Prepared for

ASPIRE CONSORTIUM ON BEHALF OF NSW LAND AND HOUSING CORPORATION

Traffic Impact Assessment

Ivanhoe Estate, Macquarie Park – Stage 1

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1 Introduction

1.1 Background

Ason Group has prepared this Traffic Impact Assessment (TIA) report to support a Development Application for Stage 1 of the Ivanhoe Estate redevelopment, a State Significant Development (SSD) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). It has been prepared for Aspire Consortium on behalf of NSW Land and Housing Corporation.

In September 2015 the Ivanhoe Estate was rezoned by the Department of Planning and Environment as part of the Macquarie University Station (Herring Road) Priority Precinct, to transform the area into a vibrant centre that benefits from the available transport infrastructure and the precinct's proximity to jobs, retail and education opportunities within the Macquarie Park corridor.

The Ivanhoe Estate is currently owned by NSW Land and Housing Corporation and comprises 259 social housing dwellings. The redevelopment of the Ivanhoe Estate is part of the NSW Government Communities Plus program, which seeks to deliver new communities where social housing blends with private and affordable housing, with good access to transport, employment, improved community facilities and open space.

The Communities Plus program seeks to leverage the expertise and capacity of the private and non-government sectors. As part of this program, Aspire Consortium, comprising Frasers Property Australia, and Mission Australia Housing, was selected as the successful proponent to develop the site in July 2017.

In September 2017, DPE issued the Secretary's Environmental Assessment Requirements for a comprehensive Masterplan application that will establish the framework for the staged redevelopment of the site. This Development Application for Stage 1 of the Ivanhoe Estate redevelopment represents the first stage of detailed works pursuant to the Ivanhoe Estate Masterplan.

This report should be read having regard to the Masterplan Traffic Impact Assessment undertaken by Ason Group which provides the framework and relevant background assessments.

1.2 Report Structure

This report is structured to provide an assessment of the traffic impact and transport accessibility issues relating to the proposed Ivanhoe Estate development. This report is structured as follows:

- Section 1 provides an overview of the project, background information and the study objectives.
- Section 2 details the Ivanhoe Estate project, background information and Masterplan.
- Section 3 provides an overview of the existing road network and travel patterns in the region.
- Section 4 provides an overview of the Stage 1 detailed works within the Ivanhoe Estate development proposal pursuant to the concurrent Ivanhoe Estate Masterplan.
- Section 5 establishes the public and active transport infrastructure (both existing and future) and the current transport capacity and performance of the surrounding roads.
- Section 6 provides an assessment of the parking requirements and provisions for Stage 1.
- Section 7 provides details of the Site access, internal circulation and car parking arrangements.
- Section 8 presents the traffic and transport impact assessment for Stage 1, including assessment of the road network impacts of the proposed development.
- Section 9 outlines the proposed Sustainable Travel Strategy as well as public and active transport initiatives that would assist the reduction of car dependency for the proposed development.
- Section 10 provides an overview of construction traffic management and outlines the principles that would be implemented during the construction period.
- Section 11 provides a summary of key findings of this TIA.

2 The Ivanhoe Estate Project

2.1 Introduction

The Aspire Consortium was awarded a contract by the NSW Government to redevelop the Ivanhoe Estate at Macquarie Park. The Consortium comprises development partners, Frasers Property Australia and community housing partner, Mission Australia Housing.

The proposed Masterplan is a Concept DA (in accordance with Section 4.24 of the EP&A Act), which sets out the concept proposal for the development of the site. The concept contained in the Masterplan DA establishes the planning and development framework, which will form the basis for the detailed design of the future buildings and against which the future detailed DAs will be assessed.

2.2 Site Description

The Ivanhoe Estate site is located in Macquarie Park near the corner of Epping Road and Herring Road within the Ryde Local Government Area (LGA). The site is approximately 8.2 hectares and currently accommodates 259 social housing dwellings, comprising a mix of townhouse and four storey apartment buildings set around a cul-de-sac street layout. An aerial photo of the site is provided at **Figure 1**.

Immediately to the north of the site are a series of four storey residential apartment buildings. On the north-western boundary, the site fronts Herring Road and a lot that is currently occupied by four former student accommodation buildings and is likely to be subject to redevelopment. Epping Road runs along the south-western boundary of the site and Shrimptons Creek, an area of public open space, runs along the south-eastern boundary. Vehicle access to the site is via Herring Road.

Ivanhoe Estate comprised of 17 individual lots owned and managed by the NSW Land and Housing Corporation. The Masterplan site also incorporates adjoining land, being a portion of Shrimptons Creek and part of the commercial site at 2-4 Lyonpark Road. This land is included to facilitate a bridge crossing and road connection to Lyonpark Road.

Figure 1: Ivanhoe Estate Site

2.3 Proposed Masterplan

The project will see the transformation of 259 social housing properties on the 8.2 hectare site into a socially integrated neighbourhood of approximately 3,400 dwellings with a maximum of GFA of 278,500m^2.

A key focus of the project is to address housing needs while providing practical opportunities to transition social housing residents to housing independence. Mission Australia Housing will provide support to assist social housing residents to connect with education, training and employment opportunities.

The redevelopment will also seek to help to meet the growing demand for education by providing a non-government co-educational vertical high school including approximately 1,000 students and two 75 place child care centres. A range of community facilities, public space and retail floor space are also proposed. **Figure 2** shows the Ivanhoe Estate Masterplan.

Figure 2: Ivanhoe Estate Masterplan

2.4 Internal Road Network and Site Access

In order to maximise the accessibility of the site to the external road network, access to Ivanhoe Estate is proposed via three locations (shown in **Figure 3**):

- A signalised intersection of Herring Road and Ivanhoe Place,
- A new ingress from Epping Road, and
- A new bridge connection between Ivanhoe Place and Lyonpark Road.

These accesses will provide for the distribution of traffic onto the broader road network and assist in minimising the impacts of the development on the existing operation of the road network.

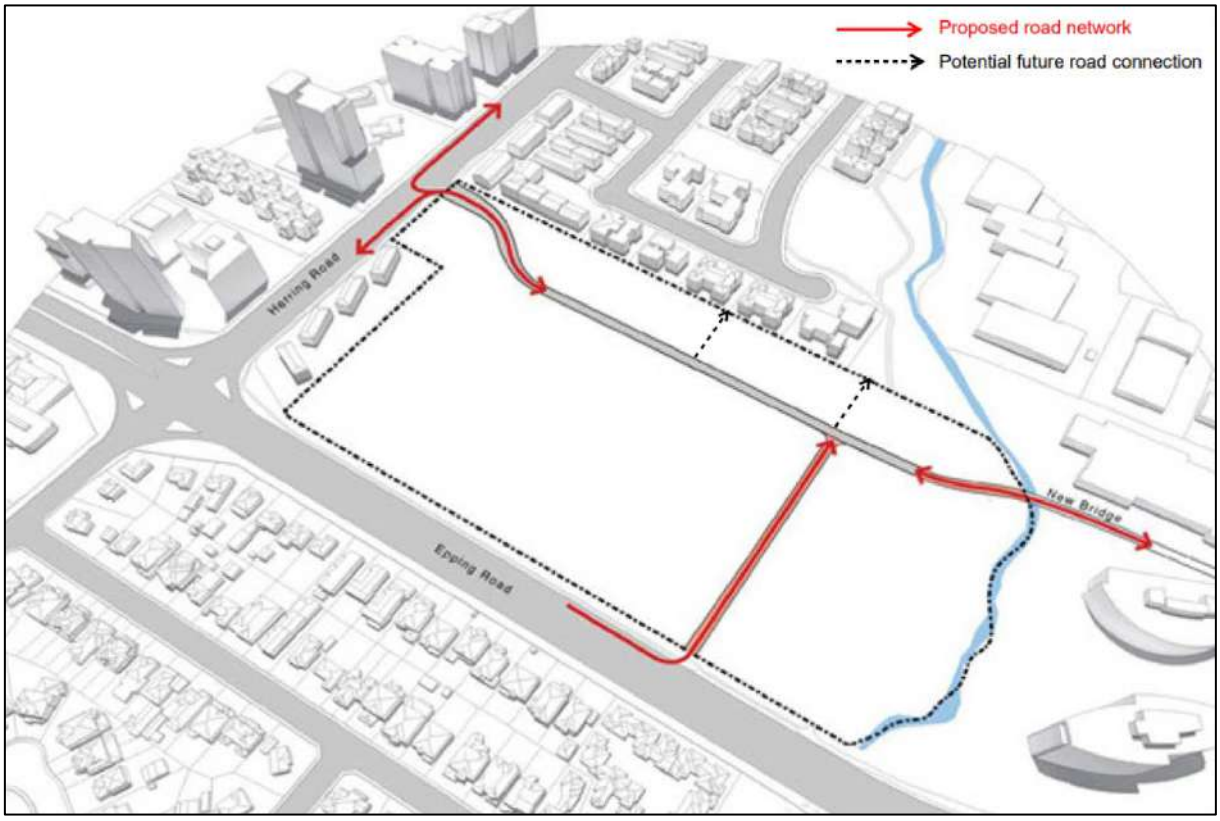

Figure 3: Ivanhoe Estate Masterplan Site Access

The street network has been set to provide a logical integration of the Site with the surrounding road network, future access locations and pedestrian desire lines, providing permeability through the future development. The proposed road network includes the provision of a Main Street traversing an east-west connection between Herring Road and the Lyonpark Road via a proposed new bridge connection. Lower order roads have been set and aligned with the surrounding street network to create walking and cycling connections between Ivanhoe Estate and the neighbouring recreational, educational and employment zones. **Figure 4** demonstrates the proposed internal road hierarchy.

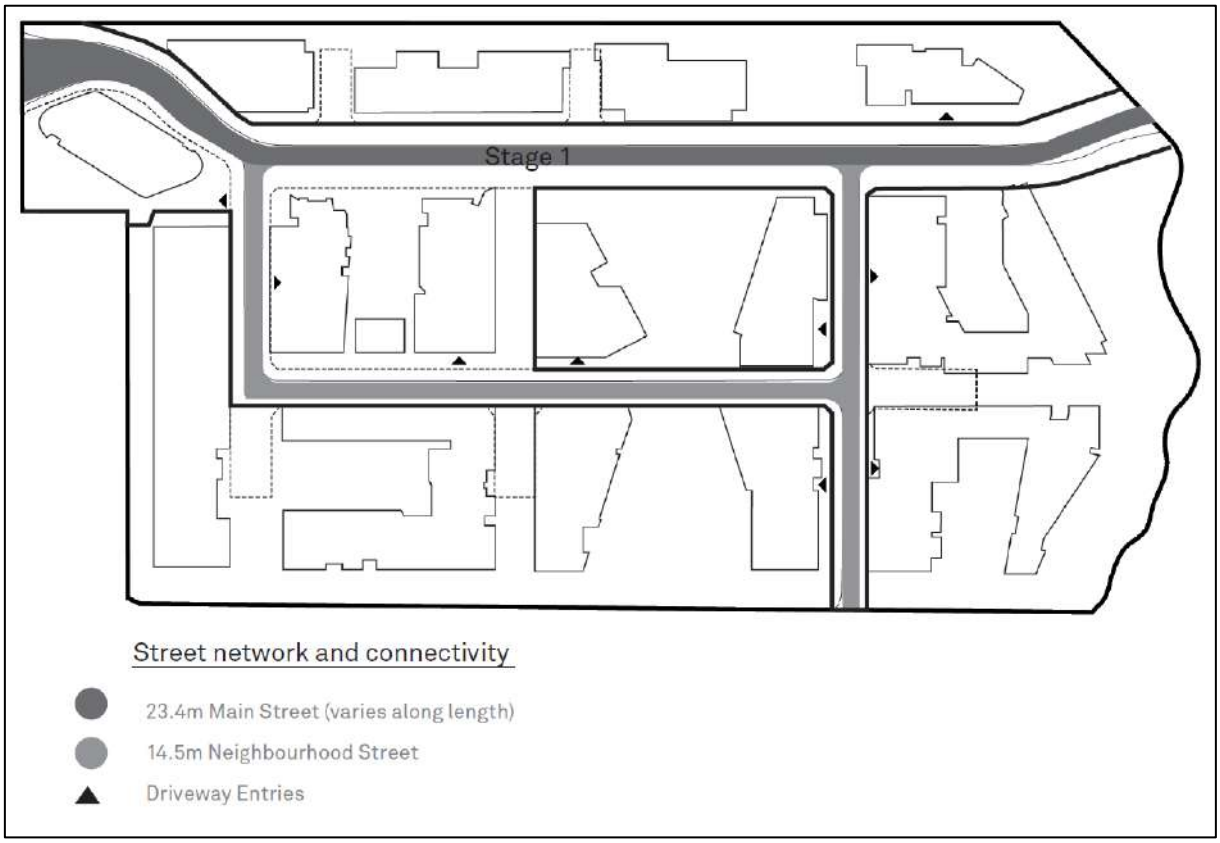

Figure 4: Ivanhoe Estate Internal Road Hierarchy

The typical road cross sections for the proposed 23.4m Main Street and 14.5m Neighbourhood Streets are provided in **Figure 5**. These roads have been developed having regard for Council's DCP and both accommodate two traffic lanes in either direction with parking provided on both sides of Main Street and on one side of the Neighbourhood Streets.

As a consequence of the signalisation of the intersection of Herring Road with Ivanhoe Place, developments on the western side of Herring Road will no longer be able to utilise the existing roundabout, currently relied on by southbound vehicles. The Masterplan road network has been designed to facilitate the redistribution of these vehicles through the provision of a connected streets, effectively providing a "U-Turn" facility. This will ensure that existing and future residents of developments on the western side of Herring Road are not adversely affected by the proposed signalisation of Ivanhoe Place.

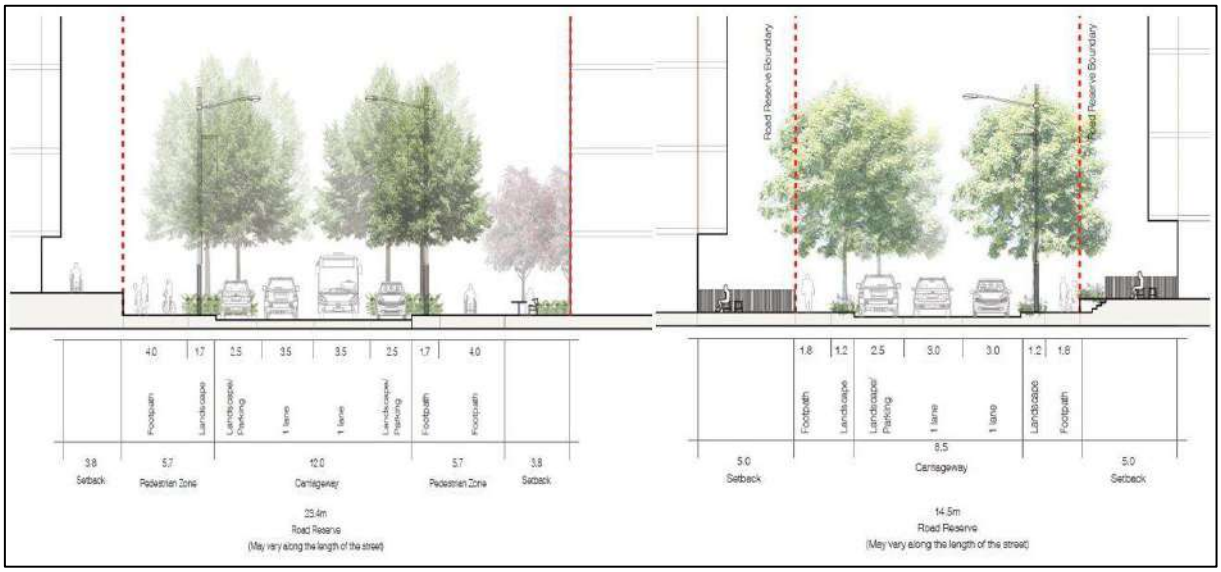

Figure 5: Ivanhoe Estate Typical Cross Sections

2.5 Pedestrian and Cycle Access

The pedestrian paths through the Site have been designed with a varying width between 1.8 to 2.4m. The routes – shown on **Figure 6** – connect along open space links providing access to the local road network and along key pedestrian desire lines, linking the site with Macquarie Park Shopping Centre and Macquarie University Railway Station. Shared paths at 4.0m in width are also provided along the length of Main Street and along the proposed bridge linking Herring Road with Lyonpark Road. This connection provides an important new pedestrian link between the employment zones of Lyonpark Road with Herring Road.

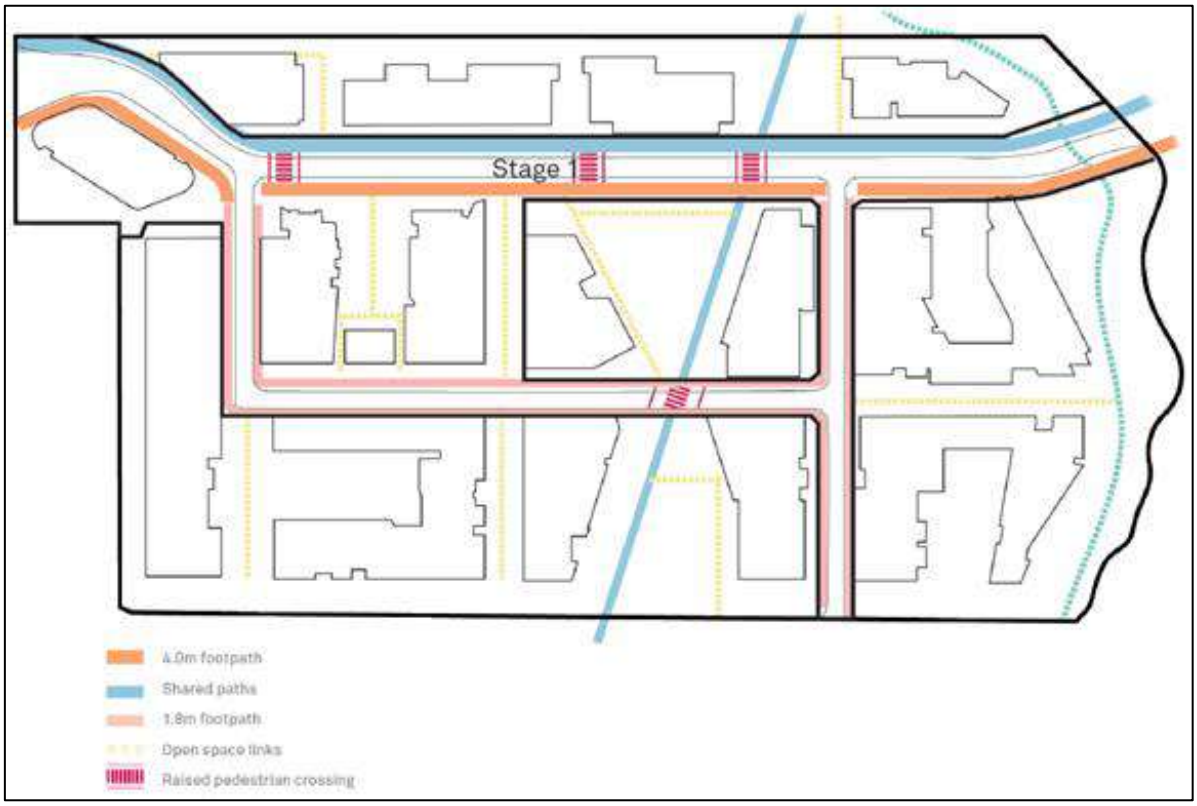

Figure 6: Pedestrian and Cycle Network

The proposal also includes the upgrade of the existing Shrimptons Creek pedestrian and cycle path which provides access to the regional cycle network traversing a north-south direction from the residential zones to the south of Epping Road to the north via Macquarie Shopping Centre. The cycle network proposed for the development is demonstrated in **Figure 7**.

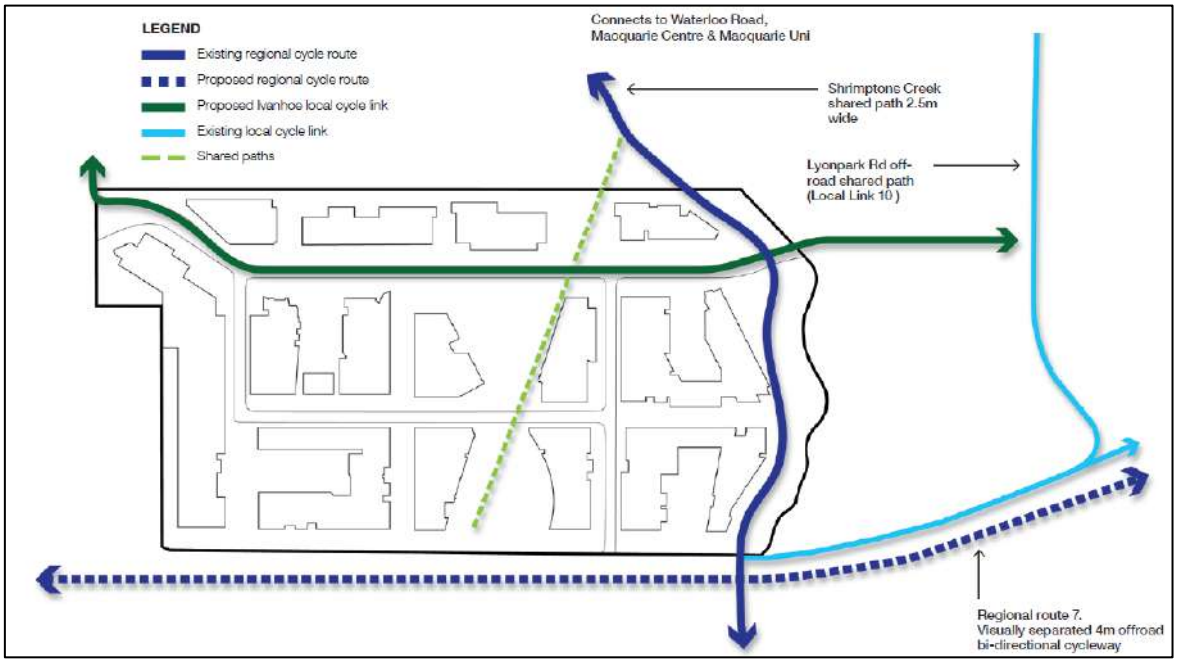

Figure 7: Ivanhoe Estate Masterplan Bicycle Network

2.6 Development Staging

The proposed staging plan is arranged to maximise the amount of public domain delivered in the first two stages of development. Stages are sequenced to maintain a consistent tenure split between social and market dwellings and to ensure that the necessary infrastructure comes online to service the relevant stages. The development staging is subject to change, however is currently envisaged to be progressed in accordance with **Figure 8**.

Figure 8: Ivanhoe Estate Staging Plan

3 Existing Conditions

3.1 Site and Location

The Site is located in one of eight urban activation precincts (UAP) announced by the NSW Government and following nomination by The City of Ryde in July 2012. Ivanhoe Estate is located at the south eastern end of the Macquarie University Station Priority Precinct (formerly Herring Road UAP) and on the southern side of Macquarie Park near the corner of Epping Road and Herring Road. The eastern boundary follows Shrimptons Creek.

The location is considered suitable to accommodate some of Sydney's growth as it is:

- strategically located close to the geographic centre of the Sydney metropolitan region – approximately 18km northwest of the Sydney CBD, 9km west of Chatswood and 15km east of Parramatta;
- a key part of Sydney's Global Economic Corridor, which extends from Sydney Airport and Port Botany through Sydney CBD, North Sydney, Chatswood, Macquarie Park towards Parramatta and Norwest Business Park;
- an important part of the Macquarie Park Specialised Precinct, identified in the Metropolitan Strategy for Sydney as a location for future jobs and housing growth;
- well serviced by public transport including the Macquarie University Train Station and bus interchange; and
- an area with strong market demand for additional housing.

An aerial photo of the site is provided in **Figure 9**.

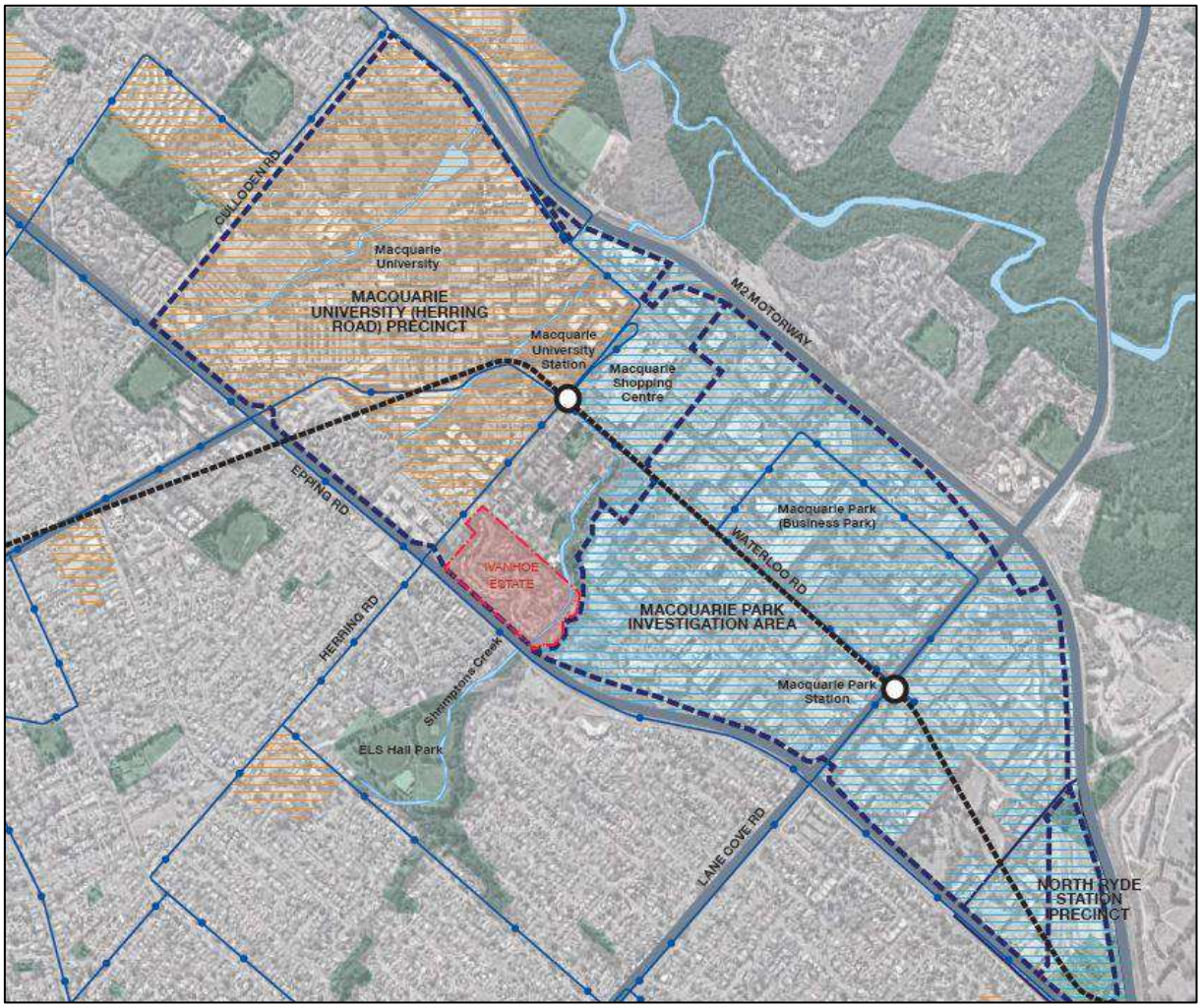

Figure 9: Site Location

3.2 Road Network

3.2.1 Existing Road Network

Some of the key roads that form the top levels of the current road hierarchy for the Macquarie Park corridor in the locality of the Site are:

M2 Motorway

The M2 Hills Motorway is an arterial road approximately 1 kilometre north-east of the Site that connects with the Lane Cove Tunnel in North Ryde and heads north-west through Macquarie Park to Epping, then West through Beecroft, Carlingford then through Baulkham Hills and onto the Westlink M7 motorway. It is a privately-owned motorway that became fully cashless, with no toll booths, in January 2012.

The following key features, located within the City of Ryde LGA have increased capacity and access to the Macquarie Park area:

- Christie Road: Eastbound exit and entrance
- Talavera Road: Westbound exit and entrance
- Lane Cove Road (A3): No exit westbound; no eastbound entrance from A3 northbound
- Delhi Road (A38): Eastbound exit and westbound entrance
- Lane Cove Tunnel: Eastern terminus continues as Lane Cove Tunnel; westbound exit to and eastbound entrance from Epping Road

The NorthConnex M1 to M2 tunnel (planned to open in 2019), includes motorway-to-motorway ramps to and from the portion of the M2 west of Pennant Hills Road/The Cumberland Highway.

Lane Cove Road

This is an arterial road 900 metres to the south-east of the Site which caters for regional north-south traffic travelling through the City of Ryde, forming part of the A3 outer arterial ring road connecting to the north and south coasts of the Sydney region, and interchanging with most of the radial arterial routes emanating from central Sydney.

The road connects regional and local traffic to the M2 Motorway in the north, and to Epping Road along the southern boundary of the Site. It also connects with the important collector routes of Waterloo Road and Talavera Road that run through the Macquarie Park corridor. Lane Cove Road carries regional to, from and around Macquarie Park whilst simultaneously providing local traffic and public transport access for the area.

Epping Road

Epping Road is an arterial road on the southern boundary of the Site which caters for regional east-west traffic travelling through the City of Ryde. Epping Road extends from the Pacific Highway and Lane Cove in the east to Epping in the west. It provides an important link between Sydney's Northern and North West suburbs and the North Shore and CBD. Epping Road provides an important access route to Macquarie University and other major land uses within Macquarie Park via Herring Road and Balaclava Road. The road serves the dual purpose of providing capacity for regional traffic through the City of Ryde LGA along with multi-modal local access.

Herring Road

Herring Road forms the north western boundary of the Site and was chosen as an urban activation precinct to accommodate some of Sydney's future growth due to its strategic location relative to the

Sydney metropolitan region. It is approximately 18 kilometres northwest of the Sydney CBD, 9 kilometres west of Chatswood and 15 kilometres east of Parramatta.

Herring Road has been identified as an intrinsic component of Sydney's Global Economic Corridor, which extends from Sydney Airport and Port Botany through Sydney CBD, North Sydney, Chatswood, Macquarie Park towards Parramatta and Norwest Business Park. The road is an important part of the Macquarie Park Specialised Precinct, identified in the Metropolitan Strategy for Sydney as a location for future jobs and housing growth. It is well serviced by public transport and includes the Macquarie University railway station and bus interchange.

Waterloo Road

Waterloo Road is a collector road running parallel to the M2 motorway and through the middle of Macquarie Park. Waterloo Road provides an important multimodal corridor for bus, cycling and pedestrian movements through Macquarie Park, and connects the public transport Interchange and Macquarie University in the northwest with Lane Cove Road to the southeast. Waterloo Road extends through to Wicks Road in the east of the study area, and to University Avenue / Balaclava Road in the west. An unconnected section of Waterloo Road extends further west outside of Macquarie Park, with the road disconnected through the Macquarie University campus.

3.2.2 Peak Hour Traffic Flows and Existing Road Network Performance

The average peak hour traffic volumes for the arterial and collector road network within Macquarie Park are illustrated below in **Figure 10** for the AM peak period and in **Figure 11** for the PM peak period (extracted from RMS Traffic Model). These figures show that Lane Cove Road and Epping Road are relatively balanced with similar volumes in both directions in both the peak periods. This is attributed to strong demand on these routes from through traffic travelling to and from the Sydney CBD, as well as high commuter flows within Macquarie Park. Waterloo Road also has high volumes in both directions during the peak periods, illustrating the limited direct access links between the central precinct area and the adjacent arterial road network, with most traffic forced to travel via Waterloo Road to access central employment and business sites.

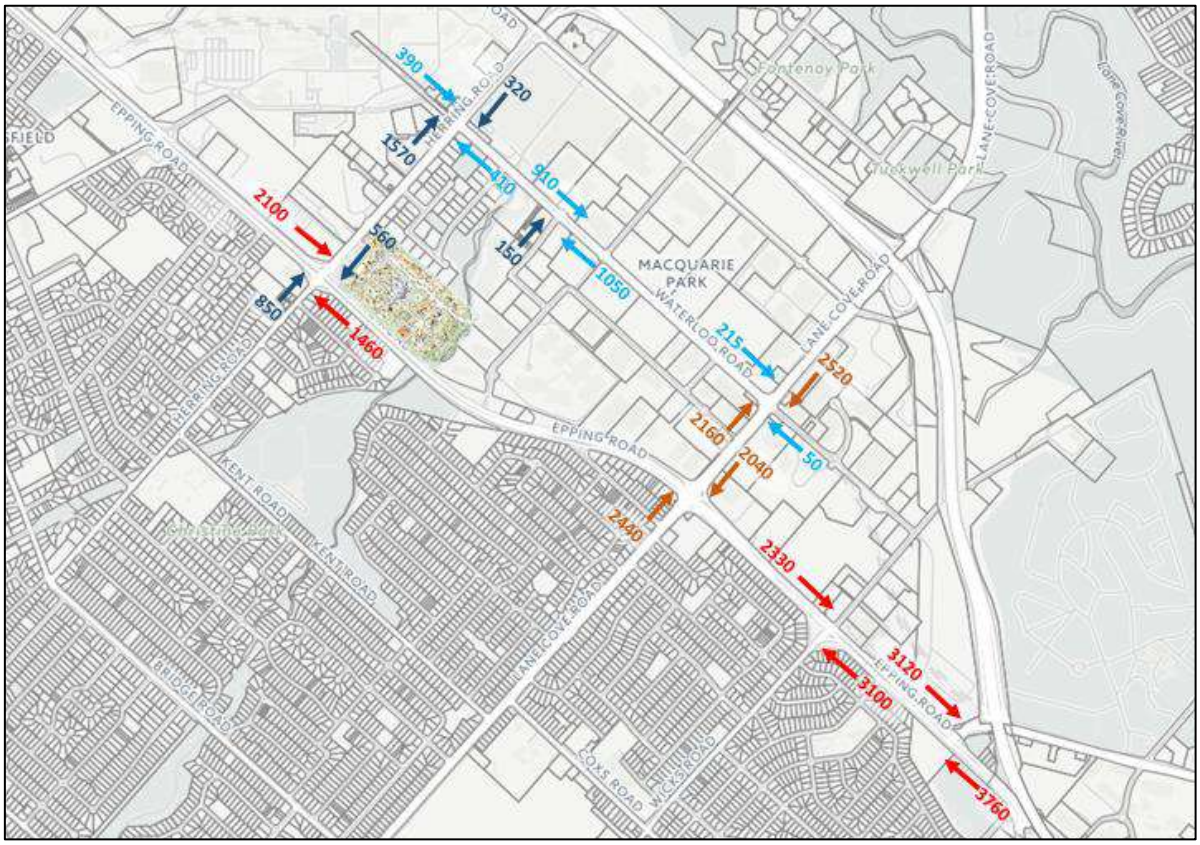

Figure 10: Existing AM Peak Hour Volumes

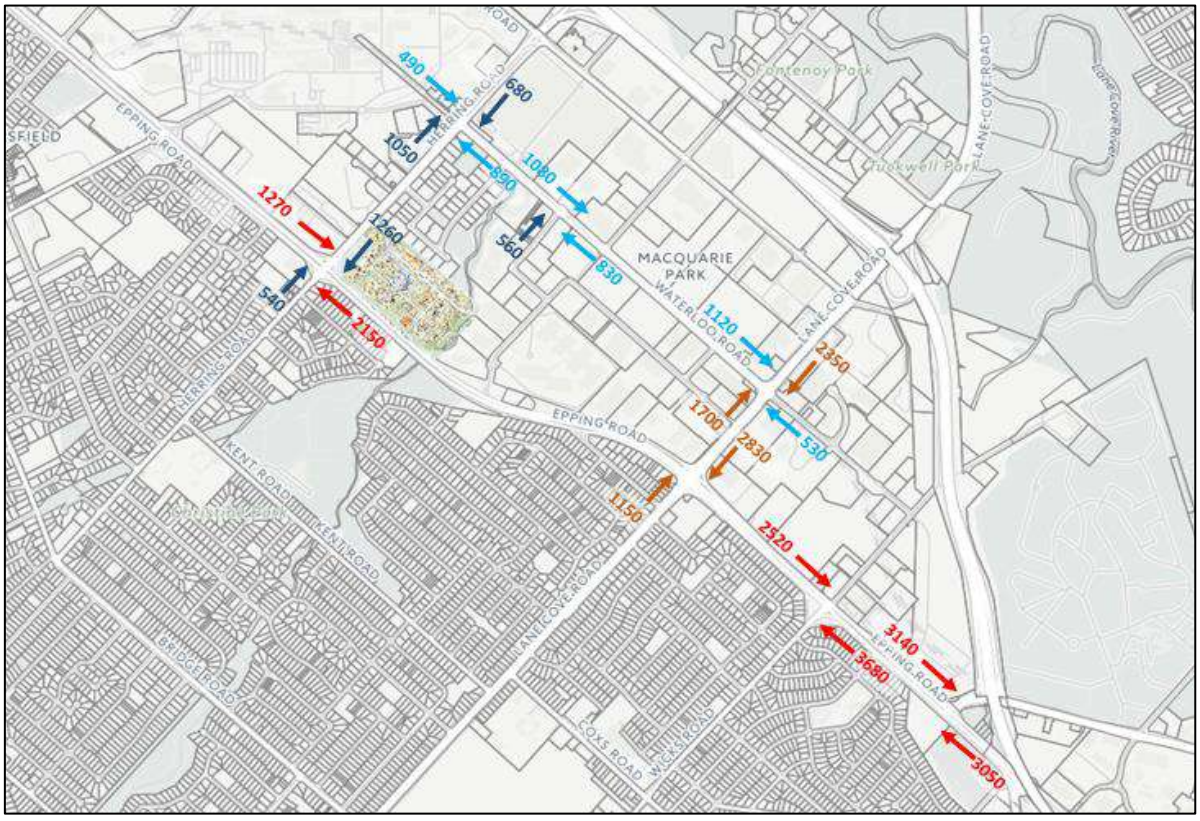

Figure 11: Existing PM Peak Hour Volumes

Traffic flow in Macquarie Park is dominated by regional traffic movements on Lane Cove Road, Epping Road in the AM and PM peak periods with internal roads (Waterloo Road, Khartoum Road and Lyonpark Road) accommodating destination-based traffic associated with the employment zones in these locations. Herring Road traffic includes a much larger proportion of local traffic due to its functions as a local traffic access route to Macquarie University Station, the university itself, and Macquarie Shopping Centre.

3.2.3 Intersection Controls and Performance

The existing performance of the key intersections surrounding the Site are summarised in **Table 2**. The modelling outputs a range of performance measures, in particular:

- Average Vehicle Delay (AVD) – The AVD (or average delay per vehicle in seconds) for intersections also provides a measure of the operational performance of an intersection and is used to determine an intersection's Level of Service (see below). For signalised intersections, the AVD reported relates to the average of all vehicle movements through the intersection. For priority (Give Way, Stop and Roundabout controlled) intersections, the AVD reported is that for the movement with the highest AVD.
- Level of Service (LOS) – This is a comparative measure that provides an indication of the operating performance, based on AVD.

Table 1 provides a recommended baseline for assessment as per the RMS Guide.

Table 1: RMS Level of Service

Level of Service	Average Delay (sec/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.

The average intersection performance Level of Service (LoS) for the AM and PM peak periods of the key intersections surrounding the Site are shown in **Table 2**. The intersection performance analysis is based on traffic volume data used by Transport for NSW for the Waterloo Road temporary bus shutdown network planning and is based on 2016 data.

The intersection of Epping Road with Herring Road experiences significant delay in the AM and PM peak periods. The traffic demand and peak period congestion at this intersection is strongly influenced by traffic movements heading into Macquarie Park via Epping Road in the AM peak period and traffic movements exiting Macquarie Park in the PM peak period.

