



46-66 & 46A O'Connell St, Caddens
Concept Plan DA
Transport Impact Assessment

Prepared for:
CWG Development Pty Ltd
24/01/2017

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1 Introduction

This report has been prepared for CWG Development Pty Ltd (CWG) to present the findings of a traffic study for a proposed residential / mixed use subdivision at 46-66 & 46A O'Connell Street, Caddens within the local government area of Penrith City Council.

The proposed CWG development site (the Site) is located within the Werrington Enterprise Living and Learning (WELL) Precinct adjacent to the Western Sydney University and NSW TAFE sites.

The development proposal for the Site includes the following land uses:

- Commercial: 2,000 m2 GFA
- Specialty / Convenience Retail: 1,000 m2 GFA
- Residential Dwellings:
 - 400 x Apartments
 - 320 x Townhouses (70 with secondary dwellings ie. garage top studio / 1 bedroom)

The Site forms part of two sub-precincts of the WELL Precinct; namely:

- Precinct Centre; and
- South Werrington Private Lands

The future development of Werrington (including the Site) has been recognised by the NSW Government and Penrith City Council which lead to the development of the WELL Precinct which sets out the objectives, guiding development principles and funding strategies for infrastructure improvements.

The WELL Precinct was informed by a number of studies, including the WELL Precinct TMAP (2007) ¹. This study has set out the relative transport impacts of the WELL Precinct development potential, the required infrastructure improvements and funding apportionments via the WELL Precinct Section 94 Plan.

This report examines external traffic implications of the proposed subdivision. In doing so it takes into account the cumulative impacts from other known developments as envisaged by the WELL Precinct TMAP along with modifications to the development yields within the Caddens Release Area to the south of the Site.

¹ Transport Management and Accessibility Plan for Werrington Enterprise Living and Learning Precinct, Maunsell / AECOM, May 2007 (WELL Precinct.)

This report is set out as follows:

- Chapter 2 discusses the Site location and the strategic planning context for the Site.
- Chapter 3 describes the existing traffic conditions surrounding the site and presents results of 2016 traffic surveys.
- Chapter 4 provides an overview of the proposed development for the Site and findings of the transport assessment of the proposal both external and internal to the Site.
- Chapter 5 presents the assessment's conclusions and recommendations

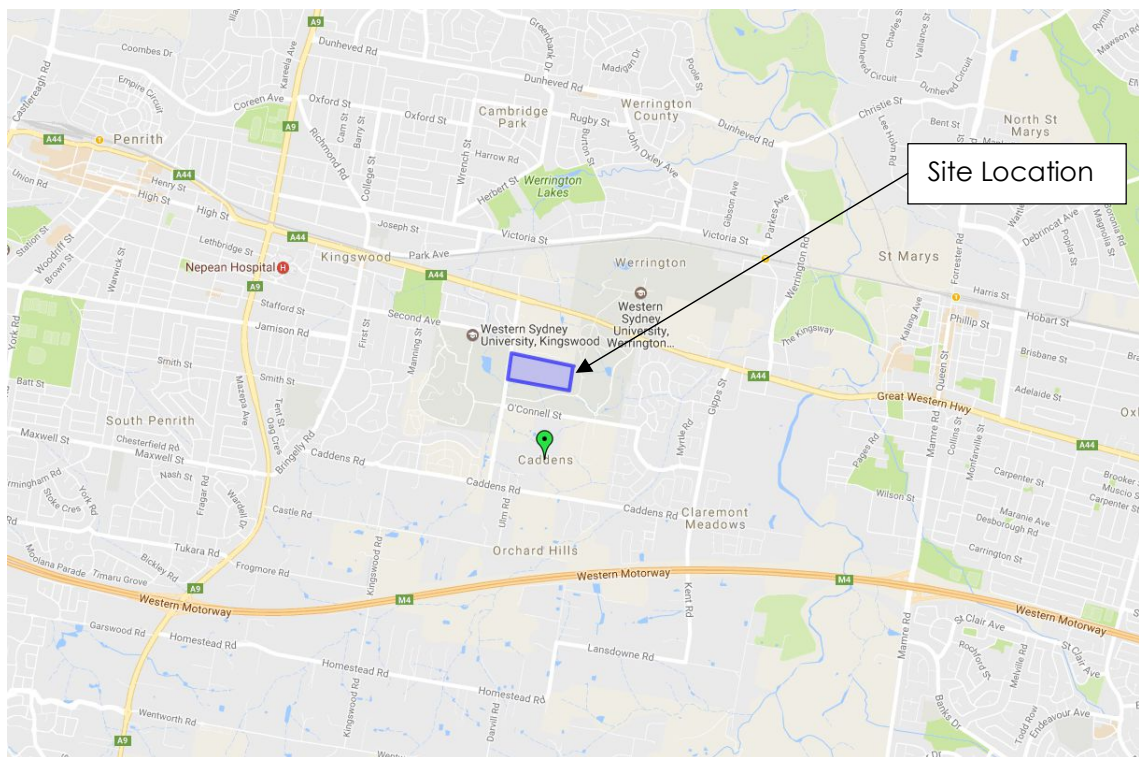
2 Background

2.1 Site Location

As shown in Figure 2.1, the Site is located on the eastern side of O'Connell Street to the south of the Great Western Highway and north of the Western Motorway.

The T1 North Shore, Northern and Western Railway Line runs east – west to the north of the site with the stations at Kingswood (1.8km) and Werrington (2.3km) the closest to the Site.

Figure 2.1: CWG Site Location – Regional Context



Source: Google Maps (2016)

As shown in Figure 2.2, the Site is located adjacent Western Sydney University land on the eastern, southern and western sides and the Nepean College (TAFE) to the north. The Caddens residential lands are located to the south of the Site.

2.2 Strategic Planning for Caddens and Surrounds

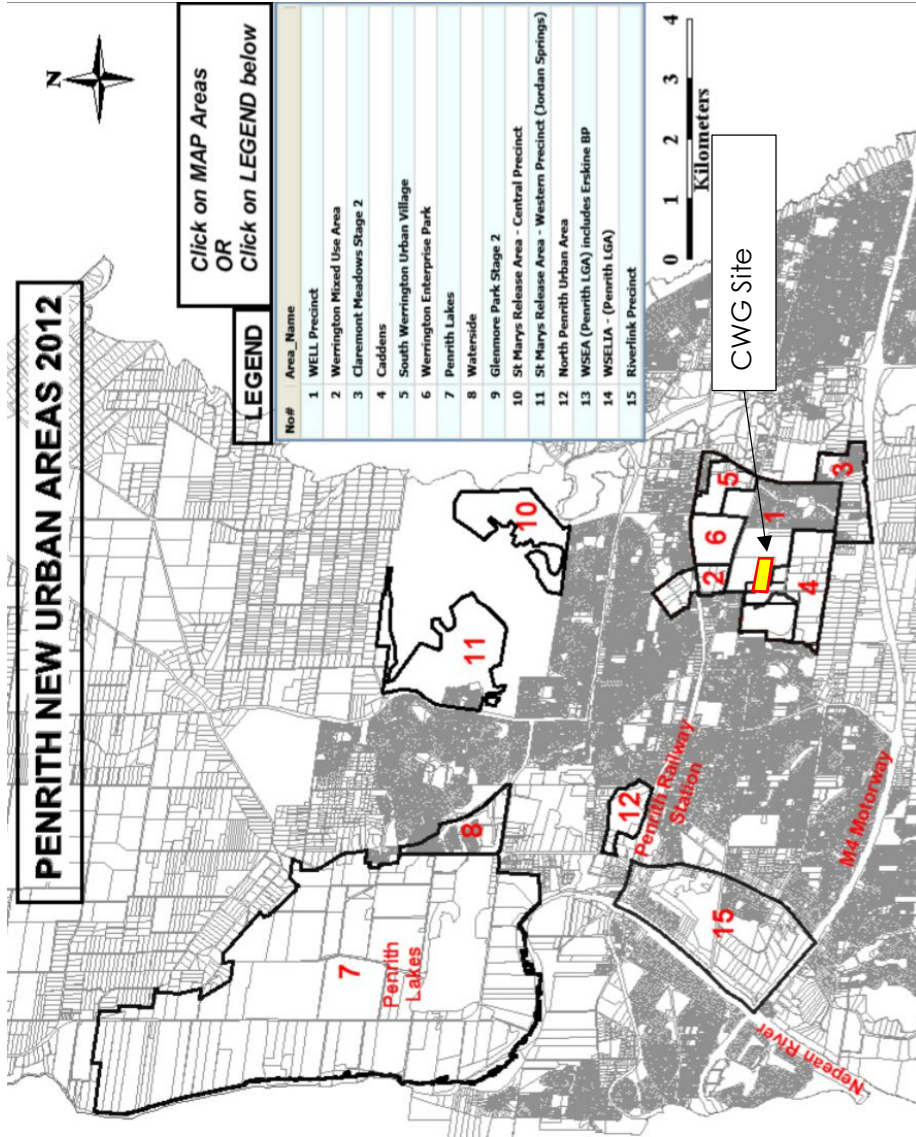
The Site and surrounding lands have been identified for urban redevelopment. Figure 2.3 shows the new urban areas as identified by Penrith City Council. As illustrated by Figure 2.3 the Site is centrally located within the WELLS Precinct.

Figure 2.2: CWG Site Location – Local Context



Source: nearmaps.com.au (2016)

Figure 2.3: Penrith New Urban Areas (2012)



Source: Penrith City Council
(<https://www.penrithcity.nsw.gov.au/Resources-and-Documents/Documents/Strategic-Planning/>)

2.2.1 WELL Precinct

The urban development of the CWG Site has been planned as an open edged estate within the WELL Precinct over a decade. The WELL Precinct Strategy (2004) identified the following key objectives for the planning of the Precinct:

- Seeking the creation of quality working, living and learning environments, delivering a viable, vital community, energised by the interactions and synergies of adjacent education, living and employment opportunities.
- Incorporating principles of sustainability into the Precinct Strategy, and incorporating principles of sustainability into the planning and design of the Precinct's built elements.
- Encouraging the development of innovative housing to support the needs of the facilities and the local community, add to the viability of public transport systems, and contribute to the vibrancy and safety of the area.
- Ensuring high quality public transport access to these facilities and the surrounding areas, aimed at reducing growth in car use.
- Identification and establishment of a Precinct Centre conveniently located to optimise synergies between existing and proposed communities, education and enterprise activities. The Centre will provide shopping, entertainment and social services to the surrounding community.

In keeping with the above planning objectives for WELL Precinct, the CWG site is proposed as a local neighbourhood with appropriate density to complement the surrounding existing and future developments within the WELL Precinct including the nearby employment and education nodes such as the Western Sydney University and TAFE campuses. The master plan prepared by Hill Thalys includes a high quality public domain located on blocks fronting on to O'Connell Street with residential dwellings located within an efficient grid pattern to the rear of the public domain area. Other elements of the proposed master plan includes edge-streets which will create the necessary synergy to allow future connection to neighbouring sites. This would enhance the future viable of the local community in the future.

The proposed density of the master plan would create additional patronage to the local public transport system which would further enhance the viability of the public transport system.

Key transport elements of the WELL Precinct Strategy included:

- Caddens Road bypass
- Western Sydney University railway station
- Werrington Arterial Link

- Shuttle bus services
- Pedestrian connectivity.

In relation to the shuttle bus services articulated in the WELL Precinct Strategy, it is envisaged that these bus services would also serve the CWG site with bus stops located on either side of O'Connell Street near the proposed primary access to the CWG site. Further, it is not expected that buses would enter the CGW site. Given the eastern boundary of the CWG site is approximately 530m from O'Connell Street, bus stops located on O'Connell Street would result in a vast majority of residents living and employees working within the site would be located within the 400m catchment of the O'Connell Street bus stops.

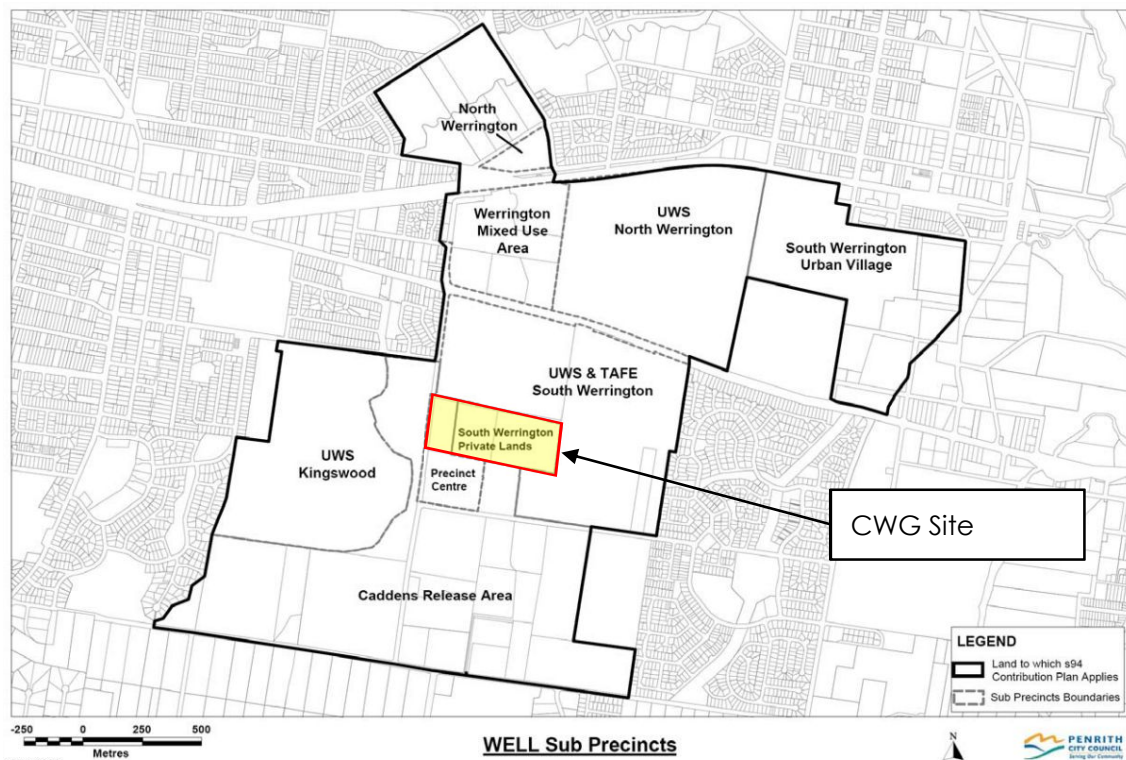
In addition, it would not be operationally efficient to divert bus services from the main roads into a residential estate. Furthermore, the internal roads have not been designed to accommodate large vehicles such as a bus. In this case, it is not appropriate to design the internal roads to accommodate large vehicles as this would result in larger footprint for road intersections. Larger intersections would be conducive to speeding by general traffic which in turn could result in poor amenity on the local residential streets.

It is noted that the project Civil Engineer has recommended that buses not travel within the CWG site.

The WELL Precinct TMAP (2007) set out the transport infrastructure requirements for the WELL Precinct and these were adopted in the WELL Precinct S.94 Development Contributions Plan.

