

# Proposed Service Industrial Development

Lot 703 (#359) Gnangara Road,  
Wangara

Transport Impact Assessment

PREPARED FOR:  
The Wangara Unit Trust

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# 1 Introduction

This TIA has been prepared by Transcore on behalf of The Wangara Unit Trust with regards to the proposed service industrial development at Lot 703 (#359) Gngangara Road, Wangara, in the City of Wanneroo.

The location of the subject site is shown in **Figure 1**. The Site is a large vacant triangular shaped Lot (about 2.13 hectares) that is surrounded by Destiny Way to the west, and Gngangara Road to the south and east. The site is located at the eastern edge of the Wangara Industrial Area.

The site has excellent access and egress opportunities having frontage to regional roads such as Gngangara Road to the south and east of the site. Currently the site has a crossover on Gngangara Road (southern boundary).

Key issues that will be addressed in this report include the traffic generation and distribution of the proposed development, operation of the development crossovers on surrounding roads and the capacity of the roundabout intersection on Gngangara Road and the nearby signalised intersection at Ocean Reef Road for the existing, 2023 and 2031 scenarios.



**Figure 1: Location of the subject site**

The location of the subject site within the *Metropolitan Region Scheme* context is illustrated in **Figure 2**. Review of the *Metropolitan Regional Scheme* confirms that Gwangara Road in this vicinity is covered by an “Other Regional Roads” Reservation. The subject site is zoned as “Industrial” in the MRS.

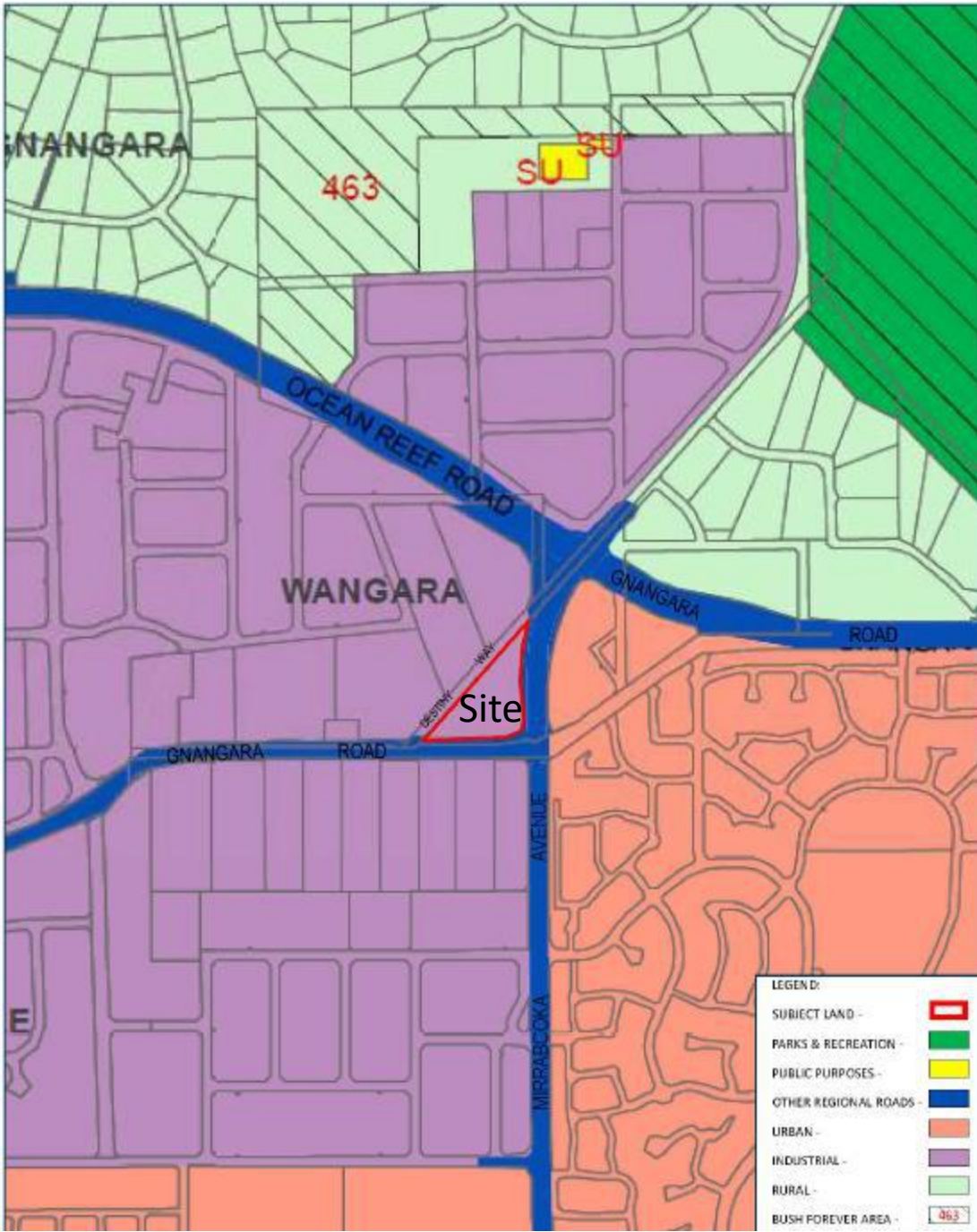


Figure 2. Site location within Metropolitan Region Scheme

## 2 Development Proposal

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The development proposal is for a service industrial development which comprises the following elements:

- Fresh Frontier wholesale distribution facility;
- Showroom tenancies;
- Convenience Store (eight light vehicle fuelling positions);
- Carwash; and,
- Two auto workshops.

A copy of the development plan is provided in **Appendix A**.

The proposed development will be developed in stages. In the first stage the proposed Fresh Frontier will be developed (say 2023) and later on the rest of the land uses will be developed (say by year 2031).

Stage 1 development entails the construction of a processing facility (approximately 5,020m<sup>2</sup> GFA) as the prime manufacturing, processing and distribution facility where fresh product is received, processed, packed and stored for wholesale distribution throughout the Perth Metropolitan Region and regional Western Australia.

The layout of operations of the proposed Fresh Frontier is over two levels. The lower ground floor is for receipt, processing, assembly, storage and distribution operation. All access to the lower ground floor is provided via Destiny Way (to dispatch area and service area) to facilitate truck receipt and delivery which is separated from the primary administration and offices on the upper floor.

The upper floor is for Fresh Frontier administration and offices. The proposed car bays on the upper level are accessible by the existing and proposed development crossovers on Gnangara Road, which will be developed as part of the Stage 1 development. The location of the access points has undergone preliminary consultation with the Department of Planning, Lands and Heritage (DPLH). Transcore prepared a concept design for the proposed left in/ left out crossover on Gnangara Road (eastern boundary of the site). A copy of the concept design is provided in **Appendix B** of this TIA.



Parking provision shown in the development plan (**Appendix A**) is a total of 218 bays on site consisting of:

### Lower Ground Level

7 Marked Bays

1 Disabled Bay

### Upper Ground Level

188 Marked Bays

7 Disabled Bay

8 Refuelling Bays (at Convenience Store)

7 Motor cycle Bays

## 2.1 Vehicle Access

The proposed access/egress system intended to serve the development is shown in **Figure 3** and comprises the following elements:

- An existing full movement crossover on Gngara Road southern boundary (C1);
- A proposed Left in/ Left out crossover on Gngara Road eastern boundary (C2);
- A full movement crossover on Destiny Way for Fresh Frontier dispatch activity (C3 at lower level); and,
- Two full movement crossovers on Destiny Way for Fresh Frontier service area (C4 and C5 at lower level).



**Figure 3. Proposed access/egress system**

The proposed development crossover on Gngangara Road (eastern boundary) is located on an “Other Regional Road”. Preliminary engagement has already occurred with DPLH in respect to the proposed treatment of access. Transcore has also developed a concept design for the proposed left turn slip lane on Gngangara Road which entails a 100m left turn slip lane (including taper) to satisfy Austroads guidelines for the posted speed limit of 70km/h (design speed 80km/h) on Gngangara Road. It should be noted that currently a bus stop (on Bus Route 376) exists to the south of the proposed Left in/ Left out crossover. This bus stop would need to be relocated to the north of the proposed Left in/ Left out crossover in consultation with the Public Transport Authority (PTA).

## 2.2 Queue Assessment

The stacking capacity of the proposed Convenience Store and queue analysis at the filling points have been assessed in more detail to investigate the impacts of higher-than-average site patronage during peak weekday operational periods (i.e. “cheap fuel days”). This sensitivity analysis was undertaken in order to confirm the capacity of the Convenience Store to operate satisfactorily under amplified traffic activity conditions.

Similarly, the stacking capacity of the proposed carwash was also reviewed to ensure that the carwash queue would not extend back to the proposed Convenience Store.

### 2.2.1 Queue analysis for light vehicles (busy day or cheap fuel day)

In order to demonstrate that during the potential extreme stacking incidents at the Convenience Store the level of potential queue can be managed within the site, with no impact on the proposed crossover on Gngangara Road, a queuing analysis is undertaken assuming occurrence of the “busy day” scenario.

The queueing assessment used for this project has previously been developed by Transcore and used for a number of similar projects for the purpose of queueing and stacking capacity assessments of service stations, carwash and fast-food restaurant drive-through facilities. The modelling methodology has been modified to fit service stations queueing at bowsters. Accordingly, this model was used to investigate the “busy day” scenario for service station operations.

The subject Convenience Store is proposed to include a total of four dispensers - 8 fuelling positions under the canopy (i.e. up to 8 vehicles can simultaneously refuel at any one time). The dispensers are placed in one by four format (one row of four dispensers) as shown on the proposed development plan attached in **Appendix A**.

Based on peak hour trip generation outlined in the TIA, it is estimated that there will be 112 (56 inbound / 56 outbound) trips during the weekday PM peak hour period, which is the busiest peak hour for combined traffic generation of the Convenience Store and Gngangara Road.

In order to ensure a robust assessment, it is conservatively assumed that the trade during the “busy day” scenario would be 50% higher than the typical weekday peak hour.

Accordingly, it is assumed that the site would attract about 84 vehicles per PM peak hour on this occasion.

Previous experience indicates that under normal circumstances the rate of service per fill point (time taken for a customer to park at a fill point, get fuel, pay for fuel and leave the fill point and Convenience Store site) is usually between 2-3 minutes. However, during the “busy day” scenario due to high turnover of vehicles and “pressure” from the patrons waiting to access the bowzers, the refuelling activity during these periods is shortened but still assumed to be at the higher end of the typical range – i.e. 3 min service time assumed.

Accordingly, conservatively a service rate of 20 vehicles per hour per fill point ( $60/3 = 20$ ) is therefore assumed for the “busy day” peak hour.

Assuming that all bowzers will be in operation during the peak periods results in a service rate of 160 ( $8 \times 20$ ) vehicles per hour for a “busy day” scenario. It is also assumed that vehicles would enter the service channel with the shortest queue, therefore over the peak hour the transactions at each service channel would be evenly split.

### Queue Modelling

A queue length analysis was undertaken to assess the provision of storage for vehicles within the service channels. For this purpose, an M/M/1 queuing model was adopted for each bowser. The M/M/1 is a single-server queue model that can be used to approximate simple systems.

The queueing model adopts the following assumptions:

- + Vehicles arrive randomly following Poisson’s probability distribution;
- + Service time is exponentially distributed;
- + There is one server per queue;
- + The capacity of the queue in which arriving users wait before being served is infinite (for the purpose of identifying queue space requirements);
- + The population of users (i.e., the pool of users) available to join the system is infinite; and,
- + The queue is serviced on a first come, first served basis.

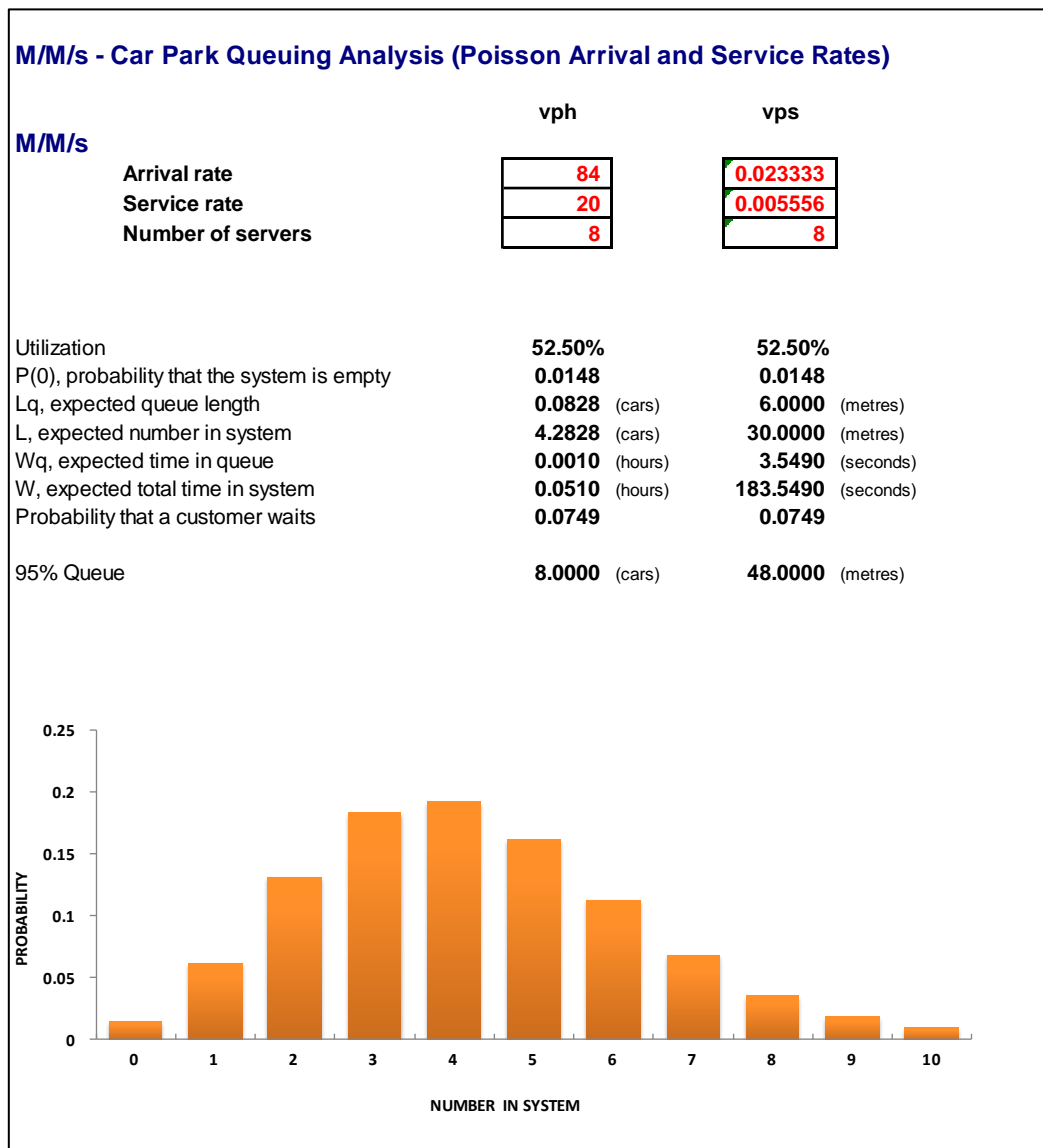
The results of the queuing analysis are detailed in **Figure 4**. In summary, critical peak hour analysis for light vehicles at the proposed Convenience Store established the following:

- + The system utilisation rate is at 53% during the weekday “busy day” PM peak hour;
- + The number of fill points in the system (refuelling) is 8;
- + The expected number in the system is 5 vehicles during the weekday “busy day” PM peak hour;
- + The expected time in the queue for a vehicle to get to a fill point is 4 seconds during the “busy day” PM peak hour;
- + The expected total time in the queue is 184 seconds during the weekday “busy day” PM peak hour; and,

- ✚ The 95<sup>th</sup> percentile queue within the whole system is 8 vehicles during the “busy day” PM peak hour.

The queuing usually adopted for robust analysis is the 95<sup>th</sup> percentile queue. This queue length will not be exceeded 95% of the time.

Moreover, in addition to the 8 vehicles parked at the bowzers, at least another 8 vehicles can be stacked behind the cars filling up at the bowzers without impacting the traffic circulations within the proposed Convenience Store. According to the queuing analysis, this site can accommodate almost twice the typical PM peak hour queuing at the bowzers. Therefore, it is concluded that under typical peak conditions all queueing will be accommodated within the subject site and no stacking or queue backs onto Gngara Road is expected.



**Figure 4. PM peak “cheap fuel” hour queuing analysis**

## 2.2.2 Stacking Capacity for the car wash

The queue analysis of the proposed carwash facility was undertaken to investigate the potential queueing during the peak weekend operational periods.

The proposed carwash facility includes five parallel bays (i.e. five parallel service channels) so that each bay is accessible independently. The total service time per vehicle is expected to be about 10 minutes. This translates into a service rate of six vehicles per hour per bay. Therefore, the proposed five parallel bays would conservatively generate about 30vph.

The peak demand is anticipated to occur on Saturdays and Sundays between 9:00AM – 12noon.

A queue length analysis was undertaken to assess the potential queueing within the carwash system. For this purpose, an M/M/1 queuing model was adopted for each COB. The M/M/1 is a single-server queue model that can be used to approximate simple systems.

The results of the queuing analysis are detailed in Figure 5.

In summary, critical hour queuing analysis of the Convenience Store established the following for each case:

- ✚ The system utilisation is at 60% during the peak weekend hour;
- ✚ The expected number in the system is up to four vehicles;
- ✚ The expected time in the queue is up to one minute; and,
- ✚ The 95th percentile queue is eight cars (five being serviced and three cars waiting).

The queue length usually adopted for robust analysis is the 95th percentile queue. Based on the queue estimation model, the estimated queue will not exceed a queue length of five vehicles 95% of the time. It is therefore concluded that under typical peak conditions an occasional queue of three vehicle (i.e. three cars waiting in the queue) during the peak operation period of the carwash will be accommodated within the site with no impact on the operation of the Convenience Store.



## M/M/s - Drive Through Queuing Analysis (Poisson Arrival and Service Rates)

M/M/s	vph	vps
Arrival rate	30	0.0083333
Service rate	10	0.0027778
Number of servers	5	5
Utilization	60.00%	60.00%
P(0), probability that the system is empty	0.0466	0.0466
Lq, expected queue length	0.3542 (cars)	6.0000 (metres)
L, expected number in system	3.3542 (cars)	24.0000 (metres)
Wq, expected time in queue	0.0118 (hours)	42.5073 (seconds)
W, expected total time in system	0.1118 (hours)	402.5073 (seconds)
Probability that a customer waits	0.2362	0.2362
95% Queue	8.0000 (cars)	48.0000 (metres)

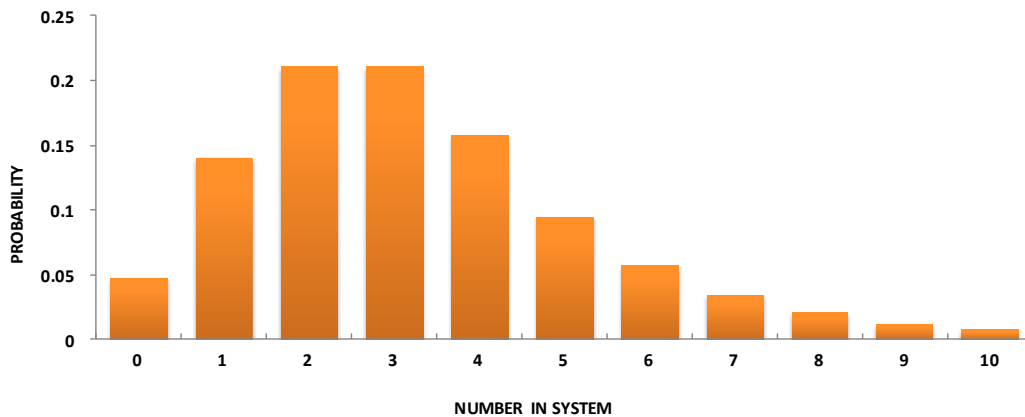


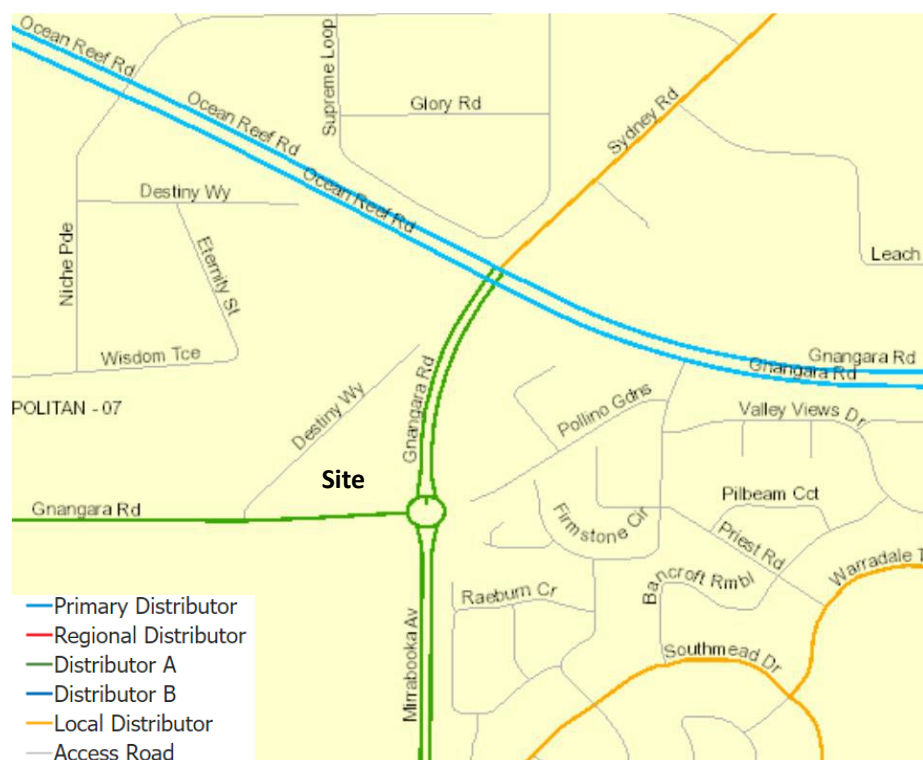
Figure 5. Peak weekend hour queuing analysis at the carwash facility

## 3 Existing Situation

### 3.1 Existing Road Network

**Gnangara Road** to the south and east of the subject site is classified as a Distributor A Road in the Main Roads WA Functional Road Hierarchy (refer **Figure 6**) and is constructed as a single carriageway road. It operates under the speed limit of 70 km/h in the vicinity of the subject site. Gnangara Road is classified as “Other Regional Road” in the MRS. The intersection of Gnangara Road and Ocean Reef Road is constructed as a signalised intersection.

