Lake Macquarie City Council

Development Contributions Plan

Traffic and Transportation Background Study

Glendale Contributions Catchment

2015 – 2030

Contents

1 Traffic and Transportation Background Study

1.1 Introduction

Traffic and transport infrastructure is essential to support the future growth anticipated within the Glendale development contributions catchment. The Glendale catchment is bounded by the Charlestown, Belmont and Toronto contribution catchments in the east and south, the Cessnock Local Government Area (LGA) in the west, and the Newcastle LGA in the North. The Glendale catchment excludes the Northlakes Urban Release Area (NURA), which has its own contributions plan (Development Contributions Plan No.2 2004, NURA, as amended 2012).

Council's Transportation Planning Section has been commissioned to prepare the Glendale Contributions Catchment Development Contributions Plan. This report focuses on traffic and transport infrastructure required for the contributions catchment until 2030.

The study includes a review of previous traffic investigations completed for a number of development and rezoning proposals, and has included assessment of key local road intersections, Sub-arterial and Collector Council roads, and public transport facilities required to support the community as development intensifies within the catchment.

1.1.1 Purpose of Study

The study identifies the traffic and transport infrastructure that is required to meet the transport demands of increased population and workforce within the Glendale catchment, anticipated to occur over the 15-year period, from 2015 to 2030.

The estimated increased population and workforce is based on an economic and development scenario prepared by Council's Integrated Planning Section, with further detail given in Section 1.4 of this report.

1.1.2 Objectives

The study includes the following tasks, with a focus on traffic and transport matters:

- Review of existing studies for a number of rezoning and planning proposals, and development application submissions in the Glendale Contributions Catchment;
- Review of existing Levels of Service (LoS) of key intersections (non-state roads) within the Glendale catchment, and projected LoS in line with the anticipated growth;
- Need for road and intersection upgrades to support future development in the area based on projected growth impacts;
- Need for upgrades to local bus infrastructure.

The overall traffic and transport objectives to be achieved were to arrive at a cost effective, safe and efficient transport system that addresses the expected increase in demand for private car

travel, goods movement and public transport, due to the anticipated increased development across the study area.

1.1.3 The Study Area

The study area covers the Glendale Development Contributions Catchment, divided into 6 sub-catchments, Figure 1.1.

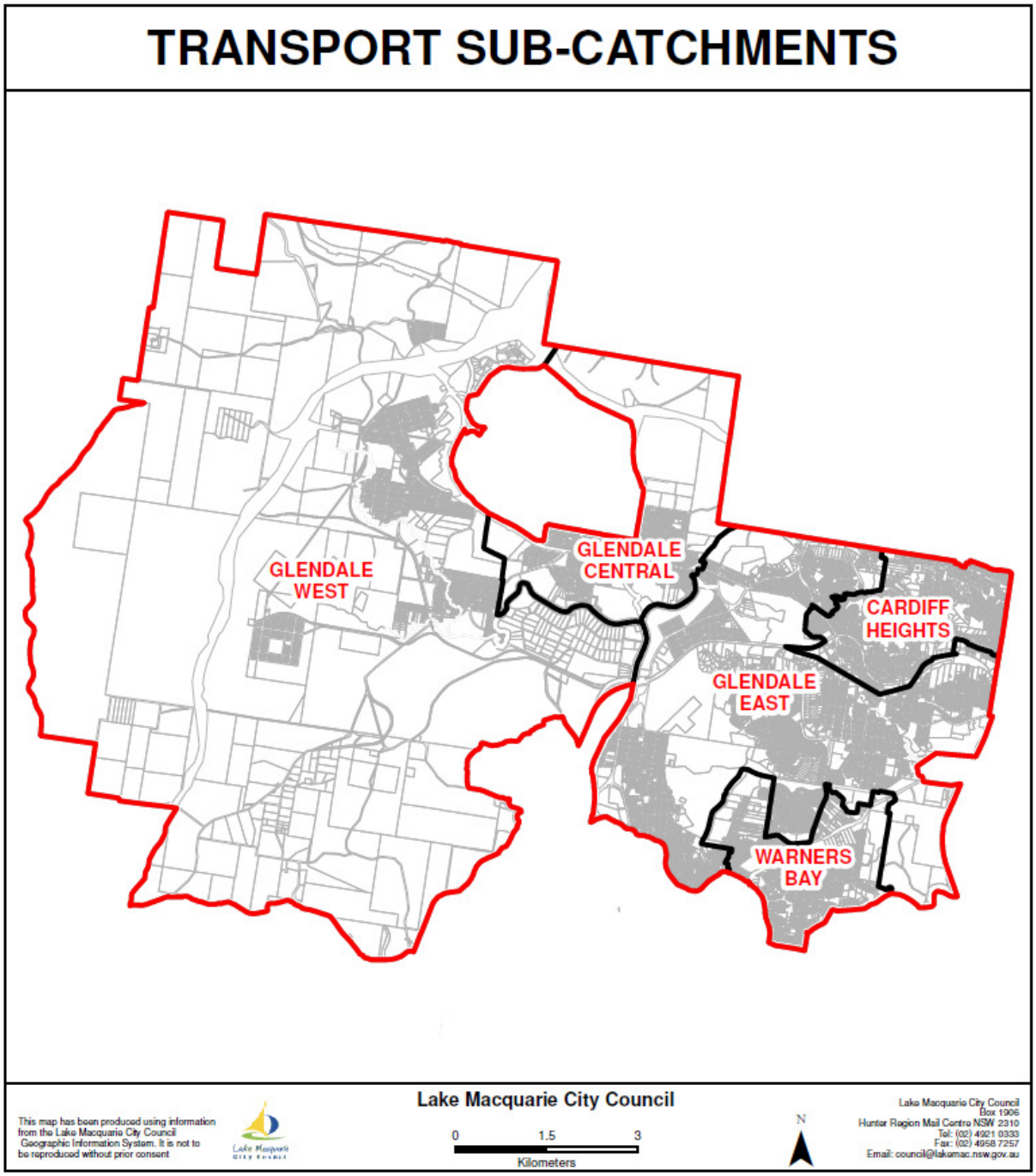


Figure 1.1: Glendale Development Contributions Catchment, split into the five sub-catchments (excluding Northlakes Urban release Area - N.U.R.A.)

The sub-catchments are:

- Glendale West
- Glendale Central
- Glendale East, which also contains the sub-catchments of:
    - Cardiff Heights
    - Warners Bay

1.1.4 Approach to the Study

The emphasis is on the provision of acceptable service levels on local infrastructure. The following approach to technical assessment of performance has been adopted.

- Agreement on Acceptable Performance Standards (Levels of Service, LoS)
- Agreement on Acceptable Minimum Service Levels (MSL's)
- Assessment of existing performance
- Upgrade of the existing situation (intersection or road segment) to meet the acceptable performance standard (where required)
- Assessment of the Agreed Growth Scenarios against the Base Facilities
- Assessment of the Upgrade Scenarios to meet Acceptable Performance Standards (where applicable).

The emphasis in the analysis has been to test threshold or incremental upgrades to facilities so that over design (and hence over investment) of facilities is minimised. This approach has been particularly important in the assessment of local road upgrades required to satisfy the adopted minimum service levels.

1.2 Discussion on Performance Standards

1.2.1 Introduction

An integral component to planning infrastructure requires the adoption of specific performance standards with regard to the operation of the transport network. The adoption requires consideration of the Levels of Service (LoS) at intersections and road segments, where it is possible to achieve a range of passenger and vehicle flow scenarios depending on the capacity and delay considerations adopted. The following sections discuss the issue of performance standards and guidelines in relation to the adopted performance criteria.

1.2.2 Level of Service (LoS) Assumptions

The concept of Level of Service (LoS) has been applied in transport planning for many years. Austroads has defined a range of traffic conditions with a scale of A to F for urban and suburban arterial roads with uninterrupted flow conditions, based on average travel speeds when related to free flow conditions.

For Council infrastructure (road segments and intersections), the Level of Service of D is the proposed maximum limit, which is considered the boundary between stable and unstable flow. It is considered appropriate to examine each differing segment of a road to assess its function, operating conditions and traffic carrying capacity, and each intersection to determine the worst movement LoS.

The 'RMS Guide to Traffic Generating Developments' is a guide that evaluates the impact of developments on traffic. It references the Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, which states that lane capacities may increase under ideal conditions to between 1,200 and 1,400 vehicles per hour. The analysis of critical road segments in the Glendale catchment has taken these limits and LoS criteria into consideration.

It should be noted that for roundabouts and sign controlled intersections (give way and stop signs), examining the highest individual average delay can be misleading. The size of the movement with the highest average delay per vehicle will also be taken into account. An intersection where all movements are operating at a LoS A, except one, which is at LoS E, may not necessarily define the intersection LoS as E if that movement is minimal. That is, longer delays to a small number of vehicles may not justify upgrading an intersection unless a safety issue occurred, or unless strategically it is the most appropriate intersection to upgrade. This would occur where an intersection offered a better outcome, and the alternative intersections (if currently operating outside the acceptable service levels) could have movements banned to improve the LoS and safety of those intersections.

1.2.3 Road Capacity Thresholds

As mentioned in the previous section, for urban arterial roads with interrupted flow the recommended traffic volumes per lane per hour are in the range of 1,200 to 1,400 vehicles.

There are many examples within the Hunter where such lane flows are observed, mostly on State roads. The flows on these roads are achieved through higher capacities relating to their physical design, but also with traffic management such as parking restrictions, signal coordination and flaring at intersections. Due to the costs associated with widening and upgrading roads, there is a consideration that a poor LoS (E) is an acceptable outcome, however where possible motorists will take the perceived fastest route, leading to local areas being infiltrated by traffic meant for the higher order roads.

The Austroads Guide quotes typical mid-block capacities with interrupted flow and without intersection flaring and with interruptions from cross and turning traffic at minor intersections. The guide continues to explain this matter of capacity as follows:

"Peak period mid-block traffic volumes may increase to between 1,200 and 1,400 vehicles per lane per hour on any approach road when the following conditions exist or can be implemented:

- *Adequate flaring at upstream junctions*
- *Uninterrupted flow from a wider carriageway upstream of an intersection approach and flowing at capacity*
- *Control or absence of crossing or entering traffic at minor intersections by major road priority controls*
- *Control or absence of parking*
- *Control or absence of right turns by banning turning at difficult intersection, or banning turning into driveways*
- *High volume flows of traffic from upstream intersections occurs during more than one phase of a signal cycle*
- *Good co-ordination of traffic signals along the route"*

In practical terms, it is possible to achieve lane capacities of up to 1,400 vehicles per lane per hour if some or all of the above conditions apply to a particular stretch of road. As npot all of these conditions can be met on the investigated roads, the capacity of principle traffic carrying routes in the study area was taken as 1,300 vehicles per hour per lane.

With the limit agreed and set at 1,300 vehicles per hour, the existing peak hour traffic volumes on Council's sub-arterial roads were obtained from peak hour counts, and indexed by the anticipated percentage growth within the sub-catchment that the road is located. Where the predicted future traffic volume exceeds capacity, the year of failure is determined and the appropriate solution is determined. It is considered for most cases, where possible, increasing the number of trafficable lanes is appropriate. Where it is not possible to increase the number of lanes, restricting right turn movements into streets and having separate deceleration lanes for left turns may assist traffic flow. Table 1.1 from the RMS and Austroads Guides shows lane capacity thresholds under various scenarios.

Table 1.1: Lane Capacity Thresholds

Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: RMS, Austroads

1.2.4 Environmental Capacity of Local Roads

The RMS Guide recognises that *"the Environmental Capacity of an area is determined by the impact of traffic, roads and various aspects of the location".*

Characteristics recognised as having influence include:

Traffic

- Traffic volume
- Percentage of heavy vehicles
- Speed

Road

- Road reserves and carriageway width
- Number of traffic lanes
- Grade
- Road pavement condition

Locality

- Distance from road carriageway to property boundary
- Nature of intervening surfaces

- Setback of building from property boundary
- Type and design of building

The Environmental Capacity of Council roads (local and collector roads) is most easily assessed by comparing the existing and predicted future traffic volume to Table 1.2, which is extracted from the RMS Guide and sourced from the AMCORD Guidelines.

Table 1.2: Environmental capacity of Local Roads

Road class	Road type	Maximum Speed (km/hr)	Maximum peak hour volume (veh/hr)
Local	Access way	25	100
	Street	40	200 environmental goal
			300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

Source: RMS

For this study, the environmental capacity is not reviewed on sub-arterial roads.

1.2.5 Intersections

The capacity of an intersection impacts the operation of the roads it is intersects. Requirements for intersection upgrades are generally determined using traffic modelling tools such as SIDRA intersection modelling, with the limit for upgrade or change required where there is a LoS D or worse. SIDRA calculates the average delay to vehicles at an intersection and gives a LoS rating (Table 1.3), which indicates the relative performance of the intersection control.

The LoS is defined in terms of delay, which is a measure of a driver's delay, frustration and lost travel time. There are six LoS measures ranging from A (very low delay, very good operating conditions) to F (over-saturation, arrival rate exceeds capacity).

Table 1.3: Intersection Level of Service Criteria

Level of service	Average delay per vehicle (d) in seconds			
	Unsignalised intersections	Roundabouts[1]	Signalised intersections	All intersection types
	HCM 2000 and 2010; SIDRA INTERSECTION	SIDRA INTERSECTION Recommended values	HCM 2000 and 2010; SIDRA INTERSECTION	RTA (1993)
A	d ≤ 10	d ≤ 10	d ≤10	d ≤ 14.5
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20	14.5 < d ≤ 28.5
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35	28.5 < d ≤ 42.5
D	25 < d ≤ 35	35 < d ≤ 50	35 < d ≤ 55	42.5 < d ≤ 56.5
E	35 < d ≤ 50	50 < d ≤ 70	55 < d ≤ 80	56.5 < d ≤ 70.5
F	50 < d	70 < d	80 < d	70.5 < d

Source: Austroads

1.2.6 Public Transport Facilities

Development contributions can provide for the provision of public transport infrastructure to satisfy the demands generated by new development and increased population. This can include associated infrastructure such as bus or taxi infrastructure compliance, and will exclude the provision or operation of public transport.

In order to encourage the use of public transport, it will be necessary to provide a sustainable public transport service to the new areas of development. At least 80% of new development areas should be within 400m of a bus stop.

In terms of local public transport facilities, bus shelters will be provided at a rate of one per 1,000 additional persons in the Glendale catchment. It is anticipated that this Plan will provide 12 shelters in the higher growth areas of the catchment between 2015 and 2030. Alternative funding for shelters is available per annum in Council's Capital Works budget, and can be achieved from successful grant funding (for example, CPTIGS, Country Passenger Transport Infrastructure Grants Scheme).

1.2.7 Cycling Facilities

The standard of cycling facilities can vary, as with public transport facilities, depending on the importance of the location (such as at shops or schools) and its patronage levels. Council has considered the overall needs of the Lake Macquarie area in its Cycling Strategy, which was adopted by Council in 2012. Cycling facilities are not considered as part of the transportation study, and are included in the Glendale Recreation and Land Plan.

1.2.8 Pedestrian Facilities

Council adopted the Footpath Strategy in 2013, applying over the 10 year period to 2023. All footpath facilities required as part of any development consent conditions will be assessed in accordance with the objectives of the Footpath Strategy and Council's guidelines.

Pedestrian footpath facilities have not been considered as part of the transportation study, and instead the shared paths have been evaluated and included in the Glendale Recreation and Land Plan.

1.3 Existing Transportation Situation

1.3.1 Introduction

Glendale has been identified as an emerging Major Regional Centre in the NSW Government's Lower Hunter Regional Strategy (LHRS). Council has invested significant resources into the road network, with works currently underway on Stage 1 of the Lake Macquarie Transport Interchange (LMTI). The Hunter Regional Development Plan 2012 to 2022 has identified the LMTI as 'a catalyst infrastructure project that will better connect the largest employment zone in the Hunter Region, Cardiff / Glendale, to the broader region. It will reduce congestion, unlock business investment, encourage property development and create jobs to support growth across the region.' Additional road works are proposed in the coming years, such as the LMTI Stage 2, which will connect Stockland Drive to Munibung Road via Pennent Street, and the Munibung Road extension between the Cardiff industrial area and Boolaroo.

Council's strategic estimate of population growth within the Glendale catchment estimates an additional 5,733 dwellings will be required over the 15-year period to 2030.

1.3.2 Roads

The existing road network comprises of a series of arterial, sub arterial road, collector and local roads. The Council controlled roads are the subject of this report, and State roads are not considered.

The key Council roads and road routes that make up the Glendale road network include:

1. Myall Road, Cardiff – Myall Road is a sub-arterial road connecting Highway 23 (H23, Newcastle Inner City Bypass) to Macquarie Road (MR527). Myall Road is majority two lane two way, with a four lane section near Cardiff High School and a three lane section near Gymea Drive.
2. Main Road, Cardiff – Main Road is a collector road that connects between Macquarie Road at H23 Newcastle Inner City Bypass (within the Newcastle City Council Local Government Area). The road is two lane two way along its length.
3. Bayview Street, Warners Bay – Bayview Street is a collector road that connects the arterial road King Street with Warners Bay Road. It is two lane two way along its length.
4. Newcastle Street, First Street, Maud Street, Gertrude Street and Crockett Street, Cardiff / Cardiff South – two lane two way collector road route that connects Hillsborough Road (MR674) with Myall Road.
5. Main Road Boolaroo / Speers Point – two lane two way road connecting between TC Frith Avenue and The Esplanade.

6. Munibung Road, Cardiff – two lane two way road that will ultimately connect between Macquarie Road (MR527) and TC Frith Avenue (MR217). It currently provides access only to the Cardiff industrial area.
7. Minmi Road, Edgeworth – Minmi Road is a sub-arterial road connecting between the Newcastle Link Road and Main Road (MR527). It is mostly two lane two way, with a four lane section operating under peak hour restrictions (otherwise two lanes) between Oakville Road and MR527.
8. Cameron Park Drive is a two lane two way sub-arterial road that connects between the Newcastle Link Road and George Booth Drive (MR527).
9. Wakefield Road Wakefield - two lane two way rural collector road that connects between the arterial road Cessnock Road (within the Toronto catchment) and Northville Drive / Appletree Road, Barnsley.
10. Northville Drive, Barnsley - two lane two way collector road that connects between Wakefield Road / Appletree Road and Main Road (MR527).
11. Withers Street and Carrington Street, West Wallsend – two lane two way collector road through West Wallsend. Connects to the arterial road George Booth Drive (MR527) at both ends.

1.3.3 Intersections

The following intersections were identified as having potential capacity limitations. They have been reviewed to assess the provision of adequate capacity for the infrastructure and development upgrades. Further details and results of the analysis are included in section 2. No roads intersecting with State roads were included as part of the investigations.

1. John Street and Francis Street, Cardiff
2. John Street and First Street, Cardiff
3. Newcastle Street and Oak Street, Cardiff
4. First and Oak Street, Cardiff
5. Crockett and Gertrude Street, Cardiff South
6. Main Road and Wallsend Road, Cardiff Heights – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.11.
7. Wallsend Road and Reservoir Road, Cardiff Heights
8. Munibung and Torrens Avenue, Cardiff
9. Munibung Road and Pendlebury Road, Cardiff

10. Munibung Road and Lachlan Road, Cardiff
11. Myall Road and Harrison Street, Cardiff – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.8.
12. Myall Road and Newcastle Street, Cardiff – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.7.
13. Myall Road, Government Road and Fifth Street Cardiff – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.6.
14. Myall Road and Coronation Avenue, Cardiff – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.5.
15. Myall Road, Lois Crescent and Louisa Avenue, Cardiff – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.4.3.
16. Myall Road and Gymea Drive, Garden Suburb – This intersection was investigated and requires improvements to formalise the existing arrangements. Refer to Section 2.4.
17. Myall Road and Prospect Road, Garden Suburb
18. Thompson Road and Fairfax Road, Speers Point
19. Lake Street and John Street, Warners Bay
20. Lake and Charles Street, Warners Bay
21. Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.12.
22. Main Road and Seventh Street, Boolaroo
23. Withers Street and Carrington Street, West Wallsend
24. Withers Street and Appletree Road, West Wallsend
25. Minmi Road and Sedgwick Avenue, Edgeworth – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.16.
26. Minmi Road, Transfield Avenue and Motherwell Place, Edgeworth – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.15.
27. Minmi Road and Northlakes Drive, Cameron Park – This intersection requires alteration prior to the 2030 horizon year of the Plan. Refer to Section 2.14.

1.3.4 Public Transport

The Glendale catchment is serviced by both Newcastle Buses and Hunter Valley Buses. The bus interchange is located at the Stockland Glendale shopping centre, off Stockland Drive, Glendale. Upgrade to bus infrastructure will be provided as part of the study in the higher growth areas of the catchment.

The Glendale catchment also contains the Sydney to Newcastle rail line, with railway stations located at Cardiff, Cockle Creek and Teralba. A future railway station is proposed in Glendale, behind Stockland Glendale shopping centre.

1.4 Future Situation

1.4.1 Demographics

Council's Strategic Land Use Planning Section has undertaken extensive demographic assessment into the future population characteristics that can be expected within the Glendale catchment. The increase in population can be converted into Peak Vehicle Trips (PVT's), which will be used to determine the growth in traffic within the relevant sub-catchments and how this affects the roads and intersections.

1.4.2 Expected growth in Peak Vehicle Trips

Table 1.4 below shows the growth in PVT's within the Glendale Catchment (and sub-catchments) from the current 32,154 trips to 41,653 trips by the year 2030.

Table 1.4: Peak Vehicle Trip (PVT's) increase per sub-catchment

Estimated projected PVT's in Glendale catchment sub-catchments 2015 to 2030				
Sub-catchment	**Existing (2015)**	**Projects PVT's**	**2030 estimate**	**Percentage Increase**
Glendale East	**26,253**	**7,486**	**33,739**	**28.51%**
Warners Bay[1]	**6,416**	**1,567**	**7,982**	**24.42%**
Gymea Drive[1]	**181**	**4**	**185**	**2.2%**
Cardiff Heights[1]	**4,475**	**810**	**5,284**	**18.09%**
Glendale West	**2,201**	**637**	**2,839**	**28.95%**
Glendale Central	**3,700**	**1,376**	**5,076**	**37.19%**
Total	**32,154**	**9,499**	**41,653**	**29.54%**

[1]These sub-catchment form part of the Glendale East sub-catchment, and not in addition to the Glendale East sub-catchment

The Glendale Central catchment (Edgeworth, Cameron Park (less Northlakes catchment)) show the highest PVT growth by percentage, however the Glendale East sub-catchment shows the highest real growth in PVT's. Table 1.5, extracted from the RMS Guide to Traffic Generating Developments, provides the estimated peak hour traffic generation of developments based on use. For this study, the following rates were used:

Table 1.5: Land Use Traffic Generation Rates

PVT Rates		
Residential	**Quantity**	**PVT**
Dwelling House / Lot	Per dwelling	0.85
Residential Accommodation with 1 bedroom / bedsit	Per dwelling	0.15
Residential Accommodation with 2 bedrooms	Per dwelling	0.30
Residential Accommodation with 3 or more bedrooms	Per dwelling	0.450
Seniors Housing	Per dwelling	0.40
Residential Care Facility	Per bed	0.15
Moveable Dwelling (Long-term)	Per site	0.40
Moveable Dwelling (Short-term)	Per site	0.40
Hostel/ Backpackers/ Boarding House/ Group Home/ Hospital	Per bed	0.40
Educational Establishment (residential component)	Per bed	0.40
Hotel or Motel Accommodation / Serviced Apartment	Per bed	0.40

Employment Generating		
Bed and Breakfast Accommodation	Per bed	0.40
Bulky Goods Premises	Per 100m² GLFA	2.70
Business Premises and Office Premises	Per 100m² GFA	1.20
Childcare Centre	Per Child	
Light Industry	Per 100m² GFA	0.78
Industry – Storage	Per 100m² GFA	0.50
Industry – Warehousing/Manufacturing	Per 100m² GFA	0.50
Medical Centre		
Retail Premises	Per 100m² GLFA	7.00
Supermarket	Per 100m² GLFA	12.30

Source: NSW RTA Guide to Traffic Generating Developments Version 2.2 October 2002

1.4.3 Alternate Development Contribution Methods

The methods available for funding local infrastructure have been amended to include:

- Section 94 development contributions
- Section 94 levy
- Voluntary Planning Agreements (VPA's).

  Within the current Glendale Contributions Catchment (2004), there are examples of two methods currently in existence:
- Section 94 developer contributions - the subject of this study
- Voluntary Planning Agreements (VPA's).

  This study focuses on the calculation of Section 94 developer contributions, with other methods considered on a case-by-case basis.

1.4.4 Determining Nexus

Nexus means the relationship between the expected types of development within an area and the demand for additional facilities generated. In terms of transport facilities, it is the relationship between the expected types of development and the demand for additional traffic and transport facilities generated.

1.4.5 Determining Apportionment

Intersections and road segments within the Glendale catchment have been investigated as part of Section 2, analysis.

For intersections or road lengths that have been modelled and currently do not fail (LoS D or better), but fail prior to the horizon year of the study (2030), any upgrade will be required as a direct result of the future growth and therefore all costs should therefore be borne by these future developments.

For intersections or road lengths that have been modelled and currently represent a LoS of E or F, this is considered the point when alternative traffic arrangements should be considered. For this case, the cost of the infrastructure upgrade will be apportioned between the new development and the existing development. The 'existing development' apportionment will most likely be funded by Council, and is related to the anticipated increase in traffic volume over time.

For intersections or road lengths that fall between two contribution catchments, the costs will be apportioned between the two catchments, with the apportionment relating to the growth anticipated in each catchment. Examples include the intersection of Bayview Street, Dunkley Parade and Warners Bay Road, located on the boundary of the Charlestown and Glendale Catchments, and the intersection of Minmi Road and Northlakes Drive, located on the boundary of the Glendale and NURA catchments.

Table 1.6 shows the apportionment for each facility proposed in the Glendale catchment.

Table 1.6: Table of apportionment between catchments and new or existing development

Intersection	**Plan**			**Development**	
	Glendale	Charlestown	Northlakes	Existing	New
Minmi Road and Northlakes Drive	34.97%	-	65.03%	-	100%
Bayview Street, Dunkley Parade and Warners Bay Road	47%	53%	-	24%	76%
Myall Road and Harrison Street	100%	-	-	-	100%
Minmi Road between Northlakes Drive and Newcastle Link Road	27.91%	-	72.09%	-	100%
Myall Road at Gymea Dive	100%	-	-	28.5%	71.5%
Wallsend Road and Main Road	100%	-	-	18%	82%
Minmi Road, Transfield Avenue and Motherwell Place	27.91%	-	72.09%	37%	63%
Myall Road between Prospect Road and Reserved Road	100%	-	-	-	100%

Intersection (continued)	Plan			Development	
	Glendale	Charlestown	Northlakes	Existing	New
Myall Road between Macquarie Road and Newcastle Street	100%	-	-	-	100%
Minmi Road between Transfield Avenue and Northlakes Drive	27.91%	-	72.09%	-	100%
Myall Road and Newcastle Street	100%	-	-	-	100%

1.4.6 Threshold Analysis

The approach to determining the requirement for new or upgraded infrastructure uses a threshold analysis approach, whereby the capacity of an item (road or intersection) is reached by triggering the requirement for provision of more capacity, or alternate infrastructure.

The threshold analysis was completed for the existing design year (2015) and the horizon year 2030. Sensitivity testing was also undertaken to determine the actual year, if applicable, where each intersection reaches a LoS E on any one leg. Further analysis was then undertaken for a projected time of ten years (for signals) or 20 years (for a roundabout) to determine the appropriate life of the intersection upgrade. An additional sensitivity test of 20% was loaded for significant infrastructure improvements to ensure that if traffic on the route increases above the anticipated growth anticipated, then the facility will be able to handle to an acceptable level.

1.5 Assessment of Future Traffic and Transport Requirements

1.5.1 Introduction

This section considers the performance of the local transport network under the future demand scenarios, comments on adequacy of existing facilities, and makes recommendations on improvements to meet the adopted performance criteria.

1.5.2 Roads

The analysis of mid-block capacities across the network has applied the LoS criteria and capacity thresholds identified and adopted in Section 1.2.2 and 1.2.3. The following process has been undertaken to determine the future traffic volumes per lane on a road segment to determine if upgrade is required:

1. Surveyed traffic volumes are indexed by percentage growth anticipated to be experienced by the sub-catchment.

2. Compare these volumes against agreed service level criteria as follows:
   i. As arterial and sub-arterial roads, using the mid-block capacities outlined in section Section 1.2.3 of this report.

   ii. In residential areas, using the mid-block Environmental Capacity outlined in the RMS Guide to Traffic Generating Development, as discussed in Section 1.2.4 of this report.

1.5.3 Intersections

Intersection analysis has been undertaken for the anticipated growth on a range of intersections within the Glendale Contributions Catchment, refer to Section 1.3.3. The study has adopted the strategic development growth and applied the percentage growth to the surveyed traffic volumes at the intersections being analysed.

The intersections were analysed in the following ways:

1. Existing situation analysis is considered as base
2. Add forecast development flows to existing
3. Confirm LoS
4. Apply upgrade where necessary to achieve acceptable LoS, and demonstrate options
5. Confirm acceptable LoS
6. Apply additional future time base factor to ensure viability
7. Apply sensitivity

The analysis in relation to points 4 and 5 above are iterated until a solution is achieved that delivers an acceptable LoS and an acceptable outcome for the road network.

1.5.4 Recommendation

Through the analysis of the proposed intersections, Table 1.7 shows the proposed intersections and roads for upgrade. Further detail is given in Section 2, Table 2.3.

Table 1.7: Summary of Identified Works and Capital Cost Estimates

Glendale Contributions Catchment			
Location	**Proposal**	**Total cost incl. land**	**Cost to Glendale Plan**
Glendale East sub-catchment			
Warners Bay – Bayview Street, Dunkley Parade and Warners Bay Road **– also located in Charlestown catchment and Warners Bay Catchment**	Roundabout	$4,834,512	**$545,333**
Cardiff – Myall Road and Harrison Street	Turn bans	$189,490	**$189,490**
Cardiff – Myall Road at Gymea Drive	Roundabout	$4,413,625	**$1,257,883**
Cardiff Heights – Wallsend Road and Main Road **– also located in Cardiff Heights catchment**	Signalisation	$2,510,894	**$451,961**
Garden Suburb - Myall Road between Prospect Road and Reserved Road	Road widening	$3,308,099	**$3,308,099**
Cardiff – Myall Road between Macquarie Road and Newcastle Street	Road widening	$2,657,942	**$2,657,942**
Cardiff – Myall Road and Newcastle Street	Road widening	$343,371	**$343,371**

Glendale Central sub-catchment			
Location	**Proposal**	**Total cost incl. land**	**Cost to Glendale Plan**
Cameron Park – Minmi Road and Northlakes Drive – **also in the NURA catchment**	Roundabout	$4,608,335	**$1,703,701**
Cameron Park – Minmi Road between Northlakes Drive and Newcastle Link Road **– also in the NURA catchment**	Road widening	$4,050,182	**$1,130,406**
Edgeworth – Minmi Road, Transfield Avenue and Motherwell Place – **also in the NURA catchment**	Roundabout	$4,002,649	**$416,693**
Edgeworth – Minmi Road between Transfield Avenue and Northlakes Drive – **also in the NURA catchment**	Road widening	$2,602,264	**$726,292**

The intersections listed below failed to reach the required performance level necessary for the intersection to function at an acceptable level by 2030.

1. Myall Road and Government Road, Cardiff
2. Myall Road and Coronation Avenue, Cardiff

The intersection of Myall Road and Gymea Drive is proposed to be upgraded to a roundabout. Once completed, the right turns from both Coronation Avenue and Government Road can be banned at Myall Road as motorists from these streets can travel to the roundabout the head in the westbound direction.

3. Minmi Road and Sedgwick Avenue, Edgeworth

Minmi Road, Transfield Avenue and Motherwell Place is proposed to be upgraded to a roundabout, and the right turn from Sedgwick Avenue can be banned at the time the roundabout is provided to allow motorists to travel in the northbound direction.

These intersections have not been included in the Plan given alternative intersections will be upgraded in close proximity, allowing motorists to choose the safer access option. Any proposal to

provide turn bans at these intersections will result in additional interruptions to traffic flow on Council's sub-arterial roads, and additional cost to developers when a satisfactory outcome is proposed.

1.5.5 Public Transport Infrastructure

The assessment of local public transport facilities has been undertaken. The rationale considered appropriate is as follows:

- Adopt rate of one shelter per 1,000 residents. This will be considered the Minimum Service Level (MSL) benchmark.
- Population in Glendale Catchment is 46,811 people.
- Existing number of shelters are 49 shelters.
- There is a current oversupply of 2.189 shelters based on this information.
- Anticipated population increase over 15 years of 13,635 people.
- At 1 shelter per 1,000 people, 13.635 shelters are required, less the existing oversupply of 2.189 shelters resulting in 11.446 (rounded to 12 shelters) being required to meet the public transport needs of the future.

The bus shelters will be provided within the higher growth areas of the Glendale catchment. The sites are nominated in the following locations:

Glendale East

1. King Street Warners Bay, north of Charles Street on western side
2. King Street Warners Bay, north of Bayview Street on eastern side
3. King Street Warners Bay, south of Hillsborough Road on eastern side
4. Myall Road Cardiff, west of Newcastle Street on southern side
5. Myall Road Cardiff, west of Newcastle Street on northern side
6. Main Road Boolaroo, south of First Street on eastern side
7. Main Road Boolaroo, south of Fourth Street on eastern side
8. Main Road Glendale, west of Glendale Drive on southern side of road

Glendale West

9. Carrington Street West Wallsend, fronting the Post Office

Glendale Central

10. Main Road Edgeworth, east of Minmi Road on north side
11. Minmi Road Edgeworth, south of Motherwell Place on east side
12. Main Road Edgeworth, west of Thomas Street on southern side

1.6 Proposed Works

The Proposed Works Schedule for roads and intersection improvements have been shown in Table 1.7, are detailed and worked in full in Table 2.3, with plans and cost estimates contained in Section 3.

Cost estimates have been developed for each item within the proposed works schedule. The approach taken to developing concept designs and estimates for the basis of developing contributions is described below.

1.6.1 Concept Designs

For the purpose of this study, a concept design is at a minimum a general arrangements plan, with sufficient detail to allow calculation of concept stage engineering estimates based on Council's Schedule of Rates or using similar constructed projects as a basis. It does not allow for any detailed consideration of ground conditions including underground or overhead service relocations, drainage calculations or any detailed level of geometric design or earthworks calculations. It relies on the principle of deriving strategic estimates for engineering road works and intersection facilities as illustrated in Figure 1.2 below.

1.6.2 Criteria for Concept Estimates

The accuracy of estimates at each stage of the design process is reflected by the extent of detailed knowledge of site conditions known at the time.

The process of preparing engineering estimates is iterative, and dependent on the level of detail information available. Types of information that can affect the estimate include the following items;

1. Existing services information
2. Relocation of existing services
3. Earthworks
4. Pavement design
5. Prepare a basic drainage layout for pipes and pit details
6. Type of traffic control (signals, priority, roundabout)
7. Traffic management control during construction
8. Cost of survey
9. Cost of design and project management
10. Cost of geotechnical investigations
11. Project management

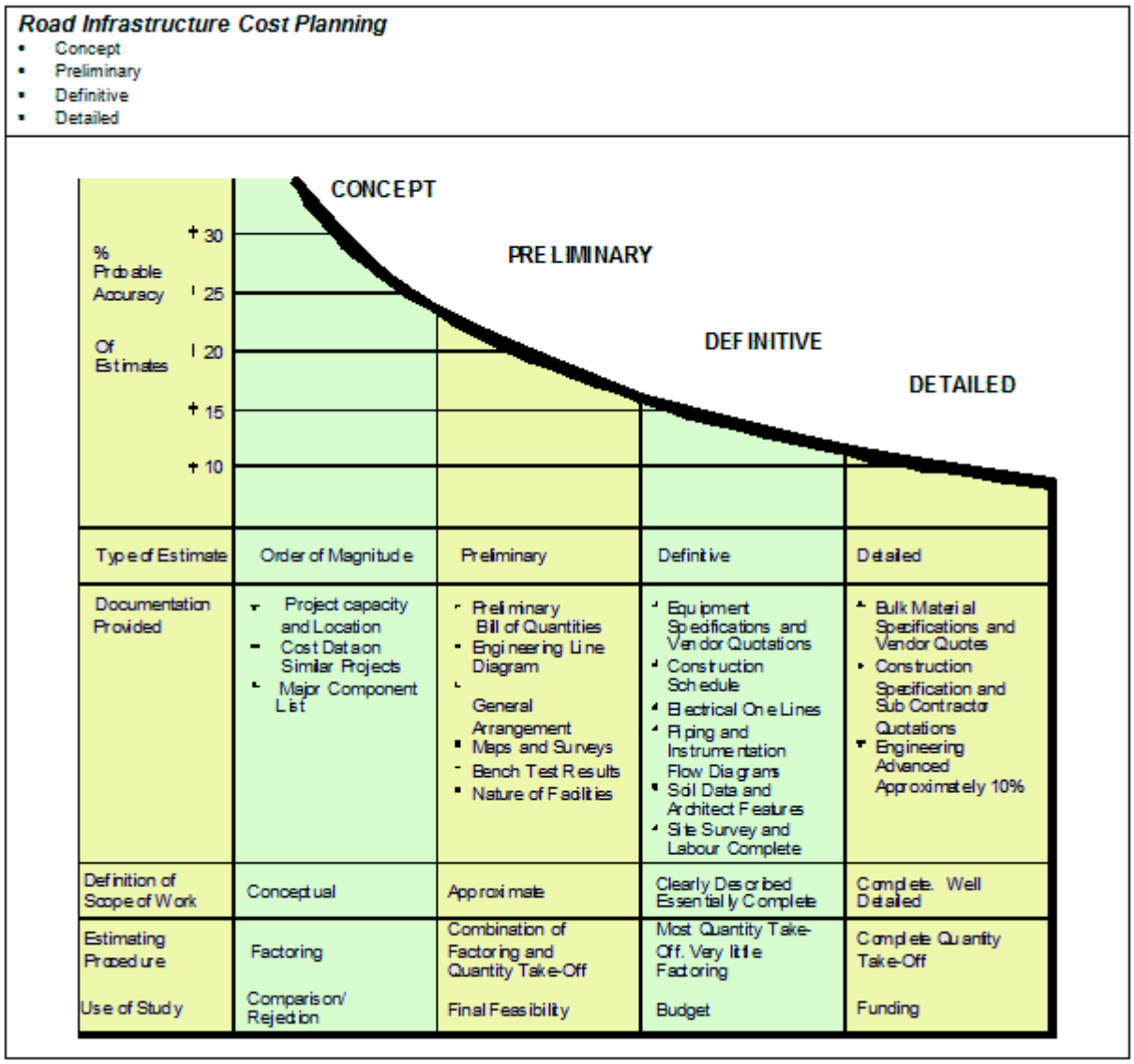


Figure 1.2: Cost Estimating Criteria

The estimating process can be staged as follows:

1. **Concept Development -** based on initial considerations such as capacity and functional requirements, costs generated from strategic estimates from comparable works.
2. **Preliminary Design Costing -** based on the existing concept layouts. No further design but enquiries to utility providers, basic appraisal of ground conditions, drainage network estimates and a basic layout added to the concept. Use standard cost rates and surface area measurements.
3. **Detailed Design** - this will cover services information, geotechnical investigation and pavement design, survey, roads and drainage design, utilities relocation agreements with providers, traffic signal design, road safety audit of design, design certification, and preparation of bills of quantities.

