Traffic Impact Assessment

Backsaddle Pty Ltd and Wallace Planning Proposal

8201806901-001

Prepared for

Backsaddle Pty Ltd and Mr. Chad Wallace

25 September 2018

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Table of Contents

Tables

Figures

Appendices

1 Introduction

1.1 Overview

Cardno (NSW/ACT) Pty Ltd (Cardno) has been commissioned by Backsaddle Pty Ltd and Mr. Chad Wallace ('the client') to undertake a Traffic Impact Assessment (TIA) study to support planning proposed for a residential development located in Kiama, NSW.

1.2 Background

The client has engaged Cardno to complete a Planning Proposal (PP) to support an amendment to the development controls and associated mapping within the Kiama Local Environmental Plan 2011(KLEP 2011) for land located off Greyleigh Drive and Old Saddleback Road in Kiama.

As per the prerequisite of the PP, Cardno undertook a Traffic Impact Assessment study to forecast the expected trip generation caused by the development and to demonstrate the impacts on the surrounding transport network. The study also focused on the public transport accessibility and active transport provisions and the potential connections to surrounding land.

The proposed development is located in the Kiama Local Government Area (LGA) on the western side of the Princes Highway, north of Old Saddleback Road and west of Greyleigh Drive in Kiama as shown in **Figure 1-1**.

Figure 1-1 Proposed Development Site Locality

Figure 1-1 illustrates that the proposed development is located in close proximity to the following:

- Kiama Railway Station (1.6 km walking distance).
- Centre of the Kiama commercial district (2 km walking distance).
- Kiama High School (Less than 1 km walking distance).

- Kiama Leisure Centre and sports complex (1.8km walking distance).
- Kiama main beaches (1.5 km walking distance).
- Kiama Harbour (2.3 km walking distance).

1.3 Reference Documents

- Premier Illawarra Routes and Timetable
- Kiama Coaches Routes and Timetable
- Roads and Maritime Guide to Traffic Generating Developments TDT 2013/04a (Roads and Maritime Guide)
- Kiama Development Control Plan (Chapter 7, 2012)
- Nearmap Imagery
- Google Maps

1.4 Report Structure

- Section 1 - Introduction
- Section 2 - Existing Condition
- Section 3 - Proposed Development
- Section 4 - Traffic Assessment
- Section 5 - Transport and Accessibility
- Section 6 - Conclusion

2 Existing Condition

2.1 Study Area

The proposed development site is located north of Old Saddleback Road and west of Greyleigh Drive and is situated within an area used for rural and residential purposes. The proposed development is sited approximately 1.6 km west of the township of Kiama and 4 km north east of Saddleback Mountain Lookout.

The development site comprises an area of approximately 38 hectares and is irregular in shape with a north-south orientation and an approximate width of 390 m and a length of 1.5 km.

As illustrated in **Figure 2-1**, the subject site has no formal public access road and has shared boundaries with the western end of the Bland Street road reserve, connection to Greyleigh Drive via an unformed Crown road reserve and a rural crossing to Old Saddleback Road.

The subject site is bound to the:

- North by rural land.
- East by low density residential land and further to the east is the Princes Highway.
- South by Old Saddleback Road and one rural residential property.
- West by rural residential land and the Spring Creek catchment.

Figure 2-1 Area the subject of the Planning Proposal application

This TIA originally investigated the area comprised of the following lots and reserves (as illustrated in **Figure 2-2)**:

- Lots 156, 183, 185, 186, 187, 188 and 189 in Deposited Plan 751279.
- Lots 99 in Deposited Plan 1042908.
- Lot 1320 in Deposited Plan 1060995.

- Lot 1 in Deposited Plan 1178500.
- Lot 1 in Deposited Plan 1003719.
- Lot 1 in Deposited Plan 995058
- Lot 2 in Deposited Plan 1135218.
- Crown Road reserves held under EP 39357 between the above lots.

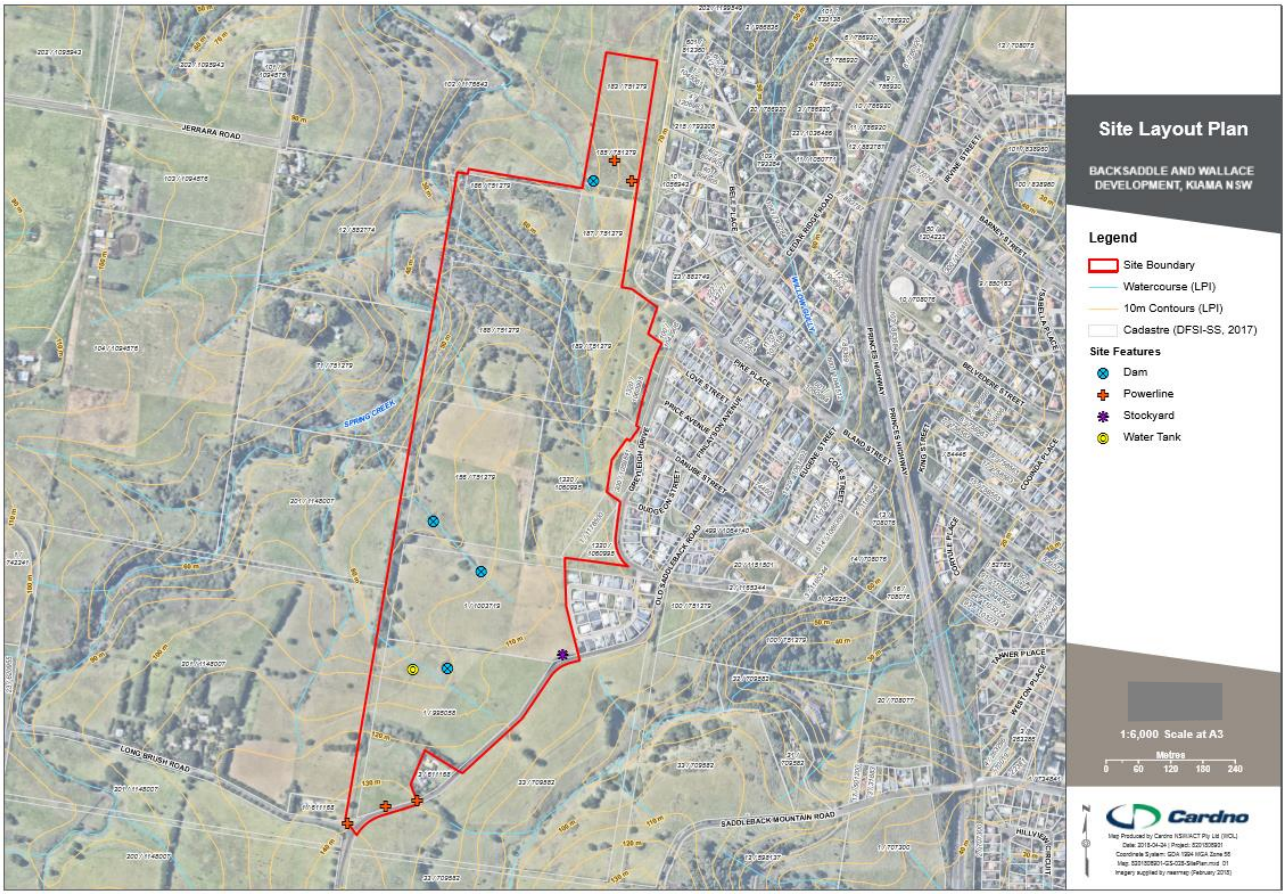


Figure 2-2 Original Study Area

The site area the subject of the Planning Proposal application is a sub-set of the original study area with Lots 183, 185 and 187 DP 751279 now not included in the final version of the Planning Proposal as explained in detail in Section 3.1.1 of the Planning Proposal report.

This Traffic Assessment therefore investigated the potential broader scale traffic generation, road and pathway connection possibilities for the original broad site and in this regard the scope goes beyond the final site area. Recommendations and conclusions are unaffected by the reduction in site area.

2.2 Existing and Future Access Arrangements

As per the existing road infrastructure connectivity and location of the proposed development site, it is evident that there is no existing formal access road to the subject site. As described in **Section 2.1** and illustrated in **Figure 2-1 and Figure 2-2 and Figure 2-3**, the development site can be accessed by Bland Street, Greyleigh Drive and Old Saddleback Road.

It is also understood that a preliminary concept internal road network has been planned for the proposed development site along with access points on Bland Street, Greyleigh Drive and Old Saddleback Road for further consideration and refinement (See **Figure 5-1**).

2.3 Road Hierarchy

2.3.1 Bland Street

Bland Street is located on the north-east corner of the site. Bland Street is the key two way road providing access to the Kiama town centre and the Princes Highway entry ramp via a roundabout intersection at Eugene Street. As per the proposed site location, it is expected that all trips from the proposed development will access Bland Street directly, via Old Saddleback Road and via Greyleigh Drive. As illustrated in **Figure 2-3**, Bland Street terminates as a turning area at the western end and it has varying carriageway width between Greyleigh Drive and Old Saddleback Road.

2.3.2 Old Saddleback Road

Old Saddleback Road is located on the southern side of the site and stretches south to north-east connecting existing residential developments with the Princes Highway through Bland Street. On the southern side of the proposed development, Old Saddleback Road has carriageway width of approximately 4.5 m with two way movement. However, the width of the road increases to nearly 5.5 m and 8.5 m at an intersection with Caliope Street and Bland Street respectively.

2.3.3 Greyleigh Drive

Greyleigh Drive is located on the south-east boundary of the site. Two way movement is permitted on Greyleigh Drive with a carriageway width of approximately 4.30 m. It is evident from **Figure 2-3** that Greyleigh Drive functions as a local bypass and runs parallel to Old Saddleback Road on the western side and connects with Bland Street.

