

Appendix 4
Transport Impact Assessment
(GTA Traffic Consultants)





Lot 6, Taronga Place, Eglinton District Structure Plan Amendment Transport Impact Assessment


Client // Urban Quarter
Office // WA
Reference // W115944
Date // 12/09/18

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Issue: Final-B 12/09/18

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Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
Final	20/08/18	Final	Neale McCracken	TM	Tanya Moran	TM
Final-A	23/08/18	Revised land areas	Neale McCracken	TM	Tanya Moran	TM
Final-B	12/09/18	Revised plan East Precinct	Neale McCracken	TM	Tanya Moran	

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1. Introduction

1.1 Background & Proposal

An amendment to the Alkimos Eglinton District Structure Plan No.18 (the 'DSP') is being prepared to a portion of Lot 6, Taronga Place in Eglinton (the subject site, or 'Lot 6'). The DSP Amendment (the 'Amendment') proposes the following:

- Modify the designation of the **Central Precinct** of Lot 6 from **Service Commercial** to **Urban** (to accommodate Residential development);
- Extend the AEDSP boundary to include the land within the **Eastern Precinct** (Lot 6 and lots between Lot 6 and Wanneroo Road) and designate this land as **Service Commercial**.

Upon full development, the Central Precinct is expected to contain between 480 and 520 residential dwellings while the Eastern Precinct is expected to deliver up to 400,000sqm gross floor area (GFA) of employment development.

GTA Consultants (GTA) previously prepared a Transport Impact Assessment (TIA) for a Local Structure Plan (LSP) on adjacent lands, known as the Lot 6 Western Precinct. GTA has now been commissioned by Urban Quarter to prepare a TIA to support the Amendment, covering the lands, as shown in in blue on Figure 1.1.

1.2 Report Purpose

The objective of this TIA is to support the modifications to the Amendment. It details the methodology and findings, which was prepared in line with the guidelines set out in the Western Australian Planning Commission publication '*Transport Impact Assessment Guidelines, August 2016*' (WAPC Guidelines)¹ and takes account of the City's planning policies. This TIA considers the Precinct's integration with the existing transport networks including walking, cycling, public transport and vehicular travel and considers the potential impact of the proposed Amendment.

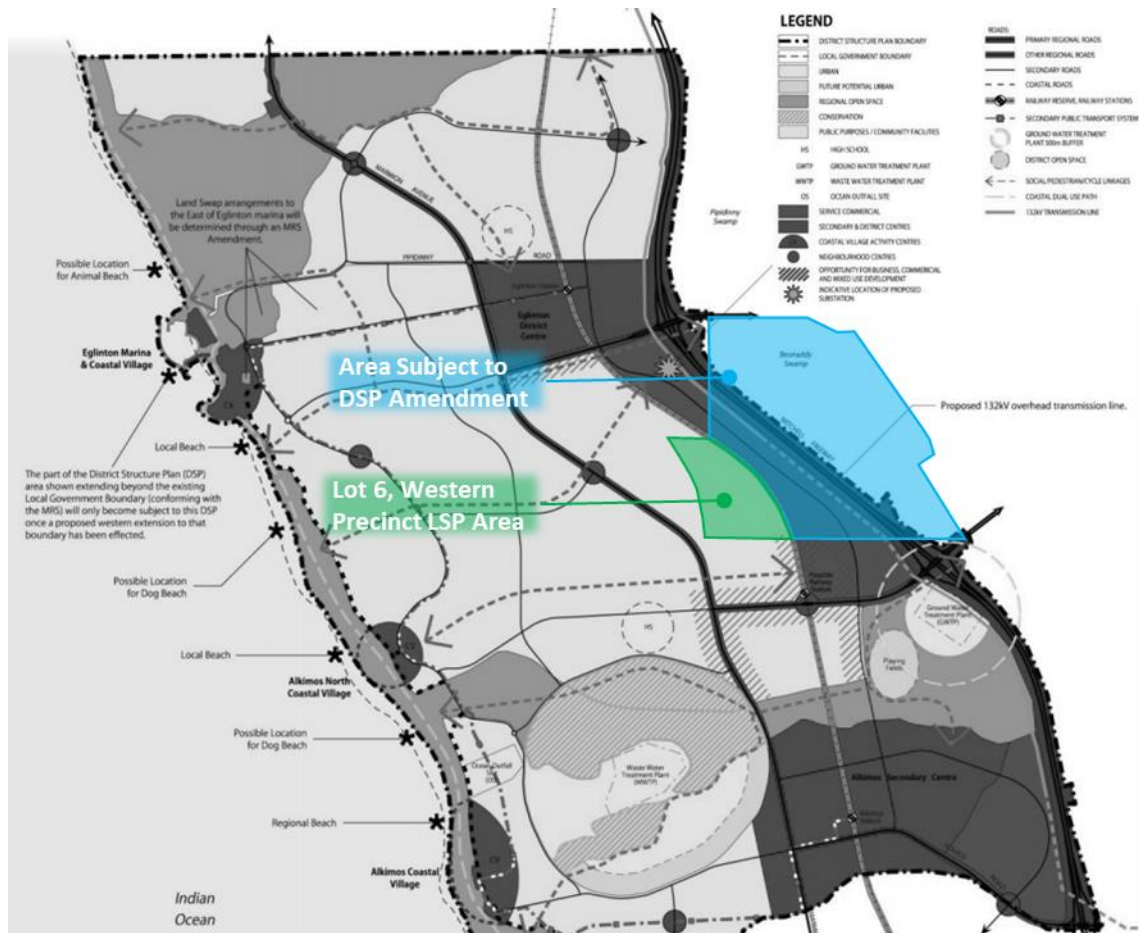
In preparing this TIA, reference was made to the current DSP traffic report (detailed in the next section) to determine if the key findings of that adopted transport assessment are changed. Specifically, these relate to the objectives of the WAPC Guidelines, where are:

- to assess the proposed internal transport networks with respect to accessibility and safety for all modes: vehicles, public transport, pedestrians and cyclists;
- to assess the level of transport integration between the DSP area and the surrounding land uses;
- to determine the impacts of the traffic generated by the DSP area on the surrounding land uses; and
- to determine the impacts of the traffic generated by the DSP on the surrounding transport networks.

The information presented in this TIA report supports that the proposed modifications to the Amendment can be supported by the planned future traffic network, as detailed herein.

¹ Transport Impact Assessment Guidelines, Volumes 1 to 5, published by WAPC August 2016.

Figure 1.1: Subject Site Location within Alkimos Eglinton DSP



Source: Alkimos Eglinton DSP, dated September 2006

1.3 References and Consultation

In preparing this report, reference has been made to the following:

- City of Wanneroo *District Planning Scheme No. 2* (gazetted 6 July 2001)
- City of Wanneroo *Local Planning Policy 3.8: Marmion Avenue Arterial Road Access* (adopted 7 February 2012, reviewed 2017)
- the Western Australian Planning Commission (WAPC) *Liveable Neighbourhoods – Draft, September 2015*
- WAPC *Transport Impact Assessment Guidelines*, dated August 2016
- *Lot1005/1006 Alkimos, Traffic and Transport Planning, Final Report*, prepared by Bruce Aulabaugh in May 2009
- *Central Alkimos Traffic & Movement Network*, Bruce Aulabaugh, Revision 1, 9 May 2013
- *Alkimos Eglinton Structure Plan, Appendix 4, Transport and Access, Final, SKM, September 2006*
- *Alkimos Eglinton Structure Plan, Transport and Access, Supplementary Report, SKM, January 2008*
- *Cycle Wanneroo*, City of Wanneroo Bike Plan
- plans for the proposed development prepared by CLE
- other documents as referenced in this report.

2. Existing Situation

2.1 Subject Site

The Amendment covers approximately 147 ha of land within the Alkimos Eglinton area of the City of Wanneroo, as shown (in blue) in Figure 2.1. The site is for the most part vacant land currently occupied by a small number of individual dwellings and outbuildings.

The subject site is bounded to the west by the northern suburbs rail line reserve and is bisected into the Central and Eastern Precincts by the future Mitchell Freeway reserve. The Eastern Precinct has an approximately 1km long frontage to Wanneroo Road. All other boundaries abut adjacent (current and future) residential subdivisions. To the south the Shorehaven Estate is established, and road infrastructure is in place. To the north-west there is an interface with the Eglinton Estates LSP, which is yet to be developed.

Figure 2.1: Subject Site and its Environs



Source: Nearmap

2.2 Existing Movement Networks

Given the largely undeveloped nature of the area and subsequent lack of travel demand, save for Wanneroo Road, current movement infrastructure provisions are limited as it relates directly for travel to, from and within the LSP area. Notwithstanding, there is some infrastructure provision which is described below. It is also worth noting that as the area matures, through this and

adjacent LSPs, the movement networks will be provided generally in accordance with the current DSP. Specific future infrastructure relevant to the site is considered in Section 3 of this report.

2.2.1 Walking and Cycling

Pedestrian paths are currently provided on Marmion Avenue where existing development has occurred abutting this road. There also exists terminated paths and crossings on Marmion Avenue which will be connected as part of a wider network as development in the area proceeds.

Shared use paths are currently provided near the southern boundary of the subject site Central Precinct, on the southern side of Bluewater Drive and on Maroon Avenue as part of the Shorehaven Estate. These paths connect to a network of further footpaths throughout the Shorehaven Estate.

Similarly, formal cycling infrastructure in the area is limited, with only a wide sealed shoulder provided on both sides of Marmion Avenue and Wanneroo Road to enable cyclists to use the route in the relative safety of the shoulder. Within the Shorehaven Estate on-road cycle lanes are provided on both sides of Bluewater Drive providing an east-west cycle connection. North-south connections are provided by way of on-road cycle lanes on Scotthorn Drive within the Shorehaven Estate. Ultimately these routes will extend south to Alkimos Drive, in line with the DSP.

2.2.2 Public Transport

Two Transperth bus routes currently operate along Marmion Avenue as detailed in Table 2.1.

Table 2.1: Existing Public Transport Provision

Service	Route #	Route Description	Location of / Distance to Nearest Stop	Frequency On/Off Peak
Bus	490	Butler Station – Two Rocks	Marmion Ave before Bluewater Drive (500m from centre of site)	10-20 minutes peak 60 minutes off peak
	491	Butler Station - Yanchep		

These routes run north-south on Marmion Avenue between Yanchep / Two Rocks and Butler Station, stopping on Marmion Avenue, generally adjacent to new residential developments. Whilst the exact location of any future bus stops cannot be determined at this stage, the DSP *Transport and Access* report illustrates an intent to at least maintain the operation of these existing services on Marmion Avenue.

The closest bus stop is located on Bluewater Drive, around 1km from the centre of the subject site. Considering the general 400m catchment for public transport, around one quarter of the site is located within this distance of the existing bus stop which is a strong starting point for development of a currently vacant site.

2.2.3 Vehicular Access

The existing primary vehicle access routes for the LSP are highlighted in Figure 2.1 and discussed below.

There are a number of future connections to be provided and routes to be developed as the area matures, these are discussed relative to the LSP area in Section 3.

Mitchell Freeway

As detailed in the DSP, long-term planning indicates that the Mitchell Freeway is proposed to be extended north from its current terminus at Hester Avenue in Clarkson. Ultimately the Mitchell

Freeway will form the major north-south distributor for the northwest corridor, with the freeway reserve bisecting the subject site as shown in Figure 2.1.

It is noted that the subject site abuts the boundary of the future Mitchell Freeway/Alkimos Drive grade separated interchange. Further details on the future road network are provided in Section 3.3 of this report.

Marmion Avenue

Marmion Avenue is a Distributor A road managed by the City of Wanneroo. It is a two-lane, two-way undivided road running in a northwest-southeast direction. Marmion Avenue is set within a road reserve of 45m width (minimum) near the subject site and has a speed limit of 80km/h in this area.

Marmion Avenue has a strategic role in the movement of traffic in the northwest development corridor of Perth, beginning north of Karrinyup Road in Stirling, extending north to Yanchep. As per the DSP and City of Wanneroo's *Marmion Avenue Arterial Road Access Policy*, Marmion Avenue is to be upgraded in the future to become a four-lane divided Integrator Arterial 'A' road. Recent discussions with the City of Wanneroo indicate that construction on the duplication between Butler and Yanchep is to begin in late 2018/early 2019.

Marmion Avenue carries approximately 19,000 vehicles per day at present⁽²⁾.

Wanneroo Road

Wanneroo Road is a Primary Regional Road managed by Main Roads WA. It is a four-lane dual carriageway road, narrowing to a two-lane single carriageway heading north along the eastern boundary of the subject site. It is however noted that Wanneroo Road is currently mostly single carriageway south of the site to Nowergup Road. Wanneroo Road is set in an approximately 100m wide road reserve (varies) near the subject site and has a speed limit of 90km/h in this area.

Wanneroo Road carries approximately 8,000 vehicles per day at present⁽³⁾.

Bluewater Drive

Bluewater Drive is a Neighbourhood Connector road running east-west within the northern boundary of the Shorehaven Estate and the southern boundary of the LSP area. It is a two-lane, two-way undivided road with a 6.6m wide vehicle carriageway, and 1.2m wide cycle lanes on either side of the road. The road reserve is currently 16m wide, although will be widened to 20m as part of the LSP proposal. Bluewater Drive has an unposted 50km/h speed limit for its entire length.

It is proposed to access the Lot 6 Central Precinct from Bluewater Drive.

² Main Roads WA count point south of Yanchep Beach Road 2015/16, 9.0% heavy vehicles.

³ Main Roads WA count point south of Yanchep Beach Road 2015/16, 12.8% heavy vehicles.

3. Development Proposal

3.1 Context

The subject site is located in the Alkimos Eglinton DSP area. The DSP covers some 2,600 hectares of land in Perth's northwest and is ultimately envisaged to contain over 22,000 dwellings, as well as schools, shops and commercial uses. The overall DSP is expected to contribute to the increase of housing supply for the City of Wanneroo and Greater Perth over the coming 10-15 years.

The WAPC endorsed the LSP and the Subdivision Application for the Lot 6 Western Precinct in December 2017. This TIA is to support the Amendment to the remaining part of Lot 6, east of the rail reserve and east of the future Mitchell Freeway reserve, as shown in Figure 2.1. The subject site that is part of this assessment has an area coverage of approximately 147 ha.

The Central Precinct is zoned 'Urban Development' under the *City of Wanneroo District Planning Scheme No. 2* (the Scheme), while the Eastern Precinct is zoned 'General Rural' in the Scheme. The amendment to the Alkimos Eglinton DSP proposes the following -

- Modify the **Central Precinct** (between Rail Corridor and Freeway Reserve) designation from **Service Commercial** to **Urban** (to accommodate Residential development). The 35 ha area (approx.) is to be subdivided as part of a LSP, similar to the Lot 6 Western Precinct.
- Extend the DSP boundary to include the land within the **Eastern Precinct** (Lot 6 and lots between Lot 6 and Wanneroo Road) and designate this land as **Service Commercial**. This area is 112 ha of land (approx.)

The Central Precinct proposes development of the land for:

- Residential purposes comprising a range of residential densities
- Public open space (POS)
- An integrated movement network for vehicular, cyclist and pedestrian traffic.

The assessment of the transport characteristics of the Amendment and subdivision is based on the accepted methodology used for the Lot 6 Western Precinct, including:

- the originally planned rail station at North-Alkimos will no longer proceed and land use immediately to the south of the site is now being progressed as mixed use (with initial development proposed as residential) and not service commercial.
- it is assumed that a bridge will be provided across the rail reserve to link the Lot 6 Central and Western Precincts. However, as this bridge is subject to further consultation and funding, GTA's analysis herein has assumed that traffic (vehicle) distributions over the bridge will be zero⁴, which provides for a more conservative higher demand analysis for the internal and external road network to/from the Central Precinct.

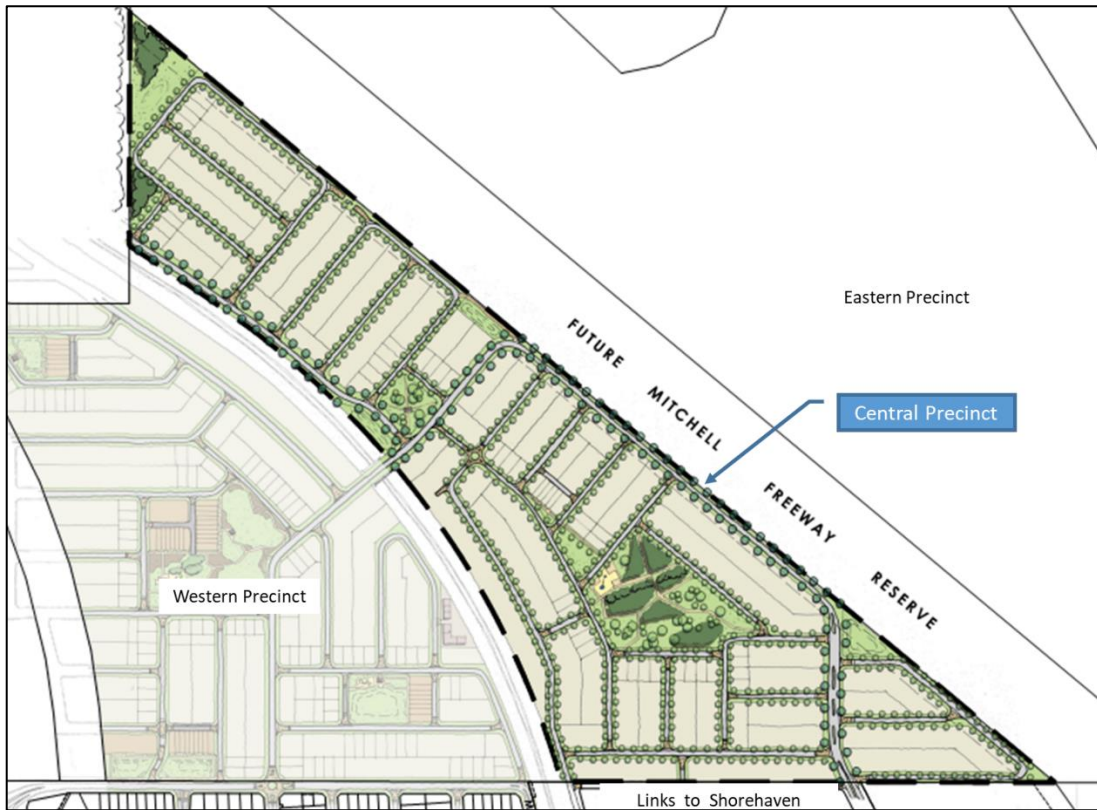
3.2 Proposed Land Uses

The proposed subdivision of the Lot 6 Western Precinct is shown in Figure 3.1, while an indicative layout for the Eastern Precinct is shown in Figure 3.2. Upon full development, the Central Precinct is expected to deliver between 480 and 520 residential dwellings while the Eastern Precinct is

⁴ In a separate exercise, a sensitivity analysis has been undertaken by GTA with the bridge in place and the resulting traffic volumes have been found not to compromise the function of the Neighbourhood Connector through the Lot 6 Taronga Western Precinct.

expected to deliver up to 400,000sqm gross floor area (GFA) of employment generating land uses. Each precinct will incorporate open space and supporting infrastructure as necessary, and in accordance with prevailing design guidelines, such as *Liveable Neighbourhoods*.

