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Annangrove Road Light Industrial Area
Traffic and Accessibility Study
For The Hills Shire Council

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1.0 INTRODUCTION

Lambert & Rehbein was commissioned by The Hills Shire Council to undertake a traffic and accessibility study for the Annangrove Road Light Industrial Area. The Annangrove Road Light Industrial Area is a 120 hectare industrial precinct located between Rouse Hill and Box Hill. The industrial area is currently zoned Light Industrial 4(b) under *Baulkham Hills Local Environmental Plan 2005*, IN2 Light Industrial under Draft The Hills Local Environmental Plan 2010 and is subject to a minimum lot size of 8,000sqm.

The Annangrove Light Industrial Area was established in 1991; however it has been unsuccessful in attracting new industrial businesses. Council's Employment Lands Direction recognises that there is a significant opportunity to provide employment growth in the industrial area due to its proximity to Windsor Road, Rouse Hill Town Centre and the proposed Box Hill precinct. Accordingly Council has developed a new master plan to establish a clear vision and concept for the Edwards Road Precinct (Also known as the Annangrove Road North Precinct) to attract new investment. This Traffic and Accessibility Study has been undertaken based on the new master plan prepared by Council.

The proposed master plan seeks to have two zones within the precinct. The south of the precinct will be similar to the existing draft zoning, IN2 Light Industrial, with a reduced minimum lot size of 2,500sqm. The north of the precinct will be zoned B6 Enterprise Corridor with minimum lot sizes of 2,500sqm, 4,000sqm and 8,000sqm. The master plan also outlines new internal roads and proposed intersections. The master plan prepared by Council is shown in Appendix A.

This study has been undertaken to assess the potential impact future developments arising from the new master plan could have on the surrounding road network and to prepare an indicative cost estimate in accordance with Councils S94 Contributions Plan requirements for inclusion in Contributions Plan No. 11 for Annangrove Light Industrial Area.

The report has been compiled in a clear and concise manner and is set out as follows:

Section 2 discusses the existing land use and traffic arrangements and provides details of existing conditions on the local road network.

Section 3 provides details of the proposed master plan, including land use and potential floor space. This section also displays the calculations and assumptions used to establish the forecast generation and distribution of the proposed development traffic.

Section 4 contains an analysis of the traffic impact of future developments on the local road network.

Section 5 discusses any infrastructure improvements that may be required as a result of the proposed master plan.

Section 6 provides an indicative cost estimate for the works required, suitable for inclusion within the Section 94 Contributions Plan.

Section 7 summarises the key outcomes of the traffic investigations.

Lambert & Rehbein has derived the data in this report primarily from the traffic surveys undertaken on Thursday 29 March 2012 and field inspections undertaken in March and April 2012, as well as data provided within planning documents provided by Council (refer to Section 2.2 below). The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

This report has been prepared on behalf of and exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Lambert & Rehbein and the Client. Lambert & Rehbein accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

2.0 SITE CONTEXT

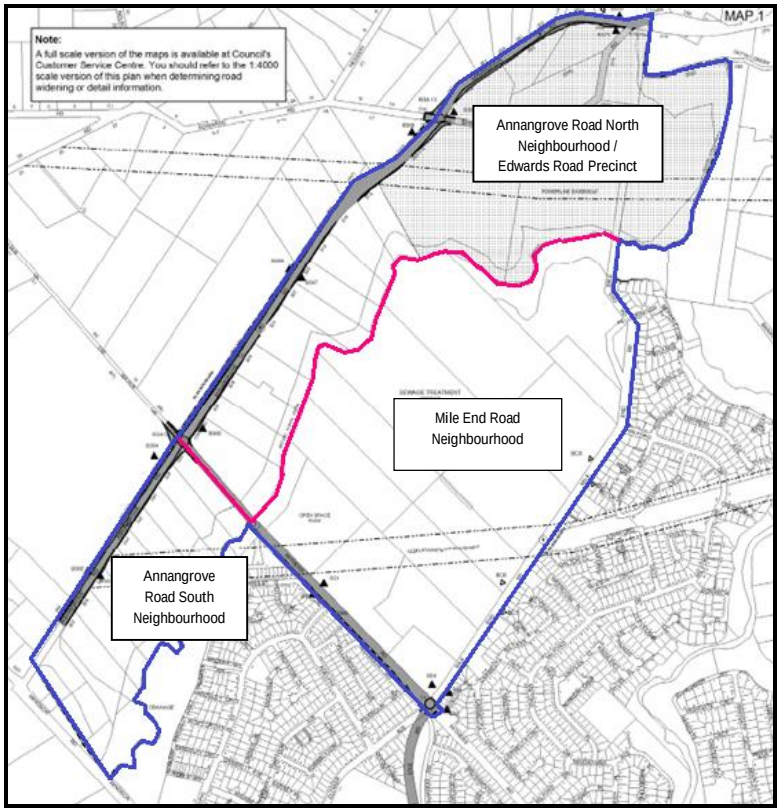
2.1 STUDY AREA

The Annangrove Road Light Industrial Area is a 120 hectare industrial precinct located between Rouse Hill and Box Hill. The industrial area is currently zoned Light Industrial 4(b) under *Baulkham Hills Local Environmental Plan 2005*, IN2 Light Industrial under Draft The Hills Local Environmental Plan 2010 and is subject to a minimum lot size of 8,000m^2.

The Annangrove Road Light Industrial Area is divided into three main areas; The Mile End Road Neighbourhood, Annangrove Road South Neighbourhood and the Annangrove Road North Neighbourhood. The Annangrove Road North Neighbourhood is also known as the Edwards Road Precinct and will be referred to as such in this report. The Annangrove Light Industrial Area is shown in Figure 2-1.

This study will focus on the Edwards Road Precinct which is located on the eastern side of Annangrove Road extending south along Annangrove Road to Withers Road with Cattai and Second Ponds Creek forming the eastern boundary as shown in Figure 2-2.

Figure 2-1 Annangrove Road Light Industrial Area



Map Source: Contributions Plan No.11

Figure 2-2 Edwards Road Precinct

Map Source: Google Maps

2.2 PREVIOUS COUNCIL PLANNING DOCUMENTS

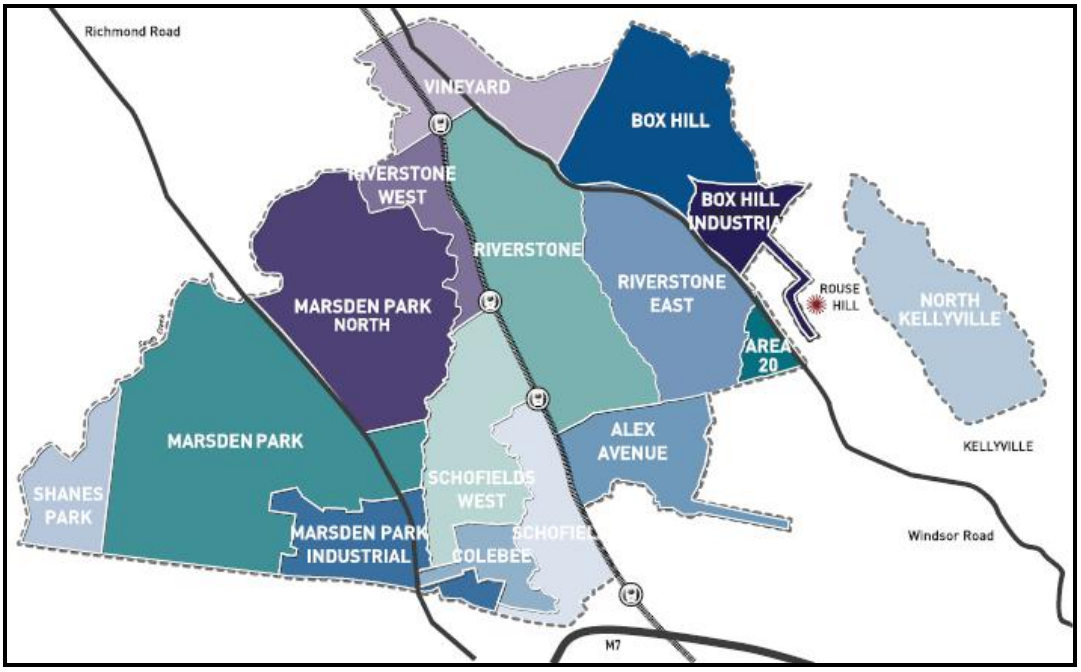
The studies below were provided by The Hills Shire Council to provide background information and input to the Annangrove Road Traffic and Accessibility Study.

2.2.1 NORTH KELLYVILLE PRECINCT PLANNING – TRAFFIC AND TRANSPORT ASSESSMENT (JANUARY 2008)

Maunsell was appointed by the Growth Centres Commission to undertake a transport assessment of the Indicative Layout Plans (ILPs) for the North Kellyville Precinct. The purpose of the assessment was to assess the ILPs by all modes of transport including walking, cycling, public transport and passenger vehicles. The study did not include an assessment of the impacts of the precinct on the adjacent transport network. Two of the proposed ILPs included a link to the north via a connection between Ross Place and Annangrove Road in order to provide improved bus service coverage for the precinct and avoid buses operating on a 'loop' within the precinct.

The North Kellyville precinct is located in the Hills Shire Council Local Government Area and is bounded by Samantha Riley Drive to the south, Smalls Creek to the west and Cattai Creek to the east see Figure 2-3 and Figure 2-4 below.

Figure 2-3 Precincts in the North West Growth Centre

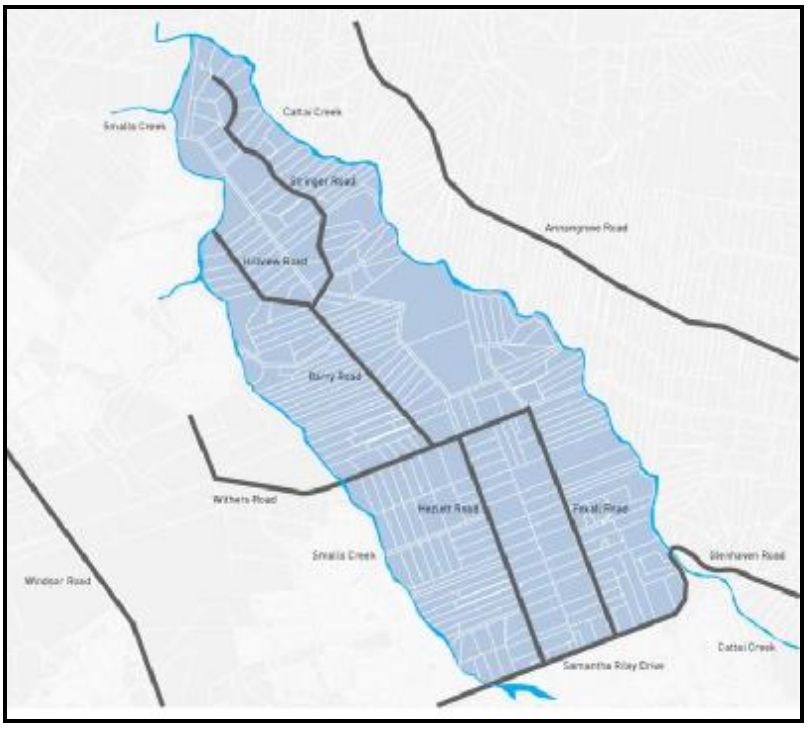


Map Source: www.gcc.nsw.gov.au

Key findings of the study relating to the Edwards Road Precinct and this study's Scope of Work include;

- Withers Road is required to be re-designed with two lanes in each direction between Smalls Creek and Barry Road to accommodate local traffic from North Kellyville;
- The northern connection between Ross Place and Annangrove Road will be designed to facilitate local traffic movements by connecting North Kellyville to destinations to the north of the precinct including Box Hill and reducing travel distance and times. The Ministry of Transport (MoT) supports the northern connection as it allows better bus planning to be introduced for the North Kellyville and surrounding precincts;
- A cycle connection along Cattai Creek will link the precinct with Annangrove Road and other areas east of the precinct.

Figure 2-4 North Kellyville Precinct



Map Source: www.gcc.nsw.gov.au

2.2.2 BOX HILL AND BOX HILL INDUSTRIAL PRECINCTS – TRANSPORT AND ACCESS STUDY (FEBRUARY 2011)

The Department of Planning engaged GHD to undertake transport, traffic and access investigations in the Box Hill local area in order to identify the development footprint of the precinct and develop a draft Indicative Layout Plan (ILP). The study focused on strategic level issues for the current ILP while attempting to facilitate sustainable outcomes.

The study area covered both Box Hill and Box Hill Industrial precinct shown in Figure 2-3 and Figure 2-5. Both precincts are within The Hills Shire Council local government area with a combined land area of 973Ha. The area is bounded by Windsor Road to the south, Annangrove Road to the East, Old Pitt Road and Edwards Road to the north and Boundary Road to the west.

Figure 2-5 Box Hill and Box Hill Industrial Precincts

Map Source: www.gcc.nsw.gov.au

Key findings of the study relating to the Edwards Road Precinct and this study's Scope of Work include;

- The existing rural road network within the precinct will comprise the framework of the road network and should be upgraded to two traffic lanes in each direction including The Water Lane;

- The Water Lane should be extended north of Hynds Road to intersect with Mason Road and Old Pitt Town Road;
- Key intersections within the precinct will operate as signalised intersections with two travel lanes per direction operating with a filtered turn phase signal;
- Future traffic levels will require upgrades to Windsor Road in order to maintain levels of service at current levels;
- Annangrove Road will be upgraded to two lanes per direction to support the requirements of the Box Hill development.

2.2.3 CONTRIBUTIONS PLAN NO.11, ANNANGROVE ROAD LIGHT INDUSTRIAL AREA

Contributions Plan No. 11 (CP 11) is a development contributions plan for the Annangrove Road Light Industrial area within the local government area of the Hills Shire Council as shown in Figure 2-1. The plan was originally adopted and came into effect in December 2003 and an amendment to the plan was adopted in December 2008 and came into effect in January 2009.

The Annangrove Road Light Industrial Area was zoned Light Industry 4(b). The total area of land zoned Light Industry 4(b) was 104.38ha. The area was divided into three Neighbourhoods namely, Mile End Road Neighbourhood, Annangrove Road South Neighbourhood and Annangrove Road North Neighbourhood as shown in Figure 2-1. The predicted total floor space and estimated traffic volumes for the Light Industrial Area are show in Table 2-1. A factor of 4.6 vehicle trips per day / 100 square metres gross floor space was adopted for the Contributions Plan and used to calculate the vehicle trips per day for the area.

Table 2-1 Annangrove Road Light Industrial Area – Floor Space and Traffic Generation

Neighbourhood	Predicted Total Floor Space (Sqm)	Vehicle trips per day
Mile End Road	149,500	6,877
Annangrove Road South	52,510	2,415
Annangrove Road North	215,495	3,189
Total	417,505	12,481

Traffic management infrastructure proposed due to the predicted traffic volumes, included in Contributions Plan No. 11 are detailed below;

- Annangrove Road to be upgraded to a Sub-Arterial Class 1 standard between Windsor Road and Murphy's Bridge to cater for the Industrial traffic. Annangrove Road to be widened to two lanes in each direction with a median strip to prevent right turning traffic movements. The road widening will taper at the bend on Annangrove Road at Crown Road.

- Annangrove Road and Edwards Road intersection to be upgraded to a two lane roundabout to accommodate traffic to and from the Edwards Road precinct and to provide a u-turn facility for vehicles to access developments along Annangrove Road.
- Withers Road between Mile End Road and Annangrove Road to be upgraded to Sub-Arterial Class 2. Traffic signals are required at Mile End Road and Withers Road, Contributions Plan No. 11 will levy 50% of the cost of the intersection upgrade.
- A two lane roundabout is required at the intersection of Annangrove Road and Withers Road. Industrial development will be responsible for the full costs levied under Contributions Plan No. 11.

2.3 ADJACENT ROAD NETWORK

Annangrove Road

Annangrove Road is a two-way sealed road with one lane in each direction and is classified as a sub-arterial road. There are formed shoulders on both sides, though there are no formed kerb structures, a signed speed limit of 70km/h applies. The section of Annangrove Road relevant to this study lies between Withers Road to the south and Murphy's Bridge to the north. Annangrove Road is a designated on-street cycleway.

Figure 2-6 Annangrove Road

Windsor Road

Windsor Road is an arterial road connecting Annangrove Road to the Northwest and the rest of Sydney. Windsor Road has two traffic lanes in each direction with two right turning lanes on the northbound approach to Annangrove Road and a left slip lane on the southbound approach to Annangrove Road.

Withers Road

Withers Road is currently a collector road connecting North Kellyville with Rouse Hill. It is a two-way sealed road with one lane each direction, with a posted speed limit of 60km/hr.

Figure 2-7 Withers Road

Edwards Road

Edwards Road is also a collector road with a posted speed limit of 60km/hr. It is a two-way sealed road with one lane each direction on the western side of Annangrove Road. Edwards Road is unformed on the eastern side of Annangrove Road with only a private gravel driveway access located within the road reserve.

Figure 2-8 Edwards Road

2.4 TRAFFIC VOLUMES

Traffic surveys were undertaken by SkyHigh – The Traffic Survey Company on Thursday 29 March 2012 from the hours of 7am to 10am and 3pm to 7pm at the Annangrove Road / Withers Road and Annangrove Road / Edwards Road intersections. The traffic surveys documented the number of light vehicle, heavy vehicle and bus movements at these intersections, there were no pedestrian or cyclist movements observed during the survey.

The morning peak traffic period was recorded from 8.15am to 9.15am for both intersections whilst the evening peak traffic period was recorded from 3.45pm to 4.45pm and 4.15pm to 5.15pm for Annangrove Road/Edwards Road and Annangrove/ Withers Road intersections respectively. Results of the traffic surveys have been included in Appendix B.

2.5 CRASH DATA

Crash data for the study area, obtained from the NSW Roads and Maritime Services, provides information on crash location and types from 2006 to 2010, which is summarised in Table 2-2.

The data shows that there were only 13 crashes recorded in the study area in the last five years, six of those recorded involved light trucks. The crash data from 2006-2010 indicates that there have been no pedestrian or cyclists involved in accidents along Annangrove Road. During this period, there were no recorded accidents that resulted in a fatality and only three accidents that resulted in an injury. There seems to be no obvious time period of concern and no safety issues in wet weather or at night time.

Significant issues identified include right turning movements from Annangrove Road to Edwards Road and conflict between eastbound movements on Edwards Road and north/south movements on Annangrove Road; this may be due to poor sight distances or clarity of priority at the intersection.

An upgrade of the Edwards Road / Annangrove Road intersection should be considered on safety grounds, particularly if there is an increase in right turn movements at the intersection.

2.6 PUBLIC TRANSPORT

Annangrove Road is serviced by the Hills Bus route 641 linking Dural to Rouse Hill Town Centre via Annangrove Road. The current service operates six times daily to Rouse Hill Town Centre from Dural westbound on Annangrove Road and four times daily eastbound on Annangrove Road in the direction of Dural from Rouse Hill. The current timetable is shown in Table 2-3 below.

Table 2-2 Crash Data for Annangrove Road

Year	Road	Location	Notes
2006	Annangrove Road	Edwards Road	Dry. Northbound rear-end.
2006	Annangrove Road	Edwards Road	Dry. Car travelling eastbound on Edwards Road crossed in front of truck travelling southbound on Annangrove Road.
2006	Annangrove Road	Edwards Road	Dry. Car travelling eastbound on Edwards Road crossed in front of car travelling northbound on Annangrove Road.
2007	Annangrove Road	Edwards Road	Wet. Northbound rear-end.
2007	Annangrove Road	Edwards Road	Dry. Motorcycle travelling eastbound on Edwards Road crossed in front of car travelling northbound on Annangrove Road.
2007	Annangrove Road	Edwards Road	Dry. Right rear collision, truck waiting to turn right.
2009	Annangrove Road	Edwards Road	Dry. Left turn side swipe.
2009	Annangrove Road	Edwards Road	Dry. Right rear collision, car turning right hit by lorry.
2009	Annangrove Road	Withers Road	Wet. Car travelling northbound went off roadway into fence when turning left.
2010	Annangrove Road	Edwards Road	Dry. Southbound rear-end involving stationary truck.
2010	Annangrove Road	Withers Road	Dry. Right rear collision, van turning right.
2010	Edwards Road	Annangrove Road	Dry. Eastbound rear-end.
2010	Windsor Road	Annangrove Road	Wet. Car went off roadway on slip lane to left into signal pole.

Table 2-3 Hills Bus Route 641 Timetable

Hills Bus - Route 641	Dural to Rouse Hill Town Centre	Rouse Hill Town Centre to Dural
Annangrove Road & Edwards Road	11.48am 4.04pm 4.29pm 5.02pm 6.04pm 6.44pm	6.33am 9.08am 12.09pm 5.30pm

2.7 FIELD ASSESSMENT

Site inspections of the land use, road condition, intersection characteristics, pedestrian access and cyclist provisions within the study were undertaken in March and April 2012. The aim of these field reviews was to collect information about the road network, intersection operation, safety characteristics, public transport, and specific network / land-use factors potentially of influence in the development of traffic management strategies for the area. The information gathered throughout these field reviews has been used in formulation of this assessment.

3.0 DETAILS OF PROPOSED MASTER PLAN

This section of the report describes the nature of the proposed master plan, a review of the proposed access arrangements and an assessment of the traffic generation and distribution of the future development.

3.1 PROPOSED LAND USE

The Edwards Road precinct is located on the eastern side of Annangrove Road extending south to Withers Road with Cattai and Second Ponds Creek forming the northern and eastern boundaries. The total site area is approximately 39Ha with a potential floor space yield of approximately 25Ha. The master plan proposes to have two zones within the precinct. The south of the precinct will be IN2 Light Industrial similar to existing, with a reduced minimum lot size of 2,500sqm. The north of the precinct will be zoned B6 Enterprise Corridor with a mix of 2,500sqm, 4,000sqm and 8,000sqm minimum lot sizes. The precinct has been divided into six areas with internal road networks linking to Annangrove Road. The proposed master plan showing the zones and areas are shown in Figure 3-1 and Figure 3-2 and can also be found in Appendix A.

Figure 3-1 Master Plan – Proposed Land Use Zone

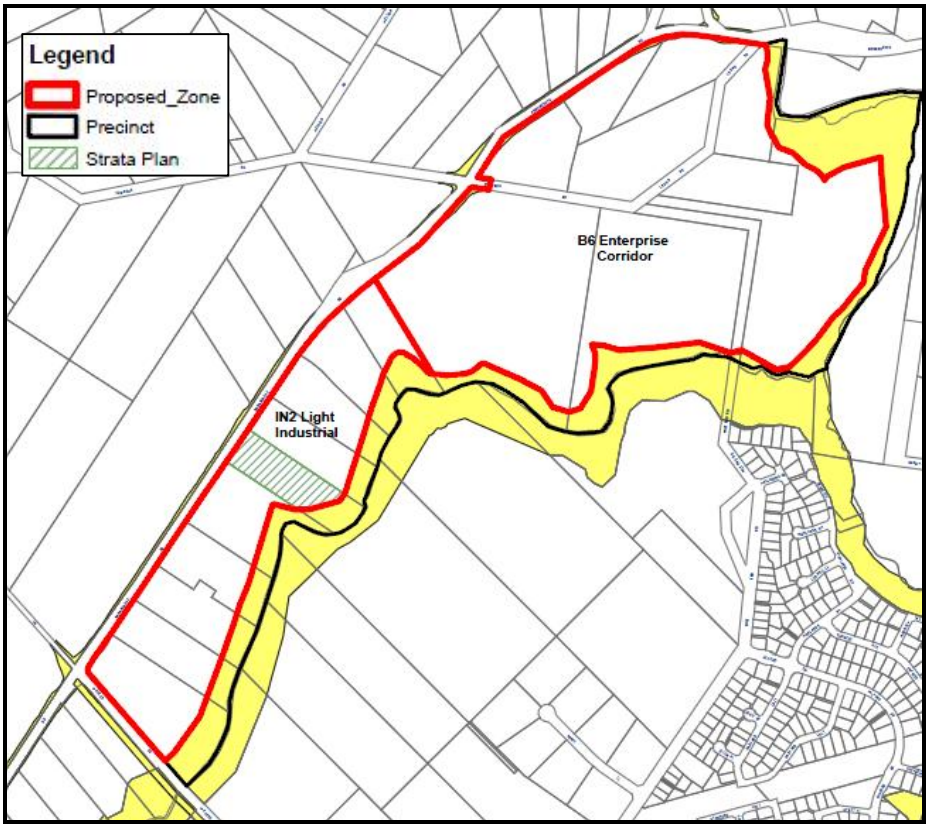
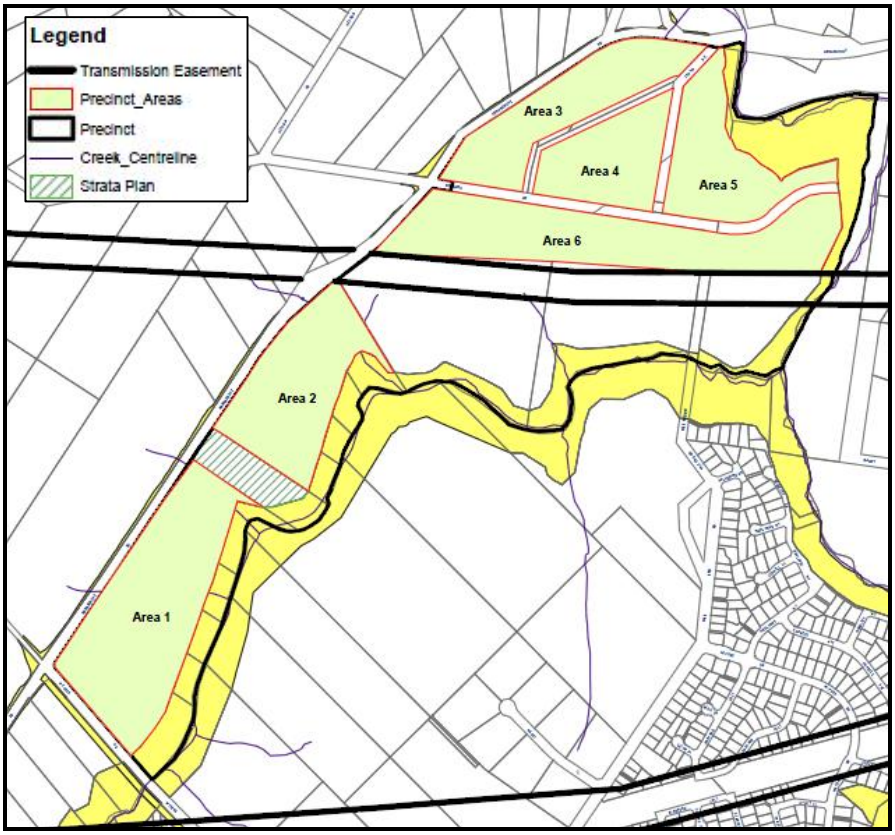


Figure 3-2 Master Plan – Proposed Precinct Areas



3.2 PROPOSED ACCESS ARRANGEMENTS

Based on the proposed master plan, access to the Edwards Road precinct is proposed via new roads, intersections and also direct access from Annangrove Road to some of the developments. Plans of the proposed new roads and intersections are shown in Figure 3-3 and Figure 3-4. Access to the proposed precinct areas are outlined below:

Area 1

Access to Area 1 of the Edwards Road precinct is proposed via direct access from Annangrove Road to each development. Left in/ left out only movements are permitted.

