

17 August 2015

Anna Pty Ltd
45 Sunningdale Avenue
ROCHEDALE SOUTH QLD 4123

Attention: Eric Yang

**PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL**

Approval no: DEV2015/727

Date: 14 October 2016



Dear Eric,

**RE: 820 GREENBANK ROAD
TRAFFIC ENGINEERING ASSESSMENT**

INTRODUCTION

This report has been prepared by Pekol Traffic and Transport (PTT), as requested by Anna Pty Ltd, to assess the traffic engineering aspects of a proposed reconfiguration of land at 820 Greenbank Road, identified as Lot 2 on RP868726 in North Maclean. The site is within the North Maclean Priority Development Area (PDA) of the Greater Flagstone Urban Development Area Development Scheme.

This report examines the access requirements from Greenbank Road for this development, within the context of the potential development of the North Maclean PDA and recommends internal road requirements.

PRIORITY DEVELOPMENT AREA AND ROAD NETWORK

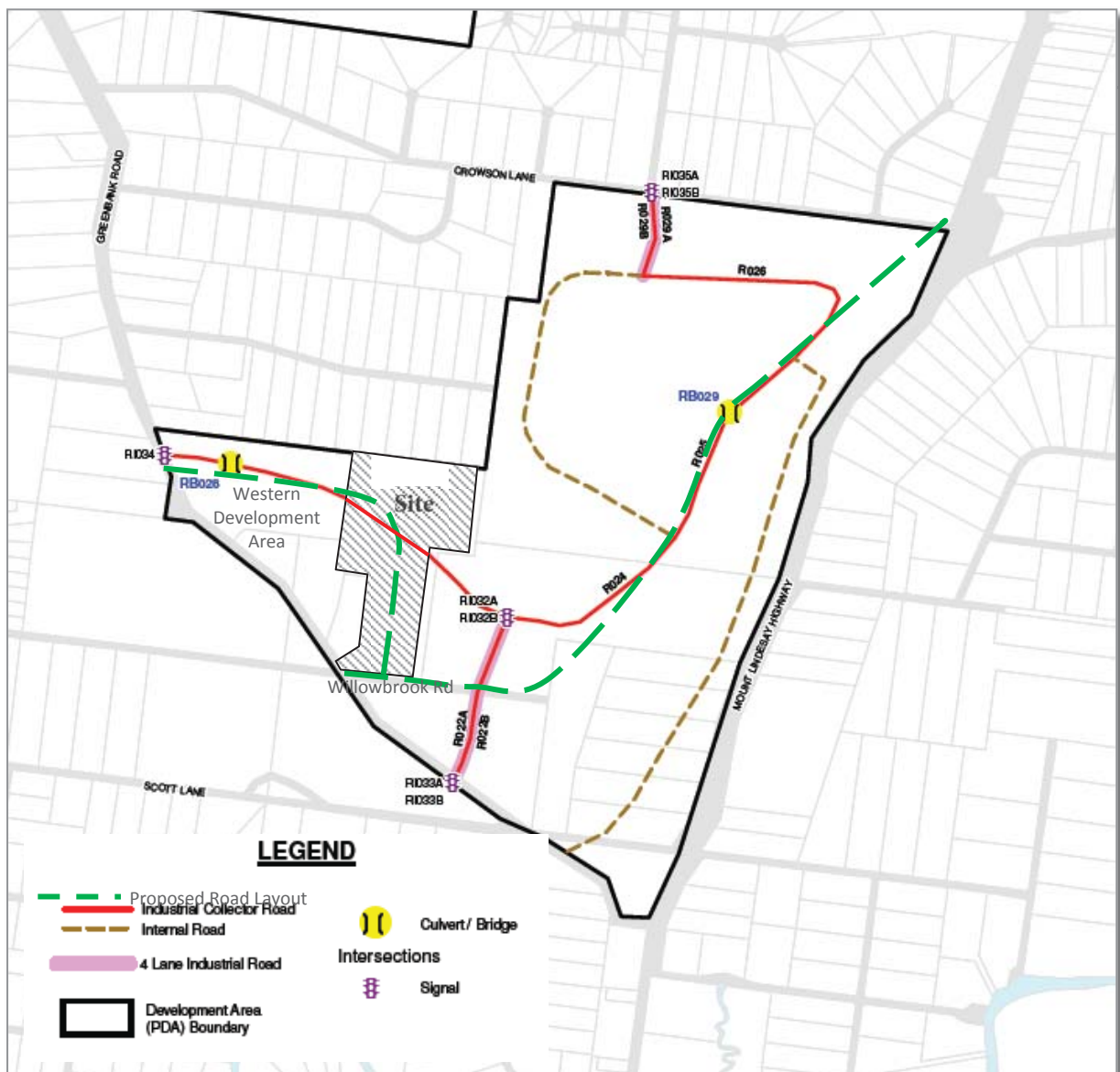
Initial road network planning for North Maclean included two four-lane roads connecting to the external road network to the north and south of the PDA. An east west industrial collector road passing through the subject site linked with the four-lane roads serviced the PDA. However, this network cannot be achieved due to vegetation constraints on the site. Also, it did not include the potential connection to the new Mount Lindesay Highway/Crowson Lane interchange.