Figure 3.1: Central Precinct, Lot 6 Taronga Place, Proposed Subdivision



Source: CLE

Figure 3.2: Eastern Precinct, Lot 6 Taronga Place, Concept Layout



Source: CLE, September 2018

3.3 Future External Road Network

Main Roads WA recently extended the Mitchell Freeway to Hester Avenue, Clarkson. The Federal Government has allocated money within their budget to further extend the Mitchell Freeway to Romeo Road, however the project was not included in the most recent State Budget, and there is currently no program for the extension of the Freeway beyond this. It is unlikely, without Government intervention, this state infrastructure will be extended to the Site in the foreseeable future.

On this basis, Marmion Avenue will be required to provide a regional road access function for the development until the freeway is further extended in the longer term and access to the freeway via Alkimos Drive (to the south) will become the second region linkage. Therefore in the interim, Marmion Avenue provides the only direct primary distributor function in the absence of the freeway.

Road access to Marmion Ave would currently occur via connection to Scotthorn Drive to the South, and then connection to Bluewater Drive, which connects onto Marmion Avenue west of the Site. The intersection of Bluewater Drive with Marmion Ave has been constructed as a full movement T-intersection, consistent with the City of Wanneroo's *Marmion Ave Access Policy*. The City of Wanneroo is currently completing a detailed design for the upgrade of Marmion Avenue from Jindalee through to Yanchep. Proposed timing for the delivery of this upgrade is for construction to commence in 2018 and be completed by 2020. In order for the Lot 6 Central DSP Area to connect to Marmion Avenue, road connections will need to be provided to the west via a bridge (subject to funding) over the rail line, or to the south to the Shorehaven Development.

Mitchell Freeway

It is currently planned to extend Mitchell Freeway to Romeo Road (next major east-west road south of Alkimos Drive), with an expected completion date of 2022. It is not clear whether further stages of freeway extension to Alkimos Drive and Eglinton Drive would also be delivered as part of a single package of works given the relatively short distances between each of these planned interchange locations.

Ultimately, Mitchell Freeway is planned to extend north of Two Rock into the Shire of Gingin. Traffic modelling conducted for the Central Alkimos LSP indicates that Mitchell Freeway is expected to carry approximately 70,000 vehicles per day upon completion of the Alkimos Eglinton DSP (notionally 2031)⁽⁵⁾.

Wanneroo Road

It is conceivable that within the lifetime of the DSP, Wanneroo Road would be upgraded to a full dual-carriageway road from Joondalup Drive to the subject site. Previous traffic modelling undertaken for the Alkimos Central LSP indicates Wanneroo Road is expected to carry approximately 14,250 vehicles per day⁽⁶⁾ upon full build-out of the DSP. It is expected that Wanneroo Road would have a speed limit of 80km/h the medium to long-term, perhaps lower still, as frontage development is constructed and the number of major intersections increases.

Alkimos Drive and Eglinton Drive (Pipidinny Road)

These are major east-west aligned sub-arterial (Distributor A/B) roads connecting the DSP area to Mitchell Freeway and further east to Wanneroo Road.

Alkimos Drive is planned as the next freeway interchange cross-street north of Romeo Road, with an alignment south of the existing Shorehaven subdivision. Eglinton Drive is proposed to partially follow the existing alignment of Pipidinny Road west of Wanneroo Road for a short distance before departing on a new road alignment further west into the DSP area via an interchange with Mitchell Freeway, north of the subject site.

Both Alkimos Drive and Eglinton Drive are expected to be 4-lane dual carriageway roads with speeds limits of 60 to 80km/h. According to previous traffic modelling, these roads are expected to carry to the following traffic volumes:

- Alkimos Drive
 - 32,000 vehicles per day west of Mitchell Freeway
 - 17,500 vehicles per day east of Marmion Avenue
- Eglinton Drive
 - 19,000 vehicles per day west of Mitchell Freeway
 - (Pipidinny Road) up to 7,000 vehicles per day east of Mitchell Freeway

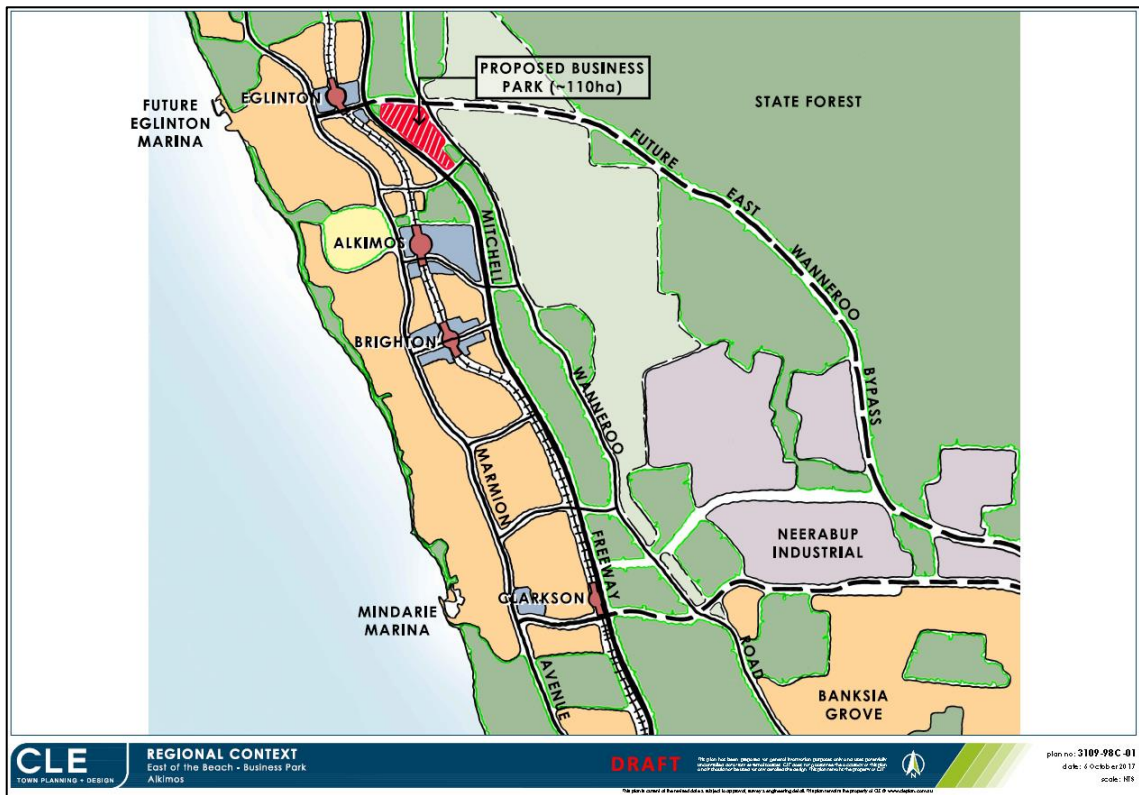
Whiteman–Yanchep Highway (Future E-W Wanneroo Bypass)

The Whiteman-Yanchep Highway is a new north-south primary distributor road that will connect the North-West sub-region to the North-East and Central sub-regions and broader regional road network. The planning for this road is not yet complete; however, it does however form part of the transport plan for Perth and Peel @ 3.5 Million. GTA is aware that this road does not form part of the current Main Roads WA Regional Operations Model (ROM) at the 2031 future year; however, it is planned for the longer term as shown conceptually in Figure 3.3.

⁵ Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013.

⁶ Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013.

Figure 3.3: Future East Wanneroo Bypass in the context of the proposed Eastern Precinct



Source: CLE

3.4 Eastern Precinct

3.4.1 Internal Movement Network

For the purposes of the Amendment, an assessment of the internal movement network of the Eastern Precinct is not required, as this will be better developed in the next stages of more detailed planning and traffic modelling. While an internal layout has been prepared, this primarily guides the planning of developable land area, after accounting for road reserve and public open space.

For a development of this type, it is critical that walking and cycling infrastructure is provided internally and extended externally including adequate connections to/from key external destinations.

The provision of walking and cycling infrastructure within the structure plan area will contribute to completing these networks with improved amenities to be provided as per the requirements of Liveable Neighbourhoods for each given level of road hierarchy. As a minimum, consideration should be made to include:

- adequate width for safe on-road cycling
- pedestrian paths on at least one side of the road along all internal access roads.

In terms of public transport, provision should be made for bus services to enter the site along key internal roads. The route alignment through the site should ensure that the majority of the development lots are within 400m walking distance of a bus stop. Bus routes, such as those associated with the future planned Secondary Transit System (STS) could conceivably be

extended into the Eastern Precinct of the subject site, connecting to the employment area to the rail corridor, the areas primary transit system.

3.4.2 Access Strategy

A broad site access strategy has been developed for this precinct for the purposes of securing these access points to provide certainty in guiding future subdivision applications. The locations of the proposed site accesses are:

- Left-in intersection on Alkimos Drive east of Mitchell Freeway (with possible future left-out dependent on further traffic assessment)
- Full-movements access on Wanneroo Road midway between Alkimos Drive and future Eglinton Drive (Pipidinny Road)
- Left-in/left-out intersection either north or south (or potentially both sides) of the full movement access on Wanneroo Road
- Full-movements access on Eglinton Drive (Pipidinny Road) west of Wanneroo Road.

Given the location of the site and the traffic volumes and mix of vehicles likely to use the site and external roads, these future full-movement site accesses may be roundabout or traffic signal intersections. With the expectation of Main Roads WA's recent general requests for roundabouts over traffic signals, the layout requirements have been modelled in regard of roundabouts, with the diameter and number of approach lanes discussed in Section 4.7. However, this does not preclude the form of intersection as signals to support the network if this is demonstrated as appropriate in the next stages of planning.

With regard to the proposed left-in/left-out site accesses, these will be designed to meet the requirements of Austroads and Main Roads WA. No particular difficulties are expected in the ability to deliver a left-in/left-out intersection either side of the proposed full-movement site access on Wanneroo Road. Further commentary on the proposed left-in, and potential left-out, site access east of the future Mitchell Freeway alignment is provided at Appendix A.

3.5 Central Precinct

The internal layout has been developed to provide an integrated movement network which is legible and useable by all modes of transport for travel, to, from and within the area. As the Central Precinct is bound to the east by the rail reserve, access and movement related to the LSP is generally focussed to the north and south. As noted in the context Section 3.1, a bridge over the rail corridor is proposed to connect the Central Precinct to the adjacent Western Precinct LSP area and ultimately Marmion Avenue, however the bridge is subject to funding.

Further, given the relatively small scale of the Central Precinct within the wider DSP, it is not possible to necessarily provide new key long distance links for travel through the DSP area but a key principle in developing the networks was to ensure consistency and contribute to adjacent LSP and DSP area planning.

3.5.1 Future External Movement Network and Land Development

The wider DSP area is largely undeveloped at present and therefore there will be a number of changes to the movement networks around the subject site Central Precinct. The provision of infrastructure within the site contributes to legible, district-wide networks that do not compromise the intent of the wider network planning.

Walking and Cycling

In order to determine the wider proposed networks, reference was made to the LSP documents for Shorehaven and Eglinton Estates, together with the Transport Impact Assessment completed by GTA for the Lot 106 Western Precinct. These illustrate a proposed network of shared paths and on-road cycle lanes (relative to road type), which can be continued into and through the Central Precinct.

The external routes identified are provided graphically in Section 3.3.2 relative to the proposed networks within the site.

Public Transport

In terms of future public transport provisions, the State Government's long-term plan for the public transport system in and around Perth includes extending the existing northern suburbs rail corridor from Butler to Yanchep, via Alkimos and Eglinton, by 2031. The delivery of the extended rail line is being managed by MetroNet and it is understood that the 13.8km extension is planned to start construction in 2019.

The DSP includes the abovementioned railway extension, with rail stations proposed at Eglinton approximately 1.5km north of the subject site and at Alkimos City Centre, approximately 2.5km to the south. The DSP also shows a station at North-Alkimos immediately south of the site within the Shorehaven Estate; however, it is understood that this station will no longer be progressed. Assumptions associated with this traffic impact assessment presented in this report reflect the removal of this station.

Locally, the operation of bus services on Marmion Avenue in the vicinity of the subject site will continue as demonstrated within the DSP, with further stops added as the area develops.

Vehicular Travel

Similar to the walking and cycling networks, the road network layout within the subject site Central Precinct is influenced by the established Shorehaven Estate and the adjacent Eglinton Estates LSP proposal. These external connections are denoted on the proposed LSP layout shown in Figure 3.1. Key links for the Central Precinct include the Scotthorn Drive connection to Alkimos Drive, other southern connections through Shorehaven Estate and the connection north to the Eglinton district centre.

3.5.2 Central Precinct Movement Network

The Central Precinct layout has been developed such that access to and from it is easily achievable without compromising the intent of the movement networks in the DSP and negatively impacting the amenity of the residential areas of the subject site. In general, there will be limited 'through' trips in the precinct i.e. the significant majority of movement within the site will originate and terminate here.

Pedestrian and Cycle Networks

The Central precinct is approximately 1.3km long north-south and approximately 650m wide at its widest point on the south boundary. At its widest point (in an east/west direction) along the southern boundary. The distances from one area of the development to another are therefore relatively small and comfortably accessible by either walking or cycling. This is also relevant for access to the local schools and retail offerings provided in the adjacent Shorehaven development to the south.

The internal movement networks have been developed in a way which provides greater amenity for pedestrians and cyclists through the provision of indirect through vehicle routes and landscaped environments. This type of environment reduces vehicle speeds by design, thus creating a safer environment which encourages active travel modes for local trips to recreation areas, local schools and retail. Furthermore, there are a large number of pedestrian and cycle routes proposed in the DSP which provide area wide linkages and networks for these modes. In this respect, the intent and principles of the wider movement networks within the DSP have also been maintained, and it is expected that any through vehicles will remain on the higher order roads within the precinct.

To further improve pedestrian amenity, footpaths shall be provided at a minimum on one side of all roads, and where appropriate and reflecting the type and location of the road, a footpath on both sides shall be provided.

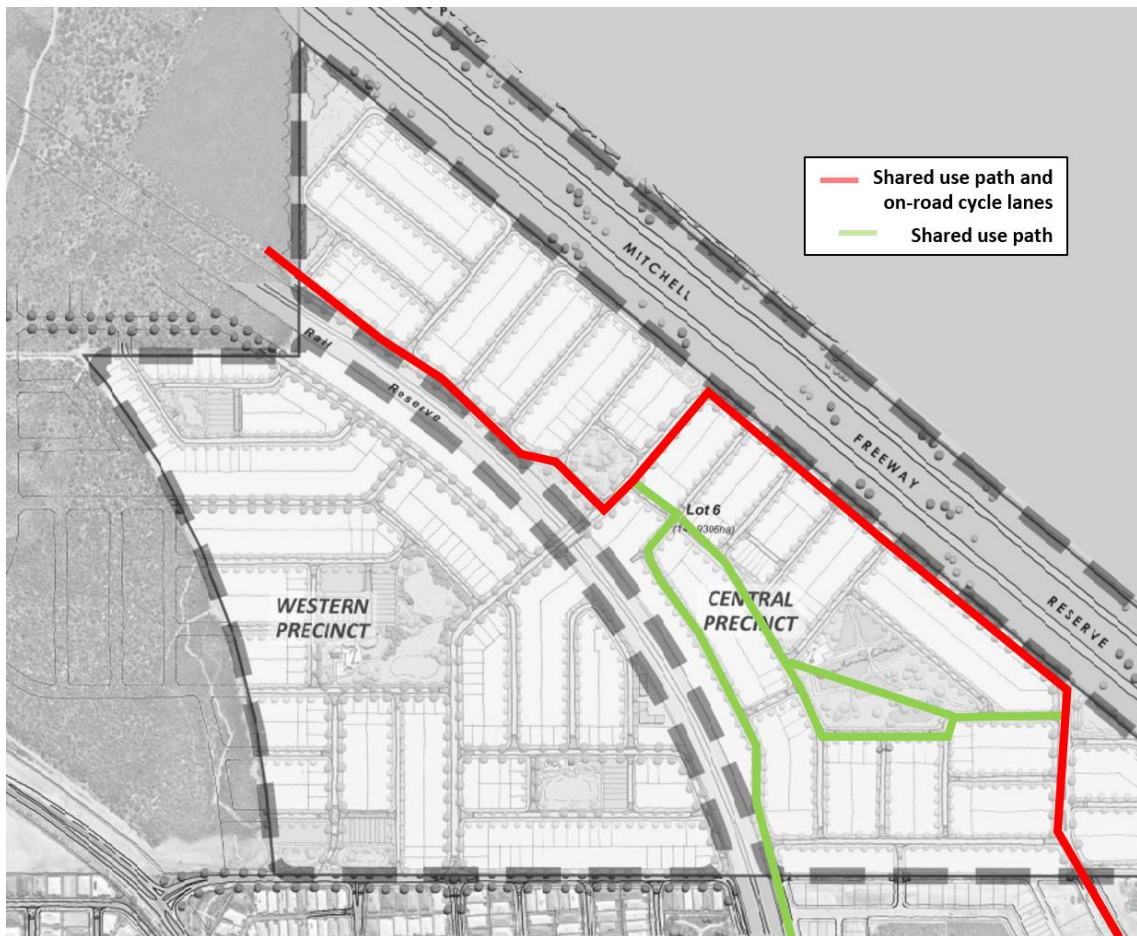
Future pedestrian and cycle infrastructure requirements for the wider area are set out in the DSP. The provision of infrastructure within the Central Precinct will contribute to completing these networks with local infrastructure to be provided as per the requirements of *Liveable Neighbourhoods* for each level of the road hierarchy. As a minimum, these would therefore include:

- a minimum of a shared path on all Neighbourhood Connector roads, with on-road cycle lanes also provided where relevant
- a minimum of one pedestrian path on all access roads with a path on both sides for key roads.

