.308	46.6	D
	East	0.988	43.9	D	1.231	81.6	F
	North	1	75.9	F	1.213	190.6	F
	West	0.988	90	F	1.25	246.7	F
	Total	**1.00**	**67.9**	**E**	**1.25**	**164.8**	**F**

> Under the 2030 Base scenario, the intersection of Werrington Road / Great Western Highway operates at capacity with LoS D in the AM peak and fails at LoS F in the PM peak. The intersection will deteriorate to LoS E under all scenarios in the AM peak. The PM peak remains at LoS F for all scenarios with increased average vehicle delay compared to Base. It is important to note that the mitigation implementation will reduce the intersection delay in the PM peak to 165 seconds compared to 188 seconds under the Approved Development.

Detailed intersection performance results extracted from SIDRA are provided in **Appendix F**.

7.3.4 2030 Design Horizon Year with Mitigation

At the request of Council, mitigation of the Werrignton Road / The Kingsway roundabout junction was investigated in order to try and achieve improved LoS. The existing road corridor in this location is relatively tight, with little available road reserve to provide additional lane capacity. The mitigation tested is the provision of an additionl northbound through lane long Werrington Road (short lane only). This is shown schematically below.



The intersection modelling results, based on the ultimate Lendlease development, are summarised below.

Table 7-13 Mitigation Level Of Service Summary

Intersection	Scenario	AM Peak DoS	AM Peak Average Delay (secs)	AM Peak LoS	PM Peak DoS	PM Peak Average Delay (secs)	PM Peak LoS
Werrington Road / East-West Link	2030 Ultimate	0.966	29.7	C	0.787	25.9	B
	2030 Ultimate + Mitigation	0.966	29.7	C	1.039	188.9	F
Werrington Road / The Kingsway	2030 Ultimate	1.258	242.3	F	1.394	373.4	F
	2030 Ultimate + Mitigation	1.404	373.6	F	1.297	292.5	F
Werrington Road / GWH	2030 Ultimate	0.988	65.9	E	1.505	210	F
	2030 Ultimate + Mitigation	1.00	67.9	E	1.25	164.8	F

- Under the 2030 Ultimate Development With Mitigation, the East-West link roundabout will operate at LoS C in the AM and fail at LoS F in the PM. This is a result of the Kingsway mitigation, which improves traffic flow across the corridor at the downstream intersections and southbound queueing at The Kingsway spills back to the roundabout.
- Under the AM peak of 2030 Base, the Werrington Road / Kingsway intersection is operating satisfactorily at LoS B and further deteriorates as a result of the additional development traffic to LoS F (Approved Development, Ultimate Development and Ultimate Development With Mitigation). It is important to note that the mitigation implementation will reduce the intersection delay in the PM peak to 361 seconds compared to 293 seconds under the Approved Development
- The Werrington Road / GWH intersection generally maintains its LoS E/F with and without the mitigation. The average delay reported in the PM is improved, but still remains as a considerably 'bad' F.

The results demonstrate that there is very little gained from the mitigation measure and only acts to push congestion along Werrington Road. This is symptomatic of the forecasted performance along the Werrignton Road corridro, which iex expected to fail under background growth only (i.e. no SWUV development), and the current approved level of development (i.e. Bathla and Statewide sites).

7.4 Residential Amenity Considerations

Reference is made to the RMS Guide (2002) which provides thresholds to consider for residential street types. These thresholds are produced in **Table 7-14** below.

Table 7-14 Residential Amenity Criteria

Road Class	Road Type	Maximum Speed (km/h)	Maximum Peak Hour Volume (veh/h)
Local	Access Way	25	100
	Street	40	200 environmental goal
			300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

Key roads subject to the consideration of residential amenity are Chapman Street, Landers Street and Walker Street. Roads within the Lendlease development dispurse traffic such that the thresholds above are now where near being met.

The Chapman Street, Landers Street and Walker Street will predominantly be utilised by Lendlease development in the north west corner, whereby the shortest (and assumed fastest) route to Werrington Road is via the Chapman Street route rather than the East-West link.

Under the ultimate arrangement (i.e. with East-West link) Cardno estimates that Stages 1A and 1C chose to route through Chapman Street, which is some 83 lots. This equates to some 44 vehicle trips. Observation surveys were conducted in 2019 at the Walker Street / Rance Road intersection which showed there is currently 14 morning peak hour and 32 evening peak hour trips. The addition of 44 trips along this link totals 58 to 76 peak hour trips well within the residential amenity threshold of a local street.

Under the initial 2022 arrangement, with the three legged roundabout would see Stage 1 utilising the Chapman Street route (159 Lots). This equates to some 85 vehicle trips. The addition of 85 trips along this link totals 69 to 117 peak hour trips well within the residential amenity threshold of a local street.

8 Response to Submissions

Responses received from both Penrith City Council and TfNSW have been taken into account as part of the updated traffic assessment. For ease of clarity, Cardno has provided respective responses to the two staholder submissions.

Item	Stakeholder Comment	Cardno Response	Document Reference
Penrith Cuty Coucil – 20 December 2019 Letter			
1	*The Traffic Assessment Report has only assessed traffic conditions and impact of traffic generated by the development on the intersection of Rance Road / East West Link Road / Werrington Road and should also assess traffic conditions impacts on the road network and required improvements including:* *• Great Western Highway / Werrington Arterial Road (Stage 1 – Gipps Street)* *• Great Western Highway / Werrington Road* *• Werrington Road / The Kingsway* *• Rance Road / Walker Street* *• The length of Rance Road and Walker Street* *• Werrington Road / Christie Street / Dunheved Road* *• Any other intersections and lengths of road requested by the RMS.*	Cardno has updated the traffic survey sites and traffic modelling to account for: > Great Western Highway / Werrington Road > Werrington Road / The Kingsway > Werrington Road / Rance Road > Werrington Road / Christie Street / Dunheved Road The surveyed sites are consistent with Council updated request and TfNSW request. The impact to the local roads of Walker Street ad Rance Road are considered to be minor particularly when the East-West link road becomes available as this will be a more attractive route to access Werrington Road.	Section
2	*The Traffic Report is requested to include assessment of the impact of traffic generated by the staged development on the residential amenity / environmental capacity of the existing precinct residential streets including Rance Road, Walker Street, Landers Road and Chapman Street.*	Assessment of the environmental capacity has been provided based on the RMS Guide (2002) thresholds for local streets, being the range of 200 to 300 vehicles per hour.	
3	*The development traffic generation rate for the 265 residential lot at the rate of 0.4 trips / dwelling lot is not appropriate (that being a rate for medium density) and rate should be the dwelling lot rate of 0.85 trips / residential lot in AM and PM peak hour.*	Cardno undertook additional analysis to determine the appropriate trip generation rate for the Lendlease Development. Through survey of 171 low density houses, it was found that a rate of 0.49-0.53 trips per dwelling was applicable for low density residential development near a train station.	

4	*The development traffic generation impact assessment should include the traffic generated by the Statewide approved development DA16/1148.*	The approved development of 83 Lots has been included in the revised trp generation and traffic modelling.	
5	*The development traffic generation rate for the 33 apartments at the rate of 0.29 trips per dwelling AM and PM peak hour is not appropriate (that being the RMS rate for high density and also noting that PCC have a higher high density rate of 0.33 trips per dwelling). The rate should be in the range for medium density dwelling at the rates of 0.4 to 0.5 trips per units up to 2 bedrooms and 0.5 to 0.65 trips for units of 3 bedrooms or more.*	It is noted that the 0.29 trips adopted in the 2019 Cardno assessment was higher than previous assessments to date, as it is believed that the current RMS trip rate of 0.15 to 0.19 trips per dwelling (which hhas been adopted by previous consultants) is not suitable. In anycase, the updated trip generation and traffic modelling accounts for the higher density rte of 0.33 trips per dwelling as the aparmtnets are not medium density (where evidence suggests medium density development in this area is at the lower end of the RMS Guide recommended trip rates).	
6	*The SIDRA modelling has calibrated the modelling to increase level of service and reduce delays based on site survey of queuing and delays for right turn out of Rance Road of 17 seconds in AM peak hour and 40 seconds in the PM peak hour. However, observations at this site by Council over a number of years has noted regular longer delays and queuing here especially in the PM peak hours after a train arrives at Werrington Station. Consequently, the calibration should be adjusted to reflect that the existing level of service and delays at Rance Road / Werrington Road are at or over capacity and do not support additional traffic generation without improvements.*	The average delay reported by SIDRA is based on the peak hour, and not any one time within the hour. Whilst there may be some instances where increased delay is experienced immediately following the arrival of a train (and departing of passengers), there are also likely to be cases where cars will find a gap upon arrival at the Rance Road / Werrington Road intersection out of coincidence. That is why the result is an average, across the hour, taking into consideration all delays above and below the average. It is not accurate to try and replicate the scenario requested by Council particularly Cardno has verified the delays through the use of survey rather than anecdotal evidence.	
7	*The staging traffic modelling design horizon year of 2022 is not considered suitable. The adjusted traffic generation and consideration of traffic generation impacts for any stage should be to at least a 10 year horizon being the year 2029.*	Cardno has undertaken updated analysis based on 2022 and 2030 as per Council request.	
8	*Directing development construction traffic and development generated traffic through the existing precinct residential streets including Rance Road, Walker Street, Landers Road and Chapman Street is not considered suitable with regard to residential amenity. It*	This can be addressed as part of a subsequent Construction Traffic Management Plan (CTMP) which is an expected condition of consent	

	is requested that construction traffic be directed along the proposed East West Link Road corridor with any staged temporary or permanent road link construction as required.		
9	*The previous SWUV development application assessments found that any development required the provision of at least a roundabout at the intersection of Rance Road / Werrington Road and that at an additional SWUV development stage that the East West Link Road with additional intersection treatment (roundabout or signalisation to be determined) at Werrington Road would be required.*	The traffic modelling supports a three legged roundabout can sustain Stage 1 development.	
10	*The proposed relocation of the Rance Road / Werrington intersection to provide a combined Rance Road / Werrington / East West Link Road intersection does not provide an acceptable level of service of at least D at 2029 (AM and PM peak hours) with any development stage and using the low traffic generation rates (to be amended and increased as requested) in the Traffic Report.*	Referring to the updated analysis, congestion alogn Werrington Road is not as a result of the proposed Lendlease development, whereby it is shown that both the Base and Approved development scenarios have unacceptable delays across all intersections. The provision of the East-West link roundabout will provide safe access to the developable land within the SWUV. The LoS of D is not appropriate for this intersection considering it is significantly influenced by existing traffic and downstream congestion. The current Werrington Road / Rance Road arrangement has been shown to perform unsatisfactorily particularly for vehicles exiting Rnace Road, whilst the East-West link will provide better opportunity for the residents and commuters between Werrington Train Station and Werrington Road. In any case, the LoS performance of the East-West link road is C or better (excluding the mitigation), however this is largely due to the delays and congestion being captured at the Kingsway and Great Western Highway intersections.	
11	*The traffic generation stages, developments and rates are requested to be adjusted as set out above and intersection arrangements and staging remodelled and reassessed. This should include providing at least intersection level of service D at 2029 for any and all stages at development and consideration of a signalised*	Refer to Item 21. Updated traffic generation and traffic modelling has been prepared for year 2022 and 2030.	

	intersection Rance Road / Werrington Road / East West Link Road intersection.		
12	*The Traffic Report is requested to include a table showing the proposed development stages and Statewide approved development DA16/1148, type and number of lots / dwellings / bedrooms and traffic generation, type and areas of industrial lots / uses and justification for traffic generation rate used (including consideration of AM and PM traffic generation rates for small scale industrial / mixed use with any potential child care centres, gyms, other uses). This will allow any staging of roadworks and intersection treatments to be conditioned by the traffic generated at that stage or alternatively any adjusted stage that generate that level of traffic.*	A breakdown of all approved development considered within the analysis is provided. Updated traffic generation and traffic modelling has been prepared for year 2022 and 2030 as requested by Council.	
Penrith City Council – Email dated 7 February 2020			
13	*The Lend Lease Traffic Report by Cardo dated Oct 2019 (LLTR) noted that the Statewide DA Traffic Report by Mott MacDonald undertook traffic surveys at Rance Road and assessed that traffic generated from m the dwellings in the Rance Road precinct were 0.44 trips/dwelling AM and 0.54 trips /dwelling PM. The Mott MacDonald Report then used 0.4 trips /dwelling for its proposed DA dwelling lots.*	Noted	
14	*The Statewide DA and trip generation was not agreed by Council and subject to LEC S94 negotiations. A Lyle Marshall Traffic Consultant peer review of the Mott MacDonald Traffic Report used the dwelling lot rates of 0.44 trips/dwelling AM and 0.54 trips/dwelling PM and included that a roundabout at Rance Rd / Werrington Road should be provided as part of DA works. The matter of trip generation was not fully resolved at LEC S94 but it was negotiated between applicant/Council/LEC that a roundabout at Rance Rd / Werrington Road be a DA condition.*	Noted.	
15	*The subsequent staged DAs in the SWUV precinct from Bathla/Universal Properties included Traffic Reports by Traffix which used the RMS rates of 0.95 trips/dwelling AM and 0.99 trips/dwelling PM for residential lots, 0.5 trips/dwelling AM and PM for medium density dwellings, 0.19 trips /dwelling AM and 0.15 trips / dwelling PM for the High Density RFB stage, 0.52 trips / 100 sq. m GFA AM*	Noted. The high density unit rate of 0.5-0.19 adopted in the Traffix Reports was reviewed by Cardno where it was opted to select the higher rate of 0.29 initially. Updated analysis now accounts for the 0.33 trips per welling as per information supplied by Council.	

	and 0.56 trips/100 sq. m GFA PM for Industrial units as well as RMS rates for Neighbourhood Centre.		
16	*The Bathla/Universal Property staged DAs and traffic reports were not fully agreed by Council and subject to LEC S94 negotiations. Council put forward that the High Density RFB rate should be as set out in the attached extract from a PCC Council Report namely 0.33 trips/HDRFB dwelling up to 2026, 0.30 trips/HDRFB dwelling at 2031 and 0.26 trips/HDRFB dwelling at 2036 . The matters in the Traffic Report were not fully accepted by Council but it was accepted by the applicant/Council/LEC that a roundabout at Rance Rd/Werrington Rd be a DA condition for each of the stages.*	Noted.	
17	*The current LLTR has referred to the Mott MacDonald Report and traffic survey and a more contemporary traffic survey by Cardo - LLTR that shows similar traffic numbers and then has used a rate of 0.4 trips / dwelling lot for the proposed subdivision lots. The LLTR has also used the RMS rate of 0.15 trips/ dwelling for HDRFB.*	The LLTR referenced here did not adopt the 0.15 trips per dwelling for high density. In any case, the current analysis (which supersedes the previous submission) adopts Council's requested rate of 0.33 trips per dwelling.	
18	*The Mott MacDonald traffic survey / Cardno LLTR survey trip generation for the existing Rance Road precinct is for the predominantly medium density townhouses with some residential lots and is requested be adjusted regarding the proposed DA stages for the lower density residential lots. This should be set out in an adjusted LLTR and may be considered at a justified rate between the surveyed / assessed trip generation and the RMS rates. There should be a break up of higher residential lot rates and rates for median density dwellings / units. The use of RMS rates for industrial lots may be acceptable subject to a break up of potential / likely other uses including Gym and Child Care Facilities trip generation rates.*	Noted. Cardno has undertaken updated trip generation surveys of low density residential development. Through survey of 171 low density houses, it was found that a rate of 0.49-0.53 trips per dwelling was applicable for low density residential development near a train station.	
18	*The traffic generation rate that PCC have adopted as set out in the attached extract of the Council Report is requested be used for HDRFB DA stages noting that HDRFB are generally over 6 story RFB developments. This is derived from assessments of similar HDRFB within proximity of stations including in the Penrith LGA.*	Noted. The current analysis (which supersedes the previous submission) adopts Council's requested rate of 0.33 trips per dwelling.	

19	*The LLTR is requested to include this impacts of traffic generated by the determined Statewide DA.*	The approved development of 83 Lots has been included in the revised trp generation and traffic modelling.	
20	*The LLTR is requested to be broken into assessment of the impact for LL proposed first stage works which are currently Stages 1a, 1b and 1c combined (I note that the LLTR mentioned a 1d stage however this is not set out in the LL plans – advice on this is requested).*	The inclusion of Stage 1d is an error and has been removed from the updated analysis.	
21	*This first stage traffic impact assessment is requested to SIDRA traffic model the intersections of Rance Rd / Werrington Road with and without roundabout at 2022 (proposed stage 1 completion) and at 2030 (10 year horizon). The roundabout may be considered as a three leg first stage roundabout with additional East West Link at Stage 2a provided it can be demonstrated as being at an acceptable levels of service for each movement and in particular right turn out of Rance Road.*	Traffic modelling is as per the Council request. The three legged roundabout performs satisfactorily for Stage 1 development.	
22	*Please note that all previous DAs for SWUV precinct required provision of a roundabout at Rance Road / Werrington Road and your LLTR with the lower traffic numbers identifies the need for a roundabout at the first stage. Consequently, any proposal to not provide a roundabout here at first stage or any part of first stage would require strong justification for consideration. Please also note that we need the intersection with first stage to function satisfactorily at the 2030 year horizon because this is normal development timeline practice and will allow for the potential of this being the only stage developed by this time.*	Traffic modelling is as per the Council request. The three legged roundabout performs satisfactorily for Stage 1 development.	
23	*The first stage assessment is requested to also assess/ SIDRA traffic model traffic impacts at Werrington / The Kingsway, Werrington Road / Great Western Highway and Werrington Road / Christie Street at 2030. If it is found that the "without development" traffic impacts have a low level of service for any traffic movements and that the with development impacts do not significantly further reduce the level of service for any traffic movements and that any improvement would not significantly improve this or be feasible and so could be accepted awaiting Werrington Arterial Stage 2 by Tens (RMS) . Then this is requested be set out in the LLTR for*	Intersection modelling shows the existing performanc of The Kingsway and Great Western Highway junctions with Werrington Road will perform unsatisfactory under the Base and Approved development scenarios. The proposed Lendlease development will not result in significant increase to these delays and is generally in line with the Approved development scenario.	

	consideration by Council and TfNSW (RMS). The turning movements at the intersection of Werrington Road / Great Western Highway are requested to be particularly addressed.	Mitigation at the Kingsway roundabout is shown to have a negative impact on the network performance of Werrignton Road.	
24	*The impact of traffic generated by the fully developed combined Stages 1a to Stage 4b plus traffic generated by Statewide DA are requested to be assess for the year 2030 and include the provision of the East West Connector Road to join the Rance Rad / Werrington Road roundabout with internal road links via Road 10 to Walker St and to Road 5 etc.*	Updated modelling is as per Councils request.	
25	*The combined stages plus Statewide DA assessment is requested to also assess traffic impacts/ SIDRA traffic model at Werrington / The Kingsway, Werrington Road / Great Western Highway and Werrington Road / Christie Street at 2030. If it is found that the without development traffic impacts have a low level of service and that the with development impacts do not significantly further reduce the level of service and that any improvement would not significantly improve this or be feasible and so could be accepted awaiting Werrington Arterial Stage 2 by TfNSW(RMS) . Then this is requested be set out in the LLTR for consideration by Council and TfNSW(RMS).*	Updated modelling is as per Councils request. The result show that the Lendlease development has neglible impact to the forecasted average delay and overall intersection LoS.	
26	*The proposed alignment of the proposed roundabout by extending the East West Connector Road directly east to join Werrington Road / Rance Road rather than alignment of the East West Connector Road to connect with realigned Werrington Road/Werrington Arterial Stage 2 as set out in the SWUV DCP plans and the TfNSW (RMS) concept plans for Werrington Aerial Stage 2 is requested to be justified to allow consideration by Council and the RMS. Please note that RMS Land Use Section referral response to Council set out that their position was that the East West Connector Road should be located as set out in the SWUV DCP and in RMS concept plans including realignments of the intersection to the south of Rance Road and realignment of Werrington Road to meet it.*	This is addressed by GLN Planning	
27	*The points raised at out Council / Lend lease meeting regarding this are appreciated, including that since the Werrington Arterial Stage 2 is not proposed to be provided by TfNSW (RMS) within any timeline and there are no designs for these works that it is more feasible/ practical for the LL SWUV DA development to connect to the*	This is addressed by GLN Planning	

	existing Werrington Road and that further realignment of the East West Connector Road and connection to a future Werrington Arterial Stage 2 alignment to the south (at a proposed signalised treatment) could then be addressed by TfNSW (RMS) at that time. The proposed LL SWUV roundabout would allow for TfNSW (RMS) construction clear of traffic and then the Rance Road / Werrington Road roundabout could be replaced with a left in / left out at Rance Road. It is requested that this position / strategy be set out in the LLTR and include a concept plan showing this possible future arrangement. This will allow further liaison with the RMS Land use Section on this matter and the intersection assessment matters.		
Transport for NSW – 24 January 2020 letter			
28	*It is understood that the vehicular access is proposed through the existing connection via Walker/Chapman streets and a new link road (Road 11) passing through the subject site to connect with Werrington Road. The alignment of Road 11 and its design is not in accordance with the south Western Urban Village (SWUV) structure plan in Council's DCP. The SWUV structure plan shows a road connection further to the south that has connectivity outside of the village.* *It is noted that the eastern extent of the alignment is proposed to be straightened to create a fourth leg of a proposed new roundabout on Werrington Road. TFNSW would only support one intersection in the ultimate arrangement as per the DCP.*	This is addressed by GLN Planning	
29	*The intersection of Great Western Highway/Werrington Road was not assessed as part of Cardno's Traffic Impact Assessment (TIA).* *The right turn from Werrington Road onto Great Western Highway already encounters considerable traffic during AM and PM peak hours. Whilst TfNSW Network Operations have previously modified the timing of the signals to accommodate the increased demand from Werrington Road, there is still a need to balance this with the Great Western Highway demands. With the additional traffic predicted as a result of the development, Werrington Road will not be able to cater for the increased demand, and there will likely be queueing through the proposed new roundabout. A traffic study should be provided to consider the impacts of the proposal on the surrounding road network and key intersections. The assessment*	Updated traffic modelling has been undertaken, inclusive of the listed intersections by TfNSW. The modelled years stipulated by Council are 2022 and 2030 and show that the proposed Lendlease development has neglible impact to the forecasted average delay and overall intersection LoS.	

