Kerosene Lane, North Baldivis LSP

Revised Transport Impact Assessment

PREPARED FOR:
Spatial Property Group

July 2019

Document history and status

Author	Revision	Approved by	Date approved	Revision type
M Rasouli	r01	R White	26/06/2015	Draft
M Rasouli	r01a	R White	22/09/2015	Final
M Rasouli	r01b	R White	18/01/2016	Revised Final
M Rasouli	r01c	M Rasouli	28/06/2019	Revised Final
B Bordbar	r01d	B Bordbar	25/07/2019	Revised Final

File name: t15.019.mr.r01c

Author: Mohammad Rasouli

Project manager: Behnam Bordbar

Client: Spatial Property Group

Project: Kerosene Lane, North Baldivis LSP

Document revision: r01c

Project number: t15.019

TABLE OF CONTENTS

REPORT FIGURES

REPORT TABLES

1.0 Introduction

In September 2015 Transcore prepared a Traffic Impact Assessment (TIA) report on behalf of Spatial Property Group with regard to the proposed Concept Structure Plan (CSP) for various lots along Kerosene Lane, in Baldivis.

The 2015 CSP included Lots 294, 295, 55 and 56 Kerosene Lane and did not include Lot 214. Spatial Property Group represented the owners of Lot 214 and accordingly a new Local Structure Plan (LSP) was prepared by Roberts Day in 2016 which included Lot 214. Lot 214 is expected to accommodate approximately 24 residential dwellings. Accordingly Transcore updated the 2015 TIA to reflect the updated LSP.

In March 2018 the Western Australian Planning Commission (WAPC) issued an updated schedule of modifications for the LSP and requested for an update on the relevant reports. This revised TIA provides addresses item 30 and 31 of the updated schedule of modifications. The revised TIA also reflects the latest LSP prepared by Roberts Day.

The proposed land uses for the proposed LSP are residential, as shown in **Figure 1** in relation to the various zones and reservations of the Metropolitan Region Scheme (MRS).

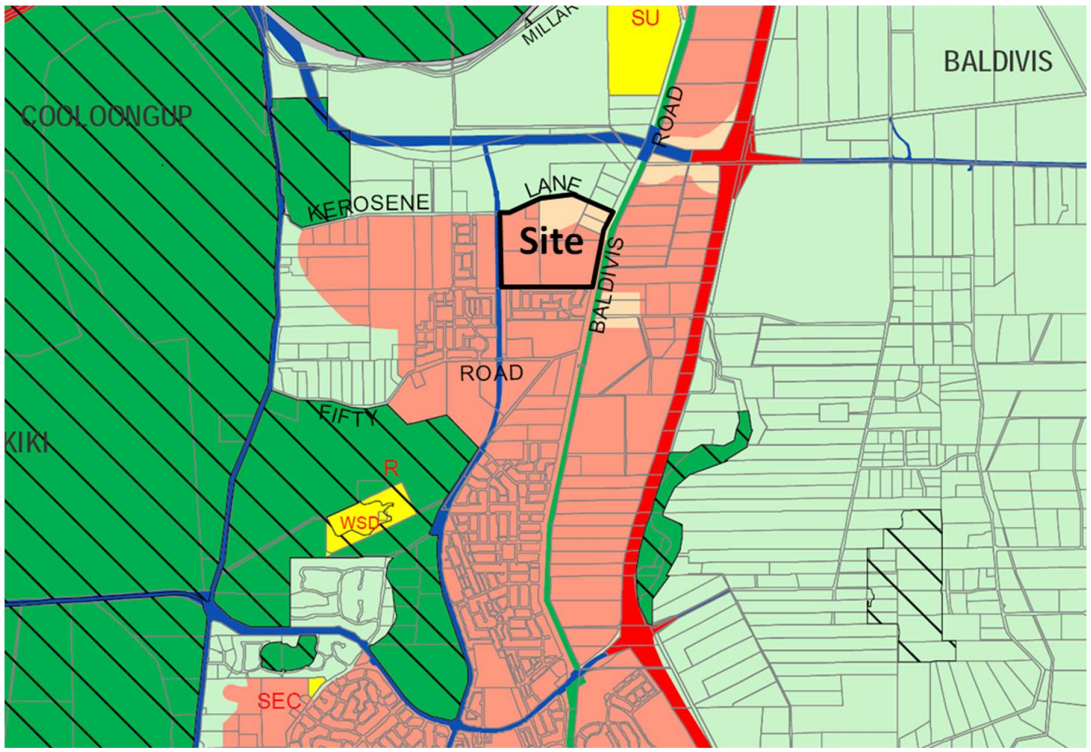


Figure 1: Location of the Subject Site

2.0 Proposed Local Structure Plan

The proposed Local Structure Plan is shown in **Figure 2**. A total of approximately 644 residential dwellings are planned for the LSP area including the 24 residential dwellings for Lot 214.

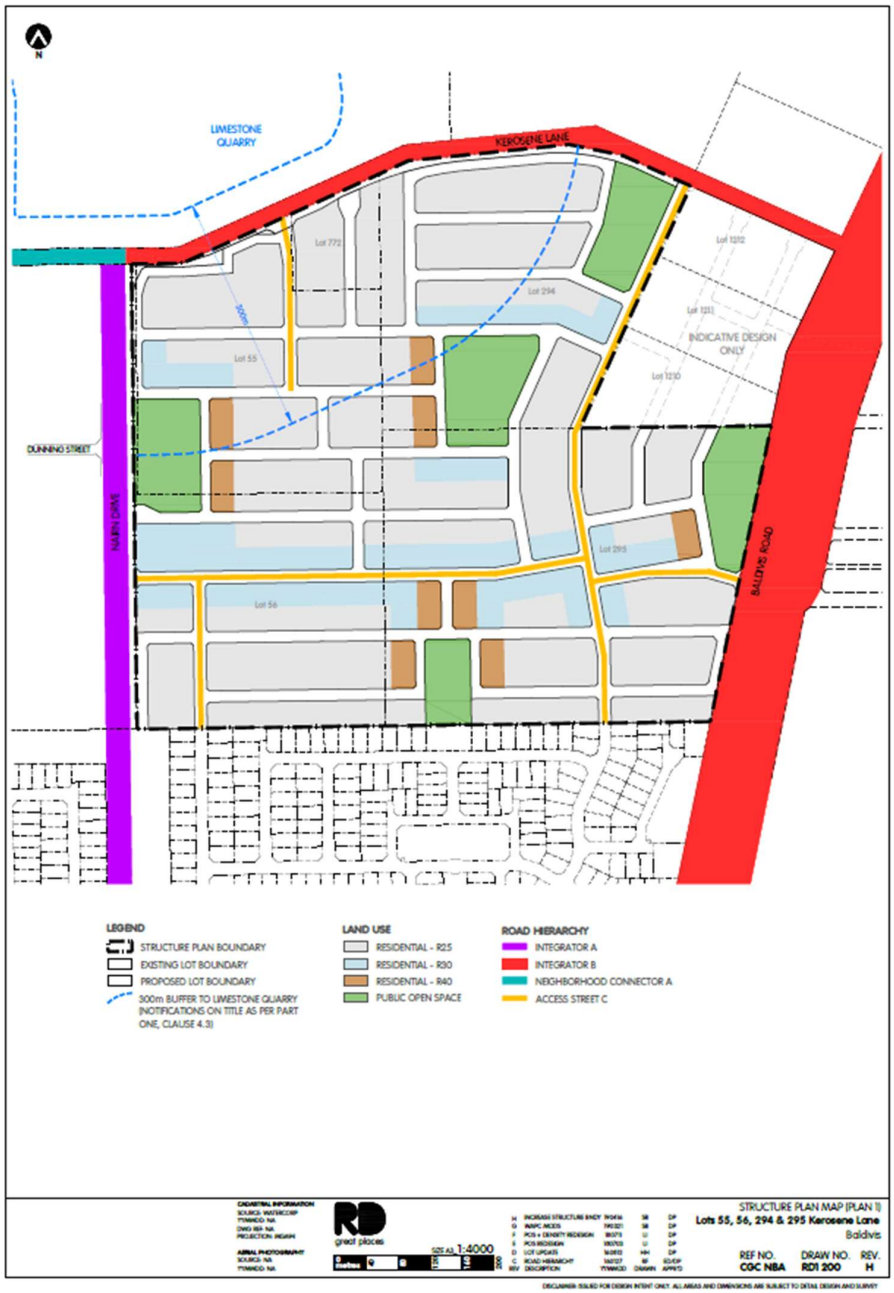


Figure 2: Proposed Local Structure Plan

3.0 Existing Situation

3.1 Existing Land Use

The subject site currently is vacant land with a few residential dwellings located within the eastern part of the LSP area. Adjacent land uses to the north are also rural in nature with few residential dwellings. Existing residential dwellings are located to the south and west of the LSP area. Baldivis Road forms the eastern boundary of the LSP area, Kerosene Lane forms the northern boundary and Nairn Drive forms the western boundary.