Figure 2.4 shows the extent of land subject to the WELL Precinct S94 Plan along with the sub precincts of the WELL Precinct. As shown in Figure 2.4 the CWG Site is located within the WELL Precinct and thus development on the Site will be the subject of S94 contributions for transport infrastructure as identified by the S94 Plan.

Figure 2.4: WELL PRECINCT - Sub Precincts



Source: Penrith City Council WELL Precinct S.94 Development Contributions Plan 2008.

The WELL Precinct S94 plan has utilised sub precincts as a measure to apportion contributions for works relative to the location and impact of individual sub precincts (local improvements) as well as precinct wide regional improvements.

At Section 3.2.4 of the WELL Precinct S94, the principles for apportionment cited in the strategy include:

- Developers should be required to contribute to the extent necessary to ameliorate the impacts generated by their development; and
- Growth in background levels of demand for facilities and infrastructure should be met by government and not by developers.

The list of transport management improvements included in the Section 94 plan are included in Appendix A.

Thus the transport assessment presented herein considers the traffic and transport implications associated directly with the development proposal, namely site access arrangements and pedestrian / cycle linkages to surrounding sites, noting that the broader regional and local contributions have been planned and funded through the Section 94 Plan mechanism.

2.2.2 DCP Objectives and Controls for Caddens Release Area

The Caddens Release Area is located within the WELL Precinct and is identified in the Penrith Development Control Plan (DCP) 2014 as a "key" precinct. As set out in the DCP, the WELL Precinct vision and objectives apply to development within the Caddens Release Area.

As shown in Figure 2.5, the Caddens Release Area includes the portion the CWG Site which is located within the "Precinct Centre" sub precinct as defined by the WELL Precinct.

Figure 2.5: Caddens Release Area Structure Plan

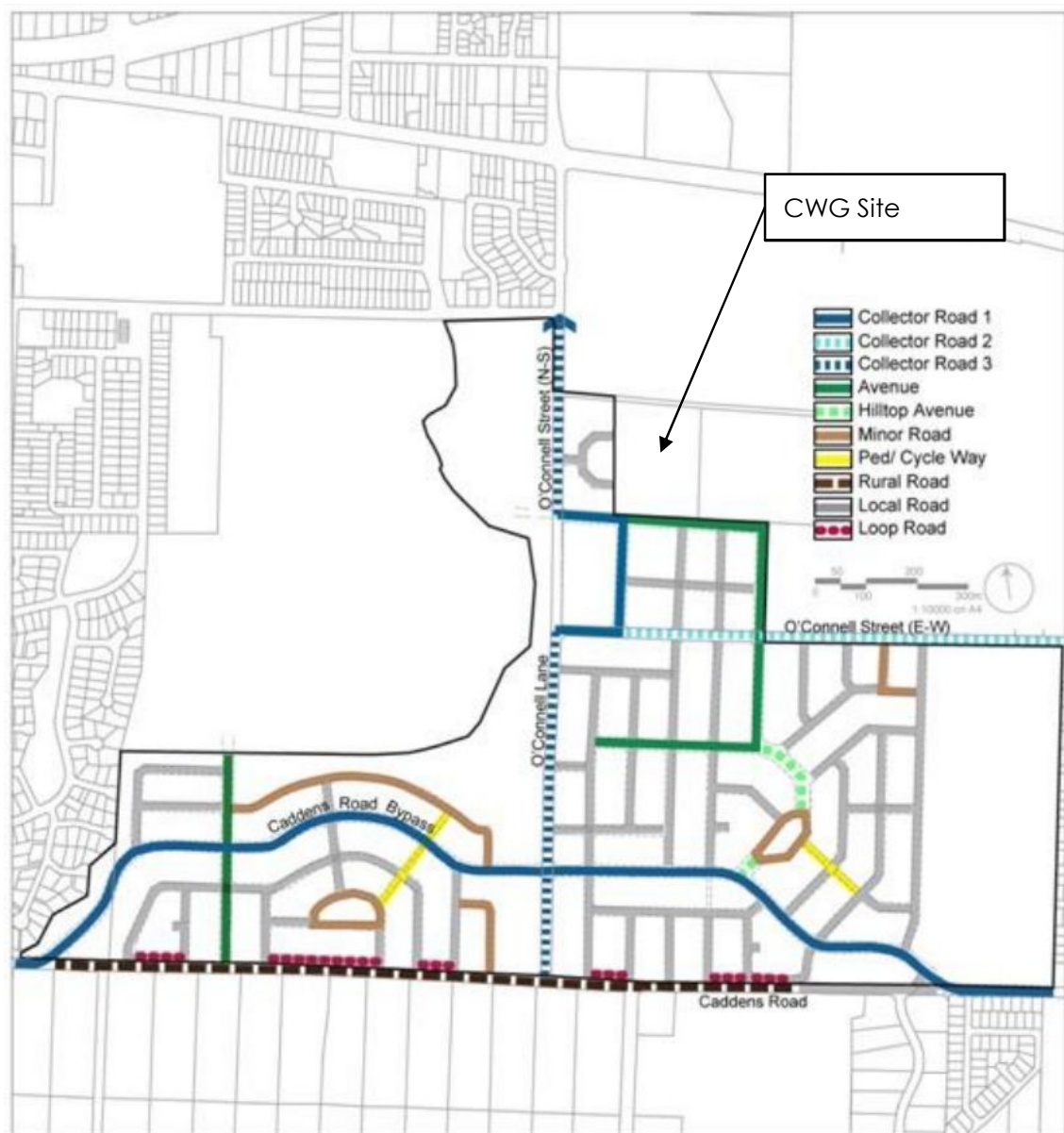


Source: Penrith DCP 2014, (Figure E1.2 – Structure Plan)

The Caddens Release Area Structure Plan and associated development controls are considered to be an important guiding tool not just for the western portion of the Site which is located within the Caddens DCP area but also the eastern portion of the Site such that the entire Site is developed in a co-ordinated manner and integrated with the surrounding lands.

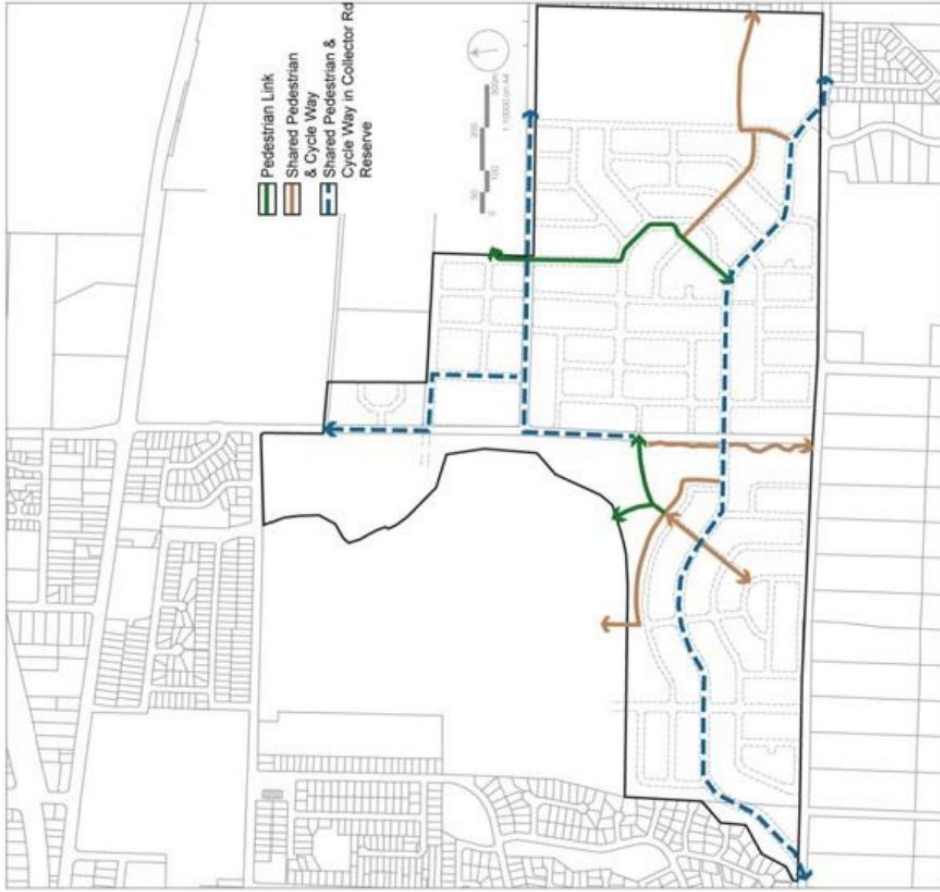
Extracts from the Penrith DCP 2014 showing the design principles for street hierarchy, pedestrian and cycle routes and public transport routes are shown in Figure 2.6 to Figure 2.8.

Figure 2.6: Caddens Road Hierarchy



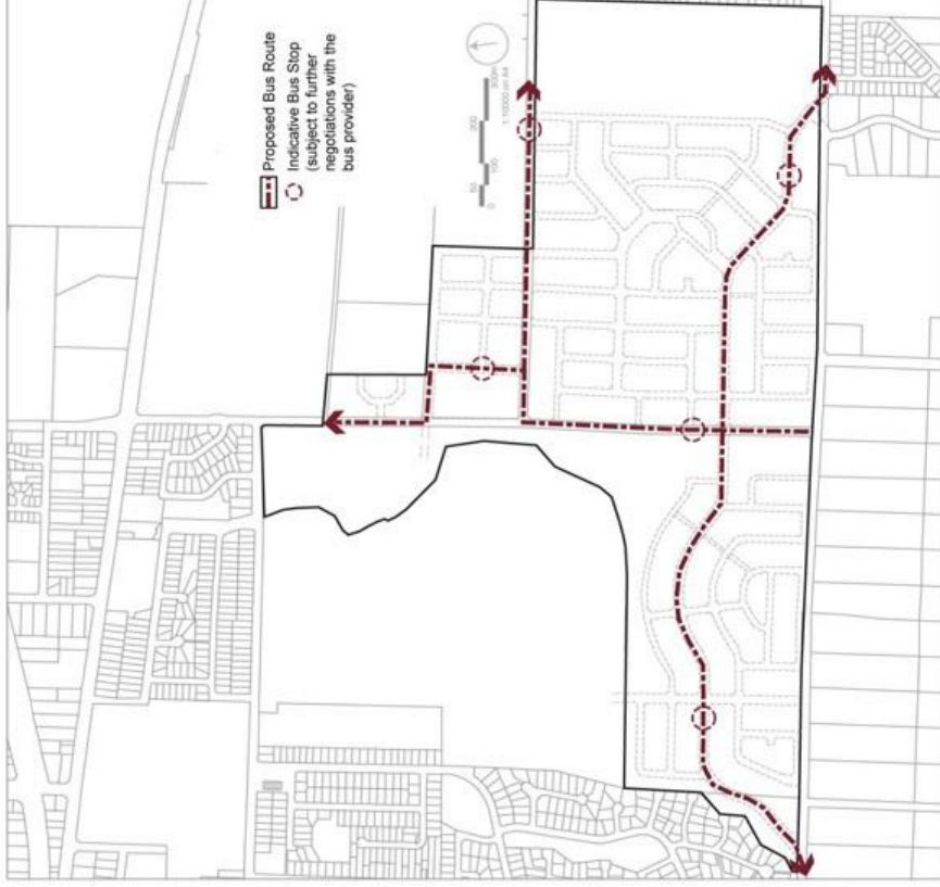
Source: Penrith DCP 2014, (Figure E1.6 – Street Hierarchy)

Figure 2.7: Caddens Pedestrian and Cycle Routes



Source: Penrith DCP 2014, (Figure E1.8 – Pedestrian & Cycle Routes)

Figure 2.8: Caddens Public Transport Network



Source: Penrith DCP 2014, (Figure E1.9 – Public Transport Network)

Key features of the DCP that are relevant to the development concept for the CWG Site include:

- The primary vehicle access to / from the CWG Site is envisaged to be via a new intersection at O'Connell Street mid way along the Site's frontage.
- O'Connell Street, along the Site's frontage is expected to be upgraded to a Collector Road (Collector Road 3 – see below and Section 4 for further discussion).
- A new Collector / Avenue Road is to be constructed along the Site's southern boundary with the Western Sydney University land to service the Precinct town centre. It is envisaged that the intersection of this road and O'Connell Street will be a higher order intersection control than the CWG Site access (see below for further discussion).
- Pedestrian, cycle and public transport routes are envisaged along the Site's western frontage to O'Connell Street and the southern frontage to the new Collector / Avenue road. Thus there are opportunities for development of the CWG site to link to these broader networks and facilitate improved connectivity through the site.

These key features have been considered as part of the development of the CWG Site development concept and are articulated in the master plan design report prepared by Hill Thalys. These are discussed further in Section 4 of this report.

Notwithstanding the above, it is noted that the DCP depicts (see Figure 2.6) O'Connell Street (except for a section north of O'Connell Street) and O'Connell Lane as collector roads (Collector Road 3). The DCP also shows another collector road (Collector Road 1) forming two dog-leg connections to join Collector Road 3. Such road hierarchy would result in poor urban design outcome as traffic would be diverted into future development sites potentially severing what could be a consolidated development site as well as drawing traffic away from the main travel desire line. In addition, the proposed arrangement could potentially result in additional traffic friction and disruption along the collector roads due to additional conflict points from the new alignment.

Separately, vehicle kilometres of travel (VKT) is a key performance indicator for congestion, greenhouse gas emission as well as safety amongst other things. The diversion of traffic would contribute to overall increase to VKT for the wider road network albeit at a very low level, but nevertheless is contrary to many State and Local Governments stated objectives in reducing private vehicle travel in various strategic planning documents relating to environmental sustainability.

In the light of this, it would be more appropriate and intuitive for Collector Road 1 to continue in a direct north-south alignment along O'Connell Street/O'Connell Lane.

The DCP also depicts a new Collector Road/Avenue Road along the southern boundary of the CWG site. The DCP also indicates that this road would be located

within the adjacent Western Sydney University site. Notwithstanding this, the master planning of the CWG site envisages an open edged estate providing ample opportunities to connect with neighbouring sites. This is consistent with various overarching planning objectives for the WELL Precinct, in particular Penrith Council's vision for the overall WELL Precinct of "*viable, vital community, energised by the interactions and synergies of adjacent education, living and employment opportunities*".

However, the creation of a new Collector Road/Avenue Road (whether within Western Sydney University site or not) could potentially destroy the potential connectives to adjacent sites proposed by the master plan for the CWG site. This is due to the existing topography constraint within the site which is generally steep, in particularly in the vicinity of the south western corner of the CWG site. Intersections formed along this new road within north-south roads from the CWG site and the Western Sydney University site could have vertical grades exceeding road design standard stipulated in Penrith City Council Design Specification. It is further noted that there is significant difference in levels between the CWG site and the Western Sydney University site.

In addition, any proposed Collector Road/Avenue Road along the southern boundary of the CWG site is to be cognisant of the remnant Cumberland Plain Woodland (CPW) located near the centre of the southern boundary of the CWG site. The CPW on the CWG site is listed as a Critically Endangered Ecological Community (CEEC) within the NSW TSC Act (1995). In addition, Penrith Council has articulated the importance of preserving the existing CPW vegetation on the site. Following meetings with Penrith Council, a Vegetation Management Plan has been formulated with the objective of retaining, regenerating and protecting a significant part of the remnant CPW. The ecologist on the project Travers Ecology has recommended the retention of 90 per cent of the CPW.

