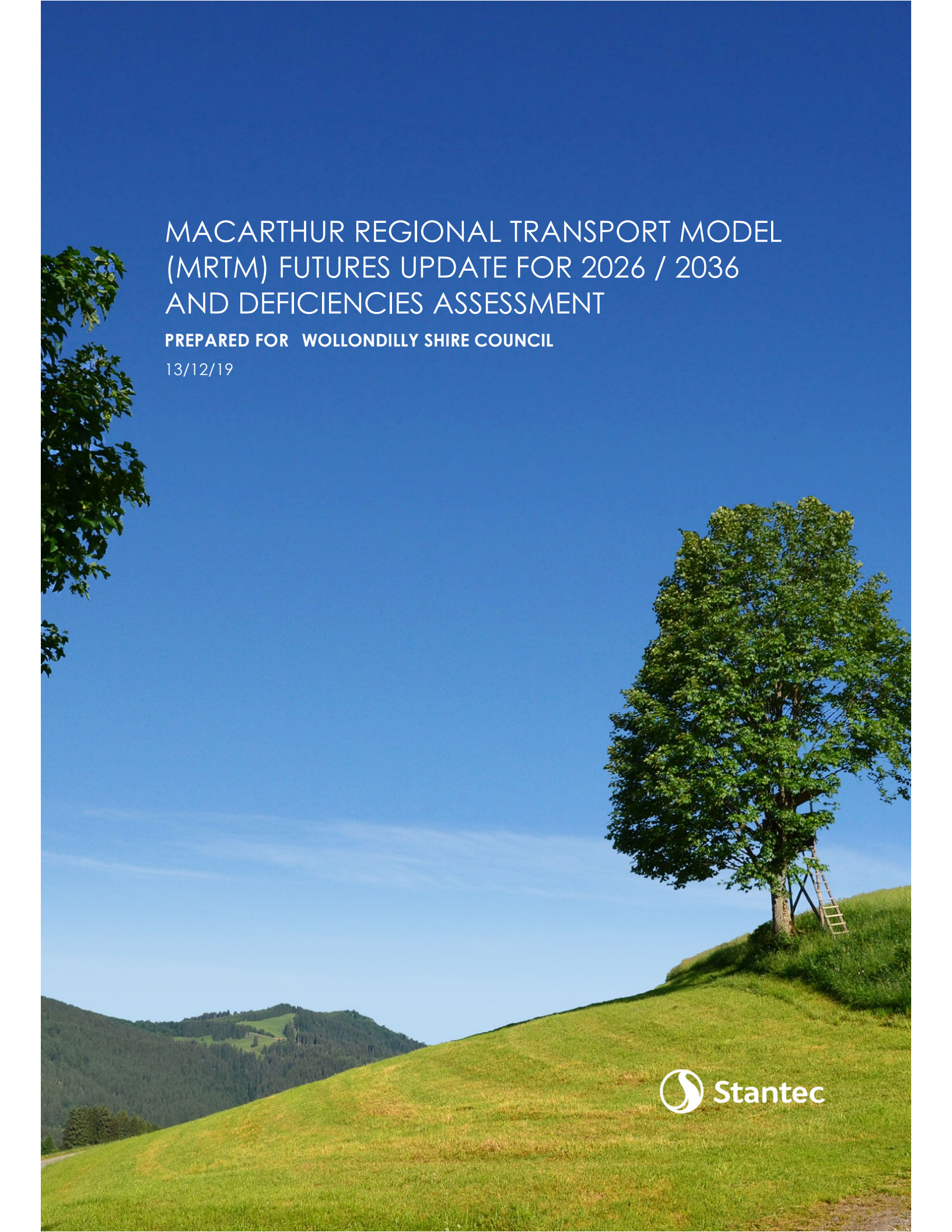




MACARTHUR REGIONAL TRANSPORT MODEL (MRTM) FUTURES UPDATE FOR 2026 / 2036 AND DEFICIENCIES ASSESSMENT

PREPARED FOR WOLLONDILLY SHIRE COUNCIL

13/12/19

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Executive Summary

Stantec have been commissioned by Wollondilly Shire Council (WSC) to update both the future land use projections and base future road networks of the Macarthur Regional Transport Model (MRTM). The model inputs for 2026 and 2036 were updated following a roundtable discussion with representatives of Wollondilly, Camden and Campbelltown Councils, held at Camden Council offices on Friday 11th October 2019. During this meeting the previous models' future growth projections were updated and an extensive list of do-minimum infrastructure improvements was confirmed for inclusion in the model.

This report highlights changes in the WSC area only but references changes in land use in the other MRTM councils, as well as any deficiencies in network performance in the other councils if they may significantly impact the WSC.

The updated Wollondilly land use indicates an expected 100% increase in the number of households and associated population within Shire between 2016 and 2036. Employment is expected to increase by a smaller 72%. This lesser growth in employment will result in a reduction in the "self-sufficiency ratio" of the Shire from 0.31 jobs/resident to 0.26 jobs/resident. As a result, more trips generated from within the shire are expected to travel outside Wollondilly for work and other employment related activities.

The adjoining Camden and Campbelltown LGA's are also expecting growth in both population and employment over the 20-year planning horizon. Camden land use projections indicate an expected 190% increase in the number of households and a 96% increase in employment. This lesser growth in employment for Camden will result in a reduction in the "self-sufficiency ratio" from 0.38 jobs/resident to 0.25 jobs/resident.

Campbelltown projections indicate an 86% increase in the number of households and a 52% increase in employment. This lesser growth in employment for Campbelltown also results in reductions in the "self-sufficiency ratio" from 0.35 jobs/resident to 0.29 jobs/resident.

The Western Sydney Airport (WSA) is in its early stages of construction and is expected to start operation in 2026. A detailed Environmental Impact Statement, undertaken for the Australian Government, indicates the expected employment within the airport complex at various stages of its development. For the purposes of this modelling, the airport and associated business park are expected to employ 3550 staff in 2026 increasing to 11380 staff by 2036.

Vehicle kilometres travelled within the Wollondilly Shire area are expected to increase by 62-69% from 2016-2036 as a result of growth in the MRTM area. The overall Wollondilly network will operate with average speeds that drop by slightly over 6kph (8-9%) in both peak periods by 2036. The overall Wollondilly network vehicle speed remains over 65kph.

The overall intersection delay is expected to increase, with average delay increasing 5-7sec from 2016-2036. Whilst this is not a large numerical increase in average delay, this still represents a 50-56% increase in average delay from the current time.

As a result of the growth in traffic, the number of intersections with approaches assessed as operating at a Level of Service (LOS) E/F in the future is expected to grow from 2 in 2016 up to 12 by 2036. The number of intersections with approaches assessed as operating at LOS C/D is also expected to grow from 5 up to 28 by 2036. Intersection LOS results, as a result of this strategic analysis, are indicative of volume stress at locations within the network and should therefore be subject to more detailed intersection analysis on a project by project basis.

The areas that appear to come under stress and may need network improvements to bring back to an acceptable standard are as follows:

- Silverdale Rd, north of Farnsworth Ave, is expected to operate at LOS E in 2026 in the AM peak at the time of the opening of the Western Sydney Airport (WSA). With the planned duplication of Silverdale Road to four lanes in 2036, the AM peak LOS is expected to return to LOS C.
- Silverdale Rd, south of Silverdale, is expected to operate at LOS D in the AM peak by 2036. The degrading of LOS at this location is likely due to a combination of local Silverdale growth, development at the WSA and congestion on other major parallel north/south routes.
- Silverdale Rd, between Warradale Road and Farnsworth Road, is expected to operate at LOS E in the PM peak by 2036 and may need to be considered for duplication to four lanes.
- The operation of the Princes Road bridge, between Argyle Street and Menangle Street, is expected to remain at equivalent to LOS F in both peak periods.

- The priority intersections of Princes Road with Argyle Street and Menangle Street are both expected to worsen to LOS F in both peak periods.
- The Argyle Street / Menangle Street intersection is expected to operate at LOS E by 2036 in both peak periods and may need active control or right turn movements banned.
- A number of approaches at the Picton Road traffic signal accesses to the Wilton development may start experiencing LOS E conditions by 2036. This however may be as a result of the phasing arrangements used in the analysis. Updated signal timings or lane arrangements may mitigate this deficiency.
- The Remembrance Drive / Cawdor Road intersection is expected to experience LOS E conditions in the AM peak period by 2036. Depending on the level of development in the Cawdor area, the intersection may benefit from upgrade to a roundabout.
- The Camden Road approach to the Menangle Road / Camden Road intersection is expected to operate at LOS E in the AM peak period as a result of the increased volume along Menangle Rd, possibly due to the duplication of Menangle Road to four lanes.

Wollondilly Shire Council

Macarthur Regional Transport Model (MRTM) Futures Update for 2026 / 2036 and Deficiencies Assessment

CONTENTS

Executive Summary	i
1. Introduction.....	1
2. Future Land Use	3
2.1 Wollondilly Shire Council	3
2.2 Camden and Campbelltown Councils.....	4
2.3 Lower Sydney Model Area.....	4
2.4 Overall Council Future Development Totals	6
3. Future Year Network Infrastructure	8
4. Future Overall Network Trips and Operation	10
5. Wollondilly Overall Network Performance Indicators.....	11
5.1 Wollondilly Network Performance Discussion.....	12
6. Level of Service Deficiency Analysis	13
6.1 LOS Descriptions	13
6.2 Wollondilly LOS Deficiencies	16
7. Conclusions	18
7.1 Level of Service Changes	18
7.2 Network Traffic Flow Changes	20

LIST OF TABLES

Table 2-1: Wollondilly Shire Council 2019 Agreed Growth Projections.....	3
Table 2-2: Camden and Campbelltown Council 2019 Agreed Growth Projections.....	4
Table 2-3: WSA EIS Estimated Direct Airport and Business Park Jobs	5
Table 2-4: MRTM Estimated Direct Airport and Business Park Jobs	5
Table 2-5: WSA Peak Hourly Passenger Vehicle Movements.....	6
Table 2-6: Base and Future 2026-2036 Land Use Totals	7
Table 3-1: Agreed Network Infrastructure Improvements.....	8
Table 4-1: Peak Hour Network Wide Trip Making	10
Table 4-2: Peak Hour Network Wide Travel Statistics.....	10
Table 5-1: AM Peak Wollondilly Network Performance Indicators 2016-2036	11
Table 5-2: PM Peak Wollondilly Network Performance Indicators 2016-2036	12
Table 6-1: Definitions of LOS	14
Table 7-1: Change in Intersection Approach LOS 2016-2036.....	18

Table 7-2: Change in Link LOS 2016-2036	18
Table 7-3: Change in Major Link Volumes 2016-2036	20

LIST OF FIGURES

Figure 1-1: MRTM Network Coverage and LGA Boundaries	2
Figure 2-1: Stage 1 Airport Site Layout and Model Zone Loading Locations	6
Figure 6-1: MRTM Link LOS Criteria	15
Figure 6-2: Wollondilly Link and Intersection LOS Totals	17

APPENDICES

Appendix A	Camden and Campbelltown Council Area Projections
Appendix B	Council Agreed MRTM Future Network Infrastructure Improvements
Appendix C	Wollondilly LOS Plots
Appendix D	Wollondilly Volume Plots
Appendix E	MRTM Model Validation Report

1. Introduction

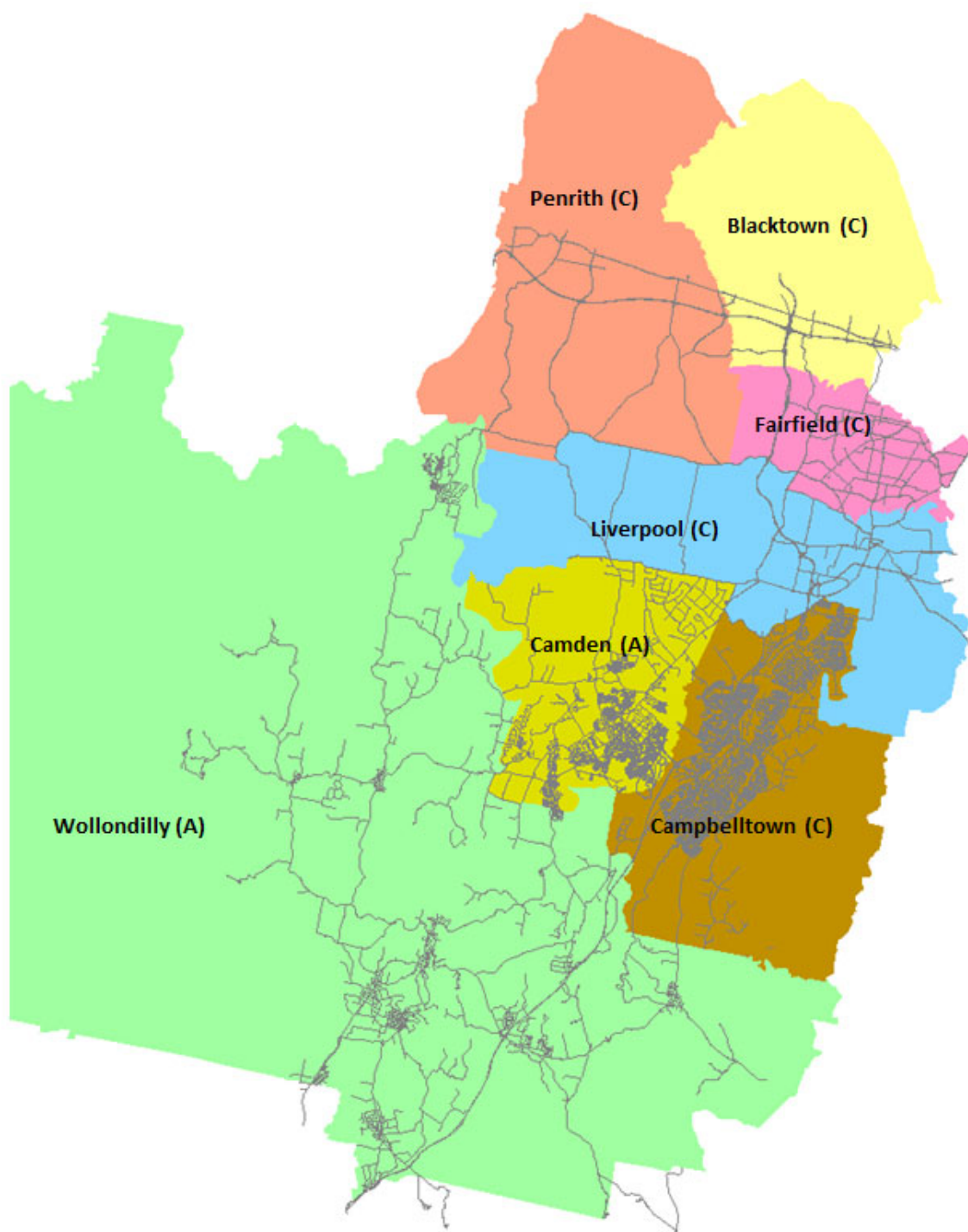
The Macarthur Regional Transport Model (MRTM) is a vehicle only model that enables prediction of vehicle flows on most major roads in the Campbelltown-Camden-Wollondilly area. To do this, the model has the vast majority of existing roads and intersections coded into it along with the number of lanes, the allowed turning movements on each lane, the effective speed limit, the type of intersection control, the phasing arrangement at traffic signals and many other parameters.

MRTM was developed and maintained by Stantec using the TRACKS Transport Modelling Suite.

The new MRTM model was built in 2017 with a validated base year of 2016 and has been previously reported in the report 'MACROC Model Development 2017' by TDG in October 2017 and is provided in Appendix E.

Stantec has been commissioned by Wollondilly Shire Council (WSC) to prepare an update to the existing future MRTM land use patterns for 2026 and 2036 and prepare a network deficiency analysis using agreed future base road networks for each of those years. This short report documents that process and the draft deficiency results for Wollondilly Shire area primarily. Significant deficiencies in the surrounding Council areas that could materially impact on Wollondilly have also been included.

The model area is shown in Figure 1-1.



2. Future Land Use

The land uses used in this assessment for the 2026 and 2036 years are the most recent MTRM development patterns and growth numbers provided by each of the contributing Councils in October 2019. The areas to the north of the MRTM area include changes that are the official Transport Performance and Analytics (TPA) future land use estimates as they currently stand except for estimates of future activity associated with the Western Sydney Airport (WSA). The future land use projections for each area are reported separately in the following sections.

2.1 Wollondilly Shire Council

WSC has a reasonably well-developed growth strategy in place which has been used in this assessment. The Wollondilly Draft Growth Management Strategy (GMS) details future population and employment development at an area-wide level which has been disaggregated into model zones to maintain a reasonable level of zonal activity. Where identified developments were of reasonable size, they were modelled in separate zones in order to properly locate them in the road network.

The future household, population and employment data contained in the GMS has been updated on an area-wide basis to meet future growth rates anticipated by WSC.

Table 2-1 details the area level 2026/2036 future land use totals for households, population and employment in the WSC region used in this assessment.

Table 2-1: Wollondilly Shire Council 2019 Agreed Growth Projections

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
Bargo North	3000	623	1901	125	740	2268	237
Bargo Station	3001	1534	4162	988	1589	4485	988
Camden Park	3004	91	270	231	94	288	231
Menangle Station	3005	663	1835	456	731	2049	456
Razorback	3006	278	892	58	288	950	58
Douglas Park Station	3007	491	1435	510	532	1601	510
Maldon Station	3008	2184	6656	2285	7384	21801	7418
Appin	3009	1163	3483	1762	1373	4192	1762
Wilton	3010	3170	9416	931	3570	10654	2497
Picton Station	3013	1959	5394	3476	2459	7034	3577
Lakesland	3014	189	585	75	196	624	75
Thirlmere Station	3015	1586	4379	531	1637	4709	531
Tahmoor Park	3016	1258	3537	1885	1528	4454	2042
Tahmoor Station	3017	1055	2854	191	1205	3366	191
Couridjah	3018	377	1058	161	423	1226	161
Buxton	3019	620	1852	196	645	2002	196
Orangeville	3022	811	2643	695	839	2808	695
The Oaks	3023	1649	4851	608	1667	5043	608
University of Sydney Camden Farms	3024	341	1062	483	354	1139	483
Oakdale - Barkers Lodge Road and Longfield Lane	3025	250	742	120	258	792	120
Warragamba Plaza	4985	617	1663	722	717	1957	767
Silverdale	4986	1357	4377	453	1657	5071	453
Total		22263	65046	16943	29884	88514	24055

2.2 Camden and Campbelltown Councils

The previous Camden Council future land use projections were based entirely on the official November 2016 Transport for New South Wales (TfNSW) 2016-2041 TPA projections for households, population and employment types throughout New South Wales. Camden Council planning staff reviewed these projections in October 2019 and made adjustments to reflect the scale and timing of development in many of the areas projected.

The previous Campbelltown Council projections were again based on the 2016 TPA projections except area totals were adjusted at the time by Council planners to better represent the level and location of development expected in the LGA. Those previous area land use values were reviewed by Council staff in October 2019 and only the 2026 projection for the Denham Court area was adjusted for this assessment to reflect the faster than expected development within that area.

Table 2-2 details the Council area 2026/2036 future land use totals for households, population and employment in the Camden and Campbelltown Council regions used in this assessment. Details of the area level totals are provided in Appendix A.

Table 2-2: Camden and Campbelltown Council 2019 Agreed Growth Projections

Council	2026			2036		
	Households	Population	Employment	Households	Population	Employment
Camden	50101	150112	41661	76323	223244	55795
Campbelltown	77300	221432	68345	100151	277887	79915

2.3 Lower Sydney Model Area

As shown in Figure 1-1, the model area includes a skeletal network for the Fairfield, Penrith, Blacktown and Liverpool Councils. These areas were included for the following reasons:

- There is significant interaction between the councils within the Macarthur area and councils within the lower Sydney area.
- The desire to ensure that traffic flow on roads at the northern boundaries of Wollondilly, Camden and Campbelltown were properly modelled as a result of changes in land use and not historic volume counts.
- The construction of the Western Sydney Airport at Badgerys Creek and associated development is expected to have a significant impact on flow to and from the three councils.

Land use within the lower Sydney area of the MRTM was taken directly from the 2016 TPA projections. These projections match those used in the current TfNSW Sydney models. The 2016 TPA projections do not however include projections associated with the Western Sydney Airport development.

2.3.1 Western Sydney Airport and Associated Employment

The projected land use associated with the Western Sydney Airport has not officially been released by TfNSW. An Environmental Impact Statement (EIS) for the WSA was undertaken in 2016 and has been published by the Australian Government's Department of Infrastructure, Transport, Cities and Regional Development in September 2016. Documents associated with the EIS have been used to provide preliminary land use information for deficiency assessment and are available at <https://www.westernsydneyairport.gov.au/media-resources/resources/environmental-assessment#eis-2016>.

The construction of the opening elements of the WSA Stage 1 was expected to start in 2018 and be completed by 2026 when the WSA is expected to open for flight operations. The EIS has initial estimates for employment within the Western Sydney Airport development for 2031 and 2041, which represent the expected lifetime of the single runway Stage 1 of the WSA, an equivalent to 10 Million Annual Passengers (MAP), and 37MAP respectively. 2063 represents the year at which expected maximum capacity of the dual runway in Stage 2 is expected to occur, when airport use is expected to achieve 82MAP.

The EIS indicates the following breakdown of direct jobs at Western Sydney Airport, shown in Table 2-3.

Table 2-3: WSA EIS Estimated Direct Airport and Business Park Jobs

Area	2026 Construction	2031 Direct Jobs	2041 Direct Jobs
Airport	3231	8730	12491
Industrial	-	3500	3440
Office	-	-	3750
Hotels	-	74	222
Petrol and Food outlets	-	200	500
Regional Shopping Centre	-	-	2222
Bulky Goods	-	665	1420
Total	3231	13169	24046

For the purposes of this deficiency assessment, the initial stages of Western Sydney Airport were expected to be operational at 2026 and were assumed to represent half of the 2031 situation with approximately 5MAP. The expected employment for 2036 was estimated by interpolating the provided 2031 and 2041 EIS employment values. As large parts of Western Sydney Airport are expected to operate in split shifts throughout the typical weekday, not all employees can be used in the model as it would have a disproportionate impact on trip distribution.

Details provided in the WSA EIS indicate that during the modelled AM and PM peak periods approximately 1/3 of all airport employees will arrive or leave during the peak periods. Similarly, it has been assumed that 1/2 of retail and shopping employees will also operate in split shifts.

The breakdown of the employment provided in the model for 2026 and 2036 for the Western Sydney Airport area is as follows in Table 2-4.

Table 2-4: MRTM Estimated Direct Airport and Business Park Jobs

Area	2026 Direct Jobs	2036 Direct Jobs
Airport	2185	3520
Industrial	600	3450
Office	-	1980
Hotels	-	100
Petrol and Food Outlets	100	150
Regional Shopping Centre	-	1125
Bulky Goods	665	1055
Total	3550	11380

Details of the Western Sydney Airport site layout are in preliminary stages of design. So that the development was not concentrated in a single large zone, the land use associated with Western Sydney Airport was split between five model zones located primarily off Elizabeth Drive and Badgerys Creek Road. A small zone representing some commercial activity at the southwestern corner of the development was provided off the realigned The Northern Road.

Figure 2-1 shows the provisional layout of WSA Stage 1 site with indicative model airport zone connections.

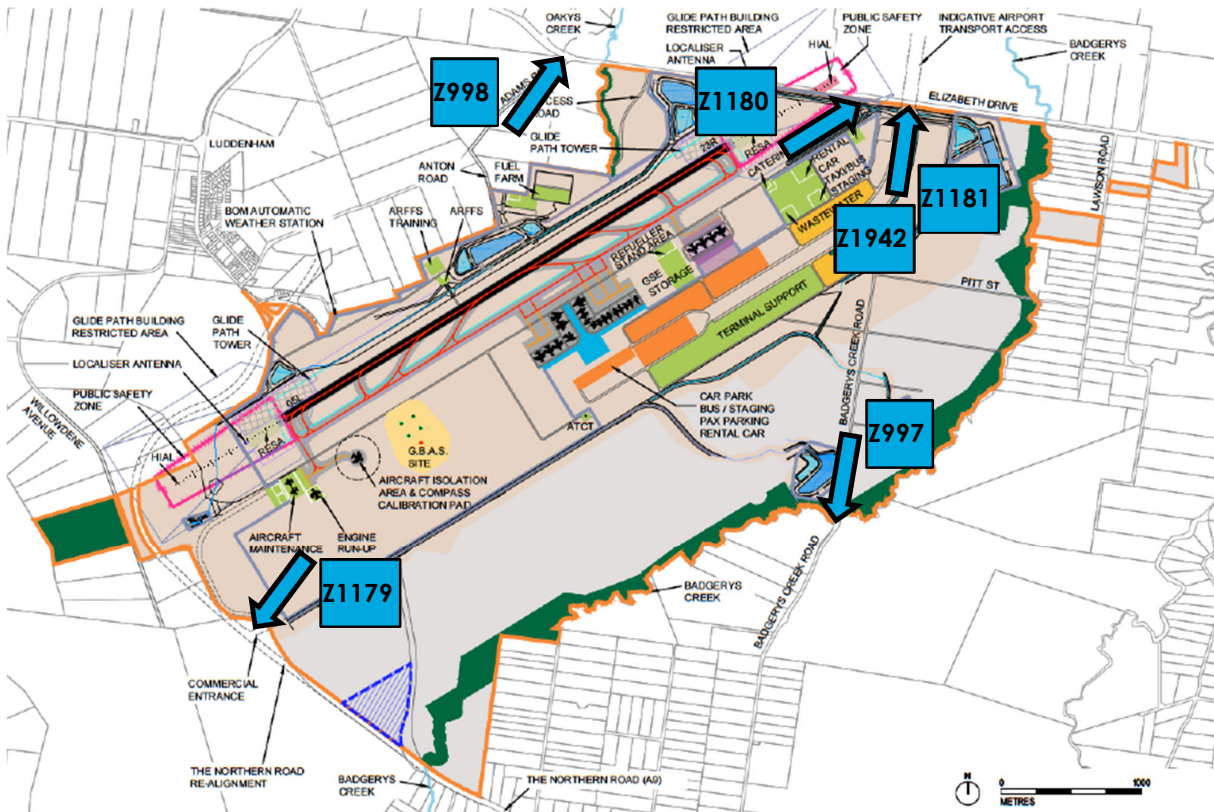


Figure 2-1: Stage 1 Airport Site Layout and Model Zone Loading Locations

2.3.2 Airport Passenger Activity

Separate to the employment activity at the WSA is the expected level of passenger movement to and from the airport. The WSA EIS details the expected level of passenger activity during a typical day for 2030 and 2063. The EIS takes into account expected aircraft arrival and departure profiles, type of flight, method of passenger transport mode, and vehicle type. The EIS provides estimated passenger related inbound/outbound vehicle movements during each of the AM and PM peak periods.

The passenger vehicle movements have been treated as external vehicle flows in the MRTM and are therefore entered directly as a model flow to and from an external zone representing WSA passenger activity. Passenger vehicle flows for 2026 were assumed to be half of the EIS 2030 volumes and therefore represent the initial operation of the WSA. 2036 passenger vehicle flows were interpolated between the EIS 2030 and 2063 volumes. The external passenger flows used in the model are shown in Table 2-5.

Table 2-5: WSA Peak Hourly Passenger Vehicle Movements

Year	Period	Into Airport	Out of Airport
2026	AM Peak Hour	692	624
	PM Peak Hour	454	373
2036	AM Peak Hour	2212	1923
	PM Peak Hour	1522	1288

2.4 Overall Council Future Development Totals

The land use that has been used in the model for 2016, 2026 and 2036 is included in Table 2-6. These forecasts show households in the entire model area growing by 75% (the MRTM area growing by over 131%), population in the entire area growing by 63% (the MRTM area growing by over 117%) and total jobs in the model area growing by 59% with the MRTM area growing by 68% over the next 20 years.

The expected growth in the WSC area indicates that both households and population will grow by 100% between 2016 and 2036, and employment will increase by a smaller 72%. This lesser growth in employment will result in a reduction in the "self-sufficiency ratio" of the Shire from 0.31 jobs/resident to 0.26

jobs/resident. As a result, more trips generated from within the Shire are expected to travel outside Wollondilly for work and other employment related activities.

Table 2-6: Base and Future 2026-2036 Land Use Totals

Land Use	Land Use Category	2016	2026	2036
Residential in Wollondilly	Total Households	14994	22973	30594
	Total Persons	45346	67334	91212
	Persons per Household	3.024	2.931	2.981
	Total Vehicles	33866	49587	64541
	Vehicles per Household	2.259	2.158	2.110
	Total Employment	14052	16984	24156
Residential in Camden	Total Households	24208	49282	75563
	Total Persons	74924	144593	217073
	Persons per Household	3.095	2.934	2.873
	Total Vehicles	50711	99086	149069
	Vehicles per Household	2.095	2.011	1.973
	Total Employment	28164	41125	55318
Residential in Campbelltown	Total Households	50140	77535	100370
	Total Persons	149714	222111	278535
	Persons per Household	2.986	2.865	2.775
	Total Vehicles	84815	128867	151764
	Vehicles per Household	1.692	1.662	1.612
	Total Employment	53114	68845	80456
Residential in Lower Sydney	Total Households	157266	191999	224400
	Total Persons	502963	590043	671133
	Persons per Household	3.198	3.073	2.991
	Total Vehicles	281094	337427	383780
	Vehicles per Household	1.787	1.757	1.710
	Total Employment	211936	264188	328435

3. Future Year Network Infrastructure

To assess the future year network deficiencies, the future year land use needs to be assigned to a base road network that includes all agreed infrastructure improvements for each future year. These improvements are works that are either currently in construction or are to be ready for construction within the assessment period.

The following Table 3-1 lists the infrastructure improvements included in the both the 2026 and 2036 future networks.

Table 3-1: Agreed Network Infrastructure Improvements

Project	From	To	2026 Improvement	2036 Improvement
Bringelly Rd	Cowpasture Rd	The Northern Rd	4L	4L
M12	The Northern Rd	M7	4L	4L
Werrington Arterial	Western MW	Great Western HY	4L	4L
Appin Road North	Narellan Road	Kellerman Dr	4L	4L
Appin Road Mid	Kellerman Dr	Blackburn Rd	2L	4L
Appin Road South	Blackburn Rd	Church Rd	2L	2L
Badgally Road-Broughton Street Link	Blaxland Rd	Moore Oxley Bypass	-	4L
Badgally Rd-Gregory Hills Drive Link	Camden Valley Way	Blaxland Rd	4L	4L
Campbelltown Rd	Hume MW overpass	Brooks Rd	4L	4L
Dunn Road Extension	Turner Rd	Rodeo Rd	2L	2L
Raby Rd	Camden Valley Way	Thunderbolt Dr	4L	4L
Raby Road and Bridge	Campbelltown Rd	Hume MW	4L	4L
Rickard Rd	Oran Park Dr	Bringelly Rd	-	4L
Camden Bypass	Old Hume Hwy	Macarthur Rd	2L	4L
Camden Bypass	Narellan Rd	Spring Farm Parkway	4L	6L
Emerald Hills Blvd	Jamboree Ave	The Hermitage Way	2L	2L
The Northern Rd	Camden Valley Way	Bringelly Rd	4L	4L
The Northern Rd	Bringelly Rd	Western MW	6L	6L
Liz Kernohan Drive Extension	Camden Valley Way	Irvine St	2L	2L
Spring Farm Parkway	Camden Bypass	Barrow Rd	4L	4L
Spring Farm Parkway	Barrow Rd	Menangle Park	-	4L
Spring Farm Parkway	Menangle Park	Menangle Rd	4L	6L
Spring Farm Parkway	Menangle Rd	Appin Rd	-	4L
Spring Farm Parkway / Appin Rd	Appin Rd		Roundabout	Roundabout
Spring Farm Parkway / Menangle Rd	Menangle Rd		Roundabout	Roundabout
Spring Farm Parkway / The Lachlan Rd	Lachlan Rd		Roundabout	Roundabout
Camden Valley Way / Macarthur Rd	Camden Valley Way	Macarthur Rd	Traffic Signals	Traffic Signals
Hume MW	Picton Rd	Macquariedale Rd	4L	4L
Hume MW	Macquariedale Rd	Spring Farm Parkway	6L	8L
Hume MW	Spring Farm Parkway	Narellan Rd	6L	8L
Hume MW Spring Farm Parkway Interchange	North Facing Ramps		Interchange	Interchange
Hume MW Spring Farm Parkway Interchange	South Facing Ramps		-	Interchange
Link Road B Link and Bridge	Macquariedale Rd	West Appin	-	-
Narellan Rd	Mt Annan Dr	Hume MW	6L	8L
Narellan Rd	Camden Valley Way	Mt Annan Dr	6L	8L
Finns Rd	Menangle Rd	Remembrance Dr	2L	2L

Project	From	To	2026 Improvement	2036 Improvement
Macquariedale Road	Finns Rd	Appin Rd	-	6L
Macquariedale Road Interchange	Hume MW		-	Interchange
Menangle Rd	Picton Rd	Narellan Rd	2L	2L
North Wilton Connection	Menangle Rd	Development	-	2L
Picton Rd	Hume MW	Prince St	2L	4L
Picton Road Interchange Upgrade	Hume MW		-	Interchange
Wilton Development	Intersections with Picton Rd		Traffic Signals	Traffic Signals
Silverdale Rd	Farnsworth Ave	Park Rd	2L	4L
Outer Sydney Orbital	Hume MW	Great Western Highway	-	-
Bringelly Road Interchange	Outer Sydney Orbital	Bringelly Rd	-	-
Burraborang Road Interchange	Outer Sydney Orbital	Burraborang Rd	-	-
Cobbitty Road Interchange	Outer Sydney Orbital	Burraborang Rd	-	-
Camden Valley Way	Narellan Rd	M7	4L	4L

A number of local subdivision improvements have been included in the model to reflect infrastructure that has been, or is expected to be, included as part of local development.

4. Future Overall Network Trips and Operation

The total growth in households and jobs over the entire model area has a similar effect on trip making, as can be seen in Table 4-1 for the morning and evening peak hours, and on network wide travel times shown in Table 4-2. These figures include results for the entire MACROC area and surrounding Sydney skeletal model area. More detailed network performance results are detailed later in Section 6.

Table 4-1: Peak Hour Network Wide Trip Making

Period	2016	2026	2036	2016-2036 % growth	2016-2036 % Growth
AM Peak Hour	206722	271487	329533	31.3%	59.4%
PM Peak Hour	212656	280367	338173	31.8%	59.0%

Table 4-2: Peak Hour Network Wide Travel Statistics

	2016		2026		2036	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Vehicle Minutes	2865422	3003436	4399660	4523869	6420912	6173087
Minutes/Trip	13.8	14.1	16.2	16.1	19.4	18.3
Vehicle Kilometres	2198854	2296920	2892721	3016880	3449636	3557398
Kilometres/Trip	10.6	10.8	10.7	10.8	10.5	10.5
Network Speed (kph)	46.0	45.9	39.4	40.0	32.2	34.6

As the traffic grows, the average trip length decreases, and the travel time increases. The average network speed will decrease significantly from 46 kph to 32 kph in the AM Peak hour, and from 46 kph to 35 kph in the PM Peak hour.

5. Wollondilly Overall Network Performance Indicators

Existing and future base model deficiencies for each modelled year of 2016, 2026 and 2036 are reported below for the whole model area on the Wollondilly Shire network shown earlier in Figure 1-1.

Table 5-1 and Table 5-2 provide a comparison of network operating costs and emissions for the entire base road network models at 2016 to 2036. The relevant indicators are as follows:

- Vehicle Kilometres Travelled (VKT) is a measure of vehicle kilometres travelled for all road vehicles considered in this study. VKT is a direct indicator of the pressure from road transport on the environment and as a basis for the calculation of vehicle emissions when combined with LOS.
- Link Vehicle Minutes Travelled (VMT) is an aggregate measure of how long people are spending travelling in their cars along links. It does not include time spent by vehicles waiting at intersections.
- Link Mean Running Speed is a measure of the average speed of vehicles travelling along a link. It does not take into account delays encountered by vehicles at intersections.
- Vehicles subject to intersection delay is a measure of how many vehicles experience any kind of delay at intersections.
- Total intersection vehicle delay in minutes is a measure of the total amount of intersection delay experience by all vehicles on the network.
- Intersection Delay per Vehicle is a measure of average delay experience by all vehicles at all intersections. This indicator provides a way to measure vehicle conflicts.
- Network Total Vehicle Minutes is a measure of the total amount of time vehicles spend on the network. This includes time spent waiting at intersections.
- Network Mean Network Speed is a measure of the average speed of vehicles travelling through the network. It includes delays experienced by vehicles at intersections.
- Fuel and emissions indicators are calculated from data provided by the NZ Ministry of Transport Vehicle Fleet Emissions Control Strategy. That strategy detailed the emission rates for each of the pollutants based on assumed average vehicle composition, number of stop/start cycles, Level of Service of links and types of links travelled. The results for all intersections and links are summed for the model area.

Table 5-1: AM Peak Wollondilly Network Performance Indicators 2016-2036

Indicator	2016	2026	2036
Vehicle kilometres	264228	336627	446738
Vehicle in-motion minutes	209120	277175	368240
Mean running speed (km/hr)	75.8	72.9	72.8
Vehicles subject to delay	64644	97375	136887
Total vehicle delay (mins)	13479	26341	45215
Delay per delayed vehicle	12.5	16.2	19.8
Total vehicle minutes (in-motion + delay)	222598	303516	413455
Mean network speed (km/hr)	71.2	66.5	64.8
Fuel use (000s of litres)	22.523	29.490	39.473
Carbon monoxide (tonnes)	1.599	2.108	3.006
Carbon dioxide (tonnes)	40.605	51.743	71.868
Fuel per vehicle km (ltr/100 veh-km)	8.524	8.760	8.836
CO per vehicle km (gms/veh-km)	7.460	7.993	8.223
CO2 per vehicle km (gms/veh-km)	189.437	196.173	199.351

Table 5-2: PM Peak Wollondilly Network Performance Indicators 2016-2036

Indicator	2016	2026	2036
Vehicle kilometres	288024	361751	466731
Vehicle in-motion minutes	224650	290634	383720
Mean running speed (km/hr)	76.9	74.7	73.0
Vehicles subject to delay	64329	98139	135163
Total vehicle delay (mins)	11946	25026	37098
Delay per delayed vehicle	11.1	15.3	16.5
Total vehicle minutes (in-motion + delay)	236596	315660	420817
Mean network speed (km/hr)	73.0	68.8	66.5
Fuel use (000s of litres)	24.297	31.225	40.891
Carbon monoxide (tonnes)	1.734	2.369	3.237
Carbon dioxide (tonnes)	44.599	59.078	79.468
Fuel per vehicle km (ltr/100 veh-km)	8.436	8.632	8.761
CO per vehicle km (gms/veh-km)	7.271	7.736	7.995
CO2 per vehicle km (gms/veh-km)	188.956	192.902	196.286

5.1 Wollondilly Network Performance Discussion

The performance of the base future networks indicates that in general the Wollondilly network is expected to continue to operate well over the next 17 years. These are overall network results and do not indicate specific areas of deficiency. Results indicate the following:

- Vehicle kilometres travelled within the Wollondilly Shire area are expected to increase by 62-69% from 2016-2036.
- The overall Wollondilly network will operate with average speeds that drop by slightly over 6kph (8-9%) in both peak periods from 2016-2036.
- Overall Wollondilly network vehicle speed remains over 65kph.
- Overall intersection delay is expected to increase with average delay increasing 5-7 seconds from 2016-2036. Whilst this is not a large numerical increase in average delay, this still represents a 50-56% increase in average day from the current time.
- It should be noted that these overall performance results include the impact of the State Highway network within the Wollondilly Shire area.

6. Level of Service Deficiency Analysis

LOS is a subjective measure of the way in which a network is operating, given the traffic demands that are placed on it. It is a concept developed by American engineers and has been generally internationally adopted. It is being used in this study to measure the performance of both roads and intersections.

This section describes the LOS criteria used for the following section of level of service across the network. The descriptions of each LOS criteria have been referenced from the Highway Capacity Manual.

6.1 LOS Descriptions

Because it is subjective, individual regions have a local perception of how individual roads and intersections are operating and that affects the local interpretation of the LOS values. It is important to note that level of service tends to be much worse during the morning and evening peaks.

The interval between these periods usually generates fewer trips and the trips tend to be shorter resulting in a much better LOS. In this study the boundaries were adopted from those used in several studies and with no modification to reflect local perceptions of network operation.

This study focuses on LOS F, E, D and C with particular attention paid to LOS F and E. The LOS boundaries are described in Table 6-1 which provides a description of:

- LOS definitions describing the type of conditions a driver faces under each level.
- Link LOS boundaries that describe the performance of traffic moving along a section of road and a function of traffic volume and link free flow speed.
- Intersection LOS boundaries which are based on two different criteria: Worst approach delay for priority-controlled intersections and roundabouts; and weighted average delay across all approaches for signalised intersections. The values used are the standard RMS intersection LOS criteria detailed in the SIDRA INTERSECTION 8 intersection analysis program.

Figure 6-1 shows how Link LOS varies depending on link type. It shows that the higher the vehicle volume and the lower the free flow speed, the worse the LOS becomes. Each link in the network is assigned a link type which indicates the physical characteristics of the road and position in the road hierarchy. It takes into account likely free flow speed, level of activity along it and its role in the network. The link type determines the speed-flow characteristics assigned to the link and therefore how the link operates with increasing volume.

Link types are assigned as follows:

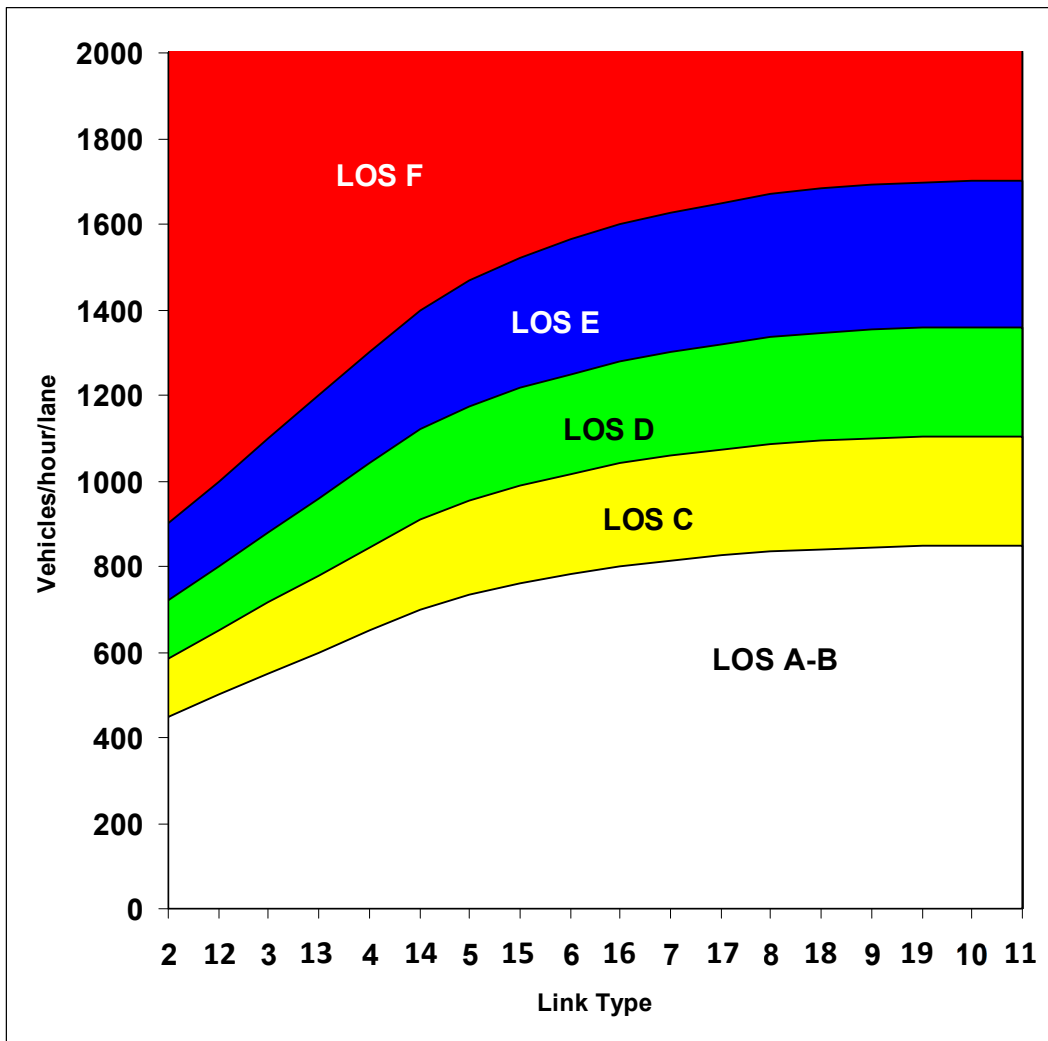
- Link type 1 equates to road speeds of 10km/hr
- Link type 2 and 12 equate to road speeds of 20km/hr and 25km/hr
- Link type 3 and 13 equate to road speeds of 30km/hr and 35km/hr
- Link type 4 and 14 equate to road speeds of 40km/hr and 45km/hr
- Link type 5 and 15 equate to road speeds of 50km/hr and 55km/hr
- Link type 6 and 16 equate to road speeds of 60km/hr and 65km/hr
- Link type 7 and 17 equate to road speeds of 70km/hr and 75km/hr
- Link type 8 and 18 equate to road speeds of 80km/hr and 85km/hr
- Link type 9 and 19 equate to road speeds of 90km/hr and 95km/hr
- Link type 10 and 11 equate to road speeds of 100km/hr and 110km/hr
- Link type 25 equates to 40km/hr school zone roads with normal speeds of 50km/hr
- Link type 26 equates to 40km/hr school zone roads with normal speeds of 60km/hr
- Link type 27 equates to 40km/hr school zone roads with normal speeds of 70km/hr

This present-day LOS provides a measure by which future network performance and deficiencies can be assessed given knowledge and experience of current conditions.

Table 6-1: Definitions of LOS

LOS	HIGHWAY CAPACITY MANUAL DESCRIPTION	MRTM LOS CRITERIA		
		Intersection Type		
		Link (vehicles per hour)	Priority (worst approach delay)	Signal (average delay)
LOS F	Forced flow. The amount of traffic approaching a point exceeds that which can pass it. Flow breakdowns occur, and queuing and delays occur.	In excess of 900-1700 depending on link type	>70 sec	>70 sec
LOS E	Traffic volumes are at or close to <i>capacity</i> and there is <i>virtually no freedom</i> to select desired speed and to manoeuvre within the traffic stream. Flow is unstable and <i>minor disturbances within the traffic stream will cause breakdowns in operation</i> .	Between 720-1360 depending on link type	>56 sec	>56 sec
LOS D	Approaching unstable flow where <i>all drivers are severely restricted</i> in their freedom to select desired speed and to manoeuvre within the traffic stream. The general level of <i>comfort and convenience is poor</i> and small increases in traffic flow will cause operational problems.	Between 585-1105 depending on link type	>42 sec	>42 sec
LOS C	Stable flow but most drivers <i>are restricted to some extent</i> in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of <i>comfort and convenience has declined noticeably</i> .	Between 450-850 depending on link type	>28 sec	>28 sec
LOS B	Stable flow where drivers still <i>have reasonable freedom</i> to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is less than LOS A.	Not Applicable	<28 sec	
LOS A	Free flow in which drivers are <i>virtually unaffected</i> by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high and the general level of <i>comfort and convenience is excellent</i> .			

Note: The LOS for priority intersections and roundabouts are dictated by the delay on the worst approach and the LOS for signalised intersections is calculated based on the weighted average delay across all approaches. It should also be noted that the intersection delay values reflect the current RMS SIDRA INTERSECTION 8 values.



Free Flow Speed (km / hr) 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 110

	LINK TYPE																	
LOS BAND Veh/Lane/Hour	2	12	3	13	4	14	5	15	6	16	7	17	8	18	9	19	10	11
LOS C	450	500	550	600	650	700	734	760	782	760	814	825	835	841	846	849	850	850
LOS D	585	650	715	780	845	910	954	988	1016	988	1058	1073	1085	1093	1100	1104	1105	1105
LOS E	720	800	880	960	1040	1120	1175	1216	1250	1216	1302	1320	1335	1346	1354	1358	1360	1360
LOS F	900	1000	1100	1200	1300	1400	1467	1520	1563	1520	1627	1650	1669	1682	1692	1698	1700	1700



Figure 6-1: MRTM Link LOS Criteria

6.2 Wollondilly LOS Deficiencies

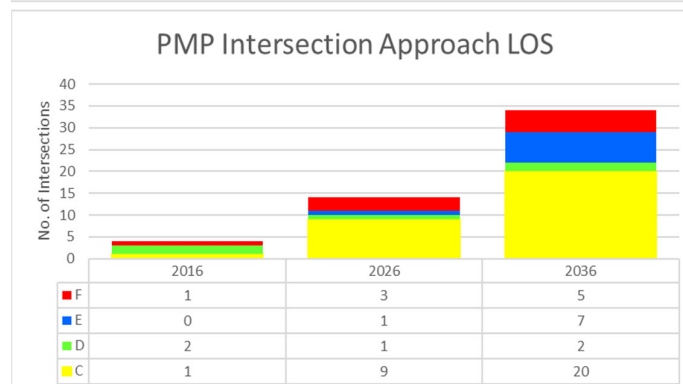
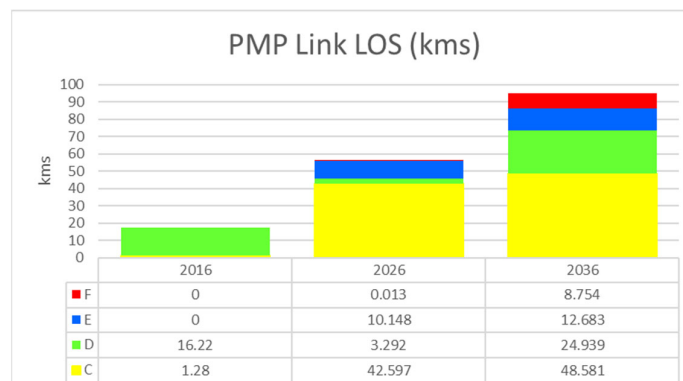
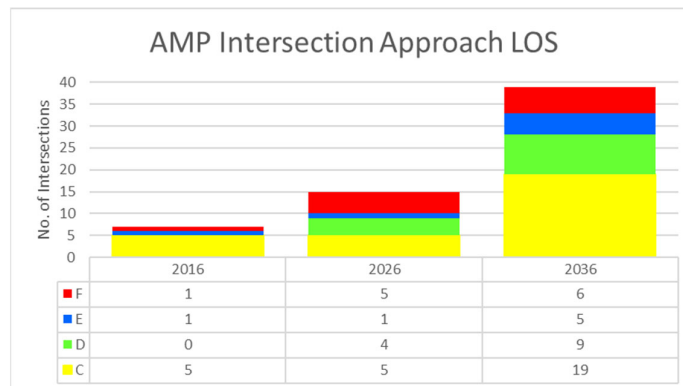
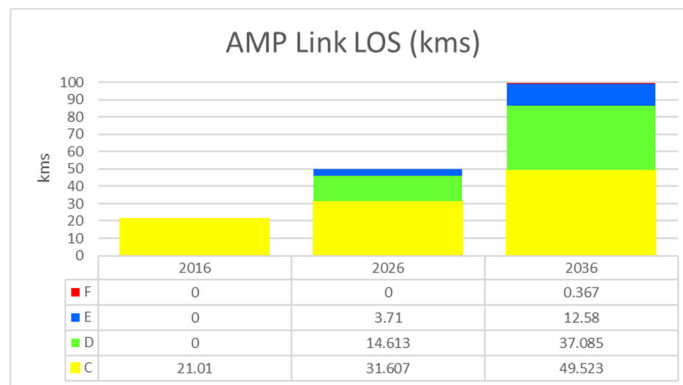
The total number of intersection approaches and network link kilometres at LOS C, D, E and F by 2016, 2026 and 2036 are shown in Figure 6-2. The use of approaches rather than simply intersection LOS allows for the inclusion of intersections that have one or a number of particularly bad approaches but overall have a lesser average intersection LOS. This means however, that a single intersection may be recorded multiple times as it may have multiple approaches with various poor LOS levels.

The LOS plots for Wollondilly in 2016, 2026 and 2036 for the AM and PM peak periods are shown in Appendix C.

Please note that LOS at give way, stop and merge intersections are assessed based on the delay at the worst approach. The level of service at roundabout and signalised intersections are based on the weighted average of delays at each approach to the intersection.

It should also be noted that some of the length of links operating at LOS C or worse in any particular year will include roads in the State Highway System and therefore the tables should be viewed in association with the later plots.

AM and PM peak one-hour network traffic volumes, associated with these levels of service, and changes in volume over time are shown in Appendix D.



7. Conclusions

7.1 Level of Service Changes

A summary of the LOS for each network deficiency, grouped by links first followed by intersections, are shown in Table 7-1 and Table 7-2. Only intersections and links that have a LOS of E or greater at some time during the analysis period are listed.

Table 7-1: Change in Intersection Approach LOS 2016-2036

Intersection	Period	2016	2026	2036	Possible Mitigation
Silverdale Road / Bents Basin Road	AMP				Roundabout
	PMP				
Silverdale Road / Marsh Road	AMP				Roundabout
	PMP				
Silverdale Road / Taylors Road	AMP				Roundabout or additional development access provision
	PMP				
Remembrance Drive/ Cawdor Road	AMP				Roundabout
	PMP				
Menangle Road / Camden Road	AMP				Roundabout
	PMP				
Argyle Street / Princes Street	AMP				Intersection redesign
	PMP				
Menangle Road / Princes Street	AMP				Intersection redesign
	PMP				
Argyle Street / Menangle Street	AMP				Intersection redesign or ban right turns
	PMP				
Picton Road / North Hume MW Ramps	AMP				Signal timing / phasing
	PMP				
Picton Road / South Hume MW Ramps	AMP				Signal timing / phasing
	PMP				
Picton Road / Pembroke Parade	AMP				Signal timing / phasing
	PMP				

Table 7-2: Change in Link LOS 2016-2036

Link	Period	2016	2026	2036	Possible Mitigation
Silverdale Road: Farnsworth Avenue – Park Road	AMP				Duplicate carriageway to four lanes
	PMP				
Silverdale Road: Warradale Road – Farnsworth	AMP				Duplicate carriageway to four lanes
	PMP				
Remembrance Drive: Finns Road – Bridgewater Boulevard	AMP				Duplicate carriageway to four lanes
	PMP				

The LOS results are summarised as follows:

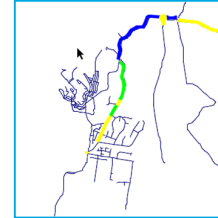
7.1.1 Overall Wollondilly Area

- The number of intersections with approaches assessed as operating at LOS E/F in the future is expected to grow from 2 in 2016 up to 12 by 2036.
- The number of intersections with approaches assessed as operating at LOS C/D in the future is expected to grow from 5 in 2016 up to 28 by 2036.

- The length of network expected to operate at LOS E/F in the future will grow significantly with 20km being affected in the PM peak by 2036. The majority of this length is the Hume Motorway, but part of the Silverdale network is also expected to perform poorly. See Figures B-9 and B-12 in Appendix B.

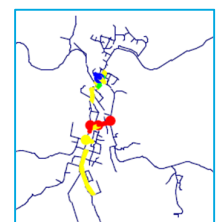
7.1.2 North Wollondilly

- Silverdale Road, north of Farnsworth Avenue, is expected to operate at LOS E in 2026 in the AM peak at the time of the opening of the WSA. With the expected duplication of Silverdale Road, the AM peak LOS is expected to return to LOS C. See Figure B-2 in Appendix B.
- Silverdale Road, south of Warradale Road, is expected to operate at LOS D in both the AM peak and PM peak by 2036. The degrading of LOS at this location is likely due to a combination of local Silverdale growth, development at the WSA and congestion on other major parallel north/south routes. See Figures B-3 and B-6 in Appendix B.
- Silverdale Road, between Warradale Road and Farnsworth Road, is expected to operate at LOS E in the PM peak by 2036. Duplication of this length of Silverdale Road may be required. See Figure B-6 in Appendix B.
- The intersection of Silverdale Road and Bents Basin Road is expected to operate at LOS F by 2036 in both peak periods. See Figures B-3 and B-6 in Appendix B.
- Whilst the Silverdale Road / Park Road / Mulgoa Road roundabout is not in the WSC LGA, it is expected to start operating poorly by 2036 in both peak periods. See Figures B-3 and B-6 in Appendix B.

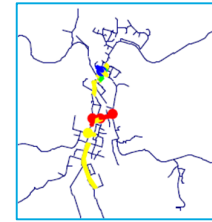


7.1.3 South Wollondilly

- Menangle Road, north of North Wilton Link Road, is expected to operate at LOS D in the AM peak and PM Peak. The construction of the four lane Macquariedale Road link and four laning of Finns Road is possibly funnelling flow onto Remembrance Drive. A possible contributing factor for the flow on Remembrance Drive is the expected congestion levels on the Hume Motorway between the Picton Road interchange and new Macquariedale Road interchange. See Figures B-9 in Appendix B.
- Remembrance Drive between Finns Road and Bridgewater Boulevard is expected to operate at LOS E by 2036 in the AM peak. See Figures B-9 in Appendix B.
- The operation of the Princes Road bridge, between Argyle Street and Menangle Street, is expected to remain at equivalent to LOS F in both peak periods. See Figures B-7 to B-12 in Appendix B.
- The priority intersections of Princes Road with Argyle Street and Menangle Street are both expected to worsen to LOS F in both peak periods. Intersection upgrades are likely to be required. See Figures B-7 to B-12 in Appendix B.



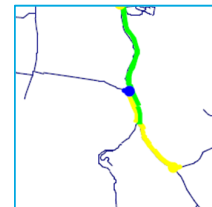
- The Argyle Street / Menangle Street intersection is expected to operate at LOS E by 2036 in both peak periods. The right turn movements out of Menangle Street, from both the east and west, are increasingly unable to turn into Argyle Street and may either need to be banned or the intersection requires a change of control. See Figures B-9 and B-12 in Appendix B.



- A number of approaches at the Picton Road traffic signal accesses to the Wilton development may start experiencing LOS E conditions by 2036. This however may be as a result of the phasing arrangements used in the analysis. Updated signal timings or lane arrangements may mitigate this deficiency. See Figures B-9 and B-12 in Appendix B.



- The Remembrance Drive / Cawdor Road intersection is expected to experience LOS E conditions in the PM peak period by 2036. Depending on the level of development in the Cawdor area, the intersection may need to have a roundabout control installed. See Figures B-12 in Appendix B.



- The Camden Road approach to the Menangle Road / Camden Road intersection is expected to operate at LOS E in the AM peak period as a result of the increased volume along Menangle Road possible due to the four laning. The intersection may need to be upgraded to a roundabout control. See Figures B-9 in Appendix B.



7.2 Network Traffic Flow Changes

A summary of the change in two-way hourly flow at a number of important links within the Wollondilly LGA, generally associated with the poor LOS results in Section 7.1, are shown in Table 7-3.

Table 7-3: Change in Major Link Volumes 2016-2036

Link	Period	2016	2026	2036
Silverdale Road North of Farnsworth Avenue	AMP	1170	1756	2467
	PMP	1199	1755	2521
Silverdale Road South of Farnsworth Avenue	AMP	838	1308	1603
	PMP	856	1282	1980
Silverdale Road South of Marsh Road	AMP	560	971	1219
	PMP	572	1025	1628
Remembrance Drive North of Cawdor Road	AMP	1250	1417	1944
	PMP	1322	1564	2047
Menangle Road North of Camden Road	AMP	655	1052	1911
	PMP	736	1117	1820
Argyle Street South of Princes Street	AMP	1541	1712	1888
	PMP	1625	1868	2055
Thirlmere Way West of Stonequarry Road	AMP	407	415	516
	PMP	483	501	525
Menangle Road South of Princes Street	AMP	1110	1250	1625
	PMP	983	1212	1612
Argyle Street North of Margaret Street	AMP	825	976	1113
	PMP	896	1081	1190

Link	Period	2016	2026	2036
Picton Road North of Hume Motorway Ramps	AMP	1046	1118	1317
	PMP	902	1103	1303
Picton Road South of Hume Motorway Ramps	AMP	1781	3222	3609
	PMP	1945	3454	3511
Hume Motorway North of Picton Road	AMP	3442	4186	5858
	PMP	3946	4823	6501
Hume Motorway North of Macquariedale Road	AMP	3442	3442	6235
	PMP	3946	4823	6379

The major changes in traffic flow plots can be summarised by the following:

- General growth of traffic in the WSC area. See general flow increases in Figures C4-C5, C9-C10, C14-C15 and C19-C20 in Appendix C.
- The construction of the North Wilton Connection draws a significant volume of traffic off Wilton Road and up onto the Menangle Road corridor. See Figures C15 and C20 in Appendix C.
- A significant increase in Hume Motorway traffic north of Picton Road. This appears to be related to the Macquariedale Road and Spring Farm Parkway interchanges. These connections have drawn traffic away from local routes as shown by the relatively low traffic growth on the parallel internal road network. See Figures C15 and C20 in Appendix C.

Appendices



Appendix A Camden and Campbelltown Council Area Projections

These land use forecasts were agreed upon at a meeting held at Camden Council offices on Friday 11th October 2019. In attendance were the following Council staff and consultants:

Mike Nelson – Manager Infrastructure Strategy and Planning, Wollondilly Shire Council

Stephen Gardiner – Manager Sustainable Growth, Wollondilly Shire Council

Cathy Kinsey – Coordinator Stormwater and Structural Design, Campbelltown Council

Tom Allen – Team Leader Traffic and Road Safety, Camden Council

Tim Sullivan – Principal, SLR Consulting

Dave Hunter – Senior Principal Transportation Engineer, Stantec

Camden Council 2019 Agreed Growth Projections

TPA TZ2016 Area Name	TPA TZ2016 Number	Households	Population	Employment	Households	Population	Employment
Carrington Centennial Hospital	3100	695	1766	720	747	1884	852
Camden	3101	237	531	4480	240	538	5278
Camden District Hospital	3102	384	920	814	394	943	967
Camden South Pubic School	3103	675	1600	724	689	1630	854
Camden High School	3104	276	927	720	295	982	852
Camden South	3105	1702	4683	625	1810	4951	734
Camden South - Cubbitch Barta Reserve	3106	649	2240	70	649	2243	81
Harrington Grove Country Club	3109	1308	4685	132	1308	4675	157
Harrington Park - Glenrowan Drive and The Boulevard	3110	611	2135	142	611	2136	164
Harrington Park	3111	869	2987	308	870	2989	362
Aircraft Museum Harrington Park	3112	882	2842	605	883	2845	702
Narellan Park, Kirkham Street and Fox Street	3113	1038	3233	1933	1109	3435	2175
Narellan Town Centre	3114	772	2160	5346	1022	2846	6199
Narellan	3115	795	2125	402	867	2305	475
Narellan - Elizabeth Scott Reserve	3116	1805	5523	269	1805	5483	317
Elderslie High School	3117	1569	4376	615	1713	4728	729
Smeaton Grange Industrial Area	3120	218	673	6826	244	756	7824
Currans Hill - Elizabeth Throsby Reserve	3121	1154	3587	232	1200	3719	274
Currans Hill Primary School	3122	835	2543	349	835	2544	410
Narellan Vale	3123	1396	4450	556	1397	4453	652
Mount Annan High School	3124	1240	3964	1528	1253	4003	1770
Elizabeth Macarthur High School	3125	1098	3450	521	1099	3452	618
Mount Annan - Yandel'ora Lake	3126	903	3148	91	904	3150	111
Camden Estate Winery - Spring Farm	3127	1210	3303	247	1210	3243	217
Spring Farm - Holland Drive & Lowan Street	3128	1550	4145	330	1550	4060	328
Spring Farm - Spring Reserve	3129	1347	3525	184	1347	3459	217
Mount Annan	3130	166	545	184	167	548	217
Mount Annan Botanic Garden	3131	1252	3953	533	1252	3954	643

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
Bringelly - Robinson Road and Jersey Road	3650	63	222	19	1367	4205	29
Bringelly Village Shopping Centre	3651	36	127	60	1231	3848	84
Bringelly - Ironbark	3652	14	44	19	335	891	29
Rossmore Primary School	3653	77	254	99	489	1426	137
Rossmore - Graham Road and Bringelly Road	3654	131	413	267	689	2015	406
Leppington - Bringelly Road and Eastwood Road	3655	661	1836	288	1603	4346	2772
Bringelly - Carrington Road and Jersey Road	3657	111	358	19	374	1158	30
Leppington Public School	3658	796	1576	1187	1789	3460	2204
Bringelly - Birling	3659	353	933	30	353	933	30
Leppington - Street Marys Catholic Church	3660	542	1550	138	1754	4873	319
Cobbity - Coates Park Farm	3661	101	305	280	101	305	404
Catherine Field - Barry Avenue and Robens Crescent	3662	76	249	134	97	308	192
Leppington - Anthony Road and Gregory Road	3663	40	149	104	1454	4182	131
Rossmore - Joseph Road and Eastwood Road	3664	387	1206	108	2007	5884	137
Leppington -Dog Training Centre	3665	524	1535	77	1668	4765	108
Leppington -Byron Road and Heath Road	3666	428	1224	66	1302	3620	89
Bringelly - Access Track	3667	2	5	19	4	12	29
Bringelly - Henry George Park	3668	0	0	174	2500	6747	174
Oran Park - Greenway	3669	1220	3293	676	1220	3293	676
Leppington - Camden Valley Way and Park Road	3670	473	1386	31	1491	4261	47
Bringelly - Recycling Centre	3671	14	38	19	2514	6796	139
Oran Park - Pondicherry	3672	719	1962	19	1540	4157	139
Catherine Field - Wholesale Nursery	3673	135	476	151	137	482	215
Leppington - Somoan Methodist Church	3674	161	540	81	1248	3991	104

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
Leppington - George Road and Riley Road	3675	488	1594	92	1965	6155	117
Leppington - Camden Valley Way and Street Andrews Road	3676	1685	5562	71	1685	5560	106
Cobbitty	3677	80	238	119	80	239	170
Cobbitty - Denbigh	3678	1259	3339	183	2278	6000	259
Oran Park - Proposed School	3679	1101	3094	240	1783	4913	346
Oran Park	3680	443	1514	19	780	2656	29
Catherine Field Reserve	3681	106	355	233	107	360	332
Cobbitty Wines	3682	213	640	394	223	666	560
Cobbitty - Macarthur Anglican School	3683	1316	3496	499	1316	3469	729
Oran Park - South Cct and Tander Street	3684	1783	5268	39	1783	5135	54
Oran Park - Peter Brock Drive and Oran Park Drive	3685	911	2636	2043	1304	3686	3654
Catherine Field Springfield Road and Charlesworth Close	3686	272	874	325	281	905	458
Camden Lakeside Golf Course	3687	737	2483	100	901	3039	147
Camden Airport	3688	218	655	98	219	657	139
Oran Park - Fussys Grape Winery	3689	905	2455	116	1500	4043	205
Oran Park - South Creek	3690	900	2950	53	1396	4568	59
Gregory Hills - Thomas Donovan Park	3691	1933	6448	2905	1933	6457	4635
Camden Valley Golf Resort	3692	1992	6668	208	1992	6676	572
Warragamba Dam	4800	3	3	150	3	3	150
Rixon Pass Cataract	5500	5	8	220	5	8	268
Yerrinbool Station – West	6007	54	136	3	55	137	3
Total		50101	150112	41661	76323	223244	55795

Campbelltown Council 2019 Agreed Growth Projections

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
Bradbury Shopping Centre	3200	1462	3927	643	1594	4274	716
Airds - Riley Park	3201	476	1456	101	476	1456	114
Bradbury - Baden Powell Reserve	3202	772	2315	502	821	2450	551
Airds Village Shopping Centre	3203	598	1661	617	596	1661	696
Bradbury	3204	982	2813	158	1012	2896	183

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
Woodland Road Primary	3205	639	1846	191	650	1878	210
St Helens Park	3206	585	1897	12	588	1908	14
St Helens Park Primary School	3207	1197	3781	249	1284	4048	279
Wedderburn	3208	169	587	310	170	589	343
Woodbine	3211	890	2750	304	959	2957	338
Leumeah Station – West	3212	3	17	2447	16	58	2747
Campbelltown Station - North	3213	219	566	3179	382	1044	4174
Blair Athol	3214	1505	5384	490	2151	7596	756
Campbelltown Town Centre - Campbelltown Station	3215	1254	2487	11089	1816	3603	12700
Centenary Park	3216	1192	2928	279	1637	3994	314
Macarthur Station – North	3217	2305	5730	1251	3049	7513	1751
Campbelltown - Waminda Avenue and Broughton Street	3218	977	2661	148	995	2709	164
Hoddle Avenue Shopping Centre	3219	1866	4711	504	2334	5843	577
Macarthur Station – South	3220	790	1902	3499	1385	3512	4001
Campbelltown Hospital	3221	1214	2491	4500	1707	3476	5098
Varroville	3224	24	81	471	24	81	530
Raby - Robert Townson High School	3225	891	2680	233	922	2775	262
Kearns	3226	762	2461	238	783	2527	265
Raby Shopping Centre	3227	1033	3223	210	1056	3294	236
Eagle Vale Market Place	3228	881	2685	604	907	2766	663
Eschol Park House	3229	720	2186	208	747	2271	235
Eagle Vale High School	3230	1197	3870	319	1275	4118	358
Claymore Shopping Centre	3231	1151	3934	216	1590	5488	244
St Gregorys College	3232	399	1319	116	471	1547	130
Holsworthy Firing Range	3235	0	0	0	0	0	0
Denham Court	3238	0	0	0	0	0	0
Ingleburn Village	3239	199	637	470	363	1149	931
Edmondson Park Anglican College	3240	132	464	124	126	464	152
Ingleburn - Macdonald Road and Nelson Road	3241	2344	6834	517	2299	6834	494
Ingleburn - Macdonald Road and Leichhardt Road	3242	972	2858	310	955	2858	354

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
Denham Court - Denham Court Road and Springmead Drive	3243	3680	10077	300	3680	10111	350
Macquarie Fields Station - West	3244	399	1384	158	402	1393	175
Scenic Hills Riding Ranch	3245	403	1331	229	404	1334	255
Ingleburn Industrial Estate - North Western End	3246	0	0	4765	0	0	5071
Ingleburn Industrial Estate - North Eastern End - Ingleburn Station	3247	85	222	3193	183	447	3634
Ingleburn High School	3248	1394	3783	2000	1638	4408	2246
Ingleburn Shopping Centre	3249	800	2419	202	831	2513	225
Ingleburn Industrial Estate - South Eastern End	3250	0	0	1169	0	0	1165
Ingleburn	3251	1301	3932	250	1480	4425	310
Ingleburn - Chester Road and Lyndia Street	3252	927	2615	180	1058	2959	202
Lagonda Shopping Village	3253	1234	3501	400	1308	3706	443
Leumeah High School	3269	1721	5092	686	1988	5832	759
Minto Heights	3270	401	1347	367	543	1782	412
Leumeah	3271	1428	3562	210	1894	4684	251
Leumeah - Angle Reserve	3272	694	1776	182	737	1885	202
Ruse	3273	822	2396	300	837	2438	334
Ruse Village Shopping Centre	3274	1157	3335	300	1200	3456	334
Glenfield Station - North	3277	2433	7248	1324	4078	11771	2394
Glenwood Primary School	3278	595	1738	409	644	1879	476
Glenfield Station - South	3279	1812	5074	686	2899	8020	1012
Glenfield - Childs Reserve	3280	467	1435	409	514	1576	476
Macquarie Fields Station - East	3281	1085	3229	1540	1194	3539	1753
Curran High School	3282	1276	3694	209	1333	3862	233
Macquarie Fields High School	3283	1433	4140	680	1529	4395	777
Long Point	3284	970	3006	221	991	3073	243
St Andrews	3287	1031	3288	133	1079	3433	149
East Minto Shopping Centre	3288	1034	3168	205	1064	3257	225
Minto Industrial Area - Northern End - Minto Station	3289	14	23	1664	14	23	1755
Minto Station - East	3290	865	2602	643	1098	3275	721

TPA TZ2016 Area Name	TPA TZ2016 Number	2026			2036		
		Households	Population	Employment	Households	Population	Employment
St. Andrews Shopping Centre	3291	1309	4093	442	1341	4192	488
Minto Shopping Centre	3292	1134	3861	586	1159	3943	642
Minto Industrial Area - Western End	3293	8	6	3451	8	6	3499
Minto	3294	1287	3838	396	1318	3930	444
Minto Industrial Area - Eastern End	3295	0	0	1801	0	0	2401
Campbelltown Golf Club	3298	856	2686	589	936	2929	649
Ambarvale Shopping Centre	3299	886	2431	382	913	2502	424
Menangle Park	3300	1498	3288	89	1867	4094	129
Glen Alpine	3301	1049	3614	243	1208	4157	270
Thomas Acres Primary School	3302	1220	3962	305	1294	4193	344
Ambarvale High School	3303	837	2526	751	883	2662	831
John Therry High School	3304	519	1618	309	536	1671	348
Menangle Park Paceway	3305	2682	7478	535	3386	9359	769
Rosemeadow	3306	1175	3677	448	1240	3881	515
Rosemeadow - Hume and Hovell Monument Gilead	3307	3579	7798	497	14301	31259	1003
Total		77300	221432	68345	100151	277887	79915

Appendix B Council Agreed MRTM Future Network Infrastructure Improvements

These network infrastructure improvements included in the future base models were agreed upon at a meeting held at Camden Council offices on Friday 11th October 2019. In attendance were the following Council staff and consultants:

Mike Nelson – Manager Infrastructure Strategy and Planning, Wollondilly Shire Council

Stephen Gardiner – Manager Sustainable Growth, Wollondilly Shire Council

Cathy Kinsey – Coordinator Stormwater and Structural Design, Campbelltown Council