Annangrove Road is proposed to be upgraded to Sub-Arterial Class 1 where typically direct vehicular access to property is not permitted. This should be taken into consideration when finalising the master plan and consultation with the Roads and Maritime Services is advised.

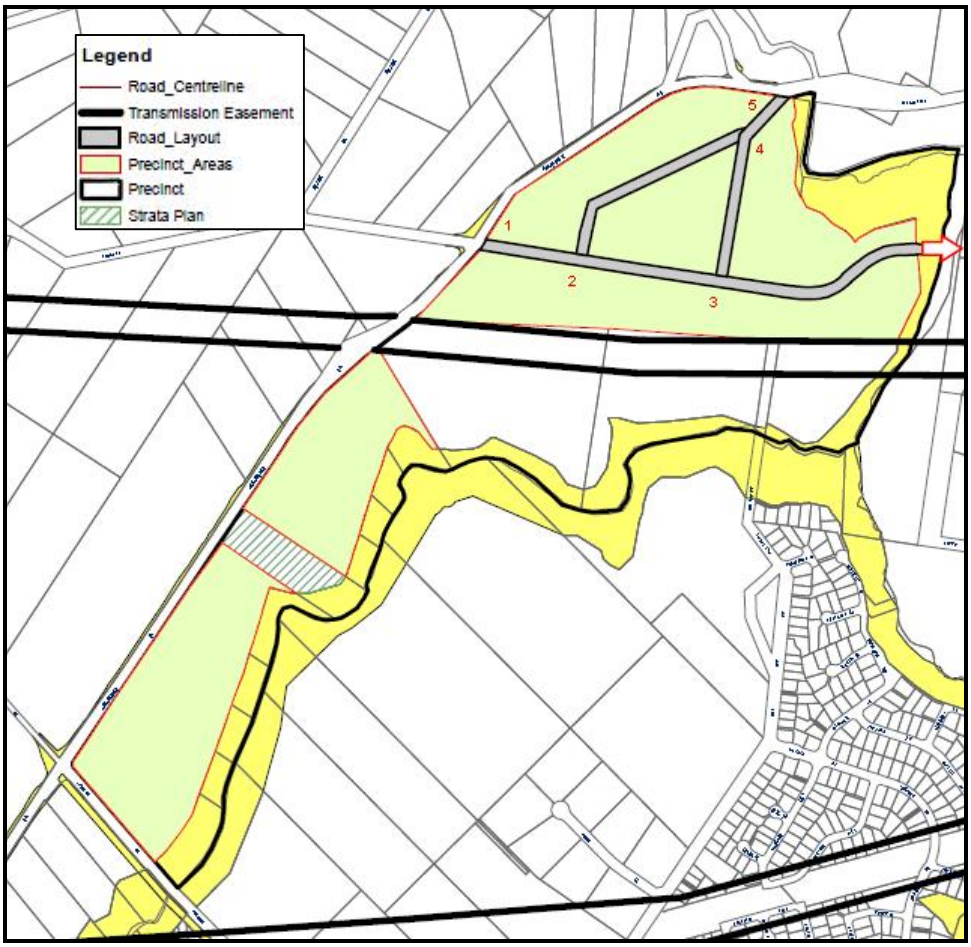
Area 2

There are two access options proposed for Area 2 of the precinct as follows:

- Option 1: Direct access from Annangrove Road to each development, left in /left out movements permitted only.

  Annangrove Road is proposed to be upgraded to Sub-Arterial Class 1 where typically direct vehicular access to property is not permitted. This should be taken into consideration when finalising the master plan and consultation with the Roads and Maritime Services is advised.

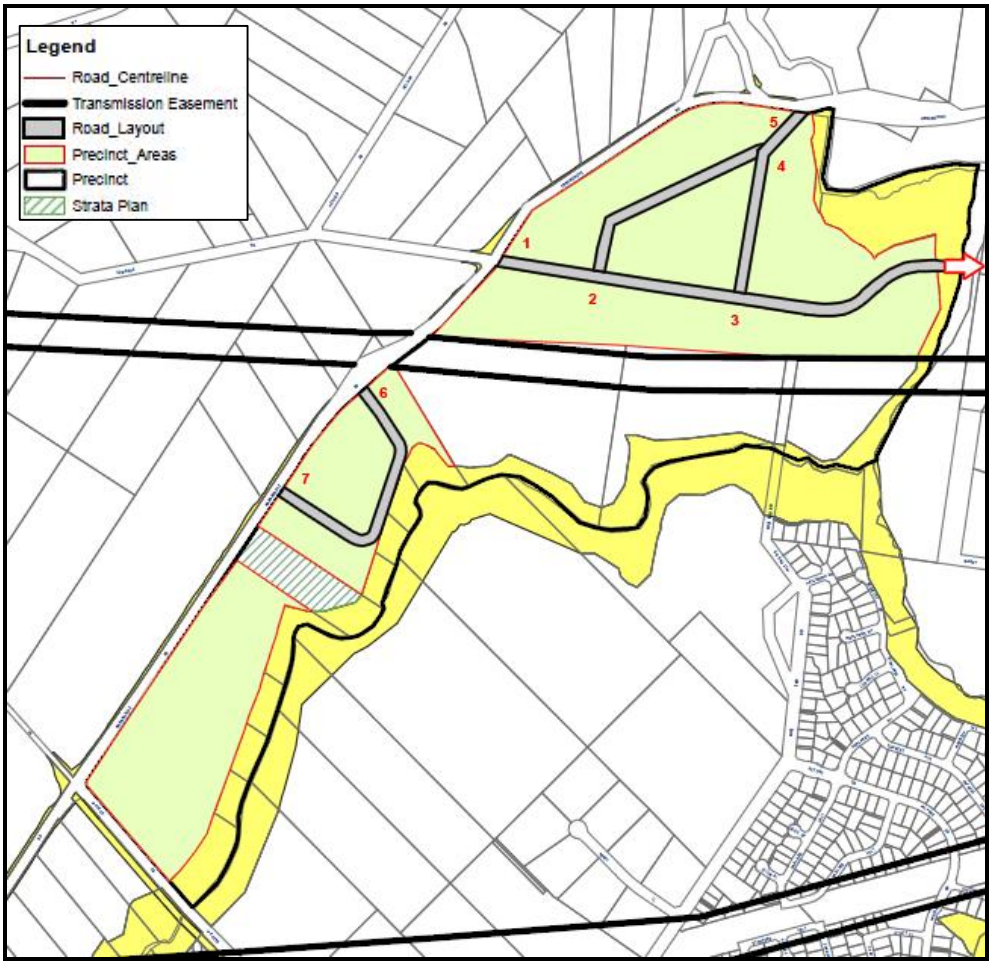
Figure 3-3 Master Plan – Proposed Road Layout Option 1



- Option 2: Two new intersections (intersections 6 and 7) on Annangrove Road. The intersections will be priority controlled left in/ left out configuration with an internal road linking to both intersections.

The project team also suggests consideration of providing just one access road to Area 2 from Annangrove Road at either intersection 6 or 7 with a cul-de-sac at the other proposed intersection. This reduces the number of intersections on Annangrove Road reducing the conflict points and potentially increasing the available floor space in the area.

Figure 3-4 Master Plan – Proposed Road Layout Option 2



Areas 3, 4, 5 and 6

These are the proposed access arrangements for Areas 3, 4, 5 and 6:

To access Areas 3 to 6 from south and west, it is proposed to extend Edwards Road east at the existing Annangrove Road / Edwards Road intersection. This intersection is proposed to be upgraded to a two lane roundabout.

From north and east, a new road, namely Crown Road, will link the extension of Edwards Road to Annangrove Road just west of Murphy's Bridge. The new intersection at Annangrove Road / Crown Road (intersection 5) is proposed to be priority controlled with a left in/ left out configuration.

Another internal road is also proposed linking Edwards Road to Crown Road; this road will provide access to Areas 3 and 4.

Based on the results of the link capacity assessment in Section 4.3, the two new intersections along Edwards Road (intersections 2 and 3) are proposed to be a roundabout and a priority controlled intersection respectively. Assessment of the operation of the two intersections is included in Section 4.7. The intersection on Crown Road (intersection 4) is proposed to have left in/ left out configuration.

3.3 TRAFFIC GENERATION AND DISTRIBUTION

3.3.1 TRAFFIC GENERATION

The Roads and Traffic Authority (now Roads and Maritime Services) *Guide to Traffic Generating Developments 2002* outlines traffic generation rates for industry. Table 3-1 summarises the traffic generation rates for daily vehicle trips and peak hour vehicle trips for different land uses. The traffic generated by the proposed master plan for the precinct has been calculated to understand the total impact of the future development in the Edwards Road Precinct.

Table 3-1 Traffic Generation Rates for Industry

Landuse	Traffic Generation Rates	
	Peak Hour Vehicle Trips	Daily Vehicle Trips
Factories	1 / 100m² GFA	5 / 100m² GFA
Warehouses	0.5 / 100m² GFA	4 / 100m² GFA

The Edwards Road precinct is proposed to be divided into two zones, IN2 Light Industrial zone to the south and B6 Enterprise Corridor to the north. Development is expected to be a mixture of small industrial units and warehousing. For the purpose of this report an average of 4.5 vehicles trips per day / 100 square metres of gross floor area and 0.75 peak hour vehicle trips / 100 square metres of gross floor area have been adopted. Table 3-2 summarises the assumptions and forecast amount of traffic generated. Traffic generation rates for precinct 2 - option 1 were utilised, as this provides a more conservative figure.

Table 3-2 Traffic Generation

Precinct Area	Proposed Zoning	Area	Rate (trips/land use)		Trips	
			Peak (per hour)	Daily (per day)	Peak (per hour)	Daily (per day)
1	IN2 Light Industrial	48,535	0.75 / 100m² GFA	4.5 / 100m² GFA	364	2,184
2: Option 1	IN2 Light Industrial	31,135	0.75 / 100m² GFA	4.5 / 100m² GFA	233	1,401
2: Option 2	IN2 Light Industrial	24,908	0.75 / 100m² GFA	4.5 / 100m² GFA	187	1,121
3	B6 Enterprise Corridor	39,562	0.75 / 100m² GFA	4.5 / 100m² GFA	297	1,780
4	B6 Enterprise Corridor	29,523	0.75 / 100m² GFA	4.5 / 100m² GFA	221	1,329
5	B6 Enterprise Corridor	35,700	0.75 / 100m² GFA	4.5 / 100m² GFA	268	1,607
6	B6 Enterprise Corridor	68,907	0.75 / 100m² GFA	4.5 / 100m² GFA	517	3,101

3.3.2 ASSUMED TRAFFIC DISTRIBUTION

Given the industrial nature of the development and based on the distribution of the traffic count undertaken, a distribution of 75% to the Edwards Road precinct in the AM peak and 25% from the precinct was adopted, with the reverse distribution ratio utilised in the PM peak. A distribution of 90% and 10% was also undertaken to provide a sensitivity test and a better assessment of a more conservative scenario. The distribution ratio to and from the Box Hill Precinct used in the GHD report is within the margins of our two scenarios (Zones 626, 641 and 653). Both scenarios were assessed utilising the same traffic condition and intersection geometry.

After a review of the potential trip ends surrounding the proposed precinct, modelling results from the Box Hill and Box Hill Industrial precincts and the survey data (refer. Appendix B) collected at the intersections of Annangrove Road / Withers Road and Annangrove Road / Edwards Road, the following assumptions regarding traffic distribution have been made to craft a proper assessment of the impact of the new development:

General

- Generated traffic from the Edwards Road precinct is distributed pro rata by the projected 2022 volumes with no development in the Edwards Road precinct. These were calculated using the observed traffic counts, applying background growth per annum and utilising the Box Hill Transport and Access Study projected traffic volumes.
- Traffic generation and its distribution from the Box Hill and Box Hill Industrial Precincts Transport and Access Study prepared by GHD in February 2011 has been utilised at the Annangrove Road / Withers Lane intersection for all traffic movements to and from The Water Lane.

- Projected traffic volumes from the GHD Report for the Annangrove Road / Edwards Road intersection were utilised for the left turn out of Edwards Road into Annangrove Road and also the right turn from Annangrove Road (north) into Edwards Road.
- Existing traffic wishing to access the Box Hill Area from Withers Road currently use Edwards Road. It has been assumed that in 2022 traffic will use the Water Lane to access the Box Hill Area, therefore, the right turn movement from Withers Road to Annangrove Road, and the left turn movement form Annangrove Road to Edwards Road have been adjusted for the year 2022 to reflect this change. Traffic volumes for the reverse movement (ie right turn from Edwards Road and left turn into Withers Road) have also been adjusted. This assumption has also been used for traffic travelling from the south on Annangrove Road, traffic will access the Box Hill Area using The Water Lane, therefore reducing the northbound through movement at the Annangrove Road / Withers Road intersection, and further reducing the left turn movement from Annangrove Road into Edwards Road.

Areas 1 and 2

- Traffic exiting Areas 1 and 2 and wishing to travel north on Annangrove Road will turn left from Areas 1 and 2, turn right onto The Water Lane, right onto Nelson Road, right onto Edwards Road and left onto Annangrove Road. The long distance to be travelled (2.4km) is due to the fact that exits from Areas 1 and 2 are configured as left in/ left out only.
- Traffic wishing to access Areas 1 and 2 (left in/ left out configuration) from Annangrove Road traveling in the northbound direction performs a U-turn at the Annangrove Road / Edwards Road intersection to access the development traveling southbound on Annangrove Road.

Areas 3, 4, 5 & 6

- Traffic traveling away from these Areas leave via the Edwards Road / Annangrove Road intersection, it is assumed that no vehicles will utilise the left in / left out configuration at Crown Road.
- Traffic leaving these Areas in the PM peak at Edwards Road / Annangrove Road is distributed pro rata by the 2022 projected volumes. This distribution is used in reverse for the AM peak for traffic travelling to these Areas.
- Traffic wishing to access these Areas from the north is distributed 40% / 60% between the Annangrove Road / Crown Road intersection (intersection 5) and the Annangrove Road / Edwards Road intersection (intersection 1), respectively.
- Edwards Road and Annangrove Road are not connected to Ross Place.

Mile End Road Precinct

- Traffic generated from the Mile End Road precinct would utilise Mile End Road and Samantha Riley Drive to access Windsor Road. It has been assumed that 30% of traffic generated from the precinct would be distributed to the Annangrove Road / Withers Road intersection. It was assumed that 10% of this would be distributed to The Water Lane which has been included in the projected traffic volumes from the GHD report. The remaining 20% was distributed pro rata utilising the turning volumes from the traffic surveys undertaken.
- It has been assumed that there has been no development in the precinct to date.

Annangrove Road South Precinct

- Traffic exiting the Annangrove Road South precinct and wishing to travel north on Annangrove Road or west on The Water Lane and Edwards Road will turn left from the precinct, turn left onto Windsor Road, and travel to Annangrove Road via Mile End Road and Withers Road. This is due to the left in / left out access arrangement.
- Traffic wishing to access the precinct from the Annangrove Road / Windsor Road intersection is required to travel north on Annangrove Road and perform a u-turn at the roundabout at Edwards Road to access the precinct from the northern side. It has been assumed that traffic travelling westbound on Windsor Road wishing to access Annangrove Road South precinct would be split equally between Annangrove Road and Mile End Road.
- Traffic travelling to and from the precinct was distributed pro rata utilising the turning volumes from the traffic counts undertaken.
- It has been assumed that there has been no development in the precinct to date.

Based on the above guidelines and assumptions, traffic flow diagrams for the Withers Road and Edwards Road intersections detailing the estimated additional traffic generated by the future industrial development of the Annangrove Light Industrial Area and surrounding developments are included in Appendix C.

4.0 IMPACT ASSESSMENT

This section of the report describes the analysis scenarios and presents summaries of the potential impact the development generated traffic volumes could have on Annangrove Road, with a particular focus on the intersections of Annangrove Road at Withers Road and Edwards Road.

4.1 DESIGN TRAFFIC SCENARIOS

In assessing the appropriate form of the intersections on Annangrove Road at Withers Road and Edwards Road, SIDRA Intersection analysis was conducted for the 2012 and 2022, 10 Year Design Horizon scenarios to confirm that the intersection will operate efficiently and safely in its proposed form. In the analysis of the intersection, the following traffic flow scenarios were adopted:

- 2012 AM and PM Peak – Existing Layout;
- 2022 AM and PM Peak (Background Traffic + Industrial Precinct) 90% / 10% Distribution – Proposed Layout; and
- 2022 AM and PM Peak (Background Traffic + Industrial Precinct) 75% / 25% Distribution - Proposed Layout.

4.2 FORECASTED TRAFFIC VOLUMES

As previously discussed, traffic count data was obtained for the intersections of Annangrove Road with Withers Road and Edwards Road, for both peak periods on a weekday to understand the current movement and distribution of vehicles into and out of the existing light industrial area.

The 2022 background traffic volumes (i.e. the through movements) have been calculated by applying a compound growth rate of 3% per annum to the through movement on Annangrove Road and to the turning movements of the side streets, agreed upon with Council. Forecasted volumes for The Water Lane were taken from the Box Hill and Box Hill Industrial Precinct Transport and Access Study, utilising the same growth rate “backwards” from 2036 to 2022.

In establishing the future year design volumes, the development generated traffic was added to the 2012 and estimated 2022 background traffic flows. The traffic flow diagrams for each of the analysis scenarios identified above are shown in Appendix C.

4.3 LINK CAPACITY ASSESSMENT

Assessment of the capacity of roads for the year 2022 has been undertaken utilising general principles found in Section 5.2 of the AUSTROADS Guide to Traffic Management. These principles are shown below:

- Considering median or an inner lane:
    - Divided road - 1,000 vehicles per hour per lane.
    - Undivided road – 900 vehicles per hour per lane.
- Considering a middle lane - 3-lane carriageway:
    - Divided road – 900 vehicles per hour per lane.
    - Undivided road - 1,000 vehicles per hour per lane.
- Considering a kerb lane:
    - Adjacent to parking lane – 900 vehicles per hour per lane.
    - Occasional parked vehicles – 600 vehicles per hour per lane.
    - Clearway conditions – 900 vehicles per hour per lane.

The roads which will have their capacities assessed in this Report are Annangrove Road, Withers Road and Edwards Road. The Water Lane has been left out of the scope as it has already been assessed in the Box Hill and Box Hill Industrial Precincts – Transport and Access Study by GHD.

Annangrove Road

It is assumed that Annangrove Road will have a general configuration of two lanes per direction, divided along its extension, with occasional parked vehicles. Its capacity per direction has been calculated as:

- Section - North of Edwards Road Intersection, Section – Between Edwards Road Intersection and Withers Road Intersection, and Section – South of Withers Road

  1000 vehicles/h median lane + 600 vehicles/h occasional parked vehicles = 1600 vehicles/h

Withers Road and Edwards Road

Based on the LEP and CP11, Edwards Road and Withers Road are proposed to have one travelling lane per direction, undivided. The capacity of the roads has been calculated as below:

- Edwards Road and Withers Road

  900 vehicles/h undivided road

Volume – Capacity Ratios (VCR)

Table 4-1 to Table 4-4 demonstrate the calculated AM and PM Peak volume-capacity ratios (VCRs) respectively utilising the above mentioned methodology.

Table 4-1 AM Peak Volume Capacity Ratios (VCRs) - Distribution: 90% / 10%

Road	Section	Direction	Volume (veh)	Capacity (veh)	VCR
Annangrove Road	North of Edwards Road Intersection	NB	662	1600	0.41
		SB	1375	1600	0.86
	Edwards Road Intersection to Withers Road Intersection	NB	1046	1600	0.65
		SB	794	1600	0.50
	South of Withers Road Intersection	NB	677	1600	0.42
		SB	798	1600	0.50
Withers Road	East of Annangrove Intersection	EB	683	900	0.76
		WB	1144	900	1.27
Edwards Road	West of Annangrove Intersection	EB	665	900	0.74
		WB	366	900	0.41
	East of Annangrove Intersection (Precinct)	EB	950	900	1.06
		WB	132	900	0.15

Table 4-2 PM Peak Volume Capacity Ratios (VCRs) - Distribution: 90% / 10%

Road	Section	Direction	Volume (veh)	Capacity (veh)	VCR
Annangrove Road	North of Edwards Road Intersection	NB	1491	1600	0.93
		SB	645	1600	0.40
	Edwards Road Intersection to Withers Road Intersection	NB	458	1600	0.27
		SB	1105	1600	0.69
	South of Withers Road Intersection	NB	562	1600	0.35
		SB	607	1600	0.38
Withers Road	East of Annangrove Intersection	EB	840	900	0.93
		WB	933	900	1.04
Edwards Road	West of Annangrove Intersection	EB	611	900	0.68
		WB	556	900	0.62
	East of Annangrove Intersection (Precinct)	EB	141	900	0.16
		WB	1175	900	1.31

Table 4-3 AM Peak Volume Capacity Ratios (VCRs) - Distribution: 75% / 25%

Road	Section	Direction	Volume (veh)	Capacity (veh)	VCR
Annangrove Road	North of Edwards Road Intersection	NB	796	1600	0.5
		SB	1258	1600	0.78
	Edwards Road Intersection to Withers Road Intersection	NB	922	1600	0.58
		SB	904	1600	0.57
	South of Withers Road Intersection	NB	608	1600	0.38
		SB	795	1600	0.50
Withers Road	East of Annangrove Intersection	EB	725	900	0.81
		WB	1088	900	1.21
Edwards Road	West of Annangrove Intersection	EB	642	900	0.71
		WB	422	900	0.47
	East of Annangrove Intersection (Precinct)	EB	795	900	0.88
		WB	327	900	0.36

Table 4-4 PM Peak Volume Capacity Ratios (VCRs) - Distribution: 75% / 25%

Road	Section	Direction	Volume (veh)	Capacity (veh)	VCR
Annangrove Road	North of Edwards Road Intersection	NB	1334	1600	0.83
		SB	708	1600	0.44
	Edwards Road Intersection to Withers Road Intersection	NB	569	1600	0.36
		SB	1051	1600	0.66
	South of Withers Road Intersection	NB	622	1600	0.39
		SB	586	1600	0.37
Withers Road	East of Annangrove Intersection	EB	791	900	0.88
		WB	956	900	1.06
Edwards Road	West of Annangrove Intersection	EB	622	900	0.69
		WB	507	900	0.56
	East of Annangrove Intersection (Precinct)	EB	281	900	0.31
		WB	980	900	1.09

From Table 4-1, Table 4-2, Table 4-3 and Table 4-4, we obtain the following:

- Traffic volumes forecasted for the year 2022 for most of the main roads within this Study will be accommodated in a satisfactory manner, not exceeding the road capacities calculated above, except in the following sections/ period, where volumes will be close to road capacity (over 0.90):
    - Annangrove Road – North of Edwards Road – PM Peak – NB – VCR=0.93 (90%/10% distribution).
    - Withers Road – East of Annangrove Road – PM Peak – EB – VCR=0.93 (90%/10% distribution).
- The westbound AM and PM peak volumes on Withers Road will exceed capacity in both the 90%/10% and 75%/25% distribution scenarios.
- The eastbound AM peak volume on Edwards Road, east of Annangrove Road will exceed road capacity for the 90%/10% distribution scenario.
- The PM peak westbound volumes on Edwards Road, east of Annangrove will exceed road capacity for both the 90%/10% and 75%/25% distribution scenarios.

Based on the Volume Capacity Ratios calculated above, it is recommended that both Withers Road and Edwards Road East be upgraded to two traffic lanes in each direction in order to provide sufficient capacity to accommodate the volume of traffic generated by the Edwards Road Precinct and surrounding developments.

Table 4-5 below shows the VCR's for Edwards Road and Withers Road when upgraded to two traffic lanes in each direction showing.

Table 4-5 Volume Capacity Ratios (VCRs) for Withers Road and Edwards Road East

	Road	Section	Direction	Volume (veh)	Capacity (veh)	VCR
AM Peak – 90% / 10%	Withers Road	East of Annangrove	WB	1144	1500	0.76
	Edwards Road	East of Annangrove	EB	950	1500	0.63
PM Peak – 90% / 10%	Withers Road	East of Annangrove	EB	840	1500	0.56
			WB	933	1500	0.62
	Edwards Road	East of Annangrove	WB	1175	1500	0.78
AM Peak – 75% / 25%	Withers Road	East of Annangrove	WB	1088	1500	0.73
PM Peak – 75% / 25%	Withers Road	East of Annangrove	WB	956	1500	0.64
	Edwards Road	East of Annangrove	WB	980	1500	0.65

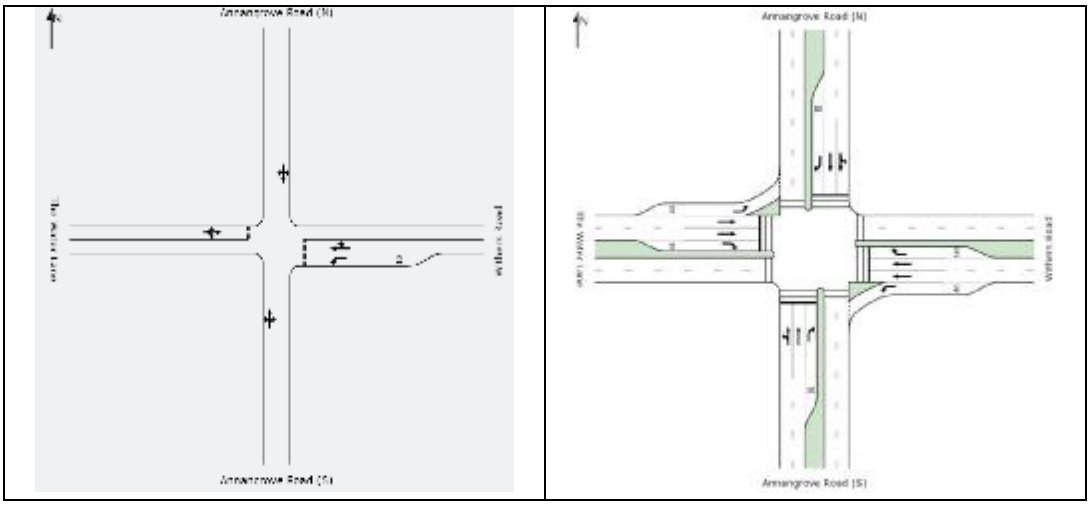
4.4 PROPOSED INTERSECTION LAYOUTS

4.4.1 ANNANGROVE ROAD / WITHERS ROAD

The Annangrove Road / Withers Road intersection is currently a priority controlled intersection. Annangrove Road has one traffic lane in each direction, Withers Road also has one lane in each direction with one traffic lane on approach to the intersection and space for one left turning vehicle at the yield line. The Water Lane is currently a narrow road with one lane per direction.

The intersection of Annangrove Road and Withers Road is proposed to be a signalised intersection with two traffic lanes in each direction on Annangrove Road, Withers Road and The Water Lane. There are right turn bays on all approaches to the intersection with left turn slip lanes on Withers Road and The Water Lane. Figure 4-1 shows the existing and proposed intersection layouts.

