



North Ryde Station Precinct - M2 Site
State Significant Development Application
Traffic & Transport Impact Assessment
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prepared for

Urban Growth

prepared by

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Executive Summary

Urban Growth NSW (**UGNSW**) proposes a Development Application for State Significant Development (**SSDA**) in regard to the *High Density Residential Precinct* and *Mixed Use Precinct* – collectively referred to as the **M2 Site** - located within the North Ryde Station Urban Activation Precinct (**NRSUAP**). The M2 Site comprises Lot 101 in Deposited Plan 1131776. The NRSUAP was rezoned on the 23rd September 2013 for Transit Orientated Development (**TOD**) by State Environment Planning Policy Amendment (North Ryde Station Precinct 2013).

ARC Traffic + Transport (**ARC**) has been commissioned by UGNSW to prepare a Traffic & Transport Impact Assessment (**TTIA**) - incorporating a Public Transport Facilities Plan (**PTFP**) and Parking Management Strategy (**PMS**) - to assess the traffic and transportation characteristics of the SSDA, which specifically provides for works that will facilitate the future development of the M2 Site. Further to that assessment, ARC provides the following summary.

i. SSDA Amendments

The SSDA is based upon an amended M2 Site land use mix from that examined in the **NRSUAP Rezoning** process, including: -

- An increase in high density residential units from 2,116 units to 2,373 units
- A reduction in commercial floor space from 24,400m² GFA to 10,000m² GFA
- A reduction in retail floor space from 5,000m² GFA to 2,500m² GFA
- A reduction in community centre floor space from 2,500m² GFA to 1,500m² GFA

The SSDA provides for amendments to the M2 Site road network, retaining the central Spine Road and key roads through the *Mixed-Use Precinct*; and connecting each future super-lot to the Spine Road. The previously identified M2 Edge Road is no longer proposed.

Road profile amendments specifically respond to the **Linear Park** adjacent to the Spine Road, which will accommodate significant pedestrian and cycle infrastructure. Notwithstanding, the SSDA road network meets the objectives of the North Ryde Station Precinct Development Control Plan (**NRSP DCP**) in regard to vehicular, servicing, pedestrian and cycle accessibility and efficiency of movement.

ii. Site Access

Vehicular access to the M2 Site is provided in accordance with the NRSP DCP. Primary access is via a new approach to the existing intersection of Wicks Road & Waterloo Road, which will be signalised. A minor left turn ingress only intersection will also be provided from Epping Road to the Spine Road. These M2 Site **interface intersections** provide the same level of vehicular accessibility as determined in the North Ryde Station Precinct Project Transport Management and Accessibility Plan (the **TMAP**).

Further to significant drainage works at the intersection of Wicks Road & Waterloo Road & Spine Road, emergency access can be provided from this intersection and as such there will no emergency or other access to the M2 Site from the M2 Delhi Road on-ramp.

iii. Traffic Impact Assessment

• M2 Site Trip (all modes) Generation

The amended land use mix upon which the SSDA is based results in a significant reduction in the M2 Site total (all mode) trip generation compared to the TMAP forecast. The amended land use mix provides the following trip outcomes: -

- Daily trips are reduced from approximately 25,900 trips forecast in the TMAP to approximately 21,200 trips
- AM peak hour trips are reduced from approximately 2,600 forecast in the TMAP to approximately 2,050 trips
- PM peak hour trips are reduced from approximately 3,200 forecast in the TMAP to approximately 1,950 trips

• M2 Site Vehicle Trip Generation

The amended land use mix results in a significant reduction in the M2 Site vehicle trip generation compared to the TMAP forecast. The amended land use mix provides the following vehicle trip generation outcomes: -

- Daily trips are reduced from approximately 8,400 trips forecast in the TMAP to approximately 6,800 trips.
- AM peak hour trips are reduced from approximately 760 trips forecast in the TMAP to approximately 620 trips.
- PM peak hour trips are reduced from approximately 860 trips forecast in the TMAP to approximately 540 trips.

• Road Network Performance

On behalf of UGNSW, Parsons Brinkerhoff assessed the amended land use mix using the same traffic model developed for the TMAP. The 2014 TMAP Traffic Modelling Review (TMAP Review) concludes: -

While the intersections modelled are still forecast to be under substantial pressure, the results indicate that the impact of the development on the road network will be substantially reduced.

More broadly, the TMAP Review details improved intersection performance [when compared to the TMAP forecasts] at all key intersections.

While it is acknowledged that the local traffic environment will in the future remain under pressure, given these improved road network performance outcomes when compared to the TMAP it must be concluded that the SSDA is supportable in regard to traffic impacts.

- **Intersection Upgrades & Funding**

In accordance with the NRSP DCP and the TMAP, the SSDA provides for the construction of both M2 Site interface intersections. Funding and scheduling for external intersection upgrades will be determined in an identical manner to that recommended in the TMAP.

iv. Pedestrian and cycle access

Pedestrian and cycle infrastructure for the M2 Site is proposed in accordance with the NRSP DCP, and specifically to fulfil the requirements of the PTFP.

Primary pedestrian and cycle infrastructure through the M2 Site will be provided by the Spine Road; the Linear Park; Park Street; the Central Park; Plaza Street; and the Plaza, which connects to a pedestrian, cycle and disabled accessible bridge over Delhi Road and the M2 (the **Shared Bridge**) and then to the North Ryde **Station Sites**.

The SSDA provides external infrastructure required with regard to the Macquarie University to Riverside Corporate Park Active Transport Spine (**MATS**). Along with the M2 Site internal infrastructure and the Shared Bridge, the SSDA also provides for the installation of signalised pedestrian crossings at the intersection of Wicks Road & Waterloo Road & Spine Road.

With reference to the North Ryde Station Precinct Finalisation Report, future M2 Site developer contributions will facilitate the upgrade of the Waterloo Road (north) existing path to a shared path between Eden Park Drive and Wicks Road.

With reference to the 2014 North Ryde Station Site North Infrastructure Works Development Application - Transport impact assessment (SSN TIA), it is proposed that a shared path along Delhi Road, and a shared path across Road 38, will be constructed as part of the Station Site North *enabling infrastructure works* and thereby provide shared access paths between the Shared Bridge and the Riverside Corporate Park.

The provision of this extensive pedestrian and cycle infrastructure through and beyond the NRSUAP will provide for the completion of the entire MATS between Macquarie University and the Riverside Corporate in line with the PTFP requirements, and therefore maximise pedestrian and cycle connectivity to, through and from the NRSUAP.

v. Public Transport

Further to the above, public transport infrastructure for the M2 Site is proposed in accordance with the NRSP DCP, and specifically to fulfil the requirements of the PTFP.

Key pedestrian and cycle connections to North Ryde Station (rail and bus services) and Waterloo Road (rail and bus services) will be constructed as part of the SSDA. Additionally, a new pedestrian path will link to the Epping Road (north) bus stop, which will be relocated to the immediate west of the Epping Road pedestrian overpass to provide for the Epping Road ingress lane to Spine Road.

Additional public transport infrastructure will be provided under a proposed Voluntary Planning Agreement, including funding for the provision of bus shelters at the Epping Road (north and south) bus stops adjacent to the Epping Road pedestrian overpass; and for the provision of a bus shelter at the Epping Road (south) bus stop east of Delhi Road.

The provision of this public transport infrastructure in line with the PTFP requirements will significantly enhance key public transport facilities external to the M2 Site.

vi. Parking

A range of Parking Management Strategies are proposed as part of the SSDA to ensure that the M2 Site promotes TOD, not least of which are the immediate access to high frequency public transport services; significant pedestrian and cycle infrastructure provisions; and intentionally restrictive parking rates for all land uses. In addition, the Parking Management Strategy proposes: -

- The designation of time restricted on-street parking throughout the M2 Site, with time limits appropriate to the adjacent land use.
- The introduction of measures to prohibit NRSUAP parking extending into the adjacent Macquarie Park Cemetery
- The designation of more than 30 "car share" spaces across the M2 Site
- The development of a *Travel Access Guide* as part of the Development Application process for each super-lot

With reference to parking rates provided in the NRSP DCP, the M2 Site would require some 2,770 parking spaces, an increase of approximately 100 parking spaces over the TMAP forecast. Notwithstanding, the increase in required parking does not result in an increase in daily or peak period traffic generation.

With reference to Ryde DCP, bicycle parking requirements remain virtually unchanged, with a requirement for some 1,100 bicycle parking spaces across the M2 Site.

Specific vehicle and bicycle parking requirements, and service vehicle access and set down requirements, will require determination as part of future Development Applications for each super-lot, and would necessarily be provided in accordance with the parking and servicing requirements outlined in the NRSP DCP and the Ryde DCP.

vii. Construction

All demolition and construction works will require the preparation of a Construction Traffic Management Plan, specifically detailing key construction traffic management issues such as vehicle [and general construction] operating hours, routes and volumes; construction staff access and parking; and Traffic Controls Plans to safely and efficiently manage both construction staff and the public. The details of the construction task will be finalised further to the commission of a construction contractor.

More broadly, the demolition and construction task is estimated to employ up to 120 people on the M2 Site; this represents less than half the M2 Widening Project construction staff currently utilising the M2 Site for parking, and only a minor percentage of the future vehicle trip generation of the developed M2 Site. As such, it is expected that the M2 Site demolition and construction works will have lower impacts on the road network than the M2 Widening Project or the future developed M2 Site.

Following our assessment of the key issues associated with the SSDA, ARC Traffic + Transport has concluded that the SSDA is supportable from a traffic and transport perspective.

1 Introduction

1.1 State Significant Development Application Overview

Urban Growth NSW (**UGNSW**) proposes a Development Application for State Significant Development (**SSDA**) in regard to the *High Density Residential Precinct* and *Mixed Use Precinct* – collectively referred to as the **M2 Site** - located within the North Ryde Station Urban Activation Precinct (**NRSUAP**). The M2 Site comprises Lot 101 in Deposited Plan 1131776. The NRSUAP was rezoned on the 23rd September 2013 for Transit Orientated Development (**TOD**) by State Environment Planning Policy Amendment (North Ryde Station Precinct 2013).

With specific reference to traffic and transport components, the SSDA proposes: -

- The allocation of gross floor area (**GFA**) to development **super-lots** within the M2 Site
- The construction of the two M2 Site **interface intersections**, at Wicks Road and at Epping Road
- The construction of key M2 Site internal roads, including the Spine Road, Park Street, Retail Street and Plaza Street; the establishment of “**mews**” access road intersection locations along the Spine Road; and provisions for a **Future Link Road** from the Spine Road to the adjacent [existing] commercial/industrial precinct
- The construction/funding of key pedestrian, cycle and public transport infrastructure, including: -
 - A shared pedestrian/cycle/disable accessible bridge (the **Shared Bridge**) linking the M2 Site with the NRSUAP **Station Sites**, and specifically with North Ryde Rail Station
 - Signalised crossings of the intersection of Wicks Road & Waterloo Road & Spine Road
 - Pedestrian paths and crossings in Epping Road, Wicks Road and through the M2 Site
 - The relocation of the Epping Road (north) bus stop from east of the Epping Road pedestrian overpass to west of the Epping Road pedestrian overpass
 - [As part of a Voluntary Planning Agreement (**VPA**)] funding for the provision bus shelters at the Epping Road (north and south) bus stops adjacent to the Epping Road pedestrian overpass; and at the Epping Road (south) bus stop east of Delhi Road

1.2 Traffic & Transport Impact Assessment

ARC Traffic + Transport (**ARC**) has been commissioned by UGNSW to prepare a Traffic & Transport Impact Assessment (**TTIA**) - incorporating a Public Transport Facilities Plan (**PTFP**) and Parking Management Strategy (**PMS**) - to assess the traffic and transportation characteristics of the SSDA, which specifically provides for works that will facilitate the future development of the M2 Site. As part of this TTIA, ARC has: -

- Referenced the specific assessment requirements provided by the Director-General in regard to the SSDA (Reference SSD 5093, February 2014). A summary of the TTIA Section responding to each of the requirements is provided below.

Direction General Requirements – 6. Transport and Accessibility		TTIA Section
i	<i>Provide details of the proposed roads, pedestrian/cycle routes and intersection upgrades in accordance with section 3.2 Circulation Networks and Figure 4 of the NRSP DCP 2013.</i>	Section 4, Section 5 and Section 3 respectively
ii	<i>Demonstrate that the proposed works provide clear, safe and high amenity pedestrian and cycle linkages to key destination points such as North Ryde Rail Station and Waterloo Road</i>	Section 5, Section 6, and Appendix B
iii	<i>Demonstrate that all proposed roads satisfy the street dimensions and designs set out in Section 4.1 of the NRSP DCP 2013.</i>	Section 4
iv	<i>Provide for adequate road side collection points for all super lots accessible to Council's waste vehicles.</i>	Section 4 and 7
v	<i>Demonstrate how future access points identified in Figure 4 of the NRSP DCP 2013, and within the development site, will be connected or preserved</i>	Section 4
vi	<i>Provide details of the proposed access and parking provisions associated with the application, including compliance with the relevant Australian Standards</i>	Section 7
vii	<i>Demonstrate that the road and pedestrian/cycle route designs provide for safe and efficient movement and adequate capacity, having regard to modelling and site investigation carried out for the North Ryde Rail Station urban activation precinct.</i>	Section 3, Section 4, Section 5 and Appendix B
viii	<i>Provide details of the pedestrian/cycle link between the North Ryde Rail Station and the Mixed Use Sub-Precinct in accordance with section 4.3 of the NRSP DCP 2013</i>	Section 4, Section 5 and Appendix B
ix	<i>Identify any existing and proposed public transport facilities to be delivered or upgraded under section 3.3 of the NRSP DCP 2013 as relevant works proposed for the High Density Residential and Mixed Use Sub-Precincts</i>	Section 6 and Appendix B
x	<i>Identify bicycle parking areas as relevant to works proposed for the High Density Residential and Mixed Use Sub-Precincts.</i>	Section 4 and 5
Xi	<i>Demonstrate provision of emergency access from the Site to the M2 in accordance with section 3.2(3) of the NRSP DCP 2013.</i>	Section 2
Direction General Requirements – 13. Construction		
<i>Provide an assessment of construction and operational impacts and identify appropriate mitigation measures in accordance with relevant guidelines. This should include (but not be limited to) the following matters:</i>		
i	<i>Construction traffic impacts, including an estimation of truck movements</i>	Section 8

expected during the construction phase

- ii** *Measures to manager, where appropriate, accessibility, amenity and safety of public transport use, walking and cycling, and emergency vehicle access during construction works* Section 8

- Completed a detailed assessment of the traffic and transport characteristics of the SSDA. This has included: -
 - A detailed review of the North Ryde Station Precinct Project Transport Management and Accessibility Plan (the **TMAP**), which was prepared as part of the **NRSUAP Rezoning** process, and the recommendations of which form the basis of the North Ryde Station Precinct Development Control Plan (NRSP DCP) traffic and transport requirements
 - An assessment of the land use mix provided for in the TMAP, and the potential impacts arising from the amendments to that land use mix which underlie the SSDA
 - An assessment of road profiles with reference to the NRSP DCP
 - Modelling of internal traffic flows along the M2 Site Spine Road to ensure appropriate levels of service are provided at key internal intersections
 - With reference to the PTFP requirements, an assessment of pedestrian and cycle linkages across the M2 Site, the broader NRSP, and to key external destinations including Macquarie University, Macquarie Centre and the Riverside Corporate Park
 - A review of future super-lot parking and servicing requirements
 - Reference to the appropriate planning, traffic and transport guidelines and assessment criteria, including: -
 - NRSP DCP
 - Ryde Development Control Plan 2010 (Ryde DCP)
 - RTA Guide to Traffic Generating Developments (RTA Guide)
 - RMS Technical Direction 2013 04a – Guide to Traffic Generating Developments; Updated traffic surveys (RMS Guide Update)
 - AustRoads Guide to Road Design Part 4A Unsignalised and Signalised Intersections (AustRoads GRD4A)
 - Australian Standard 2890.1: Parking Facilities – Off Street Car Parking (AS 2890.1)
 - Australian Standard 2890.2: Parking Facilities – Off Street Commercial Vehicle Facilities (AS 2890.2)

1.3 The TMAP

The scope of work provided in this TTIA is not significantly different to the scope of work provided in the TMAP; indeed, it is acknowledged from the outset that this TTIA draws significantly from the TMAP and additional work completed by Parsons Brinkerhoff and provided by UGNSW to ARC.

The TMAP provided an assessment of [existing and] future conditions relevant to the creation of the NRSUAP. Given the subsequent rezoning to create the NRSUAP it must be considered that the future conditions described in the TMAP – and specifically the future operation of the sub-regional road network serving the NRSUAP – represent acceptable conditions.

As such, if it can be determined that the potential traffic impacts of the SSDA are no different (or more specifically no worse) than the traffic impacts determined in the TMAP, then the SSDA traffic 'impacts' must in our opinion be considered supportable.

2 The SSDA

2.1 The North Ryde Station Urban Activation Precinct

2.1.1 Background

In late 2012, the NSW Government endorsed the NRSUAP, designating it as land with specific re-development significance. The subsequent NRSUAP Rezoning process was undertaken to ensure that future development of the NRSUAP conformed to key TOD planning principles, while also providing benefits to the broader community.