The Waterloo Road with Herring Road intersection has limited traffic capacity but has a significant demand from local and through traffic accessing the Macquarie Centre and to/from the M2. The large traffic demand conflicts with the high volume of competing pedestrian movements between the major generators of the University, Macquarie Centre, Bus Interchange and Macquarie Rail Station. The Waterloo Road southeast approach operates over capacity and with queues over 200 metres.

Table 2: Existing Peak Intersection Performance

Intersection	Peak	Level of Service
		Delay (sec)
Epping Road / Herring Road	AM	F
		167
	PM	F
		76
Ivanhoe Place / Herring Road	AM	A
		12
	PM	A
		13
Waterloo Road / Herring Road	AM	F
		94
	PM	F
		121
Epping Road / Lyonpark Rd	AM	A
		7
	PM	A
		7
Waterloo Road / Byfield Street	AM	A
		12
	PM	A
		14

The Lane Cove Road with Waterloo Road intersection is a major access route into / out of Macquarie Park for all modes of transport, competing for space and time with through traffic on Lane Cove Road in both peak and off-peak times, leading to relatively poor levels of service for all modes throughout the day. The intersection performance is particularly constrained during the PM peak and traffic exiting Macquarie Park via Waterloo Road in the PM peak experiences delay as the intersection is operating over capacity for these movements, with queues over 350 metres for regional traffic heading south along Lane Cove Road travelling away from M2 and Macquarie Park.

The intersection of Lane Cove Road and Epping Road has major conflicts between buses, cars, trucks and regional cycling routes, with poor level of services for all modes during peak periods. The Epping Road approaches operate over capacity in the AM and PM peak periods, influenced by the demand for traffic entering and exiting Lane Cove Road in the peak periods.

4 Overview of Stage 1 Proposed Development

4.1 Summary of Proposed Development

The proposed Stage 1 Development Application seeks consent for the first stage of detailed works within the Ivanhoe Estate, pursuant to the Ivanhoe Estate Masterplan under Section 4.24 of the EP&A Act. The Masterplan establishes the planning and development framework against which this Stage 1 Development Application will be assessed.

A detailed description of the proposed works is provided in the Environmental Impact Statement (EIS) prepared by Ethos Urban. A summary of the relevant works are provided below:

- Construction of the internal road network;
- The consolidation of existing lots and subdivision of the Ivanhoe Estate to reflect the revised road layout, open space, and provide superblocks corresponding to the Masterplan;
- The signalisation of the intersection of Herring Road with Ivanhoe Place in generally accordance with the Masterplan Application layout. The developer will liaise with RMS to finalise design and construction detail;

The Stage 1 Development Application seeks approval for:

- site preparation works, including tree removal, demolition of roads, services, and earthworks across the Ivanhoe Estate;
- the provision and augmentation of utilities and services infrastructure across the Ivanhoe Estate;
- the construction of all internal roads including public domain within the road reserves, and the bridge crossing and road connection to Lyonpark Road;
- the consolidation of existing lots and subdivision of the Ivanhoe Estate to reflect the revised road layout, open space, and provide superblocks corresponding to the Masterplan;
- the construction and use of Buildings A1 and C1 comprising residential uses (including social housing), a childcare centre, and retail / community spaces.

Reference should be made to the plans prepared by Bates Smart (Building A1 and Estate Layout) and Candalepas (Building C1), which are submitted separately. A reduced copy of the Stage 1 Staging Plan illustrating the staging of the road network is shown in **Figure 12**. An image of the Masterplan, identifying Buildings A1 and C1 and, is shown in **Figure 2**.

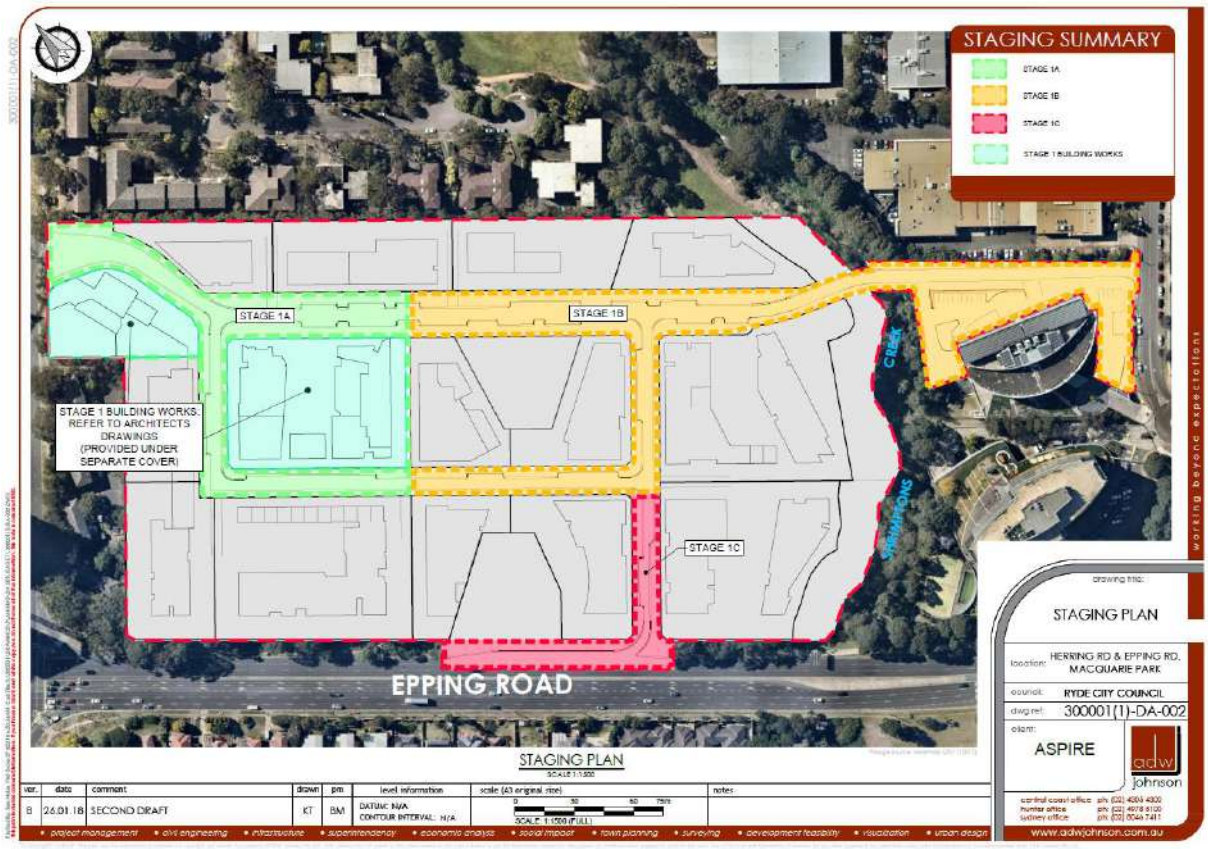

Figure 12: Stage 1 Staging Plan

5 Public Transport, Cycling and Pedestrian Access

This section describes the existing public transport and active transport infrastructure (both existing and future) and the current transport capacity and performance of the surrounding roads. This information will provide a benchmark from which to assess the likely changes attributable to the Project.

5.1 Rail Services

5.1.1 Railway Infrastructure

The Integrated Public Transport Service Planning Guidelines, Sydney Metropolitan Area (TfNSW, December 2013), states that train services influence the travel mode choices of areas within 800 metres walking distance (approximately 10 minutes) of a train station. It is therefore noteworthy that the main access of the Site is located approximately 400 metres from Macquarie University railway station, on the future Sydney Metro Northwest line (currently referred to as the Chatswood to Epping Rail Link). Accordingly, a significant proportion of future commuters travelling from the Site would be expected to use train services. An overview of the distance from the intersection of Herring Road and Ivanhoe Place to available public transport is presented in **Figure 13**.

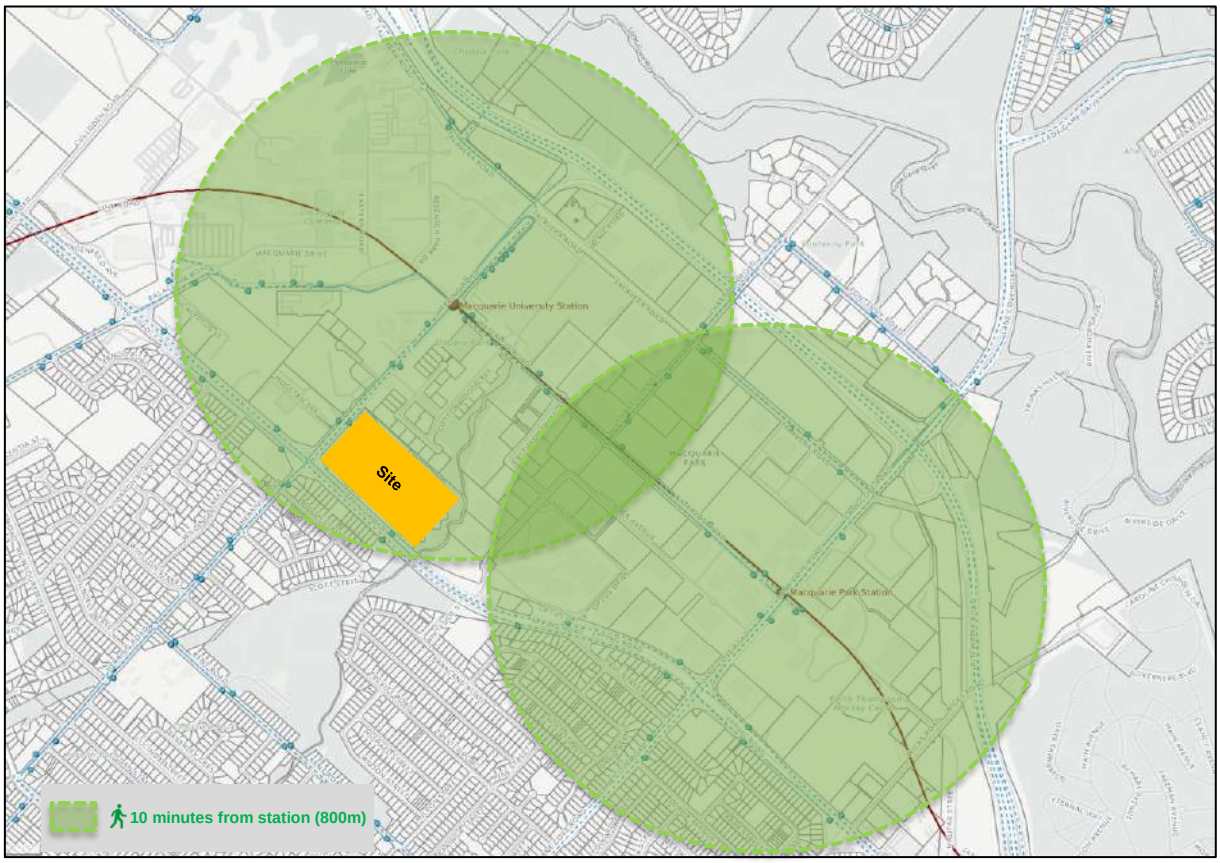

Figure 13: Distance to nearby Public Transport Services

It is anticipated that service frequencies will increase upon conversion of the Chatswood to Epping Rail Link to part of the Sydney Metro, The T1 railway network line runs through Macquarie University station, providing train services towards the City as well as to northern areas, as summarised below:

- T1 North Shore and Northern Line:
- City to Berowra via Gordon (and return)
- City to Hornsby via Macquarie University (and return)
- T1 Northern Line: City to Epping and Hornsby via Strathfield (and return).

Connections to intercity train services and other services on the rail network are available at Epping and Chatswood stations, in addition to a range of alternative services from Central Station.

Trains currently operate at Macquarie University railway station frequently to both directions (Citybound and northbound), on weekdays and weekends, between 5:30 am and midnight. The frequency of existing train operation during peak hours of a weekday vary between 10 and 15 minutes, on each direction. **Table 3** summarises the peak hour train frequencies at this station on a typical weekday.

Table 3: Existing Train Frequencies – Macquarie University T1 Line

Station – Line	To Epping	To Chatswood	Total
Morning Peak Hour (8-9AM)	7	4	11
Afternoon Peak Hour (5-6PM)	4	7	11

The Sydney Trains Network Map is shown in **Figure 14**.

Figure 14: Suburban Rail Network

5.1.2 Sydney Metro Northwest

The Sydney Metro is a new standalone rail network identified in Sydney's Rail Future and consists of the Sydney Metro Northwest (SMNW) and the Sydney Metro City and Southwest. Sydney Metro Northwest is the first stage of Sydney Metro and will be the first fully-automated metro rail system in Australia. Sydney Metro City and Southwest is the second stage.

Sydney Metro Northwest is an integrated transport solution from Rouse Hill through to Chatswood. Sydney Metro Northwest will connect directly with the existing Epping to Chatswood railway to allow the new trains to operate a distance of 36 kilometres between Rouse Hill and Chatswood. While the second harbour crossing is being delivered, extending metro rail from Chatswood, customers will need to walk across the platform at Chatswood to change to an existing service. The proposed stations for the new Sydney Metro Northwest are shown in **Figure 15**.

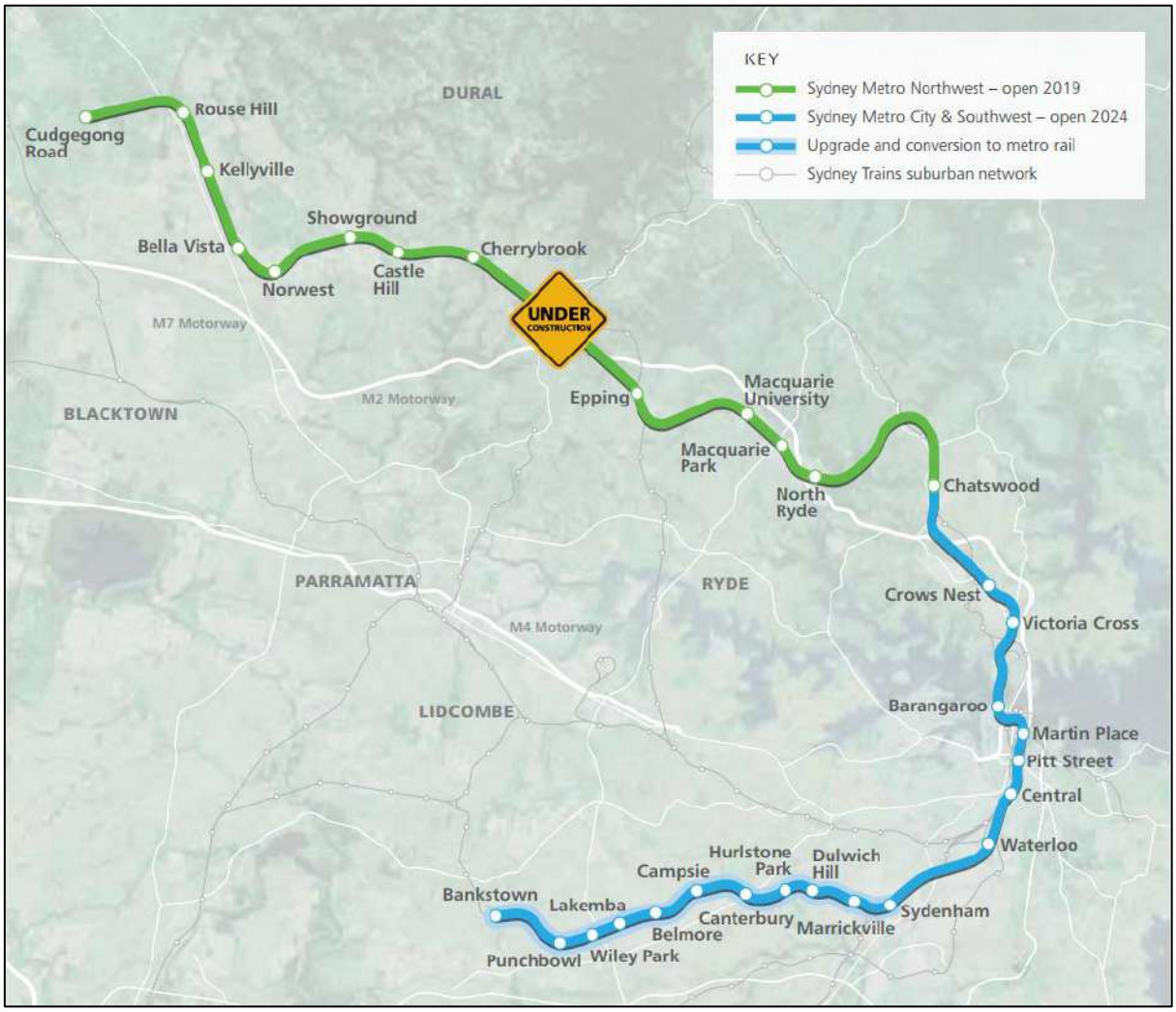

Figure 15: Proposed Stations for the SMNW

The key project features include:

- A train at least every 4 minutes in the peak
- 4000 commuter car parking spaces
- 8 new railway stations
- 5 existing railway stations upgraded
- 36km total project length
- 23km of new metro line
- 15km twin tunnels
- 4km elevated skytrain.

Sydney Metro Northwest is delivering eight new railway stations and 4000 commuter car parking spaces to Sydney's growing Northwest. In peak hours, there will be a train at least every four minutes. On the North Shore Line from Chatswood towards the city, there will be a train every three minutes.

To convert the existing suburban line to next-generation metro standards, major upgrades will be needed, including overhauling the stations, 26 kilometres of new cabling, power and signalling systems and customer improvements such as platform screen doors. The five existing stations along the line, at

Epping, Macquarie University, Macquarie Park, North Ryde and Chatswood, will have screen doors along the full length of the metro platforms to keep people and objects away from the tracks, improving customer safety and allowing trains to get in and out of stations much faster.

Sydney Metro Northwest will deliver, for the first time, a reliable public transport service to a region which has the highest car ownership levels per household in NSW. Over the coming decades, an extra 200,000 people will move into Sydney's North West, taking its population above 600,000, or twice the size of Canberra.

5.2 Bus Services

5.2.1 Existing Bus Services

The Macquarie Park precinct and specifically the Herring Road precinct is well serviced by bus infrastructure with the major bus interchange located approximately 400m from the site at the Macquarie Shopping Centre. The bus routes currently operating in Macquarie Park are presented in **Figure 16**.

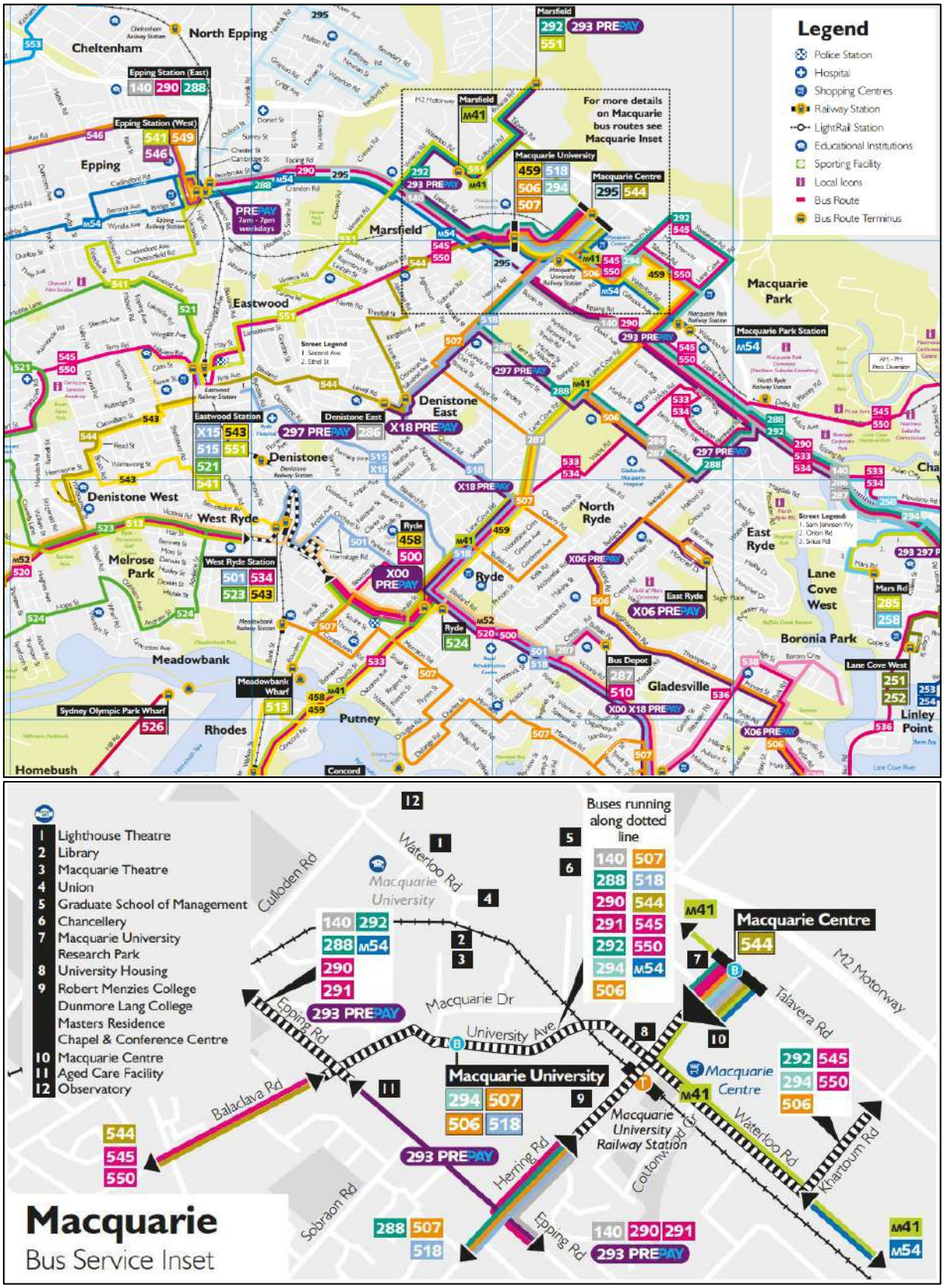

Figure 16: State Transit Bus Routes Map

Bus stops are generally “paired” i.e. location of a bus stop on any side of the road is matched with another bus stop on the opposite side of the road. Bus routes operating on these roads and their frequencies are summarised in the Traffic Impact Assessment submitted with the Masterplan Application.

5.2.2 Macquarie Park Bus Priority and Capacity Improvement

The Macquarie Park Bus Priority and Capacity Improvement (MPBPCI) project is being undertaken by TfNSW to improve the road network in Macquarie Park as part of the Bus Priority Infrastructure works, aimed to increase the reliability and efficiency of bus services, while easing congestion for all road users.

Key features of the Macquarie Park Bus Priority and Capacity Improvement (MPBPCI) project include:

- upgrading the intersection of Herring Road and Epping Road;
- upgrading the roundabout intersection of Herring Road and Ivanhoe Place to a signalised intersection;
- adjusting the median along Herring Road, between Ivanhoe Place and Waterloo Road to provide continuous bus lanes in both directions;
- upgrading the intersection of Herring Road and Waterloo Road;
- widening Waterloo Road between Cottonwood Crescent and Lane Cove Road to provide continuous bus lanes in both directions;
- upgrading the roundabout intersection of Byfield Street and Waterloo Road to a signalised intersection;
- upgrading the roundabout intersection of Khartoum Road and Waterloo Road to a signalised intersection;
- upgrading the intersection of Waterloo Road and Lane Cove Road;
- extending the existing southbound bus lane on Lane Cove Road, between Waterloo Road and Epping Road;
- upgrading the intersection of Lane Cove Road and Epping Road; and
- extending the right turn lane northbound on Lane Cove Road onto Epping Road eastbound, between Allengrove Crescent and Lorna Avenue.

The proposal, as outlined in the MPBPCI Project Review of Environmental Factors March 2017, would provide bus priority infrastructure and general capacity to address public transport reliability and cater for travel demand now and into the future for the Macquarie Park precinct. With the upcoming

construction of the Sydney Metro North West requiring the upgrade of the ECR for seven months, the proposal has been split into two stages to manage change and disruption.

The project is to be under taken in two stages with the Stage 1 works proposed to commence in early 2018 and be completed prior to the ECR closure (expected late 2018). To minimise any impacts to traffic and buses during the upgrade period, road works along the Temporary Transport Plan bus routes would not be undertaken.

Stage 2 would include the remaining construction works and would commence after Sydney Metro Northwest is complete (likely from late 2019) and would take about 18-24 months to complete. The construction methodology for Stage 2 works would be planned during detailed design and closer to the construction date.

The scope for Stage 1 works is driven by the need to provide traffic improvements whilst also minimising impacts to utilities and avoiding works requiring any property acquisition due to the long lead time to carry out these activities. As a result, Stage 1 is of a nature and extent that can be delivered within the required timeframes with minimal risks. Larger scale upgrades to intersections and road widenings would be delivered as part of Stage 2, following the completion of Sydney Metro North West.

During the ongoing design development process, the Stage 1 scope of works and design that were presented in the Review of Environmental Factors have been revised as per the MPBPCO Project Submissions report dated October 2017, which are shown in **Figure 17**.

Figure 17: Proposed MPBPCI Stage 1 Works

Stage 1 work will include adjustments to lanes, medians, traffic islands, traffic lights, footpaths, drainage, utilities and road pavements. These upgrades will take place at:

1) the intersection of Herring Road and Epping Road

2) Herring Road (between Waterloo Road and Epping Road)

3) the intersection of Waterloo Road and Herring Road

4) Waterloo Road (between Herring Road and entry to Macquarie Centre)

5) the intersection of Waterloo Road and Lane Cove Road

6) Lane Cove Road (between Waterloo Road and Epping Road)

7) the intersection of Lane Cove Road and Epping Road

8) Lane Cove Road (between Lorna Avenue and Allengrove Crescent)

5.3 Existing Active Transport Provision

The City of Ryde promotes active transport through providing accessible walking and cycling routes for the community. The Macquarie Park area has several recreational walks and cycling facilities, as discussed in detail in the following sections.

5.3.1 Pedestrian Demands and Desire Lines

Macquarie Park is a specialised centre with a mixture of land uses. The primary land use in the corridor is a commercial core, with surrounding business parks. These land uses are mainly located around Waterloo Road, Epping Road and Lane Cove Road. Education and mixed uses form the remainder of the Macquarie Park corridor, located to the northwest.

The Macquarie Park Pedestrian Access and Mobility Plan provides an extensive review of the existing pedestrian facilities in Macquarie Park. The ARUP report identifies Macquarie University as the major attractor between University Avenue and Culloden Road. There is also various mixed land located along Herring Road creating the pedestrian demands illustrated in **Figure 18**.

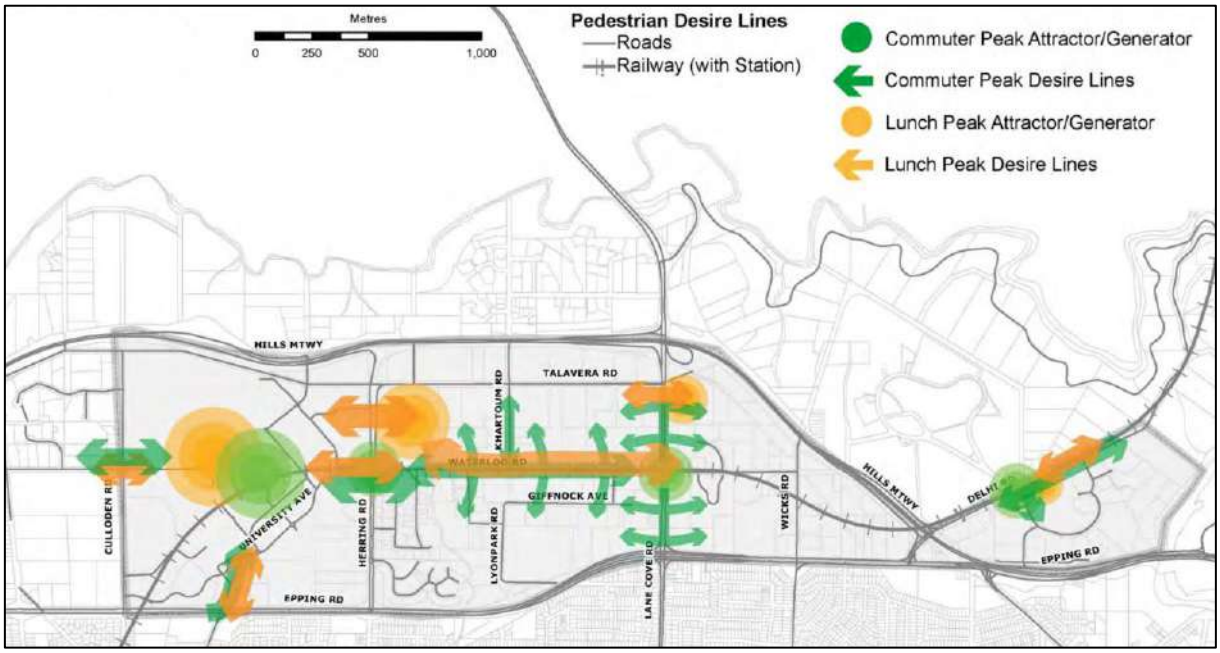

Figure 18: Macquarie Park Pedestrian Desire Lines

The ARUP assessment also identifies Macquarie shopping centre is a key pedestrian trip attractor in the area. The centre provides a wide range of goods and services that draws shoppers from both within and outside of the Ryde LGA. During lunch time, there is a high level of pedestrian activity around the centre from students in Macquarie University and workers in Macquarie Park.

The Singtel Optus campus is one of the key single trip attractors/generators within the study area. Over 6000 Optus employees commute to this campus on Lyonpark Road daily. During morning and afternoon peak periods, Optus staff resulted in high pedestrian movement between both Macquarie Park and Macquarie University stations and Lyonpark Road. The lunch time peak period for pedestrian movement is skewed towards Macquarie Shopping Centre as discussed above.

5.3.2 Pedestrian Infrastructure

The existing pedestrian infrastructure through the Macquarie Park Precinct is presented in **Figure 19**, and demonstrates existing footpath and pedestrian crossing locations. In general, pedestrian facilities are provided along public roadways within limited permeability at midblock locations.

In relation to the Site, footpaths are provided on both sides of Herring Road to allow pedestrian access between the site and Macquarie University Railway Station and Waterloo Road. A pedestrian underpass links the residential land uses to the south of Epping Road with Shrimptons Creek. This same pedestrian link along Shrimptons Creek provides access to Macquarie Shopping Centre to the north. Signalised crossing facilities are also provided at major intersections along Herring Road, Epping Road and Waterloo Road.

Notwithstanding, limited pedestrian access is provided between the Site and Peach Tree Road and no access is provided to Lyonpark Road.

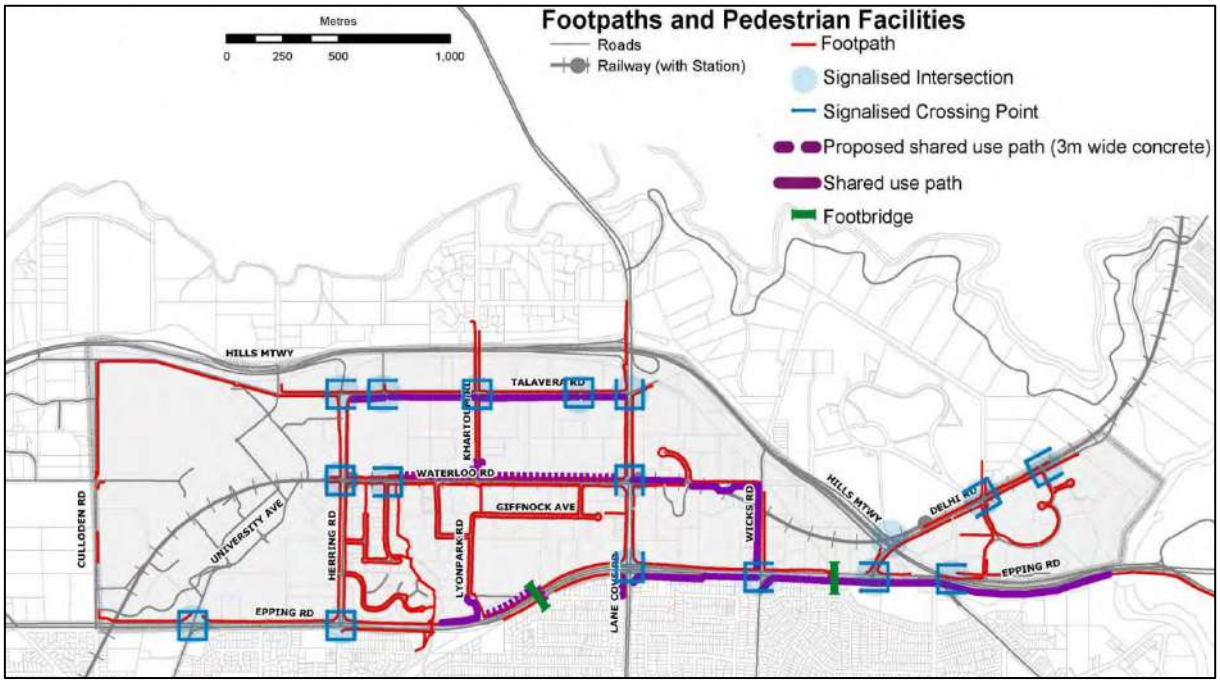

Figure 19: Existing Macquarie Park Pedestrian Facilities (Arup)

The accessibility of the Site to surrounding land uses is shown in **Figure 20** which demonstrates the 5 to 15 minutes walkable catchment to and from Herring Road / Ivanhoe Place intersection. The walking catchment includes the Macquarie University Station, Macquarie University, Macquarie Shopping Centre, employment precincts along Waterloo Road and recreational areas.

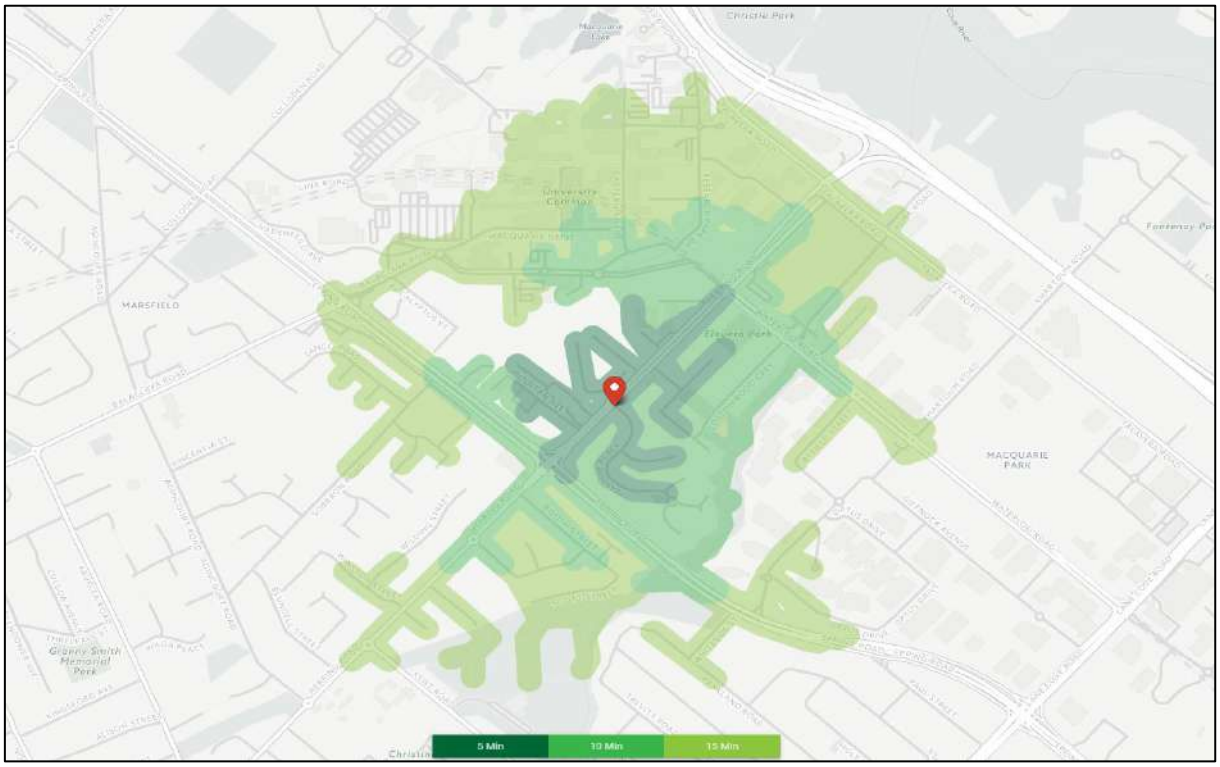

Figure 20: Walkable Catchment from Ivanhoe Place / Herring Road Intersection

5.3.3 Cycling

The existing Macquarie Park cycle network is illustrated below in **Figure 21**. There are sections of well-developed, shared, off-road paths linking to the Site from all directions other than to the south and west where gaps in the network are evident.

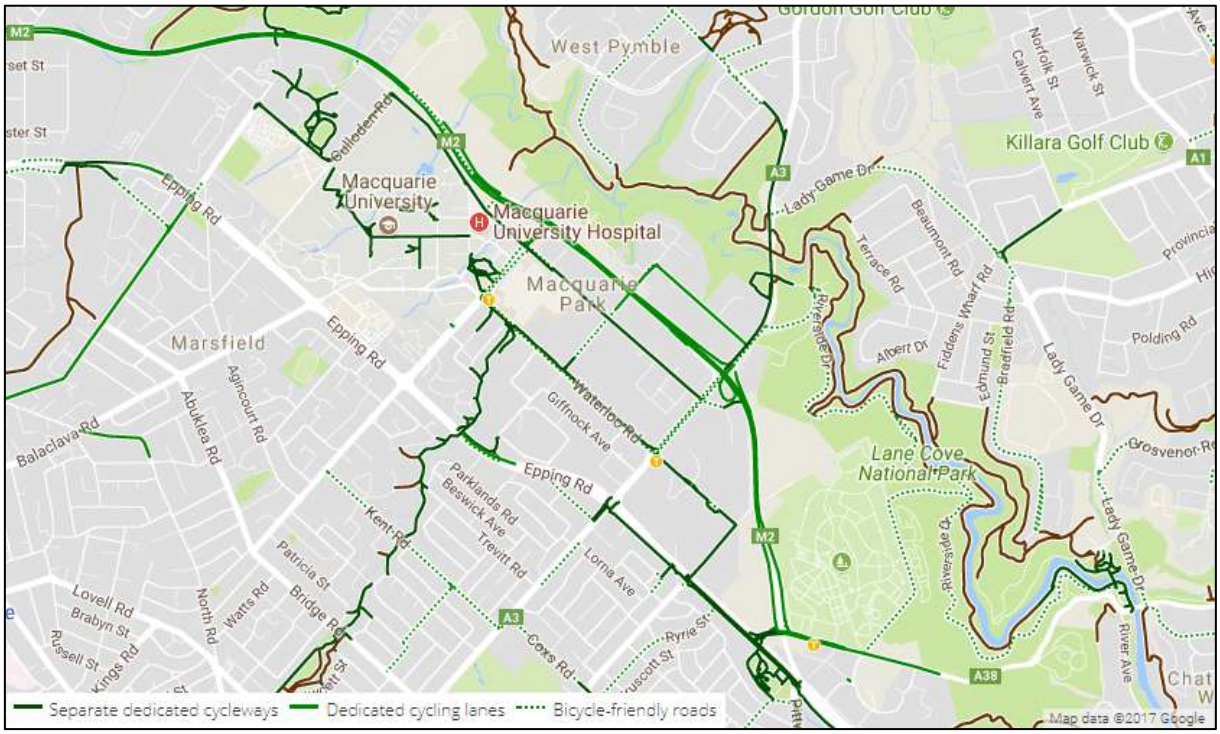

Figure 21: Existing Macquarie Park Cycle Network

There are a number of off-road shared cycleways along the major roads, including Waterloo Road and Lane Cove Road. However, the network is incomplete, and parts of the network require shared access with pedestrians. The lack of a fine grain street network further restricts existing cycling opportunities.

