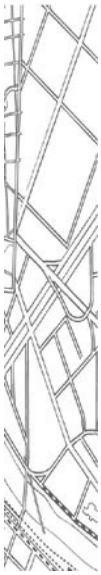
Appendix G

TRAFFIC ASSESSMENT - CATHERINE HILL BAY AND MOONEE



Transport Report

Proposed Moonee Hamlets Development, Catherine Hill Bay

6 August 2007

Prepared for

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Contents

1. Introduction

This report has been prepared on behalf of Rose Property Group to review the traffic and parking implications of the proposed Moonee Hamlets development at Catherine Hill Bay. This report is presented in two parts as follows:

- a review of the Concept Plan for Moonee Hamlets, which includes the development of some 600 residential dwellings with a Village Centre of some 1,800m² of retail and commercial floor space.
- a review of the project application proposal for the Village Centre and residential Hamlets 1 and 2.

The Concept Plan is presented in the "Catherine Hill Bay and Gwandalan Concept Plan" report prepared for Rose Property Group by Conybeare Morrison International + Context Landscape Design. Civil engineering plans, including details of road layouts, have been prepared by consultant Parsons Brinckerhoff. This report should be read in conjunction with these reports and plans.

The remainder of the report is set out as follows:

- Section 2 outlines the background situation with regard to traffic conditions, including the road network, traffic volumes, the operation of key intersections, and forecast growth in traffic on Pacific Highway.
- Section 3 reviews the Concept Plan for Catherine Hill Bay, including future traffic volumes, the operation of intersections, the proposed road hierarchy and road design standards.
- Section 4 reviews the proposed development of the Village Centre and Hamlets 1 and 2. This review specifically covers arrangements for access to residential dwellings and within the proposed Village Centre.
- Section 5 provides a summary and presents the conclusions of the investigation.

2. Existing Situation

2.1 Site Location

The proposed development in Catherine Hill Bay is located on the redundant Moonee Colliery site, as shown on **Figure 1**. Mining activity ceased in 2002, and some 42 cottages and one hotel remain in the town. A significant number of cottages are rented for holiday accommodation. The site straddles the boundary between Lake Macquarie Council and Wyong Council.

2.2 Road System

Pacific Highway is the main north-south arterial route through the area. It links to the north to Newcastle and to the south through the Central Coast area. The section of the Pacific Highway through Catherine Hill Bay has a divided four lane carriageway with two lanes northbound and two lanes southbound.

Montefiore Street is the southern access road for Catherine Hill Bay. The intersection of Montefiore Street with the Pacific Highway is a "seagull" type, with a right turn protected bay into Montefiore Street and a separate acceleration lane in the centre of Pacific Highway for traffic turning right on to the Highway. There is also a left turn deceleration lane for traffic turning left from the Highway.

The intersection occurs just to the north of a bend in the Highway which is signposted with an advisory speed limit of 75 km/hr. The Highway has shoulders about 3m wide and guard rails on each side.

Immediately to the north of this intersection is the intersection that provides entry to the Wallarah Colliery mine site on the western side of Pacific Highway. That intersection is also formed as a seagull intersection with sheltered right turn acceleration and deceleration lanes in the centre of the Highway plus a left turn lane into the access road.

The acceleration lanes in the centre of the road between the two intersections have a short chevron marked channelisation between them. To the north of the Wallarah mine access the north and south bound carriageways to the highway are separated by a Briffen wire barrier fence.

The speed limit on the highway past these two intersections is 90km/hr.

The intersection of Flowers Road (northern access to Catherine Hill Bay) with Pacific Highway also has a widened intersection with right turn lanes in the centre of the Highway to shelter turns into Flowers Road to the east and into Cams Wharf Road to the west. There are no right turn acceleration lanes in the centre of the highway for right turns out of these roads.

The Pacific Highway has two lanes each way and it has left turn deceleration lanes each way for turns into each side street.

Cams Wharf Road and Flowers Drive are controlled by Stop signs. Flowers Drive has a double centre line leading up to the intersection and a 60km/hr speed control. It has a guard rail on its southern side which curves around to run a short distance along the Pacific Highway at the intersection.

The bend to the north of the intersection on Pacific Highway has an advisory 70km/hr speed restriction. The bend to the south of the intersection has an 85km/hr advisory speed restriction.

Flowers Drive has a two lane carriageway which winds away from the Pacific Highway. It has a double centre line over a significant portion of the approach. About 300m from the Highway its speed limit changes to 80km/hr.

About a kilometre from the Highway a 50km/hr zone applies through the Catherine Hill Bay northern village area (Middle Camp). This has a series of cottages constructed on each side of the road and a double centre line continues through most of the initial village section.

Past the beach access to the south at the start of Catherine Hill Bay village there is a switch back sharp curve from Flowers Drive to Clarke Street via Lindsley Street with a double centre line and a bus stop. This also has cottages close to the edge of the road on each side. The road way is about 10m wide which allows parking on each side plus one travel lane.

The through route on Clarke Street slopes up to the top of the hill at which there is T-intersection with Montefiore Street. Clarke Street traffic has to give way.

The alignment of Montefiore Street is quite good with generous lanes and a wide shoulder on each side.

2.3 Existing Traffic Flows

To examine existing traffic flows in the Catherine Hill Bay area traffic count surveys were undertaken at the following intersections:

- Pacific Highway and Montefiore Street
- Pacific Highway and Wallarah Colliery access
- Pacific Highway, Flowers Drive and Cams Wharf Road

The surveys were conducted on Tuesday and Wednesday, 16 and 17 December 2003 between 7:00am and 9:00am and between 3.00pm and 6.00pm. The morning peak hour occurred between 7:30am and 8:30am and the evening peak hour occurred between 3:30pm and 4:30pm. Traffic volumes on Montefiore Street and Flowers Drive now are considered to be similar to those experienced in 2003, as there has been no development in the area since that time.

The peak hour movements are shown in **Figure 2** of this report. The figures indicate traffic volumes along the Pacific Highway of 1,300 to 1,400 vehicles per hour during the morning and evening peak periods. These are consistent with its arterial function. Relatively low volumes were recorded on the roads to the Catherine Hill Bay village (less than 80 vehicles per hour on each road).

The surveyed peak hour traffic volumes are summarised in Table 2.1.

Table 2.1 – Existing and 10 Year Future Weekday Peak Hour Traffic Flows (veh/hr)

Road	Location	Morning Peak Hour			Evening Peak Hour		
		NB or EB	SB or WB	Total	NB or EB	SB or WB	Total
Existing							
Pacific Highway	S of Montefiore St	594	718	1,312	714	638	1,352
Pacific Highway	E of Flowers Drive	664	749	1,413	749	672	1,421
Montefiore St	E of Pacific Highway	11	12	23	24	19	43
Wallarah Colliery Rd	W of Pacific Highway	0	0	0	1	1	2
Flowers Drive	S of Pacific Highway	24	17	41	31	41	72
10 Year Future							
Pacific Highway	S of Montefiore St	730	874	1,604	866	774	1,640
Pacific Highway	E of Flowers Drive	803	858	1,661	906	810	1,715
Montefiore St	E of Pacific Highway	11	12	23	24	19	43
Wallarah Colliery Rd	W of Pacific Highway	0	0	0	1	1	2
Flowers Drive	S of Pacific Highway	24	17	41	31	41	72

In order to assess the implications of seasonal variations in traffic flows on Pacific Highway, a review of weekly volumes was done, with reference to the 2004 data collected at the RTA's permanent count station on Pacific Highway 2km south of Swansea Bridge. This data shows that the weekly volume in the equivalent week in December 2004 was the highest over the whole year, and was 4.2% higher than the 85th percentile week. Thus the surveyed flows are considered to be higher than the typical design level, and satisfactorily take into account the variation in flows during holiday and other busy periods of the year. No seasonal factor needs to be applied to the surveyed volumes.

Automatic tube counters were also used to record traffic volumes for a one week period. The automatic counters were placed at the following locations:

- Montefiore Street – 100 metres east of the Pacific Highway (June 2004)
- Flowers Drive – 100 metres south of the Pacific Highway (June 2004)
- Flowers Drive – about 500 metres north of Lindsley Street (between the beach car park and Northwood Road
- Montefiore Street – west of Clarke Street (February 2007)
- Clarke Street – south of Lindsley Street (February 2007)
- Flowers Drive – north of Lindsley Street (February 2007).

A summary of these count results is shown in Table 2.2.

Table 2.2 – Summary of Automatic Count Results

	Montefiore Street		Flowers Drive			Clarke St
	100m E of Pacific Hwy (2004)	W of Clarke (2007)	100m S of Pacific Hwy (2004)	500m N of Lindsley (2004)	N of Lindsley (2007)	S of Lindsley (2007)
Average Weekday AM Peak						
North or Eastbound	11	18	20	15	19	20
South or Westbound	11	15	18	14	18	17
Two Way	22	33	38	29	37	37
Maximum Weekday AM Peak						
North or Eastbound	-	25	-	-	35	31
South or Westbound	-	17	-	-	22	18
Two Way	24	42	48	39	57	49
	(Fri)	(Fri)	(Fri)	(Fri)	(Fri)	(Wed)
Average Weekday PM Peak						
North or Eastbound	22	23	34	27	25	28
South or Westbound	24	31	42	32	27	31
Two Way	46	54	76	59	52	59
Maximum Weekday PM Peak						
North or Eastbound	-	22	-	-	28	39
South or Westbound	-	40	-	-	38	39
Two Way	62	62	98	78	66	78
	(Fri)	(Tue)	(Mon)	(Fri)	(Fri)	(Fri)
Weekday						
Average Weekday	465	634	711	574	698	723
Maximum Weekday	516	732	831	715	809	851
	(Thu)	(Fri)	(Fri)	(Fri)	(Fri)	(Fri)
Average Weekend	762	1,375	1,130	993	1,516	1,667
Weekend						
Maximum Weekend	913	1,711	1,326	1,198	1,718	2,052
	(Sun)	(Sun)	(Sun)	(Sun)	(Sun)	(Sun)
Maximum Weekend 1 hour flow	109 (1-2pm Sun)	191 (12-1pm Sun)	161 (3-4pm Sun)	147 (12-1pm Sun)	220 (12-1pm Sun)	278 (12-1pm Sun)

The weekday morning commuter peak hour was recorded between 8.00am and 9.00am and the evening peak commuter hour between 3.00pm and 4.00pm in 2004, and between 5:00pm and 6:00pm in 2007.

Table 2.2 above indicates the following:

- Flowers Road currently carries higher volumes of traffic to the Pacific Highway than Montefiore Street.
- The highest traffic volumes recorded occurred on weekends rather than weekdays.
- The day with the greatest traffic volumes was Sunday.
- Generally the weekday with the highest traffic volumes was Friday.

2.4 Background Traffic Growth on Pacific Highway

Traffic volumes are expected to continue to increase along the Pacific Highway as the population continues to grow between the Central Coast and Newcastle. For analysis purposes, a 2 percent per annum growth rate was assumed for a 10 year analysis period. The resulting two way traffic volumes are summarised in Table 2.3, and the turning movements are presented in **Figure 2**.

Table 2.3 – Future Weekday Peak Hour Traffic Flows with 10 Years' Growth (veh/hr)

Road	Location	Morning Peak Hour			Evening Peak Hour		
		NB or EB	SB or WB	Total	NB or EB	SB or WB	Total
Pacific Highway	S of Montefiore St	730	874	1,604	866	774	1,640
Pacific Highway	E of Flowers Drive	803	858	1,661	906	810	1,715
Montefiore St	E of Pacific Highway	11	12	23	24	19	43
Wallarah Colliery Rd	W of Pacific Highway	0	0	0	1	1	2
Flowers Drive	S of Pacific Highway	24	17	41	31	41	72

2.5 Accident History

Accident data has been obtained for the Pacific Highway in the Catherine Hill Bay area from the RTA traffic accident database for the nine-year period 1996-2004.

It should be noted that this database is based on accidents where the police attend and this is only a partial picture of the pattern of all traffic accidents.

The following is a summary of accidents recorded in the length of the Pacific Highway between 500 metres north of Cams Wharf Road to 500 metres south of Montefiore Street over the nine year period for which data was obtained:

- Fatal accidents 2
- Accidents causing injury 32
- Towaway accidents 58
- Total 92

The majority of accidents involved vehicles leaving the road on a left or right bend on the Pacific Highway. This suggests that drivers are going faster than is appropriate for the conditions, especially in rain. The data indicates that speeding was a contributory factor in 62% of the recorded accidents.

The data revealed that only a small number of accidents occurred at or near the intersections of the Pacific Highway and streets relevant to this study.

Only three accidents were recorded at the Montefiore Street intersection. A summary of the accidents is provided in Table 2.4 below:

Table 2.4 – Accidents At or Near the Pacific Highway/Montefiore St Intersection

Location and Description	Casualties	Conditions	Time	Speeding involved?
1. Vehicle runs off end of Montefiore Street	None	Wet	Dark	No
2. Head on collision – 30m south of Montefiore St	Three injured	Wet	Daytime	Yes
3. Vehicle turning right hit on right side by vehicle going straight	Five injured	Dry	Daytime	No

The nature of the three accidents in the table above suggest that only one of them were specifically related to the intersection itself.

The Flowers Drive/Cams Wharf Road had seven recorded accidents over the nine year period which included a total of nine injuries. The details of the accidents are noted in Table 2.5 below.

Table 2.5 – Accidents At or Near Pacific Hwy/Flowers Dr/Cams Wharf Rd Intersection

Location and Description	Casualties	Conditions	Time	Speeding involved?
1. Cross Traffic collision at intersection	One injured	Wet	Daytime	Yes
2. Vehicle turning right hit on right side by vehicle going straight	Four injured	Fine	Daytime	No
3. Cross Traffic collision at intersection	Three injured	Fine	Daytime	No
4. Vehicle turning right hit on right side by vehicle going straight	One injured	Fine	Daytime	No
5. Cross Traffic collision at intersection	None	Fine	Daytime	No
6. Cross Traffic collision at intersection	None	Fine	Daytime	No
7. Vehicle turning right hit on side by vehicle going straight	None	Fine	Daytime	No

Four of the accidents involved cross traffic collisions and the remaining three involved right turn vehicles. The prevailing conditions during the time of most of the accidents were favourable with dry and sunny weather, and speeding was generally not regarded as a contributing factor.

The accident records at the Pacific Highway intersections indicate that the Montefiore Street intersection, which has a seagull configuration, is the safer of the two intersections that provide access to the Catherine Hill Bay village east of the Pacific Highway.

The cross traffic accidents at the Flowers Drive intersection combined with its lack of right turn and cross traffic capacity suggest that it would need signalisation if side street traffic volumes were to increase significantly.

2.6 Public Transport

The private bus company Busways provides public transport services through the Catherine Hill Bay village area. It operates one route through the village which extends from Charlestown in the north to Wyong in the south. There are two services in the northerly direction and two services in the southerly direction on weekdays and one service in each direction on Saturday.

An additional one service per day operates on weekdays during school holidays.

It is anticipated that bus services would be augmented progressively as population increased in the future.

2.7 Intersection Operation

The Pacific Highway intersections that intersect with the two roads that access Catherine Hill Bay have been analysed using the SIDRA Intersection analysis programme. SIDRA Intersection performs analysis of the operating conditions which can be compared to the performance criteria set out in Table 2.6.

Table 2.6 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and 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
F	over 70	Extra capacity required	Extreme delay, traffic signal or other major treatment required

Adapted from Guide to Traffic Generating Developments, RTA, 2002

The analysis results are summarised in Table 2.7 below for both the surveyed volumes and with forecast background growth in traffic along the highway over 10 years, without the proposed Moonee Hamlets development. A ten year growth factor based on historic growth was applied to Pacific Highway traffic. The average delay is given in seconds per vehicle, and is reported for the movement with the worst average delay per vehicle.

Table 2.7 – Existing Layout SIDRA Intersection Results for Highway Intersections

Intersection	Control	Peak	Avg Delay (sec/veh)	Worst Movement	LOS
Existing					
Pacific and Flowers	priority	AM	>100	TR from Cams Wharf Rd	F
		PM	>100	TR from Cams Wharf Rd	F
Pacific and Montefiore	priority	AM	35.1	R onto highway	C
		PM	41.8	R onto highway	C
With 10 Years' Growth					
Pacific and Flowers	priority	AM	>100	TR from Cams Wharf Rd	F
		PM	>100	TR from Cams Wharf Rd	F
Pacific and Montefiore	priority	AM	44.4	R onto highway	D
		PM	54.7	R onto highway	E

Table 2.7 indicates that the intersection of the Pacific Highway with Montefiore Street currently operates at an acceptable level of service with low average delays. The right turn movement onto the highway from Montefiore Street experiences the highest average delay per vehicle. The right turn movement into Montefiore Street experiences only short delays, and the through movements on the highway experience negligible delays due to the intersection. The forecast growth in through traffic on the highway would increase delays to the turning vehicles, nearing unacceptable levels of service.

The intersection of the Pacific Highway with Flowers Drive and Cams Wharf Road has a level of service F due to the delays associated with the right turn movements from Cams Wharf Road and Flowers Road, and the through movement between Flowers Road and Cams Wharf Road across the Pacific Highway. The movements along and from the highway experience good levels of service and short delays. The situation would remain similar with the forecast growth in traffic along the highway, with increased delays to those critical movements. It is noted that these delays are experienced by a small number of vehicles on each movement.

3. The Concept Plan and its Impacts

3.1 Description of the Concept Plan Development

The Concept Plan for Moonee Hamlets development includes the development of up to 600 residential dwellings with a Village Centre of some 1,800m² GFA of retail and commercial floor space and community facilities.

The proposed layout of the development includes seven residential hamlets which would have their vehicular access to and from an east-west collector road (Montefiore Street) and a north-south collector road. The hamlets would each contain some community title land, and varying numbers of residential lots. The following schedule of dwellings in each hamlet shows the maximum possible within each hamlet, with a total of some 650 dwellings. The overall total number of dwellings in all hamlets combined would however not exceed 600 dwellings:

- Hamlet 1 – 70 dwellings, 1,800m² retail/commercial space
- Hamlet 2 – 108 dwellings
- Hamlet 3 – 93 dwellings
- Hamlet 4 – 160 dwellings
- Hamlet 5 – 86 dwellings
- Hamlet 6 – 79 dwellings
- Hamlet 7 – 55 dwellings
- Community facilities.

Each hamlet would gain access to the collector road system via a local road, and access to individual lots would be via car courts. The proposed road hierarchy is shown in **Figure 3**.

3.2 Traffic Generation and Distribution

The potential evening peak hour traffic generation of the Concept Plan development has been estimated as follows.

The retail and commercial space is expected to generate vehicle trips at an average rate of 12.5 vehicle trips per 100m² GLFA during the evening peak hour, which is the average rate surveyed by the RTA for Friday evening peak generation of small

shopping centres less than 10,000m² GLFA. The proposed 1,800m² GFA would be equivalent to 1,530m² GLFA, and so would be expected to generate some 190 vehicle trips per hour during the evening peak hour. These trips would be generated within the Catherine Hill Bay area, with the majority being to and from the proposed new dwellings. An allowance of 20 vehicle trips was made for traffic generated by the proposed community facilities. The Village Centre is therefore expected to generate around 210 vehicle trips per hour during the evening peak hour.