	should consider the impacts of other known planning proposals and major development applications in the area. In this regard, the ultimate development year plus 10 years growth should be considered in the network analysis. The assessment should include SIDRA modelling of at the least the following intersections (but not limited to): *i. Great Western Highway/Werrington Road* *ii. Werrington Road/Kingsway* *iii. Werrington Road/Rance Road*		
30	*Traffic Modelling and analysis for the application should consider the cumulative traffic impact of the development on surrounding roads and intersections in the context of any other known planning proposals and developments in the precinct and surrounds, and the need for upgrades or improvement works including consideration to timing and funding (if required).*	Inclusion of known approved development and a background growth rate has been adopted.	
31	*All SIDRA files are to be provided to TfNSW for review.*	SIDRA files can be accessed in **Appendix F**	
32	*TfNSW will review any proposed upgrades as a result of this staged development once all matters raised have been addressed.*	Noted	

9 Conclusion

The traffic impact assessment undertaken for the Werrington subdivision results in the following conclusions:

- Previous traffic reports have shown that:
  - Traffix has previously undertaken a TIA for the SWUVP development. The SWUVP Concept Plan envisaged a proposed development of some 2,000 units of high and medium density with a mix of employment and industrial land as well;
  - Cardno's review of the document identified that with no development, Rance Road / Werrington Road performs at LoS B & F during the AM and PM peak hour respectively. The Traffix report states that provision of the new East-West link between the subject site and the future signalised intersection with Werrington Road should be considered a priority for redevelopment of the South Werrington Urban Village as a result of the poor performance identified at Rance Road. The proposed signalised intersection along Werrington Road with the new East-West link (at the south of Rance Road) would provide additional capacity and ensure acceptable level of service intersection performance to cope with future developmental traffic; and
  - Provision of signalised intersection likely to be warranted when some 950 residential units are developed to achieve 200veh/hr on the minor road required under the warrant criteria at the time of the assessment.
- Approved development under SWUV assumes a total of 262 residential lots, 95 apartments and 3 residue lots at the study area. It was estimated that 208 and 205 vehicular trips during the morning and evening peaks respectively;
- The Lot yield plan is proposing a development which will ultimately provide for a total of 389 dwellings. This is split up into 266 Lots, 91 future Lots and 33 future apartments. The development also includes the creation of 14 industrial lots comprising 31,005 m^2 gross land area. The development scale is considerably lower when compared to the yield highlighted in Traffix's report;
- Traffic generation exercise determined a more appropriate trip generation rate (this case) for low density development of **0.53** and **0.49** trips/dwelling in the morning and evening peak respectively;
- A 2% per annum background traffic growth has been added across Werrington Road to capture significant growth from the SWUV and other growth precincts nearby;
- The complete development is expected to generate 361 and 359 vehicular trips per hour in the AM and PM peaks respectively;
- Vehicular access into and out of the proposed development will be through the existing connections to the development via Walker Street/Chapman Street and a new link road (East-West link), which will connect to Werrington Road;
- Cardno adopted the shortest distance calculation approach in order to derive the number of lots that are expected to use the two site accesses (new East-West link and Rance Road):
  - Traffic generation from Stage 1A, 1B and 1C is assumed to access Werrington Road / Rance Road under the 2022 design year;
  - Under 2030 Ultimate Development traffic from development stages 1A and 1C are assumed to divert to Chapman Street / Railway Street / Rance Road; and
  - The remaining development stages (1B, 2A, 2B, 3, 4A and 4B) are expected to use the new East-West link upon construction completion.
- The TIA assessed a roundabout design at Werrington Road / Rance Road using SIDRA in both 2022 and 2030 with the following specifications:
  - 3-approach roundabout conversion at Werrington Road / Rance Road by 2022 and 2030 (Stage 1 and Approved Development);
  - 4-approach roundabout conversion tying in the East-West link to the west by 2030 (Ultimate Development & Ultimate Development With Mitigations).
- SIDRA results shows that under existing conditions (2019/2020):

- Werrington Road / Rance Road is operating at LoS B and D in the AM and PM peaks respectively;
- Werrington Road / The Kingsway is operating at LoS A in the AM and fails at LoS F in the PM peak;
- Werrington Road / Great Western Highway is operating at capacity in the AM peak (LoS D) and over-capacity in the PM peak (LoS F).

> SIDRA results shows that under the 2022 design year:

- Intersection of Werrington Road / Rance Road under the 2022 Base, shows an operation of LoS B and D in the AM and PM peaks respectively. Improvement are shown under the Approved Development and Stage 1 as the new roundabout is introduced (LoS A for both peak periods and options);
- Werrington Road / EW LInk is operating (proposed 3-approach roundabout) satisfactorily in both Approved Development and Stage 1 at LoS A in both peak periods;
- Werrington Road / The Kingsway operates at LoS A in the AM peak and fails at LoS F in the PM peak (Base). The intersection will further deteriorate in terms of average vehicle delay in the PM peak when compared to the Base due to the additional developmental traffic under the Approved Development and Stage 1 scenarios. LoS B is reported in the AM peak for Approved Development and Stage 1;
- Werrington Road / The Kingsway is operating at LoS A in the AM and fails at LoS F in the PM peak;
- Werrington Road / Great Western Highway under the 2020 Base is operating at capacity in the AM peak (LoS C) and over-capacity in the PM peak (LoS F). LoS worsens to D in the AM peak for the Approved Development and Stage 1 and remains at LoS F (with increased delay) in the PM peak.

> SIDRA results shows that under the 2030 design year:

- Werrington Road / Rance Road is operating at LoS C and fails at F in the AM and PM peaks respectively under the 2030 Base. Improvements are shown under all other assessed scenarios as the new roundabout is introduced (LoS A for both peak periods and options except PM peak of Ultimate Development With Mitigation which operates at LoS B);
- Proposed 3-approach roundabout under the Approved Development and Stage 1 will operate satisfactorily in both scenarios at LoS B or better in both peak periods. Under the 2030 Ultimate Development with the introduction of the additional traffic generation and fourth approach of the EW link, the roundabout is expected to operate at LoS C or better. Under the 2030 Ultimate Development With Mitigation, the roundabout will operate at LoS C in the AM and fail at LoS F in the PM. This is a result of the Kingsway mitigation, which improves traffic flow across the corridor at the downstream intersections and southbound queueing at The Kingsway spills back to the roundabout;
- Werrington Road / The Kingsway fails at LoS F across all scenarios in the PM peak period. Under the AM peak of 2030 Base, the intersection is operating satisfactorily at LoS B and further deteriorates as a result of the additional development traffic to LoS F (Approved Development, Ultimate Development and Ultimate Development With Mitigation). Note that the mitigation implementation reduces the intersection's delay (PM peak) to 361 compared to 293 seconds under the Approved Development;
- Werrington Road / Great Western Highway under the 2030 Base is operating at capacity in the AM peak (LoS D) and fails in the PM peak (LoS F). The intersection deteriorates to LoS E under all scenarios in the AM peak. The PM peak remains at LoS F for all scenarios with increased average vehicle delay compared to Base. Note that the mitigation implementation will reduce the intersection delay in the PM peak to 165 seconds compared to 188 seconds under the Approved Development;

> The introduction of the proposed East-West link as the fourth arm to the roundabout's design (west approach), will result in unsatisfactory performance during the PM peak of Ultimate Design With Mitigation with LoS F. The roundabout design however significantly improves the delay performance when compared to the 2030 base case. LoS in the AM peak is satisfactory (C or better) under all scenarios. The afternoon peak hour is reported as LoS "F" however, again this is considerably better than the base scenario (>400 seconds);

> It is important to state that the development of the Werrington site is part of the wider SWUV precinct development. Under the SWUV, it was intended that the East-West link intersection with Werrington Road would be signalised and as such providing additional capacity, making the roundabout design and corresponding LoS performance redundant;

> Similarly, the SWUV structure plan relies upon the delivery of the Werrington Arterial Stage 2 project. The performance of the intersection of the East West links, Werrington Road and Rance Road will ultimately

improve once the capacity of Werrington road increases per the planned Werrington Arterial Road Stage 2 upgrade

APPENDIX

A

TRAFFIC SURVEYS

TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of The Kingsway and Werrington Road, Werr

GPS *-33.7655, 150.7581*

Date:	Tue 27/08/19
Weather:	Overcast
Suburban:	Werrington
Customer:	Cardno

North:	Werrington Road
East:	The Kingsway
South:	Werrington Road
West:	N/A

Survey Period	AM:	6:30 AM-9:30 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	5:00 PM-6:00 PM

All Vehicles

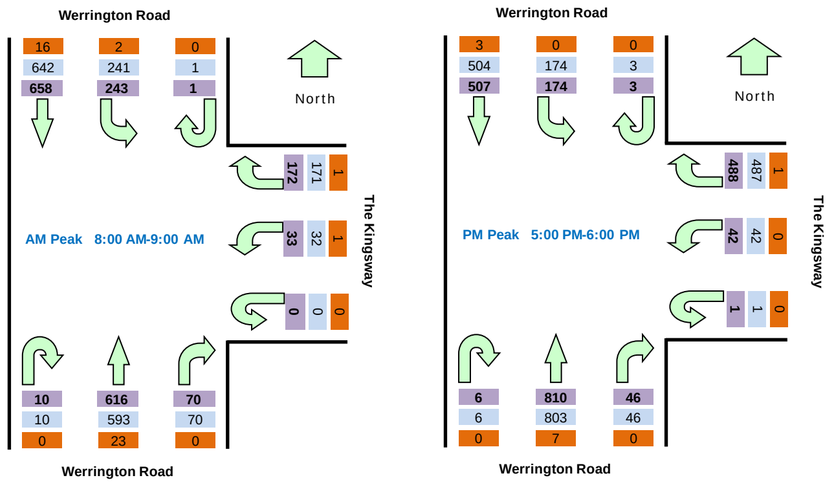
Time		rth Approach Werrington Rc			East Approach The Kingsway			uth Approach Werrington Rc			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
6:30	6:45	1	144	38	0	17	5	1	17	84	1348	
6:45	7:00	0	191	36	0	17	4	0	5	106	1465	
7:00	7:15	0	155	29	0	15	2	4	10	117	1528	
7:15	7:30	0	143	68	0	22	3	3	15	96	1627	
7:30	7:45	0	167	56	0	37	5	1	18	140	1721	
7:45	8:00	0	154	74	0	41	7	1	9	136	1763	
8:00	8:15	0	154	50	0	40	5	2	16	164	1803	Peak
8:15	8:30	1	166	74	0	39	7	2	22	133	1784	
8:30	8:45	0	176	53	0	46	8	4	16	163	1708	
8:45	9:00	0	162	66	0	47	13	2	16	156		
9:00	9:15	0	134	61	0	41	13	2	14	147		
9:15	9:30	0	113	57	0	39	13	2	14	130		
16:00	16:15	1	113	66	0	122	11	4	20	164	2002	
16:15	16:30	2	121	48	0	119	9	0	10	201	2046	
16:30	16:45	0	119	41	0	113	7	2	9	207	2049	
16:45	17:00	0	126	41	0	101	12	3	10	200	2063	
17:00	17:15	0	150	38	0	123	11	2	13	208	2077	Peak
17:15	17:30	2	138	33	0	141	13	3	8	175	1983	
17:30	17:45	1	115	54	0	128	9	1	10	194	1901	
17:45	18:00	0	104	49	1	96	9	0	15	233	1783	
18:00	18:15	0	114	52	0	87	10	1	19	168	1618	
18:15	18:30	0	125	36	0	87	6	2	13	162		
18:30	18:45	0	108	35	0	87	10	0	15	139		
18:45	19:00	0	104	34	0	51	6	1	12	134		

Peak Time		rth Approach Werrington Rc			East Approach The Kingsway			uth Approach Werrington Rc			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
8:00	9:00	1	658	243	0	172	33	10	70	616	1803
17:00	18:00	3	507	174	1	488	42	6	46	810	2077

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		North Approach Werrington			East Approach The Kingswa			South Approach Werrington		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
6:30	6:45	1	137	38	0	16	5	1	17	81
6:45	7:00	0	184	36	0	16	4	0	5	100
7:00	7:15	0	147	29	0	15	2	4	10	110
7:15	7:30	0	135	68	0	22	3	3	15	93
7:30	7:45	0	159	53	0	37	5	1	18	131
7:45	8:00	0	145	74	0	41	7	1	8	132
8:00	8:15	0	151	49	0	39	4	2	16	161
8:15	8:30	1	160	74	0	39	7	2	22	128
8:30	8:45	0	172	53	0	46	8	4	16	157
8:45	9:00	0	159	65	0	47	13	2	16	147
9:00	9:15	0	132	61	0	41	13	2	14	141
9:15	9:30	0	111	57	0	39	13	2	14	127
16:00	16:15	1	108	66	0	121	11	4	20	160
16:15	16:30	1	118	48	0	119	9	0	10	195
16:30	16:45	0	114	41	0	113	7	2	9	204
16:45	17:00	0	123	40	0	101	12	3	10	200
17:00	17:15	0	150	38	0	123	11	2	13	205
17:15	17:30	2	135	33	0	141	13	3	8	172
17:30	17:45	1	115	54	0	127	9	1	10	193
17:45	18:00	0	104	49	1	96	9	0	15	233
18:00	18:15	0	114	52	0	87	10	1	19	167
18:15	18:30	0	125	36	0	87	6	2	13	161
18:30	18:45	0	108	35	0	87	10	0	15	139
18:45	19:00	0	104	34	0	51	6	1	12	131

Queue length

Time		South Approach	East Approach	North Approach
Period Start	Period End			
6:30	6:35	2	3	0
6:35	6:40	0	4	0
6:40	6:45	6	3	0
6:45	6:50	1	3	0
6:50	6:55	2	3	0
6:55	7:00	2	0	0
7:00	7:05	1	1	0
7:05	7:10	2	1	0
7:10	7:15	0	1	6
7:15	7:20	3	3	4
7:20	7:25	1	6	4
7:25	7:30	2	2	7
7:30	7:35	2	2	6
7:35	7:40	3	3	2
7:40	7:45	3	2	3
7:45	7:50	4	2	6
7:50	7:55	2	2	3
7:55	8:00	5	3	10
8:00	8:05	2	3	5
8:05	8:10	2	2	2
8:10	8:15	3	2	1
8:15	8:20	4	3	1
8:20	8:25	4	3	4
8:25	8:30	3	5	5
8:30	8:35	4	4	2
8:35	8:40	2	7	5
8:40	8:45	4	5	4
8:45	8:50	1	3	2
8:50	8:55	6	3	3
8:55	9:00	3	3	1
9:00	9:05	2	3	7
9:05	9:10	4	3	10
9:10	9:15	6	4	1
9:15	9:20	4	7	2
9:20	9:25	4	5	3
9:25	9:30	5	2	5
16:00	16:05	6	5	9
16:05	16:10	10	5	10
16:10	16:15	8	6	4
16:15	16:20	8	13	6
16:20	16:25	7	4	10
16:25	16:30	8	6	2
16:30	16:35	12	6	2
16:35	16:40	10	3	3
16:40	16:45	6	7	0
16:45	16:50	5	7	3
16:50	16:55	6	9	3
16:55	17:00	5	13	2
17:00	17:05	10	7	0
17:05	17:10	9	5	3
17:10	17:15	12	14	2
17:15	17:20	9	13	1
17:20	17:25	12	20	0
17:25	17:30	12	8	1
17:30	17:35	10	3	3
17:35	17:40	12	8	1
17:40	17:45	11	3	1
17:45	17:50	8	5	0
17:50	17:55	12	4	0
17:55	18:00	5	4	2
18:00	18:05	6	6	0
18:05	18:10	8	4	2
18:10	18:15	4	5	1
18:15	18:20	4	5	3
18:20	18:25	6	10	0
18:25	18:30	3	4	1
18:30	18:35	5	6	2
18:35	18:40	7	3	1
18:40	18:45	4	3	1
18:45	18:50	6	3	0
18:50	18:55	7	3	0
18:55	19:00	4	3	0

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Rance Road and Werrington Road, Werri

GPS *-33.76331, 150.75879*

Date:	Tue 27/08/19
Weather:	Overcast
Suburban:	Werrington
Customer:	Cardno

North:	Werrington Road
East:	N/A
South:	Werrington Road
West:	Rance Road

Survey	AM:	6:30 AM-9:30 AM
Period	PM:	4:00 PM-7:00 PM
Traffic	AM:	7:15 AM-8:15 AM
Peak	PM:	4:45 PM-5:45 PM

All Vehicles

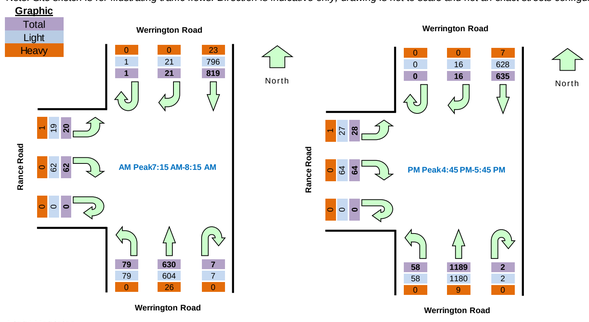
Time		rth Approach Werrington Rd			uth Approach Werrington Rd			West Approach Rance Road			Hourly Total	
Period Start	**Period End**	**U**	**R**	**SB**	**U**	**NB**	**L**	**U**	**R**	**L**	**Hour**	**Peak**
6:30	6:45	1	3	178	0	90	6	0	6	4	1269	
6:45	7:00	0	0	207	0	101	10	0	11	0	1391	
7:00	7:15	0	2	181	2	115	18	0	7	2	1470	
7:15	7:30	0	4	196	0	97	13	0	11	4	1553	
7:30	7:45	0	8	215	0	144	26	0	11	6	1633	
7:45	8:00	1	5	213	0	152	22	0	9	6	1639	Peak
8:00	8:15	0	11	184	2	164	22	0	21	6	1639	Peak
8:15	8:30	0	2	214	1	147	20	0	18	3	1624	
8:30	8:45	0	3	208	4	167	15	0	14	5	1572	
8:45	9:00	0	2	198	3	175	8	0	14	8		
9:00	9:15	0	0	190	2	159	16	0	15	13		
9:15	9:30	0	0	167	2	147	14	0	13	10		
16:00	16:15	0	5	161	3	264	18	0	4	13	1916	
16:15	16:30	0	7	154	0	284	17	0	12	5	1969	
16:30	16:45	0	8	150	0	299	13	0	6	9	1977	
16:45	17:00	0	4	159	1	286	11	0	12	11	1992	Peak
17:00	17:15	0	7	174	1	306	14	0	16	3	1988	
17:15	17:30	0	4	148	0	296	16	0	18	5	1902	
17:30	17:45	0	1	154	0	301	17	0	18	9	1826	
17:45	18:00	0	4	137	0	307	15	0	15	2	1713	
18:00	18:15	0	1	157	0	243	17	0	6	11	1563	
18:15	18:30	0	2	135	0	233	11	0	26	4		
18:30	18:45	0	7	127	0	213	16	0	18	6		
18:45	19:00	0	4	121	1	176	10	0	16	2		

