Greenland (Sydney) Lachlans Line
Macquarie Park Development Pty Ltd
Lachlan's Line - Lots 104 and 105
Transport Assessment

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1 Introduction

1.1 Background

Greenland (Sydney) Lachlans Line Macquarie Park Development Pty Ltd has engaged Arup to conduct a transport assessment for the development of Lots 104 and 105 (the ‘development site’) of the Lachlan’s Line site located in North Ryde, Sydney. Lachlan’s Line form part of the wider North Ryde Station Precinct.

Both Lots 104 and 105 contain a mix of residential, community and retail spaces located in multi-storey buildings.

This transport assessment makes reference to a number of documents relating to the planning of the wider North Ryde Station Precinct, including:

- North Ryde Station Precinct Project Transport Management and Accessibility Plan (TMAP) (Parsons Brinckerhoff, 2012)
- North Ryde Station Precinct Development Control Plan (DCP)

1.2 North Ryde Station Precinct Overview

The North Ryde Station Precinct project is a mixed land use transit-oriented development (TOD) comprising five sites located around the intersection of Epping Road and Delhi Road. The Precinct comprises five separate but linked parcels of land known as:

- Lachlan’s Line (known formally as the M2 Site)
- Station Site North
- Station Site South
- OSL Site
- RMS Site

It is estimated that North Ryde Station Precinct could deliver in the region of

- 251,060 m² residential gross floor area (allowing for approximately 2,564 residential dwellings and 125 student accommodation dwellings)
- 85,625 m² commercial gross floor area (including potential for 125 serviced apartments)
- 6,100 m² retail floor area (which could include a small supermarket)
1.3 **Scope**

This traffic impact assessment supports the development of Lots 104 and 105 of the Lachlan’s Line project, and outlines the following:

- Existing conditions
- Development proposals
- Road/intersection upgrades
- Access
- Car parking arrangements
- Pedestrian and bicycle access
- Garbage collection and goods delivery arrangements.
2 Existing Conditions

2.1 Existing Road Network

The site is serviced by a number of key arterial roads, namely:

- M2 Hills Motorway
- Epping Road
- Delhi Road

The M2 Hills Motorway is a major toll road running from north-west to south-east in Sydney’s north-west. Access to this highway is gained by an elevated road ramp from the eastern exit of the existing site.

Epping Road is a main road running north-west/south-east, and operates as a dual carriageway with four lanes in each direction, with a fifth bus lane in the south-east direction forming directly in front of the proposed site location. There is currently no direct access from the site to this road.

Delhi Road is a main road running east-west. It is located immediately south of the site, and is bound by Epping Road by way of a signalised T-intersection with slip lane provisions for left turning. It is predominantly a dual carriageway with two lanes in both directions, with additional lanes located around points of intersection. There is currently no direct access from the site to this road.

In addition to the arterial roads listed above, the M2 site within which the development site is located is accessible by two key collector roads; Wicks Road and Waterloo Road.

Due to the number of intersecting arterial roads, relatively high traffic volumes and complex traffic movements, many of the intersections in the area surrounding the Project sites are controlled by traffic signals. Notable intersections within close proximity of the development site include:

- Epping Road/Delhi Road signalised intersection
- Epping Road/Wicks Road signalised intersection
- Delhi Road/M2 Interchange signalise intersection
- Wicks Road/Waterloo Road priority intersection
2.2 Public Transport

The site has good access to public transport, with several bus stops serviced by a number of routes and North Ryde Station located within walking distance.

2.2.1 Bus

A number of bus stops are located in close proximity to the site, with the closest primarily located along Epping Road. A total of ten routes are able to be reached within approximately 300m walking distance of the site. Table 1 below provides an overview of the ten routes and their peak hour frequencies, while further detail regarding these routes and bus stops in the greater area can be found in the North Ryde Station Precinct TMAP.

Table 1 Summary of Lachlan’s Line bus network

<table>
<thead>
<tr>
<th>Bus Route</th>
<th>Peak Hour Frequency (No. Trips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A – Warriewood via Dee Why to Sydney Olympic</td>
<td>Temporary buses operated by Sydney Olympic Park Major Event Buses</td>
</tr>
<tr>
<td>140 – Epping to Manly via Macquarie</td>
<td>2 trips daily</td>
</tr>
<tr>
<td>290 – Epping to City via Macquarie</td>
<td>3 - 4</td>
</tr>
<tr>
<td>292 – Marsfield to City via Epping</td>
<td>4</td>
</tr>
<tr>
<td>293 – Marsfield to City via freeway</td>
<td>4 - 6</td>
</tr>
<tr>
<td>294 – Epping to City via St Leonards</td>
<td>1* – 6 (*PM peak time)</td>
</tr>
<tr>
<td>545 – Parramatta to Chatswood via Macquarie</td>
<td>5 - 6</td>
</tr>
<tr>
<td>550 – Chatswood to Parramatta via Eastwood</td>
<td>4 trips daily</td>
</tr>
<tr>
<td>621 – Castle Hill to City via Macquarie Park</td>
<td>2 - 3</td>
</tr>
<tr>
<td>651 – Castle Hill to City via Macquarie</td>
<td>2 - 3</td>
</tr>
</tbody>
</table>