3.2 Existing Road Network

The existing road network and its classification in the Main Roads WA functional road hierarchy is illustrated in **Figure 3.**

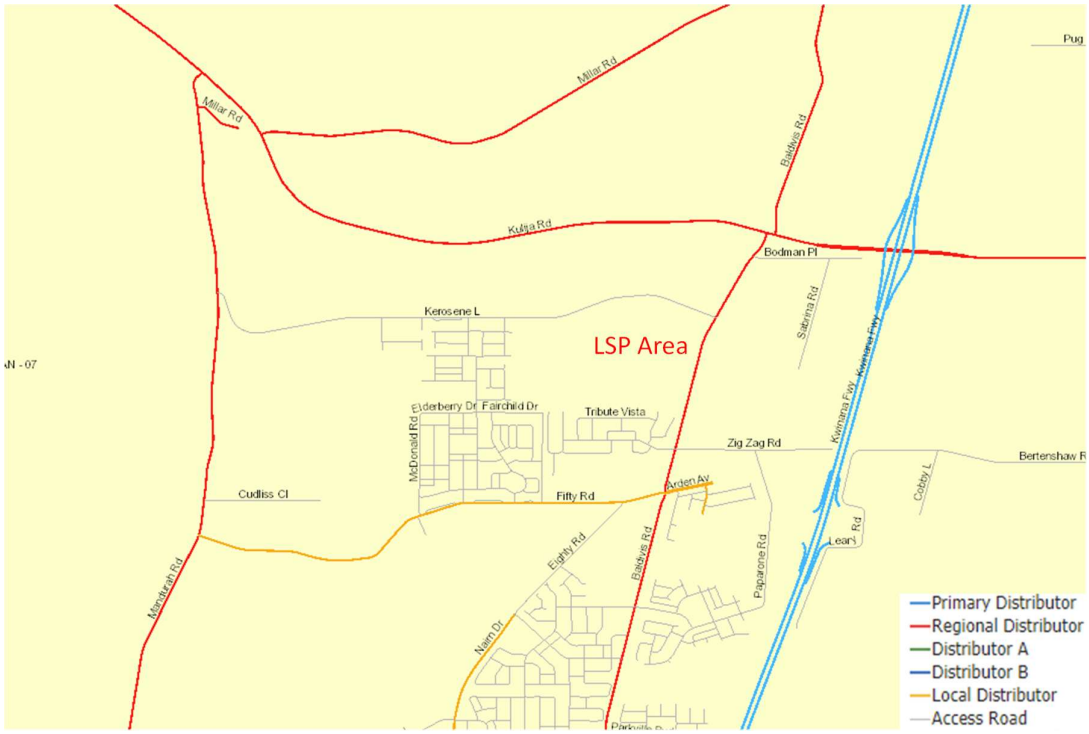


Figure 3: Existing road hierarchy

3.3 Existing Traffic Volumes

Existing average weekday traffic (AWT) volume on Baldivis Road was obtained from Main Roads WA and are illustrated in and **Figure 4**.

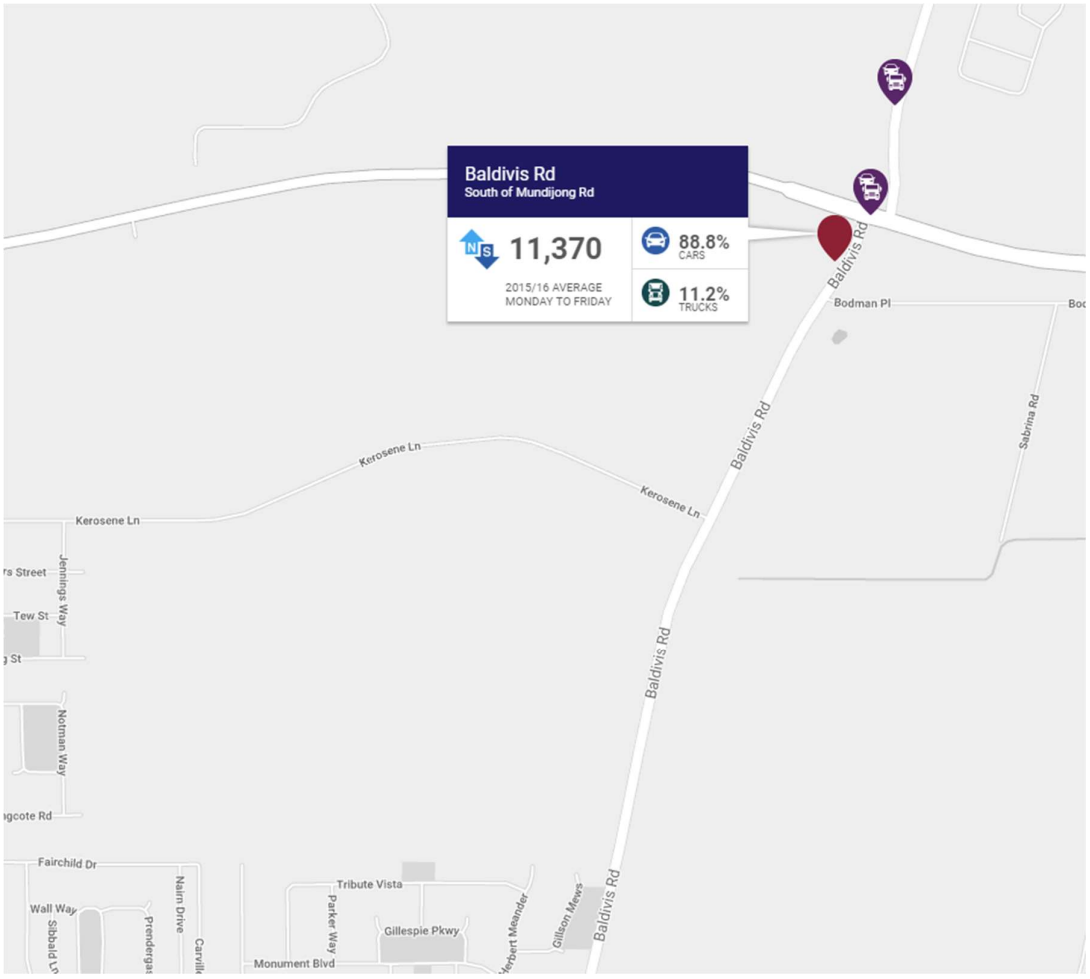


Figure 4: Existing traffic volumes

Baldivis Road

Baldivis Road is constructed as a single carriageway, two-lane, rural road providing north south access through Baldivis for connections to Kwinana Freeway at Mundijong Road, Safety Bay Road and Karnup Road.

Baldivis Road is a Regional Distributor road according to Main Roads WA Functional Road Hierarchy and operates under the speed limit of 80km/h in the vicinity of the LSP area.

According to traffic counts published by Main Roads WA Baldivis Road in this vicinity (south of Mundijong Road/ Kulija Road) carried about 11,370vpd with 11.2% heavy vehicles in 2015/2016. **Figure 5** shows the existing traffic profile along Baldivis Road.

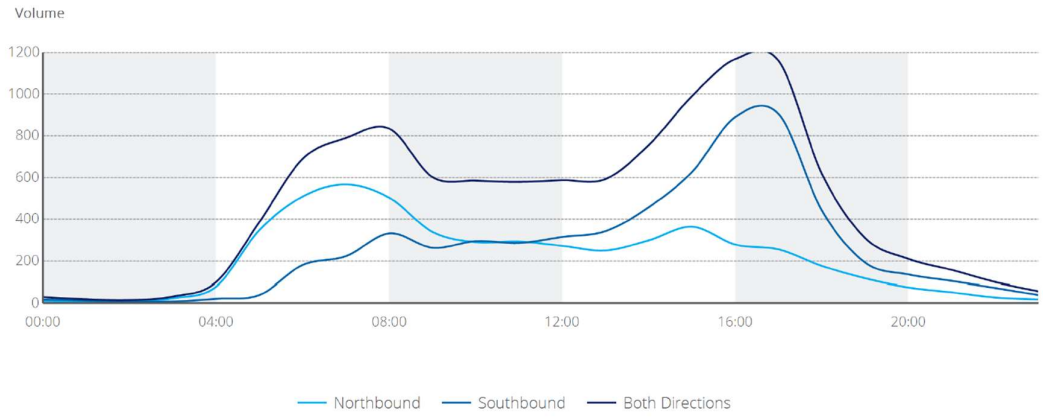


Figure 5: Existing traffic flow on Baldivis Road (sourced from Main Roads WA)

According to the traffic counts sourced from City of Rockingham, Baldivis Road south of Kulija Road carried weekday traffic flows of 10,159vpd in October 2018.

Kerosene Lane

Kerosene Lane is a 7m wide single undivided carriageway and is classified an Access Road in the Main Road WA Functional Road Hierarchy with a sign-posted speed limit of 80km/hr in the vicinity of the subject site (refer **Figure 6**). There are no footpaths on either side of this road in the vicinity of the subject site.

According to traffic counts sourced from City of Rockingham, Kerosene Lane carried weekday traffic flows of 2,947vpd in September 2018.

Figure 6: Kerosene Lane Looking West, fronting the Subject Site

Currently, some sections of Kerosene Lane fronting the developed subdivision areas to the west of the subject site have been upgraded. **Figure 7** illustrates the standard of the upgraded section of Kerosene Lane to the west of the subject site. This

section of Kerosene Lane has been upgraded to "Neighbourhood Connector A" standard with two 5m carriageways and 2m solid median with occasional openings at intersections.

Figure 7: Existing Upgraded Section of Kerosene Lane

(Source Nearmap, May 2019)

Kerosene Lane connects to Baldivis Road in the form of a priority controlled T-intersection without turn lanes on Baldivis Road. **Figure 8** illustrates the existing standard of the Kerosene Lane and Baldivis Road intersection.

Figure 8: Intersection of Kerosene Lane and Baldivis Road

3.4 Heavy Vehicles

Kerosene Lane and Baldivis Road adjacent to the subject site forms part of RAV Tandem Drive Network 4 as shown in **Figure 9** and Tri-Drive Network 1 as shown in **Figure 10**. The RAV 4 Network classification permits a variety of prime mover and trailer combinations, up to a maximum length of 27.5m as detailed in **Figure 11** .