Peak Time		rth Approach Werrington Rd			uth Approach Werrington Rd			West Approach Rance Road			Peak
Period Start	**Period End**	U	R	SB	U	NB	L	U	R	L	**total**
7:45	8:45	1	21	819	7	630	79	0	62	20	1639
16:45	17:45	0	16	635	2	1189	58	0	64	28	1992

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		North Approach Werrington			South Approach Werrington			West Approach Rance Road		
Period Start	**Period End**	U	R	SB	U	NB	L	U	R	L
6:30	6:45	0	3	171	0	85	6	0	6	4
6:45	7:00	0	0	200	0	94	9	0	11	0
7:00	7:15	0	2	174	2	107	18	0	7	2
7:15	7:30	0	4	188	0	93	13	0	11	4
7:30	7:45	0	8	204	0	136	25	0	11	6
7:45	8:00	1	5	204	0	146	22	0	9	5
8:00	8:15	0	11	180	2	157	22	0	21	6
8:15	8:30	0	2	208	1	141	20	0	18	3
8:30	8:45	0	3	204	4	160	15	0	14	5
8:45	9:00	0	2	194	3	166	7	0	14	8
9:00	9:15	0	0	187	2	152	16	0	15	13
9:15	9:30	0	0	163	2	143	14	0	13	10
16:00	16:15	0	5	156	3	259	18	0	4	13
16:15	16:30	0	7	149	0	277	17	0	12	5
16:30	16:45	0	8	145	0	295	12	0	6	9
16:45	17:00	0	4	155	1	286	11	0	12	10
17:00	17:15	0	7	174	1	302	14	0	16	3
17:15	17:30	0	4	145	0	293	16	0	18	5
17:30	17:45	0	1	154	0	299	17	0	18	9
17:45	18:00	0	4	137	0	307	15	0	15	2
18:00	18:15	0	1	157	0	241	17	0	6	11
18:15	18:30	0	2	135	0	231	11	0	26	4
18:30	18:45	0	7	126	0	213	16	0	18	6
18:45	19:00	0	4	121	1	174	10	0	16	2

Peak Time		rth Approach Werrington Rd			uth Approach Werrington Rd			West Approach Rance Road			Peak
Period Start	**Period End**	U	R	SB	U	NB	L	U	R	L	**total**
7:45	8:45	1	21	796	7	604	79	0	62	19	1589
16:45	17:45	0	16	628	2	1180	58	0	64	27	1975

Heavy Vehicles

Time		rth Approach Werrington Rd			uth Approach Werrington Rd			West Approach Rance Road		
Period Start	**Period End**	U	R	SB	U	NB	L	U	R	L
6:30	6:45	1	0	7	0	5	0	0	0	0
6:45	7:00	0	0	7	0	7	1	0	0	0
7:00	7:15	0	0	7	0	8	0	0	0	0
7:15	7:30	0	0	8	0	4	0	0	0	0
7:30	7:45	0	0	11	0	8	1	0	0	0
7:45	8:00	0	0	9	0	6	0	0	0	1
8:00	8:15	0	0	4	0	7	0	0	0	0
8:15	8:30	0	0	6	0	6	0	0	0	0
8:30	8:45	0	0	4	0	7	0	0	0	0
8:45	9:00	0	0	4	0	9	1	0	0	0
9:00	9:15	0	0	3	0	7	0	0	0	0
9:15	9:30	0	0	4	0	4	0	0	0	0
16:00	16:15	0	0	5	0	5	0	0	0	0
16:15	16:30	0	0	5	0	7	0	0	0	0
16:30	16:45	0	0	5	0	4	1	0	0	0
16:45	17:00	0	0	4	0	0	0	0	0	1
17:00	17:15	0	0	0	0	4	0	0	0	0
17:15	17:30	0	0	3	0	3	0	0	0	0
17:30	17:45	0	0	0	0	2	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	2	0	0	0	0
18:15	18:30	0	0	0	0	2	0	0	0	0
18:30	18:45	0	0	1	0	0	0	0	0	0
18:45	19:00	0	0	0	0	2	0	0	0	0

Peak Time		rth Approach Werrington Rd			uth Approach Werrington Rd			West Approach Rance Road			Peak
Period Start	**Period End**	U	R	SB	U	NB	L	U	R	L	**total**
7:45	8:45	0	0	23	0	26	0	0	0	1	50
16:45	17:45	0	0	7	0	9	0	0	0	1	17

Queue length

Time		North Approach Werrington Road		South Approach Werrington Road		West Approach Rance Road	
Period Start	**Period End**	**WL**	**EL**	**WL**	**EL**	**NL**	**SL**
6:30	6:35	0	0	0	0	0	1
6:35	6:40	0	0	0	0	0	0
6:40	6:45	0	0	0	0	1	1
6:45	6:50	0	0	0	0	0	1
6:50	6:55	0	0	0	0	0	2
6:55	7:00	0	0	0	0	0	1
7:00	7:05	0	0	0	0	1	0
7:05	7:10	0	0	0	0	0	2
7:10	7:15	0	0	0	0	1	2
7:15	7:20	2	0	0	0	0	1
7:20	7:25	0	0	0	0	1	1
7:25	7:30	0	0	0	0	0	2
7:30	7:35	1	0	0	0	1	1
7:35	7:40	1	0	0	0	0	2
7:40	7:45	0	0	0	0	2	2
7:45	7:50	2	0	0	0	1	1
7:50	7:55	0	0	0	0	0	1
7:55	8:00	1	0	0	0	0	1
8:00	8:05	0	0	0	0	1	2
8:05	8:10	1	0	0	0	1	3
8:10	8:15	1	0	0	0	0	1
8:15	8:20	0	0	0	0	0	2
8:20	8:25	1	0	0	0	0	3
8:25	8:30	0	0	0	0	0	1
8:30	8:35	1	0	0	0	1	2
8:35	8:40	0	0	0	0	1	2
8:40	8:45	0	0	0	0	1	2
8:45	8:50	0	0	0	0	1	3
8:50	8:55	2	0	0	0	0	1
8:55	9:00	0	0	0	0	1	2
9:00	9:05	0	0	0	0	1	2
9:05	9:10	0	0	0	0	1	2
9:10	9:15	0	0	0	0	0	1
9:15	9:20	0	0	0	0	1	2
9:20	9:25	0	0	0	0	1	1
9:25	9:30	0	0	0	0	1	1
16:00	16:05	1	0	0	0	4	2
16:05	16:10	1	0	0	0	1	1
16:10	16:15	0	0	0	0	2	1
16:15	16:20	1	0	0	0	1	3
16:20	16:25	0	0	0	0	1	1
16:25	16:30	0	0	0	0	2	2
16:30	16:35	1	0	0	0	1	2
16:35	16:40	0	0	0	0	3	1
16:40	16:45	2	0	0	0	1	3
16:45	16:50	0	0	0	0	2	3
16:50	16:55	1	0	0	0	1	2
16:55	17:00	0	0	0	0	1	3
17:00	17:05	1	0	0	0	0	1
17:05	17:10	1	0	0	0	0	1
17:10	17:15	1	0	0	0	1	4
17:15	17:20	1	0	0	0	1	2
17:20	17:25	0	0	0	0	1	2
17:25	17:30	0	0	0	0	1	3
17:30	17:35	1	0	0	0	1	1
17:35	17:40	0	0	0	0	1	1
17:40	17:45	0	0	0	0	2	5
17:45	17:50	1	0	0	0	0	1
17:50	17:55	2	0	0	0	0	2
17:55	18:00	0	0	0	0	1	3
18:00	18:05	0	0	0	0	1	0
18:05	18:10	1	0	0	0	1	1
18:10	18:15	0	0	0	0	1	6
18:15	18:20	0	0	0	0	1	6
18:20	18:25	0	0	0	0	1	1
18:25	18:30	1	0	0	0	1	2
18:30	18:35	1	0	0	0	1	2
18:35	18:40	1	0	0	0	1	4
18:40	18:45	0	0	0	0	0	1
18:45	18:50	1	0	0	0	0	4
18:50	18:55	1	0	0	0	1	3
18:55	19:00	0	0	0	0	0	2

	Turn	Cardno (August 2019)	MacDonald (December
		M (7:45-8:4	(16:45-17:4 M (7:45-8:4	(16:45-17:45)
North	T	819	635	860	645
	R	21	16	11	10
South	L	79	58	56	66
	T	630	1189	517	1174
West	L	20	28	25	26
	R	62	64	51	63
Total		1631	1990	1520	1984

TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of Walker St and Rance Road, Werrington

GPS *-33.76071, 150.75868*

Date:	Tue 27/08/19
Weather:	Overcast
Suburban:	Werrington
Customer:	Cardno

North:	Rance Road
East:	Walker St
South:	Rance Road
West:	Walker St

Survey	AM:	6:30 AM-9:30 AM
Period	PM:	4:00 PM-7:00 PM
Traffic	AM:	7:30 AM-8:30 AM
Peak	PM:	5:00 PM-6:00 PM

All Vehicles

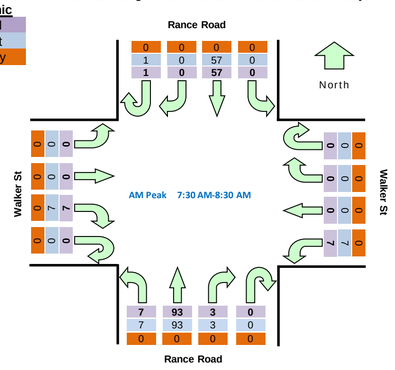
Time		North Approach Rance Road				East Approach Walker St				South Approach Rance Road				West Approach Walker St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
6:30	6:45	0	0	5	0	0	0	0	4	0	0	7	0	0	0	0	0	98	
6:45	7:00	0	0	6	0	0	0	0	1	0	0	9	2	0	2	0	0	126	
7:00	7:15	0	0	6	0	0	0	0	1	0	2	16	0	0	2	0	0	147	
7:15	7:30	0	0	12	0	0	0	0	2	0	0	14	6	0	1	0	0	171	
7:30	7:45	0	0	14	0	0	0	0	1	0	1	28	0	0	0	0	0	175	Peak
7:45	8:00	0	0	12	0	0	0	0	0	0	1	23	3	0	2	0	0	164	
8:00	8:15	0	0	18	0	0	0	0	3	0	1	25	2	0	2	0	0	152	
8:15	8:30	1	0	13	0	0	0	0	3	0	0	17	2	0	3	0	0	141	
8:30	8:45	0	0	15	0	0	0	0	3	0	1	13	1	0	0	0	0	134	
8:45	9:00	0	0	13	0	0	0	0	4	0	1	7	0	0	4	0	0		
9:00	9:15	0	0	21	0	0	0	0	1	0	1	11	3	0	3	0	0		
9:15	9:30	0	0	16	0	0	0	0	2	0	1	7	5	0	1	0	0		
16:00	16:15	0	0	11	0	0	0	0	1	0	0	16	1	0	3	0	0	137	
16:15	16:30	0	0	13	0	0	0	0	1	0	4	13	6	0	1	0	0	144	
16:30	16:45	0	0	11	0	0	0	0	2	0	1	10	8	0	1	0	0	146	
16:45	17:00	0	0	17	0	0	0	0	1	0	1	10	3	0	2	0	0	155	
17:00	17:15	0	0	12	0	0	0	0	1	0	7	7	6	0	6	0	0	156	Peak
17:15	17:30	0	0	16	0	0	0	0	1	0	1	12	5	0	4	0	1	150	
17:30	17:45	0	0	24	0	0	0	0	1	0	4	10	2	0	1	0	0	152	
17:45	18:00	0	0	13	0	0	0	0	1	0	2	11	5	0	3	0	0	152	
18:00	18:15	0	0	12	0	0	0	0	4	0	4	8	4	0	1	0	0	147	
18:15	18:30	0	0	24	0	0	0	0	2	0	1	6	6	0	3	0	0		
18:30	18:45	0	0	17	0	0	0	0	1	0	1	13	5	0	5	0	0		
18:45	19:00	0	0	14	0	0	0	0	0	0	1	6	6	0	3	0	0		

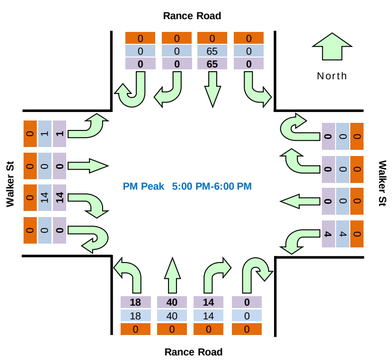
Peak Time		North Approach Rance Road				East Approach Walker St				South Approach Rance Road				West Approach Walker St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
7:30	8:30	1	0	57	0	0	0	0	7	0	3	93	7	0	7	0	0	175
17:00	18:00	0	0	65	0	0	0	0	4	0	14	40	18	0	14	0	1	156

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy





Light Vehicles

Time		North Approach Rance Road				East Approach Walker St				South Approach Rance Road				West Approach Walker St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:30	6:45	0	0	5	0	0	0	0	4	0	0	7	0	0	0	0	0
6:45	7:00	0	0	6	0	0	0	0	1	0	0	8	2	0	2	0	0
7:00	7:15	0	0	6	0	0	0	0	1	0	2	16	0	0	2	0	0
7:15	7:30	0	0	12	0	0	0	0	2	0	0	14	6	0	1	0	0
7:30	7:45	0	0	14	0	0	0	0	1	0	1	28	0	0	0	0	0
7:45	8:00	0	0	12	0	0	0	0	0	0	1	23	3	0	2	0	0
8:00	8:15	0	0	18	0	0	0	0	3	0	1	25	2	0	2	0	0
8:15	8:30	1	0	13	0	0	0	0	3	0	0	17	2	0	3	0	0
8:30	8:45	0	0	15	0	0	0	0	3	0	1	13	1	0	0	0	0
8:45	9:00	0	0	13	0	0	0	0	4	0	1	7	0	0	4	0	0
9:00	9:15	0	0	20	0	0	0	0	1	0	1	11	2	0	3	0	0
9:15	9:30	0	0	16	0	0	0	0	2	0	1	7	5	0	1	0	0
16:00	16:15	0	0	11	0	0	0	0	1	0	0	16	1	0	3	0	0
16:15	16:30	0	0	13	0	0	0	0	1	0	4	13	5	0	1	0	0
16:30	16:45	0	0	10	0	0	0	0	2	0	1	10	7	0	1	0	0
16:45	17:00	0	0	17	0	0	0	0	1	0	1	10	3	0	2	0	0
17:00	17:15	0	0	12	0	0	0	0	1	0	7	7	6	0	6	0	0
17:15	17:30	0	0	16	0	0	0	0	1	0	1	12	5	0	4	0	1
17:30	17:45	0	0	24	0	0	0	0	1	0	4	10	2	0	1	0	0
17:45	18:00	0	0	13	0	0	0	0	1	0	2	11	5	0	3	0	0
18:00	18:15	0	0	12	0	0	0	0	4	0	4	8	4	0	1	0	0
18:15	18:30	0	0	24	0	0	0	0	2	0	1	6	6	0	3	0	0
18:30	18:45	0	0	17	0	0	0	0	1	0	1	13	5	0	5	0	0
18:45	19:00	0	0	14	0	0	0	0	0	0	1	6	6	0	3	0	0

Peak Time		North Approach Rance Road				East Approach Walker St				South Approach Rance Road				West Approach Walker St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
7:30	8:30	1	0	57	0	0	0	0	7	0	3	93	7	0	7	0	0	175
17:00	18:00	0	0	65	0	0	0	0	4	0	14	40	18	0	14	0	1	156

Heavy Vehicles

Time		North Approach Rance Road				East Approach Walker St				South Approach Rance Road				West Approach Walker St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:30	6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45	7:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
7:00	7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
16:30	16:45	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Rance Road				East Approach Walker St				South Approach Rance Road				West Approach Walker St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
7:30	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Queue length

Time		North Approach	East Approach	South Approach	West Approach
Period Start	Period End				
6:30	6:35	0	0	0	0
6:35	6:40	0	0	0	0
6:40	6:45	0	0	0	0
6:45	6:50	0	0	0	0
6:50	6:55	0	0	0	0
6:55	7:00	0	0	0	0
7:00	7:05	0	0	0	1
7:05	7:10	0	0	0	0
7:10	7:15	0	0	0	0
7:15	7:20	0	0	0	0
7:20	7:25	0	0	0	0
7:25	7:30	0	0	0	0
7:30	7:35	0	0	0	0
7:35	7:40	0	1	0	0
7:40	7:45	0	0	0	0
7:45	7:50	0	0	0	0
7:50	7:55	0	0	0	1
7:55	8:00	0	0	0	0
8:00	8:05	0	0	0	0
8:05	8:10	0	0	0	1
8:10	8:15	0	0	0	1
8:15	8:20	0	0	0	1
8:20	8:25	0	0	0	1
8:25	8:30	0	0	0	0
8:30	8:35	0	0	0	0
8:35	8:40	0	0	0	0
8:40	8:45	0	0	0	0
8:45	8:50	0	0	0	1
8:50	8:55	0	0	0	1
8:55	9:00	0	1	0	0
9:00	9:05	0	0	0	1
9:05	9:10	0	0	0	0
9:10	9:15	0	0	0	0
9:15	9:20	0	0	0	0
9:20	9:25	0	0	0	0
9:25	9:30	0	0	0	0
16:00	16:05	0	0	0	0
16:05	16:10	0	1	0	0
16:10	16:15	0	0	0	0
16:15	16:20	0	0	0	1
16:20	16:25	0	0	0	0
16:25	16:30	0	0	0	0
16:30	16:35	0	0	0	0
16:35	16:40	0	0	0	1
16:40	16:45	0	0	0	0
16:45	16:50	0	0	0	0
16:50	16:55	0	0	0	0
16:55	17:00	0	0	0	1
17:00	17:05	0	0	0	1
17:05	17:10	0	0	0	1
17:10	17:15	0	0	0	0
17:15	17:20	0	0	0	1
17:20	17:25	0	0	1	1
17:25	17:30	0	0	0	1
17:30	17:35	0	0	0	0
17:35	17:40	0	0	0	1
17:40	17:45	0	0	0	0
17:45	17:50	0	0	0	0
17:50	17:55	0	0	0	0
17:55	18:00	0	0	0	1
18:00	18:05	0	0	0	0
18:05	18:10	0	0	0	1
18:10	18:15	0	0	1	0
18:15	18:20	0	0	0	1
18:20	18:25	0	0	0	0
18:25	18:30	0	0	0	0
18:30	18:35	0	0	0	1
18:35	18:40	0	0	0	0
18:40	18:45	0	0	0	0
18:45	18:50	0	1	0	1
18:50	18:55	0	0	0	0
18:55	19:00	0	0	0	1

Station (spots (west of Rance Rd)

50 100

AM

TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of Rance Road and Werrington Road, Werrington

GPS	*-33.76331, 150.75879*
Date:	Tue 27/08/19
Weather:	Overcast
Suburban:	Werrington
Customer:	Cardno

North:	Werrington Road
East:	N/A
South:	Werrington Road
West:	Rance Road

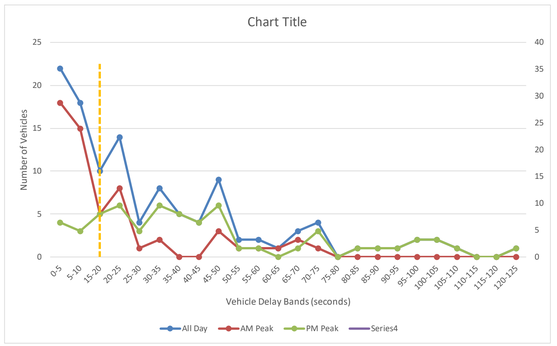
Delay for Rance Rd right turn onto Werrington Rd