2.2.2 Rail

North Ryde Station is located approximately 500m to the east of the site and services the T1 North Shore, Northern and Western Line. The Station is served by trains departing every fifteen minutes and takes approximately thirty minutes (nine stops) to Sydney CBD.

Figure 1 below outlines public transport facilities and routes in the Lachlan’s Line development area.
Figure 1  Overview of site public transport facilities
2.3 Walking and Cycling

The existing site is not especially suited for pedestrian and cyclist access given the proximity of main arterial roads and intersections to the site, however pedestrian facilities are provided at numerous locations in the immediate area.

A pedestrian footbridge provides access to both sides of Epping Road, with paved footpaths on the developed portions of the Road. The paved footpath ends directly outside the site area, and whilst there is sufficient space for pedestrian access, the path and kerb have not been developed for safe movement along this portion of the road until the signalised at-grade intersection of Epping Road/Delhi Road is reached.

Delhi Road also provides pedestrians with paved footpaths. The pedestrian facilities on the road side fronting the site end once the M2 Hills Motorway entry is reached, while facilities on the opposite side extend and contain guardrails for additional pedestrian safety.

Wicks Road provides reasonable facilities for pedestrian access to the site, with the stretch bound by Epping Road and Waterloo Road containing paved footpaths. Beyond Waterloo Road, Wicks Road no longer contains pedestrian facilities and there is little space on the road fronting side of the site for pedestrian movement given the current width of the grassed median.

Shared pedestrian and cycle paths exist along Epping Road, Wicks Road and Waterloo Road. Marked cycle lanes exist to the west of the site, on Ryrie and Avon Roads, with the closest dedicated bicycle area located at North Ryde Station. For further information regarding the greater cycle network of the area, refer to the North Ryde Station Precinct TMAP.
3 Proposed Development

3.1 Development Description

The North Ryde Station Precinct project is located in Macquarie Park – 12km north-west of the Sydney CBD and exists in the City of Ryde LGA.

Lot 104 and Lot 105 form part of Lachlan’s Line site which is bound by Epping Road, Delhi Road, the M2 Motorway and Wicks Road. Lot 104 and Lot 105 are located within the southern section of the site.

3.2 Development Schedule

Lot 104 and Lot 105 includes a mix of residential, retail, commercial and community uses. The development schedule for each Lot is provided below.

Table 2: Lot 104 Development Schedule

<table>
<thead>
<tr>
<th>Block</th>
<th>Residential</th>
<th>Retail/Commercial</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Studio</td>
<td>1 bedroom</td>
<td>2 bedroom</td>
</tr>
<tr>
<td>L1</td>
<td>0</td>
<td>84</td>
<td>42</td>
</tr>
<tr>
<td>L2</td>
<td>0</td>
<td>74</td>
<td>62</td>
</tr>
<tr>
<td>L3</td>
<td>0</td>
<td>71</td>
<td>57</td>
</tr>
<tr>
<td>L4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>L5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M</td>
<td>58</td>
<td>16</td>
<td>105</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>245</td>
<td>266</td>
</tr>
</tbody>
</table>

Table 3: Lot 105 Development Schedule

<table>
<thead>
<tr>
<th>Block</th>
<th>Residential</th>
<th>Retail/Commercial</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Studio</td>
<td>1 bedroom</td>
<td>2 bedroom</td>
</tr>
<tr>
<td>J</td>
<td>0</td>
<td>66</td>
<td>97</td>
</tr>
<tr>
<td>K</td>
<td>9</td>
<td>78</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>144</td>
<td>155</td>
</tr>
</tbody>
</table>
3.3 Car Parking Provision

3.3.1 Car Parking Requirement

Section 7.2 of the North Ryde Station Precinct DCP sets out the maximum parking rates for the entire North Ryde Station Precinct including Lachlan’s Line and the development site. Car parking rates applicable to the development site include:

- Residential:
  - 0 spaces per studio
  - 0.6 spaces per 1 bedroom dwelling
  - 0.9 spaces per 2 bedroom dwelling
  - 1.4 spaces per 3 bedroom dwelling
  - 0.1 spaces per dwelling (visitors)
- Commercial - 1 space per 90 m² GFA
- Community centre - 1 space per 100 m² GFA
- Supermarket – 1 space per 60 m² GFA

A total of 180 retail car parking spaces are proposed for Lot 104 and 105 (combined). Justification for these additional spaces in relation to the overall traffic generation of the development is provided in section 4.6 of this document.