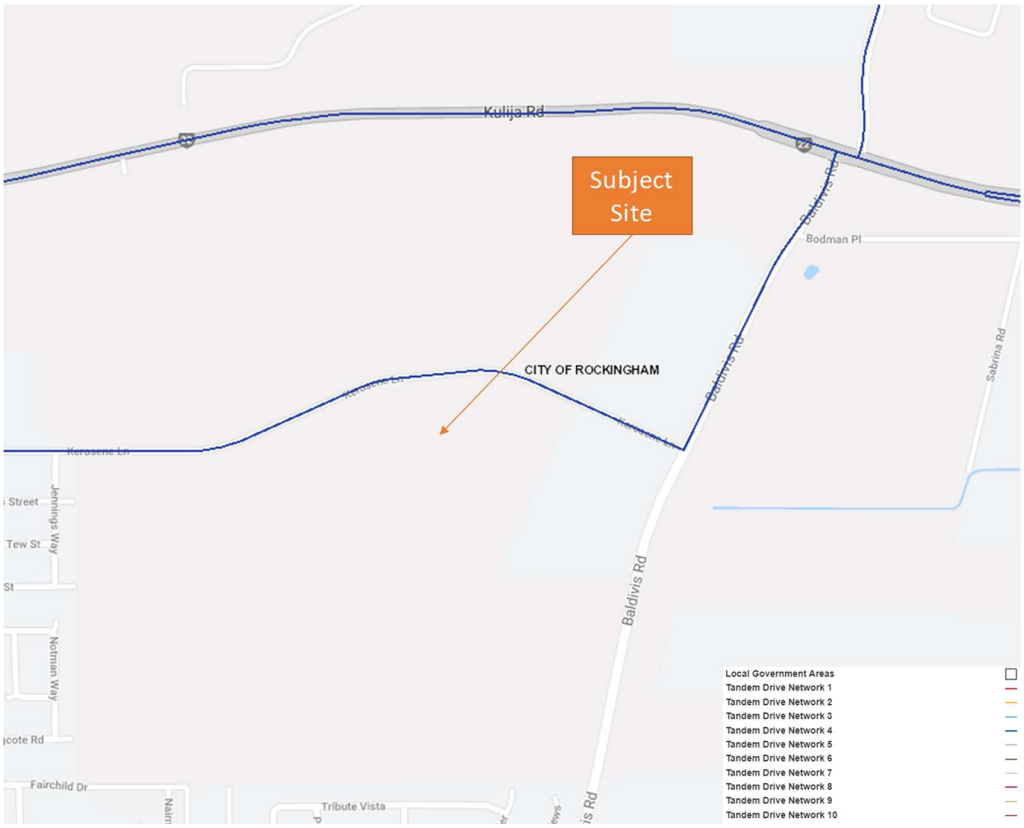


Figure 9: RAV – Tandem Drive Network Map

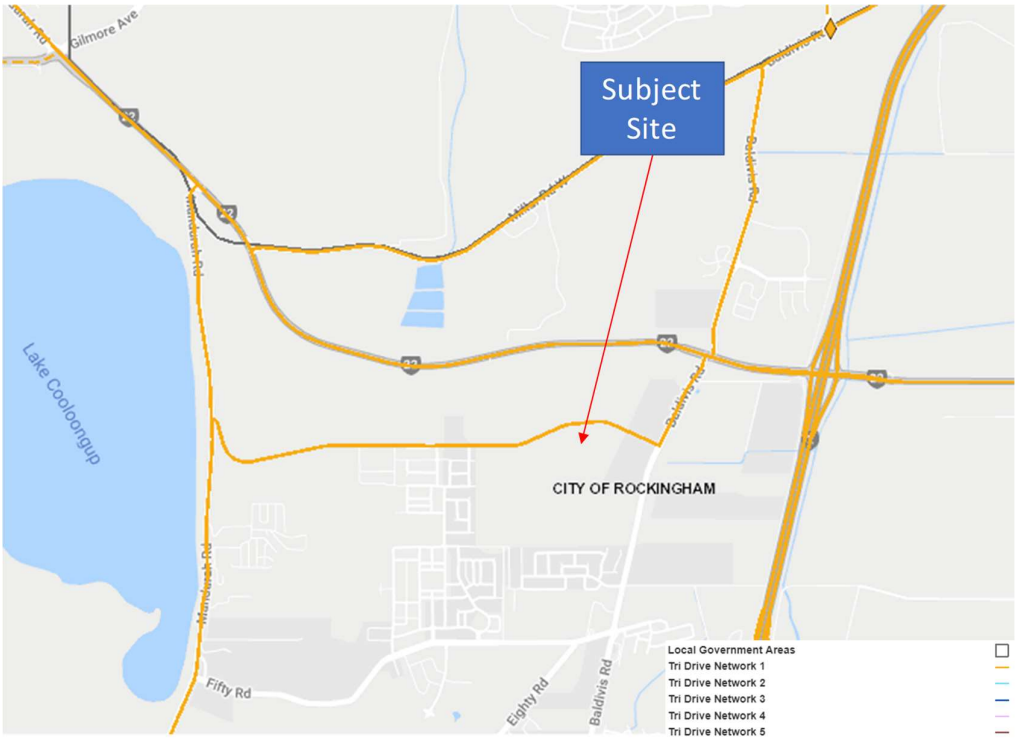


Figure 10: RAV – Tri Drive Network Map

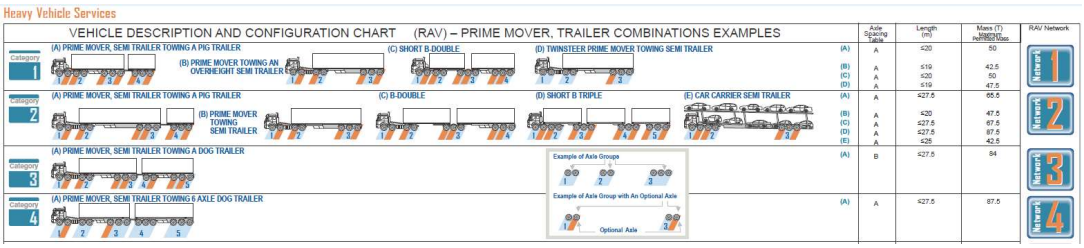


Figure 11: Examples of permitted prime mover – trailer combinations (Source: MRWA)

3.5 Public Transport

Currently there is no public transport facility along Baldivis Road or Kerosene Lane in the vicinity of the proposed LSP area. The closest existing bus route to the LSP area is Bus Route No. 568 from Warnbro Train Station, which currently terminates at McDonald Road/Sierra Parade, as shown in **Figure 12**.