The introduction of these facilities within the LSP will support the City of Wanneroo's Bike Plan document, "*Cycle Wanneroo*". This document aims to establish cycling in the City of Wanneroo by providing infrastructure, legible routes and policy to support its growth with a focus on infrastructure and path provision in public open spaces.

The proposed key cycle routes through the Central Precinct, relative to the external cycle routes is illustrated in Figure 3.3.

Figure 3.4: Central Precinct Proposed Key Cycle Routes



Source: CLE

3.5.3 Proposed Vehicular Access

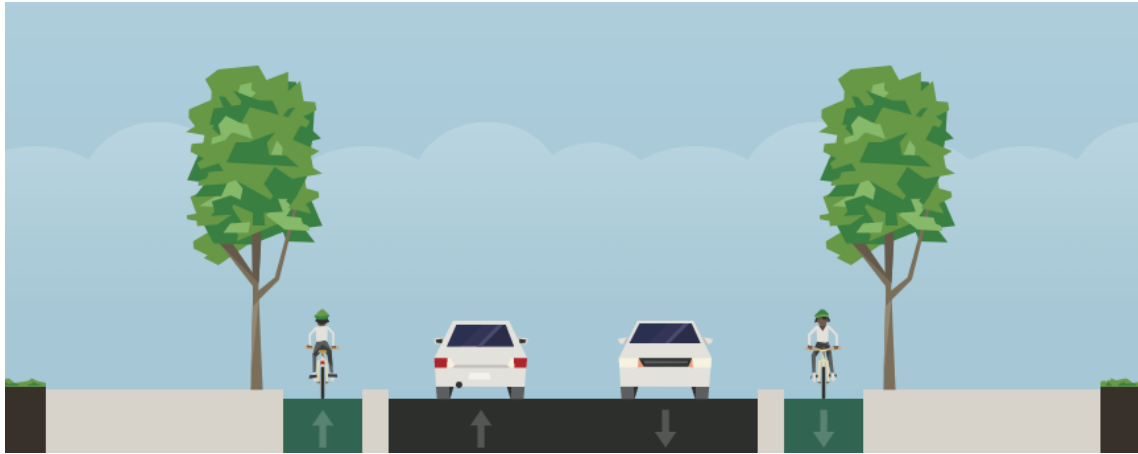
Given the sites location in relation to the surrounding LSPs, it does not have direct frontage to strategic roads in the area, nor is it required or intended to. Rather secondary access to the Central Precinct is gained via the higher order road network developed within the DSP, together with connections to and through the adjacent LSP areas. The Lot 6 Central DSP area comprises a network of development roads including a Neighbourhood Connector running south-east to north-west, and local access roads and laneways.

In this regard, the Shorehaven Estate has been used to guide the key routes to and from the Central Precinct and the key access points. The Central Precinct road network therefore has been designed with regard to the adjoining structure plans in the area which are currently under construction.

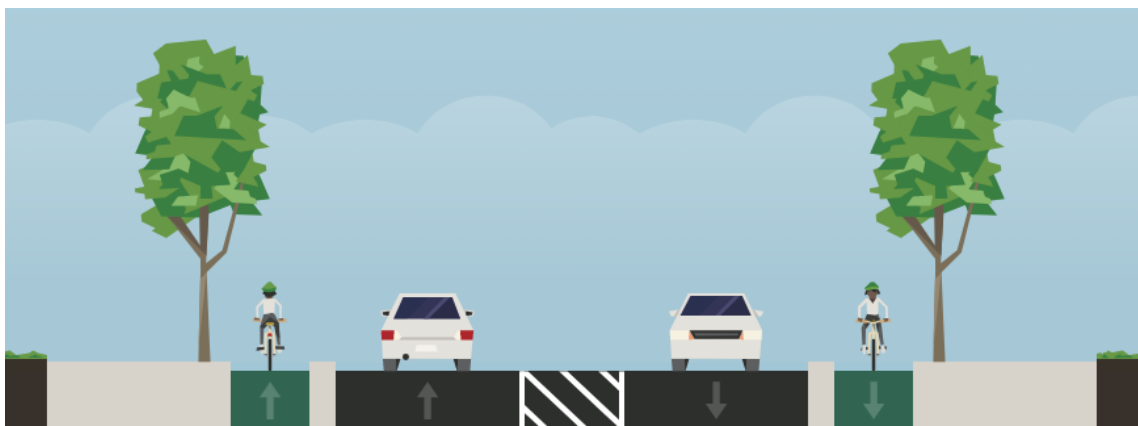
The Central Precinct will link to Shorehaven at three locations, at Scotthorn Drive and at two other minor roads to the west. At present Scotthorn Drive has a 25m road reserve, but as part of the Central Precinct development, this will be reduced to 20m in accordance with its typology as a neighbourhood connector without on-street parking. This arrangement is illustrated indicatively on Figure 3.5, and should be adapted to suit the City of Wanneroo sight distance requirements and the *Liveable Neighbourhoods* guidelines. In particular, it is proposed that the development

roads be designed to suit lower vehicle operating speeds to ensure safer operation and improved pedestrian movement.

Figure 3.5: Indicative Neighbourhood Connector Road Typologies (20m Reserve Width)



Cross-section consists of the following widths: 5.0m verges, 1.5m bicycle lanes with 0.5m kerbed buffer and 3.5m vehicle lanes.

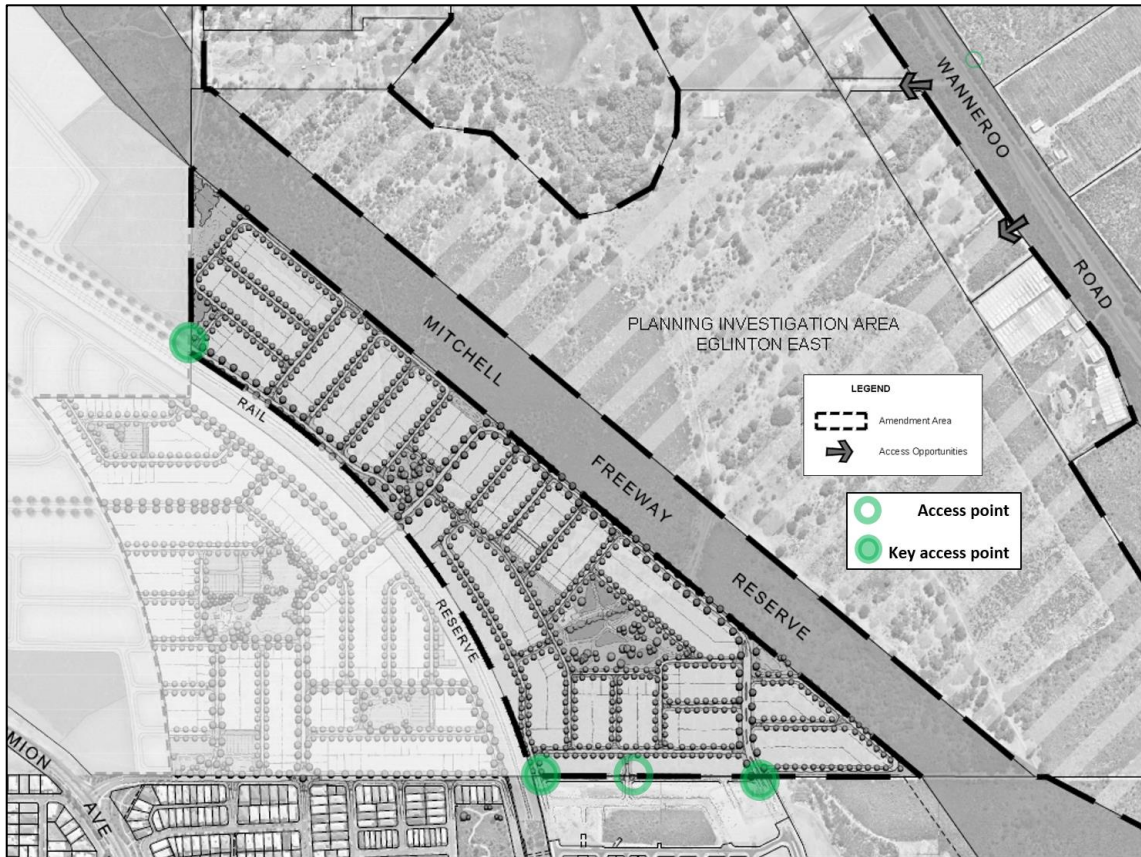


Cross-section consists of the following widths: 5.0m verges including 1.5m bicycle lanes, 0.5m kerbed buffer, 2.0m painted median and 3.5m vehicle lanes.

Source: Streetmix

Overall, there are a total of 4 points at which access can be gained to/from adjacent development areas, as shown on Figure 3.6.

Figure 3.6: Central Precinct Vehicle Access Points



The key proposed access points to the central precinct are all through-roads to the Shorehaven development to the south. These roads, particularly Scotthorn Drive, provide good connections to the future planned Alkimos Drive which will provide the required east-west link on the strategic road network, which in turn will provide access to Marmion Avenue and Mitchell Freeway (once extended). This level of access to the strategic road network is of great benefit for both private vehicle and public transport access. It is expected that a minor amount of development traffic will be drawn north towards the Eglinton district centre; therefore, access to the wider road network will largely be focused south at the Alkimos Drive/Scotthorn Drive intersection.

4. Traffic Impact Assessment

4.1 Overview

The process for identifying, assessing and quantifying the potential traffic related implications of the proposed structure plan and the Amendment is described in this section of the TIA.

Significant highway infrastructure improvements to roads around the subject site are planned as noted in the previous sections of this report. The intention of this section of the report is to identify the degree to which the proposed development relies on the delivery of this infrastructure and/or if any interim arrangements could support the development of the site.

The assessment methodology is as follows:

- Ascertain the required performance objectives
- Establish the appropriate future design year
- Determine the baseline volumes (existing background traffic growth)
- Estimate the quantum of traffic generated by the development proposal
- Assign the traffic to the future transport network
- Assess the performance of key intersections connecting to the site accounting for changes to the external road network, to be delivered by the project site and in future by Main Roads WA
- Assess the mid-block capacity of key roads in the area in the post-development scenario.

4.2 Threshold Criteria

TIA guidelines indicate a traffic analysis is required when a proposed development adds 100 vehicles per hour or more to a particular lane mid-block, based on this increase approximating 10% capacity of an urban road lane.

4.3 Assessment Context

The traffic impact assessment for the subject site has been completed for the 2031 design year, consistent with the planning and transport modelling completed by Main Roads WA for the Perth metropolitan area, as well as being consistent the design year adopted in the transport study for the DSP.

It is assumed the overall development of both the Central and Eastern Precincts of the subject site will be fully operational at 2031 (i.e. ultimate development scenario), as this is the furthest design year for which Main Roads WA modelling has been completed; however, it is acknowledged that development of the Eastern Precinct is likely to extend beyond this horizon.

4.4 Land Use Traffic Generation Rates

4.4.1 Residential

The vehicle trip generation rates adopted in this assessment are based on the principles set out in the WAPC Guidelines.

A single house on a standard lot in an outer metropolitan area will typically generate up to 0.8 to 1.0 trips in the peak hour and 8 to 10 trips per day. Medium density dwellings generally exhibit a lower traffic generation rate. In outer metropolitan areas, where public transport accessibility is relatively low, the rate for medium density units is typically in the order of 6 to 8 trips per day. Closer to an inner metropolitan area the rate reduces to in the order of 3 to 6 trips per day depending on dwelling size, socioeconomic demographic, parking provisions and accessibility to public transport and local amenities, among other things. The location of the subject site, potentially within the catchment of a future rail station on the Ellenbrook rail line, may further reduce car-based trips made during peak hours. Peak hour rates are typically 10–12% of daily rates.

It is noted that transport modelling completed to for the Shorehaven LSP, immediately south of the subject lands, identified a vehicle trip rate of 6.35 vehicle movements per day per dwelling, with 10% occurring in peak hours. In the interests of remaining conservative (on the high) side for this stage of planning, the WAPC high-level trip rate of 8 vehicles per dwelling per day is adopted within this assessment, with 10% assumed to occur in peak hours.

4.4.2 Employment

The employment land use scenarios in this assessment have a substantial land coverage and a developable floor area exceeding 100,000sqm overall. For sites on this scale, internal trip capture is an important consideration as the trip generating characteristics (external attracted trips) of an overall business park or industrial estate are less intensive than individual buildings.

In this regard, GTA has reviewed several sources of data that could be relevant to the proposed employment land use, together with some commentary on the appropriateness of each source:

- **WAPC TIA Guidelines** (commercial, industrial land uses) – not suitable due to significant departure from the principle of shared use within an overall estate development. These are considered representative of small or single-building employment sites.
- **RTA Guide to Traffic Generating Developments (2001)** (warehouse, industrial estate, business park land uses) – potentially suitable, although no immediately apparent appreciation of the scale or mix of land uses that the trip rates are based upon, with the exception of business park which is based on sites up to 38,200sqm only. While the document is dated 2002, the surveys supporting the trip rates date from much earlier, potentially from the later 1970s.
- **RMS NWS Guide to Traffic Generating Developments - Updated traffic surveys (August 2013)** (business parks and industrial estate) – relatively recent (2012) compilation of trip survey data at employment developments in Sydney and elsewhere in New South Wales. It is noted that average rates in this survey are similar to the trips rates for warehouse in the earlier RTA guide from 2002 (approximately 0.5 – 0.6 trips/100sqm in peak hours). The latest RMS guide includes survey site details, including overall floor area and mix of business types. For larger sites, there are four in the RMS sample, ranging from approximately 89,000sqm to 695,000sqm. The peak hour vehicle trip rates of these sites vary from 0.16/100sqm to 0.92/100sqm, with an average of 0.28/100sqm.

The variation is caused by the differing mix of land uses at each site, with sites that are mainly logistical distribution uses being less intense, through to sites at the upper end that have a strong office-based and retail mix of land uses in addition to logistical distribution uses.

- **GTA Database** (business parks) - surveys of employment land uses in outer urban areas in metropolitan Melbourne which are close to freeways. The surveyed sites include Northcorp Business Park, Broadmeadows and Global Business Park, Tullamarine. Peak hour vehicle trip rates ranged from 0.07/100sqm to 0.3/100sqm. It is worth noting that GTA has adopted a peak hour vehicle rate of 0.3/100sqm for employment sites in outer urban growth areas in metropolitan Melbourne.

On the above basis, and particularly on the basis of the large scale of the site, GTA consider the following peak hour vehicle trip rates potentially suitable for use in this assessment:

- 0.2/100sqm, representative of a development that is mainly logistical distribution
- 0.3/100sqm, representative of a development that is mainly logistical distribution but has some office/retail uses.
- 0.5/100sqm, representative of a development that contains a more substantial mix of logistical distribution/office/retail use.

GTA's assessment of land use traffic generation for these land uses indicates that peak hour traffic generation is approximately 10% of daily traffic generation.

4.5 Background Traffic Volumes

As previously discussed, given the location and scale of the subject in the context of the DSP movement networks, it is expected there will be limited through traffic, particularly at the Eastern Precinct, which can be considered a contained development site. Accordingly, the following aspects are considered to be the focal points of the study for each precinct:

- **Central Precinct** - traffic generation and operation of the Alkimos Drive/Scotthorn Drive intersection.
- **Eastern Precinct** – Traffic generation and operation of site accesses and Wanneroo Road/Alkimos Drive.

4.5.1 DSP and Adjacent LSPs

The DSP documents and LSP documents for Shorehaven and Eglinton Estates have been reviewed to determine any relevant traffic volumes for consideration. It is important to note in this respect that traffic generation associated with the LSP area has been considered within the DSP and the movement networks originally defined on this basis. The current proposed development in the Central Precinct is consistent with the most recent transport study for the area, which was completed by GTA for Western Precinct. That study considered the Central Precinct as a residential development, rather than the commercial zoning that forms part of the DSP.

The LSP report prepared for the Shorehaven Estate to the south states that Scotthorn Drive is expected to carry in the region of 4,500 vehicles per day (vpd) at the southern boundary of the Central Precinct, and around 7,650 vpd north of its intersection with Alkimos Drive. The Shorehaven Estate LSP traffic report indicates that other roads north of Alkimos Drive, east of the rail corridor area expected to carry up to 500 vpd. Note however, that the volumes on the key roads are considered to be particularly high since these assume a rail station with park and ride at Alkimos North. As this rail station will no longer be provided, traffic flows included in the Shorehaven Estate LSP report are likely to be significantly higher than will be realised.

A summary of adjacent road categories and forecast volumes on the surrounding road networks as described above and extracted from the adjacent LSP reports noted as follows:

- **Mitchell Freeway** (Primary Regional Road)
 - 70,000 vehicles per day north of Alkimos Drive
- **Wanneroo Road** (Primary Regional Road)
 - 14,250 vehicles per day north of Alkimos Drive
- **Marmion Avenue** (District Distributor A Road)
 - 31,000 vehicles per day north of Alkimos Drive
- **Alkimos Drive** (District Distributor A/B road)
 - 32,000 vehicles per day west of Mitchell Freeway
 - 17,500 vehicles per day east of Marmion Avenue
- **Eglinton Drive** (District Distributor A/B road)
 - 19,000 vehicles per day west of Mitchell Freeway
 - (Pipidiny Road) up to 7,000 vehicles per day east of Mitchell Freeway
- **Scotthorn Drive** (neighbourhood connector road)
 - 7,650 vehicles per day north of Alkimos Drive

For currently zoned DSP lands, traffic volumes at the key intersection connecting the Lot 6 Central Precinct to the distributor road network (Alkimos Drive/Scotthorn Drive) are shown in Figure 4.1 and Figure 4.2 below. These volumes are extracted from the traffic and movement study for Alkimos Vista (then Central Alkimos)⁽⁷⁾ and form the base position for the assessment of proposed changes to land zoning.