Tom Allen – Team Leader Traffic and Road Safety, Camden Council

Tim Sullivan – Principal, SLR Consulting

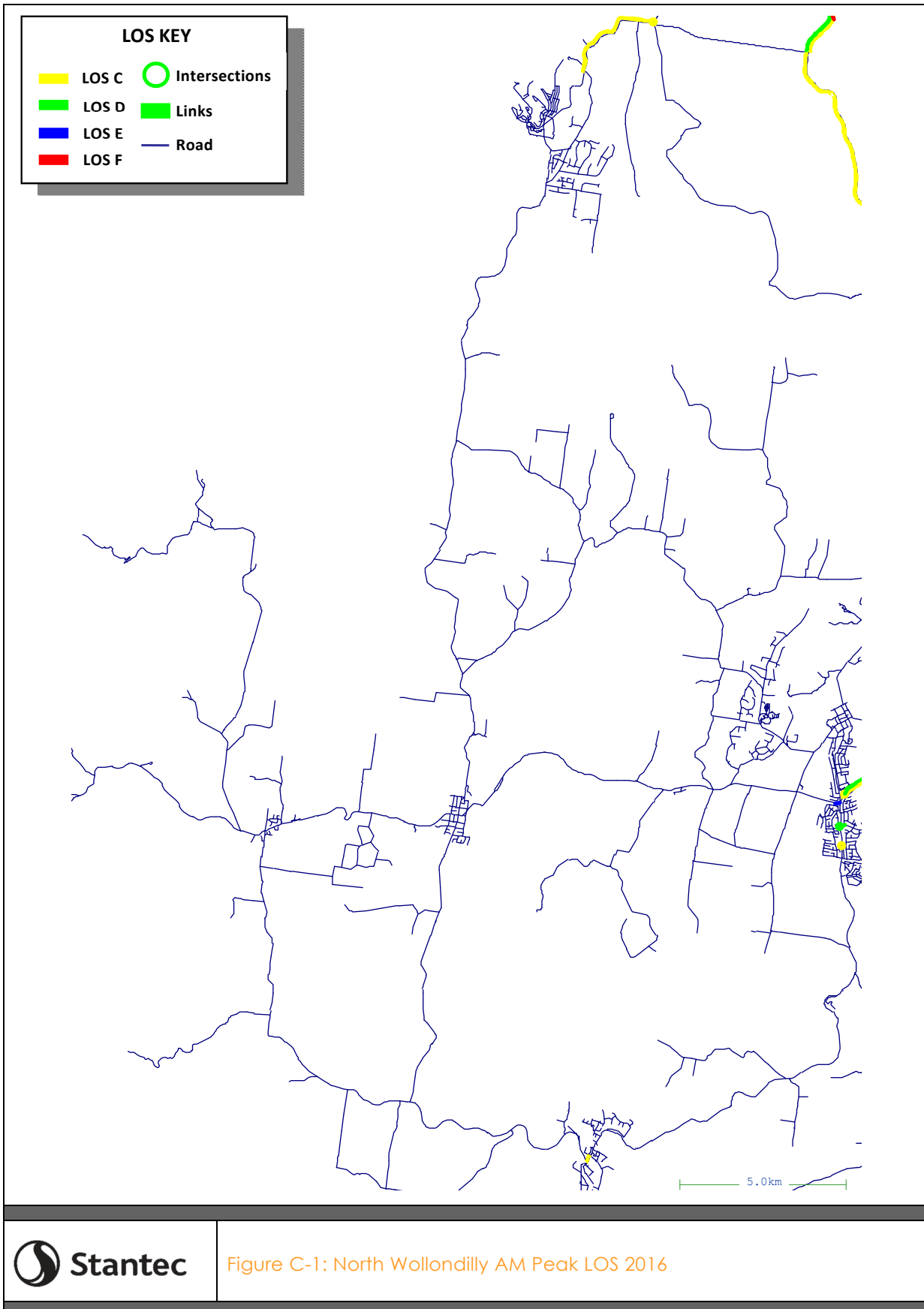
Dave Hunter – Senior Principal Transportation Engineer, Stantec

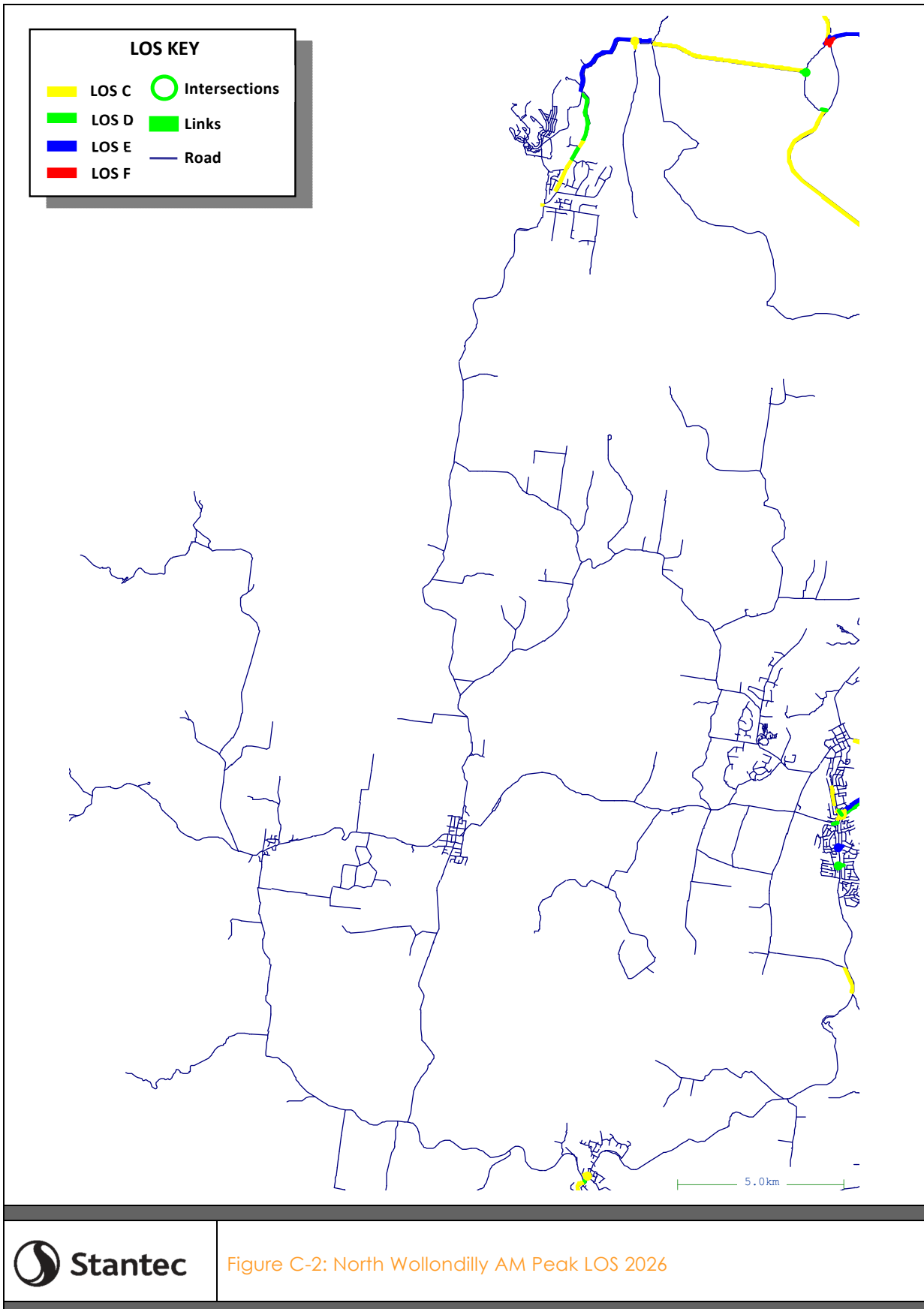
Agreed Network Infrastructure Improvements

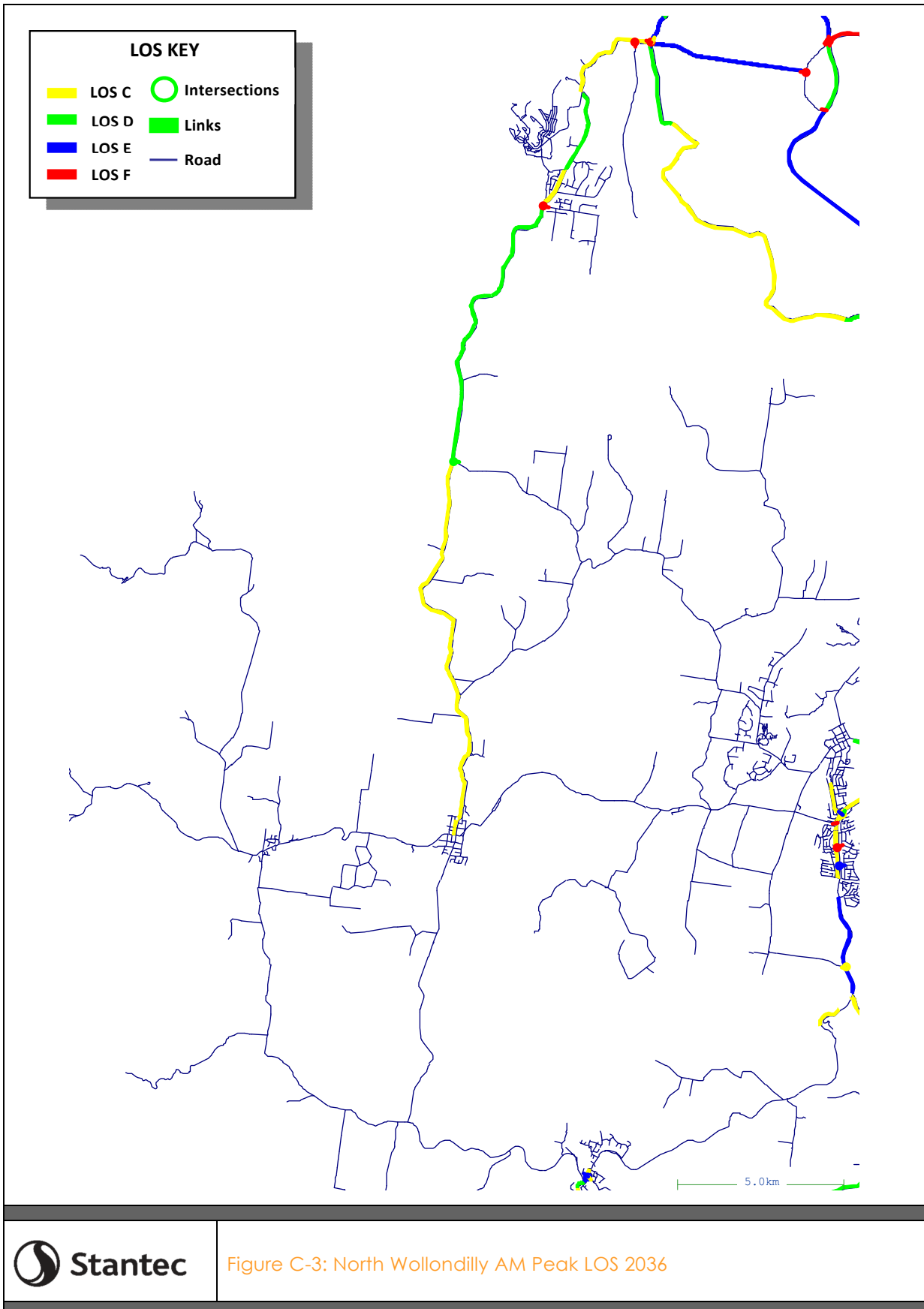
Project	From	To	2026 Improvement	2036 Improvement
Bringelly Road	Cowpasture Road	The Northern Road	4L	4L
M12	The Northern Road	M7	4L	4L
Werrington Arterial	Western Motorway	Great Western Highway	4L	4L
Appin Road North	Narellan Road	Kellerman Drive	4L	4L
Appin Road Mid	Kellerman Drive	Blackburn Road	2L	4L
Appin Road South	Blackburn Road	Church Road	2L	2L
Badgally Road-Broughton Street Link	Blaxland Road	Moore Oxley Bypass	-	4L
Badgally Road-Gregory Hills Drive Link	Camden Valley Way	Blaxland Road	4L	4L
Campbelltown Road	Hume Motorway overpass	Brooks Road	4L	4L
Dunn Road Extension	Turner Road	Rodeo Road	2L	2L
Raby Road	Camden Valley Way	Thunderbolt Drive	4L	4L
Raby Road and Bridge	Campbelltown Road	Hume Motorway	4L	4L
Rickard Road	Oran Park Drive	Bringelly Road	-	4L
Camden Bypass	Old Hume Highway	Macarthur Road	2L	4L
Camden Bypass	Narellan Road	Spring Farm Parkway	4L	6L
Emerald Hills Boulevard	Jamboree Avenue	The Hermitage Way	2L	2L
The Northern Road	Camden Valley Way	Bringelly Road	4L	4L
The Northern Road	Bringelly Road	Western Motorway	6L	6L
Liz Kernohan Drive Extension	Camden Valley Way	Irvine Street	2L	2L
Spring Farm Parkway	Camden Bypass	Barrow Road	4L	4L
Spring Farm Parkway	Barrow Road	Menangle Park	-	4L
Spring Farm Parkway	Menangle Park	Menangle Road	4L	6L
Spring Farm Parkway	Menangle Road	Appin Road	-	4L
Spring Farm Parkway / Appin Road	Appin Road		Roundabout	Roundabout
Spring Farm Parkway / Menangle Road	Menangle Road		Roundabout	Roundabout
Spring Farm Parkway / The Lachlan Road	Lachlan Road		Roundabout	Roundabout
Camden Valley Way / Macarthur Road	Camden Valley Way	Macarthur Road	Traffic Signals	Traffic Signals
Hume Motorway	Picton Road	Macquariedale Road	4L	4L
Hume Motorway	Macquariedale Road	Spring Farm Parkway	6L	8L
Hume Motorway	Spring Farm Parkway	Narellan Road	6L	8L
Hume Motorway Spring Farm Parkway Interchange	North Facing Ramps		Interchange	Interchange
Hume Motorway Spring Farm Parkway Interchange	South Facing Ramps		-	Interchange
Link Road B Link and Bridge	Macquariedale Road	West Appin	-	-
Narellan Road	Mt Annan Drive	Hume Motorway	6L	8L
Narellan Road	Camden Valley Way	Mt Annan Drive	6L	8L
Finns Road	Menangle Road	Remembrance Drive	2L	2L
Macquariedale Road	Finns Road	Appin Road	-	6L
Macquariedale Road Interchange	Hume Motorway		-	Interchange
Menangle Road	Picton Road	Narellan Road	2L	2L
North Wilton Connection	Menangle Road	Development	-	2L
Picton Road	Hume Motorway	Prince Street	2L	4L

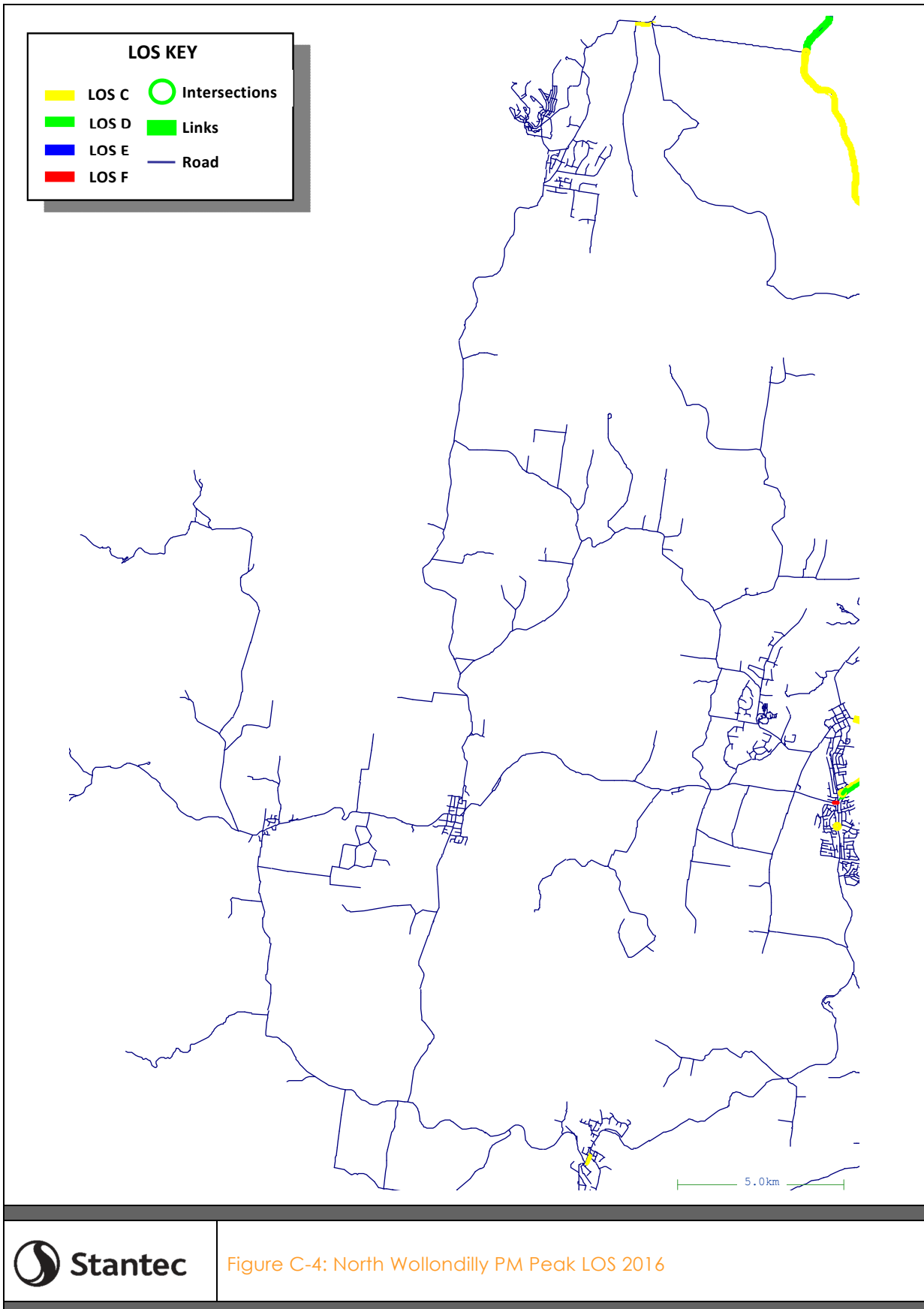
Project	From	To	2026 Improvement	2036 Improvement
Picton Road Interchange Upgrade	Hume Motorway		-	Interchange
Wilton Development	Intersections with Picton Road		Traffic Signals	Traffic Signals
Silverdale Road	Farnsworth Avenue	Park Road	2L	4L
Outer Sydney Orbital	Hume Motorway	Great Western Highway	-	-
Bringelly Road Interchange	Outer Sydney Orbital	Bringelly Road	-	-
Burraborang Road Interchange	Outer Sydney Orbital	Burraborang Road	-	-
Cobbitty Road Interchange	Outer Sydney Orbital	Burraborang Road	-	-
Camden Valley Way	Narellan Road	M7	4L	4L

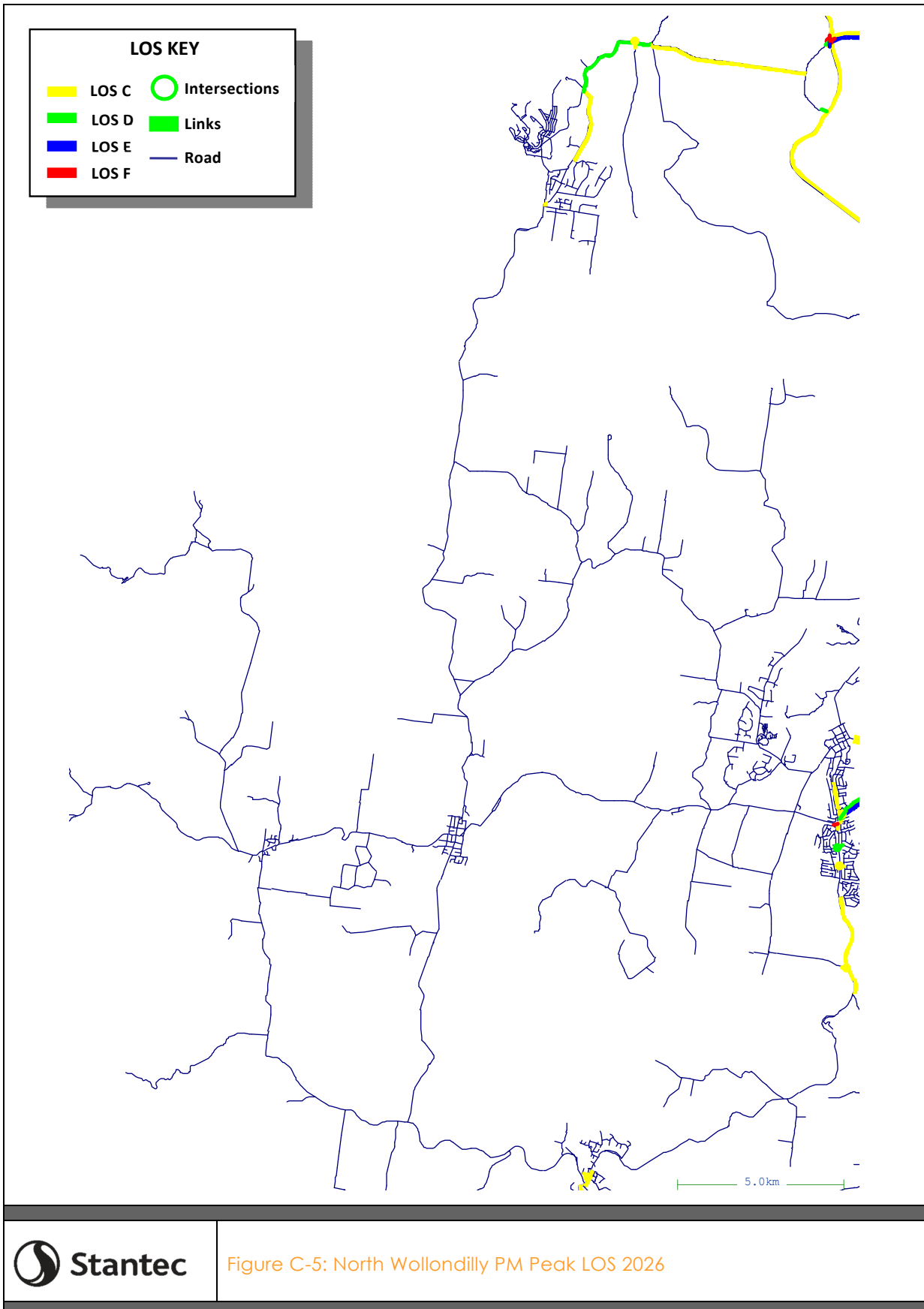
Appendix C Wollondilly LOS Plots

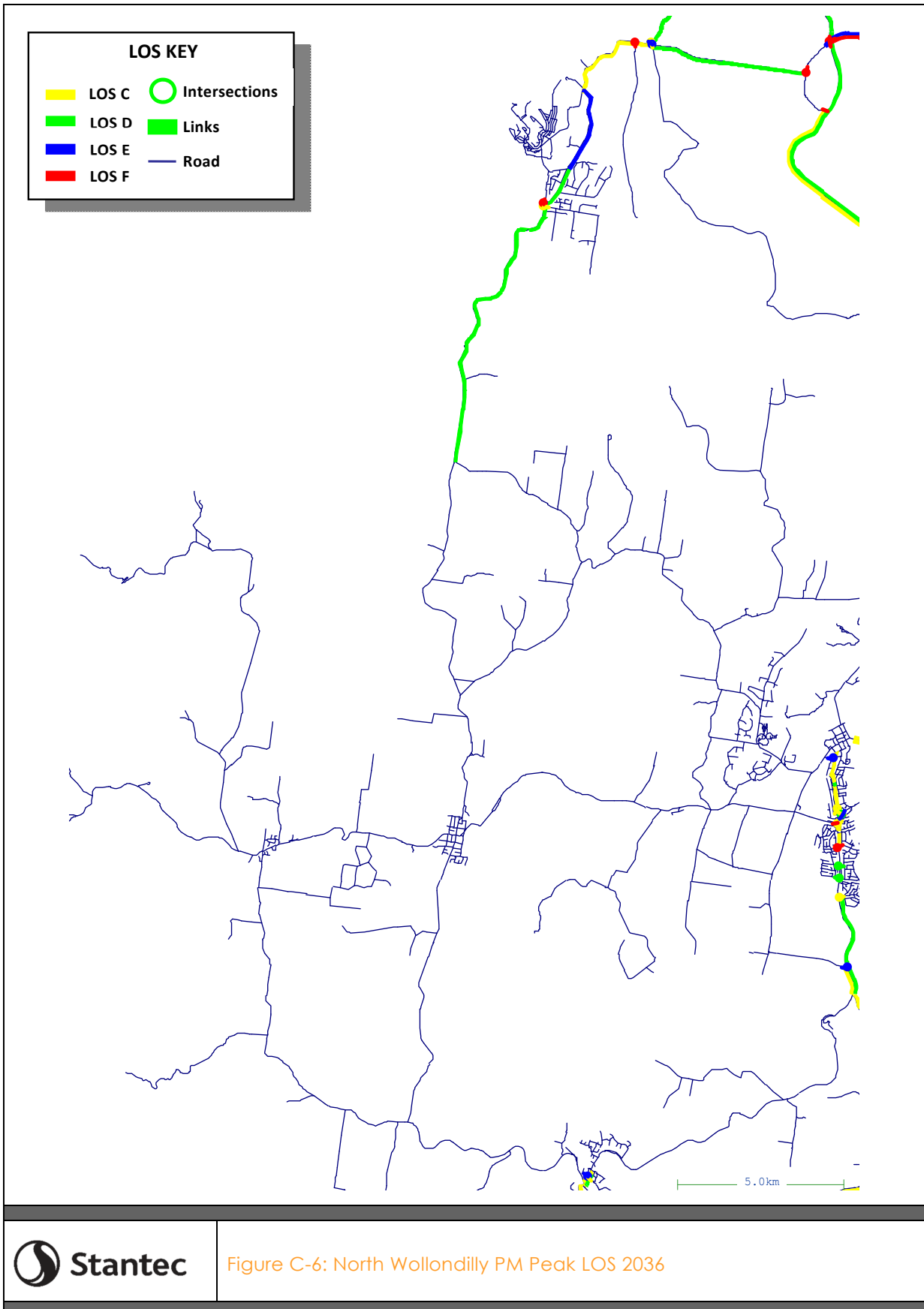


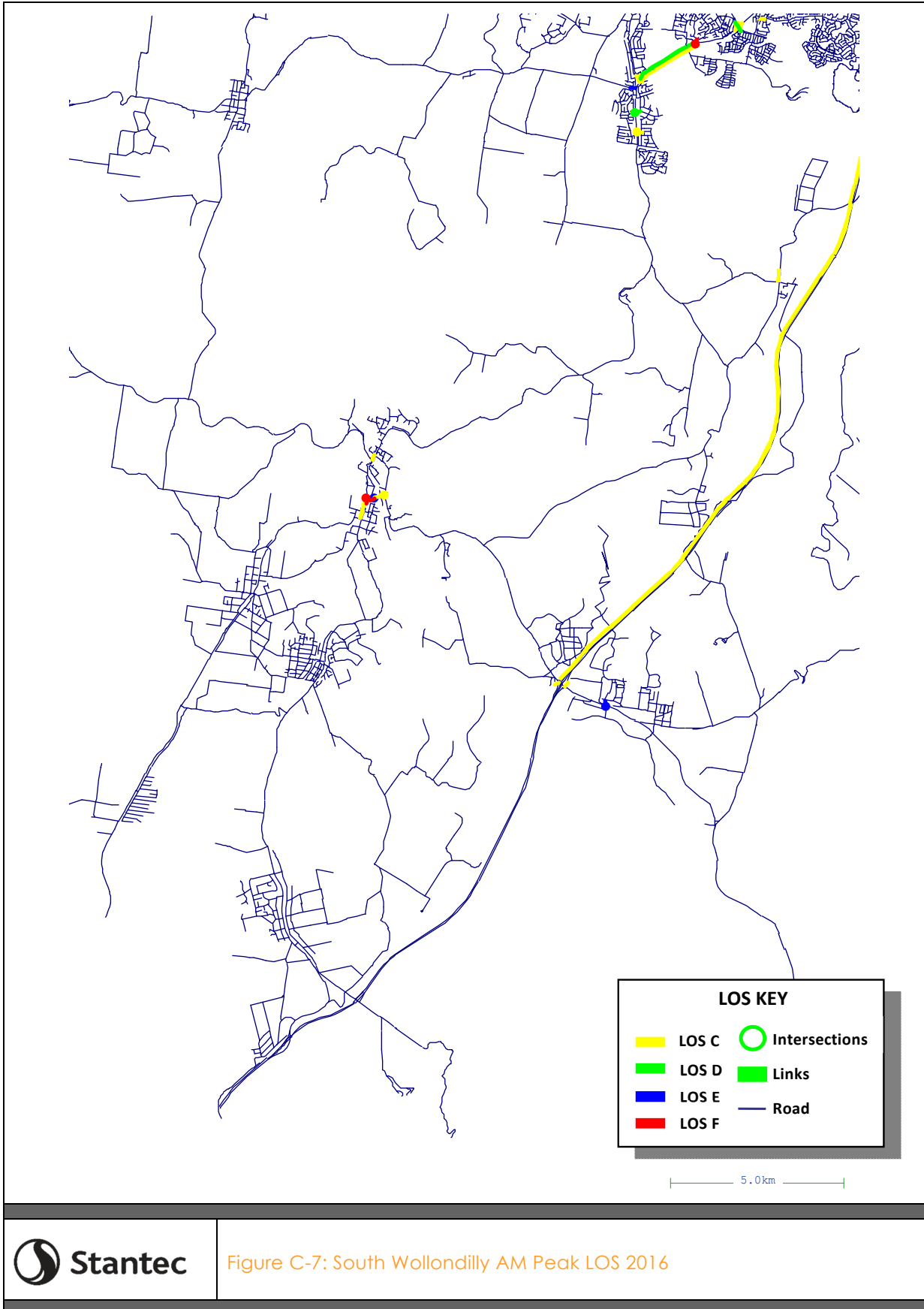


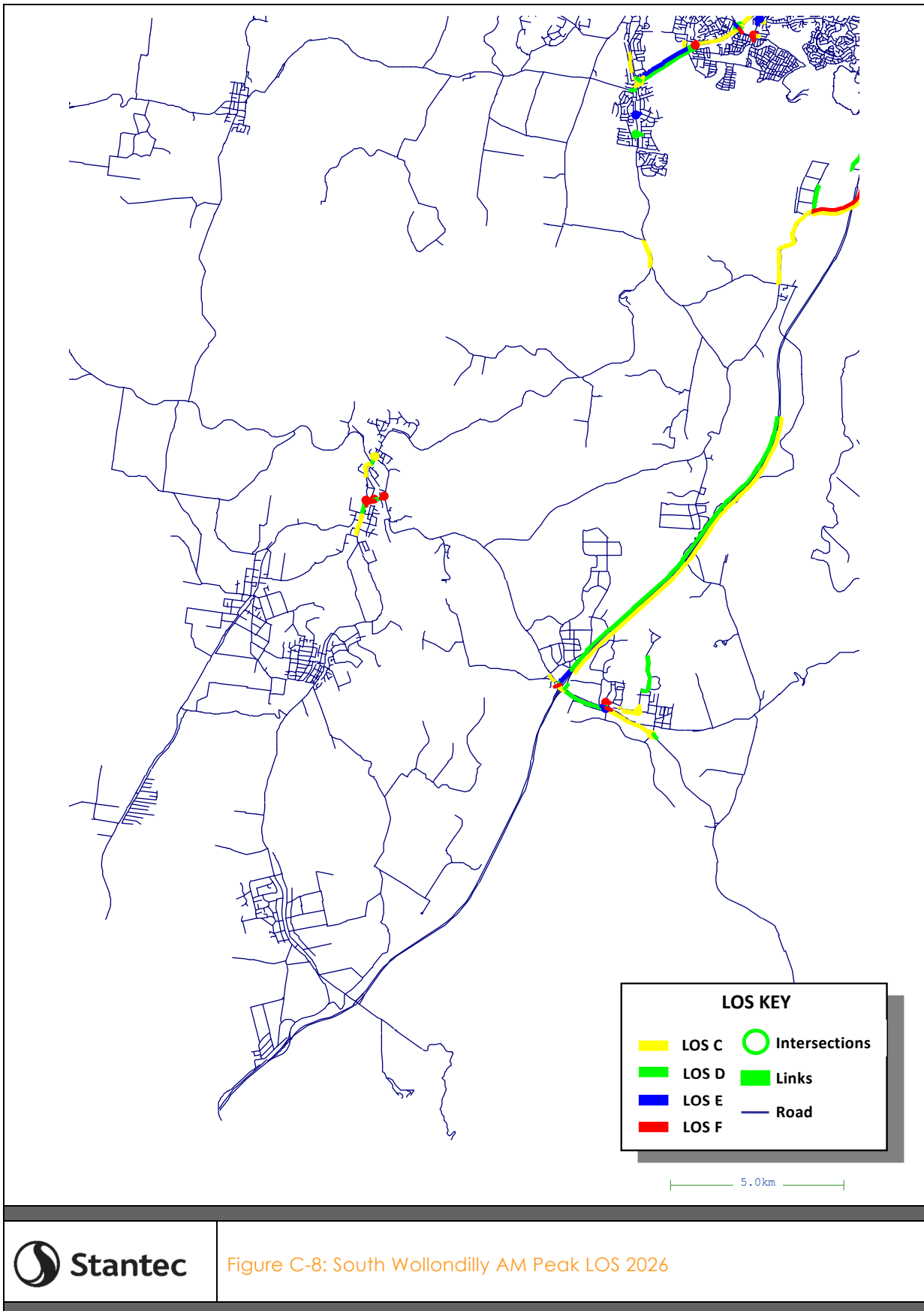


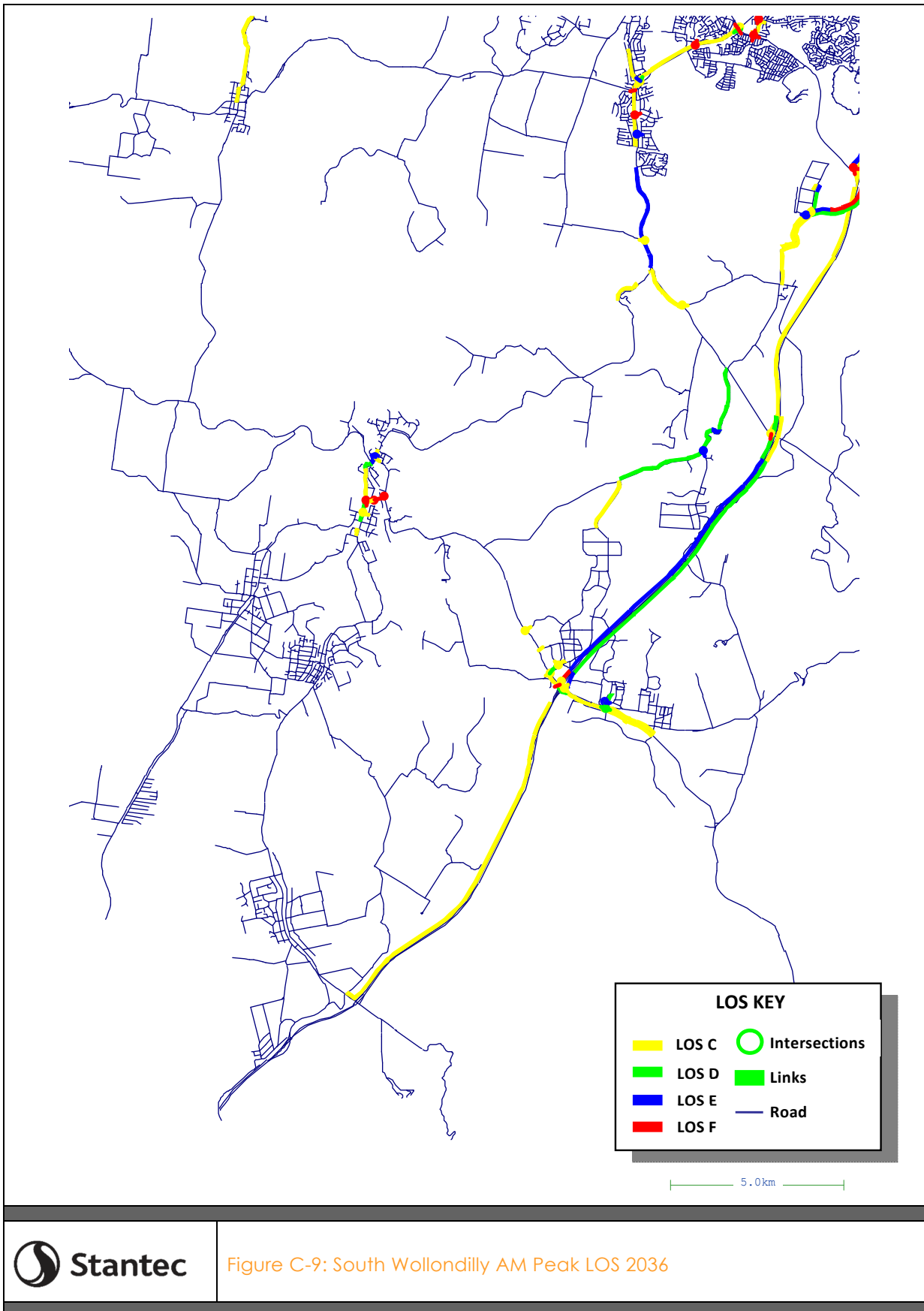


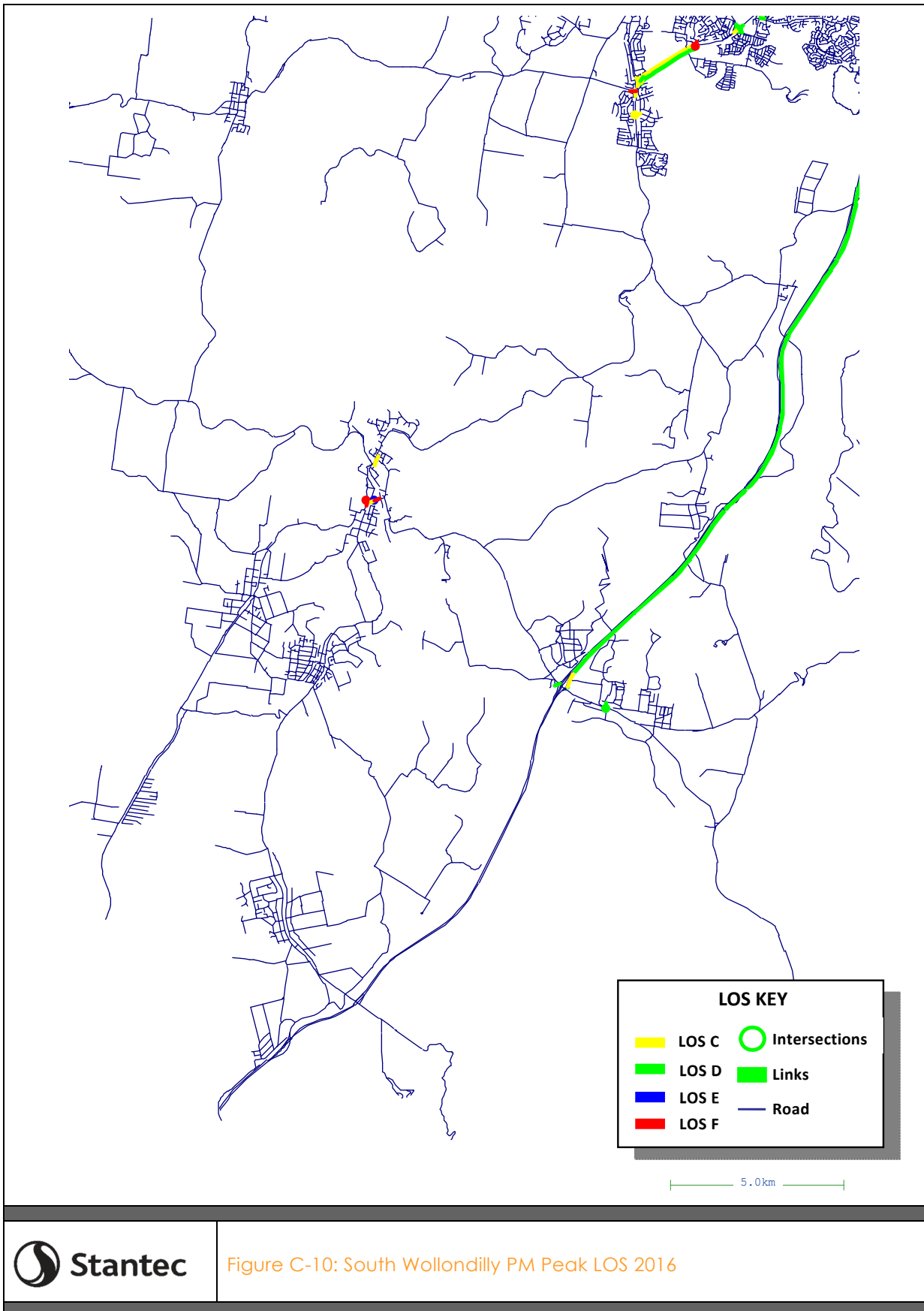


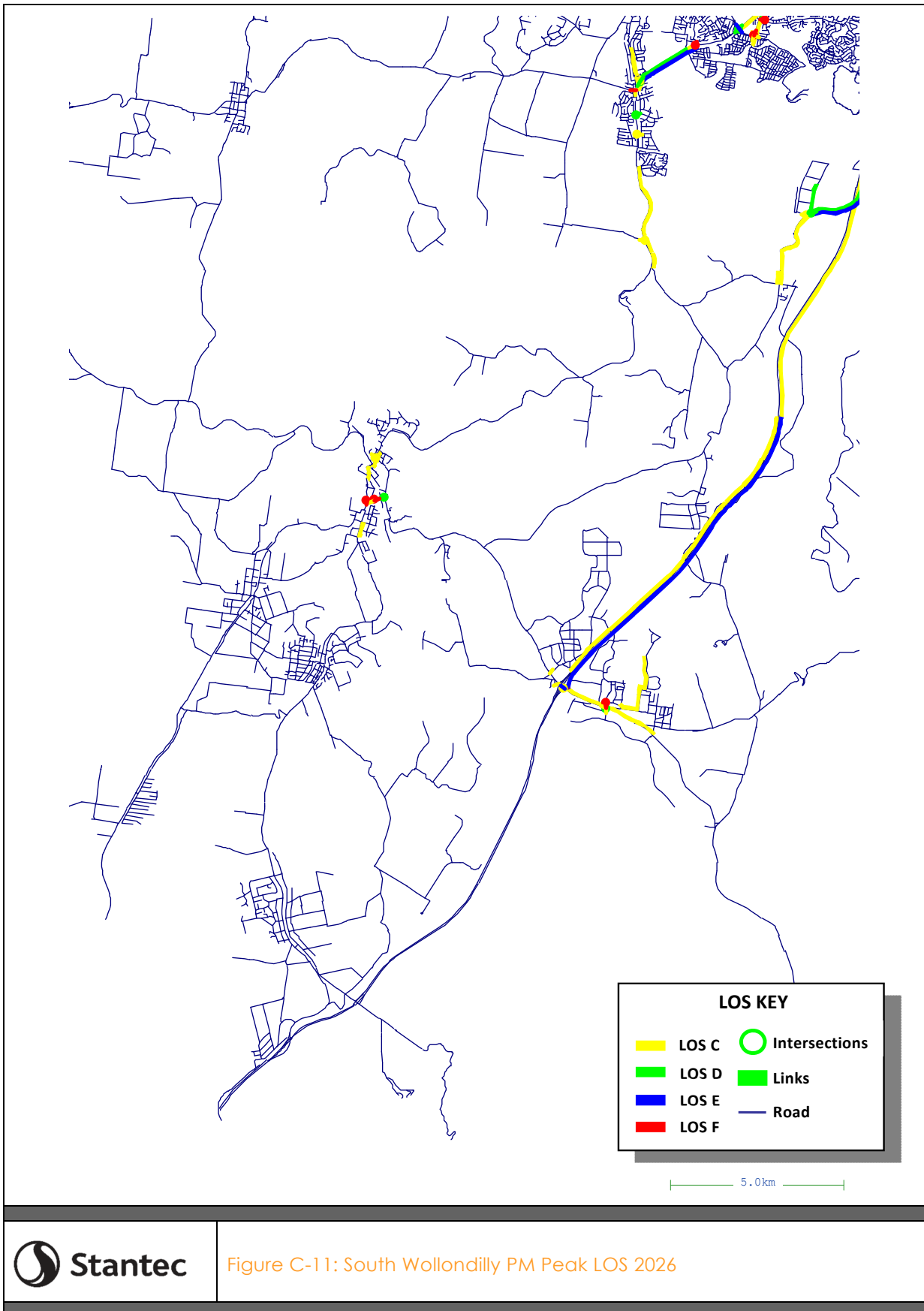


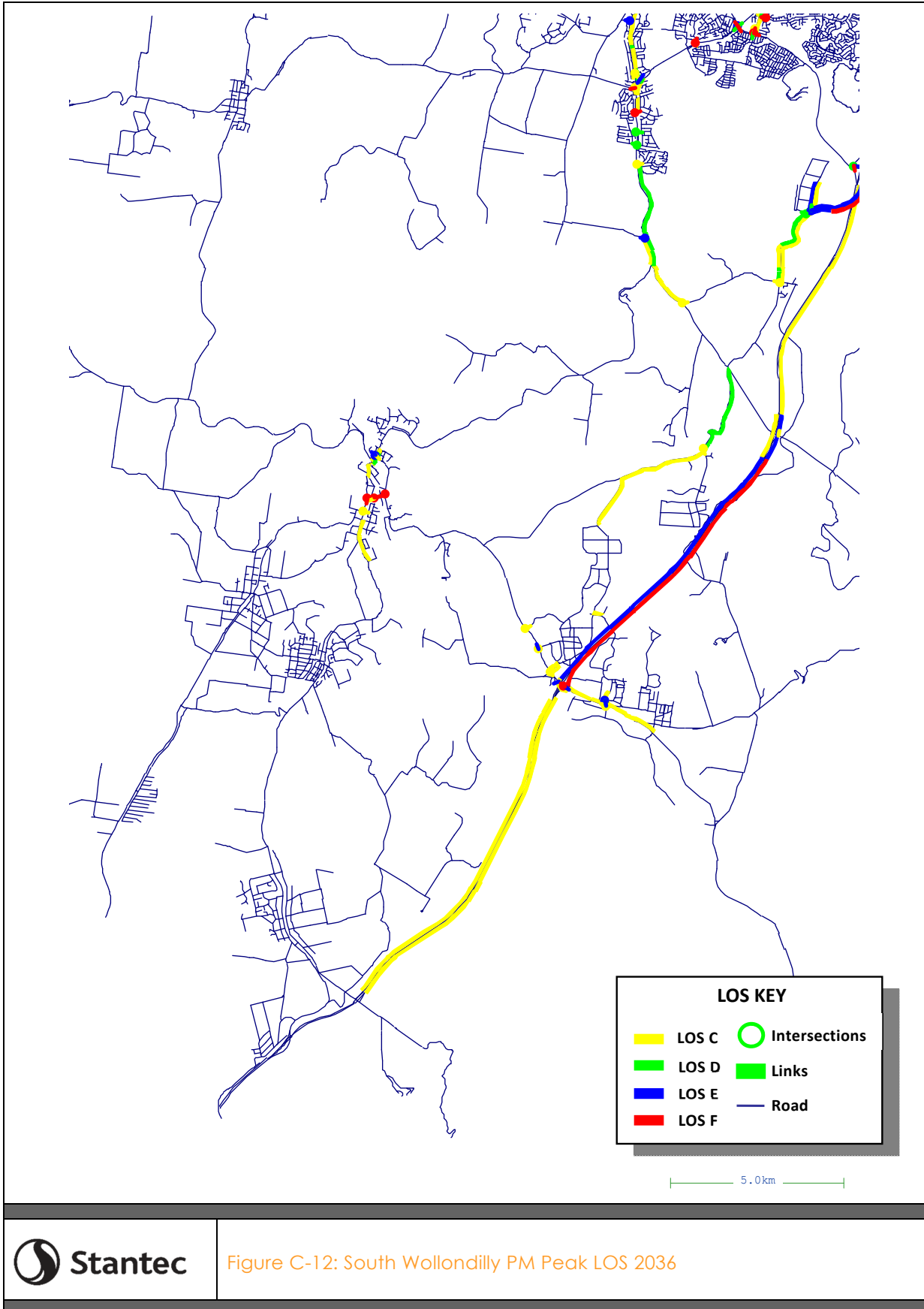




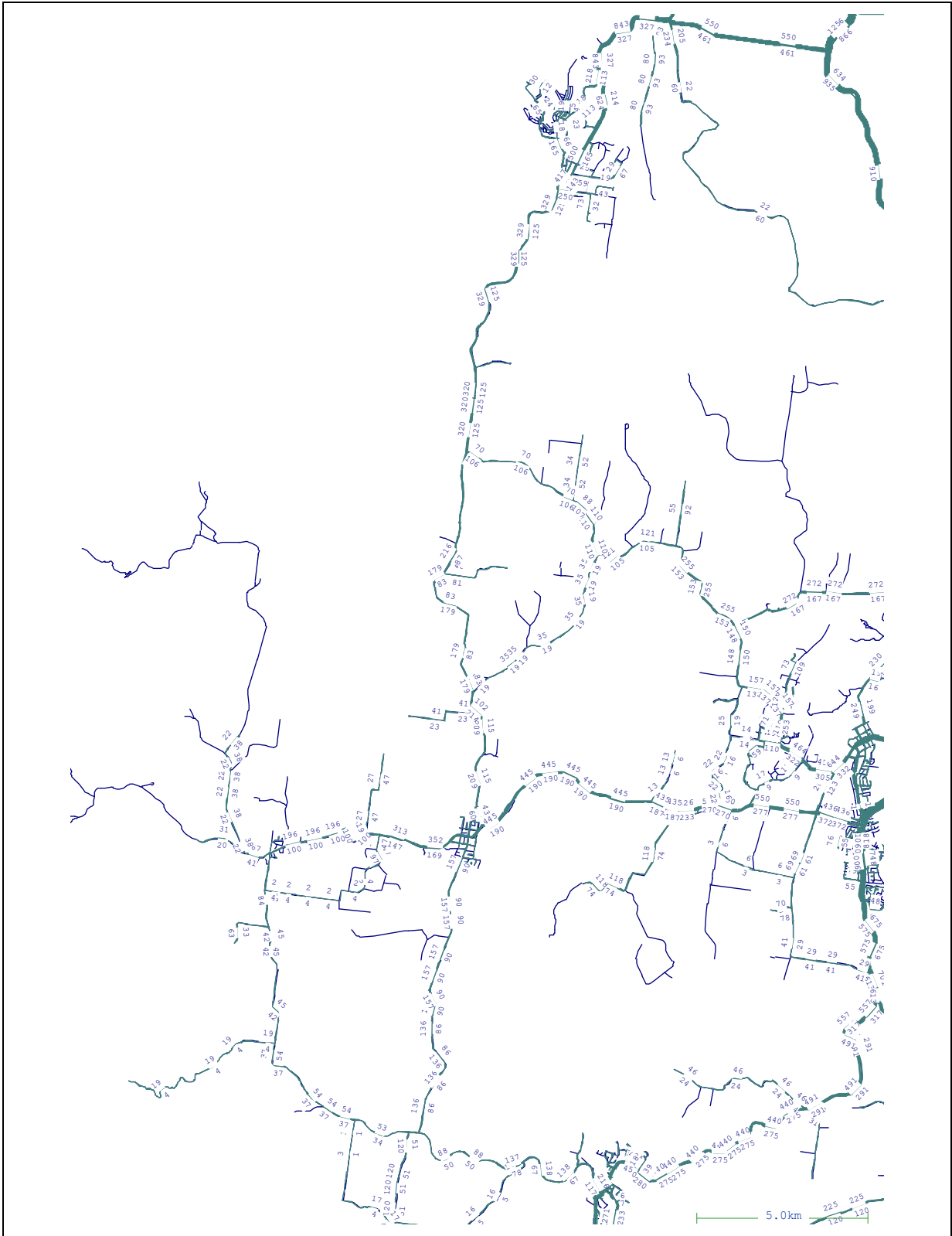








Appendix D Wollondilly Volume Plots



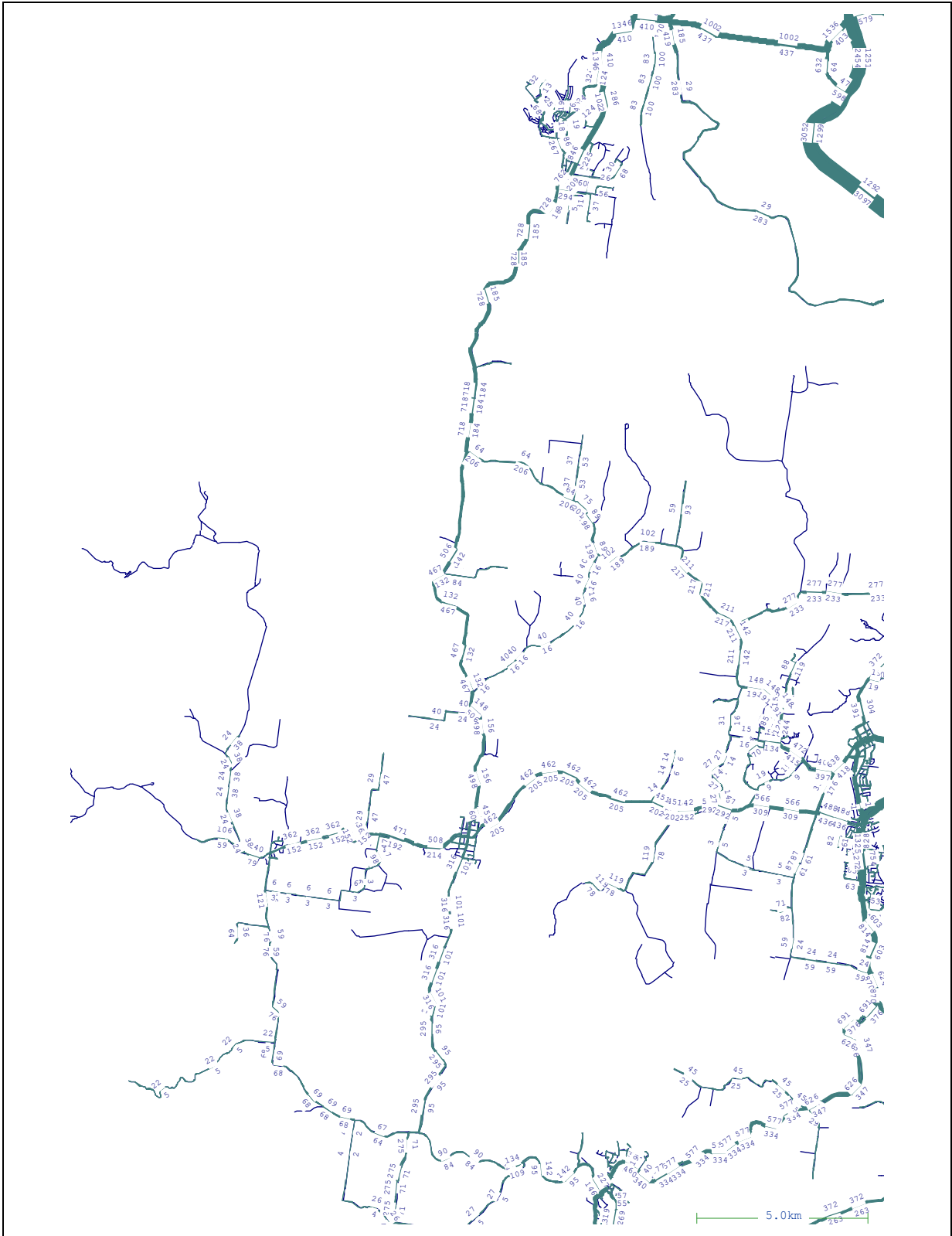


Figure D-2: North Wollondilly AM Peak 2026 Volume

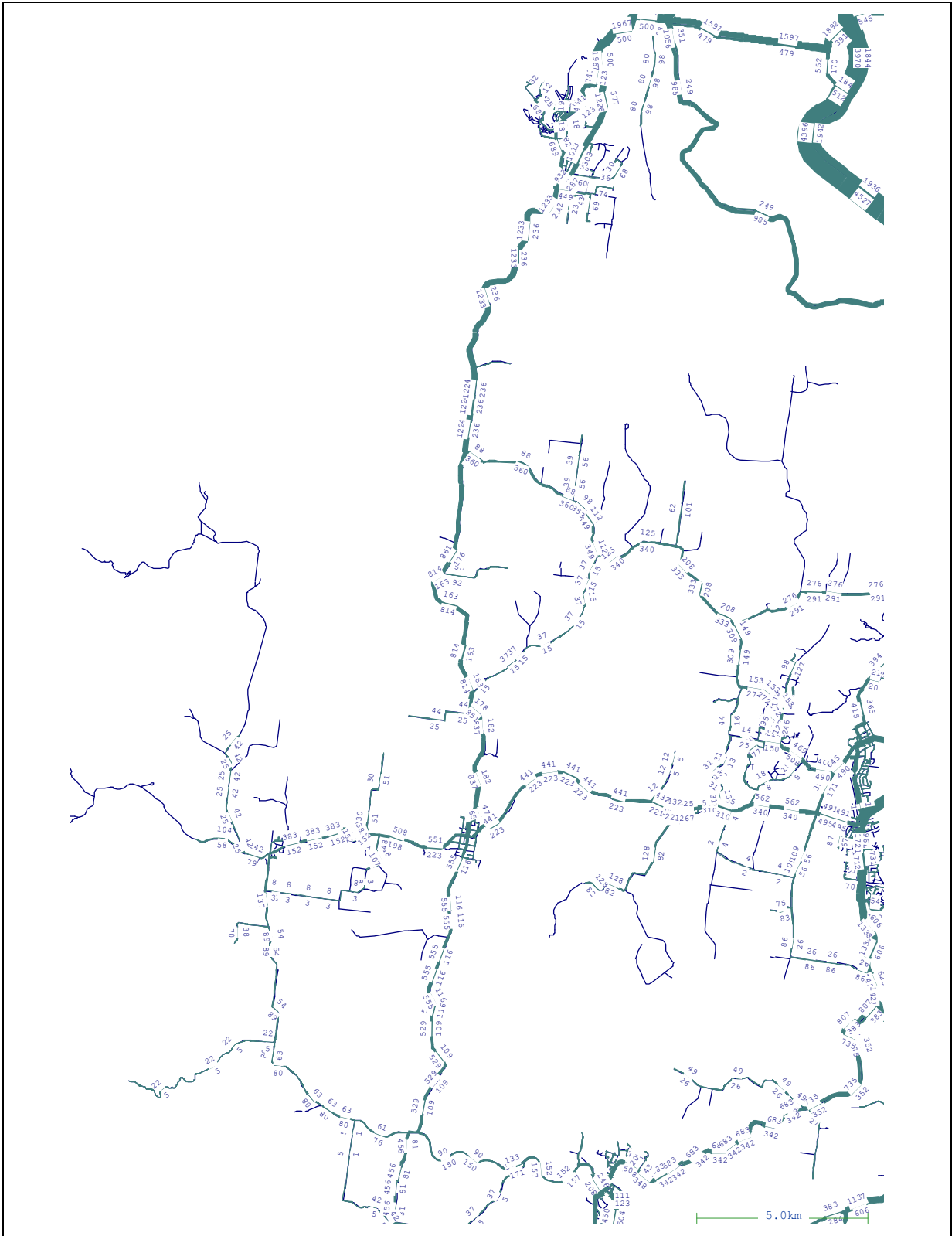


Figure D-3: North Wollondilly AM Peak 2036 Volume

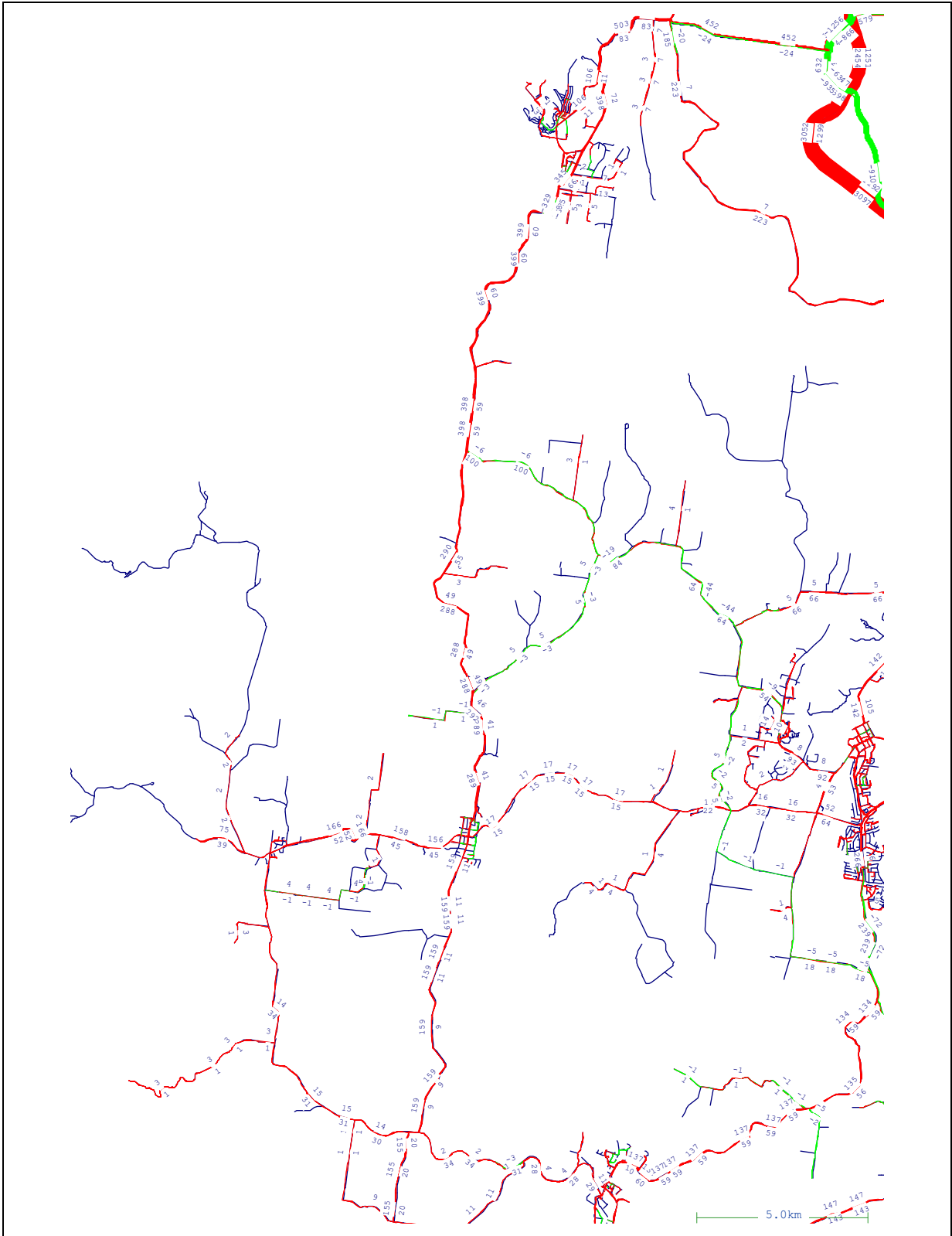
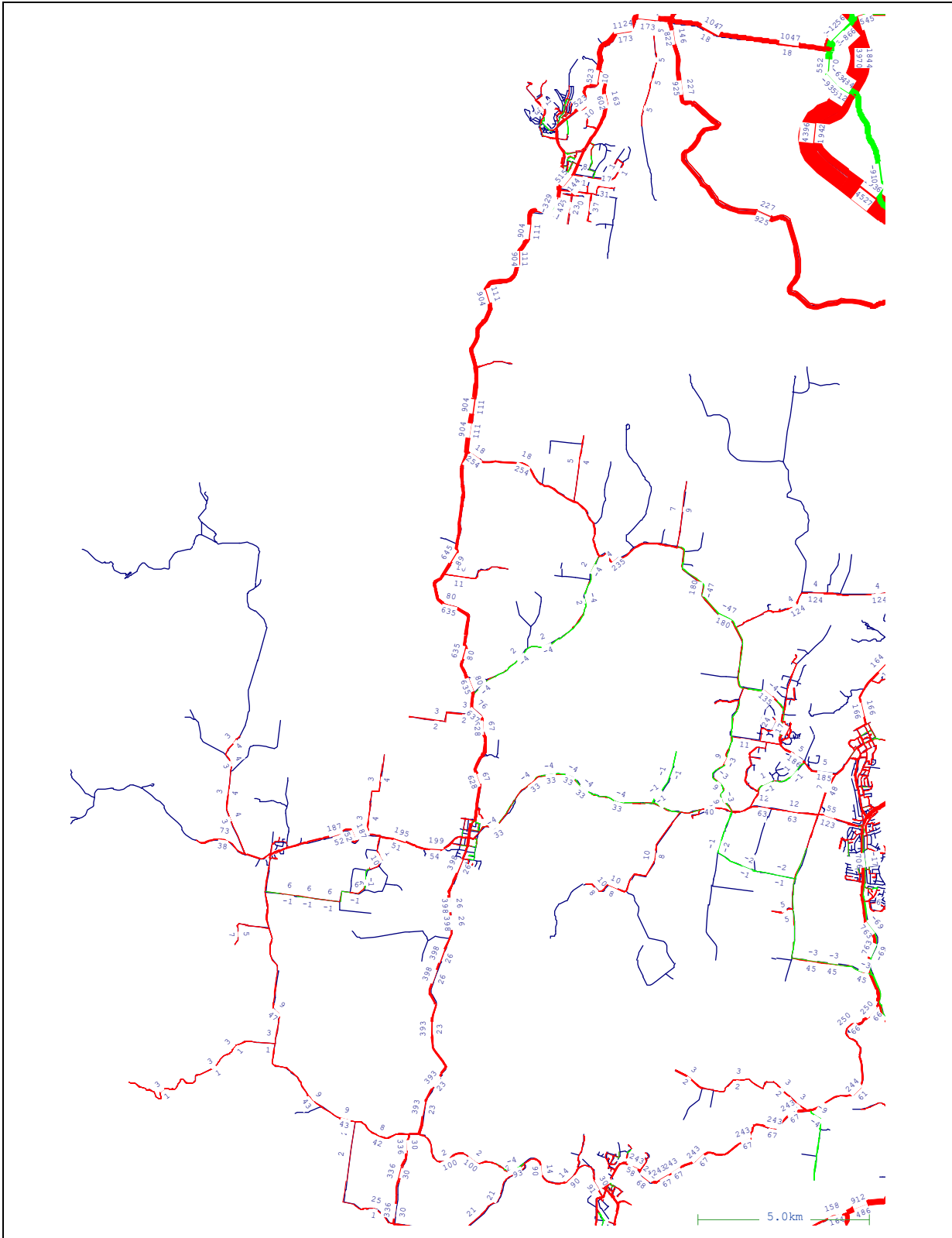