The proposed City of Ryde Bicycle Network is illustrated in **Figure 22**, illustrating the number of routes still to be developed to provide save and attractive cycle access to the Site.

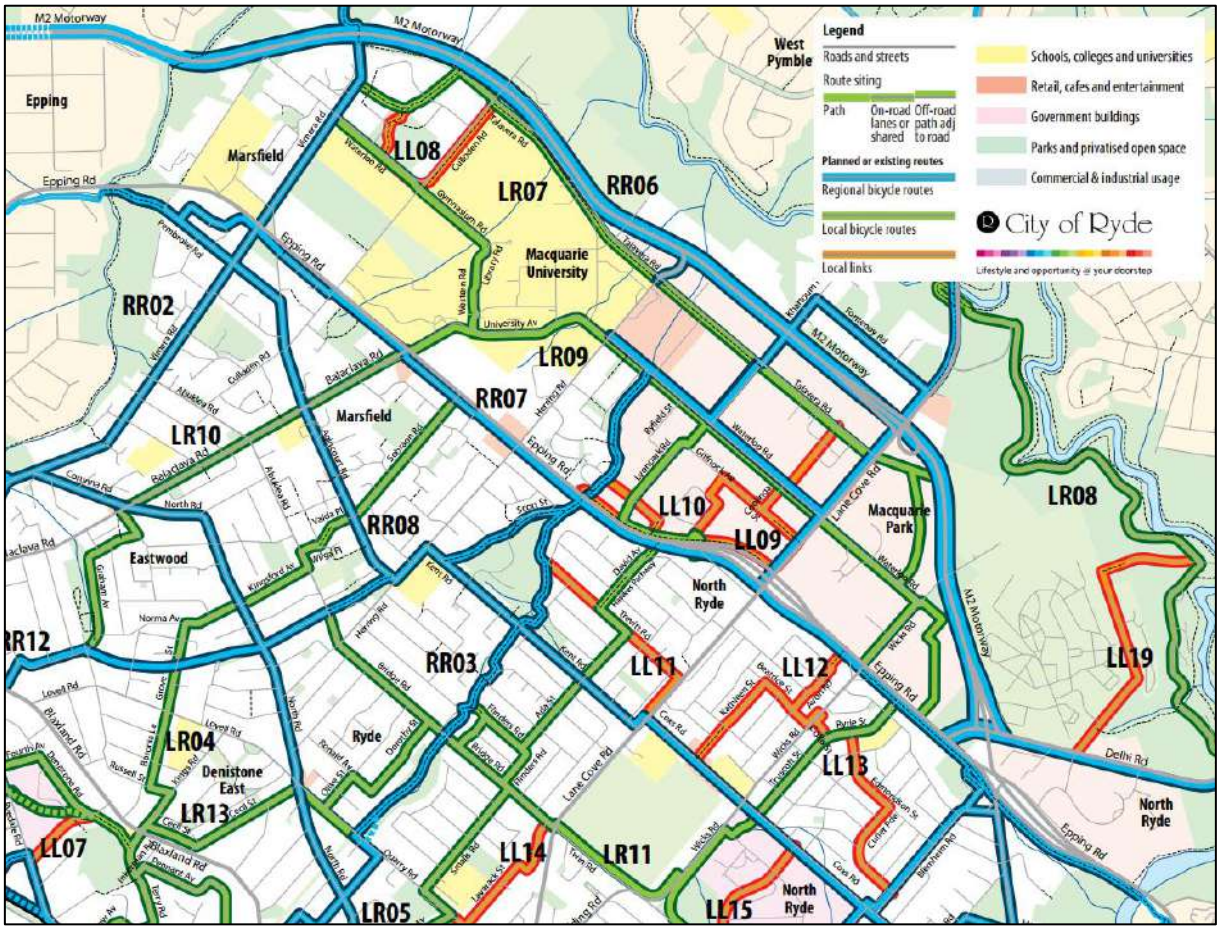

Figure 22: Proposed Bicycle Network

The focus is on providing for cyclists at train stations and along property frontages on Waterloo Road. Parking at train stations is traditionally for people commuting out of the area by public transport and these facilities could be utilised by Ivanhoe Estate residents. They could also potentially be utilised by people arriving in Macquarie Park in the morning by train and completing the last leg of their commute by bicycle from the station to the Site. If demand exists for this type of journey, then bike hire services may be a popular option in future.

6 Parking and Servicing Requirements

6.1 Proposed Car Parking

Car parking for the Ivanhoe will be provided in accordance with the requirements of Council's Macquarie Park DCP and other relevant state planning documents. **Table 4** provides the parking rates plied applied to the proposed development, which are consistent with that proposed by the Masterplan.

Table 4: Parking Rates

Land Use	Proposed Rate	Comments
Residential (Market and Social)		
1 Bed	Max 0.6 spaces per Unit	DCP Requirement
2 Bed	Max 0.9 spaces per Unit	DCP Requirement
3 Bed	Max 1.4 spaces per Unit	DCP Requirement
Social Housing Units	Min 0.5 spaces per unit	SEPP (Affordable Housing) 2009 requirement
Social Housing ILUs	Min 0.5 spaces per unit	SEPP (Housing for Seniors or People with a Disability) 2004 requirement
Visitor	1 space per 20 Units	Half DCP requirement: reasonable for a portion to be provided on-street, Site's access to public/active transport
Non-Residential		
Retail	Max 1 space per 100m^2	LEP Requirement
Child Care	1 space per 8 children and 1 space per 2 employees	DCP Requirement

It is noted that the minimum rates for the Social Housing under the State Environmental Planning Policy for affordable housing at a rate not less than 0.5 spaces per unit.

6.1.1 Building A1 Parking

The corresponding parking provision for Building A1 is provided in **Table 5**. Application of the rates provided in **Table 4** to the proposed Building A1 results in a maximum provision of 233 parking spaces. In response, a provision of 233 spaces is proposed within the basement car park with 3 spaces for the childcare centre provided on-street adjacent to the main building access.

Table 5: Building A1 Parking Provision

Land Use	DCP Maximum Requirement	Yield	Maximum Parking Provision	Proposed Parking
Residential (Market)				
Studio	0	7	0	0
1 Bed	0.6	111	67	67
2 Bed	0.9	141	127	127
3 Bed	1.4	10	14	14
Visitor	1 space per 20 units	-	12	12
Subtotal	**-**	**269**	**220**	**220**
Non-Residential				
Child Care	1 space per 8 children + 1 space per 2 employees	75 Children + 1 Staff	13	13
Total	**-**	**-**	**233**	**233**

6.1.2 Building C1 Parking Provision

The corresponding parking provision for Building C1 is provided in **Table 6**. Application of the rates provided in **Table 4** to the proposed Building C1 results in a maximum provision of 345 parking spaces. In response a provision of 345 spaces are proposed.

Table 6: Building C1 Parking Provision

Land Use	DCP Maximum Requirement	Yield	Maximum Parking Provision	Proposed Parking
Residential (market based on DCP maximum requirements)				
Studio	0	14	0	0
1 Bed	0.6	61	37	37
2 Bed	0.9	119	107	107
3 Bed	1.4	14	19	19
4 Bed	1.4	4	5	5
Visitor	1 space per 20 units	-	11	11
Subtotal	**-**	**212**	**179**	**179**
Residential (social based on DCP maximum requirements)				
Studio	0	42	0	0
1 Bed	0.6	118	70	70
2 Bed	0.9	99	89	89
3 Bed	1.4	0	0	0
Visitor	1 space per 20 units	-	4	4
Subtotal	**-**	**259**	**163**	**163**
Non-Residential				
Retail / Community	1 / 100m^2 GFA	244m^2	3	3
Total	**-**	**-**	**345**	**345**

It is noted that the Affordable Housing and Housing for Seniors or People with a Disability SEPPs permit parking for the social housing at a minimum rate of 0.5 spaces per dwelling. On this basis, the parking proposed for the social dwellings is consistent with the requirements of the SEPP.

6.2 Accessible Parking

The masterplan concept approval requires 5% of the market dwellings to be provided with accessible parking, thus the development responds by providing the following accessible parking provisions:

- Building A1 – 12 accessible spaces provided for the market housing, 1 accessible visitor space and 1 accessible space for the childcare centre.
- Building C1 – 11 accessible spaces provided for the market housing and notwithstanding the 5% of market only, there is also a provision of 17 accessible spaces for the social housing which can be used as visitor or adaptable apartments parking.

6.3 Bicycle Parking and Facilities

Having regard to the future TOD nature of the site, a high provision of bicycle parking is proposed. In this regard each dwelling has been provided with either a dedicated bicycle parking space or sufficient storage to accommodate a bike. On this basis, the bicycle parking proposed for each building is as follows:

- Building A1 – 269 resident bicycle parking and 14 visitor spaces (including 6 for the childcare centre)
- Building C1 – a total of 471 bicycle parking spaces will be provided.

In addition to the cycle parking, end of trip facilities will be provided in Buildings C1.

6.4 Motorcycle Parking

There will be 4 motorcycle spaces provided in Building A1 and 10 in Building C1 respectively.

6.5 Servicing and Waste Collection

6.5.1 Building A1

Servicing for Building A1 is proposed within the basement car park and accessed from the main driveway. The proposed dock has been designed to accommodate vehicles up to and including a 12.5 metre Heavy Rigid Vehicle HSRV) truck. This exceeds the dimension of councils existing garbage collection fleet and is suitable to accommodate the servicing needs of residents and the childcare centre.

The dock is to be operated using a mechanical turn table which is considered supportable. Suitable measures will be put in place to ensure that the turn table can be used in the event of mechanical failure, ensuring access to the dock at all times.

It is noted, that the design as shown in **Appendix F** reflects the interim design until such time that the balance of Building A is developed. It is likely that the dock will be increased in size and reformatted as part of a future application for Building A2, to provide additional loading bays suitable to accommodate the loading requirements of both developments. This is not however part of this application, which complies with the relevant requirements of AS2890.2.

6.5.2 Building C1

Servicing for Building C1 is proposed within the basement car park and accessed from a separate loading dock driveway. The proposed dock has been designed to accommodate vehicles up to and including a 12.5 metre Heavy Rigid Vehicle truck. This exceeds the dimension of councils existing garbage collection fleet and is suitable to accommodate the servicing needs of residents and the future proposed Community Centre.

The dock is to be operated using a mechanical turn table which is considered supportable. Suitable measures will be put in place to ensure that the turn table can be used in the event of mechanical failure, ensuring access to the dock at all times.

It is noted, that the swept path analysis shown in **Appendix F** complies with the relevant requirements of AS2890.2.

7 Internal Building Design

7.1 Relevant Design Standards

The site access, internal circulation and car parking arrangements have been developed with consideration of the requirements of Council's DCP and relevant Australian Standards (i.e. AS2890.1, AS2890.2 and AS2890.6). The following characteristics are noteworthy with regard to the design of the site access driveway, loading docks and on-grade car park.

7.1.1 Site Access

Access to the Ivanhoe Estate is proposed via three locations:

- A signalised intersection of Herring Road and Ivanhoe Place,
- A new ingress from Epping Road, and
- A new bridge connection between Ivanhoe Place and Lyonpark Road.

These accesses will provide for the distribution of traffic onto the broader road network and assist and minimising the impacts of the development on the existing operation of the road network.

For the purposes of Stage 1, the access will be taken via the existing Ivanhoe Place, by way of Herring Road. As Stage 1 only represents a small proportion of the traffic to be generated by the Estate under the Masterplan, the upgrade of the existing Herring Road / Ivanhoe Place roundabout intersection to a signalised intersection is not deemed necessary.

7.1.2 Building A1 Access

Access to building A1 is proposed via a Category 2 driveway being a combined entry and exit driveway with a clear width of 6.5m located on the eastern site boundary. The driveway has been designed to also accommodate access by vehicles up to and including a 12.5m HRV with a 4.5m height clearance. Grades within the driveway have also been designed in accordance and comply with AS2890.1 and AS2890.2.

7.1.3 Building C1 Access

Building C1 is serviced by two driveways providing access to the social and market housing car parking. Access to building to the Social Housing car parking is proposed via a Category 2 driveway being a combined entry and exit driveway with a clear width of 6.7m located on the western site boundary. Access to the Market housing car parking is also provided with a Category 2 driveway being a 6.6m

combined entry and exit driveway located on the southern site boundary. This access has also been designed

Both driveway have been designed to also accommodate access by vehicles up to and including a B99 vehicle with minimum head height of 2.2m. Grades within the driveway have also been designed in accordance and comply with AS2890.1.

7.2 Car Park Design

All internal basement areas have need designed to comply with the requirements of AS2890.1 and AS2890.2. It is expected that any detailed construction drawings in relation to any modified areas of the car park or site access would comply with these Standards. Furthermore, compliance with the above Standards would be expected to form a standard condition of consent to any development approval. The key design components of each building are summarised below.

7.2.1 Building A1 Internal Design

- The basement has been designed for both access by residents and child care centre staff and visitors and includes:
  - All resident parking spaces and staff spaces are designed in accordance with a User Class 1A and are to be provided with a minimum space length of 5.4m, a minimum aisle width of 5.8m and a minimum space width of 2.4m
  - All child care centre visitor spaces are designed as a User Class 3 and are provided with a minimum space length of 5.4m, an aisle width of 5.8m and minimum space width of 2.6m
- Child Care visitor and staff parking is provided on the lower ground level and is separated from the resident parking by a control point providing access to the Basement 1 level.
- Dead-end aisles are provided with the required 1.0m aisle extension in accordance with Figure 2.3 of AS2890.1.
- All disabled and adaptable parking spaces are to be provided in accordance with AS2890.6, which requires a space with a clear width of 2.4m and located adjacent to a minimum shared area of 2.4m.

7.2.2 Building C1 Design

- All resident parking spaces and staff spaces are designed in accordance with a User Class 1A and are to be provided with a minimum space length of 5.4m, a minimum aisle width of 5.8m and a minimum space width of 2.4m

- Dead-end aisles are provided with the required 1.0m aisle extension in accordance with Figure 2.3 of AS2890.1.
- All disabled and adaptable parking spaces are to be provided in accordance with AS2890.6, which requires a space with a clear width of 2.4m and located adjacent to a minimum shared area of 2.4m.
- All internal ramps have been designed with a minimum width of 5.5m and provide for two-way flow. It is noted that mirrors have been used within the Social housing car park to improve inter-visibility at key areas.

7.3 Service Vehicle Access

The commercial (heavy) vehicle facilities of Building A1 and C1 have been designed having regard for the operational requirements of the future tenant and the requirements of AS2890.2. In this regard the following is considered noteworthy:

- The internal design of the service area has been undertaken in accordance with the requirements of AS28090.2 for the maximum length vehicle accessing the site being a HRV of 12.5m in length.
- A minimum clear head height of 4.5m is provided within all areas traversed by service vehicles.
- A minimum bay width of 3.5m is provided, and
- All service vehicles can enter and exit the site in a forward direction.

A swept path analysis is provided on the plans attached at **Appendix F**, which demonstrate compliance with relevant sections of AS2890.2.

8 Transport Assessment

8.1 Ivanhoe Estate Road Upgrades and Future Intersection Operation

As part of the Stage 1 DA, the following upgrades are proposed to be undertaken:

- Bridge Connection between Ivanhoe Place and Lyon Park Road (two way),
- Signalisation of Ivanhoe Place with Herring Road, and
- Left in access to Ivanhoe development from Epping Road, including new deceleration lane.

The future performance of the key intersections in the surrounding road network has been analysed as part of the Masterplan Assessment and outlined in the Ason Group TMAP that accompanied this application. The modelling assessment considered the proposed upgrades as well as traffic generated from the completed Ivanhoe Estate. A summary of the future operation is provided in **Table 9**.

Table 7: Local Network Performance, Cumulative Future Scenario Based on Completed Masterplan

Intersection	Peak	Level of Service (delay in seconds)		
		2021 RMS Base	2021 RMS Base + Development	2021 RMS Base + Development + Upgrades
Epping Road / Herring Road	AM	F	F	F
		86	92	92
	PM	E	F	E
		59	73	64
Ivanhoe Place / Herring Road	AM	B	B	B
		23	23	23
	PM	B	D	C
		24	45	30
Waterloo Road / Herring Road	AM	B	C	B
		26	37	27
	PM	C	C	C
		33	34	31
Epping Road / Lyonpark Road	AM	A	A	A
		7	7	7
	PM	A	A	A
		7	7	7
Waterloo Road / Byfield Street	AM	A	A	A
		10	11	10
	PM	A	B	A
		14	17	12

The operation of the network under the Proposed development scenario (including the upgrades), demonstrates minimal increase in delays at the intersections of Epping Road with Herring Road during the morning and evening peak periods under the Masterplan conditions. The additional delays resulting from the development are generally offset by the proposed upgrades which will facilitate improved distribution of traffic around the network.

8.2 Stage 1 Traffic Generation

Having regard to the trip rates undertaken for the Masterplan, **Table 8** provides the forecast traffic generation for Building A1 and **Table 9** provides the traffic generation for Building C1.

Table 8: Proposed Building A1 Trip Rates and Traffic Generation

Land Use	Yield	AM Trip Rate	PM Trip Rate	AM Generation (veh/hr)	PM Generation (veh/hr)
Residential Land Uses					
Market Dwellings	269	0.14 / unit	0.12 / unit	38	32
Non-Residential Land Uses					
Child Care	75 children	0.1 per child + 6 staff	0.1 per child + 6 staff	14	14
			Total Generation	**52**	**46**

Table 9: Proposed Building C1 Trip Rates and Traffic Generation

Land Use	Yield	AM Trip Rate	PM Trip Rate	AM Generation (veh/hr)	PM Generation (veh/hr)
Residential Land Uses					
Market Dwellings	212	0.14 / unit	0.12 / unit	30	25
Social Dwellings	259	0.03 / unit	0.05 / unit	8	13
			Residential Sub-total	**38**	**38**
Non-Residential Land Uses					
Ancillary Retail	525m^2	1 / 100m^2	1 / 100m^2	5	5
			Total Generation	**43**	**43**

Building A1 is predicted to generate a total of 52 veh/hr in the AM peak and a total of 46 veh/hr in the PM peak. Building C1 is predicted to generate a total of 43 veh/hr in the AM peak and 43 veh/hr in the PM peak.

Thus, the proposed Stage 1 development will generate 95 veh/hr in the AM peak and 89 veh/hr in the PM peak. A comparison of the Stage 1 development traffic generation, to that predicted and assessed as part of the Masterplan application is provided in **Table 10**.

Table 10: Stage 1 Total Traffic Generation vs Masterplan Traffic Generation (veh/hr)

Land Use	Proposal (Building A1 + C1)		Estate Masterplan	
	AM	PM	AM	PM
Residential Land Uses				
Market Dwellings	68	57	325	282
Social Dwellings	8	13	26	44
Residential Sub-total	76	70	351	326
Non-Residential Land Uses				
Child Care	14	14	30	30
Ancillary Retail	5	5	12	12
Non-Residential Sub-total	19	19	42	42
Total Generation	**95**	**89**	**393**	**368**

8.3 Traffic Impacts

8.3.1 Proposed Development Traffic Impact

As established in Section 8.2, the Stage 1 Proposal will generate a total of 95 veh/hr in the AM peak and 89 veh/hr in the PM peak; this generation falls well within the peak thresholds outlined by the Estate Masterplan.

Table 11: Traffic Generation Balance

	AM Generation (veh/hr)	PM Generation (veh/hr)
Ivanhoe Estate Masterplan	692	584
Stage 1 (Buildings A1 and C1)	(-) 95	(-) 89
Balance	**597**	**495**

As the traffic generated as a result of the Proposal will form part of the total traffic generation under the completed Estate, it is supported and is consistent with the previous traffic assessment undertaken.

8.3.2 Interim Network Operation

With consideration of a proposed Stage 1 interim traffic arrangement – the MPBPCI upgrading of the roundabout intersection of Herring Road with Ivanhoe Place to a signalised intersection – the future performance of this key access intersection has been modelled using the SIDRA Intersection computer program. The modelling assessment considered the signalising of the intersection in the 2021 RMS Base scenario as well as the traffic generated from Stage 1 of the Ivanhoe Estate.

It should be noted that the base scenario was provided to Ason Group by RMS, who developed an Aimsun model to assess the MPBPCI project (please refer to the Ivanhoe Estate Masterplan TMAP for more information). The full SIDRA outputs are shown in Appendix E and a summary of the results is shown in **Table 12**.

Table 12: Intersection Performance of Ivanhoe Place / Herring Road

Intersection	Peak	Level of Service (delay in seconds)	
		2021 RMS Base	2021 RMS Base + Stage 1
Ivanhoe Place / Herring Road	AM	B	B
		21	21
	PM	B	B
		24	25

The results show that the Proposal would have minimal material impact on the operation of the local area network with the key intersection of Ivanhoe Place / Herring Road continuing to operate with similar delays and levels of service as currently occurs under roundabout control and negligible impact once the intersection is signalised. This is attributable to the relatively unimpeded left slip lane out of Ivanhoe Place.

8.4 Stage 1A Road Network

The Masterplan road network has been designed to facilitate the redistribution of vehicles from developments on the western side of Herring Road through the provision of connected streets, effectively providing a “U-Turn” facility. This will ensure that existing and future residents of developments on the western side of Herring Road are not adversely affected by the proposed signalisation of Ivanhoe Place.

Until such time that roads associated with future stages of the Ivanhoe Estate are constructed – at the completion of Stage 1C – a strategy has been developed to enable sufficient access and turning areas to accommodate the U-turn manoeuvre with the provision of turning heads at the end of the proposed north and south roads (Main Street and Neighbourhood Street) as shown in **Figure 23**.

Consideration should be given to potential parking restrictions under interim access arrangements to ensure suitable passing opportunities are maintained for two-way flow.

Figure 23: Proposed Iterim U-Turn Facility

9 Sustainable Travel

A Sustainable Travel Strategy (STS) for the Ivanhoe Estate has been developed to encourage the use of public transport, walking, cycling wherever possible for all journey purposes. Where alternatives to the car are not viable, options to encourage car sharing can be promoted to minimise the need for single occupancy vehicle travel.

The STS will assist Ivanhoe Estate in achieving its strategic direction of becoming a liveable precinct which provides for healthy and active lifestyles, does not negatively adversely impact on the environment, seeks to address sustainability and climate change objectives, and does not lead to unnecessary vehicle trip generation and highway network congestion.

The STS includes a range of targets and objectives and measures to achieve them. The objectives include:

- 40% non-car mode share for journeys to/from work
- 50% combined walk and cycle mode share for all school travel
- 50% combined walk and cycle mode share for all town centre trips
- 50% combined walk and cycle mode share as access mode for Macquarie Park Station

Measures to achieve the above objectives include a range of different types of initiatives which together reinforce the principles and objectives of the sustainable travel strategy. The measures that will be implemented for Stage 1 include:

- Provision of Household Information Packs (HIP) to each new residence to set out the sustainable travel options. This would include public transport leaflets, route maps and timetables.
- Each household will also receive one Opal card that has been preloaded with a nominal amount of $20 to encourage uptake of public transport by new residents from day one.
- It is recommended that a bus service be established from the opening of Stage 1. The bus routes will connect Ivanhoe Estate with Macquarie University Station.
- To maximise bicycle usage throughout the Site and the wider precinct, the provision of superior end of trip facilities, such as bicycle parking, will be provided.
- Bicycling initiatives will be promoted, including NSW bicycle week and cycle to work day.
- ‘Voluntary workplace travel plans will be encouraged for new businesses. A Green Travel plan for the Estate is provided as Appendix D.

- Parking restraint measures mean that parking for the high density residential element of the Estate will be restrained to reflect its high accessibility levels to sustainable transport.
- A commitment of 50 GoGet vehicles across the development to set up a car sharing network for Ivanhoe Estate.
- Through promotion in the HIP, additional measures include adopting sustainable practices for deliveries and sustainable principles in local food production.

10 Construction Traffic Management Plan

A detailed Construction Traffic Management Plan (CTMP) will be prepared once development consent is granted for relevant stages and prior to issue of a Construction Certificate (CC). The CTMP in Appendix C provides an overview of construction traffic management and outlines the principles that would be implemented during the construction period. While the traffic impacts of construction of the development are likely to be minor, the following measures should be undertaken to minimise the impacts of the construction activities of the development:

- Traffic control would be required to manage and regulate traffic movements into and out of the site during construction.
- Disruption to road users would be kept to a minimum by scheduling intensive delivery activities outside of peak hours.
- Construction and delivery vehicles would be limited to the use of Epping Road, the M2 and the necessary local roads and restricted to non-peak periods and utilise a temporary access when required.
- All vehicles to enter and exit the site in a forward direction with reverse movements to occur only as necessary and subject to supervision.
- All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any items depositing onto the roadway during travel to and from the Site.

The draft CTMP in **Appendix C** will be refined during future DA stages and developed to comply with RMS requirements and TCAW manual, and prepared in consultation with City of Ryde Council, RMS and any other relevant stakeholders.

11 Conclusions

Ason Group has prepared this Traffic Impact Assessment (TIA) report to support a Development Application for the Ivanhoe Estate – Stage 1, a State Significant Development (SSD) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) – the Proposal. It has been prepared for Aspire Consortium on behalf of NSW Land and Housing Corporation.

The key findings of this Traffic Impact Assessment are:

- The DA for the Ivanhoe Estate Masterplan has been submitted and will provide the overall concept for the planned redevelopment of the Ivanhoe Estate. The redevelopment of the Estate will create an integrated neighbourhood including social housing mixed with affordable and private housing, as well as seniors housing, a new school, child care centres, community facilities and retail development.
- This Stage 1 DA seeks consent for the first stage of detailed works within the Ivanhoe Estate – buildings A1, C1, the internal road network and bridge connection over Shrimptons Creek – pursuant to the concurrent Ivanhoe Estate Masterplan. This will allow for the timely staging and delivery of works across the Estate in accordance with the Masterplan. It will also prioritise the delivery of 259 social housing dwellings, to replace the existing stock within the Estate.
- Building A1 will provide 269 market dwellings and a child care centre with space for 75 children. Building C1 will provide 212 market dwellings, 259 social dwelling and 525m^2 of ancillary retail space.
- The parking rates applied to the Proposal are consistent with that of the Masterplan and results in a total of 233 spaces being provided for Building A1 and 345 spaces for Building C1. This is consistent with the maximum parking rates permitted under Council's DCP.
- Building A1 will generate some 52 veh/hr in the AM peak hour and 46 veh/hr in the PM peak hour. Building C1 will generate some 43 veh/hr in the AM peak hour and 43 veh/hr in the PM peak hour. Under the Masterplan, the Estate will generate some 692 veh/hr in the AM peak and 584 veh/hr in the PM peak. Thus, the proposed development falls well within the traffic generation threshold for the Estate.
- As part of the Stage 1 works, it is proposed to signalise the intersection of Herring Road with Ivanhoe Place, in accordance with the proposed layout identified under the Masterplan application.
- The impacts of the Proposal are consistent with that previously assessed as part of the Masterplan application. Notwithstanding, the proposed signalisation of the Herring Road with Ivanhoe Place

intersection will provide sufficient capacity to accommodate the additional traffic resulting from the Stage 1 development.

- A preliminary Construction Traffic Management Plan has been provided as **Appendix C** that sets out the number of principles that should be adopted by any future detailed CTMP that is developed in coordination with the prospective building contractor.
- The access and basement design has generally been designed having regard for relevant Australian Standards (AS2890 series). A standard condition of consent requiring compliance with AS2890 would be considered sufficient to ensure that any minor changes to the plans required, if any, could be undertaken as part of detailed Construction Certificate documentation.

In summary, the Proposal is supportable on traffic planning grounds and will not result in any adverse impacts on the surrounding road network or the availability of on-street parking.

Appendix A

Secretary's Environmental Assessment Requirements

Issue	Source	TIA Reference
Address the relevant provisions, goals and objectives in the following: • NSW State Priorities • A Plan for Growing Sydney • Towards our Greater Sydney 2056 • Draft North District Plan • NSW Apartment Design Guide • Development Near Rail Corridors and Busy Roads- Interim Guideline • Guide to Traffic Generating Developments (RMS) • Sydney's Bus Future 2013 • Sydney's Walking Future 2013 • Sydney's Cycling Future 2013 • NSW Planning Guidelines for Walking and Cycling • NSW Long Term Transport Masterplan • EIS Guidelines - Road and Related Facilities • Guide to Traffic Management- Part 12: Traffic Impacts of Development (AUSTROADS) • Future Directions for Social Housing in NSW • City of Ryde Development Control Plan 2014 • City of Ryde Section 94 Development Contributions Plan 2007 (Interim Update 2014) • Ryde 2025 Community Strategic Plan.	SEARs Key Issue 1	Appendix B
Demonstrate consistency with the Concept Development Application (SSD 8707) Transport and Traffic Impact Assessment.	SEARs Key Issue 8	Sections 2, 8
Provide accurate details of the current daily and peak hour vehicle, public transport, pedestrian and bicycle movements and existing traffic and transport facilities provided on the road network located adjacent to the proposed development.	SEARs Key Issue 8	Sections 5, 8
Provide estimated total daily and peak hour trips likely to be generated by the proposed development including vehicle, public transport, pedestrian and bicycle trips.	SEARs Key Issue 8	Section 8
Provide a detailed assessment of the existing and future safety and performance of key intersections providing access to the site and/or otherwise nominated by Roads and Maritime Services, and any road/intersection upgrades or new roads/intersections required as a result of the development. The assessment of the existing and future road network operations needs to consider the cumulative impacts of traffic volumes from other developments in the locality. The assessment needs to be supported by appropriate modelling and analysis to the satisfaction of Roads and Maritime Services.	SEARs Key Issue 8	Section 8 Appendix E
Provide details of measures to mitigate any associated traffic impacts including any upgrading or road improvement works required to accommodate the proposed development.	SEARs Key Issue 8	Sections 2.4, 8.1, 9
Detail the design and operation of the proposed road network in consultation with Roads and Maritime Services and City of Ryde Council.	SEARs Key Issue 8	Sections 2.4, 8.1, 8.4, 9
Provide a staging plan for all proposed civil infrastructure works.	SEARs Key Issue 8	Sections 2.6
Provide an assessment of traffic impacts in the event external transport infrastructure to be delivered by third parties is not delivered.	SEARs Key Issue 8	Sections 3.2, 8.4
Provide details of the proposed number of car parking spaces and compliance with appropriate parking codes and Australian Standards. It should demonstrate a minimalist approach to the provision of on-site parking and how traffic generation (number of vehicles and time of access) will be managed in response to capacity limitations on the road network.	SEARs Key Issue 8	Section 6
Detail the adequacy of public transport, pedestrian and bicycle networks and infrastructure to meet the likely future demand of the proposed development and details of measures to mitigate potential impacts including required upgrades to pedestrian/cycle connections.	SEARs Key Issue 8	Section 5
Provide details regarding connections to existing and planned public transport networks and services and opportunities for greater usage for residents, visitors, and child care centre users and workers.	SEARs Key Issue 8	Sections 5, 6

Issue	Source	TIA Reference
Provide details of existing and proposed vehicular access for residents, visitors, child care centre users and workers, and emergency vehicles	SEARs Key Issue 8	Sections 5, 6, 7
Provide opportunities to provide safe and efficient loading and servicing for the development	SEARs Key Issue 8	Section 7
Develop a Green Travel Plan containing details of sustainable travel initiatives for residents, visitors and child care centre users and workers.	SEARs Key Issue 8	Appendix D
Provide an assessment of cumulative impacts associated with other construction activities in the area.	SEARs Key Issue 8	Section 10 Appendix C
Provide details of anticipated truck movements to and from the site	SEARs Key Issue 8	Section 10 Appendix C
Provide details of access arrangements for workers to/from the site, emergency vehicles and service vehicle movements	SEARs Key Issue 8	Section 10 Appendix C
Provide details of temporary cycling and pedestrian access during construction	SEARs Key Issue 8	Section 10 Appendix C
Provide details of proposed construction vehicle access arrangements at all stages of construction	SEARs Key Issue 8	Section 10 Appendix C
Provide an assessment of traffic and transport impacts during construction and how these impacts will be mitigated for any associated traffic, pedestrian, cyclist and public transport, including the preparation of a draft Construction Pedestrian and Traffic Management Plan to demonstrate the proposed management of impact. This Plan needs to include vehicle routes, number of trucks, hours of operation, access arrangements and traffic control measures for all demolition/construction activities.	SEARs Key Issue 8	Section 10 Appendix C

Appendix B

Policy and Planning Context Tables

B1 State and Regional Strategic Planning Policies

B1.1 NSW State Priorities

NSW State Priorities	
Organisation	NSW Government
Date	14 July 2017
Purpose	Improving outcomes for the people of NSW – with clear goals and accountability
Content	**Building infrastructure** Improving road travel reliability – to ensure consistency of journey times on key roads continues to improve, we are working to make better use of existing road infrastructure, build extra road capacity and encourage commuters to use public transport and to undertake off-peak travel more often. This will enable business and the community to move around the city with greater ease, reducing travel times, boosting productivity and reducing business costs. **Increasing housing supply** Increase housing supply across NSW - Deliver more than 50,000 approvals every year A Plan for Growing Sydney estimates that Sydney will need 664,000 new homes over the next 20 years. The government is supporting future growth by establishing housing targets across NSW, and providing record allocations to the Housing Acceleration Fund to build the infrastructure to support this growth. **Creating sustainable social housing** Increase the number of households successfully transitioning out of social housing by 5% over three years. Addressing the growing demand for social housing – and ensuring that it provides a sustainable safety net to the most vulnerable – requires a number of strategies. Working with households to successfully and safely transition them out of social housing increases the ability of those households to participate in the economy and exit the cycle of entrenched disadvantage. **Ensure on-time running for public transport** Maintain or improve reliability of public transport services over the next four years. Public transport services in Sydney are crucial in getting customers to their destinations. Although Sydney is undergoing a large amount of infrastructure construction, we are working to ensure that public transport services continue to run on time. The government is also improving integration across public transport services, updating timetables and providing clear information to get people to their destinations on time.
Relevance to Ivanhoe Estate	Ivanhoe Estate will be developed into an integrated community of market, social and affordable housing units over the next 10 to 12 years. As the first major project being delivered under the Future Directions and the Communities Plus program, the project will increase the supply of social housing properties by almost fourfold, which means more people in need can move off the social housing waiting list. Connectivity and permeability of the urban design encourages public transport use.

B1.2 NSW Long Term Transport Masterplan

NSW Long Term Transport Masterplan	
Organisation	NSW Government
Date	December 2012
Purpose	Setting the framework for the NSW Government to deliver an integrated, modern transport system that puts the customer first.

NSW Long Term Transport Masterplan	
Content	The Masterplan is principally focused on the **six key transport challenges** that emerged from our analysis and our engagement with our customers. • Integrating modes to meet customer needs • Getting Sydney moving again • Sustaining growth in Greater Sydney • Providing essential access to regional NSW • Supporting efficient and productive freight • Statewide actions The Masterplan responds to these challenges through **four types of action**: • Integrate transport services • Modernise our system • Grow our networks to meet future demand (including the important tasks of corridor preservation) • Maintain important road and public transport assets.
Relevance to Ivanhoe Estate	Develop strategic bus corridors to provide rapid and more frequent services: • Hurstville to Macquarie Park via Burwood • Parramatta to Macquarie Continue to build connected cycling networks in Greater Sydney • Construction of a cycleway from North Ryde to Macquarie University (Waterloo Road, Macquarie Park) Strengthen public transport links between Parramatta, the Sydney CBD, North Sydney and Macquarie Park An increase in train services to Macquarie University and Macquarie Park. Preserve 19 major transport corridors across Sydney for future transport requirements: • Macquarie Park to Sydney Olympic Park • Parramatta to Macquarie Park

B1.3 NSW Apartment Design Guide

NSW Apartment Design Guide	
Organisation	NSW Government
Date	2015
Purpose	Provides consistent planning and design standards for apartments across the State.
Content	Provides design criteria and general guidance about how development proposals can achieve the nine design quality principles identified in SEPP 65 (State Environmental Planning Policy No 65 - Design Quality of Residential Apartment Development) – context and neighbourhood character, built form and scale, density, sustainability, landscape, amenity, safety, housing diversity and social interaction, and aesthetics.
Relevance to Ivanhoe Estate	Ivanhoe Estate is attempting to comply with all nine quality principles contained in the guide in order to achieve good design and planning practice, not just for the residential apartments, but for the development as a whole.

B1.4 Guide to Traffic Generating Developments (RMS)

Guide to Traffic Generating Developments (RMS)	
Organisation	RTA

Guide to Traffic Generating Developments (RMS)	
Date	2002
Purpose	Outlines all aspects of traffic generation considerations relating to developments. The Guide provides information regarding traffic issues for those submitting Development Applications, and for those involved in the assessment of these applications. The overall objective is that both parties have access to common information relevant to the development approval process.
Content	The Guide is separated into a number of sections each dealing with specific issues relating to traffic generating developments: Section 1 Policies and issues Section 2 Traffic impact studies Section 3 Land use traffic generation Section 4 Interpretation of traffic impacts Section 5 Parking requirements for specific land uses Section 6 Access and parking area design Section 7 Residential subdivisions - traffic and safety Section 8 Cost impacts of traffic generated by developments Section 9 Administration of the State Environmental Planning Policy No 11 Section 10 Reference Material
Relevance to Ivanhoe Estate	The Guide has been referenced during the development of this TIA and for the purpose of calculating the appropriate requirements and specifications for Stage 1.

B1.5 EIS Guidelines – Road and Related Facilities

EIS Guidelines – Road and Related Facilities	
Organisation	Department of Urban Affairs and Planning
Date	1996
Purpose	This guideline outlines issues which may need to be addressed in an EIS for a road or related facility to fulfil this function. The guideline is also relevant when assessing proposals requiring a lesser degree of environmental assessment.
Content	If a road proposal is designated, an EIS must be prepared and lodged with a development application, usually to the local council. If a road proposal (which requires development consent) is not designated, a Statement of Environmental Effects (SEE) which assesses the impacts of the proposal must be submitted with the development application. This guideline helps identify the range of issues which should be addressed in a SEE.
Relevance to Ivanhoe Estate	The Proposal has the potential to significantly affect the environment and an EIS is required under the EP&A Act.

B1.6 Guide to Traffic Management – Part 12: Traffic Impacts of Development (AUSTROADS)

Guide to Traffic Management – Part 12: Traffic Impacts of Development (AUSTROADS)	
Organisation	AUSTROADS
Date	2016
Purpose	Identifies and manages the impacts on the road system arising from land use developments. It provides guidance for planners and engineers associated with the design, development and management of a variety of land use developments.

Guide to Traffic Management – Part 12: Traffic Impacts of Development (AUSTROADS)	
Content	Part 12 presents the land use and transport planning context for traffic impact assessment, including travel demand, safety, parking and access management issues. It provides guidance on the need and criteria for impact assessments, and a detailed procedure for identifying and assessing the traffic impacts, and mitigating their effects. Assessment of safety, infrastructure and environmental effects is also covered. Examples are given of checklists, report structures, traffic generation rates and case study projects.
Relevance to Ivanhoe Estate	Ivanhoe Estate is a designated SSD located along one of Sydney's largest motorways, within the Macquarie Park precinct – a modern, highly connected, multi-modal transport hub with a variety of options for travelling in and around the business centre.

B1.7 Future Directions for Social Housing in NSW

Future Directions for Social Housing in NSW	
Organisation	NSW Government
Date	2016
Purpose	Driving better outcomes for tenants including helping those who are able to transition out of social housing.
Content	Actions including: • More social housing • More opportunities, support and incentives to build housing independence • A better social housing experience
Relevance to Ivanhoe Estate	The eight hectare Ivanhoe Estate at Macquarie Park (currently with 259 social housing dwellings), will be transformed into a high quality integrated community with market, social and affordable dwellings.