Figure 4.1: Alkimos Drive/Scotthorn Drive Current DSP Traffic AM Peak 2031*

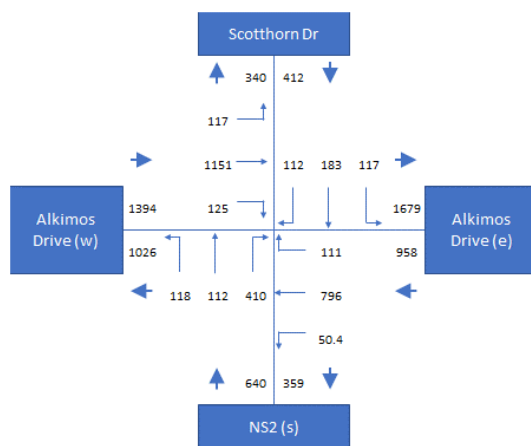
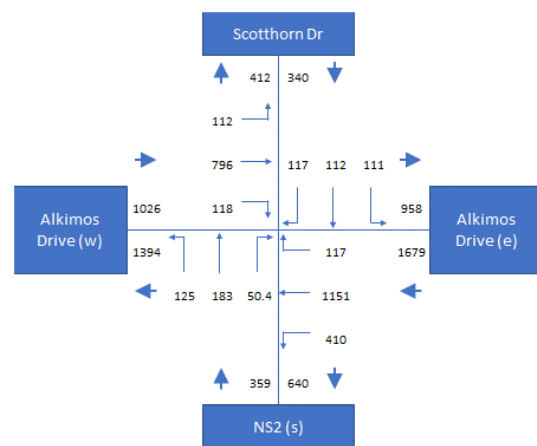


Figure 4.2: Alkimos Drive/Scotthorn Drive Current DSP Traffic PM Peak 2031



* DSP modelling has traffic data for PM peak hour and daily volumes only. For the purposes of this assessment, the AM peak hour is represented by inverting the PM peak hour traffic movements.

4.5.2 Rezoning of Lot 6 Central Precinct

The most recent traffic modelling for the Shorehaven LSP include the Lot 6 Central Precinct as an employment land use. With the proposal to change this precinct to a residential land use, the directional split of traffic during peak hours becomes an important consideration as this may

⁷ Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013.

have an influence on intersection performance. In this regard, it is appropriate to remove the employment related vehicle trips associated with this zoning, before adding the proposed change to a residential land use.

On the basis of the development area in the Central Precinct being approximately 35 hectares (not including roads and open space), it is assumed that a potential employment developable floor area would be approximately 50% of this, which allows for car parking, landscaping, loading areas and back of house. A possible employment floor area for the Central Precinct is therefore estimated at 103,000sqm.

For the purposes of assessing the future highway network, based on the reasoning set out in Section 4.4, it is assumed that the previous employment land zoning would generate traffic at a rate of 0.5 vehicle movements per hour per 100sqm. The traffic generation under these assumptions is set out below in Table 4.1.

Table 4.1: Estimated Central Precinct Employment Zoning Traffic Generation

Land Use	Size	Daily Trip Generation		Peak Hour Trip Generation	
		Daily Rate	Daily Trips	Peak Rate	Peak trips
Employment	103,000sqm	5.0 trips/100sqm/day	5,150 trips/day	0.5 trips /100sqm/day	515 trips/hr

Also for the purposes of this assessment, and to be conservative on the high side, it is assumed that 60% of this traffic would use the intersection at Alkimos Drive/Scotthorn Drive, and that the traffic would be distributed at the intersection according to the proportions identified in the traffic and movement study for Alkimos Vista.

Figure 4.3: Alkimos Drive/Scotthorn Drive Background Traffic AM Peak 2031

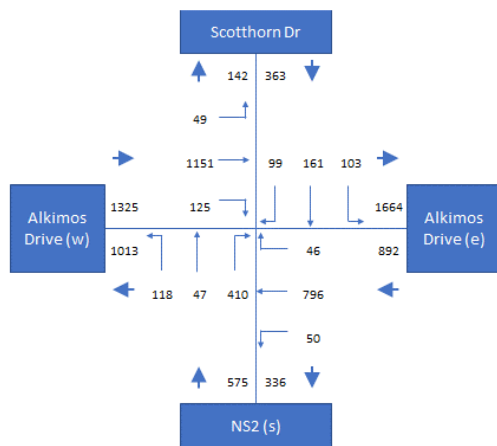
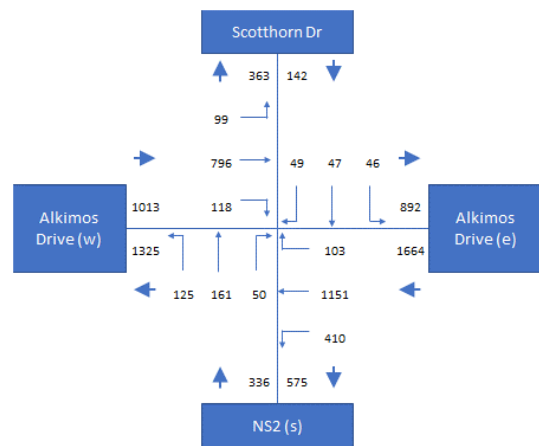


Figure 4.4: Alkimos Drive/Scotthorn Drive Background Traffic PM Peak 2031



4.6 Central Precinct - Residential Land Use Traffic Impact

4.6.1 Context

Previous TIA work prepared by GTA for the Lot 6 Western Precinct included an assumption that a road bridge would connect the Western and Central Precinct over the rail corridor. While this is a conservative assumption for the Western Precinct subdivision (as more traffic is drawn onto those roads), a scenario without a bridge is conservative for roads within the Central Precinct. As the viability of a bridge is subject to funding, GTA has assumed zero distribution over the bridge from the Central Precinct to the Western Precinct, meaning traffic is distributed in the north/south directions only, which in turn means traffic on internal roads will likely to be higher.

4.6.2 Traffic Generation

Based on discussions in Section 4.4, Table 4.2 sets out traffic generation estimates for both peak hour and daily periods based on the above, using the broad directional split of in/out vehicle traffic noted in the WAPC guidelines.

Table 4.2: Adopted Residential Trip Generation Rates and Traffic Generation Estimates

Dwellings	Peak Hour Assessment						Daily Traffic
	AM			PM			
	In	Out	Total	In	Out	Total	
1 Dwelling	0.2	0.6	0.8	0.5	0.3	0.8	8
506 Dwellings	101	304	405	253	152	405	4,050

4.6.3 Distribution and Assignment

Methodology

The directional distribution and assignment of traffic generated by the Central Precinct is influenced by a number of key factors, including:

- configuration of the surrounding road network, intersection locations and permitted movements at intersections
- anticipated future operations of roads and intersections in the area
- surrounding land uses, employment and commercial centres in relation to the site
- the proposed site access arrangements and turning movements permitted at these access locations.

Having consideration for these factors, the external traffic distribution proportions between the four key access intersections have been assumed as shown in Figure 4.5.

Figure 4.5: Estimated Distribution of Residential Traffic at Central Precinct Site Access Points



Source: Background plan by CLE, September 2018

In order to determine traffic distribution on individual roads, a series of traffic generating zones were devised within the precinct, as illustrated in Figure 4.6.

Figure 4.6: Traffic Generation Zones



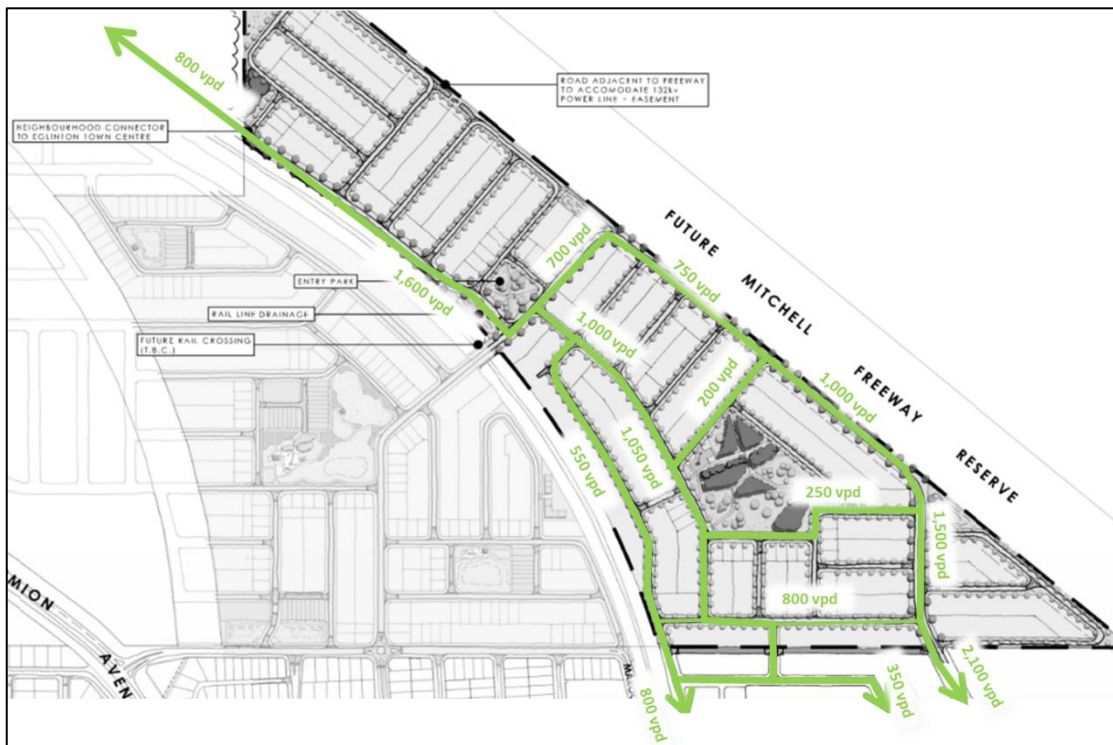
Source: Background plan by CLE

Daily Traffic

Traffic from these zones were then assigned onto the internal road network based on their attraction to the key access points shown in Figure 4.5. The daily demands expected on the proposed road network, including background traffic, are set out in Figure 4.7.

Of importance to note, the daily traffic volumes of the Lot 6 Central Precinct as a residential development are in line with (less than) the potential traffic generation of the same site as an employment land use. No daily traffic impact on external roads is expected in terms of overall traffic volume.

Figure 4.7: Estimated daily vehicle demands



Source: Background plan by CLE

Peak Hour Traffic at External Intersections

The Central Precinct residential development traffic as a result of the Amendment is shown at the key external intersection (Alkimos Drive/Scotthorn Drive) on Figure 4.8 and Figure 4.9. The distribution of traffic attracted to this intersection is based on the methodology noted above (80% of development traffic) with traffic assigned to individual movements based on the proportions identified in the traffic and movement study for Alkimos Vista.

Figure 4.8: Alkimos Drive/Scotthorn Drive Central Precinct Residential Development Traffic AM Peak

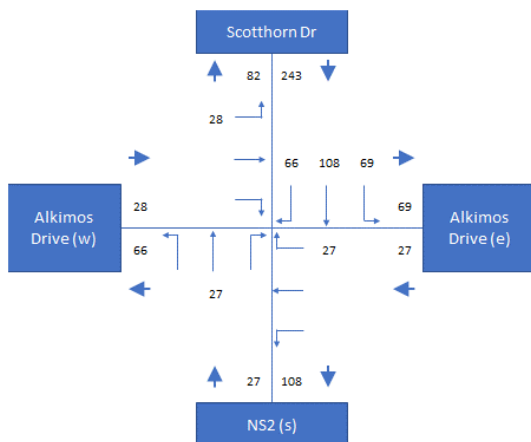
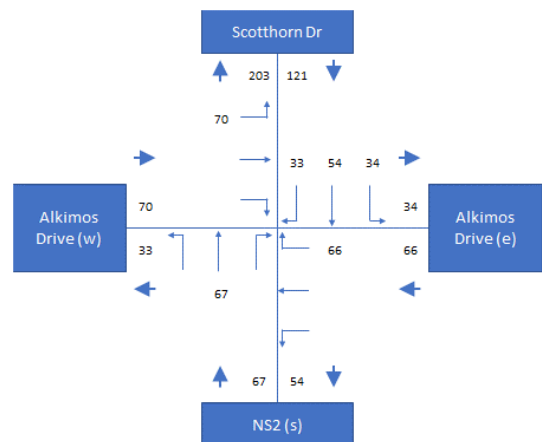


Figure 4.9: Alkimos Drive/Scotthorn Drive Central Precinct Residential Development Traffic PM Peak



It is noted that 20% of development traffic is estimated to be distributed to the north to/from Eglinton drive, representing approximately 80 two-way vehicle movements per hour. At most this is expected to result in maximum of 60 vehicle movements in any one-direction, in this case

leaving the development in the AM peak hour. This does not exceed the thresholds for further assessment as set out in WAPC Guidelines; GTA consider it a suitable position to adopt at this stage of planning.

The overall post-development traffic at the design year 2031 i.e. background traffic plus development traffic, is shown on Figure 4.10 and Figure 4.11.

Figure 4.10: Alkimos Drive/Scotthorn Drive Post Development Traffic AM Peak 2031

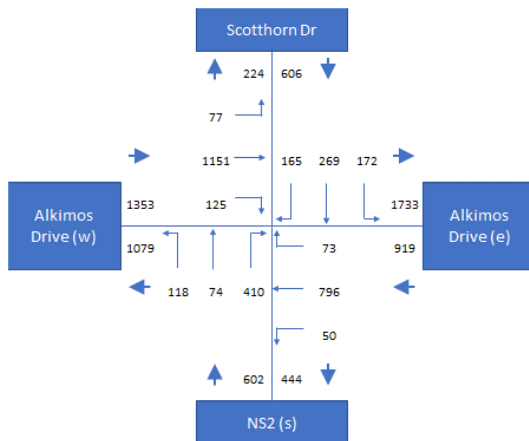
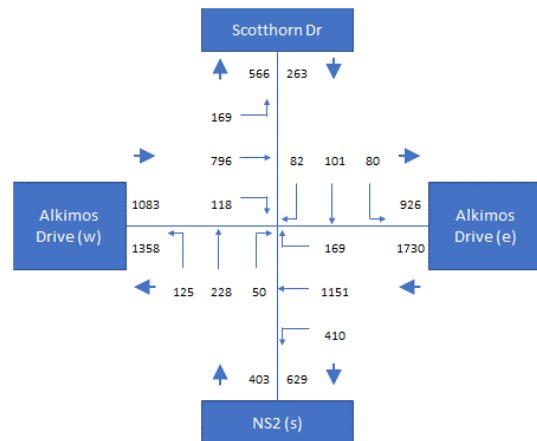


Figure 4.11: Alkimos Drive/Scotthorn Drive Post Development Traffic PM Peak 2031



External Intersection Performance

The assessment of the future base versus proposed intersection operational performance has been conducted using *SIDRA INTERSECTION*⁸. In this case, the base case is taken to be the Lot 6 Central Precinct zoned as employment within the DSP, with the proposed case taken to be the precinct rezoned for residential use.

The commonly used measure of intersection performance in Western Australia is referred to as the *Level of Service (LOS)*⁹. The LOS is banded measure of delay for the most critical movement on each leg of the intersection. WAPC guidelines indicates that LOS D is the acceptable maximum for all vehicles passing through an intersection, while a threshold indicative of a mid-LOS E is the acceptable maximum for individual movements.

While LOS is a useful guide to intersection performance, it often masks underlying performance characteristics. There are instances whereby a particular movement would report a very low LOS, but the vehicle demand may also quite low. It is improbable that a development application would be refused on the basis of low LOS for a minor traffic movement. For this reason, and many other others, a fuller appreciation of intersection performance is required, including review of the physical capacity (Degree of Saturation, DOS) and the queueing characteristics.

⁸ Program used under license from Akcelik & Associates Pty Ltd.

⁹ SIDRA INTERSECTION adopts the following criteria for Level of Service assessment:

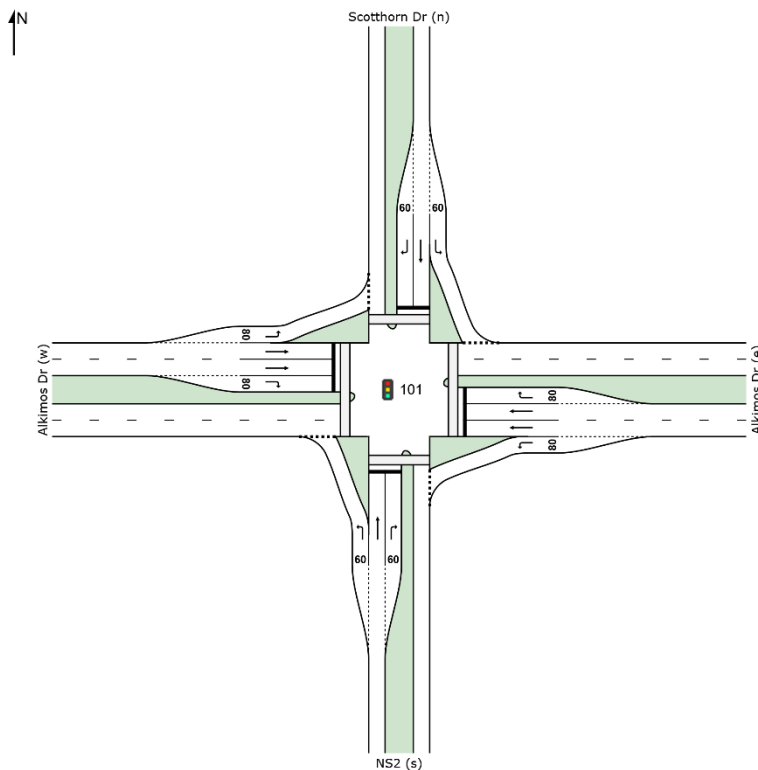
Level of Service		Intersection Delay (seconds)	
		Signalised Intersection	Unsignalised Intersection
A	Excellent	<=0.10	<=10
B	Very Good	10-20	10-16
C	Good	20-35	15-25
D	Acceptable	35-55	25-35
E	Poor	55-80	35-50
F	Very Poor	>=80	>=50

For signalised intersections, a DOS of around 0.95 has been typically considered the practical limit, beyond which queuing and delay increase disproportionately. It is also important to review queuing to ensure that the reported queues remain within the available auxiliary lane length and do not spill back into adjacent lanes. For unsignalised movements, particularly at roundabouts, it is important to check for:

- Instances of low opposing flow and high entry flow creating long queues but with low average delay
- Instance of high opposing flow and low entry flow creating long delays but short queues.

