



**Warradale Terrace Development,  
Landsdale  
Burgess Design Group**

**TRANSPORT ASSESSMENT**

- Revision 2
- 16/10/14

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## 1. Introduction/Background

This report was commissioned by Burgess Design Group on behalf of the landholders of Lots 16, 17 & 923 Grayswood Court, Lots 924- 926 Warradale Terrace and Lot 927 Kevo Place to document the traffic and transport impacts for the City of Wanneroo for a proposed rezoning of the site from ‘Special Residential R2’ to ‘Residential R40’..

The proposed rezoning is expected to provide for up to 126 new dwellings across the 3.5Ha site.

As part of the approval processes, a Transport Assessment (due to the size of the development, a “moderate” impact is expected) is required to support the application approval by the City of Wanneroo, but they have requested that a Transport Assessment be provided.

Refer to the regional context plan in **Appendix A**.

## 2. Proposed Rezoning

As discussed in the previous section Lots 16, 17 & 923 Grayswood Court, Lots 924- 926 Warradale Terrace and Lot 927 Kevo Place, Landsdale are proposed to be rezoned from 'Special Residential R2' to 'Residential R40' . A plan of the proposed rezoning area is shown in **Appendix B**.

The proposed rezoning will allow for up to 126 additional dwellings in varying sizes suitable for R40 zoning. The most likely development will lead to grouped housing on the seven individual lots (either built strata or possibly survey strata).

There is no major attractor/generator within the proposed structure plan area, with the estate being entirely residential.

From a traffic and transport point of view, the main issue is the provision of a suitable connection for future development onto the immediately adjacent road network of Warrdale Terrace, Grayswood Court and Kevo Place.

The proposed development lies approximately 6km or a 10-minute drive from the Kingsway City Shopping Centre via Mirrabooka avenue and then Hepburn Avenue and approximately 20km or a 40-minute drive from the Perth CBD via Alexander Drive. The estate is well located for FIFO workers; with Perth airport (terminals T1, T2, T3 and T4) approximately 21-23km or a 25-minute drive away via the Hepburn Avenue and Tonkin Highway. The site is located 400m or a 5-minute walk from the Landsdale Primary School and 800m or a 10-minute walk from the Landsdale Forum Shopping Centre on the corner of The Broadview and Abbottswood Drive.

## **3. Existing Situation**

### **3.1 Existing Land Uses**

The current land use within the subject site is as a combination of six single residential properties and a vacant lot.

Within 800m of the subject site the existing land uses are predominantly residential, with Warradale Park immediately opposite the site and the previously mentioned primary school located 400m to the south of the site along Warradale Terrace.

### **3.2 Existing Road Network within the Subject Site**

There are no roads within the subject site. However, there are four roads that future development will directly front or link into, these being:

- Kevo Place between Warradale Terrace and Raeside Drive;
- Warradale Terrace between Kevo Place and Rockdale Pass;
- Rockdale Pass between Warradale Terrace and Grayswood Court; and,
- Grayswood Court, north of Rockdale Pass.

#### **3.2.1 Kevo Street**

This street is a two lane, two-way road subject to the built up area speed limit of 50km/h. It is classified as an Access Road under the Functional Road Hierarchy and is neither a Primary nor Other Regional Road under the Metropolitan Region Scheme. It is estimated that approximately 300 vehicles per day (vpd) use this section of Kevo Street. Kevo Street intersects with Warradale Terrace at a T-junction, with Kevo Street being the terminating road. There is a brick paving threshold in Kevo Street, delineating this right of way. The reserve width is approximately 20m and the road width is approximately 6.0m between kerbs. There are no footpaths on either both side of Kevo Street.

#### **3.3 Warradale Terrace**

This street is a two lane, two-way road subject to the built up area speed limit of 50km/h. It is classified as an Access Road under the Functional Road Hierarchy and is neither a Primary nor Other Regional Road under the Metropolitan Region Scheme. It is estimated that approximately 700 vehicles per day (vpd) use this section of Warradale Terrace. Warradale Terrace intersects with Rockdale Pass at a single lane roundabout. There are brick paving thresholds on all approaches to this roundabout. The reserve width is approximately 20m and the road width is approximately 6.0m between kerbs. There are no footpaths on either both side of Kevo Street, but there is embayed parking provided on the western side of Warradale Terrace, for the use by visitors to Warradale Park.

### **3.3.1 Rockdale Pass**

This street is a two lane, two-way road subject to the built up area speed limit of 50km/h. It is classified as an Access Road under the Functional Road Hierarchy and is neither a Primary nor Other Regional Road under the Metropolitan Region Scheme. It is estimated that approximately 500 vehicles per day (vpd) use this section of Rockdale Pass. The reserve width is approximately 18m and the road width is approximately 6.0m between kerbs. There are no footpaths on either both side of Rockdale Pass.

### **3.3.2 Grayswood Court**

This street is a two lane, two-way road subject to the built up area speed limit of 50km/h. It is classified as an Access Road under the Functional Road Hierarchy and is neither a Primary nor Other Regional Road under the Metropolitan Region Scheme. It is estimated that approximately 50 vehicles per day (vpd) use Grayswood Court. Grayswood Court intersects with Rockdale Pass at a T-junction, with Grayswood Court being the terminating road. There is a brick paving threshold in Grayswood Court, delineating this right of way. The reserve width is approximately 16m and the road width is approximately 6.0m between kerbs. There are no footpaths on either both side of Grayswood Court although there is a pedestrian access way at the cul-de-sac head which connects through to Raeside Drive to the east.