A new Collector Road/Avenue Road within the CWG site along the southern boundary of the site would have adverse impacts and result in significant loss of the remnant CPW. As such, it is not feasible to provide such a road along the southern boundary of the site.

3 Existing Transport Context

3.1 Existing Road Network

The road network surrounding the Site is shown in Figure 2.1. The Western Motorway and Great Western Highway together with the Northern Road, and Mamre Road form the arterial road network in the vicinity of the Site.

In addition to the above, the Werrington Arterial is currently under construction along the Gipps Street alignment. When completed will form another arterial north south road connection between the Great Western Highway and the Western Motorway.

The Werrington Arterial was a key transport facility included in the WELL Precinct Strategy.

Bringelly Road, Werrington Road, O'Connell Street, Second Avenue and Caddens Road form the Local Collector roads in the area.

O'Connell Street south of the Great Western Highway and is a two way two lane road (one travel lane in each direction). To the north of the Site, O'Connell Street has a posted speed limit of 50km/hr where the road travels through existing established urban frontages. South of the Site, the speed limit increases to 60km/hr and reflects the existing more rural type frontages.

The width of sealed road shoulders along the north south section of O'Connell Street vary. On street parking along O'Connell Street is generally permitted although is typically only utilised at the northern end adjacent to the TAFE and residential developments.

3.2 Existing (2016) Peak Hour Traffic Flows

TTPP commissioned intersection peak period turning movement counts at the following intersections within the vicinity of the Site:

- O'Connell Street (N-S) / Second Avenue;
- O'Connell Street (N-S) / O'Connell Street (E-W) / WSU Site Access; and
- O'Connell Street (N/S) / Caddens Road.

These surveys were undertaken on 20th and 21st October 2016.

A summary of the peak period two way flows along O'Connell Street are summarised in Table 3.1 and Table 3.2. Detailed traffic flow diagrams are provided in Appendix B.

Table 3.1: Surveyed (2016) O'Connell Street Traffic Flows (vehicles / hr) - AM Peak

O'Connell Street	Northbound or Eastbound	Southbound or Westbound	Total
Between GWH – Second Ave	308	523	831
Between Second Ave – O'Connell Street EW (Site Frontage)	271	235	506
Between O'Connell Street EW – Caddens Rd	315	116	431
East of O'Connell St NS	135	163	298

Source: TPP Surveys (October 2016)

Table 3.2: Surveyed (2016) O'Connell Street Traffic Flows (vehicles / hr) - PM Peak

O'Connell Street	Northbound or Eastbound	Southbound or Westbound	Total
Between GWH – Second Ave	376	370	746
Between Second Ave – O'Connell Street EW (Site Frontage)	192	236	428
Between O'Connell Street EW – Caddens Rd	87	236	323
East of O'Connell St NS	159	161	320

Source: TPP Surveys (October 2016)

The summary traffic flows presented in the above tables indicates that O'Connell Street carries significantly higher peak period flows at the northern end compared to the southern end in the vicinity of the Site. This is a reflection of the activation of land along the northern section of O'Connell Street compared to the existing conditions to the south.

Notwithstanding the above, the surveyed traffic flows at the northern end of O'Connell Street are typical of a Local Collector Road function which it performs in the road network. The lower flows along the southern section indicates that the southern section is underutilised relative to its function as a Local Collector Road and has spare capacity to accommodate additional traffic flows.

3.3 Existing Intersection Operation

The existing operation of the nearby intersections to the Site have been assessed using SIDRA Intersection 7, a computer based modelling package which assesses intersection performance under prevailing traffic conditions.

SIDRA calculates intersection performance measures such as 'average delay' that vehicles encounter and the level of service (LoS). SIDRA provides analysis of the operating conditions which can be compared to the performance criteria set out in Table 3.3.

Table 3.3: Level of Service Criteria for Intersection Operation

Level of Service	Average Delay (seconds per vehicle)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 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.	at capacity, requires other control mode
F	Greater than 71	unsatisfactory with excessive queuing	unsatisfactory with excessive queuing; requires other control mode

Source: RMS Guide to Traffic Generating Developments, 2002

The results of the SIDRA intersection analysis are presented in Table 3.4. The results indicate that the nearby intersections on the local road network operate satisfactorily with minimum delays and significant spare capacity.

Table 3.4: Existing (2016) Intersection Operation

Intersection	Intersection Control	AM Peak Hr		PM Peak Hr	
		Ave. Delay (sec/veh)	Level of Service	Ave. Delay (sec/veh)	Level of Service
O'Connell St / Second Ave	Roundabout	8	A	8	A
O'Connell St ns / O'Connell St EW / WSU access	Priority	8	A	8	A
O'Connell Street / Caddens Rd	Priority	6	A	6	A

Source: SIDRA based on TTPP Surveys (October 2016)

3.4 Existing Public Transport Services

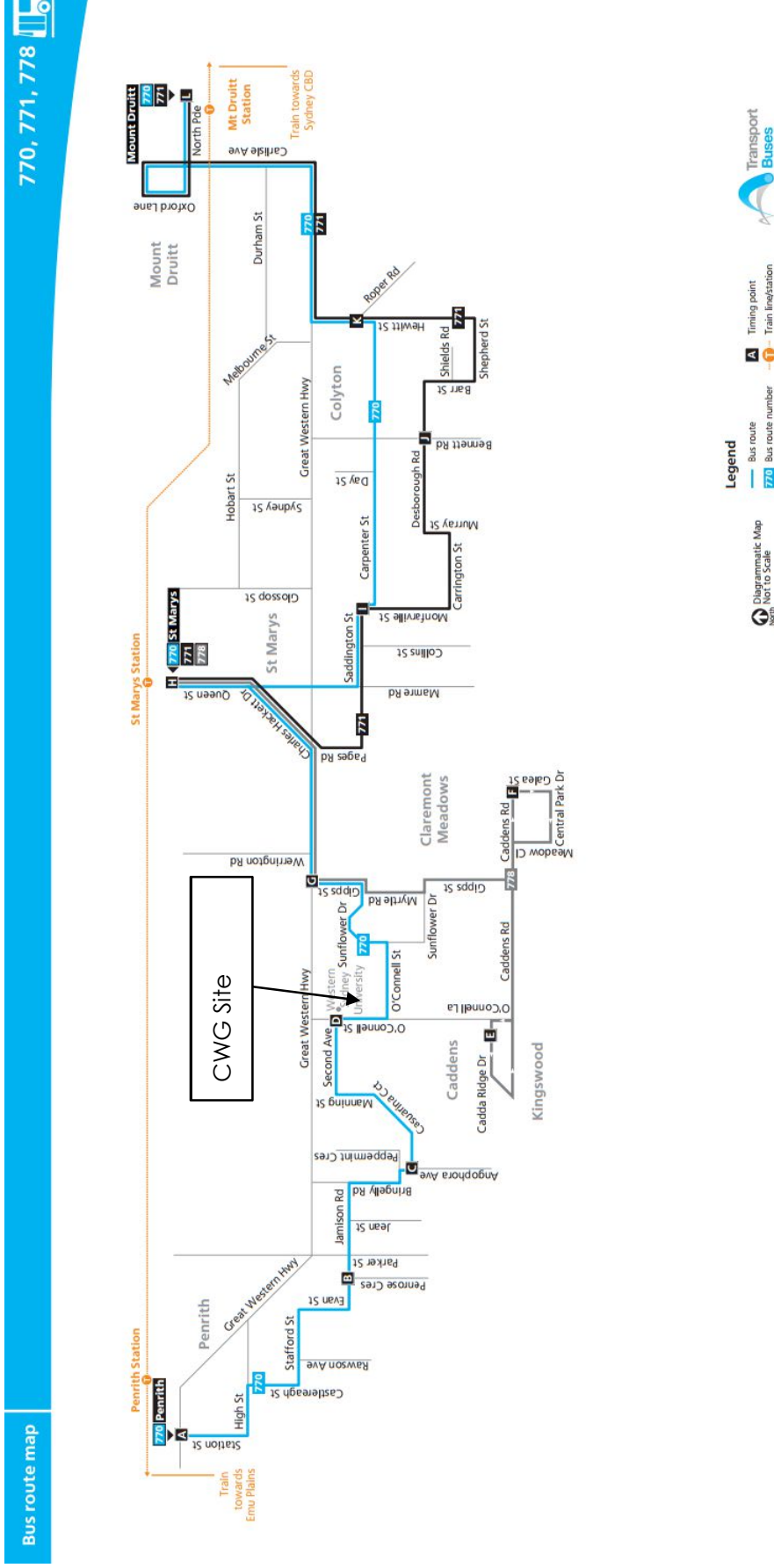
The site is currently serviced by Busways Route 770 running between Penrith and Mt Druitt railway stations via St Marys railway station.

The route which includes O'Connell Street along the Site's frontage is shown in Figure 3.1. Bus stops are located both north and south of the Site adjacent to TAFE and WSU. Services run every 30 minutes on weekdays and 60 minutes on weekends and public holidays.

Routes 774, 775 and 776 each operate between Penrith and St Marys Station via Second Avenue before dispersing to various different routes. The bus stop at the O'Connell Street / Second Avenue intersection is approximately 250 metres walking distance to Site's proposed access at O'Connell Street. Thus the Site can be considered to be within walking distance of a number of bus stops and services with onward access to railway stations.

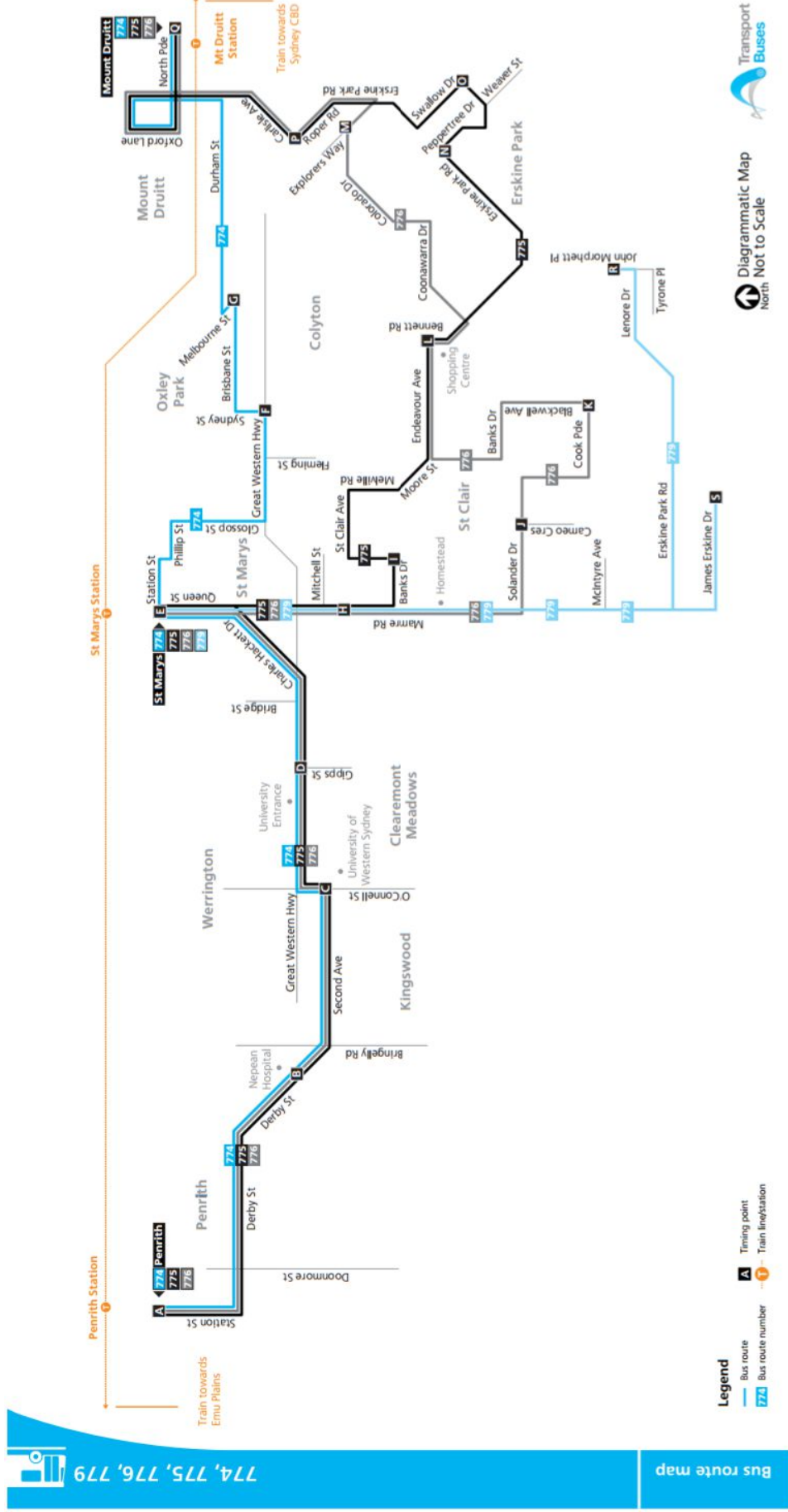
The Western Sydney University also operates shuttle buses travelling from Kingswood station (South side) to Kingswood campus library, Werrington South Campus, Werrington Corporate Park and Werrington North Campus. Services operate approximately every 35 minutes on weekdays.

Figure 3.1: Existing Bus Routes – 770, 771, 778



Source: www.busways.com.au

Figure 3.2: Existing Bus Routes – 744, 775, 776, 779



Source: www.busways.com.au

4 Assessment of Proposed Development

4.1 Overview of Proposed Subdivision Development

A master plan for the proposed subdivision of the CWG site at Caddens has been prepared by Hills Thallis Architects on behalf of CWG. The proposed master plan is shown in Appendix C.

4.1.1 Development Land Uses and Yields

The development proposal for the Site includes the following land uses:

- Commercial: 2,000 m2 GFA
- Specialty / Convenience Retail: 1,000 m2 GFA
- Residential Dwellings:
 - 400 x Apartments
 - 320 x Townhouses
 - 70 x Garage top studios / 1 bedroom apartments as secondary dwellings to townhouses.

In preparing the traffic assessment presented herein, it has been assumed that the retail offering would be in the order of 1,000m2 GFA and including secondary or specialty retail uses such as café, news agents, hair dresses and convenience stores.

It is not envisaged that supermarkets will be provided on site. Retail on the CWG Site is considered to be secondary or supportive of the main Precinct Centre retail envisaged to be located on the WSU site to the south.

Commercial floor space is envisaged to include professional suites such as accounts, lawyers and medical practitioners.

4.1.2 External Road Network Connections

The CWG Site is currently serviced by two vehicle accesses, namely:

- A driveway to the existing dwelling located midway along the Site's frontage to O'Connell Street; and
- An existing private road running along the Site's northern boundary with an intersection (unformed) at the Site's northern most frontage to O'Connell Street.

The proposed vehicle Site accesses at O'Connell Street are to be located generally at the same locations as the existing Site accesses as shown in Figure 2.5. The proposed vehicle site accesses are also articulated in the master plan prepared by Hill Thalís – see Figure 4.1 below.

