

# **Mudgee Township**

## **Traffic Management Study 2014**

### Final Report

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### **Mid-Western Regional Council**

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## ***Executive Summary***

### ***S.1 Background***

Mudgee is located within the Mid-Western Regional Council Local Government Area (LGA) and the Central West of NSW. Strong growth has occurred in recent years in the LGA but more particularly in the township of Mudgee. In 2011, the LGA has a total population of 23,000, an increase from 22,220 recorded in 2001, and is predicted to reach 26,100 by 2031 (DOPI, 2013). This growth is being assisted by a number of major developments within the LGA. Council requires a better understanding of the transport infrastructure requirements in Mudgee during these times of growth to enable appropriate planning for the future. Similarly, in 2011 the population of Mudgee Township was 9,830 an increase of about 20 percent since 2006 when a population of about 8,250 prevailed. A projected increase to 11,470 persons is anticipated by 2031.

The objective of the study is the preparation of an effective Traffic Management Plan for the township of Mudgee (**Figure 1**). This objective was achieved through:

- Establishing current and predicted traffic flows incorporating existing problem areas.
- Determination of current traffic and transport infrastructure and treatment measures required resulting from present day and predicted traffic volumes.
- Identify road infrastructure upgrades that promote efficient traffic movement around Mudgee bearing mind in new developments and end destinations,
- Prioritise upgrades so that implementation is timely with growth and levels of service remain satisfactory.
- Inform the Section 94 developer contributions plan
- Determination of both current and future needs in regard rail crossing points.

All figures referred to in the report have been placed at the end of this document.

### ***S.2 Consultation***

A notice was placed in local newspapers inviting residents to make submissions. Furthermore, two meetings were held during the course of the study with key stakeholders including Police Service, Roads & Maritime Service, Mudgee Chamber of Commerce, Mudgee Taxis, Independent Bus Operators, School Bus Operator, Community Transport, Ogden's Coaches and Mid-Western Regional Council.

The draft document was placed on public exhibition between 27<sup>th</sup> October and 24<sup>th</sup> November 2014 with a public meeting held on 29<sup>th</sup> October 2014. The draft document was amended to reflect community expectations.

## ***S.3 Existing Traffic Conditions***

### ***S.3.1 Existing Street System***

The Castlereagh Highway (B55) passes through the Mid-Western Regional Council. It provides the major link between Lithgow and Gilgandra via Gulgong. Through Mudgee it follows the route along Sydney Road, Horatio Street, Douro Street and Market Street. Ulan Road approaches Mudgee from the north via Church Street.

The road network within and around Mudgee is shown on **Figure 2**. The locations of traffic controls at all intersections within the Mudgee Township are noted in **Figure 3**.

Ogden's Coaches provides the only town bus services in Mudgee which operate along four primary routes in the Mudgee urban area shown in **Figure 4**. Other companies provide school buses services.

### ***S.3.2 Safety in Mudgee***

Council provided crash statistics for the five year period from 1 January 2008 to 31 December 2012. A total of 183 recorded crashes occurred in the Mudgee Township. These crashes resulted in 101 injuries and one (1) fatality. Six (6) vehicular crashes involving pedestrians or cyclists occurred within Mudgee. The location, frequency and consequence of crashes are noted in **Figures 5a and 5b**.

By far the highest number of crashes (6) occurred at the intersection of Horatio Street with Church Street resulting in four (4) injured persons. The intersection of Horatio Street with Douro Street experienced the second highest number of intersection crashes (5) resulting in five (5) injured persons.

Off road collisions with fixed object or parked cars accounted for about 32 percent of all mid-block crashes and about 34 percent of all injuries.

About 40 percent of all crashes occurred along the roads forming part of the Castlereagh Highway through Mudgee resulting in 47 percent of all injuries/fatality.

### ***S.3.3 Existing Traffic Patterns***

Daily traffic counts at 23 locations within Mudgee together with percentage heavy vehicles and 85<sup>th</sup> speeds (speed exceeded by 15 percent of vehicles) are noted in **Figure 6**. The afternoon peak hourly volumes at critical intersections are noted in **Figure 7**.

The highest volume of traffic within Mudgee is along Church Street between Horatio Street and Denison Street with over 10,000 vpd on weekdays, reducing to about 8,900 vpd south of the railway crossing

The highest daily number of trucks recorded at the surveyed sites travelled along Perry Street (~400 trucks) near the CBD. The Castlereagh Highway continues to carry the highest number of trucks in Mudgee with over 750 and 400 trucks previously recorded along Horatio Street and Market Street respectively.

The 85<sup>th</sup> recorded speed exceeded the speed limit at 11 locations. These locations are further away from the CBD in residential areas; closer to the CBD speeds are generally below the speed limit.

Church Street generally operates at a good level of service "B" or better. All other streets including the Castlereagh Highway operate at a very good Level of Service "A".

All intersections operate at a level of Service "B" or better except the intersection of Church Street with Denison Street, which operates at a level of service "C". Definition of levels of service for road carriageway and intersections are included in **Appendices C** and **E** respectively.

## ***S.4 Future Traffic Conditions in Mudgee***

### ***S.4.1 Future Residential Growth in Mudgee***

The residential growth in Mudgee over the next ten to twenty years will take place to the west of the Township in the following areas (yields are approximate):

- 220 lots in North Mudgee
- Some 1,545 lots in the Caerleon, Bellevue Hill and Salesyard area
- 530 lots in South-West Mudgee
- 240 lots in South Mudgee.

Thus some 2,535 lots are anticipated to be released and developed by 2032. It should be noted that about 80 percent of development is anticipated by 2022. Some 20 hectares for industrial uses are also planned along Hill End Road to accommodate developments by 2022.

### ***S.4.2 Traffic Impact***

About 18,600 vehicle trips per day may be generated over the next 15 to 20 years by the potential residential areas in Mudgee; correspondingly, about 2,000 trips per hour are anticipated during the afternoon peak hour. Some 200 industrial trips would also be generated during the peak hours. The additional trips, generated by all the future release areas at all critical intersections within Mudgee are presented in **Figure 8**.

Streets where traffic volumes are expected to considerably increase as a result of the potential new residential releases include Hill End Road, Fairydale Lane, Bell Street, Bellevue Road, Henry Bayly Drive, Madeira Road, Lions Drive and Robertson Street.

The major impact of the future residential releases would occur along Church Street between Horatio Street and Denison Street where a level of service "C" is expected. All other streets will operate at level of service "B" or better.

The intersection of Sydney Road with Burrundulla Road and Lions Drive would operate in the future at a very poor level of service "F". A roundabout with pedestrian refuges should be provided.



The intersections of Douro Street with Gladstone Street and with Denison Street would operate in the future at a near to a poor level of service "D" or worse. Roundabouts are recommended at these two locations. A similar situation is anticipated at the intersection of Church Street with Denison Street. Following public exhibition of these recommendations however, it was found that roundabouts at the intersections of Douro and Gladstone Streets and Church and Denison Streets were unacceptable to the community. Instead a roundabout at the intersection of Industrial Avenue and the Sydney Road was preferred.

The roundabouts at the intersections of Church Street with Horatio Street and with Mortimer Street would operate a good level of service "B". All other roundabouts would continue to operate at very good levels of service.

## *S.5 Specific Traffic Matters*

### *S.5.1 School Buses Related Issues*

In order to address issues raised by operators of bus companies the following matters would be appropriate:

- The provision of a crossing supervisor would control the flow of children across Horatio Street thus alleviating the backlog in buses accessing the High School
- The relocation of the Give Way signs in Gladstone Street to give priority to Perry Street traffic would ensure a smoother flow of traffic along Perry Street as well reducing current delays experienced by school buses.
- Issues near Catholic School in Lewis Street

### *S.5.2 Safety Related Issues*

- **Safety in Mudgee** - The high proportion of crashes involving single vehicles out of control is usually an indication of excessive speed. Better monitoring by the police is required.
- **Church Street north of Meares Street** - Consideration should be given for the provision of slowing devices adjacent to the medical centre.
- **Intersection of Horatio Street with Church Street** - Serious consideration should be given to increase the deflection of vehicles entering the roundabout from all approaches to ensure they either slow down or even stop before entering the roundabout.
- **Intersection of Horatio Street with Douro Street** - The provision of a roundabout would considerably improve safety at this intersection.
- **Intersection of Robertson Street with Lions Drive** - The provision of a pedestrian refuge in Lions Drive, at Robertson Street and in Robertson Street north of Lions Drive would improve the safety of pedestrians. Furthermore, signage advising motorists to slow down to allow safe pedestrian crossing should also be considered.
- **Denison Street, between Lewis Street and Church Street** - Consideration could be given for the provision of slowing devices in this section of Denison

Street. Furthermore, the provision of pedestrian refuges at the intersection of Denison Street with Church would facilitate the crossing of Denison Street.

- **Intersection of Church Street and Spring Road** – a submission was received during the public exhibition phase of this document requesting for traffic calming or safety measures at this location. It is recommended that this issue be further investigated in consultation with the resident in the area.

### *S.5.3 Cycleway*

The existing cycleway is situated at the rear of dwellings fronting Winter Street. It currently terminates at the end of Horatio Street at Douro Street. Following a site inspection, a suitable route to the CBD via the High School has been identified generally along Horatio Street and Perry Street.

During public exhibition of this document a suggestions from the community that a cycleway continuing out the Ulan Road to the TAFE campus be considered. This suggestion is recommended.

### *S.5.4 Intersection Related Issues*

- **Intersection of Church Street with Denison Street** - This intersection has the worse level of service in Mudgee and requires alternative control such as a roundabout in the near future to considerably improve the situation. Following the public exhibition phase this recommendation was removed due to community concern. It is recommended that this intersection be monitored for future traffic studies.
- **Intersection of Inglis Street with Douro Street** - Observation of the intersection did not highlight any specific problem; however as previously recommended (Gennaoui, 2008), the provision of a seagull arrangement would facilitate traffic movements at this location as well as improve safety.

**Intersection of Gladstone Street with Denison Street** - The provision of a seagull arrangement would facilitate traffic movements at this location as well as improve safety. Consideration could also be given for the provision of slowing devices along Gladstone Street as it would be used in the future as an alternative access road to the CBD.

- **Castlereagh Highway with Bell St and Putta Bucca Rd Intersections** - The proposed new residential and industrial releases in west Mudgee (including the Caerleon subdivision) would increase traffic volumes along the Castlereagh Highway as well as along Putta Bucca Road and Bell Street. The combined intersections of Castlereagh Highway with Bell Street and with Putta Bucca Road experienced four crashes (2 injuries). A realignment of Bell Street with Putta Bucca Road at the Castlereagh Highway together with the provision of a roundabout at this location would considerably improve safety as well as facilitate access to both roads.

### ***S.5.5 Roads Related Matters***

- **Ring Road in Mudgee CBD** – Designation of a route along Horatio Street, Lewis Street, Short Street and Douro Street to by-pass the CBD should be given serious consideration. The provision of a roundabout may be required at the intersection of Horatio Street with Lewis Street.
- **Road Linkages between CBD and West Mudgee** - Access to the CBD from the Caerleon subdivision will be mostly along the Castlereagh Highway and Market Street. Access to the highway will be via Hill End Road and Fairydale Lane/Bell Street. Traffic accessing the CBD would also use Gladstone Street. Traffic accessing schools and the industrial areas to the east of Mudgee may also use Bellevue Road and other streets in South Mudgee. The analysis of future traffic conditions concluded that all roads accessing the CBD from the west would operate a good level of service “B” or better. Furthermore, all intersections along the routes to and from the CBD would operate satisfactory subject to the provision of new roundabouts.

### ***S.5.6 Traffic Related Matters***

- **Traffic Calming in West Mudgee** – Consideration should be given for the provision of traffic calming devices along Bellevue Street and Fairydale Lane concurrently.
- **Problems along Church Street (outside Aldi & Mitre10)** – None identified
- **Possible Closure of Perry Street between Horatio and Denison Streets** - In order to maintain accessibility for buses and patrons of the school and park, and to achieve a safer environment along this section of Perry Street, it is suggested that it be converted into a “shared zone”.
- **Closure of Church Street Between Mortimer and Market Streets** – A full closure is not supported however the conversion of this section of Church Street to a “shared zone” has merit.
- **Closure of Perry Street North of Market Street** – This closure is not supported.
- **Opening of Lovejoy Street to Douro Street** - This measure is generally not supported. Consideration may however be given by Council to the prohibition of the right turning movement to and from Lovejoy Street at Douro Street.
- **South Mudgee Surgery Medical Centre in Oporto Road** - Over 15 percent of vehicles exceeds the speed limit. This situation has the potential for increased conflicts between pedestrians crossing Oporto Street and vehicles along this road. Consideration should therefore be given for the provision of slowing devices at this location.

### ***S.5.7 Railway Crossings***

There is a railway line connecting Lithgow to Gulgong and beyond via Mudgee; through Mudgee it is crossed at four locations. There are currently no passenger trains to and from Mudgee. The lack of railway crossings to access South Mudgee has been of major concern to residents particularly in the context of potential

increase in traffic accessing the CBD past the Mudgee High School conflicting with the high number of students.

Suggestions have been made for the re-opening of the Cox Street and Court Street railway crossings. The re-opening of Cox Street railway crossing would effectively divert traffic of the order of 1000-2000 vpd from the Douro Street crossing to Cox Street; it may also divert some traffic from Fairydale Lane (~1000-1500vpd). A similar situation would occur if Court Street was reopened to traffic.

Whilst traffic conditions including intersections along Douro Street in proximity of the High School would improve, residents along Cox Street and Court Street may not favour the increase of traffic along their street. The reopening of either Cox Street or Court Street at the railway crossing is not considered necessary from a traffic point of view. However, as this matter has been raised in the past, Council may wish to further explore as development takes place in west and south-west Mudgee, the need to provide an additional railway crossing by reopening Cox Street. Council received a number of submissions supporting the opening of Cox Street during the public exhibition period of the document. Council should pursue this avenue in order to provide another access to south Mudgee.

It is also recommended that in the event the railway line is used in the future, "flashing lights and bells" be provided at that crossing together with boom gates. Boom gates should also be considered at the Sydney Road and Douro Street railway crossings.

## ***S.6 Road Hierarchy & Truck Routes***

### ***S.6.1 Road Hierarchy***

Council has adopted the Road Hierarchy recommended in the previous study (Gennaoui, 2008) for streets within Mudgee, illustrated in **Figure 9**. Based on the traffic analysis, the location of major traffic generators and a review of the inter-connections of roads, a slightly amended Road Hierarchy is proposed as illustrated in **Figure 10**.

The standard of construction of each street within the road network depends on its function, likely traffic volumes, abutting land use and access to properties. Council's DCP stipulates for urban roads in new developments the construction standards included in the table below; these are considered appropriate for Mudgee.

<b>Road Type</b>	<b>Road Reserve</b>	<b>Carriageway</b>	<b>Nature Strip</b>	<b>Footpath</b>	<b>Kerb Type</b>
Minor Road- Cul-de-sac serves $\leq 10$ dwellings	16m	8m	2x4m	No	Roll-over
Residential Road – serves 31-120 dwellings	18m	9m	2x4.5m	1x1.2m	Roll-over
Major Residential Road (collector road) - serves > 120 dwellings	20m	11m	2x4.5m	1x1.2m	Roll-over
Sub-arterial Road –Bus Route and/or cycle lane (on one side only)	22m	13m	2x4.5m	2.5m	Barrier
Commercial & Industrial subdivision roads	24m	13m	2x5.5m	1x1.2m	Barrier/ Roll

### ***S.6.2 Truck Routes***

Trucks can currently travel along most streets in Mudgee. Trucks travelling non-stop through Mudgee mostly travel along the Castlereagh Highway. A Truck Routes Network, illustrated in **Figure 11**, is proposed include the following three road categories:

- B-double Route (All trucks)
- Designated Truck Route (All trucks, except B-Double)
- Low Tonnage Routes (Rigid Trucks Only) accessing Residential Areas
- Other Streets (Only for direct delivery & pick up of goods)

## ***S.7 Traffic Management Plan***

The Draft Final Traffic Management Plan illustrated in **Figure 12** incorporates the following measures in order of Priority.

### ***S.7.1 Policy Matters***

- Council adopts the road hierarchy illustrated in **Figure 10** together with the road standards included in **Table 5.1** for the Mudgee urban area including new subdivisions.
- Council promotes a ring road system around the CBD which includes Horatio Street, Douro Street, Short Street and Lewis Street.
- Council adopts the Truck Route Network, illustrated in **Figure 11** together the following:
  - Provision of suitable sign posting of each Truck Route
  - Implementation of an appropriate advertising program.
  - An assessment of the suitability of the pavement of each designated road to carry the anticipated volume of trucks and improved where necessary.
- Council to explore the need or the re-opening of the railway crossing at Cox Street.
- Police to enforce speed limit at all locations with excessive speeding problems and safety related issues.

### ***S.7.2 Immediate Improvements (within two years)***

#### *Bus Related Matters*

- Approach the High School to assist with the supervision of students using the crossing in Horatio Street.
- Relocation of the Give Way signs from Perry Street to Gladstone Street
- Extend bus zone in Lewis Street at the Catholic School with the introduction of No Parking restrictions from 2.30 to 4.00pm, between the northern driveway to the school and Market Street.



### *Safety Matters*

- Increase the deflection of vehicles entering the roundabout from all approaches at the intersection of Horatio Street with Church Street
- Provision of slowing devices in
  - Church Street north of Meares Street
  - Denison Street between Lewis Street and Church Street
  - Oporto Street at the Southside Shopping Centre

### *Pedestrian Improvements*

- Installation of pedestrian warning signage advising motorists to slow down at the intersection of Robertson Street with Lions Drive.
- Provision of a pedestrian refuge in Lions Drive, at Robertson Street and in Robertson Street north of Lions Drive.
- Investigate relocating the pedestrian crossing in Perry Street near the intersection of Denison Street further to the south in consultation with the schools.
- Request RMS consider warrants for a pedestrian crossing on Douro south of the railway line and before the intersection of Inglis Street

## ***S.7.3 Short Term (within 5 years)***

### *Cycleway*

- Provision of a dedicated cycleway from Winter Street to the CBD via the High School incorporating the following works:
  - Improving the connection between the existing cycleway and Horatio Street to comply with minimum standards
  - The provision of suitable signposting along Horatio Street to Douro Street
  - Improving access from the closed section of Horatio Street to Douro Street
  - Provision of a safe pedestrian/cyclists crossing of Douro Street at Horatio Street to access the school
  - Provision of a two way cycleway and suitable signposting on the northern side of Horatio Street between Douro Street and Perry Street.
  - Provision of a cycleway and suitable signposting on both sides of Perry Street to Mortimer Street for northbound and southbound direction respectively.
- Provision by line marking of two traffic lanes and two cycle lanes along
  - Lions Drive between Sydney Road and Robertson Street
  - Madeira Road

### *Road Improvements and Traffic Measures*

- Provision of traffic calming devices such as entry and mid-block thresholds along Madeira Road, between Douro Street and Henry Bayly Drive.
- Provision of a seagull arrangement (that is the right turning movements are protected from through traffic) at the following intersections:
  - Madeira Road with Robertson Street
  - Inglis Street with Douro Street
- During the public exhibition phase of this document a submission was received to consider kerb blisters at the intersection of Lewis and Mortimer Streets with a longer term view of a roundabout at this location. This suggestion is supported.

### *Pedestrian Improvements*

- Provision of a Shared Zone in Perry Street between Horatio Street and Denison Street including the implementation of the following:
  - Speed limit of 10 kmh
  - Provision of entry thresholds in Perry Street at Horatio Street and Denison Street
  - Restrict traffic to one way northbound between Horatio and Denison Streets
  - Provide angle parking on eastern side of Perry Street
  - Retain bus zone on western side of Perry Street
- Provision of a Shared Zone in Church Street between Mortimer Street and Market Street including the implementation of the following:
  - Speed limit of 10 kmh
  - Provision of entry thresholds in Church Street at Mortimer Street and Market Street
  - Retain angle parking on both sides of Church Street

### *Caerleon Subdivision Requirements*

- Sealing the pavement of Fairydale Lane between Gladstone Street and the new access to Bellevue Hill Estate, to provide two traffic lanes and two cycle lanes. Developers to pay a contribution towards the upgrade of Fairydale Lane to provide two sealed travel lanes (3.25m each), two sealed shoulders (0.5m each) and two unsealed shoulder (1m each).
- Developer to design and construct the intersection of Hill End Road with the new Spine Road in accordance with clause 34 of the Notice of Determination for the subdivision dated 9 August 2013
- Developer to design and construct the intersection of Hill End Road with the Castlereagh Highway in accordance with clause 35 of the Notice of Determination for the subdivision dated 9 August 2013.



### ***S.7.4 Medium Term (5 to 10 years)***

The following improvements, also noted in **Figure 12**, are recommended for implementation in the medium term.

#### *Road Improvement*

- Realignment of the intersections of Bell Street and Putta Bucca Road at Castlereagh Highway together with the provision of a roundabout.

#### *Traffic Measures*

- Provision of a roundabout with pedestrian refuges at the following intersections:
  - Sydney Road with Burrundulla Road and Lions Drive
  - Douro Street with Denison Street
  - Douro Street with Horatio Street
  - Horatio Street with Lewis Street
  - Industrial Avenue and Sydney
- Road Provision of a seagull arrangement at the following intersections:
  - Gladstone Street with Denison Street
  - Fairydale Lane with Gladstone Street
- Provision of slowing devices at the following locations:
  - Gladstone Street between Fairydale Lane and Cox Street
  - Fairydale Lane Banjo Patterson Avenue
  - Construct safety improvements at the Church Street and Spring Road intersection in consultation with the resident.

### ***S.7.5 Long Term (over 10 years)***

The following improvements are recommended for implementation in the long term if a coal mine proceeds and coal freight trains travel through Mudgee:

- Provision of boom gates with “flashing lights and bells” at the Fairydale Lane crossing.
- Provision of boom gates at the Sydney Road railway crossing
- Provision of boom gates at the Douro Street railway crossing.

A roundabout is also recommended at the intersection of Mortimer and Lewis Streets following a submission that was received during public exhibition of this document.

## ***S.8 Funding Recommended Improvements***

The source of funding for the recommended improvements could be categorised as follows:

- Through a section 94 contribution plan for improvements required as a direct result of future developments.
- Through specific funding agreements such as the Caerleon Estate
- Funding from other sources (eg coal mines)
- By Council and RMS for projects which are currently required and not directly attributed to future releases such as safety related matters.

The total cost of all improvements in **Table 7.1**, which could be included in a Section 94 contribution plan has been preliminary estimated by Council at \$7,010,000

# 1. Introduction

## 1.1 Background

Mudgee is located within the Mid-Western Regional Council Local Government Area (LGA) and the Central West of NSW. Strong growth has occurred in recent years in the LGA but more particularly in the township of Mudgee. In 2011, the LGA has a total population of 23,000, an increase from 22,220 recorded in 2001, and is predicted to reach 26,100 by 2031 (DOPI, 2013). This growth is being assisted by a number of major developments within the LGA. Council requires a better understanding of the transport infrastructure requirements in Mudgee during these times of growth to enable appropriate planning for the future.

Similarly, in 2011 the population of Mudgee Township was 9,830, an increase of about 20 percent since 2006 when a population of about 8,250 prevailed. A projected increase to 11,470 persons is anticipated by 2031.

A Traffic study management study for the Mudgee Township was completed in 2008 (Gennaoui, 2008), The study enabled Council and the community to acquire a better understanding of the needs of the town's traffic and transport infrastructure during these times of growth. Council adopted all the recommendations of the 2008 study.

The purpose of this project is to review and update the Mudgee Traffic Management Study 2008 with the most current data and information. The focus of the review is to update the study report for the current and projected future needs of the transport infrastructure within the Mudgee Township. This report will be used by Council to prioritise infrastructure upgrade works and determine projects that need to be funded from Councils current budgets or a Section 94 Contributions Plan.

Council has commissioned Gennaoui Consulting Pty Ltd to undertake this review and prepare a report detailing the current and projected future needs of the traffic and transport infrastructure within the Mudgee Township.

All figures referred to in the report have been placed at the end of this document.

## 1.2 Study Area

For the purpose of the study, the evaluation and analysis covers the whole urban area of Mudgee defined in **Figure 1**. The boundaries of the Study Area, where and if required, were widened to consider the implications of conditions or situations outside the defined study area.

### 1.3 Objectives of Study

The objective of this study is the preparation of an effective Traffic Management Plan for the urban area of Mudgee. This objective was achieved through:

- Establishing current and predicted traffic flows
- Determination of current traffic and transport infrastructure and treatment measures required resulting from present day traffic volumes
- Determination of future traffic and transport infrastructure and treatment measures required resulting from predicted traffic volumes
- Determination of both current and future needs in regard to rail crossing points.

The primary aim of this study is also to inform the Section 94 developer contributions plan. To achieve this, the study has:

- Compared current levels of service with future levels of service in accordance with projected growth,
- Identified road infrastructure upgrades that promote efficient traffic movement around Mudgee bearing mind in new developments and end destinations,
- Prioritised upgrades so that implementation is timely with growth and levels of service remain satisfactory.