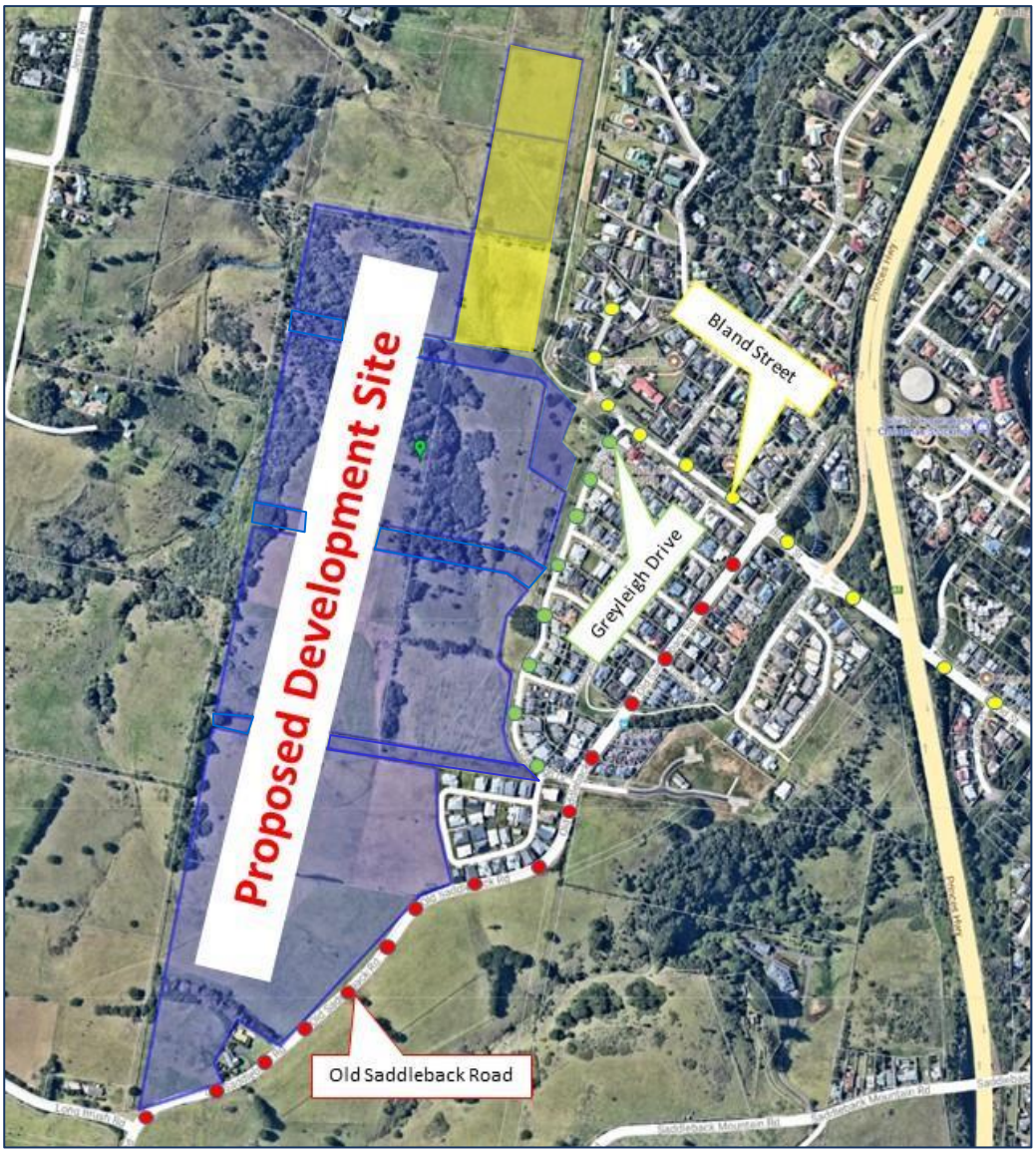


Figure 2-3 Road Network in the vicinity of Proposed Development (shaded blue)

2.4 Existing Public Transport

It has been noted from a desktop review and direct consultation with Transport for NSW (TfNSW) that two bus routes are currently operating in the vicinity of the site. The two routes are operated by different operators being Route 702 by Kiama Coaches Services and Route 71 by Premier Illawarra.

Figure 2-4 illustrates the map for Route 702 and Route 71 operated by Kiama Coaches Services and Premier Illawarra respectively.

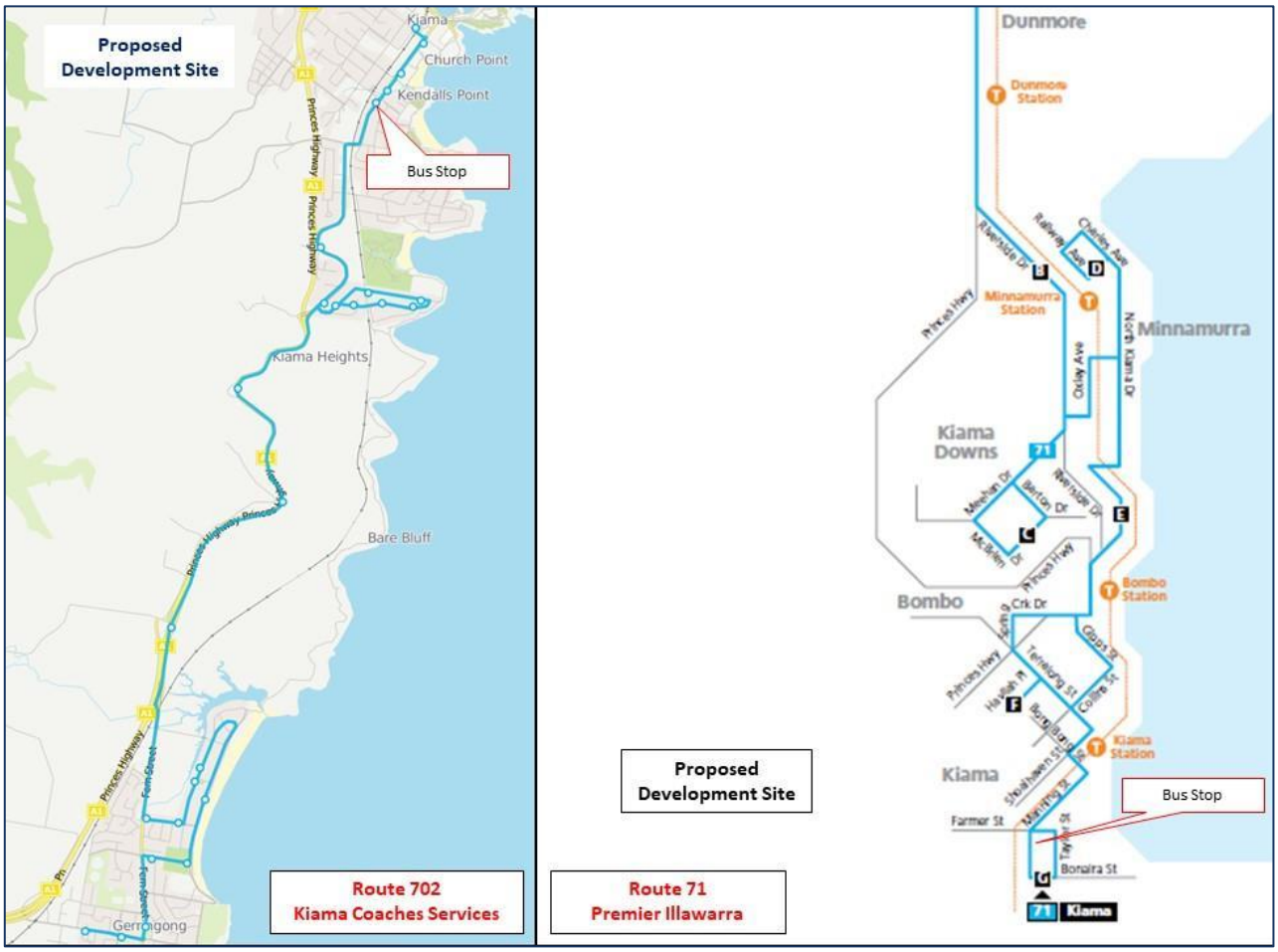


Figure 2-4 Existing Public Transport Routes

2.4.2 Kiama Coaches Route 702

This route is operated by Kiama Coaches Services and provides a loop service between Kiama, Kiama Heights, Gerringong, Gerroa and Seven Mile Beach. As illustrated in **Figure 2-5**, the fourth stop of Route 702 (southbound i.e. towards Gerringong) is located at Manning Street near Farmer Street. This is the nearest bus stop to the proposed development site on Route 702 and is a minimum 1.2 km walking distance.

As described in **Table 2-1** and **Table 2-2**, Route 702 provides only two loop services in both the AM and PM peak hours at approximately hourly intervals towards Kiama Station and only one service in between two peaks. It has been noted that only two loop services are provided on Saturdays and no service is provided on Sundays and public holidays.

Table 2-1 Route # 702 Frequency from Kiama to Seven Mile Beach

Day	AM Peak (0500-0900)	Inter-Peak	PM Peak (1530-2030)
Weekdays	2	1	2
Saturday	NA	2	NA
Sunday and Public Holidays	NA	NA	NA

Table 2-2 Route # 702 Frequency from Seven Mile Beach to Kiama

Day	AM Peak (0500-0900)	Inter-Peak	PM Peak (1530-2030)
Weekdays	2	1	2
Saturday	NA	1	1
Sunday and Public Holidays	NA	NA	NA

2.4.3 Premier Illawarra Route 71

Premier Illawarra operates this route and provide a loop service between Shellharbour City Centre and Kiama. Route 71 operates through Stockland Shellharbour, Riverside Drive, McBrien Drive, Minnamurra Public School Link Drive, North Kiama Drive, Kiama Leisure Centre and Bonaira Street. As illustrated in **Figure 2-4**, the nearest bus stop to access Route 71 is on Manning Street after Farmer Street.