Figure 4-1 Existing and Proposed Layout at Annangrove Road/Withers Road Intersection



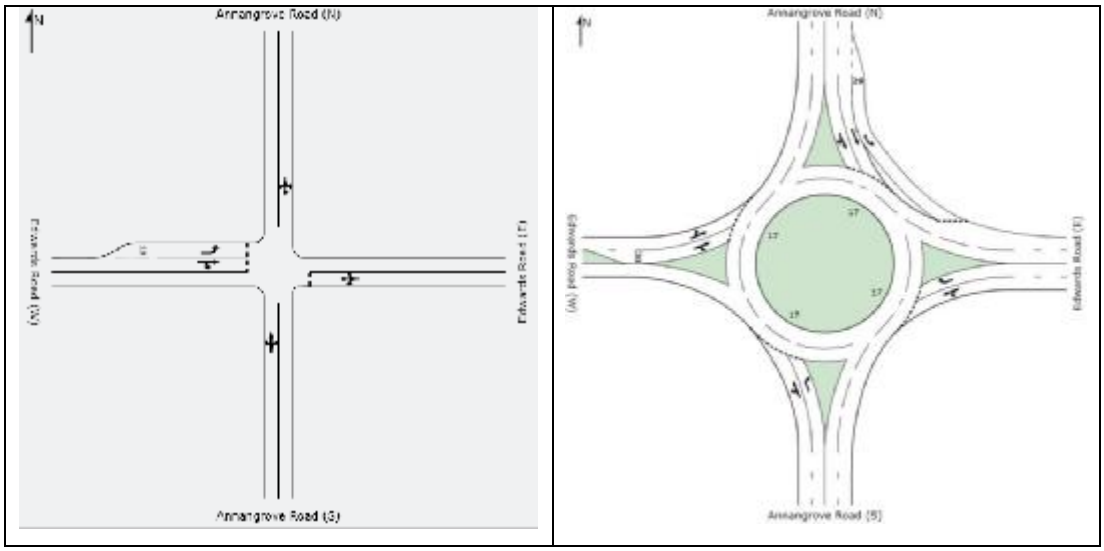
4.4.2 ANNANGROVE ROAD / EDWARDS ROAD

The intersection of Annangrove Road and Edwards Road is currently a priority controlled intersection. Annangrove Road has one traffic lane in each direction; Edwards Road west is one lane per direction with one lane on the approach to the intersection and space for one left turning vehicle at the yield line. Edwards Road east is currently an unformed road with only a private gravel driveway access located within the road reserve.

A two lane roundabout has been proposed at the Annangrove Road and Edwards Road intersection. Annangrove Road is proposed to have two lanes in each direction with a 20m left turn slip lane on the northern approach to the roundabout. Edwards Road west is proposed to have one lane per direction with an additional 30m lane on approach to the roundabout for through and right turning traffic.

Based on the VCR's calculated above Edwards Road east (new extension) is proposed to have two lanes on approach to and departing the roundabout. Figure 4-2 shows the existing and proposed intersection layouts.

Figure 4-2 Existing and Proposed Layout at Annangrove Road/Edwards Road Intersection



4.5 SIDRA INTERSECTION ANALYSIS

SIDRA Intersection 5.0 models have been developed to confirm that the intersections will operate efficiently up to the 2022 Ten Year Design Horizon. The intersections have been assessed using the current intersection layout and the proposed intersection layout. A summary of the SIDRA Intersection 5.0 output tables are included in Appendix D. It should be noted that the analysis for the 2022 scenario was undertaken on the basis of the industrial area being fully developed.

SIDRA is an intersection assessment tool that assesses each intersection in isolation, without considering the interaction of adjacent intersections. While SIDRA can include an improvement to the arrival type to reflect co-ordination, it does not consider the interaction between the adjacent intersections. Any studies of particular options being taken forward should incorporate further assessment to ensure that these impacts are considered.

For the purpose of the SIDRA assessment, the default SIDRA software parameters have been adopted for this study and assessment, unless otherwise stated in this Report.

The following assumptions have been made whilst performing intersection analysis in SIDRA Intersection 5.0:

- Peak Flow Period is 60 minutes;
- Peak Flow Factor is 100%;

- Signal Analysis Method – Fixed Time; and
- Heavy Vehicle percentage (HV%) is 8% in the AM peak and 6% in the PM peak, these figures represent the average contribution of heavy vehicles in the recent traffic survey undertaken.

The criterion used to assess the operational performance of the intersections is described below:

- Level of Service (LoS)

  Represented by a letter from A to F, reflected by and set according to the control delay (sum of the approach and acceleration delay);

Table 4-6 Level of Service Definition (RMS method)

Level of Service	Control Delay per vehicle (seconds)
A	d <= 14.5
B	14.5 < d <= 28.5
C	28.5 < d <= 42.5
D	42.5< d <= 56.5
E	56.5 < d <= 70.5
F	d > 70.5

- Degree of Saturation (DoS)

  The degree of saturation is defined as the ratio of demand flow to capacity also known as volume / capacity. A value above 1.0 represents an oversaturated condition (demand flows exceed capacity) and degrees of saturation below 1.0 represent undersaturated conditions (demand flows are below capacity);

- Average Delay (seconds)

  The average delay is a time in seconds, representing the total delay for vehicles in all lanes on the approach to an intersection. This value is the sum of the queue delay and the acceleration delay;

- Average Queue (vehicles)

  The average queue is a length represented by the number of vehicles on an approach to an intersection travelling equal to or less than the queue threshold which is set to 25% of the free-flow speed;

4.5.1 2012 BASE CASE

Analysis of the Annangrove Road / Withers Road intersection and Annangrove Road / Edwards Road intersection was undertaken for the 2012 base case scenario using traffic volumes from the traffic survey undertaken and using the existing geometry of the intersection.

This analysis shows how the intersections are currently operating. The results of the intersection analysis are shown below in Table 4-7.

Table 4-7 2012 Base Case

Approach	AM Peak				PM Peak			
	DOS	95% Queue (veh)	Average Delay (sec)	LOS	DOS	95% Queue (m)	Average Delay (sec)	LOS
Annangrove Road/Withers Road intersection								
Annangrove Road (S)	0.165	1.2	5.8	NA*	0.181	1.1	4.6	NA*
Withers Road (E)	0.644	4.4	21.8	B	0.581	4.1	18.4	B
Annangrove Road (N)	0.275	2.0	5.7	NA*	0.154	1.0	5.6	NA*
The Water Lane (W)	0.010	0.0	14.6	B	0.581	4.1	1.02	NA*
Annangrove Road /Edwards Road intersection								
Annangrove Road (S)	0.157	1.2	3.5	NA*	0.166	1.1	4.9	NA*
Edwards Road (E)	0.022	0.1	33.7	C	0.010	0.0	12.9	A
Annangrove Road (N)	0.252	1.6	5.2	NA*	0.283	1.7	7.0	NA*
Edwards Road (W)	0.444	2.2	16.2	B	0.358	0.8	12.4	A

* NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

4.5.2 2022 BACKGROUND TRAFFIC + INDUSTRIAL PRECINCT: DISTRIBUTION 90%/10% - PROPOSED LAYOUT

The analysis of the proposed intersection upgrades was undertaken for the 2022 design traffic scenario to ensure that the new intersections would operate at a satisfactory level to a 10 year design horizon. As discussed previously the 2022 background traffic volumes at the intersections were derived by applying a 3% per annum growth rate to the 2012 through and turning movements. In calculating the traffic for this scenario the additional generated traffic was simply added to the 2022 background traffic flows. A distribution of 90% and 10% was used to and from the precinct in the AM peak respectively, with the reverse in the PM peak. The results of the intersection analysis are shown in Table 4-8.

4.5.3 2022 BACKGROUND TRAFFIC + INDUSTRIAL PRECINCT: DISTRIBUTION 75%/25% - PROPOSED LAYOUT

This scenario is similar to the scenario analysed in Section 4.5.2 above with a distribution of 75% and 25% to and from the precinct in the AM peak respectively, with the reverse in the PM peak. The results of the intersection analysis are shown in Table 4-9.

Table 4-8 2022 Background Traffic + Industrial Precinct (90%/10%) - Proposed Layout

Approach	AM Peak				PM Peak			
	DOS	95% Queue (veh)	Average Delay (sec)	LOS	DOS	95% Queue (m)	Average Delay (sec)	LOS
Annangrove Road/Withers Road intersection								
Annangrove Road (S)	0.677	15.5	44.8	D	0.402	8.6	28.1	B
Withers Road (E)	0.782	20.5	30.6	C	0.756	10.5	31.4	C
Annangrove Road (N)	0.794	21.2	49.7	D	0.754	18.8	33.3	C
The Water Lane (W)	0.520	9.1	42.2	C	0.321	5.2	29.1	C
Annangrove Road /Edwards Road intersection								
Annangrove Road (S)	0.652	6.2	15.2	B	0.552	4.0	16.0	B
Edwards Road (E)	0.175	1.0	17.1	B	0.651	4.9	14.2	A
Annangrove Road (N)	0.753	10.0	21.2	B	0.210	1.1	10.0	A
Edwards Road (W)	0.544	3.6	14.1	A	0.794	10.5	25.2	B

Table 4-9 2022 Background Traffic + Industrial Precinct (75%/25%) - Proposed Layout

Approach	AM Peak				PM Peak			
	DOS	95% Queue (veh)	Average Delay (sec)	LOS	DOS	95% Queue (veh)	Average Delay (sec)	LOS
Annangrove Road/Withers Road intersection								
Annangrove Road (S)	0.538	12.9	41.3	C	0.459	9.0	29.3	C
Withers Road (E)	0.756	18.4	31.4	C	0.717	11.2	28.6	C
Annangrove Road (N)	0.768	22.0	45.7	D	0.714	17.2	34.2	C
The Water Lane (W)	0.520	9.1	42.4	C	0.321	5.2	28.7	C
Annangrove Road /Edwards Road intersection								
Annangrove Road (S)	0.549	4.1	15.0	B	0.487	3.3	15.2	B
Edwards Road (E)	0.354	2.1	16.0	B	0.592	4.1	14.1	A
Annangrove Road (N)	0.587	5.5	14.8	B	0.254	1.4	10.5	A
Edwards Road (W)	0.496	3.1	13.4	A	0.700	6.8	17.9	B

4.6 SIDRA ASSESSMENT CONCLUSIONS

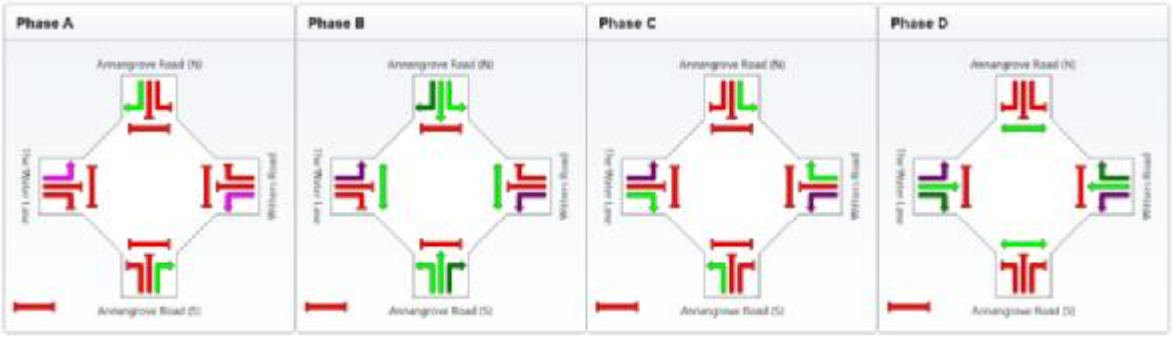
The following discussion and conclusions are based on the SIDRA intersection analysis carried out.

4.6.1 ANNANGROVE ROAD / WITHERS ROAD / THE WATER LANE INTERSECTION

- The Annangrove Road / Withers Road intersection will be controlled by traffic signals. The Box Hill and Box Hill Industrial Precincts Transport and Access Study as well as Council acknowledge this solution, and it has been incorporated into this study.
- All roads leading to the intersection are required to be widened to accommodate traffic generated by the new Edwards Road Precinct as well as the Box Hill Precincts, Mile End Road and Annangrove Road South development.
- The performance of the intersection in 2022 is satisfactory, operating at Level of Service (LOS) C on the approaches in the AM and PM peak periods for the 90%/10% and 75%/25% distribution scenarios.
- Annangrove Road (north) southbound approach:
    - To accommodate traffic turning right to The Water Lane, a 80m long dedicated right turning lane is required.
    - 90%/10% distribution scenario: The approach will operate at LOS D in the AM and B in the PM peak periods with an average delay of 44.8 and 28.1 seconds
    - 75%/25% distribution scenario: The approach will also operate at LOS C in the AM and PM peak periods with average delays of 41.3 and 29.3 seconds.
    - However the DOS in the AM peak for the 90%/10% and 75%/25% distribution scenarios are 0.677 and 0.402 respectively which are well below the maximum acceptable value of 0.9 for a signalised intersection.
- Annangrove Road (south) northbound approach:
    - A 30m right turning lane will also be required on the northbound approach of Annangrove Road to accommodate traffic turning right into Withers Road.
    - 90%/10% distribution scenario: The approach will operate at LOS D in the AM peak and LOS C in the PM. The DOS is 0.794 in the AM which is below the maximum acceptable value of 0.9 for a signalised intersection. There is an average delay of 49.7 and 33.3 seconds in the AM and PM peak periods respectively.
    - 75%/25% distribution scenario: This approach will operate at LOS D in the AM peak and C in the PM peak period with an average delay of 45.7 and 34.2 seconds.

- Withers Road (east) westbound approach:
  - Due to the high volumes of right turning traffic in the AM and PM, there will be a 160m dedicated right turning lane on approach to the intersection. There will also be two through lanes and a 40m left turn slip lane on approach to the intersection.
  - The approach operates at LOS C in the AM and PM peak periods for the 90%/10% distribution scenario with a DOS of 0.782 and 0.756 in the AM for the 90%/10% and 75%/25% distributions respectively.
- The Water Lane (west) eastbound approach:
  - A 10m slip lane will accommodate left turning traffic on approach to the intersection with two straight through lanes and 10m dedicated right turning lane.
  - The approach will operate at LOS C in both the AM and PM peak periods for both distribution scenarios with a DOS of 0.520 and 0.321 in the 90%/10% distribution which are well below the acceptable maximum value.
- The operation of the traffic signals will provide four phases as shown in Figure 4-3.
- The cycle time is 115 seconds in the AM and 90 seconds in the PM.
- A default value of 50 pedestrians per hour was utilised during the assessment. However no pedestrians were recorded during the pedestrian survey undertaken and future volumes were not considered.

Figure 4-3 Diamond Phasing at Annangrove Road / Withers Road Intersection



4.6.2 ANNANGROVE ROAD / EDWARDS ROAD INTERSECTION

- Annangrove Road is to be widened as per CP11, to two lanes per direction, divided by a median. The Annangrove Road / Edwards Road intersection is proposed be controlled by a two lane roundabout.

- In both the 25%/75% and 10%/90% distribution scenarios the performance of the roundabout is satisfactory and accommodates traffic operating at LOS B in both the AM peak periods for the 90%/10% and 75%/25% distribution scenarios and LOS A and B in the PM. The DOS is below the acceptable maximum value of 0.8 for un-signalised intersections.
- Annangrove Road (north) southbound approach:
    - There are two through lanes on this approach to the intersection, with the right lane shared for right turning traffic and a left slip lane of 20m to accommodate traffic turning left into Areas 3, 4, 5 and 6 of the Edwards Road precinct. The left slip lane is required for the 90%/10% distribution scenario to accommodate traffic approaching the roundabout from the north in the AM peak; however two lanes on the approach would be sufficient for the 75%/25% distribution scenario.
    - 90% / 10% distribution scenario: The approach operates at a LOS B and A with average delays of 17.1 and 14.2 seconds in the AM and PM peak periods respectively. The absence of the left turn bay would worsen the performance of the approach to LOS F for the AM peak with no change in the PM peak.
    - 75% / 25% distribution scenario: The approach operates at a LOS B in the AM and A in the PM peak period with an average delay of 16 and 14.1 seconds. The absence of the left turn bay would worsen the performance of the approach to LOS D for the AM peak with no change in the PM peak.
- Annangrove Road (south) northbound approach:
    - There are two lanes on the northbound approach to the roundabout, the inside lane is a dedicated right turning lane due to the high number of vehicles turning right into Areas 3, 4, 5 and 6, and performing u-turn movements (364 and 271 in the AM, 46 and 109 in the PM for 90%/10% and 75%/25% distribution scenarios respectively).
    - The approach operates satisfactorily at LOS B in the AM and PM peak periods for both distribution scenarios with and average delay of 15.2 and 16 seconds in the AM and PM for the 90%/10% distribution scenario and 15 and 15.2 for the 75%/25% distribution scenario.
- Edwards Road (east) westbound:
    - Edwards Road east has two lanes on the approach to the roundabout, one being a dedicated right turn lane to accommodate the high right turning traffic in the PM peak (598 vehicles in 90%/10% scenario, 498 in the 75%/25%).
    - 90% / 10% distribution scenario: The approach operates at LOS B and A for the morning and evening peak periods with average delays of 17.1 and 14.2 seconds.

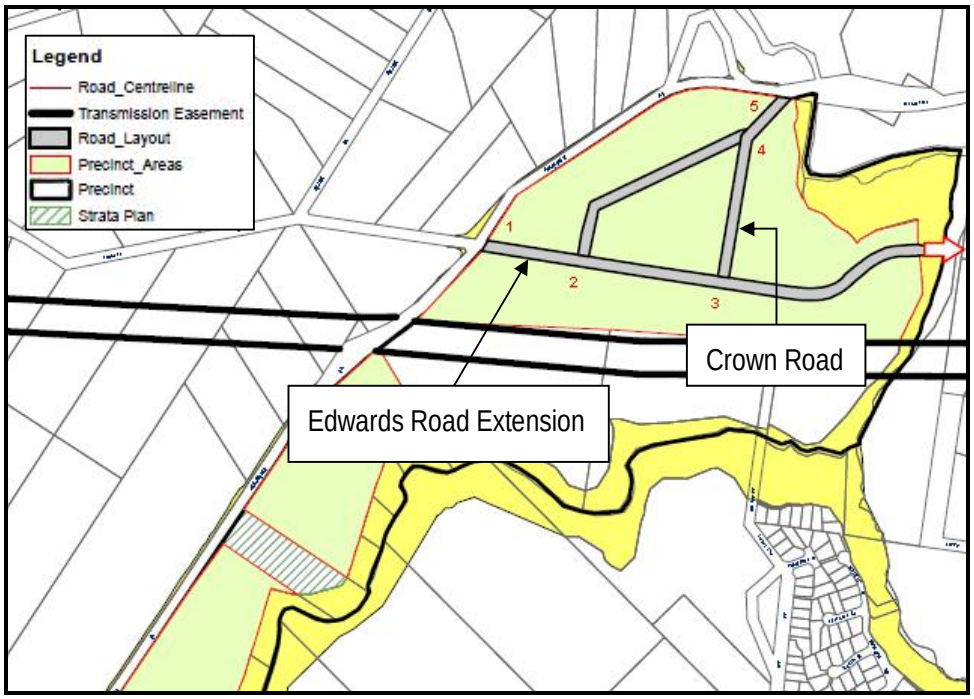
- 75%/25% distribution scenario: The approach operates at LOS B and A for the morning and evening peak periods with an average delay of 16 and 14.1 seconds.

- Edwards Road (west) eastbound approach:
  - Edwards Road west has two lanes on the approach to the roundabout.
  - The approach operates at LOS A in the AM peak period for both distribution scenarios and LOS B in the PM for the 90%/10% and 75%/25% distribution scenarios. The DOS is 0.544 and 0.496 in the AM for the 90%/10% and 75%/25% distribution scenarios which are below the acceptable maximum value of 0.8 for un-signalised intersections.
- Pedestrian and bicycle access were not incorporated in the intersection layout, this must be undertaken during the Concept Design Stage.

4.7 EDWARDS ROAD EXTENSION – INTERSECTIONS 2 & 3

In addition to the main intersections on Annangrove Road at Withers Road and Edwards Road, SIDRA Intersection Analysis was also undertaken for the two new intersections proposed on the Edwards Road extension. These intersections and proposed roads provide access to Areas 3, 4, 5 and 6 of the Edwards Road precinct. The proposed intersections, intersection 2 and 3, are shown in Figure 4-4.

Figure 4-4 Intersections 2 and 3



4.7.1 PROPOSED INTERSECTION LAYOUTS

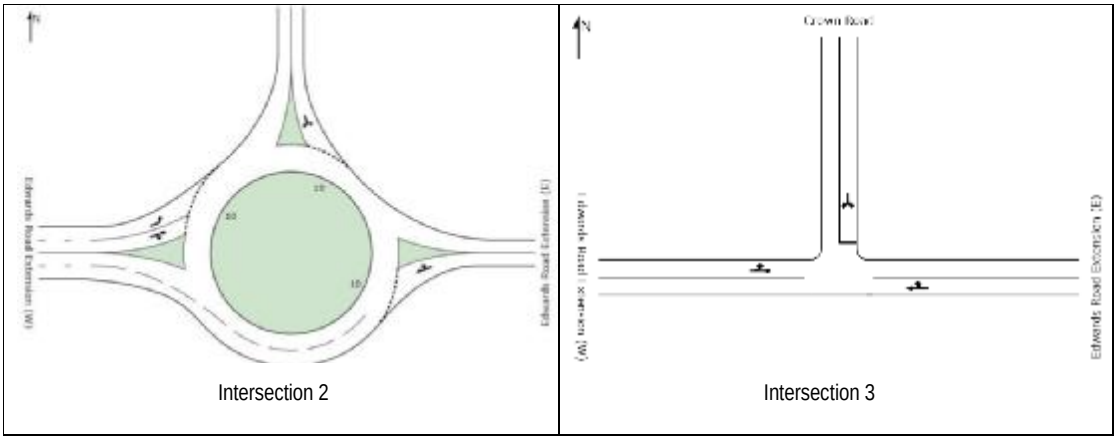
Intersection 2

Based on the VCR's calculated, Edwards Road extension is proposed to have two lanes in each direction between Annangrove Road and Intersection 2, the proposed new road at Intersection 2 will be one lane per direction. A one lane roundabout is recommended at this intersection to provide a u-turn facility for vehicles and facilitate left in / left out restrictions between Annangrove Road and Intersection 2. This will increase safety by preventing vehicles turning across three lanes of traffic. There will be two lanes on the western approach to the roundabout, one through and right and one dedicated left turning lane, there will be one lane on all other approaches to the roundabout. Figure 4-5 shows the proposed intersection layout.

Intersection 3

Edwards Road is proposed to have one lane per direction between Intersection 2 and 3, with one lane per direction on Crown Road also. A priority controlled intersection is proposed at Intersection 3. Figure 4-5 shows the proposed intersection layout

Figure 4-5 Proposed Intersection Layouts



Intersection 2 | Intersection 3

4.7.2 SIDRA INTERSECTION ANALYSIS

Similar to the above SIDRA assessment, the default SIDRA software parameters have been adopted for this assessment. The analysis of the proposed intersections was undertaken for the 2022 design traffic scenario to ensure that the new intersections would operate at a satisfactory level to a 10 year design horizon. A summary of the SIDRA Intersection 5.0 output tables are included in Appendix D. It should be noted that the analysis for the 2022 scenario was undertaken on the basis of the industrial area being fully developed.

A distribution of 90%/10% and 75%/25% was used to and from the precinct in the AM peak, with the reverse in the PM peak. The results of the intersection analysis are shown in Table 4-10 and Table 4-11.

This analysis was carried out based on the following assumptions;

- Left in / left out only movements at Intersections 4 and 5.
- Traffic travelling to Areas 3, 4, 5 and 6 from the north is split 40% and 60% between the intersections at Annangrove Road / Crown Road and Annangrove Road / Edwards Road respectively.
- Traffic travelling from Areas 3, 4, 5 and 6 to the north access Annangrove Road via the Annangrove Road / Edwards Road intersection.

4.7.3 SIDRA ASSESSMENT CONCLUSIONS

The following discussion and conclusions are based on the SIDRA intersection analysis carried out.

Intersection 2

Intersection 2 operates satisfactorily at LOS A for all approaches in the AM and PM peak periods and for both distribution scenarios. The DOS for all situations are well below the maximum value of 0.8 for an un-signalised intersection with average delays of 7.5 and 7.7 seconds on Edwards Road in the eastbound direction during the AM peak period for the 90%/10% and 75%/25% distribution scenarios.

Intersection 3

Similarly Intersection 3 operates satisfactorily for all approaches in the AM and PM peak periods for both distribution scenarios. The DOS is also well below the maximum value for an un-signalised intersection. Average delays of 15.9 and 14.7 seconds were calculated on Crown Road in the PM peak period for the 90%/10% and 75%/25% distributions in the southbound direction.

Table 4-10 2022 Background Traffic + Industrial Precinct (90%/10%)

Approach	AM Peak				PM Peak			
	DOS	95% Queue (veh)	Average Delay (sec)	LOS	DOS	95% Queue (veh)	Average Delay (sec)	LOS
Intersection 2								
Edwards Road (E)	0.084	0.4	7.7	A	0.595	5.0	7.9	A
New Road (N)	0.060	0.3	12.8	A	0.191	1.0	11.5	A
Edwards Road (W)	0.349	2.4	7.5	A	0.031	0.2	6.1	A
Intersection 3								
Edwards Road (E)	0.035	0.2	4.4	NA	0.160	1.0	0.7	NA
Crown Road (N)	0.188	0.8	12.5	A	0.354	1.9	15.9	B
Edwards Road (W)	0.122	0.0	3.4	NA	0.016	0.0	3.4	NA

* NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Table 4-11 2022 Background Traffic + Industrial Precinct (75%/25%)

Approach	AM Peak				PM Peak			
	DOS	95% Queue (veh)	Average Delay (sec)	LOS	DOS	95% Queue (veh)	Average Delay (sec)	LOS
Intersection 2								
Edwards Road (E)	0.190	1.0	7.4	A	0.565	4.7	9.0	A
New Road (N)	0.108	0.6	13.3	A	0.221	1.2	12.3	A
Edwards Road (W)	0.308	2.1	7.7	A	0.155	1.0	8.9	A
Intersection 3								
Edwards Road (E)	0.058	0.3	2.6	NA	0.136	0.8	1.0	NA
Crown Road (N)	0.212	0.9	12.8	A	0.306	1.4	14.7	B
Edwards Road (W)	0.103	0.0	3.4	NA	0.040	0.0	3.3	NA

* NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

4.8 CONSIDERATION OF THE BOX HILL AND NORTH KELLYVILLE PRECINCTS MODELLING

The project team acknowledges the importance of the results and conclusions of the Box Hill and Box Hill Industrial Precincts Transport and Access Study and the North Kellyville Precinct Traffic and Transport Assessment undertaken by GHD and Maunsell respectively.

It was unclear from the Box Hill Transport and Access Study report and a conversation with a representative from GHD if the traffic generation from the Annangrove Light Industrial Area and North Kellyville Precinct was included in the modelling for the Box Hill Precincts. Therefore our approach has been conservative in the whole assessment of traffic flows for the Edwards Road precinct.