4. **Contract Stage -** will require preparation of tender documents, inviting tenders, assessment of tenders, negotiations and arranging signing the contract, negotiations and agreement with RMS and Council on certifying and approving procedures, contract administration and inspections, Contract Completion procedures and Works as Executed drawings.

Using Figure 1.2 as a guide for engineering cost estimates, the confidence limit and therefore contingency are outlined in Table 1.8 below

Table 1.8: Engineering Works Cost Estimations

Stage	Confidence Limits	Comments
Concept Design	**+ 40% to – 20%**	Scope of works defined in outline & global estimates made for groups of elements.
Preliminary Design	**+ 25% to – 15%**	Most works identified & sized; global estimates made for some groups of elements; a detailed bill prepared for other elements.
Detailed Design Review	**+ 20% to - 10%**	All works sized & identified with some quantities at preliminary level, and some work methods not specified; a detailed estimate made for all elements.
Pre tender	**+ 15% to - 5%**	All elements, which have been designed & identified, are quantified. A cost is estimated for each element taking into account issues related to methods of construction.
Contract Agreement	**+ 10%**	Prices for all identified works agreed between owner & constructor
Construction completed	**+/- 0%**	All costs known & agreed & works accepted by owner

Notes

- The confidence limit is interpreted as the contingency range applicable to the project at that stage of design. It is considered at concept design stage, the contingency is in the order of 20 to 40%. Based on previous experience, for roundabouts a contingency of 35% has been allowed for, and for all other projects a contingency of 20% has been applied.
- The actual cost of works can only be known when the works have been finished and accepted as meeting the requirements specified.
- If an element of the works is identified, it can be quantified and an estimate of cost applied to this element. Not all elements can be identified during the design stages resulting in omissions from the estimates. As the design is developed in detail, the accuracy of identifying and estimating each element increases.

- If the opinion of cost is derived from the elements of the works, it will usually only have plus errors of estimate. Minus errors (reductions) are rare because it is rare to identify elements, which are later not, required as part of the works.
- In presenting the opinion of cost, the actual amount to be stated should be the total amount including the contingency.

1.6.3 Basis of Applied Unit Rates for Construction

For the purpose of this study, concept estimates have been derived from available data and a comparison of unit rates / comparable constructions for civil engineering works.

This approach provides for reasonable average costs estimates. Final costs determined at contract stage may be higher or lower but overall will be consistent with the average costs so that individual contribution rates for transport facilities are appropriately determined.

1.6.4 Land Value

Where an item of upgrade works identifies the need for land acquisition as part of the design process, Council's Property Services Department will provide land valuations to enable land costs to be incorporated into the relevant works schedules and contributions calculations.

Table 1.9 below provides a summary of the estimated land area to be acquired for each identified upgrade.

Table 1.9: Land Acquisition Schedule

Site	Address	Lot and DP	Area (sqm)
Minmi Road and Northlakes Drive	11 Blackwood Circuit, CAMERON PARK	Lot 3400 DP 1202508	43
Bayview Street, Dunkley Parade and Warners Bay Road	300 Warners Bay Road, MOUNT HUTTON	Lot PT6 DP 17261	500
	195 Bayview Street, MOUNT HUTTON	Lot 7393 DP 1164604	50
Cameron Park	140 Minmi Road, CAMERON PARK	Lot 3 DP 877349	1,000

Site	Address	Lot and DP	Area (sqm)
Main Road and Wallsend Road	131 Main Road, CARDIFF HEIGHTS	Lot 422 DP 1143744	50
Minmi Road, Transfield Avenue and Motherwell Place	73 Minmi Road, EDGEWORTH	Lot 1 DP 1001693	1,233
	80 Minmi Road, EDGEWORTH	Lot 111 DP 665948	260
	1 Motherwell Place, EDGEWORTH	Lot 101 DP 1163391	45
	2 Transfield Avenue, EDGEWORTH	Lot 11 DP 874633	30
Myall Road between Prospect and Louisa Avenue	69 Myall Road, CARDIFF	Lot 100 DP 811772	5,545
Minmi Road between Transfield Avenue and Northlakes Drive	80 Minmi Road, EDGEWORTH	Lot 111 DP 665948	1,150
Myall Road and Newcastle Street	170 Myall Road, CARDIFF	Lot E DP 390674	1,785
		Total	**11,691**

1.7 Monitoring and Review

1.7.1 Review Requirements

The Legislation governing the application of s94 Contribution Plans require plans to apply to 'reasonable' timeframes, and to include review mechanisms to ensure contributions collected and works planned are delivered with the prescribed timeframe of the plan. Council has therefore proposed regular reviews of the plan, so that any time and monetary adjustments can be made.

1.7.2 Indexation

All contribution rates will be subject to indexation, the rate to be agreed with Council as appropriate for application to the proposed works.

1.8 References

- Lake Macquarie Cycling Strategy 2012 to 2022
- Lake Macquarie Footpath Strategy 2013 to 2023
- Lake Macquarie City Council Development Control Plan 2014
- LMCC Section 94 Contributions Plan Citywide 2004
- RMS Guide to Traffic Generating Developments 2002 and update Technical Direction TDT 2013/04a

2 Analysis – Assessment of Traffic and Transportation requirements

The Glendale Catchment is the largest development contributions catchment within the Lake Macquarie Local Government Area. The intersections evaluated are listed in Table 2.1 (Glendale East) and Table 2.2 (Glendale West and Glendale Central).

Table 2.1: Intersections and roads within the Glendale East sub-catchment

I.D Number	Location	Worst movement				Comments
		2015 LoS		2030 LoS		
		AM	PM	AM	PM	
1	John Street and Francis Street, Cardiff	B	B	B	B	No works required
2	John Street and First Street, Cardiff	A	A	A	A	No works required
3	Newcastle Street and Oak Street, Cardiff	A	A	A	A	No works required
4	First Street and Oak Street, Cardiff	A	A	A	A	No works required
5	Crockett Street and Gertrude Street, Cardiff South	A	A	B	B	No works required
6	Main Road and Wallsend Road, Cardiff Heights	C	F	C	D	Section 2.11
7	Wallsend Road and Reservoir Road, Cardiff Heights	B	A	C	A	No works required
8	Munibung Road and Torrens Avenue, Cardiff	B	A	B	B	No works required
9	Munibung Road and Pendlebury Road, Cardiff	D	E	D	E	No works required
10	Munibung Road and Lachlan Road, Cardiff	B	B	C	C	No works required

I.D Number	Location	Worst movement				Comments
		2015 LoS		2030 LoS		
		AM	PM	AM	PM	
11	Myall Road and Harrison Street, Cardiff	B	C	A	A	Section 2.8
12	Myall Road and Newcastle Street, Cardiff	B	B	B	B	Section 2.7
13	Myall Road, Government Road and Fifth Street Cardiff	F	D	E	B	Section 2.6
14	Myall Road and Coronation Avenue, Cardiff	F	D	C	B	Section 2.5
15	Myall Road, Lois Crescent and Louisa Avenue, Cardiff	F	F	B	B	Section 2.4.3
16	Myall Road and Gymea Drive, Garden Suburb	B	B	A	A	Section 2.4
17	Myall Road and Prospect Road, Garden Suburb	C	B	C	B	Section 2.3
18	Thompson Road and Fairfax Road, Speers Point	A	A	A	A	No works required
19	Lake Street and John Street, Warners Bay	A	A	A	A	No works required
20	Lake and Charles Street, Warners Bay	A	A	A	A	No works required
21	Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton	F	F	C	A	Section 2.12

Table 2.2: Intersections and roads within the Glendale West / Glendale Central sub-catchment

I.D Number	Location	Worst movement				Comments
		2015 LoS		2030 LoS		
		AM	PM	AM	PM	
22	Main Road and Seventh Street, Boolaroo	A	B	C	C	No works required
23	Withers Street and Carrington Street, West Wallsend	A	A	A	B	No works required
24	Withers Street and Appletree Road, West Wallsend	A	A	A	A	No works required
25	Minmi Road and Sedgwick Avenue, Edgeworth	F	D	B	B	Section 2.16
26	Minmi Road, Transfield Avenue and Motherwell Place, Edgeworth	D	E	A	A	Section 2.15
27	Minmi Road and Northlakes Drive, Cameron Park	B	B	B	B	Section 2.14
28	Myall Road between Macquarie Road and H23	D	D	D	D	Section 2.1
29	Minmi Road between Main Road and Newcastle Link Road	D	D	D	D	Section 2.14

The Works Schedule (Table 2.3) details the works required at intersections and road lengths within the Glendale catchment.

Table 2.3: Detailed Works Schedule – Glendale Catchment

Suburb	Location	Existing	Proposal	Year upgrade required	Existing PVT's	PVT's to failure	Land acquisition area	Total Facility Cost	Cost apportioned to this Plan
Cameron Park	Minmi Road and Northlakes Drive	Seagull	Installation of roundabout	2015	2,062	No failure	43	$4,608,335 34.97% apportioned to Glendale	$1,703,701
Warners Bay	Bayview Street, Dunkley Parade and Warners Bay Road	CHR	Installation of roundabout	2015 - 2020	2,181	Failed	550	$4,834,512 47% apportioned to Glendale, 24% attributable to new development	$545,333
Cardiff	Myall Road and Harrison Street	CHR	Turn bans	2015 - 2020	1,966	162	-	$189,490	$189,490
Cameron Park	Minmi Road	Two-lane two-way	Upgrade Minmi Road between Northlakes Drive and Newcastle Link Road to four-lane two-way, 900m	2015 - 2020	2,193	207	1,000	$4,050,182 27.91% apportioned to Glendale	$1,130,406

Suburb	Location	Existing	Proposal	Year upgrade required	Existing PVT's	PVT's to failure	Land acquisition area	Facility Cost	Total cost
Cardiff	Myall Road and Gymea Drive	Four way intersection	Roundabout, banning right out of Coronation Avenue, Government Road and Louisa Avenue at Myall Road	2020 - 2025	2,085	No failure	-	$4,413,625 28.5% attributable to new development	$1,257,883
Cardiff Heights	Wallsend Road and Main Road	T-intersection	Upgrade to signalised intersection	2020 - 2025	1,799	0	50	$2,510,894 18% attributable to existing development	$451,961
Edgeworth	Minmi Road, Transfield Avenue and Motherwell Place	Four-way intersection	Upgrade to roundabout, banning of right turn from Sedgwick Avenue into Minmi Road	2020 - 2025	1,929	0	1,568	$4,002,649, 27.91% apportioned to Glendale plan 37.3% attributable to new development	$416,693
Garden Suburb	Myall Road	Two-lane two-way	Upgrade Myall Road to four-lane two-way b/w Prospect and Reserved Rd, 800m	2020 - 2025	1,060	140	5,545	$3,308,099	$3,308,099

Suburb	Location	Existing	Proposal	Year upgrade required	Existing PVT's	PVT's to failure	Land acquisition area	Facility Cost	Total cost
Cardiff	Myall Road	Two-lane two-way	Upgrade Myall Road to four-lane two-way between Macquarie Road and Newcastle Street, 500 metre length	2020 - 2025	2,036	364	0	$2,657,942	$2,657,942
Edgeworth	Minmi Road	Two-lane two-way	Upgrade Minmi Road to four-lane two-way between Transfield Avenue and Northlakes Drive, 580 metre length	2025 - 2030	1,848	552	1,150	$2,602,264 27.91% apportioned to Glendale	$726,292
Cardiff	Myall Road and Newcastle Street	Round about	Upgrade approach and departure lanes east of the roundabout to four-lane two-way for 160 metres length	2025 - 2030	2,986	505	0	$343,371	$343,371
	Total	$12,058,831							

2.1 Myall Road, Cardiff

Myall Road is a sub-arterial road connecting the State roads Newcastle Inner City Bypass (H23) and Macquarie Road (MR527). It also passes the eastern edge of the Cardiff CBD, links to the Cardiff industrial estate and Munibung Road, which will form the most direct route to TC Frith Avenue (MR217) and the western side of Lake Macquarie once completed.

Several intersections along Myall Road have been analysed for this study, including:

- Myall Road and Prospect Road
- Myall Road and Gymea Drive
- Myall Road, Lois Crescent and Louisa Avenue
- Myall Road and Coronation Avenue
- Myall Road and Government Road
- Myall Road and Newcastle Street
- Myall Road and Harrison Street

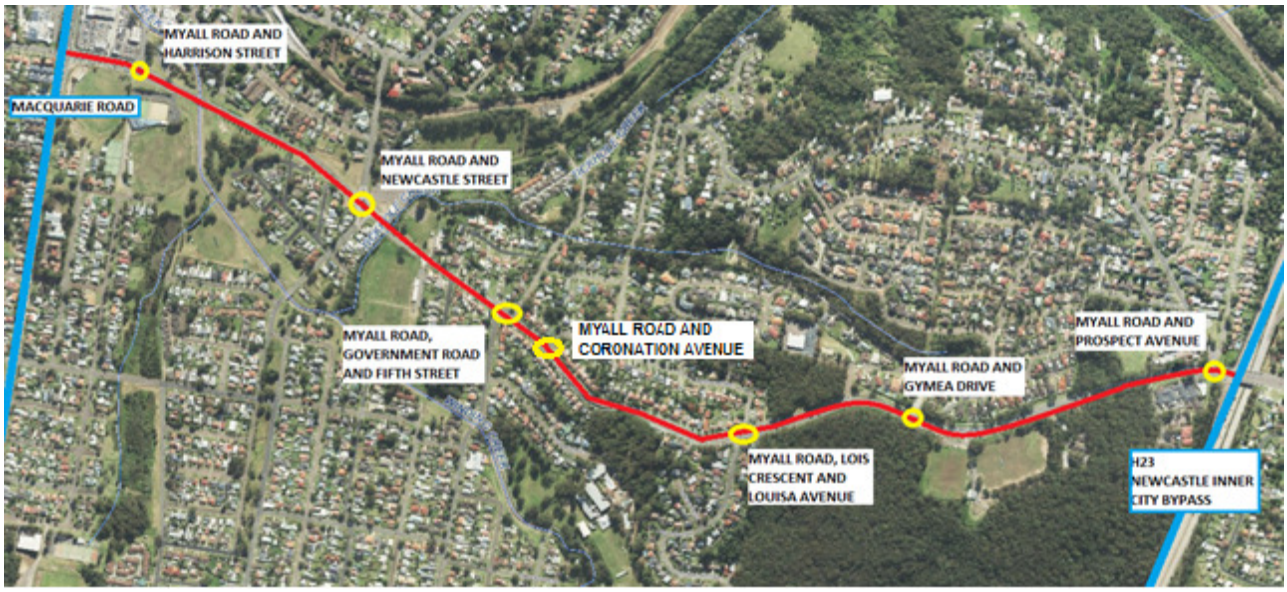


Figure 2.1: Myall Road and the intersections investigated along its length

2.1.1 Projected and historical growth

Myall Road has not been investigated as part of the RMS's strategic Lower Hunter Traffic Model. Historical Traffic Data shows that the Average Daily Traffic (ADT) volume on Myall Road has remained steady between 1986 (13,153) and 2001 (12,736). A traffic survey of Myall Road undertaken by Council in 2012 has the Average Daily Traffic (ADT) volume at 19,600 vehicles per day, representing a 53% increase over the previous 11 years.

Myall Road is a regional road, and the ADT is estimated to increase in line with the Glendale East catchment at 28.51% over the next 15 years, which if realised would result in an ADT of over 25,000 vehicles per day. Based on historical data, this increase appears conservative.

For this study, it has been adopted that the upper limit of traffic volume for any one travel lane is 1,300 vehicles per hour per lane (refer to section 1.2.3). Whilst this is considered LoS D from the Austroads Guide for uninterrupted traffic flow, it is noted that Myall Road does have interruptions and additional interruptions may occur if intersections are upgraded along the route.

To determine if Myall Road will require widening in the future, it was assessed in four sections.

- Section 1 - Prospect Road to Gymea Drive - 2 lane 2 way (distance 650 metres). It is proposed within the 2004 Glendale s94 plan to widen to 4 lane 2 way. This section can be widened as there is a wide road reserve available and there is no direct access to residential properties. Estimated Average Weekday Traffic (AWT) volume 19,310 vehicles per day (vpd).

Table 2.5: Myall Road near Gymea Drive peak hour traffic volumes

		Current 2015		**Estimated 2030**		**Year upgrade required (over 1,300 v/h/l/)** *v/h/l = vehicles per hour per lane
		Peak hour volume	**LoS**	**Peak hour volume**	**LoS**	
AM	**east**	973	C	1,250	D	2033
	west	1,060	D	1,370	D	2027
PM	**east**	905	D	1,170	D	2036
	west	890	C	1,150	D	2037

As seen from table 2.5, Myall Road near Gymea Drive requires upgrading to four-lane two-way in 2027. Alternative configuration could be three lane two way, however this can be reassessed in the future if the traffic volume split alters.

- Section 2 - Gymea Drive to pedestrian signals at number 104 - 4 lane 2 way (distance 550 metres), partially divided by a concrete median. The road carriageway will not require any additional widening as part of this plan.
- Section 3 – Pedestrian signals at number 104 to Newcastle Street - two lane two way road (distance 710 metres) constrained by narrow road reserve (20.2 metres) and narrow road pavement (12.2 metres). The road is also constrained by around 50 driveway connections, power poles located close to the kerb, and the steep footpath area, all of which will limit any widening within the current road reserve. Additionally, it will not be possible to add travelling lanes to comply with current Austroads design guidelines without widening of the

carriageway, which will involve property acquisition from approximately 28 properties. Estimated AWT volume 21,345 vpd.

Table 2.6: Myall Road near Fifth Street peak hour traffic volumes

		Current 2015		Estimated 2030		Year upgrade required (over 1,300 v/h/l/)
		Peak hour volume	LoS	Peak hour volume	LoS	
AM	**east**	969	D	1,246	D	2033
	west	1,084	D	1,394	D	2025
PM	**east**	852	C	1,095	D	2043
	west	1,054	D	1,354	D	2027

Table 2.6 shows that Myall Road near Fifth Street requires widening to four lane two way in 2025, however it may not be possible due to the previously identified constraints. To improve traffic flow it is considered that peak hour restrictions may be installed opposite and around intersections to ensure traffic flow is not interrupted, and right turns can be banned or channelised at intersections.

- Section 4 - Newcastle Street to Macquarie Road - 2 lane 2 way (distance 580 metres). Myall Road can be widened to 4 lane 2 way between Macquarie Road and Newcastle Street as there is a wide road reserve and no direct access to residential properties, with the widening of the culvert at Winding Creek required. Estimated AWT volume 22,600 vpd.

Table 2.7: Myall Road near Winding Creek peak hour traffic volumes

		Current 2015		Estimated 2030		Year upgrade required (over 1,300 v/h/l/)
		Peak hour volume	LoS	Peak hour volume	LoS	
AM	**east**	968	D	1,240	D	2033
	west	1,042	D	1,340	D	2028
PM	**east**	994	D	1,280	D	2031
	west	950	D	1,220	D	2034

Myall Road near Winding Creek requires upgrading to four-lane two-way in 2028.

2.1.2 Recommendation

Myall Road requires widening to four-lane two-way configuration between Prospect Road and Reserved Road in 2027, and between Harrison Street and Newcastle Street in 2028.

2.2 Access from the Myall Road north (Prospect Road and Gymea Drive catchments), and Myall Road south catchments

The Prospect Road catchment (Figure 2.2) connects Myall Road at different uncontrolled intersections. These are Prospect Road, Louisa Avenue, Coronation Avenue and Government Road. Prospect Road carries the highest left turning traffic volumes, and Government Road carries the highest right turning traffic volumes.

Largely developed, there may be a small amount of in-fill development occurring throughout the Prospect Road catchment as the larger lots are subdivided into smaller lots, however there is unlikely to be any residential estates created in the catchment in the short to medium term.

As the volume on Myall Road approaches saturation, the number of connections via traffic signals or roundabouts will be minimised to reduce interruptions to the traffic flow. For this report, it will be considered that the 70+ lot subdivision south of Myall Road opposite the Gymea Drive estate will progress within the life of the plan.

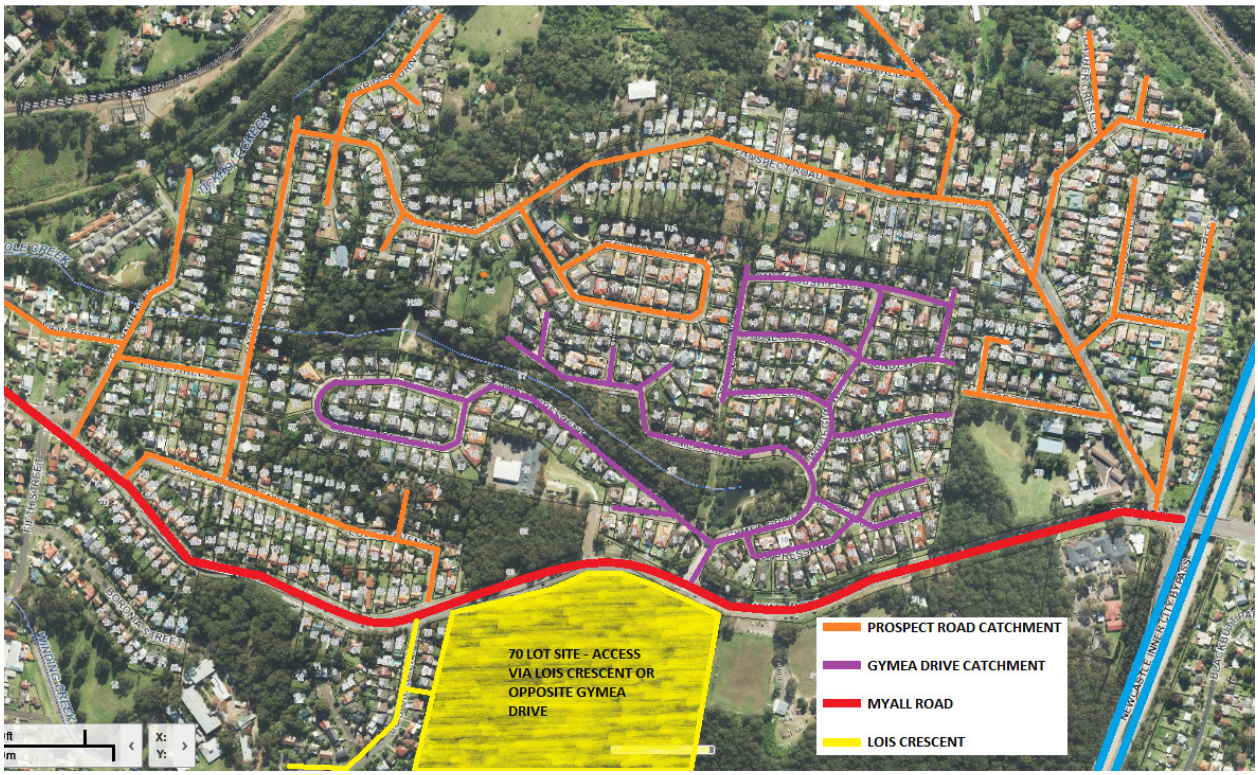


Figure 2.2: Prospect Road and Gymea Drive catchment and relation to Myall Road.

For improved Level of Service (LoS) from of the Prospect Road catchment, an upgrade of either the Prospect Road, Louisa Avenue, Coronation Avenue or Government Road intersections at Myall Road may be considered. Further refining the access opportunities, it would be appropriate to link the north and south residential catchments along Myall Road. The access opportunities to be investigated are:

1. Connection of the Myall Road south subdivision to Myall Road opposite Gymea Drive, and upgrade of Gymea Drive to traffic signals. The Myall Road south subdivision proposes additional connection to Lois Crescent via Gillian Crescent. To connect the Prospect Road and Gymea Drive catchments, Gymea Drive could be connected to Prospect Road via number 94 Prospect Road. Number 94 Prospect Road is part of four lots that front Prospect Road (94 to 112), zoned RU6 rural with a total area in excess of 14,500sqm. For connection to occur, the lots may have to be rezoned and subdivided.
2. Connection of the 70+ lot subdivision to Lois Crescent via the unformed road reserve between 8 and 10 Lois Crescent. Lois Crescent is located opposite Louisa Avenue, and this four-way intersection with Myall Road will be required to be upgraded to signals if the connection proceeded. Government Road and Coronation Avenue intersections at Myall Road should have the right turn onto Myall Road restricted as part of this proposal.

2.3 Myall Road and Prospect Road, Garden Suburb.

2.3.1 Background

Prospect Road intersects with Myall Road within 30 metres of the Newcastle Inner City Bypass (H23, Figure 2.3). The intersection has a short right turn lane into Prospect Road from Myall Road, and a queuing space when exiting Prospect Road right into Myall Road. There is no acceleration or merging lane once entering Myall Road, however the layout allows two stage movement with the concrete median in the middle of the road. The Garden Suburb Public School is located on the corner of Myall Road and Prospect Road, with the entrance to the school from Prospect Road. The school is a major generator of traffic at the intersection during the morning drop off, which coincides with the AM peak.

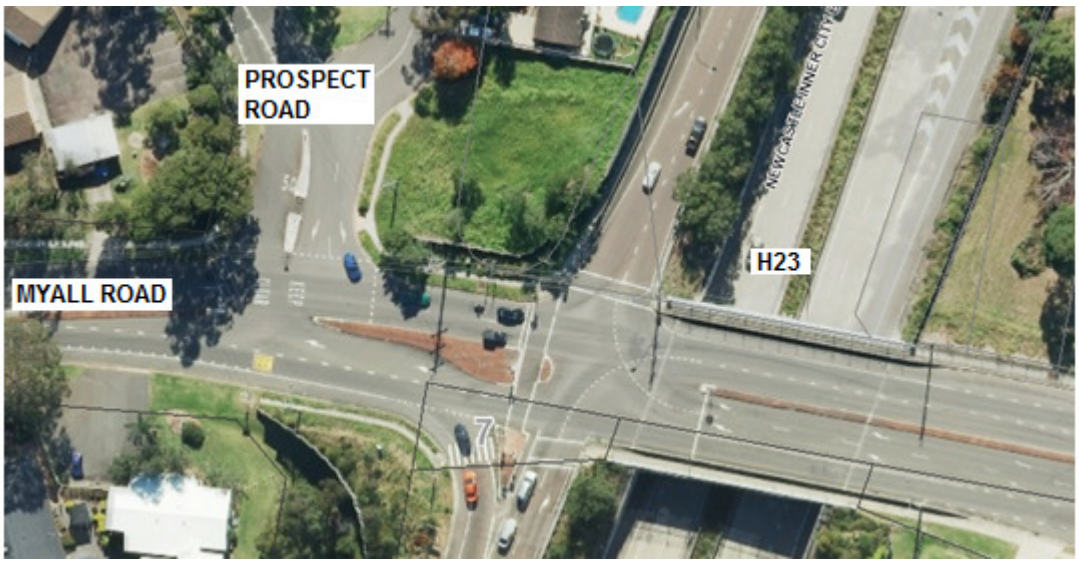


Figure 2.3: Myall Road and Prospect Road intersection, and proximity to H23

2.3.2 Projected Growth

The increase to traffic in the Prospect Road catchment is likely to be in-fill development, for example subdivision of larger blocks into smaller blocks, and dual occupancies. There are no large parcels expected to generate growth that would influence the traffic volumes along Prospect Road. The traffic volume increase along Myall Road is anticipated in-line with the Glendale east sub-catchment at 28.51% between 2015 and 2030, as Myall Road is a sub-arterial road connecting between State roads.

2.3.3 Analysis

A survey at the intersection of Myall Road and Prospect Road was undertaken in 2013. Due to the proximity of Prospect Road to the H23 off ramp signalised intersection, modelling was undertaken using Sidra Network modelling, to account for the queuing on Myall Road in the eastbound direction. Table 2.8 shows the LoS for AM Prospect Road right turn manoeuvre, and Table 2.9 shows the LoS for the AM merging right turn Prospect Road traffic into the westbound Myall road traffic stream (not as part of a networked intersection). The PM results are shown in Tables 2.10 and 2.11.

Table 2.8: Right turn from Prospect Road into Myall Road, AM 2013

Site: Myall Road and Prospect Road AM 2013 right from Prospect — **Network: Network6**

right turn from Prospect Road
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east													
6	R2	61	0.0	61	0.0	0.152	13.9	LOS A	0.5	3.2	0.75	0.90	47.7
Approach		61	0.0	61	0.0	0.152	13.9	NA	0.5	3.2	0.75	0.90	47.7
North: Prospect Road													
7	L2	118	0.0	118	0.0	0.290	28.5	LOS C	2.1	14.8	0.87	1.02	32.2
9	R2	31	0.0	31	0.0	0.093	17.6	LOS B	0.3	2.1	0.76	1.00	46.2
Approach		148	0.0	148	0.0	0.290	26.3	LOS B	2.1	14.8	0.85	1.01	35.9
West: Myall Road west													
10	L2	20	0.0	20	0.0	0.541	5.5	LOS A	32.5	227.3	0.00	0.02	57.9
11	T1	1043	0.0	1043	0.0	0.541	0.0	LOS A	40.7	285.1	0.00	0.01	59.4
Approach		1063	0.0	1063	0.0	0.541	0.3	NA	40.7	285.1	0.00	0.01	59.4
All Vehicles		1273	0.0	1273	0.0	0.541	3.8	NA	40.7	285.1	0.14	0.17	53.7

Table 2.9: Merge lane from for right turning vehicles into Myall Road westbound traffic, AM 2013

Site: Myall Road and Prospect Road AM 2013 merge lane

merge lane from Prospect Road
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: merge lane											
21a	L1	31	0.0	0.046	5.7	LOS A	0.2	1.1	0.61	0.74	47.9
Approach		31	0.0	0.046	5.7	LOS A	0.2	1.1	0.61	0.74	47.9
East: Myall Road east											
5	T1	788	0.0	0.404	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	61	0.0	0.152	13.9	LOS A	0.5	3.7	0.75	0.90	47.6
Approach		849	0.0	0.404	1.0	NA	0.5	3.7	0.05	0.06	58.8
North: Prospect Road											
7	L2	118	0.0	0.182	11.7	LOS A	0.7	4.7	0.54	0.99	49.9
Approach		118	0.0	0.182	11.7	LOS A	0.7	4.7	0.54	0.99	49.9
West: Myall Road west											
10	L2	20	0.0	0.273	5.6	LOS A	0.0	0.0	0.00	0.02	58.1
11	T1	1043	0.0	0.273	0.0	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		1063	0.0	0.273	0.1	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		2061	0.0	0.404	1.3	NA	0.7	4.7	0.06	0.10	58.6

Table 2.10: Right turn from Prospect Road into Myall Road, PM 2013

Site: Myall Road and Prospect Road PM 2013 right from Prospect **Network: Network7**

right turn from Prospect Road
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east													
6	R2	144	0.0	144	0.0	0.257	11.6	LOS A	0.9	6.2	0.68	0.88	49.3
Approach		144	0.0	144	0.0	0.257	11.6	NA	0.9	6.2	0.68	0.88	49.3
North: Prospect Road													
7	L2	83	0.0	83	0.0	0.175	27.0	LOS B	1.3	9.4	0.89	0.85	33.1
9	R2	15	0.0	15	0.0	0.034	14.6	LOS B	0.1	0.8	0.67	0.97	48.0
Approach		98	0.0	98	0.0	0.175	25.1	LOS B	1.3	9.4	0.85	0.87	36.0
West: Myall Road west													
10	L2	27	0.0	27	0.0	0.422	5.5	LOS A	49.9	349.1	0.00	0.04	57.8
11	T1	808	0.0	808	0.0	0.422	0.0	LOS A	60.9	426.6	0.00	0.02	59.4
Approach		836	0.0	836	0.0	0.422	0.3	NA	60.9	426.6	0.00	0.02	59.3
All Vehicles		1078	0.0	1078	0.0	0.422	4.0	NA	60.9	426.6	0.17	0.21	53.7

Table 2.11: Merge lane from for right turning vehicles into Myall Road westbound traffic, PM 2013

Site: Myall Road and Prospect Road PM 2013 merge lane

merge lane from Prospect Road
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: merge lane											
21a	L1	15	0.0	0.032	8.4	LOS A	0.1	0.7	0.73	0.85	44.9
Approach		15	0.0	0.032	8.4	LOS A	0.1	0.7	0.73	0.85	44.9
East: Myall Road east											
5	T1	992	0.0	0.509	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
6	R2	144	0.0	0.256	11.6	LOS A	1.1	7.4	0.68	0.89	49.0
Approach		1136	0.0	0.509	1.5	NA	1.1	7.4	0.09	0.11	58.2
North: Prospect Road											
7	L2	83	0.0	0.108	10.4	LOS A	0.4	2.7	0.46	0.92	50.7
Approach		83	0.0	0.108	10.4	LOS A	0.4	2.7	0.46	0.92	50.7
West: Myall Road west											
10	L2	27	0.0	0.215	5.6	LOS A	0.0	0.0	0.00	0.04	58.0
11	T1	808	0.0	0.215	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
Approach		836	0.0	0.215	0.2	NA	0.0	0.0	0.00	0.02	59.7
All Vehicles		2069	0.0	0.509	1.4	NA	1.1	7.4	0.07	0.11	58.4

The AM peak is the critical peak with reduced LoS from Prospect Road. However the intersection operates well. The intersection was modelled for the 2030 study horizon year to determine the LoS on Prospect Road at that time. This is shown in Tables 2.12 and 2.13.

Table 2.12: Right turn from Prospect Road into Myall Road, AM 2030

Site: Myall Road and Prospect Road AM 2030 right from Prospect — **Network: Network8**

right turn from Prospect Road
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east													
6	R2	84	0.0	81	0.0	0.352	24.2	LOS B	1.1	7.5	0.89	0.99	42.1
Approach		84	0.0	81[N1]	0.0	0.352	24.2	NA	1.1	7.5	0.89	0.99	42.1
North: Prospect Road													
7	L2	140	0.0	140	0.0	0.425	35.0	LOS C	3.2	22.1	0.86	1.14	28.9
9	R2	54	0.0	54	0.0	0.281	29.0	LOS C	0.9	6.6	0.89	1.03	40.5
Approach		194	0.0	194	0.0	0.425	33.4	LOS C	3.2	22.1	0.87	1.11	33.0
West: Myall Road west													
10	L2	42	0.0	42	0.0	0.700	5.5	LOS A	113.2	792.5	0.00	0.04	57.4
11	T1	1341	0.0	1341	0.0	0.700	0.0	LOS A	140.0	979.9	0.00	0.02	59.0
Approach		1383	0.0	1383	0.0	0.700	0.5	NA	140.0	979.9	0.00	0.02	58.9
All Vehicles		1661	0.0	1658[N1]	0.0	0.700	5.2	NA	140.0	979.9	0.15	0.19	51.6

Table 2.13: Merge lane from for right turning vehicles into Myall Road westbound traffic, AM 2030

Site: Myall Road and Prospect Road AM 2030 merge lane

merge lane from Prospect Road
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: merge lane											
21a	L1	42	0.0	0.140	12.4	LOS A	0.4	3.0	0.80	0.89	40.9
Approach		42	0.0	0.140	12.4	LOS A	0.4	3.0	0.80	0.89	40.9
East: Myall Road east											
5	T1	1014	0.0	0.520	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
6	R2	84	0.0	0.364	25.0	LOS B	1.3	9.4	0.89	1.01	41.6
Approach		1098	0.0	0.520	2.0	NA	1.3	9.4	0.07	0.08	57.9
North: Prospect Road											
7	L2	140	0.0	0.270	14.1	LOS A	1.1	7.5	0.64	1.03	48.5
Approach		140	0.0	0.270	14.1	LOS A	1.1	7.5	0.64	1.03	48.5
West: Myall Road west											
10	L2	42	0.0	0.355	5.6	LOS A	0.0	0.0	0.00	0.04	58.0
11	T1	1341	0.0	0.355	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
Approach		1383	0.0	0.355	0.2	NA	0.0	0.0	0.00	0.02	59.7
All Vehicles		2663	0.0	0.520	1.9	NA	1.3	9.4	0.07	0.11	58.0

The right turn from Prospect Avenue reduces to a LoS C in 2030, and the merge lane continues to operate well.

2.3.4 Crash History

There were three reported crashes at this intersection in the 5 year period 1 July 2009 to 30 June 2014. Two of these crashes were right turning from Prospect Road and one was turning left. All of the crashes were minor (no injuries reported), and occurred in daylight during fine weather. Two of the crashes occurred just prior to the AM peak hour, and one just after the PM peak hour.

2.3.5 Further Analysis

The community of Prospect Road have requested that this intersection be reviewed for upgrade previously to assist the right turn out of Prospect Road onto Myall Road.

Upgrading the intersection to signals, networked with the neighbouring Myall Road and Highway 23 (H23) on / off ramp signalised intersection, will increase the delay and queuing on Prospect Road, and also affect the LoS on Myall Road. Additionally, the signals at Prospect Road will result in failure on the State road network (Table 2.14), which is unlikely to be supported by the Roads and Maritime Services (RMS).