### 1.4 Appreciation of the Issues

The brief required the review and update of the previous report (Gennaoui, 2008) and the preparation of a report detailing the current and projected future needs of the traffic and transport infrastructure within the Mudgee Township. During the development of the plan, consideration was given to the following:

- Review and update the adopted road hierarchy for Mudgee allowing for growth into newly developed areas.
- Assessment of the intersection capacities (LOS) and identification of necessary upgrades of major intersections.
- Conduct a heavy route assessment.
- Investigate the provision of a dedicated cycle lane within the traffic lanes that looks to link the existing footpath from Winter Street and the CBD via the High School,
- Investigation of present linkages between Bellevue Hill Estate and the Caerleon Subdivision with the CBD and identify and prioritise works that will promote efficient traffic flow between these precincts.
- Identification of areas needing traffic calming, bearing in mind destinations and re-alignment of Fairydale Lane and the impact of pushing traffic onto alternate routes as a result of the traffic calming devices.
- Investigation of potential opening railway crossings to traffic, particularly at Cox Street.

- Investigate the provision of roundabouts at the following intersections:
  - Sydney Road with Lions Drive and Burrundulla Road
  - Castlereagh Highway / Market Street with Putta Bucca Road and Bell Street.
  - Horatio Street with Douro Street.
- Investigation of the following traffic management matters:
  - possible treatment to the intersection of Ulan Road and Henry Lawson Drive
  - opening of Lovejoy Street to Douro Street
  - change of the traffic priority along Gladstone Street, at Perry Street, particularly in relation to traffic coming from the school
  - problem areas in Church Street (outside Aldi & Mitre10) and at the South Mudgee Surgery Medical Centre in Oporto Road.
  - implications and possible solutions to the closure of Perry Street between Horatio Street and Denison Street
  - problems at the intersections of Inglis Street with Douro Street, of Church Street with Denison Street, and of Gladstone Street with Denison Street.

It has also been appreciated that it was necessary to bear in mind the proposed railway crossing between Caerleon and Saleyards Lane subdivisions. We have also assessed if the proposed re-alignment of Fairydale Lane in conjunction with a potential roundabout at the intersection of the Castlereagh Highway with Putta Bucca Road, Market Street and Bell Street is the most appropriate solution for moving traffic from these precincts to the CBD. It was further necessary to consider the implications and possible solutions for improved traffic flow on Market Street.

It was also understood that traffic lights should generally be avoided as a solution and only considered as an absolute last option.

This report provides Council with the basis to determine a priority for infrastructure upgrade works and determine projects that need to be funded from Council's current budgets or a Section 94 Contributions Plan.

## **1.5 Study Approach**

The main objective of the study is to provide a means of managing traffic within the Mudgee Township, to formulate the basis for a section 94 plan, including a detailed works schedule, and a desired timetable of works, to fund the provision of works. The Traffic Management Plan for the Mudgee Township was produced in the context of the following seven (7) phases:

- Assessment and review of all available technical data and planning information; relevant Council policies and strategies and existing planning controls. During this phase, a number of key stakeholders will be consulted.
- Establish potential growth in the area and forecast population levels.
- Establish existing traffic conditions within the Study area (intersection counts would be carried out where necessary);

- Based on the likely traffic generation and distribution of potential floor space in CBD and residential dwellings, future traffic conditions within the Township will be established; an evaluation of the level of service and adequacy of the existing road system will be carried out.
- Development of a Traffic Management Scheme to cater for increased traffic and a Strategy Plan for its implementation.
- Formulate the basis for the funding of all recommended improvements including section 94 Contribution.
- The preparation of a Draft and final reports which will document the surveys, findings, strategies and action plans.

These phases and associated tasks included a four-stage process of:

- Consultation with key stakeholders
- Data collection, collation and review and analysis;
- Derivation of a range of options; and
- Formulation of preferred strategy and action plan.

## **1.6 Collection and Review of Available Information**

The following information was collected from Council, reviewed and taken into account during the course of the study:

- Latest mid-block traffic counts obtained from electronic counters including detail of time of day, class and speed of vehicle.
- Traffic Management Study – Mudgee Final Report (J388 17/03/08 revH),
- Map of Mudgee showing Highway and Regional Road routes and existing intersection treatments in digital format (AutoCAD/MapInfo)
- Recent aerial photography of Mudgee in digital format
- Draft Draft Mudgee Town Structure Plan November 2013,
- Mudgee CBD Car Parking Study 2005,
- Roads Asset Management Plan 2013,
- Crash data within the study area.
- Existing issues raised by the community over the last 12 months.
- Existing treatment and proposed works design plans (if available)
- Development Control Plans indicating road networks for future subdivisions
- Location of bus routes;
- Mudgee adopted Road Hierarchy Plan
- 2011 Dwellings, population and car ownership statistics
- Draft Caerleon Development Control Plan Prepared by Elton Consulting (2012).
- Traffic Impact assessment. Caerleon Rezoning Mudgee prepared by Traffix (2012).

## 1.7 Improvements since 2008 Study

The following improvements recommended in the previous study (Gennaoui, 2008) have been implemented:

### 1.7.1 Policy Matters

- Council adopted the road hierarchy illustrated in **Figure 9**.

### 1.7.2 Safety Matters

- Inclusion of the intersection of Perry Street with Gladstone Street as part of the School Zone in Perry Street.
- Provision of permanent 40 km/h flashing lights during school hours in Douro Street, in Horatio Street, in Perry Street and in Lewis Street.

### 1.7.3 Traffic Control

- Provision of Give Way signs in Lewis Street, south of Short Street, together with the removal of the Stop Sign in Short Street, east of Lewis Street.
- Provision of traffic calming devices such as mid-block thresholds along Robertson Street, between Lions Drive and Madeira Road.
- Provision of roundabouts at the following intersections
  - Market Street with Douro Street.
  - Perry Street with Byron Place and Lovejoy
  - Ulan Road with Pitts Lane and Lue Road. Pitt Lane and Lue Road have been realigned to form a four way intersection.

### 1.7.4 Pedestrian Improvements

- Upgrade roundabout at the intersection of Horatio Street with Church Street including the provision of safe pedestrian refuges on all approaches.
- Provision of pedestrian refuges along all approaches at the intersection of Perry Street with Gladstone Street.
- Provision of a pedestrian refuge in Church Street between Horatio Street and Inglis Street.

### 1.7.5 Public Transport Improvements

- Relocation of the Taxi rank (north side) in Mortimer Street to follow on from the bus stop opposite the Soldiers Club. The existing taxi rank should be designated for angle parking.
- Changes to bus stops and "lay-over" in Madeira Road and Atkinson Street.
- School buses should be re-routed to avoid Church Street and the CBD where possible.

## **1.8 Scope of Report and Study Output**

The main output of the study is a Traffic Management Plan for the Township of Mudgee to achieve the agreed objectives by combining our appreciation of the issues raised by residents and factors relating to traffic and safety conditions within the township.

Section 2 summarises the public consultation phase of the study. Section 3 describes the present traffic conditions in Mudgee. Section 4 addresses the impact of future growth on the road network; the basis for a contribution plan is also included in this section. A number of specific safety and traffic related matters are addressed in section 5.

The adopted Road Hierarchy of the Mudgee Township is reviewed in Section 6. This section also identifies a Truck Route network for Mudgee.

Measures to address the issues and problems identified during the course of the study are presented in Section 7 together with a strategy for the implementation of the recommended improvements and funding mechanism.



## 2. Consultation

### 2.1 Identification of Issues

#### 2.1.1 Consultation with Council Officers

A meeting was held at the commencement of the study with Council's officers to confirm milestones, reporting arrangements and finalise the scope of works and timetable for completion of the study. Available Council information was collected and relevant background information noted.

Safety problems experienced by pedestrians crossing Church Street between Meares Street and the railway overbridge were also raised for consideration in the study.

#### 2.1.2 Consultation with Key Stakeholders

The importance of providing key stakeholders the opportunity to raise issues in relation to the Study Area and what changes they would like to see to improve the amenity of the area was recognised. A combined meeting with the following key stakeholders was held on 11 February 2014 to identify issues and problems areas:

- Police Service
- Roads & Maritime Service
- Mudgee Chamber of Commerce
- Mudgee Taxis
- Independent Bus Operators
- School Bus Operator
- Community Transport
- Mid-Western Regional Council

The issues identified in Section 1.4 were confirmed by all stakeholders in attendance. The following matters were also raised by stakeholders:

- Do not support the introduction of 40 km/h speed limit in some sections of the CBD.
- Do not support the introduction of a 60 kmh speed limit along the highway as recommended in the 2008 report.
- Consideration of promoting a ring road around the CBD for through traffic.
- Walkway and cycleway should be incorporated in all new subdivision
- Chamber of commerce would not support the opening of Lovejoy Street to Douro Street
- Investigate possible roundabout at the intersection of Church Street with Meares Street
- Safety problems experienced by pedestrians crossing Church Street between Meares Street and the railway overbridge. Consideration for more parking in Church Street near the medical centre.
- Bus parking in Mortimer Street and Lewis Street in the vicinity of Catholic School not adequate.

### **2.1.3 Responses to Newspaper Notice**

Resident participation in such studies can progress hand in hand with the technical overview if the structures for communication exist. The ideal situation, which appears to apply to Mudgee, is one where residents have expressed a concern about traffic conditions in their area. In the first instance, a notice advising the public of the study was placed in Local Newspapers seeking submissions. Only two (2) submissions were received raising the following matters:

- Concern about a steady increase in both heavy and speeding traffic in Denison Street between Lewis and Church Street over the past couple of years but more substantially over the past 3 to 6 months.
- Create a more pedestrian friendly environment for locals and visitors by closing Church St midway between Market Street and Mortimer Street to through traffic.
  - Closure of Perry Street north of Market Street to improve traffic flow at the roundabout.

These matters have been considered and addressed in the body of the report.

## **2.2 Comments Regarding Draft Plan**

The draft Traffic Management Plan was presented at the meeting of key stakeholders held on 10 June 2014. The meeting was attended by representatives of the following organisations:

- Police Service
- Roads & Maritime Service
- Mudgee Chamber of Commerce
- Ogden Coaches
- Mid-Western Regional Council

At that meeting all recommendations included in Section 7 were accepted with the exception of the designation of Putta Bucca Road as a B-double route. It was agreed to retain the existing route along Market Street, Short Street and Ulan Road for such vehicles.

## 3. Existing Traffic Conditions

### 3.1 Existing Street System

#### 3.1.1 Major Road Network

The Castlereagh Highway (B55) passes through the Mid-Western Regional Council. It provides the major link between Lithgow and Gilgandra via Gulgong. Through Mudgee it follows the route along Sydney Road, Horatio Street, Douro Street and Market Street. Ulan Road approaches Mudgee from the north via Church Street.

#### 3.1.2 Road Inventory

An inventory of all streets within the Township of Mudgee, including traffic control and circulation, was carried out in conjunction with the previous study (Gennaoui, 2008). Since then, Banjo Patterson Avenue was completed between Bellevue Road and Fairydale Lane. Furthermore, Lue Road and Pitt Lane have been realigned to form a four way intersection with Ulan Road.

The number of effective traffic lanes for streets within the Mudgee Study Area is illustrated in **Figure 2**.

The majority of streets within the urban area have predominantly very wide carriageways consisting of angle parking and two (2) lanes for traffic.

#### 3.1.3 Traffic Controls

Roundabouts control the following intersections:

- Church Street with Horatio Street
- Church Street with Gladstone Street
- Church Street with Mortimer Street
- Church Street with Market Street
- Church Street with Short Street
- Church Street with Madeira Road
- Perry Street with Mortimer Street
- Perry Street with Market Street
- Douro Street with Market Street (installed in early 2010)
- Perry Street with Lovejoy Street (installed in 2009)
- Ulan Road with Pitt Lane and Lue Road (installed in early 2012)

The majority of the remaining intersections within Mudgee are controlled by Give Way signs or subject to the T-junction rule; a small number of intersections are controlled by Stop signs. There are no traffic signals within Mudgee.

Pedestrian crossings are largely located within the town centre and near schools. No consistent bicycle facilities are currently provided in Mudgee.

In order to reduce speed, slowing devices have been provided along Robertson Street and Inglis Street.

Pedestrian crossings in Gladstone Street west of Perry Street and in Perry Street south of Gladstone have been removed and replaced by pedestrian refuges; furthermore pedestrian refuges have been provided at the other two approached to this intersection.

All traffic controls within the Mudgee Township are noted in **Figure 3**.

## 3.2 Bus Services in Mudgee

Ogden's Coaches provides the only town bus services in Mudgee which operate along four primary routes in the Mudgee urban area. These routes, illustrated in **Figure 4**, are as follows:

- Mudgee East Loop (route 560 – 4 per day) - leaving the CBD circuit eastbound via Mortimer Street to service the eastern area via Cedar Avenue and Mulgoa Way;
- Mudgee West Loop (route 561 - 4 per day) - leaving the CBD via Market Street to service the Mudgee western area north of the railway line;
- Mudgee South Loop (route 562 - 4 per day) - leaving the CBD via Church Street to service the Mudgee area south of the railway line; and
- Mudgee North Loop (route 563 - 3 per day) - leaving the CBD to the north via Ulan Road to service the TAFE college and the Putta Bucca Road area.

School buses are also provided by Ogden's coaches and other operators.

The main route taken by the vast majority of the school buses in the afternoon start at Cudgegong Valley Public School on Madeira Road, then travel to the Mudgee High School on Perry Street before continuing to the Mudgee Public School also on Perry Street. Buses then proceed to Lewis Street where the Catholic School is located. Once they have picked up the children, some buses go straight ahead while others turn at Market Street both left and right and then disperse out of town. A number of issues identified by the school bus operators are discussed in Section 5.1.

## 3.3 Crash Analysis

### 3.3.1 Crash Statistics

Council provided crash statistics for the period 1 January 2008 to 31 December 2012. Analysis of these crash records have given the distribution of all crashes related to intersections as well as mid-block (between intersections) along all streets within the Study Area. The location, frequency and consequence of crashes are shown in **Figure 5**. Detailed information for intersection and mid-block crashes are included in **Appendix A**.

A total of 183 recorded crashes occurred in Mudgee during the five (5) year period ending December 2012; these crashes resulted in 101 injuries and one (1) fatality. A summary of the number of yearly crashes at intersections and at mid-block is included in **Table 3.1** and detailed in Tables A1 and A2 of **Appendix A** respectively.

**Table 3.1: Yearly Frequency of Crashes**

	2008 to 2012						2002 to 2006				
	2008	2009	2010	2011	2012	Total	I	F	Total	I	F
Crashes at intersections	21	21	26	17	23	108	63	0	72	45	1
Crashes at mid-block	9	16	13	19	18	75	38	1	48	32	
<b>Total</b>	<b>30</b>	<b>37</b>	<b>39</b>	<b>36</b>	<b>41</b>	<b>183</b>	<b>101</b>	<b>1</b>	<b>120</b>	<b>77</b>	<b>1</b>

I Injuries F Fatality

The number of crashes has considerably increased by about 53 percent when compared to the 2002-2006 period; however the number of injuries and fatalities experienced a lower increase of 31 percent.

The type of crashes at intersections and at mid-block is detailed in Tables A3 and A4 of **Appendix A** and summarised in **Table 3.2**.

**Table 3.2: Type of Crashes 2008-2012**

Crashes at	Cross Traffic Right angle		Rear End		Head On		Out of Control		Pedestrians		Others		Total	
	A	I	A	I	A	I	A	I	A	I	A	I	A	I
intersections	53	37	12	10	6	3	30	10	1	1	6	2	108	63
mid-block			22	14	4	2	24	14	5	1	20	8	75	39
<b>Total</b>	<b>53</b>	<b>37</b>	<b>34</b>	<b>24</b>	<b>10</b>	<b>5</b>	<b>54</b>	<b>24</b>	<b>6</b>	<b>2</b>	<b>26</b>	<b>10</b>	<b>183</b>	<b>102</b>
	29%	36%	19%	24%	5%	5%	30%	24%	3%	2%	14%	9%	100%	100%

Includes 1 fatality

The most common type of crashes involved single vehicles out of control colliding with fixed object or parked cars, accounting for about 30 percent of total crashes and resulting in 23 injured persons and one fatality (about 24% of all injuries).

### 3.3.2 Crashes at Intersections

A total of 108 crashes occurred at 53 intersections within the Mudgee study area, during the period from January 2008 to December 2012 (noted in **Figure 5**). As a result of these crashes there were 63 injuries and no fatality. The frequencies and type of crashes at each intersection are summarised in **Table A3 of Appendix A**.

The most common type of intersection crashes involved vehicles crossing an intersection from the intersecting streets (right angle or similar crashes) which accounted for about 49 percent of total intersection crashes and resulted in 37 injured persons (about 59% of all injuries).

The next most common type of intersection crashes involved single vehicle out of control colliding with fixed object or parked cars, accounting for about 28 percent of

total intersection crashes and resulting in ten injured persons (about 16% of all injuries). Only one intersection crash involved an injured pedestrian.

The intersection of Horatio Street with Church Street which is controlled by a roundabout experienced the highest number of intersection crashes (6) resulting in four (4) injured persons. Most crashes at the former intersection which is controlled by a roundabout were between vehicles entering the roundabout and those already in the roundabout. Serious consideration should be given to increase the deflection of vehicles entering the roundabout to ensure they either slow down or even stop before entering the roundabout.

The intersection of Horatio Street with Douro Street which is subject to the T junction rule and include a seagull arrangement experienced the second highest number of intersection crashes (5) resulting in five (5) injured persons. The next highest number of crashes occurred at the following intersections:

- Douro Street with Mortimer Street (4 crashes, 4 injuries)
- Mortimer Street with Perry Street (4 crashes, 3 injuries)
- Castlereagh Highway with Bell St and Putta Bucca Rd (4 crashes, 2 injuries)
- Sydney Road with Lions Drive & Burrandella Rd (4 crashes, 2 injuries)
- Horatio Street with Perry Street (4 crashes, 2 injuries)
- Douro Street with Gladstone Street (4 crashes, 1 injury)
- Douro Street with Denison Street (3 crashes, 1 injury)
- Horatio Street with Lewis Street (3 crashes, no injury)
- Church Street with Gladstone Street (3 crashes, 3 injuries)
- Lions Road with Robinson Street (3 crashes, 1 injury)
- Ulan Road with Lue Road (3 crashes, 4 injuries)

Two (2) crashes occurred at each of 15 other intersections; the remaining 26 intersections were subject to one crash each during the five year period.

About 49 percent of all intersection crashes occurred along the roads forming part of the Castlereagh Highway through Mudgee.

The installation of a roundabout at the intersection of Market Street with Douro Street since the last study has considerably reduced the number of crashes from nine (9) in the 2002-2006 period to two (2) crashes in the 2008-2012 period.

The realignment of Pitt Lane and Lue Road to form one intersection with Ulan Road and the installation of a roundabout in 2012 would undoubtedly improve safety of this location.

### 3.3.3 Crashes at Mid-Block

Some 75 mid-block crashes occurred along 24 streets within Mudgee, during the five year period between January 2008 and December 2012. Thirty eight (38) injuries resulted from these crashes; one fatality was recorded at mid-block. The frequencies and type of mid-block crashes along the different roads are summarised in Table A4 of **Appendix A** and noted in **Figure 5**. About 27 percent of all mid-block crashes occurred along the roads forming part of the Castlereagh Highway through Mudgee.

Off road collisions with fixed object or parked cars accounted for about 32 percent of all mid-block crashes and about 34 percent of all injuries. Rear end and similar

crashes accounted for about 30 percent of all crashes and resulted in about 37 percent of injuries. Pedestrians were involved in about nine (9) percent (5) of all mid-block crashes, resulting in 13 percent of all injuries. Vehicles emerging from driveways also accounted for 13 percent (10 crashes) resulting in about five (5) of all injuries.

## 3.4 Existing Traffic Patterns

### 3.4.1 Daily Traffic Volumes

Annual average daily traffic (AADT) volumes, for the urban area of Mudgee were obtained from the RMS published and other for the period between 1996 and 2002 (RTA, 2002). This information, supplemented by more recent counts supplied by RMS, is summarised in **Table 3.3**.

**Table 3.3: AADT Volumes**

Location	AADT		AWDT <sup>(2)</sup>		
	2002 <sup>(1)</sup>	2005	2009	2010	2011
Douro St, north of Denison St	5,926	6,479			
Horatio Street, east of Church St			6,959		
Horatio Street, west of Church St	4,567	5,076			
Market Street, west of Douro Street	7,165	7,600	6,995		
Sydney Road, south of rail crossing	4,358	5,097	4395	5876	6577
Castlereagh Hwy, south of Burrundulla Rd	2,342	2,371			

\* These figures are equivalent passenger vehicles; actual vehicle numbers would be lower

Notes: (1) RTA (2002)

(2) RMS Average Weekly Daily Traffic

Traffic volumes along Sydney Road south of the railway crossing have continuously increased between 2002 and 2011. It is reasonable to assume that traffic volumes along Market Street, Douro Street and Horatio Street would have also increased over the same period.

### 3.4.2 Carriageway Volume Counts

#### *Previous Counts*

The carriageway traffic counts at 40 locations carried out between May 2006 and May 2007 (Gennaoui, 2008) are included as **Appendix B**. Locations where volumes exceeded 3,000 per day in the 2008 study are summarised in **Table 3.4**. To the east of Church Street, Horatio Street carried over 8,500 vpd.

**Table 3.4: Traffic Counts in 2008 Study\***

Street Heavy	Location		Average Weekly Daily Traffic			
			Weekday	Weekend	Weekly	
Church Street	Market St	&	Short St	4,685	4,818	4,723
Church Street	Mealy St	&	Denison St	10,059	8,078	9,493
Church Street	Mears St	&	Railway X	7,818	6,628	7,478
Douro Street	Gladstone		Mortimer	7,063	5,747	6,687
Douro Street	at Railway X			5,266	4,251	4,976
Horatio Street	Lochel Ln	&	George St	8,535	5,123	7,560
Horatio Street	Perry St	&	Douro St	4,177	3,012	3,844
Lewis Street	Gladstone St	&	Mortimer St	3,627	2,231	3,228
Market St	Douro St	&	Court St	6,875	5,594	6,509
Market St	Third St	&	Bell St	4,917	4,014	4,659
Oporto Road	Madeira Rd	&	Norman Rd	3,029	2,427	2,857
Perry Street0	south of Market			4,837	3,007	4,314
Sydney Road	at Railway Crossing			8,536	4,119	7,274

\* source: Gennaoui, 2008

The highest volumes of traffic within Mudgee in 2008 was along Church Street between Horatio Street and Denison Street with over 10,000 vpd on weekdays, reducing to about 8,900 vpd south of the railway crossing.

#### *Existing Traffic Counts*

These counts were supplemented by weekly carriageway counts at 23 locations within Mudgee, carried out by Mid-Western Regional Council, between June 2011 and February 2014. The average weekday daily traffic volumes at these locations is noted in **Figure 6** and included in **Table 3.5**.

**Table 3.5: Daily Traffic Volumes (vehicles) 2014 Study**

Location	2014 Study			2008 Study		
	AWDT	%HV	85 <sup>th</sup> tle Speed	AWDT	%HV	85 <sup>th</sup> tle speed
Atkinson St N of Meares st	655	5.7%	47.5			
Atkinson St S of Meares st	385	5.1%	51.8			
Banjo Patterson S of Palmer	634	10.1%	57.6			
Byron Place E of Perry	3986	1.7%	25.9			
Church St N of Meares St	8911	2.1%	53.3	7818	1.4%	55.1
Denison St W of Perry St	1111	7.6%	34.6			
Gladstone St E of Court St	2947	3.1%	55.8			
Henry Bayly Dr N of Menah	241	6.2%	54.0			
Lovejoy St W of Perry St	253	1.2%	24.1			
Madeira Rd W of Gilham Ln	1548	5.1%	56.2			
Maderia Rd @ school	2949	4.2%	53.3	2763	2.1%	46.1
Market St W of Perry	3117	3.3%	33.1			
Market St E of Perry	5561	2.9%	36.4			
Mortimer St W of Perry	581	2.9%	27.7			
Oporto Rd N of Spring Rd	1227	5.5%	52.6			
Oporto Rd N Havilah	2094	5.0%	54.7			
Perry St N of Market	2606	11.0%	23.0	1514	4.8%	24.5
Perry St N of Mortimer	5449	7.2%	40.0			
Perry St S of Market	5617	4.1%	37.8	4837	2.7%	41.0
Perry St N of Horatio St	2174	4.6%	39.3			
Putta Bucca Rd E of Chestnut	1013	11.0%	79.6			
Robertson St, N of Abernethy	2765	3.7%	53.6	1911	6.6%	63

\* 85<sup>th</sup>tle represent the speed exceeded by 15 percent of vehicles



Results of counts previously carried out at similar location as those in **Table 3.4** have also been included. Traffic volumes appear to have increased by about 2 and 3 percent per annum since the previous counts.

### 3.4.3 Classification Counts

The type of vehicles was also recorded at all current locations. The proportion of heavy vehicles is also noted in **Figure 6**. Locations which carried over 100 medium and large size trucks on weekdays are summarised in **Table 3.6**.