As described in **Table 2-3** and **Table 2-4**, Route 71 provides two and three loop services in the AM and PM peak hours respectively. Whereas four loop services are provided during inter-peak hours and total four loop services are operated on Saturdays. As per the Route 71 timetable, no bus service is provided on Sundays and public holidays.

Table 2-3 Route 71 Frequency from Kiama to Shellharbour

Day	AM Peak (0500-0900)	Inter-Peak	PM Peak (1530-2030)
Weekdays	2	4	3
Saturday	1	2	1
Sunday and Public Holidays	NA	NA	NA

Table 2-4 Route 71 Frequency from Shellharbour to Kiama

Day	AM Peak (0500-0900)	Inter-Peak	PM Peak (1530-2030)
Weekdays	1	5	2
Saturday	1	2	1
Sunday and Public Holidays	NA	NA	NA

As per Cardno's desktop review and discussion with Kiama Coaches, there is a designated bus stop at Old Saddleback Road before Danube Street for Route 702. It has been noted that no bus route services to/from this bus stop making it inactive.

The detailed time tables for both Route 702 and Route 71 are provided in **Appendix A**.

2.5 Walking Catchment Analysis to Existing Bus Stop

As described in **Section 2.4.2**, the nearest active bus stop to the proposed development is located on Manning Street near Farmer Street. Despite existing substantial residential development east of the site and west of the Princes Highway, no bus service is provided west of the highway.

Cardno undertook a walking catchment analysis using google maps to assess the walking distance and time to access the nearest active bus stop on Manning Street from the site. **Figure 2-5** illustrates the most feasible route map to access Kiama railway station using public transport services.

It is evident from **Figure 2-5** that in the existing scenario, one has to walk 1.7 km for 22 minutes to reach the nearest active bus stop. The long walking distance and extended walking time is a major discouraging factor to use active transport modes and consequently results in increased private car trips.

Considering the existing location of the nearest actively serviced bus stop, it is clear that the existing bus routes need to be extended / diverted and additional bus stops are required on Bland Street and within the proposed development site to achieve a desired 400 m walking catchment for bus stops.

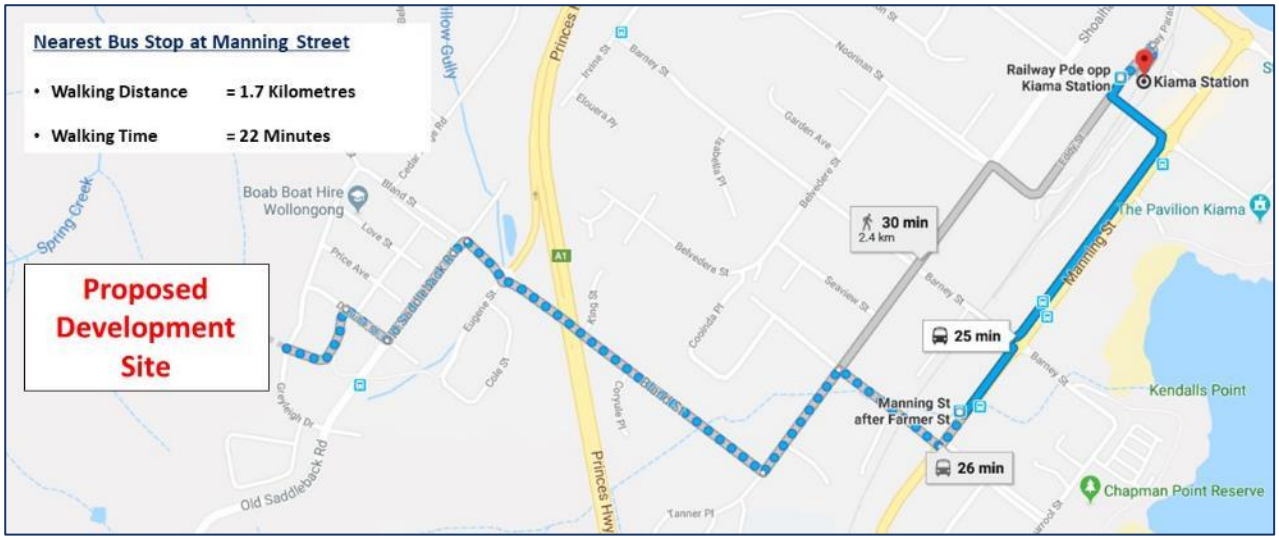


Figure 2-5 Walking Catchment Analysis for Existing Nearest Actively Serviced Bus Stop

Refer to **Section 5.2** for the recommended public transport plan in support of the proposed development.

3 Proposed Development

As described in **Section 2.1**, the Planning proposal seeks to facilitate residential development of the site. At present, the site is a greenfield land parcel. As per planning estimates, it is expected that the proposed development will compromise approximately 400 new dwellings with construction including low and medium density housing (See **Figure 3-1**).

Figure 3-1 Proposed Concept Plan

4 Traffic Assessment

4.1 Trip Rates and Generation

As stated in **Section 3** and illustrated in **Figure 3-1** the proposed development will comprise approximately 400 dwellings. Combined with a large area of environmental protection lands the overall density per hectare of the site will be equivalent to low density residential development.

The traffic generation rates adopted for this analysis are sourced from the *Roads and Maritime (RMS) Guide to Traffic Generating Developments TDT 2013/04a*.

The following calculations are the average trip generation rates for regional developments described in *RMS Technical Directions* (*TDT 2013/04a)* published in August 2013:

Low Density Residential Dwellings

- Average AM (site peak) vehicle trip rate: 0.71 per dwelling.
- Average PM (site peak) vehicle trip rate: 0.78 per dwelling.
- Average daily vehicle trip rate: 7.40 per dwelling.

Accordingly, the above trip rates per dwelling have been adopted for the purpose of traffic generation assessment from future low density residential land use. The results of the traffic generation assessment are summarised in **Table 4-1**.

Table 4-1 Traffic Generation Estimate

Land Use	RMS Guide Definition	No.	Traffic Generation		
			AM Peak	PM Peak	Daily
Residential	Low Density	400 dwellings	284 trips	312 trips	2960 trips

It is evident from **Table 4-1** that the proposed development will generate 284 and 312 vehicular trips in the morning and evening peak period respectively. It is also noted that total 2960 trips will be generated in a day by a potential 400 lot development.

4.2 Traffic Assignment Methodology

The following methodology was adopted in order to derive appropriate trip distribution and traffic assignment for the proposed 400 dwelling development in Kiama:

- Inbound/outbound traffic split of 0.2/0.8 and 0.8/0.2 was assumed for AM and PM peak respectively.
- It is anticipated that 100% of inbound trips in the AM and PM peak will travel to north (towards Old Saddleback Road) while negotiating Bland Street / Eugene Street / Princes Highway Ramp intersection.
- It is anticipated that 90% of the outbound trips in the AM peak will use take left turn from Bland Street / Eugene Street / Princes Highway Ramp intersection to access Princes Highway.
- It is anticipated that 10% of the outbound trips in the AM peak will travel to south (towards Shoalhaven Street) while negotiating Bland Street / Eugene Street / Princes Highway Ramp intersection.
- It is anticipated that 40% of the inbound trips in the AM peak will travel to west (towards Bong Bong Street) while negotiating Collins Street / Terralong Street intersection.
- It is anticipated that 10% of the outbound trips in the AM peak will travel to east (towards Minnamurra Street) while negotiating Collins Street / Terralong Street intersection.
- It is anticipated that 90% of the inbound trips in the PM peak will travel to west (towards Bong Bong Street) while negotiating Collins Street / Terralong Street intersection.
- It is anticipated that 10% of the outbound trips in the PM peak will travel to east (towards Minnamurra Street) while negotiating Collins Street / Terralong Street intersection.

4.3 Traffic Surveys

Considering the existing road infrastructure connectivity and desktop review of most likely commuter routes, Cardno selected the following two intersections for detailed analysis to assess impacts of proposed developments:

- Bland Street / Eugene Street / Princes Highway Ramp intersection
- Collins Street / Terralong Street intersection

Both aforementioned intersections are roundabouts with capacity control. As part of this assessment, Cardno engaged a sub-consultant to carry out detailed intersection traffic counts at both intersections. The intersection surveys were undertaken in May 2018 during the morning and evening peak periods.