Table 2.14: Myall Road and Prospect Avenue networked signals with H23 signals

Site: 2013 AM - Myall Road and Prospect Avenue, and H23 exit Garden Suburb Network: Network1

Signals - Fixed Time Coordinated Cycle Time = 100 seconds (Network Cycle Time)

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east													
5	T1	788	4.3	748	4.2	0.799	18.4	LOS B	5.6	40.8	0.81	0.75	38.2
6	R2	61	5.2	58	5.1	0.529	50.8	LOS D	2.9	21.4	0.99	0.79	22.8
Approach		849	4.3	806[N1]	4.3	0.799	20.7	LOS B	5.6	40.8	0.82	0.76	36.4
North: Prospect Avenue													
7	L2	118	2.7	118	2.7	0.379	35.5	LOS C	4.6	33.2	0.83	0.78	27.9
9	R2	31	3.4	31	3.4	0.054	31.4	LOS C	1.0	7.5	0.73	0.70	38.7
Approach		148	2.8	148	2.8	0.379	34.7	LOS C	4.6	33.2	0.81	0.77	30.8
West: Myall Road west													
10	L2	20	5.3	20	5.3	0.897	47.7	LOS D	31.5	232.1	0.95	1.09	34.7
11	T1	1043	6.1	1043	6.1	0.897	42.2	LOS C	31.5	232.1	0.95	1.09	25.3
Approach		1063	6.0	1063	6.0	0.897	42.4	LOS C	31.5	232.1	0.95	1.09	25.5
All Vehicles		2061	5.1	2017[N1]	5.2	0.897	33.2	LOS C	31.5	232.1	0.89	0.93	29.5
South: H23 exit south													
1	L2	320	2.6	320	2.6	1.080	150.7	LOS F	32.5	232.9	1.00	1.47	10.4
2	T1	1	0.0	1	0.0	1.056	125.4	LOS F	16.5	117.9	1.00	1.28	19.0
3	R2	385	2.2	385	2.2	1.056	131.0	LOS F	16.5	117.9	1.00	1.28	18.9
Approach		706	2.4	706	2.4	1.080	139.9	LOS F	32.5	232.9	1.00	1.37	15.1
East: Myall Road east													
5	T1	529	5.4	529	5.4	1.161	212.6	LOS F	66.8	489.1	1.00	2.02	7.6
6	R2	256	4.1	256	4.1	0.186	23.5	LOS B	4.3	31.5	0.64	0.74	42.0
Approach		785	5.0	785	5.0	1.161	151.0	LOS F	66.8	489.1	0.88	1.61	12.6
West: Myall Road west													
10	L2	193	7.7	193	7.7	1.180	225.6	LOS F	5.5	40.8	1.00	2.02	7.5
11	T1	1040	5.3	1040	5.3	1.180	223.5	LOS F	5.6	40.8	1.00	2.07	7.6
Approach		1233	5.6	1233	5.6	1.180	223.8	LOS F	5.6	40.8	1.00	2.07	7.6
All Vehicles		2724	4.6	2724	4.6	1.180	181.1	LOS F	66.8	489.1	0.97	1.75	10.5

2.3.6 Recommendation

No intersection upgrade is considered required at this time due to increased development. This analysis will be retained within the report as part of the Myall Road investigation.

2.4 Myall Road and Gymea Drive, Garden Suburb.

2.4.1 Background

Gymea Drive is a local road connecting to Myall Road in Garden Suburb. The intersection is currently designed as a seagull type intersection, with no merge required for right turning vehicles into the westbound traffic stream due to a continuous lane.

There is a proposal (via DA/1284/2013) for a 70-lot subdivision south of Myall Road opposite Gymea Drive. As part of the application, it is proposed to alter to a four-leg intersection to provide access to the proposed 70-lot housing estate to the south. Two of the 70 lots are

proposed to be super lots, capable of housing multiple dwellings. This estate will be referred to as the Myall Road south estate.

Figure 2.4: Myall Road and Gymea Drive, Garden Suburb 2014

The preferred option is a roundabout at this intersection, however alternatives will be investigated.

2.4.2 Projected Growth

Between 2015 and 2030, the Peak Vehicle Trips (PVT's) are expected to increase on Myall Road by 28.51%. The Gymea Drive estate is currently at full development, and the catchment does not connect to the surrounding older parts of Garden Suburb. Unless Gymea Drive is connected to Prospect Road via the undeveloped lots 94 to 112 Prospect Road (currently zoned Rural (Ru6)), the PVT's on Gymea Drive are not expected to increase. (Note, there are five vacant blocks within the estate, however there are no plans to create any additional lots within the estate).

2.4.3 Analysis: Existing Intersection

The existing intersection is a Seagull type configuration, which allows a two-stage movement from the minor road into the major road. The first stage is the right turn from Gymea Drive, opposed by the eastbound Myall Road traffic, and the right turn from Myall Road into Gymea Drive. The second stage is the merge, however this intersection is designed with a continuous lane and there is no merge required until Myall Road narrows to one lane in each direction, which occurs approximately 550 metres west. Therefore, the Seagull merge lane modelling has not been included as it will be at LOS A.

The modelling (Table 2.15) indicates that the right turn from Gymea Drive into Myall Road currently performs at a LoS B for both the AM and PM peak, with minor queuing and delay. The AM peak is the critical peak as the delay is slightly longer. With the traffic volumes projected to 2030, the intersection continues to operate well (Table 2.16).

Table 2.15: Myall Road and Gymea Drive Seagull, AM 2015

Site: Myall Road and Gymea Drive AM peak 2015

Existing Seagull
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
6	R2	23	0.0	0.043	11.7	LOS A	0.2	1.1	0.71	0.85	49.1
Approach		23	0.0	0.043	11.7	NA	0.2	1.1	0.71	0.85	49.1
North: Gymea Drive											
7	L2	77	2.0	0.099	11.1	LOS A	0.4	2.7	0.53	0.94	50.3
9	R2	38	2.0	0.147	18.8	LOS B	0.4	2.8	0.76	1.00	45.5
Approach		115	2.0	0.147	13.6	LOS A	0.4	2.8	0.60	0.96	48.6
West: Myall Road west											
10	L2	15	5.0	0.286	5.6	LOS A	0.0	0.0	0.00	0.02	57.9
11	T1	1064	5.0	0.286	0.0	LOS A	0.0	0.0	0.00	0.01	59.9
Approach		1079	5.0	0.286	0.1	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1217	4.6	0.286	1.6	NA	0.4	2.8	0.07	0.11	58.3

Table 2.16: Myall Road and Gymea Drive Seagull, AM 2030

Site: Myall Road and Gymea Drive AM peak 2030

Existing Seagull
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
6	R2	23	0.0	0.070	16.5	LOS B	0.2	1.7	0.83	0.93	46.2
Approach		23	0.0	0.070	16.5	NA	0.2	1.7	0.83	0.93	46.2
North: Gymea Drive											
7	L2	77	2.0	0.125	12.7	LOS A	0.5	3.3	0.60	1.00	49.4
9	R2	38	2.0	0.247	29.4	LOS C	0.7	4.8	0.87	1.02	40.3
Approach		115	2.0	0.247	18.2	LOS B	0.7	4.8	0.69	1.01	45.9
West: Myall Road west											
10	L2	15	5.0	0.364	5.6	LOS A	0.0	0.0	0.00	0.01	57.9
11	T1	1368	3.9	0.364	0.0	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		1383	3.9	0.364	0.1	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1521	3.7	0.364	1.7	NA	0.7	4.8	0.06	0.10	58.2

2.4.4 Recommendation

Based on this analysis, the intersection does not need to be upgraded. However, if the new estate progresses then an intersection will have to be constructed.

2.4.5 Options to connect catchments to Myall Road

There are various options to consider for the connection of the Myall Road south estate. These options will be investigated and are:

1. Fourth leg connected at Myall Road opposite Gymea Drive via a signalised intersection
2. Fourth leg connected at Myall Road opposite Gymea Drive via a roundabout intersection
3. The estate is connected to Lois Crescent via the unformed road reserve between 8 and 10 Lois Crescent, and the intersection of Myall Road, Lois Crescent and Louisa Avenue is upgraded to traffic signals
4. Access to the estate is gained from a new Seagull intersection on Myall Road, staggered from Gymea Drive.

* Either option 1 or 2 should consider connection of Gymea Drive to Prospect Road

2.4.5.1 Option 1, Traffic Signals at Myall Road, Gymea Drive and new road

Traffic signals would provide the benefit of improved pedestrian access across Myall Road. On the northern side of Myall Road is the Gymea Drive estate, Garden Suburb Public School and a bus stop. On the southern side of the road is the proposed Myall Road south estate, sporting grounds and a bus stop. Cardiff High School is located further west.

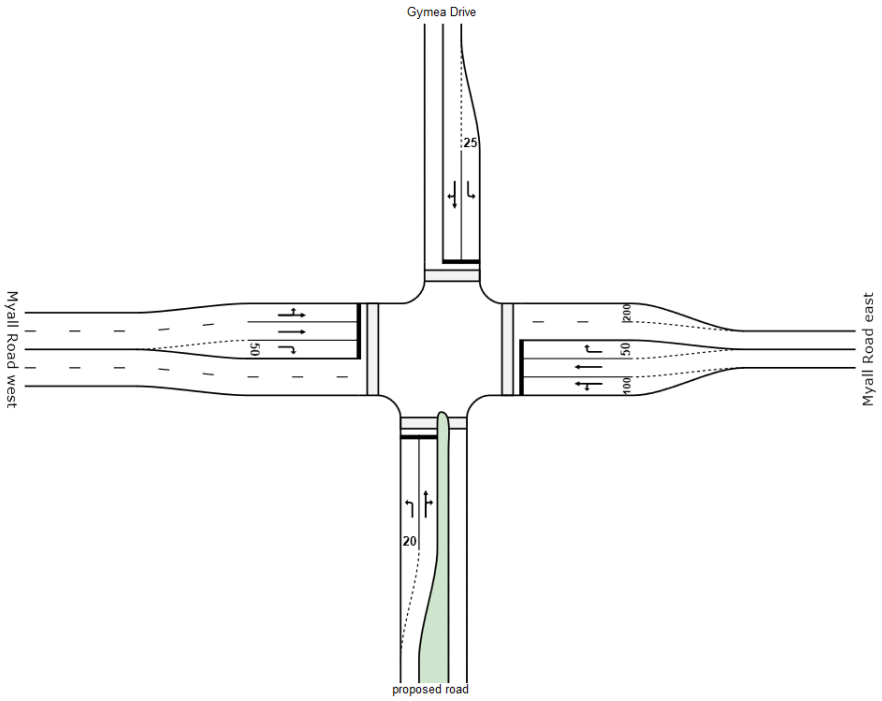


Figure 2.5: Myall Road, Gymea Drive and proposed road, Traffic Signals

For Traffic Signals to be installed, they are to meet the minimum warrant for installation in accordance with the RMS Traffic Signal guidelines. As the side roads traffic volumes (Gymea Drive and the proposed road) are below the required minimum, the RMS were approached to

determine if they had any objections to Council pursuing this option. The following is an extract from their response (full response in Trim D06850554):

Roads and Maritime would support the installation of traffic signals at the subject intersection subject to Council preparing and submitting a traffic impact assessment for Roads and Maritime approval…

Traffic Signals are required to be modelled for a minimum 10-year life. However as the intersection is being modelled for a 2015 upgrade (Table 2.17), it is considered that the intersection should be modelled to the horizon year of the plan, 2030. The results are shown in Table 2.18, where the intersection is operating at a LoS B. The intersection is modelled with a 20% sensitivity in Table 2.19, and 2030 PM with 20% sensitivity (Table 2.20) has been checked to ensure the intersection is performing well in both peaks. The intersection continues to perform at an overall LoS B with Myall Road west having longer queues in the AM, and Myall Road east having longer queues in the PM. The delay however is proportionately minor.

Table 2.17: Myall Road and Gymea Drive Traffic Signals, AM 2015

Site: Myall Road, Gymea Drive AM 2015 with fourth leg

Including fourth leg into proposed 72 lot estate
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: new road											
1	L2	17	0.0	0.106	41.9	LOS C	0.6	3.9	0.95	0.69	27.8
2	T1	1	0.0	0.081	20.8	LOS B	0.9	6.3	0.77	0.73	33.5
3	R2	34	0.0	0.081	28.9	LOS C	0.9	6.3	0.77	0.73	33.5
Approach		52	0.0	0.106	33.0	LOS C	0.9	6.3	0.83	0.71	31.4
East: Myall Road east											
4	L2	7	0.0	0.529	26.3	LOS B	10.6	74.3	0.82	0.71	38.0
5	T1	788	0.0	0.529	18.1	LOS B	10.6	74.3	0.82	0.71	38.0
6	R2	23	0.0	0.145	42.2	LOS C	0.8	5.5	0.96	0.71	27.7
Approach		819	0.0	0.529	18.8	LOS B	10.6	74.3	0.83	0.71	37.6
North: Gymea Drive											
7	L2	77	2.0	0.490	43.8	LOS D	2.7	19.3	0.99	0.76	27.2
8	T1	1	0.0	0.092	20.9	LOS B	1.0	7.2	0.78	0.73	33.4
9	R2	38	2.0	0.092	29.0	LOS C	1.0	7.2	0.78	0.73	33.4
Approach		116	2.0	0.490	38.8	LOS C	2.7	19.3	0.92	0.75	29.0
West: Myall Road west											
10	L2	15	5.0	0.742	29.8	LOS C	16.8	122.6	0.92	0.85	35.5
11	T1	1064	5.0	0.742	21.6	LOS B	16.8	122.6	0.92	0.85	35.6
12	R2	5	0.0	0.033	41.2	LOS C	0.2	1.2	0.94	0.65	28.1
Approach		1084	5.0	0.742	21.8	LOS B	16.8	122.6	0.92	0.85	35.5
All Vehicles		2071	2.7	0.742	21.9	LOS B	16.8	122.6	0.88	0.79	35.8

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	5	19.3	LOS B	0.0	0.0	0.74	0.74
P2	East Full Crossing	11	29.3	LOS C	0.0	0.0	0.91	0.91
P3	North Full Crossing	11	17.9	LOS B	0.0	0.0	0.71	0.71
P4	West Full Crossing	5	29.3	LOS C	0.0	0.0	0.91	0.91
All Pedestrians		32	23.8	LOS C			0.82	0.82

Table 2.18: Myall Road and Gymea Drive Traffic Signals, AM 2030

Site: Myall Road, Gymea Drive AM 2030 with fourth leg

Including fourth leg into proposed 72 lot estate
Signals - Fixed Time Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: new road											
1	L2	17	0.0	0.121	47.6	LOS D	0.7	4.6	0.96	0.69	25.9
2	T1	1	0.0	0.092	26.0	LOS B	1.1	7.5	0.81	0.73	31.0
3	R2	34	0.0	0.092	34.2	LOS C	1.1	7.5	0.81	0.73	31.0
Approach		52	0.0	0.121	38.4	LOS C	1.1	7.5	0.86	0.72	29.1
East: Myall Road east											
4	L2	7	0.0	0.566	25.1	LOS B	14.5	101.7	0.78	0.69	38.9
5	T1	1014	0.0	0.566	16.9	LOS B	14.5	101.8	0.78	0.69	38.9
6	R2	23	0.0	0.166	47.9	LOS D	0.9	6.3	0.97	0.71	25.8
Approach		1044	0.0	0.566	17.6	LOS B	14.5	101.8	0.78	0.69	38.5
North: Gymea Drive											
7	L2	77	2.0	0.560	50.1	LOS D	3.2	22.5	1.00	0.78	25.2
8	T1	1	0.0	0.105	26.1	LOS B	1.2	8.6	0.81	0.73	30.9
9	R2	38	2.0	0.105	34.3	LOS C	1.2	8.6	0.81	0.73	30.9
Approach		116	2.0	0.560	44.7	LOS D	3.2	22.5	0.94	0.76	26.9
West: Myall Road west											
10	L2	15	5.0	0.793	30.5	LOS C	24.6	179.6	0.91	0.87	35.2
11	T1	1367	5.0	0.793	22.3	LOS B	24.6	179.6	0.91	0.87	35.2
12	R2	5	0.0	0.038	46.9	LOS D	0.2	1.4	0.95	0.65	26.2
Approach		1387	5.0	0.793	22.5	LOS B	24.6	179.6	0.91	0.87	35.2
All Vehicles		2599	2.7	0.793	21.8	LOS B	24.6	179.6	0.86	0.79	35.8

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	11	16.9	LOS B	0.0	0.0	0.65	0.65
P2	East Full Crossing	11	34.2	LOS D	0.0	0.0	0.93	0.93
P3	North Full Crossing	21	15.6	LOS B	0.0	0.0	0.63	0.63
P4	West Full Crossing	11	34.2	LOS D	0.0	0.0	0.93	0.93
All Pedestrians		53	23.3	LOS C			0.75	0.75

Table 2.19: Myall Road and Gymea Drive Traffic Signals, AM 2030 + 20%

Site: Myall Road, Gymea Drive AM 2035 with fourth leg - 20% sensitivity

Including fourth leg into proposed 72 lot estate
Signals - Fixed Time Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: new road											
1	L2	17	0.0	0.136	53.4	LOS D	0.7	5.2	0.97	0.69	24.3
2	T1	1	0.0	0.104	31.3	LOS C	1.3	8.8	0.84	0.73	28.8
3	R2	34	0.0	0.104	39.5	LOS C	1.3	8.8	0.84	0.73	28.8
Approach		52	0.0	0.136	43.9	LOS D	1.3	8.8	0.88	0.72	27.1
East: Myall Road east											
4	L2	7	0.0	0.601	24.2	LOS B	18.6	130.3	0.75	0.67	39.6
5	T1	1217	0.0	0.601	16.0	LOS B	18.6	130.4	0.75	0.67	39.6
6	R2	23	0.0	0.187	53.7	LOS D	1.0	7.2	0.98	0.71	24.2
Approach		1247	0.0	0.601	16.8	LOS B	18.6	130.4	0.75	0.67	39.1
North: Gymea Drive											
7	L2	77	2.0	0.629	56.5	LOS D	3.6	25.6	1.00	0.80	23.5
8	T1	1	0.0	0.118	31.5	LOS C	1.4	10.0	0.84	0.73	28.7
9	R2	38	2.0	0.118	39.6	LOS C	1.4	10.0	0.84	0.73	28.7
Approach		116	2.0	0.629	50.7	LOS D	3.6	25.6	0.95	0.78	25.0
West: Myall Road west											
10	L2	15	5.0	0.841	32.8	LOS C	34.4	251.4	0.92	0.91	33.9
11	T1	1641	5.0	0.841	24.6	LOS B	34.4	251.4	0.92	0.91	34.0
12	R2	5	0.0	0.043	52.5	LOS D	0.2	1.6	0.96	0.65	24.5
Approach		1661	5.0	0.841	24.7	LOS B	34.4	251.4	0.92	0.91	33.9
All Vehicles		3076	2.8	0.841	22.8	LOS B	34.4	251.4	0.85	0.80	35.2

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	11	15.0	LOS B	0.0	0.0	0.58	0.58
P2	East Full Crossing	11	39.2	LOS D	0.0	0.0	0.93	0.93
P3	North Full Crossing	21	13.9	LOS B	0.0	0.0	0.56	0.56
P4	West Full Crossing	11	39.2	LOS D	0.0	0.0	0.93	0.93
All Pedestrians		53	24.3	LOS C			0.71	0.71

Table 2.20: Myall Road and Gymea Drive Traffic Signals, PM 2030 + 20%

Site: Myall Road, Gymea Drive PM 2030 with fourth leg - 20% sensitivity

Including fourth leg into proposed 72 lot estate
Signals - Fixed Time Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: new road											
1	L2	4	0.0	0.030	46.7	LOS D	0.2	1.1	0.95	0.64	26.2
2	T1	1	0.0	0.025	25.3	LOS B	0.3	2.0	0.79	0.67	31.5
3	R2	8	0.0	0.025	33.5	LOS C	0.3	2.0	0.79	0.67	31.5
Approach		14	0.0	0.030	36.9	LOS C	0.3	2.0	0.84	0.66	29.6
East: Myall Road east											
4	L2	17	0.0	0.857	35.9	LOS C	31.4	219.6	0.96	0.98	32.3
5	T1	1528	0.0	0.857	27.8	LOS B	31.4	219.7	0.96	0.98	32.3
6	R2	42	0.0	0.302	48.7	LOS D	1.7	11.7	0.98	0.73	25.6
Approach		1587	0.0	0.857	28.4	LOS B	31.4	219.7	0.96	0.98	32.1
North: Gymea Drive											
7	L2	7	2.0	0.054	47.1	LOS D	0.3	2.0	0.95	0.66	26.1
8	T1	1	0.0	0.054	25.7	LOS B	0.6	4.3	0.80	0.70	31.2
9	R2	19	2.0	0.054	33.8	LOS C	0.6	4.3	0.80	0.70	31.2
Approach		27	1.9	0.054	37.1	LOS C	0.6	4.3	0.84	0.69	29.6
West: Myall Road west											
10	L2	17	5.0	0.774	29.3	LOS C	23.2	169.3	0.90	0.85	35.9
11	T1	1319	5.0	0.774	21.1	LOS B	23.2	169.3	0.90	0.84	36.0
12	R2	34	0.0	0.242	48.4	LOS D	1.3	9.3	0.98	0.72	25.7
Approach		1369	4.9	0.774	21.8	LOS B	23.2	169.3	0.90	0.84	35.6
All Vehicles		2998	2.2	0.857	25.5	LOS B	31.4	219.7	0.93	0.91	33.6

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	11	16.9	LOS B	0.0	0.0	0.65	0.65
P2	East Full Crossing	11	34.2	LOS D	0.0	0.0	0.93	0.93
P3	North Full Crossing	21	15.6	LOS B	0.0	0.0	0.63	0.63
P4	West Full Crossing	11	34.2	LOS D	0.0	0.0	0.93	0.93
All Pedestrians		53	23.3	LOS C			0.75	0.75

The intersection performs well as signals. Whilst the queues are lengthy, the delay is acceptable.

2.4.5.2 Option 2, Roundabout at Myall Road, Gymea Drive and new road

Gymea Drive was constructed at Myall Road in the 1990's. The intersection has been partially constructed as a concrete roundabout on the northern (Gymea Drive) approach in anticipation of the future roundabout construction. The intersection is currently listed in the 2004 Lake Macquarie Section 94 Contributions Plan Citywide – Glendale Catchment, proposing upgrade to a Roundabout including Pedestrian Refuges.

The majority of traffic anticipated to increase in the catchment is as a direct result of the proposed residential development south of Gymea Drive. The traffic volumes on Myall Road have been indexed using the Glendale East sub-catchment projections over the 20 life of the roundabout. The commencement year for the roundabout will be 2015, and horizon year being 2035. Table 2.21 shows the operation of the four-leg roundabout in 2035 as performing well, with an overall LoS A.

Table 2.21: Myall Road and Gymea Drive Roundabout, AM 2035

Site: Myall Road and Gymea Drive AM peak 2035

Including fourth leg into proposed 72 lot estate
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: New Road											
1	L2	17	0.0	0.075	9.5	LOS A	0.3	2.0	0.60	1.68	44.9
2	T1	1	0.0	0.075	8.7	LOS A	0.3	2.0	0.60	1.68	44.9
3	R2	34	0.0	0.075	14.4	LOS A	0.3	2.0	0.60	1.68	44.9
Approach		52	0.0	0.075	12.7	LOS A	0.3	2.0	0.60	0.84	44.9
East: Myall Road east											
4	L2	7	0.0	0.353	6.6	LOS A	3.1	21.9	0.24	0.89	50.6
5	T1	1088	0.0	0.353	5.6	LOS A	3.1	21.9	0.25	0.90	50.4
6	R2	23	0.0	0.353	11.4	LOS A	3.1	21.4	0.26	0.92	50.2
Approach		1119	0.0	0.353	5.8	LOS A	3.1	21.9	0.25	0.45	50.4
North: Gymea Drive											
7	L2	77	2.0	0.118	11.0	LOS A	0.6	4.0	0.74	1.74	46.0
8	T1	1	0.0	0.086	12.0	LOS A	0.4	2.6	0.74	1.84	41.1
9	R2	38	2.0	0.086	17.8	LOS B	0.4	2.6	0.74	1.84	41.1
Approach		116	2.0	0.118	13.3	LOS A	0.6	4.0	0.74	0.89	44.2
West: Myall Road west											
10	L2	15	5.0	0.487	6.7	LOS A	4.6	33.9	0.30	0.88	50.1
11	T1	1468	5.0	0.487	5.8	LOS A	4.6	33.9	0.32	0.89	50.0
12	R2	5	0.0	0.487	11.6	LOS A	4.6	33.7	0.33	0.90	49.9
Approach		1488	5.0	0.487	5.9	LOS A	4.6	33.9	0.32	0.44	50.0
All Vehicles		2775	2.8	0.487	6.3	LOS A	4.6	33.9	0.31	0.47	49.8

To test the sensitivity to failure, a 20% loading is increased on the traffic main road volumes. Table 2.22 shows that the intersection continues to operate at a LoS A with the 20% loading. To

confirm that the PM also continues to operate at 2035 with 20% sensitivity, the results are shown in Table 2.23.

Table 2.22: Myall Road and Gymea Drive Roundabout, AM 2035 + 20% sensitivity

Site: Myall Road and Gymea Drive AM peak 2035 - 20% sensitivity

Including fourth leg into proposed 72 lot estate
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: New Road											
1	L2	17	0.0	0.081	10.1	LOS A	0.3	2.2	0.64	1.74	44.4
2	T1	1	0.0	0.081	9.3	LOS A	0.3	2.2	0.64	1.74	44.4
3	R2	34	0.0	0.081	15.0	LOS B	0.3	2.2	0.64	1.74	44.4
Approach		52	0.0	0.081	13.3	LOS A	0.3	2.2	0.64	0.87	44.4
East: Myall Road east											
4	L2	7	0.0	0.451	6.6	LOS A	3.9	27.6	0.25	0.89	50.5
5	T1	1306	0.0	0.451	5.7	LOS A	3.9	27.6	0.26	0.91	50.4
6	R2	23	0.0	0.451	11.4	LOS A	3.9	27.2	0.26	0.92	50.2
Approach		1337	0.0	0.451	5.8	LOS A	3.9	27.6	0.26	0.45	50.4
North: Gymea Drive											
7	L2	77	2.0	0.136	12.2	LOS A	0.7	4.8	0.79	1.81	44.9
8	T1	1	0.0	0.101	13.7	LOS A	0.4	3.2	0.78	1.87	39.9
9	R2	38	2.0	0.101	19.5	LOS B	0.4	3.2	0.78	1.87	39.9
Approach		116	2.0	0.136	14.6	LOS B	0.7	4.8	0.79	0.91	43.0
West: Myall Road west											
10	L2	15	5.0	0.621	6.8	LOS A	6.4	47.0	0.35	0.89	49.8
11	T1	1762	5.0	0.621	5.9	LOS A	6.4	47.0	0.36	0.90	49.7
12	R2	5	0.0	0.621	11.7	LOS A	6.4	46.9	0.37	0.91	49.6
Approach		1782	5.0	0.621	5.9	LOS A	6.4	47.0	0.36	0.45	49.7
All Vehicles		3286	2.8	0.621	6.3	LOS A	6.4	47.0	0.34	0.47	49.6

Table 2.23: Myall Road and Gymea Drive Roundabout, PM 2035 + 20% sensitivity

Site: Myall Road and Gymea Drive PM peak 2035 - 20% sensitivity

Including fourth leg into proposed 72 lot estate
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: New Road											
1	L2	17	0.0	0.095	11.4	LOS A	0.4	2.7	0.70	1.80	43.3
2	T1	1	0.0	0.095	10.6	LOS A	0.4	2.7	0.70	1.80	43.3
3	R2	34	0.0	0.095	16.3	LOS B	0.4	2.7	0.70	1.80	43.3
Approach		52	0.0	0.095	14.6	LOS B	0.4	2.7	0.70	0.90	43.3
East: Myall Road east											
4	L2	7	0.0	0.560	6.6	LOS A	5.7	39.9	0.29	0.89	50.2
5	T1	1642	0.0	0.560	5.7	LOS A	5.7	39.9	0.30	0.90	50.1
6	R2	23	0.0	0.560	11.5	LOS A	5.7	39.6	0.31	0.91	50.0
Approach		1673	0.0	0.560	5.8	LOS A	5.7	39.9	0.30	0.45	50.1
North: Gymea Drive											
7	L2	77	2.0	0.114	10.7	LOS A	0.5	3.8	0.72	1.72	46.3
8	T1	1	0.0	0.083	11.6	LOS A	0.3	2.5	0.72	1.83	41.4
9	R2	38	2.0	0.083	17.4	LOS B	0.3	2.5	0.72	1.83	41.4
Approach		116	2.0	0.114	12.9	LOS A	0.5	3.8	0.72	0.88	44.5
West: Myall Road west											
10	L2	15	5.0	0.504	6.7	LOS A	4.3	31.7	0.29	0.89	50.2
11	T1	1416	5.0	0.504	5.8	LOS A	4.3	31.7	0.30	0.90	50.1
12	R2	5	0.0	0.504	11.6	LOS A	4.3	31.4	0.31	0.90	50.1
Approach		1436	5.0	0.504	5.8	LOS A	4.3	31.7	0.30	0.45	50.1
All Vehicles		3276	2.3	0.560	6.2	LOS A	5.7	39.9	0.32	0.47	49.8

As a roundabout, the intersection operates very well for the projected 2030 traffic volumes, with a 20% sensitivity loading.

2.4.5.3 Additional consideration for Option 1 and 2 - Connection of Gymea Drive to Prospect Road

If the intersection of Myall Road and Gymea Drive is upgraded, consideration should be given for future connection of the Prospect Road catchment to Gymea Drive. Connecting Prospect Road to Gymea Drive will improve access for the Prospect Road catchment to and from Myall Road, however it is considered that predominantly the increase in traffic volume on Gymea Drive will be from the right turning (west bound) traffic from the Prospect Road catchment. The other existing turning manoeuvres at other Myall Road intersections, Prospect Road, Louisa Avenue, Coronation Avenue and Government Road, are functioning adequately, with the right turn from these streets onto Myall Road being the worst movement for each intersection (LoS F at Louisa Avenue, Coronation Avenue and Government Road).

Gymea Drive is constructed to a Collector road standard at 11 metres width between Myall Road and number 36 Gymea Drive. Fronting number 36 is a raised threshold, delineating the start of the local road segment, which continues at 7 metres width to the end (with properties on one side only). Gymea Drive ends at the fence to the rear of 94 Prospect Road, which along with neighbouring properties 96, 110 and 112 are zoned RU6 (transitional land use zone).

2.4.5.4 Increased traffic volume as a result of the Gymea Drive to Prospect Road link

The RMS *Guide to Traffic Generating Developments* (RTA 2002) indicates a desirable maximum peak volume (the “environmental goal”) of 200 vehicles/hour and an absolute maximum of 300 vehicles/hour for local streets. For Collector roads, an environmental goal of 300 vehicles and absolute maximum of 500 vehicles is recommended.

The catchment for Gymea Drive from number 36 to the end is 27 dwellings. The current peak hour traffic volume past number 36 would (in accordance with RMS Guide to Traffic Generating Developments) be approximately 31 vehicles in the peak hour, or 310 vehicles per day. Gymea Drive east of Cypress Way currently carries around 1,220 vehicles per day, or 122 vehicles in the peak hour.

Traffic counts have been undertaken on the left and right turning vehicles during the peak hour at Government Road, Louisa Avenue, Coronation Avenue and Prospect Road. The majority of left turning traffic is at Prospect Road, and right turning traffic is at Government Road and Coronation Avenue. It is unlikely that the left turning traffic will re-route via Gymea Drive to use the traffic signals to exit the Prospect Road catchment. It is considered that 100% of the right turning traffic from Gymea Drive, Coronation Avenue and Louisa Avenue will re-direct to Gymea Drive as it is likely that the right turn movement from these streets will be banned as part of improvements along Myall Road. The right and left turns in to the catchment are not proposed to be altered.

Using these figures, it is considered that the additional traffic volume on Gymea Drive if connected to Prospect Road, from the Prospect Road catchment is considered to be an additional 95 vehicles in the AM peak and 24 in the PM peak. The resulting estimated traffic load on Gymea Drive in the AM peak near Myall Road is 217 vehicles, and at the north western end of Gymea Drive of 126 vehicles. These figures are under the maximum environmental capacity limit of 300 vehicles per hour considered appropriate for the Collector road end of Gymea Drive. Outside the peak times, the traffic volume would be considerably less.

Figure 2.7: Possible connection of Gymea Drive to Prospect Road.

If the option of connecting Gymea Drive to Myall Road is not supported, or does not occur in the short term, then the installation of a roundabout at the intersection of Myall Road and Gymea Drive would provide an outcome which would allow motorists to leave the Prospect Road

catchment from either Government Road, Coronation Avenue or Louisa Avenue by turning left onto Myall Road, and travel east to the roundabout in order to travel in the western direction.

2.4.5.5 Option 3, Connection of the Myall Road south estate via Lois Crescent

An alternative to providing a fourth leg to the Myall Road and Gymea Drive intersection could be connecting the estate by a road through the vacant road reserve between 8 and 10 Lois Crescent, and upgrading the exiting four-way intersection at Myall Road, Lois Crescent and Louisa Avenue to signals. This is represented in Figure 2.8.

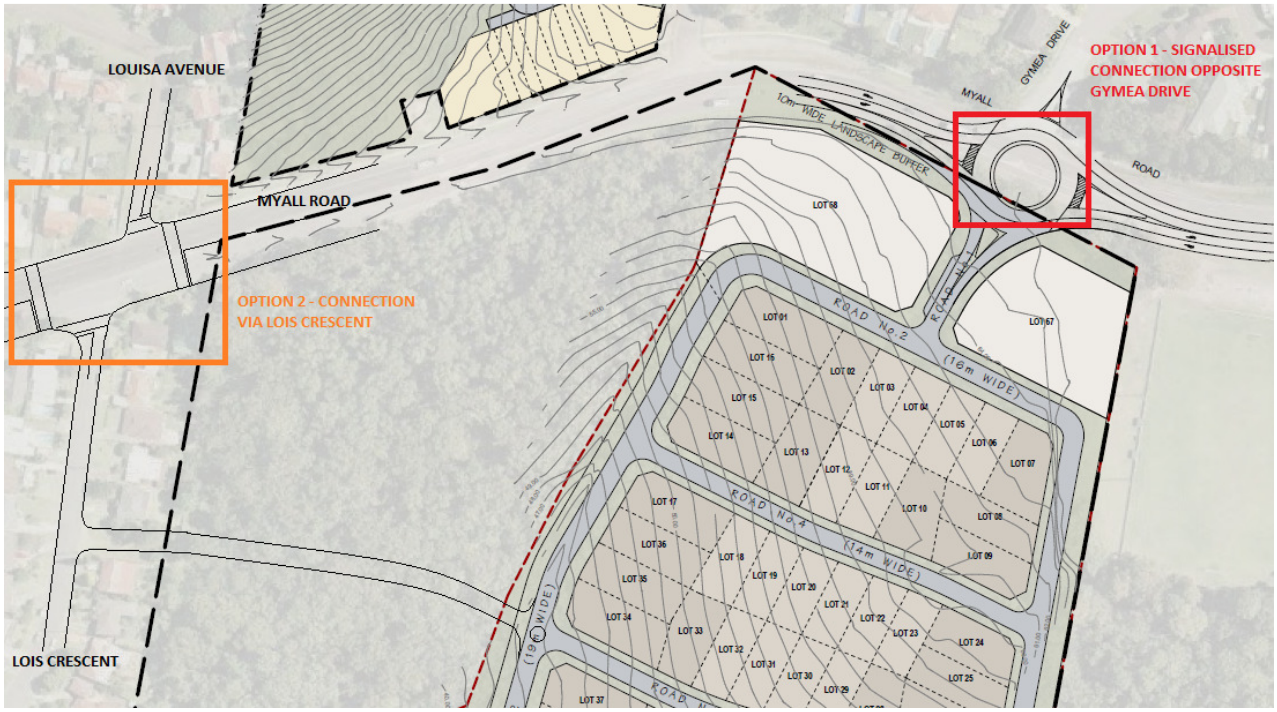


Figure 2.8: connection of the Myall Road south estate to Myall Road via upgraded Myall Road, Lois Crescent and Louisa Avenue intersection

Myall Road at Lois Crescent and Louisa Avenue is a four-lane two-way divided road, with right turn lanes into the minor streets. The turn lanes are narrow and do not comply with current design standards, however they provide the minor road through and right turning traffic the option to queue in the centre of the road when exiting. As a consequence the gap acceptance for right turning and through traffic has been reduced to show the actual queuing that occurred during the traffic survey. The Myall Road, Lois Crescent and Louisa Avenue intersection was modelled to determine the existing LoS. The intersection is considered four-way even though Lois Crescent and Louisa Avenue are slightly staggered. The AM peak is the critical peak, with the results of the existing intersection shown in Table 2.24.

Lois Crescent and Louisa Avenue are both 9 metres width. This width is adequate for a local street with a bus route, however these roads are the narrowest in the catchment to connect to

Myall Road. It is considered that if this option is considered the most appropriate solution, that parking restrictions and traffic calming devices may be required.

Table 2.24: Myall Road, Lois Crescent and Louisa Avenue, AM 2015

Site: Myall Road, Louisa Avenue and Lois Cresent, AM 2015

Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lois Crescent											
1	L2	22	0.0	0.028	8.0	LOS A	0.1	0.7	0.47	0.67	51.8
2	T1	1	0.0	0.709	270.1	LOS F	1.9	13.6	0.99	1.05	10.7
3	R2	14	0.0	0.709	281.4	LOS F	1.9	13.6	0.99	1.05	10.7
Approach		37	0.0	0.709	117.0	LOS F	1.9	13.6	0.68	0.82	20.4
East: Myall Road east											
4	L2	9	0.0	0.005	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
5	T1	1002	0.0	0.257	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	8	0.0	0.031	16.5	LOS B	0.1	0.7	0.74	0.89	46.0
Approach		1020	0.0	0.257	0.2	NA	0.1	0.7	0.01	0.01	59.7
North: Louisa Avenue											
7	L2	29	0.0	0.184	8.0	LOS A	0.5	3.4	0.76	0.85	43.0
8	T1	1	0.0	0.184	154.1	LOS F	0.5	3.4	0.76	0.85	43.5
9	R2	2	0.0	0.184	159.6	LOS F	0.5	3.4	0.76	0.85	43.2
Approach		33	0.0	0.184	22.5	LOS B	0.5	3.4	0.76	0.85	43.0
West: Myall Road west											
10	L2	1	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	981	0.0	0.252	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	14	0.0	0.053	17.4	LOS B	0.2	1.1	0.76	0.90	45.7
Approach		996	0.0	0.252	0.3	NA	0.2	1.1	0.01	0.01	59.7
All Vehicles		2085	0.0	0.709	2.6	NA	1.9	13.6	0.03	0.04	57.4

It can be seen that Lois Crescent and Louisa Avenue currently perform at LoS F for the right turn and through manoeuvres. It is considered that if the Myall Road south housing estate were to access primarily from Lois Crescent, that the intersection would be required to be upgraded to signals. The result of the additional traffic loading from the estate (in accordance with the RMS Guide to Traffic Generating Developments) has been added. On Louisa Avenue, the right turn traffic volume from both Government Road and Coronation Avenue has been added as this is a desirable alternative to those intersections with signals installed. It is unlikely that any right turning traffic from Prospect Road intersection with Myall Road will transfer to this intersection. This scenario upgraded to signals is shown in Table 2.25.

