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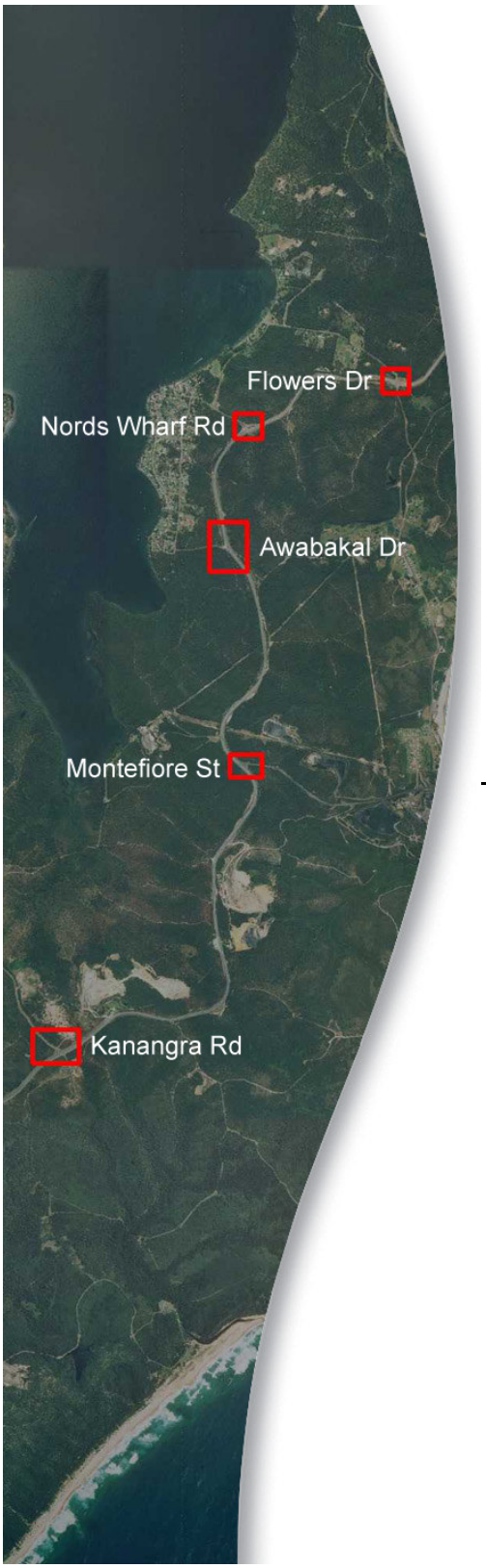

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Managed by Rio Tinto Coal Australia

Lower Hunter Land Development Southern Estate Catherine Hill Bay (Middle Camp)

Traffic and Transport Addendum

Friday, 12 Sept 2008

Report no: F003-AA001459-NSR-10

Hyder Consulting

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Traffic and Transport Addendum

Author: Alen Krljic

Checker: Mukit Rahman

Approver: Jim Dumont

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Hyder Consulting Pty Ltd
ABN 76 104 485 289
Level 5, 141 Walker Street, North Sydney NSW 2060, Australia
Tel: +61 2 8907 9000 Fax: +61 2 8907 9001 www.hyderconsulting.com

Hyder Consulting

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1 Introduction

In November 2007 Coal and Allied submitted an Environmental Assessment (EA) report to the Department of Planning (DoP) in support of a concept plan for a development in Catherine Hill Bay. The original concept plan provided for a new residential development of up to 300 dwellings.

Following the development review undertaken by the Independent Hearing and Assessment Panel (IHAP) a number of changes were made to the concept plan due to ecological considerations. This resulted in a reduction of 78 lots or dwellings at areas C and D from the original concept plan. The proposed bypass, which was planned under original concept plan, will no longer be required because the bypass constitutes developments at C and D between Catherine Hill Bay and Middle Camp.

Coal and Allied (C & A) engaged Hyder Consulting to prepare a traffic and transport addendum report to consider the reduced lot yield and to identify the impact on Flowers Drive through Middle Camp without the proposed bypass. In assessing traffic impact from Catherine Hill Bay site, we consulted the previous traffic and transport report prepared by the Parsons Brinckerhoff (PB) *Lower Hunter Land Development Southern Estate-Catherine Hill Bay (Middle Camp), Traffic and Transport*, 2112523A_PR1440_RevE, November 2007. C & A provided Hyder a copy of the traffic data, report and associated aaSIDRA modelling files which were used in PB's original traffic assessment. Hyder reviewed all traffic data from PB which then formed the basis of the revised impact assessment for the Catherine Hill Bay site.

1.1 Our approach

This traffic addendum report was prepared to examine the impact on road network from reduced yield at Catherine Hill Bay site. The key objective of this addendum was to reassess traffic parameters and proposed upgrading works at the Pacific Highway intersections. Cumulative impact was also reassessed including proposed Rose Group and C & A developments at Catherine Hill Bay, Nords Wharf and Gwandalan. The potential trip distribution to/from Catherine Hill Bay site was based on the assumption given in PB report (based on 2007 traffic counts). That assumption indicated about 60% of traffic spread is towards the north (Newcastle) and about 40 % towards the south (Wyong).

In assessing the traffic impact from 222 lots we considered the broader traffic assumptions, impact on road network and the implications of the reduced traffic generation on the Pacific Highway intersections performances based on the cumulative impact. We re-evaluated the traffic impact in the following areas:

- Additional development trips from reduced yields

- Future forecasts on internal and external network particularly impact on Flowers Drive through Middle Camp
- Model assumptions and scenarios
- Impact on regional road network and intersection operation
- Impact of traffic from the C & A Catherine Hill Bay site-scenario S2
- Cumulative traffic impact –Scenario S3
- Impact of holiday traffic
- Revised concept plan assessment
- Management and mitigation

Table 1-1 summarises the key development assumptions likely to affect traffic outcomes. For a better comparison, we also showed the parameters assumed in the original concept plan. In summary, the revised concept plan at Catherine Hill Bay involved:

- Residential lots reduced from 300 to 222 lots. Hamlets C and D have been deleted (see Figure 1-1);
- The development completion dates would remain unchanged. For instance, full development at C & A Catherine Hill Bay site could occur by 2012;
- Assumptions in association with Rose Group development changed for Gwandalan site only. Rose Group now proposed to develop 187 dwellings in Gwandalan;
- Our revised assessment assumed the cumulative impact from 1722 dwellings-a reduction of 183 dwellings from the assumption in the earlier assessment.

Table 1-1 Changes in proposed development

Original Concept Plan			Revised Concept Plan		Changes
Developers	**Sites**	**No of lots**	**Sites**	**No of lots**	**No of lots**
C & A	Catherine Hill Bay	300	Catherine Hill Bay	**222**	Reduction of 78 lots
C & A	Gwandalan	**492 residential lots + 208 lots (retirement village) +2800m^2 GFA of retail**	Gwandalan	**415** residential lots +208 lots (retirement village)+2800m^2 GFA of retail	Reduction of 77 residential lots
C & A	Nords Wharf	90	Nords Wharf	90	Unchanged
Rose Group	Catherine Hill Bay	**600 lots + 1800m^2 GFA of retail**	Catherine Hill Bay	600 lots + 1800m^2 GFA of retail	Unchanged
Rose Group	Gwandalan	**215**	Gwandalan	187	Reduction of 28 lots
Totals		**1905**		**1722**	**-183**