Morning peak hour traffic generation of retail centres is typically around one third of the evening peak volume. Given that the Village Centre is proposed to contain a mix of retail and commercial space, a conservatively high assessment was undertaken, assuming that the morning peak hour generation of the Village Centre would be around one half of the evening peak generation rate. On this basis, the Village Centre is expected to generate around 106 vehicle trips per hour during the morning peak hour.

The residential dwellings are expected to generate vehicle trips at an average rate of 0.65 vehicle trips per dwelling during the morning and evening peak hours. This reflects an expectation that because of the location of the site, a significant number of trips generated by the dwellings will be purpose ones made away from the area. The absence of major shops or similar facilities in the area would encourage residents to be more efficient in the travel habits. For the proposed 600 dwellings, this is equivalent to 390 vehicle trips per hour. This total includes trips to and from the Village Centre retail and commercial space and community facilities.

The volume of traffic generated during the evening peak hour would typically be around 10 per cent of the daily total, thus the residential dwellings would generate some 3,900 vehicle trips per day, and the retail/commercial and community facilities would generate some 2,100 vehicle trips per day.

The analysis which follows assumes the following:

- All trips to and from the Village Centre would be generated within the Catherine Hill Bay area, with the majority (80%) being to and from the proposed new dwellings. The remaining 20% are assumed to be generated to and from the existing dwellings in the area, and the distribution has been simplified such that this traffic is generated to/from Lindsley Street west of Clarke St. This will tend to overestimate future traffic forecasts on Lindsley Street.
- All trips to and from the Village Centre would be generated to and from the loop road formed as the eastern prolongation of Montefiore Street past Hale Street.
- The calculated residential traffic generation above includes the trips to and from the Village Centre.
- New residential traffic generation external to the Catherine Hill Bay area would tend to use Montefiore Street (80%) to access Pacific Highway rather than Flowers Drive (20%).

- At each intersection with Pacific Highway, traffic is assumed to be split so that half travels northbound and half southbound.

3.3 Future Traffic Volumes

The traffic generated by the proposed Concept Plan development was added to the road system as above, and the resulting traffic movements on roads and intersections determined. Table 3.1 summarises the resulting two way traffic volumes at key locations in Catherine Hill Bay during the morning and evening peak hours. This includes the existing volumes, the volumes with background growth on Pacific Highway, and with the traffic estimated to be generated by the Concept Plan Moonee Hamlets development. The forecast turning movements at key intersections are presented in **Figure 4**.

It is noted that in some locations, existing volumes have been estimated from surrounding survey results. These locations are noted in the table. The table also presents the actual or proposed designation of each road within the road hierarchy.

Table 3.1 – Existing and Future Weekday AM and PM Peak Hour Traffic (veh/hr)

Road & Location	Classification	Existing		+ Growth		+ Concept Plan	
		AM	PM	AM	PM	AM	PM
Pacific Hwy	Arterial						
South of Montefiore St		1,318	1,352	1,604	1,640	1,739	1,742
East of Flowers Dr		1,373	1,421	1,661	1,715	1,828	1,842
Montefiore St	Collector						
East of Pacific Hwy		23	43	23	43	293	246
East of Hamlets 4 & 6		33	53	33	53	234	266
East of Clarke St*		4	5	4	5	108	178
East of Hale St*		9	10	9	10	115	222
Clarke St	Minor Collector						
North of Montefiore St		37	59	37	59	98	104
Lindsley St	Minor Collector						
East of Clarke St*		30	47	30	47	112	135
Hale St	Collector						
North of Montefiore St*		7	5	7	5	49	68
Flowers Dr	Collector						
South of Pacific Hwy		41	72	41	72	106	122
Proposed Local Roads	Local Street						
Hamlet 2 Access Rd		-	-	-	-	70	70
Hamlet 3 Access Rd		-	-	-	-	60	60
Hamlet 4 Access Rd		-	-	-	-	104	104
Hamlet 5 Access Rd		-	-	-	-	56	56
Hamlet 6 Access Rd		-	-	-	-	51	51
Hamlet 7 Access Rd		-	-	-	-	36	36

* Existing is estimated, not directly from survey results

The Environmental Capacity of an area is determined by the impact of traffic, roads and various aspects of the location. The RTA has identified performance standards for environmental capacity of residential streets, as set out below.

Table 3.2 – Environmental Capacity Performance Standards for Residential Streets

Road Class	Road Type	Maximum Peak Hour Volume (veh/hr)
Local	Access Way	100
	Street	200 environmental goal 300 maximum
Collector	Street	300 environmental goal 500 maximum

Source: RTA Guide to Traffic Generating Developments, 2002

Comparing these performance standards with the results in Table 3.1 indicates that future volumes on the collector and local roads are expected to be well below the RTA's environmental goals for those street types.

Forecast weekday flows on the Catherine Hill Bay road system are presented in Table 3.3.

Table 3.3 – Future Weekday Daily Flows (veh/day)

Road	Classification	North or East Bound	South or West Bound	Two Way
Montefiore Street	Collector			
West of Hamlet 7		1,361	1,416	2,777
West of Hamlets 4&6		1,355	1,409	2,764
West of Clarke St		1,190	1,244	2,434
West of Hale St		850	849	1,698
East of Hale St		1,061	1.060	2,121
Clarke Street	Minor Collector			
North of Montefiore St		573	629	1,202
Lindsley Street	Minor Collector			
West of Hale St		510	566	1,077
Flowers Drive	Collector			
North of Lindsley St		574	645	1,219
Proposed Local Streets	Local			
Hamlet 2 Access Rd		351	351	702
Hamlet 3 Access Rd		302	302	605
Hamlet 4 Access Rd		520	520	1,040
Hamlet 5 Access Rd		280	280	559
Hamlet 6 Access Rd		257	257	514
Hamlet 7 Access Rd		179	179	358

Comparing these performance standards with the results in Table 3.3 (noting that peak hour flows are typically 8 to 10 per cent of daily flows) indicates that future volumes on the collector and local roads are expected to be well below the RTA's environmental goals for those street types.

3.4 Future Intersection Operation

3.4.1 Local Intersections

The operation of the key intersections within Catherine Hill Bay was analysed to determine the likely future operating conditions. The results are presented in Table 3.4. These results assume that these intersections would operate under priority control, with single lane approaches, i.e. no additional turn lanes. Priority is proposed to lie along Montefiore Street at the intersections of Clarke Street and Hale Street, and along Hale

Street at its intersection with Lindsley Street. The reported average delay is in seconds per vehicle, and is for the movement with the highest average delay per vehicle.

Table 3.4 – Operation of Catherine Hill Bay Intersections

Intersection	Control	Average Delay (sec/veh)		Level of Service	
		AM Peak	PM Peak	AM Peak	PM Peak
Montefiore St and Clarke St	priority	9.3	9.4	A	A
Montefiore St and Hale St	priority	9.0	9.9	A	A
Lindsley St and Hale St	priority	8.9	8.9	A	A

The results indicate that the intersections would operate at good levels of service, with only short delays to traffic. Detailed results showing 95th percentile queues and delays to each movement are provided in Appendix A.

It is proposed to realign the Lindsley Street/Hale Street intersection to regularise the shape of the intersection and better separate Hale Street from an existing residence on the western side of Hale Street. This arrangement will:

- improve amenity of the residence,
- make the functioning of the intersection more legible, and
- minimise the inclination for additional traffic to use Clarke Street, thus protecting amenity of residents on that street as well.

3.4.2 Highway Access Intersections

MWT has previously provided advice regarding the options for upgrading of the intersections of Pacific Highway with Montefiore Road and Flowers Drive/Cams Wharf Road. This advice has been issued to Department of Planning, and been reviewed by both the Roads and Traffic Authority (RTA) and Hunter Regional Development Committee (HRDC). A copy of that report of December 2006 is provided in Appendix B, noting that the traffic forecasts were based on a different development scheme than that currently under investigation. This earlier scheme was for larger development, and the resulting traffic flows at the intersections on Pacific Highway in that report would be greater than under the current Concept Plan.

The HRDC supports the use of traffic signal control at the intersections of Pacific Highway with Montefiore Street and with Flowers Drive/Cams Wharf Road. The RTA however considers traffic signal control inappropriate, and expressed a preference to either restrict access to left in/left out only at the two main accesses to Catherine Hill Bay with U-turn facilities at appropriate locations, or provide a grade separated interchange which would allow for all movements into and out of Catherine Hill Bay.

In light of this inconsistency in the advice regarding the treatment of access to and from the Pacific Highway, it is understood that Rose Property Group intends to further discuss this matter with RTA to develop a preferred option that meets the needs of both local and highway traffic. Rose Property Group intends to provide access treatments to meet the requirements of RTA.

3.5 Proposed Road Network and Hierarchy

The proposed road network for the Concept Plan includes an east-west collector road (Montefiore Street) and a north-south collector road (Flowers Drive/Hale Street) which meet at the access to the Village Centre. A minor collector route follows Clarke Street and Lindsley Street where they parallel the collector route.

Montefiore Street (collector road) is proposed to be constructed within a 20.0m road reserve dedication. The existing 8.0m wide pavement would be widened to 10.0m and would accommodate a single travel lane in each direction and a 2.0m wide cycleway. A 6.0m verge is proposed on the northern side, and a 4.0m wide verge on the southern side. Overhead street lighting would be provided to the relevant Australian Standard.

Local roads are proposed to provide access to and from the residential hamlets from the collector roads. Each hamlet would be accessed via a local road, and a local road would connect between Hamlets 5, 4, 3 and 2, to the south of Montefiore Street.

The local roads are proposed to have a minimum road reserve of 15m, with an 8.5m carriageway on which parking would be permitted on one side. The parking lane would be 2.5m wide and constructed of a contrasting material from the main carriageway. The parking lane would also accommodate street trees. A 2.5m wide services verge would be provided on the parking side, while the other side would comprise a 1.5m wide landscape strip and a 2.5m wide drainage swale. Overhead street lighting would be provided to the relevant Australian Standard.

Hale Street is proposed to be a similar profile to the local roads, with the exception that the 1.5m wide landscape strip would be replaced with a cycleway.

Car courts would provide access from the local roads to the individual allotments. These are proposed to have a 13.0m wide reserve, with an 8.0m carriageway on which parking would be permitted on one side. The parking lane would be 2.5m wide and would also accommodate street trees. A 2.5m services verge would be provided on the parking side, with a 2.5m wide drainage swale on the other side.

Wyong Council and Lake Macquarie Council each have a DCP which sets out standards for road types and dimensions in new subdivisions. Key aspects of these are summarised below, together with the equivalent guidelines set out in the AMCORD guidelines[1]. These are compared with the proposed road system in Moonee Hamlets. It is noted that the site straddles Lake Macquarie and Wyong LGAs, and that as the development is being assessed by Department of Planning, strict compliance with any

[1] Commonwealth Department of Housing and Regional Development (1995) *AMCORD (Australian* Model *Code for Residential Development) – A National Resource Document for Residential Development* Australian Government Publishing Service, Canberra.

one or other of the DCPs or AMCORD is not required. Rather, this comparison is provided as a guide to considering the suitability of the proposed road system within the context of the local area.

Table 3.5 – Road Characteristics

Characteristic	Wyong	Lake Macquarie	AMCORD	Proposed
Collector Roads				
- Road Reserve	18.5m 23.0m bus route	20.0m 22.0m bus route	16.5m	20.0m
- Carriageway	7.5m 12.0m bus route	11.0m 13.0m bus route	7.0-7.5m, or 6.0-6.5m + indented parking	10.0m incl. cycleway
- Verge	2 x 5.5m	2 x 4.5m	2 x 4.5m	1 x 6.0m, 1 x 4.0m
- Footpath	2 x 1.2m	2 x 1.2m	2 x 1.2m	
Local Roads				
- Road Reserve	16.5m	16.0m	13.0m	15.0m
- Carriageway	5.5m	8.0m	5.0-5.5m	8.5m incl. parking
- Verge	2 x 5.5m	1 x 4.5m, 1 x 3.5m	2 x 4.0m	1 x 2.5m, 1 x 4.0m
- Footpath	2 x 1.2m	1 x 1.2m	No	No
Car Courts				
- Road Reserve	14.0m	13.0m	10.0m	13.0m
- Carriageway	5.0m	6.0m	3.5m or 5.0m	8.0m incl. parking
- Verge	2 x 4.5m	2 x 3.5m	-	2 x 2.5m
- Footpath	2 x 1.2m	No	No	No

Comparing these characteristics, it can be seen that the proposed geometry is generally consistent with the various requirements, taking into account that on-street parking would not be permitted on the collector roads, and that separate parking lanes are proposed on the local roads and car courts. It is understood that the bus route roads have been designed to accommodate the turning movements of buses, and it is recommended that at bus stops, the carriageway width be widened to allow buses to stand clear of passing cars.

3.6 Pedestrian and Cycle Accessibility

A network of informal bicycle and pedestrian tracks is proposed to provide for the movement of cycles and pedestrians throughout the development area. Bicycle routes are proposed along the collector roads, and the major pedestrian/cycle paths would link to these. The proposed pedestrian/cycle tracks are shown in **Figure 3**.

As the pedestrian paths would be shared with cyclists, they are proposed to be 2.5m wide. The low traffic volumes in the area would provide good amenity for cyclists on all roads within the Catherine Hill Bay area.

3.7 Public Transport

A bus route is proposed along the collector roads, with a turn around loop proposed off Montefiore Street around the community facilities. Bus stops are proposed near the access to each hamlet, and near the intersection of Lindsley Street and Flowers Drive. The proposed bus route and locations of stops are presented in **Figure 3**.

It is understood that no formal arrangement has been made with existing bus service providers regarding this route, however it is anticipated that new services and stops would be introduced progressively by the local service provider as the population and demand increases.

3.8 Holiday Local Traffic Conditions

Considering the area's proximity to the beach, it can be expected that there would be additional vehicle trips around the Moonee Hamlets area during summer, particularly on weekends. Local residents would generally be within walking or cycling distance of the beach, and so would not tend to generate a significant number of additional vehicle trips. Beach visitors from outside the Moonee Hamlets local area would generate additional trips within the local area to access Moonee Beach and Middle Camp Beach.

It is difficult to quantify the level of additional traffic associated with future beach activities, however the following points are noted:

- peak vehicular activity associated with the beaches is unlikely to coincide with the commuter peak periods; the holiday peak traffic would tend to occur when background traffic volumes would otherwise be low.
- traffic volumes could be approximately double the commuter peak volumes on most roads in the local area, and the RTA's Environmental Capacity performance standards discussed in Section 3.3 would still be satisfied. This suggests that traffic influences on residential amenity would remain satisfactory even if beach traffic volumes were significantly higher than those which have been forecast for the commuter peak periods.
- the analysis of commuter peak operation of local intersections (Section 3.4.1) shows significant spare capacity at the key intersections, suggesting that significant increases in traffic could be accommodated before the Levels of Service would become unacceptable.
- the availability and location of public parking for beach visitors would influence the amount of traffic generated, noting that Rose Property Group is investigating the possibility of a public car park close to Moonee Beach. Such a car park would reduce the influence of beach traffic on local traffic conditions, as its access would be directly from Montefiore Street west of Moonee Hamlets. It is understood that this car park is the subject of discussions between Rose Property Group and National Parks and Wildlife Service.

Overall, it is considered that the design of the proposed road system is sufficiently robust to satisfactorily accommodate additional beach activity during summer holiday periods.

4. Project Application Hamlets 1 and 2 Development

4.1 Description of the Proposed Development

The proposed development of the Hamlets 1 and 2 comprises the following:

- 1,800m² retail and commercial space with vehicular access via an eastern prolongation of Montefiore Street past Hale Street
- rear access to parking and service areas off local roads at the back of the shops
- 69 residential dwellings Hamlet 1, with main vehicular access via a southern leg at the intersection of Montefiore Street and Hale Street. Some lots would have access via local roads off Hale Street, north of the Village Centre and off Montefiore Street west of Hale Street.
- 108 residential dwellings in Hamlet 2, with vehicular access via a local road forming a southern leg at the intersection of Montefiore Street and Clarke Street
- a shared parking area on the northern side of Montefiore Street to serve the community centre and any seasonal parking overflow
- Village Centre employee parking under and behind the shops.

4.2 Traffic Generation

The traffic generated by the residential component of the development during the evening peak hour is estimated to be:

Hamlet 1 – 69 dwellings @ 0.65 trips/dwelling = 45 veh/hr
Hamlet 2 – 108 dwellings @ 0.65 trips/dwelling = 70 veh/hr.

The retail/commercial/community facilities component would ultimately generate some 210 vehicle trips per hour during the evening peak hour (see Section 3.2) however it would not reach this level of activity until the whole Catherine Hill Bay area is developed.

4.3 Proposed Road System and Access

The road system for the development of Hamlets 1 and 2 has been designed to accommodate the future development potential of the entire Catherine Hill Bay area. The proposed collector road system would accommodate the future traffic demands of full development as discussed in Section 3 with regard to both operational

requirements and amenity considerations. It follows that the lower flows expected upon completion of Hamlets 1 and 2 would be easily accommodated by the road system.

Vehicular access for the Village Centre is proposed via an eastern leg at the intersection of Montefiore Street with Hale Street. East of the intersection, this new road would form a one way clockwise loop around a park, with around 25 parallel parking spaces along the outside of the loop.

Vehicular access for the proposed dwellings in the southern part of Hamlet 1 is proposed via a southern leg at the intersection of Montefiore Street and Hale Street. To the south of the intersection, this local road is proposed to form a two way loop road providing access to individual allotments, and also to the rear of some the retail/commercial lots in the Village Centre.

Vehicular access to the residential lots to the north of the Village Centre is proposed via a road which is proposed to loop off Hale Street. This road would also provide rear access to some of the retail/commercial lots in the Village Centre. A separate car court from Hale Street is proposed to provide access to the northernmost residential lots.

A small number of residential lots are proposed along the western side of Hale Street, and would have frontage to both Montefiore Street and to a car court at their rear. Public parking for some 60 cars is also proposed on the northern side of Montefiore Street, which would share their access from Montefiore Street with these residences.

Access to and from Hamlet 2 is proposed via a local road which would extend southwards from the intersection of Montefiore Street with Clarke Street. This local road would provide access to car courts, which would give access to the individual residential allotments. The local road would extend through the centre of Hamlet 2, and would ultimately link through to the local roads which would serve Hamlet 4 and 5.

4.4 Car Parking Provision and Layout

The parking provision for the development is proposed to be in accordance with Lake Macquarie Council's DCP, which has the following requirements of relevance to the development:

- 1 undercover and 1 space as single file parking per dwelling (small lot housing)
- 0.75 spaces per small dwelling (<75m² or 1 bedroom, multiple dwelling housing)
- 1.0 space per medium dwelling (75-100m² or 2 bedrooms, multiple dwelling housing)
- 1.5 spaces per large dwelling (>100m² or 3 bedrooms, multiple dwelling housing)
- 0.25 visitor spaces per dwelling for residential flat buildings
- 0.5 visitor spaces per dwelling for multiple dwelling housing

- 1 space per 25m² GFA for shops = 72 spaces for 1,800m² GFA.

By way of comparison, the RTA's guidelines set out the following requirements:

- one space (preferably two) per detached dwelling house
- 1.0 space per 1 bedroom dwelling (medium density)
- 1.2 spaces per 2 bedroom dwelling (medium density)
- 1.5 spaces per 3 bedroom dwelling (medium density)
- 6.1 spaces per 100m² GLFA retail = 93 spaces for 1,800m² GFA.