Table 2.25: Myall Road, Lois Crescent and Louisa Avenue plus development and Government Road right turning traffic, upgraded to signals, AM peak 2015.

Site: Myall Road, Louisa Avenue, Lois Cresent, AM 2015 + 70 lot dev traffic + Government Road rt turn traf

Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lois Crescent											
1	L2	47	0.0	0.449	29.7	LOS C	2.2	15.2	0.97	0.76	39.6
2	T1	1	0.0	0.449	24.2	LOS B	2.2	15.2	0.97	0.76	40.4
3	R2	39	0.0	0.449	29.8	LOS C	2.2	15.2	0.97	0.76	39.8
Approach		87	0.0	0.449	29.7	LOS C	2.2	15.2	0.97	0.76	39.7
East: Myall Road east											
4	L2	16	0.0	0.021	15.3	LOS B	0.2	1.6	0.63	0.66	46.9
5	T1	1002	0.0	0.650	13.5	LOS A	10.3	72.4	0.86	0.75	49.1
6	R2	8	0.0	0.038	27.5	LOS B	0.2	1.3	0.91	0.66	40.4
Approach		1026	0.0	0.650	13.6	LOS A	10.3	72.4	0.86	0.75	49.0
North: Louisa Avenue											
7	L2	29	0.0	0.547	30.3	LOS C	2.7	19.1	0.98	0.80	39.4
8	T1	1	0.0	0.547	24.7	LOS B	2.7	19.1	0.98	0.80	40.1
9	R2	77	0.0	0.547	30.3	LOS C	2.7	19.1	0.98	0.80	39.6
Approach		107	0.0	0.547	30.2	LOS C	2.7	19.1	0.98	0.80	39.5
West: Myall Road west											
10	L2	1	0.0	0.001	15.1	LOS B	0.0	0.1	0.61	0.59	47.0
11	T1	981	0.0	0.639	13.3	LOS A	10.1	70.4	0.86	0.74	49.2
12	R2	20	0.0	0.093	28.0	LOS B	0.5	3.2	0.92	0.69	40.2
Approach		1002	0.0	0.639	13.6	LOS A	10.1	70.4	0.86	0.74	49.0
All Vehicles		2223	0.0	0.650	15.0	LOS B	10.3	72.4	0.87	0.75	48.0

The intersection performs well with signalisation. The intersection was modelled for the 2030 peak (Table 2.26), taking into account the increased traffic on Myall Road in line with the Glendale East sub-catchment estimated increase of 28.51%.

Table 2.26: Myall Road, Lois Crescent and Louisa Avenue plus development and Government Road right turning traffic, upgraded to signals, AM peak 2030.

Site: Myall Road, Louisa Avenue and Lois Cresent, PM 2030 plus 28.51% Myall and full development

Signals - Actuated Isolated Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lois Crescent											
1	L2	21	0.0	0.106	29.9	LOS C	1.4	9.8	0.76	0.71	39.6
2	T1	2	0.0	0.106	24.4	LOS B	1.4	9.8	0.76	0.71	40.4
3	R2	24	0.0	0.106	30.0	LOS C	1.4	9.8	0.76	0.71	39.8
Approach		47	0.0	0.106	29.7	LOS C	1.4	9.8	0.76	0.71	39.8
East: Myall Road east											
4	L2	71	0.0	0.095	22.1	LOS B	1.7	12.0	0.63	0.71	43.1
5	T1	1149	0.0	0.789	23.1	LOS B	20.4	142.7	0.89	0.79	43.4
6	R2	24	0.0	0.130	43.5	LOS D	0.9	6.3	0.92	0.70	34.3
Approach		1244	0.0	0.789	23.4	LOS B	20.4	142.7	0.88	0.78	43.2
North: Louisa Avenue											
7	L2	16	0.0	0.149	30.4	LOS C	1.9	13.5	0.77	0.73	39.4
8	T1	1	0.0	0.149	24.8	LOS B	1.9	13.5	0.77	0.73	40.1
9	R2	47	0.0	0.149	30.4	LOS C	1.9	13.5	0.77	0.73	39.5
Approach		64	0.0	0.149	30.3	LOS C	1.9	13.5	0.77	0.73	39.5
West: Myall Road west											
10	L2	1	0.0	0.001	21.0	LOS B	0.0	0.2	0.60	0.60	43.7
11	T1	1119	0.0	0.757	22.9	LOS B	20.0	139.7	0.88	0.78	43.6
12	R2	71	0.0	0.394	45.3	LOS D	2.7	19.2	0.95	0.75	33.8
Approach		1191	0.0	0.757	24.2	LOS B	20.0	139.7	0.89	0.78	42.8
All Vehicles		2546	0.0	0.789	24.1	LOS B	20.4	142.7	0.88	0.78	42.9

The intersection continues to perform well, however the right turn movements into the minor roads are approaching the upper limit of LoS D with long delays but minimal queue.

To check the intersections' propensity to failure under increased traffic conditions, 20% sensitivity was loaded onto the Myall Road traffic volumes. The result is shown in Table 2.27.

Table 2.27: Myall Road, Lois Crescent and Louisa Avenue plus development and Government Road right turning traffic, plus 20% sensitivity, AM peak 2030.

Site: Myall Road, Louisa Avenue and Lois Cresent, AM 2030 + 28.51% Myall + full dev + 20% sens

Signals - Actuated Isolated Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lois Crescent											
1	L2	47	0.0	0.290	34.0	LOS C	2.7	18.8	0.88	0.76	37.9
2	T1	1	0.0	0.290	28.5	LOS B	2.7	18.8	0.88	0.76	38.6
3	R2	39	0.0	0.290	34.1	LOS C	2.7	18.8	0.88	0.76	38.1
Approach		87	0.0	0.290	34.0	LOS C	2.7	18.8	0.88	0.76	38.0
East: Myall Road east											
4	L2	16	0.0	0.018	16.3	LOS B	0.3	2.0	0.54	0.65	46.3
5	T1	1543	0.0	0.851	18.8	LOS B	23.8	166.7	0.93	0.84	45.8
6	R2	8	0.0	0.053	39.5	LOS C	0.3	1.9	0.92	0.66	35.7
Approach		1567	0.0	0.851	18.8	LOS B	23.8	166.7	0.92	0.84	45.8
North: Louisa Avenue											
7	L2	29	0.0	0.384	34.8	LOS C	3.4	23.7	0.90	0.77	37.6
8	T1	1	0.0	0.384	29.2	LOS C	3.4	23.7	0.90	0.77	38.2
9	R2	77	0.0	0.384	34.8	LOS C	3.4	23.7	0.90	0.77	37.7
Approach		107	0.0	0.384	34.7	LOS C	3.4	23.7	0.90	0.77	37.7
West: Myall Road west											
10	L2	1	0.0	0.001	16.0	LOS B	0.0	0.1	0.53	0.59	46.5
11	T1	1514	0.0	0.834	18.1	LOS B	22.9	160.6	0.91	0.82	46.2
12	R2	20	0.0	0.130	40.2	LOS C	0.7	4.7	0.93	0.69	35.4
Approach		1535	0.0	0.834	18.4	LOS B	22.9	160.6	0.91	0.82	46.0
All Vehicles		3297	0.0	0.851	19.5	LOS B	23.8	166.7	0.92	0.83	45.3

It can be seen that the intersection continues to perform well with the 20% increased traffic on Myall Road. The RMS were consulted and were not supportive of the proposal for the following reasons:

1. The geometry of the intersection is poor, with significant lateral shift across the intersection.
2. Limited site distance across the intersection as Lois Crescent rises significantly approaching Myall Road.
3. Signal phasing – simple through phasing is not appropriate due to the offset of the side streets. Split approach phasing would need to be considered which can lead to performance /efficiency issues.
4. Performance of intersection would be significantly affected by single-lane approaches on side streets, as pedestrian protection will be required and it results in left turning traffic blocking through and right turning traffic.
5. Intersection is suitable for low traffic volumes only.
6. Concerns are raised as to whether the new intersection will become a collector for Prospect Road and adjacent streets allowing controlled access onto Myall Road.

It is therefore considered that this intersection should not be pursued, as rectifying the issues raised by the RMS would render the intersection unfeasible in terms of cost.

A solution to the poorly performing right and through turning movement would be to ban the movements, with vehicles having to use the roundabouts on Myall Road to travel in the desired direction.

2.4.5.6 Option 4, Installation of new seagull intersection, staggered from Gymea Drive intersection

The location of a new independent intersection into this estate is constrained by the bend in Myall Road. The treatment would be required to be a seagull with an acceleration lane and deceleration lane in compliance with Austroad's Standards. Similarly the acceleration lane for the Gymea Drive seagull, currently a continuous lane, must be maintained at least to the minimum length. When siting the independent intersection, it does not fit within the road geometry between the Gymea Drive and Lois Crescent intersections, to meet the required acceleration lane lengths. Therefore this option will not be pursued.

2.4.5.6.1 Crash History - Myall Road at Gymea Drive

There was one reported crash at this intersection in the 5 year period 1 July 2009 to 30 June 2014. The crash was a rear end type crash in the eastbound direction. One injury was sustained in the crash, which occurred in daylight during fine weather, outside of the peak hour.

2.4.5.6.2 Crash History - Myall Road at Lois Crescent and Louisa Avenue

There was one reported crash at this intersection in the 5 year period 1 July 2009 to 30 June 2014. The crash was a head-on type crash in the eastbound direction. Two injuries were sustained in the crash, which occurred in daylight during wet weather, outside of the peak hour.

2.4.5.7 Recommendation

If a fourth leg were provided at the intersection of Myall Road and Gymea Drive to facilitate access to the Myall Road south intersection, the installation of a roundabout is considered to provide the best outcome for Myall Road for the following reasons:

1. A roundabout operates at the optimal LoS.
2. The roundabout would allow motorists from Government Road, Coronation Avenue and Louisa Avenue a controlled intersection to turn at to travel in the western direction, which would allow the right turn from these intersections to be banned in the future when required.
3. The upgrade would allow future connection of the Myall Road and Prospect Road catchments, at a time when (or if) 94 to 112 Myall Road is rezoned to allow connection of the roads.

4. The roundabout is partially built, with the Gymea Drive leg constructed in concrete, and the original design from 1997 is available which may minimise design and construction costs.

5. Pedestrian refuges will be provided on each approach to improve pedestrian access across all legs of the intersection, particularly Myall Road.

2.5 Myall Road and Coronation Avenue, Cardiff

2.5.1 Background

Coronation Avenue is located within 100 metres of the Government Road intersection, with both roads designated bus routes. Coronation Avenue carries the second highest number of right turning vehicles from the Prospect Road catchment onto Myall Road.

Figure 2.9: Myall Road and Coronation Avenue, and proximity to Government Road and Louisa Avenue intersections

2.5.2 Projected Growth

The Prospect Road catchment is not anticipated to increase significantly in density or population due to the limited development opportunities within the catchment. Myall Road traffic volume is estimated to increase in line with the Glendale East sub-catchment of 28.51%.

2.5.3 Analysis – Existing Conditions

Coronation Avenue in the AM peak operates at a LoS F with lengthy delays, Table 2.28, and LoS D in the PM peak (Table 2.29). This was witnessed on-site, with vehicles choosing minimal gaps in the Myall Road traffic volume to turn right from Coronation Avenue and travel in the west direction.

Table 2.28: Myall Road and Coronation Avenue AM peak

Site: 2015 AM Myall Road and Coronation Avenue

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	1141	0.0	0.595	0.3	LOS A	0.3	2.4	0.03	0.00	59.7
6	R2	4	0.0	0.595	25.8	LOS B	0.3	2.4	0.03	0.00	57.7
Approach		1145	0.0	0.595	0.3	NA	0.3	2.4	0.03	0.00	59.6
North: Coronation Avenue											
7	L2	5	0.0	0.017	18.2	LOS B	0.1	0.4	0.79	0.98	46.2
9	R2	35	0.0	0.556	83.3	LOS F	1.5	10.6	0.98	1.05	25.2
Approach		40	0.0	0.556	74.8	LOS F	1.5	10.6	0.95	1.04	26.8
West: Myall Road west											
10	L2	11	0.0	0.529	5.5	LOS A	0.0	0.0	0.00	0.01	58.2
11	T1	1020	0.0	0.529	0.0	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		1031	0.0	0.529	0.1	NA	0.0	0.0	0.00	0.01	59.7
All Vehicles		2216	0.0	0.595	1.6	NA	1.5	10.6	0.03	0.02	58.4

Table 2.29: Myall Road and Coronation Avenue PM peak

Site: 2015 PM Myall Road and Coronation Avenue

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	1109	0.0	0.573	0.1	LOS A	0.1	0.9	0.01	0.00	59.9
6	R2	2	0.0	0.573	20.0	LOS B	0.1	0.9	0.01	0.00	57.9
Approach		1112	0.0	0.573	0.1	NA	0.1	0.9	0.01	0.00	59.9
North: Coronation Avenue											
7	L2	7	0.0	0.018	15.2	LOS B	0.1	0.4	0.72	0.95	47.9
9	R2	19	0.0	0.218	46.9	LOS D	0.6	3.9	0.95	1.01	33.6
Approach		26	0.0	0.218	38.1	LOS C	0.6	3.9	0.88	0.99	36.7
West: Myall Road west											
10	L2	22	0.0	0.472	5.5	LOS A	0.0	0.0	0.00	0.01	58.1
11	T1	897	0.0	0.472	0.0	LOS A	0.0	0.0	0.00	0.01	59.7
Approach		919	0.0	0.472	0.2	NA	0.0	0.0	0.00	0.01	59.7
All Vehicles		2057	0.0	0.573	0.6	NA	0.6	3.9	0.02	0.02	59.3

The intersection Myall Road and Gymea Drive has previously been recommended to be upgraded to a roundabout, which would allow a controlled right turn from the Prospect Road catchment. Neither Louisa Avenue, Coronation Avenue or Government Road intersections are ideal to upgrade given their longitudinal grade, width, and alignment. It is recommended that the right turn out of each of these intersections be restricted. Additionally, the right turn volume into Coronation Avenue is very low and operates at a LoS F due to the high opposing traffic flow. It is also recommended that this turn be banned.

Table 2.30 shows the intersection operating in 2030 AM peak, with the right turn from Coronation Avenue banned.

Table 2.30: Myall Road and Coronation Avenue AM peak 2030, right turn into and out of Coronation Avenue banned

Site: 2030 AM Myall Road and Coronation Avenue

right turn from Coronation Avenue banned
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	1467	0.0	0.752	0.0	LOS A	0.0	0.0	0.00	0.00	59.5
Approach		1467	0.0	0.752	0.2	NA	0.0	0.0	0.00	0.00	59.5
North: Coronation Avenue											
7	L2	5	0.0	0.043	35.1	LOS C	0.1	0.8	0.92	1.00	38.2
Approach		5	0.0	0.043	35.1	LOS C	0.1	0.8	0.92	1.00	38.2
West: Myall Road west											
10	L2	11	0.0	0.678	5.5	LOS A	0.0	0.0	0.00	0.00	58.0
11	T1	1312	0.0	0.678	0.0	LOS A	0.0	0.0	0.00	0.00	59.6
Approach		1322	0.0	0.678	0.2	NA	0.0	0.0	0.00	0.00	59.6
All Vehicles		2795	0.0	0.752	0.1	NA	0.1	0.8	0.00	0.00	59.5

2.5.4 Crash History

There was one reported crash at this intersection in the 5 year period 1 July 2009 to 30 June 2014. The crash was a cross traffic crash, with a vehicle turning right from Coronation Avenue colliding with a through eastbound vehicle on Myall Road. No injuries were sustained in the crash, which occurred in daylight during fine weather, during the PM peak hour.

2.5.5 Recommendation

It is recommended that the right turn into and out of Coronation Avenue be banned at the time that an alternative controlled treatment is provided from the catchment.

2.6 Myall Road, Government Road and Fifth Street, Cardiff

2.6.1 Background

Government Road provides access to the Prospect Road catchment of Garden Suburb and Cardiff. As the most westerly access into the Prospect Road catchment, it carries the highest right turn traffic volume for vehicles wanting to travel in the west direction. In 2013, Council via the National Blackspot Program funded alterations to the intersection of Myall Road and Fifth Street to restrict Fifth Street to left in, left out. This was following an extensive crash history with the right turn / through movement from Fifth Street. Government Road was not altered at this time.

Figure 2.10: Myall Road and Government Road, and Fifth Street Cardiff

2.6.2 Projected growth

Traffic within the Prospect Road catchment is unlikely to increase due to limited available land. Traffic on Myall Road is anticipated to increase in line with the Glendale East sub-catchment of 28.51%.

2.6.3 Analysis

The intersection was modelled for the current layout in the AM and PM peak. The modelling indicated queuing and delay that was not in accordance to that observed on inspection. To

obtain a more realistic representation of the current traffic situation, the gap acceptance parameters were amended until the queue length was more realistic. The AM peak analysis is shown in Table 2.31, and the PM peak is shown in Table 2.32.

Table 2.31: Myall Road, Government Road and Fifth Street AM peak, 2015

Site: Myall Road, Government Road and Fifth Street - AM 2015

Existing intersection
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Fifth Street											
1	L2	109	2.9	0.268	17.2	LOS B	1.0	7.3	0.77	1.03	46.7
Approach		109	2.9	0.268	17.2	LOS B	1.0	7.3	0.77	1.03	46.7
East: Myall Road east											
4	L2	73	4.3	0.500	23.1	LOS B	11.6	83.8	1.00	0.00	45.2
5	T1	869	3.9	0.500	17.5	LOS B	11.6	83.8	1.00	0.00	46.3
6	R2	1	0.0	0.500	22.9	LOS B	11.6	83.8	1.00	0.00	44.9
Approach		943	3.9	0.500	17.9	NA	11.6	83.8	1.00	0.00	46.2
North: Government Road											
7	L2	16	20.0	0.893	125.9	LOS F	4.1	29.5	0.99	1.28	19.6
8	T1	16	0.0	0.893	124.7	LOS F	4.1	29.5	0.99	1.28	19.6
9	R2	44	0.0	0.893	124.5	LOS F	4.1	29.5	0.99	1.28	19.6
Approach		76	4.2	0.893	124.8	LOS F	4.1	29.5	0.99	1.28	19.6
West: Myall Road west											
10	L2	44	9.5	0.528	5.7	LOS A	0.0	0.0	0.00	0.03	57.5
11	T1	944	5.8	0.528	0.1	LOS A	0.0	0.0	0.00	0.03	59.6
Approach		988	6.0	0.528	0.3	NA	0.0	0.0	0.00	0.03	59.5
All Vehicles		2117	4.8	0.893	13.5	NA	11.6	83.8	0.52	0.11	49.0

Table 2.32: Myall Road, Government Road and Fifth Street PM peak, 2015

Site: Myall Road, Government Road and Fifth Street - PM 2015

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Fifth Street											
1	L2	58	3.6	0.122	14.7	LOS B	0.4	3.0	0.69	1.00	48.2
Approach		58	3.6	0.122	14.7	LOS B	0.4	3.0	0.69	1.00	48.2
East: Myall Road east											
4	L2	54	5.9	0.464	8.0	LOS A	0.6	4.3	0.07	0.04	57.2
5	T1	803	1.7	0.464	0.3	LOS A	0.6	4.3	0.07	0.04	59.0
6	R2	13	0.0	0.464	13.5	LOS A	0.6	4.3	0.07	0.04	56.9
Approach		869	1.9	0.464	1.0	NA	0.6	4.3	0.07	0.04	58.9
North: Government Road											
7	L2	7	42.9	0.236	19.2	LOS B	0.7	5.1	0.88	1.02	39.6
8	T1	8	0.0	0.236	51.2	LOS D	0.7	5.1	0.88	1.02	40.4
9	R2	23	0.0	0.236	24.8	LOS B	0.7	5.1	0.88	1.02	40.3
Approach		39	8.1	0.236	29.4	LOS C	0.7	5.1	0.88	1.02	40.2
West: Myall Road west											
10	L2	66	3.2	0.405	5.6	LOS A	0.0	0.0	0.00	0.05	57.7
11	T1	713	1.2	0.405	0.0	LOS A	0.0	0.0	0.00	0.05	59.4
Approach		779	1.4	0.405	0.5	NA	0.0	0.0	0.00	0.05	59.3
All Vehicles		1745	1.9	0.464	1.8	NA	0.7	5.1	0.08	0.10	58.0

It has been recommended previously that the intersection of Myall Road, Lois Crescent, and Louisa Avenue be upgraded to signals, which would allow a controlled right turn from the Prospect Road catchment. Neither Coronation Avenue or Government Road are ideal intersections to upgrade given their grade and width, and it is recommended that the right turn out of each of these intersections be restricted. Table 2.33 shows the intersection operating in 2030 AM peak, with the right turn from Government Road banned. The right turn into Government Road operates at a LoS E, however the volume is extremely low so this movement will be retained.

Table 2.33: Myall Road and Government Road AM peak 2030, right turn from Government Road banned

Site: Myall Road, Government Road and Fifth Street - AM 2030

Government Road through movement and right turn ban
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Fifth Street											
1	L2	109	2.9	0.492	30.4	LOS C	1.9	13.5	0.91	1.08	40.1
Approach		109	2.9	0.492	30.4	LOS C	1.9	13.5	0.91	1.08	40.1
East: Myall Road east											
4	L2	73	4.3	0.625	9.6	LOS A	0.5	3.9	0.02	0.04	57.3
5	T1	1107	3.0	0.625	0.4	LOS A	0.5	3.9	0.02	0.04	59.1
6	R2	1	0.0	0.625	62.3	LOS E	0.5	3.9	0.02	0.04	56.9
Approach		1181	3.1	0.625	1.0	NA	0.5	3.9	0.02	0.04	58.9
North: Government Road											
7	L2	16	20.0	0.135	38.4	LOS C	0.4	3.2	0.92	1.00	36.8
Approach		16	20.0	0.135	38.4	LOS C	0.4	3.2	0.92	1.00	36.8
West: Myall Road west											
10	L2	44	9.5	0.025	5.7	LOS A	0.0	0.0	0.00	0.57	53.2
11	T1	1202	4.6	0.635	0.0	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1246	4.7	0.635	0.3	NA	0.0	0.0	0.00	0.02	59.5
All Vehicles		2553	4.0	0.635	2.1	NA	1.9	13.5	0.06	0.08	57.8

2.6.4 Crash History

There is an extensive crash history at this intersection, however turn bans were implemented and enforced in June 2013 through blackspot funding. No crashes on Fifth Street to Myall Road will be included prior to 30 June 2013.

There were two reported crashes on Government Road at Myall Road in the 5 year period 1 July 2009 to 30 June 2014. Both crashes were right turning from Government Road. One crash was in the daylight, dry conditions and no injury was sustained. The other crash was at night, in wet conditions and was an injury crash. All of the crashes were minor (no injuries reported), and occurred in daylight during fine weather. Both crashes were outside of the peak hour.

2.6.5 Recommendation

It is recommended that the right turn from Government Road be banned at the time that an alternative controlled treatment is provided from the catchment.

2.7 Myall Road and Newcastle Street, Cardiff

2.7.1 Background

The intersection of Myall Road and Newcastle Street was upgraded from an uncontrolled intersection to a roundabout in 1994 as part of the Federal Blackspot Program.

Figure 2.11: Myall Road and Newcastle Street roundabout, current layout shown on right

2.7.2 Projected Growth

Myall Road is anticipated to increase in accordance with the Glendale East sub-catchment total growth of 28.51%. The turning movements and minor road (Newcastle Street) is expected to increase as part of the Cardiff CBD sub-catchment at 16.29%.

2.7.3 Analysis

The intersection was modelled for the 2015 AM (Table 2.34) and PM (Table 2.35) peak.

Table 2.34: Myall Road and Newcastle Street roundabout, 2015 AM peak

Site: AM 2015 Newcastle Street and Myall Road, Cardiff

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Newcastle Street south											
1	L2	109	3.0	0.238	9.8	LOS A	1.2	8.5	0.77	0.88	51.3
2	T1	238	3.0	0.516	10.1	LOS A	3.9	27.7	0.88	1.01	51.5
3	R2	122	3.0	0.516	15.3	LOS B	3.9	27.7	0.88	1.01	51.6
Approach		469	3.0	0.516	11.4	LOS A	3.9	27.7	0.85	0.98	51.5
East: Myall Road east											
4	L2	59	3.0	0.252	6.7	LOS A	1.6	11.1	0.64	0.67	53.0
5	T1	714	3.0	0.641	7.5	LOS A	7.1	50.7	0.78	0.77	53.1
6	R2	228	3.0	0.641	12.8	LOS A	7.1	50.7	0.82	0.80	52.8
Approach		1001	3.0	0.641	8.6	LOS A	7.1	50.7	0.79	0.77	53.0
North: Newcastle Street north											
7	L2	177	3.0	0.301	8.3	LOS A	1.6	11.5	0.76	0.87	52.3
8	T1	194	3.0	0.416	8.0	LOS A	2.7	19.5	0.81	0.87	52.4
9	R2	123	3.0	0.416	13.1	LOS A	2.7	19.5	0.81	0.87	52.5
Approach		494	3.0	0.416	9.4	LOS A	2.7	19.5	0.79	0.87	52.4
West: Myall Road west											
10	L2	69	3.0	0.270	7.7	LOS A	1.7	12.4	0.73	0.75	52.5
11	T1	693	3.0	0.616	8.8	LOS A	6.8	48.7	0.85	0.86	52.9
12	R2	123	3.0	0.616	14.2	LOS A	6.8	48.7	0.89	0.89	52.7
Approach		885	3.0	0.616	9.5	LOS A	6.8	48.7	0.85	0.86	52.8
All Vehicles		2849	3.0	0.641	9.5	LOS A	7.1	50.7	0.82	0.85	52.6

Table 2.35: Myall Road and Newcastle Street roundabout, 2015 PM peak

Site: PM 2015 Newcastle Street and Myall Road, Cardiff

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Newcastle Street south											
1	L2	112	3.0	0.213	8.7	LOS A	1.1	8.3	0.76	0.86	52.1
2	T1	182	3.0	0.399	7.9	LOS A	2.7	19.7	0.84	0.84	52.3
3	R2	113	3.0	0.399	13.1	LOS A	2.7	19.7	0.84	0.84	52.4
Approach		406	3.0	0.399	9.6	LOS A	2.7	19.7	0.82	0.84	52.3
East: Myall Road east											
4	L2	165	3.0	0.284	8.5	LOS A	1.9	13.3	0.78	0.80	52.2
5	T1	711	3.0	0.722	12.6	LOS A	10.2	73.5	0.98	1.06	50.7
6	R2	58	3.0	0.722	18.0	LOS B	10.2	73.5	0.99	1.07	50.6
Approach		934	3.0	0.722	12.2	LOS A	10.2	73.5	0.95	1.01	50.9
North: Newcastle Street north											
7	L2	127	3.0	0.300	10.9	LOS A	1.7	11.9	0.85	0.92	50.5
8	T1	171	3.0	0.438	11.0	LOS A	3.1	22.3	0.91	1.00	51.0
9	R2	81	3.0	0.438	16.2	LOS B	3.1	22.3	0.91	1.00	51.0
Approach		379	3.0	0.438	12.1	LOS A	3.1	22.3	0.89	0.97	50.8
West: Myall Road west											
10	L2	118	3.0	0.326	6.3	LOS A	2.1	15.4	0.63	0.63	53.1
11	T1	728	3.0	0.741	7.6	LOS A	10.2	73.3	0.81	0.77	52.7
12	R2	421	3.0	0.741	13.2	LOS A	10.2	73.3	0.87	0.81	52.2
Approach		1267	3.0	0.741	9.4	LOS A	10.2	73.3	0.81	0.77	52.6
All Vehicles		2986	3.0	0.741	10.6	LOS A	10.2	73.5	0.86	0.88	51.8

The intersection is currently operating at an acceptable LoS. When modelled for the projected 2030 traffic volumes, the AM peak continues to operate at a LoS B with minimal delay). The PM peak however falls to a LoS F on both Myall Road east and Newcastle Street north, Table 2.36.

Table 2.36: Myall Road and Newcastle Street roundabout, 2030 PM peak

Site: PM 2030 Newcastle Street and Myall Road, Cardiff

28.51% Myall Road through traffic
16.29% minor roads and turning traffic

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Newcastle Street south											
1	L2	131	3.0	0.272	9.5	LOS A	1.5	10.7	0.80	0.89	51.5
2	T1	213	3.0	0.506	10.0	LOS A	4.0	28.5	0.90	1.01	51.4
3	R2	132	3.0	0.506	15.2	LOS B	4.0	28.5	0.90	1.01	51.5
Approach		475	3.0	0.506	11.3	LOS A	4.0	28.5	0.88	0.98	51.5
East: Myall Road east											
4	L2	193	3.0	0.444	12.4	LOS A	3.5	25.4	0.93	0.98	49.5
5	T1	914	3.0	1.127	142.3	LOS F	93.9	674.1	1.00	3.74	18.4
6	R2	67	3.0	1.127	157.2	LOS F	93.9	674.1	1.00	3.95	17.6
Approach		1174	3.0	1.127	121.8	LOS F	93.9	674.1	0.99	3.30	20.4
North: Newcastle Street north											
7	L2	148	3.0	0.549	23.1	LOS B	3.7	26.7	0.96	1.08	43.2
8	T1	321	3.0	1.071	130.3	LOS F	35.6	255.5	1.00	2.50	19.6
9	R2	95	3.0	1.071	135.4	LOS F	35.6	255.5	1.00	2.50	19.6
Approach		564	3.0	1.071	102.9	LOS F	35.6	255.5	0.99	2.13	22.8
West: Myall Road west											
10	L2	138	3.0	0.423	6.8	LOS A	3.0	21.8	0.72	0.69	52.7
11	T1	937	3.0	0.963	20.4	LOS B	35.1	252.3	0.93	1.23	45.1
12	R2	491	3.0	0.963	30.1	LOS C	35.1	252.3	1.00	1.41	42.8
Approach		1565	3.0	0.963	22.3	LOS B	35.1	252.3	0.93	1.24	44.9
All Vehicles		3778	3.0	1.127	63.9	LOS E	93.9	674.1	0.95	1.98	29.9

The intersection was iterated with the average per annum increase to model at what year the intersection would fail, which was determined to be 2027 provided development occurred at the estimated rate (Table 2.37).

Table 2.37: Myall Road and Newcastle Street roundabout, 2027 PM peak

Site: PM 2027 Newcastle Street and Myall Road, Cardiff

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Newcastle Street south											
1	L2	126	3.0	0.308	11.3	LOS A	1.8	12.6	0.86	0.92	50.2
2	T1	206	3.0	0.573	13.7	LOS A	5.0	36.0	0.97	1.09	49.0
3	R2	127	3.0	0.573	18.9	LOS B	5.0	36.0	0.97	1.09	49.0
Approach		460	3.0	0.573	14.5	LOS A	5.0	36.0	0.94	1.04	49.3
East: Myall Road east											
4	L2	186	3.0	0.399	10.5	LOS A	2.9	21.1	0.89	0.92	50.8
5	T1	873	3.0	1.014	65.6	LOS E	49.4	354.9	0.99	2.36	29.5
6	R2	65	3.0	1.014	74.7	LOS F	49.4	354.9	1.00	2.46	28.7
Approach		1124	3.0	1.014	57.0	LOS E	49.4	354.9	0.98	2.13	31.7
North: Newcastle Street north											
7	L2	65	3.0	0.239	14.4	LOS A	1.3	9.3	0.89	0.94	48.1
8	T1	144	3.0	0.806	32.6	LOS C	9.2	66.2	1.00	1.32	39.0
9	R2	193	3.0	0.806	37.8	LOS C	9.2	66.2	1.00	1.32	39.1
Approach		402	3.0	0.806	32.1	LOS C	9.2	66.2	0.98	1.26	40.2
West: Myall Road west											
10	L2	134	3.0	0.406	6.7	LOS A	2.9	20.8	0.71	0.68	52.7
11	T1	895	3.0	0.925	15.0	LOS B	25.9	186.3	0.93	1.06	48.2
12	R2	476	3.0	0.925	22.9	LOS B	25.9	186.3	1.00	1.19	46.5
Approach		1504	3.0	0.925	16.8	LOS B	25.9	186.3	0.93	1.07	48.0
All Vehicles		3491	3.0	1.014	31.2	LOS C	49.4	354.9	0.95	1.43	40.5

Myall Road between Newcastle Street and Harrison Street is proposed to be widened to four lanes between 2025 and 2030. Using this improved layout of the western side of the intersection, and proposing to widening Myall Road to four lanes on the eastern side of the intersection along the length of the Council owned land (160 metre length), the LoS is significantly improved (Table 2.38). This is as the queuing delay is lessened as there are two lanes in the western direction to queue in and free flow west of the intersection, and additional merge length on the eastern side of the intersection for eastbound vehicles.

Table 2.38: Myall Road and Newcastle Street roundabout, 2027 PM peak, additional lane length on Myall Road approach

Site: PM 2027 Newcastle Street and Myall Road, Cardiff

Additional travel lanes on Myall Road

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Newcastle Street south											
1	L2	126	3.0	0.263	8.3	LOS A	1.2	9.0	0.76	0.87	52.4
2	T1	206	3.0	0.481	8.1	LOS A	3.1	22.2	0.84	0.90	52.3
3	R2	127	3.0	0.481	13.3	LOS A	3.1	22.2	0.84	0.90	52.4
Approach		460	3.0	0.481	9.6	LOS A	3.1	22.2	0.82	0.89	52.3
East: Myall Road east											
4	L2	186	3.0	0.722	16.1	LOS B	10.6	76.1	1.00	1.16	47.3
5	T1	873	3.0	0.722	17.5	LOS B	10.6	76.1	1.00	1.19	47.5
6	R2	65	3.0	0.722	24.2	LOS B	9.1	65.7	1.00	1.23	46.5
Approach		1124	3.0	0.722	17.7	LOS B	10.6	76.1	1.00	1.19	47.4
North: Newcastle Street north											
7	L2	65	3.0	0.172	9.4	LOS A	0.8	5.5	0.78	0.88	51.5
8	T1	144	3.0	0.566	10.1	LOS A	3.8	27.0	0.89	1.03	50.7
9	R2	193	3.0	0.566	15.3	LOS B	3.8	27.0	0.89	1.03	50.8
Approach		402	3.0	0.566	12.5	LOS A	3.8	27.0	0.87	1.00	50.9
West: Myall Road west											
10	L2	134	3.0	0.666	7.5	LOS A	7.7	55.6	0.83	0.77	52.0
11	T1	895	3.0	0.666	7.8	LOS A	7.7	55.6	0.84	0.80	53.0
12	R2	476	3.0	0.666	14.0	LOS A	7.5	54.0	0.86	0.88	51.1
Approach		1504	3.0	0.666	9.7	LOS A	7.7	55.6	0.84	0.82	52.3
All Vehicles		3491	3.0	0.722	12.6	LOS A	10.6	76.1	0.89	0.97	50.5

2.7.4 Crash History

There were fifteen reported crashes at the intersection of Myall Road and Newcastle Street in the 5 year period 1 July 2009 to 30 June 2014. The crashes were as follows:

- Eight crashes were vehicles heading east on Myall Road colliding with vehicles travelling north on Newcastle Street;
- One crash was a vehicle heading south on Newcastle Street colliding with eastbound Myall Road vehicle
- One crash was southbound Newcastle Street vehicle colliding with westbound Myall Road vehicle
- One crash was northbound Newcastle Street colliding with westbound Myall Road vehicle
- One crash was eastbound Myall Road vehicle colliding with westbound right turning Myall Road vehicle
- One crash was an eastbound Myall Road vehicle side swiping another eastbound Myall Road vehicle
- Two were single vehicle off-carriageway crashes at the intersection.

All crashes were in dry weather, and the majority (11 of 15) were in daylight.

2.7.5 Recommendation

The intersection of Myall Road and Newcastle Street fails in 2027. To improve the LoS, the Myall Road approaches need to be widened to improve storage and resulting delay. It has been recommended that Myall Road between Harrison Street and Newcastle Street be widened, and further widening on the eastern side of the intersection for a distance of 160 metres will improve the intersection from a LoS E to and overall LoS A.

The crash statistics show a trend of crashes occurring, and this is possibly due to the minimum deflection on the eastbound approach. It is recommended that this matter be investigated independent of the Section 94 study.

2.8 Myall Road and Harrison Street, Cardiff

2.8.1 Background

The intersection of Myall Road and Harrison Street is located approximately 130 metres east of the major intersection of Macquarie Road, Myall Road and Munibung Road, along the southern edge of the Cardiff CBD.

Figure 2.12: Myall Road and Harrison Street, Cardiff

2.8.2 Projected Growth

Between 2015 and 2030 the peak vehicle trips related to population and commercial floor space is anticipated to increase in the Cardiff CBD catchment by 16.29%, and on regional road Myall Road by 28.51%.

2.8.3 Analysis

The existing intersection was modelled. The right turn from Harrison Street into Myall Road can be performed in two-stages. The first stage is the right turn from Harrison Street, which is opposed by the eastbound Myall Road traffic and the westbound right turning traffic. The second stage is the merge from the queue space at the central island into the westbound Myall Road traffic stream.

The right turn from Harrison Street has been modelled and currently operates at a LoS B in the AM and LoS C in the PM peak. The PM peak is the critical peak (Tables 2.39 and 2.40).