**Destiny Way** is a local distributor road servicing industrial premises and is a local road under the control of the City of Wanneroo. It entails a 6.0m pavement and unsealed shoulders on both sides.



**Figure 6: Existing road hierarchy**

## 3.2 Existing Traffic Volumes on Roads

The most recent available SCATS data for the signalised intersection of Gngangara Road/ Ocean Reef Road was sourced from Main Roads WA. Transcore also undertook a video traffic survey at the roundabout intersection on Gngangara Road in November 2020. **Figure 7** illustrates the existing traffic counts on the surrounding roads and intersections.

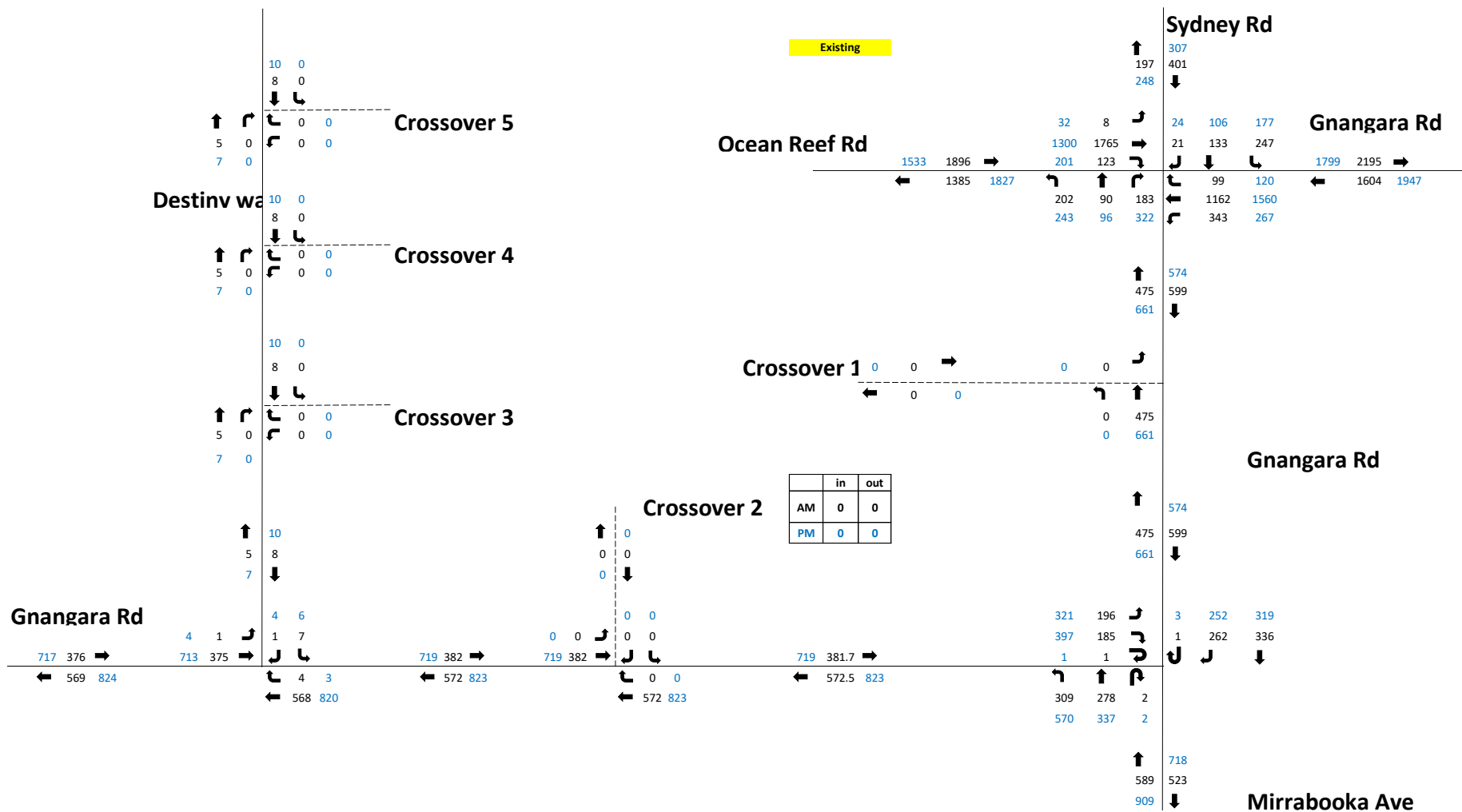


Figure 7: Existing traffic counts for AM/ PM peak hours



### 3.4 Public Transport Access

Available nearby transport services are shown in **Figure 9**. At present, the subject locality has convenient access to public transport services. Bus route 376 travels along Gngangara Road with a bus stop located on Gngangara Road on the eastern side of the subject site (Stop No: 27698).

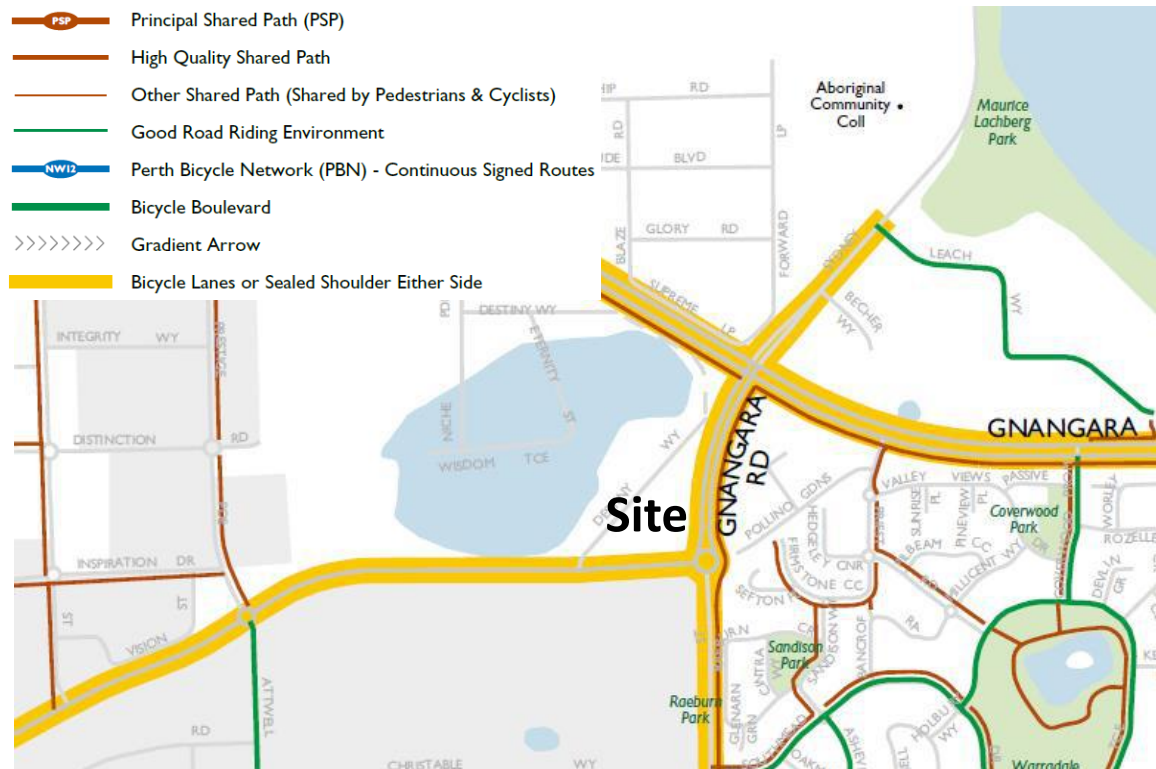


**Figure 9: Existing bus routes (source: Transperth)**

### 3.5 Pedestrian and Cyclist Facilities

Currently, high quality shared paths are provided on Gnangara Road to the east of the subject site, as shown in the Department of Transport's Perth Bike Map series (refer **Figure 10**), which continues along Gnangara Road to the east of the traffic lights.

A 3.0m shared path is also in place along the western side of Gnangara Road (not shown on the Bike Map) which connects to the existing shared path on Ocean Reef Road to the north of the subject site.



**Figure 10: Bike Map**

## 4 Changes to Surrounding Transport Networks

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As part of this proposed development, a new left in/ left out crossover will be constructed on Gngangara Road (eastern boundary of the site) with a left turn slip lane approximately 100m long (including taper). The existing bus stop on Gngangara Road would also need to be relocated to the north of the proposed Left in/ Left out crossover with consultation with PTA.

The existing full movement crossover on Gngangara Road (southern boundary of the site) would be retained but modified to accommodate the turning movements of fuel tankers and service vehicles.

Three full movement crossovers are proposed on Destiny Way.



## 5 Integration with Surrounding Area

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The proposed development entails a service industrial development which is in line with the existing and future surrounding land uses in the area.

The subject site is zoned 'Industrial' under the Metropolitan Region Scheme (MRS). The site forms the eastern edge of the Wangara Industrial area and is positioned as the interface between the Wangara Industrial area and the residential suburb of Landsdale, separated by Gnangara Road.

## 6 Traffic Assessment

### 6.1 Assessment Period

The assessment years that are adopted for the analysis are 2023 and 2031, with the following assumptions:

- 2023: Full development of proposed Fresh Frontier; and,
- 2031: Full development of the entire site.

### 6.2 Trip Generation and Distribution

Based on the information provided to Transcore, the proposed Fresh Frontier will operate with the following activities summarised in **Table 1** during the 24 hours of operation.

**Table 1: Fresh Frontier activities and staff profile**

items	Shift patterns	numbers
Deliveries	8 AM-4 PM	1 semi (20 meters) a day & various trucks (4 to 8 meters)
Dispatch	3 AM- 6 AM	various trucks (4 to 8 meters)
Rubbish	10 AM - 11 AM	3 times a week
Production Staff *	6 AM - 9 PM	65 Staff
Office Staff	8 AM-4:30 PM	12 Staff
Parked vehicle on site	Overnight	1 small van

*\*4 start at 6.00 am, 30 start between 8.00 am & 9.00am, 15 start at 1.00 pm*

Review of the activities summarised in **Table 1** indicates that the dispatch and deliveries would not happen during the road network peak hours. The main activities during the peak hours are the arrival and departure of the production and office staff which is estimated to be about 40 inbound and 4 outbound trips during the AM peak hour and the reverse during the PM peak hour.

As evident the trip generation of the proposed Fresh Frontier is estimated to be less than 100vph and according to WAPC Guidelines the traffic impact of the Stage 1 development is expected to be minimal and would not warrant further assessment.

The trip generation of the proposed Convenience Store, showroom and workshop areas have been estimated using the trip rates suggested in RTA NSW – Guide to Traffic Generating Developments and the Institute of Transport Engineers Trip Generation Manual (10th Edition).

Trip generation of the proposed carwash was estimated to be about 30vph assuming total service time per vehicle of about 10 minutes which translates into a service rate of six vehicles per hour per bay (total of 5 bays).

It should be noted that since showroom types of land uses typically generate minimal trips during the weekday AM peak hour of the adjacent road network (typically businesses commence operations around 9 or 10AM), adjustment factors have been applied for such land uses in an attempt to realistically represent the actual traffic generation of these land uses during this period.

Due to the land use mix within the proposed development incidences of multi-purpose trips<sup>1</sup> (i.e., cross-trade) are anticipated in 2031. Accordingly, the applied cross-trade adjustment is calculated to result in a moderate overall reduction in trip generation of approximately 25% (In accordance with RTA NSW – Guide to Traffic Generating Developments) mainly during the weekday afternoon and for overall daily trips.

Accordingly, it is estimated that after full development of all land uses, the proposal would generate a total of approximately 1,864 trips per weekday (both inbound and outbound) and approximately 200vph during the AM and PM peak hours (refer **Table 2**). **Table 3** summarises the passing trade and primary trips component of the total generated trips for 2031.

The distribution of traffic to and from the proposed development for year 2023 and 2031 was evaluated by considering the catchment area of the proposed development as well as the available access and egress routes to and from the site. Separate distributions were modelled for primary trips (non-passing trade) and pass-by trips. Accordingly, the total 2023 and 2031 development traffic are illustrated in **Figure 11** and **Figure 12**.

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<sup>1</sup> Multi-purpose trips are incidences where more than one shop/outlet are visited within the development (also referred to as “cross-trade”)

**Table 2: 2031 Weekday daily, morning peak, afternoon peak hour trip generation for the proposed land uses**

Land use	Quantity	Daily Rate	Weekd-AM	Weekd-PM	Cross Trade	Daily Trips	Weekd-AM	Weekd-PM	AM		PM	
			Peak	Peak			trips	trips	IN	OUT	IN	OUT
Fresh Frontier						165	44	44	40	4	4	40
Convenience Store	8	205.36	12.47	13.99	0.25	1232	100	84	50	50	42	42
Showroom	1500	0.33	0.0042	0.042	0.25	371	6	47	3	3	24	23
Workshop (Auto Tyres and Auto Motor servicing)	490	0.2	0.014	0.023	0.25	81	7	8	4	3	4	4
Carwash	5	48	6	6	0.25	180	30	23	15	15	11	12
<b>TOTAL TRAFFIC</b>						<b>2029</b>	<b>187</b>	<b>206</b>	<b>112</b>	<b>75</b>	<b>85</b>	<b>121</b>

**Table 3: 2031 Passing trade and primary trips components of the trip generation**

Passing Trade Component					
	Daily Trips	AM		PM	
		IN	OUT	IN	OUT
0	0	0	0	0	0
60%	739	30	30	25	25
28%	104	1	1	7	7
43%	35	2	1	2	2
60%	108	9	9	7	7
	<b>986</b>	<b>42</b>	<b>41</b>	<b>41</b>	<b>41</b>

Primary Trips Component					
	Daily Trips	AM		PM	
		IN	OUT	IN	OUT
0	0	40	4	4	40
60%	493	20	20	17	17
28%	267	2	2	17	16
43%	46	2	2	2	2
60%	72	6	6	4	5
	<b>878</b>	<b>70</b>	<b>34</b>	<b>44</b>	<b>80</b>

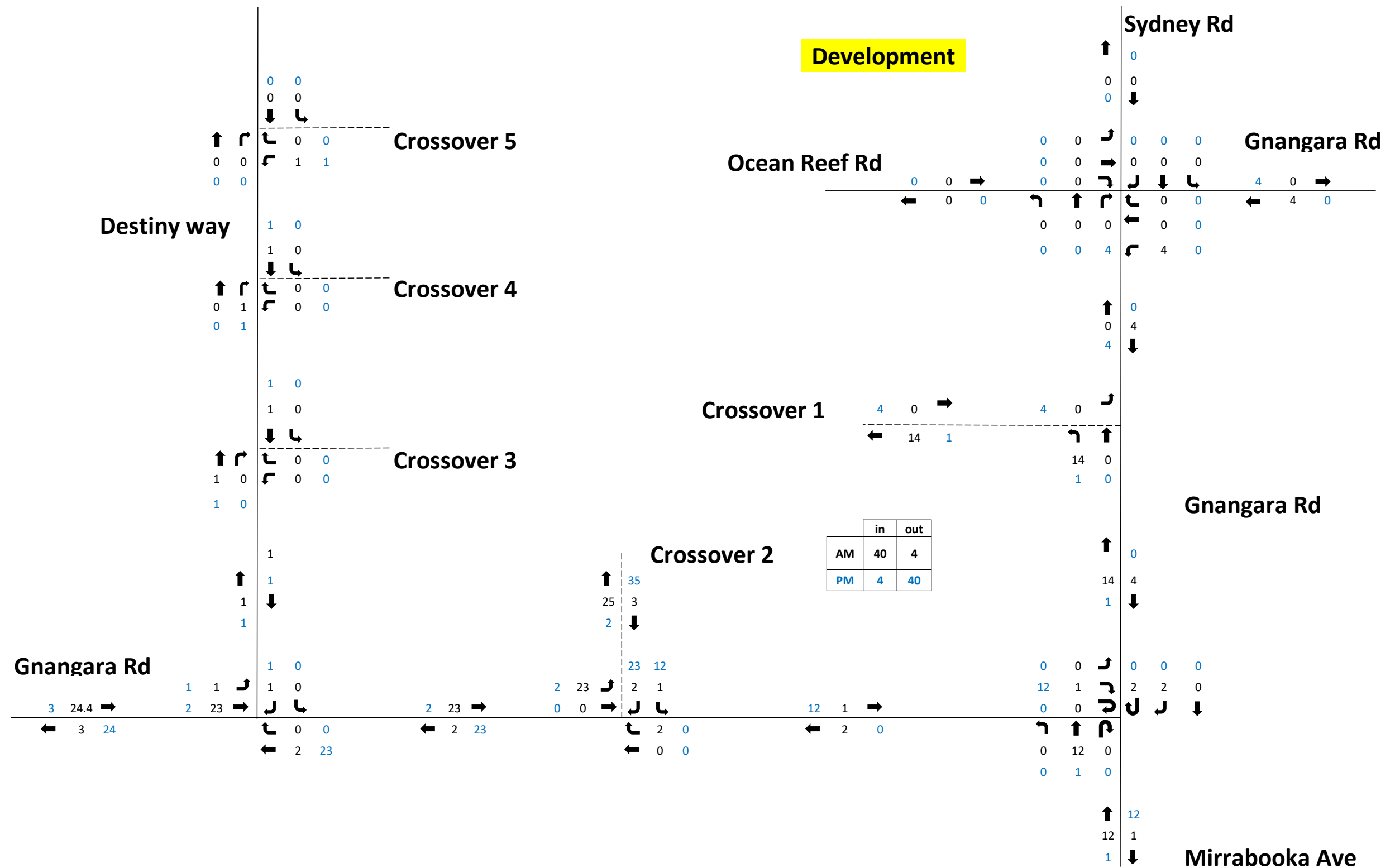


Figure 11: 2023- Total development traffic – AM Weekday, PM Weekday

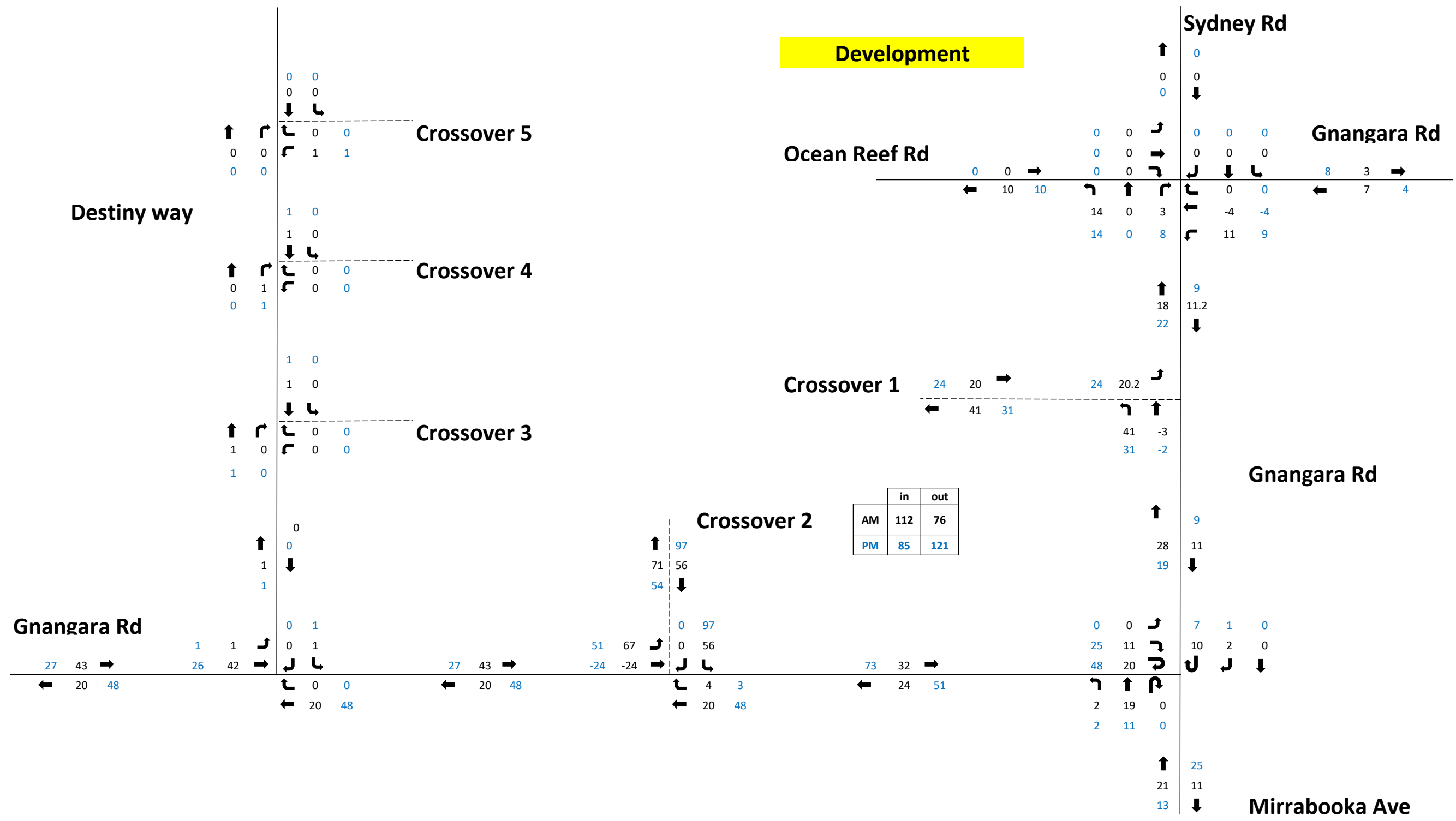


Figure 12: 2031- Total development traffic – AM Weekday, PM Weekday

## 6.3 Traffic Flow Forecasts

The existing traffic counts on surrounding roads and intersections were presented in **Figure 7**. The total projected traffic volumes for year 2023 and 2031 are presented in **Figure 13** and **Figure 14**.