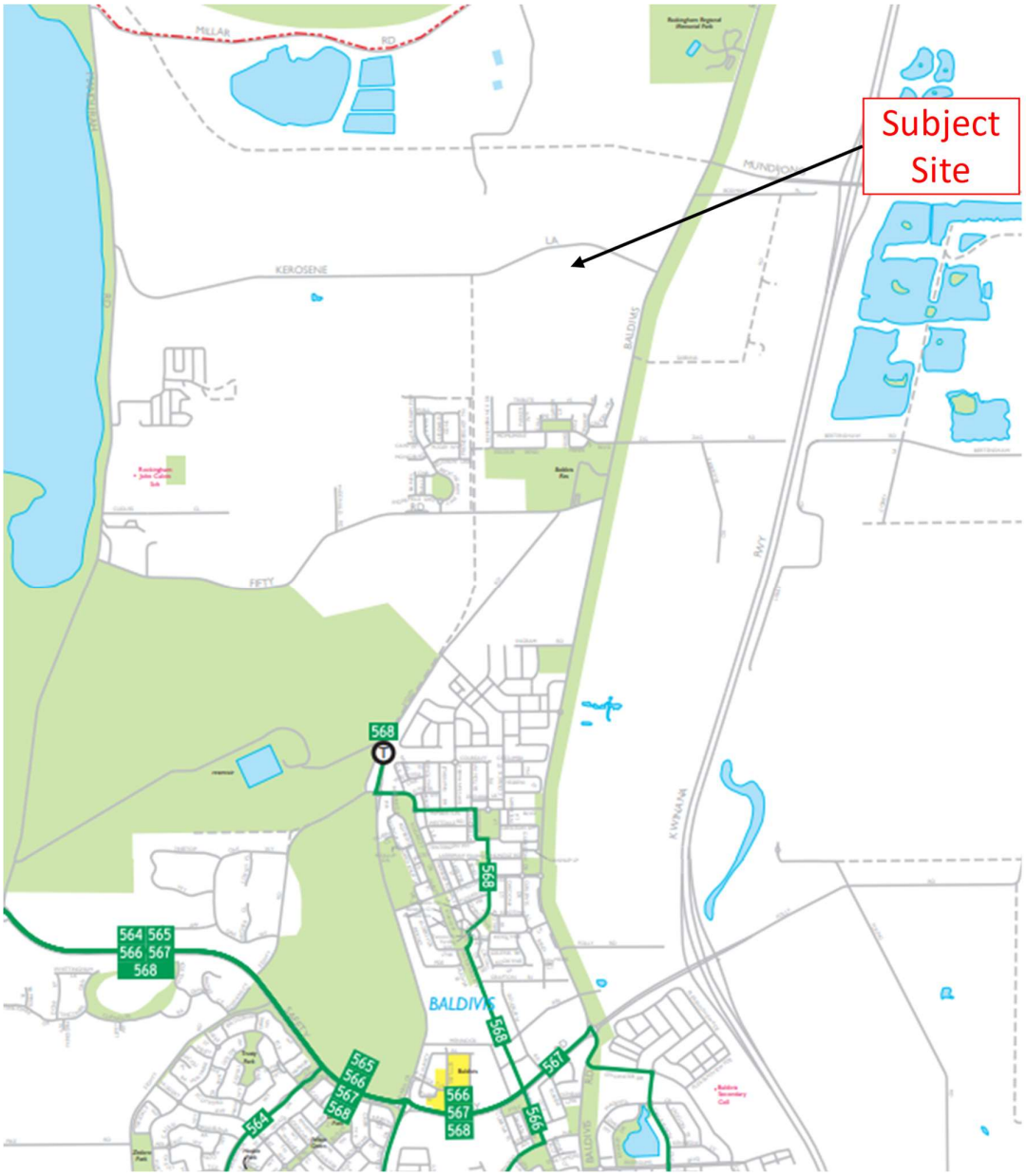


Figure 12: Existing Bus Routes

3.6 Pedestrian and Cyclist Facilities

There are no paths on Baldivis Road or Kerosene Lane adjacent to the LSP area. The Department of Transport's Perth Bike Map series (see **Figure 13**) shows that Baldivis Road, Kerosene Lane and Fifty Road in the vicinity of the proposed LSP are considered a good road riding environment.

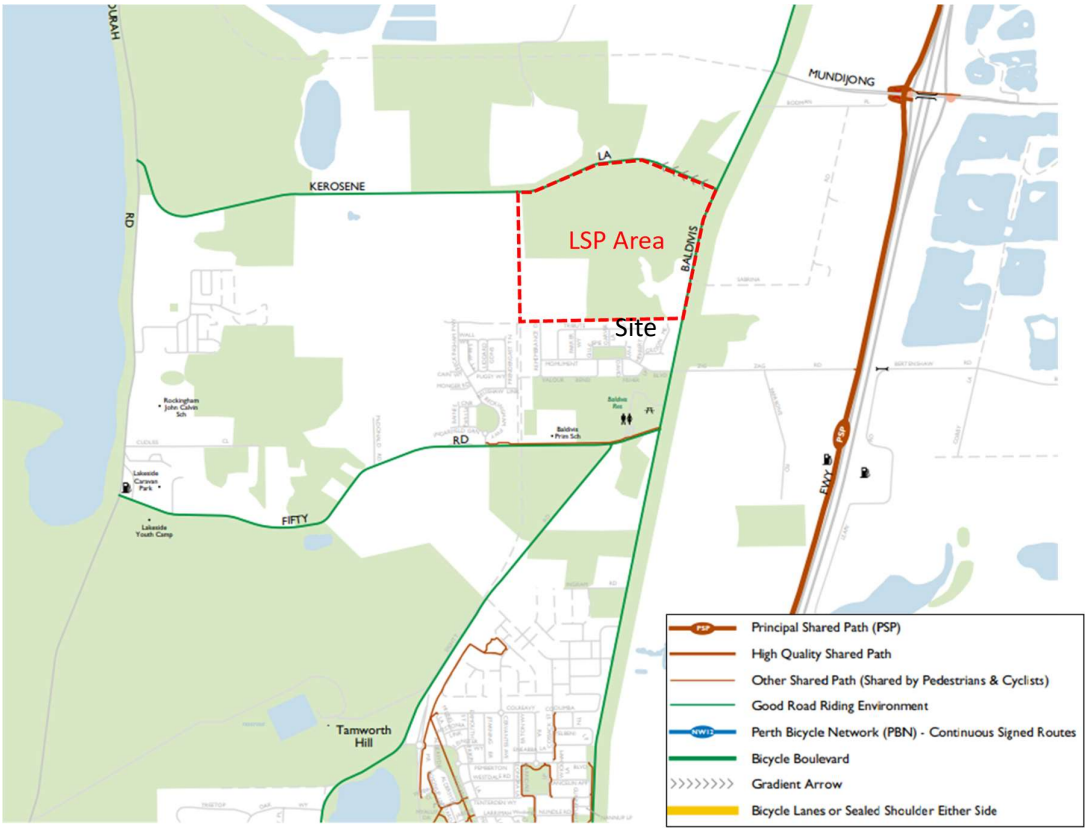


Figure 13: Bike Map

3.7 Crash Data

Main Roads WA Intersection *Crash Ranking Report* provides detailed crash data for the Baldivis Road/Kerosene Road intersection over the 5-year period ending 31 December 2018. Crash report information for this intersection is presented in **Table 1**. The crash history data for the intersection indicates that the majority of the crashes were rear end and right-angle crashes.

Table 1: Crash history for the Baldivis Road/Kerosene Road intersection

Intersection				Total Crashes	Casualty
Baldivis Road/Kerosene Road				6	1
Right Angle	Rear End	Right turn Thru	Pedestrian	Wet	Dry
1	5	0	0	1	2

3.8 Changes to the Surrounding Road Network

Long-term road network planning for this part of the Metropolitan Region includes the future extension of Nairn Drive as the main north south district distributor road through Baldivis and Karnup. The alignment of this planned Other Regional Road (also referred to as a blue road) in the Metropolitan Region Scheme (MRS) is shown in **Figure 1**. The first 2-lane carriageway of Nairn Drive is currently constructed up to Amazon Drive, linking into Eighty Road.

The Traffic Assessment report prepared for "Baldivis East District Structure Plan" by Shawmac (20th February 2015) indicates that ultimately Mundijong Road (Kulija Road) will fly over Baldivis Road with no connection.

According to the South Metropolitan Peel Subregional Planning Framework (the Framework) which has been released recently, the eastern section of Kerosene Lane between Nairn Drive and Baldivis Road is classified as "Integrator Arterial" road. It must be noted that the proposed Framework is at draft level currently and the projected daily traffic volume and proposed road standard of Kerosene Lane between Nairn Drive and Baldivis Road will be reviewed and confirmed by the outcome of the transport modelling and analysis which is currently being undertaken by Main Road WA.

3.9 Public Transport Network Planning

Based on liaison with the Public Transport Authority it is expected that two bus routes would serve North Baldivis area. These routes are shown in **Figure 14**.

The 'Western Route' currently known as Route 568 will extend via Cervantes Avenue and Amazon Drive to Kerosene Lane by Nairn Drive or McDonald Avenue. This route would eventually end up in Rockingham through Mandurah Road and

Dixon Road. The route extension to Rockingham will be a long term option with an interim terminus required in the vicinity of Nairn Drive and Kerosene lane.

The 'Eastern Route' known as Future Route 569 is expected to run along Kerosene Lane and a (yet to be identified) Neighbourhood Connector running parallel to and to the east of Baldivis Road. This route will probably terminate at Wellard Station.

