



# Transport Impact Assessment

Project: Proposed Service Station  
310 Bernard Road North, Carabooda

Client: Vibe Petroleum c/o Light and Space Architects

Author: Paul Nguyen

Date: 9<sup>th</sup> May 2022

Shawmac Document #: 2203014-TIA-001

CONSULTING CIVIL AND TRAFFIC ENGINEERS  
1 ST. FLOOR, 908 ALBANY HIGHWAY, EAST VICTORIA PARK WA 6101.  
PHONE|+61 8 9355 1300  
EMAIL| admin@shawmac.com.au



**ISO 9001 QUALITY**  
Certified System



Document Status: Client Review

Version	Prepared By	Reviewed By	Approved By	Date
A	P Nguyen	R Needham	P Nguyen	09/05/2022

Disclaimer

Although all care has been taken in the preparation of this document, Shawmac Pty Ltd and all parties associated with the preparation of this document disclaim any responsibility for any errors or omissions. Shawmac Pty Ltd reserves the right to amend or change this document at any time. This document does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Liability is expressly disclaimed by Shawmac Pty Ltd for any loss or damage which may be sustained by any person acting on this document © Shawmac Pty. Ltd. 2022 ABN 51 828 614 001

File Reference: Y:\Jobs Active 2022\T&T - Traffic & Parking\Light and Space\_Vibe Carabooda\_TIA\_2203014\3. Documents\3.2 Reports\Light and Space\_Vibe Carabooda\_TIA\_Draft.docx



## Contents

1.	Introduction and Background .....	1
1.1.	Proponent .....	1
1.2.	Site Location .....	1
1.3.	Scope.....	2
2.	Development Proposal.....	3
2.1.	Land Uses.....	3
2.2.	Access Arrangement.....	3
3.	Existing Situation.....	5
3.1.	Road Network .....	5
3.1.1.	Layout and Hierarchy .....	5
3.1.2.	Traffic Counts .....	6
3.2.	Changes to Surrounding Transport Networks.....	8
4.	Transport Assessment .....	9
4.1.	Assessment Parameters .....	9
4.2.	Traffic Generation .....	9
4.2.1.	Weekday .....	9
4.3.	Traffic Distribution .....	11
4.4.	Traffic Impact .....	12
4.4.1.	Intersection Capacity.....	12
4.5.	Auxiliary Lanes.....	14
5.	Road Safety .....	17
5.1.	Crash History .....	17
6.	Public Transport Access .....	19
7.	Pedestrian / Cycle Access and Amenity.....	19
8.	Parking Assessment .....	20
8.1.	Car Parking .....	20



---

8.2. Parking Layout.....	20
9. Conclusions .....	21
Appendix A – SIDRA Intersection Analysis Results .....	22
Appendix B – Swept Paths.....	26

## Figures

Figure 1: General Site Location.....	1
Figure 2: Aerial View of the Site (January 2022) .....	2
Figure 3: Proposed Site Layout and Access Arrangement.....	4
Figure 4: Existing Road Network Hierarchy.....	5
Figure 5: Existing Speed Limits .....	6
Figure 6: Wanneroo Road - Traffic Counts.....	7
Figure 7: Mitchell Freeway Extension and Wanneroo Road Duplication .....	8
Figure 8: Distribution of Peak Hour Site Traffic .....	11
Figure 9: Intersection Model Layout .....	12
Figure 10: Major Road Traffic Volume Calculation .....	14
Figure 11: Warrants Assessment Results .....	15
Figure 12: Typical AUL, CHL and CHR Layouts.....	16
Figure 13: Crash History January 2017 to December 2021 .....	17

## Tables

Table 1: Proposed Development Vehicle Trip Generation .....	9
Table 2: Wanneroo Road / Bernard Road North - SIDRA Intersection Capacity Analysis Results Summary .....	13

## 1. Introduction and Background

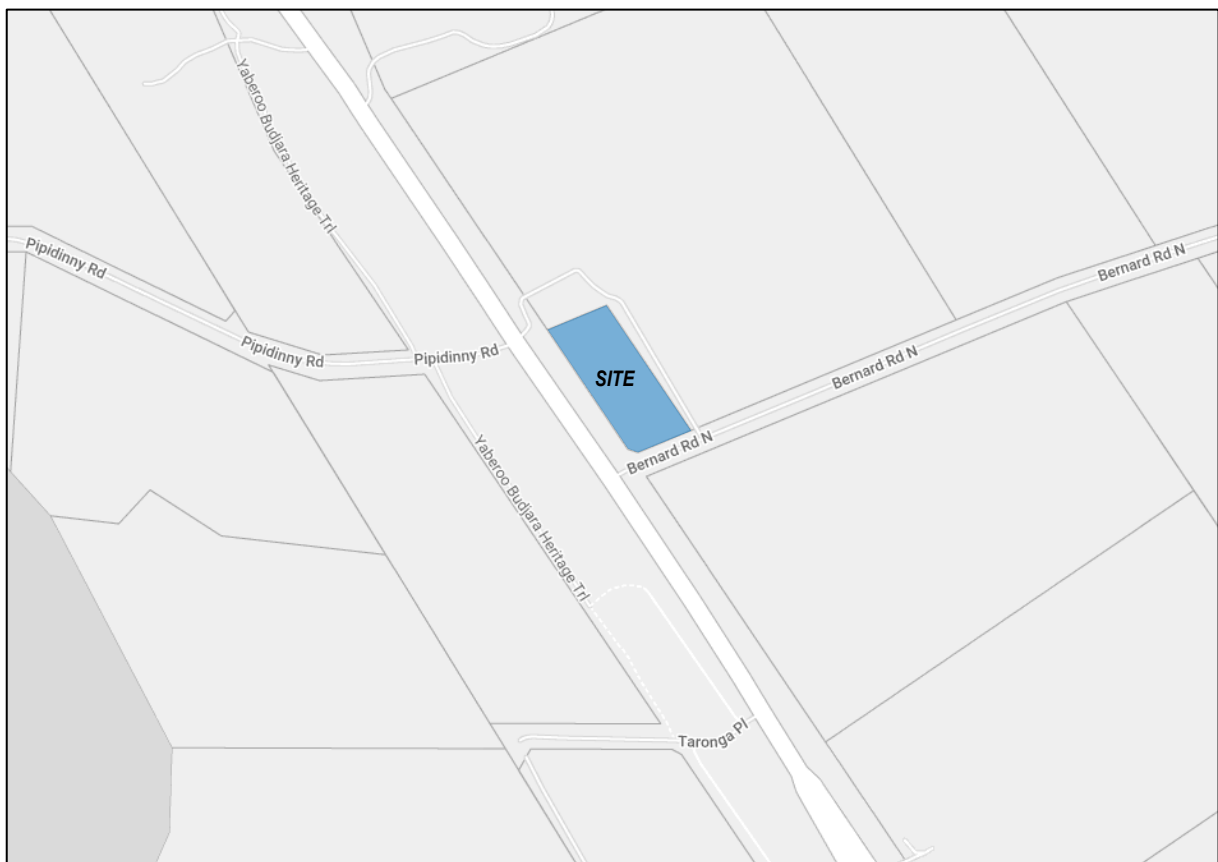
---

### 1.1. Proponent

Shawmac Pty Ltd has been engaged by Vibe Petroleum to prepare a Transport Impact Assessment (TIA) for a proposed service station at 310 Bernard Road North in Carabooda.

### 1.2. Site Location

The general site location is shown in **Figure 1**. The local authority is the City of Wanneroo.



**Figure 1: General Site Location**

An aerial view of the existing site is shown in **Figure 2**.



Figure 2: Aerial View of the Site (January 2022)

### 1.3. Scope

This TIA has been prepared in accordance with the Western Australian Planning Commission's (WAPC) *Transport Impact Assessment Guidelines*. According to the TIA guidelines, the key objectives of a TIA are to:

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



---

## 2. Development Proposal

---

### 2.1. Land Uses

The proposed development is a new service station comprising 16 fuelling positions and a convenience store.

### 2.2. Access Arrangement

Preliminary advice from Main Roads WA is that direct vehicle access to Wanneroo Road will not be supported and that all vehicle access will need to be via the Bernard Road North frontage.

The Wanneroo Road / Bernard Road North intersection would then need to be upgraded with left and right turn lanes to minimise the impact on through traffic along Wanneroo Road. This is discussed later in this assessment.

The proposed site layout and vehicle access arrangement is shown in **Figure 3**. The layout of the upgraded intersection is subject to engineering design in accordance with Main Roads WA and Austroads guidelines.