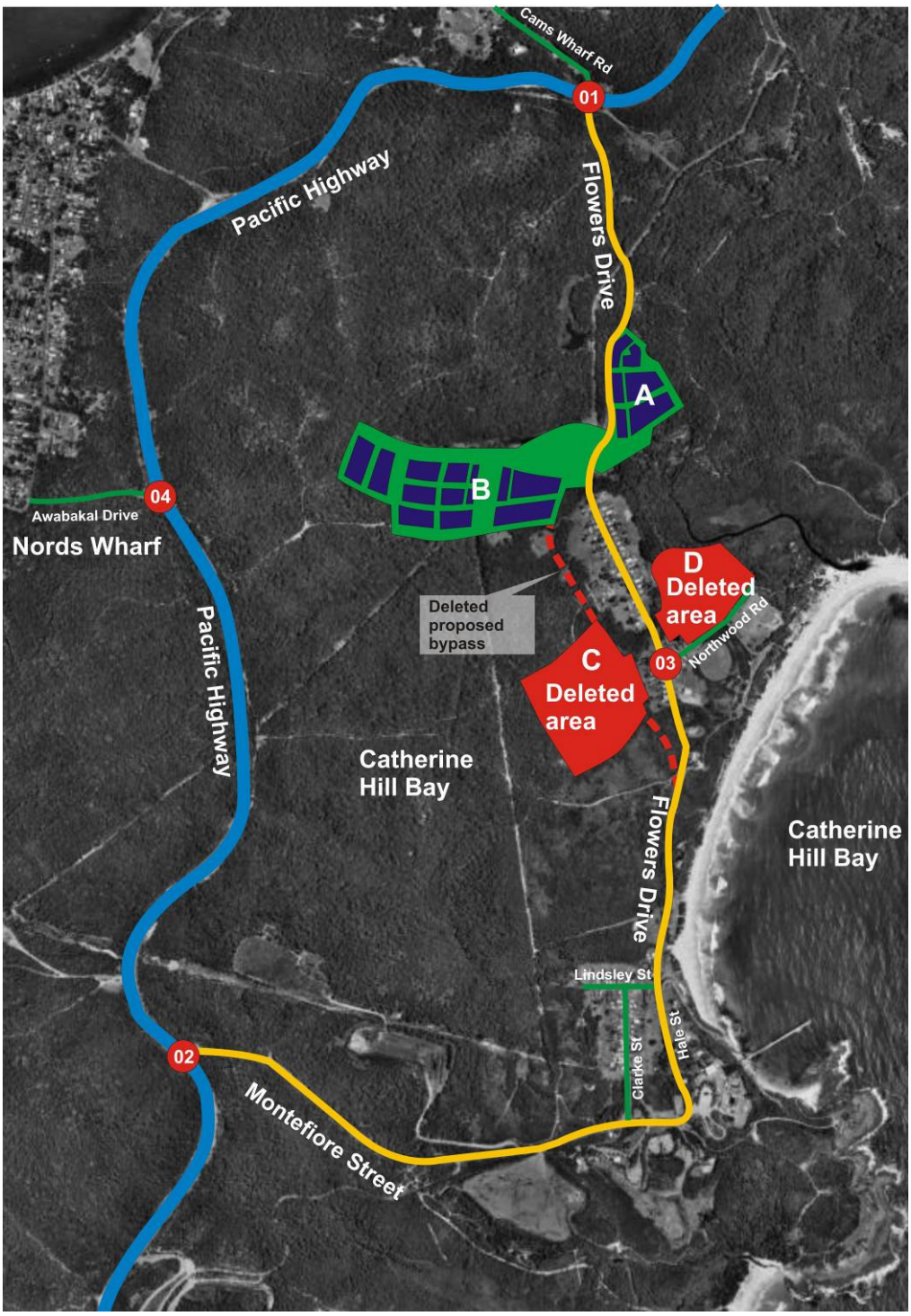


Figure 1-1 Revised Concept Plan at C & A Catherine Hill Bay

2 Impact Assessment

2.1 Additional development trips

Peak hour trips for Catherine Hill Bay development was estimated based on RTA's trip generation guideline "The Guide to Traffic Generating Developments, RTA, 2002. We used conservative trip generation rate for dwellings of 0.85 vehicle trips per peak hour. The percentage of internal trips for the Catherine Hill Bay development would be negligible. The revised yields of 222 lots will generate about 189 peak hour trips compared to the original estimate of 255 trips. The new yield will reduce peak hour trips by about 25%.

2.2 Access and circulation

The external road network, serving the C & A Catherine Hill Bay development, comprises Flowers Drive and Montefiore Street, both linking to the Pacific Highway. C & A previously established the broad access management strategy in consultation with the RTA, Lake Macquarie Council and Rose Group. The access management strategy, to accommodate the cumulative impact of both the C & A and Rose Group developments, indicated that a number of intersections on the Pacific Highway at Flowers Drive and Montefiore Street would require modification (upgrade) to minimise the impact of the additional traffic. The agreed proposed upgrades with the Pacific Highway comprised the following modifications:

- Cams Wharf Road/ Flowers Drive: provide a seagull intersection with full access to Cams Wharf Road. Flowers Drive traffic will be restricted to left in/left out only.
- Montefiore Street: provide a seagull intersection with full access to Montefiore Street and traffic signal control on the Pacific Highway southbound and Montefiore Street.

Considering the above external traffic works on the Pacific Highway and deletion of two hamlets (C and D) and associated bypass, we anticipate some change in access and traffic circulation patterns that were previously reported in PB's report. We envisage the major access points to the individual sites of C & A development (hamlets A B) will now be maintained more directly to and from Pacific Highway via Flowers Drive.

2.3 Traffic data

C & A provided Hyder with a copy of the traffic count data undertaken in July 2007. We used following traffic data in our revised analysis:

- Midblock data on Flowers Drive;

- Midblock data on Montefiore Street;
- Turning movement counts at Pacific Highway/Flowers Drive and Pacific Highway/Montefiore Street intersections.

We consider that those counts are adequate for the revised analysis. No supplementary counts are required for this analysis. A description of traffic patterns in the study area can be found at Chapter 5 of PB's report. Figure 2-1 shows the existing 2007 traffic volumes at critical intersections for the AM and PM peak hours.