The projected intersection turning volumes generated by the NETANAL traffic model for Box Hill Precinct were utilised for turning movements to and from The Water Lane. Projected turning volumes were also utilised at Edwards Road for traffic entering Edwards Road from the north on Annangrove Road and also traffic turning left from Edwards Road onto Annangrove Road in the northbound direction. Travel zones (TZs) TZ665, TZ626 and TZ653 within Box Hill were used to compare distribution ratios as the zones have similar land use patterns to the Edwards Road precinct.

Forecasted traffic flows from the North Kellyville Precinct were not utilised in the assessment of the Edwards Road precinct. It was assumed that traffic generated from the North Kellyville precinct would utilise Commercial Road and Samantha Riley Drive to access Windsor Road, therefore traffic surveys undertaken in 2012 were utilised to forecast traffic volumes on Withers Road for 2022.

The northern connection to Annangrove Road via Ross Place was not included in this study for the Edwards Road precinct. If a Bus connection was to be provided between the North Kellyville and the Edwards Road precinct this would have minimal impact on the performance of the Annangrove Road / Edwards Road intersection and the capacity of Edwards Road. Consideration would need to be given to the potential use of Edwards Road as a bus route when designing the intersection treatments along the section of Edwards Road.

5.0 INFRASTRUCTURE

5.1 INFRASTRUCTURE IMPROVEMENTS

Following the SIDRA intersection analysis and the link assessment, the following infrastructure improvements are recommended;

Annangrove Road / Withers Road Intersection

- Annangrove Road (North) Southbound – three lanes
    - dedicated 80m long right turn bay
    - one through lane
    - one through and left turn lane
- Annangrove Road (South) Northbound – three lanes
    - dedicated 30m long right turn bay
    - one through lane
    - one shared through and left turn lane
- Withers Road (East) Westbound - four lanes
    - dedicated 160m right turn bay
    - two through lanes
    - 40m left turn slip lane
- The Water Lane (West) Eastbound - four lanes
    - dedicated 10m right turn bay
    - two through lanes
    - 10m left turn slip lane

Annangrove Road / Edwards Road Intersection

- Annangrove Road (North) Southbound – two lanes
    - one shared through and right turn lane
    - one through lane
    - one 20m long left slip lane
- Annangrove Road (South) Northbound – two lanes
    - one shared through and left turn lane

  - one right turn lane
- Edwards Road Extension (East) Westbound - two lanes
  - one shared through and left turn lane
  - one right turn lane
- Edwards Road (West) Eastbound - two lanes
  - one shared through and left turn lane
  - dedicated 20m long right turn bay

Edwards Road Extension – Intersection 2

- Edwards Road Extension (East) Westbound - one lane
  - one shared through and right turn lane
- Edwards Road Extension (West) Eastbound- two lanes
  - dedicated left turn lane
  - one shared through and right turn lane
- New Road (north) Southbound – one lane
  - one shared through, left turn and right turn lane

Edwards Road Extension – Intersection 3

- Edwards Road Extension (East) Westbound - one lane
  - one shared through and right turn lane
- Edwards Road Extension (West) Eastbound- one lane
  - one shared through and left turn lane
- Crown Road (north) Southbound – one lane
  - one shared through, left turn and right turn lane

Edwards Road Extension

Based on the link assessment in Section 4.3 the Edwards Road extension is recommended to be a Sub Arterial Class III road between the Annangrove Road / Edwards Road Intersection and Intersection 2. Consideration may be given to the provision of a central median to prevent right turn movements along this section of Edwards Road. A collector road is recommended between Intersection 2 and 3.

Withers Road

Withers Road is currently designated to be a Sub Arterial Class II road in CP11 which provides for only one travelling lane in each direction. Based on the link assessment in Section 4.3 it is recommended that Withers Road be upgraded to two traffic lanes in each direction in order to provide sufficient capacity to accommodate the volume of traffic generated by the Edwards Road Precinct and surrounding developments. Discussions with Council confirmed that they believe this could be achieved within the typical section of the Sub Arterial Class II road and the concept design has been prepared on this basis.

Conceptual design drawings of the proposed new signalised intersection at the Annangrove Road / Withers Road intersection and for the amendments to the proposed new roundabout at Annangrove Road / Edwards Road intersection are included in Appendix E.

5.2 FEASIBILITY OF CONSTRUCTION

Based on the concept design drawings and a site inspection by this office there appears to be no major impediments with respect to topography and vegetation for the constructability of the proposed intersections at Annangrove Road / Withers Road and Annangrove Road / Edwards Road. However this would need to be reviewed during the detailed design process.

5.3 SWEPT PATH ANALYSIS

A swept path analysis has been undertaken for the proposed new intersection treatments at Annangrove Road / Withers Road and Annangrove Road / Edwards Road. This confirmed that the turning movements for a 19.0m semi-trailer design vehicle can be accommodated.

6.0 INDICATIVE COST ESTIMATES

6.1 BACKGROUND

The Hills Shire Council Contributions Plan No. 11 – Annangrove Road Light Industry (CP 11) provides the current Section 94 contribution levies applicable to development within the Annangrove Road Light Industry Area. In order to determine the relevant levy amounts conceptual design drawings and associated cost estimates of the essential road infrastructure were prepared by various consultants on Councils behalf. These essential works included the intersections of Annangrove Road / Withers Road and Annangrove Road / Edwards Road. As described in previous Sections of this report amendment to the arrangement of these intersections as proposed in the current CP11 are required to facilitate the new master plan being developed by Council.

In order for Council to be able to update the CP11 to reflect the requirements of the new master plan we have prepared indicative cost estimates for the proposed new signalised intersection at the Annangrove Road / Withers Road intersection and for the amendments to the proposed new roundabout at Annangrove Road / Edwards Road intersection.

6.2 ASSUMPTIONS

The following assumptions have been made in determining the cost estimate:

6.2.1 ANNANGROVE ROAD / WITHERS ROAD

- We have relied on the drawings titled "Upgrade of Annangrove Road Between Windsor Road and Murphy's Bridge - Concept Design Drawings" dated May 2005 prepared by GHD and "Proposed Road Upgrade Withers Road, Rouse Hill Annangrove Road to Mile End Road" dated May 2004 prepared by Cardno Willing as a basis for the preparation of the concept design drawings including the location of existing property boundaries on which acquisition requirements were determined;
- The extent of works included in the cost estimate is the area defined by the start of the right turning lane on the Annangrove Road and Water Lane approaches of the intersection and the left turning lane on the Withers Road approach. Whilst there are some physical works beyond these locations, as nominated on the concept drawings, this provides a conservative delineation point for cost purposes. The per lineal metre construction cost rates for the previously determined typical sections of Annangrove Road and Withers Road can be utilised by Council for works beyond these areas;
- We have included a budget amount for the relocation of existing utilities however no detailed investigation of utilities relocation requirements has been undertaken;

- We have assumed a future road reserve width of 27.2m for Water Lane in accordance with findings of the Box Hill and Box Hill Industrial Precinct – Transport & Access Study February 2011;
- We have maintained lane and verge widths in Annangrove Road in accordance with the previous concept designs prepared by GHD; and
- We have assumed that Withers Road will be maintained as a Sub Arterial Class 2 road and have maintained the elements of its typical cross section except for the addition of a 3.0m wide right turn lane and associated 1.8m wide median on approach to the intersection.

6.2.2 ANNAGROVE ROAD / EDWARDS ROAD

- We have relied on the drawings titled "Upgrade of Annangrove Road Between Windsor Road and Murphy's Bridge - Concept Design Drawings" dated May 2005 prepared by GHD as a basis for the preparation of the concept design drawings including the location of existing property boundaries on which acquisition requirements were determined;
- The cost estimate detailed below includes for the provision of a left turn slip lane on the northern approach to the intersection. The cost estimate detailed below is the additional cost over and above the costs previously allowed in CP11 for the construction of the roundabout.

6.3 INDICATIVE COST ESTIMATE

Annangrove Road / Withers Road Signalised Intersection:	$4,850,000.00
Annangrove Road / Edwards Road Roundabout:	$ 100,000.00

(Left Turn Slip Lane Only)

The above indicative cost estimates exclude escalation, GST, investigation, design, project management and other professional fees and charges.

It is important to note that this is an indicative estimate of the cost only, to provide Council information to prepare an updated cost schedule for inclusion within the CP11. For more detailed cost estimates, investigation during the design development stage is recommended.

Contingency amounts have been allowed in the indicative cost estimates with an overall accuracy of +/- 30% provided.

6.4 LAND ACQUISITION REQUIREMENTS

Land acquisition requirements as a result of the proposed new intersection arrangements have been detailed on drawing no. S12006- CSK2 & CSK3 included in Appendix E. These depict the land area requirements for each individual land title. Only those areas that differ from the areas depicted on the GHD Concept Design drawings have been shown. A summary of the land acquisition areas that have changed as a result of the proposed new intersection arrangements is also summarised in Table 6-1.

Table 6-1 Land Acquisition Areas

Property Description	Previous Area on GHD Concept Design Drawings (m2)	New Area (m2)
Lot 1 on DP1088407	646.33	1990.1
Lot 13 on DP 833069	309.16	556.1
Lot 12 on DP 833069	165.70	567.7
Lot 34 on DP 834050	196.67	304.5
Lot 2 on DP1071664	2789.90	3756.7
Part of Lot 1 on DP 546799 (No. 283)	575.97	1153.5
Lot 3 on DP 222080	1328.61	1177.3

The indicative cost estimates detailed in Section 6.3 do not include the relevant land acquisition costs. These will need to be calculated by Council based on the areas provided for incorporation into the update to CP11.

6.5 SECTION 94 CONTRIBUTIONS PLAN

The indicative cost estimates detailed in Section 6.3 should be utilised by Council to update the CP11 to reflect the requirements of the new master plan.

It is noted that some of the identified roads and facilities will also be serving other nearby residential and industrial development areas including the Box Hill Residential and Industrial Precincts and the Kellyville / Rouse Hill Precinct. Therefore some level of cost apportionment should be considered by Council when determining the update to CP11.

7.0 SUMMARY AND CONCLUSION

This Traffic and Accessibility Study has been undertaken on behalf of The Hills Shire Council to assess the potential impact future developments arising from the new master plan could have on the surrounding road network, recommend intersection treatments and layouts, and to prepare an indicative cost estimate in accordance with Councils S94 Contributions Plan requirements for inclusion in Contributions Plan No. 11 for Annangrove Light Industrial Area. This Study is based on the master plan prepared by Council and the existing CP11.

Based on the SIDRA Intersection Analysis and Link Assessment the key outcomes of this Traffic and Accessibility Study include;

- Recommended layout for the Annangrove Road / Withers Road signalised intersection;
    - three lanes on Annangrove Road, northbound and southbound approach, including dedicated right turn lanes; and
    - four lanes on Withers Road, westbound approach, and The Water Lane, eastbound approach, including dedicated right turn lanes and left turn slip lanes.
- Recommended layout for the Annangrove Road / Edwards Road roundabout intersection;
    - three lanes on Annangrove Road, southbound approach including a left turn slip lane;
    - two lanes on Annangrove Road, northbound approach;
    - two lanes on Edwards Road, eastbound and westbound approaches.
- Based on the link assessment undertaken it is recommended that the Edwards Road extension should be a Sub Arterial Class III road between the Annangrove Road / Edwards Road Intersection and Intersection 2. A collector road is recommended between Intersection 2 and 3.
- A one lane roundabout is recommended at Intersection 2, to provide a u-turn facility for vehicles and facilitate left in / left out restrictions on Edwards Road between Annangrove Road and Intersection 2. There will be two lanes on the western approach to the roundabout, including a dedicated left turning lane. There will be one lane on all other approaches to the roundabout.
- A priority controlled intersection is proposed at Intersection 3 with one lane on all approaches to the intersection.
- Indicative Cost estimates based on the recommended intersection upgrades at the Annangrove Road / Withers Road and the Annangrove Road / Edwards Road intersections are as follows;

- Annangrove Road / Withers Road Signalised Intersection: $4,850,000.00
- Annangrove Road / Edwards Road Roundabout: $ 100,000.00

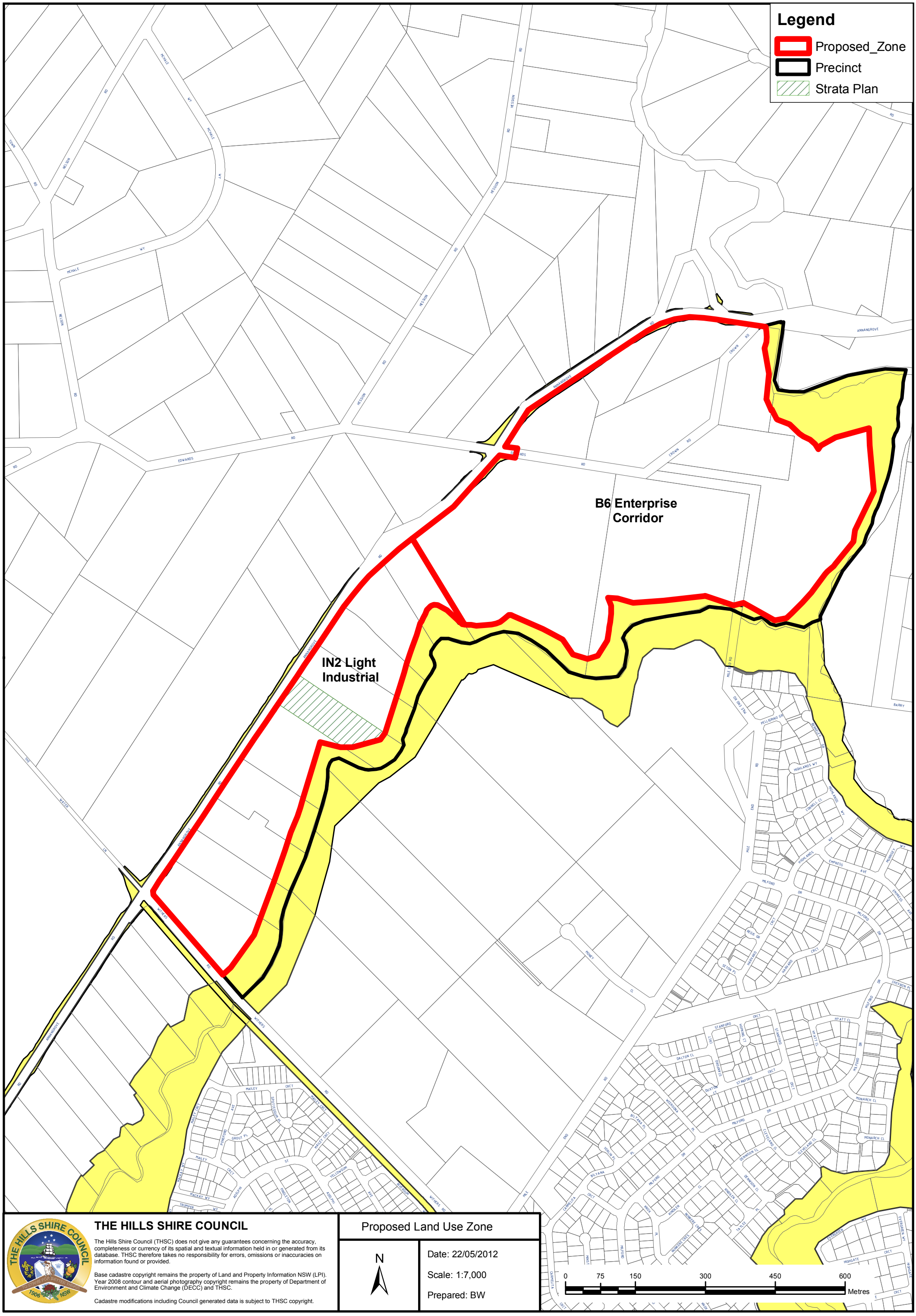
The cost estimate detailed above for Annangrove Road / Edwards Road is the additional cost over and above the costs previously allowed in CP11 for the construction of the roundabout.

- Land acquisition is required to accommodate the proposed new intersection treatments and layouts at both intersections. The cost of land acquisition requirements has not been included in the indicative cost estimates and is required to be calculated by Council using the land acquisition areas provided in this report in order to update CP11.

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

APPENDIX A

PROPOSED MASTER PLAN FOR EDWARDS ROAD PRECINCT



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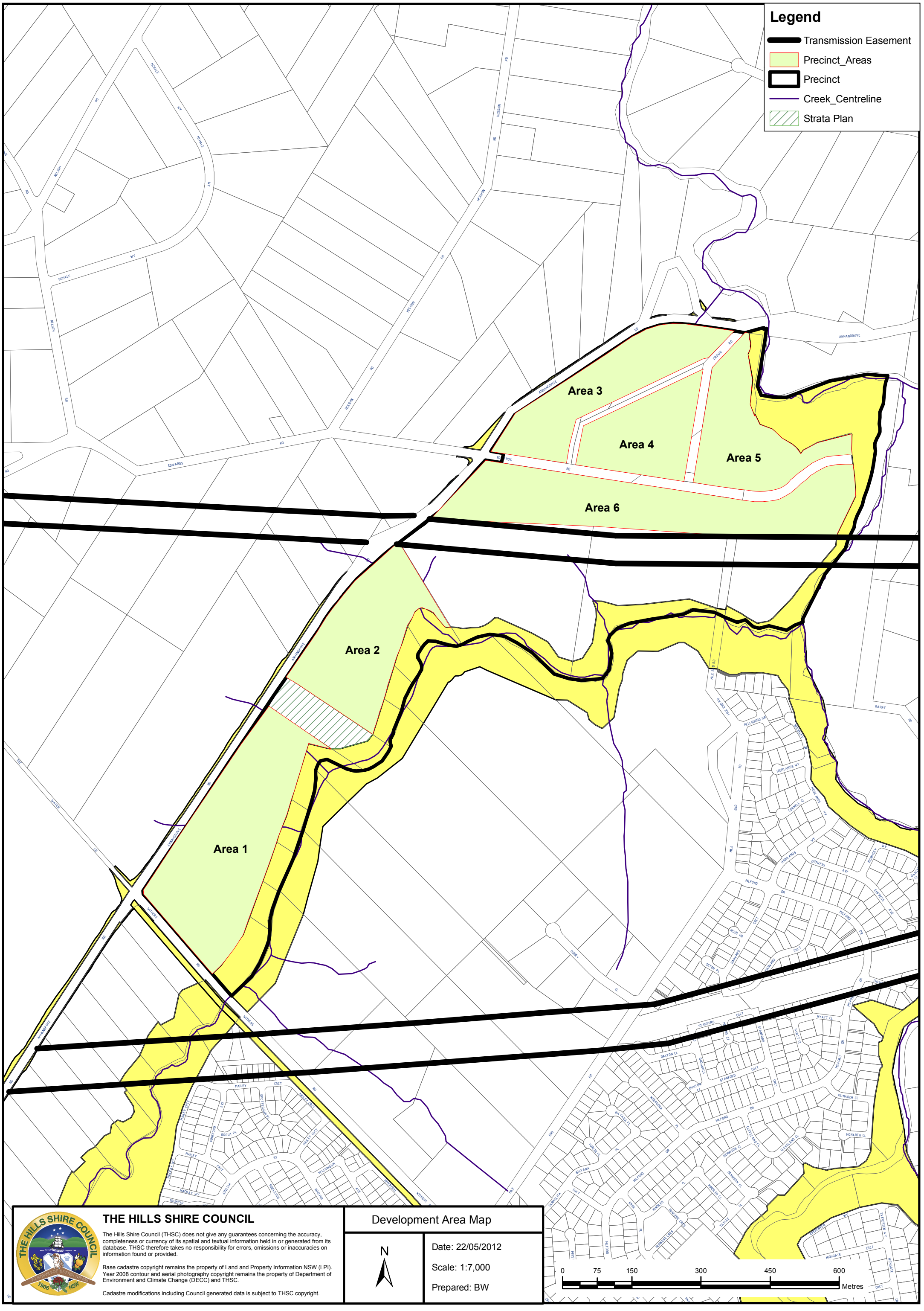
Proposed Land Use Zone

N

Date: 22/05/2012

Scale: 1:7,000

Prepared: BW



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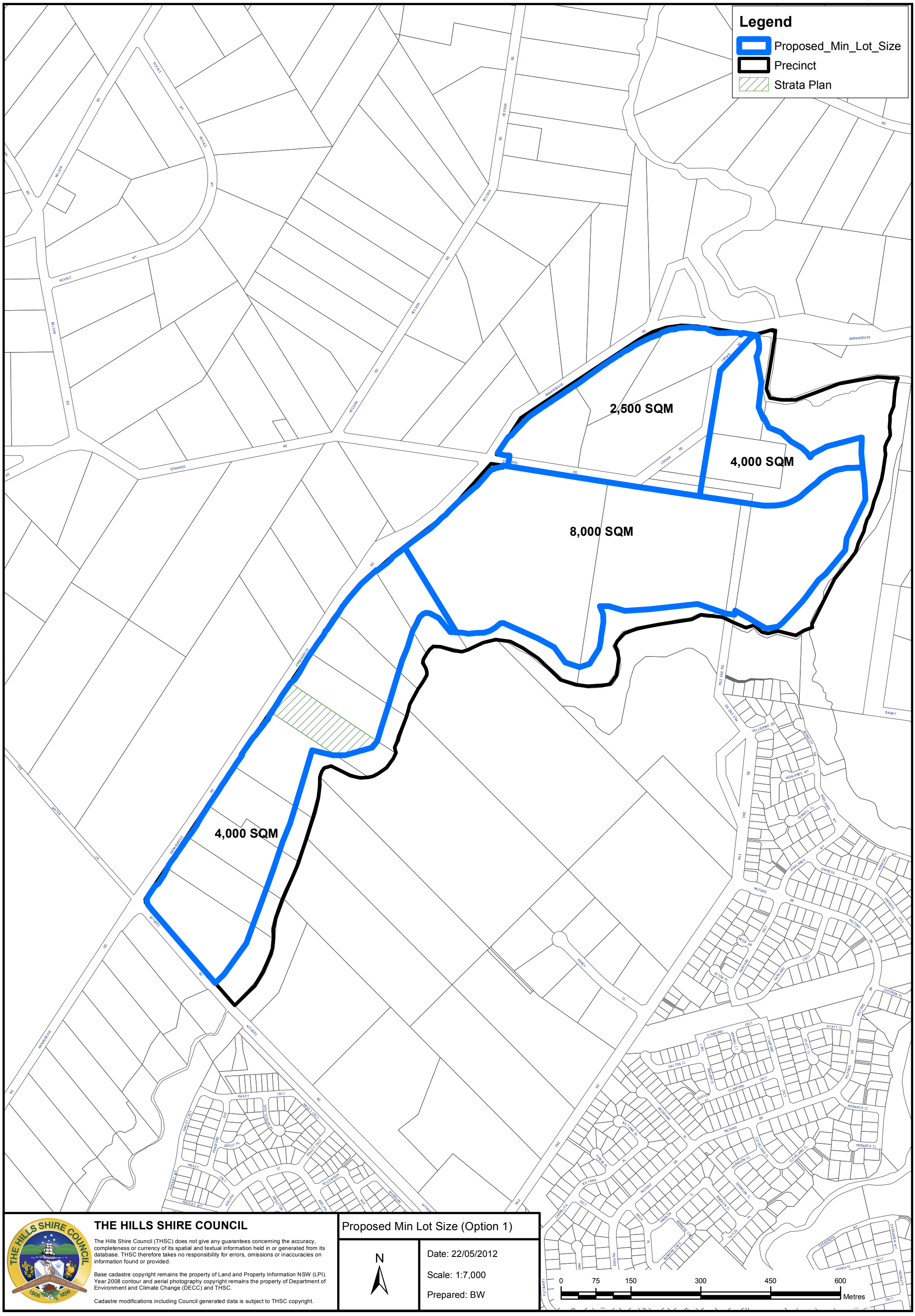
Development Area Map

N

Date: 22/05/2012

Scale: 1:7,000

Prepared: BW



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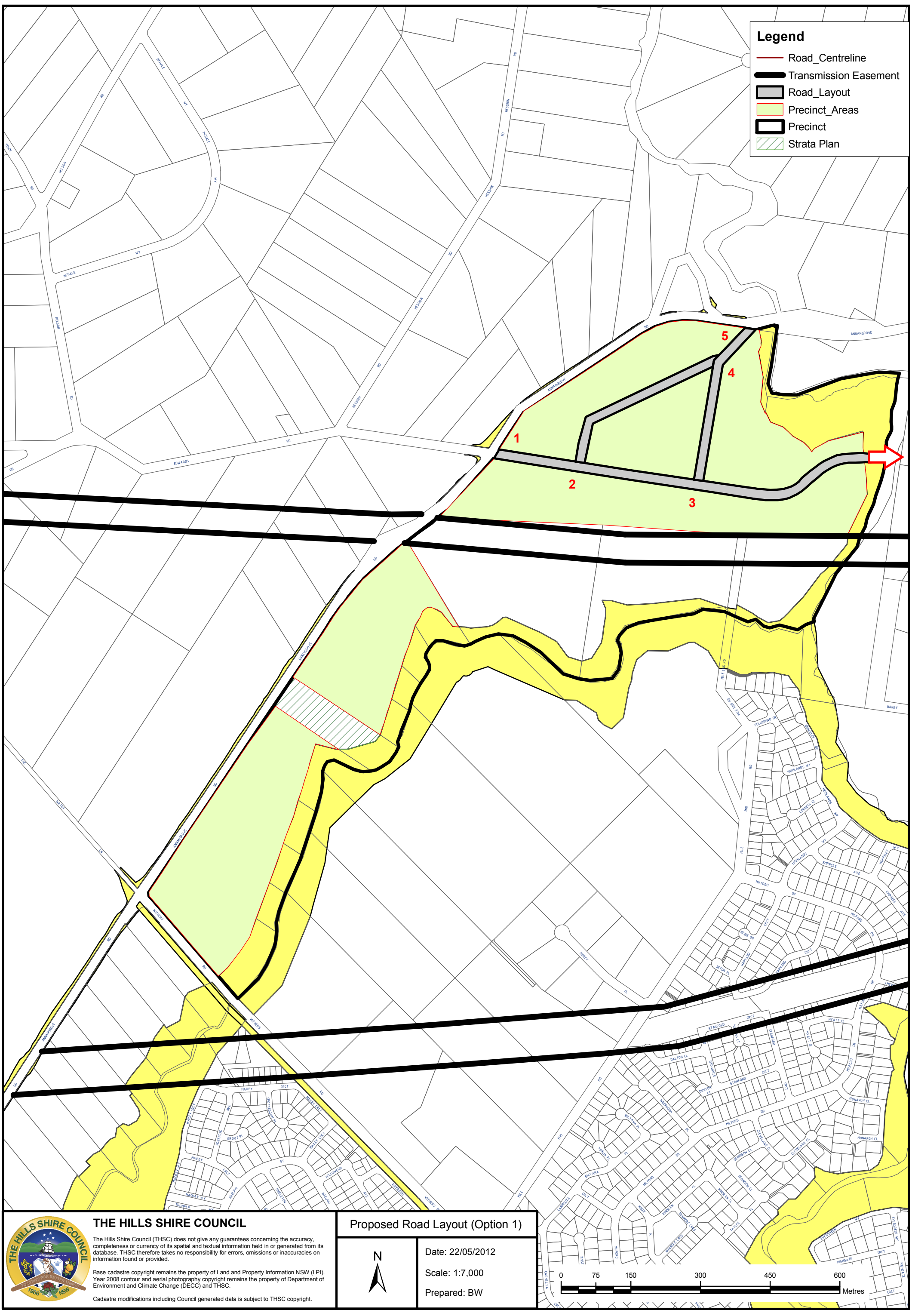
Proposed Min Lot Size (Option 1)