### **3.4 Existing Pedestrian/Cyclist Networks within the Subject Site**

Apart from the frontage roads described above, there are no current pedestrian or cycling networks within the subject site. The current width of the frontage streets and traffic volumes make these roads acceptable for on-road cycling, with Warradale Road having been identified by the Department of Transport as a “Good” riding environment as part of the Perth Bike Network.

### **3.5 Existing Public Transport Services within the Subject Site**

There are no public transport services within the subject site. However, there is a bus stop located on Warradale Terrace approximately 50m north of the intersection of Rockdale Pass. This stop provides for route 352, 376 and 377 between the Whitfords train station and Mirrabooka Square shopping centre. This stop is not on a local footpath network but it is immediately in front of the development site.

### **3.6 Existing Road Network within 2km of the Subject Site**

Warradale Terrace generally provides the function of connecting the current local area to Gnangara Road to the north and Kingsway to the south. Access to the main north-south distributors can be gained via Queensway to the east to and from Alexander Drive and Southmead Drive to the west providing access to and from Mirrabooka Avenue.

The main intersections providing access to and from the proposed development to the wider network are:

- Mirrabooka Avenue/Southmead Drive – an unsignalised T-junction;



- Gnangara Drive/Coverwood Promenade – an unsignalised T-junction; and,
- Alexander Drive/Queensway – an unsignalised T-junction.

### **3.7 Existing Pedestrian/Cycle Networks within 800m of the Subject Site**

There is a footpath network that can be utilised to gain access to and from the nearby primary school and shopping centre. In the adjacent park, there is a footpath which connects to a path on the western side of Warradale Terrace, south of Rockdale Pass. This runs past the primary school and then connects to a path on the western side of The Broadview. This then connects to the Landsdale Forum shopping centre.

### **3.8 Existing Public Transport Services within 800m of the Subject Site**

As discussed previously, the nearby public transport services run along Warradale Terrace, connecting to Whitfords train station and Mirrabooka Square shopping centre. These routes have a single stop located approximately 50m north of Rockdale Pass.

## 4. Proposed Internal Transport Networks

### 4.1 Changes to Existing Road Network

At this stage there are no indicative plans for the future development. The following is suggested as possible changes to the road network.

There are not expected to be any changes to the number of access points onto the external road network. With each lot being developed individually, the access is expected to remain as is. Thus, there would be:

- five accesses onto Warradale terrace (four existing and a new access to the currently vacant Lot 926 Warradale Terrace); and,
- three access onto Grayswood Court (all existing).

These new intersections are suggested to be treated in a similar fashion to the current intersection of Warradale terrace and Kevo Place, with brick paved thresh-holds on the terminating roadway approach.

### 4.2 Road Reserve Widths

Road reserve widths for roads in the development are expected to be 8m common property laneways throughout.

### 4.3 Road Cross-sections & Speed Limits

The speed limit through the development is expected to be approximately 20km/h. The general road cross sections are suggested to be 5.0 to 5.5m wide between kerbs and allow up to 1.5m wide verges each side.

### 4.4 Intersection Controls

Intersection controls are expected to be T-junctions with right of way enhanced with brick paved thresh-holds or similar treatments on the terminating road approach. The spacing of the intersections along the frontage roads are suggested to be no less than 20m in accordance with Liveable Neighbourhoods. Allowing for evenly spaced intersections the average spacing between intersections is expected to be:

- Warradale Terrace – approximately 50m; and,
- Grayswood Court - approximately 25-30m.

### 4.5 Pedestrian/Cycle Networks & crossing facilities

All internal laneways are expected to have a footpath provided on one side of the laneways. These paths will not have connectivity to existing paths on the frontage roads, because there are presently no footpaths on these roads. It is suggested that paths be provided:

- on the eastern side of Warradale Road between Kevo Place and Rockdale Pass;
- on the southern side of Kevo Place;
- on the northern side of Rockdale Pass between Warradale Terrace and Grayswood Court;  
and,
- on the northern side of Grayswood Court.

No special measures are proposed for road crossings apart from the standard kerb ramps from the road level to the path at kerb height.

#### **4.6 Public Transport routes**

No public transport services are expected or proposed to be rerouted from Warradale Terrace and thus no special measures have been adopted to incorporate them into the internal transport network.

## **5. Changes to External Transport Networks**

No changes are proposed as part of the estate or proposed as part of works by others to the external transport networks in the vicinity of the development.

## **6. Integration with Surrounding Area**

### **6.1 Trip Attractors/Generators within 800m**

The main trip attractors within 800m of the proposed estate are the Landsdale Primary school, the Landsdale Forum shopping centre and Warradale Park, opposite the site. There are no other attractors within 800m outside the estate such as schools, shopping centres or sports facilities.

### **6.2 Proposed Changes to Land Uses within 800m**

No changes to land use is expected within 800m of the estate to the west. The semi-rural/market garden land to the east of the estate is in the process of being developed into residential lots, but this is not expected to generate any significant vehicular trips to and from this development site.

### **6.3 Travel Desire Lines from Structure Plan to these Attractors/Generators**

The travel desire lines between the attractors and generators within 800m are well catered for as they lie on direct road routes able to be used by motor vehicles, pedestrians and cyclists.

### **6.4 Adequacy and Deficiencies in External Transport Networks**

There has been a deficiency identified in the provision of footpath network on the current street network. This has resulted in no footpaths on the immediately fronting roads which will allow connectivity to the footpaths in the vicinity and then to trip attractors in the area.

