TRAFFIC IMPACT ASSESSMENT

RESIDENTIAL PLANNING PROPOSAL

LOT 642 IN DP 1027231, LOT 100 IN DP 1044282 & LOT 644 IN DP 1027231

405 – 415 PACIFIC HIGHWAY, LAKE MUNMORAH, 425 PACIFIC HIGHWAY & 2 KANANGRA DRIVE, CRANGAN BAY

PREPARED FOR: DARKINJUNG LALC

APRIL 2018

16/136

PRELIMINARY TRAFFIC ASSESSMENT
DARKINJUNG LALC

PLANNING PROPOSAL
RESIDENTIAL DEVELOPMENT
LOT 642 IN DP 1027231, LOT 100 IN DP 1044282 & LOT 644 IN DP 1027231
405 – 415 PACIFIC HIGHWAY, LAKE MUNMORAH, 425 PACIFIC HIGHWAY & 2 KANANGRA DRIVE, CRANGAN BAY.

Intersect Traffic Pty Ltd (ABN: 43 112 606 952)

Address:
Shop 7 Metford Shopping Village
Cnr Chelmsford Drive & Tennyson Street
Metford NSW 2323
PO Box 268
East Maitland NSW 2323

Contact:
(Ph) 02 4936 6200
(Mob) 0423 324 188
Email: jeff@intersecttraffic.com.au

QUALITY ASSURANCE

This document has been prepared, checked and released in accordance with the Quality Control Standards established by Intersect Traffic Pty Ltd.

Issue	Date	Description	By
A	11/01/17	Draft	JG
B	09/04/18	Edit	JG
D	09/04/18	Final Proof / Client Amendments	JG
E	09/04/18	Approved	JG

Copyright © Intersect Traffic Pty Ltd

This document has been authorised by

Date   9th April 2018

CONTENTS

ATTACHMENTS

FIGURES

PHOTOGRAPHS

TABLES

1.0 INTRODUCTION

Intersect Traffic Pty Ltd (Intersect Traffic) has been engaged by Darkinjung Local Aboriginal Land Council (Darkinjung LALC) to prepare a Traffic Impact Assessment Report for a planning proposal for a residential development proposal on Lot 642 in DP 1027231 - 405 – 415 Pacific Highway, Lake Munmorah, Lot 100 in DP 1044282 – 425 Pacific Highway, Crangan Bay and Lot 644 in DP 1027231 – 2 Kanangra Drive, Crangan Bay. These three adjoining properties are located on the western and eastern side of Chain Valley Bay Road respectively at its intersection with the Pacific Highway. The proposal is likely to yield in the order of 545 low density residential lots and 4 residual lots.

The planning proposal currently includes the full width upgrading of Chain Valley Bay Road along the site frontage and the construction of (4) four new public roads accessing the residential subdivision off Chain Valley Bay at two proposed four way cross-intersections. The road upgrading / improvements are to be in accordance with Central Coast Council requirements. The proposed concept development plan is shown in **Attachment A**.

This report is required to support a planning proposal to Central Council as the consent authority for the rezoning of the subject land for low density residential development. It will allow the Council and NSW Roads and Maritime Services (NSW RMS) to assess the proposal in regard to its traffic impacts on the local and state road network.

This report presents the findings of the traffic assessment and includes the following;

1. An outline of the existing situation in the vicinity of the site.
2. An assessment of the traffic impacts of the proposed development including the predicted traffic generation and its impact on existing road and intersection capacities as well as road safety.
3. Determines any triggers for the provision of additional infrastructure.
4. Reviews parking, public transport, pedestrian and cycle way requirements for the proposed development, including assessment against Council's DCP and Australian Standard requirements.
5. Presentation of conclusions and recommendations.

2.0 SITE LOCATION

The subject site is located on the eastern and western sides of Chain Valley Bay Road, Lake Munmorah at its intersection with the Pacific Highway. The development area extends approximately 700 metres north of the Pacific Highway, 500 metres east of Chain Valley Bay Road and 460 metres west of Chain Valley Bay Road. The main residential, commercial and educational precincts of Lake Munmorah lie to the south-west of the site while the village of Chain Valley Bay lies to the north-west of the site. *Figure 1* below shows the site location from a local context.

The site contains two separate land titles as described below;

- ♦ Lot 642 in DP 1027231 – 405 – 415 Pacific Highway, Lake Munmorah;
- ♦ Lot 100 in DP 1044282 – 425 Pacific Highway, Crangan Bay; and
- ♦ Lot 644 in DP 1027231 – 2 Kanangra Drive, Crangan Bay.

Whilst the site has a total area of approximately 154 ha only part of the site is proposed for residential development with a development area of approximately 60 ha. The site is currently vacant rural land. Pursuant to the Wyong LEP (2013) the site is currently zoned E2 – Environmental Conservation and E3 – Environmental Management.

Photograph 1 shows the existing conditions at the site west of Chain Valley Bay Road while *Photograph 2* shows the existing conditions at the site east of Chain Valley Bay Road.
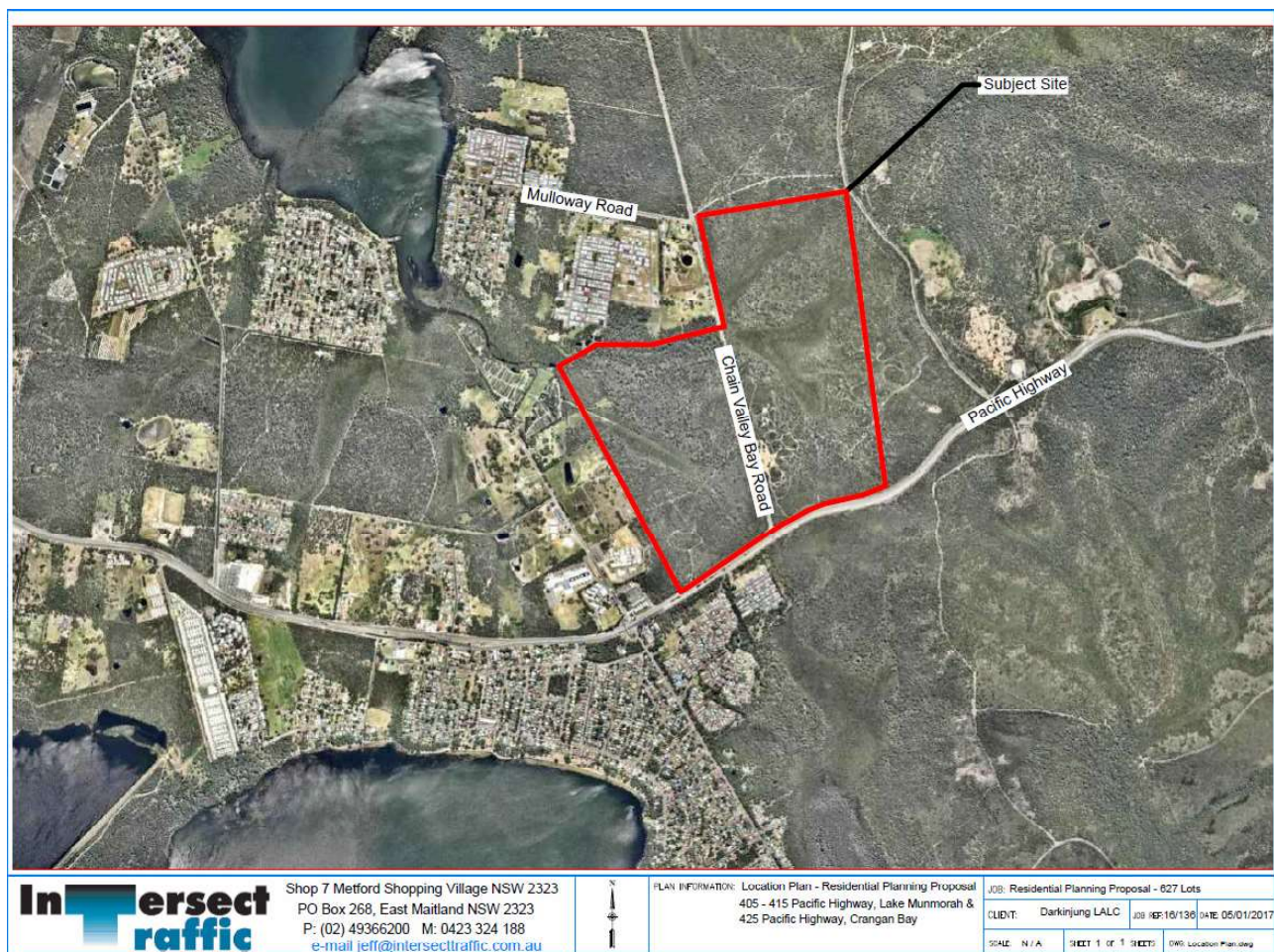
Figure 1 – Site Location

Photograph 1 – Development site west of Chain Valley Bay Road

Photograph 2 – Development site east of Chain Valley Bay Road

3.0 EXISTING ROAD NETWORK

3.1 Pacific Highway

The Pacific Highway would currently be classified as an arterial road under a functional road classification and as such is under the care and control of NSW RMS. The Pacific Highway is a major transport route and connects the southern suburbs of Newcastle and the Central Coast suburbs. In the vicinity of the site it is a median separated (dual carriageway) four lane two way road with each carriageway having a sealed width of approximately 12.5 metres. Lane widths are approximately 3.7 metres with break down / shoulder sealed widths of 4.0 metres (approx.) adjacent to the inside lane and 0.3 to 1.0 metre (approx.) adjacent to the outside lane. *Photograph 3* below shows the standard of the Pacific Highway in this location. At the time of inspection the Pacific Highway was in good condition and an 80 km/h speed zone applied in this location.

Photograph 3 – The Pacific Highway adjacent to Chain Valley Bay Road

3.2 Chain Valley Bay Road

Chain Valley Bay Road is a local collector road under the care and control of Central Coast Council. In the vicinity of the site it is two way two lane rural road with a sealed carriageway width of approximately 6.5 metres. Sealed lane widths vary between 3.0 and 3.5 metres and the grassed and / or gravel shoulders are generally 1.5 metres wide. Chain Valley Bay Road provides access to other local roads and to properties along its length and connects to the Pacific Highway. The intersection with the Pacific Highway is constructed as a rural channelised right turn (CHR) / auxiliary left turn (AUL) T- intersection with a U-turn facility for eastbound traffic.

An 80 km/h speed zoning applies to Chain Valley Bay Road adjacent to the site and through to the Pacific Highway intersection. At the time of inspection Chain Valley Road was found to be in fair condition. *Photograph 4* shows Chain Valley Bay Road near the northern end of the site while *Photograph 5* shows Chain Valley Bay Road at its intersection with the Pacific Highway.

Photograph 4 – Chain Valley Bay Road near the northern end of the site

Photograph 5 – Chain Valley Bay Road at its intersection with the Pacific Highway

4.0 ROAD NETWORK IMPROVEMENTS

No proposed road network improvements are known in the vicinity of the site that would increase the capacity of the road network. Upgrading works as part of Central Coast Council's and NSW RMS forward works programs may occur in the future.