N

Date: 22/05/2012

Scale: 1:7,000

Prepared: BW



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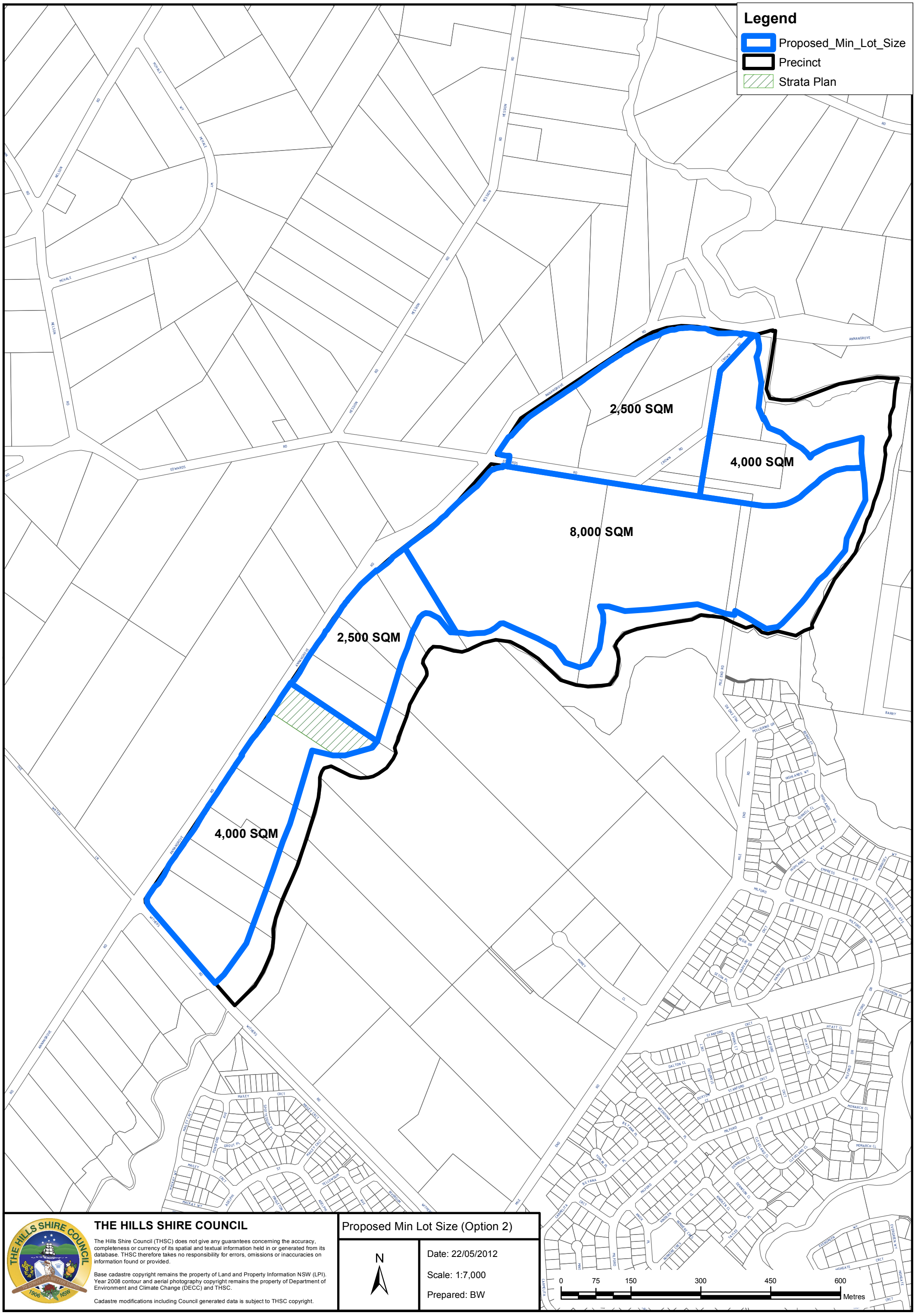
Proposed Road Layout (Option 1)

N

Date: 22/05/2012

Scale: 1:7,000

Prepared: BW



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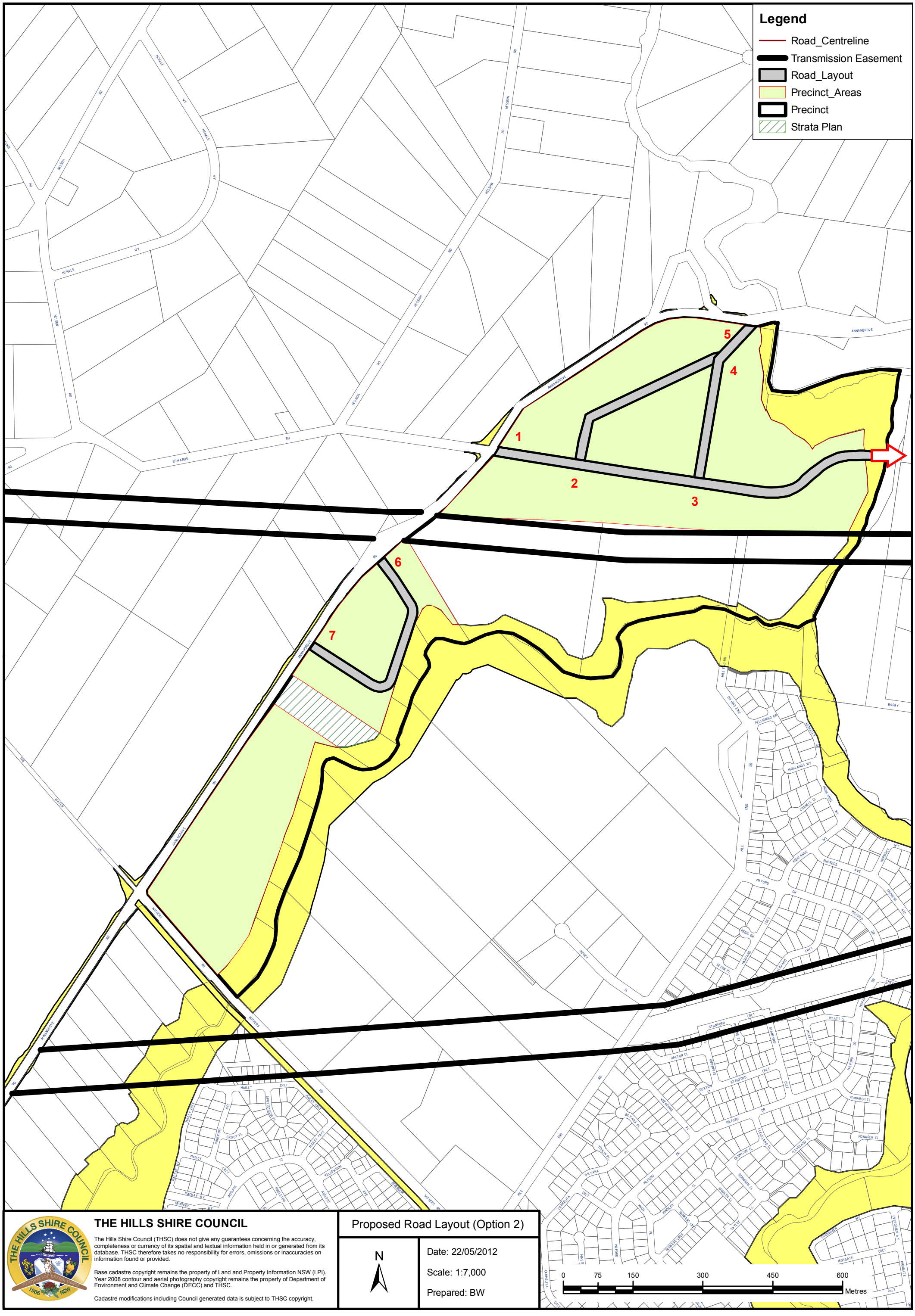
Proposed Min Lot Size (Option 2)

N

Date: 22/05/2012

Scale: 1:7,000

Prepared: BW



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Proposed Road Layout (Option 2)

N

Date: 22/05/2012

Scale: 1:7,000

Prepared: BW

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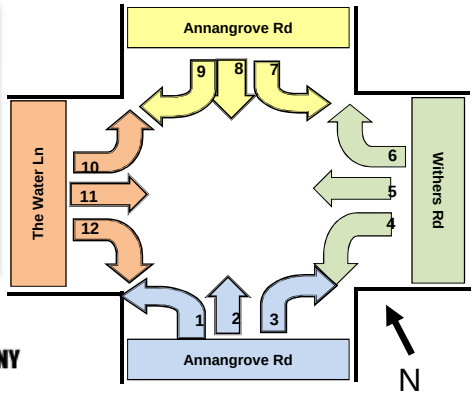
APPENDIX B

TRAFFIC SURVEY DATA

Client:	Lambert & Rehbein		
Site:	Annangrove Rd		
	Withers Rd		
Day:	29.03.2012 (Thursday)		
Description:	Traffic Counts (15mins & 1hour Data)		
Weather:	Fine		
AM Peak:	8:15	to	9:15
PM Peak:	16:15	to	17:15

SKYHIGH
THE TRAFFIC SURVEY COMPANY



Approach	Annangrove Rd												Withers Rd											
Direction	Direction 1 (Left turn)				Direction 2 (Through)				Direction 3 (Right turn)				Direction 4 (Left turn)				Direction 5 (Through)				Direction 6 (Right turn)			
Time Period 15mins	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total
7:00 to 7:15	0	0	0	0	25	1	0	26	9	0	0	9	19	1	0	20	0	0	0	0	24	0	0	24
7:15 to 7:30	0	0	0	0	28	1	0	29	8	0	0	8	20	0	0	20	0	0	0	0	28	1	1	30
7:30 to 7:45	0	0	0	0	26	1	0	27	15	1	1	17	18	0	0	18	0	0	0	0	28	0	0	28
7:45 to 8:00	0	0	0	0	25	5	0	30	10	0	0	10	28	0	0	28	0	0	0	0	20	1	1	22
8:00 to 8:15	0	0	0	0	24	3	1	28	16	0	0	16	25	1	0	26	0	0	0	0	38	0	0	38
8:15 to 8:30	0	0	0	0	23	3	0	26	9	0	0	9	28	0	0	28	0	0	0	0	35	1	2	38
8:30 to 8:45	1	0	0	1	25	3	0	28	14	2	0	16	24	2	0	26	0	0	0	0	38	0	2	40
8:45 to 9:00	0	0	0	0	22	3	0	25	4	0	0	4	15	4	0	19	0	0	0	0	43	1	1	45
9:00 to 9:15	0	0	0	0	39	2	1	42	10	1	0	11	16	0	0	16	0	0	0	0	31	0	0	31
9:15 to 9:30	0	0	0	0	27	7	0	34	5	0	0	5	7	0	0	7	0	0	0	0	25	2	0	27
9:30 to 9:45	0	0	0	0	22	8	0	30	7	0	0	7	15	1	0	16	0	0	0	0	17	1	0	18
9:45 to 10:00	0	0	0	0	15	5	0	20	8	1	0	9	6	0	0	6	0	0	0	0	13	1	0	14
AM Totals	1	0	0	1	301	42	2	345	115	5	1	121	221	9	0	230	0	0	0	0	340	8	7	355
15:00 to 15:15	0	0	0	0	20	0	1	21	8	0	2	10	8	0	0	8	0	0	0	0	32	0	0	32
15:15 to 15:30	0	0	0	0	28	0	0	28	6	1	1	8	10	0	0	10	0	0	0	0	29	0	0	29
15:30 to 15:45	0	0	0	0	26	2	0	28	5	1	2	8	6	0	2	8	0	0	0	0	25	1	0	26
15:45 to 16:00	0	0	0	0	27	0	0	27	18	1	0	19	8	2	0	10	0	0	0	0	35	1	0	36
16:00 to 16:15	0	0	0	0	40	3	0	43	13	1	0	14	17	0	0	17	0	0	0	0	45	1	2	48
16:15 to 16:30	0	1	0	1	24	3	0	27	11	0	0	11	16	0	0	16	0	0	0	0	44	1	0	45
16:30 to 16:45	0	0	0	0	25	1	0	26	15	0	0	15	15	3	0	18	0	1	0	1	43	1	0	44
16:45 to 17:00	0	0	0	0	29	4	0	33	16	1	0	17	15	0	0	15	0	0	0	0	34	1	0	35
17:00 to 17:15	0	0	0	0	39	2	0	41	22	0	0	22	21	0	0	21	0	0	0	0	49	0	0	49
17:15 to 17:30	0	0	0	0	23	2	0	25	20	0	1	21	12	0	0	12	0	0	0	0	30	1	1	32
17:30 to 17:45	0	0	0	0	28	0	0	28	17	0	0	17	12	0	0	12	0	0	0	0	41	0	0	41
17:45 to 18:00	0	0	0	0	15	0	0	15	12	0	0	12	17	0	0	17	0	0	0	0	24	0	0	24
18:00 to 18:15	0	0	0	0	30	1	1	32	11	0	0	11	21	0	0	21	0	0	0	0	27	1	0	28
18:15 to 18:30	0	0	0	0	26	1	0	27	9	1	0	10	9	0	0	9	0	0	0	0	28	0	0	28
18:30 to 18:45	0	0	0	0	20	2	0	22	3	0	0	3	15	0	0	15	0	0	0	0	36	0	0	36
18:45 to 19:00	0	0	0	0	28	1	0	29	7	0	0	7	11	0	0	11	0	0	0	0	19	0	0	19
PM Totals	0	1	0	1	428	22	2	452	193	6	6	205	213	5	2	220	0	1	0	1	541	8	3	552

Approach	Annangrove Rd												The Water Ln											
Direction	Direction 7 (Left turn)				Direction 8 (Through)				Direction 9 (Right turn)				Direction 10 (Left turn)				Direction 11 (Through)				Direction 12 (Right turn)			
Time Period 15mins	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total
7:00 to 7:15	15	0	0	15	27	3	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 to 7:30	18	0	0	18	25	2	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
7:30 to 7:45	20	0	0	20	24	4	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 to 8:00	18	0	0	18	21	5	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 to 8:15	33	0	1	34	34	4	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 to 8:30	39	1	1	41	31	1	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 to 8:45	45	1	0	46	41	7	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 to 9:00	31	0	0	31	29	6	0	35	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
9:00 to 9:15	64	0	1	65	50	6	1	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15 to 9:30	21	1	0	22	22	2	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30 to 9:45	16	0	0	16	31	8	0	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45 to 10:00	18	0	0	18	12	1	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AM Totals	338	3	3	344	347	49	1	397	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1
15:00 to 15:15	17	0	2	19	18	0	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15 to 15:30	24	0	2	26	14	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30 to 15:45	20	1	3	24	22	1	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45 to 16:00	19	1	4	24	19	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00 to 16:15	24	0	1	25	22	0	1	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

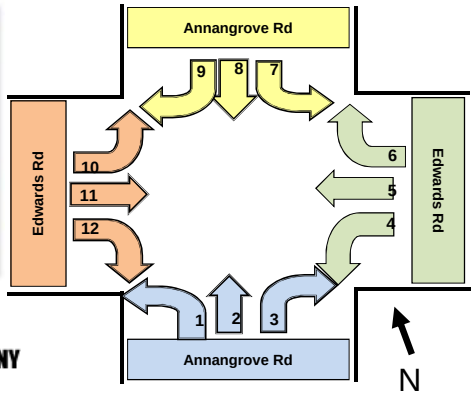
16:15 to 16:30	35	1	0	36	28	3	1	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30 to 16:45	25	0	0	25	18	2	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45 to 17:00	20	0	0	20	25	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00 to 17:15	23	0	0	23	19	0	2	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15 to 17:30	13	1	0	14	15	2	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30 to 17:45	20	0	0	20	19	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45 to 18:00	19	0	1	20	8	1	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00 to 18:15	20	0	0	20	25	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15 to 18:30	23	0	0	23	20	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
18:30 to 18:45	15	1	0	16	11	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45 to 19:00	15	0	0	15	14	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM Totals	332	5	13	350	297	10	6	313	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

Approach	**Annangrove Rd**												**Withers Rd**											
Direction	**Direction 1 (Left turn)**				**Direction 2 (Through)**				**Direction 3 (Right turn)**				**Direction 4 (Left turn)**				**Direction 5 (Through)**				**Direction 6 (Right turn)**			
Time Period 1h	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**
7:00 to 8:00	0	0	0	0	104	8	0	112	42	1	1	44	85	1	0	86	0	0	0	0	100	2	2	104
7:15 to 8:15	0	0	0	0	103	10	1	114	49	1	1	51	91	1	0	92	0	0	0	0	114	2	2	118
7:30 to 8:30	0	0	0	0	98	12	1	111	50	1	1	52	99	1	0	100	0	0	0	0	121	2	3	126
7:45 to 8:45	1	0	0	1	97	14	1	112	49	2	0	51	105	3	0	108	0	0	0	0	131	2	5	138
8:00 to 9:00	1	0	0	1	94	12	1	107	43	2	0	45	92	7	0	99	0	0	0	0	154	2	5	161
8:15 to 9:15	1	0	0	1	109	11	1	121	37	3	0	40	83	6	0	89	0	0	0	0	147	2	5	154
8:30 to 9:30	1	0	0	1	113	15	1	129	33	3	0	36	62	6	0	68	0	0	0	0	137	3	3	143
8:45 to 9:45	0	0	0	0	110	20	1	131	26	1	0	27	53	5	0	58	0	0	0	0	116	4	1	121
9:00 to 10:00	0	0	0	0	103	22	1	126	30	2	0	32	44	1	0	45	0	0	0	0	86	4	0	90
AM Total	1	0	0	1	301	42	2	345	115	5	1	121	221	9	0	230	0	0	0	0	340	8	7	355
15:00 to 16:00	0	0	0	0	101	2	1	104	37	3	5	45	32	2	2	36	0	0	0	0	121	2	0	123
15:15 to 16:15	0	0	0	0	121	5	0	126	42	4	3	49	41	2	2	45	0	0	0	0	134	3	2	139
15:30 to 16:30	0	1	0	1	117	8	0	125	47	3	2	52	47	2	2	51	0	0	0	0	149	4	2	155
15:45 to 16:45	0	1	0	1	116	7	0	123	57	2	0	59	56	5	0	61	0	1	0	1	167	4	2	173
16:00 to 17:00	0	1	0	1	118	11	0	129	55	2	0	57	63	3	0	66	0	1	0	1	166	4	2	172
16:15 to 17:15	0	1	0	1	117	10	0	127	64	1	0	65	67	3	0	70	0	1	0	1	170	3	0	173
16:30 to 17:30	0	0	0	0	116	9	0	125	73	1	1	75	63	3	0	66	0	1	0	1	156	3	1	160
16:45 to 17:45	0	0	0	0	119	8	0	127	75	1	1	77	60	0	0	60	0	0	0	0	154	2	1	157
17:00 to 18:00	0	0	0	0	105	4	0	109	71	0	1	72	62	0	0	62	0	0	0	0	144	1	1	146
17:15 to 18:15	0	0	0	0	96	3	1	100	60	0	1	61	62	0	0	62	0	0	0	0	122	2	1	125
17:30 to 18:30	0	0	0	0	99	2	1	102	49	1	0	50	59	0	0	59	0	0	0	0	120	1	0	121
17:45 to 18:45	0	0	0	0	91	4	1	96	35	1	0	36	62	0	0	62	0	0	0	0	115	1	0	116
18:00 to 19:00	0	0	0	0	104	5	1	110	30	1	0	31	56	0	0	56	0	0	0	0	110	1	0	111
PM Total	0	1	0	1	428	22	2	452	193	6	6	205	213	5	2	220	0	1	0	1	541	8	3	552

Approach	**Annangrove Rd**												**The Water Ln**											
Direction	**Direction 7 (Left turn)**				**Direction 8 (Through)**				**Direction 9 (Right turn)**				**Direction 10 (Left turn)**				**Direction 11 (Through)**				**Direction 12 (Right turn)**			
Time Period 1h	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**
7:00 to 8:00	71	0	0	71	97	14	0	111	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
7:15 to 8:15	89	0	1	90	104	15	0	119	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
7:30 to 8:30	110	1	2	113	110	14	0	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 to 8:45	135	2	2	139	127	17	0	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 to 9:00	148	2	2	152	135	18	0	153	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
8:15 to 9:15	179	2	2	183	151	20	1	172	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
8:30 to 9:30	161	2	1	164	142	21	1	164	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
8:45 to 9:45	132	1	1	134	132	22	1	155	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
9:00 to 10:00	119	1	1	121	115	17	1	133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AM Total	338	3	3	344	347	49	1	397	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1
15:00 to 16:00	80	2	11	93	73	1	1	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15 to 16:15	87	2	10	99	77	1	1	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30 to 16:30	98	3	8	109	91	4	2	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45 to 16:45	103	2	5	110	87	5	2	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00 to 17:00	104	1	1	106	93	5	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15 to 17:15	103	1	0	104	90	5	3	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30 to 17:30	81	1	0	82	77	4	2	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45 to 17:45	76	1	0	77	78	3	2	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00 to 18:00	75	1	1	77	61	4	2	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15 to 18:15	72	1	1	74	67	4	0	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30 to 18:30	82	0	1	83	72	2	0	74	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
17:45 to 18:45	77	1	1	79	64	1	0	65	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
18:00 to 19:00	73	1	0	74	70	0	1	71	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
PM Total	332	5	13	350	297	10	6	313	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

Client:	Lambert & Rehbein		
Site:	Annangrove Rd		
	Edwards Rd		
Day:	29.03.2012 (Thursday)		
Description:	Traffic Counts (15mins & 1hour Data)		
Weather:	Fine		
AM Peak:	8:15	to	9:15
PM Peak:	15:45	to	16:45

SKYHIGH
THE TRAFFIC SURVEY COMPANY



Approach	Annangrove Rd												Edwards Rd											
Direction	Direction 1 (Left turn)				Direction 2 (Through)				Direction 3 (Right turn)				Direction 4 (Left turn)				Direction 5 (Through)				Direction 6 (Right turn)			
Time Period 15mins	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total
7:00 to 7:15	8	1	0	9	32	3	1	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 to 7:30	7	0	1	8	27	2	0	29	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
7:30 to 7:45	7	0	0	7	39	1	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 to 8:00	6	0	0	6	29	2	1	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 to 8:15	12	1	0	13	37	0	1	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 to 8:30	10	1	0	11	38	5	3	46	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
8:30 to 8:45	13	0	0	13	40	3	1	44	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
8:45 to 9:00	13	0	0	13	58	4	1	63	2	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
9:00 to 9:15	15	1	1	17	64	2	2	68	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
9:15 to 9:30	16	0	0	16	43	4	1	48	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
9:30 to 9:45	12	1	0	13	55	2	0	57	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
9:45 to 10:00	10	1	0	11	37	2	0	39	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
AM Totals	129	6	2	137	499	30	11	540	14	1	0	15	2	0	0	2	0	1	0	1	0	0	0	0
15:00 to 15:15	22	2	0	24	27	0	1	28	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
15:15 to 15:30	34	1	0	35	20	0	0	20	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
15:30 to 15:45	25	0	2	27	25	3	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45 to 16:00	29	2	0	31	38	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00 to 16:15	36	0	1	37	45	4	1	50	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
16:15 to 16:30	40	2	0	42	32	2	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30 to 16:45	25	1	0	26	46	1	0	47	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
16:45 to 17:00	37	0	1	38	32	5	0	37	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
17:00 to 17:15	24	0	0	24	55	2	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15 to 17:30	28	2	0	30	39	1	1	41	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
17:30 to 17:45	26	0	0	26	40	0	0	40	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
17:45 to 18:00	25	0	2	27	20	0	0	20	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
18:00 to 18:15	22	0	0	22	28	2	1	31	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
18:15 to 18:30	29	1	1	31	22	0	0	22	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
18:30 to 18:45	31	1	0	32	26	1	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45 to 19:00	22	1	0	23	27	0	0	27	1	0	0	1	3	0	0	3	0	0	0	0	0	0	0	0
PM Totals	455	13	7	475	522	21	4	547	9	0	0	9	12	0	0	12	0	0	0	0	0	0	0	0

Approach	Annangrove Rd												Edwards Rd											
Direction	Direction 7 (Left turn)				Direction 8 (Through)				Direction 9 (Right turn)				Direction 10 (Left turn)				Direction 11 (Through)				Direction 12 (Right turn)			
Time Period 15mins	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total
7:00 to 7:15	0	0	0	0	54	2	0	56	30	2	1	33	45	1	1	47	0	0	0	0	18	1	0	19
7:15 to 7:30	0	0	0	0	48	1	0	49	28	2	0	30	49	0	1	50	0	0	0	0	15	0	0	15
7:30 to 7:45	0	0	0	0	40	4	0	44	42	1	0	43	46	0	3	49	0	0	0	0	22	0	0	22
7:45 to 8:00	0	0	0	0	52	5	0	57	53	0	0	53	57	1	1	59	0	0	0	0	15	1	0	16
8:00 to 8:15	0	0	0	0	53	2	0	55	50	1	1	52	61	2	3	66	0	0	0	0	43	0	0	43
8:15 to 8:30	0	0	0	0	48	2	0	50	35	1	1	37	58	6	0	64	0	0	0	0	26	4	1	31
8:30 to 8:45	0	0	0	0	66	8	0	74	21	1	2	24	55	1	1	57	0	1	0	1	40	0	0	40
8:45 to 9:00	0	0	0	0	39	8	3	50	25	2	1	28	34	2	0	36	4	0	0	4	31	1	0	32
9:00 to 9:15	0	0	0	0	45	3	2	50	47	0	0	47	58	0	2	60	2	0	0	2	25	2	1	28
9:15 to 9:30	0	0	0	0	34	4	0	38	35	2	0	37	47	3	0	50	4	0	0	4	43	0	0	43
9:30 to 9:45	0	0	0	0	25	2	2	29	38	1	1	40	46	2	1	49	3	0	0	3	38	0	1	39
9:45 to 10:00	0	0	0	0	37	4	1	42	26	1	2	29	42	1	2	45	5	0	0	5	24	1	0	25
AM Totals	0	0	0	0	541	45	8	594	430	14	9	453	598	19	15	632	18	1	0	19	340	10	3	353
15:00 to 15:15	0	0	0	0	25	0	3	28	42	0	1	43	38	1	2	41	0	0	0	0	6	0	0	6
15:15 to 15:30	0	0	0	0	22	0	2	24	48	2	2	52	48	2	1	51	2	0	0	2	9	1	0	10
15:30 to 15:45	0	0	0	0	29	2	2	33	56	0	3	59	46	0	0	46	0	0	0	0	13	0	1	14
15:45 to 16:00	0	0	0	0	30	1	4	35	52	1	3	56	46	0	2	48	2	0	0	2	14	0	0	14
16:00 to 16:15	0	0	0	0	32	0	2	34	40	0	1	41	39	2	3	44	0	0	0	0	10	1	0	11