Wyong Council's DCP 61 has the following requirements of relevance to the proposed development. It is noted that the DCP does not have a specific requirement for detached dwellings, thus the rates quoted below are for cluster housing and residential flat buildings:

- 1.5 spaces per 1 or 2 bedroom dwelling (cluster housing/residential flat buildings)
- 2.0 spaces per 3+ bedroom dwelling (cluster housing/residential flat buildings)
- 1.0 space per dwelling less than 125 m²GFA (dual occupancy)
- 2.0 spaces per dwelling greater than 125m² GFA (dual occupancy)
- 1 space per 30m² GFA for shops = 60 spaces for 1,800m² GFA.

Parking for visitors in the residential areas would be available on-street on the residential streets and in the car courts. A public car park for 60 cars is proposed on the northern side of Montefiore Street east of Clarke Street, with access to and from Montefiore Street. The layout of car parking would comply with the relevant parts of the Australian Standard AS2890 for parking facilities. Parking for people with disabilities would also be included in the overall parking provision. This car park would serve community events at the community centre, and any seasonal overflow from shops at times when such was likely to occur.

4.5 Servicing and Emergency Access

Servicing of the retail/commercial space is proposed via the 6m wide lanes at the rear of the Village Centre. This is a satisfactory arrangement, which would separate the movement of service vehicles from general traffic around the Village Centre.

Emergency access would be facilitated by the proposed road network, noting that the road system would provide through roads of sufficient width for emergency vehicle access.

4.6 Bicycles and Pedestrians

Some local portions of the planned pedestrian and cycle network would be constructed as part of the development of Hamlets 1 and 2, including a path along Montefiore Street (off the carriageway) which would be shared with pedestrians and cyclists. The low traffic volumes would result in good cycle amenity on the local roads.

The layout of the development allows a high level of permeability for the movement of bicycles and pedestrians. Neighbourhood destinations are proposed to include secure bicycle parking racks.

5. Summary and Conclusions

5.1 Summary

Existing Situation

- The proposed development is located on the redundant Moonee Colliery site.
- The Pacific Highway is the main north-south arterial route through the area, and access to Catherine Hill Bay is provided via its intersections with Montefiore Street and with Flowers Drive.
- Intersection vehicle movement surveys reveal that Pacific Highway carries some 1,300 to 1,400 vehicles per hour during peak hours, while Montefiore Street carries fewer than 50 vehicles per hour, and Flowers Drive carries up to 70 vehicles per hour.
- Traffic volumes on Montefiore Street and Flowers Drive tend to peak on weekends rather than weekday commuter peak hours.
- Busways operates limited bus services through Catherine Hill Bay village area.
- The intersection of Montefiore Street with Pacific Highway operate at a satisfactory levels of service for most movements, however this is expected to decline with growth in through traffic on the highway.
- Small numbers of vehicles experience poor levels of service at the intersection of Flowers Drive and Pacific Highway. This would decline with growth in through traffic on the highway, however vehicles travelling along and from the highway experience good levels of service.

The Concept Plan and its Impacts

- The Concept Plan for the Moonee Hamlets development includes the development of up to 600 residential dwellings and some 1,800m² GFA of retail and commercial floor space with community facilities.
- The layout includes seven residential hamlets with vehicular access to and from an east-west collector road and a north-south collector road.
- The retail/commercial/community facilities are expected to generate 210 vehicle trips per hour during the evening peak hour.
- The residential component of the development is expected to generate 390 vehicle trips per hour during the evening peak hour, which includes the trips generated by the Village Centre.

- Future traffic volumes on the planned road system are well below the RTA's environmental capacity performance standards, which is satisfactory.
- The key intersections in the Moonee Village would operate at good levels of service, with spare capacity and only short delays to traffic.
- The treatment of the access to and from Pacific Highway will be a matter for ongoing discussion between Rose Property Group and RTA, noting that HRDC and RTA have provided conflicting advice regarding the treatment. Rose Property Group intends to provide a treatment to the satisfaction of RTA, which provides for the needs of both the development and the highway traffic.
- The proposed road network geometry is generally consistent with standards set out by AMCORD, Wyong Council and Lake Macquarie Council. It is recommended that the carriageway width on the bus routes be widened to allow buses to stand clear of passing cars.
- A network of informal bicycle and pedestrian tracks is proposed. The low traffic volumes in the area would provide good amenity for cyclists on all roads.
- A bus route is proposed through the site, with stops near the access to individual hamlets. It is anticipated that new services and stops would be introduced progressively as the population increases.

Project Application Hamlets 1 and 2 Development

- The proposed development of Hamlets 1 and 2 comprises 1,800m² retail and commercial space, 177 residential dwellings, and a shared parking area on the northern side of Montefiore Street.
- The residential dwellings are expected to generate 115 vehicle trips per hour during the evening peak hour, some of which would be to and from the Village Centre retail/commercial space.
- The road system for the development has been designed to accommodate the future development potential of the entire Moonee Hamlets development. It follows that the lower traffic flows resulting from the Hamlets 1 and 2 development would easily be accommodated on the road system.
- The parking provision is proposed to be in accordance with Lake Macquarie Council's DCP.
- The layout of car parking would be in accordance with the Australian Standard for parking facilities.

5.2 Conclusions

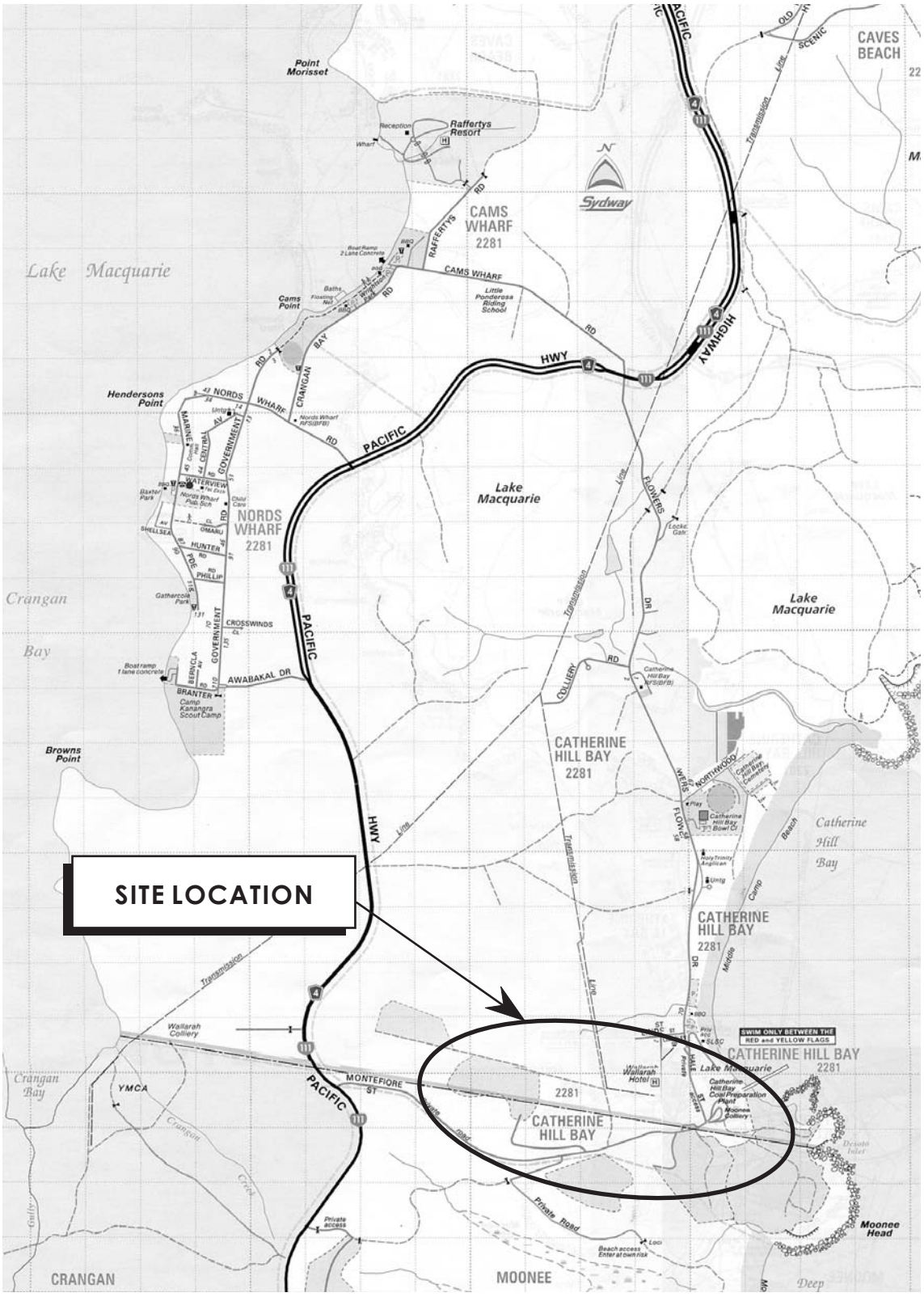
The traffic and transport aspects of the proposed Hamlets 1 and 2 development and the overall Concept Plan for the Moonee Hamlets development would be satisfactory subject to the following traffic management measures:

- Satisfactory treatment of the access to and from Pacific Highway, which is a matter for ongoing discussion between Rose Property Group and RTA.
- augmentation of normal bus services progressively as population and activity in the area increases.

Cycle paths, pedestrian facilities and public transport services are generally consistent with Wyong and Lake Macquarie Council requirements and are considered to be satisfactory, subject to widening of bus route roads.

SITE LOCATION

CATHERINE HILL BAY



MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

Figure 1

Filename: 032262di39.ai

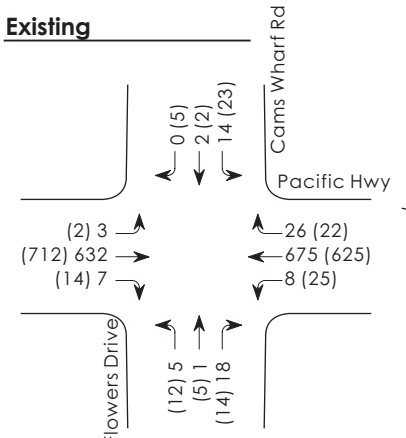
Date: 20 July 2007

EXISTING & FUTURE WEEKDAY PEAK HOUR TRAFFIC FLOWS

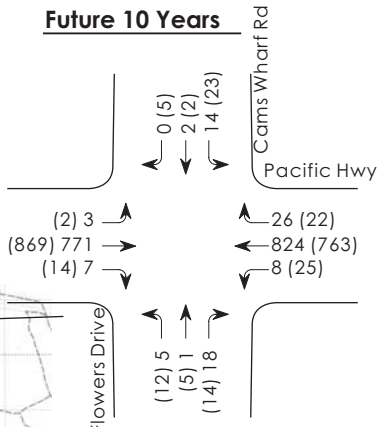
CATHERINE HILL BAY

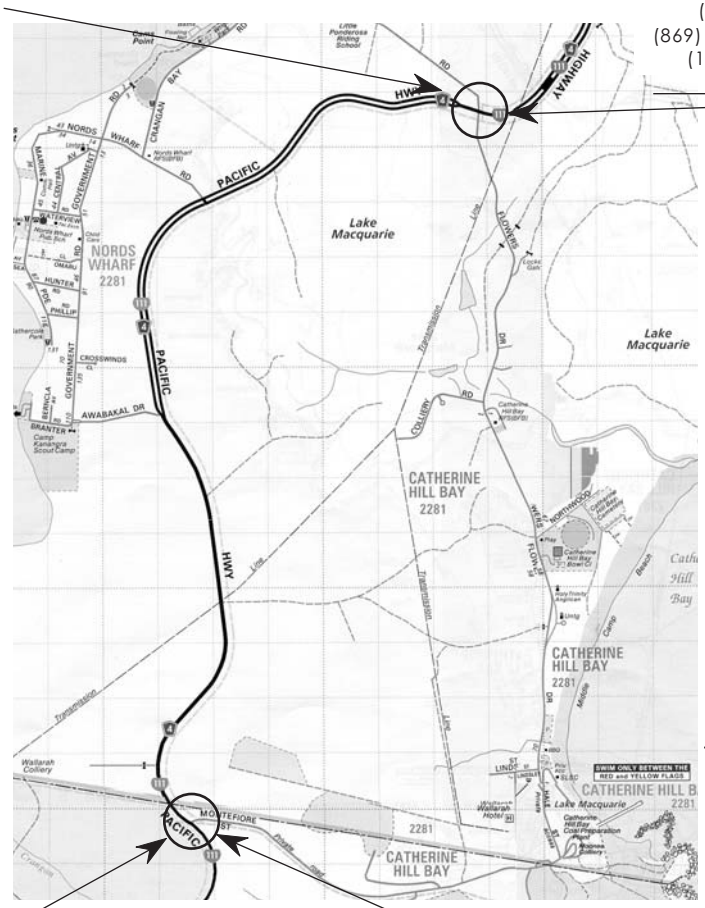
North

Existing

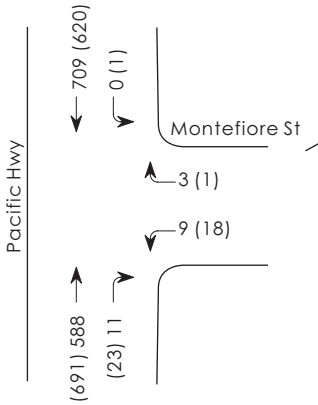


Future 10 Years

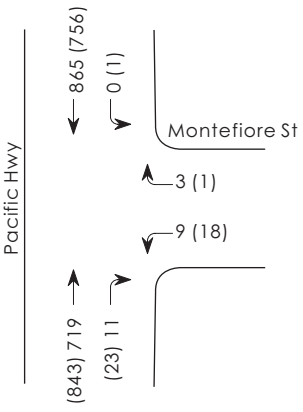




Existing



Future 10 Years



Key

5: AM Peak (7:30-8:30)

(5): PM Peak (3:30-4:30)

MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

Figure 2

Filename: 032262di13.ai

Date: 6 July 2007

PROPOSED ROAD HIERARCHY AND CIRCULATION

CATHERINE HILL BAY

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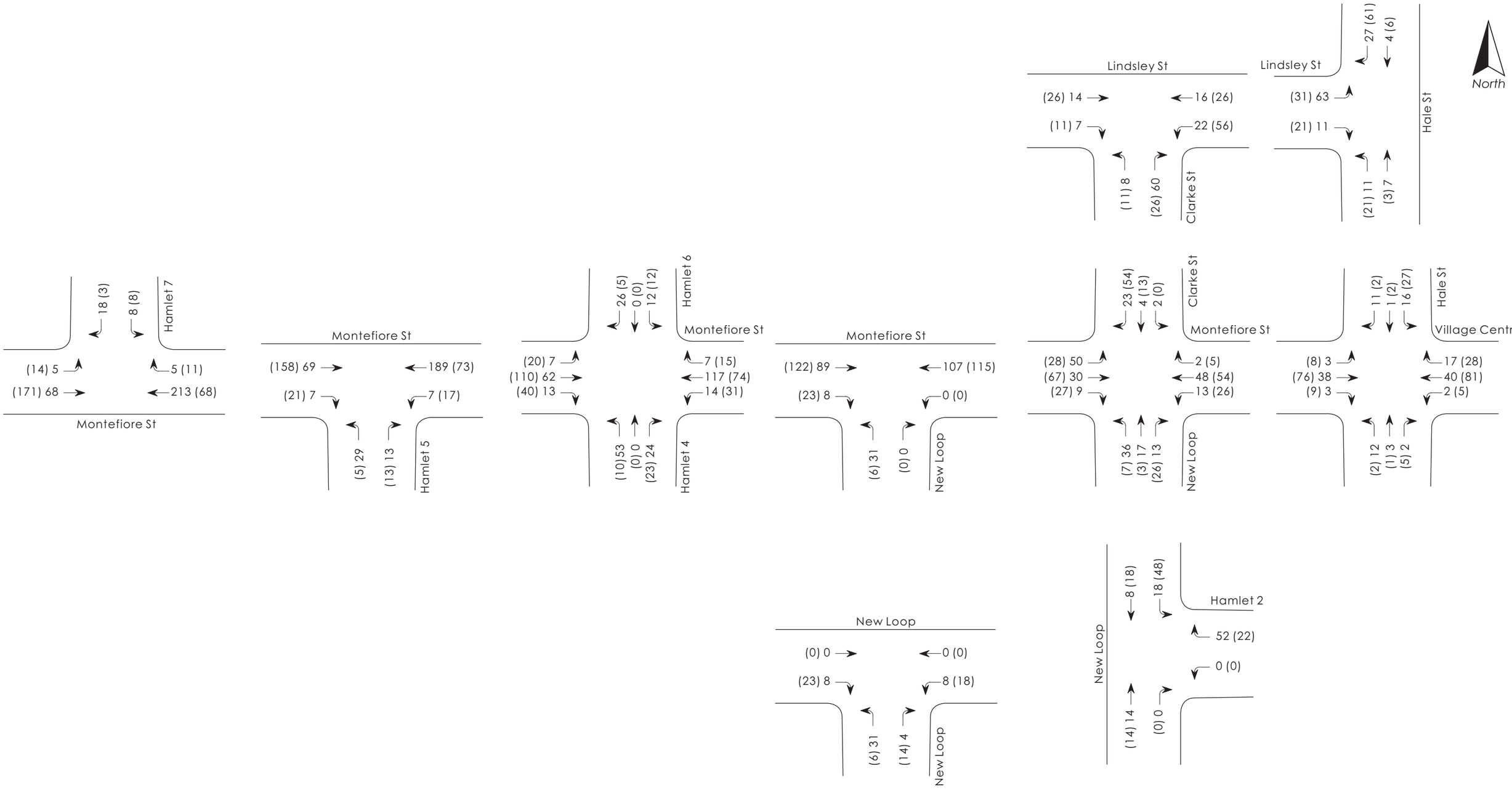
Figure 3

Filename: 032262di38.ai

Date: 6 July 2007

FUTURE MORNING AND EVENING PEAK HOUR TRAFFIC FLOWS

CATHERINE HILL BAY



Key

5: AM Peak (8:00 - 9:00am)

(5): PM Peak (17:00 - 18:00pm)

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TRAFFIC AND TRANSPORT CONSULTANTS