3.3.2 Car Parking Provision

The parking provision by land use type for Lot 104 and Lot 105 is detailed in Table 4 and Table 5 below.

It should be noted that 46 of the maximum permissible 85 residential visitor parking is to be provided, equivalent to a parking rate of 1 space per 19 dwellings. This is in accordance with the North Ryde Station DCP which provides a maximum parking rate for residential visitors (1 space per 10 dwellings). Car parking between the residential visitors and retail users may be shared during peak demand periods, which is an efficient way of allocating car parking given the peaks for these two users typically do not coincide.
Table 4: Car parking provision Lot 104

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Spaces</th>
<th>Parking Rate</th>
<th>Total Area / Dwellings</th>
<th>Total spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail</td>
<td>1</td>
<td>Per 33.1sqm GFA</td>
<td>2,316 sqm</td>
<td>70</td>
</tr>
<tr>
<td>Supermarket</td>
<td>1</td>
<td>Per 33.1sqm GFA</td>
<td>2,884 sqm</td>
<td>87</td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Per studio apartment</td>
<td>58</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>Per one bedroom dwelling</td>
<td>255</td>
<td>147</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>Per two bedroom dwelling</td>
<td>266</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>Per three bedroom dwelling</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Per 19 dwellings (Visitor parking)</td>
<td>577</td>
<td>30</td>
</tr>
<tr>
<td>Sub-Total - Residential</td>
<td></td>
<td></td>
<td><strong>577</strong></td>
<td><strong>428</strong></td>
</tr>
<tr>
<td>Community</td>
<td>1</td>
<td>Per 100sqm GFA</td>
<td>2,500sqm</td>
<td>25</td>
</tr>
<tr>
<td>Car share</td>
<td>1</td>
<td>Per 50 residential car spaces</td>
<td>624</td>
<td>12</td>
</tr>
</tbody>
</table>

Total car parking spaces: Lot 104 622

Table 5: Car parking provision Lot 105

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Spaces</th>
<th>Parking Rate</th>
<th>Total Area / Dwellings</th>
<th>Total spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail</td>
<td>1</td>
<td>Per 26sqm GFA</td>
<td>766 sqm</td>
<td>23</td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Per studio apartment</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>Per one bedroom dwelling</td>
<td>144</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>Per two bedroom dwelling</td>
<td>155</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>Per three bedroom dwelling</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Per 19 dwellings (Visitor parking)</td>
<td>308</td>
<td>16</td>
</tr>
<tr>
<td>Sub-Total - Residential</td>
<td></td>
<td></td>
<td><strong>308</strong></td>
<td><strong>239</strong></td>
</tr>
</tbody>
</table>

Total car parking spaces: Lot 105 262

3.4 Bicycle Parking Provision

The Ryde Council DCP recommends that bicycle parking be provided equivalent to 10% of the required residential car spaces. This would require 62 bicycle parking to be provided across both developments. Considering the scale of development, proximity to nearby public transport and the general objective of the precinct to encourage active transport usage, a significantly higher bicycle parking provision is proposed. This includes 200 dedicated bicycle parking spaces as well as 470 additional residential storage cages.

3.5 Car Share

In accordance with Ryde Council requirements, 1 car share space will be provided for every 50 standard residential car parking bays. Based on the 621 residential car spaces provided across both lot 104 and lot 105, there is provision for 12 car share spaces within the lot 104 basement.
4 Transport Impact Assessment

4.1 Future Road Network Upgrades

To support the development of the North Ryde Station precinct a number of upgrades to the surrounding road network are proposed which support vehicle movements to/from the site. These include:

- Waterloo Road/Wicks Road: new traffic signals and pedestrian crossings
- Epping Road: left-in only connection to Lachlan’s Line site including deceleration lane
- Epping Road / Wicks Road: Local intersection works to improve capacity
- Delhi Road: Widening between M2 Motorway to Julius Avenue
- Wicks Road: Widening at approaches to intersections of Epping Road and Spine Road
- Delhi Road / M2: Intersection upgrade works

This is illustrated in Figure 2 below.

![Figure 2 Future road network upgrades](image-url)
4.2 **Internal Site Access**

The development site is accessed via a Spine Road which runs in a north-south direction from Epping Road to Waterloo Road. The Spine Road is the main vehicular connection through the Lachlan’s Line site.