For the 2023 and 2031 traffic projections on Gwangara Road a 2% annual traffic growth was applied to the through traffic on Gwangara Road.

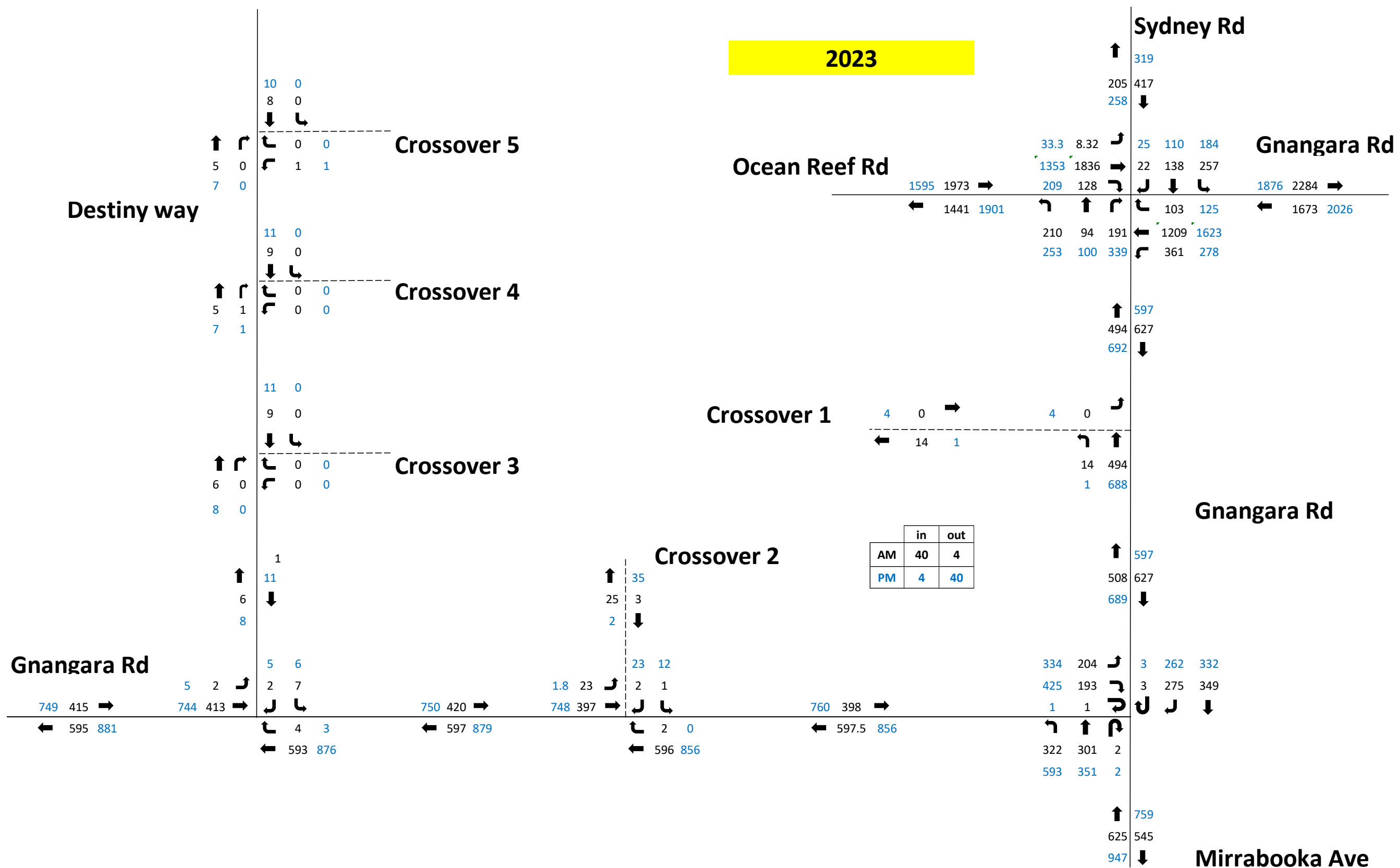


Figure 13: Total (2023) traffic – AM Weekday, PM Weekday



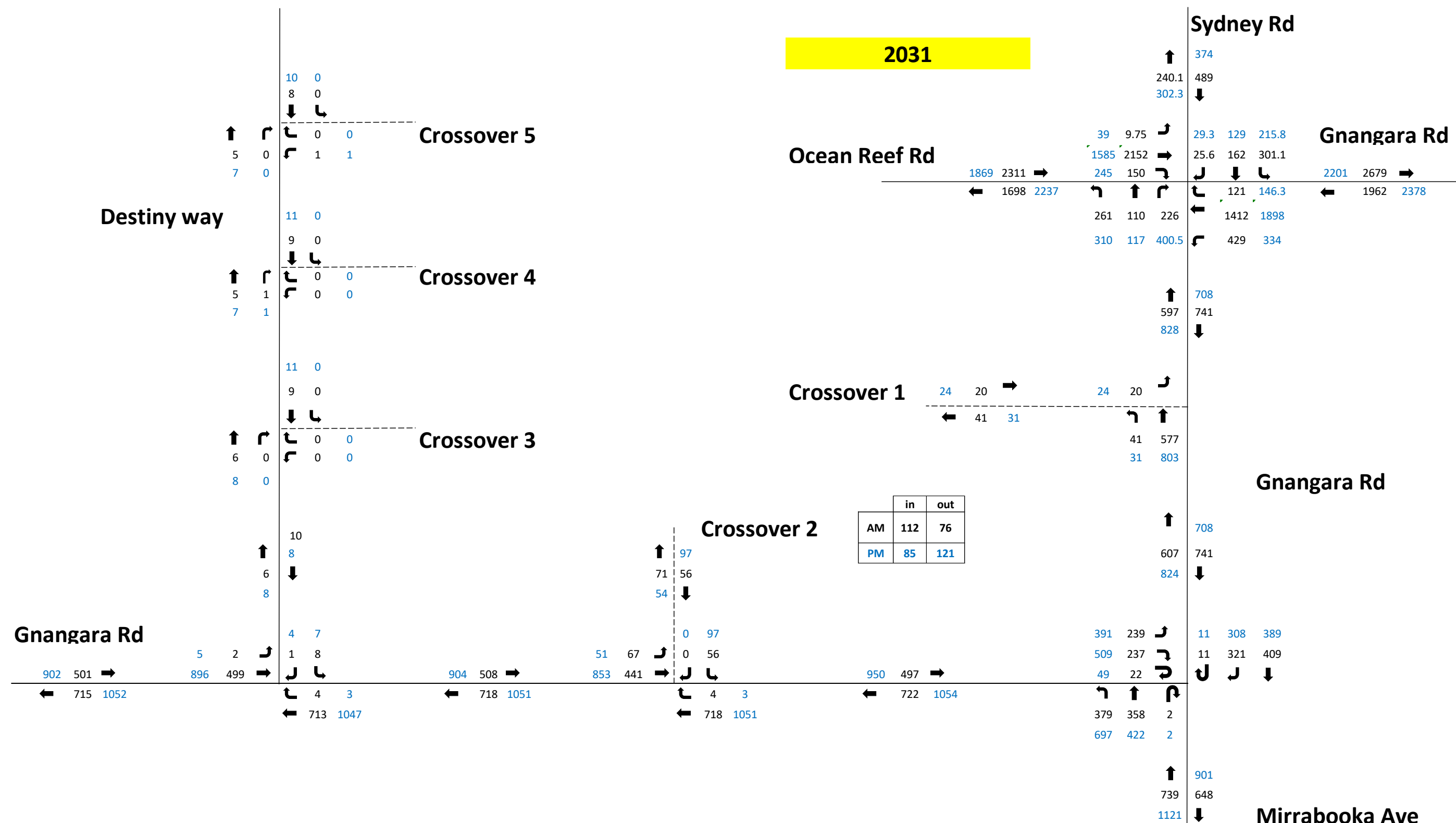


Figure 14: Total (2031) traffic – AM Weekday, PM Weekday

## 6.4 Analysis of Local Intersections & Crossovers

As mentioned before the trip generation of the proposed Fresh Frontier in 2023 is estimated to be less than 100vph and according to WAPC TIA Guidelines the traffic impact of the Stage 1 development is expected to be minimal and would not warrant further assessment. Therefore, capacity analysis was not undertaken for year 2023.

Network capacity analysis was undertaken using the SIDRA computer software package for year 2031. 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.

SIDRA Network models (refer **Figure 15**) were developed to assess the proposed development crossovers on Gnangara Road, intersection of Gnangara Road/ Destiny Way and nearby roundabout and signalised intersection as an integrated traffic network. The proposed Fresh Frontier crossovers on Destiny Way are used for dispatch and servicing and would not generate much traffic during the peak hours and therefore have not been included in the SIDRA network.

The results of the SIDRA network analysis for year 2031 are summarised in **Appendix C**. The SIDRA intersection models were coded with reference to Main Roads WA Operational Modelling Guidelines. All relevant parameters such as heavy vehicle groups, PCU factors, etc. were coded as per the Main Roads WA Guidelines.



**Figure 15: SIDRA Network Model – 2031**

#### **SIGNALISED INTERSECTION**

SIDRA analysis undertaken indicates that the existing signalised intersection of Gngangara Road/ Ocean Reef Road/ Sydney Road currently operates at capacity and with moderate queues on both approaches of Gngangara Road. The level of queues was observed during the AM and PM peak hours to develop the existing calibrated model. In order to achieve the calibration for the observed queues, the environment factor for some approaches of the signalised intersection were adjusted slightly in SIDRA. The suggested adjustments were kept the same for developing the future scenarios.

The intersection analysis for year 2031 indicates that the additional development traffic would not change significantly the traffic operation of the existing intersection. The reported LoS remains the same during the AM peak hour and would change slightly for some of the movements during the PM peak hours.

#### **GNANGARA ROAD ROUNDABOUT**

SIDRA analysis and site observations undertaken indicate that the existing Gngangara Road roundabout currently operates satisfactorily with LoS A and moderate queues and delays. The level of queues was observed during the AM and PM peak hours to develop the existing calibrated model. In order to achieve the calibration for the observed queues, the area factor for Gngangara Road eastbound approach were adjusted slightly in SIDRA. The suggested adjustment was kept the same for developing the future scenarios.

#### **GNANGARA ROAD/ DESTINY WAY INTERSECTION**

SIDRA analysis and site observations undertaken indicate that the existing intersection of Gngangara Road/ Destiny Way operates satisfactorily with minimal queues at the intersection. Currently some delays are experienced for the right turn movement out of Destiny Way into Gngangara Road which is related to the through traffic on Gngangara Road. However, the reported queue is less than one car on Destiny Way.

The proposal would not add any additional traffic on Destiny Way and its approach to the intersection with Gngangara Road during the peak hours. All the delivery and services would happen outside of the road network peak hours. Accordingly, no significant changes to the operation of the intersection are expected.

#### **DEVELOPMENT CROSSOVERS**

SIDRA analysis indicates that the proposed left in/ left out crossover on Gngangara Road (eastern boundary of the site) would operate satisfactorily and well within capacity. The full movement crossover on Gngangara Road (southern boundary of the site) would also operate satisfactorily during the peak hours except the right-out movement from the development to Gngangara Road due to the sheer volume of traffic on Gngangara Road. It is expected that the right-out movements would turn left at the crossover and make a U-turn at the roundabout intersection on Gngangara Road instead. It should be noted that the projected right turn movements are minimal and would not affect the traffic operation of the roundabout intersection. The right turn movements would still happen satisfactorily during the rest of the day (off-peak).

#### **NETWORK OPERATION**

Relevant SIDRA network outputs were reviewed for assessed peak hours to establish the operation of the development crossovers and the nearby roundabout and signalised intersections on Gngangara Road as an integrated network.

As detailed in **Figure 16** and **Figure 17** there are no queue back from the nearby intersections to the development crossovers. Similarly, no queue back from development crossovers to the nearby intersections is reported.

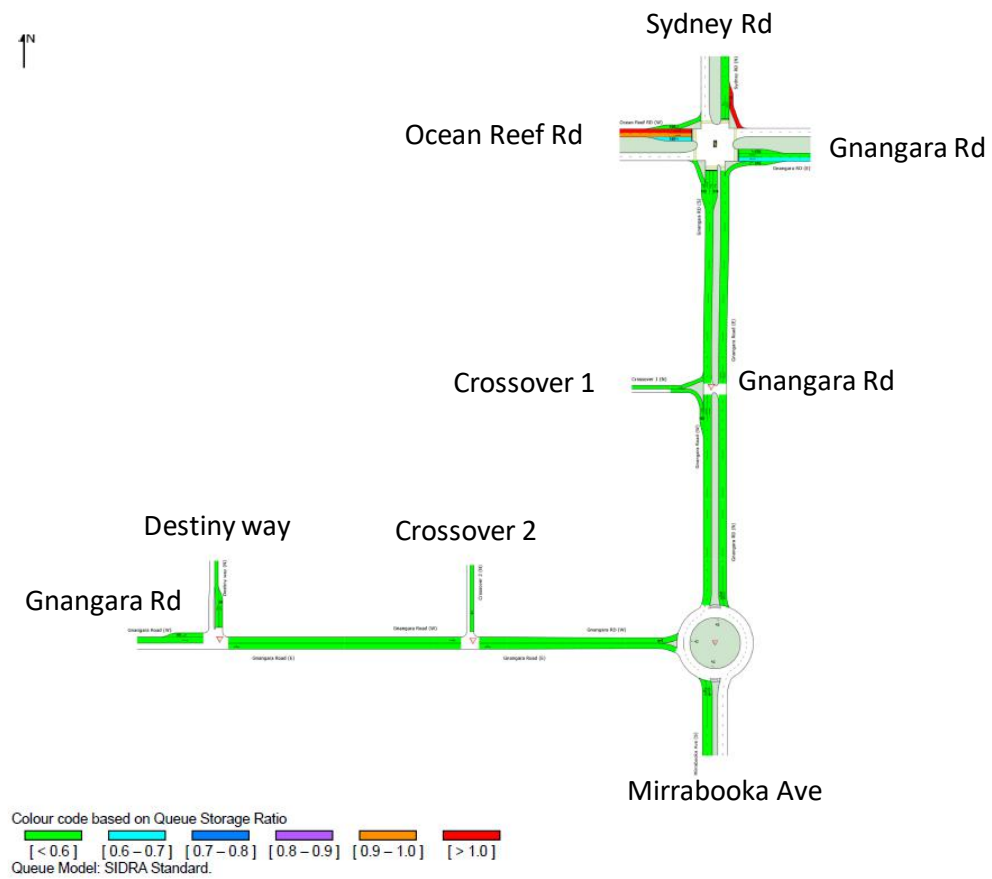
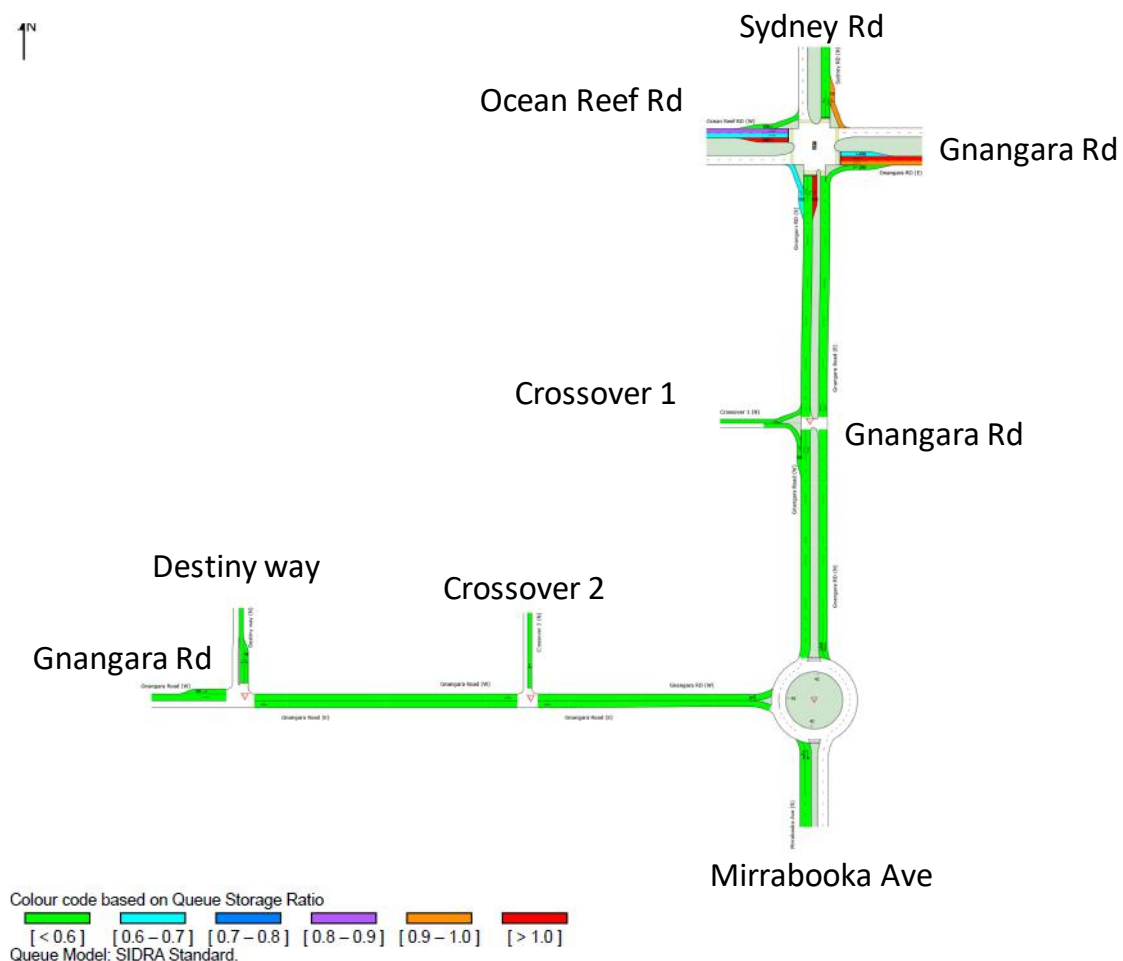


Figure 16: Weekday AM peak hour network analysis – queue storage ratio (2031)



**Figure 17: Weekday PM peak hour network analysis – queue storage ratio (2031)**

## 6.5 Impact on Surrounding Roads

The WAPC *Transport Impact Assessment Guidelines* (2016) provides the following guidance on the assessment of traffic impacts:

*“As a general guide, an increase in traffic of less than 10 percent of capacity would not normally be likely to have a material impact on any particular section of road, but increases over 10 percent may. All sections of road with an increase greater than 10 percent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 percent of capacity. Therefore, any section of road where development traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis.”*

The proposed development will not increase traffic flows near the quoted WAPC threshold to warrant further detailed analysis. The proposed development will not increase traffic on any lanes on the surrounding road network by more than 100vph,

therefore the impact on the surrounding road network and intersection will not be significant.

## **6.6 Impact on Neighbouring Areas**

Due to the location of the subject site, its accessibility via major regional roads, significant passing trade component and limited number of residential dwellings within the immediate vicinity, the traffic impact from the development in the area will be limited.

## **6.7 Traffic Noise and Vibration**

Due to the location of the subject site, its accessibility via major regional roads, significant passing trade component, the traffic impact from the development in the area will be limited.

It generally requires a doubling of traffic volumes on a road to produce a perceptible 3dB(A) increase in road noise. The proposed development will not increase traffic volumes or noise on surrounding roads anywhere near this level.

## 7 Parking

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The proposed parking provision for the proposed Fresh Frontier is 110 bays including 3 disabled bays. The parking provision for the other land uses within the site is 107 bays including five disabled bays and eight refuelling bays for the proposed Convenience Store.

It is considered that the proposed parking provision is adequate to meet the parking demand of the proposed development.



## 8 Provision for Heavy Vehicles

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There are a number of heavy vehicles associated with different land uses within the proposed development as explained below:

### **Fresh Frontier**

The dispatch will happen from the proposed dedicated crossover on Destiny Way which leads to the ground floor and provides access/ egress to three loading bays on the ground floor. The Ground Floor level is set so that there is 2% cross fall to the verge and it is about 1% over the landscape strip. The dispatch area is under the suspended slab and is level. The dispatch vehicles are up to 8.8m long and are expected to have sufficient height clearance when reversing to the ground floor.

Turn path analysis undertaken confirms satisfactory traffic movements of the dispatch trucks reversing to the dispatch area and exiting the dispatch area in forward gear. It should be noted that the dispatching will start at 3.00 am and the trucks would leave the site by 6.00 am. Therefore, no traffic is expected on Destiny Way to oppose/ conflict with the movements of the delivery trucks entering and exiting the dispatch area.

The largest truck that would enter and exit the Fresh Frontier service area is a 19.0m semi-trailer which would visit the site once a day. Four to six deliveries per day are also expected by smaller trucks up to 8.8m long.