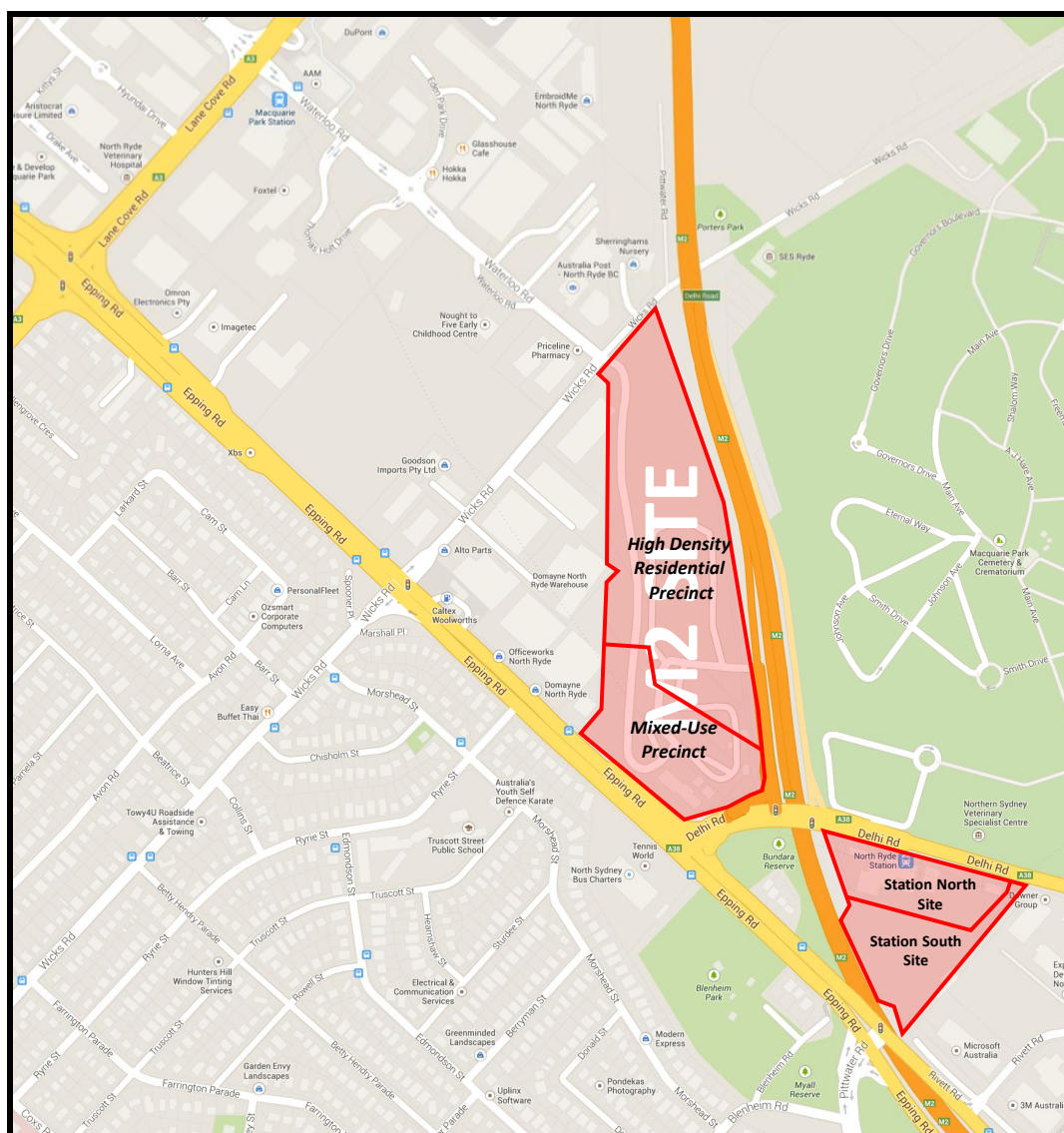
The NRSUAP Rezoning process established site specific planning provisions for the NRSUAP, embodied in the NRSP DCP, which sets out requirements in relation to land use zones; building design; floor space ratios; and vehicle, pedestrian and cycle networks. In regard to access, traffic and parking characteristics, the NRSP DCP essentially mirrors the outcomes and recommendations of the TMAP.

2.1.2 The Approved NRSP Sites

The M2 Site – which comprises the NRSUAP *High Density Residential Precinct* and the *Mixed-Use Precinct* - was originally one of five sites considered in the NRSUAP Rezoning; the other original NRSUAP Sites included: -

- The Station Site North
- The Station Site South
- The Office of Strategic Lands (**OSL**) Site
- The RMS Site

Further to the NRSUAP Rezoning process, two of the NRSUAP Sites – the OSL Site and the RMS Site – were removed from the broader NRSUAP Rezoning (and from consideration in the NRSP DCP). The remaining NRSP Sites are shown below in **Figure 2.1.2**.

Figure 2.1.2 North Ryde Station Urban Activation Precinct

Source: Google Maps, [NRSU DCP](#) and ARC

2.1.3 NRSUAP Rezoning Land Use Mix

Planning – and particularly traffic planning – for the NRSUAP Rezoning process was based on an indicative land use mix that reflected general TOD principles, acknowledging the location of the NRSUAP in regard to Macquarie Park and to public transport; and also the need for further housing options in the sub-region. A summary of the land use mix examined in the NRSUAP Rezoning (and modelled in the [TMAP](#)) is reproduced below.

Table 2.1.3 NRSUAP Rezoning Land Use Mix

Site name		M2 Site	Station Site North	Station Site South
Ownership		TfNSW	TfNSW	Goodman
Residential	m ²	201,000	-	27,890
	<i>dwelling</i> s	<i>2,116</i>	-	<i>294</i>
Retail (m ²)		5,000	900	-
Commercial (m ²)		24,400	20,000	31,225
Community centre (m ²)		2,500	-	-
Student housing	m ²	-	7,500	-
	<i>bed</i> s	-	<i>125</i>	-
Serviced apartments	m ²	-	10,000	-
	<i>bed</i> s	-	<i>125</i>	-
Total (m ²)		232,900	38,400	59,115

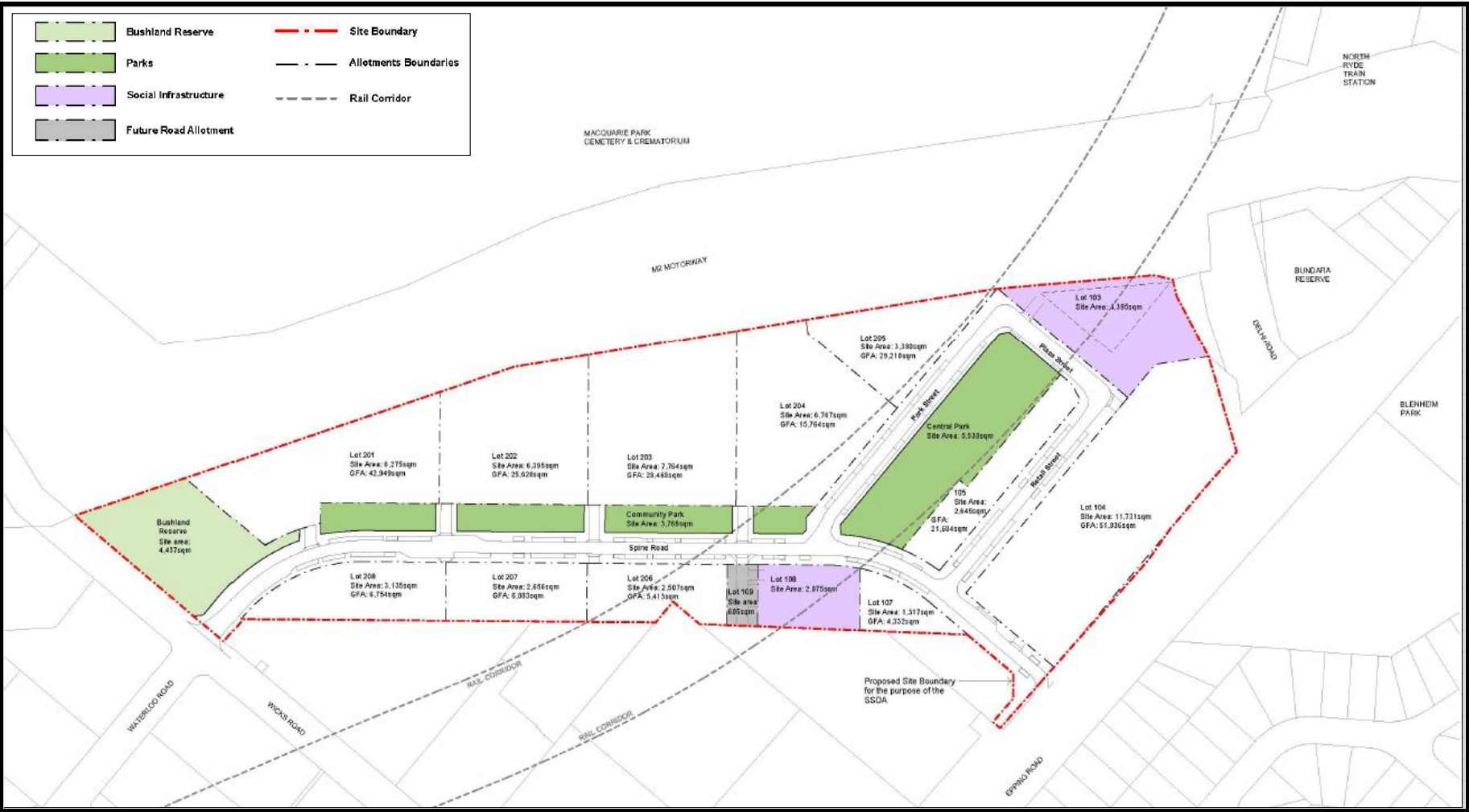
Source: *TMAP*

2.2 The SSDA

The SSDA provides amendments to the land use mix and road network as assessed in the NRSUAP Rezoning process for the M2 Site, but provides those amendments with specific reference to the NRSP DCP Objectives and Controls relating to TOD development.

A site plan showing the amendments to the M2 Site road network is provided in **Figure 2.2**, and the key components of the SSDA are examined further below.

Figure 2.2 The SSDA M2 Site



Source: Bates Smart

2.2.1 Land Use Mix

The SSDA provides an amendment to the land use mix contemplated by the TMAP (as per **Table 2.1.3** above). This amended land use mix is described in the 2014 TMAP Traffic Modelling Review (TMAP Review) prepared by Parsons Brinkerhoff, which is attached as **Appendix A** and summarised below.

Table 2.2.1 M2 Site SSDA Land Use

M2 Site SSDA	Residential	Commercial	Retail	Community
Units or m²	2,373	10,000	3,500	1,500

Source: TMAP Review

The M2 Site land use amendments result in changed trip generation, and particularly changed vehicle trip generation, from that described in the TMAP. The potential impacts associated with these changes are examined in detail in **Section 3**.

2.2.2 Interface Intersections

With reference to **Figure 2.2**, the SSDA provides the key interface intersections at Wicks Road and at Epping Road in accordance with the NRSP DCP.

Conversely – and further to significant drainage works proposed at the intersection of Wicks Road & Waterloo Road & Spine Road as part of the SSDA - emergency vehicle access (all conditions) will be available from this intersection. This effectively negates the previously [NRSP DCP] identified requirement for emergency access to be provided from the [existing] M2 Site access point from the Delhi Road M2 on-ramp. As a result, the SSDA does not propose any emergency or other access to the M2 Site from the Delhi Road M2 on-ramp.

2.2.3 Internal Roads

With reference to **Figure 2.2**, and in accordance with the NRSP DCP, the SSDA provides the key Spine Road which runs through the M2 Site between Wicks Road and Epping Road. The design profile of the Spine Road reflects the NRSP DCP requirement to provide for all travel modes along this central spine of the M2 Site, but also accounts for the adjacent **Linear Park**, and specifically the provision of pedestrian and cycle facilities within the Linear Park.

Through the M2 Site *High Density Residential Precinct*, the SSDA proposes amendments to the NRSP DCP Indicative Vehicular Movement Plan, with the most significant difference being the removal of the *Local Road M2 Edge*. Internal super-lot access will be provided by a series of intersections providing access to private access ways (referred to as “mews”).

Through the M2 Site *Mixed-Use Precinct*, the SSDA provides a similar network to the NRSP DCP Indicative Vehicular Movement Plan, with Park Street, Retail Street and Plaza Street each designed with reference to their individual land use frontages.

With reference to the NRSP DCP Indicative Vehicular Movement Plan, the SSDA also provides for a Future Access Link to the existing commercial and industrial precinct to the immediate south-west of the M2 Site.

The design and operation of the M2 Site internal road network is examined in detail in **Section 4**.

2.2.4 Pedestrian and Cycle Access

The SSDA retains all key pedestrian and cycle linkages through the M2 Site and to key external destinations in accordance with the NRSP DCP Indicative Pedestrian and Cycle Links Plan. Perhaps the most significant of these links is the Shared Bridge linking the M2 Site with the Station Sites. Additionally, the pedestrian and cycle network is significantly enhanced by the provision of the Linear Park, which allows for dedicated shared paths for the length of the M2 Site.

The provision of this pedestrian and cycle infrastructure within the NRSUAP; the [pedestrian] signals at the intersection of Wicks Road & Waterloo Road & Spine Road; and the shared path link to the Riverside Corporate Park adjacent to the Station Site North provides a significant contribution towards the completion of the Macquarie University to Riverside Corporate Park Active Transport Spine (**MATS**) as per the PTFP requirements.

Pedestrian and cycle accessibility is examined in **Section 5**, while the proposed pedestrian and cycle infrastructure to fulfil the PTFP requirements is summarised in **Section 5** and **Section 6**, and detailed in the PTFP attached as **Appendix B**.

2.2.5 Public Transport Accessibility

The key to maximising public transport use is to maximise public transport accessibility. For this purpose, the pedestrian and cycle infrastructure outlined above is essential. In addition – and in accordance with the PTFP requirements – the SSDA provides for the relocation of the existing Epping Road (north) bus stop adjacent to the Epping Road pedestrian overpass; and [VPA funding] for bus shelters at the Epping Road (north and south) bus stops adjacent to the pedestrian overpass, and at the Epping Road (south) bus stop east of Delhi Road.

Public transport accessibility and services are examined in **Section 6**, while the proposed public transport infrastructure to fulfil the PTFP requirements is summarised in **Section 6** and detailed in the PTFP attached as **Appendix B**.

2.2.6 Parking

The fundamental Parking Management Strategy adopted at the M2 Site – and across the NRSUAP – is the provision of mixed-use development with immediate proximity to high frequency public transport services; and the provision of pedestrian and cycle link through the NRSUAP and to readily accessible external commercial, educational and retail precincts. In addition, the PMS proposes measures by which to provide a sustainable level of on-site parking; incentives to reduce car driver percentages; and to enhance awareness of the viability of public transport, walk and cycle trip options.

The detailed PMS is provided as **Appendix C**.

At this time, the exact parking requirements for each super-lot have yet to be determined – a detailed assessment of individual super-lot access, parking and servicing requirements will necessarily be provided as part of future super-lot Development Applications (**DAs**). Nonetheless, **Section 7** provides a review of parking and servicing objectives and requirements upon which those future DA assessments would be based.

2.2.7 Construction

Section 8 provides an overview of the construction requirements, general impact minimisation strategies, and the process for the [future] completion of appropriate Construction Traffic Management Plans.

3 SSDA Traffic Impact Assessment

3.1 Vehicle Access

3.1.1 Interface Intersections

The SSDA interface intersections to the existing road network are the same as those provided for in the NRSP DCP. Principle vehicle access to the M2 Site will be via the signalised intersection of Wicks Road & Waterloo Road & Spine Road, while an ingress only (left turn in) intersection will also be provided from Epping Road to the Spine Road.

3.1.2 Future 'External' Links

The NRSP DCP Indicative Vehicular Movement Plan requires *potential future road connections* to and through the existing commercial and industrial precinct to the immediate west of the M2 Site (a roughly triangular precinct bounded by the M2 Site, Wicks Road and Epping Road). The SSDA provides for the Spine Road to incorporate a Future Access Link intersection to that precinct (see **Section 4**).

Notwithstanding, any future connection(s) to/through the adjacent precinct will precipitate additional traffic analysis. The potential implications of such a link(s) are not examined in this TTIA, nor were they considered in the TMAP.

3.2 Trip Generation

The trip generation forecasts provided in the TMAP specifically reference the TOD based trip minimisation principles to be implemented at the M2 Site. Vehicles trip reductions – essentially arising from a reduced percentage of car drivers – are generated through the provisions for increased public transport usage (given the proximity of transit services); minimal parking provision across the M2 Site (for all proposed land uses); and the proximity (walking/cycle distance) of commercial, retail, recreational and educational services to residents and employees. The SSDA retains all of these provisions.

This section provides a review of the trip generation forecasts determined in the TMAP and a comparative assessment of the SSDA trip generation (further to the SSDA land use amendments described in **Section 2.2.1**). As part of this analysis, UGNSW has provided ARC with the TMAP Review; and the 2014 North Ryde Station Site North Infrastructure Works Development Application - Transport impact assessment (SSN TIA) also prepared by Parsons Brinkerhoff.

3.2.1 Residential Trip Generation

- **TMAP**

The TMAP estimates residential trip generation based on the Bureau of Travel Statistics (**BTS**) *Household Travel Survey* (**HTS**), and specifically with consideration of person trips; unit occupancy; and trips generated in the peak hour. The TMAP provides a forecast of 6.97 daily trips (all modes) per unit, and 0.77 peak hour trips (all modes) per unit.

Mode split analysis (as detailed in the TMAP) provides a vehicle trip estimate of some 470 vehicle trips per hour (**vph**) in the AM peak; and 490 vph in the PM peak. These totals are commensurate with the RTA Guide rate for high density residential units (0.24 vph per unit).

- **SSDA**

In 2013 the RMS published revised trip generation rates in the RMS Guide Update, which report lower generation rates for high density resident units than those provided in the RTA Guide, being 0.19 vph per unit in the AM peak, and 0.15 vph per unit in the PM peak. Further to the resulting revisions to trips per unit (all modes), mode split analysis provides a vehicle trip estimate of approximately 490 vph in the AM peak; and 380 vph in the PM peak.

These forecast flows are commensurate with the RMS Guide Update *trip rate per unit*, though ARC notes that the RMS Guide Update also provides *trip rates per parking space*, which are lower again; given that the NRSP DCP will specifically restrict parking provision (to a maximum of one space per unit) it would not be inappropriate to use these lower rates for assessment, i.e. a further reduced residential vehicle trip generation (without detailed consideration of mode split, to approximately 390 vph in the AM peak and 310 vph in the PM peak).

Notwithstanding, and as noted also in the SSN TIA, it is acknowledged that there is the potential for a slightly higher modal split to car driver per unit at the expense of the internal containment of walking and cycle commuter trips (i.e. the reduced internal commercial floorspace reduces potential resident-employee numbers) and as such the vehicle trip generation determined with the *trip rate per unit* has been used for the assessment. This also aligns with the trip rates used in the TMAP Review modelling (see **Section 3.6** below)

3.2.2 M2 Site Commercial Trip Generation

- **TMAP**

The TMAP estimates commercial trip generation with reference to the RTA Guide, the BTS HTS, and a target car driver percentage generated by restricted on-site parking. Further to consideration of car driver percentages and increased floor-space per employee, the TMAP provides an estimate of 13.5 trips (all modes) per day per 100m² of

commercial gross floor area (**GFA**); and 2.7 trips (all modes) in the [AM and] PM peak hour per 100m² of commercial GFA.

Mode split analysis then provides a vehicle trip estimate of 250 vph in both the AM and PM peak.

- **SSDA**

Reference to the RMS Guide Update indicates that commercial trip rates have reduced from the RTA Guide rates, a result of factors such as reduced employees working the standard “9 to 5”. This particularly impacts PM peak trips, with the RMS Guide Update reporting PM peak vehicle trips are 25% lower than AM peak vehicle trips.

Reference to the Guide Update, and to the TMAP mode split analysis, provides a vehicle trip estimate of approximately 100 vph in the AM peak and 80 vph in the PM peak.

3.2.3 M2 Site Retail Trip Generation

- **TMAP**

The TMAP estimates retail trip generation with reference to the RTA Guide and BTS HTS at 136.1 daily trips (all modes) per 100m² retail GFA; and 14.5 [Thursday] PM peak hour trips (all modes) per 100m² retail GFA. The AM peak hour trip generation is estimated at one third of PM peak hour generation; this is commensurate with numerous retail precinct studies completed by ARC.

Accounting for mode split, the TMAP provides an estimate of 22 vph in the AM peak and 109 vph in the PM peak.