To the south the Spine Road forms a left in only intersection with Epping Road. To the north the Spine Road forms a four way signalised intersection with Wicks Road and Waterloo Road.

The DCP for the site contemplates future links from the Spine Road to Wicks Road and Epping Road although this does not form part of this application.

![Figure 3 Site Access](image-url)
4.3 Road Network Design

The street designs within the development site have been designed with regard to the Macquarie Park DCP 2010, AMCORD and Australian Standard AS2890.5-1993 On-street Parking.

4.3.1 Spine Road

The Spine Road is classified as a collector road, and exists the length of the Lachlan’s Line site. An allocated 20m road reserve will comprise two 3.25m carriage ways. On-street parking will be provided in some sections. To the south the Spine Road forms a left in only intersection with Epping Road. To the north the Spine Road forms a four way signalised intersection with Wicks Road and Waterloo Road.

Figure 4 Spine Road cross section
4.3.2 High Street

High Street exists as a two-way local street and turns into Plaza Street which borders Lot 105. An allocated 17.5m road reserve will comprise two 3.25m carriage ways.

![High Street cross section](image)

Figure 5 High Street cross section

Table 6: Relevant street dimensions

<table>
<thead>
<tr>
<th></th>
<th>Carriageway</th>
<th>Parking</th>
<th>Planting</th>
<th>Pavements</th>
<th>Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine Road</td>
<td>2 x 3.25m</td>
<td>2 x 2.5m</td>
<td>1 x 2.5m + planting in parking bays</td>
<td>2 x 3.0m</td>
<td>20m</td>
</tr>
<tr>
<td>High Street</td>
<td>2 x 3.25m</td>
<td>2 x 2.5m</td>
<td>Planting in parking bays</td>
<td>2 x 3.0m</td>
<td>20m</td>
</tr>
</tbody>
</table>
4.4 Mode Split and Travel Patterns

The proposed development will generate a growth in residential population whilst also attracting non-residents (e.g. for purposes of shopping, work and other activities). The mode share for both residents and non-residents reflects the TOD qualities of the precinct and reduced car parking rates.

4.4.1 Non-Residential Mode Share

Mode share for non-residents, as set down in Table 7 below, has been extracted from the North Ryde Station Precinct Project TMAP (Table 6.4, p. 71).

Table 7: Non-residential mode share

<table>
<thead>
<tr>
<th>Mode</th>
<th>Retail AM Peak</th>
<th>Retail Daily</th>
<th>Community Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle – driver</td>
<td>10%</td>
<td>36%</td>
<td>25%</td>
</tr>
<tr>
<td>Vehicle – passenger</td>
<td>3%</td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>Train</td>
<td>17%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Bus</td>
<td>6%</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td>Walk</td>
<td>60%</td>
<td>32%</td>
<td>40%</td>
</tr>
<tr>
<td>Cycle</td>
<td>4%</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.4.2 Residential Mode Share

Mode share for residents has been extracted from the North Ryde Station Precinct Project TMAP (Table 6.5, p. 71).

The TMAP includes a range of mode share percentages based on residential car parking allocation. The mode share set down in Table 8 below assumes an average rate of 0.8 car parking spaces per dwelling. This is reflective of the average car parking allocation applied to residential units in Lot 104 and Lot 105.

Table 8: Residential mode share

<table>
<thead>
<tr>
<th>Mode</th>
<th>Purpose</th>
<th>Work</th>
<th>Education</th>
<th>Shopping</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle – driver</td>
<td>35%</td>
<td>2%</td>
<td>32%</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>Vehicle – passenger</td>
<td>4%</td>
<td>25%</td>
<td>11%</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>Train</td>
<td>30%</td>
<td>21%</td>
<td>11%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td>17%</td>
<td>23%</td>
<td>10%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Walk</td>
<td>12%</td>
<td>24%</td>
<td>32%</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>Cycle</td>
<td>2%</td>
<td>4%</td>
<td>4%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
4.5  Site Access

4.5.1  Basement Access, Layout and Circulation

Off-street parking in the facility will be compliant with AS/NZS 2890.1:2004 and AS/NZS 2890.6:2009. Parking will exist on 4 levels – level 00, lower ground/basement 01 and basements 02 and 03. Retail/community allocated parking spaces will exist on levels 00 and 01, whilst residential allocated parking spaces will exist on basement levels 01, 02 and 03.

Access to the parking facility will be via lower ground/basement 01, where a two-way access ramp with an additional entry merging lane will be provided and intersect with Spine Road. A merge lane is provided for ingressing vehicles so as to limit vehicle queuing on the Spine Road.