Turn path analysis undertaken for 19.0m semi-trailer and 8.8m delivery trucks confirms satisfactory traffic movements within the Fresh Frontier service area and its crossovers on Destiny Way.

### **Convenience Store**

19.0m fuel tankers are expected to be used for the fuel deliveries. The fuel tankers would enter the site via the existing crossover on Gngangara Road (southern boundary) and exit the site from the proposed left in/ left out crossover on Gngangara Road (eastern boundary). Minor modifications to the existing crossover on Gngangara Road (southern boundary) are required to accommodate the turning movements of fuel tankers.

12.5m service vehicles are expected to be used for deliveries which show satisfactory access, circulation and egress within the site.

Turn path analysis undertaken for 19.0m fuel tanker and 12.5m service vehicle are presented in **Appendix D**.

### **Carwash**

8.8m service vehicles are expected to be used for the rubbish collection and deliveries associated with the proposed carwash and are expected to visit the site outside of the peak operating time of the proposed carwash. Turn path analysis undertaken for 8.8m service vehicles are presented in **Appendix D** and confirms satisfactory traffic movements of the 8.8m trucks entering and exiting the site.

### **Showroom and Workshops**

8.8m service vehicles are expected to use the proposed loading bays provided for the proposed showroom and workshops which show satisfactory access, circulation and egress within the site.

Turn path analysis undertaken for 8.8m service vehicles are presented in **Appendix D**.

## 9 Public Transport Access

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Details of the available public transport services in this locality are provided in section 3.4 of this report. At present, bus stop (Stop No: 27698) on Bus route 376 is located to the south of the proposed left in/ left out crossover on Gnamara Road and will be located within the proposed left turn slip lane which is suggested for this crossover. It is recommended to relocate the existing bus stop to the north of the proposed crossover in consultation with PTA.

## 10 Pedestrian Access

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Details of the pedestrian and cyclist facilities in this locality are provided in section 3.5 of the report.

# 11 Conclusions

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This TIA has been prepared by Transcore on behalf of The Wangara Unit Trust with regards to the proposed commercial development at Lot 703 (#359) Gngangara Road, Wangara, in the City of Wanneroo.

The proposed development will be developed in stages. In the first stage the proposed Fresh Frontier will be developed (say 2023) and later on the rest of the land uses will be developed (say by year 2031).

The assessment years that are adopted for the analysis are 2023 and 2031, with the following assumptions:

- 2023: Full development of proposed Fresh Frontier; and,
- 2031: Full development of the entire site.

The trip generation of the proposed Fresh Frontier is estimated to be less than 100vph and according to WAPC Guidelines the traffic impact of the Stage 1 development is expected to be minimal and would not warrant further assessment.

The layout of operations of the proposed Fresh Frontier is over two levels. All access to the lower ground floor is provided via Destiny Way (to dispatch area and service area) to facilitate truck receipt and delivery which is separated from the primary administration and offices on the upper floor.

The upper floor is for Fresh Frontier administration and offices. The proposed car bays provided on the upper level are accessible by the existing and proposed development crossovers on Gngangara Road which will be developed as part of the Stage 1 development.

Preliminary engagement has already occurred with DPLH in respect to the proposed treatment of access. Transcore has also developed a concept design for the proposed left turn slip lane Gngangara Road (eastern boundary of the site) which entails a 100m left turn slip lane (including taper) in accordance with Austroads guidelines for the posted speed limit of 70kmh on Gngangara Road. It should be noted that currently a bus stop (on Bus Route 376) exists to the south of the proposed Left in/ Left out crossover. This bus stop would need to be relocated to the north of the proposed Left in/ Left out crossover in consultation with the Public Transport Authority (PTA).

It is estimated that after full development of all land uses, the proposal would generate a total of approximately 1,864 trips per weekday (both inbound and outbound) and approximately 200vph during the AM and PM peak hours in 2031.

SIDRA Network models were developed to assess the proposed development crossovers on Gngangara Road, intersection of Gngangara Road/ Destiny Way and nearby roundabout and signalised intersection as an integrated traffic network for AM and PM peak hours.

Relevant SIDRA network outputs were reviewed for assessed peak hours to establish the operation of the development crossovers and the nearby roundabout and signalised intersections on Gngangara Road as an integrated network. As detailed in **Figure 16** and **Figure 17** there are no queuing of traffic back from the nearby intersections to the development crossovers. Similarly, no queue back from development crossovers to the nearby intersections is reported.

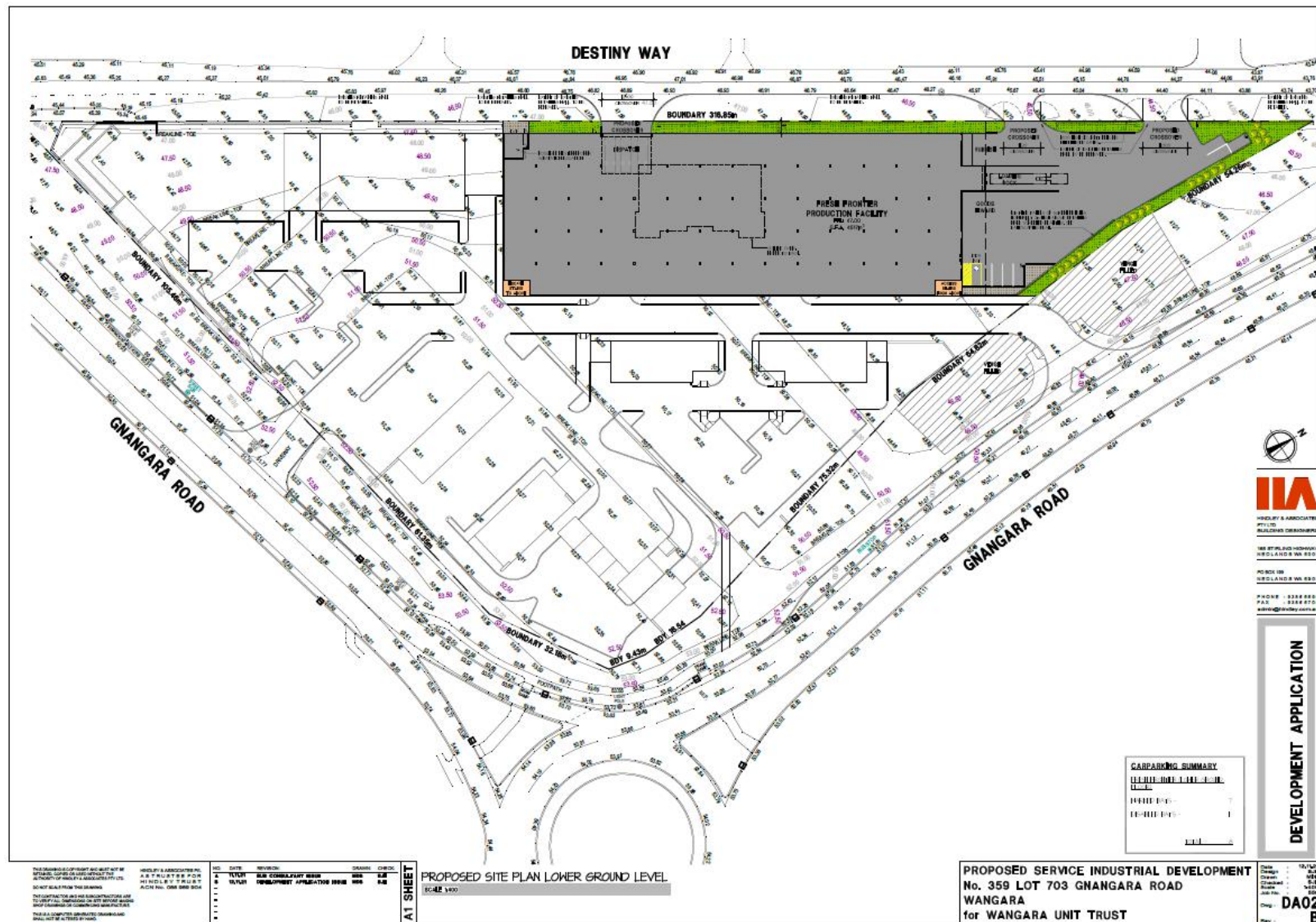
# Appendix A

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## PROPOSED DEVELOPMENT







# Appendix B

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**PROPOSED CONCEPT LAYOUT FOR THE DEVELOPMENT  
CROSSOVER ON GNANGARA ROAD (EASTERN BOUNDARY)**





Lot 703 (#359) Gngangara Road, Wangara  
Gngangara Road left turn slip lane

t21.166.sk19  
29/10/2021  
Scale: 1:500 @ A3



# Appendix C

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## INTERSECTION ANALYSIS – SIDRA RESULTS

## MOVEMENT SUMMARY

▼ Site: [Gnangara Rd & Destiny way - Existing - AM (Site Folder: Existing)]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %				[ Veh. veh	Dist ] m				
East: Gnangara Road (E)														
5	T1	568	15.8	598	15.8	0.340	0.1	LOS A	0.1	0.9	0.01	0.00	0.02	69.7
6	R2	4	20.0	4	20.0	0.340	10.1	LOS B	0.1	0.9	0.01	0.00	0.02	45.0
Approach		572	15.8	602	15.8	0.340	0.1	NA	0.1	0.9	0.01	0.00	0.02	69.5
North: Destiny way (N)														
7	L2	7	20.0	7	20.0	0.008	6.9	LOS A	0.0	0.3	0.46	0.58	0.46	36.9
9	R2	1	20.0	1	20.0	0.006	24.7	LOS C	0.0	0.2	0.84	0.85	0.84	34.6
Approach		8	20.0	8	20.0	0.008	9.1	LOS A	0.0	0.3	0.51	0.61	0.51	36.4
West: Gnangara Road (W)														
10	L2	1	20.0	1	20.0	0.001	6.8	LOS A	0.0	0.0	0.00	0.61	0.00	52.5
11	T1	375	20.1	395	20.1	0.228	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		376	20.1	396	20.1	0.228	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.8
All Vehicles		956	17.5	1006	17.5	0.340	0.2	NA	0.1	0.9	0.01	0.01	0.01	69.3



## MOVEMENT SUMMARY

**Site:** [Gnangara Rd & Sydney Rd & Ocean Reef Rd - Existing  
- AM (Site Folder: Existing)]

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %	v/c	sec		[ Veh. veh	Dist ] m				km/h
South: Gnangara RD (S)														
10	L2	202	12.0	213	12.0	0.167	10.2	LOS B	2.9	24.5	0.34	0.68	0.34	51.7
11	T1	90	12.0	95	12.0	0.159	34.8	LOS C	4.0	33.0	0.82	0.65	0.82	27.6
12	R2	183	12.0	193	12.0	*0.579	62.6	LOS E	5.3	43.8	1.00	0.78	1.02	25.6
Approach		475	12.0	500	12.0	0.579	35.0	LOS D	5.3	43.8	0.69	0.71	0.69	33.8
East: Gnangara RD (E)														
1	L2	343	16.3	361	16.3	0.117	7.9	LOS A	0.0	0.0	0.00	0.59	0.00	59.6
2	T1	1162	16.3	1223	16.3	0.502	28.1	LOS C	24.8	219.6	0.83	0.72	0.83	49.7
3	R2	99	16.3	104	16.3	0.621	64.9	LOS E	5.7	50.8	1.00	0.77	1.04	24.9
Approach		1604	16.3	1688	16.3	0.621	26.0	LOS C	24.8	219.6	0.66	0.70	0.66	48.9
North: Sydney RD (N)														
4	L2	247	16.1	260	16.1	0.248	17.8	LOS B	6.7	57.9	0.56	0.75	0.56	44.2
5	T1	133	16.1	140	16.1	*0.245	36.8	LOS D	6.0	52.0	0.85	0.71	0.85	26.6
6	R2	21	16.1	22	16.1	0.138	60.6	LOS E	1.2	10.0	0.97	0.70	0.97	25.2
Approach		401	16.1	422	16.1	0.248	26.3	LOS C	6.7	57.9	0.68	0.73	0.68	36.9
West: Ocean Reef RD (W)														
7	L2	8	15.2	8	15.2	0.004	8.8	LOS A	0.1	0.5	0.20	0.62	0.20	57.1
8	T1	1765	15.2	1858	15.2	*0.784	31.8	LOS C	45.0	392.2	0.94	0.84	0.94	47.3
9	R2	123	15.2	129	15.2	*0.760	66.8	LOS E	7.3	63.8	1.00	0.83	1.17	25.3
Approach		1896	15.2	1996	15.2	0.784	34.0	LOS C	45.0	392.2	0.94	0.84	0.95	45.4
All Vehicles		4376	15.3	4606	15.3	0.784	30.5	LOS C	45.0	392.2	0.79	0.76	0.79	44.7





## MOVEMENT SUMMARY

 Site: [Mirrabooka Ave & Gngara Rd - Existing - AM (Site Folder: Existing)]

Site Category: (None)  
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %				[ Veh. veh	Dist ] m				
South: Mirrabooka Ave (S)														
10	L2	309	12.0	325	12.0	0.261	5.5	LOS A	1.6	13.5	0.49	0.56	0.49	52.4
11	T1	278	12.0	293	12.0	0.261	5.7	LOS A	1.6	13.5	0.52	0.51	0.52	45.5
12u	U	2	12.0	2	12.0	0.261	15.7	LOS B	1.5	12.7	0.52	0.51	0.52	60.7
Approach		589	12.0	620	12.0	0.261	5.6	LOS A	1.6	13.5	0.51	0.54	0.51	48.7
North: Gngara RD (N)														
5	T1	336	16.1	354	16.1	0.262	4.7	LOS A	1.7	14.9	0.46	0.46	0.46	54.6
6	R2	262	16.4	276	16.4	0.262	12.5	LOS B	1.7	14.5	0.49	0.65	0.49	25.0
6u	U	1	16.4	1	16.4	0.262	15.4	LOS B	1.7	14.5	0.49	0.65	0.49	26.8
Approach		599	16.2	631	16.2	0.262	8.1	LOS A	1.7	14.9	0.47	0.54	0.47	40.2
West: Gngara RD (W)														
7	L2	196	20.1	206	20.1	0.211	3.6	LOS A	1.1	9.6	0.35	0.59	0.35	43.1
9	R2	185	16.1	195	16.1	0.211	10.5	LOS B	1.1	9.6	0.35	0.59	0.35	52.1
9u	U	1	20.1	1	20.1	0.211	13.4	LOS B	1.1	9.6	0.35	0.59	0.35	36.9
Approach		382	18.2	402	18.2	0.211	7.0	LOS A	1.1	9.6	0.35	0.59	0.35	48.4
All Vehicles		1570	15.1	1653	15.1	0.262	6.9	LOS A	1.7	14.9	0.46	0.55	0.46	45.1



## MOVEMENT SUMMARY

▽ Site: [Gngangara Rd & Destiny way - Existing - PM (Site Folder: Existing)]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV % ]	[ Total veh/h	HV % ]				[ Veh. veh	Dist ] m				
East: Gngangara Road (E)														
5	T1	820	15.8	863	15.8	0.491	0.3	LOS A	0.3	2.5	0.02	0.00	0.03	69.2
6	R2	3	20.0	3	20.0	0.491	25.0	LOS D	0.3	2.5	0.02	0.00	0.03	44.6
Approach		823	15.8	866	15.8	0.491	0.4	NA	0.3	2.5	0.02	0.00	0.03	69.1
North: Destiny way (N)														
7	L2	6	20.0	6	20.0	0.014	11.3	LOS B	0.0	0.5	0.69	0.77	0.69	32.8
9	R2	4	20.0	4	20.0	0.147	123.3	LOS F	0.4	3.7	0.98	0.99	0.98	15.5
Approach		10	20.0	11	20.0	0.147	56.1	LOS F	0.4	3.7	0.80	0.86	0.81	19.8
West: Gngangara Road (W)														
10	L2	4	20.0	4	20.0	0.003	6.8	LOS A	0.0	0.0	0.00	0.61	0.00	52.5
11	T1	713	20.1	751	20.1	0.434	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
Approach		717	20.1	755	20.1	0.434	0.2	NA	0.0	0.0	0.00	0.00	0.00	69.4
All Vehicles		1550	17.8	1632	17.8	0.491	0.6	NA	0.4	3.7	0.02	0.01	0.02	68.3



## MOVEMENT SUMMARY

**Site:** [Gnangara Rd & Sydney Rd & Ocean Reef Rd - Existing  
- PM (Site Folder: Existing)]

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist. m				km/h
South: Gnangara RD (S)														
10	L2	243	12.0	256	12.0	0.200	13.8	LOS B	4.9	40.6	0.48	0.71	0.48	48.4
11	T1	96	12.0	101	12.0	0.155	29.7	LOS C	3.7	31.0	0.80	0.63	0.80	30.4
12	R2	322	12.0	339	12.0	*0.927	70.4	LOS E	9.9	82.3	1.00	1.02	1.57	23.8
Approach		661	12.0	696	12.0	0.927	43.7	LOS D	9.9	82.3	0.78	0.85	1.06	30.5
East: Gnangara RD (E)														
1	L2	267	16.3	281	16.3	0.091	7.9	LOS A	0.0	0.0	0.00	0.59	0.00	59.6
2	T1	1560	16.3	1642	16.3	*0.893	43.0	LOS D	43.9	388.0	1.00	1.00	1.15	41.4
3	R2	120	16.3	126	16.3	0.513	56.4	LOS E	6.1	54.0	1.00	0.77	1.00	27.2
Approach		1947	16.3	2049	16.3	0.893	39.1	LOS D	43.9	388.0	0.86	0.93	0.98	41.7
North: Sydney RD (N)														
4	L2	177	16.1	186	16.1	0.161	14.9	LOS B	3.7	31.8	0.49	0.72	0.49	46.5
5	T1	106	16.1	112	16.1	*0.177	31.0	LOS C	4.2	35.9	0.81	0.67	0.81	29.6
6	R2	24	16.1	25	16.1	0.144	55.1	LOS E	1.2	10.3	0.96	0.71	0.96	26.7
Approach		307	16.1	323	16.1	0.177	23.6	LOS C	4.2	35.9	0.64	0.70	0.64	38.6
West: Ocean Reef RD (W)														
7	L2	32	15.2	34	15.2	0.017	8.9	LOS A	0.2	2.0	0.22	0.64	0.22	56.9
8	T1	1300	15.2	1368	15.2	0.739	33.9	LOS C	30.7	267.7	0.96	0.84	0.96	46.1
9	R2	201	15.2	212	15.2	*0.847	62.0	LOS E	11.1	97.0	1.00	0.89	1.27	26.5
Approach		1533	15.2	1614	15.2	0.847	37.0	LOS D	30.7	267.7	0.95	0.84	0.98	43.1
All Vehicles		4448	15.3	4682	15.3	0.927	38.0	LOS D	43.9	388.0	0.86	0.87	0.97	40.4



## MOVEMENT SUMMARY

 Site: [Mirrabooka Ave & Gngara Rd - Existing - PM (Site Folder: Existing)]

Site Category: (None)  
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %				[ Veh. veh	Dist ] m				
South: Mirrabooka Ave (S)														
10	L2	570	12.0	600	12.0	0.458	5.7	LOS A	3.5	29.1	0.60	0.60	0.60	51.7
11	T1	337	12.0	355	12.0	0.349	5.9	LOS A	2.3	18.8	0.57	0.52	0.57	45.1
12u	U	2	12.0	2	12.0	0.349	15.8	LOS B	2.3	18.8	0.57	0.52	0.57	60.3
Approach		909	12.0	957	12.0	0.458	5.8	LOS A	3.5	29.1	0.59	0.57	0.59	48.8
North: Gngara RD (N)														
5	T1	319	16.1	336	16.1	0.299	6.1	LOS A	2.2	18.8	0.68	0.58	0.68	52.6
6	R2	252	16.4	265	16.4	0.316	14.4	LOS B	2.1	18.6	0.71	0.77	0.71	33.3
6u	U	3	16.4	3	16.4	0.316	17.3	LOS B	2.1	18.6	0.71	0.77	0.71	35.1
Approach		574	16.2	604	16.2	0.316	9.8	LOS A	2.2	18.8	0.69	0.67	0.69	44.6
West: Gngara RD (W)														
7	L2	321	20.1	338	20.1	0.415	4.1	LOS A	2.9	25.9	0.51	0.63	0.51	41.5
9	R2	397	16.1	418	16.1	0.415	11.0	LOS B	2.9	25.9	0.51	0.63	0.51	50.8
9u	U	1	20.1	1	20.1	0.415	13.9	LOS B	2.9	25.9	0.51	0.63	0.51	35.6
Approach		719	17.9	757	17.9	0.415	7.9	LOS A	2.9	25.9	0.51	0.63	0.51	47.6
All Vehicles		2202	15.0	2318	15.0	0.458	7.5	LOS A	3.5	29.1	0.59	0.62	0.59	47.3



## MOVEMENT SUMMARY

Site: [Gngangara Rd & Crossover 1 - 2031 - AM (Site Folder: 2031)]

Network: N101 [AM (Network Folder: 2033)]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total HV ] veh/h	%	v/c	sec		[ Veh. veh	Dist ] m				km/h
South: Gngangara Road (W)														
10	L2	43	2.0	43	2.0	0.024	8.4	LOS A	0.0	0.0	0.00	0.67	0.00	33.7
11	T1	607	12.0	607	12.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		651	11.3	651	11.3	0.176	0.6	NA	0.0	0.0	0.00	0.04	0.00	64.1
North: Gngangara Road (E)														
5	T1	780	16.1	780	16.1	0.234	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		780	16.1	780	16.1	0.234	0.0	NA	0.0	0.0	0.00	0.00	0.00	69.8
West: Crossover 1 (N)														
7	L2	21	2.0	21	2.0	0.022	1.4	LOS A	0.1	0.6	0.37	0.24	0.37	16.8
Approach		21	2.0	21	2.0	0.022	1.4	LOS A	0.1	0.6	0.37	0.24	0.37	16.8
All Vehicles		1452	13.8	1452	13.8	0.234	0.3	NA	0.1	0.6	0.01	0.02	0.01	67.1