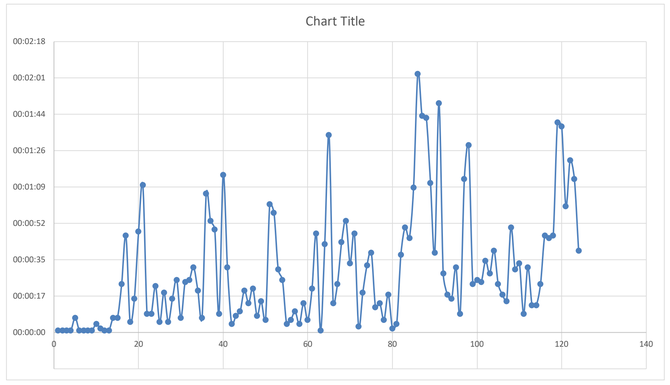
Arrival time	Departure time	Delay time	
7:30:16	7:30:17	00:00:01	1
8:00:36	8:00:37	00:00:01	1
8:02:16	8:02:17	00:00:01	1
8:03:30	8:03:31	00:00:01	1
8:09:28	08:09:35	00:00:07	7
8:10:15	8:10:16	00:00:01	1
8:11:05	8:11:06	00:00:01	1
8:13:30	8:13:31	00:00:01	1
8:14:25	8:14:26	00:00:01	1
8:16:40	8:16:44	00:00:04	4
8:19:33	8:19:35	00:00:02	2
8:22:07	8:22:08	00:00:01	1
8:23:37	8:23:38	00:00:01	1
7:30:03	7:30:10	00:00:07	7
7:33:43	7:33:50	00:00:07	7
7:35:09	7:35:32	00:00:23	23
7:35:17	7:36:03	00:00:46	46
7:37:19	7:37:24	00:00:05	5
7:37:24	7:37:40	00:00:16	16
7:40:17	7:41:05	00:00:48	48
7:40:24	7:41:34	00:01:10	70
7:43:28	7:43:37	00:00:09	9
7:44:11	7:44:20	00:00:09	9
7:45:17	7:45:39	00:00:22	22
7:46:02	7:46:07	00:00:05	5
7:46:22	7:46:41	00:00:19	19
7:50:40	7:50:45	00:00:05	5
7:52:52	7:53:08	00:00:16	16
7:53:15	7:53:40	00:00:25	25
7:56:16	7:56:23	00:00:07	7
7:57:14	7:57:38	00:00:24	24
7:58:16	7:58:41	00:00:25	25
8:01:02	8:01:33	00:00:31	31
8:01:16	8:01:36	00:00:20	20
8:01:48	8:01:55	00:00:07	7
8:05:40	8:06:46	00:01:06	66
8:05:53	8:06:46	00:00:53	53
8:05:59	8:06:48	00:00:49	49
8:07:47	8:07:56	00:00:09	9
8:08:12	8:09:27	00:01:15	75
8:08:57	8:09:28	00:00:31	31
8:10:50	8:10:54	00:00:04	4
8:11:16	8:11:24	00:00:08	8
8:12:58	8:13:08	00:00:10	10
8:14:29	8:14:49	00:00:20	20
8:16:48	8:17:02	00:00:14	14
8:16:53	8:17:14	00:00:21	21
8:17:53	8:18:01	00:00:08	8
8:17:58	8:18:13	00:00:15	15
8:18:27	8:18:33	00:00:06	6
8:20:30	8:21:31	00:01:01	61
8:20:51	8:21:48	00:00:57	57
8:22:28	8:22:58	00:00:30	30
8:22:38	8:23:03	00:00:25	25
8:23:27	8:23:31	00:00:04	4
8:23:28	8:23:34	00:00:06	6
8:24:52	8:25:02	00:00:10	10
8:25:51	8:25:55	00:00:04	4
8:27:45	8:27:59	00:00:14	14
8:28:17	8:28:23	00:00:06	6
8:29:45	8:30:06	00:00:21	21
16:44:44	16:45:31	00:00:47	47
17:31:48	17:31:49	00:00:01	1
16:44:50	16:45:32	00:00:42	42
16:44:52	16:46:26	00:01:34	94
16:46:14	16:46:28	00:00:14	14
16:47:23	16:47:46	00:00:23	23
16:47:25	16:48:08	00:00:43	43
16:48:16	16:49:09	00:00:53	53
16:50:01	16:50:34	00:00:33	33
16:57:19	16:58:06	00:00:47	47
16:58:14	16:58:17	00:00:03	3
16:59:11	16:59:30	00:00:19	19
16:59:18	16:59:50	00:00:32	32
16:59:24	17:00:02	00:00:38	38
17:01:28	17:01:40	00:00:12	12
17:02:50	17:03:04	00:00:14	14
17:03:43	17:03:49	00:00:06	6
17:05:39	17:05:57	00:00:18	18
17:09:19	17:09:21	00:00:02	2
17:09:59	17:10:03	00:00:04	4
17:10:23	17:11:00	00:00:37	37
17:10:33	17:11:23	00:00:50	50
17:10:41	17:11:26	00:00:45	45
17:10:49	17:11:58	00:01:09	69
17:11:14	17:13:17	00:02:03	123
17:11:35	17:13:18	00:01:43	103
17:11:44	17:13:26	00:01:42	102
17:13:12	17:14:23	00:01:11	71
17:13:37	17:14:15	00:00:38	38
17:13:45	17:15:34	00:01:49	109
17:17:10	17:17:38	00:00:28	28
17:18:01	17:18:19	00:00:18	18
17:20:33	17:20:49	00:00:16	16
17:21:12	17:21:43	00:00:31	31
17:21:43	17:21:52	00:00:09	9
17:23:48	17:25:01	00:01:13	73
17:24:15	17:25:44	00:01:29	89
17:25:27	17:25:50	00:00:23	23
17:25:27	17:25:52	00:00:25	25
17:26:13	17:26:37	00:00:24	24
17:26:18	17:26:52	00:00:34	34
17:26:25	17:26:53	00:00:28	28
17:27:00	17:27:39	00:00:39	39
17:27:19	17:27:42	00:00:23	23
17:27:26	17:27:44	00:00:18	18
17:28:05	17:28:20	00:00:15	15
17:29:09	17:29:59	00:00:50	50
17:29:33	17:30:03	00:00:30	30
17:31:55	17:32:28	00:00:33	33
17:34:10	17:34:19	00:00:09	9
17:34:48	17:35:19	00:00:31	31
17:40:23	17:40:36	00:00:13	13
17:40:24	17:40:37	00:00:13	13
17:41:05	17:41:28	00:00:23	23
17:41:33	17:42:19	00:00:46	46
17:41:38	17:42:23	00:00:45	45
17:41:40	17:42:26	00:00:46	46
17:41:45	17:43:25	00:01:40	100
17:41:49	17:43:27	00:01:38	98
17:42:37	17:43:37	00:01:00	60
17:42:42	17:44:04	00:01:22	82
17:43:07	17:44:20	00:01:13	73
17:43:45	17:44:24	00:00:39	39

			All Day	AM Peak	PM Peak	
0-5	0	5	22	18	4	
5-10	5	10	18	15	3	
15-20	15	20	10	5	5	18
20-25	20	25	14	8	6	
25-30	25	30	4	1	3	
30-35	30	35	8	2	6	
35-40	35	40	5	0	5	
40-45	40	45	4	0	4	
45-50	45	50	9	3	6	
50-55	50	55	2	1	1	
55-60	55	60	2	1	1	
60-65	60	65	1	1	0	
65-70	65	70	3	2	1	
70-75	70	75	4	1	3	
75-80	75	80	0	0	0	
80-85	80	85	1	0	1	
85-90	85	90	1	0	1	
90-95	90	95	1	0	1	
95-100	95	100	2	0	2	
100-105	100	105	2	0	2	
105-110	105	110	1	0	1	
110-115	110	115	0	0	0	
115-120	115	120	0	0	0	
120-125	120	125	1	0	1	

745-845	00:00:17
445-545	00:00:40

Average Delay per Vehicl	00:00:18
Average Delay per Vehicl	00:00:41
Average Delay per Vehicle	00:00:30
Maximum Delay per Vehic	00:01:15
Maximum Delay per Vehic	00:02:03
Maximum Delay per Vehicle	00:02:03





APPENDIX

B

ADDITIONAL TRAFFIC SURVEYS

TRANS TRAFFIC SURVEY
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Site Isabella St

Direction Northbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	09:00	09:00	09:00	09:00	00:00	00:00	N/A	09:00	N/A	09:00	N/A	00:00
PM Peak	17:00	15:00	15:00	15:00	15:00	12:00	12:00	N/A	15:00	N/A	15:00	N/A	12:00
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	1	0	0	0	0	1	0	1	0	0	0
05:00	0	1	2	1	0	0	0	4	1	4	1	0	0
06:00	0	2	2	0	2	0	0	6	1	6	1	0	0
07:00	0	3	1	2	1	0	0	7	1	7	1	0	0
08:00	0	4	7	3	2	0	0	16	2	16	3	0	0
09:00	0	7	8	7	7	0	0	29	4	29	6	0	0
10:00	0	0	0	3	3	0	0	6	1	6	1	0	0
11:00	0	4	4	6	6	0	0	20	3	20	4	0	0
12:00	0	5	5	3	4	0	0	17	2	17	3	0	0
13:00	0	5	3	6	6	0	0	20	3	20	4	0	0
14:00	0	2	2	4	2	0	0	10	1	10	2	0	0
15:00	0	17	22	13	18	0	0	70	10	70	14	0	0
16:00	0	13	6	9	7	0	0	35	5	35	7	0	0
17:00	5	6	14	4	1	0	0	30	4	30	6	0	0
18:00	4	3	7	7	3	0	0	24	3	24	5	0	0
19:00	3	1	4	4	1	0	0	13	2	13	3	0	0
20:00	2	1	2	2	2	0	0	9	1	9	2	0	0
21:00	2	2	3	1	2	0	0	10	1	10	2	0	0
22:00	1	1	1	0	0	0	0	3	0	3	1	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	17	77	94	75	67	0	0	330	45	330	66	0	0
% Heavy	0.00%	3.90%	1.06%	2.67%	1.49%	0.00%	0.00%	2.12%		2.12%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Isabella St

Direction Southbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	08:00	08:00	08:00	08:00	00:00	00:00	N/A	08:00	N/A	08:00	N/A	00:00
PM Peak	17:00	14:00	14:00	14:00	14:00	12:00	12:00	N/A	14:00	N/A	14:00	N/A	12:00
00:00	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	1	1	0	0	0	2	0	2	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	1	2	1	2	0	0	6	1	6	1	0	0
05:00	0	2	1	0	0	0	0	3	0	3	1	0	0
06:00	0	2	4	4	3	0	0	13	2	13	3	0	0
07:00	0	4	6	3	1	0	0	14	2	14	3	0	0
08:00	0	9	11	15	11	0	0	46	7	46	9	0	0
09:00	0	4	3	5	6	0	0	18	3	18	4	0	0
10:00	0	8	2	8	2	0	0	20	3	20	4	0	0
11:00	0	2	4	2	3	0	0	11	2	11	2	0	0
12:00	0	1	3	2	2	0	0	8	1	8	2	0	0
13:00	0	1	2	4	5	0	0	12	2	12	2	0	0
14:00	0	8	6	9	6	0	0	29	4	29	6	0	0
15:00	0	2	4	5	3	0	0	14	2	14	3	0	0
16:00	0	4	3	5	4	0	0	16	2	16	3	0	0
17:00	4	4	6	1	2	0	0	17	2	17	3	0	0
18:00	2	2	4	4	4	0	0	16	2	16	3	0	0
19:00	4	4	3	1	2	0	0	14	2	14	3	0	0
20:00	0	1	2	0	2	0	0	5	1	5	1	0	0
21:00	0	0	1	1	0	0	0	2	0	2	0	0	0
22:00	0	2	0	1	1	0	0	4	1	4	1	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	10	61	68	72	59	0	0	270	39	270	54	0	0
% Heavy	0.00%	3.28%	0.00%	1.39%	0.00%	0.00%	0.00%	1.11%		1.11%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Cygnus Cl

Direction Northbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	11:00	09:00	09:00	09:00	00:00	00:00	N/A	09:00	N/A	09:00	N/A	00:00
PM Peak	18:00	15:00	14:00	15:00	15:00	12:00	12:00	N/A	15:00	N/A	15:00	N/A	12:00
00:00	0	1	1	1	0	0	0	3	0	3	1	0	0
01:00	0	0	1	1	0	0	0	2	0	2	0	0	0
02:00	0	1	0	0	0	0	0	1	0	1	0	0	0
03:00	0	0	0	2	1	0	0	3	0	3	1	0	0
04:00	0	0	2	0	1	0	0	3	0	3	1	0	0
05:00	0	1	2	2	2	0	0	7	1	7	1	0	0
06:00	0	1	3	3	5	0	0	12	2	12	2	0	0
07:00	0	5	6	6	2	0	0	19	3	19	4	0	0
08:00	0	9	11	8	7	0	0	35	5	35	7	0	0
09:00	0	9	13	19	14	0	0	55	8	55	11	0	0
10:00	0	10	12	17	9	0	0	48	7	48	10	0	0
11:00	0	12	13	12	7	0	0	44	6	44	9	0	0
12:00	0	14	12	17	12	0	0	55	8	55	11	0	0
13:00	0	13	12	13	11	0	0	49	7	49	10	0	0
14:00	0	10	22	15	11	0	0	58	8	58	12	0	0
15:00	1	15	19	23	16	0	0	74	11	74	15	0	0
16:00	15	12	16	9	12	0	0	64	9	64	13	0	0
17:00	14	11	14	14	12	0	0	65	9	65	13	0	0
18:00	16	13	8	15	12	0	0	64	9	64	13	0	0
19:00	10	8	12	8	14	0	0	52	7	52	10	0	0
20:00	4	5	7	15	9	0	0	40	6	40	8	0	0
21:00	8	5	8	6	7	0	0	34	5	34	7	0	0
22:00	7	4	6	5	1	0	0	23	3	23	5	0	0
23:00	4	5	4	1	0	0	0	14	2	14	3	0	0
Total	79	164	204	212	165	0	0	824	116	824	167	0	0
% Heavy	0.00%	3.05%	4.90%	3.30%	2.42%	0.00%	0.00%	3.16%		3.16%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Cygnus Cl

Direction Southbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	08:00	08:00	09:00	08:00	00:00	00:00	N/A	08:00	N/A	08:00	N/A	00:00
PM Peak	17:00	17:00	15:00	15:00	17:00	12:00	12:00	N/A	17:00	N/A	17:00	N/A	12:00
00:00	0	3	0	2	0	0	0	5	1	5	1	0	0
01:00	0	1	1	2	0	0	0	4	1	4	1	0	0
02:00	0	1	1	0	0	0	0	2	0	2	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	1	0	0	1	0	1	0	0	0
05:00	0	2	3	3	4	0	0	12	2	12	2	0	0
06:00	0	5	3	4	15	0	0	27	4	27	5	0	0
07:00	0	8	17	15	6	0	0	46	7	46	9	0	0
08:00	0	16	22	16	17	0	0	71	10	71	14	0	0
09:00	0	14	9	20	4	0	0	47	7	47	9	0	0
10:00	0	15	15	11	9	0	0	50	7	50	10	0	0
11:00	0	5	11	18	8	0	0	42	6	42	8	0	0
12:00	0	11	7	14	9	0	0	41	6	41	8	0	0
13:00	0	8	16	10	8	0	0	42	6	42	8	0	0
14:00	0	12	17	18	6	0	0	53	8	53	11	0	0
15:00	1	8	20	19	9	0	0	57	8	57	11	0	0
16:00	14	9	12	9	16	0	0	60	9	60	12	0	0
17:00	18	15	18	12	19	0	0	82	12	82	16	0	0
18:00	11	8	8	18	11	0	0	56	8	56	11	0	0
19:00	3	8	6	8	15	0	0	40	6	40	8	0	0
20:00	4	3	3	2	4	0	0	16	2	16	3	0	0
21:00	3	3	3	6	3	0	0	18	3	18	4	0	0
22:00	4	4	5	2	0	0	0	15	2	15	3	0	0
23:00	3	7	6	2	0	0	0	18	3	18	4	0	0
Total	61	166	203	211	164	0	0	805	118	805	158	0	0
% Heavy	0.00%	3.01%	4.93%	3.32%	2.44%	0.00%	0.00%	3.23%		3.23%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Malcolm Ave

Direction Eastbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	09:00	09:00	09:00	08:00	00:00	00:00	N/A	09:00	N/A	09:00	N/A	00:00
PM Peak	17:00	15:00	15:00	14:00	15:00	12:00	12:00	N/A	15:00	N/A	15:00	N/A	12:00
00:00	0	0	0	2	0	0	0	2	0	2	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	1	2	1	0	0	4	1	4	1	0	0
05:00	0	2	3	2	2	0	0	9	1	9	2	0	0
06:00	0	4	2	3	2	0	0	11	2	11	2	0	0
07:00	0	5	4	4	2	0	0	15	2	15	3	0	0
08:00	0	5	8	3	6	0	0	22	3	22	4	0	0
09:00	0	9	13	7	6	0	0	35	5	35	7	0	0
10:00	0	1	8	5	5	0	0	19	3	19	4	0	0
11:00	0	3	3	2	5	0	0	13	2	13	3	0	0
12:00	0	3	4	4	6	0	0	17	2	17	3	0	0
13:00	0	3	3	4	5	0	0	15	2	15	3	0	0
14:00	0	2	3	5	5	0	0	15	2	15	3	0	0
15:00	0	13	13	4	11	0	0	41	6	41	8	0	0
16:00	0	7	3	5	5	0	0	20	3	20	4	0	0
17:00	2	2	8	1	0	0	0	13	2	13	3	0	0
18:00	2	1	9	3	3	0	0	18	3	18	4	0	0
19:00	1	4	3	1	3	0	0	12	2	12	2	0	0
20:00	1	2	1	1	1	0	0	6	1	6	1	0	0
21:00	0	1	0	2	0	0	0	3	0	3	1	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	67	89	60	68	0	0	290	42	290	58	0	0
% Heavy	0.00%	4.48%	3.37%	5.00%	5.88%	0.00%	0.00%	4.48%		4.48%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Malcolm Ave

Direction Westbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	09:00	08:00	08:00	08:00	00:00	00:00	N/A	08:00	N/A	08:00	N/A	00:00
PM Peak	18:00	14:00	14:00	14:00	13:00	12:00	12:00	N/A	14:00	N/A	14:00	N/A	12:00
00:00	0	0	0	1	0	0	0	1	0	1	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	1	1	1	0	0	0	3	0	3	1	0	0
06:00	0	2	1	1	0	0	0	4	1	4	1	0	0
07:00	0	1	3	0	2	0	0	6	1	6	1	0	0
08:00	0	3	9	5	6	0	0	23	3	23	5	0	0
09:00	0	6	5	5	6	0	0	22	3	22	4	0	0
10:00	0	1	3	1	2	0	0	7	1	7	1	0	0
11:00	0	4	3	3	5	0	0	15	2	15	3	0	0
12:00	0	1	3	4	2	0	0	10	1	10	2	0	0
13:00	0	0	2	3	8	0	0	13	2	13	3	0	0
14:00	0	6	7	10	6	0	0	29	4	29	6	0	0
15:00	0	6	5	3	6	0	0	20	3	20	4	0	0
16:00	2	5	2	8	7	0	0	24	3	24	5	0	0
17:00	2	3	6	2	1	0	0	14	2	14	3	0	0
18:00	3	4	3	1	3	0	0	14	2	14	3	0	0
19:00	2	3	3	1	2	0	0	11	2	11	2	0	0
20:00	0	3	4	3	4	0	0	14	2	14	3	0	0
21:00	0	0	2	1	1	0	0	4	1	4	1	0	0
22:00	0	3	0	3	0	0	0	6	1	6	1	0	0
23:00	1	1	1	1	0	0	0	4	1	4	1	0	0
Total	10	53	63	57	61	0	0	244	35	244	50	0	0
% Heavy	0.00%	3.77%	3.17%	3.51%	4.92%	0.00%	0.00%	3.69%		3.69%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Perigee Cl

Direction Northbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	10:00	11:00	10:00	11:00	00:00	00:00	N/A	10:00	N/A	10:00	N/A	00:00
PM Peak	16:00	16:00	15:00	14:00	15:00	12:00	12:00	N/A	16:00	N/A	16:00	N/A	12:00
00:00	0	1	0	0	0	0	0	1	0	1	0	0	0
01:00	0	2	1	4	0	0	0	7	1	7	1	0	0
02:00	0	3	0	5	4	0	0	12	2	12	2	0	0
03:00	0	4	2	2	3	0	0	11	2	11	2	0	0
04:00	0	4	3	5	2	0	0	14	2	14	3	0	0
05:00	0	4	5	4	4	0	0	17	2	17	3	0	0
06:00	0	9	7	7	4	0	0	27	4	27	5	0	0
07:00	0	2	5	7	9	0	0	23	3	23	5	0	0
08:00	0	10	15	12	13	0	0	50	7	50	10	0	0
09:00	0	17	19	18	14	0	0	68	10	68	14	0	0
10:00	0	22	17	27	17	0	0	83	12	83	17	0	0
11:00	0	22	21	20	23	0	0	86	12	86	17	0	0
12:00	0	14	9	23	26	0	0	72	10	72	14	0	0
13:00	0	20	20	29	24	0	0	93	13	93	19	0	0
14:00	0	17	15	31	11	0	0	74	11	74	15	0	0
15:00	8	30	26	27	42	0	0	133	19	133	27	0	0
16:00	25	32	26	27	38	0	0	148	21	148	30	0	0
17:00	22	21	15	20	36	0	0	114	16	114	23	0	0
18:00	20	29	24	29	36	0	0	138	20	138	28	0	0
19:00	18	26	25	20	30	0	0	119	17	119	24	0	0
20:00	24	16	9	27	18	0	0	94	13	94	19	0	0
21:00	14	14	19	22	19	0	0	88	13	88	18	0	0
22:00	8	14	10	11	2	0	0	45	6	45	9	0	0
23:00	9	3	8	13	0	0	0	33	5	33	7	0	0
Total	148	336	301	390	375	0	0	1550	221	1550	312	0	0
% Heavy	2.70%	0.89%	0.33%	1.28%	0.27%	0.00%	0.00%	0.90%		0.90%		#DIV/0!	