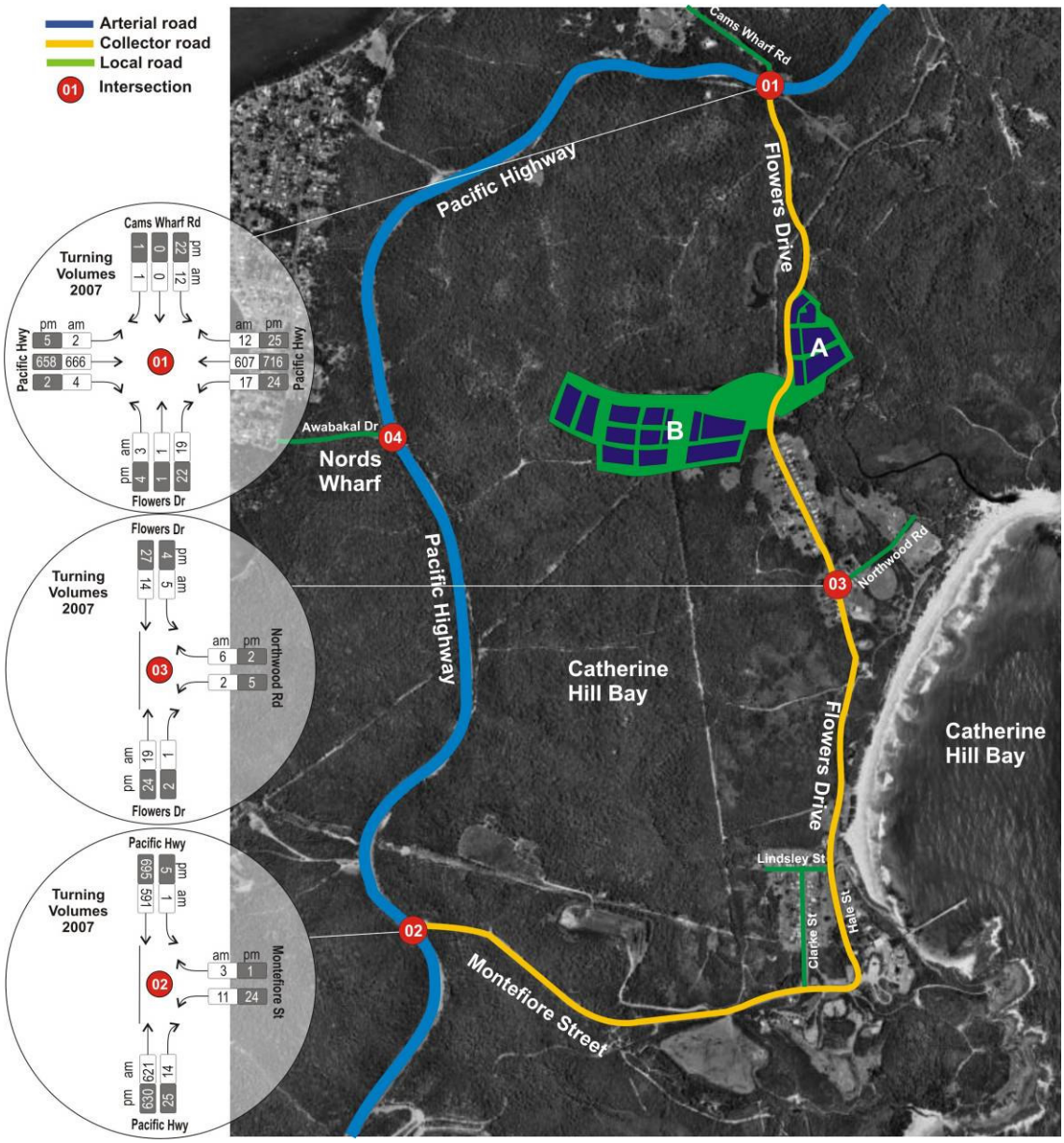


Figure 2-1 Intersection turning volumes for the AM and PM peak hours in 2007

2.4 Future trip distribution and growth on the Pacific Highway

In assessing the revised traffic impact from the Catherine Hill Bay site, we considered three important assumptions built into the spreadsheet traffic model including:

- Future traffic distribution to and from Catherine Hill Bay site;
- Traffic distribution to and from other developments which was used in the cumulative assessment. This included C & A sites at Nords Wharf and Gwandalan, and Rose Group developments at Gwandalan and Catherine Hill Bay;
- Background traffic growth on the Pacific Highway.

Future traffic distribution from both C & A and Rose Group developments together with background growth on the Pacific Highway, are summarised in Table 2-1. A 2% traffic growth rate per annum on the Pacific Highway in the next 10 years is appropriate, and is consistent with historical growth observed at RTA's permanent count site two kilometres south of Macquarie Bridge at Swansea.

Table 2-1 Trip distribution and background traffic growth assumptions

Developers	Sites	Basic model assumptions and data
C & A	Catherine Hill Bay	▪ 80 % of new trips are outbound and 20% inbound during AM peak. PM peak will mirror the AM peak pattern; ▪ Future horizon year for full development is 2012; ▪ 60 % of trips would travel north to/from Newcastle via Pacific Highway/Flowers Drive intersection under existing intersection controls; ▪ 40 % of trips would travel south to/from Wyong/Gosford areas via Pacific Highway/Montefiore Street under existing intersection controls;
C & A	Gwandalan	▪ 80 % of new trips are outbound and 20% inbound during AM peak. PM peak will mirror the AM peak pattern; ▪ Future horizon year for full development is 2018; ▪ 20 % of trips would travel north to/from Newcastle via Pacific Highway/Kanangra Drive Intersection; ▪ 80 % of trips would travel south to/from Wyong/Gosford via Pacific Highway/Kanangra Drive intersection;
C & A	Nords Wharf	▪ 80 % of new trips are outbound and 20% inbound during AM peak. PM peak will mirror the AM peak pattern; ▪ Future horizon year for full development is 2011; ▪ 60 % of trips would travel north to/from Newcastle via Pacific Highway/Awabakal Drive intersection; ▪ 40 % of trips would travel south to/from Wyong/Gosford via Pacific Highway/Awabakal Drive Intersection;
Rose Group	Catherine Hill Bay	▪ 60 % of trips would travel north to/from Newcastle and would use both the Pacific Highway/Flowers Drive and the Pacific Highway/Montefiore Street intersections under existing intersection controls; ▪ 40 % of trips would travel south to/from Wyong/Gosford via Pacific Highway/Montefiore Street under existing intersection controls; ▪ Future horizon year for full development is 2018
Rose Group	Gwandalan	▪ During the morning peak, around 70% of total traffic in and out of Gwandalan/Summerland Point is outbound, and in the evening peak, around 65% is inbound; ▪ Future horizon year for full development is 2018
-		▪ A conservative estimate of 2% per annum background traffic growth on the Pacific Highway; ▪ Peak hour through traffic for holiday period would increase by about 10% above the 2007July counts.

2.5 Future forecasts and impact on key intersections

Consistent with the previous assessment we prepared traffic forecasts for three scenarios with reduced yields at Catherine Hill Bay:

- S1 represents the base case;
- S2 represents the base case plus C & A Catherine Hill Bay development traffic;
- S3 cumulative impact considering other developments in and around Catherine Hill Bay including Rose Group.

The trip generation rate from revised yields was applied to scenarios S2 and S3. Table 2-2 summarised assumptions made for model three scenarios.

Table 2-2 Scenario descriptions

The scenarios		Description
S1	**Base Case**	Reflects background traffic growth of 2% per annum on the Pacific Highway
S2	**Development Case**	Reflects Base Case (S1) plus proposed full development at C & A Catherine Hill Bay (222 residential lots) in 2012.
S3	**Cumulative Case**	Reflects Development Case (S2) plus all other proposed developments including Nords Wharf (90 lots), Gwandalan (623 lots) and Rose Group sites at Catherine Hill Bay (600 lots) and Gwandalan (187 lots) in 2018.

Scenarios S2 and S3 were remodelled using revised development yields at C & A Catherine Hill Bay and Gwandalan. All key intersections likely to be affected by the reduced yields were reanalysed using aaSIDRA. Intersection performance was reported in terms of degree of saturation (DoS), level of service (LoS), average delay per vehicle and 95th percentile queue length. For a more complete comparison, we have shown intersection performance results for existing conditions and *base case S1* sourced from PB's report.

In presenting the model results for all three scenarios, we first showed intersection performance (LoS, DoS, queue.) followed by forecast turning movements, which formed the input data to intersection models. This way we could clearly demonstrate the impact from the Catherine Hill Bay development alone followed by the cumulative impact. Results are summarised at Pacific Highway/Flowers Drive, Pacific Highway/Montefiore Street and Flowers Drive/Northwood Road intersections as follows:

- Table 2-3 shows aaSIDRA results for 2007 conditions
- Figure 2-1 shows turning movements for 2007 conditions

- Table 2-4 shows aaSIDRA results for the *base case S1*
- Figure 2-2 shows turning movements for the *base case S1*
- Table 2-5 shows aaSIDRA results for the *development case S2*
- Figure 2-3 shows turning movements for the *development case S2*
- Table 2-6 shows aaSIDRA results for the *cumulative case S3*
- Figure 2-4 shows turning movements for the *cumulative case S3*

Table 2-3 aaSIDRA Intersection parameters for 2007 traffic conditions (existing)

ID	Intersection	Control	DoS	AVG Delay (s)	LoS	Queue (veh)	Critical Movements
	AM						
I-01 AM	Pacific Hwy-Flowers Dr	Stop	0.30	72	F	2	19 vehs right turn from Flowers Dr , DoS=0.30; LoS=F; 1 cross traffic veh between Flowers Dr & Cams Wharf Rd DoS=0.03; LoS=D; 4 vehs right turn from Pacific Hwy to Flowers Dr DoS=0.01; LoS=B;
I-02 AM	Pacific Hwy-Montefiore St	Seagull	0.17	16	B	1	3 vehs right turn from Montefiore St, DoS=0.01; LoS=B; 14 vehs right turn from Pacific Hwy, DoS=0.02; LoS=B;
I-03 AM	Flowers Dr-Northwood Rd	Give-way	0.01	8	A	1	6 vehs right turn from Northwood Rd, DoS=0.01; LoS=A; 1 veh right turn from Flowers Dr DoS=0.01; LoS=A;
	PM						
I-01 PM	Pacific Hwy-Flowers Dr	Stop	0.74	226	F	3	22 vehs right turn from Flowers Dr, DoS=0.74; LoS=F; 1 cross traffic veh between Flowers Dr and Cams Wharf Rd,DoS=0.03; LoS=E; 2 vehs right turn from Pacific Hwy to Flowers Dr, DoS=0.01; LoS=B;
I-02 PM	Pacific Hwy-Montefiore St	Seagull	0.19	16	B	1	1 veh right turn from Montefiore St, DoS=0.01; LoS=A; 25 vehs right turn from Pacific Hwy,DoS=0.04; LoS=B;
I-03 PM	Flowers Dr-Northwood Rd	Give-way	0.02	7	A	1	1 veh right turn from Northwood Rd, DoS=0.01; LoS=A; 2 vehs right turn from Flowers Dr DoS=0.01; LoS=A;