Figure 4.1: Master Plan Vehicle Access Locations



Source: Hill Thalís

It is proposed that to support the traffic generation potential of the Site (see Section 4.2) that the primary access at the centre of the Site's frontage to O'Connell Street will be a priority controlled 3 way intersection permitting all turning movements.

The design of the proposed primary intersection would be similar to other site access road intersecting with a local collector along O'Connell Street.

Figure 4.2: Example of Primary Site Access Intersection (O'Connell St / Algie St)



Source: www.nearmap.com.au

A secondary access is also proposed to be located at the existing “private road” intersection at O’Connell Street at the northern end of the Site’s frontage to O’Connell Street. It is proposed that this access be restricted to left in / left out movements such that the right turn in movements from O’Connell Street can be limited to a single location and thus minimise the potential disruption to through traffic flows.

As a left in / left out intersection there would be no demand for right turn provisions at the intersection (ie. No need for widening the existing northbound road shoulder on O'Connell Street to allow vehicles to pass right turning movements.

These site access intersection configurations have been modelled using SIDRA to determine intersection capacity and level of service for future development scenarios.

4.1.3 Internal Road Network

The internal Site road network as shown in the Master Plan in Appendix C, has been set out to a grid style network with north-south and east-west roads running through the site. In developing the master plan as it relates to road and transport design, the following design principles have been applied (extracted from the Urban Design Report prepared by Hill Thalix:

- Streets and lanes - a legible network of social spaces for walking, cycling, visitor carparking and servicing, providing address for all future residents and visitors
 - Establishes a highly connective public realm that aligns with and highlights the significant features of the site
 - Provides edge-streets to allow future connection to neighbouring proposals, integrating with and contributing to the wider region
 - Retains the established Cumberland Plain Woodland through the establishment of a central park
 - Creates open vistas at the ends of all streets to connect to the broader locality and provide spatial release via long views, particularly to the Blue Mountains
 - New streets are calibrated by their width and arrangement e.g. North-south streets reveal the rolling topography and are generous in their reservation to allow significant landscape links across the site
 - New streets are given character and identity through landscape and significant tree plantings, choosing robust native species where possible and coordinating deciduous species on east-west streets to balance summer shade with winter sun penetration
 - New streets integrate Water Sensitive Urban Design to cleanse and detain runoff in an explicit and urban manner
- Transport - creating a connective city
 - Creates a slow speed street environment that allows easy and safe pedestrian and cycle movements
 - Provides a street network that is legible and provides options for connections to future public transport, including potential bus routes through the site.

It is noted that the internal road network includes roads on the northern, eastern and part of the southern boundary and would enable connections to future development on adjacent sites should it occur.

The east-west internal roads are designed as one way pairs which will facilitate vehicle circulation while minimising conflict points within the network. Furthermore the one way circulation will encourage the use of the primary vehicle access at O'Connell Street.

North – south roads are designed as two way roads such that they can facilitate potential road connections to adjacent sites.

The internal road layout has been designed to accommodate Council's waste and recycling collection vehicles. The north – south roads have been designed with straight alignments such that they could accommodate local bus services should it be desirable to provide a service through this and adjacent sites.

4.2 Future Traffic Generation

4.2.1 Future Traffic Scenarios

In estimating future traffic conditions on the surrounding road network it is recognised that the CWG Site will be developed along with other sites within the WELL Precinct.

Thus to assess the future traffic implications of the CWG Site, an assessment of the following future traffic scenarios has been undertaken:

- Existing Traffic (Existing Base Case) – existing traffic as per 2016 surveys
- Future Base Case – existing 2016 surveys + WELLS Precinct and Caddens (excluding the CWG Site)
- Future with Proposed CWG Site development (future base case + proposed development site traffic)

The Future Base Case traffic conditions have been based traffic flow scenarios as presented and assessed in the following documents:

- WELL Precinct TMAP (Maunsell / AECOM 2007);
- Caddens Release Area TMAP (MWT, 2008); and
- Caddens Knoll DA Traffic Assessment (Halcrow, 2012).

As such, the traffic assessment presented in this report, considers the cumulative traffic conditions associated with the envisaged development within the WELLS Precinct and specifically the Caddens Release area.

It is noted that some development within the Caddens Release area has occurred with a portion of residential dwellings currently occupied. An allowance for occupied residential dwellings in Caddens has been accounted for based on existing traffic surveys such that traffic from Caddens is not double counted.

Furthermore, it is noted that there is potential for development of other sites, including the adjacent Western Sydney University (WSU) and TAFE site. Details of any such developments are unknown to TTPP and thus the traffic assessment presented herein has assumed development levels of WSU and TAFE in accordance with the expectations set out in the WELLS Precinct planning and site design as set out in the Penrith DCP (2014).

4.2.2 Proposed CWG Development Traffic Generation Potential

The traffic generation potential for the CWG Site at Caddens has been based upon previous traffic modelling assumptions undertaken for the WELLS Precinct (and Caddens Release Area) and recent RMS traffic generation guidelines.

The application of these rates to the proposed development yields is provided in Table 4.1. The distribution of the estimated site generated traffic flows and future traffic scenarios are shown in Appendix B.

Table 4.1: CWG Site Development – Potential Traffic Generation (vehicles / peak hour)

Land Use	Size	Trip Rate		Trip Generation	
		AM Peak	PM Peak	AM Peak	PM Peak
Townhouse	320 units	0.5 trips per unit	0.5 trips per unit	1.60 trips	1.60 trips
Townhouse + Garage Top	70 units	0.65 trips per unit	0.65 trips per unit	45.5 trips	45.5 trips
Apartments	200 units	0.4 trips per unit	0.4 trips per unit	80 trips	80 trips
	200 units	0.5 trips per unit	0.5 trips per unit	100 trips	100 trips
Commercial	2,000m ²	1.6 trips per 100m	1.2 trips per 100m	32 trips	24 trips
Speciality Retail	1,000m ²	1.15 trips per 100m	4.6 trips per 100m	5.75 trips	23 trips
Total Trips				424 trips	433 trips

Distribution	AM Rate		PM Rate	AM Traffic		PM Traffic	
	In	Out		In	Out	In	Out
Townhouse				32 trips	128 trips	128 trips	32 trips
Garage Top	20%	80%	80%	9.1 trips	36.4 trips	36.4 trips	9.1 trips
Apartments				36 trips	144 trips	144 trips	36 trips
Commercial	80%	20%	20%	25.6 trips	6.4 trips	6.4 trips	19.2 trips
Speciality Retail	50%	50%	50%	2.875 trips	2.875 trips	11.5 trips	11.5 trips
Total Distribution				106 trips	318 trips	325 trips	108 trips

The two way traffic flows for O'Connell Street for each of the assessed traffic scenarios is presented in Table 4.2. This table indicates that traffic flows are expected to increase with non-CWG site development and again with additional traffic flows from the CWG Site.

Table 4.2 assumes that non-CWG Site development (and thus traffic generation) would occur as envisaged by the WELL Precinct and Section 94 Plan prior to the development of the CWG Site.

Table 4.2: O'Connell Street Two Way Traffic Flows (veh / hr)

	AM Peak Hour Veh/Hr (% Heavy Vehicle)	PM Peak Hour Veh/Hr (% Heavy Vehicle)
Existing (surveyed) Flows 2016	545	481
Future Base (Existing + background growth (2026))	725	768
Future Base + CWG Development (2026)	986	1,036

4.3 Regional Transport Implications of Development

As outlined in Section 2.2 of this report, the CWG site is located within the WELL Precinct and as such future development of the site is expected to occur and planned for.

While the local traffic impacts and site specific arrangements need to be addressed and funded by individual developments, the regional transport implications of development have been assessed as part of the WELL Precinct TMAP.

Furthermore the funding arrangements for regional transport improvements have been established as part of the WELL Precinct Section 94 Plan for which development of the CWG site will be required to make a contribution.

4.4 Site Access Arrangements

Site inspections were undertaken by TTPP to determine the appropriateness of the proposed Site access locations with regard to road geometry characteristics.

The inspections determined that the available sight distances at both the primary access and secondary access intersection at O'Connell Street would be able to satisfactorily meet Australian Standard (AS2890.1) requirements for site access roads.

The provision of satisfactory sight distances is an important geometric design consideration to ensure intersections operate safely and efficiently.

The operation of the proposed primary and secondary site access intersections with O'Connell Street have been assessed using SIDRA. The Site development traffic generation has been added to the existing surveyed traffic flows and the future background flows and assessed to determine if the proposed arrangements will satisfactorily accommodate the expected future traffic demands of the site and the surrounding road network.

The results of the analysis are presented in Table 4.3.

Table 4.3: Site Access Intersection Operation (Ultimate Development Scenario) With CWG Site Traffic Generation

Intersection	AM Peak		PM Peak	
	Average Delay (sec)	LoS	Average Delay (sec)	LoS
O'Connell St / Primary Site Access	21	B	18	B
O'Connell St / Secondary Access	7	A	7	A

The analysis indicates that the proposed Site access intersection arrangements can satisfactorily accommodate WELL Precinct and proposed CWG Site traffic generation.

4.5 Local Road Network Intersection Operation

The operation of the local road intersections has been analysed using SIDRA for the future development scenarios as set out in Section 4.2.1.

These results have been compared with the existing operating conditions. The results of the SIDRA analysis are presented in Table 4.4.

Table 4.4: Intersection Operation for Future Development Scenarios

Intersection	Peak Hour	Existing Base Case		Future 2026 Base Case (plus background traffic only)		Ultimate 2026 Future Case (post-development)	
		Average Delay (sec)	LoS	LoS	Average Delay (sec)	Average Delay (sec)	LoS
O'Connell St / Second Avenue	AM Peak	8	A	9	A	10	A
	PM Peak	8	A	8	A	9	A
O'Connell St / WSU Site Access	AM Peak	8	A	10	A	11	A
	PM Peak	8	A	10	A	13	A
O'Connell St / Caddens Rd	AM Peak	6	A	8	A	8	A
	PM Peak	6	A	10	A	11	A

The results of the SIDRA analysis shown in Table 4.4 indicate that the existing local intersection arrangements along O'Connell Street within the vicinity of the Site will have sufficient spare capacity to adequately accommodate future background and CWG Site development traffic generations with minimum delays and good levels of service.

4.6 Parking Assessment

Table 4.5 provides a summary of the Penrith DCP requirements for off-street car parking provision.

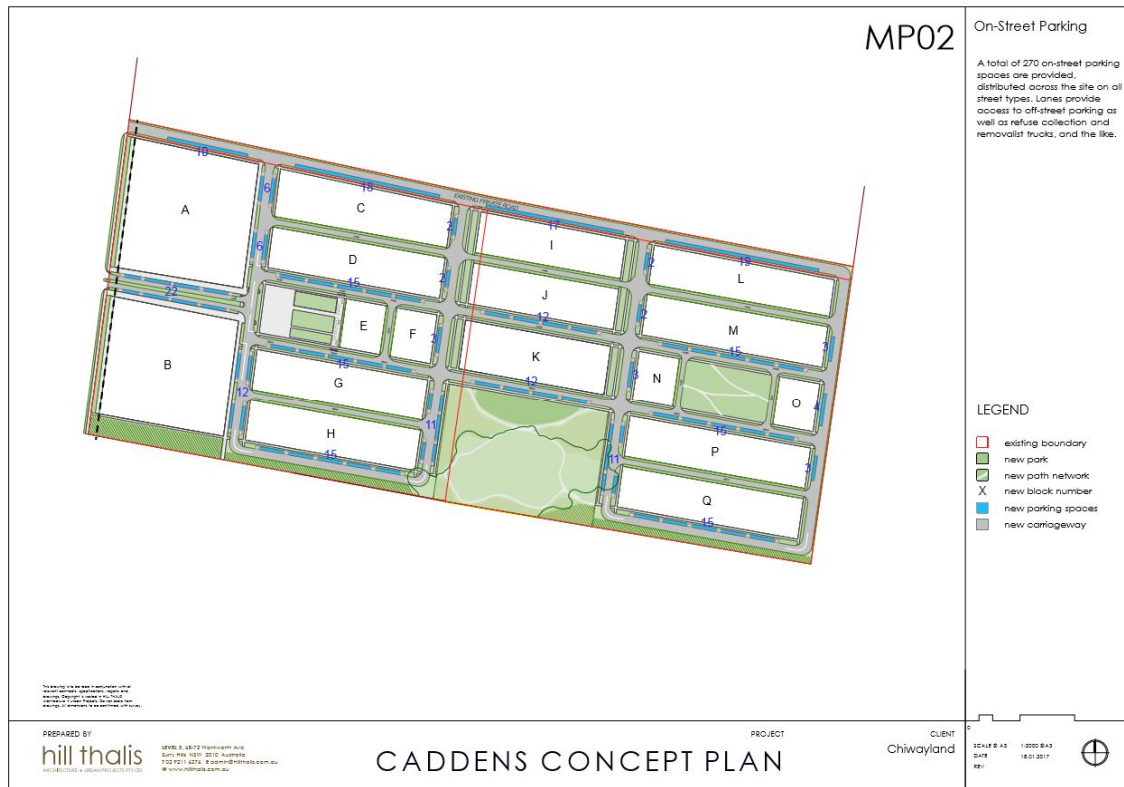
Table 4.5: On-Site Car Parking Requirement

Land Use	Yield	DCP Parking Requirement	Required Parking Provision
Commercial	2,000 m ² GFA	1 space per 40m ² GFA	50
Specialty / Convenience Retail	1,000 m ² GFA	1 space per 30m ² GFA	33
Residential	400 Apartments: Assume 200 x 1-2 bedroom units	1 space per 1 or 2 bedrooms	200
	Assume 200 x 3 or more bedroom units	2 spaces per 3 or more bedrooms	400
		1 space per 40 units for service vehicles	10
		1 space per every 5 dwellings, or part thereof for visitor parking	80
	390 Townhouses: 70 with secondary dwellings ie. garage top studio / 1 bedroom	1 car space per 1 bedroom	70
Assume 62 x 2-bed townhouses	1.5 car spaces per 2 bedrooms or part thereof	93	
Assume 258 x 3-bed or more townhouses	2 car spaces per 3 or more bedrooms	516	
	1 space per every 5 dwellings, or part thereof for visitor parking	78	
Total			1,530

In recognition of various State and Local Government strategic planning policies to reduce travel by private vehicles, it is recommended that suppressed on-site parking be provided for developments located within the CWG site and that the above DCP parking requirement be set as the maximum permissible parking.

While the DCP does not specify on-street parking requirements, it is proposed to provide 270 parking spaces in the road network within the CWG development site as shown in Figure 4.3.

Figure 4.3: Proposed On-Street Parking



4.7 Public Transport Implications

The WELL Precinct TMAP envisaged that additional development within the WELL Precinct would increase the demand for and viability of additional public transport services within the Precinct.

As shown in Figure 2.8, the Penrith DCP 2014 envisages a new or modified bus route to run along O'Connell Street along the CWG site's frontage. This would replicate or be in addition to the existing bus service along O'Connell Street.

The proposed development of the CWG Site would not impact on the existing bus services nor restrict the ability to provide bus services along the site's frontage in the future.