Figure D-4: North Wollondilly AM Peak 2016-2026 Change in Volume



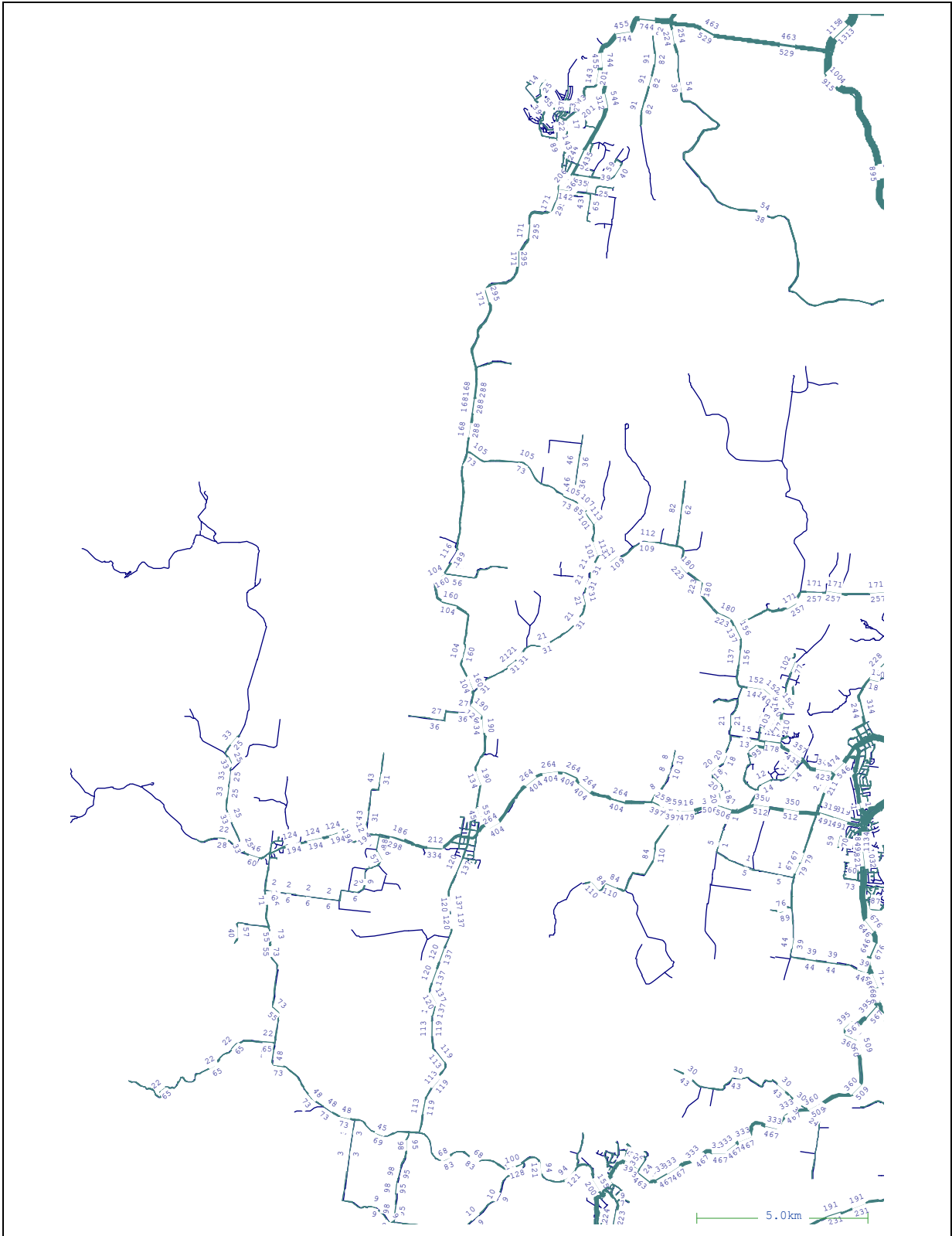


Figure D-6: North Wollondilly PM Peak 2016 Volume

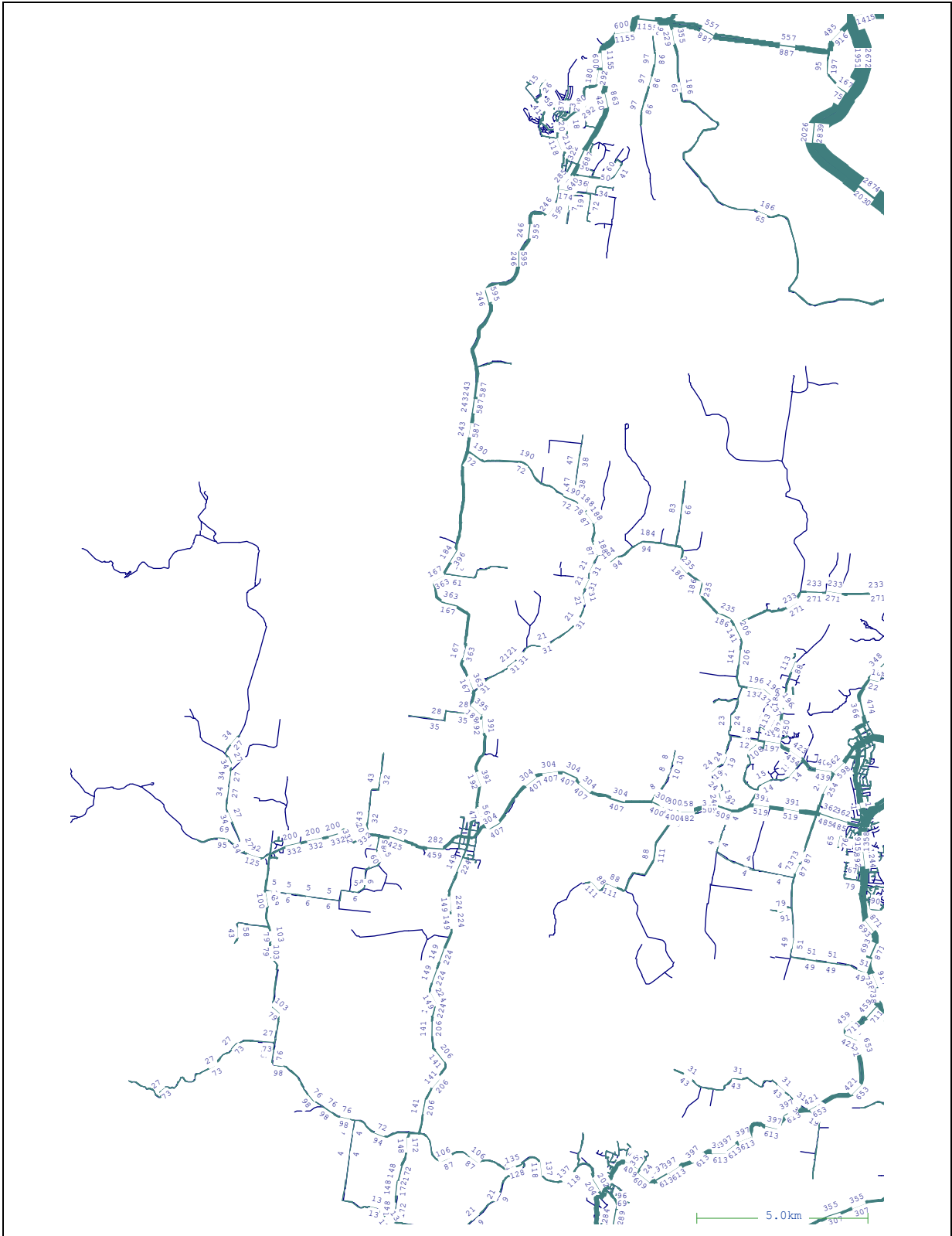


Figure D-7: North Wollondilly PM Peak 2026 Volume

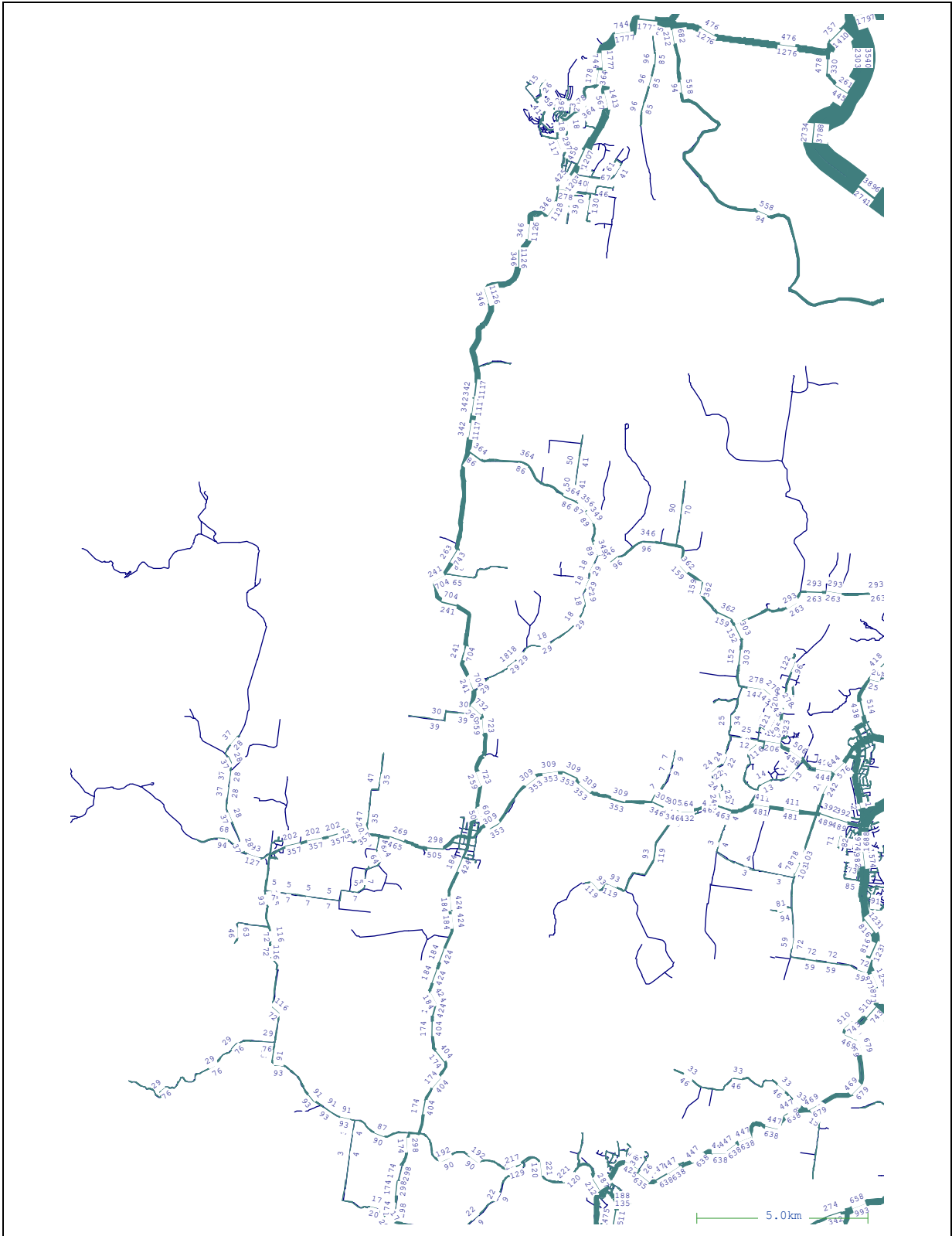


Figure D-8: North Wollondilly PM Peak 2036 Volume

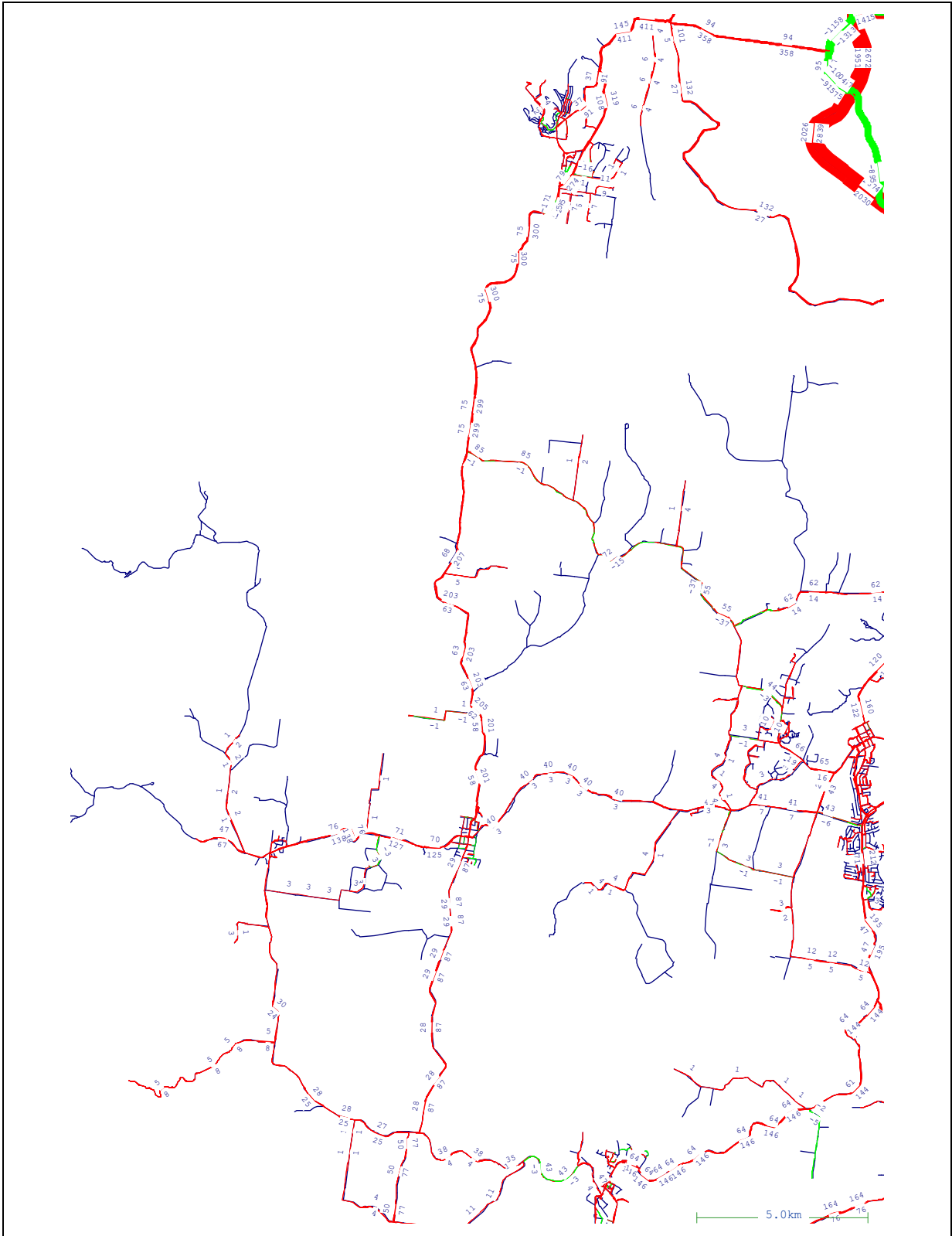


Figure D-9: North Wollondilly PM Peak 2016-2026 Change in Volume







Figure D-12: South Wollondilly AM Peak 2026 Volume



Figure D-13: South Wollondilly AM Peak 2036 Volume

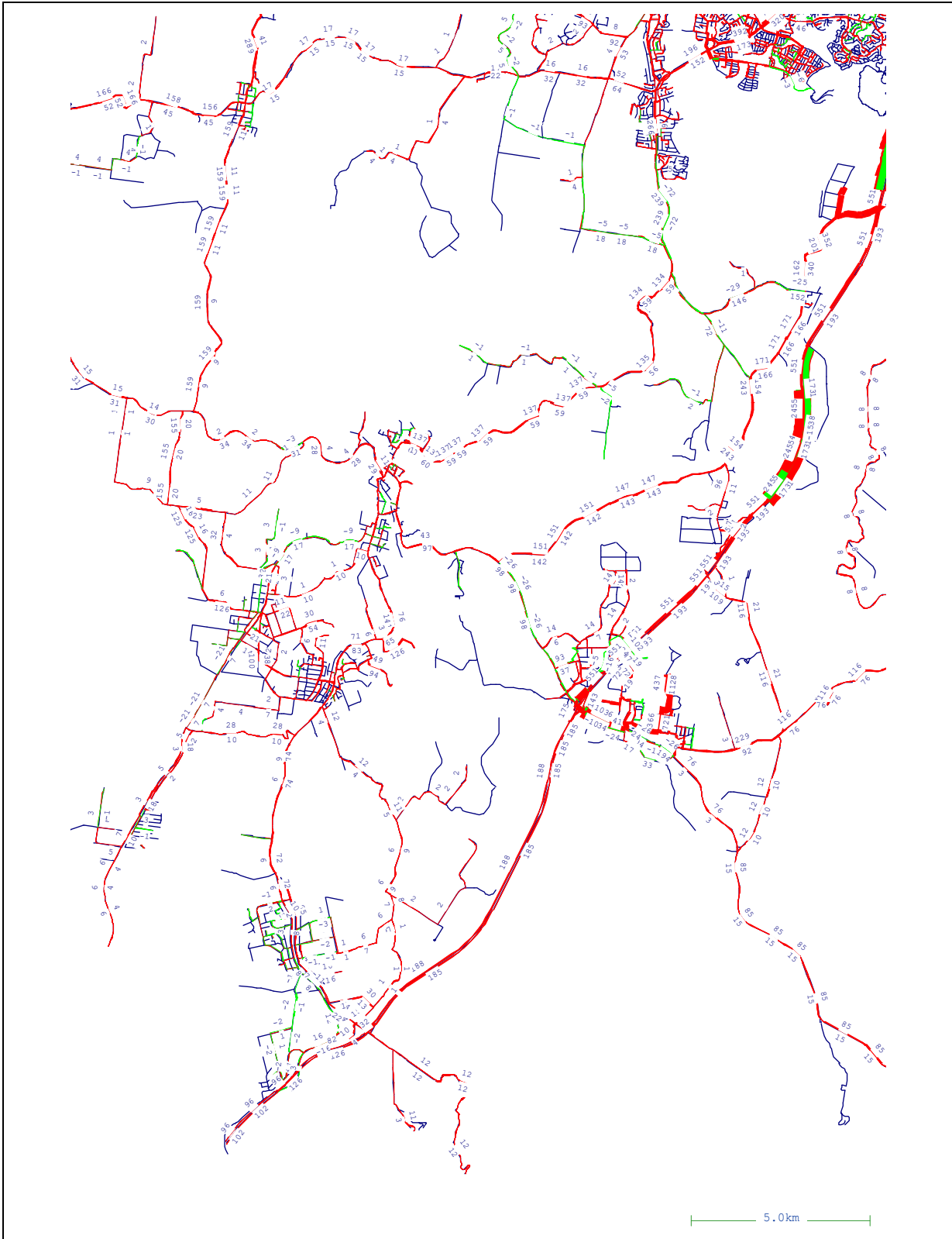
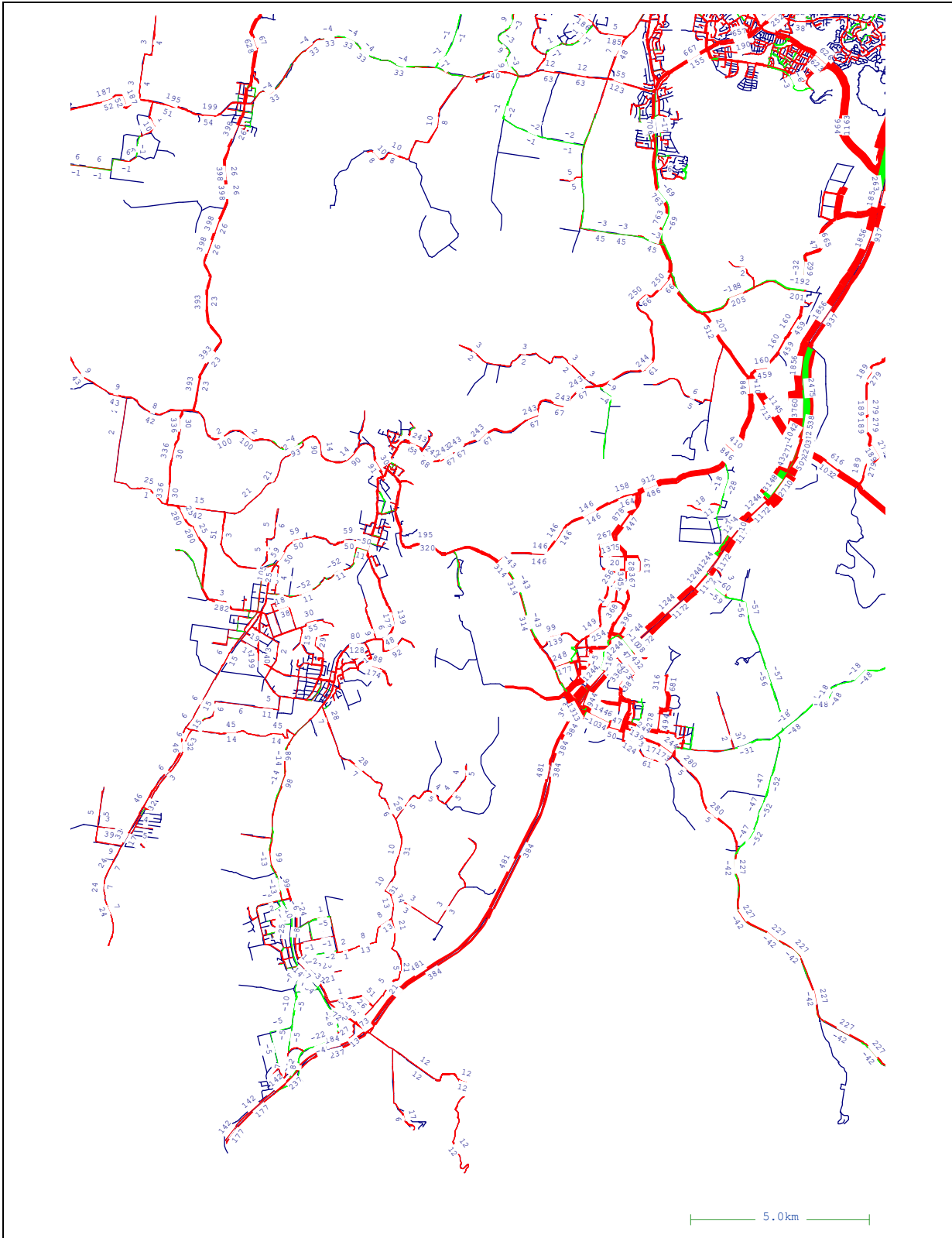


Figure D-14: South Wollondilly AM Peak 2016-2026 Change in Volume



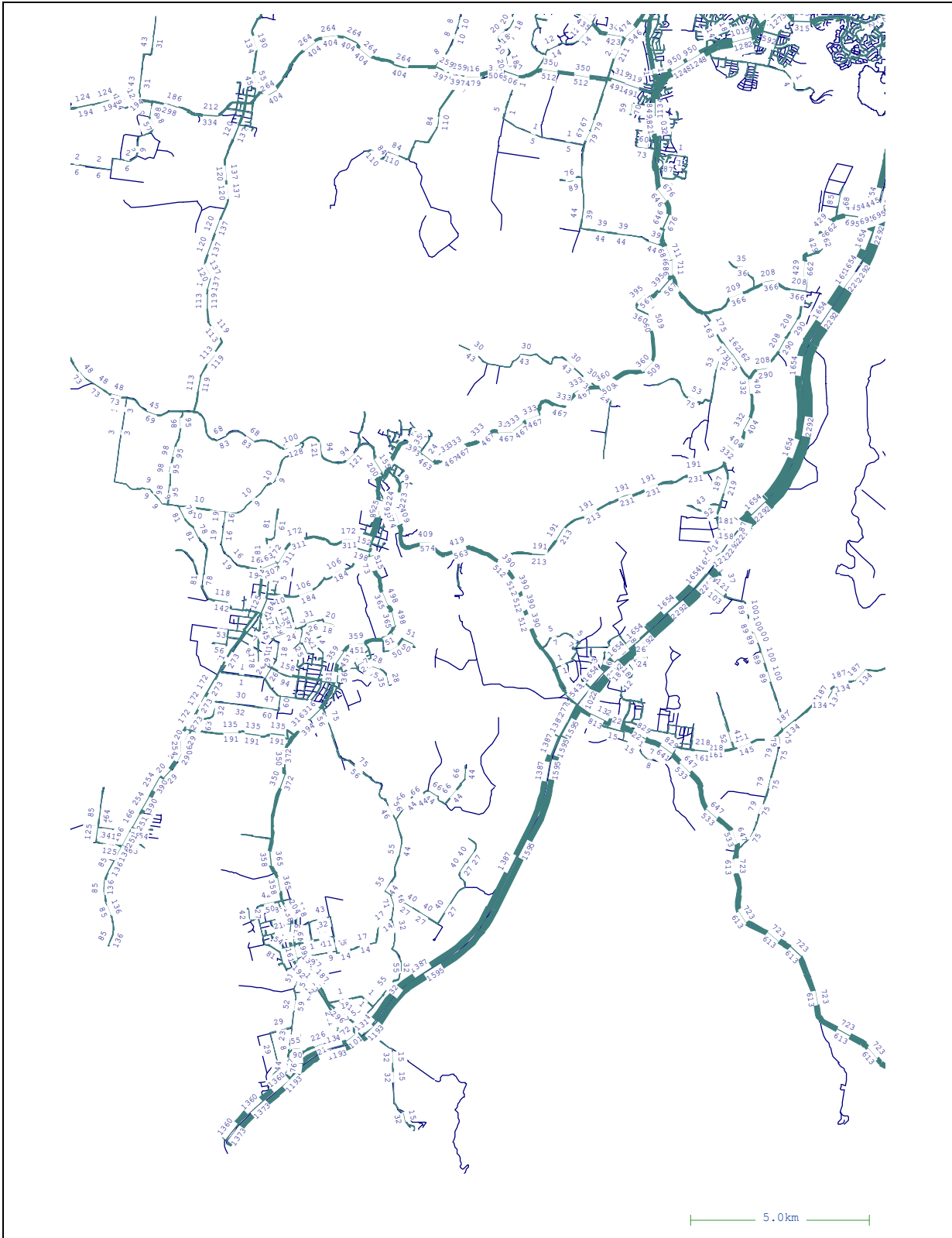
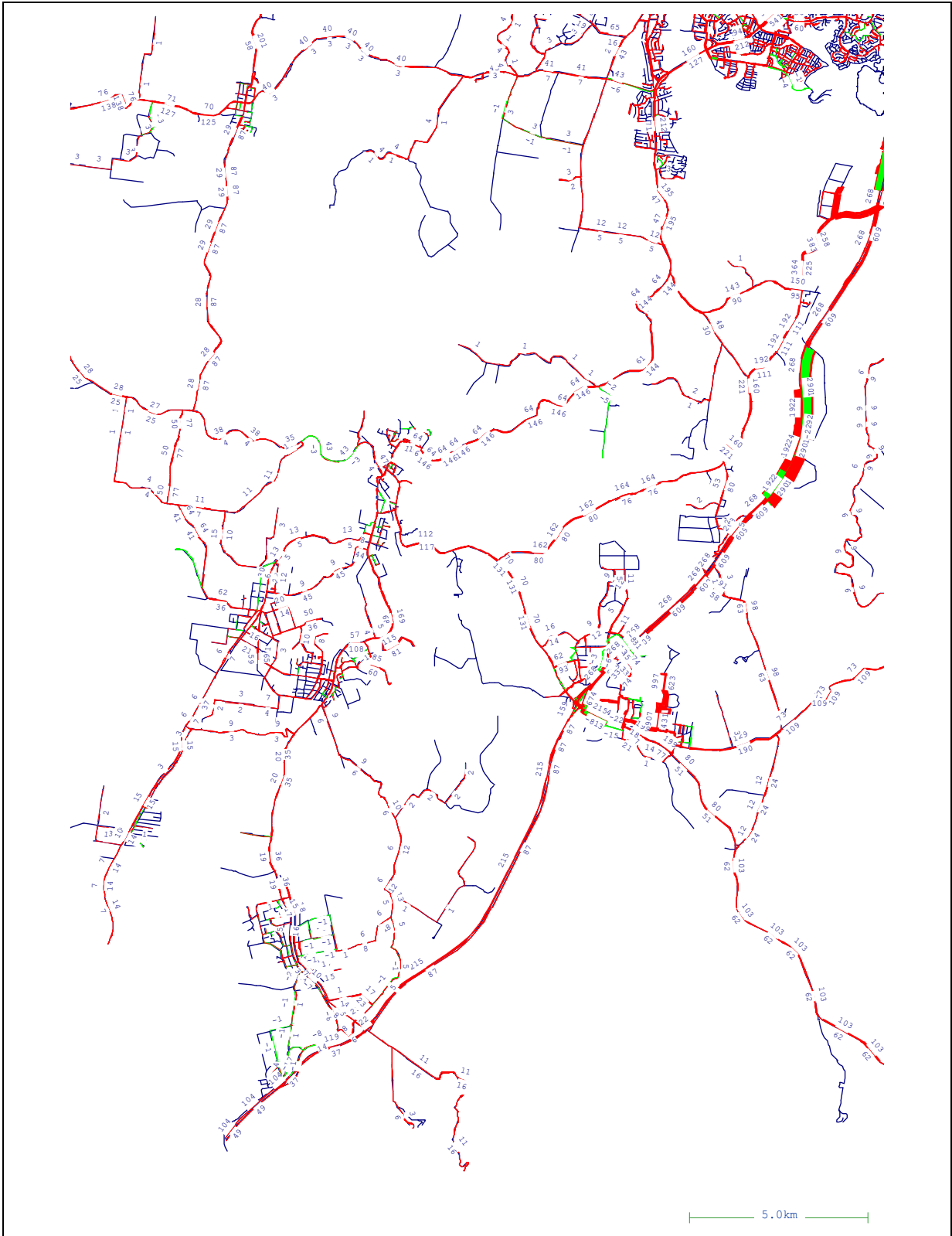


Figure D-16: South Wollondilly PM Peak 2016 Volume



Figure D-17: South Wollondilly PM Peak 2026 Volume





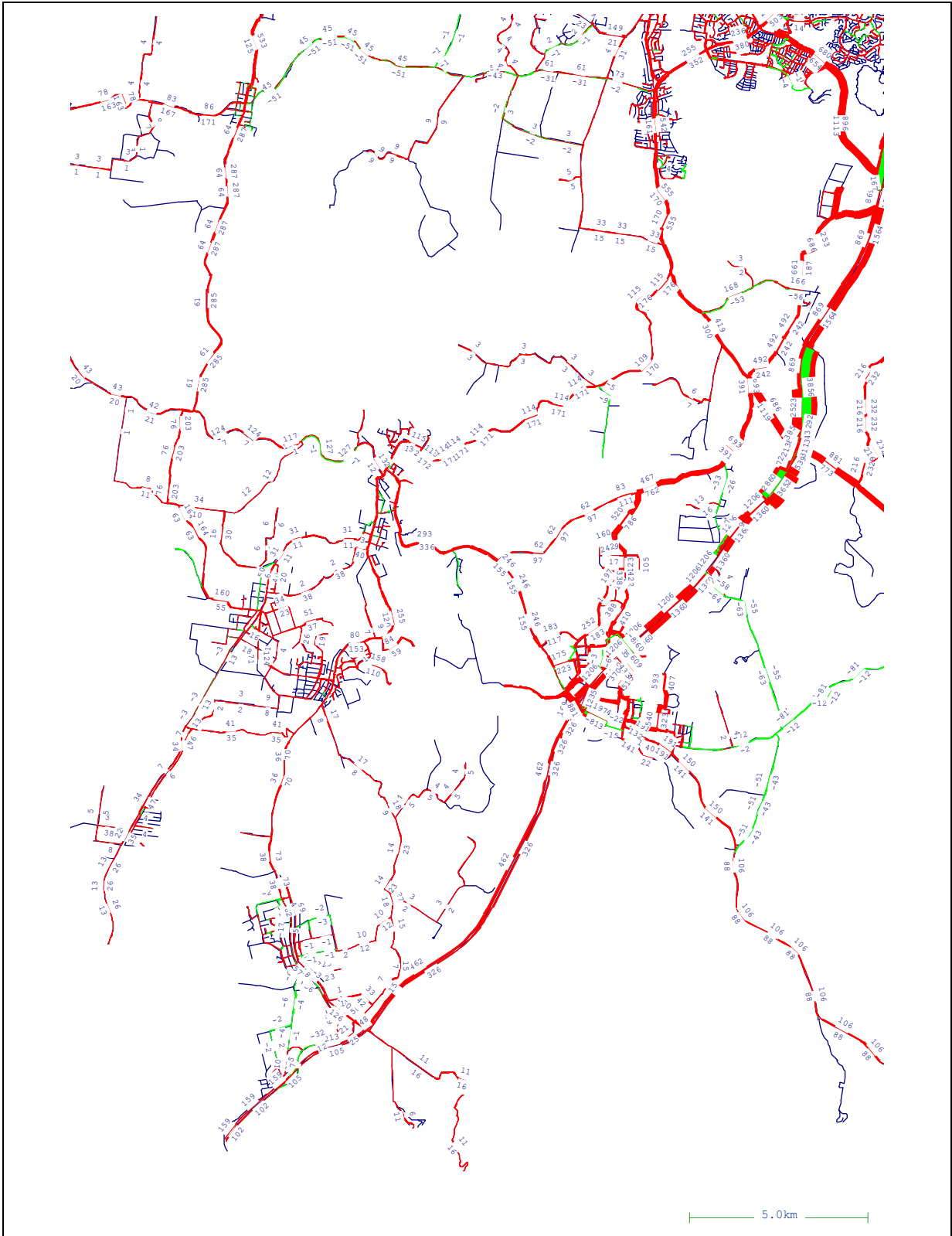


Figure D-20: South Wollondilly PM Peak 2016-2036 Change in Volume

Appendix E MRTM Model Validation Report



MACROC Model Development 2017

Camden Council - Wollondilly Shire
Council - Campbelltown City
Council

Transportation Model Development

October 2017

MACROC Model Development 2017

Camden Council - Wollondilly Shire
Council - Campbelltown City
Council

Transportation Model Development

Quality Assurance Statement

Prepared by:

Pip Masters

Project Transportation Planner



Reviewed by:

Dave Hunter

Senior Principal Transportation
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Approved for Issue by:

Dave Hunter

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Status: Final Report

Date: 17 October 2017



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Table of Contents

1.	Introduction	1
1.1	Objectives	1
1.2	Report Content	1
2.	Model Overview.....	2
2.1	Model Form	2
2.2	The Road Network	4
2.3	The Zone System.....	5
2.4	Mode Share	5
3.	Land Use Data	10
3.1	2016 Land Use	10
3.2	Land Use Summary	11
4.	Trip End Generation.....	12
4.1	General	12
4.2	Private Trip End Productions	13
4.3	Goods Vehicle Trips	21
4.4	External Trips	22
5.	Trip Distribution and the Costs of Travel	31
5.1	The Gravity Distribution Model	31
5.2	The Distribution Function	31
6.	Trip Assignment	33
6.1	Costs of Travel	33
6.2	Loading Profiles	33
6.3	Network Links	34
6.4	Network Intersections	38
7.	Model Convergence	41
7.1	Assignment and Distribution Loop	41
8.	Model Validation.....	42
8.1	General	42
8.2	Network Screenline Validation	42
8.3	Cordon Validation Results	50
8.4	Trip Length Frequency	66
9.	Conclusion.....	69

Appendix A

2016 Land Use Zone Files

Appendix B

Cordon Validation Output File

Appendix C

2016 Network

Appendix D

2016 Zone System

1. Introduction

1.1 Objectives

The original Camden-Wollondilly Transportation model was developed and maintained by TDG using the TRACKS Transportation Modelling Suite for both the Camden and Wollondilly Shire Councils.

Whilst the Camden-Wollondilly model included all the roads and intersections within Campbelltown, the level of coding used in the Campbelltown area only allowed for the important interaction between Campbelltown and Camden-Wollondilly and did not include any level of validation against actual traffic counts included within the Campbelltown area.

To enable the Campbelltown part of the model to be used in a predictive sense, the model required expansion with validated traffic flows in Campbelltown comparable to the Camden-Wollondilly part of the model.

The objectives of this project were to:

- Expand the Camden-Wollondilly Transportation model to form a new MACROC Transportation Model;
- Validate the Campbelltown model area along with a revalidation of the model within the existing Wollondilly and Camden areas to ensure the model continues to perform to the high level of accuracy expected by all of the contributing Councils.

1.2 Report Content

This report is a technical document and it is intended to be a reference volume of how the transportation model was built and contains all the information necessary to completely build the analytical system. It highlights the assumptions made, the techniques adopted and the relationship used. This report also demonstrates the extent to which the model was validated and how well it replicates travel demand and actual traffic flows.

2. Model Overview

2.1 Model Form

Planning of a land use transport system requires that the system can be adequately modelled and the effects of any change can be reliably forecast.

A useful method is to build mathematical models that simulate travel behaviour. The land use and traffic modelling used for this study comprised three sequential stages. They were trip generation, trip distribution, and trip assignment followed by a number of evaluation procedures. The transportation model was developed within the transportation planning package TRACKS, and run on PC systems.

2.1.1 Trip End Generation

The generation of trip ends for each sub area (zone) within the study area. The trip ends were generated according to the pattern of households and employment activity, and then allocated accordingly.

The model is based on vehicle trips, rather than person trips because at this stage of network analysis we are primarily interested in is vehicle interaction, road network performance and vehicle parking rather than the movement of individuals. As a result, the modal split phase was inherent in the trip end generation rather than following the distribution stage.

2.1.2 Trip Distribution

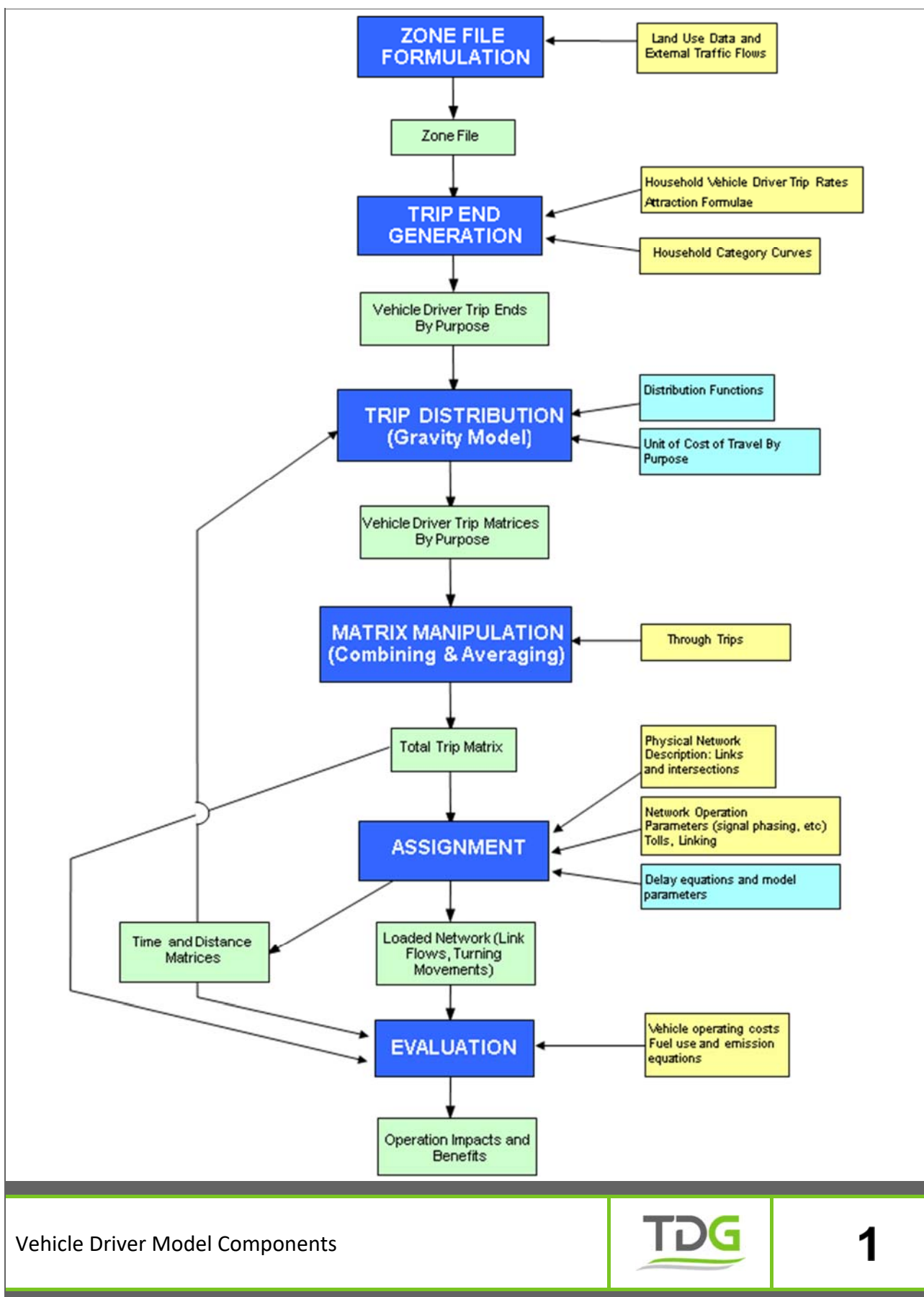
The conversion of trip ends to trips distributed within the study area according to a function of activity and travel cost.

2.1.3 Trip Assignment

The loading of trips onto the road network as traffic flows between zones. The evaluation of the model in its validation stage is to ensure that it replicates actual conditions as they occurred in 2016.

The relationships between the different components are summarised schematically in **Figure 1**. Evaluation and operational impacts of particular projects will be the subject of later reports for Council decision making and funding.

There is an iterative process where the interzonal times and distances which result from the assignment phase feed back into the trip distribution phase. The process can be started by assuming times and distances as initial inputs to distribution, or by assuming initial trips as input to assignment. In any event, the assignment/distribution loop is repeated until there is little or no change in the vehicle hours and vehicle kilometres of travel between iterations. Note that this will only occur if there is sufficient capacity in the network.



2.2 The Road Network

The original road network of the 2006 Camden-Wollondilly Model was obtained from the both the Camden Council and Wollondilly Shire Council GIS databases with the original model boundary stopping at Silverdale Road in the north and Narellan Road in the east. The 2006 model network is shown in **Figure 2**.

This 2006 model was expanded east to include Campbelltown (in detail) and north into Sydney (in “buffer” form). The geographic area of the new MACROC model stretches from Penrith and Blacktown in the north, Bargo in the south and Campbelltown in the east. The townships of Wedderburn and Appin are also included. The MACROC model coverage is shown in the **Figure 3**.

Two road network centreline GIS layers were used to construct the model road network. Firstly the RMS Local Roads GIS layer, which contains all of the road types from Local Road to major State Highway, was used for the Wollondilly, Camden and Campbelltown areas. This permitted the model to undertake a detailed level of intersection and link analysis within the studied areas.

Secondly the RMS Classified Road GIS layer which contained all of the main arterial and collector road links only. This coarser road network detail was used for the Liverpool, Fairfield, Blacktown and Penrith areas to provide a “buffer” network to the north to model the interaction between Camden-Wollondilly and neighbouring Sydney areas in the north.

More detailed model networks plots are shown in the Appendix C. Figures C-2 to C-3 show the modelled road network in the Camden-Wollondilly, Figure C-4 shows the modelled road network in the Campbelltown, and Figure C-5 shows all main roads modelled in the Sydney areas of the model.

Because the network is a true representation of a road, distances have been calculated directly from the three dimensional co-ordinate data. Link distances are calculated directly from the GIS based centrelines.

All other components of network coding were prepared from visual inspection or from the latest Google Earth aerial images. This included:

- Link lanes
- Link free flow speeds
- Approach controls
- Approach lanes and discipline

All roundabouts and priority intersections were coded into the network. As the network is GIS based, the movement conflicts for priorities are calculated from geometry after the approach control and lane disciplines are coded. It is not necessary for the user to define which movement conflicts with which. Conflicting movements are automatically identified within the software from the geometry of the network. The data entry programs in SIDRA 2.1 are used to code signalised intersection files.

2.3 The Zone System

Originally, the 400 zones used in the 2006 Camden-Wollondilly Model were based on the available Census Collector District (CCD) boundaries. The zone system has been reconstructed and expanded to utilise the new Australian Bureau of Statistics Statistical Area Level 1 (SA1) census boundaries and the Bureau of Transport Statistics (BTS) 2016 Travel Zone (TZ11) system. These expand the original 400 zones up to 1250 zones, including 115 spare zones for future model development and 58 external zones representing external inbound and outbound flows from outside the model area.

Both the SA1 and TZ11 boundaries were used to define the zone system. SA1 boundaries were used for the Wollondilly, Camden and Campbelltown areas to provide a finer level of zonal detail. TZ11 boundaries were used within the coarser buffer area in the north of the model area.

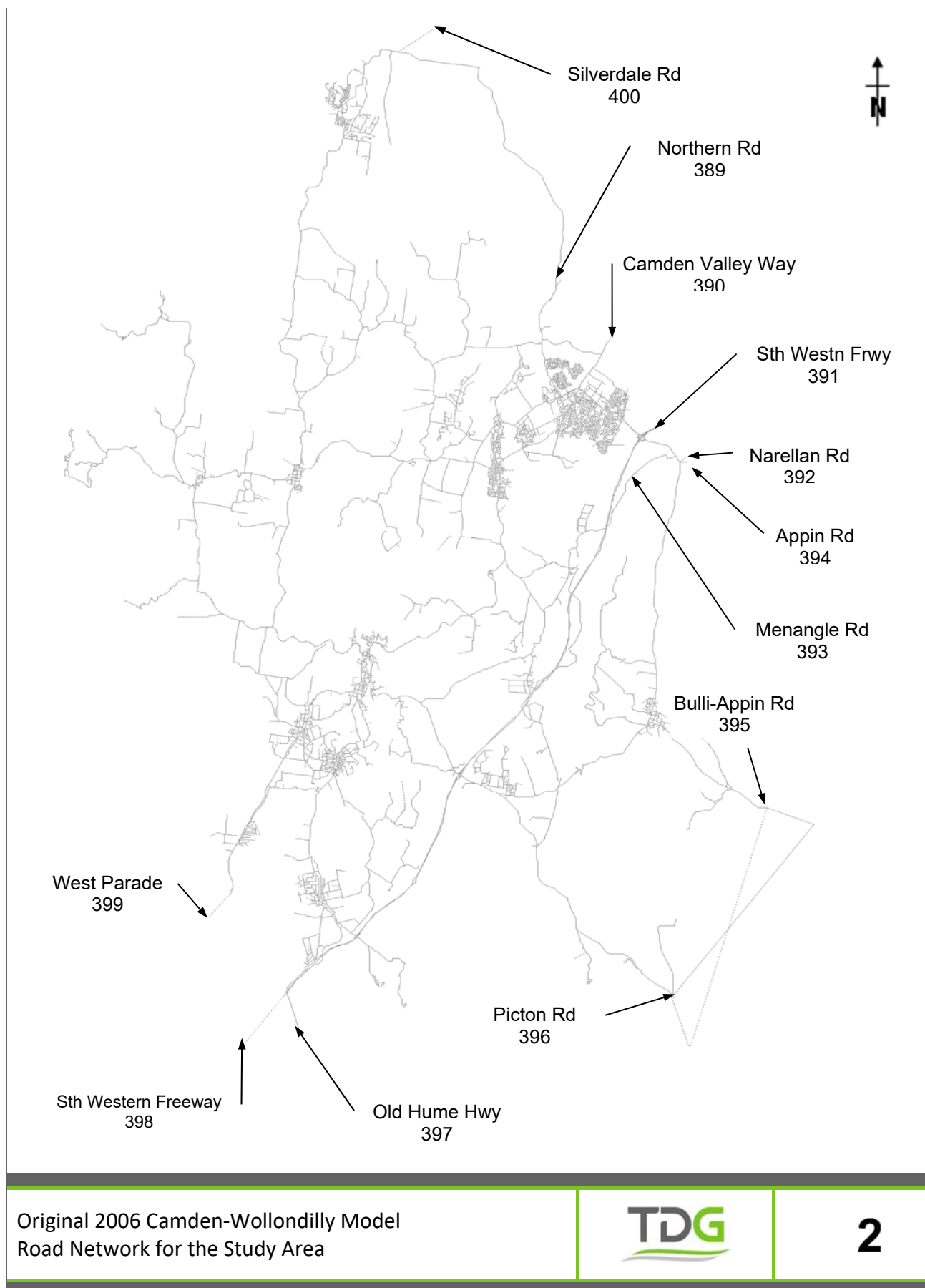
Each SA1 zone within the detailed part of the model was correlated to the TZ11 that corresponded with its location. This enabled the use of BTS projections for land use within the entire model area. As SA1 areas are based predominantly on the number of households with each area, some of the SA1 zones representing industrial areas were found to be very large and included a disproportionately high number of jobs relative to other areas. These areas were manually split into smaller sub-SA1 areas that contained activity more comparable to other zones.

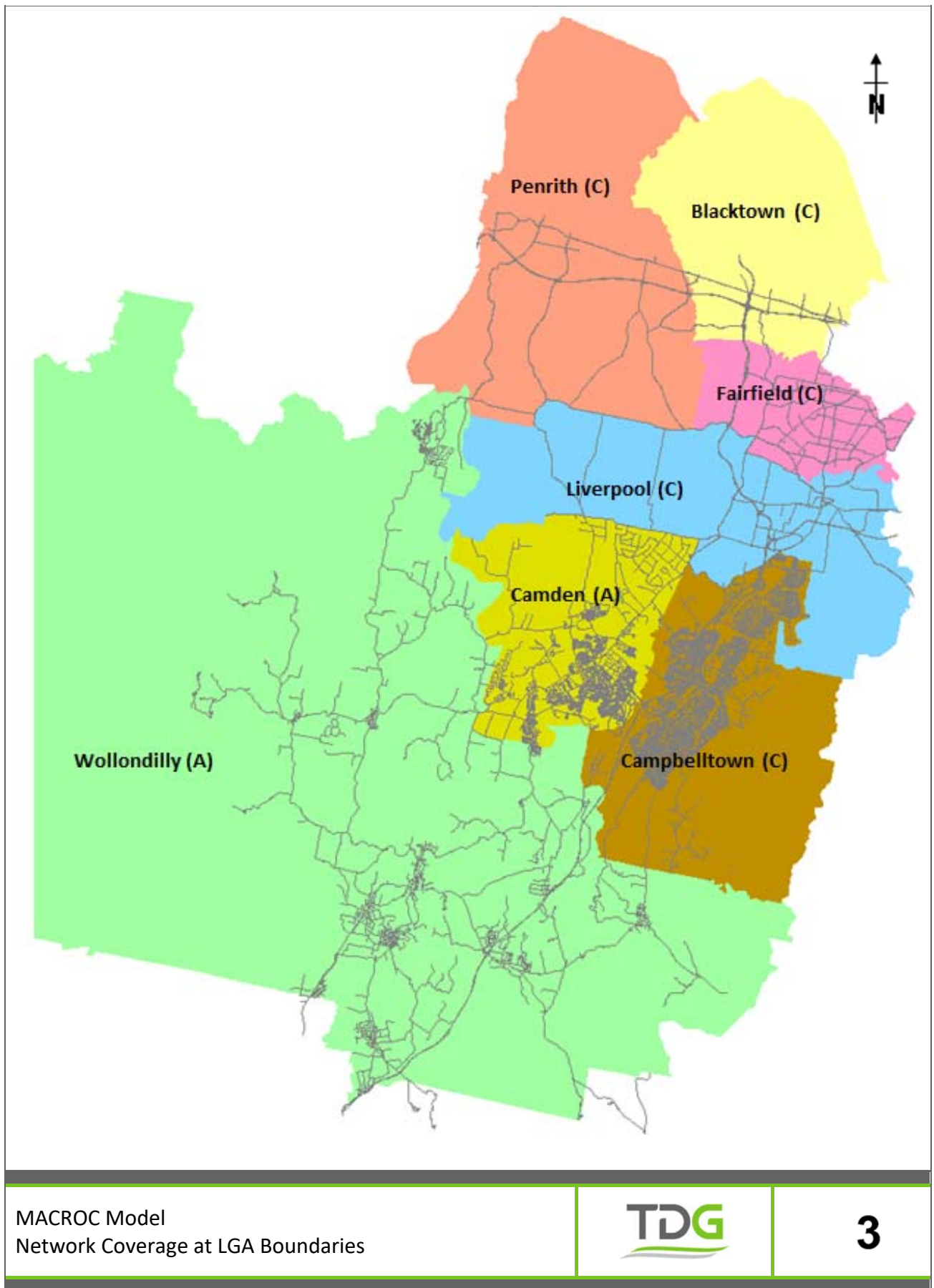
Based on the visual inspection, zone boundaries were carefully defined to avoid boundaries crossing geographic barriers (e.g. stream, mountains) and cutting through major arterial roads.

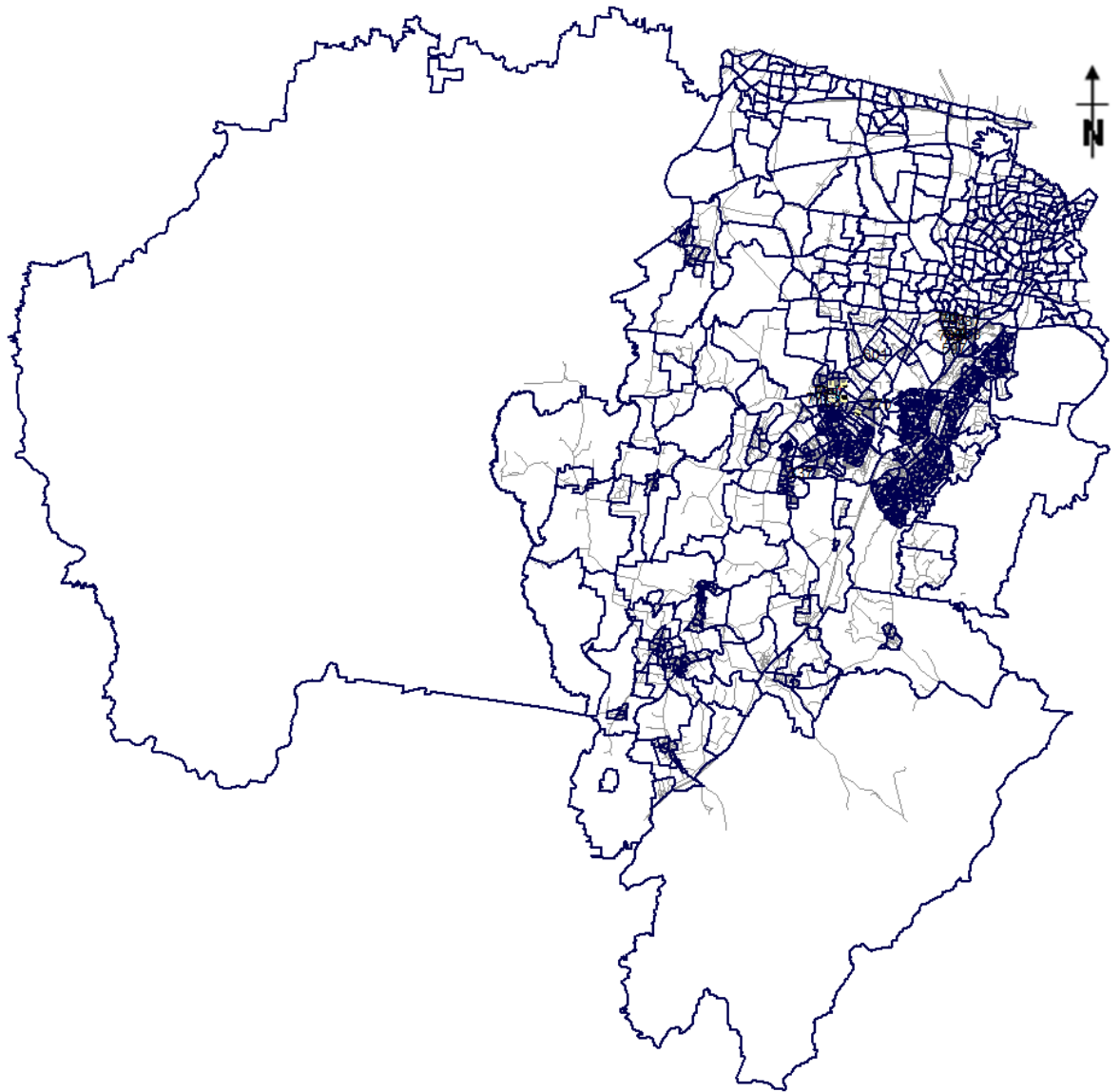
The model zone boundaries are shown in **Figure 4** and a zoomed in view of the zone boundaries in Campbelltown is shown in **Figure 5**. The detailed zone system plots are illustrated based on LGA Boundaries and shown in the Appendix D.

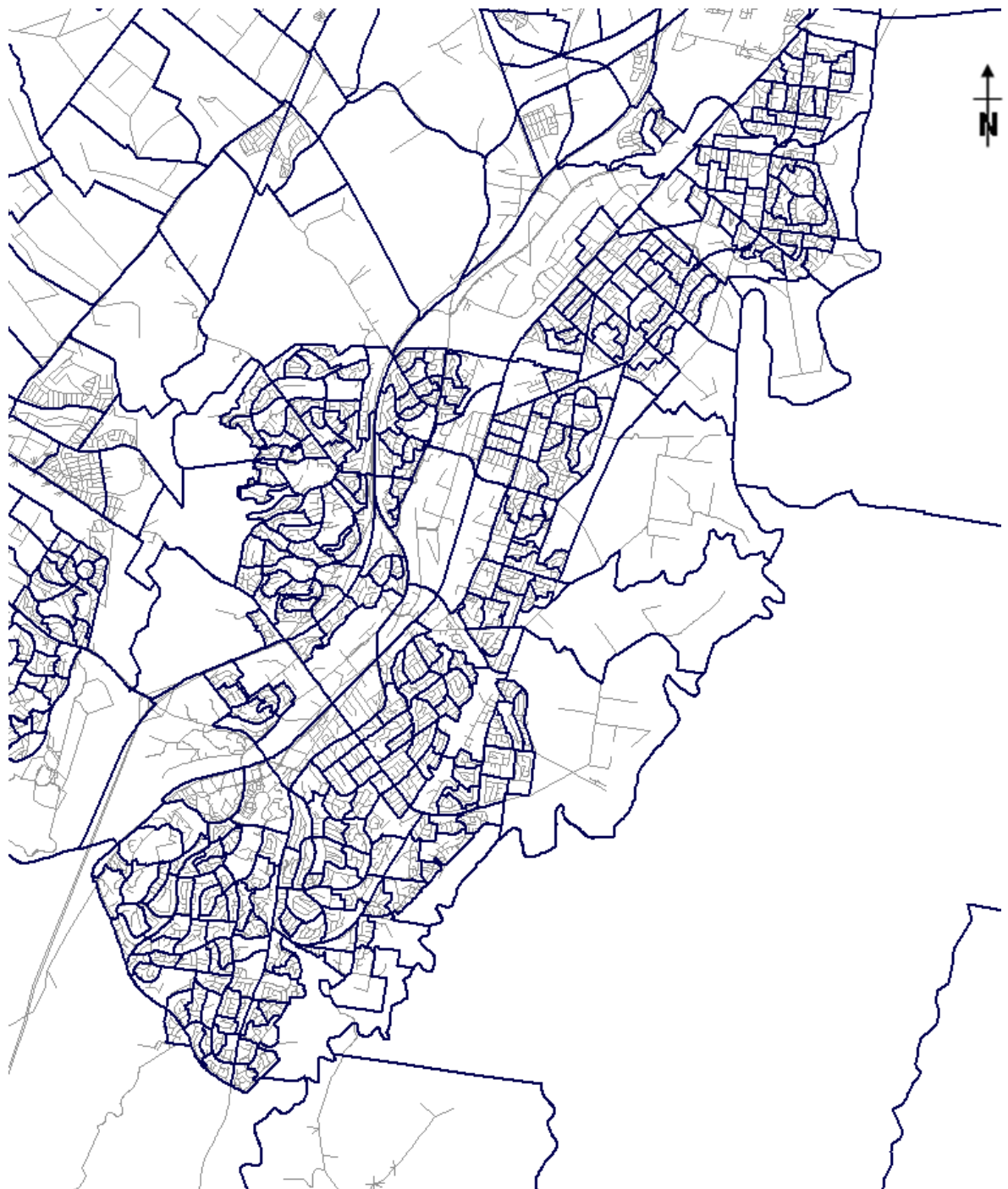
2.4 Mode Share

At this stage, only a three-step vehicle driver model has been developed. This has the implicit assumption that the existing mode share i.e. vehicle driver, passenger and public transport, as a proportion of the total trips are maintained in the future.









Campbelltown Zone System



5

3. Land Use Data

3.1 2016 Land Use

The key land use variables used by the modelling system were based on 2016 TPA land use projections and in association with 2016 census data:

- Households
- Average persons/household
- Average number of cars/household

At the workplace location jobs have been included as follows:

- All full time and part time jobs (i.e. number of people employed) by Australian Standard Industry Classifications (ASIC) Major Divisions:
 - Education
 - Retail
 - Accommodation
 - Wholesale
 - Construction
 - Health
 - Arts and Recreation
 - Manufacturing
 - Mining
 - Total Employment

3.2 Land Use Summary

Table 1 summarises the 2016 land use totals that apply to the model area.

Main Land Use Categories	Description of Land Use Categories	Code	Study Area Totals 2016
Residential in Camden-Wollondilly-Campbelltown (CWC)	Total Households	(HH)	89312
	Persons	(PP)	269890
	Persons per Household		3.022
	Vehicles	(CAR)	169331
	Vehicles per Household		1.896
Residential in Lower Sydney	Total Households	(HH)	157295
	Persons	(PP)	503093
	Persons per Household		3.198
	Vehicles	(CAR)	281185
	Vehicles per Household		1.788
Jobs	Education	(EDU)	27115
	Retail	(RET)	38527
	Accommodation	(ACC)	21138
	Wholesale	(WHO)	14968
	Construction	(CON)	27298
	Health	(HEA)	41193
	Arts and Recreation	(ART)	3824
	Manufacturing	(MAN)	11979
	Mining	(MIN)	2520
	Total Jobs	(TOT)	306412
Special Land Use	CBD Parks	(CBD)	1486
	AM External Inbound Job Attractions	(AMIJ)	46094
	AM External Outbound Job Attractions	(AMOJ)	50764
	PM External Inbound Job Attractions	(PMIJ)	54830
	PM External Outbound Job Attractions	(PMOJ)	47493

Table 1: Land Use 2016

4. Trip End Generation

4.1 General

Trip end generation is divided into three main categories – private, commercial and external.

The private trip generation used in this update has been taken directly from the analysis prepared by TDG for the Roads and Maritime Services (RMS) of Illawarra household trip generation. This analysis involved data for “Illawarra” households obtained by the Bureau of Transport Statistics (BTS) as part of its continuous Household Travel Survey (HTS) between 2002 and 2012. When producing the 2006 traffic model only vehicle driver trips were considered. These private trips can be split into a number of purposes depending upon what activity or type of land use involved at the origin and destination.

Not all purposes, shown in **Table 2**, are relevant to each time period and the compression of these 20 overall purposes into statistically significant purposes for each time period has occurred. The private purposes may include the following:

Purpose Number	From	To
1	Home	Work
2		Education
3		Employers Business
4		Shopping
5		Personal Business
6		Social/Recreation
7		Serve Passenger
8		Change mode
9		Other
10	Non-Home Based	Work related
11	Non-Home Based	Personal
12	Work	Home
13	Education	
14	Employers Business	
15	Shopping	
16	Personal Business	
17	Social/Recreation	
18	Serve Passenger	
19	Change mode	
20	Other	

Table 2: Grouped Trip End Purposes into Trip Purposes

The production of these private trip purpose rates has been reported in “12711 21040715 Sydney HTS Analysis Report”, TDG July 2014. This report has been provided to the RMS and all councils in the “Illawarra” region for reference and should be referenced in association with this report. The calculation of the “Illawarra” trip rates involved HTS data collected in Campbelltown, Camden, Wollondilly, Wollongong, Shellharbour, Wingecarribee and Shoalhaven. Councils with reasonably high levels of interaction with each other and Sydney make up 82% of the data included in the trip rate analysis. Data directly related to Camden, Wollondilly and Campbelltown makes up 35% of the total data used in the assessment. The HTS data is considered representative of overall trip generation within the MACROC area.

The other trip purposes used for the study were:

- Light Goods Vehicles (LGV)
- Heavy Goods Vehicles (HGV)

External Traffic (EXT) including:

- Through traffic (external to external)
- Internally generated private trips (internal to external)
- Other internally generated trips and externally generated trips (external to internal)

4.2 Private Trip End Productions

Based on experience with the present generation of the Illawarra models, households were identified using a two dimensional household category model – namely five household size categories against four car ownership categories. The household size categories were 0, 1, 2, 3, 4 and 5+ people per household, while the car ownership categories were 0, 1, 2, and 3+ cars per household.

Household category curves have been calibrated with persons per household, or vehicles per household, plotted against the proportion of households in that category. These were subject to the constraints that the sum of proportions at any point was equal to 1.0, and that when multiplied out the average for the point was maintained. The curves describing the percentage of households within each category for a specific household composition are shown in **Figure 6**. These curves enable households of differing person and car combinations to be present in the same model and have trips appropriate to each household category calculated.

The assumption inherent in the use of these surveys is that the two variables (persons/HH and cars/HH) are not highly cross-correlated. The second reason for choosing these variables was the need to have categories that can be readily forecast, and persons, and cars are perhaps the easiest.

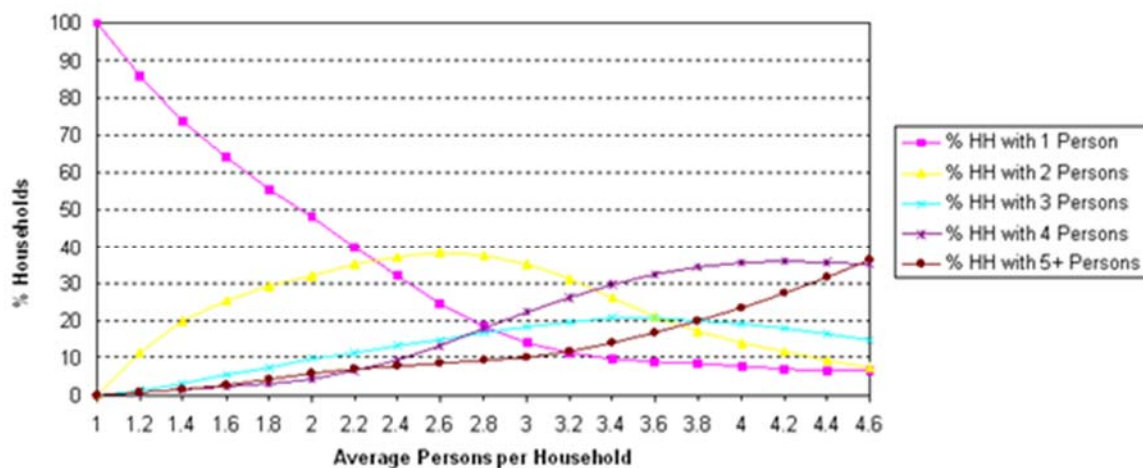
The number of households in each of the 20 categories for a zone depends on the average persons per household and cars per household giving a combined probability.

$$\text{i.e. } p_{2, 3+} = p_2 \times c_{3+}$$

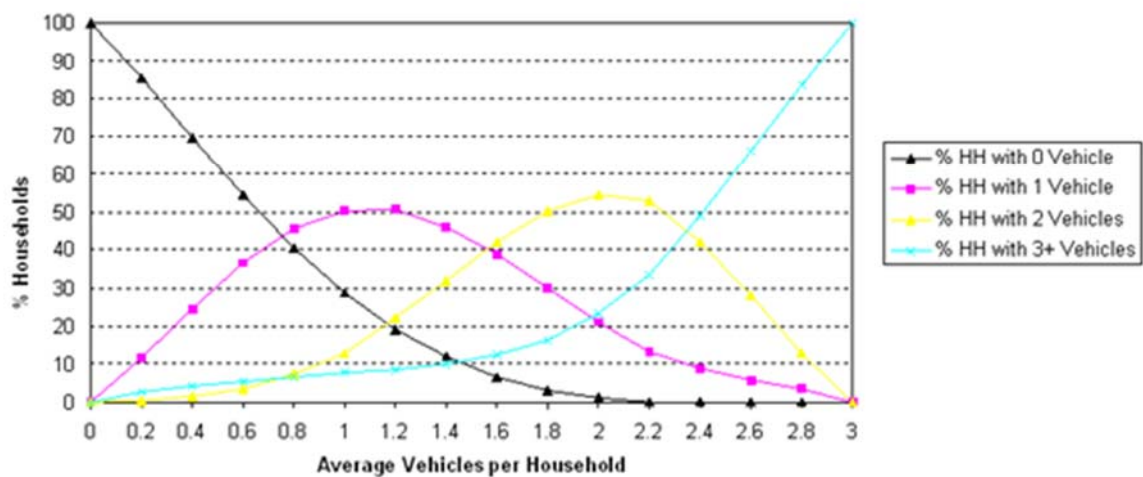
Where:

$p_{2, 3+}$ = proportion of households in category 2 person, and 3+ cars

PERSONS CATEGORY CURVES



VEHICLE OWNERSHIP CATEGORY CURVES



p_2 = proportion of households with two persons

c_{3+} = proportion of households with 3+ cars

The AM (0700-0900) and PM (1500-1800) peak trip rates (i.e. number of vehicle trips per household within these time periods) have been calculated.

The private trips were divided into separate purposes, as shown in Table 3 below. The number and type of trip purposes differ between periods depending on which purposes are statistically significant within each period.

Period	Trip Purpose
AM Peak	Home to Work (HTW)
	Home to Education (HTE)
	Home to Employer Business (HTB)
	Home to Other (HTO)
	Non Home Based Long (NHBL)
	Non Home Based Short (NHBS)
	Other to Home (OTH)
PM Peak	Home to Other (HTO)
	Non Home Based Long (NHBL)
	Non Home Based Short (NHBS)
	Work to Home (WTH)
	Shop to Home (STH)
	Other to Home (OTH)

Table 3: Trip Purposes

Experience has shown that where possible 'from home' and 'to home' trips should be modelled separately in order to preserve the directionality of the trips. This is particularly important in the inter peak period where these purposes are of similar order and in the evening peak, which is more diverse than the morning peak.

It is plausible that a household which does not have a vehicle available may still generate a small number of trips. This would be the case where a car is loaned from another source (friend, family member at another household or use of a company car) later in the day.

4.2.1 Morning Peak Private Trip End Productions

Private car driver trip ends were produced by using the 'category model' derived from the HTS data. The morning peak period generation is for the two hours for trips beginning between 7am and 9am. Generation was carried out as 'Home to' and 'to Home' purposes to reflect the tidal movement of trips.

Note that the resulting two-hour trip matrix is later converted to a one-hour matrix (by multiplying by a factor of 0.508) when the total trip matrix is formed. This peak hour factor

was calculated from over 25 count locations throughout the model area and represents the overall average two-hour to one-hour factor for the AM Peak period.

The trip rates used are shown in **Table 4** below.

Home to Work - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.121	0.000	0.000	0.097
2	0.000	0.056	0.407	0.000	0.276
3	0.000	0.082	0.274	0.635	0.381
4	0.000	0.147	0.320	0.718	0.463
5+	0.000	0.000	0.480	0.461	0.421
Average	0.000	0.094	0.374	0.611	0.306
Home to Education - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.015	0.000	0.000	0.012
2	0.000	0.000	0.019	0.000	0.012
3	0.000	0.046	0.045	0.051	0.046
4	0.000	0.000	0.025	0.087	0.048
5+	0.000	0.000	0.036	0.107	0.073
Average	0.000	0.011	0.026	0.080	0.031
Home to Employers Business - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.086	0.000	0.000	0.069
2	0.000	0.013	0.105	0.000	0.071
3	0.000	0.027	0.095	0.215	0.130
4	0.000	0.079	0.059	0.218	0.129
5+	0.000	0.000	0.038	0.188	0.120
Average	0.000	0.053	0.089	0.208	0.096
Home to Other - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.209	0.000	0.000	0.167
2	0.000	0.387	0.342	0.000	0.347
3	0.000	0.711	0.584	0.511	0.559
4	0.000	0.362	1.022	0.776	0.816
5+	0.000	0.804	1.159	1.193	1.131
Average	0.000	0.343	0.583	0.804	0.513

Non Home Based Total - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.068	0.000	0.000	0.108
2	0.000	0.066	0.181	0.000	0.273
3	0.000	0.184	0.238	0.294	0.489
4	0.000	0.180	0.318	0.469	0.720
5+	0.000	0.113	0.436	0.643	1.040
Average	0.000	0.174	0.479	0.915	0.438
Other to Home - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.048	0.000	0.000	0.038
2	0.000	0.059	0.129	0.000	0.157
3	0.000	0.241	0.235	0.194	0.443
4	0.000	0.247	0.358	0.242	0.512
5+	0.000	0.352	0.500	0.512	0.944
Average	0.000	0.092	0.224	0.305	0.417

Table 4: Morning Peak Trip Rates by Purpose – Car Drivers

For any particular zone the average number of vehicles per household and number of persons per household were provided in the land use zone files. The proportion of households in each category was established from the combined probability curves shown in Figure 6. These curves are applied to all period models.

These category trip rates have been calibrated for typical Illawarra council areas. As a result they appeared to result in a total number of household trips per period higher than would be typically expected in large built-up urban areas with high public transport use such as Campbelltown and the other buffer areas of the Sydney. As a result, for all Campbelltown and Sydney zones the rates shown in Table 4 have been reduced by 23% to better reflect the lower private vehicle trip making in these high density urban areas.

The HTS study indicated that over the all-day period the Campbelltown trip rate distribution between household categories was not appreciably different to the other areas in the Illawarra analysis area. However it was also apparent that the overall Campbelltown all-day car trip rate was over 15% lower than both Camden and Wollondilly. As suggested above, the significantly greater access to public transport in Campbelltown could be a contributing factor to this difference. It is also likely that there would be little difference between the areas during the inter-peak periods and that the majority of that reduced daily rate would need to be accounted for during the AM and PM peak periods.

4.2.2 Evening Peak Private Trip End Productions

Private car driver trip ends were similarly produced for the evening peak. The evening peak period generation is for trips which began between the three hours from 3pm to 6pm. Generation was carried out as 'Home to' and 'to Home' purposes to reflect the tidal movement of trips.

Note that the resulting three-hour trip matrix is later converted to a one-hour matrix (by multiplying by a factor of 0.347) when the total trip matrix is formed. As with the morning peak period, this peak hour factor was calculated from over 25 count locations throughout the model area and represents the overall average three-hour to one-hour factor for the pM Peak period.

The trip rates used are shown in **Table 5** below.

Home to Other - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.172	0.000	0.000	0.137
2	0.000	0.302	0.317	0.000	0.302
3	0.000	0.428	0.428	0.653	0.508
4	0.000	0.699	0.826	1.059	0.901
5+	0.000	1.050	1.039	1.068	1.042
Average	0.000	0.300	0.495	0.915	0.487
Non Home Based Total - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.162	0.000	0.000	0.258
2	0.000	0.110	0.264	0.000	0.442
3	0.000	0.139	0.269	0.479	0.649
4	0.000	0.312	0.493	0.737	1.135
5+	0.000	0.461	0.618	0.627	1.201
Average	0.000	0.321	0.707	1.222	0.642
Work to Home - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.161	0.000	0.000	0.129
2	0.000	0.072	0.376	0.000	0.262
3	0.000	0.133	0.358	0.628	0.419
4	0.000	0.240	0.479	0.680	0.527
5+	0.000	0.000	0.521	0.660	0.548
Average	0.000	0.129	0.405	0.655	0.339

Shopping to Home - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.255	0.000	0.000	0.204
2	0.000	0.559	0.581	0.000	0.556
3	0.000	0.719	0.658	0.824	0.718
4	0.000	0.826	1.201	1.238	1.154
5+	0.000	1.144	1.498	1.460	1.424
Average	0.000	0.465	0.791	1.154	0.709

Other to Home - Car Driver Trip Rates					
	Cars per Household				
Persons / HH	0	1	2	3+	Average
1	0.000	0.075	0.000	0.000	0.060
2	0.000	0.007	0.172	0.000	1.028
3	0.000	0.095	0.086	0.270	0.904
4	0.000	0.000	0.192	0.341	1.175
5+	0.000	0.000	0.188	0.473	1.819
Average	0.000	0.047	0.162	0.355	1.108

Table 5: Evening Peak Trip Rates by Purpose – Car Drivers

Again, these category trip rates have been calibrated for typical Illawarra council areas. As a result they result in a total number of household trips per period higher than would be typically expected in large built-up urban areas with high public transport use such as Campbelltown and the other buffer areas of the Sydney. As a result, for all Campbelltown and Sydney zones the rates shown in Table 5 have been reduced by 23% to better reflect the lower private vehicle trip making in these high density urban areas.

4.2.3 Private Trip Attractions

Attractions have come from the analysis of the HTS and the procedure followed to calculate the models calibrated regression equations are fully documented in “12711 21040715 Sydney HTS Analysis Report”, TDG July 2014. The attractions for each trip purpose are detailed in **Table 6** and **Table 7**.

Each of the purpose trip ends were regressed against the land use variables provided by BTS for each of the travel zones within the model area. This data consisted of households and jobs by workplace location for the 22 ANZSIC06 job industry classifications. The following land uses were used as the independent variables:

HH	=	Number of Households
RET	=	Retail Jobs
EDU	=	Education Jobs
ACC	=	Accommodation Jobs
MAN	=	Manufacturing Jobs

MIN = Mining Jobs
 CON = Construction Jobs
 HEA = Health Jobs
 TOT = Total Jobs
 AMI = AM Inbound External Attraction
 AMO = AM Outbound External Attraction
 PMI = PM Inbound External Attraction
 PMO = PM Outbound External Attraction

4.2.4 Morning Peak Private Trip Attractions

Trip Purpose	Attraction Equation
Home to Work	$0.161TOT + 1.023AMO$
Home to Education	$0.542EDU$
Home to Employer Business	$0.029TOT + 0.091HH$
Home to Other	$0.200EDU + 0.746ACC + 0.241RET + 0.179HH$
Non Home Based Long – (FROM)	$0.105TOT + 0.149HH + 0.255AMI$
Non Home Based Long – (TO)	$0.146TOT + 0.096HH + 0.229AMO$
Non Home Based Short – (FROM)	$0.105TOT + 0.149HH + 0.255AMI$
Non home based Short – (TO)	$0.146TOT + 0.096HH + 0.229AMO$
Other to Home	$0.179RET + 0.365WHO + 0.124HH + 1.698AMI$

Table 6: Morning Peak Attraction Equations

4.2.5 Evening Peak Private Trip Attractions

Trip Purpose	Attraction Equation
Home to Other	$1.094ACC + 0.423HEA + 2.652ART + 0.100HH + 0.717PMO$
Non Home Based Long – (FROM)	$1.371ACC + 0.054EDU + 0.106TOT + 0.118HH + 0.343PMI$
Non Home Based Long – (TO)	$1.233ACC + 0.393RET + 0.084EDU + 0.166HH + 0.368PMO$
Non Home Based Short – (FROM)	$1.371ACC + 0.054EDU + 0.106TOT + 0.118HH + 0.343PMI$

Non Home Based Short – (TO)	1.233ACC + 0.393RET + 0.084EDU + 0.166HH + 0.368PMO
Work to Home	0.148TOT + 0.924PMI
Shopping to Home	0.654ACC + 0.581RET + 0.223HH
Other to Home	0.248MAN + 0.133EDU + 0.101HH + 0.133PMI

Table 7: Evening Peak Attraction Equations

Note that a proportion of the internally generated home based trips are attracted to the external zones due to employment, retail centres and other attractors outside of the Study Area (especially in Sydney).

Land use variables for in and out bound related attraction have been used to allow internally generated private trips within the distribution model to compete between internal and external attractions. This variable does not equate to specific jobs outside the model area but instead establishes a distribution of attractions across the external roads.

The attraction to and from the externals are based on the external flow at each of the external zones. The coefficients used in the attraction model are primarily aimed at attracting northern area flows to northern externals as the majority of flow to and from northern zones are to other areas within Sydney rather than down into the Camden-Wollondilly-Campbelltown area. The coefficients have been tuned so that internal to external generated flow equals external to internal generated flow for each model period.

The BTS Journey to work (JTW) analysis indicates that approximately 51% of all Home Based Work trips to and from the model area have a destination in Sydney outside the model area. In addition, a proportion of internally generated Home Based Other and Non Home Based trips have destinations outside the model area. The RMS Sydney Road Assignment Model (SRAM) has been used to determine the overall percentage of period trips with an origin or destination in the model area but with the other end of their trip outside the model in Sydney.

The RMS model indicates that in the AM period 25.1% of inbound external trips and 25.9% of outbound external trips are to/from internal model location. In the PM period 25.1% of inbound external trips and 23.5% of outbound external trips are to/from internal model location. The above attraction equations have been calibrated to match those percentages.

Overall, the model therefore assumes that approximately 40% of all external model flow results from internally generated traffic. Zones 1193 to 1199, in the Penrith area, and 1246 to 1250, in the South Wollondilly area, were not considered to be significant attractors of internally generated trips and so have not been included in the private trip external distribution model.

4.3 Goods Vehicle Trips

Light and Heavy Goods Vehicle movements are important components of transport models. This study has incorporated a general background level of goods vehicle activity by modelling these trips as two separate purposes.

Regression equations were used to provide both productions and attractions for goods vehicles. For internal to internal trips it is difficult to determine whether the origin or destination generates the demand for the trip. Hence the same equation is used to generate both the productions and attractions.

The LGV and HGV equations are the same as those used in the Illawarra models and originate from the Christchurch Commercial Vehicle Survey (1993). The equations used were:

AM Peak

$$\text{LGV} = 0.034\text{HH} + 0.064\text{EDU} + 0.245\text{RET} + 0.245\text{ACC} + 0.064\text{HEA} + 0.064\text{ART} + 0.057\text{MAN} + 0.057\text{MIN}$$

$$\text{HGV} = 0.017\text{HH} + 0.100\text{EDU} + 0.088\text{RET} + 0.088\text{ACC} + 0.100\text{HEA} + 0.100\text{ART} + 0.022\text{MAN} + 0.022\text{MIN}$$

PM Peak

$$\text{LGV} = 0.027\text{HH} + 0.052\text{EDU} + 0.198\text{RET} + 0.198\text{ACC} + 0.052\text{HEA} + 0.052\text{ART} + 0.047\text{MAN} + 0.047\text{MIN}$$

$$\text{HGV} = 0.015\text{HH} + 0.080\text{EDU} + 0.072\text{RET} + 0.072\text{ACC} + 0.080\text{HEA} + 0.080\text{ART} + 0.017\text{MAN} + 0.017\text{MIN}$$

4.4 External Trips

For vehicle trips entering or leaving the study area there are 48 external cordon stations. Traffic entering the study area via roads crossing the study area boundary is called external traffic.

External traffic consists of trips travelling through the study area and travel generated internally as Home to Work or other private trips where the destination is generally Sydney. It also includes the remaining traffic generated within the study area (e.g. goods vehicles trips) and those generated externally.

The Sydney Road Assignment Model (SRAM) has been used to provide 2016 MACROC Model with a more rigorous estimate of through movements and external inbound/outbound flows. Several through movement values have also been adjusted to more closely reflect surveyed flows, especially along the Hume Highway.

4.4.1 Through External to External Vehicle Trips

Through trips are explicitly detailed in the model using through matrices of both light and commercial vehicles combined. To ensure that they are not double counted, the number of through trips at each external station is subtracted from the total external flows before the remaining external-to-internal trips are generated and distributed. The through matrix is taken directly from the RMS SRAM model but is adjusted slightly for southern externals to reflect actual count data for those locations. Zero values indicate that no through trips to/from the external were recorded.

Table 8 details the total inbound and outbound through vehicle trips.