The general layout of the site access for the purposes of this assessment is shown in Figure 4.12 and is based on the layout as per the current DSP. Outputs of the intersection performance assessment are summarised in Table 4.3 with full results presented at Appendix B of this report.

Figure 4.12: Alkimos Drive/Scotthorn Drive – Assumed Lane Layout



Source: Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013.

Table 4.3: Alkimos Drive/Scotthorn Drive Base and Proposed Intersection Performance

Scenario	Arm	DOS	LOS	Avrg Delay	95th %ile Q
Base AM (Current DSP)	NS2 (s)	1.05	F	98s	315m
	Alkimos Dr (e)	0.86	D	40s	159m
	Scotthorn Dr (n)	0.71	D	41s	82m
	Alkimos Dr (w)	1.04	F	109s	439m
	Intersection		1.05	E	79s
Base PM (Current DSP)	NS2 (s)	0.71	D	42s	82m
	Alkimos Dr (e)	0.82	C	26s	239m
	Scotthorn Dr (n)	0.82	D	44s	57m
	Alkimos Dr (w)	0.82	C	26s	115m

Scenario	Arm	DOS	LOS	Avrg Delay	95th %ile Q
	Intersection	0.82	C	29s	239m
Proposed AM (Rezoned Central Precinct)	NS2 (s)	1.04	F	96s	303m
	Alkimos Dr (e)	0.70	D	37s	154m
	Scotthorn Dr (n)	1.03	E	70s	186m
	Alkimos Dr (w)	1.02	F	102s	423m
	Intersection	1.04	E	78s	423m
Proposed PM (Rezoned Central Precinct)	NS2 (s)	0.82	D	46s	106m
	Alkimos Dr (e)	0.85	C	30s	252m
	Scotthorn Dr (n)	0.76	D	45s	35m
	Alkimos Dr (w)	0.59	C	24s	117m
	Intersection	0.85	C	31s	252m

The results in Table 4.3 demonstrate the proposed rezoning of the Lot 6 Central Precinct is unlikely to have anything but a marginal impact on the performance of the Alkimos Drive/Scotthorn Drive intersection.

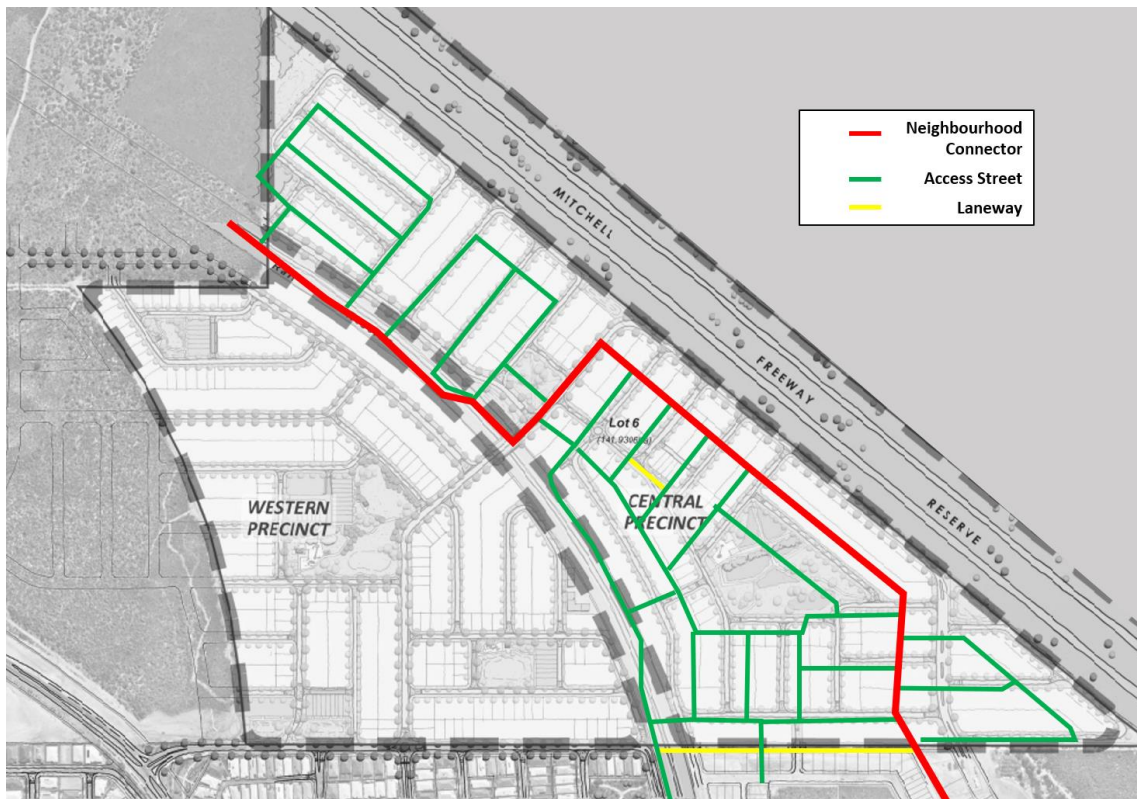
Internal Intersection Types

Given the sole residential land use within the Central Precinct, and the expected weighted one-directional peak hour flows within the internal road network, it is not expected any capacity issues will occur and that uncontrolled priority and roundabout intersections will be sufficient to accommodate expected demand.

4.6.4 Central Precinct Internal Road Hierarchy

The proposed internal road hierarchy for the Central Precinct was developed on the basis of the assigned daily traffic volumes, which is shown in Figure 4.13. This road hierarchy has been developed using the guidelines and indicative daily traffic volume limits set out in *Liveable Neighbourhoods*, together with the overall design principles and aims for the Central Precinct.

Figure 4.13: Proposed Central Precinct Road Hierarchy



Source: Background plan by CLE

The road reserve widths proposed for each class of road are in line with the guidance set out in *Liveable Neighbourhoods*, as set out below:

- Neighbourhood Connector = 19.4 – 24.4m
- Access Street D = 14.2 - 15m
- Laneway = 6 – 6.4m.

4.7 Eastern Precinct – Additional Land Use Traffic Impact

4.7.1 Context

The addition of the land area within the Lot 6 Eastern Precinct, between the Mitchell Freeway and Wanneroo Road, requires an appreciation of the likely site access requirements and external traffic impacts. The intention for the proposed employment generating land uses are likely a mix of logistical distribution/office/bulky good retail and other supporting service commercial and industrial land uses.

Of benefit to the development of the Eastern Precinct as a regional employment centre, is the future Whiteman-Yanchep Highway (Future East Wanneroo Bypass) which is a planned new north-south primary distributor road that will connect the North-West sub-region to the North-East and Central sub-regions and broader regional road network. This strategic road link forms part of the transport plan for Perth and Peel @ 3.5 Million (shown conceptually in Figure 3.3). The Eastern Precinct is ideally located to take full advantage of this future link and is expected to reduce the traffic demands that would otherwise travel directly south on Wanneroo Road, or south-west along Alkimos Drive and to the Mitchell Freeway, providing some alleviation to the intersections along future Alkimos Drive.

For the purposes of this TIA, the focus of the assessment is on site access and immediately adjacent key intersections of the Eastern Precinct, with a broader review of wider traffic effects on the distributor road network within the DSP area.

4.7.2 Traffic Generation

Based on discussions in Section 4.4 and the context set out above, Table 4.2 notes traffic generation estimates for both peak hour and daily periods, using the broad directional split of in/out vehicle traffic noted in the WAPC guidelines for an industrial/commercial land use.

Table 4.4: Adopted Employment Trip Generation Rates and Traffic Generation Estimates

Site Area	Peak Hour Assessment						Daily Traffic
	AM			PM			
	In	Out	Total	In	Out	Total	
100sqm	0.4	0.1	0.5	0.1	0.4	0.5	5
400,000sqm	1,600	400	2,000	400	1,600	2,000	20,000

4.7.3 Distribution and Assignment

Geographical Distribution

The directional distribution and assignment of traffic generated by the Eastern Precinct has been based on outputs from the Northwest Corridor Traffic Model (shown in Figure 4.14) with a further allowance for internal traffic assignment on east-west distributor road network within the DSP area.

Figure 4.14: DSP External Traffic Distribution



Source: Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013 – edited by GTA

The North West Corridor Traffic Model has an internal to external split of trips of 77% to 23%. For the purposes of this assessment, and as this employment area is in addition to the existing DSP area, GTA has assumed that 50% of trips will be internal to the DSP area, with 50% adding externally. At this stage of planning, no allowance has been made for trip discounting due to internal home-based work trips within the DSP area, this is again conservative on the high side.

Similarly, as the planned Whiteman-Yanchep Highway (Future East Wanneroo Bypass) is not currently part of the MRWA ROM, GTA has not accounted for the potential redistribution of traffic to this key strategic link. As noted previously, this future link and is expected to reduce the traffic demands that would otherwise travel directly south on Wanneroo Road, or south-west along Alkimos Drive and to the Mitchell Freeway. The analysis presented here for the intersections of Alkimos Drive is therefore again conservative on the high side.

Having consideration for these factors, the traffic distribution proportions to key roads external to the site are assumed as set out below:

- Mitchell Fwy (n) 5%
- Mitchell Fwy (s) 35%
- Wanneroo Rd (n) 5%
- Wanneroo Rd (s) 15%
- Alkimos Dr 25%
- Eglinton Dr 15%

Site Access Distribution

The site access strategy for the subject site Eastern Precinct comprises:

- Left-in intersection on Alkimos Drive east of Mitchell Freeway (with possible future left-out dependent on further traffic assessment)
- Full-movements access on Wanneroo Road midway between Alkimos Drive and future Eglinton Drive (Pipidinny Road)
- Left-in/left-out intersection either north or south (or potentially both sides) of the full movement access on Wanneroo Road
- Full-movements access on Eglinton Drive (Pipidinny Road) west of Wanneroo Road

Based on the above and given the limited movements at some of the site accesses, the adopted distribution of traffic to each of the access points is as set out in Table 4.5.

Table 4.5: Eastern Precinct Site Access Traffic Distribution

Access Point	Arrivals	Departures
Alkimos Drive (left-in)	40%	0%
Wanneroo Road (full-movements)	20%	60%
Wanneroo Road (left-in/left-out)	10%	5%
Eglinton Drive (full-movements)	30%	35%

4.7.4 Daily Traffic Volumes

Having account for the traffic generation and distribution of the site, together with expected future background traffic flows from current DSP modelling, the estimated future increase and total daily traffic on key roads in the study area is set out in Table 4.6.

Table 4.6: Estimated Daily Traffic Volumes

Road/Location	Future Background [1]	Expected Increase	Total Post-Development Traffic
Mitchell Freeway s of Alkimos Drive	80,760	7,000	87,760
Mitchell Freeway n of Alkimos Drive	70,110	2,000	72,110
Alkimos Drive (w of Mitchell Freeway)	31,650	5,000	36,650
Alkimos Drive (e of Mitchell Freeway)	9,660	10,500	20,160
Eglinton Drive (w of Mitchell Freeway)	19,000	3,000	22,000
Eglinton Drive (e of Mitchell Freeway)	7,000	5,500	12,500
Eglinton Drive (w of Wanneroo Road)	7,000	1,200	8,198
Wanneroo Road (n of Alkimos Drive)	14,250	9,470	23,719
Wanneroo Road (s of Alkimos Drive)	19,710	3,000	22,710
Wanneroo Road (n of Eglinton Drive)	9,820	1,000	10,820

[1] 2031 traffic volumes extracted from the Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013, unless stated otherwise.

[2] As per Section 4.5 of this report.

[3] As per Section 4.5 of this report, further estimated by GTA based on 20/80 north/south split of traffic using Alkimos Drive traffic using turning movements at Wanneroo Road.

[4] As per Section 4.5 of this report, further estimated by GTA based on 20/80 north/south split of traffic using Eglinton Drive (Pipidinny Road) traffic using turning movements at Wanneroo Road.

The total future volumes in Table 4.6 are within what are typically considered to be the functional capacities of roads on the primary and district distributor road network.

4.7.5 Internal Road Network & Intersection Types

An internal road network layout for the subject site Eastern Precinct has not been developed at this stage of planning. The Eastern Precinct is essentially a contained site, therefore it is not expected that a local road network operating north-south between adjacent lands, supplementing the primary road network, would be required.

Notwithstanding the above, it is expected that the need for an efficient movement network will be required to accommodate multiple modes of travel and traffic volumes to/from the site access points. Given traffic volumes generated by the employment land use are expected to be approximately 20,000 vpd spread over four or more access points, noting the distribution of traffic to these site access in Table 4.5, the largest roads in the precinct would be of the industrial connector type within a road reserve of generally 20-25m midblock, widened at intersections.

The connector road network would be supplemented by industrial access roads serving individual properties.

Given the sole employment land use within the Eastern Precinct, and the expected weighted one-directional peak hour flows within the internal road network, it is not expected any capacity issues will occur and that uncontrolled priority and roundabout intersections will be sufficient to accommodate expected demand.

4.7.6 Intersection Performance

The assessment of the future base versus proposed intersection operational performance has been conducted using *SIDRA INTERSECTION*. In this case, the full movements site accesses have been tested, it is assumed that the lightly trafficked left-out component of the supplementary access point(s) along Wanneroo Road will have sufficient capacity. As noted, the site access at Alkimos Drive is assumed to be left-in only; however, a left-out may be possible subject to further testing of intersection interactions in a later stage of planning.

Site Accesses

The general layouts of the full movements site access have been modelled as roundabouts as shown in Figure 4.15 and Figure 4.16 below, though this may also be in the form of traffic signals (subject to further analysis and stakeholder approval). Outputs of the intersection performance assessment are summarised in Table 4.7 with full results presented at Appendix B of this report.

Figure 4.15: Wanneroo Road/Site Access, assumed Roundabout (60m dia.)

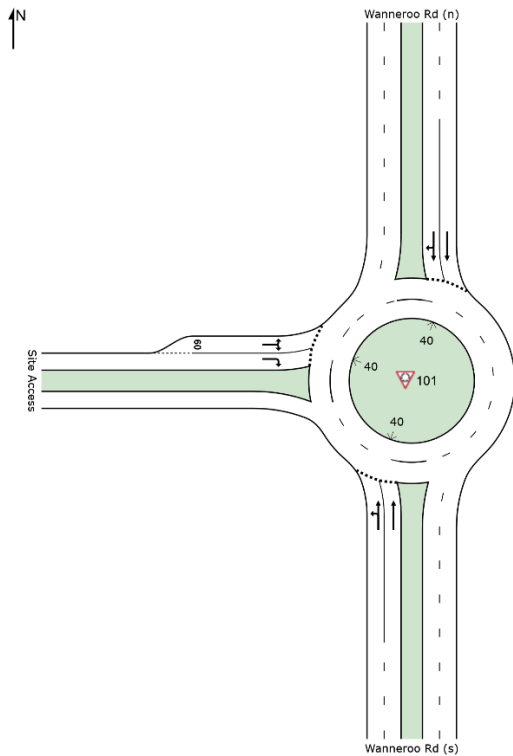


Figure 4.16: Eglinton Drive (Pipidinnny Road)/Site Access, assumed Roundabout (60m dia.)

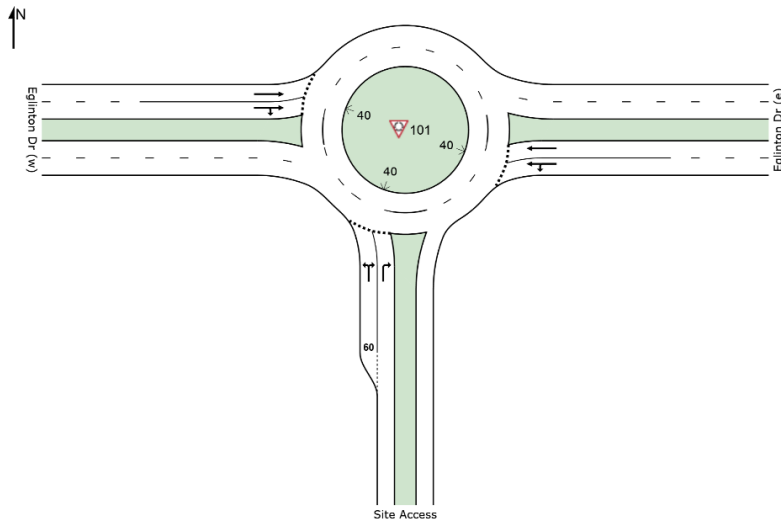


Table 4.7: Site Access Intersection Post Development Operational Performance

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
AM Wanneroo Rd/Site Access	Wanneroo Rd (s)	0.34	A	3s	17m
	Wanneroo Rd (n)	0.39	A	5s	17m
	Site Access	0.15	B	12s	5m
	Intersection	0.39	A	5s	17m
PM Wanneroo Rd/Site Access	Wanneroo Rd (s)	0.31	A	3s	16m
	Wanneroo Rd (n)	0.52	A	8s	26m
	Site Access	0.62	B	15s	35m
	Intersection	0.62	A	9s	35m

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
AM Wanneroo Rd/Site Access	Site Access	0.11	A	6s	4m
	Eglinton Dr (e)	0.26	A	5s	11m
	Eglinton Dr (w)	0.29	A	7s	14m
	Intersection	0.29	A	6s	14m
PM Wanneroo Rd/Site Access	Site Access	0.41	A	6s	18m
	Eglinton Dr (e)	0.12	A	3s	4m
	Eglinton Dr (w)	0.21	A	5s	8m
	Intersection	0.41	A	5s	18m

The results in Table 4.7 demonstrate that the proposed full movements Eastern Precinct site accesses are expected to operate acceptably upon full development of the site.