TRANS TRAFFIC SURVEY
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Site Perigee Cl

Direction Southbound

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	17/02/2020	18/02/2020	19/02/2020	20/02/2020	21/02/2020	22/02/2020	23/02/2020	Total	Average	Total	Average	Total	Average
AM Peak	00:00	10:00	08:00	10:00	08:00	00:00	00:00	N/A	08:00	N/A	08:00	N/A	00:00
PM Peak	18:00	18:00	14:00	14:00	18:00	12:00	12:00	N/A	18:00	N/A	18:00	N/A	12:00
00:00	0	5	0	4	1	0	0	10	1	10	2	0	0
01:00	0	3	1	3	3	0	0	10	1	10	2	0	0
02:00	0	3	0	4	2	0	0	9	1	9	2	0	0
03:00	0	6	5	6	4	0	0	21	3	21	4	0	0
04:00	0	10	8	12	14	0	0	44	6	44	9	0	0
05:00	0	11	9	6	7	0	0	33	5	33	7	0	0
06:00	0	18	15	18	14	0	0	65	9	65	13	0	0
07:00	0	11	12	24	18	0	0	65	9	65	13	0	0
08:00	0	19	28	25	29	0	0	101	14	101	20	0	0
09:00	0	16	20	17	17	0	0	70	10	70	14	0	0
10:00	0	22	18	27	25	0	0	92	13	92	18	0	0
11:00	0	18	20	16	16	0	0	70	10	70	14	0	0
12:00	0	13	8	23	15	0	0	59	8	59	12	0	0
13:00	0	16	15	17	21	0	0	69	10	69	14	0	0
14:00	0	16	22	30	12	0	0	80	11	80	16	0	0
15:00	4	21	14	21	28	0	0	88	13	88	18	0	0
16:00	17	19	11	17	24	0	0	88	13	88	18	0	0
17:00	16	18	19	19	29	0	0	101	14	101	20	0	0
18:00	18	27	20	19	42	0	0	126	18	126	25	0	0
19:00	14	27	16	21	21	0	0	99	14	99	20	0	0
20:00	14	18	15	12	23	0	0	82	12	82	16	0	0
21:00	10	11	9	21	10	0	0	61	9	61	12	0	0
22:00	8	10	6	13	1	0	0	38	5	38	8	0	0
23:00	6	6	8	9	0	0	0	29	4	29	6	0	0
Total	107	344	299	384	376	0	0	1510	213	1510	303	0	0
% Heavy	2.80%	1.16%	0.33%	1.30%	0.27%	0.00%	0.00%	0.93%		0.93%		#DIV/0!	

TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of Christie Rd and Werrington Rd, Werringto

GPS -33.750503, 150.759441

Date:	Tue 18/02/20
Weather:	Overcast
Suburban:	Werrington
Customer:	Cardno

North:	N/A
East:	Christie Rd
South:	Werrington Rd
West:	Dunheved Rd

Survey Period	AM:	6:30 AM-9:30 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	7:45 AM-8:45 AM
	PM:	4:45 PM-5:45 PM

All Vehicles

Time		East Approach Christie Rd			South Approach Werrington Rd			West Approach Dunheved Rd			Hourly Total	
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
6:30	6:45	0	75	28	0	61	52	0	102	162	2113	
6:45	7:00	0	79	46	0	78	54	0	103	167	2219	
7:00	7:15	0	74	39	0	78	35	0	114	167	2335	
7:15	7:30	0	72	43	0	81	61	0	127	215	2403	
7:30	7:45	0	73	48	0	83	61	0	110	211	2365	
7:45	8:00	0	90	56	0	104	55	0	116	222	2404	Peak
8:00	8:15	0	98	50	0	89	56	0	103	179	2343	
8:15	8:30	0	103	63	0	82	73	0	98	142	2288	
8:30	8:45	0	127	64	0	102	64	0	92	176	2155	
8:45	9:00	0	112	50	0	83	73	0	101	163		
9:00	9:15	0	96	55	0	68	75	0	91	135		
9:15	9:30	0	79	55	0	61	46	0	84	103		
16:00	16:15	0	168	118	0	65	166	0	56	144	2794	
16:15	16:30	0	196	98	0	73	154	0	54	133	2802	
16:30	16:45	0	136	115	0	60	143	0	52	133	2792	
16:45	17:00	0	172	113	0	58	157	0	68	162	2823	Peak
17:00	17:15	0	178	111	0	58	162	0	54	162	2666	
17:15	17:30	0	171	110	0	54	167	0	66	130	2505	
17:30	17:45	0	151	92	0	58	170	0	58	141	2355	
17:45	18:00	0	134	56	0	66	156	0	55	106	2146	
18:00	18:15	0	142	57	0	39	149	0	58	119	1854	
18:15	18:30	0	135	60	0	51	138	0	54	110		
18:30	18:45	0	111	51	0	48	113	0	52	86		
18:45	19:00	0	56	22	0	27	74	0	39	63		

Peak Time		East Approach Christie Rd			South Approach Werrington Rd			West Approach Dunheved Rd			Peak total
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	
7:45	8:45	0	418	233	0	377	248	0	409	719	2404
16:45	17:45	0	672	426	0	228	656	0	246	595	2823

Pedestrians Crossing

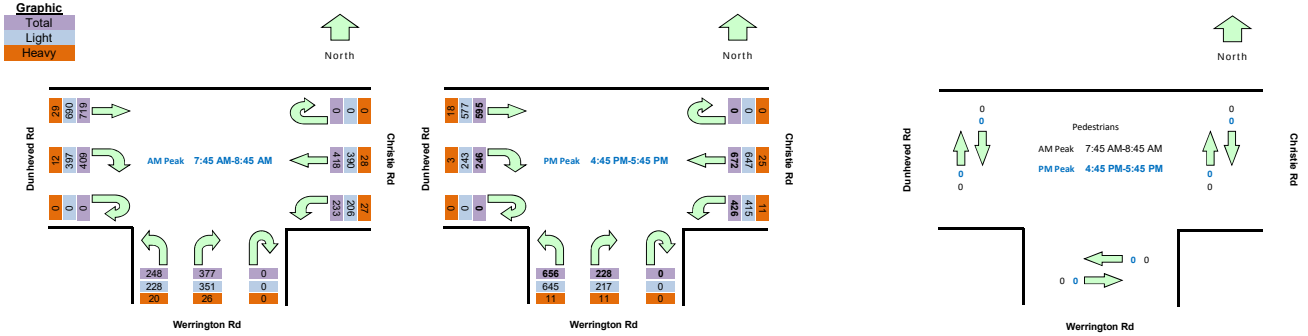
Time		East Approach Christie Rd		South Approach Werrington Rd		West Approach Dunheved Rd		Hourly Total
Period Start	Period End	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
6:30	6:45	0	0	0	0	0	0	0
6:45	7:00	0	0	0	0	0	0	0
7:00	7:15	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	
9:00	9:15	0	0	0	0	0	0	
9:15	9:30	0	0	0	0	0	0	
16:00	16:15	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	
18:30	18:45	0	0	0	0	0	0	
18:45	19:00	0	0	0	0	0	0	

Peak Time		East Approach Christie Rd		South Approach Werrington Rd		West Approach Dunheved Rd		Peak total
Period Start	Period End	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
7:45	8:45	0	0	0	0	0	0	0
16:45	17:45	0	0	0	0	0	0	0

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
6:30	6:45	0	67	19	0	55	49	0	97	149
6:45	7:00	0	71	42	0	70	50	0	98	156
7:00	7:15	0	66	34	0	76	30	0	110	152
7:15	7:30	0	68	33	0	77	58	0	124	203
7:30	7:45	0	64	43	0	72	60	0	106	202
7:45	8:00	0	84	51	0	95	51	0	113	215
8:00	8:15	0	92	41	0	83	54	0	102	168
8:15	8:30	0	95	58	0	78	68	0	90	137
8:30	8:45	0	119	56	0	95	55	0	92	170
8:45	9:00	0	107	45	0	76	72	0	98	154
9:00	9:15	0	86	47	0	57	70	0	85	123
9:15	9:30	0	74	45	0	48	41	0	82	93
16:00	16:15	0	158	114	0	60	156	0	56	137
16:15	16:30	0	190	92	0	69	146	0	53	129
16:30	16:45	0	131	112	0	57	140	0	50	125
16:45	17:00	0	167	109	0	55	155	0	67	160
17:00	17:15	0	168	109	0	55	159	0	54	156
17:15	17:30	0	166	106	0	50	163	0	66	125
17:30	17:45	0	146	91	0	57	168	0	56	136
17:45	18:00	0	126	55	0	64	155	0	53	104
18:00	18:15	0	139	56	0	38	146	0	55	113
18:15	18:30	0	131	59	0	50	135	0	53	107
18:30	18:45	0	105	51	0	47	113	0	52	84
18:45	19:00	0	55	21	0	27	72	0	38	63

Peak Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	390	206	0	351	228	0	397	690	2262
16:45	17:45	0	647	415	0	217	645	0	243	577	2744

Heavy Vehicles

Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
6:30	6:45	0	7	9	0	6	2	0	5	12
6:45	7:00	0	7	4	0	8	4	0	5	8
7:00	7:15	0	7	5	0	2	4	0	4	14
7:15	7:30	0	3	10	0	4	3	0	3	11
7:30	7:45	0	8	5	0	8	1	0	4	9
7:45	8:00	0	6	5	0	8	2	0	3	6
8:00	8:15	0	6	8	0	4	2	0	1	10
8:15	8:30	0	7	5	0	4	4	0	8	5
8:30	8:45	0	7	8	0	7	7	0	0	6
8:45	9:00	0	5	5	0	7	1	0	3	8
9:00	9:15	0	9	7	0	9	5	0	6	11
9:15	9:30	0	5	9	0	13	5	0	2	9
16:00	16:15	0	9	4	0	5	9	0	0	6
16:15	16:30	0	4	6	0	4	8	0	0	4
16:30	16:45	0	4	3	0	3	3	0	2	6
16:45	17:00	0	5	4	0	3	2	0	1	2
17:00	17:15	0	9	2	0	3	3	0	0	5
17:15	17:30	0	4	4	0	4	4	0	0	4
17:30	17:45	0	4	1	0	1	2	0	2	4
17:45	18:00	0	5	1	0	2	1	0	2	1
18:00	18:15	0	2	1	0	1	3	0	3	4
18:15	18:30	0	4	1	0	1	3	0	1	3
18:30	18:45	0	4	0	0	1	0	0	0	1
18:45	19:00	0	1	1	0	0	2	0	1	0

Peak Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	28	27	0	26	20	0	12	29	142
16:45	17:45	0	25	11	0	11	11	0	3	18	79

Bus

Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
6:30	6:45	0	1	0	0	0	1	0	0	1
6:45	7:00	0	1	0	0	0	0	0	0	3
7:00	7:15	0	1	0	0	0	1	0	0	1
7:15	7:30	0	1	0	0	0	0	0	0	1
7:30	7:45	0	1	0	0	3	0	0	0	0
7:45	8:00	0	0	0	0	1	2	0	0	1
8:00	8:15	0	0	1	0	2	0	0	0	1
8:15	8:30	0	1	0	0	0	1	0	0	0
8:30	8:45	0	1	0	0	0	2	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	1
9:00	9:15	0	1	1	0	2	0	0	0	1
9:15	9:30	0	0	1	0	0	0	0	0	1
16:00	16:15	0	1	0	0	0	1	0	0	1
16:15	16:30	0	2	0	0	0	0	0	1	0
16:30	16:45	0	1	0	0	0	0	0	0	2
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	1	0	0	0	0	0	0	1
17:15	17:30	0	1	0	0	0	0	0	0	1
17:30	17:45	0	1	0	0	0	0	0	0	1
17:45	18:00	0	3	0	0	0	0	0	0	1
18:00	18:15	0	1	0	0	0	0	0	0	2
18:15	18:30	0	0	0	0	0	0	0	0	0
18:30	18:45	0	2	0	0	0	0	0	0	1
18:45	19:00	0	0	0	0	0	0	0	0	0

Peak Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	2	1	0	3	5	0	0	2	13
16:45	17:45	0	3	0	0	0	0	0	0	3	6

Cyclists

Time		East Approach Christie Rd			South Approach Werrington			West Approach Dunheved R		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
6:30	6:45	0	0	0	0	0	0	0	0	0
6:45	7:00	0	0	0	0	0	0	0	0	0
7:00	7:15	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	1	0	0	0	0
7:30	7:45	0	0	1	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	1	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

trafficsurvey.com.au

Intersection of Great Western Hwy and Werrington Rd, Werrington

GPS -33.768192, 150.757834

Date:	Tue 18/02/20
Weather:	Overcast
Suburban:	Werrington
Customer:	Cardno

North:	Werrington Rd
East:	Great Western Hwy
South:	Werrington Rd
West:	Great Western Hwy

Survey Period	AM:	6:30 AM-9:30 AM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	4:30 PM-5:30 PM

All Vehicles

Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
6:30	6:45	0	81	3	57	0	19	126	3	0	5	5	3	0	17	166	17	2348	
6:45	7:00	0	74	4	59	0	37	150	3	0	6	0	6	0	7	184	43	2553	
7:00	7:15	0	71	6	74	0	26	128	5	0	2	6	6	0	10	217	28	2706	
7:15	7:30	0	92	4	74	0	32	153	4	0	12	7	4	0	17	258	37	2902	
7:30	7:45	0	71	3	77	0	26	194	2	0	3	4	9	0	11	267	40	3031	
7:45	8:00	0	97	6	59	0	34	172	5	0	6	12	7	0	18	252	58	3103	
8:00	8:15	0	77	2	43	0	39	254	7	0	6	9	5	0	8	255	70	3146	Peak
8:15	8:30	0	112	2	54	0	35	281	5	0	5	5	10	0	15	258	41	3039	
8:30	8:45	0	93	3	49	0	38	266	7	0	12	6	4	0	13	230	58	2864	
8:45	9:00	0	124	7	61	0	38	250	6	0	6	5	10	0	15	198	49		
9:00	9:15	0	94	5	39	0	32	240	4	0	12	2	12	0	15	171	42		
9:15	9:30	0	66	2	59	0	47	219	9	0	5	6	5	0	23	168	39		
16:00	16:15	0	118	4	35	0	52	273	3	0	2	7	8	0	19	252	54	3275	
16:15	16:30	0	78	2	38	0	70	289	3	0	8	7	3	0	18	251	55	3288	
16:30	16:45	0	91	3	42	0	66	246	7	0	6	8	8	0	18	261	55	3339	Peak
16:45	17:00	0	77	2	55	0	63	251	5	0	15	10	8	0	19	250	60	3323	
17:00	17:15	0	109	0	39	0	57	267	5	0	4	3	10	0	14	269	63	3277	
17:15	17:30	0	93	5	39	0	72	313	3	0	11	2	2	0	13	267	53	3133	
17:30	17:45	0	90	4	39	0	82	269	9	0	6	5	4	0	17	210	60	2911	
17:45	18:00	0	102	4	36	0	74	261	7	0	9	9	7	0	19	186	55	2611	
18:00	18:15	0	70	6	41	0	72	185	12	0	8	7	1	0	10	223	61	2357	
18:15	18:30	0	84	5	45	0	55	202	7	0	14	5	0	0	16	165	53		
18:30	18:45	0	61	2	33	0	41	182	4	0	5	6	4	0	11	113	33		
18:45	19:00	0	48	3	38	0	52	174	5	0	4	5	1	0	13	129	43		

Peak Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
8:00	9:00	0	406	14	207	0	150	1051	25	0	29	25	29	0	51	941	218	3146
16:30	17:30	0	370	10	175	0	258	1077	20	0	36	23	28	0	64	1047	231	3339

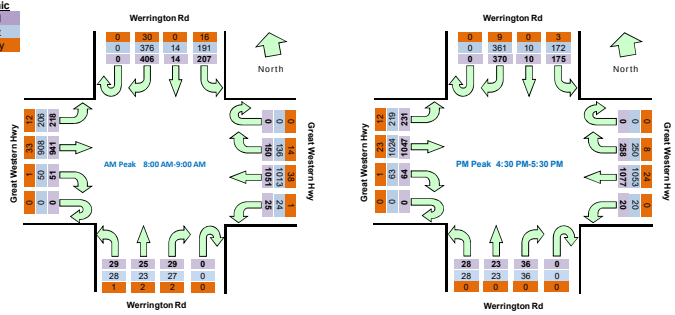
Pedestrians Crossing

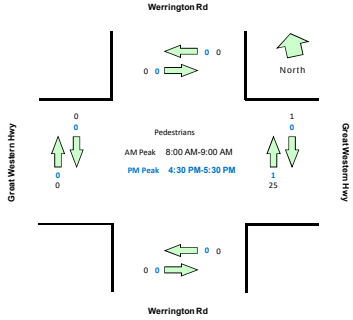
Time		North Approach Werrington Rd	East Approach Great Western Hwy			South Approach Werrington Rd	East Approach Great Western Hwy			Hourly Total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
6:30	6:45	0	0	0	1	0	0	0	0	7
6:45	7:00	0	0	0	1	2	1	0	0	7
7:00	7:15	0	0	0	1	0	1	0	0	9
7:15	7:30	0	0	0	0	0	0	0	0	16
7:30	7:45	0	0	0	1	0	0	0	0	29
7:45	8:00	1	0	1	2	1	1	0	0	30
8:00	8:15	0	0	0	9	0	0	0	0	26
8:15	8:30	0	0	1	12	0	0	0	0	18
8:30	8:45	0	0	0	2	0	0	0	0	5
8:45	9:00	0	0	0	2	0	0	0	0	
9:00	9:15	0	0	0	0	0	1	0	0	
9:15	9:30	0	0	0	0	0	0	0	0	
16:00	16:15	0	0	0	1	0	0	0	0	2
16:15	16:30	0	0	0	0	0	0	0	0	1
16:30	16:45	0	0	0	0	0	0	0	0	1
16:45	17:00	0	0	0	1	0	0	0	0	1
17:00	17:15	0	0	0	0	0	0	0	0	1
17:15	17:30	0	0	0	0	0	0	0	0	1
17:30	17:45	0	0	0	0	0	0	0	0	1
17:45	18:00	0	0	0	1	0	0	0	0	1
18:00	18:15	0	0	0	0	0	0	0	0	1
18:15	18:30	0	0	0	0	0	0	0	0	
18:30	18:45	0	0	0	0	0	0	0	0	
18:45	19:00	0	0	0	0	0	0	1	0	

Peak Time		North Approach Werrington Rd	East Approach Great Western Hwy			South Approach Werrington Rd	East Approach Great Western Hwy			Peak hour total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
8:00	9:00	0	0	1	25	0	0	0	0	26
16:30	17:30	0	0	0	1	0	0	0	0	1