**Table 3.6: Daily Traffic Volumes and Proportion Heavy Vehicles (weekday)**

Street	2014 Study			2008 Study		
	Total	HV	%	Total	HV	%
Church St 100m north of Meares S	8911	187	2.1%	7818	4	1.4%
Maderia Rd @ school	2949	192	4.2%	2763	53	2.1%
Market St 20m west of Perry	3117	272	3.3%			
Market St 50 east of Perry	5561	109	2.9%			
Oporto Road 15m N Havilah	2094	105	5.0%			
Perry 10m north of Market	2606	287	11.0%			
Perry 50m N of Mortimer	5449	392	7.2%			
Perry 50m south of Market	5617	230	4.1%	4837	131	2.7%
Perry Street, north of Horatio St	2174	100	4.6%			
Putta Bucca Rd 30m E of Chestnut Cl	1013	111	11.0%			
Robertson St, N of Abernethy	2765	102	3.7%	1911	124	6.6%

The results of the previous counts are included in **Appendix B**.

The highest daily number of trucks recorded at the surveyed sites travelled along Perry Street (~400 trucks) near the CBD.

The Castlereagh Highway continues to carry the highest number of trucks in Mudgee with over 750 and 400 trucks previously recorded along Horatio Street and Market Street respectively.

### 3.4.4 Vehicle Speeds

A 50 km/h speed limit was introduced in July 2002 on all streets within the Mudgee Township including the Castlereagh Highway. Vehicle speeds were also recorded in conjunction with the classification counts. The 85<sup>th</sup> percentile speed for the latest counts are included in **Table 3.5** and noted in **Figure 6**. The 85<sup>th</sup> percentile recorded speed exceeded the speed limit at 11 locations. These locations are further away from the CBD in residential areas; closer to the CBD speeds are generally below the speed limit.

As recommended in the previous study (Gennaoui, 2008), speed reducing devices have been provided in Robertson Street where over 80 percent of vehicles exceeded the speed limit. Since then, the 85<sup>th</sup> percentile speed has reduced from 63 to 54 km/hr.

In the 2008 study it was found that, Madeira Road, west of Douro Street was the subject of excessive speeds; over 60 percent of vehicles exceeded the speed limit, about a quarter of which exceeded 60 km/h. Current observation indicates that the situation has not improved along this road which provides access to a school. Consideration should still be given for the placement of traffic calming devices along Madeira Road, between Douro Street and Henry Bayly Drive.

### 3.4.5 Intersection Counts

In order to gauge the traffic conditions within the study area, traffic movements were counted at 25 intersections within Mudgee. The surveys were carried out during the afternoon peak period between 4.00 pm and 6.00 pm on 21 March 2014. The weekday volumes at these intersections peaked at different time as follows:

- 4.00 to 5.00 pm 18 intersections
- 4.15 to 5.15 pm 3 intersections
- 4.30 to 5.30 pm 2 intersections
- 4.45 to 5.45pm 1 intersection
- 5.00 to 6.00 pm 1 intersection

The peak hourly volumes recorded at each intersection are shown in **Figure 7**. The majority of intersections peaked between 4.00 and 5.00pm.

Counts were also undertaken, between 2.00 and 4.00 pm, at six (6) of these intersections in the vicinity of the High School, the Cudgegong Valley Public School and St Matthew Catholic School. Peak conditions near the schools occurred between 3.00 and 4.00pm. In effect these volumes were higher than those recorded between 4.00 and 6.00pm as noted in **Figure 7**.

## 3.5 Evaluation of Existing Traffic Operation

### 3.5.1 Carriageway Level of Service

An evaluation of the capacity of most streets in Mudgee was carried out to identify current and potential deficiencies in the road system so that appropriate steps could be taken to remedy such situations.

The capacity of roads was based on an assessment of their operating level of service. The concept of level of service, together with the recommended traffic flows at different levels of service, is described in **Appendix C**.

One-way peak hourly volumes along the different streets were obtained from the intersection counts and supplemented from the daily counts. These vehicle counts were then converted in passenger car equivalent units (PCU) to take into account the proportion of heavy vehicles in the traffic stream; the PCU volumes including the corresponding levels of service are included in **Appendix D**. Locations with volumes in excess of 600 PCU/hr are included in **Table 3.7**.

In a regional town such as Mudgee, it is reasonable to base the roadwork improvements on a requirement to achieve no worse than a level of service "C" (Stable flow with acceptable delays). The assessment of all streets within Mudgee has therefore been based on this premise; the improvements identified in the following sections should be considered as minimum requirements to achieve a Level of Service "C" or better.

**Table 3.7: Existing Carriageway Levels of Service (Volumes PCU)**

Street	Location	Lanes	N/E	S/W	Total	LoS
Church Street	Mortimer & Market	4UP	437	435	<b>872</b>	A
Church Street	Gladstone & Mortimer	4UP	515	525	<b>1040</b>	A
Church Street	Mealy St & Denison St	4UP	486	542	<b>1028</b>	B
Church Street	Denison & Gladstone	4UP	495	525	<b>1020</b>	A
Church Street	Horatio St & Inglis St	4UP	411	518	<b>929</b>	A
Church Street	Meares St & Railway X	2U*	340	462	<b>802</b>	A
Douro Street	Gladstone & Mortimer	4UP	329	439	<b>768</b>	A
Douro Street	Denison & Gladstone	4UP	354	443	<b>797</b>	A
Douro Street	at Railway X	2U*	282	415	<b>697</b>	A
Horatio Street	Church St & Perry	4UP	335	332	<b>667</b>	A
Market Street	Douro St & Perry	4UP	307	336	<b>643</b>	A
Market St	Douro St & Court	4UP	312	368	<b>680</b>	A
Mortimer Street	Church & Perry	4UP	308	326	<b>634</b>	A
<i>Sydney Road</i>	<i>at Railway Crossing</i>	2U*	572	517	<b>1089</b>	A
Sydney Road	Burrundulla & Industrial	4UP*	329	402	<b>731</b>	A
Ulan	Short & Pitt / Lue	2U*	423	410	<b>833</b>	A
Ulan	Pitt/ Lue & Henry Lawson	2U*	330	366	<b>696</b>	A

Interrupted Flow *Uninterrupted flows*

4UP 2 traffic lanes & 2 parking lanes

2U 2 traffic lanes

The highest volume of traffic within Mudgee continues to be along Church Street between Horatio Street and Mortimer Street with over 1,000 pcu/hr on weekdays, reducing to over 800 pcu/hr north of Mortimer Street and south of the railway crossing. To the east Sydney Road carries over 1,000 pcu/hr.

For the purpose of analysis, all roads were analysed as urban roads with interrupted flow conditions except for Sydney Road, Ulan Road, Henry Lawson Drive, and the railway crossings which were analysed with uninterrupted flow conditions.

Church Street generally operates at a good level of service "B" or better. All other streets including the Castlereagh Highway operate at a very good Level of Service "A".

### 3.5.2 Operation of Intersections

The concepts of intersection capacity and level of service, as defined in the Guidelines published by the RTA (2002), are discussed in **Appendix E** together with criteria for their assessment. The assessment of the level of service of roundabouts and signed controlled intersections is based on the average delay (seconds/vehicle) of the critical movement.

The assessment of the level of service of traffic signals is based on the evaluation of the average delay (seconds/vehicle) of vehicles on all approaches.

The analysis of the operation of a number of low volume sign controlled intersections was carried out using the **INTANAL** computer modelling program (version 2004-001); this software, more suitable for low volume intersections allows comparisons between different forms of intersection control, and different forms of intersection configurations to be readily evaluated. INTANAL was used to assess all intersections in the previous study (Gennaoui, 2008).

The operation of most roundabouts and three of the busiest intersections in Mudgee were analysed using the **SIDRA** software which is more appropriate for busy intersections and roundabouts. Peak hourly turning movements at all intersections took into account the proportion of heavy vehicles in the traffic stream. The results of this analysis are summarised in **Table 3.8**.

**Table 3.8: Existing Operation of Intersection in Mudgee**

Intersections	Afternoon Peak		School Period	
	Ave Delay	LoS	Ave Delay	LoS
<b>Roundabout Controlled</b>				
Castlereagh Rd with Bell & Putta Bucca Rd *	12.0	A		
Church St with Short St *	12.1	A		
Church St with Market St *	13.0	A		
Church St with Mortimer St *	13.7	A		
Church St with Gladstone St *	11.8	A		
Church St with Horatio St *	13.7	A		
Church Street with Madeira Rd	8.7	A	8.7	A
Douro St with Market St *	12.4	A		
Perry St with Market St *	12.2	A		
Perry St with Lovejoy St *	11.0	A		
Ulan Rd with Pitt Ln and Lue Rd @	10.8	A		
<b>Sign Controlled Intersections</b>				
Bellevue Rd with Henry Bayly Dr @	7.0	A		
Castlereagh Rd with Bell Street @	8.2	A		
Castlereagh Rd with Putta Bucca Rd @	7.9	A		
Castlereagh Rd with Bell & Putta Bucca Rd *	10.5	A		
Castlereagh Road with Hill End Road #	16.4	B		
Church St with Denison St @	29.1	C		
Church St with Meares St @	19.6	B		
Douro St with Denison St @	20.3	B	21.6	B
Douro St with Gladstone St @	19.7	B		
Douro St with Horatio Street *	10.3	A	10.6	A
Douro St with Inglis St @	8.0	A		
Fairydale Ln with Gladstone St @	6.0	A		
Lewis St with Gladstone St @	12.1	A	13.5	A
Lewis St with Mortimer St @	10.4	A	11.6	A
Perry St with Gladstone St @	9.0	A	10.1	A
Sydney Rd with Industrial Rd @	11.0	A		
Sydney Rd with Lion St and Burrudulla Rd *	18.5	B		
Ulan Rd with Henry Lawson Dr @	8.2	A		

\* Analysed with SIDRA Software      @ Analysed with INTANAL software

# Source: Traffix (2012)

All roundabouts within Mudgee currently operate at a very good level of service "A". The intersection of Church Street with Denison Street, controlled by Give way signs in Denison Street, operates at a level of service 'C' during the afternoon; the RTA guidelines (2002) suggests a requirement of a crash analysis. Only one crash was recorded at this intersection during the five years period ending December 2012. No further action is therefore considered at this stage.

The remaining signed controlled intersections currently operate at a good level of service 'B' or better.

## 4. Future Traffic Conditions in Mudgee

### 4.1 Future Growth in Mudgee

#### 4.1.1 Future Residential Growth

The residential growth in Mudgee over the next ten to fifteen years will take place to the west and south-west and to a lesser extent south of the Township in the following areas illustrated on the next page (yields are approximate):

- 220 lots in North Mudgee
- Some 1,545 lots in the Caerleon, Bellevue Hill and Saleyards area
- 530 lots in South-West Mudgee
- 240 lots in South Mudgee.

These developments will effectively increase the 2011 number of dwellings by about 58 percent as shown in **Table 4.1**.

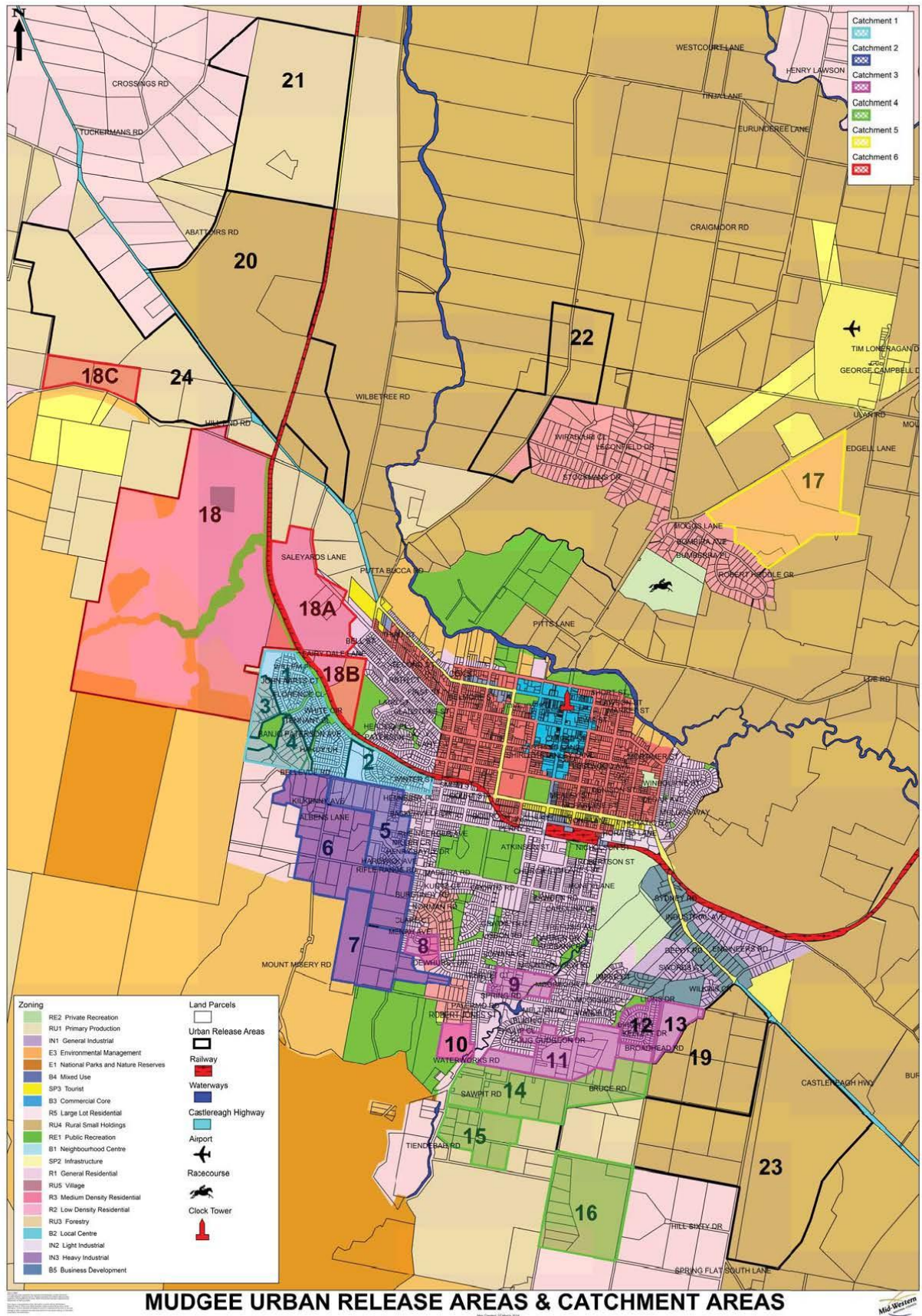
**Table 4.1: Future Residential Releases in Mudgee up to 2032 \***

Zones **	Location	By 2022		By 2032	
		Lots	%	Lots	%
<b>West Mudgee</b>					
1 to 4	Bellevue Hill	15	1%	15	1%
18	Caerleon	955	47%	1235	49%
18A	Saleyards	195	10%	195	8%
18	Fairydale Ln s of Railway X	50	2%	50	2%
18B	Fairydale Ln	50	2%	50	2%
	<b>Sub-Total</b>	<b>1,265</b>	<b>62%</b>	<b>1,545</b>	<b>61%</b>
6	South West Mudgee	300	15%	300	12%
9 to 10,	South West Mudgee	35	2%	35	1%
5 & 7 & 8	South West Mudgee	195	10%	195	8%
	<b>Sub-Total</b>	<b>530</b>	<b>27%</b>	<b>530</b>	<b>21%</b>
13	Yallambee	50	2%	50	2%
11 & 14 & 16	South Mudgee	50	2%	160	6%
19 & 23	Spring Flat/Burrundulla	10	1%	30	1%
	<b>Sub-Total</b>	<b>110</b>	<b>5%</b>	<b>240</b>	<b>9%</b>
17	North Mudgee	120	6%	220	9%
	<b>Total</b>	<b>2,025</b>	<b>100%</b>	<b>2,535</b>	<b>100%</b>
	Existing Lots (2011) *	4,346		4,346	
	<b>Increase %</b>	<b>47%</b>		<b>58%</b>	

\* source: Draft Mudgee Town Structure Plan

\*\* Ref Table 7 of Structure Plan

Thus some 2,535 lots are anticipated to be released and developed by 2032. It should be noted that about 80 percent of development is anticipated by 2022. However, these targets may not be achieved if some proposed mines in the region do not eventuate.



### 4.1.2 Future Industrial Growth

The Draft Mudgee Town Structure Plan (Mid-Western, 2013) assumes the release of some 20 hectares for industrial uses along Hill End Road to accommodate up to 50 lots by 2022. The industrial area designated as zone 18C is also shown on the map.

## 4.2 Trip Generation and Distribution

### 4.2.1 Trips Generation of New Residential Developments

The following trip generation rates for low density residential dwellings in regional areas, included in the RMS Technical Direction N°4A (RMS, 2013) were adopted to estimate the trips generated by the potential residential developments:

- An average of 7.4 vehicles per day per dwelling;
- An afternoon peak hourly rate of 0.78 trip per dwelling; the morning peak hourly rate is lower at 0.71 trip per dwelling.

Thus about 18,600 vehicle trips per day may be generated over the next 15 to 20 years by the potential residential areas in Mudgee. Correspondingly, about 2,000 trips per hour are anticipated during the afternoon peak hour as noted in **Table 4.2**.

**Table 4.2: Trip Generation of Future Residential Releases (2032)**

Location	Zone	Lots	Daily Trips	Afternoon Peak Hour Trips		
				Arrival	Departure	Total
<b>West Mudgee</b>						
Caerleon	18	1,235	9,077	626	337	963
Saleyards	18A	195	1,433	99	53	152
Fairydale Ln S of railway	18	50	368	25	14	39
Fairydale Ln, N of railway	18B	50	368	25	14	39
Bellevue Hill	1 to 4	15	110	8	4	12
<b>Sub-Total</b>		<b>1,545</b>	<b>11,356</b>	<b>783</b>	<b>422</b>	<b>1,205</b>
South West Mudgee	6	300	2205	152	82	234
South West Mudgee	9 & 10	35	257	18	10	27
South West Mudgee	5, 7 & 8	195	1,433	99	53	152
<b>Sub-Total</b>		<b>530</b>	<b>3,896</b>	<b>269</b>	<b>145</b>	<b>413</b>
Yallabee	13	50	368	25	14	39
South Mudgee	11, 14 & 16	160	1,176	81	44	125
Spring Flat/Burrundulla	19 & 23	30	221	15	8	23
<b>Sub-Total</b>		<b>240</b>	<b>1,764</b>	<b>122</b>	<b>66</b>	<b>187</b>
North Mudgee	17	220	1,617	112	60	172
<b>Total</b>		<b>2,535</b>	<b>18,632</b>	<b>1,285</b>	<b>692</b>	<b>1,977</b>

### 4.2.2 Trips Generation of Potential Industrial Developments

The potential industrial area would generate some 1,700 and 200 industrial trips during the day and peak hours respectively based on the following assumptions:

- 20% of the site would be occupied with 25% factory and 75% warehousing
- Factory trip generation rates per 100 m<sup>2</sup> GFA : Daily 5 trips, peak hour 1 trip
- Warehousing trip generation rates per 100 m<sup>2</sup> GFA: Daily 4 trips, peak hour 0.33 trip

### 4.2.3 Distribution of Future Trips

For the purpose of this study, it has been assumed that the trip generated by the future residential lots would have a destination or an origin in accordance to the distribution included in **Table 4.3**. Residential trips have also been allocated to the new Hill End Road industrial area

**Table 4.3: Trip Distribution of Residential Developments**

<b>Destinations</b>	<b>Arrival</b>	<b>Departure</b>	<b>Arrival</b>	<b>Departure</b>
CBD 1	14%	18%	175	121
CBD 2	14%	18%	175	121
Industrial 1 E of Sydney Rd	12%	6%	158	40
Industrial 2 W of Sydney Rd	10%	5%	127	32
Industrial 3 Hill End Rd	12%	6%	158	40
Residential north of railway	5%	7%	70	48
Residential south of railway	5%	7%	70	48
Internal to subdivision	11%	14%	140	97
<b>External Routes</b>				
Sydney Rd, south of Lions Dr	5%	7%	70	48
Ulan Rd, N of Henry Lawson	9%	12%	117	81
Castlereagh Rd, W of Hill End	2%	2%	23	16
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>1,285</b>	<b>692</b>

The number of trips arriving and departing a residential area during the afternoon peak hour are summarised in **Table 4.4**.

**Table 4.4: PM Peak Trip Distribution of Future Residential Areas**

<b>Destinations</b>	<b>West Mudgee</b>		<b>South West</b>		<b>South Mudgee</b>		<b>North Mudgee</b>	
	Dep	Arr	Dep	Arr	Arr	Dep	Arr	Dep
CBD 1	107	71	37	25	13	11	15	11
CBD 2	107	71	37	25	13	11	15	11
Industrial 1 E of Sydney Rd	96	23	33	8	12	4	14	3
Industrial 2 W of Sydney Rd	77	19	26	7	10	3	11	3
Industrial 3 Hill End Rd	96	23	33	8	12	4	14	3
Residential north of railway	43	29	15	10	5	5	6	4
Residential south of railway	43	29	15	10	5	5	6	4
Internal to subdivisions	86	57	29	20	11	9	12	8
<b>External Routes</b>								
Sydney Rd, south of Lions Dr	43	29	15	10	5	5	6	4
Ulan Rd, N of Henry Lawson	71	48	24	17	9	8	10	7
Castlereagh, W of Hill End	14	10	5	3	2	2	2	1
<b>Total</b>	<b>783</b>	<b>408</b>	<b>269</b>	<b>145</b>	<b>97</b>	<b>66</b>	<b>112</b>	<b>60</b>

### 4.2.4 Traffic Assignment

Access to the general road network from the new lots in West Mudgee including Caerleon and the Bellevue Hill estate would generally use Bellevue Road, Fairydale Lane and new road to Hill End Road and the Castlereagh Highway. Access to the South West Mudgee area has been assumed to also be via Bellevue Road and Fairydale Road as well as Rifle Range Road and the extension of Richards Street, then along Henry Bayly Drive.



Access to the South Mudgee area would be gained via Lions Drive and Spring Road, then along Sydney Road, Robertson Road/Madeira Road, Church Street and Oporto Road. Traffic was then assigned to the road network in accordance to the road distribution in **Table 4.5**. Furthermore, all trips were assigned to the higher order roads, arterial and sub-arterial, until close to their destinations.

**Table 4.5: Road Distribution of Future Residential Trips**

	%	Arrival	Departure	Total
<b>West Mudgee</b>				
<b>Bellevue Hill/Fairydale Ln</b>				
Bellevue Road	75.0%	25	13	38
Fairydale Lane	25.0%	8	4	13
<b>Sub-Total</b>	<b>100.0%</b>	<b>33</b>	<b>18</b>	<b>51</b>
<b>Caerleon</b>				
Castlereagh Highway	50.0%	313	169	482
Fairydale Lane/	30.0%	188	101	289
Bellevue Rd	20.0%	125	67	193
<b>Sub-Total</b>	<b>100.0%</b>	<b>626</b>	<b>337</b>	<b>963</b>
<b>Saleyards Rd</b>				
Fairydale Lane/ Bell	80.0%	99	54	153
Castlereagh Highway	20%	25	13	38
<b>Sub-Total</b>	<b>100%</b>	<b>124</b>	<b>67</b>	<b>191</b>
<b>North Mudgee Ulan Rd</b>	<b>100.0%</b>	<b>112</b>	<b>60</b>	<b>172</b>
<b>South West Mudgee</b>				
Bellevue Rd	28.0%	75	41	116
Fairydale Ln	28.0%	75	41	116
Henry Bayly Dr	44.0%	118	64	182
<b>Sub-Total</b>	<b>100.0%</b>	<b>269</b>	<b>145</b>	<b>413</b>
<b>South Mudgee</b>				
Lions / Castlereagh	20.0%	24	13	37
Robertson/ Madeira	20.0%	24	13	37
Spring/ Church	40.0%	49	26	75
Oporto	20.0%	24	13	37
<b>Sub-Total</b>	<b>100.0%</b>	<b>122</b>	<b>66</b>	<b>187</b>
<b>Total</b>		<b>1,285</b>	<b>692</b>	<b>1,977</b>

The additional trips generated by the new release areas at all critical intersections within Mudgee are presented in **Figure 8**.

## 4.3 Traffic Impact of Future Residential Developments

### 4.3.1 Future Traffic volumes

Streets where traffic volumes are expected to considerably increase as a result of the potential new residential releases include Hill End Road, Fairydale Lane, Bell Street, Bellevue Road, Henry Bayly Drive, Madeira Road, Lions Drive and Robertson Street as noted in **Table 4.6**. Roads with highest increases in traffic volumes will be in the vicinity of Caerleon subdivision and Bellevue Estate. Closer to the CBD, Market Street is expected to experience increases by at least 50 percent over the next 15 to 20 years.