## MOVEMENT SUMMARY

Site: [Gngangara Rd & Crossover 2 - 2031 - AM (Site Folder: 2031)]

Network: N101 [AM (Network Folder: 2033)]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total HV ] veh/h	%	v/c	sec		[ Veh. veh	Dist ] m				km/h
East: Gngangara Road (E)														
5	T1	756	15.8	756	15.8	0.426	0.1	LOS A	0.1	0.9	0.01	0.00	0.02	68.5
6	R2	4	2.0	4	2.0	0.426	10.0	LOS A	0.1	0.9	0.01	0.00	0.02	66.1
Approach		760	15.7	760	15.7	0.426	0.1	NA	0.1	0.9	0.01	0.00	0.02	68.5
North: Crossover 2 (N)														
7	L2	59	2.0	59	2.0	0.067	2.1	LOS A	0.2	1.9	0.50	0.41	0.50	14.6
9	R2	1	2.0	1	2.0	0.067	16.1	LOS C	0.2	1.9	0.50	0.41	0.50	14.6
Approach		60	2.0	60	2.0	0.067	2.4	LOS A	0.2	1.9	0.50	0.41	0.50	14.6
West: Gngangara Road (W)														
10	L2	71	2.0	71	2.0	0.305	5.6	LOS A	0.0	0.0	0.00	0.08	0.00	33.0
11	T1	464	20.1	464	20.1	0.305	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	60.1
Approach		535	17.7	535	17.7	0.305	0.7	NA	0.0	0.0	0.00	0.08	0.00	53.4
All Vehicles		1355	15.9	1355	15.9	0.426	0.5	NA	0.2	1.9	0.03	0.05	0.03	58.1



## MOVEMENT SUMMARY

Site: [Gngara Rd & Destiny way - 2031 - AM (Site Folder: 2031)]

Network: N101 [AM (Network Folder: 2033)]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist ] m				km/h
East: Gngara Road (E)														
5	T1	751	15.8	751	15.8	0.426	0.1	LOS A	0.2	1.5	0.02	0.00	0.02	69.5
6	R2	4	20.0	4	20.0	0.426	13.9	LOS B	0.2	1.5	0.02	0.00	0.02	44.9
Approach		755	15.8	755	15.8	0.426	0.2	NA	0.2	1.5	0.02	0.00	0.02	69.4
North: Destiny way (N)														
7	L2	8	20.0	8	20.0	0.012	8.1	LOS A	0.0	0.4	0.54	0.65	0.54	35.5
9	R2	1	20.0	1	20.0	0.014	48.1	LOS E	0.0	0.4	0.93	0.96	0.93	26.8
Approach		9	20.0	9	20.0	0.014	12.5	LOS B	0.0	0.4	0.58	0.68	0.58	32.7
West: Gngara Road (W)														
10	L2	2	20.0	2	20.0	0.001	6.8	LOS A	0.0	0.0	0.00	0.61	0.00	52.5
11	T1	525	20.1	525	20.1	0.304	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		527	20.1	527	20.1	0.304	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.6
All Vehicles		1292	17.6	1292	17.6	0.426	0.3	NA	0.2	1.5	0.01	0.01	0.02	69.2



## MOVEMENT SUMMARY

**Site:** [Gnangara Rd & Sydney Rd & Ocean Reef Rd - 2031- AM  
(Site Folder: 2031)]

**Network:** N101 [AM  
(Network Folder: 2033)]


Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist ] m				km/h
South: Gnangara RD (S)														
10	L2	275	12.0	275	12.0	0.238	12.5	LOS B	5.5	46.1	0.43	0.71	0.43	49.5
11	T1	116	12.0	116	12.0	0.213	40.5	LOS D	5.5	45.7	0.86	0.68	0.86	25.0
12	R2	238	12.0	238	12.0	*0.781	71.5	LOS E	7.4	61.8	1.00	0.86	1.21	23.6
Approach		628	12.0	628	12.0	0.781	40.0	LOS D	7.4	61.8	0.72	0.76	0.80	31.7
East: Gnangara RD (E)														
1	L2	452	16.3	452	16.3	0.147	7.9	LOS A	0.0	0.0	0.00	0.59	0.00	60.7
2	T1	1486	16.3	1486	16.3	0.577	27.8	LOS C	34.5	304.9	0.81	0.72	0.81	49.9
3	R2	127	16.3	127	16.3	0.709	70.3	LOS E	7.7	68.1	1.00	0.80	1.10	23.7
Approach		2065	16.3	2065	16.3	0.709	26.1	LOS C	34.5	304.9	0.65	0.70	0.65	48.4
North: Sydney RD (N)														
4	L2	317	16.1	317	16.1	0.330	24.4	LOS C	11.3	97.8	0.69	0.78	0.69	39.6
5	T1	171	16.1	171	16.1	*0.325	42.8	LOS D	8.3	72.1	0.88	0.74	0.88	14.1
6	R2	27	16.1	27	16.1	0.187	66.5	LOS E	1.6	13.6	0.98	0.71	0.98	23.8
Approach		515	16.1	515	16.1	0.330	32.7	LOS C	11.3	97.8	0.77	0.76	0.77	31.1
West: Ocean Reef RD (W)														
7	L2	11	15.2	11	15.2	0.005	8.9	LOS A	0.1	0.7	0.20	0.63	0.20	56.9
8	T1	2265	15.2	2265	15.2	*0.860	33.2	LOS C	61.4	535.4	0.96	0.88	0.97	46.5
9	R2	158	15.2	158	15.2	*0.867	74.8	LOS E	10.0	87.4	1.00	0.90	1.32	19.2
Approach		2434	15.2	2434	15.2	0.867	35.8	LOS D	61.4	535.4	0.96	0.88	0.99	44.3
All Vehicles		5642	15.3	5642	15.3	0.867	32.4	LOS C	61.4	535.4	0.80	0.79	0.82	43.2



## MOVEMENT SUMMARY

 Site: [Mirrabooka Ave & Gngangara Rd - 2031 - AM (Site Folder: 2031)]

 Network: N101 [AM (Network Folder: 2033)]

Site Category: (None)  
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist m ]				
South: Mirrabooka Ave (S)														
10	L2	399	12.0	399	12.0	0.355	6.0	LOS A	2.5	20.6	0.62	0.63	0.62	51.9
11	T1	377	12.0	377	12.0	0.355	6.5	LOS A	2.5	20.6	0.64	0.58	0.64	50.6
12u	U	2	12.0	2	12.0	0.355	16.5	LOS B	2.3	19.0	0.64	0.58	0.64	59.7
Approach		778	12.0	778	12.0	0.355	6.3	LOS A	2.5	20.6	0.63	0.61	0.63	51.3
North: Gngangara RD (N)														
5	T1	431	16.1	431	16.1	0.343	5.3	LOS A	2.5	21.3	0.57	0.51	0.57	53.6
6	R2	338	16.4	338	16.4	0.354	13.2	LOS B	2.4	21.2	0.61	0.71	0.61	31.2
6u	U	12	16.4	12	16.4	0.354	16.2	LOS B	2.4	21.2	0.61	0.71	0.61	31.2
Approach		780	16.2	780	16.2	0.354	8.9	LOS A	2.5	21.3	0.59	0.60	0.59	45.6
West: Gngangara RD (W)														
7	L2	252	20.1	252	20.1	0.285	3.8	LOS A	1.6	14.5	0.45	0.62	0.45	33.6
9	R2	249	16.1	249	16.1	0.285	10.7	LOS B	1.6	14.5	0.45	0.62	0.45	51.3
9u	U	23	20.1	23	20.1	0.285	13.6	LOS B	1.6	14.5	0.45	0.62	0.45	33.6
Approach		524	18.2	524	18.2	0.285	7.5	LOS A	1.6	14.5	0.45	0.62	0.45	45.5
All Vehicles		2082	15.1	2082	15.1	0.355	7.6	LOS A	2.5	21.3	0.57	0.60	0.57	47.7





## MOVEMENT SUMMARY

Site: [Gngangara Rd & Crossover 1 - 2031 - PM (Site Folder:  Network: N101 [PM (Network Folder: 2033)])]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist ] m				km/h
South: Gngangara Road (W)														
10	L2	33	2.0	33	2.0	0.018	8.4	LOS A	0.0	0.0	0.00	0.67	0.00	33.7
11	T1	845	12.0	845	12.0	0.244	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		878	11.6	878	11.6	0.244	0.3	NA	0.0	0.0	0.00	0.02	0.00	66.4
North: Gngangara Road (E)														
5	T1	745	16.1	745	16.1	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		745	16.1	745	16.1	0.224	0.0	NA	0.0	0.0	0.00	0.00	0.00	69.8
West: Crossover 1 (N)														
7	L2	25	2.0	25	2.0	0.031	2.2	LOS A	0.1	0.8	0.45	0.34	0.45	15.6
Approach		25	2.0	25	2.0	0.031	2.2	LOS A	0.1	0.8	0.45	0.34	0.45	15.6
All Vehicles		1648	13.5	1648	13.5	0.244	0.2	NA	0.1	0.8	0.01	0.02	0.01	67.5

## MOVEMENT SUMMARY

Site: [Gngangara Rd & Crossover 2 - 2031 - PM (Site Folder:  Network: N101 [PM (Network Folder: 2033)])]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist ] m				km/h
East: Gngangara Road (E)														
5	T1	1106	15.8	1106	15.8	0.624	0.2	LOS A	0.3	2.7	0.02	0.00	0.04	65.8
6	R2	3	2.0	3	2.0	0.624	29.9	LOS D	0.3	2.7	0.02	0.00	0.04	64.0
Approach		1109	15.8	1109	15.8	0.624	0.3	NA	0.3	2.7	0.02	0.00	0.04	65.8
North: Crossover 2 (N)														
7	L2	102	2.0	102	2.0	0.281	8.9	LOS A	1.0	7.6	0.81	0.89	0.93	7.7
9	R2	1	2.0	1	2.0	0.281	143.7	LOS F	1.0	7.6	0.81	0.89	0.93	7.7
Approach		103	2.0	103	2.0	0.281	10.3	LOS B	1.0	7.6	0.81	0.89	0.93	7.7
West: Gngangara Road (W)														
10	L2	54	2.0	54	2.0	0.547	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	34.0
11	T1	898	20.1	898	20.1	0.547	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	64.8
Approach		952	19.1	952	19.1	0.547	0.4	NA	0.0	0.0	0.00	0.04	0.00	61.1
All Vehicles		2164	16.6	2164	16.6	0.624	0.8	NA	1.0	7.6	0.05	0.06	0.06	56.5



## MOVEMENT SUMMARY

Site: [Gnangara Rd & Destiny way - 2031 - PM (Site Folder: 2031)] Network: N101 [PM (Network Folder: 2033)]

Site Category: (None)  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist m				km/h
East: Gnangara Road (E)														
5	T1	1102	15.8	1102	15.8	0.631	0.8	LOS A	0.8	7.3	0.04	0.00	0.06	67.9
6	R2	3	20.0	3	20.0	0.631	56.1	LOS F	0.8	7.3	0.04	0.00	0.06	43.7
Approach		1105	15.8	1105	15.8	0.631	1.0	NA	0.8	7.3	0.04	0.00	0.06	67.8
North: Destiny way (N)														
7	L2	7	20.0	7	20.0	0.027	16.9	LOS C	0.1	0.8	0.81	0.91	0.81	26.8
9	R2	4	20.0	4	20.0	0.871	1214.4	LOS F	2.2	21.4	1.00	1.05	1.19	2.2
Approach		12	20.0	12	20.0	0.871	452.3	LOS F	2.2	21.4	0.88	0.96	0.95	3.3
West: Gnangara Road (W)														
10	L2	5	20.0	5	20.0	0.004	6.8	LOS A	0.0	0.0	0.00	0.61	0.00	52.5
11	T1	943	20.1	943	20.1	0.546	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.4
Approach		948	20.1	948	20.1	0.546	0.3	NA	0.0	0.0	0.00	0.00	0.00	69.2
All Vehicles		2065	17.8	2065	17.8	0.871	3.2	NA	2.2	21.4	0.03	0.01	0.04	62.9



## MOVEMENT SUMMARY

Site: [Gnangara Rd & Sydney Rd & Ocean Reef Rd - 2031 - PM (Site Folder: 2031)] Network: N101 [PM (Network Folder: 2033)]

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site Practical Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total veh/h	HV %	v/c	sec		[ Veh. veh	Dist m				km/h
South: Gnangara RD (S)														
10	L2	326	12.0	326	12.0	0.298	18.5	LOS B	10.4	86.8	0.55	0.75	0.55	44.6
11	T1	123	12.0	123	12.0	0.264	51.4	LOS D	7.1	59.2	0.89	0.71	0.89	21.2
12	R2	422	12.0	422	12.0	*0.862	81.0	LOS F	15.5	129.2	1.00	0.91	1.24	21.8
Approach		872	12.0	872	12.0	0.862	53.4	LOS D	15.5	129.2	0.82	0.82	0.93	27.3
East: Gnangara RD (E)														
1	L2	352	16.3	352	16.3	0.114	7.9	LOS A	0.0	0.0	0.00	0.59	0.00	60.8
2	T1	1998	16.3	1998	16.3	*0.853	37.2	LOS D	59.0	521.9	0.92	0.84	0.92	44.3
3	R2	154	16.3	154	16.3	0.538	73.4	LOS E	10.1	89.7	1.00	0.79	1.00	23.0
Approach		2503	16.3	2503	16.3	0.853	35.3	LOS D	59.0	521.9	0.80	0.80	0.80	43.4
North: Sydney RD (N)														
4	L2	227	16.1	227	16.1	0.242	22.2	LOS C	8.2	71.2	0.60	0.76	0.60	41.0
5	T1	136	16.1	136	16.1	*0.302	53.0	LOS D	7.9	68.5	0.90	0.74	0.90	11.8
6	R2	31	16.1	31	16.1	0.130	68.8	LOS E	1.9	16.5	0.94	0.72	0.94	23.3
Approach		394	16.1	394	16.1	0.302	36.4	LOS D	8.2	71.2	0.73	0.75	0.73	29.2
West: Ocean Reef RD (W)														
7	L2	41	15.2	41	15.2	0.019	9.2	LOS A	0.4	3.4	0.20	0.64	0.20	56.6
8	T1	1668	15.2	1668	15.2	0.690	34.6	LOS C	49.4	431.0	0.86	0.77	0.86	45.7
9	R2	258	15.2	258	15.2	*0.889	83.2	LOS F	19.0	165.5	1.00	0.91	1.26	17.7
Approach		1967	15.2	1967	15.2	0.889	40.4	LOS D	49.4	431.0	0.86	0.78	0.90	41.1
All Vehicles		5736	15.3	5736	15.3	0.889	39.9	LOS D	59.0	521.9	0.82	0.79	0.85	39.0



## MOVEMENT SUMMARY

Site: [Mirrabooka Ave & Gngara Rd - 2031 - PM (Site Folder: 2031)]

Network: N101 [PM (Network Folder: 2033)]

Site Category: (None)  
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h	HV %	[ Total HV ] veh/h	%	v/c	sec		[ Veh. veh	Dist ] m				km/h
South: Mirrabooka Ave (S)														
10	L2	734	12.0	734	12.0	0.617	7.4	LOS A	6.2	51.3	0.80	0.76	0.87	50.5
11	T1	444	12.0	444	12.0	0.491	7.1	LOS A	3.7	30.6	0.75	0.63	0.76	49.4
12u	U	2	12.0	2	12.0	0.491	17.1	LOS B	3.7	30.6	0.75	0.63	0.76	58.8
Approach		1180	12.0	1180	12.0	0.617	7.3	LOS A	6.2	51.3	0.78	0.71	0.83	50.0
North: Gngara RD (N)														
5	T1	409	16.1	409	16.1	0.440	7.6	LOS A	3.8	32.6	0.89	0.73	0.89	50.8
6	R2	324	16.4	324	16.4	0.497	17.9	LOS B	4.3	37.3	0.91	0.95	1.02	27.3
6u	U	12	16.4	12	16.4	0.497	20.8	LOS C	4.3	37.3	0.91	0.95	1.02	27.3
Approach		745	16.2	745	16.2	0.497	12.3	LOS B	4.3	37.3	0.89	0.83	0.95	41.9
West: Gngara RD (W)														
7	L2	412	20.1	412	20.1	0.591	4.8	LOS A	5.4	47.9	0.71	0.70	0.72	31.4
9	R2	536	16.1	536	16.1	0.591	11.7	LOS B	5.4	47.9	0.71	0.70	0.72	49.5
9u	U	52	20.1	52	20.1	0.591	14.6	LOS B	5.4	47.9	0.71	0.70	0.72	31.4
Approach		999	18.0	999	18.0	0.591	9.0	LOS A	5.4	47.9	0.71	0.70	0.72	44.3
All Vehicles		2924	15.1	2924	15.1	0.617	9.1	LOS A	6.2	51.3	0.79	0.74	0.82	45.8

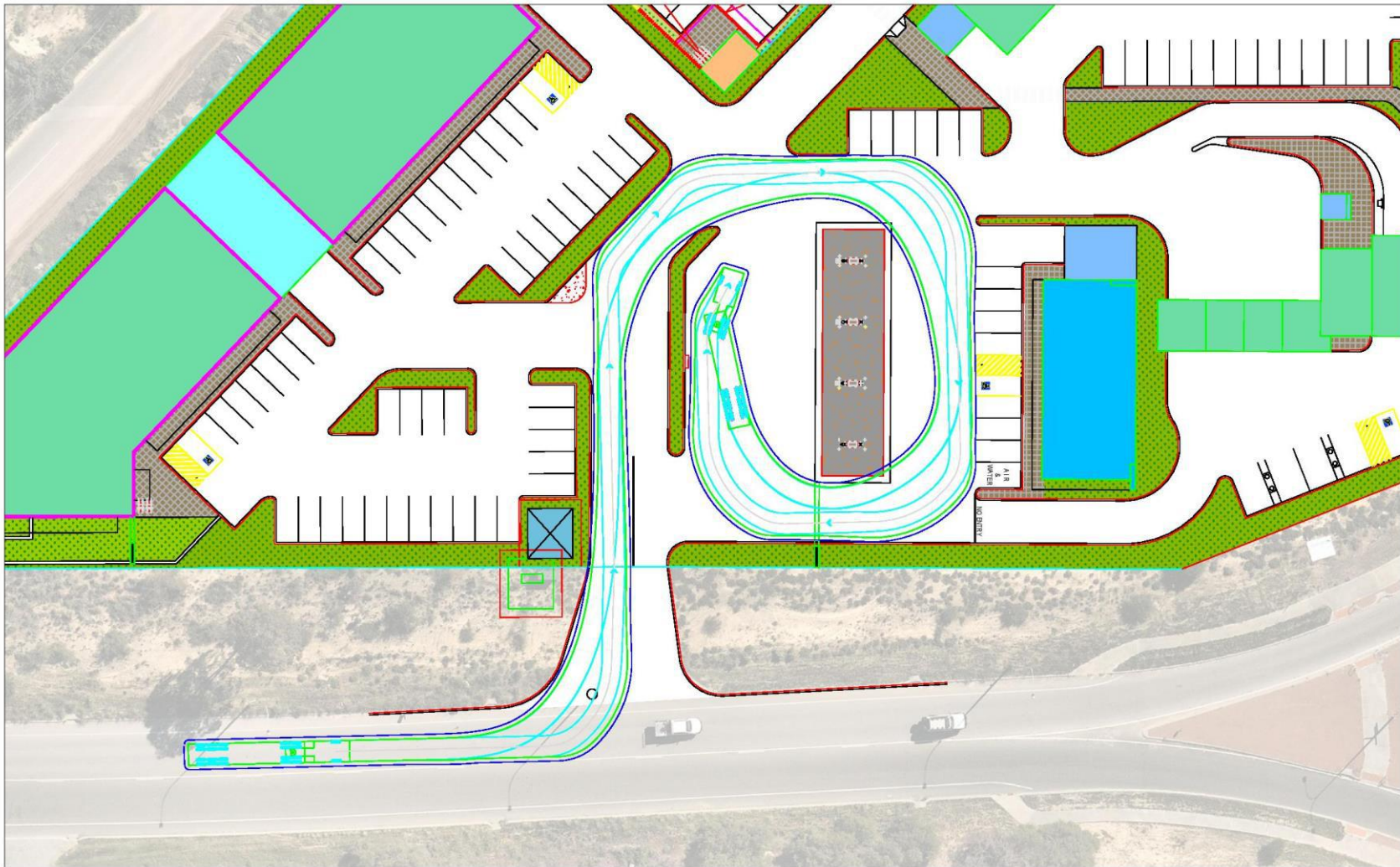


# Appendix D

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## TURN PATH ANALYSIS





Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 19.0m Semi-Trailer  
 Fuel tanker entry

