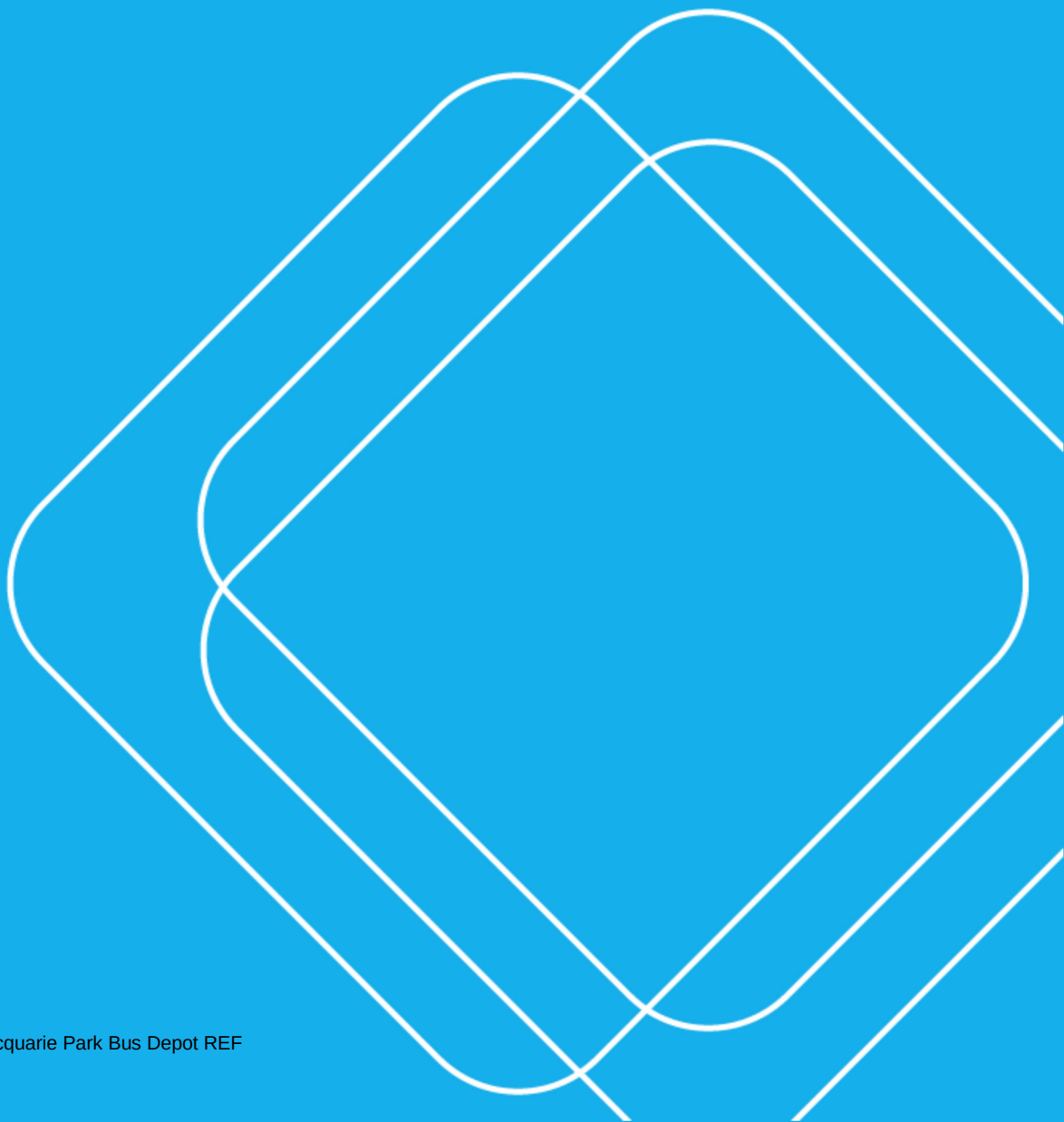
SCT Consulting

ZERO EMISSION BUSES MACQUARIE PARK BUS DEPOT

Traffic and Transport Assessment

18 APRIL 2024



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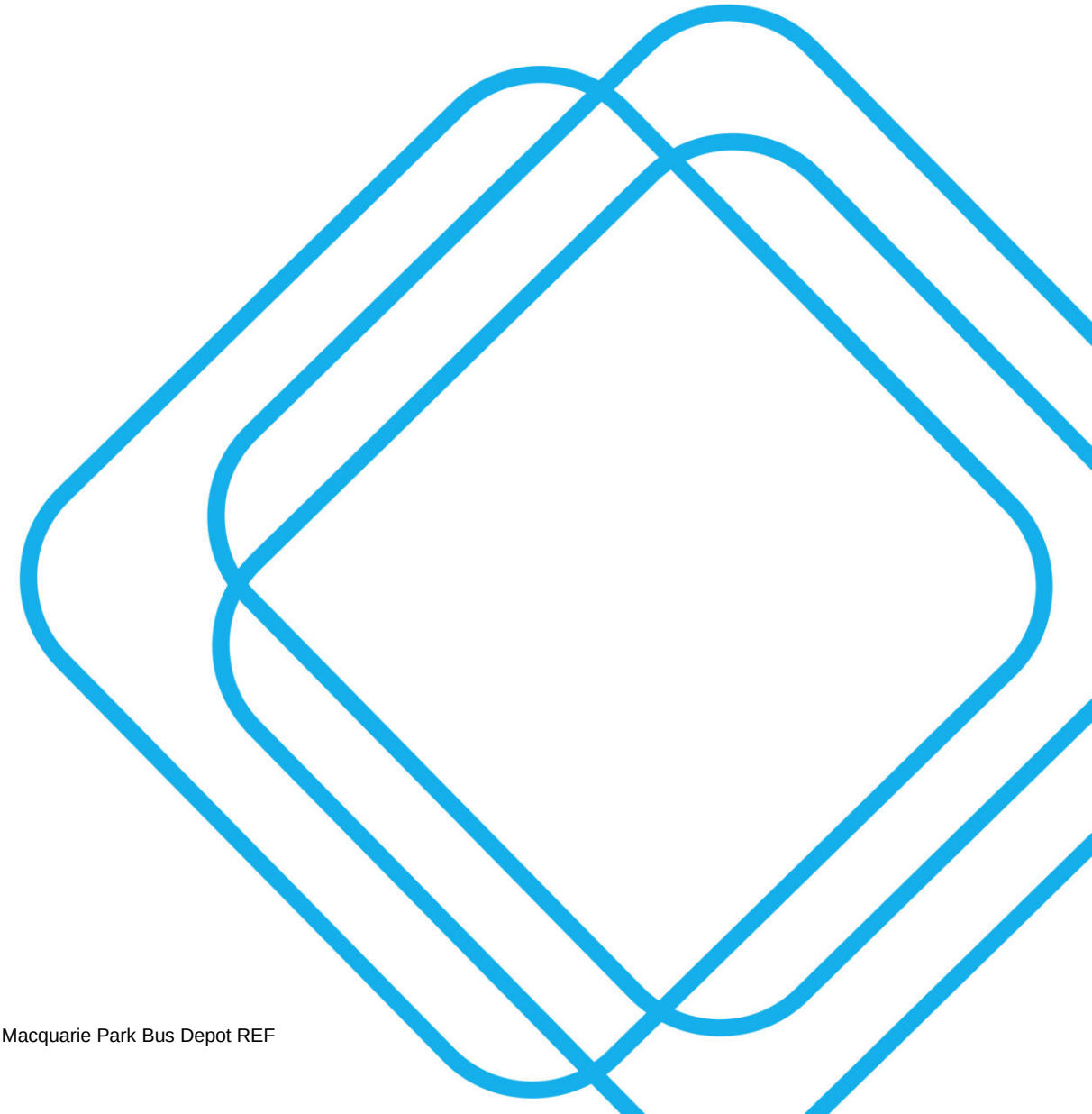
We pay our respects to Elders past, present and emerging.



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Executive Summary

Background

The NSW Government is committed to reaching net zero emissions by 2050, and to provide more comfortable journeys and liveable places for passengers and communities. The Zero Emission Buses (ZEB) Macquarie Park Bus Depot project is a multi-billion dollar program that will transition NSW's 8,000 plus diesel and natural gas public transport buses bus fleet from internal combustion engine (ICE) to zero emissions technology vehicles. As part of the first stage of the transition, 11 existing bus depots will be upgraded to support the new fleet and a new bus depot will be built in Macquarie Park.

SCT Consulting has been engaged by AtkinsRéalis to prepare this Traffic and Transport Assessment to assess the traffic and transport impacts of the proposed ZEB Macquarie Park Bus Depot to support the Review of Environment Factors for the Proposal.

Existing conditions

The depot site is located in Macquarie Park in the Ryde City Council LGA, about 16 kilometres northwest of Sydney CBD and 14 kilometres northeast of Parramatta CBD. Macquarie Park is a strategic centre with businesses, innovation, research, and education facilities and is undergoing a major transformation, catalysed by the Sydney Metro.

The site is located within the Macquarie Park Innovation Precinct, which is the largest non-CBD market in Australia and the fourth largest employment centre in Greater Sydney. It is surrounded by the State Roads: M2 Hills Motorway, Lane Cove Road and Epping Road, as well as Talavera Road and Wicks Road, which is partly regional and partly local.

Journey to Work data shows that people traveling on public transport accounted for about 36 per cent, while car (as driver or passenger) as a mode of transport was 32 per cent. About 17 per cent walked or cycled to work, with only 0.5 per cent of these trips being bicycle users.

The site is surrounded by shared paths, on-road cycle routes and road shoulders (along the M2 Hills Motorway), which provides good cycling access to the regional cycle network and nearby suburbs, such as Chatswood, North Ryde and Epping. A separate bicycle path is also provided along the northern boundary of the site, accessed from Talavera Road and the M2. Some barriers to pedestrian and cycling movements include the heavily trafficked M2 Hills Motorway, Lane Cove Road and Epping Road.

Bus routes run along Lane Cove Road, Waterloo Road, and Talavera Road, with about 70 services per hour in the AM and PM peaks, to the City, Lane Cove, Mona Vale, Chatswood, Ryde, Parramatta, and Hornsby. The Metro North West line between Chatswood and Tallawong serves Macquarie Park Metro Station, about 500m west of the site, with one train every four minutes in the AM and PM peak and every 10 minutes in the off-peak service the station.

Intersection performance was assessed for the Waterloo Road / Halifax Road / Wicks Road intersection because the Proposal is expected to have the highest impact on this intersection in the future. It currently performs at a Level of Service (LoS) B and with acceptable delays and Degree of Saturation (DoS) in both the AM and PM peak hours.

The Proposal

Key features of the proposal would include:

– Building new facilities to support future bus operations including:

- a single-level underground staff and visitor car park accommodating up to 163 cars including accessible parking spaces, car share spaces, electric vehicle spaces with charging equipment and bike storage options
- a multilevel administration office featuring a wide selection of office spaces and staff facilities including end of trip facilities, a first aid room, social breakout and gaming rooms, and an outdoor rooftop garden
- a bus maintenance facility accommodating up to 30 staff and featuring a spray booth, inspection pits and a multilevel staff facility including an outdoor BBQ area, a kitchen and toilet facilities
- a designated bus wash bay with washing and water recycling equipment.

- Removal of the existing one-way bike path connection between the M2 Motorway and Talavera Road to make way for the new bus maintenance facility
- Delivering up to 165 bus parking spaces including:
  - 129 charging bays for 12.5 metre standard rigid buses
  - 22 charging bays for 19 metre articulated buses
  - 14 maintenance bays
- One breakdown bay
- One bus wash bay
- Installation of gantries to facilitate the preferred bus arrangement and charging structure
- Installation of standard 75kW and fast 150kW plug-in chargers for buses around the depot
- Upgrading Pittwater Road to enable two-way bus access to and from the bus depot
- Essential fire services such as hydrant and sprinkler system, a fire control room and pump building, smoke detection and warning systems, hardstand area for one fire truck, portable fire extinguishers and fire blankets
- Installation of new pedestrian crossing and footpaths, security booths, fencing and lighting.

The site will have bus access from Pittwater Road and staff car park access from Talavera Road.

Operational traffic impact assessment

The bus movement peaks do not align with the traffic network peaks, which limits the impact of the Proposal on the surrounding road network. Overall, the impact on the surrounding network is minimal with intersection LoS and congestion hotspots remaining the same as in the Do Nothing case. Key findings included:

- There is significant queueing at the Wicks Road / Waterloo Road intersection during the PM peak hour. A mitigation scenario was run to test an option to replace the filter right turn from Wicks Road southbound into Waterloo Road with an additional right turn arrow phase.
- The results of the mitigation option to the Wicks Road / Waterloo Road intersection were inconclusive as there was an improvement in the AM peak but a deterioration in the PM peak. It is recommended that a road safety review be undertaken of this intersection to test the following potential mitigation options to accommodate the additional bus movements:
  - Addition of a green arrow right turn phase from Wicks Road southbound into Waterloo Road.
  - Some terminating bus services will use Halifax Street and turn right at Wicks Road to access the depot. This movement will require a new “Buses Excepted” sign applied to the existing “No Right Turn” sign from Halifax Street to Wicks Road.
- As highlighted in the Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024), the Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal.
- The alignment of the bike path between Talavera Road and the M2 Hills Motorway crosses into the footprint of the proposed underground carpark and the current design includes the removal of this path. Transport for NSW (Transport) is having ongoing discussions about the potential relocation of the cycle path with Ryde Council and Transurban. Because of the removal, future cycling access configurations to the site may need to be considered.
- No upgrades to the public transport network are expected to be required.

Construction activities

it is anticipated that the site construction duration for the ZEB Macquarie Park Bus Depot would be around 15-21 months, based on the building and civil works being undertaken concurrently. Given most of the works for the project are constrained to within the site boundaries rather than on public roads, it is anticipated that works will occur during the standard hours of work only. Some exceptions for out of hours works are however permitted.

Construction site access for heavy and light vehicles will be:

- Primary construction access for the works from Pittwater Road, with limited access from Talavera Road.

– Access needs to be maintained from Pittwater Road through the site to the footprint of the underground carpark, administration building and maintenance facility to limit the use of Talavera Road by construction vehicles.

Construction workers accessing the site should be encouraged to use public transport to travel to and from the site, given its proximity to Metro and bus services. Parking on site could however be accommodated within some of the earthworks areas as they progress. It could also be accommodated within the verge of Pittwater Road. If it were not possible for the primary site facilities to be located on site, then an off-site facility would need to be sourced. This is anticipated to need to provide 15 spaces for staff and supervisor parking and 40 spaces for workforce parking.

Construction impacts assessment

Construction activities are expected to generate 66 vehicle trips in the AM and PM peak hours. Intersection performance results indicate that these vehicles would have a negligible impact on the Waterloo Road / Halifax Road / Wick Road intersection, which is forecast to still perform at LoS B in the AM and PM peak hours.

The following mitigation measures may be required:

– Management of the high voltage power supply upgrade at Waterloo Road and Lane Cove Road (night works) which will involve lane closures and the reinstatement of open trenches and pits at the end of each shift.

– The proposed driveway entrance to the underground car park may require modifications to the existing driveway entrance at 1 Talavera Road, which could entail some minor works to the kerb crossing at the driveway.

– Minor trenching works may be required on either Talavera Road or Wicks Road to complete service and utility connections (to be confirmed). This could be completed under single-lane shuttle-flow conditions.

– Signage may however be required along Wicks Road near Pittwater Road and along Lane Cove Road, near Talavera Road, to manage any impact on the pedestrian and cycling network.

– The alignment of the bike path between Talavera Road and the M2 Hills Motorway crosses into the footprint of the proposed underground carpark and will need to be removed. Management of cyclists needs to be considered, by the installation of appropriate signage and alternative routes.

– If temporary removal of on-street parking is required, for construction vehicle parking along Wicks Road, the approval of a work zone by Council may need be required.

– The Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal. Wicks Road services the NSW State Emergency Service Ryde Unit and Ryde Resource Recovery Centre, so access for emergency vehicles must always be maintained.

A detailed Construction Traffic Management Plan (CTMP), which will include a construction traffic control plan, will be prepared separate from this report at a later stage. This will be done before the commencement of construction and per the *Traffic Control at Work Sites Technical Manual (Transport, 2022)*.

The CTMP will address the overall traffic management of the site during the construction phase, including provision for vehicular and pedestrian access, parking for construction vehicles and appropriate wayfinding. The vehicular movements and expected routes to and from the site will also be further quantified and defined.

Conclusion

Based on the Transport and Traffic Assessment undertaken for the proposed ZEB Macquarie Park Bus Depot, the existing transport network and parking situation surrounding the site can accommodate the operation of the Proposal as well as the construction phase, with the implementation of the proposed transport and traffic solutions and mitigation measures.

1.0 Introduction

1.1 Background

The NSW Government is committed to reaching net zero emissions by 2050, and to provide more comfortable journeys and liveable places for passengers and communities. The transport sector has been identified as a large contributor to emissions in NSW, of which Transport for NSW (Transport) bus operations are a significant component. The ZEB Macquarie Park Bus Depot project is a multi-billion dollar program that will transition NSW's 8,000 plus diesel and natural gas public transport buses bus fleet from internal combustion engine (ICE) to zero emissions technology vehicles.

The first stage of the transition began in 2023 and will introduce 1,200 new electric buses for Greater Sydney customers by 2028. As part of the first stage, 11 existing bus depots will be upgraded to support the new fleet, and a new bus depot will be built in Macquarie Park (the subject of this report). Along with planned new electric buses and those already in service, 1,700 zero emission buses (ZEBs) are expected to be operating on Sydney roads by the end of 2028.

The conversion of the Region 7 depots (at Willoughby and Ryde) leads to a loss of depot parking capacity due to the reconfiguration of these depots to suit operation of ZEBs. To make up the shortfall of required bus depot parking capacity, it is proposed to construct a new battery electric bus depot at 1A and 1B Talavera Road, Macquarie Park.

SCT Consulting has been engaged by AtkinsRéalis to prepare this assessment of the traffic and transport impacts of the proposed ZEB Macquarie Park Bus Depot to support the Review of Environment Factors (REF) for the introduction of the new depot.

A traffic microsimulation model (AIMSUN) was previously developed for the Macquarie Park Detailed Precinct Transport Study and results of the future operation of the bus depot were reported in the *Greenfield Macquarie Park Zero Emission Bus Depot: Traffic Assessment* (WSP, October 2023). The modelling results were reviewed as part of this Traffic and Transport Assessment and used to assess the road network performance once the depot is operational.

1.2 The site

The site, which is accessed from Pittwater Road and Talavera Road, is located at 1A-B Talavera Road, Macquarie Park in the Ryde Council Local Government Area (LGA) NSW, as shown in **Figure 1-1** and covers the following lots:

– Lot 12 / DP 883750

– Lot 13 / DP 883750

– Lot 25 / DP 232697

– Lot 27 / DP 232964

– Lot 105 / DP 1001474.