Two-way ramps exist on all levels, and do not exceed a grade of 1:5 between levels containing retail/community allocated spaces and 1:4 between levels containing residential allocated spaces in accordance with Australian Standards.

Parking aisles will be two-way to allow full circulation with 90 degree parking spaces and a minimum of 5.8m aisle width exists throughout the entire facility to comply with AS/NZS 2890.1:2004. Standard parking space dimensions will be 2.6m width by 5.4m length whilst disabled parking spaces will be 3.9m width by 5.4m length, of which a minimum of 2.4m width will be dedicated parking space.

Vehicle swept paths are provided in Appendix A of this document.
4.5.2 Loading Areas

A loading dock exists in the western corner of lower ground/basement 01, and access is provided adjacent to the car park entrance. This loading dock will accommodate up to six service vehicles at any one time, up to articulated vehicles. A 19m turntable has been provided to accommodate vehicle manoeuvrability within the loading dock. Vehicle swept paths are provided in Appendix A of this document.

Figure 6 Retail loading area

4.5.3 Waste

Residential waste collection will be via lower ground/basement 01 level, whereby the car park entrance will be adequate in accommodating garbage collection vehicles. Garbage loading area will be located at the base of the tunnel connecting to the lot 105 car park, where adequate room is provided for the vehicles to perform turning manoeuvres.

Access for garbage vehicles will typically be out of hours and not coincide with the traffic peak for the retail and residential uses. This will minimise any potential conflicts between traffic and minimise vehicle queuing within the site.

Vehicle swept paths for the residential waste loading area are provided in Appendix A of this document.
4.6 Traffic Generation

The following section considers the total traffic generation for the precinct in the context of the proposed higher retail car parking provision. Providing a suitable number of on-site car parking spaces for the retail development is important to ensure that parking is confined to the site and not adjacent streets. To this end the potential for additional car parking to service the retail component of Lachlan’s Line was investigated.

The total traffic generation estimate for the Lachlan’s Line site in the revised North Ryde Station Precinct Transport Management and Accessibility Plan (TMAP) is 537 vehicles in the PM peak hour. Therefore the methodology adopted to determine the maximum number of additional retail car parking spaces involved forecasting the traffic generation for the site (based on updated land use data) and ensuring this was similar to the original 537 forecast vehicle trips.

Numerous sections of the State Significant Development Application Transport Impact Assessment prepared for the Lachlan’s Line site (ARC traffic and transport, 2014) specifically identified the fact that lower residential parking provision would reduce residential trip generation, and specifically provide for analysis using the updated RMS Guide to Traffic Generating Developments (TDT 2013/04) residential trip rates per parking space, which are as follows:

- 0.15 AM peak hour trips per parking space
- 0.12 PM peak hour trips per parking space

Based on the dwelling mix proposed under this development application, and applying the same proportions to the envisaged 2,373 for the entire Lachlan’s Line site, the total quantum of on-site parking can be estimated. This is presented in Table 9 below.

Table 9: Forecast parking – entire Lachlan’s Line site

<table>
<thead>
<tr>
<th>Dwelling Type</th>
<th>Studio</th>
<th>1 bed</th>
<th>2 bed</th>
<th>3 bed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 104 dwelling mix</td>
<td>58</td>
<td>245</td>
<td>266</td>
<td>8</td>
<td>577</td>
</tr>
<tr>
<td>Lot 105 dwelling mix</td>
<td>9</td>
<td>144</td>
<td>155</td>
<td>0</td>
<td>308</td>
</tr>
<tr>
<td>Number of dwellings Lot 104 + Lot 105</td>
<td>67</td>
<td>389</td>
<td>421</td>
<td>8</td>
<td>885</td>
</tr>
<tr>
<td>Proportion of dwellings</td>
<td>8%</td>
<td>44%</td>
<td>48%</td>
<td>1%</td>
<td>100%</td>
</tr>
<tr>
<td>Total dwellings across M2 site</td>
<td>180</td>
<td>1043</td>
<td>1129</td>
<td>21</td>
<td>2373</td>
</tr>
<tr>
<td>Residential parking rate (per dwelling)</td>
<td>0.6</td>
<td>0.9</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of residential parking spaces – M2 site</td>
<td>626</td>
<td>1016</td>
<td>30</td>
<td>1672</td>
<td></td>
</tr>
<tr>
<td>Visitor parking rate (per dwelling)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>45</td>
</tr>
<tr>
<td>Number of visitor parking spaces – M2 site</td>
<td>104</td>
<td>113</td>
<td>2</td>
<td>237</td>
<td></td>
</tr>
<tr>
<td>Total parking across M2 site</td>
<td>18</td>
<td>730</td>
<td>1,129</td>
<td>32</td>
<td>1,909</td>
</tr>
</tbody>
</table>
Given the constrained parking environment around the site, a suitable method for estimating the level of traffic generating by the retail component is to consider the quantum of parking provided. The typical length of time a vehicle generally occupies a car parking space in a retail centre with the mix of uses proposed in Lachlan’s Line is approximately 1 hour to 90 minutes. Surveys undertaken by Arup at West Ryde shopping village confirmed this figure. Therefore, every car parking space generates two vehicle trips in the peak hour. This rate has been adopted in the analysis.