External Intersections

The external intersections immediately adjacent the subject site include:

- Wanneroo Road/Alkimos Drive
- Wanneroo Road/Eglinton Drive (Pipidinny Road)

Potential future roundabout layouts for these intersections are generally shown in Figure 4.17 and Figure 4.18 below. Outputs of the intersection performance assessment are summarised in Table 4.8 with full results presented in Appendix B of this report.

Figure 4.17: Potential Wanneroo Road/Alkimos Drive Roundabout (70m dia.)

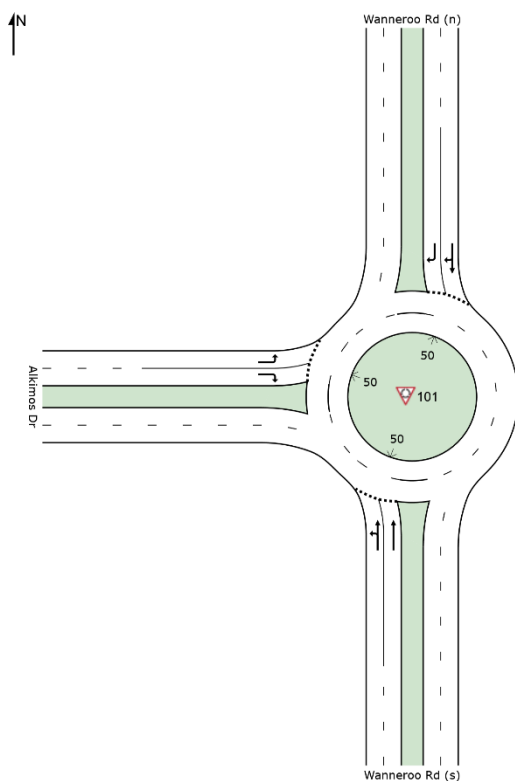


Figure 4.18: Potential Wanneroo Road/Eglinton Drive Roundabout (60m dia.)

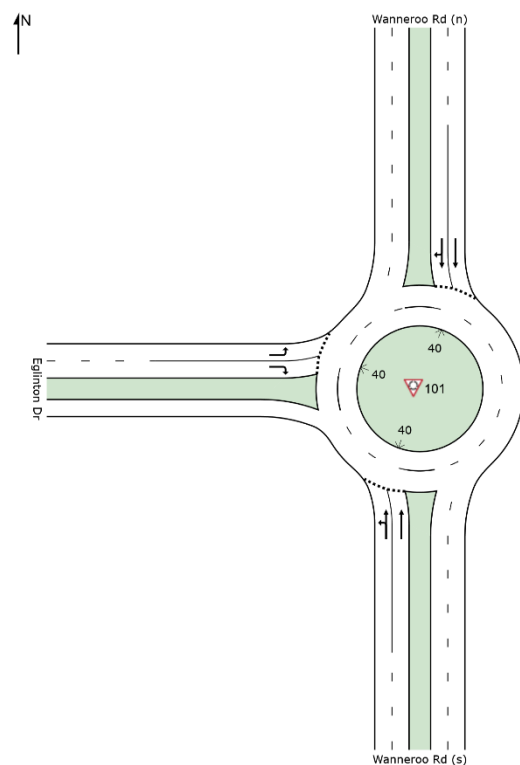


Table 4.8: External Intersection Post Development Operational Performance

Location	Arm	DOS	LOS	Avrg Delay	95th %ile Q
AM Wanneroo Rd/Alkimos Dr	Wanneroo Rd (s)	0.51	A	4s	29m
	Wanneroo Rd (n)	0.67	A	7s	54m
	Alkimos Dr	0.41	A	9s	17m
	Intersection	0.67	A	7s	54m
PM Wanneroo Rd/Alkimos Dr	Wanneroo Rd (s)	0.86	B	18s	93m
	Wanneroo Rd (n)	0.82	B	14s	98m
	Alkimos Dr	0.44	B	10s	22m
	Intersection	0.86	B	14s	98m
AM Wanneroo Rd/Eglinton Dr	Wanneroo Rd (s)	0.30	A	4s	13m
	Wanneroo Rd (n)	0.33	A	5s	14m
	Eglinton Dr	0.20	A	9s	8m
	Intersection	0.33	A	5s	14m
PM Wanneroo Rd/Eglinton Dr	Wanneroo Rd (s)	0.32	A	3s	15m
	Wanneroo Rd (n)	0.18	A	6s	8m
	Eglinton Dr	0.39	B	11s	15m
	Intersection	0.39	A	6s	15m

The results in Table 4.8 demonstrate that these potential future intersections can be expected to operate acceptably upon full development of the subject site's Eastern Precinct.

Of particular note is the low level of queuing on Alkimos Drive in the eastbound approach to Wanneroo Road. In this regard, it is considered that there would be no queuing interaction with a potential left-out site access at Alkimos Drive.

Further afield, and based on the commentary provided in the traffic and movement report for Alkimos Vista¹⁰, external intersections, particularly along Alkimos Drive, are anticipated to be at or near capacity without the Eastern Precinct being developed. It is expected that further work will be required at a future stage of planning to determine the preferred form of control (roundabout or signals) and ultimate geometric requirements of these intersections.

The potential to access the site in a satisfactory manner as described above, indicates that the Amendment to add the subject site Eastern Precinct as an employment site is acceptable in this regard.

¹⁰ Central Alkimos Traffic & Movement Network, Bruce Aulabaugh, Revision 1, 9 May 2013

5. Conclusion

This Transport Impact Assessment Report has been prepared in support of the modification to the Alkimos Eglinton District Structure Plan AEDSP (No.18) 'The Amendment'. The Amendment proposes to:

- Modify the designation of the Central Precinct of Lot 6 from 'Service Commercial' to 'Urban' (to accommodate Residential development); and
- Extend the AEDSP boundary to include the land within the Eastern Precinct (Lot 6 and lots between Lot 6 and Wanneroo Road) and designate this land as 'Service Commercial'.

Based on the analysis and discussions presented within this report, the following conclusions are made:

i Lot 6 Central Precinct

- The proposed site area covers approximately 35 ha of developable area and located immediately east of the railway reserve. The Amendment includes designation of the land from Service Commercial to Urban (residential), entailing the following:
 - 480 to 520 residential dwellings
 - Associated open space (to be provided in accordance with *Liveable Neighbourhoods*).
- This site is located in the DSP area for which the future transport networks have been mapped out. The site layout has been developed in this regard and intends to enhance the movement networks in the area.
 - It is proposed to provide footpaths alongside all Neighbourhood Connectors and a minimum of one side of all roads (with key access roads provided with a footpath on both sides).
 - Shared use paths and on-road cycle lanes are to be provided on key links.
- Vehicular access to/from the Central Precinct has regard to the adjacent structure plan layouts. In total four access points are provided, with three of these expected to be key.
- Given the relatively small scale of the Central Precinct within the wider DSP, it is not possible to provide new key long-distance links for travel through the DSP area. A key principle in developing the networks was to ensure consistency and contribute to adjacent LSP and DSP area planning.
- The Central Precinct is expected to generate up to 4,050 vehicle trips per day.
- The road network within the Central Precinct has been determined on the basis of daily flows and in accordance with *Liveable Neighbourhoods*.
- The designation of this land from Service Commercial to Urban (to accommodate Residential development) will not compromise the traffic network as the daily traffic volumes of the Lot 6 Central Precinct as a Residential development are in line with (less than) the potential traffic generation of the same site area as the previously assumed Service Commercial employment land use. As such, no daily adverse traffic impacts on external roads is expected in terms of overall traffic volume when compared with the current DSP.
- It is expected the external traffic generation associated with the Central Precinct can be accommodated on the future planned external road network.

ii Lot 6 Eastern Precinct

- The DSP boundary is proposed to be extended to include approximately 112 ha of developable land located immediately east of the Mitchell Freeway road reserve. The Amendment includes adding this land to the DSP area to provide up to 400,000sqm of building floor area, roads, and associated open space to support employment generating land uses.
- A site access strategy for the Eastern Precinct has been developed, including full movements access points supported by left-in/left-out accesses.
- Justification for a proposed left-in, and potential left-out, site access intersection on Alkimos Drive east of the future Mitchell Freeway interchange is provided in this report.
- The Eastern Precinct is expected to generate up to 20,000 vehicle trips on a daily basis, with 10% occurring in peak hours.
- The road network within the Eastern Precinct is expected to consist of industrial connector road and access roads.
- Site accesses and future planned adjacent external intersections are expected to operate acceptably upon full development of the subject site. Further work will be required at a future stage of planning to determine external intersection requirements in the wider area.
- It is noted that the performance of site accesses and immediate external intersections indicates that a left-out component at the proposed Alkimos Drive site access may be acceptable. This subject to further confirmation at a future stage of planning.
- Of significant benefit to the development of the Eastern Precinct as regional employment land uses, is the future Whiteman-Yanchep Highway (Future East Wanneroo Bypass) which is a planned new north-south primary distributor road that will connect the North-West sub-region to the North-East and Central sub-regions and broader regional road network. This strategic road link forms part of the transport plan for Perth and Peel @ 3.5 Million. The Eastern Precinct is ideally located to take full advantage of this future link and is expected to reduce the traffic demands that would otherwise travel directly to/from the south on Wanneroo Road, or to/from south-west along Alkimos Drive and the Mitchell Freeway south.
- The high-level determination of this TIA is that the inclusion of the Eastern Precinct area in the DSP, under the assumed traffic generation and distributions noted in this TIA does not critically compromise the DSP transport network. The location of future intersections and network of links as per the current DSP remain the same, with only the *form* of intersections subject to further confirmation in the next stages of planning.

It can be concluded from the information presented in this TIA that the proposed modifications to the DSP can be supported by the future traffic network. Accordingly, the transport characteristics of the Amendment are considered acceptable.

Appendix A

GTA Technical Note - Site access rationalisation at future Alkimos Drive, east of the future Mitchell Freeway

MEMORANDUM

TO: Cossill and Webley

CC:

FROM: GTA Consultants

DATE: 20/03/2017 revised 30/07/2018

OUR REF: W115940

PAGE 1 OF 3 excl. Attachments

RE: **Proposed Alkimos Drive Intersection**

GTA Consultants (GTA) has prepared this Memorandum to provide advice around the suitability / feasibility of a proposed intersection on the future Alkimos Drive, east of the extended Mitchell Freeway, in the City of Wanneroo.

Location

The intersection would be located on the eastbound carriageway of the section of Alkimos Drive between the Alkimos Drive/Mitchell Freeway interchange and Wanneroo Road, approximately 200m east of the southbound Freeway off-ramp.

Proposal

It is proposed to construct a left-in, left-out intersection which connects the eastbound carriageway of Alkimos Drive to a parcel of land north of Alkimos Drive, currently being proposed for subdivision. The proposed intersection layout is presented at Attachment A.

Scope of Works and Findings

GTA has been requested by Cossill and Webley to carry out a review of the location of the intersection, and to determine its suitability in respect of relevant design criteria and other traffic movement / capacity considerations.

In the context of the above, GTA have reviewed the proposal in respect of *Austroads Guide to Road Design* and *Main Roads Western Australia Supplements* to these. GTA has also considered relevant traffic movement and capacity considerations in relation to the proposal. The findings of the assessment are set out below.

Design Criteria

The design criteria review includes initial consideration of intersection spacing and geometric design criteria. The review has been conducted on the basis of an assumed 70km/h posted speed and therefore an assumed 80km/h design speed.

Table 1: Design Criteria Review

Criteria	Source	Assumptions	Requirement	Achieved	Acceptable
Intersection Spacing (between intersection and start of auxiliary lane)	MRWA Supplement to Austroads Guide to Road Design - Part 4 – 10.3.2	N/A	5s of travel time @ posted speed (70km/h) = 97m	No (94.2m), however, traffic likely to be exiting roundabout at lower speed, accelerating to 70km/h. The marginal difference is acceptable in this regard.	Yes
Deceleration Length	Austroads Guide to Road Design - Part 4	30km/h exit curve speed (since intersection is left-in, left-out only)	85m	Yes	Yes
Physical Taper	Austroads Guide to Road Design - Part 4	N/A	25m	Yes	Yes
Safe Intersection Sight Distance	Austroads Guide to Road Design - Part 4	2.0s reaction time 2% downgrade correction factor	185m	Yes	Yes

As illustrated, the proposed intersection concept design satisfies the considered design criteria.

Intersection Capacity

Alkimos Drive is proposed to have two lanes for traffic travelling eastbound, as such, it is likely to carry reasonably high volumes of traffic and intersection capacity should therefore be considered.

Since the proposed intersection layout will be left-in, left-out only, it is not expected that any queueing back to Alkimos Drive will occur since vehicles entering the intersection from Alkimos Drive are unopposed.

The intersection is also located downstream of the Freeway interchange roundabout, and despite the expected high traffic volumes on Alkimos Drive, traffic is expected to exit the roundabout with gaps between vehicles, rather in platoons as with a signal intersection.

In this context it is not expected intersection capacity will be an issue, but it is recommended this is tested further with an intersection capacity assessment if the principle of this intersection proposed is approved.

Vehicle Demands and Routing

The proposed subdivision will attract traffic from Mitchell Freeway.

Vehicles leaving the site will utilise Wanneroo Road to access the Freeway via Alkimos Drive (westbound).

Vehicles entering the site from the Freeway will do so from the eastbound carriageway of Alkimos Drive. Irrespective of the provision of the proposed intersection, traffic will always use this route to the subdivision since the alternative entry point would be located on Wanneroo Road (as per the

exit). The provision of the access will therefore shorten vehicular journey distances to enter the subdivision and will reduce demand travelling through the Alkimos Drive / Wanneroo Road intersection turning left onto Wanneroo Road.

Intersection Permissibility

It is understood that Alkimos Drive is not intended to be a Control of Access Route and in this context, it is possible to provide an intersection at the proposed location. A similar example to the proposal can be found at Hodges Drive in Joondalup, as presented in Figure 1.

Figure 1: Hodges Drive Example



Summary

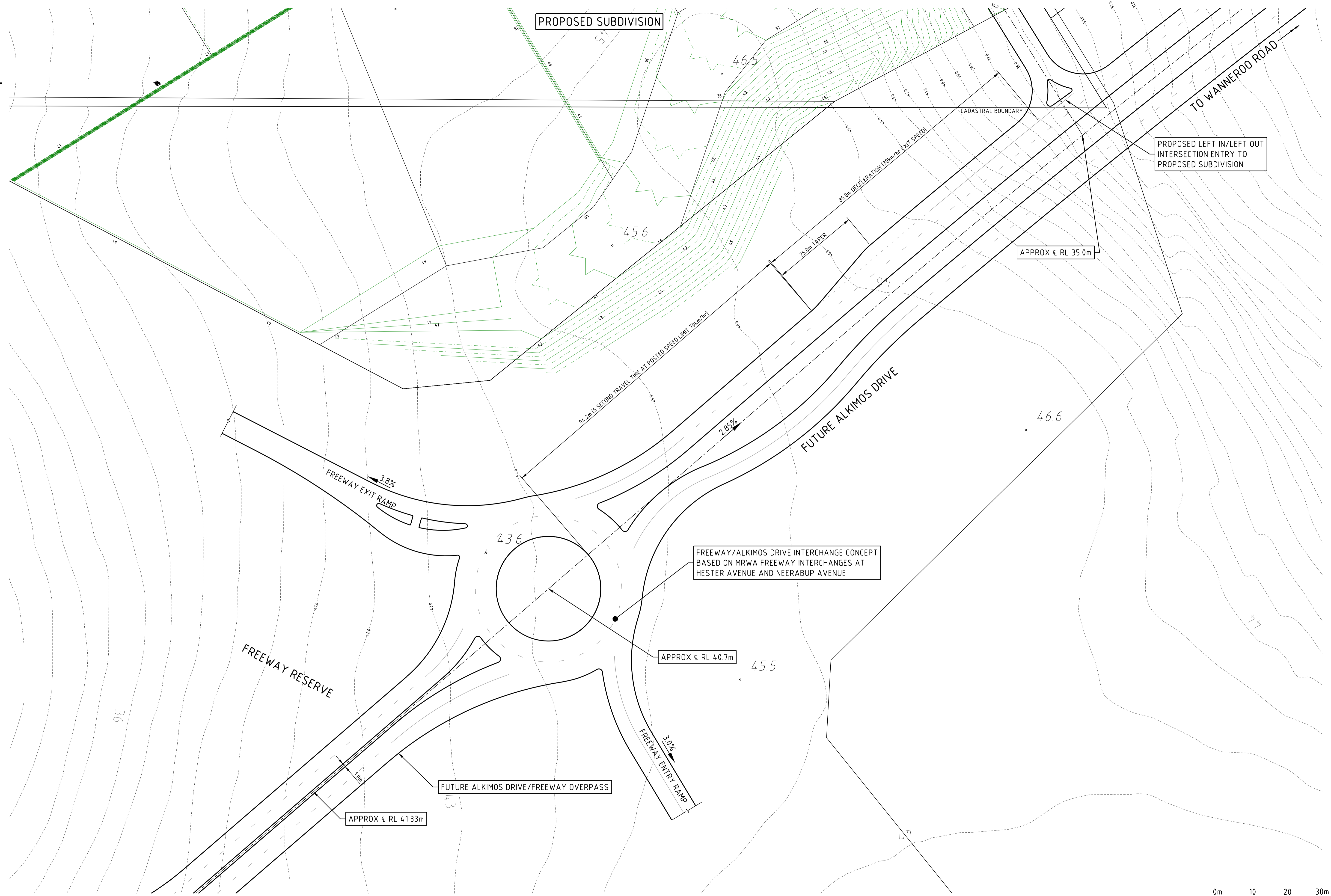
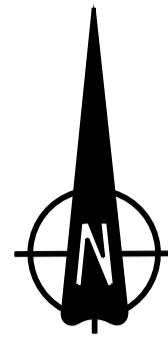
- The proposed intersection layout presented at Attachment A was reviewed in the context of key design and traffic movement criteria
- Following an initial review, the layout is deemed to satisfy the key criteria considered
- It is not expected that the proposal will negatively impact traffic flow in the local area, nor is the intersection expected to have any capacity issues.