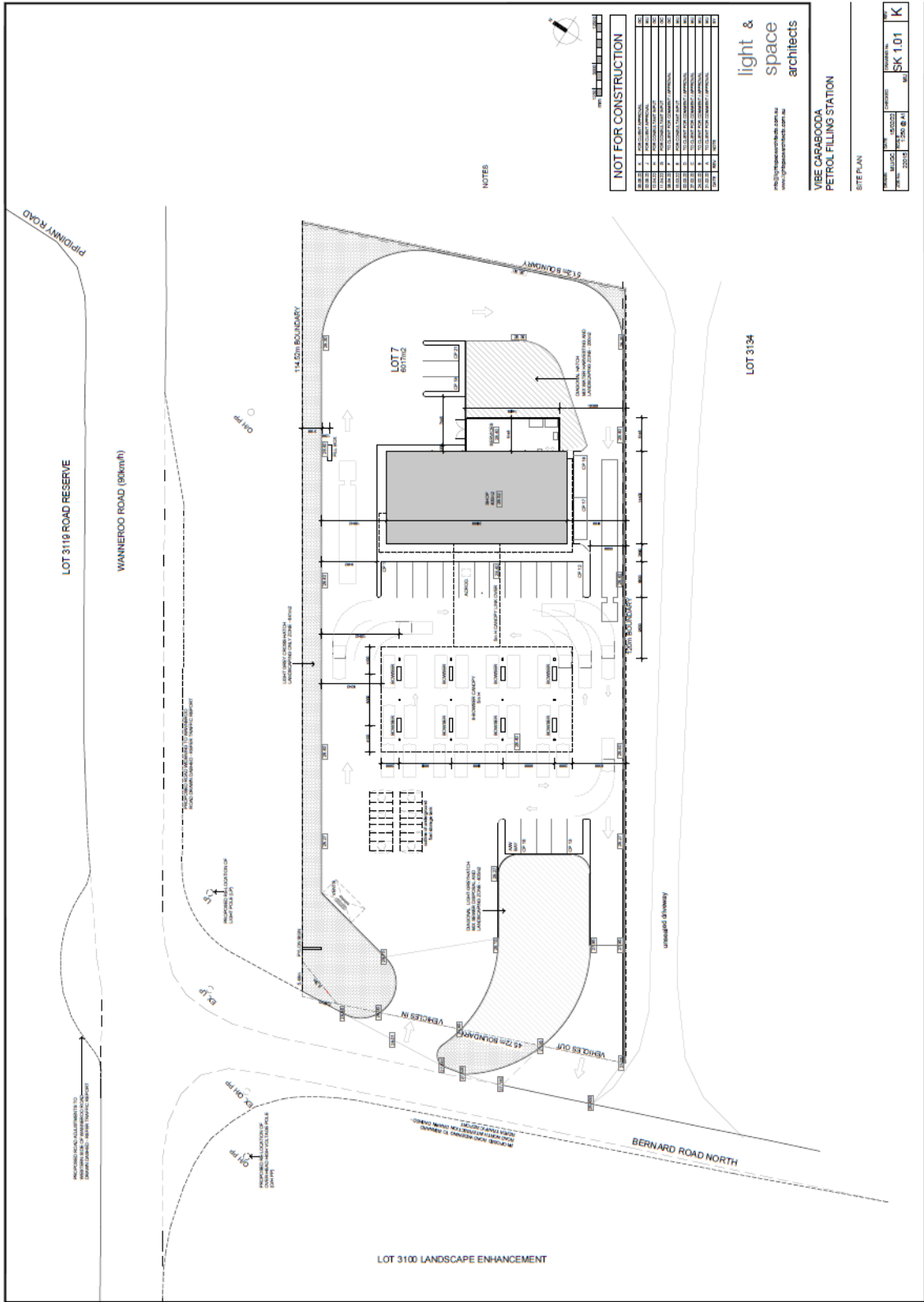


Figure 3: Proposed Site Layout and Access Arrangement



### 3. Existing Situation

#### 3.1. Road Network

##### 3.1.1. Layout and Hierarchy

The layout and hierarchy of the existing local road network according to the Main Roads WA *Road Information Mapping System* is shown in **Figure 4**.

As shown, Wanneroo Road is a Primary Distributor Road which is controlled by Main Roads WA. In the vicinity of the site, Wanneroo Road is constructed as a two-lane, single carriageway road.

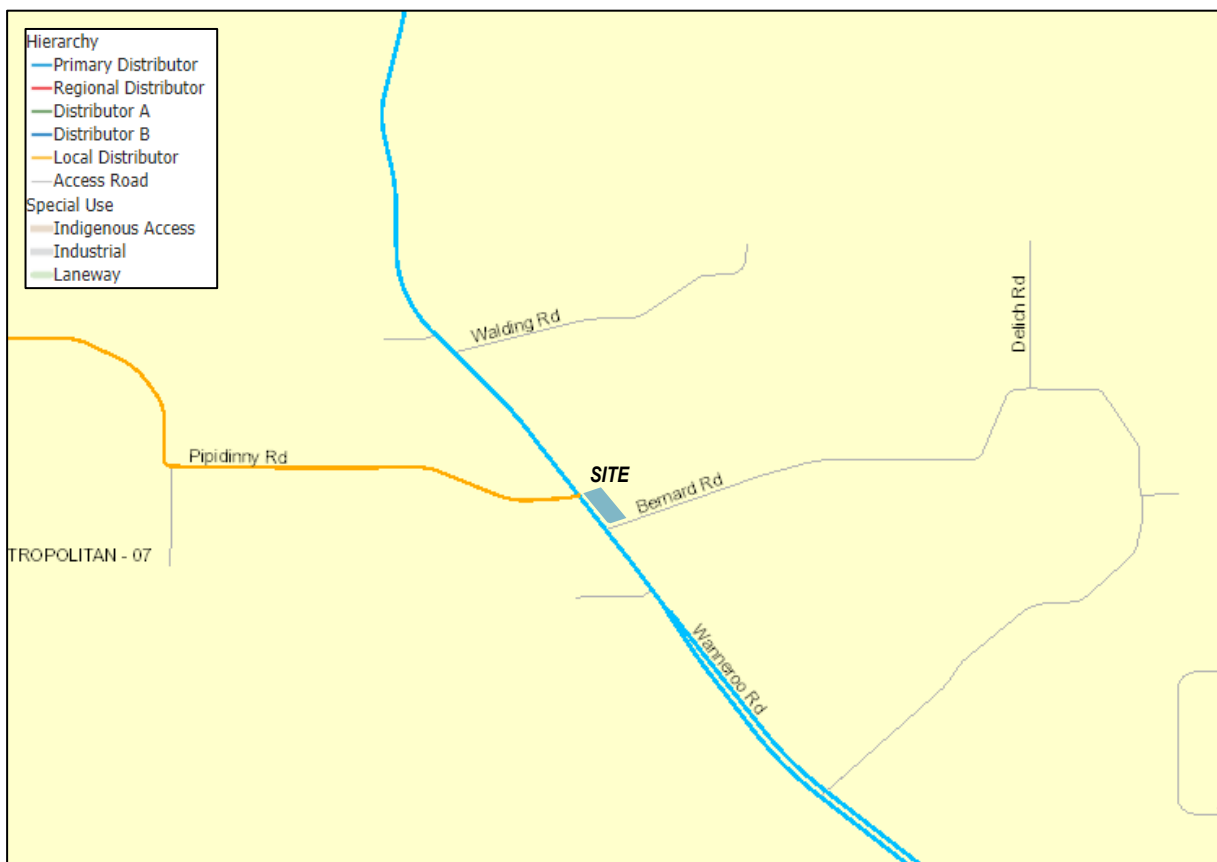


Figure 4: Existing Road Network Hierarchy

The existing speed limits are shown in **Figure 5**.



**Figure 5: Existing Speed Limits**

**3.1.2. Traffic Counts**

The latest traffic counts for Wanneroo Road were obtained from the Main Roads WA *Traffic Map* as shown in **Figure 6**. As shown, the daily and peak hour volumes are highest on a Friday. Although the daily traffic volume is much lower on a Sunday, the Sunday peak hour (11am to 12pm) traffic volume is almost as high as the Friday afternoon peak hour volume.