4.3.1 Survey Results

Bland Street / Eugene Street / Princes Highway Ramp intersection

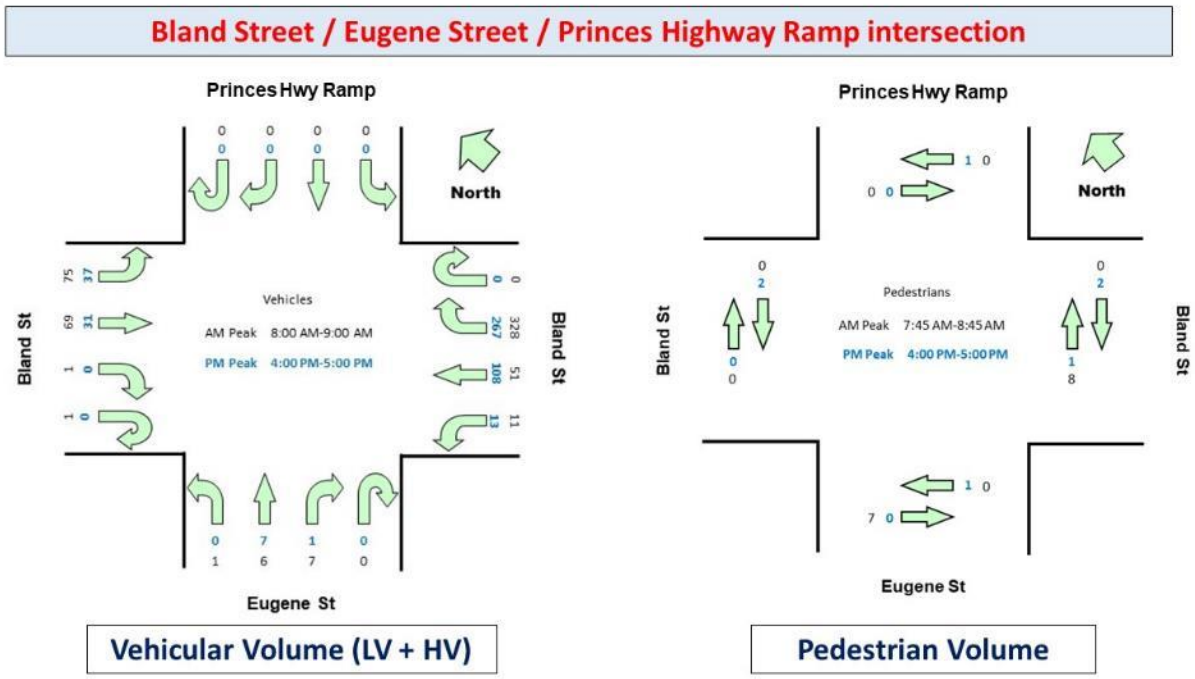


Figure 4-1 Existing peak hour (AM & PM) volume Bland Street / Eugene Street / Princes Highway Ramp intersection

Collins Street / Terralong intersection

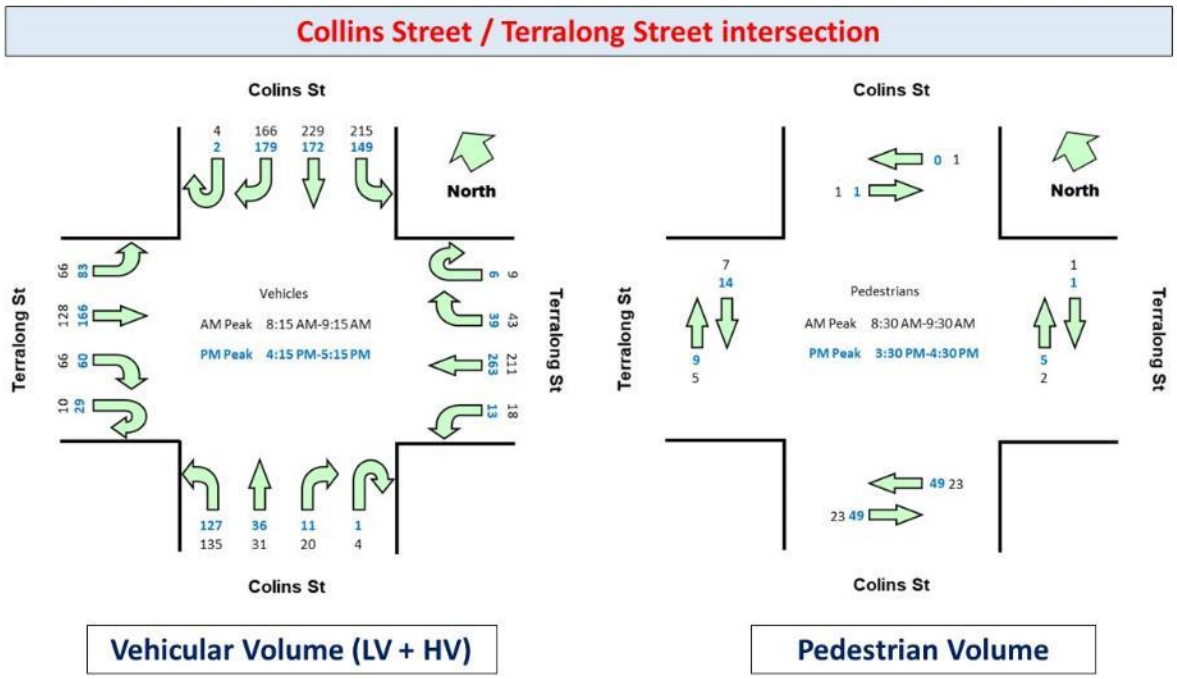


Figure 4-2 Existing peak hour (AM & PM) volume Collins Street / Terralong Street intersection

4.4 SIDRA Assessment

As described in **Section 4.3**, considering the existing and future primary access route for the proposed development and most likely commuter route choice, there is a need to study in detail the performance of Bland Street / Eugene Street / Princes Highway Ramp and Collins Street / Terralong Street intersections for future year 2024 and 2030. This analysis will identify capacity issues at the intersection and will assist in proposing mitigation measures (if any) that would ensure a sustained satisfactory performance.

4.4.1 Intersection Performance Criteria

The capacity of a road network can be largely determined by the capacity of the controlling intersections. The key indicator of intersection performance Level of Service (LoS) is delay, where results are placed on a continuum from 'A' to 'F' are shown in **Table 4-2**.

Table 4-2 Level of Service Criteria

Level of Service	Average Delay per Vehicle (seconds)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays	At capacity, requires other control mode
F	>70	Unsatisfactory and requires additional capacity	Unsatisfactory and requires additional capacity

**Source: RMS Traffic Modelling Guidelines (2013)*

Roads and Maritime guidelines state that for roundabouts and priority control intersections a Level of Service (LoS) assessment should be reported based on the worst performing movement of the intersection. For traffic signals, the average movement delay and corresponding LoS over all movements should be determined and reported.

4.4.2 Growth Rate Assessment

In order to determine the optimum growth rate for future year performance assessments of Bland Street / Eugene Street / Princes Highway Ramp and Collins Street / Terralong Street intersections, Cardno undertook a historical growth rate analysis of the nearest RMS permanent counter 20 m east of Turpentine Street, Kiama (ID number 07096).

The permanent counter is located on Jamberoo Road near Turpentine Street nearly 1.25 km west of the Collins Street / Terralong Street intersections. It was assumed that the historical traffic growth trends will be a reliable source for future years intersection performance assessment using SIDRA modelling.

Table 4-3 describes the AM and PM peak hour eastbound traffic volume i.e. towards Collins Street / Terralong Street intersection from year 2008 to 2018. **Table 4-4** highlights the westbound traffic volume coming from Collins Street / Terralong Street intersection from year 2008 to 2018.

It is evident from **Table 4-3** and **Table 4-4** that the traffic growth trends are not consistent in both AM and PM peaks for both directions. As per the analysis results, westbound traffic has the highest average growth rate of 1.97% in the last ten years from 2008 to 2018.

Table 4-3 Traffic growth rate assessment of eastbound Traffic (towards Collins St / Terralong St intersection)

RMS Permanent Counter 20m East of Turpentine Street , Kiama 2533					
Eastbound Traffic (towards Collins St / Terralong St intersection) Analysis					
AM Peak Hour			**PM Peak Hour**		
Year	**Volume**	**% Growth**	**Year**	**Volume**	**% Growth**
2018	316	8.22%	2018	464	17.17%
2016	292	6.96%	2016	396	9.09%
2015	273	0.37%	2015	363	-2.68%
2014	272	-2.51%	2014	373	-8.35%
2013	279	2.95%	2013	407	0.00%
2012	271	1.50%	2012	407	0.25%
2011	267	3.09%	2011	406	-3.10%
2010	259	-0.77%	2010	419	-5.20%
2009	261	-3.69%	2009	442	7.54%
2008	271		2008	411	
Average		**1.79%**	**Average**		**1.63%**

Table 4-4 Traffic growth rate assessment of westbound Traffic (coming from Collins St / Terralong St intersection)

RMS Permanent Counter 20m East of Turpentine Street , Kiama 2533					
Westbound Traffic (coming from Collins St / Terralong St intersection) Analysis					
AM Peak Hour			**PM Peak Hour**		
Year	**Volume**	**% Growth**	**Year**	**Volume**	**% Growth**
2018	306	5.15%	2018	411	9.60%
2016	291	17.81%	2016	375	8.07%
2015	247	1.23%	2015	347	-1.14%

2014	244	-9.96%	2014	351	-3.84%
2013	271	-2.52%	2013	365	3.69%
2012	278	3.35%	2012	352	-1.12%
2011	269	1.89%	2011	356	0.56%
2010	264	0.00%	2010	354	-1.94%
2009	264	0.76%	2009	361	1.12%
2008	262		2008	357	
Average		**1.97%**	**Average**		**1.67%**

Considering the growth rate assessment results, Cardno adopted the annual growth rate of 2% for intersections performance assessment in future years.

4.4.3 Assessment of Bland Street / Eugene Street / Princes Highway Ramp Intersection

4.4.3.1 Base Layout

Figure 4-3 illustrates the base layout of Bland Street / Eugene Street / Princes Highway Ramp Intersection. All the geometric parameters including lane widths, roundabout diameter, entry angle and approach / exit distance were measured using latest Nearmap imagery.