Figure 4

Filename: 032262di37.ai

Date: 6 July 2007

Appendix A - Sidra Intersection Movement Summaries

SIDRA INTERSECTION

Movement Summary

Montefiore St and Hale St

Future AM

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
To Hamlet 1										
1	L	13	7.7	0.021	8.7	LOS A	1	0.14	0.62	48.3
2	T	3	25.0	0.021	7.4	LOS A	1	0.14	0.57	49.6
3	R	2	33.3	0.021	8.9	LOS A	1	0.14	0.67	48.1
Approach		**20**	**15.0**	**0.021**	**8.4**	**LOS A**	**1**	**0.14**	**0.62**	**48.5**
Village Centre										
4	L	2	33.3	0.038	8.3	LOS A	1	0.11	0.59	48.4
5	T	42	2.4	0.038	0.1	LOS A	1	0.11	0.00	58.4
6	R	18	5.3	0.038	8.7	LOS A	1	0.11	0.66	48.2
Approach		**64**	**4.7**	**0.038**	**3.0**	**LOS A**	**1**	**0.11**	**0.22**	**54.5**
Hale St										
7	L	17	5.6	0.032	8.7	LOS A	1	0.14	0.62	48.3
8	T	1	50.0	0.032	7.4	LOS A	1	0.14	0.58	49.6
9	R	12	8.3	0.032	9.0	LOS A	1	0.14	0.67	48.1
Approach		**32**	**9.4**	**0.032**	**8.7**	**LOS A**	**1**	**0.14**	**0.63**	**48.3**
Montefiore St W										
10	L	3	25.0	0.027	8.4	LOS A	1	0.14	0.57	48.3
11	T	40	2.5	0.027	0.2	LOS A	1	0.14	0.00	58.1
12	R	3	25.0	0.027	8.6	LOS A	1	0.14	0.65	48.1
Approach		**48**	**6.2**	**0.027**	**1.6**	**LOS A**	**1**	**0.14**	**0.10**	**56.2**
All Vehicles		**164**	**7.3**	**0.038**	**4.4**	**Not Applicable**	**1**	**0.13**	**0.32**	**52.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Montefiore St and Hale St

Future PM

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
To Hamlet 1										
1	L	2	33.3	0.015	9.6	LOS A	1	0.29	0.60	47.4
2	T	2	33.3	0.015	8.4	LOS A	1	0.29	0.59	48.7
3	R	4	20.0	0.015	9.9	LOS A	1	0.29	0.66	47.1
Approach		**11**	**27.3**	**0.015**	**9.4**	**LOS A**	**1**	**0.29**	**0.62**	**47.6**
Village Centre										
4	L	4	20.0	0.070	8.4	LOS A	3	0.18	0.55	48.2
5	T	89	2.2	0.070	0.3	LOS A	3	0.18	0.00	57.6
6	R	26	3.7	0.070	8.8	LOS A	3	0.18	0.65	47.9
Approach		**122**	**3.3**	**0.070**	**2.5**	**LOS A**	**3**	**0.18**	**0.17**	**54.7**
Hale St										
7	L	25	3.8	0.033	8.9	LOS A	1	0.20	0.62	48.1
8	T	2	33.3	0.033	7.6	LOS A	1	0.20	0.60	49.3
9	R	2	33.3	0.033	9.1	LOS A	1	0.20	0.69	47.8
Approach		**32**	**9.4**	**0.033**	**8.8**	**LOS A**	**1**	**0.20**	**0.62**	**48.2**
Montefiore St W										
10	L	1	50.0	0.051	8.5	LOS A	2	0.20	0.53	48.1
11	T	84	2.4	0.051	0.3	LOS A	2	0.20	0.00	57.3
12	R	6	14.3	0.051	8.9	LOS A	2	0.20	0.65	47.8
Approach		**94**	**4.3**	**0.051**	**1.1**	**LOS A**	**2**	**0.20**	**0.06**	**56.2**
All Vehicles		**259**	**5.4**	**0.070**	**3.1**	**Not Applicable**	**3**	**0.19**	**0.20**	**54.0**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Lindsley St and Flowers Dr

Future AM

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Hale St										
1	L	12	8.3	0.015	8.6	LOS A	1	0.19	0.54	48.1
2	T	7	12.5	0.015	0.4	LOS A	1	0.19	0.04	57.5
Approach		**20**	**10.0**	**0.015**	**5.3**	**LOS A**	**1**	**0.19**	**0.34**	**51.5**
Flowers Dr										
8	T	4	20.0	0.035	0.3	LOS A	1	0.15	0.04	57.9
9	R	28	3.4	0.035	8.9	LOS A	1	0.15	0.65	48.0
Approach		**34**	**5.9**	**0.035**	**7.6**	**LOS A**	**1**	**0.15**	**0.56**	**49.3**
Lindsley St										
10	L	66	1.5	0.043	8.3	LOS A	0	0.00	0.67	49.0
12	R	12	8.3	0.043	8.5	LOS A	0	0.00	0.70	48.6
Approach		**78**	**2.6**	**0.043**	**8.3**	**LOS A**		**0.00**	**0.67**	**48.9**
All Vehicles		**132**	**4.5**	**0.043**	**7.7**	**Not Applicable**	**1**	**0.07**	**0.59**	**49.4**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: LindFlowersAM
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SIDRA INTERSECTION

Movement Summary

Lindsley St and Flowers Dr

Future PM

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Hale St										
1	L	22	4.3	0.017	8.6	LOS A	1	0.18	0.55	48.1
2	T	3	25.0	0.017	0.3	LOS A	1	0.18	0.04	57.5
Approach		**27**	**7.4**	**0.017**	**7.4**	**LOS A**	**1**	**0.18**	**0.47**	**49.3**
Flowers Dr										
8	T	4	20.0	0.070	0.4	LOS A	2	0.16	0.04	57.8
9	R	63	1.6	0.071	8.9	LOS A	2	0.16	0.66	48.0
Approach		**68**	**2.9**	**0.071**	**8.3**	**LOS A**	**2**	**0.16**	**0.61**	**48.6**
Lindsley St										
10	L	33	3.0	0.031	8.3	LOS A	0	0.00	0.67	49.0
12	R	22	4.3	0.031	8.5	LOS A	0	0.00	0.70	48.6
Approach		**56**	**3.6**	**0.031**	**8.4**	**LOS A**		**0.00**	**0.68**	**48.8**
All Vehicles		**151**	**4.0**	**0.071**	**8.1**	**Not Applicable**	**2**	**0.10**	**0.61**	**48.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: LindFlowersPM
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SIDRA INTERSECTION

Movement Summary

Montefiore St and Clarke St

Future AM

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
To Hamlet 2										
1	L	38	2.6	0.067	8.6	LOS A	2	0.17	0.62	48.2
2	T	18	5.3	0.067	7.4	LOS A	2	0.17	0.57	49.4
3	R	14	7.1	0.067	8.9	LOS A	2	0.17	0.66	48.0
Approach		**71**	**4.2**	**0.067**	**8.4**	**LOS A**	**2**	**0.17**	**0.61**	**48.5**
Montefiore St E										
4	L	14	7.1	0.037	8.7	LOS A	2	0.24	0.51	47.9
5	T	51	2.0	0.037	0.4	LOS A	2	0.24	0.00	56.8
6	R	2	33.3	0.038	8.8	LOS A	2	0.24	0.63	47.7
Approach		**68**	**4.4**	**0.037**	**2.5**	**LOS A**	**2**	**0.24**	**0.13**	**54.3**
Clarke St										
7	L	2	33.3	0.038	8.9	LOS A	1	0.23	0.60	47.9
8	T	4	20.0	0.038	7.7	LOS A	1	0.23	0.56	49.1
9	R	24	4.0	0.037	9.3	LOS A	1	0.23	0.66	47.7
Approach		**33**	**9.1**	**0.038**	**9.0**	**LOS A**	**1**	**0.23**	**0.64**	**47.9**
Montefiore St W										
10	L	53	1.9	0.053	8.5	LOS A	2	0.21	0.53	48.0
11	T	32	3.1	0.053	0.2	LOS A	2	0.21	0.00	57.2
12	R	9	10.0	0.053	8.7	LOS A	2	0.21	0.63	47.8
Approach		**95**	**3.2**	**0.053**	**5.7**	**LOS A**	**2**	**0.21**	**0.36**	**50.8**
All Vehicles		**267**	**4.5**	**0.067**	**6.0**	**Not Applicable**	**2**	**0.21**	**0.40**	**50.6**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Montefiore St and Clarke St

Future PM

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
To Hamlet 2										
1	L	6	14.3	0.047	9.1	LOS A	2	0.24	0.60	47.9
2	T	3	25.0	0.047	7.8	LOS A	2	0.24	0.58	49.0
3	R	29	3.3	0.047	9.4	LOS A	2	0.24	0.66	47.7
Approach		**41**	**7.3**	**0.047**	**9.2**	**LOS A**	**2**	**0.24**	**0.64**	**47.8**
Montefiore St E										
4	L	29	3.3	0.051	8.6	LOS A	2	0.23	0.51	47.9
5	T	57	1.8	0.051	0.3	LOS A	2	0.23	0.00	56.9
6	R	5	16.7	0.051	8.9	LOS A	2	0.23	0.64	47.7
Approach		**93**	**3.2**	**0.051**	**3.6**	**LOS A**	**2**	**0.23**	**0.21**	**53.0**
Clarke St										
7	L	5	16.7	0.085	9.2	LOS A	3	0.26	0.61	47.8
8	T	13	7.7	0.084	7.9	LOS A	3	0.26	0.58	48.9
9	R	56	1.8	0.084	9.4	LOS A	3	0.26	0.66	47.6
Approach		**75**	**4.0**	**0.084**	**9.1**	**LOS A**	**3**	**0.26**	**0.65**	**47.8**
Montefiore St W										
10	L	29	3.3	0.070	8.5	LOS A	3	0.19	0.54	48.1
11	T	63	1.6	0.070	0.3	LOS A	3	0.19	0.00	57.4
12	R	27	3.6	0.070	8.8	LOS A	3	0.19	0.65	47.9
Approach		**121**	**2.5**	**0.070**	**4.3**	**LOS A**	**3**	**0.19**	**0.28**	**52.5**
All Vehicles		**330**	**3.6**	**0.085**	**5.8**	**Not Applicable**	**3**	**0.23**	**0.39**	**50.9**

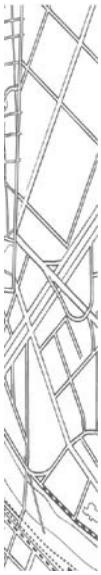
Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

Appendix B - MWT Report re Highway Intersection Options



Traffic Report

Catherine Hill Bay Access Options

8 December 2006

Prepared for

Rose Property Group

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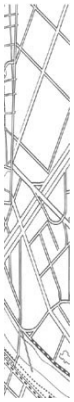
MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS



Document:
Title: Catherine Hill Bay Access Options
File Name: 032262r06

Client:
Rose Property Group

Issue Date:
8 December 2006

Authorised by:
Bruce Masson

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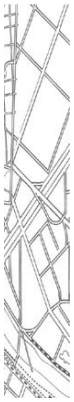

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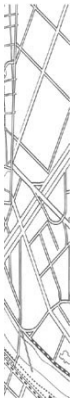


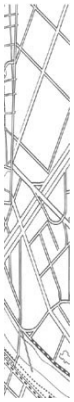
1. Introduction

This report provides a comparative assessment of access options for the proposed development of a residential village on a former mine site at Catherine Hill Bay. In particular it considers options for provision of access to/from the Pacific Highway. It has been prepared at the request of the Roads and Traffic Authority and Wyong and Lake Macquarie Councils and should be read in conjunction with a development application traffic report for the proposed development. It has been prepared to assist these authorities in determining the most appropriate form of access for Catherine Hill Bay from the Pacific Highway.

This report considers:

- implications of alternative access options to/from Pacific Highway including consideration of alternative distribution of generated traffic to/from the north and south,
- sight distance implications of the Pacific Highway/Montefiore Street intersection, and
- journey times for each route from the proposed development.

This information is submitted for joint consideration by the applicant (Rose Property Group), the RTA, and Wyong and Lake Macquarie Councils.



2. Access Options

2.1 Intersection Options

A number of arrangements for access to the Catherine Hill development have been assessed. These include sensitivity tests for the relative split of traffic to the north and south. The existing priority controls are "seagull" control at the Montefiore Street intersection, and "give way" controls at the Flowers Drive and Cams Wharf Road intersection.

Base – Existing Priority Controls at Both Intersections

- Option Base A – development traffic split 60% north and 40% south
- Option Base B – development traffic split 40% north and 60% south

Option 1 – Signals at Pacific Highway and Flowers Drive

- Option 1A – development traffic split 60% north and 40% south with existing priority seagull at Montefiore Street
- Option 1B – development traffic split 40% north and 60% south, with existing priority seagull at Montefiore Street
- Option 1C – development traffic split 60% north and 40% south, with signals at Montefiore Street
- Option 1D – development traffic split 40% north and 60% south, with signals at Montefiore Street

Option 2 – Right Turn Banned from Flowers Drive to Pacific Highway

- Option 2A – development traffic split 60% north and 40% south, with existing priority seagull at Montefiore Street
- Option 2B – development traffic split 40% north and 60% south, with existing priority seagull at Montefiore Street
- Option 2C – development traffic split 60% north and 40% south, with signals at Montefiore Street
- Option 2D – development traffic split 40% north and 60% south, with signals at Montefiore Street

Option 3 – Flowers Drive Closed at Northern End

- Option 3A – development traffic split 60% north and 40% south, with existing priority seagull at Montefiore Street
- Option 3B – development traffic split 40% north and 60% south, with existing priority seagull at Montefiore Street

Option 4 – Flowers Drive Closed at Northern End, Signals at Montefiore Street

- Option 4A – development traffic split 60% north and 40% south
- Option 4B – development traffic split 40% north and 60% south.

Option 5 – Signals at Pacific Hwy and Flowers Dr, and Left In/Left Out at Montefiore St

- Option 5A – development traffic split 60% north and 40% south,
- Option 5B – development traffic split 40% north and 60% south

Table 2.1 – Summary of Options

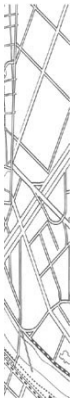
		Flowers Drive Intersection			
Montefiore St Intersection		Priority All Turns Allowed	Priority No Right Turn Out of Flowers	Priority Flowers Closed	Signals
	Seagull All Turns	Base A, Base B	2A, 2B	3A, 3B	1A, 1B
	Priority Left In/Left Out	-	-	-	5A, 5B
	Signals	-	2C, 2D	4A, 4B	1C, 1D

The above options were assessed using the SIDRA Intersection modelling software. Details and results of this analysis can be found in Chapter 3 of this report.

2.2 Assumptions

Where traffic signal control is applied in the following analyses, a simple two phase operation has been assumed, where right turning vehicles give way to opposing through and left turning traffic. This may not be the optimum phasing, and is discussed further in Section 3.9.

The analyses assume that Montefiore Street and Flowers Drive would be sufficiently widened at their approaches to Pacific Highway to allow two lanes for around 30m from the intersection.



3. Analysis Results

Intersections are the critical parts of the road system as their operation governs capacity. Accordingly, the intersections in the vicinity of the subject site have been analysed using SIDRA Intersection analysis program. SIDRA Intersection determines operational characteristics such as the average delay that vehicles encounter, the degree of saturation of the intersection, and its level of service.

The traffic flows were sourced from a previous traffic report undertaken by Masson Wilson Twiney Pty Limited in April 2005. A ten year growth factor based on historic growth was applied to Pacific Highway traffic, and future traffic due to the proposed development was added. The flows used in the analysis for each of the access options are presented in Appendix A of this report.

The SIDRA Intersection outputs can be compared to the performance criteria set out in Table 3.1 below.

Table 3.1 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and 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
F	over 70	Extra capacity required	Extreme delay, traffic signal or other major treatment required

Adapted from Guide to Traffic Generating Developments, RTA, 2002

At signals, the average delay considered is over all movements at the intersection. At roundabouts and priority intersections, the average delay considered is for the movement with the highest average delay per vehicle. The results in the following

sections include which movement experiences the highest average delays per vehicle under priority control.

3.1 Options Base A and Base B

The existing intersections are priority controlled, as shown below, and have been analysed with the future peak hour traffic flows shown in Appendix A. These volumes include the existing surveyed volumes plus 10 years of growth along Pacific Highway, plus traffic generated by all proposed and potential developments in Catherine Hill Bay. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the SIDRA Intersection analysis are presented in Table 3.2.

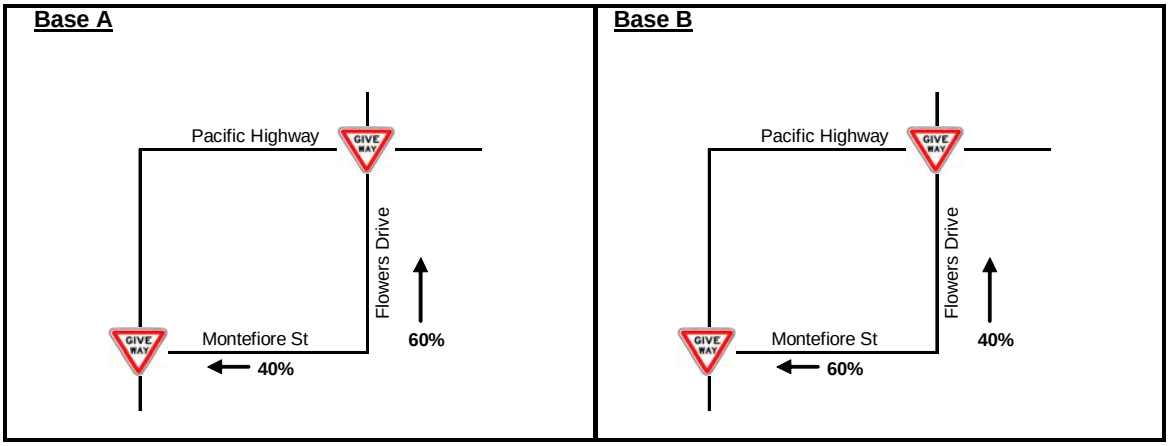


Table 3.2 – Existing Layout SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movement	LOS
Option Base A						
Pacific and Flowers	priority	AM	>1.00	>200	Nth TR & Sth LTR	F
		PM	>1.00	>200	Nth TR & Sth LTR	F
Pacific and Montefiore	priority	AM	0.88	96.9	East R	F
		PM	0.88	139.0	East R	F
Option Base B						
Pacific and Flowers	priority	AM	>1.00	>200	Nth TR & Sth LTR	F
		PM	>1.00	>200	Nth TR & Sth LTR	F
Pacific and Montefiore	priority	AM	>1.00	>200	East R	F
		PM	>1.00	>200	East R	F

The existing scenario analysis above shows that with the current Pacific Highway/Montefiore Street layout, the demand for various turning movements would exceed the demand. These vehicles would experience excessive delays.

3.2 Options 1A and 1B

Options 1A and 1B assume that the intersection of Pacific Highway with Flowers Drive is controlled with traffic signals, with the existing priority control at the intersection of Pacific Highway with Montefiore Street. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.3.