### **6.5 Remedial Measures to Address Deficiencies**

The provision of footpaths as described previously in **Section 5.5** is suggested to improve connectivity to the local footpath network and allow foot access to the nearby school and shopping centre.

## **7. Analysis of Internal Transport Networks**

### **7.1 Assessment Year(s) and Time Period(s)**

The development has been assumed to be fully developed by 2034, or approximately in 10 years.

### **7.2 Future Development Generated Traffic**

#### **7.2.1 Trip Generation Rate**

The proposed development is to be a residential subdivision or grouped housing. The traffic generation calculation for the site is based on the publication Land Use Traffic Generation Guidelines (Director General of Transport, SA, 1987).

The rate assumed was based on the daily rate for a detached dwelling occupied by families and children, which is 8 trips per day per dwelling. This is considered higher than would apply to a group housing development, which would be in the order of 6 trips per dwelling. The higher rate will provide a more robust assessment with traffic generation rates approximately 33% higher than would ordinarily be used for these purposes.

#### **7.2.2 Trip Generation of Site**

Using the above generation rate for 126 dwellings (this being conservative as some of the smaller lots would have generation rate somewhat less than 8 trips per day) there should be in the order of 1,000 trips per day generated by the proposed development with 500 entering and 500 exiting over an entire day. For the AM peak there should be about 75 trips per hour (7.5% of the daily trips) with 56 exiting (75% of the total AM peak trips) and 19 (25%) entering and in the PM peak there should be about 100 trips (10% of the daily trips) with 33 exiting (33%) and 67 entering (67%).

This traffic generation of the site assumes that there is no traffic generated from the current land-uses on the site.

The majority of these trips is determined to be via Queensway to the south/east (500 vpd) with the remainder via Coverwood Promenade to the north (200 vpd) and Southmead Drive to the south/west (approximately 300 vpd).

### **7.3 Extraneous (Through) Traffic**

There is not expected to be any through traffic through the proposed development, with all traffic expected to be local only.

### **7.4 Design Traffic Flows (i.e. Total Traffic)**

Internal traffic volumes are expected to be approximately 150 vpd on the laneways existing each of the lots exiting the site, with the eight access points onto the adjacent road network.

All these flows are appropriate for the proposed road cross sections as discussed previously. The general 5.5m wide pavement streets throughout the estate can cater for daily flows up to 1,000 vpd.

## 7.5 Road Cross-Sections

Based on the calculated traffic volumes expected for the estate, the proposed road cross sections discussed previously are thus considered appropriate.

## 7.6 Intersection Controls

Assessing the expected traffic volumes in the estate, the proposed intersection controls are still valid and appropriate. The traffic volumes are within acceptable ranges for roads of the proposed width and there are no imbalances in traffic flows at T-junctions.

With regards to intersections, Table 2.4 from the Austroads publication, *Guide to Traffic Management Part 6 – Intersections, Interchanges and Crossings* provides advice as to intersection and crossover performance in peak flow conditions with regards to possible further analysis. This is summarised in **Table 8.1**.

■ **Table 8.1 – Austroads Guidelines**

Major Road Type	Major Road Flow	Minor Road Flow
	(vph, two-way)	(vph, two-way)
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

The peak vph would be roughly 7.5% of the daily flows for the AM peak and 10% in the PM peak. The traffic volumes are low enough so as to not warrant further assessment as they would fall well below the first row of the above table. It is therefore concluded that all internal intersections are acceptable.

## 7.7 Access Strategy

As discussed previously, the estate is proposed to have access to the existing road network via:

- Five accesses on Warradale Terrace; and,
- Three accesses on Grayswood Court.

The impact of these connections is further assessed in the subsequent section of this report.

### **7.8 Pedestrian / Cycle Networks**

The internal road network is expected to carry traffic volumes that should not impede pedestrians or cyclists. Hourly traffic flows are expected to be, at worst, approximately, 20 vph. This falls comfortably well below the 2,800 vph level for a divided two way road at which point the traffic flow affects pedestrian crossing amenity.

### **7.9 Safe Routes to Schools**

There is a single school in the nearby (within 800m) vicinity of the development site, being Landsdale Primary. With the provision of suggested internal road network footpaths and new footpaths on the frontage roads, children going to primary school will be able to do so by walking, thus reducing the reliance on motor vehicles.

### **7.10 Pedestrian Permeability & Efficiency**

As discussed previously, access to current public transport is via the existing bus stops 50m north of Rockdale Pass on Warradale Terrace. Utilising the proposed and current footpath network, all 126 dwellings or 100% of the estate is within a 400m or 5-minute walking distance of this bus stop. This level of access to the bus stops far exceeds the Liveable Neighbourhood requirement of 60% of dwellings within a 400m walking distance of an existing or potential bus stop.

### **7.11 Access to Public Transport**

In terms of the broad Transperth requirements of a bus stop within 500m of 95% of Perth's population, this distance measured in a straight line from the current bus stops, 100% of the development site falls within this 500m straight line distance.



## 8. Analysis of External Transport Networks

### 8.1 Extent of Analysis

The extent of the assessment of the external road networks was:

- Five accesses on Warradale Terrace;
- Three accesses on Grayswood Court;
- intersection of Kevo Place/Warradale Terrace;
- intersection of Warradale Terrace/Rockdale Pass;
- intersection of Grayswood Court/Rockdale Pass;
- intersection of Alexander Drive/Queensway;
- intersection of Gngara Road/Coverwood Promenade; and,
- intersection of Mirrabooka Drive/Southmead Drive.