5.0 TRAFFIC VOLUMES

To determine existing traffic volumes on the road network Northern Transport Planning and Engineering (NTPE) on behalf of Intersect Traffic undertook traffic counts at the Chain Valley Bay Road and Pacific Highway intersection during the AM and PM peak traffic periods on Tuesday 6th December 2016. Counts were undertaken from 7 am to 9 am and 4.00 pm to 5.00 pm with the peak hour periods found to be 7.30 am – 8.30 am and 4.00 pm to 5.00 pm. The manual count sheets are provided in **Attachment B.**

NTPE also installed traffic classifiers on each leg of this intersection and collected data for a period of 1 week from Thursday 8th December 2016. The classifier data determined the following peak hour traffic volumes;

- ◆ Pacific Highway west of Chain Valley Bay Road – 2097 vtph (AM) and 2386 vtph (PM)
- ◆ Chain Valley Bay Road north of the Pacific Highway – 251 vtph (AM) and 263 vtph (PM)

This data showed that on average the peak hour traffic volume recorded was 20 % higher on Chain Valley Bay Road in both the AM and PM peak, 6 % higher on the Pacific Highway in the PM peak but 11% lower in the AM peak than during the manual intersection count on Tuesday 6th December 2016. Therefore both the road mid-block capacity and intersection analysis have been adjusted allowing for a 20 % increase in traffic volumes on Chain Valley Bay Road in both the AM and PM peaks and a 6 % traffic volume increase in traffic volumes on the Pacific Highway in the PM peak.

The resultant 2016, 2021 and 2031 peak hour traffic volumes for the intersection determined from the collected traffic data and by adopting a background traffic growth rate of 1.5 % per annum are as shown below in **Table 1**;

Table 1 – Peak Hour Traffic Data – Pacific Highway / Chain Valley Bay Road Intersection

Road Section	2016 AM peak hour (vtph)	2016 PM peak hour (vtph)	2021 AM peak hour (vtph)	2021 PM peak hour (vtph)	2031 AM peak hour (vtph)	2031 PM peak hour (vtph)
Pacific Highway east of Chain Valley Bay Road	2164	2193	2331	2363	2706	2742
Pacific Highway west of Chain Valley Bay Road	2344	2529	2525	2725	2931	3162
Chain Valley Bay Road north of Pacific Highway	301	263	324	283	377	329

Further data collection on the local road network to update the 2016 counts will be carried as part of a traffic impact assessment for each stage of the proposal during the development application process should the project progress to that stage.

6.0 ROAD CAPACITY

The capacity of urban and rural roads is generally determined by the capacity of intersections. However, Tables 4.3, 4.4 & 4.5 of the RMS's *Guide to Traffic Generating Developments* provides some guidance on mid-block capacities for urban and rural roads and likely levels of service.

The criteria adopted for capacity assessment for the roads at the Pacific Highway / Chain Valley Bay Road intersection, are rural road, a level terrain, 5% heavy vehicles and 80 km/h speed zoning. Therefore the use of Table 4.5 above is warranted, noting the level of service (LoS), vehicles per hour, require factoring by 0.9 for a reduction of the speed travel from 100 km/h to 80 km/h. Table 4.5 is reproduced below.

Table 4.5
peak hour flow on two-lane rural roads (veh/hr)
(Design speed of 100km/hr)

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	760	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

The data for Table 4.5 assumes the following criteria:

- *terrain level* with 20% no overtaking.

- *rolling* with 40% no overtaking.

- *mountainous* with 60% no overtaking.

- 3.7 m traffic lane width with side clearances of at least 2m.

- 60/40 directional split of traffic.

Source: - RTA's Guide to Traffic Generating Developments (2002).

A desirable level of service on a rural road is generally considered to be a level of service (LoS) C or better however on an arterial road such as the Pacific Highway a LoS D is still considered acceptable. Utilising this criteria and from Table 4.5 above a LoS E for two way two lanes of flow occurs when mid-block traffic volumes exceed 2,500 vtph x 0.9 = 2,250 vtph. Therefore the two way two lane mid-block traffic volume threshold for a LoS D is 2,250 vph. This means the two way four lane mid-block traffic volume threshold for a LoS D for the Pacific Highway is approximately 4,500 vtph. Therefore it is considered that the Pacific Highway in the vicinity of the site as a four lane two way rural road has a two-way mid-block road capacity of at least 4,500 vtph.

Similarly, for a LoS C on a two way two lane flow occurs when mid-block traffic volumes exceed 1,550 x 0.9 vtph = 1,395 vtph therefore the two way two lane mid-block traffic volume threshold for a LoS C is 1,395 vtph. This means the two-way two lane mid-block traffic volume threshold for a LoS C for Chain Valley Bay Road is 1,395 vph.

From the traffic data sourced and calculated in *Section 5* and noting the likely technical two-way mid-block road capacities of the Pacific Highway and Chain Valley Bay Road are well in excess of the predicted 2021 and 2031 traffic volumes on the road network it is considered that the adjacent road network is operating within its technical capacity and has scope to cater for additional traffic generated by the new development.

7.0 ALTERNATE TRANSPORT MODES

Busways Central Coast operates public transport (bus) services to the area. Bus routes that pass the site are;

♦ Route 95 - Lake Haven - Gwandalan - Lake Munmorah - Morisset
♦ Route 95X - Lake Haven - Gwandalan - Lake Munmorah - Wyee
♦ Route 98 - Lake Haven - Blue Haven - Chain Valley Bay
♦ Route 99 - Lake Haven - Blue Haven - Gwandalan - Swansea - Charlestown

Route 95, 95X and 98 bus route services are provided on morning and evenings and operate on weekdays only. It provides transport to various nearby local suburbs and railway stations as well as to other bus service routes for bus and train travel to destinations further afield. Route 99 which provides a regular service to Swansea and Charlestown on weekdays also provides a very infrequent weekend only service for the proposed development.

The nearest bus stops are located on the Pacific Highway in front of the site approximately 180 metres west of Chain Valley Bay Road as shown in **Photograph 6**. The local bus route map (extract) is provided below in **Figure 2**.

Figure 2 – Local Bus Routes

There are no constructed pedestrian pathways or on or off road cycle paths in the vicinity of the site and pedestrian and cyclists would currently need to use the grass verges and / or share the outside travel lanes on the road network. However approximately 800 metres north west of the site a 2.5 metre wide concrete pathway on Mulloway Road (**Photograph 7**) commences 150 metres west of Chain Valley Bay Road, is approximately 650 metre long and ends at Trevally Avenue. In practice it operates as a shared cycleway / pedestrian path for access into Chain Valley Bay.

Photograph 6 – Bus stop Pacific Highway near the site.

Photograph 7 – Off-road cycle / pedestrian path in Mulloway Road north west of the site.

8.0 DEVELOPMENT PROPOSAL

The planning proposal involves the rezoning of the subject site to permit a residential development (R2 - Low density residential). The proposal is likely to yield in the order of 627 low density residential lots. The planning proposal currently includes the full width upgrading of Chain Valley Bay Road along the site frontage and the construction of (4) four new public roads accessing the residential subdivision off Chain Valley Bay at two proposed four way cross-intersections. The road upgrading / improvements are to be in accordance with Central Coast Council requirements. The proposed concept development plan is shown in **Attachment A**.

It would be expected that most of traffic generated by the development would utilise Chain Valley Bay Road to the Pacific Highway in their trip making as part of their origin / destination travel routes for all purposes during peak traffic periods.

All new internal roads, connections and other roadside infrastructure would be constructed to the requirements of Central Coast Council as per the Wyong Council DCP (2013) and engineering documentation. Detailed assessment of road upgrading requirements would need to be further assessed at development application stage should the rezoning proposal proceed to that stage of the approval process.

9.0 TRAFFIC GENERATION

The RMS' *Guide to Traffic Generating Development's* provides specific advice on the traffic generation potential of various land uses. However the RMS has released a Technical Direction (TDT 2013/4) releasing the results of updated traffic surveys and as a result amended land use traffic generation rates.

In regard to low density residential dwellings the following amended advice is provided within the Technical Direction.

Daily vehicle trips = 10.7 per dwelling in Sydney, 7.4 per dwelling in regional areas
Weekday average evening peak hour vehicle trips = 0.99 per dwelling in Sydney (maximum 1.39), 0.78 per dwelling in regional areas (maximum 0.90).
Weekday average morning peak hour vehicle trips = 0.95 per dwelling in Sydney (maximum 1.32), 0.71 per dwelling in regional areas (maximum 0.85).
*(The above rates do **not** include trips made internal to the subdivision, which may add up to an additional 25 %).*

Adopting an average rate approach for regional areas and assessing the residual lots except Lot 548 with a single dwelling on each the following additional development traffic from the proposed planning proposal can be calculated (rounded up)

- ◆ *Daily vehicle trips*　　　　*548 x 7.4 =* **4,056 vtpd**

- ◆ *AM weekday peak hour*　　*548 x 0.71 =* **390 vtph**

- ◆ *PM weekday peak hour*　　*548 x 0.78 =* **428 vtph**

10.0 TRIP DISTRIBUTION

Before carrying out any traffic assessment the peak hour traffic generated by the development needs to be distributed through the adjoining road network. This involves making a number of assumptions as to distribution patterns to and from the development. In distributing the generated peak hour traffic through the adjacent road network the following assumptions have been made for this site.

- In the AM peak period 30% of traffic will enter the site and 70% will exit the site – based on the existing traffic count at the Chain Valley Bay Road / Pacific Highway intersection.
- In the PM peak period 60% of traffic will enter the site and 40% will exit the site– based on the existing traffic count at the Chain Valley Bay Road / Pacific Highway intersection.
- 95% of traffic entering / exiting the site will be via Chain Valley Bay Road south.
- 5% of traffic entering / exiting the site will be via Chain Valley Bay Road north.
- Traffic distributed at the intersection of the Pacific Highway and Chain Valley Bay Road will have a 15% origin / destination via Pacific Highway east and 85% will have an origin / destination via Pacific Highway west which approximates current distributions.
- At the southern subdivision access 45 % of the lots will access to / from the west and 25 % of the lots will access to / from the east.
- At the northern subdivision access 20 % of the lots will access to / from the west and 10 % of the lots will access to / from the east.
- These assumptions will result in the trip distributions shown in **Figure 3** for the relevant traffic movements.
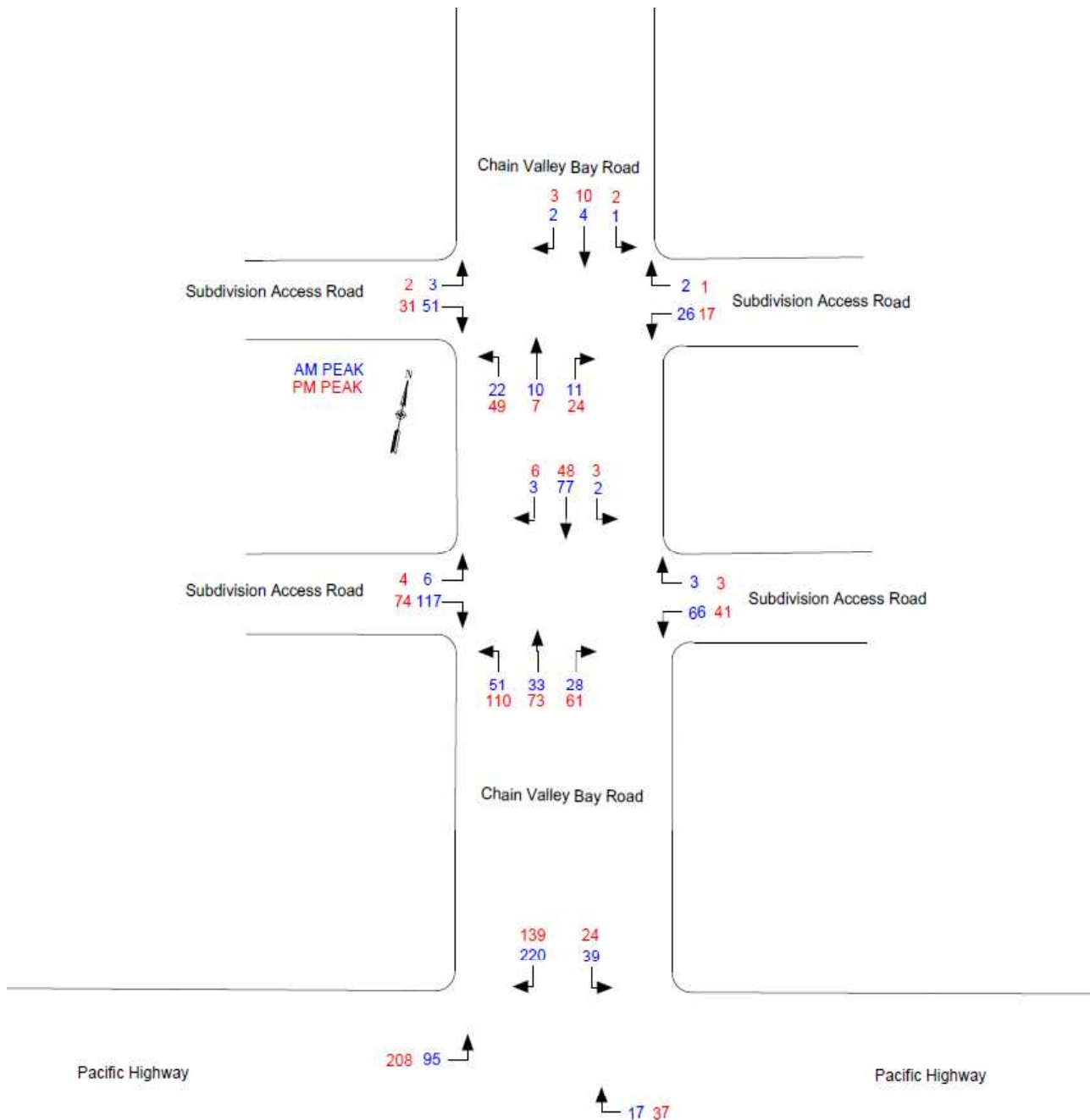
Figure 3 – Development Trip Distribution