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1193	Sheehys Creek Rd	38	9	18	44
1194	Western Motorway	1750	870	867	2280
1195	Old Bathurst Road	380	197	158	499
1196	Russell Street	212	80	79	269
1197	Castlereagh Road	213	669	595	208
1198	Nth of Belmore Street	56	130	174	81
1199	Parker Street	356	420	414	386
1200	Dummy Zone on Great Western Hwy	0	0	0	0
1201	Dummy Zone on Great Western Hwy	0	0	0	0
1202	Werrington Road	236	209	321	314
1203	Charles Hackett Drive	9	167	103	7
1204	Queen Street	61	241	232	125
1205	Glossop Street	286	508	315	383
1206	Sydney Street	21	39	16	73
1207	Melbourne Street	160	0	146	0
1208	Mt Druitt Road	114	83	94	96
1209	Carlisele Ave	758	534	579	561
1210	George Street	214	44	144	112
1211	Chandler Street	144	66	64	75
1212	Beaconsfield Road	211	64	117	89
1213	Rooty Hill Road S	4	4	1	6
1214	Westlink M7 NB	1345	648	817	962
1215	Westlink M7 SB	0	1405	0	1992
1216	Doonside Road	1741	0	1370	0
1217	Walters Road	644	837	681	642
1218	Reservoir Road	378	92	454	70
1219	Flushcombe Road	1462	1051	965	1544
1220	Prospect Highway NB	846	628	387	975
1221	Prospect Highway SB	1917	1294	0	0
1222	Blacktown Road	1496	867	1154	1196
1223	Great Western Hwy EB	602	849	624	423
1224	Great Western Hwy WB	2352	4397	4067	2656

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1225	M4 Western Mtw EB	0	6395	0	4054
1226	M4 Western Mtw WB	4512	0	5072	0
1227	Hassall Street	118	136	134	150
1228	Warren Road	251	252	432	341
1229	Fairfield Road	414	350	343	434
1230	Pine Road	19	145	49	117
1231	Ellis Parade	18	3	3029	9
1232	Donald Street	205	85	175	135
1233	Woodville Road	1062	1453	838	1755
1234	Middleton Road	238	220	451	90
1235	Christinea Road	142	267	286	98
1236	Liewellyn Ave	0	1	2	0
1237	Binna Burra Street	85	34	121	91
1238	Hume Hwy	636	380	539	366
1239	Henry Lawson Road	1355	1074	1451	1100
1240	Milperra Road	188	267	380	251
1241	S Western Mtw EB	0	506	0	774
1242	S Western Mtw WB	769	0	600	0
1243	Heathcote Road	613	327	425	575
1244	Appin Road	102	163	150	221
1245	Picton Road	300	211	241	226
1246	Dummy Zone on Avon Dam Road	0	0	0	0
1247	Dummy Zone on Remembrance Drive	0	0	0	0
1248	Remembrance Drive NB	0	1317	0	1275
1249	Remembrance Drive NB	957	0	1457	0
1250	Wilson Drive	5	1	1	6
	All External Stations	29990	29990	28134	28134

Table 8: External Traffic – Through Movements

4.4.2 Internal to External Trips

The remaining external flow is made up of traffic that is either internally generated, as detailed in Section 4.2.5, or generated by external sources. The number of internally generated trips produced by internal households and attracted to external destinations is shown in **Table 9**. Zero values indicate that no internally generated inbound and outbound trips were attracted to/from the external.

The remaining external trips are generated by external sources and are therefore the external road flow less through trips and the internally generated trips. These externally generated external trips are shown in Table 10. This remaining flow is attracted using the following attraction equations:

AM Peak

$$\begin{aligned}\text{Inbound} &= 0.083\text{Total Jobs} \\ \text{Outbound} &= 0.048\text{Households}\end{aligned}$$

PM Peak

$$\begin{aligned}\text{Inbound} &= 0.048\text{Households} \\ \text{Outbound} &= 0.023\text{Households} + 0.054\text{Total Jobs}\end{aligned}$$

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1193	Sheehys Creek Rd	0	0	18	62
1194	Western Motorway	0	0	0	0
1195	Old Bathurst Road	0	0	0	0
1196	Russell Street	0	0	0	0
1197	Castlereagh Road	0	0	0	0
1198	Nth of Belmore Street	0	0	0	0
1199	Parker Street	2315	1441	1843	2121
1200	Dummy Zone on Great Western Hwy	0	0	0	0
1201	Dummy Zone on Great Western Hwy	0	0	0	0
1202	Werrington Road	522	554	618	521
1203	Charles Hackett Drive	41	296	275	100
1204	Queen Street	189	500	491	466
1205	Glossop Street	726	765	651	713
1206	Sydney Street	88	96	75	137
1207	Melbourne Street	134	0	79	44
1208	Mt Druitt Road	200	215	210	211
1209	Carlisle Ave	1354	1586	1554	1771
1210	George Street	150	25	106	147
1211	Chandler Street	459	435	435	442
1212	Beaconsfield Road	204	170	169	211
1213	Rooty Hill Road S	176	143	163	90
1214	Westlink M7 NB	1123	695	814	1127
1215	Westlink M7 SB	0	2842	0	2215
1216	Doonside Road	2718	0	2576	0
1217	Walters Road	864	898	634	860
1218	Reservoir Road	52	374	16	461

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1219	Flushcombe Road	772	677	697	652
1220	Prospect Highway NB	245	89	66	161
1221	Prospect Highway SB	1055	962	0	0
1222	Blacktown Road	38	0	43	115
1223	Great Western Hwy EB	145	149	90	95
1224	Great Western Hwy WB	363	219	534	407
1225	M4 Western Mtw EB	0	2185	0	2286
1226	M4 Western Mtw WB	3065	0	3498	0
1227	Hassall Street	1135	987	953	940
1228	Warren Road	2710	3574	3542	2435
1229	Fairfield Road	707	1247	1025	851
1230	Pine Road	101	242	90	335
1231	Ellis Parade	523	770	742	660
1232	Donald Street	88	131	207	126
1233	Woodville Road	1231	1598	1630	1380
1234	Middleton Road	219	139	231	148
1235	Christinea Road	366	664	524	379
1236	Liewellyn Ave	0	125	60	20
1237	Binna Burra Street	169	59	195	112
1238	Hume Hwy	1641	2115	2157	1712
1239	Henry Lawson Road	505	766	514	665
1240	Milperra Road	1743	2408	2752	1948
1241	S Western Mtw EB	0	5204	0	4821
1242	S Western Mtw WB	4822	0	4765	0
1243	Heathcote Road	1559	889	1041	1244
1244	Appin Road	877	307	303	837
1245	Picton Road	0	0	0	0
1246	Dummy Zone on Avon Dam Road	0	0	0	0
1247	Dummy Zone on Remembrance Drive	0	0	0	0
1248	Remembrance Drive NB	0	0	0	0
1249	Remembrance Drive NB	0	0	0	0
1250	Wilson Drive	0	0	0	0
	All External Stations	35396	36542	36387	34029

Table 9: External Traffic – Internally Generated Movements

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1193	Sheehys Creek Rd	0	0	9	24
1194	Western Motorway	3249	1322	1782	3028
1195	Old Bathurst Road	1072	369	545	1055
1196	Russell Street	499	212	329	559
1197	Castlereagh Road	2702	2143	2563	3000
1198	Nth of Belmore Street	1758	779	1389	1718
1199	Parker Street	700	561	934	839
1200	Dummy Zone on Great Western Hwy	0	0	0	0
1201	Dummy Zone on Great Western Hwy	0	0	0	0
1202	Werrington Road	158	215	313	206
1203	Charles Hackett Drive	12	115	139	40
1204	Queen Street	57	195	249	184
1205	Glossop Street	219	298	330	282
1206	Sydney Street	27	37	38	54
1207	Melbourne Street	41	0	40	18
1208	Mt Druitt Road	60	84	106	84
1209	Carlisele Ave	409	617	788	701
1210	George Street	45	10	54	58
1211	Chandler Street	139	169	220	175
1212	Beaconsfield Road	61	66	85	83
1213	Rooty Hill Road S	53	56	83	36
1214	Westlink M7 NB	339	271	413	446
1215	Westlink M7 SB	0	1106	0	876
1216	Doonside Road	821	0	1306	0
1217	Walters Road	261	350	321	340
1218	Reservoir Road	16	145	8	182
1219	Flushcombe Road	233	264	353	258
1220	Prospect Highway NB	74	35	34	64
1221	Prospect Highway SB	319	374	0	0
1222	Blacktown Road	11	0	22	46
1223	Great Western Hwy EB	44	58	46	37
1224	Great Western Hwy WB	110	85	270	161
1225	M4 Western Mtw EB	0	850	0	904
1226	M4 Western Mtw WB	926	0	1773	0
1227	Hassall Street	343	384	483	372
1228	Warren Road	819	1391	1795	963
1229	Fairfield Road	214	485	519	337
1230	Pine Road	30	94	46	133

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1231	Ellis Parade	158	300	376	261
1232	Donald Street	27	51	105	50
1233	Woodville Road	372	622	826	546
1234	Middleton Road	66	54	117	59
1235	Christinea Road	111	258	266	150
1236	Liewellyn Ave	0	48	30	8
1237	Binna Burra Street	51	23	99	44
1238	Hume Hwy	496	823	1093	677
1239	Henry Lawson Road	153	298	261	263
1240	Milperra Road	527	937	1395	771
1241	S Western Mtw EB	0	2025	0	1907
1242	S Western Mtw WB	1457	0	2415	0
1243	Heathcote Road	471	346	527	492
1244	Appin Road	265	120	154	331
1245	Picton Road	918	993	919	1143
1246	Dummy Zone on Avon Dam Road	0	0	0	0
1247	Dummy Zone on Remembrance Drive	0	0	0	0
1248	Remembrance Drive NB	0	1067	0	1325
1249	Remembrance Drive NB	1097	0	1119	0
1250	Wilson Drive	188	132	131	211
	All External Stations	22178	21239	27221	25502

Table 10: External Traffic – Externally Generated Movements

4.4.3 Total External Trips

The total external traffic flow, including through traffic, used in the study area is shown in **Table 11** below.

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1193	Sheehys Creek Rd	0	0	45	130
1194	Western Motorway	4998	2192	2649	5307
1195	Old Bathurst Road	1452	566	704	1554
1196	Russell Street	711	293	408	829
1197	Castlereagh Road	2915	2813	3158	3208
1198	Nth of Belmore Street	1814	909	1562	1799
1199	Parker Street	3371	2422	3190	3346
1200	Dummy Zone on Great Western Hwy	0	0	0	0
1201	Dummy Zone on Great Western Hwy	0	0	0	0

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1202	Werrington Road	916	978	1253	1041
1203	Charles Hackett Drive	62	579	518	146
1204	Queen Street	308	935	973	775
1205	Glossop Street	1230	1571	1297	1378
1206	Sydney Street	136	173	129	264
1207	Melbourne Street	335	0	265	62
1208	Mt Druitt Road	373	382	410	391
1209	Carlisele Ave	2520	2737	2921	3033
1210	George Street	410	78	304	317
1211	Chandler Street	742	669	719	692
1212	Beaconsfield Road	476	301	371	383
1213	Rooty Hill Road S	234	203	247	132
1214	Westlink M7 NB	2808	1613	2044	2535
1215	Westlink M7 SB	0	5353	0	5083
1216	Doonside Road	5280	0	5252	0
1217	Walters Road	1769	2085	1636	1842
1218	Reservoir Road	446	611	479	713
1219	Flushcombe Road	2466	1992	2015	2455
1220	Prospect Highway NB	1164	751	487	1200
1221	Prospect Highway SB	3290	2630	0	0
1222	Blacktown Road	1545	868	1219	1357
1223	Great Western Hwy EB	790	1056	759	555
1224	Great Western Hwy WB	2825	4701	4871	3225
1225	M4 Western Mtw EB	0	9430	0	7245
1226	M4 Western Mtw WB	8503	0	10343	0
1227	Hassall Street	1597	1507	1570	1462
1228	Warren Road	3780	5217	5769	3740
1229	Fairfield Road	1335	2083	1888	1621
1230	Pine Road	150	481	185	585
1231	Ellis Parade	699	1074	1147	930
1232	Donald Street	320	267	488	310
1233	Woodville Road	2665	3673	3294	3682
1234	Middleton Road	523	414	800	296
1235	Christinea Road	618	1190	1075	627
1236	Liewellyn Ave	1	174	92	28
1237	Binna Burra Street	305	116	415	247
1238	Hume Hwy	2773	3318	3789	2754
1239	Henry Lawson Road	2013	2138	2225	2028

ZONE	DESCRIPTION	AM (7-9)		PM (4-6)	
		In	Out	In	Out
1240	Milperra Road	2458	3612	4526	2969
1241	S Western Mtw EB	0	7736	0	7503
1242	S Western Mtw WB	7048	0	7780	0
1243	Heathcote Road	2644	1562	1993	2311
1244	Appin Road	1244	589	607	1390
1245	Picton Road	1218	1204	1160	1368
1246	Dummy Zone on Avon Dam Road	0	0	0	0
1247	Dummy Zone on Remembrance Drive	0	0	0	0
1248	Remembrance Drive NB	0	2385	0	2600
1249	Remembrance Drive NB	2054	0	2576	0
1250	Wilson Drive	193	132	132	217
	All External Stations	87527	87763	91742	87665

Table 11: External Traffic – Total External Movements

5. Trip Distribution and the Costs of Travel

5.1 The Gravity Distribution Model

The gravity model form chosen for this work was:

$$T_{ij} = P_i \cdot K_i \cdot A_j \cdot L_j \cdot f(c_{ij})$$

Subject to the double constraints of:

$$K_i = \frac{P_i}{\sum_j T_{ij}}$$

$$L_j = \frac{A_j}{\sum_i T_{ij}}$$

Where:

T_{ij}	=	Trips between zones i and j
P_i	=	Productions at zone i
A_j	=	Attractions at zone j
$f(c_{ij})$	=	Function of the travel cost between zones i and j
$K_i L_j$	=	Balancing factors

The balancing factors are successively applied until there is convergence. Some 50 iterations were used, and all purposes converged so that there was no difference between iterations to five decimal places.

The derivation of P_i and A_j has been discussed earlier. This section will deal with the distribution function $f(c_{ij})$ and the costs of travel.

5.2 The Distribution Function

Trip distribution is time only based. A time-based distribution was found to give a better fit than using a generalised cost derived from both time and distance costs

The time only distribution function can be approximated to an exponential line of the form:

$$f(c_{ij}) = e^{-\alpha t_{ij}}$$

Where:

$f(c_{ij})$	=	function of time only cost of travel between zone i and zone j
C_{ij}	=	cost of travel between zones i and j for time only
α	=	exponent
t_{ij}	=	time to travel between zone i and zone j (minutes)

The distribution function values used (α) are shown in **Table 12**.

Trip Purpose	Morning Peak	Evening Peak
Home to Work	0.15	-
Home to Education	0.36	-
Home to Employers Business	0.18	-
Home to Other	0.17	0.17
Non Home Based - Long	0.16	0.16
Non Home Based - Short	0.18	0.18
Work to Home	-	0.15
Shopping to Home	-	0.17
Other to Home	0.17	0.17

Table 12: Time Based Distribution Function Exponents

The Non Home Based trips for the AM and PM Peaks have been split such that 50% are “short” trips and 50% are “long” trips. By applying a larger exponent to the Non Home Based Short trip purpose the trip lengths are shortened. These represent trips of a similar length to Home Based School trips whereas the Non Home Based Long trip lengths are akin to Home Based Business and Home Based Other trips.

6. Trip Assignment

6.1 Costs of Travel

When undertaking transportation analyses it is important to make the distinction between the travel costs seen by the driver, (commonly termed perceived or behavioural costs) and the true cost of a trip from the viewpoint of the country as a whole.

Behavioural costs are defined as those costs that give the best empirical fit to the observed behaviour of travellers. They represent the cost or price that travellers perceive they are paying in terms of time, distance, comfort and convenience. For example, it can be argued that when deciding whether or not to make a trip by car most drivers consider as their mileage costs only the cost of the fuel that they buy.

The cost value of time that people place on travel depends on the type of journey undertaken, so that behavioural time costs for journeys to work, journeys during working hours and shopping trips are different.

Resource costs are defined as the sum of resources consumed per unit of travel to the nation as a whole. The difference between resource and behavioural cost lies in the distance cost. For example, resource cost per km does not include fuel tax, as this is purely an internal or 'paper' transfer, but does include allowances for oil, maintenance and other operating costs.

The discrepancy between behavioural and resource costs has been termed 'driver misperception.' That is the hidden costs that play little or no part in a driver's trip making decisions. The values that resulted from the above analysis are shown in the following tables for each model period.

6.2 Loading Profiles

The total traffic matrix is assigned to the road network using a flat incremental assignment procedure with multiple iterations and a flat uniform loading profile for each time period. Traffic is loaded in time slices onto the network at flow rates that each represent between 12% and 1% of the total flow over the time period modelled. The TRACKS assignment program ASSIGN version 7.0 was used.

Interzonal time and distance matrices were extracted during the assignment process and is a weighted sum corresponding to the points on the loading profile. The loading profiles for each period are shown in **Table 13** and **Table 14**. In the three stage model, the perceived assignment time and distance costs are used to determine the relative affect travel time and distance has on the route choice selection process. The actual values themselves only serve greater importance in a multi-modal model where public transport, parking and toll costs are also built into the process and calculated car travel costs are important for mode choice. In this model, it has been assumed that the relativity of time and distance in the route choice process is the same during both the morning and evening peak periods.

Assignment Increment	% Trip Matrix Loaded	% of Peak Hourly Flow Rate Experienced	Steady State Time (Minutes)	Perceived Assignment Costs	
1	12		0	32.48 c/min	19.50 c/km
2	12		0		
3	12		0		
4	12		0		
5	12		0		
6	12		0		
7	12		0		
8	11		15		
9	3		15		
10	1		15		
11	1	100%	15		

Table 13: Morning Peak Period Assignment Parameters

Assignment Increment	% Trip Matrix Loaded	% of Peak Hourly Flow Rate Experienced	Steady State Time (Minutes)	Perceived Assignment Costs	
1	12		0	32.48 c/min	19.50 c/km
2	12		0		
3	12		0		
4	12		0		
5	12		0		
6	12		0		
7	12		0		
8	5		15		
9	7		15		
10	2		15		
11	2	100%	15		

Table 14: Evening Peak Period Assignment Parameters

6.3 Network Links

Travel Journey times are established by a combination of link times and delays at intersections. The simplest form of calculating journey times used in New Zealand in the 1960's and 70's where all delay (link and intersection) was attributed to a link. Speed/flow, or volume/delay relationships, were derived for various types of road. Selection of the appropriate curve was based on a number of variables that physically described the road.

Results from surveys in the 1988 Wellington GATS Study first allowed link only delays to be empirically separated from intersection delays. The volume delay relationships used in this study were for delays on links only and were based on those analytically derived by Akcelik using a time dependent Davidson model. As a result, these curves give 'link only' delays, allowing intersection delays to be separately calculated. The J_A parameter, or friction factor, in Akcelik's equation for travel time was set for each link type so that $V_{\text{capacity}}/V_{\text{free flow}} = 0.5$. This is consistent with standard traffic theory and Fisk's behavioural model and matches the data collected in Wellington. As a result these curves give 'link only' times, allowing intersection delays to be separately calculated. Each link in the network is given a volume delay curve depending of the speed limit, function and characteristic of the road the link represents. A steady state period of one hour was used.

Akcelik's formula is:

$$t = t_o \{ 1 + 0.25 r_f [(x - 1) + ((x-1)^2 + (8J_A x) / (Q t_o r_f))^{1/2}] \}$$

Where:

- t = travel time per unit distance (e.g., secs/km)
- t_o = minimum (zero flow) travel time per unit distance (e.g., secs/km)
- J_A = delay (side friction, LoS) parameter
- x = q/Q = degree of saturation
- q = demand (arrival) flow rate (veh/sec)
- Q = capacity (veh/sec) per lane
- r_f = ratio of flow period T_f , to minimum travel time t_o

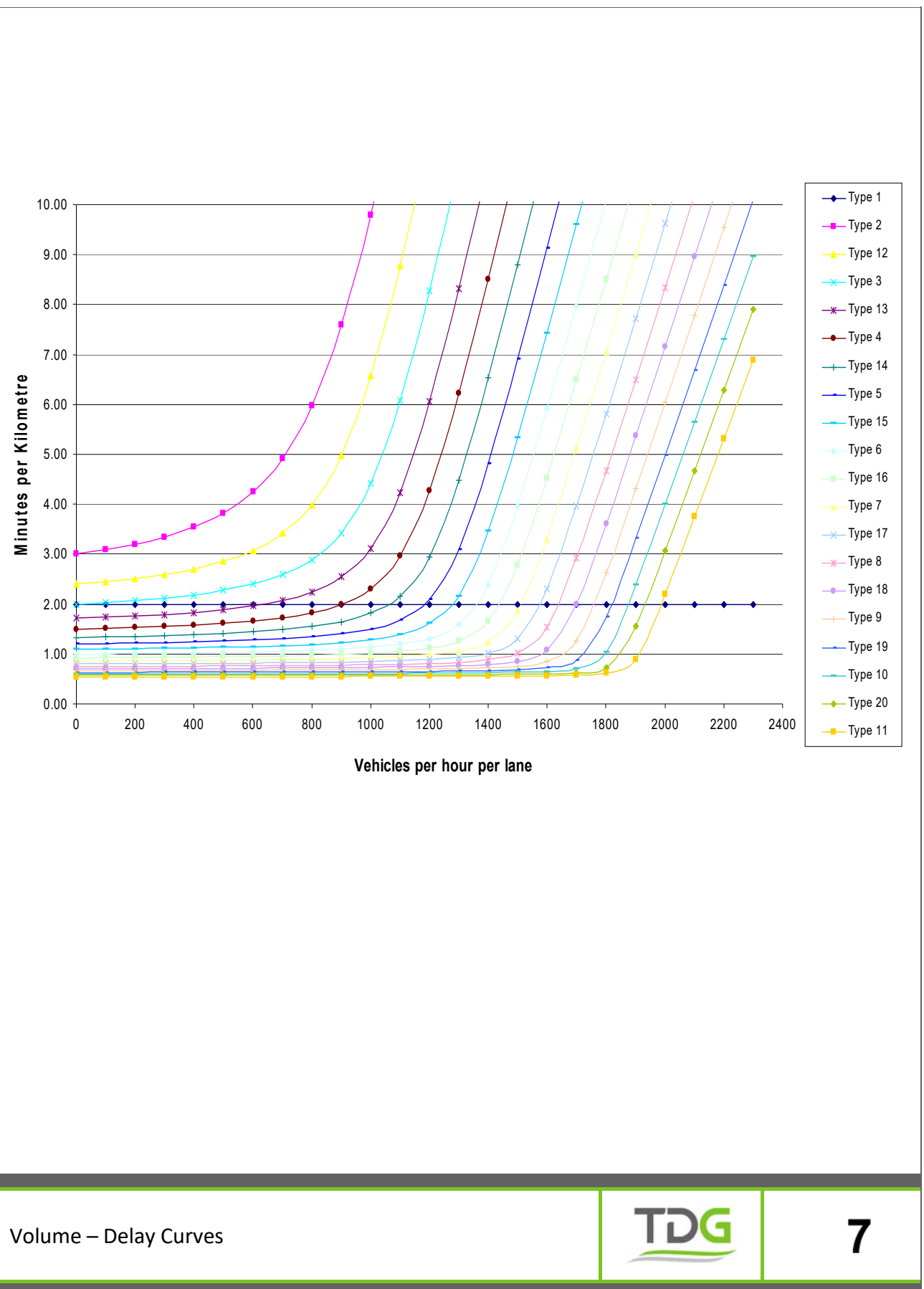
Twenty curves were developed with free flow times at 5km/hr intervals. The capacities and J_A values used for each curve are given below. Curve number 1 is a flat line for a centroid connector. The resulting volume/delay curves used for this study are shown in **Table 15** and **Figure 7**.

Each link in the network was allocated a curve from an assessment of the free flow speed, its capacity and the environmental conditions of the link.

New future links should be coded by assessing the environment in which the link will operate, and choosing a curve with an appropriate free flow speed and capacity, given the way in which link with a similar curve operate under current traffic condition. During evaluation of a project it would be useful to test the sensitivity of the choice of curves on traffic flows, and benefits.

Speed (KPH)	Capacity (VPH)	Free Flow Time (t_o) min/km	J_A	Link Type
20	900	3.00	10.55	2
25	1000	2.40	7.10	12
30	1100	2.00	5.20	3
35	1200	1.71	3.90	13
40	1300	1.50	3.00	4
45	1400	1.33	2.35	14
50	1500	1.20	1.90	5
55	1500	1.09	1.52	15
60	1600	1.00	1.25	6
65	1600	0.92	1.02	16
70	1700	0.86	0.84	7
75	1800	0.80	0.67	17
80	1900	0.75	0.54	8
85	2000	0.71	0.44	18
90	2000	0.67	0.34	9
95	2200	0.63	0.26	19
100	2200	0.60	0.20	10
105	2300	0.57	0.16	20
110	2400	0.55	0.13	11

Table 15: Link Types



6.4 Network Intersections

6.4.1 Priority Intersections

Delays at priority intersections are calculated at the movement level. That is, left, right and through movements on all legs have delays calculated specifically.

The approach lanes at each intersection are coded as one of eight movement types as shown below. From the intersection geometry, determined from the link coordinates, the opposing traffic flows are calculated.

- (i) Left, Through and Right
- (ii) Left and Right
- (iii) Left
- (iv) Left free
- (v) Left and Through
- (vi) Through
- (vii) Through and Right
- (viii) Right

The way each lane type was treated came from the publication titled, "Performance Analysis of Priority Intersections - A Practitioner's Guide" by Gabites Porter: (1991).

The delays were determined by a queuing theory model. The queuing theory formulation adopted is that described by Fisk:(1989) which uses an M/M/1 model (indicates a queuing system with negative exponential distributions for arrival headway and service times, with one service channel) and a coordinate transformation approximation to allow for over saturated conditions.

The formulation is:

$$d = \begin{matrix} r/\mu(1-r) & \text{steady state conditions, } r < 1 \\ (r-1)t/2 & \text{deterministic conditions, } r > 1 \end{matrix}$$

Where: $r = q_2 / \mu$

$$\mu = \frac{q_1 e^{-q_1 t}}{1 - e^{-q_1 b}}$$

- t = duration of *time period over which a steady state is assumed*
- q_1 = major road flow rate
- q_2 = minor road flow rate, always defined as approach being delayed
- t = critical gap
- b = move-up time for minor road traffic
- μ = mean service rate

r = traffic intensity

Fisk shows that the delay equation can be written:

$$d = \frac{-(2 + \mu t - r\mu t) + \sqrt{(2 + \mu t - r\mu t)^2 + 8r\mu t}}{4\mu} + \frac{1}{\mu}$$

when the coordinate transform is included and this formulation is used.

The critical gaps and move up times used in the model are shown in **Table 16**.

Lane Types	Critical Gap (sec)	Move Up Time (sec)
Left Turn - Non-Priority	5	3
Left Turn - Priority	5	3
Thru/Right - Non-Priority	5	3
Thru/Right - Priority	5	3
Merge	3	2
Bottleneck	3	2
Roundabout	4	2.5

Table 16: Critical Gap and Move Up Time Values

Other parameters used include:

Tracking Headway	1.2 seconds
Lane Sharing Convergence Parameter	0.01
Number of external iterations	50
Number of internal iterations (lane sharing algorithm)	200

6.4.2 Signalised Intersections

Movement using the formulations in ARR123, including eqn 6.4, 6.3 and 6.1 shown below, calculates delays at signalised intersections. While ARR123 is the basis for SIDRA it does not give exactly the same results, especially for the more recent versions of SIDRA.

A general formula for the average delay per vehicle, d (in seconds) is:

$$d = D/q \quad \text{eqn (6.4)}$$

D = total delay (veh/hr/hr)

q = flow rate (veh/s)

$$D = \frac{qc(1-u)^2}{2(1-\gamma)} + N_0x \quad \text{eqn (6.3)}$$

Where:

qc = average number of arrivals in vehicles/cycle

- q = flow (veh/sec)
 c = cycle time (sec)
 u = green time ratios = g/c
 y = flow ratio = q/s
 s = saturation flow (veh/sec)
 N_0 = average overflow queue (vehicles)
 x = q/Q = degree of saturation

$$N_0 = \begin{cases} \frac{QT_f}{4} \left[z + \sqrt{z^2 + \frac{12(x - x_0)}{QT_f}} \right] & \text{for } x > x_0 \\ 0 & \text{for } x \leq x_0 \end{cases} \quad \text{eqn (6.1)}$$

Where:

- Q = capacity (veh/hr)
 T_f = flow period (hours)
 z = $x - 1$
 x_0 = degree of saturation below which the average overflow queue is approximately zero = $0.67 + sg/600$

Signalised intersections were modelled specifically and each required a SIDRA input data file.

6.4.3 Geometric Delays

The delays calculated above are the stopped delays for vehicles. As vehicles decelerate to stop or negotiate a corner a geometric delay is encountered. The geometric delay is calculated from the formulations in Gabites Porter: (1991).

7. Model Convergence

7.1 Assignment and Distribution Loop

Time and distance matrices are required as inputs for trip distribution. As assigning the trips to the network generates these matrices, after each assignment the trip distribution needs to be re-run and the trips re-assigned until the time and distances matrices converge.

In practice, it is unlikely that absolute convergence occurs. The assignment and distribution steps are run iteratively until the totals of both the time and distance matrices between successive runs remain close to each other and relatively constant.

The totals for the time and distance matrices for two successive Assignment/Distribution Loops (after many previous runs) are shown below in **Table 17** where:

TVM = Total Vehicle Minutes

TVK = Total Vehicle Kilometres

PERIOD	AM PEAK		PM PEAK	
	TVM	TVK	TVM	TVK
Last Run	2833254	2189027	2964909	2292597
Previous Run	2833256	2189114	2965098	2292549
Absolute Difference	2	87	189	48
% Difference	<0.01%	<0.01%	<0.01%	<0.01%

Table 17: 2015 Convergence

The percentage change in generalised user cost between consecutive loops should be less than 1%. As the total vehicle minutes and total vehicle kilometres change less than 1% between runs (shown above), and unit time and distance costs are constant between runs, generalised user cost also changes less than 1% between runs.

When validating the model it is difficult to get a long series of runs prior to convergence because of the continual changing of the model components to get a better fit, even though these changes were often small. Once converged the periods were then run several times and remained stable.

For any model, if the network is heavily congested, convergence may not occur. Although the network is currently stable, when any changes are made to the network (e.g. option testing or land use), then convergence must be checked to ensure the network is still stable. In the unlikely event of the network not stabilising, modifications will have to be made to the network so that it will converge. These modifications should then be incorporated into the option or year being tested.

8. Model Validation

8.1 General

One of the requirements of model building is that the model should replicate actual conditions, that is the travel patterns and traffic flows that existed in 2016. The process is called validation. The primary test is the ability of the model to replicate traffic flow measured in 2016.

8.2 Network Screenline Validation

Flow comparisons are tested using a number of statistical measures. Traffic counts were grouped into screenlines, and the following measures calculated:

- Comparisons of individual links
- Comparisons of total trips over each screenline
- Percentage difference
- Correlation coefficient
- % Root mean square
- *GEH*

The correlation coefficient is a first order measure of the co-relation, using the formula:

$$P_{x,y} = \frac{\frac{1}{n} \sum (x_i - \bar{x}_i) (y_i - \bar{y}_i)}{\sigma_x \sigma_y}$$

The *GEH* is a form of the Chi-squared statistic that incorporates both relative and absolute errors. It is designed to be more tolerant of the large percentage differences in lower flows. The form of the statistic is: Where *m* is the modelled flow and *o* is the observed count.

$$GEH = \sqrt{\frac{2(m-o)^2}{m+o}}$$

The RMS Guidelines for model validation are based on Transport for London (TfL) guidelines for models that generally involve a significant level of matrix estimation as part of the calibration process. The TfL guidelines also indicate that comparisons with counts are only valid when the counts themselves have been collected multiple times and are consistent to within +/-50 vehicles or have an accuracy of GEH=2.0. As a result the RMS guidelines assume a high level of count consistency and matrix adjustment.

The RMS guidelines for a Highway Model validation are as follows:

- 95 per cent of individual link volumes to have a GEH $\leq$ 5.0
- All individual link and turn volumes should have GEH $\leq$ 10
- Plots of model vs. count have R2 value to be included with plots and to be > 0.9
- All counts RMSE should be 30.0 or lower
- Each directional screenline or cordon total to have GEH < 4.0

These guidelines apply to any Highway model of any size and complexity and therefore, whilst ideally the model should satisfy the RMS validation guidelines, the New Zealand Transport Authority (NZTA) have identified that models of different sizes need different levels of validation to reflect the modelling techniques associated with the different model sizes.

This model falls between two levels of validation within the NZTA guidelines for Model Type B:Strategic Network and Model Type C:Urban Area. The NZTA guidelines include a greater number of validation guides and vary the level of validation depending on the model type. The NZTA Model Type B and C guidelines are shown in **Table 18**, **Table 19** and **Table 20**.

Criteria	Strategic Model	Urban Area Model
% of Screenlines with GEH <5.0	$>75\%$	$>85\%$
% of Screenlines with GEH <7.5	$>85\%$	$>90\%$
% of Screenlines with GEH <10.0	$>95\%$	$>95\%$
% of Screenlines with 5% of Count	$>80\%$	$>90\%$
% of Screenlines with 10% of Count	$>90\%$	$>95\%$

Table 18: All Screenlines Validation

Criteria	Strategic Model	Urban Area Model
% of Link Volumes with GEH <5.0	$>80\%$	$>85\%$
% of Link Volumes with GEH <7.5	$>85\%$	$>90\%$
% of Link Volumes with GEH <10.0	$>90\%$	$>95\%$
% of Link Volumes with GEH <12.0	$>95\%$	$>100\%$
% of <700 vph Link Volumes with 100vph of Count	$>80\%$	$>85\%$
% of 700-2700vph Link Volumes with 15% of Count	$>80\%$	$>85\%$
% of >2700 vph Link Volumes with 400vph of Count	$>80\%$	$>85\%$

Table 19: All Counts Validation

Criteria	Strategic Model	Urban Area Model
R ²	>0.9	>0.95
Slope of Line of Best Fit	$Y=0.9x - 1.1x$	$Y=0.9x - 1.1x$
RMSE	25.0	20.0

Table 20: Plot Validation

The screenline and miscellaneous count sites used in this model are as follows:

- 1 - South of Oakdale, Mt Hunter and Camden Lateral
- 2 - South of Thirlmere, Tahmoor and Wilton Lateral
- 2a – South of Bargo
- 3 - East of Mt Hunter, Picton and Tahmoor Longitudinal
- 4 - Picton Cordon
- 5 – Picton – Cliffe to Menangle Cordon
- 6 – Picton – Prince St to Barkers Lodge Rd
- 7 - Picton – Argyle & Colden N of Menangle
- 8 - Picton CBD Spot Counts
- 9 - Appin Spot Counts
- 10 - Wollondilly Miscellaneous Spot Counts
- 11 - Camden Spot Counts
- 12 - Camden Valley Way / Richardson Intersection
- 13 – Narellan Intersections
- 13a – Camden CBD Counts August 2013
- 14 - Camden N or Narellan
- 15 – Silverdale
- 16 – S Campbelltown
- 16a – CS Campbelltown
- 17 – R Campbelltown (Railway)
- 18 – CN Campbelltown
- 18a – C Campbelltown
- 19 – N Campbelltown
- 20 – M Campbelltown
- 20a – M Campbelltown
- 21 – in/out Campbelltown
- 22 – Oran Park
- All Campbelltown Counts
- All Counts

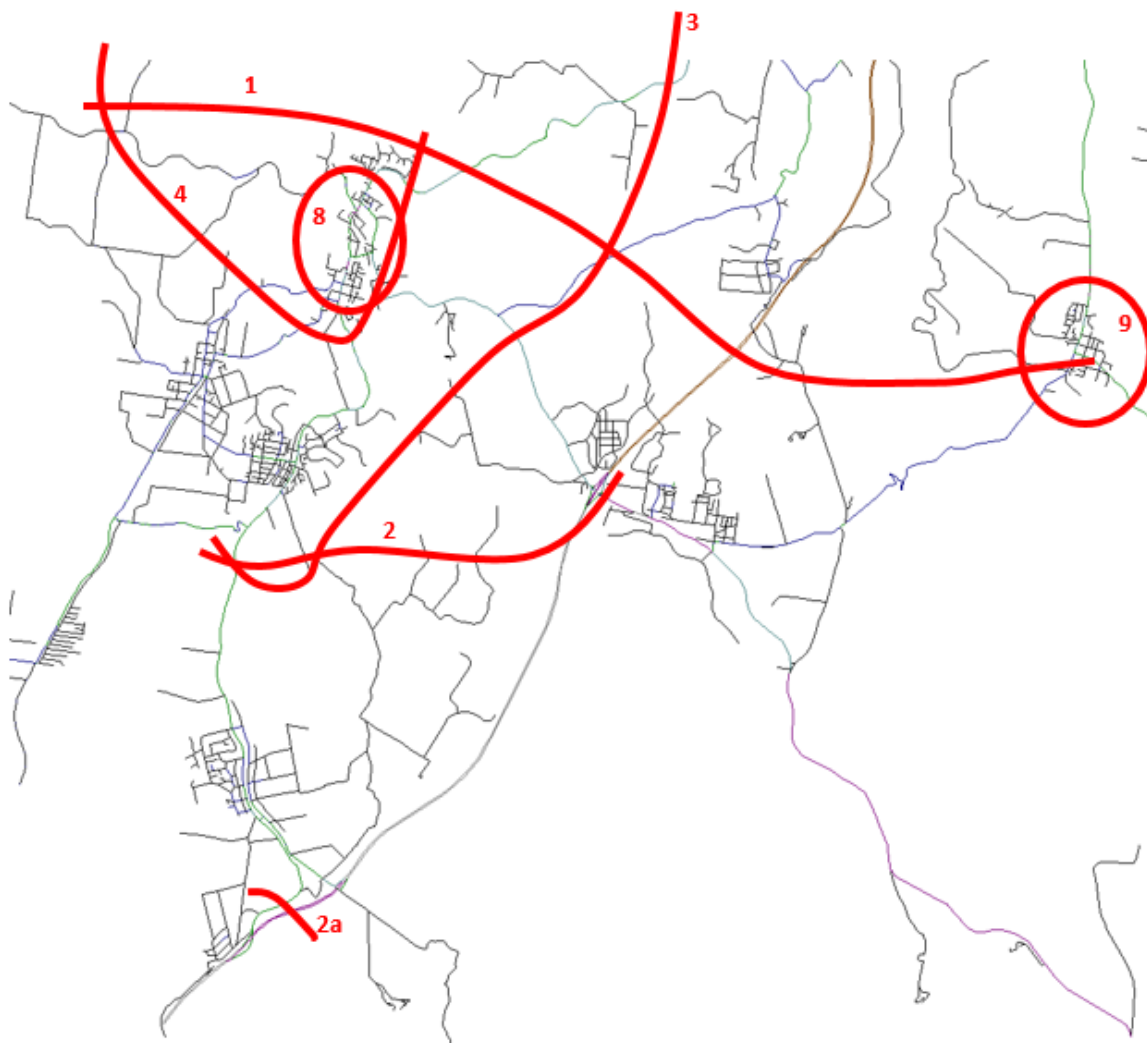
Section 8.3 contains the detailed network validation statistics for the screenlines in each of the AM and PM models developed. The full cordon outputs of observed (count) versus modelled (volume) traffic volumes for all cordon and miscellaneous counts can be found in Appendix B. The general location of each of the cordons is shown in **Figure 8** to **Figure 12**.



Campbelltown Area Cordons



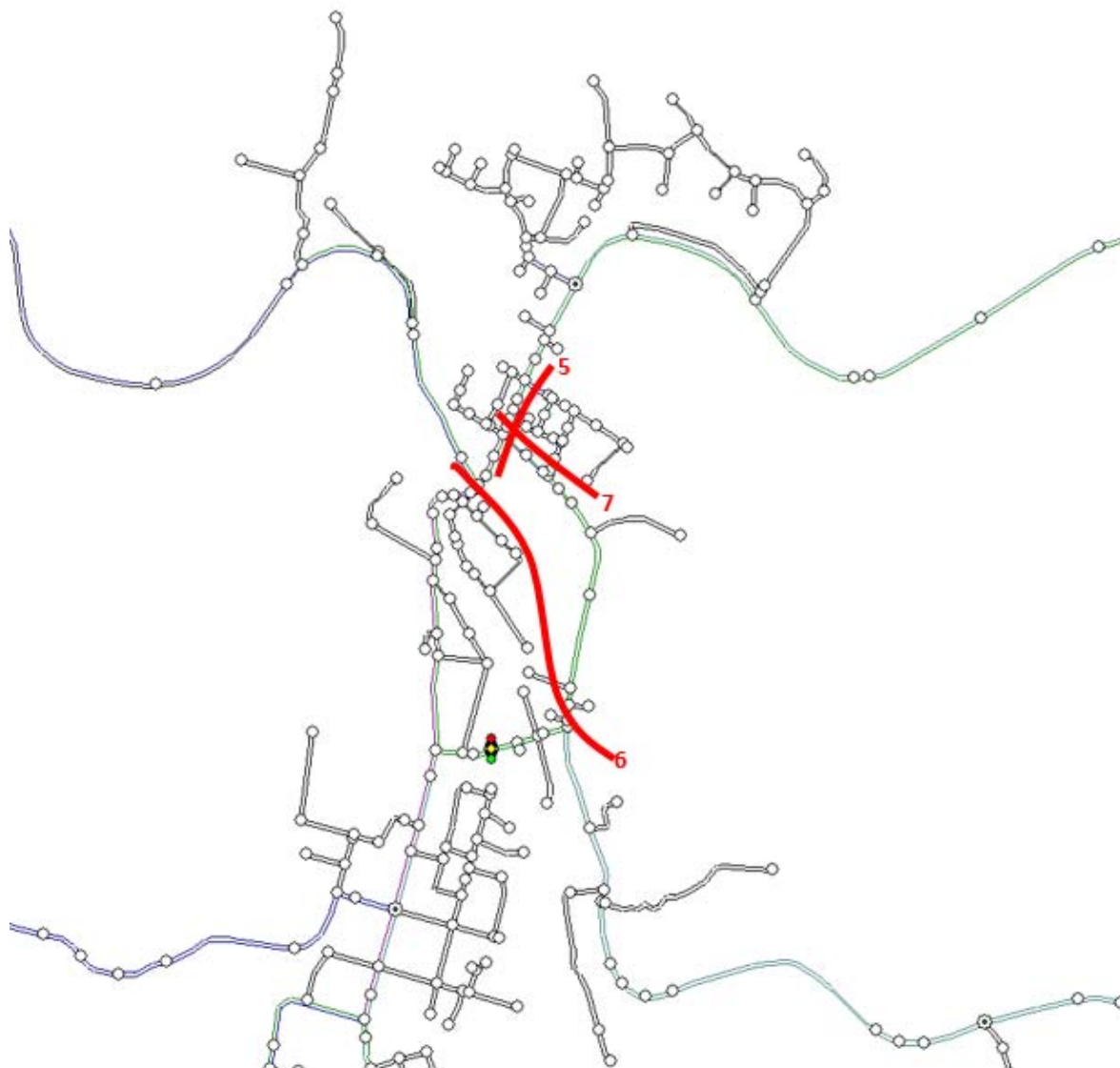
8



Picton Thirlmere Area Cordons



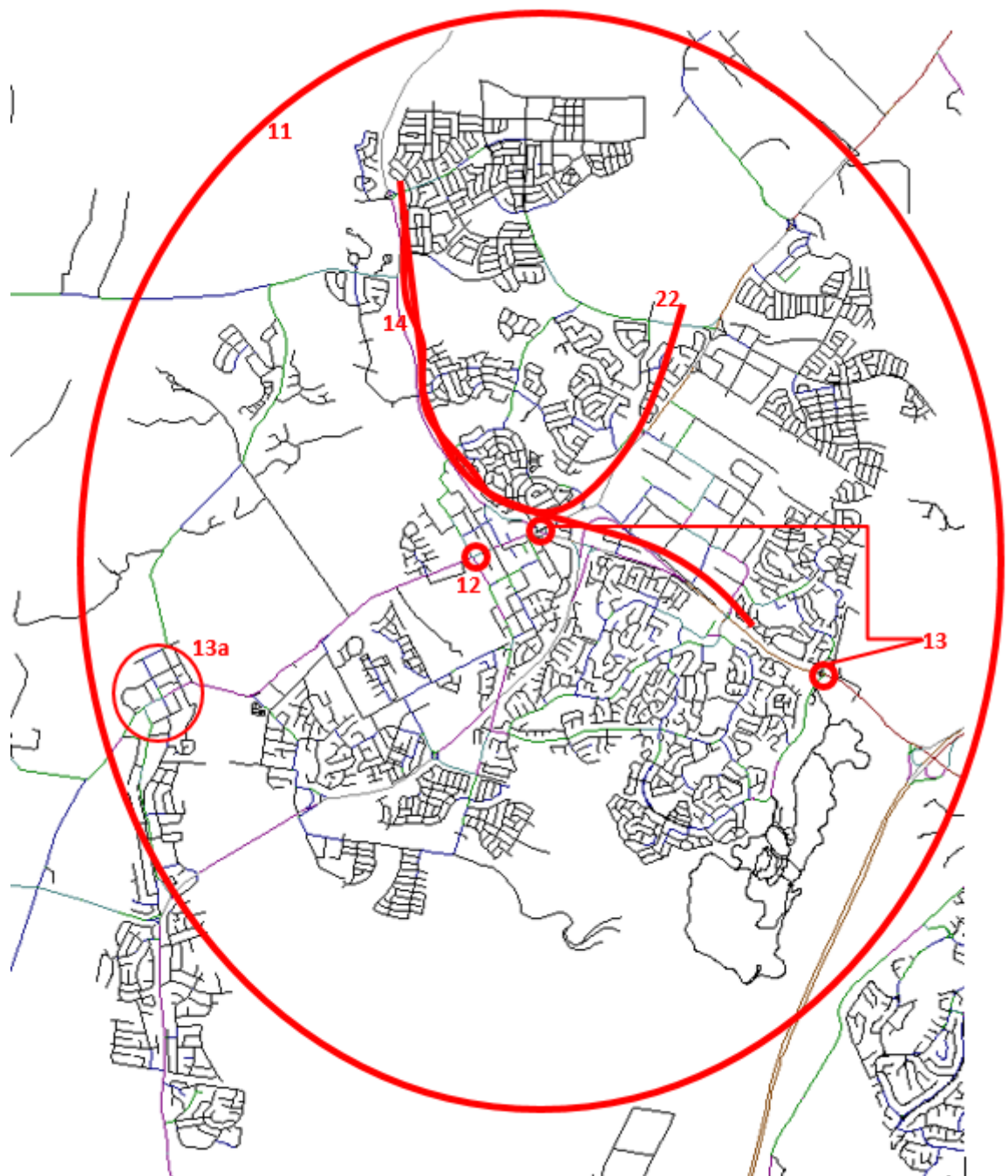
9



Additional Picton Cordons



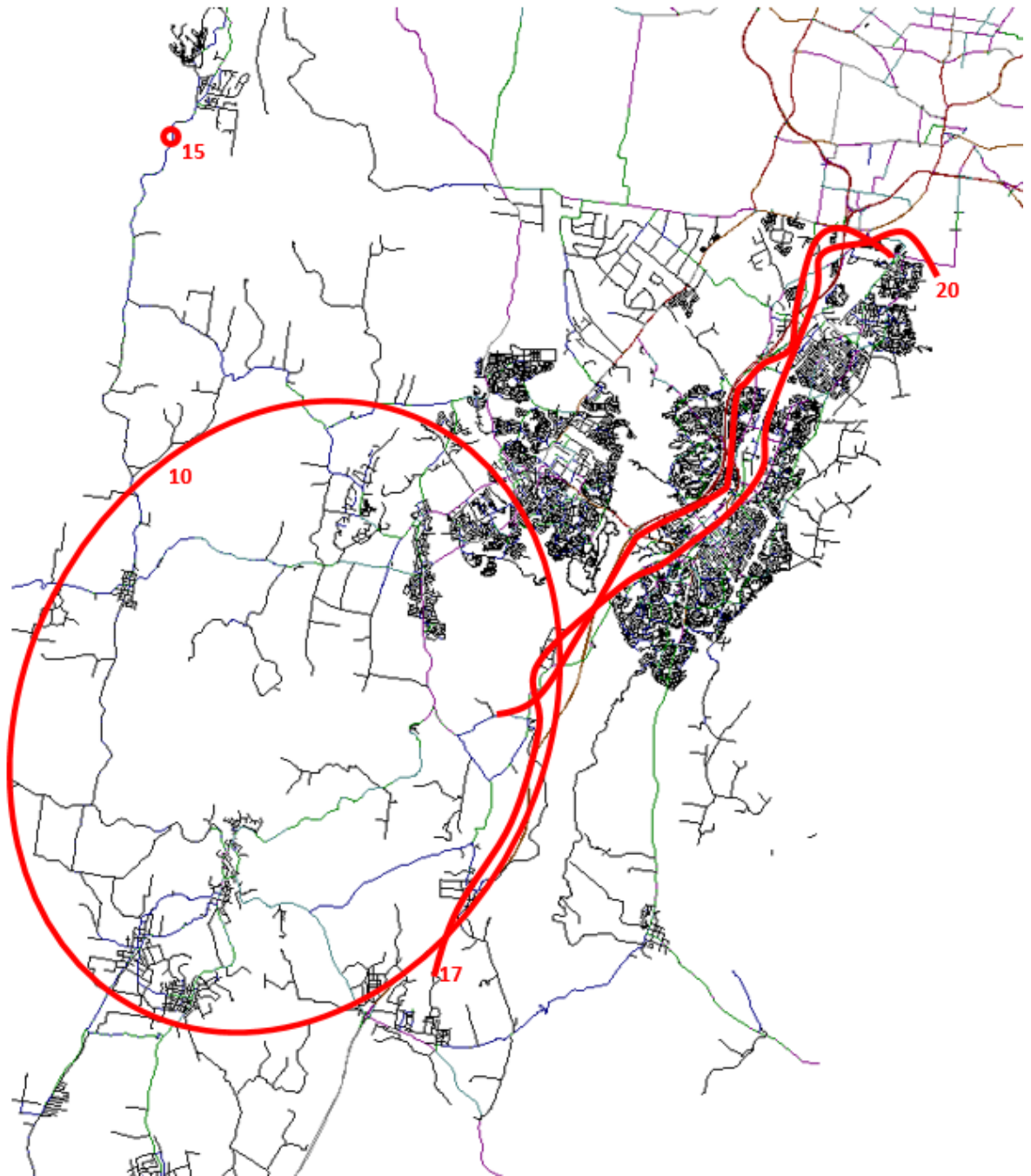
10



Camden Area Cordons



11



Additional Study Area Cordons



12

8.3 Cordon Validation Results

The overall screenline results for the AM and PM Peak hour models are shown in the following Section 8.3.1 and Section 8.3.2. These show that the model generally reflects the counts provided for this model validation. **Table 22** and **Table 24** show how the model complies with the NZTA criteria for a model of this type and size.

Scatterplots of flows during each period show that there are few instances of modelled flows being significantly different to surveyed flows. Instances of large differences appear to relate to either an inconsistency between screenlines counts along the same corridor or reflect the significant impact the current construction along Narellan Rd is having on trip route choice. It is thought that in some instances the construction is altering the route trips are taking into Campbelltown, trips along Narellan Rd between Campbelltown and Camden and the operation of a number of traffic signals in the Narellan Rd area. Being heavily congested, the operation of the signals is impacted and the modelled route choice may not reflect what is happening “on the ground” during the construction period.

Scatterplots of all counts for each period are shown in **Figure 13** at the end of this section.

8.3.1 Morning Peak Validation

Screenline 1 - Screenline	Forward	Back
Count Locations	5	4
Count Volume	2799	2233
Model Volume	2914	2150
Difference	104%	96%
GEH (modified for 1hr flows only)	2.2	1.8
Screenline 2 - Screenline - Sth Thirlmere	Forward	Back
Count Locations	5	4
Count Volume	2352	2561
Model Volume	2341	2753
Difference	100%	107%
GEH (modified for 1hr flows only)	0.2	3.7
Screenline 3 - Screenline - Sth Thirlmere - Avon	Forward	Back
Count Locations	3	2
Count Volume	1110	1140
Model Volume	1089	1202
Difference	98%	105%
GEH (modified for 1hr flows only)	0.6	1.8
Screenline 4 - Screenline - East of Mt Hunter	Forward	Back
Count Locations	5	5
Count Volume	1566	1737
Model Volume	1426	1728
Difference	91%	99%
GEH (modified for 1hr flows only)	3.6	0.2
Screenline 5 - 4 Screenline - Picton Cordon	Forward	Back
Count Locations	6	6
Count Volume	1971	1377
Model Volume	1990	1552
Difference	101%	113%
GEH (modified for 1hr flows only)	0.4	4.6
Screenline 6 - Screenline - Picton - Cliffe to Men	Forward	Back
Count Locations	2	2
Count Volume	433	255
Model Volume	453	236
Difference	105%	93%
GEH (modified for 1hr flows only)	1.0	1.2

Screenline 7 - Screenline - Picton - Prince St - B	Forward	Back
Count Locations	2	2
Count Volume	957	652
Model Volume	922	522
Difference	96%	80%
GEH (modified for 1hr flows only)	1.1	5.4
Screenline 8 - Screenline - Picton - Argyle & Cold	Forward	Back
Count Locations	2	2
Count Volume	766	486
Model Volume	772	416
Difference	101%	86%
GEH (modified for 1hr flows only)	0.2	3.3
Screenline 9 - Picton CBD Spot Counts	Forward	Back
Count Locations	13	13
Count Volume	3325	3006
Model Volume	3358	3142
Difference	101%	105%
GEH (modified for 1hr flows only)	0.6	2.5
Screenline 10 - Appin Spot Counts	Forward	Back
Count Locations	2	2
Count Volume	567	307
Model Volume	566	344
Difference	100%	112%
GEH (modified for 1hr flows only)	0.0	2.1
Screenline 11 - - Wollondilly Miscellaneous	Forward	Back
Count Locations	7	7
Count Volume	1156	984
Model Volume	1131	1083
Difference	98%	1%
GEH (modified for 1hr flows only)	0.7	3.1
Screenline 12 - - Camden Counts - Locations accurate	Forward	Back
Count Locations	7	7
Count Volume	5563	4230
Model Volume	5883	4554
Difference	106%	108%
GEH (modified for 1hr flows only)	4.2	4.9
Screenline 13 - - Camden Valley Way \ Richardson I	Forward	Back
Count Locations	4	4
Count Volume	2557	2557
Model Volume	2374	2374
Difference	93%	93%
GEH (modified for 1hr flows only)	3.7	3.7

Screenline 14 - - Narellan Intersections	Forward	Back
Count Locations	5	5
Count Volume	5140	6356
Model Volume	5638	6208
Difference	110%	98%
GEH (modified for 1hr flows only)	6.8	1.9
Screenline 15 - - Camden CBD Counts August 2013	Forward	Back
Count Locations	11	11
Count Volume	4094	3152
Model Volume	3941	3025
Difference	96%	96%
GEH (modified for 1hr flows only)	2.4	2.3
Screenline 16 - 14 - Camden N of Narellan	Forward	Back
Count Locations	6	6
Count Volume	2938	2891
Model Volume	2742	2940
Difference	93%	102%
GEH (modified for 1hr flows only)	3.7	0.9
Screenline 17 - 15 - Silverdale	Forward	Back
Count Locations	1	1
Count Volume	124	81
Model Volume	330	125
Difference	266%	154%
GEH (modified for 1hr flows only)	13.7	4.3
Screenline 18 - 16 - Screenline S Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	2798	1232
Model Volume	2594	1473
Difference	93%	120%
GEH (modified for 1hr flows only)	3.9	6.6
Screenline 19 - 16a - Screenline CS Campbelltown	Forward	Back
Count Locations	4	3
Count Volume	2874	1512
Model Volume	2835	1594
Difference	99%	105%
GEH (modified for 1hr flows only)	0.7	2.1
Screenline 20 - 17 - Screenline R Campbelltown	Forward	Back
Count Locations	14	10
Count Volume	9547	9090
Model Volume	9798	9530
Difference	103%	105%
GEH (modified for 1hr flows only)	2.6	4.6

Screenline 21 - 18 - Screenline CN Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1583	1459
Model Volume	1662	1807
Difference	105%	105%
GEH (modified for 1hr flows only)	2.0	8.6
Screenline 22 - 18a - Screenline C Campbelltown	Forward	Back
Count Locations	6	4
Count Volume	3366	3593
Model Volume	3654	3772
Difference	109%	105%
GEH (modified for 1hr flows only)	4.9	2.9
Screenline 23 - 19 - Screenline N Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1964	1347
Model Volume	2011	1376
Difference	102%	102%
GEH (modified for 1hr flows only)	1.1	0.8
Screenline 24 - 20 - Screenline M Campbelltown	Forward	Back
Count Locations	11	10
Count Volume	8919	10152
Model Volume	9163	10423
Difference	103%	103%
GEH (modified for 1hr flows only)	2.6	2.7
Screenline 25 - 20a - Screenline M Campbelltown	Forward	Back
Count Locations	4	3
Count Volume	1558	2362
Model Volume	1562	2241
Difference	100%	95%
GEH (modified for 1hr flows only)	0.1	2.5
Screenline 26 - 21 - in/out Campbelltown	Forward	Back
Count Locations	10	9
Count Volume	9549	6840
Model Volume	9194	7128
Difference	96%	104%
GEH (modified for 1hr flows only)	3.7	3.4
Screenline 27 - 22 - Oran Park	Forward	Back
Count Locations	5	5
Count Volume	682	1304
Model Volume	799	1490
Difference	117%	114%
GEH (modified for 1hr flows only)	4.3	5.0

Table 21 provides a comparison of count volume with model volume for each screenline identified section 8.2.

Screenline 1 - Screenline	Forward	Back
Count Locations	5	4
Count Volume	2799	2233
Model Volume	2914	2150
Difference	104%	96%
GEH (modified for 1hr flows only)	2.2	1.8
Screenline 2 - Screenline - Sth Thirlmere	Forward	Back
Count Locations	5	4
Count Volume	2352	2561
Model Volume	2341	2753
Difference	100%	107%
GEH (modified for 1hr flows only)	0.2	3.7
Screenline 3 - Screenline - Sth Thirlmere - Avon	Forward	Back
Count Locations	3	2
Count Volume	1110	1140
Model Volume	1089	1202
Difference	98%	105%
GEH (modified for 1hr flows only)	0.6	1.8
Screenline 4 - Screenline - East of Mt Hunter	Forward	Back
Count Locations	5	5
Count Volume	1566	1737
Model Volume	1426	1728
Difference	91%	99%
GEH (modified for 1hr flows only)	3.6	0.2
Screenline 5 - 4 Screenline - Picton Cordon	Forward	Back
Count Locations	6	6
Count Volume	1971	1377
Model Volume	1990	1552
Difference	101%	113%
GEH (modified for 1hr flows only)	0.4	4.6
Screenline 6 - Screenline - Picton - Cliffe to Men	Forward	Back
Count Locations	2	2
Count Volume	433	255
Model Volume	453	236
Difference	105%	93%
GEH (modified for 1hr flows only)	1.0	1.2

Screenline 7 - Screenline - Picton - Prince St - B	Forward	Back
Count Locations	2	2
Count Volume	957	652
Model Volume	922	522
Difference	96%	80%
GEH (modified for 1hr flows only)	1.1	5.4
Screenline 8 - Screenline - Picton - Argyle & Cold	Forward	Back
Count Locations	2	2
Count Volume	766	486
Model Volume	772	416
Difference	101%	86%
GEH (modified for 1hr flows only)	0.2	3.3
Screenline 9 - Picton CBD Spot Counts	Forward	Back
Count Locations	13	13
Count Volume	3325	3006
Model Volume	3358	3142
Difference	101%	105%
GEH (modified for 1hr flows only)	0.6	2.5
Screenline 10 - Appin Spot Counts	Forward	Back
Count Locations	2	2
Count Volume	567	307
Model Volume	566	344
Difference	100%	112%
GEH (modified for 1hr flows only)	0.0	2.1
Screenline 11 - - Wollondilly Miscellaneous	Forward	Back
Count Locations	7	7
Count Volume	1156	984
Model Volume	1131	1083
Difference	98%	1%
GEH (modified for 1hr flows only)	0.7	3.1
Screenline 12 - - Camden Counts - Locations accurate	Forward	Back
Count Locations	7	7
Count Volume	5563	4230
Model Volume	5883	4554
Difference	106%	108%
GEH (modified for 1hr flows only)	4.2	4.9
Screenline 13 - - Camden Valley Way \ Richardson I	Forward	Back
Count Locations	4	4
Count Volume	2557	2557
Model Volume	2374	2374
Difference	93%	93%
GEH (modified for 1hr flows only)	3.7	3.7

Screenline 14 - - Narellan Intersections	Forward	Back
Count Locations	5	5
Count Volume	5140	6356
Model Volume	5638	6208
Difference	110%	98%
GEH (modified for 1hr flows only)	6.8	1.9
Screenline 15 - - Camden CBD Counts August 2013	Forward	Back
Count Locations	11	11
Count Volume	4094	3152
Model Volume	3941	3025
Difference	96%	96%
GEH (modified for 1hr flows only)	2.4	2.3
Screenline 16 - 14 - Camden N of Narellan	Forward	Back
Count Locations	6	6
Count Volume	2938	2891
Model Volume	2742	2940
Difference	93%	102%
GEH (modified for 1hr flows only)	3.7	0.9
Screenline 17 - 15 - Silverdale	Forward	Back
Count Locations	1	1
Count Volume	124	81
Model Volume	330	125
Difference	266%	154%
GEH (modified for 1hr flows only)	13.7	4.3
Screenline 18 - 16 - Screenline S Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	2798	1232
Model Volume	2594	1473
Difference	93%	120%
GEH (modified for 1hr flows only)	3.9	6.6
Screenline 19 - 16a - Screenline CS Campbelltown	Forward	Back
Count Locations	4	3
Count Volume	2874	1512
Model Volume	2835	1594
Difference	99%	105%
GEH (modified for 1hr flows only)	0.7	2.1
Screenline 20 - 17 - Screenline R Campbelltown	Forward	Back
Count Locations	14	10
Count Volume	9547	9090
Model Volume	9798	9530
Difference	103%	105%
GEH (modified for 1hr flows only)	2.6	4.6

Screenline 21 - 18 - Screenline CN Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1583	1459
Model Volume	1662	1807
Difference	105%	105%
GEH (modified for 1hr flows only)	2.0	8.6
Screenline 22 - 18a - Screenline C Campbelltown	Forward	Back
Count Locations	6	4
Count Volume	3366	3593
Model Volume	3654	3772
Difference	109%	105%
GEH (modified for 1hr flows only)	4.9	2.9
Screenline 23 - 19 - Screenline N Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1964	1347
Model Volume	2011	1376
Difference	102%	102%
GEH (modified for 1hr flows only)	1.1	0.8
Screenline 24 - 20 - Screenline M Campbelltown	Forward	Back
Count Locations	11	10
Count Volume	8919	10152
Model Volume	9163	10423
Difference	103%	103%
GEH (modified for 1hr flows only)	2.6	2.7
Screenline 25 - 20a - Screenline M Campbelltown	Forward	Back
Count Locations	4	3
Count Volume	1558	2362
Model Volume	1562	2241
Difference	100%	95%
GEH (modified for 1hr flows only)	0.1	2.5
Screenline 26 - 21 - in/out Campbelltown	Forward	Back
Count Locations	10	9
Count Volume	9549	6840
Model Volume	9194	7128
Difference	96%	104%
GEH (modified for 1hr flows only)	3.7	3.4
Screenline 27 - 22 - Oran Park	Forward	Back
Count Locations	5	5
Count Volume	682	1304
Model Volume	799	1490
Difference	117%	114%
GEH (modified for 1hr flows only)	4.3	5.0

Table 21: AM Peak Screenline Results

Following are the summarised validation results for the morning peak model. For most criteria the MACROC model performs better than both the NZTA Strategic Model and the Urban Area Model validation guidelines.

The number of screenlines which fall within 5% and 10% of traffic counts do not fall below the Strategic model threshold although there is no clear explanation for the variability in traffic flows. It is likely that traffic flows across a number of screenlines are affected by construction along the Narellan Road. In some cases flows across screenlines do not fall within expected ranges but flows across screenlines either side accurately reflect traffic counts.

Criteria	AMP Model Results	Strategic Model Guideline	Urban Area Model Guideline
% of Screenlines with GEH<5.0	91%	>75%	>85%
% of Screenlines with GEH<7.5	96%	>85%	>90%
% of Screenlines with GEH<10.0	98%	>95%	>95%
% of Screenlines within 5% of Count	59%	>80%	>90%
% of Screenlines within 10% of Count	82%	>90%	>95%
% of Link Volumes with GEH<5.0	83%	>80%	>85%
% of Link Volumes with GEH<7.5	95%	>85%	>90%
% of Link Volumes with GEH<10.0	99%	>90%	>95%
% of Link Volumes with GEH<12.0	100%	>95%	>100%
% of <700vph Link Volumes with 100vph of Count	89%	>80%	>85%
% of 700-2700vph Link Volumes with 15% of Count	83%	>80%	>85%
% of >2700vph Link Volumes with 400vph of Count	100%	>80%	>85%
R ²	0.9654	>0.9	>0.95
Slope of Line of Best Fit	1.0186	Y=0.9x – 1.1x	Y=0.9x – 1.1x
RMSE	12.0	<25.0	<20.0

Table 22: Morning Peak Validation

8.3.2 Evening Peak Validation

Screenline 1 - Screenline	Forward	Back
Count Locations	5	4
Count Volume	2377	3330
Model Volume	2368	3419
Difference	100%	103%
GEH (modified for 1hr flows only)	0.2	1.5
Screenline 2 - Screenline - Sth Thirlmere	Forward	Back
Count Locations	5	4
Count Volume	2912	2480
Model Volume	3175	2604
Difference	109%	105%
GEH (modified for 1hr flows only)	4.8	2.5
Screenline 3 - Screenline - Sth Thirlmere - Avon	Forward	Back
Count Locations	3	2
Count Volume	1357	1345
Model Volume	1360	1407
Difference	100%	105%
GEH (modified for 1hr flows only)	0.1	1.7
Screenline 4 - Screenline - East of Mt Hunter	Forward	Back
Count Locations	5	5
Count Volume	2046	1379
Model Volume	1690	1445
Difference	83%	105%
GEH (modified for 1hr flows only)	8.2	1.8
Screenline 5 - 4 Screenline - Picton Cordon	Forward	Back
Count Locations	6	6
Count Volume	1622	2100
Model Volume	1676	1941
Difference	103%	92%
GEH (modified for 1hr flows only)	1.3	3.5
Screenline 6 - Screenline - Picton - Cliffe to Men	Forward	Back
Count Locations	2	2
Count Volume	287	397
Model Volume	274	357
Difference	95%	90%
GEH (modified for 1hr flows only)	0.8	2.1
Screenline 7 - Screenline - Picton - Prince St - B	Forward	Back
Count Locations	2	2
Count Volume	767	894
Model Volume	625	831
Difference	81%	93%
GEH (modified for 1hr flows only)	5.4	2.1

Screenline 8 - Screenline - Picton - Argyle & Cold	Forward	Back
Count Locations	2	2
Count Volume	638	836
Model Volume	511	724
Difference	80%	87%
GEH (modified for 1hr flows only)	5.3	4.0
Screenline 9 - Picton CBD Spot Counts	Forward	Back
Count Locations	13	13
Count Volume	3238	3598
Model Volume	3108	3305
Difference	96%	92%
GEH (modified for 1hr flows only)	2.3	5.0
Screenline 10 - Appin Spot Counts	Forward	Back
Count Locations	2	2
Count Volume	350	619
Model Volume	374	666
Difference	107%	108%
GEH (modified for 1hr flows only)	1.3	1.9
Screenline 11 - - Wollondilly Miscellaneous	Forward	Back
Count Locations	7	7
Count Volume	1151	1321
Model Volume	1147	1178
Difference	100%	0%
GEH (modified for 1hr flows only)	0.1	4.0
Screenline 12 - - Camden Counts - Locations accurate	Forward	Back
Count Locations	7	7
Count Volume	4807	5772
Model Volume	4852	5550
Difference	101%	96%
GEH (modified for 1hr flows only)	0.6	3.0
Screenline 13 - - Camden Valley Way \ Richardson I	Forward	Back
Count Locations	4	4
Count Volume	2689	2689
Model Volume	2525	2524
Difference	94%	94%
GEH (modified for 1hr flows only)	3.2	3.2
Screenline 14 - - Narellan Intersections	Forward	Back
Count Locations	5	5
Count Volume	6477	5721
Model Volume	6334	5997
Difference	98%	105%
GEH (modified for 1hr flows only)	1.8	3.6

Screenline 15 - - Camden CBD Counts August 2013	Forward	Back
Count Locations	11	11
Count Volume	3564	4223
Model Volume	3574	4223
Difference	100%	100%
GEH (modified for 1hr flows only)	0.2	0.0
Screenline 16 - 14 - Camden N of Narellan	Forward	Back
Count Locations	6	6
Count Volume	2962	3086
Model Volume	2720	2949
Difference	92%	96%
GEH (modified for 1hr flows only)	4.5	2.5
Screenline 17 - 15 - Silverdale	Forward	Back
Count Locations	1	1
Count Volume	83	179
Model Volume	171	295
Difference	206%	165%
GEH (modified for 1hr flows only)	7.8	7.5
Screenline 18 - 16 - Screenline S Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1535	2803
Model Volume	1551	2594
Difference	101%	93%
GEH (modified for 1hr flows only)	0.4	4.0
Screenline 19 - 16a - Screenline CS Campbelltown	Forward	Back
Count Locations	4	3
Count Volume	1448	2869
Model Volume	1919	2819
Difference	133%	98%
GEH (modified for 1hr flows only)	11.5	0.9
Screenline 20 - 17 - Screenline R Campbelltown	Forward	Back
Count Locations	14	10
Count Volume	9001	10483
Model Volume	9885	10505
Difference	110%	100%
GEH (modified for 1hr flows only)	9.1	0.2
Screenline 21 - 18 - Screenline CN Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1155	2023
Model Volume	1393	1965
Difference	121%	121%
GEH (modified for 1hr flows only)	6.7	1.3

Screenline 22 - 18a - Screenline C Campbelltown	Forward	Back
Count Locations	6	4
Count Volume	3425	4057
Model Volume	3873	3952
Difference	113%	97%
GEH (modified for 1hr flows only)	7.4	1.7
Screenline 23 - 19 - Screenline N Campbelltown	Forward	Back
Count Locations	3	3
Count Volume	1319	1979
Model Volume	1454	2071
Difference	110%	105%
GEH (modified for 1hr flows only)	3.6	2.0
Screenline 24 - 20 - Screenline M Campbelltown	Forward	Back
Count Locations	11	10
Count Volume	10392	9559
Model Volume	10426	9780
Difference	100%	102%
GEH (modified for 1hr flows only)	0.3	2.2
Screenline 25 - 20a - Screenline M Campbelltown	Forward	Back
Count Locations	4	3
Count Volume	2005	1551
Model Volume	2115	1858
Difference	105%	120%
GEH (modified for 1hr flows only)	2.4	7.4
Screenline 26 - 21 - in/out Campbelltown	Forward	Back
Count Locations	10	9
Count Volume	7587	9047
Model Volume	8024	8812
Difference	106%	97%
GEH (modified for 1hr flows only)	4.9	2.5
Screenline 27 - 22 - Oran Park	Forward	Back
Count Locations	5	5
Count Volume	1066	1198
Model Volume	1211	1022
Difference	114%	85%
GEH (modified for 1hr flows only)	4.3	5.3

Table 23: PM Peak Screenline Results

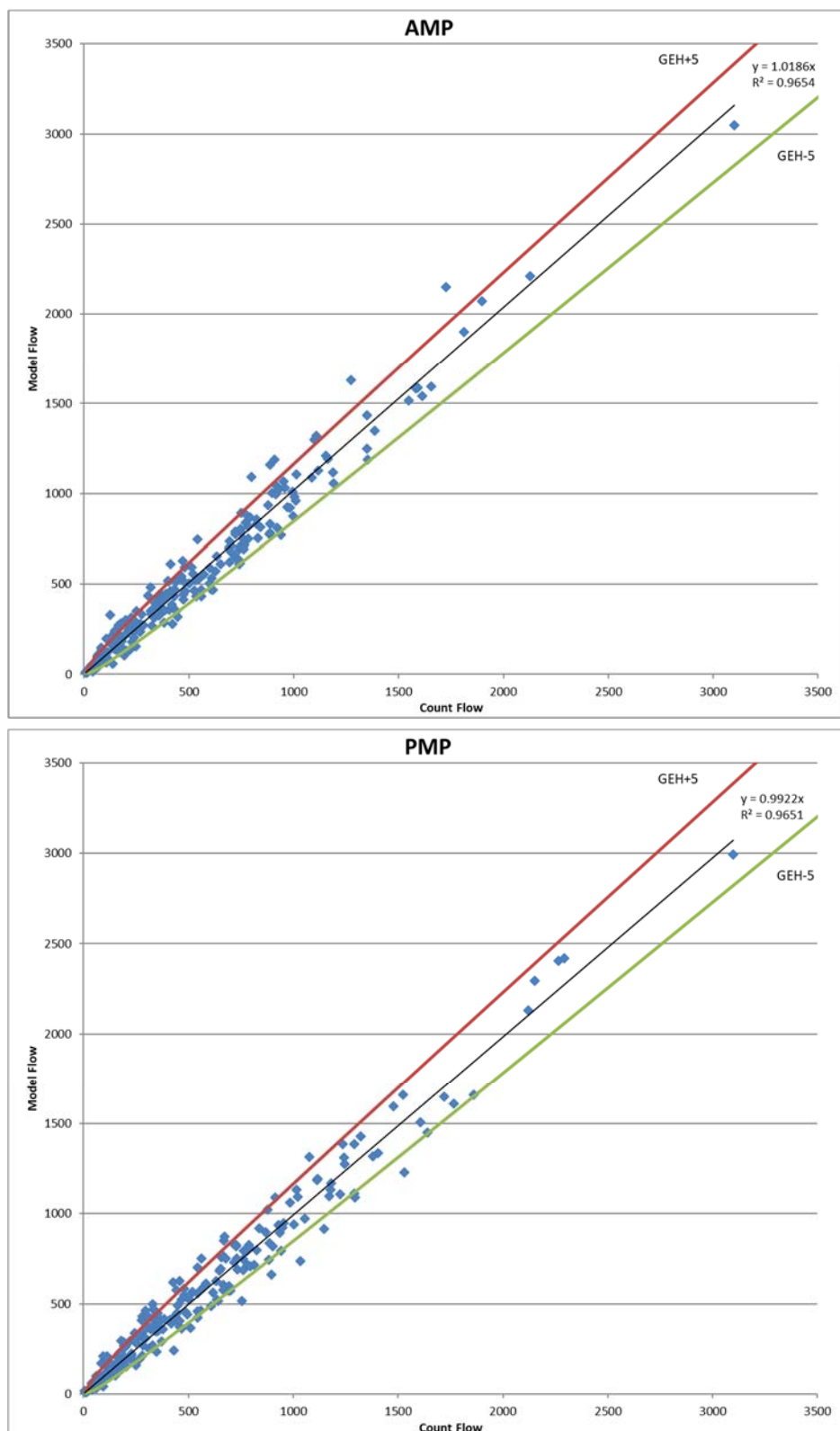
To follow are the summarised validation results for the evening peak model. For most criteria the MACROC model performs better than both the NZTA Strategic Model and the Urban Area Model validation guidelines.