Source: PB's report

Table 2-4 aaSIDRA intersection parameters for Pacific Highway intersections (Base Case S1)

Site ID	Intersection	Control	2007 Existing Model				2011 Nords Wharf				2012 Catherine Hill Bay				2018 Gwandalan			
			DoS	Delays (S)	LoS	Queue (Veh)	DoS	Delays (S)	LoS	Queue (Veh)	DoS	Delays (S)	LoS	Queue (Veh)	DoS	Delays (S)	LoS	Queue (Veh)
	Morning peak																	
I-1	Pacific Hwy-Flowers Dr	Stop	0.30	72	F	2					0.40	101	F	2				
I-2	Pacific Hwy-Montefiore St	Seagull	0.17	16	B	1					0.18	17	B	1				
I-4	Pacific Hwy-Awabakal Dr	Give-way	0.31	58	E	2	0.39	73	F	2								
I-6	Pacific Hwy-Kanangra Dr	Signals	0.58	22	B	11									0.68	22	B	13
	Evening peak																	
I-1	Pacific Hwy-Flowers Dr	Stop	0.74	226	F	3					1.00	433	F	6				
I-2	Pacific Hwy-Montefiore St	Seagull	0.19	16	B	1					0.21	17	B	1				
I-4	Pacific Hwy-Awabakal Dr	Give-way	0.36	85	F	2	0.47	119	F	2								
I-6	Pacific Hwy-Kanangra Dr	Signals	0.66	22	B	13									0.79	23	B	17

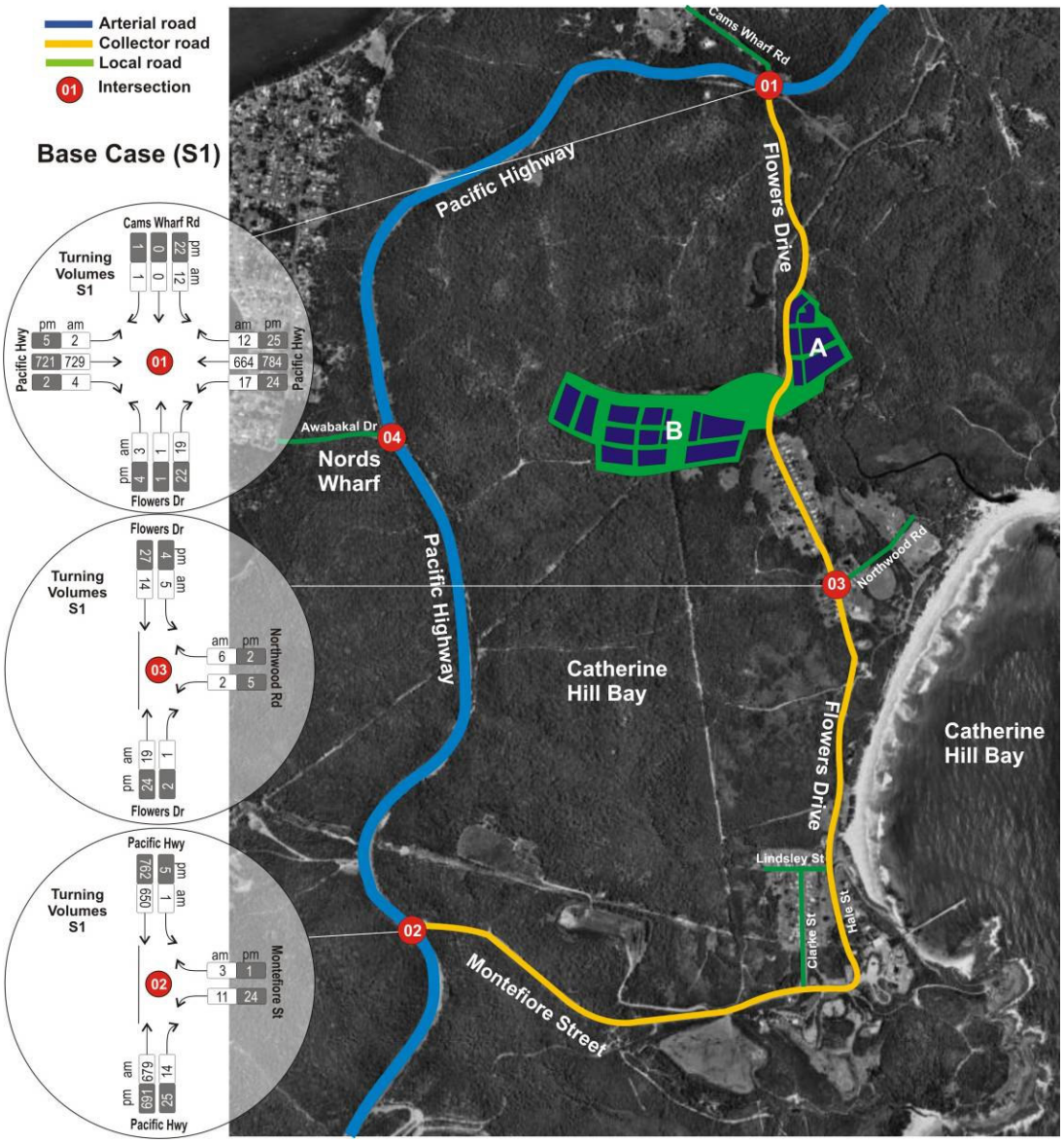


Figure 2-2 Forecasts of intersection turning volumes with Base Case S1

Table 2-5 aaSIDRA intersection parameters with Catherine Hill Bay full development in 2012 (Development Case S2)

Ints ID	Intersection	Control	DoS	AVG Delay (s)	LoS	Queue (veh)	Critical Movements
	AM						
I-01 AM	Pacific Hwy-Flowers Dr	Stop	(1.92)	(924)	F	(42)	(109 vehs) right turn from Flowers Dr (DoS=1.92), LoS=F; 1 cross traffic veh between Flowers Dr and Cams Wharf Rd (DoS=0.02, LoS=B) 4 vehs right turn from Pacific Hwy to Flowers Dr (DoS=0.01, LoS=B);
I-02 AM	Pacific Hwy-Montefiore St	Seagull	0.18	18	B	1	3 vehs right turn from Montefiore St DoS=0.01, LoS=B; (29 vehs) right turn from Pacific Hwy (DoS=0.04), LoS=B;
I-03 AM	Flower Dr-Northwood Rd	Give-way	0.04	(8)	A	1	(6 vehs) right turn from Northwood Rd (DoS=0.01), LoS=A; (1 vehs) right turn from Flowers Dr (DoS=0.02), LoS=A;
	PM						
I-01 PM	Pacific Hwy-Flowers Dr	Stop	1.00	(315)	F	(7)	(44 vehs) right turn from Flowers Dr DoS=1.00, LoS=F; 1 cross traffic veh between Flowers Dr and Cams Wharf Rd, DoS=0.05, LoS=F; 2 veh right turn from Pacific Hwy to Flowers Dr (DoS=0.01, LoS=C);
I-02 PM	Pacific Hwy-Montefiore St	Seagull	0.21	17	B	1	1 veh right turn from Montefiore St (DoS=0.003, LoS=A); (86 vehs) right turn from Pacific Hwy (DoS=0.14), LoS=B;
I-03 PM	Flower Dr-Northwood Rd	Give-way	(0.05)	7	A	1	(2 vehs) right turn from Northwood Rd (DoS=0.006), LoS=A; (2 vehs) right turn from Flowers Dr (DoS=0.05), LoS=A;

Note: Numbers highlighted in brackets were changed as per impact from revised concept plan.