Yours Sincerely

GTA Consultants

Attachment A

Proposed Intersection Layout



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REV	DATE	DRN	CKD	APP	AMENDMENT	REV	DATE	DRN	CKD	APP	AMENDMENT
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CLIENT
URBAN QUARTER

APPROVED
CHECK PRINT

DESIGNED
DPM

SCALE
1:500

PROJECT
LOT 6 SPIERS

TITLE
PROPOSED ENTRY EAST OF FREEWAY OFF ALKIMOS DRIVE

WAPC No.
N/A

DRAWING No.
5826-00-SK29

REVISION
A

ORIGINAL SIZE A1

Appendix B

SIDRA Modelling Outputs

MOVEMENT SUMMARY

 Site: 101 [PM Wanneroo Rd/Site Access 3 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m		per veh	km/h
South: Wanneroo Rd (s)											
1	L2	60	25.0	0.310	3.4	LOS A	2.1	16.3	0.11	0.29	56.5
2	T1	895	10.0	0.310	3.0	LOS A	2.1	16.3	0.12	0.29	59.1
Approach		955	10.9	0.310	3.0	LOS A	2.1	16.3	0.12	0.29	59.0
North: Wanneroo Rd (n)											
8	T1	713	10.0	0.519	7.6	LOS A	3.4	26.0	0.82	0.82	54.8
9	R2	16	25.0	0.519	15.8	LOS B	3.1	23.5	0.81	0.92	54.8
Approach		728	10.3	0.519	7.8	LOS A	3.4	26.0	0.82	0.82	54.8
West: Site Access											
10	L2	32	25.0	0.619	8.0	LOS A	4.1	35.0	0.71	0.98	49.4
12	R2	1036	25.0	0.619	15.1	LOS B	4.1	35.0	0.72	0.99	50.9
Approach		1067	25.0	0.619	14.8	LOS B	4.1	35.0	0.72	0.99	50.8
All Vehicles		2751	16.2	0.619	8.9	LOS A	4.1	35.0	0.54	0.70	54.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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Organisation: GTA CONSULTANTS | Processed: Thursday, 28 June 2018 3:36:41 PM

Project: \\gta.com.au\projectfiles\ProjectFilesPerth\W11500-11599\W115944 Lot 6 Taronga Place (Central Pre\Modelling\Warehouse only 1180628sid_Wanneroo-SiteAccess3.sip7

LANE LEVEL OF SERVICE

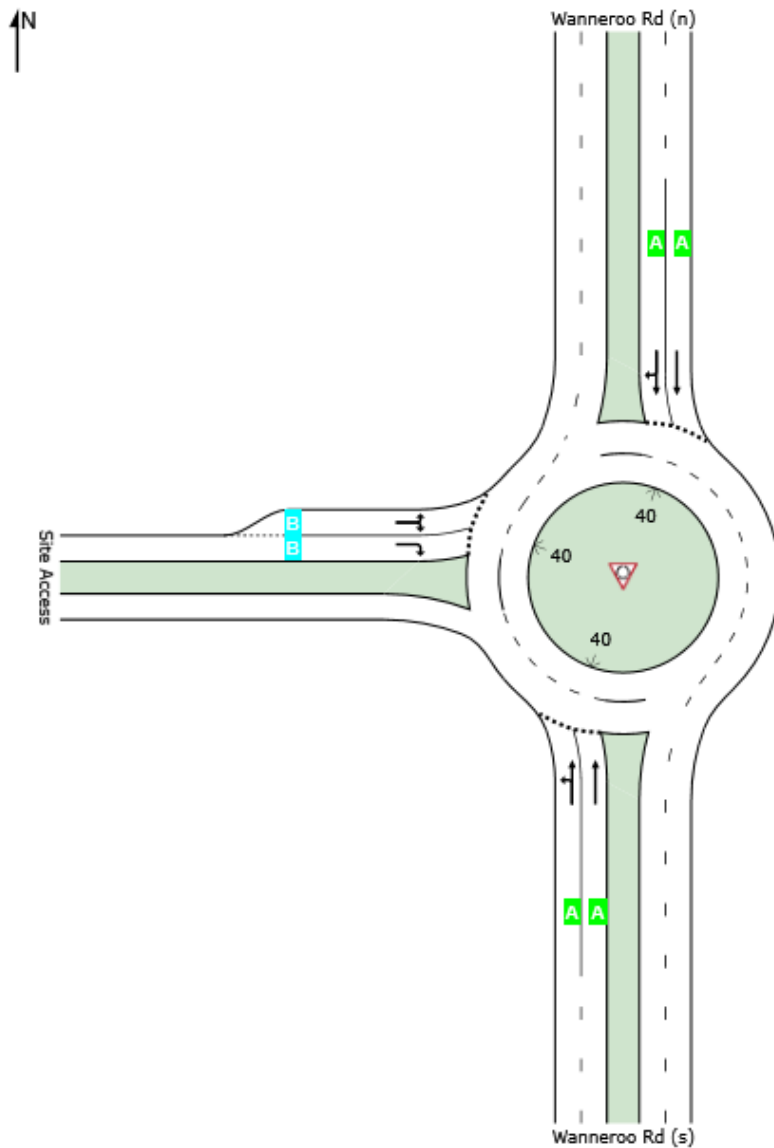
Lane Level of Service

 **Site: 101 [PM Wanneroo Rd/Site Access 3 2031 Post Development]**

New Site
Roundabout

All Movement Classes

	South	North	West	Intersection
LOS	A	A	B	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

\180628sid_Wanneroo-SiteAccess3.sip7

MOVEMENT SUMMARY

 Site: 101 [AM Wanneroo Rd/Site Access 3 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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: Wanneroo Rd (s)											
1	L2	240	25.0	0.340	3.7	LOS A	2.1	16.6	0.23	0.35	55.8
2	T1	720	10.0	0.340	3.2	LOS A	2.1	16.6	0.24	0.33	58.4
Approach		960	13.8	0.340	3.3	LOS A	2.1	16.6	0.24	0.34	57.7
North: Wanneroo Rd (n)											
8	T1	863	10.0	0.392	4.0	LOS A	2.2	16.6	0.47	0.42	56.7
9	R2	63	25.0	0.392	11.1	LOS B	2.1	16.4	0.49	0.47	56.4
Approach		926	11.0	0.392	4.5	LOS A	2.2	16.6	0.47	0.42	56.7
West: Site Access											
10	L2	8	25.0	0.151	5.4	LOS A	0.6	5.4	0.53	0.76	50.7
12	R2	259	25.0	0.151	12.0	LOS B	0.6	5.4	0.54	0.77	52.6
Approach		267	25.0	0.151	11.8	LOS B	0.6	5.4	0.54	0.77	52.6
All Vehicles		2154	14.0	0.392	4.9	LOS A	2.2	16.6	0.38	0.43	56.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

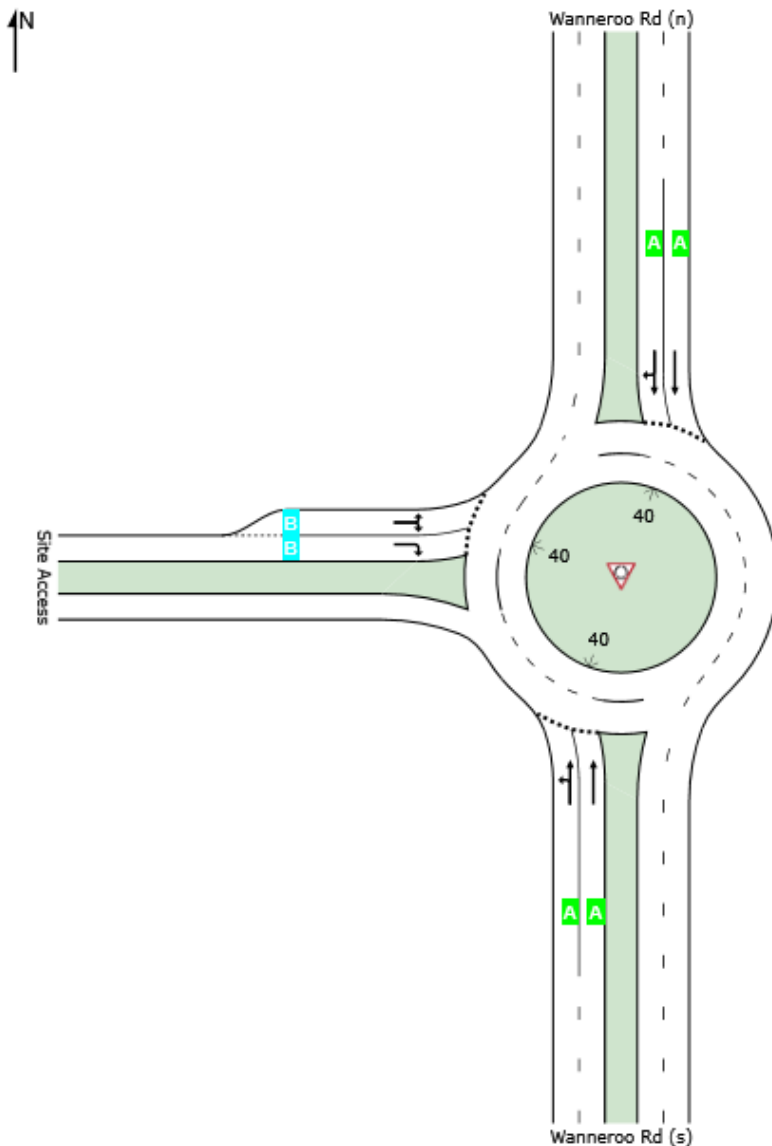
Lane Level of Service

 **Site: 101 [AM Wanneroo Rd/Site Access 3 2031 Post Development]**

New Site
Roundabout

All Movement Classes

	South	North	West	Intersection
LOS	A	A	B	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

\180628sid_Wanneroo-SiteAccess3.sip7

MOVEMENT SUMMARY

 Site: 101 [PM Wanneroo Rd/Site Access 4 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m			
South: Site Access											
10	L2	484	25.0	0.407	4.6	LOS A	2.1	17.7	0.46	0.54	54.9
12	R2	101	25.0	0.134	11.5	LOS B	0.5	4.4	0.42	0.69	52.9
Approach		585	25.0	0.407	5.8	LOS A	2.1	17.7	0.45	0.57	54.5
East: Eglinton Dr (e)											
1	L2	25	25.0	0.121	3.8	LOS A	0.5	4.2	0.24	0.34	55.7
2	T1	295	10.0	0.121	3.3	LOS A	0.5	4.2	0.25	0.33	58.3
Approach		320	11.2	0.121	3.4	LOS A	0.5	4.2	0.25	0.33	58.1
West: Eglinton Dr (w)											
8	T1	442	10.0	0.207	3.3	LOS A	1.1	8.1	0.26	0.37	57.6
9	R2	111	25.0	0.207	10.2	LOS B	1.0	8.3	0.27	0.48	56.4
Approach		553	13.0	0.207	4.7	LOS A	1.1	8.3	0.26	0.39	57.4
All Vehicles		1458	17.4	0.407	4.8	LOS A	2.1	17.7	0.34	0.45	56.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

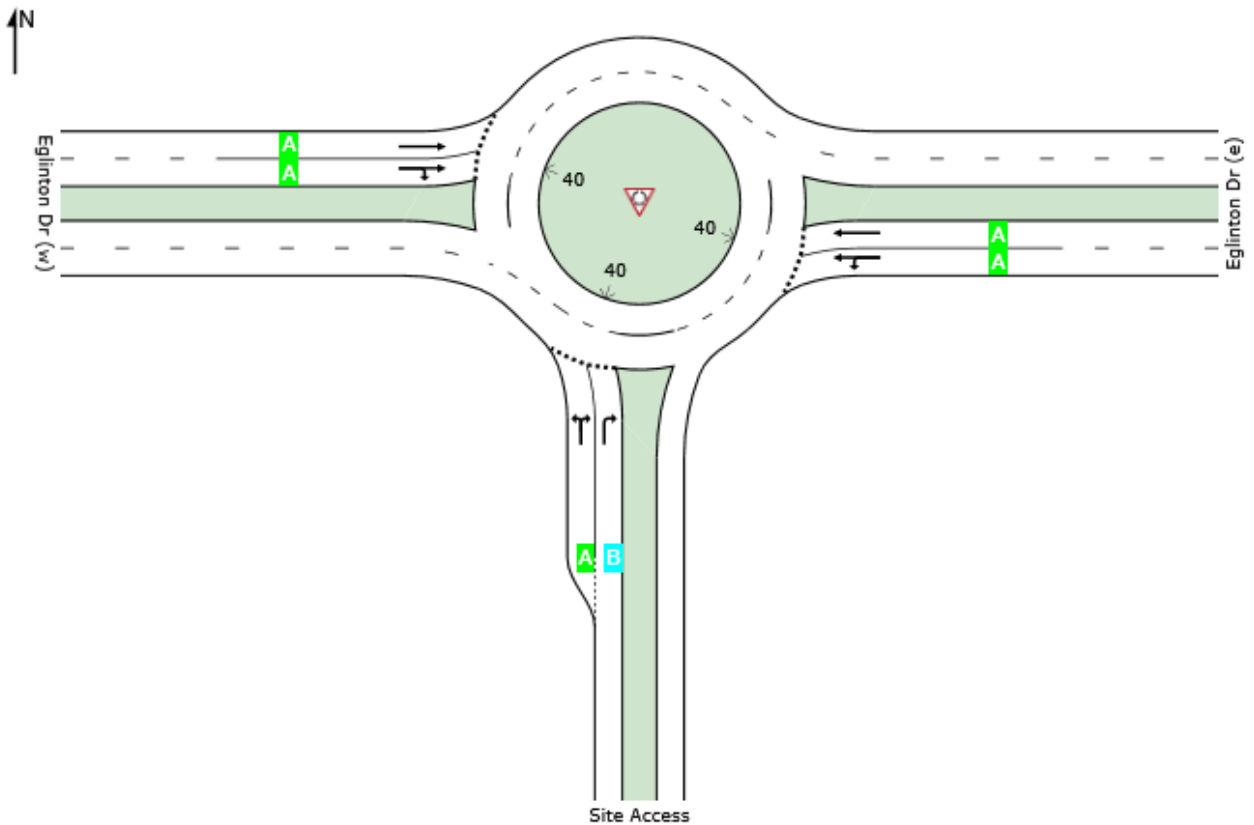
Lane Level of Service

 **Site: 101 [PM Wanneroo Rd/Site Access 4 2031 Post Development]**

New Site
Roundabout

All Movement Classes

	South	East	West	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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MOVEMENT SUMMARY

 Site: 101 [AM Wanneroo Rd/Site Access 4 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
		Total veh/h	HV %				Vehicles veh	Distance m				
South: Site Access												
10	L2	121	25.0	0.114	4.6	LOS A	0.5	4.1	0.46	0.54	54.9	
12	R2	25	25.0	0.038	12.0	LOS B	0.1	1.2	0.49	0.69	52.7	
Approach		146	25.0	0.114	5.9	LOS A	0.5	4.1	0.46	0.57	54.5	
East: Eglinton Dr (e)												
1	L2	101	25.0	0.262	5.6	LOS A	1.4	11.1	0.54	0.54	54.2	
2	T1	442	10.0	0.262	5.2	LOS A	1.4	11.1	0.55	0.53	56.5	
Approach		543	12.8	0.262	5.3	LOS A	1.4	11.1	0.55	0.53	56.1	
West: Eglinton Dr (w)												
8	T1	295	10.0	0.216	3.0	LOS A	1.1	8.7	0.13	0.29	59.1	
9	R2	442	25.0	0.292	9.8	LOS A	1.7	14.4	0.13	0.58	54.0	
Approach		737	19.0	0.292	7.1	LOS A	1.7	14.4	0.13	0.46	55.9	
All Vehicles		1426	17.3	0.292	6.3	LOS A	1.7	14.4	0.32	0.50	55.8	

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

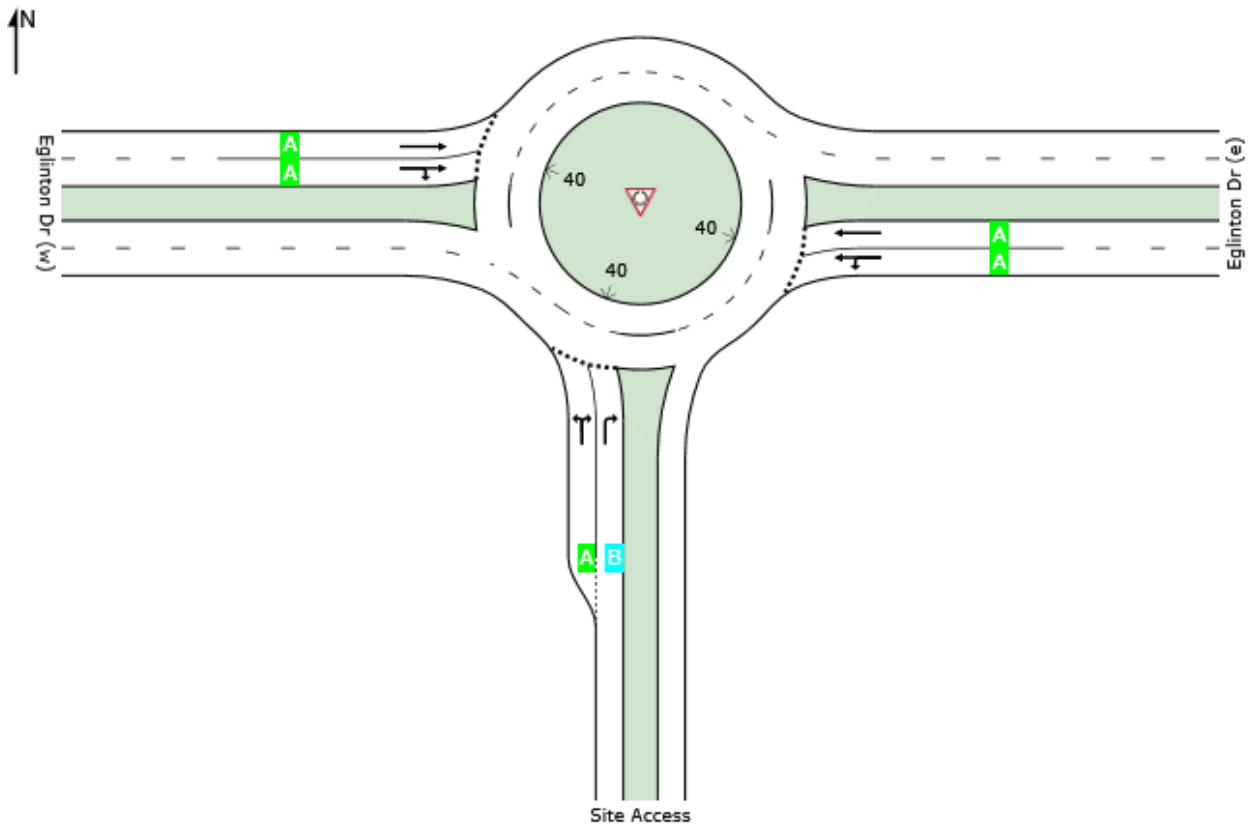
Lane Level of Service

 **Site: 101 [AM Wanneroo Rd/Site Access 4 2031 Post Development]**

New Site
Roundabout

All Movement Classes

	South	East	West	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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MOVEMENT SUMMARY