11.0   OTHER KNOWN DEVELOPMENTS

The only other known significant development in the Chain Valley Bay area that will impact on traffic volumes in the study area is a residential planning proposal at 15 Mulloway Road, Chain Valley Bay (Lot 273 in DP 755266) proposed by Mr Noel Smith and resulting in an additional 174 residential lots in Chain Valley Bay. This proposal would increase traffic volumes on the road network by more than the normal 1.5 % background traffic growth and needs to be separately considered in this assessment. All other development in the area is at this stage only likely to be in-fill development catered for within the 1.5 % background traffic growth. Any new major developments proposed in the future would need to undertake their own traffic assessments that consider both the Mulloway Road planning proposal and the subject Darkinjung LALC planning proposal.

Intersect Traffic undertook the traffic assessment (October 2016) for the Mulloway Road planning proposal (Smith) and determined that the trips distribution for this proposal at the Pacific Highway / Chain Valley Bay Road intersection would be as shown in *Figure 4* below. This additional traffic from the Mulloway Road planning proposal has been included in all mid-block road and intersection analysis undertaken in this analysis to ensure the cumulative traffic impacts of both major developments are considered.
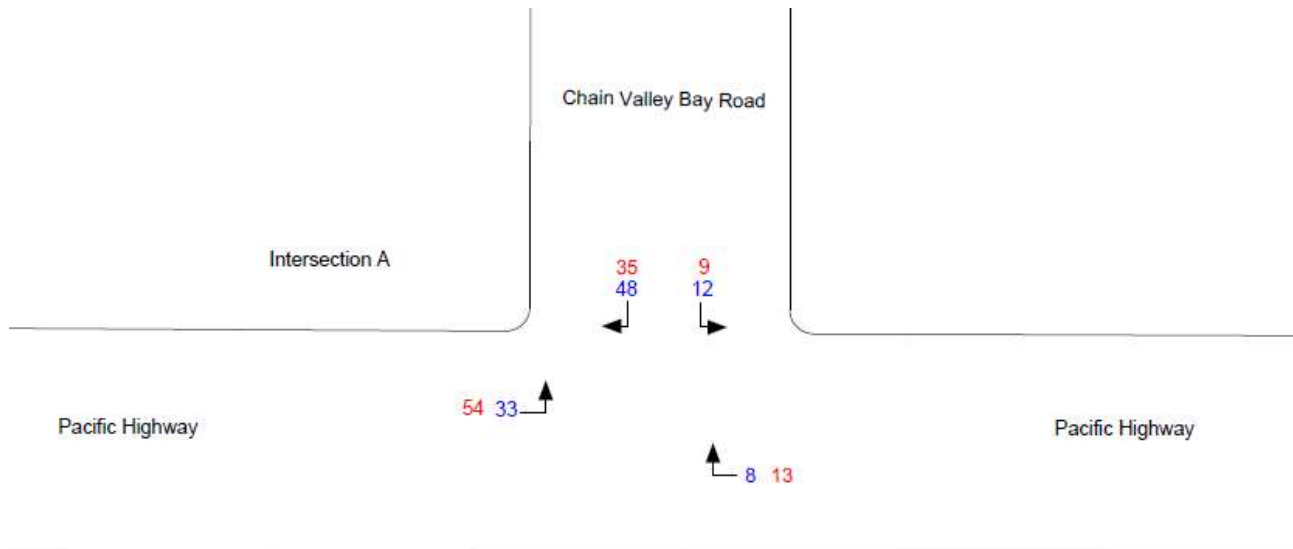
Figure 4 – Mulloway Road Planning Proposal Trip Distribution

12.0   TRAFFIC IMPACTS OF DEVELOPMENT

12.1   Road Network Capacity

It has previously been shown in **Section 6** of this report that the local road network is currently operating within its technical mid-block capacity.

The proposed planning proposal is likely to generate the following additional traffic on the local road network based on the trip distributions shown in **Figure 3**;

- ◆ The Pacific Highway west of Chain Valley Bay Road – 361 vtph in the AM peak and 397 vtph in the PM peak.
- ◆ The Pacific Highway east of Chain Valley Bay Road – 64 vtph in the AM peak and 70 vtph in the PM peak.
- ◆ Chain Valley Bay Road south of the Pacific Highway – 425 vtph in the AM peak and 467 vtph in the PM peak.

The Mulloway Road planning proposal is also likely to generate the following additional traffic on the local road network based on the trip distributions shown in **Figure 4**;

- ◆ The Pacific Highway west of Chain Valley Bay Road – 81 vtph in the AM peak and 89 vtph in the PM peak.
- ◆ The Pacific Highway east of Chain Valley Bay Road – 20 vtph in the AM peak and 21 vtph in the PM peak.
- ◆ Chain Valley Bay Road south of the Pacific Highway – 101 vtph in the AM peak and 110 vtph in the PM peak.

The addition of this traffic from both planning proposals onto the 2016 traffic volumes determined in **Section 5** will not result in the capacity thresholds for the local road network determined in **Section 6** to be reached.   Further consideration of likely 2021 and 2031 traffic volumes indicates the mid-block traffic capacity thresholds are still not reached as demonstrated in **Tables 2 and 3** below.

Table 2 - Road Capacity Assessment – AM post development

Road	Capacity (vtph)	Darkinjung LALC Development AM (vtph)	Mulloway Rd Development AM (vtph)	Post Development		
				2016 AM peak (vtph)	2021 AM peak (vtph)	2031 AM Peak (vtph)
Pacific Highway west of Chain Valley Bay Road	4500	315	81	2740	2921	3302
Pacific Highway east of Chain Valley Bay Road	4500	56	20	2321	2407	2782
Chain Valley Bay Road north of Pacific Highway	1350	371	101	773	796	849

Table 3 - Road Capacity Assessment – PM post development

Road	Capacity (vtph)	Darkinjung LALC Development PM (vtph)	Mulloway Rd Development PM (vtph)	Post Development		
				2016 PM peak (vtph)	2021 PM peak (vtph)	2031 PM Peak (vtph)
Pacific Highway west of Chain Valley Bay Road	4500	347	89	2965	3161	3598
Pacific Highway east of Chain Valley Bay Road	4500	61	21	2364	2445	2824
Chain Valley Bay Road north of Pacific Highway	1350	408	110	781	801	847

Therefore in analysing the assessment shown in **Table 2 and 3** above it can be concluded that the local road network subject to suitable intersection controls being in place has sufficient spare capacity to cater for the additional traffic generated by the proposed planning proposal.

It is noted that all roads within the planning proposal will need to be constructed in accordance with Central Coast Council's DCP requirements and some upgrading to existing roads may also be required particularly in terms of pavement and shoulder width along the site frontage on Chain Valley Bay Road for which the planning proposal results in additional traffic.

12.2 Intersection Capacity

12.2.1 Pacific Highway / Chain Valley Bay Road

In assessing intersection performance the main existing intersection of concern will be the Pacific Highway / Chain Valley Bay Road roundabout.

The impacts of the development are best assessed using the SIDRA intersection modelling software. This software package predicts likely delays, queue lengths and thus levels of service that will occur at intersections. Assessment is then based on the level of service requirements of the RMS shown below;

Table 4.2
Level of service criteria for intersections

Level of Service	Average Delay per Vehicle (secs/veh)	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 Roundabouts require other control mode	At capacity, requires other control mode

Source: - RTA's Guide to Traffic Generating Developments (2002).

Assumptions made in this modelling were;

- The intersection layout will remain as per current conditions.
- Traffic volumes used in the modelling were collected by NTPE on behalf of Intersect Traffic on Tuesday 6th December 2016 but increased by 20% on Chain Valley Bay Road for both the AM and PM peaks and 6 5 on the Pacific Highway in the PM peak.
- 2021 and 2031 traffic volumes have been predicted using a 1.5 % per annum background traffic growth rate.
- Traffic generated by the planning proposal is distributed as per **Figure 3.**
- Traffic generated by the Mulloway Road planning proposal (Smith) is as per *Figure 4.*

The results of the modelling are summarised in **Table 4** below showing the 'all vehicles' summary results except for the LoS for the give way intersection which is the worst result for any movement. The Sidra Movement Summary Tables are provided in **Attachment C.**

Table 4 – The Pacific Highway / Chain Valley Bay Road T Intersection – Sidra Modelling – Results Summary

Model Scenario	Degree of Saturation (v/c)	Average Delay (s)	LoS	95% Back of Queue Length (cars)
2016 AM give way	1.420	30.4	F	37.5
2016 PM give way	1.066	7.8	F	9.3
2016 AM traffic signals	0.876	21.8	B	18.1
2016 PM traffic signals	0.871	20.4	B	18.7
2021 AM - Darkinjung only	0.897	32.4	C	28
2021 AM - Darkinjung + Smith	0.910	37.6	C	32.2
2021 PM - Darkinjung only	0.896	22.9	B	29.6
2021 PM - Darkinjung + Smith	0.894	24.2	B	33.1
2031 AM - Darkinjung only	0.903	36.1	C	39.9
2031 AM - Darkinjung + Smith	0.900	39.9	C	45.1
2031 PM - Darkinjung only	0.897	24.1	B	38.1
2031 PM - Darkinjung + Smith	0.904	26.6	B	44.9

This modelling shows that the Pacific Highway / Chain Valley Bay Road intersection does not currently operate satisfactorily during both the AM and PM peak periods and obviously would continue to do so post development through to 2031. Whilst average delays, LoS and 95 % back of queue lengths for the majority of movements at the intersection remain at acceptable levels based on the RMS assessment criteria listed above the right turn movement from Chain Valley Bay Road has unacceptable average delays, LoS and 95 % back of queue lengths. The intersection therefore already requires upgrading to traffic signals.