1.3 Overview of the proposed Macquarie Park Bus Depot

Key features of the proposal would include:

– Building new facilities to support future bus operations including:

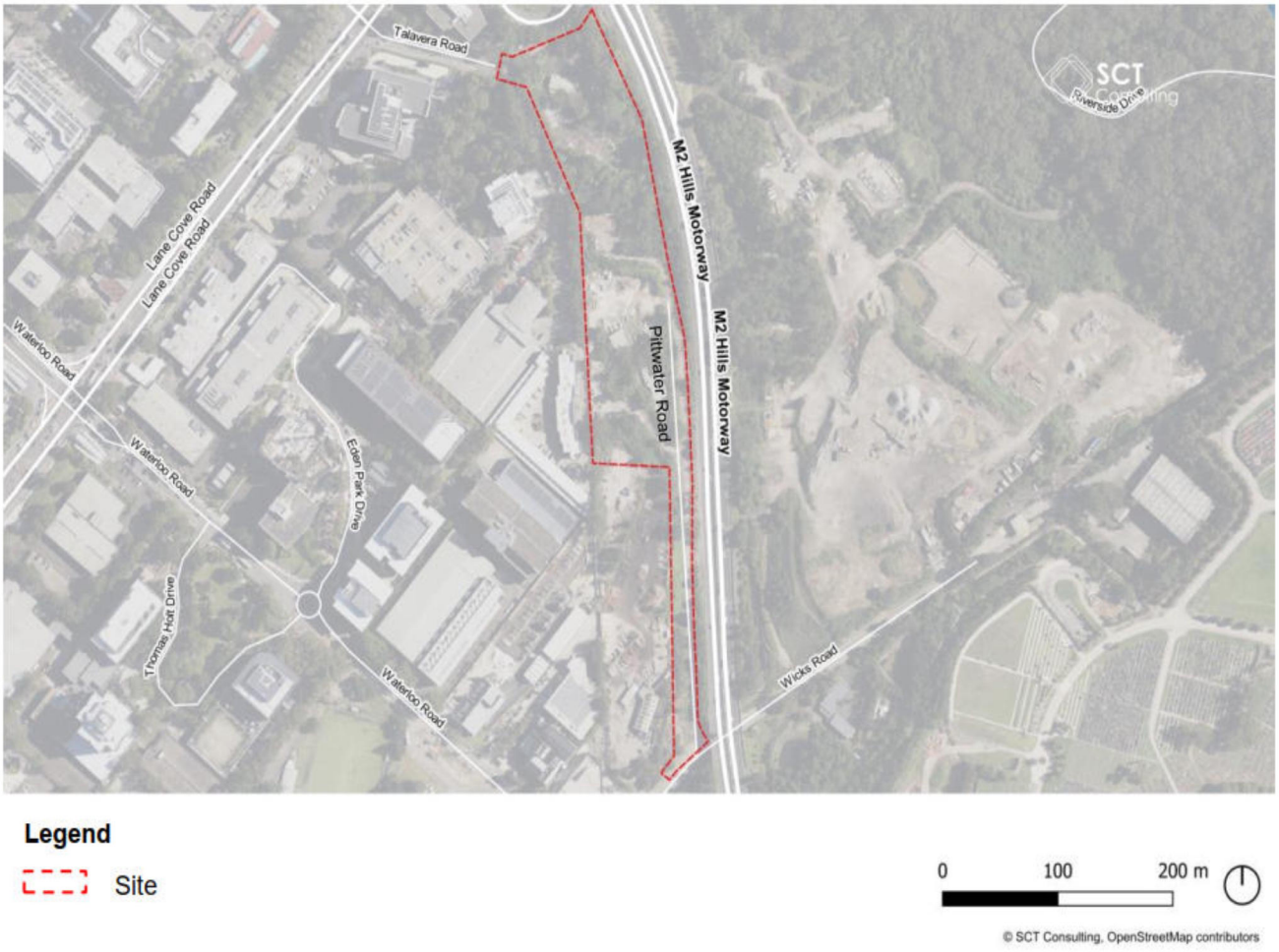
  - a single-level underground staff and visitor car park accommodating up to 163 cars including accessible parking spaces, car share spaces, electric vehicle spaces with charging equipment and bike storage options
  - a multilevel administration office featuring a wide selection of office spaces and staff facilities including end of trip facilities, a first aid room, social breakout and gaming rooms, and an outdoor rooftop garden
  - a bus maintenance facility accommodating up to 30 staff and featuring a spray booth, inspection pits and a multilevel staff facility including an outdoor BBQ area, a kitchen and toilet facilities
  - a designated bus wash bay with washing and water recycling equipment.

– Removal of the existing one-way bike path connection between the M2 Hills Motorway and Talavera Road to make way for the new bus maintenance facility

– Delivering up to 165 bus parking spaces including:
  - 129 charging bays for 12.5 metre standard rigid buses
  - 22 charging bays for 19 metre articulated buses
  - 14 maintenance bays
– One breakdown bay
– One bus wash bay
– Installation of gantries to facilitate the preferred bus arrangement and charging structure
– Installation of standard 75kW and fast 150kW plug-in chargers for buses around the depot
– Upgrading Pittwater Road to enable two-way bus access to and from the bus depot
– Essential fire services such as hydrant and sprinkler system, a fire control room and pump building, smoke detection and warning systems, hardstand area for one fire truck, portable fire extinguishers and fire blankets
– Installation of new pedestrian crossing and footpaths, security booths, fencing and lighting.

Access for buses will be via Pittwater Road in the south, while light vehicles will access the site from Talavera Road in the north.

Figure 1-1 The location of the proposed Macquarie Park Bus Depot (the site)



1.4 Purpose of the report

SCT Consulting has been engaged by AtkinsRéalis to carry out a Traffic and Transport Assessment for the proposed bus depot at Macquarie Park. The assessment includes the following major tasks:

- Review of relevant background documents and information including relevant planning policies, transport planning documents and Council DCP.
- Analysis of existing conditions, including site location and existing traffic, parking, public transport and active transport facilities and conditions.
- Description of depot upgrade proposal, including:
  - Proposed construction activities, working hours, size and type of vehicles, access routes and volumes.
  - Proposed operations trip generation (increase in bus movements) and distribution to the surrounding road network, vehicle, pedestrian and cyclist access to the depot as well as proposed staff parking.
- Analysis of traffic, transport and access impact, including:
  - Construction impacts on active transport access, public transport operations, road network performance, property access and parking activities.
  - Operations impacts on active transport access, public transport operations, road network performance, property access and parking activities.
- Discussion of any mitigation measures that may be required.

1.5 Report structure

The report is structured as follows:

- **Section 2** presents the findings of a background review of relevant documents for the project.
- **Section 3** describes and reviews existing travel conditions surrounding the site. This includes existing travel patterns, vehicular transport, active transport, public transport, access, and on-site parking.
- **Section 4** describes the details of the Proposal including proposed parking supply, access arrangements, trip generation of the Depot once operational and future public and active transport demand.
- **Section 5** describes the construction phase including proposed parking supply, access arrangements, trip generation of construction and staff vehicles, and required works on the surrounding road network.
- **Section 6** assesses the impact of the Proposal once operational. This includes an impact assessment for vehicular traffic, active transport, public transport, parking, and access.
- **Section 7** assesses the impact of the construction activities. This includes an impact assessment for vehicular traffic, active transport, public transport, parking, and access.
- **Section 8** summarises the key findings and presents the conclusion of the report.

2.0 Review of relevant background documentation

2.1 City of Ryde Integrated Transport Strategy 2041

The Integrated Transport Strategy 2041 represents a new direction for the City of Ryde. The Strategy explores the future of local transport and land use, examining the impacts of a growing population and an expanding economy. Both population and employment are expected to increase in the City of Ryde, with population increasing approximately 58 percent from 134,000 (2020) to an estimated 211,500 (2041).

A revised vision for City of Ryde (**Figure 2-1**) is proposed as part of the strategy, being:

'A sustainable, accessible, safe and convenient transport system for a vibrant global city'

Relevant key public transport network policies that support this vision are:

– Public transport efficiently moves passengers to key destinations, within and outside the City of Ryde, using direct, accessible and connected services. Public transport infrastructure is designed to provide a travel time advantage over cars, with equitable service coverage.

– Transport interchanges provide convenient connections between modes and provide the user with a pleasant 'place' experience. Ideally, interchanges are located at activity centres.

– Advocate for public transport changes that support evolving local needs, including routing, service level and infrastructure investment.

The key objectives for planning and operating public transport in City of Ryde are:

– Efficient modal integration occurs at public transport interchanges by reducing interchange times and increasing interchange convenience

– Park and Ride capacity is supported only in centres that have insufficient bus feeder services and poor interchange convenience

– Ensure the bus route network is simple and direct but with significant coverage

– Bus travel times are equal to or less than private vehicle travel times in peak times in key corridors

– Public transport modes are introduced where they can leverage off development growth and help to shape a more sustainable land use form.

– Council supports Transport rapid bus corridor projects:

  - Eastwood to Parramatta rapid bus
  - Macquarie Park to Blacktown rapid bus
  - Macquarie Park to Mona Vale (and Hurstville) rapid bus
  - Parramatta to Sydney CBD via Ryde along Victoria Road rapid bus.

The mode split targets for public and active transport for Macquarie Park are higher than those proposed for Ryde as a whole. The mode split targets for Macquarie Park are:

– Private vehicle to decrease to 40 per cent from 65 per cent.

– Public transport to increase to 45 per cent from 20 per cent

– Active transport to increase to 15 per cent from four per cent.

Figure 2-1 The Integrated Transport Strategy's visionary transport options

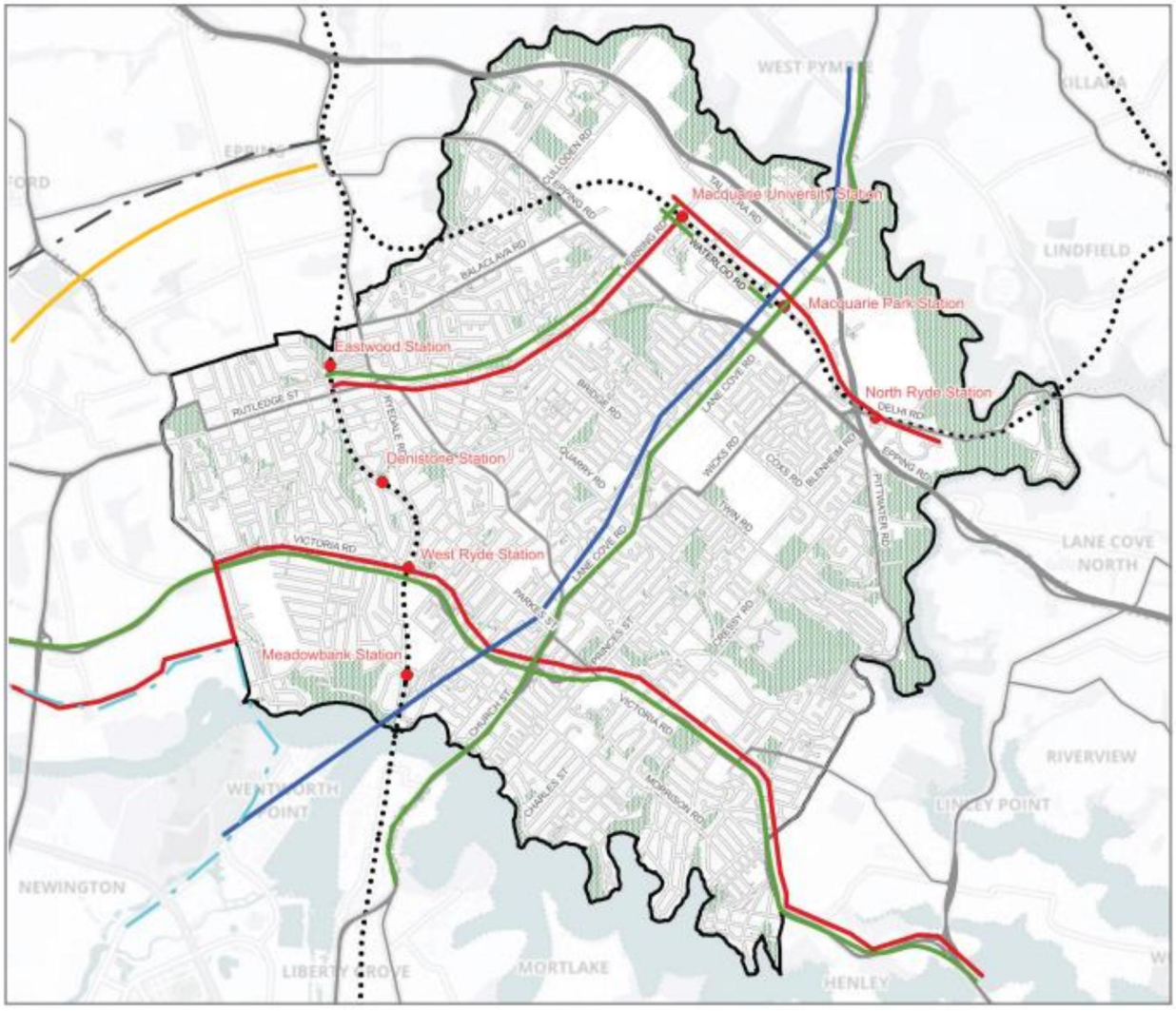


Figure 1

Visionary Transport Options

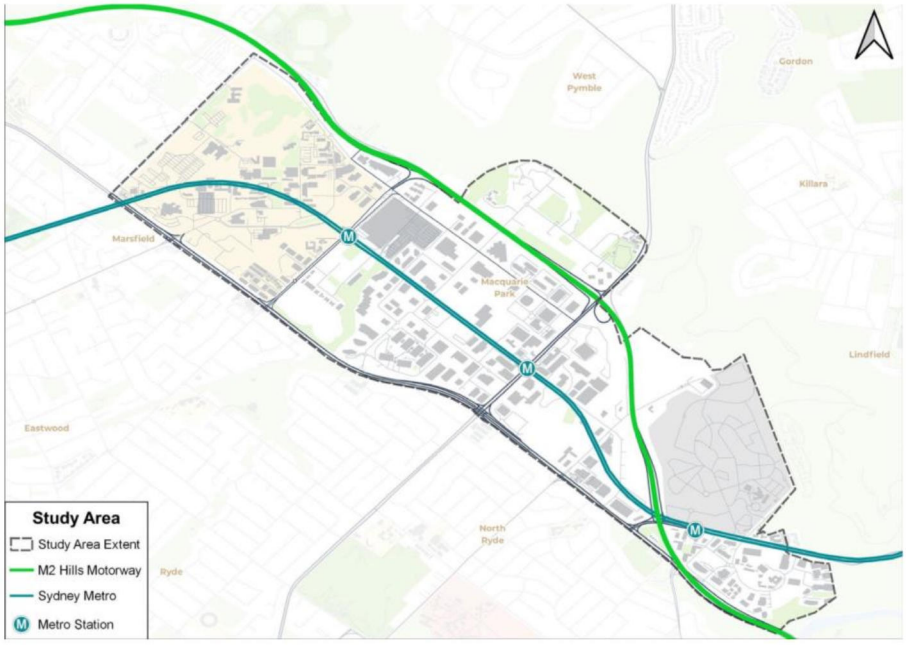
Source: The City of Ryde Integrated Transport Strategy 2041 (City of Ryde Council)

Implication for the ZEB Macquarie Park Bus Depot: The Transport Strategy highlights the importance of improved future public transport networks and services around the Macquarie Park area. It also proposes more ambitious mode share targets for public and active transport in Macquarie Park, compared to the rest of the Ryde LGA.

2.2 Macquarie Park Detailed Precinct Transport Study

Macquarie Park Precinct (**Figure 2-1**) is the fourth largest employment hub in Greater Sydney, fostering world-class businesses, innovation, research and education. It is undergoing a major transformation into a vibrant place for people and business, catalysed by the opening of three Sydney Metro stations. With the area's population growing at four times the Greater Sydney average, the vision for Macquarie Park is to be a successful place for people that puts community and Country at the centre.

Figure 2-2 The Macquarie Park Precinct Study Area



Source: Macquarie Park Detailed Precinct Transport Study (NSW Government, September 2023)

The NSW Government's ambition for Macquarie Park Innovation Precinct (MPIP) includes the addition of 20,000 jobs and 7,650 new homes. This growth is supported by the MPIP Place Strategy (Place Strategy), MPIP Master Plan (Master Plan), and Macquarie Park Strategic Infrastructure and Services Assessment (SISA), which identified 180 initiatives ranging from mass transit to schools, green spaces, and fine grain walking and cycling networks, noting that most of these initiatives are currently unfunded.

The transport vision for Macquarie Park is to:

– Enable successful places for people that connect to Wallumedegal Country, and put the community at the centre, through adaptable transport planning and transport services.

– Enable economic activity through efficient and sustainable goods movement that optimises existing infrastructure.

– Connect our customers' whole lives by providing multi-modal end-to-end journeys.

The key recommendations for transport included:

– Provide additional enhancements to bus priority, and pedestrian access, amenity and safety.

– Implement a holistic approach to drive a shift to public and active transport.

– Develop a fine grain street and pathway network to provide high-quality walking and cycling connections.

– Integrate Connection with Country and women's safety in tandem to acknowledge and connect with Wallumedegal Country, increase walkability; and foster safe, inclusive public spaces and transport systems for everybody.

Implication for the ZEB Macquarie Park Bus Depot: The Transport Strategy highlights the importance of improved future public transport networks and services, around the Macquarie Park area. It also outlines higher mode share targets for public and active transport in Macquarie Park, compared the rest of Ryde LGA.

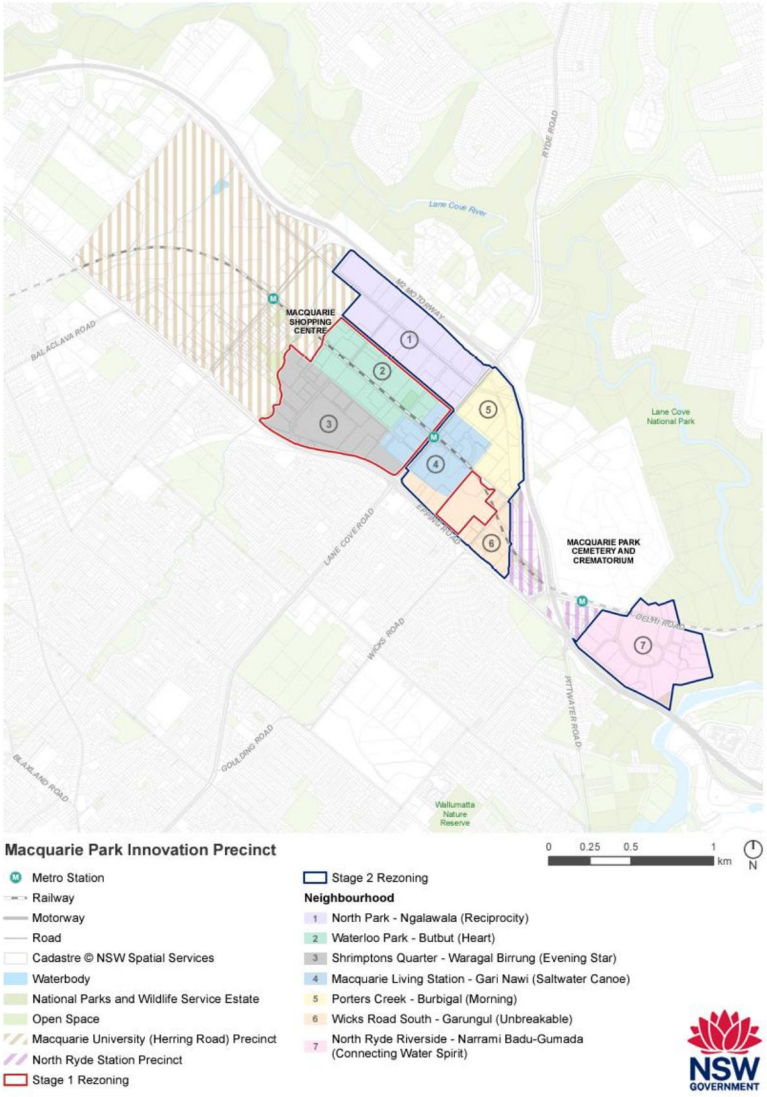
2.3 Macquarie Park Innovation Precinct – Stage 1 Rezoning Proposal

The Macquarie Park Innovation Precinct – Stage 1 Rezoning Proposal, including master plan and proposed new planning controls was on exhibition from 9 November to 10 December 2023. The land included for the rezoning include the site, as seen in **Figure 2-3**.

The Stage 1 rezoning proposal builds on the vision set out in the Macquarie Park Innovation Precinct Place Strategy and Master Plan (which is supported by the Detailed Precinct Transport Study as described in **Section 2.2**), to guide renewal of the Precinct to reach its potential as a world-class place for business, innovation and collaboration.