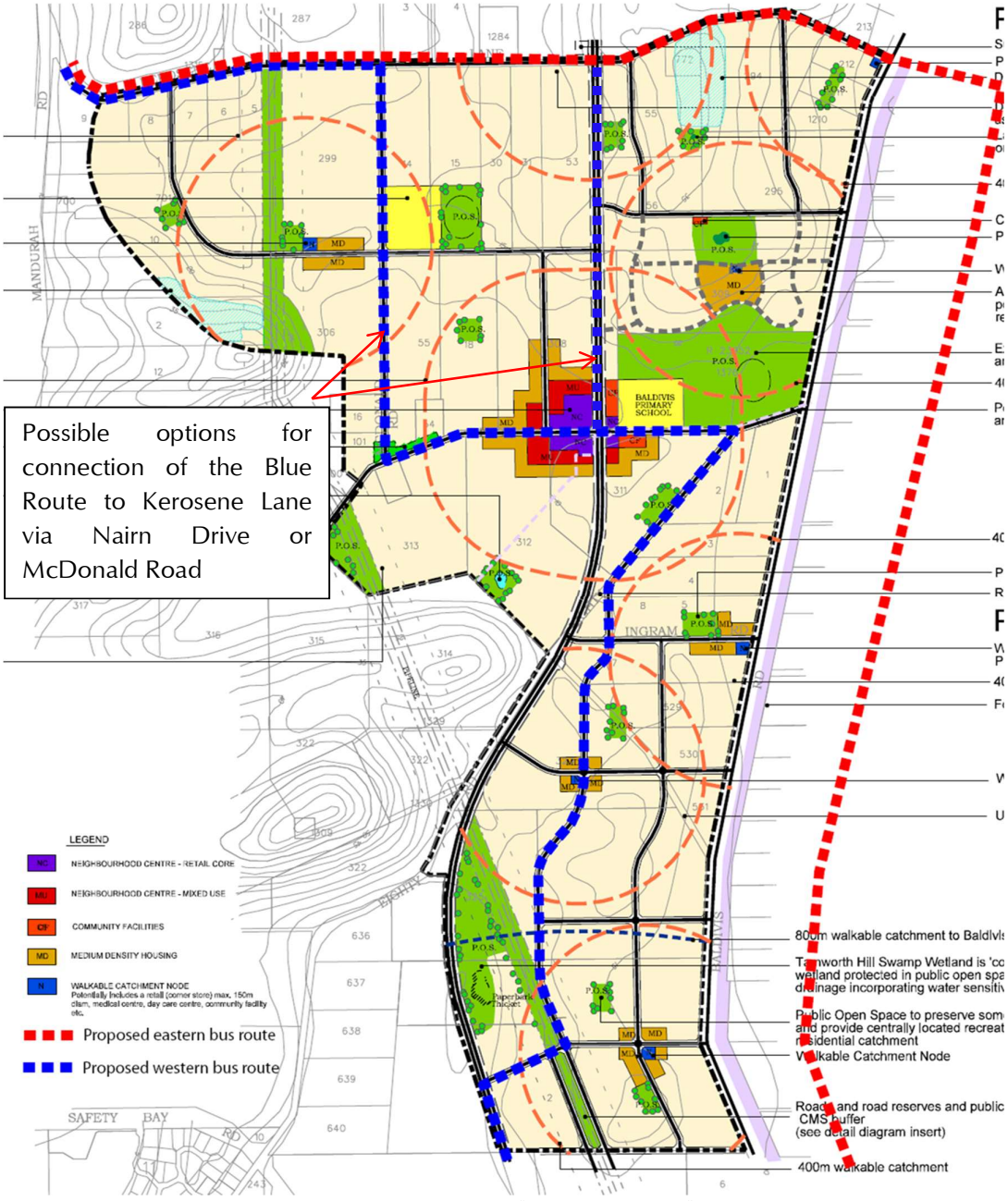
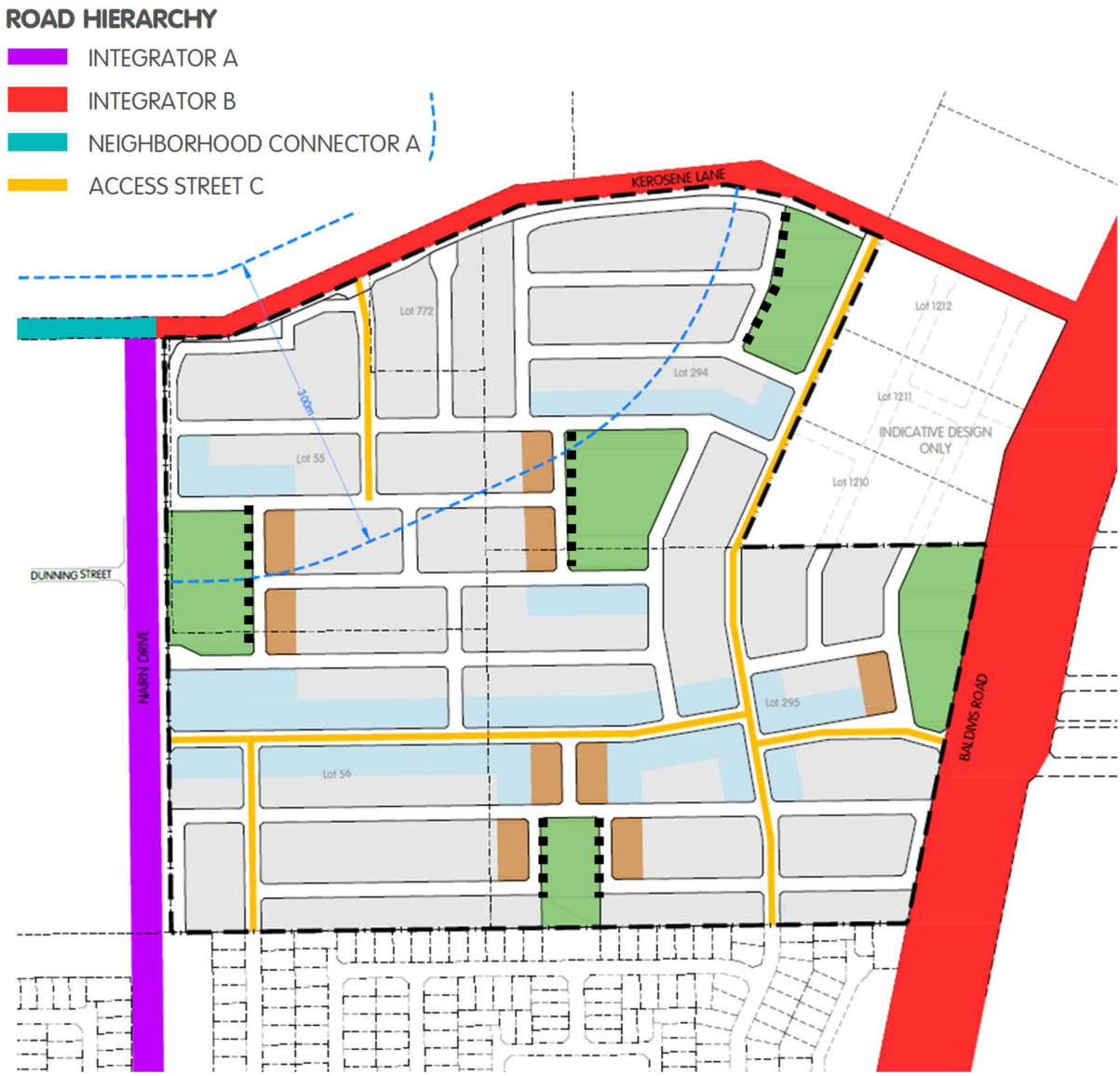


Figure 14: Proposed Bus Routes Plan

4.0 Proposed Transport Network

4.1 Road Hierarchy

The proposed hierarchy of roads within the LSP area is illustrated in **Figure 15** using the road hierarchy classification from Liveable Neighbourhoods guidelines (2007). This hierarchy has been developed based on traffic modelling undertaken for the LSP (refer section 5.0 of this report) and consistency with other work undertaken in the area.



Note: The rest of the roads are classified as Access Street D

Figure 15: Proposed Road Hierarchy

Some key characteristics of the relevant road classifications have been summarised in Table 2. These are generally based on Liveable Neighbourhoods guidelines although the proposed widths would vary slightly from the standard Liveable Neighbourhoods cross-section diagrams.

Table 2: Key Characteristics for the Proposed LSP Road Classifications

Road Classification	Indicative upper volume (vpd)	Indicative road reserve width (m)	Indicative road pavement width (m)
Integrator A	35,000	40m	2 x 8.5m (incl. cycle lanes) + 6m median
Integrator B	15,000	25m	2 x 5m (incl. cycle lanes) + median
Neighbourhood Connector A	7,000	23m	2 x 5m (incl. cycle lanes), 2m median and embayed parking
Neighbourhood Connector B	3,000	20m	7.4m and embayed parking
Access Street C	3,000	16m	6m (plus embayed parking) or 7.2m (with no embayed parking)
Access Street D	1,000	14.2m	6m

It should be noted that these reserve widths are indicative only and are subject to further adjustment in consultation with the Department of Planning Land and Heritage and City of Rockingham during detailed subdivision design.

Integrator A

Nairn Drive is expected to carry about 30,000vpd in the vicinity of the LSP area and therefore is classified as Integrator A Road of dual carriageway standard.

Integrator B

Baldivis Road will be an Integrator B road in the Liveable Neighbourhoods road hierarchy. The existing upgraded section in the vicinity of Amazon Drive demonstrates the road cross section that has been considered appropriate adjacent to previous subdivision areas. It involves two 5m carriageways and a 2m median.

Kerosene Lane fronting the LSP area is classified as Integrator B road according to the South Metropolitan Peel Subregional Planning Framework (the Framework), however modelling and analysis undertaken by Transcore indicates that this section of Kerosene Lane would accommodate about 5,000vpd and therefore can be classified as Neighbourhood Connector A road.

Neighbourhood Connectors

The section of Kerosene Lane west of the LSP area is expected to carry about 5,000vpd and is classified as Neighbourhood Connector A road as per LN

guidelines. The existing upgraded section of Kerosene Lane to the west of the subject site demonstrates the road cross section that has been considered appropriate adjacent to previous subdivision areas.

Access Streets

The basic standard of Access Street D roads within the LSP area is a 6m wide carriageway in a 14.2m road reserve in accordance with Liveable Neighbourhoods guidelines. This road standard is proposed where the future total traffic volumes are less than 1000vpd. It is anticipated that most of the access streets shown in the LSP would be of this category.

Access Streets with a future traffic volume over 1,000vpd will be designed as an Access Street C. This is based on a 16m road reserve width and a 7.2m carriageway width or 6m plus embayed parking where required.

On Access Streets abutting POS Liveable Neighbourhoods allows the verge adjacent to the park to be reduced in width as there is no requirement for underground services for the park and it is appropriate for paths and street trees to be located within the park, if required. Liveable Neighbourhoods allows this verge to be reduced to 1.0m. In this LSP area it is proposed to reduce these verges by 2.2m (i.e. 1.9m verge adjacent to POS), which results in 12m road reserves adjacent to POS as shown in dotted lines figure 15.

4.2 Public Transport

Existing bus services in this area are described in section 3.3 of this report and current planning by the Public Transport Authority is discussed in section 3.6.

4.3 Pedestrian and Cyclist Facilities

A highly permeable road network within the LSP area creates excellent opportunities for the provision of good pedestrian and cyclist facilities that maximise use of non-motorised transport modes.

Figure 16 outlines the proposed pedestrian and cyclist network for the LSP area.

In accordance with current practice adopted by the City of Rockingham it is proposed to construct all paths to a minimum width of 2.0 metres so that they can all be designated as shared paths for pedestrians and cyclists. Paths will be provided on at least one side of all roads. Laneway lots are to have footpath access to visitor parking bays provided in a nearby road reserve.

On-street cycle lanes are normally included on Integrator A, Integrator B and Neighbourhood Connector A roads, as indicated in the details of the road hierarchy listed in Table 1.