### 8.2 Impact Assessment

#### 8.2.1 Trip Distribution

With the site bordered by three roads and the location of the estate and the regional context the proposed distribution of trips is expected to be as summarised below.

- Rockdale Pass/Queensway to the east – 50%;
- Warradale Terrace/Coverwood Promenade to the north – 20%; and,
- Warradale Terrace/Southmead Drive to the west – 30%.

#### 8.2.2 Traffic Impact of Development Traffic

All bordering and connecting roads are expected to have traffic volumes that should not exceed the maximum traffic flows for similar roads of their type. These values are not expected to exceed the maximum daily flow rates expected for roads of their classes and should be manageable and acceptable (see the following intersection assessments). The comparisons to maximum flows that these roads should carry are shown in **Tables 9.1 and 9.2** on the following page.

■ **Table 9.1 – Current Daily Flows**

Road	Indicative Maximum Daily Flow (two-way)	Current Daily Flow (two-way)
Kevo Place	1,000 <sup>1</sup>	300
Warradale Terrace	2,000 <sup>2</sup>	700
Rockdale Pass	1,000	500
Grayswood Court	1,000	50

■ **Table 9.2 – Expected Daily Flows**

Road	Indicative Maximum Daily Flow (two-way)	Expected Daily Flow (two-way)
Kevo Place	1,000	400
Warradale Terrace	2,000	1,200
Rockdale Pass	1,000	1,000
Grayswood Court	1,000	390

It can be seen that traffic is expected to increase in Warradale terrace by about 500 vpd and by. This traffic increase will not exceed the maximum traffic flow for this street. The traffic increase in Rockdale Pass east of Warradale Terrace is expected to be approximately 500 vpd to approximately 1,000 vpd, which is close to the indicative maximum for a 6.0m wide road.

The current access points with new traffic flows are expected to have traffic flows below the values listed in **Table 8.1** and thus no further assessment is required. The worst expected intersection is the intersection of Warradale terrace and Rockdale Pass. Traffic flows are expected to be about 120 per hour on Warradale Terrace and 100 on Rockdale Pass, this being well below the first row of **Table 8.1**. Thus, all other intersections should be acceptable.

<sup>1</sup> Volume based on Access Street D type road, Liveable Neighbourhoods

<sup>2</sup> Volume based on Access Street B/D type road, Liveable Neighbourhoods

To further assess the performance of the intersections of Alexander Drive/Queensway, Gngangara Road/Coverwood Promenade and Mirrabooka Avenue/Southmead Drive during the AM peak a computer program called Sidra Intersection (Version 6) was utilised. The output tables from Sidra Intersection system for the current and expected traffic flows are shown on the following pages. The AM peak was chosen, as the site is residential and the nearby land uses are predominantly residential with AM flows having the worst impacts as vehicles try to exit the district onto the wider arterial network (Alexander Drive, Gngangara Road and Mirrabooka Avenue)

### 8.2.3 Alexander Drive/Queensway Intersection Performance

This intersection was assessed based on the current traffic volumes with those expected from the proposed development. **Tables 9.3 and 9.4** show the expected performance of the intersection.

■ **Table 9.3 – Alexander Drive/Queensway Current AM Peak Performance**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Alexander Dr													
Lane 1	73	8.0	1120	0.065	100	5.8	LOS A	0.3	1.9	Short	105	0.0	0.0
Lane 2	304	9.0	1842	0.165	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	304	9.0	1842	0.165	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	681	8.9		0.165		0.6	LOS A	0.3	1.9				
North: Alexander Dr													
Lane 1	600	4.0	1901	0.316	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	600	4.0	1901	0.316	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	29	14.0	652	0.044	100	9.5	LOS A	0.2	1.2	Short	110	0.0	0.0
Approach	1229	4.2		0.316		0.3	NA	0.2	1.2				
NorthWest: Median RT													
Lane 1	191	1.0	254	0.752	100	33.9	LOS D	4.3	30.4	Full	500	0.0	0.0
Approach	191	1.0		0.752		33.9	LOS D	4.3	30.4				
West: Queensway													
Lane 1	40	10.0	526	0.076	100	10.5	LOS B	0.3	2.0	Short	35	0.0	0.0
Lane 2	191	1.0	472	0.404	100	13.9	LOS B	2.0	14.0	Full	500	0.0	0.0
Approach	231	2.6		0.404		13.3	LOS B	2.0	14.0				
Intersection	2332	5.2		0.752		4.4	NA	4.3	30.4				

■ **Table 9.4 – Alexander Drive/Queensway Expected AM Peak Performance**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Alexander Dr													
Lane 1	79	8.0	1116	0.071	100	5.9	LOS A	0.3	2.1	Short	105	0.0	0.0
Lane 2	304	9.0	1842	0.165	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	304	9.0	1842	0.165	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	687	8.9		0.165		0.7	LOS A	0.3	2.1				
North: Alexander Dr													
Lane 1	600	4.0	1901	0.316	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	600	4.0	1901	0.316	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	32	14.0	652	0.049	100	9.5	LOS A	0.2	1.3	Short	110	0.0	0.0
Approach	1232	4.3		0.316		0.3	NA	0.2	1.3				
NorthWest: Median RT													
Lane 1	214	1.0	254	0.842	100	43.1	LOS E	6.0	42.4	Full	500	0.0	0.0
Approach	214	1.0		0.842		43.1	LOS E	6.0	42.4				
West: Queensway													
Lane 1	45	10.0	526	0.086	100	10.5	LOS B	0.3	2.2	Short	35	0.0	0.0
Lane 2	214	1.0	471	0.455	100	14.6	LOS B	2.4	16.9	Full	500	0.0	0.0
Approach	259	2.6		0.455		13.9	LOS B	2.4	16.9				
Intersection	2392	5.1		0.842		5.7	NA	6.0	42.4				

From the above tables it can be seen that proposed intersection with the expected traffic flows from the proposed development operates at a level of service of A to B in the AM. The only exception is the right turn from Queensway into Alexander Drive. This presently experiences delays of approximately 34 seconds on average and this is expected to increase to about 43 seconds. The total delays for vehicles turning right from Queensway into Alexander Drive is expected to increase from approximately 48 seconds to approximately 58 seconds.