Table 2.39: Myall Road and Harrison Street – right turn from Harrison Street - PM peak 2015

Site: PM 2015 Harrison Street and Myall Road - right turn from Harrison

Harrison Street and Myall Road - PM peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
6	R2	204	3.0	0.532	19.2	LOS B	2.6	18.7	0.85	1.07	44.4
Approach		204	3.0	0.532	19.2	NA	2.6	18.7	0.85	1.07	44.4
North: Harrison Street											
7	L2	248	3.0	0.800	31.5	LOS C	5.4	38.4	0.93	1.33	38.8
9	R2	49	3.0	0.346	35.8	LOS C	1.2	8.6	0.90	1.00	37.0
Approach		298	3.0	0.800	32.2	LOS C	5.4	38.4	0.93	1.28	38.5
West: Myall Road west											
10	L2	128	3.0	0.071	5.6	LOS A	0.0	0.0	0.00	0.58	53.5
11	T1	837	3.0	0.438	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		965	3.0	0.438	0.8	NA	0.0	0.0	0.00	0.08	58.9
All Vehicles		1467	3.0	0.800	9.7	NA	5.4	38.4	0.31	0.46	51.1

Table 2.40: Myall Road and Harrison Street – merge lane into Myall Road westbound - PM peak 2015

Site: PM 2015 Harrison Street and Myall Road - merge lane

Harrison Street and Myall Road - PM peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: merge lane											
21a	L1	49	0.0	0.050	6.6	LOS A	0.2	1.3	0.48	0.66	52.7
Approach		49	0.0	0.050	6.6	LOS A	0.2	1.3	0.48	0.66	52.7
East: Myall Road east											
5	T1	499	3.0	0.261	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	204	3.0	0.532	19.2	LOS B	2.6	18.7	0.85	1.07	44.2
Approach		703	3.0	0.532	5.6	NA	2.6	18.7	0.25	0.31	54.3
North: Harrison Street											
7	L2	248	3.0	0.800	31.5	LOS C	5.4	38.4	0.93	1.33	38.8
Approach		248	3.0	0.800	31.5	LOS C	5.4	38.4	0.93	1.33	38.8
West: Myall Road west											
10	L2	128	3.0	0.071	5.6	LOS A	0.0	0.0	0.00	0.58	53.5
11	T1	837	3.0	0.438	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		965	3.0	0.438	0.8	NA	0.0	0.0	0.00	0.08	58.9
All Vehicles		1966	2.9	0.800	6.5	NA	5.4	38.4	0.22	0.33	53.6

The intersection currently operates at an acceptable LoS. The intersection was modelled using the projected growth to determine if the LoS falls to an unacceptable level prior to the 2030 horizon year. The right turn from Harrison Street was found to fall below LoS E in 2019 with lengthy delays (Table 2.41).

Table 2.41: Myall Road and Harrison Street – right turn from Harrison Street - PM peak 2019

Site: PM 2019 Harrison Street and Myall Road - right turn from Harrison

Harrison Street and Myall Road - PM peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
6	R2	228	3.0	0.692	26.0	LOS B	3.9	27.7	0.91	1.19	41.0
Approach		228	3.0	0.692	26.0	NA	3.9	27.7	0.91	1.19	41.0
North: Harrison Street											
7	L2	268	3.0	1.008	84.4	LOS F	14.6	105.2	1.00	2.12	24.8
9	R2	55	3.0	0.484	49.6	LOS D	1.7	12.3	0.94	1.04	32.4
Approach		323	3.0	1.008	78.5	LOS F	14.6	105.2	0.99	1.94	25.9
West: Myall Road west											
10	L2	139	3.0	0.076	5.6	LOS A	0.0	0.0	0.00	0.58	53.5
11	T1	900	3.0	0.471	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1039	3.0	0.471	0.8	NA	0.0	0.0	0.00	0.08	58.9
All Vehicles		1591	3.0	1.008	20.2	NA	14.6	105.2	0.33	0.61	44.5

Options considered for upgrade were traffic signals and roundabout, however due to the proximity of the intersection to the major signalised intersection of Myall Road, Macquarie Road and Munibung Road, it was considered that that restricting the right turn out would be more appropriate to not impact minimise the impact on the existing signals.

The right turn traffic volume will be added to the left turn volume to create a worst case scenario, which requires a short continuous left lane to be created to assist in with merging the two travel lanes together. Table 2.42 shows the 2019 PM peak with these alterations.

Table 2.42: Myall Road and Harrison Street – right turn from Harrison Street banned - PM peak 2019

Site: PM 2019 Harrison Street and Myall Road - right turn from Harrison banned

right turn from Harrison Street banned
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	499	3.0	0.549	2.9	LOS A	6.0	43.4	1.00	0.00	55.9
6	R2	228	3.0	0.692	26.0	LOS B	3.9	27.7	0.91	1.19	41.0
Approach		727	3.0	0.692	10.1	NA	6.0	43.4	0.97	0.37	50.1
North: Harrison Street											
7	L2	318	3.0	0.175	5.6	LOS A	0.0	0.0	0.00	0.53	54.8
Approach		318	3.0	0.175	5.7	NA	0.0	0.0	0.00	0.53	54.8
West: Myall Road west											
10	L2	139	3.0	0.076	5.6	LOS A	0.0	0.0	0.00	0.58	53.5
11	T1	900	3.0	0.471	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1039	3.0	0.471	0.8	NA	0.0	0.0	0.00	0.08	58.9
All Vehicles		2084	3.0	0.692	4.8	NA	6.0	43.4	0.34	0.25	54.9

The intersection operates well with the right turn from Harrison Street banned, and the left turn slip lane from Harrison Street installed.

This treatment was iterated to determine if this treatment continued to operate well after the 2030 horizon year of the plan, with the left turn slip operating well in 2030. However, the right turn from Myall Road into Harrison Street fell below LoS E in 2026 (Table 2.43)

Table 2.43: Myall Road and Harrison Street ban right turn and left turn slip, 2026

Site: PM 2026 Harrison Street and Myall Road, Cardiff - banned right and left turn slip Harrison

Harrison Street and Myall Road - PM peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	603	3.0	0.315	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	228	3.0	0.904	57.4	LOS E	7.3	52.4	0.98	1.56	23.2
Approach		832	3.0	0.904	15.8	NA	7.3	52.4	0.27	0.43	41.8
North: Harrison Street											
7	L2	334	3.0	0.184	7.6	LOS A	0.0	0.0	0.00	0.59	49.8
Approach		334	3.0	0.184	7.6	NA	0.0	0.0	0.00	0.59	49.8
West: Myall Road west											
10	L2	144	3.0	0.079	8.2	LOS A	0.0	0.0	0.00	0.65	48.9
11	T1	1012	3.0	0.529	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
Approach		1156	3.0	0.529	1.1	NA	0.0	0.0	0.00	0.08	58.2
All Vehicles		2321	3.0	0.904	7.3	NA	7.3	52.4	0.10	0.28	50.0

The right turn from Myall Road into Harrison Street reaches a LoS E in 2026, and at that time the queue length exceeds the length of the turning lane provided, the right turn will have to be banned with the intersection designated left in, left out, (Figure 2.13). This is modelled with the results given in Table 2.44.

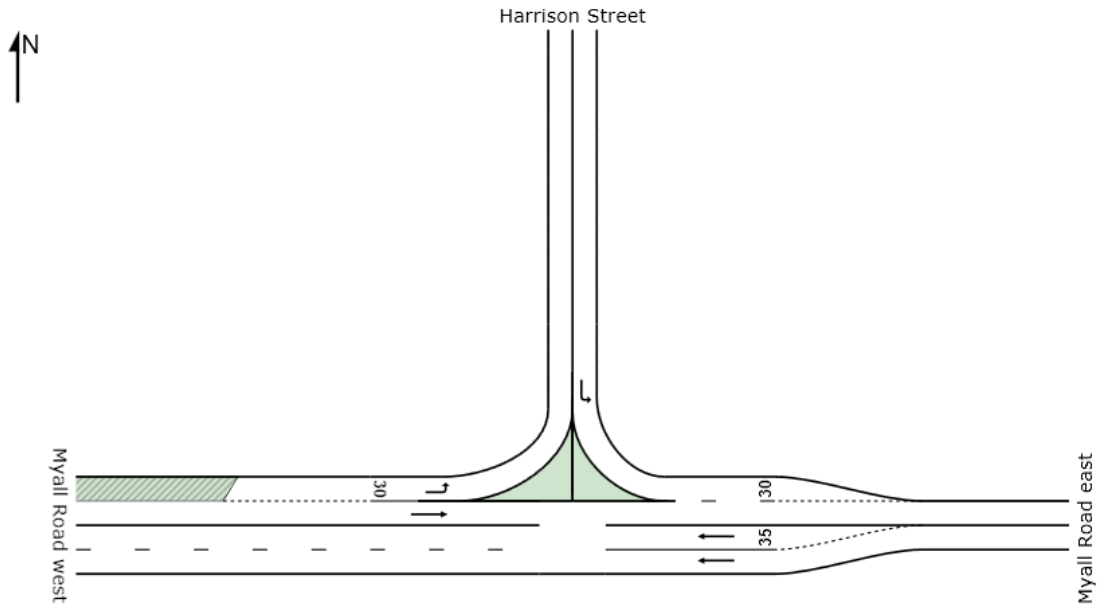


Figure 2.13: Myall Road and Harrison Street banned right turns and left turn slip lane

Table 2.44: Myall Road and Harrison Street banned right turns and left turn slip lane

Site: PM 2026 Harrison Street and Myall Road, Cardiff - banned rights and left turn slip

Right turns banned into and out of Harrison Street, left turn slip lane provided from Harrison Street
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	603	3.0	0.158	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		603	3.0	0.158	0.0	NA	0.0	0.0	0.00	0.00	60.0
North: Harrison Street											
7	L2	334	3.0	0.184	5.6	LOS A	0.0	0.0	0.00	0.53	54.8
Approach		334	3.0	0.184	5.7	NA	0.0	0.0	0.00	0.53	54.8
West: Myall Road west											
10	L2	144	3.0	0.079	5.6	LOS A	0.0	0.0	0.00	0.58	53.5
11	T1	1012	3.0	0.529	0.0	LOS A	0.0	0.0	0.00	0.00	59.8
Approach		1156	3.0	0.529	0.8	NA	0.0	0.0	0.00	0.07	58.9
All Vehicles		2093	3.0	0.529	1.3	NA	0.0	0.0	0.00	0.12	58.5

2.8.4 Traffic Signals

The intersection was modelled as signals. The through traffic on Myall Road was modelled using the Glendale East catchment growth (which is higher than the Cardiff CBD growth), as Myall Road is considered a regional road with potential for the traffic to increase when Munibung Road is extended to TC Frith Avenue in Boolaroo. This option is shown diagrammatically (Figure 2.14), with the results of the signalised intersection for the model year 2015 given in Table 2.45.

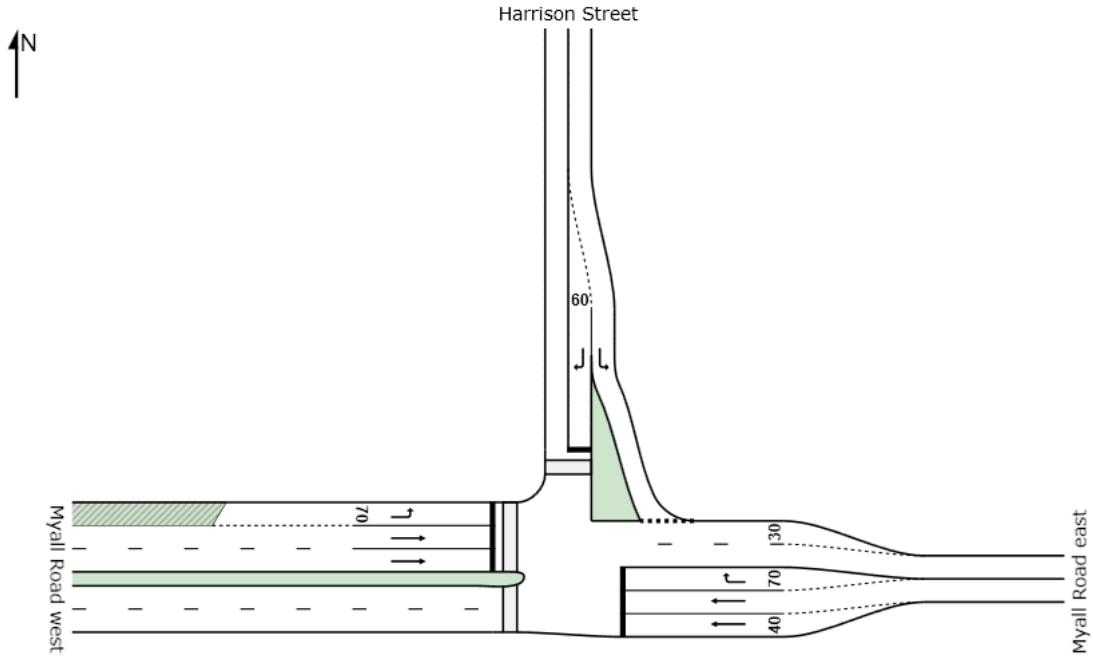


Figure 2.14: Myall Road and Harrison Street signal layout

Table 2.45: Myall Road and Harrison Street Traffic Signals, 2015

Site: PM 2015 Harrison Street and Myall Road, Cardiff

Harrison Street and Myall Road - PM peak
Signals - Actuated Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	499	3.0	0.209	7.1	LOS A	4.1	29.8	0.45	0.38	48.4
6	R2	204	3.0	0.911	41.9	LOS C	9.0	64.4	1.00	0.93	27.8
Approach		703	3.0	0.911	17.2	LOS B	9.0	64.4	0.61	0.54	39.9
North: Harrison Street											
7	L2	248	3.0	0.350	15.4	LOS B	4.8	34.6	0.58	0.76	42.1
9	R2	49	3.0	0.121	36.2	LOS C	1.6	11.2	0.81	0.74	30.0
Approach		298	3.0	0.350	18.8	LOS B	4.8	34.6	0.62	0.76	39.5
West: Myall Road west											
10	L2	128	3.0	0.160	15.1	LOS B	3.0	21.3	0.43	0.65	44.1
11	T1	837	3.0	0.674	10.4	LOS A	19.2	137.9	0.66	0.62	44.2
Approach		965	3.0	0.674	11.0	LOS A	19.2	137.9	0.63	0.62	44.2
All Vehicles		1966	3.0	0.911	14.4	LOS A	19.2	137.9	0.62	0.61	41.8

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P3	North Full Crossing	21	34.3	LOS D	0.0	0.0	0.93	0.93
P4	West Full Crossing	21	34.3	LOS D	0.0	0.0	0.93	0.93
All Pedestrians		42	34.3	LOS D			0.93	0.93

The queue on Myall Road west for a 2015 upgrade is in excess of 130 metres, which is the distance between this intersection and the intersection of Myall Road, Macquarie Road and Munibung Road.

As the growth in the catchment increases, the queue on Myall Road west increases. For the horizon year of 2030, the queue has increased in excess of 400 metres (Table 2.46), which has the potential to cause significant delays on Macquarie Road.

Table 2.46: Myall Road and Harrison Street Traffic Signals, 2030

Site: PM 2030 Harrison Street (16.29% growth) and Myall Road (28.51% growth)

Harrison Street and Myall Road - PM peak
Signals - Actuated Cycle Time = 109 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Myall Road east											
5	T1	642	2.3	0.240	6.5	LOS A	6.1	43.3	0.38	0.33	49.3
6	R2	244	2.6	0.730	56.2	LOS D	12.5	89.8	0.97	0.83	23.5
Approach		886	2.4	0.730	20.2	LOS B	12.5	89.8	0.54	0.47	37.9
North: Harrison Street											
7	L2	288	2.9	0.351	26.0	LOS B	9.1	65.4	0.68	0.77	35.0
9	R2	59	3.6	0.169	49.4	LOS D	2.6	19.1	0.85	0.75	25.4
Approach		347	3.0	0.351	30.0	LOS C	9.1	65.4	0.71	0.77	32.9
West: Myall Road west											
10	L2	149	2.8	0.179	27.3	LOS B	4.6	33.2	0.61	0.76	34.2
11	T1	1076	2.4	0.988	52.5	LOS D	62.2	444.6	0.93	1.04	23.7
Approach		1225	2.5	0.988	49.5	LOS D	62.2	444.6	0.89	1.00	24.6
All Vehicles		2459	2.5	0.988	36.2	LOS C	62.2	444.6	0.74	0.78	29.4

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P3	North Full Crossing	21	48.7	LOS E	0.1	0.1	0.95	0.95
P4	West Full Crossing	21	48.7	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		42	48.7	LOS E			0.95	0.95

It is considered that the queue length and resultant impact on the Macquarie Road, Myall Road and Munibung Road intersection is not appropriate in this location, and therefore signals will not be considered.

2.8.5 Crash History

There were seven reported crashes at the intersection of Myall Road and Harrison Street in the 5 year period 1 July 2009 to 30 June 2014. The crashes were as follows:

- Three crashes were vehicles turning right out of Harrison Street colliding with eastbound Myall Road traffic;
- Three crashes were right turn from Harrison Street colliding with vehicles turning right in to Harrison Street from Myall Road;
- One crash was a vehicle turning right into Harrison Street from Myall Road and colliding with an eastbound Myall Road motorist.

The majority of crashes (6 of 7) were in dry weather, and the majority (6 of 7) were in daylight.

2.8.6 Recommendation

In the short term, the intersection requires the right turn from Harrison Street into Myall Road banned and the left turn converted into a slip lane to assist the left turn to merge against the high volume Myall Road traffic.

Modelling indicates that by year 2025, the right turn from Myall Road into Harrison Street will need to be banned as the queue length exceeds the length of the turn lane, and this lane cannot be modified without removing the right turn lane into the bowling club (located opposite the intersection).

Upgrade the intersection of Myall Road and Harrison Street by banning the right turn movements, and install a left turn slip lane into and out of Harrison Street.

2.9 Munibung Road between Cardiff and Boolaroo

Munibung Road is a local road connecting the Cardiff Industrial Estate to the Macquarie Road and Myall Road intersection. A second access to the estate exists via Pendlebury Road, however the majority of traffic utilises Munibung Road. Both accesses are at the eastern end of the estate, and there is no western access.

Munibung Road currently carries 16,700 vehicles per day (weekday traffic) east of Lachlan Road, and 11,800 vehicles per day (weekday traffic) east of Mitchell Road. The weekend traffic is significantly lower.

The traffic volume within the catchment is not expected to increase significantly as there is minimal additional development to occur.

2.9.1 Munibung Road extension to Boolaroo

Munibung Road has recently been constructed at the western end, connecting to the TC Frith Avenue, Lake Road, Main Road and Munibung Road roundabout. The missing link between the Cardiff and Boolaroo ends is approximately 750 metres in length (Figure 2.15)

Figure 2.15: Missing link between Cardiff and Boolaroo ends of Munibung Road

When completed, the missing link will create a direct route comprising Myall Road and Munibung Road between the RMS controlled State Roads of Highway 23 (Newcastle Inner City Bypass), Macquarie Road, and TC Frith Avenue. Munibung Road following connection would be 3.8 km in length, with one set of traffic signals along its length. The alternative route via Main Road and Lake Road is 5 km in length, has seven sets of traffic signals and one roundabout, (Figure 2.16).

Figure 2.16: Myall Road (red), Munibung Road (orange), State roads (blue)

Munibung Road currently operates at a Level of Service (LoS) C with a maximum of 800 vehicles per hour per lane. The accepted volume where a road will transition from LoS D to E, which is also the trigger for additional lanes to be investigated, is 1,300 vehicles per hour per lane. The completion of Munibung Road is not essential for the operation of the Cardiff Industrial Estate. Munibung Road is considered to fail due to the queue and delay caused by the poor operation of the State road signalised intersection of Macquarie Road, Munibung Road and Myall Road.

A point to point travel time survey was undertaken between Munibung Road at the intersections with TC Frith Avenue at the eastern end and Macquarie Road at the western end, with Munibung Road hypothetically connected along its length. The average travel time is shown in Table 2.47.

Table 2.47: Travel time difference between Boolaroo and Cardiff via different routes

Direction		Off peak	PM peak
Munibung Road	**east**	4m20s	4m24s
	west	4m22s	4m25s
Via Cardiff	**north**	8m09s	8m56s
	south	6m35s	7m44s

The average travel time saving by Munibung Road being connected is 4 minutes and 11 seconds in the east direction, and 2 minutes and 47 seconds in the west direction.

Without Munibung Road being extended, a motorist located at the western end of the Cardiff Industrial Estate travelling towards the intersection of Munibung Road, TC Frith Avenue and Main Road, the travel time between the two points would exceed 11 minutes. With Munibung Road extended the travel time would most likely be less than a minute, resulting in a travel time saving of 10 minutes between the two points.

2.9.2 Traffic volumes on alternate routes - State Roads Main Road and Lake Road

Lake Road near Waratah Golf Club currently carries around 27,700 vehicles per day, with an estimated 1,300 vehicles per hour per lane. The road is a two-lane two way configuration, and is considered interrupted flow due to number of signalised intersections. If the traffic volume increases in line with the Glendale East sub-catchment, then the traffic volume on Lake Road in 2030 is estimated at over 35,000 vehicles per day.

The peak hour performance on Lake Road is assumed to be a LoS E given that the high traffic volume is impacting on the vehicle speed. Lake Road and Main Road will require to be upgraded to four-lane two-way traffic prior to 2030. The completion of Munibung Road will provide an

additional route for traffic to travel and avoid these road, and potentially alleviate some of the congestion.

2.10 Lake Macquarie Transport Interchange (LMTI)

Stage 1 section 1 of the LMTI will connect Glendale Drive to Stockland Drive. Stage 1 will alleviate the congestion on Stockland Drive, which results from the poor intersection performance of the Stockland Drive, Lake Road and Frederick Street (State road) intersection. Stockland Drive is currently a four-lane two-way road and this configuration will easily accommodate the peak hour traffic volumes of 1,000 vehicles each way.

Stage 1 section 2 of the LMTI connects from Stockland Drive to Munibung Road via Pennent Street. This link will provide an additional access for the Cardiff Industrial Estate to exit, and would form a third access connecting the Cardiff Industrial Estate to the Main Road / Macquarie Road State road.

As can be seen in the future road network (Figure 2.17), the LMTI and Munibung Road provide additional alternatives to the State road network. Although the LMTI will improve the road network by redistributing eastbound and some northbound traffic away from Stockland Drive and the Lake Road, Stockland Drive and Frederick Street intersection, it is considered that the State road network and State road intersections operate at a poor LoS. The LMTI will assist the State road operation, however the local roads requiring construction are not being constructed to solve existing local road capacity or intersection issues, and therefore it is considered that development contributions will not be an appropriate funding source for these works.

Figure 2.17: State roads (blue), Munibung Road (orange), Lake Macquarie Transport Interchange and Stockland Drive (yellow), Myall Road (red)

2.10.1 Recommendation

The anticipated traffic volume increase due to development within the Cardiff Industrial Estate is not expected to generate the need for the completion of Munibung Road or construction of the LMTI to be funded by developer contributions.

The completion of the LMTI and Munibung Road will form an important link that would provide a bypass to the congested State road network, and a continuation of the direct route connecting the three State roads (Highway 23, Macquarie Road and TC Frith Avenue) via Myall Road and Munibung Road. The completion will also result in reduced travel times for businesses within the estate that wish to travel south via the western side of the lake, and also reduced travel time for through traffic.

It is considered that the Munibung Road link should be funded external to development contributions, or by the RMS as an interim measure to upgrading the State road network.

2.11 Main Road and Wallsend Road, Cardiff Heights

2.11.1 Background

Main Road is a sub-arterial road connecting (via Cardiff Road) the State Roads Newcastle Inner City Bypass (H23) with Macquarie Road (MR527), and continues through the Cardiff CBD. Main Road carries approximately 13,500 vehicles per day. Wallsend Road is a collector road and carries approximately 5,000 vehicles per day. The intersection is constrained by development on all boundaries.

Figure 2.18: Main Road and Wallsend Road Cardiff Heights

Council had previously planned construction of Traffic Signals at this intersection, to be commenced in the 2004 / 2005 financial year*. The intersection was not upgraded and has had no alterations undertaken since that time.

*Refer to TRIM document F2004/08877

2.11.2 Projected Growth

The intersection of Main Road and Wallsend Road is located in the north-eastern section of the Glendale catchment, away from the majority of the high growth areas. This section of the catchment has a 15-year growth projection (2015 to 2030) of 18.09%.

For Main Road, the RTA/RMS counting station 05.564 has provided the traffic volumes in Table 2.48.

Table 2.48 – Main Road Cardiff ADT counting station results

Year	AADT	Annual Growth Rate Main Road Cardiff Heights	
		Between surveys	Relative to 1995
1995	13,331		
1998	13,938	5%	5%
2001	13,847	-0.6%	4%
2004	15,234	10%	14%
2012 (council)	13,215	-13.3%	-0.9%

The traffic volumes on Main Road, east of Wallsend Road, have not increased over the last 20 years, and has reduced within the last 10 years. Comparing the 2004 turning volumes survey with the 2015 turning volume survey shows that the turning patterns at the intersection have changed between -13% (that is, reduced in traffic by 13%) and 24%. It is considered from this historical data that the projected growth rate of 18.09% over the next 15 years is conservative.

Due to the constrained geometry of the intersection, a roundabout will not be investigated, with traffic signals considered the optimal upgrade.

2.11.3 Analysis

The Wallsend Road leg of the intersection is currently operating at a LoS F in the PM peak for the right turn movement, Table 2.49.

Table 2.49: Main Road and Wallsend Road existing intersection, PM peak 2015

Site: PM 2015 Wallsend Road and Main Road

Existing intersection alignment
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Main Road south											
1	L2	251	2.1	0.324	8.2	LOS A	0.0	0.0	0.00	0.35	54.9
2	T1	362	1.5	0.324	0.0	LOS A	0.0	0.0	0.00	0.35	54.9
Approach		613	1.7	0.324	3.4	NA	0.0	0.0	0.00	0.35	54.9
North: Main Road north											
8	T1	329	2.9	0.589	6.5	LOS A	7.0	50.2	0.81	0.62	44.5
9	R2	375	2.2	0.589	14.8	LOS B	7.0	50.2	0.81	0.62	44.5
Approach		704	2.5	0.589	11.0	NA	7.0	50.2	0.81	0.62	44.5
West: Wallsend Road											
10	L2	272	3.9	0.284	12.8	LOS A	1.3	9.1	0.50	0.91	45.3
12	R2	211	3.5	0.963	76.5	LOS F	9.1	65.7	0.99	1.75	19.5
Approach		482	3.7	0.963	40.6	LOS C	9.1	65.7	0.71	1.28	28.8
All Vehicles		1799	2.6	0.963	16.3	NA	9.1	65.7	0.51	0.70	41.1

The intersection is surrounded by predominantly residential uses, with The Groves House Aged Care Facility located on the north-eastern corner of the intersection. The Lyndon Grove Retirement Village is located next door to the aged care facility, with requests for improved pedestrian crossing facilities across Main Road frequenting Councils transportation requests register, aiming to improve crossing for the aged between the bus stops located on each side of the road. The intersection layout investigated is shown in Figure 2.19.

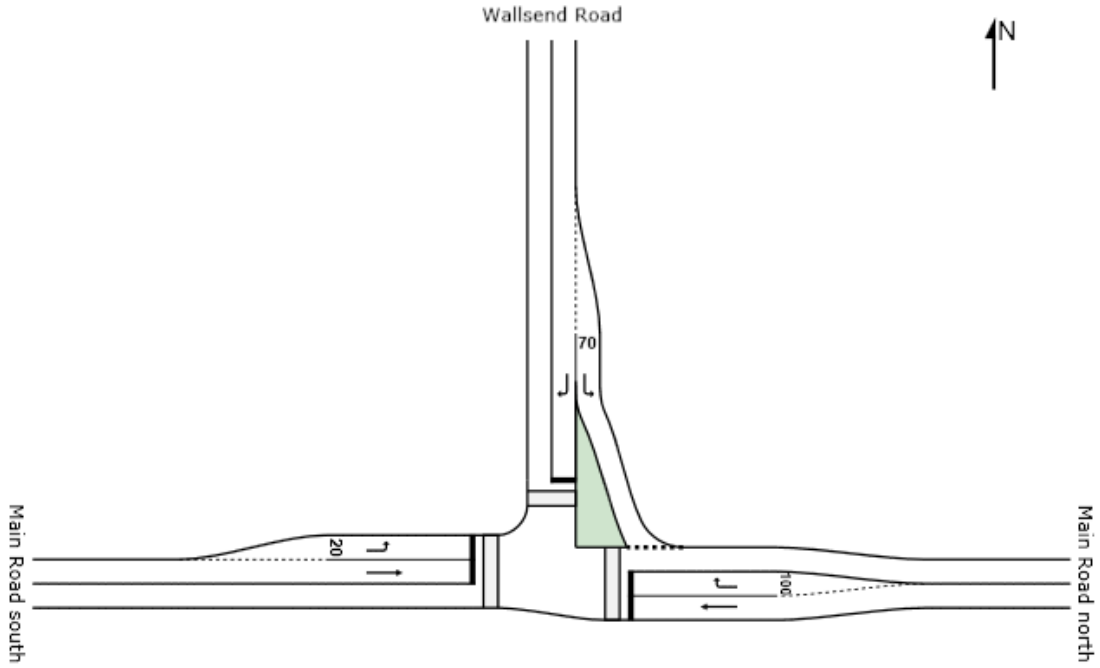


Figure 2.19: Main Road and Wallsend Road Traffic Signal upgrade

Traffic signals are required to be modelled for a minimum 10-year life. For this report, the horizon year is 2030. It is considered that even though the right turn from Wallsend Road into Main Road is a LoS F in the PM peak, it is unlikely that funds will be available to upgrade this intersection within the next 5 years, with the construction year estimated at 2020. Therefore the intersection will be modelled with a commencement year of 2020 (Table 2.50), and for the horizon year of 2030.

Table 2.50: Main Road and Wallsend Road Traffic Signals PM 2020

Site: PM 2020 Wallsend Road and Main Road - current volume plus 5 years growth

Existing intersection alignment
Signals - Fixed Time Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Main Road south											
1	L2	266	2.0	0.530	25.6	LOS B	7.2	51.1	0.73	0.79	35.1
2	T1	384	1.4	0.693	19.3	LOS B	11.3	80.0	0.78	0.69	37.3
Approach		651	1.6	0.693	21.9	LOS B	11.3	80.0	0.76	0.73	36.4
North: Main Road north											
8	T1	349	2.7	0.275	5.9	LOS A	5.6	39.9	0.44	0.38	49.8
9	R2	398	2.1	0.695	28.4	LOS B	12.8	91.0	0.94	0.92	33.6
Approach		747	2.4	0.695	17.9	LOS B	12.8	91.0	0.71	0.67	39.6
West: Wallsend Road											
10	L2	288	3.6	0.256	10.6	LOS A	3.0	21.5	0.38	0.71	46.4
12	R2	224	3.3	0.659	42.6	LOS D	8.5	61.5	0.98	0.84	27.6
Approach		513	3.5	0.659	24.6	LOS B	8.5	61.5	0.64	0.77	35.8
All Vehicles		1911	2.4	0.695	21.1	LOS B	12.8	91.0	0.71	0.72	37.4

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	11	32.4	LOS D	0.0	0.0	0.90	0.90
P3	North Full Crossing	11	32.4	LOS D	0.0	0.0	0.90	0.90
P4	West Full Crossing	11	16.9	LOS B	0.0	0.0	0.65	0.65
All Pedestrians		32	27.2	LOS C			0.82	0.82

The intersection operates well with traffic signals, with an overall LoS B. The right turn queue on Main Road into Wallsend Road at 91 metres is accommodated within the proposed 100 metre length turn lane.

The intersection has been modelled for the 2030 year, shown in Table 2.51.

Table 2.51: Main Road and Wallsend Road Traffic Signals PM 2030

Site: PM 2030 Wallsend Road and Main Road + 18.09% growth

Existing intersection alignment
Signals - Actuated Cycle Time = 98 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Main Road south											
1	L2	297	1.8	0.713	31.0	LOS C	10.0	71.1	0.73	0.80	32.3
2	T1	428	1.2	0.832	24.6	LOS B	15.5	109.9	0.79	0.69	34.2
Approach		725	1.5	0.832	27.3	LOS B	15.5	109.9	0.77	0.73	33.4
North: Main Road north											
8	T1	389	2.4	0.301	7.2	LOS A	7.5	53.6	0.43	0.38	48.4
9	R2	443	1.9	0.972	53.3	LOS D	21.9	155.9	1.00	0.98	24.3
Approach		833	2.1	0.972	31.7	LOS C	21.9	155.9	0.73	0.70	31.7
West: Wallsend Road											
10	L2	321	3.3	0.280	12.1	LOS A	4.9	35.4	0.40	0.72	45.0
12	R2	249	3.0	0.672	49.5	LOS D	11.3	80.9	0.95	0.83	25.3
Approach		571	3.1	0.672	28.4	LOS B	11.3	80.9	0.64	0.77	33.6
All Vehicles		2128	2.2	0.972	29.3	LOS C	21.9	155.9	0.72	0.73	32.8

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	11	36.9	LOS D	0.0	0.0	0.87	0.87
P3	North Full Crossing	11	36.9	LOS D	0.0	0.0	0.87	0.87
P4	West Full Crossing	11	40.4	LOS E	0.0	0.0	0.91	0.91
All Pedestrians		32	38.1	LOS D			0.88	0.88

The intersection overall continues to operate well, however the predicted queue for the right turn on Main Road into Wallsend Road exceeds the length of the turn lane by 50%.

Due to the growth estimate being considered conservative for this intersection, and the 10-year growth showing significant issues with the length of the right turn into Wallsend Road, the 20% sensitivity will not be modelled. Instead, the intersection will be monitored throughout the life of the plan. It is considered that there are measures that can be undertaken (for example, double right turn from Main Road into Wallsend Road), to improve the intersection should the growth be realised and this can be considered for upgrade in future amendments to the s94 plan. These measures should not be implemented until such time that the works are required, as the double right turn from Main Road into Wallsend Road impacts on the access into properties 112 to 124 Main Road. Figure 2.20 and Table 2.52 show the operation of the signals with the double right turn, to demonstrate that the queuing and delay at the intersection can be improved if works are required in the future.

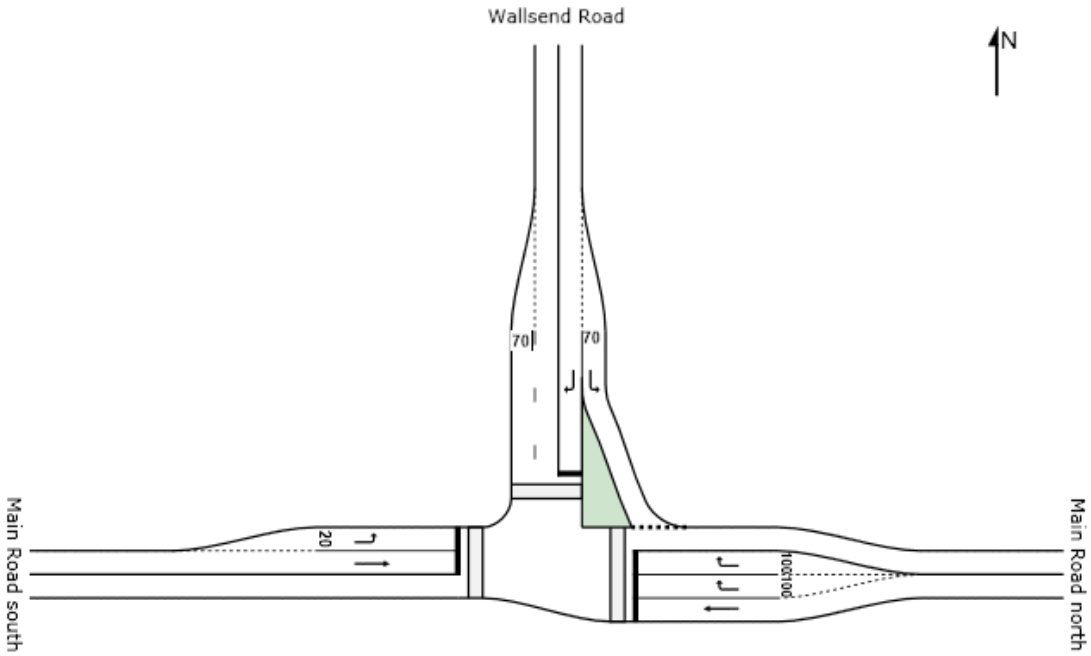


Figure 2.20: Main Road and Wallsend Road Traffic Signals

Table 2.52: Main Road and Wallsend Road 2030 with double right turn

Site: PM 2030 Wallsend Road and Main Road with double right turn

Existing intersection alignment
Signals - Actuated Cycle Time = 98 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Main Road south											
1	L2	297	1.8	0.713	31.0	LOS C	10.0	71.1	0.73	0.80	32.3
2	T1	428	1.2	0.832	24.6	LOS B	15.5	109.9	0.79	0.69	34.2
Approach		725	1.5	0.832	27.3	LOS B	15.5	109.9	0.77	0.73	33.4
North: Main Road north											
8	T1	389	2.4	0.301	7.2	LOS A	7.5	53.6	0.43	0.38	48.4
9	R2	443	1.9	0.695	30.7	LOS C	10.1	72.0	0.91	0.82	32.4
Approach		833	2.1	0.695	19.7	LOS B	10.1	72.0	0.68	0.61	38.4
West: Wallsend Road											
10	L2	321	3.3	0.280	12.1	LOS A	4.9	35.4	0.40	0.72	45.0
12	R2	249	3.0	0.672	49.4	LOS D	11.3	80.9	0.95	0.83	25.4
Approach		571	3.1	0.672	28.4	LOS B	11.3	80.9	0.64	0.77	33.7
All Vehicles		2128	2.2	0.832	24.6	LOS B	15.5	109.9	0.70	0.69	35.3

2.11.4 Recommendation

It is recommended that the intersection be upgraded to signals.

2.12 Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton

2.12.1 Background

Council upgraded the intersection of Tennent Road, Progress Road, Dunkley Parade and Warners Bay Road in 2011. When approving the upgrade, Council at their ordinary meeting dated 15 June 2010 recommended that the design and construction of the Warners Bay Road extension, as a long term option, proceed. This extension is the southern leg (currently closed) at the Warners Bay Road, Dunkley Parade and Bayview Street intersection (Figure 2.21). Historical aerial photos show that the southern Warners Bay Road leg was closed to traffic at this intersection in the 1970's, with Dunkley Parade forming the main road route.

Figure 2.21: Warners Bay Road, Bayview Street, and Dunkley Parade intersection, 2012

2.12.2 Projected Growth

The intersection of Bayview Street, Dunkley Parade and Warners Bay Road is located on the boundary of the Charlestown and Glendale catchments. Between 2010 and 2025, the population and commercial floor space of the Mount Hutton sub-catchment is projected to increase 21% through the Charlestown plan. Between 2015 and 2030 the population and commercial floor space of the Warners Bay suburb sub-catchment is projected to increase 24.4% through the Glendale plan.

2.12.3 Analysis

The existing seagull intersection was inspected during the AM and PM peak hours, and it was noted that most right turning motorists from Bayview Street are not utilising the seagull storage

lane, possible due to it being painted and undersized which does not provide any protection for the motorists to feel safe to use the storage area. Because of this, the gap acceptance for the right turning traffic was kept as the default, and not altered to suit the lesser gap usually accepted at seagull intersections. The current delay, queue length and LoS was modelled for the right turn from Bayview Street into Dunkley Parade (with a queue in the seagull), and for the seagull storage area into the traffic stream for the AM peak (Table 2.53 and Table 2.54) and the PM peak (Table 2.55 and Table 2.56).