The incidence of passing trade (linked trips) can reduce overall trip generation rates. A linked trip is a trip taken as a side-track from another trip, for example, a person calling in to the centre on the way home from work. Given the location of Lachlan’s Line with respect to key roads, particularly Epping Road and the M2 Motorway, it would be appropriate to apply a discount of 25% on the trips generated by the retail component. This discount is consistent with that recommended for retail uses (for centres with less than 10,000m² retail GLFA) as noted in Section 3.6.1 the RMS Guide to Traffic Generating Developments.

The overall number of vehicle trips generated by the site in the PM peak hour, considered the traffic generation rates noted above, is summarised in Table 10 below.

Table 10: PM peak hour traffic generation

<table>
<thead>
<tr>
<th>Land use mix (GFA)</th>
<th>PM peak hour traffic generation rate</th>
<th>% Passing Trade</th>
<th>PM peak hour traffic generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential 1,909 Parking spaces</td>
<td>0.13 veh / space</td>
<td>0%</td>
<td>248</td>
</tr>
<tr>
<td>Community 2,500 m² GFA</td>
<td>0.75 veh / 100m²</td>
<td>0%</td>
<td>19</td>
</tr>
<tr>
<td>Retail 180 Parking spaces</td>
<td>2.0 veh / space</td>
<td>25%</td>
<td>270</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>537</strong></td>
</tr>
</tbody>
</table>

As evident in Table 10, the forecast level of traffic generation with a total of 180 retail car parking spaces (94 more than the 86 permissible under the current DCP) equivalent to that forecast in the TMAP modelling review.

Therefore proposed additional retail car parking for the site is not forecast to generate impacts on the surrounding road network over and above that used to inform the transport infrastructure works required for the site as outlined in the TMAP modelling review for the M2 site (Parsons Brinkerhoff, January 2014).
4.7 Road Network Impacts

The PB Transport Assessment report, including the modelling review undertaken in 2014, assessed the traffic impacts associated with the Lachlan’s Line site, which accounted for the surrounding development and growth in the North Ryde Station Precinct. The road system is proposed to be upgraded in stages to account for the timing of surrounding development and growth. The PB Transport Assessment report modelled the future year 2031 (when all expected development was to occur) via a micro-simulation traffic model. This modelling informed the development of the recommended road infrastructure works as previously detailed in Section 4.1 of this report.

As previously noted in Table 10 of this report, the forecast level of traffic generation from Lots 104 and 105, even with a higher rate of retail car parking, is consistent with that envisaged in the TMAP modelling review for the precinct. This strategy established the overall traffic generation for the development for the North Ryde Station Precinct including the Lachlan’s Line, which was the basis for the transport and traffic infrastructure upgrades. Therefore no additional road infrastructure works are required to support the site beyond those recommended in the PB Transport Assessment and subsequent TMAP modelling review.

4.8 Public Transport Access

4.8.1 Heavy Rail

Users of the precinct will benefit from convenient access to the North Ryde railway station. Access will be significantly improved following the construction of a new pedestrian bridge over Delhi Road which would remove this major road corridor as a barrier to pedestrian movement.

From 2019 rail services at North Ryde station will be significantly improved following the completion of the Sydney Metro project. The Sydney Metro concept involves 66km of metro rail between Rouse Hill and Bankstown. Sydney Metro Northwest (previously known as the North West Rail Link) is currently under construction and includes eight new fully accessible railway stations and 4,000 commuter car parking spaces. Metro services will start in the first half of 2019 with a train every four minutes in the peak, or 15 trains an hour.
Future bus passengers travelling to and from the site would enjoy close proximity to major bus corridors. Existing pedestrian facilities that assist access to the surrounding bus stops would be augmented by new facilities proposed with the development, including:

- The pedestrian bridge over Delhi Road and M2 Motorway
- Traffic signals with pedestrian crossings at the intersection of Wicks Road and Waterloo Road
- A pedestrian path from the southern end of the North Ryde Station Site South to Epping Road at the intersection with Pittwater Road
- Internal pedestrian crossings and shared zones.
4.9 Pedestrian and Cycle Upgrades