With increased development west of Alexander Drive (and east of this proposed development site), Queensway will form the main access to and from the Landsdale district via Alexander Drive. With a doubling of traffic on Queensway and an increase in traffic on Alexander Drive by 6%pa over the next 10 years (this increase is based on traffic growth over the past 3-4 years), the performance of the intersection is expected to be as shown in **Table 9.4a** without any modifications.

This assessment has been undertaken to ensure a thorough assessment of the possible impacts of traffic increases in the future.

■ **Table 9.4a – Alexander Drive/Queensway Expected AM Peak Performance in 10 years**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Alexander Dr													
Lane 1	158	8.0	1078	0.147	100	6.1	LOS A	0.6	4.6	Short	105	0.0	0.0
Lane 2	547	9.0	1842	0.297	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	547	9.0	1842	0.297	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1252	8.9		0.297		0.8	LOS A	0.6	4.6				
North: Alexander Dr													
Lane 1	1080	4.0	1901	0.568	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	1080	4.0	1901	0.568	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	64	14.0	297	0.215	100	18.2	LOS C	0.7	5.5	Short	110	0.0	0.0
Approach	2224	4.3		0.568		0.6	NA	0.7	5.5				
NorthWest: Median RT													
Lane 1	28	1.0	25	1.111	100	601.3	LOS F	7.3	51.5	Full	500	0.0	0.0
Approach	28	1.0		1.111		601.3	LOS F	7.3	51.5				
West: Queensway													
Lane 1	98	10.0	224	0.437	100	26.1	LOS D	1.7	12.8	Short	35	0.0	0.0
Lane 2	428	1.0	27	15.600	100	26444.8	LOS F	542.9	3832.7	Full	500	0.0	100.0
Approach	526	2.7		15.600		21522.7	LOS F	542.9	3832.7				
Intersection	4030	5.5		15.600		2813.9	NA	542.9	3832.7				

From the above table it is evident, that this intersection will require to be modified at some point in the next 10 years to accommodate the growth in traffic flows, this being from traffic generated as a result of other developments, not this proposed development. The most obvious solution is the installation of traffic signals. The effects of this is shown below in **Table 9.4b**.

■ **Table 9.4b – Alexander Drive/Queensway Expected AM Peak Performance in 10 years with TCS**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Alexander Dr													
Lane 1	158	8.0	1306	0.121	100	6.6	LOS A	0.6	4.5	Short	105	0.0	0.0
Lane 2	547	9.0	860	0.636	100	13.3	LOS B	12.3	93.1	Full	500	0.0	0.0
Lane 3	547	9.0	860	0.636	100	13.3	LOS B	12.3	93.1	Full	500	0.0	0.0
Approach	1252	8.9		0.636		12.4	LOS B	12.3	93.1				
North: Alexander Dr													
Lane 1	1080	4.0	1267	0.852	100	15.1	LOS B	30.6	221.2	Full	500	0.0	0.0
Lane 2	1080	4.0	1267	0.852	100	15.1	LOS B	30.6	221.2	Full	500	0.0	0.0
Lane 3	64	14.0	350	0.183	100	13.7	LOS B	0.7	5.6	Short	110	0.0	0.0
Approach	2224	4.3		0.852		15.0	LOS B	30.6	221.2				
West: Queensway													
Lane 1	98	10.0	799	0.123	100	10.0	LOS B	1.1	8.4	Short	60	0.0	0.0
Lane 2	214	1.0	246	0.870	100	42.0	LOS D	7.6	53.3	Full	500	0.0	0.0
Lane 3	214	1.0	246	0.870	100	42.0	LOS D	7.6	53.3	Full	500	0.0	0.0
Approach	526	2.7		0.870		36.0	LOS D	7.6	53.3				
Intersection	4002	5.5		0.870		17.0	LOS B	30.6	221.2				

From the above it can be seen that the conversion of this intersection to a traffic signalised controlled intersection should address the longer-term performance issues expected to be

experienced by this intersection. It should be noted this very same issue was also identified in the East Landsdale Cell 9 Local Structure Plan, which suggested traffic signals be installed in 10 years time (from a 2008 dated report). However, these increases in traffic volumes on Alexander Drive were seen as reliant in the upgrade of Gngangara Road, to support the increased traffic flows expected to the north of the intersection.

It is stressed that the proposed zoning changes is not expected to have any significant impacts beyond those highlighted in **Table 9.4**. The longer term impacts are as a result of the development of the East Landsdale Cell 9 Local Structure Plan area.

### 8.2.4 Gngangara Road/Coverwood Promenade Intersection Performance

This intersection was assessed under the similar basis as the previous intersection. The current and expected operation of the intersection is shown below in **Tables 9.5** and **9.6**.