B1.8 NSW Planning Guidelines for Walking and Cycling

NSW Planning Guidelines for Walking and Cycling	
Organisation	NSW Government
Date	December 2004
Purpose	Assisting land use planners and related professionals to improve consideration of walking and cycling in their work. It is anticipated that this will ultimately create more opportunities for people to live in places with easy walking and cycling access to urban services and public transport.
Content	Assistance is provided by these guidelines in the form of principles, background information, case studies and references to other supportive policies and guidelines. This information can be used to develop planning instruments, at all levels, that are supportive of walking and cycling.
Relevance to Ivanhoe Estate	In 2002, a TMAP was prepared for the NSW Government and Ryde Council to guide the redevelopment of the Macquarie Park employment corridor for the next 15 to 20 years.

B2 Regional Transport Context Documents

B2.1 Draft North District Plan

Draft North District Plan	
Organisation	Great Sydney Commission
Date	November 2016
Purpose	Setting out aspirations and proposals for Greater Sydney's North District
Content	This draft District Plan includes three chapters focusing on the means to enhance the District's productivity, sustainability and liveability in accordance with A Plan for Growing Sydney and the Commission's mandate.
Relevance to Ivanhoe Estate	Macquarie University Station (Herring Road) Priority Precinct will deliver up to 5,800 new homes by 2031 and includes the redevelopment of Ivanhoe Estate. The rezoning proposal for the precinct was finalised in September 2015. Development will be staged over the next 10 to 20 years. The North District will continue to require social housing, and much of this provision will come through Communities Plus. One of the four Communities Plus initiatives underway in Greater Sydney is at the 8.2 hectare Ivanhoe Estate at Macquarie Park. It currently accommodates 259 social housing dwellings that will be transformed into an integrated community of 2,500 homes including more social housing mixed with affordable and private housing. The Ivanhoe Estate was rezoned as part of the Macquarie University Station (Herring Road) Priority Precinct. The Precinct optimises the use of existing and planned infrastructure and is well located for rail and bus services. It also has easy access to a major shopping centre, includes a top-ten university campus and is close to a growing local jobs market. World-class urban design, community-based place making, and quality facilities will support a vibrant, cohesive and sustainable community.

B2.2 A Plan for Growing Sydney

A Plan for Growing Sydney	
Organisation	NSW Government Planning and Environment
Date	December 2014
Purpose	To development a competitive economy with world-class services and transport; to deliver greater housing choice to meet our changing needs and lifestyles; to create communities that have a strong sense of wellbeing; and to safeguard our natural environment.
Content	The actions include: • accelerating urban renewal across Sydney at train stations, providing homes closer to jobs • growing a more internationally competitive Sydney CBD • growing Greater Parramatta as Sydney's second CBD • transforming the productivity of Western Sydney through growth and investment • enhancing capacity at Sydney's Gateways – Port Botany, Sydney Airport and Badgerys Creek Airport • delivering the infrastructure that is needed • promoting Sydney's arts and culture, tourism and entertainment industries • protecting our natural environment • managing long-term growth

A Plan for Growing Sydney	
Relevance to Ivanhoe Estate	Priorities for strategic centres - Macquarie Park: • Work with council to retain a commercial core in Macquarie Park for long-term employment growth. • Work with council to concentrate capacity for additional mixed-use development around train stations, including retail, services and housing. • Facilitate delivery of Herring Road, Macquarie Park Priority Precinct, and North Ryde Station Priority Precinct. • Investigate potential future opportunities for housing in areas within walking distance of train stations. • Support education and health-related land uses and infrastructure around Macquarie University and Macquarie University Private Hospital. • Support the land use requirements of the Medical Technology knowledge hub. • Investigate a potential light rail corridor from Parramatta to Macquarie Park via Carlingford. • Investigate opportunities to deliver a finer grain road network in Macquarie Park. • Investigate opportunities to improve bus interchange arrangements at train stations. • Work with council to improve walking and cycling connections to North Ryde train station.

B2.3 Towards our Greater Sydney 2056

Towards our Greater Sydney 2056	
Organisation	Great Sydney Commission
Date	November 2016
Purpose	Outlines a draft amendment to A Plan for Growing Sydney which aligns with the vision established in the draft District Plans.
Content	This amendment reconceptualises Greater Sydney as a metropolis of three cities: • Established Eastern City • Developing Central City • Emerging Western City A productive Sydney A liveable Sydney A sustainable Sydney
Relevance to Ivanhoe Estate	The principles within the Towards our Greater Sydney 2056 align with intent of the Ivanhoe Estate and in particular the development of the Central City as an economic corridor providing housing in proximity to employment and critical services.

B2.4 Development Near Rail Corridors and Busy Roads – Interim Guideline

Development Near Rail Corridors and Busy Roads – Interim Guideline	
Organisation	NSW Government Department of Planning
Date	2008
Purpose	To assist in reducing the health impacts of rail and road noise and adverse air quality on sensitive adjacent development. To assist in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads.

Development Near Rail Corridors and Busy Roads – Interim Guideline	
Content	Strategic planning context: contains general guidance for council strategic planning purposes, and also for other government agencies or private proponents investigating possible locations for residential development, places of worship, hospitals, child care centres and schools. It also provides guidance on site selection to reduce or avoid the need for mitigation measures Potential impacts of roads and railways on adjacent development: contains information on development that may be impacted by rail corridors and busy roads. Potential impacts of adjacent development on roads and railways: contains information on development that may impact on rail corridors and busy roads.
Relevance to Ivanhoe Estate	The Ivanhoe Estate Masterplan places significant emphasis on the delivery of an integrated transport and land use development that maximises the benefits of the State Government's investment public transport

B2.5 Sydney's Bus Future 2013

Sydney's Bus Future 2013	
Organisation	NSW Government
Date	December 2013
Purpose	Deliver simpler, faster and better bus services for customers, and attract more customers to use bus services throughout Sydney.
Content	Three-tiered network will operate with each level delivering a defined level of service consistency and reliability. • Rapid service routes • Suburban service routes • Local service routes The three stages of Sydney's Bus Future: • Improve bus customers' experience • Integrate bus service across Sydney • Serve future growth
Relevance to Ivanhoe Estate	Rapid bus routes: Parramatta – Macquarie Park via Carlingford and Epping Hurstville – Macquarie Park via Burwood Northern Sydney – Hornsby, Ryde, North Shore and Northern Beaches: Approximately 30 extra weekday services will link Macquarie Park to Burwood via Top Ryde Direct connections will link the Northern Beaches to major centres such as Chatswood, St Leonards and Macquarie Park Parramatta and Western Sydney: New and upgraded Rapid routes will strengthen connections between Parramatta, Macquarie Park, Castle Hill, Bankstown, Liverpool, the North-West Growth Centre, and central Sydney via Top Ryde Over 50 extra Rapid services will operate every weekday between Parramatta and Macquarie Park, with improvements starting to be delivered in the short term

B2.6 Sydney's Walking Future 2013

Sydney's Walking Future 2013	
Organisation	NSW Government
Date	December 2013
Purpose	Getting people in Sydney walking more through actions that make it a more convenient, better connected and safer mode of transport.
Content	Three pillars of Sydney's Walking Future • PROMOTE benefits and provide information • CONNECT through infrastructure and technology • ENGAGE through policy and partnerships
Relevance to Ivanhoe Estate	In 2011-12, the NSW Government delivered 65 pedestrian infrastructure projects, including the delivery of $5 million pedestrian footbridge at Macquarie Park connecting Epping High School students and local residents to locations across Epping Road. Transport Management Associations, which are partnerships across multiple levels of government and local businesses, are being piloted at Macquarie Park and will be rolled out progressively in other areas of Sydney.

B2.7 Sydney's Cycling Future 2013

Sydney's Cycling Future 2013	
Organisation	NSW Government
Date	December 2013
Purpose	Making bicycle riding a safer and more convenient option, and encouraging residents to ride bikes for everyday transport.
Content	Three pillars of Sydney's Cycling Future • CONNECT Safe, connected networks • PROMOTE Better use of existing Infrastructure • ENGAGE Policy and partnerships
Relevance to Ivanhoe Estate	Bicycle network plans will be developed with councils within five kilometre catchments of Major Centres, including Macquarie Park. Together with the Transport Management Association – a partnership between multiple levels of government and local businesses – currently being piloted at Macquarie Park, the proposed infrastructure will achieve the objectives of the Sydney's Cycling Future.

B3 Local Planning Context

B3.1 City of Ryde DCP 2014 – Part 4.5 Macquarie Park Corridor

City of Ryde Development Control Plan 2014	
Organisation	City of Ryde Council
Date	14 February 2017
Purpose	The Development Control Plan (DCP) 2014 provides guidelines, objectives and controls for people who wish to carry out development in the City of Ryde. Part 4.5 provides objectives, controls and design criteria to achieve desirable development outcomes in line with Council's vision for the Macquarie Park Corridor
Content	Development Control Plan 2014 Part: 4.5 Macquarie Park Corridor
Relevance to Ivanhoe Estate	Ivanhoe Estate is located on the southern boundary of the land covered by this part.

B3.2 City of Ryde 2025 Community Strategic Plan

Ryde 2025 Community Strategic Plan	
Organisation	City of Ryde Council
Date	25 June 2013
Purpose	Developed seven key outcomes for the Ryde Community Strategic Plan that responds to the clear and consistent priorities of our community.
Content	7 Outcomes • A city of liveable neighbourhoods • A city of wellbeing • A city of Prosperity • A city environmental sensitivity • A city of connections • A city of harmony and culture • A city of progressive leadership
Relevance to Ivanhoe Estate	Traffic management issues of Macquarie Park need to be addressed. Transport solutions for Macquarie Park and the university will be explored through a Transport Management Authority. Supporting a night time economy at the intersection of the university and the business park will provide additional animation to the precinct making it attractive to the younger workforce that responds to the needs of innovative industry.

B3.3 City of Ryde Section 94 Development Contributions Plan (Interim Update 2014)

City of Ryde Section 94 Development Contributions Plan 2007 (Interim Update 2014)	
Organisation	City of Ryde Council
Date	10 December 2014
Purpose	Section 94 of the Environmental Planning and Assessment Act 1979 enables Councils to levy contributions for public amenities and services as a consequence of development.

City of Ryde Section 94 Development Contributions Plan 2007 (Interim Update 2014)	
Content	Section 3.6 Roads and Traffic Management Facilities Strategy Plan Section 3.7 Transport and Accessibility Strategy Plan Section 3.8 Cycleways Strategy Plan
Relevance to Ivanhoe Estate	Council's Section 94 Development Contributions Plan applies to all land within the Ryde local government area.

Appendix C

Construction Traffic Management Plan

Prepared for

ASPIRE CONSORTIUM ON BEHALF OF NSW LAND AND HOUSING CORPORATION

Preliminary Construction Traffic Management Plan

Ivanhoe Estate, Macquarie Park – Stage 1

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18/10/2018

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Project No: 0555

Project: Ivanhoe Estate, Macquarie Park – Stage 1

Client: Aspire Consortium on behalf of NSW Land and Housing Corporation

File Reference: Ivanhoe CTMP

Revision History

Revision	Date	Details	Author	Approved by
-	5/3/2018	Draft	D. Budai	A. Johnson
1	15/3/2018	Issue I	D. Budai	A. Johnson
2	22/3/2018	Issue II	D. Budai	A. Johnson
3	29/3/2018	Issue III	D. Budai	A. Johnson
4	13/4/2018	Issue IV	D. Budai	A. Johnson
5	8/10/2018	Issue V	D. Budai	A. Johnson
6	18/10/2018	Issue VI	D. Budai	A. Johnson

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Appendices

1 Introduction

1.1 Overview

A detailed Construction Traffic Management Plan (CTMP) will be prepared once development consent is granted for Stage 1 of the Masterplan and prior to issue of a Construction Certificate (CC). This document provides an overview of construction traffic management and outlines the principles that would be implemented during the construction period. The objectives of the CTMP are as follows:

- Minimise traffic impacts on the surrounding road network
- Ensure safety and efficiency for workers, pedestrians and road users
- Provide information regarding the construction vehicle access routes and any changed road conditions

This plan is based on an indicative construction programme provided by the developer at this early phase. Please note that Ason Group is responsible for the preparation of this CTMP only and not for its implementation, which is the responsibility of the project manager/builder.

1.2 Site Location

Ivanhoe Estate, on the corner of Epping Road and Herring Road (the Site) is located within Macquarie Park in the City of Ryde Council LGA, and is less 5 kilometres north-west of Chatswood and 11.5 kilometres north-west of Sydney CBD. The Site has an approximate area of 82,000m^2 with frontages to commercial premises to the east, residential properties to the north, Herring Road to the west, and Epping Road to the south.

A Site Plan giving an appreciation of the site and the existing conditions presented in Figure 1. The Site consists of several residential houses, a childcare centre and a small parklands area. The site shares the corner of Epping Road and Herring Road with one of the entrances to Macquarie Park train station, and is well situated to take advantage of the public transport services in the area, with bus interchanges and train stations located within a 600m radius.

Figure 1: Site location and Road Hierarchy

1.3 Development Staging

The proposed staging plan is arranged to maximise the amount of public domain delivered in the first two stages of development. Stages are sequenced to maintain a consistent tenure split between social and market dwellings and to ensure that the necessary infrastructure comes online to service the

relevant stages. The development staging is subject to change, however is currently envisaged to be progressed in accordance with **Figure 2**.

Figure 2: Ivanhoe Estate Staging Plan

2 Overview of Stage 1 Proposed Development

2.1 Summary of Proposed Development

A detailed description of the proposed works is provided in the Environmental Impact Statement (EIS) prepared by Ethos Urban. A summary of the relevant works are provided below:

- Construction of the internal road network;
- The consolidation of existing lots and subdivision of the Ivanhoe Estate to reflect the revised road layout, open space, and provide superblocks corresponding to the Masterplan;
- The signalisation of the intersection of Herring Road with Ivanhoe Place in generally accordance with the Masterplan Application layout. The developer will liaise with RMS to finalise design and construction detail;

The Stage 1 Development Application seeks approval for:

- site preparation works, including tree removal, demolition of roads, services, and earthworks across the Ivanhoe Estate;
- the provision and augmentation of utilities and services infrastructure across the Ivanhoe Estate;
- the construction of all internal roads including public domain within the road reserves, and the bridge crossing and road connection to Lyonpark Road;
- the consolidation of existing lots and subdivision of the Ivanhoe Estate to reflect the revised road layout, open space, and provide superblocks corresponding to the Masterplan;
- the construction and use of Buildings A1 and C1 comprising residential uses (including social housing), a childcare centre, and retail / community spaces.

Reference should be made to the plans prepared by Bates Smart (Building A1 and Estate Layout) and Candalepas (Building C1), which are submitted separately. A reduced copy of the Stage 1 site plan is shown for context in **Figure 3**.

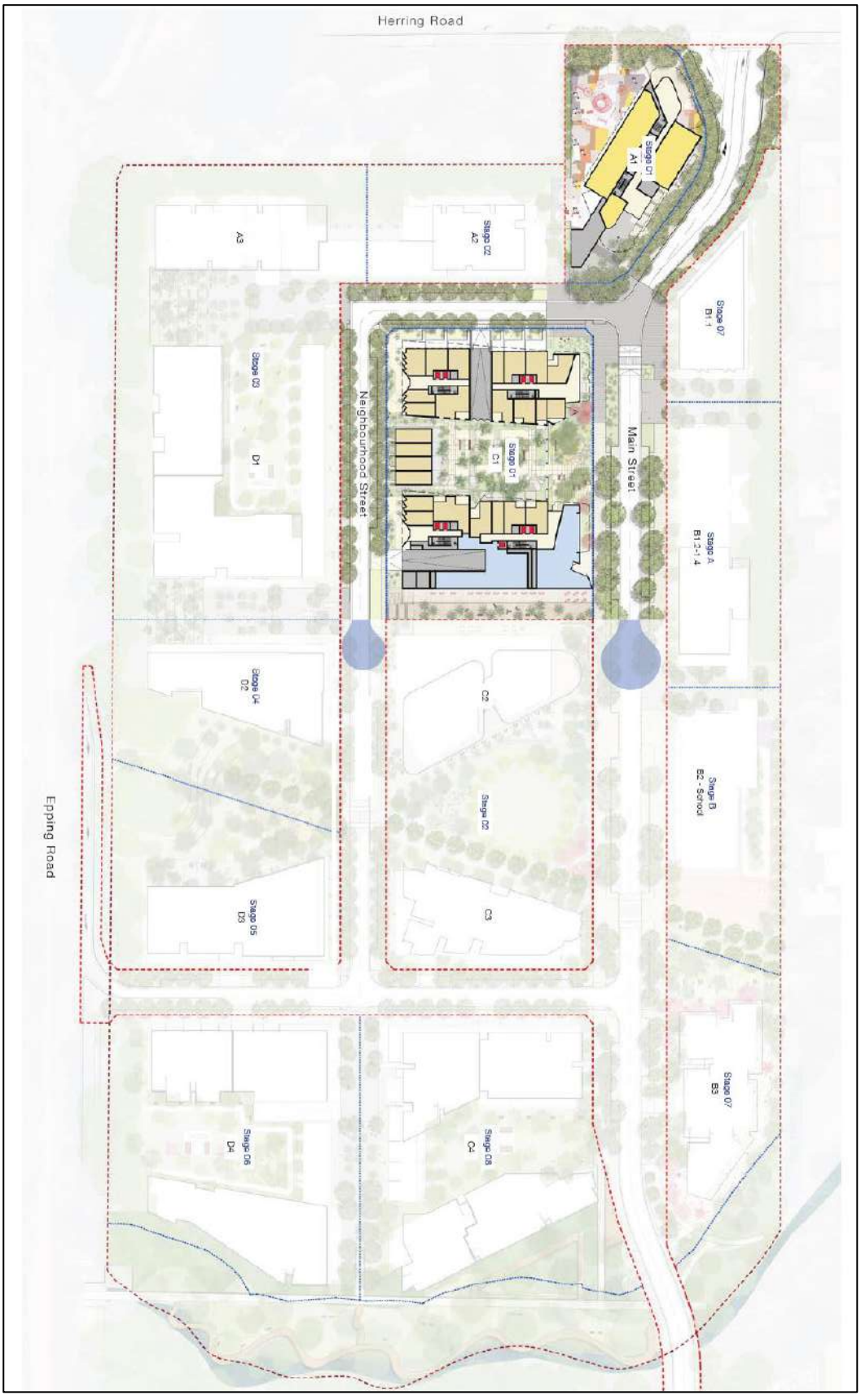


Figure 3: Stage 1A Site Plan

3 Overview of Works

3.1 Hours of Operation

All demolition and/or construction associated with Stage 1 will be restricted to the following hours:

- Monday to Friday: 7:00AM to 7:00PM
- Saturday: 8:00AM to 4:00PM
- Sundays and Public Holidays: No work

The working hours above recognises the existing peak network operation within Macquarie Park.

3.2 Construction Vehicle Access Routes

It is proposed that construction vehicles would enter and exit the Site via the routes shown in **Figure 4**. This figure also identifies the location of a temporary access on Epping Road which will be required during the initial construction of the internal road network. A copy of the truck route would be provided to all drivers prior to travel to the site. In accordance with the Vehicle Movement Plan (VMP) to be distributed by the lead contractor during prior to construction, all vehicles (both light and heavy) shall enter and leave the site in a forward direction.

Two options have been given for the construction vehicle access routes to site – one with the ability to turn right into and out of Ivanhoe Place, and the other without. Until the intersection of Herring Road and Ivanhoe Place is upgraded to a signalised intersection, RMS may decide that larger vehicles will be unable to access the Site with a right turn from the existing roundabout, therefore an ancillary route has been displayed with a left-in-left-out type arrangement on Epping Road.

The routes shown in **Figure 4** are to be utilised by all construction vehicles travelling to and from the site and represents the shortest route between the local and regional road network - hence minimising the impacts of the construction process.

The key roads in the vicinity of the Site are as shown in Figure 3 and are described in the following sections.

- M2 Motorway – an RMS State Road (MR 6002) that generally runs in an east-west direction between Lane Cove in the east and Baulkham Hills in the west. The M2 Motorway is one of Sydney's major transport corridors to the north-western suburbs. It carries in the order of 95,000 vehicles per day (vpd).

- Epping Road – an RMS State Road (MR 373) that generally runs in an east-west direction between the M2 Motorway (at Lane Cove) in the east and Blaxland Road (Epping) in the west. Epping Road carries approximately 50,000 vpd.
- Herring Road – a collector road that generally runs in a north-south direction which provides direct access to the site from the M2 motorway and Epping Road. Herring Road has a posted speed limit of 60km/hr and has parking on both sides of the road. Given the existing access arrangements, all vehicular traffic will be advised to arrive to the site from the north and depart to the north along Herring Road.
- Waterloo Road – a collector road that runs in an east-west direction between Wicks Road and Herring Road. It is subject to a 60km/hr speed limit and generally carries two lanes of traffic in either direction.
- Lane Cove Road – a RMS Classified arterial road that generally runs in a north-south direction to the east of the site. It is subjected to a 70km/hr speed limit and generally carries three lanes of traffic in each direction within the vicinity of the site.

Construction of the Proposal would generate additional movements within the network. Given that the M2 and Epping Road routes currently carry high volumes of traffic, construction of the development is not anticipated to have a material impact to the existing volumes on the M2 and the local network. As a safety measure, a temporary left-in-left-out (LILO) access will be created on to Epping Road for the duration of construction for all vehicles, to ease congestion on the already failing intersection of Epping Road and Herring Road.

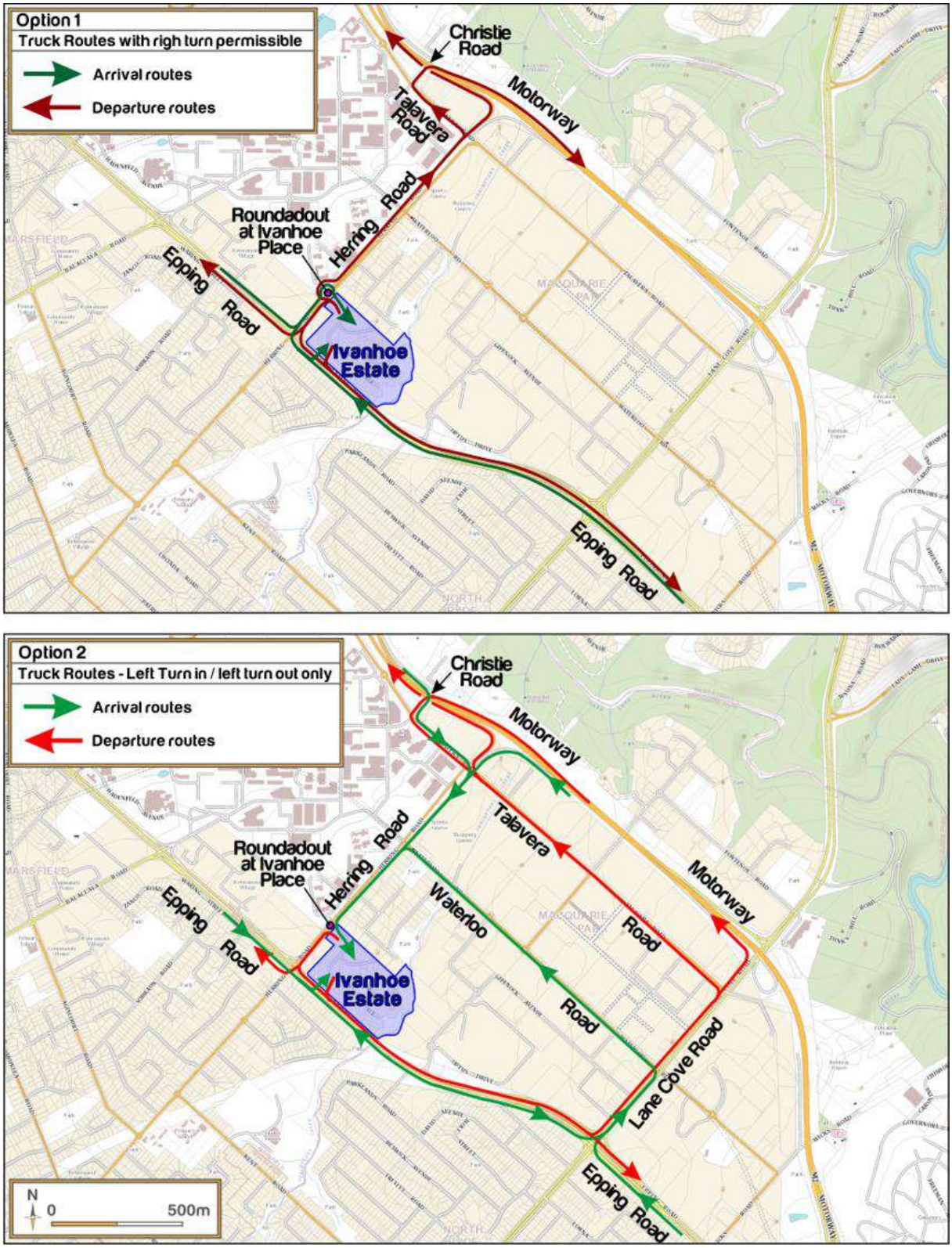


Figure 4: Heavy Vehicle Routes

3.3 Construction Vehicle Traffic Generation

3.3.1 Construction of Structure and Façade

Based on the construction methodology, duration of works and the type of truck being used, it is estimated that the construction of the core structure and façade is to generate a maximum of 108 construction heavy vehicle arrivals per day. This equates to approximately 14 vehicle movements (7 entry and 7 exit) on average over the proposed working hours (16 hours per day).

Recognising the proposed working hours of 7:00AM-7:00PM are intended to limit construction vehicle traffic movements during on-street peak periods to reduce impacts on the local road network, the majority of truck movements would be expected to occur over a reduced period of say 12 hours per day. Therefore, average heavy vehicle arrivals during non-peak periods may be in the order of 18 vehicles per hour (9 in, 9 out). Heavy vehicle arrivals would generally be minimal during the peak periods and operating at the aforementioned levels outside the peak periods.

It is also anticipated that a maximum of 400 contractors may be on-site at any one time during the main construction stage. The majority of workers will utilise public transport from the nearby Macquarie University Station to access the site, however, some contractors would still be required to drive to the site. Assuming 40% of contractors rely on public transport to access the site (as per Council's objectives for the locality), it is expected that a maximum of 240 contractors would arrive/depart on-site via private vehicles during the morning and evening periods. This includes vehicle passengers as part of car-pooling arrangements.

Assuming an average vehicle occupancy of 2.5 persons per vehicle and a 90-minute peak arrival period, the estimated traffic volumes would be 64 arrival/departure trips at the start and end of work periods. These flows would generally occur between the hours of 7:00AM-8:00AM and 6:00PM-7:00PM.

A summary of the average traffic flows generated from this stage of works is shown in **Table 1**.

Table 1: Summary of Average Construction Vehicle Generation – Stage 1

Vehicle Type	Cars		Trucks		Combined	
	In	Out	In	Out	In	Out
Morning Site Peak (7:00AM-8:00AM)	64	-	9	9	73	9
Morning On-street Peak (7:00AM-9:00AM)	-	-	5	5	5	5
Evening On-street Peak (4:00PM-6:00PM)	-	-	5	5	5	5
Evening Site Peak (6:00PM-7:00PM)	-	64	9	9	9	73
Daily Movements	96	96	108	108	204	204

It can be seen from table above that the estimated 'Site Peak' construction traffic flows (82 veh/hr including both heavy vehicles and site worker traffic) are sufficiently below the estimated peak traffic generated by the proposed development, once operational.

3.3.2 External Finishes / Fit-out

It is estimated that the final stages of construction would generate a maximum of 72 construction heavy vehicle arrivals per day. This equates to approximately an average of 12 vehicle movements (6 entry and 6 exit) over the proposed working hours, taking into consideration the reduced truck movements during on-street peak periods.

It is also anticipated that a maximum of 300 contractor staff will be on-site at any one time during the main construction stage. Similar to the previous stage, the majority of workers would be utilising public transport from the nearby Macquarie University Station or car pool to access the site. As such, it is expected that a maximum of 48 contractors would arrive/depart on-site via private vehicles during the morning and evening periods (7:00AM-8:00AM and 6:00PM-7:00PM).

A summary of the average traffic flows generated from this stage of works is shown in **Table 2**.

Table 2: Summary of Average Construction Vehicle Generation – Stage 2

Vehicle Type	Cars		Trucks		Combined	
	In	Out	In	Out	In	Out
Morning Site Peak (7:00AM-8:00AM)	48	-	6	6	54	6
Morning On-street Peak (7.00AM-9.00AM)	-	-	5	5	5	5
Evening On-street Peak (4:00PM-6:00PM)	-	-	5	5	5	5
Evening Site Peak (6:00PM-7:00PM)	-	48	6	6	6	54
Daily Movements	72	72	72	72	144	144

The table above demonstrates that the anticipated traffic flows are lower than that forecasted for the Stage 1 works, which reflects the type of work undertaken at this stage. As such, the proposed Stage 2 construction activities will also not result in an adverse impact on the operational capacity of the surrounding network.

3.4 Heavy Vehicle Management

In accordance with RMS requirements, all vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or dirt particles depositing onto the roadway during travel to and from the site. All subcontractors must be inducted by the lead contractor to ensure that the procedures are met for all vehicles entering and exiting the construction site. The lead contractors will monitor the roads leading to and from the Site and take all necessary steps to rectify any road deposits caused by site vehicles.

Vehicle movements to, from and within the Site shall do so in a manner, which does not create unreasonable or unnecessary noise or vibration. No tracked vehicles will be permitted or required on any paved roads. Public roads and access points will not be obstructed by any materials, vehicles, waste skips or the like, under any circumstances.

All drivers are to be familiar with the Driver Code of Conduct before attending the Site. A copy of the Code is included in **Appendix A.**

3.5 Employee Parking

It is expected that construction employees would avail of the excellent public transport facilities, thereby ensuring that there would be minimal parking demand. The Site's accessibility to public transport is depicted in **Figure 5**.

It is anticipated that the construction activities will result in a maximum of 400 contractors on-site over the entire construction program. Accordingly, the estimated maximum number of contractor vehicles that would be on-site over the course of the day would be 96 vehicles. As such, parking space within the lot would exceed the expected parking demands. In this regard, there will be no reliance on on-street parking within the North Ryde and Macquarie Park areas.

Some parking for employees will be provided on-site with others encouraged to carpool and utilise the extensive public transport service in the area. As such, on-street parking will not be utilised by contractors or site employees, and the proposed construction activities will have minimal impact on the availability of surrounding public car parking throughout construction.

3.6 Emergency Vehicle Access

Emergency vehicle access to and from the site will be available at all times the site is occupied by construction workers. This process would be implemented through emergency protocols on the site, which would include a requirement for site personnel to assist with emergency access if required.

3.7 Public Transport

Macquarie Park in general, and more specifically the Site is well serviced with public transport, with more details on Public transport within the locality can be found in **Figure 5**.

The Site benefits from excellent access to bus services with bus stops for up to 25 services provided within 400 metres of the Site transporting commuters to the City, Hurstville, Blacktown and the Hills to name a few.

In addition, Macquarie University Railway Station is located within 400 metres of the Site, and will transport commuters to the City, Penrith and Hornsby. Ancillary to the existing rail lines, the introduction of the Sydney Metro Northwest will further improve serviceability to and from the Site.

The construction activities will have no material impact on the existing public transport services along Herring Road or Epping Road with all bus services to continue as currently occurs.

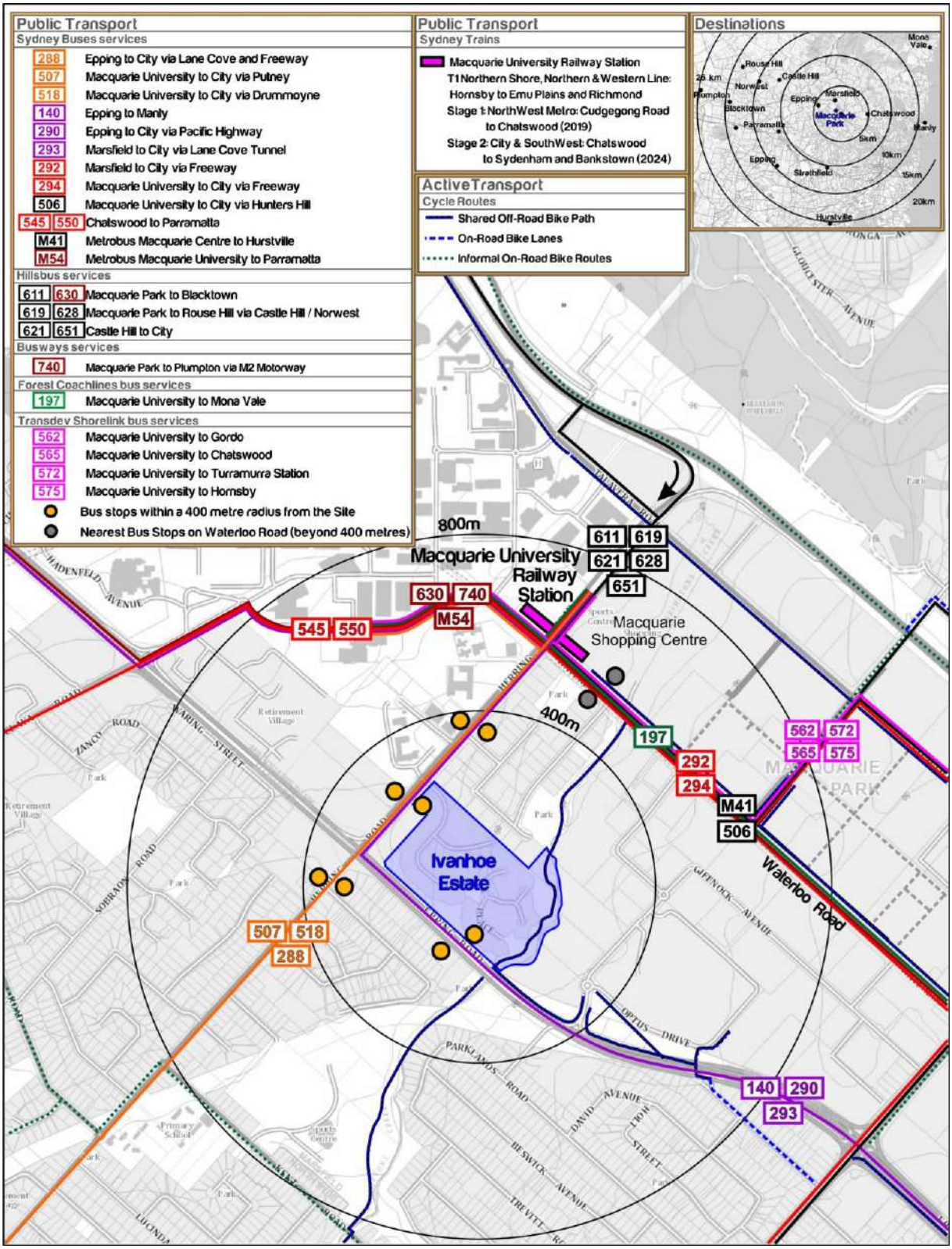


Figure 5: Public Transport Map

3.8 Pedestrian and Cyclist Access

As shown in **Figure 4** all construction activities will occur within the Site. Accordingly, the existing pedestrian and cycle connections on Herring Road and Epping Road will remain unchanged and will continue to operate as is.

All truck movements to the Site will make use of the existing access from Ivanhoe Place. The existing footpaths on Herring Road will remain open during construction., with Traffic Controllers stopping pedestrians and cyclists during the arrival and departure of heavy vehicles.

The dedicated cycleway that runs within the Site will ultimately be shut, although it is unclear during which stage of construction this will be. Although a matter for a specific stage's DA, the closure of this dedicated cycleway will not occur until a new cycleway is built, therefore ensuring cyclists and pedestrians will not be adversely affected during construction. All other footpaths outside the Site will remain unaffected by demolition works at all times.

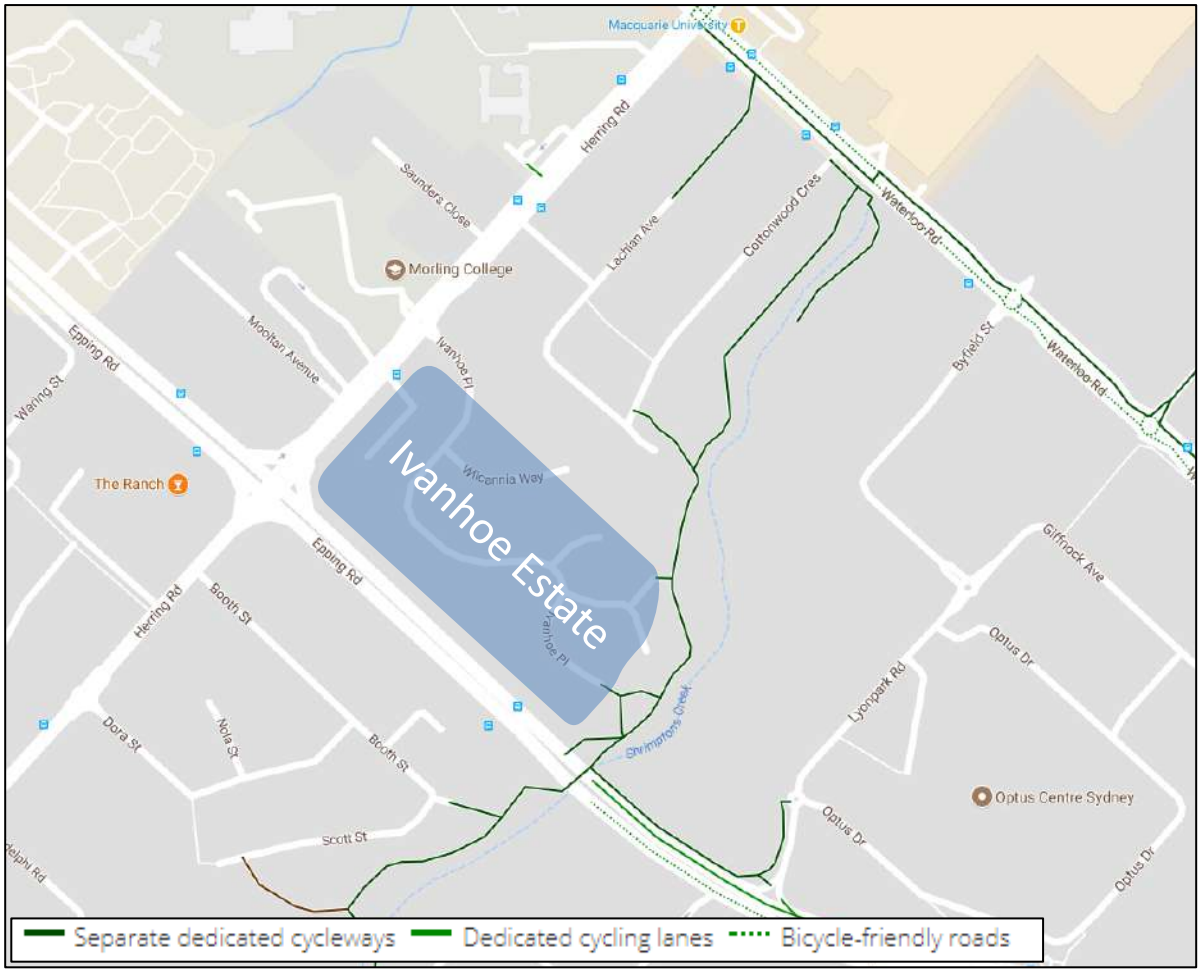


Figure 6: Active Transport Map

4 Traffic Control

4.1 Traffic Control

The RMS guide “Traffic Control at Worksites” (TCAW) manual contains standard traffic control plans (TCPs) for a range or work activities. The manual objective is to maximise safety by ensuring traffic control at worksites complies with best practice. The RMS TCAW outlines the requirement for a Vehicle Movement Plan (VMP).

A VMP is a diagram showing the preferred travel paths for vehicles associated with a work site entering, leaving or crossing the through traffic stream. A VMP should also show travel paths for trucks at key points on routes remote from the work site such as places to turn around, accesses, ramps and side roads. It may be combined with or superimposed on to a TCP if warranted.