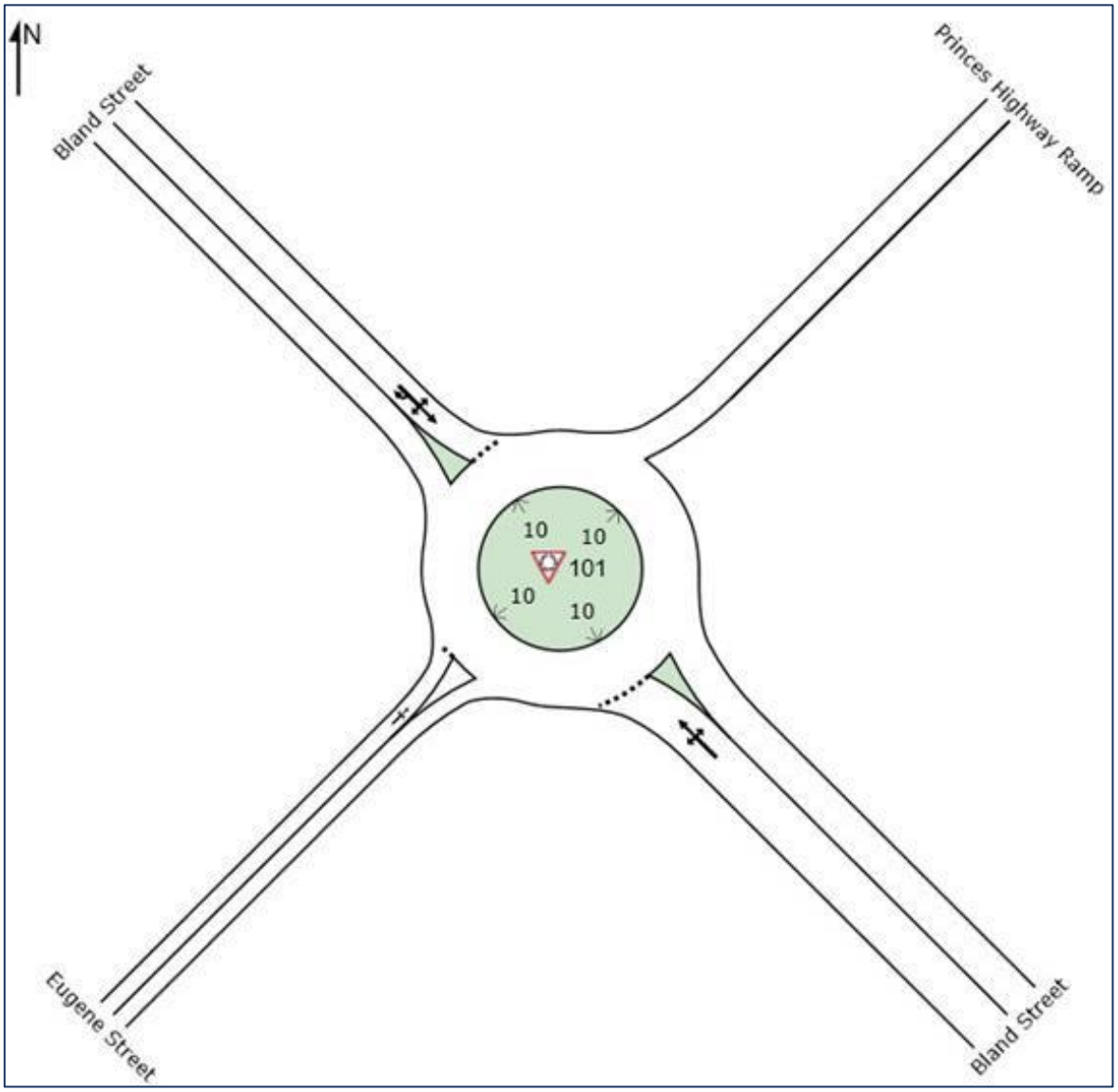
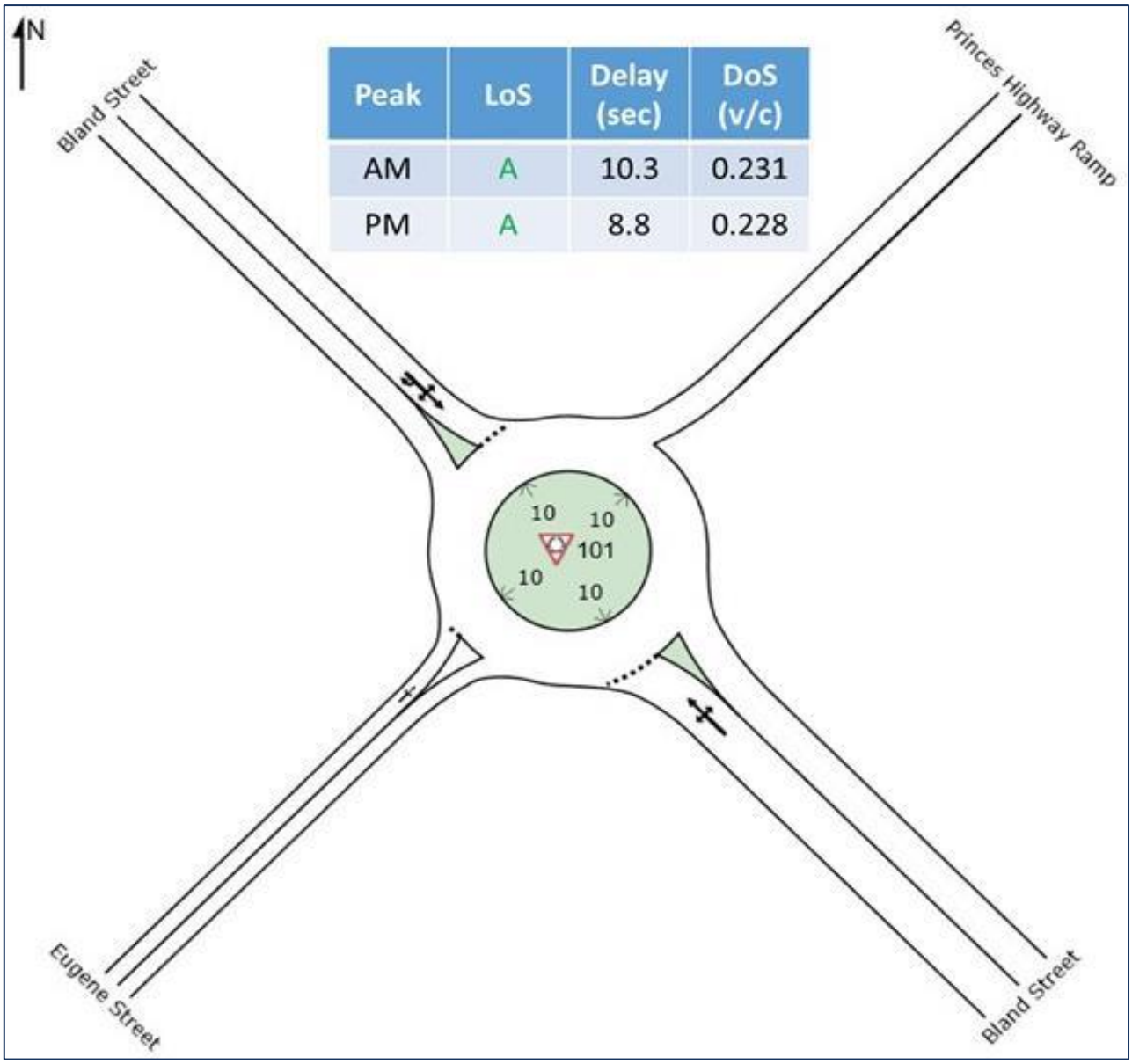


Figure 4-3 SIDRA intersection base layout of Bland Street / Eugene Street / Princes Highway Ramp Intersection

4.4.3.2 2018 SIDRA Model Results without Proposed Development

Figure 4-4 shows that the Bland Street / Eugene Street / Princes Highway Ramp Intersection is operating at satisfactory Level of Service "A" in both AM and PM peak periods without proposed development traffic.



Peak	LoS	Delay (sec)	DoS (v/c)
AM	A	10.3	0.231
PM	A	8.8	0.228

Figure 4-4 2018 SIDRA results (worst movement) for Bland Street / Eugene Street / Princes Highway Ramp Intersection

4.4.3.3 2028 SIDRA Model Results with Proposed Development Traffic

SIDRA modelling results with proposed development yield and projected traffic volumes at a 2% growth rate (See **Section 4.4.2**) for future year 2028 are illustrated in **Figure 4-5**. It is evident that the proposed development yield will not substantially affect the performance of Bland Street / Eugene Street / Princes Highway Ramp Intersection and the subject intersection will keep operating at LoS "A" in future year 2028.

It has been observed from comparison of **Figure 4-4** and **Figure 4-5** that Degree of Saturation and Delay corresponding to worst movements has slightly increased due to proposed development yield but overall intersection performance is expected to remain satisfactory and in compliance with RMS requirements.