■ **Table 9.5 – Gngangara Road/Coverwood Promenade – Current AM Peak Performance**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Coverwood Promenade													
Lane 1	59	2.0	181	0.326	100	28.5	LOS D	1.1	7.8	Full	500	0.0	0.0
Lane 2	20	0.0	145	0.138	100	29.6	LOS D	0.4	2.9	Short	20	0.0	0.0
Approach	79	1.5		0.326		28.7	LOS D	1.1	7.8				
East: Gngangara Road													
Lane 1	16	10.0	1109	0.014	100	5.8	LOS A	0.1	0.4	Short	95	0.0	0.0
Lane 2	629	8.0	1854	0.339	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	629	8.0	1854	0.339	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1274	8.0		0.339		0.1	LOS A	0.1	0.4				
West: Gngangara Road													
Lane 1	890	8.0	1854	0.480	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	890	8.0	1854	0.480	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	29	7.0	241	0.120	100	20.3	LOS C	0.4	2.8	Short	120	0.0	0.0
Approach	1809	8.0		0.480		0.4	NA	0.4	2.8				
SouthWest: Median RT													
Lane 1	17	0.0	59	0.286	100	71.0	LOS F	0.8	5.6	Full	500	0.0	0.0
Approach	17	0.0		0.286		71.0	LOS F	0.8	5.6				
Intersection	3179	7.8		0.480		1.4	NA	1.1	7.8				

■ **Table 9.6 – Gnangara Road/Coverwood Promenade– Expected AM Peak Performance**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Coverwood Promenade													
Lane 1	59	2.0	181	0.326	100	28.5	LOS D	1.1	7.8	Full	500	0.0	0.0
Lane 2	20	0.0	145	0.138	100	29.6	LOS D	0.4	2.9	Short	20	0.0	0.0
Approach	79	1.5		0.326		28.7	LOS D	1.1	7.8				
East: Gnangara Road													
Lane 1	16	10.0	1109	0.014	100	5.8	LOS A	0.1	0.4	Short	95	0.0	0.0
Lane 2	629	8.0	1854	0.339	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	629	8.0	1854	0.339	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1274	8.0		0.339		0.1	LOS A	0.1	0.4				
West: Gnangara Road													
Lane 1	890	8.0	1854	0.480	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	890	8.0	1854	0.480	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	29	7.0	241	0.120	100	20.3	LOS C	0.4	2.8	Short	120	0.0	0.0
Approach	1809	8.0		0.480		0.4	NA	0.4	2.8				
SouthWest: Median RT													
Lane 1	20	0.0	59	0.337	100	74.4	LOS F	1.0	6.7	Full	500	0.0	0.0
Approach	20	0.0		0.337		74.4	LOS F	1.0	6.7				
Intersection	3182	7.8		0.480		1.5	NA	1.1	7.8				

As can be seen, the delays, queues and levels of service are quite acceptable for the intersection in peak periods. The worst level of service is F for the median right turn approach but the queuing is minimal. However, all these parameters are acceptable with minimal difference with the proposed development traffic.

### 8.2.5 Mirrabooka Avenue/Southmead Drive Intersection Performance

This intersection was assessed under the similar basis as the previous intersection. The current and expected operation of the intersection is shown below in **Tables 9.7** and **9.8**.

■ **Table 9.7 – Mirrabooka Avenue/Southmead Drive – Current AM Peak Performance**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mirrabooka Avenue													
Lane 1	452	7.0	1865	0.242	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	28	4.0	767	0.037	100	8.5	LOS A	0.1	1.0	Full	500	0.0	0.0
Approach	480	6.8		0.242		0.5	NA	0.1	1.0				
East: Southmead Drive													
Lane 1	155	1.0	738	0.210	100	8.9	LOS A	0.8	5.7	Full	500	0.0	0.0
Lane 2	66	2.0	234	0.283	100	22.9	LOS C	1.1	7.5	Short	20	0.0	0.0
Approach	221	1.3		0.283		13.1	LOS B	1.1	7.5				
North: Mirrabooka Avenue													
Lane 1	47	4.0	1273	0.037	100	5.8	LOS A	0.1	0.9	Short	120	0.0	0.0
Lane 2	531	8.0	1854	0.286	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	578	7.7		0.286		0.5	LOS A	0.1	0.9				
Intersection	1279	6.3		0.286		2.7	NA	1.1	7.5				

■ **Table 9.8 – Mirrabooka Avenue/Southmead Drive – Expected AM Peak Performance**

	Demand Flows		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue		Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
	Total veh/h	HV %						Veh	Dist m				
South: Mirrabooka Avenue													
Lane 1	452	7.0	1865	0.242	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	31	4.0	767	0.040	100	8.5	LOS A	0.2	1.1	Full	500	0.0	0.0
Approach	482	6.8		0.242		0.6	NA	0.2	1.1				
East: Southmead Drive													
Lane 1	167	1.0	738	0.227	100	8.9	LOS A	0.9	6.2	Full	500	0.0	0.0
Lane 2	72	2.0	233	0.307	100	23.4	LOS C	1.2	8.3	Short	20	0.0	0.0
Approach	239	1.3		0.307		13.2	LOS B	1.2	8.3				
North: Mirrabooka Avenue													
Lane 1	51	4.0	1271	0.040	100	5.8	LOS A	0.1	1.0	Short	120	0.0	0.0
Lane 2	531	8.0	1854	0.286	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	581	7.7		0.286		0.5	LOS A	0.1	1.0				
Intersection	1302	6.2		0.307		2.9	NA	1.2	8.3				

Overall this intersection currently operates at a level of service A-C in the AM peak and this is expected to remain relatively unchanged with the expected traffic flows from the proposed development.