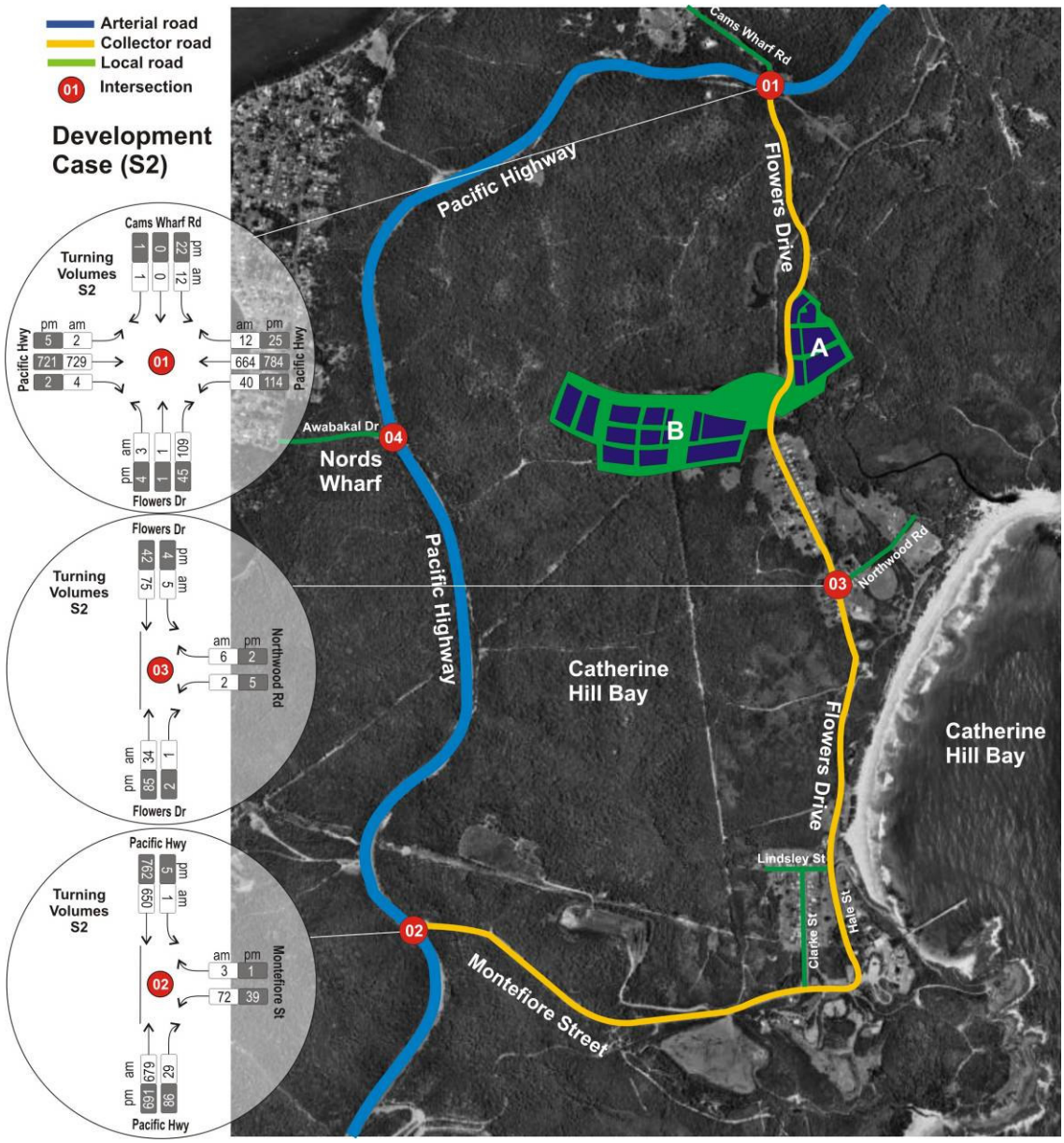


Figure 2-3 Forecasts of intersection turning volumes with Catherine Hill Bay development in 2012 (Development Case S2)

Table 2-6 aaSIDRA intersection parameters with cumulative traffic impact (Cumulative Case S3)

Ints ID	Intersection Name	Ints Control Type	Ints DOS	Ints LOS	Queue (veh)	Critical Movements
	Morning Peak					
I-01 AM	Pacific Hwy-Flowers Dr	Stop sign	(2.36)	**F**	(60)	(135 vehs) right turn from Flowers Dr (DoS=2.36), LoS=F; 1 cross traffic veh between Flowers Dr & Cams Wharf Rd, DoS=0.11, LoS=F; 10 vehs right turn from Pacific Hwy to Flowers Dr, DoS=0.02, LoS=B;
I-02 AM	Pacific Hwy-Montefiore St	Seagull	(0.41)	**B**	(2)	111 vehs right turn from Montefiore St DoS=0.32, LoS=B; 180 vehs left turn from Montefiore St (DoS=0.41), LoS=B;
I-03 AM	Flower Dr-Northwood Rd	Give-way	(0.05)	**A**	(1)	(6 vehs) right turn from Northwood Rd (DoS=0.01), LoS=A; 1 veh right turn from Flowers Dr (DoS=0.03), LoS=A;
I-04 AM	Pacific Hwy-Awabakal Dr	Give-way	1.00	**F**	8	50 vehs right turn from Awabakal Dr DoS=1.00, LoS=F; 11 vehs right turn from Pacific Hwy (DoS=0.02), LoS=B;
I-06 AM	Pacific Hwy-Kanangra Dr	Signals	(0.92)	**C**	(26)	(547 vehs) right turn from Kanangra Dr (DoS=0.91, LoS=D); 747 through vehs from Pacific Hwy NB DoS=0.92, LoS=D;
	Evening Peak					
I-01 PM	Pacific Hwy-Flowers Dr	Stop sign	(1.00)	**F**	(10)	(50 vehs) right turn from Flowers Dr (DoS=1.00), LoS=F; 1 cross traffic veh between Flowers Dr & Cams Wharf Rd, DoS=0.23; LoS=C; 22 veh right turn from Pacific Hwy to Flowers Dr, DoS=0.07; LoS=B;
I-02 PM	Pacific Hwy-Montefiore St	Seagull	(0.38)	**B**	(2)	22 vehs right turn from Montefiore St (DoS=0.08), LoS=B; (167 vehs) right turn from Pacific Hwy (DoS=0.38), LoS=B;
I-03 AM	Flower Dr-Northwood Rd	Give-way	(0.05)	**A**	1	(2 vehs) right turn from Northwood Rd (DoS=0.01), LoS=A; (2 vehs) right turn from Flowers Dr (DoS=0.05), LoS=A
I-04 PM	Pacific Hwy-Awabakal Dr	Give-way	1.00	**F**	6	26 vehs right turn from Awabakal Dr DoS=1.00, LoS=F; 46 vehs right turn from Pacific Hwy DoS=0.09, LoS=B;
I-06 PM	Pacific Hwy-Kanangra Dr	Signals	(0.98)	**(C)**	(30)	(596 vehs) left turn from Pacific Hwy to Kanangra Dr, DoS=0.97, LoS=B; (148 vehs) right turn from Pacific Hwy to Kanangra Dr, DoS=0.98, LoS=F;

Note: Numbers highlighted in brackets were changed as per impact from revised concept plan.