Table 2.53: Bayview Street, Dunkley Parade and Warners Bay Road, right turn from Bayview Street – AM 2015

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - right turn from Bayview AM 2015

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
6	R2	262	1.5	0.765	25.3	LOS B	4.1	29.0	0.93	1.25	41.4
Approach		262	1.5	0.765	25.3	NA	4.1	29.0	0.93	1.25	41.4
North: Bayview Street											
7	L2	387	1.5	1.006	74.2	LOS F	19.1	135.3	1.00	2.37	27.1
9	R2	63	1.5	1.053	217.6	LOS F	7.0	49.8	1.00	1.49	13.0
Approach		451	1.5	1.053	94.3	LOS F	19.1	135.3	1.00	2.24	23.6
West: Dunkley Parade											
10	L2	189	1.5	0.557	5.6	LOS A	0.0	0.0	0.00	0.11	57.2
11	T1	876	1.5	0.557	0.1	LOS A	0.0	0.0	0.00	0.11	58.8
Approach		1065	1.5	0.557	1.1	NA	0.0	0.0	0.00	0.11	58.6
All Vehicles		1778	1.5	1.053	28.3	NA	19.1	135.3	0.39	0.82	40.7

Table 2.54: Bayview Street, Dunkley Parade and Warners Bay Road, merge lane into Dunkley Parade – AM 2015

Site: Bayview Street, Dunkley Parade and Warners Bay Road - merge lane AM 2015

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Merge lane											
21a	L1	63	1.5	0.069	9.4	LOS A	0.3	1.8	0.45	0.90	50.8
Approach		63	1.5	0.069	9.4	LOS A	0.3	1.8	0.45	0.90	50.8
East: Warners Bay Road											
5	T1	403	1.5	0.209	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	262	1.5	0.765	25.2	LOS B	4.1	29.0	0.93	1.25	41.2
Approach		665	1.5	0.765	9.9	NA	4.1	29.0	0.37	0.49	50.8
North: Bayview Street											
7	L2	387	1.5	1.006	74.2	LOS F	19.1	135.3	1.00	2.37	27.1
Approach		387	1.5	1.006	74.2	LOS F	19.1	135.3	1.00	2.37	27.1
West: Dunkley Parade											
10	L2	189	1.5	0.557	5.6	LOS A	0.0	0.0	0.00	0.11	57.2
11	T1	876	1.5	0.557	0.1	LOS A	0.0	0.0	0.00	0.11	58.8
Approach		1065	1.5	0.557	1.1	NA	0.0	0.0	0.00	0.11	58.5
All Vehicles		2181	1.5	1.006	17.0	NA	19.1	135.3	0.30	0.65	46.6

Table 2.55: Bayview Street, Dunkley Parade and Warners Bay Road, right turn from Bayview Street – PM 2015

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - right turn from Bayview PM 2015

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
6	R2	458	1.5	0.730	16.7	LOS B	6.2	44.2	0.83	1.24	45.8
Approach		458	1.5	0.730	16.7	NA	6.2	44.2	0.83	1.24	45.8
North: Bayview Street											
7	L2	216	1.5	0.381	14.4	LOS A	1.8	12.9	0.64	1.06	48.3
9	R2	80	1.5	0.786	78.6	LOS F	3.5	25.0	0.97	1.22	26.0
Approach		296	1.5	0.786	31.7	LOS C	3.5	25.0	0.73	1.11	39.2
West: Dunkley Parade											
10	L2	135	1.5	0.347	5.6	LOS A	0.0	0.0	0.00	0.12	57.2
11	T1	529	1.5	0.347	0.0	LOS A	0.0	0.0	0.00	0.12	58.8
Approach		664	1.5	0.347	1.2	NA	0.0	0.0	0.00	0.12	58.5
All Vehicles		1418	1.5	0.786	12.6	NA	6.2	44.2	0.42	0.69	49.1

Table 2.56: Bayview Street, Dunkley Parade and Warners Bay Road, merge lane into Dunkley Parade – PM 2015

Site: Bayview Street, Dunkley Parade and Warners Bay Road - merge lane PM 2015

Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Merge lane											
21a	L1	80	1.5	0.215	17.0	LOS B	0.8	5.3	0.78	1.01	46.3
Approach		80	1.5	0.215	17.0	LOS B	0.8	5.3	0.78	1.01	46.3
East: Warners Bay Road											
5	T1	928	1.5	0.481	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
6	R2	458	1.5	0.730	16.7	LOS B	6.2	44.2	0.83	1.24	45.6
Approach		1386	1.5	0.730	5.6	NA	6.2	44.2	0.27	0.41	54.3
North: Bayview Street											
7	L2	216	1.5	0.381	14.4	LOS A	1.8	12.9	0.64	1.06	48.3
Approach		216	1.5	0.381	14.4	LOS A	1.8	12.9	0.64	1.06	48.3
West: Dunkley Parade											
10	L2	135	1.5	0.347	5.6	LOS A	0.0	0.0	0.00	0.12	57.2
11	T1	529	1.5	0.347	0.0	LOS A	0.0	0.0	0.00	0.12	58.8
Approach		664	1.5	0.347	1.2	NA	0.0	0.0	0.00	0.12	58.5
All Vehicles		2346	1.5	0.730	5.5	NA	6.2	44.2	0.25	0.41	54.4

The AM peak is the critical peak. The left and right turn from Bayview Street is at capacity (LoS F) with long delays. This was noted when the site was inspected during the peak hours.

The options available for upgrade are signals and a roundabout.

2.12.4 Roundabout

The intersection was modelled as a roundabout for the horizon year of 2030, in the critical AM peak (Table 2.57). As the intersection is located across the boundary of the Charlestown (Mount Hutton sub-catchment) and Glendale (Warners Bay suburb sub-catchment) catchments, the traffic volumes will be distributed as follows:.

- 2030 AM – 80% of the 24.42% growth from the Warners Bay suburb sub-catchment travel to / from Mount Hutton sub-catchment
- 20% of the 21% growth from the Mount Hutton sub-catchment travel to / from Warners Bay sub-catchment
- 100% of the Mount Hutton sub-catchment (21%) travel on Warners Bay Road.
- 2030 PM - 20% of the 24.42% growth from the Warners Bay sub-catchment travel to / from the Mount Hutton sub-catchment
- 80% of the 21% growth from the Mount Hutton sub-catchment travel to / from the Warners Bay sub-catchment
- 100% of the Mount Hutton sub-catchment (21%) travel on Warners Bay Road.

The Warners Bay Road and Dunkley Parade route is considered a regional road, however it is removed from the higher growth Charlestown sub-catchment so it is considered that the growth from the Mount Hutton sub-catchment is considered an appropriate growth rate.

The installation of a roundabout in this location may require either a retaining wall to be placed along the southern edge of the road, which would exclude Warners Bay Road from being easily connected in the future, or the fourth leg could be constructed at the same time as the intersection and remain blocked until Council has the need and funding to complete the continuation of the road extension.

With the above assumptions, for the intersection to function well for the 15 year plan life, the layout (Figure 2.22) was required which resulted in the AM peak (Table 2.57) and PM peak (Table 2.58).

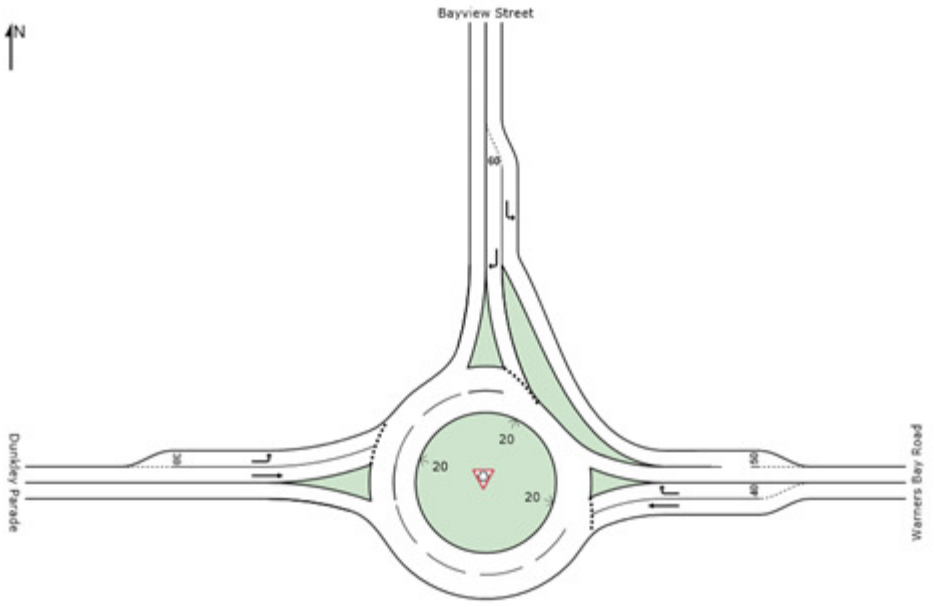


Figure 2.22: Warners Bay Road, Bayview Street, and Dunkley Parade roundabout

Table 2.57: Warners Bay Road, Bayview Street, and Dunkley Parade 2030 AM peak

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - AM 2030

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
5	T1	457	1.5	0.288	4.6	LOS A	2.5	17.8	0.34	0.42	55.3
6	R2	325	1.5	0.245	9.3	LOS A	2.0	13.9	0.34	0.59	52.2
Approach		782	1.5	0.288	6.5	LOS A	2.5	17.8	0.34	0.49	54.0
North: Bayview Street											
7	L2	480	1.5	0.261	3.5	LOS A	0.0	0.0	0.00	0.44	56.3
9	R2	79	1.5	0.209	18.5	LOS B	1.6	11.5	1.00	0.92	47.0
Approach		559	1.5	0.261	5.6	LOS A	1.6	11.5	0.14	0.51	54.7
West: Dunkley Parade											
10	L2	235	1.5	0.357	7.8	LOS A	2.0	14.5	0.62	0.72	52.5
11	T1	1060	1.5	1.005	42.5	LOS C	45.8	324.8	1.00	1.75	36.0
Approach		1295	1.5	1.005	36.2	LOS C	45.8	324.8	0.93	1.57	38.1
All Vehicles		2636	1.5	1.005	20.9	LOS B	45.8	324.8	0.59	1.02	44.9

Table 2.58: Warners Bay Road, Bayview Street, and Dunkley Parade 2030 PM peak

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - PM 2030

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
5	T1	1123	1.5	0.706	5.2	LOS A	10.1	71.5	0.60	0.47	54.1
6	R2	568	1.5	0.454	9.7	LOS A	4.3	30.2	0.46	0.60	51.8
Approach		1692	1.5	0.706	6.7	LOS A	10.1	71.5	0.56	0.51	53.3
North: Bayview Street											
7	L2	264	1.5	0.144	3.5	LOS A	0.0	0.0	0.00	0.44	56.3
9	R2	100	1.5	0.134	12.2	LOS A	0.9	6.4	0.76	0.77	50.9
Approach		364	1.5	0.144	5.9	LOS A	0.9	6.4	0.21	0.53	54.7
West: Dunkley Parade											
10	L2	167	1.5	0.316	9.9	LOS A	1.8	12.5	0.73	0.84	51.0
11	T1	641	1.5	0.721	12.9	LOS A	9.0	64.1	0.93	1.05	50.3
Approach		808	1.5	0.721	12.3	LOS A	9.0	64.1	0.89	1.01	50.5
All Vehicles		2864	1.5	0.721	8.2	LOS A	10.1	71.5	0.61	0.65	52.6

The intersection operates well in the PM peak. In the AM peak, The eastbound approach from Dunkley Parade to Warners Bay Road operates at a LoS C and has lengthy queues and delays. This indicates that at the horizon year of the plan (2030) that the intersection is approaching failure, however has not reached the LoS E upgrade limit. The intersection was modelled using the projections after the horizon year (assuming the same growth), resulting in the eastbound Dunkley Parade traffic reaching a capacity (LoS E) in 2032 (Table 2.58).

Table 2.58: Warners Bay Road, Bayview Street, and Dunkley Parade 2032 AM peak

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - AM 2032

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
5	T1	471	1.5	0.297	4.6	LOS A	2.6	18.6	0.35	0.42	55.3
6	R2	337	1.5	0.254	9.3	LOS A	2.1	14.6	0.35	0.59	52.2
Approach		807	1.5	0.297	6.6	LOS A	2.6	18.6	0.35	0.49	53.9
North: Bayview Street											
7	L2	496	1.5	0.270	3.5	LOS A	0.0	0.0	0.00	0.44	56.3
9	R2	82	1.5	0.213	18.3	LOS B	1.7	11.8	1.00	0.92	47.1
Approach		578	1.5	0.270	5.6	LOS A	1.7	11.8	0.14	0.51	54.7
West: Dunkley Parade											
10	L2	242	1.5	0.373	8.0	LOS A	2.2	15.3	0.64	0.74	52.4
11	T1	1089	1.5	1.040	64.1	LOS E	61.2	434.0	1.00	2.27	29.8
Approach		1332	1.5	1.040	53.9	LOS D	61.2	434.0	0.93	1.99	32.3
All Vehicles		2717	1.5	1.040	29.6	LOS C	61.2	434.0	0.59	1.23	40.7

It is considered that at the time that the LoS reaches E in the AM peak, that the roundabout can be investigated for metering (signalisation) on the Warners Bay Road leg (Table 2.59) to extend its life by approximately 5 years to 2037. Alternatively the proposal to open access to the intersection from Warners Bay Road south leg can be investigated, as this proposal redistributes the traffic (assumed 90% of the Dunkley Parade traffic volume will use this new leg). The Warners Bay Road south leg has the advantage of a wide road reserve which will allow a greater number of lanes to approach the roundabout, which spreads the queuing over the two lanes. This matter will be investigated in later plans, however Figure 2.23 and Table 2.60 show that opening the southern Warners Bay Road leg as the main road will improve the performance of the intersection.

Table 2.59: Warners Bay Road, Bayview Street, and Dunkley Parade 2032 AM peak with roundabout metering on the Warners Bay Road approach

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - AM 2032

Roundabout Metering

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
5	T1	471	1.5	0.812	24.2	LOS B	21.4	151.8	0.99	0.88	43.7
6	R2	337	1.5	0.702	25.0	LOS B	14.0	99.0	0.94	0.83	43.5
Approach		807	1.5	0.812	24.6	LOS B	21.4	151.8	0.97	0.86	43.6
North: Bayview Street											
7	L2	496	1.5	0.270	3.5	LOS A	0.0	0.0	0.00	NaN	NaN
9	R2	82	1.5	0.149	14.3	LOS A	1.1	7.5	0.88	NaN	NaN
Approach		578	1.5	0.270	5.0	LOS A	1.1	7.5	0.12	NaN	NaN
West: Dunkley Parade											
10	L2	242	1.5	0.265	5.1	LOS A	1.5	10.5	0.51	0.60	53.7
11	T1	1089	1.5	0.876	9.9	LOS A	16.6	117.9	0.98	0.82	52.3
Approach		1332	1.5	0.876	9.0	LOS A	16.6	117.9	0.90	0.78	52.6
All Vehicles		2717	1.5	0.876	12.8	LOS A	21.4	151.8	0.75	NaN	NaN

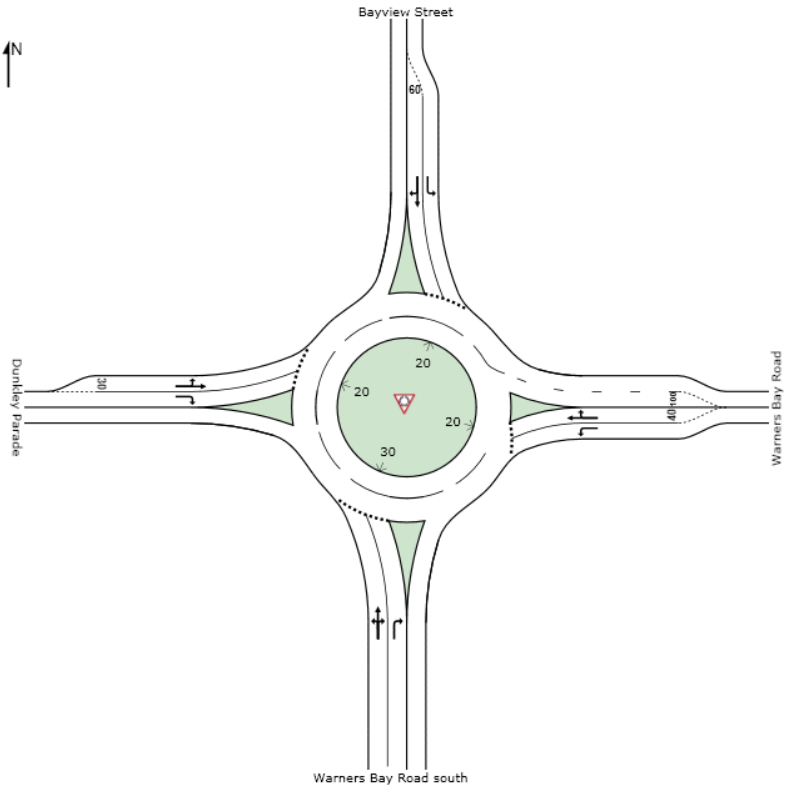


Figure 2.23: After 2030 – Following opening of the Warners Bay Road south leg

Table 2.60: Warners Bay Road, Bayview Street and Dunkley Parade 2032 AM peak with Warners Bay Road south leg utilised

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - AM 2032 - two lanes, WB south op

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Warners Bay Road south											
1	L2	11	0.0	0.610	6.5	LOS A	5.3	36.9	0.69	0.77	51.2
2	T1	218	0.0	0.610	6.7	LOS A	5.3	36.9	0.69	0.77	52.4
3	R2	979	0.0	0.610	11.6	LOS A	5.3	36.9	0.66	0.77	52.0
Approach		1207	0.0	0.610	10.7	LOS A	5.3	36.9	0.66	0.77	52.1
East: Warners Bay Road											
4	L2	421	0.0	0.266	4.5	LOS A	2.1	14.5	0.33	0.47	54.4
5	T1	49	1.5	0.285	4.5	LOS A	2.2	15.7	0.35	0.58	53.0
6	R2	337	1.5	0.285	9.6	LOS A	2.2	15.7	0.35	0.58	52.9
Approach		807	0.7	0.285	6.6	LOS A	2.2	15.7	0.34	0.52	53.7
North: Bayview Street											
7	L2	496	1.5	0.705	12.8	LOS A	6.0	42.5	0.90	1.10	49.0
8	T1	74	0.0	0.204	10.9	LOS A	0.9	6.3	0.74	0.86	51.4
9	R2	8	1.5	0.204	15.7	LOS B	0.9	6.3	0.74	0.86	51.7
Approach		578	1.3	0.705	12.6	LOS A	6.0	42.5	0.88	1.06	49.4
West: Dunkley Parade											
10	L2	24	1.5	0.260	10.8	LOS A	1.5	10.6	0.86	0.92	50.4
11	T1	111	1.5	0.260	10.9	LOS A	1.5	10.6	0.86	0.92	51.7
12	R2	11	0.0	0.033	18.2	LOS B	0.2	1.1	0.80	0.88	47.2
Approach		145	1.4	0.260	11.4	LOS A	1.5	10.6	0.86	0.92	51.2
All Vehicles		2738	0.6	0.705	9.9	LOS A	6.0	42.5	0.62	0.77	51.9

2.12.5 Traffic Signals

The intersection was investigated for signals. The site is constrained by the terrain and narrow road reserve along the Warners Bay Road and Dunkley Parade corridor.

For the horizon year AM peak traffic volumes, the intersection was unable to function at an acceptable level, and the geometry created issues with multiple property acquisitions. Figure 2.24 shows the geometry, and Table 2.61 shows the delay and queues. It is considered that signals is not a viable upgrade alternative for this intersection.

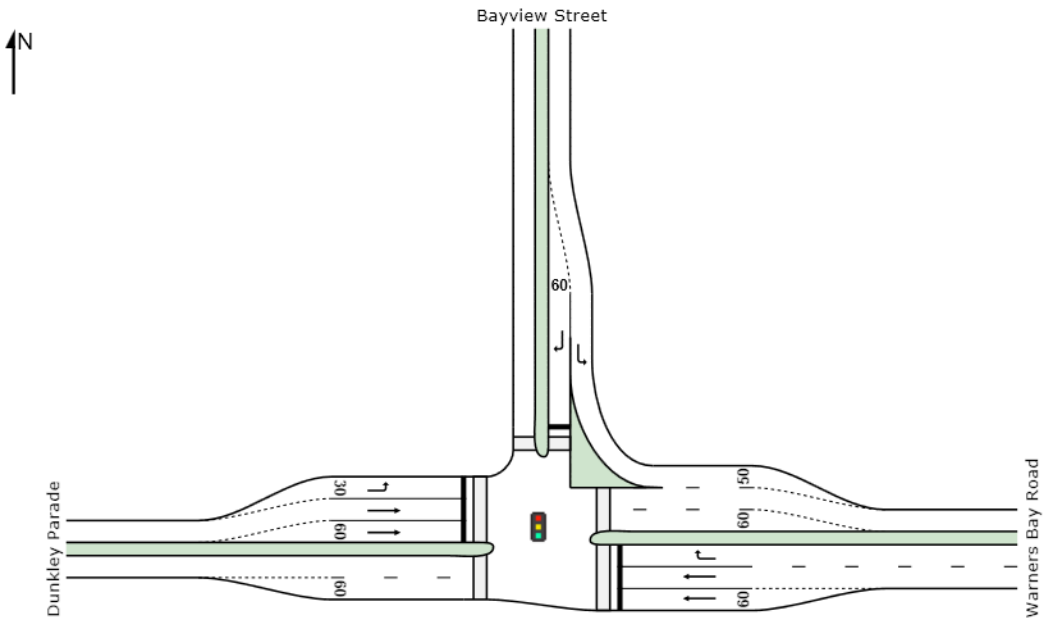


Figure 2.24: Warners Bay Road, Bayview Street, and Dunkley Parade signals

Table 2.61: Warners Bay Road, Bayview Street, and Dunkley Parade 2030 AM peak

Site: Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - right turn from Bayview AM 2030

Dunkley Parade, Bayview Street and Warners Bay Road intersection

Signals - Actuated Cycle Time = 111 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Warners Bay Road											
5	T1	488	1.5	0.414	22.0	LOS B	13.1	92.6	0.68	0.58	44.1
6	R2	326	1.5	0.986	74.4	LOS F	21.7	153.6	1.00	0.98	26.8
Approach		815	1.5	0.986	43.0	LOS D	21.7	153.6	0.81	0.74	35.0
North: Bayview Street											
7	L2	517	1.5	0.281	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
9	R2	84	1.5	0.221	46.7	LOS D	3.8	27.1	0.85	0.75	33.5
Approach		601	1.5	0.281	11.4	LOS A	3.8	27.1	0.12	0.56	50.4
West: Dunkley Parade											
10	L2	236	1.5	0.393	26.8	LOS B	8.0	56.5	0.65	0.75	40.9
11	T1	1063	1.5	1.070	96.0	LOS F	70.9	502.6	0.90	1.23	23.3
Approach		1299	1.5	1.070	83.4	LOS F	70.9	502.6	0.86	1.14	25.2
All Vehicles		2715	1.5	1.070	55.3	LOS D	70.9	502.6	0.68	0.89	31.4

2.12.6 Crash Statistics

The Roads and Maritime Services (RMS) have provided the crash statistics for this intersection. In the 5 year period 1 September 2009 to 1 September 2014, there were 7 reported crashes at this intersection, 6 of which were injury crashes. The crashes are summarised as follows:

- Two rear end crashes in Bayview Street for left turning vehicles into Warners Bay Road;
- Two right turning vehicle crashes from Bayview Street with eastbound Dunkley Parade motorists;

- Two right turning vehicle crashes from Warners Bay Road with eastbound Dunkley Parade motorists;
- One left turning vehicle crash from Bayview Street with eastbound Dunkley Parade motorist.

2.12.7 Recommendation

The intersection of Warners Bay Road, Bayview Street and Dunkley Parade be upgraded to a roundabout with a slip lane for the Bayview Street left turn movement.

Modelling indicates that the roundabout is operating will in the horizon year of 2030, however fails soon after in 2032 due to the increasing Dunkley Parade traffic volume towards the intersection.

The roundabout required to function for this plan can be considered as Stage 1. Stage 2 of the roundabout will be investigated for future plans if development projections are realised, with the Warners Bay Road south leg being opened at the intersection as the main road. Opening this leg will allow the traffic volume to be distributed among the four legs and allow greater queuing approaching the roundabout as the Warners Bay Road south road reserve is wide enough to allow additional storage.

2.13 Minmi Road, Edgeworth / Cameron Park

Minmi Road is classified as an arterial road in the Lake Macquarie City Council road hierarchy, connecting the Newcastle Link Road to Main Road (MR527). Figure 2.25 shows Minmi Road (red) related to the surrounding State road network (green).

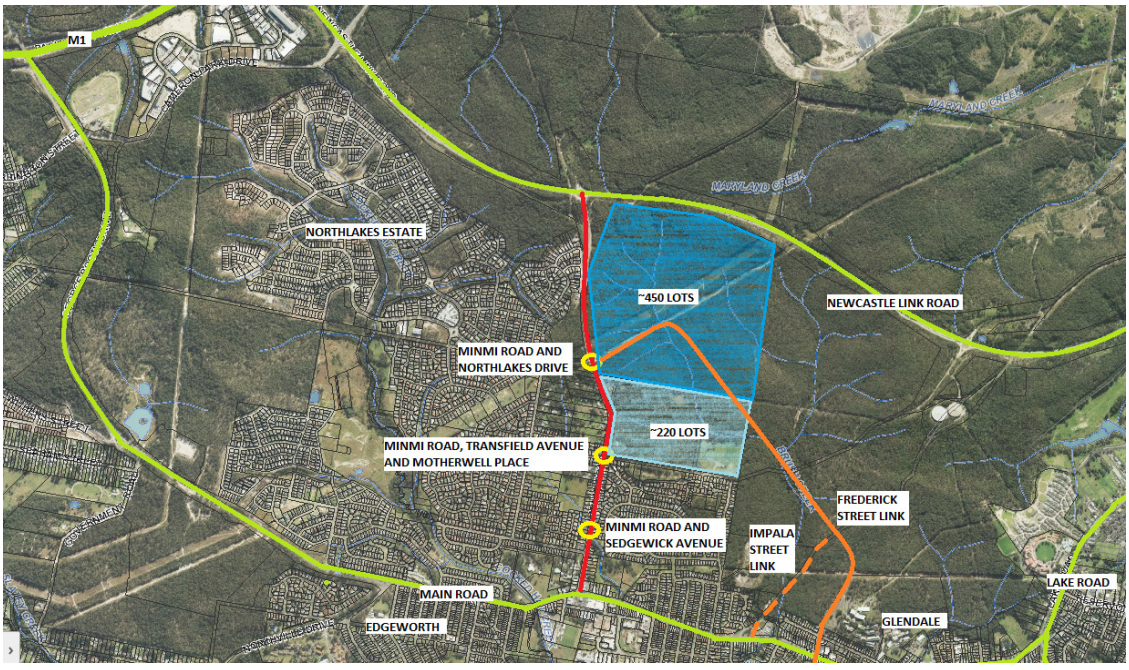


Figure 2.25: Minmi Road in Glendale central catchment

2.13.1 Projected and Historical Growth

Between 2001 and 2014, the traffic volume on Minmi Road has increased at an average rate of 4.8% per annum as development in the Cameron Park (Northlakes Estate) and further north has occurred. It is anticipated that the growth in the Glendale Central sub-catchment will increase by 37.3% between 2015 and 2030, which represents an average yearly increase of 2.274%. As Minmi Road is a regional road, Glendale Central sub-catchment growth will be applied.

The traffic volume recorded on Minmi Road north of Northlakes Drive in 2014 was 16,500 vehicle per day. Increasing the volume by the anticipated growth yields a horizon year traffic volume on Minmi Road north of Northlakes Drive of 22,200 vehicles per day. The Lower Hunter Traffic Model (source from RMS) estimates the growth in the region based on State Planning Targets. The 2031 estimate of traffic on Minmi Road is 22,400 vehicles per day, which shows that Councils model results are similar to the RMS model for this road.

Minmi Road will be separated into four sections, and the traffic volumes on each indexed to determine if and when widening is required.

Table 2.62: Minmi Road between Main Road and Oakville Road (Section 1)

		Current 2015		Estimated 2030		Year upgrade required (over 1,300 v/h/l/)
		Peak hour volume	LoS	Peak hour volume*	LoS	
AM	**North**	860	C	1,181	D	2037
	South	970	D	1,332	D	2030
PM	**North**	1111	D	1,525	E	2022
	South	1111	D	1,525	E	2022

*peak hour restrictions apply to kerbside lane

Minmi Road requires peak hour restrictions between Main Road and Oakville Road by 2022. Currently peak hour restrictions apply in the southbound direction, and the northbound direction has peak hour restrictions applying with the exception of the school bus zone, which coincides with the PM peak. The road is currently marked as four-lane two-way.

Table 2.63: Minmi Road between Oakville Road and Transfield Avenue (Section 2)

		Current 2015		Estimated 2030		Year upgrade required (over 1,300 v/h/l/)
		Peak hour volume	LoS	Peak hour volume	LoS	
AM	**North**	858	C	1,178	D	2038
	South	741	C	1,017	D	2048
PM	**North**	847	C	1,163	D	2039
	South	892	C	1,225	D	2035

Minmi Road between Oakville Road and Sedgwick Avenue is marked as four-lane two-way with peak hour restrictions applying, which were installed to assist the traffic movements at the Minmi Road and Oakville Road traffic signals. Between Sedgwick Avenue and Transfield Avenue, Minmi Road is marked as two-lane two-way, with no parking restrictions applying. Prior to 2030, this section of the road is not requiring any additional lanes.

Table 2.64: Minmi Road between Transfield Avenue and Northlakes Drive (Section 3)

		Current 2015		Estimated 2030		Year upgrade required (over 1,300 v/h/l/)
		Peak hour volume	LoS	Peak hour volume	LoS	
AM	**North**	974	C	1,337	D	2030
	South	843	C	1,157	D	2038
PM	**North**	851	C	1,168	D	2038
	South	1,013	D	1,391	D	2027

Minmi Road between Transfield Avenue and Northlakes Drive requires widening to two lanes in the south direction by 2027. The upgrade of Minmi Road between Transfield Avenue and Northlakes Drive to four-lane two-way should be undertaken at this time. This will require property acquisition along the eastern side of Minmi Road between Transfield and Northlakes Drive, which is currently undeveloped.

Table 2.65: Minmi Road between Northlakes Drive and Newcastle Link Road (Section 4)

		Current 2015		Estimated 2030		Year upgrade required (over 1,300 v/h/l/)
		Peak hour volume	LoS	Peak hour volume	LoS	
AM	**North**	1,079	D	1,481	E	2024
	South	714	C	980	D	2051
PM	**North**	708	C	972	D	2052
	South	1,114	D	1,530	E	2022

Minmi Road north of Northlakes Drive requires widening to four-lane two-way between 2022 and 2024. This will require property acquisition where the road reserve narrows.

2.13.2 Recommendation

Minmi Road will require widening as follows:

1. Minmi Road between Newcastle Link Road and Northlakes Drive requires widening to four-lane two-way in 2022.
2. Minmi Road between Oakville Road and Main Road will require peak hour clearway to be imposed on both sides prior to 2022. Currently the school bus zone impacts on Northbound traffic.
3. Minmi Road between Northlakes Drive and Transfield Avenue will require widening in 2027.

2.14 Minmi Road, Northlakes Drive and the new road intersection, Cameron Park

2.14.1 Background

The intersection of Minmi Road and Northlakes Drive, Cameron Park is within the current Northlakes Section 94 plan. Due to the residential estate proposed on the eastern side of Minmi Road, the intersection will be included within the Glendale Plan for construction of the new road component of the intersection.

Figure 2.26: Minmi Road and Northlakes Drive intersection (highlighted in yellow), Frederick Street (red) and Impala Street links (orange).

2.14.2 Projected Growth and Other Assumptions

- An average of 150 lots have been released from within the Northlakes Urban Release Area (NURA). There are approximately 1,000 lots remaining, which would result in the NURA reaching full residential development within 7 years.
- The growth rate into and out of the NURA (i.e. on Northlakes Drive) will be from the residential development projection only until full development, and then at a low rate of 0.5% p.a for the years following. The low growth rate is due to minimal attractors being developed within the NURA attracting outside traffic.

- Of the new development traffic within the NURA, it is assumed that 40% will use the Minmi Road access into the estate for the first 5 years, the other 60% will use the Cameron Park Drive access. The majority of the new development is close to the Cameron Park Drive access.
- After 5 years (for the last 2 years of residential development until full residential development), it is assumed that the Portland Drive connection to Northridge Drive will be complete, allowing traffic to travel out of the estate via George Booth Drive. It is assumed at this time that only 20% of new development traffic will use the Minmi Road access, given the two other access choices into the estate and the location of the new development relative to the Minmi Road access.
- The new development traffic into and out of Northlakes Drive will be distributed as follows:
    - AM peak - 80% of traffic out of the NURA, 20% into the NURA,
    - PM peak - 20% of traffic out of the NURA, 80% into the NURA,
    - The development traffic left and right turn movements into the NURA from Minmi Road will be distributed at 50% each movement,
    - The development traffic left and right turn movements out of the NURA from Northlakes Drive will be distributed at 50% each movement.
- The Glendale Central catchment is anticipated to grow 37.3% (2.487% p.a) between 2015 and 2030. This growth will be applied to the any regional roads within the catchment (Minmi Road is considered a regional road). This growth results in a 2030 estimated ADT on Minmi Road of 22,200vpd. The Lower Hunter Traffic Model estimates the traffic volume on Minmi Road at 22,400vpd in 2031, so it is considered that the LMCC model is in-line with the LHTM.
- The intersection will be modelled as a four-leg intersection. Access to the land to the east of Minmi Road is considered to be primarily via a fourth leg. This fourth leg may continue to Main Road via Impala Street or Frederick Street and create a collector or sub-arterial route if connected.
- It is considered that the intersection will be modelled:
    - For full development of the Minmi Road east estate (estimated +380 Peak Vehicle Trips). It is considered that the estate will be completed within 10 years of commencement. The split is estimated at:
    - AM Peak – 20% in, 80% out, of this 50% to and from north and 50% to and from south
    - PM Peak – 80% in, 20% out, of this 50% to and from north and 50% to and from south

- For the case where the road through this estate also connects to Main Road, it is estimated that 50% of traffic heading to and from the Glendale direction will be via the Frederick Street / Impala Street link Road
- Heavy vehicles will be at 1%. Minmi Road is a Light Traffic Thoroughfare with a 5 tonne load limit, however buses and smaller trucks use the roads.

2.14.3 Analysis – Existing Intersection

The existing intersection is a Seagull treatment type intersection. A seagull intersection allows two-stage movement from the minor road to the major road. Stage one is the right turn from Northlakes Drive opposing the northbound Minmi Road traffic, and stage two is the merge from the acceleration lane into southbound traffic.

This intersection will be modelled for two stage movement with the relevant opposed movements modelled included in each stage. The first stage (Table 2.66 AM, Table 2.68 PM) is the right turn from Northlakes Drive being opposed by the right turn from Minmi Road and the northbound Minmi Road traffic, and the second stage (Table 2.67 AM and Table 2.69 PM) is the acceleration lane merging with the southbound Minmi Road traffic.

Table 2.66: Minmi Road and Northlakes Drive Seagull intersection AM 2014 – opposed right turn from Northlakes Drive

Site: Minmi Road and Northlakes Drive AM 2014 right turn opposition

Existing Seagull intersection - right turn from Northlakes Drive opposed by right turn in from Minmi Road and northbound Minmi Road traffic
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	111	1.0	0.060	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
2	T1	882	1.0	0.455	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		993	1.0	0.455	0.7	NA	0.0	0.0	0.00	0.06	59.1
North: Minmi Road north											
9	R2	105	1.0	0.196	12.2	LOS A	0.8	5.3	0.74	0.90	48.6
Approach		105	1.0	0.196	12.2	NA	0.8	5.3	0.74	0.90	48.6
West: Northlakes Drive											
10	L2	157	1.0	0.376	18.1	LOS B	1.6	11.2	0.80	1.06	46.2
12	R2	241	1.0	0.945	52.3	LOS D	8.0	56.6	0.98	1.70	32.4
Approach		398	1.0	0.945	38.8	LOS C	8.0	56.6	0.91	1.45	36.7
All Vehicles		1496	1.0	0.945	11.6	NA	8.0	56.6	0.29	0.49	50.2

Note, the gap acceptance for the right turn movement from Northlakes Drive was altered to replicate the realistic queue and delay experienced at this intersection. The model defined gap acceptance resulted in a 40 car length queue, and the most counted on-site was 8 vehicles.