New planning controls proposed will help deliver improved pedestrian and active transport connections, new public open spaces, while introducing new residential clusters to bring vibrancy and opportunities for more local businesses through after-work entertainment, dining, networking and recreation. Once the review of the feedback period is undertaken, the new planning controls which will help shape the future of Macquarie Park, can be finalised.

Figure 2-3 The Macquarie Park Innovation Precinct



Source: https://pp.planningportal.nsw.gov.au/draftplans/under-consideration/macquarie-park-innovation-precinct-stage-1-rezoning-proposal, March 2024

Implication for the ZEB Macquarie Park Bus Depot: New planning controls proposed as part of the rezoning and improvements such as better pedestrian and active transport connections within the Precinct will apply to the site.

2.4 City of Ryde bicycle strategy and action plan

The City of Ryde Bicycle Strategy 2022 – 2030 aims to encourage and enable more people to safely and efficiently use a bicycle for transport and recreation.

As seen in **Figure 2-4**, cycle routes are planned in the future along the western side of the site, parallel to Pittwater Road and along Lane Cove Road as well as through the site. It should however be noted that future cycle routes through the ZEB Macquarie Park Bus Depot will not be possible.

Figure 2-4 City of Ryde's existing and planned bicycle routes

Source: The City of Ryde Bicycle Strategy 2022 – 2030 (City of Ryde)

Implication for the ZEB Macquarie Park Bus Depot: The presence of existing routes already provides some cycle access to the site. The planned cycle routes in proximity to the site could encourage a further shift towards cycling for future patrons of the site.

2.5 Greenfield Macquarie Park Zero Emission Bus Depot Traffic Assessment

To determine the road network impact and any infrastructure mitigation measures for the operational scenario of the proposed bus depot, an AIMSUN model was used with results presented in the *Greenfield Macquarie Park Zero Emission Bus Depot Traffic Assessment* (WSP, October 2023).

The modelled road network was bounded by Culloden Road in the northwest, Epping Road along the southern boundary and Talavera Road along the northern boundary. All major intersections and selected driveway accesses were included in the modelled road network. The Aimsun models were developed for the AM peak period (7.30 to 9.30am) and PM peak period (4.15 to 5.15pm) along with a 30-minute warm up and cool down period applied either side of the analysis period.

As part of the modelling, the following options were tested:

– **Do Nothing 2031**: Existing conditions road network + background traffic growth

– **Project Case 2031**: Existing conditions road network + background traffic growth + bus access/exit via Pittwater Road only and light vehicle access from Talavera Road only

– **Mitigation Option**: Project case with the replacement of the filter right turn with a right turn arrow phase at the intersection of Wicks Road and Waterloo Road.

The findings of the modelling presented in the report were used in this Traffic and Transport Assessment to assess the operational impact on the road network of the Proposal, and to identify any mitigation measures.

Implication for the ZEB Macquarie Park Bus Depot: The findings of the modelling presented in the Greenfield Traffic Assessment were used to assess the operational impact of the Proposal on the road network, and to identify any mitigation measures, as outlined in **Section 4.0** and **Section 6.0**.

2.6 Macquarie Park Zero Emission Bus Depot 80% Constructability report

The Macquarie Park Zero Emissions Bus Depot 80% Constructability report (Bellwether, January 2024) documents the potential construction methodology for the concept design to ensure the Macquarie Park Zero Emission Bus Depot project can be constructed practically and efficiently.

The Constructability report was reviewed and used as part of this Traffic and Transport Assessment to outline construction stages and duration, proposed hours of work, the site's construction access points and likely heavy and light vehicle movements accessing the site. It also gives an understanding of potential traffic and transport associated issues that may arise during construction, as well as works required on the surrounding road network. These have been used to determine the impact that the construction of the Depot will have for all modes of transport.

Implication for the ZEB Macquarie Park Bus Depot: The details presented in the 80% Constructability report were used to described the construction activities and assess the construction impact of the Proposal, and required mitigation measures throughout construction, as outlined in **Section 5.0** and **Section 7.0**.

3.0 Existing conditions

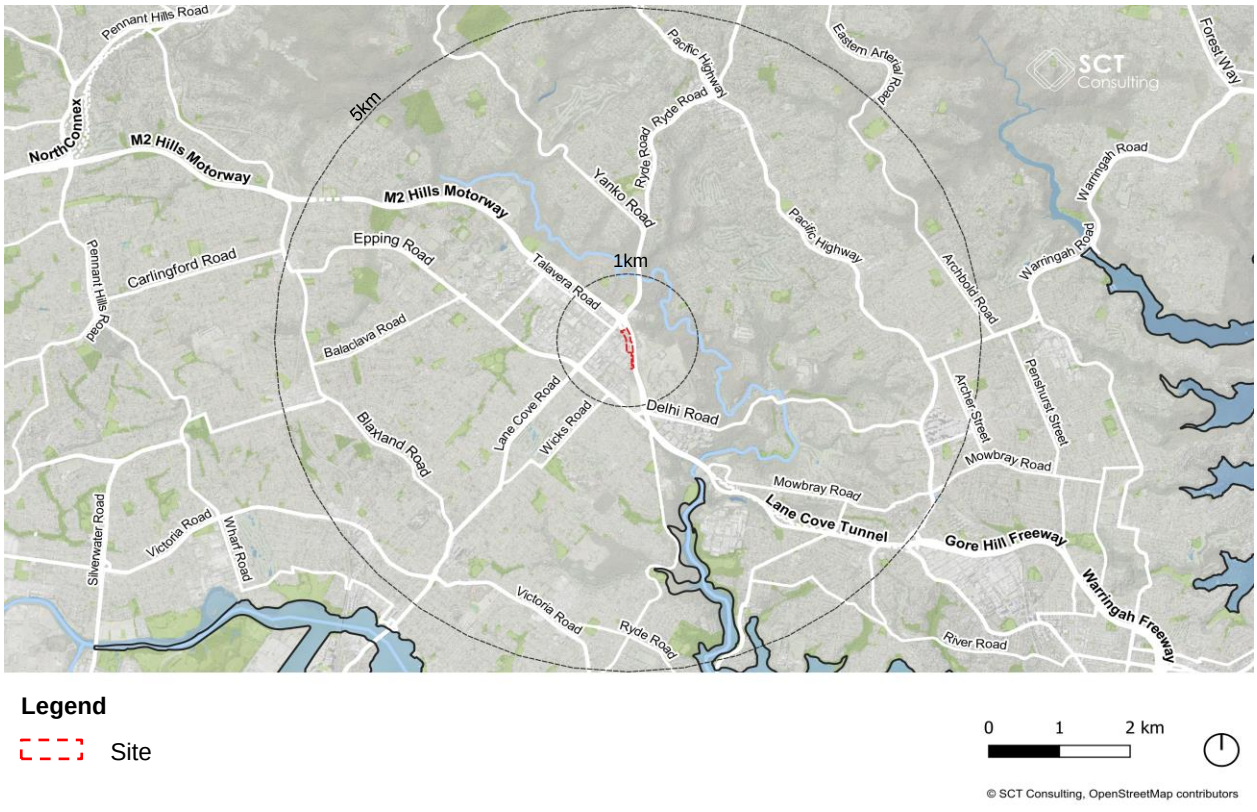
3.1 The site

The site is in the suburb of Macquarie Park in the Ryde City Council LGA, approximately 16 kilometres northwest of Sydney CBD and 14 kilometres northeast of Parramatta CBD. Macquarie Park is a strategic centre with businesses, innovation, research, and education facilities. It is currently undergoing a major transformation into a vibrant place for people and business, catalysed by the opening of Sydney Metro North West. Macquarie Park includes a university (Macquarie University), a shopping centre (Macquarie Centre) and a predominance of commercial development, with some pockets of housing.

The site is located within the Macquarie Park Innovation Precinct (MPIP), which is the largest non-central business district (CBD) market in Australia and the fourth largest employment centre in Greater Sydney. The NSW Government's ambition for MPIP includes 20,000 additional jobs and 7,650 new homes, as outlined in the MPIP Place Strategy and Strategic Master Plan.

The site is surrounded by the State Roads: M2 Hills Motorway, Lane Cove Road and Epping Road, as well as Talavera Road and Wicks Road, which is partly regional and partly local. The site in its regional context is shown in **Figure 3-1**. It is located north of an Australian Native Landscapes supply store and Sherringhams Nursery, with access from Pittwater Road. It is currently occupied by Quickways as a storage site for stockpiles, with a couple of existing on-site buildings.

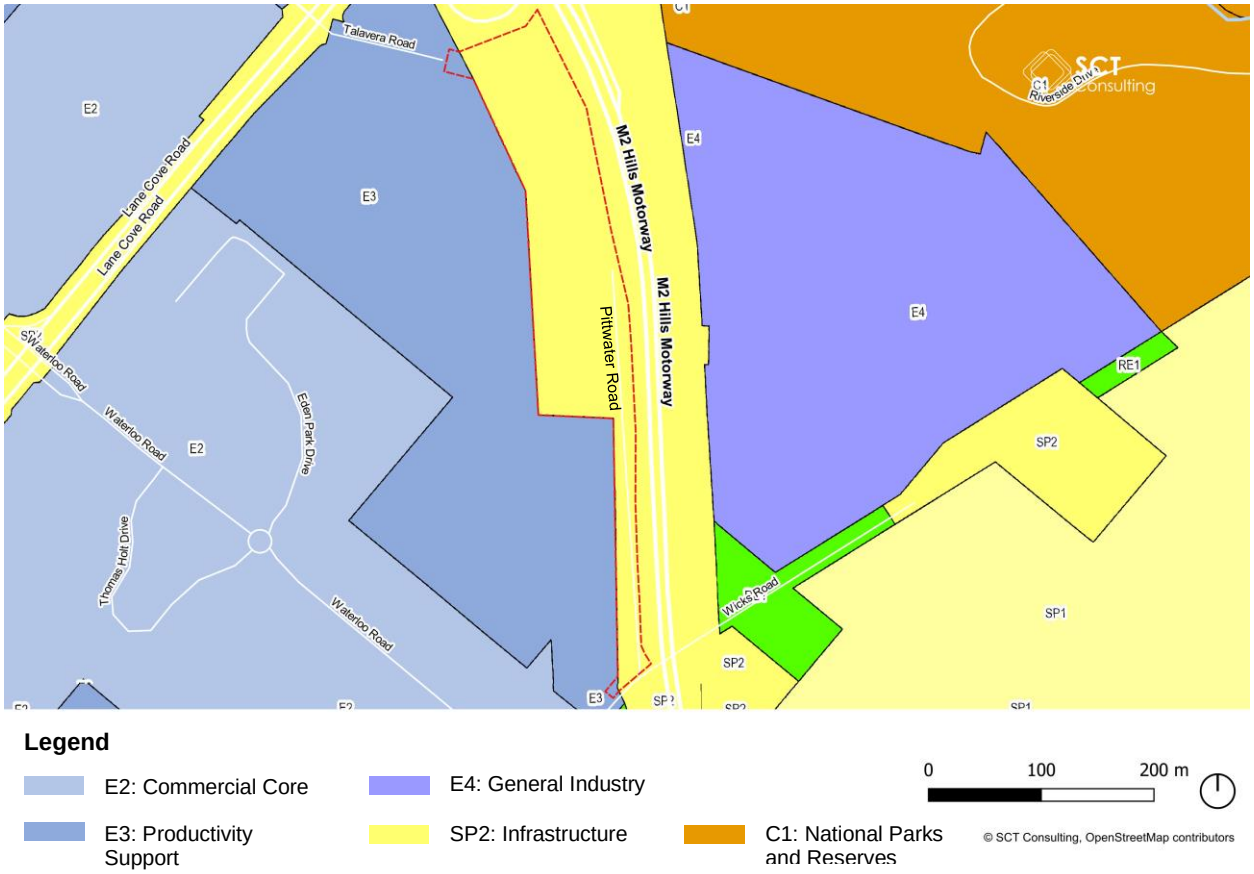
Figure 3-1 The site location in a regional context



3.2 Land use zoning

The site is zoned 'Infrastructure (SP2)' while the land use immediately surrounding the site is mainly zoned 'Productivity support (E3)', 'General industry (E4)' or 'Natural Parks and Nature Reserves (C1)'. The existing zoning of the site and surrounding areas is shown in **Figure 3-2**.

Figure 3-2 The land use zoning surrounding the site



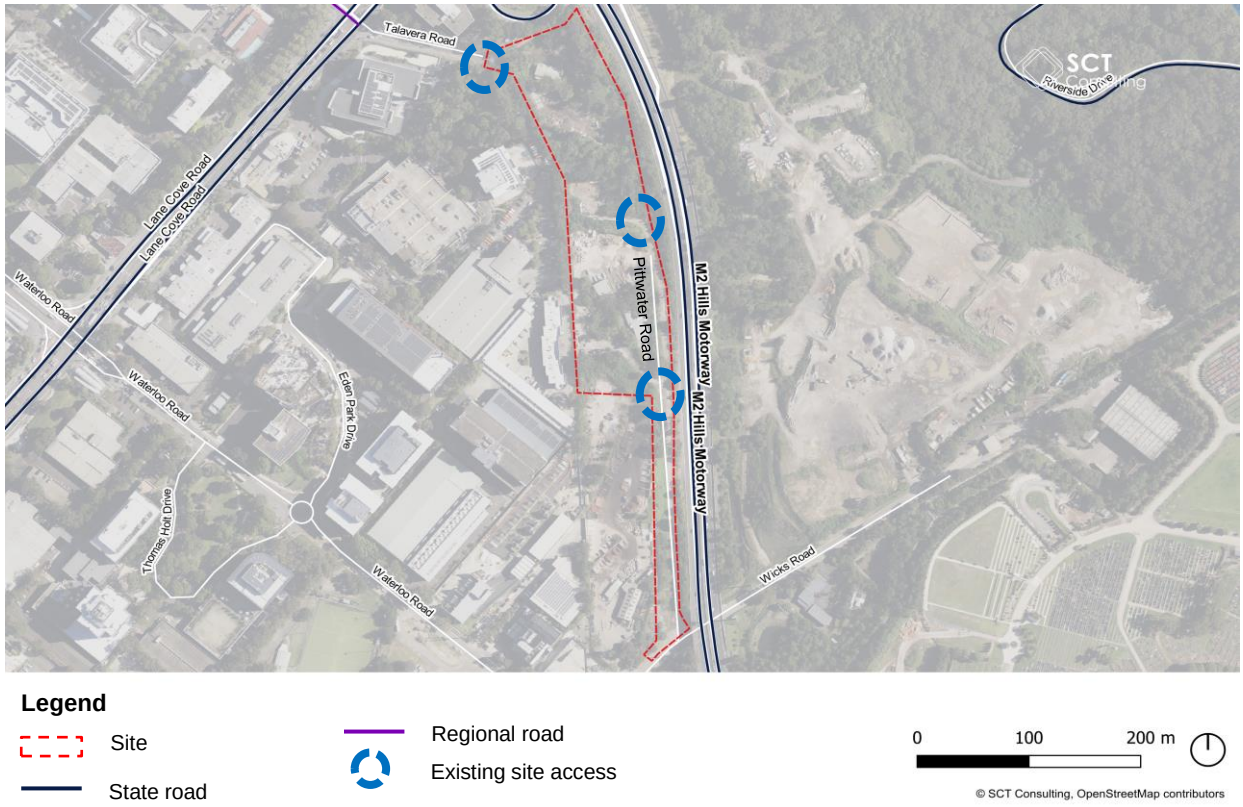
3.2.1 Site access

The main entrance for the site is from Pittwater Road, on the southeast corner of the site, as seen in **Figure 3-3**. Driveway access to 1 Talavera Road is currently provided from the cul-de-sac just northwest of the northern boundary of the site. A bicycle path runs along the northern boundary of the site and connects the Talavera Road cul-de-sac to the M2 Hills Motorway east of the site.

3.2.2 Existing use

The site is currently used by Quickways, accessed from Talavera Road, as a storage site for stockpiles, with a couple of on-site buildings present. The existing uses currently generates a limited and infrequent number of vehicle movements to and from site.

Figure 3-3 The site's existing access points



3.3 Journey to Work Data

The 2016 Journey to Work (JTW) data was analysed to determine current mode split for vehicles traveling to and from the Macquarie Park Statistical Area of the City of Ryde LGA. JTW data presenting mode split is available for 2021; however, due to the influence of the COVID-19 pandemic on travel patterns and modes, the 2016 JTW data has been used for the purpose of mode split analysis. The mode split analysis is summarised in **Table 3-1**.

As seen, people traveling on public transport accounted for about 36 per cent, while car (as driver or passenger) as a mode of transport was about 32 per cent. About 17 per cent walked or cycled to work, with only 0.5 per cent of these trips being bicycle users.

Table 3-1 Mode split based on 2016 JTW data for the Macquarie Park Statistical Area

Mode split	Number	Proportion (%)
Train	1,066	26.5%
Bus	395	9.8%
Car – as driver	1,192	29.6%
Car – as passenger	106	2.6%
Other	95	2.4%
Bicycle	21	0.5%
Walked only	674	16.7%
Worked at home / did not go to work	478	11.9%

Source: Source: Australian Bureau of Statistics, modified by SCT Consulting; 2024

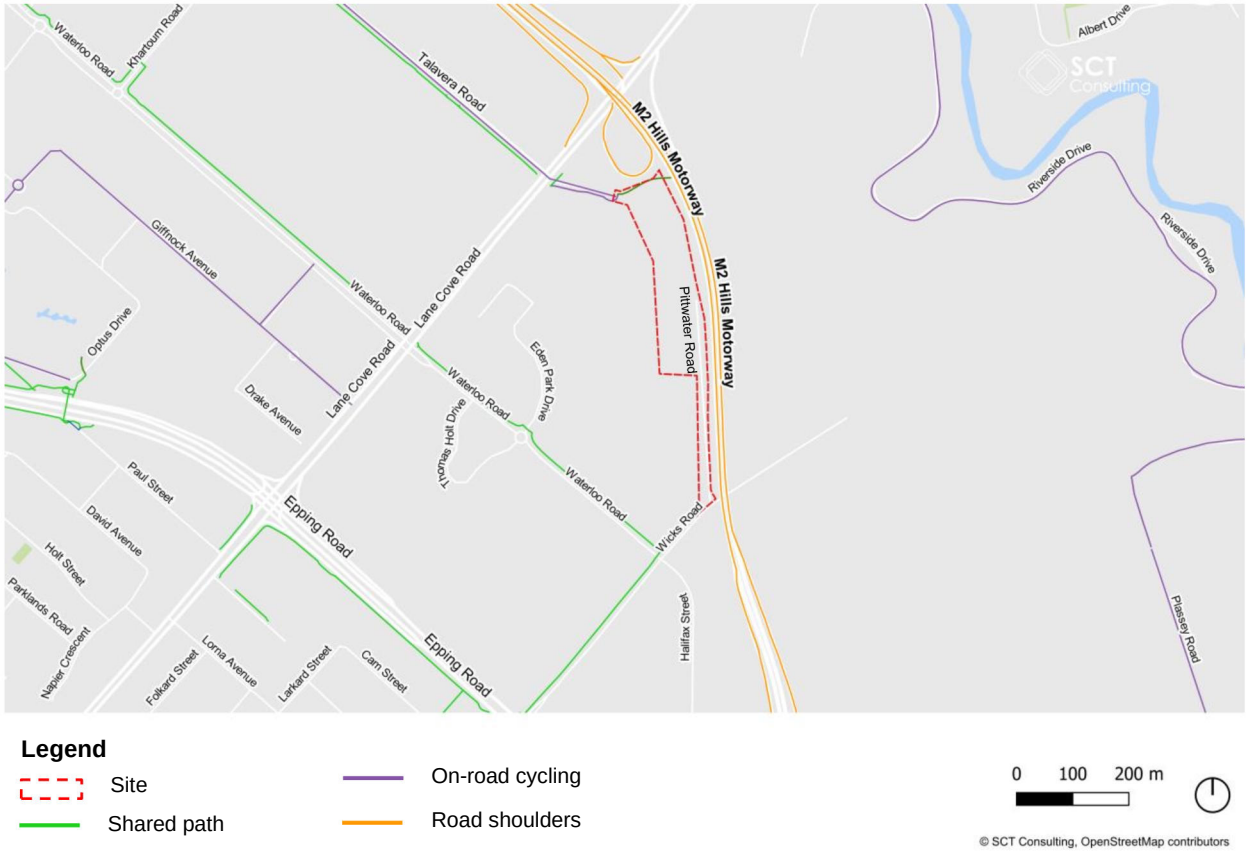
3.4 Active transport

As seen in **Figure 3-4**, the site is surrounded by shared paths, on-road cycle routes and road shoulders (along the M2 Hills Motorway), which provides good cycling access to the regional cycle network, as well as nearby suburbs such as Chatswood, North Ryde and Epping.