DCP 2014 envisages that a new bus route would utilise the new east west Collector Road along WSU land on the Site's southern boundary. A new bus stop is envisaged to be located within the Precinct Centre again located on the WSU land.

Furthermore the WELL Precinct TMAP and Section 94 Plan identifies a planned WSU railway station which together with regular and shuttle bus services will significantly

increase the attractiveness of public transport modes for travel to and from the WELL Precinct and CWG Site.

In order to potentially facilitate new bus service routes, the north south internal road network within the CWG Site has been designed to accommodate future bus service connections should they be required and / or warranted to facilitate broader Precinct improvements for public transport accessibility.

4.8 Pedestrians and Cyclists

Like public transport connection, DCP 2014 envisages improved bicycle and pedestrian connections along O'Connell Street and into the new Precinct centre located on the adjacent WSU site.

While these links are not within the CWG Site, the internal road network of the site has been developed with consideration of connections to existing and proposed linkages external to the site along with potential through site links.

5 Conclusions and Recommendations

This report has examined the traffic and transport implications of a proposed master plan development application for the CWG Site located at 46-66 & 46A O'Connell Street, Caddens.

The Site is located within the area referred to as the WELL Precinct which is an area recognised by State Government and Penrith City Council for future potential redevelopment as an enterprise, living and learning precinct.

With regard to future regional transport demands and infrastructure requirements, the WELL Precinct TMAP and associated Section 94 Plan sets out the funding mechanisms for developments to deliver future infrastructure. As the CWG Site is part of the WELL Precinct, development to site will represent a proportion of the transport demands and thus be required to contribute to the provision of regional transport infrastructure.

Based on the findings of this assessment the following conclusions have been made:

- The proposed development of the Site will provide a mixture of retail, commercial and residential development.
- Traffic generation of the site is estimated to be in the order of 430 additional peak hour trips to and from the Site to the surrounding road network.
- The provision of two site access intersections at O'Connell Street are sufficient and can be designed to adequately accommodate estimated site traffic generation in a manner which provides acceptable vehicle delays and satisfactory levels of service both for the Site and the surrounding road network.
- The proposed Site access arrangements are consistent with similar intersection treatments and road functionality along O'Connell Street.
- The proposed internal road network and external road connections are consistent with the *Caddens Release Area Structure Plan* and *Caddens Road Hierarchy* as set out in Penrith DCP 2014.
- The proposed Site Master Plan will facilitate the provision of public transport networks (bus), cyclist and pedestrian routes and envisaged in the Penrith DCP 2014.

Overall the proposed development as represented by the Master Plan is considered acceptable with regard to traffic and transport.

Appendix A

WELL Precinct Section 94 Plan Transport Works

4. Part D - Works schedules, maps and references

4.1 Works schedules and maps

WELL Precinct Transport Management Facilities

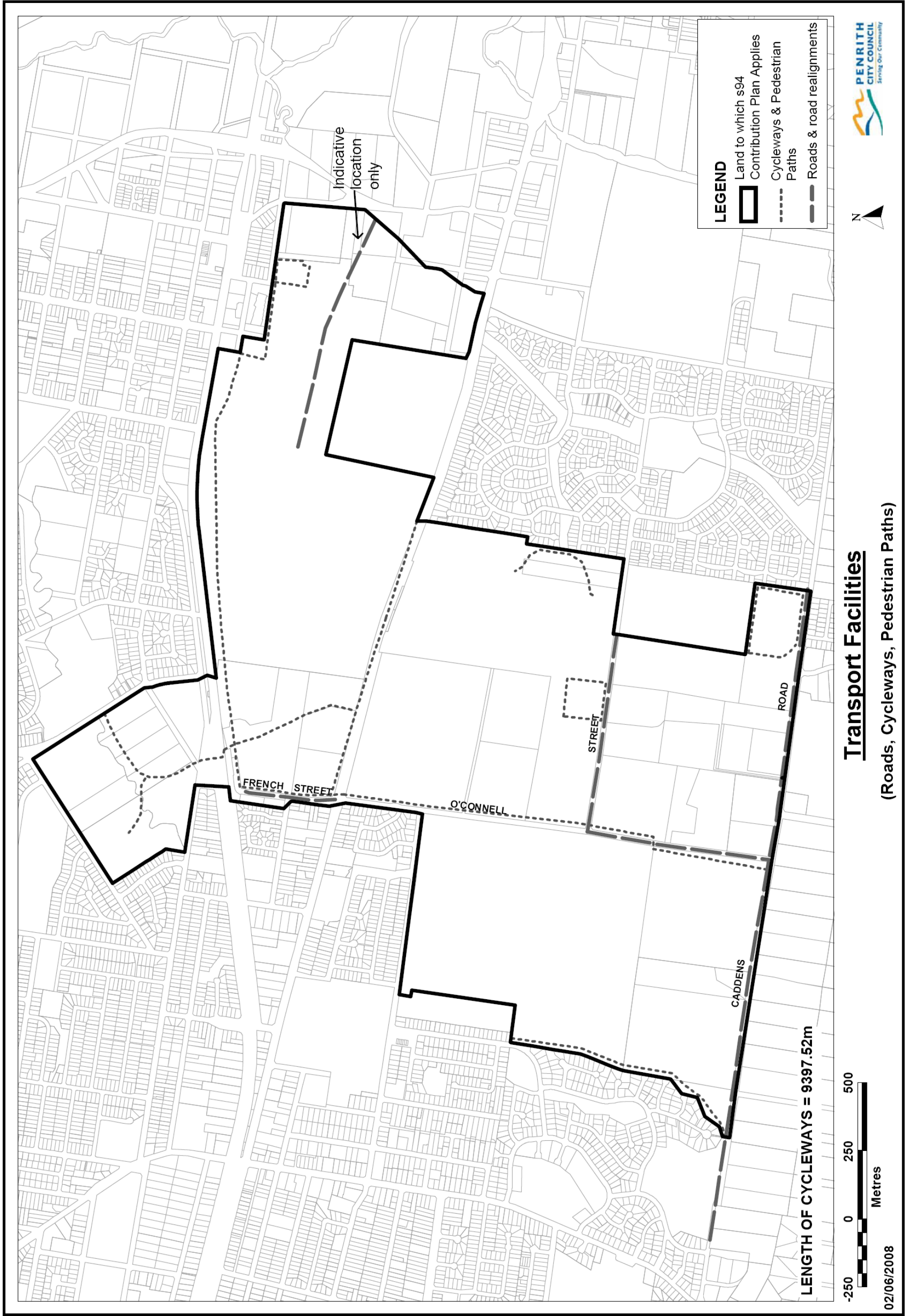
Item	Facility	Location and TMAP Reference	Area / No.	Unit	Rate	Subtotal	Preliminaries(%) + margin (5%), LSL (0.35%) and professional fees (12%)	Env. Approvals (1%)	Project Management (3%)	Estimated Total Cost	Apportioned Estimated Total Cost	Contribution Rate (per hectare of net developable land*)	Timing/Threshold	Comments
T1	LAND ACQUISITION													
T1.1	Collector Road Construction	French Street extension (11m width)	2200	m2	\$ 150	\$ 330,000				\$ 330,000	\$ 330,000		Refer to Works below	
T1.2	Collector Road Construction	East-West Link collector road link through South Werrington Urban Village sub precinct (22m width)	2200	m2	\$ 150	\$ 3,300,000				\$ 3,300,000	\$ 3,300,000		Refer to Works below	
	Sub-total					\$ 3,630,000				\$ 3,630,000	\$ 3,630,000			
	On Costs associated with land acquisition (2%)					\$ 72,600				\$ 72,600	\$ 72,600			
	Total		24,200	m2	\$	\$ 3,702,600				\$ 3,702,600	\$ 3,702,600			
T2	WORKS													
T2.39	Local Facilities													
T2.40	Intersection Improvements	I35 O'Connell Street/TAFE access Intersection Improvements				\$ 300,000	\$ 70,050	\$ 3,000	\$ 9,000	\$ 382,050	\$ 382,050		Upon 50% of development of retail floor space in Precinct Centre sub-precinct	TMAP cost + on costs derived from WT Partnership analysis
T2.41	Intersection Improvements	I36 O'Connell Street/Second Avenue Intersection Improvements				\$ 500,000	\$ 116,750	\$ 5,000	\$ 15,000	\$ 636,750	\$ 426,623		Upon 50% of development of retail floor space in Precinct Centre sub-precinct	TMAP cost + on costs derived from WT Partnership analysis
T2.42	Intersection Improvements	I37 Second Avenue/UWS eastern access Intersection Improvements				\$ 300,000	\$ 70,050	\$ 3,000	\$ 9,000	\$ 382,050	\$ 382,050		Upon 50% of development of retail floor space in Precinct Centre sub-precinct	TMAP cost + on costs derived from WT Partnership analysis
T2.43	Intersection Improvements	I38 Second Avenue/UWS western access Intersection Improvements				\$ 300,000	\$ 70,050	\$ 3,000	\$ 9,000	\$ 382,050	\$ 382,050		Upon 50% of development of retail floor space in Precinct Centre sub-precinct	TMAP cost + on costs derived from WT Partnership analysis
T2.44	Transport Services	TS1 External cycle lanes				\$ 1,000,000	\$ 233,500	\$ 10,000	\$ 30,000	\$ 1,273,500	\$ 636,750		Rolled out as part of the development adjoining lands	TMAP cost + on costs derived from WT Partnership analysis
T2.45	Transport Services	TS2 Cycle Parking				\$ 100,000	\$ 23,350	\$ 1,000	\$ 3,000	\$ 127,350	\$ 127,350		Rolled out as part of the development adjoining lands	TMAP cost + on costs derived from WT Partnership analysis
T2.46	Transport Services	TS3 Upgrade of External Footpaths				\$ 600,000	\$ 140,100	\$ 6,000	\$ 18,000	\$ 764,100	\$ 382,050		Rolled out as part of the development adjoining lands	TMAP cost + on costs derived from WT Partnership analysis
T2.47	Transport Services	TS6 Travel Plan				\$ 500,000	\$ 116,750	\$ 5,000	\$ 15,000	\$ 636,750	\$ 636,750		As part of the development of lands adjacent to the bus routes	TMAP cost + on costs derived from WT Partnership analysis
T2.48	Transport Services	WELL Precinct cycleways				\$ 1,527,097	\$ 356,577	\$ 15,271	\$ 45,813	\$ 1,944,758	\$ 1,944,758		Rolled out as part of the development adjoining lands	TMAP cost + on costs derived from WT Partnership analysis
T2.49	Collector Road Upgrades	O'Connell Street (East)	19400	m2	\$ 109	\$ 2,114,600	\$ 493,759	\$ 21,146	\$ 63,438	\$ 2,692,943	\$ 2,692,943		Upon 50% of development of retail floor space in Precinct Centre sub-precinct	Assumes 20m wide reserve. Base cost and on costs based on WT Partnership SWUV estimates for collector roads
T2.50	Collector Road Upgrades	Caddens Road between Southern Sportsfields and Caddens western boundary	separate cost estimate								\$ 1,577,588		As part of the development of Caddens sub-precinct lands adjacent to existing Caddens Road alignment	Cost based on estimates prepared by Council officers in April 2008 and titled '06/04/03 Caddens Rd Section 94 Contribution Draft Rev B
T2.51	Collector Road Construction	French Street extension	2200	m2	\$ 109	\$ 239,800	\$ 55,993	\$ 2,398	\$ 7,194	\$ 305,385	\$ 305,385		As part of the construction of the new railway station	Assumes 11m wide reserve. Base cost and on costs based on WT Partnership SWUV estimates for collector roads
T2.52	Collector Road Construction	East-West Link collector road link through South Werrington Urban Village sub precinct	2200	m2	\$ 109	\$ 2,398,000	\$ 559,933	\$ 23,980	\$ 71,940	\$ 3,053,853	\$ 3,053,853		Staged construction as part of the development of land in the UWS North Werrington and Werrington Mixed Use Area sub-precincts	Assumes 22m wide reserve. Base cost and on costs based on WT Partnership SWUV estimates for collector roads
T2.53	Collector Road Construction	O'Connell Lane	8500	m2	\$ 109	\$ 926,500	\$ 216,338	\$ 9,265	\$ 27,795	\$ 1,179,898	\$ 1,179,898		As part of the development of Caddens sub-precinct lands	Assumes 20m wide reserve. Base cost and on costs based on WT Partnership SWUV estimates for collector roads
T2.54	Collector Road Upgrades	Caddens Road west of WELL Precinct – realignment	4895	m2	\$ 109	\$ 533,555	\$ 124,585	\$ 5,336	\$ 16,007	\$ 679,482	\$ 679,482		As part of the development of Caddens sub-precinct lands	Assumes 11m wide reserve. Base cost and on costs based on WT Partnership SWUV estimates for collector roads
T3	OTHER													
T3.1	Contribution to contributions plan preparation		0.25		\$ 54,840	\$ 13,710				\$ 13,710	\$ 13,710			
T3.2	Contribution to land valuation assessment preparation		0.25		\$ 7,700	\$ 1,925				\$ 1,925	\$ 1,925			
T3.3	Contribution to TMAP preparation		1.00		\$ 74,547	\$ 74,547				\$ 74,547	\$ 74,547			
	Total					\$ 11,485,734	\$ 2,860,394	\$ 113,936	\$ 341,807	\$ 14,599,870	\$ 14,948,531			