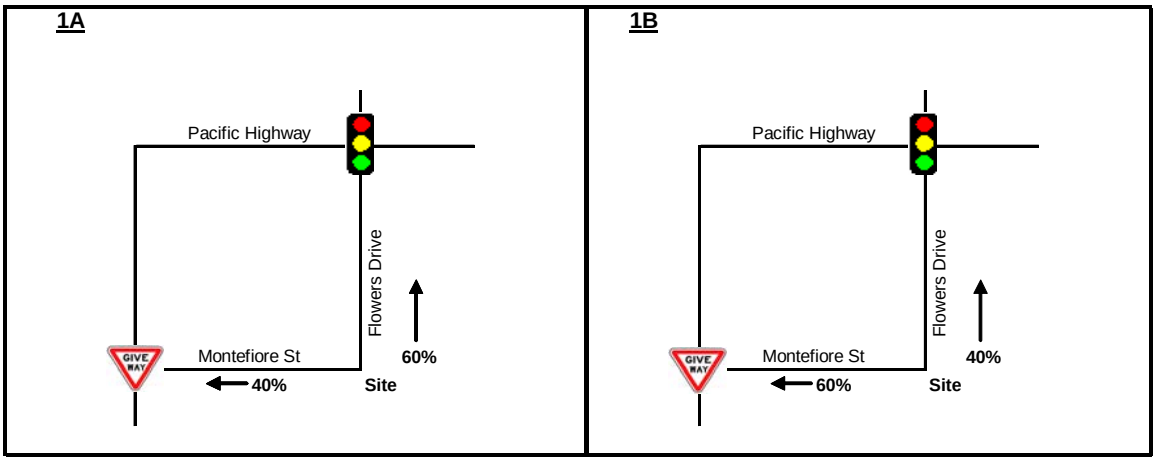


Table 3.3 – Options 1A and 1B SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movement	LOS
Option 1A						
Pacific and Flowers	signals	AM	0.63	14.6	-	B
		PM	0.75	12.7	-	A
Pacific and Montefiore	priority	AM	0.88	96.9	East R	F
		PM	0.88	139.0	East R	F
Option 1B						
Pacific and Flowers	signals	AM	0.63	12.1	-	A
		PM	0.60	10.6	-	A
Pacific and Montefiore	priority	AM	>1.00	>200	East R	F
		PM	>1.00	>200	East R	F

The results indicate that give way control at the intersection of Pacific Highway and Montefiore Street would not provide sufficient capacity for the right turn movements exiting Montefiore Street. The demand would exceed the capacity, and excessive delays would result for this movement.

In reality the problem movement of right turns from Montefiore Street to Pacific Highway would be unlikely to reach 40% or 60% of newly generated traffic with delays as high as calculated. Thus traffic flows on Flowers Drive would be greater than the theoretical assumption in the exercise due to most northbound traffic transferring to this route.

With this happening the level of service of the Montefiore Street intersection would change to LOSB (LOSD in pm for Option 1B) with this applying to the right turns into Montefiore Street.

3.3 Options 1C and 1D

Options 1C and 1D assume that the intersections of Pacific Highway with Flowers Drive and with Montefiore Street are both controlled with traffic signals. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.4.

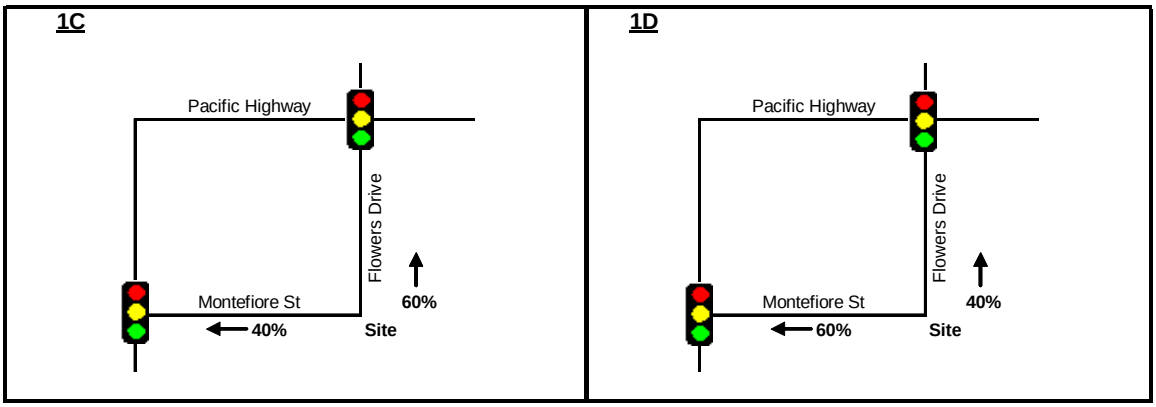


Table 3.4 – Options 1C and 1D SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	LOS
Option 1C					
Pacific and Flowers	signals	AM	0.63	14.6	B
		PM	0.75	12.7	A
Pacific and Montefiore	signals	AM	0.66	10.8	A
		PM	0.85	9.5	A
Option 1D					
Pacific and Flowers	signals	AM	0.63	12.1	A
		PM	0.60	10.6	A
Pacific and Montefiore	signals	AM	0.54	12.6	A
		PM	1.00	12.5	A

These results indicate that signal control of the two intersections would provide sufficient capacity under either traffic distribution option.

3.4 Options 2A and 2B

Options 2A and 2B assume that right turn movements from Flowers Drive into Pacific Highway would be banned, with the existing priority control at the intersection of Pacific Highway with Montefiore Street. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.5.

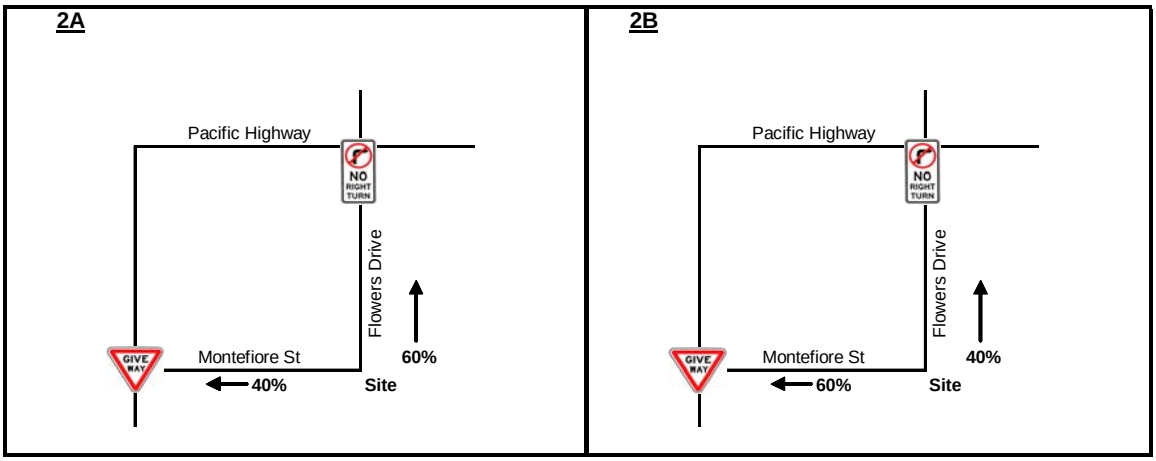


Table 3.5 – Options 2A and 2B SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movement	LOS
Option 2A						
Pacific and Flowers	priority	AM	>1.00	>200	Nth TR & Sth T	F
		PM	>1.00	>200	Nth TR & Sth T	F
Pacific and Montefiore	priority	AM	>1.00	>200	East R	F
		PM	0.89	142.9	East R	F
Option 2B						
Pacific and Flowers	priority	AM	>1.00	>200	Nth TR & Sth T	F
		PM	>1.00	>200	Nth TR & Sth T	F
Pacific and Montefiore	priority	AM	>1.00	>200	East R	F
		PM	0.97	199.2	East R	F

These results indicate that priority control of the two intersections with right turns banned exiting Flowers Drive would result in poor levels of service at both intersections. There would not be sufficient capacity for the vehicles turning right from Montefiore Street, nor for the through traffic between Flowers Drive and Cams Wharf Road, or the right turn from Cams Wharf Road (although the demand for this movement is negligible).

3.5 Options 2C and 2D

Options 2C and 2D assume that right turn movements from Flowers Drive into Pacific Highway would be banned, and that the intersection of Pacific Highway with Montefiore Street is controlled with traffic signals. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.6.

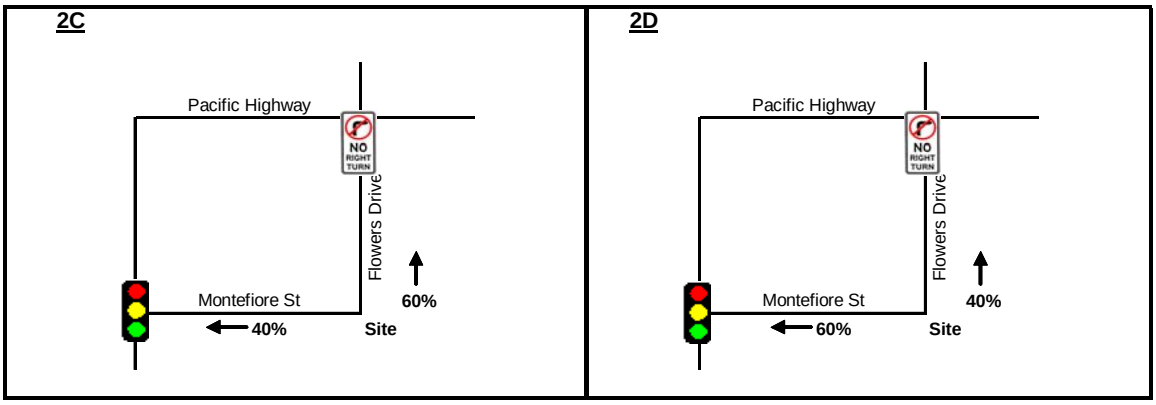


Table 3.6 – Options 2C and 2D SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movements	LOS
Option 2C						
Pacific and Flowers	priority	AM	>1.00	>200	Nth TR & Sth T	F
		PM	>1.00	>200	Nth TR & Sth T	F
Pacific and Montefiore	signals	AM	0.63	13.8	-	A
		PM	0.87	11.4	-	A
Option 2D						
Pacific and Flowers	priority	AM	>1.00	>200	Nth TR & Sth T	F
		PM	>1.00	>200	Nth TR & Sth T	F
Pacific and Montefiore	signals	AM	1.00	14.1	-	A
		PM	1.00	12.0	-	A

These results indicate that as for Options 2a and 2b, priority control of the Flowers Drive intersection with right turns banned exiting Flowers Drive would result in poor levels of service at the intersection. There would not be sufficient capacity for the through traffic between Flowers Drive and Cams Wharf Road if it was required to still allow these movements. For safety reasons such is not recommended without traffic signals. The intersection of Montefiore Street and Pacific Highway would operate at a satisfactory level of service.

3.6 Options 3A and 3B

Options 3A and 3B assume that Flowers Drive is closed at its northern end near Pacific Highway, and the two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.7.

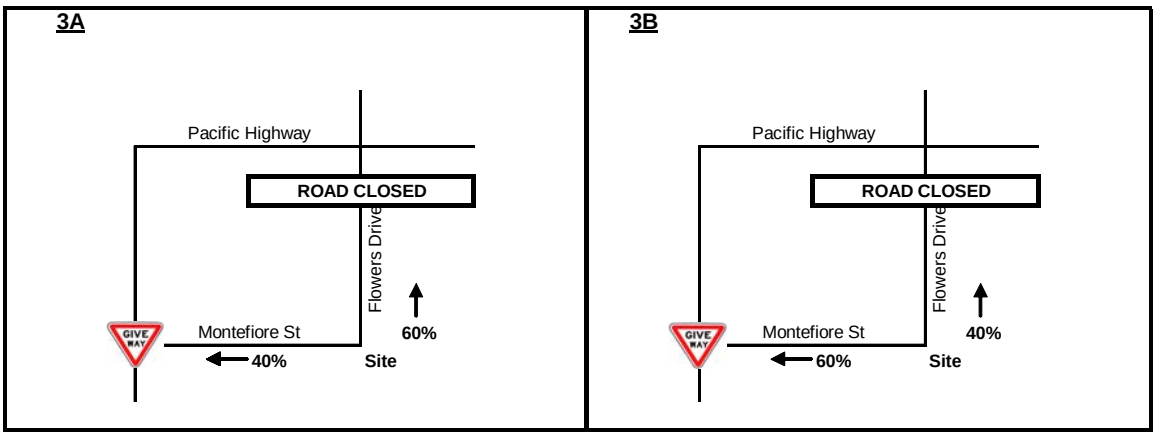


Table 3.7 – Options 3A and 3B SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movement	LOS
Option 3A						
Pacific and Flowers	priority	AM	>1.00	>200	North R	F
		PM	>1.00	>200	North R	F
Pacific and Montefiore	priority	AM	>1.00	>200	East LR	F
		PM	>1.00	>200	East LR	F
Option 3B						
Pacific and Flowers	priority	AM	>1.00	>200	North R	F
		PM	>1.00	>200	North R	F
Pacific and Montefiore	priority	AM	>1.00	>200	East LR	F
		PM	>1.00	>200	East LR	F

These results indicate that closure of Flowers Drive would result in the demand exceeding the available capacity at the intersection of Montefiore Street with Pacific Highway. There would be insufficient capacity for vehicles to exit Montefiore Street, and under Option 3B, there would be insufficient capacity for the right turn movement into Montefiore Street.

At the intersection of Pacific Highway and Cams Wharf Road, there would be insufficient capacity and excessive delays for the vehicles turning right from Cams Wharf Road into Pacific Highway. It should be noted however that the demand for this movement is very low, at 2vph in the morning peak hour, and 7vph in the evening peak hour. The remainder of movements at this intersection would operate with spare capacity and delays equivalent to Level of Service A or B.

3.7 Options 4A and 4B

Options 4A and 4B assume that Flowers Drive is closed at its northern end near Pacific Highway, and that that the intersection of Pacific Highway with Montefiore Street is controlled with traffic signals. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.8.

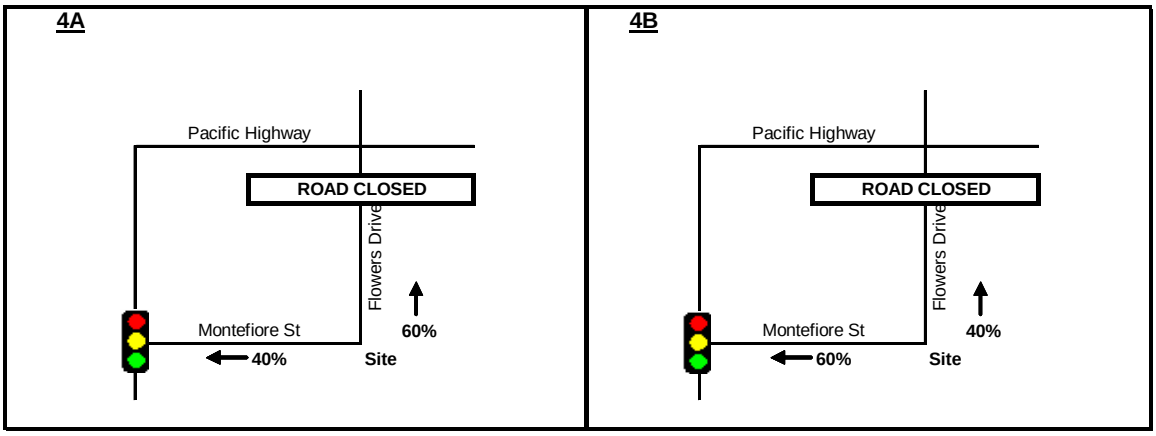


Table 3.8 – Options 4A and 4B SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movement	LOS
Option 4A						
Pacific and Flowers	priority	AM	>1.00	>200	North R	F
		PM	>1.00	>200	North R	F
Pacific and Montefiore	signals	AM	0.74	16.7	-	B
		PM	1.00	16.5	-	B
Option 4B						
Pacific and Flowers	priority	AM	>1.00	>200	North R	F
		PM	>1.00	>200	North R	F
Pacific and Montefiore	signals	AM	1.00	18.0	-	B
		PM	>1.00	15.7	-	B

These results indicate that as for Options 3A and 3B, the right turn movement from Cams Wharf Road would experience excessive delays with the closure of Flowers Drive. However, the demand for this movement is very low, at 2 and 7 vehicles per hour during the morning and evening peak hours respectively.

Signals would result in satisfactory levels of service at the intersection of Pacific Highway and Montefiore Street.

3.8 Options 5A and 5B

Options 5A and 5B assume that only left turn movements would be permitted into and out of Montefiore Street at its intersection with Pacific Highway, and that the intersection of Pacific Highway with Flowers Drive is controlled with traffic signals. The two options assume different splits of traffic to the north and south, as shown in the following figures. The results of the Sidra analysis are presented in Table 3.9.

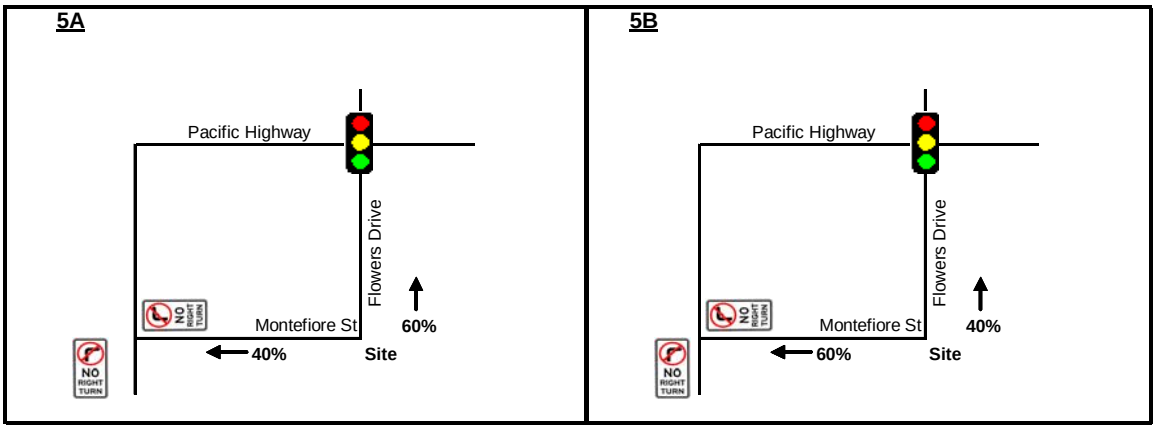


Table 3.9 – Options 5A and 5B SIDRA Intersection Results

SIDRA Results	Control	Peak	Degree of Saturation	Avg Delay (sec/veh)	Worst Movement	LOS
Option 5A						
Pacific and Flowers	signals	AM	0.61	14.8	-	B
		PM	0.77	13.2	-	A
Pacific and Montefiore	priority	AM	0.61	26.3	East L	B
		PM	0.31	19.0	East L	B
Option 5B						
Pacific and Flowers	signals	AM	0.60	12.5	-	A
		PM	0.59	10.7	-	A
Pacific and Montefiore	priority	AM	0.85	35.5	East L	C
		PM	0.45	20.6	East L	B

These results indicate that the two intersections would operate at satisfactory levels of service with left in/left out at Montefiore Street, and signals at the Flowers Drive intersection.

3.9 Discussion

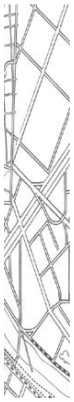
The results show that signalisation of at least one of the intersections of Pacific Highway with Montefiore Street and Flowers Road would be required to ensure satisfactory levels of service at both intersections with the additional traffic generated within Catherine Hill Bay.

The SIDRA Intersection results show that only two of the options investigated would result in satisfactory levels of service at both intersections for all existing movements. These are:

- left in/left out priority control at Montefiore Street, with signals at the Flowers Drive intersection (Option 5), and
- signals at both intersections (Options 1C and 1D).

It should be noted that with Flowers Drive closed and signals at the Montefiore Street intersection (Option 4), satisfactory operation can be achieved at both intersections with the exception of the right turn movements from Cams Wharf Road. The demand for these movements is very low, at 2 and 7 vehicles per hour during the morning and evening peak hours respectively and because there are other options it is considered that these movements could reasonably be prohibited.