Shared paths are provided along sections of Waterloo Road, Epping Road, Talavera Road, Lane Cove Road, and Wicks Road in proximity to the site, providing access (separated from traffic) for cyclists and pedestrians to the site. A separated bicycle path (with no access permitted for pedestrians) is also provided along the northern boundary of the site, accessed from Talavera Road and the M2 Hills Motorway. There are however some barriers to pedestrian and cycling movements due to the major roads (M2 Hills Motorway, Lane Cove Road and Epping Road) surrounding the site.

Signalised pedestrian crossings are provided at the Lane Cove Road / Talavera Road intersection northwest of the site, with footpaths provided on both sides along both Lane Cove Road and Talavera Road in proximity to the site. The Wicks Road / Waterloo Road / Halifax Street intersection also provides signalised pedestrian crossings south of the site, but there are no footpaths provided along either side of Wicks Road south of Pittwater Road. Footpaths are provided along both sides of Lane Cove Road and along the southern side of Waterloo Road (while a shared path is present along the northern side), in proximity to the site.

Figure 3-4 Cycle network surrounding the site



3.5 Public transport

3.5.1 Buses

Bus routes (**Figure 3-5**) in proximity to the site run along Lane Cove Road, Waterloo Road and Talavera Road, and the frequencies of these are shown in **Table 3-2**. As seen, the site is well served by about 70 services per hour during the AM and PM peak hours respectively, and 35 services per hour during the weekends. The bus routes provide access to several destinations including the City, Lane Cove, Mona Vale, Chatswood, Ryde, Parramatta, Epping, and Hornsby.

The bus stops closest to the site are located on Talavera Road and Waterloo Road, about 250m and 200m from the site entrance at Talavera Road.

Table 3-2 Current bus routes and frequencies

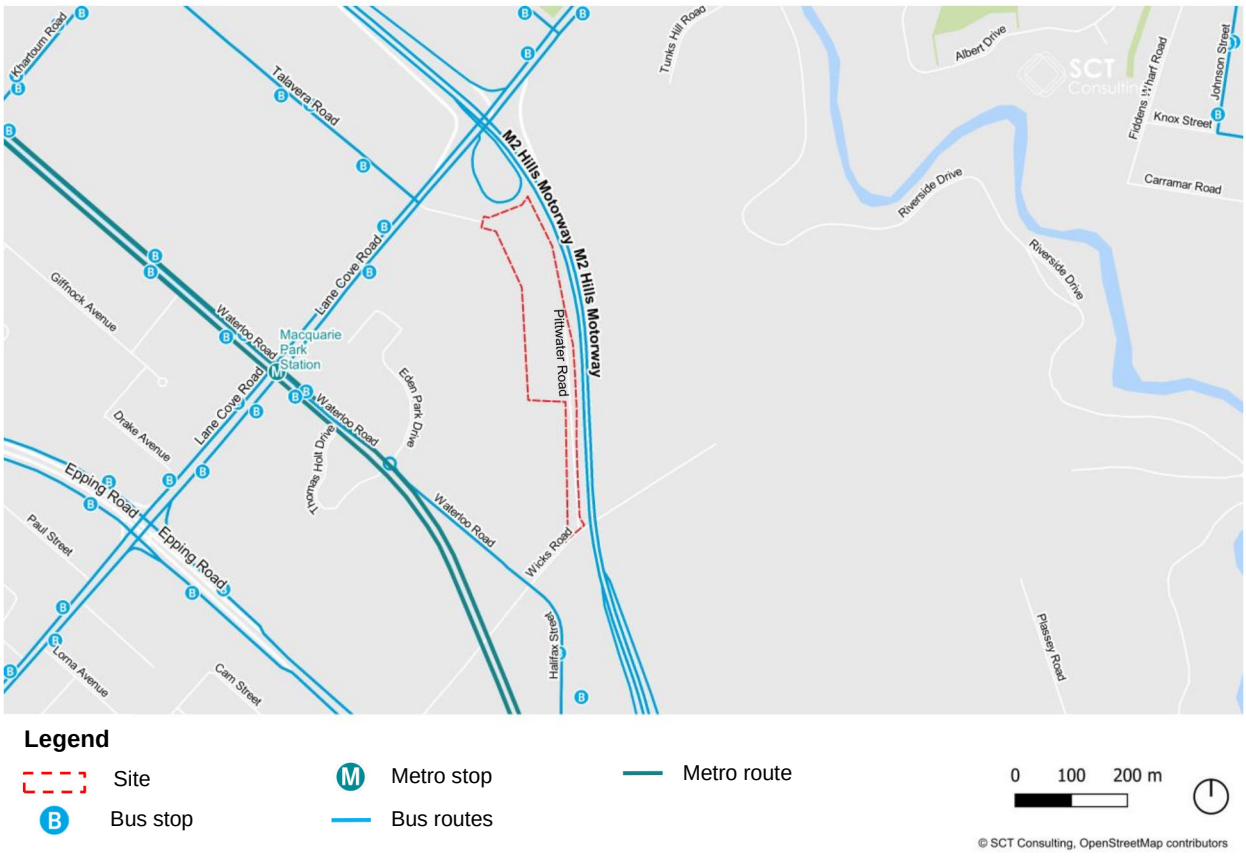
Route	Corridor	Origin / destination	Frequency (services per hour in both directions)		
			AM peak	PM peak	Weekend
197	Lane Cove Road	Mona Vale to Macquarie University via Gordon	6	7	2
259	Lane Cove Road	Macquarie Centre to Chatswood via Macquarie Park & North Ryde	8	8	4
292	Lane Cove Road	Marsfield to City Erskine St via Macquarie Park, Lane Cove North & Freeway	6	4	4
294	Lane Cove Road / Talavera Road	Macquarie University to City Wynyard via Freeway	8	3	0
506	Lane Cove Road / Talavera Road	Macquarie University to City Domain via East Ryde	4	3	5
545	Waterloo Road	Parramatta to Macquarie Park via Telopea & Eastwood	8	8	4
550	Waterloo Road	Parramatta to Macquarie Park via Epping	8	8	4
611	Waterloo Road	Blacktown to Macquarie Park via M2 Mwy	8	8	4
619	Waterloo Road	Castle Hill to Macquarie Park via Baulkham Hills & M2 Mwy	4	4	-
565	Talavera Road	Chatswood to Macquarie University	3	5	2
572	Talavera Road	Turramurra to Macquarie University via South Turramurra & West Pymble	4	5	2
575	Talavera Road	Hornsby to Macquarie University via Turramurra	7	6	4

Source: Transport for NSW 2024 trip planner

3.5.2 Metro

The Metro North West Line runs between Chatswood and Tallawong and serves Macquarie Park Metro Station, located about 500m west of the site, as seen in **Figure 3-5**. The station is serviced by a train every four minutes during weekday peak hours and every 10 minutes during weekdays off-peak hours and weekends, in each direction.

Figure 3-5 Public transport network surrounding the site



3.6 Road network

3.6.1 Road classification

The site is bounded by Pittwater Road and the M2 Hills Motorway to the east, while Wicks Road and Waterloo Road run to the south and west of the site respectively. Access to the site is currently provided from the southeast, via Pittwater Road, and from a driveway access off Talavera Road northwest of the northern boundary of the site. The road network surrounding the site is shown in **Figure 3-6**, and the key characteristics of the roads are:

– **The M2 Hills Motorway**

  The M2 Hills Motorway is a six-lane, two-way separated State Road that runs between Artarmon in the east and Baulkham Hills in the west. It connects the site to the surrounding arterial road network via on- and off-ramps at Lane Cove Road (via Talavera Road) north of the site.

– **Lane Cove Road**

  Lane Cove Road is a six-lane, two-way separated State Road that runs between Mona Vale in the east and Hurstville in the south. Lane Cove Road connects to the site in the north via a signalised intersection with Talavera Road. No Parking restrictions are in place along both sides of Lane Cove Road in proximity to the site and the posted speed limit is 70 km/h. A northbound 24h bus lane is provided along Lane Cove Road, in a northbound direction south of Waterloo Road.

– **Epping Road**

Epping Road is a six-lane, two-way separated state road that runs between Epping in the west and Longueville in the east. Along this section, it provides an east-west alternative to the M2. The posted speed limit along Epping Road is 70 km/h in proximity to the site. No Stopping and No Parking restrictions as well as clearway restrictions (6am to 7pm Mon to Fri and 9am to 6pm Sat – Sun and public holidays) are in place along both sides of Epping Road in proximity to the site. A left turn only for buses into Lane Cove Road is provided along Epping Road in a northbound direction. In a southbound direction (south of Lane Cove Road), a transit lane is in place from 6am to 10am Monday to Friday.

– **Talavera Road**

The section of Talavera Road west of Lane Cove Road is a regional road, while the eastern section, which ends in a cul-de-sac just short of the northern site boundary, is an unclassified local road. Talavera Road runs between the site in the east and Busaco Road in the west. It is generally a two-way, four-lane separated road with turning lanes at major intersections. No Stopping or No parking is in place along Talavera Road in proximity to the site and the posted speed limit is 50 kilometres per hour. Buses currently run along Talavera Road west of Lane Cove Road, but no east of Lane Cove Road.

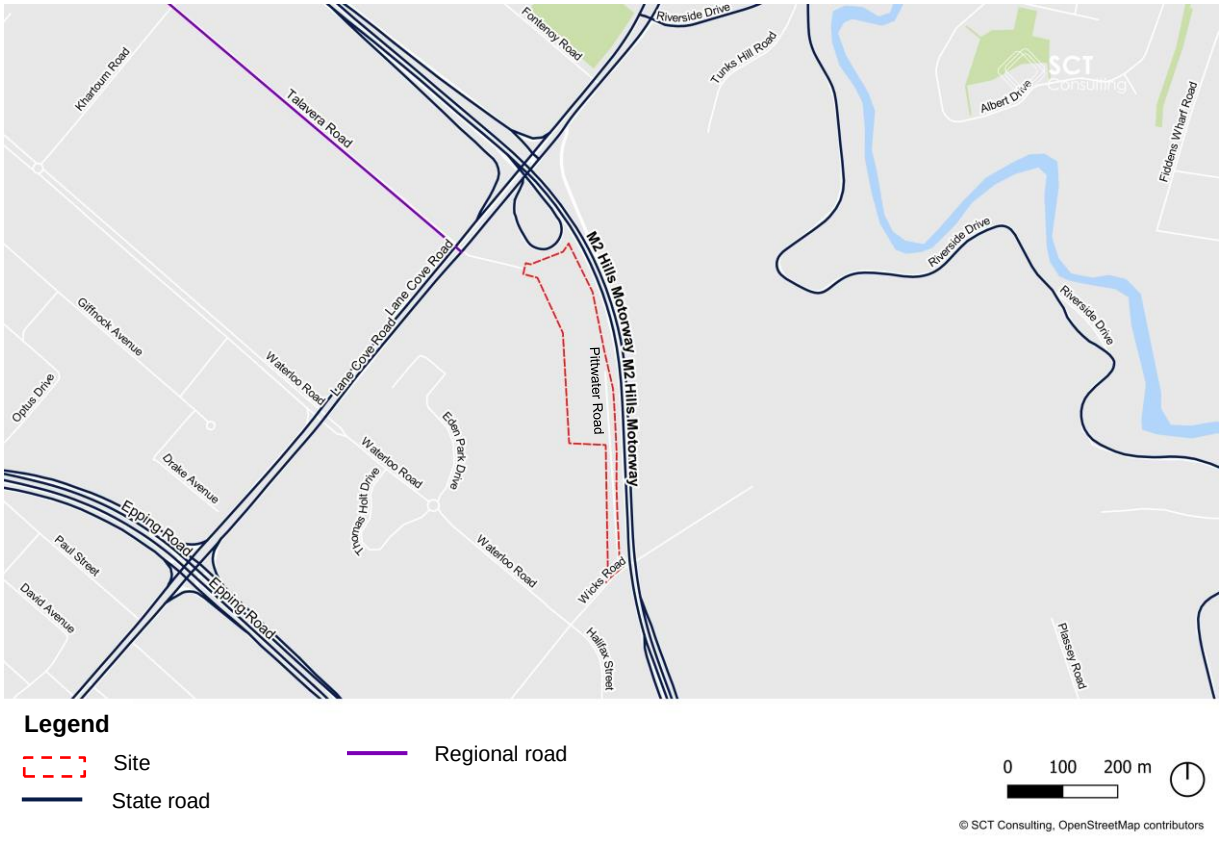
– **Wicks Road**

Wicks Road is a two-way, two-lane local road that runs between the Resource Recovery Centre in the north and Twin Road in the south, with a posted speed limit is 60 km/h. The only access to the site in the south is currently provided from Wicks Road via Pittwater Road. South of Pittwater Road there are No Stopping restrictions in place along the western side of the road, while 2P (8am to 6pm Mon to Fri) or No Parking (8am to 5pm, City of Ryde authorised vehicles expected) are in place along the eastern side of the road.

– **Pittwater Road**

Pittwater Road is a local road that runs in a north-south direction parallel to the M2 and currently provides the only access to the site, via a T-intersection with Wicks Road. Currently Pittwater Road provides access to the Australian Native Landscapes supply store and Sherringhams Nursery located on the site.

Figure 3-6 Road network surrounding the site



3.6.2 Intersection traffic volumes

Traffic counts were undertaken at the intersections close to the site, shown in **Figure 3-7**, on Wednesday 14 September 2022. Based on these traffic counts, the common traffic network peak hours in proximity to the site are between 8.30 and 9.30am and between 4.45 and 5.45pm during weekdays. The traffic volumes at these time periods are outlined in **Table 3-3**. The traffic counts showed that the intersection with the lowest volumes close to the site is the Waterloo Road / Halifax Road / Wicks Road intersection, located just south of the site's access on Pittwater Road.

Figure 3-7 Intersections in proximity to the site

Table 3-3 Existing intersection traffic flows (vehicles per hour)

Intersection	Existing intersection traffic flows (vph)	
	AM Peak Hour*	PM Peak Hour*
1. Lane Cove Road / Talavera Road (signalised)	5,113 (288)	5,243 (132)
2. Lane Cove Road / Waterloo Road (signalised)	5,221 (340)	5,360 (176)
3. Wicks Road / Epping Road (signalised)	6,238 (346)	6,771 (132)
4. Waterloo Road / Halifax Road / Wicks Road (signalised)	938 (90)	939 (26)
5. Epping Road / Lane Cove Road (signalised)	5,355 (334)	5,688 (143)

Source: Trans Traffic Surveys 2022, modified by SCT Consulting 2024

* AA(BB) indicates: Total vehicles (Heavy vehicles)

3.6.3 Intersection performance

Operational performance of intersections is typically measured through an assessment of the throughput of network, with average delay per vehicle used to access the performance of an individual intersection. The average delay per vehicle measure is linked to a Level of Service (LoS) index which characterises the intersection's operational performance. **Table 3-4** provides a summary of the LoS performance bands, as defined by the Transport Traffic Modelling Guidelines.

Intersection performance is also measured using the Degree of Saturation (DoS), which is a measure of the spare capacity of each intersection. A degree of DoS greater than 1.0 implies that the turning movement is at capacity and not acceptable.

Table 3-4 Level of Service categories

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

Source: Roads and Maritime Services (2002), Traffic Modelling Guidelines

Intersection performance based on the existing traffic volumes and conditions was undertaken for the Waterloo Road / Halifax Road / Wicks Road intersection for the AM and PM peak hours. This intersection was assessed because the Proposal is expected to have the highest impact on this intersection in the future, given its low traffic volumes, and the fact that all vehicles accessing the site via Pittwater Road will go through this intersection. This is discussed further in **section 7.1.1**.

The performance result of the Waterloo Road / Halifax Road / Wicks Road intersection is shown in **Table 3-5**. As seen, the intersection performs at a LoS B in both the AM and PM peak hour with acceptable delays and DoS.

Table 3-5 Existing performance of the Waterloo Road / Halifax Road / Wicks Road intersection

Weekday time period	Intersection performance			
	Volume (vph)	DoS	Delay (secs)	LoS
AM Peak Hour (8.30am – 9.30am)	938	0.58	23.8	B
PM Peak Hour (4.45pm – 5.45pm)	939	0.49	24.4	B

Notes: LoS = Level of service (average of all arms of the intersection). For priority and roundabout intersections, the delay and LoS for the worst performing movement is reported.

4.0 The Proposal

4.1 The Zero Emission Buses Macquarie Park Bus Depot

The primary aim of the ZEB Macquarie Park Bus Depot Project (the Proposal) is to provide a state-of-the-art facility suitable for use by both the current and future Region 7 bus operator in collaboration with Transport and other stakeholders. The aim of the Services is to develop designs for a fully operating depot supporting ZEB operations including all its bus parking, bus charging, maintenance, security, staff amenity facilities and all the ancillary infrastructure required. The key depot functional requirements to be delivered include:

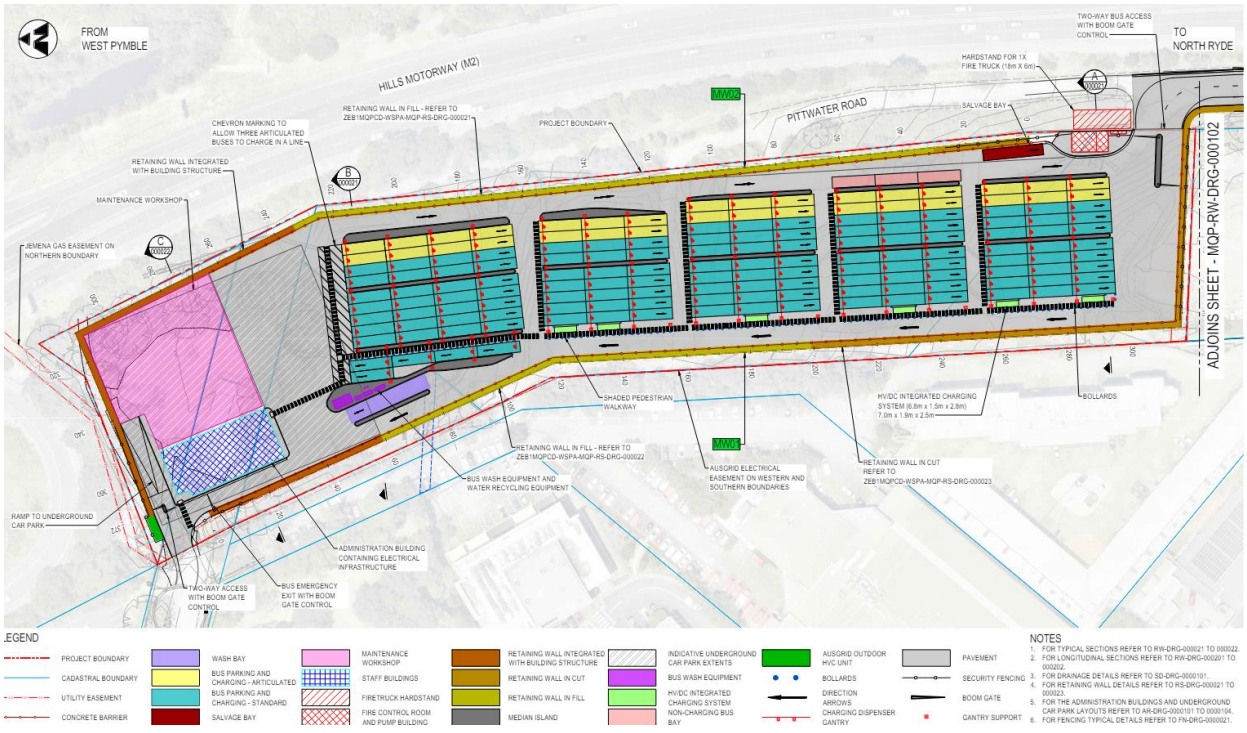
Key features of the proposal would include:

- Building new facilities to support future bus operations including:
  - a single-level underground staff and visitor car park accommodating up to 163 cars including accessible parking spaces, car share spaces, electric vehicle spaces with charging equipment and bike storage options
  - a multilevel administration office featuring a wide selection of office spaces and staff facilities including end of trip facilities, a first aid room, social breakout and gaming rooms, and an outdoor rooftop garden
  - a bus maintenance facility accommodating up to 30 staff and featuring a spray booth, inspection pits and a multilevel staff facility including an outdoor BBQ area, a kitchen and toilet facilities
  - a designated bus wash bay with washing and water recycling equipment.
- Removal of the existing one-way bike path connection between the M2 Hills Motorway and Talavera Road to make way for the new bus maintenance facility
- Delivering up to 165 bus parking spaces including:
  - 129 charging bays for 12.5 metre standard rigid buses
  - 22 charging bays for 19 metre articulated buses
  - 14 maintenance bays
- One breakdown bay
- One bus wash bay
- Installation of gantries to facilitate the preferred bus arrangement and charging structure
- Installation of standard 75kW and fast 150kW plug-in chargers for buses around the depot
- Upgrading Pittwater Road to enable two-way bus access to and from the bus depot
- Essential fire services such as hydrant and sprinkler system, a fire control room and pump building, smoke detection and warning systems, hardstand area for one fire truck, portable fire extinguishers and fire blankets
- Installation of new pedestrian crossing and footpaths, security booths, fencing and lighting
- One bus access points from Pittwater Road and one staff car park access point from Talavera Road.