As part of the North Ryde Station Precinct Project, there are a number of significant pedestrian and cycling infrastructure upgrades (see Figure 8) that are relevant to the development site as per the North Ryde Station Precinct – Development Control Plan:

- A pedestrian bridge from Lachlan’s Line, across Delhi Road, across the M2 Motorway and connecting to the North Ryde Station Site North
- A footpath along the northern side of Epping Road connecting the Epping Road footbridge to the intersection with Delhi Road
- Pedestrian crossings at the intersection of Waterloo Road and Wicks Road via the provision of new traffic signals
- A new footpath along the eastern side of Wicks Road in front of the Lachlan’s Line site
- The creation of a continuous shared pedestrian and cycle path from the Riverside Corporate Park, through the North Ryde Station Site North, over the new pedestrian bridge, through the Lachlan’s Line site and connecting to the new shared paths on Waterloo Road
- A shared zone around the central open space within the Lachlan’s Line site and pedestrian crossings with raised thresholds on either side to maintain the pedestrian and cycle priority over traffic through the site
- Footpath alongside Spine Road from Epping Road to the intersection of Waterloo Road and Wicks Road which will serve as a primary pedestrian route, as well as on-road cycling facilities

Figure 8 Pedestrian and cycle upgrades
The major upgrade to pedestrian and cycling infrastructure will be the new shared bridge connecting the Lachlan’s Line site to the Station site along Delhi Road. The bridge deck would have a clear width of 3.0m divided into two shared lanes. Based on forecast data as per the North Ryde Station Precinct Project - Transport Management and Accessibility Plan, this bridge is expected to experience a peak flow of 20 people per meter width per minute. This pedestrian bridge will significantly reduce pedestrian and cyclist travel time and distance to and from the station, as pedestrians are able to bypass crossing of two signalised intersection whilst also accommodating pedestrian desire lines.

Figure 9  Lachlan’s Line pedestrian bridge

Source: KI Studio

4.10  Travel Demand Management

A number of travel initiatives are proposed in order to reduce single occupancy vehicle trips and car ownership. This can be enforced through the introduction of a suite of travel demand management measures contained within a green travel plan (GTP).

The main objectives of the GTP are to reduce the need to travel and promotion of sustainable means of transport. The implementation of a GTP would address travel demand and sustainable travel initiatives for the residential, commercial and retail components of the site, and would bring benefits such as:

- Residents and employees can enjoy improved health, less stress, a better quality of life, cost and time savings, and greater travel choice;
- Reduced traffic congestion;
- Benefit from improved air quality, less noise and pollutants; and
- Deliver health benefits, tackle obesity and improve residents quality of life

The GTP details proposed initiatives to encourage sustainable travel alternatives. The GTP is catered to residents, visitors and staff of the precinct. The GTP also
includes aspects of monitoring and administration to ensure the schemes are executed and improved over time.

Some of the initiatives that may be included within the GTP could include the following:

**4.10.1 Travel Packs**

A new development provides an opportunity to offer residents advice on travel modes to and from the site. At this time, new travel habits are being established and people may particularly welcome information about the travel services and facilities available to them.

A travel pack could be supplied to all residents. The pack will include information on the development travel plan, bicycle and walking routes, bus and rail timetables, information on car sharing and membership information for the development car club. The pack could also include discount vouchers for a local bicycle retailer and a questionnaire about travel behaviour. Short term membership to a car share organisation may also be provided in the travel pack.

**4.10.2 General marketing and promotion**

The objectives of the Green Travel Plan will only be achieved with the support of residents. Marketing the benefits and promoting the sustainable alternatives available are therefore crucial in encouraging residents to adopt the Green Travel Plan measures. It is important that at an early stage, residents are made aware of the need for the Green Travel Plan, and that it is emphasised that the measures are being introduced to support and encourage people to use cars more wisely. In addition to raising general awareness, any successes achieved will be fully publicised to residents in order to motivate them to use sustainable modes of transport.

- Travel information and poster could be set up at public area, for example, lobby, notice board, or inside the elevators;
- A Green Travel Plan ‘e-flyer’ should be distributed to residents during the launch of the Plan. The ‘e-flyer’ will provide a summary of the benefits to residents of the Travel Plan, its objectives and measures. This could be distributed to residents via the managing strata corporation;
- Events such as National Bike Week, Bike2Work Days, walk to work day should be promoted to residents through notice board posters and email;

**4.10.3 Travel during the day**

To provide residents with a choice of convenient sustainable transport options for travelling during the day, the following initiatives should be promoted:

- Provide bus, train and ferry timetable and routes information specific to the building location at lobby;
- Provide walking and cycling maps to the surrounding public transport nodes, recreational area and local attractions; and
Promote use of bikes for short journeys within the precinct;

4.10.4  Cycling

The site will have good access to the local cycling network and onsite facilities for cyclists. Bicycle parking will be provided for the development. Additional visitor parking spaces will be provided near the entrances to the building.