A peak hour traffic survey was undertaken in March 2022 to determine the existing weekday peak hour traffic volumes on Bernard Road North. Bernard Road North currently carries approximately 7 vehicles (4 light vehicles and 3 heavy vehicles) during the morning peak hour and 17 vehicles (11 light vehicles and 6 heavy vehicles) during the afternoon peak hour.



mainroads  
WESTERN AUSTRALIA

## RAW Hourly Volume By Day

Wanneroo Rd (H035)

South of Pipidiny Rd (SLK 43.31)

SITE 53248

Week Starting 23/11/2020

All Vehicles

	Monday 23/11/2020			Tuesday 24/11/2020			Wednesday 25/11/2020			Thursday 26/11/2020			Friday 27/11/2020			Saturday 28/11/2020			Sunday 29/11/2020		
	NB	SB	Both	NB	SB	Both	NB	SB	Both	NB	SB	Both	NB	SB	Both	NB	SB	Both	NB	SB	Both
00:00	21	9	30	28	15	43	32	10	42	31	13	44	25	10	35	38	13	51	42	26	68
01:00	17	8	25	19	13	32	22	10	32	12	14	26	20	12	32	32	16	48	37	27	64
02:00	21	20	41	10	18	28	13	15	28	17	15	32	22	12	34	19	10	29	24	17	41
03:00	18	31	49	20	49	69	27	50	77	27	48	75	19	39	58	17	19	36	24	18	42
04:00	53	171	224	79	203	282	83	173	256	94	172	266	84	162	246	71	61	132	42	30	72
05:00	203	610	813	180	624	804	180	638	818	209	631	840	187	558	745	151	161	312	77	67	144
06:00	452	715	1167	424	711	1135	411	699	1110	413	700	1113	399	641	1040	228	222	450	149	112	261
07:00	381	731	1112	323	738	1061	356	701	1057	350	745	1095	361	743	1104	263	369	632	181	201	382
08:00	370	695	1065	320	676	996	360	673	1033	357	661	1018	371	689	1060	344	489	833	241	295	536
09:00	391	491	882	350	501	851	366	569	935	370	500	870	373	589	962	495	527	1022	454	507	961
10:00	410	481	891	361	439	800	377	467	844	353	511	864	443	572	1015	577	548	1125	451	794	1245
11:00	425	499	924	383	412	795	374	432	806	380	483	863	496	510	1006	603	569	1172	538	769	1307
12:00	472	456	928	351	376	727	381	409	790	421	410	831	586	473	1059	592	528	1120	480	784	1264
13:00	412	455	867	461	350	811	436	404	840	427	467	894	612	456	1068	596	470	1066	441	691	1132
14:00	537	458	995	557	427	984	580	430	1010	574	439	1013	746	542	1288	531	422	953	426	604	1030
15:00	685	506	1191	718	456	1174	708	480	1188	744	533	1277	844	561	1405	527	431	958	432	653	1085
16:00	781	383	1164	773	406	1179	768	447	1215	777	459	1236	868	457	1325	480	424	904	402	560	962
17:00	757	342	1099	724	354	1078	785	371	1156	713	375	1088	912	380	1292	423	412	835	383	406	789
18:00	434	207	641	465	241	706	512	203	715	457	200	657	588	252	840	280	278	558	195	242	437
19:00	205	122	327	221	113	334	243	159	402	254	170	424	276	159	435	186	204	390	122	145	267
20:00	143	85	228	145	78	223	181	103	284	210	88	298	204	109	313	135	146	281	104	96	200
21:00	97	56	153	117	53	170	158	70	228	132	63	195	170	79	249	111	83	194	75	62	137
22:00	58	26	84	80	32	112	96	32	128	107	39	146	141	45	186	146	89	235	58	42	100
23:00	27	20	47	40	16	56	32	21	53	39	18	57	68	29	97	90	41	131	24	19	43
TOTAL	7370	7577	14947	7149	7301	14450	7481	7566	15047	7468	7754	15222	8815	8079	16894	6935	6532	13467	5402	7167	12569

Peak Statistics

AM TIME	06:15	07:15	06:00	06:00	07:15	06:00	06:15	07:30	06:00	06:15	07:15	07:15	10:45	07:15	07:15	11:00	11:00	11:00	11:00	10:15	10:45
VOL	462	741	1167	424	749	1135	427	714	1110	417	760	1114	506	751	1121	603	569	1172	538	837	1354
PM TIME	16:30	14:45	15:15	16:15	15:15	15:15	16:30	14:45	16:15	15:30	15:30	15:30	16:45	14:45	15:00	13:00	12:00	12:00	12:00	12:00	12:00
VOL	794	525	1203	789	457	1209	828	490	1264	789	537	1326	927	568	1405	596	528	1120	480	784	1264

No Data Available

Public Holidays

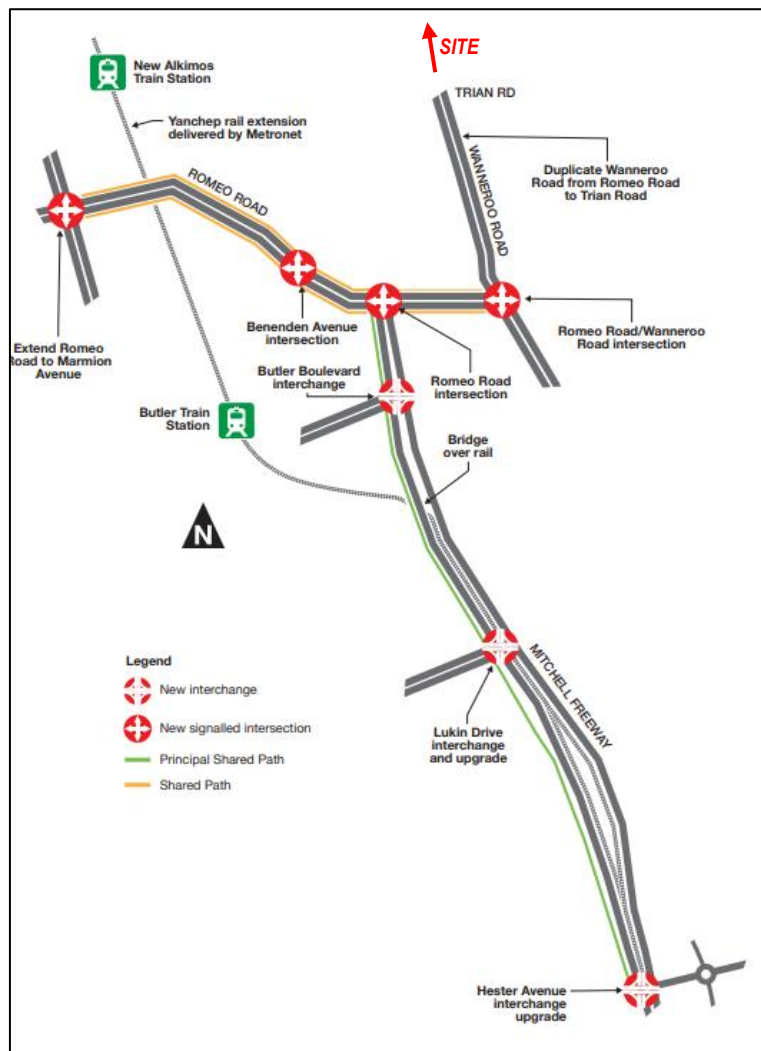
Figure 6: Wanneroo Road - Traffic Counts

### 3.2. Changes to Surrounding Transport Networks

Following proposed changes to the external road network are being progressed:

- Mitchell Freeway is being extended north of Hester Avenue to Romeo Road. Construction is underway and is due for completion by mid-2023.
- The section of Wanneroo Road to the south to the south of the site between Trian Road and Dunstan Road is being widened from a single carriageway to a four-lane, dual carriageway road. Construction is underway and due for completion by mid-2024.

The proposed changes are shown in **Figure 7**.



**Figure 7: Mitchell Freeway Extension and Wanneroo Road Duplication**

It is ultimately planned to duplicate the section of Wanneroo Road adjacent to the site but the timing of upgrading this section is not known.

## 4. Transport Assessment

### 4.1. Assessment Parameters

Transport Impact Assessments generally include consideration of two development horizons including:

- The year that the development is completed and operational which is currently estimated to be 2023.
- 10 years after opening which would be 2033.

As service stations rely on pass-by traffic, the critical peak hours for assessment would be the peak hours on the road network which would be the afternoon peak hour on a Friday (3 to 4pm) and the mid-day peak hour on a Sunday (11am to 12pm).

### 4.2. Traffic Generation

#### 4.2.1. Weekday

The volume of traffic generated by the development on a weekday has been estimated using standard vehicle trip generation rates from the Institute of Transportation Engineers (ITE) *Trip Generation*. The closest applicable land use was determined to be *Convenience Store / Gas Station*. The following is noted with regards to the trip generation:

- There was no daily trip generation rate for the weekend and so the weekday trip rate was used for the weekend.
- The distribution of trips was 50% entering / 50% exiting for all scenarios.
- The trip rates used are based on surveys in general urban and suburban settings. As the site is relatively rural, the actual trip generation is likely to be lower.

The estimated trip generation is calculated in **Table 1**.

**Table 1: Proposed Development Vehicle Trip Generation**

Land Use	Units	Quantity	Generation Rate			Number of Trips		
			Daily	AM Peak	PM Peak	Daily	AM Peak	PM Peak
Convenience Store / Gas Station - Weekday	Fuelling Positions	16	265.12	16.06	18.42	4,242	257	295
Convenience Store / Gas Station - Weekend	Fuelling Positions	16	265.12	17.01	-	4,242	272	-

As shown, the proposed development is estimated to generate 4,242 vehicles per day (vpd), 257 vehicles per hour (vph) during the weekday AM peak hour, 295 vph during the PM peak hour and 272 vph during the weekend mid-day peak hour.