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic: Total / Light / Heavy





Light Vehicles

Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:30	6:45	0	72	3	54	0	18	116	3	0	5	5	3	0	17	157	15
6:45	7:00	0	66	4	54	0	35	139	3	0	6	0	5	0	7	175	37
7:00	7:15	0	69	6	70	0	23	115	5	0	2	6	6	0	10	204	23
7:15	7:30	0	85	4	69	0	31	150	4	0	12	7	4	0	16	248	36
7:30	7:45	0	69	3	73	0	24	180	2	0	3	4	8	0	10	256	38
7:45	8:00	0	89	6	51	0	32	164	5	0	6	12	7	0	17	243	56
8:00	8:15	0	74	2	41	0	34	238	6	0	5	8	5	0	8	246	68
8:15	8:30	0	99	2	50	0	33	275	5	0	5	5	9	0	15	251	40
8:30	8:45	0	88	3	47	0	35	258	7	0	11	5	4	0	12	221	53
8:45	9:00	0	115	7	53	0	34	242	6	0	6	5	10	0	15	190	45
9:00	9:15	0	84	5	36	0	28	231	4	0	12	2	12	0	14	164	37
9:15	9:30	0	60	2	54	0	43	205	9	0	5	4	5	0	23	158	32
16:00	16:15	0	117	4	34	0	50	264	3	0	2	7	8	0	18	247	49
16:15	16:30	0	75	2	37	0	66	283	2	0	7	7	3	0	18	243	51
16:30	16:45	0	86	3	40	0	65	242	7	0	6	8	8	0	18	257	54
16:45	17:00	0	75	2	55	0	61	245	5	0	15	10	8	0	19	244	56
17:00	17:15	0	108	0	38	0	54	259	5	0	4	3	10	0	13	259	59
17:15	17:30	0	92	5	39	0	70	307	3	0	11	2	2	0	13	264	50
17:30	17:45	0	85	4	38	0	79	265	8	0	6	5	4	0	17	203	60
17:45	18:00	0	99	4	33	0	72	255	7	0	9	9	7	0	18	186	53
18:00	18:15	0	68	6	41	0	70	183	12	0	8	7	1	0	10	216	61
18:15	18:30	0	83	5	44	0	53	196	7	0	14	5	0	0	16	162	53
18:30	18:45	0	61	2	32	0	41	177	4	0	5	6	4	0	11	110	33
18:45	19:00	0	48	3	38	0	51	172	5	0	4	5	1	0	12	124	42

Peak Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	376	14	191	0	136	1013	24	0	27	23	28	0	50	908	206	2996
16:30	17:30	0	361	10	172	0	250	1053	20	0	36	23	28	0	63	1024	219	3259

Heavy Vehicles

Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:30	6:45	0	9	0	3	0	1	6	0	0	0	0	0	0	0	6	2
6:45	7:00	0	8	0	5	0	2	11	0	0	0	0	1	0	0	6	6
7:00	7:15	0	2	0	4	0	3	9	0	0	0	0	0	0	0	9	5
7:15	7:30	0	7	0	5	0	1	3	0	0	0	0	0	0	1	3	1
7:30	7:45	0	1	0	4	0	2	10	0	0	0	0	1	0	1	5	2
7:45	8:00	0	7	0	8	0	2	6	0	0	0	0	0	0	1	5	2
8:00	8:15	0	1	0	0	0	4	12	1	0	1	1	0	0	0	6	2
8:15	8:30	0	11	0	4	0	2	4	0	0	0	0	1	0	0	4	1
8:30	8:45	0	4	0	2	0	3	6	0	0	1	1	0	0	1	8	5
8:45	9:00	0	8	0	8	0	4	5	0	0	0	0	0	0	0	6	4
9:00	9:15	0	10	0	2	0	4	6	0	0	0	0	0	0	1	5	5
9:15	9:30	0	4	0	5	0	4	8	0	0	0	2	0	0	0	7	7
16:00	16:15	0	1	0	1	0	2	5	0	0	0	0	0	0	1	2	5
16:15	16:30	0	3	0	0	0	4	2	1	0	1	0	0	0	0	2	4
16:30	16:45	0	5	0	2	0	1	3	0	0	0	0	0	0	0	2	1
16:45	17:00	0	2	0	0	0	2	2	0	0	0	0	0	0	0	4	4
17:00	17:15	0	1	0	1	0	3	4	0	0	0	0	0	0	1	5	4
17:15	17:30	0	1	0	0	0	2	2	0	0	0	0	0	0	0	3	3
17:30	17:45	0	5	0	1	0	2	2	1	0	0	0	0	0	0	2	0
17:45	18:00	0	3	0	3	0	2	0	0	0	0	0	0	0	1	0	2
18:00	18:15	0	2	0	0	0	2	1	0	0	0	0	0	0	0	2	0
18:15	18:30	0	1	0	1	0	2	3	0	0	0	0	0	0	0	2	0
18:30	18:45	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0
18:45	19:00	0	0	0	0	0	1	1	0	0	0	0	0	0	1	2	1

Peak Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	30	0	16	0	14	38	1	0	2	2	0	0	1	33	12	150
16:30	17:30	0	9	0	3	0	8	24	0	0	0	0	0	0	1	23	12	80

Bus

Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:30	6:45	0	0	0	0	0	0	4	0	0	0	0	0	0	0	3	0
6:45	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
7:00	7:15	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
7:30	7:45	0	1	0	0	0	0	4	0	0	0	0	0	0	0	6	0
7:45	8:00	0	1	0	0	0	0	2	0	0	0	0	0	0	0	4	0
8:00	8:15	0	2	0	2	0	1	4	0	0	0	0	0	0	0	3	0
8:15	8:30	0	2	0	0	0	0	2	0	0	0	0	0	0	0	3	0
8:30	8:45	0	1	0	0	0	0	2	0	0	0	0	0	0	0	1	0
8:45	9:00	0	1	0	0	0	0	3	0	0	0	0	0	0	0	2	0
9:00	9:15	0	0	0	1	0	0	3	0	0	0	0	0	0	0	2	0
9:15	9:30	0	2	0	0	0	0	6	0	0	0	0	0	0	0	3	0
16:00	16:15	0	0	0	0	0	0	4	0	0	0	0	0	0	0	3	0
16:15	16:30	0	0	0	1	0	0	4	0	0	0	0	0	0	0	6	0
16:30	16:45	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0
16:45	17:00	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0
17:00	17:15	0	0	0	0	0	0	4	0	0	0	0	0	0	0	5	0
17:15	17:30	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	1	2	0	0	0	0	0	0	0	5	0
17:45	18:00	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0
18:15	18:30	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0
18:30	18:45	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0
18:45	19:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0

Peak Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	6	0	2	0	1	11	0	0	0	0	0	0	0	9	0	29
16:30	17:30	0	0	0	0	0	0	13	0	0	0	0	0	0	0	9	0	22

Cyclists

Time		North Approach Werrington Rd				East Approach Great Western Hwy				South Approach Werrington Rd				West Approach Great Western Hwy			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:30	6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00	7:15	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7:30	7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
16:15	16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX C

TRIP GENERATION ANALYSIS

Site 2 Survey

No of Dwellings (all)	140	Werrington Peak Period
No of Dwellings (Perigee Cl)	92	
No of Dwellings (Cygnus Cl)	48	

Perigee Cl	Monday	Tuesday	Wednesday	Thursday	Friday	Tue-Thur		Trip Rate (trips/dwe
	########	########	########	########	########	Total	Average	Tue-Thu
00:00	0	6	0	4	1	**10**	3.333333	0.04
01:00	0	5	2	7	3	**14**	4.666667	0.05
02:00	0	6	0	9	6	**15**	5	0.05
03:00	0	10	7	8	7	**25**	8.333333	0.09
04:00	0	14	11	17	16	**42**	14	0.15
05:00	0	15	14	10	11	**39**	13	0.14
06:00	0	27	22	25	18	**74**	24.66667	0.27
07:00	0	13	17	31	27	**61**	20.33333	0.22
08:00	0	29	43	37	42	**109**	36.33333	0.39
09:00	0	33	39	35	31	**107**	35.66667	0.39
10:00	0	44	35	54	42	**133**	44.33333	0.48
11:00	0	40	41	36	39	**117**	39	0.42
12:00	0	27	17	46	41	**90**	30	0.33
13:00	0	36	35	46	45	**117**	39	0.42
14:00	0	33	37	61	23	**131**	43.66667	0.47
15:00	12	51	40	48	70	**139**	46.33333	0.50
16:00	42	51	37	44	62	**132**	44	0.48
17:00	38	39	34	39	65	**112**	37.33333	0.41
18:00	38	56	44	48	78	**148**	49.33333	0.54
19:00	32	53	41	41	51	**135**	45	0.49
20:00	38	34	24	39	41	**97**	32.33333	0.35
21:00	24	25	28	43	29	**96**	32	0.35
22:00	16	24	16	24	3	**64**	21.33333	0.23
23:00	15	9	16	22	0	**47**	15.66667	0.17
	255	**680**	**600**	**774**	**751**			

No of Dwellings	31	Werrington Peak Period						
Isabella St/Malcolm Ave	Monday	Tuesday	Wednesday	Thursday	Friday	Tue-Thur		Trip Rate (trips/dwe
	########	########	########	########	########	Total	Average	Tue-Thu
00:00	0	0	0	3	0	**3**	1	0.03
01:00	0	0	0	0	0	**0**	0	0.00
02:00	0	0	1	1	0	**2**	0.666667	0.02
03:00	0	0	0	0	0	**0**	0	0.00
04:00	0	1	4	3	3	**8**	2.666667	0.09
05:00	0	6	7	4	2	**17**	5.666667	0.18
06:00	0	10	9	8	7	**27**	9	0.29
07:00	0	13	14	9	6	**36**	12	0.39
08:00	0	21	35	26	25	**82**	27.33333	0.88
09:00	0	26	29	24	25	**79**	26.33333	0.85
10:00	0	10	13	17	12	**40**	13.33333	0.43
11:00	0	13	14	13	19	**40**	13.33333	0.43
12:00	0	10	15	13	14	**38**	12.66667	0.41
13:00	0	9	10	17	24	**36**	12	0.39
14:00	0	18	18	28	19	**64**	21.33333	0.69
15:00	0	38	44	25	38	**107**	35.66667	1.15
16:00	2	29	14	27	23	**70**	23.33333	0.75
17:00	13	15	34	8	4	**57**	19	0.61
18:00	11	10	23	15	13	**48**	16	0.52
19:00	10	12	13	7	8	**32**	10.66667	0.34
20:00	3	7	9	6	9	**22**	7.333333	0.24
21:00	2	3	6	5	3	**14**	4.666667	0.15
22:00	1	6	1	4	1	**11**	3.666667	0.12
23:00	1	1	1	1	0	**3**	1	0.03
	43	**258**	**314**	**264**	**255**			

Cygnus Cl	Monday	Tuesday	Wednesday	Thursday	Friday	Tue-Thur		Trip Rate (trips/dwe
	########	########	########	########	########	Total	Average	Tue-Thu
00:00	0	4	1	3	0	**8**	2.666667	0.06
01:00	0	1	2	3	0	**6**	2	0.04
02:00	0	2	1	0	0	**3**	1	0.02
03:00	0	0	0	2	1	**2**	0.666667	0.01
04:00	0	0	2	0	2	**2**	0.666667	0.01
05:00	0	3	5	5	6	**13**	4.333333	0.09
06:00	0	6	6	7	20	**19**	6.333333	0.13
07:00	0	13	23	21	8	**57**	19	0.40
08:00	0	25	33	24	24	**82**	27.33333	0.57
09:00	0	23	22	39	18	**84**	28	0.58
10:00	0	25	27	28	18	**80**	26.66667	0.56
11:00	0	17	24	30	15	**71**	23.66667	0.49
12:00	0	25	19	31	21	**75**	25	0.52
13:00	0	21	28	23	19	**72**	24	0.50
14:00	0	22	39	33	17	**94**	31.33333	0.65
15:00	2	23	39	42	25	**104**	34.66667	0.72
16:00	29	21	28	18	28	**67**	22.33333	0.47
17:00	32	26	32	26	31	**84**	28	0.58
18:00	27	21	16	33	23	**70**	23.33333	0.49
19:00	13	16	18	16	29	**50**	16.66667	0.35
20:00	8	8	10	17	13	**35**	11.66667	0.24
21:00	11	8	11	12	10	**31**	10.33333	0.22
22:00	11	8	11	7	1	**26**	8.666667	0.18
23:00	7	12	10	3	0	**25**	8.333333	0.17
	140	**330**	**407**	**423**	**329**			

APPENDIX

D

DEVELOPMENT LAYOUT

DATE PLOTTED: 1 October 2019 8:00 PM BY : AARON GRAY

MAIN WESTERN RAILWAY

NORTH

1000

STAGE 1A

ROAD 16 (18.1m WIDE)

STAGE 1C

RAILWAY ST

CHAPMAN STREET

ST LANDERS

WALKER ST

EASEMENT TO DRAIN WATER 20m WIDE

EXISTING TOWN HOUSES

WEBB STREET

1066 (RESIDUE)

1055

1056 1057 1058 1059 1060 1061 1062 1063 1064

1027 1028 1029

1054 1030 1053 1031 1052 1032 1051 1033 1050 1034 1049 1035 1048 1036 1047 1037 1046 1038 1045 1039

1044 1043 1042 1041 1040

ROAD 01 (16.6m WIDE)

ROAD 02 (16.6m WIDE)

ROAD 03 (16.6m WIDE)

1001 1002 1003

1026 1004 1025 1005 1024 1006 1023 1007 1022 1008 1021 1009 1020 1010 1019 1011 1018 1012

1017 1016 1015 1014 1013

1101 1102 1103 1104

1105 (RESIDUE)

CENTRAL PARK

2269

2268 (RESIDUE)

ROAD 16 (16.6m WIDE & VARIABLE)

(12.5m) 2267 (RESIDUE) (12.5m)

EASTERN PARK

3000

STAGE 3

3001 (RESIDUE)

ROAD 13

3002 3003 3004 3005 3006 3007 3008 3009 3010

3025 3026 3024 3027 3023 3028 3022 3029 3021 3030 3020 3031

3019 3018 3017 3016 3015 3014 3013 3012 3011

ROAD 15 (16.6m WIDE)

4000 (RESIDUE)

1 DP 221780

RANCE ROAD

1

1

1

101

WESTERN SYDNEY UNIVERSITY

1200 1201 1202 1203 1204 1205 1206 1207 1208 1209 1210 1211 1212 1213

STAGE 2A

ROAD 05 (16.6m WIDE)

STAGE 2B

1214 (RESIDUE)

1231 1215 1230 1216 1229 1217 1228 1218 1227 1219 1226 1220

1225 1224 1223 1222 1221

1232 (RESIDUE)

1251 1233 1250 1234 1249 1235 1248 1236 1247 1237 1246 1238 1245 1239

1244 1243 1242 1241 1240

2000 (RESIDUE)

1253 2001 1254 2002 1255 2003 1256 2004 1257 2005 1258 2006 1259 2007 1260 2008

1261 1262 2011 2010 2009

ROAD 06 (16.6m WIDE)

2012 (RESIDUE)

2033 2013 2032 2014 2031 2015 2030 2016 2029 2017 2028 2018 2027 2019 2026 2020

2025 2024 2023 2022 2021

ROAD 07 (16.6m WIDE)

2200 (RESIDUE)

2034 2201 2035 2202 2036 2203 2037 2204 2038 2205 2039 2206 2040 2207 2041 2208 2042 2209

2043 2044 2045 2211 2210

ROAD 08 (16.6m WIDE)

2213 (RESIDUE)

2236 2214 2235 2215 2234 2216 2233 2217 2232 2218 2231 2219 2230 2220 2229 2221 2228 2222

2227 2226 2225 2224 2223

ROAD 09 (16.6m WIDE)

2237 (RESIDUE)

2266 2238 2265 2239 2264 2240 2263 2241 2262 2242 2261 2243 2260 2244 2259 2245 2258 2246 2257 2247 2256 2248 2255 2249

2254 2253 2252 2251 2250

ROAD 10 (19.6m WIDE)

ROAD 01 (16.6m WIDE)

1252 (RESIDUE)

2034 (RESIDUE)

2046 (RESIDUE)

2212 (RESIDUE)

ROAD 11 (24m WIDE)

STAGE 1B

STAGE 4B

STAGE 4A

4109 4108 4107 4106 4105 4104 4103 4102 4101

4005 4004 4003 4002 4001

ROAD 12 (19.6m WIDE)

1

COBHAM JUVENILE DETENTION CENTRE

4

WOLLEMI COLLEGE

GIPPS STREET

LEGEND

- STAGE 1A
- STAGE 1B
- STAGE 1C
- STAGE 2A
- STAGE 2B
- STAGE 3
- STAGE 4A
- STAGE 4B

XREFs: XR-80219053-CI-SURVEY; XR-80219053-001-SK080 LOT LAYOUT; XR-80219053-CI-ROAD

CAD File: N:\Projects\80\2FY19\053_Chapman St-Werrington\Drawings\Bulk\000 Masterplan\Sketches\80219053-001-SK080 SK082-SK091.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
3	1/10/2019	FINAL CLIENT REVIEW	AG	AG	
2	26/09/2019	CONSULTANCY ISSUE	AG	AG	
1	25/09/2019	CONSULTANCY ISSUE	AG	AG	

0 25 50 75 100 125m

SCALE 1:1250 @A1

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Drawn	MDH
Date	25/09/2019
Checked	
Date	
Designed	
Date	
Verified	
Date	
Approved	

Client: LENDLEASE COMMUNITIES

Project: CHAPMAN STREET WERRINGTON
CIVIL WORKS

Title: SUBDIVISION PLAN WITH STAGING

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	DATE	Scale	Size
AHD	SEP'19	1:1250	A1

Drawing Number: 80219053-001-SK080

Revision: 3

APPENDIX

E

RANCE ROAD/WERRINGTON ROAD INTERSECTION DESIGN

DATE PLOTTED: 10 September 2019 4:47 PM BY : AARON GRAY

Rev.	Date	Description	Des.	Verif.	Appd.
2	10/09/2019	AMENDED LAYOUT	JBC		
1	02/09/2019	ISSUED FOR INFORMATION	JBC		

0 5 10 15 20 25m

SCALE 1:250 @A1

NORTH

DP132721

EXISTING ISLANDS TO BE DEMOLISHED

EXISTING STORMWATER PIT TO BE RELOCATED

PROPOSED BOUNDARY ADJUSTMENT
APPROX. 125m²

DP527752

EXISTING ELECTRICAL OVERHEAD LINE TO BE RELOCATED

EXISTING LIGHT POLE TO BE RELOCATED

EXISTING WATER MAIN TO BE POTHOLED
TO CHECK AGAINST PROPOSED LEVELS

PROPOSED ROAD

RANCE ROAD

WERRINGTON ROAD

R12

EXISTING POWER POLE TO BE RELOCATED

EXISTING LIGHT POLE TO BE RELOCATED

DP734612

APPROXIMATE PROPOSED BOUNDARY ADJUSTMENT

EXISTING SIGN POST TO BE RELOCATED

DP844168

PROPOSED BOUNDARY ADJUSTMENT
APPROX. 200m²

EXISTING SIGN TO BE RELOCATED

EXISTING GUARDRAILTO BE REALIGNED
TO SUIT PROPOSED ROUNDABOUT LAYOUT

PROPOSED BOUNDARY ADJUSTMENT
APPROX. 11m²

EXISTING SIGN TO BE REMOVED

EXISTING CULVERT HEADWALL

DP263098

EXISTING BOUNDARY FROM SIX MAP CLIP AND SHIP

NOTE: PROPOSED CONCEPT LAYOUT AND
APPROXIMATE AREAS IS FOR DISCUSSION
PURPOSES ONLY AND IS SUBJECT TO FINAL DESIGN

XREFs: XR-80219053-CI-LOT LAYOUT; XR-80219053-CI-SURVEY; XR-80219053-CI-AERIAL; XR-80219053-CI-ROUNDABOUT
CAD File: N:\Projects\802\FY19\053_Chapman St-Werrington\Drawings\Build\000 Masterplan\Sketches\80219053-001-SK032.dwg

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Drawn YNL	Date 02.09.2019
Checked	Date
Designed JBC	Date 02.09.2019
Verified	Date
Approved	

Client: LENDLEASE COMMUNITIES

Project: CHAPMAN STREET WERRINGTON
CIVIL WORKS

Title: WERRINGTON ROAD ROUNDABOUT
SERVICES AND STREETSIGNS RELOCATION / REMOVED

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	DATE	Scale	Size
AHD	JUL' 19	1:250	A1

Drawing Number: 80219053-001-SK032

Revision: 2

APPENDIX

F

SIDRA FILES

https://fileshare.cardno.com/wl/?id=a33iS4R81NZ1lSwIMT2erTpdjEP41Z5w

Select the above link to download relevant modelling file.

APPENDIX G

STAKEHOLDER SUBMISSIONS

Our Reference: DA19/0704

20 December 2019

Lendlease Communities (Werrington) Pty LTD

Dear Mr Nay,

Development Application No.: DA19/0704

Proposed: Staged Subdivision of Land to Create 265 Residential Lots, 14 Industrial Lots, Open Space Lots, 17 Residue Lots and Road Dedication. Works include Site Preparation, Vegetation Removal, Bulk Earthworks, Civil Works, Construction of Roads, Including the East-West Collector Road and Round-a-bout on Werrington Road, Stormwater Infrastructure and Basins, Parking and Operation of a Temporary Exhibition Village for Sales and Information

Address: 16 Chapman Street, Werrington

An assessment of your Development Application has been undertaken. It is noted that the subdivision proposal is generally acceptable and reflects your continued engagement with Council staff leading up to the lodgement of the DA.

However, there are some matters, as discussed below, that will require attention and a possible re-design. These matters relate largely to the interface design and treatments and may be resolvable through further clarification, re-design, or excising certain components from this Development Application to be re-visited through a separate/later application.