On roads with an average daily total (ADT) of more than 1,500 vehicles, approach speeds of between 60 km/hr and 80 km/hr, with truck movements > 20 veh/hr, and sight distance is less than 2*d* (where *d* equals the posted speed limit and in this instance the sight distance is required to be up to 160 metres), the following is required by the RMS TCAW manual:

- TCP with Traffic controllers/Traffic Signals Yes
- VMP Yes
- Warning Signs required during shifts Yes

For the purpose of this preliminary CTMP, truck movements have been assumed to be greater than 20 vehicles per hour, however, if truck movement were to be less than 20 vehicles per hour, the following would be required by the RMS TCAW manual:

- TCP with Traffic controllers/Traffic Signals N/A
- VMP N/A
- Warning Signs required during shifts N/A

Irrespective of the nominal RMS requirements, it is proposed to implement a site-specific version of TCP 195 (TCP 195 is shown in **Appendix B).** The site-specific TCP will be drawn during future DA stages. With these adopted construction traffic management principles, all construction vehicles will be able to exit the Site via the temporary priority controlled intersection.

4.2 Authorised Traffic Controller

There is a requirement for an authorised traffic controller to be present throughout the demolition, excavation and construction stages of the project. These responsibilities include:

- Supervision of all vehicle movements across pedestrian footpaths at all times, and
- Supervision of all loading and unloading of construction materials during the deliveries in the construction phase of the project.
- Pedestrian management, to ensure that adverse conflicts between vehicle movements and pedestrians do not occur.

5 Summary

While the traffic impacts of construction of the development are likely to be minor, the following measures should be undertaken to minimise the impacts of the construction activities of the development:

- Traffic control would be required to manage and regulate traffic movements into and out of the Site during construction.
- Disruption to road users would be kept to a minimum by scheduling intensive delivery activities outside of peak hours.
- Construction and delivery vehicles would be limited to the use of Epping Road, the M2 and the necessary local roads and restricted to non-peak periods.
- All vehicles to enter and exit the Site in a forward direction with reverse movements to occur only as necessary and subject to supervision.
- All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any items depositing onto the roadway during travel to and from the Site.

The CTMP will be developed to comply with RMS requirements and the TCAW manual, and prepared in consultation with Ryde Council, RMS and any other relevant stakeholders. The above provides an appropriate overview of the likely impacts and outlines the principles that would be adopted in preparing the detailed Construction Traffic Management Plan.

Appendix A

Driver Code of Conduct

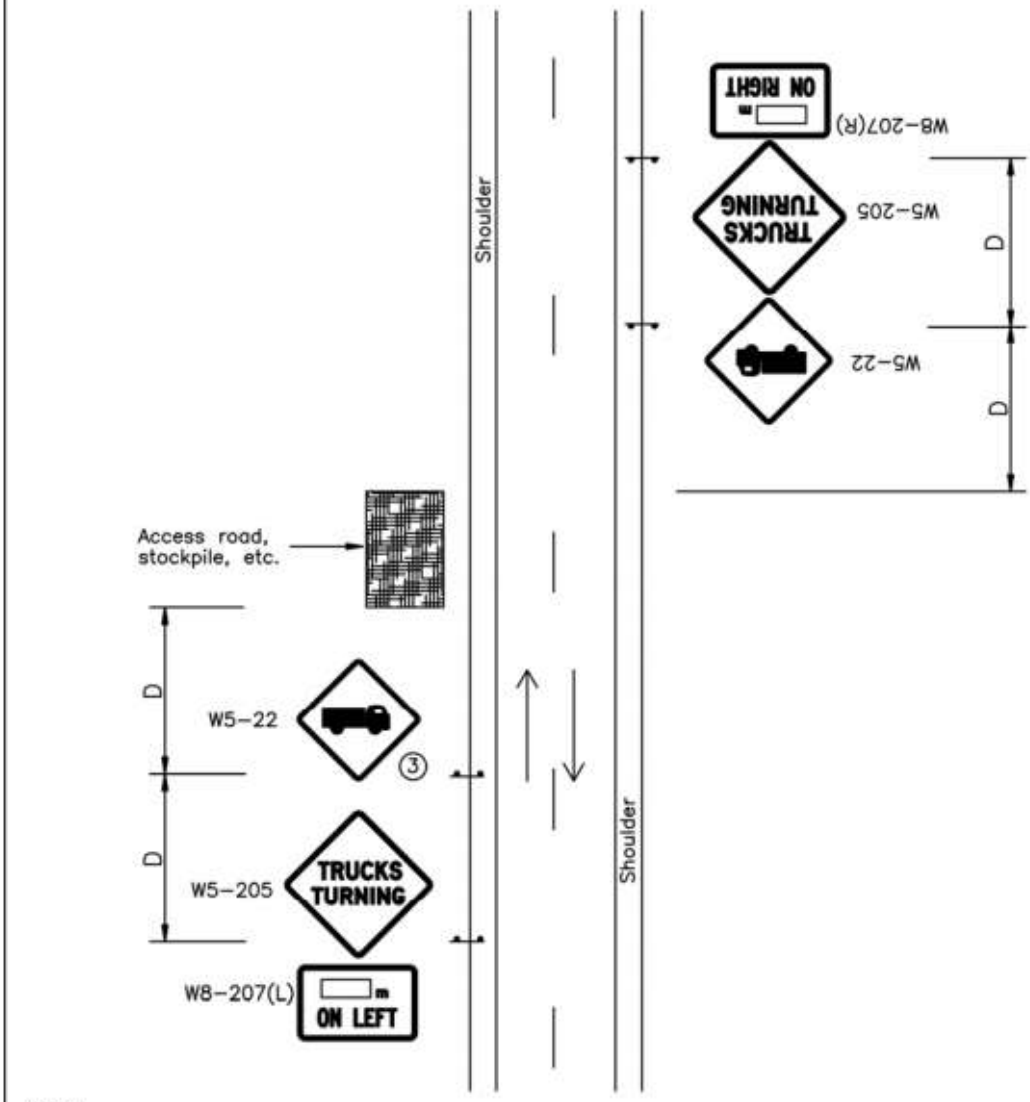
- Driver Code of Conduct -

All vehicle operators accessing the Site must:

- Take reasonable care for his or her own personal health and safety.
- Not adversely, by way of actions or otherwise, impact on the health and safety of other persons.
- Notify their employer if they are not fit for duty prior to commencing their shift.
- Obey all applicable road rules and laws at all times.
- Obey the applicable driving hours in accordance with legislation and take all reasonable steps to manage their fatigue and not drive with high levels of drowsiness.
- Obey all on-site signposted speed limits and comply with directions of traffic control supervisors in relation to movements in and around temporary or fixed work areas.
- Ensure all loads are safely restrained, as necessary.
- Operate their vehicles in a safe and professional manner, with consideration for all other road users.
- Hold a current Australian State or Territory issued driver's licence.
- Notify their employer or operator immediately should the status or conditions of their driver's license change in any way.
- Comply with other applicable workplace policies, including a zero tolerance of driving while under the influence of alcohol and/or illicit drugs.
- Not use mobile phones when driving a vehicle or operating equipment. If the use of a mobile device is required, the driver shall pull over in a safe and legal location prior to the use of any mobile device.
- Advise management of any situations in which you know, or think may, present a threat to workplace health and safety.
- Drive according to prevailing conditions (such as during inclement weather) and reduce speed, if necessary.
- Have necessary identification documentation at hand and ready to present to security staff on entry and departure from the Site, as necessary, to avoid unnecessary delays to other vehicles.

Appendix B

Traffic Control Plan (TCP)



NOTE:

① For use where roadside is generally undeveloped, ADT is more than 1,500 vehicles per day, sight distance is restricted and there are more than 20 truck movements per shift.

② See ***Traffic control at work sites***, Section 7.7, ***Signs for depots, stockpiles, quarries, gravel pits etc.***

③ For short term works use T2–25.

ACCESS TO DEPOT, STOCKPILE, QUARRY, GRAVEL PIT ETC.
ALL ROADS
LONG TERM USE

T000195

TCP 195

Appendix D

Green Travel Plan

Prepared for

ASPIRE CONSORTIUM ON BEHALF OF NSW LAND AND HOUSING CORPORATION

Green Travel Plan

Ivanhoe Estate, Macquarie Park – Stage 1

Ref: 0555r02v06
18/10/2018

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Document Control

Project No: 0555

Project: Ivanhoe Estate, Macquarie Park – Stage 1

Client: Aspire Consortium on behalf of NSW Land and Housing Corporation

File Reference: Ivanhoe Estate – Stage 1 GTP

Revision History

Revision	Date	Details	Author	Approved by
-	5/3/2018	Draft	D. Budai	A. Johnson
1	15/3/2018	Issue I	D. Budai	A. Johnson
2	22/3/2018	Issue II	D. Budai	A. Johnson
3	29/3/2018	Issue III	D. Budai	A. Johnson
4	10/4/2018	Issue IV	D. Budai	A. Johnson
5	8/10/2018	Issue V	D. Budai	A. Johnson
6	18/10/2018	Issue VI	D. Budai	A. Johnson

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Appendices

1 Introduction

1.1 Background

This Green Travel Plan (GTP) has been developed to support a Development Application for Stage 1 of the Ivanhoe Estate redevelopment, a State Significant Development (SSD) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). It has been prepared for Aspire Consortium on behalf of NSW Land and Housing Corporation.

In September 2015 the Ivanhoe Estate was rezoned by the Department of Planning and Environment as part of the Macquarie University Station (Herring Road) Priority Precinct, to transform the area into a vibrant centre that benefits from the available transport infrastructure and the precinct's proximity to jobs, retail and education opportunities within the Macquarie Park corridor.

The Ivanhoe Estate is currently owned by NSW Land and Housing Corporation and comprises 259 social housing dwellings. The redevelopment of the Ivanhoe Estate is part of the NSW Government Communities Plus program, which seeks to deliver new communities where social housing blends with private and affordable housing, with good access to transport, employment, improved community facilities and open space.

The Communities Plus program seeks to leverage the expertise and capacity of the private and non-government sectors. As part of this program, Aspire Consortium, comprising Frasers Property Australia, Citta Property Group and Mission Australia Housing, was selected as the successful proponent to develop the site in July 2017.

In September 2017, DPE issued the Secretary's Environmental Assessment Requirements for a comprehensive Masterplan application that will establish the framework for the staged redevelopment of the site. This Development Application for Stage 1 of the Ivanhoe Estate redevelopment represents the first stage of detailed works pursuant to the Ivanhoe Estate Masterplan.

1.2 Objective

This management strategy comprises a package of measures designed to address the specific travel needs and impacts of the proposed Ivanhoe Estate development on the corner of Epping Road and Herring Road, Macquarie Park (the Site). The overall intention of this Green Travel Plan (GTP) is to encourage and facilitate the use of alternatives to single-occupancy car travel for journeys associated with the Site.

Incorporation of physical infrastructure into the Masterplan and subsequent staged development applications will avoid the need and expense associated with retro-fitting facilities, and other measures i.e. marketing and promotion, etc. can be developed and ready to roll out at first occupation of the Site. This therefore provides a significant opportunity to influence travel behaviour before a tendency towards single occupancy car travel is entrenched. In addition, the availability of a GTP at this stage helps planning and road authorities to better understand the likely impacts of the development, bearing in mind the mitigating effects of the GTP, as part of the approval process.

The primary objectives of the GTP will be to:

- Reduce the environmental footprint of the proposed development
- Promote the use of 'active transport' modes, particularly for short-medium distance journeys.
- Reduce reliance on the use of private vehicles for all journeys.
- Encourage a healthier, happier and more active social culture.

Having regard for the above, this GTP would seek to adopt the movement hierarchy shown in with priority given to 'active transport'.

Figure 1: Movement Hierarchy

2 Site Audit and Targets

An audit of the Site and proposed development was conducted to determine facilities in the area and projected modal splits. The audit considered the following:

- Public transport services in the area, including proximity to the Site, frequency of services and accessibility;
- Location of nearby car share pods;
- Bicycle and pedestrian facilities, including accessibility, connectivity and safety;
- Mode-split data for the Site and local area;

Travel Zones (TZs) are the geographic units of the Bureau of Transport Statistics' (BTS) data collection, transport modelling and analysis. TZs allow for detailed spatial analysis as they are smaller than Statistical Local Areas (SLA), but generally larger than an ABS Collection District (CD) or Mesh Block (MB). In order to provide for a similar level of trip generation across zones, TZs are configured so that they tend to be small in areas with high land use densities and larger in areas of lower density. The key land uses of interest in defining TZs are employment, housing and transport infrastructure.

The Macquarie Park area is comprised of 13 TZs. TZs that are located within 800m of a train station (Macquarie University, Macquarie Park) along the T1 Line, have permeability through an accessible network of streets serving the stations, and have other similar travel characteristics to the completed Ivanhoe Estate development were analysed to establish the potential travel pattern and trip destinations.

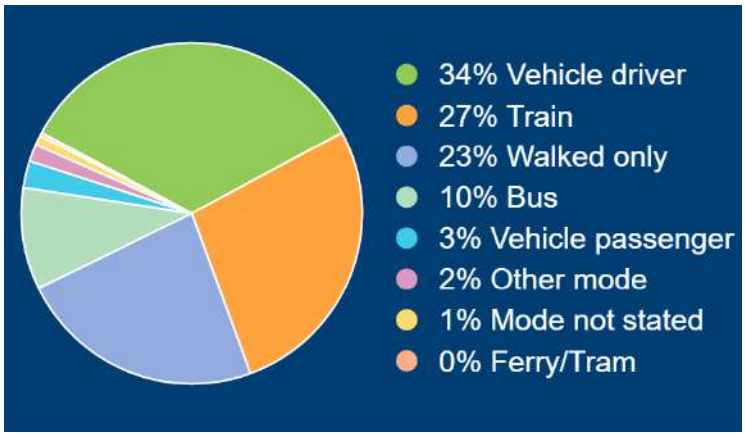


Figure 2: JTW Mode Split

The GTP is intended to develop a package of site specific measures to promote and maximise the use of sustainable travel modes, including walking, cycling, public transport and car sharing. It will include a review of existing transport choices and sets targets so that the effective implementation of the plan can be assessed. These targets are to be realistic but ambitious enough to initiate substantiative behavioural change to achieve the desired outcomes. The plan shall be monitored as part of an ongoing review to ensure it remains relevant and reflective of current conditions.

With regards to the Proposal, the existing public transport infrastructure available within close proximity to the Site has been identified in the Transport Access Guide in Appendix A. Due to the existing provision of multiple bus stops within close proximity to the Site, no additional infrastructure is proposed.

2.1 Mode Share Changes

The objectives for the Site aim to deliver public transport, walking, and cycling journeys in line with NSW government state targets. City of Ryde DCP2014 (DCP2014) requires the adoption of strategies and procedures to meet a 40% public transport / 60% private transport target for the development for journey-to-work trips, to minimise drive-alone vehicle trips and to encourage transport choice to and within the Macquarie Park Corridor.

Ivanhoe Estate also aspires to be a Transit Oriented Development (TOD), hence it's transport targets should aim to achieve even higher shifts in travel behaviour away from car use than those stated in NSW 2021.

Therefore, the proposed set of transport targets for the development upon completion are:

- journey to work mode share of 40% car driver or less;
- bicycle mode share for all trips of 3%, compared to current value for the area of less than 1%;
- walking to increase to 23% of daily travel;
- provide a low provision of car parking;
- on-street car parking spaces to serve dual and complimentary uses within the estate;
- 40% non-car mode share for journeys to / from work;
- 50% combined walk and cycle mode share for all school travel;
- 50% combined walk and cycle mode share for all Macquarie Park trips; and
- 50% combined walk and cycle mode share as access mode for Macquarie Park Station.

These high level objectives dovetail with the following NSW state government transport targets for Metropolitan Sydney, which apply to Ivanhoe Estate. The relevant state government targets for transport are as follows:

- 28% public transport mode share for journeys to work;
- 20% public transport mode share for journey to work into Liverpool CBD; and
- 5% bicycle mode share for trips of less than 10km.

Figure 2 details the existing and proposed mode share targets. These targets have been developed with consideration to the NSW 2021 plan and the NSW Long Term Transport Master Plan. A target of 25% of trips undertaken by public transport is proposed in the aforementioned documents and Council also seeks to meet a target of 40% of total trips to be undertaken by public transport.

In consideration of these objectives, the following modal splits and journey characteristics are proposed:

- Train and Bus increase use a 28% public transport mode share target and the existing reference ratios. These increases are considered conservative, based on the proposed proximity, accessibility, and frequency of infrastructure and services.
- Bicycle increases to 5% mode share from NSW state government transport targets and corresponding 5% for walking are derived from 50% combined walk and cycle mode share for all school travel, 50% combined walk and cycle mode share for all Site trips, and 50% combined walk and cycle mode share as access mode for Macquarie University Station. These increases are considered conservative, based on the proposed proximity and accessibility of infrastructure and services.
- Car Driver reductions have been subtracted from public transport, and bicycle and walk increases. From census data, non-car modes trips increase for localities that are close to railway stations along the South Rail Line.

A large number of rigorous empirical studies link urban development and travel patterns and show that, even after accounting for socioeconomic and demographic differences, residents of communities with frequent, reliable, easily accessible public transport services and well designed pedestrian and bicycle networks drive significantly less, and walk, bicycle and ride public transport more than their counterparts in ‘traditional’ communities. The initiatives and strategies outlined **Table 1** also provide several incentives to avoid vehicle trips and is likely to be more than the proposed 14% for retail and 19% for residential.

3 Action Strategies

Six main strategies have been identified and the actions required for each are detailed in **Table 1** below. The table details how the targets the specific actions to be implemented as part of this GTP and who will be responsible for implementing each action. In developing this GTP and the strategies and actions comprising it, it is recognised that the end user is not known to the developer. Consequently, it is vital that the developer explains to future tenants the expectations regarding travel planning that are agreed for the Site to facilitate the important process of monitoring and review.

Table1: Proposed Ivanhoe Estate GTP Strategies

STRATEGY	HOW IT WORKS	IMPLEMENTATION	RESOURCES / RESPONSIBILITY
1 Travel Planning and Demand Management			
1.1 Car Sharing	Extend the provision of established car share schemes to set up a car sharing network of 50 vehicles for Ivanhoe Estate, reducing residents need to own and operate their own vehicle.	City of Ryde Council should consider extending the provision of established car share schemes to Ivanhoe Estate, reduce residents need to own and operate their own vehicle, safe in the knowledge that they can get access to a vehicle if they require one.	Developer, council
1.2 Carpooling	Establish a car pooling program to help people find someone to share in their daily commute.	Prepare information sheets specific to residential commuters and employees on site.	Building Management, commercial space staff
1.3 Travel Plans	• Develop mandatory Travel Plans for school and provide information for Workplace Travel Plans. • Management of Travel Plans • Promotion of Travel Plans	Provide information and resources, and implement a range of additional initiatives to reward and encourage those who travel actively to help develop a healthy, active culture and meet travel targets. Continued support of the person/organisation in charge of managing the GTP. Undertake a GTP event annually. Promote the follow initiatives via bulletins and web pages: • Travel Survey Results; and • Progress and update of GTP.	Developer, school, employees
1.4 Flexible Working hours	Allowing staff the flexibility to commute outside peak periods to reduce overall congestion and travel time.	Manage staff rosters where possible.	Employers
1.5 Teleworking	Provide the option to work remotely to reduce the number of vehicles on the road and encourage teleconferencing rather than travelling to meetings.	Manage staff rosters, and develop work-from-home policies and procedures, where possible.	Employers

STRATEGY		HOW IT WORKS	IMPLEMENTATION	RESOURCES / RESPONSIBILITY
2 Promoting Public Transport				
2.1	Travel Pass Loan Schemes	Commercial business may consider subsidising staff travel passes to increase public transport use. Alternatively, staff can pay for their own annual travel pass through their salary, spreading the cost over the year to make it more affordable.	Subject to owner/tenant negotiations and incentives.	Commercial tenant responsibility
2.2	Integration of Public Transport Services	Maximise integration of bus and train services providing linked timetables for residents to/from local and regional employment, retail, and commerce centres.	Dedicated bus-rail interchange designed. Increased headway and service commitments already made for bus and Metro services. Monitor and review services periodically.	Transport for NSW, Developer
2.3	Maximise Bus Service Coverage	Maximise coverage of the development and to provide connections for residents to major services.	The proposed bus network should be designed to maximise the coverage of the development throughout the different stages.	Transport for NSW, Developer
2.4	Implement Early Start-up Buses	Reduce car dependency by development and staging early 'Start-up' buses.	Bus service should be established from "Day of opening" to encourage the use of public transport by the residents. Bus routes will connect EPS, EP Park Station, Site, as well as regional destinations.	Transport for NSW, Developer
2.5	Maximise Bus Service Frequency	Meet or exceed Transport NSW bus planning guidelines.	Decrease headway where possible, especially during peak periods.	Transport for NSW, Developer
2.6	Good Quality Bus Stops with Pedestrian Links	Account for service frequency and potential patronage with high standards of infrastructure.	Design with high standards of infrastructure, to provide shelter, seating, information such as timetable and network map (real-time information?). Facilities provided at each bus stop will be determined by surrounding land uses, account for service frequency and potential patronage.	Transport for NSW, Developer
2.7	Public Transport for Business travel	The commercial space tenants can promote public transport as the first preference for business travel. This should be supported by employees having access to travel passes.	Subject to owner/tenant negotiations and incentives.	Commercial tenants
3 Promoting Cycling				
3.1	Provide Dedicated Cycle Routes	Provision for connections for all journey purposes for employment and education, as well as leisure and recreation. The routes will be a dedicated bicycle network.	Provide a dedicated bicycle network with high quality infrastructure designed to make bicycle travel attractive, convenient, safe, and efficient for all journey purposes.	Developer

STRATEGY		HOW IT WORKS	IMPLEMENTATION	RESOURCES / RESPONSIBILITY
3.2	Bicycle Fleets	Building management staff and commercial tenant may consider having bicycle fleets which employees can use for local trips.	Utilisation of on-site bicycle parking facilities and purchase/lease of shared bicycles.	Building management
3.3	Providing & Maintaining End of Journey Facilities	Providing facilities such as showers, change rooms, lockers.	Bicycle parking spaces will be provided for residents and staff. Commercial tenant will provide access to other facilities such as showers.	Developer, commercial tenant
3.4	Bicycle Fleets	Building management staff and commercial tenant may consider having bicycle fleets which employees can use for local trips.	Utilisation of on-site bicycle parking facilities and purchase/lease of shared bicycles.	Building management
3.5	Promote Bicycle User Groups	Set up dedicated Bicycle User Group (BUG) for Ivanhoe Estate to encourage bicycle use and promote bicycle rides and initiatives.	Encourage the local community to set up a dedicated Bicycle User Group (BUG) for Ivanhoe Estate, or join an existing BUG which is active in the local area.	Developer, local BUGs
3.6	Promote Bicycle Initiatives	Promotion of bicycle initiatives – NSW bicycle week, cycle to work day etc.	In addition to a local BUG, promote and encourage cycling in the precinct. Local schools, businesses and councils should actively participate in recognised NSW government bicycle initiatives such as bicycle week and cycle to work day.	Local schools, businesses, City of Ryde Council
3.7	Provide Cycle Training	Encourages those who wouldn't previously consider cycle as a mode choice to do so.		Developer/Employer
4 Promoting Walking				
4.1	Provide a Pedestrian Network	Provision of a high quality, highly permeable pedestrian network throughout Ivanhoe Estate.	Design and construct continuous pedestrian footpaths and pedestrian crossing facilities at key locations. Limit delays to walk trips and make them pleasant convenient, direct, and integrated with land uses. Consider safety in design to provide well-lit links for safety and ambience to encourage pedestrian travel.	Developer
4.2	Providing End of Journey Facilities	Provision of sufficient end of trip facilities such, showers, change rooms, lockers etc to maximise pedestrian activity throughout the site and the wider precinct.	Provide pedestrian facilities and amenities in close proximity to schools and sports facilities, in the Site and at the rail station.	Developer, commercial tenants
4.3	Walking School Bus	Groups of children will walk to school with one or more adults to overcome parents' safety fears and reluctance to allow them to walk to school.	The proposed high school in Ivanhoe Estate will be encouraged to implement a walking bus program. These types of programs can also lead to a mindset which encourages active travel throughout life for both children and parents for other journeys, and is as educational and supportive of behavioural change as it is practical.	Schools, residents

STRATEGY	HOW IT WORKS	IMPLEMENTATION	RESOURCES / RESPONSIBILITY
5 Restraining Parking			
5.1 Reduce Residential Parking Rates	Restrain parking requirements for the Site high density residential apartments to account for the availability of other travel options.	The high density residential development in the Site will have very good access by public transport, as well as good quality pedestrian and cycle networks, and a good range of local shops, services and facilities in close proximity, thereby reducing residents need to own and operate a car.	Developer
5.2 Site Co-sharing Parking	Provision of co-ordinated and shared parking in the Site.	Provide parking in the Site that is co-ordinated and where possible shared across multiple land uses or shared between retail and commuter parking that don't have similar peak parking demands.	Developer, Employers, Councils
5.3 Transport Access Guide	Provide residents and staff with a Transport Access Guide (Appendix A) and advise them of the transport options available in the area.	Keep a copy of the Transport Access Guide current, relevant, useful and accessible. The TAG should be clearly displayed in communal areas.	Building management
6 Influencing Travel Behaviour			
6.1 Provision of Sustainable Travel Packs to Residents	Introduces residents to the GTP and provides information on walking and cycling routes, and travel by bus & train. Contact details for who is responsible for the GTP will also be provided	To be provided on first occupation of dwellings	Developer
6.2 Promotional Free Travel	Providing the option to work remotely means there will be fewer vehicles on the road.	Manage staff rosters, and develop work-from-home policies and procedures, where possible.	Employers
6.3 Transport Access Guide	Provide residents and staff with a Transport Access Guide advising them of the transport options available in the area.	Keep a copy of the Transport Access Guide current, relevant, useful and accessible. The TAG should be clearly displayed in communal areas.	Building management, employers
6.4 Sustainable Home Deliveries Guide	Encourage sustainable home deliveries of groceries using local producers.	Adopt sustainable practices for deliveries and sustainable principles in local food production to reduce peoples' need to travel (for shopping) and hence reduce travel demand for residents, whilst also reducing the transport of food produce.	Developer, local community organisations

Appendix A

Transport Access Guide

Transport Access Guide: Ivanhoe Estate, Macquarie Park

Public Transport bus and train services

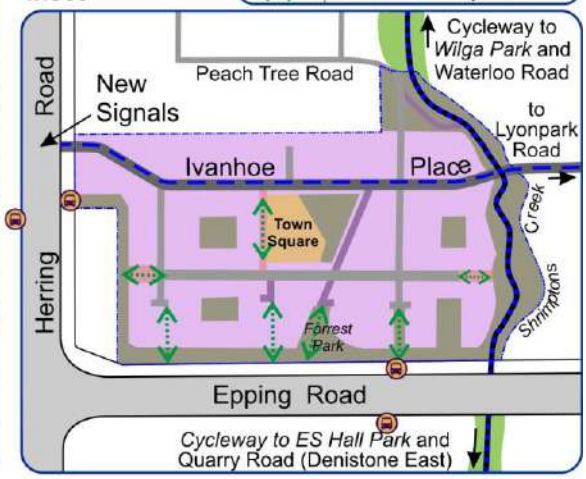
Stops	Operator	Route	Destinations
Herring Road	Sydney Buses	288	Epping to City via Lane Cove and Freeway
		507	Macquarie University to City via Putney
		518	Macquarie University to City via Drummoyne
Epping Road and Herring Road		140	Epping to Manly
		290	Epping to City via Pacific Highway
		293	Marsfield to City via Lane Cove Tunnel
		292	Marsfield to City via Freeway
		294	Macquarie University to City via Freeway
		506	Macquarie University to City via Hunters Hill
		545 550	Chatswood to Parramatta
		M41	Metrobus Macquarie Centre to Hurstville
		M54	Metrobus Macquarie University to Parramatta
Waterloo Road	Hillsbus	611 630	Macquarie Park to Blacktown
		619 628	Macquarie Park to Rouse Hill via Castle Hill / Norwest
		621 651	Castle Hill to City
	Busways	740	Macquarie Park to Plumpton via M2 Motorway
	Forest Coachlines	197	Macquarie University to Mona Vale
	Transdev ShoreLink	562	Macquarie University to Gordo
		565	Macquarie University to Chatswood
		572	Macquarie University to Turramurra Station
		575	Macquarie University to Hornsby

Macquarie University Railway Station	Sydney Trains	T1 Northern Shore, Northern and Western Line	Hornsby to Emu Plains and Richmond via Chatswood
	Sydney Metro	Stage 1: NorthWest (2019)	Cudgegong Road to Chatswood
		Stage 2: City & SouthWest (2024)	Chatswood to Sydenham and Bankstown

Active Transport cycle routes

	Shared Off-Road Bike Path
	On-Road Bike Lanes
	Informal On-Road Bike Routes
	Pedestrian Pathway Links

Inset



Appendix E

SIDRA Output

MOVEMENT SUMMARY

Site: 101 [Herring Road/Epping Road_Existing AM_ 2016]

Network: N101 [AM]

Epping Road - Herring Road
Existing
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	18	0.0	18	0.0	0.662	54.6	LOS D	23.1	165.6	0.94	0.82	32.1
2	T1	544	2.7	544	2.7	0.662	47.2	LOS D	23.1	165.6	0.90	0.77	15.6
3	R2	337	1.6	337	1.6	1.239	301.2	LOS F	57.1	405.3	1.00	1.55	13.5
Approach		899	2.2	899	2.2	1.239	142.5	LOS F	57.1	405.3	0.94	1.06	14.1
East: Epping Road E (1200m)													
4	L2	106	2.0	106	2.0	0.719	59.9	LOS E	19.3	136.8	0.98	0.86	39.4
5	T1	821	1.5	821	1.5	0.719	56.4	LOS D	21.3	151.3	0.98	0.85	43.6
6	R2	611	2.9	611	2.9	1.246	304.6	LOS F	50.6	362.9	1.00	1.46	11.6
Approach		1538	2.1	1538	2.1	1.246	155.2	LOS F	50.6	362.9	0.99	1.09	23.3
North: Herring Road N (200m)													
7	L2	293	4.7	293	4.7	0.179	6.2	LOS A	1.6	11.4	0.13	0.59	61.5
8	T1	186	6.2	186	6.2	0.401	61.8	LOS E	7.8	57.2	0.95	0.76	18.3
9	R2	131	1.6	131	1.6	0.401	67.8	LOS E	6.9	50.6	0.95	0.78	25.9
Approach		609	4.5	609	4.5	0.401	36.4	LOS C	7.8	57.2	0.55	0.68	39.1
West: Epping Road W (600m)													
10	L2	575	1.5	575	1.5	0.318	6.7	LOS A	0.0	0.0	0.00	0.57	58.0
11	T1	1616	1.8	1616	1.8	1.254	300.1	LOS F	92.3	655.8	1.00	1.87	16.2
12	R2	31	0.0	31	0.0	0.123	64.5	LOS E	1.9	13.4	0.89	0.73	27.8
Approach		2221	1.7	2221	1.7	1.254	221.0	LOS F	92.3	655.8	0.74	1.52	17.6
All Vehicles		5267	2.2	5267	2.2	1.254	167.0	LOS F	92.3	655.8	0.82	1.22	19.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 6 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	55.1	LOS E	0.2	0.2	0.86	0.86
P2	East Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	58.6	LOS E	0.2	0.2	0.89	0.89
P4	West Full Crossing	53	52.5	LOS E	0.2	0.2	0.84	0.84
All Pedestrians		211	58.8	LOS E			0.89	0.89

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [Herring Road/Ivanhoe Place_Existing AM_2016]

Network: N101 [AM]

Herring Road_Ivanhoe Place
Existing
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	5	0.0	5	0.0	0.602	4.2	LOS A	5.0	35.8	0.17	0.36	29.5
2	T1	1877	2.0	1757	2.0	0.602	3.9	LOS A	5.0	35.8	0.18	0.37	44.0
3	R2	1	0.0	1	0.0	0.602	9.2	LOS A	4.5	32.3	0.18	0.37	51.2
Approach		1883	2.0	1763 N1	2.0	0.602	3.9	LOS A	5.0	35.8	0.18	0.37	44.0
East: Ivanhoe Place (125m)													
4	L2	35	0.0	35	0.0	0.045	3.4	LOS A	0.2	1.1	0.35	0.48	35.3
5	T1	6	0.0	6	0.0	0.045	3.3	LOS A	0.2	1.1	0.35	0.48	19.9
6	R2	6	0.0	6	0.0	0.045	8.5	LOS A	0.2	1.1	0.35	0.48	35.3
Approach		47	0.0	47	0.0	0.045	4.0	LOS A	0.2	1.1	0.35	0.48	31.7
North: Herring Road (380m)													
7	L2	4	0.0	4	0.0	0.153	4.0	LOS A	0.8	5.6	0.08	0.36	50.9
8	T1	418	4.5	418	4.5	0.153	3.7	LOS A	0.8	5.6	0.08	0.38	51.1
9	R2	24	4.3	24	4.3	0.153	9.0	LOS A	0.7	5.3	0.08	0.40	43.1
Approach		446	4.5	446	4.5	0.153	4.0	LOS A	0.8	5.6	0.08	0.38	50.6
West: Morling College (20m)													
10	L2	1	0.0	1	0.0	0.025	7.2	LOS A	0.2	1.1	0.77	0.71	17.1
11	T1	1	0.0	1	0.0	0.025	7.5	LOS A	0.2	1.1	0.77	0.71	31.3
12	R2	15	0.0	15	0.0	0.025	11.8	LOS A	0.2	1.1	0.77	0.71	17.1
Approach		17	0.0	17	0.0	0.025	11.2	LOS A	0.2	1.1	0.77	0.71	18.3
All Vehicles		2394	2.4	2274 N1	2.5	0.602	4.0	LOS A	5.0	35.8	0.17	0.37	45.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 6 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [Herring Road/Waterloo Road_Existing AM_2016] Network: N101 [AM]

Herring Road_Waterloo Road
Existing
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	115	1.8	107	1.8	1.983	955.9	LOS F	30.0	213.0	1.00	1.44	2.5
2	T1	739	2.7	692	2.6	0.951	62.1	LOS E	52.2	373.6	0.88	1.01	24.7
3	R2	806	1.4	755	1.4	0.936	66.6	LOS E	22.3	157.8	1.00	1.06	15.9
Approach		1660	2.0	1555 N1	2.0	1.983	126.1	LOS F	52.2	373.6	0.95	1.06	12.5
East: Waterloo Road (380m)													
4	L2	212	1.5	212	1.5	0.281	21.8	LOS B	6.3	44.7	0.71	0.76	31.3
5	T1	147	1.4	147	1.4	0.530	60.4	LOS E	9.4	66.7	0.98	0.79	25.1
6	R2	138	44.3	138	44.3	0.799	77.4	LOS F	10.0	96.4	1.00	0.91	21.3
Approach		497	13.3	497	13.3	0.799	48.7	LOS D	10.0	96.4	0.87	0.81	25.0
North: Herring Road (320m)													
7	L2	126	39.2	126	39.2	0.730	74.1	LOS F	8.8	82.7	1.00	0.86	12.9
8	T1	224	7.0	224	7.0	0.209	39.3	LOS C	5.7	42.0	0.79	0.64	20.6
9	R2	86	47.6	86	47.6	0.865	87.8	LOS F	6.7	65.6	1.00	0.95	18.4
Approach		437	24.3	437	24.3	0.865	58.9	LOS E	8.8	82.7	0.89	0.77	17.4
West: Waterloo Road (320m)													
10	L2	87	54.2	87	54.2	0.713	68.3	LOS E	11.7	101.4	1.00	0.87	22.5
11	T1	299	1.4	299	1.4	0.777	64.8	LOS E	14.7	104.1	1.00	0.89	14.4
12	R2	69	1.5	69	1.5	0.314	66.8	LOS E	4.4	31.1	0.95	0.76	14.0
Approach		456	11.5	456	11.5	0.777	65.8	LOS E	14.7	104.1	0.99	0.87	16.2
All Vehicles		3049	8.5	2944 N1	8.8	1.983	93.7	LOS F	52.2	373.6	0.93	0.95	14.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 6 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	53	46.9	LOS E	0.2	0.2	0.82	0.82
P3	North Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	24.8	LOS C	0.1	0.1	0.60	0.60
All Pedestrians		211	49.8	LOS E			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 101 [Waterloo Road_Byfield Sreet_Existing AM_2016]

Network: N101 [AM]

Waterloo Road_Byfield Sreet
Existing
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	83	1.3	83	1.3	0.078	5.4	LOS A	0.5	3.8	0.70	0.60	41.2
3	R2	69	1.5	69	1.5	0.087	11.5	LOS A	0.5	3.9	0.71	0.73	41.5
Approach		153	1.4	153	1.4	0.087	8.2	LOS A	0.5	3.9	0.71	0.66	41.4
East: Waterloo Road (155m)													
4	L2	542	1.6	542	1.6	0.430	4.9	LOS A	4.2	30.1	0.42	0.48	45.1
5	T1	625	10.9	625	10.9	0.430	4.8	LOS A	4.2	30.1	0.44	0.44	38.5
Approach		1167	6.6	1167	6.6	0.430	4.9	LOS A	4.2	31.0	0.43	0.46	42.9
West: Waterloo Road (380m)													
11	T1	882	7.3	846	7.5	0.341	4.4	LOS A	2.5	18.6	0.23	0.44	51.5
12	R2	126	1.7	121	1.7	0.341	9.1	LOS A	2.4	17.8	0.24	0.49	50.3
Approach		1008	6.6	967 N1	6.8	0.341	5.0	LOS A	2.5	18.6	0.23	0.45	51.3
All Vehicles		2328	6.2	2287 N1	6.4	0.430	5.1	LOS A	4.2	31.0	0.37	0.47	47.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 6 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [Herring Road/Epping Road_Existing PM _2016]

Network: N101 [PM]

Epping Road - Herring Road
Existing
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	46	0.0	46	0.0	0.896	83.4	LOS F	20.5	146.9	1.00	1.02	24.6
2	T1	402	3.4	402	3.4	0.896	78.7	LOS F	20.5	146.9	1.00	1.02	10.4
3	R2	122	1.7	122	1.7	0.662	73.4	LOS F	8.8	62.4	1.00	0.84	34.5
Approach		571	2.8	571	2.8	0.896	77.9	LOS F	20.5	146.9	1.00	0.98	18.9
East: Epping Road E (1200m)													
4	L2	281	1.5	281	1.5	0.974	96.2	LOS F	56.4	399.9	1.00	1.16	30.9
5	T1	1606	1.6	1606	1.6	0.974	88.3	LOS F	60.4	428.9	1.00	1.16	36.0
6	R2	386	3.3	386	3.3	0.971	111.8	LOS F	18.1	130.3	1.00	1.05	25.2
Approach		2274	1.9	2274	1.9	0.974	93.3	LOS F	60.4	428.9	1.00	1.14	33.6
North: Herring Road N (200m)													
7	L2	274	5.0	274	5.0	0.169	6.2	LOS A	1.6	11.6	0.13	0.59	61.5
8	T1	575	2.6	575	2.6	0.986	104.4	LOS F	39.6	283.0	1.00	1.20	12.4
9	R2	496	1.5	496	1.5	0.986	113.6	LOS F	33.8	241.0	1.00	1.13	18.4
Approach		1344	2.7	1344	2.7	0.986	87.8	LOS F	39.6	283.0	0.82	1.05	21.3
West: Epping Road W (600m)													
10	L2	323	1.6	323	1.6	0.179	6.7	LOS A	0.0	0.0	0.00	0.57	58.1
11	T1	931	1.5	931	1.5	0.477	40.9	LOS C	17.8	126.2	0.84	0.72	48.8
12	R2	85	1.2	85	1.2	0.425	72.7	LOS F	5.9	41.5	0.97	0.78	25.9
Approach		1339	1.5	1339	1.5	0.477	34.7	LOS C	17.8	126.2	0.64	0.69	48.0
All Vehicles		5527	2.1	5527	2.1	0.986	76.2	LOS F	60.4	428.9	0.87	0.99	32.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 3.4 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	41.4	LOS E	0.2	0.2	0.75	0.75
P2	East Full Crossing	53	64.0	LOS F	0.2	0.2	0.93	0.93
P3	North Full Crossing	53	44.5	LOS E	0.2	0.2	0.77	0.77
P4	West Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	54.7	LOS E			0.85	0.85

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.