4.2 The preferred bus depot option

Several options were considered for the layout and design of the Depot. The sketches were refined through collaboration with relevant internal and external stakeholders to achieve acceptance on the depot design approach and finalise the depot general arrangement. Over thirty layout options were considered as part of the Concept Design optioneering process, and the preferred layout option is shown in **Figure 4-1**.

Figure 4-1 The preferred layout option of the Proposal



Source: Zero Emissions Buses Macquarie Park Depot 80% Concept Design (WSP, 2024)

4.3 Proposed parking supply and requirements

4.3.1 Vehicle parking

A one-storey basement car park with 163 car parking spaces (**Figure 4-2**) for staff will be provided to maximise the at-ground level space for future bus bays. The number of bus bays, bus wash bays, charging bays, breakdown bays and car parking spaces is summarised in **Table 4-1.**

Table 4-1 Proposed number of bus and car parking spaces

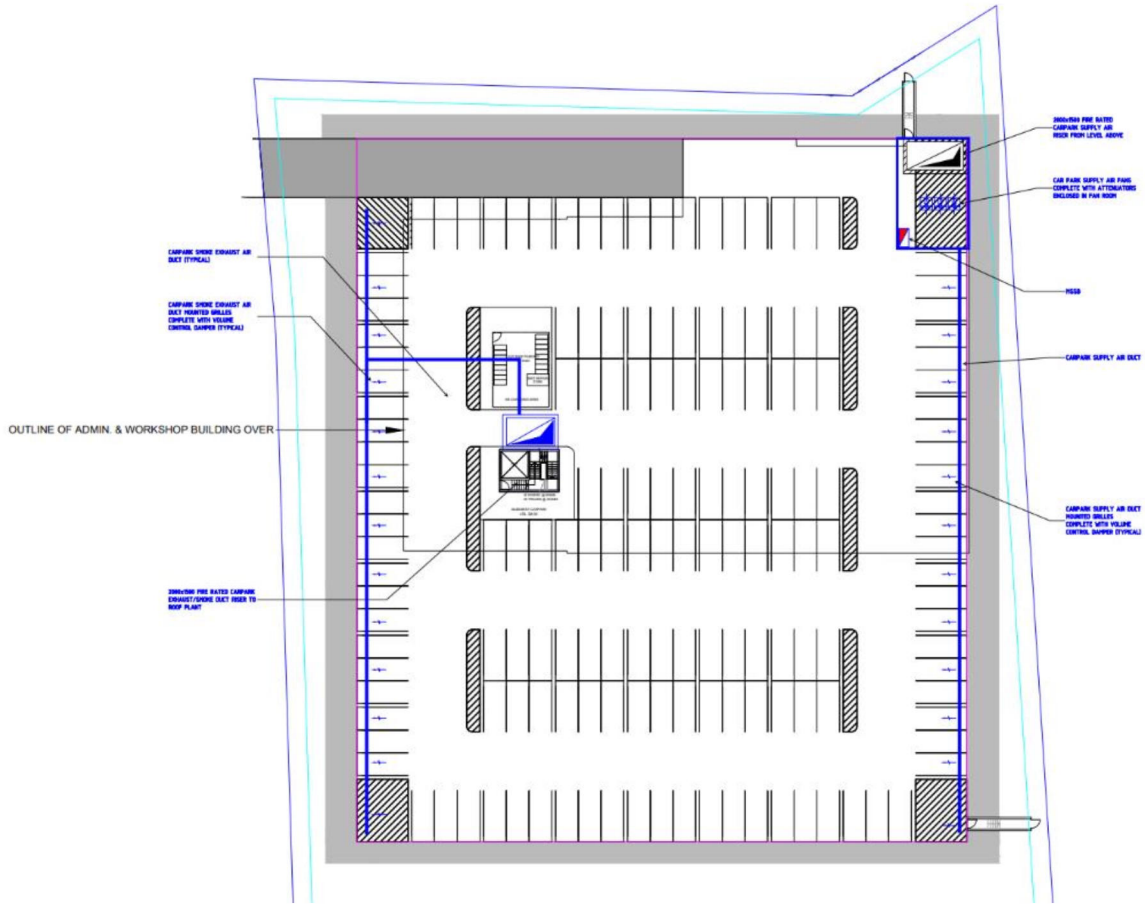
Type of parking	Number of spaces	Type of facility
Standard (12.5m) bus charging spaces	129	Fast charging for ~10% of charging spaces with a 150 kW plug-in charging solution
Articulated (19.0m) bus charging spaces	22	Standard charging with a 75 kW plug-in charging solution at 1:2 charger to on duty bus ratio
Maintenance bays and bus wash facility	14 (11 x standard 12.5m and 3 x articulated 19.0m buses)	Bus bays and bus wash facilities
Basement car parking spaces for staff	Up to 163	One per cent accessible spaces Five per cent visitor spaces 10 per cent EV spaces 2.5 per cent car share spaces

Source: Zero Emission Buses Greater Sydney Tranche 1 – Macquarie Park Depot 80% Concept Design Report (February 2024)

A review of parking rates in the City of Ryde LGA's Development Control Plan (DCP) 2014 was undertaken. The DCP does not specifically outline parking rates for bus depots, but it states that rates for office and business premises within the Macquarie Park corridor should be lower than the standard rates, due to its proximity to high quality public transport. This is also in line with the 2016 Journey to Work data (**Section 3.3**) which shows that about 32 per cent of employees travel to work in a private vehicle, while 36 per cent use public transport.

The proposed number of parking spaces for the Proposal has been provided on a first principles basis to accommodate the expected parking demand.

Figure 4-2 The preferred layout option of the basement car park



Source: Zero Emission Buses Greater Sydney Tranche 1 – Macquarie Park Depot 80% Concept Design Report (February 2024)

4.3.2 Bicycle parking

Bicycle parking is proposed to be provided on site in accordance with the Ryde Council DCP, which refers to AS 2890.3:2015. The DCP states that bicycle parking should be provided at a rate of 10% of total on-site car parking. Therefore, a minimum of 16 bicycle parking spaces are proposed to be provided. The parking type is proposed to be bicycle cages or lockers as shown in **Table 4-2**.

Table 4-2 Bicycle parking security levels

Security level	Style	Suitability
A	Bicycle locker	Long term parking that includes overnight storage
B	Bicycle cage	Day parking for staff and public transport users
C	Bicycle rack	Short term parking such as visitor parking

Source: Zero Emission Buses Greater Sydney Tranche 1 – Macquarie Park Depot 80% Concept Design (February 2024), based on AS2890.3:2015

4.4 Proposed access and movement patterns

4.4.1 Vehicle access points and access routes

The Depot will be accessed by buses from the south, via Pittwater Road, while light vehicles will access the site from the north, via Talavera Road, as seen in **Figure 4-3**, while **Figure 4-4** shows the proposed internal movements on the site.

The design vehicles for the depot are 12.5m standard bus and 19.0m articulated buses, and all internal movements are accessible for these vehicle types. Swept path analysis for bus site access via Pittwater Road, and for the emergency exit route onto Talavera Road have been undertaken to confirm access of the design vehicles. These diagrams of the swept paths are presented in **Appendix B**.

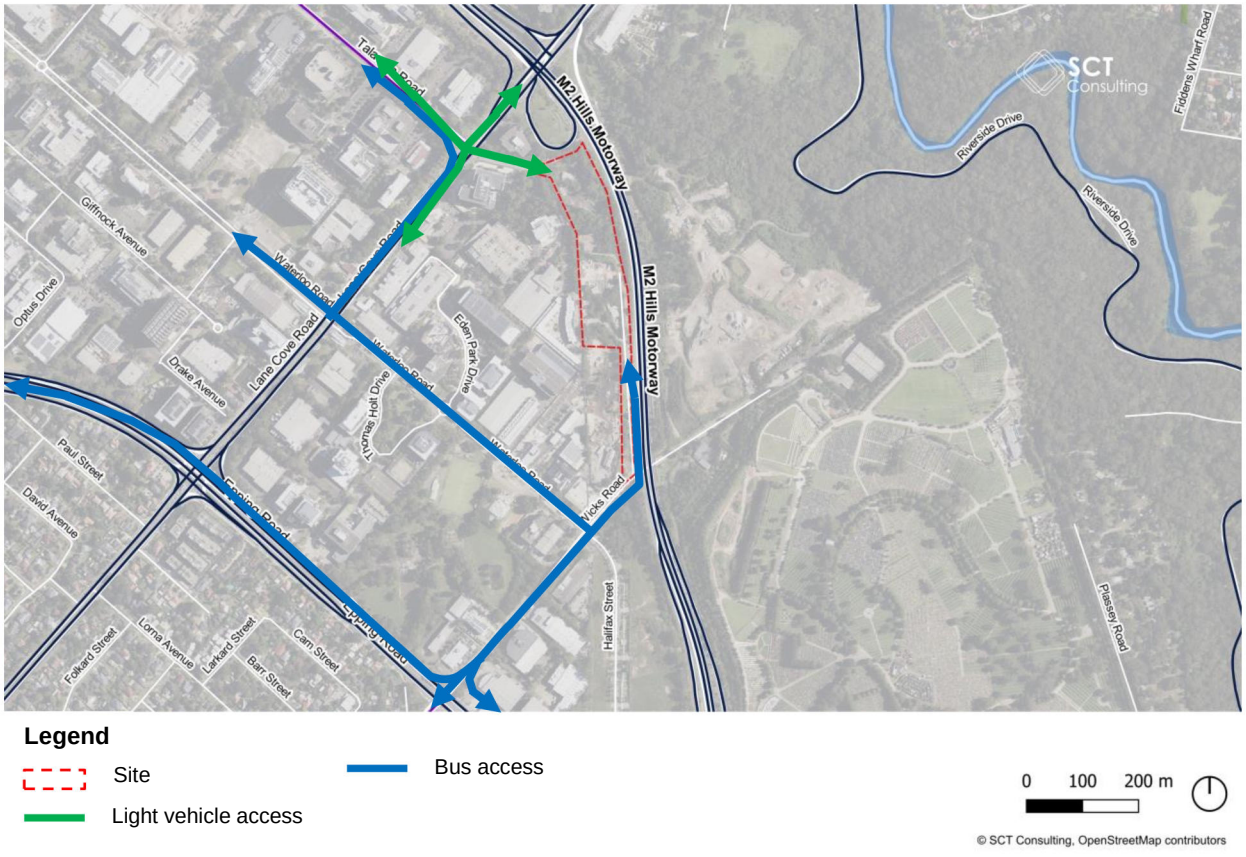
4.4.2 Cycling and pedestrian access

Pedestrian entry and exit to the Depot will be via Talavera Road only. Pedestrian accessibility via Pittwater Road has been excluded as there is a lack of point of interest and pedestrian facilities along Wicks Road.

Internally, pedestrian movements are concentrated along a path covering the length of the site, providing access between the bus stack and the admin building via a marked zebra crossing. Additional marked pedestrian connections to access each bus stack are provided along the rear of each stack. This arrangement allows pedestrians to access the designated path without crossing any bus movements within the stack.

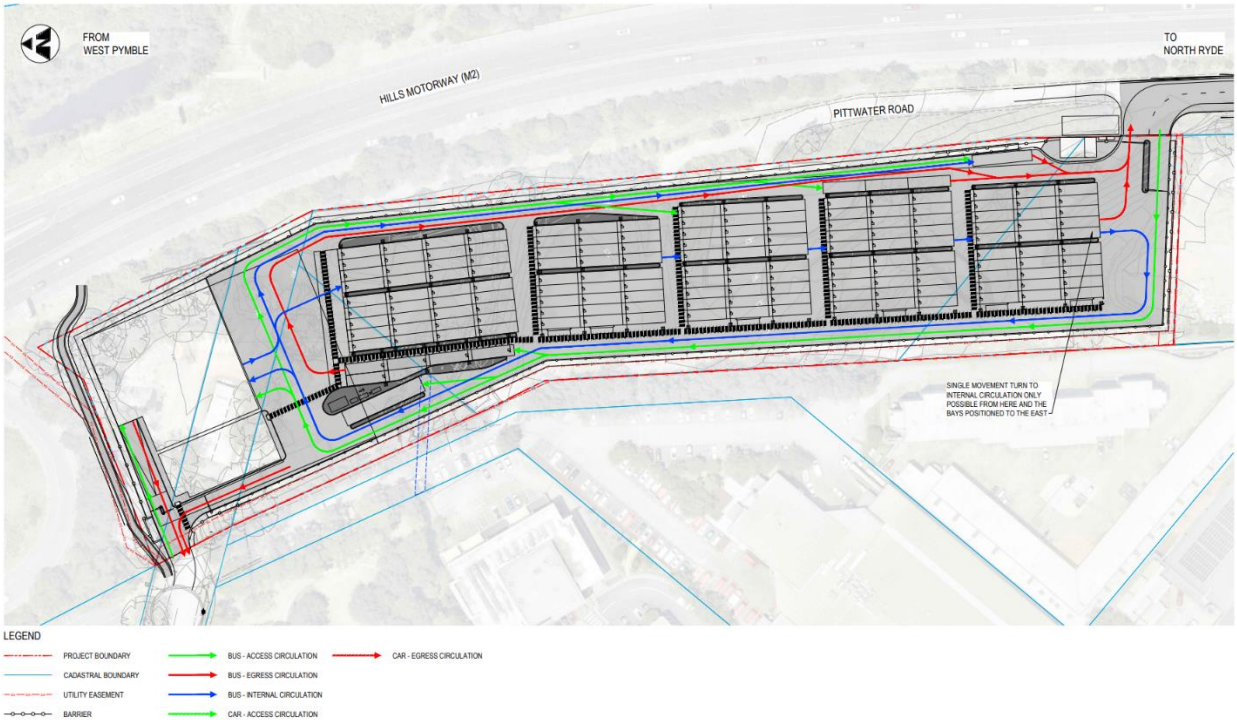
There is an existing cycle path linking the Hills Motorway to Talavera Road, which runs along the northern boundary of the site. The current design includes the removal of this path. Transport is having ongoing discussions about the potential relocation of the cycle path with Ryde Council and Transurban. Future cycling access configurations to the site is subject to the relocation of this cycleway.

Figure 4-3 The future key bus and car access routes to and from the site



Source: Zero Emissions Buses Macquarie Park Depot 30% Concept Design (WSP, 2023)

Figure 4-4 Indicative future access and internal movement arrangements of the site



Source: Zero Emissions Buses Macquarie Park Depot 80% Concept Design (WSP, 2024)

4.5 Operational trip generation and distribution

As outlined in the *Greenfield Macquarie Park Zero Emission Bus Depot: Traffic Assessment* (WSP, October 2023), the timing of bus arrivals and departures to the site have been aligned with the bus scheduling data provided by Transport. The analysed data shows that the maximum rate of buses accessing the depot are:

– AM peak max = 63 buses / hr out (6.45-7.45am), 40 buses / hr in (9-10am)

– PM peak max = 54 buses / hr out (2.30-3.30pm), 38 buses / hr in (6.00-7.00pm)

The analysis of light vehicle arrival rates shows the following maximums (assuming a 100% staff mode share to private vehicle):

– AM peak max = 40 cars / hr out (9-10am), 63 cars / hr in (7-8am)

– PM peak max = 42 cars / hr out (3.45-4.45pm), 54 cars / hr in (2.15-3.15pm)

The bus movement peaks identified above do not align with the traffic network peaks (7.30-8.30am and 4.15-5.15pm) as outlined in the *Greenfield Macquarie Park Zero Emission Bus Depot Traffic Assessment* (WSP, October 2023), which limits the impact of the Proposal on the surrounding road network. The impact of the operation of the Proposal during the road network's peak times is further described in **Section 6.1**.

As described in **Section 4.4.1**, the buses will enter and exit the site via Pittwater Road, while the light vehicles will enter and exit the site from Talavera Road.

4.6 Active and public transport demand

As described in **Section 4.5**, the maximum number of bus and light vehicle trips generated by the Proposal will not necessarily align with the surrounding road network's peak hours. However, to estimate the maximum active and public transport demand generated by the Proposal, a worst-case scenario for the site's AM and PM peak hours was assumed.

Assuming bus drivers arriving and leaving 10 mins before and after buses, a total of 142 and 57 buses and light vehicles (as a worst-case scenario) would enter or leave the site during the AM and PM peak hours respectively.

4.6.1 Active transport demand

Based on the existing journey to work data in **Section 3.3**, about 17 per cent of employees will travel to and from the site by active transport (walk only or cycling), while the majority will be car trips. Based on the worst-case number of vehicle trips generated by the Proposal (142 and 57 trips in the AM and PM peak hours respectively), about 70 and 30 walk only trips will be generated in the AM and PM peak hours respectively, while only four and two trips would be made by cycling in the AM and PM peak hours respectively.

Walking trips generated by the Proposal are also generated by the car trips arriving to and from the site. However, most of these trips are expected to be internal, as drivers will drive into and park within the site.

4.6.2 Public transport demand

Based on the existing journey-to-work data in **Section 3.3**, approximately 36 per cent will travel to and from the site by public transport, which is higher than the car trip proportion. Based on the vehicle trips generated by the Proposal (142 and 57 trips in the AM and PM peak hours respectively), about 40 and 20 bus trips will be generated in the AM and PM peak hours respectively, while about 110 and 50 trips would be made by train (or Metro) in the AM and PM peak hours respectively.

5.0 Construction activities

The information outlined in the following sections is based on the Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024). The purpose of that report was to document the potential construction methodology for the concept design to ensure the ZEB Macquarie Park Bus Depot project can be constructed practically and efficiently.

5.1 Construction stages and duration

Based on a high-level assessment of the current scope of works and proposed design, it is anticipated that the site construction duration for the ZEB Macquarie Park Bus Depot would be around 15-21 months, based on the building and civil works being undertaken concurrently. This excludes the pre-mobilisation period (i.e. between awarding of a contract to a construction contract and their commencement on site), and post-completion period (i.e. between handover and completion of as-constructed records).