* Refer to accompanying apportionment schedule

WELL Precinct Transport Management Facilities Apportionment Schedule

Item	Facility	Location and TMAP Reference	Total areas: Intersection total apportionment cost	Sub-Precinct						Comments			
				Werrington Mixed Use	UWS North Werrington	South Werrington Urban Village	UWS & TAFE South Werrington	South Werrington Private Lands	Precinct Centre		UWS Kingswood	Caddens	North Werrington
T1	LAND ACQUISITION	Contribution Catchment (Net developable area (m ²):	2,829,122	166,519	361,092	342,532	521,300	98,342	67,704	425,644	815,169	30,820	
T1.1	French Street extension		\$330,000										
	Apportionment factor			100.0%									
	Apportioned amount		\$330,000	\$330,000									
	Contribution rate		\$19,818	\$19,818									
T1.2	East-West Link collector road link through South Werrington Urban Village sub precinct		\$3,300,000										
	Apportionment factor			50.0%									
	Apportioned amount		\$1,650,000	\$1,650,000									
	Contribution rate		\$48,171	\$48,171									
	Total contribution per hectare		\$19,818	\$45,695	\$48,171	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
T2	WORKS												
	Local Facilities												
	Intersection Improvements												
T2.39	I35 O'Connell Street/TAFE access Intersection		\$382,050	\$40,756	\$31,316	\$24,857	\$16,403	\$4,871	\$62,631	\$13,324	\$187,893	\$0	
	Apportionment appearing in TMAP		61.0%	6.5%	5.0%	4.0%	2.6%	0.8%	10.0%	2.1%	30.0%	0.0%	
	Apportionment adjusted from TMAP		100.0%	10.7%	8.2%	6.5%	4.3%	1.3%	16.4%	3.5%	49.2%	0.0%	
	Contribution rate		\$2,448	\$2,448	\$867	\$726	\$315	\$495	\$9,251	\$313	\$2,305	\$0	
T2.40	I36 O'Connell Street/Second Avenue Intersection		\$426,623	\$33,666	\$31,838	\$20,533	\$13,550	\$4,023	\$171,923	\$11,006	\$140,085	\$0	
	Apportionment appearing in TMAP		67.0%	5.3%	5.0%	3.2%	2.1%	0.6%	27.0%	1.7%	22.0%	0.0%	
	Apportionment adjusted from TMAP		100.0%	7.9%	7.5%	4.8%	3.2%	0.9%	40.3%	2.6%	32.8%	0.0%	
	Contribution rate		\$2,022	\$2,022	\$882	\$599	\$260	\$409	\$25,393	\$259	\$1,718	\$0	
T2.41	I37 Second Avenue/UWS eastern access		\$382,050	\$51,794	\$34,732	\$31,568	\$20,846	\$6,190	\$121,561	\$16,933	\$98,407	\$0	
	Apportionment appearing in TMAP		66.0%	8.9%	6.0%	5.5%	3.6%	1.1%	21.0%	2.8%	17.0%	0.0%	
	Apportionment adjusted from TMAP		100.0%	13.6%	9.1%	8.3%	5.5%	1.6%	31.8%	4.4%	25.8%	0.0%	
	Contribution rate		\$3,110	\$3,110	\$962	\$922	\$400	\$629	\$17,955	\$398	\$1,207	\$0	
T2.42	I38 Second Avenue/UWS western access		\$382,050	\$55,305	\$25,902	\$33,730	\$22,259	\$6,609	\$90,656	\$18,081	\$129,508	\$0	
	Apportionment appearing in TMAP		59.0%	8.5%	4.0%	5.2%	3.4%	1.0%	14.0%	2.8%	20.0%	0.0%	
	Apportionment adjusted from TMAP		100.0%	14.5%	6.8%	8.8%	5.6%	1.7%	23.7%	4.7%	33.9%	0.0%	
	Contribution rate		\$3,321	\$3,321	\$717	\$985	\$427	\$672	\$13,390	\$425	\$1,589	\$0	
	Transport Services												
T2.43	TS1 External cycle lanes		\$636,750	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	
T2.44	TS2 Cycle Parking		\$127,350	\$450	\$450	\$450	\$450	\$450	\$450	\$450	\$450	\$450	
T2.45	TS3 Upgrade of External Footpaths		\$636,750	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	\$2,251	
T2.46	TS6 Travel Plan		\$68,769	\$243	\$243	\$243	\$243	\$243	\$243	\$243	\$243	\$243	
T2.47	TS9 Bus stops and shelters		\$1,944,758	\$6,874	\$6,874	\$6,874	\$6,874	\$6,874	\$6,874	\$6,874	\$6,874	\$6,874	
T2.48	WELL Precinct cycleways												
T2.49	O'Connell Street (East)		\$2,692,943										
	Apportionment factor												
	Apportioned amount												
	Contribution rate												
T2.50	Caddens Road between Southern Sportsfields and Caddens western boundary		\$1,577,588										
	Apportionment factor												
	Apportioned amount												
	Contribution rate												
T2.51	French Street extension		\$305,385										
	Apportionment factor												
	Apportioned amount												
	Contribution rate												
T2.52	East-West Link collector road link through South Werrington Urban Village sub precinct		\$3,053,853										
	Apportionment factor												
	Apportioned amount												
	Contribution rate												
T2.53	O'Connell Lane		\$1,179,898										
	Apportionment factor												
	Apportioned amount												
	Contribution rate												
T2.54	Caddens Road west of WELL Precinct - realignment		\$679,482										
	Apportionment factor												
	Apportioned amount												
	Contribution rate												
T3	OTHER												
T3.1	Contribution to contributions plan preparation		\$	\$48	\$48	\$48	\$48	\$48	\$48	\$48	\$48	\$48	\$48
T3.2	Contribution to land valuation assessment preparation		\$	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7
T3.3	Contribution to TMAP preparation		\$	\$263	\$263	\$263	\$263	\$263	\$263	\$263	\$263	\$263	\$263
	Total contribution per hectare		\$42,978	\$59,452	\$61,548	\$31,578	\$18,468	\$182,689	\$74,426	\$18,656	\$13,738	\$0	\$0

Water detention areas outside of open space areas excluded from net developable area totals that appear in assumptions sheet



Transport Facilities

(Roads, Cycleways, Pedestrian Paths)