A high proportion of vehicle trips to service stations are “pass-by” trips which are trips that are already on the road network that would divert to the site and then continue on. ITE surveys indicates that the proportion of pass-by trips at service stations are approximately 76% during the weekday AM peak and 75% during the weekday PM. There was no pass-by rate for the weekend peak hour but it is reasonable to assume that it would be of a similar magnitude as the weekday PM peak hour.

The net increase in traffic on the adjacent road network resulting from the development is therefore approximately 62 vehicles during the weekday AM peak hour, 74 vehicles during the weekday PM peak hour and 68 vehicles during the weekend mid-day peak hour.

According to the WAPC TIA guidelines, an increase of between 10 to 100 peak hour vehicles is considered to have a low to moderate impact. The estimated 62 to 74 additional peak hour vehicles is around the middle of this range and so the development traffic is considered to have a moderate impact on the road network.

### 4.3. Traffic Distribution

It is assumed that all development traffic would travel to and from the site via Wanneroo Road.

The north/south split of traffic has been derived from the directional traffic volumes along Wanneroo Road which are approximately 60% north / 40% south during the weekday PM peak and 40% north / 60% south during the weekend mid-day peak.

The development traffic has been assigned to the road network based on the above distribution as shown in **Figure 8**.

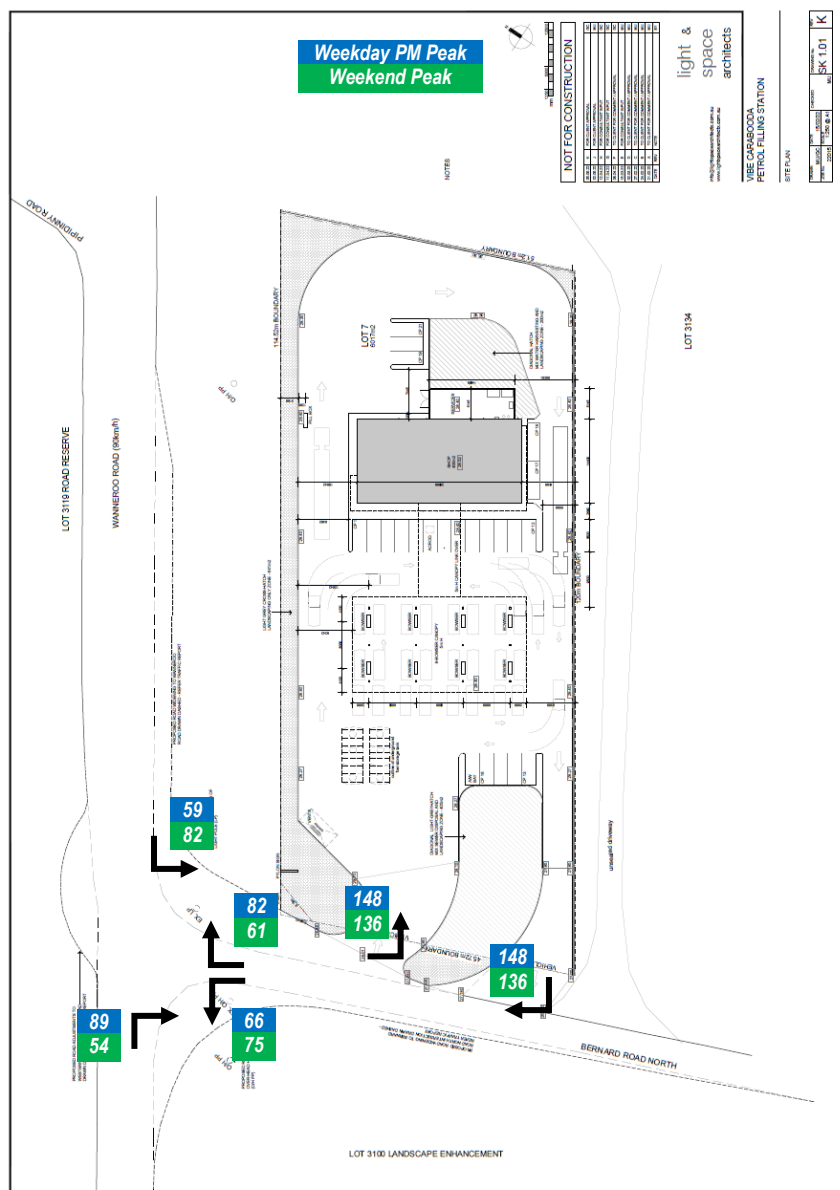
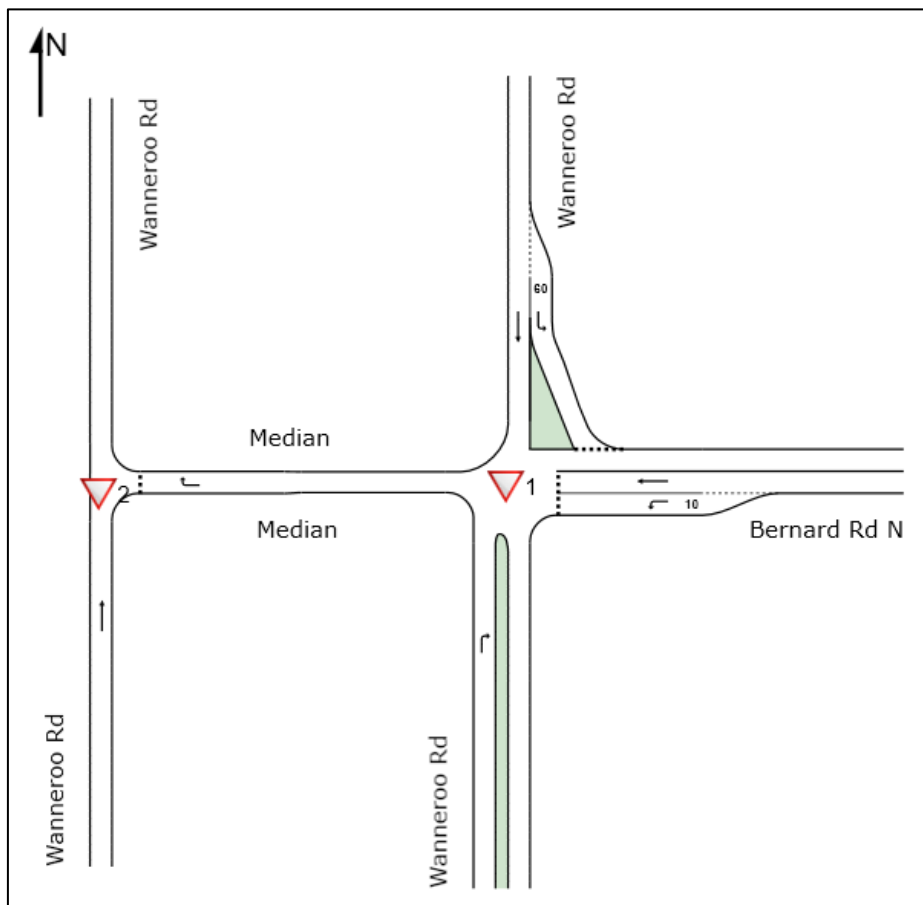


Figure 8: Distribution of Peak Hour Site Traffic

## 4.4. Traffic Impact

### 4.4.1. Intersection Capacity

The peak hour capacity of the Wanneroo Road / Bernard Road North intersection has been analysed in SIDRA Intersection 9.0 in accordance with Main Roads WA's *Operational Modelling Guidelines*. The layout was modelled with left and right turn lanes and a wide median to allow for staged right turns. The modelled layout is shown in **Figure 9**.



**Figure 9: Intersection Model Layout**

Historical traffic counts along Wanneroo Road indicate that traffic volumes have increased by approximately 4% per year and so the base volumes along Wanneroo Road have been factored up accordingly to account for ongoing development in the area up to the two development horizons (2023 and 2033).

The results of the assessment are attached as **Appendix A** and summarised in **Table 2**.