MOVEMENT SUMMARY

Site: 101 [Herring Road/Ivanhoe Place_Existing PM_2016]

Network: N101 [PM]

Herring Road_Ivanhoe Place
Existing
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	4	0.0	4	0.0	0.564	4.6	LOS A	4.4	31.8	0.25	0.39	27.7
2	T1	1098	2.5	1098	2.5	0.564	4.2	LOS A	4.4	31.8	0.24	0.39	43.1
3	R2	1	0.0	1	0.0	0.564	9.5	LOS A	1.3	9.6	0.20	0.40	50.8
Approach		1103	2.5	1103	2.5	0.564	4.2	LOS A	4.4	31.8	0.24	0.39	43.0
East: Ivanhoe Place (125m)													
4	L2	33	3.2	33	3.2	0.109	7.8	LOS A	0.4	3.0	0.72	0.65	28.1
5	T1	8	0.0	8	0.0	0.109	7.6	LOS A	0.4	3.0	0.72	0.65	17.8
6	R2	8	0.0	8	0.0	0.109	12.8	LOS A	0.4	3.0	0.72	0.65	28.1
Approach		49	2.1	49	2.1	0.109	8.6	LOS A	0.4	3.0	0.72	0.65	25.4
North: Herring Road (380m)													
7	L2	22	4.8	22	4.8	0.721	4.1	LOS A	2.6	18.5	0.09	0.36	50.8
8	T1	1285	2.4	1285	2.4	0.721	3.7	LOS A	4.2	29.9	0.10	0.38	51.0
9	R2	68	1.5	68	1.5	0.721	9.0	LOS A	4.2	29.9	0.10	0.39	43.1
Approach		1376	2.4	1376	2.4	0.721	4.0	LOS A	4.2	29.9	0.10	0.38	50.5
West: Morling College (20m)													
10	L2	6	0.0	6	0.0	0.034	5.4	LOS A	0.2	1.1	0.69	0.66	18.8
11	T1	1	0.0	1	0.0	0.034	5.7	LOS A	0.2	1.1	0.69	0.66	35.1
12	R2	13	0.0	13	0.0	0.034	10.0	LOS A	0.2	1.1	0.69	0.66	18.8
Approach		20	0.0	20	0.0	0.034	8.3	LOS A	0.2	1.1	0.69	0.66	20.0
All Vehicles		2548	2.4	2548	2.4	0.721	4.2	LOS A	4.4	31.8	0.17	0.39	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 3.4 %
Number of Iterations: 10 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [Herring Road/Waterloo Road Existing PM_2016]

Network: N101 [PM]

Herring Road_Waterloo Road
Existing
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	35	3.0	35	3.0	1.368	374.6	LOS F	11.9	85.5	1.00	1.23	5.5
2	T1	665	3.0	665	3.0	1.368	392.5	LOS F	86.4	620.1	1.00	2.32	5.7
3	R2	418	1.5	418	1.5	0.803	73.2	LOS F	14.7	104.4	1.00	0.89	14.8
Approach		1118	2.4	1118	2.4	1.368	272.6	LOS F	86.4	620.1	1.00	1.76	6.8
East: Waterloo Road (380m)													
4	L2	735	1.4	735	1.4	0.776	42.0	LOS C	28.9	204.8	0.84	0.84	21.9
5	T1	96	1.1	96	1.1	0.776	45.9	LOS D	28.9	204.8	0.97	0.88	27.7
6	R2	169	37.3	169	37.3	0.730	69.7	LOS E	11.6	106.7	1.00	0.87	22.8
Approach		1000	7.5	1000	7.5	0.776	47.0	LOS D	28.9	204.8	0.88	0.84	22.8
North: Herring Road (320m)													
7	L2	105	57.0	105	57.0	0.517	65.7	LOS E	6.8	70.4	0.96	0.80	14.2
8	T1	619	3.4	619	3.4	0.730	51.1	LOS D	19.4	140.0	0.96	0.83	17.2
9	R2	105	42.0	105	42.0	0.512	67.0	LOS E	6.8	64.7	0.97	0.80	21.9
Approach		829	15.1	829	15.1	0.730	55.0	LOS D	19.4	140.0	0.96	0.82	17.6
West: Waterloo Road (320m)													
10	L2	128	36.1	128	36.1	0.454	48.2	LOS D	11.6	97.0	0.86	0.78	27.4
11	T1	340	1.5	340	1.5	0.494	44.7	LOS D	14.6	103.5	0.89	0.76	18.8
12	R2	92	1.1	92	1.1	0.319	62.1	LOS E	5.6	39.4	0.93	0.77	14.8
Approach		560	9.4	560	9.4	0.494	48.4	LOS D	14.6	103.5	0.89	0.77	20.4
All Vehicles		3507	8.0	3507	8.0	1.368	121.0	LOS F	86.4	620.1	0.94	1.12	11.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 3.4 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	51.1	LOS E	0.2	0.2	0.86	0.86
P2	East Full Crossing	53	51.9	LOS E	0.2	0.2	0.87	0.87
P3	North Full Crossing	53	49.3	LOS E	0.2	0.2	0.84	0.84
P4	West Full Crossing	53	48.5	LOS E	0.2	0.2	0.84	0.84
All Pedestrians		211	50.2	LOS E			0.85	0.85

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.

MOVEMENT SUMMARY

Site: 101 [Waterloo Road_Byfield Sreet_Existing PM_2016]

Network: N101 [PM]

Waterloo Road_Byfield Sreet
Existing
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	403	1.6	403	1.6	0.428	7.9	LOS A	3.6	25.7	0.90	0.82	38.5
3	R2	186	1.7	186	1.7	0.276	14.0	LOS A	1.9	13.6	0.84	0.86	39.4
Approach		589	1.6	589	1.6	0.428	9.9	LOS A	3.6	25.7	0.88	0.84	38.9
East: Waterloo Road (155m)													
4	L2	148	1.4	148	1.4	0.348	4.7	LOS A	3.0	22.1	0.38	0.44	45.3
5	T1	788	9.1	788	9.1	0.348	4.5	LOS A	3.0	22.1	0.39	0.43	39.1
Approach		937	7.9	937	7.9	0.348	4.5	LOS A	3.0	22.1	0.39	0.43	41.1
West: Waterloo Road (380m)													
11	T1	1094	6.8	1094	6.8	0.492	5.4	LOS A	4.1	30.5	0.49	0.54	49.9
12	R2	105	2.0	105	2.0	0.492	10.2	LOS A	3.9	28.9	0.50	0.57	49.4
Approach		1199	6.4	1199	6.4	0.492	5.8	LOS A	4.1	30.5	0.49	0.54	49.9
All Vehicles		2725	5.9	2725	5.9	0.492	6.2	LOS A	4.1	30.5	0.54	0.57	45.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 3.4 %
Number of Iterations: 10 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [AM_Herring_Epping _2021 RMS] Network: N101 [RMS AM - updated]

Epping Road - Herring Road
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	15	0.0	15	0.0	1.014	109.0	LOS F	27.9	199.5	1.00	1.19	17.4
2	T1	631	2.5	631	2.5	1.014	113.0	LOS F	33.4	238.7	1.00	1.23	6.9
3	R2	349	1.5	349	1.5	0.724	67.5	LOS E	11.9	84.3	0.96	0.84	35.9
Approach		995	2.1	995	2.1	1.014	96.9	LOS F	33.4	238.7	0.98	1.09	17.4
East: Epping Road E (1200m)													
4	L2	107	2.0	107	2.0	0.428	33.6	LOS C	16.8	119.5	0.72	0.69	49.2
5	T1	1018	1.6	1018	1.6	0.428	28.0	LOS B	18.3	129.5	0.72	0.65	53.7
6	R2	381	3.6	381	3.6	1.015	132.4	LOS F	19.7	142.3	1.00	1.12	22.5
Approach		1506	2.1	1506	2.1	1.015	54.8	LOS D	19.7	142.3	0.79	0.77	42.4
North: Herring Road N (200m)													
7	L2	168	7.5	168	7.5	0.174	22.7	LOS B	5.8	43.4	0.53	0.71	51.3
8	T1	233	5.4	233	5.4	0.396	61.7	LOS E	7.7	56.3	0.95	0.76	18.5
9	R2	145	2.2	145	2.2	0.257	65.8	LOS E	4.7	33.4	0.92	0.76	26.1
Approach		546	5.2	546	5.2	0.396	50.7	LOS D	7.7	56.3	0.81	0.74	31.0
West: Epping Road W (600m)													
10	L2	577	1.5	577	1.5	0.489	13.6	LOS A	15.3	108.3	0.49	0.74	49.2
11	T1	2127	1.7	2127	1.7	1.015	108.5	LOS F	80.1	568.7	1.00	1.28	32.4
12	R2	23	0.0	23	0.0	0.310	86.2	LOS F	1.7	12.2	1.00	0.71	23.4
Approach		2727	1.6	2727	1.6	1.015	88.2	LOS F	80.1	568.7	0.89	1.16	33.3
All Vehicles		5775	2.2	5775	2.2	1.015	77.5	LOS F	80.1	568.7	0.87	1.01	32.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 10.8 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.0	LOS D	0.1	0.1	0.65	0.65
P2	East Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	39.2	LOS D	0.2	0.2	0.73	0.73
P4	West Full Crossing	53	67.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	51.7	LOS E			0.82	0.82

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 102 [AM_Herring_Ivanhoe 2021 RMS] Network: N101 [RMS AM - updated]

Herring Road_Ivanhoe Place
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	1	0.0	1	0.0	0.020	17.7	LOS B	0.2	2.9	0.57	0.42	17.7
2	T1	1503	2.2	1488	2.2	0.815	22.8	LOS B	25.9	183.5	0.93	0.91	20.4
3	R2	1	0.0	1	0.0	0.007	40.7	LOS C	0.0	0.3	0.94	0.58	19.1
Approach		1505	2.2	1490 N1	2.2	0.815	22.8	LOS B	25.9	183.5	0.93	0.91	20.4
East: Ivanhoe Place (125m)													
4	L2	1	0.0	1	0.0	0.004	15.1	LOS B	0.0	0.2	0.71	0.52	23.1
5	T1	1	0.0	1	0.0	0.004	10.6	LOS A	0.0	0.2	0.71	0.52	27.8
6	R2	1	0.0	1	0.0	0.003	24.9	LOS B	0.0	0.2	0.80	0.48	4.1
Approach		3	0.0	3	0.0	0.004	16.8	LOS B	0.0	0.2	0.74	0.51	10.2
North: Herring Road (380m)													
7	L2	1	0.0	1	0.0	0.023	17.7	LOS B	0.3	3.2	0.57	0.42	40.7
8	T1	512	3.7	512	3.7	0.275	13.7	LOS A	5.7	40.4	0.66	0.56	38.0
9	R2	23	0.0	23	0.0	0.150	42.3	LOS C	0.8	5.9	0.96	0.70	23.3
Approach		536	3.5	536	3.5	0.275	15.0	LOS B	5.7	40.4	0.67	0.56	36.8
West: Morling College (70m)													
10	L2	8	0.0	8	0.0	0.015	22.4	LOS B	0.2	1.6	0.69	0.62	11.2
11	T1	1	0.0	1	0.0	0.015	17.9	LOS B	0.2	1.6	0.69	0.62	20.6
12	R2	21	0.0	21	0.0	0.061	30.3	LOS C	0.6	4.4	0.83	0.68	9.1
Approach		31	0.0	31	0.0	0.061	27.7	LOS B	0.6	4.4	0.78	0.66	10.0
All Vehicles		2075	2.5	2059 N1	2.5	0.815	20.9	LOS B	25.9	183.5	0.86	0.81	24.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 10.8 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	18.8	LOS B	0.1	0.1	0.71	0.71
P3	North Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	18.1	LOS B	0.1	0.1	0.69	0.69
All Pedestrians		211	25.1	LOS C			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 103 [AM_Herring_Waterloo _2021 RMS] Network: N101 [RMS AM - updated]

Herring Road_Waterloo Road
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	126	1.7	125	1.7	0.136	14.1	LOS A	3.0	22.6	0.47	0.64	44.9
2	T1	826	2.7	818	2.7	0.539	31.7	LOS C	21.3	150.9	0.79	0.70	34.9
3	R2	651	1.5	644	1.5	0.364	18.1	LOS B	8.2	58.2	0.66	0.75	34.4
Approach		1603	2.1	1587 N1	2.1	0.539	24.7	LOS B	21.3	150.9	0.71	0.72	35.5
East: Waterloo Road (380m)													
4	L2	332	1.6	332	1.6	0.368	18.1	LOS B	8.5	60.0	0.66	0.76	34.1
5	T1	132	1.6	132	1.6	0.368	41.7	LOS C	6.1	43.6	0.77	0.68	30.7
6	R2	180	34.5	180	34.5	0.535	69.3	LOS E	7.8	55.7	0.98	0.79	23.1
Approach		643	10.8	643	10.8	0.535	37.3	LOS C	8.5	60.0	0.77	0.75	28.3
North: Herring Road (320m)													
7	L2	123	40.2	123	40.2	0.352	29.8	LOS C	4.9	47.7	0.84	0.76	25.3
8	T1	216	7.3	216	7.3	0.352	47.1	LOS D	5.7	40.5	0.87	0.70	18.7
9	R2	111	37.1	111	37.1	0.523	67.0	LOS E	7.1	65.9	0.97	0.80	22.2
Approach		449	23.7	449	23.7	0.523	47.1	LOS D	7.1	65.9	0.89	0.74	21.1
West: Waterloo Road (320m)													
10	L2	121	39.1	121	39.1	0.275	44.2	LOS D	6.1	57.4	0.79	0.77	27.9
11	T1	278	1.5	278	1.5	0.508	60.2	LOS E	8.9	62.8	0.97	0.78	15.5
Approach		399	12.9	399	12.9	0.508	55.3	LOS D	8.9	62.8	0.92	0.78	19.4
All Vehicles		3095	8.4	3079 N1	8.5	0.539	34.6	LOS C	21.3	150.9	0.78	0.74	29.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 10.8 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.84	0.84
P2	East Full Crossing	53	59.1	LOS E	0.2	0.2	0.92	0.92
P3	North Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	31.2	LOS D	0.1	0.1	0.67	0.67
All Pedestrians		211	50.8	LOS E			0.85	0.85

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.

MOVEMENT SUMMARY

Site: 104 [AM_Waterloo Road_Byfield Sreet_2021 RMS]

Network: N101 [RMS AM - updated]

Waterloo Road_Byfield Sreet
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	198	1.6	198	1.6	0.186	5.8	LOS A	1.8	13.1	0.20	0.57	41.1
3	R2	43	2.4	43	2.4	0.075	58.2	LOS E	1.2	8.9	0.88	0.70	19.6
Approach		241	1.7	241	1.7	0.186	15.2	LOS B	1.8	13.1	0.32	0.59	32.7
East: Waterloo Road (155m)													
4	L2	31	3.4	31	3.4	0.110	17.0	LOS B	2.5	27.2	0.43	0.42	37.9
5	T1	604	11.3	604	11.3	0.239	13.1	LOS A	8.5	60.5	0.49	0.42	26.2
Approach		635	10.9	635	10.9	0.239	13.2	LOS A	8.5	60.5	0.48	0.42	27.3
West: Waterloo Road (380m)													
11	T1	667	9.1	664	9.2	0.208	5.1	LOS A	5.8	41.4	0.31	0.27	52.0
12	R2	147	1.4	146	1.4	0.239	11.7	LOS A	2.7	19.3	0.42	0.67	44.2
Approach		815	7.8	810 N1	7.8	0.239	6.3	LOS A	5.8	41.4	0.33	0.34	50.0
All Vehicles		1691	8.1	1686 N1	8.1	0.239	10.2	LOS A	8.5	60.5	0.39	0.41	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 10.8 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		105	63.8	LOS F			0.96	0.96

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 [PM_Herring_Epping _2021 RMS] Network: N101 [RMS PM - updated]

Epping Road - Herring Road
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	22	0.0	22	0.0	0.897	99.9	LOS F	23.0	164.9	1.00	1.07	21.9
2	T1	549	2.9	549	2.9	0.897	86.1	LOS F	23.4	167.6	1.00	1.05	9.7
3	R2	163	1.3	163	1.3	0.264	64.0	LOS E	5.2	36.7	0.91	0.77	36.8
Approach		735	2.4	735	2.4	0.897	81.7	LOS F	23.4	167.6	0.98	0.98	17.8
East: Epping Road E (1200m)													
4	L2	324	1.6	324	1.6	0.904	65.5	LOS E	46.3	328.2	1.00	1.02	37.5
5	T1	1565	1.6	1565	1.6	0.904	59.8	LOS E	50.1	355.6	1.00	1.01	42.6
6	R2	365	3.5	365	3.5	0.907	92.7	LOS F	15.3	110.4	1.00	0.97	28.4
Approach		2255	1.9	2255	1.9	0.907	66.0	LOS E	50.1	355.6	1.00	1.01	39.6
North: Herring Road N (200m)													
7	L2	279	4.9	279	4.9	0.246	10.0	LOS A	5.8	42.0	0.37	0.67	58.8
8	T1	648	2.4	648	2.4	0.890	75.4	LOS F	25.9	185.0	1.00	1.02	16.0
9	R2	488	1.9	488	1.9	0.709	67.8	LOS E	16.9	120.4	0.99	0.85	25.6
Approach		1416	2.8	1416	2.8	0.890	59.9	LOS E	25.9	185.0	0.87	0.89	26.7
West: Epping Road W (600m)													
10	L2	302	1.4	302	1.4	0.231	10.4	LOS A	5.1	35.9	0.33	0.68	52.9
11	T1	1024	1.5	1024	1.5	0.484	38.4	LOS C	19.0	134.8	0.82	0.71	49.7
12	R2	173	1.8	173	1.8	0.825	83.3	LOS F	13.3	94.6	1.00	0.90	23.9
Approach		1499	1.5	1499	1.5	0.825	37.9	LOS C	19.0	134.8	0.74	0.73	46.5
All Vehicles		5904	2.1	5904	2.1	0.907	59.3	LOS E	50.1	355.6	0.90	0.91	36.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.8 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	40.7	LOS E	0.2	0.2	0.74	0.74
P2	East Full Crossing	53	67.8	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	41.4	LOS E	0.2	0.2	0.75	0.75
P4	West Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	54.7	LOS E			0.85	0.85

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: 102 [PM_Herring_Ivanhoe 2021 RMS]

Network: N101 [RMS PM - updated]

Herring Road_Ivanhoe Place
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	1	0.0	1	0.0	0.020	17.7	LOS B	0.2	2.9	0.57	0.42	17.7
2	T1	1076	2.4	1076	2.4	0.588	16.5	LOS B	14.6	103.6	0.80	0.70	25.0
3	R2	2	50.0	2	50.0	0.019	42.2	LOS C	0.1	0.7	0.94	0.61	17.8
Approach		1079	2.5	1079	2.5	0.588	16.5	LOS B	14.6	103.6	0.80	0.70	25.0
East: Ivanhoe Place (125m)													
4	L2	1	0.0	1	0.0	0.005	18.8	LOS B	0.0	0.3	0.71	0.52	19.9
5	T1	1	0.0	1	0.0	0.005	14.3	LOS A	0.0	0.3	0.71	0.52	24.6
6	R2	1	0.0	1	0.0	0.003	24.9	LOS B	0.0	0.2	0.80	0.48	4.1
Approach		3	0.0	3	0.0	0.005	19.4	LOS B	0.0	0.3	0.74	0.51	9.8
North: Herring Road (380m)													
7	L2	1	0.0	1	0.0	0.023	17.7	LOS B	0.3	3.2	0.57	0.42	40.7
8	T1	1422	2.3	1422	2.3	0.866	28.4	LOS B	28.3	200.8	0.95	1.00	27.4
9	R2	53	2.0	53	2.0	0.347	43.4	LOS D	2.0	14.0	0.98	0.74	22.9
Approach		1476	2.3	1476	2.3	0.866	29.0	LOS C	28.3	200.8	0.95	0.99	27.1
West: Morling College (70m)													
10	L2	20	0.0	20	0.0	0.031	21.2	LOS B	0.5	3.5	0.67	0.65	11.5
11	T1	1	0.0	1	0.0	0.031	16.6	LOS B	0.5	3.5	0.67	0.65	21.1
12	R2	13	0.0	13	0.0	0.039	30.1	LOS C	0.4	2.6	0.82	0.66	9.2
Approach		34	0.0	34	0.0	0.039	24.4	LOS B	0.5	3.5	0.73	0.66	10.8
All Vehicles		2592	2.4	2592	2.4	0.866	23.7	LOS B	28.3	200.8	0.88	0.87	26.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.8 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	18.8	LOS B	0.1	0.1	0.71	0.71
P3	North Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	18.1	LOS B	0.1	0.1	0.69	0.69
All Pedestrians		211	25.1	LOS C			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 103 [PM_Herring_Waterloo _2021 RMS] Network: N101 [RMS PM - updated]

Herring Road_Waterloo Road
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	27	0.0	27	0.0	0.083	33.4	LOS C	1.5	13.4	0.76	0.65	34.2
2	T1	666	3.0	666	3.0	0.666	48.5	LOS D	20.2	143.0	0.94	0.81	28.6
3	R2	435	1.5	435	1.5	0.696	65.3	LOS E	14.2	100.7	1.00	0.84	16.2
Approach		1128	2.3	1128	2.3	0.696	54.6	LOS D	20.2	143.0	0.96	0.82	24.0
East: Waterloo Road (380m)													
4	L2	754	1.7	754	1.7	0.689	41.0	LOS C	30.8	218.6	0.88	0.85	22.3
5	T1	181	1.7	181	1.7	0.689	48.6	LOS D	21.4	152.1	0.96	0.84	27.5
6	R2	234	27.5	234	27.5	0.654	67.4	LOS E	11.3	80.6	0.98	0.81	23.4
Approach		1168	6.8	1168	6.8	0.689	47.4	LOS D	30.8	218.6	0.91	0.84	23.6
North: Herring Road (320m)													
7	L2	156	39.2	156	39.2	0.326	39.2	LOS C	8.1	77.5	0.76	0.76	21.2
8	T1	625	3.4	625	3.4	0.693	47.8	LOS D	18.7	132.3	0.93	0.80	18.5
9	R2	185	24.4	185	24.4	0.678	65.6	LOS E	12.1	102.7	0.99	0.84	22.5
Approach		966	13.2	966	13.2	0.693	49.8	LOS D	18.7	132.3	0.91	0.80	19.9
West: Waterloo Road (320m)													
10	L2	159	29.8	159	29.8	0.243	31.3	LOS C	6.6	58.2	0.66	0.75	32.9
11	T1	433	1.5	433	1.5	0.465	48.1	LOS D	12.5	88.6	0.90	0.76	18.2
Approach		592	9.1	592	9.1	0.465	43.6	LOS D	12.5	88.6	0.84	0.75	22.3
All Vehicles		3855	7.5	3855	7.5	0.696	49.5	LOS D	30.8	218.6	0.91	0.81	22.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.8 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	36.1	LOS D	0.1	0.1	0.72	0.72
P2	East Full Crossing	53	52.8	LOS E	0.2	0.2	0.87	0.87
P3	North Full Crossing	53	54.5	LOS E	0.2	0.2	0.89	0.89
P4	West Full Crossing	53	46.9	LOS E	0.2	0.2	0.82	0.82
All Pedestrians		211	47.6	LOS E			0.83	0.83

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.

MOVEMENT SUMMARY

Site: 101v [PM_Waterloo Road_Byfield Sreet_2021 RMS]

Network: N101 [RMS PM - updated]

Waterloo Road_Byfield Sreet
RMS Base 2021
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	565	1.5	565	1.5	0.593	23.5	LOS B	22.0	156.3	0.75	0.92	26.7
3	R2	12	0.0	12	0.0	0.019	56.3	LOS D	0.3	2.3	0.86	0.65	20.1
Approach		577	1.5	577	1.5	0.593	24.2	LOS B	22.0	156.3	0.75	0.92	26.4
East: Waterloo Road (155m)													
4	L2	2	0.0	2	0.0	0.106	24.8	LOS B	2.2	28.4	0.55	0.45	33.8
5	T1	1113	6.9	1113	6.9	0.585	25.3	LOS B	26.6	188.3	0.74	0.66	17.4
Approach		1115	6.9	1115	6.9	0.585	25.3	LOS B	26.6	188.3	0.74	0.66	17.4
West: Waterloo Road (380m)													
11	T1	988	7.3	988	7.3	0.318	6.0	LOS A	10.1	71.8	0.35	0.31	50.8
12	R2	258	1.6	258	1.6	0.479	20.8	LOS B	9.2	65.4	0.84	0.82	38.5
Approach		1246	6.2	1246	6.2	0.479	9.0	LOS A	10.1	71.8	0.45	0.42	46.9
All Vehicles		2938	5.5	2938	5.5	0.593	18.2	LOS B	26.6	188.3	0.62	0.61	32.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.8 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	51.1	LOS E	0.2	0.2	0.86	0.86
P4	West Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		105	57.4	LOS E			0.91	0.91

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 [AM_Herring_Epping _2021 Base+Dev]

Network: N101 [2021 Base+Dev AM - update]

Epping Road - Herring Road
AM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	15	0.0	15	0.0	1.031	119.3	LOS F	28.5	203.8	1.00	1.22	16.4
2	T1	651	2.6	651	2.6	1.031	122.7	LOS F	37.8	270.5	1.00	1.27	6.5
3	R2	347	1.5	347	1.5	0.689	65.3	LOS E	11.6	81.9	0.95	0.82	36.5
Approach		1013	2.2	1013	2.2	1.031	103.0	LOS F	37.8	270.5	0.98	1.11	16.5
East: Epping Road E (1200m)													
4	L2	108	1.0	108	1.0	0.435	34.3	LOS C	17.1	121.2	0.73	0.70	48.9
5	T1	1019	1.5	1019	1.5	0.435	28.7	LOS C	18.5	131.4	0.73	0.65	53.4
6	R2	432	3.4	432	3.4	1.032	141.5	LOS F	25.0	180.1	1.00	1.15	21.4
Approach		1559	2.0	1559	2.0	1.032	60.3	LOS E	25.0	180.1	0.80	0.79	40.5
North: Herring Road N (200m)													
7	L2	458	3.4	458	3.4	0.444	26.5	LOS B	15.3	110.5	0.62	0.85	49.4
8	T1	277	4.6	277	4.6	0.469	62.5	LOS E	9.3	67.4	0.96	0.78	18.3
9	R2	167	1.3	167	1.3	0.295	66.2	LOS E	5.4	38.5	0.93	0.77	26.0
Approach		902	3.4	902	3.4	0.469	44.9	LOS D	15.3	110.5	0.78	0.81	36.0
West: Epping Road W (600m)													
10	L2	585	1.4	585	1.4	0.547	14.5	LOS B	17.2	121.6	0.53	0.75	48.2
11	T1	2102	1.7	2102	1.7	1.053	134.9	LOS F	86.7	615.9	1.00	1.40	28.4
12	R2	23	0.0	23	0.0	0.310	86.2	LOS F	1.7	12.2	1.00	0.71	23.4
Approach		2711	1.6	2711	1.6	1.053	108.5	LOS F	86.7	615.9	0.90	1.25	29.4
All Vehicles		6184	2.1	6184	2.1	1.053	86.2	LOS F	86.7	615.9	0.87	1.05	30.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 9.1 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.6	LOS D	0.1	0.1	0.65	0.65
P2	East Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	41.4	LOS E	0.2	0.2	0.75	0.75
P4	West Full Crossing	53	66.9	LOS F	0.2	0.2	0.95	0.95
All Pedestrians		211	52.2	LOS E			0.83	0.83

MOVEMENT SUMMARY

Site: 102 [AM_Herring_Ivanhoe 2021 Base+Dev]

Network: N101 [2021 Base+Dev AM - update]

Herring Road_Ivanhoe Place
AM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	1	0.0	1	0.0	0.018	17.7	LOS B	0.2	2.6	0.57	0.42	17.7
2	T1	1465	2.2	1445	2.1	0.840	24.8	LOS B	28.2	199.7	0.92	0.93	19.3
3	R2	120	1.8	118	1.8	0.778	47.6	LOS D	4.8	34.2	1.00	0.90	17.2
Approach		1586	2.1	1564 N1	2.1	0.840	26.6	LOS B	28.2	199.7	0.92	0.93	19.0
East: Ivanhoe Place (125m)													
4	L2	355	1.5	355	1.5	0.349	6.2	LOS A	2.9	20.7	0.34	0.62	31.4
5	T1	1	0.0	1	0.0	0.349	1.7	LOS A	2.9	20.7	0.34	0.62	35.7
6	R2	20	0.0	20	0.0	0.060	25.8	LOS B	0.6	4.2	0.83	0.59	4.0
Approach		376	1.4	376	1.4	0.349	7.2	LOS A	2.9	20.7	0.37	0.62	23.1
North: Herring Road (380m)													
7	L2	15	0.0	15	0.0	0.042	17.8	LOS B	0.6	5.4	0.58	0.53	38.5
8	T1	512	3.9	512	3.9	0.275	13.7	LOS A	5.7	40.4	0.66	0.56	38.0
9	R2	24	0.0	24	0.0	0.157	42.4	LOS C	0.9	6.1	0.96	0.70	23.3
Approach		551	3.6	551	3.6	0.275	15.0	LOS B	5.7	40.4	0.67	0.56	36.8
West: Morling College (70m)													
10	L2	9	0.0	9	0.0	0.017	21.7	LOS B	0.3	1.8	0.68	0.63	11.4
11	T1	1	0.0	1	0.0	0.017	17.2	LOS B	0.3	1.8	0.68	0.63	20.9
12	R2	20	0.0	20	0.0	0.057	30.2	LOS C	0.6	4.2	0.82	0.68	9.1
Approach		31	0.0	31	0.0	0.057	27.1	LOS B	0.6	4.2	0.77	0.66	10.1
All Vehicles		2543	2.3	2521 N1	2.3	0.840	21.2	LOS B	28.2	199.7	0.78	0.80	23.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 9.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	18.8	LOS B	0.1	0.1	0.71	0.71
P3	North Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	18.1	LOS B	0.1	0.1	0.69	0.69

All Pedestrians	211	25.1	LOS C	0.81	0.81

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: 103 [AM_Herring_Waterloo _2021 Base+Dev]

Network: N101 [2021 Base+Dev AM - update]

Herring Road_Waterloo Road
AM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	96	1.1	94	1.1	0.125	19.3	LOS B	3.0	22.5	0.57	0.66	41.3
2	T1	835	2.6	817	2.6	0.637	39.4	LOS C	23.7	168.3	0.88	0.77	31.7
3	R2	646	1.5	633	1.5	0.623	30.9	LOS C	11.6	82.5	0.93	0.83	26.4
Approach		1577	2.1	1543 N1	2.1	0.637	34.6	LOS C	23.7	168.3	0.88	0.79	30.5
East: Waterloo Road (380m)													
4	L2	331	1.6	331	1.6	0.385	18.8	LOS B	8.0	56.5	0.69	0.77	33.5
5	T1	154	1.4	154	1.4	0.427	37.5	LOS C	7.9	55.8	0.77	0.60	32.3
6	R2	173	36.0	173	36.0	0.371	62.2	LOS E	6.9	48.9	0.93	0.78	24.6
Approach		657	10.6	657	10.6	0.427	34.6	LOS C	8.0	56.5	0.77	0.73	29.5
North: Herring Road (320m)													
7	L2	124	39.8	124	39.8	0.357	31.8	LOS C	5.4	52.8	0.84	0.76	24.3
8	T1	229	6.9	229	6.9	0.357	50.3	LOS D	6.3	44.7	0.90	0.72	17.9
9	R2	107	38.2	107	38.2	0.445	63.5	LOS E	6.7	62.4	0.95	0.79	22.9
Approach		461	23.1	461	23.1	0.445	48.3	LOS D	6.7	62.4	0.89	0.75	20.7
West: Waterloo Road (320m)													
10	L2	121	39.1	121	39.1	0.257	41.7	LOS C	5.9	55.5	0.77	0.76	28.7
11	T1	278	1.5	278	1.5	0.508	60.2	LOS E	8.9	62.8	0.97	0.78	15.5
Approach		399	12.9	399	12.9	0.508	54.6	LOS D	8.9	62.8	0.91	0.78	19.6
All Vehicles		3094	8.4	3060 N1	8.5	0.637	39.3	LOS C	23.7	168.3	0.86	0.77	27.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 9.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	53	61.9	LOS F	0.2	0.2	0.94	0.94
P3	North Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	37.5	LOS D	0.2	0.2	0.74	0.74
All Pedestrians		211	56.7	LOS E			0.90	0.90

MOVEMENT SUMMARY

Site: 104 [AM_Waterloo Road_Byfield Sreet_2021 Base+Dev]

Network: N101 [2021 Base+Dev AM - update]

Waterloo Road_Byfield Sreet
AM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	112	1.9	112	1.9	0.102	6.9	LOS A	1.4	10.0	0.24	0.58	39.8
3	R2	11	0.0	11	0.0	0.018	57.2	LOS E	0.3	2.1	0.87	0.65	19.9
Approach		122	1.7	122	1.7	0.102	11.2	LOS A	1.4	10.0	0.30	0.58	35.6
East: Waterloo Road (155m)													
4	L2	49	2.1	49	2.1	0.154	25.2	LOS B	3.4	35.1	0.57	0.54	32.2
5	T1	731	9.7	731	9.7	0.389	22.9	LOS B	15.4	109.4	0.66	0.57	18.5
Approach		780	9.2	780	9.2	0.389	22.9	LOS B	15.4	109.4	0.65	0.57	19.9
West: Waterloo Road (380m)													
11	T1	664	9.0	660	9.1	0.206	5.1	LOS A	5.8	41.1	0.31	0.27	52.0
12	R2	162	1.3	161	1.3	0.240	13.0	LOS A	2.9	20.7	0.50	0.70	43.3
Approach		826	7.5	821 N1	7.6	0.240	6.7	LOS A	5.8	41.1	0.35	0.35	49.5
All Vehicles		1728	7.9	1723 N1	7.9	0.389	14.4	LOS A	15.4	109.4	0.48	0.47	36.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 9.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.84	0.84
P4	West Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		105	56.6	LOS E			0.90	0.90

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 [PM_Herring_Epping _2021 Base+Dev]

Network: N101 [2021 Base+Dev PM - update]

Epping Road - Herring Road
PM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	20	0.0	20	0.0	0.942	114.7	LOS F	24.0	171.6	1.00	1.14	19.9
2	T1	532	3.0	532	3.0	0.942	99.1	LOS F	24.2	173.8	1.00	1.12	8.6
3	R2	194	1.6	194	1.6	0.342	66.8	LOS E	6.3	45.1	0.94	0.78	36.1
Approach		745	2.5	745	2.5	0.942	91.1	LOS F	24.2	173.8	0.98	1.03	17.4
East: Epping Road E (1200m)													
4	L2	366	1.4	366	1.4	0.944	78.3	LOS F	51.7	366.6	1.00	1.08	34.3
5	T1	1539	1.6	1539	1.6	0.944	73.3	LOS F	56.0	397.3	1.00	1.09	39.2
6	R2	519	2.8	519	2.8	0.948	99.8	LOS F	23.3	166.8	1.00	1.02	27.1
Approach		2424	1.9	2424	1.9	0.948	79.7	LOS F	56.0	397.3	1.00	1.07	35.9
North: Herring Road N (200m)													
7	L2	354	4.2	342	4.3	0.294	10.9	LOS A	8.3	60.6	0.42	0.69	58.2
8	T1	671	2.4	648	2.4	0.957	93.2	LOS F	29.0	207.4	1.00	1.13	13.7
9	R2	496	1.5	479	1.5	0.746	70.9	LOS F	17.1	121.0	1.00	0.86	25.0
Approach		1520	2.5	1468 N1	2.5	0.957	66.8	LOS E	29.0	207.4	0.87	0.94	25.6
West: Epping Road W (600m)													
10	L2	292	1.4	292	1.4	0.222	10.3	LOS A	4.8	33.9	0.32	0.68	53.0
11	T1	1048	1.5	1048	1.5	0.514	40.3	LOS C	20.0	141.8	0.84	0.73	49.0
12	R2	177	1.8	177	1.8	0.625	71.0	LOS F	12.2	86.8	0.99	0.82	26.4
Approach		1517	1.5	1517	1.5	0.625	38.1	LOS C	20.0	141.8	0.76	0.73	46.5
All Vehicles		6206	2.0	6155 N1	2.0	0.957	67.7	LOS E	56.0	397.3	0.91	0.95	34.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 5.2 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	42.2	LOS E	0.2	0.2	0.75	0.75
P2	East Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	42.9	LOS E	0.2	0.2	0.76	0.76
P4	West Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96

All Pedestrians	211	55.7	LOS E	0.86	0.86

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: 102 [PM_Herring_Ivanhoe 2021 Base+Dev]

Network: N101 [2021 Base+Dev PM - update]

Herring Road_Ivanhoe Place
PM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	1	0.0	1	0.0	0.022	18.9	LOS B	0.2	3.0	0.60	0.44	17.3
2	T1	987	2.6	987	2.6	0.651	17.7	LOS B	16.2	115.2	0.82	0.71	23.9
3	R2	202	1.6	202	1.6	0.995	77.9	LOS F	11.4	80.9	1.00	1.27	11.9
Approach		1191	2.4	1191	2.4	0.995	28.0	LOS B	16.2	115.2	0.85	0.81	19.0
East: Ivanhoe Place (125m)													
4	L2	141	1.5	141	1.5	0.184	14.8	LOS B	2.8	19.6	0.60	0.66	20.9
5	T1	1	0.0	1	0.0	0.184	10.3	LOS A	2.8	19.6	0.60	0.66	25.7
6	R2	7	0.0	7	0.0	0.022	25.4	LOS B	0.2	1.5	0.81	0.55	4.0
Approach		149	1.4	149	1.4	0.184	15.3	LOS B	2.8	19.6	0.61	0.66	17.4
North: Herring Road (380m)													
7	L2	100	1.1	100	1.1	0.158	20.5	LOS B	2.6	19.7	0.66	0.69	35.2
8	T1	1383	2.4	1383	2.4	1.044	101.4	LOS F	54.5	386.7	1.00	1.69	11.4
9	R2	47	2.2	47	2.2	0.234	40.5	LOS C	1.7	11.9	0.95	0.73	23.9
Approach		1531	2.3	1531	2.3	1.044	94.2	LOS F	54.5	386.7	0.97	1.59	12.2
West: Morling College (70m)													
10	L2	20	0.0	20	0.0	0.030	19.8	LOS B	0.5	3.3	0.64	0.65	12.1
11	T1	1	0.0	1	0.0	0.030	15.2	LOS B	0.5	3.3	0.64	0.65	21.9
12	R2	13	0.0	13	0.0	0.044	30.3	LOS C	0.4	2.6	0.82	0.67	9.1
Approach		34	0.0	34	0.0	0.044	23.6	LOS B	0.5	3.3	0.71	0.65	11.1
All Vehicles		2904	2.2	2904	2.2	1.044	62.2	LOS E	54.5	386.7	0.90	1.21	13.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 5.2 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	20.2	LOS C	0.1	0.1	0.73	0.73
P3	North Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	19.5	LOS B	0.1	0.1	0.72	0.72
All Pedestrians		211	25.8	LOS C			0.83	0.83

MOVEMENT SUMMARY

Site: 103 [PM_Herring_Waterloo _2021 Base+Dev]

Network: N101 [2021 Base+Dev PM - update]