- **SSDA**

The RMS Guide Update provides a reduced [PM] peak hour vehicle trip rate for retail of 12.5 vph per 100m². With no data to suggest any change in [the previously estimated] daily trips per 100m², and with reference to the modal split for retail adopted in the TMAP, the retail component of the SSDA is estimated to generate 15 vph in the AM peak and 66 vph in the PM peak.

3.2.4 M2 Site Community Centre Trip Generation

- **TMAP**

As the RTA Guide does not provide trip rates for community facilities such as proposed for the M2 Site, the TMAP calculates the trip generation of the community centre based on trip rates provided in the American Institution of Transportation Engineers Trip Generation Handbook (ITE TGH), which is key source reference for the RTA Guide.

The ITE TGH (*Land Use 495 – Regional Community Centre*) provides a vehicle trip rate of 21.3 daily vehicle trips per 100m² of community centre; and 1.5 PM Peak hour vehicle trips per 100m² of community centre.

With the application of a lower modal split to car, the TMAP forecasts a community centre generation of some 20 vph in both the AM and PM peak.

- SSDA

The trip generation of the community centre has been estimated using the same trip rates and mode split as used in the TMAP, with the result being an estimate of 11 vph in both the AM and PM peak.

3.3 M2 Site SSDA Trip Generation Summary

With reference to all available information, ARC provides below a summary of the trips (all mode) generated by the M2 Site as assessed in the TMAP, and as assessed with reference to the SSDA.

Table 3.3.1 TMAP M2 Site Trip Assessment

M2 Site TMAP Trip Calculations	Daily	Residential	Commercial	Retail	Community	Total Trips by Mode		AM Peak	Residential	Commercial	Retail	Community	Total Trips by Mode		PM Peak	Residential	Commercial	Retail	Community	Total Trips by Mode	
	Units or m ²	2116	24400	5000	2500	Total Trips by Mode	% Mode	Units or m ²	2116	24400	5000	2500	Total Trips by Mode	% Mode	Units or m ²	2116	24400	5000	2500	Total Trips by Mode	% Mode
	Trip Rate per unit or 100m ²	6.97	13.50	136.10	42.50			Trip Rate per unit or 100m ²	0.77	2.70	4.35	3.00			Trip Rate per unit or 100m ²	0.80	2.70	14.50	3.00		
	Total Trips	14749	3294	6805	1063			Total Trips	1622	659	218	75			Total Trips	1702	659	725	75		
	Car	4451	1252	2477	266	8445	33%	Car	467	250	22	19	758	29%	Car	487	250	109	19	865	27%
	Car Passenger	1880	165	681	266	2991	12%	Car Passenger	194	33	7	19	253	10%	Car Passenger	205	33	30	19	288	9%
	Train	2468	988	708	0	4164	16%	Train	356	198	37	0	591	23%	Train	373	198	123	0	694	22%
	Bus	1775	428	558	0	2761	11%	Bus	248	86	13	0	346	13%	Bus	261	86	65	0	412	13%
	Walk	3648	395	2178	425	6646	26%	Walk	310	79	131	30	549	21%	Walk	326	79	372	30	807	26%
	Cycle	527	66	204	106	903	3%	Cycle	47	13	9	8	77	3%	Cycle	50	13	25	8	96	3%
	Total Trips	14749	3294	6805	1063	25910	100%	Total Trips	1622	659	218	75	2574	100%	Total Trips	1702	659	725	75	3161	100%

Table 3.3.2 SSDA M2 Site Trip Assessment

M2 Site SSDA Revised Trip Calculations	Daily	Residential	Commercial	Retail	Community	Total		AM Peak	Residential	Commercial	Retail	Community	Total		PM Peak	Residential	Commercial	Retail	Community	Total	
	Units or m ²	2373	10000	3500	1500	Total	% Mode	Units or m ²	2373	10000	3500	1500	Total	% Mode	Units or m ²	2373	10000	3500	1500	Total	% Mode
	Trip Rate per unit or 100m ²	6.09	13.50	136.10	42.50			Trip Rate per unit or 100m ²	0.67	2.70	4.17	3.00			Trip Rate per unit or 100m ²	0.53	2.03	12.50	3.00		
	Total Trips	14452	1350	4764	638			Total Trips	1590	270	146	45			Total Trips	1255	203	438	45		
	Car	4374	513	1734	159	6780	32%	Car	489	103	15	11	618	30%	Car	384	77	66	11	538	28%
	Car Passenger	1843	73	476	159	2552	12%	Car Passenger	189	14	4	11	218	11%	Car Passenger	142	10	18	11	182	9%
	Train	2393	400	495	0	3288	16%	Train	340	81	25	0	445	22%	Train	279	61	74	0	415	21%
	Bus	1691	176	391	0	2257	11%	Bus	243	35	9	0	287	14%	Bus	183	26	39	0	249	13%
	Walk	3650	162	1524	255	5591	26%	Walk	278	32	87	18	416	20%	Walk	232	24	224	18	498	26%
	Cycle	500	27	143	64	734	3%	Cycle	51	5	6	5	66	3%	Cycle	35	4	15	5	59	3%
	Total Trips	14452	1350	4764	638	21203	100%	Total Trips	1590	270	146	45	2051	100%	Total Trips	1255	203	438	45	1940	100%

3.4 Vehicle Trip Distribution

3.4.1 TMAP Origin/Destination Profile

The TMAP provides different vehicle distribution profiles for each of the different land uses as shown below in **Table 3.4.1**. There is no information available to suggest any changes to these distribution profiles.

Table 3.4.1 TMAP Trip Distribution – Origin & Destination

Trip entry/exit direction	Residential ¹			Retail ^{1,5}	Commercial ^{1,3,4}
	Work ^{2,4} /Other	Education ⁵	Shopping ⁵		
Delhi Road (east of Lane Cove River)	10%	20%	20%	20%	9%
Epping Road (east of Lane Cove River)	25%	6%	15%	15%	14%
Pittwater Road	14%	5%	2%	5%	11%
Blenheim Road	3%	4%	1%	5%	2%
Wicks Road (south of Epping Road)	7%	3%	15%	10%	3%
Lane Cove Road (south of Epping Road)	10%	7%	5%	10%	8%
Epping Road (west of Lane Cove Road)	13%	2.5%	5%	10%	17%
Waterloo Road (west of Lane Cove Road)	4%	52%	30%	20%	0%
M2 Motorway (west of Lane Cove Road)	6%	0%	5%	0%	17%
Lane Cove Road (north of M2 Motorway)	7%	0.5%	2%	5%	18%
Total	100%	100%	100%	100%	100%

Source: TMAP

The TMAP does not specifically provide a distribution profile for the minor *Community* trip generation; for the trips assignment provided in **Section 3.5** below, ARC has distributed community trips using the *Retail* trip distribution profile.

3.4.2 Arrival & Departure Distribution

The TMAP provides different arrival and departure characteristics for each of the different land uses, as shown in **Table 3.4.2** below. Again, there is no information available to suggest any changes to these distribution profiles.

Table 3.4.2 TMAP Trip Distribution – Arrival & Departure

Time period	Direction	Residential ¹	Serviced Apartment	Retail	Commercial	Community
AM peak	In	25%	60%	50%	90%	60%
	Out	75%	40%	50%	10%	40%
	Total	100%	100%	100%	100%	100%
PM peak	In	60%	50%	50%	15%	30%
	Out	40%	50%	50%	85%	70%
	Total	100%	100%	100%	100%	100%

Source: TMAP

3.5 Trip Assignment

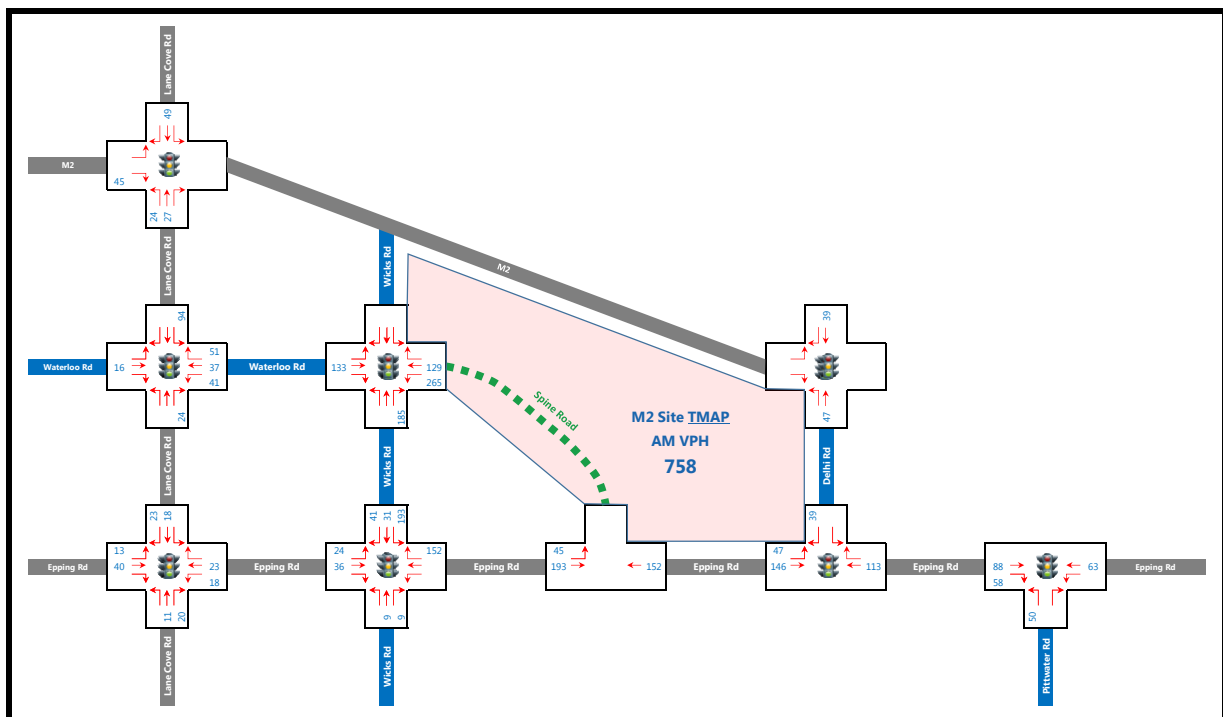
With reference to the available access network detailed in **Section 3.1**; vehicle trip generation detailed in **Section 3.3**; and trip distribution detailed in **Section 3.4**, a simple trip assignment has been prepared to illustrate the distribution of M2 Site trips to the surrounding road network.

This trip assignment does not provide for existing (and future) traffic flows and conditions as per the TMAP model, and as such the potential for route diversion arising from congestion (etc) along certain routes - as discussed, the TMAP Review has been prepared to specifically model the amended land use mix described in **Section 2.2.1** above. Rather, the trip assignment below provides a simple yet clear illustration of forecast traffic flows to key intersections around the M2 Site; and the flow reductions [from the TMAP forecasts) resulting from the amended land use mix.

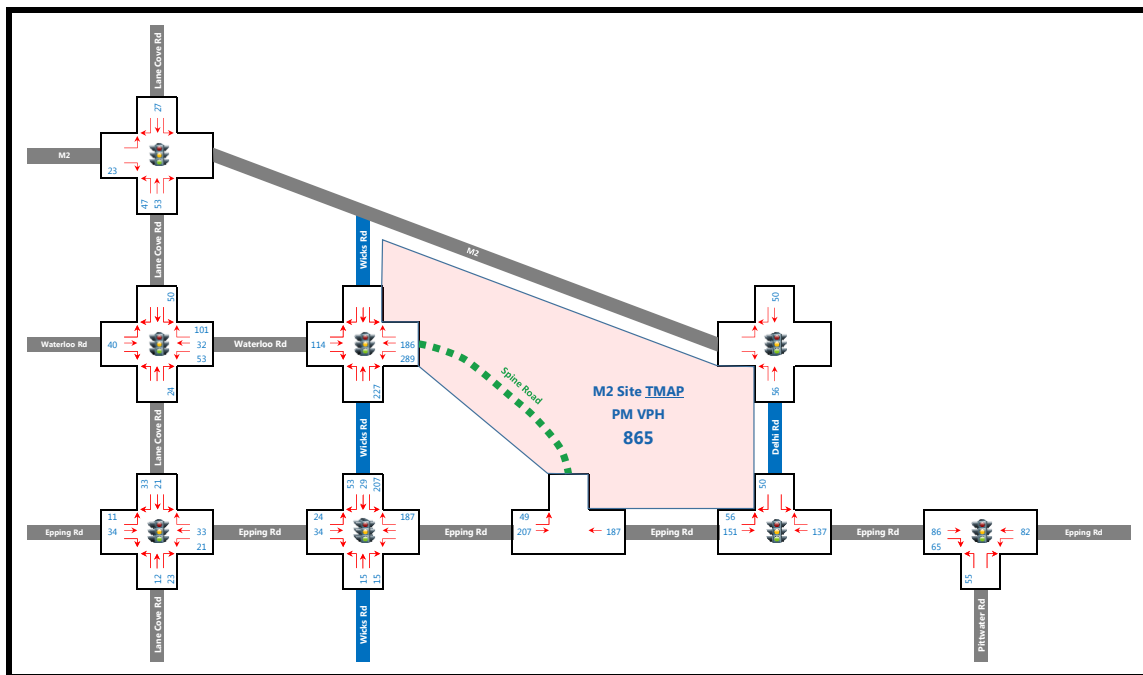
3.5.1 M2 Site TMAP Trip Assignment

The M2 Site TMAP assignment distributes M2 Site trips as determined with reference to the TMAP calculations. The resulting flows at key intersections are shown in **Figure 3.5.1.1** (AM Peak) and **Figure 3.5.1.2** (PM Peak).

3.5.1.1 M2 Site TMAP AM Peak Vehicle Trips



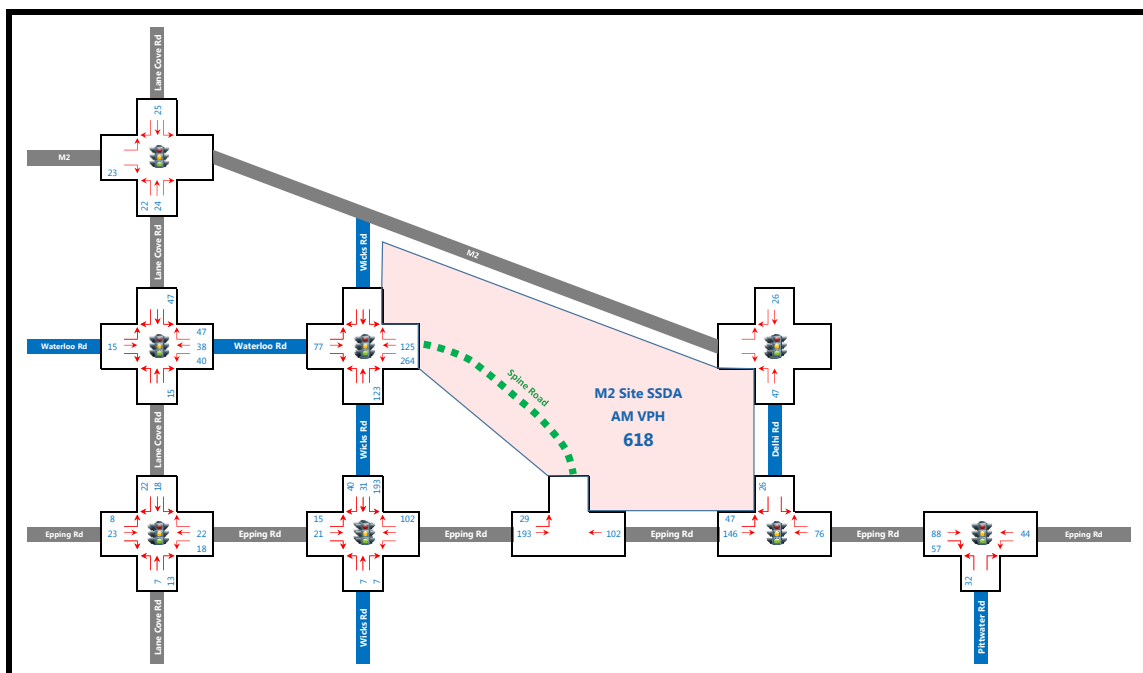
3.5.1.2 M2 Site TMAP PM Peak Vehicle Trips



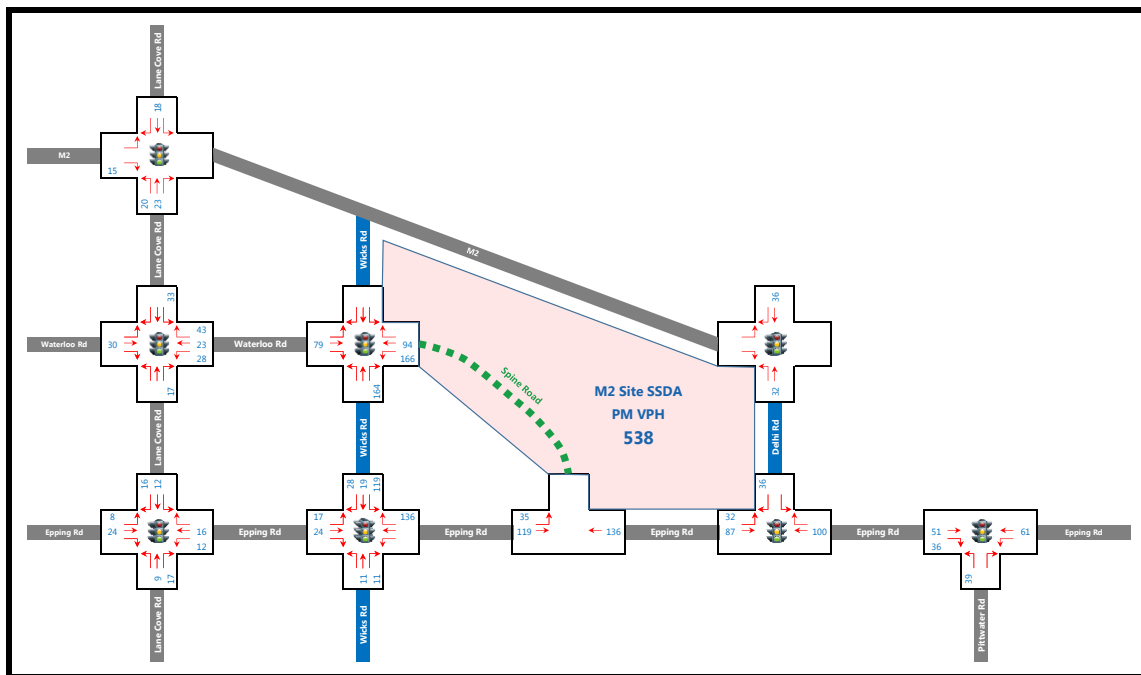
3.5.2 M2 Site SSDA Trip Assignment

The M2 Site SSDA assignment distributes M2 Site trips as determined with reference to the amended land use mix described in **Section 2.2.1**. The resulting flows at key intersections are shown in **Figure 3.5.2.1** (AM Peak) and **Figure 3.5.2.2** (PM Peak).