A new internal layout has been discussed between the Department of Infrastructure, Local Government and Planning and the planners for the subject site to facilitate access to this development and address the above issues.

Willowbrook Road, an unformed road reserve, on the southern boundary of the site will form a connection from

the west and will ultimately connect to the Crowson Lane interchange as the PDA develops. An industrial access road is proposed to service the subject site from Willowbrook Road and connect back to Greenbank Road to the north west. This will provide access to future development sites in the western part of the PDA. The initial planning and proposed road layout are shown in Figure 1.

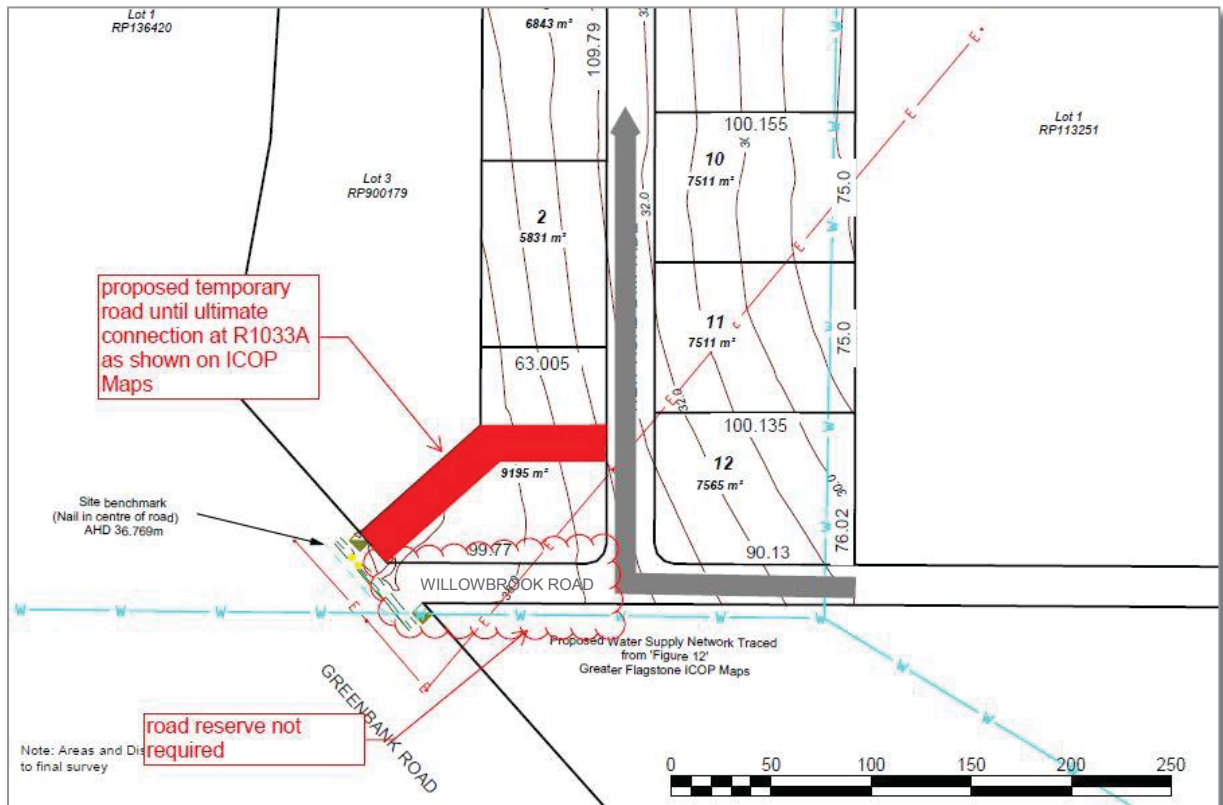
Figure 1: NORTH MACLEAN PDA ROAD LAYOUT



A second option for site access has been considered in the event that land to the east develops at a similar time or prior to the subject site. This concept includes an internal connection to the east and a temporary connection to

Greenbank Road as shown in Figure 2. If this option were to proceed, it will be subject to the appropriate approvals for design and traffic management at that time.

Figure 2: OPTION 2 CONCEPT



Transport and Main Roads (TMR) are undertaking works on Mount Lindesay Highway to improve safety. Ultimately, the Mount Lindesay Highway will be upgraded to the four lane divided cross section that exists to the north.

Logan City Council (LCC) future planning is contained within their Road Hierarchy. This shows that Crowson Lane (and its westward extension) and Scott Lane are to form the key east-west connectors between Mount Lindesay Highway and Teviot Road. They are both identified as rural arterial dual carriageway roads. That is two, two-lane carriageways or four lanes in total. Greenbank Road links these roads and forms the western boundary of the PDA. It is classified as a rural collector with two lanes. The Logan City Council Infrastructure Charges Plan does not include any projects in the PDA, but identifies the TMR Mt Lindesay Highway upgrade. Regardless, LCC commenced pavement rehabilitation of Greenbank Road at the time of writing this letter. Rehabilitation includes 500mm deep pavement construction to the existing horizontal and vertical alignment.

TRAFFIC DEMAND