In order to activate and promote cycling the following measures should be taken:

- Supply a communal bike toolkit—this can consist of puncture repair equipment, a bike pump, a spare lock and lights;
- Inform residents on public transport cycling carriage policies and cycle storage facilities at rail stations;
- Formation of a Bicycle User Group in order to provide a body of regular cyclists who can discuss on issues relating to the provision of on-site cycling facilities and the maintenance of off-site cycle routes; and

4.10.5  Public transport

To promote the use of public transport:

- Provide information of useful website links to journey planning websites in Sydney;
- Provide useful public transport maps and promotional items to potential and current public transport users;
- Notice boards in public areas should have news of events / generic posters promoting public transport;
- provision of bus passes for the initial occupation of the units so that residents would be encouraged to make public transport their modal choice from the day they moved into the unit

4.10.6  Walking

Specific travel plan measures designed to encourage more walking trips for short distance trips.

- Improvements to (and maintenance of) the walking network and signage;
- Formation of local walking group using Heart Foundation Walking Walkers kit (www.heartfoundation.org.au/walking). Hold regular recreational walks for residents; and
- Participate in Walk to Work day and look into holding a ‘healthy breakfast’ as a reward to all those who participate.

4.11  Construction Traffic Management

The construction of the development will require access for heavy vehicles travelling to and from the site. Prior to the commencement of construction, a Construction Traffic Management Plan (CTMP) should be prepared to ensure the
safest possible management of construction access and appropriate mitigation measures. The CMTP would address:

- The likely construction vehicle numbers and frequency;
- Approach and departure routes;
- Parking access arrangements during construction; and
- Provision of acceptable pedestrian management measures

Construction vehicles would be restricted to higher order roads such as collector and arterial roads, with movements along local residential streets prohibited. It is envisaged the key traffic routes for construction vehicles would be via Epping Road, Wicks Road and the M2 Motorway.

As a general principle, construction of the proposed development will be staged to minimise impacts to traffic and other modes of transport. The overall principles for traffic management during construction of the development will include:

- Maintain access to properties located in the vicinity of the site at all times during the construction process;
- Manage and control construction traffic movements on the adjacent road network and vehicles movements to and from the construction site;
- Trucks to enter and exit the site in a forward direction;
- Maintain traffic capacity at intersections and mid-block in the vicinity of the site;
- Restrict construction vehicle activity to designated truck routes through the area;
- Construction access driveways and on-street work zones to be managed and controlled by site personnel;
- Provide a convenient and appropriate environment for pedestrians;
- Maintain convenient access and circulation for public transport;
- Pedestrian movements adjacent to construction activity, across construction access driveways and to/from public transport facilities will be managed and controlled by site personnel;
- Pedestrian warning signs and construction safety signs/devices to be utilised in the vicinity of the site and to be provided in accordance with WorkCover requirements;
- Construction activity to be carried out in accordance with Council’s approved hours of work.
5 Summary

Greenland (Sydney) Lachlans Line Macquarie Park Development Pty Ltd engaged Arup to conduct a transport assessment for the development of Lots 104 and 105 of the Lachlan’s Line site located in North Ryde, Sydney. Lachlan’s Line form part of the wider North Ryde Station Precinct. Lot 104 and Lot 105 are located within the southern section of the development site. The development proposal involves a mix of residential, retail, commercial and community uses.

Key findings of the assessment in relation to transport are as follows:

- To support the development of the North Ryde Station precinct a number of upgrades to the surrounding road network are proposed which support vehicle movements to/from the site
- The development site is accessed via a Spine Road which runs in a north-south direction from Epping Road to Waterloo Road
- Off-street parking in the facility will be compliant with AS/NZS 2890.1:2004 and AS/NZS 2890.6:2009.
- Bicycle parking is to be provided at a higher rate than that recommended in the Ryde Council DCP to encourage active transport usage
- The site will benefit from good quality public transport connections including the future Sydney Metro project
- As part of the North Ryde Station Precinct Project, there are a number of significant pedestrian and cycling infrastructure upgrades that will benefit the site, particularly a pedestrian bridge from Lachlan’s Line, across Delhi Road, across the M2 Motorway and connecting to the North Ryde Station Site North
Appendix A

Vehicle Swept Paths