3.5.2.1 SSDA M2 Site AM Peak Vehicle Trips



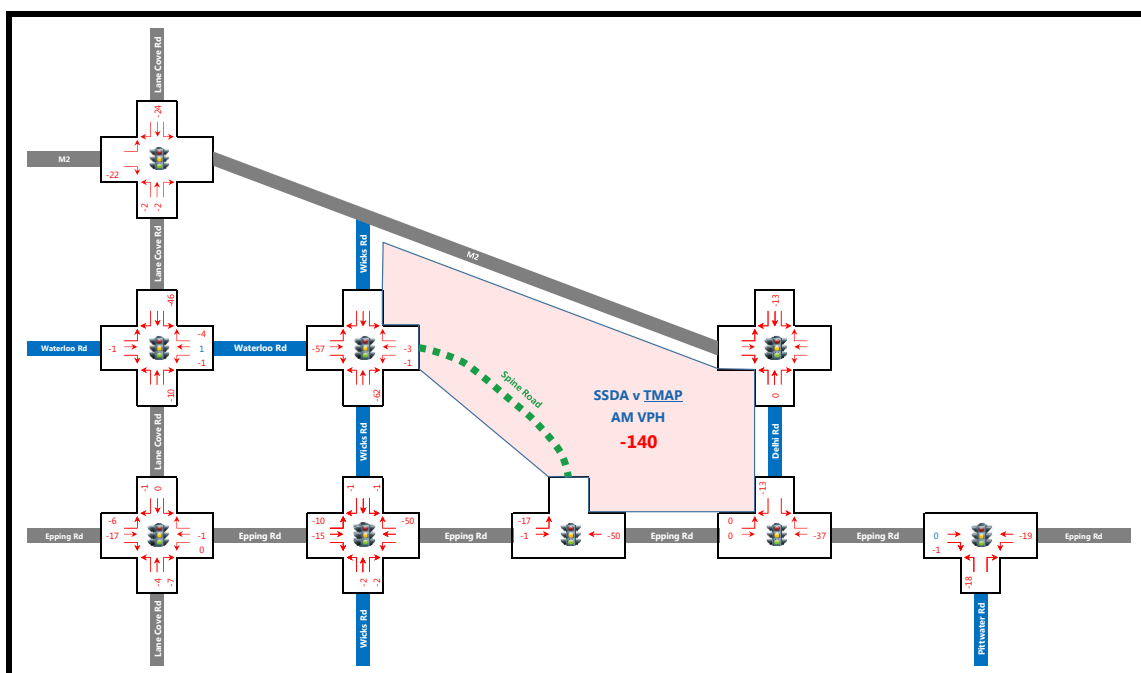
3.5.2.2 SSDA M2 Site PM Peak Vehicle Trips



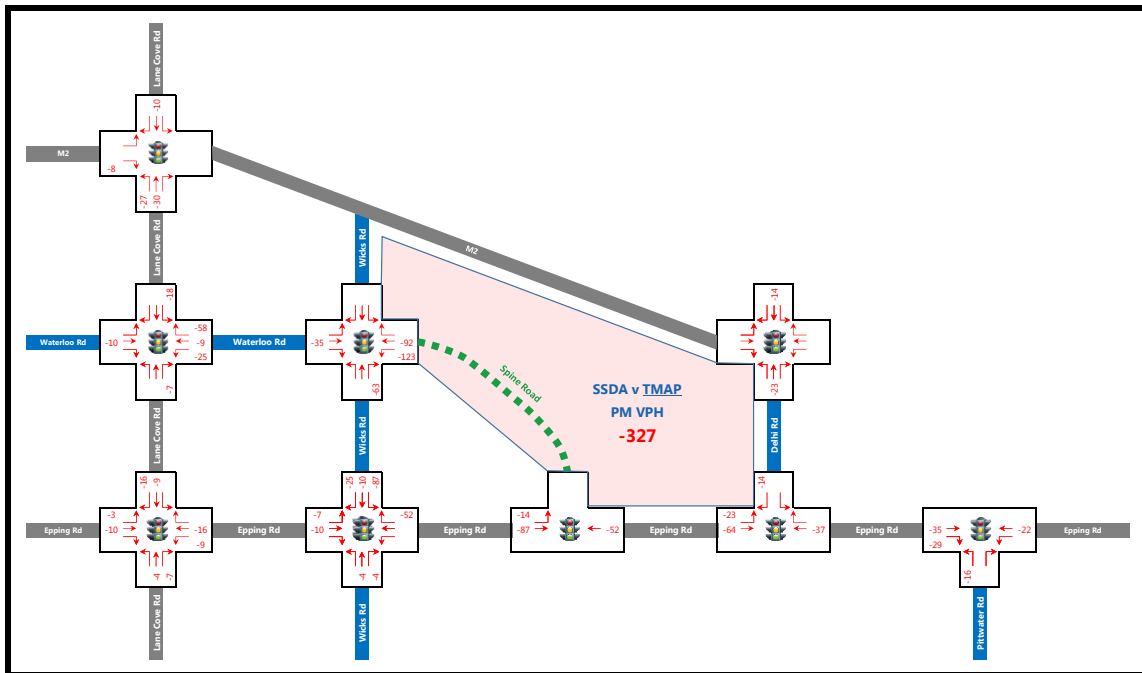
3.5.3 M2 Site Trip Comparison

The M2 Site trips generated with reference to the amended land use mix have been compared to the trips generated with reference to the TMAP. The resulting flow changes key intersections are shown in **Figure 3.5.3.1** (AM Peak) and **Figure 3.5.3.2** (PM Peak).

3.5.3.1 M2 Site AM Peak Vehicle Trip Comparison



3.5.3.2 M2 Site PM Peak Vehicle Trips Comparison



3.5.4 Trip Assignment Summary

As discussed, while the trip assignment provide above not does take into account existing (and future) conditions which may divert some trip paths to and from the M2 Site, it nonetheless illustrates the reduced M2 Site traffic generation in both peak periods (and particularly the PM peak); and the resulting lower flows to all key roads and intersections.

3.6 TMAP Traffic Modelling Review

3.6.1 NRSUAP Land Use Mix

The TMAP Review uses the same traffic model developed for the TMAP but applies the amended land use mix, along with land use mix amendments proposed for the Station Site North and Station Site South. The land use mix used in the TMAP Review traffic modelling is shown below.

Figure 3.6.1 TMAP Review Land Use Mix

Site name	Station Site North	Station Site South	M2 Site	Total
Residential m ²	29,400	61,405	225,419	316,224
dwelling	309	810	2,373	3,492
Retail (m ²)	500	1,000	3,500	6,000
Commercial (m ²)	-	-	10,000	10,000
Community centre (m ²)	-	-	1,500	1,500
Total (m²)	29,900	62,405	240,419	332,724

Source: TMAP Review

3.6.2 Revised Trip Rates

The TMAP Review incorporates the trips rate revisions provided in the RMS Guide Update for residential units, commercial and retail floorspace as detailed in **Section 3.2**.

3.6.3 TMAP Review Intersection Performance Results

The key measure of the performance of the surrounding road network is the performance of key intersections. The results of the [LinSig and SIDRA] modelling are shown in **Table 3.6.3**.

Table 3.6.3 TMAP Review Intersection Performance

Intersection	AM peak		PM peak	
	Average delay (sec/veh)	LoS	Average delay (sec/veh)	LoS
TMAP 2012				
TCS 551 – Epping Road/Delhi Road	107	F	279	F
TCS 226 - Epping Road/Wicks Road	431	F	346	F
TCS 195 - Epping Road/Lane Cove Road	420	F	687	F
TCS 1012 - Lane Cove Road/Waterloo Road	553	F	274	F
Waterloo Road/Wicks Road (traffic signals) ¹	38	C	42	C
This assessment				
TCS 551 – Epping Road/Delhi Road	65	E	202	F
TCS 226 - Epping Road/Wicks Road	83	F	107	F
TCS 195 - Epping Road/Lane Cove Road	378	F	448	F
TCS 1012 - Lane Cove Road/Waterloo Road	449	F	85	F
Waterloo Road/Wicks Road (traffic signals) ¹	34	C	40	C

Source: TMAP Review

Note 1: The TMAP Review uses the SIDRA model to examine the intersection of Wicks Road & Waterloo Road & Spine Road; all other intersections are assessed using the LinSig model. *This is identical to the modelling completed for the TMAP.*

With reference to **Table 3.6.3**, all key intersections report lower delays than those reported in the TMAP. The TMAP Review provides the following conclusions in regard to these results: -

While the intersections modelled are still forecast to be under substantial pressure, the results indicate that the impact of the development on the road network will be substantially reduced:

- Intersection of Epping Road and Delhi Road is forecast to operate better than it was in the TMAP due to the reduced traffic generation from the development
- Intersection of Epping Road and Wicks Road is forecast to operate better than the TMAP and better than the 2031 base (without development) due to the proposed upgrade.
- Intersections of Lane Cove Road / Epping Road and Lane Cove Road / Waterloo Road are forecast to operate better than they were in the TMAP due to the reduced traffic generation from the development
- Intersection of Wicks Road and Waterloo Road is slightly improved compared to the TMAP scenario. This intersection was forecast to exceed its capacity in the future base in its current configuration.

3.6.4 TMAP Review Queue Length Results

The TMAP Review also reports on queue lengths at the key intersections, with the results provided in **Table 3.6.4**.

Table 3.6.4 TMAP Review Queue Lengths

Parameter		TMAP 2012	This assessment
Wicks Road right turn into site	AM peak	62m	44m
	PM peak	112m	76m
Wicks Road southbound at Epping Road ¹	AM peak	219m	345m
	PM peak	105m	182m
Waterloo Road westbound at Lane Cove Road	AM peak	379m	373m
	PM peak	212m	212m

Source: TMAP Review

Note 1: The TMAP Review recommends a reduced upgrade at the intersection of Epping Road & Wicks Road to the upgrade modelled in the TMAP. More information in this regard is provided below.

With reference to **Table 3.6.4**, the key intersections report shorter or the same queue lengths than those reported in the TMAP, with the exception of the Wicks Road [southbound] approach to Epping Road in both the AM and PM Peak. The TMAP Review provides the following conclusion in regard to these results: -

The impact on queuing generally matches the reduction in traffic volumes. The major exception is at the intersection of Epping Road and Wicks Road, where the extent of the proposed intersection upgrade has been reduced to reduce its impact on the surrounding land (requiring less acquisition). This change is expected to improve the feasibility and reduce the cost of the upgrade. The consequence is increased queues on Wicks Road. However, these can be managed by adjusting the green time given to the Wicks Road northbound and Wicks Road southbound signal phases.

3.6.5 TMAP Review Conclusions

In summary, the TMAP Review provides the following conclusions: -

- *Road network will operate better at the currently proposed development than it would have under the TMAP development scenario*
- *Queuing at the critical intersections can be managed by road upgrades and traffic signal modifications*
- *The upgrade at the intersection of Epping Road and Wicks Road proposed in the TMAP can be reduced to improve the feasibility/constructability and reduce land acquisition and cost. While queue lengths on Wicks Road will increase as a result, but overall performance of the intersection is improved compared to the TMAP scenario due to the reduced traffic volumes*
- *The left-turn lane on the Spine Street within the M2 site can be reduced to 50 metres.*

Overall, the TMAP Review shows that the amended land use mix across the whole of the NRSUPA will result in improved intersection performance in comparison to the performance forecast in the TMAP.

As reported in the TMAP Review, there is [and will be] significant congestion in the surrounding network, but ARC would restate that the benchmark performance standards are those established in the TMAP, given that those performance standards were acknowledged as being the outcome of the rezoning of the NRSUPA. **Given that the TMAP Review shows improved conditions when compared to the TMAP, it is the conclusion of ARC that the traffic conditions further to the SSDA are therefore inherently supportable.**

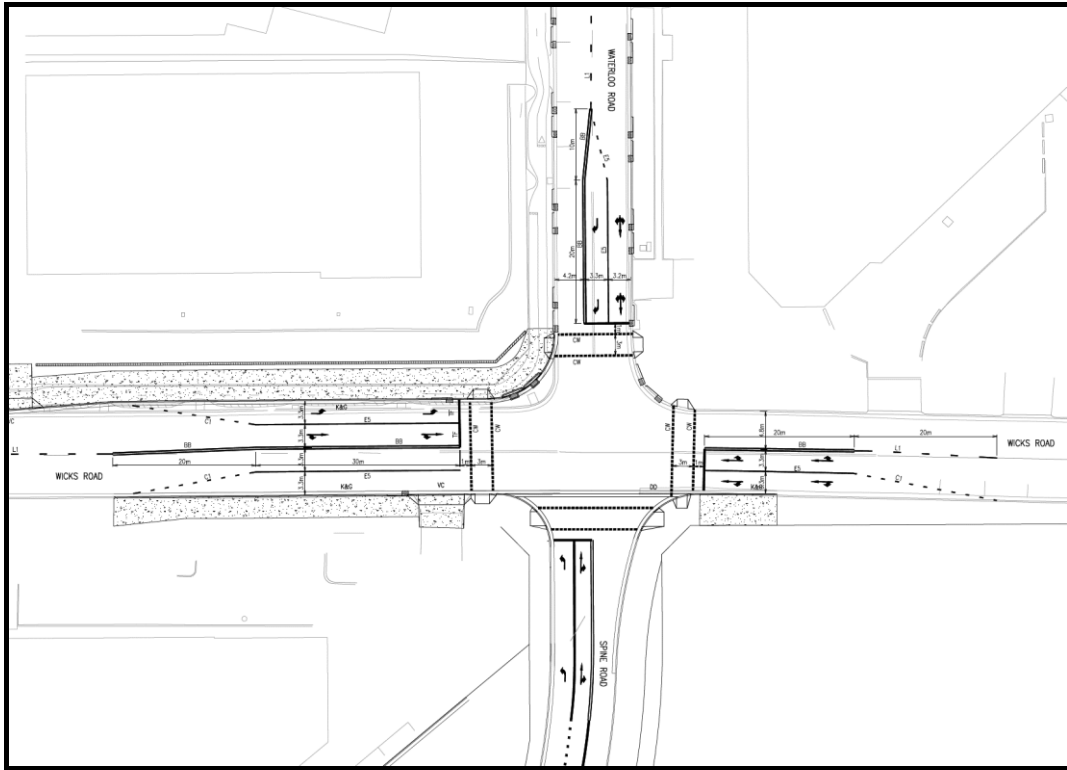
3.7 Intersection Upgrade Recommendations

The TMAP Review provides revised intersection upgrade recommendations for 3 of the key intersections: -

- *Intersection of Epping Road and Wicks Road – number of additional turn bays reduced from three to two. RMS has already conditioned the redevelopment of the service station on the corner of Epping Road and Wicks Road to allow for widening for one additional lane width. Due to this change this current allowance will be sufficient.*
- *Intersection of Wicks Road and Waterloo Road – length of left-turn lane leaving the site reduced from 100 metres to 50 metres due to reduced traffic volumes/reduced queuing.*
- *Intersection of Lane Cove Road and Waterloo Road – no change.*

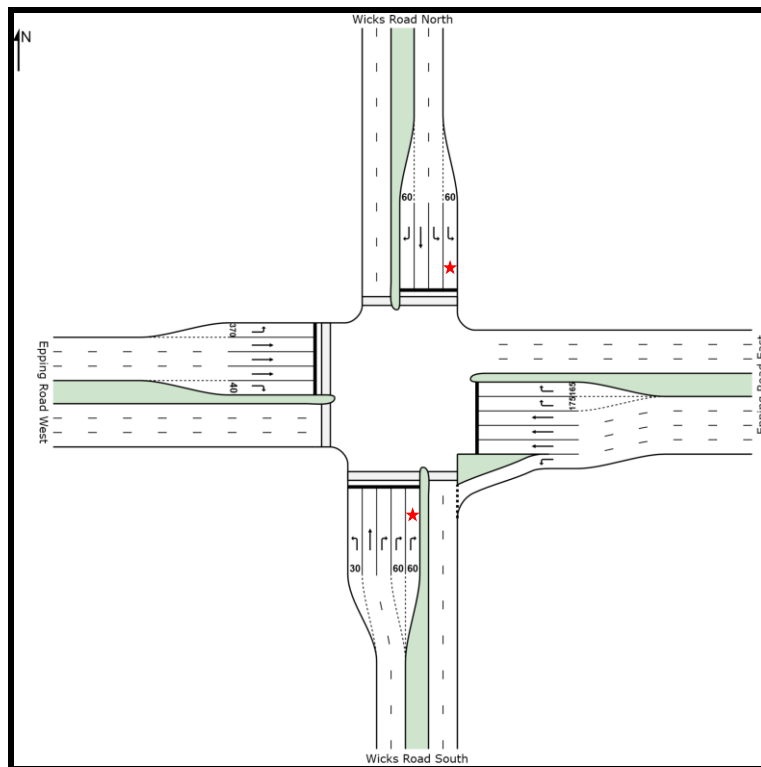
No revisions are proposed in the TMAP Review to the other key intersections examined in the TMAP. The TMAP Review revised intersection upgrade recommendations are illustrated below.

Figure 3.7.1 Wicks Road & Waterloo Road & Spine Road TMAP Review Upgrade



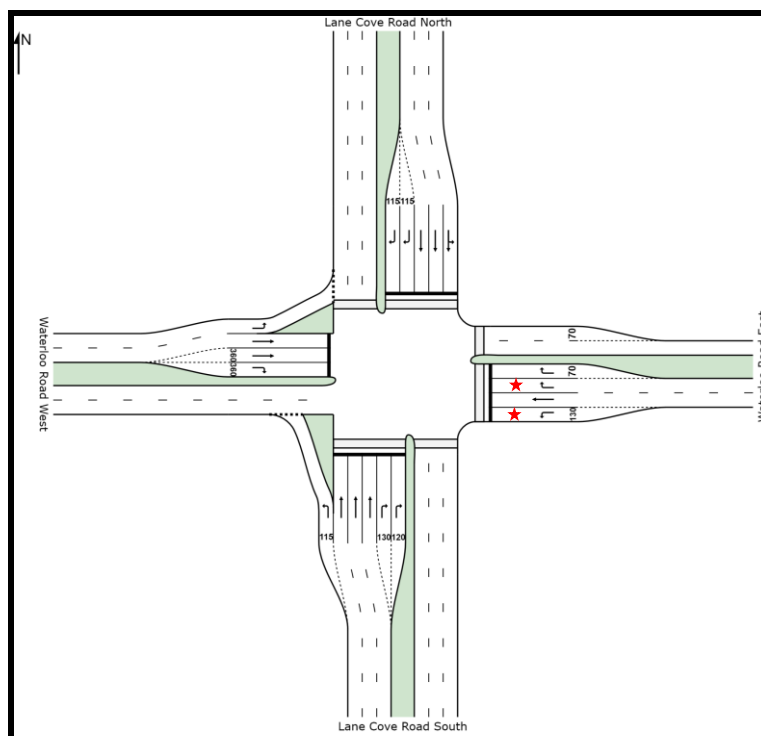
Source: Robert Bird Group

Figure 3.7.2 Epping Road & Wicks Road TMAP Review Upgrade



Source: TMAP Review

Figure 3.7.3 Lane Cove Road & Waterloo Road TMAP Review Upgrade



Source: TMAP Review

3.8 Intersection Upgrades Funding & Scheduling

The SSDA provides for the upgrade of the intersection of Wicks Road & Waterloo Road & Spine Road (signalisation, marking and new Spine Road approach); and the construction of the new intersection of Epping Road & Spine Road (slip lane). These are the fundamental pieces of infrastructure required to provide for general M2 Site access in accordance with the NRSP DCP.