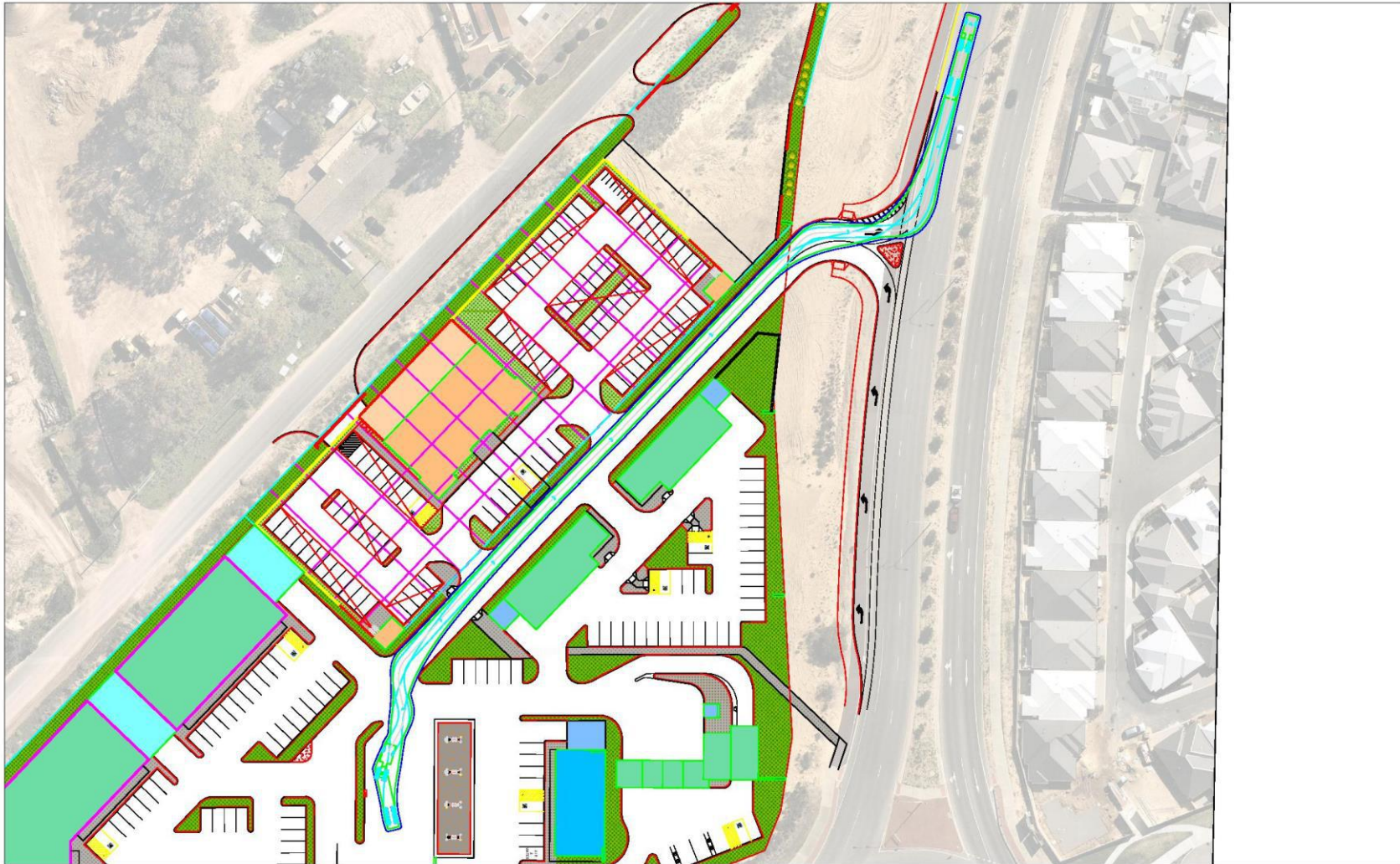
LEGEND  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk01a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austrorads 2013: 19.0m Semi-Trailer  
 Fuel tanker exit

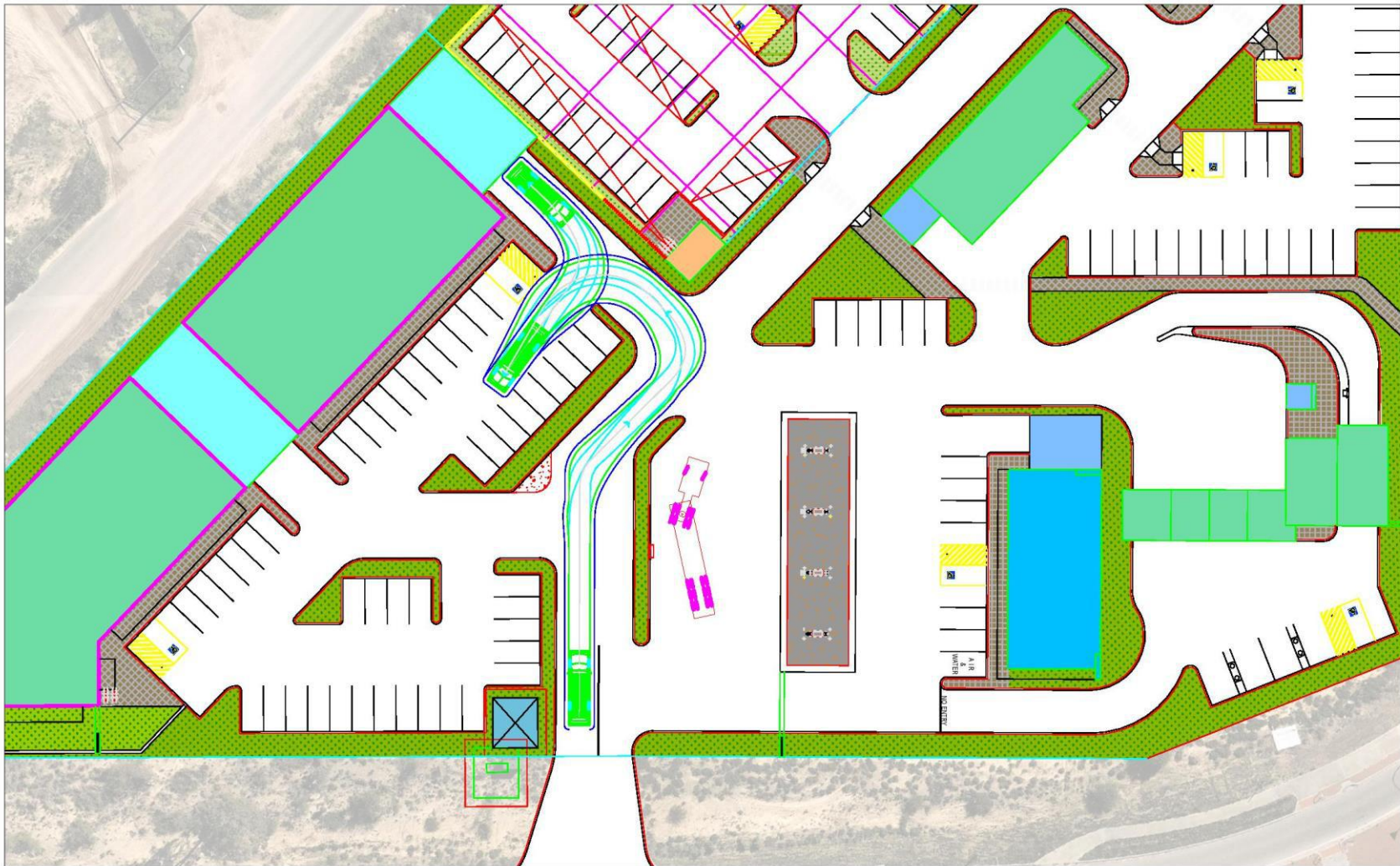
LEGEND  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



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 3/11/2021  
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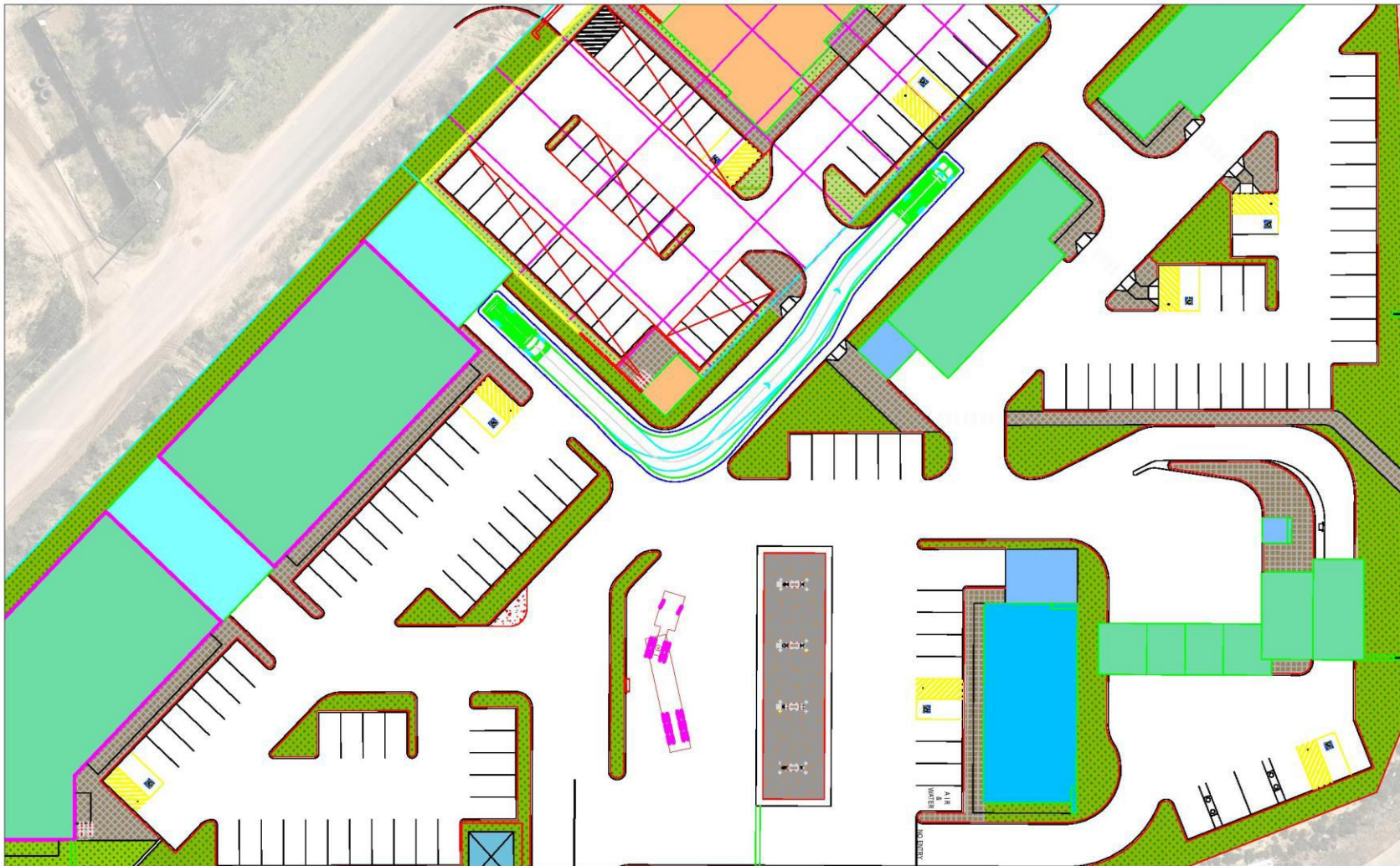
Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry - movement 1

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk09a  
 3/11/2021  
 Scale: 1:400 @ A3





Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle exit - movement 1

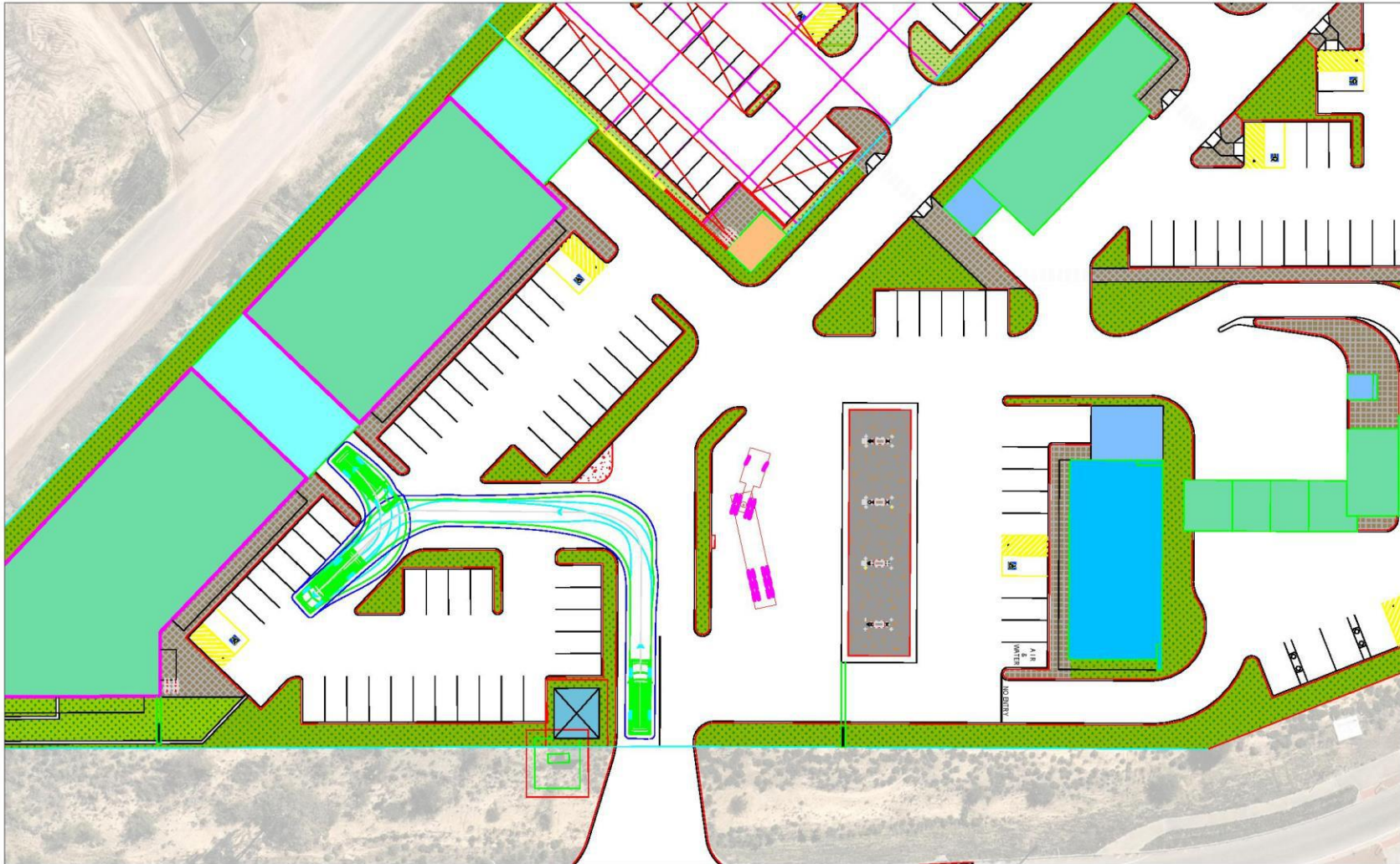
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk10a  
 3/11/2021  
 Scale: 1:400 @ A3







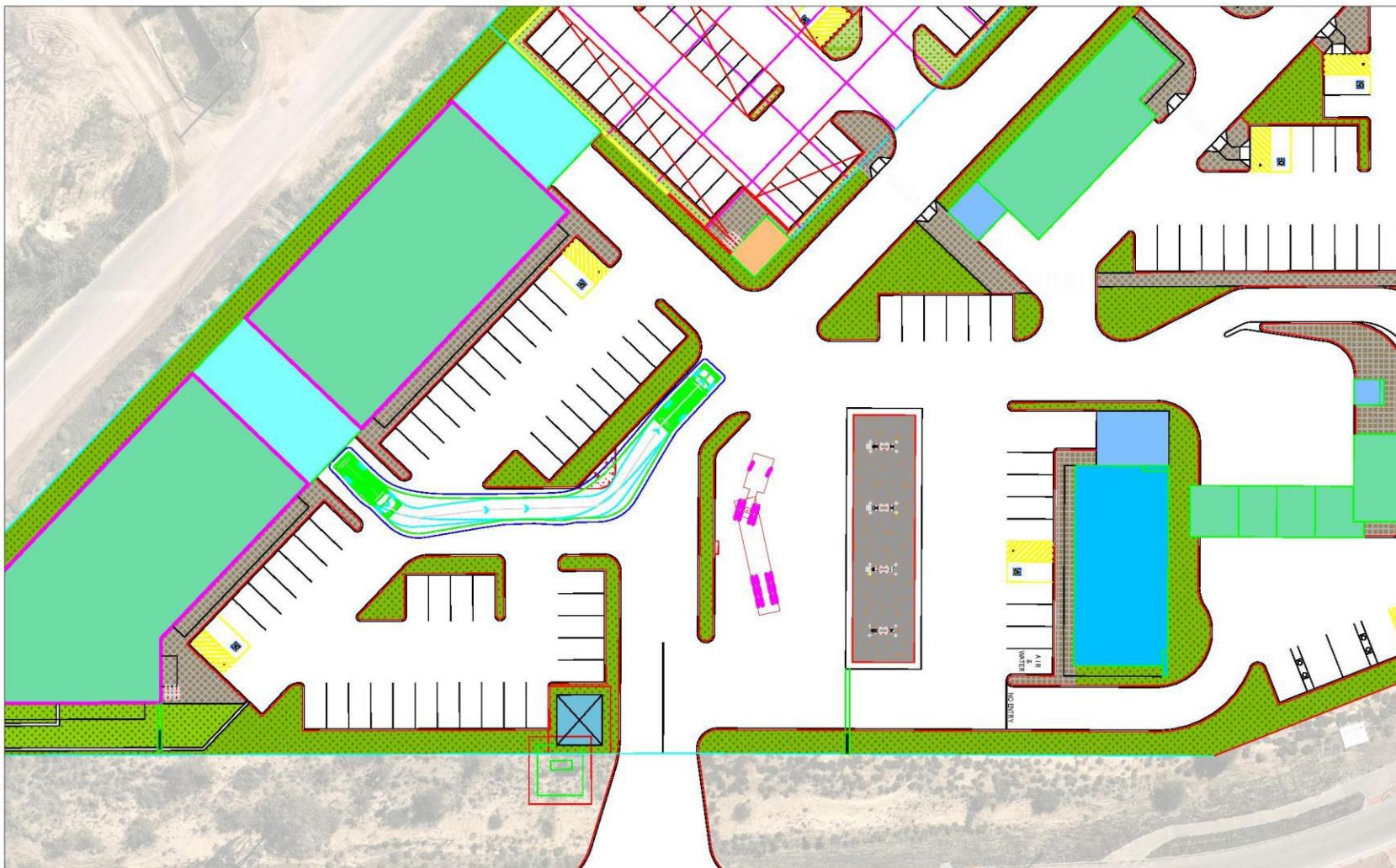
Lot 703 (#359) Gngara Road, Wangara  
 Austrorads 2013: 8.8m Service Vehicle  
 Service vehicle entry - movement 2

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk11a  
 3/11/2021  
 Scale: 1:400 @ A3





Lot 703 (#359) Gngangara Road, Wangara  
Austroads 2013: 8.8m Service Vehicle  
Service vehicle exit - movement 2