Although not formally tested, allowing left turns only into and out of Flowers Drive with signals at the Montefiore Street intersection would also result in satisfactory levels of service.



4. Sight Distances

As part of this assessment the sightlines provided at the Pacific Highway/Montefiore Street intersection were investigated. AustRoads[1] guidelines present sight distance standards which should be met at intersections. These are dependent upon the speed of vehicles, which in this case is 90kph on Pacific Highway.

Approach Sight Distance (ASD) is the distance which should be provided on each leg and turning lane of an intersection. It is the minimum requirement for to provide the driver of a vehicle adequate distance to observe the roadway layout in sufficient time to react and stop if necessary before entering the conflict area. ASD should be a minimum of 128m (desirable 140m).

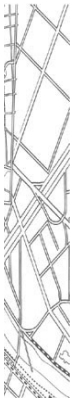
Safe Intersection Sight Distance (SISD) is the minimum standard which should be provided on the major road at any intersection, and provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle from the minor road moving into a collision situation. SISD should be a minimum of 203m (desirable 215m). These distances do not take into account the effects of grade.

The sight distances at the Pacific Highway/Monterfiore Street intersection have been measured as follows:

- Montefiore Street looking left at eastbound Pacific Highway traffic – 210m
- Montefiore Street looking right at westbound Pacific Highway traffic – 290m

The existing sight distances meet the desirable Safe Intersection Sight Distance (SISD) for vehicles exiting Montefiore Street and are therefore considered to be acceptable.

[1] Guide to Engineering Practice Part 5: Intersections at Grade, Austroads

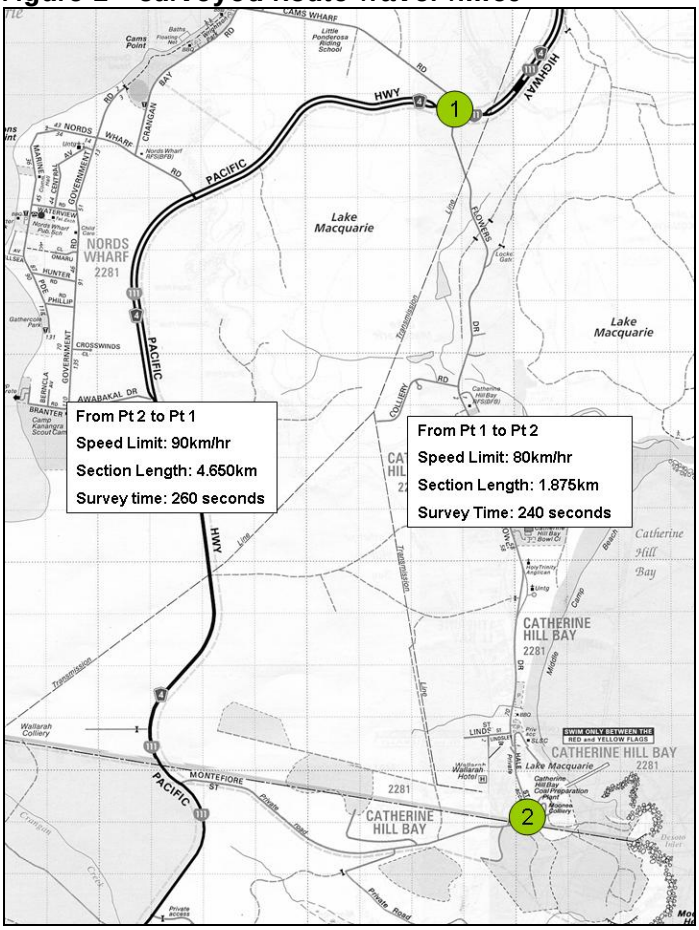


5. Route Travel Times

A request was made that travel times to and from the north along the two alternative routes be analysed in order to examine the propensity for traffic to use one or the other. This was requested to assist in a decision on which option would best protect the amenity of residents living on Flowers Road.

The different route options for vehicles travelling to the north from the proposed Catherine Hill Bay development were assessed in terms of journey times taking into account distances, speed limits and delays at intersections. Figure 1 presents the surveyed free flow travel times. These are late night travel times with minimal delays at intersections.

Figure 1 – Surveyed Route Travel Times



Additional delays at the intersections would occur during day time conditions. These were taken from the SIDRA Intersection analysis of the access options. The delays for the two options which would result in satisfactory levels of service are as follows:

Table 5.1 – SIDRA Intersection Average Vehicle Delays at Intersections (sec/veh)

	Existing	Option 1C	Option 1D	Option 5A	Option 5B
Morning Peak Hour					
Right Exit from Montefiore	35.1	35.1	36.2	-	-
Right Exit from Flowers	41.8	24.4	24.4	23.9	23.2
Evening Peak Hour					
Right Exit from Montefiore	83.7	39.9	40.5	-	-
Right Exit from Flowers	75.6	28.7	24.7	29.0	24.8

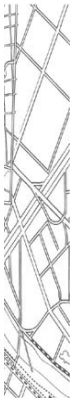
When the intersection delays are taken into account, the journey times for the two route options during peak periods are as set out in Table 5.2.

Table 5.2 – Northbound Journey Times from Proposed Development (sec)

Route	Free Flow	Option 1C	Option 1D	Option 5A	Option 5B
Morning Peak Hour					
via Pacific/Montefiore	260	295.1	296.2		
via Pacific/Flowers	240	264.4	264.4	263.9	263.2
Evening Peak Hour					
via Pacific/Montefiore	260	299.9	300.5		
via Pacific/Flowers	240	268.7	264.7	269.0	264.8

The analysis indicates that the Flowers Road route would be the quickest to/from the north if left open.

Thus in terms of protecting the amenity of residents living on Flowers Road an option involving traffic signals at Montefiore Road and either a full closure of Flowers Road or left in/left out access would best protect Flowers Road residents.

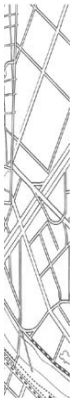


6. Conclusions

This investigation has been conducted to assist the RTA and Wyong and Lake Macquarie Councils in determining the most appropriate form of access for future development in Catherine Hill Bay.

This investigation has found that:

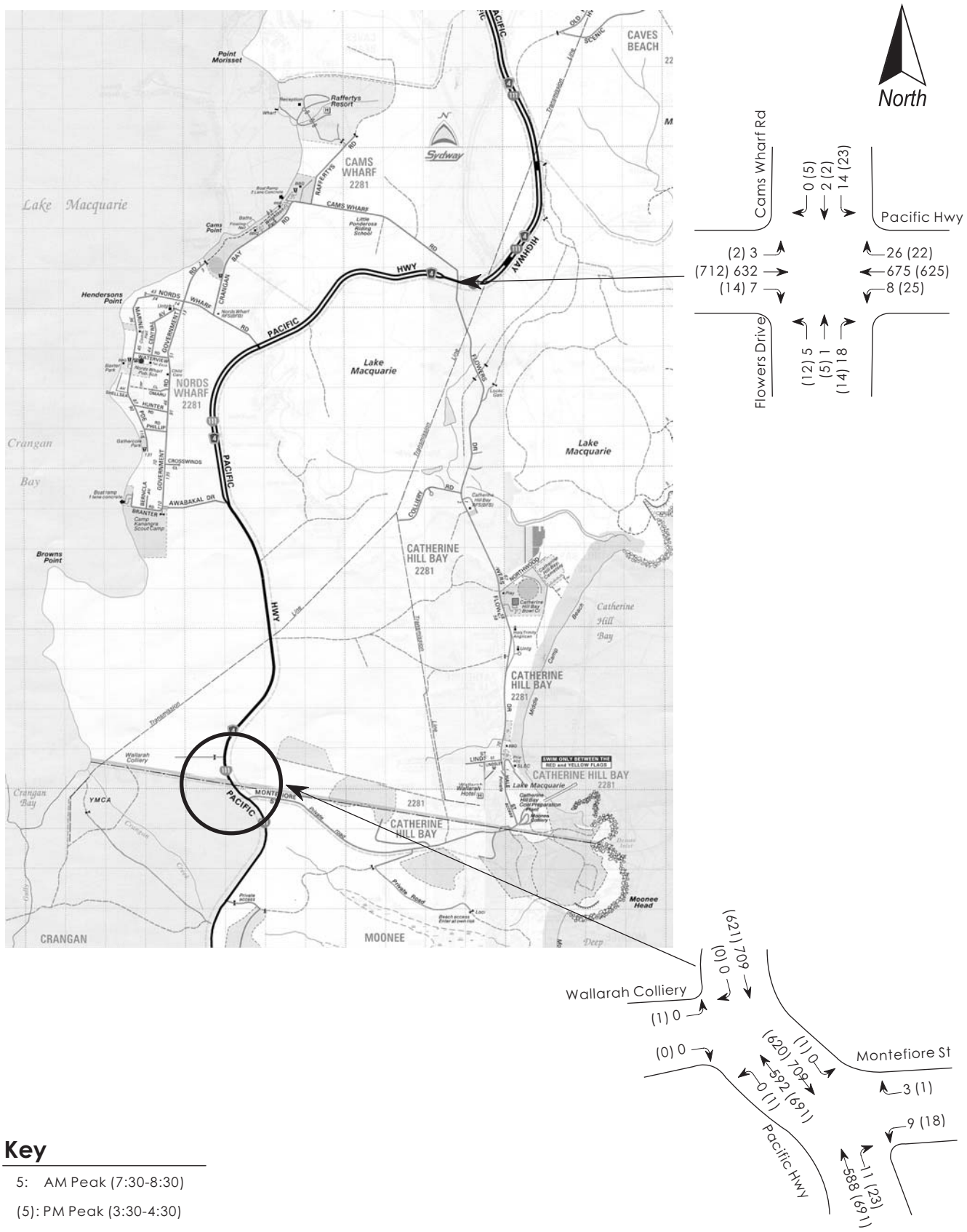
- Development of the Rose Property Group land at Catherine Hill Bay as proposed would necessitate signalisation of either the Flowers Road or Montefiore Street intersection but not both;
- Adequate sight distance is available at the Montefiore Street intersection to allow this to take place;
- Subject to possible traffic restrictions at the Flowers Road intersection, Flowers Road would be the quickest route to/from the north. Thus if traffic was to be limited on Flowers Road to protect the amenity of residents living in Middle Camp and Catherine Hill Bay Villages then it would b e necessary to signalise the Montefiore Street intersection and close or restrict to left in/left out the Flowers Road intersection.



Appendix A - Traffic Flows

EXISTING WEEKDAY PEAK HOUR TRAFFIC FLOWS

CATHERINE HILL BAY - MWT APRIL 2005 REPORT



Key

5: AM Peak (7:30-8:30)

(5): PM Peak (3:30-4:30)

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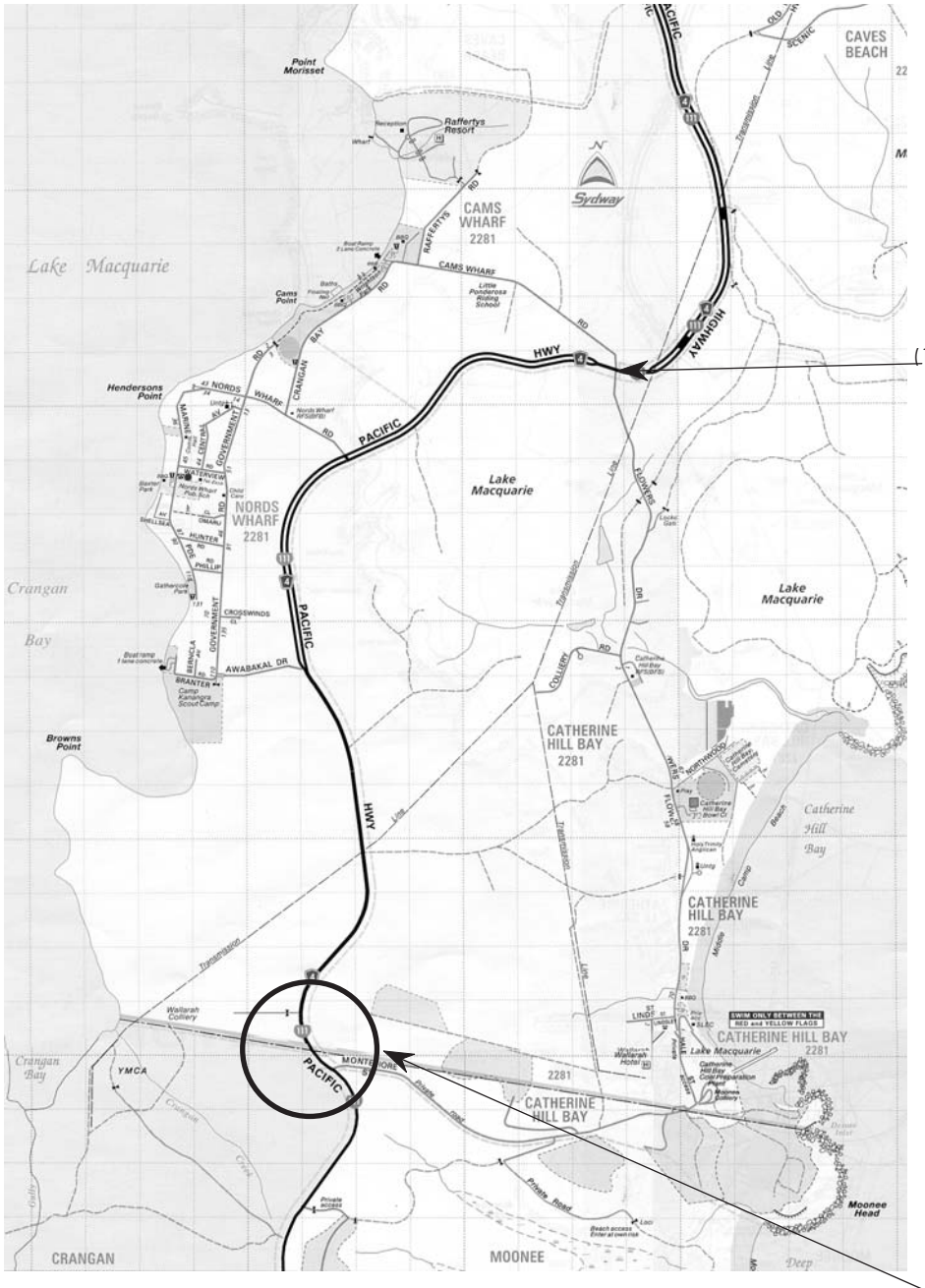
Figure 1

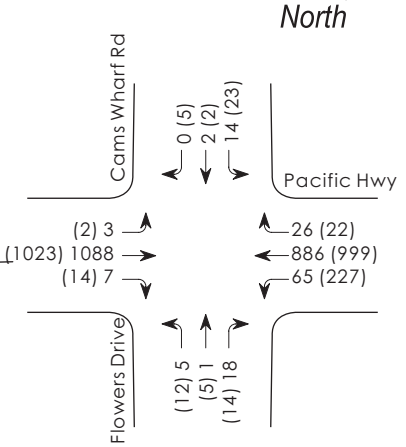
Filename: 032262di22.ai

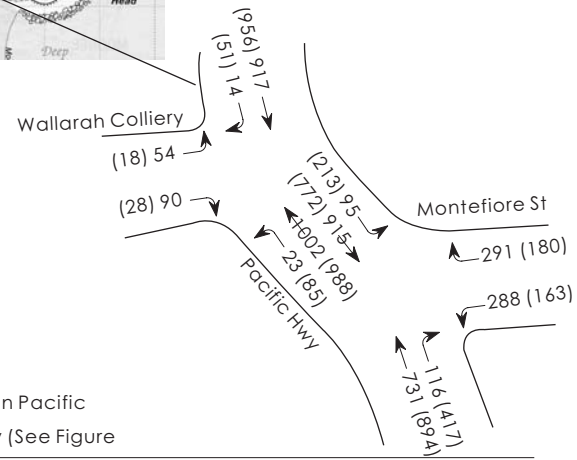
Date: 29 September 2006

FUTURE WEEKDAY PEAK HOUR TRAFFIC FLOWS

CATHERINE HILL BAY







Key

5: AM Peak (7:30-8:30)

(5): PM Peak (3:30-4:30)

Note: Future traffic includes existing surveyed volumes plus 10 year growth on Pacific Highway plus all proposed and potential developments in Catherine Hill Bay (See Figure

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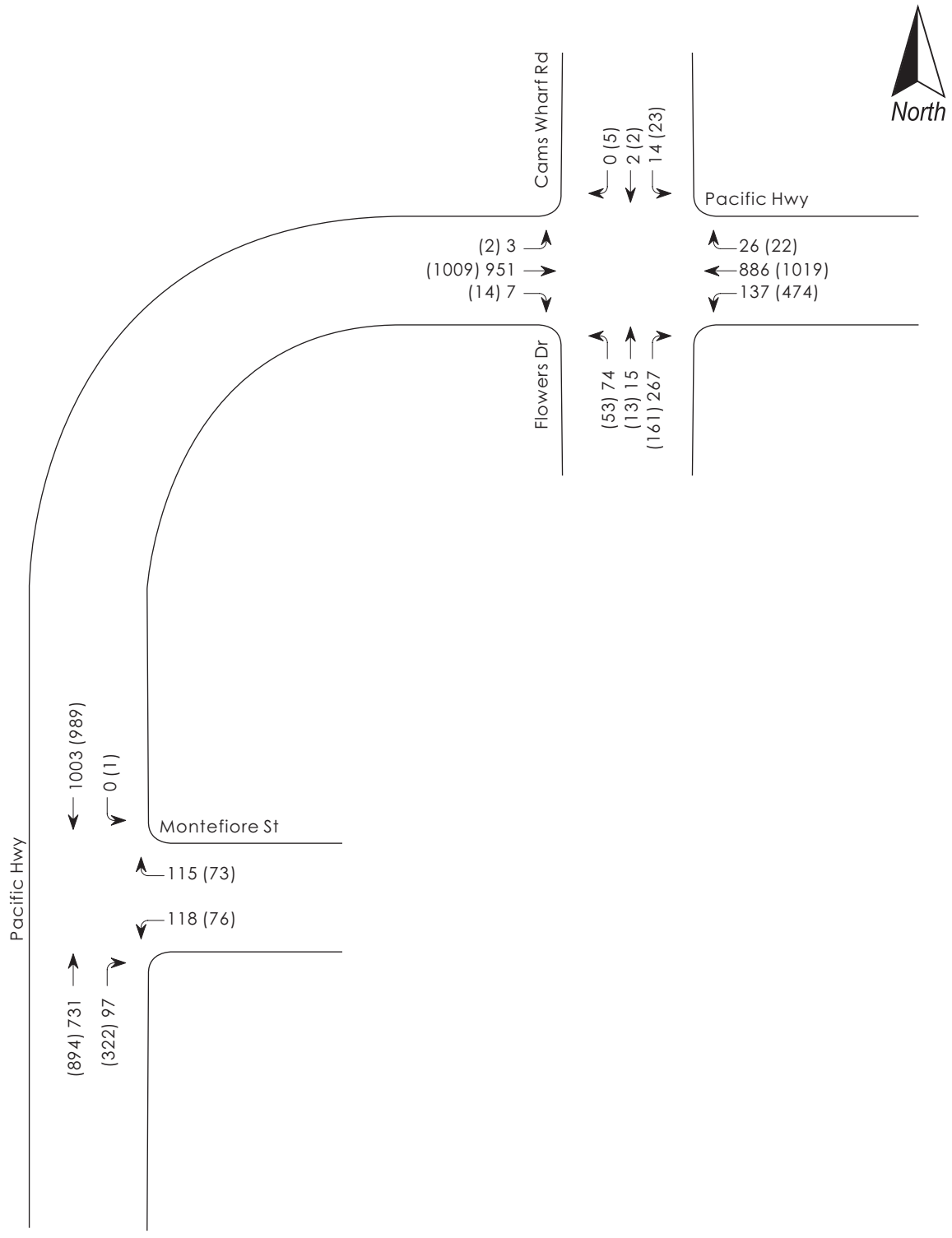
Figure 2