In regard to broader intersection upgrades, the funding and scheduling of future works will be determined by the key transport authorities, and specifically the RMS, in consultation with Council and M2 Site land holders/developers. It remains the case that the M2 Site generates a relatively minor percentage of traffic flows to the surrounding road network - and indeed an even lower percentage than suggested in the TMAP given the lower traffic generation of the amended land use mix as detailed in **Section 3.3**. The ultimate responsibility for broader upgrade works will therefore remain with the RMS, a conclusion which is entirely consistent with the conclusions of the TMAP, which states: -

The road upgrades is [sic] proposed to address the existing congestion and delay issues that are exacerbated by the growth and development traffic. As the traffic from the development represents only a small percentage of the total traffic on the network, it is proposed that the works would be led by the Project in some instances and the relevant road authority in others (with a funding contribution from the Project to their cost).

And further: -

The future road network requirements have been assessed for the 2031 future scenario with base traffic growth and other planned major developments and finally the Project...As many of the upgrades are addressing current congestion problem, and the Project contributes a small percentage of the need for the upgrade, it is proposed that the agency responsible for the undertaking the works be as indicated in Table 11.5.

For many of these, the Project would only contribute a small amount to the need for the upgrade, with existing traffic congestion and future growth requiring road upgrades to maintain reasonable levels of service.

Table 11.5 Proposed road upgrades and lead agency

Item	Road upgrade	Lead agency responsible for undertaking works
1	Widen Delhi Road eastbound from M2 Motorway to east of Julius Avenue (eastern intersection), including the: a) Modification of the intersection of Delhi Road and Road 38 b) Modification of the intersection of Delhi Road and M2 Motorway Ramps c) Modification of the intersection of Delhi Road, Julius Avenue and Plassey Road d) Relocation of an eastbound bus stop on Delhi Road.	RMS
2	Add an additional left-turn bay from Pittwater Road to Epping Road.	RMS
3	Install additional lanes on Wicks Road at Epping Road.	RMS
4	Install traffic signals at the intersection of Wicks Road and Waterloo Road.	NRSP Project
5	Provide additional capacity on Waterloo Road at Lane Cove Road.	RMS
6	Redesign on-ramp from Rivett Street/Lucknow Road intersection inside Riverside Corporate Park to Epping Road.	Riverside Corporate Park

4 M2 Site Internal Road Network

4.1 SSDA Road Network

The SSDA retains the central Spine Road running from Wicks Road through to Epping Road; and the key roads through the *Mixed-Use Precinct*. Public road crossovers connect each super-lot with the Spine Road, and in turn will provide access to privately owned mews comprising parking/servicing infrastructure within each super-lot.

The SSDA provides for the construction of the Spine Road, Park Street, Retail Street and Plaza Street; intersections with the Spine Road related to the proposed private mews; and provisions for the Future Access Link to the adjacent precinct. Infrastructure in the proposed mews would be constructed as part of the future development consents for buildings on the development super-lots.

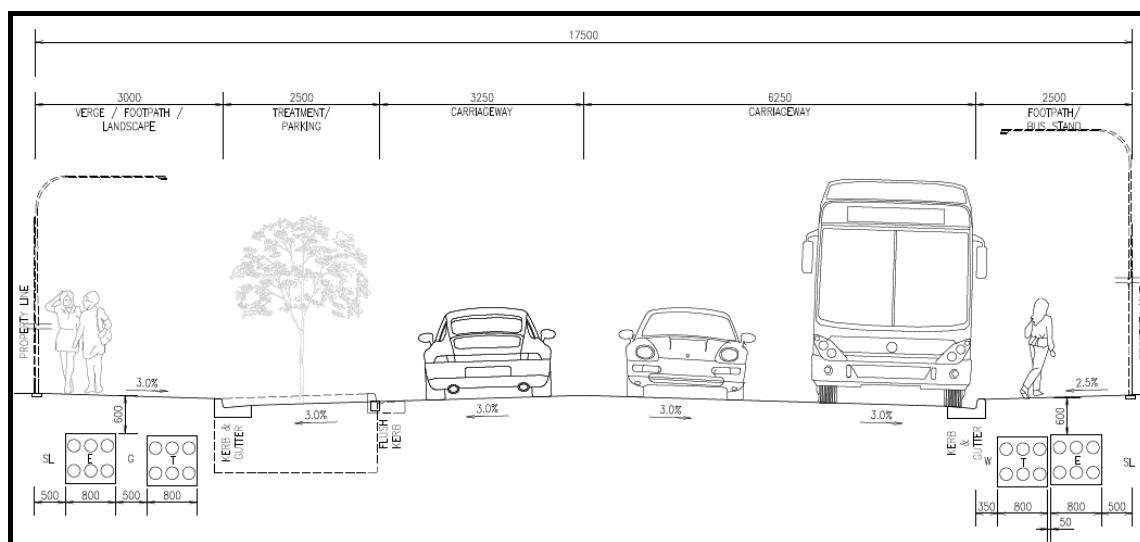
4.2 Spine Road

One of the key features of the SSDA M2 Site design is the inclusion of a Linear Park (to be constructed as part of the SSDA) which runs through the M2 Site on the northern side of the Spine Road linking the Bushland Park and the Central Park. The design of the Linear Park provides a continuous green corridor between Wicks Road and the Plaza.

Along with the benefits of providing green space through the M2 Site, the design provides the opportunity to move [pedestrian and] cycle paths from Spine Road into the adjacent parks, and specifically into the Linear Park. The NRSP DCP Spine Road profile has been accordingly amended, as outlined below.

4.2.1 Spine Road North

In the northern section of the Spine Road (adjacent to the Bushland Park) the Spine Road profile accounts for the implementation of the MATS, which [in the future] will establish a shared path along the northern side of Waterloo Road, connecting to the signalised crossing of Wicks Road and then to the northern side of the Spine Road (see also **Section 5** and **Appendix B**). The design profile for the Spine Road (North) is shown in **Figure 4.2.1**.

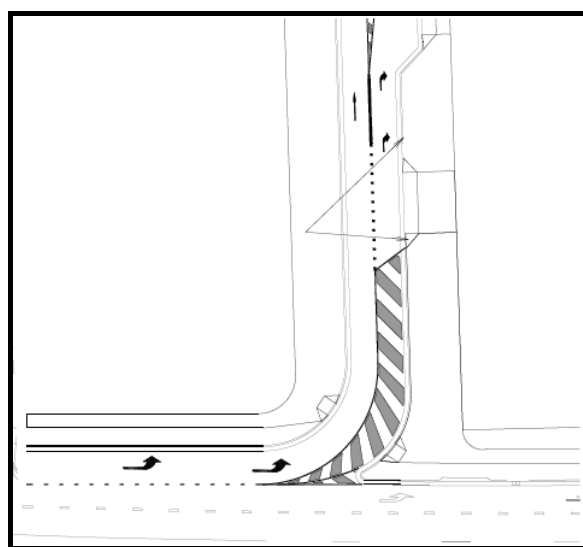
Figure 4.2.2.2 Spine Road (Central) Bus Stop Profile

Source: Robert Bird Group

4.2.3 Spine Road South

South of Retail Street, the Spine Road provides 2 lanes for a short distance to an entry point into the mixed-use building, south of which Spine Road becomes a single entry lane. Through this portion, Spine Road would provide pedestrian paths on both the western (3.0m) and eastern (2.0m) sides of the road, with the wider 3.0m path specifically provided to link to the Epping Road path to the Epping Road (north) bus stop adjacent to the Epping Road pedestrian overpass.

The Spine Road (South) design is shown in **Figure 4.2.3**.

Figure 4.2.3 Spine Road South

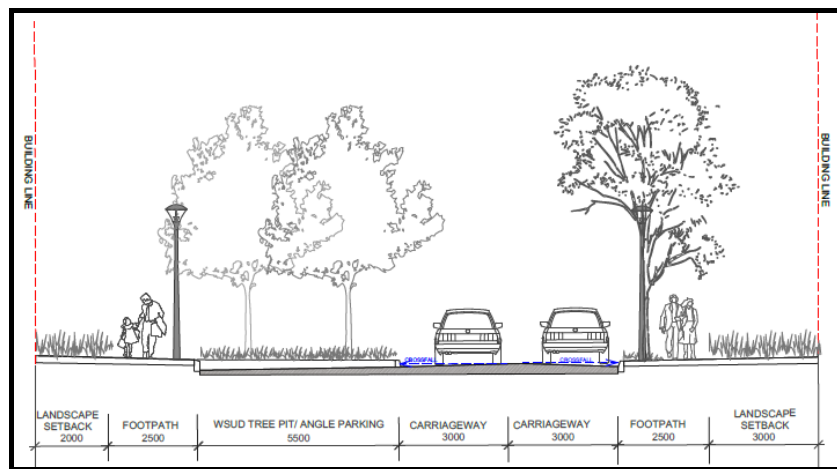
Source: Robert Bird Group

4.3 Additional Road Profiles

4.3.1 Private Mews

Private mews will provide access from Spine Road within each of the adjoining super-lots. As discussed, the SSDA provides for the construction of the intersections with the Spine Road required for connection with the private mews. An indicative design profile for the mews is shown in **Figure 4.3.1**.

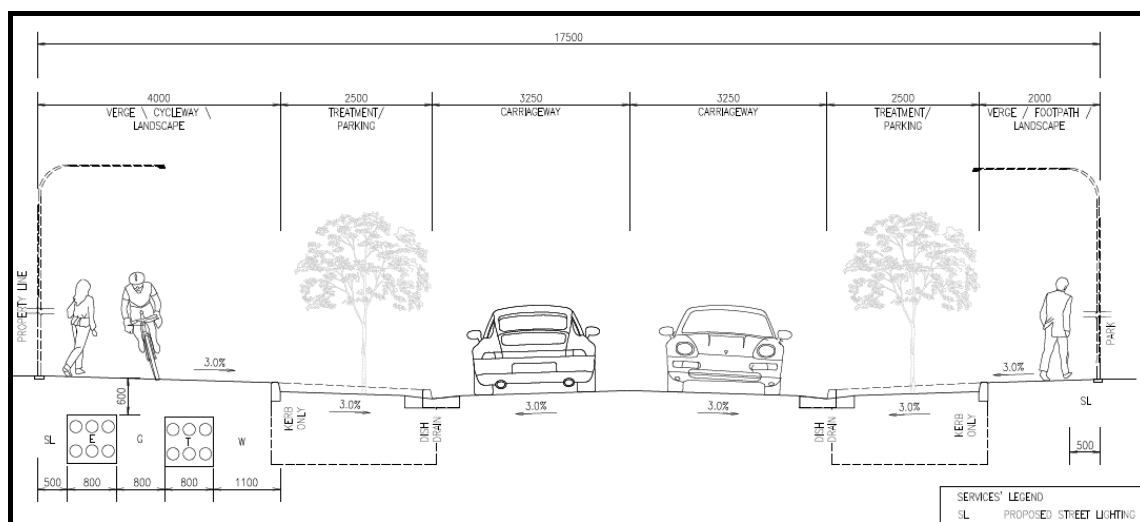
Figure 4.3.1 Indicative Private Mews Profile



Source: Bates Smart

4.3.2 Park Street

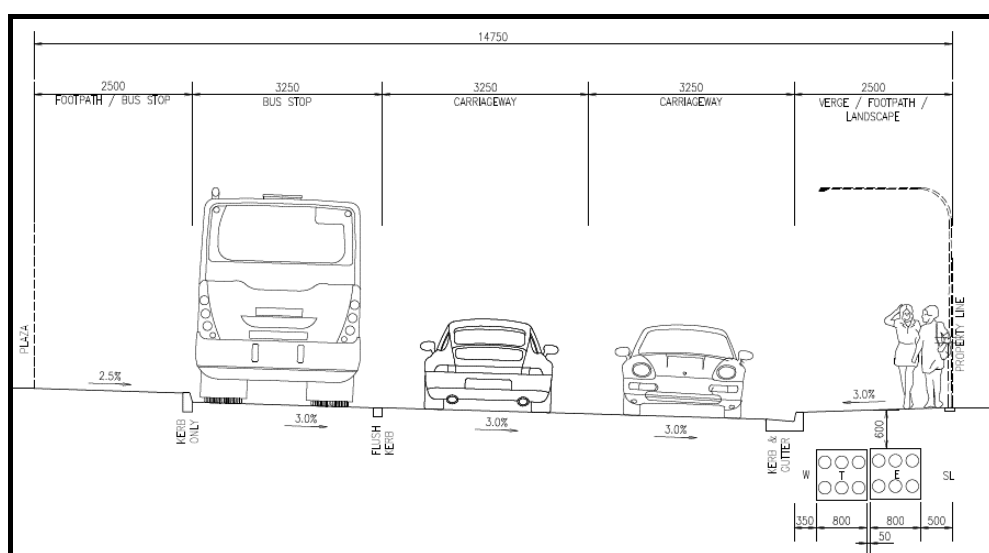
Park Street provides for the continuation of the shared path from the Spine Road/Linear Park through to Plaza Street and the Plaza itself; and then through to the Shared Bridge. The design also acknowledges its frontage to a residential super-block, and to the adjacent Central Park. The design profile for Park Street is shown in **Figure 4.3.2**.

Figure 4.3.2 Park Street Profile

Source: Robert Bird Group

4.3.3 Plaza Street

Plaza Street provides the transition between the Central Park and the *Mixed-Use Precinct*, and the Plaza (and thence the Shared Bridge), and as such has a profile that essentially allows the road reserve to extend into the adjoining public spaces. The Plaza Street profile is shown in **Figure 4.3.3**.

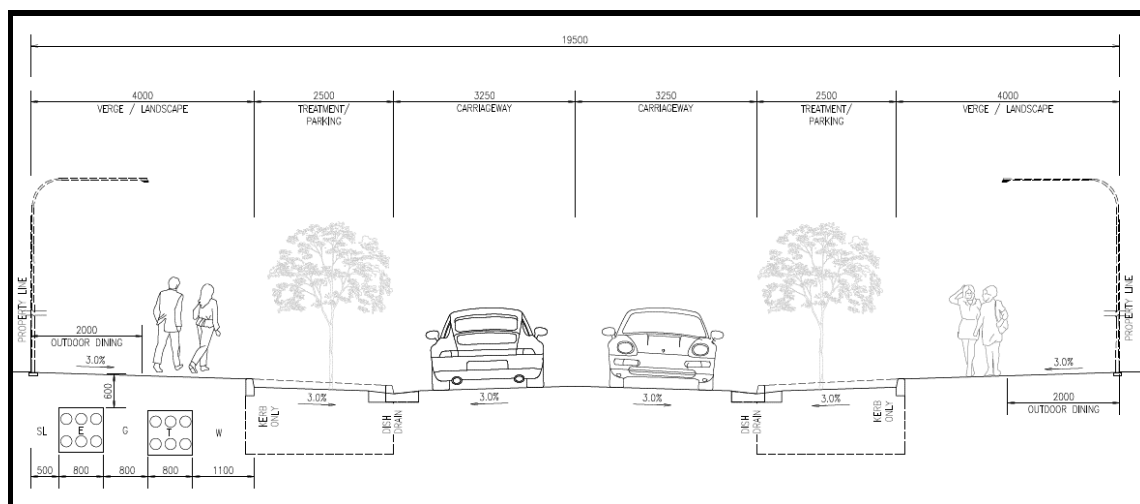
Figure 4.3.3 Plaza Street Profile

Source: Robert Bird Group

4.3.4 Retail Street

Retail Street runs through the centre of the *Mixed-Use Precinct*, and is designed to provide for outdoor cafes/restaurants etc for its length. The Retail Street profile is shown in **Figure 4.3.4**.

4.3.4 Retail Street Profile



Source: Robert Bird Group

4.4 Internal Intersection Operations

To test the operation of the internal intersections, a trip assignment has been prepared based on the SSDA traffic generation by land-use as detailed in **Section 3.3**; the **TMAP** distribution profiles as detailed in **Section 3.4**; the SSDA M2 Site internal road network as shown in **Figure 2.2**; and the preliminary forecast land-use of each of the super-lots (also as per **Figure 2.2**).

The resulting trips at each of the internal intersections are shown below in **Figure 4.4.1** (AM Peak) and **Figure 4.4.2** (PM Peak).