16:15 to 16:30	0	0	0	0	49	2	1	52	57	2	0	59	45	1	0	46	3	0	0	3	5	2	0	7
16:30 to 16:45	0	0	0	0	43	2	0	45	45	0	2	47	42	2	2	46	2	0	0	2	8	0	1	9
16:45 to 17:00	0	0	0	0	45	0	0	45	49	2	0	51	37	2	0	39	0	0	0	0	6	0	0	6
17:00 to 17:15	0	0	0	0	30	0	2	32	56	0	1	57	30	1	1	32	0	0	0	0	9	0	0	9
17:15 to 17:30	0	0	0	0	25	2	0	27	52	1	0	53	25	0	0	25	0	0	0	0	8	1	0	9
17:30 to 17:45	0	0	0	0	39	1	0	40	43	0	2	45	27	2	1	30	2	0	0	2	5	0	0	5
17:45 to 18:00	0	0	0	0	22	1	1	24	35	1	0	36	25	1	0	26	0	0	0	0	8	0	0	8
18:00 to 18:15	0	0	0	0	40	0	0	40	38	0	1	39	23	1	2	26	1	0	0	1	9	0	1	10
18:15 to 18:30	0	0	0	0	27	0	0	27	46	1	0	47	28	2	1	31	0	0	0	0	12	1	0	13
18:30 to 18:45	0	0	0	0	18	1	0	19	35	0	2	37	26	2	1	29	0	0	0	0	15	0	0	15
18:45 to 19:00	0	0	0	0	22	0	1	23	38	1	2	41	22	1	1	24	0	0	0	0	10	0	0	10
PM Totals	0	0	0	0	498	12	18	528	732	11	20	763	547	20	17	584	12	0	0	12	147	6	3	156

Approach	**Annangrove Rd**												**Edwards Rd**											
Direction	**Direction 1 (Left turn)**				**Direction 2 (Through)**				**Direction 3 (Right turn)**				**Direction 4 (Left turn)**				**Direction 5 (Through)**				**Direction 6 (Right turn)**			
Time Period 1h	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**
7:00 to 8:00	28	1	1	30	127	8	2	137	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
7:15 to 8:15	32	1	1	34	132	5	2	139	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
7:30 to 8:30	35	2	0	37	143	8	5	156	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
7:45 to 8:45	41	2	0	43	144	10	6	160	1	0	0	1	1	0	0	1	0	1	0	1	0	0	0	0
8:00 to 9:00	48	2	0	50	173	12	6	191	3	1	0	4	1	0	0	1	0	1	0	1	0	0	0	0
8:15 to 9:15	51	2	1	54	200	14	7	221	5	1	0	6	1	0	0	1	0	1	0	1	0	0	0	0
8:30 to 9:30	57	1	1	59	205	13	5	223	6	1	0	7	0	0	0	0	0	1	0	1	0	0	0	0
8:45 to 9:45	56	2	1	59	220	12	4	236	10	1	0	11	0	0	0	0	0	0	0	0	0	0	0	0
9:00 to 10:00	53	3	1	57	199	10	3	212	11	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
AM Total	129	6	2	137	499	30	11	540	14	1	0	15	2	0	0	2	0	1	0	1	0	0	0	0
15:00 to 16:00	110	5	2	117	110	3	1	114	1	0	0	1	2	0	0	2	0	0	0	0	0	0	0	0
15:15 to 16:15	124	3	3	130	128	7	1	136	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
15:30 to 16:30	130	4	3	137	140	9	1	150	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
15:45 to 16:45	130	5	1	136	161	7	1	169	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0
16:00 to 17:00	138	3	2	143	155	12	1	168	2	0	0	2	3	0	0	3	0	0	0	0	0	0	0	0
16:15 to 17:15	126	3	1	130	165	10	0	175	2	0	0	2	2	0	0	2	0	0	0	0	0	0	0	0
16:30 to 17:30	114	3	1	118	172	9	1	182	2	0	0	2	3	0	0	3	0	0	0	0	0	0	0	0
16:45 to 17:45	115	2	1	118	166	8	1	175	3	0	0	3	1	0	0	1	0	0	0	0	0	0	0	0
17:00 to 18:00	103	2	2	107	154	3	1	158	5	0	0	5	1	0	0	1	0	0	0	0	0	0	0	0
17:15 to 18:15	101	2	2	105	127	3	2	132	5	0	0	5	2	0	0	2	0	0	0	0	0	0	0	0
17:30 to 18:30	102	1	3	106	110	2	1	113	5	0	0	5	3	0	0	3	0	0	0	0	0	0	0	0
17:45 to 18:45	107	2	3	112	96	3	1	100	4	0	0	4	3	0	0	3	0	0	0	0	0	0	0	0
18:00 to 19:00	104	3	1	108	103	3	1	107	1	0	0	1	6	0	0	6	0	0	0	0	0	0	0	0
PM Total	455	13	7	475	522	21	4	547	9	0	0	9	12	0	0	12	0	0	0	0	0	0	0	0

Approach	**Annangrove Rd**												**Edwards Rd**											
Direction	**Direction 7 (Left turn)**				**Direction 8 (Through)**				**Direction 9 (Right turn)**				**Direction 10 (Left turn)**				**Direction 11 (Through)**				**Direction 12 (Right turn)**			
Time Period 1h	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**	**Cars**	**Trucks**	**Buses**	**Total**
7:00 to 8:00	0	0	0	0	194	12	0	206	153	5	1	159	197	2	6	205	0	0	0	0	70	2	0	72
7:15 to 8:15	0	0	0	0	193	12	0	205	173	4	1	178	213	3	8	224	0	0	0	0	95	1	0	96
7:30 to 8:30	0	0	0	0	193	13	0	206	180	3	2	185	222	9	7	238	0	0	0	0	106	5	1	112
7:45 to 8:45	0	0	0	0	219	17	0	236	159	3	4	166	231	10	5	246	0	1	0	1	124	5	1	130
8:00 to 9:00	0	0	0	0	206	20	3	229	131	5	5	141	208	11	4	223	4	1	0	5	140	5	1	146
8:15 to 9:15	0	0	0	0	198	21	5	224	128	4	4	136	205	9	3	217	6	1	0	7	122	7	2	131
8:30 to 9:30	0	0	0	0	184	23	5	212	128	5	3	136	194	6	3	203	10	1	0	11	139	3	1	143
8:45 to 9:45	0	0	0	0	143	17	7	167	145	5	2	152	185	7	3	195	13	0	0	13	137	3	2	142
9:00 to 10:00	0	0	0	0	141	13	5	159	146	4	3	153	193	6	5	204	14	0	0	14	130	3	2	135
AM Total	0	0	0	0	541	45	8	594	430	14	9	453	598	19	15	632	18	1	0	19	340	10	3	353
15:00 to 16:00	0	0	0	0	106	3	11	120	198	3	9	210	178	3	5	186	4	0	0	4	42	1	1	44
15:15 to 16:15	0	0	0	0	113	3	10	126	196	3	9	208	179	4	6	189	4	0	0	4	46	2	1	49
15:30 to 16:30	0	0	0	0	140	5	9	154	205	3	7	215	176	3	5	184	5	0	0	5	42	3	1	46
15:45 to 16:45	0	0	0	0	154	5	7	166	194	3	6	203	172	5	7	184	7	0	0	7	37	3	1	41
16:00 to 17:00	0	0	0	0	169	4	3	176	191	4	3	198	163	7	5	175	5	0	0	5	29	3	1	33
16:15 to 17:15	0	0	0	0	167	4	3	174	207	4	3	214	154	6	3	163	5	0	0	5	28	2	1	31
16:30 to 17:30	0	0	0	0	143	4	2	149	202	3	3	208	134	5	3	142	2	0	0	2	31	1	1	33
16:45 to 17:45	0	0	0	0	139	3	2	144	200	3	3	206	119	5	2	126	2	0	0	2	28	1	0	29
17:00 to 18:00	0	0	0	0	116	4	3	123	186	2	3	191	107	4	2	113	2	0	0	2	30	1	0	31
17:15 to 18:15	0	0	0	0	126	4	1	131	168	2	3	173	100	4	3	107	3	0	0	3	30	1	1	32
17:30 to 18:30	0	0	0	0	128	2	1	131	162	2	3	167	103	6	4	113	3	0	0	3	34	1	1	36
17:45 to 18:45	0	0	0	0	107	2	1	110	154	2	3	159	102	6	4	112	1	0	0	1	44	1	1	46
18:00 to 19:00	0	0	0	0	107	1	1	109	157	2	5	164	99	6	5	110	1	0	0	1	46	1	1	48
PM Total	0	0	0	0	498	12	18	528	732	11	20	763	547	20	17	584	12	0	0	12	147	6	3	156

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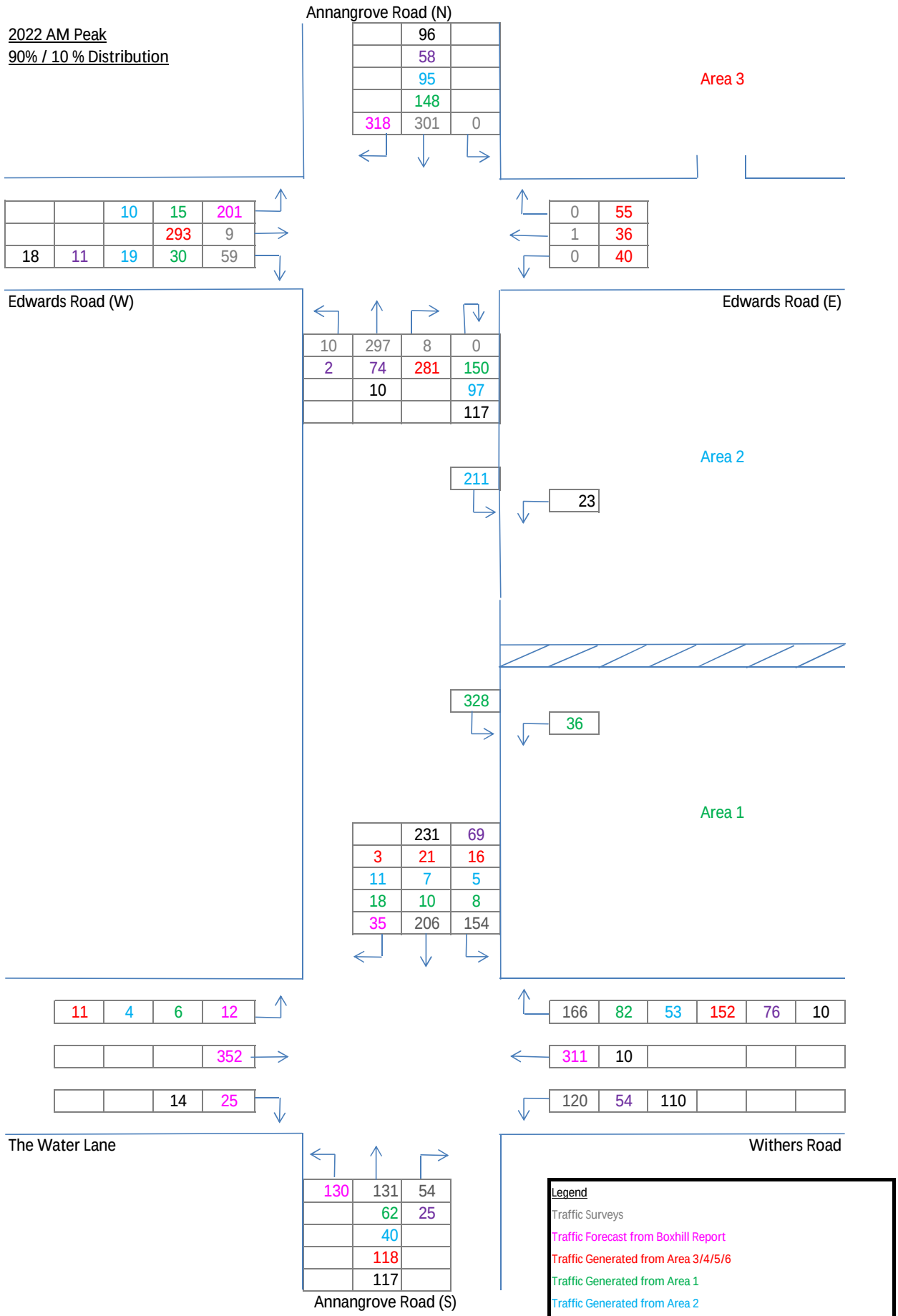
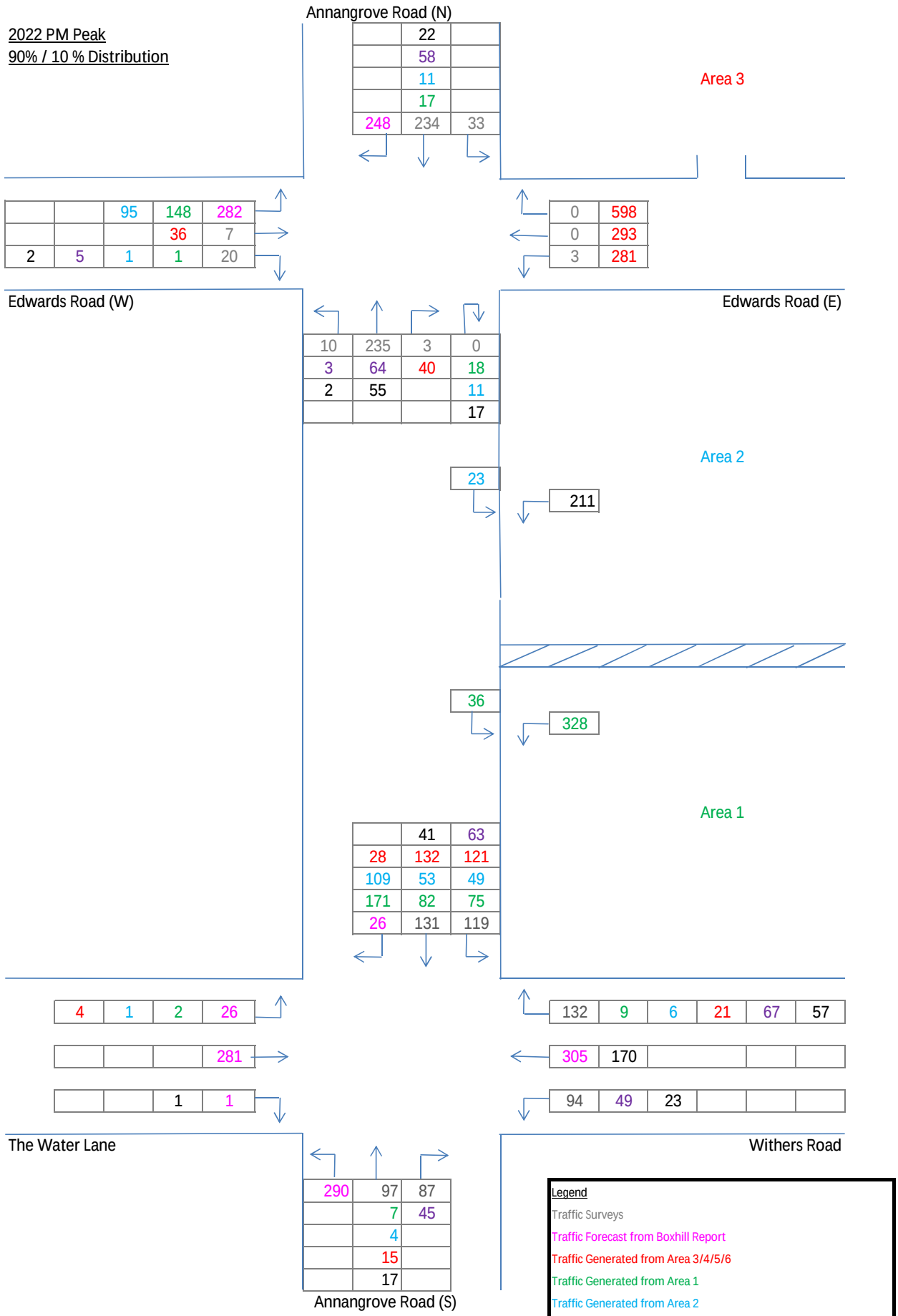
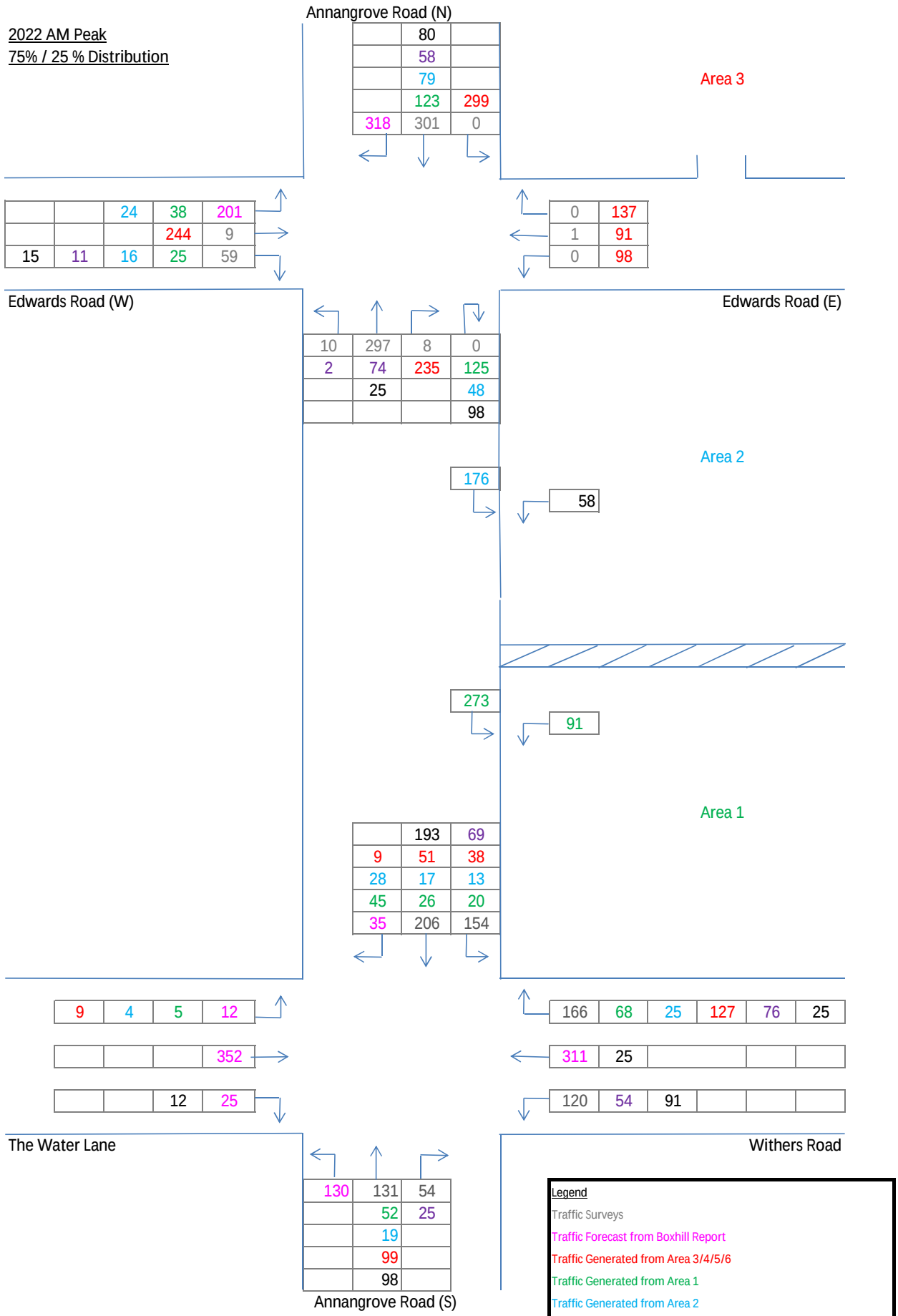
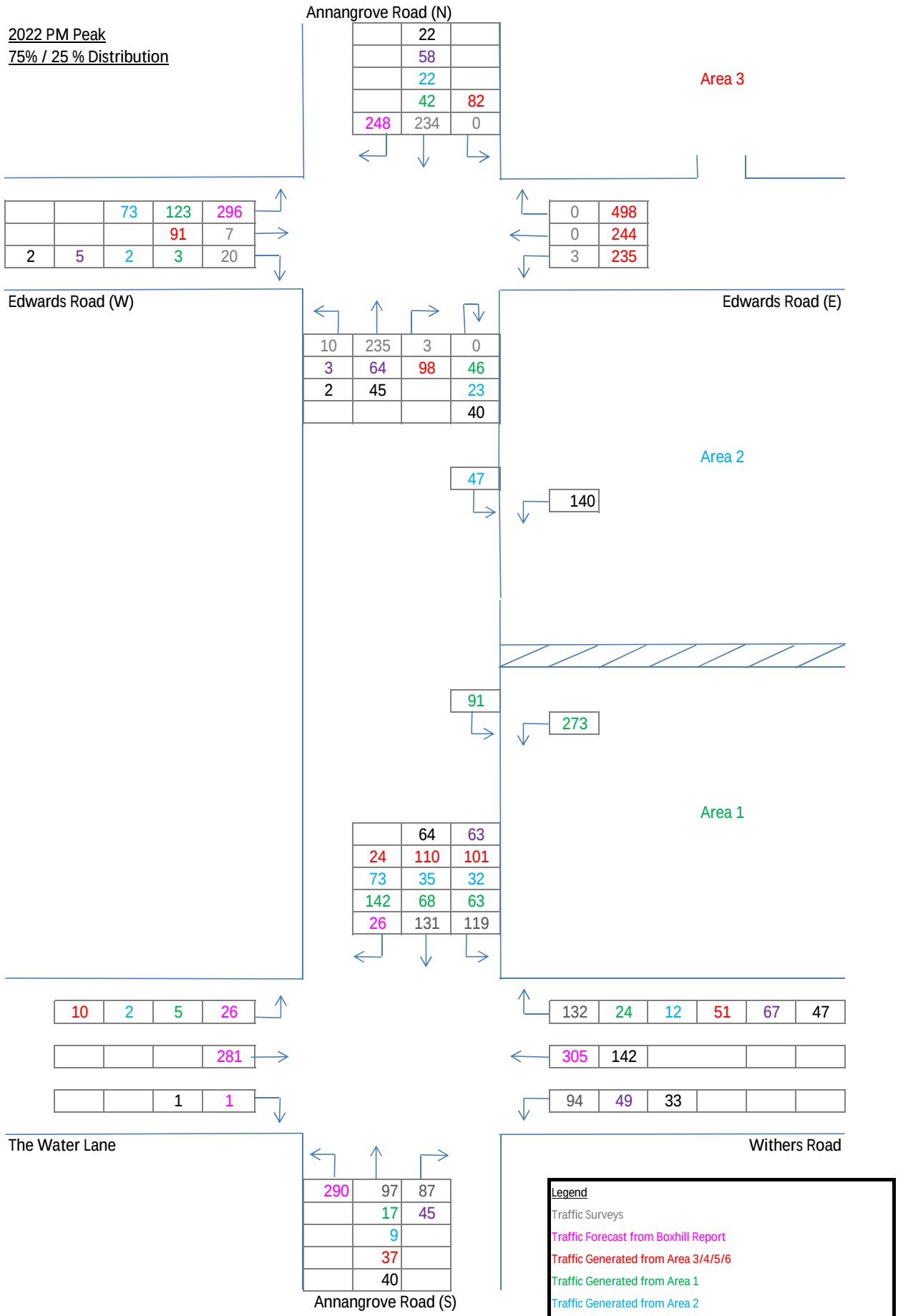
APPENDIX C

TRAFFIC GENERATION AND DISTRIBUTION PLANS


2022 AM Peak
90% / 10 % Distribution
Annangrove Road (N)
96
58
95
148
318 301 0
Area 3
10 15 201
293 9
18 11 19 30 59
0 55
1 36
0 40
Edwards Road (W)
Edwards Road (E)
10 297 8 0
2 74 281 150
10 97
117
Area 2
211
23
328
36
Area 1
231 69
3 21 16
11 7 5
18 10 8
35 206 154
11 4 6 12
352
14 25
166 82 53 152 76 10
311 10
120 54 110
The Water Lane
Withers Road
130 131 54
62 25
40
118
117
Annangrove Road (S)
Legend
Traffic Surveys
Traffic Forecast from Boxhill Report
Traffic Generated from Area 3/4/5/6
Traffic Generated from Area 1
Traffic Generated from Area 2
Traffic Generated from End Mile Road Precinct
Traffic Generated from Annangrove Road South Precinct


2022 PM Peak
90% / 10 % Distribution
Annangrove Road (N)
Area 3
Edwards Road (W)
Edwards Road (E)
Area 2
Area 1
The Water Lane
Withers Road
Annangrove Road (S)
Legend
Traffic Surveys
Traffic Forecast from Boxhill Report
Traffic Generated from Area 3/4/5/6
Traffic Generated from Area 1
Traffic Generated from Area 2
Traffic Generated from End Mile Road Precinct
Traffic Generated from Annangrove Road South Precinct


2022 AM Peak
75% / 25 % Distribution
Annangrove Road (N)
80
58
79
123 299
318 301 0
Area 3
24 38 201
244 9
15 11 16 25 59
0 137
1 91
0 98
Edwards Road (W)
Edwards Road (E)
10 297 8 0
2 74 235 125
25 48
98
Area 2
176
58
273
91
Area 1
193 69
9 51 38
28 17 13
45 26 20
35 206 154
9 4 5 12
352
12 25
166 68 25 127 76 25
311 25
120 54 91
The Water Lane
Withers Road
130 131 54
52 25
19
99
98
Annangrove Road (S)
Legend
Traffic Surveys
Traffic Forecast from Boxhill Report
Traffic Generated from Area 3/4/5/6
Traffic Generated from Area 1
Traffic Generated from Area 2
Traffic Generated from End Mile Road Precinct
Traffic Generated from Annangrove Road South Precinct


2022 PM Peak
75% / 25 % Distribution
Annangrove Road (N)
22
58
22
42 82
248 234 0
Area 3
73 123 296
91 7
2 5 2 3 20
0 498
0 244
3 235
Edwards Road (W)
Edwards Road (E)
10 235 3 0
3 64 98 46
2 45 23
40
Area 2
47
140
91
273
Area 1
64 63
24 110 101
73 35 32
142 68 63
26 131 119
10 2 5 26
281
1 1
132 24 12 51 67 47
305 142
94 49 33
The Water Lane
Withers Road
290 97 87
17 45
9
37
40
Annangrove Road (S)
Legend
Traffic Surveys
Traffic Forecast from Boxhill Report
Traffic Generated from Area 3/4/5/6
Traffic Generated from Area 1
Traffic Generated from Area 2
Traffic Generated from End Mile Road Precinct
Traffic Generated from Annangrove Road South Precinct