However with conversion of the intersection to traffic signals the intersection will operate satisfactorily through to 2031 with the additional traffic from both this planning proposal and the Mulloway Road planning proposal. Average delays, LoS and 95 % back of queue lengths for all movements at the intersection remain at acceptable levels based on the RMS assessment criteria listed above.

As this intersection already fails the intersection should only be subject to contributions from the developer based on the proportion of traffic generated by the development against the total traffic on the intersection. Based on traffic volumes on Chain Valley Bay Road utilising 2031 AM volumes being the critical peak the contribution apportionments would be calculated as follows;

Existing 2031 AM peak traffic volume	= 377 vtph
Darkinjung LALC PP AM peak traffic volume	= 390 vtph
Mulloway Road PP AM peak traffic volume	= 101 vtph
Total	= 868 vtph

Darkinjung LALC contribution rate	= 390 / 868	= 45 %
Mulloway Road PP contribution rate	= 101 / 868	= 12 %
Road Authority contribution rate	= 377 / 868	= 43 %.

Contributions would need to be applied either through a S94 developer contributions plan, a voluntary planning agreement or as the Pacific Highway is a state classified highway via the State Infrastructure Contributions (SIC) levy.

12.2.2 Chain Valley Bay Road / Internal Subdivision Roads

Two new intersections are proposed on Chain Valley Bay Road for intersection access with both proposed as four way cross intersections. These intersections have also been modelled using the SIDRA intersection modelling program using the trip distributions determined in *Figure's 3 and 4* (includes Mulloway Road planning proposal) as well as the traffic data collected and described in *Section 5.* Note an internal subdivision trip movement was also assumed across the intersections representing 25 % of the external trip movements (as recommended by NSW RMS) in the leg.

The results for both intersections known as the northern and southern intersections are provided in *Tables 5 and 6* below while the Sidra Movement Summary Sheets are provided in *Attachment C.*

Table 5 – Chain Valley Bay Road / Southern access intersection – Sidra Modelling – Results Summary

Model Scenario	Degree of Saturation (v/c)	Average Delay (s)	LoS	95% Back of Queue Length (cars)
2021 AM	0.666	7.2	C	3.8
2031 AM	0.727	7.9	C	4.3
2021 PM	0.479	5.1	B	2.1
2031 PM	0.529	5.4	C	2.3

Table 6 – Chain Valley Bay Road / Northern access intersection – Sidra Modelling – Results Summary

Model Scenario	Degree of Saturation (v/c)	Average Delay (s)	LoS	95% Back of Queue Length (cars)
2021 AM	0.189	2.5	A	0.7
2031 AM	0.209	2.5	A	0.7
2021 PM	0.129	2.3	A	0.4
2031 PM	0.143	2.2	A	0.4

This modelling shows that both intersections which were modelled as channelised right turn (CHR) / auxiliary left turn (AUL) intersections on Chain Valley Bay Road will operate satisfactorily post development with average delays, LoS and 95 % back of queue lengths for all movements at the intersections remaining at acceptable levels based on the RMS assessment criteria through to 2031.

It is noted however that the southern access does operate with some level's of service (LoS) C and therefore there may be a road safety argument to construct this intersection as a roundabout which would also act as a traffic calming structure on Chain Valley Bay Road.

The assessment of safe intersection sight distance for the new subdivision intersection connections to Chain Valley Bay Road will be further reviewed at detailed design stage however from observation on-site the available sight distance at the proposed subdivision accesses on Chain Valley Bay Road would exceed the Austroad requirements (*Table 3.2 of Austroads Guide to Road Design – Part 4A Unsignalised and signalised intersections*) of approximately 180 metres for an 80 km/h design speed.

Overall it is concluded that subject to the Pacific Highway / Chain Valley Bay Road intersection being upgraded to a signal controlled intersection the planning proposal would not adversely impact on the efficiency of the local road network. As this intersection is already failing the upgrading of the intersection needs to be included within a suitable mechanism i.e. S94 developer contributions plan, voluntary planning agreement or SIC levy contribution as it is unreasonable to require the developer of this planning proposal to fully fund the upgrade.

Further it is concluded that both subdivision access intersections off Chain Valley Bay Road could be constructed as CHR / AUL cross intersections though there would be road safety advantages in constructing the southern access intersection as a roundabout.

12.3   Road Safety

A preliminary road safety assessment of the existing road network around the site identified the following issues;

- ◆ Difficulty in turning right out of Chain Valley Bay Road onto the Pacific Highway due to peak traffic volumes on the Highway, a restricted sight distance to the east and a short acceleration / merge storage lane at the intersection.
- ◆ The pavement condition and lack of sealed shoulders on Chain Valley Bay Road; and
- ◆ Poor night time delineation on Chain Valley bay Road due to lack of edge marking, guide posts and raised pavement markers.

It would however be expected that the upgrading of Chain Valley Bay Road along the site frontage required for this planning proposal would result in an improvement pavement, provision of sealed shoulders and improved night time delineation with edge marking, additional guide posts and raised pavement markers. Further the upgrading of the Pacific Highway / Chain Valley Bay Road intersection to a signalised intersection would resolve all road safety issues currently associated with this intersection.

It is therefore concluded that there are no road safety issues on the local road network that could not be overcome through normal road upgrading conditions for the planning proposal and as such road safety is not a constraint to the approval of the planning proposal.

12.4   On-site car parking

On-site car parking in accordance with Central Coast Council as per Wyong Council DCP 2013 needs to be provided within the planning proposal. Whilst this will be assessed in detail in future development applications for development on the individual allotments contained in the planning proposal a general assessment has been carried out in this report.

As the lot sizes are equal to or greater than the minimum lot size required by Central Coast Council it is considered that a dwelling with suitable covered and uncovered parking can be provided in accordance with the Wyong Council DCP (2013).

13.0   PEDESTRIAN & CYCLE FACILITIES

The planning proposal will generate pedestrian and bicycle traffic therefore a nexus would exist to provide additional facilities. It is also noted that to the north west of the site a shared pedestrian cycle pathway exists in Mulloway Road providing connection into Chain Valley Bay village area.

Therefore there would be some benefit and nexus to providing a shared pedestrian / cycle pathway within Chain Valley Bay Road (western side only) along the frontage of the planning proposal site. This pathway should also connect to the local bus stops on the Pacific Highway.

Internally the provision of concrete pedestrian pathways and cycleways would need to be in accordance with Central Coast Council's requirements as per the relevant DCP documentation but at least within all collector roads.

14.0   PUBLIC TRANSPORT FACILITIES

The proposed development is likely to generate additional public transport usage of the existing service to the area. However, it is noted that the majority of new residential lots will not be more than 400 metres away from the existing bus services using Chain Valley Bay Road. The only lots further than 400 metres away from Chain Valley Bay Road are the lots in the western side of the planning proposal. Therefore the subdivision road network should be designed such that a loop bus route is provided from the southern access intersection through to the far western section of the planning proposal to ensure all lots could be within 400 metres of a bus route. Whether the bus companies altered their routes to include the bus route loop for regular and / or school services will be subject to future demand.

Additional bus stops, seats and shelters will be required both on Chain Valley Bay Road and the bus route loop within the subdivision and further consultation with the provider of the local bus services i.e. Busways and NSW Transport will be required to determine the likely future bus routes, stops and facilities should a future development application be lodged for development of the planning proposal.

15.0   CONCLUSIONS

This traffic impact assessment for a planning proposal for residential development on Lot 642 in DP 1027231 - 405 – 415 Pacific Highway, Lake Munmorah, Lot 100 in DP 1044282 – 425 Pacific Highway, Crangan Bay and Lot 644 in DP 1027231 – 2 Kanangra Drive, Crangan Bay has concluded;

- Existing traffic volumes on the local road network are within the technical mid-block road capacities determined by Austroads and the NSW Roads and Maritime Services (RMS) therefore the local road network has capacity to cater for additional traffic associated with new development in the area.

- The planning proposal when fully developed is likely to generate an additional 4,056 vtpd; or 390 vtph during the AM peak and 428 vtph during the PM peak traffic periods.

- The local road network currently has sufficient spare capacity to cater for the traffic generated by this development without adversely impacting on current levels of service experienced by motorists on the local road network.

- Sidra modelling of the Pacific Highway / Chain Valley Bay Road intersection has shown that the right hand turn movement onto the Pacific Highway from Chain Valley Bay Road currently operates with unsatisfactory average delays, LoS and 95 % back of queue lengths which is only exacerbated by the proposed development.   Therefore this intersection will be required to be upgraded to a signal controlled intersection before further development occurred. Provision of a signal controlled intersection will result in satisfactory operation of the local road network through to 2031 with all known developments in the area considered.

- As the Pacific Highway / Chain Valley Bay Road intersection is currently 'failing' the upgrading of the intersection would also provide benefit to existing road users and future developments in the area. It would therefore be unreasonable to expect the developer to fully fund the development and the upgrading of the intersection should be contained within a Section 94 developer contributions plan, voluntary planning agreement or through a SIC levy providing a mechanism for a fair and reasonable contribution to the intersection upgrade from all developers who would gain benefit from the intersection upgrade as well as the road authority for existing traffic.

- Both subdivision access intersections off Chain Valley Bay Road could be constructed as CHR / AUL cross intersections as satisfactory operation of these intersections has been demonstrated through Sidra modelling of these intersections. However, there would be road safety advantages in constructing the southern access intersection as a roundabout.

- The available sight distance at the proposed subdivision access connections on Chain Valley Bay Road would exceed the Austroad requirements (*Table 3.2 of Austroads Guide to Road Design – Part 4A Unsignalised and signalised intersections*) of approximately 180 metres for an 80 km/h design speed.

- The proposed new lots within the planning proposal are considered large enough to accommodate the car parking requirements of Central Coast Council, the Wyong Council DCP 2013.

- There are no road safety issues on the local road network that could not be overcome through normal road upgrading conditions for the planning proposal and as such road safety is not a constraint to the approval of the planning proposal.

- The proposed subdivision will generate pedestrian and cycle traffic therefore a nexus would exist to provide additional facilities. There would be some benefit and nexus to providing a shared pedestrian / cycle pathway within Chain Valley Bay Road (western side only) along the frontage of the planning proposal site. This pathway should also connect to the local bus stops on the Pacific Highway. Internally the provision of concrete pedestrian pathways

and cycleways would need to be in accordance with Central Coast Council's requirements as per the relevant DCP documentation but at least within all collector roads.

♦ The site is likely to generate increased usage for the existing public transport services. Therefore the subdivision road network should be designed such that a loop bus route is provided from the southern access intersection through to the far western section of the planning proposal to ensure all lots could be within 400 metres of a bus route. The need for the existing bus routes to be diverted through the new development will need to be the subject of future consultation with Central Coast Council, Transport NSW and Busways should the planning proposal proceed to development application stage.

♦ Additional bus stops, seats and shelters will be required both on Chain Valley Bay Road and the bus route loop within the subdivision.

16.0 RECOMMENDATION

Having carried out this preliminary traffic impact assessment for the proposed planning proposal for a residential development Lot 642 in DP 1027231 - 405 – 415 Pacific Highway, Lake Munmorah, Lot 100 in DP 1044282 – 425 Pacific Highway, Crangan Bay and Lot 644 in DP 1027231 – 2 Kanangra Drive, Crangan Bay it is recommended that the proposal can be supported from a traffic impact perspective. Subject to the upgrading of the Pacific Highway / Chain Valley Bay Road intersection to a signalised intersection it will not adversely impact on the local and state road network and complies with all relevant Central Coast Council, Austroads, and NSW Roads and Maritime Services (RMS) requirements.