The construction will be undertaken in the following stages:

– Stage 0: Early works

– Stage 1: Site establishment, clearing and demolition

– Stage 2: Flood storage culvert, retaining wall MW01 and bulk earthworks

– Stage 3: Bulk earthworks, retaining wall MW01 and administration building

– Stage 4: Bulk earthworks, retaining wall MW02 and administration building

– Stage 5: Charging gantries and administration building

– Stage 6: Pavement and finishing works

Key traffic-related considerations and constraints for the construction staging are:

– Primary construction access for the site will be via Pittwater Road, with construction access via Talavera Road to be limited.

– Bulk earthworks balance and minimisation of both disposal and importation of material to / from offsite.

– Proposed works footprint covers entire site, with limited adjacent site compound and laydown areas available. Construction materials will generally need to be stored within the works footprint and require staging.

– Limited availability of areas for site compounds and facilities.

5.2 Hours of work

The recommended standard hours for construction work in NSW are generally as follows:

– Monday to Friday 7 am to 6 pm

– Saturday 8 am to 1 pm

– No work on Sundays or public holidays.

5.3 Site access

The following assumptions apply for site access of both heavy and light vehicles during construction:

– Primary construction access for the works from Pittwater Road, with limited access from Talavera Road.

– Access will also need to be maintained from Pittwater Road during construction through the site to the footprint of the underground carpark, administration building and maintenance facility to limit the use of Talavera Road by construction vehicles. This will require coordination between the building works, flood storage culvert works, retaining wall works and bulk earthworks.

Anticipated site access during each of the construction stages is summarised in **Table 5-1**.

Given most of the works for the project are constrained to within the site boundaries rather than on public roads, it is anticipated that works will occur during the standard hours of work only. Some exceptions for out of hours works are however permitted.

Table 5-1 Anticipated construction site access by construction stage

Stage	Stage description	Anticipated site access
0	Early works	– Works conducted along local roads from Ausgrid Macquarie Park Zone on Waterloo Road
1	Site establishment, clearing and demolition	– Primary site access via Pittwater Road – Secondary site access via Talavera Road until temporary crossing of drainage corridor established
2	Flood storage culvert, retaining wall MW01 and bulk earthworks	– Primary site access via Pittwater Road – Secondary site via Talavera Road where access is not possible across the drainage corridor from Pittwater Road
3	Bulk earthworks, retaining wall MW01 and administration building	– Primary site access via Pittwater Road – Secondary site access from Talavera Road for new staff buildings only where access is not possible across the drainage corridor from Pittwater Road
4	Bulk earthworks, retaining wall MW02 and administration building	– Primary site access via Pittwater Road – Secondary site access from Talavera Road for new staff buildings only where access is not possible across the drainage corridor from Pittwater Road
5	Charging gantries and administration building	– Primary site access via Pittwater Road – Secondary site access from Talavera Road for new staff buildings only where access is not possible across the drainage corridor from Pittwater Road
6	Pavement and finishing works	– Primary site access via Pittwater Road – Secondary site access from Talavera Road for new staff buildings only where access is not possible across the drainage corridor from Pittwater Road

5.4 Parking for workers

Construction workers accessing the site should be encouraged to use public transport to travel to and from the site, given its proximity to Metro and bus services. However, there will still be a need for some trades to bring tools and equipment with them daily, which will require parking on site. This could initially be accommodated within some of the earthworks areas as they progress. Staff parking could be accommodated within the footprint of the preferred site facility location on Pittwater Road.

Some clearing of the low vegetation in the verge along the western side of Pittwater Road from Wicks Road could also be undertaken to provide space for parking, subject to permission.

5.5 Identified construction constraints (traffic)

Based on site visits, the following traffic-related constraints were identified:

– The existing network conditions limit the use of Talavera Road for site operations

– The existing M2 Hill Motorway cycle track is within the northern project boundary and must be relocated.

– There is restricted space on site for location of site facilities, stockpile, laydown areas and worker parking

– Controlled access will be required to the construction site

– Access to the works for construction from Talavera Road, and deliveries of materials in general.

5.6 Construction trip generation and distribution

The number of construction-related trips expected to be generated during the construction phase are shown in **Table 5-2**. As seen, the number of construction vehicles entering and leaving the site during the AM and PM peak hours are evenly distributed, as a truck entering the site is generally expected to drop off material and then leave within the same hour. As expected, the number of light vehicles (mainly construction employees) entering the site in the AM peak hour is then reversed in the PM peak hour, when the light vehicles are forecast to leave the site.

It Is expected that the light vehicles would arrive before 7am (start of shift) and leave after 6pm (end of shift), while the heavy vehicles may arrive and leave outside of the traffic network peak hours.

Table 5-2 Number of trips (vph) generated by construction activities

Type of vehicle	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Heavy vehicles	6	6	6	6
Light vehicles	54	0	0	54
Total vehicles (one way)	60	6	6	60
Total vehicles (two ways)	**66**		**66**	

Source: SCT Consulting, based on The Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024)

As described in **Section 5.3**, the primary access point during construction will be via Pittwater Road, with limited access from Talavera Road. Based on this, the majority of construction-related vehicles (heavy and light) are expected to enter and exit the site at the Pittwater Road site access point and will therefore travel through the Waterloo Road / Halifax Road / Wicks Road intersection. The following assumptions have been made regarding the distribution of construction-related vehicles entering and exiting the site:

– The light vehicle routing has been based on current traffic patterns at the surrounding intersections and distributed between the intersections from Lane Cove and Epping Road.

– The heavy vehicle routing has been assumed from the north from the M2 Hills Motorway, right into Lane Cove Road, left into Waterloo Road, left into Wicks Road and left into Pittwater Road. This route would be reversed for exiting heavy vehicles.

5.7 Works on the surrounding road network

Most of the works for the ZEB Macquarie Park Bus Depot will be contained within the existing site and will not interface with traffic on public roads. However, some works required on nearby roads may be required, including:

– High voltage power supply upgrade from the Ausgrid Macquarie Park Zone on Waterloo Road, running along the eastern side of Lane Cove Road, and entering the ZEB depot from Talavera Road.

– Widening and upgrading to the Pittwater Road / Wicks Road intersection to accommodate the increased future volume of bus traffic associated with the Proposal.

– Modifications to the existing driveway entrance for 1 Talavera Road, to accommodate the proposed driveway entrance to the underground car park on Talavera Road. This could entail some minor works to the kerb crossing at the existing driveway entrance.

– The scope and impact of any service and utility connections has not been determined at this time. Minor trenching works may be required on either Talavera Road or Wicks Road to complete these connections to the existing infrastructure. It is expected that any works could be completed under single-lane shuttle-flow conditions during standard working hours.

The anticipated impact of these works is further described in **Section 7.1**.

5.8 Preparation of a Construction Traffic Management Plan

A detailed Construction Traffic Management Plan (CTMP), which will include a construction traffic control plan, will be prepared separate from this report at a later stage. This will be done before the commencement of construction and per the *Traffic Control at Work Sites Technical Manual (Transport, 2022)*.

The CTMP will address the overall traffic management of the site during the construction phase, including provision for vehicular and pedestrian access, parking for construction vehicles and appropriate wayfinding. The vehicular movements and expected routes to and from the site will also be further quantified and defined.

6.0 Operational traffic impact assessment

6.1 Road network impact

6.1.1 Modelling results

To determine the road network impact for the operational scenario of the proposed ZEB Macquarie Park Bus Depot, an AIMSUN model was developed by WSP on behalf of Transport.

The modelled road network, which is bounded by Culloden Road in the northwest, Epping Road along the southern boundary and Talavera Road along the northern boundary, is shown in **Figure 6-1**. All major intersections and selected driveway accesses were included in the modelled road network.

The Aimsun models were developed for the AM peak period (7.30 to 9.30am) and PM peak period (4.15 to 5.15pm) along with a 30-minute warm up and cool down period applied either side of the analysis period.

As part of the modelling, the following options were tested:

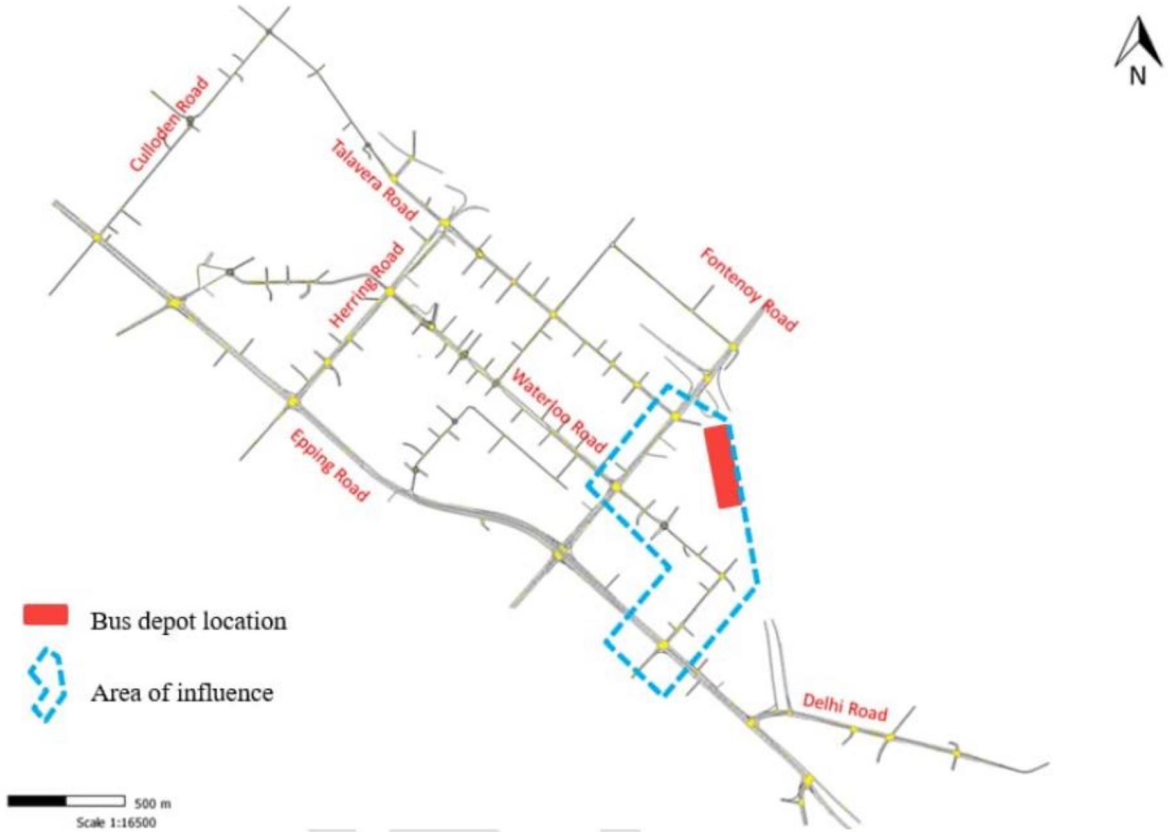
– **Do Nothing 2031**: Existing conditions road network + background traffic growth

– **Project Case 203**1: Existing conditions road network + background traffic growth + bus access/exit via Pittwater Road only and light vehicle access from Talavera Road only

– **Mitigation Optio**n: Project case with the replacement of the filter right turn with a right turn arrow phase at the intersection of Wicks Road and Waterloo Road.

The performance of the intersections surrounding the site, based on the outcome of the modelling is outlined in **Table 6-1** and **Table 6-2** for the AM and PM peak hour respectively.

Figure 6-1 The extent of the modelled road network



Source: Greenfield Macquarie Park Zero Emission Bus Depot: Traffic Assessment (WSP, October 2023)

Table 6-1 Do Nothing and with the Depot (Project Case) intersection performance for the AM Peak Hour (2031)

Intersection	Intersection performance		
	Volume (vph)	Delay (secs)	LoS
Lane Cove Road / Talavera Road (signalised) Do Nothing	5,800	53.4	D
Lane Cove Road / Talavera Road (signalised) Project Case	5,811	53.8	D
Lane Cove Road / Waterloo Road (signalised) Do Nothing	6,078	73.8	F
Lane Cove Road / Waterloo Road (signalised) Project Case	6,244	71.3	F
Wicks Road / Epping Road (signalised) Do Nothing	4,751	59.1	E
Wicks Road / Epping Road (signalised) Project Case	4,752	61.1	E
Wicks Road / Waterloo Road (signalised) Do Nothing	855	25.0	B
Wicks Road / Waterloo Road (signalised) Project Case	809	25.5	B
Wicks Road / Pittwater Road bus depot entry (unsignalised) Do Nothing	N/A	N/A	N/A
Wicks Road / Pittwater Road bus depot entry (unsignalised) Project Case	74	4.7	A

Source: Greenfield Macquarie Park Zero Emission Bus Depot: Traffic Assessment (WSP, October 2023)

Notes: LoS = Level of service (average of all arms of the intersection). For priority and roundabout intersections, the delay and LoS for the worst performing movement is reported.

Table 6-2 Do Nothing and with the Depot (Project Case) intersection performance for the PM Peak Hour (2031)

Intersection	Intersection performance		
	Volume (vph)	Delay (secs)	LoS
Lane Cove Road / Talavera Road (signalised) Do Nothing	5,430	47.0	D
Lane Cove Road / Talavera Road (signalised) Project Case	5,396	51.1	D
Lane Cove Road / Waterloo Road (signalised) Do Nothing	5,563	89.7	F
Lane Cove Road / Waterloo Road (signalised) Project Case	5,548	77.5	F
Wicks Road / Epping Road (signalised) Do Nothing	5,527	81.1	F
Wicks Road / Epping Road (signalised) Project Case	5,386	72.0	F
Wicks Road / Waterloo Road (signalised) Do Nothing	874	28.1	C
Wicks Road / Waterloo Road (signalised) Project Case	878	29.1	C
Wicks Road / Pittwater Road bus depot entry (unsignalised) Do Nothing	N/A	N/A	N/A
Wicks Road / Pittwater Road bus depot entry (unsignalised) Project Case	56	7.0	A

Source: Greenfield Macquarie Park Zero Emission Bus Depot: Traffic Assessment (WSP, October 2023)

Notes: LoS = Level of service (average of all arms of the intersection). For priority and roundabout intersections, the delay and LoS for the worst performing movement is reported.

Overall, the impact of the project on the surrounding network is minimal, with intersection LoS and congestion hotspots remaining the same as in the Do Nothing case. The key findings of the assessment are as follows:

– The network along Lane Cove Road and Epping Road is heavily congested in all scenarios. The Waterloo Road / Lane Cove Road intersection performs at LoS F in the AM and PM peak hours. The Epping Road / Wicks Road intersection performs at LoS E in AM peak hour and LoS F in the PM peak hour.

– The overall intersection performance for each of the assessed intersections remains at the same LoS for both the Do Nothing and Project Case scenarios in both the AM and PM peak hours.

– The new intersection of the bus depot (at Pittwater Road) with Wicks Road will perform at a LoS A in all scenarios.
– There are significant queueing and delays at the Lane Cove Road / Talavera Road intersection and along Lane Cove Road, even without the depot in place.
– There is significant queueing at the Wicks Road / Waterloo Road intersection during the PM peak hour. A mitigation scenario was run to test an option to replace the filter right turn from Wicks Road southbound into Waterloo Road with an additional right turn arrow phase.
    - The results of the mitigation option to the Wicks Road / Waterloo Road intersection were inconclusive as there was an improvement in the AM peak but a deterioration in the PM peak. This option should therefore be further investigated from a road safety perspective.

6.1.2 Upgrades to the Pittwater Road / Wicks Road intersection

As highlighted in the Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024), the Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal.

6.2 Public transport network impact

As described in **Section 3.5**, both the available public transport options (bus stops or the Metro) are currently accessible via a short walk from the site, with frequent services during both the AM and PM peak hours. The Metro station is located about 500m from the site, while bus stops are available on both Lane Cove Road and Talavera Road.

As described in **Section 4.6**, the Proposal would generate about 40 and 20 bus trips in the AM and PM peak hours respectively, while about 110 and 50 trips would be made by train (or Metro) in the AM and PM peak hours respectively.

With 24 Metro services in the AM and PM peak hour respectively, the additional demand would result in five and two additional passengers on each train in each peak hour respectively. Because about 70 bus services are provided in the AM and PM peak hours, the additional demand would result in less than one additional bus passenger on each service. The existing public transport provision is expected to be able to cater for this future demand.

6.3 Active transport impact

As described in **Section 4.6**, approximately 70 and 30 walk only trips will be generated in the AM and PM peak hours respectively by the Proposal, while there would only be four and two additional cycling trips generated in the AM and PM peak hours respectively. Walking trips are also generated by the car trips arriving to and from the site. However, most of these trips are expected to be internal, as drivers will drive into and park within the site, and only a portion of these trips are expected to impact on the surrounding pedestrian road network.

The site is well served by both footpaths and shared paths, and the surrounding road network is expected to be able to cater for the additional active transport demand generated by the Proposal. Cycle parking will also be provided within the site, so no patrons are expected to need to park their bike at public facilities.

An existing bike path runs along the northern boundary of the site, connecting Talavera Road with the bike lane on the westbound carriageway of the M2 Hills Motorway. The alignment of the bike path crosses into the footprint of the proposed underground carpark and the current design includes the removal of this path. Transport is having ongoing discussions about the potential relocation of the cycle path with Ryde Council and Transurban.

As part of the City of Ryde's Bicycle Strategy 2022 – 2030 (as described in **Section 2.3**), additional cycle routes are planned in the future along the western side of the site, parallel to Pittwater Road and along Lane Cove Road as well as through the site. It should however be noted that future cycle routes through the ZEB Macquarie Park Bus Depot will not be possible. The introduction of the routes surrounding the site could encourage a further mode shift towards cycling by the site's employees in the future.

6.4 Parking impact

As described in **Section 4.3**, a one-storey basement car park with 163 car parking spaces for staff will be provided to maximise the at-ground level space for future bus bays. It is expected that all staff will park off-street and not on the surrounding public road network.

Bus parking bays including maintenance bays and bus wash facilities will be provided on-site, so no buses are expected to park on the public road network.

Based on the above, the Proposal is not expected to have a negative impact on public parking on the surrounding road network.

6.5 Proposed transport solutions

Proposed infrastructure upgrades and transport solutions required because of the Proposal are outlined in the following sections. No upgrades to the public transport network are expected to be required.

6.5.1 Active transport

– The alignment of the bike path between Talavera Road and the M2 Hills Motorway crosses into the footprint of the proposed underground carpark and the current design includes the removal of this path. Transport is having ongoing discussions about the potential relocation of the cycle path with Ryde Council and Transurban. Because of the removal, future cycling access configurations to the site may need to be considered.

6.5.2 Road network

Based on the *Greenfield Macquarie Park Zero Emission Bus Depot Traffic Assessment* (WSP, October 2023) study, it was recommended that the following actions be considered:

– Undertake a road safety review of the intersection of Halifax Street and Wicks Road to test the following potential mitigation options to accommodate the additional bus movements:

  - Addition of a green arrow right turn phase from Wicks Road southbound into Waterloo Road.
  - Some terminating bus services will use Halifax Street and turn right at Wicks Road to access the depot. This movement will require a new “Buses Excepted” sign applied to the existing “No Right Turn” sign from Halifax Street to Wicks Road.

– As highlighted in the Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024), the Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal.

7.0 Construction traffic impact assessment

7.1 Road network impact

7.1.1 Proportional impact on traffic volumes

Based on traffic counts undertaken in September 2022, the surrounding traffic network peak hours in Macquarie Park are 8.30 to 9.30am and 4.45 to 5.45pm. As a worst-case scenario for testing impacts, it has been assumed that all construction-related vehicles (both light and heavy vehicles) will arrive and leave the site during these traffic network peak hours. In reality, the light vehicles would arrive before 7am (start of shift) and leave after 6pm (end of shift) and the heavy vehicles may arrive and leave outside of the traffic network peak hours.