As for the morning peak model, the number of screenlines which fall within 5% and 10% of the traffic counts are greater than the recommended Strategic model threshold. Again,

there is no clear explanation for the variability in traffic flows but it is likely that construction in Narellan has impacted on traffic counts.

Criteria	PMP Model	Strategic Model	Urban Area Model
% of Screenlines with GEH<5.0	80%	>75%	>85%
% of Screenlines with GEH<7.5	93%	>85%	>90%
% of Screenlines with GEH<10.0	98%	>95%	>95%
% of Screenlines within 5% of Count	54%	>80%	>90%
% of Screenlines within 10% of Count	78%	>90%	>95%
% of Link Volumes with GEH<5.0	81%	>80%	>85%
% of Link Volumes with GEH<7.5	94%	>85%	>90%
% of Link Volumes with GEH<10.0	99%	>90%	>95%
% of Link Volumes with GEH<12.0	100%	>95%	>100%
% of <700vph Link Volumes with 100vph of Count	82%	>80%	>85%
% of 700-2700vph Link Volumes with 15% of Count	85%	>80%	>85%
% of >2700vph Link Volumes with 400vph of Count	100%	>80%	>85%
R ²	0.9651	>0.9	>0.95
Slope of Line of Best Fit	0.9922	Y=0.9x – 1.1x	Y=0.9x – 1.1x
RMSE	11.4	<25.0	<20.0

Table 24: Evening Peak Validation



Scatterplots of all Counts for Morning Peak and Evening Peak



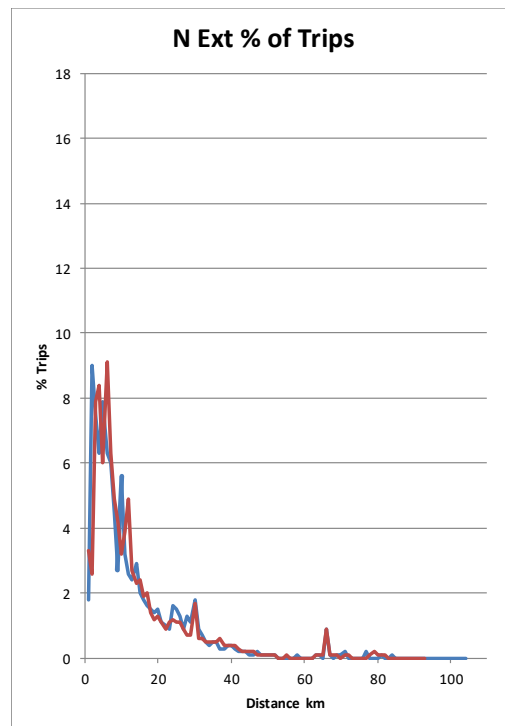
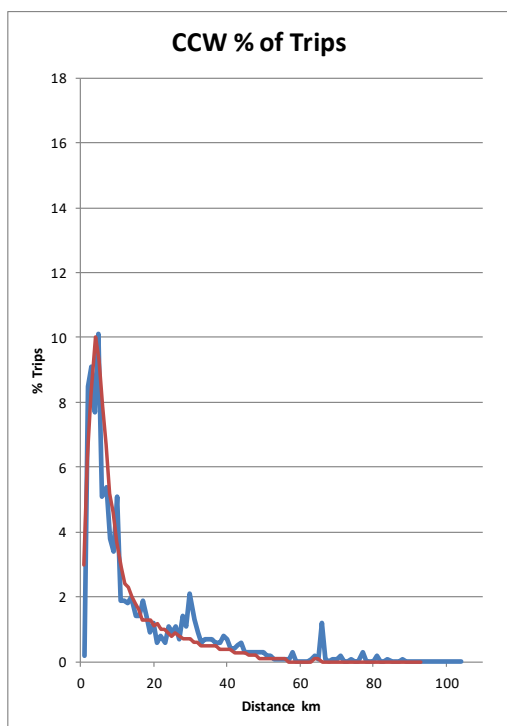
13

8.4 Trip Length Frequency

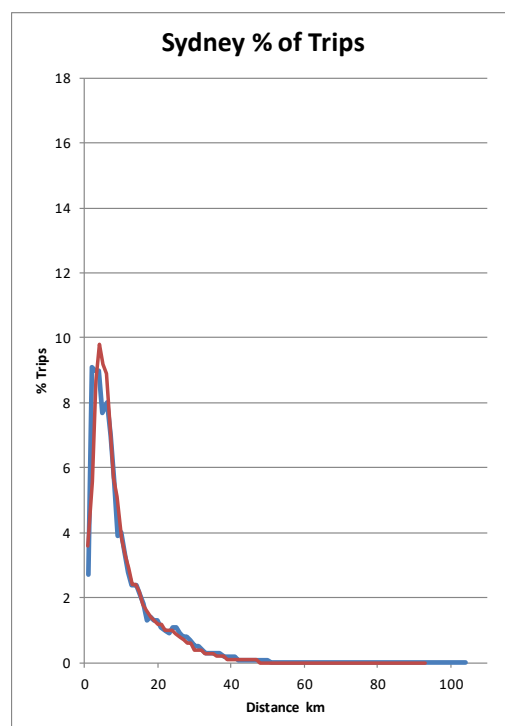
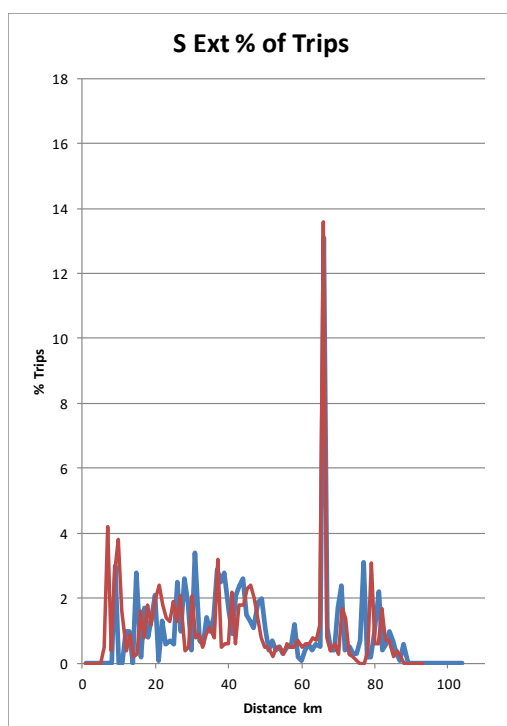
Trip length frequencies from the MACROC model were compared to trip length frequencies from the RMS Sydney Road Assignment model for various areas in the model. This was to ensure that the MACROC model is generally reflecting the same distribution of trips as the larger RMS regional model.

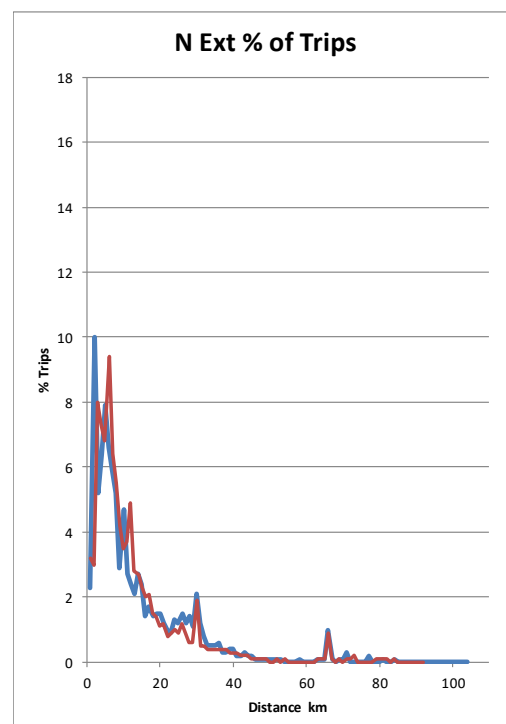
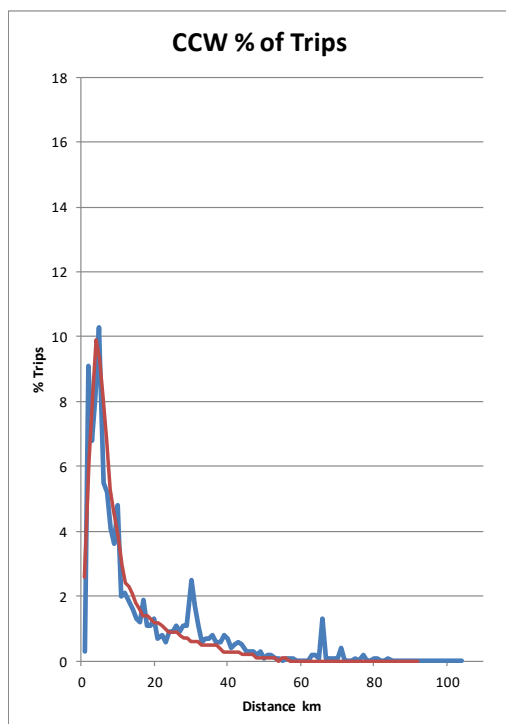
Figure 14 and Figure 15 compare the percentage of trips of different trip lengths for both the MACROC model and the RMS strategic model in the morning peak and evening peak periods. These have been assessed separately for the Campbelltown/Camden/Wollondilly area (CCW), Northern externals (N Ext), Southern externals (S Ext) and trips in the southern Sydney area of the model (Sydney).

For each area and each period the trip distance frequencies for the RMS model and the MACROC model follow the same general pattern. It is clear from the plots below that the MACROC model trip lengths replicate closely the overall strategic model.

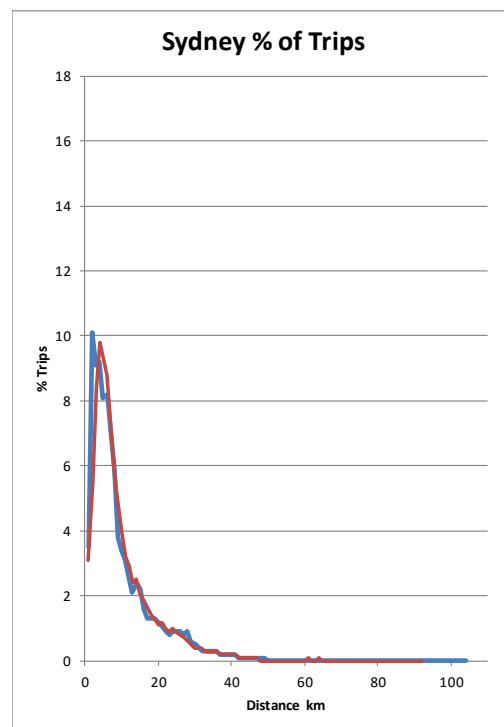
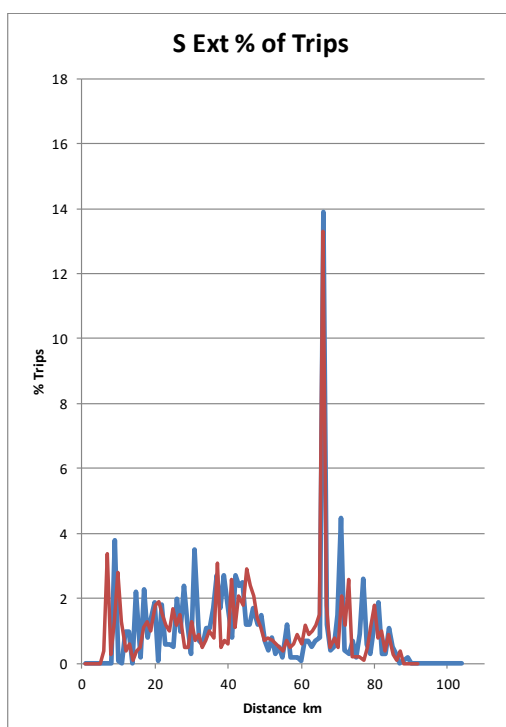


— RMS
— MACROC





— RMS
— MACROC



9. Conclusion

The 2016 MACROC model development has been undertaken using the 2016 TPA employment projections for the model area in association with the 2016 census household data. The generation and attraction models have come from the analysis of the Sydney Household Travel Survey (HTS) data under a separate contract with RMS. The External model has come from the RMS Road Assignment Model, in part, but the attraction equations from the HTS analysis have needed some modification to account for Internal / External and External / Internal trips.

The modelled network has been taken from RMS GIS databases for local and classified strategic roads for Camden, Wollondilly, Campbelltown and areas of Sydney to the north of Camden.

The MACROC Model has been validated to the levels very close to those required for overall validation by the RMS Modelling Guidelines for Highway Assignment Models but in most cases satisfy the NZTA guidelines for Strategic and Urban Area models which take into account the size and type of model and include a greater number of validation guidelines.

The significant and rapid housing development growth in some areas of Camden has made validation to some counts extremely difficult. The growth, reflected in the model, has occurred after many of the validation counts included for Camden were collected and the model is therefore producing flow different at those locations. Whilst every effort has been made to account for these differences, in some instances they are as a result of construction activity or interruption to normal travel patterns.

This model will provide a useful indication of demands, travel patterns and traffic impacts in the model area. It is suitable for broad assessment of travel patterns in the area, and as such is capable of meeting urban-level transport modelling demands. For specific area projects and assessments for plan changes in particular locations, it may be prudent to carry out model refinement and Local Area Validation in order to achieve an appropriate level of detail for the model application.

Appendix A

2016 Land Use Zone Files

```

\ZONEDTV7.04
*CAMDEN - WOLLONDILLY MODEL - 2016 LANDUSE DATA
ZONE16.000
1250
Persons/HH CWC
Cars/HH CWC
Households CWC
Persons/HH Urban Sydney
Cars/HH Urban Sydney
Households Urban Sydney
1 2.181 1.469 10
2 2.181 1.469 10
3 2.181 1.469 4
4 2.181 1.469 46
5 2.181 1.469 6
6 3.022 1.896 0
7 3.022 1.896 0
8 3.022 1.896 0
9 3.022 1.896 0
10 3.022 1.896 0
11 3.022 1.896 0
12 3.022 1.896 0
13 2.181 1.469 29
14 2.461 1.861 62
15 2.181 1.469 23
16 3.022 1.896 0
17 3.022 1.896 0
18 3.022 1.896 0
19 3.022 1.896 0
20 2.181 1.469 6
21 2.181 1.469 2
22 3.022 1.896 0
23 3.022 1.896 0
24 3.022 1.896 0
25 3.022 1.896 0
26 3.022 1.896 0
27 3.022 1.896 0
28 2.181 1.469 2
29 2.181 1.469 4
30 3.022 1.896 0
31 3.022 1.896 0
32 3.022 1.896 0
33 3.022 1.896 0
34 3.022 1.896 0
35 3.022 1.896 0
36 3.022 1.896 0
37 3.022 1.896 0
38 3.022 1.896 0
39 3.022 1.896 0
40 3.022 1.896 0
41 3.022 1.896 0
42 3.022 1.896 0
43 3.022 1.896 0
44 3.022 1.896 0
45 3.022 1.896 0
46 3.022 1.896 0
47 3.022 1.896 0
48 3.022 1.896 0
49 3.022 1.896 0
50 3.022 1.896 0
51 3.022 1.896 0
52 3.623 2.138 77
53 3.235 2.033 226
54 3.381 2.067 84
55 2.768 1.488 82
56 3.045 2.042 110
57 3.423 1.862 71
58 3.351 2.191 94
59 2.827 1.780 173
60 3.122 1.925 147
61 3.053 1.855 170
62 3.221 2.122 95
63 2.981 1.775 161
64 3.217 2.116 83
65 2.946 2.013 149
66 3.041 1.858 148
67 3.225 2.112 129
68 3.202 1.969 168
69 2.700 1.634 123
70 3.000 2.123 158
71 3.379 2.614 161
72 3.181 2.008 193
73 3.739 2.537 92
74 3.074 1.834 136
75 3.121 2.008 173
76 3.101 2.154 109
77 3.095 1.949 95
78 2.790 1.657 105
79 3.284 2.078 95
80 3.351 2.423 94
81 3.185 2.249 151
82 3.503 2.599 151
83 2.883 1.820 111
84 3.282 2.222 117
85 3.431 2.374 130
86 3.172 2.054 122
87 3.031 1.716 131
88 3.279 2.070 154
89 3.360 2.137 111
90 3.513 2.427 113
91 3.067 2.165 165
92 3.117 1.972 94
93 3.630 2.411 127
94 3.309 2.237 81
95 3.348 2.332 135
96 3.062 2.051 129
97 3.599 2.286 147
98 3.662 2.370 139
99 3.671 2.535 155
100 3.312 2.099 189
101 3.302 2.517 53
102 2.966 2.131 147
103 3.075 2.128 160
104 3.094 2.232 170
105 2.182 0.909 11
106 3.364 2.113 473
107 2.899 1.946 303
108 3.770 2.422 35
109 3.480 2.314 125
110 3.417 2.323 96
111 3.813 2.177 96

```

112	3.463	2.242	149
113	3.417	2.321	132
114	3.149	1.857	87
115	3.272	2.254	103
116	3.365	2.095	126
117	3.700	1.947	60
118	3.333	2.245	147
119	3.754	2.490	187
120	3.436	2.166	137
121	4.118	2.506	17
122	3.310	2.132	248
123	3.351	2.157	94
124	2.948	2.085	97
125	3.468	2.147	154
126	2.904	2.140	73
127	3.165	2.237	91
128	2.936	2.021	78
129	3.022	1.896	0
130	3.571	2.694	63
131	3.443	2.613	61
132	2.879	2.185	107
133	2.292	1.874	106
134	2.873	1.898	102
135	3.022	1.896	0
136	3.000	1.986	69
137	2.903	1.992	103
138	2.907	2.060	151
139	2.768	1.964	190
140	2.413	2.096	92
141	3.333	2.000	3
142	2.544	1.864	227
143	3.139	1.974	423
144	3.236	2.108	437
145	2.314	1.738	175
146	2.938	1.946	209
147	3.149	2.205	161
148	3.150	2.133	80
149	3.159	2.057	126
150	2.693	1.913	140
151	2.473	1.830	188
152	2.800	2.572	65
153	3.537	2.866	203
154	1.909	1.061	8
155	2.777	2.040	121
156	3.079	2.427	89
157	1.338	0.823	237
158	2.005	1.408	211
159	2.739	2.165	115
160	3.353	3.008	150
161	3.242	2.655	95
162	2.322	1.554	211
163	3.198	2.595	162
164	2.722	2.191	115
165	2.865	2.025	178
166	3.022	2.234	202
167	1.789	1.182	166
168	3.024	2.344	250
169	2.808	2.047	167
170	3.181	1.985	14
171	2.916	1.919	155
172	3.022	1.896	0
173	2.795	2.023	112
174	3.022	1.896	0
175	2.640	1.857	189
176	3.022	1.896	0
177	2.591	1.808	154
178	3.022	1.896	0
179	2.450	1.701	202
180	3.022	1.896	0
181	2.901	2.190	141
182	3.022	1.896	0
183	2.878	2.064	156
184	3.022	1.896	0
185	2.959	2.323	169
186	3.505	2.483	91
187	3.583	2.607	151
188	2.871	2.089	140
189	2.525	1.796	141
190	3.385	2.481	312
191	2.715	1.680	130
192	3.521	2.434	165
193	3.022	1.896	0
194	2.477	1.686	195
195	3.022	1.896	0
196	3.149	2.379	127
197	3.104	2.208	106
198	3.575	2.664	181
199	3.408	3.016	103
200	3.444	2.594	171
201	3.763	2.837	59
202	3.561	2.777	108
203	2.988	2.477	41
204	3.662	2.697	68
205	3.170	2.644	153
206	3.763	2.761	76
207	3.145	2.649	110
208	2.930	2.341	72
209	3.116	3.070	69
210	3.394	2.747	132
211	3.630	2.885	146
212	3.351	2.550	191
213	3.083	2.767	48
214	3.068	2.302	88
215	3.293	2.748	123
216	3.329	3.320	70
217	3.343	2.619	134
218	3.289	2.487	97
219	3.222	2.593	90
220	3.011	2.635	91
221	3.034	2.345	117
222	3.048	2.677	52
223	2.878	2.032	131
224	3.112	2.336	107
225	3.305	2.788	164
226	3.276	2.355	76
227	2.802	1.990	101
228	3.152	2.374	138
229	2.913	2.076	103
230	3.022	2.367	92
231	3.155	2.466	103
232	3.022	1.896	0

233	3.147	2.453	129
234	3.021	2.448	143
235	3.322	2.584	146
236	2.174	1.582	132
237	3.317	2.271	82
238	2.804	2.045	184
239	3.238	2.461	122
240	3.203	2.235	133
241	3.213	2.196	89
242	2.816	2.371	98
243	2.701	1.843	154
244	3.130	2.507	34
245	2.337	1.470	193
246	2.842	1.830	122
247	2.772	1.943	228
248	3.022	1.896	0
249	2.500	1.411	135
250	2.449	1.463	118
251	3.018	1.834	166
252	3.145	2.121	214
253	2.395	1.842	39
254	3.064	2.138	132
255	2.990	2.217	104
256	2.553	1.820	152
257	2.716	1.972	109
258	3.000	2.435	92
259	2.964	2.240	169
260	3.506	2.709	77
261	3.036	2.070	83
262	2.658	1.789	161
263	2.580	1.779	143
264	2.461	1.861	92
265	2.767	1.890	133
266	3.022	1.896	0
267	3.013	2.220	96
268	3.022	1.896	0
269	3.486	2.074	35
270	3.141	2.361	71
271	3.241	1.786	29
272	3.056	2.580	71
273	2.958	2.150	96
274	3.348	2.585	66
275	3.184	2.988	98
276	2.973	2.134	146
277	2.971	2.105	137
278	2.773	2.110	216
279	1.743	1.182	152
280	3.174	2.657	46
281	3.102	2.252	196
282	1.600	0.000	5
283	2.495	1.590	103
284	2.657	2.331	99
285	2.972	2.646	108
286	3.232	2.396	203
287	3.441	2.576	68
288	3.163	2.699	123
289	3.209	2.363	358
290	3.514	2.834	105
291	2.855	2.235	172
292	3.011	2.402	94
293	3.384	2.739	125
294	2.891	2.494	64
295	2.377	1.804	212
296	2.957	2.184	69
297	2.100	1.504	150
298	3.459	1.854	74
299	3.174	2.270	340
300	2.984	2.064	192
301	2.941	2.363	119
302	3.431	2.455	137
303	3.130	2.184	77
304	3.105	2.421	86
305	2.944	2.168	143
306	3.478	2.416	191
307	3.279	2.737	43
308	2.577	2.535	52
309	1.000	1.000	3
310	3.022	1.896	0
311	3.022	1.896	0
312	3.022	1.896	0
313	3.770	2.422	104
314	3.770	2.422	208
315	3.770	2.422	208
316	2.544	1.864	25
317	3.022	1.896	0
318	2.899	1.946	151
319	3.022	1.896	0
320	3.181	1.985	7
321	3.181	1.985	251
322	3.181	1.985	153
323	3.181	1.985	7
324	3.181	1.985	98
325	3.181	1.985	14
326	2.899	1.946	316
327	2.899	1.946	454
328	3.279	2.737	43
329	3.022	1.896	0
330	3.022	1.896	0
331	3.022	1.896	0
332	3.022	1.896	0
333	3.478	2.416	64
334	3.209	2.363	40
335	2.899	1.946	151
336	3.022	1.896	0
337	3.022	1.896	0
338	3.022	1.896	0
339	3.022	1.896	0
340	3.022	1.896	0
341	3.022	1.896	0
342	3.022	1.896	0
343	3.022	1.896	0
344	3.022	1.896	0
345	3.022	1.896	0
346	3.022	1.896	0
347	3.022	1.896	0
348	3.022	1.896	0
349	3.022	1.896	0
350	3.327	2.593	107
351	3.754	2.984	61
352	3.022	1.896	0
353	3.022	1.896	0

354	2.930	1.845	185
355	2.970	1.763	164
356	3.523	2.025	153
357	3.219	2.028	137
358	3.750	2.193	84
359	3.037	1.756	81
360	2.884	1.384	112
361	2.789	1.749	90
362	2.959	1.906	98
363	3.473	2.024	169
364	3.528	2.243	127
365	3.248	1.750	109
366	2.900	1.603	70
367	3.078	1.849	90
368	3.281	1.702	171
369	3.157	1.386	70
370	2.864	1.622	169
371	3.186	1.939	102
372	3.212	1.772	151
373	3.018	2.063	114
374	3.323	2.029	133
375	3.230	1.680	135
376	3.617	2.285	230
377	2.766	1.625	145
378	2.630	1.713	165
379	2.806	1.812	134
380	3.479	1.756	96
381	2.852	1.756	149
382	2.952	1.718	83
383	3.077	1.866	142
384	2.976	1.929	166
385	2.716	1.749	109
386	2.827	1.720	98
387	3.176	2.014	187
388	2.135	0.646	96
389	2.952	0.762	42
390	2.904	1.207	115
391	2.930	2.034	128
392	3.214	1.700	84
393	3.143	1.914	84
394	3.739	2.360	134
395	3.337	2.006	104
396	3.357	1.923	140
397	3.228	1.580	79
398	3.000	0.888	129
399	2.699	1.187	153
400	3.227	1.107	75
401	3.000	1.008	72
402	3.379	2.198	124
403	3.150	2.039	107
404	3.215	1.895	130
405	3.387	1.955	155
406	3.016	1.794	128
407	3.882	2.359	68
408	3.571	2.468	126
409	3.514	2.493	148
410	3.314	2.508	102
411	3.437	2.490	71
412	2.919	2.481	99
413	3.346	2.325	179
414	3.039	2.243	127
415	3.789	2.473	90
416	3.021	1.704	96
417	3.049	1.782	102
418	3.268	2.035	97
419	3.542	2.092	59
420	2.609	1.406	202
421	2.965	1.410	144
422	2.126	1.146	103
423	3.022	1.604	89
424	2.762	1.347	143
425	3.331	2.299	139
426	2.138	1.235	449
427	2.097	1.246	662
428	2.781	1.664	215
429	2.993	1.907	134
430	2.842	1.752	171
431	2.630	1.972	100
432	2.883	1.640	162
433	3.006	1.303	159
434	3.112	0.821	134
435	3.022	1.896	0
436	2.648	1.189	88
437	2.270	0.646	148
438	2.703	0.941	158
439	3.158	2.082	114
440	3.005	1.668	213
441	2.729	1.288	96
442	2.840	1.518	156
443	2.579	1.532	190
444	2.587	1.663	201
445	2.727	1.714	139
446	3.134	1.647	187
447	3.230	2.043	61
448	3.443	1.066	61
449	2.849	1.083	152
450	3.315	1.288	73
451	3.000	1.066	121
452	3.256	2.319	129
453	2.911	1.773	157
454	2.782	1.813	193
455	2.674	1.807	178
456	2.852	1.765	162
457	2.942	1.660	104
458	2.877	2.086	179
459	2.925	1.803	120
460	3.066	1.781	181
461	3.031	1.961	98
462	2.765	1.813	119
463	3.054	1.946	129
464	3.126	1.800	127
465	2.901	2.003	121
466	2.833	1.603	144
467	2.899	1.754	99
468	2.948	1.682	211
469	2.724	1.451	192
470	2.412	1.264	153
471	3.022	1.896	0
472	2.364	1.289	173
473	2.165	0.990	206
474	2.390	0.962	182

475	2.359	1.309	117
476	2.717	1.386	219
477	2.565	1.477	184
478	3.031	1.904	96
479	2.909	1.541	88
480	2.865	1.596	163
481	2.903	1.802	103
482	2.595	1.599	264
483	2.419	1.291	129
484	2.052	1.244	225
485	2.187	1.131	166
486	2.558	1.334	208
487	2.880	1.643	125
488	2.571	1.375	231
489	2.135	1.125	170
490	2.737	1.481	167
491	2.806	1.581	93
492	2.149	1.052	442
493	2.692	1.484	211
494	2.607	1.516	150
495	2.875	1.598	120
496	2.808	1.634	130
497	3.264	2.044	140
498	3.033	2.078	183
499	2.725	1.498	207
500	3.022	1.896	0
501	3.022	1.896	0
502	3.022	1.896	0
503	3.802	2.287	101
504	3.810	2.273	121
505	3.721	2.417	154
506	2.933	1.722	120
507	4.128	2.285	117
508	3.948	1.966	154
509	2.333	0.000	3
510	3.613	2.022	111
511	3.167	1.167	12
512	3.029	2.183	140
513	3.234	1.865	154
514	3.449	2.314	118
515	3.045	1.987	111
516	2.675	1.566	77
517	2.890	1.640	109
518	0.750	0.000	4
519	3.178	1.873	129
520	3.274	1.691	117
521	3.448	0.813	96
522	3.388	0.913	80
523	3.690	0.995	84
524	3.690	0.913	80
525	3.651	1.128	86
526	3.088	0.824	34
527	3.203	0.750	64
528	3.206	1.959	155
529	3.106	1.039	66
530	3.265	1.951	189
531	3.401	1.717	172
532	3.182	2.207	55
533	3.319	2.122	116
534	2.938	2.000	113
535	3.135	2.056	104
536	3.138	1.968	138
537	3.085	1.981	129
538	3.206	1.711	97
539	3.080	1.758	100
540	3.022	1.896	0
541	2.874	1.820	151
542	2.929	1.876	140
543	3.169	2.056	189
544	2.853	2.016	163
545	2.823	1.630	79
546	3.272	2.062	125
547	3.309	1.941	81
548	3.272	2.109	92
549	3.041	1.653	121
550	3.192	1.946	104
551	3.423	2.123	111
552	3.026	1.994	155
553	3.088	1.836	137
554	2.992	2.006	128
555	2.857	1.845	133
556	3.111	1.847	81
557	3.250	2.343	88
558	3.022	1.896	0
559	3.168	2.131	101
560	3.415	2.558	118
561	3.494	2.402	87
562	3.685	2.252	127
563	3.158	2.157	120
564	2.776	1.784	76
565	3.395	2.037	86
566	3.333	2.296	90
567	3.147	2.083	143
568	3.246	2.114	138
569	2.929	1.953	184
570	3.017	2.075	176
571	2.992	1.511	121
572	3.143	2.055	91
573	1.692	0.615	13
574	2.882	1.731	102
575	3.264	1.604	91
576	3.267	1.893	105
577	3.000	2.090	111
578	2.309	1.612	81
579	2.973	2.046	74
580	2.553	1.820	123
581	3.185	2.109	184
582	3.109	2.344	64
583	3.143	2.096	133
584	3.271	2.190	140
585	2.913	2.037	126
586	3.146	1.932	151
587	3.322	2.058	121
588	2.909	1.845	89
589	3.247	2.066	85
590	3.219	1.746	96
591	3.372	2.093	129
592	3.079	2.072	165
593	3.545	2.210	101
594	3.022	1.896	0
595	3.106	1.887	104

596			2.705	1.764	61
597			3.338	1.988	28
598			3.022	1.896	0
599			3.172	1.858	74
600			3.333	2.578	27
601	3.356	2.071	280		
602	3.188	2.120	307		
603	3.338	2.541	133		
604	3.055	3.338	87		
605	3.300	2.762	90		
606	3.233	2.653	90		
607	3.616	2.741	99		
608	3.301	2.761	123		
609	3.675	2.758	80		
610	3.337	2.364	101		
611	2.956	2.312	113		
612	3.022	2.070	89		
613	3.467	2.331	75		
614	1.807	1.319	114		
615	3.356	2.071	72		
616	3.172	1.858	20		
617	3.172	1.858	27		
618	3.172	1.858	13		
619	3.356	2.071	72		
620			3.441	1.786	787
621			3.022	1.896	0
622			3.174	2.342	121
623			3.633	2.314	259
624			3.022	1.896	0
625			3.204	1.561	113
626			2.977	1.785	130
627			3.040	1.919	101
628			3.228	1.946	114
629			3.092	1.871	119
630			2.708	1.215	171
631			2.800	1.448	150
632			2.583	1.236	127
633			3.068	1.609	117
634			2.739	1.226	115
635			2.734	1.277	184
636			0.917	0.417	12
637			2.973	1.475	75
638			3.432	1.746	111
639			3.284	2.059	74
640			2.808	1.447	120
641			3.164	1.848	134
642			2.760	1.300	196
643			2.893	1.550	84
644			3.022	1.896	0
645			2.679	1.625	137
646			2.813	1.456	96
647			2.994	1.632	163
648			3.068	1.385	176
649			2.746	1.270	114
650			2.695	1.332	177
651			2.786	1.229	117
652			3.184	1.584	174
653			3.032	1.306	155
654			2.407	0.691	123
655			3.267	1.137	161
656			2.795	1.129	132
657			2.950	1.248	121
658			3.146	1.131	96
659			2.535	0.964	170
660			3.205	1.411	151
661			3.104	0.926	135
662			3.097	1.917	155
663			2.686	1.673	118
664			3.394	1.978	127
665			3.183	1.563	104
666			2.933	1.912	134
667			3.202	1.675	114
668			3.325	1.713	120
669			2.531	1.268	194
670			2.706	1.556	119
671			3.021	1.484	141
672			2.959	1.356	222
673			3.187	1.739	155
674			3.200	1.844	160
675			3.111	3.013	63
676			3.013	2.213	79
677			3.270	2.003	159
678			3.071	1.886	197
679			2.923	1.674	156
680			2.470	1.307	168
681			2.867	1.648	75
682			2.436	1.532	117
683			2.488	1.192	211
684			2.591	1.147	208
685			2.906	1.442	139
686			3.459	1.589	111
687			2.855	1.564	138
688			2.778	1.683	144
689			2.744	1.749	90
690			2.467	1.347	150
691			2.990	1.708	104
692			3.130	2.026	100
693			3.024	1.684	212
694			2.678	1.477	227
695			2.938	1.280	192
696			3.091	1.366	154
697			3.055	1.621	146
698			2.970	1.229	164
699			2.726	1.548	164
700			2.817	1.279	131
701			3.109	1.819	129
702			3.000	1.912	121
703			2.787	1.572	108
704			2.978	1.843	184
705			3.660	2.703	97
706			3.622	2.400	45
707			2.524	1.288	185
708			3.144	1.730	132
709			3.263	1.967	114
710			3.075	1.608	80
711			3.017	1.006	172
712			3.246	2.143	126
713			2.944	1.659	160
714			3.037	2.106	136
715			2.961	1.291	203
716			3.071	1.767	126

717			3.152	1.364	151
718			3.333	2.058	111
719			3.550	2.119	131
720			3.224	2.073	98
721			3.393	1.533	135
722			3.432	1.614	486
723			3.108	1.450	139
724			3.530	1.870	100
725			3.353	1.661	136
726			2.936	1.440	156
727			3.085	1.059	118
728			3.775	1.720	120
729			3.022	1.896	0
730			2.786	1.425	182
731			3.477	1.558	130
732			3.524	1.524	63
733			3.000	1.086	35
734			3.025	1.222	81
735			2.713	1.571	167
736			3.123	1.666	130
737			2.968	1.485	124
738			2.957	1.981	162
739			2.873	1.670	197
740			3.033	1.841	152
741			2.824	1.854	119
742			3.218	2.012	101
743			2.927	1.773	133
744			3.135	2.000	133
745			2.963	1.564	240
746			3.525	2.093	80
747	3.188	2.117	314		
748	3.188	2.120	460		
749	3.188	2.120	153		
750	3.022	1.896	0		
751	2.988	2.477	41		
752	3.561	2.777	56		
753	3.022	1.896	0		
754	3.022	1.896	0		
755	3.022	1.896	0		
756	3.022	1.896	0		
757	3.022	1.896	0		
758	3.149	2.379	14		
759	3.022	1.896	0		
760	3.022	1.896	0		
761	3.022	1.896	0		
762	3.022	1.896	0		
763	3.022	1.896	0		
764	3.505	2.483	10		
765	3.770	2.422	208		
766	3.022	1.896	0		
767	3.022	1.896	0		
768	3.188	2.120	77		
769	3.188	2.120	77		
770	3.188	2.120	77		
771	3.188	2.120	77		
772	3.338	1.988	330		
773	3.338	1.988	28		
774	3.338	1.988	55		
775	3.672	2.087	12		
776	3.672	2.087	17		
777	3.770	2.422	69		
778	3.770	2.422	69		
779	3.181	1.985	59		
780	3.181	1.985	140		
781	3.181	1.985	7		
782	3.181	1.985	7		
783	3.181	1.985	167		
784	3.181	1.985	186		
785	3.022	1.896	0		
786	3.022	1.896	0		
787	3.672	2.087	145		
788	3.338	1.988	55		
789	3.198	1.788	0		
790	3.672	2.087	139		
791	1.806	1.397	62		
792	3.092	2.435	224		
793	3.672	2.087	93		
794	3.672	2.087	58		
795	3.672	2.087	116		
796	3.338	1.988	55		
797	3.198	1.788	0		
798			3.198	1.788	0
799			3.145	2.406	345
800			3.388	2.223	480
801			3.331	1.726	996
802			3.208	1.936	969
803			3.198	1.788	0
804			3.379	2.135	1259
805			3.240	1.883	590
806			2.961	1.423	463
807			3.198	1.788	0
808			1.000	1.000	3
809			3.228	2.041	1095
810			3.223	1.979	1111
811			2.770	1.659	1107
812			3.341	1.988	1256
813			3.005	1.935	634
814			2.930	1.742	825
815			3.198	1.788	0
816			3.004	1.940	289
817			2.556	1.012	1275
818			2.403	0.844	316
819			3.198	1.788	0
820			3.115	1.971	1050
821			2.150	1.575	40
822			3.001	2.048	565
823			2.684	1.422	83
824			3.198	1.788	0
825			2.247	0.971	700
826			2.563	1.081	1412
827			2.865	1.138	1017
828			2.478	0.928	1429
829			3.128	1.524	1091
830			3.100	1.545	972
831			3.076	1.881	699
832			3.297	1.876	1066
833			3.716	2.056	700
834			3.912	2.148	537
835			3.892	2.066	704
836			3.852	2.246	379
837			3.722	2.156	666

838	3.646	1.991	686
839	3.581	2.170	444
840	3.788	2.187	702
841	3.732	2.180	153
842	3.534	1.871	676
843	3.675	2.014	501
844	3.490	1.962	631
845	4.167	1.000	6
846	1.000	1.000	3
847	3.320	1.620	1056
848	3.000	1.495	736
849	3.116	1.557	948
850	3.198	1.788	0
851	2.682	1.163	827
852	3.128	1.472	1147
853	3.172	1.726	811
854	3.198	1.788	0
855	2.483	0.950	781
856	3.198	1.788	0
857	3.117	2.129	1150
858	3.323	1.961	294
859	3.088	1.850	467
860	3.365	1.308	828
861	3.122	1.199	896
862	3.527	1.704	347
863	3.567	1.821	555
864	3.232	1.498	599
865	2.721	1.263	1182
866	3.179	1.484	494
867	3.380	1.376	49
868	3.275	1.341	313
869	3.347	1.510	600
870	3.607	1.739	613
871	4.160	2.043	148
872	3.520	1.569	1006
873	2.805	1.143	610
874	2.505	0.876	428
875	3.065	1.097	556
876	3.337	1.649	763
877	3.111	1.529	796
878	3.025	1.447	798
879	3.390	1.763	794
880	3.368	1.473	1476
881	2.931	0.978	842
882	2.732	0.999	1077
883	3.516	1.611	697
884	3.406	1.692	591
885	3.540	1.708	657
886	3.571	1.924	629
887	3.671	1.808	537
888	2.725	1.056	1063
889	3.490	1.627	1061
890	3.497	1.628	614
891	3.568	1.769	1070
892	3.744	1.868	861
893	3.490	1.708	1070
894	3.849	1.746	425
895	2.845	1.012	1351
896	2.830	0.828	937
897	2.828	1.012	38
898	3.311	1.382	1005
899	3.320	1.585	749
900	3.170	1.552	935
901	3.395	1.772	592
902	3.293	1.882	840
903	3.187	1.414	1023
904	3.364	1.550	866
905	3.285	1.670	527
906	3.311	1.515	1318
907	3.123	1.453	938
908	2.668	1.163	939
909	3.689	2.023	808
910	3.862	2.228	421
911	3.608	2.015	410
912	3.663	2.186	603
913	3.624	2.123	757
914	3.575	1.865	814
915	3.680	2.007	888
916	3.535	1.947	940
917	3.852	2.301	690
918	3.605	2.300	912
919	3.745	2.360	1176
920	3.776	2.371	875
921	3.750	2.124	1038
922	3.559	1.928	569
923	3.391	2.000	806
924	3.481	1.591	724
925	2.792	1.203	389
926	3.545	2.066	952
927	3.529	2.232	418
928	3.478	2.221	608
929	3.644	2.091	705
930	3.783	2.141	727
931	3.457	2.103	486
932	3.499	2.007	1182
933	3.421	1.919	499
934	3.429	1.884	854
935	3.623	1.985	626
936	3.348	1.774	767
937	3.412	2.163	770
938	3.500	2.486	1195
939	3.070	2.414	43
940	3.623	2.258	493
941	3.308	2.064	1146
942	3.424	1.918	962
943	3.252	1.702	254
944	3.267	1.948	704
945	3.632	1.947	723
946	3.579	1.797	435
947	3.309	1.662	1094
948	3.065	1.707	1265
949	3.369	1.888	84
950	3.201	1.802	849
951	3.302	1.956	673
952	3.341	1.963	478
953	3.254	2.018	531
954	1.833	2.167	2
955	1.833	2.167	2
956	1.833	2.167	2
957	3.694	2.696	49
958	3.230	2.630	61

959	3.667	2.725	72
960	3.657	2.854	300
961	3.261	2.365	203
962	3.338	2.737	222
963	3.455	2.646	211
964	3.274	1.981	680
965	3.377	2.368	154
966	3.385	2.481	142
967	3.537	2.587	54
968	3.575	2.703	97
969	3.345	2.076	42
970	2.939	2.164	122
971	3.597	2.003	151
972	3.597	2.003	302
973	3.847	2.308	1237
974	3.127	2.061	79
975	2.831	2.113	112
976	3.093	2.318	101
977	3.412	2.283	118
978	3.396	2.255	102
979	3.817	2.283	727
980	3.863	2.203	775
981	2.645	1.748	171
982	2.723	2.075	102
983	3.361	2.378	121
984	3.385	2.279	68
985	3.617	2.369	153
986	3.678	2.653	85
987	3.837	2.801	124
988	3.837	2.801	67
989	3.074	2.384	193
990	3.268	2.510	69
991	2.964	2.687	33
992	3.356	2.758	90
993	3.268	2.510	69
994	3.198	1.788	0
995	3.379	2.428	9
996	3.379	2.428	35
997	3.379	2.428	15
998	3.128	2.318	192
999	3.670	2.266	46
1000	2.982	2.201	502
1001	3.200	2.338	325
1002	3.230	2.313	231
1003	3.262	2.097	211
1004	3.262	2.097	507
1005	3.091	1.981	623
1006	3.468	2.393	997
1007	3.366	2.344	522
1008	3.117	2.041	1277
1009	3.072	2.069	1181
1010	3.227	1.928	989
1011	3.128	2.213	651
1012	2.882	1.982	204
1013	2.953	2.110	807
1014	2.781	1.957	874
1015	2.727	1.726	950
1016	2.731	1.819	971
1017	2.224	1.425	340
1018	2.033	1.261	1167
1019	2.948	1.890	921
1020	2.726	1.774	963
1021	2.971	1.914	1020
1022	2.707	1.673	1321
1023	2.709	1.734	767
1024	1.953	1.032	1153
1025	2.316	1.332	881
1026	2.100	1.067	396
1027	2.385	1.164	646
1028	2.232	1.098	836
1029	2.774	1.685	1295
1030	3.095	1.852	349
1031	3.790	2.818	119
1032	3.136	2.019	655
1033	3.339	2.003	773
1034	2.373	1.199	1218
1035	2.854	1.066	1520
1036	2.891	1.590	949
1037	3.084	1.833	728
1038	2.880	1.800	1063
1039	3.198	1.788	0
1040	3.364	2.071	760
1041	3.518	2.212	740
1042	3.677	2.065	99
1043	4.667	3.000	3
1044	3.198	1.788	0
1045	1.417	0.917	12
1046	3.198	1.788	0
1047	3.198	1.788	0
1048	3.284	2.273	843
1049	3.313	2.150	1017
1050	3.163	1.933	572
1051	3.174	1.997	1382
1052	3.128	2.119	920
1053	3.270	2.185	1061
1054	1.667	1.000	3
1055	3.220	2.112	832
1056	3.060	2.144	1323
1057	3.236	2.625	370
1058	3.304	2.346	39
1059	3.871	2.719	106
1060	3.871	2.719	106
1061	0.000	0.000	0
1062	0.000	0.000	0
1063	0.000	0.000	0
1064	0.000	0.000	0
1065	0.000	0.000	0
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1079	0.000	0.000	0

1080			0.000	0.000	0
1081			0.000	0.000	0
1082			0.000	0.000	0
1083			0.000	0.000	0
1084			0.000	0.000	0
1085			0.000	0.000	0
1086			0.000	0.000	0
1087			0.000	0.000	0
1088			0.000	0.000	0
1089			0.000	0.000	0
1090			0.000	0.000	0
1091			0.000	0.000	0
1092			0.000	0.000	0
1093			0.000	0.000	0
1094			0.000	0.000	0
1095			0.000	0.000	0
1096			0.000	0.000	0
1097			0.000	0.000	0
1098			0.000	0.000	0
1099	3.022	1.896	0		
1100	3.022	1.896	0		
1101	3.022	1.896	0		
1102	3.022	1.896	0		
1103	3.022	1.896	0		
1104	2.571	2.133	21		
1105	2.775	2.000	89		
1106	6.044	3.792	0		
1107	2.873	1.896	102		
1108	3.022	1.896	0		
1109	3.022	1.896	0		
1110	3.022	1.896	0		
1111	2.000	2.625	8		
1112	1.909	1.061	10		
1113	1.909	1.061	32		
1114	1.909	1.061	14		
1115	3.022	1.896	0		
1116	3.022	1.896	0		
1117	3.022	1.896	0		
1118	1.909	1.061	31		
1119	1.909	1.061	5		
1120	2.500	1.411	15		
1121	3.022	1.896	0		
1122	2.708	1.587	4		
1123	2.708	1.587	56		
1124	2.708	1.587	60		
1125	2.842	1.830	30		
1126	3.022	1.896	0		
1127	3.022	1.896	0		
1128	3.130	2.507	3		
1129	3.130	2.507	24		
1130	3.130	2.507	4		
1131	3.130	2.507	3		
1132	3.064	2.138	40		
1133	3.022	1.896	0		
1134	2.395	1.842	19		
1135	2.395	1.842	26		
1136	2.395	1.842	32		
1137	2.395	1.842	13		
1138	2.181	1.469	19		
1139	2.181	1.469	19		
1140	2.181	1.469	14		
1141	3.013	2.220	60		
1142	3.013	2.220	33		
1143	3.013	2.220	50		
1144	2.980	2.555	16		
1145	2.980	2.555	15		
1146	2.980	2.555	14		
1147	2.980	2.555	31		
1148	2.980	2.555	26		
1149	3.022	1.896	0		
1150	3.022	1.896	0		
1151	3.181	1.985	112		
1152	3.181	1.985	7		
1153	3.181	1.985	7		
1154	3.181	1.985	84		
1155	3.181	1.985	56		
1156	3.181	1.985	7		
1157	3.181	1.985	7		
1158	3.770	2.422	69		
1159			3.022	1.896	0
1160			3.022	1.896	0
1161			3.022	1.896	0
1162			3.022	1.896	0
1163			3.022	1.896	0
1164			3.022	1.896	0
1165			3.022	1.896	0
1166			3.022	1.896	0
1167			2.000	0.000	6
1168			2.052	1.244	338
1169			3.022	1.896	0
1170			0.750	0.000	4
1171			3.022	1.896	0
1172	3.022	2.234	202		
1173	0.000	0.000	0		
1174	0.000	0.000	0		
1175	0.000	0.000	0		
1176	0.000	0.000	0		
1177	0.000	0.000	0		
1178	0.000	0.000	0		
1179	0.000	0.000	0		
1180	0.000	0.000	0		
1181	0.000	0.000	0		
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1189	0.000	0.000	0		
1190	0.000	0.000	0		
1191	0.000	0.000	0		
1192	0.000	0.000	0		
1193	0.000	0.000	0		
1194	0.000	0.000	0		
1195	0.000	0.000	0		
1196	0.000	0.000	0		
1197	0.000	0.000	0		
1198	0.000	0.000	0		
1199	0.000	0.000	0		
1200	0.000	0.000	0		

1201	0.000	0.000	0
1202	0.000	0.000	0
1203	0.000	0.000	0
1204	0.000	0.000	0
1205	0.000	0.000	0
1206	0.000	0.000	0
1207	0.000	0.000	0
1208	0.000	0.000	0
1209	0.000	0.000	0
1210	0.000	0.000	0
1211	0.000	0.000	0
1212	0.000	0.000	0
1213	0.000	0.000	0
1214	0.000	0.000	0
1215	0.000	0.000	0
1216	0.000	0.000	0
1217	0.000	0.000	0
1218	0.000	0.000	0
1219	0.000	0.000	0
1220	0.000	0.000	0
1221	0.000	0.000	0
1222	0.000	0.000	0
1223	0.000	0.000	0
1224	0.000	0.000	0
1225	0.000	0.000	0
1226	0.000	0.000	0
1227	0.000	0.000	0
1228	0.000	0.000	0
1229	0.000	0.000	0
1230	0.000	0.000	0
1231	0.000	0.000	0
1232	0.000	0.000	0
1233	0.000	0.000	0
1234	0.000	0.000	0
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1236	0.000	0.000	0
1237	0.000	0.000	0
1238	0.000	0.000	0
1239	0.000	0.000	0
1240	0.000	0.000	0
1241	0.000	0.000	0
1242	0.000	0.000	0
1243	0.000	0.000	0
1244	0.000	0.000	0
1245	0.000	0.000	0
1246	0.000	0.000	0
1247	0.000	0.000	0
1248	0.000	0.000	0
1249	0.000	0.000	0
1250	0.000	0.000	0

ZONEDTV7.04

*CAMDEN - WOLLONDILLY MODEL - 2016 LANDUSE DATA

ZONE16.000

1250

*Households

*CBD Parks

*Education jobs

*Retail jobs

*Accommodation jobs

*Wholesale jobs

*Construction jobs

*Health Jobs

*Arts & Recreation jobs

*Manufacturing jobs

*Mining jobs

*Total jobs

*Train Station Parks

*Campbelltown Households

*AMP External Inbound Job Attractor

*AMP External Outbound Job Attractor

*PMP External Inbound Job Attractor

*PMP External Outbound Job Attractor

*SOUTHERN Ampeak inbound ext

*SOUTHERN Ampeak outbound ext

*SOUTHERN Ampeak inbound accounted for

*SOUTHERN Ampeak Outbound accounted for

*SOUTHERN Pmpeak inbound externals

*SOUTHERN Pmpeak outbound externals

*SOUTHERN Pmpeak inbound accounted for

*SOUTHERN Pmpeak Outbound

*NORTHERN Ampeak inbound ext

*NORTHERN Ampeak outbound ext

*NORTHERN Ampeak inbound accounted for

*NORTHERN Ampeak Outbound accounted for

*NORTHERN Pmpeak inbound externals

*NORTHERN Pmpeak outbound externals

*NORTHERN Pmpeak inbound accounted for

*NORTHERN Pmpeak

	Ou	Edu	Ret	Acc	Who	Con	Hea	Art	Man	Min	Tot	Train	Camp
1	10	131	0	0	0	0	0	0	0	0	0	0	0
2	10	12	0	0	0	0	0	0	0	0	0	0	0
3	4	36	17	17	14	2	24	13	5	11	5	167	0
4	46	0	0	0	0	0	0	0	0	0	0	0	0
5	6	0	0	0	0	0	0	0	0	0	0	0	0
6	0	188	0	0	0	0	0	0	0	0	0	0	0
7	0	9	17	17	14	2	24	13	5	11	5	167	0
8	0	35	10	10	8	1	14	8	3	7	3	100	0
9	0	19	7	7	6	1	10	5	2	4	2	67	0
10	0	86	10	10	8	1	14	8	3	7	3	100	0
11	0	244	24	24	20	2	34	18	7	15	7	234	0
12	0	42	6	6	5	1	9	5	2	4	2	64	0
13	29	14	0	0	0	0	0	0	0	0	0	0	0
14	62	27	10	10	8	1	14	8	3	7	3	100	0
15	23	36	0	0	0	0	0	0	0	0	0	0	0
16	0	85	10	10	8	1	14	8	3	7	3	100	0
17	0	42	17	17	14	2	24	13	5	11	5	167	0
18	0	12	7	7	6	1	10	5	2	4	2	67	0
19	0	12	13	14	11	1	19	10	4	9	4	134	0
20	6	125	0	0	0	0	0	0	0	0	0	0	0
21	2	0	0	0	0	0	0	0	0	0	0	0	0
22	0	29	13	14	11	1	19	10	4	9	4	134	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	43	17	17	14	2	24	13	5	11	5	167	0
26	0	134	17	17	14	2	24	13	5	11	5	167	0
27	0	44	0	0	0	0	0	0	0	0	0	0	0
28	2	30	10	10	8	1	14	8	3	7	3	100	0
29	4	0	39	40	33	4	56	30	13	26	11	392	0
30	0	10	10	10	8	1	14	8	3	7	3	100	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	83	403	27	224	510	45	59	112	5	2663	0
52	77	0	0	0	0	0	0	0	0	0	0	0	0
53	226	0	0	0	0	0	0	0	0	0	0	0	0
54	84	0	0	0	0	0	0	0	0	0	0	0	0
55	82	0	0	0	0	0	0	0	0	0	0	0	0
56	110	0	0	0	0	0	0	0	0	0	0	0	0
57	71	0	0	0	0	0	0	0	0	0	0	0	0
58	94	0	0	0	0	0	0	0	0	0	0	0	0
59	173	0	0	0	0	0	0	0	0	0	0	0	0
60	147	0	106	12	5	6	41	46	6	0	0	282	0
61	170	0	0	0	0	0	0	0	0	0	0	0	0
62	95	0	0	0	0	0	0	0	0	0	0	0	0
63	161	0	0	0	0	0	0	0	0	0	0	0	0
64	83	0	24	12	3	5	18	21	20	1	0	126	0
65	149	0	0	0	0	0	0	0	0	0	0	0	0
66	148	0	0	0	0	0	0	0	0	0	0	0	0
67	129	0	9	436	307	14	41	129	33	3	0	1141	0
68	168	0	0	0	0	0	0	0	0	0	0	0	0
69	123	0	0	0	0	0	0	0	0	0	0	0	0
70	158	0	70	38	19	6	52	52	13	0	0	360	0
71	161	0	0	0	0	0	0	0	0	0	0	0	0
72	193	0	9	5	2	1	7	7	2	0	0	45	0
73	92	0	0	0	0	0	0	0	0	0	0	0	0
74	136	0	0	0	0	0	0	0	0	0	0	0	0
75	173	0	0	0	0	0	0	0	0	0	0	0	0
76	109	0	0	0	0	0	0	0	0	0	0	0	0
77	95	0	0	0	0	0	0	0	0	0	0	0	0
78	105	0	149	0	0	0	0	0	0	0	0	149	0
79	95	0	0	0	0	0	0	0	0	0	0	0	0
80	94	0	0	0	0	0	0	0	0	0	0	0	0
81	151	0	0	0	0	0	0	0	0	0	0	0	0
82	151	0	0	0	0	0	0	0	0	0	0	0	0
83	111	0	0	0	0	0	0	0	0	0	0	0	0



205	153	0	10	1	1	8	28	3	3	5	0	104	0	0
206	76	0	14	2	2	11	37	4	4	6	0	139	0	0
207	110	0	3	0	0	3	9	1	1	2	0	35	0	0
208	72	0	3	0	0	3	9	1	1	2	0	35	0	0
209	69	0	3	0	0	3	9	1	1	2	0	35	0	0
210	132	0	14	2	2	11	37	4	4	6	0	139	0	0
211	146	0	10	1	1	8	28	3	3	5	0	104	0	0
212	191	0	23	6	7	4	32	4	4	2	4	145	0	0
213	48	0	31	8	9	5	43	5	4	3	5	193	0	0
214	88	0	21	10	20	6	77	7	23	0	0	231	0	0
215	123	0	2	1	2	1	6	1	2	0	0	19	0	0
216	70	0	2	1	2	1	6	1	2	0	0	19	0	0
217	134	0	3	3	20	0	18	3	1	2	1	93	0	0
218	97	0	7	7	6	1	10	5	2	4	2	67	0	0
219	90	0	12	3	4	2	18	2	2	1	2	78	0	0
220	91	0	10	3	3	2	14	2	2	1	2	60	0	0
221	117	0	2	1	1	0	3	0	0	0	0	12	0	0
222	52	0	5	1	1	1	7	1	1	1	1	30	0	0
223	131	0	15	4	4	2	20	3	2	2	2	91	0	0
224	107	0	10	3	3	2	13	2	1	1	2	61	0	0
225	164	0	5	1	1	1	7	1	1	1	1	30	0	0
226	76	0	5	1	1	1	7	1	1	1	1	30	0	0
227	101	0	10	3	3	2	13	2	1	1	2	61	0	0
228	138	0	15	4	4	2	20	3	2	2	2	91	0	0
229	103	0	10	3	3	2	13	2	1	1	2	61	0	0
230	92	0	15	4	4	2	20	3	2	2	2	91	0	0
231	103	0	5	1	1	1	7	1	1	1	1	30	0	0
232	0	0	0	0	0	0	0	0	0	0	0	0	0	0
233	129	0	0	0	4	0	3	0	0	0	0	15	0	0
234	143	0	5	7	4	2	6	9	2	1	0	53	0	0
235	146	0	13	8	3	1	17	6	1	2	0	82	0	0
236	132	0	2	7	5	1	14	4	1	0	0	67	0	0
237	82	0	5	2	0	0	5	1	0	1	0	20	0	0
238	184	0	10	3	0	0	10	1	0	1	0	39	0	0
239	122	0	13	4	0	0	13	2	0	2	0	49	0	0
240	133	0	13	4	0	0	13	2	0	2	0	49	0	0
241	89	0	0	3	3	0	9	0	0	0	0	32	0	0
242	98	0	0	3	3	0	9	0	0	0	0	32	0	0
243	154	0	1	3	1	1	2	2	0	2	4	19	0	0
244	34	0	0	4	3	0	11	0	0	0	0	40	0	0
245	193	0	1	1	0	0	1	1	0	1	2	10	0	0
246	122	0	3	6	2	1	4	0	5	7	11	46	0	0
247	228	0	4	8	3	2	5	0	7	13	57	0	0	
248	0	0	52	100	34	20	55	57	0	84	164	709	0	0
249	135	0	5	10	3	2	5	6	0	3	16	69	0	0
250	118	0	8	15	5	3	8	8	0	12	24	104	0	0
251	166	0	0	0	0	0	0	0	0	0	0	0	0	0
252	214	0	0	0	0	0	0	0	0	0	0	0	0	0
253	39	0	2	3	2	1	2	3	1	0	0	21	0	0
254	132	0	9	14	9	4	11	17	3	1	1	106	0	0
255	104	0	12	17	11	5	14	22	4	2	1	133	0	0
256	152	0	5	7	4	2	6	9	2	1	0	53	0	0
257	109	0	2	3	2	1	3	4	1	0	0	27	0	0
258	92	0	2	3	2	1	3	4	1	0	0	27	0	0
259	169	0	2	3	2	1	3	4	1	0	0	27	0	0
260	77	0	10	10	8	1	14	8	3	7	3	100	0	0
261	83	0	0	0	0	0	0	0	0	0	0	0	0	0
262	161	0	7	7	6	1	10	5	2	4	2	67	0	0
263	143	0	0	0	0	0	0	0	0	0	0	0	0	0
264	92	0	3	3	3	0	5	3	1	2	1	33	0	0
265	133	0	0	0	0	0	0	0	0	0	0	0	0	0
266	0	0	1	1	0	1	0	2	1	0	0	13	0	0
267	96	0	0	0	0	0	0	0	0	0	0	0	0	0
268	0	0	7	7	6	1	10	5	2	4	2	67	0	0
269	35	0	0	0	0	0	0	0	0	0	0	0	0	0
270	71	0	8	15	5	3	8	8	0	12	24	104	0	0
271	29	0	8	15	5	3	8	8	0	12	24	104	0	0
272	71	0	3	5	2	1	3	3	0	4	8	35	0	0
273	96	0	2	2	2	1	4	2	0	1	2	20	0	0
274	66	0	0	0	0	0	0	0	0	0	0	0	0	0
275	98	0	0	0	0	0	0	0	0	0	0	0	0	0
276	146	0	8	10	8	3	16	7	3	6	7	99	0	0
277	137	0	0	0	0	0	0	0	0	0	0	0	0	137
278	216	0	29	35	27	11	57	23	9	21	23	346	0	216
279	152	0	0	0	0	0	0	0	0	0	0	0	0	0
280	46	0	11	13	10	4	21	9	4	8	9	128	0	0
281	196	0	2	2	2	1	3	1	1	1	1	20	0	0
282	5	0	7	4	0	0	18	5	4	3	86	180	0	0
283	103	0	4	5	4	2	8	3	1	3	3	49	0	0
284	99	0	16	20	16	6	33	13	5	12	13	198	0	0
285	108	0	12	15	12	5	24	10	4	9	10	148	0	0
286	283	0	1	1	1	0	2	1	0	1	1	10	0	0
287	68	0	1	1	1	0	2	1	0	1	1	10	0	0
288	123	0	1	1	1	0	2	1	0	1	1	10	0	0
289	358	0	3	0	0	2	11	2	0	3	27	70	0	0
290	105	0	2	1	0	1	11	0	1	10	0	57	0	0
291	172	0	13	0	2	8	34	11	0	0	135	255	0	0
292	94	0	4	0	1	2	10	3	0	0	41	77	0	0
293	125	0	2	1	2	1	9	3	2	0	0	42	0	0
294	64	0	4	0	1	2	14	10	0	0	28	119	0	0
295	212	0	8	0	3	0	41	42	0	2	6	365	0	0
296	69	0	92	10	12	2	19	5	30	0	5	198	0	0
297	150	0	80	8	10	1	16	64	21	0	3	247	0	0
298	74	0	1716	7	20	0	5	30	9	0	0	1838	0	0
299	340	0	12	12	10	1	42	4	18	18	236	441	0	0
300	192	0	5	4	0	17	2	4	7	94	176	0	0	0
301	119	0	12	12	10	1	42	4	10	18	236	441	0	0
302	137	0	18	20	16	2	67	7	16	28	377	705	0	0
303	77	0	4	0	1	2	10	3	0	0	41	77	0	0
304	86	0	2	5	2	0	12	2	0	0	5	49	0	0
305	143	0	3	9	3	0	20	4	0	0	9	82	0	0
306	191	0	4	11	4	0	24	5	0	0	10	98	0	0
307	43	0	1	2	1	0	4	1	0	0	2	16	0	0
308	52	0	0	0	0	0	1	0	0	0	0	3	0	0
309	3	0	13	5	18	4	17	14	6	4	0	150	0	0
310	0	0	3	22	3	18	106	20	7	5	0	317	0	0
311	0	0	21	17	11	14	29	15	2	11	2	213	0	0
312	0	0	0	0	0	0	0	0	0	0	0	0	0	0
313	104	0	3	0	0	1	4	2	1	0	0	16	0	0
314	208	0	7	1	1	2	11	4	3	0	0	43	0	0
315	208	0	5	1	1	1	8	3	2	0	0	32	0	0
316	25	0	4	1	2	0	3	8	1	0	0	32	0	0
317	0	0	1	2	0	0	22	2	0	0	0	49	0	0
318	151	0	1	2	0	0	22	2	0	0	0	49	0	0
319	0	0	1	1	0	0	20	2	0	0	0	44	0	0
320	7	0	0	0	0	0	4	0	0	301	0	308	0	0
321	251	0	0	0	0	0	2	0	0	0	0	4	0	0
322	153	0	0	0	0	0	3	0	0	1	0	7	0	0
323	7	0	0	0	0	0	18	0	0	3	0	39	0	0
324	98	0	0	0	0	0	2	0	0	0	0	5	0	0
325	14	0	0	1	0	1	24	1	0	4	0	54	0	0

326	316	0	1	1	0	0	20	2	0	0	0	44	0	0
327	454	0	0	1	0	0	7	1	0	0	0	15	0	0
328	43	0	1	2	1	0	4	1	0	0	2	16	0	0
329	0	0	9	2	0	4	42	0	5	35	0	211	0	0
330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
331	0	0	2	0	0	1	8	0	1	6	0	38	0	0
332	0	0	0	0	0	0	0	0	0	0	0	0	0	0
333	64	0	2	7	3	0	16	3	0	0	7	65	0	0
334	40	0	2	1	0	1	11	0	1	10	0	57	0	0
335	151	0	1	1	0	0	20	2	0	0	0	44	0	0
336	0	0	1	1	0	0	20	2	0	0	0	44	0	0
337	0	0	2	5	0	0	59	5	1	0	1	133	0	0
338	0	0	1	1	0	0	20	2	0	0	0	44	0	0
339	0	0	0	0	0	0	0	0	0	0	0	0	0	0
340	0	0	0	0	0	0	0	0	0	0	0	0	0	0
341	0	0	0	0	0	0	0	0	0	0	0	0	0	0
342	0	0	0	0	0	0	0	0	0	0	0	0	0	0
343	0	0	0	0	0	0	0	0	0	0	0	0	0	0
344	0	0	0	0	0	0	0	0	0	0	0	0	0	0
345	0	0	0	0	0	0	0	0	0	0	0	0	0	0
346	0	0	0	0	0	0	0	0	0	0	0	0	0	0
347	0	0	0	0	0	0	0	0	0	0	0	0	0	0
348	0	0	0	0	0	0	0	0	0	0	0	0	0	0
349	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	107	0	0	5	0	0	25	0	6	0	71	145	0	0
351	61	0	0	5	0	0	25	0	6	0	71	145	0	0
352	0	0	0	0	0	0	0	0	0	0	0	0	0	0
353	0	0	13	13	1	1	8	10	3	1	0	65	0	0
354	185	0	0	0	0	0	0	0	0	0	0	0	0	185
355	164	0	0	0	0	0	0	0	0	0	0	0	0	164
356	153	0	0	0	0	0	0	0	0	0	0	0	0	153
357	137	0	0	0	0	0	0	0	0	0	0	0	0	137
358	84	0	0	0	0	0	0	0	0	0	0	0	0	84
359	81	0	0	0	0	0	0	0	0	0	0	0	0	81
360	112	0	0	0	0	0	0	0	0	0	0	0	0	112
361	90	0	0	0	0	0	0	0	0	0	0	0	0	90
362	98	0	24	9	0	3	17	15	0	0	0	99	0	98
363	169	0	24	9	0	3	17	15	0	0	0	99	0	169
364	127	0	0	0	0	0	0	0	0	0	0	0	0	127
365	109	0	0	0	0	0	0	0	0	0	0	0	0	109
366	70	0	0	0	0	0	0	0	0	0	0	0	0	70
367	90	0	0	0	0	0	0	0	0	0	0	0	0	90
368	171	0	0	0	0	0	0	0	0	0	0	0	0	171
369	70	0	43	3	6	0	8	142	3	0	0	279	0	70
370	169	0	0	0	0	0	0	0	0	0	0	0	0	169
371	102	0	0	0	0	0	0	0	0	0	0	0	0	102
372	151	0	183	0	0	0	34	4	0	0	0	273	0	151
373	114	0	0	0	0	0	0	0	0	0	0	0	0	114
374	133	0	0	0	0	0	0	0	0	0	0	0	0	133
375	135	0	143	133	102	4	7	118	0	3	0	546	0	135
376	230	0	3	1	0	0	2	2	0	0	0	12	0	230
377	145	0	0	0	0	0	0	0	0	0	0	0	0	145
378	165	0	0	0	0	0	0	0	0	0	0	0	0	165
379	134	0	8	11	1	0	4	6	3	1	0	43	0	134
380	96	0	0	0	0	0	0	0	0	0	0	0	0	96
381	149	0	0	0	0	0	0	0	0	0	0	0	0	149
382	83	0	15	22	3	0	8	13	6	3	0	86	0	83
383	142	0	3	1	0	0	3	1	0	0	0	14	0	142
384	166	0	3	1	0	0	3	1	0	0	0	14	0	166
385	109	0	4	2	1	0	5	1	1	0	0	21	0	109
386	98	0	4	2	1	0	5	1	1	0	0	21	0	98
387	187	0	0	0	0	0	0	0	0	0	0	0	0	187
388	96	0	0	0	0	0	0	0	0	0	0	0	0	96
389	42	0	0	0	0	0	0	0	0	0	0	0	0	42
390	115	0	0	0	0	0	0	0	0	0	0	0	0	115
391	128	0	36	33	26	1	2	30	0	1	0	137	0	128
392	84	0	0	0	0	0	0	0	0	0	0	0	0	84
393	84	0	0	0	0	0	0	0	0	0	0	0	0	84
394	134	0	1	3	1	0	10	1	0	1	0	33	0	134
395	104	0	0	0	0	0	0	0	0	0	0	0	0	104
396	140	0	0	0	0	0	0	0	0	0	0	0	0	140
397	79	0	20	5	0	0	14	8	1	1	0	68	0	79
398	129	0	0	0	0	0	0	0	0	0	0	0	0	129
399	153	0	0	0	0	0	0	0	0	0	0	0	0	153
400	75	0	0	0	0	0	0	0	0	0	0	0	0	75
401	72	0	0	0	0	0	0	0	0	0	0	0	0	72
402	124	0	0	0	0	0	0	0	0	0	0	0	0	124
403	107	0	0	0	0	0	0	0	0	0	0	0	0	107
404	130	0	0	0	0	0	0	0	0	0	0	0	0	130
405	155	0	0	0	0	0	0	0	0	0	0	0	0	155
406	128	0	60	15	0	0	41	23	3	2	0	204	0	128
407	68	0	1	3	1	0	10	1	0	1	0	33	0	68
408	126	0	1	3	1	0	10	1	0	1	0	33	0	126
409	148	0	0	0	0	0	0	0	0	0	0	0	0	148
410	102	0	1	2	1	0	7	1	0	1	0	22	0	102
411	71	0	1	3	1	0	10	1	0	1	0	33	0	71
412	99	0	1	3	1	0	10	1	0	1	0	33	0	99
413	179	0	1	3	1	0	10	1	0	1	0	33	0	179
414	127	0	4	95	30	2	13	59	7	6	0	273	0	127
415	90	0	2	57	18	1	8	35	4	3	0	164	0	90
416	96	0	0	0	0	0	0	0	0	0	0	0	0	96
417	102	0	0	0	0	0	0	0	0	0	0	0	0	102
418	97	0	0	0	0	0	0	0	0	0	0	0	0	97
419	59	0	0	0	0	0	0	0	0	0	0	0	0	59
420	202	0	35	7	4	1	2	4	6	0	0	69	0	202
421	144	0	0	0	0	0	0	0	0	0	0	0	0	144
422	103	0	139	26	14	2	7	15	24	0	0	275	0	103
423	89	0	0	0	0	0	0	0	0	0	0	0	0	89
424	143	0	0	0	0	0	0	0	0	0	0	0	0	143
425	139	0	2	38	12	1	5	23	3	2	0	109	0	139
426	449	0	0	0	0	0	0	0	0	0	0	0	0	449
427	662	0	0	0	0	0	0	0	0	0	0	0	0	662
428	215	0	0	0	0	0	0	0	0	0	0	0	0	215
429	134	0	0	0	0	0	0	0	0	0	0	0	0	134
430	171	0	6	2	1	0	7	2	1	0	0	28	0	171
431	108	0	4	2	1	0	5	1	1	0	0	21	0	108
432	162	0	4	2	1	0	5	1	1	0	0	21	0	162
433	159	0	0	0	0	0	0	0	0	0	0	0	0	159
434	134	0	84	13	7	0	2	43	2	0	0	218	0	134
435	0	0	0	0	0	0	0	0	0	0	0	0	0	0
436	88	0	0	0	0	0	0	0	0	0	0	0	0	88
437	148	0	127	19	10	0	3	65	2	0	0	328	0	148
438	158	0	48	1	1	0	6	10	0	0	0	90	0	158
439	114	0	0	0	0	0	0	0	0	0	0	0	0	114
440	213	0	0	0	0	0	0	0	0	0	0	0	0	213
441	96	0	0	0	0	0	0	0	0	0	0	0	0	96
442	156	0	0	0	0	0	0	0	0	0	0	0	0	156
443	190	0	55	46	19	4	26	42	9	2	0	290	0	190
444	201	0	0	0	0	0	0	0	0	0	0	0	0	201
445	139	0	0	0	0	0	0	0	0	0	0	0	0	139
446	187	0	0	0	0	0	0	0	0	0	0	0	0	187