**LEGEND**

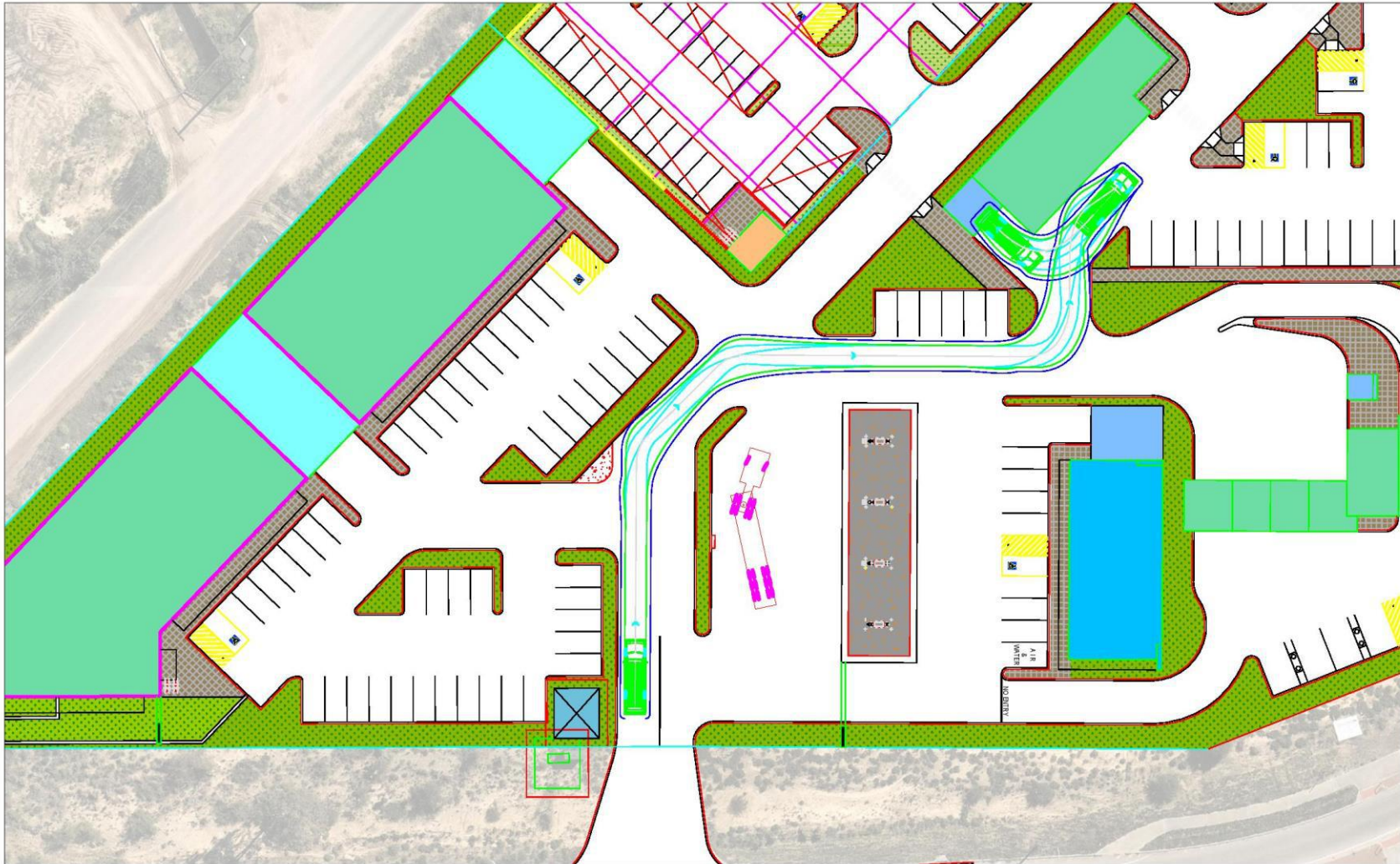
Vehicle Body  
Wheel Path  
500mm Clearance



t21.166.sk12a  
3/11/2021  
Scale: 1:400 @ A3







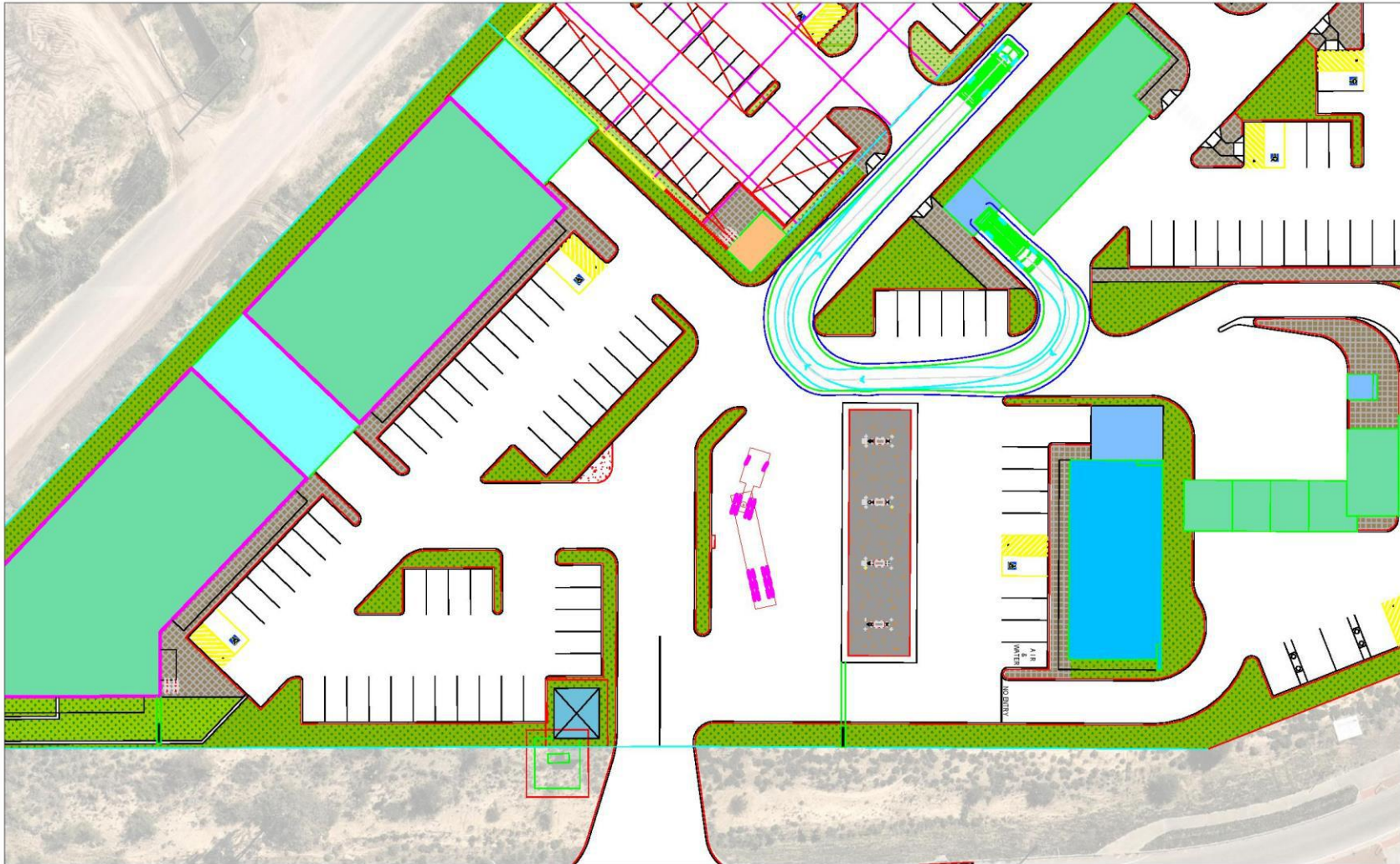
Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry - movement 3

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk13a  
 3/11/2021  
 Scale: 1:400 @ A3





Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle exit - movement 3

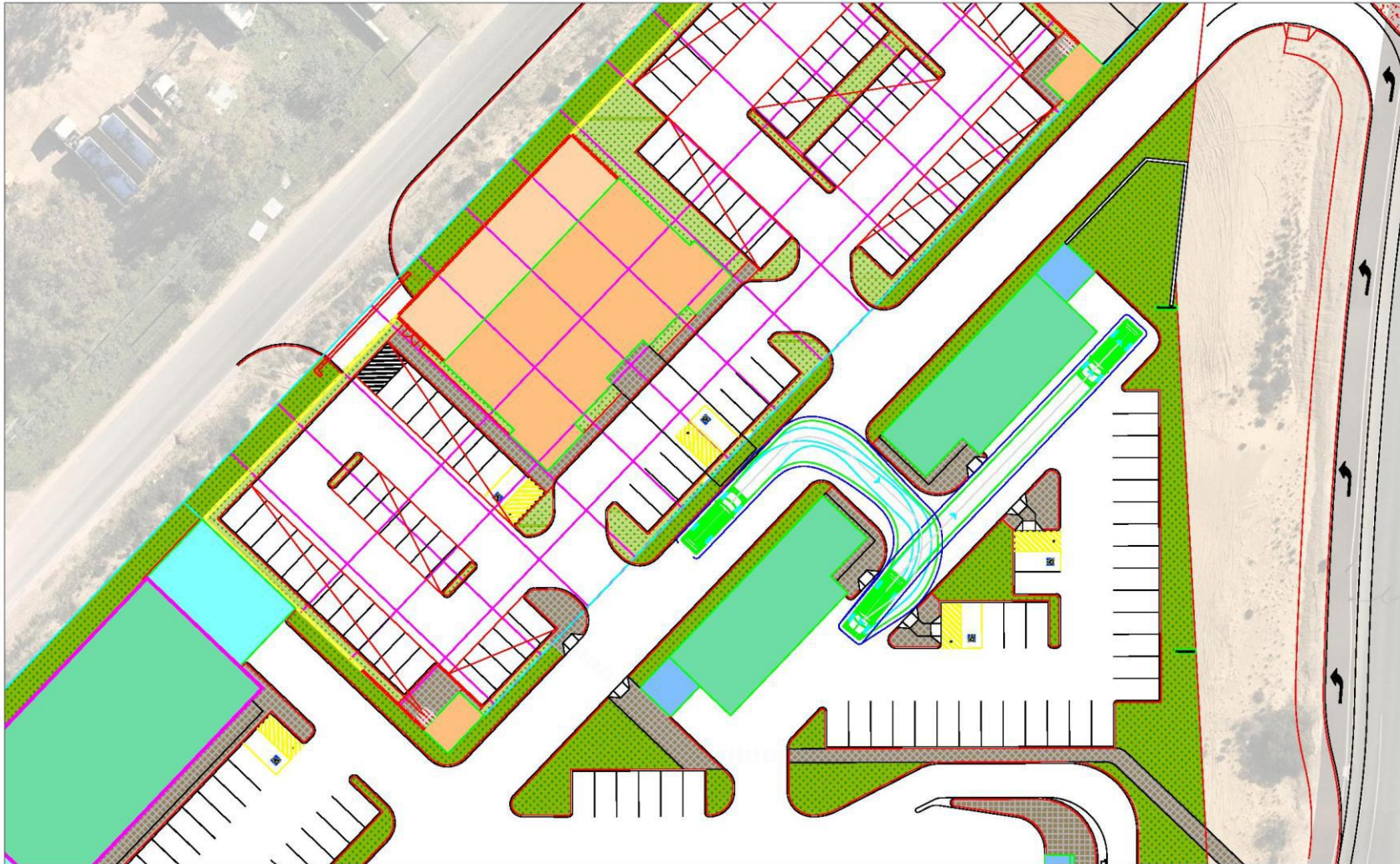
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk14a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry - movement 4

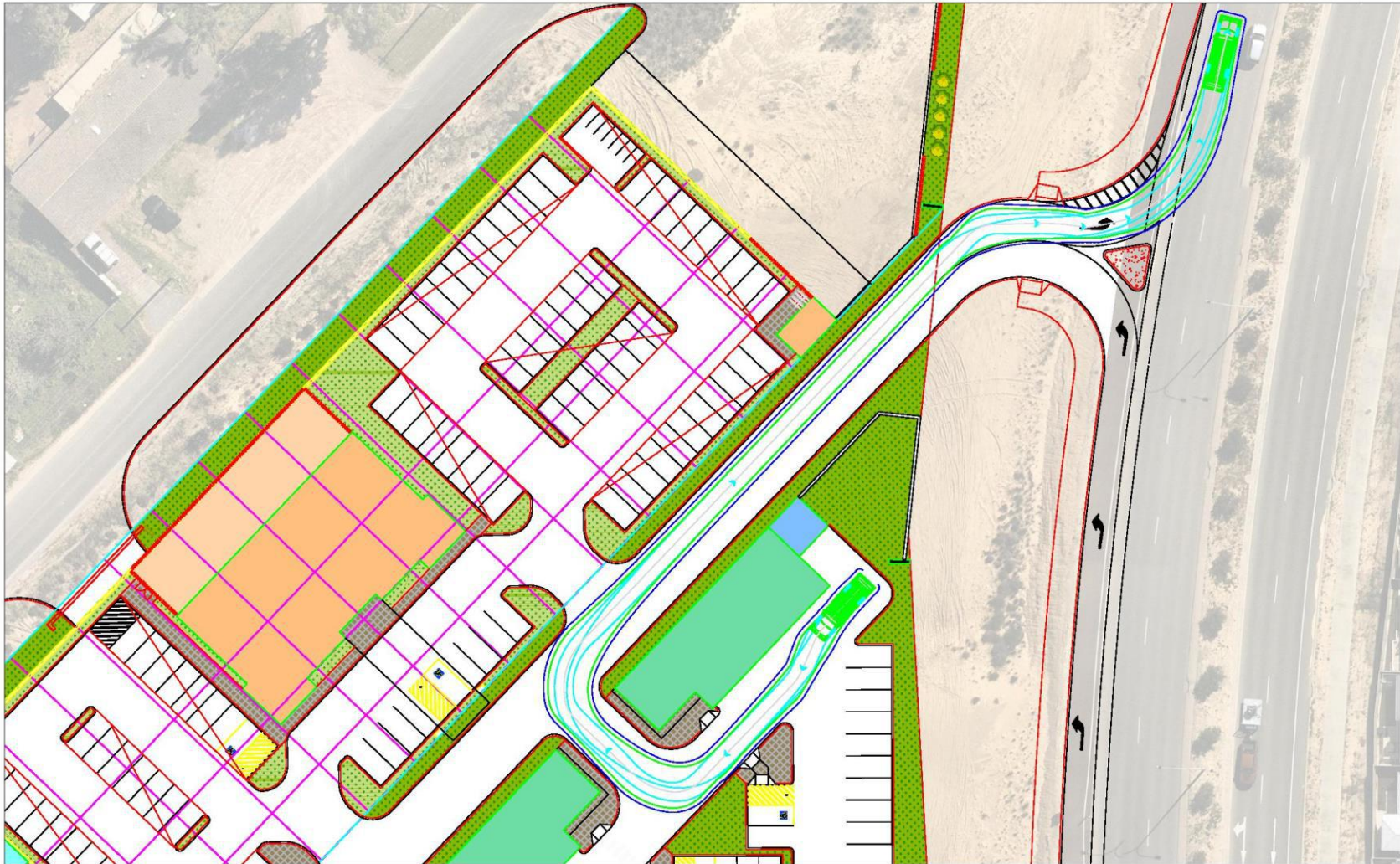
LEGEND  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk15a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle exit - movement 4

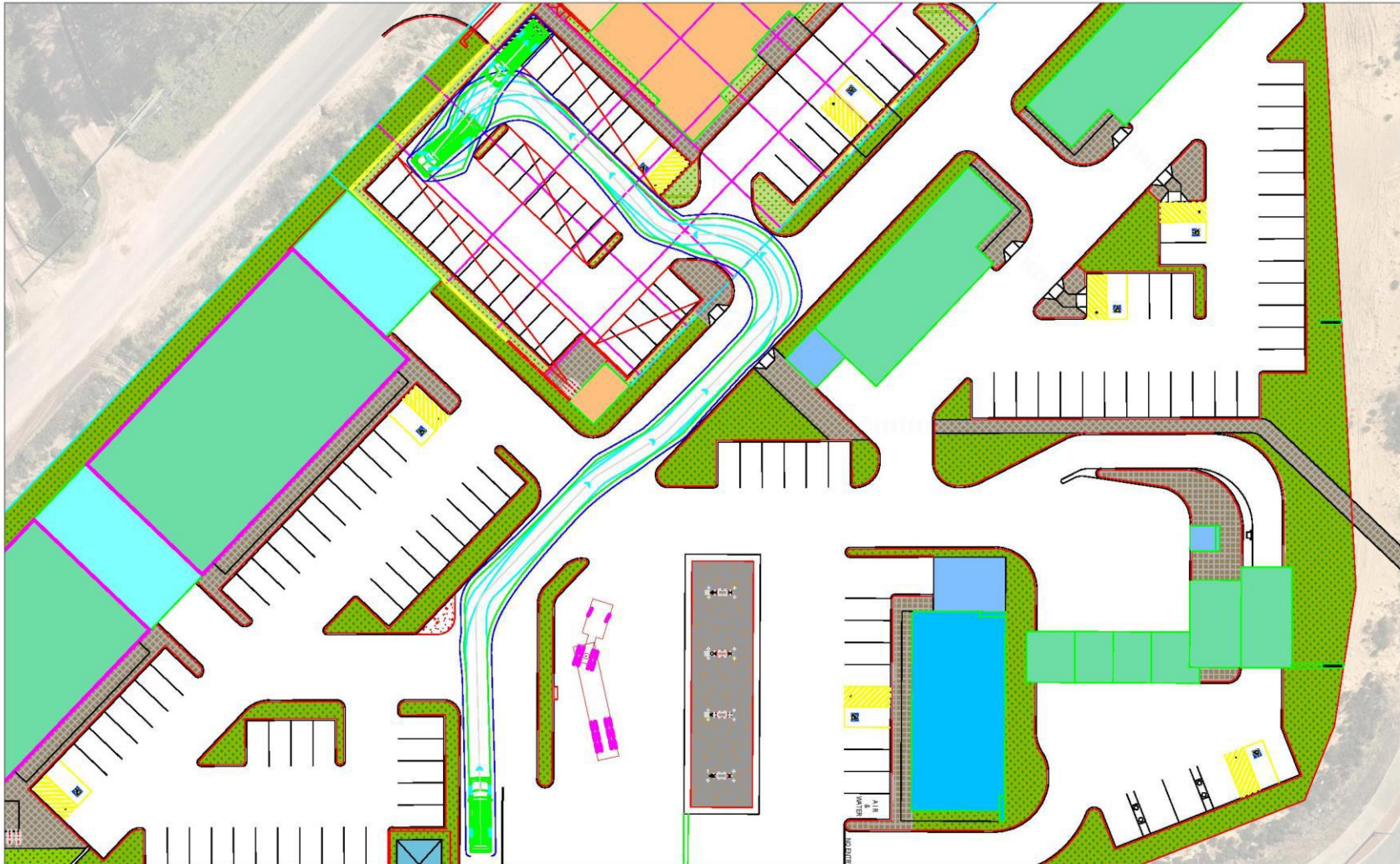
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk16a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry - movement 5

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk17a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle exit - movement 5

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk18a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 19m Semi-Trailer  
 Semi-trailer entry for delivery - movement 1

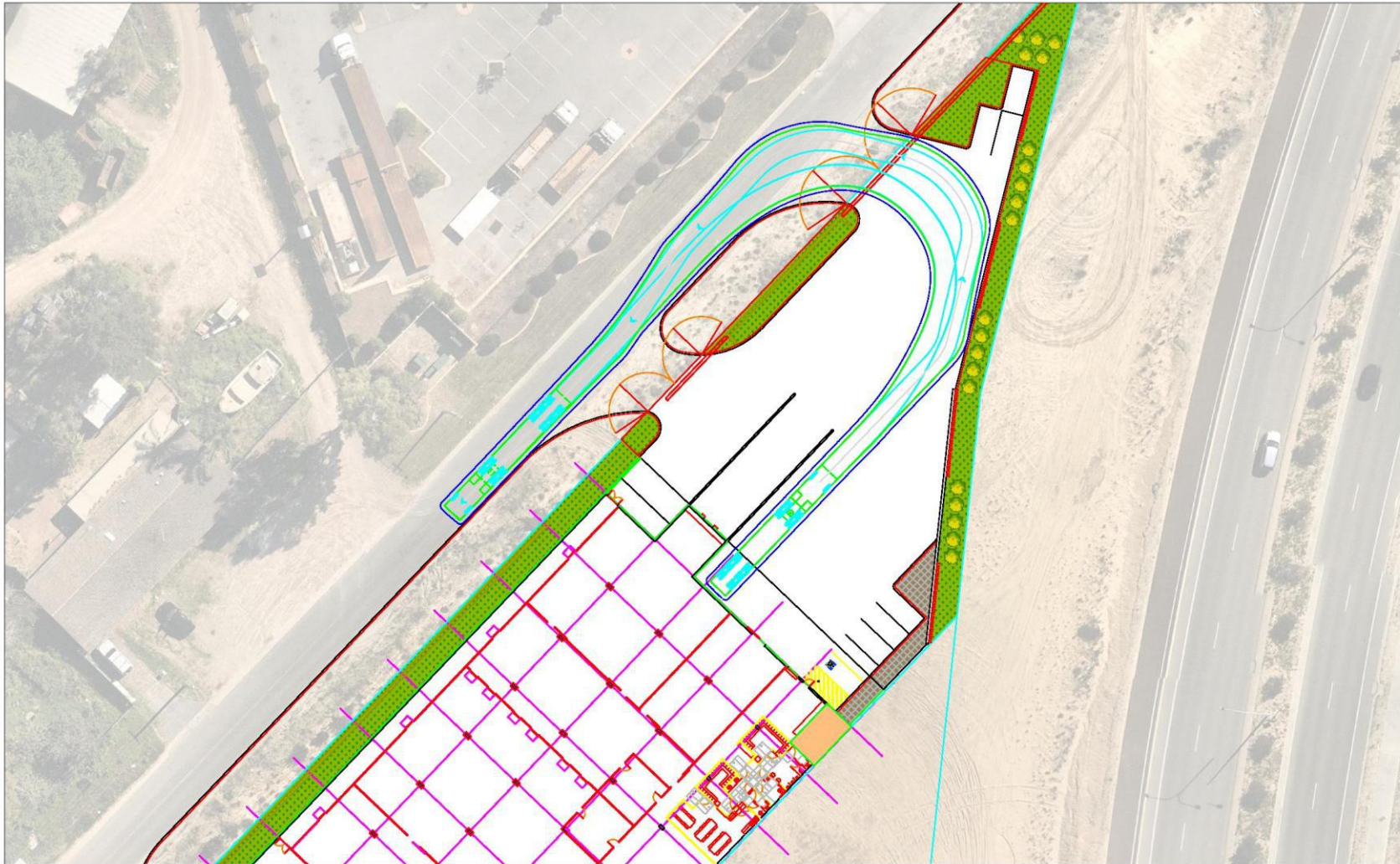
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk19a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 19m Semi-Trailer  
 Semi-trailer exit after delivery - movement 1

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk20a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 19m Semi-Trailer  
 Semi-trailer entry for delivery - movement 2