Table 2.67: Minmi Road and Northlakes Drive Seagull intersection AM 2014 – merge lane

Site: Minmi Road and Northlakes Drive AM 2014 merge lane

Existing Seagull intersection - merge lane from Northlakes Drive opposed by southbound Minmi Road traffic
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	111	1.0	0.060	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
2	T1	882	1.0	0.455	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		993	1.0	0.455	0.7	NA	0.0	0.0	0.00	0.06	59.1
NorthEast: seagull merge lane											
24a	L1	241	1.0	0.412	14.3	LOS A	2.0	14.4	0.64	1.15	48.6
Approach		241	1.0	0.412	14.3	LOS A	2.0	14.4	0.64	1.15	48.6
North: Minmi Road north											
8	T1	562	0.0	0.288	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	105	1.0	0.280	15.8	LOS B	1.1	7.6	0.80	0.95	46.1
Approach		667	0.2	0.288	2.5	NA	1.1	7.6	0.13	0.15	57.2
West: Northlakes Drive											
10	L2	157	1.0	0.513	23.7	LOS B	2.2	15.6	0.86	1.11	43.3
Approach		157	1.0	0.513	23.7	LOS B	2.2	15.6	0.86	1.11	43.3
All Vehicles		2058	0.7	0.513	4.6	NA	2.2	15.6	0.18	0.30	55.5

Table 2.68: Minmi Road and Northlakes Drive Seagull intersection PM 2014 – opposed right turn from Northlakes Drive

Site: Minmi Road and Northlakes Drive PM 2014 right turn opposition

Existing Seagull intersection - right turn from Northlakes Drive opposed by right turn in from Minmi Road and northbound Minmi Road traffic
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	188	1.0	0.102	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
2	T1	454	1.0	0.234	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		642	1.0	0.234	1.7	NA	0.0	0.0	0.00	0.17	57.9
North: Minmi Road north											
9	R2	246	1.0	0.264	8.8	LOS A	1.2	8.8	0.61	0.82	50.9
Approach		246	1.0	0.264	8.8	NA	1.2	8.8	0.61	0.82	50.9
West: Northlakes Drive											
10	L2	108	1.0	0.125	10.5	LOS A	0.5	3.4	0.50	0.93	50.7
12	R2	145	1.0	0.501	22.0	LOS B	2.0	14.2	0.79	1.10	44.0
Approach		254	1.0	0.501	17.1	LOS B	2.0	14.2	0.66	1.03	46.7
All Vehicles		1142	1.0	0.501	6.6	NA	2.0	14.2	0.28	0.50	53.5

Table 2.69: Minmi Road and Northlakes Drive Seagull intersection PM 2014 – merge lane performance

Site: Minmi Road and Northlakes Drive PM 2014 merge lane

Existing Seagull intersection - merge lane from Northlakes Drive opposed by southbound Minmi Road traffic
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	188	1.0	0.102	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
2	T1	454	1.0	0.234	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		642	1.0	0.234	1.7	NA	0.0	0.0	0.00	0.17	57.9
NorthEast: seagull merge lane											
24a	L1	145	1.0	0.516	25.2	LOS B	2.2	15.2	0.87	1.13	42.7
Approach		145	1.0	0.516	25.2	LOS B	2.2	15.2	0.87	1.13	42.7
North: Minmi Road north											
8	T1	920	0.0	0.472	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	246	1.0	0.352	10.5	LOS A	1.8	12.4	0.63	0.91	49.5
Approach		1166	0.2	0.472	2.3	NA	1.8	12.4	0.13	0.19	57.3
West: Northlakes Drive											
10	L2	108	1.0	0.157	11.2	LOS A	0.6	4.0	0.51	0.97	50.2
Approach		108	1.0	0.157	11.2	LOS A	0.6	4.0	0.51	0.97	50.2
All Vehicles		2062	0.6	0.516	4.2	NA	2.2	15.2	0.16	0.29	55.7

The AM peak is critical. The critical movements perform adequately with the seagull in place, the right turn from Northlakes Drive and the merge lane both at LoS B. It is noted however that there is a crash trend occurring at this intersection for the right turn from Northlakes Drive into the seagull.

The installation of a fourth leg on the intersections, to allow all movements, will require the intersection to be upgraded to signals or a roundabout. As a roundabout is committed at this intersection. the analysis will be undertaken for a roundabout upgrade.

2.14.4 Roundabout

The roundabout (Figure 2.27) is proposed to be installed in the short term, commencement mid-2015, operational by mid-2016 (Table 2.70). It is considered for modelling purposes that the Minmi Road east estate will be fully operational by 2030 (Table 2.71), which is the horizon year of the study.

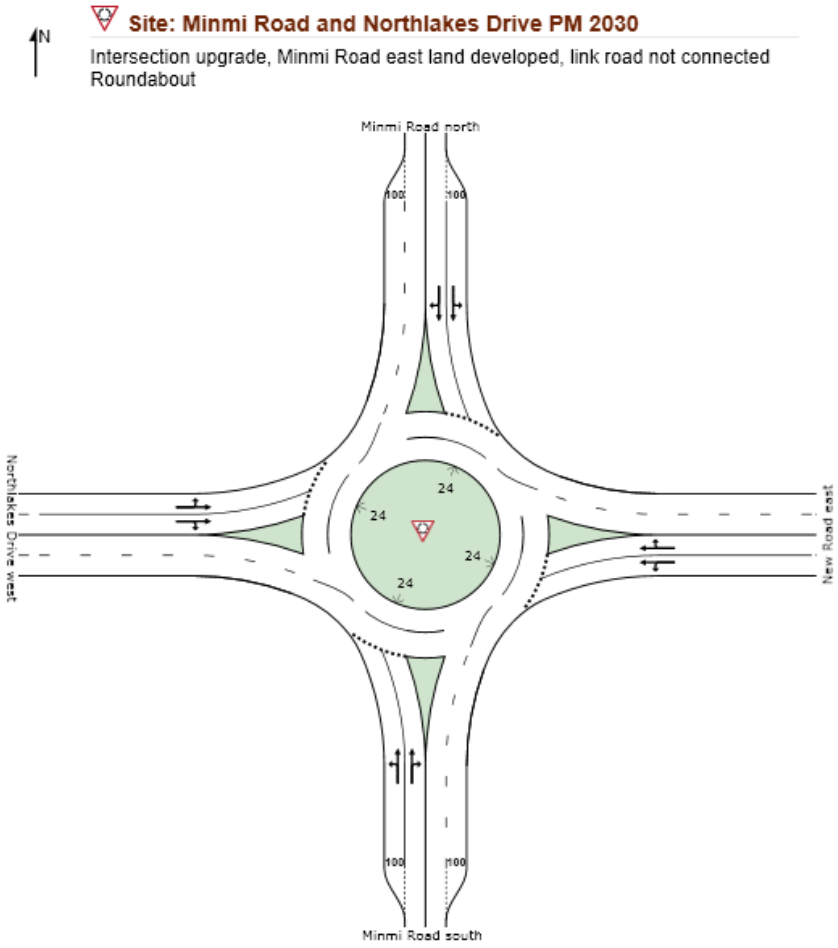


Figure 2.27: Minmi Road, Northlakes Drive and fourth leg – roundabout

Table 2.70: Minmi Road and Northlakes Drive roundabout upgrade – AM 2016 – fourth leg installed not operational

Site: Minmi Road and Northlakes Drive AM 2016

Intersection upgrade, Minmi Road east land undeveloped, fourth leg constructed
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	121	1.0	0.317	4.5	LOS A	1.8	12.6	0.32	0.46	54.4
2	T1	922	1.0	0.466	4.5	LOS A	3.2	22.9	0.34	0.44	55.9
3	R2	1	1.0	0.466	9.5	LOS A	3.2	22.9	0.35	0.44	55.9
Approach		1044	1.0	0.466	4.5	LOS A	3.2	22.9	0.34	0.44	55.7
East: New Road east											
4	L2	1	1.0	0.002	6.4	LOS A	0.0	0.1	0.61	0.53	53.3
5	T1	1	1.0	0.002	6.6	LOS A	0.0	0.1	0.61	0.56	53.9
6	R2	1	1.0	0.002	12.0	LOS A	0.0	0.1	0.61	0.62	52.3
Approach		3	1.0	0.002	8.3	LOS A	0.0	0.1	0.61	0.57	53.2
North: Minmi Road north											
7	L2	1	1.0	0.257	5.4	LOS A	1.4	9.7	0.48	0.52	53.5
8	T1	588	1.0	0.378	5.2	LOS A	2.4	16.7	0.50	0.55	54.7
9	R2	116	1.0	0.378	10.2	LOS A	2.4	16.7	0.51	0.56	54.4
Approach		705	1.0	0.378	6.1	LOS A	2.4	16.7	0.50	0.55	54.6
West: Northlakes Drive west											
10	L2	200	1.0	0.273	7.5	LOS A	1.3	8.9	0.66	0.82	52.9
11	T1	1	1.0	0.273	7.5	LOS A	1.3	8.9	0.66	0.82	54.5
12	R2	284	1.0	0.312	11.9	LOS A	1.6	11.1	0.66	0.87	51.5
Approach		485	1.0	0.312	10.1	LOS A	1.6	11.1	0.66	0.85	52.1
All Vehicles		2238	1.0	0.466	6.2	LOS A	3.2	22.9	0.46	0.57	54.5

Table 2.71: Minmi Road and Northlakes Drive roundabout upgrade – AM 2030 – fourth leg operational but not connected as link road

Site: Minmi Road and Northlakes Drive AM 2030

Intersection upgrade, Minmi Road east land developed, link road not connected
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	148	1.0	0.502	5.9	LOS A	3.1	22.2	0.58	0.61	53.2
2	T1	1216	1.0	0.737	6.9	LOS A	8.2	57.6	0.69	0.70	54.0
3	R2	40	1.0	0.737	12.3	LOS A	8.2	57.6	0.74	0.74	53.8
Approach		1404	1.0	0.737	6.9	LOS A	8.2	57.6	0.68	0.70	53.9
East: New Road east											
4	L2	160	1.0	0.256	8.6	LOS A	1.5	10.3	0.81	0.89	52.1
5	T1	11	1.0	0.256	8.6	LOS A	1.5	10.3	0.81	0.89	53.6
6	R2	160	1.0	0.303	14.8	LOS B	1.6	11.2	0.81	0.93	49.6
Approach		331	1.0	0.303	11.6	LOS A	1.6	11.2	0.81	0.91	50.9
North: Minmi Road north											
7	L2	40	1.0	0.401	6.4	LOS A	2.5	17.5	0.66	0.64	52.8
8	T1	776	1.0	0.589	6.7	LOS A	5.2	36.4	0.72	0.70	53.6
9	R2	143	1.0	0.589	12.0	LOS A	5.2	36.4	0.76	0.74	53.3
Approach		959	1.0	0.589	7.5	LOS A	5.2	36.4	0.72	0.71	53.5
West: Northlakes Drive west											
10	L2	295	1.0	0.654	17.5	LOS B	4.9	34.7	0.92	1.10	46.3
11	T1	11	1.0	0.654	15.9	LOS B	5.6	39.6	0.94	1.12	46.7
12	R2	382	1.0	0.654	20.2	LOS B	5.6	39.6	0.95	1.13	46.4
Approach		687	1.0	0.654	19.0	LOS B	5.6	39.6	0.94	1.12	46.4
All Vehicles		3381	1.0	0.737	10.0	LOS A	8.2	57.6	0.76	0.81	51.8

The intersection continues to operate well by 2030. For the case where the fourth leg is connected to Impala Street or Frederick Street in the future (referred to as *new link road*), the traffic volumes will have to be estimated.

It is considered if this new link road were created, that through traffic between the Newcastle Link Road and the Glendale area will use this road, easing the traffic on Minmi Road south of Northlakes Drive. It is estimated that 50% of traffic on Minmi Road will use the New Link Road. Additionally a percentage of new properties that connect along this route would be using the Minmi Road and Northlakes Drive roundabout each day. The traffic volumes for 2030 were redistributed, with 50% of the Minmi Road south traffic now using the link road, and the traffic using the link road was increased by 10% to account for additional development traffic along the road route. It is considered that if the link road were provided by 2030, that full development along the route would not have occurred. Additionally, 50% of the Minmi Road east estate (left turning traffic) would enter and leave the area via the new link road. These redistributed traffic volumes are shown in Table 2.72 (AM) and Table 2.73 (PM).

Table 2.72: Minmi Road and Northlakes Drive roundabout upgrade – AM 2030 – link road connected

Site: Minmi Road and Northlakes Drive AM 2030 - link road connected

Intersection upgrade, Minmi Road east land developed, link road connected
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	74	1.0	0.515	13.0	LOS A	3.6	25.3	0.90	1.01	49.2
2	T1	607	1.0	0.758	16.2	LOS B	8.4	59.6	0.97	1.16	48.3
3	R2	44	1.0	0.758	22.5	LOS B	8.4	59.6	1.00	1.22	47.6
Approach		725	1.0	0.758	16.2	LOS B	8.4	59.6	0.97	1.15	48.4
East: New Road east											
4	L2	80	1.0	0.336	9.9	LOS A	1.8	12.8	0.75	0.86	51.3
5	T1	95	1.0	0.336	9.8	LOS A	1.8	12.8	0.75	0.86	52.8
6	R2	845	1.0	0.991	54.2	LOS D	36.8	259.9	1.00	2.10	32.9
Approach		1020	1.0	0.991	46.6	LOS D	36.8	259.9	0.96	1.89	35.0
North: Minmi Road north											
7	L2	472	1.0	0.491	6.2	LOS A	3.2	22.9	0.66	0.75	53.4
8	T1	387	1.0	0.496	5.8	LOS A	3.3	23.6	0.66	0.65	53.7
9	R2	143	1.0	0.496	10.9	LOS A	3.3	23.6	0.66	0.65	53.8
Approach		1002	1.0	0.496	6.7	LOS A	3.3	23.6	0.66	0.69	53.6
West: Northlakes Drive west											
10	L2	295	1.0	0.823	36.7	LOS C	10.9	77.1	1.00	1.42	37.3
11	T1	202	1.0	0.823	38.9	LOS C	10.9	77.1	1.00	1.40	36.9
12	R2	191	1.0	0.823	45.9	LOS D	9.1	64.0	1.00	1.38	35.9
Approach		687	1.0	0.823	39.9	LOS C	10.9	77.1	1.00	1.40	36.8
All Vehicles		3435	1.0	0.991	27.2	LOS B	36.8	259.9	0.88	1.29	42.1

The queue and delay for the right turn from the New Link Road into Minmi Road has increased due to the high right turn. If these queues were to occur then it is considered some of this traffic may redistribute back on to the existing Main Road / Minmi Road route if it were beneficial.

Table 2.73: Minmi Road and Northlakes Drive roundabout upgrade – PM 2030 – link road connected

Site: Minmi Road and Northlakes Drive PM 2030 - link road connected

Intersection upgrade, Minmi Road east land developed, link road connected
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	147	1.0	0.300	8.3	LOS A	1.6	10.9	0.74	0.85	52.4
2	T1	300	1.0	0.442	8.1	LOS A	2.9	20.4	0.79	0.86	52.9
3	R2	88	1.0	0.442	13.2	LOS A	2.9	20.4	0.80	0.86	52.9
Approach		536	1.0	0.442	9.0	LOS A	2.9	20.4	0.78	0.86	52.8
East: New Road east											
4	L2	53	1.0	0.594	23.1	LOS B	5.2	37.0	1.00	1.14	43.4
5	T1	162	1.0	0.594	23.1	LOS B	5.2	37.0	1.00	1.14	44.5
6	R2	375	1.0	0.801	40.8	LOS C	11.7	82.5	1.00	1.37	37.1
Approach		589	1.0	0.801	34.4	LOS C	11.7	82.5	1.00	1.29	39.4
North: Minmi Road north											
7	L2	855	1.0	0.763	7.9	LOS A	8.9	62.5	0.77	0.79	52.7
8	T1	617	1.0	0.807	7.9	LOS A	10.7	75.6	0.80	0.80	52.4
9	R2	405	1.0	0.807	12.9	LOS A	10.7	75.6	0.80	0.80	52.5
Approach		1877	1.0	0.807	9.0	LOS A	10.7	75.6	0.78	0.80	52.5
West: Northlakes Drive west											
10	L2	152	1.0	0.214	6.8	LOS A	1.2	8.4	0.67	0.73	53.2
11	T1	105	1.0	0.214	7.1	LOS A	1.2	8.4	0.67	0.77	53.2
12	R2	95	1.0	0.214	12.4	LOS A	1.1	8.0	0.67	0.80	52.4
Approach		352	1.0	0.214	8.4	LOS A	1.2	8.4	0.67	0.76	53.0
All Vehicles		3354	1.0	0.807	13.4	LOS A	11.7	82.5	0.81	0.89	49.7

In the PM peak, the queue and delay on the New Link Road has decreased and is adequate. It is considered that the roundabout operates well for 2030 traffic volumes at full development of Northlakes and Minmi East estate.

2.14.5 Crash Statistics

The Roads and Maritime Services have provided the crash statistics for this intersection. In the 5 year period 1 September 2009 to 1 September 2014, there were 19 reported crashes at this intersection, 6 of which were injury crashes. The crashes are summarised as follows:

- Seventeen crashes were vehicles turning right from Northlakes Drive colliding with northbound Minmi Road motorists
- Two crashes were vehicles turning right from Northlakes Drive colliding with southbound Minmi Road motorists who were turning right into Northlakes Drive.

2.14.6 Recommendation

A roundabout be installed in the short term at the intersection of Minmi Road, Northlakes Drive and the proposed road.

2.15 Minmi Road, Transfield Avenue and Motherwell Place, Edgeworth

2.15.1 Background

Minmi Road and Transfield Avenue have intersection as a T intersection since the 1950's. In the early 2000's, Transfield Avenue was added as a fourth leg following the development of a small residential catchment. The alignment of Motherwell Place resulted due to the retention of the existing residential dwelling on the north-western corner.

Figure 2.28: Minmi Road, Transfield Avenue and Motherwell Place intersection

2.15.2 Projected Growth

Between 2015 and 2030, the traffic volume on Minmi Road is expected to increase by the Glendale Central sub-catchment average of 37.3%. The traffic volume on Motherwell Place and Transfield Avenue is expected to increase by the surrounding residential development.

2.15.3 Analysis

The existing intersection was modelled to determine the current LoS in the AM (Table 2.74) and PM (Table 2.75) peaks.

Table 2.74: Minmi Road, Transfield Avenue and Motherwell Place 2015 AM

Site: Minmi Road, Transfield Avenue and Motherwell Place AM 2015

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	9	0.0	0.478	20.7	LOS B	9.8	70.0	1.00	0.01	41.6
2	T1	888	2.7	0.478	12.5	LOS A	9.8	70.0	1.00	0.01	41.6
3	R2	5	0.0	0.478	21.0	LOS B	9.8	70.0	1.00	0.01	41.6
Approach		903	2.7	0.478	12.6	NA	9.8	70.0	1.00	0.01	41.6
East: Transfield Avenue											
4	L2	6	16.7	0.348	53.6	LOS D	1.0	7.3	0.94	1.01	24.1
5	T1	1	0.0	0.348	52.4	LOS D	1.0	7.3	0.94	1.01	24.1
6	R2	24	0.0	0.348	53.9	LOS D	1.0	7.3	0.94	1.01	24.1
Approach		32	3.3	0.348	53.8	LOS D	1.0	7.3	0.94	1.01	24.1
North: Minmi Road north											
7	L2	115	0.0	0.466	21.1	LOS B	9.6	68.6	1.00	0.01	40.8
8	T1	763	2.2	0.466	12.9	LOS A	9.6	68.6	1.00	0.01	40.8
9	R2	4	0.0	0.466	21.4	LOS B	9.6	68.6	1.00	0.01	40.8
Approach		882	1.9	0.466	14.0	NA	9.6	68.6	1.00	0.01	40.8
West: Motherwell Place											
10	L2	8	0.0	0.215	38.9	LOS C	0.6	4.3	0.92	0.98	29.0
11	T1	6	0.0	0.215	37.7	LOS C	0.6	4.3	0.92	0.98	29.0
12	R2	11	0.0	0.215	39.2	LOS C	0.6	4.3	0.92	0.98	29.0
Approach		25	0.0	0.215	38.7	LOS C	0.6	4.3	0.92	0.98	29.0
All Vehicles		1842	2.3	0.478	14.4	NA	9.8	70.0	1.00	0.04	40.4

Table 2.75: Minmi Road, Transfield Avenue and Motherwell Place 2015 PM

Site: Minmi Road, Transfield Avenue and Motherwell Place PM 2015

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	12	0.0	0.473	21.0	LOS B	10.5	73.7	1.00	0.01	46.7
2	T1	872	0.6	0.473	15.4	LOS B	10.5	73.7	1.00	0.01	47.8
3	R2	8	0.0	0.473	20.9	LOS B	10.5	73.7	1.00	0.01	46.3
Approach		892	0.6	0.473	15.5	NA	10.5	73.7	1.00	0.01	47.7
East: Transfield Avenue											
4	L2	9	11.1	0.408	62.2	LOS E	1.2	8.5	0.95	1.02	29.2
5	T1	2	0.0	0.408	60.7	LOS E	1.2	8.5	0.95	1.02	29.3
6	R2	20	0.0	0.408	62.0	LOS E	1.2	8.5	0.95	1.02	29.1
Approach		32	3.3	0.408	61.9	LOS E	1.2	8.5	0.95	1.02	29.2
North: Minmi Road north											
7	L2	59	0.0	0.525	18.9	LOS B	11.0	78.1	1.00	0.01	47.8
8	T1	925	1.6	0.525	13.3	LOS A	11.0	78.1	1.00	0.01	48.9
9	R2	8	0.0	0.525	18.8	LOS B	11.0	78.1	1.00	0.01	47.4
Approach		993	1.5	0.525	13.7	NA	11.0	78.1	1.00	0.01	48.9
West: Motherwell Place											
10	L2	4	0.0	0.163	45.5	LOS D	0.4	3.0	0.93	0.98	33.8
11	T1	1	0.0	0.163	44.1	LOS D	0.4	3.0	0.93	0.98	33.9
12	R2	8	0.0	0.163	45.4	LOS D	0.4	3.0	0.93	0.98	33.6
Approach		14	0.0	0.163	45.3	LOS D	0.4	3.0	0.93	0.98	33.7
All Vehicles		1929	1.1	0.525	15.6	NA	11.0	78.1	1.00	0.03	47.7

Transfield Avenue operates at LoS E in the PM peak, the delays are lengthy but the queues are not, which is a result of the high traffic volumes on Minmi Road and the low right turning traffic volume on Transfield Avenue. It is considered that if the intersection of Minmi Road, Transfield Avenue and Motherwell Place were to be upgraded, that the right turn from Sedgwick Avenue into Minmi Road would be restricted. This right turning traffic from Sedgwick Avenue is considered to be relocated to Transfield Avenue for the purposes of this analysis.

The intersection was investigated for upgrade to signals and a roundabout for the horizon year of 2030.

2.15.4 Signals

The intersection was modelled for signalisation. The installation of signals would require significant road widening along both the north and southbound directions of Minmi Road, including lands already developed.

However, modelling indicates that the intersection modelled with the 2030 projected traffic volume fails on all approaches with the road widening, indicating that signals is not the appropriate treatment.

2.15.5 Roundabout

The intersection was modelled with a roundabout upgrade (Figure 2.29, Table 2.76). Installing a roundabout at this intersection will require land acquisition on all four sides, with the most significant being on the north-western corner in order to align Motherwell Place more appropriately with the roundabout.

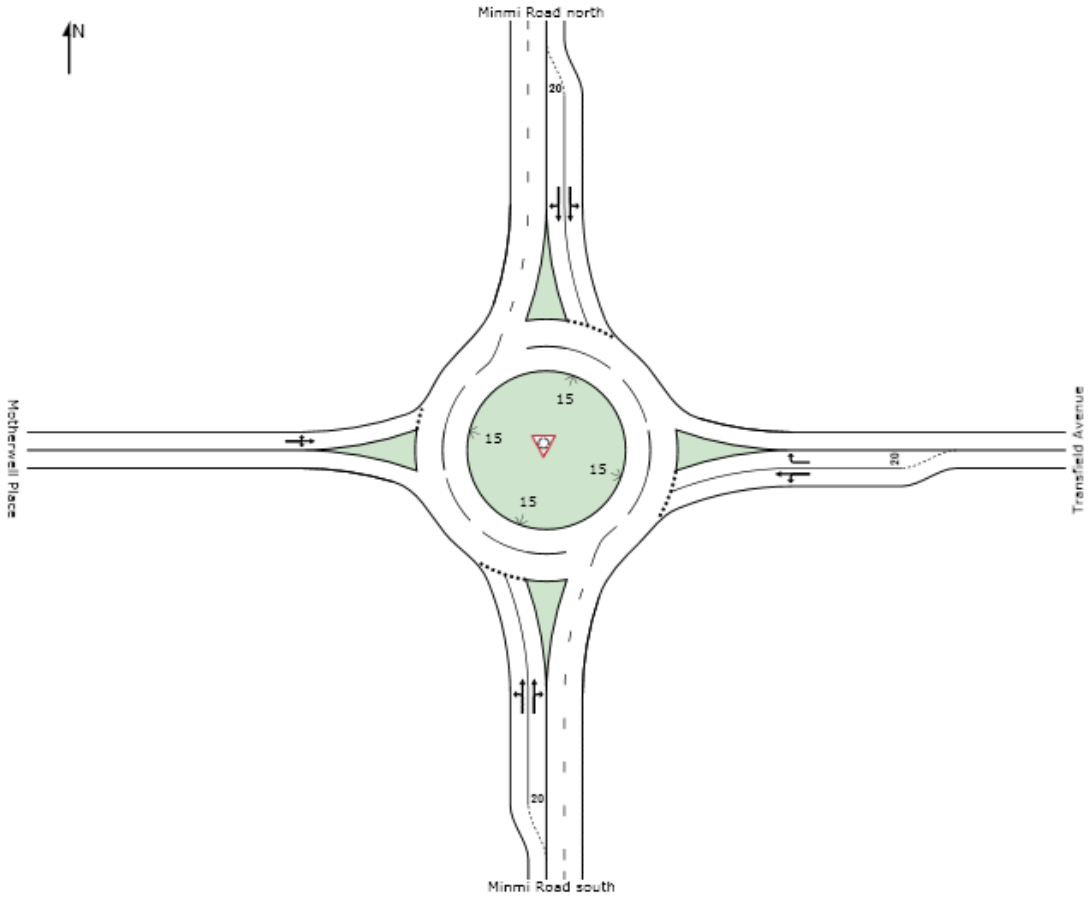


Figure 2.29: Minmi Road, Motherwell Place and Transfield Avenue roundabout

Table 2.76: Minmi Road, Motherwell Place and Transfield Avenue - PM 2030

Site: Minmi Road, Transfield Avenue and Motherwell Place PM 2030

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	32	0.0	0.486	5.1	LOS A	3.7	26.3	0.39	0.48	53.2
2	T1	1167	0.5	0.486	5.2	LOS A	3.7	26.3	0.40	0.50	54.3
3	R2	87	0.0	0.486	9.3	LOS A	3.7	26.1	0.41	0.52	53.9
Approach		1286	0.4	0.486	5.5	LOS A	3.7	26.3	0.40	0.50	54.3
East: Transfield Avenue											
4	L2	17	6.3	0.077	9.8	LOS A	0.3	2.5	0.72	0.84	50.7
5	T1	22	0.0	0.077	9.8	LOS A	0.3	2.5	0.72	0.84	52.1
6	R2	43	0.0	0.067	12.6	LOS A	0.3	2.2	0.72	0.85	50.1
Approach		82	1.3	0.077	11.3	LOS A	0.3	2.5	0.72	0.84	50.7
North: Minmi Road north											
7	L2	153	0.0	0.547	5.3	LOS A	4.6	32.5	0.44	0.50	53.1
8	T1	1237	1.2	0.547	5.4	LOS A	4.6	32.5	0.45	0.51	54.2
9	R2	48	0.0	0.547	9.5	LOS A	4.6	32.3	0.45	0.51	53.9
Approach		1438	1.0	0.547	5.5	LOS A	4.6	32.5	0.45	0.51	54.1
West: Motherwell Place											
10	L2	15	0.0	0.095	9.4	LOS A	0.4	2.9	0.71	0.89	49.5
11	T1	5	0.0	0.095	9.8	LOS A	0.4	2.9	0.71	0.89	50.6
12	R2	28	0.0	0.095	13.8	LOS A	0.4	2.9	0.71	0.89	50.4
Approach		48	0.0	0.095	12.1	LOS A	0.4	2.9	0.71	0.89	50.1
All Vehicles		2855	0.7	0.547	5.8	LOS A	4.6	32.5	0.44	0.52	54.0

The Minmi Road south leg has been modelled with two lanes in the southbound direction, which can fit within the current road boundaries. The northbound approach is one lane, with a short second lane at the intersection, which will require widening.

The Minmi Road north leg has been modelled similarly with two lanes in the northbound direction. It is considered that the road reserve on Minmi Road between Transfield Avenue and Northlakes Drive will be acquired provided at sufficient width for future widening to a four-lane two-way road.

The intersection was modelled for 20% sensitivity to determine the propensity for failure, which showed the intersection continuing to operate well in the AM and PM. The AM peak is critical under this case (Table 2.77), with a slightly reduced LoS on Motherwell Place. Ultimately however, the intersection continues to perform well.

Table 2.77: Minmi Road, Motherwell Place and Transfield Avenue – 2030 AM + 20% sensitivity

Site: Minmi Road, Transfield Avenue and Motherwell Place AM 2030

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
1	L2	29	0.0	0.537	5.9	LOS A	4.4	30.6	0.59	0.59	52.3
2	T1	1197	0.4	0.537	6.0	LOS A	4.4	30.6	0.60	0.60	53.6
3	R2	13	0.0	0.537	10.2	LOS A	4.3	30.1	0.61	0.61	53.3
Approach		1239	0.4	0.537	6.1	LOS A	4.4	30.6	0.60	0.60	53.5
East: Transfield Avenue											
4	L2	38	2.8	0.109	11.6	LOS A	0.4	3.1	0.70	0.85	49.5
5	T1	5	0.0	0.109	11.7	LOS A	0.4	3.1	0.70	0.85	50.7
6	R2	203	0.0	0.274	12.4	LOS A	1.3	9.4	0.71	0.90	50.2
Approach		246	0.4	0.274	12.3	LOS A	1.3	9.4	0.71	0.89	50.1
North: Minmi Road north											
7	L2	138	0.0	0.434	4.8	LOS A	3.6	25.1	0.33	0.46	53.5
8	T1	1039	1.4	0.434	5.0	LOS A	3.6	25.1	0.33	0.46	54.7
9	R2	15	0.0	0.434	9.0	LOS A	3.5	24.8	0.34	0.46	54.5
Approach		1192	1.2	0.434	5.0	LOS A	3.6	25.1	0.33	0.46	54.6
West: Motherwell Place											
10	L2	48	0.0	0.253	10.8	LOS A	1.2	8.4	0.79	0.91	49.5
11	T1	32	0.0	0.253	11.1	LOS A	1.2	8.4	0.79	0.91	50.5
12	R2	31	0.0	0.253	15.2	LOS B	1.2	8.4	0.79	0.91	50.3
Approach		111	0.0	0.253	12.1	LOS A	1.2	8.4	0.79	0.91	50.0
All Vehicles		2787	0.8	0.537	6.4	LOS A	4.4	30.6	0.50	0.57	53.5

2.15.6 Crash Statistics

There were two reported crashes at the intersection of Minmi Road, Transfield Avenue and Motherwell Place between 1 July 2009 and 30 June 2014. One crash was a vehicle turning right from Transfield Avenue colliding with a southbound Minmi Road motorist. The second crash was a northbound Minmi Road motorist colliding rear end with a northbound motorist, who stopped to turn right into Transfield Avenue.

2.15.7 Recommendation

It is recommended that the intersection of Minmi Road, Transfield Avenue and Motherwell Place be upgraded to a roundabout, in conjunction with banning the right turn from Sedgwick Avenue at Minmi Road.

2.16 Minmi Road and Sedgwick Avenue, Edgeworth

Sedgwick Avenue connects at Minmi Road as a T-intersection (Figure 2.30), and is located approximately 115 metres north of the signalised Oakville Road intersection and 400 metres south of Transfield Avenue.

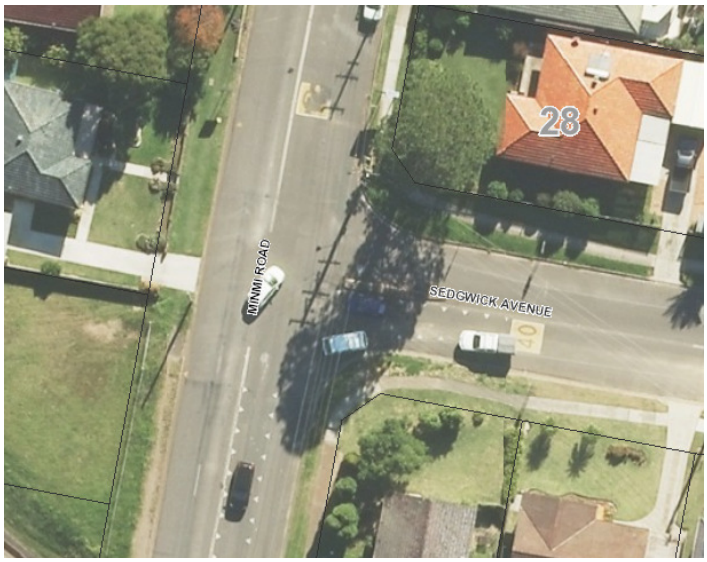


Figure 2.30: Minmi Road and Sedgwick Avenue intersection

2.16.1 Analysis

The existing intersection was analysed, which determined the AM peak being the critical peak, with a LoS F. The results are shown in Table 2.78.

Table 2.78: Minmi Road and Sedgwick Avenue 2015 AM

Site: Minmi Road at Sedgewick Avenue AM 2015

Existing layout
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
2	T1	865	0.0	0.452	9.7	LOS A	7.8	54.9	0.79	0.05	51.6
3	R2	44	0.0	0.452	17.8	LOS B	7.8	54.9	1.00	0.07	48.6
Approach		909	0.0	0.452	10.1	NA	7.8	54.9	0.80	0.05	51.4
East: Sedgewick Avenue											
4	L2	38	0.0	0.048	10.1	LOS A	0.2	1.2	0.43	0.89	50.9
6	R2	85	0.0	0.928	138.4	LOS F	5.2	36.6	0.99	1.35	18.3
Approach		123	0.0	0.928	98.9	LOS F	5.2	36.6	0.82	1.21	22.8
North: Minmi Road north											
7	L2	151	0.0	0.270	5.6	LOS A	0.0	0.0	0.00	0.17	56.9
8	T1	897	0.0	0.270	0.0	LOS A	0.0	0.0	0.00	0.07	59.3
Approach		1047	0.0	0.270	0.8	NA	0.0	0.0	0.00	0.09	58.9
All Vehicles		2080	0.0	0.928	10.7	NA	7.8	54.9	0.40	0.14	50.9

The delay on Sedgwick Avenue is lengthy however the queue is not. The Minmi Road, Motherwell Place and Transfield Avenue intersection, previously recommended for upgrade to a roundabout, allows the same catchment access onto Minmi Road and therefore the right turning traffic from Sedgwick Avenue can utilise this intersection for improved safety. At the time of construction of the roundabout at Minmi Road, Transfield Avenue and Motherwell Place, the right turn from Sedgwick Avenue can be banned.

The intersection has been modelled for the 2030 AM peak (Table 2.79) with the right turn ban, which shows the intersection operating overall well, with the right turn into Sedgwick from Minmi Road operating satisfactorily at a LoS B with minimal queues and delay.

Table 2.79: 2030 AM with right turn ban from Sedgwick Avenue into Minmi Road

Site: Minmi Road at Sedgewick Avenue AM 2030 - right turn ban

right turn from Sedgwick Avenue banned
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Minmi Road south											
2	T1	1161	0.0	0.595	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
3	R2	44	0.0	0.156	15.9	LOS B	0.4	2.9	0.79	0.92	46.3
Approach		1205	0.0	0.595	0.7	NA	0.4	2.9	0.03	0.03	59.1
East: Sedgewick Avenue											
4	L2	38	0.0	0.060	11.5	LOS A	0.2	1.4	0.51	0.94	50.1
Approach		38	0.0	0.060	11.5	LOS A	0.2	1.4	0.51	0.94	50.1
North: Minmi Road north											
7	L2	151	0.0	0.349	5.6	LOS A	0.0	0.0	0.00	0.13	57.2
8	T1	1203	0.0	0.349	0.0	LOS A	0.0	0.0	0.00	0.06	59.4
Approach		1354	0.0	0.349	0.7	NA	0.0	0.0	0.00	0.07	59.1
All Vehicles		2597	0.0	0.595	0.8	NA	0.4	2.9	0.02	0.06	59.0

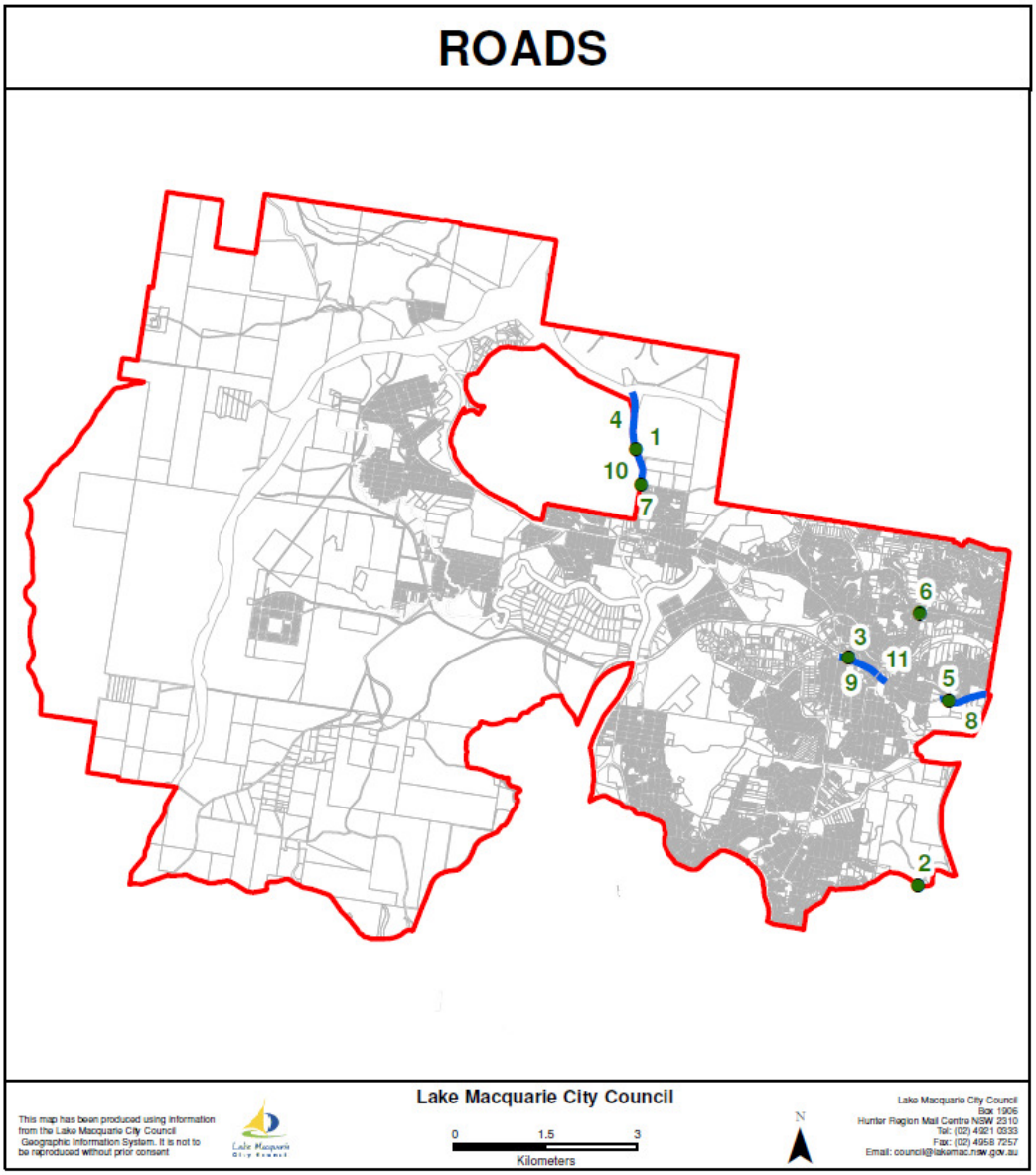
2.16.2 Crash Statistics

There were two reported crashes at the intersection of Minmi Road and Sedgwick Avenue between 1 July 2009 and 30 June 2014. One crash was a vehicle turning right from Sedgwick Avenue colliding with a northbound Minmi Road motorist. The second crash was a southbound Minmi Road motorists turning left into Sedgwick Avenue losing control and colliding with a stationary vehicle in Sedgwick Avenue.