Traffic generation has been estimated based on the intended form of industrial development for the PDA. That is manufacturing, warehousing and ancillary uses, but not noxious or difficult to locate industries. The following assumptions have been adopted:

- the development potential of 172ha assumes all constraints have been removed (5,200 employees)
- roads account for 12% (based on subject site areas)
- 45% of site area is the actual GFA
- peak trip generation is 0.75 trips/hour/100m² GFA (average of factory and warehousing rates from TMR Road Planning and Design Manual)
- 80/20 traffic directional split - 80% of the demand is in the peak direction

This relates to 4,300 trips in the peak hour.

Traffic distribution from the PDA has been assumed to split equally between external destinations. North Maclean is surrounded by existing and developing residential areas as a source of employees such as New Beith, Springwood, Jimboomba and the emerging Flagstone development (8km to the south). The highest existing population is located to the north at Park Ridge (approx 8km). Also, existing and developing industrial and commercial centres including Bromelton, Yatala, southern Brisbane industrial areas and Springfield CBD will create additional business trip interactions.

A manual trip distribution was undertaken by splitting the PDA into seven precincts representing the development site and tracing travel paths to the external destinations. Three PDA development stages were considered for this analysis, with 15 years background growth on Greenbank Road, namely:

- proposed development
- proposed development with lots immediately to the west developed
- PDA fully developed

The three external connections, proposed by DILGP, for the PDA road network will be inadequate for the expected peak hour demand. To cater for the total PDA demand, additional connections to the road network will be required and could be implemented through future development proposals. This is likely to include signalised intersections to allow multiple turn lanes with auxiliary lanes in Greenbank Road as originally planned for the PDA. This will be a matter for future planning of the PDA road network. A logical connection would be a new link onto the formalised Scott Lane to the south. This report only shows that this development can operate satisfactorily in the interim and is part of a logical longer term road network.