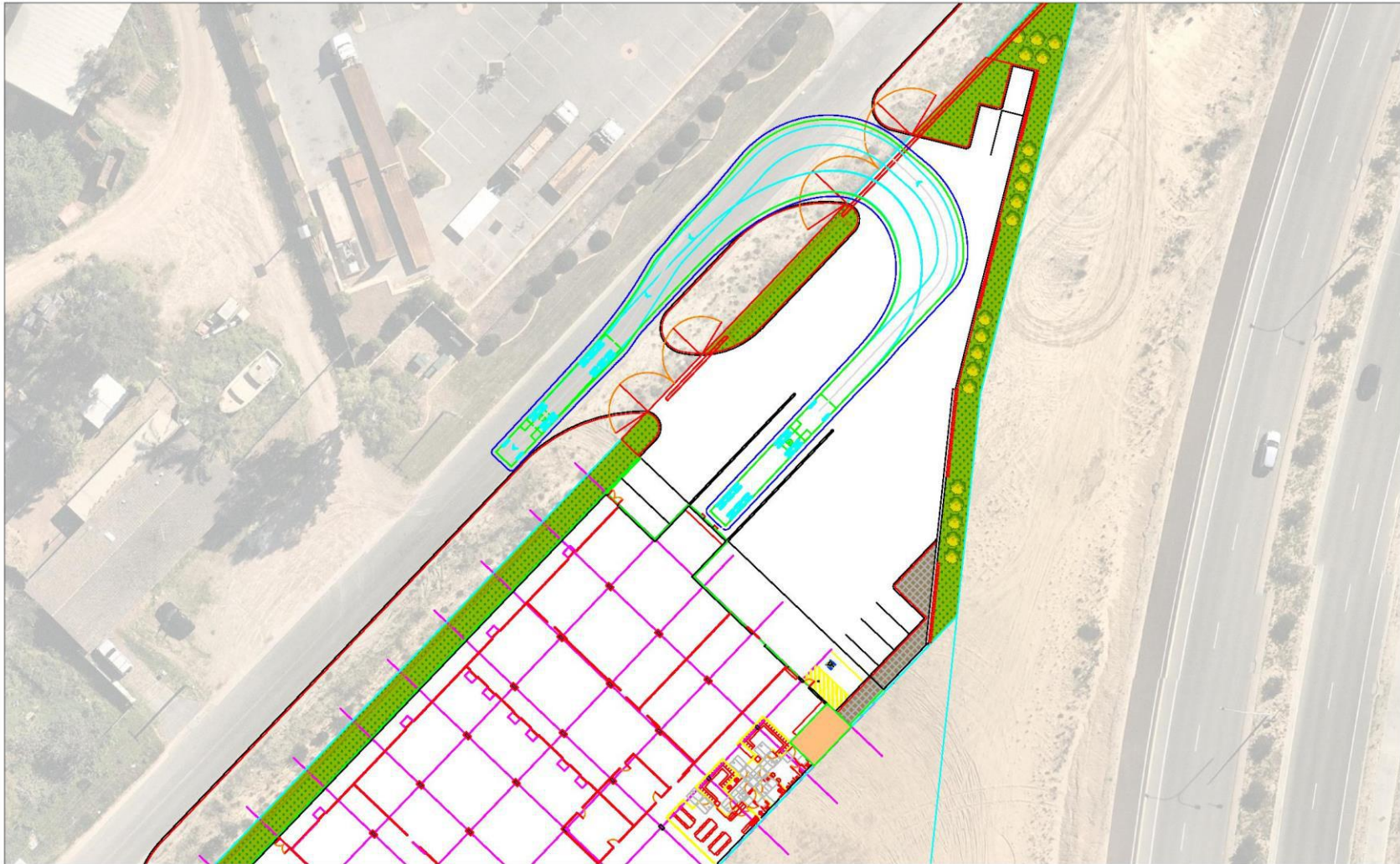
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk21a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 19m Semi-Trailer  
 Semi-trailer exit after delivery - movement 2

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk22a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry & exit movements for delivery

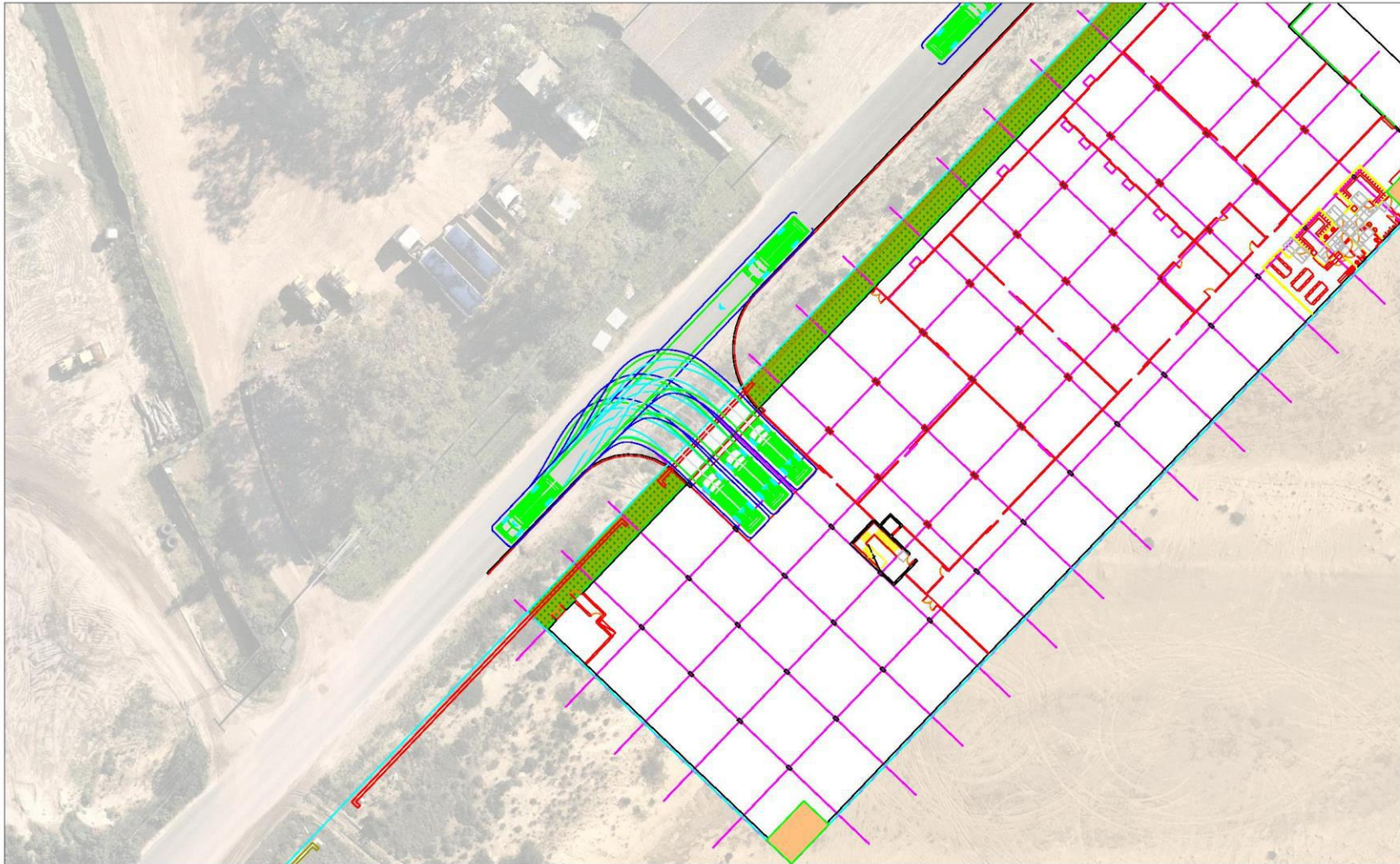
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk23a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle reverse entries for dispatch area

LEGEND  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk25a  
 3/11/2021  
 Scale: 1:400 @ A3







Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle forward exist from dispatch area

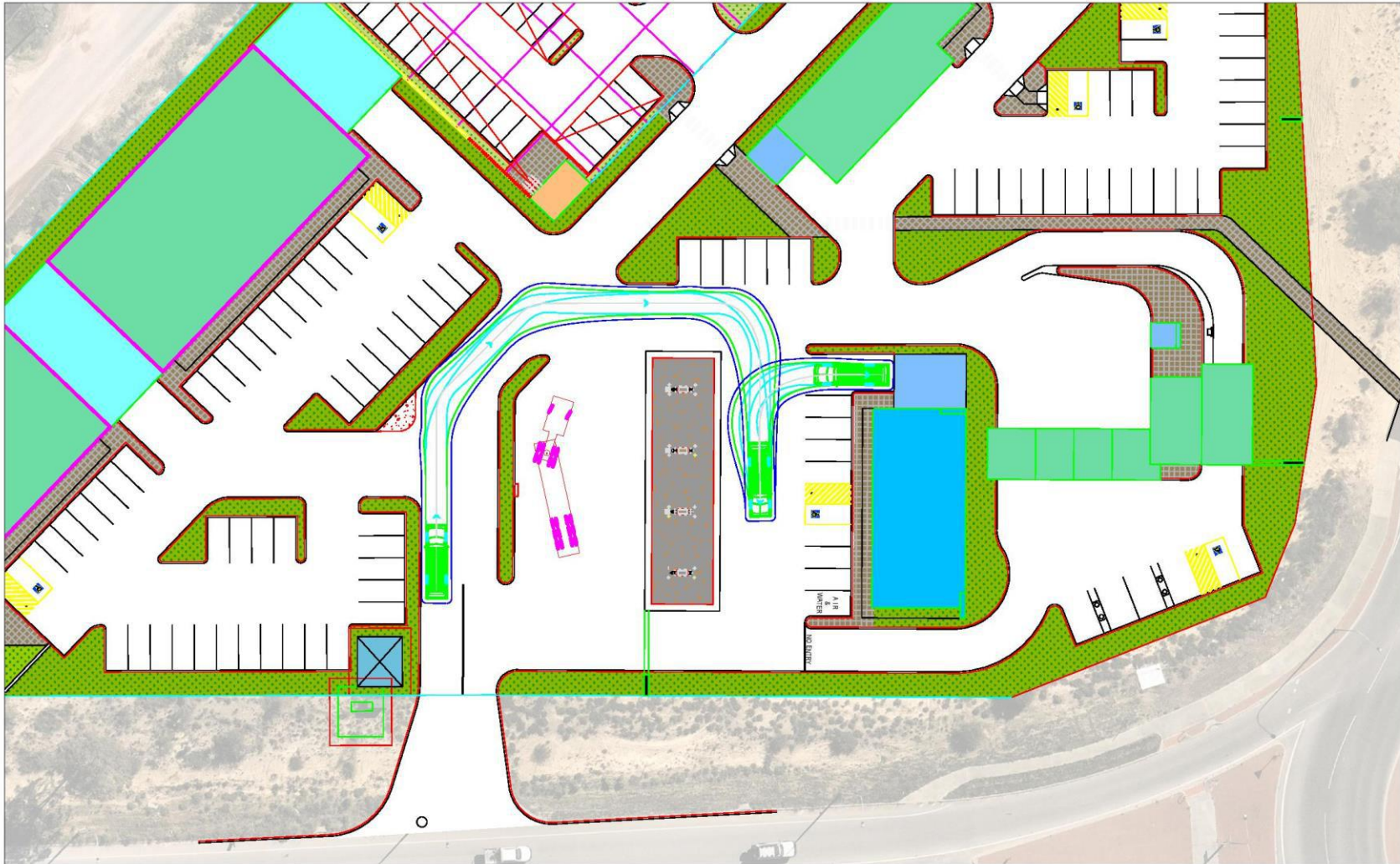
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk26a  
 3/11/2021  
 Scale: 1:400 @ A3







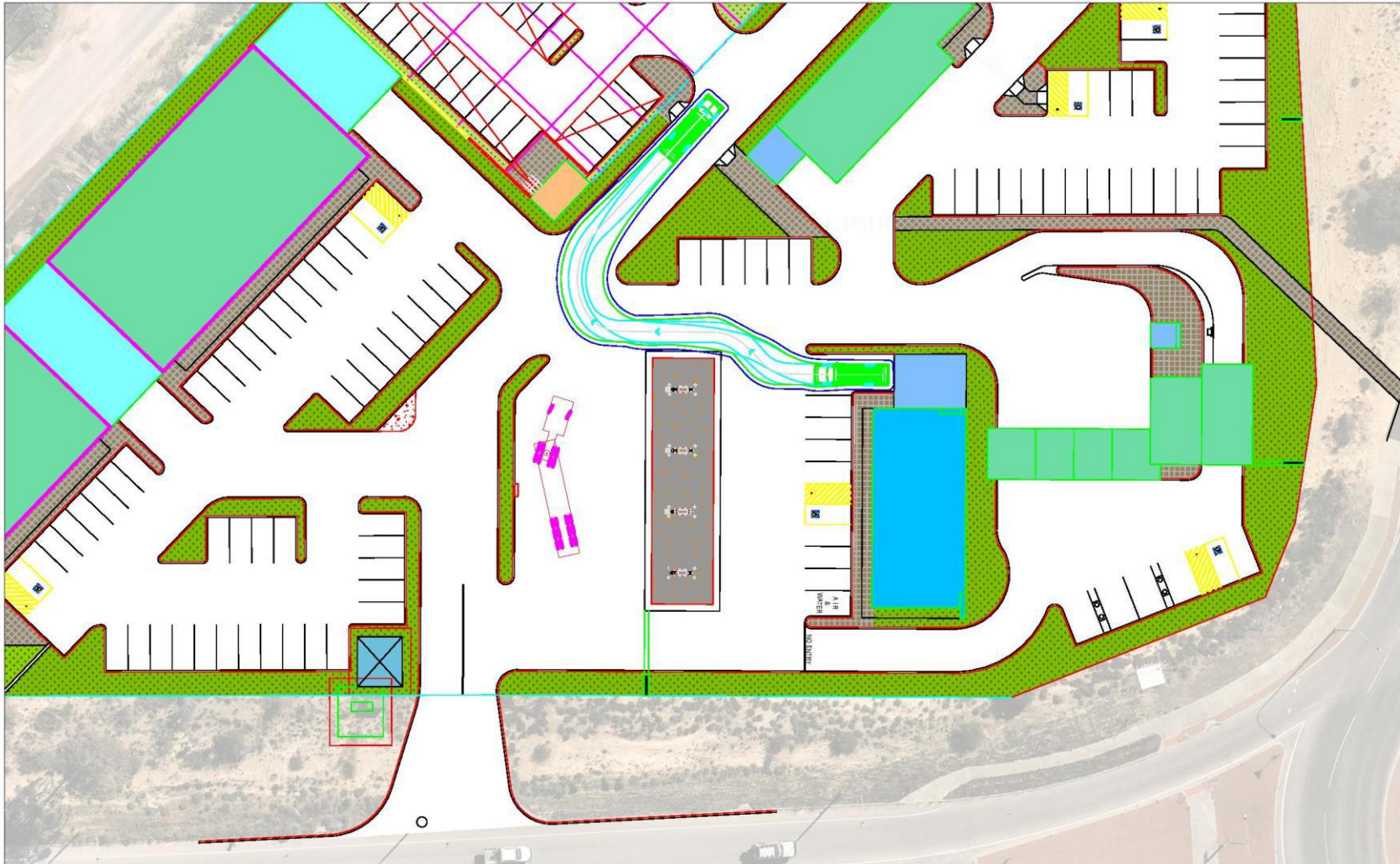
Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry (service station)

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk27a  
 3/11/2021  
 Scale: 1:400 @ A3





Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle exit (service station)

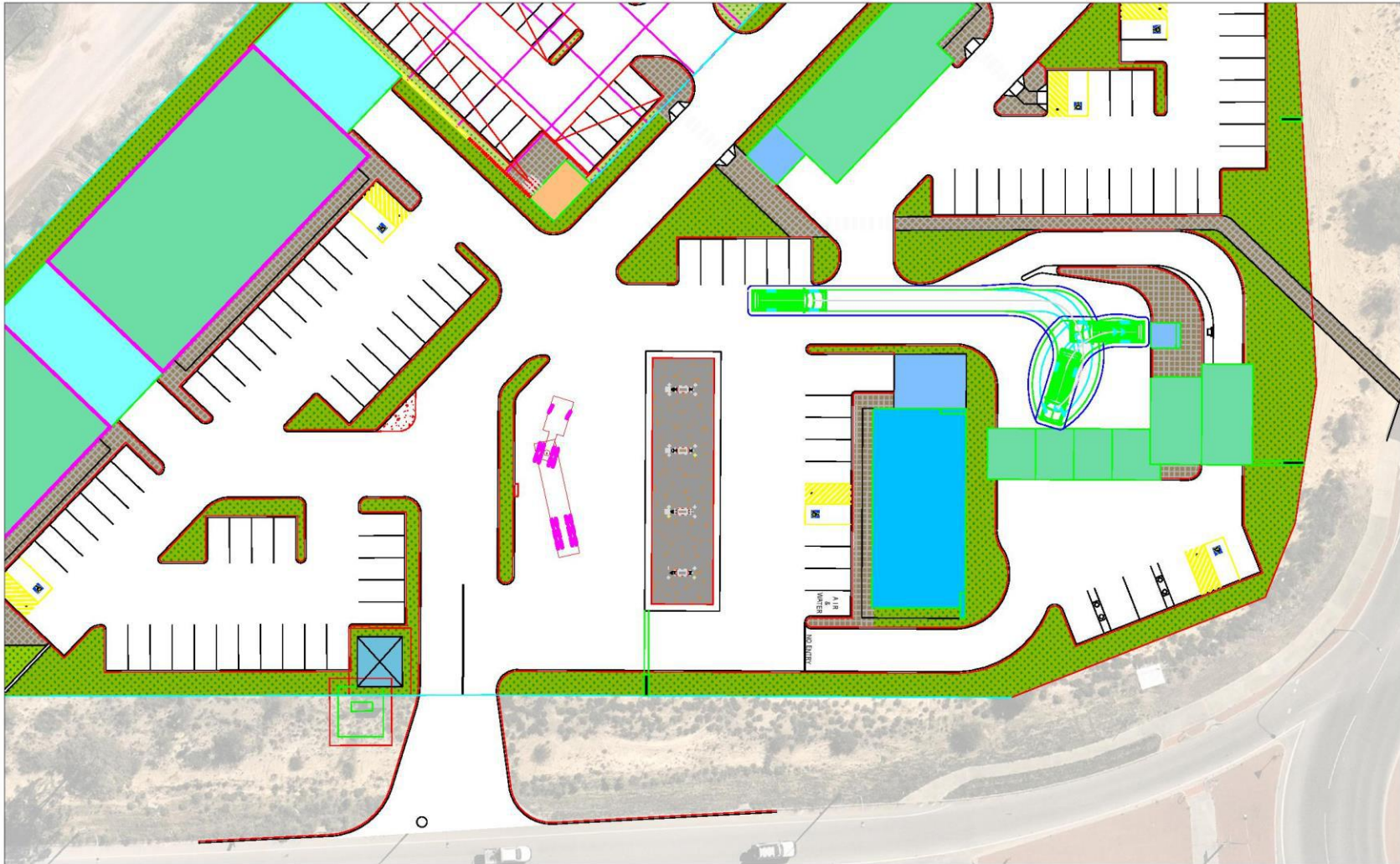
**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk28a  
 3/11/2021  
 Scale: 1:400 @ A3







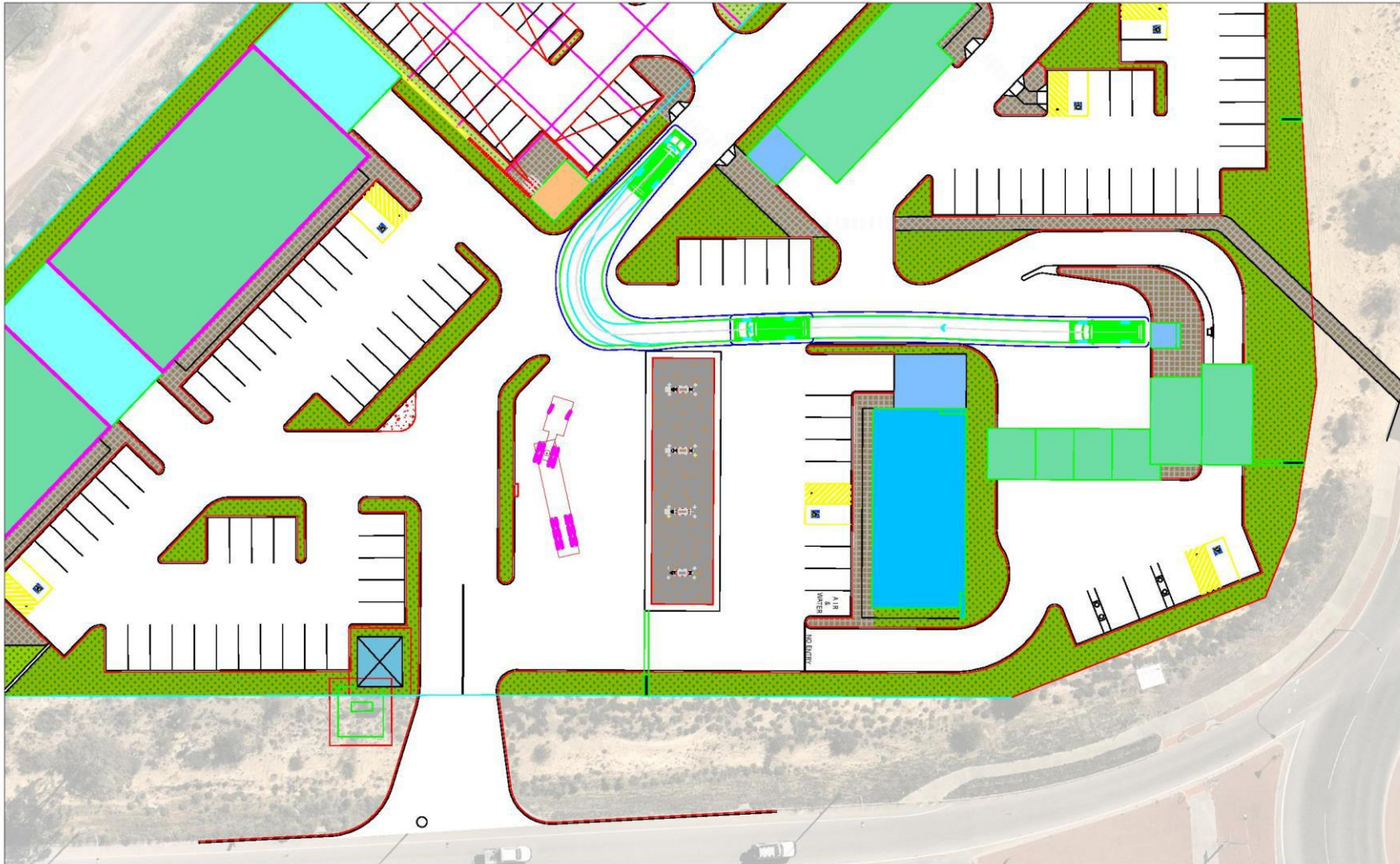
Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle entry (car wash)

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk29a  
 3/11/2021  
 Scale: 1:400 @ A3





Lot 703 (#359) Gngara Road, Wangara  
 Austroads 2013: 8.8m Service Vehicle  
 Service vehicle exit (car wash)

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t21.166.sk30a  
 3/11/2021  
 Scale: 1:400 @ A3