**Table 4.6: Daily Traffic Volumes (PCU)**

Street	Location	Existing	Future	% increase
Bell Street	South of Castlereagh	1170	3010	157%
Bellevue Road	west of Henry Bayly Dr	3010	5900	96%
Denison Street	Church Perry	660	1180	79%
Denison Street	Church Lewis	590	950	61%
Douro Street	Denison Gladstone	7970	12120	52%
Fairydale Lane	Gladstone & railway X	1110	6280	466%
Gladstone Street	Church Perry	2780	4440	60%
Gladstone Street	Perry Douro	1810	4500	149%
Gladstone Street	Douro St Cox	2860	6190	116%
Henry Bayly Dr	Baskerville Inglis	1130	2690	138%
Henry Lawson Dr	Ulan Putta Bucca	2300	3940	71%
Hill End Road	south of Castlereagh Hwy	1380	6150	346%
Horatio Street	Perry & Douro	4470	7840	75%
Lions Drive	Sydney & Broadhead	2880	4860	69%
Byron Place	east of Perry	4410	6750	53%
Madeira Road	Grant Church	2840	4330	52%
Madeira Road	Church & Atkinson	2690	4860	81%
Market St	Douro & Court	6800	10450	54%
Market St	Third & Bell	5180	8740	69%
Putta Bucca	north of Castlereagh	570	2210	288%
Robertson St	Trefusis & Madeira	2765	4176	51%

### 4.3.2 Impact on Carriageway Level of Service

The anticipated traffic volumes along all roads during the afternoon peak hour within Mudgee are also summarised in **Appendix D**, together with their appropriate level of service. The assessment of roads has been based on a requirement to achieve no worse than a projected level of service "C".

Locations where the level of service has worsened due to the additional traffic are included in **Table 4.7**.

**Table 4.7: Future Weekday Afternoon Peak Period Levels of Service**

Street	Location	Existing			Future			
		Lanes	N/E	S/W	LoS	N/E	S/W	LoS
Church St	Mortimer & Market	4UP	437	435	A	532	536	B
Church St	Gladstone & Mortimer	4UP	515	525	A	623	639	B
Church St	Mealy & Denison	4UP	486	542	B	545	641	C
Church St	Denison & Gladstone	4UP	495	525	A	554	608	B
Church St	Horatio St & Denison	4UP	411	518	A	471	617	B
Church St	Horatio & Inglis	4UP	411	518	A	459	572	B
Douro St	Denison & Gladstone	4UP	354	443	A	626	586	B
Horatio St	Church & Perry	4UP	335	332	A	417	548	B
Market St	Douro & Court	4UP	312	368	A	451	594	B
Sydney Rd	at Railway Crossing	2U	572	517	A	776	589	B

North of Horatio Street, Church Street would operate at a level of service "B" except for the section between Mealy Street and Denison Street which would operate at still satisfactory level of service "C". Levels of service along Douro Street, Market Street and Sydney Road are expected to slightly worsen to a still good level of service "B". All other roads would continue to operate a very good level of service "A".

Nevertheless, it is also considered necessary to ensure smooth and safe flow of traffic, to widen the sealed pavement in the following streets in conjunction with the future releases:

- Lions Drive to provide two traffic lanes and two parking/cycle lanes;
- Madeira Road to provide two traffic lanes and two parking/cycle lanes;

### 4.3.3 Impact on Intersection Operation

The operational characteristics of all surveyed intersections within Mudgee were then reassessed for the future using the SIDRA and INTANAL software (version 2004.001) as discussed in section 3.5.2. The resultant future delays and levels of service at these intersections are summarised in **Table 4.8**.

The roundabouts at the intersections of Church Street with Horatio Street and with Mortimer Street would operate a good level of service "B". All other roundabouts would continue to operate at very good levels of service "A".

The intersection of Sydney Road with Lions Drive & Burrundulla Road is anticipated to operate at a very poor level of service "F". This is largely due to the extensive delays likely to be experienced by vehicles right turning from Burrundulla Road into Sydney Road. The provision of an exclusive right turning lane (~30m) in Burrundulla Road would improve the operation of the intersection to a level of service "D". However this level of service still indicates a requirement for alternative traffic control such as a roundabout. A roundabout with pedestrian refuges would also considerably improve the safety of this intersection.

The operation of intersection of Horatio Street with Douro Street is expected to worsen and operate at a level of service "C". The provision of a roundabout with pedestrian refuges as suggested in section 5.2.6 would considerably improve the safety of this intersection.

The intersection of Gladstone Street with Douro Street would operate in the future at a very poor level of service "F" if the current traffic controls are retained. The provision of a roundabout with pedestrian refuges at all approaches would be required. This measure would also considerably improve the safety of this location in the vicinity of the High School.

The intersection of Denison Street with Douro Street would operate in the future at a poor level of service "D". The provision of a roundabout with pedestrian refuges at all approaches would be required. This measure would also considerably improve the safety of this location in the vicinity of the High School.

A similar situation would prevail at the intersection of Denison Street with Church Street which would also operate at a poor level of service "D". The provision of a roundabout with pedestrian refuges at all approaches would be required.

**Table 4.8: Future Operation of Intersections in Mudgee**

Intersections	Existing Peak		With Developments	
	Ave Delay	LoS	Ave Delay	LoS
<b>Roundabout Controlled</b>				
Castlereagh Rd with Bell/Putta Bucca Rd *^	12.0	A	13.9	A
Church St with Short St *	12.1	A	12.5	A
Church St with Market St *	13.0	A	13.7	A
Church St with Mortimer St *	13.7	A	16.4	B
Church St with Gladstone St *	11.8	A	12.7	A
Church St with Horatio St *	13.7	A	19.5	B
Church Street with Madeira Rd	8.7	A	9.8	A
Douro St with Market St *	12.4	A	13.5	A
Perry St with Market St *	12.2	A	12.7	A
Perry St with Lovejoy St *	11.0	A	11.8	A
Ulan Rd with Pitt Ln and Lue Rd @	10.8	A	11.8	A
<b>Sign Controlled Intersections</b>				
Bellevue Rd with Henry Bayly Dr @	7.0	A	8.4	A
Castlereagh Rd with Bell Street @	8.2	A	12.0	A
Castlereagh Rd with Putta Bucca Rd *	10.5	A	36.3	C
Castlereagh Road with Hill End Road #	16.4	B	19.1	B
Church St with Denison St @	29.1	C	43.9	D
Church St with Meares St @	19.6	B	24.6	B
Douro St with Denison St @	20.3	B	44.1	D
Douro St with Gladstone St @	19.7	B	>70	F
Douro St with Horatio Street *	11.1	A	35.3	C
Douro St with Inglis St @	8.0	A	9.4	A
Fairydale Ln with Gladstone St @	6.0	A	7.1	A
Lewis St with Gladstone St @	12.1	A	14.0	A/B
Lewis St with Mortimer St @	10.4	A	11.6	A
Perry St with Gladstone St @	9.0	A	11.3	A
Sydney Rd with Industrial Rd @	11.0	A	12.6	A
Sydney Rd with Lion St and Burrundulla Rd *	19.5	B	>70	F
Ulan Rd with Henry Lawson Dr @	8.2	A	10.2	A

\* Analysed with SIDRA Software

@ Analysed with INTANAL software

# Source: Traffix (2012)

^ Assumed roundabout controlled combined intersections

d= Delay in seconds/vehicle of critical approach

LoS= Level of Service

All other unsignalised intersections are expected to operate at a good level of service "B" or better.

Furthermore, to ensure smooth and safe flow of traffic at the following intersections likely to be used by future traffic, the provision of a seagull arrangement, recommended in the previous study (Gennaoui, 2008), is recommended:

- Fairydale Lane with Gladstone Street.
- Madeira Road with Robertson Street

## **5. Assessment of Specific Traffic Matters**

### **5.1 School Buses Related Issues**

The following bottleneck locations affecting buses at schools during the afternoon were raised during the course of the study.

#### **5.1.1 Horatio Street at High School**

The school crossing in Horatio Street at the High School does not have a crossing supervisor. As result students haphazardly and continuously cross Horatio Street resulting in long queues extending along Douro Street past the railway line. Thus any time lag between buses is lost, and by the time buses arrive at the School gate in Perry Street to pick up student, up to 9-10 buses may be queuing in at the same time. The provision of a crossing supervisor would control the flow of children across Horatio Street thus alleviating the backlog in buses accessing the school. The RMS stipulates that a crossing supervisor can only be provided at a primary school. It is therefore suggested that the school be approached to assist in this matter.

#### **5.1.2 Intersection of Perry Street with Gladstone Street**

The Give Way signs in Perry Street at Gladstone Street impeding the smooth flow of traffic along Perry Street. This exacerbates the problem school buses experience as a result of the delays discussed above and which arrive and depart the public school in convoy. On occasion buses due to the delays at Gladstone Street may queue past Denison Street. The relocation of the Give Way signs from Perry Street to Gladstone Street would give priority to traffic along Perry Street to ensure a smoother flow of traffic along Perry Street as well reducing current delays experienced by school buses. It should be noted that Perry Street carries considerably more traffic than Gladstone Street at this location.

#### **5.1.3 St Matthews Catholic School**

Conflicts between parent picking-up children at the St Matthews Catholic School and buses servicing the school. Currently the bus zone can accommodate up to 4 buses (one short). In front of the bus zone there are two unrestricted angle spaces adjacent to two spaces for cars displaying a Mobility Impaired Permit followed by seven (7) spaces with No Parking restrictions from 8.00 to 9.30am and between 2.30 and 4.00pm. During the afternoon pick up period it was observed that four buses arrived and departed between 3.00 pm and 3.30pm, and 15 buses in the following 15 minutes: It was also observed

- Cars picking up children use the "No Parking" areas to do so usually exceeding the available space suitable for only three (3) cars parallel to the kerb; cars then back up on the carriageway obstructing buses from exiting the kerbside lane.
- The first bus in a queue tends to stop about 3 to 4 metres away from the first parked car in order to exit the kerbside lane. It is then further obstructed by cars queuing on the traffic lane to pick up children.

In order to improve the situation it is recommended that consideration be given for the extension of the bus zone to include the two unrestricted angle spaces. This would ensure that four buses can use the bus zone at any one time.

Furthermore, to improve the pick-up of children, consideration could be given for the introduction of a "No Parking" restriction from 2.30 to 4.00pm between the northern driveway to the school and Market Street.

## **5.2 Safety Related Issues**

### **5.2.1 Safety in Mudgee**

The high proportion of crashes involving single vehicles out of control is usually an indication of excessive speed. Better monitoring by the police is required.

### **5.2.2 Church Street north of Meares Street**

Safety problems experienced by pedestrians crossing Church Street between Meares Street and the railway overbridge were raised for consideration in the study.

This section of road carries over 8,900 vehicles per day. Over 15 percent of vehicles exceed the speed limit of 50 km/h (85<sup>th</sup> speed of 53.3 km/h).

One crash involving a pedestrian was recorded in 2002. Since then only one rear end crash with no injury was recorded in this section of Church Street in 2010.

Activities in this section of road were video recorded from 3.45 to 6.15pm. During a two hours period, less than 5 pedestrians were observed crossing Church Street at this location; in addition some two cyclists travelling in a southbound direction crossed over from the eastern to the western side of Church Street. The only observed safety issue of concern related to two children roller skating on the carriageway as well as crossing the street.

There are currently space for about 20 angle spaces on the western side of Church Street and 15 parallel spaces on the eastern side. At most time, some spaces are vacant. Suggestion has been made to provide a pedestrian refuge at this location. Such a measure would result in the loss of up 15 spaces with no substantive benefit.

However, in view of the current speeds, consideration may be given for the provision of slowing devices at this location.

### **5.2.3 Intersection of Horatio Street with Church Street**

In accordance with the recommendation of the previous study (Gennaoui, 2008) pedestrian refuges have been provided on all approaches at the roundabout controlling the intersection of Horatio Street with Church Street. As a result, no crashes involving pedestrians have been recorded during the 2008-2012 period. However, this intersection is still the subject of the largest number of crashes during that period. The majority of these crashes are right angle between vehicles travelling along Horatio Street and entering the roundabout from Church Street; a crash also involved a single car going off the carriageway, probably at high speed.

To resolve this safety problem, serious consideration should be given to increase the deflection of vehicles entering the roundabout from all approaches to ensure they either slow down or even stop before entering the roundabout.

#### **5.2.4 Intersection of Robertson Street with Lions Drive**

Three crashes were recorded at this location from 2008 to 2012. Concern was previously expressed about children crossing Robertson Street and Lions Drive during the afternoon after being dropped by bus (Gennaoui, 2008). Over 15 percent of vehicles travel at speeds in excess of 53 km/h along Robertson Street.

The provision of a pedestrian refuge in Lions Drive, at Robertson Street and in Robertson Street north of Lions Drive would improve the safety of pedestrians crossing at this location. Furthermore, signage advising motorists to slow down to allow safe pedestrian crossing should also be considered. These improvements were recommended in the previous study (Gennaoui, 2008).

#### **5.2.5 Denison Street, between Lewis Street and Church Street**

Concern has been expressed by a resident of this street about the difficulty for children to cross Denison Street. The complainant has advised that traffic has been on the increase but more substantially over the past 3 to 6 months. Cars and trucks including semi-trailers and garbage trucks have been observed cutting the corner from both directions at speed mostly at peak morning and afternoon times.

Three crashes resulting in one injury were recorded in this section of roads including the two intersections. Two of these crashes involved out of control vehicles, inferring high speeds.

The recent increase in traffic along this section of road may be due to the redirection of some traffic as a result of road works in Gladstone Street and Mortimer Street including their intersection with Church Street.

Consideration could be given for the provision of slowing devices in this section of Denison Street. Furthermore, the provision of pedestrian refuges in conjunction with a roundabout at the intersection of Denison Street with Church Street recommended in section 4.4.3 would facilitate the crossing of Denison Street. Following public exhibition of this document, a roundabout at this location is no longer recommended.

#### **5.2.6 Intersection of Horatio Street with Douro Street**

This intersection, subject to the T junction rule, includes a seagull arrangement to separate the northbound through traffic along Douro Street from the right turning movement out of Horatio Street. Notwithstanding, five (5) crashes resulting in five (5) injured persons occurred during the five year period ending 2012. Most crashes involved collisions between cars entering the intersection from Horatio Street with traffic along Douro Street.

The provision of the seagull arrangement appears to give a false sense of security to drivers. The intersection currently operates at a very good level of service "A". In the

future, a level of service "C" is anticipated. The provision of a roundabout with pedestrian refuges would considerably improve the safety of this intersection.

### **5.2.7 Intersection of Ulan Road with Henry Lawson Drive**

The intersection of Henry Lawson Drive with Ulan Road currently operates a very good level of service "A" and is anticipated to do so in the future. A seagull arrangement protects the right turning movement from Henry Lawson Road into Ulan Road. Two crashes resulting in three (3) injuries were recorded at this location in the five years period ending December 2012. Both crashes involved vehicles entering Ulan Road colliding with through traffic along Ulan Road.

### **5.2.8 Intersection of Church Street and Spring Road**

A submission was received during the public exhibition phase of this document with a request for traffic calming or safety measures at this location. It is recommended that this issue be further investigated in consultation with the resident in the area.

## **5.3 Cycleway**

The brief required the investigation of the provision of a dedicated cycle lane from Winter Street to the CBD via the High School, within the existing carriageway.

The existing cycleway is situated at the rear of dwellings fronting Winter Street. It currently terminates at the end of Horatio Street at Douro Street. Following a site inspection, the following route considered suitable for cycling is suggested:

- Existing cycleway at rear of Winter Street be improved and provided with street lighting
- Cyclist would then travel along Horatio Street to Douro Street which is accessed by a narrow path
- Cyclist would continue along Horatio Street to Perry Street then follow Perry Street to Mortimer Street; provision of a route along Douro Street is not considered suitable in view to the narrow carriageway and considerable volume of traffic including heavy vehicles.

The implementation of the proposed cycle route to be further investigated by Council and the local traffic committee would necessitate

- Improving the connection between the existing cycleway and Horatio Street to comply with minimum standards
- The provision of suitable signposting along Horatio Street to Douro Street
- Improving access from the closed section of Horatio Street to Douro Street
- The provision of a safe pedestrian/cyclists crossing of Douro Street at Horatio Street to access the school. Therefore, a pedestrian refuge should be included with the proposed roundabout at this location (refer section 5.2.6).
- Provision of a two way cycleway and suitable signposting on the northern side of Horatio Street between Douro Street and Perry Street.



- Provision of a one way cycleway and suitable signposting on both sides the west and the east (southbound) side of Perry Street to Mortimer Street for northbound and southbound direction respectively; Perry Street has a large pavement which could accommodate the cycleway and parallel parking as well as two traffic lanes.

During public exhibition of this document suggestions from the community that a cycleway continuing out the Ulan Road to the TAFE campus be considered. This suggestion is recommended.

## **5.4 Specific Intersection Related Issues**

### **5.4.1 Intersection of Church Street with Denison Street**

The intersection of Church Street with Denison Street is controlled by Give way signs in Denison Street. It operates a satisfactory level of service 'C' during the afternoon peak period; the RTA guidelines (2002) require a crash analysis to establish if further action is necessary. Only one crash was recorded during the period 2008-2012. This intersection has the worse level of service in Mudgee and requires alternative control such as a roundabout in the near future to considerably improve the situation.

Following the public exhibition phase this recommendation was removed due to community concern. It is recommended that this intersection be monitored for future traffic studies.

### **5.4.2 Intersection of Inglis Street with Douro Street**

This intersection currently operates a very good level of service "A". No crashes were recorded during the five years period ending December 2012. Observation of the intersection did not highlight any specific problem. However as previously recommended (Gennaoui, 2008), the provision of a seagull arrangement would facilitate traffic movements at this location as well as improve safety.

### **5.4.3 Intersection of Gladstone Street with Denison Street**

This intersection operates a very good level of service "A". Only one (1) crash was recorded during the five years period ending December 2012. No injury resulted from that crash. Observation of the intersection showed that a proportion of traffic along Gladstone Street travel at speed in excess to the 50 kmh speed limit. The provision of a seagull arrangement would facilitate traffic movements at this location as well as improve safety. Consideration could also be given for the provision of slowing devices along Gladstone Street as it would be used in the future as an alternative access road to the CBD.

#### **5.4.4 Castlereagh Highway with Bell St and Putta Bucca Rd Intersections**

The proposed new residential and industrial releases in west Mudgee including the major Caerleon subdivision would increase traffic conditions along the Castlereagh Highway as well as along Putta Bucca Road and Bell Street.

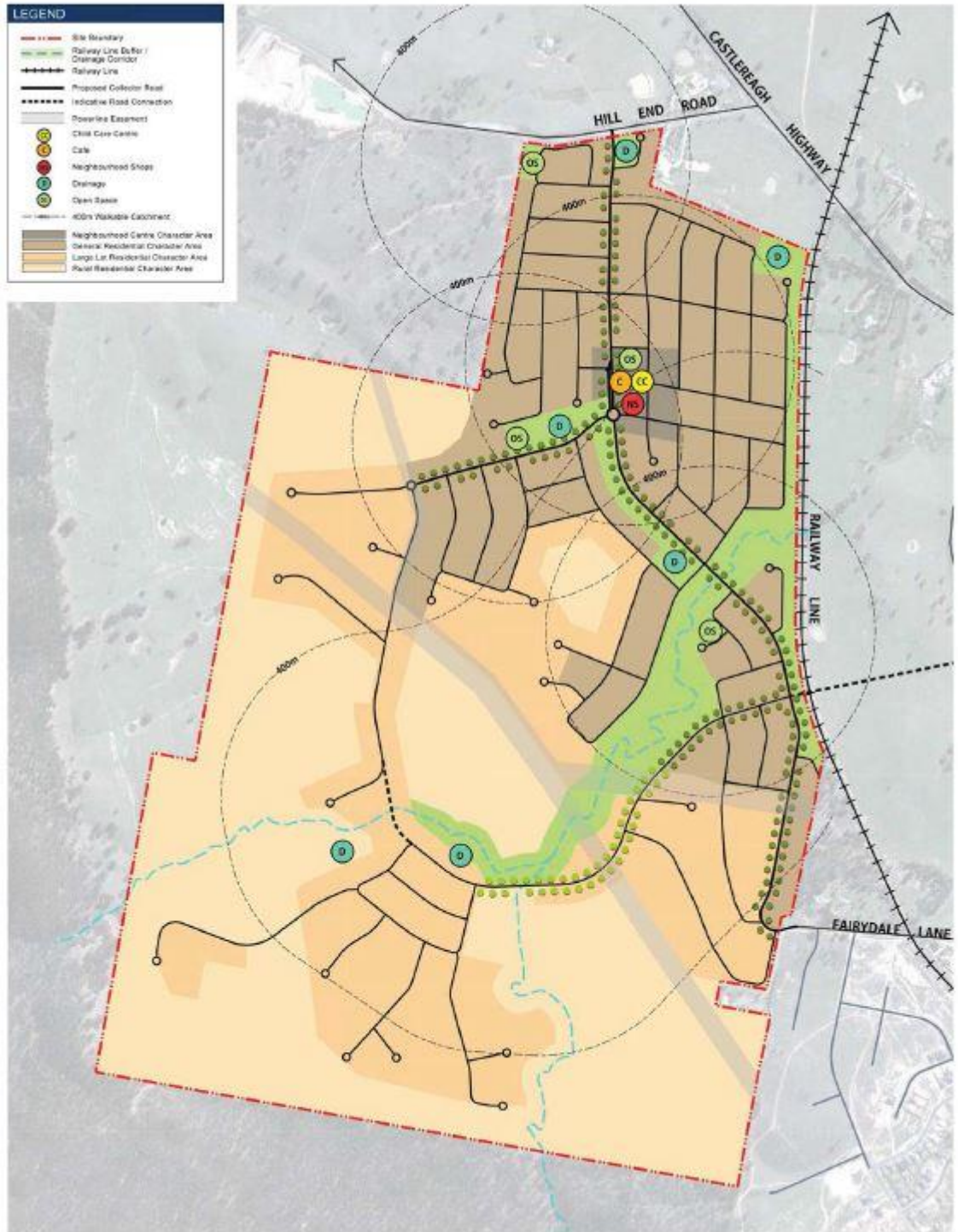
The combined intersections of Castlereagh Highway with Bell Street and with Putta Bucca Road were the location of four (4) crashes resulting in two (2) injuries.

A realignment of Bell Street with Putta Bucca Road at the Castlereagh Highway together with the provision of a roundabout at this location would considerably improve safety as well as facilitate access to both side roads. Such a roundabout would operate at a very good level of service "A". A realignment of the two roads without a roundabout would operate at level of service "C" and would not necessarily improve the safety of this location.

## 5.5 Road Related Matters

### 5.5.1 Road Linkages between CBD and West Mudgee

The Brief requires the investigation of the present linkages between Bellevue Hill Estate and the Caerleon subdivision with the CBD. The proposed Caerleon subdivision is illustrated below. A Spine Road will provide access to Hill End Road to the west and Fairydale Lane to the south.



Access to the CBD from the Caerleon subdivision will be mostly along the Castlereagh Highway and Market Street. Access to the highway will be via Hill End Road and Fairydale Lane/Bell Street. Traffic accessing the CBD would also use Gladstone Street. Traffic accessing schools and the industrial areas to the east of Mudgee may also use Bellevue Road and other streets in South Mudgee.

The developer of the Caerleon subdivision is required to:

- Design the intersection of Hill End Road with the new Spine Road in accordance with clause 34 of the Notice of Determination for the subdivision dated 9 August 2013
- Design the intersection of Hill End Road with the Castlereagh Highway in accordance with clause 35 of the Notice of Determination for the subdivision dated 9 August 2013.

The developers are also required to pay a contribution towards the upgrade of Fairydale Lane to provide two sealed travel lanes (3.25m each), two sealed shoulders (0.5m each) and two unsealed shoulder (1m each). These works would considerably improve access to the highway then onto the CBD. The proposed realignment of Bell Street and Putta Bucca at the Castlereagh Highway and the provision of a roundabout would, when provided, facilitate safe access to both streets. The analysis of future traffic conditions concluded that all roads accessing the CBD from the west would operate a good level of service "B" or better. Furthermore, all intersections along the routes to and from the CBD would operate satisfactory subject to the provision of new roundabouts where identified in section 4.3.3.

### 5.5.2 Ring Road in Mudgee CBD

The brief required the consideration of promoting a ring road around the CBD for through traffic. Based on an assessment of the peak hourly volumes, it has been estimated that non CBD through traffic along Church Street are of the order of 150 and 120 vph in the northbound and southbound direction respectively.

Thus about 2700 vehicles per day or about 25 percent of all traffic along Church Street do not stop in the CBD and could be redirected to a ring road. Three alternative ring road routes were assessed.

**Route 1** – This route would direct through traffic to the west of the CBD along Horatio Street, Douro Street and Short Street. This route is mostly along the Castlereagh Highway. The carriageway along this route currently operates with a very good level of service "A". The redirection of traffic would result in Douro Street operating at still good level of service "B". This route would attract the least objection as it is mostly along the highway.

However, it would necessitate the provision of the three roundabouts at the intersections of Douro Street with Horatio Street, with Denison Street and with Gladstone Street earlier than necessary as a result of future growth.

**Route 2** – As per route 1 and would include Lewis Street and Short Street to the east of the CBD. The Lewis Street and Short Street would attract about 40 percent of traffic travelling along Church Street through the CBD. The carriageway along the eastern route currently operates with a very good level of service “A”; the redirection of traffic would not affect its current level of service of the roadway. The intersections along this route would also continue to operate a good level of service “B” or better. Land uses along Lewis Street include a school, commercial development and residences. Whilst the inclusion of Lewis Street as a bypass road would reduce the impact on Douro Street, it would attract some opposition from residents and the school along it.

It should be noted that Council has adopted Lewis Street as a sub-arterial road to be used as a bypass of the CBD (refer section 5.2.1). Route 2 is therefore supported. Appropriate signage should be placed in Horatio Street at Lewis Street, in Church Street at Short Street and in Market Street at Douro Street advising through traffic to Ulan Road to divert along Lewis Street and Short Street. In the medium to longer term, the provision of a roundabout at the intersection of Horatio Street with Lewis Street may be required.