WILLOWBROOK ROAD PLANNING

The Willowbrook Road reserve is approximately 20.5m wide. This road will be required to function as an industrial connector as it forms part of the network through the development and connects to external roads. Industrial connector streets are generally required to be 25m wide and include:

- carriageway 15m
- 3.5m traffic lanes
- 2.5m parking lanes
- 1.5m on road cycle lanes
- 5m verges

The verge requirements could be maintained within the available cross section if the parking lanes were removed for the length of the site frontage. This is recommended because:

- parking should be banned on the approach to the Greenbank Road intersection
- individual lots will not front Willowbrook Road in this location
- the road reserve could be widened beyond this site in future stages to allow parking

GREENBANK ROAD

Greenbank Road is currently a two-lane, two-way rural road with sealed traffic lanes and functions as a rural collector. It is signed at 80km/h with curve warning signs at bends. The LCC Road Design Standards indicate a "likely signed" speed for a rural collector is 70km/h. A traffic survey was undertaken adjacent the unformed Willowbrook Road reserve during the week 13-17 July 2015. The results of the survey are summarised in Table 1. This showed that the typical weekday flow is 2,030 vehicles per day. The highest two-way peak hour traffic volume occurred from 4:00 to 5:00 pm. The northbound volumes are higher than southbound for all survey results. The average speed of 80.8km/h is just over the signed speed limit. However, the northbound 85th percentile speed is nearly 90km/h.

Therefore, 90km/h has been assumed as the existing design speed on Greenbank Road.

Table 1: GREENBANK ROAD SURVEY RESULTS

Survey Result		Northbound	Southbound	Two-Way
Peak Day - Friday		1170	860	2030
Morning Peak	6 am - 7 am	90	58	146
Afternoon	4 pm - 5 pm	111	66	169
Proportion Heavy Vehicles		20.1%	9.2%	15.5%
Speed (Km/h)	Average	82.2	78.9	80.8
	85th Percentile	89.5	85.5	87.8

PROPOSED WILLOWBROOK ROAD / GREENBANK ROAD INTERSECTION

Initially, this intersection will be priority controlled. Safe intersection design is based on the visibility of vehicles approaching an intersection. There are three sight distance criteria:

- Approach Sight Distance (ASD) minimum that must be provided
- Safe Intersection Sight Distance (SISD)
- Minimum Gap Sight Distance (MGSD)

The sight distance requirements for the proposed intersection are shown in Table 2. The sight distance requirements for the LCC "likely signed" speed of 70km/h (design speed 80km/hr) are also included.

Table 2: SIGHT DISTANCE REQUIREMENTS

Approach	Design Speed (km/h)	Sight Distance (m)		
		ASD	SISD	MGSD
Greenbank Road	90 (Existing)	142	217	126
	80 (Likely signed)	117	184	112
Willowbrook Road	60	71	NA	84

Source: AUSTROADS

The intersection is located on a slight crest vertical curve, with horizontal curves to the north and south. Field observations confirmed that from a vehicle positioned in the Willowbank Road reserve, the required sight distances can be achieved. Greenbank Road is straight to the north for the length of the sight distance requirements. Contours from LCC online mapping shows the natural surface is level, or with a slight down grade, for the length of the sight distance requirements before the grade steepens to the north.

Based on this analysis and field observations, the proposed location for the intersection is appropriate.

As this section of road transitions to an employment activity area with greater traffic conflicts, it may be appropriate to adopt the lower "likely signed" speed of 70km/h. In both cases the sight lines are within the road reserve.

Intersection Geometry

Austroads Guide to Road Design sets out the requirements for safe intersection design. A key feature of this is the need for good visibility and clear sight lines for the sight distance requirements, as discussed above.

Willowbrook Road will be an industrial environment as the PDA develops. Therefore, it is appropriate to design it as an industrial collector with a signed speed of 50km/h and design speed of 60km/h.