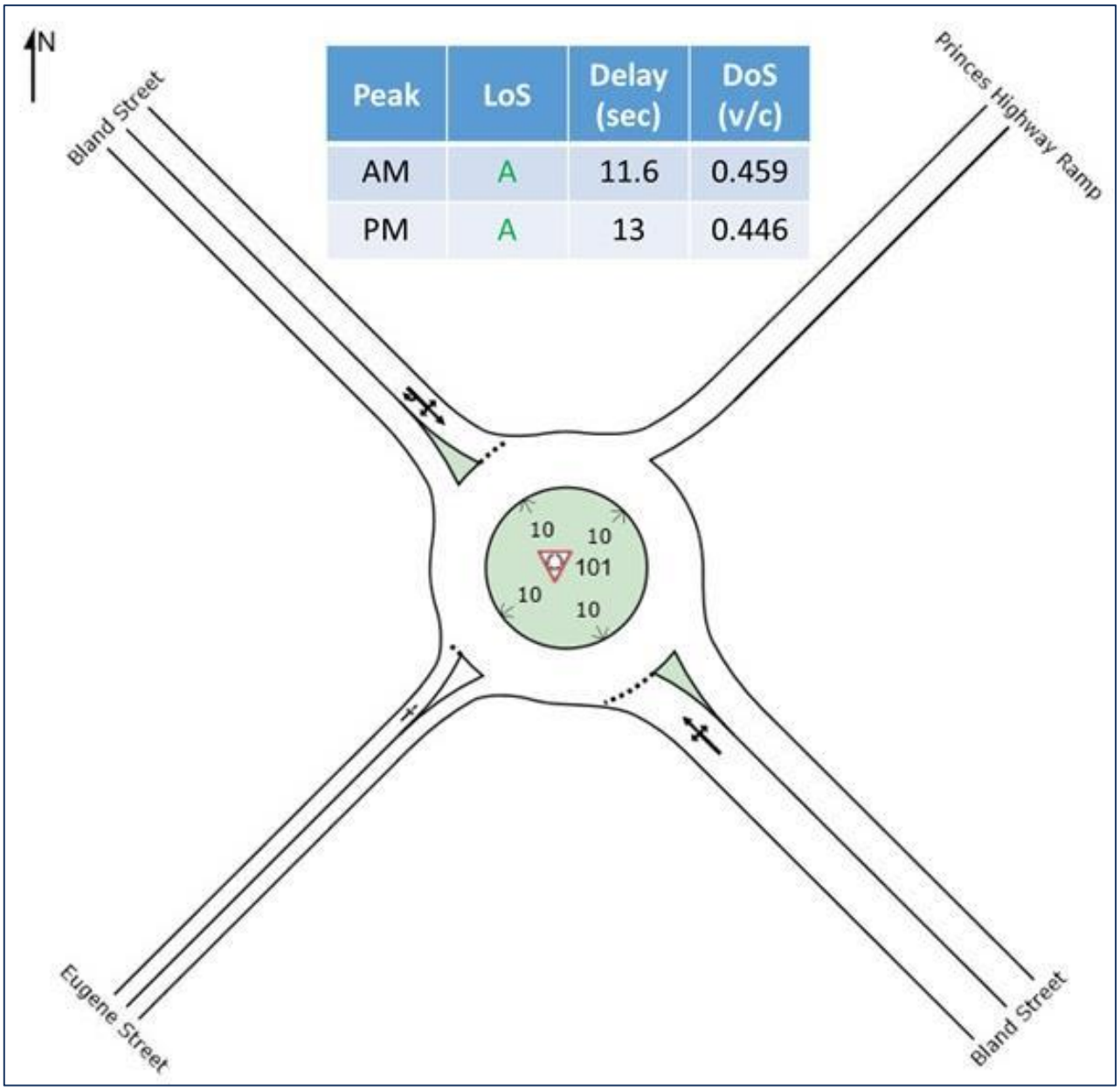


Figure 4-5 2028 SIDRA results (worst movement) for Bland Street / Eugene Street / Princes Highway Ramp Intersection

4.4.4 Assessment of Collins Street / Terralong Street intersection

4.4.4.1 Base Layout

As described in **Section 4.4.3.1**, latest Nearmap imagery was used to determine geometric parameters including lane widths, roundabout diameter, entry angle and approach / exit distance for base layout development using SIDRA. The basic Collins Street / Terralong Street intersection layout is illustrated in **Figure 4-6.**

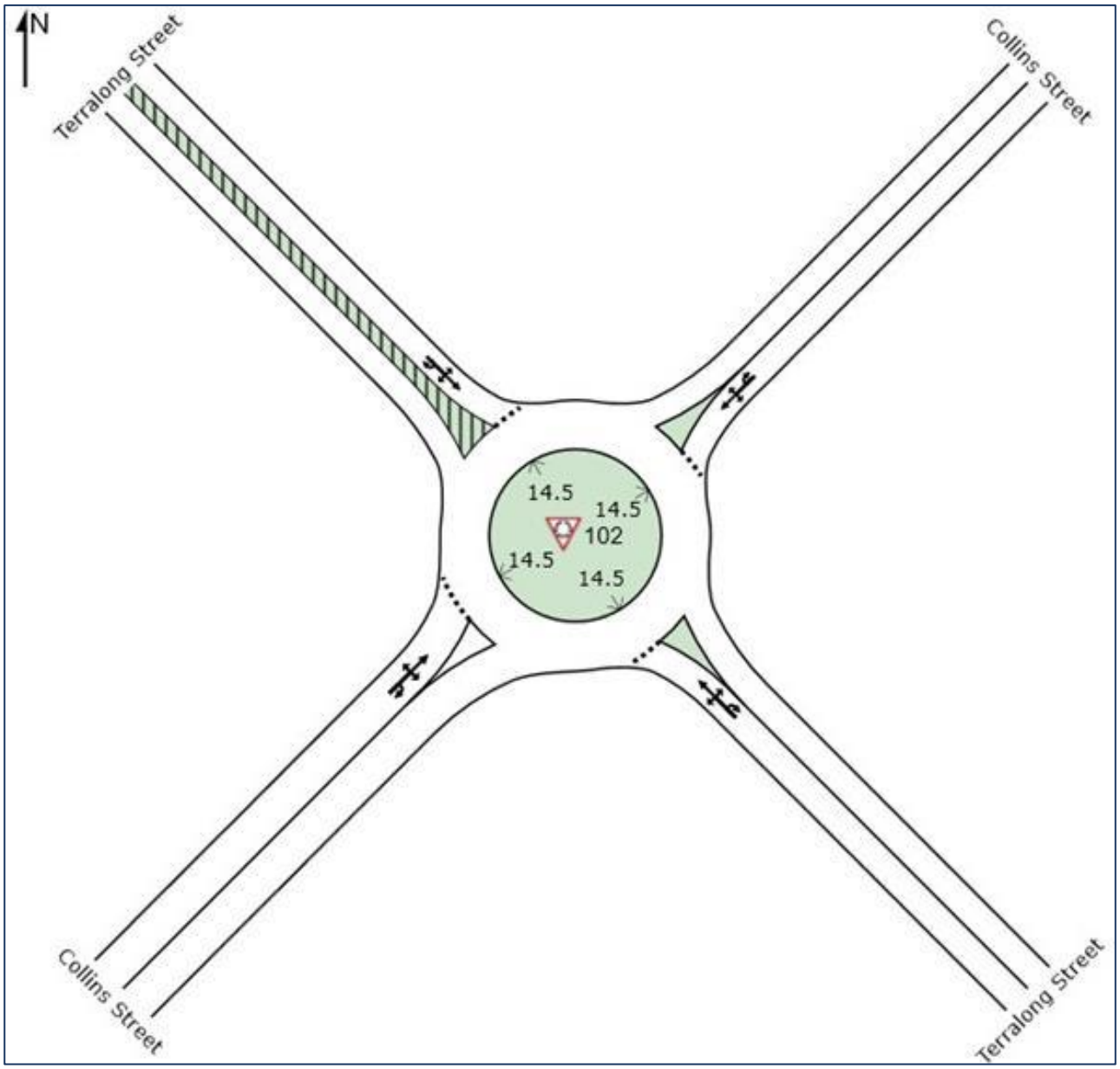


Figure 4-6 SIDRA intersection base layout of Collins Street / Terralong Intersection

4.4.4.2 2018 SIDRA Model Results without Proposed Development

As illustrated in **Figure 4-7**, Collins Street / Terralong Street intersection is currently operating at LoS “A” in both AM and PM peak periods without proposed development traffic. In line with RMS guidelines described in **Section 4.4.1**, the results corresponds to the worst movement and trip generation scenarios.

It is evident that the Degree of Saturation for worst movement is 0.571 and 0.495 in AM and PM peak respectively.