JR Garry BE (Civil), Masters of Traffic
Director
Intersect Traffic Pty Ltd

ATTACHMENT A
Development Plans

ATTACHMENT B
Traffic Count Data

6/12/2016 - PACIFIC HWY / CHAIN VALLEY BAY RD, FREEMANS

8:30 <<< HOUR ENDING   Tuesday

Summary:

PACIFIC HWY / CHAIN VALLEY BAY RD	
2239	Total Light Vehicles
120	Total Heavy Vehicles
0	Total Pedestrians

tpe Quality Surveys
172571

CHAIN VALLEY BAY RD

PACIFIC HWY

12	0

0	3	0
0	131	17
9	8	7

PACIFIC HWY

1	44	6
2	898	57
3	11	0

0
10

0	0	6
2	7	5
52	1131	4

0
11

N

44	Light Vehicles
6	Heavy Vehicles
0	Pedestrian

5/12/2016 - PACIFIC HWY / CHAIN VALLEY BAY RD, FREEMANS

17:00 <<< HOUR ENDING   Monday

Summary:

PACIFIC HWY / CHAIN VALLEY BAY RD	
2196	Total Light Vehicles
67	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys

172571

CHAIN VALLEY BAY RD

12 | 0

0	1	0
0	66	14
9	8	7

PACIFIC HWY

1	110	6
2	1009	21
3	11	0

0

10

PACIFIC HWY

0

11

0	0	6
1	21	5
38	965	4

N

110	Light Vehicles
6	Heavy Vehicles
0	Pedestrian
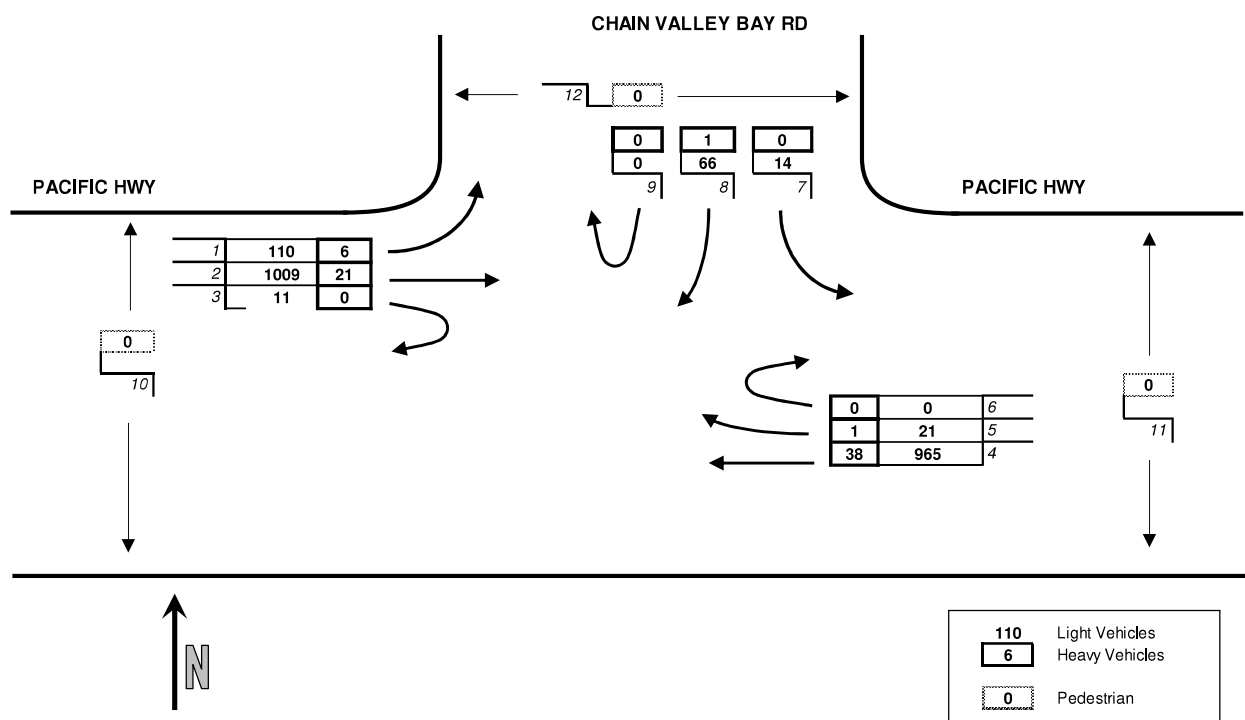
Site 4   Pacific Hwy - 300m N of Elizabeth Bay Dr   Northbound

Day Time	Thu 08/12/16	Fri 09-12-16	Sat 10-12-16	Sun 11-12-16	Mon 12-12-16	Tue 13-12-16	Wed 14-12-16	W/Day Ave.	W/End Ave.	7 Day Ave
0:00	56	74	106	177	54	77	103	73	142	92
1:00	46	44	72	57	20	72	68	50	65	54
2:00	28	26	37	44	18	33	26	26	41	30
3:00	36	36	48	46	35	40	44	38	47	41
4:00	93	94	62	69	87	98	101	95	66	86
5:00	313	328	147	98	296	295	322	311	123	257
6:00	762	694	261	223	737	770	756	744	242	600
7:00	937	897	474	262	904	944	935	923	368	765
8:00	809	908	608	451	795	912	852	855	530	762
9:00	720	758	787	723	689	768	738	735	755	740
10:00	774	796	947	936	706	736	754	753	942	807
11:00	849	859	1048	1101	790	769	771	808	1075	884
12:00	811	845	1067	1031	767	791	764	796	1049	868
13:00	774	808	898	897	766	787	773	782	898	815
14:00	958	1149	943	873	977	962	1019	1013	908	983
15:00	1248	1244	904	864	1136	1171	1216	1203	884	1112
16:00	1163	1290	1021	877	1168	1256	1146	1205	949	1132
17:00	1205	1315	894	837	1246	1196	1198	1232	866	1127
18:00	815	874	694	620	664	677	698	746	657	720
19:00	480	598	451	433	449	487	481	499	442	483
20:00	390	451	346	346	317	352	384	379	346	369
21:00	330	360	297	206	220	289	233	286	252	276
22:00	225	292	351	164	183	162	184	209	258	223
23:00	151	213	222	103	130	123	134	150	163	154
Total	**13973**	**14953**	**12685**	**11438**	**13154**	**13767**	**13700**	**13909**	**12062**	**13381**
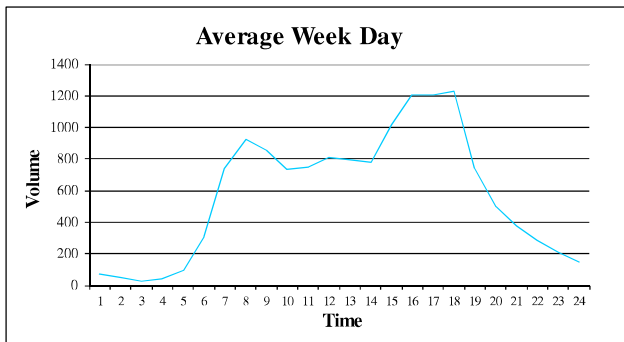
Average Week Day

Summary			
	from	**to**	
AM Peak	7:00 AM	8:00 AM	**944**
PM Peak	5:00 PM	6:00 PM	**1315**
	Week Day Average		**13909**
	Weekend Day Average		**12062**
	7 Day Average		**13381**

Site 4   Pacific Hwy - 300m N of Elizabeth Bay Dr   **Southbound**

Day Time	Thu 08/12/16	Fri 09-12-16	Sat 10-12-16	Sun 11-12-16	Mon 12-12-16	Tue 13-12-16	Wed 14-12-16	W/Day Ave.	W/End Ave.	7 Day Ave
0:00	38	55	106	156	38	45	48	45	131	69
1:00	34	31	49	85	30	34	40	34	67	43
2:00	39	33	37	36	28	48	40	38	37	37
3:00	77	67	48	31	73	71	86	75	40	65
4:00	245	227	120	79	250	245	233	240	100	200
5:00	581	502	206	131	643	594	610	586	169	467
6:00	882	813	423	255	899	887	926	881	339	726
7:00	1098	1031	521	426	1117	1153	1123	1104	474	924
8:00	1135	1105	820	665	1107	1165	1137	1130	743	1019
9:00	896	927	934	876	893	907	926	910	905	908
10:00	781	900	1082	1027	783	769	795	806	1055	877
11:00	777	899	937	1071	823	776	835	822	1004	874
12:00	788	778	916	992	724	817	770	775	954	826
13:00	821	919	854	890	804	829	767	828	872	841
14:00	957	954	856	1013	876	941	962	938	935	937
15:00	954	1061	901	1100	1024	996	997	1006	1001	1005
16:00	1014	1096	900	919	1007	1013	1018	1030	910	995
17:00	1014	1048	738	851	960	1036	1046	1021	795	956
18:00	703	800	574	563	635	694	671	701	569	663
19:00	374	421	390	429	350	360	315	364	410	377
20:00	298	326	285	337	249	290	294	291	311	297
21:00	316	274	296	247	177	226	220	243	272	251
22:00	191	223	228	136	145	131	146	167	182	171
23:00	91	172	244	63	69	68	71	94	154	111
Total	14104	14662	12465	12378	13704	14095	14076	14128	12422	13641

Average Week Day

Summary

	from	to	
AM Peak	8:00 AM	9:00 AM	1165
PM Peak	4:00 PM	5:00 PM	1096
Week Day Average			14128
Weekend Day Average			12422
7 Day Average			13641

Site 5 Chain Valley Bay Rd - 200m W of Pacific Hwy   Eastbound
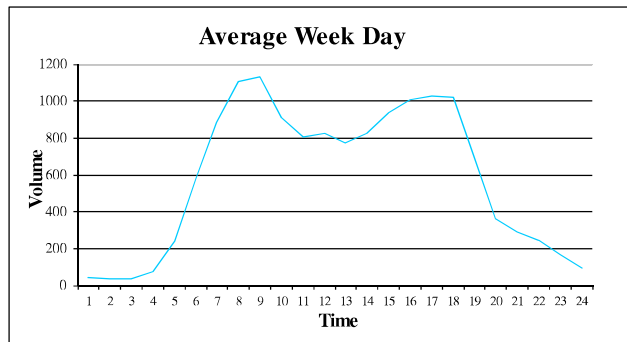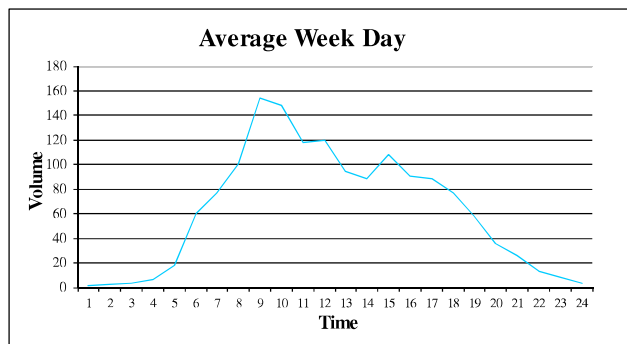
Day Time	Thu 08/12/16	Fri 09-12-16	Sat 10-12-16	Sun 11-12-16	Mon 12-12-16	Tue 13-12-16	Wed 14-12-16	W/Day Ave.	W/End Ave.	7 Day Ave
0:00	0	0	4	7	1	2	4	1	6	3
1:00	0	2	3	6	2	1	5	2	5	3
2:00	2	2	3	5	2	6	5	3	4	4
3:00	6	9	2	2	5	8	5	7	2	5
4:00	22	15	11	7	17	19	19	18	9	16
5:00	56	49	17	12	62	71	61	60	15	47
6:00	89	73	38	27	74	73	75	77	33	64
7:00	86	95	54	54	103	108	108	100	54	87
8:00	164	145	115	78	143	171	149	154	97	138
9:00	131	154	134	130	133	151	172	148	132	144
10:00	123	131	156	123	105	128	103	118	140	124
11:00	109	121	102	126	130	108	132	120	114	118
12:00	97	105	99	75	89	83	99	95	87	92
13:00	76	94	89	80	100	88	86	89	85	88
14:00	122	92	76	80	103	113	111	108	78	100
15:00	85	89	75	65	95	91	92	90	70	85
16:00	88	96	70	64	88	76	95	89	67	82
17:00	71	90	76	66	67	78	80	77	71	75
18:00	65	56	71	58	52	62	58	59	65	60
19:00	44	39	33	30	34	33	30	36	32	35
20:00	15	22	26	35	26	35	30	26	31	27
21:00	12	25	18	7	10	14	5	13	13	13
22:00	12	13	15	7	3	5	7	8	11	9
23:00	3	10	18	3	3	1	2	4	11	6
Total	**1478**	**1527**	**1305**	**1147**	**1447**	**1525**	**1533**	**1502**	**1226**	**1423**