568	138	0	0	0	0	0	0	0	0	0	0	0	138
569	184	0	0	0	0	0	0	0	0	0	0	0	184
570	176	0	0	0	0	0	0	0	0	0	0	0	176
571	121	0	0	0	0	0	0	0	0	0	0	0	121
572	91	0	89	32	6	0	21	36	0	0	0	299	91
573	13	0	11	63	28	199	268	17	0	112	5	1533	13
574	102	0	0	0	0	0	0	0	0	0	0	0	102
575	91	0	0	0	0	0	0	0	0	0	0	0	91
576	105	0	0	0	0	0	0	0	0	0	0	0	105
577	111	0	0	0	0	0	0	0	0	0	0	0	111
578	81	0	123	7	1	0	15	22	3	3	0	205	81
579	74	0	0	0	0	0	0	0	0	0	0	0	74
580	123	0	0	0	0	0	0	0	0	0	0	0	123
581	184	0	0	0	0	0	0	0	0	0	0	0	184
582	64	0	0	0	0	0	0	0	0	0	0	0	64
583	133	0	0	0	0	0	0	0	0	0	0	0	133
584	140	0	0	0	0	0	0	0	0	0	0	0	140
585	126	0	0	0	0	0	0	0	0	0	0	0	126
586	151	0	0	0	0	0	0	0	0	0	0	0	151
587	121	0	0	0	0	0	0	0	0	0	0	0	121
588	89	0	0	0	0	0	0	0	0	0	0	0	89
589	85	0	0	0	0	0	0	0	0	0	0	0	85
590	96	0	0	0	0	0	0	0	0	0	0	0	96
591	129	0	12	0	2	2	11	10	0	2	0	60	129
592	165	0	0	0	0	0	0	0	0	0	0	0	165
593	161	0	12	0	2	2	11	10	0	2	0	60	161
594	9	0	0	44	15	93	90	3	0	253	2	1283	9
595	104	0	0	0	0	0	0	0	0	0	0	0	104
596	61	0	2	18	6	50	86	9	3	28	2	484	61
597	28	0	4	0	0	0	0	3	0	0	0	7	28
598	0	0	0	0	0	0	0	0	0	0	0	0	0
599	74	0	0	3	0	2	18	7	0	0	0	53	74
600	27	0	249	14	3	0	31	45	7	5	0	418	27
601	280	0	1	0	0	3	13	1	0	0	0	55	0
602	307	0	0	0	6	0	6	2	1	0	0	19	0
603	133	0	7	10	2	8	77	16	2	3	0	221	0
604	87	0	1	2	0	2	15	3	0	1	0	44	0
605	90	0	4	5	1	5	42	9	1	2	0	123	0
606	90	0	1	7	3	2	31	3	0	2	0	86	0
607	99	0	0	0	0	0	8	0	0	1	0	16	0
608	123	0	32	5	3	11	89	0	0	0	0	204	0
609	80	0	2	0	0	8	30	2	0	0	0	128	0
610	101	0	2	0	0	7	29	2	0	0	0	128	0
611	113	0	5	7	7	2	18	4	2	6	0	83	0
612	89	0	10	12	0	5	22	3	0	11	0	121	0
613	75	0	9	25	6	13	17	16	2	0	0	145	0
614	114	0	2	6	1	3	4	4	0	0	0	33	0
615	72	0	0	1	8	1	8	2	2	1	0	25	0
616	20	0	0	0	0	0	1	1	0	0	0	3	0
617	27	0	0	0	0	0	1	1	0	0	0	3	0
618	13	0	0	0	0	0	1	1	0	0	0	3	0
619	72	0	0	1	8	1	8	2	2	1	0	25	0
620	787	0	305	14	34	0	119	4	0	0	33	614	787
621	0	0	4	0	27	3	18	4	30	7	0	143	0
622	121	0	0	0	0	0	0	0	0	0	0	0	121
623	259	0	0	0	0	0	0	0	0	0	0	0	259
624	0	0	0	0	0	0	0	0	0	0	0	0	0
625	113	0	0	0	0	0	0	0	0	0	0	0	113
626	130	0	0	0	0	0	0	0	0	0	0	0	130
627	101	0	0	0	0	0	0	0	0	0	0	0	101
628	114	0	0	0	0	0	0	0	0	0	0	0	114
629	119	0	0	0	0	0	0	0	0	0	0	0	119
630	171	0	14	7	4	2	15	268	2	2	0	358	171
631	150	0	0	0	0	0	0	0	0	0	0	0	150
632	127	0	40	38	23	0	57	51	3	3	0	326	127
633	117	0	13	13	8	0	19	17	1	1	0	109	117
634	115	0	0	0	0	0	0	0	0	0	0	0	115
635	184	0	0	0	0	0	0	0	0	0	0	0	184
636	12	0	14	7	4	2	15	268	2	2	0	358	12
637	75	0	0	0	0	0	0	0	0	0	0	0	75
638	111	0	0	0	0	0	0	0	0	0	0	0	111
639	74	0	0	0	0	0	0	0	0	0	0	0	74
640	120	0	0	0	0	0	0	0	0	0	0	0	120
641	134	0	38	40	20	0	9	10	0	0	0	181	134
642	196	0	0	0	0	0	0	0	0	0	0	0	196
643	84	0	0	0	0	0	0	0	0	0	0	0	84
644	0	0	69	5	0	0	4	30	6	0	0	150	0
645	137	0	0	0	0	0	0	0	0	0	0	0	137
646	96	0	76	80	39	0	1	19	20	0	0	363	96
647	163	0	0	0	0	0	0	0	0	0	0	0	163
648	176	0	25	27	13	0	6	7	0	0	0	121	176
649	114	0	0	0	0	0	0	0	0	0	0	0	114
650	177	0	40	12	5	0	7	16	0	2	0	108	177
651	117	0	0	0	0	0	0	0	0	0	0	0	117
652	174	0	114	121	59	1	28	30	0	0	0	544	174
653	155	0	0	0	0	0	0	0	0	0	0	0	155
654	123	0	0	0	0	0	0	0	0	0	0	0	123
655	161	0	0	0	0	0	0	0	0	0	0	0	161
656	132	0	0	0	0	0	0	0	0	0	0	0	132
657	121	0	0	0	0	0	0	0	0	0	0	0	121
658	96	0	0	0	0	0	0	0	0	0	0	0	96
659	170	0	17	1	0	0	1	8	1	0	0	37	170
660	151	0	0	0	0	0	0	0	0	0	0	0	151
661	135	0	0	0	0	0	0	0	0	0	0	0	135
662	155	0	0	3	2	5	15	6	0	0	0	50	155
663	118	0	0	0	0	0	0	0	0	0	0	0	118
664	127	0	0	0	0	0	0	0	0	0	0	0	127
665	104	0	0	0	0	0	0	0	0	0	0	0	104
666	134	0	0	0	0	0	0	0	0	0	0	0	134
667	114	0	0	0	0	0	0	0	0	0	0	0	114
668	120	0	0	0	0	0	0	0	0	0	0	0	120
669	194	0	0	0	0	0	0	0	0	0	0	0	194
670	119	0	0	0	0	0	0	0	0	0	0	0	119
671	141	0	0	0	0	0	0	0	0	0	0	0	141
672	222	0	0	0	0	0	0	0	0	0	0	0	222
673	155	0	161	46	22	0	27	62	0	7	0	434	155
674	160	0	0	0	0	0	0	0	0	0	0	0	160
675	63	0	0	9	5	16	44	17	0	0	0	149	63
676	79	0	8	2	1	3	6	2	0	0	0	36	79
677	159	0	8	2	1	3	6	2	0	0	0	36	159
678	197	0	8	2	1	3	6	2	0	0	0	36	197
679	156	0	8	2	1	3	6	2	0	0	0	36	156
680	168	0	0	0	0	0	0	0	0	0	0	0	168
681	75	0	0	0	0	0	0	0	0	0	0	0	75
682	117	0	0	0	0	0	0	0	0	0	0	0	117
683	211	0	0	0	0	0	0	0	0	0	0	0	211
684	208	0	87	350	172	11	50	234	4	15	0	1459	208
685	139	0	10	39	19	1	6	26	0	2	0	162	139
686	111	0	0	0	0	0	0	0	0	0	0	0	111
687	138	0	8	2	1	3	6	2	0	0	0	36	138
688	144	0	29	2	23	0	5	8	0	1	0	90	144

689	90	0	0	0	0	0	0	0	0	0	0	0	0	90
690	150	0	0	0	0	0	0	0	0	0	0	0	0	150
691	104	0	0	0	0	0	0	0	0	0	0	0	0	104
692	100	0	87	5	69	0	16	24	0	3	0	270	0	100
693	212	0	0	0	0	0	0	0	0	0	0	0	0	212
694	227	0	37	2	0	0	11	10	0	0	0	80	0	227
695	192	0	4	8	0	2	19	7	3	5	0	76	0	192
696	154	0	4	8	0	2	19	7	3	5	0	76	0	154
697	146	0	0	0	0	0	0	0	0	0	0	0	0	146
698	164	0	0	0	0	0	0	0	0	0	0	0	0	164
699	164	0	0	0	0	0	0	0	0	0	0	0	0	164
700	131	0	0	0	0	0	0	0	0	0	0	0	0	131
701	129	0	37	2	0	0	11	10	0	0	0	80	0	129
702	121	0	0	0	0	0	0	0	0	0	0	0	0	121
703	108	0	0	0	0	0	0	0	0	0	0	0	0	108
704	184	0	0	0	0	0	0	0	0	0	0	0	0	184
705	97	0	11	0	0	1	35	18	0	1	0	110	0	97
706	45	0	29	0	0	0	17	11	0	0	0	124	0	45
707	185	0	13	0	0	0	8	0	0	0	0	37	0	185
708	132	0	0	0	0	0	0	0	0	0	0	0	0	132
709	114	0	0	0	0	0	0	0	0	0	0	0	0	114
710	80	0	0	0	0	0	0	0	0	0	0	0	0	80
711	172	0	0	0	0	0	0	0	0	0	0	0	0	172
712	126	0	0	0	0	0	0	0	0	0	0	0	0	126
713	160	0	13	0	0	0	8	0	0	0	0	37	0	160
714	136	0	0	0	0	0	0	0	0	0	0	0	0	136
715	203	0	0	0	0	0	0	0	0	0	0	0	0	203
716	126	0	0	0	0	0	0	0	0	0	0	0	0	126
717	151	0	27	0	0	0	16	0	0	0	0	74	0	151
718	111	0	0	0	0	0	0	0	0	0	0	0	0	111
719	131	0	0	0	0	0	0	0	0	0	0	0	0	131
720	98	0	0	0	0	0	0	0	0	0	0	0	0	98
721	135	0	0	0	0	0	0	0	0	0	0	0	0	135
722	486	0	15	8	14	1	2	4	0	0	0	54	0	486
723	139	0	0	0	0	0	0	0	0	0	0	0	0	139
724	100	0	44	24	43	3	5	13	0	1	0	161	0	100
725	136	0	17	10	26	1	3	48	3	1	0	144	0	136
726	156	0	0	0	0	0	0	0	0	0	0	0	0	156
727	118	0	50	30	79	2	9	143	10	2	0	432	0	118
728	120	0	88	48	86	6	10	25	0	2	0	322	0	120
729	0	0	0	69	12	109	119	20	0	410	0	1686	0	0
730	182	0	46	0	0	0	27	32	0	0	0	261	0	182
731	130	0	0	0	0	0	0	0	0	0	0	0	0	130
732	63	0	0	0	0	0	0	0	0	0	0	0	0	63
733	35	0	0	0	0	0	0	0	0	0	0	0	0	35
734	81	0	0	0	0	0	0	0	0	0	0	0	0	81
735	167	0	0	0	0	0	0	0	0	0	0	0	0	167
736	130	0	0	0	0	0	0	0	0	0	0	0	0	130
737	124	0	0	0	0	0	0	0	0	0	0	0	0	124
738	162	0	0	0	0	0	0	0	0	0	0	0	0	162
739	197	0	0	0	0	0	0	0	0	0	0	0	0	197
740	152	0	0	0	0	0	0	0	0	0	0	0	0	152
741	119	0	0	0	0	0	0	0	0	0	0	0	0	119
742	101	0	0	0	0	0	0	0	0	0	0	0	0	101
743	133	0	0	0	0	0	0	0	0	0	0	0	0	133
744	133	0	0	0	0	0	0	0	0	0	0	0	0	133
745	240	0	17	0	22	1	4	4	0	0	0	62	0	240
746	80	0	11	0	0	1	35	18	0	1	0	110	0	80
747	314	0	6	9	2	7	66	14	2	2	0	189	0	0
748	460	0	0	0	1	0	2	0	0	0	0	5	0	0
749	153	0	0	1	20	1	23	6	5	1	0	66	0	0
750	0	0	0	1	11	1	12	3	2	1	0	37	0	0
751	41	0	0	2	0	1	0	1	1	0	0	23	0	0
752	56	0	0	0	0	0	0	0	0	0	0	0	0	0
753	0	0	0	0	0	0	0	0	0	0	0	0	0	0
754	0	0	0	0	0	0	0	0	0	0	0	0	0	0
755	0	0	0	0	0	0	0	0	0	0	0	0	0	0
756	0	0	0	0	0	0	0	0	0	0	0	0	0	0
757	0	0	0	0	0	0	0	0	0	0	0	0	0	0
758	14	0	0	0	0	0	0	0	0	0	0	0	0	0
759	0	0	0	0	0	0	0	0	0	0	0	0	0	0
760	0	0	0	0	0	0	0	0	0	0	0	0	0	0
761	0	0	0	0	0	0	0	0	0	0	0	0	0	0
762	0	0	0	0	0	0	0	0	0	0	0	0	0	0
763	0	0	0	0	0	0	0	0	0	0	0	0	0	0
764	10	0	0	0	0	0	0	0	0	0	0	0	0	0
765	208	0	0	0	0	0	0	0	0	0	0	0	0	0
766	0	0	0	0	0	0	0	0	0	0	0	0	0	0
767	0	0	0	0	0	0	0	0	0	0	0	0	0	0
768	77	0	1	1	0	1	7	2	0	0	0	18	0	0
769	77	0	0	0	1	0	2	0	0	0	0	5	0	0
770	77	0	0	0	6	0	6	2	1	0	0	18	0	0
771	77	0	0	0	6	0	6	2	1	0	0	18	0	0
772	330	0	0	10	0	5	53	21	0	0	0	155	0	330
773	28	0	1	0	0	0	0	0	0	0	0	1	0	28
774	55	0	4	0	0	0	0	3	0	0	0	7	0	55
775	12	0	1	0	0	0	0	0	0	0	0	2	0	0
776	17	0	1	0	1	0	0	0	0	0	0	3	0	0
777	69	0	1	0	0	0	2	1	0	0	0	6	0	0
778	69	0	1	0	0	0	1	0	0	0	0	3	0	0
779	59	0	0	0	0	0	1	0	0	0	0	1	0	0
780	140	0	0	0	0	0	2	0	0	0	0	6	0	0
781	7	0	0	0	0	0	2	0	0	0	0	4	0	0
782	7	0	0	0	0	0	1	0	0	0	0	1	0	0
783	167	0	0	0	0	0	3	0	0	1	0	7	0	0
784	186	0	0	0	0	0	3	0	0	1	0	7	0	0
785	0	0	0	0	0	0	0	0	0	0	0	0	0	0
786	0	0	0	0	0	0	0	0	0	0	0	0	0	0
787	145	0	9	1	5	1	3	3	1	0	0	32	0	0
788	55	0	1	0	0	0	0	1	0	0	0	2	0	0
789	0	0	0	0	0	0	0	0	0	0	0	0	0	0
790	139	0	7	1	4	1	3	2	1	0	0	23	0	0
791	62	0	9	24	6	12	15	15	2	0	0	136	0	0
792	224	0	0	1	0	0	4	2	0	0	0	11	0	0
793	93	0	5	0	3	0	2	1	0	0	0	16	0	0
794	58	0	3	0	2	0	1	1	0	0	0	9	0	0
795	116	0	7	0	4	1	3	2	1	0	0	25	0	0
796	55	0	1	0	0	0	0	1	0	0	0	2	0	55
797	0	0	7	216	38	3	0	0	0	0	0	272	0	0
798	0	0	31	4	60	3	23	51	0	0	0	2686	0	0
799	345	0	0	0	4	6	87	4	0	0	0	157	0	0
800	480	0	4	4	0	0	30	9	0	0	0	165	0	0
801	906	0	30	0	11	6	41	39	0	4	0	227	0	0
802	969	0	13	0	5	3	18	17	0	2	0	98	0	0
803	0	0	10	27	53	315	36	4	0	35	0	2119	0	0
804	1259	0	88	47	16	6	57	36	6	4	0	391	0	0
805	590	0	11	42	45	0	21	44	13	15	0	276	0	0
806	463	0	89	17	49	10	34	48	0	0	0	382	0	0
807	0	0	0	62	8	186	50	4	0	72	0	1975	0	0
808	3	0	5	105	19	254	100	4	0	262	0	2097	0	0
809	1095	0	56	19	0	0	28	51	0	4	0	321	0	0

810	1111	0	295	150	46	6	37	68	8	0	0	765	0	0
811	1107	0	79	62	66	4	78	611	31	0	0	1138	0	0
812	1256	0	0	118	61	6	55	9	17	0	5	349	0	0
813	634	0	9	0	0	0	28	9	0	0	0	91	0	0
814	825	0	58	230	100	3	39	119	6	4	0	716	0	0
815	0	0	7	155	27	270	237	24	23	186	5	2444	0	0
816	289	0	0	7	0	16	7	4	0	22	0	219	0	0
817	1275	0	30	22	0	6	68	72	0	0	0	361	0	0
818	316	0	257	576	415	46	207	1366	51	200	0	7691	0	0
819	0	0	5	47	0	43	21	0	0	3	0	738	0	0
820	1050	0	195	38	160	16	57	104	0	12	0	683	0	0
821	40	0	24	201	38	641	420	68	8	149	14	3657	0	0
822	565	0	5	21	0	12	37	138	0	3	0	309	0	0
823	83	0	21	10	0	16	34	7	211	63	0	945	0	0
824	0	0	335	119	112	20	329	5396	0	167	0	6876	0	0
825	700	0	288	186	109	97	55	161	8	68	0	1272	0	0
826	1412	0	130	1576	292	16	153	861	0	15	0	3594	0	0
827	1017	0	0	11	0	12	39	85	0	0	0	447	0	0
828	1429	0	65	78	102	6	66	144	99	5	0	1114	0	0
829	1091	0	29	264	141	22	100	186	0	27	0	1260	0	0
830	972	0	111	47	74	0	48	85	0	6	0	449	0	0
831	699	0	82	562	97	6	23	50	8	59	0	1050	0	0
832	1066	0	11	31	57	24	62	70	21	11	0	398	0	0
833	700	0	27	0	0	9	41	37	0	0	0	162	0	0
834	537	0	63	3	38	7	26	21	7	0	0	233	0	0
835	704	0	63	3	38	7	26	21	7	0	0	233	0	0
836	379	0	3	27	6	3	34	69	3	5	0	284	0	0
837	666	0	1	12	2	1	14	29	1	2	0	120	0	0
838	686	0	291	57	4	3	23	17	4	0	0	447	0	0
839	444	0	64	18	0	3	34	7	0	0	0	191	0	0
840	702	0	69	20	0	4	37	8	0	0	0	210	0	0
841	153	0	57	405	198	18	31	27	0	235	0	1108	0	0
842	676	0	24	6	51	0	10	7	0	0	0	134	0	0
843	501	0	143	64	127	0	58	91	6	0	0	578	0	0
844	631	0	74	8	25	0	137	148	5	5	0	529	0	0
845	6	0	196	215	0	29	27	14	0	111	5	1072	0	0
846	3	0	22	149	187	619	654	81	16	198	10	3638	0	0
847	1056	0	159	0	4	3	48	13	0	3	0	298	0	0
848	736	0	83	4	0	3	25	28	0	6	0	189	0	0
849	948	0	4	63	64	19	71	41	8	10	0	405	0	0
850	0	0	70	175	107	312	420	60	4	152	0	2426	0	0
851	827	0	8	19	12	35	47	7	0	17	0	269	0	0
852	1147	0	130	41	81	6	91	173	4	0	0	689	0	0
853	811	0	82	20	18	4	36	131	13	3	3	379	0	0
854	0	0	7	122	60	57	0	0	0	206	0	632	0	0
855	781	0	82	12	5	12	5	40	0	16	0	211	0	0
856	0	0	4	480	82	12	349	0	14	0	0	981	0	0
857	1150	0	31	78	5	7	53	48	4	7	0	332	0	0
858	294	0	33	52	19	179	124	8	10	400	5	1034	0	0
859	467	0	11	174	66	79	43	12	5	84	0	654	0	0
860	828	0	129	25	46	3	43	257	0	3	0	552	0	0
861	896	0	23	73	98	4	49	107	32	0	0	500	0	0
862	347	0	4	127	36	72	10	0	0	36	0	461	0	0
863	555	0	93	17	24	6	37	5	0	4	0	216	0	0
864	599	0	160	15	11	0	37	27	0	3	0	288	0	0
865	1182	0	52	19	64	16	33	524	0	39	0	814	0	0
866	494	0	9	11	16	0	10	19	0	0	0	86	0	0
867	49	0	5	62	16	4	0	35	0	3	0	139	0	0
868	313	0	14	106	80	3	45	35	50	3	0	460	0	0
869	600	0	28	11	0	3	7	68	0	0	0	153	0	0
870	618	0	144	26	8	12	33	22	0	15	0	410	0	0
871	148	0	20	378	60	297	127	11	4	277	0	2415	0	0
872	1006	0	43	73	18	66	162	132	0	36	9	1245	0	0
873	610	0	68	10	258	18	44	15	10	26	0	565	0	0
874	428	0	107	739	310	36	60	610	40	122	0	3577	0	0
875	556	0	271	347	41	3	62	196	0	4	0	1262	0	0
876	763	0	6	7	1	0	1	4	0	0	0	25	0	0
877	796	0	0	11	4	6	34	16	5	4	0	152	0	0
878	798	0	12	0	8	0	44	84	5	5	0	198	0	0
879	794	0	6	11	0	3	36	8	0	2	0	111	0	0
880	1476	0	102	123	90	3	36	206	5	15	0	825	0	0
881	842	0	7	12	3	0	23	44	0	8	0	163	0	0
882	1077	0	8	13	3	0	25	48	0	9	0	178	0	0
883	697	0	33	16	2	14	20	19	2	1	0	172	0	0
884	591	0	34	17	2	15	21	20	2	1	0	178	0	0
885	657	0	4	7	0	2	23	5	0	1	0	71	0	0
886	629	0	171	5	0	0	19	5	0	0	0	239	0	0
887	537	0	9	13	73	3	9	30	3	1	0	214	0	0
888	1063	0	34	53	293	12	35	120	12	3	0	858	0	0
889	1061	0	2	11	15	2	8	13	1	3	0	75	0	0
890	614	0	22	99	137	14	69	118	13	24	0	681	0	0
891	1070	0	130	21	24	2	26	41	3	2	0	328	0	0
892	861	0	154	31	48	12	48	40	11	7	0	397	0	0
893	1070	0	9	15	0	17	43	23	0	0	0	186	0	0
894	425	0	111	22	62	0	37	33	5	0	0	313	0	0
895	1351	0	0	8	17	0	17	154	0	0	0	269	0	0
896	937	0	56	62	46	0	10	52	10	3	0	340	0	0
897	38	0	68	743	443	14	43	353	29	35	0	2806	0	0
898	1005	0	227	18	82	18	104	47	5	30	0	704	0	0
899	749	0	5	0	2	0	2	1	0	1	0	13	0	0
900	935	0	74	25	17	0	32	17	0	3	0	210	0	0
901	592	0	38	18	423	0	43	45	84	4	0	741	0	0
902	840	0	9	20	38	5	39	45	3	2	0	244	0	0
903	1023	0	159	10	5	3	29	48	5	0	0	301	0	0
904	866	0	66	9	11	3	21	75	2	4	0	249	0	0
905	527	0	5	11	20	3	21	24	2	1	0	132	0	0
906	1318	0	69	10	11	3	22	78	2	6	0	260	0	0
907	938	0	107	0	0	0	21	26	0	0	0	194	0	0
908	939	0	470	194	62	7	12	196	32	3	0	1182	0	0
909	808	0	75	24	11	9	45	23	4	0	0	389	0	0
910	421	0	35	11	5	4	21	11	2	0	0	183	0	0
911	410	0	1	24	4	5	21	15	1	2	0	482	0	0
912	603	0	78	14	5	3	56	33	0	10	0	281	0	0
913	757	0	7	6	0	3	23	14	0	0	0	131	0	0
914	814	0	220	399	201	3	33	96	5	6	0	1228	0	0
915	888	0	8	5	0	7	64	45	0	4	0	208	0	0
916	940	0	98	25	40	6	62	76	4	3	0	460	0	0
917	690	0	17	4	7	1	11	13	1	1	0	81	0	0
918	912	0	259	18	22	3	62	17	5	4	0	491	0	0
919	1176	0	4	95	15	19	83	62	4	7	0	394	0	0
920	875	0	378	4	43	6	73	28	0	6	0	684	0	0
921	1038	0	4	18	24	6	63	19	13	0	0	262	0	0
922	509	0	0	14	4	3	30	9	0	5	0	94	0	0
923	806	0	0	18	5	4	38	12	0	7	0	121	0	0
924	724	0	149											

931	486	0	4	28	23	4	14	169	0	0	0	282	0	0
932	1182	0	124	11	117	4	56	16	19	8	0	431	0	0
933	499	0	82	0	60	4	19	38	13	0	0	690	0	0
934	854	0	144	81	12	0	31	16	0	7	0	399	0	0
935	626	0	102	31	20	5	19	33	0	1	0	291	0	0
936	767	0	7	4	74	14	39	58	21	0	0	242	0	0
937	770	0	298	4	16	14	31	20	5	3	0	367	0	0
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940	493	0	29	22	62	5	29	57	8	3	0	284	0	0
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943	254	0	146	1028	332	14	17	1303	45	11	0	3356	0	0
944	704	0	0	10	13	0	31	24	19	0	0	137	0	0
945	723	0	13	19	5	0	19	42	0	3	0	141	0	0
946	435	0	56	9	10	1	11	18	1	1	0	141	0	0
947	1094	0	254	115	16	3	34	12	5	7	0	537	0	0
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949	84	0	160	237	181	234	136	29	6	75	5	2121	0	0
950	849	0	7	10	11	21	46	20	0	28	0	315	0	0
951	673	0	283	113	44	0	24	57	42	9	0	687	0	0
952	478	0	41	5	2	6	27	25	0	2	0	167	0	0
953	531	0	41	5	2	6	27	25	0	2	0	167	0	0
954	2	0	0	59	26	214	281	4	5	564	5	2292	0	0
955	2	0	17	361	251	953	896	44	21	800	20	8025	0	0
956	2	0	40	410	108	2092	1203	158	28	686	20	10570	0	0
957	49	0	21	26	16	26	65	22	3	3	0	336	0	0
958	61	0	213	4	5	16	32	58	0	0	0	365	0	0
959	72	0	7	28	8	81	39	4	10	17	15	493	0	0
960	300	0	4	6	0	14	90	20	0	7	0	207	0	0
961	203	0	10	13	8	13	32	11	2	1	0	166	0	0
962	222	0	0	5	8	11	135	32	0	9	0	295	0	0
963	211	0	6	4	0	10	66	0	0	7	0	323	0	0
964	680	0	0	3	0	1	6	1	0	0	0	30	0	0
965	154	0	74	5	31	7	62	0	34	0	17	402	0	0
966	142	0	4	24	0	3	64	29	0	0	0	239	0	0
967	54	0	0	1	3	2	11	4	0	1	0	66	0	0
968	97	0	0	3	5	3	23	8	0	2	1	137	0	0
969	42	0	0	7	0	1	15	2	0	0	0	68	0	0
970	122	0	0	10	0	2	21	3	0	0	0	97	0	0
971	151	0	98	0	9	2	26	27	2	0	0	251	0	0
972	302	0	98	0	9	2	26	27	2	0	0	251	0	0
973	1237	0	51	21	4	13	48	8	6	9	0	240	0	0
974	79	0	76	32	7	20	72	11	6	9	0	364	0	0
975	112	0	7	0	7	5	41	10	0	1	0	111	0	0
976	101	0	0	8	0	6	48	12	0	2	0	133	0	0
977	118	0	0	3	5	3	23	8	0	2	1	133	0	0
978	102	0	0	3	5	3	23	8	0	2	1	137	0	0
979	727	0	71	59	31	23	131	111	0	10	0	613	0	0
980	775	0	8	7	3	3	15	12	0	1	0	69	0	0
981	171	0	49	30	17	7	33	108	11	2	1	392	0	0
982	102	0	24	15	9	3	17	54	6	1	0	195	0	0
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985	153	0	13	12	0	7	17	16	2	0	0	153	0	0
986	85	0	11	10	0	6	14	13	2	0	0	127	0	0
987	124	0	6	6	0	1	49	7	0	1	0	104	0	0
988	67	0	3	4	0	1	28	4	0	1	0	60	0	0
989	193	0	0	3	2	5	28	9	4	4	0	149	0	0
990	69	0	5	5	0	1	42	6	0	1	0	90	0	0
991	33	0	2	3	0	1	21	3	0	1	0	46	0	0
992	90	0	0	5	3	7	42	13	6	5	0	223	0	0
993	69	0	0	0	1	4	24	0	0	17	1	100	0	0
994	0	0	1	0	1	14	4	0	0	0	0	38	0	0
995	9	0	2	0	2	22	7	0	0	0	0	61	0	0
996	35	0	2	0	2	22	7	0	0	0	0	61	0	0
997	15	0	0	0	4	10	65	0	0	47	3	270	0	0
998	192	0	14	57	31	2	60	16	15	7	0	308	0	0
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1000	502	0	48	43	83	19	150	32	20	7	0	551	0	0
1001	325	0	19	32	54	0	101	23	0	0	8	361	0	0
1002	231	0	13	0	1	2	9	1	3	0	2	44	0	0
1003	211	0	8	0	1	1	5	1	2	0	1	25	0	0
1004	507	0	20	0	2	3	15	2	5	0	3	69	0	0
1005	623	0	3	6	3	0	34	16	2	1	0	140	0	0
1006	997	0	5	11	6	0	61	28	3	2	0	249	0	0
1007	522	0	57	4	19	3	27	4	0	0	0	204	0	0
1008	1277	0	271	0	0	20	73	88	5	0	0	555	0	0
1009	1181	0	24	256	202	10	55	77	15	10	0	791	0	0
1010	989	0	62	36	5	3	22	65	2	2	0	317	0	0
1011	651	0	77	46	6	4	27	81	2	4	0	398	0	0
1012	204	0	15	9	1	1	5	16	0	0	0	77	0	0
1013	807	0	57	7	32	17	51	40	51	4	0	342	0	0
1014	874	0	15	47	0	6	59	20	0	6	0	203	0	0
1015	950	0	91	253	85	6	64	153	31	19	0	846	0	0
1016	971	0	129	98	71	11	60	113	7	8	4	695	0	0
1017	340	0	11	62	919	3	51	204	150	6	0	1504	0	0
1018	1167	0	52	1154	337	215	742	184	203	106	0	4422	0	0
1019	921	0	40	70	66	0	62	55	5	0	0	387	0	0
1020	963	0	4	177	39	0	55	52	0	6	0	418	0	0
1021	1020	0	225	58	90	3	46	27	11	5	0	550	0	0
1022	1321	0	40	43	28	9	64	42	10	4	0	329	0	0
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1024	1153	0	73	718	143	12	110	1078	36	11	0	2561	0	0
1025	881	0	4	38	8	1	6	57	2	0	0	133	0	0
1026	396	0	543	3076	1130	122	216	1878	124	64	0	14354	0	0
1027	646	0	40	58	60	0	79	4278	10	0	0	4691	0	0
1028	836	0	47	209	62	3	11	113	16	0	0	554	0	0
1029	1295	0	212	5	4	3	53	38	10	8	0	452	0	0
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1031	119	0	148	16	0	6	31	13	0	0	0	265	0	0
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1038	1063	0	159	50	57	9	71	58	0	129	0	606	0	0
1039	0	0	11	1724	281	276	208	126	9	82	0	5630	0	0
1040	760	0	66	90	20	14	11	28	0	7	0	349	0	0
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1101	0	0	37	179	12	99	227	20	26	50	2	1183	0	0
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1106	0	0	56	674	359	22	129	239	20	17	0	2115	0	0
1107	102	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	0	0	4	49	21	21	67	1	4	11	0	347	0	0
1109	0	0	7	87	37	38	121	3	8	19	0	625	0	0
1110	0	0	3	44	19	19	60	1	4	10	0	312	0	0
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1112	10	0	7	18	18	1	7	16	1	0	0	108	0	0
1113	32	0	15	35	35	3	14	32	3	1	0	216	0	0
1114	14	0	30	71	70	5	27	63	5	1	0	422	0	0
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1132	40	0	2	3	2	1	3	4	1	0	0	27	0	0
1133	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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1135	26	0	0	0	0	0	0	0	0	0	0	0	0	0
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1140	14	0	0	0	0	0	0	0	0	0	0	0	0	0
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1146	14	0	0	0	0	0	0	0	0	0	0	0	0	0
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1149	0	0	14	27	9	5	15	15	0	23	44	190	0	0
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1153	7	0	0	0	0	0	1	0	0	300	0	303	0	0
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1155	56	0	0	0	0	0	3	0	0	1	0	7	0	0
1156	7	0	0	0	0	0	1	0	0	300	0	301	0	0
1157	7	0	0	0	0	0	0	0	0	0	0	0	0	0
1158	69	0	0	0	0	0	0	0	0	0	0	0	0	0
1159	0	0	8	71	23	198	346	37	13	113	8	1937	0	0
1160	0	0	4	152	9	72	32	19	0	7	0	1122	0	0
1161	0	0	40	41	33	4	58	31	13	26	11	402	0	0
1162	0	0	50	848	266	4	12	109	30	22	2	1650	0	0
1163	0	0	41	694	218	3	9	89	25	18	2	1350	0	0
1164	0	0	10	63	40	2	14	502	10	1	10	761	0	0
1165	0	0	26	173	111	6	38	1379	29	4	29	2093	0	0
1166	0	0	150	402	318	18	33	484	20	11	1	2458	0	0
1167	6	0	91	244	193	11	20	294	12	7	1	1492	0	0
1168	338	0	80	216	170	10	18	259	11	6	1	1317	0	0
1169	0	0	74	120	9	54	62	7	0	27	0	578	0	0
1170	4	0	2	59	26	266	160	19	11	99	0	1821	0	0
1171	0	0	5	29	10	62	65	2	0	168	1	855	0	0
1172	202	0	26	1										



1243		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2030	1236	1568	1737	0	0
0	0	0	0	0	0	0	2644	1562	2180	1219	1993	2311	1472	1825	0	0	0	1142	427	457	1169	1246	591
1244		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985	473	610	1393	458	1065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1245		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1224	1209	
306	216	1170	1384	251	241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1246		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1247		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1248		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1318	0	2601	0	1276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2386	
1249		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
957	0	2577	0	0	1457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2055	0	
1250		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193	132	
5	1	132	217	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B

Cordon Validation Output File

```

+-----+
| TRACKS TRACKS TRACKS TRACKS TRACKS TR |
| TRACKS +-----+ TRACKS |
| S TRACKS |
| KS TRACK | Program : CORDON | S TRACKS |
| CKS TRAC | Version : V7.08 | CKS TRAC |
| ACKS TRA |
| RACKS TR | Date run : 16-OCT-17 | RACKS TR |
| TRACKS T | Time run : 16:24:16 | TRACKS T |
| TRACKS | Platform : Win 95/NT | TRACKS |
| S TRACKS+-----+S TRACKS |
| KS TRACKS TRACKS TRACKS TRACKS TRACKS |
+-----+
| TRACKS Licenced to |
| TDG |
| at : BNZ Centre, Chch |
+-----+
Build Date : 08/05/17 08:16
Parameter version : V7.00

```

Network Period Factor : 1.000

Cordon Period Factor : 1.000

GEH Period Factor : 1.000

CSV Output File :

Cordon Data File : "AM_CORDON.TXT"MACROC AM PEAK MODEL - 2016 LUSE - 000 NTWK
Loaded Network : "MR16EXALL01.NL" *WOLLONDILLY 2016 Model for Base study
36472 Links in network

Cordon Number : 1
Description : No.1 ScreenLine

FORWARD				BACK				TOTAL								
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
3182	3184	85.	136	51.	160.0	4.9	109.	86	-23.	78.9	2.3	194.	222	28.	114.4	MONTPELIER DR - Matrix Count - Mar 2017
2196	3932	429.	433	4.	100.9	0.2	267.	280	13.	104.9	0.8	696.	713	17.	102.4	REMEMBRANCE DR - Matrix Count - Mar 2017
2948	2950	1812.	1902	90.	105.0	2.1	NoBlk					1812.	1902	90.	105.0	Hume Motorway at Menangle Site 7737 Northbound
2944	2947	NoFlk					1613.	1540	-73.	95.5	1.8	1613.	1540	-73.	95.5	Hume Motorway at Menangle Site 7737 Southbound
2691	2131	473.	443	-30.	93.7	1.4	244.	244	0.	100.0	0.0	717.	687	-30.	95.8	07 - Appin Road, north NR177 SITE 750 - 2016

Number of Links = 5 Number of forward links = 4 Number of back links = 4

TOTALS FORWARD BACK TOTALS

COUNT 2799. 2233. 5032.
VOLUME 2914. 2150. 5064.
CHANGE 115. -83. 32.
% 104. 96. 101.

CORREL.
COEFF. 0.999 1.000 0.996
%RMS 8.89 8.03 6.17
r^2 0.997 0.999 0.992
GEH 2.2 1.8 0.5

GEH <5 <7.5 <10 <12 >12
8 8 8 8 0
% 100.0 100.0 100.0 100.0 0.0

Cordon Number : 2
Description : No.2 ScreenLine - Sth Thirlmere

FORWARD				BACK				TOTAL								
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
2780	2776	374.	356	-18.	95.2	0.9	440.	349	-91.	79.3	4.6	814.	705	-100.	86.6	REMEMBRANCE DR - Matrix Count - Mar 2017
2747	2745	31.	46	15.	148.4	2.4	67.	72	5.	107.5	0.6	98.	118	20.	120.4	ROCKFORD RD - Matrix Count - Mar 2017
2732	4149	1163.	1191	28.	102.4	0.8	NoBlk					1163.	1191	28.	102.4	M31 Hume Motorway E of Pheasants Nest Site 07736 Southbound
2734	4150	NoFlk					1097.	1299	202.	118.4	5.8	1097.	1299	202.	118.4	M31 Hume Motorway E of Pheasants Nest Site 07736 Northbound
2839	2838	784.	748	-36.	95.4	1.3	957.	1033	76.	107.9	2.4	1741.	1781	40.	102.3	Picton Rd E of Hume HW 07.406 20001. Feb 2015

Number of Links = 5 Number of forward links = 4 Number of back links = 4

TOTALS FORWARD BACK TOTALS

COUNT 2352. 2561. 4913.
VOLUME 2341. 2753. 5094.
CHANGE -11. 192. 181.
% 100. 107. 104.

CORREL.
COEFF. 0.998 0.990 0.985
%RMS 5.03 21.13 11.98
r^2 0.997 0.980 0.971
GEH 0.2 3.7 2.6

GEH <5 <7.5 <10 <12 >12
7 8 8 8 0
% 87.5 100.0 100.0 100.0 0.0

Cordon Number : 3
Description : No.2a Screenline - Sth Thirlmere - Avon

FORWARD				BACK				TOTAL								
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
2296	4101	885.	773	-112.	87.3	3.9	NoBlk					885.	773	-112.	87.3	BRGSC - M31 Avon Dam Road site
2297	4082	NoFlk					1004.	982	-22.	97.8	0.7	1004.	982	-22.	97.8	BRGSC - M31 Avon Dam Road site
4419	4083	225.	316	91.	140.4	5.5	136.	220	84.	161.8	6.3	361.	536	175.	148.5	Remembrance Driveway W of Lupton Site T0492

Number of Links = 3 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT 1110. 1140. 2250.
VOLUME 1080. 1202. 2291.
CHANGE -21. 62. 41.
% 98. 105. 102.

CORREL.
COEFF. 1.000 1.000 0.952
%RMS 26.00 15.23 19.70
r^2 1.000 1.000 0.905
GEH 0.6 1.8 0.9

GEH <5 <7.5 <10 <12 >12
2 4 4 4 0
% 50.0 100.0 100.0 100.0 0.0

Cordon Number : 4
Description : No.3 Screenline - East of Mt Hunter

FORWARD				BACK				TOTAL								
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
3290	3308	380.	295	-95.	75.0	5.2	650.	611	-39.	94.0	1.6	1030.	896	-134.	87.0	Finns Rd - STH OF REMEMBRANCE DR
3009	3014	238.	204	-34.	85.7	2.3	168.	123	-45.	73.2	3.7	406.	327	-79.	80.5	MENANGLE RD - Matrix Count - Mar 2017
3821	3844	441.	516	75.	117.0	3.4	514.	592	78.	115.2	3.3	955.	1108	153.	116.0	MENANGLE RD - Matrix Count - Mar 2017
2745	2747	67.	72	5.	107.5	0.6	31.	46	15.	148.4	2.4	98.	118	20.	120.4	ROCKFORD RD - Matrix Count - Mar 2017
2776	2780	440.	349	-91.	79.3	4.6	374.	356	-18.	95.2	0.9	814.	705	-100.	86.6	REMEMBRANCE DR - Matrix Count - Mar 2017

Number of Links = 5 Number of forward links = 5 Number of back links = 5

TOTALS FORWARD BACK TOTALS

COUNT 1566. 1737. 3303.
VOLUME 1426. 1728. 3154.
CHANGE -140. -9. -149.
% 91. 99. 95.

CORREL.
COEFF. 0.905 0.981 0.957
%RMS 24.79 14.52 18.52
r^2 0.820 0.963 0.916
GEH 3.6 0.2 2.6

GEH <5 <7.5 <10 <12 >12
9 10 10 10 0
% 90.0 100.0 100.0 100.0 0.0

Cordon Number : 5
Description : No. 4 Screenline - Picton Cordon

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3933	2196	429.	433	4.	100.9	0.2	267.	280	13.	104.9	0.8	696.	713	17.	102.4	REMEMBRANCE DR - Matrix Count - Mar 2017
3150	3161	34.	34	0.	100.0	0.0	47.	53	6.	112.8	0.8	81.	87	6.	107.4	BARKERS LODGE RD - Matrix Count - Mar 2017
3821	3844	441.	516	75.	117.9	3.4	514.	592	78.	115.2	3.3	955.	1108	153.	116.0	MENANGLE RD - Matrix Count - Mar 2017
2398	3816	194.	214	20.	110.3	1.4	132.	160	28.	121.2	2.3	326.	374	48.	114.7	BRIDGE ST - Matrix Count - Mar 2017
2999	3807	680.	533	-75.	87.7	3.1	336.	329	-16.	95.2	0.9	944.	853	-91.	90.4	REMEMBRANCE DR - Matrix Count - Mar 2017
3845	3843	265.	260	-5.	98.1	0.3	81.	147	66.	181.5	6.2	346.	407	61.	117.6	THIRLMERE WY - Matrix Count - Mar 2017

Number of links = 6 Number of forward links = 6 Number of back links = 6

TOTALS FORWARD BACK TOTALS

COUNT	1971.	1377.	3348.
VOLUME	1990.	1552.	3542.
CHANGE	19.	175.	194.
%	101.	113.	106.
CORREL.			
COEFF.	0.972	0.982	0.977
%RMS	14.72	21.06	15.63
r^2	0.945	0.965	0.954
GEH	0.4	4.6	3.3

GEH	<5	<7.5	<10	<12	>12
#	11	12	12	12	0
%	91.7	100.0	100.0	100.0	0.0

Cordon Number : 6
Description : No.5 Screenline - Picton - Cliffe to Men

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3929	2197	113.	122	9.	108.0	0.8	96.	102	6.	106.2	0.6	209.	224	15.	107.2	Margaret St S of Old Hume Hwy Sep 2016
3921	2394	320.	331	11.	103.4	0.8	159.	134	-25.	84.3	2.1	479.	465	-14.	97.1	Menangle Rd S of Old Hume Hwy Sep 2016

Number of links = 2 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT	433.	255.	688.
VOLUME	453.	236.	689.
CHANGE	20.	-19.	1.
%	105.	93.	100.
CORREL.			
COEFF.	1.000	1.000	1.000
%RMS	6.56	20.16	5.96
r^2	1.000	1.000	1.000
GEH	1.0	1.2	0.0

GEH	<5	<7.5	<10	<12	>12
#	4	4	4	4	0
%	100.0	100.0	100.0	100.0	0.0

Cordon Number : 7
Description : No.6 Screenline - Picton - Prince St - B

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
2072	3916	634.	652	18.	102.8	0.7	421.	278	-143.	66.9	7.6	1055.	930	-125.	88.2	Old Hume Hwy S of Barkers Lodge Rd Sep 2016
3861	3878	323.	270	-53.	83.6	3.1	231.	244	13.	105.0	0.8	554.	514	-40.	92.8	Menangle St N of Prince St Sep 2016

Number of links = 2 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT	957.	652.	1609.
VOLUME	922.	522.	1444.
CHANGE	-35.	-130.	-165.
%	96.	80.	90.
CORREL.			
COEFF.	1.000	1.000	1.000
%RMS	11.70	44.05	10.31
r^2	1.000	1.000	1.000
GEH	1.1	5.4	4.2

GEH	<5	<7.5	<10	<12	>12
#	3	3	4	4	0
%	75.0	75.0	100.0	100.0	0.0

Cordon Number : 8
Description : No.7 Screenline - Picton - Argyle & Cold

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3912	18483	196.	219	23.	111.7	1.6	80.	59	-21.	73.8	2.5	276.	278	2.	100.7	Colden St N of Menangle St Sep 2016
3921	18464	570.	553	-17.	97.0	0.7	406.	357	-49.	87.9	2.5	976.	910	-66.	93.2	Old Hume Hwy N of Menangle Rd Sep 2016

Number of links = 2 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT	766.	486.	1252.
VOLUME	772.	416.	1188.
CHANGE	6.	-70.	-64.
%	101.	86.	95.
CORREL.			
COEFF.	1.000	1.000	1.000
%RMS	7.47	21.94	10.55
r^2	1.000	1.000	1.000
GEH	0.2	3.3	1.8

GEH	<5	<7.5	<10	<12	>12
#	4	4	4	4	0
%	100.0	100.0	100.0	100.0	0.0

Cordon Number : 9
Description : No.8 Picton CBD Spot Counts

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3916	3929	746.	790	44.	105.9	1.6	447.	318	-129.	71.1	6.6	1193.	1108	-85.	92.9	Old Hume Hwy N of Barkers Lodge Rd Sep 2016
3916	5124	76.	117	41.	153.9	4.2	170.	216	46.	127.1	3.3	246.	333	87.	135.4	Barkers Lodge Rd N of Hume Hwy Sep 2016
3921	18464	570.	553	-17.	97.0	0.7	406.	357	-49.	87.9	2.5	976.	910	-66.	93.2	Old Hume Hwy N of Menangle Rd Sep 2016
2394	3921	159.	134	-25.	84.3	2.1	320.	331	11.	103.4	0.6	479.	465	-14.	97.1	Menangle Rd S of Old Hume Hwy Sep 2016
3295	3929	418.	386	-32.	92.3	1.6	411.	461	50.	112.2	2.4	829.	847	18.	102.2	Old Hume Hwy N of Margaret St Sep 2016
2197	3929	172.	102	-70.	59.3	6.0	161.	122	-39.	75.8	3.3	333.	224	-109.	67.3	Margaret St S of Old Hume Hwy Sep 2016
3847	3861	402.	516	114.	128.4	5.3	480.	592	112.	123.3	4.8	882.	1108	226.	125.6	Menangle St S of Prince St Sep 2016
3877	3861	367.	404	37.	110.1	1.9	197.	301	104.	152.8	6.6	564.	795	141.	125.0	Prince St W of Menangle St Sep 2016
3902	3914	9.	13	4.	144.4	1.2	14.	19	5.	135.7	1.2	23.	32	9.	139.1	Coull St S of Icton Ave Sep 2016
3912	18484	247.	155	-92.	62.8	6.5	207.	284	77.	137.2	4.9	454.	439	-15.	96.7	Menangle St N of Colden St Sep 2016
19458	3922	8.	8	0.	100.0	0.0	15.	9	-6.	60.0	1.7	23.	17	-6.	73.9	Margaret St S of Colden St Sep 2016
19459	3922	87.	89	2.	102.3	0.2	77.	64	-13.	83.1	1.5	144.	153	9.	106.2	Colden St S of Margaret St Sep 2016
3922	18466	64.	91	27.	142.2	3.1	101.	68	-33.	67.3	3.6	165.	159	-6.	96.4	Margaret St N of Colden St Sep 2016 Sep 2016

Number of links = 13 Number of forward links = 13 Number of back links = 13

TOTALS FORWARD BACK TOTALS

COUNT	3325.	3006.	6311.
VOLUME	3358.	3142.	6500.
CHANGE	33.	136.	169.
%	101.	105.	103.
CORREL.			
COEFF.	0.977	0.926	0.973
%RMS	20.82	29.52	19.08
r^2	0.955	0.858	0.946
GEH	0.6	2.5	2.4

GEH	<5	<7.5	<10	<12	>12
#	21	26	26	26	0
%	80.8	100.0	100.0	100.0	0.0

Cordon Number : 10
Description : No.9 Appin Spot Counts

		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
2962	2971	94.	123	29.	130.9	2.8	63.	100	37.	158.7	4.1	157	223	66.	142.0
2691	2131	473.	443	-30.	93.7	1.4	244.	244	0.	100.0	0.0	717.	687	-30.	95.8
Number of links =		2 Number of forward links =		2 Number of back links =		2									
TOTALS	FORWARD	BACK	TOTALS												
COUNT	567.	307.	874.												
VOLUME	566.	344.	910.												
CHANGE	-1.	37.	36.												
%	100.	112.	104.												
CORREL.															
COEFF.	1.000	1.000	1.000												
%RMS	14.72	24.10	16.59												
r^2	1.000	1.000	1.000												
GEH	0.0	2.1	1.2												
GEH	<5	<7.5	<10	<12	>12										
#	4	4	4	4	0										
%	100.0	100.0	100.0	100.0	0.0										
Cordon Number : 11															
Description : No.10 - Wollondilly Miscellaneous															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5241	5257	33.	35	2.	106.1	0.3	16.	19	3.	118.8	0.7	49.	54	5.	110.2
3976	3983	8.	11	3.	137.5	1.0	19.	20	1.	105.3	0.2	28.	31	3.	110.7
3178	3206	21.	24	3.	114.3	0.6	54.	46	-8.	85.2	1.1	75.	70	-5.	93.3
3607	2500	180.	182	2.	101.1	0.1	161.	155	-6.	96.3	0.5	341.	337	-4.	98.8
3264	3263	186.	144	-42.	77.4	3.3	430.	473	43.	110.0	2.0	616.	617	1.	100.2
3174	3187	372.	410	38.	110.2	1.9	212.	246	34.	116.0	2.2	594.	656	72.	112.3
3187	3216	356.	325	-31.	91.3	1.7	92.	124	32.	134.8	3.1	448.	449	1.	100.2
Number of links =		7 Number of forward links =		7 Number of back links =		7									
TOTALS	FORWARD	BACK	TOTALS												
COUNT	1156.	984.	2141.												
VOLUME	1131.	1083.	2214.												
CHANGE	-25.	99.	73.												
%	98.	110.	103.												
CORREL.															
COEFF.	0.986	0.996	0.996												
%RMS	16.01	18.68	9.68												
r^2	0.972	0.991	0.992												
GEH	0.7	3.1	1.6												
GEH	<5	<7.5	<10	<12	>12										
#	14	14	14	14	0										
%	100.0	100.0	100.0	100.0	0.0										
Cordon Number : 12															
Description : No.11 - Camden Counts - Locations accurate															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5040	5046	1152.	1211	59.	105.1	1.7	995.	1009	14.	101.4	0.4	2147.	2220	73.	103.4
5861	5555	526.	465	-61.	88.4	2.7	411.	609	198.	148.2	8.8	937.	1074	137.	114.6
10809	5859	913.	996	83.	109.1	2.7	895.	1002	107.	112.0	3.5	1808.	1998	190.	110.5
6512	6535	145.	240	95.	165.5	6.8	227.	180	-47.	79.3	3.3	372.	420	48.	112.9
12824	12946	2127.	2211	84.	103.9	1.8	1349.	1433	84.	106.2	2.3	3476.	3644	168.	104.8
4908	5004	364.	445	81.	122.3	4.0	149.	190	41.	127.5	3.1	513.	635	122.	123.8
2643	5832	336.	315	-21.	93.8	1.2	204.	131	-73.	64.2	5.6	540.	446	-94.	82.6
Number of links =		7 Number of forward links =		7 Number of back links =		7									
TOTALS	FORWARD	BACK	TOTALS												
COUNT	5563.	4230.	9793.												
VOLUME	5883.	4554.	10437.												
CHANGE	320.	324.	644.												
%	106.	108.	107.												
CORREL.															
COEFF.	0.997	0.985	0.998												
%RMS	9.90	17.50	9.87												
r^2	0.993	0.971	0.995												
GEH	4.2	4.9	6.4												
GEH	<5	<7.5	<10	<12	>12										
#	11	13	14	14	0										
%	78.6	92.9	100.0	100.0	0.0										
Cordon Number : 13															
Description : No.12 - Camden Valley Way \ Richardson I															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5843	5845	877.	936	59.	106.7	2.0	761.	693	-68.	91.1	2.5	1638.	1629	-9.	99.5
5847	5845	739.	611	-128.	82.7	4.9	769.	840	71.	109.2	2.5	1508.	1451	-57.	96.2
9300	5845	614.	469	-145.	76.4	6.2	423.	368	-55.	87.0	2.8	1037.	837	-200.	80.7
6490	5845	327.	358	31.	109.5	1.7	604.	473	-131.	78.3	5.6	931.	831	-100.	89.3
Number of links =		4 Number of forward links =		4 Number of back links =		4									
TOTALS	FORWARD	BACK	TOTALS												
COUNT	2557.	2557.	5114.												
VOLUME	2374.	2374.	4748.												
CHANGE	-183.	-183.	-366.												
%	93.	93.	93.												
CORREL.															
COEFF.	0.907	0.933	0.993												
%RMS	18.48	15.60	10.43												
r^2	0.823	0.870	0.985												
GEH	3.7	3.7	5.2												
GEH	<5	<7.5	<10	<12	>12										
#	6	8	8	8	0										
%	75.0	100.0	100.0	100.0	0.0										
Cordon Number : 14															
Description : No.13 - Narellan Intersections															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5854	5853	908.	1189	281.	130.9	8.7	1549.	1517	-32.	97.9	0.8	2457.	2706	249.	110.1
5851	5856	880.	111	273.	130.7	8.5	1190.	1056	-134.	88.7	4.0	2078.	2217	139.	106.7
7496	10798	1897.	2072	175.	109.2	3.9	3102.	3048	-54.	98.3	1.0	4999.	5120	121.	102.4
9376	10797	559.	433	-126.	77.5	5.7	264.	236	-28.	89.4	1.8	823.	669	-154.	81.3
7813	10799	888.	783	-105.	88.2	3.6	251.	351	100.	139.8	5.8	1139.	1134	-5.	99.6
Number of links =		5 Number of forward links =		5 Number of back links =		5									
TOTALS	FORWARD	BACK	TOTALS												
COUNT	5140.	6356.	11496.												
VOLUME	5638.	6208.	11846.												
CHANGE	498.	-148.	350.												
%	110.	98.	103.												
CORREL.															
COEFF.	0.953	0.998	0.997												
%RMS	22.34	7.11	7.52												
r^2	0.908	0.990	0.995												
GEH	6.8	1.9	3.2												
GEH	<5	<7.5	<10	<12	>12										
#	6	8	10	10	0										
%	60.0	80.0	100.0	100.0	0.0										
Cordon Number : 15															
Description : No.13 - Camden CBD Counts August 2013															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5143	5144	481.	462	-19.	96.0	0.9	228.	248	20.	108.8	1.3	719.	710	0.	100.0
Site 1: Cawdor Road															

5388	5828	970.	925	-45.	95.4	1.5	540.	530	-16.	97.1	0.7	1516.	1455	-61.	96.0	Site 2: Argyle Street
5836	5835	741.	694	-47.	93.7	1.8	694.	735	41.	105.9	1.5	1434.	1429	-5.	99.7	Site 4: Argyle Street
5836	5834	699.	709	10.	101.4	0.4	829.	754	-75.	91.0	2.7	1528.	1463	-65.	95.7	Site 5: Argyle Street
5828	5384	136.	57	-79.	41.9	8.0	63.	36	-27.	57.1	3.8	199.	93	-106.	46.7	Site 6: Oxley Street
5831	5492	228.	263	35.	115.4	2.2	147.	142	-5.	96.6	0.4	375.	405	30.	108.0	Site 7: John Street
5836	6328	145.	139	-6.	95.9	0.5	196.	66	-40.	62.3	4.3	250.	205	-45.	82.0	Site 8: Elizabeth Street
5145	5394	530.	523	-7.	98.7	0.3	221.	286	65.	129.4	4.1	751.	809	58.	107.7	Site 9: Murray Street
5491	5831	100.	125	25.	125.0	2.4	191.	106	-85.	55.5	7.0	290.	231	-59.	79.7	Site 10: John Street
14643	5835	24.	30	6.	125.0	1.2	110.	94	-16.	85.5	1.6	134.	124	-10.	92.5	Site 11: Hill Street
6229	5836	40.	14	-26.	35.9	5.0	17.	28	11.	164.7	2.3	57.	42	-15.	73.7	Site 12: View Street

Number of links = 11 Number of forward links = 11 Number of back links = 11

TOTALS FORWARD BACK TOTALS

COUNT	4094.	3152.	7244.
VOLUME	3941.	3025.	6966.
CHANGE	-153.	-127.	-278.
%	96.	96.	96.
CORREL.			
COEFF.	0.995	0.986	0.997
%RMS	0.99	16.42	8.22
r^2	0.990	0.973	0.993
GEH	2.4	2.3	3.3

GEH	<5	<7.5	<10	<12	>12
#	19	21	22	22	0
%	86.4	95.5	100.0	100.0	0.0

Cordon Number : 16

Description : No. 14 - Camden N of Narellan

		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5862	2895	41.	19	-22.	46.3	4.0	205.	125	-80.	61.0	6.2	246.	144	-102.	58.5
19015	9949	107.	197	90.	184.1	7.3	177.	282	105.	159.3	6.9	284.	479	195.	168.7
7480	9747	284.	271	-13.	95.4	0.8	325.	355	30.	109.2	1.0	609.	626	17.	102.8
5855	5857	1351.	1189	-162.	88.9	4.5	952.	1066	114.	112.0	3.6	2303.	2255	-48.	97.9
10881	8212	888.	830	-58.	93.5	2.0	699.	679	-20.	97.1	0.8	1587.	1509	-78.	95.1
10797	9376	267.	236	-31.	88.4	2.0	533.	433	-100.	81.2	4.6	800.	669	-131.	83.6
Dan Cleary Dr - Matrix Count Mar 2017															
GLENNWAY DR - Matrix Count - Mar 2017															
Fairwater Dr - Matrix Count Mar 2017															
Cadden Valley Rd (East) (Matrix IC Mar 2017)															
Hartley Rd - Matrix Count Mar 2017															
Tramway Drive N of Narellan - Matrix Count Mar 2017															

Number of links = 6 Number of forward links = 6 Number of back links = 6

TOTALS FORWARD BACK TOTALS

COUNT	2938.	2891.	5829.
VOLUME	2742.	2940.	5682.
CHANGE	-196.	49.	-147.
%	93.	102.	97.
CORREL.			
COEFF.	0.995	0.964	0.990
%RMS	18.11	18.96	12.54
r^2	0.991	0.930	0.979
GEH	3.7	0.9	1.9

GEH	<5	<7.5	<10	<12	>12
#	9	12	12	12	0
%	75.0	100.0	100.0	100.0	0.0

Cordon Number : 17

Description : No. 15 - Silverdale

NODE1	NODE2	FORWARD					BACK					TOTAL					
		COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%		
2419	2420	124.	330	206.	266.1	13.7	81.	125	44.	154.3	4.3	285.	455	250.	222.0	SILVERDALE RD - Matrix Count - Mar 2017	

Number of links = 1 Number of forward links = 1 Number of back links = 1

TOTALS FORWARD BACK TOTALS

COUNT	124.	81.	205.
VOLUME	330.	125.	455.
CHANGE	206.	44.	250.
%	266.	154.	222.
CORREL.			
COEFF.	0.000	0.000	0.000
%RMS	0.00	0.00	0.00
r^2	0.000	0.000	0.000
GEH	13.7	4.3	13.8

GEH	<5	<7.5	<10	<12	>12
#	1	1	1	1	1
%	50.0	50.0	50.0	50.0	50.0

Cordon Number : 18

Description : No. 16 - Screenline S Campbelltown

NODE1	NODE2	FORWARD					BACK					TOTAL					
		COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%		
14592	14799	219.	135	-84.	61.6	6.3	164.	273	109.	166.5	7.4	383.	408	25.	106.5	Parkside Cres W of Central Rd (Hospital)- Matrix Count Mar 2017	
3596	6105	997.	874	-123.	87.7	4.0	275.	332	57.	120.7	3.3	1272.	1296	-66.	94.8	Menangle Rd E of Taillby- Matrix Count Mar 2017	
7297	4490	1582.	1585	3.	100.2	0.1	793.	808	75.	109.5	2.6	2375.	2453	78.	103.3	Appin Rd S of Narellan Rd	

Number of links = 3 Number of forward links = 3 Number of back links = 3

TOTALS FORWARD BACK TOTALS

COUNT	2798.	1232.	4030.
VOLUME	2594.	1473.	4067.
CHANGE	-204.	241.	37.
%	93.	120.	101.
CORREL.			
COEFF.	0.998	0.997	0.998
%RMS	11.29	24.81	5.54
r^2	0.995	0.994	0.996
GEH	3.9	6.6	0.6

GEH	<5	<7.5	<10	<12	>12
#	4	6	6	6	0
%	66.7	100.0	100.0	100.0	0.0

Cordon Number : 19

Description : No. 16a - Screenline CS Campbelltown

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME		CHANGE	%
14003	15309	NoFlk					306.	436	130.	142.5	6.7	306.	436	130.	142.5	
15309	15390	722.	774	52.	107.2	1.9	NoFlk					722.	774	52.	107.2	Englerie Park Dr S of Gilchrist Dr (sbd)- Matrix Count Mar 2017
14022	14931	765.	714	-51.	93.3	1.9	464.	544	80.	117.2	3.6	1229.	1258	29.	102.4	Matrix Count Mar 2017
10516	10517	1387.	1347	-40.	97.1	1.1	742.	614	-128.	82.7	4.9	2129.	1961	-168.	92.1	Woodhouse Dr S of Therry Rd - Matrix Count Mar 2017
																Appin Rd S of Woodhouse Rd - Matrix Count Mar 2017

Number of links = 4 Number of forward links = 3 Number of back links = 3

TOTALS FORWARD BACK TOTALS

COUNT	2874.	1512.	4386.
VOLUME	2835.	1594.	4429.
CHANGE	-39.	82.	43.
%	99.	105.	101.
CORREL.			
COEFF.	0.990	0.961	0.999
%RMS	0.13	27.95	11.62
r^2	0.979	0.924	0.998
GEH	0.7	2.1	0.6

GEH	<5	<7.5	<10	<12	>12
#	5	6	6	6	0
%	83.3	100.0	100.0	100.0	0.0

Cordon Number : 20

Description : No. 17 - Screenline R Campbelltown

NODE1	NODE2	FORWARD					BACK					TOTAL					
		COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%		
26289	27101	385.	353	-32.	91.7	1.7	928.	1020	92.	109.9	2.9	1313.	1373	60.	104.6	Cambridge Ave W of Canterbury Rd - Matrix Count Mar 2017	
26770	27036	693.	623	-70.	89.9	2.7	501.	504	3.	100.6	0.1	1194.	1127	-67.	94.4	Glennfield Rd - Matrix Count Mar 2017	
27071	6121	737.	623	-114.	85.9	4.0	370.	432	62.	116.8	3.1	1107.	1065	-42.	96.2	Campebbellown Rd W of S Western Fwy - Matrix Count Mar 2017	
22682	23184	763.	893	130.	117.0	4.5	821.	857	36.	104.4	1.2	1584.	1750	166.	110.5	Ben Lomond Dr W of Pembroke Rd - Matrix Count Mar 2017	
22853	22854	NoFlk					541.	747	206.	138.1	8.1	541.	747	206.	138.1	Rose Peyton Dr E of Airds Rd (southbound)- Matrix Count Mar 2017	





MACROS Model Development 2017, Camden Council - Wollondilly Shire Council - Campbelltown City Council
Transportation Model Update

Page 7

r^2	0.944	0.962	0.979												
GEH	2.4	8.1	7.4												
GEH	<5	<7.5	<10												
#	61	68	73												
%	83.6	93.2	100.0												
0	0	0	0												
Cordon Number :	29														
Description :	ALL Counts														
NODE1	NODE2	COUNT	FORWARD VOLUME	CHANGE	%	GEH	COUNT	BACK VOLUME	CHANGE	%	GEH	TOTAL COUNT	TOTAL VOLUME	CHANGE	%
2691	2131	473.	443	-30.	93.7	1.4	244.	244	0.	100.0	0.0	717.	687	-30.	95.8
16414	18515	736.	637	-99.	86.5	3.8	329.	319	-10.	97.0	0.6	1065.	956	-109.	89.8
7297	4498	1582.	1585	3.	100.2	0.1	793.	868	75.	109.5	2.6	2375.	2453	78.	103.3
10516	10517	1387.	1347	-40.	97.1	1.1	742.	614	-128.	82.7	4.9	2129.	1961	-168.	92.1
16759	16954	559.	469	-90.	83.9	4.0	939.	772	-167.	82.2	5.7	1498.	1241	-257.	82.8
3150	3161	34.	34	0.	100.0	0.0	47.	53	6.	112.8	0.8	81.	87	6.	107.4
3916	5124	76.	117	41.	153.9	4.2	170.	216	46.	127.1	3.3	246.	333	87.	135.4
22682	23184	763.	893	130.	117.0	4.5	821.	857	36.	104.4	1.2	1584.	1750	166.	110.5
18863	18920	721.	650	-71.	90.2	2.7	NoBlk	691	69	101.2	0.3	721.	650	-71.	90.2
18860	19335	NoFlk					NoBlk	699	69	101.2	0.3	691	699	8.	101.2
5241	5257	33.	35	2.	106.1	0.3	16.	19	3.	118.8	0.7	49.	54	5.	110.2
2296	4181	885.	773	-112.	87.3	3.9	NoBlk					885.	773	-112.	87.3
2297	4082	NoFlk					1084.	982	-22.	97.8	0.7	1084.	982	-22.	97.8
2398	3816	194.	214	20.	119.3	1.4	132.	160	28.	121.2	2.3	326.	374	48.	114.7
24382	24381	1117.	1126	9.	100.8	0.3	720.	790	70.	109.7	2.5	1837.	1916	79.	104.3
4980	5084	364.	445	81.	122.3	4.0	149.	190	41.	127.5	3.1	513.	635	122.	123.8
26289	27181	385.	353	-32.	91.7	1.7	928.	1029	92.	109.9	2.9	1313.	1373	60.	104.6
5040	5046	1152.	1211	59.	105.1	1.7	995.	1069	74.	101.4	0.4	2147.	2220	73.	103.4
5855	5857	1351.	1189	-162.	88.0	4.5	952.	1066	114.	112.0	3.6	2303.	2255	-48.	97.9
5851	5856	888.	1161	273.	130.7	8.5	1190.	1056	-134.	88.7	4.0	2078.	2217	139.	106.7
5859	10809	895.	1002	107.	112.0	3.5	913.	996	83.	109.1	2.7	1888.	1998	110.	110.5
12824	12946	2127.	2211	84.	103.9	1.8	1349.	1433	84.	106.2	2.3	3476.	3644	168.	104.8
5847	5845	739.	611	-128.	82.7	4.9	769.	849	71.	109.2	2.5	1508.	1451	-57.	96.2
5843	5845	877.	936	59.	106.7	2.0	761.	693	-68.	91.1	2.5	1638.	1629	-9.	99.5
24569	24823	358.	357	-1.	99.7	0.1	1809.	959	-58.	95.0	1.6	1367.	1316	-51.	96.3
18843	22083	NoFlk	1629	356.	128.0	9.3	NoBlk					1629	1629	0.	100.0
18892	1891	NoFlk					1591.	1588	-3.	99.8	0.1	1591.	1588	-3.	99.8
24743	24566	840.	815	-25.	97.0	0.9	750.	892	142.	118.9	5.0	1590.	1707	117.	107.4
27971	6121	737.	633	-104.	85.9	4.0	370.	432	62.	116.8	3.1	1107.	1065	-42.	96.2
26856	26854	759.	759	0.	100.0	0.0	690.	591	-99.	85.5	6.4	1273.	1029	-244.	80.8
5861	6555	526.	465	-61.	88.4	2.7	411.	609	198.	148.2	8.8	937.	1074	137.	114.6
3912	10483	196.	219	23.	111.7	1.6	80.	59	-21.	73.8	2.5	276.	278	2.	100.7
10459	3922	87.	89	2.	102.3	0.2	77.	64	-13.	83.1	1.5	144.	153	9.	106.2
25119	24035	331.	116	-33.	116.3	3.0	376.	402	26.	115.2	2.6	878.	878	0.	100.0
3902	3914	9.	13	4.	144.4	0.2	14.	19	5.	135.7	1.2	33.	32	-1.	93.9
24953	24954	406.	453	47.	111.6	2.3	393.	431	38.	109.7	1.9	799.	884	85.	110.6
5862	2895	41.	19	-22.	46.3	4.0	285.	125	-89.	61.0	6.2	246.	144	-102.	58.5
15609	7212	317.	358	31.	109.5	1.7	604.	473	-131.	78.3	5.6	923.	871	-52.	93.3
2962	2971	94.	123	29.	130.9	2.8	63.	100	37.	158.7	4.1	157.	223	66.	142.0
15389	15390	722.	774	52.	107.2	1.9	NoBlk					722.	774	52.	107.2
14963	15399	NoFlk					306.	436	130.	142.5	6.7	306.	436	130.	142.5
7490	9747	284.	271	-13.	95.4	0.8	325.	355	30.	109.2	1.0	609.	626	17.	102.8
6534	3167	70.	111	41.	158.6	4.3	243.	294	51.	121.0	3.1	313.	405	92.	129.4
3200	3308	380.	285	-95.	75.0	5.2	650.	611	-39.	94.4	1.6	1030.	896	-134.	87.0
13955	14044	1186.	1188	-68.	94.3	2.0	NoBlk					1186.	1118	-68.	94.3
4095	15108	NoFlk					1106.	1319	213.	119.3	6.1	1106.	1118	12.	110.1
26770	27036	693.	623	-70.	89.9	2.7	501.	504	3.	100.6	0.1	1194.	1127	-67.	94.4
26034	26033	744.	708	-36.	95.2	1.3	821.	830	9.	101.1	0.3	1565.	1538	-27.	98.3
10015	9949	107.	197	90.	184.1	7.3	177.	282	105.	159.3	6.9	284.	479	195.	168.7
6490	5845	327.	358	31.	109.5	1.7	604.	473	-131.	78.3	5.6	923.	871	-52.	93.3
18881	8212	1808.	308	-58.	93.5	2.0	699.	679	-20.	97.1	0.8	1587.	1509	-78.	95.1
2948	2950	1812.	1902	90.	105.0	2.1	NoBlk					1812.	1902	90.	105.0
2944	2947	NoFlk					1613.	1540	-73.	95.5	1.8	1613.	1540	-73.	95.5
26733	26546	1054.	1595	-59.	96.4	1.4	NoBlk					1054.	1595	-59.	96.4
23012	23118	NoFlk					1726.	2150	424.	124.6	9.6	1726.	2150	424.	124.6
23013	20639	520.	557	37.	107.1	1.6	NoBlk					520.	557	37.	107.1
29969	20683	NoFlk					782.	816	34.	104.3	1.2	782.	816	34.	104.3
19958	18504	625.	571	-54.	91.4	2.2	390.	447	57.	114.6	2.0	1055.	1018	-37.	96.4
3976	3983	8.	11	3.	137.5	0.3	19.	20	1.	105.3	0.2	29.	31	2.	110.7
2734	4150	NoFlk					1097.	1299	202.	118.4	5.8	1097.	1299	202.	118.4
2732	4149	1163.	1191	28.	102.4	0.8	NoBlk					1163.	1191	28.	102.4
2643	5832	326.	315	-21.	93.0	1.2	264.	131	-73.	64.2	5.6	540.	446	-94.	82.6
5057	26256	472.	415	-57.	87.9	2.7	479.	510	31.	106.5	1.4	951.	925	-26.	97.3
6512	6535	145.	240	95.	165.5	6.8	227.	180	-47.	79.3	3.3	372.	420	48.	112.9
3187	3216	356.	325	-31.	91.3	1.7	92.	124	32.	134.8	3.1	448.	449	1.	100.2
3174	3187	372.	410	38.	110.2	1.9	212.	246	34.	116.0	2.2	584.	656	72.	112.3
3022	10466	64.	91	27.	142.2	3.1	107.	68	-32.	67.3	3.0	159.	159	0.	100.0
10458	3922	8.	8	0.	100.0	0.0	15.	9	-6.	60.0	1.7	23.	17	-6.	73.9
3929	2197	113.	122	9.	108.0	0.8	96.	102	6.	106.2	0.6	209.	224	15.	107.2
3089	3014	238.	264	26.	85.5	2.3	168.	123	-45.	73.2	3.7	406.	327	-79.	89.5
3821	3844	441.	516	75.	117.0	3.4	514.	592	78.	115.5	3.3	955.	1108	153.	116.9
3596	6105	997.	874	-123.	87.7	4.0	275.	342	57.	120.7	3.3	1272.	1206	-66.	94.8
3921	2394	320.	331	11.	103.4	0.6	159.	134	-25.	84.3	2.1	479.	465	-14.	97.1
3577	4538	919.	811	-108.	88.2	7.7	269.	274	5.	101.9	0.3	1088.	1095	7.	100.6
3912	10484	247.	155	-92.	62.8	6.5	207.	284	77.	137.2	4.9	455.	439	-16.	93.9
3861	3878	323.	270	-53.	83.6	3.1	231.	244	13.	105.6	0.8	554.	514	-40.	92.8
3847	3861	402.	516	114.	128.4	5.3	480.	592	112.	123.3	4.8	882.	1108	226.	125.6
3182	3184	85.	130	45.	160.0	4.9	109.	86	-23.	78.9	2.3	194.	222	28.	114.4
7813	10799	353.	353	0.	100.0	0.0	251.	351	100.	139.8	5.8	1139.	1134	-5.	99.5
3178	3206	21.	24	3.	114.3	0.6	54.	46	-8.	85.2	1.1	75.	70	-5.	93.3
7496	10798	1897.	2072	175.	109.2	3.9	3102.	3048	-54.	98.3	1.0	4999.	5120	121.	102.4
5854	5855	908.	1189	281.	130.9	8.7	1549.	1517	-32.	97.9	0.8	2457.	2706	249.	110.1
10520	17708	1011.	1105	94.	109.3	2.9	1350.	1240	-101.	92.5	5.8	2301.	2354	53.	102.2
3916	3920	746.	790	44.	105.9	1.6	447.	318	-129.	71.1	6.6	1193.	1108	-85.	92.9
3929	3295	411.	461	50.	112.2	2.4	418.	386	-32.	92.3	1.6	829.	847	18.	102.2
3921	18464	570.	553	-17.	97.0	0.7	406.	357	-49.	87.9	2.5	976.	910	-66.	93.2
2072	3916	634.	634	0.	100.0	0.0	421.	278	-143.	66.0	7.0	1055.	930	-125.	88.7
14592	14799	219.	135	-84.	61.6	6.3	164.	273	109.	166.5	7.4	383.	408	25.	106.5
18535	19102	747.	804	57.	107.6	2.0	921.	1038	117.</						

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| TRACKS TRACKS TRACKS TRACKS TRACKS TRACKS TR |
| TRACKS +-----+ TRACKS |
| S TRACKS | | S TRACKS |
| KS TRACK | Program : CORDON | KS TRACK |
| CKS TRAC | Version : V7.08 | CKS TRAC |
| ACKS TRA | | ACKS TRA |
| RACKS TR | Date run : 12-OCT-17 | RACKS TR |
| TRACKS T | Time run : 16:25:43 | TRACKS T |
| TRACKS | Platform : Win 95/NT | TRACKS |
| S TRACKS+-----+S TRACKS |
| KS TRACKS TRACKS TRACKS TRACKS TRACKS TRACKS |
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| TRACKS Licenced to |
| TDG |
| at : BNZ Centre, Chch |
+-----+
| Build Date : 08/05/17 08:16 |
| Parameter version : V7.00 |
+-----+

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Network Period Factor : 1.000

Cordon Period Factor : 1.000

GEH Period Factor : 1.000

CSV Output File :

Cordon Data File : "PM_CORDON.TXT"MACROC PM PEAK MODEL - 2016 LUSE - 000 NTWK
Loaded Network : "MR16EXPALL01.NL" *WOLLONDILLY 2016 Model for Base study
36472 Links in network

Cordon Number : 1
Description : No.1 ScreenLine

NODE1	NODE2	FORWARD				% GEH	BACK				% GEH	TOTAL				
		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%	
3182	3184	103.	112	9.	108.7	0.9	131.	119	-12.	90.8	1.1	234.	231	-3.	98.7	MONTPELIER DR - Matrix Count - Mar 2017
2196	3932	272.	334	62.	122.8	3.6	544.	461	-83.	84.7	3.7	816.	795	-21.	97.4	REMEMBRANCE DR - Matrix Count - Mar 2017
2948	2950	1720.	1651	-69.	96.0	1.7	NoBk					1720.	1651	-69.	96.0	Hume Motorway at Menangle Site 7737 Northbound
2944	2947	NoBk					2151.	2294	143.	106.6	3.0	2151.	2294	143.	106.6	Hume Motorway at Menangle Site 7737 Southbound
2691	2131	282.	271	-11.	96.1	0.7	504.	545	41.	108.1	1.8	786.	816	30.	103.8	07 - Appin Road, north NR177 SITE 750 - 2014

Number of Links = 5 Number of forward links = 4 Number of back links = 4

TOTALS FORWARD BACK TOTALS

COUNT 2377. 3330. 5707.
VOLUME 2368. 3419. 5787.
CHANGE -9. 80. 80.
% 100. 103. 101.