As discussed, we would encourage a meeting to discuss the content of this letter in the new year. Please contact me with your preferred dates/times so that I can best facilitate this.

The proposal has been considered and the following matters require your attention:

Planning Matters

The Exhibition Village/Stage 1C

The inclusion of the exhibition village in this development application is not thought to be appropriate. This is due to the fact that these types of development can be complex proposals in their own right and warrant their own assessment/consent.

The suitability for this portion of the site to contain single dwelling houses/four lots is not thought to be a good design outcome in this location. This is due to the isolation/severing of these lots from the remainder of the subdivision, the presentation/interface (multiple road frontage, the park and adjoining multi dwelling housing) and the dwelling typology is not thought to be suitable given the lots proximity to the station and the park – further consideration should be afforded to multi dwelling housing or higher densities.

It is understood, you are also still engaged in discussions with Council's property team regarding the acquisition of Webb Street. It is encouraged that any final decision regarding the exhibition village/or final design of future uses is delayed until such time as the outcome of the ownership of this road is known.

Any future application for an exhibition village should contain:

- Details regarding the period of operation the exhibition village is seeking.
- Designs for the dwellings should be provided, given the proposed dual frontage and prominent interface with the central park.
- Details regarding future uses once the exhibition village use is ceased.
- The acoustic impacts of the exhibition village (including traffic and pedestrian movements) on residential receivers has not been assessed. The impacts associated with this village need to be addressed in an acoustic report.
- Signage.

It is therefore requested that the exhibition village is excised from this Development Application, to be pursued through its own application/approval pathway.

Residential lots adjacent to Western Sydney University (WSU) Site

It is acknowledged that the topography and consequently, drainage is a major factor in design outcomes for this proposal and does present challenges. The interface with lots 1055 -1213 and the WSU site is not appropriate as currently proposed (fence, drainage swale, fence, tiered retaining wall). This is because;

- Amenity related impacts, including; privacy, overshadowing, visual between the two sites (WSU and lots 1055 -1213).
- The drainage swale/batter will be located on private property presenting management issues and becomes unusable (location).
- Even though a tiered retaining wall is proposed the amenity/visual impacts of placing a 1.8 fence on top of this is not appropriate.
- For future dwellings construction on the land there is nothing preventing change to levels/additional or greater retaining walls, that may again further exacerbate an inappropriate design through CDC approvals.
- It is an unknown as to what development will occur on the WSU site (there is a current planning proposal under assessment). This presents as a risk with the current levels proposed and any future works may further exacerbate level differences, impacting on the amenity of these lots.

Additionally, it is also problematic that lots 1213 to 1209 are impacted by batter, which in turn raises questions regarding how a dwelling design/POS (with good amenity) is to be achieved on the lots.

As discussed in our meeting on the 12 December 2019 we encourage you to continue liaising with WSU in respect to potentially locating the drainage swale on their site (as it captures run off from the WSU site) and discussion regarding WSU vision for uses on land adjoining your proposed residential lots.

As per the pre-lodgement advice a perimeter road between the WSU site and any proposed residential lots is Council's preference and is also aligned with the DCP requirements. It is suggested that this option is further explored.

Residue Lots for "Smart Homes" adjoining road 11/East West Collector Rd

This land is currently zoned IN2 therefore residential development can only be considered pursuant to clause 5.3 Development near zone boundaries of PLEP 2010. The proposed lots are not supported as the lot shape and size will result in lots that are unable to accommodate dwellings consistent with the DCP. In addition:

- The interface treatment between these proposed residential lots and the public domain (road 11) is a poor design outcome. While the intention of raising these lots is understood from a privacy/separation point from future industrial land uses, it detrimentally impacts on the public domain. The reduced rear setback proposed and elevation of these lots means the rear façade of any future dwelling will be a prominent feature on the public domain and the plans/information provided, lack the level of detail to offset these detrimental visual impacts. If these were supportable (irrespective of the above regarding zoning considerations) a greater verge/landscaping would be required as well as a larger rear setback for these lots (which the DCP necessitates in any case for lots with a northern frontage).
- The proposed elevation of these lots would also mean views into the existing Cobham Justice Facility, which is a privacy concern for the facility and an undesirable outlook for any future dwelling.
- It is acknowledged that locating POS in front of the building line will provide the best solar access arrangements. However, the predominant street appearance of fence and grange is not desirable (decreased passive surveillance and poor street presentation). This would need to be re-designed to address the above.
- The proposal also provides insufficient detail regarding the pedestrian links and how these are integrated with the considerations above. No details have been provided regarding these i.e. dimensions, stairs, ramps, pathways, planting etc.

N.B. *A future integrated dwelling and subdivision application may be considered for residue lots 1214, 1232, 2000, 2012, 2200, 2213, 2237.*

Road 16 in Stage 2B (also known as road 4 on the civil works plans)

It is requested that road 16 is removed from this DA. Council are not prepared to support this road that sets up a design outcome in relation to (residue lot 2267) lots that

would not be capable of DCP compliant dwelling designs. This is also a PLEP consideration as per clause 4.1(e). Further, to this there are concerns about how the dwellings would satisfactorily present to the dual frontages and in some instances 3 frontages.

It is encouraged that a more traditional multi dwelling housing arrangement is afforded to this lot (when a subsequent DA is lodged) that is responsive and compatible with the adjoining multi dwelling development to the north.

Road 13 in Stage 3

The termination of the road 13 in a cul-de-sac is not in accordance with the DCP. The DCP objectives focus on a clear road hierarchy and a high degree of connectivity. You are therefore requested to amend the plans to show a connection of road 13 to road 15 for further review.

East West Collector Road & Interface with Cobham Justice Centre

As per our discussions it is noted that the levels proposed for the industrial lots are to facilitate drainage. However, these level changes are significant (approximately 3m) and minimal details have been provided to allow adequate assessment. You are therefore requested to provide the following for review:

- Existing ground levels along the Cobham Justice centre interface.
- Detailed section for the southern boundary shared with Cobham Justice centre, to extend from the security fence of Cobham through to road no 11. This section should show; maximum height of all retaining walls, location and height of Cobham security fence, access tracks, built form location on industrial lots and lot boundaries.
- Detail any security measures to ensure that the throwing of objects and obscuring of views into Cobham are to be prevented.
- Consideration should be afforded to nominating building envelopes on these lots to ensure adequate security and privacy for the adjoining Cobham Justice Centre.

Landscaping

A street tree master plan has been supplied with the DA package. Amendments and further information are requested as per below:

- Street trees should be natives and tall species, as per the DCP. It is noted that there are number of exotic trees proposed that will require amendment. If exotic trees are proposed their selection should be justified/clarified for review

- A service/driveway plan and a bin pad presentation area should be overlayed on the street tree plan to ensure there is no conflict.
- A detailed landscape plan should be provided for the verges along road 11 as well as the pedestrian links.

Basins within the Parks

- The basins provided in the western park appear to separate the existing vegetation on the site with the adjoining conservation land. This is at odds with the overarching principles of the DCP. Consideration should be given the form and location of these basins to maintain connectivity of vegetation.
- It would be Council's preference that the Eastern Park basin adopt a more organic form/shape. The plans should be amended to have consideration to Figure E12.18b as per the DCP.

Miscellaneous Matters

- It is noted that owner's consent for the works proposed on Wollemi College has not yet been provided to Council. Can you please provide Wollemi College owners consent?
- The DCP states that views up to the heritage listed Frogmore house on the WSU site are to be protected and should not be obscured. You are requested to provide commentary regarding this aspect and how views up to Frogmore house are to be protected.
- The DCP talks to an overall dwelling yield for the site. I note that a lot tally has been provided but not a dwelling tally. You are requested to provide an intended dwelling tally for review.
- It is requested that building envelope plans be submitted to confirm location of driveways, which then informs availability of street parking and garbage collection areas. Additionally, this should also ensure that driveways are located more than 6m from the tangent points of kerb returns.
- A typical sketch plan (to scale) is also to be provided for two adjoining 10m frontage lots showing the location of the laybacks, driveways and street trees so as to demonstrate how on street car parking can be achieved along with bin collection areas.
- It is requested that the plans are amended to detail a shared path network extended along the north-south road to provide a direct link to Werrington Railway Station. It is noted that in the pre-lodgement comments that pedestrian connections to the station/public transport was to be maximised.
- Lots 1213, 2254 &1212 appear to have no vehicular access from road 1. They conflict with the proposed pedestrian link from road 1 to road 11.

Engineering Matters

Retaining Walls

To help determine the full impact upon adjoining development, detailed cross sections, to a similar level of detail as shown on the typical road cross sections in the engineering plans, are required at the following locations:

- Road No 11 through to Road No 01 including residential lots to the north of Road No 01. Detailed section to show maximum height of retaining wall, batter slopes, compliant grades for vehicular access to residential lots, built form location on residential lots, future lot fencing and lot boundaries.
- Western boundary at interface with Western Sydney University (WSU) lands. Detailed section to show maximum height of retaining wall(s), location of future boundary lot fencing, proposed catch drain details, proposed batter treatment. Future maintenance of batter behind retaining wall to be addressed.
- Cul-de-sac at end of Road No 12 through retaining wall. Detailed section to show maximum height of retaining wall, location of road including kerb & gutter and footpath, verge area, safety barrier treatment to end of road and boundary location. Future ownership and maintenance of retaining wall to be addressed.
- Road No 5 through to open space. Detailed section to show road (including kerb & gutter), verge area, footpath, safety barriers for pedestrians and vehicles, maximum retaining wall height, finished surface levels of the open space. Future ownership and maintenance of retaining wall to be addressed.
- Road No 4 through to existing townhouse development adjoining the northern boundary. Detailed section to show built form location on residential lots, maximum retaining wall height, existing and proposed lot boundary fencing, location of existing townhouses, existing ground levels within townhouse area.

Additional Survey

Additional survey information is required at the following locations to determine the developments impact upon existing surface sheet flow of stormwater:

- Existing natural surface levels along the northern interface within the existing townhouses courtyard areas.
- The drainage systems of the rear courtyard areas of the existing townhouse developments is to be confirmed.
- Existing natural surface levels in the area south of Road No 12 (i.e. Lot 1 DP 1176624) within the vicinity of the retaining wall.
- Existing natural surface levels along the Cobham Juvenile Justice Centre interface.

Road Widths

- Road No 11 is to be designed with a 14m wide pavement in accordance with the DCP. The shared path may be reduced to 3.0m in width.
- Road No 12, south of Road No 11, is to be designed with a 13m wide pavement to accommodate industrial traffic.
- Road No 14 is to be designed with a 11m wide pavement to match with the existing alignment of Chapman Street.

Road Patterns

The following information is to be included on the Road Hierarchy Plan (engineering plan sheet No 1041)

- A possible future alignment of Road No 12, south from the cul-de-sac, is to be shown through to the Great Western Highway.
- The existing street layout of the residential area north east of the site is to be shown
- The street layout of the adjoining subdivision approved under development consent DA15/0207 is to be shown.
- The corridor alignment of the future Werrington Arterial is to be shown.
- Future possible bus route and possible bus stop locations are to be shown in accordance with the DCP. Bus stops are to be positioned so as all dwellings are located within a 400m walking distance.

Existing Easements

- Council records (DP 1186996) indicate that Cobham Juvenile Justice Centre is currently burdened by a 6m wide easement to drain water and 6m wide easement for services. The easement benefits Lot 101 (Western Sydney University lands) & Lot 102 (since subdivided) of DP 1140594. The proposed development will sever any access to the easement from Lot 101 (WSU lands). Confirmation is required from the benefiting lots that the easement is not required or if the easement is required what measures are to be put in place to ensure Lot 101 (WSU) has access to the easement.
- The development lot being Lot 1 DP 1226122 is burdened by a sewerage easement over a line of existing pits and pipes. Details of this easement are to be shown on plans.

Drainage

- Provision is to be made to capture and manage overland flows from the E2 Conservation Area north of Road No 14 (catchments A, B & C). Diversion bunds and channels currently exist at the eastern end that divert flows away from the existing town house developments in Chapman Street. The proposed development will sever these diversion bunds and cause flooding to downstream properties.
- The development has not adequately catered for the future development of the upstream catchment within the WSU lands with the diversion of external catchment F into external catchment H. The proposed development is to consider a developed upstream catchment. The pipe draining catchment 6 is to be upsized to cater for future developed flows. It is also to be demonstrated that no adverse impact will

occur to the Cobham site with the diversion of external Catchment F into external Catchment H. Additional survey information will be required within the Cobham site to determine the locations of existing sheet flows and overland flow paths.

General

- Lot numbers are to be shown on the engineering plans
- Justification of the raised platform marked pedestrian crossings within the local road network is required. Council does not support such devices within a local road network.
- The alignment of the pipeline that services Cobham is located under the footpath and may conflict with utility services. A section is required showing the pipeline and any possible utility services that may service the industrial lots.
- A Stage 2 Road Safety Audit is to be undertaken and the report submitted to Council.

Traffic Matters

The Traffic Assessment Report has only assessed traffic conditions and impact of traffic generated by the development on the intersection of Rance Road / East West Link Road / Werrington Road and should also assess traffic conditions impacts on the road network and required improvements including:

- Great Western Highway / Werrington Arterial Road (Stage 1 – Gipps Street)
- Great Western Highway / Werrington Road
- Werrington Road / The Kingsway
- Rance Road / Walker Street
- The length of Rance Road and Walker Street
- Werrington Road / Christie Street / Dunheved Road
- Any other intersections and lengths of road requested by the RMS.

The Traffic Report is requested to include assessment of the impact of traffic generated by the staged development on the residential amenity / environmental capacity of the existing precinct residential streets including Rance Road, Walker Street, Landers Road and Chapman Street.

The development traffic generation rate for the 265 residential lot at the rate of 0.4 trips / dwelling lot is not appropriate (that being a rate for medium density) and rate should be the dwelling lot rate of 0.85 trips / residential lot in AM and PM peak hour.

The development traffic generation impact assessment should include the traffic generated by the Statewide approved development DA16/1148.

The development traffic generation rate for the 33 apartments at the rate of 0.29 trips per dwelling AM and PM peak hour is not appropriate (that being the RMS rate for high density and also noting that PCC have a higher high density rate of 0.33 trips per dwelling). The rate

should be in the range for medium density dwelling at the rates of 0.4 to 0.5 trips per units up to 2 bedrooms and 0.5 to 0.65 trips for units of 3 bedrooms or more.

The SIDRA modelling has calibrated the modelling to increase level of service and reduce delays based on site survey of queuing and delays for right turn out of Rance Road of 17 seconds in AM peak hour and 40 seconds in the PM peak hour. However, observations at this site by Council over a number of years has noted regular longer delays and queuing here especially in the PM peak hours after a train arrives at Werrington Station. Consequently, the calibration should be adjusted to reflect that the existing level of service and delays at Rance Road / Werrington Road are at or over capacity and do not support additional traffic generation without improvements.

The staging traffic modelling design horizon year of 2022 is not considered suitable. The adjusted traffic generation and consideration of traffic generation impacts for any stage should be to at least a 10 year horizon being the year 2029.

Directing development construction traffic and development generated traffic through the existing precinct residential streets including Rance Road, Walker Street, Landers Road and Chapman Street is not considered suitable with regard to residential amenity. It is requested that construction traffic be directed along the proposed East West Link Road corridor with any staged temporary or permanent road link construction as required.

The previous SWUV development application assessments found that any development required the provision of at least a roundabout at the intersection of Rance Road / Werrington Road and that at an additional SWUV development stage that the East West Link Road with additional intersection treatment (roundabout or signalisation to be determined) at Werrington Road would be required.

The proposed relocation of the Rance Road / Werrington intersection to provide a combined Rance Road / Werrington / East West Link Road intersection does not provide an acceptable level of service of at least D at 2029 (AM and PM peak hours) with any development stage and using the low traffic generation rates (to be amended and increased as requested) in the Traffic Report.

The traffic generation stages, developments and rates are requested to be adjusted as set out above and intersection arrangements and staging remodelled and reassessed. This should include providing at least intersection level of service D at 2029 for any and all stages at development and consideration of a signalised intersection Rance Road / Werrington Road / East West Link Road intersection.

The Traffic Report is requested to include a table showing the proposed development stages and Statewide approved development DA16/1148, type and number of lots / dwellings / bedrooms and traffic generation, type and areas of industrial lots / uses and justification for traffic generation rate used (including consideration of AM and PM traffic generation rates for small scale industrial / mixed use with any potential child care centres, gyms, other uses). This will allow any staging of roadworks and intersection treatments to be conditioned by the traffic generated at that stage or alternatively any adjusted stage that generate that level of traffic.

Environmental Management Matters

Noise impact

The noise assessment has been reviewed ("16 Chapman Street, Werrington: Precinct Subdivision - Noise Assessment" prepared by SLR Consulting Australia Pty Ltd dated September 2019). The following points will need to be addressed/amended to progress the DA:

- Section 1.2 identifies potential noise sources that may impact on the development. In relation to road traffic noise, it is noted that the internal roads of the development are identified as local roads with low traffic volumes. However, there will be a collector road running east-west through the development (road 11 in Figure 2 of the report). Impacts associated with this road need to be addressed (with consideration of the traffic volumes put forward in the traffic report and future traffic volumes).
- In Section 4, the impact assessment is based on the assumption that the 'northern most lots which face the rail corridor in the north west portion' will be double storey, with other lots being single storey. It is intended that the double storey lots will be able to provide a level of mitigation from rail noise to lots developed further south. However, it is not clear what impacts will be experienced should lots beyond also be constructed as double storey. The application does not propose any restrictions to building heights in this area. Given that the modeling has been based on specific lots being a certain height, restrictions will be required to be placed on the land titles to ensure that double storey dwellings are constructed. In turn, a site plan or table needs to be produced that identifies which lots will be required to be two storeys. If this is not supported by you, then additional modeling will need to be carried out.
- Further to the above, Section 4.3.4 puts forward that façade upgrades will be required for 'northern' lots, subject to the 'exact location of the lot' and dwelling details. Given the lot locations have been identified in the application, and that the development type is known, the report should identify which lots will require treatment (in association with the submitted subdivision plan), and what levels of treatment, so that restrictions can be placed on land titles.
- In addition to the above points regarding rail traffic noise, no comment has been made regarding the proposed north-south rail link. Given that the new rail line will diverge from the western line to the west of the proposed development, and that rail services along the western line may increase at this location given the proposed link, the report is to address this aspect.
- Whilst it is acknowledged that the occupiers and uses of the industrial lots are not known, development of these lots may impact residential receivers to the north, as well as Wollemi College and Cobham Juvenile Centre. A number of strategies to address noise are put forward in Section 4.4, however, as the proposed subdivision layout is known (with confirmed separation distances), and the development types have also been nominated, additional assessment is to be carried out regarding the potential noise impacts associated with light industrial activities (including vehicle movements) on all sensitive receivers. It needs to be confirmed that noise goals for these receivers can be achieved, particularly as the dwellings may be constructed prior to the industrial developments. It may be appropriate to address future noise

impacts through building design and fencing treatments on the residential lots, given that acoustic barrier fencing would not be supported by Council along the northern boundary of the industrial lots. Alternatively, it may be that certain restrictions could be placed on the future development of the industrial lots (such as through 88B restrictions in relation to total noise levels produced) to ensure that the internal noise levels as outlined in AS/NZS 2107:2016 *Acoustics-Recommended design sound levels and reverberation times for building interiors* can be achieved for the residential dwellings.

- It is not clear whether the assessment has considered the future topography of the land, after the bulk earthworks have been completed. This aspect needs to be clarified.
- No assessment has been made in the report regarding vibration impacts associated with the rail corridor. This needs to be addressed.
- The *Development near Rail Corridors and Busy Roads – Interim Guideline* also puts forward that external spaces should be considered when carrying out an acoustic assessment of lots impacted by road or rail noise. The report does not discuss this aspect.
- The report does not assess noise impacts associated with the construction of the development on existing residential receivers, Wollemi College and Cobham Juvenile Centre, as well as other sensitive receivers. This needs to be addressed.

Land contamination

A number of documents have been submitted as a part of this application to address SEPP 55, including:

- "Report on Phase 1 Contamination Assessment: South Werrington Sub Precinct", prepared by Douglas Partners Pty Ltd, dated April 2007 (Project 43739A Rev1);
- "Preliminary Phase 2 Environmental Assessment University of Western Sydney South Werrington Sub-Precinct", prepared by WSP Environmental Pty Ltd, dated February 2009 (Ref. RP01 Draft);
- "Site Audit Report - UWS South Werrington Sub-Precinct" (including Site Audit Statement No. MGH 53), prepared by Michael Hayter of ENVIRON Australia Pty Ltd, dated March 2009 (Ref. AS120943); and
- “Reference: Asbestos Clearance Inspection - Walker Street Werrington NSW”, prepared by Pacific Environmental Australia Pty Ltd and dated 19 May 2016.