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APPENDIX D

SIDRA ANALYSIS OUTPUT TABLES

MOVEMENT SUMMARY

Annangrove Road / Withers Road
2012 AM Base Case
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 20 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	1	0.0	0.165	12.4	LOS A	1.2	9.2	0.58	0.45	52.1
2	T	169	9.9	0.165	3.4	LOS A	1.2	9.2	0.58	0.00	55.5
3	R	56	7.5	0.165	12.8	LOS A	1.2	9.2	0.58	1.01	52.1
Approach		227	9.3	0.165	5.8	NA	1.2	9.2	0.58	0.25	54.7
East: Withers Road											
4	L	125	6.7	0.270	11.8	LOS A	0.6	4.6	0.47	0.78	47.0
5	T	1	0.0	0.644	25.2	LOS B	4.4	31.8	0.82	1.15	34.8
6	R	216	4.5	0.644	27.5	LOS B	4.4	31.8	0.82	1.17	35.5
Approach		342	5.3	0.644	21.8	LOS B	4.4	31.8	0.70	1.03	39.0
North: Annangrove Road (N)											
7	L	256	2.2	0.275	10.1	LOS A	2.0	15.2	0.52	0.43	52.5
8	T	241	12.2	0.275	1.0	LOS A	2.0	15.2	0.52	0.00	55.7
9	R	1	0.0	0.275	10.2	LOS A	2.0	15.2	0.52	0.79	52.8
Approach		498	7.0	0.275	5.7	NA	2.0	15.2	0.52	0.22	54.0
West: The Water Lane											
10	L	1	0.0	0.010	15.2	LOS B	0.0	0.2	0.50	0.59	43.7
11	T	1	0.0	0.010	13.2	LOS A	0.0	0.2	0.50	0.70	43.6
12	R	1	0.0	0.010	15.3	LOS B	0.0	0.2	0.50	0.78	43.8
Approach		4	0.0	0.010	14.6	LOS B	0.0	0.2	0.50	0.69	43.7
All Vehicles		1071	6.9	0.644	10.9	NA	4.4	31.8	0.59	0.49	48.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Annangrove Road / Withers Road
2012 PM Base Case
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 20 years

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	1	100.0	0.181	14.5	LOS B	1.1	8.2	0.43	0.63	50.2
2	T	178	7.9	0.181	1.5	LOS A	1.1	8.2	0.43	0.00	58.3
3	R	91	1.5	0.181	10.7	LOS A	1.1	8.2	0.43	0.90	53.3
Approach		270	6.2	0.181	4.6	NA	1.1	8.2	0.43	0.31	56.5
East: Withers Road											
4	L	98	4.3	0.183	10.2	LOS A	0.4	2.8	0.33	0.68	48.3
5	T	1	100.0	0.581	23.2	LOS B	4.1	29.0	0.73	1.02	37.4
6	R	242	1.7	0.581	21.6	LOS B	4.1	29.0	0.73	1.10	39.0
Approach		342	2.9	0.581	18.4	LOS B	4.1	29.0	0.62	0.98	41.2
North: Annangrove Road (N)											
7	L	146	1.0	0.154	10.0	LOS A	1.0	7.5	0.47	0.47	52.6
8	T	137	8.2	0.154	0.9	LOS A	1.0	7.5	0.47	0.00	56.8
9	R	1	0.0	0.154	10.1	LOS A	1.0	7.5	0.47	0.80	52.8
Approach		284	4.4	0.154	5.6	NA	1.0	7.5	0.47	0.24	54.6
West: The Water Lane											
10	L	1	0.0	0.008	13.2	LOS A	0.0	0.2	0.46	0.59	45.5
11	T	1	0.0	0.008	11.2	LOS A	0.0	0.2	0.46	0.65	45.5
12	R	1	0.0	0.008	13.3	LOS A	0.0	0.2	0.46	0.75	45.5
Approach		4	0.0	0.008	12.6	LOS A	0.0	0.2	0.46	0.66	45.5
All Vehicles		900	4.4	0.581	10.2	NA	4.1	29.0	0.51	0.54	49.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Annangrove Road / Edwards Road
2012 AM Base Case
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	54	5.6	0.157	10.8	LOS A	1.2	9.3	0.49	0.57	53.8
2	T	221	9.5	0.157	1.5	LOS A	1.2	9.3	0.49	0.00	57.5
3	R	6	16.7	0.157	11.4	LOS A	1.2	9.3	0.49	0.99	54.1
Approach		281	8.9	0.157	3.5	NA	1.2	9.3	0.49	0.13	56.7
East: Edwards Road (E)											
4	L	1	0.0	0.022	33.1	LOS C	0.1	0.6	0.74	0.62	32.6
5	T	1	100.0	0.022	34.9	LOS C	0.1	0.6	0.74	0.89	32.1
6	R	1	0.0	0.022	33.2	LOS C	0.1	0.6	0.74	0.91	32.7
Approach		3	33.3	0.022	33.7	LOS C	0.1	0.6	0.74	0.80	32.5
North: Annangrove Road (N)											
7	L	1	0.0	0.252	10.7	LOS A	1.6	12.4	0.46	0.52	53.0
8	T	224	11.6	0.252	1.7	LOS A	1.6	12.4	0.46	0.00	57.4
9	R	136	5.9	0.252	11.1	LOS A	1.6	12.4	0.46	0.89	53.1
Approach		361	9.4	0.252	5.2	NA	1.6	12.4	0.46	0.34	55.8
West: Edwards Road (W)											
10	L	217	5.5	0.421	11.4	LOS A	1.2	8.7	0.41	0.75	47.4
11	T	7	14.3	0.444	22.1	LOS B	2.2	16.5	0.77	0.99	37.0
12	R	131	6.9	0.444	24.0	LOS B	2.2	16.5	0.77	1.03	37.6
Approach		355	6.2	0.444	16.2	LOS B	2.2	16.5	0.55	0.86	43.1
All Vehicles		1000	8.2	0.444	8.7	NA	2.2	16.5	0.50	0.47	50.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2012 PM Base Case

Annangrove Road / Edwards Road
2012 PM Base Case
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	136	4.4	0.166	10.0	LOS A	1.1	8.1	0.43	0.53	52.9
2	T	169	4.7	0.166	0.8	LOS A	1.1	8.1	0.43	0.00	57.9
3	R	1	0.0	0.166	10.0	LOS A	1.1	8.1	0.43	0.83	53.1
Approach		306	4.6	0.166	4.9	NA	1.1	8.1	0.43	0.24	55.6
East: Edwards Road (E)											
4	L	3	0.0	0.010	13.3	LOS A	0.0	0.2	0.41	0.60	45.4
5	T	1	0.0	0.010	11.3	LOS A	0.0	0.2	0.41	0.66	45.5
6	R	1	0.0	0.010	13.4	LOS A	0.0	0.2	0.41	0.79	45.4
Approach		5	0.0	0.010	12.9	LOS A	0.0	0.2	0.41	0.65	45.4
North: Annangrove Road (N)											
7	L	1	0.0	0.283	10.9	LOS A	1.7	12.7	0.48	0.45	52.3
8	T	166	7.2	0.283	1.8	LOS A	1.7	12.7	0.48	0.00	56.4
9	R	203	4.4	0.283	11.2	LOS A	1.7	12.7	0.48	0.84	52.4
Approach		370	5.7	0.283	7.0	NA	1.7	12.7	0.48	0.46	54.2
West: Edwards Road (W)											
10	L	184	6.5	0.358	10.8	LOS A	0.8	6.2	0.38	0.71	48.0
11	T	7	0.0	0.150	16.6	LOS B	0.5	4.1	0.67	0.85	40.6
12	R	41	9.8	0.150	19.2	LOS B	0.5	4.1	0.67	0.91	41.0
Approach		232	6.9	0.358	12.4	LOS A	0.8	6.2	0.44	0.75	46.4
All Vehicles		913	5.6	0.358	7.7	NA	1.7	12.7	0.45	0.46	52.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Annangrove Road / Withers Road
2022 AM Upgrade
Signals - Fixed Time Cycle Time = 115 seconds (Optimum Cycle Time - Shortest Queue)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	130	8.0	0.677	51.6	LOS D	15.5	116.2	0.96	0.86	27.2
2	T	468	8.0	0.677	43.1	LOS D	15.5	116.2	0.96	0.82	28.6
3	R	79	8.0	0.481	44.2	LOS D	3.3	25.0	0.99	0.76	28.9
Approach		677	8.0	0.677	44.8	LOS D	15.5	116.2	0.97	0.82	28.4
East: Withers Road											
4	L	284	8.0	0.545	13.2	LOS A	4.7	35.1	0.38	0.71	45.9
5	T	321	8.0	0.474	46.1	LOS D	8.2	61.3	0.94	0.77	25.4
6	R	539	8.0	0.782	30.6	LOS C	20.5	153.4	0.93	0.89	34.0
Approach		1144	8.0	0.782	30.6	LOS C	20.5	153.4	0.80	0.81	33.2
North: Annangrove Road (N)											
7	L	252	8.0	0.794	55.2	LOS D	21.2	158.6	0.99	0.91	25.6
8	T	475	8.0	0.794	47.8	LOS D	21.2	158.6	1.00	0.92	27.0
9	R	67	8.0	0.341	42.4	LOS C	2.8	21.0	0.94	0.75	29.6
Approach		794	8.0	0.794	49.7	LOS D	21.2	158.6	0.99	0.90	26.7
West: The Water Lane											
10	L	33	8.0	0.097	19.1	LOS B	0.8	5.7	0.51	0.69	41.2
11	T	352	8.0	0.520	46.5	LOS D	9.1	67.9	0.95	0.78	25.3
12	R	39	8.0	0.111	22.4	LOS B	1.0	7.3	0.60	0.71	38.8
Approach		424	8.0	0.520	42.2	LOS C	9.1	67.9	0.89	0.77	27.1
All Vehicles		3039	8.0	0.794	40.4	LOS C	21.2	158.6	0.90	0.83	29.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	50	51.7	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	50	45.2	LOS E	0.1	0.1	0.89	0.89
P5	Across N approach	50	51.7	LOS E	0.2	0.2	0.95	0.95
P7	Across W approach	50	45.2	LOS E	0.1	0.1	0.89	0.89
All Pedestrians		200	48.4	LOS E			0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Annangrove Road / Withers Road
2022 PM Upgrade
Signals - Fixed Time Cycle Time = 90 seconds (Optimum Cycle Time - Shortest Queue)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	290	6.0	0.376	27.9	LOS B	8.6	63.4	0.72	0.81	36.6
2	T	140	6.0	0.269	27.5	LOS B	4.8	35.6	0.82	0.67	36.2
3	R	132	6.0	0.402	29.1	LOS C	3.4	25.2	0.93	0.78	36.0
Approach		562	6.0	0.402	28.1	LOS B	8.6	63.4	0.79	0.77	36.4
East: Withers Road											
4	L	166	6.0	0.281	12.2	LOS A	2.1	15.2	0.37	0.70	46.7
5	T	475	6.0	0.542	33.3	LOS C	9.3	68.8	0.93	0.78	29.9
6	R	292	6.0	0.756	39.3	LOS C	10.5	77.0	0.96	0.95	30.2
Approach		933	6.0	0.756	31.4	LOS C	10.5	77.0	0.84	0.82	32.1
North: Annangrove Road (N)											
7	L	427	6.0	0.728	36.0	LOS C	18.8	138.3	0.92	0.88	32.5
8	T	439	6.0	0.728	32.4	LOS C	18.8	138.3	0.96	0.85	33.1
9	R	334	6.0	0.754	31.0	LOS C	10.8	79.2	0.93	0.88	34.9
Approach		1200	6.0	0.754	33.3	LOS C	18.8	138.3	0.94	0.87	33.4
West: The Water Lane											
10	L	33	6.0	0.044	10.6	LOS A	0.3	1.9	0.28	0.66	48.3
11	T	281	6.0	0.321	31.3	LOS C	5.2	38.2	0.87	0.71	30.9
12	R	2	6.0	0.006	28.9	LOS C	0.1	0.4	0.80	0.63	34.9
Approach		316	6.0	0.321	29.1	LOS C	5.2	38.2	0.81	0.70	32.2
All Vehicles		3011	6.0	0.756	31.3	LOS C	18.8	138.3	0.87	0.82	33.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
P3	Across E approach	50	34.7	LOS D	0.1	0.1	0.88	0.88
P5	Across N approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
P7	Across W approach	50	34.7	LOS D	0.1	0.1	0.88	0.88
All Pedestrians		200	36.9	LOS D			0.91	0.91

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Annangrove Road / Edwards Road
2022 AM Upgrade
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	12	8.0	0.473	11.0	LOS A	3.1	23.1	0.68	0.83	51.6
2	T	381	8.0	0.473	10.8	LOS A	3.1	23.1	0.68	0.79	51.9
3	R	653	8.0	0.652	17.9	LOS B	6.2	46.3	0.78	0.89	45.7
Approach		1046	8.0	0.652	15.2	LOS B	6.2	46.3	0.74	0.86	47.8
East: Edwards Road (E)											
4	L	40	8.0	0.175	15.1	LOS B	1.0	7.6	0.88	0.96	44.5
5	T	37	8.0	0.175	13.2	LOS A	1.0	7.6	0.88	0.94	43.9
6	R	55	8.0	0.164	21.3	LOS B	0.8	6.3	0.85	0.96	40.2
Approach		132	8.0	0.175	17.1	LOS B	1.0	7.6	0.87	0.95	42.4
North: Annangrove Road (N)											
7	L	359	8.0	0.307	9.4	LOS A	1.7	12.8	0.59	0.72	51.6
8	T	698	8.0	0.753	23.2	LOS B	10.0	75.0	1.00	1.25	41.2
9	R	318	8.0	0.753	30.0	LOS C	8.4	62.6	0.99	1.24	36.3
Approach		1375	8.0	0.753	21.2	LOS B	10.0	75.0	0.89	1.11	42.0
West: Edwards Road (W)											
10	L	226	8.0	0.544	13.6	LOS A	3.6	27.2	0.84	1.01	45.8
11	T	302	8.0	0.544	12.3	LOS A	3.6	27.2	0.84	0.98	44.6
12	R	137	8.0	0.544	19.3	LOS B	3.4	25.4	0.83	1.05	42.2
Approach		665	8.0	0.544	14.1	LOS A	3.6	27.2	0.84	1.00	44.4
All Vehicles		3218	8.0	0.753	17.6	LOS B	10.0	75.0	0.83	1.00	44.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Annangrove Road / Edwards Road
2022 PM Upgrade
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	15	6.0	0.552	15.1	LOS B	4.0	29.7	0.87	1.03	47.6
2	T	354	6.0	0.552	14.9	LOS B	4.0	29.7	0.87	1.02	48.5
3	R	89	6.0	0.226	20.8	LOS B	1.0	7.5	0.75	0.94	43.2
Approach		458	6.0	0.552	16.0	LOS B	4.0	29.7	0.85	1.00	47.3
East: Edwards Road (E)											
4	L	284	6.0	0.651	12.8	LOS A	4.9	35.9	0.74	0.99	46.4
5	T	293	6.0	0.651	10.9	LOS A	4.9	35.9	0.74	0.95	46.0
6	R	598	6.0	0.610	16.3	LOS B	4.3	31.8	0.71	0.99	43.8
Approach		1175	6.0	0.651	14.2	LOS A	4.9	35.9	0.73	0.98	44.9
North: Annangrove Road (N)											
7	L	55	6.0	0.042	7.7	LOS A	0.2	1.1	0.18	0.54	54.4
8	T	342	6.0	0.210	8.3	LOS A	1.1	8.0	0.30	0.56	54.6
9	R	248	6.0	0.210	12.8	LOS A	1.1	7.7	0.31	0.69	48.8
Approach		645	6.0	0.210	10.0	LOS A	1.1	8.0	0.29	0.61	52.2
West: Edwards Road (W)											
10	L	525	6.0	0.794	26.4	LOS B	10.5	77.4	1.00	1.34	36.2
11	T	43	6.0	0.183	14.2	LOS A	0.9	6.5	0.76	0.87	42.9
12	R	29	6.0	0.183	20.6	LOS B	0.9	6.5	0.76	0.96	41.2
Approach		597	6.0	0.794	25.2	LOS B	10.5	77.4	0.97	1.28	36.8
All Vehicles		2875	6.0	0.794	15.8	LOS B	10.5	77.4	0.70	0.96	44.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Edwards Road East Intersection 2
2022 AM Peak 90/10
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	76	8.0	0.090	8.0	LOS A	0.4	3.3	0.36	0.57	48.5
6	R	20	8.0	0.090	12.3	LOS A	0.4	3.3	0.36	0.74	45.7
Approach		96	8.0	0.090	8.9	LOS A	0.4	3.3	0.36	0.61	47.9
North:											
7	L	20	8.0	0.060	10.0	LOS A	0.3	2.4	0.61	0.66	46.8
9	R	30	8.0	0.060	14.6	LOS B	0.3	2.4	0.61	0.77	43.7
Approach		50	8.0	0.060	12.8	LOS A	0.3	2.4	0.61	0.72	44.9
West: Edwards Road Extension (W)											
10	L	269	8.0	0.201	7.2	LOS A	1.2	8.8	0.12	0.54	49.9
11	T	440	8.0	0.349	5.7	LOS A	2.5	18.3	0.12	0.43	51.3
12	R	156	8.0	0.349	13.2	LOS A	2.5	18.3	0.12	0.90	45.0
Approach		865	8.0	0.349	7.5	LOS A	2.5	18.3	0.12	0.55	49.6
All Vehicles		1011	8.0	0.349	7.9	LOS A	2.5	18.3	0.17	0.56	49.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Edwards Road East Intersection 2
2022 AM Peak 90/10
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	679	6.0	0.636	10.2	LOS A	6.0	44.4	0.70	0.74	46.8
6	R	1	6.0	0.636	14.1	LOS A	6.0	44.4	0.70	0.84	44.3
Approach		680	6.0	0.636	10.2	LOS A	6.0	44.4	0.70	0.74	46.8
North:											
7	L	1	6.0	0.201	7.9	LOS A	1.1	7.9	0.19	0.57	48.6
9	R	269	6.0	0.201	11.3	LOS A	1.1	7.9	0.19	0.68	45.8
Approach		270	6.0	0.201	11.3	LOS A	1.1	7.9	0.19	0.68	45.8
West: Edwards Road Extension (W)											
10	L	30	6.0	0.021	8.4	LOS A	0.1	0.8	0.02	0.67	48.9
11	T	55	6.0	0.032	6.9	LOS A	0.2	1.3	0.02	0.56	50.5
12	R	1	6.0	0.032	12.4	LOS A	0.2	1.3	0.02	0.96	45.2
Approach		86	6.0	0.032	7.5	LOS A	0.2	1.3	0.02	0.61	49.9
All Vehicles		1036	6.0	0.636	10.3	LOS A	6.0	44.4	0.51	0.71	46.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Edwards Road East Intersection 3
2022 AM Peak 90/10
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	31	8.0	0.035	1.0	LOS A	0.2	1.3	0.33	0.00	53.1
6	R	20	8.0	0.035	9.6	LOS A	0.2	1.3	0.33	0.80	48.4
Approach		51	8.0	0.035	4.4	NA	0.2	1.3	0.33	0.31	51.2
North: Crown Road											
7	L	140	8.0	0.188	12.5	LOS A	0.8	5.7	0.35	0.88	45.7
9	R	25	8.0	0.188	12.4	LOS A	0.8	5.7	0.35	0.95	45.8
Approach		165	8.0	0.188	12.5	LOS A	0.8	5.7	0.35	0.89	45.7
West: Edwards Road Extension (W)											
10	L	89	8.0	0.122	8.5	LOS A	0.0	0.0	0.00	0.87	49.0
11	T	133	8.0	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		222	8.0	0.122	3.4	NA	0.0	0.0	0.00	0.35	55.0
All Vehicles		438	8.0	0.188	6.9	NA	0.8	5.7	0.17	0.55	50.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Edwards Road East Intersection 3
2022 AM Peak 90/10
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	273	6.0	0.160	0.1	LOS A	1.0	7.0	0.12	0.00	57.6
6	R	20	6.0	0.160	8.7	LOS A	1.0	7.0	0.12	1.01	48.9
Approach		293	6.0	0.160	0.7	NA	1.0	7.0	0.12	0.07	56.9
North: Crown Road											
7	L	13	6.0	0.354	16.0	LOS B	1.9	13.8	0.40	0.73	42.5
9	R	186	6.0	0.354	15.9	LOS B	1.9	13.8	0.40	1.00	42.6
Approach		199	6.0	0.354	15.9	LOS B	1.9	13.8	0.40	0.99	42.6
West: Edwards Road Extension (W)											
10	L	12	6.0	0.016	8.4	LOS A	0.0	0.0	0.00	0.87	49.0
11	T	18	6.0	0.016	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		30	6.0	0.016	3.4	NA	0.0	0.0	0.00	0.35	55.0
All Vehicles		522	6.0	0.354	6.7	NA	1.9	13.8	0.22	0.44	50.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Annangrove Road / Withers Road
2022 AM Upgrade
Signals - Fixed Time Cycle Time = 115 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	130	8.0	0.538	47.5	LOS D	12.9	96.4	0.90	0.86	28.5
2	T	399	8.0	0.538	39.1	LOS C	12.9	96.4	0.91	0.77	30.2
3	R	79	8.0	0.463	42.4	LOS C	3.2	24.0	0.98	0.76	29.6
Approach		608	8.0	0.538	41.3	LOS C	12.9	96.4	0.92	0.79	29.8
East: Withers Road											
4	L	265	8.0	0.524	13.4	LOS A	4.5	33.5	0.39	0.71	45.7
5	T	336	8.0	0.496	46.3	LOS D	8.6	64.5	0.95	0.77	25.4
6	R	487	8.0	0.756	31.0	LOS C	18.4	137.9	0.93	0.87	33.9
Approach		1088	8.0	0.756	31.4	LOS C	18.4	137.9	0.80	0.80	32.7
North: Annangrove Road (N)											
7	L	294	8.0	0.768	50.6	LOS D	22.0	164.7	0.97	0.90	27.0
8	T	493	8.0	0.768	43.9	LOS D	22.0	164.7	0.98	0.89	28.3
9	R	117	8.0	0.488	40.6	LOS C	4.9	36.6	0.92	0.78	30.3
Approach		904	8.0	0.768	45.7	LOS D	22.0	164.7	0.97	0.88	28.1
West: The Water Lane											
10	L	30	8.0	0.080	16.7	LOS B	0.6	4.5	0.45	0.68	42.9
11	T	352	8.0	0.520	46.5	LOS D	9.1	67.9	0.95	0.78	25.3
12	R	37	8.0	0.110	24.0	LOS B	1.0	7.4	0.64	0.71	37.7
Approach		419	8.0	0.520	42.4	LOS C	9.1	67.9	0.89	0.77	27.0
All Vehicles		3019	8.0	0.768	39.2	LOS C	22.0	164.7	0.89	0.82	29.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	50	51.7	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	50	42.6	LOS E	0.1	0.1	0.86	0.86
P5	Across N approach	50	51.7	LOS E	0.2	0.2	0.95	0.95
P7	Across W approach	50	42.6	LOS E	0.1	0.1	0.86	0.86
All Pedestrians		200	47.1	LOS E			0.90	0.90

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Annangrove Road / Withers Road
2022 PM Upgrade
Signals - Fixed Time Cycle Time = 90 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	290	6.0	0.396	28.1	LOS B	9.0	66.4	0.73	0.82	36.6
2	T	200	6.0	0.396	29.7	LOS C	9.0	66.4	0.87	0.72	34.9
3	R	132	6.0	0.459	31.3	LOS C	3.8	27.6	0.95	0.78	34.8
Approach		622	6.0	0.459	29.3	LOS C	9.0	66.4	0.82	0.78	35.6
East: Withers Road											
4	L	176	6.0	0.281	11.7	LOS A	2.0	14.7	0.35	0.70	47.2
5	T	447	6.0	0.510	33.0	LOS C	8.7	64.1	0.92	0.77	30.1
6	R	333	6.0	0.717	31.7	LOS C	11.2	82.8	0.92	0.85	33.5
Approach		956	6.0	0.717	28.6	LOS C	11.2	82.8	0.81	0.78	33.6
North: Annangrove Road (N)											
7	L	378	6.0	0.708	36.8	LOS C	17.2	126.5	0.92	0.87	32.2
8	T	408	6.0	0.708	33.1	LOS C	17.2	126.5	0.96	0.84	32.7
9	R	265	6.0	0.714	32.2	LOS C	8.6	63.6	0.94	0.85	34.2
Approach		1051	6.0	0.714	34.2	LOS C	17.2	126.5	0.94	0.86	32.9
West: The Water Lane											
10	L	43	6.0	0.072	11.9	LOS A	0.5	3.5	0.35	0.67	47.0
11	T	281	6.0	0.321	31.3	LOS C	5.2	38.2	0.87	0.71	30.9
12	R	2	6.0	0.005	26.0	LOS B	0.1	0.4	0.75	0.63	36.5
Approach		326	6.0	0.321	28.7	LOS C	5.2	38.2	0.80	0.70	32.4
All Vehicles		2955	6.0	0.717	30.8	LOS C	17.2	126.5	0.86	0.80	33.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
P3	Across E approach	50	36.5	LOS D	0.1	0.1	0.90	0.90
P5	Across N approach	50	39.2	LOS D	0.1	0.1	0.93	0.93
P7	Across W approach	50	36.5	LOS D	0.1	0.1	0.90	0.90
All Pedestrians		200	37.8	LOS D			0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Annangrove Road / Edwards Road
2022 AM Upgrade
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	12	8.0	0.493	11.8	LOS A	3.2	24.1	0.70	0.90	51.2
2	T	396	8.0	0.493	11.6	LOS A	3.2	24.1	0.70	0.86	51.8
3	R	514	8.0	0.549	17.6	LOS B	4.1	30.4	0.73	0.92	45.9
Approach		922	8.0	0.549	15.0	LOS B	4.1	30.4	0.72	0.90	48.3
East: Edwards Road (E)											
4	L	98	8.0	0.354	14.1	LOS A	2.1	15.7	0.86	0.97	45.4
5	T	91	8.0	0.354	12.2	LOS A	2.1	15.7	0.86	0.94	44.8
6	R	137	8.0	0.328	19.9	LOS B	1.7	13.0	0.84	0.97	41.2
Approach		326	8.0	0.354	16.0	LOS B	2.1	15.7	0.85	0.96	43.3
North: Annangrove Road (N)											
7	L	299	8.0	0.244	9.0	LOS A	1.3	9.7	0.53	0.69	52.0
8	T	641	8.0	0.587	14.7	LOS B	5.5	41.2	0.88	1.01	48.7
9	R	318	8.0	0.587	20.5	LOS B	4.9	36.7	0.87	1.07	42.8
Approach		1258	8.0	0.587	14.8	LOS B	5.5	41.2	0.80	0.95	47.7
West: Edwards Road (W)											
10	L	263	8.0	0.496	12.8	LOS A	3.1	23.3	0.80	0.98	46.4
11	T	253	8.0	0.496	11.5	LOS A	3.1	23.3	0.80	0.95	45.2
12	R	126	8.0	0.496	18.3	LOS B	2.9	21.9	0.80	1.03	42.9
Approach		642	8.0	0.496	13.4	LOS A	3.1	23.3	0.80	0.97	45.2
All Vehicles		3148	8.0	0.587	14.7	LOS B	5.5	41.2	0.78	0.94	46.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Annangrove Road / Edwards Road
2022 PM Upgrade
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Annangrove Road (S)											
1	L	15	6.0	0.487	13.2	LOS A	3.3	24.0	0.81	0.98	49.6
2	T	344	6.0	0.487	13.0	LOS A	3.3	24.0	0.81	0.96	50.5
3	R	210	6.0	0.362	19.1	LOS B	1.9	14.2	0.76	0.96	44.6
Approach		569	6.0	0.487	15.2	LOS B	3.3	24.0	0.79	0.96	48.1
East: Edwards Road (E)											
4	L	235	6.0	0.592	12.8	LOS A	4.1	29.9	0.75	0.98	46.4
5	T	244	6.0	0.592	10.9	LOS A	4.1	29.9	0.75	0.94	46.0
6	R	498	6.0	0.548	16.3	LOS B	3.6	26.6	0.72	0.98	43.8
Approach		977	6.0	0.592	14.1	LOS A	4.1	29.9	0.74	0.97	44.9
North: Annangrove Road (N)											
7	L	82	6.0	0.062	8.0	LOS A	0.3	1.9	0.29	0.56	53.6
8	T	378	6.0	0.254	9.0	LOS A	1.4	10.7	0.47	0.63	53.3
9	R	248	6.0	0.254	13.6	LOS A	1.4	10.1	0.49	0.75	48.2
Approach		708	6.0	0.254	10.5	LOS A	1.4	10.7	0.46	0.66	51.4
West: Edwards Road (W)											
10	L	492	6.0	0.700	18.6	LOS B	6.8	50.0	0.92	1.15	41.2
11	T	98	6.0	0.305	13.4	LOS A	1.5	10.8	0.76	0.88	43.8
12	R	32	6.0	0.305	19.8	LOS B	1.5	10.8	0.76	0.98	41.9
Approach		622	6.0	0.700	17.9	LOS B	6.8	50.0	0.89	1.10	41.6
All Vehicles		2876	6.0	0.700	14.3	LOS A	6.8	50.0	0.71	0.92	46.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: 2022 AM Peak 75_25