 Site: 101 [PM Wanneroo Rd/Eglinton Dr 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wanneroo Rd (s)											
1	L2	256	10.0	0.322	3.5	LOS A	2.0	15.0	0.23	0.35	56.1
2	T1	671	10.0	0.322	3.2	LOS A	2.0	15.0	0.23	0.33	58.4
Approach		926	10.0	0.322	3.3	LOS A	2.0	15.0	0.23	0.34	57.8
North: Wanneroo Rd (n)											
8	T1	295	10.0	0.176	4.7	LOS A	1.0	7.5	0.55	0.50	55.9
9	R2	64	10.0	0.176	11.5	LOS B	0.9	7.1	0.56	0.60	55.6
Approach		359	10.0	0.176	5.9	LOS A	1.0	7.5	0.55	0.52	55.9
West: Eglinton Dr											
10	L2	109	10.0	0.155	6.3	LOS A	0.6	4.6	0.55	0.70	54.6
12	R2	434	10.0	0.394	11.7	LOS B	2.0	15.0	0.59	0.79	52.7
Approach		543	10.0	0.394	10.6	LOS B	2.0	15.0	0.59	0.77	53.1
All Vehicles		1828	10.0	0.394	6.0	LOS A	2.0	15.0	0.40	0.50	55.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

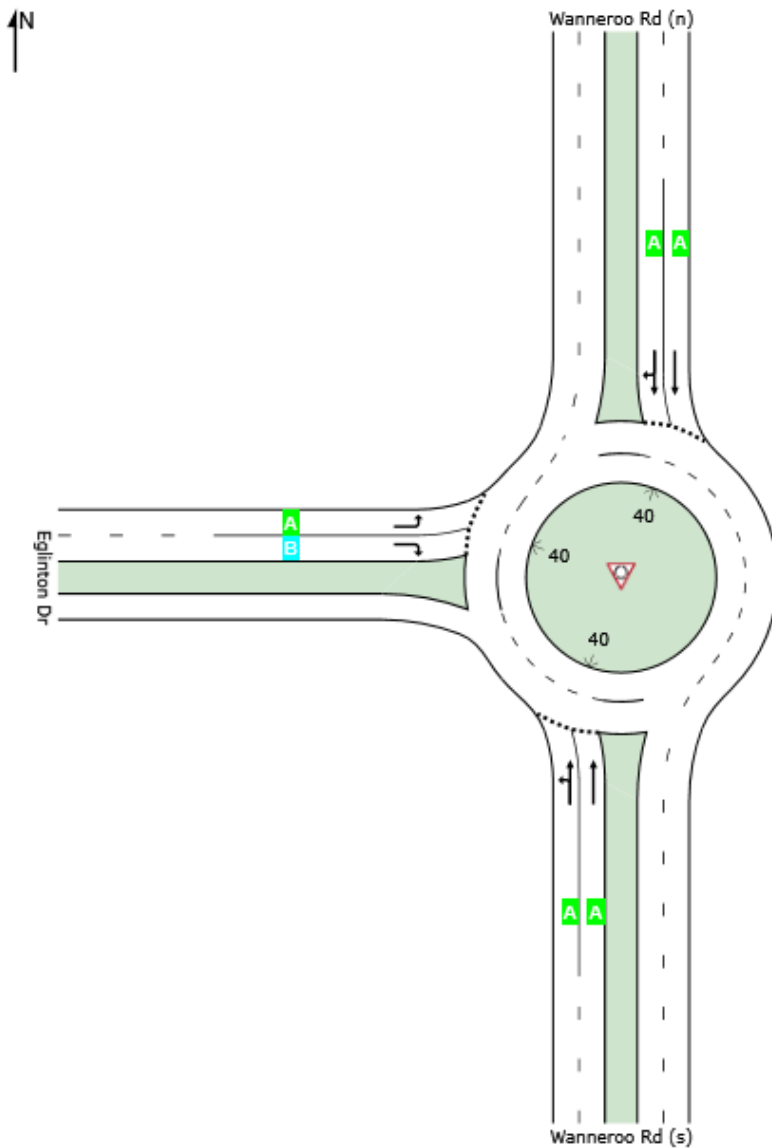
Lane Level of Service

 **Site: 101 [PM Wanneroo Rd/Eglinton Dr 2031 Post Development]**

New Site
Roundabout

All Movement Classes

	South	North	West	Intersection
LOS	A	A	B	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

 Site: 101 [AM Wanneroo Rd/Eglinton Dr 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wanneroo Rd (s)											
1	L2	434	10.0	0.298	3.7	LOS A	1.7	12.9	0.28	0.42	55.9
2	T1	295	10.0	0.240	3.4	LOS A	1.2	9.5	0.29	0.34	58.1
Approach		728	10.0	0.298	3.6	LOS A	1.7	12.9	0.29	0.39	56.8
North: Wanneroo Rd (n)											
8	T1	671	10.0	0.325	4.1	LOS A	1.9	14.3	0.45	0.44	56.6
9	R2	109	10.0	0.325	10.8	LOS B	1.8	13.8	0.46	0.51	56.4
Approach		780	10.0	0.325	5.0	LOS A	1.9	14.3	0.45	0.45	56.6
West: Eglinton Dr											
10	L2	64	10.0	0.079	5.0	LOS A	0.3	2.5	0.42	0.52	55.3
12	R2	256	10.0	0.204	10.6	LOS B	1.0	7.8	0.42	0.65	53.4
Approach		320	10.0	0.204	9.5	LOS A	1.0	7.8	0.42	0.63	53.7
All Vehicles		1828	10.0	0.325	5.2	LOS A	1.9	14.3	0.38	0.46	56.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

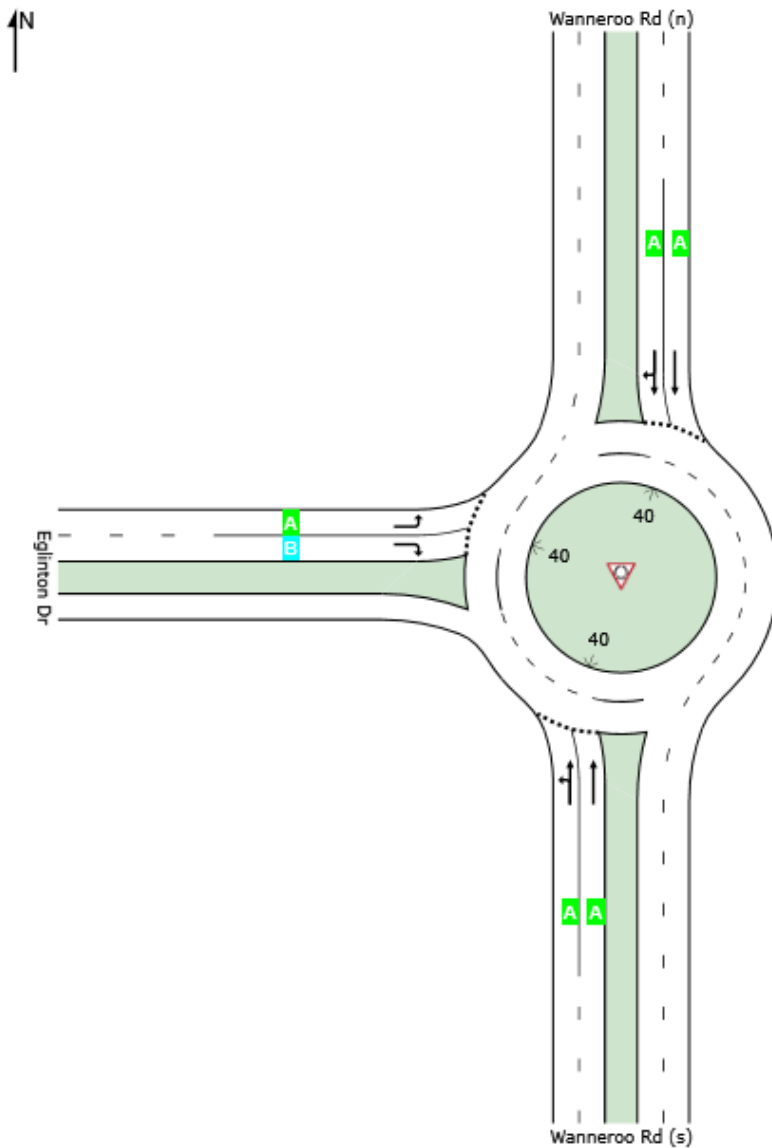
Lane Level of Service

 Site: 101 [AM Wanneroo Rd/Eglinton Dr 2031 Post Development]

New Site
Roundabout

All Movement Classes

	South	North	West	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

 Site: 101 [PM Wanneroo Rd/Alkimos Dr 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wanneroo Rd (s)											
1	L2	391	10.0	0.858	16.6	LOS B	12.3	93.2	1.00	1.32	48.0
2	T1	804	10.0	0.858	18.0	LOS B	12.3	93.2	1.00	1.32	48.9
Approach		1195	10.0	0.858	17.5	LOS B	12.3	93.2	1.00	1.32	48.6
North: Wanneroo Rd (n)											
8	T1	787	10.0	0.818	8.7	LOS A	12.8	97.5	0.95	0.96	54.2
9	R2	961	10.0	0.818	17.4	LOS B	12.8	97.5	0.96	1.04	51.2
Approach		1748	10.0	0.818	13.5	LOS B	12.8	97.5	0.95	1.00	52.5
West: Alkimos Dr											
10	L2	159	10.0	0.237	5.7	LOS A	1.2	9.0	0.70	0.70	54.8
12	R2	408	10.0	0.438	12.2	LOS B	2.9	21.7	0.77	0.81	52.9
Approach		567	10.0	0.438	10.4	LOS B	2.9	21.7	0.75	0.78	53.4
All Vehicles		3511	10.0	0.858	14.4	LOS B	12.8	97.5	0.94	1.07	51.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

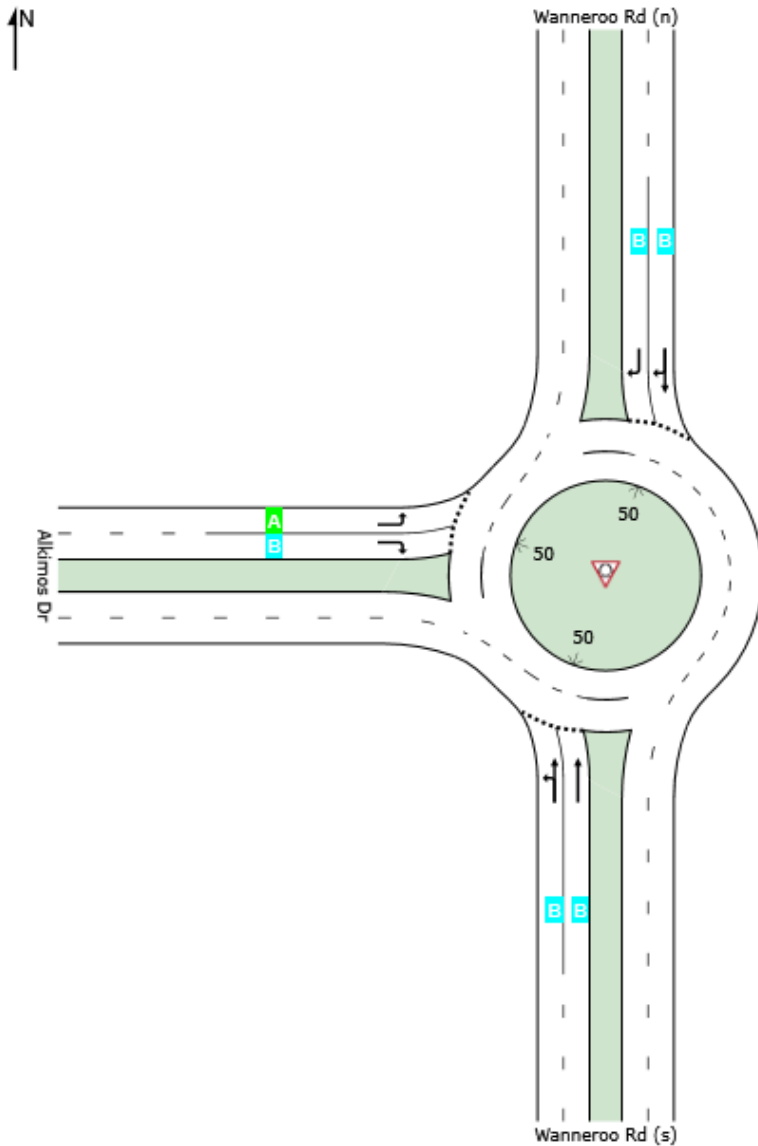
Lane Level of Service

 Site: 101 [PM Wanneroo Rd/Alkimos Dr 2031 Post Development]

New Site
Roundabout

All Movement Classes

	South	North	West	Intersection
LOS	B	B	B	B



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

\180628sid_Wanneroo-Alkimos.sip7

MOVEMENT SUMMARY

 Site: 101 [AM Wanneroo Rd/Alkimos Dr 2031 Post Development]

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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: Wanneroo Rd (s)											
1	L2	408	10.0	0.510	4.4	LOS A	3.8	28.7	0.61	0.48	55.0
2	T1	787	10.0	0.510	4.0	LOS A	3.8	28.7	0.62	0.44	57.2
Approach		1196	10.0	0.510	4.2	LOS A	3.8	28.7	0.62	0.46	56.5
North: Wanneroo Rd (n)											
8	T1	804	10.0	0.671	5.6	LOS A	7.1	54.0	0.79	0.63	56.1
9	R2	318	10.0	0.359	12.0	LOS B	2.1	16.3	0.62	0.76	53.5
Approach		1122	10.0	0.671	7.4	LOS A	7.1	54.0	0.74	0.67	55.3
West: Alkimos Dr											
10	L2	324	10.0	0.410	6.3	LOS A	2.3	17.3	0.71	0.79	54.8
12	R2	391	10.0	0.381	11.9	LOS B	2.2	16.5	0.69	0.78	53.2
Approach		715	10.0	0.410	9.4	LOS A	2.3	17.3	0.70	0.79	53.9
All Vehicles		3033	10.0	0.671	6.6	LOS A	7.1	54.0	0.68	0.61	55.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

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LANE LEVEL OF SERVICE

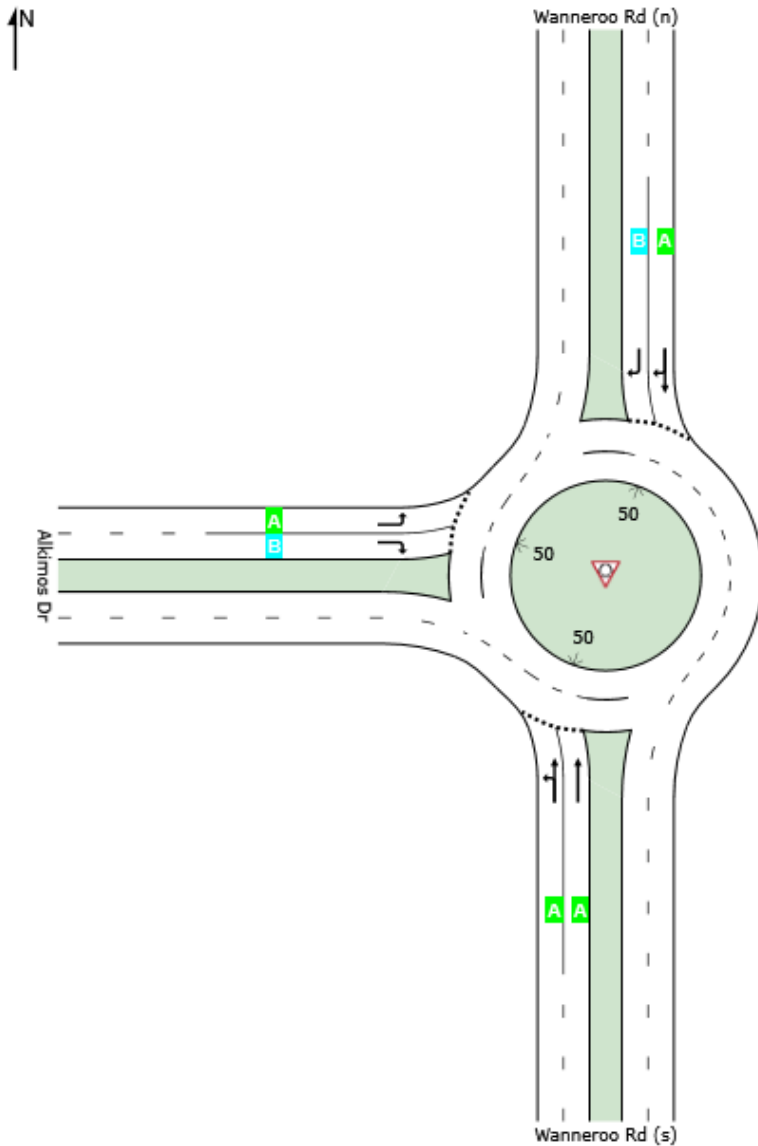
Lane Level of Service

 Site: 101 [AM Wanneroo Rd/Alkimos Dr 2031 Post Development]

New Site
Roundabout

All Movement Classes

	South	North	West	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Lane LOS values are based on average delay per lane.

Intersection and Approach LOS values are based on average delay for all lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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