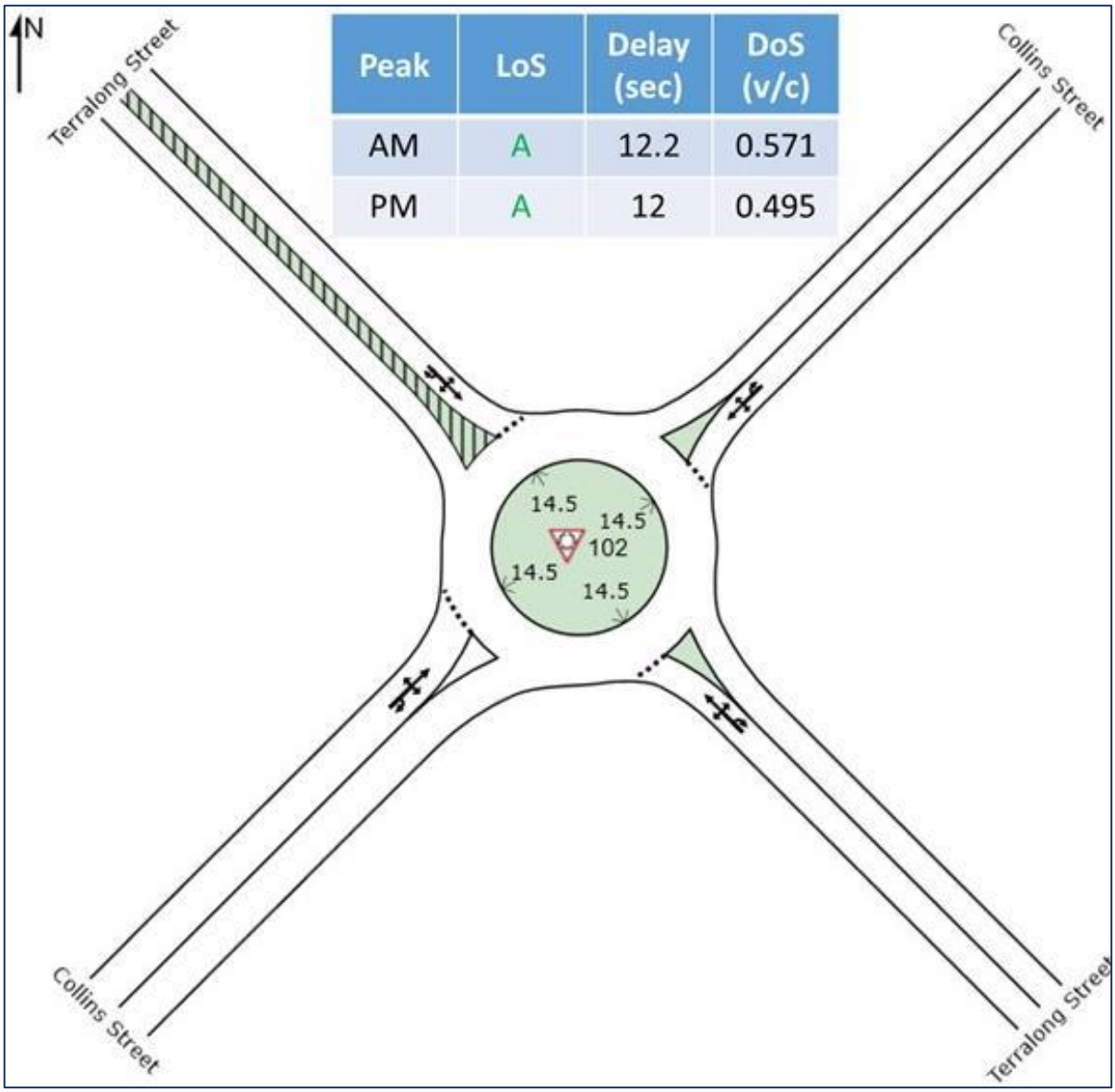
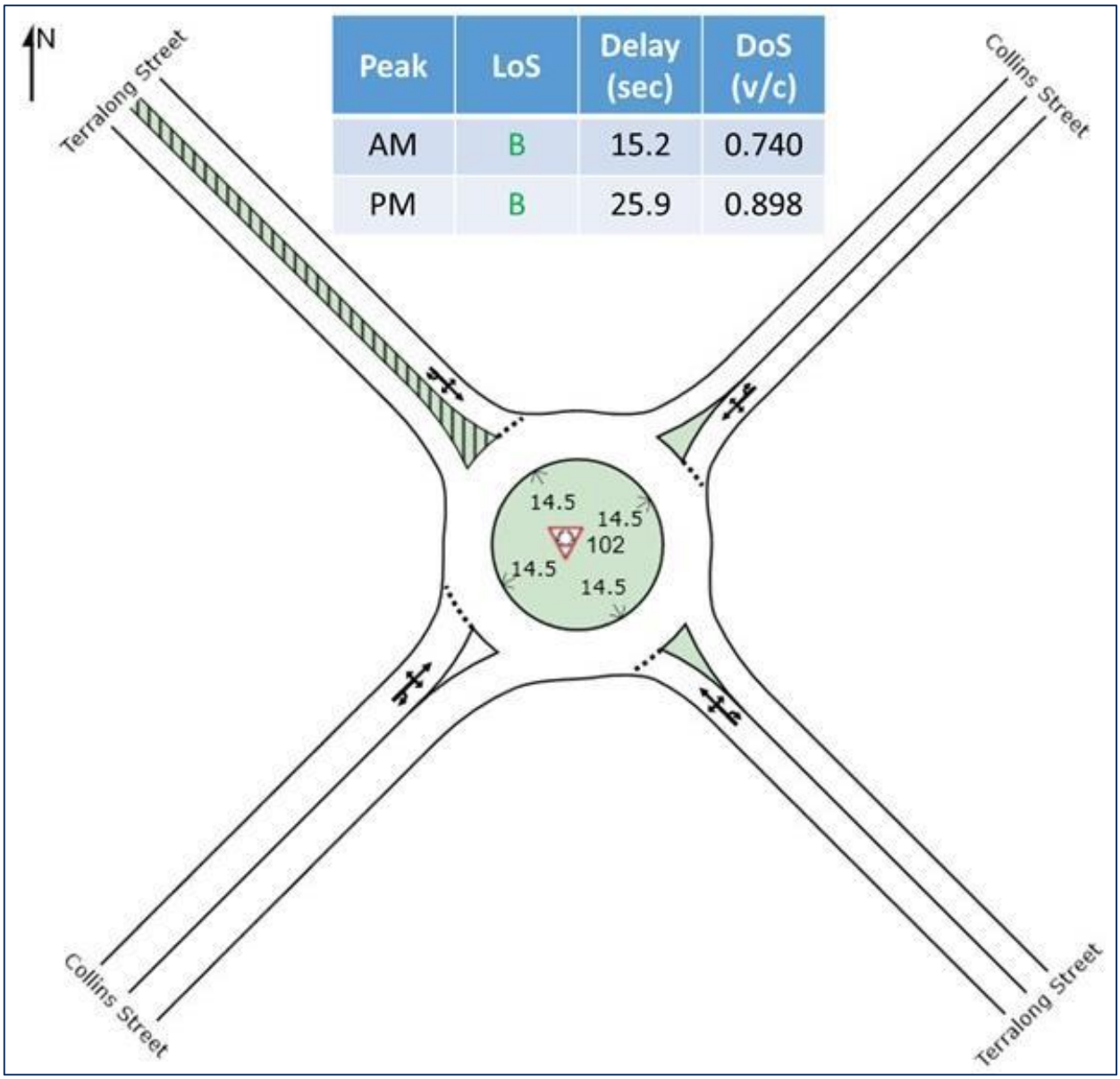


Figure 4-7 2018 SIDRA results (worst movement) for Collins Street / Terralong Street intersection

4.4.4.3 2028 SIDRA Model Results with Proposed Development Traffic

Figure 4-8 illustrates the future year 2028 SIDRA modelling results of Collins Street / Terralong Street intersection with proposed development traffic and projected traffic volumes at 2 % growth rate (See **Section 4.4.2**). It is expected that the Collins Street / Terralong Street intersection will be operating with worst movement having LoS “B” in both AM and PM peak thus indicating satisfactory performance in future year 2028.



Peak	LoS	Delay (sec)	DoS (v/c)
AM	B	15.2	0.740
PM	B	25.9	0.898

Figure 4-8 2028 SIDRA results (worst movement) for Collins Street / Terralong Intersection

It has been observed from comparison of Figure 4-7 and Figure 4-8 that the worst movement Degree of Saturation and Delay will increase but overall intersection performance is expected to remain satisfactory and in compliance with RMS requirements.

The detailed SIDRA outputs for 2018 model (without proposed development), 2018 model (with proposed development) and 2028 model (with proposed development) are provided in Appendix B.

5 Transport and Accessibility

5.1 Road Hierarchy

As illustrated in **Figure 3-1**, a concept-only internal road network plan has been drawn up in compliance with Section 16 and Control 61 of Kiama Development Control Plan (Chapter 7, 2012). The concept layout is preliminary only and undertaken to test feasibility and potential compliance.

The following four road types have been proposed in the development:

- 13.5m wide roads – Access Street
- 15m wide roads – Access Road
- 16.5m wide roads – Minor Collector
- 18.5m wide roads – Major Collector

A concept road hierarchy is illustrated in **Figure 5-1** and had accommodated for potential connection to Cedar Grove as considered recently by Council. It is noted that this northern portion and connectivity has been deleted from the Planning Proposal application as studies were considered collectively and used to refine and develop the first version of the Concept Plan.

The type of road to be along south-west boundary of the proposed development is currently under review by the planning team. However, most probably it will be a Minor or Major Collector Road. The concept road hierarchy will be further refined with feedback from the Council Stage 1 and Gateway assessment processes and **Figure 5-1** will be further updated prior to public exhibition.

The road hierarchy plan in this report is to demonstrate that a local hierarchy compliant with the Kiama DCp can potentially be achieved. The final road layout will be further refined with feedback from Council as the Planning Proposal and overall redevelopment program proceeds.