### 8.2.6 Level of Service Concepts

The level of service concept describes the quality of traffic service in terms of six levels, designated A to F, with level of service A (LOS A) representing the best operating condition (i.e. at or close to free flow), and level of service F (LOS F) the worst (i.e. forced flow). More specifically:

- *LOS A*: Individual drivers are virtually unaffected by others in the traffic stream. Their freedom to select their own desired speed and to manoeuvre in the traffic stream is extremely high, and the general level of comfort and convenience is excellent;
- *LOS B*: Individual drivers still have reasonable freedom to select their desired speed and to manoeuvre in the traffic stream, although the general level of comfort and convenience is less than at LOS A;
- *LOS C*: Most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre in the traffic stream;
- *LOS D*: All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre in the traffic stream. Traffic is close to the upper limit of stable flow, the general level of comfort and convenience is poor, and small increases in traffic flow will usually cause operational problems;
- *LOS E*: Traffic volumes are at, or close to capacity, and drivers have virtually no freedom to select their desired speed or to manoeuvre. Traffic flow is unstable and minor disturbances will result in stop-start conditions; and,
- *LOS F*: Flow is forced and the amount of traffic approaching the point under consideration exceeds that which it can handle. Stop-start conditions apply and queuing and delays result.



In addition to the above:

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

### **8.2.7 Traffic Impact of Development on Local Area**

Based on the above assessment it is concluded that the development will have an acceptable impact on the immediately surrounding roads and intersections with no required changes to the road network or geometry of intersections, except for the improved access configuration for the intersection of Alexander Drive and Queensway with the installation of traffic signals.

### **8.3 Road Cross-Sections**

The current road cross-sections are considered suitable for the expected traffic flows from the proposed development in combination with the current and expected traffic flows on the current road network. This has been shown in **Table 9.2**.

### **8.4 Intersection Layouts & Controls**

From the above assessments, the current intersection layouts and controls are not required to be modified. The only exception is the intersection of Alexander Drive and Queensway that is recommended to be upgraded.

### **8.5 Pedestrian/Cycle Networks**

All external roads in the immediate vicinity of the development site are expected to have traffic volumes no more than approximately 1,200 vehicles per day (or approximately 120 vehicles per hour), this being for Warradale Terrace. This amount of traffic flow will allow crossing of the roads in one movement and be suitable for traffic flows up to 1,100 vph, which Warradale Terrace is not expected to ever exceed.