The Site Audit Statement confirmed that the site was suitable for the proposed use, although it included a condition that required the "asbestos cement pipe found near TP04 to be delineated and removed in accordance with best practice". The Asbestos Clearance Certificate documents an inspection that aims to address this condition. However, the Certificate does not include a site plan that shows the location, length and depth of the cement pipe. Furthermore, the relevant receipts for waste disposal have also not been included. This information is sought to ensure that appropriate records are available that clearly identify the location of the asbestos impacted and remediated area and confirm

appropriate waste management.

Council has also received other reports that document the condition of the site since the Site Audit Report was prepared, including:

- "Report on Preliminary Environmental Site Assessment: South Werrington Urban Village Precinct, Lot 102 DP1140594, 16 Chapman Street, Werrington NSW", prepared by Douglas Partners Pty Ltd, dated February 2014 (Ref: 73741);
- "Detailed Site Investigation: South Werrington Urban Village Precinct, Lot 102 DP1140594, 16 Chapman Street, Werrington NSW", prepared by Martens & Associates Pty Ltd, dated October 2015 (Ref: P1504996JR01V01); and
- "Environmental Data Gap Assessment Report for Proposed Residential Development - 16 Chapman Street, Werrington, NSW", prepared by Geotesta Pty Ltd, dated 20 October 2017 (Ref: NE211).

The 2014 Douglas Partners "Preliminary Environmental Site Assessment" made a number of recommendations to address a small shed, toilet, and areas of fly tipping and filling. The 2015 Martens "Detailed Site Investigation" reviewed the findings of the previous investigations and made comment that one of the areas of concern had still not been investigated as structures had not yet been demolished - beneath an existing site shed and composting toilet. The report also recommended that an unexpected finds protocol be produced. It concluded that once these two recommendations have been undertaken then "the site shall be deemed fit for the proposed residential development". Whilst the unexpected finds protocol can be addressed through conditions of consent, a further 'data gap' investigation has since been carried out to address potential impacts associated with the shed and toilet.

The 2017 Geotesta "Data Gap Assessment" involved a sampling program undertaken to address the shed and composting toilet. Nine samples were taken from varying depths - 2 within the shed, 2 from the toilet, and 5 from around the structures. The samples were analysed for a range of parameters, and compared against the appropriate criteria. Borehole 6 and 7 were found to exceed the criteria for a range of contaminants, including chromium and lead, whilst also having levels above the laborarory detection limit for TRH. The report concluded "that the site can be made suitable for the proposed residential development", subject to additional assessment targeting the footprint of the structures following demolition works.

The shed structures could not be clearly identified on the site survey plan submitted with the application, so they may have been demolished since the time of this assessment. In turn, the above recommended additional assessment is to be carried out by a suitably qualified environmental consultant to confirm that this area is suitable for the proposed development. It is important to note that all remediation works in the Penrith local government area require development consent, in line with the requirements of SREP 20 and SEPP 55. Should these investigations identify that remediation works are required, then consent for these works is to be sought as a part of this application (with the advertised development requirements needing to be met).

Environmental Waterways Matters

The civil engineering report indicates that water conservation measures will be achieved with 2kL rainwater tanks installed on each residential property. It is unclear how the water conservation measures will be achieved in the commercial areas.

In terms of stormwater treatment, 3 Rocla CDS GPTs are proposed and a total of 4 bioretention systems with a combined filter area of 3,350m^2 (2,000m^2, 800m^2, 100m^2 and 450m^2). It is noted that the basins have been sized to accommodate the adjacent Rance Road development.

The stormwater report indicates that the industrial lots and apartment site are proposed to be treated. This is also reflected in the MUSIC model screen shot. However, additional details on what is proposed are requested:

- An electronic version of the MUSIC model should be submitted for review
- Additional detail on the proposed stormwater treatment and water conservation commitments for the industrial lots and apartment building should be provided.
- Revised concept drainage plans prepared in accordance with Council's WSUD Technical Guidelines and include additional detail on the proposed vegetation used both in the bioretention systems as well as surrounding areas (vegetation type and densities).
- There is a need to reconsider the configuration of access paths to the basins to ensure that adequate access to the basin's inlets and filter areas. Adequate access should be provided to all areas of the basins to enable both short and long-term maintenance
- In regard to the design of the bioretention systems, council has a preference that only low flows are directed to the filter area, and the higher flows bypass the filter. This seems to have been considered with Basin A but Basin B does not seem to have been considered. In this regard, it is requested that additional consideration be afforded to Basin B.
- Discussion of the Stream erosion index (SEI value) should be included in the report
- Draft operation and maintenance manuals for the proposed stormwater treatment measures. Council's WSUD Technical Guidelines provide guidance on what should be included in the manuals.
- It is suggested that additional consideration around the basin design options be explored. For example, to ensure that maximum integration into the surrounding landscape is achieved, we have a preference that they are not set down with step retaining walls.

Biodiversity Matters

It is noted that correspondence has been received from the Commonwealth Government in relation to a referral that you have sent in consideration to biodiversity of national significance. The Department of Environment and Energy have advised that they have deemed that the proposed is a controlled action requiring assessment and approval under the EPBC Act.

While the DA process can proceed without having to wait on the above outcome, it is recommended that you delay significant amendments to this DA until such time as the referral process is completed by the Department of Environment and Energy. This is because the outcome of the referral/assessment may impact on the development (as approved). Any changes as requested by The Department of Environment and Energy could have flow on effects to not only biodiversity assessment but also on design, engineering, etc.

N.B *An assessment under the state legislation is still occurring and further information in respect to biodiversity matters may still yet be requested.*

Waste Matters

For subdivisions to permit unobstructed waste collection, the following provisions are to be provided in accordance with section 4 of the *'Residential Subdivisions Waste Management Guideline'* document:

Section *4.1.2 Waste Collection Vehicle Turning Provisions* of the '*Residential subdivisions waste management guideline'* document outlines:

Staged developments are to provide temporary turning facilities where the full length of the road will not be completed as a part of the initial staged proposal. The size of the temporary turning facilities to be large enough to accommodate Council's 12.5m heavy rigid waste collection vehicle (section 5.1), with a minimum diameter of 20m. All temporary turning facilities to be removed when the final stage of the development is completed

The plans are therefore required to be amended to detail:
- Proposed cul-de-sacs are to accommodate Councils 12.5m heavy rigid collection vehicle (section 5.1)
- A minimum diameter of 20m is required

N.B. Council is still yet to receive referral responses from RMS & RFS. These comments will be forwarded (if required) to you upon receipt.

You are requested to submit the additional information to Council by 3 February 2020.

Should you have any further queries on this matter, please contact me on 02 4732 7834.

Yours sincerely

Kathryn Sprang

Development Assessment Planner

From: Graham Green <Graham.Green@penrith.city>
Sent: Friday, 7 February 2020 11:45 AM
To: Hayden Calvey <hayden.calvey@cardno.com.au>
Cc: Stephen Masters <stephen.masters@penrith.city>; David Drozd <David.Drozd@penrith.city>; Kate Smith <kate.smith@penrith.city>; Natalie Stanowski <natalie.stanowski@penrith.city>; Kathryn Sprang <Kathryn.Sprang@penrith.city>
Subject: Lend Lease SWUV - Werrington Subdivision Traffic Impact Report and Staged DAs and Works - Council Traffic Comments 7 February 2020

Good morning Hayden,

I called yesterday and left a message to allow our discussion on the adjustments for the Lend Lease SWUV Traffic Impact Assessment – Werrington Subdivision dated 2 October 2019 (copy attached).

To progress this discussion, I am sending this email with dot point Council Traffic comments for discussion regarding Lend Lease Traffic Impact Assessment – Werrington Subdivision dated 2 Oct 2020 and proposed DA staging and works:

- The Lend Lease Traffic Report by Cardo dated Oct 2019 (LLTR) noted that the Statewide DA Traffic Report by Mott MacDonald undertook traffic surveys at Rance Road and assessed that traffic generated from m the dwellings in the Rance Road precinct were 0.44 trips/dwelling AM and 0.54 trips /dwelling PM. The Mott MacDonald Report then used 0.4 trips /dwelling for its proposed DA dwelling lots.
- The Statewide DA and trip generation was not agreed by Council and subject to LEC S94 negotiations. A Lyle Marshall Traffic Consultant peer review of the Mott MacDonald Traffic Report used the dwelling lot rates of 0.44 trips/dwelling AM and 0.54 trips/dwelling PM and included that a roundabout at Rance Rd / Werrington Road should be provided as part of DA works. The matter of trip generation was not fully resolved at LEC S94 but it was negotiated between applicant/Council/LEC that a roundabout at Rance Rd / Werrington Road be a DA condition.
- The subsequent staged DAs in the SWUV precinct from Bathla/Universal Properties included Traffic Reports by Traffix which used the RMS rates of 0.95 trips/dwelling AM and 0.99 trips/dwelling PM for residential lots, 0.5 trips/dwelling AM and PM for medium density dwellings, 0.19 trips /dwelling AM and 0.15 trips / dwelling PM for the High Density RFB stage, 0.52 trips / 100 sq. m GFA AM and 0.56 trips/100 sq. m GFA PM for Industrial units as well as RMS rates for Neighbourhood Centre.
- The Bathla/Universal Property staged DAs and traffic reports were not fully agreed by Council and subject to LEC S94 negotiations. Council put forward that the High Density RFB rate should be as set out in the attached extract from a PCC Council Report namely 0.33 trips/HDRFB dwelling up to 2026, 0.30 trips/HDRFB dwelling at 2031 and 0.26 trips/HDRFB dwelling at 2036 . The matters in the Traffic Report were not fully accepted by Council but it was accepted by the applicant/Council/LEC that a roundabout at Rance Rd/Werrington Rd be a DA condition for each of the stages.
- The current LLTR has referred to the Mott MacDonald Report and traffic survey and a more contemporary traffic survey by Cardo -LLTR that shows similar traffic numbers and then has used a rate of 0.4 trips / dwelling lot for the proposed subdivision lots. The LLTR has also used the RMS rate of 0.15 trips/ dwelling for HDRFB.
- The Mott MacDonald traffic survey / Cardno LLTR survey trip generation for the existing Rance Road precinct is for the predominantly medium density townhouses with some residential lots and is requested be adjusted regarding the proposed DA stages for the lower density residential lots. This should be set out in an adjusted LLTR and may be considered at a justified rate between the surveyed / assessed trip generation and the RMS rates. There should be a break up of higher residential lot rates and rates for median density dwellings / units. The use of RMS rates for industrial lots may be acceptable subject to a break up of potential / likely other uses including Gym and Child Care Facilities trip generation rates.
- The traffic generation rate that PCC have adopted as set out in the attached extract of the Council Report is requested be used for HDRFB DA stages noting that HDRFB are generally over 6 story RFB developments. This is derived from assessments of similar HDRFB within proximity of stations including in the Penrith LGA.
- The LLTR is requested to include this impacts of traffic generated by the determined Statewide DA.
- The LLTR is requested to be broken into assessment of the impact for LL proposed first stage works which are currently Stages 1a, 1b and 1c combined (I note that the LLTR mentioned a 1d stage however this is not set out in the LL plans – advice on this is requested).

- This first stage traffic impact assessment is requested to SIDRA traffic model the intersections of Rance Rd / Werrington Road with and without roundabout at 2022 (proposed stage 1 completion) and at 2030 (10 year horizon). The roundabout may be considered as a three leg first stage roundabout with additional East West Link at Stage 2a provided it can be demonstrated as being at an acceptable levels of service for each movement and in particular right turn out of Rance Road.
- Please note that all previous DAs for SWUV precinct required provision of a roundabout at Rance Road / Werrington Road and your LLTR with the lower traffic numbers identifies the need for a roundabout at the first stage. Consequently, any proposal to not provide a roundabout here at first stage or any part of first stage would require strong justification for consideration. Please also note that we need the intersection with first stage to function satisfactorily at the 2030 year horizon because this is normal development timeline practice and will allow for the potential of this being the only stage developed by this time.
- The first stage assessment is requested to also assess/ SIDRA traffic model traffic impacts at Werrington / The Kingsway, Werrington Road / Great Western Highway and Werrington Road / Christie Street at 2030. If it is found that the “without development” traffic impacts have a low level of service for any traffic movements and that the with development impacts do not significantly further reduce the level of service for any traffic movements and that any improvement would not significantly improve this or be feasible and so could be accepted awaiting Werrington Arterial Stage 2 by Tens (RMS) . Then this is requested be set out in the LLTR for consideration by Council and TfNSW (RMS). The turning movements at the intersection of Werrington Road / Great Western Highway are requested to be particularly addressed.
- The impact of traffic generated by the fully developed combined Stages 1a to Stage 4b plus traffic generated by Statewide DA are requested to be assess for the year 2030 and include the provision of the East West Connector Road to join the Rance Rad / Werrington Road roundabout with internal road links via Road 10 to Walker St and to Road 5 etc.
- The combined stages plus Statewide DA assessment is requested to also assess traffic impacts/ SIDRA traffic model at Werrington / The Kingsway, Werrington Road / Great Western Highway and Werrington Road / Christie Street at 2030. If it is found that the without development traffic impacts have a low level of service and that the with development impacts do not significantly further reduce the level of service and that any improvement would not significantly improve this or be feasible and so could be accepted awaiting Werrington Arterial Stage 2 by TfNSW(RMS) . Then this is requested be set out in the LLTR for consideration by Council and TfNSW(RMS).
- The proposed alignment of the proposed roundabout by extending the East West Connector Road directly east to join Werrington Road / Rance Road rather than alignment of the East West Connector Road to connect with realigned Werrington Road/Werrington Arterial Stage 2 as set out in the SWUV DCP plans and the TfNSW (RMS) concept plans for Werrington Aerial Stage 2 is requested to be justified to allow consideration by Council and the RMS. Please note that RMS Land Use Section referral response to Council set out that their position was that the East West Connector Road should be located as set out in the SWUV DCP and in RMS concept plans including realignments of the intersection to the south of Rance Road and realignment of Werrington Road to meet it.
- Attached for your information is a TfNSW/RMS referral response letter with intersection assessment requests as well as land acquisition plan and a Werrington Arterial Stage 2 concept plan.
- The points raised at out Council / Lend lease meeting regarding this are appreciated, including that since the Werrington Arterial Stage 2 is not proposed to be provided by TfNSW (RMS) within any timeline and there are no designs for these works that it is more feasible/ practical for the LL SWUV DA development to connect to the existing Werrington Road and that further realignment of the East West Connector Road and connection to a future Werrington Arterial Stage 2 alignment to the south (at a proposed signalised treatment) could then be addressed by TfNSW (RMS) at that time. The proposed LL SWUV roundabout would allow for TfNSW (RMS) construction clear of traffic and then the Rance Road / Werrington Road roundabout could be replaced with a left in / left out at Rance Road. It is requested that this position / strategy be set out in the LLTR and include a concept plan showing this possible future arrangement. **This will allow further liaison with the RMS Land use Section on this matter and the intersection assessment matters.**

Could you please consider these matters and further contact me to discuss.

Kind regards,

Graham

Graham Green
Senior Traffic Engineer

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CITY COUNCIL

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24 January 2020

Our Reference: SYD19/01456/01
Council Ref: DA19/0704

Kathryn Sprang
Penrith City Council
PO Box 60
PENRITH NSW 2751

Dear Ms Sprang

PROPOSED STAGED SUBDIVISION OF LAND TO CREATE 265 RESIDENTIAL LOTS, 14 INDUSTRIAL LOTS, OPEN SPACE LOTS, AND ROAD DEDICATION.17 RESIDUE LOTS – 16 CHAPMAN STREET AND 2 WATER STREET, WERRINGTON

Reference is made to Council's correspondence dated 5 November 2019 with regard to the abovementioned Development Application, which was referred to Transport for NSW (TfNSW) in accordance with *Schedule 3 of State Environmental Planning Policy (Infrastructure) 2007*.

TfNSW has reviewed the submitted application and notes that the proposed development seeks to create 265 Residential Lots together with 14 light industrial lots. The light industrial lots have a combined Land Area of 31,000 m^2. The development also creates several super lots which create the potential for a further 91 Residential Lots and 33 apartments, however construction of these lots/apartments are not proposed as part of this Development Assessment. The subdivision is proposed to be completed in stages 1 – 4 between the years of 2022 – 2029.

TfNSW does not support the proposed application in its current form. In this regard, TfNSW provides the following comments to Council's consideration:

1. It is understood that the vehicular access is proposed through the existing connection via Walker/Chapman streets and a new link road (Road 11) passing through the subject site to connect with Werrington Road.

   The alignment of Road 11 and its design is not in accordance with the south Western Urban Village (SWUV) structure plan in Council's DCP. The SWUV structure plan shows a road connection further to the south that has connectivity outside of the village.

   It is noted that the eastern extent of the alignment is proposed to be straightened to create a fourth leg of a proposed new roundabout on Werrington Road. TFNSW would only support one intersection in the ultimate arrangement as per the DCP.

Transport for NSW
27 Argyle Street, Parramatta NSW 2150 | Locked Bag 5085, Parramatta NSW 2124
P (02) 8849 2666 | W transport.nsw.gov.au | ABN 18 804 239 602

2. The intersection of Great Western Highway/Werrington Road was not assessed as part of Cardno's Traffic Impact Assessment (TIA).

   The right turn from Werrington Road onto Great Western Highway already encounters considerable traffic during AM and PM peak hours. Whilst TfNSW Network Operations have previously modified the timing of the signals to accommodate the increased demand from Werrington Road, there is still a need to balance this with the Great Western Highway demands. With the additional traffic predicted as a result of the development, Werrington Road will not be able to cater for the increased demand, and there will likely be queueing through the proposed new roundabout.

   A traffic study should be provided to consider the impacts of the proposal on the surrounding road network and key intersections. The assessment should consider the impacts of other known planning proposals and major development applications in the area. In this regard, the ultimate development year plus 10 years growth should be considered in the network analysis. The assessment should include SIDRA modelling of at the least the following intersections (but not limited to):
   i. Great Western Highway/Werrington Road
   ii. Werrington Road/Kingsway
   iii. Werrington Road/Rance Road

3. Traffic Modelling and analysis for the application should consider the cumulative traffic impact of the development on surrounding roads and intersections in the context of any other known planning proposals and developments in the precinct and surrounds, and the need for upgrades or improvement works including consideration to timing and funding (if required).

4. All SIDRA files are to be provided to TfNSW for review.

5. TfNSW will review any proposed upgrades as a result of this staged development once all matters raised have been addressed.

TfNSW has following advisory comments for Council's consideration:

6. TfNSW has previously acquired land for road (Lot 12 DP734612) along the frontage of the subject property, as shown by blue colour on **Attachment A Aerial - "X".**

   TfNSW has no other approved proposal that requires any part of the subject property for road purposes.

   However, the subject property is located within a possible future area of investigation north of the Great Western Highway for an extension of the existing Werrington Arterial Stage 1 (Gipps Street).

   Werrington Arterial Stage 2 proposal provides a potential link between the current Werrington Arterial Stage 1 & the defined Castlereagh Freeway corridor to the north.

   The Werrington Arterial Stage 2 proposal has not yet advanced to the stage where the corridor has been defined and accordingly it is not possible at this date to identify if any part of the subject property would be required to accommodate this proposal. However this proposal may be subject to future investigations which, at that time, would include appropriate community consultation.

In addition any future year modelling for this development, shall not include this corridor at this stage.

7. TfNSW released *Future Transport 2056* in March 2018, which along with the Department of Planning Industry and Environment's (DPIE) Greater Sydney Region Plan provide an integrated vision for transport and land use development in the state. The strategy identifies the Outer Sydney Orbital (OSO) corridor, a major transport infrastructure project proposed between Richmond Road and Menangle.

   Currently, the design of the Outer Sydney Orbital at this location is in the early stages of investigation. A number of options are under consideration. TfNSW requests Penrith Council, as consent authority, condition the applicant, Lendlease Communities, to continue to consult with TfNSW to minimise any impacts the proposed development may have on the delivery of future transport infrastructure.

The application is to be modified with the abovementioned requirements/comments and submitted to TfNSW for review prior to the determination of the application. Upon receipt of the information TfNSW will undertake an assessment and provide a response accordingly.

If you have any further questions, Laura van Putten, Land Use Planner at TfNSW, would be pleased to take your call on (02) 8849 2480 or please email development.sydney@rms.nsw.gov.au.

Yours sincerely

Pahee Rathan
A/Senior Manager Land Use Assessment

Attachment A – Aerial - "X"