Filename: 032262di10.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS BASE A & BASE B

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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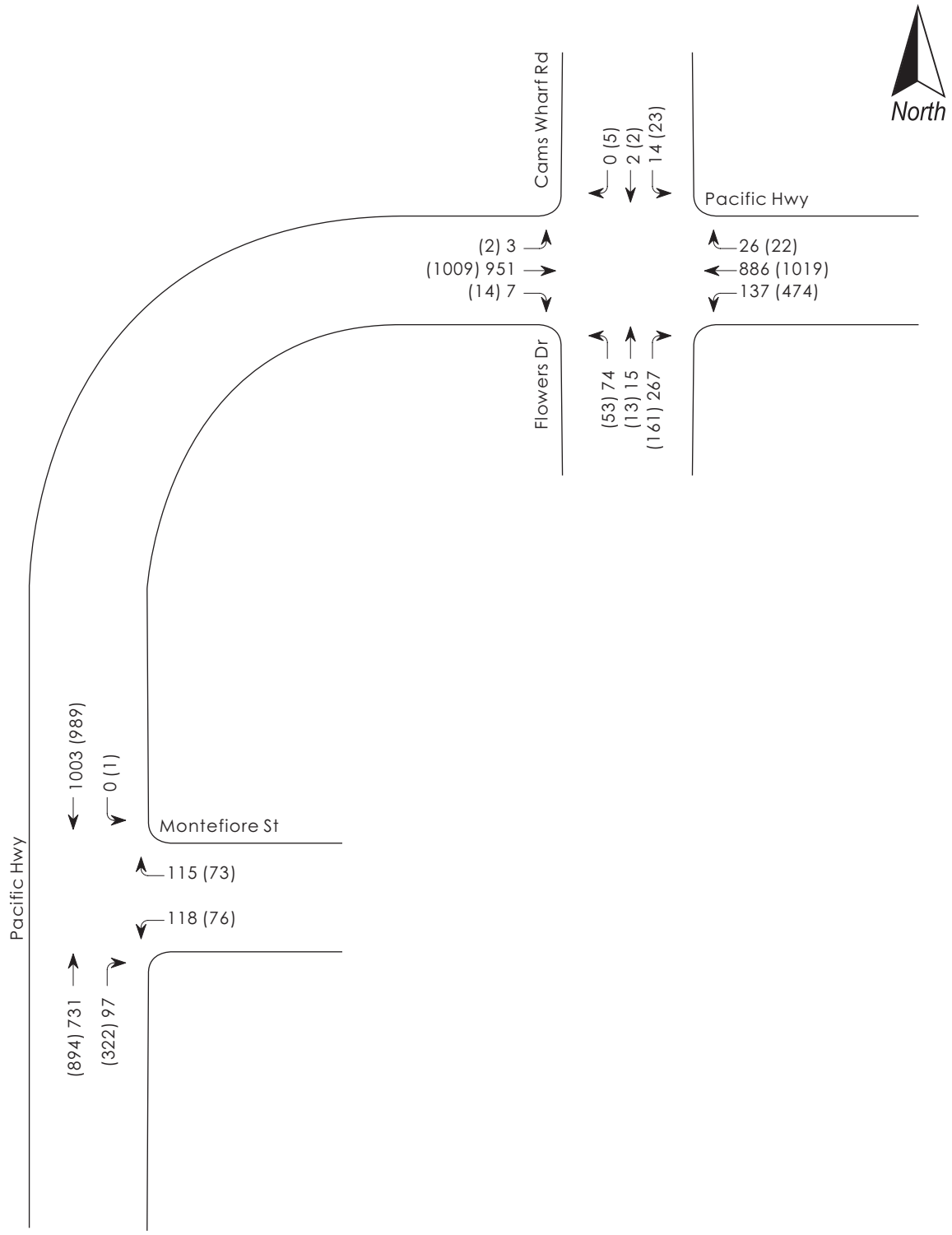
Figure 3

Filename: 032262di24.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 1 A & 1C

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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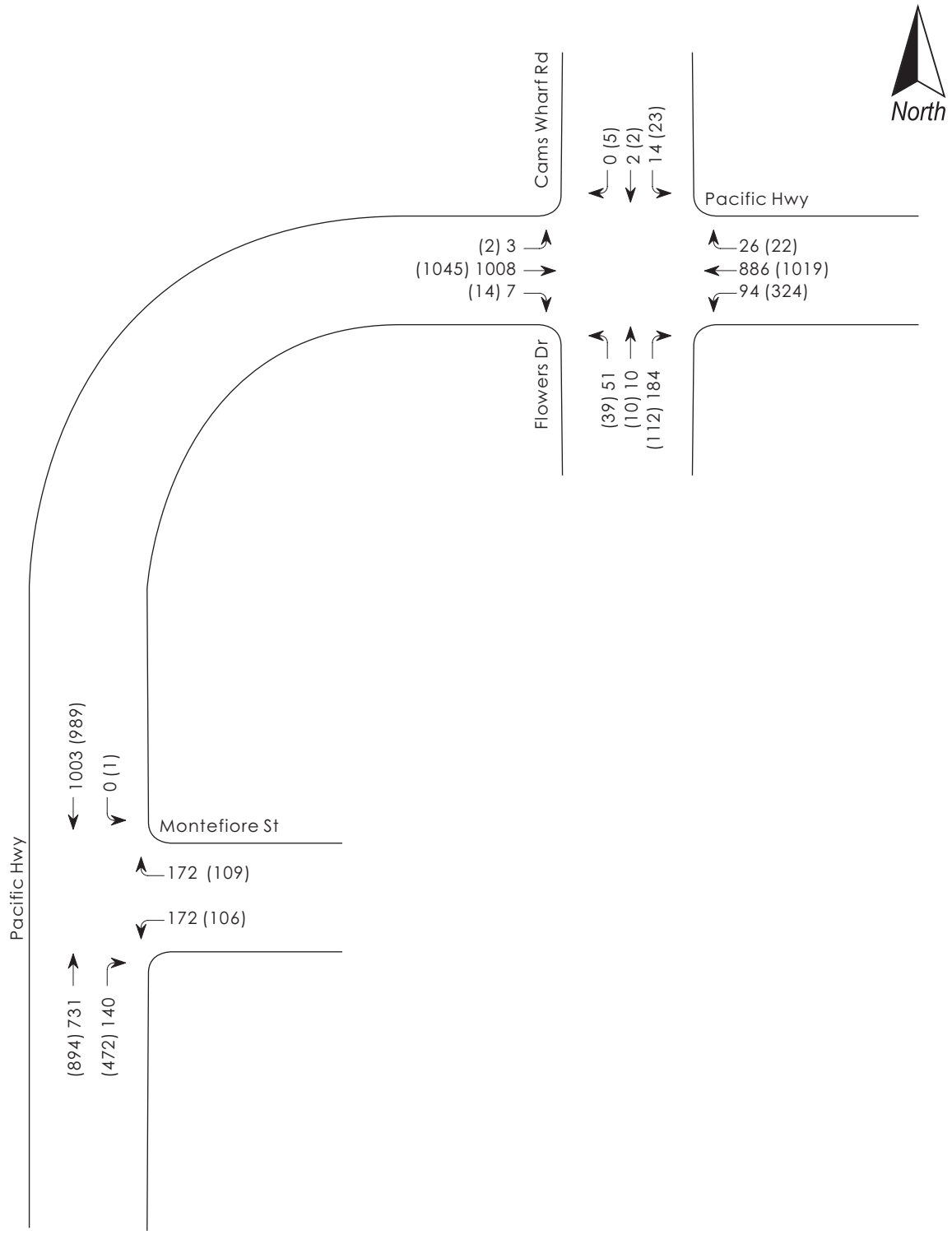
Figure 4

Filename: 032262di25.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 1B & 1D

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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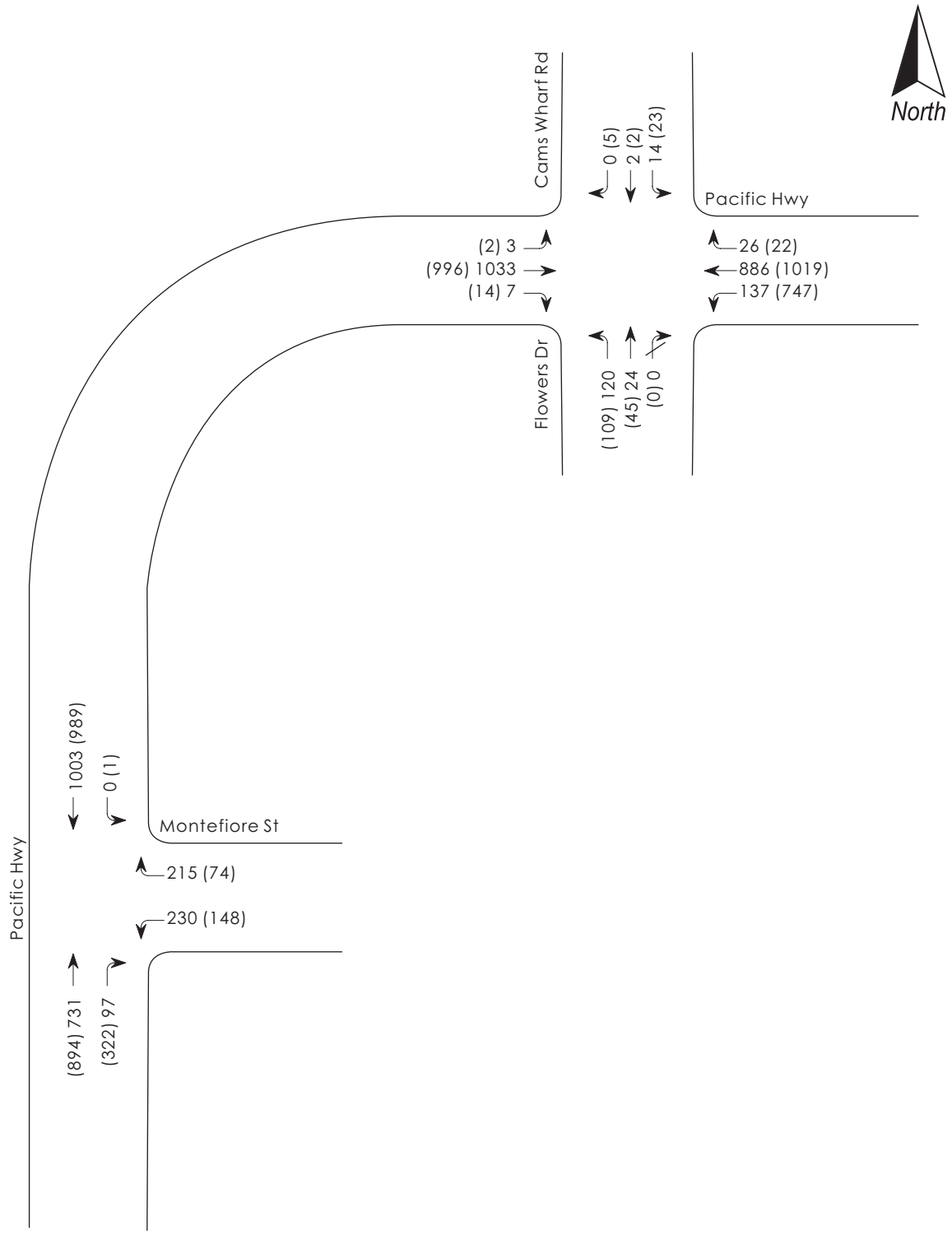
Figure 5

Filename: 032262di26.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 2A & 2C

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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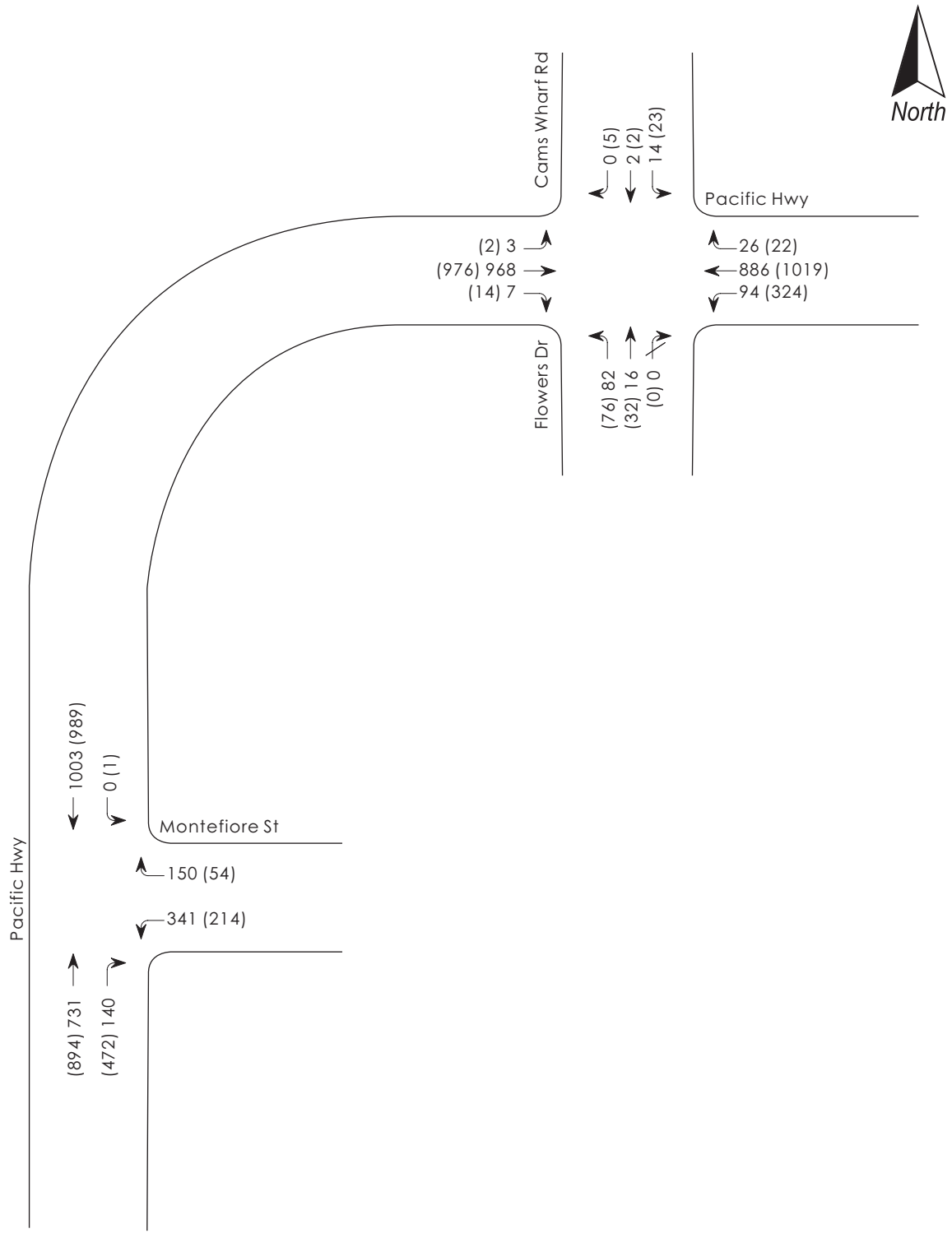
Figure 6

Filename: 032262di27.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 2B & 2D

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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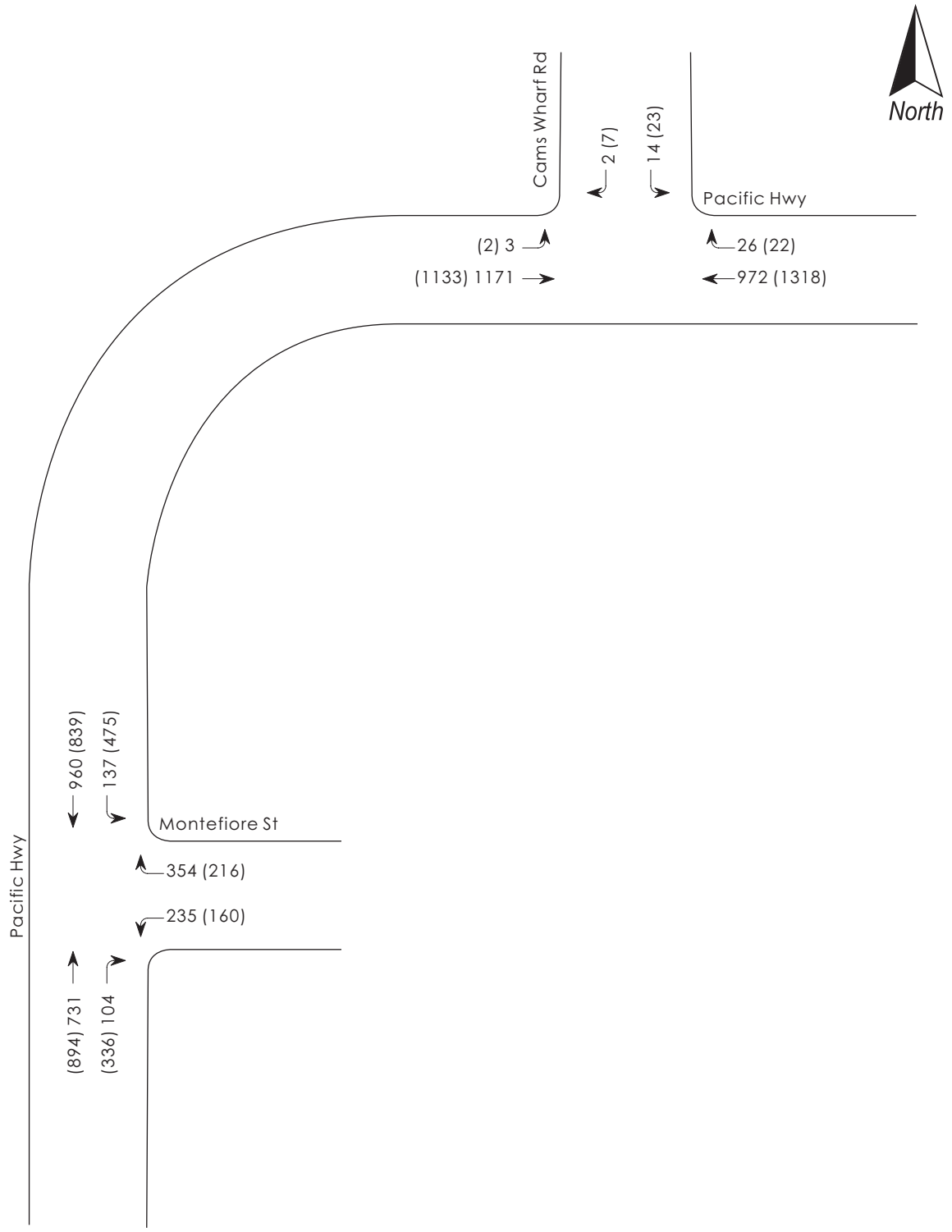
Figure 7