As described in **Section 5.3**, the majority of construction related vehicles (heavy and light) are expected to travel through the Waterloo Road / Halifax Road / Wicks Road intersection and enter and exit the site at the Pittwater Road access point. The following assumptions have been made regarding the distribution of construction related vehicles entering and exiting the site:

– The light vehicle routing has been based on current traffic patterns at the surrounding intersections and distributed between the intersections from Lane Cove and Epping Road.

– The heavy vehicle routing has been assumed from the north from the M2 Hills Motorway, right into Lane Cove Road, left into Waterloo Road, left into Wicks Road and left into Pittwater Road. This route would be reversed for exiting heavy vehicles.

Based on the above assumptions, the proportional impact (based on traffic volume increase) on the intersections in proximity to the site was assessed, as presented in **Table 7-1**. As seen, the largest impact is at the Waterloo Road / Halifax Rd / Wicks Road intersection, as all construction (light and heavy) vehicles will travel through this intersection. The increase at the other four intersections is minimal (0.6 per cent or less) and therefore will have minimal impacts to delays and intersection performance. A traffic variance of less than one per cent is assumed to be less than the general daily variation in traffic flows at these intersections.

Based on the above, it is proposed to only model the Waterloo Road / Halifax Road / Wicks Road intersection to assess the construction-related traffic impact, as the increase (7.0% in each peak hour) is large enough to have a measurable impact.

Table 7-1 Existing intersection and with construction intersection traffic flows (vehicles per hour)

Intersection	Existing intersection traffic flows (vph)*		Forecast vehicle flows (vph)*		Impact (% of existing flows)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Lane Cove Road / Talavera Road	5,113 (288)	5,243 (132)	23 (12)	17 (12)	0.5%	0.3%
Lane Cove Road / Waterloo Road	5,221 (340)	5,360 (176)	32 (12)	22 (12)	0.6%	0.4%
Wicks Road / Epping Road	6,238 (346)	6,771 (132)	33 (0)	34 (0)	0.5%	0.5%
Waterloo Road / Halifax Road / Wicks Road	938 (90)	939 (26)	66 (12)	66 (12)	7.0%	7.0%
Epping Road / Lane Cove Road	5,355 (334)	5,688 (143)	20 (0)	22 (0)	0.4%	0.4%

Source: Trans Traffic Surveys 2022, modified by SCT Consulting 2024

* AA(BB) indicates: Total vehicles (Heavy vehicles)

7.1.2 Intersection performance

Intersection performance based on the existing traffic volumes and the additional traffic generated by construction vehicles was assessed for the Waterloo Road / Halifax Road / Wicks Road intersection for the AM and PM peak hours. The results with existing traffic volumes compared to with construction traffic are shown in **Table 7-2**. Due to the constrained traffic conditions surrounding the site, it is unlikely that any further traffic growth will occur that will impact the Waterloo Road / Wicks Road / Halifax Road intersection during the construction phase. Therefore, no traffic background growth has been applied to the road network.

Table 7-2 Existing and with construction traffic performance of the Waterloo Road / Halifax Road / Wicks Road intersection

Scenario	AM Peak Hour				PM Peak Hour			
	Volume	DoS	Average delay (sec)	LoS	Volume	DoS	Average delay (sec)	LoS
Existing traffic volumes	938	0.58	23.8	B	939	0.49	24.4	B
With construction traffic	1,004	0.58	23.8	B	1,005	0.49	24.9	B

Notes: LoS = Level of service (average of all arms of the intersection). For priority and roundabout intersections, the delay and LoS for the worst performing movement is reported.

As discussed in **Section 5.6**, construction activities are expected to generate a total 66 vehicle trips in the AM and PM peak hour. The results indicate that these vehicles have a negligible impact to the operation of the signalised intersection of Waterloo Road/ Halifax Road/ Wick Road. The intersection, with construction traffic, is forecast to perform at LoS B in the AM and PM peak hours.

7.1.3 Works on the surrounding road network

As described in the Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024), it is expected that most of the works for the Proposal will be contained within the existing site and will not interface with traffic on public roads. However, there will be some works required on nearby roads, which may impact the road network surrounding the site. These works and anticipated impacts are described in the following sections.

High voltage power supply upgrade (Waterloo Road / Lane Cove Road)

The high voltage power supply upgrade (early works) from the Ausgrid Macquarie Park Zone will impact Waterloo Road and will also run along the eastern side of Lane Cove Road, entering the site from Talavera Road. Given the absence of shoulders on Lane Cove Road, it's anticipated that these works would likely need to be completed at night under lane closures to avoid disruption to traffic. Any open trenches or pits would need to be reinstated or covered with trafficable steel plates before reopening the lane to traffic at the end of each shift.

Driveway works for the underground car park on Talavera Road

The proposed driveway entrance to the underground car park on Talavera Road may require modifications to the existing driveway entrance for 1 Talavera Road, which could entail some minor works to the kerb crossing at the existing driveway entrance. This will likely be completed during standard working hours with minimal disruption to traffic. However, this will depend on access requirements for the tenants of 1 Talavera Road and outside of working hours work may be required to mitigate potential impacts.

Service and utility connections (Talavera Road / Wicks Road)

The scope and impact of any service and utility connections has not been determined at this time. Minor trenching works may be required on either Talavera Road or Wicks Road to complete these connections to the existing infrastructure. It is expected that any works could be completed under single-lane shuttle-flow conditions during standard working hours. However, they could be conducted outside of working hours to mitigate supply disruptions to existing customers.

7.2 Active transport impact

7.2.1 Pedestrian network

The site is well served by both footpaths and shared paths. However, because there currently are no footpaths along Wicks Road, south of Pittwater Road, no pedestrians are expected to walk along this route. The impact on the surrounding active transport network because of construction activities is therefore expected to be minimal. Signage may be required along Wicks Road near Pittwater Road and along Lane Cove Road, near Talavera Road, to manage any impact on the pedestrian network in proximity to any works associated with the site.

7.2.2 Bicycle network

An existing bike path runs along the northern boundary of the site, connecting Talavera Road with the bike lane on the westbound carriageway of the M2 Hills Motorway. The alignment of the bike path crosses into the footprint of the proposed underground carpark and the current design includes the removal of this path. Transport is having ongoing discussions about the potential relocation of the cycle path with Ryde Council and Transurban.

Management of cyclists needs to be considered, by the installation of appropriate signage and alternative routes.

7.3 Public transport network impact

Workers should be encouraged to use public transport to travel to and from the site whenever possible, given the proximity of the site to public transport. The public transport services available are expected to be able to cope with the additional demand from construction activities. Any required re-routing of services due to construction activities should however be further considered as part of the Construction Traffic Management Plan.

7.4 Parking impact

Given the excellent access of the site to public transport, construction workers will be highly encouraged to use public transport to access the site to minimise parking impacts. However, there will still be a need for some trades to bring tools and equipment with them daily, which will require parking on site. This could initially be accommodated within some of the earthworks areas as they progress.

Some clearing of the low vegetation in the western verge along Pittwater Road from Wicks Road could also be undertaken to provide space for parking, subject to permission.

7.5 Access impact

The Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal.

Given the existing road width of Wicks Road, it is expected that any works could be completed under single-lane shuttle-flow conditions during standard working hours. Some shoulder closures and reduction in overall carriageway widths may be required to remain outside of working hours, but it is expected that two-way two-lane traffic flow could be maintained, subject to the final scope of required work. Wicks Road services the NSW State Emergency Service Ryde Unit and Ryde Resource Recovery Centre, so access for emergency vehicles will always need to be maintained.

7.6 Proposed construction mitigation measures

Proposed mitigation measures required to manage the construction of the Proposal are outlined in the following sections. No upgrades to the public transport network or services are expected at this stage.

7.6.1 Road network

– Management of the high voltage power supply upgrade at Waterloo Road and Lane Cove Road (night works), which will involve lane closures and the reinstatement of open trenches and pits at the end of each shift.

– The proposed driveway entrance to the underground car park on Talavera Road may require modifications to the existing driveway entrance for 1 Talavera Road, which could entail some minor works to the kerb crossing at the existing driveway entrance.

– Minor trenching works may be required on either Talavera Road or Wicks Road to complete service and utility connections (to be confirmed). These works could be completed under single-lane shuttle-flow conditions during standard working hours.

7.6.2 Active transport network

– Signage may however be required along Wicks Road near Pittwater Road and along Lane Cove Road, near Talavera Road, to manage any impact on the pedestrian and cycling network.

– It is expected that parking for construction workers be provided within the site, but any potential worker parking provided off-site need to involve safe walking routes to the site.

– Due to the removal of the bike path between Talavera Road and the M2 Hills Motorway, management of cyclists needs to be considered, by the installation of appropriate signage and alternative routes.

7.6.3 Parking

– Some clearing of the low vegetation in the verge western along Pittwater Road from Wicks Road may be required to provide space for parking, subject to permission.

7.6.4 Access

– The Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal. Some shoulder closures and reduction in overall carriageway widths may be required to remain outside of working hours, but it is expected that two-way two-lane traffic flow could be maintained, subject to the final scope of required work. Wicks Road services the NSW State Emergency Service Ryde Unit and Ryde Resource Recovery Centre, so access for emergency vehicles must always be maintained.

A detailed Construction Traffic Management Plan (CTMP), which will include a construction traffic control plan, will be prepared separate from this report at a later stage. This will be done before the commencement of construction and per the *Traffic Control at Work Sites Technical Manual (Transport, 2022)*.

The CTMP will address the overall traffic management of the site during the construction phase, including provision for vehicular and pedestrian access, parking for construction vehicles and appropriate wayfinding. The vehicular movements and expected routes to and from the site will also be further quantified and defined.

8.0 Summary and conclusion

8.1 Report purpose

This Traffic and Transport Assessment report outlines the traffic and transport impacts of the proposed ZEB Macquarie Park Bus Depot, to support the Review of Environment Factors (REF) for the introduction of a new Depot. The following sections summarise the outcome of the impact assessment for the operational phase, and the construction activities, as well as any proposed traffic and transport solutions to mitigate these impacts.

8.2 Operational impacts and proposed transport solutions

8.2.1 Road network

Based on the *Greenfield Macquarie Park Zero Emission Bus Depot Traffic Assessment* (WSP, October 2023) study, it was recommended that the following actions be transferred to the Depot concept design phase:

– Undertake a road safety review of the intersection of Halifax Street and Wicks Road to test the potential mitigation options (below), to accommodate the additional bus movements:
  - Addition of a green arrow right turn phase from Wicks Road southbound into Waterloo Road.
  - Some terminating bus services will use Halifax Street and turn right at Wicks Road to access the depot. This movement will require a new “Buses Excepted” sign applied to the existing “No Right Turn” sign from Halifax Street to Wicks Road.
– As highlighted in the Macquarie Park Zero Emission Bus Depot 80% Constructability report (Bellwether, January 2024), the Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal.

8.2.2 Active transport

– The alignment of the bike path between Talavera Road and the M2 Hills Motorway crosses into the footprint of the proposed underground carpark and the current design includes the removal of this path. Transport is having ongoing discussions about the potential relocation of the cycle path with Ryde Council and Transurban. Because of the removal, future cycling access configurations to the site may need to be considered.

8.2.3 Public transport

– No upgrades to the public transport network are expected to be required.

8.3 Construction impacts and proposed mitigation measures

The construction activities are expected to generate a total 66 vehicle trips in the AM and PM peak hour. Intersection performance results indicate that these vehicles have a negligible impact to the operation of the Waterloo Road / Halifax Road / Wick Road intersection, which is forecast to still perform at LoS B in the AM and PM peak hour.

8.3.1 Road network

– Management of the high voltage power supply upgrade at Waterloo Road and Lane Cove Road (night works), which will involve lane closures and the reinstatement of open trenches and pits at the end of each shift.
– The proposed driveway entrance to the underground car park on Talavera Road may require modifications to the existing driveway entrance for 1 Talavera Road, which could entail some minor works to the kerb crossing at the existing driveway entrance.
– Minor trenching works may be required on either Talavera Road or Wicks Road to complete service and utility connections (to be confirmed). These works could be completed under single-lane shuttle-flow conditions during standard working hours.

8.3.2 Active transport network

– Signage may however be required along Wicks Road near Pittwater Road and along Lane Cove Road, near Talavera Road, to manage any impact on the pedestrian and cycling network.

– It is expected that parking for construction workers be provided within the site,.

– Due to the removal of the bike path between Talavera Road and the M2 Hills Motorway, management of cyclists needs to be considered, by the installation of appropriate signage and alternative routes.

8.3.3 Parking

– Some clearing of the low vegetation in the verge western along Pittwater Road from Wicks Road may be required to provide space for parking, subject to permission.

8.3.4 Access

– The Pittwater Road / Wicks Road intersection may require widening and upgrading to accommodate future two-way bus movements associated with the Proposal. Some shoulder closures and reduction in overall carriageway widths may be required to remain outside of working hours, but it is expected that two-way two-lane traffic flow could be maintained, subject to the final scope of required work. Wicks Road services the NSW State Emergency Service Ryde Unit and Ryde Resource Recovery Centre, so access for emergency vehicles must always be maintained.

A detailed Construction Traffic Management Plan (CTMP), which will include a construction traffic control plan, will be prepared separate from this report at a later stage. This will be done before the commencement of construction and per the *Traffic Control at Work Sites Technical Manual (Transport, 2022)*.

The CTMP will address the overall traffic management of the site during the construction phase, including provision for vehicular and pedestrian access, parking for construction vehicles and appropriate wayfinding. The vehicular movements and expected routes to and from the site will also be further quantified and defined.

8.4 Conclusion

Based on the Transport and Traffic Assessment undertaken for the proposed ZEB Macquarie Park Bus Depot, the existing transport network and parking situation surrounding the site can accommodate the operation of the Proposal as well as the construction phase, with the implementation of the proposed transport and traffic solutions and mitigation measures.

APPENDIX A

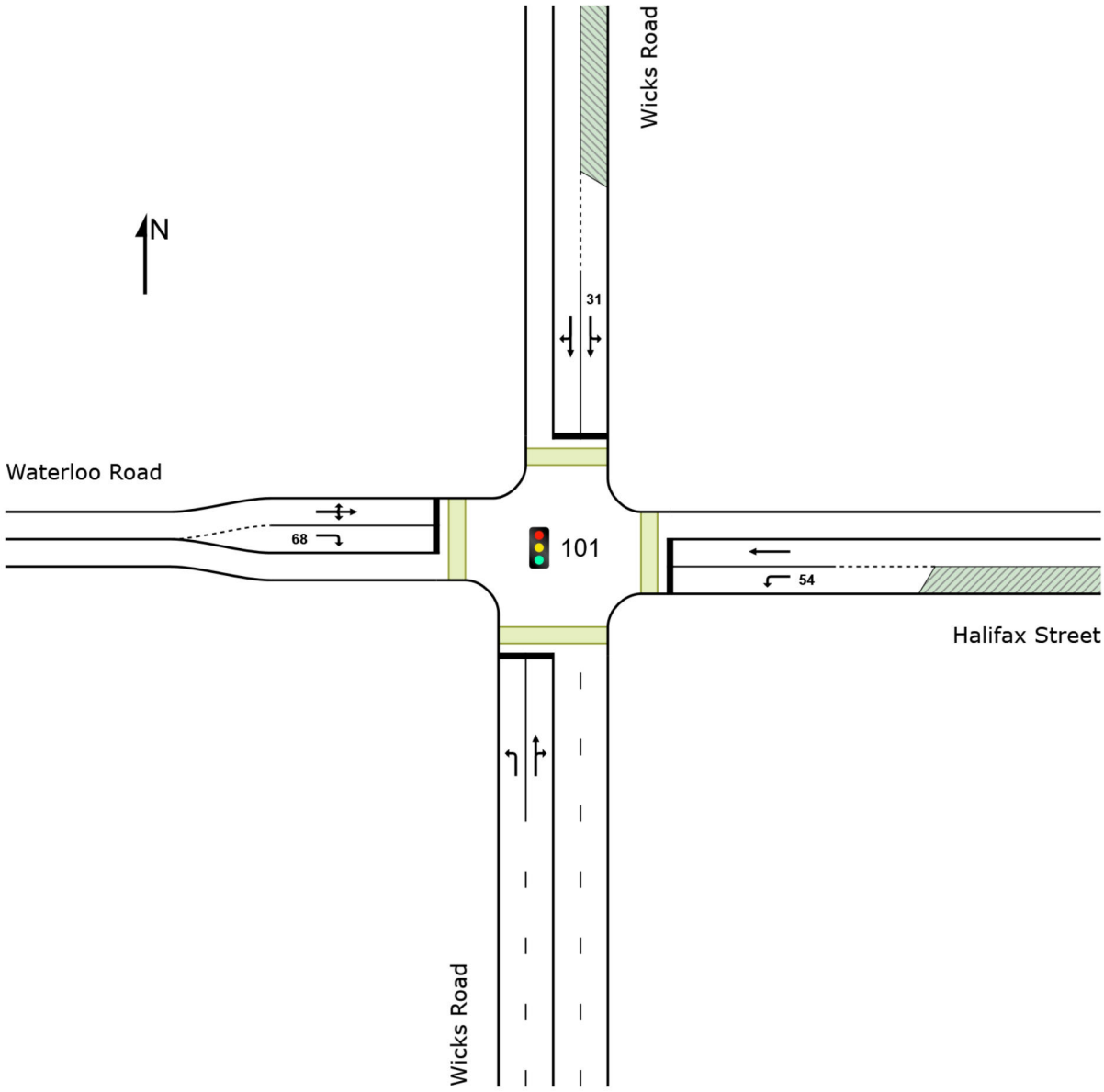
SIDRA ANALYSIS OF EXISTING CONDITIONS

SITE LAYOUT

Site: 101 [WIC_WAT_PM_2022_X (Site Folder: Base year - 2022 Existing)]

Wicks Road | Waterloo Road Signalised
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: SCT CONSULTING PTY LTD | Licence: NETWORK / FLOATING | Created: Friday, 22 March 2024 2:41:39 PM
Project: S:\Projects\SCT_00488_Zero Emission Buses Tranche 1 REF\4. Tech Work\1. Modelling\SCT_Macquarie Park Bus Depot_SIDRA_v0.1_DL.sip9

MOVEMENT SUMMARY

Site: 101 [WIC_WAT_AM_2022_X (Site Folder: Base year - 2022 Existing)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

Wicks Road | Waterloo Road Signalised
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 73 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wicks Road															
1	L2	All MCs	496	2.8	496	2.8	* 0.584	21.1	LOS B	13.1	93.6	0.79	0.82	0.79	37.3
2	T1	All MCs	42	35.0	42	35.0	* 0.308	31.2	LOS C	2.2	19.2	0.93	0.73	0.93	36.4
3	R2	All MCs	23	18.2	23	18.2	0.308	37.9	LOS C	2.2	19.2	0.93	0.73	0.93	32.1
Approach			561	5.8	561	5.8	0.584	22.6	LOS B	13.1	93.6	0.80	0.81	0.80	36.9
East: Halifax Street															
4	L2	All MCs	92	6.9	92	6.9	* 0.472	40.7	LOS C	3.3	24.3	0.98	0.77	0.98	29.8
5	T1	All MCs	46	9.1	46	9.1	0.184	31.3	LOS C	1.5	11.5	0.92	0.69	0.92	33.5
Approach			138	7.6	138	7.6	0.472	37.6	LOS C	3.3	24.3	0.96	0.74	0.96	30.9
North: Wicks Road															
7	L2	All MCs	1	0.0	1	0.0	0.132	37.7	LOS C	1.0	9.3	0.90	0.66	0.90	36.5
8	T1	All MCs	28	48.1	28	48.1	0.132	30.2	LOS C	1.0	9.3	0.90	0.66	0.90	37.7
9	R2	All MCs	25	37.5	25	37.5	0.147	38.6	LOS C	0.9	7.9	0.92	0.71	0.92	30.2
Approach			55	42.3	55	42.3	0.147	34.2	LOS C	1.0	9.3	0.91	0.69	0.91	33.9
West: Waterloo Road															
10	L2	All MCs	16	53.3	16	53.3	0.141	11.8	LOS A	2.3	17.9	0.57	0.66	0.57	42.0
11	T1	All MCs	24	21.7	24	21.7	0.141	4.8	LOS A	2.3	17.9	0.57	0.66	0.57	43.3
12	R2	All MCs	194	6.0	194	6.0	0.141	18.3	LOS B	2.4	17.5	0.59	0.70	0.59	40.0
Approach			234	10.8	234	10.8	0.141	16.4	LOS B	2.4	17.9	0.59	0.69	0.59	40.5
All Vehicles			987	9.3	987	9.3	0.584	23.8	LOS B	13.1	93.6	0.78	0.76	0.78	36.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Wicks Road												
P1	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08
East: Halifax Street												
P2	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08