**Route 3** – As per route 1 but would include Lawson Street and Short Street to the east of the CBD. North of Gladstone Street, the pavement along Lawson Street would require widening to provide two traffic and two parking lanes. The land use along Lawson Street is mostly residential in nature; residents along this road would strongly object to making it a by-pass to the CBD. For these reasons this route is therefore not supported

## 5.6 Traffic Related Matters

### 5.6.1 Problems along Church Street (outside Aldi & Mitre10)

Activities in this section of Church Street were obtained by means of a video recorder (from 3.45 to 6.15pm). No safety or traffic related issue were observed. During that period,

- Very few pedestrians were observed crossing Church Street
- The small delays for traffic travelling along Church Street were due to vehicles accessing an on-street parking space

A total of ten (10) intersection and mid-block crashes were recorded between Denison Street and Mortimer Street during the five year period to 2012. Of these, three (3) crashes occurred in the section between Denison Street and Gladstone Street including one rear-ender and one crash involving a vehicle exiting a driveway. These could be a reflection of impatience or poor sight distance.

### 5.6.2 Traffic Calming in West Mudjee

Fairydale Lane and Banjo Patterson Avenue are likely to experience increased traffic volumes in the future. In order to minimise the impact of this traffic on these streets, traffic calming devices could be provided to ensure speeds along these street remain within safe limits. To be effective, slowing devices would need to be provided on both streets concurrently.

### 5.6.3 Possible Closure of Perry Street between Horatio & Denison Sts

Perry Street carries about 2,180 vehicles per day between Horatio Street and Denison Street of which some 190 vehicles were recorded during the afternoon peak hour. Five crashes were recorded at the intersections of Perry Street with Horatio Street (4) and Denison Street (1).

This section of Perry Street is fronted by the High School to the west and a Park to the east. Vehicular access to the park is provided from Perry Street. A bus zone is provided on the western side of Perry Street for most of its length.

The full closure of this section of Perry Street would result in the diversion of all traffic to either Church Street or Horatio Street. It would also impact on buses currently dropping off and picking up students from the High School. Parking associated with the park and the school would also be affected.

The analysis of existing future traffic conditions concluded that both Douro Street and Church Street would operate a good level of service "B" or better. However, most intersections along these two streets would operate at poor levels of service unless new roundabouts are provided where identified in **section 4.3.3**.

In order to maintain accessibility for buses and patrons of the school and park, and to achieve a safer environment along this section of Perry Street, it is suggested that it be converted into a "shared zone". This measure would require the implementation of the following measures

- Speed limit of 10 kmh
- Provision of entry thresholds in Perry Street at Horatio Street and Denison Street
- Restrict traffic to one way northbound between Horatio and Denison Streets
- Provide angle parking on eastern side of Perry Street
- Retain bus zone on western side of Perry Street

### 5.6.4 Closure of Church Street between Mortimer & Market Streets

A submission was received suggesting the creation of a more pedestrian friendly environment for locals and visitors in Church St between Market Street and Mortimer Street. To achieve this objective, the submission suggested the following:

- The removing of all non-shopping through traffic
- The closure of Church Street at the pedestrian crossing. On-street parking would be mostly retained subject to the provision of a suitable turning area either side of the closure.

This suggestion has the following advantages:

- Minimal effect on shops as parking is mostly retained
- Traffic along Church St is considerably reduced

However, the following disadvantages have been identified which would more than offset the abovementioned benefits:

- Medium to large rigid delivery trucks would find difficult to access the area.
- Increase traffic adjacent to the Catholic school would not be well received.
- Earlier provision of a roundabout at the intersection of Horatio Street with Lewis Street to redirect traffic from Church Street to Lewis Street which is not currently needed.
- Church Street currently carries about 900 vehicles per hour during the peak; most of this traffic. About 60 percent is traffic with an origin or destination within the CBD. Whilst the through traffic may be redirected to Lewis Street, the redirection of the remaining traffic along other already busy CBD streets would not be acceptable.

A possible alternative would be to convert the section of Church Street between Mortimer Street and Market Street to a "shared zone. This measure would require the implementation of the following measures

- Speed limit of 10 kmh
- Provision of entry thresholds in Church Street at Mortimer Street and Market Street
- Retain angle parking on both sides of Church Street

### **5.6.5 Opening of Lovejoy Street to Douro Street**

Lovejoy Street is currently closed between Perry Street and Douro Street some 75m west of Perry Street. It has a divided carriageway with two traffic and two parking lanes. Parking on the eastern section of Lovejoy Street is used by resident as well as visitors to the CBD. The western section of Lovejoy Street is mostly by resident of that street and visitors accessing the park. The opening of Lovejoy Street to Douro Street is generally not supported for the following reasons:

- Considerable increase in traffic along Lovejoy Street to the detriment of residents.
- Right turning access to Douro Street would be difficult thus requiring alternate traffic control. This traffic is better served by using Perry Street and Market Street.

However, if the objective is to divert a large proportion of traffic destined to south and south-west Mudgee directly to Douro Street, consideration may be given by Council to the prohibition of the right turning movement to and from Lovejoy Street at Douro Street.

### **5.6.6 Closure of Perry Street North of Market Street**

A submission was received expressing concerns about traffic congestion at the roundabout controlling the intersection of Market Street with Perry Street, more particularly the queue in Perry Street extending to the Big W access.

The closure of Perry Street north of Market Street was suggested as a mean to improve traffic flows at the roundabout and provide a smooth traffic flow into the Big W car park. Angle parking is permitted on the western side of this section of Perry Street. Two narrow traffic lanes provide access to the Big W car park.

This suggestion has the following advantages:

- Traffic along Perry Street would be reduced.
- The operation of the roundabout would improve.

However, this closure is not supported for the following reasons:

- This closure would redirect all traffic accessing the Big W car park to do so via Short Street.
- Most of the traffic using this section of Perry Street non-stop between Market Street and Short Street would need to relocate to Market Street east of Perry Street then Church Street; this situation is not acceptable.
- The junction of Perry Street with Short Street would be impacted.
- The operation of Big W is better served with two access roads.
- The section of Perry Street north of Market Street may need to be widened with the possible loss of on-street parking.

### **5.6.7 South Mudgee Surgery Medical Centre in Oporto Road**

The South Mudgee Medical Centre situated near the Southside Shopping Centre is located on the eastern side of Oporto Street. A pedestrian refuge is in place near the access driveways. This section of road carries about 2,100 vehicles per day, about 5 percent of which are heavy vehicles. Over 15 percent of vehicles exceed the speed limit of 50 km/h (85<sup>th</sup>le speed of 54.7 km/h). This situation has the potential for increased conflicts between pedestrians crossing Oporto Street and vehicles along this road. Consideration should therefore be given for the provision of slowing devices at this location.

## **5.7 Railway Crossings**

The brief required the investigation of a potential opening of the railway crossings to traffic, particularly at Cox Street.

### **5.7.1 Existing Situation**

The existing railway line connects Lithgow to Gulgong and beyond via Mudgee. There are currently no passenger trains to and from Mudgee; the Railway Station has been converted to a Restaurant.



Through Mudgee it is crossed at the following four locations:

- Along Church Street, via an overbridge between Inglis Street and Meares Street;
- Along Sydney Road about 500m south of Horatio Street controlled by “flashing lights and bells”;
- Along Douro Street between Horatio Street and Inglis Street controlled by “flashing lights and bells”;
- Along Fairydale Lane, west of Gladstone Street, controlled by “Stop” signs.

None of the three at-grade railway crossings are controlled by boom gates. Railway crossings at Cox Street and Court Street are closed to traffic.

The lack of railway crossings to access South Mudgee has been of major concern to residents particularly in the context of future developments in the south west area of Mudgee. The potential increase in traffic accessing the CBD would travel past the Mudgee High School along Douro Street and Horatio Street, thus conflicting with the high number of students walking to and from the school and crossing these two roads.

### 5.7.2 Future Conditions at Railway Crossings

The existing and future daily volumes along the four existing railway crossings are summarised in **Table 5.1**.

**Table 5.1: Existing and Future Traffic at Railway Crossings**

Railway Crossings	Daily Volumes PCU			Future PM Peak vph		
	Existing	Future	% increase	N'bnd	S'bnd	LoS
Church Street	9,290	10,310	11%	459	572	A
Douro Street	6970	9,740	40%	400	574	A
Fairydale Lane	1,110	6,280	466%	232	396	A
Sydney Road	10,890 ,	13,650	25%	776	589	A

The development of the Caerleon Estate and other development in West Mudgee such as the Bellevue Estate would increase traffic along an improved Fairydale Lane at the railway crossing. It is therefore recommended that in the event the railway line is used in the future, “flashing lights and bells” be provided at that crossing together with boom gates. Boom gates should also be considered at the Sydney Road and Douro Street railway crossings.

### 5.7.3 Opening of Cox Street Railway Crossing

Suggestions have been made for the re-opening of the Cox Street and Court Street railway crossings. The re-opening of the Cox Street railway crossing would effectively divert in the future traffic of the order of 1,000-2,000 vpd from the Douro Street crossing to Cox Street. It may also divert some traffic from Fairydale Lane. A similar situation could occur if Court Street was reopened to traffic. The reopening of both Cox Street and Court Street would increase to a lesser extent traffic in both streets. During the afternoon peak about 180 vehicles per hour are anticipated at the railway crossing.

An assessment of the impact of the opening of the railway crossing at Cox Street on nearby intersections was carried out. Traffic volumes were generally redirected from Douro Street to Cox Street, Market Street and Gladstone Street. The result of this analysis is included in **Table 5.2**.

**Table 5.2: Impact on Intersections of Opening Cox Street Railway Crossing**

Intersections	Existing		Future		Cox St Opened	
	Ave Delay	LoS	Ave Delay	LoS	Ave Delay	LoS
<b>Roundabout Controlled</b>						
Douro St with Market St *	12.4	A	13.5	A	13.7	A
<b>Sign Controlled Intersections</b>						
Douro St with Horatio Street *	11.1	A	35.3	C	27.7	B
Douro St with Gladstone St @	19.7	B	>70	F	40.5	C
Douro St with Inglis St @	8.0	A	9.4		8.7	A
Inglis Street with Cox Street @					7.4	A

\* Analysed with SIDRA Software

@ Analysed with INTANAL software

With the opening of Cox Street

- The intersection of Douro Street with Market Street would only be slightly affected and would continue to operate at very good level of service "A".
- The intersection of Douro Street with Horatio Street would considerably improve and would operate at the upper level but still good level of service "B".
- The intersections of Inglis Street with Cox Street and with Douro Street would operate at a very good level of service "A".
- The intersection of Gladstone Street with Douro Street would improve in the future; however, it would still operate at a level of service "C". The provision of a roundabout with pedestrian refuges at all approaches as previously recommended would still be required. This measure would also considerably improve the safety of this location in the vicinity of the High School.

Whilst traffic conditions along Douro Street in the proximity of the High School and Fairydale Lane would improve, residents along Cox Street and Court Street may not favour the increase of traffic along their streets. Furthermore, Douro Street forms part of the highway and functions as an arterial road.

The reopening of either Cox Street at the railway crossing is not considered necessary from a traffic point of view. However, as this matter has been raised in the past, Council may consider as development take place in west and south-west Mudgee, the need to provide an additional railway crossing by reopening Cox Street.

The level of support or opposition to the reopening of Cox Street would be better assessed during the public exhibition phase. Council received a number of submissions supporting the opening of Cox Street during the public exhibition period of the document. Council should pursue this avenue in order to provide another access to south Mudgee.

## 6. Road Hierarchy & Truck Routes

### 6.1 Basis of Road Hierarchy

#### 6.1.1 Functional Classification of Roads

The adoption of a hierarchy of roads for the urban area of Mudgee provided Council with a powerful planning tool. Any changes proposed to the existing road hierarchy in this study were selected so that the roads would better serve their designated function. The planning of the road network should ensure that unacceptable combinations of traffic/road design and urban environment/land development are avoided.

The functional classification of roads in the town gives consideration to the following two competing goals:

- the provision of reasonable living and environmental conditions; or
- the provision of reasonable mobility for movement of people and goods in road vehicles.

The first consideration is the preservation of environmental quality, especially in residential areas. In traffic terms, it is the adequate provision for vehicle access to/from the land uses served by the roads.

The second consideration recognises the need to making adequate provisions for the safe and efficient movement of vehicles to, from and through the city. In the Mudgee context, there are large vehicle movements to/from the major traffic generators such as the industrial areas and the Mudgee Town Centre.

The hierarchy of roads is composed of four basic road classes. They are arterial, sub-arterial, collector and local roads which are in decreasing order of importance for traffic efficiency and with increasing emphasis on local amenity. The terms relevant to functional classification of roads are defined as follows:

- **arterial roads** - predominantly carry through traffic from one region to another forming principal avenues of communication for urban traffic movements;
- **sub-arterial roads** - connect the arterial road to areas of development or carry traffic directly from one part of a region to another. They may also relieve traffic on arterial roads in some circumstances;
- **collector roads** - connect the sub-arterial roads to the local road system in developed areas; and
- **local roads** - are the sub-divisional roads within a particular developed area. These are used solely as local access roads.

The functional hierarchy of roads defines the real purpose of each road in an urban area. A road can serve more than one type of traffic movement, but the predominant use should be determined and then the appropriate design standards and traffic management measures can be selected.

The main reasons for the orderly grouping of roads into a hierarchy are:

- to establish a logical, integrated network which brings together all roads and streets of similar function under the one classification because of their traffic service;
- to group together those roads and streets which require the same general level of design and operation;
- to provide a basis to assist in assigning responsibility for each class of road and street to the level of government having the greatest basic interest; and
- to provide a rational basis for longer term works programming, improvement priorities and financial planning.

It must be remembered that the road itself is not classified, but rather the character of the traffic proposed to use it. Once a road hierarchy has been adopted, it can then be used as the frame of reference for its implementation:

- in the management of traffic on existing roads; and
- in the design of new roads.

### 6.1.2 Benefits of the Road Hierarchy Strategy Plan

The development of a Road Hierarchy Strategic Plan for Mudgee to service the existing and future growth of the Township:

- enables the adoption of appropriate standards of design and construction for the various streets in the area;
- enables the preparation of a priority program of works to implement the hierarchy;
- Provides Council with a sound basis for future traffic, transport and land use planning, as well as:
  - provides a logical basis for the operation of the road network;
  - enables an appropriate and efficient traffic management schemes to be implemented in local residential precincts, shopping centres and industrial zones;
  - assists the local traffic committee to consider the effect of its decisions on the surrounding area;
  - provides an input in Local Environment Plans.

## 6.2 Review Road Hierarchy

### 6.2.1 Existing Adopted Road Hierarchy

Council has adopted the functional classification for streets within Mudgee recommended in the previous study. It is illustrated in **Figure 9** and described below:

#### *Arterial Roads*

- Sydney Road
- Horatio Street, east of Douro Street
- Douro Street, between Horatio Street and Market Street
- Market Street, west of Douro Street

***Sub-Arterial Road***

- Church Street, between Spring Road and Gladstone Street
- Douro Street, north of Market Street
- Douro Street, between Madeira Road and Horatio Street
- Henry Lawson Drive
- Lewis Street, north of Horatio Street
- Lions Drive
- Lue Road
- Short Street, between Lewis Street and Douro Street
- Ulan Road

***Major Collector Roads***

- Bellevue Road
- Gladstone Street, between Lewis Street and Denison Street
- Henry Bayly Drive, north of Rifle Range
- Inglis Street, west of Douro Street
- Madeira Road, between Robertson Street and Henry Bayly Drive
- Oporto Road, north of Lisbon Road
- Putta Bucca Road
- Robertson Street, between Spring Street and Madeira Road
- Spring Road, between Robertson Street and Oporto Road

***Minor Collector Roads***

- Denison Street, between Cox Street and Burrundulla Avenue
- Dewhurst Drive
- Fairydale Lane
- Gladstone Street, between Denison Street and Fairydale Lane
- Henry Bayly Drive, south of Madeira Road
- Mortimer Street, between Cox Street and Douro Street
- Mortimer Street, between Lewis Street and Mulgoa Way
- Redbank Road/ Trefusis Avenue
- Rifle Range Road

***CBD Roads***

- Market Street, between Douro Street and Lewis Street
- Mortimer Street, between Douro Street and Lewis Street
- Church Street, between Gladstone Street and Short Street
- Perry Street, between Gladstone Street and Short Street

***Local Roads***

- All other roads

## 6.2.2 Proposed Road Hierarchy

In reviewing the adopted Road Hierarchy for Mudgee, a range of options have been tested based on the following broad objectives:

- create a safer residential environment;
- minimise conflicts between through and local traffic and pedestrians;
- maximising environmental opportunities.

Based on the traffic analysis and the location of major new residential releases and the inter-connections of roads, the proposed road hierarchy illustrated in **Figure 10** is recommended. In essence it is similar to the current road hierarchy shown in **Figure 9** with the following addition and amendments:

### *Sub-Arterial Roads*

- Hill End Road

### *Major Collector Roads*

- Banjo Patterson Avenue (from local)
- Bell Street (from local)
- Fairydale Lane (from minor collector)
- Gladstone Street, between Denison Street and Fairydale Lane (from minor collector)
- Spine Road in Caerleon Subdivision

### *Minor Collector Roads*

- Bellevue Road, west of Banjo Patterson Avenue (from major collector)

## 6.3 Implementation of Road Hierarchy

### 6.3.1 Approach for Implementation

The approach to management of traffic, on each road of the street network within Mudgee depends on its function and that road's physical characteristic.

For local access streets, with abutting residential land use, the emphasis should be on the provision of a safe and pleasant environment for residents. Traffic measures should be aimed at discouraging through traffic and possibly excluding it from some areas entirely.

On the other hand, for Arterial roads, the emphasis should be to facilitate large traffic movements, and management aimed, primarily, at providing an efficient and safe facility for these traffic movements.

On Collector and Sub-arterial roads, the objective should be to obtain a balance between providing for traffic and preserving the amenity of residential areas.

The adoption of a Traffic Management Plan for Mudgee:

- will give an opportunity to co-ordinate traffic planning and engineering works with the projected council budgets and road maintenance programs;
- will give logical reasons for a program of works in each part of the Township;
- will assist in counteracting the pressures from local residents to undertake studies in each of their areas as soon as possible.

### 6.3.2 Standard of Construction

The standard of construction of each street within the road network depends on its function within the Hierarchy, existing and likely traffic volumes, abutting land use and access to properties. Council's DCP stipulates for urban roads in new developments the construction standards included in **Table 6.1**; these are considered appropriate for Mudgee.

**Table 6.1: Construction Standards in Mudgee Urban Areas**

Road Type	Road Reserve	Carriageway	Nature Strip	Footpath	Kerb Type
Minor Road- Cul-de-sac serves $\leq 10$ dwellings	16m	8m	2x4m	No	Roll-over
Residential Road – serves 31-120 dwellings	18m	9m	2x4.5m	1x1.2m	Roll-over
Major Residential Road (collector road) - serves > 120 dwellings	20m	11m	2x4.5m	1x1.2m	Roll-over
Sub-arterial Road –Bus Route and/or cycle lane (on one side only)	22m	13m	2x4.5m	2.5m	Barrier
Commercial & Industrial subdivision roads	24m	13m	2x5.5m	1x1.2m	Barrier/ Roll over

Source: Mid-Western Council (2013c)

Aspects which should be kept in mind when using **Table 6.1** are listed below:

- whilst the pavement width between kerb depends on the type of road the road reserves in existing roads should be retained;
- on-street parking would still be possible; the adoption of the above standards should not preclude the provision of angle parking where possible.

## 6.4 Heavy Vehicle Route Network

### 6.4.1 Truck Movements in Mudgee

Trucks can currently travel along most streets in Mudgee. Trucks travelling non-stop through Mudgee mostly travel along the Castlereagh Highway.

The proportion of heavy vehicles along the Castlereagh Highway and along some of the major Council's roads which carry over 100 trucks on weekdays are summarised in **Table 6.2**. A review of the counts indicates that:

- The Castlereagh Highway carry the highest number of trucks in Mudgee with over 750 and 400 trucks previously recorded along Horatio Street and Market Street respectively.
- The highest daily number of trucks recorded at the recently surveyed sites travelled along Perry Street (~400 trucks) near the CBD.
- Other streets carrying over 100 trucks include Church Street and Lewis Street

**Table 6.2: Daily Traffic Volumes and Proportion Heavy Vehicles (weekday)**

Street	2014 Study			2008 Study		
	Total	HV	%	Total	HV	%
<b>Along Castlereagh Highway</b>						
Douro Street, N of Gladstone St				7,063	480	6.8%
Horatio Street, near George St				8,535	768	9.0%
Horatio Street, W of Perry St				4,177	418	10%
Market Street, W of Douro St				5,290	428	8.1%
Market Street, E of Bell St				4,917	393	8.0%
Sydney Road at Railway X				8,536	640	7.5%
<b>Along Council's Road</b>						
Bellevue Road, W of Henry Bayly Dr				1,326	106	8.0%
Church St 100m north of Meares S	8911	187	2.1%	7818	109	1.4%
Church Street, N of Denison St				10,059	282	2.8%
Church Street, N of Market St				4,685	192	4.1%
Douro Street at Railway X				5,266	153	2.9%
Lewis Street, N of Gladstone St				3,627	254	7.0%
Lewis Street, S of Denison St				2,827	277	9.8%
Madeira Rd @ school	2949	192	4.2%	2763	53	2.1%
Market St 20m west of Perry	3117	272	3.3%			
Market St 50 east of Perry	5561	109	2.9%			
Market Street, E of Church St				2,141	122	5.7%
Oporto Road 15m N Havilah	2094	105	5.0%			
Perry 10m north of Market	2606	287	11.0%			
Perry 50m N of Mortimer	5449	392	7.2%			
Perry 50m south of Market	5617	230	4.1%	4837	131	2.7%
Perry Street, north of Horatio St	2174	100	4.6%			
Putta Bucca Rd 30m E of Chestnut Cl	1013	111	11.0%			
Robertson St, N of Abernethy	2765	102	3.7%	1911	124	6.6%
Short Street, E of Church St				2,124	204	9.6%
Short Street, E of Douro St				1,500	151	9.7%

#### 6.4.2 Future Industrial Traffic

The following assumptions were used to estimate the daily trip generation of the potential new industrial area off Hill End Road:

- 20% of the site would be occupied with 25% factory and 75% warehousing
- Trip generation rates for factory component: 5 trip per 100 m<sup>2</sup> GFA
- Trip generation rates for warehousing component: 4 trip per 300 m<sup>2</sup> GFA
- About 12 percent of daily trips are made by trucks

Thus about 1,700 industrial trips would be generated on a typical weekday including about 200 trucks. This traffic would use the Castlereagh Highway and Hill End Road to access the proposed industrial area.



### 6.4.3 Objectives of a Truck Route Network

A designated truck route network for the Mudgee Township should generally achieve the following objectives:

- Trucks servicing the residential area and neighbourhood centres in Mudgee should use the Castlereagh Highway for most of their trip
- Intrusion of trucks in residential area should be minimised
- Trucks should not travel through the CBD unless picking up or delivering goods
- B-double trucks travelling through Mudgee should be restricted to the Highway.

### 6.4.4 Proposed Truck Route Network

The recommended Truck Routes Network, illustrated in **Figure 11**, addresses the objectives stipulated above. In summary the proposed Truck Route Network for Mudgee would include the roads noted below.

#### *B-double Route (All trucks)*

- Castlereagh Highway along Market Street, Douro Street, Horatio Street and Sydney Road
- Short Street, from Douro Street to Church
- Ulan Road
- Hill End Road
- Industrial Road
- Depot Road

#### *Designated Truck Route (All trucks, except B-Double)*

- Lewis Street, from Horatio to Short Street
- Short Street, from Lewis to Church Street
- Putta Bucca Road
- Henry Lawson Drive, between Putta Bucca Road and Ulan Road

#### *Low Tonnage Routes (Rigid Trucks Only) accessing Residential Areas*

- Lions Drive
- Robertson Street, between Madeira Road and Spring Road
- Madeira Road
- Church Street
- Spring Road
- Henry Bayly Drive, between Madeira Road and Bellevue Road
- Bellevue Road

#### *Other Streets (Only for direct delivery & pick up of goods)*

### 6.4.5 Implementation of Truck Route Network

In order to attract and encourage heavy vehicles to use the proposed Truck Routes Network, the implementation of the Truck Route Network should include

- Suitable sign posting of each Truck Route
- Appropriate advertising of the proposed scheme within and outside the Town.
- An assessment of the suitability of the pavement of each designated road to carry the anticipated volume of trucks and improved where necessary.

## 7. Draft Traffic Management Plan

### 7.1 Policy Matters

- Council adopts the road hierarchy illustrated in **Figure 10** together with the road standards included in **Table 5.1** for the Mudgee urban area including new subdivisions.
- Council promotes a ring road system around the CBD which includes Horatio Street, Douro Street, Short Street and Lewis Street.
- Council adopts the Truck Route Network, illustrated in **Figure 11** together the following:
  - Provision of suitable sign posting of each Truck Route
  - Implementation of an appropriate advertising program.
  - An assessment of the suitability of the pavement of each designated road to carry the anticipated volume of trucks and improved where necessary.
- Council to explore the need or the reopening of the railway crossing at Cox Street.
- Police to enforce speed limit at all locations with excessive speeding problems and safety related issues.