Figure 4.4.1 M2 Site Internal Traffic Flows AM Peak Hour

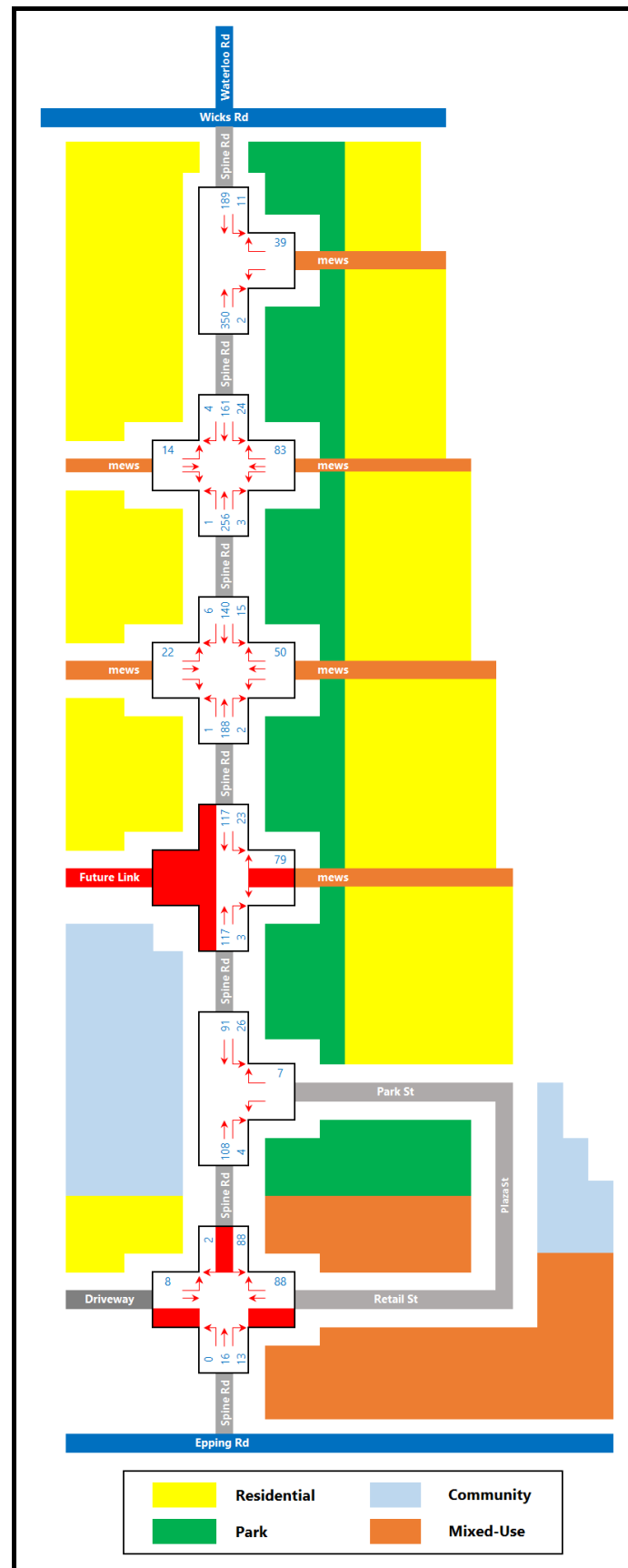
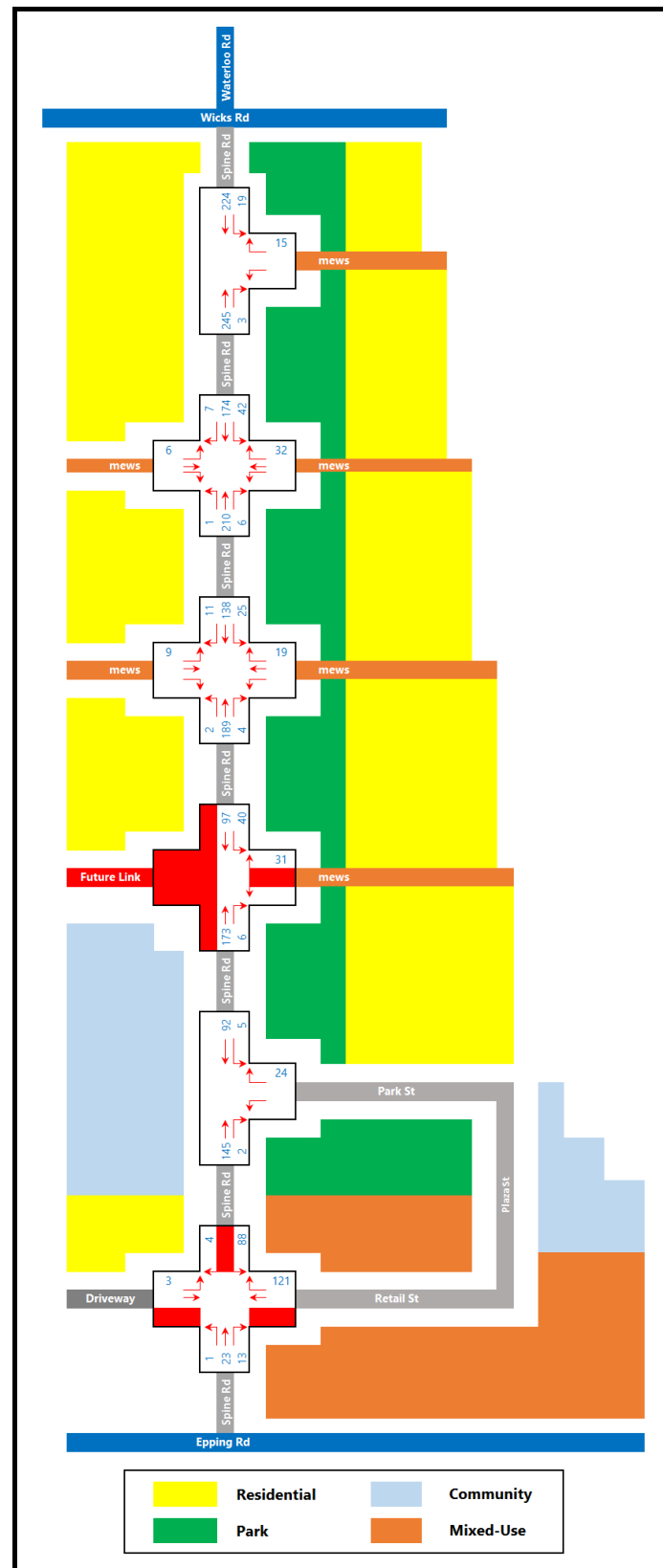


Figure 4.4.2 M2 Site Internal Traffic Flows PM Peak Hour



The M2 Site internal intersections have been tested using the SIDRA model, which provides key performance indicators such as Level of Service; average and worst approach delays; and degree of saturation (capacity). **The results of the SIDRA modelling confirm that: -**

- **All internal intersections operate at a good level of service “A”**
- **All internal intersections operate with very minimal average and worst approach delays**
- **All internal intersections operate with significant spare capacity**

With reference to the trip distribution figures above, ARC notes the potential (indeed certainty) for “internal trips”, i.e. trips from [for example] one of the residential super-blocks to [for example] the *Mixed-Use Precinct*; this would generate more turning movements at the internal intersections. However, even with these additional movements, SIDRA sensitivity modelling indicates that the M2 Site internal intersections will continue to operate at a very high level across the day.

5 Pedestrian & Cycle Accessibility

The pedestrian and cycle infrastructure provided in the SSDA is essentially the same as that provided in the TMAP (and as indicated in the NRSP DCP). Much of this infrastructure is provided to fulfil the requirements of the PTFP (see **Appendix B**).

5.1 Shared Bridge M2 Site to Station Sites

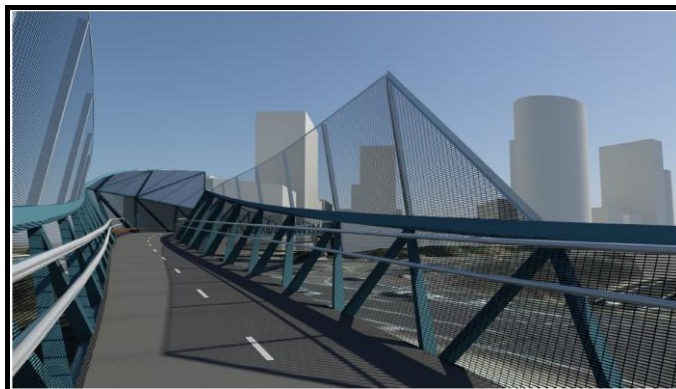
The SSDA provision of a new pedestrian, cycle and disabled accessible Shared Bridge over Delhi Road and the M2 linking the M2 Site with the Station Sites is perhaps the most significant piece of infrastructure for the entire NRSUAP, as it provides the essential pedestrian/cycle connectivity between the M2 Site and North Ryde Rail Station. Indicative designs for the Shared Bridge are shown in the figures below.

Figure 5.1.1 Indicative Shared Bridge Design



Source: ARUP

Figure 5.1.2 Indicative Shared Bridge Deck Design



Source: ARUP

5.2 Spine Road Connectivity

As described in **Section 4.2.1**, the Spine Road, Linear Park, Park Street, Central Park, Plaza Street and Plaza will together provide for shared paths/environments from Wicks Road through to the Shared Bridge. The provision of these shared paths along the central M2 Site axis provides the most efficient and direct path to Wicks Road and Waterloo Road; to the *Mixed-Use Precinct*; and to the Shared Bridge connection to the Station Sites.

5.3 External Pedestrian Paths

The SSDA provides for: -

- A new pedestrian footpath along the northern side of Epping Road, connecting the relocated Epping Road (north) bus stop and Epping Road pedestrian overpass to the Spine Road, and then along Epping Road to Delhi Road.
- A new/upgraded pedestrian path along the eastern side of Wicks Road from Spine Road south to the end of the road widening and drainage works proposed for the Wicks Road & Waterloo Road & Spine Road intersection.

With regard to the future upgrade of the existing Waterloo Road (north) path to a shared path (between Eden Park Drive and Lane Cove Road) the *Infrastructure Schedule (Item10)* of the North Ryde Station Precinct Finalisation Report (NRSP Finalisation Report) provides the following: -

Construction of sections of the active transport spine that extend beyond the precinct would require funding from relevant developers on an apportionment basis, or be delivered by UGNSW, with potential local contributions levy offset to be negotiated with Council.

Waterloo Road already provides a shared path along the northern side of the road between Lane Cove Road and Eden Park Drive, and then on the southern side of Waterloo Road between Eden Park Drive and Wicks Road. Notwithstanding, the provision of a continuous shared path along Waterloo Road (north) linking to the Waterloo Road (north) shared path to the west (to Macquarie University); and the Spine Road/Linear Park (north) shared path to the east (and then through the Station Sites to Riverside Corporate Park) would essentially complete the MATS.

More information in regard to the MATS is provided in the PTFP (**Appendix B**).

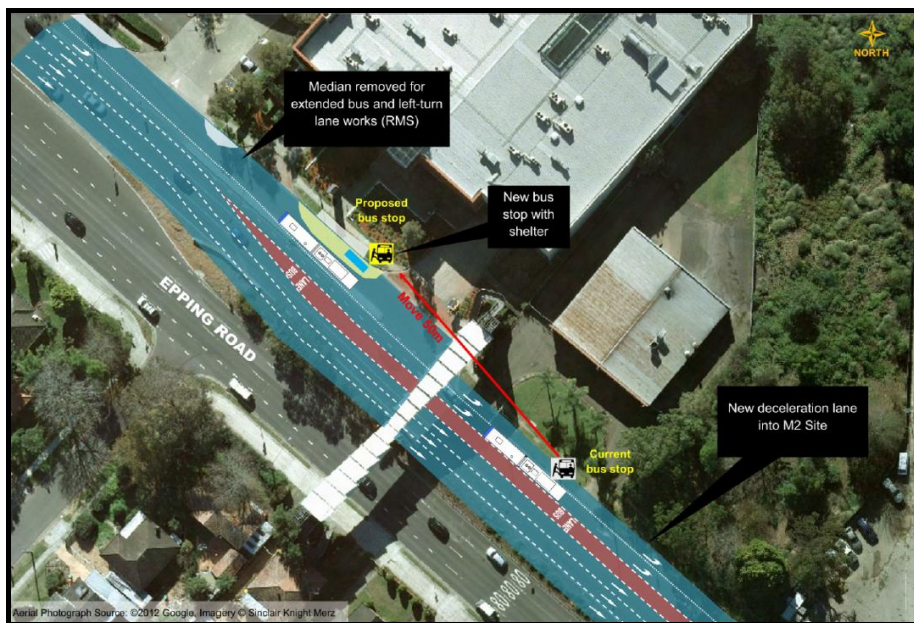
5.4 Pedestrian Crossing Facilities

As part of the SSDA, signalised pedestrian crossings will be provided on all approaches at the intersection of Wicks Road & Waterloo Road & Spine Road. Internally, crossings are provided at key locations in the Spine Road, Park Street and Retail Street, and shared paths extend across each crossover on the Spine Road.

5.5 Epping Road Bus Stop Pedestrian Link

To provide for the short deceleration lane [ingress only] from Epping Road to the Spine Road, the SSDA provides for the relocation of the Epping Road (north) bus-stop from its existing location immediately east of the Epping Road pedestrian overpass, to a new location immediately west of the Epping Road pedestrian overpass (see also **Section 6.2**). This relocation is required so as to appropriately allow for the merge requirements of buses from the [new] kerbside lane across the Delhi Road/M2 turn lane to the dedicated eastbound bus lane, and is shown in **Figure 5.5** below.

Figure 5.5 Epping Road (north) Bus Stop Relocation



Source: TMAP

Along with the relocation, and as detailed in **Section 5.3**, the SSDA provides for the construction of a new footpath between the Spine Road and this new bus stop location.

6 Public Transport

6.1 Public Transport Facilities Plan

The viability of the M2 Site as a site for TOD is largely dependent on residents, employees and visitors utilising the [immediately] available public transport; and being able to access everyday retail, commercial, social and recreation services via walk and cycle trips. These *Objectives* are detailed in Section 3.3 of the NRSP DCP: -

- a. Reduce reliance on private vehicles.*
- b. Maximise use of public transport by future residents and workers, particularly of North Ryde Station and Epping Road bus services.*
- c. Improve facilities for bus users.*
- d. Facilitate easy and safe pedestrian and cycle access to public transport facilities.*

The NRSP DCP Controls relating to these *Objectives* are provided below: -

1. *A Public Transport Facilities Plan is to be prepared for the Precinct identifying the location, design, timing, funding and responsibilities for delivery of key public transport facilities within the Precinct.*
2. *The key public transport facilities are:*
 - a. passenger set-down/pick up and cycle parking at the North Ryde railway station;*
 - b. new bus shelter and facilities at Epping Road inbound stop between Wicks and Delhi Roads;*
 - c. new bus facilities at Epping Road outbound stop at Delhi Road;*
 - d. relocation of bus stop and facilities at Delhi Road eastbound stop at Road 38;*
 - e. completion of the Macquarie University to Macquarie Park North Ryde active transport spine; and*
 - f. Waterloo Road (northern side) shared pedestrian and cycle path.*

In line with the NRSP DCP controls, ARC has prepared a detailed Public Transport Facilities Plan (**Appendix B**) which examines each of these key public transport – and public transport accessibility – measures. With reference to the PTFP: -

- The SSN TIA details the provision of passenger set down and cycle parking facilities to be provided in Station Street as part of the Station Site North *enabling infrastructure works*.
- Funding for bus shelters at the Epping Road (north and south) bus stops adjacent to the Epping Road pedestrian overpass would be provided through a proposed Voluntary Planning Agreement (**VPA**)
- Funding for a bus shelter at the Epping Road (south) bus stop east of Delhi Road would be provided through a proposed VPA.

- With reference to the SSN TIA, revised TMAP modelling in regard to the intersections adjacent to the Station Site North concludes that the relocation of the Delhi Road intersection as proposed in the TMAP is no longer required.
- The SSDA provides for the implementation of all M2 Site related Macquarie Active Spine infrastructure, specifically including: -
 - Signalised pedestrian crossings at the intersection of Wicks Road & Waterloo Road & Spine Road
 - Continuous pedestrian and cycle paths between Wicks Road and the Shared Bridge
 - The construction of the Shared Bridge between the M2 Site and the Station Sites.
- With reference to the SSN TIA, UGNSW as developers of the Station Site North have committed to the provision of a shared path linking the Shared Bridge to the Riverside Corporate Park, to be constructed as part of the *enabling infrastructure works* for the Station Site North.
- With reference to the NRSP Finalisation Report, a Waterloo Road (north) shared path between Eden Park Drive and Wick Road will be constructed further to future [likely Section 94] contributions from developers of land outside of the M2 Site.

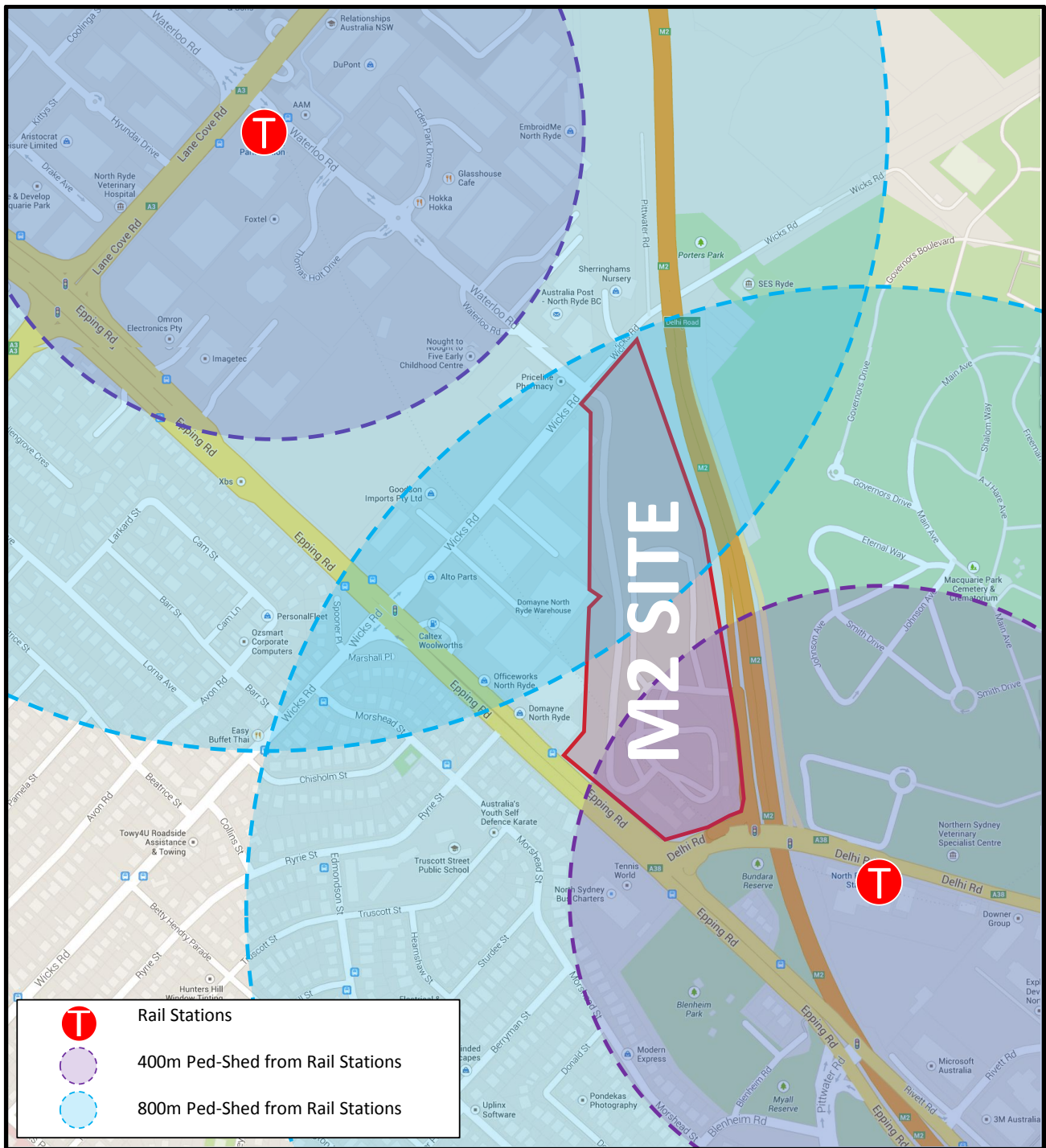
The provision of these public transport facility enhancements, paired with the extensive pedestrian and cycle infrastructure to be provided through and beyond the NRSUAP) will provide for the completion of the entire MATS between Macquarie University and the Riverside Corporate in line with the PTFP requirements, and therefore maximise pedestrian and cycle connectivity to, through and from the NRSUAP.

Full details of these proposals are provided in the PTFP in **Appendix B**.

6.2 Rail Services

6.2.1 Rail Accessibility

As described in the TMAP, all parts of the M2 Site lie within 800m walking distance of either North Ryde Rail Station or Macquarie Park Rail Station, the equivalent of a 10 minute walk. Approximately 40% of the M2 Site – including the *Mixed-Use Precinct* – lies within 400m of North Ryde Rail Station, the equivalent of a 5 minute walk. The Rail Station catchment across the M2 Site is essentially identical to the catchment determined in the TMAP, and is shown in **Figure 6.2.1**.