Figure 16: Proposed Pedestrian and Cyclist Network

5.0 Integration with Surrounding Area

The proposed land uses for the LSP area are residential dwellings which are in line with the surrounding existing and proposed land uses in this area.

The road network of the LSP area will connect to the surrounding road network at a number of locations. This will include two intersections onto Kerosene Lane, one intersection on Baldivis Road and one on Nairn Drive.

6.0 Analysis of the Transport Network

6.1 Assessment Period

The assessment year that has been adopted for this analysis is 2031, with full development of Baldivis as envisaged in the Western Australian Planning Commission's *Directions 2031 and Beyond* planning framework (Aug 2010) and *Outer Metropolitan Perth and Peel Sub-regional Strategy* (draft, Aug 2010).

6.2 Traffic generation and distribution

Transcore has developed a subregional traffic model of weekday traffic flows for the Mandurah-Rockingham area using the EMME transport modelling software package. This model has been developed in more detail for various projects in the Karnup-Baldivis area including this proposed LSP. Overall, the future scenario modelled in this area reflects the land use aspirations of *Directions 2031* as detailed in the *Outer Metropolitan Perth and Peel Sub-regional Strategy*.

The daily traffic generation rate used in the LSP area for this transport assessment is 8 vehicle trips per day (vpd) per dwelling, which corresponds to peak hour trip generation rates recommended in the Western Australian Planning Commission (WAPC) *Transport Assessment Guidelines for Development* (2006).

The anticipated yield of up to 644 dwellings in the LSP area will therefore generate approximately 5,150vpd.

The distribution of these trips is determined by the traffic model in proportion to the location of trip productions and attractors for work trips, education trips and other trips (shopping, social, recreational, etc.) among all the land uses in the traffic model.

6.3 Traffic Flow Forecasts

Figure 17illustrates future total daily traffic flows estimated for the road network of the LSP area.

The future total daily traffic flows on the road network in and around the LSP area has been modelled for the future scenario of full development of this area as discussed above.

Note: All the other roads carry less than 1,000vpd

Figure 17: Projected Daily Traffic Volumes

The transport modelling undertaken reflects the full development of Baldivis as envisaged in the Western Australian Planning Commission's Directions 2031 and Beyond planning framework (Aug 2010) and Outer Metropolitan Perth and Peel Sub-regional Strategy (draft, Aug 2010) and assumes the following long-term road network planning for this part of the Metropolitan Region:

- The future extension of Nairn Drive to Kulija Road as the main north south district distributor road through Baldivis and Karnup; and
- Mundijong Road (Kulija Road) will fly over Baldivis Road with no connection to Baldivis Road.

Figure 18 illustrates the future road network modelled in Transcore's Strategic Transport Model for this part of the South Metropolitan and Peel Region. According to this figure the regional traffic would travel on Nairn Drive and Kulija Road rather than Nairn Drive and the eastern section of Kerosene Lane due to the proposed flyover at Baldivis Road and Kulija Road.

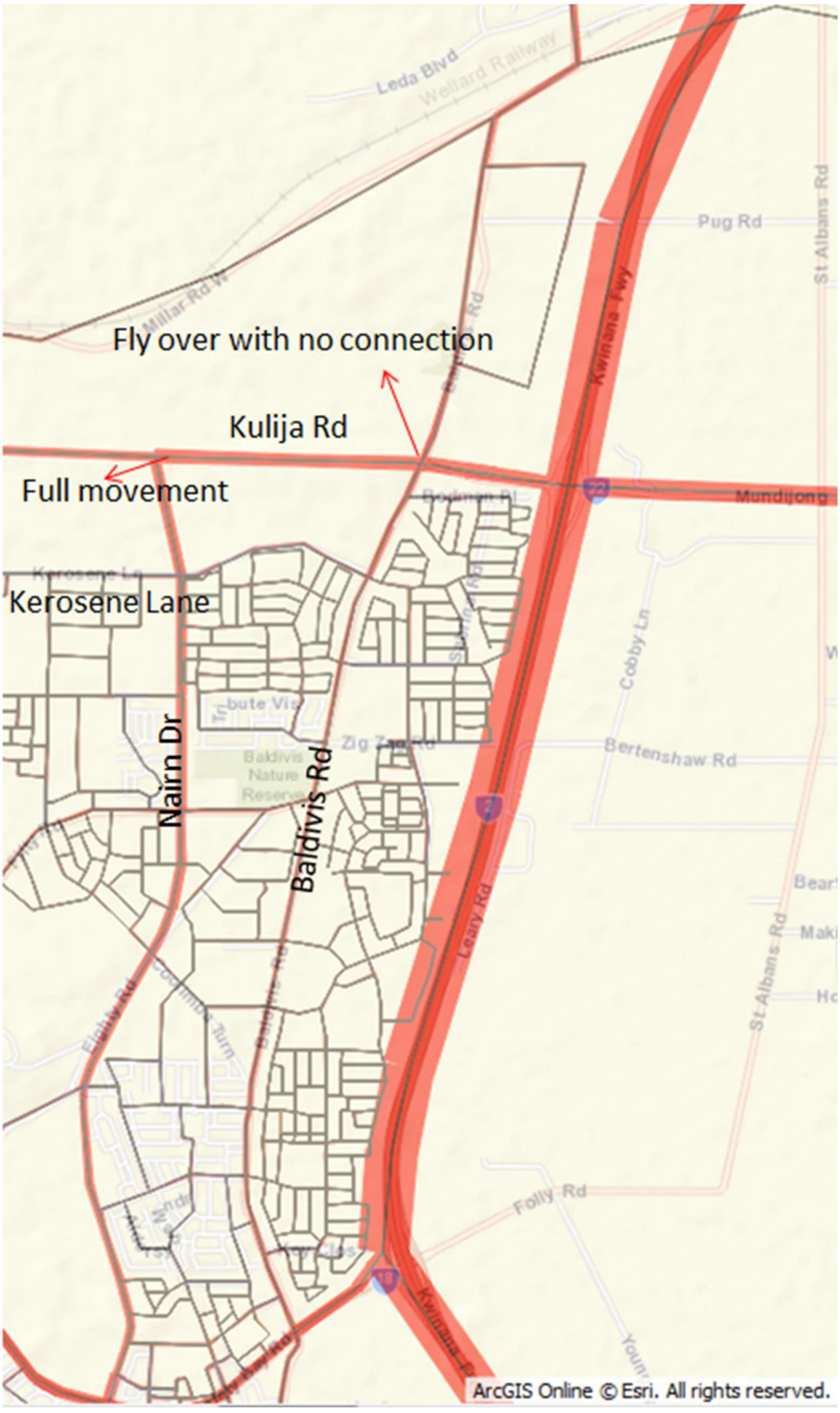


Figure 18: Transcore Strategic Transport Model, 2031 Model Road Network

6.4 Roads and Intersections

The proposed road network to accommodate these traffic volumes has been discussed in section 4 of this report, including the details of the proposed road hierarchy in section 4.1.

Figure 19 details the proposed controls for intersections within the LSP area.

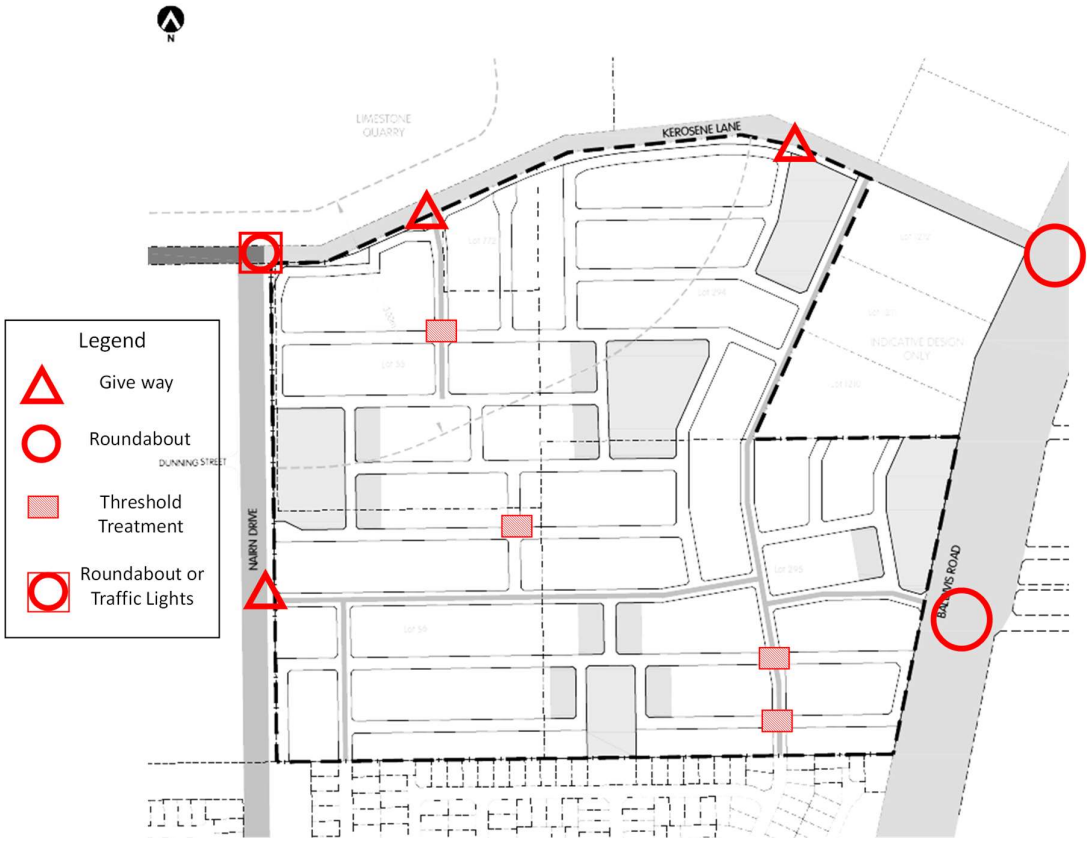


Figure 19: Intersection treatments

Baldivis Road Intersections

The future planning for Baldivis Road assumes it will be upgraded to a two-lane boulevard (i.e. one lane each way with a central median) as has already been constructed on some sections further south. The future traffic volume of 10,000 to 15,000vpd adjacent to the LSP area modelled in this transport assessment is consistent with this road standard.