02/06/2008

0 250 500
Metres



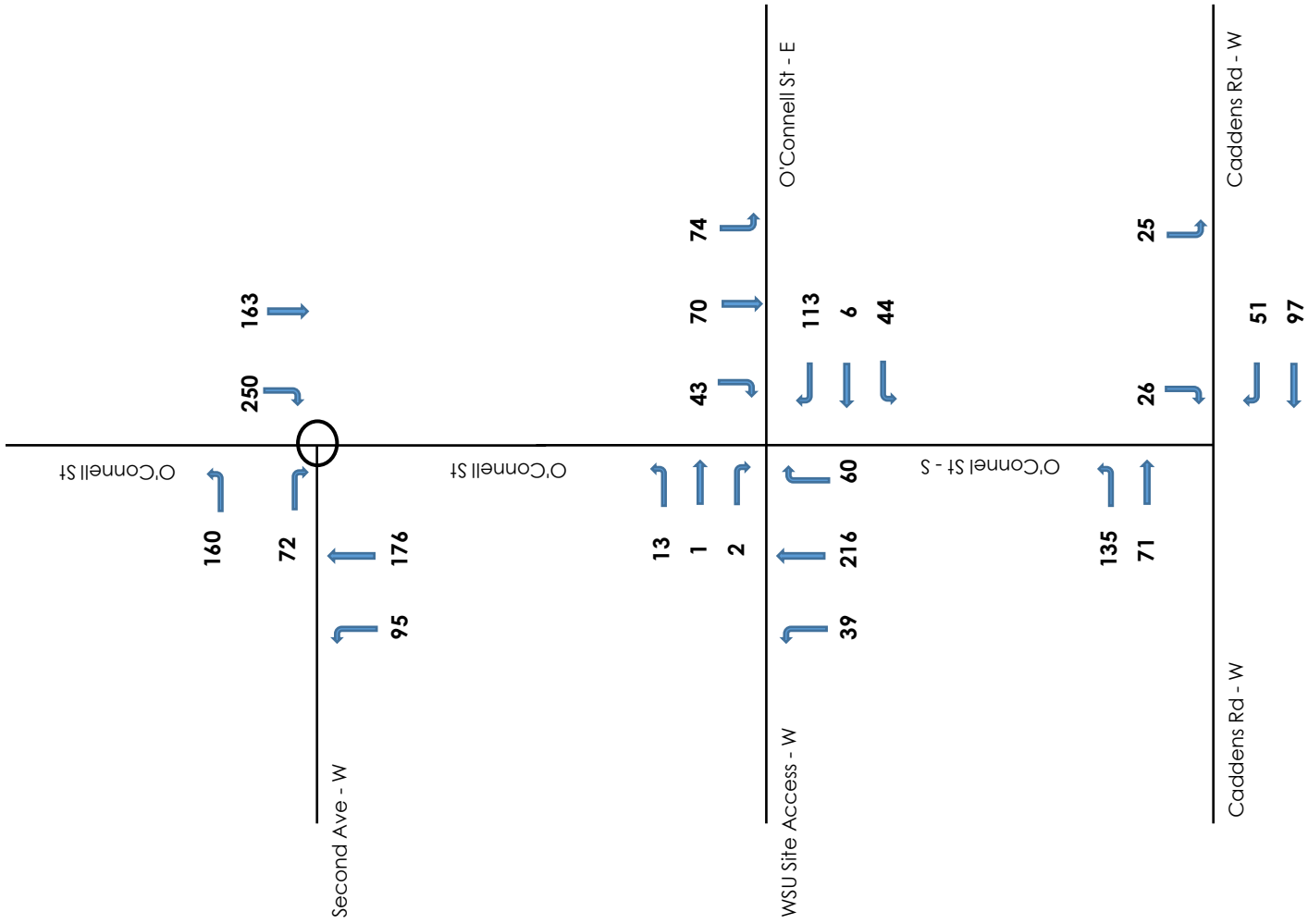
Appendix B

Traffic Flow Diagrams

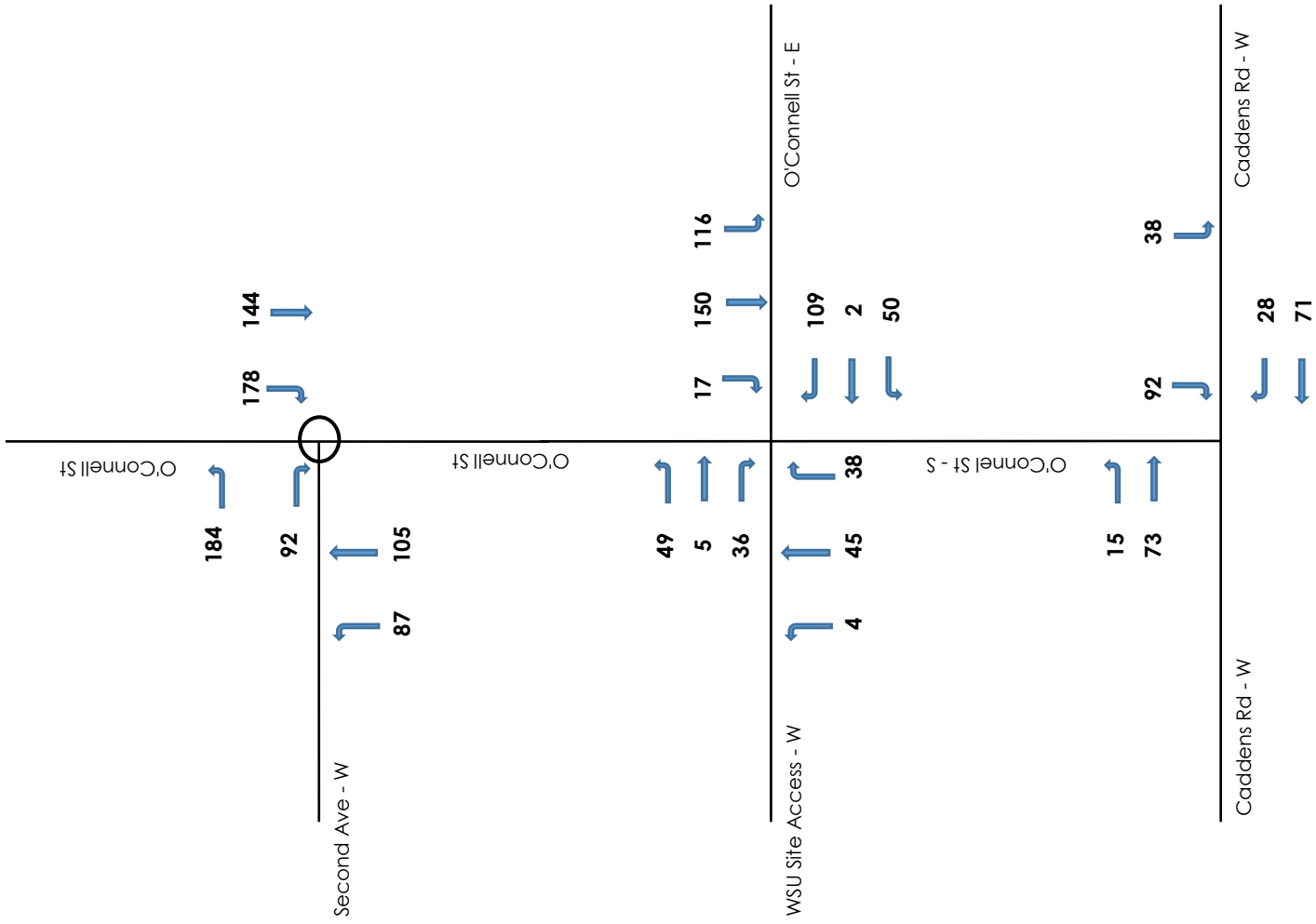
TTPP

Existing

Weekday AM



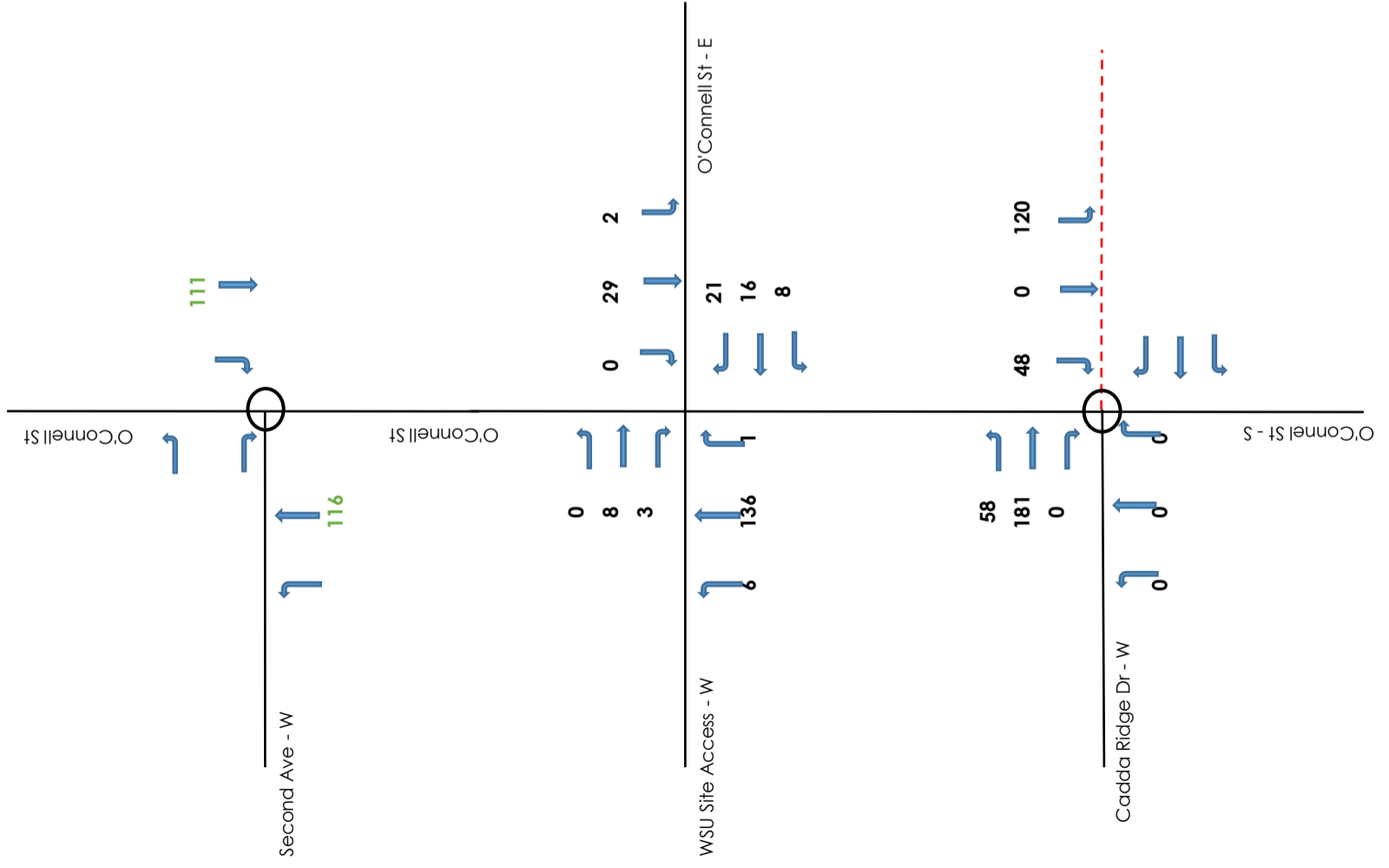
Weekday PM



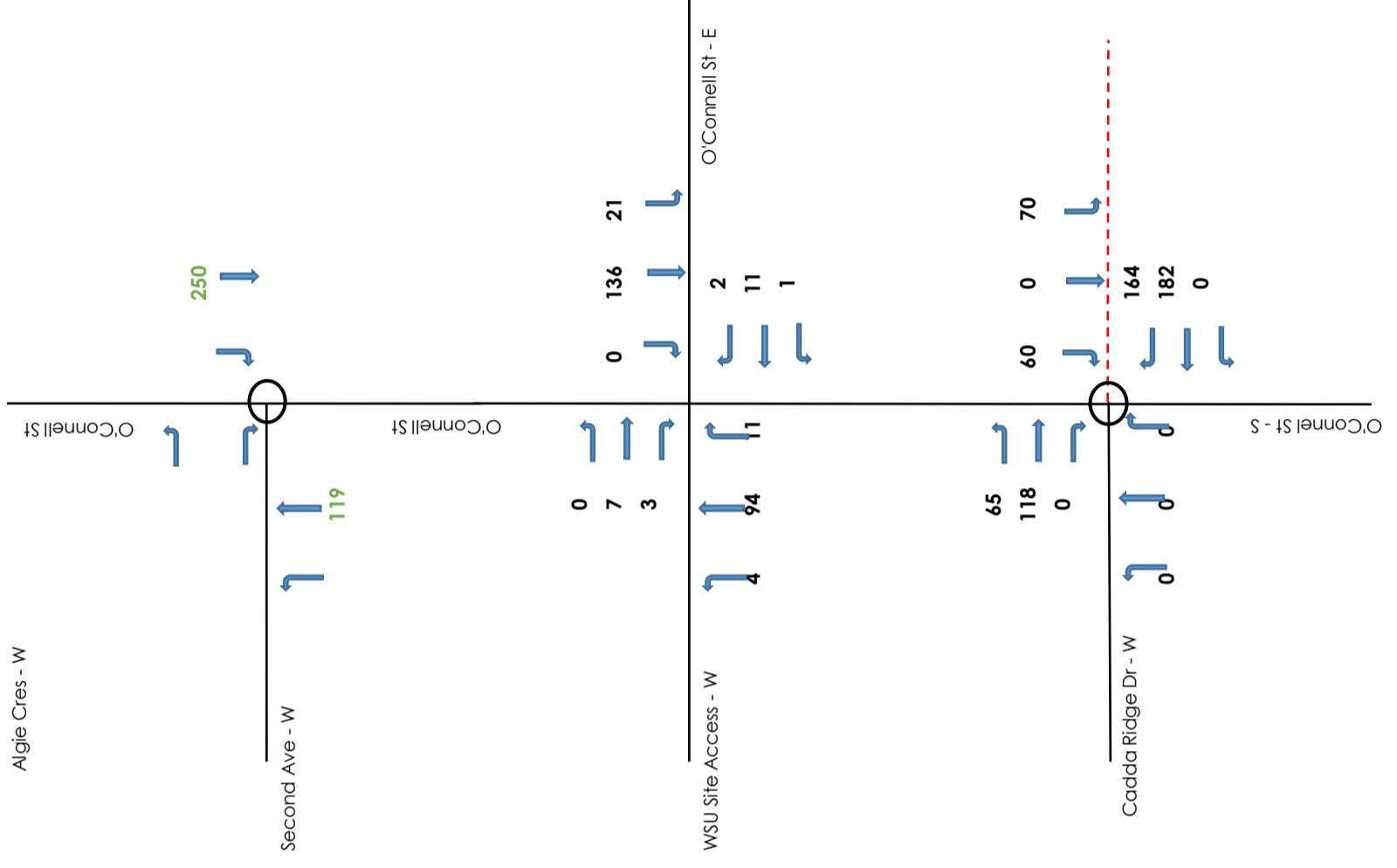
TTPP

Background Traffic

AM Background



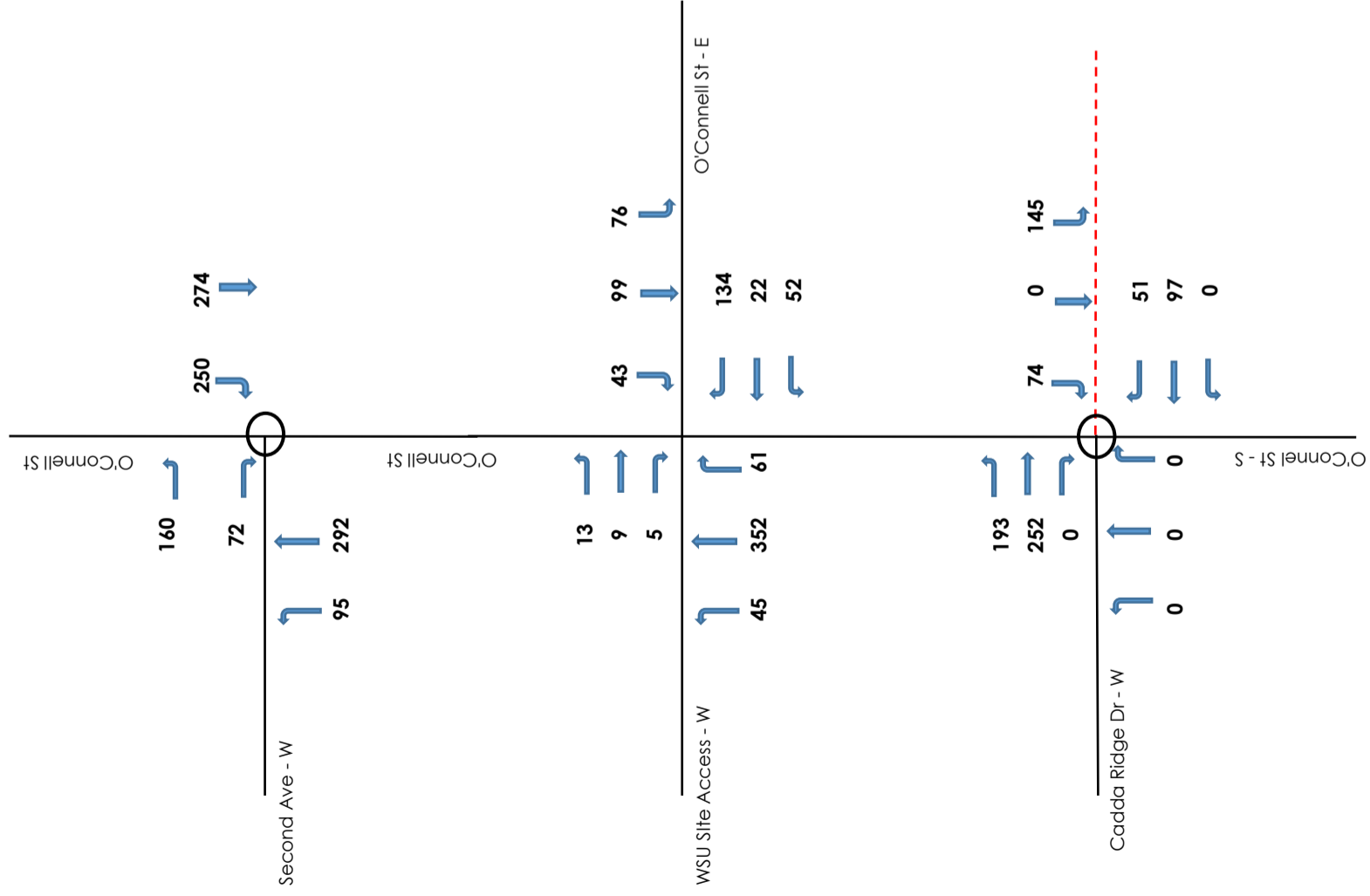
PM Background



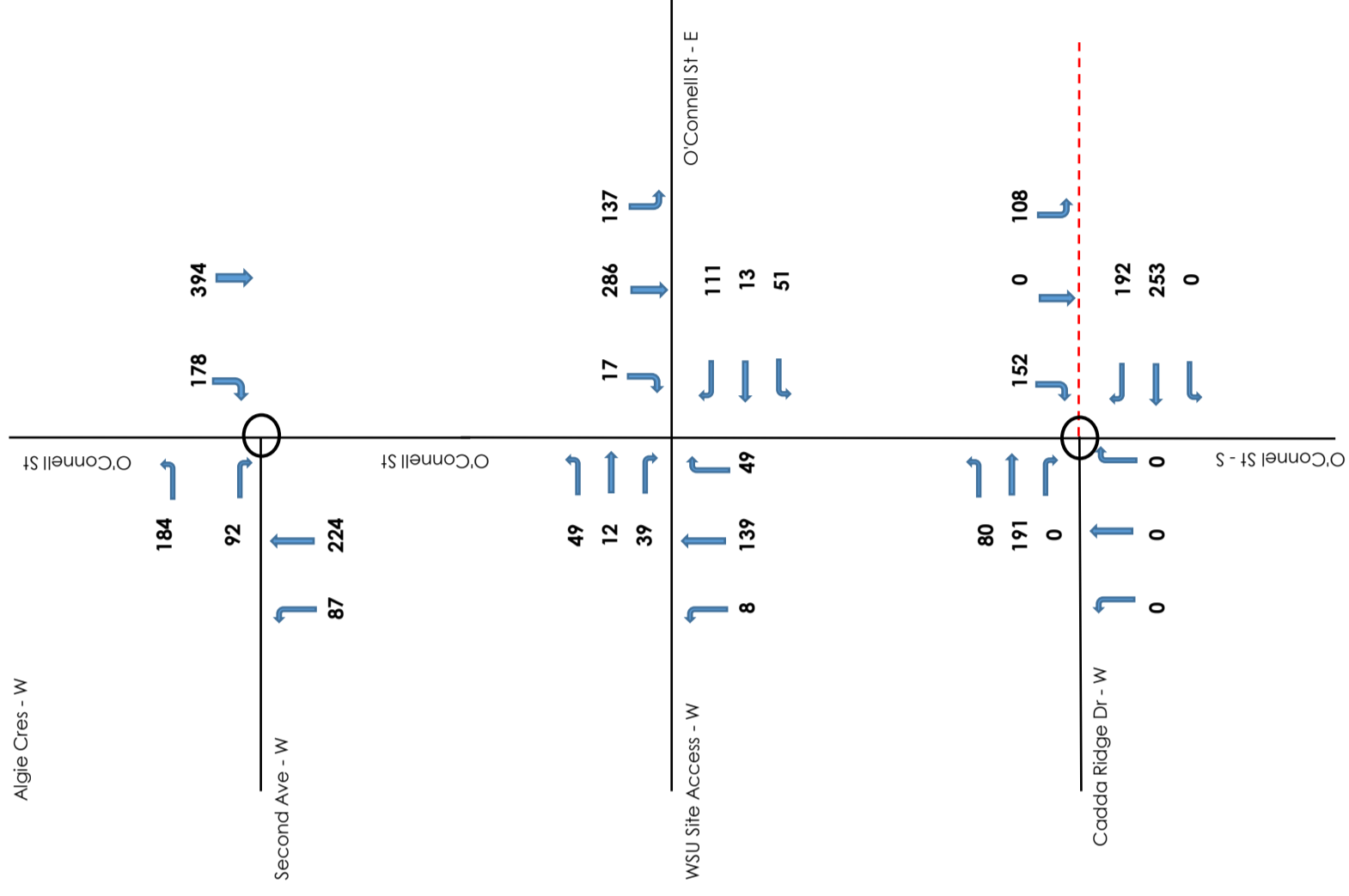
TTPP

Existing + BG

Future AM



Future PM



Commercial / Retail area	3,000m ²
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Land Use	Size	Trip Rate		Trip Generation	
		AM Peak	PM Peak	AM Peak	PM Peak
Townhouse	320 units	0.5 trips per unit	0.5 trips per unit	160 trips	160 trips
Townhouse + Garage Top	70 units	0.65 trips per unit	0.65 trips per unit	45.5 trips	45.5 trips
	200 units	0.4 trips per unit	0.4 trips per unit	80 trips	80 trips
Apartments	200 units	0.5 trips per unit	0.5 trips per unit	100 trips	100 trips
	2,000m ²	1.6 trips per 100m	1.2 trips per 100m	32 trips	24 trips
Commercial	1,000m ²	1.15 trips per 100m	4.6 trips per 100m	5.75 trips	23 trips
Total Trips				424 trips	433 trips

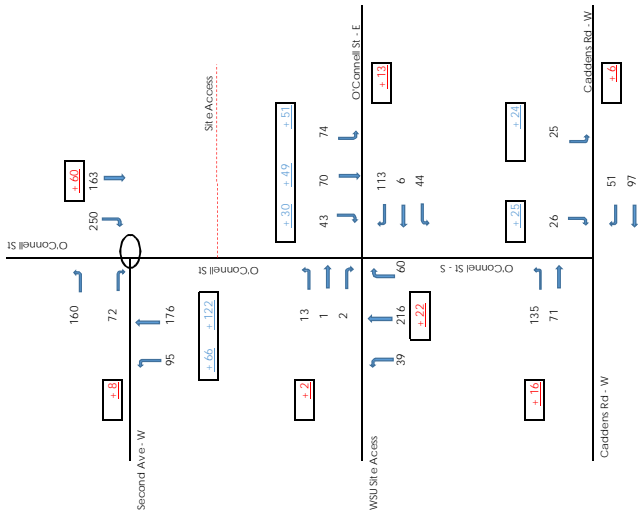
Apartment mix	400
- 1-2 bedroom	0.5
- 3+ bedroom	0.5

linked/multi-purpose trips for retail:	0.5
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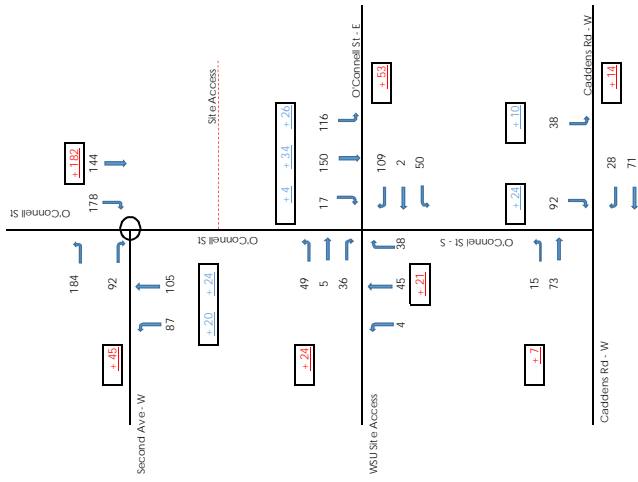
Distribution	AM Rate		PM Rate		AM Traffic		PM Traffic	
	In	Out	In	Out	In	Out	In	Out
Townhouse					32 trips	128 trips	128 trips	32 trips
Garage Top	20%	80%	80%	20%	9.1 trips	36.4 trips	36.4 trips	9.1 trips
Apartments					36 trips	144 trips	144 trips	36 trips
Commercial	80%	20%	20%	80%	25.6 trips	6.4 trips	6.4 trips	19.2 trips
Specialty Retail	50%	50%	50%	50%	2.875 trips	2.875 trips	11.5 trips	11.5 trips
Total Distribution					106 trips	318 trips	325 trips	108 trips