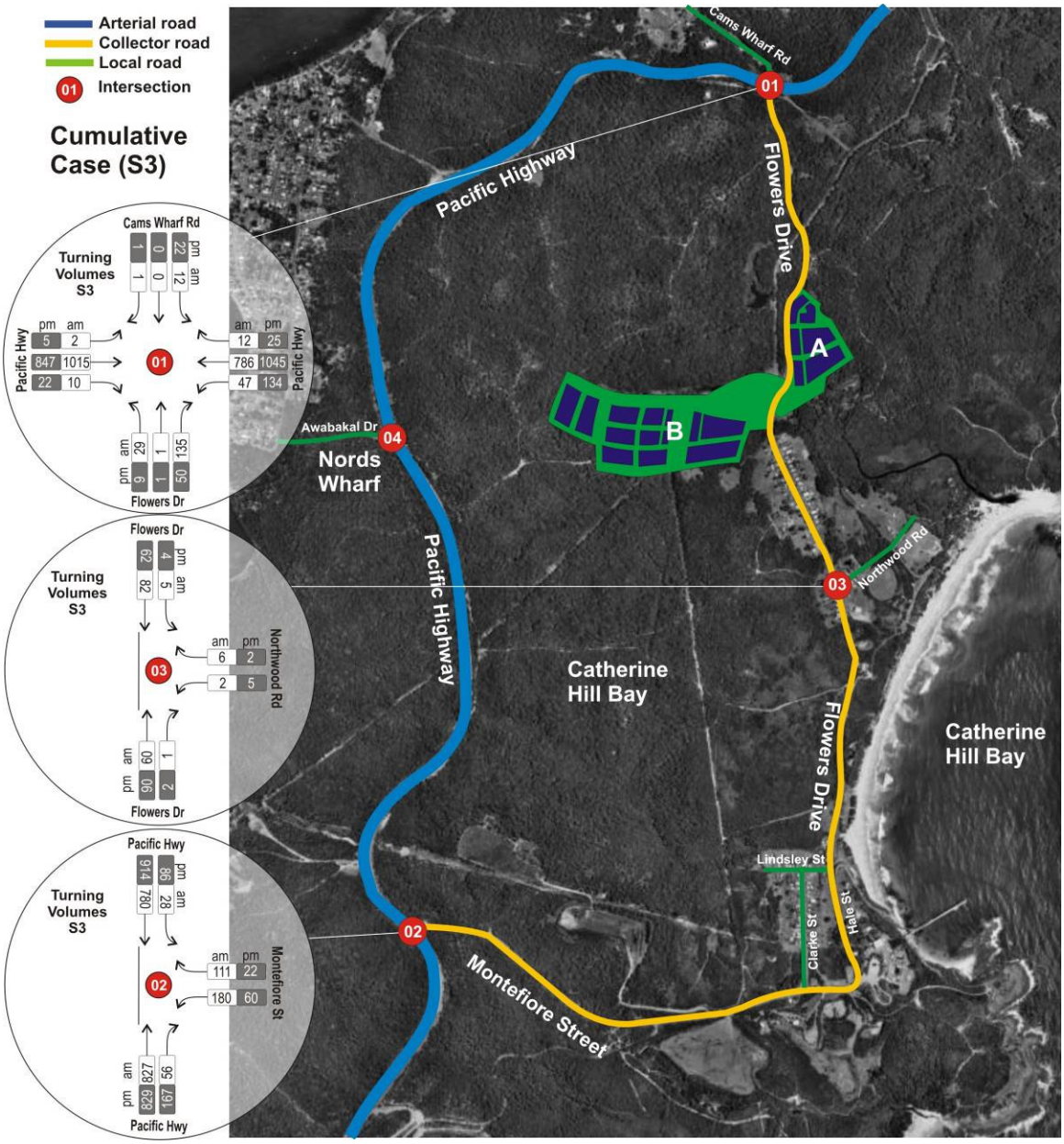


Figure 2-4 Forecasts of intersection turning volumes with cumulative traffic impact (Cumulative Case S3)

Key findings from Table 2-3 to Table 2-6 are summarised as follows:

- At present, the Pacific Highway/Flowers Drive intersection shows LoS F for the right turn from Flowers Drive and DoS between 0.30 and 0.74 for AM and PM peak. The modelling result for this intersection implies that there is a problem for the right turn from Flowers Drive with very high average delay values of 72 seconds to 226 seconds. The Pacific Highway/Montefiore Street intersection shows LoS B with critical movements DoS between 0.17 and 0.19 for AM and PM peak. This intersection does not show a capacity problem under existing traffic conditions.
- For the *base case S1*, the Pacific Highway/Flowers Drive and Pacific Highway/Montefiore Street intersections is predicted a minor impact attributable to background growth on the Pacific Highway.
- Modelling results suggests the C & A development (*under development case S2*) at Catherine Hill Bay will have significant impact on Pacific Highway at Flowers Drive intersection. The traffic model suggests LoS F with DoS between 1.0 and 1.92 for PM and AM peaks (right turn from Flowers Drive). This is slightly lower than the previous forecast but still has very high DoS.
- Pacific Highway/Montefiore Street intersection under *development case S2* shows LoS B with slightly increased DoS between 0.18 and 0.21 for the AM and PM peaks. This implies Montefiore Street intersection does not show significant capacity problem with the C & A Catherine Hill Bay development alone.
- Under *cumulative case S3*, the Pacific Highway/Montefiore Street intersection is predicted with a LoS B but with increased DoS between 0.38 and 0.41 for PM and AM peak. The additional impact at this intersection is primarily driven by the growth from Rose Group development. Similarly, we expect some additional impact at Pacific Highway/ Flowers Drive from Rose Group development. The model suggests DoS between 1.0 and 2.36 for the PM and AM peak (right turn from Flowers Drive). Our analysis therefore confirms that key intersections on the Pacific Highway will require upgrade works even when the reduced yields at C & A Catherine Hill Bay development are taken into account.

2.6 Testing of upgrading works

Figure 2-5 and Figure 2-6 show the conceptual intersection improvements at Pacific Highway/Flowers Drive and Pacific Highway/Montefiore Street intersections for a post upgrade condition. Detailed upgrading works are described in previous section 2.2.

Figure 2-5 Proposed conceptual intersection improvements at Pacific Highway/Flowers Drive intersection

Figure 2-6 Proposed conceptual intersection improvements at Pacific Highway/Montefiore St intersection

Table 2-7 shows revised intersection performance at key intersections with the Pacific Highway for post upgrading works. Considering cumulative impact, the critical DoS for Flowers Drive and Montefiore Street intersections are predicted between 0.51 and 0.53 within acceptable threshold. The analysis suggests proposed upgrading works are effective to reduce adverse impact from both C& A and Rose Group developments.

Table 2-7 aaSIDRA results for cumulative conditions (for upgrade Option, weekday condition)

Site ID	Intersection	Upgrade Option 3			
		DoS	Delays (S)	LoS	Queue (Veh)
	Morning peak				
I-1	Pacific Hwy-Flowers Dr	0.32	(45)	D	1
I-2	Pacific Hwy-Montefiore St	(0.51)	(15)	B	(13)
I-4	Pacific Hwy-Awabakal Dr	0.30	(21)	B	1
	Evening peak				
I-1	Pacific Hwy-Flowers Dr	0.28	(45)	D	1
I-2	Pacific Hwy-Montefiore St	(0.53)	14	A	15
I-4	Pacific Hwy-Awabakal Dr	0.26	18	B	1

Note: Numbers highlighted in brackets were changed as per impact from revised concept plan.

As a worst case scenario, we have also tested the above upgrading works considering increased traffic on the Pacific Highway during holiday periods. Consistent with the earlier assessment, we ran the aaSIDRA model with a 10 percent traffic increase on the Pacific Highway. Table 2-8 shows intersection performance with seasonal factors. The result indicated that both Pacific Highway intersections are forecast to operate at satisfactory LoS not only during the weekday peak periods but also at the critical holiday period.

Table 2-8 aaSIDRA results for cumulative condition (for upgrade Option, peak Highway condition)

Site ID	Intersection	Upgrade Option 3			
		DoS	Delays (S)	LoS	Queue (Veh)
	Morning peak				
I-1	Pacific Hwy-Flowers Dr	0.34	61	E	1
I-2	Pacific Hwy-Montefiore St	(0.54)	(14)	B	(14)
I-4	Pacific Hwy-Awabakal Dr	0.32	23	B	1
	Evening peak				
I-1	Pacific Hwy-Flowers Dr	0.31	60	E	1
I-2	Pacific Hwy-Montefiore St	(0.55)	(13)	A	(15)
I-4	Pacific Hwy-Awabakal Dr	0.28	19	B	1

Note: Numbers highlighted in brackets were changed as per impact from revised concept plan.