Figure 6.2.1 Rail Accessibility

Source: ARC and Google Maps

As indicated in **Figure 6.2.1**, the northern portion of the M2 Site – which will be predominantly residential – has relatively equal access to both stations; given that the stations provide identical services, the choice of which rail station to use will be largely personal for those in the northern portion of the M2 Site.

6.2.2 Rail Services

The rail services available at the stations are essentially unchanged from those described in the TMAP, with both stations served by Northern Line trains linking between Chatswood and Epping; and in turn providing access to the broader metropolitan rail network, with key connections direct to Chatswood and the Sydney CBD; and to Hornsby. Table 4.7 of the TMAP shows the number of peak hour services and operating hours for North Ryde Station (again essentially identical to those at Macquarie Park Station) and is reproduced below.

Table 6.2.2 North Ryde Station Rail Services

Line	Direction	AM peak hour services	PM peak hour services	Daily services	Weekday operating hours (from North Ryde)
Northern Line	To City	4	4	67	5.11–23.12
	To Epping	4	4	70	5.47–12.21 (next morning)

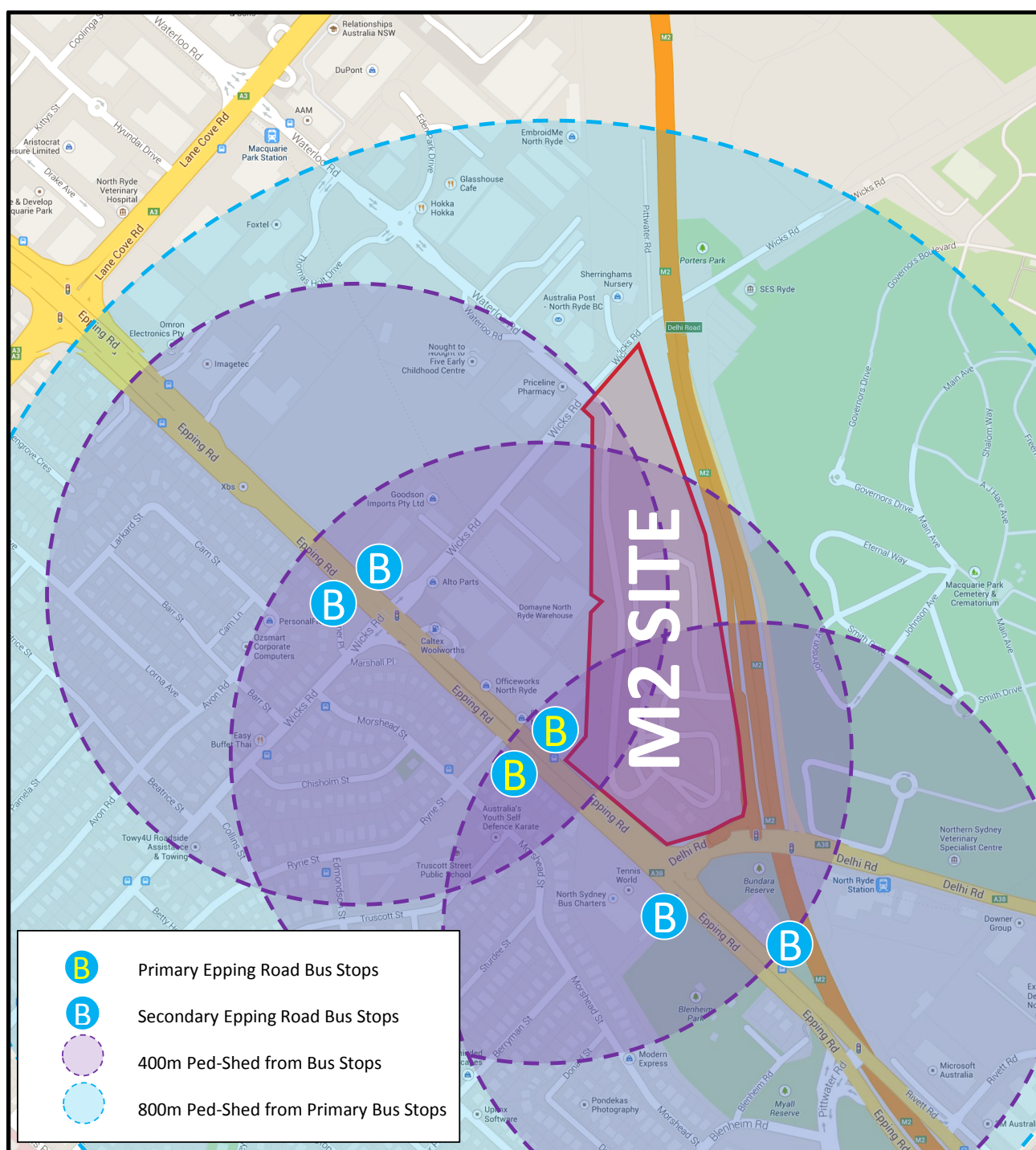
Source: TMAP

A review of current (2014) Sydney Trains timetables (www.sydneytrains.info) shows essentially identical services to those shown in **Table 6.2.2**, with both stations serviced every 15 minutes across the day to Chatswood (and then the Sydney CBD) and to Epping (and then Hornsby).

6.3 Bus Services

6.3.1 Bus Accessibility

As described in the TMAP, all parts of the M2 Site lie within 800m walking distance of bus stops in either Epping Road, Delhi Road or Waterloo Road, again the equivalent of a 10 minute walk. Almost the entire M2 Site lies within 400m of the relocated [see **Section 5.1.5**] bus stops in Epping Road, the equivalent of a 5 minute walk. The bus stop catchment across the M2 Site is essentially identical to the catchment determined in the TMAP and is shown in in **Figure 6.3.1**.

Figure 6.3.1 Bus Stop Accessibility

Source: ARC and Google Maps

6.3.2 Bus Services

The bus services available along the various route corridors around the M2 Site remains essentially unchanged from those described in the TMAP, including bus routes, peak services and operating hours. Table 4.9 of the TMAP is reproduced below.

Table 6.3.2 Bus Services

Origin and Destination	Operator	AM peak frequency	Off peak frequency	PM peak frequency
140 ⁽²⁾ – Epping to Manly via Macquarie	STA	2 trips	-	2 trips
286 ⁽²⁾ – Denistone East to Milsons Point via Pacific Highway	STA	30 min	-	30 min
287 – Ryde to Milsons Point via Pacific Highway	STA	15–30 min	-	30 min
288 – Epping to City via Macquarie	STA	7.5 min	15 min	8.5 min
290 – Epping to City via St Leonards	STA	20 min	30 min	20 min
292 – Marsfield to City via Epping	STA	15 min	30 min	12 min
293 ⁽²⁾ – Marsfield to City via freeway	STA	12 min	-	20 min
294 ⁽²⁾ – Epping to City via St Leonards	STA	10 min	-	1 trip
297 ⁽²⁾ – Denistone East to City via North Ryde	STA	7 trips	-	20 min
533 – Sydney Olympic Park and Chatswood via Ryde	STA	15 min ⁽¹⁾	-	20 min ⁽¹⁾
534 – Ryde to Chatswood via North Ryde	STA	15 min ⁽¹⁾	40 min	15 min ⁽¹⁾
545 – Parramatta to Chatswood via Macquarie	STA	10 min	15 min	10 min
550 ⁽²⁾ – Chatswood to Parramatta via Eastwood	STA	-	-	4 trips
610 – Rouse Hill to City via Castle Hill	Hillsbus	30 min	30 min	20 min
612 ⁽²⁾ – Riley T-way Station to Milsons Point via St Leonards	Hillsbus	7.5 min	-	10 min
613 ⁽²⁾ – Bella Vista to City via M2	Hillsbus	3 trips	-	5 trips
614 ⁽²⁾ – Bella Vista to City via Winston Hills	Hillsbus	8 trips	-	20 min
615 ⁽²⁾ – Riley T-way Station to City via Baulkham Hills	Hillsbus	5 trips	-	4 trips
616 ⁽²⁾ – Rouse Hill to City via Stanhope Gardens	Hillsbus	4 trips	-	5 trips
618 ⁽²⁾ – Bella Vista to City via Baulkham Hills	Hillsbus	15 min	-	20–30 min
620 ⁽²⁾ – Dural to City via Cherrybrook	Hillsbus	2 trips	-	-
621 – Castle Hill to City via Macquarie Park	Hillsbus	30 min	60 min	30 min
622 ⁽²⁾ – Dural to Millers Point via Cherrybrook	Hillsbus	20 min	-	30 min
642 ⁽²⁾ – Round Corner to City via West Pennant Hills	Hillsbus	30–40 min	60 min	40 min
650 ⁽²⁾ – West Pennant Hills Valley to City via M2	Hillsbus	1 trip	-	1 trip
651 – Castle Hill to City via Macquarie	Hillsbus	30 min	60 min	30 min
653 ⁽²⁾ – West Pennant Hills to Milsons Point via North Sydney	Hillsbus	20 min	-	30 min

Source: www.131500.com.au, accessed 26/07/2011

(1) Route 533 and 534 operate in opposite directions along similar route in the peak periods

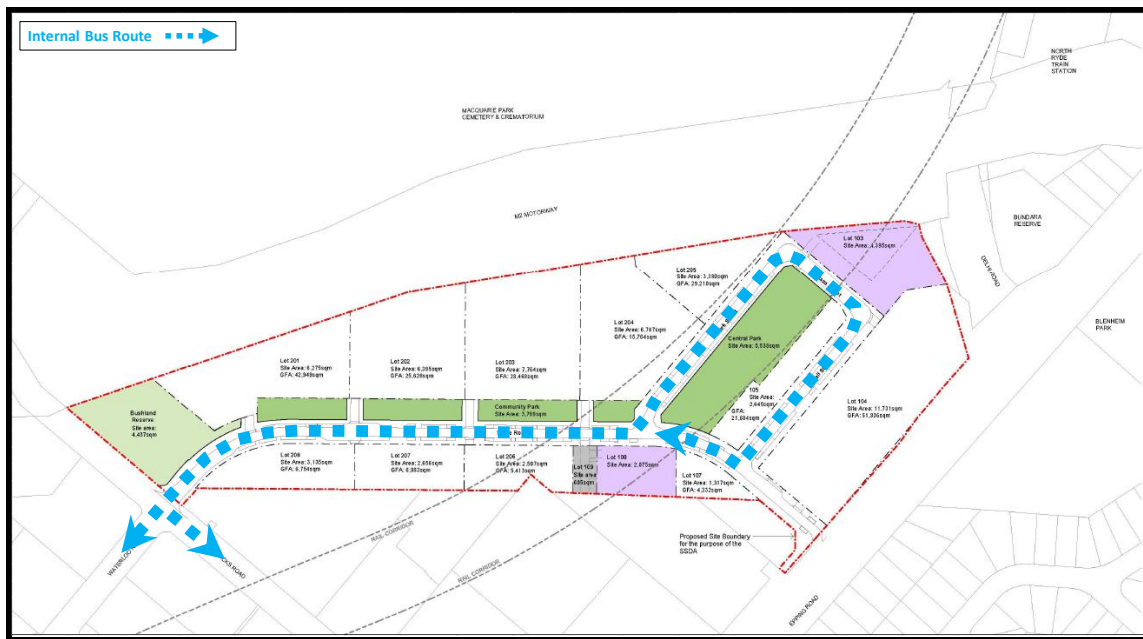
(2) Route operates in peak direction only. Limited stops on Epping Road

Source: TMAP

A review of current (2014) Sydney Buses routes and timetables (www.sydneybuses.info 2014) shows essentially identical services to those shown in **Table 6.2.2**, though ARC notes that the Hillsbus routes operating along the M2 are not realistically available to the M2 Site.

6.3.3 M2 Site Internal Bus Services

As described in Section 7.4.4 of the TMAP, the potential exists for the extension of a bus service (or services) through the M2 Site, and the road network described in **Section 4** specifically provides for such, with a route anticipated along the Spine Road, Park Street, Plaza Street and Retail Street, then returning via Spine Road to the Wicks Road/Waterloo Road intersection. This route is shown in **Figure 6.3.3**.

Figure 6.3.3 M2 Site Internal Bus Route

The operation of future bus services will require consultation with bus companies further to the super-lot DA process.

7 Parking & Servicing

7.1 Parking Management Strategy

ARC has prepared a detailed Parking Management Strategy (**Appendix C**) which inherently builds on the pedestrian, cycle and public transport opportunities as detailed above – and specifically on the achievable means by which to reduce car dependency for those living, working and visiting the M2 Site. With reference to the PMS: -

- The immediate proximity to the available public transport services afforded by the M2 Site is the key means by which to reduce traffic and parking demands – essentially to provide sustainable travel practices. As discussed in sections above, the SSDA will provide from the outset essential pedestrian and cycle infrastructure across the M2 Site, and specifically the key links to North Ryde Rail Station, Macquarie Rail Station and high frequency bus services in Epping Road.
- The fundamental provision of parking spaces at lower rates (see **Section 7.2** below) than for standard development in and of itself reduces car trips – if parking is not made available on-site, then residents, workers and visitors must utilise non-car travel.
- Concurrently, parking controls can be introduced to prevent the potential use of off-site parking, particularly in regard to the Macquarie Cemetery and Wicks Road.
- Concurrently, restrictions to on-street parking within the M2 Site (see **Section 7.3** below) prohibit the potential for commuter parking while still providing for short term parking demands across the M2 Site.
- Some 32 car share spaces are to be provided across the M2 Site, including spaces through both the *High Density Retail Precinct* and the *Mixed-Use Precinct*.
- Carpooling opportunities – particular for M2 Site workers – are excellent, and would ideally be supported by future employers offering parking incentives for carpooling workers.
- General employee incentive opportunities are excellent, and would ideally be supported by future employers offering public transport travel benefits as opposed to car based travel incentives. Employers are already likely to support such initiatives simply by choosing the M2 Site in the first instance.
- Travel access guides would be an essential means by which to provide residents, workers and visitors details of public transport, walk and cycle opportunities, and would necessarily be provided as part of the super-lot DA process.

Full details of these proposals are provided in the PMS in **Appendix C**.

7.2 NRSP DCP Parking Rates

As discussed in the TMAP, the M2 Site (and broader NRSUAP) has been specifically designed with reference to TOD principles. It is important to note that there are few 'new' sites within the Sydney metropolitan area that could offer the same potential for significantly reduced vehicle trips, specifically given: -

- Proximity to a rail station with high frequency services
- Proximity to a major bus corridor and local bus services
- Proximity to internal and external social, commercial, retail and recreational services
- A high standard internal and external pedestrian and cycle network

Having identified this accessibility, the NRSP DCP provides parking rates which reflect these TOD principles. [Restrictive] parking rates are provided for each land use type proposed for the M2 Site, and importantly are consistent with the parking rates that underlay the traffic generation forecasts provided in the TMAP. The NRSP DCP parking rates are shown in **Table 7.2**, and detailed further below.

Table 7.2 **NRSP DCP Parking Rates**

Use	Maximum Parking Rate
Commercial	1 space per 90sqm GFA
Retail	1 space per 100sqm GFA
Supermarket	1 space per 60sqm GFA
Residential	1 space per 1, 2 or 3 bedroom dwelling 0 space per studio 1 space per 10 dwellings for visitor parking
Community	1 space per 100sqm GFA
Student housing and serviced apartments	1 space per 5 bedrooms

Source: NRSP DCP

7.2.1 Residential Units

Based on the development of 2,373 residential units (all of which would provide at least 1 bedroom) the total residential unit parking required for the M2 Site would be: -

- 2,373 parking spaces allocated at 1 space per unit
- 238 parking spaces allocated to visitors
- **A total of 2,611 residential parking spaces.**

Briefly – and with reference to the traffic assessment provided in **Section 3** – reference to the RMS Guide Update provides an AM peak hour trips rate of 0.15 vehicle trips *per parking space*, and a PM peak hour trip rate of 0.12 vehicle trips *per parking space*.

A general application of these rates to the 2,611 parking spaces required for the M2 Site suggests a residential trip generation of some 390 vph in the AM and 315 vph in the PM; these are flows commensurate – **but indeed lower** – than those calculated in **Section 3**, which in our opinion reinforces the validity of the [residential] traffic forecasts in **Section 3**, and also reflects the potential for ‘maximum’ parking rates to achieve traffic flow reductions as surveyed by the RMS.

7.2.2 Commercial

Based on the development of 10,000m² GFA of commercial space, the total commercial parking required for the M2 Site would be 111 parking spaces. Like the Sydney CBD, the commercial rate of 1 space per 90m² inherently restricts car driver potential – simply, there are not enough parking spaces available to commercial employees to provide for the ‘standard’ car mode model, and with no spaces realistically available in the local area, public transport, pedestrian and cycle trips must instead be generated.

7.2.3 Retail

Based on the development of 3,500m² GFA of retail space, the total retail parking required for the M2 Site would be 35 parking spaces. The inclusion of a small supermarket would require additional parking (at 1 space per 60m²).

The majority of retail trips are likely to constitute residential trips within the M2 Site, i.e. the [moderate number of] trips where a resident might require a car to carry goods (for example the weekly shopping).

7.2.4 Community Space

Based on the development of 1,500m² GFA of community space, the total community space parking required for the M2 Site would be 15 parking spaces.

7.2.5 M2 Site Parking Total

In total, the M2 Site would require some 2,770 parking spaces, an increase of approximately 100 spaces over the IMAP estimate. This results from the amended land use mix described in **Section 2.2.1**, and specifically the increase in residential units which have higher net parking requirements than commercial and retail floorspace. Notwithstanding, the peak traffic generation of residential parking spaces is lower in net terms than commercial and retail floorspace, and therefore – as described in **Section 3** – the traffic generation arising from the amended land use mix is lower than the IMAP forecast.

A summary of all M2 Site parking requirements is provided in **Table 7.2.5**. More information in regard to bicycle parking is provided in **Section 7.4**, and more information in regard to car share spaces is provided in the Parking Management Strategy (**Appendix C**).