Post Development Traffic

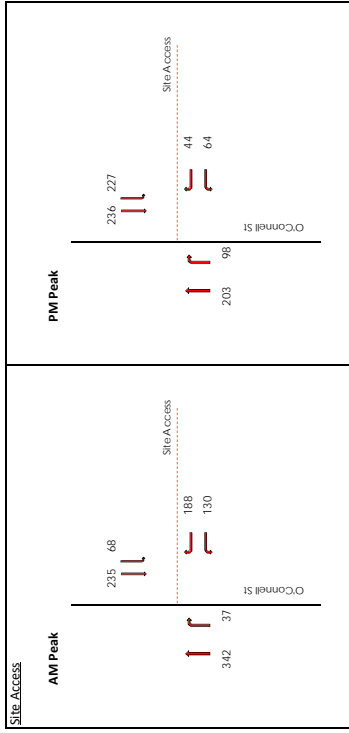
Weekday AM



Weekday PM



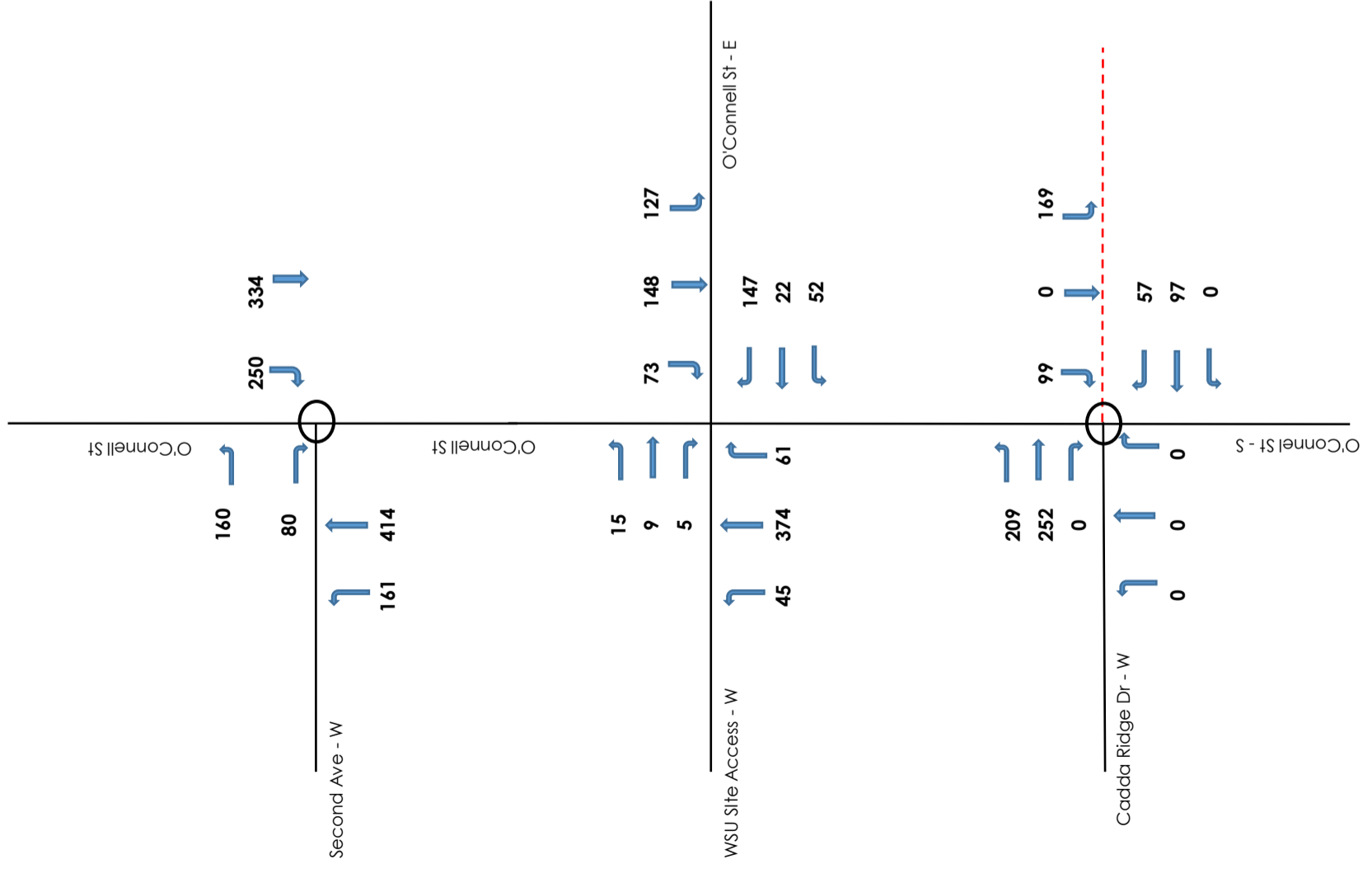
XX Inbound Dev Traffic
 XX Outbound Dev Traffic



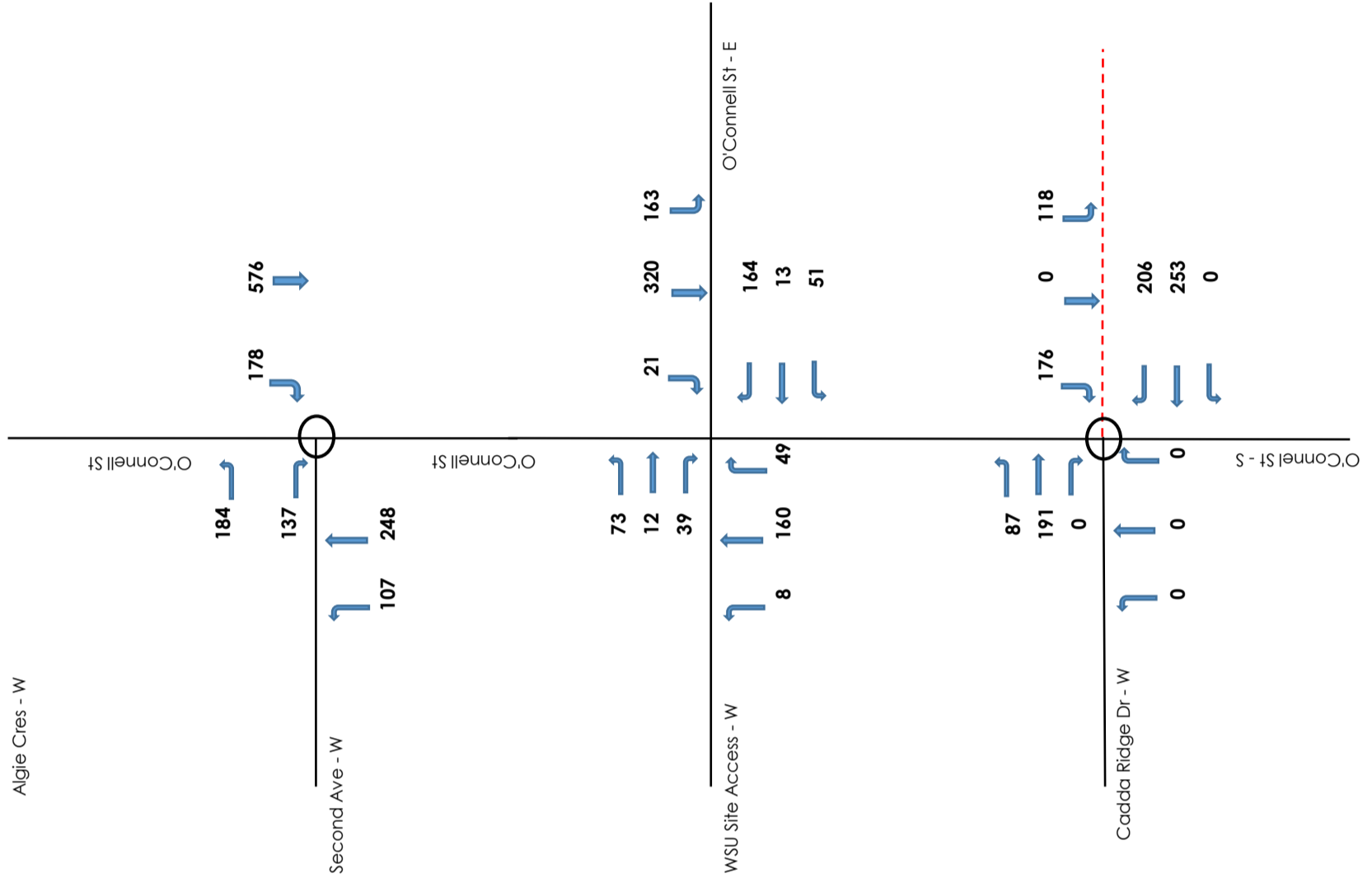
TTPP

Existing + BG + PD

Ultimate Future AM



Ultimate Future PM



Appendix C

CWG Site – Proposed Master Plan

A07

Potential Subdivision

The subdivision pictured is indicative. The block structure is such that a range of calibrations are possible, resulting in a choice of housing types and lot sizes.

The approach to subdivision employed here provides a difference of type and form along streets within blocks, calibrated to park frontage and orientation.

At corners, larger lots with 2x semi-detached dwellings offer architectural difference to the more typical terrace runs within blocks.

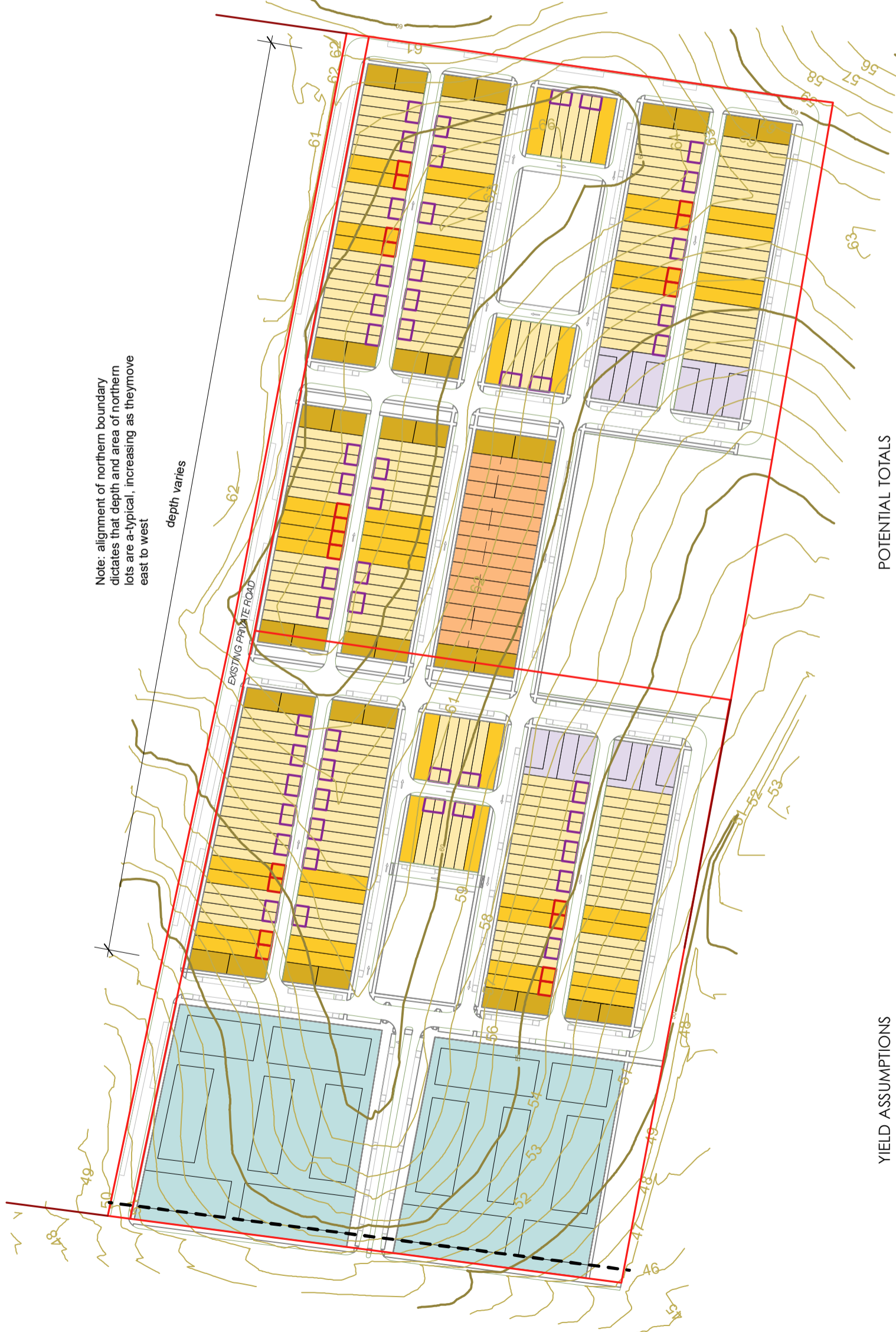
Around parks a number of building types are proposed to maximise the number of residents able to enjoy these spaces, as well as offer an array of architectural types and household types.

LEGEND

- existing boundary
- 6m required setback

HOUSING TYPES

- 1 apartment
- 2 single, attached
- 3 park-front dual 6.2m
- 4 terrace 6.2m
- 5 terrace 4.5m
- 6 paired housing >8m
- 7 secondary dw'g 4.5m
- 8 secondary dw'g 6.2m



Note: alignment of northern boundary dictates that depth and area of northern lots are atypical, increasing as they move east to west

depth varies

POTENTIAL TOTALS

- A) 2 bed + SLUG (48+14) = 62
 - B) 3 bed (includes +loft/study)+SLUG (144+16+14) = 174
 - C) 3 bed + DLUG (48+36) = 84
 - D) studio/1 bed garage top (20+50) = 70
- = 320 dwellings + garage-top**

YIELD ASSUMPTIONS

- 1) Apartments TBC
- 2) 3 bed + SLUG
- 3) 3 bed + tandem LUG (app 150sqm lot) / 2 bed +SLUG (app 73sqm lot)
- 4) 3 bed + DLUG
- 5) 2 bed + loft (3rd bed loft/study) + SLUG @75% / 2 bed + SLUG @25%
- 6) 3 bed + SLUG x2 per lot
- 7) studio/1 bed garage-top unit
- 8) studio/1 bed garage-top unit

This drawing is to be read in conjunction with all relevant contracts, specifications, reports and drawings. Copyright is vested in HILL THALIS from drawings. All dimensions to be confirmed with survey.

0 20 40 80m

SCALE @ A3 1:2000 @A3
DATE 22.12.2016
REV

CLIENT
Chiwayland

PROJECT

CADDENS SUBDIVISION

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