### 7.2 Recommended Improvements

#### 7.2.1 Immediate Improvements (within two years)

The following improvements, illustrated in **Figure 12**, are recommended for implementation in the immediate term.

##### *Bus Related Matters*

- Approach the High School to assist with the supervision of students using the crossing in Horatio Street.
- Relocation of the Give Way signs from Perry Street to Gladstone Street
  - Extend bus zone in Lewis Street at the Catholic School with the introduction of No Parking restrictions from 2.30 to 4.00pm, between the northern driveway to the school and Market Street.

##### *Safety Matters*

- Increase the deflection of vehicles entering the roundabout from all approaches at the intersection of Horatio Street with Church Street
- Provision of slowing devices in
  - Church Street north of Meares Street
  - Denison Street between Lewis Street and Church Street
  - Oporto Street at the Southside Shopping Centre

##### *Pedestrian Improvements*

- Installation of pedestrian warning signage advising motorists to slow down at the intersection of Robertson Street with Lions Drive.
- Provision of a pedestrian refuge in Lions Drive, at Robertson Street and in Robertson Street north of Lions Drive.

- Investigate relocating the pedestrian crossing in Perry Street near the intersection of Denison Street further to the south in consultation with the schools.
- Request RMS consider warrants for a pedestrian crossing on Douro south of the railway line and before the intersection of Inglis Street

### 7.2.2 Short Term (within 5 years)

The following improvements, illustrated in **Figure 12**, are recommended for implementation in the short term:

#### *Cycleway*

- Provision of a dedicated cycleway from Winter Street to the CBD via the High School incorporating the following works:
  - Improving the connection between the existing cycleway and Horatio Street to comply with minimum standards
  - The provision of suitable signposting along Horatio Street to Douro Street
  - Improving access from the closed section of Horatio Street to Douro Street
  - Provision of a safe pedestrian/cyclists crossing of Douro Street at Horatio Street to access the school
  - Provision of a two way cycleway and suitable signposting on the northern side of Horatio Street between Douro Street and Perry Street.
  - Provision of a cycleway and suitable signposting on both sides of Perry Street to Mortimer Street for northbound and southbound direction respectively.
- Provision by line marking of two traffic lanes and two cycle lanes along
  - Lions Drive between Sydney Road and Robertson Street
  - Madeira Road

#### *Road Improvements and Traffic Measures*

- Provision of traffic calming devices such as entry and mid-block thresholds along Madeira Road, between Douro Street and Henry Bayly Drive.
- Provision of a seagull arrangement (that is the right turning movements are protected from through traffic) at the following intersections:
  - Madeira Road with Robertson Street
  - Inglis Street with Douro Street
- During the public exhibition phase of this document a submission was received to consider kerb blisters at the intersection of Lewis and Mortimer Streets with a longer term view of a roundabout at this location. This suggestion is supported.

#### *Pedestrian Improvements*

- Provision of a Shared Zone in Perry Street between Horatio Street and Denison Street including the implementation of the following:
  - Speed limit of 10 kmh
  - Provision of entry thresholds in Perry Street at Horatio Street and Denison Street

- Restrict traffic to one way northbound between Horatio and Denison Streets
  - Provide angle parking on eastern side of Perry Street
  - Retain bus zone on western side of Perry Street
- Provision of a Shared Zone in Church Street between Mortimer Street and Market Street including the implementation of the following:
  - Speed limit of 10 kmh
  - Provision of entry thresholds in Church Street at Mortimer Street and Market Street
  - Retain angle parking on both sides of Church Street

#### ***Caerleon Subdivision Requirements under VPA***

- Sealing the pavement of Fairydale Lane between Gladstone Street and the new access to Bellevue Hill Estate, to provide two traffic lanes and two cycle lanes. Developers to pay a contribution towards the upgrade of Fairydale Lane to provide two sealed travel lanes (3.25m each), two sealed shoulders (0.5m each) and two unsealed shoulder (1m each).
- Developer to design and construct the intersection of Hill End Road with the new Spine Road in accordance with clause 34 of the Notice of Determination for the subdivision dated 9 August 2013
- Developer to design and construct the intersection of Hill End Road with the Castlereagh Highway in accordance with clause 35 of the Notice of Determination for the subdivision dated 9 August 2013.

### **7.2.3 Medium Term (5 to 10 years)**

The following improvements, also noted in **Figure 12**, are recommended for implementation in the medium term.

#### ***Road Improvement***

- Realignment of the intersections of Bell Street and Putta Bucca Road at Castlereagh Highway together with the provision of a roundabout.

#### ***Traffic Measures***

- Provision of a roundabout with pedestrian refuges at the following intersections:
  - Sydney Road with Burrundulla Road and Lions Drive
  - Douro Street with Denison Street
  - Douro Street with Horatio Street
  - Horatio Street with Lewis Street
  - Industrial Avenue and Sydney Road
- Provision of a seagull arrangement at the following intersections:
  - Fairydale Lane with Gladstone Street
  - Gladstone Street with Denison Street
  - Provision of slowing devices at the following locations:
    - Gladstone Street between Fairydale Lane and Cox Street
    - Fairydale Lane
    - Banjo Patterson Avenue
    - Construct safety improvements at the Church Street and Spring Road intersection in consultation with the resident.

*Cycleway*

- Extending our Ulan Road to entrance of TAFE campus

**7.2.4 Long Term (over 10 years)**

The following improvements are recommended for implementation in the long term if a coal mine proceeds and coal freight trains travel through Mudgee:

- Provision of boom gates with “flashing lights and bells” at the Fairydale Lane crossing.
- Provision of boom gates at the Sydney Road railway crossing
- Provision of boom gates at the Douro Street railway crossing.
- A roundabout is also recommended at the intersection of Mortimer and Lewis Streets following a submission that was received during public exhibition of this document.

## 7.3 Funding Recommended Improvements

The source of funding for the recommended improvements can be categorized as follows:

- Through a section 94 contribution plan for improvements required as a direct result of future developments.
- Through specific funding agreements such as the Caerleon Estate
- Funding from other sources (eg coal mines)
- By Council and RMS for projects which are currently required and not directly attributed to future releases such as safety related matters.

### 7.3.1 Section 94 Contribution Plan

All recommended improvements included in **Table 7.1** in section 7.7.2 could be subject to a Section 94 Contribution Plan.

### 7.3.2 Specific Funding Agreements

The cost of the following improvements will be met in accordance with a Voluntary Planning Agreement (VPA) between Council and the Caerleon Estate:

- Sealing the pavement of Fairydale Lane between Gladstone Street and the new access to Bellevue Hill Estate, to provide two traffic lanes and two cycle lanes. Developers to pay a contribution towards the upgrade of Fairydale Lane to provide two sealed travel lanes (3.25m each), two sealed shoulders (0.5m each) and two unsealed shoulder (1m each).
- Developer to design and construct the intersection of Hill End Road with the new Spine Road in accordance with clause 34 of the Notice of Determination for the subdivision dated 9 August 2013
- Developer to design and construct the intersection of Hill End Road with the Castlereagh Highway in accordance with clause 35 of the Notice of Determination for the subdivision dated 9 August 2013.
- The developer is also contributing other money for water and sewer upgrades.

### 7.3.3 Funding from Other Sources

The following improvements, to be funded by coal mines in the event coal freight trains travel through Mudgee:

- Provision of boom gates with “flashing lights and bells” at the Fairydale Lane crossing.
- Provision of boom gates at the Sydney Road railway crossing
- Provision of boom gates at the Douro Street railway crossing.

### 7.3.4 Funding by Council or RMS

All other improvements stipulated in section 7.1 and 7.2 should be funded by Council and/or the RMS.

## 7.4 Input in Section 94 Contribution

Council cannot possibly fund all of the needed road improvements in time to meet the demands of the new developments, particularly with the other demands for rate-payers funds. Therefore, Council needs to seek contributions from the developers to assist in the implementation of road and traffic improvements required as a direct result of these developments.

The contribution to road and traffic improvements allocated to a new development should be based on the estimated use of road and intersection capacity by the traffic generated by that development. The cost allocation approach adopted has been based on the following:

- use of the measure (peak vehicle trips) that creates the need for increased road and intersection capacity requiring their improvement;
- use of peak hour traffic as the controlling factor in terms of the need for road and traffic improvements;
- establishment of a standard for road and intersection level of service considered as the upper limit for traffic congestion;
- allocation of only the costs associated with the road and intersection improvements required by the additional traffic generated by all new developments.

The improvements included in **Table 7.1** could be included as part of a section 94 Contribution applicable to the future releases assumed in this study. The costs, provided by Council, included in the table are only estimates which should be firmed up following preliminary design.

The cost of all recommended improvements which could form part of a contribution plan has been estimated at about \$7,010,000.

**Table 7.1: Costs of Improvements Subject to a Contribution Plan**

<b>Immediate Improvements</b>	<b>Estimated Costs</b>
Provision of a pedestrian refuge in Lions Drive, at Robertson Street and in Robertson Street north of Lions Drive with appropriate warning signs.	\$20,000
<b>Short Term Improvements</b>	
Linemark Lions Drive for two traffic lanes and two parking/cycle lanes.	\$10,000
Linemark Madeira Road for two traffic lanes and two parking/cycle lanes	\$10,000
Provision of traffic calming devices along Madeira Road, between Douro Street and Henry Bayly Drive.	\$20,000
Provision of a seagull arrangement at the intersection of Madeira Road with Robertson Street	\$100,000
Provision of a seagull arrangement at the intersection of Inglis Street with Douro Street	\$100,000
Construct kerb blisters at intersection of Mortimer and Lewis Street	\$190,000
<b>Medium Term</b>	
Realignment of the intersections of Bell Street and Putta Bucca Road at Castlereagh Highway together with the provision of a roundabout	\$950,000
Provision of a roundabout with pedestrian refuges at the intersection of Sydney Road with Burrundulla Road and Lions Drive	\$950,000
Cycleway extending our Ulan Road to entrance of TAFE campus	\$240,000
Construct safety improvements at the Church Street and Spring Road intersection	\$50,000
Provision of a roundabout with pedestrian refuges at the intersection of Douro Street with Denison Street	\$950,000
Provision of a roundabout with pedestrian refuges at the intersection of Douro Street with Horatio Street	\$950,000
Provision of a roundabout with pedestrian refuges at the intersection of Horatio Street with Lewis Street	\$950,000
Provision of a roundabout at the intersection of Industrial Avenue and the Sydney Road was also preferred.	\$950,000
Provision of a seagull arrangement at the intersection of Fairydale Lane with Gladstone Street	\$100,000
Provision of a seagull arrangement at the intersection of Gladstone Street with Denison Street	\$100,000
Provision of slowing devices in Gladstone Street between Fairydale Lane and Cox Street	\$20,000
Provision of slowing devices in Fairydale Lane	\$20,000
Provision of slowing devices in Banjo Patterson Avenue	\$30,000
<b>Long Term</b>	
Construct roundabout at Lewis & Mortimer Street	\$300,000
<b>Total Estimated Costs</b>	<b>\$7,010,000</b>

\*Source: Council



## 8. References

Department of Planning & Infrastructure (2013).

Elton Consulting (2012). "*Draft Caerleon Development Control Plan*". October.

Gennaoui Consulting Pty Ltd (2008). "*Traffic Management Study – Mudgee*." Mid-Western Regional Council. March Rev H.

Mid-Western Regional Council (2013a). "*Draft Mudgee Town Structure Plan*". Strategic Planning. November.

Mid-Western Regional Council (2013b). "*Road Asset Management Plan 2013/2014-2023/2024*." May.

Mid-Western Regional Council (2013b). "*Development Control Plan 2013 Amendment N°1*." December.

Roads & Traffic Authority (2002). "*Traffic Volumes Data for Western Region 2002*."

Roads & Maritime Services (2013). "*Technical Direction 4A Guide to Traffic Generating Developments Updated Traffic Surveys*".

Traffix (2012). "*Traffic Impact assessment. Caerleon Rezoning Mudgee*." Blaxland Property Pty Ltd. August

## **Appendices**

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## **Appendix A**

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Crash Statistics

APPENDIX A								
Table A1 Mudgee Township Intersection Crashes - Yearly Frequency								
Intersections	2008	2009	2010	2011	2012	Total	I	F
<b>Bawden Rd with</b>								
Clifton Ave					1	1	0	
<b>Bell Street with</b>								
Cohen St			1			1	1	
Gladstone St	1					1		
Salesyard Rd					1	1		
<b>Burrandella Ave with</b>								
Mortimer St	1					1	0	
<b>Castlereagh Hwy with</b>								
Bell St			1		1	2	1	
Putta Bucca Rd with			1	1		2	1	
Willbertree Rd	1		1			2	0	
<b>Church with</b>								
Denison St		1				1	1	
Gladstone St			3			3	3	
Madeira St	1	1				2	1	
Market St				1		1		
Mortimer St		1				1	0	
<b>Cox St with</b>								
Denison St			1			1		
Gladstone St			1			1	1	
Short St		1			1	2	1	
<b>Denison with</b>								
Cameron St	1	1				2		
George St					1	1	1	
Gladstone St			1			1	0	
Headley Pl					1	1	1	
Lawson St					1	1	1	
Perry St			1			1	0	
<b>Douro Street with</b>								
Denison St	1	1			1	3	1	
Gladstone St	1		1		2	4	1	
Mortimer St		1	1	1	1	4	4	
Market St		1		1		2	1	
Madeira Rd	1	1	1			3	3	
Nicholson St			1	1	1	3	3	
<b>Gladstone St with</b>								
Court St		1		1		2	0	
Park Av	1					1	1	
Perry St			1		1	2	1	
<b>Horatio St with</b>								
Church St	2	1		2	1	6	4	
Douro St	3	1		1		5	5	
George St				1	1	2	1	
Lewis St	1	1	1			3	0	
Perry St	1			2	1	4	2	
<b>Lewis St with</b>								
Denison St			1			1	0	
Meares St		1				1	0	
Market St			2			2	1	
<b>Lions Dr with</b>								
Robertson St		1	1		1	3	1	
<b>Mortimer with</b>								
Court St	1					1	0	
Lawson St		1	1			2	4	
Lewis St					1	1	0	
Perry St	1	1		1	1	4	3	
<b>Oporto Rd with</b>								
Havilah Tce				1		1	0	
<b>Perry St with</b>								
Market St	1					1		
Short St		1				1	0	
<b>Putta Bucca Rd with</b>								
Henry Lawson Dr			1			1	1	
Tinja Ln	1					1	0	
<b>Sydney Rd with</b>								
Depot Rd			2			2	3	
Industrial Ave	1			1		2	1	
Lions/Burrudulla Rd		1			3	4	2	
<b>Ulan Rd with</b>								
Henry Lawson Dr		1		1		2	3	
Lue Rd		1	1		1	3	4	
Moggs Ln	1					1		
<b>Sub-Total intersections</b>	<b>21</b>	<b>21</b>	<b>26</b>	<b>17</b>	<b>23</b>	<b>108</b>	<b>63</b>	<b>0</b>
	19.4%	19.4%	24.1%	15.7%	21.3%	100.0%		

APPENDIX A						1.5		
Table A2 Mudgee Township Mid-Block Crashes - Yearly Frequency								
	2008	2009	2010	2011	2012	Total	I	F
<b>Bateman Ave</b>			1			1	0	
<b>Bellevue Rd</b>						0		
Marshfield Ln to Albens Ln		1				1	1	
<b>Burrundulla Ave</b>						0		
Cedar to Mulgoa			1			1	1	
<b>Burrundulla Road</b>						0		
Sydney to Industrial					1	1		
<b>Castlereah Hwy</b>						0		
Salesyard to Hill End	1					1	0	
						0		
<b>Church St</b>						0		
Market to Mortimer	1	1	1		1	4	2	
Gladstone to Mortimer		1	1			2	1	
Denison to Gladstone	1	2				3	0	
Horatio to Denison		1			1	2	0	
Meares to Rail X			1			1	0	
Madeira to Meares			1			1	2	
Lisbon to Madeira	1					1	0	
<b>Court St</b>						0		
Gladstone to Mortimer			1			1	0	
<b>Cox St</b>						0		
Denison to Gladstone				1		1	1	
<b>Denison St</b>						0		
Lahy to Rayner				1		1	0	
Menchin to Cameron				1		1	1	
Douro to Perry				1		1	0	
Church to Lewis					1	1	0	
<b>Douro Street</b>						0		
Denison to Gladstone					1	1	0	
Mortimer to Lovejoy					1	1	0	
Horatio to Railway Line			1			1	1	
<b>Gladstone St</b>						0		
Park to Cox	1		1	1		3	3	
Park to First			1			1	1	
<b>Henry Lawson</b>						0		
Ulan to Putta Bucca		1				1	0	
<b>Horatio St</b>						0		
Burrundulla to George		1			1	2	0	
Church to Lewis		1				1	0	
Douro to Perry				1		1	2	
George to Lawson				1		1	4	
<b>Industrial Rd</b>						0		
Sydney to Burrundulla		1	1			2	1	
<b>Inglis St</b>						0		
Douro to Court						0		
<b>Lewis St</b>						0		
Gladstone to Mortimer					1	1	1	
<b>Lions Dr</b>						0		
Kellett to Robertson					1	1	0	
<b>Market St</b>						0		
Church to Perry				1		1	1	
Douro to Perry				1		1	1	
Douro to Court					1	1	1	
Court to Cox		1				2	0	
Second to Third		1				1	0	
Third to Bell				1		1	2	1
<b>Mortimer St</b>						0		
George to Lawson	1					1	0	
Lawson to Lewis					1	1	0	
Lewis to Church					1	1	1	
Perry to Douro					1	1	1	
Cox to Park				1		1	0	
<b>Oporto Rd</b>						0		
Havilah to Burgundy		1				1	0	
<b>Perry Street</b>						0		
Market to Short			1	1		2	0	
Mortimer to Gladstone				1		1	1	
						0		
<b>Putta Bucca Rd</b>						0		
Castleragh to Tinja		1		1		2	1	
<b>Sydney Rd</b>						0		
Burrundulla Ave to Industrial				2		2	0	
Industrial to Burrundulla Rd		1	1			2	2	
Burrundulla Rd to Spring Flat Rd	1	1				2	1	
<b>Ulan Rd</b>						0		
Lue to Henry Lawson	2			1	4	7	3	
Henry Lawson to Moggs Ln				1		1	1	
<b>White Cct</b>						0		
east of Banjo Patterson				1		1	0	
<b>Sub Total Mid Block</b>	<b>9</b>	<b>16</b>	<b>13</b>	<b>19</b>	<b>18</b>	<b>75</b>	<b>38</b>	<b>1</b>
	12.0%	21.3%	17.3%	25.3%	24.0%	100.0%		
<b>TOTAL</b>	<b>30</b>	<b>37</b>	<b>39</b>	<b>36</b>	<b>41</b>	<b>183</b>	<b>101</b>	<b>1</b>

APPENDIX A																	
TABLE A3																	
CRASHES AT INTERSECTIONS IN MUDGEE 2008-2012																	
Intersection	Cross Traffic/ Right angle		Rear End		Head On		Out of Control		U Turn		Pedestrian		Others		TOTAL		
	A	I	A	I	A	I	A	I	A	I	A	I	A	I	A	I	F
<b>Bawden Rd with</b>																	
Clifton Ave	1															1	0
<b>Bell Street with</b>																	
Cohen St							1	1							1	1	
Gladstone St													1		1	0	
Salesyard Rd							1								1	0	
<b>Burrandella Ave with</b>																	
Mortimer St							1								1	0	
Sydney Rd															0	0	
<b>Castlereagh Hwy with</b>																	
Bell St			1				1	1							2	1	
Putta Bucca Rd							1		1	1					2	1	
Willbertree Rd							2								2	0	
<b>Church with</b>																	
Denison St	1	1													1	1	
Gladstone St	1	1	2	2											3	3	
Madeira St	2	1													2	1	
Market St							1								1	0	
Mortimer St							1								1	0	
<b>Cox St with</b>																	
Denison St					1										1	0	
Gladstone St											1	1			1	1	
Short St	1		1	1											2	1	
<b>Denison with</b>																	
Cameron St	1						1								2	0	
George St	1	1													1	1	
Gladstone St	1														1	0	
Headley Pl	1	1													1	1	
Lawson St	1	1													1	1	
Perry St	1														1	0	
<b>Douro Street with</b>																	
Denison St	1						2	1							3	1	
Gladstone St	2				2	1									4	1	
Mortimer St	3	3										1	1		4	4	
Market	2	1													2	1	
Madeira Rd			2	3			1								3	3	
Nicholson St	3	3													3	3	
<b>Gladstone St with</b>																	
Court St			1				1								2	0	
Park Av							1	1							1	1	
Perry St	2	1													2	1	
<b>Horatio St with</b>																	
Church St	5	4					1								6	4	
Douro St	4	5											1		5	5	
George St			2	1											2	1	
Lewis St	3														3	0	
Perry St	1				2	2	1								4	2	
<b>Inglis St with</b>															0	0	
<b>Lewis St with</b>																	
Denison St							1								1	0	
Meares St	1														1	0	
Market St	2	1													2	1	
<b>Lions Dr with</b>																	
Robertson St	1	1					2								3	1	
<b>Madeira Rd with</b>															0	0	
<b>Mortimer with</b>																	
Court St	1														1	0	
Lawson St	2	4													2	4	
Lewis St	1														1	0	
Perry St	1	1					3	2							4	3	
<b>Oporto Rd with</b>																	
Havilah Tce													1		1	0	
<b>Perry St with</b>																	
Market St							1								1	0	
Short St									1						1	0	
<b>Putta Bucca Rd with</b>																	
Henry Lawson Dr	1	1													1	1	
Tinja Ln							1								1	0	
<b>Sydney Rd with</b>																	
Depot Rd	1	3					1								2	3	
Industrial Ave					1		1	1							2	1	
Lions/Burrudulla Rd	1		1				2	2							4	2	
<b>Ulan Rd with</b>																	
Henry Lawson Dr	2	3													2	3	
Lue Rd	1		1	3			1	1							3	4	
Moggs Ln			1												1	0	
<b>TOTAL</b>	<b>53</b>	<b>37</b>	<b>12</b>	<b>10</b>	<b>6</b>	<b>3</b>	<b>30</b>	<b>10</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>108</b>	<b>63</b>	
	49.1%	58.7%	11.1%	15.9%	5.6%	4.8%	27.8%	15.9%	1.9%	1.6%	0.9%	1.6%	3.7%	1.6%	100%	100%	
A	Number of crashes																
I	Number of injuries																
F	Fatality																

APPENDIX A																					
TABLE A4																					
CRASHES AT MID-BLOCK IN MUDGEE 2008-2012																					
Mid Block	Head on		RearEnd		U-Turn		Off Carriageway			Pedestrians		Side Swipe		Emerging from Driveways Parking		Other		Total			
	A	I	A	I	A	I	A	I	F	A	I	A	I	A	I	A	I	A	I	F	
Bateman Ave							1	0											1	0	
Bellevue Rd																			0	0	
Marshfield Ln to Albens Ln							1	1											1	1	
Burrundulla Ave																			0	0	
Cedar to Mulgoa																	1	1	1	1	
Burrundulla Road																			0	0	
Sydney to Industrial																	1	0	1	0	
Castlereah Hwy																			0	0	
Salesyard to Hill End	1	0																	1	0	
Church St																			0	0	
Market to Mortimer			2	0						2	2								4	2	
Gladstone to Mortimer			1	1			1	0											2	1	
Denison to Gladstone			1	0								1	0	1	0				3	0	
Horatio to Denison			2	0															2	0	
Meares to Rail X			1	0															1	0	
Madeira to Meares			1	2															1	2	
Lisbon to Madeira			1	0															1	0	
Court St												0							0	0	
Gladstone to Mortimer							1	0											1	0	
Cox St																			0	0	
Denison to Gladstone	1	1																	1	1	
Denison St																			0	0	
Lahy to Rayner							1	0											1	0	
Menchin to Cameron							1	1											1	1	
Douro to Perry			1	0															1	0	
Church to Lewis							1	0											1	0	
Douro Street																			0	0	
Denison to Gladstone							1	0											1	0	
Mortimer to Lovejoy							1	0											1	0	
Horatio to Railway Line							1	1											1	1	
Gladstone St																			0	0	
Park to Cox			1	1			2	2											3	3	
Park to First							1	1											1	1	
Henry Lawson												1	0						0	0	
Ulan to Putta Bucca																			1	0	
Horatio St																			0	0	
Burrundulla to George							2	0						1	0				2	0	
Church to Lewis																			1	0	
Douro to Perry			1	2															1	2	
George to Lawson							1	4											1	4	
Industrial Rd												0							0	0	
Sydney to Burrundulla	1	1					1	0											2	1	
Lewis St																			0	0	
Gladstone to Mortimer			1	1															1	1	
Lions Dr																			0	0	
Kellett to Robertson							1	0											1	0	
Market St																			0	0	
Church to Perry													1	1					1	1	
Douro to Perry										1	1								1	1	
Douro to Court			1	1															1	1	
Court to Cox						2	0												2	0	
Second to Third	1	0																	1	0	
Third to Bell							1	2	1										1	2	1
Mortimer St																			0	0	
George to Lawson										1	0				1	0			1	0	
Lawson to Lewis																			1	0	
Lewis to Church										1	1								1	1	
Perry to Douro																	1	1	1	1	
Cox to Park										1	0								1	0	
Oporto Rd																			0	0	
Havilah to Burgundy													1	0					1	0	
Perry Street																			0	0	
Market to Short													1	0	1	0			2	0	
Mortimer to Gladstone													1	1					1	1	
Putta Bucca Rd																			0	0	
Castleragh to Tinja							2	1											2	1	
Sydney Rd																			0	0	
Burrundulla Ave to Industrial			1	0									1	0					2	0	
Industrial to Burrundulla Rd			1	2									1	0					2	2	
Burrundulla Rd to Spring Flat Rd			2	1															2	1	
Ulan Rd																			0	0	
Lue to Henry Lawson			3	2			2	0		1	1			1	0				7	3	
Henry Lawson to Moggs Ln			1	1															1	1	
White Cct																			0	0	
east of Banjo Patterson							1	0											1	0	
<b>Total Mid Block</b>	<b>4</b>	<b>2</b>	<b>22</b>	<b>14</b>	<b>2</b>	<b>0</b>	<b>24</b>	<b>13</b>	<b>1</b>	<b>7</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>10</b>	<b>2</b>	<b>5</b>	<b>2</b>	<b>75</b>	<b>38</b>	<b>1</b>	
	5.3%	5.3%	29.3%	36.8%	2.7%	0.0%	32.0%	34.2%	100.0%	9.3%	13.2%	1.3%	0.0%	13.3%	5.3%	6.7%	5.3%	100%	100%		
A	Number of crashes																				
I	Number of injuries																				
F	Number of Fatalities																				