Table 7.2.5 M2 Site Parking Requirements

Super-Lot	Estimated Units per Super-lot	Commercial, Retail or Community m2 GFA	Car parking per NRSP DCP	Bicycle parking per Ryde DCP	Car Share Spaces
Lot 201	490		539	204	6
Lot 202	294		324	123	4
Lot 203	325		357	135	4
Lot 204	180		198	75	2
Lot 205	333		366	139	4
Lot 206	62		68	26	1
Lot 207	80		88	33	1
Lot 208	87		96	36	1
Lot 103		1500	15		
Lot 104	254		279	106	3
Lot104		10000	111	63	2
Lot 104		3500	35	19	1
Lot 105	219		241	91	3
Lot 107	50		55	21	1
TOTAL			2771	1071	32

7.3 Off-Street Parking & Servicing

The future design of access ramps, parking and servicing areas will necessarily be provided in accordance with access and parking *Objectives* and *Controls* within the NRSP DCP: -

Objectives

- Integrate adequate car parking, access and servicing without compromising street character, landscape or pedestrian amenity and safety.*
- Encourage the active use of street frontages.*
- Ensure that vehicle crossings over footpaths minimise disruption to pedestrian movement and do not threaten safety.*
- Make vehicle access to buildings compatible with the public domain.*
- Ensure vehicle entry points are integrated into building design and contribute to high quality architecture.*

Controls

- Design of driveway crossings is to be in accordance with Part 8.3 of Ryde DCP 2010.*
- Driveway widths/grades, vehicular ramp width/grades and passing bays are to be in accordance with the relevant Australian Standard.*

- c. *The location and design of access ways to underground parking is to consider residential amenity particularly the location of doors and windows of habitable rooms.*
- d. *Potential pedestrian/vehicle conflict is to be minimised by:*
 1. *providing vehicle access from minor or secondary streets rather than primary streets or streets with major pedestrian activity, where practicable;*
 2. *limiting the width and number of vehicle access points - generally one crossing per lot will be permitted and where practicable, adjoining buildings may share or amalgamate vehicle access points;*
 3. *ensuring clear sight lines at pedestrian and vehicle crossings;*
 4. *utilising traffic calming devices;*
 5. *separating and clearly distinguishing between pedestrian and vehicular accessways; and*
 6. *all vehicles must be able to enter and leave the site in a forward direction.*
- e. *The appearance of car parking and service entries is to be improved by:*
 - a. *minimising the size, quantity and visual intrusion of vehicle access points;*
 - b. *locating or screening garbage collection, loading and servicing areas visually away from the street;*
 - c. *setting back or recessing car park entries from the main façade line;*
 - d. *avoiding black holes in the façade by providing security doors to car park entries;*
 - e. *where doors are not provided, it is to be ensured that the visible interior of the car park is incorporated into the façade design and material selection and that building services pipes and ducts are concealed;*
 - f. *returning the façade material into the car park entry recess for the extent visible from the street as a minimum; and*
 - g. *avoiding ramping vehicular access along boundary alignments edging the public domain and streets.*

While the design of the individual super-lots may provide different types of access that still meet the *Objectives* and *Controls* of NRSP DCP, at this time it is envisioned that: -

- For the majority of super-lots, vehicle access to underground parking will be provided by driveways from the **mews** which intersect with the Spine Road.
- For a small number of [lower generating] super-lots, driveway access is provided to the Spine Road.
- The design of the internal road network establishes a requirement for on-site servicing for each super-lot, i.e. **all future waste and service vehicle areas would be provided off-street within each super-lot**. The design of service areas would necessarily reference Ryde DCP (as required in the NRSP DCP) and the relevant Australian Standards and be detailed as part of the future super-lot DA process.
- The potential exists for a future community facility adjacent to the Future Link Road; such a facility would require access to either the Spine Road or the Future Link Road. An assessment of the most appropriate access location – taking into account driveway demand etc – would necessarily be provided as part of a future DA.

7.4 On-Street Parking

The on-street parking provided by the SSDA road network is not significantly different to the parking 'provided' with reference to the TMAP internal road network.

On-street parking provides for short term demands through the M2 Site, but also encourages the active use of street frontages; provides passive calming (speed reduction); and provides a buffer between footpath activities and traffic movements. It is also important to local businesses to have available immediate [short term] parking.

On-street parking will be allocated in the same manner as recommended in the TMAP, to include: -

- Disabled parking – 3% to comply with Ryde DCP.
- On-street car share spaces (see **PMS, Appendix C**).
- Loading zones within the retail/commercial area to provide for short stay deliveries and the like; these spaces would revert to general parking outside of business hours to facilitate visits to the adjacent retail and mixed-use precinct.
- Short-stay parking would be located within the commercial and retail areas (likely Park Street and Retail Street) and provide a mixture of 1 hour and 2 hour limit parking. At this time it is envisaged that the suggested time limits provided in the TMAP - 7.00am to 7.00pm Monday to Friday; and 8.30am to 12.30pm on Saturday - would be implemented.
- In order to limit the potential for [all day] commuter parking through the remainder of the M2 Site, a 4 hour limit (7.00am to 7.00pm Monday to Friday) is proposed. This would still provide for [almost all] residential, commercial, retail and community demand.

The final designation of on-street parking zones around the M2 Site will be determined further to consultation with Council.

7.4 Bicycle Parking

Bicycle parking requirements are outlined in the Ryde DCP, and summarised below: -

- **Residential**
 - Resident minimum 1 space per 3 units
 - Visitor minimum 1 space per 12 units
- **Commercial**
 - Employee minimum 1 space per 200m² GFA

- Visitor minimum 1 space per 750m² GFA
- **Retail**
 - Employees minimum 1 space per 300m² floor area
 - Shoppers minimum 1 space per 500m² floor area

With reference to **Table 7.2.5** above, the M2 Site would require some 1,070 bicycle parking spaces.

The provision of an appropriate level of bicycle parking is essential to provide for and encourage cycle use; while secure storage areas will be required for all M2 super-lots, it is recommended that commercial and community facilities also provide showers and change rooms so that cycling becomes a viable alternative for residents and employees of the M2 Site.

8 Construction

This section provides a preliminary response to the DGRs relating to construction traffic impacts (as per **Section 1**). These details may change further to the ongoing design and construction process, and to the appointment of a demolition and construction contractor (**D&C Contractor**).

8.1 Construction Hours

While requiring confirmation with reference to D&C Contractor proposals, and to environment factors (such as noise amenity) the following work hours are expected: -

- Monday to Friday 7.00am to 6.00pm
- Saturday 8.00am to 3.00pm
- No work would be undertaken on Sundays and public holidays

With reference to some of the key pieces of infrastructure provided for in the SSDA – and specifically the construction of the two M2 Site interface intersections and the Shared Bridge - there is a high probability that out of [traffic] hours work will be required so as not to significantly impact the sub-regional road network. Any such work would be subject to a separate application, and include a work specific Construction Traffic Management Plan (**CTMP**) that would necessarily be required as a condition of insurance on any construction certificate.

8.2 Construction Vehicle Access

8.2.1 Site Access

All M2 Site construction access will be via the intersection of Wicks Road & Waterloo Road (& Spine Road), the same access point as currently being utilised by workers on the M2 Motorway Widening Project (**M2 Project**) who park across the M2 Site.

8.2.2 Construction Vehicle Routes

The determination of construction vehicle (i.e. heavy vehicle) travel routes reduces the potential impacts on residential areas, and limits such vehicles to roads expressly designed to carry them. While acknowledging that final routes will only be determined further to the appointment of the D&C Contractor, **Figure 8.2.2** provides a summary of the routes most appropriate to travel by construction vehicles, and those from which construction vehicles would ideally be prohibited.

Figure 8.2.2 Construction Vehicle Routes

Source: Google

The construction vehicle access routes outlined in **Figure 8.2.2** would also be appropriate for the movement of low loaders and vehicles carrying wide loads, such as for the delivery and collection of demolition and construction equipment and materials. While it will be the responsibility of the D&C Contractor to arrange for Road Occupancy Licences (**ROL**) for these movements, such trips would ideally occur outside of peak periods, and indeed outside of general business hours (i.e. they would occur late at night or early in the morning).

Finally, vehicles carrying hazardous materials would necessarily be required to travel along designated routes, and would be prohibited from travelling via the Lane Cove Tunnel as per current NSW Road Rules.

8.3 Construction Traffic Generation

Construction traffic will include both light (staff) and heavy vehicles throughout the construction process. UGNSW has provided ARC with estimates in regard to peak construction demands; this information (in regard to the M2 Site) is also provided in the SSN TIA, as the expectation of UGNSW is that both the M2 Site and Station Site North will be developed concurrently.

8.3.1 M2 Site Construction Staff Vehicles

It is estimated that during the peak period of construction some 120 construction staff would be employed (across the two Sites); the M2 Site is estimated to employ up to 80 construction staff during peak construction periods.

While counter to the underlying principles of the NRSP, it is nonetheless acknowledged that the majority of construction staff are expected to drive to and from the Sites, potentially with little car sharing; this is simply a product of construction staff who necessarily need to transport heavy equipment and the like to and from a construction site. As such, a worst case scenario would have all construction staff travelling to and from the M2 Site each day in separate vehicles, i.e. generating some 80 vph prior to the existing AM Commuter Peak (i.e. before 7:00am); and 80 vph after the existing PM Commuter Peak (i.e. after 6:00pm).

8.3.2 M2 Site Construction Heavy Vehicles

Construction vehicles would include tipper trucks, semi-trailers and ready-mix (concrete) trucks. In addition, truck & dog combinations will be used for the removal of spoil, and special vehicles would deliver construction plant and bridge erection equipment. To the extent possible, specific construction plant will be installed on-site so as to reduce the demand for daily construction vehicle generation.

During peak demolition and construction periods, it is estimated that the M2 Site and Station Site could together require approximately 70 construction vehicles per day, or some 140 construction vehicle trips per day.

8.4 Construction Impacts

8.4.1 Traffic Impacts

As discussed, the M2 Site is currently being utilised as a staging post for the M2 Project. Based on information provided by UGNSW to ARC, it is estimated that the M2 Project employs over 750 construction staff, and that at least half of those staff park on the M2 Site.

Given that the M2 Project has similar work hours to the M2 Site construction hours, the M2 Project would therefore currently generate some 350 vph prior to the AM peak hour and following the PM peak hour, as well as construction vehicles throughout the day. These trips are generated to the intersection of Wicks Road & Waterloo Road (via a M2 Project construction access point essentially aligning with the future Spine Road).

As such, the M2 Site construction vehicle trip generation would represent a significant reduction from the traffic currently generated by the M2 Project, and indeed would represent minor percentage of the traffic generated by the future occupied M2 Site, and as such traffic impacts in the adjacent road network would likely be significantly reduced from current levels. Notwithstanding, potential impacts would necessarily be reviewed in the CTMP once detailed M2 Site construction trip generation is determined.

8.4.2 General Impacts

More broadly, the potential exists for some key construction tasks to impact on pedestrians and cyclists, particularly through the construction of the Shared Bridge. However, in this case - and indeed wherever pedestrians or cyclists were impacted by M2 Site construction works - the D&C Contractor would be required to prepare appropriate *Traffic Control Plans* to minimise such impacts; these would include the clear designation of alternative travel paths; the potential use of traffic controllers; and – as discussed above – the construction of key pieces of infrastructure outside of peak periods.

The M2 Site construction is not expected to have any impact on public transport services, with the construction of the Shared Bridge (and Station Site North) expected to retain access to North Ryde Rail Station from Delhi Road. Bus services in Epping Road would also continue to operate through the construction of the key Epping Road pedestrian and bus stop infrastructure.

Finally, very minimal impacts to emergency vehicles are expected through the M2 Site construction; should potential impacts arise – for example through the construction of the Shared Bridge - the D&C Contractor would directly inform emergency services in regard to any possible delays/detours that might be in place.

8.5 Construction Parking

All construction staff and construction vehicle parking will be contained within the M2 Site for the duration of the demolition and construction period; no parking will be generated to the adjacent parking environment by the M2 Site construction, nor will construction vehicles be allowed to 'rest' with the adjacent road network, but rather proceed directly to the M2 Site.

8.6 Construction Traffic Management Plans

As stated, a detailed CTMP(s) will be prepared further to the commission of the D&C Contractor and the finalisation of the construction schedule (and therefore staff and construction vehicle demands). The CTMP will necessarily detail the following: -

- Construction schedule, including a breakdown to peak demolition/construction phases
- Construction staff numbers during across all demolition/construction phases
- Construction vehicle numbers during across all demolition/construction phases
- Construction vehicle travel routes, including routes to be used by oversized vehicles and vehicles carrying hazardous materials
- Traffic and parking management strategies to minimise impacts to the local traffic, pedestrian and cyclist environment
- Traffic management plans for key demolition/construction phases, including (but not limited to) the following: -
 - The construction/upgrade of the intersection of Wicks Road & Waterloo Road & Spine Road
 - The construction of the intersection of Epping Road & Spine Road
 - The construction of the Shared Bridge

9 Conclusions

Further to a detailed assessment of the traffic and transport characteristics of the SSDA, ARC provides the following conclusions.

9.1 Site Access

Vehicular access to the M2 Site is provided in accordance with the NRSP DCP, and will provide the same level of vehicular accessibility as determined in the 2012 TMAP. Further to significant drainage works at the intersection of Wicks Road & Waterloo Road & Spine Road, emergency vehicle access can be provided from this intersection and as such there will be no emergency or other access to the M2 Site from the M2 Delhi Road on-ramp.

9.2 Traffic Impact Assessment

9.2.1 M2 Site Trip (all modes) Generation

The amended land use mix upon which the SSDA is based results in a significant reduction in the M2 Site total (all mode) trip generation compared to the TMAP forecast. The amended land use mix provides the following trip outcomes: -

- Daily trips are reduced from approximately 25,900 trips forecast in the TMAP to approximately 21,200 trips
- AM peak hour trips are reduced from approximately 2,600 forecast in the TMAP to approximately 2,050 trips
- PM peak hour trips are reduced from approximately 3,200 forecast in the TMAP to approximately 1,950 trips

9.2.2 M2 Site Vehicle Trip Generation

The amended land use mix results in a significant reduction in the M2 Site vehicle trip generation compared to the TMAP forecast. The amended land use mix provides the following vehicle trip generation outcomes: -

- Daily trips are reduced from approximately 8,400 trips forecast in the TMAP to approximately 6,800 trips.
- AM peak hour trips are reduced from approximately 760 trips forecast in the TMAP to approximately 620 trips.
- PM peak hour trips are reduced from the approximately trips forecast in the TMAP to approximately 540 trips.

9.2.3 Road Network Performance

The TMAP Review assessment of the amended land use mix (and a broader amended land use mix across the NRSUAP) concludes: -

While the intersections modelled are still forecast to be under substantial pressure, the results indicate that the impact of the development on the road network will be substantially reduced.

More broadly, the TMAP Review details improved intersection performance [when compared to the TMAP forecasts] at all key intersections.

While it is acknowledged that the local traffic environment will in the future remain under pressure, given these improved road network performance outcomes when compared to the TMAP it must be concluded that the SSDA is supportable in regard to traffic impacts.

9.2.4 Intersection Upgrades & Funding

In accordance with the NRSP DCP and the TMAP, the SSDA provides for the construction of both M2 Site interface intersections. Funding and scheduling for external intersection upgrades will be determined in an identical manner to that recommended in the TMAP.

9.3 Pedestrian and cycle access

Pedestrian and cycle infrastructure for the M2 Site is proposed in accordance with the NRSP DCP, and specifically to fulfil the requirements of the PTFP.

Primary pedestrian and cycle infrastructure through the M2 Site will be provided by the Spine Road; the Linear Park; Park Street; the Central Park; Plaza Street; and the Plaza, which connects to the Shared Bridge and thence the North Ryde Station Sites.

The SSDA provides the external infrastructure required with regard to the MATS. Along with the M2 Site internal infrastructure and the Shared Bridge, the SSDA also provides for the installation of signalised pedestrian crossings at the intersection of Wicks Road & Waterloo Road & Spine Road.

With reference to the NRSP Finalisation Report, future M2 Site developer contributions will facilitate the upgrade of the Waterloo Road (north) existing path to a shared path between Eden Park Drive and Wicks Road.

With reference to the SSN TIA, it is proposed that a shared path along Delhi Road, and a shared path across Road 38, will be constructed as part of the Station Site North *enabling infrastructure works* and thereby provide shared access paths between the Shared Bridge and the Riverside Corporate Park.

The provision of this extensive pedestrian and cycle infrastructure through and beyond the NRSUAP will provide for the completion of the entire MATS between Macquarie University and the Riverside Corporate in line with the PTFP requirements, and therefore maximise pedestrian and cycle connectivity to, through and from the NRSUAP.

9.4 Public Transport

Further to the above, public transport infrastructure for the M2 Site is proposed in accordance with the NRSP DCP, and specifically to fulfil the requirements of the PTFP.

Key pedestrian and cycle connections to North Ryde Station (rail and bus services) and Waterloo Road (rail and bus services) will be constructed as part of the SSDA. Additionally, a new pedestrian path will link to the Epping Road (north) bus stop, which will be relocated to the immediate west of the Epping Road pedestrian overpass to provide for the Epping Road ingress lane to Spine Road.

Additional public transport infrastructure will be provided under a proposed VPA, including funding for the provision of bus shelters at the Epping Road (north and south) bus stops adjacent to the Epping Road pedestrian overpass; and for the provision of a bus shelter at the Epping Road (south) bus stop east of Delhi Road.

The provision of this public transport infrastructure in line with the PTFP requirements will significantly enhance key public transport facilities external to the M2 Site.

9.5 Parking

9.5.1 Parking Management Strategy

A range of Parking Management Strategies are proposed as part of the SSDA to ensure that the M2 Site promotes TOD, not least of which are the immediate access to high frequency public transport services; significant pedestrian and cycle infrastructure provisions; and intentionally restrictive parking rates for all land uses. In addition, the Parking Management Strategy proposes: -

- The designation of time restricted on-street parking throughout the M2 Site, with time limits appropriate to the adjacent land use.
- The introduction of measures to prohibit NRSUAP parking extending into the adjacent Macquarie Park Cemetery
- The designation of more than 30 "car share" spaces across the M2 Site
- The development of a *Travel Access Guide* as part of the Development Application process for each super-lot

9.5.2 Parking and Servicing Requirements

With reference to parking rates provided in the NRSP DCP, the M2 Site would require some 2,770 parking spaces, an increase of approximately 100 parking spaces over the TMAP forecast. Notwithstanding, the increase in required parking does not result in an increase in daily or peak period traffic generation.

With reference to Ryde DCP, bicycle parking requirements remain virtually unchanged, with a requirement for some 1,100 bicycle parking spaces across the M2 Site.

Specific vehicle and bicycle parking requirements, and service vehicle access and set down requirements, will require determination as part of future Development Applications for each super-lot, and would necessarily be provided in accordance with the parking and servicing requirements outlined in the NRSP DCP and the Ryde DCP.

9.6 Construction

All demolition and construction works will require the preparation of a Construction Traffic Management Plan, specifically detailing key construction traffic management issues such as vehicle [and general construction] operating hours, routes and volumes; construction staff access and parking; and Traffic Controls Plans to safely and efficiently manage both construction staff and the public. The details of the construction task will be finalised further to the commission of a construction contractor.

More broadly, the demolition and construction task is estimated to employ up to 120 people on the M2 Site; this represents less than half the M2 Widening Project construction staff currently utilising the M2 Site for parking, and only a minor percentage of the future vehicle trip generation of the developed M2 Site. As such, it is expected that the M2 Site demolition and construction works will have significant lower impacts on the road network than the M2 Widening Project or the future developed M2 Site.

Following our assessment of the key issues associated with the SSDA, ARC Traffic + Transport has concluded that the SSDA is supportable from a traffic and transport perspective.