Average Week Day

Summary

	from	to	
AM Peak	9:00 AM	10:00 AM	**172**
PM Peak	2:00 PM	3:00 PM	**122**
Week Day Average			**1502**
Weekend Day Average			**1226**
7 Day Average			**1423**

Site 5   Chain Valley Bay Rd - 200m W of Pacific Hwy   **Westbound**

| Day Time	Thu 08/12/16	Fri 09-12-16	Sat 10-12-16	Sun 11-12-16	Mon 12-12-16	Tue 13-12-16	Wed 14-12-16	W/Day Ave.	W/End Ave.	7 Day Ave
0:00	3	6	13	15	5	6	5	5	14	8
1:00	5	2	8	4	1	3	5	3	6	4
2:00	2	3	5	6	4	6	3	4	6	4
3:00	2	3	3	9	0	1	2	2	6	3
4:00	2	1	5	3	1	3	1	2	4	2
5:00	6	14	4	4	9	2	4	7	4	6
6:00	41	40	13	13	37	35	45	40	13	32
7:00	44	47	28	26	52	54	43	48	27	42
8:00	59	73	49	39	64	69	68	67	44	60
9:00	71	85	83	75	65	88	79	78	79	78
10:00	116	79	113	93	101	107	94	99	103	100
11:00	124	112	119	107	111	128	121	119	113	117
12:00	112	132	113	87	101	112	128	117	100	112
13:00	117	112	107	92	123	112	105	114	100	110
14:00	120	133	112	97	140	122	129	129	105	122
15:00	136	152	111	110	155	165	149	151	111	140
16:00	153	167	96	102	156	151	164	158	99	141
17:00	123	128	87	91	142	130	136	132	89	120
18:00	87	86	78	74	72	92	91	86	76	83
19:00	61	71	54	67	57	69	57	63	61	62
20:00	48	44	37	43	42	43	62	48	40	46
21:00	38	36	35	23	28	41	35	36	29	34
22:00	19	31	39	13	16	18	18	20	26	22
23:00	14	18	23	5	13	11	8	13	14	13
Total	1503	1575	1335	1198	1495	1568	1552	1539	1267	1461
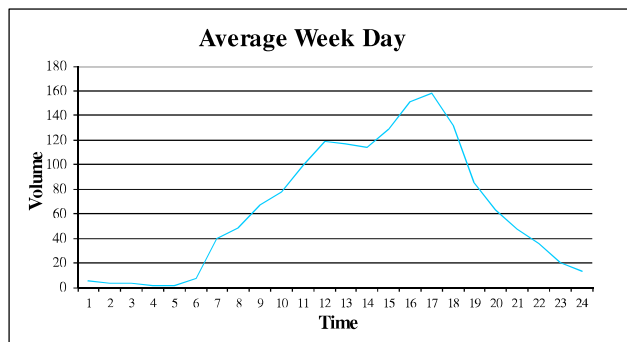
Average Week Day

Summary

	from	to	
AM Peak	11:00 AM	12:00 PM	**128**
PM Peak	4:00 PM	5:00 PM	**167**
Week Day Average			**1539**
Weekend Day Average			**1267**
7 Day Average			**1461**

ATTACHMENT C
Sidra Movement Summary Tables

MOVEMENT SUMMARY

▽ **Site: 2016 AM**

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Giveway / Yield (Two-Way)

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
Movement Performance - Vehicles											
East: Pacific Highway											
5	T1	1245	4.4	0.328	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
6	R2	12	18.2	0.066	25.5	LOS B	0.2	1.6	0.82	0.93	46.0
Approach		1257	4.5	0.328	0.3	NA	0.2	1.6	0.01	0.01	79.3
North: Chain Valley Bay Road											
7	L2	22	0.0	0.029	9.5	LOS A	0.1	0.7	0.48	0.71	62.5
9	R2	169	1.9	1.420	445.0	LOS F	37.5	266.7	1.00	2.66	7.4
Approach		192	1.6	1.420	394.8	LOS F	37.5	266.7	0.94	2.43	8.3
West: Pacific Highway											
10	L2	63	10.0	0.036	7.1	LOS A	0.0	0.0	0.00	0.63	62.1
11	T1	1005	6.0	0.268	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12u	U	12	0.0	0.100	38.2	LOS C	0.3	2.1	0.90	0.97	41.8
Approach		1080	6.1	0.268	0.9	NA	0.3	2.1	0.01	0.05	77.8
All Vehicles		2528	5.0	1.420	30.4	NA	37.5	266.7	0.08	0.21	47.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2016 AM

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 48 seconds (Practical Cycle Time)

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
Movement Performance - Vehicles											
East: Pacific Highway											
5	T1	1245	4.4	0.876	24.7	LOS B	18.1	131.4	1.00	1.06	51.9
6	R2	12	18.2	0.056	28.5	LOS B	0.3	2.1	0.91	0.68	44.3
Approach		1257	4.5	0.876	24.8	LOS B	18.1	131.4	1.00	1.06	51.8
North: Chain Valley Bay Road											
7	L2	22	0.0	0.095	28.3	LOS B	0.5	3.4	0.91	0.70	47.4
9	R2	169	1.9	0.740	32.8	LOS C	4.4	31.3	1.00	0.88	44.7
Approach		192	1.6	0.740	32.2	LOS C	4.4	31.3	0.99	0.86	45.0
West: Pacific Highway											
10	L2	63	10.0	0.058	10.9	LOS A	0.6	4.4	0.41	0.69	58.4
11	T1	1005	6.0	0.759	16.8	LOS B	12.4	91.0	0.91	0.86	58.5
12u	U	12	0.0	0.067	29.4	LOS C	0.3	1.8	0.91	0.69	46.5
Approach		1080	6.1	0.759	16.6	LOS B	12.4	91.0	0.88	0.85	58.3
All Vehicles		2528	5.0	0.876	21.8	LOS B	18.1	131.4	0.95	0.96	53.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2016 PM**

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Giveway / Yield (Two-Way)

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: Pacific Highway											
5	T1	1119	3.6	0.294	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
6	R2	27	3.8	0.188	31.1	LOS C	0.6	4.1	0.88	0.96	45.0
Approach		1146	3.6	0.294	0.8	NA	0.6	4.1	0.02	0.02	78.4
North: Chain Valley Bay Road											
7	L2	18	0.0	0.026	10.0	LOS A	0.1	0.6	0.51	0.72	62.0
9	R2	84	1.3	1.066	205.7	LOS F	9.3	65.6	1.00	1.51	14.4
Approach		102	1.0	1.066	171.4	LOS F	9.3	65.6	0.91	1.38	16.6
West: Pacific Highway											
10	L2	146	4.3	0.081	7.0	LOS A	0.0	0.0	0.00	0.63	63.9
11	T1	1149	1.9	0.298	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12u	U	13	0.0	0.079	29.7	LOS C	0.2	1.7	0.86	0.96	46.3
Approach		1308	2.2	0.298	1.1	NA	0.2	1.7	0.01	0.08	77.2
All Vehicles		2557	2.8	1.066	7.8	NA	9.3	65.6	0.05	0.11	67.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2016 PM

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 49 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: Pacific Highway											
5	T1	1119	3.6	0.757	16.7	LOS B	13.0	93.9	0.93	0.87	58.6
6	R2	27	3.8	0.124	29.1	LOS C	0.6	4.5	0.92	0.71	46.2
Approach		1146	3.6	0.757	17.0	LOS B	13.0	93.9	0.93	0.87	58.2
North: Chain Valley Bay Road											
7	L2	18	0.0	0.079	28.7	LOS C	0.4	2.8	0.91	0.69	47.1
9	R2	84	1.3	0.374	30.3	LOS C	2.0	14.2	0.96	0.76	46.2
Approach		102	1.0	0.374	30.0	LOS C	2.0	14.2	0.95	0.75	46.4
West: Pacific Highway											
10	L2	146	4.3	0.363	10.9	LOS A	1.4	10.2	0.42	0.70	59.9
11	T1	1149	1.9	0.871	24.1	LOS B	18.7	133.0	0.94	1.01	52.4
12u	U	13	0.0	0.074	30.1	LOS C	0.3	2.0	0.91	0.69	46.1
Approach		1308	2.2	0.871	22.7	LOS B	18.7	133.0	0.88	0.97	53.0
All Vehicles		2557	2.8	0.871	20.4	LOS B	18.7	133.0	0.91	0.91	54.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

🚦 Site: 2021 AM - Darkinjung + Smith

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 80 seconds (Practical Cycle Time)

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: Pacific Highway											
5	T1	1339	4.1	0.910	40.3	LOS C	32.2	233.3	1.00	1.08	42.4
6	R2	39	5.4	0.290	47.6	LOS D	1.5	11.3	0.98	0.73	37.3
Approach		1378	4.1	0.910	40.5	LOS C	32.2	233.3	1.00	1.07	42.3
North: Chain Valley Bay Road											
7	L2	78	0.0	0.134	28.3	LOS B	2.2	15.3	0.75	0.75	47.3
9	R2	464	0.7	0.879	45.9	LOS D	20.7	145.4	0.98	0.97	38.7
Approach		542	0.6	0.879	43.4	LOS D	20.7	145.4	0.95	0.94	39.7
West: Pacific Highway											
10	L2	203	3.1	0.359	9.4	LOS A	2.0	14.2	0.27	0.68	61.7
11	T1	1081	5.6	0.886	36.1	LOS C	28.6	209.5	0.94	0.99	44.6
12u	U	13	0.0	0.121	48.1	LOS D	0.5	3.5	0.96	0.69	37.6
Approach		1297	5.1	0.886	32.0	LOS C	28.6	209.5	0.83	0.94	46.6
All Vehicles		3217	3.9	0.910	37.6	LOS C	32.2	233.3	0.92	1.00	43.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

🚦 Site: 2021 AM - Darkinjung only

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 71 seconds (Practical Cycle Time)