Edwards Road East Intersection 2
2022 AM Peak 90/10
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	189	8.0	0.204	8.5	LOS A	1.1	8.3	0.44	0.62	48.1
6	R	20	8.0	0.204	12.6	LOS A	1.1	8.3	0.44	0.80	45.6
Approach		209	8.0	0.204	8.9	LOS A	1.1	8.3	0.44	0.63	47.8
North:											
7	L	20	8.0	0.117	11.2	LOS A	0.6	4.6	0.60	0.73	45.8
9	R	75	8.0	0.117	14.4	LOS A	0.6	4.6	0.60	0.78	43.5
Approach		95	8.0	0.117	13.7	LOS A	0.6	4.6	0.60	0.77	44.0
West: Edwards Road Extension (W)											
10	L	225	8.0	0.178	8.6	LOS A	1.0	7.7	0.12	0.64	48.4
11	T	368	8.0	0.320	7.1	LOS A	2.2	16.6	0.13	0.52	49.8
12	R	156	8.0	0.320	12.8	LOS A	2.2	16.6	0.13	0.83	45.0
Approach		749	8.0	0.320	8.7	LOS A	2.2	16.6	0.13	0.62	48.3
All Vehicles		1053	8.0	0.320	9.2	LOS A	2.2	16.6	0.23	0.63	47.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Edwards Road East Intersection 2
2022 AM Peak 90/10
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	566	6.0	0.610	11.3	LOS A	5.7	41.7	0.75	0.82	46.0
6	R	20	6.0	0.610	15.3	LOS B	5.7	41.7	0.75	0.90	43.4
Approach		586	6.0	0.610	11.4	LOS A	5.7	41.7	0.75	0.82	45.9
North:											
7	L	20	6.0	0.238	9.5	LOS A	1.3	9.7	0.47	0.66	47.2
9	R	225	6.0	0.238	12.7	LOS A	1.3	9.7	0.47	0.73	44.9
Approach		245	6.0	0.238	12.4	LOS A	1.3	9.7	0.47	0.72	45.1
West: Edwards Road Extension (W)											
10	L	75	6.0	0.068	8.5	LOS A	0.4	2.7	0.13	0.63	48.4
11	T	134	6.0	0.163	7.0	LOS A	1.0	7.6	0.12	0.51	49.9
12	R	130	6.0	0.163	12.7	LOS A	1.0	7.6	0.12	0.80	45.0
Approach		339	6.0	0.163	9.5	LOS A	1.0	7.6	0.12	0.65	47.5
All Vehicles		1170	6.0	0.610	11.1	LOS A	5.7	41.7	0.51	0.75	46.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2022 AM Peak 75_25

Edwards Road East Intersection 3
2022 AM Peak 90/10
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	76	8.0	0.058	0.8	LOS A	0.3	2.5	0.32	0.00	53.7
6	R	20	8.0	0.058	9.5	LOS A	0.3	2.5	0.32	0.87	48.8
Approach		96	8.0	0.058	2.6	NA	0.3	2.5	0.32	0.18	52.6
North: Crown Road											
7	L	116	8.0	0.212	12.8	LOS A	0.9	6.6	0.36	0.86	45.4
9	R	56	8.0	0.212	12.7	LOS A	0.9	6.6	0.36	0.95	45.5
Approach		172	8.0	0.212	12.8	LOS A	0.9	6.6	0.36	0.89	45.4
West: Edwards Road Extension (W)											
10	L	75	8.0	0.103	8.5	LOS A	0.0	0.0	0.00	0.87	49.0
11	T	112	8.0	0.103	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		187	8.0	0.103	3.4	NA	0.0	0.0	0.00	0.35	55.0
All Vehicles		455	8.0	0.212	6.8	NA	0.9	6.6	0.20	0.52	50.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2022 PM Peak 75_25

Edwards Road East Intersection 3
2022 AM Peak 90/10
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Edwards Road Extension (E)											
5	T	227	6.0	0.136	0.3	LOS A	0.8	6.0	0.20	0.00	56.1
6	R	20	6.0	0.136	8.9	LOS A	0.8	6.0	0.20	0.96	48.9
Approach		247	6.0	0.136	1.0	NA	0.8	6.0	0.20	0.08	55.4
North: Crown Road											
7	L	32	6.0	0.306	14.8	LOS B	1.4	10.3	0.40	0.77	43.5
9	R	153	6.0	0.306	14.7	LOS B	1.4	10.3	0.40	0.98	43.6
Approach		185	6.0	0.306	14.7	LOS B	1.4	10.3	0.40	0.94	43.6
West: Edwards Road Extension (W)											
10	L	29	6.0	0.040	8.4	LOS A	0.0	0.0	0.00	0.87	49.0
11	T	45	6.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		74	6.0	0.040	3.3	NA	0.0	0.0	0.00	0.34	55.1
All Vehicles		506	6.0	0.306	6.4	NA	1.4	10.3	0.24	0.43	50.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

APPENDIX E

INTERSECTION CONCEPT DESIGN

DRG No. S12006-CSK2 & S12006-CSK3

DRG No. S12006-CSK2 & S12006-CSK3 (INSET 'A')

LOT 2
DP 1071664

LOT 1
DP 546799

THE WATER LANE

ANNANGROVE ROAD

ANNANGROVE ROAD

LOT 57
DP 834049

LOT 58
DP 834049

LOT 1
DP 839875

LOT 1
DP 1088407

LOT 13
DP 833069

LOT 12
DP 833069

LOT 34
DP 834050

LOT 33
DP 834050

WITHERS ROAD

WITHERS ROAD

CONCEPT ONLY

LEGEND:

- CONCEPT INTERSECTION LAYOUT PREPARED BY LAMBERT & REHBEIN
- PREVIOUS CORRIDOR PLANNING PREPARED BY GHD
- PREVIOUS CORRIDOR PLANNING PREPARED BY CARDNO
- PROPERTY BOUNDARY AS COMPILED FROM SURVEY PROVIDED
- PROPERTY ADJUSTMENT LINE
- SURVEY FEATURES

NOTES:

1. INTERSECTION LAYOUTS PREPARED BY LAMBERT & REHBEIN ARE CONCEPT ONLY AND WOULD BE SUBJECT TO DETAILED DESIGN PRIOR TO CONSTRUCTION.
2. PROPERTY BOUNDARIES USED FOR DETERMINING PROPERTY ADJUSTMENT AREAS ARE TO BE CONFIRMED BY A QUALIFIED SURVEYOR. PROPERTY ADJUSTMENT LINES AND AREAS SHOWN ON THESE PLANS ARE APPROXIMATE ONLY AND FOR USE AT A CONCEPT LEVEL.

0 10 20 30 40m
SCALE 1:1000 (A1)

No.	Date	By	Amendment	Checked
B	17/12/12	CD	UPDATED PROPERTY BOUNDARIES	
A	17/7/12	CD	ORIGINAL ISSUE	

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Project: ANNANGROVE RD LIGHT INDUSTRIAL AREA TRAFFIC & ACCESSIBILITY STUDY

Title: ANNANGROVE RD / WITHERS RD INTERSECTION - CONCEPT DESIGN

Client: *THE HILLS SHIRE COUNCIL*

Draftsperson: CD	Checked: AP	Sheet Size: A1	Drawing No.: S12006-CSK1
Designer: CD	Approved: A.PEZZUTTI RPEQ No:		
Scale: AS SHOWN	Date: 16/7/12	A	B

SEE INSET 'A' FOR DETAILS

LOT 1
DP 546799

LOT 13
DP 833069

TIE IN TO EXISTING
CONCEPT PLANNING

THE WATER LANE

TIE IN TO EXISTING
CONCEPT PLANNING

WITHERS ROAD

LOT 1
DP 1088407

LOT 2
DP 1071664

ANNANGROVE ROAD

LOT 1
DP 839875

LOT 58
DP 834049

TIE IN TO EXISTING
CONCEPT PLANNING

TIE IN TO EXISTING
CONCEPT PLANNING

CONCEPT ONLY

LEGEND:

- CONCEPT INTERSECTION LAYOUT PREPARED BY LAMBERT & REHBEIN
- PREVIOUS CORRIDOR PLANNING PREPARED BY GHD
- PREVIOUS CORRIDOR PLANNING PREPARED BY CARDNO
- PROPERTY BOUNDARY AS COMPILED FROM SURVEY PROVIDED
- PROPERTY ADJUSTMENT LINE
- SURVEY FEATURES

NOTES:

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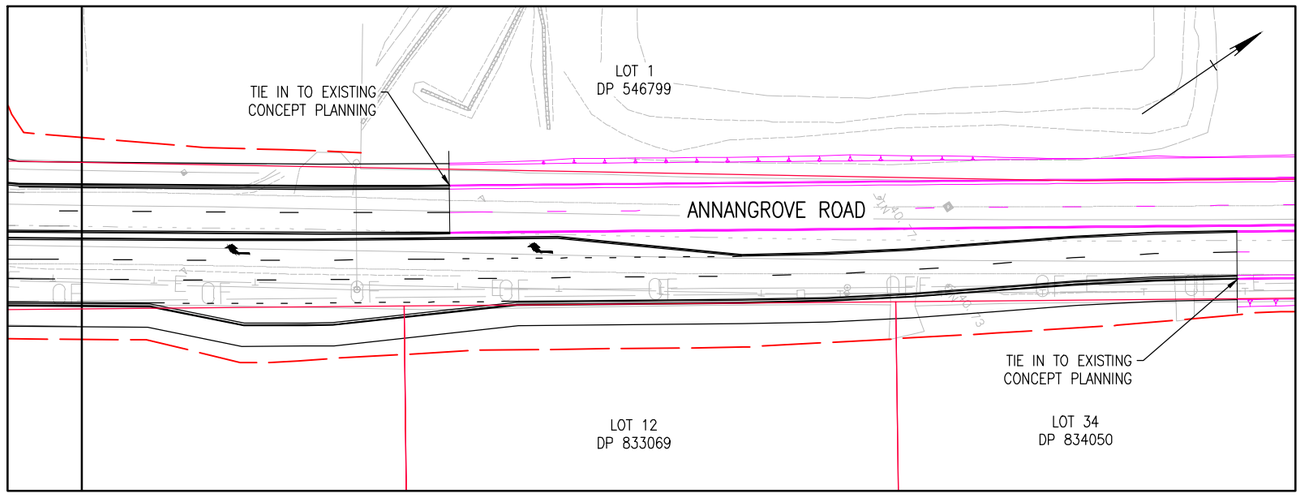

DRG No. S12006-CSK2 (INSET 'A')

SCALE 1:500 (A1)

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SCALE 1:500 (A1)

No.	Date	By	Amendment	Checked
B	17/12/12		UPDATED PROPERTY BOUNDARIES	
A	17/7/12	CD	ORIGINAL ISSUE	

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Project: ANNANGROVE RD LIGHT INDUSTRIAL AREA TRAFFIC & ACCESSIBILITY STUDY

Title: ANNANGROVE RD / WITHERS RD INTERSECTION - CONCEPT DESIGN

Client: *THE HILLS SHIRE COUNCIL*

Draftsperson: CD	Checked: AP	Sheet Size: A1	Drawing No.: S12006-CSK2
Designer: CD	Approved: A.PEZZUTTI RPEQ No:		
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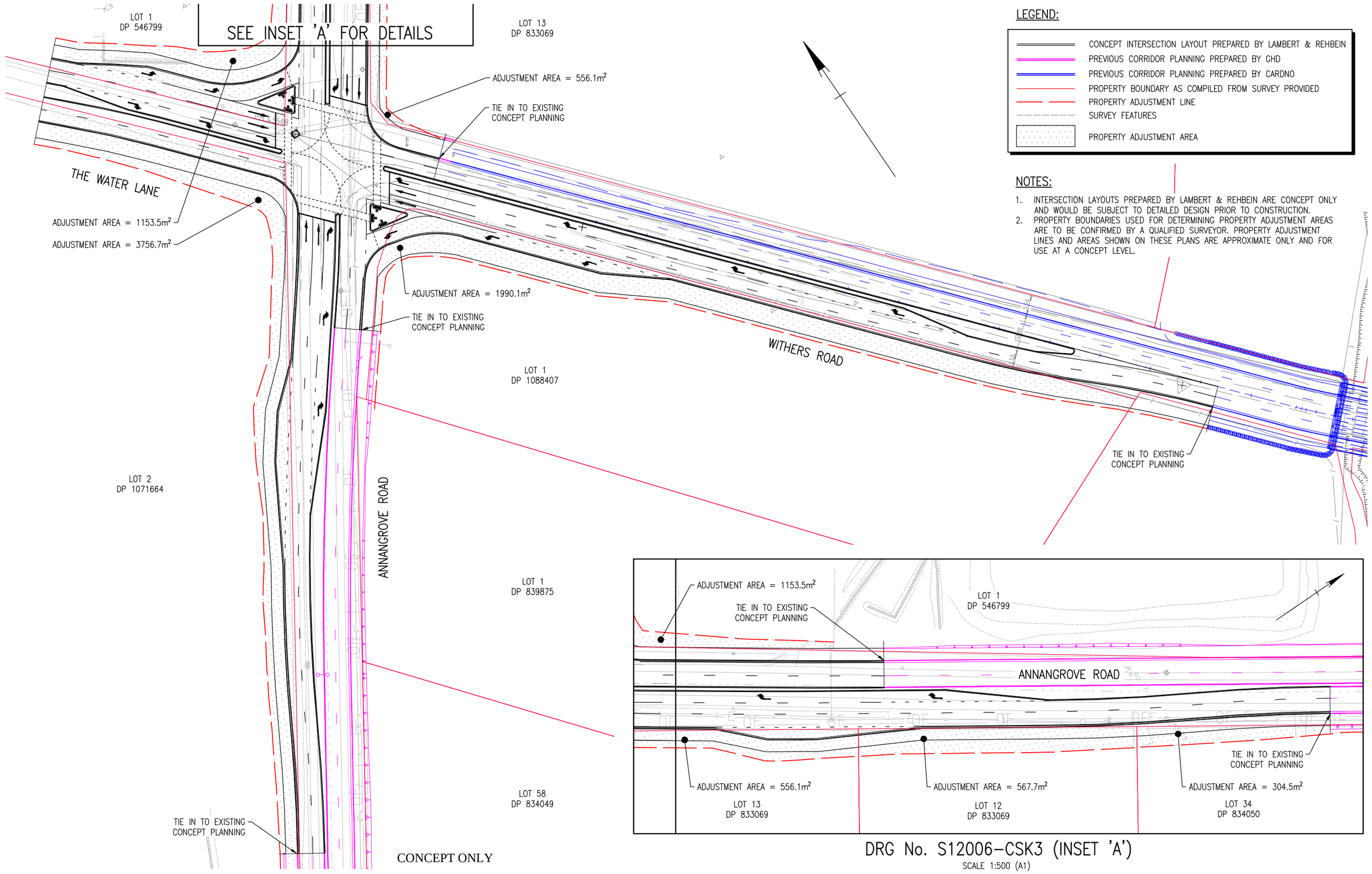

DRG No. S12006-CSK3 (INSET 'A')

SCALE 1:500 (A1)

0 5 10 15 20m

SCALE 1:500 (A1)

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A	17/7/12	CD	ORIGINAL ISSUE	

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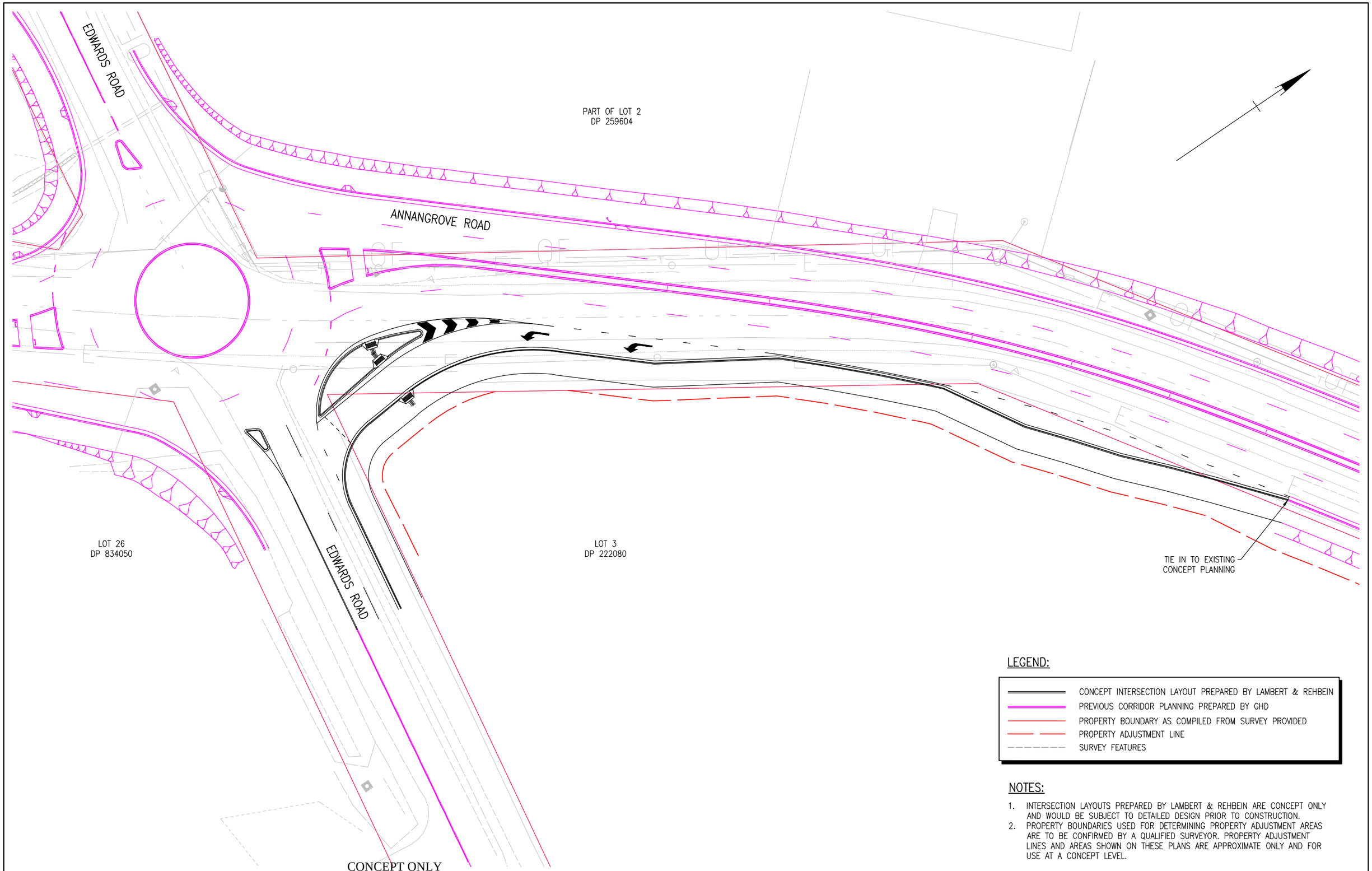
Project: ANNANGROVE RD LIGHT INDUSTRIAL AREA TRAFFIC & ACCESSIBILITY STUDY

Title: ANNANGROVE RD / WITHERS RD LAND ACQUISITION PLAN

Client: *THE HILLS SHIRE COUNCIL*

Draftsperson: CD	Checked: AP	Sheet Size: A1	Drawing No.: S12006-CSK3
Designer: CD	Approved: A.PEZZUTTI RPEQ No:		
Scale: AS SHOWN	Date: 16/7/12	A	B



CONCEPT ONLY

LEGEND:

- CONCEPT INTERSECTION LAYOUT PREPARED BY LAMBERT & REHBEIN
- PREVIOUS CORRIDOR PLANNING PREPARED BY GHD
- PROPERTY BOUNDARY AS COMPILED FROM SURVEY PROVIDED
- PROPERTY ADJUSTMENT LINE
- SURVEY FEATURES

NOTES:

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0 2 4 6 8 10m
SCALE 1:250 (A1)

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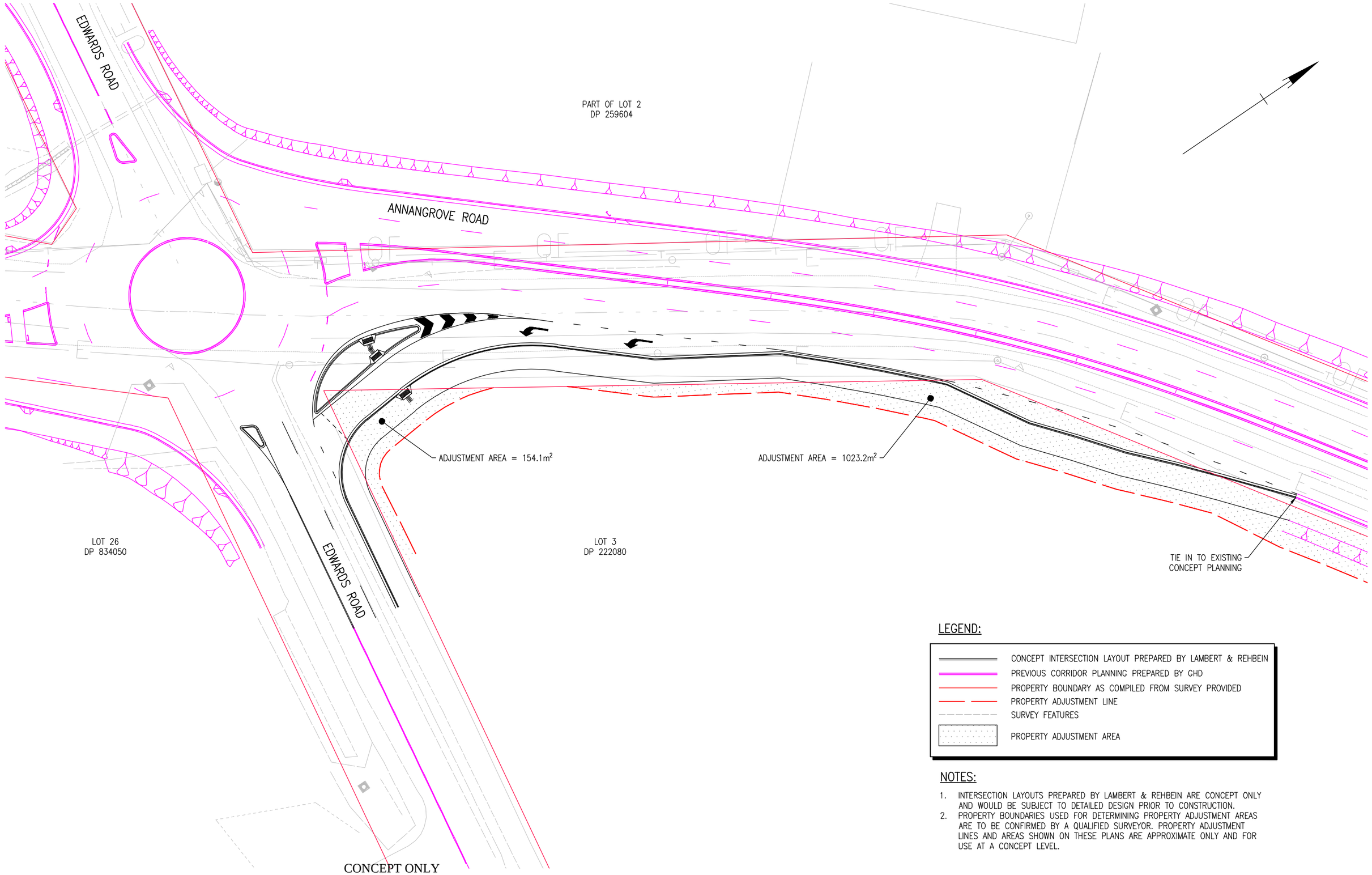
Project: ANNANGROVE RD LIGHT INDUSTRIAL AREA TRAFFIC & ACCESSIBILITY STUDY

Title: ANNANGROVE RD / EDWARDS RD ROUNDABOUT - CONCEPT DESIGN

Client: *THE HILLS SHIRE COUNCIL*

Draftsperson: CD	Checked: AP	Sheet Size: A1	Drawing No.: S12006-CSK4
Designer: CD	Approved: A.PEZZUTTI RPEQ No:		
Scale: AS SHOWN	Date: 16/7/12	A / B	



LEGEND:

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- PREVIOUS CORRIDOR PLANNING PREPARED BY GHD
- PROPERTY BOUNDARY AS COMPILED FROM SURVEY PROVIDED
- PROPERTY ADJUSTMENT LINE
- SURVEY FEATURES
- PROPERTY ADJUSTMENT AREA

NOTES:

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SCALE 1:250 (A1)

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Project: ANNANGROVE RD LIGHT INDUSTRIAL AREA TRAFFIC & ACCESSIBILITY STUDY

Title: ANNANGROVE RD / EDWARDS RD LAND ACQUISITION PLAN

Client: THE HILLS SHIRE COUNCIL

Draftsperson: CD	Checked: AP	Sheet Size: A1	Drawing No.: S12006-CSK5
Designer: CD	Approved: A.PEZZUTTI RPEQ No:		
Scale: AS SHOWN	Date: 16/7/12	A	B