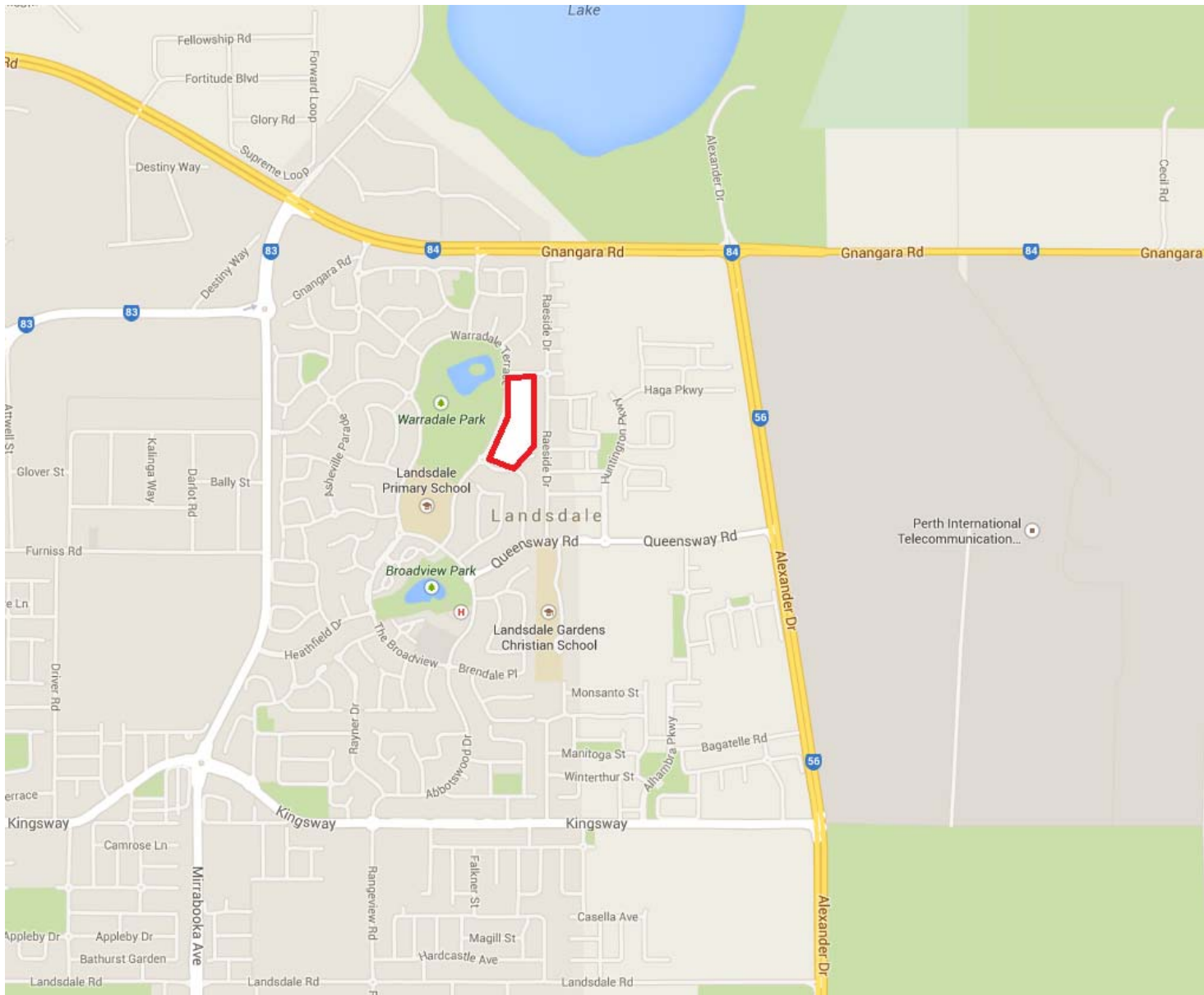
## 9. Conclusions

As a result of the traffic analysis undertaken for the proposed Warradale Terrace development, the following findings were made:

- The proposed development should generate in the order of 1,000 vehicular trips per day, with the majority entering and exiting via Warradale Terrace to Queensway;
- The impacts of the traffic volumes associated with the development on the road network are considered acceptable with little noticeable difference compared to current intersection performances;
- The development is within a short distance from local attractors of Landsdale primary school and Landsdale Forum shopping centre; and,
- 100% of the development is located within 400m of bus stops on Warradale Terrace.

The required WAPC checklist for this transport statement is at **Appendix C**.

## **Appendix A Regional Context Plan**



## **Appendix B Development Site**



Figure 2



NORTH



**burgess design group**  
TOWN PLANNING + URBAN DESIGN

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Planner: KO/MB  
Client: SRL  
Date: 19.07.13  
Plan No: SRL LAN 1-01\_1

**AERIAL PHOTOGRAPH  
WARRADALE TCE  
LANDSDALE  
CITY OF WANNEROO**

## **Appendix C WAPC Checklist**

**Project:** Warradale Terrace Development  
**Proponent:** Various

**A - Checklist for a Transport Assessment of a Structure Plan**

<b>Item</b>	<b>Status</b>	<b>Comments/Proposals</b>
<b>Summary</b>	✓	Section 1
<b>Introduction/Background</b>	✓	Section 1
<b>Structure Plan Proposal</b>		
regional context	✓	Section 2
proposed land uses	✓	Section 2
table of land uses and quantities	✓	Section 2
major attractors/generators	✓	Section 2
specific issues	✓	Section 2
<b>Existing Situation</b>		
existing land uses within structure plan	✓	Section 3.1
existing land uses within 800 metres of structure plan area	✓	Section 3.1
existing road network within structure plan area	✓	Section 3.2
existing pedestrian/cycle networks within structure plan area	✓	Section 3.4
existing public transport services within structure plan area	✓	Section 3.5
existing road network within 2 (or 5) km of structure plan area	✓	Section 3.6
traffic flows on roads within structure plan area (PM and/or AM peak hours)	✓	Section 3.6
traffic flows on roads within 2 (or 5) km of structure plan area (AM and/or PM peak hours)	✓	Section 3.6
existing pedestrian/cycle networks within 800m of structure plan area	✓	Section 3.7
existing public transport services within 800m of structure plan area	✓	Section 3.8
<b>Proposed Internal Transport Networks</b>		
changes/additions to existing road network or proposed new road network	✓	Section 4.1
road reservation widths	✓	Section 4.2
road cross-sections & speed limits	✓	Section 4.3
intersection controls	✓	Section 4.4
pedestrian/cycle networks and crossing facilities	✓	Section 4.5
public transport routes	✓	Section 4.6
<b>Changes to external transport networks</b>		
road network	✓	Section 5
intersection controls	✓	Section 5
pedestrian/cycle networks and crossing facilities	✓	Section 5
public transport services	✓	Section 5
<b>Integration with Surrounding Area</b>		
trip attractors/generators within 800m	✓	Section 6.1
proposed changes to land uses within 800m	✓	Section 6.2
travel desire lines from structure plan to these attractors/generators	✓	Section 6.3
adequacy of external transport networks	✓	Section 6.4
deficiencies in external transport networks	✓	Section 6.4
remedial measures to address deficiencies	✓	Section 6.5



**Project:** Warradale Terrace Development  
**Proponent:** Various

<b>Analysis of internal transport networks</b>		
assessment year(s) and time period(s)	✓	Section 7.1
structure plan generated traffic	✓	Section 7.2
extraneous (through) traffic	✓	Section 7.3
design traffic flows (ie. total traffic)	✓	Section 7.4
road cross-sections	✓	Section 7.5
intersection controls	✓	Section 7.6
access strategy	✓	Section 7.7
pedestrian / cycle networks	✓	Section 7.8
safe routes to schools	✓	Section 7.9
pedestrian permeability & efficiency	✓	Section 7.10
access to public transport	✓	Section 7.11
<b>Analysis of external transport networks</b>		
extent of analysis	✓	Section 8.1
base flows for assessment year(s)	✓	Section 8.2
total traffic flows	✓	Section 8.2
road cross-sections	✓	Section 8.3
intersection layouts & controls	✓	Section 8.4
pedestrian/cycle networks	✓	Section 8.5
<b>Conclusions</b>	✓	Section 9

**Proponent's name**

**Company**

**Signature**

**Date**

Rodney Ding

Tarsc

16/10/2014

**Transport assessor's name**

**Company**

**Signature**

**Date**