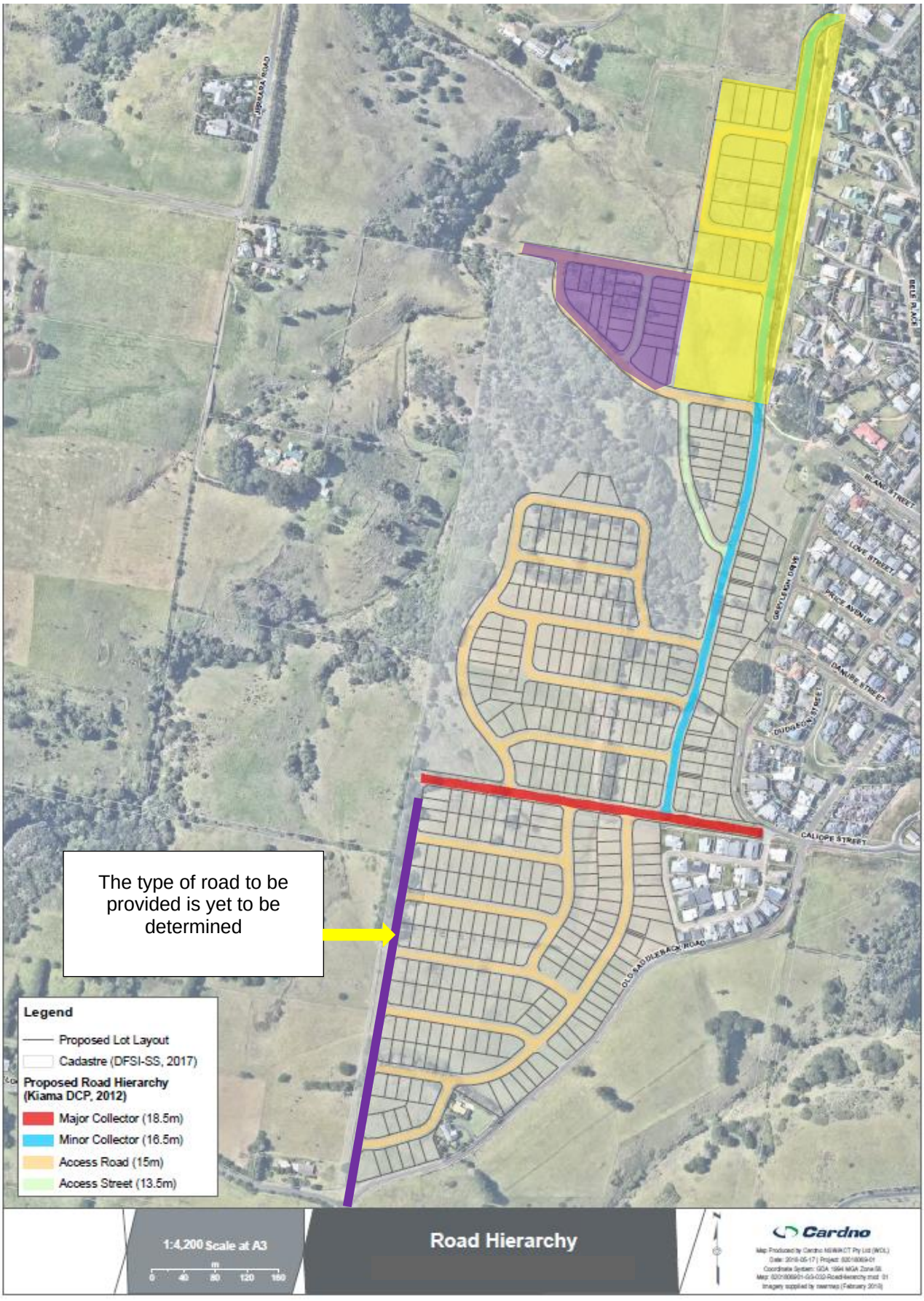


Figure 5-1 Potential Road Hierarchy Plan (yellow shared area excluded from site and purple area does not require public roads)

5.2 Public Transport Planning

As described in **Section 2.4** and illustrated in **Figure 2-5**, the existing nearest active bus stop is located at Manning Street nearly 1.7 km (22 minutes walking time) from the proposed development site. The existing public transport accessibility pattern is not compliant with the Kiama Development Control Plan's (Chapter 7, 2012) objective to ensure that the majority of residential allotments are within a 400 m walking distance from an existing or proposed new bus stop.

In order to ensure compliance with the Kiama Development Control Plan (Chapter 7, 2012), Cardno proposes three or four new bus stops to be implemented within the proposed development. Additionally, it is also proposed to make the existing inactive bus stop at Old Saddleback road operational to achieve 400 m walking catchment objective.

The proposed bus stop locations and walking catchment analysis is illustrated in **Figure 5-2**.

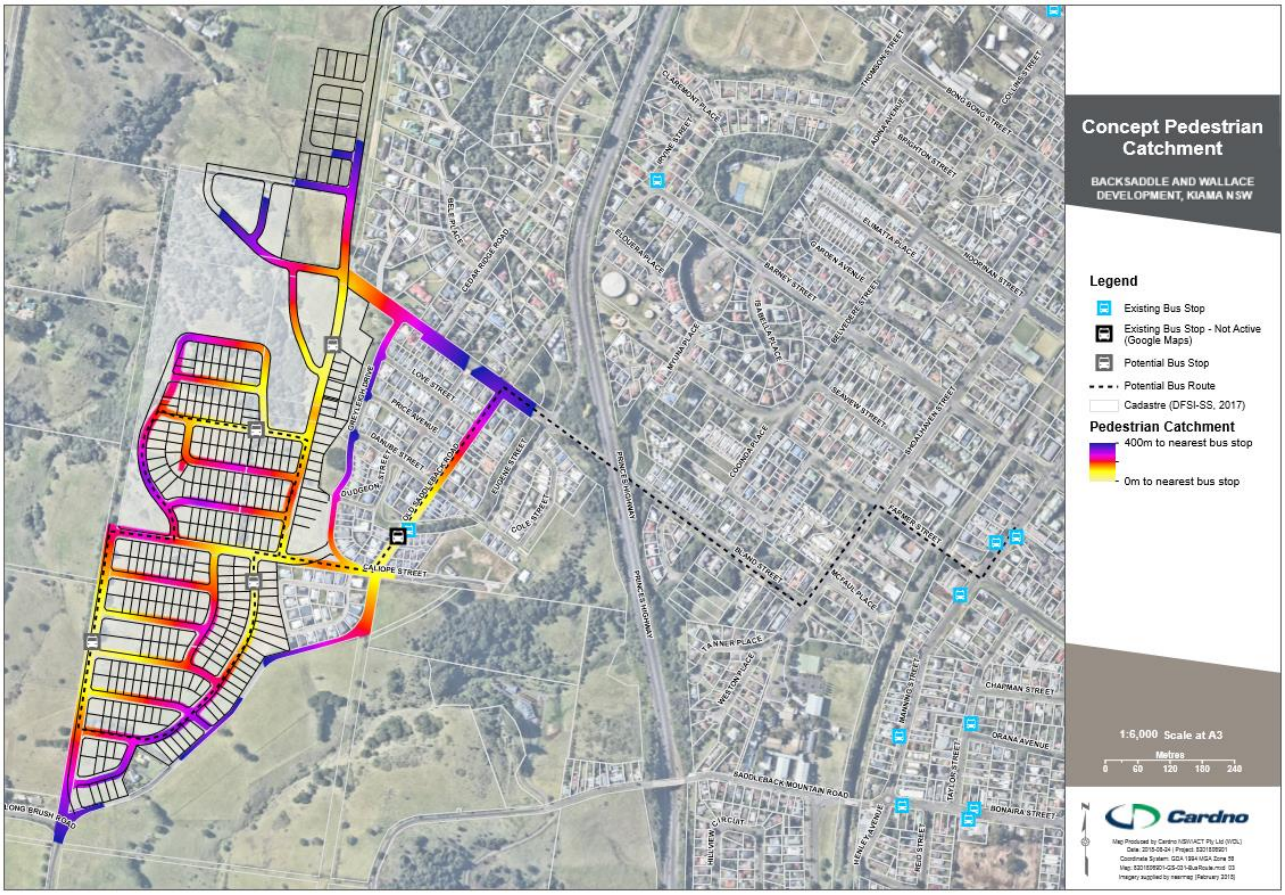


Figure 5-2 Proposed bus stop locations and walking catchment analysis

Shown in **Figure 5-2** more than 90% of the future residential areas of the site can be less than 400m walking catchment from the proposed bus stops thus complying with the objectives of Kiama Development Control Plan (Chapter 7, 2012).

The additional bus stop locations are not for the sole benefit of the development, but also provides a public benefit to existing residents by increasing the catchment of the current bus services in Kiama. As stated above, there is no bus service west of the highway. This project will create sufficient customer catchment to attract a bus service.

5.3 Pedestrian and Cycle Networks

It has been noted from the concept plan illustrated in **Figure 3-1** and **Section 5.1** that a comprehensive pedestrian and bicycle network will be developed in compliance with **Section 11** of the Kiama Development Control Plan (Chapter 7, 2012). It is also noted that provisions has been made in the road reserve widths to provide pedestrian footpath and shared paths in accordance with Control 61 of Kiama Development Control Plan (Chapter 7, 2012).

As per the Control 61 of Kiama Development Control Plan (Chapter 7, 2012), a 1.2 m wide footpath will be provided on one side of the Access Road, Minor Collector Road and Major Collector Road along with on-street shared path and 2.5 m wide shared path on minor collector road and major collector road respectively.

It is anticipated that the above-mentioned requirements of Kiama Development Control Plan (Chapter 7, 2012) will be incorporated during detailed design stage.

6 Conclusion

A summary of the main findings based on the Traffic Impact Study undertaken as part of this project is listed below:

- The proposed 400 dwelling development will generate 284 and 312 trips in AM and PM peak respectively along with 2960 daily trips.
- SIDRA results indicate that the proposed development will not have any substantial impact on Bland Street / Eugene Street / Princes Highway Ramp and Collins Street / Terralong Street intersections i.e. the intersections will keep operating at satisfactory Level of Service in future year 2028.
- At present, the nearest active bus stop at Manning Street is located at walking distance of 1.7 kilometres from the proposed development thus not complying with objectives of Kiama Development Control Plan (Chapter 7, 2012).
- Cardno has proposed new bus stops to ensure that the majority of new residential land and existing residential properties in West Kiama are within a 400 metre walking distance.
- A road hierarchy complying with Section 16 and Control 61 of Kiama Development Control Plan (Chapter 7, 2012) can be implemented
- Pedestrian and cyclist provisions can comply with **Section 11** and Control 61 of Kiama Development Control Plan (Chapter 7, 2012). A more detailed layout plan will be prepared at detailed design stage.

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APPENDIX A

Route Maps and Timetable

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APPENDIX B

Sidra Results

About Cardno

Cardno is an ASX200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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