Filename: 032262di28.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 3A

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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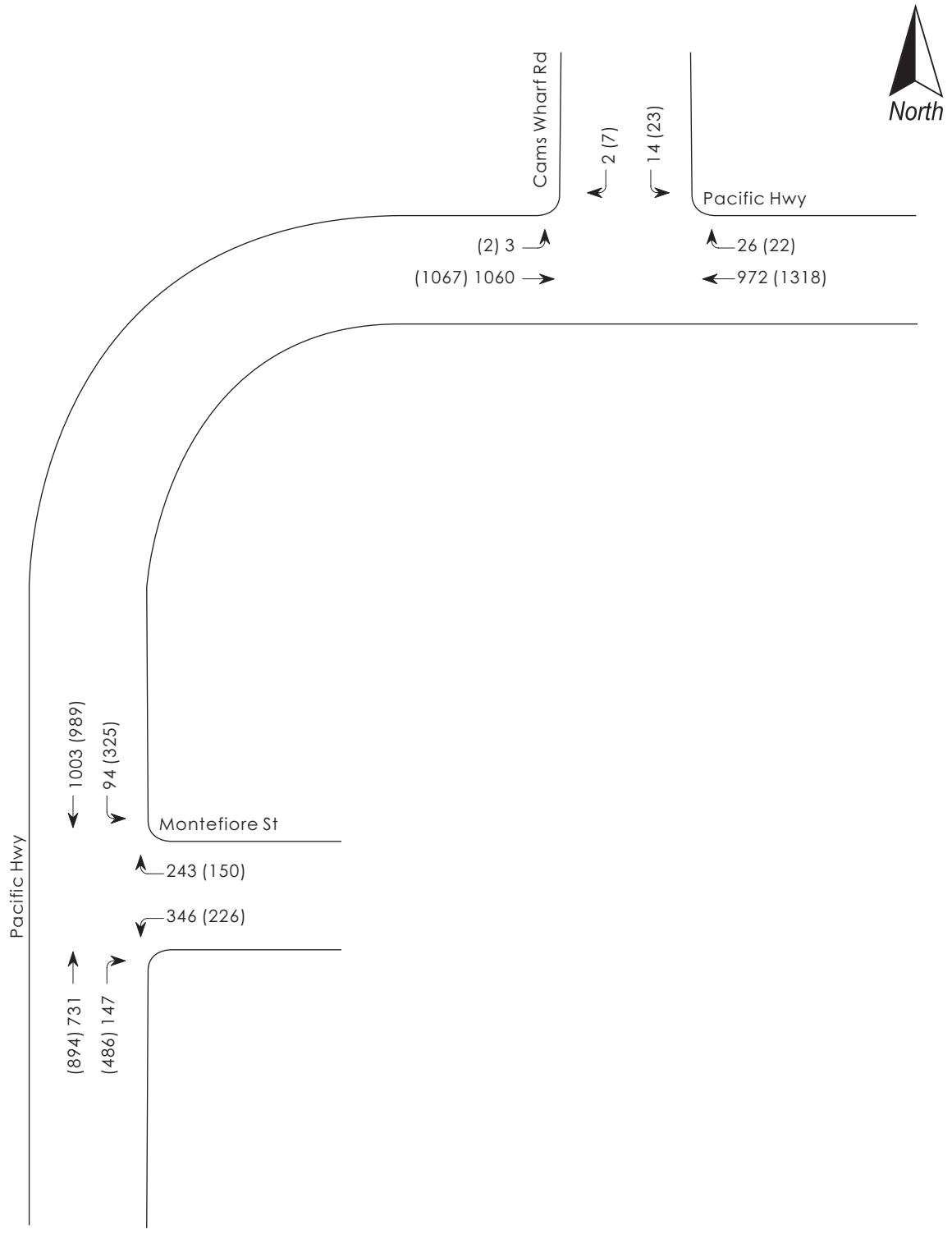
Figure 8

Filename: 032262di29.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 3B

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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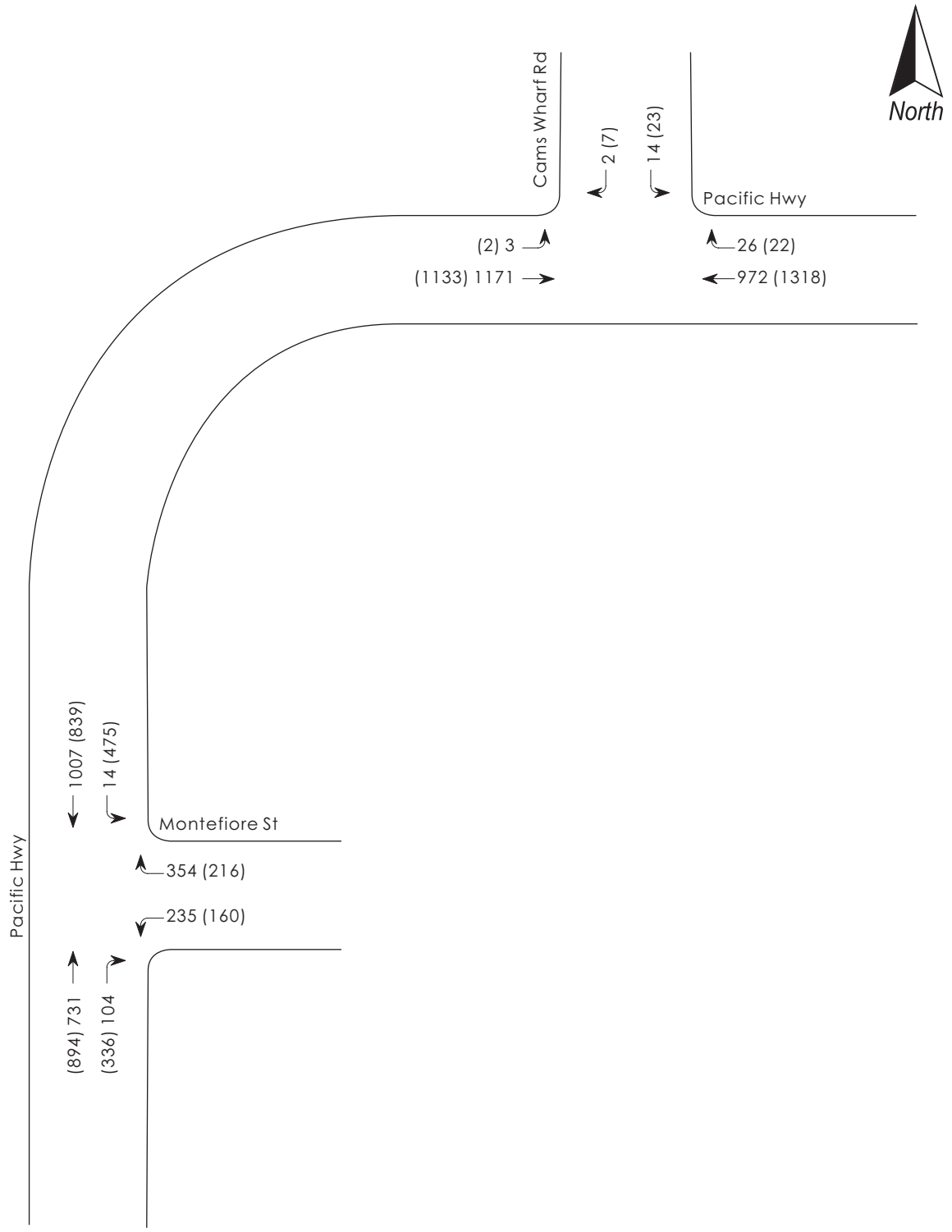
Figure 9

Filename: 032262di30.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 4A

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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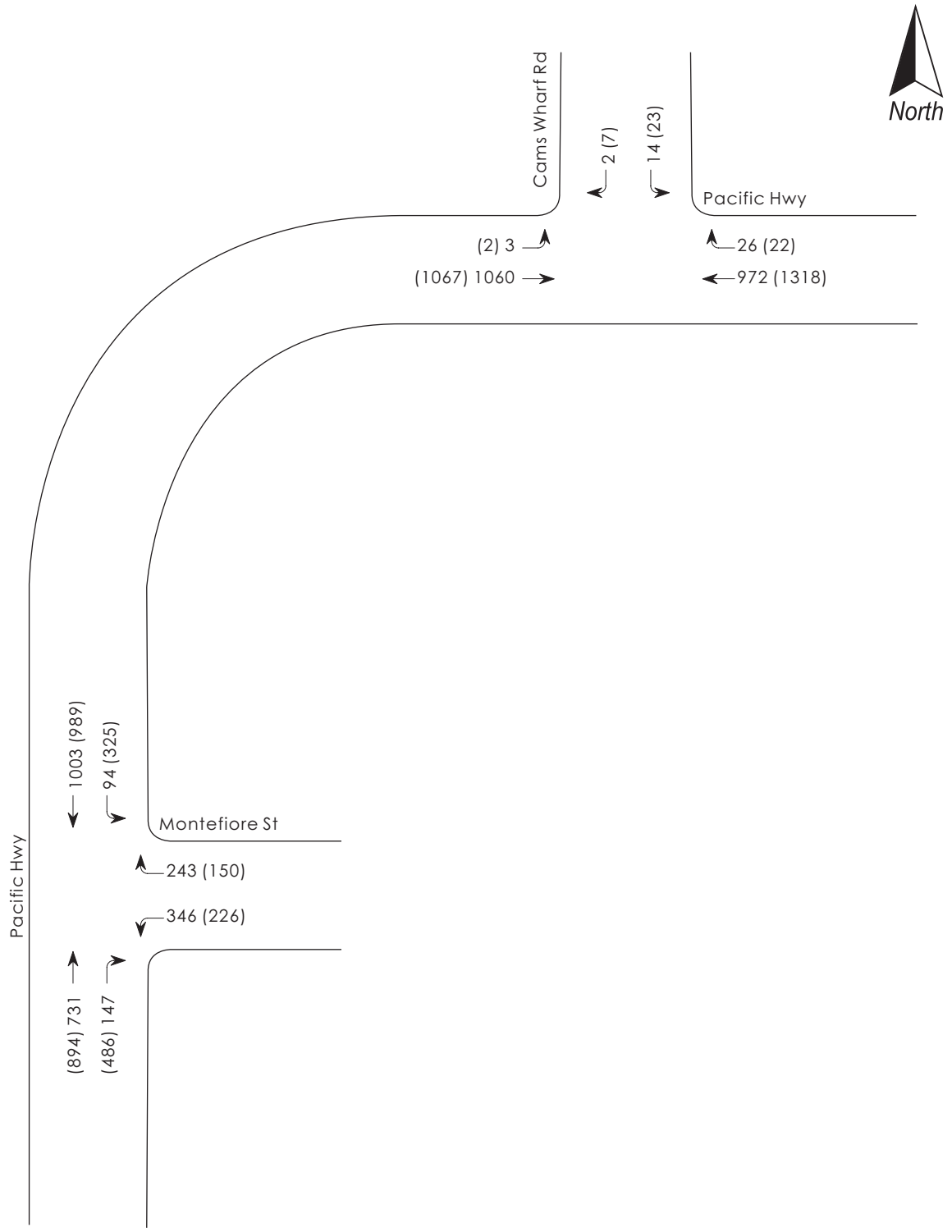
Figure 10

Filename: 032262di31.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 4B

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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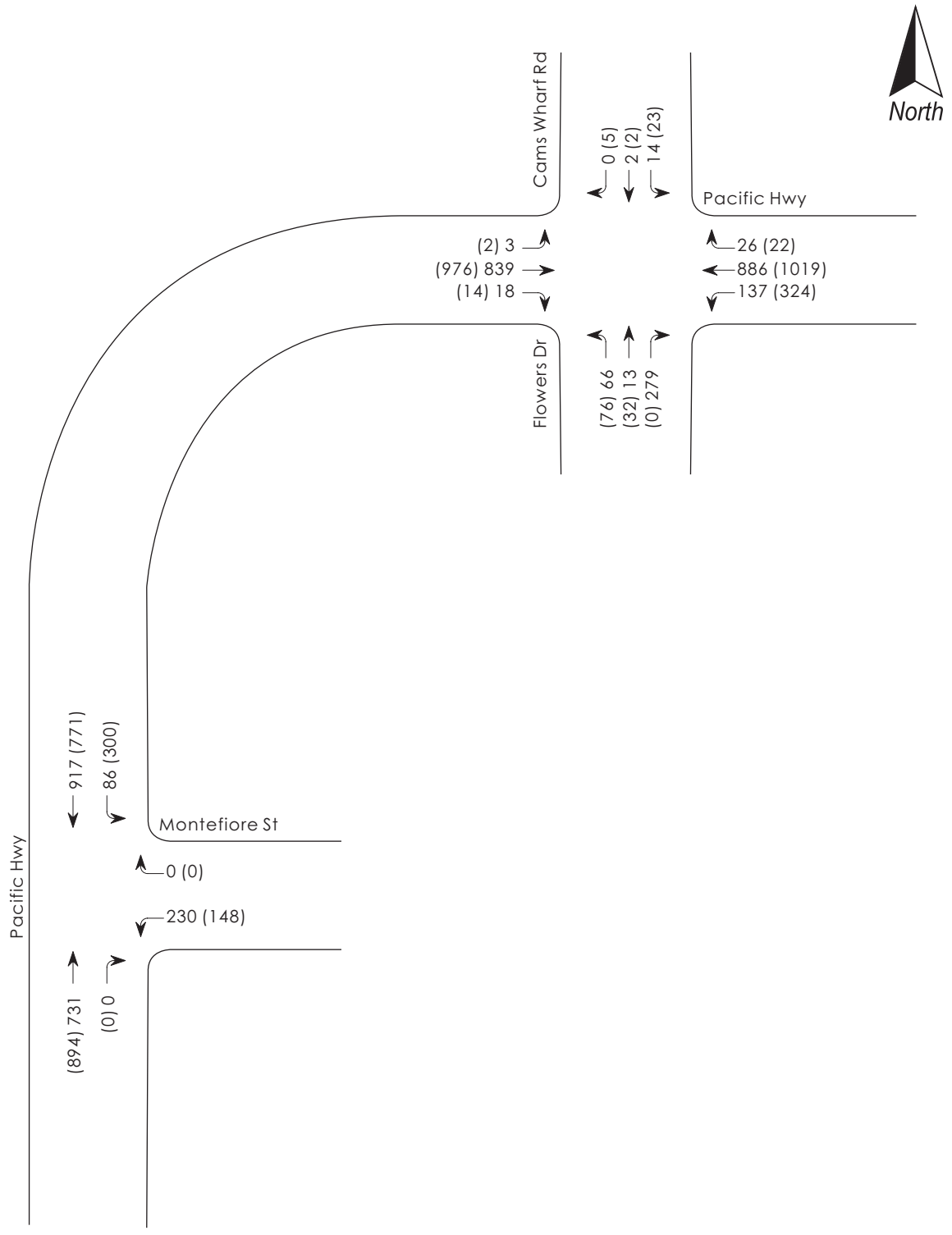
Figure 11

Filename: 032262di32.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 5A

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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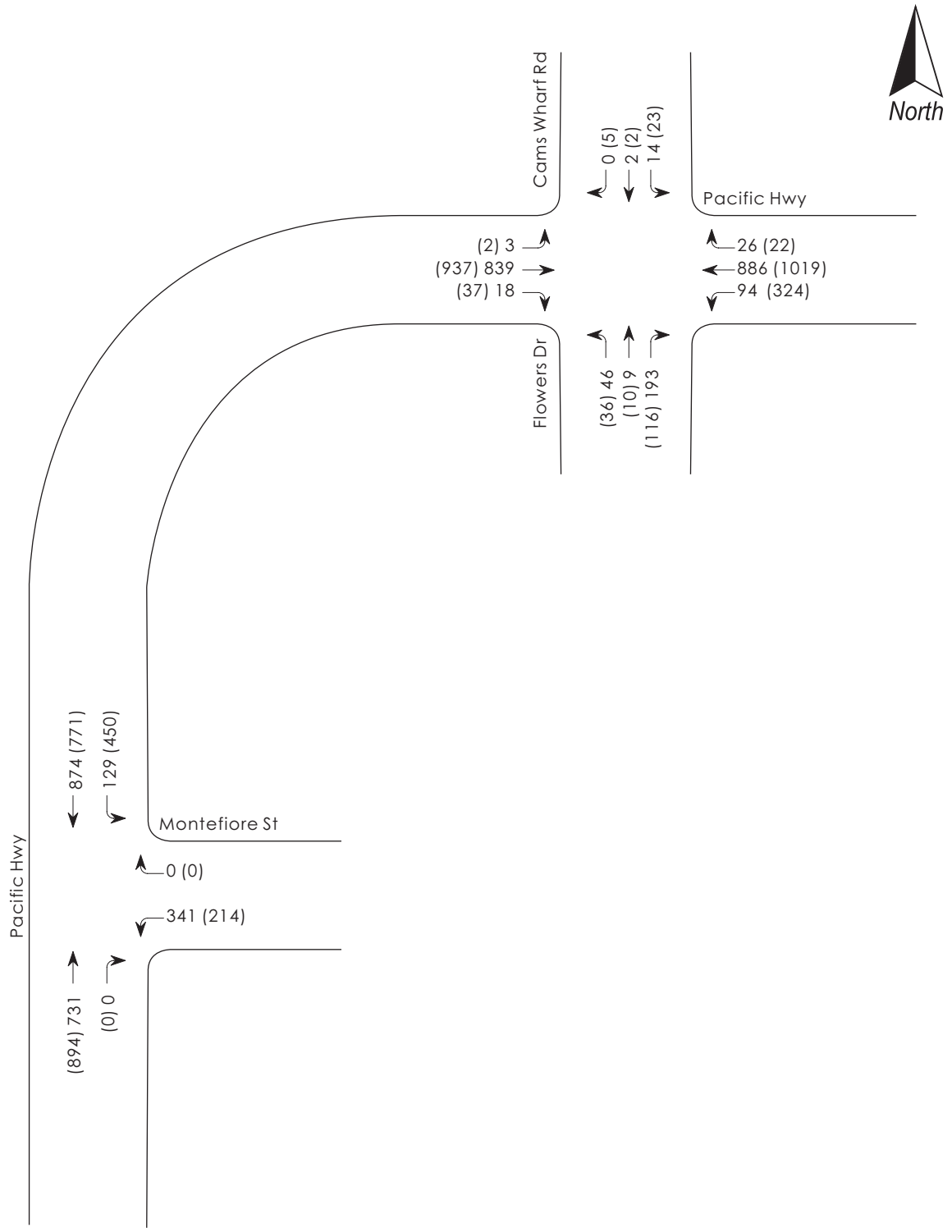
Figure 12

Filename: 032262di33.ai

Date: 29 September 2006

PEAK HOUR TRAFFIC FLOWS OPTIONS 5B

CATHERINE HILL BAY



Key

5: AM Peak

(5): PM Peak

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Figure 13

Filename: 032262di34.ai

Date: 29 September 2006