Road centre lines should be designed to intersect as close to 90 degrees as possible. It is recommended that Willowbrook Road be realigned to meet this designed criteria. The maximum deflection angle permissible in a brown field site with physical constraints is 110 degrees (+/-20 degrees from right angle) to avoid excessive "looking over the shoulder". From Table 2, there clear site lines should be maintained from the holding line to a point 84m along Willowbrook Road, measured along the approach lane centre line.

The final approach to the intersection should have a 10 to 15 m straight between reverse curves for ease of steering manoeuvres at the intersection. The typical concept for this form of intersection is shown in Figure 3.

INTERSECTION CAPACITY

SIDRA analyses were conducted to quantify the future traffic operations at the proposed Willowbank Road Greenbank Road intersection. Only future scenarios of the PDA development have been analysed since the intersection does not currently exist.

The likely impact of the development on the future year peak hour operations on the intersection has been tested using the following assumptions:

- Greenbank Road traffic will grow at 2% per annum for 15 years
- traffic accessing the site will be generated or induced traffic
- none of the development related traffic is treated as drop-in traffic

Therefore, the traffic volumes for the SIDRA analyses are the sum of the projected through traffic on Greenbank Road and the PDA generated traffic.

Due to the low traffic volumes on Greenbank Road, priority control will be adequate for this intersection. The proposed intersection layout represented in SIDRA is shown in Figure 4.

Figure 3: WILLOWBROOK ROAD / GREENBANK ROAD INTERSECTION CONCEPT

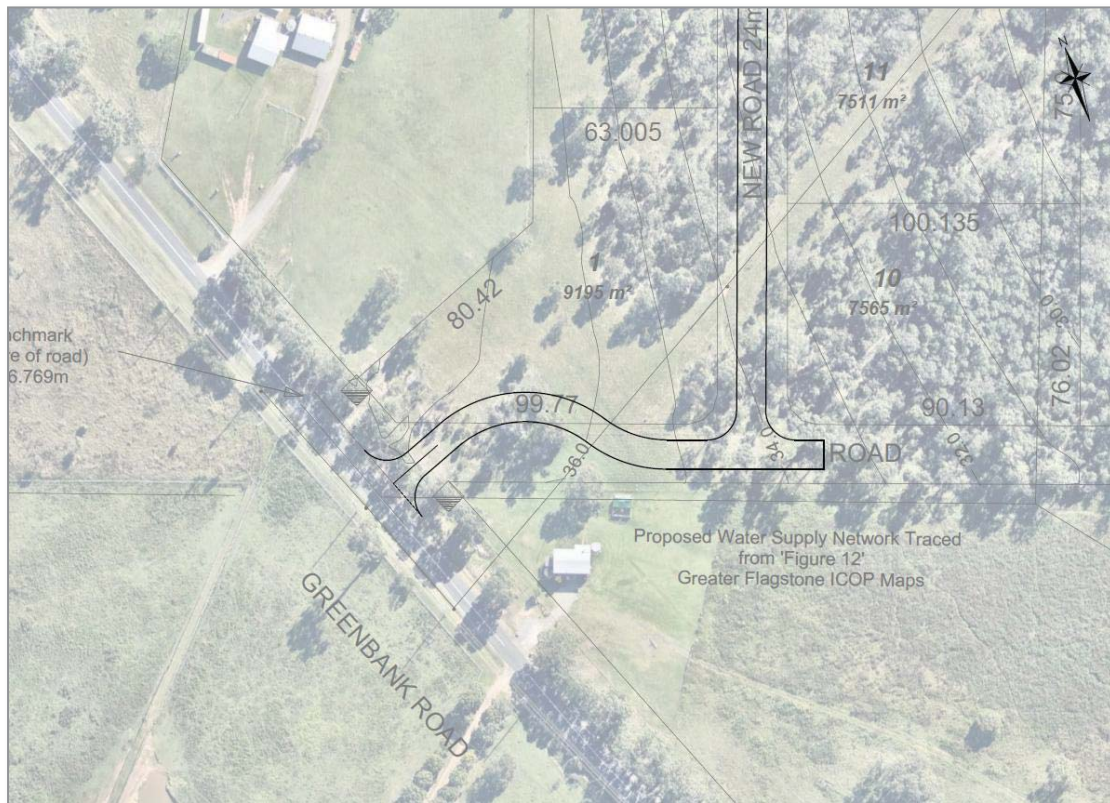
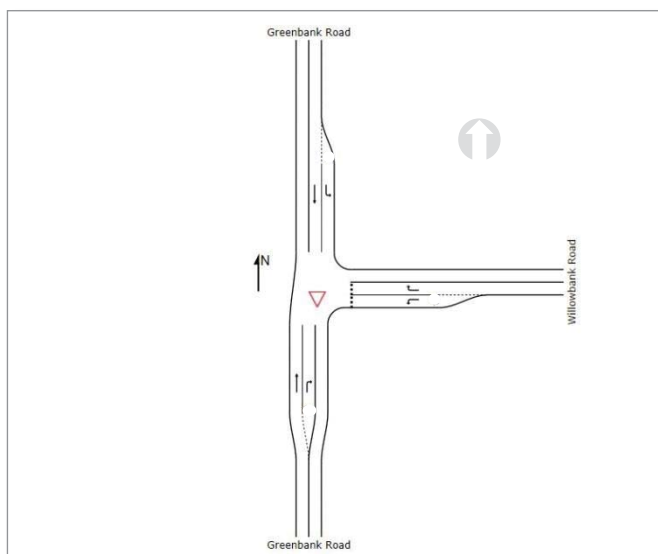