North: Wicks Road											
P3	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08
West: Waterloo Road											
P4	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08
All Pedestrians		200	211	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [WIC_WAT_PM_2022_X (Site Folder: Base year - 2022 Existing)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

Wicks Road | Waterloo Road Signalised
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Us -Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wicks Road															
1	L2	All MCs	238	1.3	238	1.3	*0.323	21.3	LOS B	5.7	40.0	0.73	0.77	0.73	37.3
2	T1	All MCs	5	20.0	5	20.0	*0.334	30.9	LOS C	2.3	17.0	0.94	0.76	0.94	35.4
3	R2	All MCs	66	3.2	66	3.2	0.334	36.5	LOS C	2.3	17.0	0.94	0.76	0.94	31.5
Approach			309	2.0	309	2.0	0.334	24.7	LOS B	5.7	40.0	0.78	0.77	0.78	35.8
East: Halifax Street															
4	L2	All MCs	141	4.5	141	4.5	*0.499	36.1	LOS C	4.6	33.7	0.96	0.79	0.96	31.5
5	T1	All MCs	55	9.6	55	9.6	0.161	26.5	LOS B	1.6	12.3	0.87	0.66	0.87	35.9
Approach			196	5.9	196	5.9	0.499	33.5	LOS C	4.6	33.7	0.94	0.75	0.94	32.6
North: Wicks Road															
7	L2	All MCs	2	0.0	2	0.0	0.027	34.3	LOS C	0.2	1.6	0.87	0.60	0.87	37.3
8	T1	All MCs	11	0.0	11	0.0	0.027	27.2	LOS B	0.2	1.6	0.87	0.61	0.87	38.5
9	R2	All MCs	2	0.0	2	0.0	0.027	33.0	LOS C	0.2	1.5	0.87	0.61	0.87	36.2
Approach			15	0.0	15	0.0	0.027	29.0	LOS C	0.2	1.6	0.87	0.61	0.87	38.0
West: Waterloo Road															
10	L2	All MCs	9	0.0	9	0.0	0.313	11.7	LOS A	5.5	39.4	0.71	0.74	0.71	41.1
11	T1	All MCs	38	13.9	38	13.9	0.313	5.2	LOS A	5.5	39.4	0.71	0.74	0.71	40.0
12	R2	All MCs	421	0.8	421	0.8	0.313	21.9	LOS B	5.5	39.4	0.72	0.76	0.72	37.7
Approach			468	1.8	468	1.8	0.313	20.4	LOS B	5.5	39.4	0.72	0.76	0.72	38.0
All Vehicles			988	2.7	988	2.7	0.499	24.4	LOS B	5.7	40.0	0.78	0.76	0.78	36.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Wicks Road												
P1	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
East: Halifax Street												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

North: Wicks Road											
P3	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.20.020	1.09
West: Waterloo Road											
P4	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.20.020	1.09
All Pedestrians		200	211	29.3	LOS C	0.1	0.1	0.92	0.92	183.20.020	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

APPENDIX B

SWEPT PATH DRAWINGS

Figure B1 Indicative articulated bus (19.0m) swept path drawing

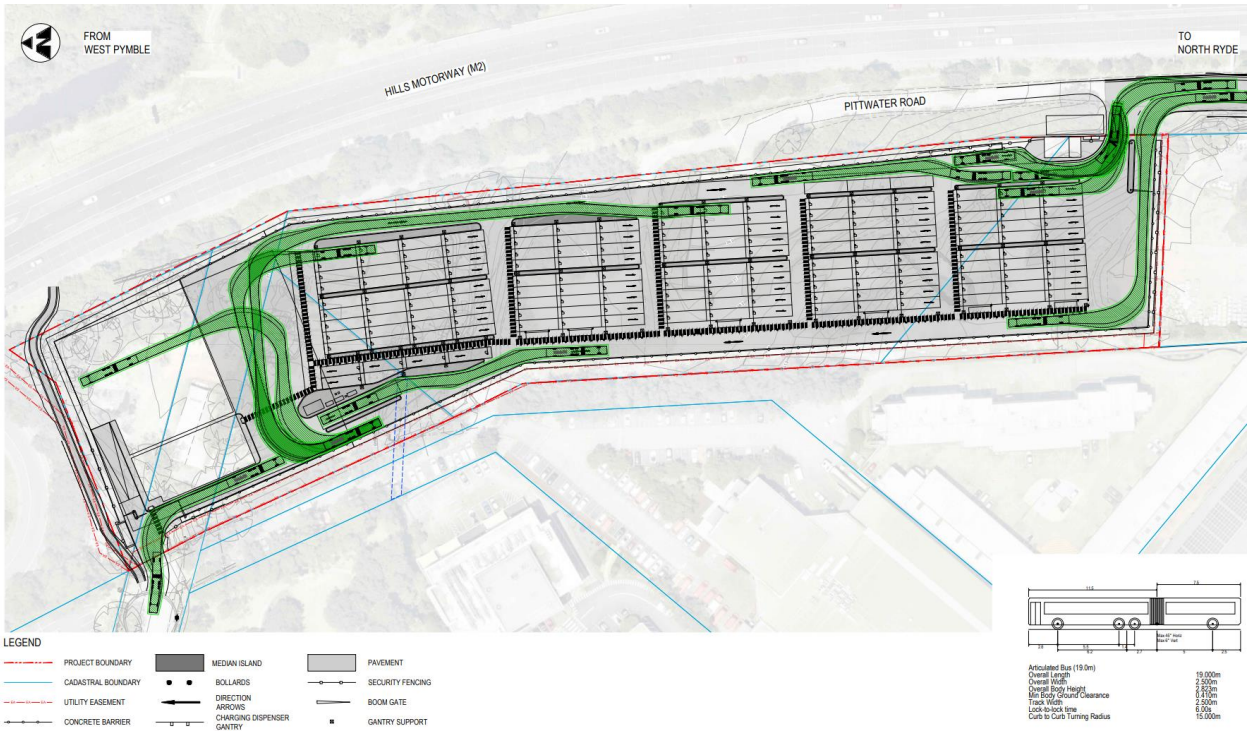
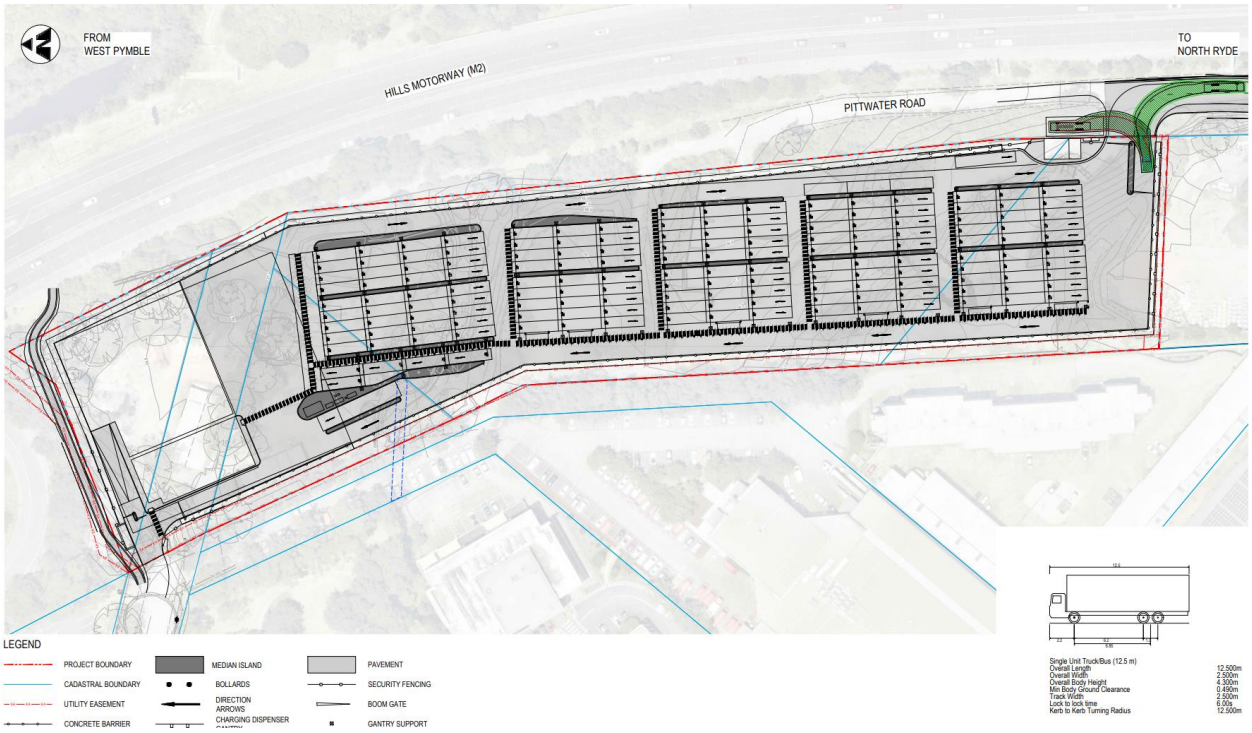


Figure B2 Indicative long rigid bus (14.5m) swept path drawing

Figure B3 Indicative single unit truck / bus (12.5m) swept path drawing



APPENDIX C

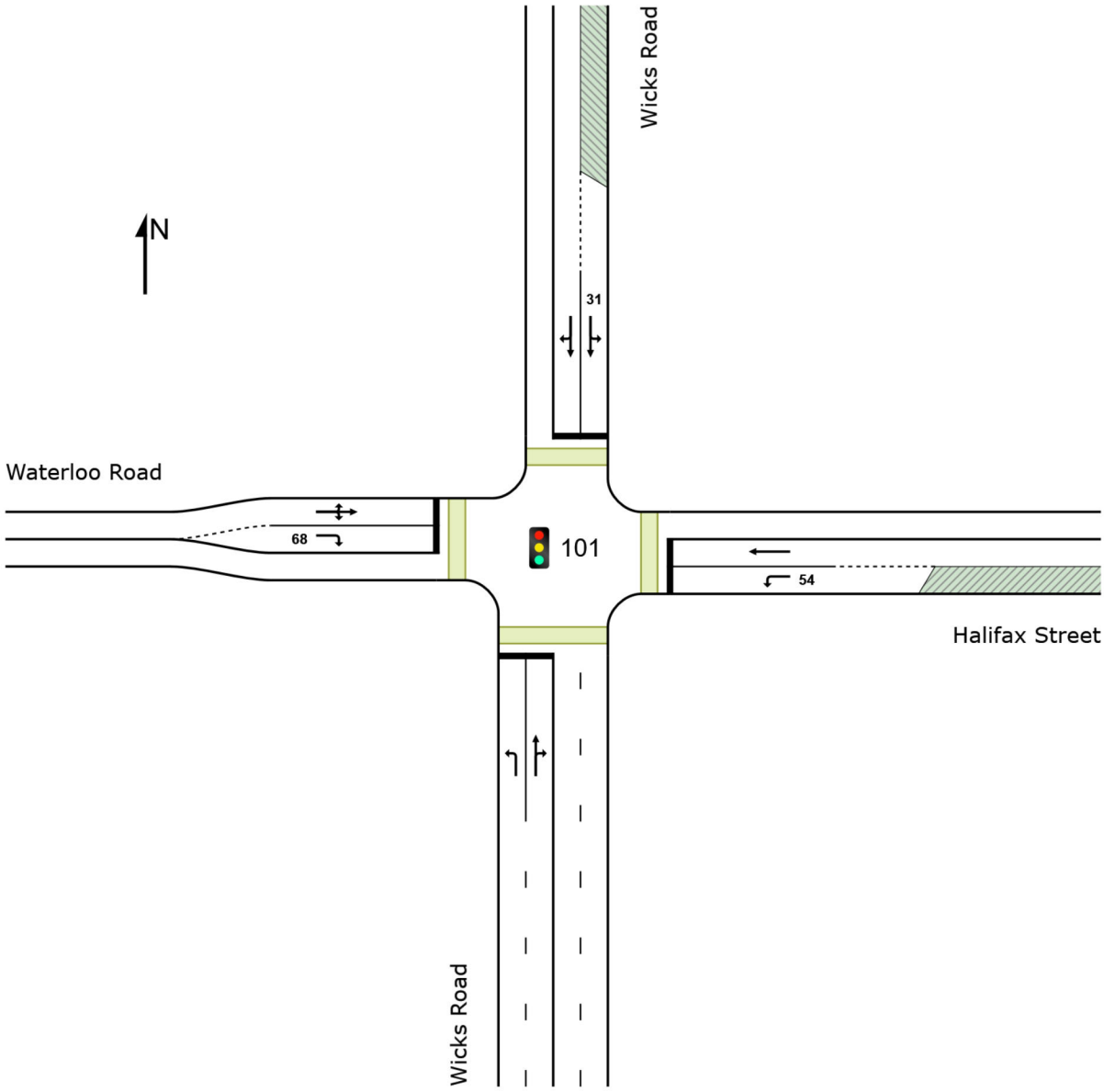
SIDRA ANALYSIS OF CONSTRUCTION TRAFFIC IMPACT

SITE LAYOUT

Site: 101 [WIC_WAT_PM_2022_X (Site Folder: Base year - 2022 Existing)]

Wicks Road | Waterloo Road Signalised
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: SCT CONSULTING PTY LTD | Licence: NETWORK / FLOATING | Created: Friday, 22 March 2024 2:41:39 PM
Project: S:\Projects\SCT_00488_Zero Emission Buses Tranche 1 REF\4. Tech Work\1. Modelling\SCT_Macquarie Park Bus Depot_SIDRA_v0.1_DL.sip9

MOVEMENT SUMMARY

Site: 101 [WIC_WAT_AM_FY_Construction (Site Folder: FY with construction traffic - no background growth)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Wicks Road | Waterloo Road Signalised
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 73 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wicks Road															
1	L2	All MCs	496	2.8	496	2.8	* 0.584	21.1	LOS B	13.1	93.6	0.79	0.82	0.79	37.3
2	T1	All MCs	77	19.2	77	19.2	* 0.427	31.8	LOS C	3.4	27.9	0.95	0.76	0.95	36.5
3	R2	All MCs	23	18.2	23	18.2	0.427	38.6	LOS C	3.4	27.9	0.95	0.76	0.95	32.2
Approach			596	5.5	596	5.5	0.584	23.2	LOS B	13.1	93.6	0.81	0.81	0.81	36.9
East: Halifax Street															
4	L2	All MCs	92	6.9	92	6.9	* 0.378	38.1	LOS C	3.1	23.2	0.95	0.77	0.95	30.7
5	T1	All MCs	46	9.1	46	9.1	0.184	31.3	LOS C	1.5	11.5	0.92	0.69	0.92	33.5
Approach			138	7.6	138	7.6	0.378	35.8	LOS C	3.1	23.2	0.94	0.74	0.94	31.5
North: Wicks Road															
7	L2	All MCs	1	0.0	1	0.0	0.132	37.7	LOS C	1.0	9.3	0.90	0.66	0.90	36.5
8	T1	All MCs	28	48.1	28	48.1	0.132	30.2	LOS C	1.0	9.3	0.90	0.66	0.90	37.7
9	R2	All MCs	32	50.0	32	50.0	0.194	39.2	LOS C	1.1	10.8	0.93	0.73	0.93	29.4
Approach			61	48.3	61	48.3	0.194	35.0	LOS C	1.1	10.8	0.92	0.69	0.92	33.0
West: Waterloo Road															
10	L2	All MCs	44	33.3	44	33.3	0.157	12.2	LOS A	2.5	20.3	0.57	0.67	0.57	42.9
11	T1	All MCs	24	21.7	24	21.7	0.157	5.3	LOS A	2.5	20.3	0.57	0.67	0.57	43.6
12	R2	All MCs	194	6.0	194	6.0	0.157	18.7	LOS B	2.7	20.3	0.59	0.71	0.59	40.0
Approach			262	12.0	262	12.0	0.157	16.3	LOS B	2.7	20.3	0.59	0.70	0.59	40.8
All Vehicles			1057	9.9	1057	9.9	0.584	23.8	LOS B	13.1	93.6	0.78	0.76	0.78	36.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Wicks Road												
P1	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08
East: Halifax Street												
P2	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08

North: Wicks Road											
P3	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08
West: Waterloo Road											
P4	Full	50	53	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08
All Pedestrians		200	211	30.8	LOS D	0.1	0.1	0.92	0.92	184.7	200.0	1.08

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [WIC_WAT_PM_FY_Construction (Site F Y with construction traffic - no background growth)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.2

Wicks Road | Waterloo Road Signalised
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) IsolatedCycle= 70 seconds (Site User -Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Wicks Road															
1	L2	All MCs	238	1.3	238	1.3	*0.323	21.3	LOS B	5.7	40.0	0.73	0.77	0.73	37.3
2	T1	All MCs	5	20.0	5	20.0	*0.340	30.0	LOS C	2.3	17.0	0.94	0.76	0.94	35.4
3	R2	All MCs	66	3.2	66	3.2	0.340	36.6	LOS C	2.3	17.0	0.94	0.76	0.94	31.5
Approach			309	2.0	309	2.0	0.340	24.7	LOS B	5.7	40.0	0.78	0.77	0.78	35.8
East: Halifax Street															
4	L2	All MCs	141	4.5	141	4.5	*0.499	36.1	LOS C	4.6	33.7	0.96	0.79	0.96	31.5
5	T1	All MCs	55	9.6	55	9.6	0.161	26.5	LOS B	1.6	12.3	0.87	0.66	0.87	35.9
Approach			196	5.9	196	5.9	0.499	33.5	LOS C	4.6	33.7	0.94	0.75	0.94	32.6
North: Wicks Road															
7	L2	All MCs	13	0.0	13	0.0	0.152	35.3	LOS C	1.3	9.3	0.90	0.69	0.90	36.8
8	T1	All MCs	46	0.0	46	0.0	0.152	28.5	LOS B	1.3	9.3	0.90	0.69	0.90	37.7
9	R2	All MCs	19	33.3	19	33.3	0.152	35.6	LOS C	1.1	8.8	0.91	0.70	0.91	32.5
Approach			78	8.1	78	8.1	0.152	31.3	LOS C	1.3	9.3	0.90	0.69	0.90	36.2
West: Waterloo Road															
10	L2	All MCs	16	40.0	16	40.0	0.320	12.3	LOS A	5.5	40.6	0.72	0.74	0.72	39.8
11	T1	All MCs	38	13.9	38	13.9	0.320	5.3	LOS A	5.5	40.6	0.72	0.74	0.72	40.0
12	R2	All MCs	421	0.8	421	0.8	0.320	22.1	LOS B	5.6	40.6	0.72	0.76	0.72	37.7
Approach			475	3.1	475	3.1	0.320	20.4	LOS B	5.6	40.6	0.72	0.76	0.72	38.0
All Vehicles			1058	3.7	1058	3.7	0.499	24.9	LOS B	5.7	40.6	0.79	0.75	0.79	36.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Wicks Road												
P1	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
East: Halifax Street												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

North: Wicks Road											
P3	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
West: Waterloo Road											
P4	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
All Pedestrians		200	211	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.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