2.16.3 Recommendation

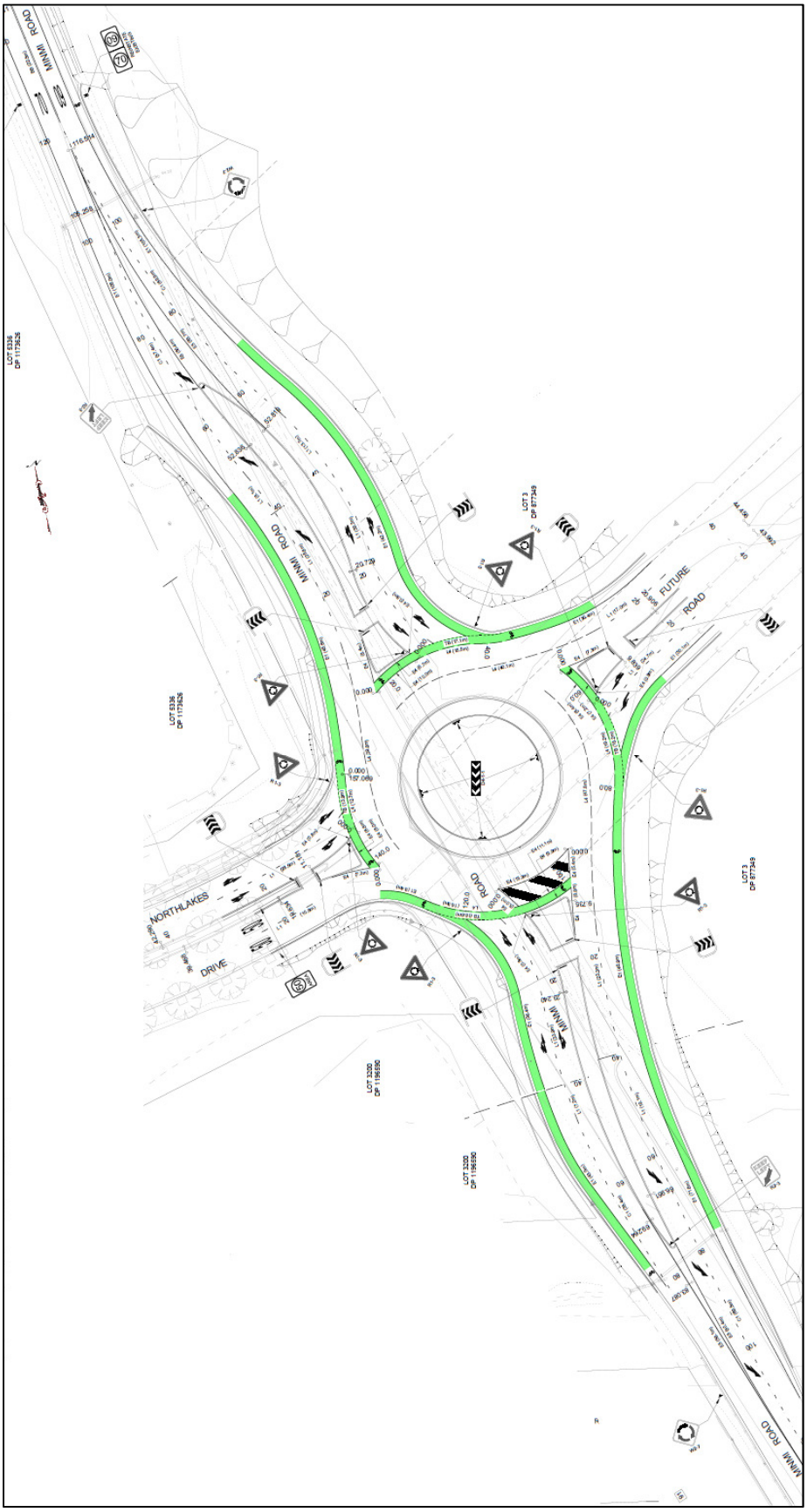
It is recommended that the right turn from Sedgwick Avenue into Minmi Road be banned at the time that the roundabout upgrade occurs to the intersection of Minmi Road, Motherwell Place and Transfield Avenue.

3 Proposed Upgrades and Cost Estimates



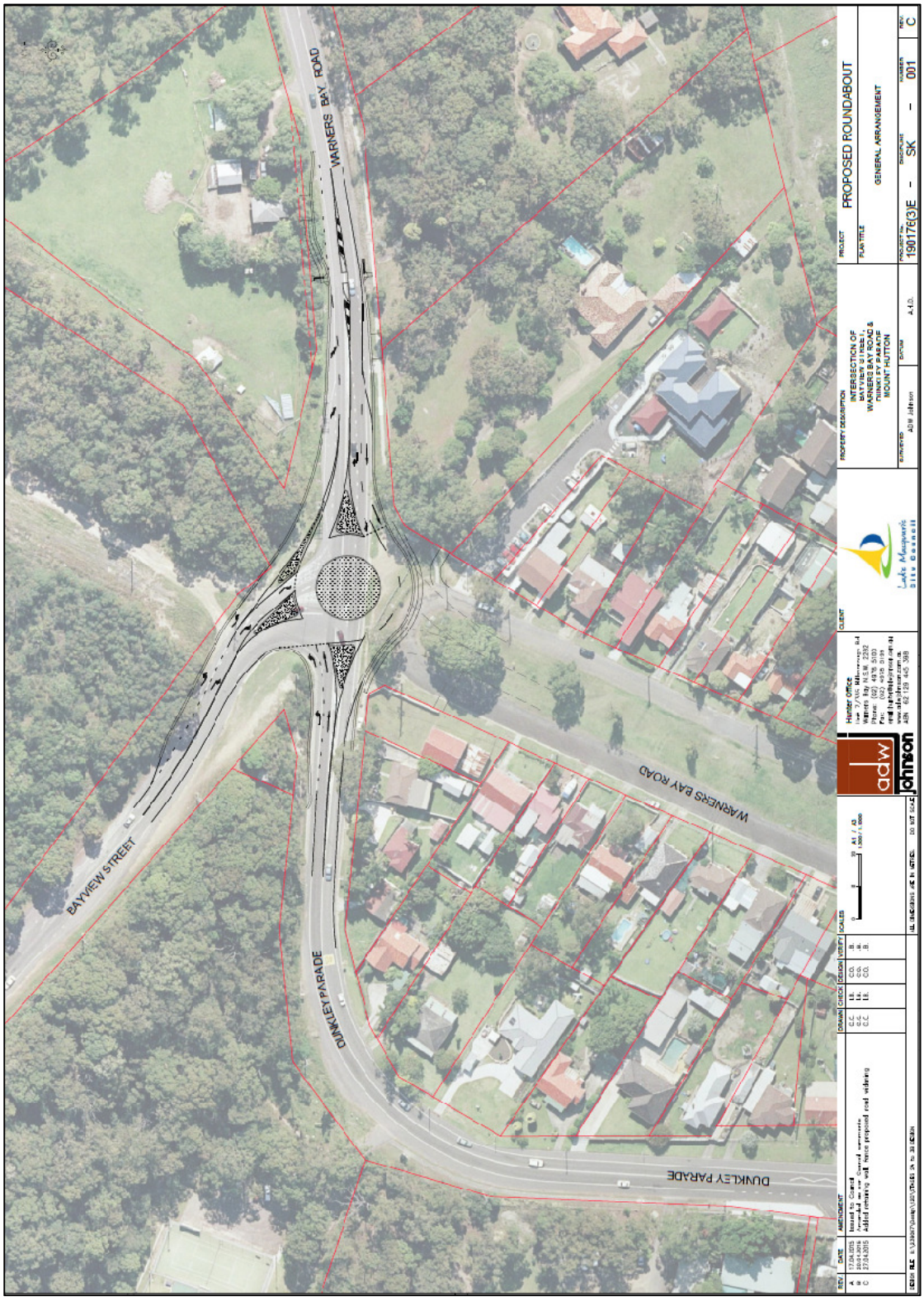
1. MINMI ROAD AND NORTHLAKES DRIVE, CAMERON PARK - ROUNDABOUT
2. BAYVIEW STREET, DUNKLEY PARADE AND WARNERS BAY ROAD, MOUNT HUTTON - ROUNDABOUT
3. MYALL ROAD AND HARRISON STREET, CARDIFF - TURN BANS
4. MINMI ROAD, CAMERON PARK, BETWEEN NORTHLAKES DRIVE AND NEWCASTLE LINK ROAD - WIDEN TO FOUR LANE TWO WAY
5. MYALL ROAD AND GYMEA DRIVE, GARDEN SUBURB - ROUNDABOUT
6. WALLSEND ROAD AND MAIN ROAD, CARDIFF HEIGHTS - TRAFFIC SIGNALS
7. MINMI ROAD, TRANSFIELD AVENUE AND MOTHERWELL PLACE, EDGEWORTH - ROUNDABOUT
8. MYALL ROAD, GARDEN SUBURB BETWEEN PROSPECT ROAD AND RESERVED ROAD - UPGRADE TO FOUR LANE TWO WAY
9. MYALL ROAD, CARDIFF, BETWEEN MACQUARIE ROAD AND NEWCASTLE STREET - UPGRADE TO FOUR LANE TWO WAY
10. MINMI ROAD, EDGEWORTH, BETWEEN TRANSFIELD AVENUE AND NORTHLAKES DRIVE - UPGRADE TO FOUR LANE TWO WAY
11. MYALL ROAD AND NEWCASTLE STREET, CARDIFF - UPGRADE TO FOUR LANE TWO WAY FOR 160 METRES

3.1 Minmi Road and Northlakes Drive, Cameron Park - Roundabout upgrade



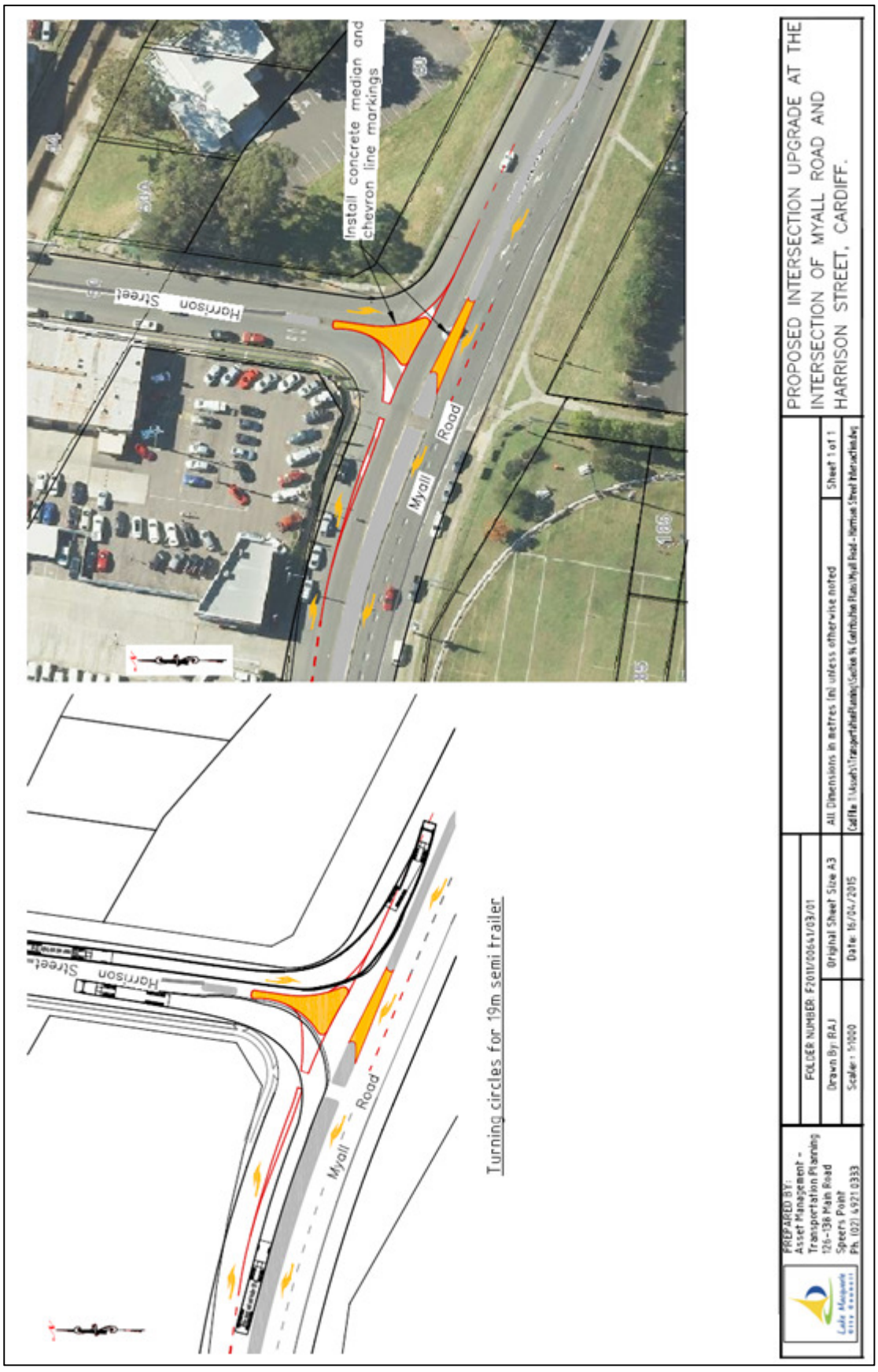
Project: Minmi Road and Northlakes Drive, Cameron Park - construction of roundabout	
Site establishment and Administration	500000
Traffic Control	400000
Service relocation	200000
Earthworks, clearing and stripping	450000
Roadworks and pavements	1000000
Kerb and Gutter	150000
Stormwater and other drainage	250000
Minor concrete works	200000
Sediment control	30007.5
Other - pavement marking, signposting, landscaping etc	107400
Miscellaneous - street lighting, maintenance etc	120000
Contingency 35%	1192593
Total	**$4,600,000**

3.2 Bayview Street, Dunkley Parade and Warners Bay Road, Mount Hutton - Roundabout upgrade



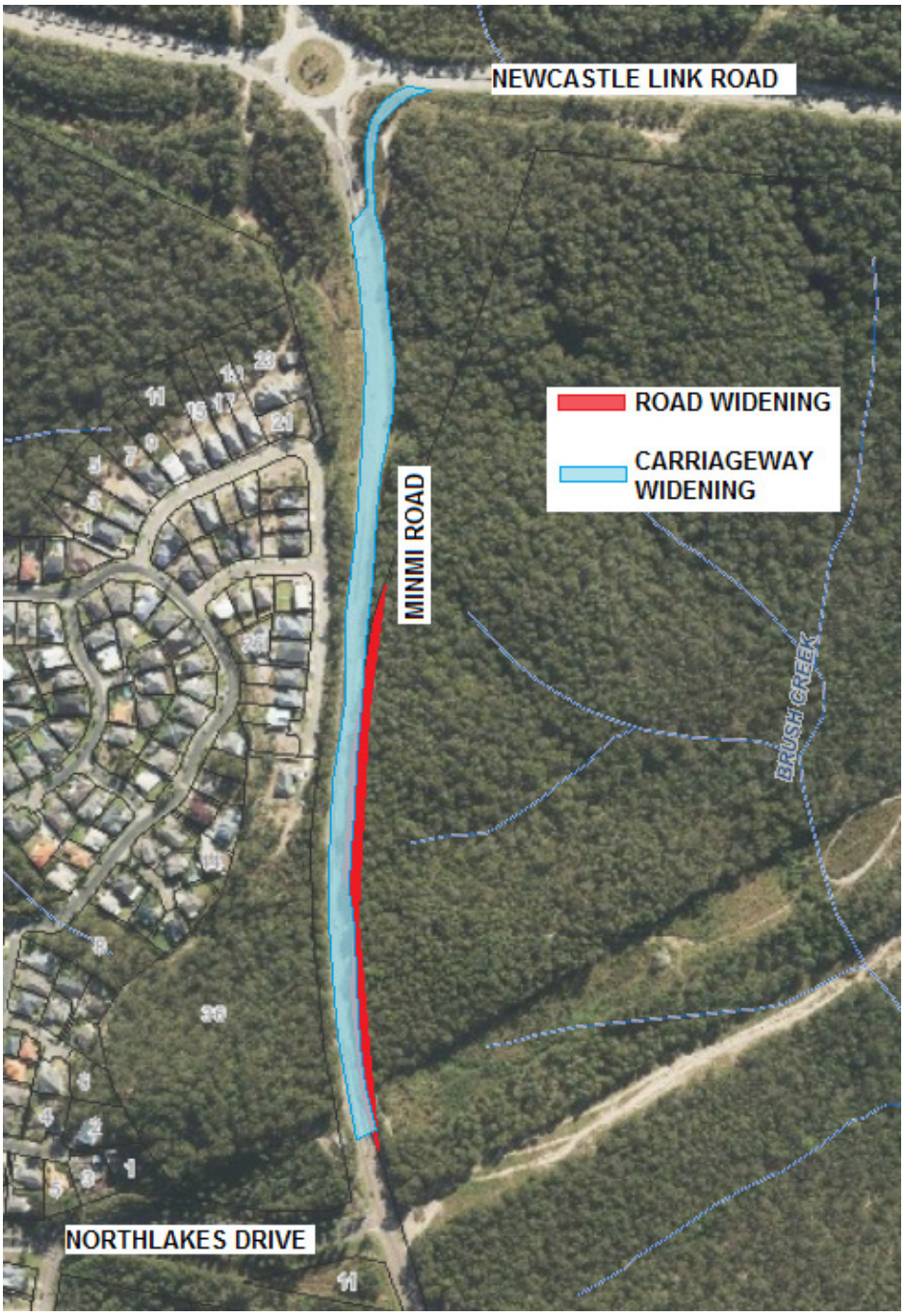
Project: Warners Bay Road, Bayview Street and Dunkley Parade, Mount Hutton - construction of roundabout	
Site establishment and Administration	$567,000
Traffic Control	$497,000
Service relocation	$147,000
Earthworks	$216,000
Roadworks and pavements	$773,000
Kerb and Gutter	$72,000
Stormwater and other drainage	$204,000
Minor concrete works	$129,000
Sediment control	$38,000
Other - pavement marking, signposting, landscaping etc	$97,000
Miscellaneous - street lighting, retaining walls etc	$532,183
Contingency 35%	$1,145,264
Total	**$4,417,447**

3.3 Myall Road and Harrison Street, Cardiff - Turn bans



Project: Myall Road and Harrison Street, Cardiff – turn bans	
Site establishment and Administration	$30,000
Traffic Control	$20,000
Service relocation	$1,000
Earthworks	$3,000
Roadworks and pavements	$5,000
Kerb and Gutter	$1,000
Minor concrete works	$70,000
Sediment control	$3,000
Other - pavement marking, signposting, landscaping etc	$10,000
Miscellaneous - street lighting, maintenance etc	$6,000
Contingency 20%	$29,800
Total	**$178,800**

3.4 Minmi Road Cameron Park, between Northlakes Drive and Newcastle Link Road - Widen to four-lane two-way



Cost estimate:

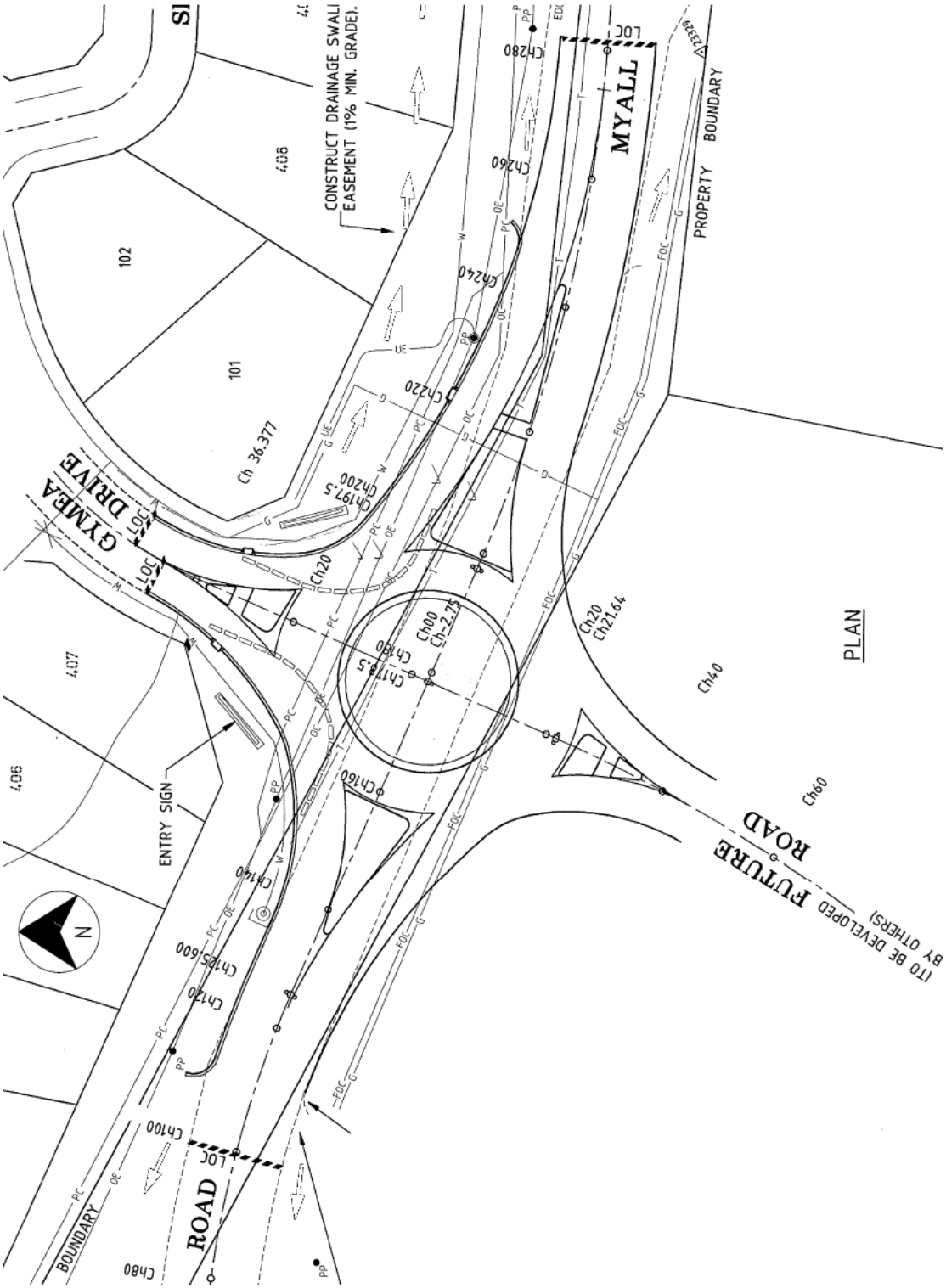
800 metre length by 8 metre width widening, $328/sqm, with 20% for kerb and drainage = $2,520,000

Miscellaneous, for example retaining walls, service relocation (7 x power poles), guardrail = $650,000

20% contingency = $634,000

Total **$3,804,000**

3.5 Myall Road and Gymea Drive, Garden Suburb - Upgrade to Roundabout



Project: Myall Road and Gymea Drive – installation / completion of roundabout	
Site establishment and Administration	$611,000
Traffic Control	$494,950
Earthworks, clearing and stripping	$530,276
Roadworks and pavements	$919,170
Kerb and Gutter	$118,901
Stormwater and other drainage	$199,562
Minor concrete works	$137,880
Sediment control	$31,408
Other - pavement marking, signposting, landscaping etc	$132,085
Miscellaneous - street lighting, maintenance etc	$94,120
Contingency 35%	$1,144,273
Total	**$4,413,625**

*Note, approximately 25% of the concrete pavement have been constructed as part of Gymea Drive which is reflected in the estimate

3.6 Wallsend Road and Main Road, Cardiff - Upgrade to Traffic Signals

Project: Main Road and Wallsend Road, Cardiff Heights – Installation of traffic signals	
Site establishment and Administration	$175,000
Traffic Control	$300,000
Service relocation	$100,000
Earthworks	$176,000
Roadworks and pavements	$605,000
Kerb and Gutter	$49,000
Stormwater and other drainage	$77,000
Minor concrete works	$34,000
Sediment control	$20,000
Other - pavement marking, signposting, landscaping etc	$70,000
Traffic signal cabling and lanterns etc	$200,000
Miscellaneous - street lighting, maintenance etc	$161,000
Contingency 20%	$393,400
Total	**$2,360,400**

3.7 Minmi Road, Transfield Avenue and Motherwell Place, Edgeworth - Upgrade to roundabout

Project: Minmi Road, Transfield Avenue and Motherwell Place, Edgeworth	
Site establishment and Administration	$425,000
Traffic Control	$400,000
Service relocation	$375,000
Earthworks	$148,000
Roadworks and pavements	$355,000
Kerb and Gutter	$28,000
Stormwater and other drainage	$146,000
Minor concrete works	$65,000
Sediment control	$30,000
Other - pavement marking, signposting, landscaping etc	$105,000
Miscellaneous - street lighting, maintenance etc	$230,000
Contingency 35%	$519,075
Total	**$3,114,450**

3.8 Myall Road Garden Suburb, between Prospect Road and Reserved Road - Upgrade to four-lane two-way

Cost estimate:

800 metre length by 7 metre width widening, $328/sqm, with 20% for kerb and drainage = $2,205,000

Miscellaneous, for example retaining walls, service relocation, guardrail = $375,000

20% contingency = $516,000

Total **$3,096,000**

3.9 Myall Road Cardiff between Macquarie Road and Newcastle Street - Upgrade to four-lane two-way

Cost estimate:

500 metre length by 7 metre width widening, $328/sqm, with 20% for kerb and drainage = $1,380,000

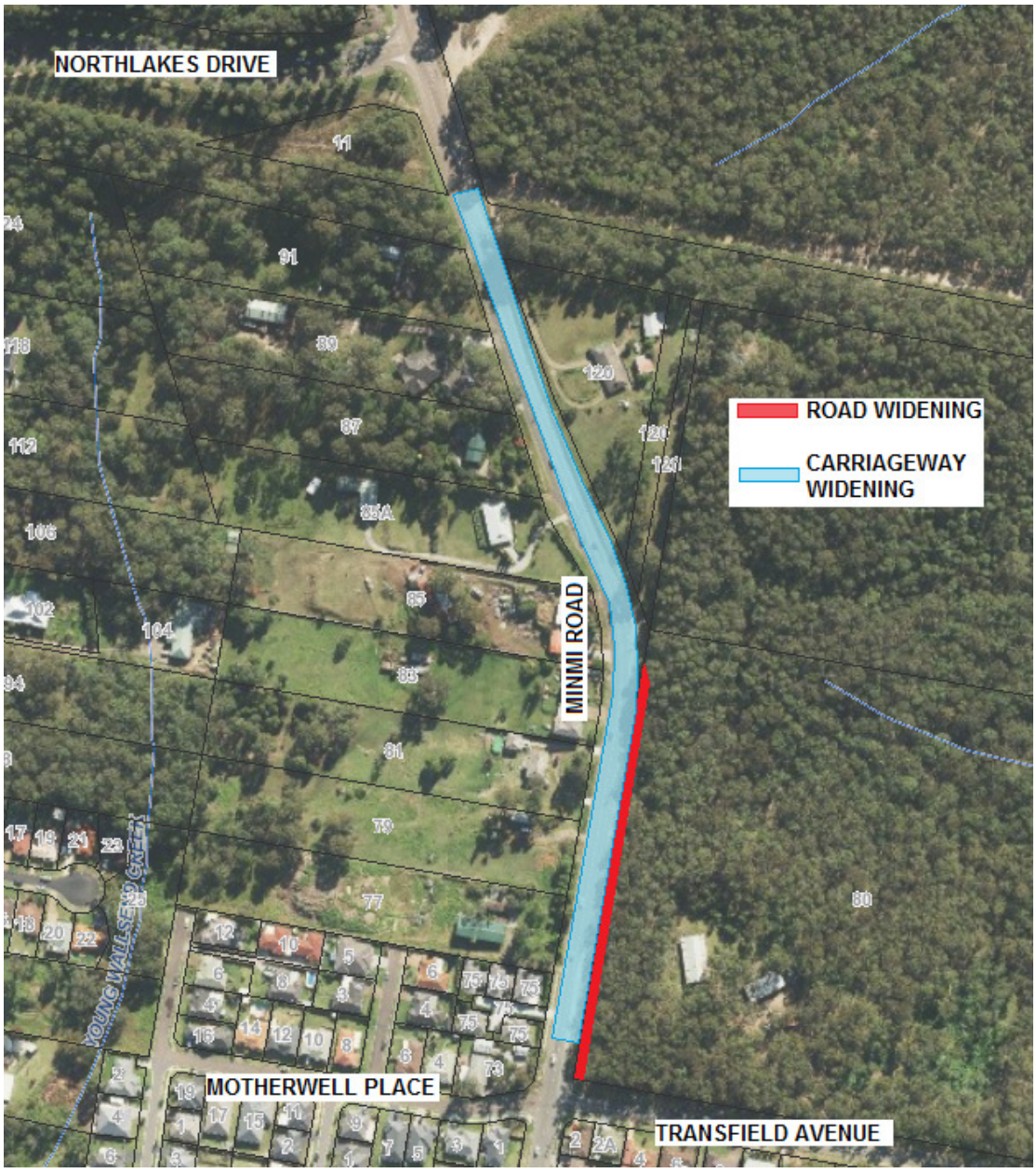
Culvert widening over Winding Creek = $500,000

Miscellaneous, for example retaining walls, service relocation, guardrail = $210,000

20% contingency = $418,000

Total **$2,508,000**

3.10 Minmi Road Edgeworth between Transfield Avenue and Northlakes Drive - Widen to four-lane two-way



Cost estimate:

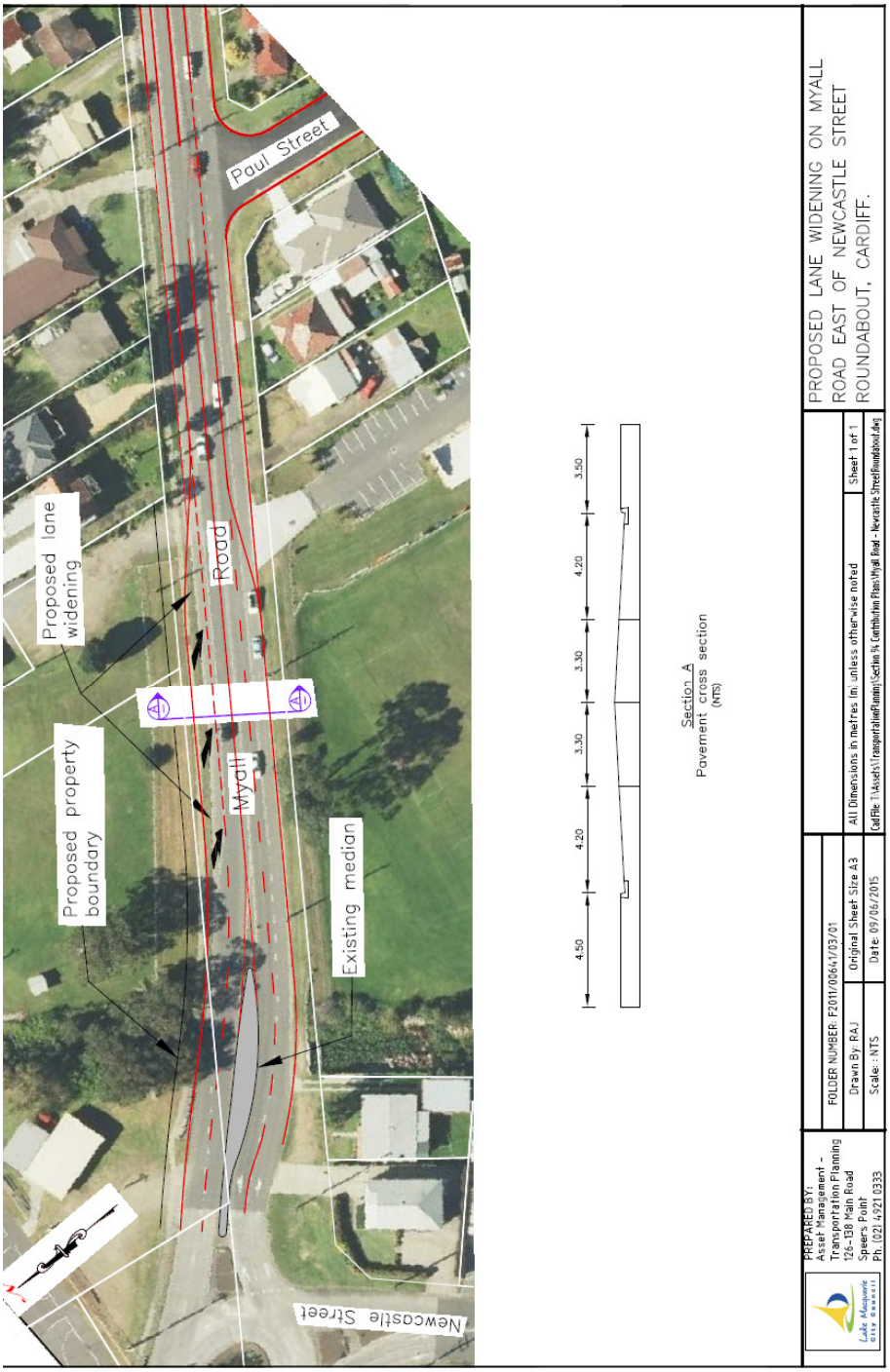
580 metre length by 7 metre width widening, $328/sqm, with 20% for kerb and drainage = $1,600,000

Miscellaneous, for example retaining walls, service relocation (8 power poles), guardrail = $420,000

20% contingency = $404,000

Total **$2,424,000**

3.11 Myall Road and Newcastle Street, Cardiff - Widen Myall Road on eastern side of Newcastle Street for 160 metres.



Cost estimate:

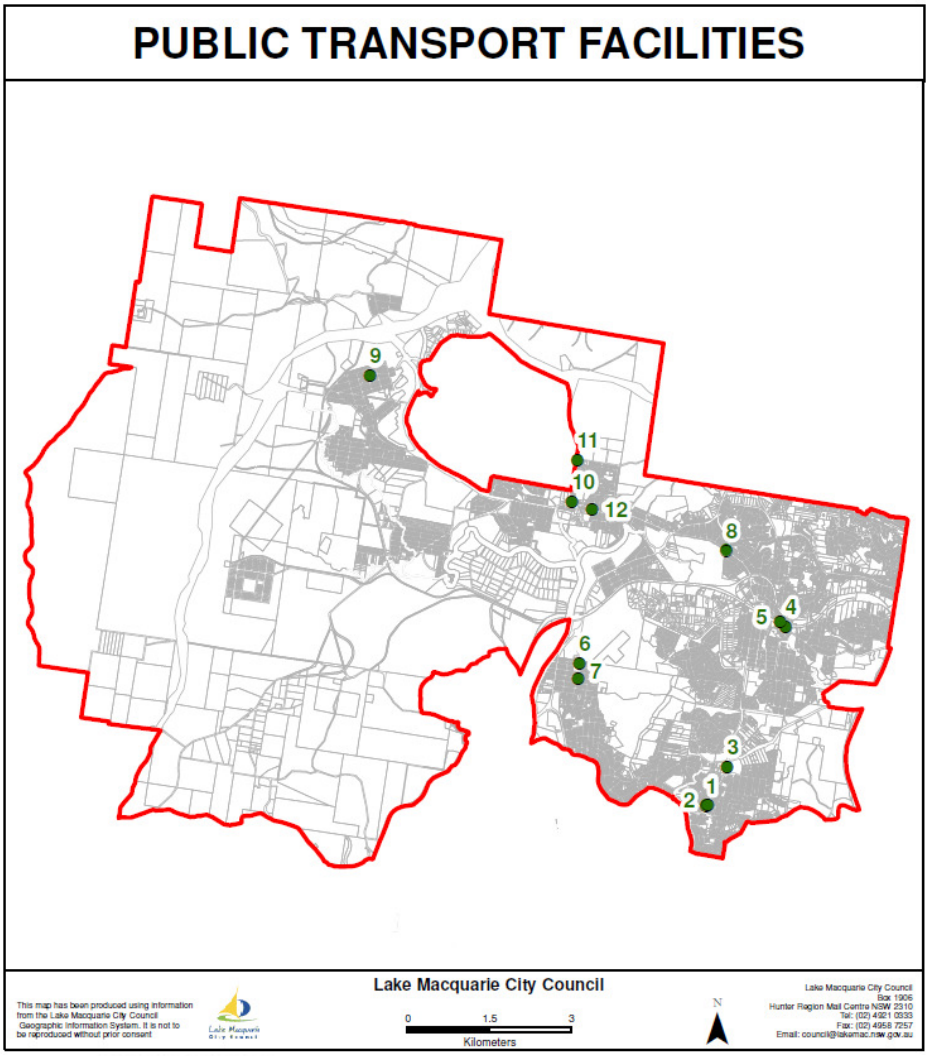
170 metre length by 3 metre width widening, $328/sqm, with 20% for kerb and drainage = $200,000

Miscellaneous, for example service relocation, guardrail = $70,000

20% contingency = $54,000

Total **$324,000**

3.12 Glendale Catchment – Proposed Public Bus Infrastructure Upgrade



Glendale East

1. King Street Warners Bay, north of Charles Street on western side
2. King Street Warners Bay, north of Bayview Street on eastern side
3. King Street Warners Bay, south of Hillsborough Road on eastern side
4. Myall Road Cardiff, west of Newcastle Street on southern side
5. Myall Road Cardiff, west of Newcastle Street on northern side
6. Main Road Boolaroo, south of First Street on eastern side
7. Main Road Boolaroo, south of Fourth Street on eastern side
8. Main Road Glendale, west of Glendale Drive on southern side of road

Glendale West

9. Carrington Street West Wallsend, fronting Post Office

Glendale Central

10. Main Road Edgeworth, east of Minmi Road on north side
11. Minmi Road Edgeworth, south of Motherwell Place on east side
12. Main Road Edgeworth, west of Thomas Street on southern side


Lake Macquarie
City Council