CORREL.
COEFF. 0.999 0.998 0.996
%RMS 0.12 11.84 7.14
r^2 0.998 0.997 0.992
GEH 0.2 1.5 1.1

GEH <5 <7.5 <10 <12 >12
8 8 8 8 0
% 100.0 100.0 100.0 100.0 0.0

Cordon Number : 2
Description : No.2 ScreenLine - Sth Thirlmere

NODE1	NODE2	FORWARD				% GEH	BACK				% GEH	TOTAL				
		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%	
2780	2776	347.	372	25.	107.2	1.3	350.	350	0.	100.0	0.0	697.	722	25.	103.6	REMEMBRANCE DR - Matrix Count - Mar 2017
2747	2745	72.	75	3.	104.2	0.3	46.	56	10.	121.7	1.4	118.	131	13.	111.0	ROCKFORD RD - Matrix Count - Mar 2017
2732	4149	1479.	1595	116.	107.6	3.0	NoBk					1479.	1595	116.	107.6	M31 Hume Motorway E of Pheasants Nest Site 07736 Southbo
2734	4150	NoBk					1291.	1387	96.	107.4	2.6	1291.	1387	96.	107.4	M31 Hume Motorway E of Pheasants Nest Site 07736 Northbo
2839	2838	1014.	1133	119.	111.7	3.6	793.	811	18.	102.3	0.6	1807.	1944	137.	107.6	Picton Rd E of Hume HW 07.406 20001. Feb 2015

Number of Links = 5 Number of forward links = 4 Number of back links = 4

TOTALS FORWARD BACK TOTALS

COUNT 2912. 2480. 5392.
VOLUME 3175. 2604. 5779.
CHANGE 263. 124. 387.
% 100. 105. 107.

CORREL.
COEFF. 1.000 0.999 1.000
%RMS 13.33 9.14 9.53
r^2 0.999 0.999 1.000
GEH 4.8 2.5 5.2

GEH <5 <7.5 <10 <12 >12
8 8 8 8 0
% 100.0 100.0 100.0 100.0 0.0

Cordon Number : 3
Description : No.2a Screenline - Sth Thirlmere - Avon

NODE1	NODE2	FORWARD				% GEH	BACK				% GEH	TOTAL				
		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%	
2296	4101	1178.	1133	-45.	96.2	1.3	1178.	1193	15.	106.8	2.2	2296.	2326	30.	104.5	BRGSTC - M31 Avon Dam Road site
2297	4082	NoBk					1117.	1193	76.	106.8	2.2	1117.	1193	76.	106.8	BRGSTC - M31 Avon Dam Road site
4419	4083	170.	227	48.	126.8	3.4	228.	214	-14.	93.9	0.9	407.	441	34.	108.4	Remembrance Driveway W of Lupton Site T0492

Number of Links = 3 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT 1357. 1345. 2702.
VOLUME 1360. 1407. 2767.
CHANGE 3. 62. 65.
% 100. 105. 102.

CORREL.
COEFF. 1.000 1.000 0.999
%RMS 9.70 11.49 7.43
r^2 1.000 1.000 0.990
GEH 0.1 1.7 1.2

GEH <5 <7.5 <10 <12 >12
4 4 4 4 0
% 100.0 100.0 100.0 100.0 0.0

Cordon Number : 4
Description : No.3 Screenline - East of Mt Hunter

NODE1	NODE2	FORWARD				% GEH	BACK				% GEH	TOTAL				
		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%		COUNT	VOLUME	CHANGE	%	
3290	3308	756.	516	-240.	68.3	9.5	313.	371	58.	119.5	3.1	1069.	887	-181.	83.1	Finns Rd - STH OF REMEMBRANCE DR
3009	3014	193.	193	0.	100.0	0.0	281.	215	-66.	76.5	4.2	474.	408	-66.	86.1	MENANGLE RD - Matrix Count - Mar 2017
3821	3844	701.	575	-126.	82.0	5.0	366.	412	46.	112.6	2.3	1067.	987	-80.	92.5	MENANGLE RD - Matrix Count - Mar 2017
2745	2747	46.	56	10.	121.7	1.4	72.	75	3.	104.2	0.3	118.	131	13.	111.0	ROCKFORD RD - Matrix Count - Mar 2017
2776	2780	350.	350	0.	100.0	0.0	347.	372	25.	107.2	1.3	697.	722	25.	103.6	REMEMBRANCE DR - Matrix Count - Mar 2017

Number of Links = 5 Number of forward links = 5 Number of back links = 5

TOTALS FORWARD BACK TOTALS

COUNT 2046. 1379. 3424.
VOLUME 1690. 1445. 3135.
CHANGE -356. 66. -289.
% 83. 105. 92.

CORREL.
COEFF. 0.976 0.944 0.985
%RMS 33.14 10.55 15.37
r^2 0.953 0.891 0.971
GEH 8.2 1.8 5.0

GEH <5 <7.5 <10 <12 >12
9 9 10 10 0
% 90.0 90.0 100.0 100.0 0.0

Cordon Number : 5
Description : No. 4 Screenline - Picton Cordon

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3933	2196	272.	334	62.	122.8	3.6	544.	461	-83.	84.7	3.7	816.	795	-21.	97.4	REMEMBRANCE DR - Matrix Count - Mar 2017
3150	3161	55.	69	14.	125.5	1.8	59.	45	-14.	76.3	1.9	114.	114	0.	100.0	BARKERS LODGE RD - Matrix Count - Mar 2017
3821	3844	781.	575	-126.	82.9	5.0	366.	412	46.	112.0	2.3	1067.	987	-80.	92.5	MENANGLE RD - Matrix Count - Mar 2017
2398	3816	139.	159	22.	116.9	1.9	192.	198	6.	183.1	0.4	322.	358	28.	109.7	BRIDGE ST - Matrix Count - Mar 2017
2999	3807	333.	374	41.	112.3	2.2	643.	515	-128.	80.1	5.3	976.	889	-87.	91.1	REMEMBRANCE DR - Matrix Count - Mar 2017
3845	3843	131.	172	41.	131.3	3.3	296.	310	14.	184.7	0.8	427.	482	55.	112.9	THIRLMERE WY - Matrix Count - Mar 2017

Number of links = 6 Number of forward links = 6 Number of back links = 6

TOTALS FORWARD BACK TOTALS

COUNT	1622.	2100.	3722.
VOLUME	1676.	1941.	3617.
CHANGE	54.	-159.	-105.
%	183.	92.	97.
CORREL.			
COEFF.	0.974	0.965	0.995
%RMS	25.50	20.53	9.73
r^2	0.950	0.931	0.990
GEH	1.3	3.5	1.7

GEH	<5	<7.5	<10	<12	>12
#	11	12	12	12	0
%	91.7	100.0	100.0	100.0	0.0

Cordon Number : 6
Description : No.5 Screenline - Picton - Cliffe to Men

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3929	2197	117.	92	-25.	78.6	2.4	161.	159	-2.	98.8	0.2	278.	251	-27.	90.3	Margaret St S of Old Hume Hwy Sep 2016
3921	2394	170.	182	12.	107.1	0.9	236.	198	-38.	83.9	2.6	406.	380	-26.	93.6	Menangle Rd S of Old Hume Hwy Sep 2016

Number of links = 2 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT	287.	397.	684.
VOLUME	274.	357.	631.
CHANGE	-13.	-40.	-53.
%	95.	90.	92.
CORREL.			
COEFF.	1.000	1.000	1.000
%RMS	19.32	19.17	10.96
r^2	1.000	1.000	1.000
GEH	0.8	2.1	2.1

GEH	<5	<7.5	<10	<12	>12
#	4	4	4	4	0
%	100.0	100.0	100.0	100.0	0.0

Cordon Number : 7
Description : No.6 Screenline - Picton - Prince St - B

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
2072	3916	419.	391	-28.	93.3	1.4	665.	686	-59.	91.1	2.3	1084.	997	-87.	92.0	Old Hume Hwy S of Barkers Lodge Rd Sep 2016
3861	3878	348.	234	-114.	67.2	6.7	229.	225	-4.	98.3	0.3	577.	459	-118.	79.5	Menangle St N of Prince St Sep 2016

Number of links = 2 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT	767.	894.	1661.
VOLUME	625.	831.	1456.
CHANGE	-142.	-63.	-205.
%	81.	93.	88.
CORREL.			
COEFF.	1.000	1.000	1.000
%RMS	30.61	13.23	17.65
r^2	1.000	1.000	1.000
GEH	5.4	2.1	5.2

GEH	<5	<7.5	<10	<12	>12
#	3	4	4	4	0
%	75.0	100.0	100.0	100.0	0.0

Cordon Number : 8
Description : No.7 Screenline - Picton - Argyle & Cold

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3912	18483	180.	136	-44.	75.6	3.5	141.	127	-14.	90.1	1.2	321.	263	-58.	81.9	Colden St N of Menangle St Sep 2016
3921	18464	458.	375	-83.	81.9	4.1	695.	597	-98.	85.9	3.9	1153.	972	-181.	84.3	Old Hume Hwy N of Menangle Rd Sep 2016

Number of links = 2 Number of forward links = 2 Number of back links = 2

TOTALS FORWARD BACK TOTALS

COUNT	638.	836.	1474.
VOLUME	511.	724.	1235.
CHANGE	-127.	-112.	-239.
%	80.	87.	84.
CORREL.			
COEFF.	1.000	1.000	1.000
%RMS	29.45	23.68	25.79
r^2	1.000	1.000	1.000
GEH	5.3	4.0	6.5

GEH	<5	<7.5	<10	<12	>12
#	4	4	4	4	0
%	100.0	100.0	100.0	100.0	0.0

Cordon Number : 9
Description : No.8 Picton CBD Spot Counts

NODE1	NODE2	FORWARD				BACK				TOTAL						
		COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	% GEH	COUNT	VOLUME	CHANGE	%			
3916	3929	485.	454	-31.	93.6	1.4	812.	715	-97.	88.1	3.5	1297.	1169	-128.	90.1	Old Hume Hwy N of Barkers Lodge Rd Sep 2016
3916	5124	194.	200	6.	103.1	0.4	109.	155	46.	142.2	4.0	303.	355	52.	117.2	Barkers Lodge Rd N of Hume Hwy Sep 2016
3921	18464	458.	375	-83.	81.9	4.1	695.	597	-98.	85.9	3.9	1153.	972	-181.	84.3	Old Hume Hwy N of Menangle Rd Sep 2016
2394	3921	170.	198	28.	116.5	2.1	236.	182	-54.	77.1	3.7	406.	380	-26.	93.6	Menangle Rd S of Old Hume Hwy Sep 2016
3295	3929	609.	487	-122.	80.0	5.2	408.	411	3.	100.7	0.1	1017.	898	-119.	88.3	Old Hume Hwy N of Margaret St Sep 2016
2197	3929	117.	159	42.	135.9	3.6	161.	92	-69.	57.1	6.1	278.	251	-27.	90.3	Margaret St S of Old Hume Hwy Sep 2016
3847	3861	692.	575	-117.	83.1	4.6	332.	412	80.	124.1	4.1	1024.	987	-37.	96.4	Menangle St S of Prince St Sep 2016
3877	3861	190.	267	77.	140.5	5.1	431.	421	-10.	97.7	0.5	621.	688	67.	110.8	Prince St W of Menangle St Sep 2016
3902	3914	5.	17	12.	340.0	3.6	14.	11	-3.	78.6	0.8	19.	28	9.	147.4	Coull St S of Icton Ave Sep 2016
3912	18484	163.	168	5.	103.1	0.4	239.	176	-63.	73.6	4.4	402.	344	-58.	85.6	Menangle St N of Colden St Sep 2016
18458	3922	7.	11	4.	157.1	1.3	10.	13	3.	130.0	0.9	17.	24	7.	141.2	Margaret St S of Colden St Sep 2016
18459	3922	88.	97	9.	110.2	0.9	62.	57	-5.	91.9	0.6	150.	154	4.	102.7	Colden St S of Margaret Sep 2016
3922	18466	60.	100	40.	166.7	4.5	89.	63	-26.	70.8	3.0	149.	163	14.	109.4	Margaret St N of Colden St Sep 2016 Sep 2016

Number of links = 13 Number of forward links = 13 Number of back links = 13

TOTALS FORWARD BACK TOTALS

COUNT	3238.	3598.	6836.
VOLUME	3100.	3305.	6413.
CHANGE	-130.	-293.	-423.
%	96.	92.	94.
CORREL.			
COEFF.	0.984	0.980	0.993
%RMS	25.07	20.86	15.23
r^2	0.969	0.961	0.985
GEH	2.3	5.0	5.2

GEH	<5	<7.5	<10	<12	>12
#	23	26	26	26	0
%	88.5	100.0	100.0	100.0	0.0

Cordon Number : 10
Description : No.9 Appin Spot Counts

		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
2962	2971	68.	103	35.	151.5	3.8	115.	121	6.	105.2	0.6	183.	224	41.	122.4
2691	2131	282.	271	-11.	96.1	0.7	504.	545	41.	108.1	1.8	786.	816	30.	103.8
Number of links =		2 Number of forward links =				2 Number of back links =				2					
TOTALS	FORWARD	BACK	TOTALS												
COUNT	350.	619.	969.												
VOLUME	374.	666.	1040.												
CHANGE	24.	47.	71.												
%	107.	108.	107.												
CORREL.															
COEFF.	1.000	1.000	1.000												
%RMS	20.96	13.39	10.49												
r^2	1.000	1.000	1.000												
GEH	1.3	1.9	2.2												
GEH	<5	<7.5	<10	<12	>12										
#	4	4	4	4	0										
%	100.0	100.0	100.0	100.0	0.0										
Cordon Number : 11															
Description : No.10 - Wollondilly Miscellaneous															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5241	5257	27.	21	-6.	77.8	1.2	60.	31	-29.	51.7	4.3	87.	52	-35.	59.8
3976	3983	15.	17	2.	113.3	0.5	16.	13	-3.	81.2	0.8	32.	30	-2.	93.8
3178	3206	52.	43	-9.	82.7	1.3	37.	30	-7.	81.1	1.2	89.	73	-16.	82.0
3687	2500	204.	156	-48.	76.5	3.6	267.	196	-71.	73.4	4.7	471.	352	-119.	74.7
3264	3263	510.	366	-144.	71.8	6.9	111.	210	99.	109.2	7.8	621.	576	-45.	92.8
3174	3187	248.	335	87.	135.1	5.1	459.	406	-53.	88.5	2.5	707.	741	34.	104.8
3187	3216	95.	209	114.	220.0	9.2	371.	292	-79.	78.7	4.3	466.	501	35.	107.5
Number of links =		7 Number of forward links =				7 Number of back links =				7					
TOTALS	FORWARD	BACK	TOTALS												
COUNT	1151.	1321.	2473.												
VOLUME	1147.	1178.	2325.												
CHANGE	-4.	-143.	-148.												
%	100.	89.	94.												
CORREL.															
COEFF.	0.876	0.945	0.983												
%RMS	51.92	34.06	16.36												
r^2	0.768	0.892	0.966												
GEH	0.1	4.0	3.0												
GEH	<5	<7.5	<10	<12	>12										
#	10	12	14	14	0										
%	71.4	85.7	100.0	100.0	0.0										
Cordon Number : 12															
Description : No.11 - Camden Counts - Locations accurate															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5040	5046	955.	948	-7.	99.3	0.2	1530.	1229	-301.	80.3	8.1	2485.	2177	-308.	87.6
5861	6555	655.	696	41.	106.3	1.6	297.	462	165.	155.6	8.5	944.	1158	214.	122.7
10809	5859	1293.	1089	-204.	84.2	5.9	885.	744	-141.	84.1	4.9	2178.	1833	-345.	84.2
6512	6535	171.	227	56.	132.7	4.0	245.	296	51.	120.8	3.1	416.	523	107.	125.7
12824	12846	1321.	1427	106.	100.0	2.9	2120.	2131	11.	100.5	0.2	3441.	3558	117.	103.4
4980	5004	200.	263	63.	131.5	4.1	445.	404	-41.	90.8	2.0	645.	667	22.	103.4
2643	5832	212.	202	-10.	95.3	0.7	250.	284	34.	113.6	2.1	462.	486	24.	105.2
Number of links =		7 Number of forward links =				7 Number of back links =				7					
TOTALS	FORWARD	BACK	TOTALS												
COUNT	4807.	5772.	10571.												
VOLUME	4852.	5550.	10402.												
CHANGE	45.	-222.	-169.												
%	101.	96.	98.												
CORREL.															
COEFF.	0.981	0.981	0.984												
%RMS	14.78	18.74	14.45												
r^2	0.962	0.962	0.968												
GEH	0.6	3.0	1.7												
GEH	<5	<7.5	<10	<12	>12										
#	11	12	14	14	0										
%	78.6	85.7	100.0	100.0	0.0										
Cordon Number : 13															
Description : No.12 - Camden Valley Way \ Richardson I															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5843	5845	658.	760	102.	115.5	3.8	937.	931	-6.	99.4	0.2	1595.	1691	96.	106.0
5847	5845	1003.	940	-63.	93.7	2.0	636.	522	-114.	82.1	4.7	1639.	1462	-177.	89.2
9300	5845	460.	363	-95.	77.6	5.2	667.	578	-89.	86.7	3.6	1135.	941	-194.	82.9
6400	5845	560.	462	-98.	82.5	4.3	449.	493	44.	109.8	2.0	1009.	955	-54.	94.6
Number of links =		4 Number of forward links =				4 Number of back links =				4					
TOTALS	FORWARD	BACK	TOTALS												
COUNT	2689.	2689.	5378.												
VOLUME	2525.	2524.	5049.												
CHANGE	-164.	-165.	-329.												
%	94.	94.	94.												
CORREL.															
COEFF.	0.933	0.934	0.938												
%RMS	16.07	12.99	12.23												
r^2	0.870	0.873	0.879												
GEH	3.2	3.2	4.6												
GEH	<5	<7.5	<10	<12	>12										
#	7	8	8	8	0										
%	87.5	100.0	100.0	100.0	0.0										
Cordon Number : 14															
Description : No.13 - Narellan Intersections															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5854	5853	1639.	1450	-189.	88.5	4.8	1243.	1311	68.	105.5	1.9	2882.	2761	-121.	95.8
5851	5856	1181.	1167	-14.	98.8	0.4	1172.	1097	-75.	93.6	2.2	2353.	2264	-89.	96.2
7490	10798	3097.	2994	-103.	96.7	1.9	2293.	2420	127.	105.5	2.6	5390.	5414	24.	100.4
9376	10797	2822.	313	31.	111.0	1.8	352.	397	45.	112.8	2.3	634.	710	76.	112.0
7813	10799	278.	410	132.	147.5	7.1	661.	772	111.	116.8	4.1	939.	1182	243.	125.9
Number of links =		5 Number of forward links =				5 Number of back links =				5					
TOTALS	FORWARD	BACK	TOTALS												
COUNT	6477.	5721.	12198.												
VOLUME	6334.	5997.	12331.												
CHANGE	-143.	276.	133.												
%	98.	105.	101.												
CORREL.															
COEFF.	0.997	0.995	0.997												
%RMS	9.83	8.82	6.08												
r^2	0.994	0.990	0.995												
GEH	1.8	3.6	1.2												
GEH	<5	<7.5	<10	<12	>12										
#	9	10	10	10	0										
%	90.0	100.0	100.0	100.0	0.0										
Cordon Number : 15															
Description : No.13 - Camden CBD Counts August 2013															
		FORWARD				BACK				TOTAL					
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%
5143	5144	222.	295	73.	132.9	4.5	545.	423	-122.	77.6	5.5	767.	718	-49.	93.6
Site 1: Cawdor Road															

5388	5828	648.	683	35.	185.4	1.4	931.	936	5.	180.5	0.2	1579.	1619	40.	182.5	Site 2: Argyle Street
5836	5835	943.	795	-148.	84.3	5.0	679.	750	71.	110.5	2.7	1622.	1545	-77.	95.3	Site 4: Argyle Street
5836	5834	764.	793	29.	183.8	1.0	824.	797	-27.	96.7	0.9	1588.	1590	2.	180.1	Site 5: Argyle Street
5836	5834	95.	43	-52.	45.3	6.3	94.	94	0.	180.0	0.0	190.	137	-53.	72.1	Site 6: Oxley Street
5831	5492	163.	281	38.	123.3	2.8	193.	288	95.	149.2	6.1	356.	489	133.	137.4	Site 7: John Street
5836	6328	76.	108	32.	142.1	3.3	133.	142	9.	106.8	0.8	209.	250	41.	119.6	Site 8: Elizabeth Street
5145	5394	383.	416	33.	198.6	1.7	518.	565	47.	109.1	2.0	901.	981	80.	188.9	Site 9: Murray Street
5491	5831	285.	152	-53.	74.1	4.0	112.	102	-10.	91.1	1.0	317.	254	-63.	80.1	Site 10: John Street
14643	5835	38.	59	21.	155.3	3.0	152.	103	-49.	67.8	4.3	190.	162	-28.	85.3	Site 11: Hill Street
6229	5836	27.	29	2.	187.4	0.4	42.	23	-19.	54.8	3.3	69.	52	-17.	75.4	Site 12: View Street
Number of Links = 11 Number of forward links = 11 Number of back links = 11																
TOTALS	FORWARD	BACK	TOTALS													
COUNT	3564.	4223.	7788.													
VOLUME	3574.	4223.	7797.													
CHANGE	10.	0.	9.													
%	100.	100.	100.													
CORREL.																
COEFF.	0.982	0.984	0.994													
%RMS	19.23	15.38	9.32													
r^2	0.963	0.968	0.989													
GEH	0.2	0.0	0.1													
GEH	<5	<7.5	<10	<12	>12											
#	18	22	22	22	0											
%	81.8	100.0	100.0	100.0	0.0											
Cordon Number : 16																
Description : No. 14 - Camden N of Narellan																
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
5862	2895	39.	36	-3.	92.3	0.5	153.	128	-25.	83.7	2.1	192.	164	-28.	85.4	Dan Cleary Dr - Matrix Count Mar 2017
10815	9949	245.	299	54.	122.0	3.3	113.	192	79.	169.9	6.4	358.	491	133.	137.2	GLENROWAN DR - Matrix Count - Mar 2017
7480	9747	378.	361	-17.	95.5	0.9	252.	301	49.	119.4	2.9	630.	662	32.	105.1	Fairwater Dr - Matrix Count Mar 2017
5855	5857	1147.	917	-230.	79.9	7.2	1244.	1276	32.	182.6	0.9	2391.	2193	-198.	91.7	Camden Valley Rd (East) (Matrix IC Mar 2017)
18881	8212	794.	710	-84.	89.4	3.1	1034.	739	-295.	71.5	9.9	1828.	1449	-379.	79.3	Hartley Rd - Matrix Count Mar 2017
10797	9376	350.	397	38.	110.6	2.0	290.	313	23.	107.9	1.3	649.	710	61.	109.4	Tramway Drive N of Narellan (Matrix IC Mar 2017)
Number of Links = 6 Number of forward links = 6 Number of back links = 6																
TOTALS	FORWARD	BACK	TOTALS													
COUNT	2962.	3886.	6848.													
VOLUME	2720.	2949.	5669.													
CHANGE	-242.	-137.	-379.													
%	92.	96.	94.													
CORREL.																
COEFF.	0.989	0.963	0.988													
%RMS	23.03	27.20	20.14													
r^2	0.979	0.927	0.977													
GEH	4.5	2.5	5.0													
GEH	<5	<7.5	<10	<12	>12											
#	9	11	12	12	0											
%	75.0	91.7	100.0	100.0	0.0											
Cordon Number : 17																
Description : No. 15 - Silverdale																
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
2419	2420	83.	171	88.	206.0	7.8	179.	295	116.	164.8	7.5	262.	466	204.	177.9	SILVERDALE RD - Matrix Count - Mar 2017
Number of Links = 1 Number of forward links = 1 Number of back links = 1																
TOTALS	FORWARD	BACK	TOTALS													
COUNT	83.	179.	262.													
VOLUME	171.	295.	466.													
CHANGE	88.	116.	204.													
%	206.	165.	178.													
CORREL.																
COEFF.	0.000	0.000	0.000													
%RMS	0.00	0.00	0.00													
r^2	0.000	0.000	0.000													
GEH	7.8	7.5	10.7													
GEH	<5	<7.5	<10	<12	>12											
#	0	0	2	2	0											
%	0.0	0.0	100.0	100.0	0.0											
Cordon Number : 18																
Description : No. 16 - Screenline S Campbelltown																
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
14592	14799	187.	186	-1.	99.5	0.1	311.	252	-59.	81.0	3.5	498.	438	-60.	88.0	Parkside Cres W of Central Rd (Hospital)- Matrix Count M
3596	6185	328.	271	-57.	82.6	3.3	886.	836	-50.	94.4	1.7	1214.	1107	-107.	91.2	Menangle Rd E of Tailby- Matrix Count Mar 2017
7297	4490	1020.	1094	74.	107.3	2.3	1666.	1506	-100.	93.8	2.5	2626.	2600	-26.	99.0	Appin Rd S of Narellan Rd
Number of Links = 3 Number of forward links = 3 Number of back links = 3																
TOTALS	FORWARD	BACK	TOTALS													
COUNT	1535.	2803.	4338.													
VOLUME	1551.	2594.	4145.													
CHANGE	16.	-209.	-193.													
%	101.	93.	96.													
CORREL.																
COEFF.	0.997	1.000	1.000													
%RMS	12.91	9.57	6.13													
r^2	0.995	0.990	0.999													
GEH	0.4	4.0	3.0													
GEH	<5	<7.5	<10	<12	>12											
#	6	6	6	6	0											
%	100.0	100.0	100.0	100.0	0.0											
Cordon Number : 19																
Description : No. 16a - Screenline CS Campbelltown																
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
14093	15399	NoFlk					760.	748	-12.	98.4	0.4	760.	748	-12.	98.4	Englorie Park Dr S of Gilchrist Dr (southbound)- Matrix
15399	15390	333.	471	138.	141.4	6.9	NoFlk					333.	471	138.	141.4	Englorie Park Dr S of Gilchrist Dr (northbound)- Matrix
14022	14931	442.	576	134.	130.3	5.9	729.	753	24.	103.3	0.9	1171.	1299	158.	113.5	Woodhouse Dr S of Therry Rd - Matrix Count Mar 2017
10516	10517	673.	872	199.	129.6	7.2	1380.	1318	-62.	95.5	1.7	2053.	2190	137.	106.7	Appin Rd S of Woodhouse Rd - Matrix Count Mar 2017
Number of Links = 4 Number of forward links = 3 Number of back links = 3																
TOTALS	FORWARD	BACK	TOTALS													
COUNT	1448.	2869.	4317.													
VOLUME	1919.	2819.	4738.													
CHANGE	471.	-50.	421.													
%	133.	98.	110.													
CORREL.																
COEFF.	0.998	0.999	0.995													
%RMS	40.55	5.00	13.42													
r^2	0.990	0.998	0.990													
GEH	11.5	0.9	6.3													
GEH	<5	<7.5	<10	<12	>12											
#	3	6	6	6	0											
%	50.0	100.0	100.0	100.0	0.0											
Cordon Number : 20																
Description : No. 17 - Screenline R Campbelltown																
NODE1	NODE2	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	GEH	COUNT	VOLUME	CHANGE	%	
26289	27181	984.	1063	79.	108.0	2.5	341.	348	7.	102.1	0.4	1325.	1411	86.	106.5	Cambridge Ave W of Canterbury Rd - Matrix Count Mar 2017
26770	27936	501.	526	25.	105.0	1.1	457.	625	168.	136.8	7.2	958.	1151	193.	120.1	Glenfield Rd - Matrix Count Mar 2017
27871	6121	408.	522	54.	111.5	2.4	634.	626	-8.	98.7	0.3	1102.	1148	46.	104.2	Campbelltown Rd W of S Western Fwy - Matrix Count Mar 20
22682	18187	790.	826	36.	104.6	1.3	991.	920	-81.	91.0	2.8	1691.	1646	-45.	97.3	Ben Lomond Rd W of Pembroke Rd - Matrix Count Mar 2017
22853	22954	NoFlk					877.	1023	146.	116.6	4.7	877.	1023	146.	116.6	Rose Pevton Dr E of Airds Rd (southbound)- Matrix Count

22788	23050	545.	702	157.	128.8	6.3	NoBlk	545.	702	157.	128.8	Rose Peyton Dr E of Airds Rd (northbound)- Matrix Count Mar 2017
18843	22903	1523.	1662	139.	109.1	3.5	NoBlk	1523.	1662	139.	109.1	Campbelltown Rd S of Blaxland (Northbound)- Matrix Count Mar 2017
18802	4891	NoFlk					1766.	1612	-154.	91.3	3.7	Campbelltown Rd S of Blaxland (Southbound)- Matrix Count Mar 2017
19520	17708	1077.	1314	237.	122.0	6.9	1225.	1107	-118.	90.4	3.5	Narellan rd S of Blaxland Rd - Matrix Count Mar 2017
13955	14044	1113.	1187	74.	106.6	2.2	NoBlk	1113.	1187	74.	106.6	Gilchrist Dr S of Goldsmith Ave (Northbound)- Matrix Count Mar 2017
4095	15160	NoFlk					1235.	1386	151.	112.2	4.2	Gilchrist Dr S of Goldsmith Ave (Southbound)- Matrix Count Mar 2017
2948	2950	1720.	1651	-69.	96.0	1.7	NoBlk	1720.	1651	-69.	96.0	Hume Motorway at Menangle Site 7737 Northbound
2944	2947	NoFlk					2151.	2294	143.	106.6	3.0	Hume Motorway at Menangle Site 7737 Southbound
4537	4538	280.	432	152.	154.3	8.1	896.	664	-232.	74.1	8.3	Menangle Rd S of Racecourse Ave - Matrix Count Mar 2017
Number of links = 14 Number of forward links = 10 Number of back links = 10												
TOTALS		FORWARD	BACK	TOTALS								
COUNT	9001.	10483.	19484.									
VOLUME	9885.	10505.	20390.									
CHANGE	884.	22.	906.									
%	110.	100.	105.									
CORREL.												
COEFF.	0.983	0.968	0.976									
%RMS	14.08	13.89	9.17									
r^2	0.967	0.937	0.952									
GEH	9.1	0.2	6.4									
GEH	<5	<7.5	<10	<12	>12							
#	15	18	20	20	0							
%	75.0	90.0	100.0	100.0	0.0							
Cordon Number : 21												
Description : No. 18 - Screenline CN Campbelltown												
NODE1	NODE2	COUNT	FORWARD VOLUME	CHANGE	%	GEH	BACK COUNT	VOLUME	CHANGE	%	GEH	TOTAL COUNT
24743	24566	479.	584	105.	121.9	4.6	1290.	1110	-180.	86.0	5.2	1769.
24953	24954	355.	448	93.	126.2	4.6	426.	424	-2.	99.5	0.1	781.
25118	24035	321.	361	40.	112.5	2.2	307.	431	124.	140.4	6.5	628.
Number of links = 3 Number of forward links = 3 Number of back links = 3												
TOTALS		FORWARD	BACK	TOTALS								
COUNT	1155.	2023.	3178.									
VOLUME	1393.	1965.	3358.									
CHANGE	238.	-58.	180.									
%	121.	97.	106.									
CORREL.												
COEFF.	0.982	0.993	0.999									
%RMS	26.79	22.92	13.48									
r^2	0.964	0.986	0.998									
GEH	6.7	1.3	3.1									
GEH	<5	<7.5	<10	<12	>12							
#	4	6	6	6	0							
%	66.7	100.0	100.0	100.0	0.0							
Cordon Number : 22												
Description : No. 18a - Screenline C Campbelltown												
NODE1	NODE2	COUNT	FORWARD VOLUME	CHANGE	%	GEH	BACK COUNT	VOLUME	CHANGE	%	GEH	TOTAL COUNT
18863	19020	728.	820	92.	112.6	3.3	NoBlk					728.
18060	19335	NoFlk					762.	687	-75.	90.2	2.8	762.
18843	22803	1523.	1662	139.	109.1	3.5	NoBlk					1523.
18002	4891	NoFlk					1766.	1612	-154.	91.3	3.7	1766.
18535	19102	839.	920	81.	109.7	2.7	913.	1089	176.	119.3	5.6	1752.
19058	18584	335.	471	136.	140.6	6.8	616.	564	-52.	91.6	2.1	951.
Number of links = 6 Number of forward links = 4 Number of back links = 4												
TOTALS		FORWARD	BACK	TOTALS								
COUNT	3425.	4057.	7482.									
VOLUME	3873.	3952.	7825.									
CHANGE	448.	-105.	343.									
%	113.	97.	105.									
CORREL.												
COEFF.	0.990	0.963	0.961									
%RMS	15.50	14.29	12.94									
r^2	0.997	0.927	0.923									
GEH	7.4	1.7	3.9									
GEH	<5	<7.5	<10	<12	>12							
#	6	8	8	8	0							
%	75.0	100.0	100.0	100.0	0.0							
Cordon Number : 23												
Description : No. 19 - Screenline N Campbelltown												
NODE1	NODE2	COUNT	FORWARD VOLUME	CHANGE	%	GEH	BACK COUNT	VOLUME	CHANGE	%	GEH	TOTAL COUNT
26024	26734	282.	345	63.	122.3	3.6	478.	548	70.	114.6	3.1	760.
26850	26684	569.	587	18.	103.2	0.7	867.	897	30.	103.5	1.0	1436.
27071	6121	468.	522	54.	111.5	2.4	634.	626	-8.	98.7	0.3	1102.
Number of links = 3 Number of forward links = 3 Number of back links = 3												
TOTALS		FORWARD	BACK	TOTALS								
COUNT	1319.	1979.	3298.									
VOLUME	1454.	2071.	3525.									
CHANGE	135.	92.	227.									
%	110.	105.	107.									
CORREL.												
COEFF.	0.990	0.961	0.990									
%RMS	13.66	8.21	9.56									
r^2	0.992	0.962	0.993									
GEH	3.6	2.0	3.9									
GEH	<5	<7.5	<10	<12	>12							
#	6	6	6	6	0							
%	100.0	100.0	100.0	100.0	0.0							
Cordon Number : 24												
Description : No. 20 - Screenline M Campbelltown												
NODE1	NODE2	COUNT	FORWARD VOLUME	CHANGE	%	GEH	BACK COUNT	VOLUME	CHANGE	%	GEH	TOTAL COUNT
26034	26033	715.	835	120.	116.8	4.3	783.	715	-68.	91.3	2.5	1498.
5057	26256	390.	499	169.	151.2	8.3	447.	448	1.	100.2	0.0	777.
24302	24301	1055.	974	-81.	92.3	2.5	937.	894	-43.	95.4	1.4	1992.
24569	24823	348.	351	3.	100.9	0.2	727.	825	98.	113.5	3.5	1075.
24565	25173	585.	614	29.	105.0	1.2	NoBlk					585.
22843	22842	1484.	1335	-69.	95.1	1.9	668.	851	183.	127.4	6.6	2072.
23012	23118	NoFlk					2264.	2404	140.	106.2	2.9	2264.
20733	20546	1800.	1662	-198.	89.4	4.7	NoBlk					1800.
16759	16054	718.	730	12.	101.7	0.4	544.	559	15.	102.8	0.6	1262.
7496	10798	3097.	2994	-103.	96.7	1.9	2293.	2420	127.	105.5	2.6	5390.
4537	4538	280.	432	152.	154.3	8.1	896.	664	-232.	74.1	8.3	1176.
Number of links = 11 Number of forward links = 10 Number of back links = 9												
TOTALS		FORWARD	BACK	TOTALS								
COUNT	10392.	9559.	19951.									
VOLUME	10426.	9780.	20206.									
CHANGE	34.	221.	255.									
%	100.	102.	101.									
CORREL.												
COEFF.	0.995	0.988	0.996									
%RMS	11.48	12.43	6.47									
r^2	0.990	0.975	0.992									
GEH	0.3	2.2	1.8									
GEH	<5	<7.5	<10	<12	>12							
#	15	16	19	19	0							
%	78.9	84.2	100.0	100.0	0.0							
Cordon Number : 25												
Description : No. 20a - Screenline M Campbelltown												



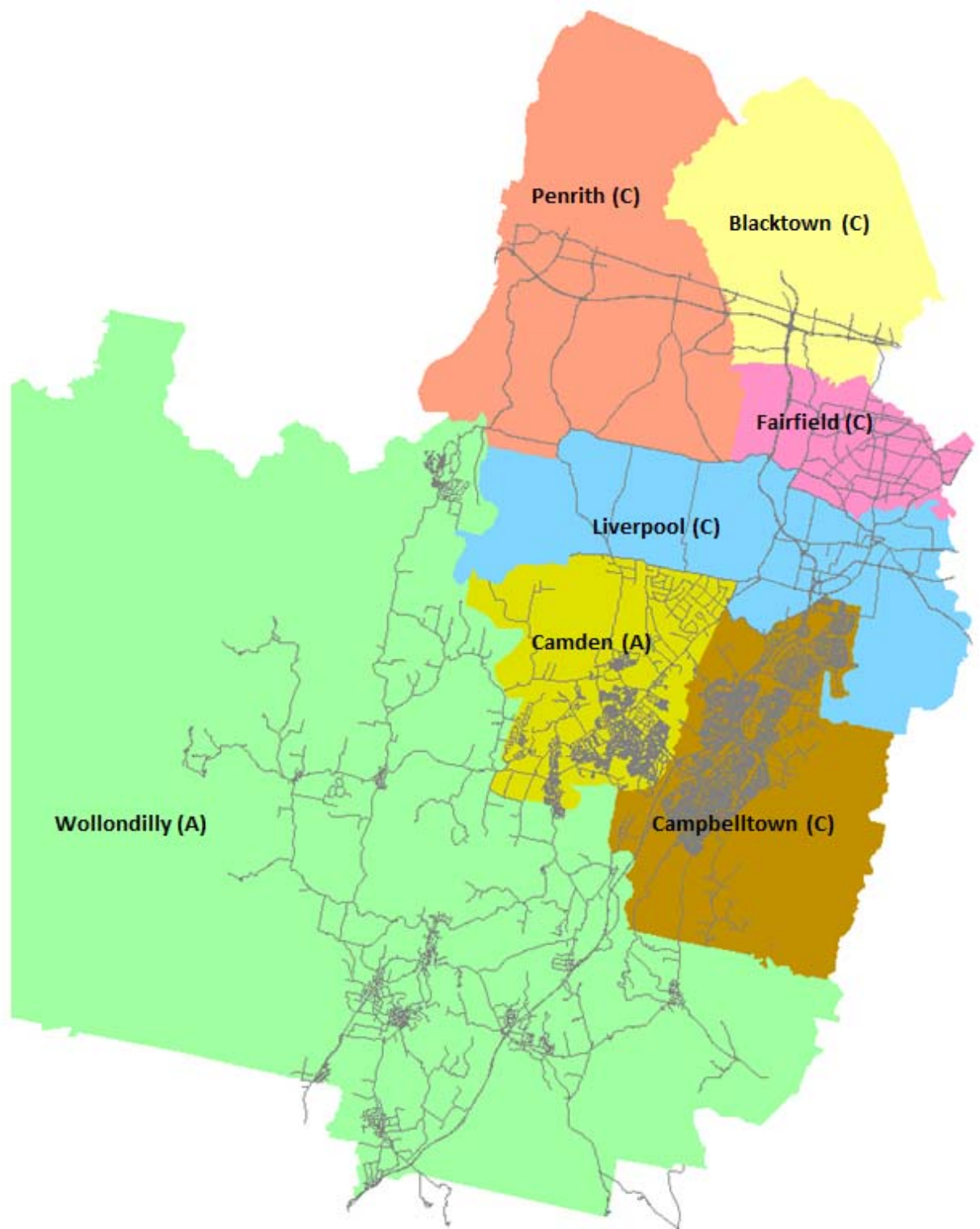
MACROSC Model Development 2017, Camden Council - Wollondilly Shire Council - Campbelltown City Council
Transportation Model Update

r^2	0.965	0.967	0.984												
GEH	13.1	1.9	10.2												
GEH	<5	<7.5	<10												
#	57	69	73												
%	78.1	94.5	100.0												
Cordon Number	: 29														
Description	: ALL Counts														
NODE1	NODE2	COUNT	FORWARD VOLUME	CHANGE	%	GEH	COUNT	BACK VOLUME	CHANGE	%	GEH	TOTAL COUNT	TOTAL VOLUME	CHANGE	%
2691	2131	282	271	-11	-96.1	0.7	594	545	-41	-108.1	1.8	786	816	30	103.8
16414	18515	357	354	-3	-99.2	0.2	733	690	-43	-94.1	1.6	1099	1044	-46	-95.8
7297	4498	1020	1094	74	107.3	2.3	1066	1506	-100	-93.8	2.5	2626	2600	-26	-99.0
10516	10517	673	872	199	129.6	7.2	1380	1318	-62	-95.5	1.7	2053	2190	137	106.7
16759	16954	718	730	12	161.7	0.4	544	559	15	102.8	0.6	1262	1289	27	102.1
3150	3161	55	69	14	125.5	1.8	59	45	-14	-76.3	1.9	114	6	-106.9	
3916	5124	194	200	6	103.1	0.4	109	155	46	142.2	4.0	303	355	52	117.2
22682	23184	790	826	36	104.6	1.3	901	820	-81	-91.0	2.8	1691	1646	-45	-97.3
18863	18920	728	820	92	112.6	3.3	762	820	58	100.0	0.0	1582	1646	64	103.8
18860	19335	NoFlk					762	820	58	100.0	0.0	1582	1646	64	103.8
5241	5257	27	21	-6	-77.8	1.2	60	31	-29	-51.7	4.3	87	52	-35	-59.8
2297	4082	NoFlk					1117	1193	76	106.8	2.2	1117	1193	76	106.8
2296	4101	1178	1133	-45	-96.2	1.3	192	198	6	103.1	0.4	1178	1133	-45	-96.2
2398	3816	139	152	12	116.9	1.7	167	198	6	103.1	0.4	322	350	28	108.7
24382	24381	1055	974	-81	-92.3	2.5	937	894	-43	-95.4	1.4	1992	1868	-124	-93.8
4980	5084	200	263	63	131.5	4.1	445	404	-41	-90.8	2.0	645	667	22	103.4
26289	27181	984	1063	79	108.0	2.5	341	348	7	102.1	0.4	1325	1411	86	106.5
5040	5046	955	948	-7	-99.3	0.2	1530	1229	-301	-80.3	8.1	2485	2177	-308	-87.7
5855	5857	1147	917	-230	-79.9	7.2	1244	1276	32	102.6	0.9	2391	2193	-198	-91.7
5851	5856	1181	1167	-14	-98.8	0.4	1172	1097	-75	-93.6	2.2	2353	2264	-89	-96.2
5859	10809	885	744	-141	-84.1	4.9	1293	1089	-204	-84.2	5.9	2178	1833	-345	-84.2
12824	12946	122	127	5	116.3	2.2	307	424	117	109.5	0.2	341	358	17	103.4
5847	5845	1093	940	-63	-93.7	2.0	636	522	-114	-82.1	4.7	1639	1462	-177	-89.2
5843	5845	658	760	102	115.5	3.8	937	931	-6	-99.4	0.2	1595	1691	96	106.0
24569	24823	348	351	3	100.9	0.2	727	825	98	113.3	3.5	1075	1176	101	109.4
18843	22083	1523	1662	139	109.1	3.5	NoFlk					139	1662	1273	106.5
18892	491	NoFlk					1766	1612	-154	-91.3	3.7	1766	1612	-154	-91.3
24743	24566	479	584	105	121.9	4.6	1290	1110	-180	-88.0	5.2	1769	1694	-75	-95.8
27971	6121	468	522	54	111.5	2.4	634	626	-8	-98.7	0.3	1182	1148	-34	-104.2
26856	26854	569	587	18	103.2	0.7	867	872	5	100.5	0.1	1619	1619	0	100.0
5861	6555	655	696	41	106.3	1.6	297	462	165	155.6	8.5	944	1158	214	122.7
3912	10483	180	136	-44	-75.6	3.5	141	127	-14	-90.1	1.2	321	263	-58	-81.9
10459	3922	88	97	9	110.0	0.9	62	57	-5	-91.9	0.6	150	154	4	102.7
25119	24035	2	36	34	112.5	2.2	307	424	117	109.5	0.2	341	358	17	103.4
3902	3914	5	17	12	134.0	3.6	14	11	-3	-78.6	0.8	19	28	9	147.4
24953	24954	355	448	93	126.2	4.6	426	424	-2	-99.5	0.1	781	872	91	111.7
5862	2895	39	36	-3	-92.3	0.5	153	128	-25	-83.7	2.1	192	164	-28	-85.4
15690	7212	490	847	357	189.2	4.9	449	493	44	109.8	2.9	1099	955	-54	-94.6
2962	2971	68	103	35	151.5	3.8	115	121	6	105.2	0.6	183	224	41	122.4
15389	15390	333	471	138	141.4	6.9	NoFlk					333	471	138	141.4
14083	15399	NoFlk					760	748	-12	-98.4	0.4	760	748	-12	-98.4
6534	3167	178	178	18	111.2	1.4	251	159	-92	-63.3	6.4	411	337	-74	-82.0
7400	9747	378	361	-17	-95.5	0.9	252	301	49	119.4	2.9	630	662	32	105.1
3200	3308	756	516	-240	-68.3	9.5	313	371	58	118.2	3.1	1068	887	-181	-83.1
13955	14044	1113	1187	74	106.6	2.2	1235	1386	151	112.5	4.2	1113	1187	74	106.6
4095	15108	NoFlk					1235	1386	151	112.5	4.2	1113	1187	74	106.6
26770	27036	501	526	25	105.0	1.1	457	628	180	136.8	7.2	958	1151	193	120.1
26034	26033	715	835	120	116.8	4.3	783	715	-68	-93.1	2.5	1498	1550	52	103.5
10015	9949	245	299	54	122.0	3.3	113	192	79	109.9	6.4	358	491	133	137.2
6490	5845	560	462	-98	-82.5	4.3	449	493	44	109.8	2.9	1099	955	-54	-94.6
10801	8212	794	710	-84	-89.4	3.1	1034	739	-295	-71.9	9.0	1828	1449	-379	-79.3
2948	2950	1720	1651	-69	-96.0	1.7	NoFlk					1720	1651	-69	-96.0
2944	2947	NoFlk					2151	2294	143	106.6	3.0	2151	2294	143	106.6
26733	20546	1060	1662	-198	-89.4	4.7	NoFlk					1060	1662	-198	-89.4
23012	23118	NoFlk					2264	2404	140	106.2	2.9	2264	2404	140	106.2
26733	20639	561	751	190	133.9	7.4	NoFlk					561	751	190	133.9
29969	20883	NoFlk					426	620	194	145.5	8.5	426	620	194	145.5
19958	18504	335	471	136	140.3	6.8	616	564	-52	-91.6	6.1	951	1035	84	108.8
3976	3983	15	17	2	113.3	0.5	16	13	-3	-81.2	0.8	32	30	-2	-93.8
2734	4150	NoFlk					1291	1387	96	107.4	2.6	1291	1387	96	107.4
2732	4149	1479	1595	116	107.8	3.0	NoFlk					1479	1595	116	107.8
2643	5832	212	202	-10	-95.3	7.7	265	284	34	113.6	2.1	462	486	24	105.2
5657	26256	339	499	160	151.2	8.3	447	448	1	100.0	0.0	777	947	170	121.9
6512	6535	171	227	56	132.7	4.0	245	296	51	120.8	3.1	416	523	107	125.7
3187	3216	95	209	114	220.0	9.2	371	292	-79	-78.7	4.3	466	501	35	107.5
3174	3187	248	335	87	135.1	5.1	459	406	-53	-88.5	2.5	707	741	34	104.8
3922	10466	60	100	40	166.7	4.5	69	83	14	109.8	3.0	149	163	14	109.4
10458	3922	7	11	4	157.1	1.3	10	13	3	130.0	0.9	17	24	7	141.2
3929	2197	117	92	-25	-78.6	2.4	161	159	-2	-98.8	0.2	278	251	-27	-90.3
3989	3914	193	433	240	180.0	8.0	281	215	-66	-76.5	4.2	474	488	14	103.5
3921	3944	781	575	-206	-82.7	5.0	306	412	106	118.0	4.1	936	986	50	103.2
3596	6105	328	271	-57	-82.6	3.3	886	816	-50	-94.4	1.7	1214	1187	-107	-91.2
2394	3921	170	198	28	116.5	2.1	236	182	-54	-77.1	3.7	406	380	-26	-93.6
4537	4538	280	432	152	154.3	8.1	896	664	-232	-74.1	8.3	116	89	-80	-93.2
3912	10484	163	168	5	103.1	0.4	239	176	-63	-73.6	4.4	402	344	-58	-94.2
3861	3878	348	234	-114	-67.2	6.7	229	225	-4	-98.3	0.3	577	459	-118	-79.5
3847	3861	692	575	-117	-83.1	4.6	332	412	80	124.1	4.1	1024	987	-37	-96.4
3182	3184	163	112	-51	-98.7	0.9	131	119	-12	-90.8	1.1	234	231	-3	-98.7
7813	10799	419	419	0	100.0	0.0	661	772	111	116.8	4.1	936	1182	246	115.9
3178	3206	52	43	-9	-82.7	1.3	37	30	-7	-81.1	1.2	89	73	-16	-82.0
7496	10798	3997	2994	-1003	-96.7	1.9	2293	2420	127	105.5	2.6	5390	5414	24	100.4
5854	5853	1639	1450	-189	-88.5	4.8	1243	1311	68	105.5	1.9	2082	2761	679	129.2
10520	17708	1077	1314	237	122.0	6.9	1225	1107	-118	-90.4	3.5	2302	2421	119	105.2
3916	3920	485	454	-31	-93.6	1.4	812	715	-97	-88.1	3.5	1297	1169	-128	-90.1
3929	3295	408	411	3	100.7	0.1	609	487	-122	-80.0	5.2	1017	898	-119	-88.3
3921	18464	458	375	-83	-81.9	4.1	695	597	-98	-85.9	3.9	1153	972	-181	-84.3
2972	3916	419	401	-18	-93.3	1.4									

CORDON terminated successfully

Appendix C

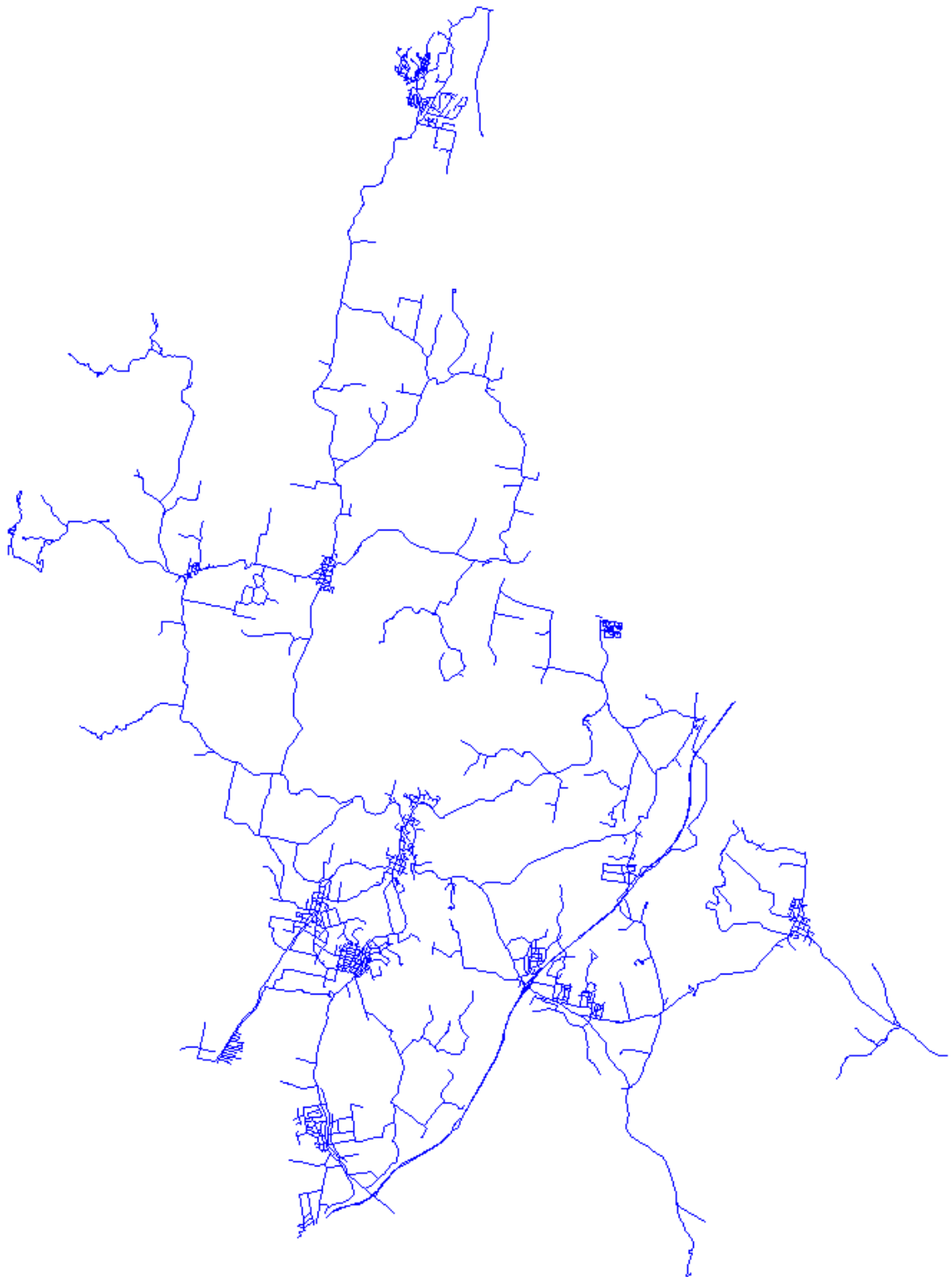
2016 Network



2016 MACROC Model
Model Coverage at LGA Boundaries



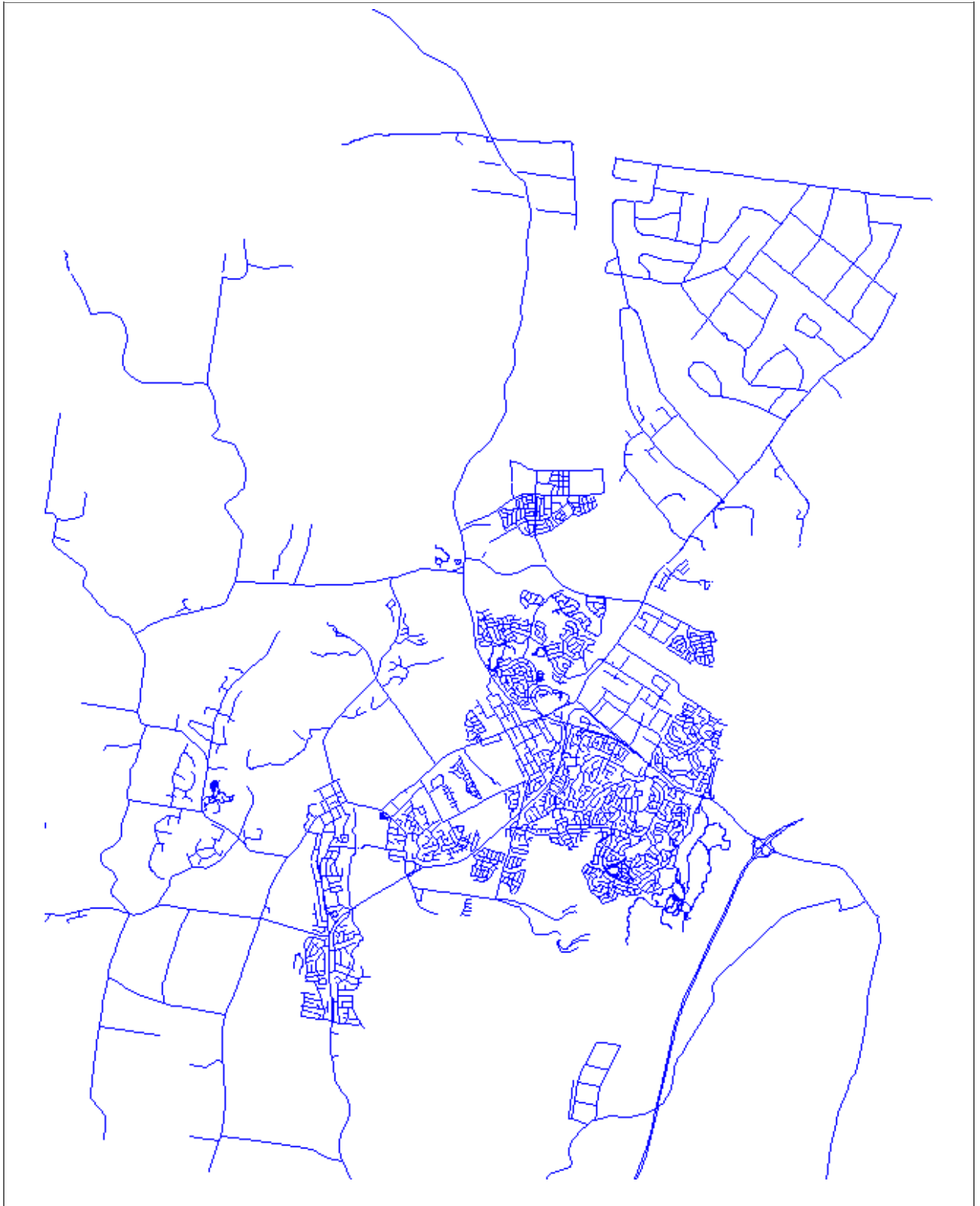
1



2016 MACROC Model
TRACKS Network – Local Roads in Wollondilly



2



2016 MACROC Model
TRACKS Network – Local Roads in Camden



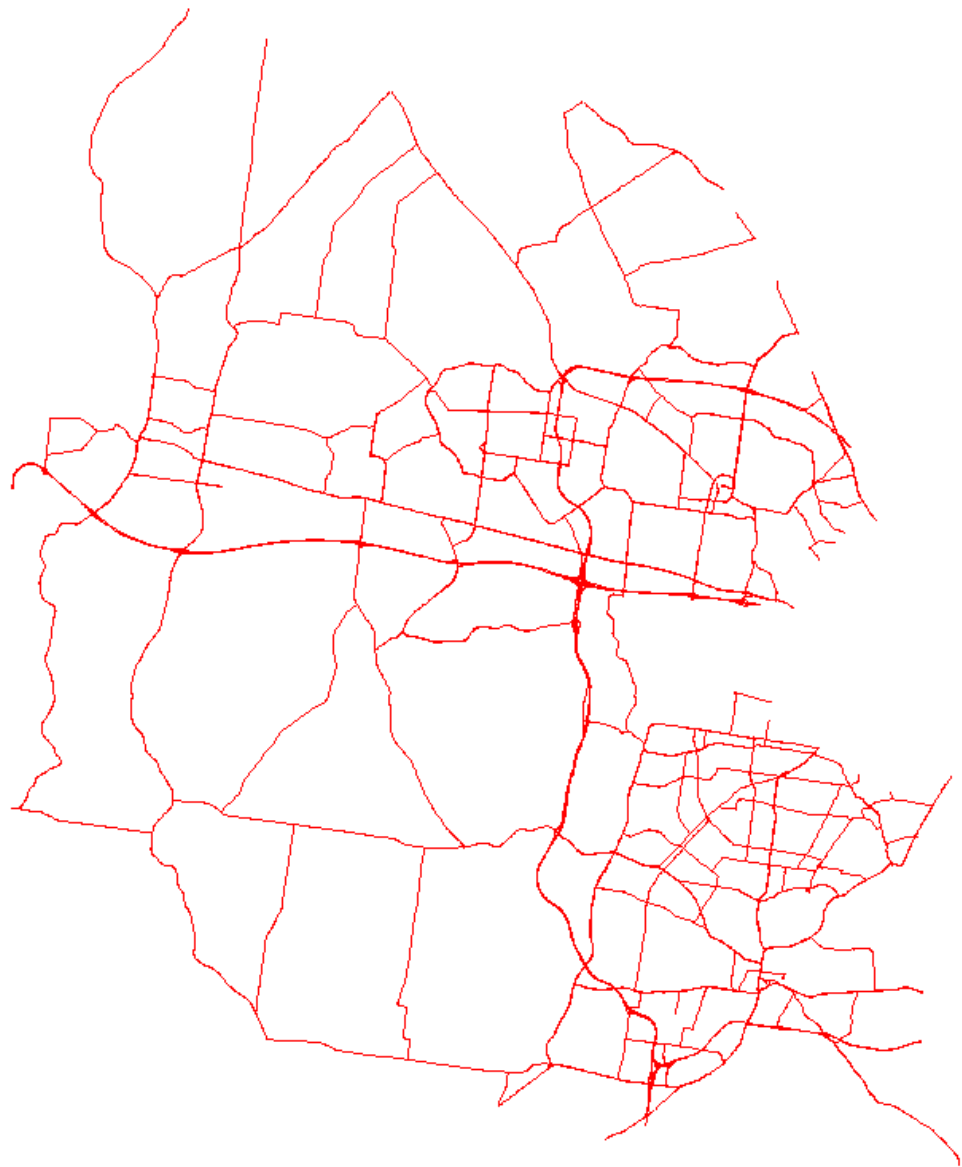
3



2016 MACROC Model
TRACKS Network – Local Roads in Campbelltown

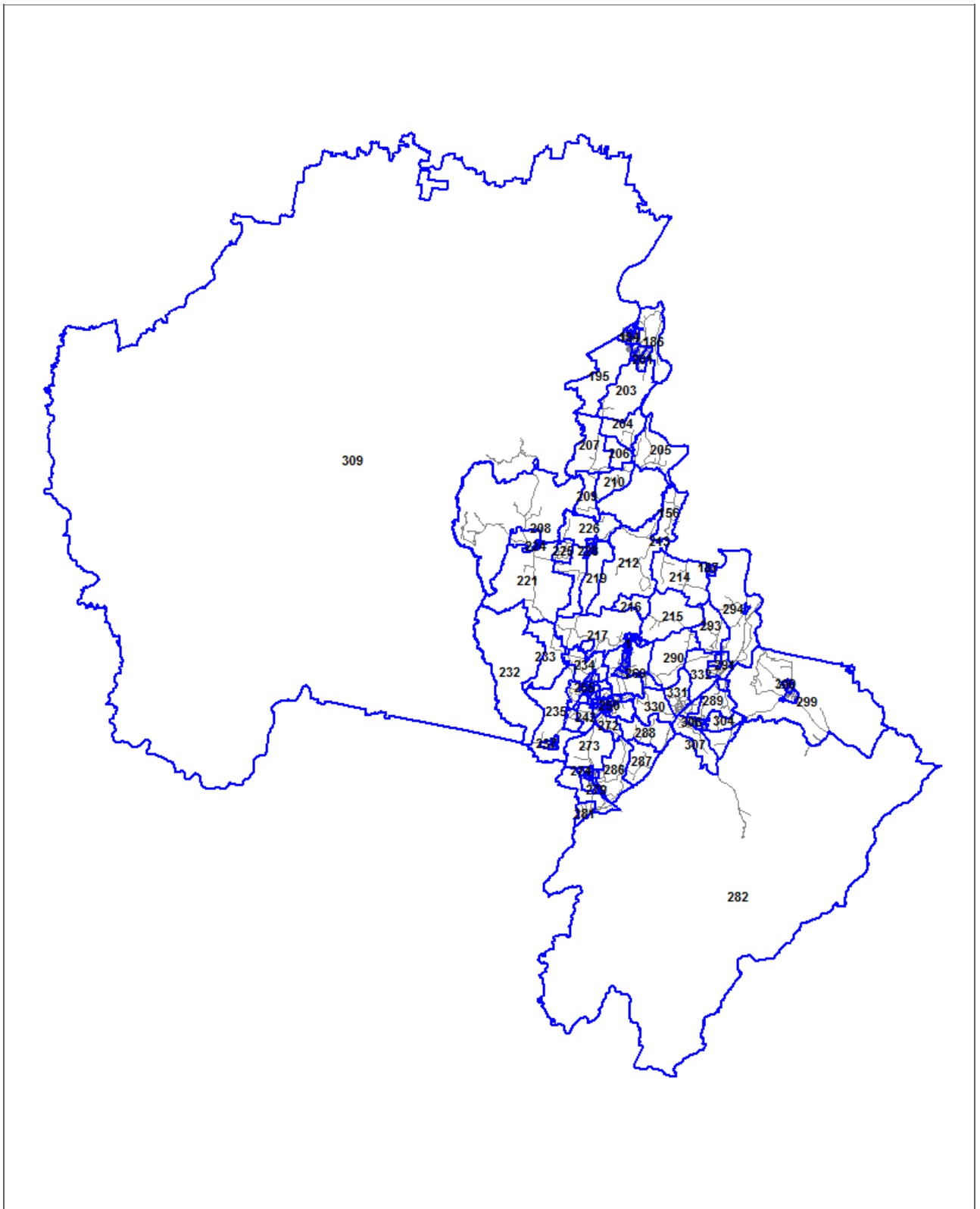


4



Appendix D

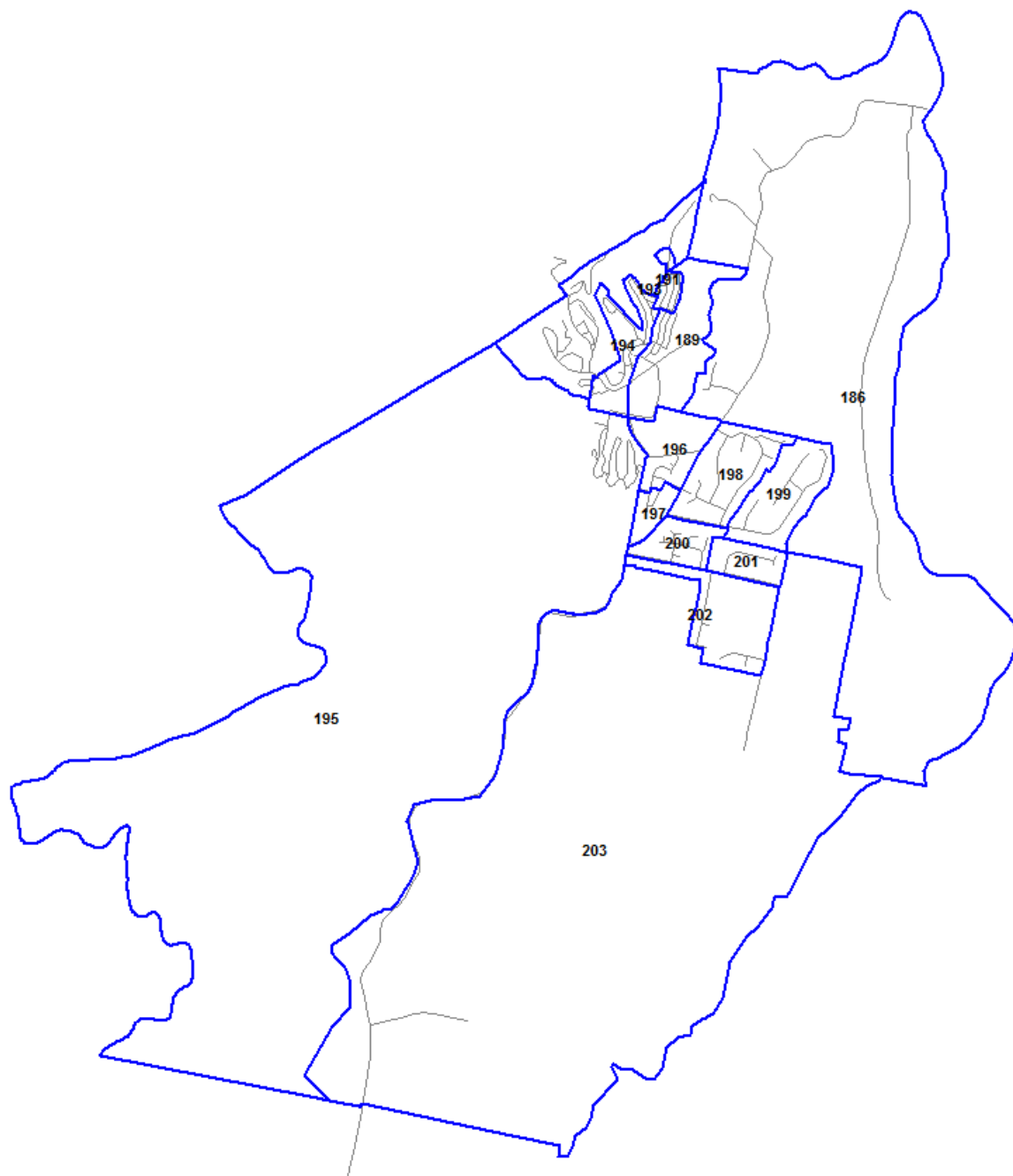
2016 Zone System



2016 MACROC Model Zone System - Travel Zone Boundaries
 Wollondilly



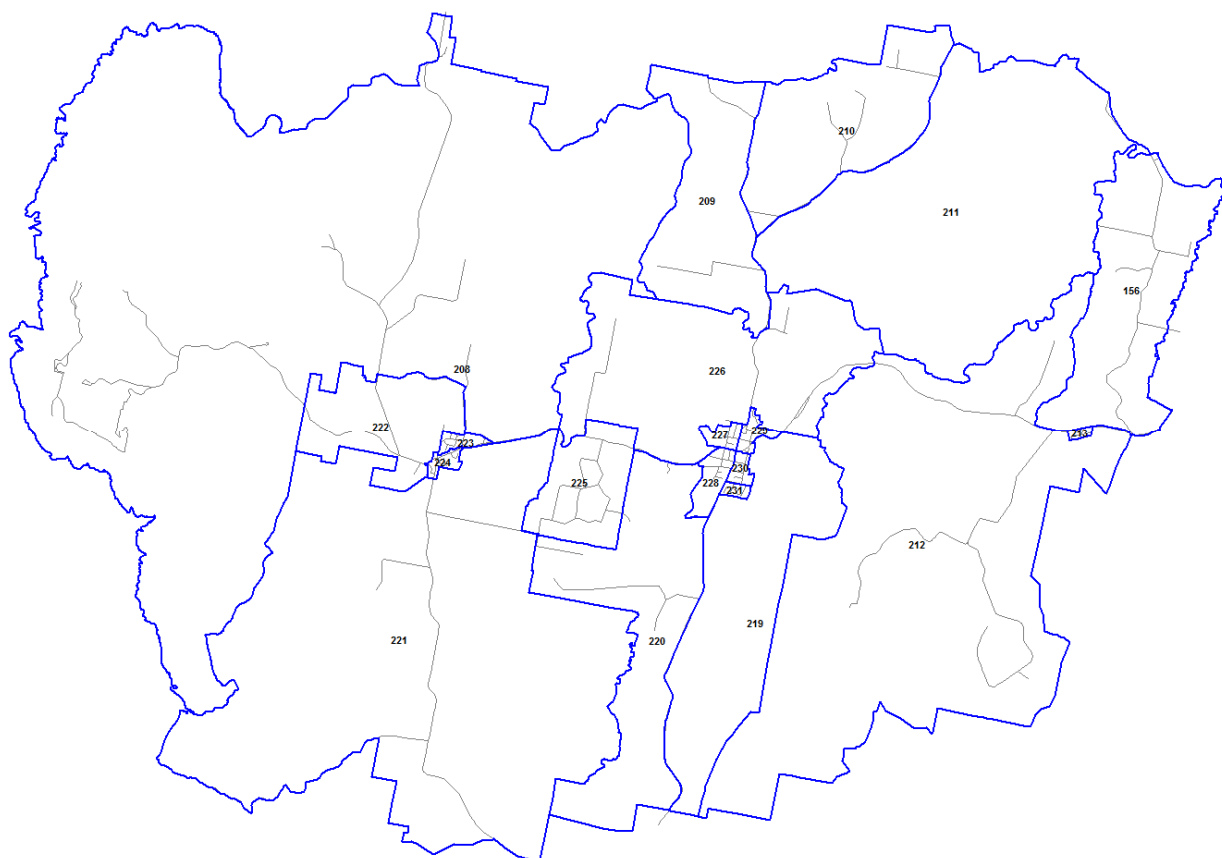
1



2016 MACROC Model Zone System - Travel Zone Boundaries
Wollondilly – Warragamba & Silverdale



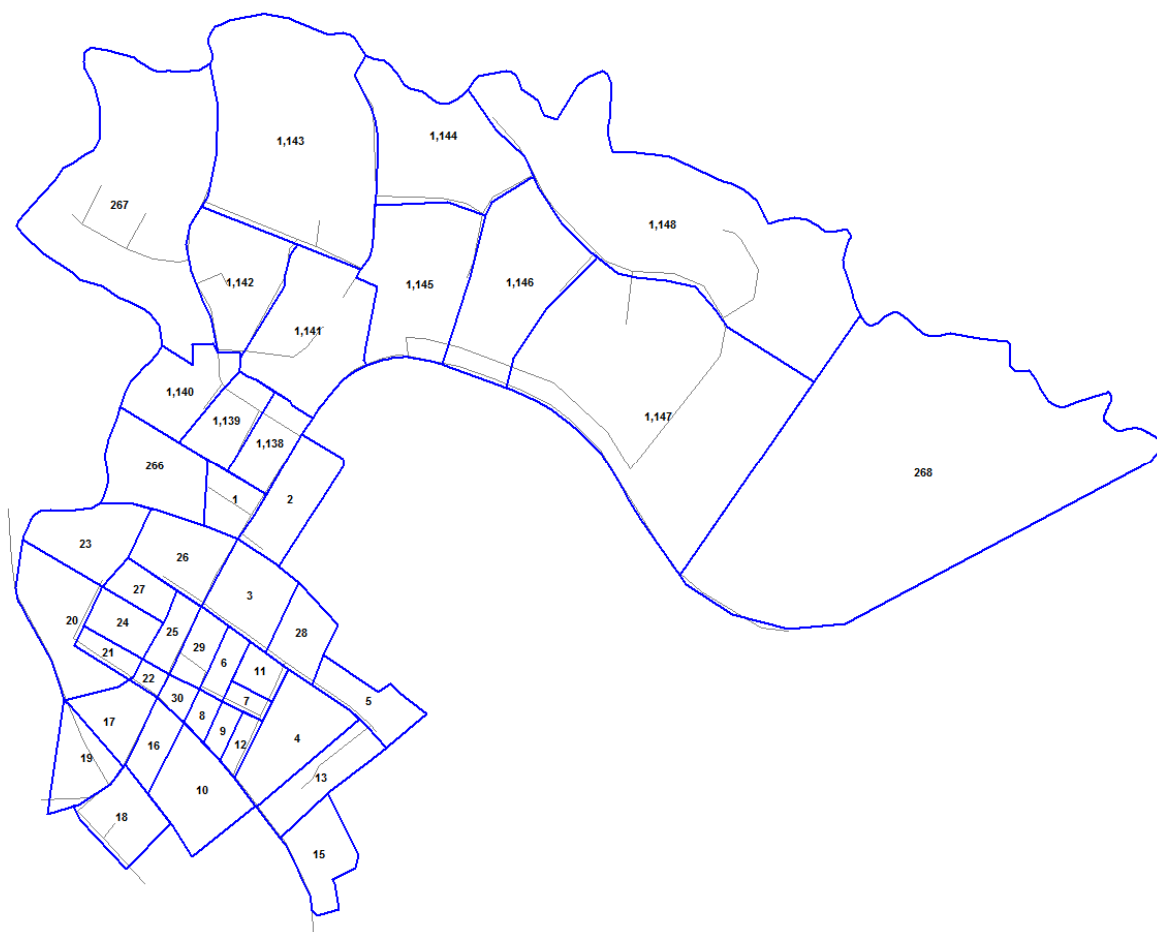
2



2016 MACROC Model Zone System - Travel Zone Boundaries
Wollondilly – Oakdale & The Oak



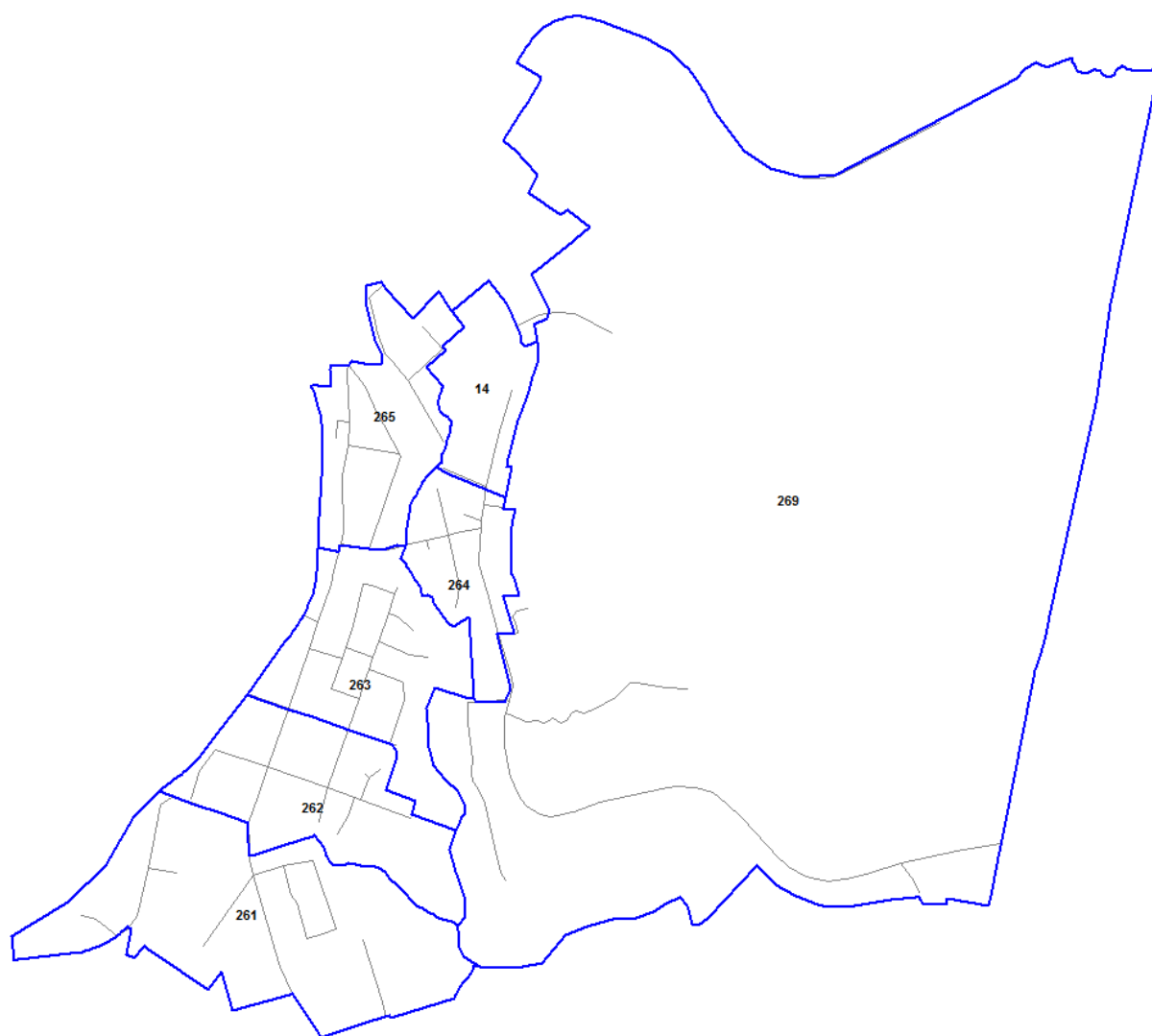
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2016 MACROC Model Zone System - Travel Zone Boundaries
Wollondilly – Picton North