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: Pacific Highway											
5	T1	1339	4.1	0.894	34.2	LOS C	28.0	202.6	1.00	1.07	45.7
6	R2	31	6.9	0.204	42.0	LOS C	1.1	7.8	0.96	0.72	39.3
Approach		1369	4.2	0.894	34.4	LOS C	28.0	202.6	1.00	1.06	45.6
North: Chain Valley Bay Road											
7	L2	65	0.0	0.131	28.5	LOS B	1.7	12.2	0.79	0.74	47.2
9	R2	414	0.8	0.897	47.1	LOS D	17.5	123.3	1.00	1.01	38.2
Approach		479	0.7	0.897	44.6	LOS D	17.5	123.3	0.97	0.97	39.2
West: Pacific Highway											
10	L2	168	3.8	0.331	9.7	LOS A	1.6	11.6	0.30	0.69	61.3
11	T1	1081	5.6	0.846	27.9	LOS B	23.0	168.4	0.92	0.93	49.6
12u	U	13	0.0	0.107	42.8	LOS D	0.4	3.1	0.95	0.69	39.7
Approach		1262	5.3	0.846	25.6	LOS B	23.0	168.4	0.84	0.90	50.8
All Vehicles		3111	4.1	0.897	32.4	LOS C	28.0	202.6	0.93	0.98	46.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

🚦 Site: 2021 PM - Darkinjung + Smith

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time 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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway											
5	T1	1203	3.3	0.649	14.7	LOS B	15.5	111.9	0.81	0.72	60.5
6	R2	82	1.3	0.521	42.8	LOS D	2.9	20.6	1.00	0.77	39.7
Approach		1285	3.2	0.649	16.4	LOS B	15.5	111.9	0.82	0.72	58.6
North: Chain Valley Bay Road											
7	L2	54	0.0	0.169	34.5	LOS C	1.6	11.3	0.89	0.74	43.8
9	R2	274	0.4	0.892	49.2	LOS D	11.4	79.8	1.00	1.01	37.4
Approach		327	0.3	0.892	46.8	LOS D	11.4	79.8	0.98	0.97	38.3
West: Pacific Highway											
10	L2	433	1.5	0.571	10.2	LOS A	4.9	34.9	0.36	0.72	61.4
11	T1	1236	1.8	0.894	31.0	LOS C	33.1	235.4	0.88	0.97	47.6
12u	U	14	0.0	0.115	42.3	LOS C	0.5	3.3	0.95	0.69	39.9
Approach		1682	1.7	0.894	25.7	LOS B	33.1	235.4	0.75	0.90	50.5
All Vehicles		3295	2.1	0.894	24.2	LOS B	33.1	235.4	0.80	0.84	51.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2021 PM - Darkinjung only

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 62 seconds (Practical Cycle Time)

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: Pacific Highway											
5	T1	1203	3.3	0.674	14.0	LOS A	14.3	103.2	0.83	0.74	61.2
6	R2	68	1.5	0.385	37.6	LOS C	2.1	14.9	0.98	0.75	42.0
Approach		1272	3.2	0.674	15.3	LOS B	14.3	103.2	0.84	0.74	59.7
North: Chain Valley Bay Road											
7	L2	44	0.0	0.164	33.1	LOS C	1.2	8.6	0.91	0.73	44.5
9	R2	237	0.4	0.881	44.9	LOS D	8.7	61.1	1.00	1.01	39.1
Approach		281	0.4	0.881	43.1	LOS D	8.7	61.1	0.99	0.97	39.9
West: Pacific Highway											
10	L2	376	1.7	0.565	10.5	LOS A	4.1	29.4	0.39	0.72	61.0
11	T1	1236	1.8	0.896	29.9	LOS C	29.6	210.1	0.89	0.99	48.3
12u	U	14	0.0	0.102	37.7	LOS C	0.4	2.9	0.94	0.69	42.1
Approach		1625	1.7	0.896	25.5	LOS B	29.6	210.1	0.78	0.93	50.7
All Vehicles		3178	2.2	0.896	22.9	LOS B	29.6	210.1	0.82	0.86	52.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

🚦 Site: 2031 AM - Darkinjung + Smith

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 109 seconds (Practical Cycle Time)

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: Pacific Highway											
5	T1	1525	3.6	0.900	42.1	LOS C	45.1	325.5	0.99	1.02	41.6
6	R2	40	5.3	0.406	64.7	LOS E	2.2	16.2	1.00	0.73	31.8
Approach		1565	3.6	0.900	42.7	LOS D	45.1	325.5	0.99	1.02	41.3
North: Chain Valley Bay Road											
7	L2	81	0.0	0.132	34.2	LOS C	3.0	21.0	0.74	0.75	43.9
9	R2	489	0.6	0.894	57.0	LOS E	28.8	202.7	0.98	0.96	34.6
Approach		571	0.6	0.894	53.8	LOS D	28.8	202.7	0.94	0.93	35.7
West: Pacific Highway											
10	L2	212	3.0	0.377	8.8	LOS A	2.0	14.7	0.20	0.67	62.4
11	T1	1232	4.9	0.858	34.9	LOS C	37.5	273.4	0.90	0.89	45.3
12u	U	14	0.0	0.178	65.2	LOS E	0.8	5.3	0.98	0.69	32.0
Approach		1457	4.6	0.858	31.4	LOS C	37.5	273.4	0.80	0.86	47.0
All Vehicles		3593	3.5	0.900	39.9	LOS C	45.1	325.5	0.90	0.94	42.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2031 AM - Darkinjung only

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 92 seconds (Practical Cycle Time)

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: Pacific Highway											
5	T1	1525	3.6	0.903	39.2	LOS C	39.9	287.6	1.00	1.05	43.0
6	R2	32	6.7	0.273	54.3	LOS D	1.4	10.7	0.98	0.72	34.8
Approach		1557	3.7	0.903	39.5	LOS C	39.9	287.6	1.00	1.05	42.8
North: Chain Valley Bay Road											
7	L2	68	0.0	0.126	32.6	LOS C	2.3	15.8	0.77	0.74	44.8
9	R2	439	0.7	0.885	52.0	LOS D	22.3	157.2	0.99	0.97	36.3
Approach		507	0.6	0.885	49.4	LOS D	22.3	157.2	0.96	0.94	37.3
West: Pacific Highway											
10	L2	177	3.6	0.353	9.1	LOS A	1.7	12.1	0.23	0.67	62.0
11	T1	1232	4.9	0.844	29.9	LOS C	31.0	226.3	0.90	0.89	48.3
12u	U	14	0.0	0.151	55.2	LOS D	0.6	4.4	0.97	0.69	35.0
Approach		1422	4.7	0.844	27.5	LOS B	31.0	226.3	0.81	0.86	49.5
All Vehicles		3486	3.6	0.903	36.1	LOS C	39.9	287.6	0.92	0.95	44.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

🚦 Site: 2031 PM - Darkinjung + Smith

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 89 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: Pacific Highway											
5	T1	1371	2.9	0.664	15.8	LOS B	21.3	152.5	0.77	0.70	59.4
6	R2	86	1.2	0.695	55.5	LOS D	4.1	28.7	1.00	0.82	34.9
Approach		1457	2.8	0.695	18.1	LOS B	21.3	152.5	0.79	0.71	57.1
North: Chain Valley Bay Road											
7	L2	57	0.0	0.160	39.9	LOS C	2.1	14.7	0.87	0.75	41.2
9	R2	286	0.4	0.870	54.4	LOS D	14.1	98.9	1.00	0.96	35.5
Approach		343	0.3	0.870	52.0	LOS D	14.1	98.9	0.98	0.92	36.3
West: Pacific Highway											
10	L2	455	1.4	0.592	9.5	LOS A	5.2	36.9	0.29	0.70	62.1
11	T1	1408	1.6	0.904	34.4	LOS C	44.9	318.7	0.86	0.94	45.6
12u	U	16	0.0	0.168	53.6	LOS D	0.7	4.9	0.97	0.70	35.6
Approach		1879	1.5	0.904	28.6	LOS C	44.9	318.7	0.72	0.88	48.6
All Vehicles		3679	1.9	0.904	26.6	LOS B	44.9	318.7	0.77	0.81	50.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2031 PM - Darkinjung only

Pacific Highway / Chain Valley Bay Road T-intersection, Lake Munmorah
Signals - Fixed Time Isolated   Cycle Time = 76 seconds (Practical Cycle Time)

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: Pacific Highway											
5	T1	1371	2.9	0.680	14.3	LOS A	18.8	134.8	0.80	0.72	60.9
6	R2	73	1.4	0.501	46.1	LOS D	2.8	19.8	1.00	0.76	38.3
Approach		1443	2.8	0.680	15.9	LOS B	18.8	134.8	0.81	0.72	59.1
North: Chain Valley Bay Road											
7	L2	47	0.0	0.162	37.7	LOS C	1.6	11.0	0.90	0.74	42.2
9	R2	249	0.4	0.881	51.3	LOS D	10.9	76.8	1.00	0.99	36.6
Approach		297	0.4	0.881	49.1	LOS D	10.9	76.8	0.98	0.95	37.4
West: Pacific Highway											
10	L2	398	1.6	0.590	9.9	LOS A	4.4	31.3	0.32	0.71	61.7
11	T1	1408	1.6	0.897	30.9	LOS C	38.1	270.0	0.86	0.95	47.7
12u	U	16	0.0	0.144	46.0	LOS D	0.6	4.1	0.96	0.70	38.4
Approach		1822	1.6	0.897	26.4	LOS B	38.1	270.0	0.74	0.89	50.1
All Vehicles		3562	2.0	0.897	24.1	LOS B	38.1	270.0	0.79	0.83	51.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 2021 AM - northern

Chain Valley Bay Road / Subdivision Access - northern intersection
Giveway / Yield (Two-Way)

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: Chain Valley Bay Road											
1	L2	23	5.0	0.013	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	135	5.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
3	R2	12	5.0	0.011	8.1	LOS A	0.0	0.3	0.36	0.61	53.3
Approach		169	5.0	0.071	1.5	NA	0.0	0.3	0.02	0.13	74.8
East: East subdivision access											
4	L2	27	5.0	0.028	5.8	LOS A	0.1	0.7	0.35	0.56	52.0
5	T1	7	5.0	0.024	9.5	LOS A	0.1	0.6	0.54	0.67	43.9
6	R2	2	5.0	0.024	11.3	LOS A	0.1	0.6	0.54	0.67	49.3
Approach		37	5.0	0.028	6.8	LOS A	0.1	0.7	0.40	0.59	50.0
North: Chain Valley Bay Road											
7	L2	1	5.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	273	5.0	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
9	R2	2	5.0	0.002	7.5	LOS A	0.0	0.0	0.26	0.57	53.6
Approach		276	5.0	0.144	0.1	NA	0.0	0.0	0.00	0.01	79.6
West: West subdivision access											
10	L2	3	5.0	0.003	5.1	LOS A	0.0	0.1	0.23	0.49	52.3
11	T1	11	5.0	0.189	10.1	LOS A	0.7	4.8	0.60	0.81	42.6
12	R2	54	5.0	0.189	13.0	LOS A	0.7	4.8	0.60	0.81	47.6
Approach		67	5.0	0.189	12.2	LOS A	0.7	4.8	0.59	0.79	46.9
All Vehicles		549	5.0	0.189	2.5	NA	0.7	4.8	0.11	0.18	69.5

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2021 PM - northern**

Chain Valley Bay Road / Subdivision Access - northern intersection
Giveway / Yield (Two-Way)