**Table 2: Wanneroo Road / Bernard Road North - SIDRA Intersection Capacity Analysis Results Summary**

Scenario	DOS	Average Delay	Worst Delay	Maximum Queue	Average LOS	Worst LOS
2023 Friday PM Peak	0.510	1.4s	10.2s	1.1m	A	B
2023 Sunday Mid-day Peak	0.467	1.6s	12.6s	1.3m	A	B
2033 Friday PM Peak	0.756	1.5s	13.9s	1.9m	A	B
2033 Sunday Mid-day Peak	0.691	2.5s	32.8s	4.2m	A	D

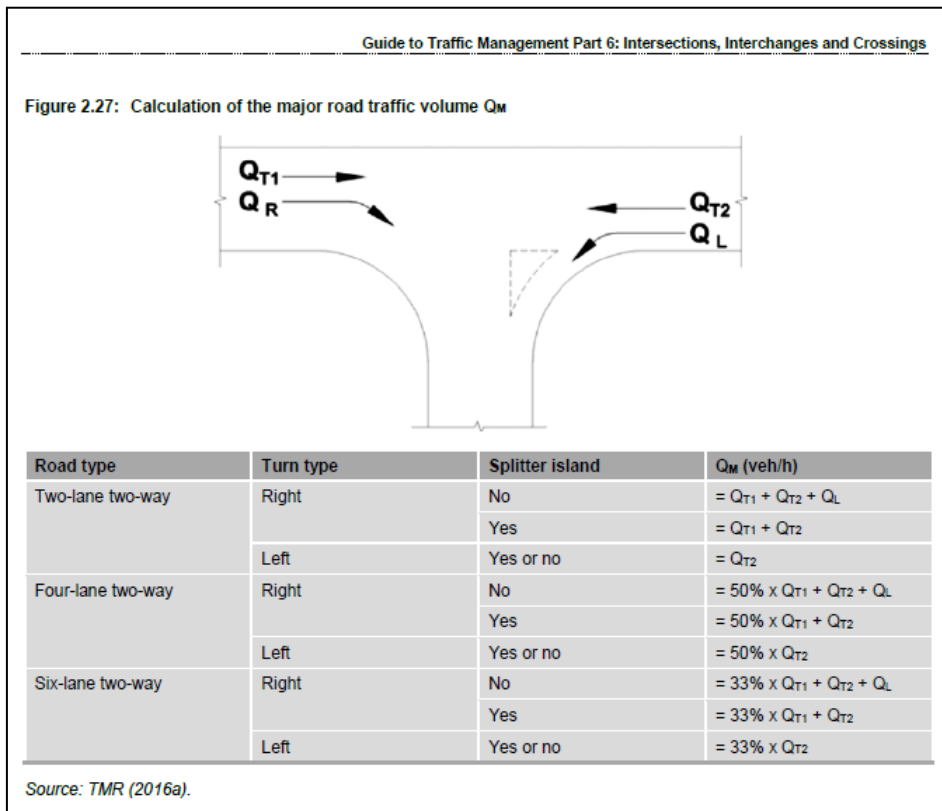
The results show that the intersection will operate within capacity for all assessed peak hour scenarios. All measures of intersection performance (degree of saturation, average delay, queueing and level of service) are within acceptable thresholds.

On this basis, the traffic generated by the proposed development can be accommodated within the capacity of the existing road network.

## 4.5. Auxiliary Lanes

Considering the high speed rural environment and relatively high proportion of heavy vehicles along Wanneroo Road, the Austroads warrants for turn treatments at intersections has been applied to the Wanneroo Road / Bernard Road intersection. The warrants are outlined in Austroads *Guide to Road Design Part 4: Intersections and Crossings – General* (AGRD04) and are used to provide guidance on the provision of intersection turn treatments from the major road based on safety and capacity. The warrants assessment has been undertaken using the Main Roads WA Intersection Warrants Calculator spreadsheet which modifies the AGRD04 equation to account for the high percentage of heavy vehicles in WA.

The input traffic volumes have been calculated as per **Figure 10**.



**Figure 10: Major Road Traffic Volume Calculation**

The results of the warrants assessment are shown in **Figure 11**.

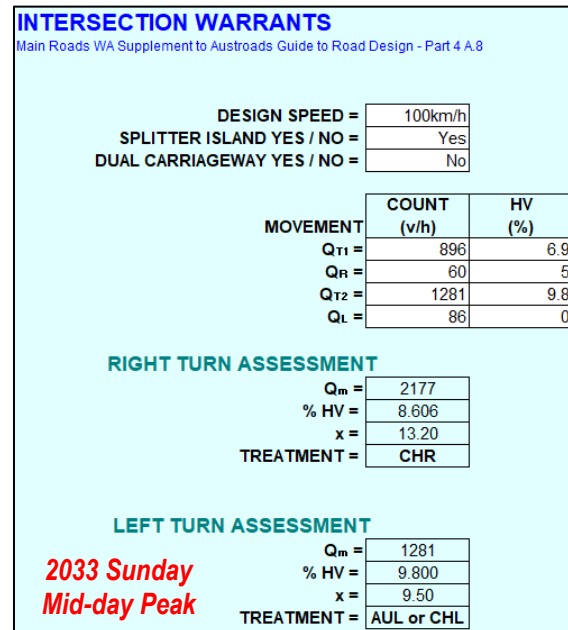
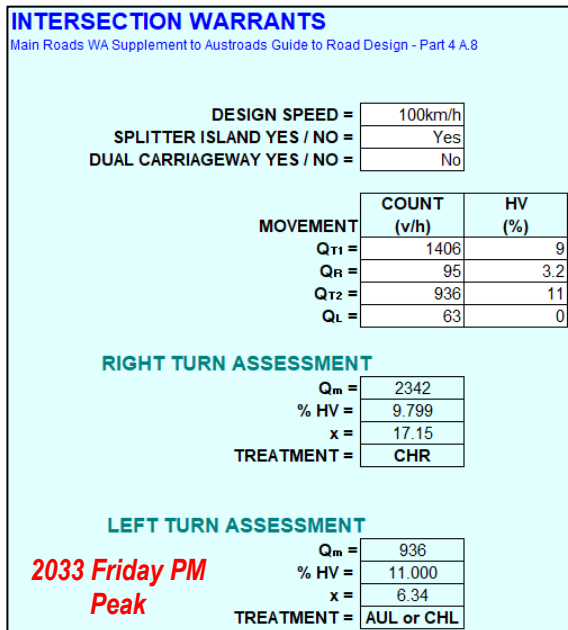
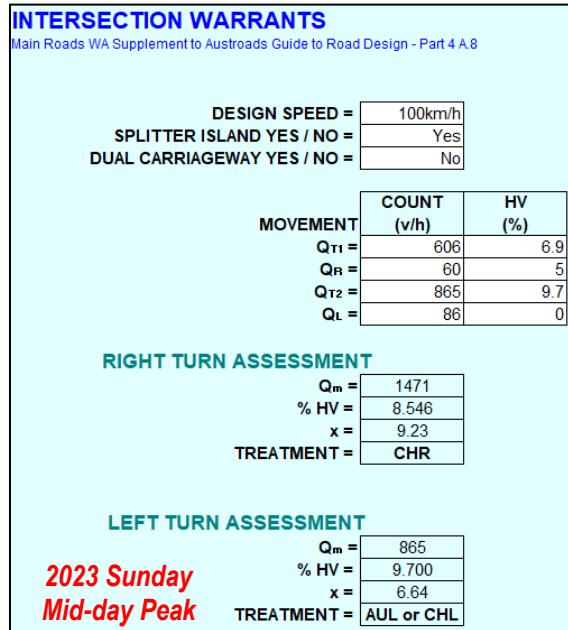
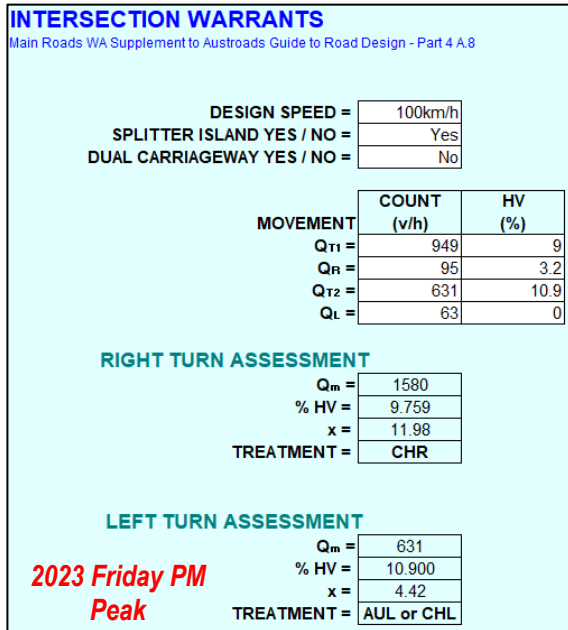


Figure 11: Warrants Assessment Results

As shown, the intersection warrants a Channelised Right (CHR) turn treatment for right turns and an Auxiliary Left (AUL) or Channelised Left (CHL) turn treatment for left turns.

The typical layout of an AUL, CHL and CHR treatment is shown in Figure 12.