We looked at possible implication of traffic management measures (Figure 2-5 and Figure 2-6) in a view to revised concept plan (i.e. deletion of hamlets C and D and associated bypass). Considering the close proximity of hamlets A and B from Pacific Highway/Flowers Drive intersection, it is plausible that some northbound commuters may use Flowers Drive, turning left (as right turn will be banned) and than make a u-turn on the Pacific Highway.

To verify this we analysed travel times on alternative routes for northbound traffic from the C & A Catherine Hill Bay development. Figure 2-7 shows northbound traffic route via Flowers Drive, Montefiore Street, and Pacific Highway (route 1). Total travel time for route 1 is about 7.5 minutes including delays at Pacific Highway/Montefiore signals. Figure 2-7 also shows alternative route for northbound traffic exiting Flowers Drive and then making a u-turn at Pacific Highway/Nords Wharf Road intersection (route 2). Total travel time for route 2 is 3.6 minutes including delays at Pacific Highway/Flowers Drive intersection and a u-turn manoeuvre.

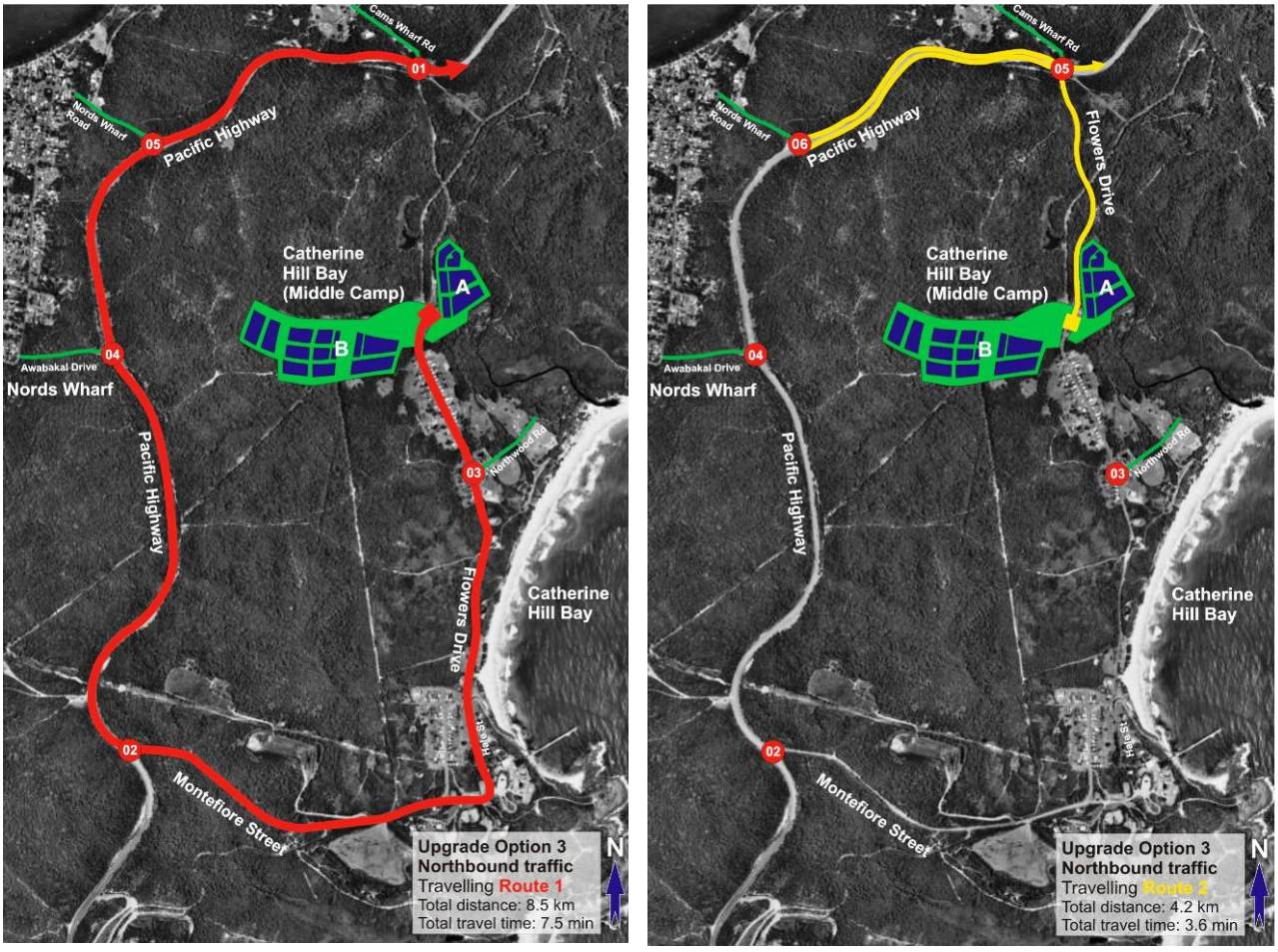


Figure 2-7 Possible travelling routes and associated travel times for northbound traffic from C & A Catherine Hill Bay development

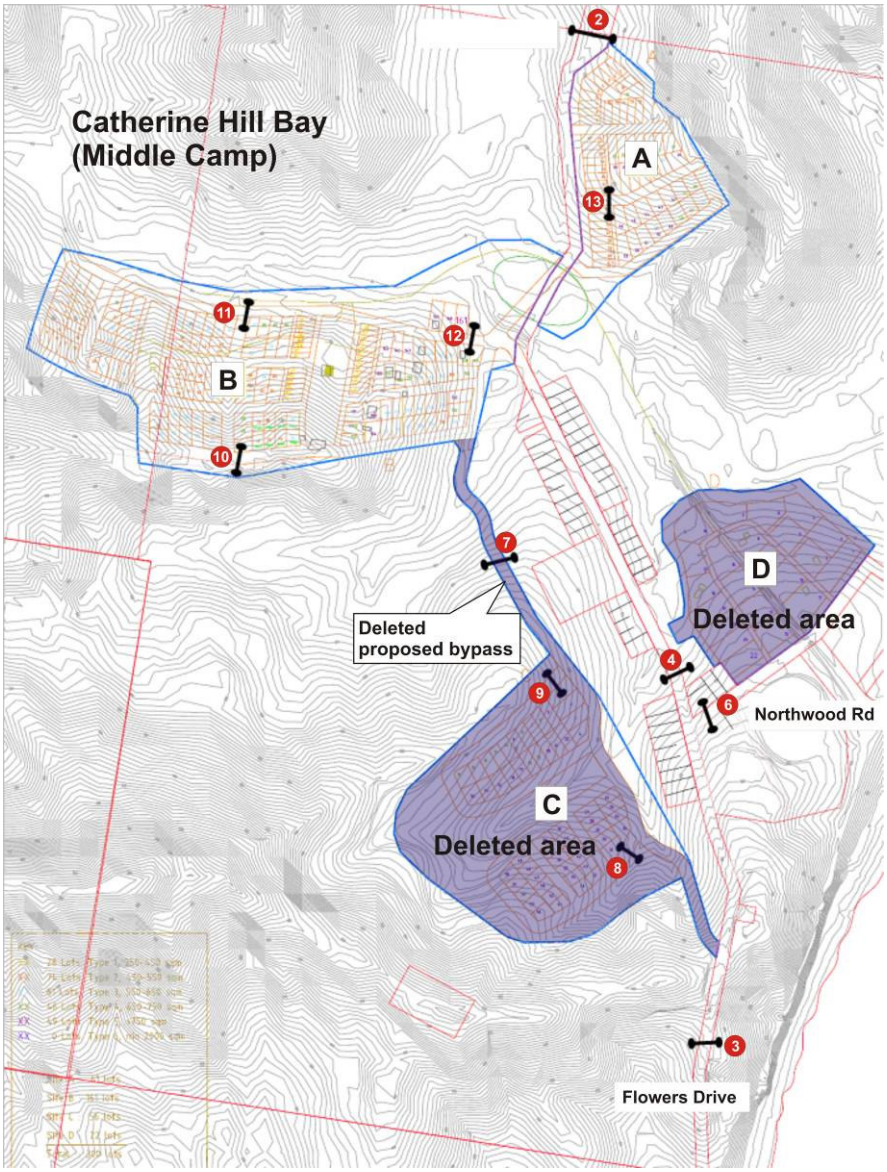
The travel time analysis shows that route 2 is more attractive than route 1 which can lead some northbound traffic to use Flowers Drive and then make a U-turn manoeuvre on the Pacific Highway. We checked the possibility of a U-turn facility on the Pacific Highway between Flowers Drive and Nords Wharf Road intersections. A U-turn facility on the Pacific Highway cannot be justified for two reasons as follows:

- Low traffic volume. If maximum of 10% of northbound traffic were to use Flowers Drive then about 27 vehicles (during worst peak hour) might use a U -turn facility. This is unlikely to be justifiable from a cost benefit perspective. We expect the majority of northbound traffic will use Montefiore Street partial signalised intersection from a safety ground;
- There was insufficient sight distance to allow the U-turn to be completed safely; or there was insufficient road and shoulder width to provide the widening required to develop the U-turn facility;

The right turn lane on the Pacific Highway at Nords Wharf intersection has adequate sight distance which allows a U-turn from the existing right turn lane. A U-turn at this location is already permitted under the current road rules.

2.7 Impact from revised concept plan

We summarised traffic forecasts on key access points and internal roads within the subdivision. Table 2-9 presents the forecast traffic with reduced yields at Catherine Hill Bay. Traffic was forecast for both peak and daily conditions. Figure 2-8 shows locations where we prepared traffic forecasts. In general, the C & A development will increase peak traffic between 20 and 170 vehicles per hour depending on location. Daily traffic would increase between 550 vehicles per day (vpd) and 1400 vpd.



Note: Location number 1 is on Pacific Highway and location number 5 is on Montefiore Street

Figure 2-8 Area of influence of C & A Catherine Hill Bay concept plan showing traffic forecasts locations (indicative lot layout)

Table 2-9 Existing and future forecasts on key roads

Location	Road	Classification	Existing-2007			With Pacific Highway background growth-2012			With development traffic-2012 (with the proposed traffic management)			Change due to development traffic		
			AM	PM	Daily	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily
1	Pacific Hwy, south of Awabakal Dr	Arterial	1,120	1,250	14,500	1,230	1,380	15,950	(1,320)	(1,400)	(16,500)	(90)	(20)	(550)
2	Flowers Dr, south of Pacific Hwy	Collector Road	50	50	730	50	50	730	(70)	(160)	(1,330)	(20)	(110)	(600)
3	Flowers Dr	Collector Road	50	50	730	50	50	730	(220)	(130)	(2,130)	(170)	(80)	(1,400)
4	Flowers Dr, through Middle Camp, north of Northwood Rd	Collector Road	50	50	730	50	50	730	(220)	(130)	(2,130)	(170)	(80)	(1,400)
5	Montefiore St, east of Pacific Hwy	Collector Road	20	40	510	20	40	510	(190)	(120)	(1,910)	(170)	(80)	(1,400)
6	Northwood Rd, east of Flowers Dr	Local Road	15	10	120	15	10	120	(15)	(10)	(120)	(0)	(0)	(0)
7	Proposed bypass	Collector Road	-	-	-	-	-	-	(0)	(0)	(0)	(0)	(0)	(0)
8	Access Rd	Local Road	-	-	-	-	-	-	(0)	(0)	(0)	(0)	(0)	(0)
9	Access Rd	Local Road	-	-	-	-	-	-	(0)	(0)	(0)	(0)	(0)	(0)
10	Access Rd	Local Road	-	-	-	-	-	-	40	40	400	40	40	400
11	Access Rd	Local Road	-	-	-	-	-	-	30	30	300	30	30	300
12	Access Rd	Local Road	-	-	-	-	-	-	50	50	500	50	50	500
13	Access Rd	Local Road	-	-	-	-	-	-	10	10	100	10	10	100

Note: Numbers highlighted in brackets were changed as per impact from revised concept plan. Volumes are rounded to the nearest tenth units..

Table 2-10 sets out the recommended Environmental Capacity performance standards on residential streets and has two value levels given, one for desirable maximum (environmental goal) and one for the absolute maximum.

Table 2-10 Environmental capacity performance standards on residential streets

Road class	Road type	Maximum speed (km/hr)	Maximum peak hour volume (vehicles/hr)	Maximum daily volume (vehicles/day)
Local	Access way	25	100	1000
	Street	40	200 environmental goal	2000 environmental goal
			300 maximum	3000 maximum
Collector	Street	50	300 environmental goal	3000 environmental goal
			500 maximum	5000 maximum

Source: RTA Guide to Traffic Generating Developments, October 2002, Table 4.6 in Section 4

Table 2-11 shows the traffic impact of the C & A Catherine Hill Bay development on key roads. We compared forecasting results with the RTA's recommended environmental capacity performance standards. The comparison shows that Flowers Drive through Middle Camp would operate below environmental capacity without proposed bypass.

Table 2-11 Future forecast volumes on key roads compared with RTA's environmental performance standards

Road	Road Class	Max Volumes		RTA's environmental goal for peak hour volumes	RTA's environmental goal for daily volumes
		Peak	Daily		
Flowers Drive	Collector	220	2130	Satisfied	Satisfied
Montefiore Street	Collector	190	1910	Satisfied	Satisfied
Northwood Road	Local Road	15	120	Satisfied	Satisfied
Access Roads at locations 10-13	Local Roads	50	500	Satisfied	Satisfied

3 Conclusions

This traffic addendum report was prepared to examine the impact on road network from reduced yield at Catherine Hill Bay site. In assessing the traffic impact from 222 lots, we considered the broader traffic assumptions, and the implications of the reduced traffic generation on the Pacific Highway intersections performances based on the cumulative impact. Key findings from our investigation are as follows:

- The revised yields at Catherine Hill Bay will generate about 189 peak hour two way trips compared to the earlier estimate of 255 trips. The yield reduction will reduce trip generation by about 25 %.
- The deletion of two hamlets (C and D) and associated bypass, we anticipate some change in access and traffic circulation patterns that were previously reported in PB's report. We envisage the major access points to the individual sites of C & A development (hamlets A B) will now be maintained more directly to and from Pacific Highway via Flowers Drive.
- Under revised concept plan, our modelling results suggested slightly better intersection performance than original plan. The critical movements would still have high DoS and operate with LoS F particularly Pacific Highway/Flowers Drive intersection. Our analysis confirmed that key intersections on the Pacific Highway would require upgrade works even when the reduced yields at C & A Catherine Hill Bay development were taken into account.
- Our analysis suggested that proposed upgrades with the Pacific Highway comprised the following modifications would still be required from both traffic capacity and safety perspectives including:
  - Cams Wharf Road/ Flowers Drive: provide a seagull intersection with full access to Cams Wharf Road. Flowers Drive traffic will be restricted to left in/left out only.
  - Montefiore Street: provide a seagull intersection with full access to Montefiore Street and traffic signal control on the Pacific Highway southbound and Montefiore Street.
- The deletion of proposed bypass will increase traffic on the Flowers Drive through Middle Camp. Model forecasts about 220 vehicles in one peak hour and 2,130 vehicles per day respectively. The post development traffic on Flowers Drive will be less than the environmental goals for residential streets set out by the RTA.
- The revised concept plan will not affect intersection controls on remaining internal road network in Hamlet A and Hamlet B as documented in PB's report. Proposed bus route 99 extension is unlikely to be affected as well. The combined pedestrian/cycle route that previously linked Hamlet D and Hamlet C could be deleted due to the reduction in lots. However, our opinion is that the pedestrian/cycle link proposal should remain unchanged as it provides a good recreational facility for Catherine Hill Bay residents. With the deletion of proposed bypass cycle route now should be on the Flowers Drive.