Figure 4: WILLOWBANK ROAD/ GREENCAMP ROAD INTERSECTION LAYOUT



These analyses were based on the traffic count data presented in Appendix A with:

- gap acceptance parameters as per SIDRA
- proportion of heavy vehicles (%HV) as detailed in Table 2
- assumed stop sign control
- Peak Flow Factors (PFF) as per Table 2.2
- SIDRA default values for other parameters

Table 3 is an extract from the SIDRA manual, which defines the operational rating and level of service in relation to the degree of saturation for priority and signal controlled intersections. The degree of saturation for a movement is defined as the ratio of traffic demand to the capacity of the movement. The critical movement relates to the approach or movement with the highest degree of saturation.

Table 3: SIDRA INTERSECTION RATINGS

RATING	LEVEL OF SERVICE	DEGREE OF SATURATION (DOS)		
		SIGNALS	ROUNDABOUT	PRIORITY
Excellent	LOS A	$x \leq 0.6$	$x \leq 0.60$	$x \leq 0.60$
Very Good	LOS B	$0.60 < x \leq 0.70$	$0.60 < x \leq 0.70$	$0.60 < x \leq 0.70$
Good	LOS C	$0.70 < x \leq 0.90$	$0.70 < x \leq 0.85$	$0.70 < x \leq 0.80$
Acceptable	LOS D	$0.90 < x \leq 0.95$	$0.85 < x \leq 0.95$	$0.80 < x \leq 0.90$
Poor	LOS E	$0.95 < x \leq 1.00$	$0.95 < x \leq 1.00$	$0.90 < x \leq 1.00$
Very Poor	LOS F	$1.00 < x$	$1.00 < x$	$1.00 < x$

The results of the intersection analyses are included in Appendix B and are summarised in Table 4. This shows that the intersection of Willowbrook Road and Greenbank Road will have an excellent level of operation with the site developed and the possible adjoining western developments

Table 4: WILLOWBROOK ROAD / GREENBANK ROAD OPERATIONS

PEAK HOUR & SCENARIO	LOS	95% QUEUE (veh)	CRITICAL MOVEMENT
AM SITE only	A	1	Greenbank Road RT
AM SITE + WEST DEVELOPMENT	A	1	Willowbrook Road RT
PM SITE only	A	1	Greenbank Road RT
AM SITE + WEST DEVELOPMENT	A	1	Willowbrook Road RT

A channelised right turn treatment (CHR) will be required in Greenbank Road to provide for the right turn traffic into the site. A basic left-turn treatment (BAL) on Greenbank Road is considered sufficient, based on the expected traffic movements.