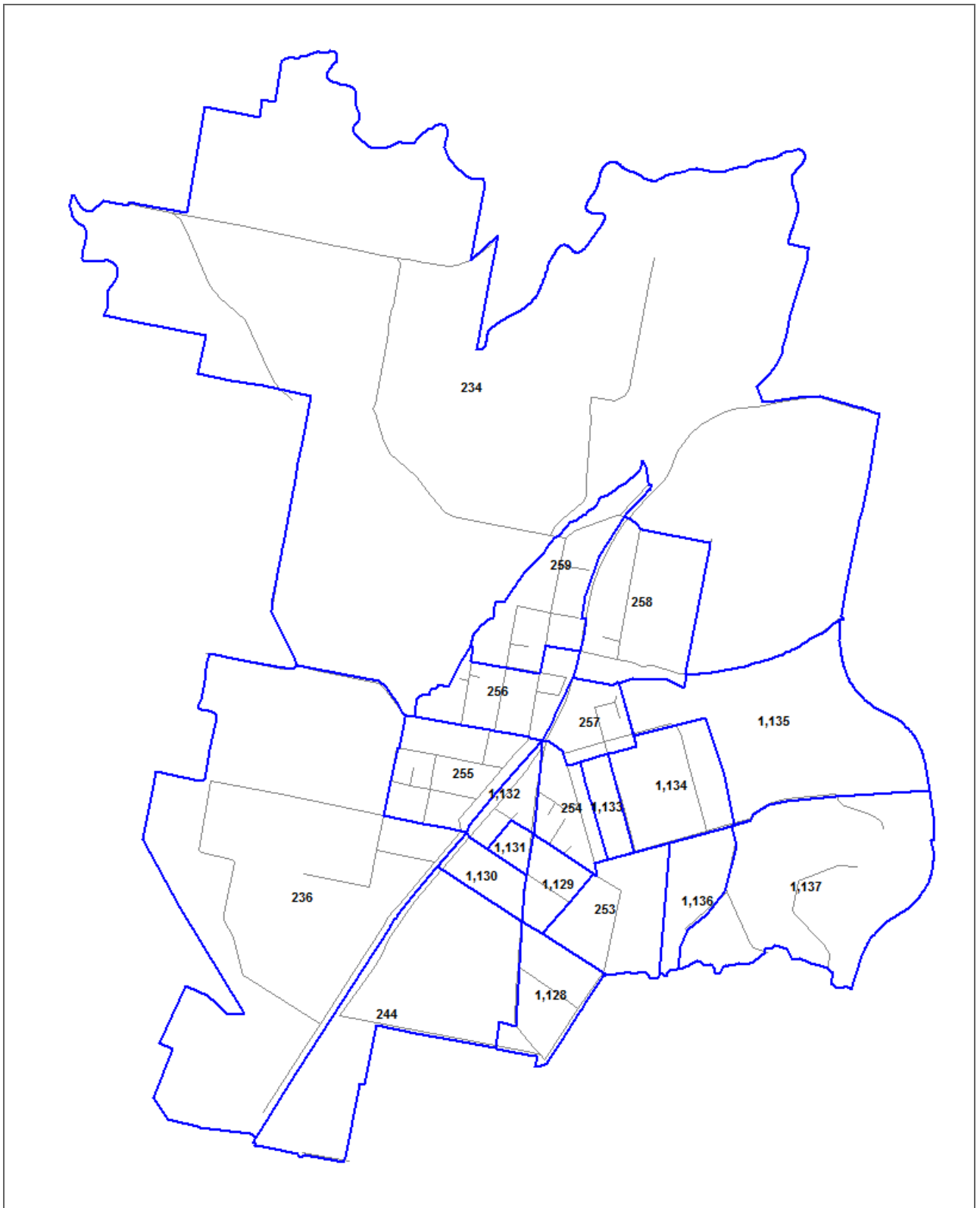
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2016 MACROC Model Zone System - Travel Zone Boundaries
Wollondilly – Picton South



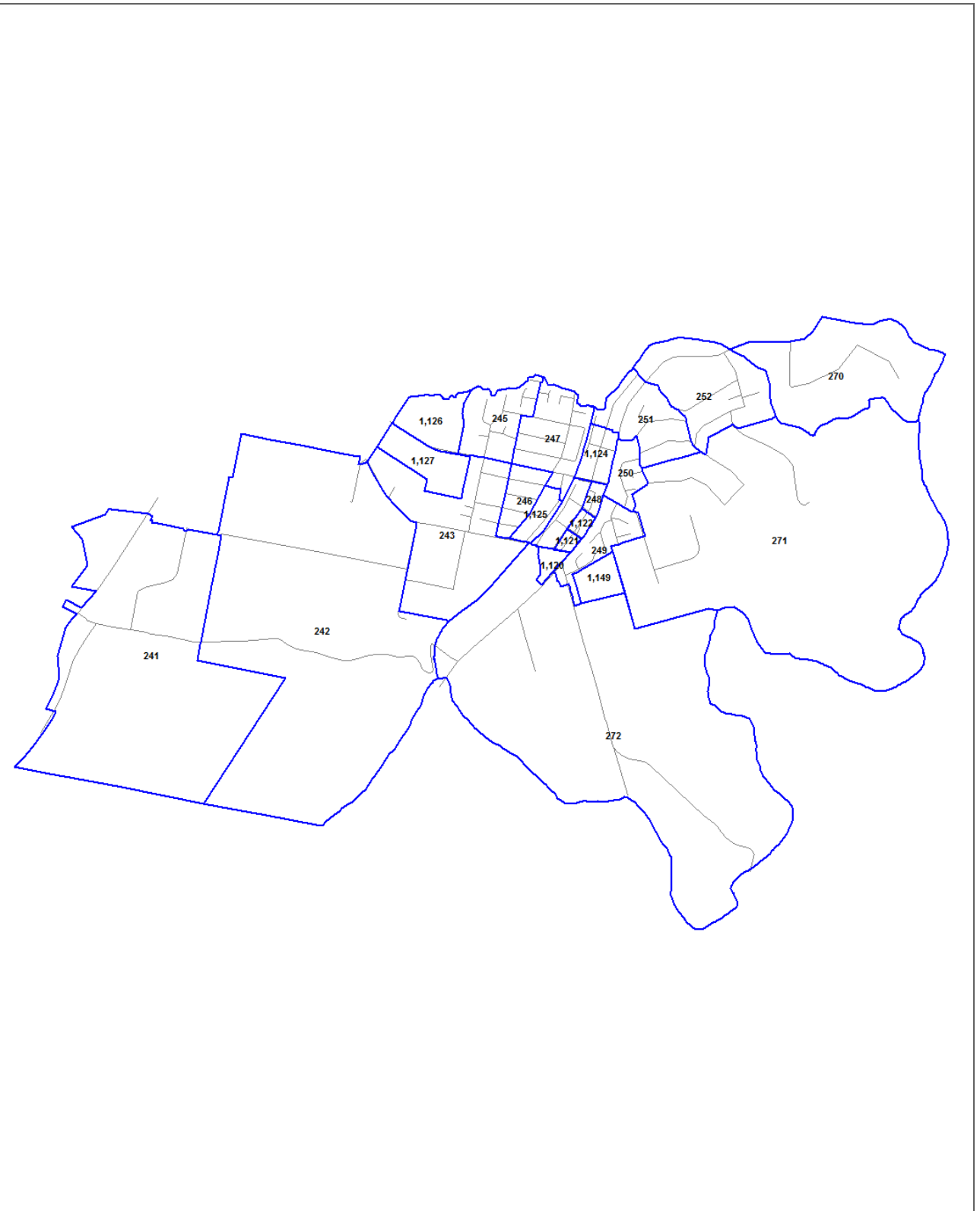
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2016 MACROC Model Zone System - Travel Zone Boundaries
Wollondilly – Thirlmere



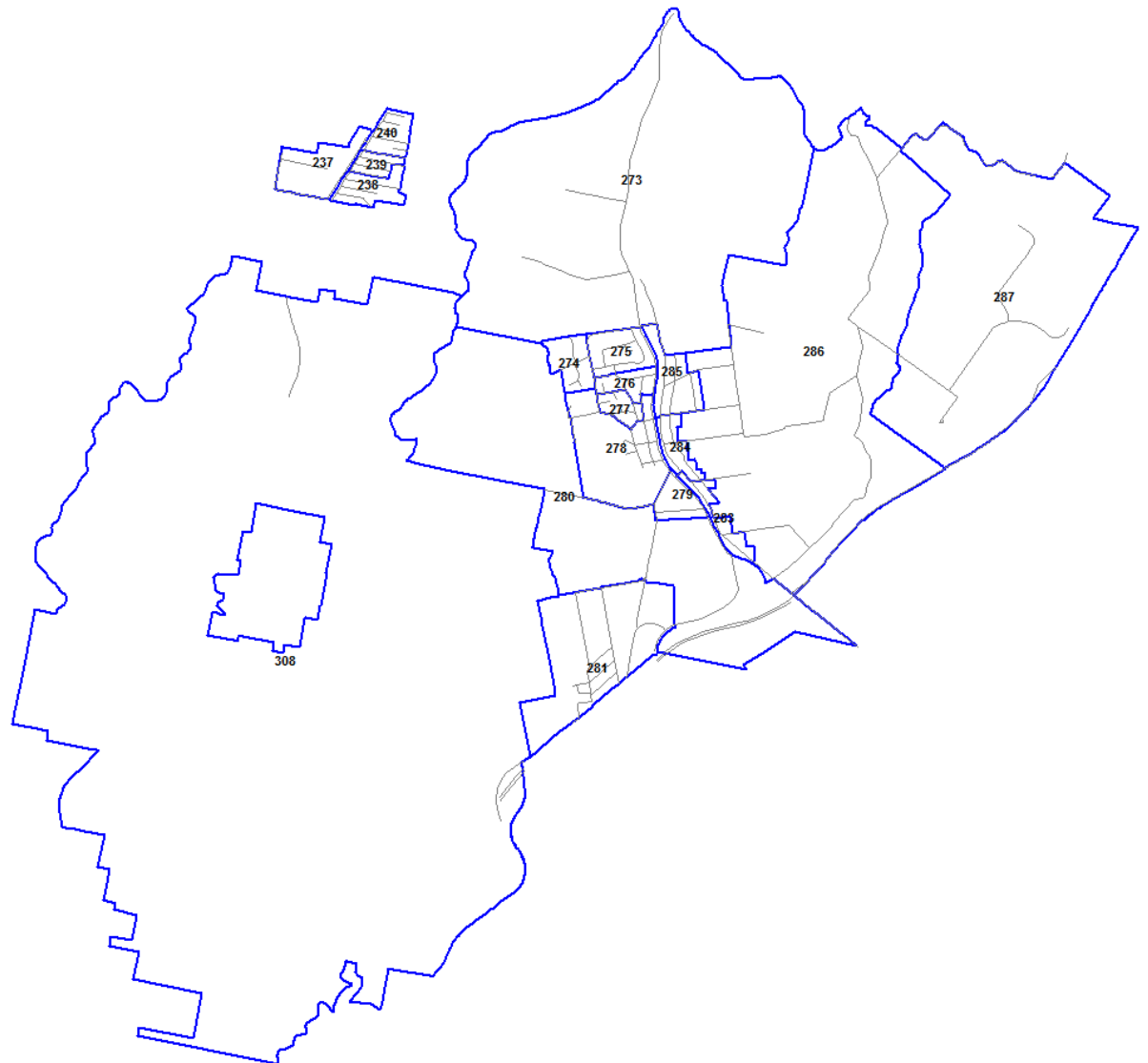
6



2016 MACROC Model Zone System - Travel Zone Boundaries
 Wollondilly – Tahmoor



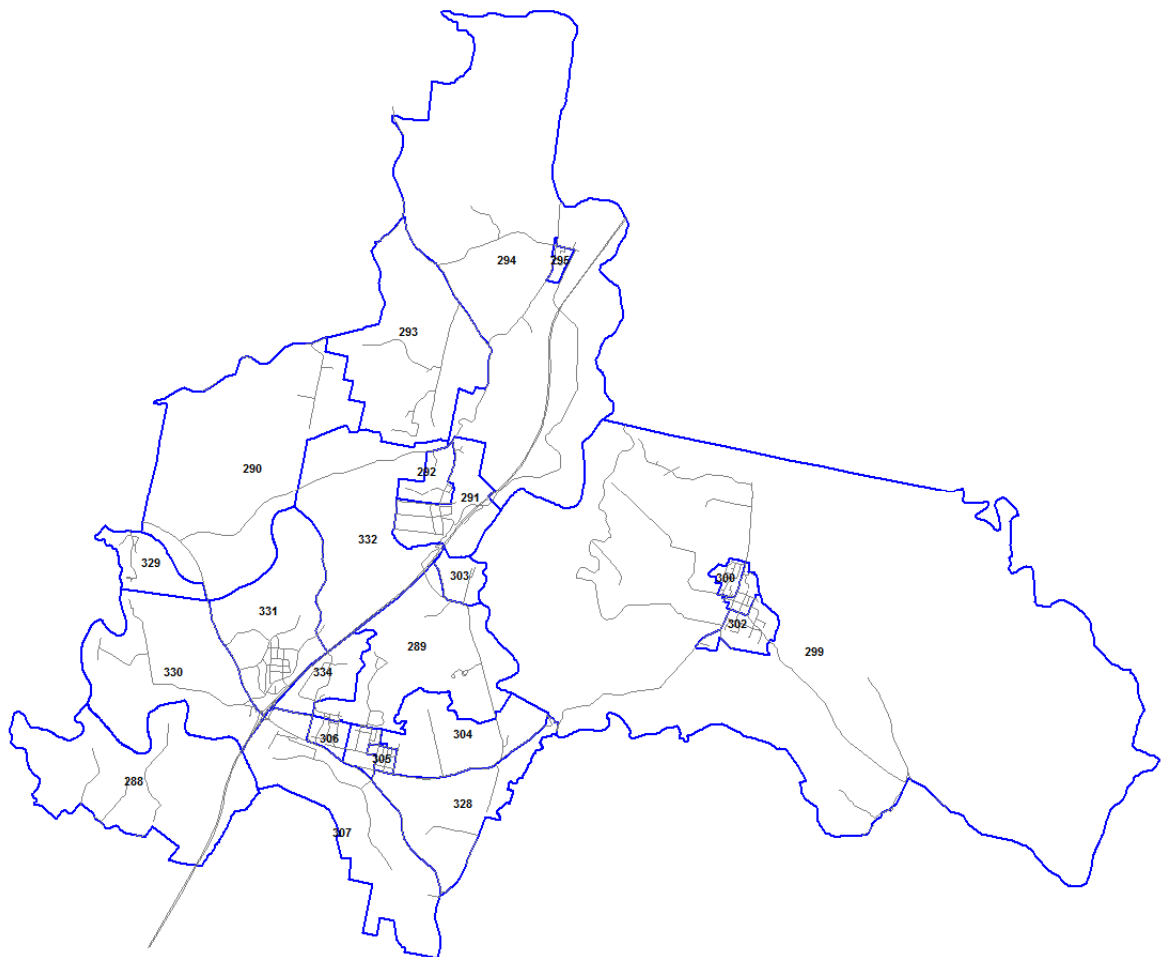
7



2016 MACROC Model Zone System - Travel Zone Boundaries
Wollondilly – Buxton and Bargo



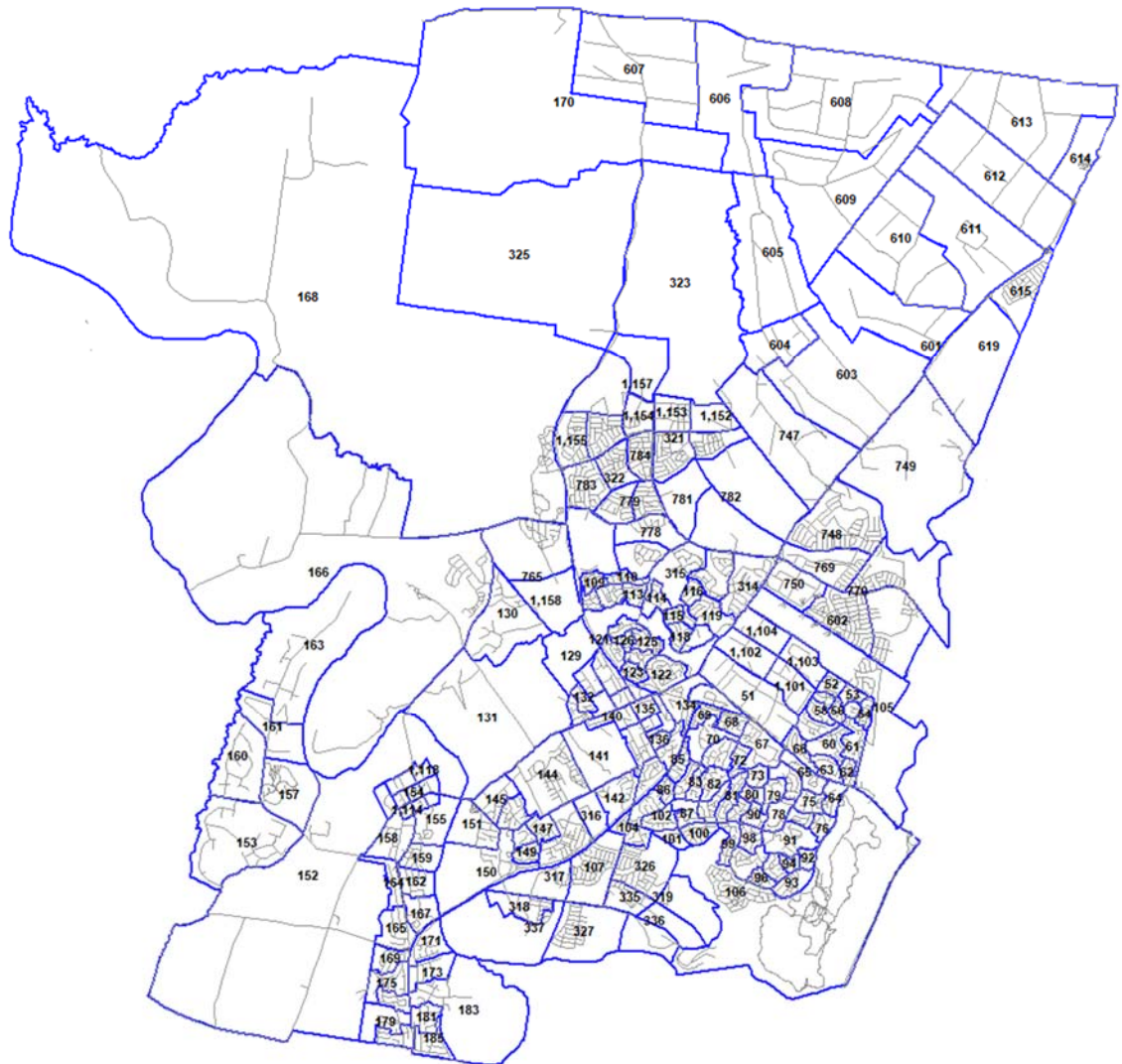
8



2016 MACROC Model Zone System - Travel Zone Boundaries
 Wollondilly – Wilton, Appin and Douglas Park



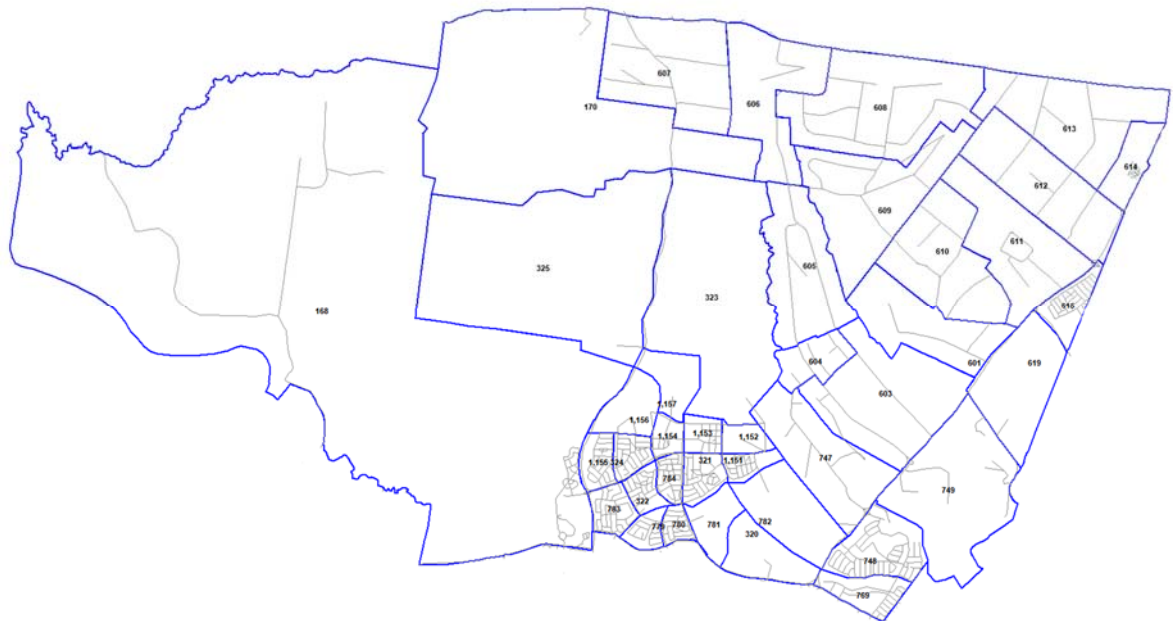
9



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden



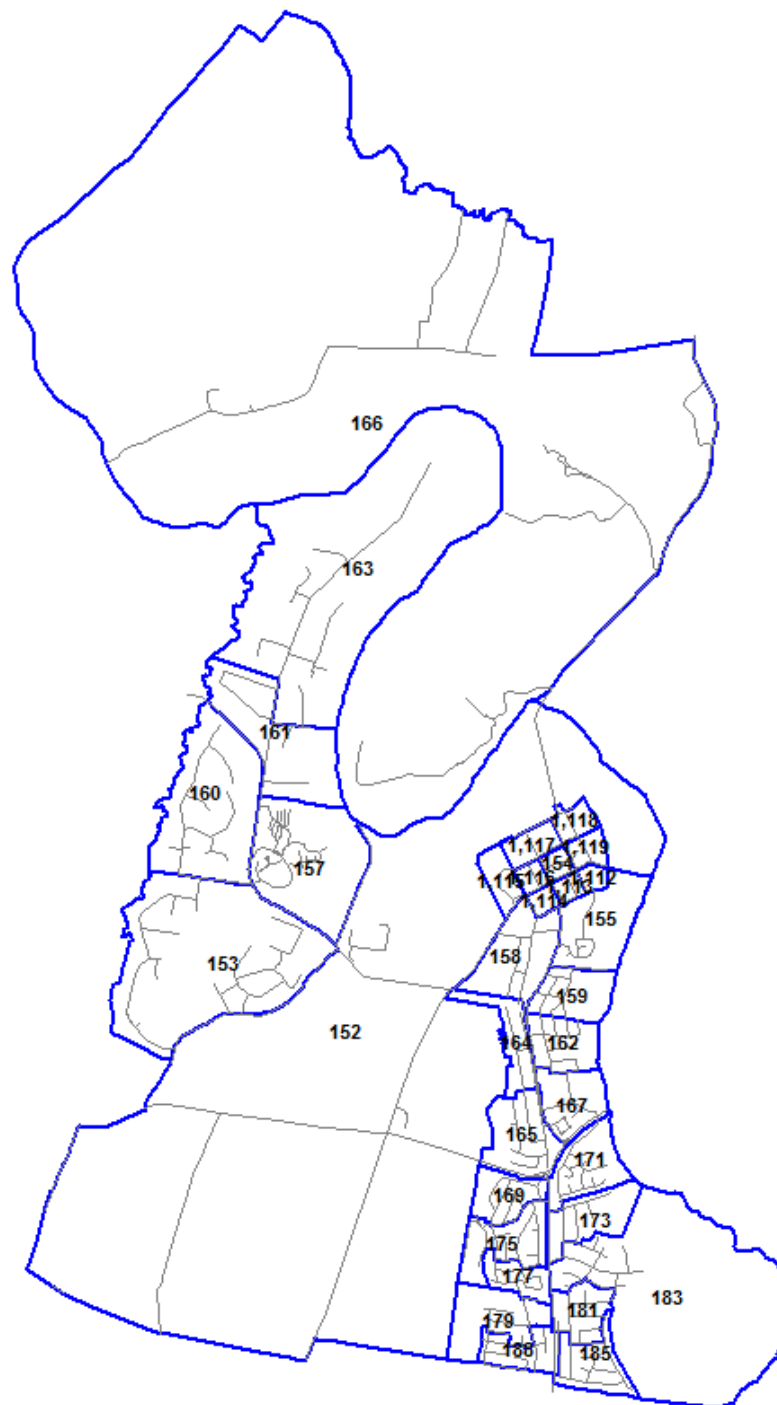
10



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden - North



11



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden – Grasmere and Camden South



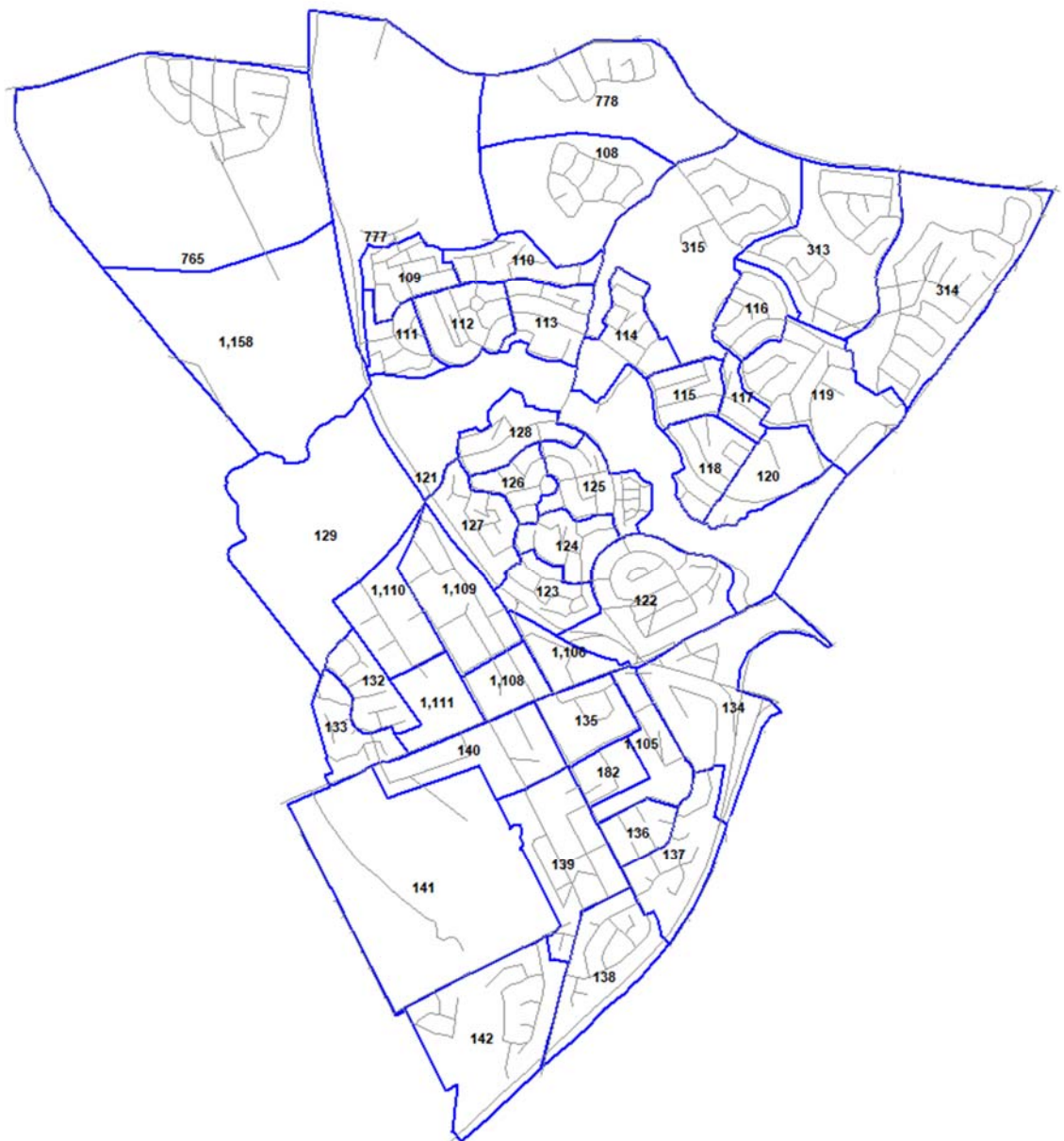
12



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden – Spring Farm



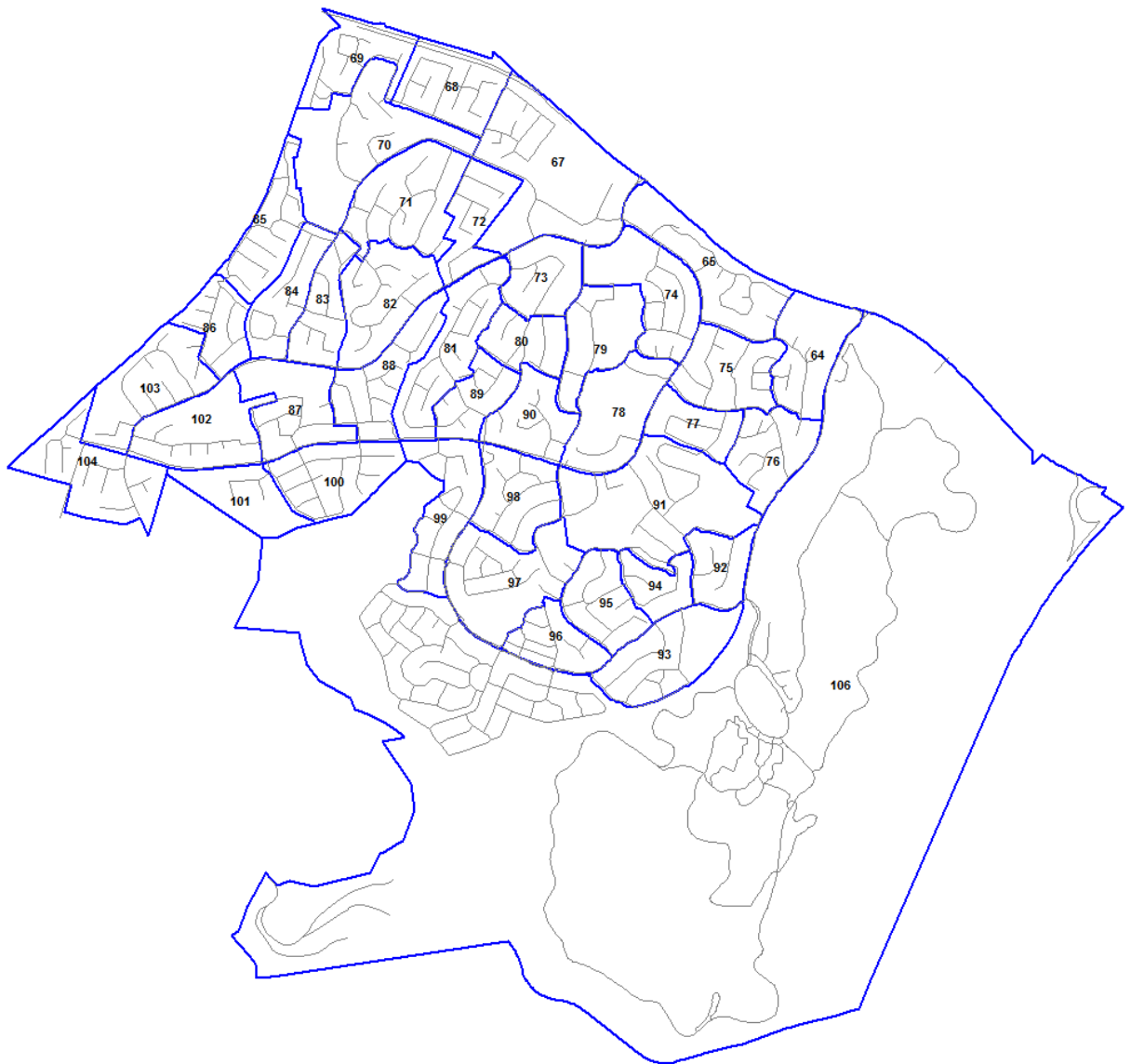
13



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden – Harrington Park and Narellan



14



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden – Narellan Vale



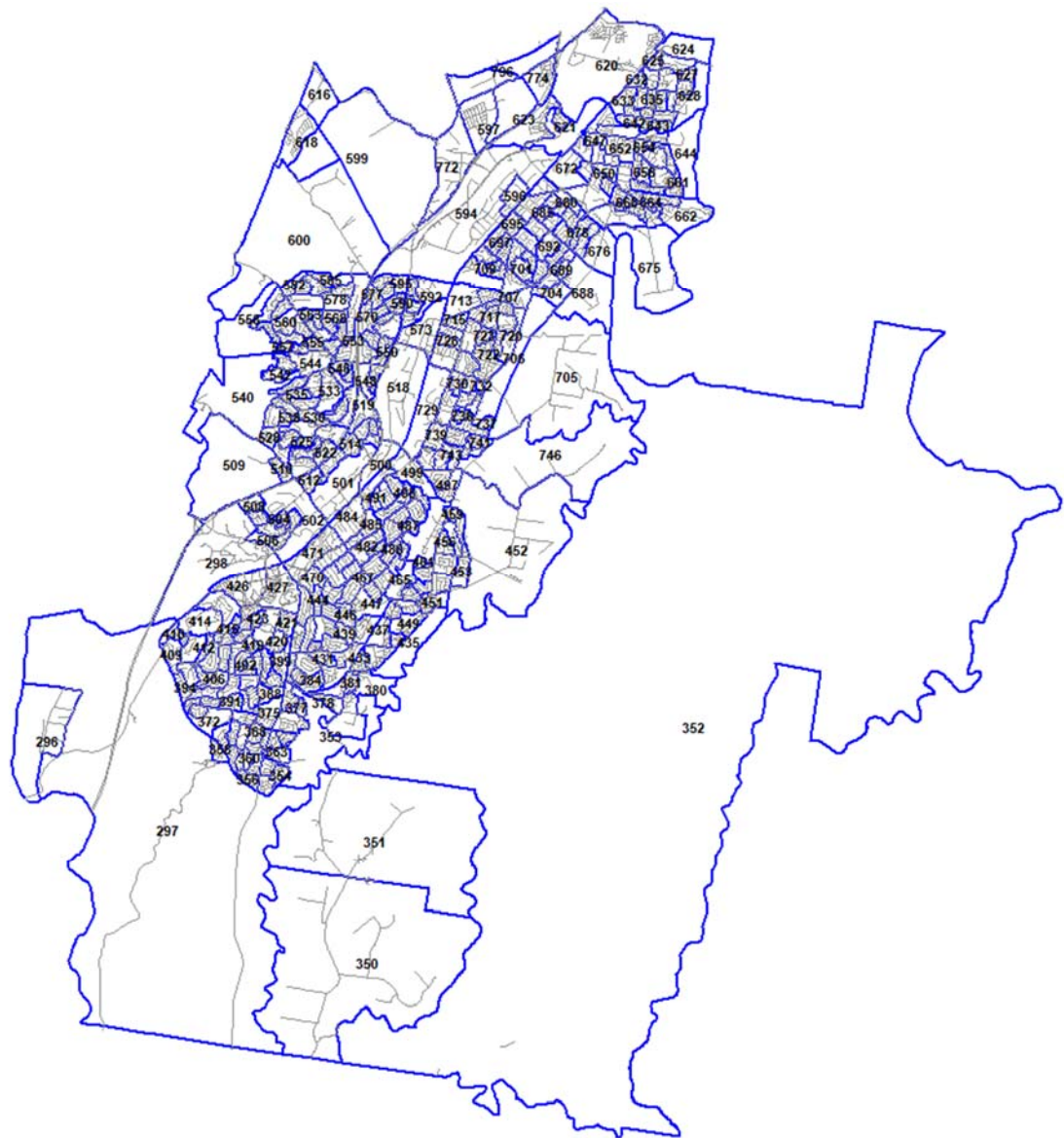
15



2016 MACROC Model Zone System - Travel Zone Boundaries
Camden – Smeaton Grange



16



2016 MACROC Model Zone System - Travel Zone Boundaries
 Campbelltown



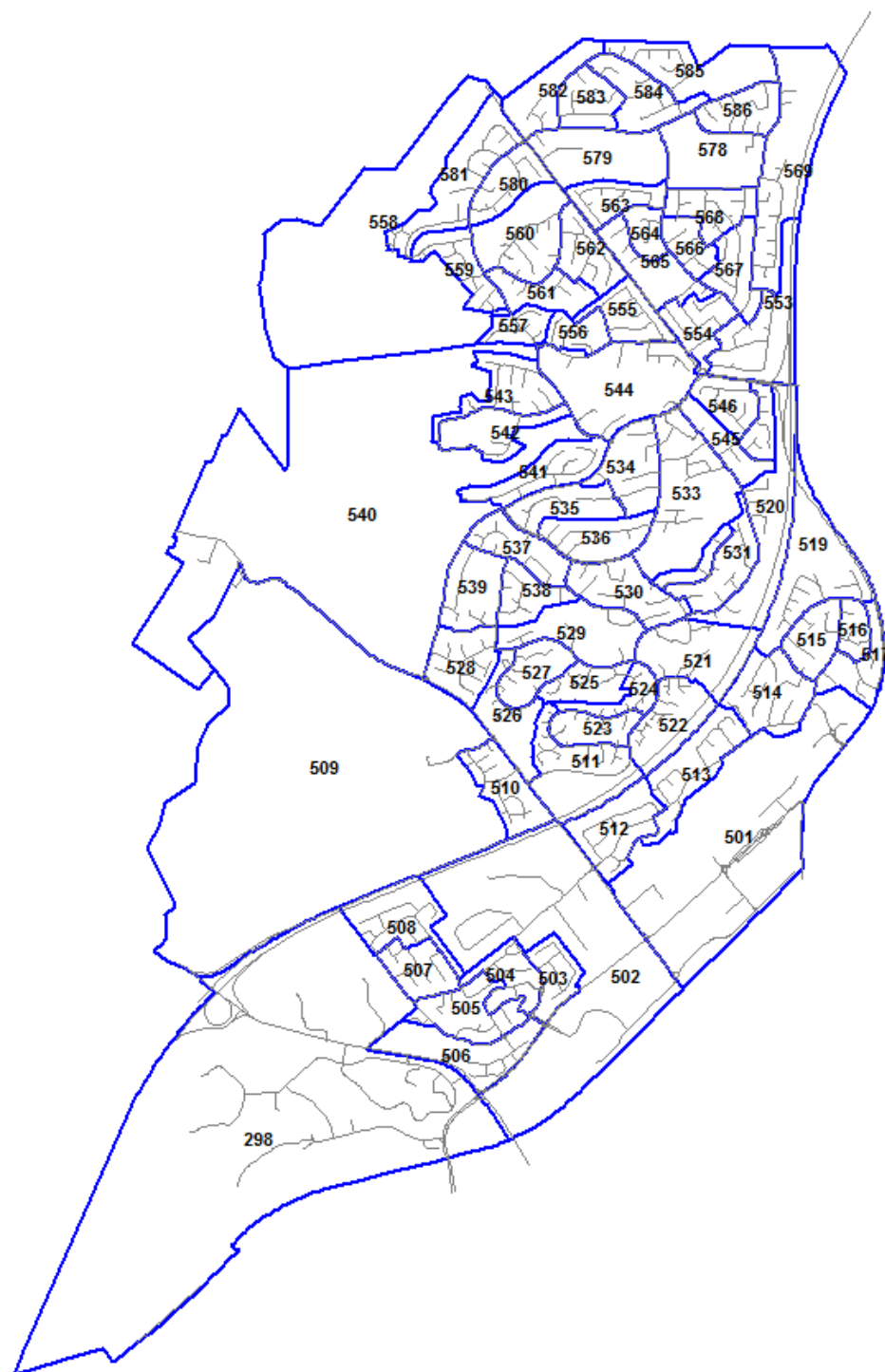
17



2016 MACROC Model Zone System - Travel Zone Boundaries
Campbelltown – Glenfield, Macquarie field and Ingleburn



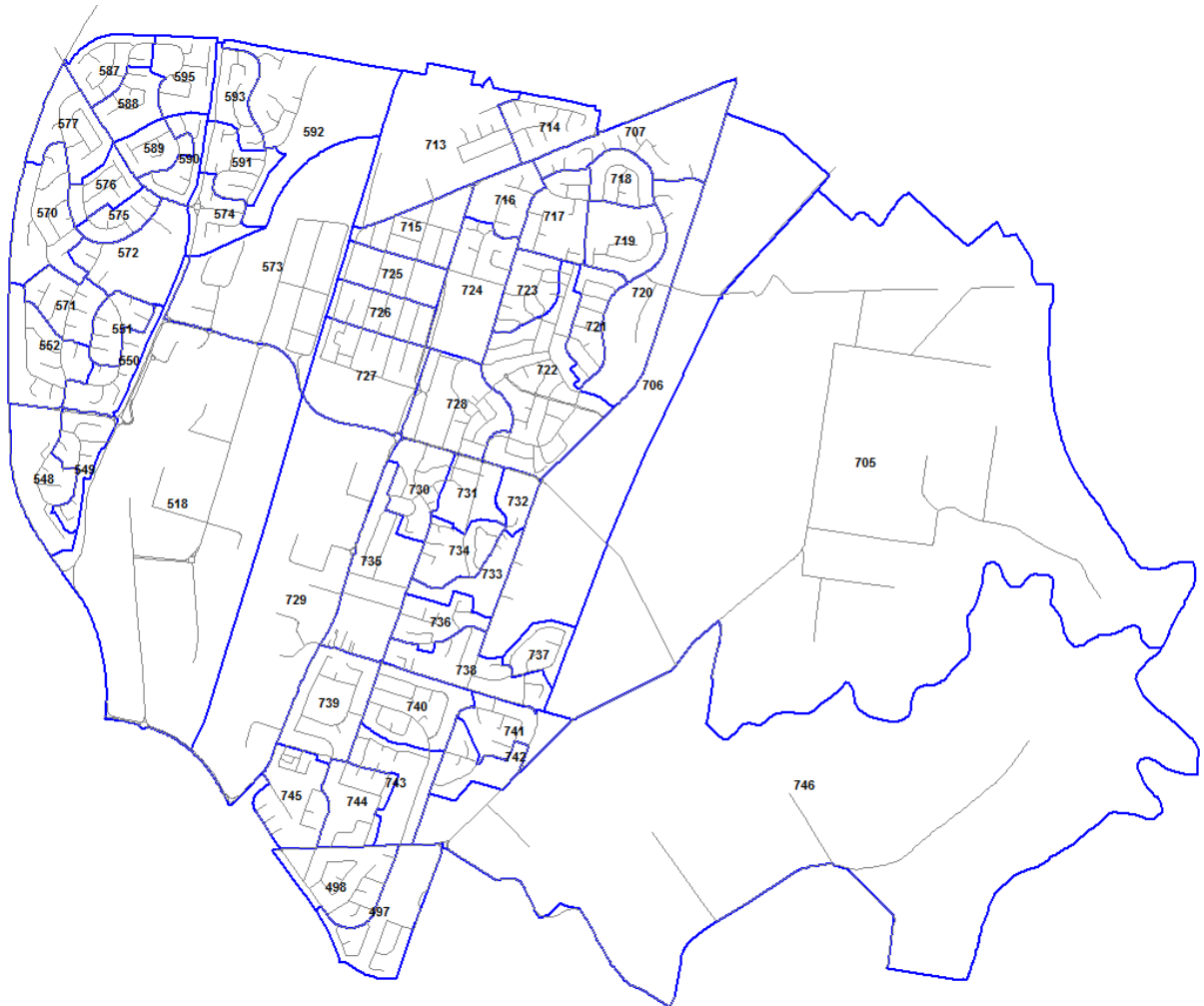
18



2016 MACROC Model Zone System - Travel Zone Boundaries
Campbelltown – Raby, Claymore and Woodbine



19



2016 MACROC Model Zone System - Travel Zone Boundaries
Campbelltown – St Andrews and Minto



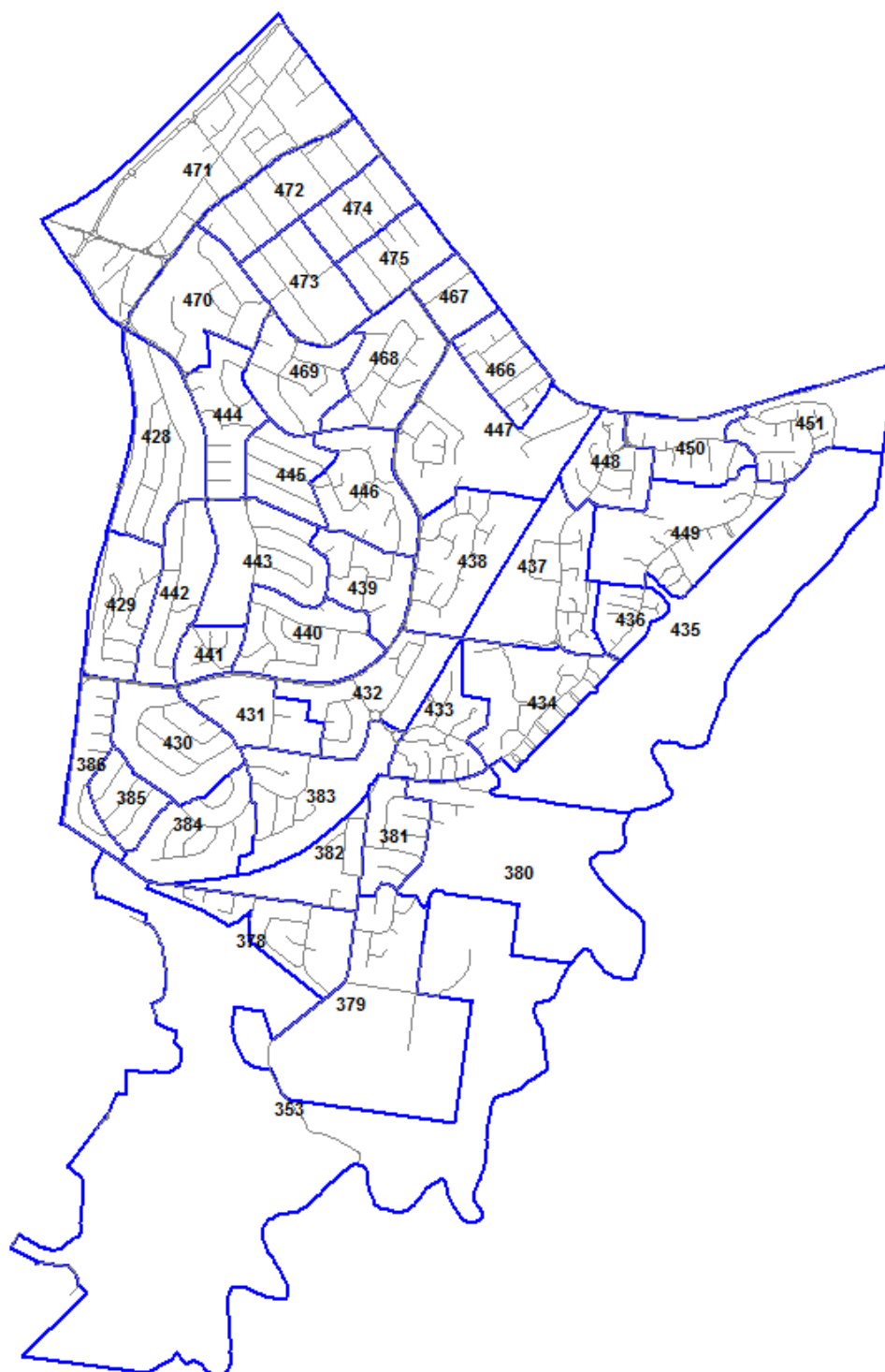
20



2016 MACROC Model Zone System - Travel Zone Boundaries
Campbelltown – Leumeah and Ruse



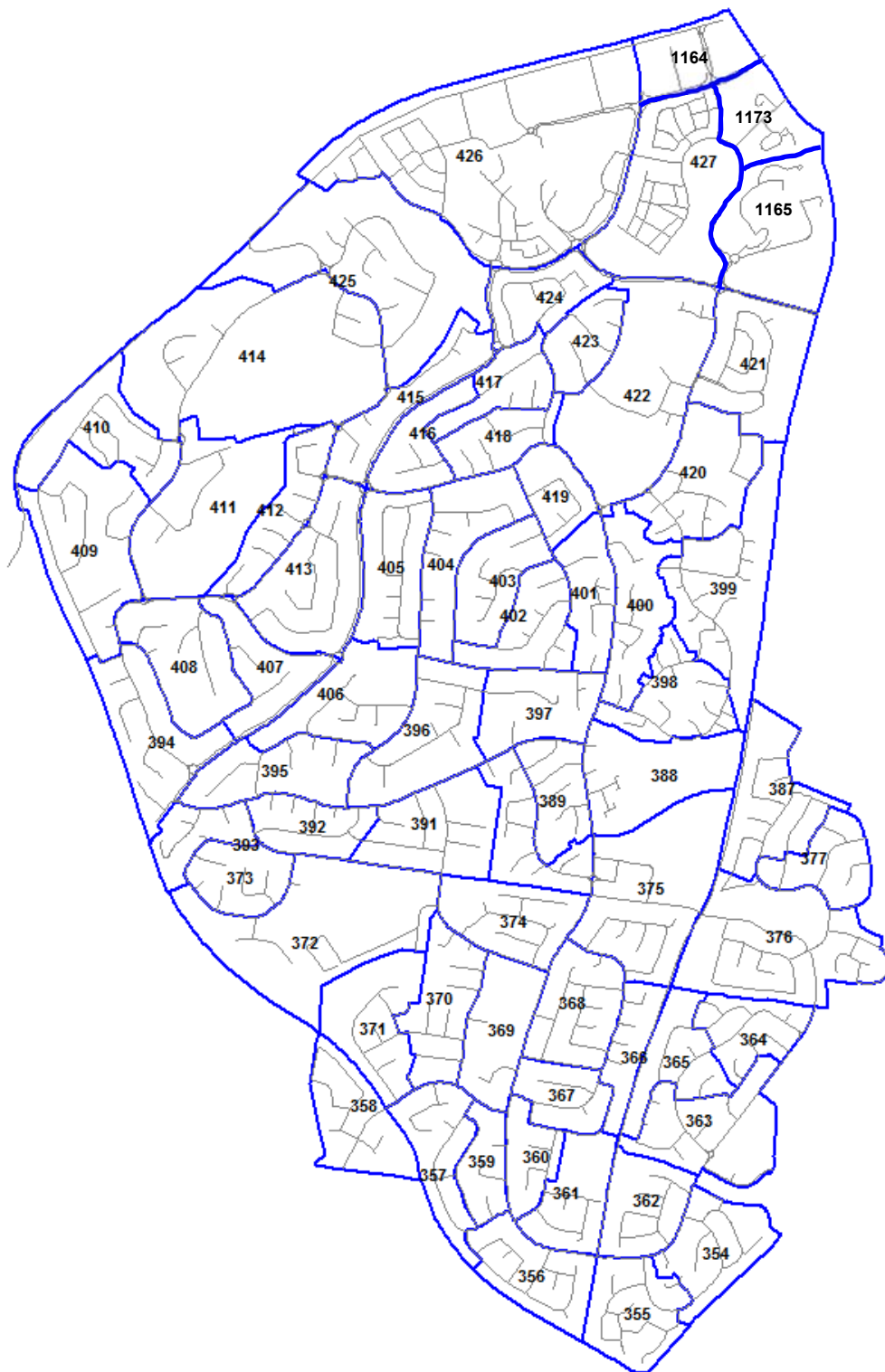
21



2016 MACROC Model Zone System - Travel Zone Boundaries
Campbelltown – Bradbury, Airds and St Helen's Park



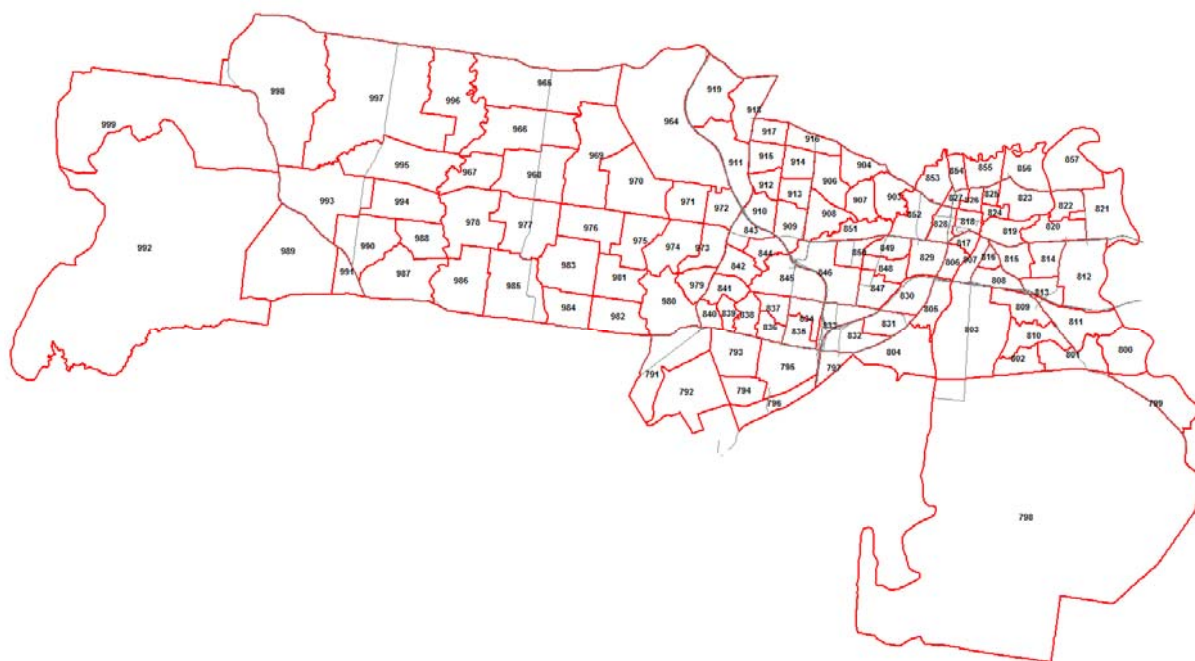
22



2016 MACROC Model Zone System - Travel Zone Boundaries
Campbelltown – Glen Alpine and Rosemeadow



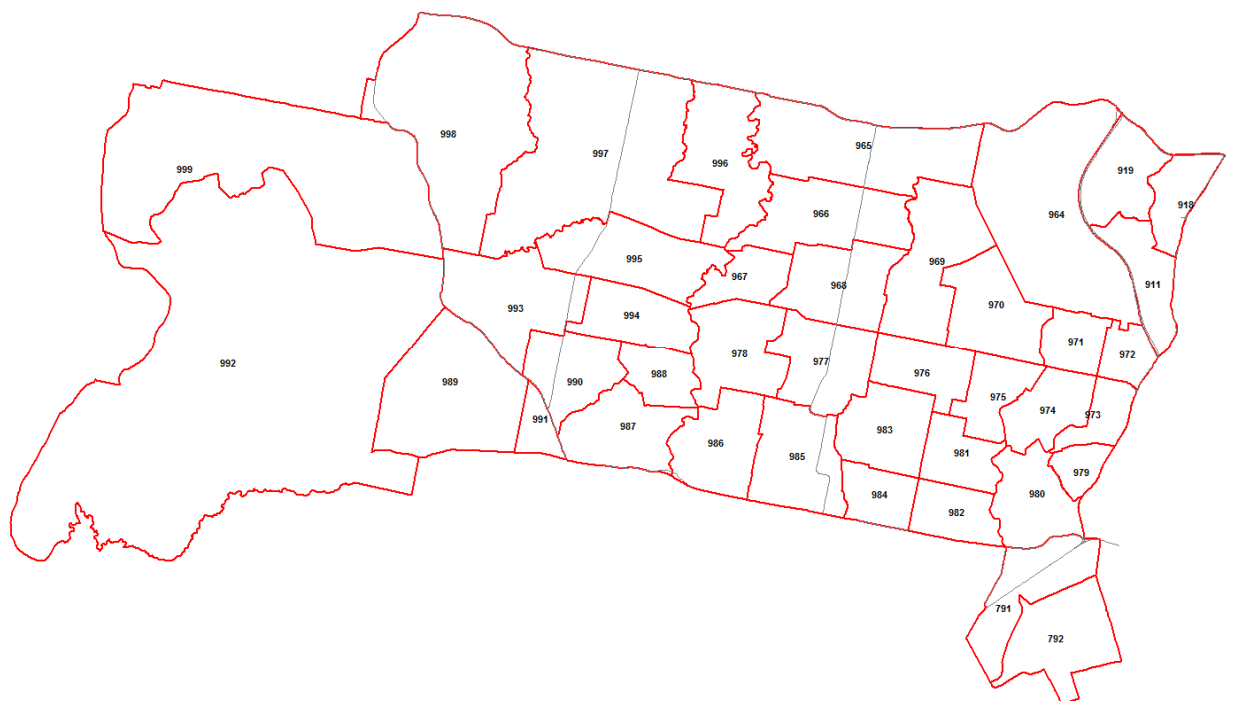
23



2016 MACROC Model Zone System - Travel Zone Boundaries
 Liverpool



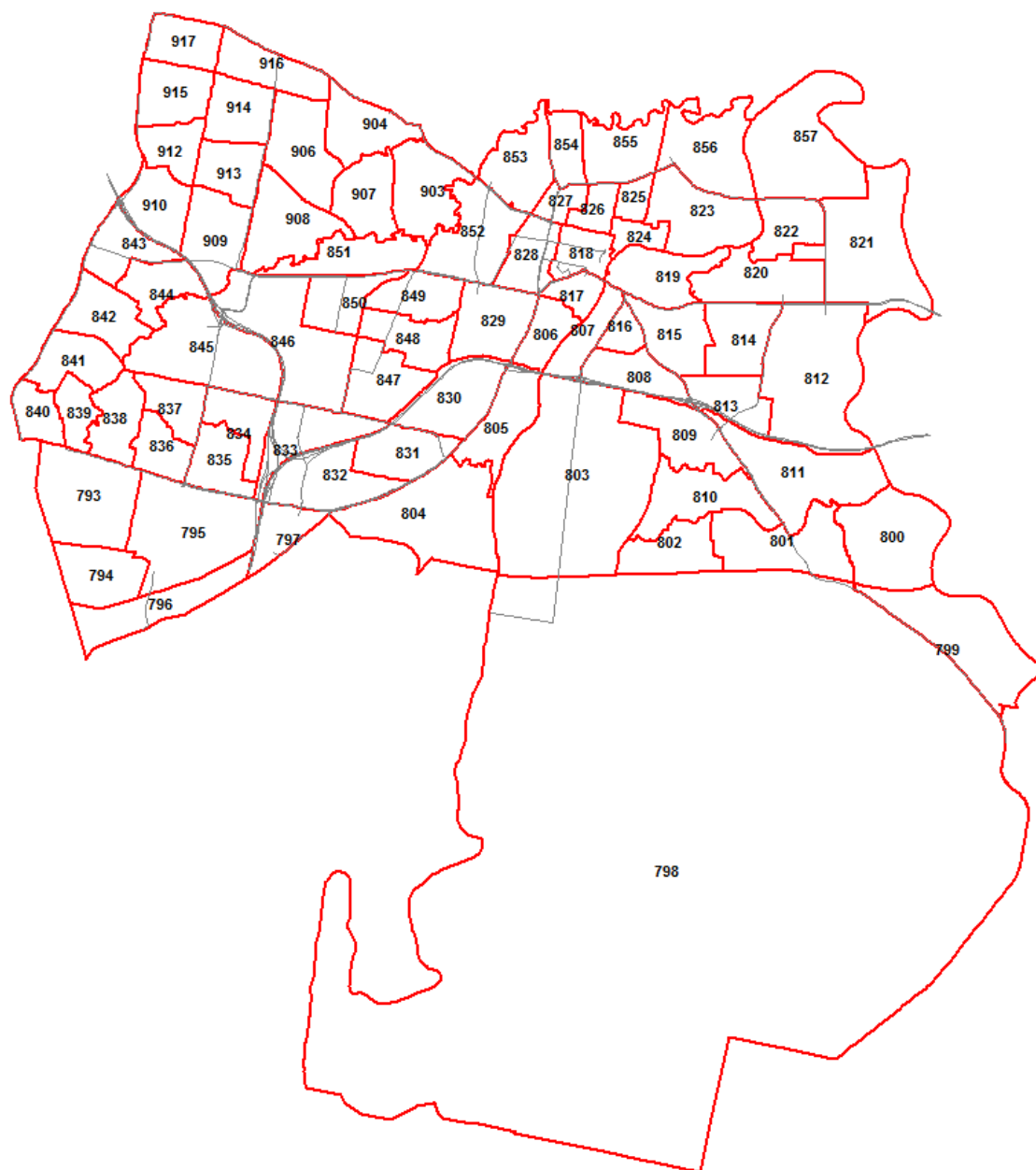
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2016 MACROC Model Zone System - Travel Zone Boundaries
 Liverpool - West



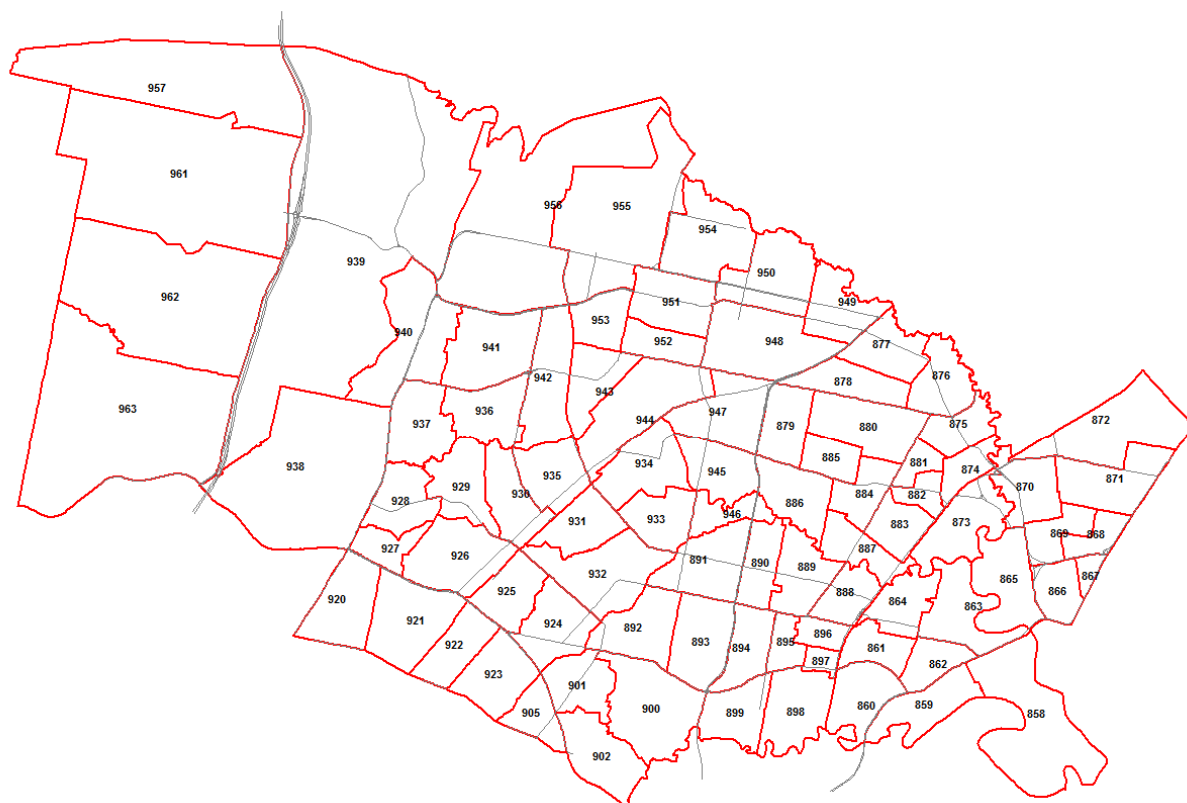
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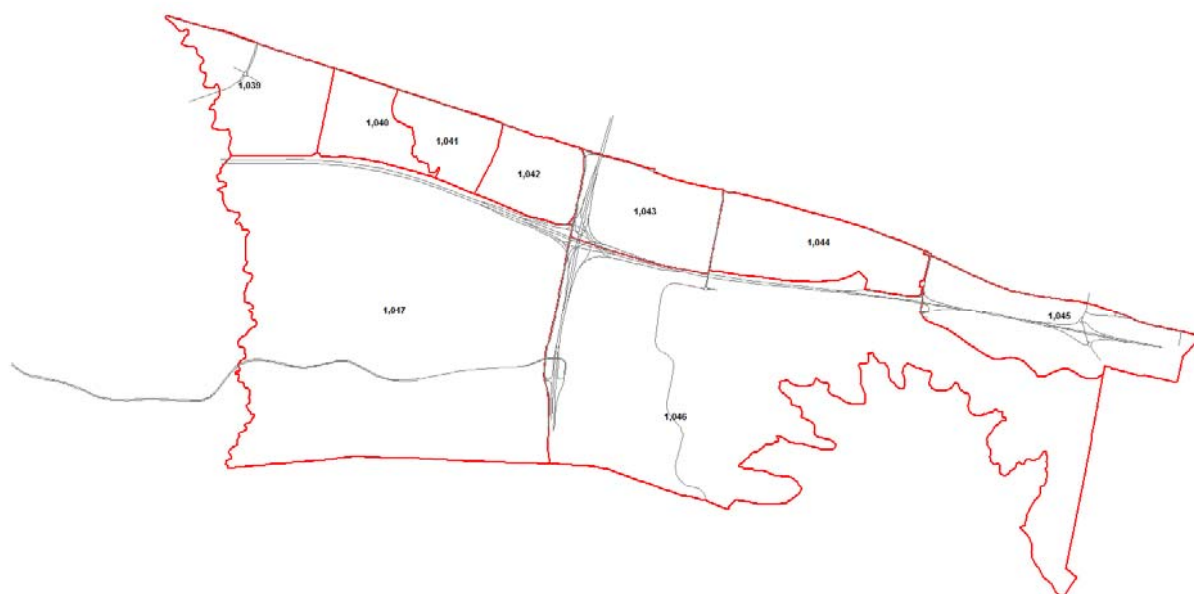


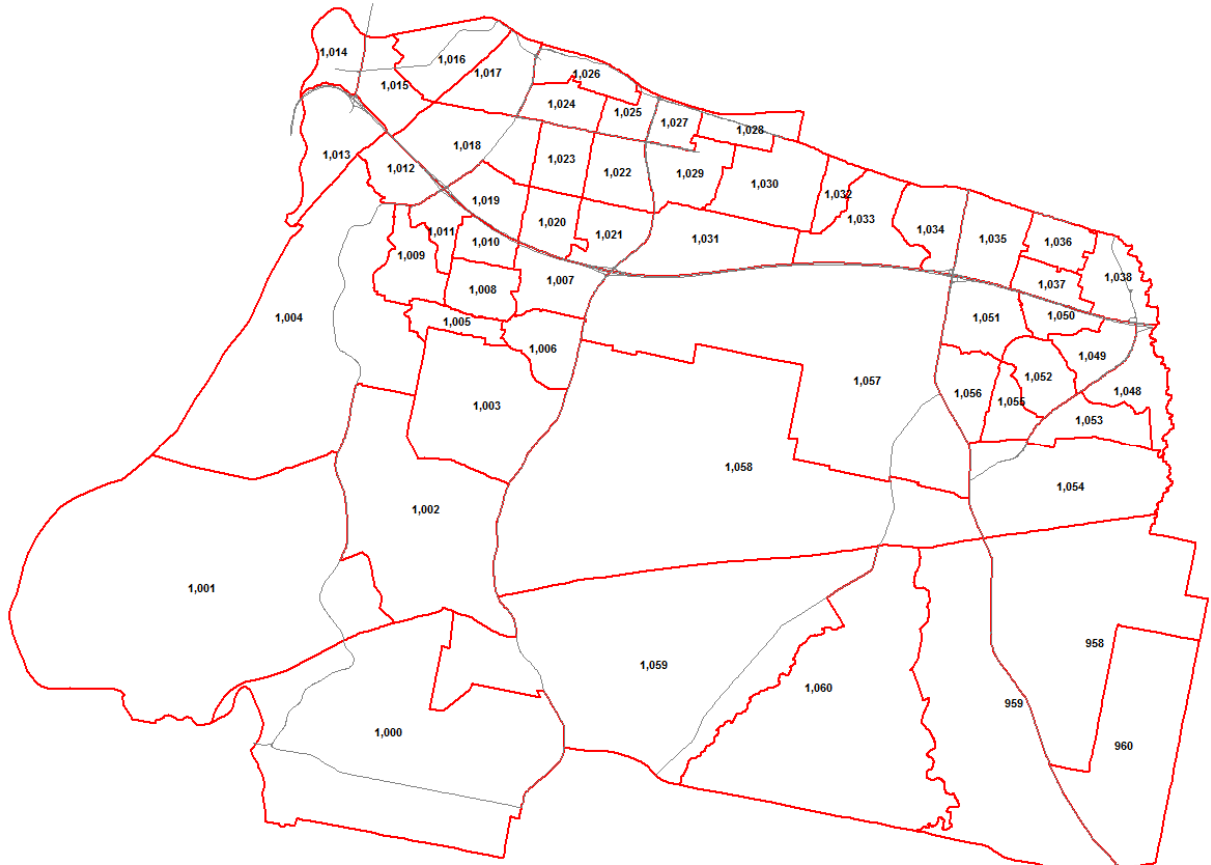
2016 MACROC Model Zone System - Travel Zone Boundaries
Liverpool - East



26







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