Access to the LSP area will be provided by a 4-way roundabout intersection on Baldivis Road at Sabrina Road (the road on the north side of the proposed primary school site within the adjacent LSP area to the east of Baldivis Road).

The intersection of Kerosene Lane and Baldivis Road is also proposed to operate as a roundabout.

Nairn Drive Intersections

The projected traffic volume on Nairn Drive is about 30,000vpd in the vicinity of the LSP area which dictates a dual carriageway standard for Nairn Drive in future. On this basis Kerosene Lane/ Nairn Drive intersection is proposed to operate as a roundabout or traffic lights. The proposed LSP access intersection to the south of Kerosene Lane is a T-intersection and is proposed to operate as priority controlled T-intersection with turn lanes on Nairn Drive.

Kerosene Lane Intersections

The LSP access intersections at Kerosene Lane are proposed to operate as priority controlled T-intersections without turn lanes on Kerosene Lane. The projected traffic volumes on LSP side roads are not significant and therefore Give Way intersections along Kerosene Lane would be able to cater for LSP traffic satisfactorily.

Internal Intersections

There are a number of four-way intersections within the LSP area on low-traffic-volume access streets. These intersections are recommended to be designed as priority-controlled intersections with Give Way controls on the minor road approaches as suggested in Liveable Neighbourhoods (LN Element 2 pages 31-33). Appropriate entry treatments are proposed on the side/minor roads to help alert drivers to the presence of the intersections and that traffic on the major road has priority. Details of the intersection treatment will be determined in consultation with the City of Rockingham at subdivision design stage.

6.5 Intersection Analysis

The key LSP access intersections that are highly likely to be affected by the LSP area traffic are:

- LSP access intersection on Baldivis Road (Baldivis Road/Sabrina Road);
- LSP access intersections on Kerosene Lane (western and eastern access intersection); and
- LSP access intersection on Nairn Drive.

Capacity analysis of these intersections has been undertaken using the SIDRA computer software package for the LSP typical peak hour. SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- Degree of Saturation is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for infrequent traffic flow up to one for saturated flow or capacity.
- Level of Service is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of

Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).

- Average Delay is the average of all travel time delays for vehicles through the intersection.
- 95% Queue is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analysis are summarised in **Appendix A**.

LSP access intersection on Nairn Drive

The proposed LSP access intersection on Nairn Drive is a priority controlled T-intersection with turn lanes on Nairn Drive. This intersection will work satisfactorily and within capacity when Nairn Drive is of two-lane, single carriageway standard. Analysis undertaken for the ultimate standard of the Nairn Drive as dual carriageway standard indicates that this intersection still would operate successfully as priority controlled T-intersection. The proposed dual carriageway including a large median on Nairn Drive would facilitate the two stage movement at this intersection (refer **Figure A1** for the proposed layout of this intersection). Analysis undertaken indicates outbound right turn movements at this intersection would be at level of service E based on average delays during peak periods but this right turn movement would only be at 67.3% of capacity, which is still well within practical capacity (85%) for an unsignalised intersection. **Table A1** summarises the performance of the LSP access intersection on Nairn Drive.

The operation of the LSP access intersection on Nairn Drive would also depend on the proposed standard of the nearby intersections including the intersection of Kerosene Lane/ Nairn Drive. If the intersection of Kerosene Lane/ Nairn Drive operates under traffic lights after duplication of Nairn Drive, then more gaps would be available for the turn movements of the LSP access intersection on Nairn Drive due to the platooning effect which will improve the operation of this intersection.

LSP access intersection on Baldivis Road

SIDRA analysis indicates that the proposed roundabout at the intersection of Baldivis Road/LSP access road will operate satisfactorily with the forecast traffic flows for full development of Baldivis. This roundabout will operate at level of service A overall for typical peak periods. **Figure A2** in Appendix A illustrates the proposed intersection layout of this intersection and **Table A2** summarises the outcome of the SIDRA analysis for this intersection.

LSP access intersections on Kerosene Lane

The LSP access intersections on Kerosene Lane are proposed to operate as basic priority controlled T-intersections without turn lanes on Kerosene Lane. Analysis undertaken for the western LSP access intersection on Kerosene Lane (which is the busiest intersection) indicates that this intersection would operate overall at LoS A (best possible level of service) during the typical peak hours. **Figure A3** illustrates the proposed layout of this intersection and **Table A3** summarises the outcome of the SIDRA analysis for this intersection.

6.6 Upgrading of the Road Network

Any land required for the upgrading and construction of Nairn Drive, Kerosene Lane and Baldivis Road will need to be ceded in accordance with State Planning Policy 3.6, Development Contributions for Infrastructure. Any such land requirement can be addressed as part of a development contribution plan and/or conditions of subdivision. A condition relating to development contribution requirements can be satisfied by different methods including ceding of land for roads and other reserves.

6.7 Access to Frontage Properties

The WAPC *Liveable Neighbourhoods* policy requires that "Development along integrator B and neighbourhood connector streets with ultimate vehicle volumes over 5,000 vehicles per day should be designed either so vehicles entering the street can do so travelling forward, or are provided with alternative forms of vehicle access. Wider lots with paired driveways and protected reversing areas in the parking lane may be used on streets with up to 7,000 vehicles per day."

On this basis no direct access is recommended to Baldivis Road, Nairn Drive and Kerosene Lane from the LSP lots.

6.8 Pedestrian / Cycle Networks

The proposed network of shared paths for pedestrians and cyclists is described in section 4.3 of this report. This network of paths will provide good level of accessibility and permeability for pedestrians and cyclists within the LSP area, and connections to neighbouring precincts at strategic locations.

6.9 Access to Public Transport

At this stage of the structure planning process neither bus stop locations nor subdivision lot layouts are known. However, in these circumstances the WAPC *Transport Assessment Guidelines for Developments* (2006) suggest that it is desirable for at least 90 per cent of dwellings to be within 400m straight line distance of a bus route. The potential future bus route along Kerosene Lane and Nairn Drive will satisfy this requirement.

7.0 Conclusions

This revised Transport Assessment report is an update to the 2016 TIA report and includes a revised Local Structure Plan including Lot 214 Kerosene Lane and addresses item 30 and 31 of the WAPC updated schedule of modifications (March 2018).

The proposed LSP is anticipated to accommodate approximately 644 dwellings including 24 dwellings for Lot 214. The total LSP area is expected to generate traffic flows of about 5,150vpd.

The road network of the LSP area is proposed to be designed based on WAPC Liveable Neighbourhoods guidelines to accommodate the future traffic flows that will be generated in this area.

The proposed LSP also provides for a network of shared paths and footpaths to encourage and facilitate non-motorised travel.

The future planning for Baldivis Road and Nairn Drive assumes two-lane boulevard standard for Baldivis Road and dual carriageway standard for Nairn Drive. The future traffic volumes adjacent to the LSP area modelled in this transport assessment are consistent with this road standard.

SIDRA analysis undertaken for the LSP access intersections on Baldivis Road and Kerosene Lane indicate that these intersections would work satisfactorily and within the capacity after full development of the LSP area and the other adjacent LSPs as per the East Baldivis Structure Plan.

The proposed LSP access intersection on Nairn Drive is proposed to operate as priority controlled T-intersection with turn lanes on Nairn Drive. SIDRA analysis undertaken for this intersection indicates satisfactorily operation within practical capacity (85%). The operation of this intersection is highly dependent on the projected traffic volumes on Nairn Drive and the operation of the proposed nearby intersections (i.e Kerosene Lane/ Nairn Drive).

If Kerosene Lane/ Nairn Drive intersection converts to traffic lights in future then more gaps would be available for the turning movements of the intersection of Nairn Drive/ LSP access Road due to the platooning effect which will improve further the operation of the LSP access intersection on Nairn Drive.