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: Chain Valley Bay Road											
1	L2	52	5.0	0.029	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	243	5.0	0.129	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
3	R2	25	5.0	0.021	7.6	LOS A	0.1	0.6	0.28	0.60	53.5
Approach		320	5.0	0.129	1.7	NA	0.1	0.6	0.02	0.15	74.0
East: East subdivision access											
4	L2	18	5.0	0.016	5.3	LOS A	0.1	0.4	0.26	0.52	52.2
5	T1	4	5.0	0.014	10.2	LOS A	0.0	0.3	0.56	0.66	43.7
6	R2	1	5.0	0.014	11.3	LOS A	0.0	0.3	0.56	0.66	49.0
Approach		23	5.0	0.016	6.4	LOS A	0.1	0.4	0.33	0.55	50.3
North: Chain Valley Bay Road											
7	L2	2	5.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	166	5.0	0.088	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
9	R2	3	5.0	0.003	8.1	LOS A	0.0	0.1	0.37	0.58	53.2
Approach		172	5.0	0.088	0.2	NA	0.0	0.1	0.01	0.02	79.0
West: West subdivision access											
10	L2	2	5.0	0.002	5.6	LOS A	0.0	0.1	0.32	0.51	52.1
11	T1	7	5.0	0.122	10.4	LOS A	0.4	3.0	0.60	0.80	42.6
12	R2	33	5.0	0.122	13.0	LOS A	0.4	3.0	0.60	0.80	47.6
Approach		42	5.0	0.122	12.2	LOS A	0.4	3.0	0.58	0.79	46.8
All Vehicles		557	5.0	0.129	2.3	NA	0.4	3.0	0.07	0.17	70.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 2031 AM - northern

Chain Valley Bay Road / Subdivision Access - northern intersection
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: Chain Valley Bay Road											
1	L2	23	5.0	0.013	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	144	5.0	0.076	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
3	R2	12	5.0	0.011	8.2	LOS A	0.0	0.3	0.38	0.61	53.2
Approach		179	5.0	0.076	1.4	NA	0.0	0.3	0.02	0.12	75.0
East: East subdivision access											
4	L2	27	5.0	0.029	5.9	LOS A	0.1	0.7	0.37	0.57	51.9
5	T1	7	5.0	0.026	10.2	LOS A	0.1	0.6	0.56	0.69	43.5
6	R2	2	5.0	0.026	12.2	LOS A	0.1	0.6	0.56	0.69	48.8
Approach		37	5.0	0.029	7.2	LOS A	0.1	0.7	0.42	0.60	49.8
North: Chain Valley Bay Road											
7	L2	1	5.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	299	5.0	0.158	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
9	R2	2	5.0	0.002	7.5	LOS A	0.0	0.0	0.27	0.57	53.5
Approach		302	5.0	0.158	0.1	NA	0.0	0.0	0.00	0.01	79.6
West: West subdivision access											
10	L2	3	5.0	0.003	5.1	LOS A	0.0	0.1	0.24	0.49	52.3
11	T1	13	5.0	0.209	11.0	LOS A	0.7	5.4	0.64	0.83	42.0
12	R2	54	5.0	0.209	14.3	LOS A	0.7	5.4	0.64	0.83	46.9
Approach		69	5.0	0.209	13.3	LOS A	0.7	5.4	0.62	0.81	46.2
All Vehicles		587	5.0	0.209	2.5	NA	0.7	5.4	0.11	0.17	69.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2031 PM - northern**

Chain Valley Bay Road / Subdivision Access - northern intersection
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: Chain Valley Bay Road
1	L2	52	5.0	0.029	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	269	5.0	0.143	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
3	R2	25	5.0	0.022	7.6	LOS A	0.1	0.6	0.29	0.60	53.5
Approach		346	5.0	0.143	1.6	NA	0.1	0.6	0.02	0.14	74.4
East: East subdivision access
4	L2	18	5.0	0.016	5.3	LOS A	0.1	0.4	0.27	0.52	52.2
5	T1	4	5.0	0.016	11.1	LOS A	0.1	0.4	0.59	0.69	43.2
6	R2	1	5.0	0.016	12.4	LOS A	0.1	0.4	0.59	0.69	48.3
Approach		23	5.0	0.016	6.7	LOS A	0.1	0.4	0.35	0.56	50.1
North: Chain Valley Bay Road
7	L2	2	5.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	182	5.0	0.096	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
9	R2	3	5.0	0.003	8.2	LOS A	0.0	0.1	0.39	0.59	53.2
Approach		187	5.0	0.096	0.2	NA	0.0	0.1	0.01	0.02	79.1
West: West subdivision access
10	L2	2	5.0	0.002	5.7	LOS A	0.0	0.1	0.34	0.51	52.0
11	T1	7	5.0	0.132	11.3	LOS A	0.4	3.2	0.64	0.82	42.0
12	R2	33	5.0	0.132	14.3	LOS A	0.4	3.2	0.64	0.82	46.9
Approach		42	5.0	0.132	13.3	LOS A	0.4	3.2	0.62	0.81	46.2
All Vehicles		599	5.0	0.143	2.2	NA	0.4	3.2	0.07	0.16	71.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2021 AM - southern**

Chain Valley Bay Road / Subdivision Access - northern intersection
Giveway / Yield (Two-Way)

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: Chain Valley Bay Road											
1	L2	54	5.0	0.030	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	161	5.0	0.085	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
3	R2	29	5.0	0.031	8.6	LOS A	0.1	0.8	0.42	0.66	53.1
Approach		244	5.0	0.085	2.6	NA	0.1	0.8	0.05	0.22	71.6
East: East subdivision access											
4	L2	69	5.0	0.078	6.4	LOS A	0.3	2.0	0.41	0.63	51.7
5	T1	18	5.0	0.073	13.5	LOS A	0.2	1.8	0.67	0.82	42.0
6	R2	3	5.0	0.073	15.9	LOS B	0.2	1.8	0.67	0.82	46.8
Approach		91	5.0	0.078	8.1	LOS A	0.3	2.0	0.47	0.67	49.3
North: Chain Valley Bay Road											
7	L2	2	5.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	353	5.0	0.187	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
9	R2	3	5.0	0.003	7.7	LOS A	0.0	0.1	0.31	0.57	53.4
Approach		358	5.0	0.187	0.1	NA	0.0	0.1	0.00	0.01	79.5
West: West subdivision access											
10	L2	6	5.0	0.006	5.2	LOS A	0.0	0.1	0.25	0.50	52.3
11	T1	32	5.0	0.666	24.5	LOS B	3.8	27.5	0.87	1.18	35.3
12	R2	123	5.0	0.666	31.6	LOS C	3.8	27.5	0.87	1.18	38.7
Approach		161	5.0	0.666	29.2	LOS C	3.8	27.5	0.85	1.16	38.4
All Vehicles		854	5.0	0.666	7.2	NA	3.8	27.5	0.23	0.36	61.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2021 PM - southern**

Chain Valley Bay Road / Subdivision Access - northern intersection
Giveway / Yield (Two-Way)

Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m			
South: Chain Valley Bay Road											
1	L2	116	5.0	0.065	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	334	5.0	0.177	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
3	R2	64	5.0	0.057	7.8	LOS A	0.2	1.6	0.32	0.62	53.4
Approach		514	5.0	0.177	2.6	NA	0.2	1.6	0.04	0.22	71.4
East: East subdivision access											
4	L2	43	5.0	0.041	5.5	LOS A	0.1	1.1	0.30	0.54	52.1
5	T1	11	5.0	0.059	16.9	LOS B	0.2	1.4	0.73	0.85	40.5
6	R2	3	5.0	0.059	17.1	LOS B	0.2	1.4	0.73	0.85	45.0
Approach		57	5.0	0.059	8.2	LOS A	0.2	1.4	0.40	0.62	49.1
North: Chain Valley Bay Road											
7	L2	3	5.0	0.002	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	206	5.0	0.109	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
9	R2	6	5.0	0.007	9.0	LOS A	0.0	0.2	0.47	0.64	52.7
Approach		216	5.0	0.109	0.4	NA	0.0	0.2	0.01	0.03	78.5
West: West subdivision access											
10	L2	4	5.0	0.005	6.1	LOS A	0.0	0.1	0.38	0.54	51.9
11	T1	19	5.0	0.479	22.3	LOS B	2.1	15.0	0.84	1.04	36.3
12	R2	78	5.0	0.479	28.6	LOS C	2.1	15.0	0.84	1.04	39.9
Approach		101	5.0	0.479	26.5	LOS B	2.1	15.0	0.82	1.02	39.5
All Vehicles		887	5.0	0.479	5.1	NA	2.1	15.0	0.15	0.29	65.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

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

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2031 AM - southern**

Chain Valley Bay Road / Subdivision Access - northern intersection
Giveway / Yield (Two-Way)

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: Chain Valley Bay Road											
1	L2	54	5.0	0.030	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	171	5.0	0.090	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
3	R2	29	5.0	0.032	8.7	LOS A	0.1	0.9	0.44	0.67	52.9
Approach		254	5.0	0.090	2.5	NA	0.1	0.9	0.05	0.21	71.8
East: East subdivision access											
4	L2	69	5.0	0.081	6.6	LOS A	0.3	2.1	0.43	0.64	51.6
5	T1	18	5.0	0.079	14.6	LOS B	0.3	1.9	0.69	0.83	41.4
6	R2	3	5.0	0.079	17.3	LOS B	0.3	1.9	0.69	0.83	46.1
Approach		91	5.0	0.081	8.5	LOS A	0.3	2.1	0.49	0.69	49.0
North: Chain Valley Bay Road											
7	L2	2	5.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	381	5.0	0.202	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
9	R2	3	5.0	0.003	7.8	LOS A	0.0	0.1	0.32	0.57	53.4
Approach		386	5.0	0.202	0.1	NA	0.0	0.1	0.00	0.01	79.5
West: West subdivision access											
10	L2	6	5.0	0.006	5.3	LOS A	0.0	0.1	0.26	0.50	52.2
11	T1	32	5.0	0.727	29.7	LOS C	4.3	31.7	0.90	1.26	33.4
12	R2	123	5.0	0.727	37.6	LOS C	4.3	31.7	0.90	1.26	36.5
Approach		161	5.0	0.727	34.8	LOS C	4.3	31.7	0.88	1.23	36.3
All Vehicles		892	5.0	0.727	7.9	NA	4.3	31.7	0.22	0.36	60.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ **Site: 2031 PM - southern**

Chain Valley Bay Road / Subdivision Access - northern intersection
Giveway / Yield (Two-Way)

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: Chain Valley Bay Road											
1	L2	116	5.0	0.065	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
2	T1	360	5.0	0.191	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
3	R2	64	5.0	0.058	7.9	LOS A	0.2	1.7	0.33	0.63	53.4
Approach		540	5.0	0.191	2.5	NA	0.2	1.7	0.04	0.21	71.8
East: East subdivision access											
4	L2	43	5.0	0.042	5.6	LOS A	0.1	1.1	0.31	0.55	52.1
5	T1	11	5.0	0.064	18.6	LOS B	0.2	1.5	0.75	0.87	39.8
6	R2	3	5.0	0.064	18.8	LOS B	0.2	1.5	0.75	0.87	44.1
Approach		57	5.0	0.064	8.7	LOS A	0.2	1.5	0.42	0.63	48.8
North: Chain Valley Bay Road											
7	L2	3	5.0	0.002	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
8	T1	222	5.0	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
9	R2	6	5.0	0.008	9.2	LOS A	0.0	0.2	0.48	0.64	52.6
Approach		232	5.0	0.118	0.4	NA	0.0	0.2	0.01	0.03	78.6
West: West subdivision access											
10	L2	4	5.0	0.005	6.2	LOS A	0.0	0.1	0.40	0.55	51.8
11	T1	19	5.0	0.529	25.8	LOS B	2.3	16.8	0.87	1.07	34.9
12	R2	78	5.0	0.529	32.9	LOS C	2.3	16.8	0.87	1.07	38.2
Approach		101	5.0	0.529	30.5	LOS C	2.3	16.8	0.85	1.05	37.9
All Vehicles		929	5.0	0.529	5.4	NA	2.3	16.8	0.14	0.28	65.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.