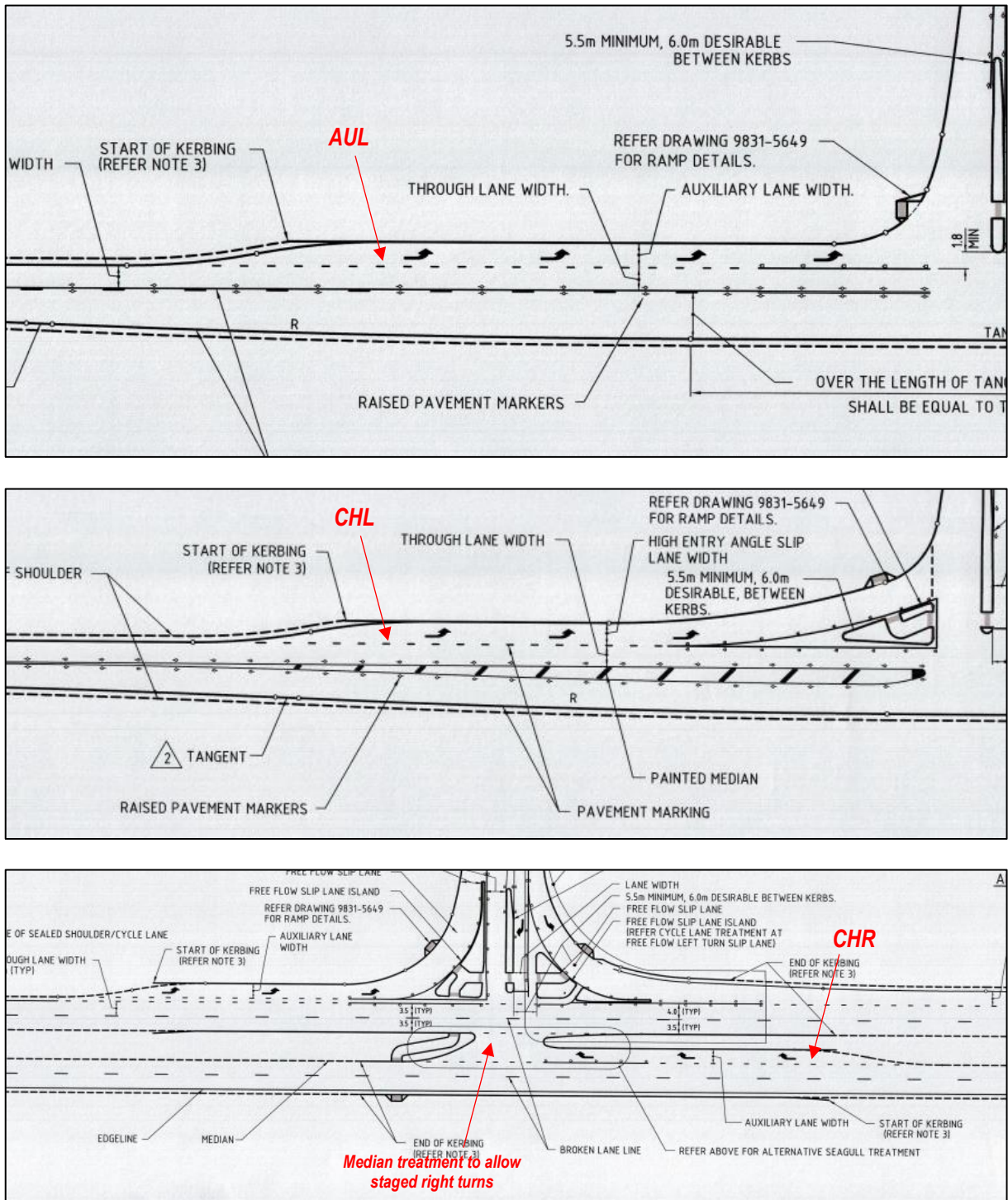


Figure 12: Typical AUL, CHL and CHR Layouts

## 5. Road Safety

### 5.1. Crash History

The crash history of the adjacent road network was obtained from the MRWA Reporting Centre. The search included the length of Wanneroo Road between Walding Road and Bernard Road South.

A summary of the recorded incidents over the five-year period ending December 2021 is shown in **Figure 13**.



**Figure 13: Crash History January 2017 to December 2021**

As shown, a relatively high number of crashes have been recorded at the Wanneroo Road / Pipidiny Road intersection including 20 right angle crashes.

It is understood that the improvements have been made including revised pavement markings in March 2020 to improve sightlines and repairs to resolve the edge drop and improvements to the existing shoulder in October



---

2020. The detailed crash history at this intersection indicates that the number of yearly crashes has reduced over time (6 crashes in 2017, 6 crashes in 2018, 6 crashes in 2019, 5 crashes in 2020 and only 1 crash in 2021).

The layout of the upgraded Wanneroo Road / Bernard Road North intersection is likely to extend beyond Pipidinny Road and so the layout of the Wanneroo Road / Pipidinny Road intersection can potentially be improved as part of the upgrade works.

The number of type of crashes along the remainder of the adjacent road network does not indicate any other major safety issues.



---

## 6. Public Transport Access

---

There are no existing public transport services within walking distance of the site. Public transport coverage is typically lower in rural areas and there is a higher reliance on private vehicle travel.

The proposed use will rely mostly on car travel and so additional public transport services are not warranted by the development.

## 7. Pedestrian / Cycle Access and Amenity

---

There is no existing path infrastructure in the vicinity of the site.

As above, the proposed use will rely mostly on car travel and so additional pedestrian and cycle infrastructure is warranted by the development.

## 8. Parking Assessment

---

### 8.1. Car Parking

The minimum car parking requirements for developments within the City of Wanneroo are outlined in the City's District Planning Scheme (DPS2). The parking requirement for a service station is 5 bays per service bay plus 7 per 100m<sup>2</sup> of non-service bay NLA. Up to 50% of non-service bays may be located in refuelling positions.

As there are no motor vehicle service bays, parking is only required for the non-service NLA. Based on the 400m<sup>2</sup> of shop floorspace, the parking requirement is 28 bays. 14 of the bays may be located in refuelling positions.

The development plans indicate that 37 bays will be provided including 16 in refuelling positions. The parking provision exceeds the minimum requirements and is therefore considered to be adequate.

### 8.2. Parking Layout

A swept path analysis has been undertaken to ensure that the proposed access and internal site layout is adequate for the largest vehicle proposed to access the site which is expected to be fuel tankers (19m semi-trailer).

A swept path has also been undertaken for a service / delivery vehicle which will need to access the service bay adjoining the main building. This has been undertaken using the Australian Standard 12.5m Heavy Rigid Vehicle which is a relatively large service vehicle.

The swept path sketches are attached as **Appendix B**. These demonstrate that the access and site layout provides adequate manoeuvring room for the expected vehicles. As expected, the Wanneroo Road / Bernard Road North intersection will require widening to accommodate the turning movements of the expected trucks in addition to the turn treatments warranted by the traffic volumes.



## 9. Conclusions

---

The Transport Impact Assessment for the proposed service station at 310 Bernard Road North in Carabooda concluded the following:

- The proposed development is estimated to generate 4,242 vehicles per day (vpd), 257 vehicles per hour (vph) during the weekday AM peak hour, 295 vph during the PM peak hour and 272 vph during the weekend mid-day peak hour. With pass by trips excluded, the net increase in traffic generation is 62 vehicles during the weekday AM peak hour, 74 vehicles during the weekday PM peak hour and 68 vehicles during the weekend mid-day peak hour.
- A peak hour capacity analysis of the Wanneroo Road / Bernard Road North intersection indicates that there will be sufficient capacity to accommodate the development traffic at opening and in the longer term scenario.
- The crash history of the adjacent road network identified a relatively high number of crashes at the Wanneroo Road / Pipidinny Road intersection including 20 right angle crashes. Several improvements have been implemented in recent years and the number of yearly crashes has reduced over time. The layout of the upgraded Wanneroo Road / Bernard Road North intersection is likely to extend beyond Pipidinny Road and so the layout of the Wanneroo Road / Pipidinny Road intersection can potentially be improved as part of the upgrade works.
- The demand for public transport use, walking and cycling is expected to be low and the provision of additional services or path infrastructure is not warranted by the development.
- 28 car parking bays are required to satisfy the minimum requirements of the City's Local Planning Scheme. The proposed 37 bays satisfies the minimum requirements.
- A preliminary swept path analysis demonstrates that the access and site layout provides adequate manoeuvring room for the expected heavy vehicles. As expected, the Wanneroo Road / Bernard Road North intersection will require widening to accommodate the turning movements of the expected trucks in addition to the turn treatments warranted by the traffic volumes.