Appendix A

INTERSECTION ANALYSIS

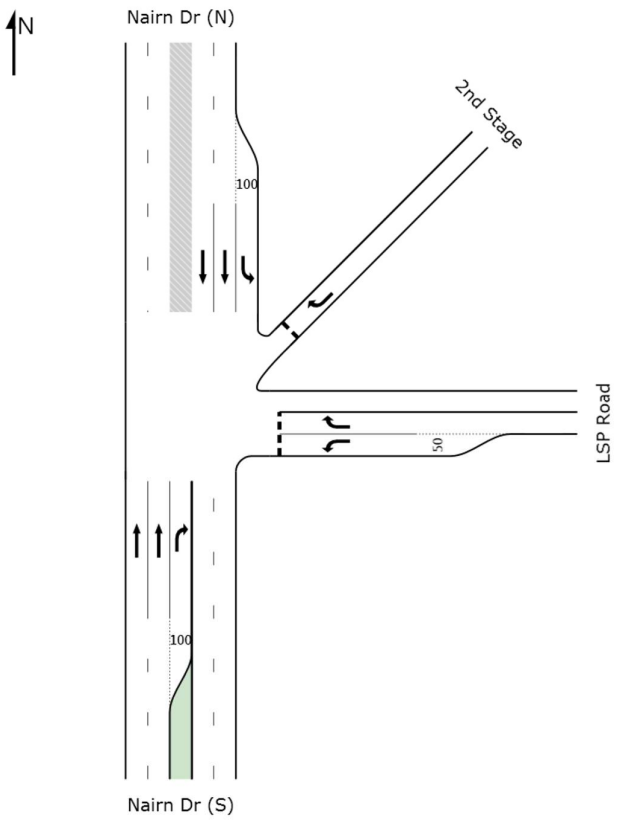


Figure A1: Nairn Drive LSP Access Intersection

Note: The diagonal link shown is not an actual road link, it is a technique used in SIDRA analysis to model the right turn from the side road in two stages (first to the median then into the northbound traffic flow)

Table A1. SIDRA results – Nairn Drive LSP Access Intersection – 2031 weekday typical peak hour with full development

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	50% Back of Queue Vehicles veh	50% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
2	T	1474	6.0	0.393	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R	55	0.0	0.249	26.6	LOS D	0.3	2.4	0.88	0.98	34.6
Approach		1528	5.8	0.393	1.0	NA	0.3	2.4	0.03	0.04	58.5
East: LSP Road											
4	L	54	0.0	0.308	31.8	LOS D	0.4	2.9	0.89	1.00	32.0
6	R	152	0.0	0.658	36.8	LOS E	1.3	8.8	0.94	1.15	29.8
Approach		205	0.0	0.658	35.5	LOS E	1.3	8.8	0.93	1.11	30.3
North East: 2nd Stage											
26	R	152	0.0	0.525	29.4	LOS D	1.0	6.7	0.92	1.08	33.2
Approach		152	0.0	0.525	29.4	LOS D	1.0	6.7	0.92	1.08	33.2
North: Nairn Dr (N)											
7	L	87	0.0	0.047	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
8	T	1474	6.0	0.393	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		1561	5.7	0.393	0.5	NA	0.0	0.0	0.00	0.04	59.3
All Vehicles		3446	5.1	0.658	4.0	NA	1.3	8.8	0.11	0.15	54.0

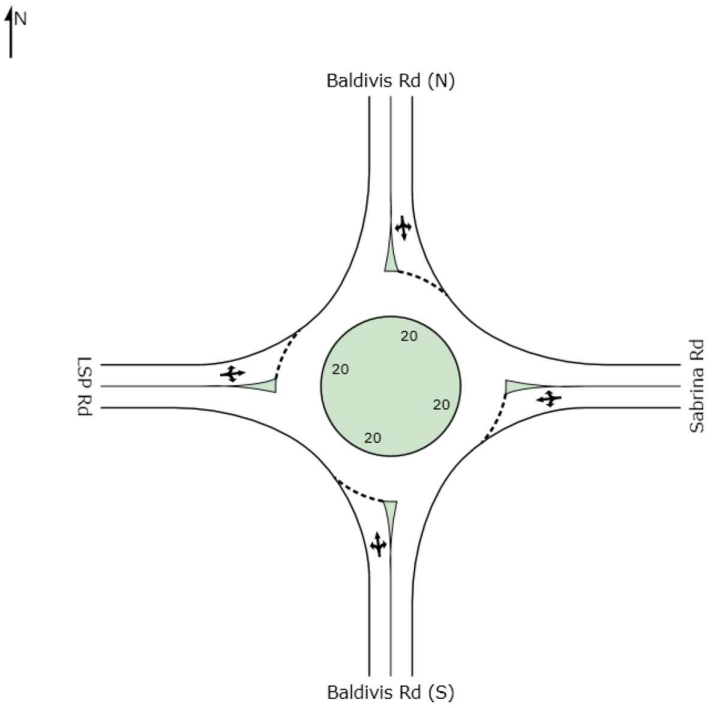


Figure A2: Baldivis Road LSP Access Intersection

Table A2. SIDRA results – Baldivis Road LSP Access Intersection – 2031 weekday typical peak hour with full development

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Baldivis Rd (S)											
1	L	13	0.0	0.394	6.9	LOS A	2.8	20.8	0.35	0.55	49.3
2	T	492	6.0	0.394	6.1	LOS A	2.8	20.8	0.35	0.48	49.8
3	R	32	0.0	0.394	11.7	LOS B	2.8	20.8	0.35	0.79	46.3
Approach		536	5.5	0.394	6.5	LOS A	2.8	20.8	0.35	0.50	49.5
East: Sabrina Rd											
4	L	32	0.0	0.112	9.0	LOS A	0.6	4.4	0.60	0.68	47.8
5	T	59	0.0	0.112	8.1	LOS A	0.6	4.4	0.60	0.64	47.9
6	R	11	0.0	0.112	13.9	LOS B	0.6	4.4	0.60	0.82	44.8
Approach		101	0.0	0.112	9.0	LOS A	0.6	4.4	0.60	0.67	47.5
North: Baldivis Rd (N)											
7	L	11	0.0	0.378	6.7	LOS A	2.7	19.6	0.31	0.54	49.5
8	T	484	6.0	0.378	6.0	LOS A	2.7	19.6	0.31	0.47	50.1
9	R	34	0.0	0.378	11.6	LOS B	2.7	19.6	0.31	0.79	46.3
Approach		528	5.5	0.378	6.4	LOS A	2.7	19.6	0.31	0.49	49.8
West: LSP Rd											
10	L	26	0.0	0.088	9.0	LOS A	0.5	3.4	0.60	0.67	47.7
11	T	39	0.0	0.088	8.1	LOS A	0.5	3.4	0.60	0.63	47.8
12	R	14	0.0	0.088	13.9	LOS B	0.5	3.4	0.60	0.80	44.7
Approach		79	0.0	0.088	9.4	LOS A	0.5	3.4	0.60	0.67	47.2
All Vehicles		1244	4.7	0.394	6.8	LOS A	2.8	20.8	0.37	0.52	49.3

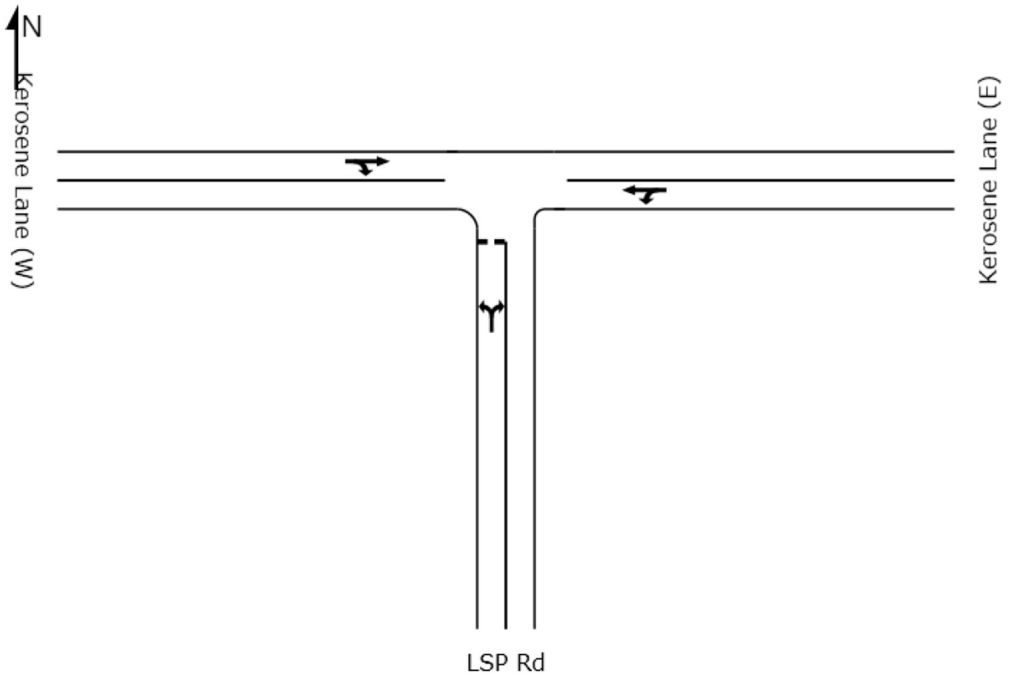


Figure A3: Kerosene Lane LSP Access Intersection

Table A3. SIDRA results – Kerosene Lane LSP Access Intersection – 2031 weekday typical peak hour with full development

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: LSP Rd											
1	L	74	0.0	0.066	9.2	LOS A	0.3	2.0	0.34	0.63	47.4
3	R	11	0.0	0.066	9.5	LOS A	0.3	2.0	0.34	0.78	47.5
Approach		84	0.0	0.066	9.3	LOS A	0.3	2.0	0.34	0.65	47.4
East: Kerosene Lane (E)											
4	L	11	0.0	0.122	8.2	LOS A	0.0	0.0	0.00	1.06	49.0
5	T	223	2.0	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		234	1.9	0.122	0.4	NA	0.0	0.0	0.00	0.05	59.4
West: Kerosene Lane (W)											
11	T	236	2.0	0.184	1.2	LOS A	1.2	8.6	0.40	0.00	52.3
12	R	71	0.0	0.184	9.6	LOS A	1.2	8.6	0.40	0.89	48.7
Approach		306	1.5	0.184	3.1	NA	1.2	8.6	0.40	0.20	51.5
All Vehicles		624	1.5	0.184	2.9	NA	1.2	8.6	0.24	0.20	53.5