## **Appendix B**

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Daily Traffic Volumes, Classes and  
Speeds in Mudgee



Street	Location	DAILY TRAFFIC VOLUMES, CLASSES & SPEEDS IN MUDGEE												
		Average Weekly Daily Traffic		Heavy Vehicles			Peak Hour		Speed					
		Weekday	Weekend	Weekly	Medium	Heavy	AM Vol	AM Time	PM Vol	PM Time	Mean	85 <sup>th</sup> %ile	50>	60>
1 Bellevue Road	west of Henry Bayly Dr	1326	990	1230	7.7%	0.3%	108	8am	135	4pm	52.8	59.8	65.4%	15.0%
2 Burrundulla Ave	Horatio St & Denison St	931	578	830	4.10%	0.10%	82	8am	87	3pm	44.6	53.6	28.0%	4.0%
3 Burrundulla Road	east of Sydney Road	1979	1216	1761	2.90%	0.10%	194	11am	195	1pm	27.3	32.4	0.1%	0.0%
4 Church Street	Market St & Short St	4685	4818	4723	4.10%	0.00%	409	8am	422	5pm	33.3	39.2	0.5%	0.0%
5 Church Street	Mealy St & Denison St	10059	8078	9493	2.70%	0.10%	725	8am	951	3pm	41.4	47.5	7.6%	0.4%
6 Church Street	Mearnes St & Railway X	7818	6628	7478	1.40%	0.00%	631	8am	786	5pm	49.7	55.1	45.4%	4.0%
7 Church Street	Spring Rd & Redbank Rd	1194	1149	1181	2.60%	0.10%	93	8am	122	5pm	49.8	56.5	49.0%	7.1%
8 Denison Street	George St & Lawson St	553	452	524	3.10%	0.00%	54	8am	54	3pm	33	38.5	0.3%	0.0%
9 Denison Street	Cox St & Gawthorne Pl	1554	1915	1657	3.30%	0.00%	96	8am	179	5pm	47.7	56.2	41.4%	7.0%
10 Denison Street	Church St & Perry St	1063	657	947	3.40%	0.00%	118	8am	127	3pm	24.8	30.6	0.0%	0.0%
11 Douro Street	Market St & Short St	1365	763	1193	7.60%	2.60%	127	8am	138	4pm	37.1	43.9	2.7%	0.1%
12 Douro Street	Gladstone St & Mortimer St	7063	5747	6687	4.80%	2.00%	600	11am	641	4pm	44.2	51.5	22.8%	1.4%
13 Douro Street	at Railway X	5266	4251	4976	2.7%	0.2%	532	8am	549	3pm	42.3	51.8	22.2%	1.8%
14 Fairydale Lane	Gladstone St & railway X	126	102	119	7.7%	0.0%	9	8am	13	4pm	38.5	49	12.9%	2.4%
15 Gladstone Street	Lewis St & Church St	1518	920	1347	1.0%	0.0%	149	8am	190	3pm	33	38.2	0.2%	0.0%
16 Gladstone Street	Court St & Cox St	2276	2094	2224	2.5%	0.0%	167	8am	222	3pm	46.3	53.6	33.6%	3.3%
17 Henry Bayly Drive	Baskerville Dr	696	623	675	10.3%	0.0%	51	8am	70	4pm	31.1	36	0.2%	0.0%
18 Horatio Street	Lochel Ln & George St	8535	5123	7560	7.1%	1.9%	677	8am	876	4pm	48.4	54.4	41.7%	3.3%
19 Horatio Street	Perry St & Douro St	4177	3012	3844	7.3%	2.7%	377	8am	396	3pm	44	51.1	19.8%	1.4%
20 Inglis Street	Douro St & Court St	2289	1848	2163	4.0%	0.0%	176	8am	225	5pm	26.4	30.6	0.0%	0.0%
21 Lawson Street	Gladstone St & Mortimer St	532	347	479	3.7%	0.0%	48	8am	66	3pm	33.6	38.9	0.6%	0.0%
22 Lewis Street	Gladstone St & Mortimer St	3627	2231	3228	6.0%	1.0%	304	8am	370	3pm	44.8	51.8	23.3%	2.0%
23 Lewis Street	Horatio St & Mealy St	2827	1693	2503	8.6%	1.2%	224	11am	303	4pm	41.4	47.5	8.0%	0.3%
24 Lions Drive	Sydney Rd & Broadhead Rd	1471	1090	1362	4.9%	0.2%	134	8am	152	4pm	50.1	57.6	50.5%	9.2%
25 Madeira Road	Church St & Atkinson St	2763	2088	2570	2.1%	0.0%	286	8am	285	3pm	38.7	46.1	5.1%	0.2%
26 Madeira Road	west of Douro St	834	792	822	1.8%	0.0%	82	8am	78	5pm	51.8	60.1	61.3%	16.1%
27 Market St	Lewis St & Church St	2141	1280	1895	5.7%	0.0%	233	8am	229	3pm	24.9	29.9	0.2%	0.0%
28 Market St	Douro St & Court St	6875	5594	6509	6.5%	0.6%	593	8am	615	4pm	40.5	48.6	10.9%	0.5%
29 Market St	Third St & Bell St	4917	4014	4659	5.7%	2.3%	428	8am	466	4pm	49.8	54.7	46.4%	4.0%
30 Mearnes Street	Grant St & Church St	2357	1986	2251	2.2%	0.0%	162	9am	240	5pm	40.4	45.7	4.0%	0.1%
31 Mortimer Street	Lawson St & Lewis St	1872	1564	1784	1.9%	0.1%	138	10am	181	4pm	46	53.6	31.2%	3.4%
32 Mortimer Street	Cox St & Park Ave	885	721	838	1.3%	0.0%	63	11am	91	4pm	41.9	48.2	10.6%	0.7%
33 Oporto Road	Madeira Rd & Norman Rd	3029	2427	2857	2.1%	0.0%	246	8am	294	4pm	41.6	47.5	8.5%	0.3%
34 Perry Street	Market St & Short St	1514	737	1292	4.8%	0.0%	144	7am	173	2pm	21.3	24.5	0.0%	0.0%
35 Perry Street	south of Market	4837	3007	4314	2.7%	0.0%	451	11am	547	3pm	32.5	41	1.4%	0.1%
36 Robertson Street	Trefusis Ave	1776	1538	1708	2.4%	0.0%	163	8am	195	5pm	43.8	54.4	27.8%	5.5%
37 Robertson Street	Abernethy	1911	1715	1855	6.5%	0.1%	181	7am	195	3pm	55.9	63	81.3%	27.8%
38 Short Street	Lewis St & Church St	2124	1501	1946	7.8%	1.8%	177	8am	213	4pm	40	46.8	6.9%	0.3%
39 Short Street	Perry St & Douro St	1550	945	1377	7.4%	2.3%	126	8am	148	4pm	47.4	55.1	37.5%	5.4%
40 Spring Road	Melton Rd & Church St	1543	1424	1509	3.6%	0.0%	137	8am	165	5pm	54.2	61.6	73.2%	20.4%

## **Appendix C**

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Guidelines for Evaluation of  
Carriageway Capacity

## APPENDIX C

### CONCEPT OF CARRIAGEWAY CAPACITY AND LEVEL OF SERVICE

The capacity of major streets within an urban area can be based on an assessment of their operating Level of Service. Level of service is defined by AUSTRROADS (1988) as a "qualitative measure of the effects of a number of features, which include speed and travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort and convenience, and operating costs. Levels of service are designated from A to F from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) as follows:

#### LEVELS OF SERVICE

- A - Free flow (almost no delays)
- B - Stable flow (slight delays)
- C - Stable flow (acceptable delays)
- D - Approaching unstable flow (tolerable delays)
- E - Unstable flow (congestion; intolerable delays)
- F - Forced flow (jammed)

A service volume, as defined by AUSTRROADS (1988), is the maximum number of vehicles that can pass over a given section of roadway in one direction during one hour while operating conditions are maintained at a specified level of service.

One-way hourly volumes for traffic flow at different level of service, in urban situations are summarised in [Tables C1 and C2](#) for interrupted and uninterrupted flow conditions respectively.

It is suggested that ideally arterial and sub-arterial roads should not exceed service volumes at level of service C. At this level, whilst most drivers are restricted in their freedom to manoeuvre, operating speeds are still reasonable and acceptable delays experienced. However, in urban situations, arterial and sub-arterial roads operating at Level of Service D, are still considered adequate.

**TABLE C1**  
**LEVEL OF SERVICE INTERRUPTED FLOW CONDITIONS ALONG URBAN ROADS (One Way Hourly Volumes)**

ROAD CLASS		LEVEL OF SERVICE						
Type	Description	Description	A	B	C	D	E	F
U1	2	2 Lane Undivided	540	630	720	810	900	F
U1	4U	4 Lane Undivided with some parking	900	1050	1200	1350	1500	O
U1	4UC	4 Lane Undivided with Clearways	1080	1260	1440	1620	1800	R
U1	4D	4 Lane Divided with Clearways	1140	1330	1520	1710	1900	C
U1	6U	6 Lane Undivided	1440	1680	1920	2160	2400	E
U1	6D	6 Lane Divided with Clearway	1740	2030	2320	2610	2900	D

**TABLE C2**  
**LEVEL OF SERVICE UNINTERRUPTED FLOW CONDITIONS ALONG URBAN ROADS (One Way Hourly Volumes\*)**

ROAD CLASS		LEVEL OF SERVICE						
Type	Description	Description	A	B	C	D	E	F
U2	2	2 Lane Undivided	760	880	1000	1130	1260	F
U2	4U	4 Lane Undivided with some parking	1260	1470	1680	1890	2100	O
U2	4UC	4 Lane Undivided with Clearways	1510	1760	2010	2270	2520	R
U2	4D	4 Lane Divided with Clearways	1600	1860	2130	2400	2660	C
U2	6U	6 Lane Undivided with Clearways	2020	2350	2690	3020	3360	E
U2	6D	6 Lane Divided with Clearway	2440	2840	3250	3660	4060	D

\* 40% higher than base volumes in Table C1

## **Appendix D**

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Carriageway Level of Service

APPENDIX D PM PEAK HOURLY TRAFFIC VOLUMES (PCU)													
Street	Location		No of Lanes	Existing Volumes PCU 2014				With New Releases (PCU)				Daily Volumes (PCU)	
				N/E	S/W	Total	LoS	N/E	S/W	Total	LoS	Existing	Future
Bell Street	South of Castlereagh		2U	53	64	117	A	110	191	301	A	1170	3010
Bellevue Road	west of Henry Bayly Dr		4UP	122	179	301	A	234	356	590	A	3010	5900
Burrandulla Road	east of Sydney Road		4U	82	107	189	A	106	224	330	A	1890	3300
Church Street	Market St	& Short	4UP	208	240	448	A	242	278	520	A	4480	5200
Church Street	Mortimer St	Market	4UP	437	435	872	A	532	536	1068	B	8720	10680
Church Street	Gladstone	Mortimer	4UP	515	525	1040	A	623	639	1262	B	10400	12620
Church Street	Mealy St	& Denison St	4UP	486	542	1028	B	545	641	1186	C	10280	11860
Church Street	Denison St	Gladstone	4UP	495	525	1020	A	554	608	1162	B	10200	11620
Church Street	Horatio St	Denison St	4UP	411	518	929	A	471	617	1088	B	9290	10880
Church Street	Horatio St	Inglis St	4UP	411	518	929	A	459	572	1031	B	9290	10310
Church Street	Meares St	& Railway X	2U*	340	462	802	A	392	514	906	A	8020	9060
Church Street	Madeira Rd	Meares St	4UP	247	334	581	A	299	386	685	A	5810	6850
Denison Street	Church St	Perry St	4UP	39	27	66	A	74	44	118	A	660	1180
Denison Street	Church St	Lewis St	4UP	28	31	59	A	47	48	95	A	590	950
Douro Street	Market St	& Short St	4UP	93	166	259	A	100	177	277	A	2590	2770
Douro Street	Mortimer St	Market St	4UP	250	322	572	A	391	407	798	A	5720	7980
Douro Street	Gladstone St	& Mortimer St	4UP	329	439	768	A	470	524	994	A	7680	9940
Douro Street	Denison St	Gladstone St	4UP	354	443	797	A	626	586	1212	B	7970	12120
Douro Street	at Railway X		2U*	282	415	697	A	400	574	974	A	6970	9740
Fairy Dale Lane	Gladstone St	& railway X	2U*	55	56	111	A	232	396	628	A	1110	6280
Gladstone Street	Lewis St	& Church	4UP	79	82	161	A	109	119	228	A	1610	2280
Gladstone Street	Church	Perry	4UP	133	145	278	A	213	231	444	A	2780	4440
Gladstone Street	Douro St	Cox St	4UP	133	153	286	A	253	366	619	A	2860	6190
Henry Bayly Drive	Baskerville Dr	Inglis	2U	58	55	113	A	161	108	269	A	1130	2690
Hill End Road	south of Castlereagh Hwy		2U	57	81	138	A	280	335	615	A	1380	6150
Horatio Street	Church St	Perry St	4UP	335	332	667	A	417	548	965	B	6670	9650
Horatio Street	Perry St	& Douro St	4UP	150	297	447	A	259	525	784	A	4470	7840
Inglis Street	Douro St	& Court St	4UP	151	228	379	A	210	302	512	A	3790	5120
Lewis Street	Mortimer St	Market	4UP	208	170	378	A	249	193	442	A	3780	4420
Byron Place	east of Perry St		4U	233	208	441	A	313	362	675	A	4410	6750
Madeira Road	Grant St	Church St	4U	145	139	284	A	196	237	433	A	2840	4330
Market St	Lewis St	& Church St	4UP	152	140	292	A	152	140	292	A	2920	2920
Market Street	Perry St	Church St	4UP	257	321	578	A	305	378	683	A	5780	6830
Market Street	Douro St	Perry St	4UP	307	336	643	A	372	428	800	A	6430	8000
Market St	Douro St	& Court St	4UP	312	368	680	A	451	594	1045	B	6800	10450
Market St	Third St	& Bell St	4UP	240	278	518	A	370	504	874	A	5180	8740
Meares Street	Grant St	& Church St	4UP	138	108	246	A	138	108	246	A	2460	2460
Mortimer Street	Lawson St	& Lewis St	4UP	111	71	182	A	111	71	182	A	1820	1820
Mortimer Street	Lewis St	Church	4UP	177	268	445	A	177	268	445	A	4450	4450
Perry Street	Market St	& Short St	4UP	241	214	455	A	256	214	470	A	4550	4700
Perry Street	south of Market		4UP	283	291	574	A	344	334	678	A	5740	6780
Perry Street	Gladstone St	& Mortimer St	4UP	179	232	411	A	235	345	580	A	4110	5800
Perry Street	Denison St	& Gladstone	4UP	102	148	250	A	113	201	314	A	2500	3140
Pitt Lane	west of Ulan		2U	13	18	31	A	13	18	31	A	310	310
Putta Bucca	north of Castreagh		2U	25	32	57	A	102	119	221	A	570	2210
Short Street	Lewis St	& Church St	4UP	177	173	350	A	189	206	395	A	3500	3950
Sydney Road	at Railway Crossing		2U*	572	517	1089	A	776	589	1365	B	10890	13650
Sydney Road	Burrundulla Rd	Industrial Rd	4UP*	329	402	731	A	438	489	927	A	7310	9270
Ulan	Short	Pitt / Lue	2U*	423	410	833	A	512	471	983	A	8330	9830
Ulan	Pitt/ Lue	Henry Lawson	2U*	330	366	696	A	419	427	846	A	6960	8460

\* Uninterrupted

## **Appendix E**

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Guidelines for Evaluation of  
Intersection Capacity

# Appendix E Guidelines for Evaluation of Intersection Capacity

The RTA has included in the latest "Guide to Traffic Engineering Developments (Dec 1993, Issue 2) has included a section on the assessment of intersections. The assessment of the level of service of an intersection is based on the evaluation of the following Measures of Effectiveness:

- average delay (secs/veh) (all forms of control)
- delay to critical movement (secs/veh) (all forms of control)
- degree of saturation (traffic signals and roundabouts)
- cycle length (traffic signals)

INTANAL was used to calculate the relevant intersection parameters. INTANAL is a software which allows comparisons between different forms of intersection control and different forms of intersection configurations to be readily evaluated. That is at each intersection the priority control, roundabout and signal control options will be examined to determine the most efficient form of control.

The best indicator of the level of service at an intersection is the average delay experienced by vehicles at that intersection. For traffic signals, the average delay over all movements should be taken. For roundabouts and priority control intersections (with Stop and Give Way signs or operating under the T-junction rule) the critical movement for level of service assessment should be that with the highest average delay.

With traffic signals, delays per approach tend to be equalised, subject to any over-riding requirements of signal co-ordination as well as to variations within individual movements. With roundabouts and priority - control intersections, the critical criteria for assessment is the movement with the highest delay per vehicle. With this type of control the volume balance might be such that some movements suffer high levels of delay while other movements have minimal delay. An overall average delay for the intersection of 25 seconds might not be satisfactory if the average delay on one movement is 60 seconds.

The average delay for level of service E should be no more than 70 seconds. The accepted maximum practical cycle length for traffic signals under saturated conditions is 120 - 140 seconds. Under these conditions 120 seconds is near maximum for two and three phase intersections and 140 seconds near maximum for more complex phase designs. Drivers and pedestrians expect cycle lengths of these magnitudes and their inherent delays in peak hours. A cycle length of 140 seconds for an intersection which is almost saturated has an average vehicle delay of about 70 seconds, although this can vary. If the average vehicle delay is more than 70 seconds, the intersection is assumed to be at Level of Service F.

**Table E1** sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in **Table E1**. In assigning a level of service, the average delay to the motoring public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner-urban areas of Sydney have a higher tolerance of delay than drivers in country areas. **Table E1** provides a recommended baseline for assessment.

## **Table E1: Level of service criteria for intersections**



Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 - 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, required other control mode

Source: RTA (2002)

The figures in **Table E1** are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

The intersection degree of saturation (DS) can also be used to measure the performance of isolated intersections. At intersections controlled by traffic signals, both queue length and delays increase rapidly as DS approaches 1.0. An upper limit of 0.9 is appropriate. When DS exceeds 0.8 - 0.85, overflow queues start to become a problem. Satisfactory intersection operation is generally achieved with a DS of about 0.7 - 0.8. (Note that these figures are based on isolated signalised intersections with cycle lengths of 120 seconds. In co-ordinated signal systems DS might be actively maximised at key intersections). Although in some situations additional traffic does not alter the level of service, particularly where the level of service is E or F, additional capacity may still be required. This is particularly appropriate for service level F, where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the Degree of Saturation are summarised in **Table E2**.

**Table E2: Criteria For Evaluating Capacity Of Signalised Intersections\***

Level Of Service	Optimum Cycle Length (Secs) (CO)	VOLUME/ SATURATION Y	Intersection Degree Of Saturation X
A/B Very good	< 90	< 0.70	< 0.80
C Satisfactory	90-120	0.70-0.80	0.80-0.85
D Poor but manageable	120-140	0.80-0.85	0.85-0.90
E/F Bad, extra capacity	>140	>0.85	> 0.90

Source: Traffic Authority (2002)

## **Appendix F**

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Origin-Destination of Future Trips



APPENDIX F		ORIGIN-DESTINATION OF TRIPS FOR FUTURE RESIDENTIAL RELEASES IN MUDGEE										DESTINATIONS									
SOUTH WEST & SOUTH MUDGEE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Sub-Tot	Total	
ORIGIN	Sub-Tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Sub-Tot	Total	
<b>South West Mudgee</b>																					
1 Bellevue Rd	0								7	7	2	2	2	3	3	3	5	1	9	35	
2 Fairydale Ln	0								7	7	2	2	2	3	3	3	5	1	9	35	
3 Henry Bayly	0								11	11	4	3	4	4	4	4	7	1	13	55	
<b>Sub-Tot</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>25</b>	<b>25</b>	<b>8</b>	<b>7</b>	<b>8</b>	<b>10</b>	<b>10</b>	<b>17</b>	<b>3</b>	<b>30</b>	<b>124</b>		
<b>South Mudgee</b>																					
4 Lions / Castlereagh	0								2	2	1	1	1	1	1	1	2	0	3	11	
5 Robertson/ Madeira	0								2	2	1	1	1	1	1	1	2	0	3	11	
6 Spring/ Church	0								5	5	1	1	1	2	2	2	3	1	6	23	
7 O'Porto	0								2	2	1	1	1	1	1	1	2	0	3	11	
<b>Sub-Tot</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11</b>	<b>11</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>8</b>	<b>2</b>	<b>14</b>	<b>56</b>		
8 CBD 1	37	10	10	16	3	3	7	3											0	53	
9 CBD 2	37	10	10	16	3	3	7	3											0	53	
10 Industrial 1 East of Sydney Rd	33	9	9	15	3	3	6	3											0	48	
11 Industrial 2 West of Sydney Rd	26	7	7	12	2	2	5	2											0	38	
12 Industrial 3 Hill End Rd	33	9	9	15	3	3	6	3											0	48	
13 Residential n of railway	15	4	4	6	1	1	3	1											0	21	
14 Residential s of railway	15	4	4	6	1	1	3	1											0	21	
<b>Sub-Tot</b>	<b>195</b>	<b>55</b>	<b>55</b>	<b>86</b>	<b>18</b>	<b>18</b>	<b>35</b>	<b>18</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>284</b>		
<b>External Routes</b>																					
15 Sydney Rd	15	4	4	6	1	1	3	1											0	21	
16 Ulan Rd	24	7	7	11	2	2	4	2											0	36	
17 Castlereah Rd , west of Hill End	5	1	1	2	0	0	1	0											0	7	
<b>Sub-Tot</b>	<b>44</b>	<b>12</b>	<b>12</b>	<b>19</b>	<b>4</b>	<b>4</b>	<b>8</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>64</b>		
<b>Total</b>	<b>239</b>	<b>67</b>	<b>67</b>	<b>105</b>	<b>22</b>	<b>22</b>	<b>43</b>	<b>22</b>	<b>37</b>	<b>37</b>	<b>12</b>	<b>10</b>	<b>12</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>25</b>	<b>5</b>	<b>44</b>	<b>529</b>	
Exclude Internal Trips																					