INTERNAL ROAD DESIGN

The maximum volume on the internal road is estimated to be 3,500 vehicles per day, or 570 in the peak hour. Its primary function is to provide access to industrial lots. The ULDA guide no 06 Street and Movement Network shows that an industrial access street is the appropriate street type to meet these characteristics. Therefore, the road reserve should be 20m wide with a carriageway width of 12m. An urban speed limit of 50km/h will be appropriate.

It is recommended that no further connections to other developments be allowed to this road, other than the lots immediately to the west. Any further increase will require the road to be an industrial collector with a road reserve of 25m.

CONCLUSIONS & RECOMMENDATIONS

Conclusions

- the three identified road connections to the external road network are unlikely to have adequate intersection capacity to serve the ultimate demand
- the Willowbrook Road Reserve (20.5m) is narrower than the typical 25m reserve for an industrial collector but can accommodate the expected uses
- the Willowbrook Road reserve meets Greenbank Road at an angle significantly less than the preferred 90 degree angle
- The Willowbrook Road / Greenbank Road intersection will have an excellent level of operation for traffic from the proposed site and the possible developments to the west
- the available sight distance at the proposed Willowbank Road intersection will satisfy Austroads requirements

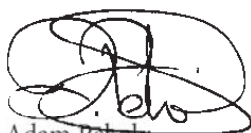
Recommendations

- further research be undertaken into the ultimate development potential of the PDA and establish the additional future connections required to the external road network and their staging after the development of the site and adjacent western developments
- Willowbrook Road be constructed without a parking lanes for the length of the site frontage within the existing road reserve
- design the Willowbank Road carriage way to meet Greenbank Road at a right angle with a straight section with storage for one semi-trailer

- the Willowbrook Road / Greenbank Road intersection should include design for turning movements described above (BAL, CHR)

If you have any questions regarding the issues discussed above, please do not hesitate to contact us.

Yours sincerely,



Adam Pekol

Director (RPEQ 5286)

APPENDIX A TRAFFIC COUNT

Traffic Count Summary Sheet

[for tube counters]

STREET NAME :	Greenbank Road	LOCATION:	between Willowbrook Road and Scott Lane
SUBURB:	North Maclean	START DATE :	13/07/2015
JOB NUMBER :	11649	FINISH DATE :	19/07/2015
SITE ID NUMBER :	1		
PREPARED BY :	Austraffic		

		DIRECTION OF TRAVEL		
		TWO-WAY	Northbound	Southbound
TRAFFIC VOLUME:	Weekdays Only	1,937	1,114	822
[VEH/DAY]	7 Days Average	1,934	1,087	847
PEAK DAY:		17-7-2015 / 18-7-2015	Friday 17 July 2015	Saturday 18 July 2015
PEAK DAY VOLUME:		2,128	1,169	999
PEAK HOUR	AM	6 AM - 7 AM	139	84
VOLUME:	PM	4 PM - 5 PM	167	104
TOTAL SPEEDS:	85th Percentile	87.8	89.5	85.5
Km/Hr	Average	80.8	82.2	78.9
CLASSIFICATION % *:	CLASS 3 ABOVE % Weekday	15.5%	20.1%	9.2%

NOTES : (OBSERVATIONS)

Automatic Traffic Counts - Site Data

Site No:	1
Date:	13/07/2015
Start Time:	0:00
Officer:	ATS
Road:	Greenbank Road
Suburb:	North Maclean
LOCATION:	between Willowbrook Road and Scott Lane
Comments:	