Herring Road_Waterloo Road
PM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	16	0.0	16	0.0	0.072	36.2	LOS C	1.1	10.6	0.79	0.64	33.3
2	T1	651	3.1	651	3.1	0.726	52.8	LOS D	20.5	145.3	0.98	0.85	27.3
3	R2	375	1.4	375	1.4	0.654	65.9	LOS E	12.2	86.2	0.99	0.82	16.1
Approach		1041	2.4	1041	2.4	0.726	57.2	LOS E	20.5	145.3	0.98	0.83	23.5
East: Waterloo Road (380m)													
4	L2	906	1.5	906	1.5	0.749	40.5	LOS C	36.0	255.3	0.90	0.87	22.4
5	T1	188	1.7	188	1.7	0.749	45.9	LOS D	26.2	185.9	0.96	0.86	28.1
6	R2	219	28.8	219	28.8	0.568	65.6	LOS E	10.1	71.7	0.97	0.80	23.8
Approach		1314	6.1	1314	6.1	0.749	45.5	LOS D	36.0	255.3	0.92	0.85	23.8
North: Herring Road (320m)													
7	L2	185	33.0	185	33.0	0.391	41.5	LOS C	9.9	91.5	0.79	0.78	20.3
8	T1	574	3.5	574	3.5	0.720	52.3	LOS D	18.0	128.0	0.96	0.83	17.4
9	R2	179	25.3	179	25.3	0.719	68.7	LOS E	12.1	102.8	1.00	0.86	21.8
Approach		938	13.5	938	13.5	0.720	53.2	LOS D	18.0	128.0	0.93	0.83	19.0
West: Waterloo Road (320m)													
10	L2	163	29.0	163	29.0	0.237	29.4	LOS C	6.5	57.1	0.64	0.74	33.7
11	T1	428	1.5	428	1.5	0.402	43.4	LOS D	11.7	83.1	0.86	0.72	19.5
Approach		592	9.1	592	9.1	0.402	39.5	LOS C	11.7	83.1	0.80	0.73	23.7
All Vehicles		3884	7.3	3884	7.3	0.749	49.6	LOS D	36.0	255.3	0.92	0.82	22.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 5.2 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.9	LOS D	0.1	0.1	0.68	0.68
P2	East Full Crossing	53	56.3	LOS E	0.2	0.2	0.90	0.90
P3	North Full Crossing	53	50.2	LOS E	0.2	0.2	0.85	0.85
P4	West Full Crossing	53	50.2	LOS E	0.2	0.2	0.85	0.85
All Pedestrians		211	47.1	LOS E			0.82	0.82

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

Site: 104 [PM_Waterloo Road_Byfield Sreet_2021 Base+Dev]

Network: N101 [2021 Base+Dev PM - update]

Waterloo Road_Byfield Sreet
PM
2021 RMS Base+Development
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Arrival Flows Total veh/h	Arrival Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	546	1.5	546	1.5	0.547	23.8	LOS B	19.7	139.6	0.70	0.91	26.5
3	R2	13	0.0	13	0.0	0.021	57.3	LOS E	0.4	2.5	0.87	0.65	19.9
Approach		559	1.5	559	1.5	0.547	24.6	LOS B	19.7	139.6	0.70	0.90	26.3
East: Waterloo Road (155m)													
4	L2	5	0.0	5	0.0	0.122	29.0	LOS C	2.6	32.0	0.61	0.50	31.3
5	T1	1172	6.6	1172	6.6	0.690	31.4	LOS C	31.8	225.6	0.83	0.74	14.8
Approach		1177	6.6	1177	6.6	0.690	31.4	LOS C	31.8	225.6	0.83	0.74	14.9
West: Waterloo Road (380m)													
11	T1	928	7.7	928	7.7	0.295	5.5	LOS A	9.0	63.9	0.33	0.30	51.4
12	R2	335	1.6	335	1.6	0.551	32.1	LOS C	12.2	86.5	0.88	0.90	33.1
Approach		1263	6.1	1263	6.1	0.551	12.6	LOS A	12.2	86.5	0.48	0.46	43.5
All Vehicles		2999	5.4	2999	5.4	0.690	22.2	LOS B	31.8	225.6	0.66	0.65	30.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 5.2 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	44.4	LOS E	0.2	0.2	0.80	0.80
P4	West Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		105	54.1	LOS E			0.88	0.88

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 [AM_Herring_Epping_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades AM - update]

Epping Road - Herring Road
AM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	15	0.0	15	0.0	1.050	131.4	LOS F	33.7	240.3	1.00	1.27	15.4
2	T1	716	2.4	716	2.4	1.050	134.5	LOS F	43.1	308.1	1.00	1.32	6.0
3	R2	283	1.5	283	1.5	0.451	61.2	LOS E	8.9	63.3	0.91	0.79	37.5
Approach		1014	2.1	1014	2.1	1.050	114.0	LOS F	43.1	308.1	0.98	1.17	13.9
East: Epping Road E (1200m)													
4	L2	95	1.1	95	1.1	0.438	35.9	LOS C	17.2	122.0	0.74	0.70	48.2
5	T1	1009	1.5	1009	1.5	0.438	30.1	LOS C	18.5	131.1	0.74	0.66	52.8
6	R2	381	3.6	381	3.6	1.011	130.4	LOS F	20.8	149.8	1.00	1.11	22.7
Approach		1485	2.0	1485	2.0	1.011	56.2	LOS D	20.8	149.8	0.81	0.78	42.0
North: Herring Road N (200m)													
7	L2	178	8.3	178	8.3	0.178	21.2	LOS B	5.9	44.0	0.51	0.70	52.0
8	T1	292	4.3	292	4.3	0.493	62.8	LOS E	9.8	71.2	0.96	0.78	18.3
9	R2	175	1.8	175	1.8	0.309	66.4	LOS E	5.7	40.5	0.93	0.77	26.0
Approach		644	4.7	644	4.7	0.493	52.3	LOS D	9.8	71.2	0.83	0.76	29.9
West: Epping Road W (600m)													
10	L2	561	1.5	561	1.5	0.524	15.1	LOS B	16.7	118.4	0.53	0.75	47.6
11	T1	2086	1.7	2086	1.7	1.043	128.3	LOS F	83.9	596.1	1.00	1.37	29.3
12	R2	21	0.0	21	0.0	0.282	86.0	LOS F	1.6	11.1	1.00	0.70	23.4
Approach		2668	1.7	2668	1.7	1.043	104.1	LOS F	83.9	596.1	0.90	1.23	30.3
All Vehicles		5812	2.2	5812	2.2	1.050	87.8	LOS F	83.9	596.1	0.88	1.05	30.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.7 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	33.0	LOS D	0.1	0.1	0.67	0.67
P2	East Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
P3	North Full Crossing	53	41.4	LOS E	0.2	0.2	0.75	0.75
P4	West Full Crossing	53	65.0	LOS F	0.2	0.2	0.93	0.93
All Pedestrians		211	52.0	LOS E			0.83	0.83

MOVEMENT SUMMARY

Site: 102 [AM_Herring_Ivanhoe_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades AM - update]

Herring Road_Ivanhoe Place
AM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	1	0.0	1	0.0	0.018	18.3	LOS B	0.2	2.6	0.58	0.43	17.5
2	T1	1421	2.1	1389	2.1	0.842	25.7	LOS B	27.7	196.5	0.92	0.94	18.9
3	R2	146	1.4	143	1.4	0.804	47.5	LOS D	5.8	41.4	1.00	0.93	17.2
Approach		1568	2.0	1533 N1	2.0	0.842	27.7	LOS B	27.7	196.5	0.93	0.94	18.6
East: Ivanhoe Place (125m)													
4	L2	383	1.4	383	1.4	0.352	6.0	LOS A	2.4	16.7	0.33	0.61	32.1
5	T1	7	0.0	7	0.0	0.352	1.5	LOS A	2.4	16.7	0.33	0.61	36.3
6	R2	31	0.0	31	0.0	0.091	26.1	LOS B	0.9	6.4	0.83	0.62	4.0
Approach		421	1.3	421	1.3	0.352	7.4	LOS A	2.4	16.7	0.37	0.61	21.4
North: Herring Road (380m)													
7	L2	56	1.9	56	1.9	0.097	19.4	LOS B	1.5	12.3	0.63	0.64	36.2
8	T1	232	6.8	232	6.8	0.124	13.3	LOS A	2.4	16.7	0.62	0.51	38.2
9	R2	17	0.0	17	0.0	0.094	40.7	LOS C	0.6	4.1	0.94	0.69	23.8
Approach		304	5.5	304	5.5	0.124	15.8	LOS B	2.4	16.7	0.64	0.54	36.4
West: Morling College (70m)													
10	L2	8	0.0	8	0.0	0.021	24.8	LOS B	0.3	2.1	0.73	0.62	10.8
11	T1	3	0.0	3	0.0	0.021	20.2	LOS B	0.3	2.1	0.73	0.62	19.8
12	R2	18	0.0	18	0.0	0.052	30.2	LOS C	0.5	3.7	0.82	0.68	9.2
Approach		29	0.0	29	0.0	0.052	27.6	LOS B	0.5	3.7	0.79	0.65	10.8
All Vehicles		2323	2.3	2288 N1	2.3	0.842	22.4	LOS B	27.7	196.5	0.79	0.82	21.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.7 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	19.5	LOS B	0.1	0.1	0.72	0.72
P3	North Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	18.8	LOS B	0.1	0.1	0.71	0.71
All Pedestrians		211	25.5	LOS C			0.82	0.82

MOVEMENT SUMMARY

Site: 103 [AM_Herring_Waterloo_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades AM - update]

Herring Road_Waterloo Road
AM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	94	1.1	92	1.1	0.110	15.4	LOS B	2.4	18.4	0.49	0.63	44.1
2	T1	836	2.6	819	2.6	0.534	31.7	LOS C	21.0	149.2	0.79	0.70	34.9
3	R2	611	1.6	598	1.6	0.333	17.5	LOS B	7.3	51.9	0.64	0.74	34.9
Approach		1540	2.1	1509 N1	2.1	0.534	25.0	LOS B	21.0	149.2	0.72	0.71	35.4
East: Waterloo Road (380m)													
4	L2	102	2.1	102	2.1	0.112	15.9	LOS B	2.2	15.6	0.56	0.70	35.9
5	T1	154	1.4	154	1.4	0.257	38.3	LOS C	7.7	54.8	0.79	0.65	32.0
6	R2	178	34.9	178	34.9	0.526	69.2	LOS E	7.7	54.6	0.98	0.79	23.1
Approach		434	15.3	434	15.3	0.526	45.7	LOS D	7.7	54.8	0.82	0.72	27.5
North: Herring Road (320m)													
7	L2	120	41.2	120	41.2	0.356	30.2	LOS C	4.8	46.9	0.84	0.76	25.1
8	T1	203	7.8	203	7.8	0.356	47.8	LOS D	5.4	38.2	0.87	0.70	18.6
9	R2	109	37.5	109	37.5	0.519	66.9	LOS E	7.1	65.4	0.97	0.80	22.2
Approach		433	24.6	433	24.6	0.519	47.6	LOS D	7.1	65.4	0.89	0.74	21.1
West: Waterloo Road (320m)													
10	L2	121	39.1	121	39.1	0.275	44.2	LOS D	6.1	57.4	0.79	0.77	27.9
11	T1	278	1.5	278	1.5	0.508	60.2	LOS E	8.9	62.8	0.97	0.78	15.5
Approach		399	12.9	399	12.9	0.508	55.3	LOS D	8.9	62.8	0.92	0.78	19.4
All Vehicles		2805	9.2	2774 N1	9.3	0.534	36.2	LOS C	21.0	149.2	0.79	0.73	28.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.7 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.84	0.84
P2	East Full Crossing	53	60.0	LOS E	0.2	0.2	0.93	0.93
P3	North Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	53	31.2	LOS D	0.1	0.1	0.67	0.67
All Pedestrians		211	51.1	LOS E			0.85	0.85

MOVEMENT SUMMARY

Site: 104 [AM_Waterloo Road_Byfield Sreet_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades AM - update]

Waterloo Road_Byfield Sreet
AM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	80	1.3	80	1.3	0.069	5.5	LOS A	0.6	4.2	0.16	0.55	41.5
3	R2	53	2.0	53	2.0	0.091	58.4	LOS E	1.5	10.9	0.89	0.71	19.6
Approach		133	1.6	133	1.6	0.091	26.5	LOS B	1.5	10.9	0.45	0.61	27.0
East: Waterloo Road (155m)													
4	L2	46	2.3	46	2.3	0.136	20.9	LOS B	3.1	32.2	0.50	0.50	34.8
5	T1	519	13.0	519	13.0	0.221	16.8	LOS B	8.0	56.6	0.54	0.47	22.6
Approach		565	12.1	565	12.1	0.221	17.0	LOS B	8.0	56.6	0.54	0.47	24.4
West: Waterloo Road (380m)													
11	T1	644	9.3	637	9.4	0.198	5.1	LOS A	5.5	39.2	0.31	0.26	52.0
12	R2	158	1.3	156	1.3	0.219	11.5	LOS A	2.9	20.3	0.41	0.67	44.4
Approach		802	7.7	793 N1	7.8	0.219	6.3	LOS A	5.5	39.2	0.33	0.34	49.9
All Vehicles		1500	8.8	1491 N1	8.9	0.221	12.2	LOS A	8.0	56.6	0.42	0.42	39.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.7 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	56.3	LOS E	0.2	0.2	0.90	0.90
P4	West Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		105	60.0	LOS F			0.93	0.93

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 [PM_Herring_Epping_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades PM - update]

Epping Road - Herring Road
PM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 149 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road S (250m)													
1	L2	22	0.0	22	0.0	0.921	105.4	LOS F	23.6	168.7	1.00	1.10	21.1
2	T1	541	2.9	541	2.9	0.921	91.6	LOS F	23.9	171.2	1.00	1.08	9.2
3	R2	219	1.4	219	1.4	0.370	66.2	LOS E	7.2	50.8	0.94	0.78	36.2
Approach		782	2.4	782	2.4	0.921	84.8	LOS F	23.9	171.2	0.98	1.00	18.9
East: Epping Road E (1200m)													
4	L2	288	1.5	288	1.5	0.925	74.5	LOS F	47.7	338.0	1.00	1.06	35.4
5	T1	1539	1.6	1539	1.6	0.925	67.8	LOS E	51.3	364.1	1.00	1.05	40.5
6	R2	395	3.5	395	3.5	0.926	95.9	LOS F	17.0	122.4	1.00	0.99	27.8
Approach		2222	1.9	2222	1.9	0.926	73.6	LOS F	51.3	364.1	1.00	1.04	37.6
North: Herring Road N (200m)													
7	L2	316	4.7	316	4.7	0.274	10.7	LOS A	7.3	53.5	0.41	0.69	58.3
8	T1	745	2.3	745	2.3	0.922	80.2	LOS F	31.3	223.0	1.00	1.07	15.3
9	R2	523	1.4	523	1.4	0.684	64.6	LOS E	17.7	125.1	0.98	0.84	26.4
Approach		1584	2.5	1584	2.5	0.922	61.2	LOS E	31.3	223.0	0.88	0.92	26.3
West: Epping Road W (600m)													
10	L2	287	1.5	287	1.5	0.219	10.3	LOS A	4.7	33.6	0.32	0.67	53.0
11	T1	1056	1.5	1056	1.5	0.528	41.2	LOS C	20.4	144.6	0.85	0.74	48.7
12	R2	176	1.8	176	1.8	0.794	80.6	LOS F	13.3	94.3	1.00	0.88	24.4
Approach		1519	1.5	1519	1.5	0.794	39.9	LOS C	20.4	144.6	0.77	0.74	45.9
All Vehicles		6107	2.0	6107	2.0	0.926	63.5	LOS E	51.3	364.1	0.91	0.93	34.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 7.3 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	42.9	LOS E	0.2	0.2	0.76	0.76
P2	East Full Crossing	53	65.0	LOS F	0.2	0.2	0.93	0.93
P3	North Full Crossing	53	43.7	LOS E	0.2	0.2	0.77	0.77
P4	West Full Crossing	53	68.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		211	55.1	LOS E			0.86	0.86

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: 102 [PM_Herring_Ivanhoe_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades PM - update]

Herring Road_Ivanhoe Place
PM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (180m)													
1	L2	1	0.0	1	0.0	0.028	23.8	LOS B	0.3	3.6	0.70	0.50	15.9
2	T1	1044	2.5	1044	2.5	0.794	27.8	LOS B	19.3	136.7	0.96	0.92	17.9
3	R2	39	2.7	39	2.7	0.258	43.0	LOS D	1.4	10.3	0.97	0.72	18.4
Approach		1084	2.5	1084	2.5	0.794	28.3	LOS B	19.3	136.7	0.96	0.91	17.9
East: Ivanhoe Place (125m)													
4	L2	677	1.6	677	1.6	0.763	18.0	LOS B	14.4	102.0	0.80	0.92	18.7
5	T1	13	0.0	13	0.0	0.763	13.5	LOS A	14.4	102.0	0.80	0.92	23.4
6	R2	191	1.7	191	1.7	0.389	21.1	LOS B	5.5	38.8	0.81	0.68	4.2
Approach		880	1.6	880	1.6	0.763	18.6	LOS B	14.4	102.0	0.80	0.87	10.7
North: Herring Road (380m)													
7	L2	16	0.0	16	0.0	0.057	24.7	LOS B	0.7	6.7	0.72	0.60	33.6
8	T1	912	2.8	912	2.8	0.919	45.4	LOS D	21.9	155.5	1.00	1.17	20.7
9	R2	45	0.0	45	0.0	0.294	43.1	LOS D	1.7	11.7	0.98	0.73	23.0
Approach		973	2.6	973	2.6	0.919	44.9	LOS D	21.9	155.5	0.99	1.14	20.9
West: Morling College (70m)													
10	L2	19	0.0	19	0.0	0.027	16.6	LOS B	0.4	3.1	0.57	0.61	14.2
11	T1	3	0.0	3	0.0	0.027	12.0	LOS A	0.4	3.1	0.57	0.61	24.5
12	R2	11	0.0	11	0.0	0.027	22.8	LOS B	0.3	1.8	0.70	0.64	11.4
Approach		33	0.0	33	0.0	0.027	18.2	LOS B	0.4	3.1	0.61	0.62	14.4
All Vehicles		2969	2.2	2969	2.2	0.919	30.8	LOS C	21.9	155.5	0.92	0.97	17.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 7.3 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P2	East Full Crossing	53	25.7	LOS C	0.1	0.1	0.83	0.83
P3	North Full Crossing	53	31.8	LOS D	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	24.9	LOS C	0.1	0.1	0.82	0.82
All Pedestrians		211	28.5	LOS C			0.87	0.87

MOVEMENT SUMMARY

Site: 103 [PM_Herring_Waterloo_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades PM - update]

Herring Road_Waterloo Road
PM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Herring Road (380m)													
1	L2	115	1.8	115	1.8	0.152	20.2	LOS B	3.8	28.8	0.57	0.67	40.7
2	T1	751	2.9	751	2.9	0.597	39.3	LOS C	21.5	152.6	0.87	0.76	31.8
3	R2	413	1.5	413	1.5	0.610	62.1	LOS E	13.0	92.1	0.97	0.82	16.8
Approach		1278	2.4	1278	2.4	0.610	44.9	LOS D	21.5	152.6	0.88	0.77	27.3
East: Waterloo Road (380m)													
4	L2	267	1.6	267	1.6	0.306	36.5	LOS C	10.5	74.2	0.73	0.77	23.9
5	T1	102	2.1	102	2.1	0.306	46.8	LOS D	7.5	53.5	0.87	0.73	28.5
6	R2	180	35.1	180	35.1	0.601	71.8	LOS F	7.9	56.4	1.00	0.79	22.6
Approach		549	12.6	549	12.6	0.601	50.0	LOS D	10.5	74.2	0.84	0.77	24.2
North: Herring Road (320m)													
7	L2	137	43.8	137	43.8	0.257	32.9	LOS C	6.4	63.2	0.68	0.73	23.8
8	T1	667	3.2	667	3.2	0.542	38.3	LOS C	18.3	129.6	0.84	0.73	21.4
9	R2	173	26.2	173	26.2	0.590	62.4	LOS E	10.9	93.3	0.97	0.82	23.2
Approach		977	12.9	977	12.9	0.590	41.7	LOS C	18.3	129.6	0.84	0.75	22.2
West: Waterloo Road (320m)													
10	L2	155	30.6	155	30.6	0.263	35.4	LOS C	6.9	61.4	0.71	0.76	31.1
11	T1	436	1.4	436	1.4	0.613	56.4	LOS D	13.7	97.1	0.97	0.81	16.2
Approach		591	9.1	591	9.1	0.613	50.9	LOS D	13.7	97.1	0.90	0.80	20.1
All Vehicles		3395	8.2	3395	8.2	0.613	45.9	LOS D	21.5	152.6	0.87	0.77	24.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 7.3 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	46.0	LOS E	0.2	0.2	0.81	0.81
P2	East Full Crossing	53	43.6	LOS E	0.2	0.2	0.79	0.79
P3	North Full Crossing	53	61.9	LOS F	0.2	0.2	0.94	0.94
P4	West Full Crossing	53	38.2	LOS D	0.2	0.2	0.74	0.74
All Pedestrians		211	47.4	LOS E			0.82	0.82

MOVEMENT SUMMARY

Site: 101v [PM_Waterloo Road_Byfield Sreet_2021 Base+Dev+Upgrades]

Network: N101 [2021 Base+Dev+Upgrades PM - update]

Waterloo Road_Byfield Sreet
PM
2021 RMS Base+Development+Upgrades
Signals - Fixed Time Isolated Cycle Time = 139 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Byfield Sreet (350m)													
1	L2	119	1.8	119	1.8	0.101	7.8	LOS A	1.8	12.8	0.28	0.59	38.7
3	R2	16	0.0	16	0.0	0.027	57.4	LOS E	0.4	3.1	0.87	0.66	19.8
Approach		135	1.6	135	1.6	0.101	13.6	LOS A	1.8	12.8	0.35	0.60	33.7
East: Waterloo Road (155m)													
4	L2	36	0.0	36	0.0	0.174	33.3	LOS C	3.6	38.6	0.67	0.59	28.4
5	T1	752	9.5	752	9.5	0.500	32.5	LOS C	19.3	136.5	0.78	0.68	14.4
Approach		787	9.1	787	9.1	0.500	32.4	LOS C	19.3	136.5	0.77	0.67	15.3
West: Waterloo Road (380m)													
11	T1	899	8.0	899	8.0	0.285	5.5	LOS A	8.6	61.1	0.33	0.29	51.5
12	R2	294	1.4	294	1.4	0.380	15.5	LOS B	6.6	46.6	0.64	0.76	41.6
Approach		1193	6.4	1193	6.4	0.380	7.9	LOS A	8.6	61.1	0.41	0.41	48.0
All Vehicles		2115	7.1	2115	7.1	0.500	17.5	LOS B	19.3	136.5	0.54	0.52	35.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 7.3 %
Number of Iterations: 10 (maximum specified: 10)

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	39.0	LOS D	0.2	0.2	0.75	0.75
P4	West Full Crossing	53	63.8	LOS F	0.2	0.2	0.96	0.96
All Pedestrians		105	51.4	LOS E			0.85	0.85

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 F

Swept Path Analysis

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building A1 Ivanhoe

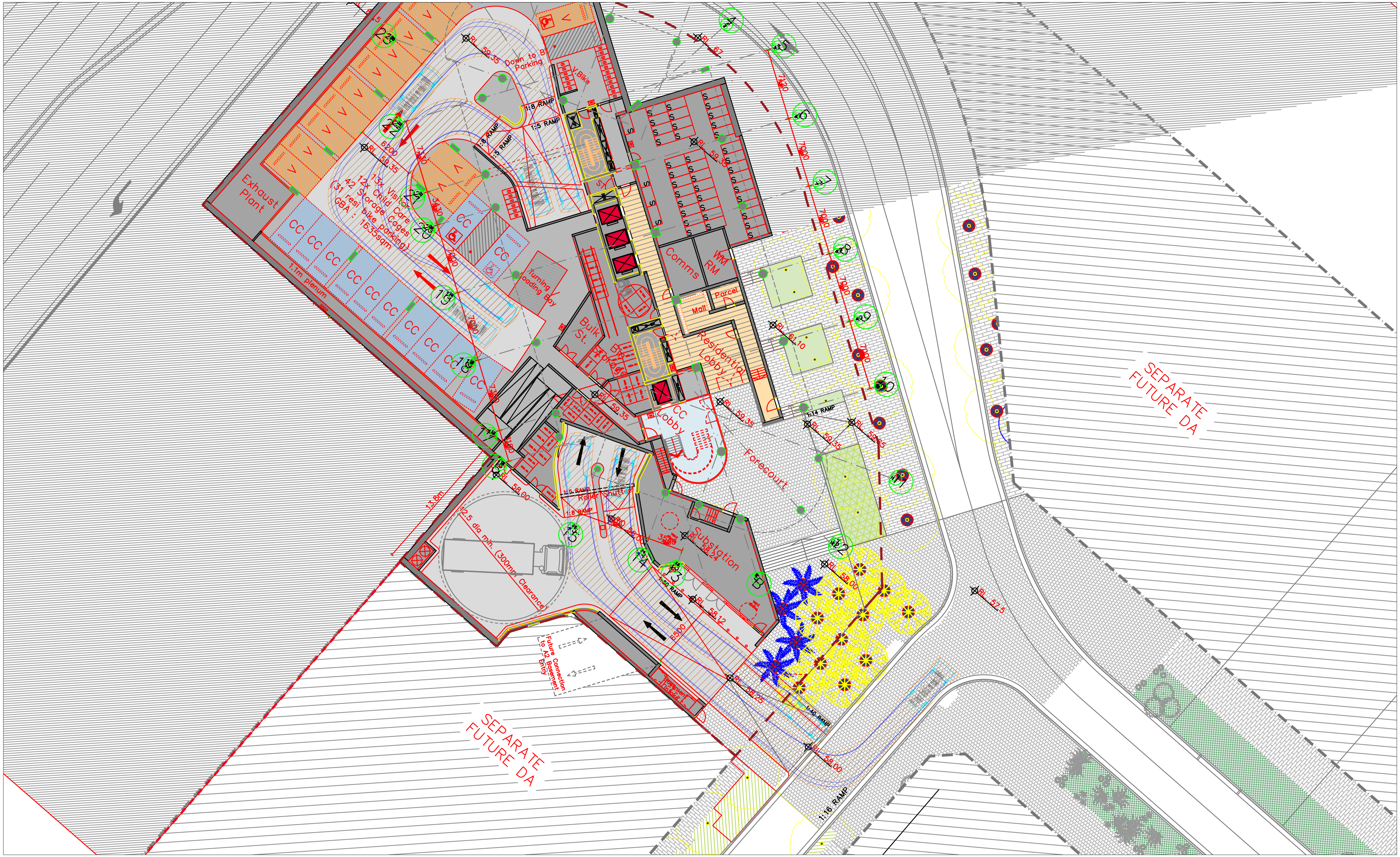
Drawing Title: HRV Access

Date: 06:03:2018

Scale @ A3: 1:350

Drawing Number: 01

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555
Building A1 Ivanhoe

Drawing Title: Car Access

Date: 06.03.2018

Scale @ A3: 1:350

Drawing Number: 02

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Sydney NSW 2000
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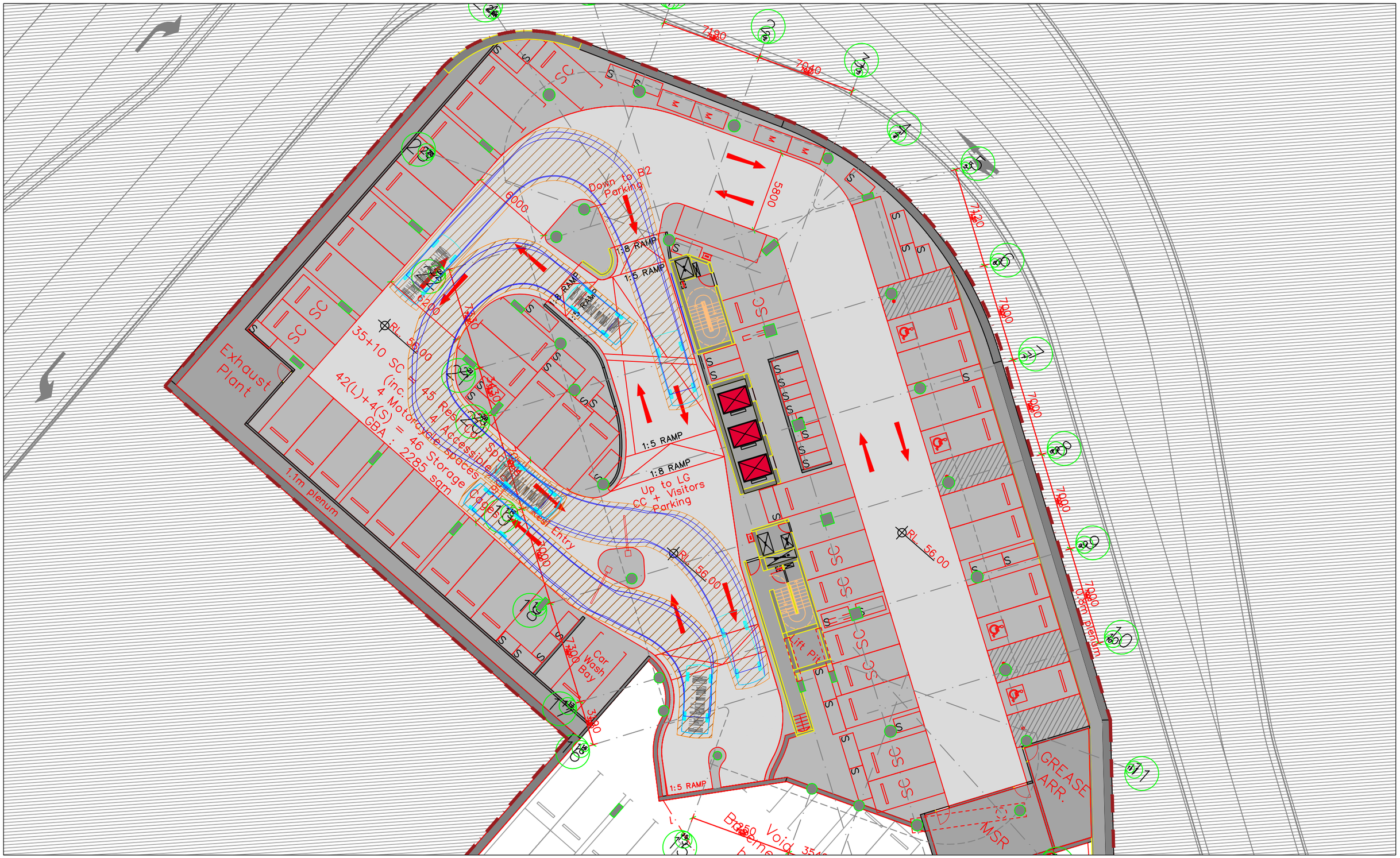

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building A1 Ivanhoe

Drawing Title: Carpar□Layout

Date: 06:03:2018

Scale @ A3: 1:250

Drawing Number: 03

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
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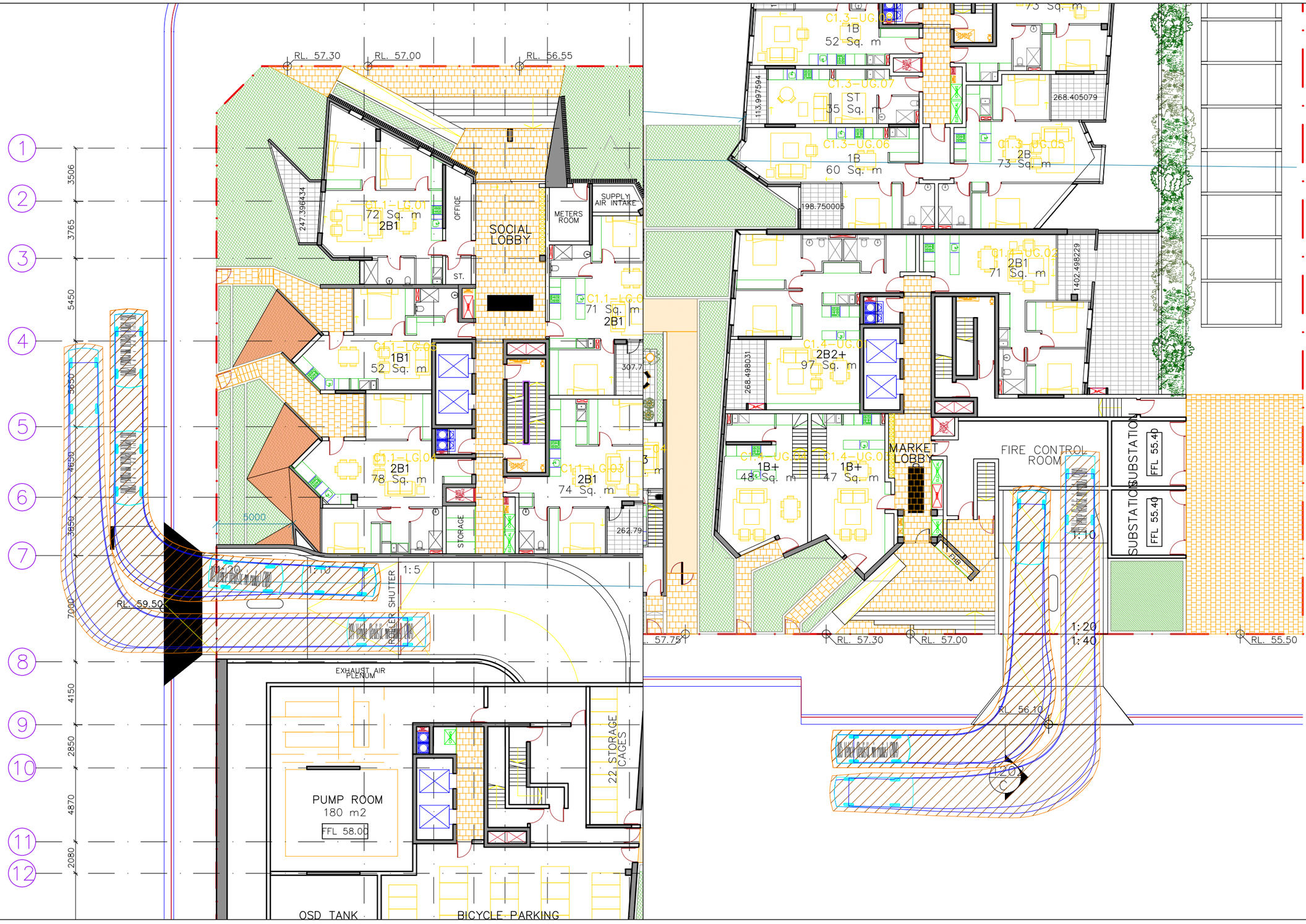

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building C1 Ivanhoe

Drawing Title: Car Access

Date: 06:03:2018

Scale @ A3: 1:250

Drawing Number: 04

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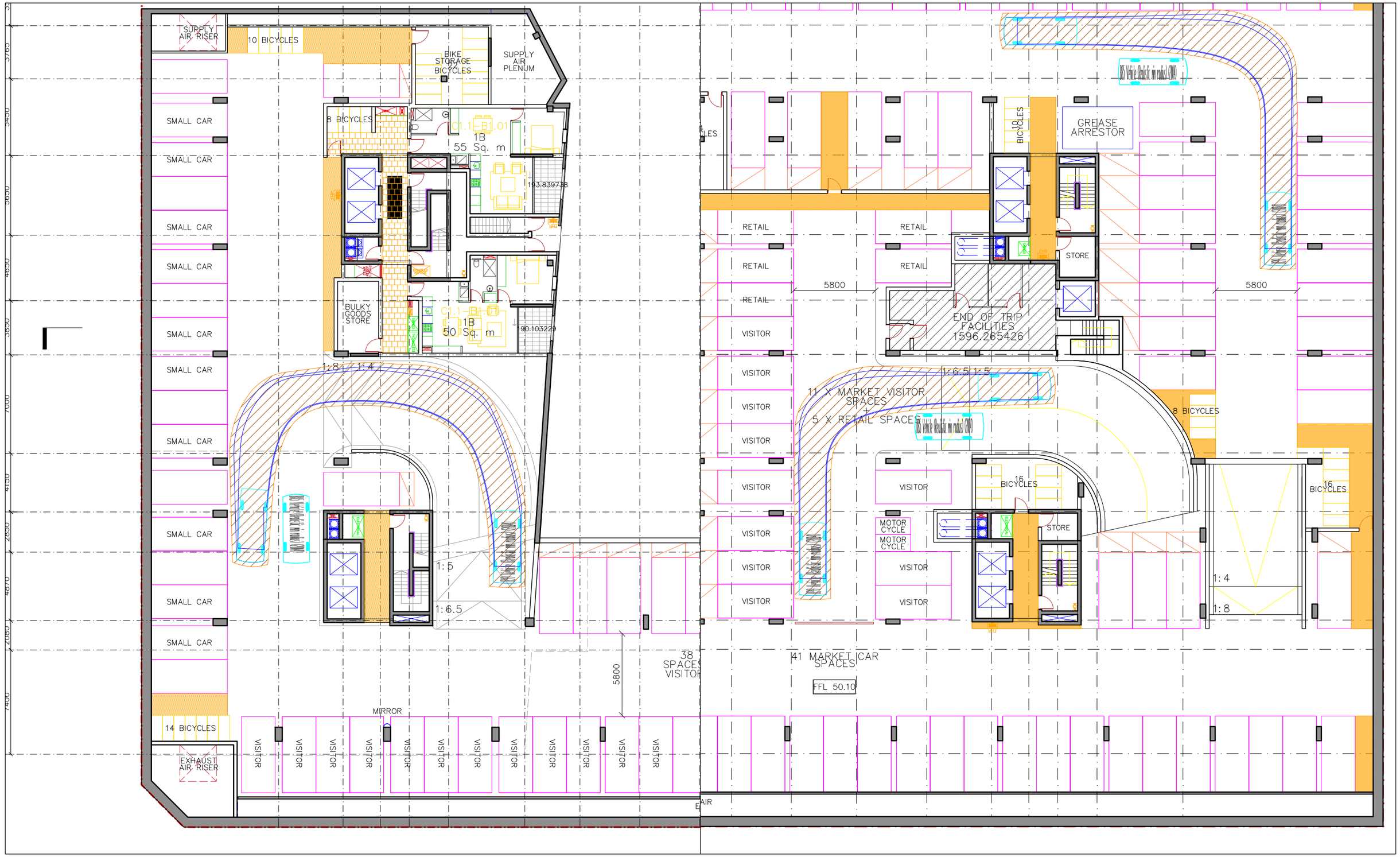

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building C1 Ivanhoe

Drawing Title: Carpar□Layout

Date: 06:03:2018

Scale @ A3: 1:250

Drawing Number: 05

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BOUNDARY

SUPPLY AIR PLENUM

SUPPLY AIR RISER

FUTURE CONNECTION TO COMMUNITY CENTRE BASEMENT

FFL 46.05

1:20

LIFT PIT

GARBAGE ROOM

5800

5800

LIFT PIT

GARBAGE ROOM

BULKY GOODS STORE

5800

RESIDENTIAL STORE

1:8

1:4

GARBAGE ROOM

GARBAGE ROOM

TANDEM

TANDEM

TANDEM

TANDEM

155 MARKET CAR SPACES

FFL 47.10

5800

EXHAUST AIR RISER

EXHAUST AIR PLENUM

Notes:

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Document Info:
Drawn by: Shihui Hu
File name: AG0555 Ivanhoe STG1 - Building C1.dwg