## Figures

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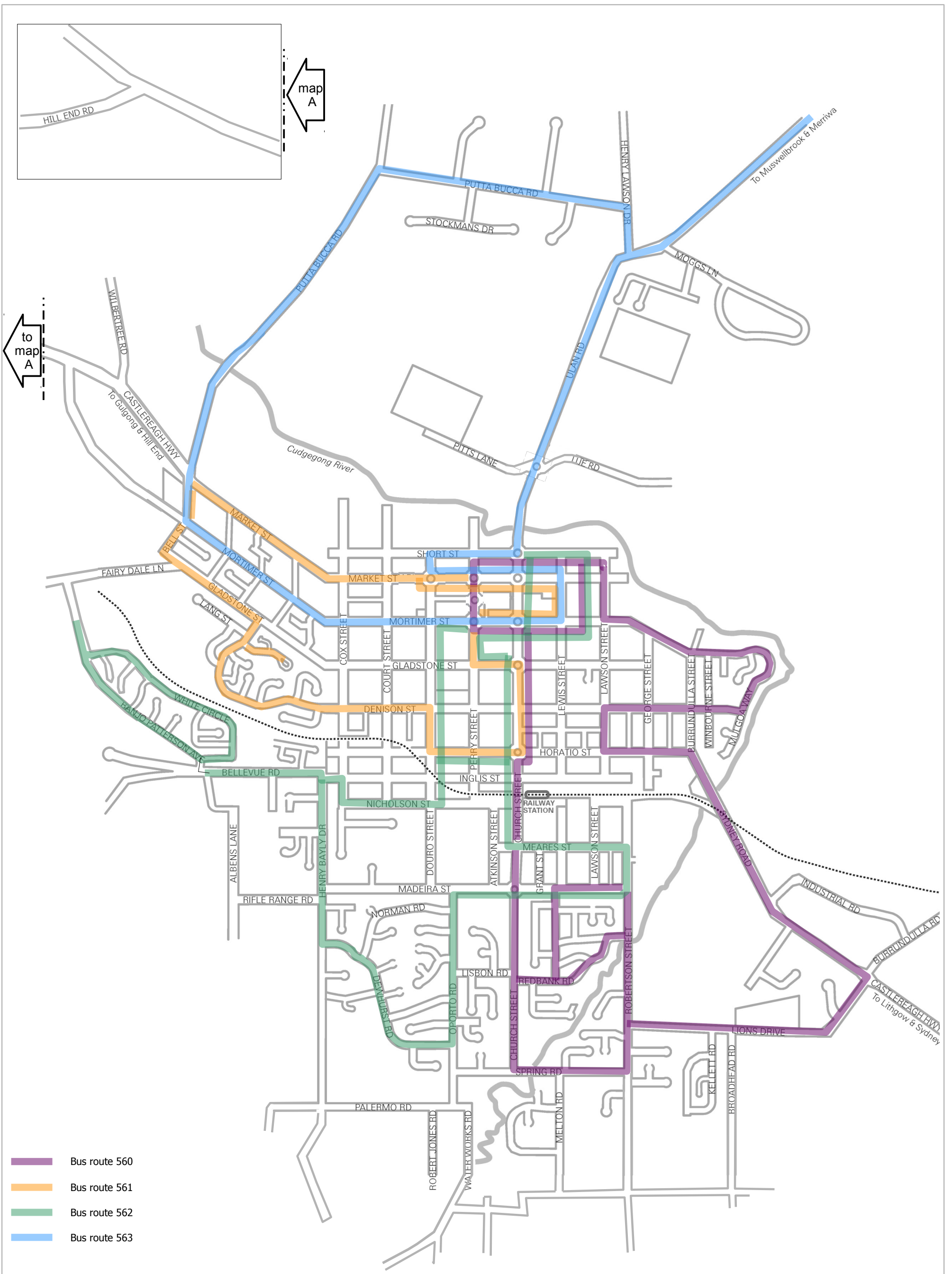


Figure 4 **Bus routes**







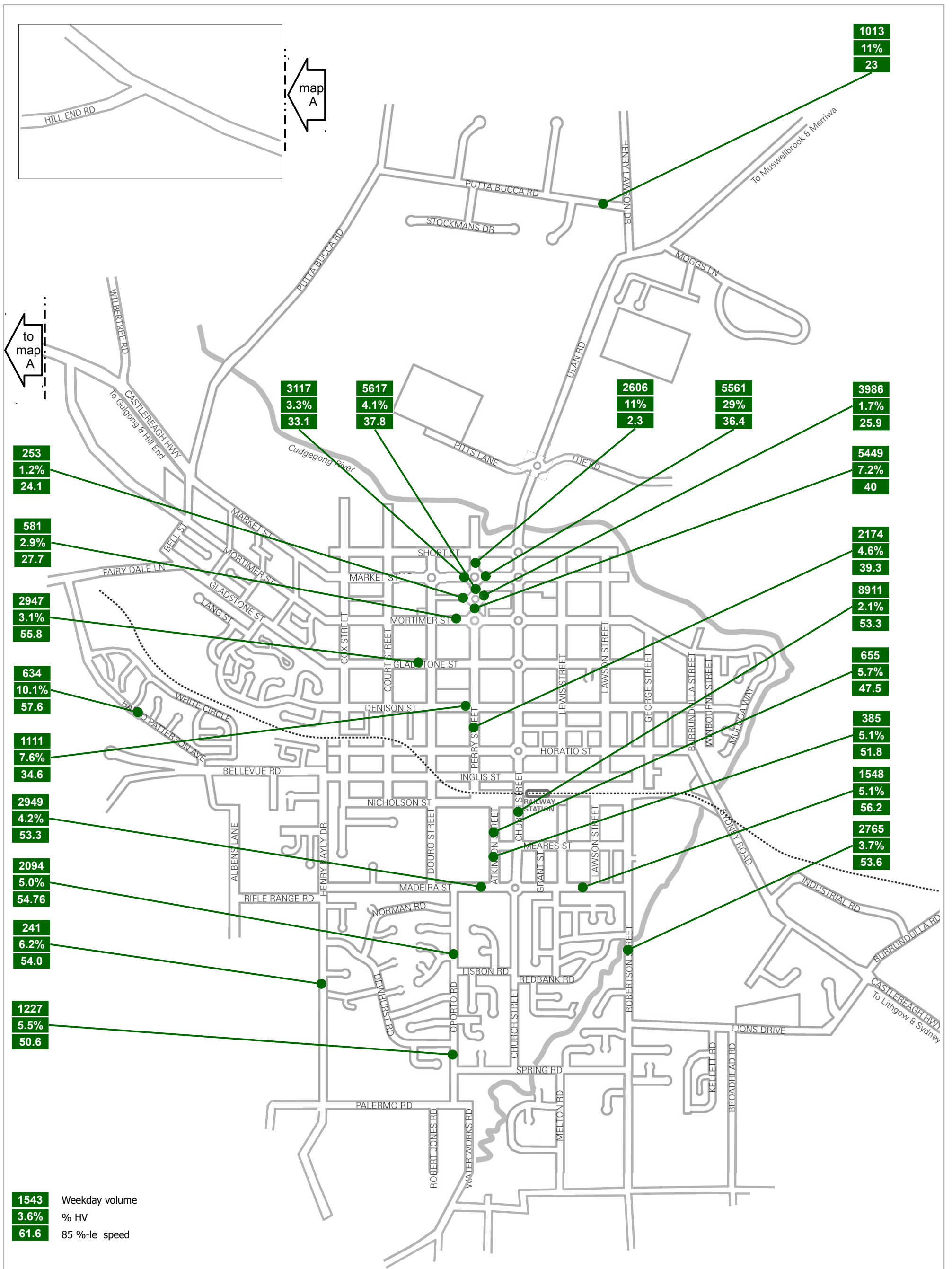


Figure 6 Existing traffic patterns



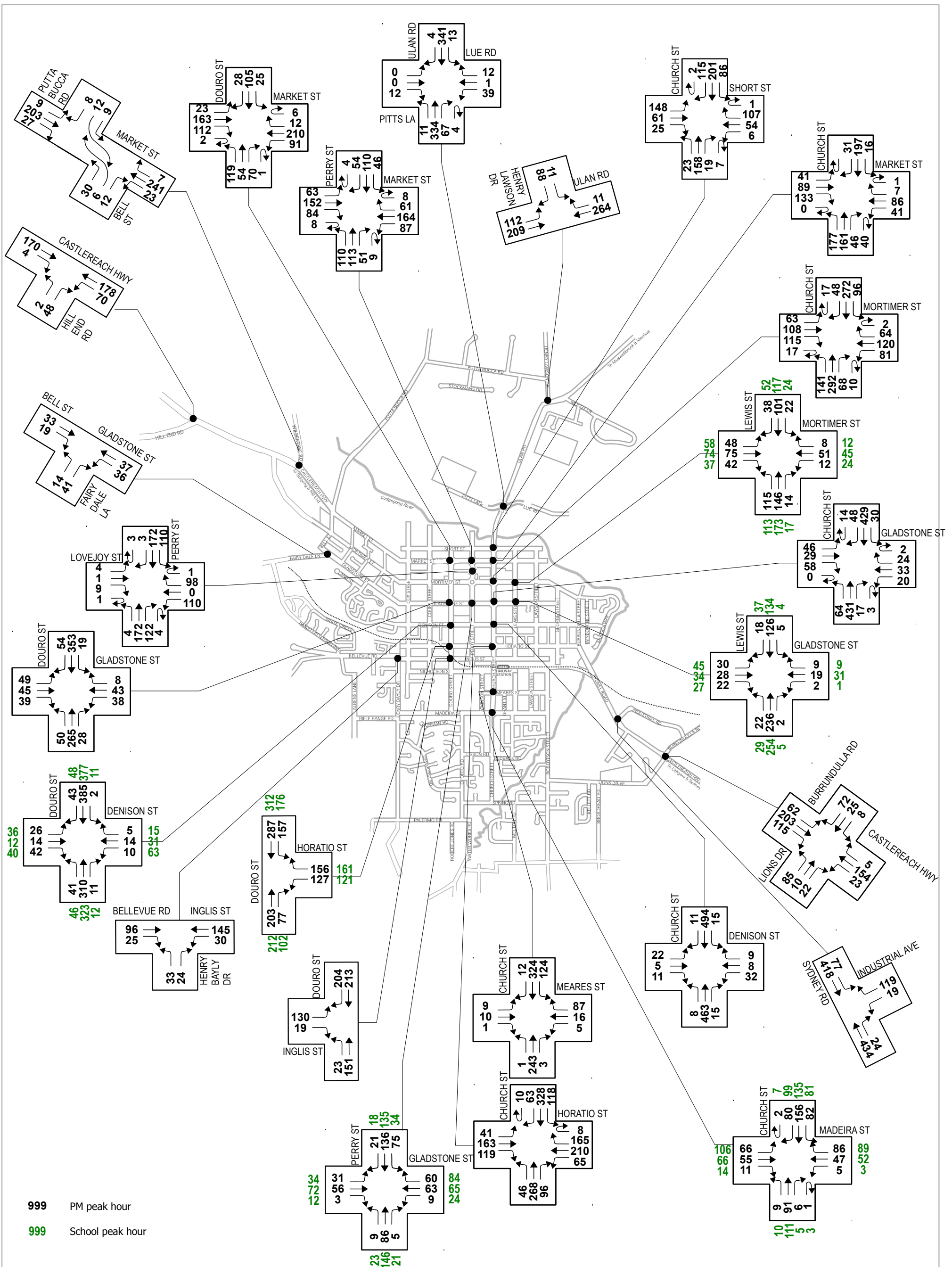


Figure 7 PM peak intersection counts



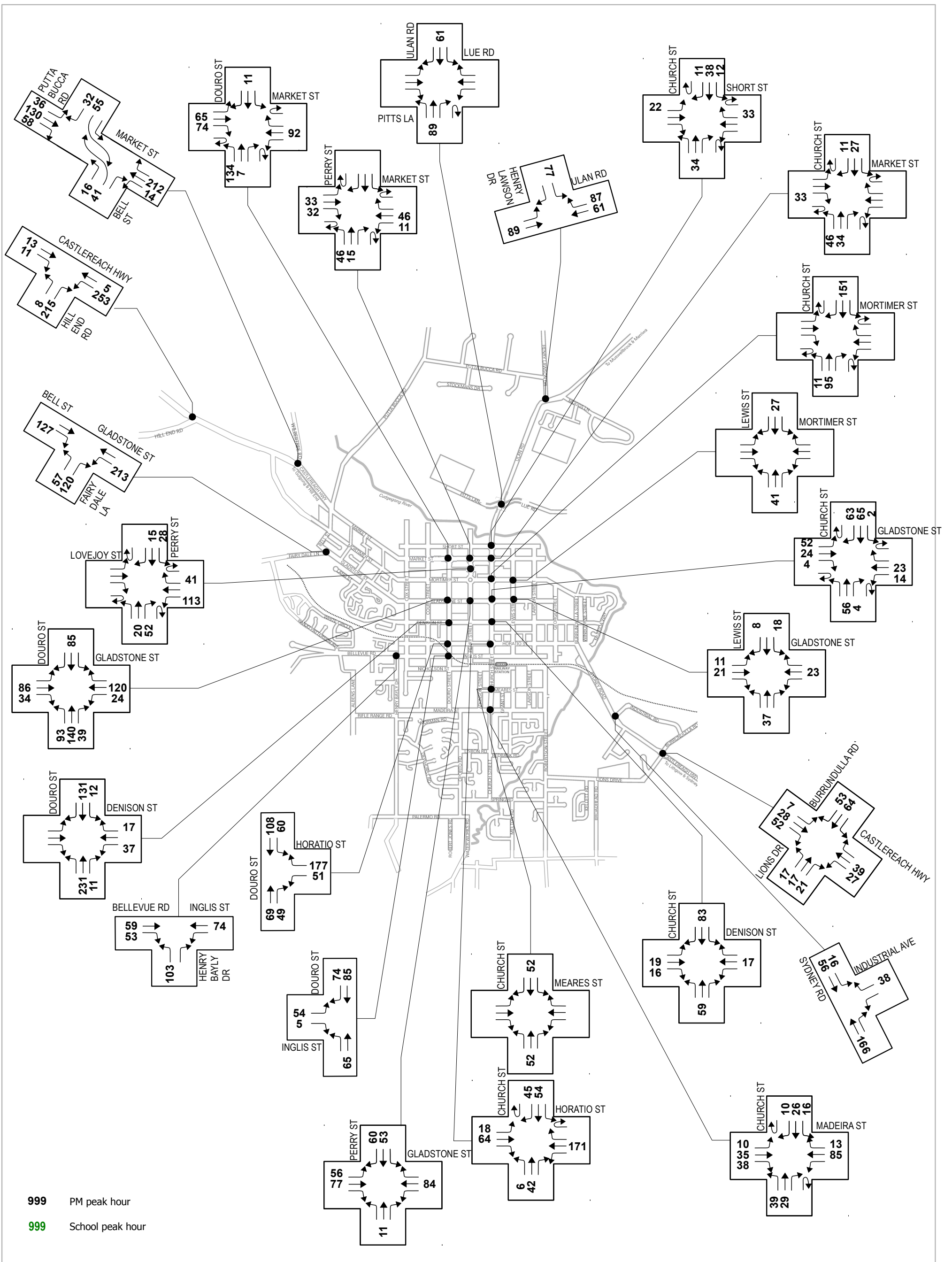


Figure 8 Additional Traffic - PM peak hour

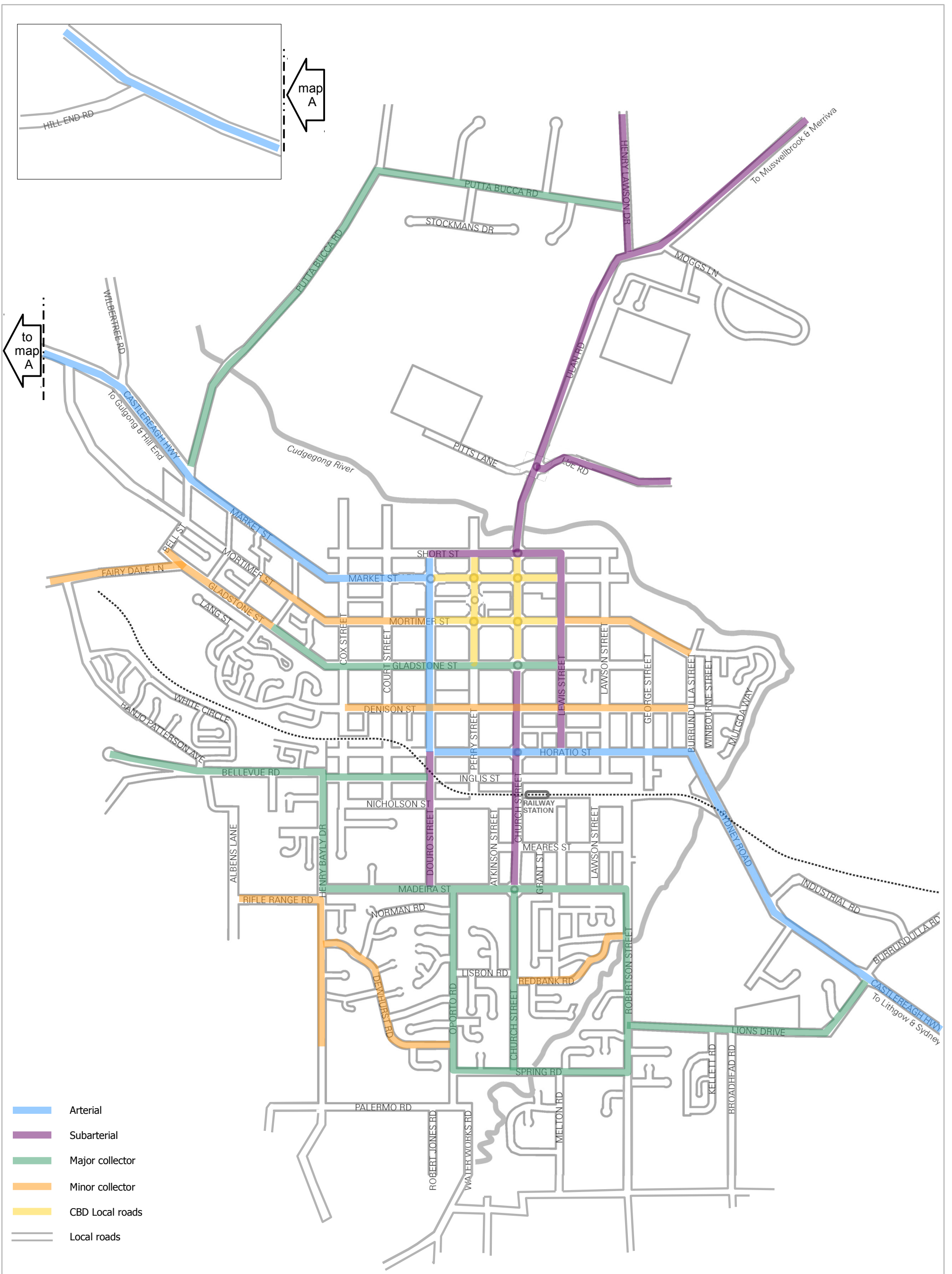


Figure 9 Adopted Road Hierarchy

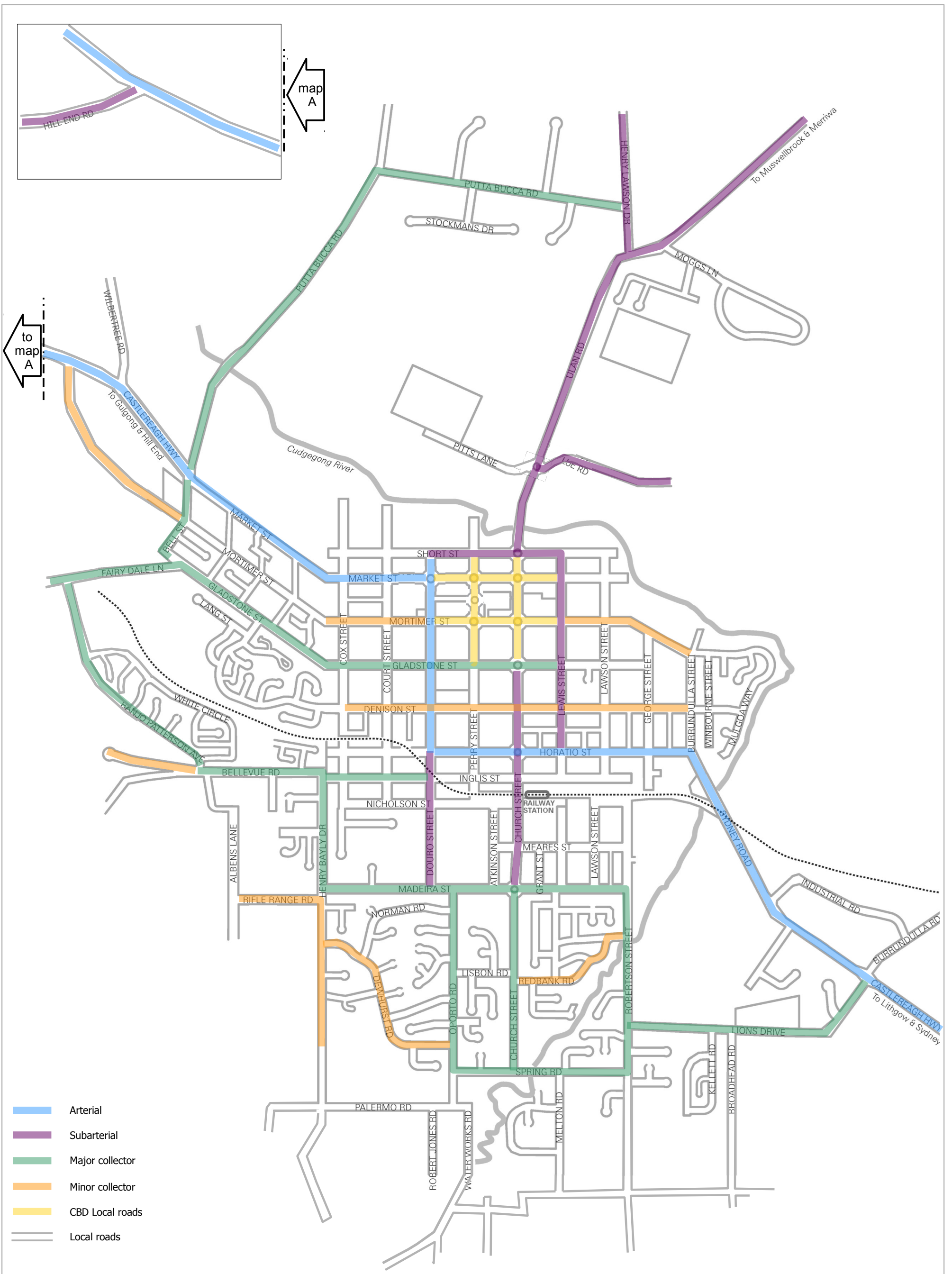


Figure 10 Recommended Road Hierarchy





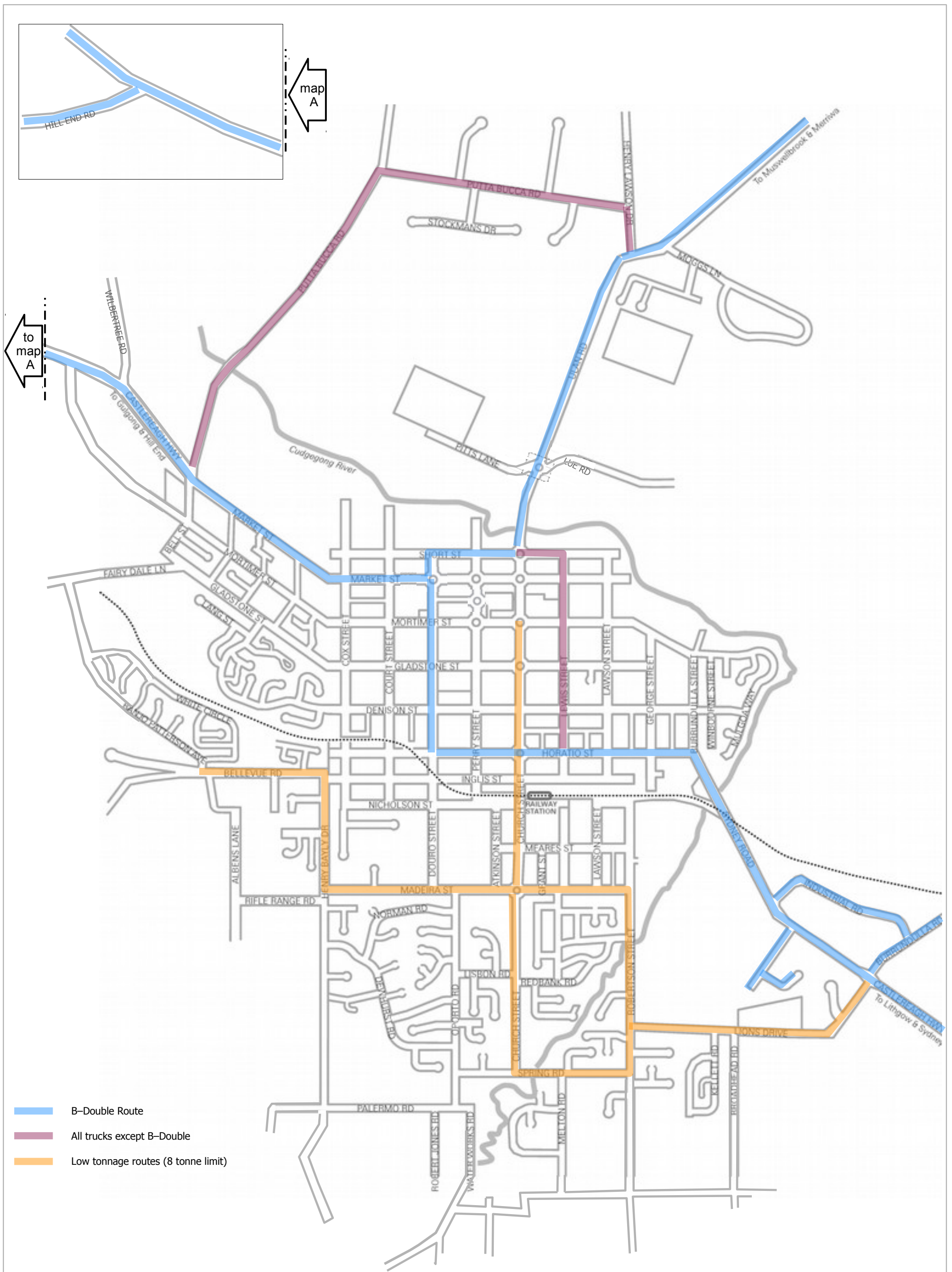


Figure 11 Proposed Truck Route Network