APPENDIX B

INTERSECTION ANALYSES

MOVEMENT SUMMARY

▽ Site: AM Model - Give Way - Conversion

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Prop. Queued Distance m	Effective Stop Rate per veh	Average Speed km/h	
South: Greenbank Road											
2	T1	179	20.0	0.119	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
3	R2	148	20.0	0.147	8.6	LOS A	0.6	5.1	0.38	0.65	57.7
Approach		327	20.0	0.147	3.9	NA	0.6	5.1	0.17	0.30	68.1
East: Willowbank Road											
4	L2	37	20.0	0.035	6.5	LOS A	0.1	1.0	0.25	0.56	52.0
6	R2	22	20.0	0.050	11.6	LOS A	0.2	1.5	0.57	0.76	48.7
Approach		59	20.0	0.050	8.4	LOS A	0.2	1.5	0.37	0.63	50.7
North: Greenbank Road											
7	L2	87	20.0	0.062	7.3	LOS A	0.0	0.0	0.00	0.63	59.1
8	T1	137	20.0	0.091	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		224	20.0	0.091	2.9	NA	0.0	0.0	0.00	0.25	70.3
All Vehicles		611	20.0	0.147	4.0	LOS A	0.6	5.1	0.13	0.31	66.6

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: PM Model - Conversion

New Site

Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Prop. Queued Distance m	Effective Stop Rate per veh	Average Speed km/h	
South: Greenbank Road											
2	T1	284	20.0	0.189	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
3	R2	40	20.0	0.034	7.7	LOS A	0.1	1.1	0.20	0.58	58.4
Approach		324	20.0	0.189	1.0	NA	0.1	1.1	0.03	0.07	76.4
East: Willowbank Road											
4	L2	148	20.0	0.131	6.1	LOS A	0.5	4.2	0.18	0.55	52.2
6	R2	87	20.0	0.166	10.6	LOS A	0.6	5.3	0.56	0.78	49.4
Approach		236	20.0	0.166	7.8	LOS A	0.6	5.3	0.32	0.63	51.1
North: Greenbank Road											
7	L2	22	20.0	0.016	7.3	LOS A	0.0	0.0	0.00	0.63	59.2
8	T1	63	20.0	0.042	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		85	20.0	0.042	1.9	NA	0.0	0.0	0.00	0.16	73.3
All Vehicles		645	20.0	0.189	3.6	LOS A	0.6	5.3	0.13	0.29	64.4

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).

Vehicle movement LOS values are based on degree of saturation per movement

Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.

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

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: AM Model - Intermediate - Conversion

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Greenbank Road											
2	T1	331	20.0	0.220	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
3	R2	148	20.0	0.155	8.9	LOS A	0.7	5.3	0.42	0.67	57.6
Approach		479	20.0	0.220	2.8	NA	0.7	5.3	0.13	0.21	71.3
East: Willowbank Road											
4	L2	37	20.0	0.037	6.7	LOS A	0.1	1.1	0.29	0.57	51.9
6	R2	22	20.0	0.072	16.0	LOS A	0.2	2.0	0.71	0.88	46.0
Approach		59	20.0	0.072	10.2	LOS A	0.2	2.0	0.45	0.69	49.5
North: Greenbank Road											
7	L2	87	20.0	0.062	7.3	LOS A	0.0	0.0	0.00	0.63	59.1
8	T1	175	20.0	0.116	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		262	20.0	0.116	2.4	NA	0.0	0.0	0.00	0.21	71.6
All Vehicles		800	20.0	0.220	3.2	LOS A	0.7	5.3	0.11	0.24	69.2

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

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New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Greenbank Road											
2	T1	322	20.0	0.215	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
3	R2	37	20.0	0.038	8.6	LOS A	0.1	1.2	0.37	0.63	57.7
Approach		359	20.0	0.215	0.9	NA	0.1	1.2	0.04	0.06	76.9
East: Willowbank Road											
4	L2	148	20.0	0.157	7.1	LOS A	0.6	5.0	0.36	0.62	51.7
6	R2	87	20.0	0.235	14.7	LOS A	0.9	7.6	0.68	0.88	46.7
Approach		236	20.0	0.235	9.9	LOS A	0.9	7.6	0.48	0.72	49.7
North: Greenbank Road											
7	L2	29	20.0	0.021	7.3	LOS A	0.0	0.0	0.00	0.63	59.2
8	T1	215	20.0	0.143	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		244	20.0	0.143	0.9	NA	0.0	0.0	0.00	0.08	76.7
All Vehicles		839	20.0	0.235	3.4	LOS A	0.9	7.6	0.15	0.25	66.6

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
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