Client:
Frasers Property

Project:
0555
Ivahoe STG1 - Building C1

Drawing Title:
B99
Basement 3

Date:
4-Oct-18

Scale @ A3:
1:280

Drawing Number:
AG01

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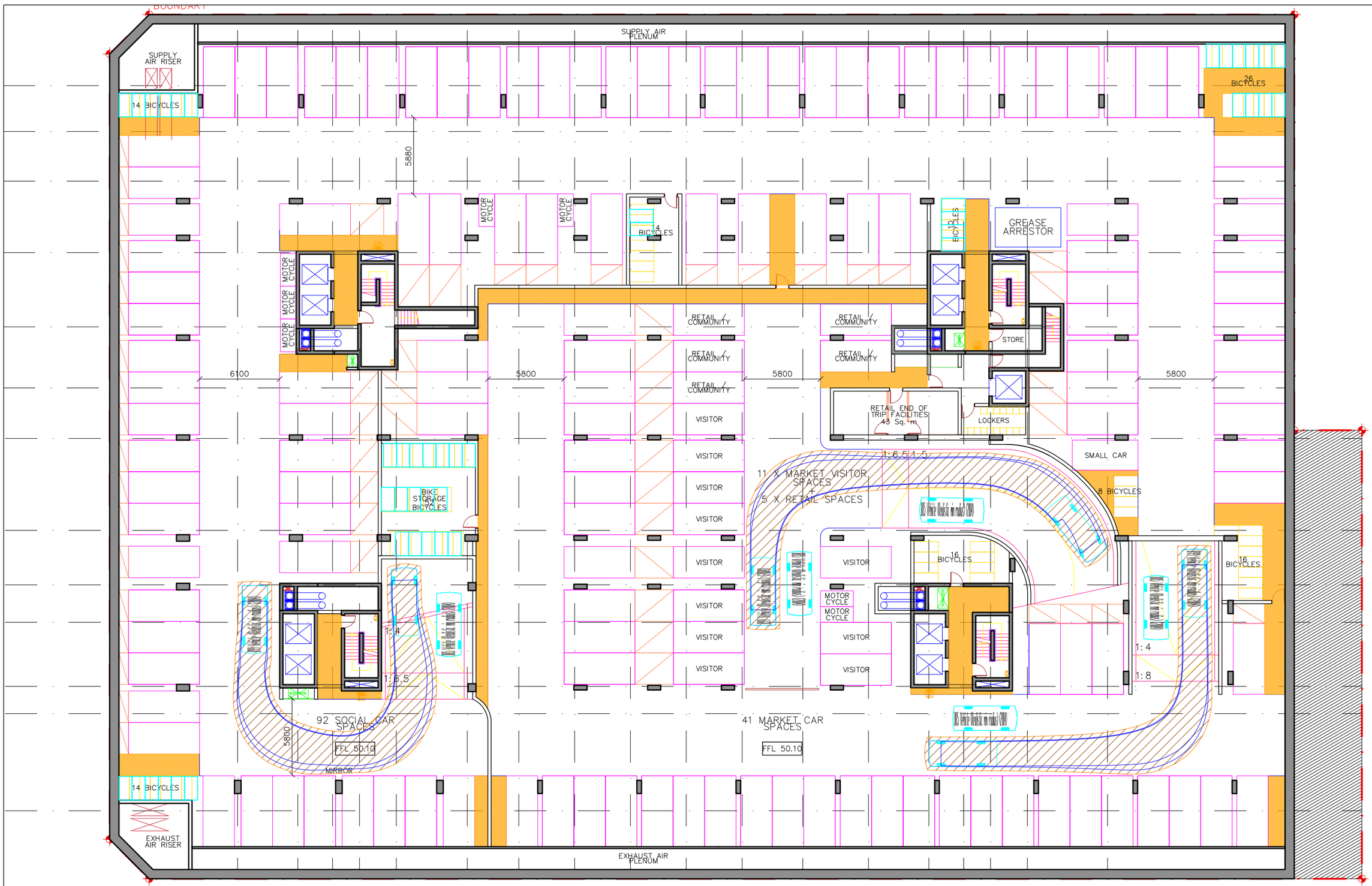

Notes:

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Document Info:

Drawn by: Shihui Hu

File name: AG0555 Ivanhoe STG1 - Building C1.dwg

Client:

Frasers Property

Project:

0555

Ivahoe STG1 - Building C1

Drawing Title:

B99

Basement 2

Date:

4-Oct-18

Scale @ A3:

1:280

Drawing Number:

AG02

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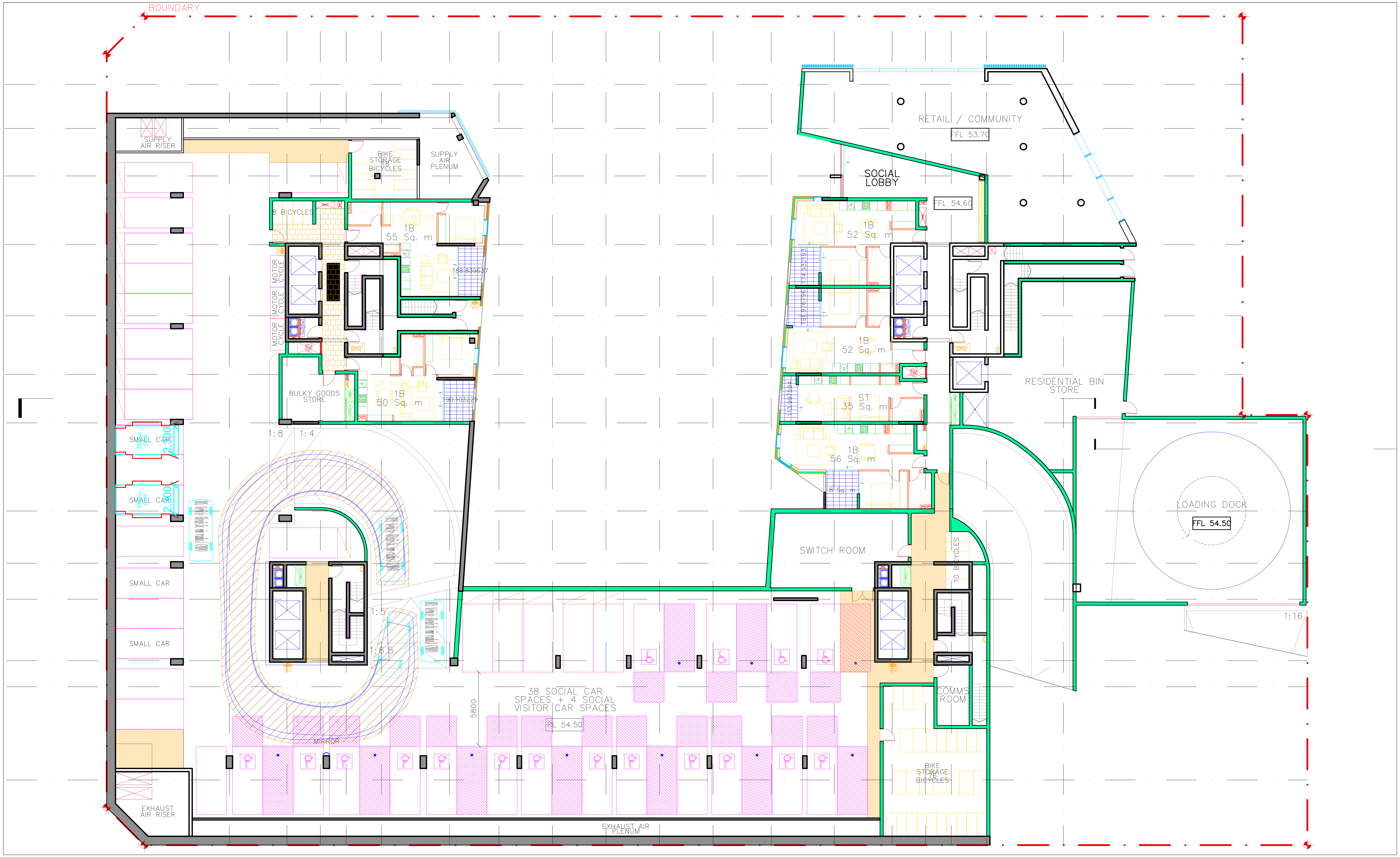

Notes:

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Client:	Frasers Property
Project:	0555 Ivahoe STG1 - Building C1
Drawing Title:	B99 Basement 1
Date:	4-Oct-18
Scale @ A3:	1:280
Drawing Number:	AG03

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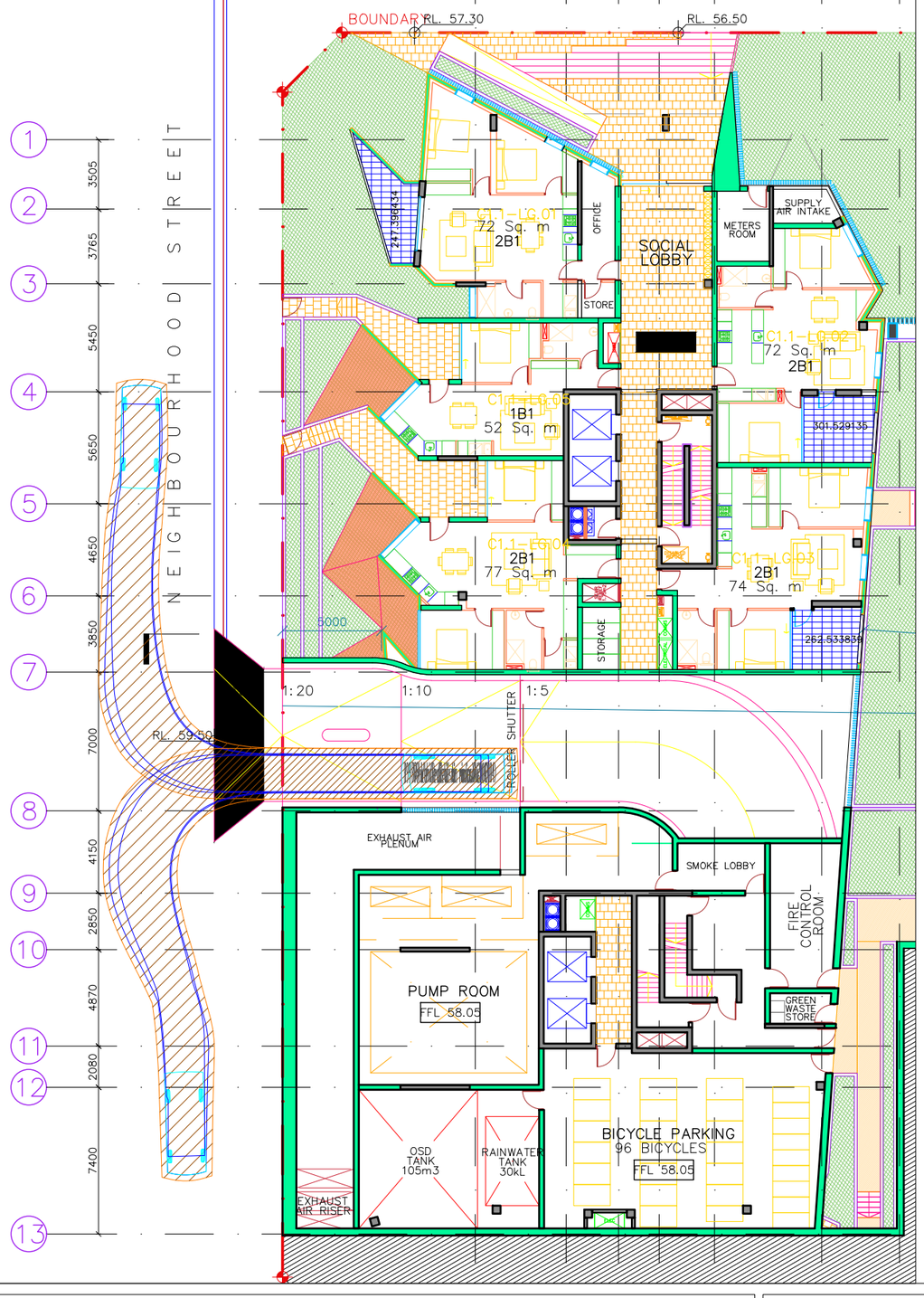

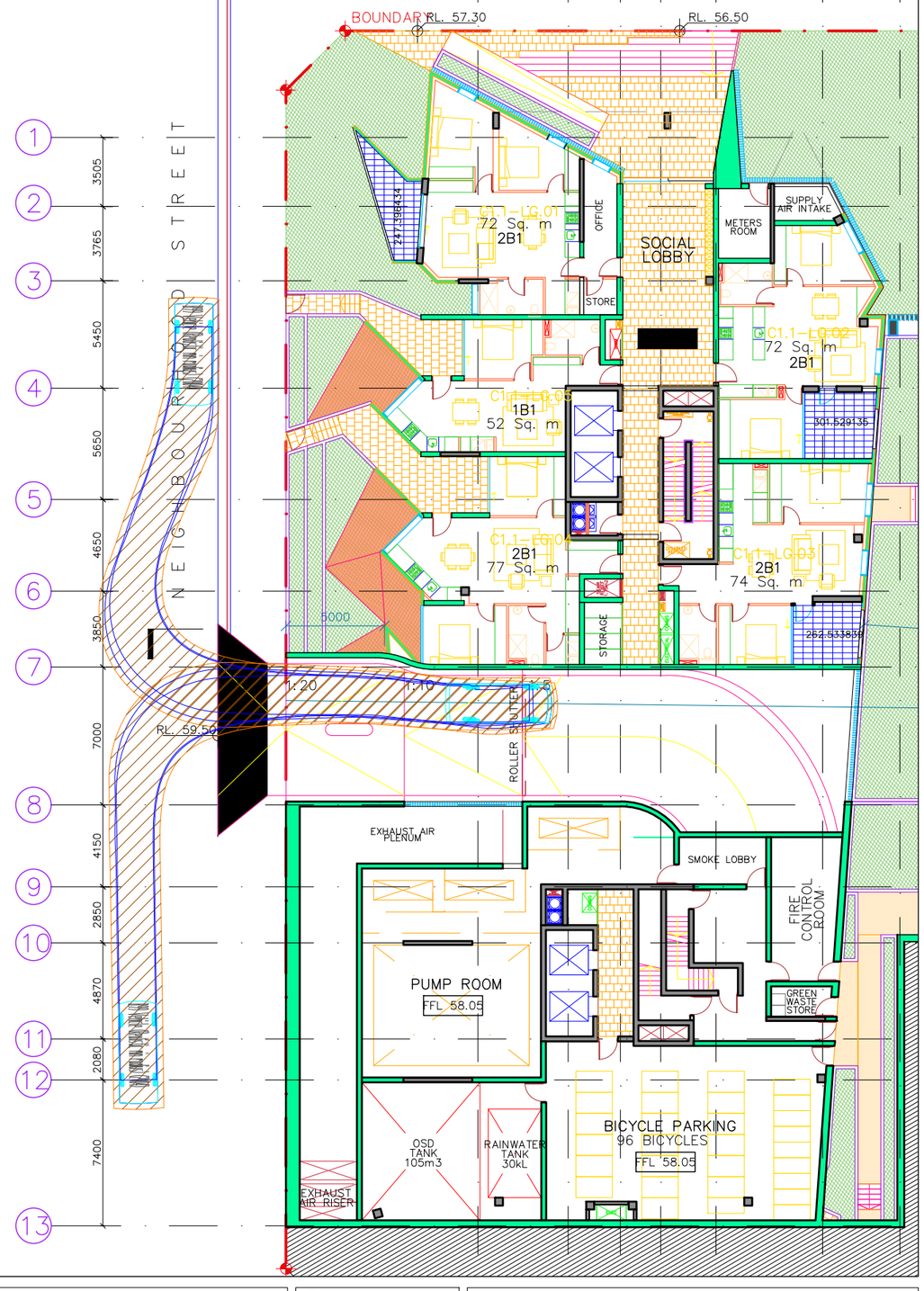

Notes:

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File name: AG0555 Ivanhoe STG1 - Building C1.dwg

Client:
Frasers Property

Project:
0555
Ivahoe STG1 - Building C1

Drawing Title:
B99
Lower Ground Floor

Date:
4-Oct-18

Scale @ A3:
1:280

Drawing Number:
AG04

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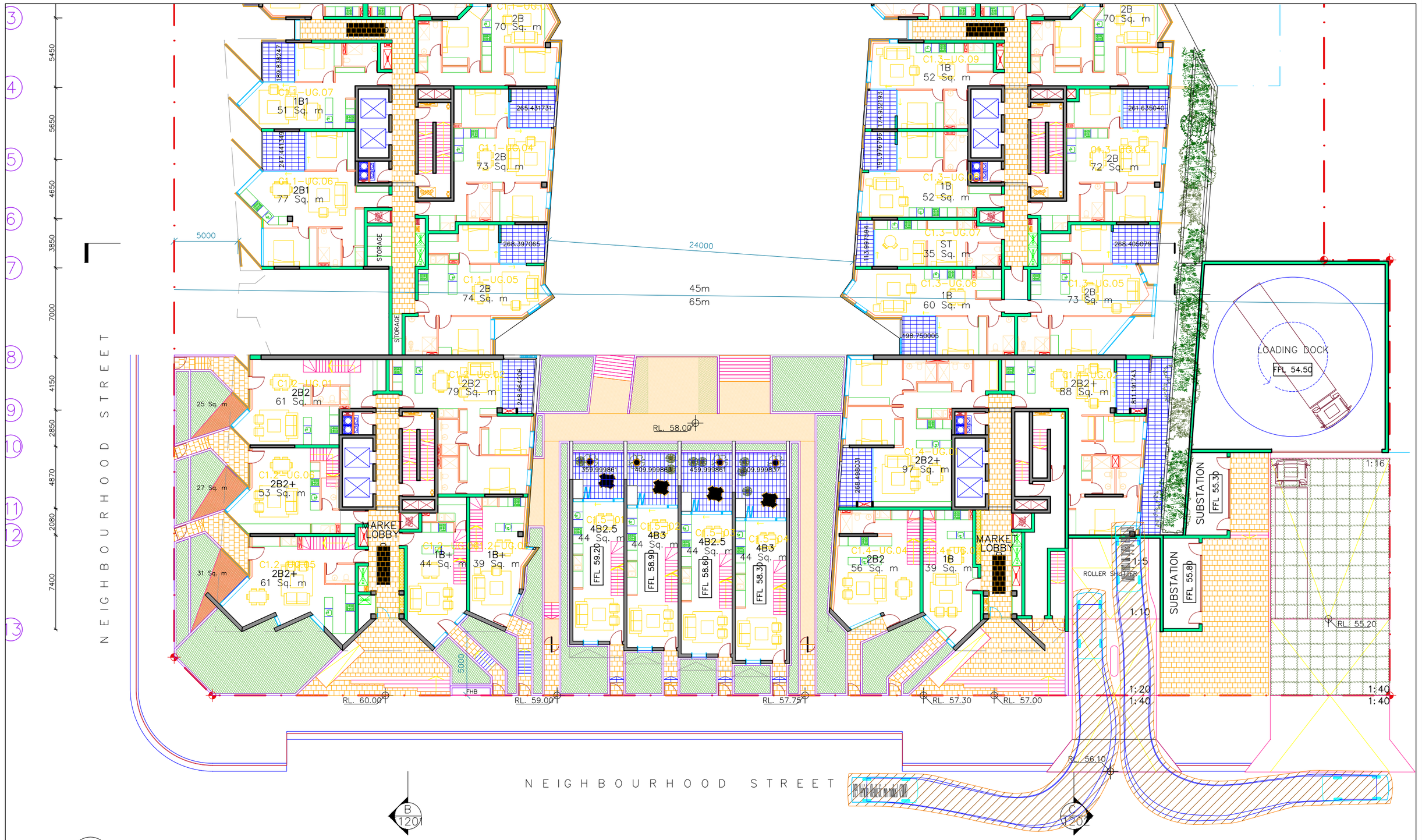

01 UPPER GROUND FLOOR PLAN
1:200

Notes:
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Document Info:
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File name: AG0555 Ivanhoe STG1 - Building C1.dwg

Client:
Frasers Property

Project:
0555
Ivahoe STG1 - Building C1

Drawing Title:
B99
Higher Ground Floor

Date:
4-Oct-18

Scale @ A3:
1:280

Drawing Number:
AG05

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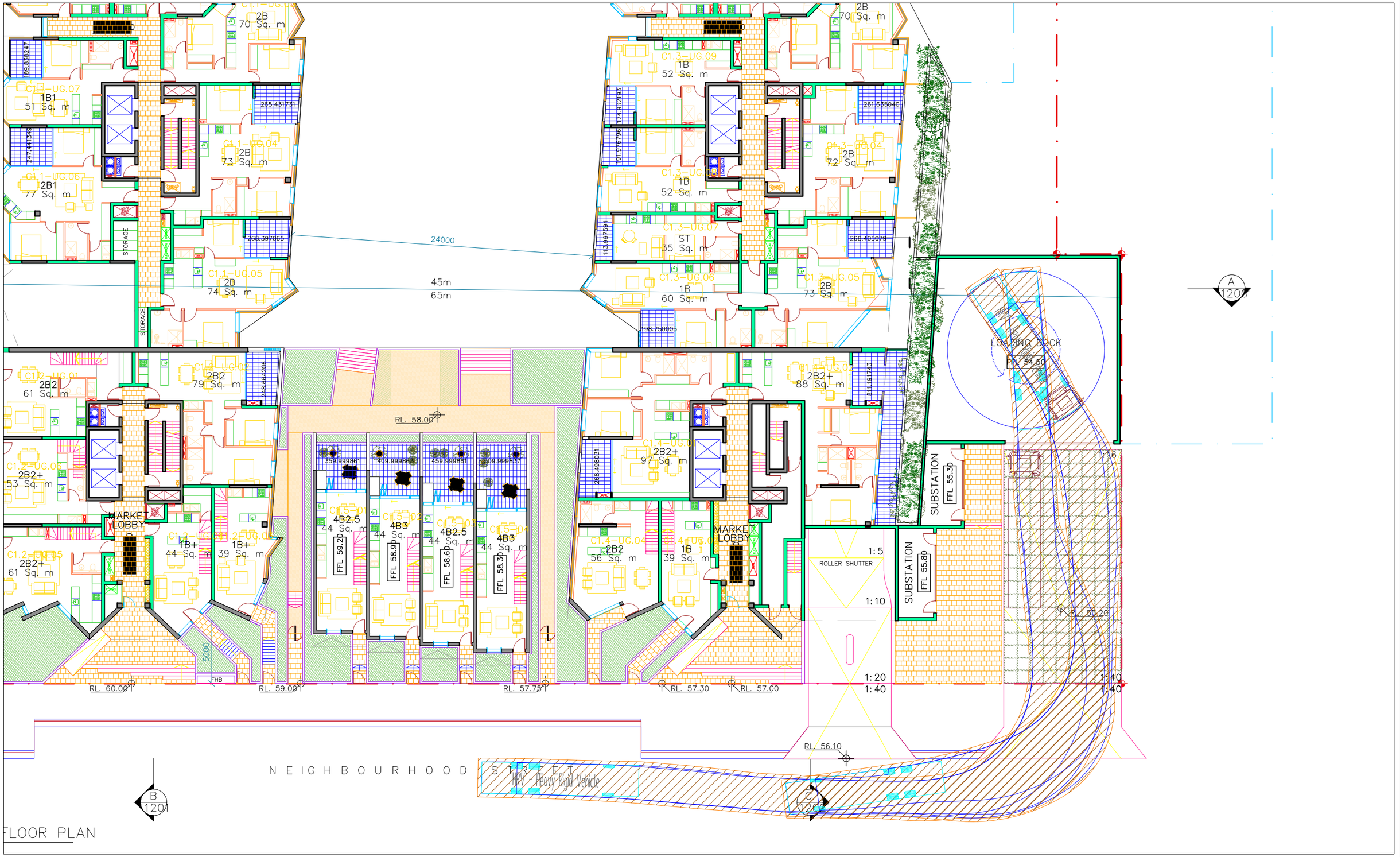

FLOOR PLAN

Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:

Drawn by: Shihui Hu

File name: AG0555 Ivanhoe STG1 - Building C1.dwg

Client:

Frasers Property

Project:

0555

Ivahoe STG1 - Building C1

Drawing Title:

12.5m HRV

Loading Bay

Date:

4-Oct-18

Scale @ A3:

1:280

Drawing Number:

AG06

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Revision notes:

Rev:	Date:	Notes:

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Drawn By: VC

Client: Frasers Property

Project: AG0555 Building A1 Ivanhoe

Drawing Title: HRV Access

Date: 06:03:2018

Scale @ A3: 1:350

Drawing Number: 01

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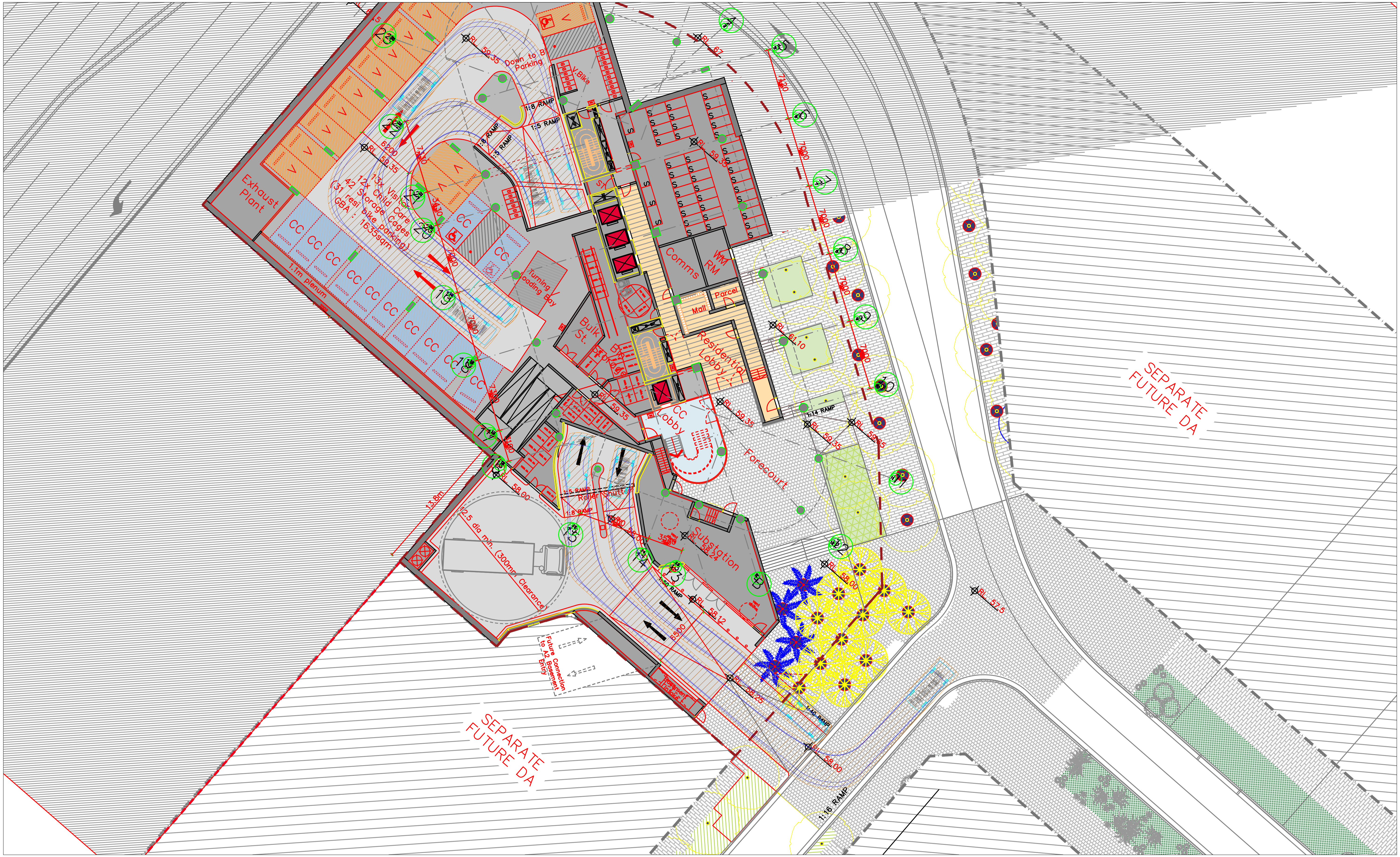

Revision notes:

Rev:	Date:	Notes:

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Drawn By:
VC

Client:
Frasers Property

Project:
AG0555
Building A1 Ivanhoe

Drawing Title:
Car Access

Date:
06.03.2018

Scale @ A3:
1:350

Drawing Number:
02

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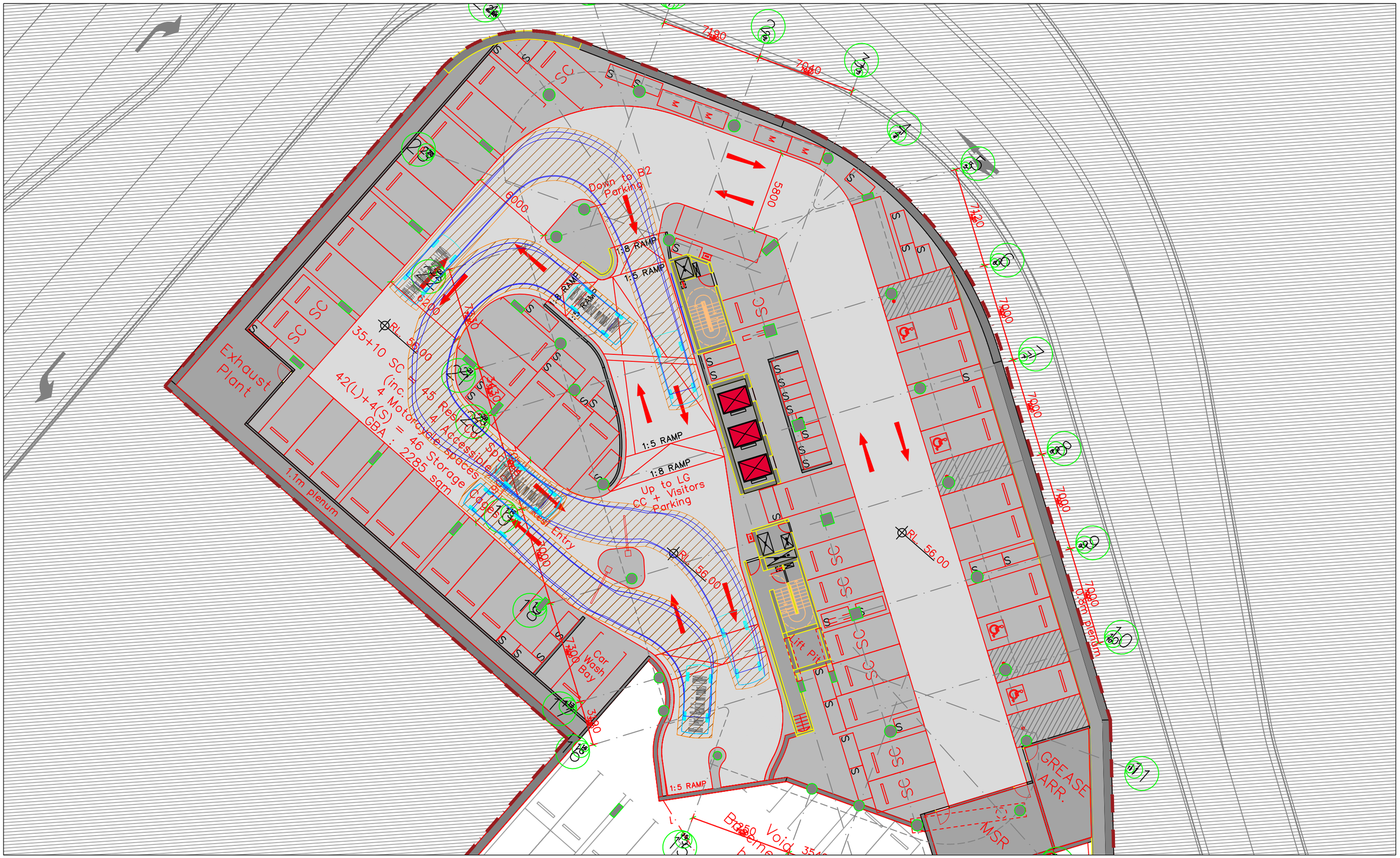

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building A1 Ivanhoe

Drawing Title: Carpar□Layout

Date: 06:03:2018

Scale @ A3: 1:250

Drawing Number: 03

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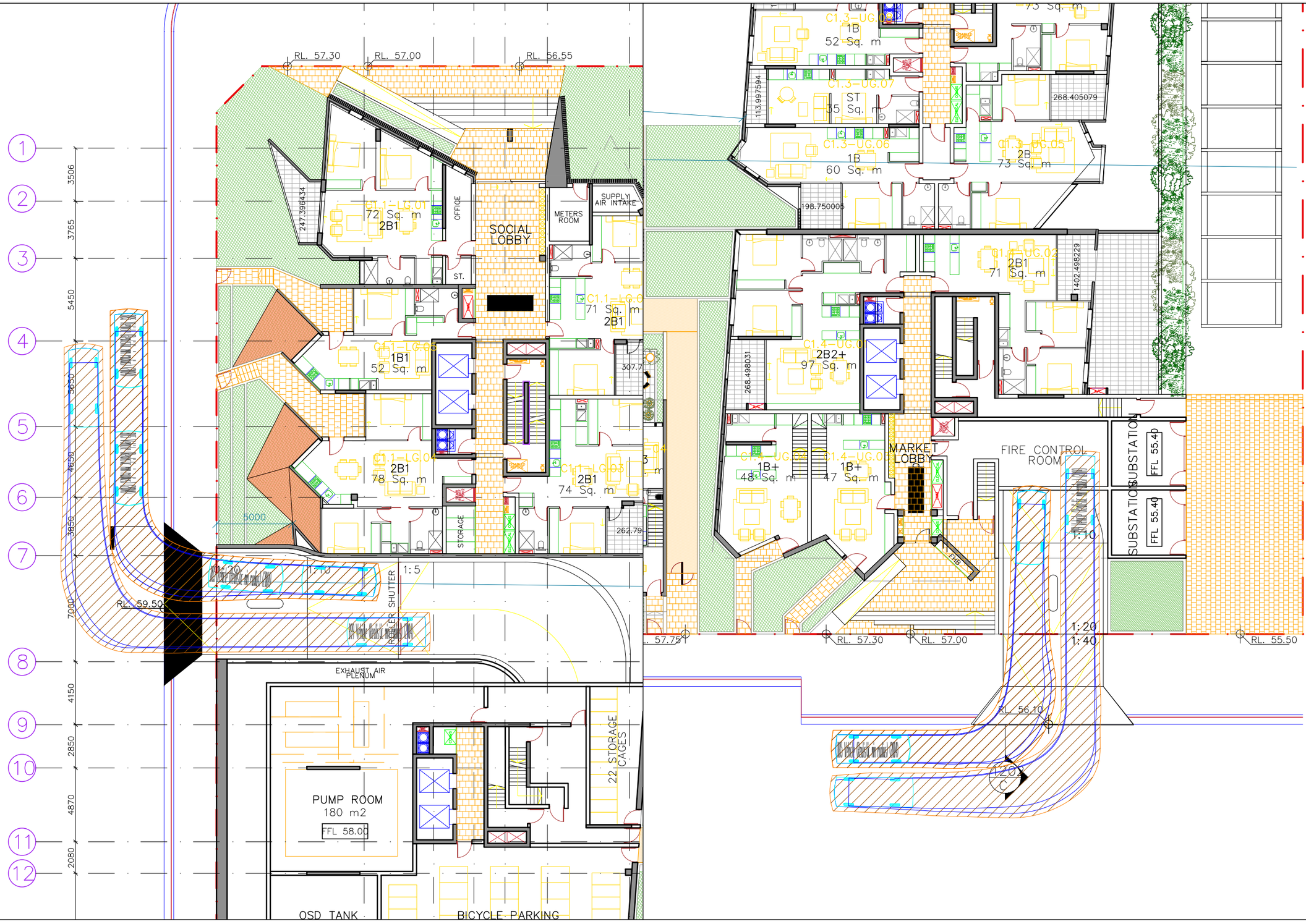

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building C1 Ivanhoe

Drawing Title: Car Access

Date: 06:03:2018

Scale @ A3: 1:250

Drawing Number: 04

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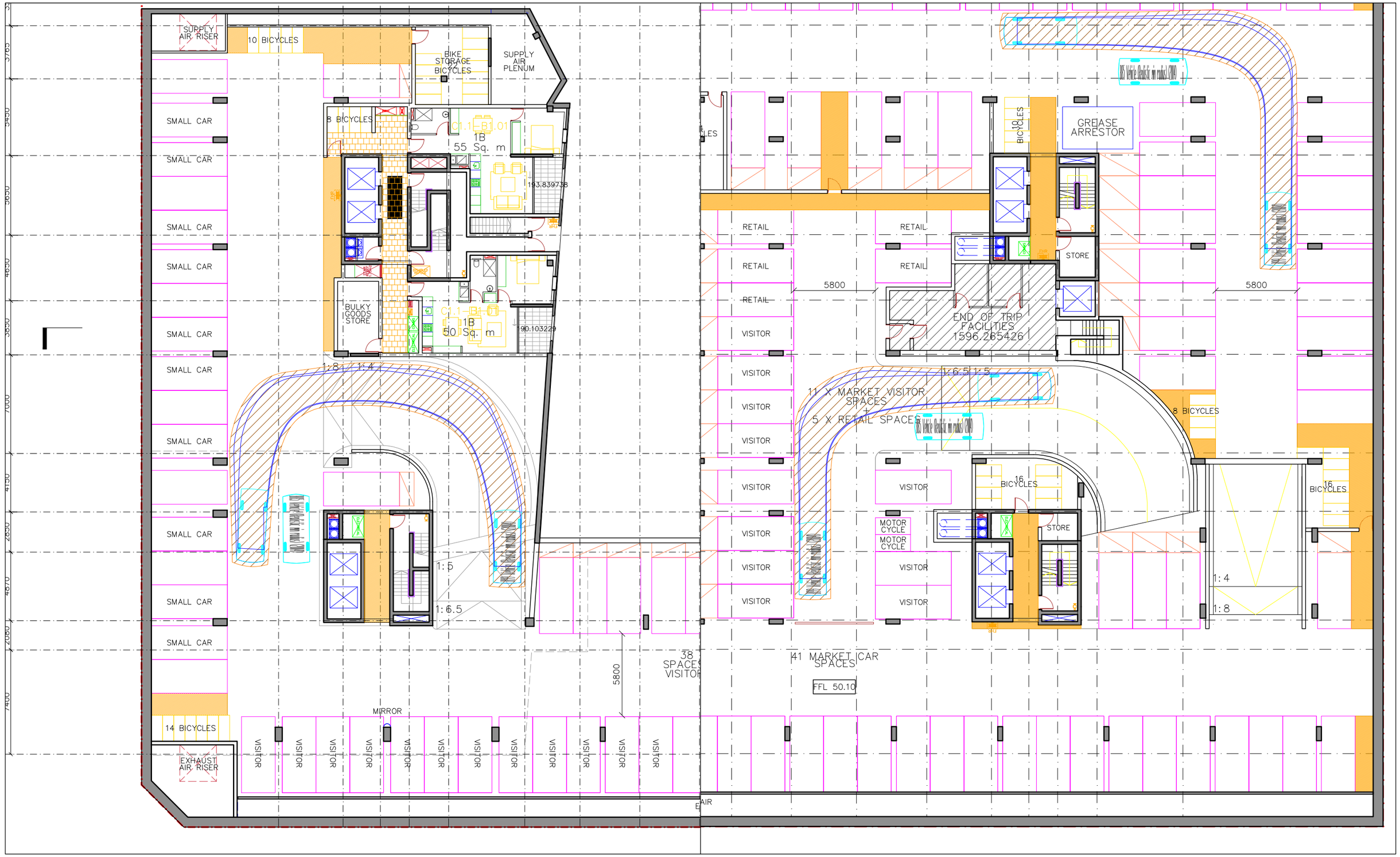

Revision notes:

Rev:	Date:	Notes:

For information purposes only - not for construction

Drawn By: VC

Client: Frasers Property

Project: AG0555 Building C1 Ivanhoe

Drawing Title: Carpar□Layout

Date: 06:03:2018

Scale @ A3: 1:250

Drawing Number: 05

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