## Appendix A – SIDRA Intersection Analysis Results

### MOVEMENT SUMMARY

Site: 1 [2023 Friday PM Peak - Stage 1 (Site Folder: Wanneroo Rd / Bernard Rd N)] Network: N101 [2023 Friday PM Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE 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: Wanneroo Rd														
3	R2	95	3.2	95	3.2	0.086	10.2	LOS B	0.2	1.1	0.62	0.78	0.62	53.9
Approach		95	3.2	95	3.2	0.086	10.2	NA	0.2	1.1	0.62	0.78	0.62	53.9
East: Bernard Rd N														
4	L2	68	1.5	68	1.5	0.067	7.2	LOS A	0.1	0.8	0.58	0.73	0.58	53.2
5	T1	84	2.4	84	2.4	0.067	5.7	LOS A	0.1	0.6	0.44	0.69	0.44	50.4
Approach		152	2.0	152	2.0	0.067	6.4	LOS A	0.1	0.8	0.50	0.71	0.50	52.1
North: Wanneroo Rd														
7	L2	63	0.0	63	0.0	0.032	8.1	LOS A	0.1	0.4	0.19	0.58	0.19	56.3
8	T1	631	10.9	631	10.9	0.343	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	89.7
Approach		694	9.9	694	9.9	0.343	0.8	LOS A	0.1	0.4	0.02	0.05	0.02	85.1
All Vehicles		941	8.0	941	8.0	0.343	2.6	NA	0.2	1.1	0.16	0.23	0.16	74.7

### MOVEMENT SUMMARY

Site: 2 [2023 Friday PM Peak - Stage 2 (Site Folder: Wanneroo Rd / Bernard Rd N)] Network: N101 [2023 Friday PM Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE 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: Wanneroo Rd														
2	T1	949	9.0	949	9.0	0.510	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	89.5
Approach		949	9.0	949	9.0	0.510	0.1	NA	0.0	0.0	0.00	0.00	0.00	89.5
East: Median														
6	R2	84	2.4	84	2.4	0.045	3.1	LOS A	0.1	0.4	0.51	0.69	0.51	62.8
Approach		84	2.4	84	2.4	0.045	3.1	LOS A	0.1	0.4	0.51	0.69	0.51	62.8
All Vehicles		1033	8.4	1033	8.4	0.510	0.4	NA	0.1	0.4	0.04	0.06	0.04	87.9



## MOVEMENT SUMMARY

Site: 1 [2023 Sunday Mid-day Peak - Stage 1 (Site Folder: Wanneroo Rd / Bernard Rd N)]

Network: N101 [2023 Sunday Mid-day Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %				[ Veh. veh	Dist ] m				
South: Wanneroo Rd														
3	R2	60	5.0	60	5.0	0.085	12.6	LOS B	0.1	1.0	0.72	0.90	0.72	52.0
Approach		60	5.0	60	5.0	0.085	12.6	NA	0.1	1.0	0.72	0.90	0.72	52.0
East: Bernard Rd N														
4	L2	82	1.2	82	1.2	0.122	9.5	LOS A	0.2	1.3	0.71	0.86	0.71	51.6
5	T1	63	3.2	63	3.2	0.063	6.4	LOS A	0.1	0.5	0.54	0.77	0.54	49.7
Approach		145	2.1	145	2.1	0.122	8.2	LOS A	0.2	1.3	0.63	0.82	0.63	51.0
North: Wanneroo Rd														
7	L2	86	0.0	86	0.0	0.043	8.0	LOS A	0.1	0.6	0.14	0.58	0.14	56.5
8	T1	865	9.7	865	9.7	0.467	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	89.6
Approach		951	8.8	951	8.8	0.467	0.8	LOS A	0.1	0.6	0.01	0.05	0.01	85.0
All Vehicles		1156	7.8	1156	7.8	0.467	2.3	NA	0.2	1.3	0.13	0.19	0.13	77.2

## MOVEMENT SUMMARY

Site: 2 [2023 Sunday Mid-day Peak - Stage 2 (Site Folder: Wanneroo Rd / Bernard Rd N)]

Network: N101 [2023 Sunday Mid-day Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %				[ Veh. veh	Dist ] m				
South: Wanneroo Rd														
2	T1	606	6.9	606	6.9	0.321	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	89.8
Approach		606	6.9	606	6.9	0.321	0.1	NA	0.0	0.0	0.00	0.00	0.00	89.8
East: Median														
6	R2	63	3.2	63	3.2	0.025	2.5	LOS A	0.0	0.3	0.39	0.56	0.39	62.9
Approach		63	3.2	63	3.2	0.025	2.5	LOS A	0.0	0.3	0.39	0.56	0.39	62.9
All Vehicles		669	6.6	669	6.6	0.321	0.3	NA	0.0	0.3	0.04	0.05	0.04	87.9



## MOVEMENT SUMMARY

Site: 1 [2033 Friday PM Peak - Stage 1 (Site Folder: Wanneroo Rd / Bernard Rd N)] Network: N101 [2033 Friday PM Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[ Total veh/h ]	HV %	[ Total veh/h ]	HV %				[ Veh. veh ]	Dist ] m				
South: Wanneroo Rd														
3	R2	95	3.2	95	3.2	0.161	13.9	LOS B	0.3	1.9	0.78	0.92	0.78	51.0
Approach		95	3.2	95	3.2	0.161	13.9	NA	0.3	1.9	0.78	0.92	0.78	51.0
East: Bernard Rd N														
4	L2	68	1.5	68	1.5	0.123	10.8	LOS B	0.2	1.3	0.76	0.89	0.76	50.6
5	T1	84	2.4	84	2.4	0.094	6.9	LOS A	0.1	0.8	0.60	0.81	0.60	49.0
Approach		152	2.0	152	2.0	0.123	8.7	LOS A	0.2	1.3	0.67	0.84	0.67	49.9
North: Wanneroo Rd														
7	L2	63	0.0	63	0.0	0.032	8.1	LOS A	0.1	0.4	0.19	0.58	0.19	56.3
8	T1	936	11.0	936	11.0	0.509	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	89.5
Approach		999	10.3	999	10.3	0.509	0.6	LOS A	0.1	0.4	0.01	0.04	0.01	86.3
All Vehicles		1246	8.7	1246	8.7	0.509	2.6	NA	0.3	1.9	0.15	0.20	0.15	76.9

## MOVEMENT SUMMARY

Site: 2 [2033 Friday PM Peak - Stage 2 (Site Folder: Wanneroo Rd / Bernard Rd N)] Network: N101 [2033 Friday PM Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[ Total veh/h ]	HV %	[ Total veh/h ]	HV %				[ Veh. veh ]	Dist ] m				
South: Wanneroo Rd														
2	T1	1406	9.0	1406	9.0	0.756	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	88.5
Approach		1406	9.0	1406	9.0	0.756	0.3	NA	0.0	0.0	0.00	0.00	0.00	88.5
East: Median														
6	R2	84	2.4	84	2.4	0.092	5.2	LOS A	0.1	0.8	0.76	0.88	0.76	58.6
Approach		84	2.4	84	2.4	0.092	5.2	LOS A	0.1	0.8	0.76	0.88	0.76	58.6
All Vehicles		1490	8.7	1490	8.7	0.756	0.6	NA	0.1	0.8	0.04	0.05	0.04	87.2



## MOVEMENT SUMMARY

Site: 1 [2033 Sunday Mid-day Peak - Stage 1 (Site Folder: Wanneroo Rd / Bernard Rd N)]

Network: N101 [2033 Sunday Mid-day Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %				[ Veh. veh	Dist ] m				
South: Wanneroo Rd														
3	R2	60	5.0	60	5.0	0.321	32.8	LOS D	0.4	3.3	0.94	1.00	1.07	40.4
Approach		60	5.0	60	5.0	0.321	32.8	NA	0.4	3.3	0.94	1.00	1.07	40.4
East: Bernard Rd N														
4	L2	82	1.2	82	1.2	0.436	30.7	LOS D	0.6	4.2	0.95	1.04	1.17	39.7
5	T1	63	3.2	63	3.2	0.117	9.7	LOS A	0.1	0.9	0.76	0.89	0.76	45.7
Approach		145	2.1	145	2.1	0.436	21.6	LOS C	0.6	4.2	0.87	0.97	0.99	41.2
North: Wanneroo Rd														
7	L2	86	0.0	86	0.0	0.043	8.0	LOS A	0.1	0.6	0.14	0.58	0.14	56.5
8	T1	1281	9.8	1281	9.8	0.691	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	88.9
Approach		1367	9.1	1367	9.1	0.691	0.7	LOS A	0.1	0.6	0.01	0.04	0.01	85.8
All Vehicles		1572	8.3	1572	8.3	0.691	3.9	NA	0.6	4.2	0.12	0.16	0.14	76.4

## MOVEMENT SUMMARY

Site: 2 [2033 Sunday Mid-day Peak - Stage 2 (Site Folder: Wanneroo Rd / Bernard Rd N)]

Network: N101 [2033 Sunday Mid-day Peak (Network Folder: General)]

Site Category: -  
Give-Way (Two-Way)

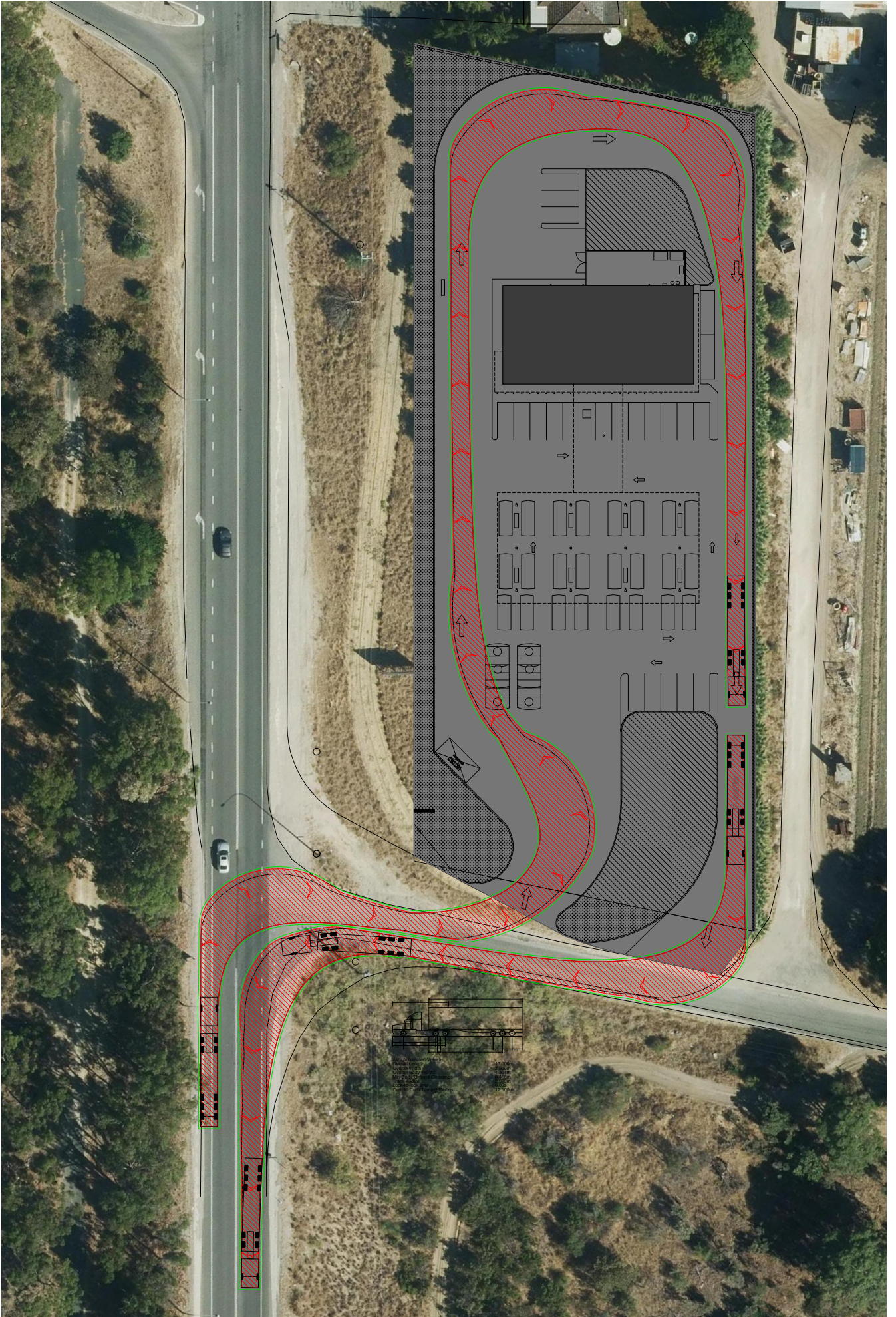
Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[ Total veh/h	HV ] %	[ Total veh/h	HV ] %				[ Veh. veh	Dist ] m				
South: Wanneroo Rd														
2	T1	896	6.9	896	6.9	0.475	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	89.6
Approach		896	6.9	896	6.9	0.475	0.1	NA	0.0	0.0	0.00	0.00	0.00	89.6
East: Median														
6	R2	63	3.2	63	3.2	0.031	2.9	LOS A	0.0	0.3	0.48	0.65	0.48	62.4
Approach		63	3.2	63	3.2	0.031	2.9	LOS A	0.0	0.3	0.48	0.65	0.48	62.4
All Vehicles		959	6.7	959	6.7	0.475	0.3	NA	0.0	0.3	0.03	0.04	0.03	88.2



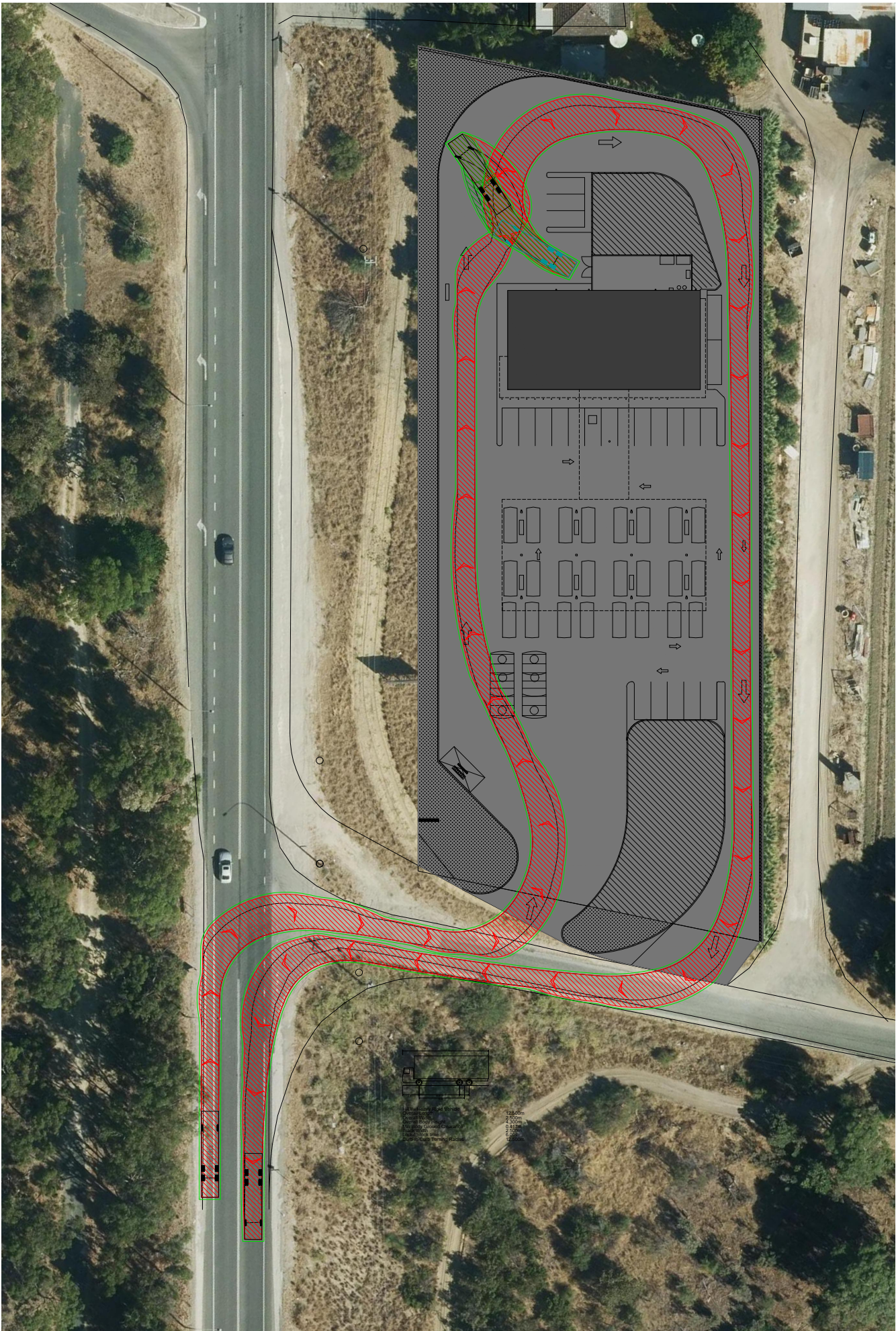
---

## Appendix B – Swept Paths

---



Site Plan  
Scale: 1" = 100'-0"  
Date: 12/25/08



Legend

1. Red Hatched Area	1.250m
2. Green Hatched Area	2.500m
3. Black Hatched Area	3.750m
4. White Hatched Area	5.000m
5. Blue Hatched Area	6.250m
6. Yellow Hatched Area	7.500m

Truck