HALIFAX
REGIONAL MUNICIPALITY

P.O. Box 1749
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Info #1

Transportation Standing Committee
November 22, 2012

TO: Chair and Members of Transportation Standing Committee

SUBMITTED BY: Peter Stickings, Acting Director, Planning & Infrastructure

DATE: October 5, 2012

SUBJECT: **Caldwell Road Traffic Assessment**

INFORMATION REPORT

ORIGIN

Referral to the Transportation Standing Committee by Regional Council, at its meeting of April 24, 2012.

BACKGROUND

The Regional Council motion requested a full traffic assessment for Caldwell Road, given the pressures of development. The non-availability of adequate traffic capacity on Caldwell Road and Portland Street has been cited for many years as a reason to limit growth in the contributing areas. Plans had been developed to extend Mount Hope Avenue from Highway 111 to Caldwell Road as a means of addressing growth, but recent positions taken by the Department of National Defense regarding the use of the Shearwater Base lands, have brought the feasibility of this connection into question.

DISCUSSION

A study was undertaken by HRM to evaluate the traffic management implications of developing vacant parcels of land along Caldwell Road, assuming that a connection from the east end of Caldwell Road to Highway 111 via the Shearwater Lands is unavailable. The study area could potentially physically include 1300 additional units. That study is attached.

The study concluded that the Portland/Caldwell and the Portland/Baker/Woodlawn intersections have traffic loading that currently exceeds their capacity and that this will be significantly worsened with additional growth. Other intersections in the study area operate adequately with current traffic loading, but will marginally exceed their capacity with additional development.

The addition of a second left turning lane on Caldwell Road at Portland Street, and other geometric modifications to the intersection, will result in improved performance for existing road users and is conceptually recommended, but will be inadequate to provide sufficient capacity for additional residential growth on Caldwell Road. HRM Staff has already undertaken functional planning and analysis for this project and it will be considered for addition to the five-year Project Plan.

The study also concludes that conversion of the Portland/Baker/Woodlawn intersection to a roundabout will not improve operational performance. The creation of additional approach lanes to add capacity is not feasible due to the extent of bordering commercial development. Staff will work with the Province to optimize the performance of this intersection in conjunction with the Highway 111 interchange, but capacity increases beyond better management of current traffic loading is not expected.

In summary, some intersection modifications will better manage existing traffic loading and a small amount of background traffic growth, but are inadequate to handle additional development along Caldwell Road. The only practical solution is to divert a portion of the traffic using this corridor to another corridor such as the Mt. Hope Extension. Until such a corridor can be created, measures to limit additional development from adding traffic loading to Caldwell Road and Portland Street are justified.

BUDGET IMPLICATIONS

There are no budget implications at this time.

FINANCIAL MANAGEMENT POLICIES / BUSINESS PLAN

This report complies with the Municipality's Multi-Year Financial Strategy, the approved Operating, Project and Reserve budgets, policies and procedures regarding withdrawals from the utilization of Project and Operating reserves, as well as any relevant legislation.

COMMUNITY ENGAGEMENT

This assessment is a technical analysis and has not involved community engagement.

ENVIRONMENTAL IMPLICATIONS

Environmental implications, if any, will be identified in the final report.

ATTACHMENTS

Morris-Russell Lake Traffic Study, September, 2012

A copy of this report can be obtained online at http://www.halifax.ca/commcoun/cc.html then choose the appropriate Community Council and meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

Report Prepared by: David McCusker, P.Eng., Manager, Strategic Transportation Planning, 490-6696

Report Approved by: Austin French, Manager, Planning, 490-6717

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Morris-Russell Lake CCC Area Remaining Lands Traffic Study

Final Report

Paul Burgess, M.Eng., P.Eng.
Program Engineer

September 2012

Contents

1.0 Objectives

The objectives of this report were to:

- Determine if any of the remaining lands within the Morris-Russell Lake Secondary Plan Area can be developed prior to the completion of the Shearwater Connector.
- Determine if there are any alternatives to the Shearwater Connector project which would permit development of all remaining lands, and if so
- Estimate project costs and cost sharing percentages.

2.0 Background

In March 2005, HRM Council approved the secondary planning strategy for the Morris-Russell Lake area. The plan area included the undeveloped lands abutting Morris Lake and Russell Lake, and the lands of CFB Shearwater located within the watershed of Morris Lake. It is shown on Figure 1.

Development in the Morris-Russell Lake master plan area was contingent upon the completion of two major transportation projects. The first was the Mount Hope Interchange and Baker Drive extension project which was completed in 2006. The second was the completion of the Caldwell (Shearwater) connector roadway to Caldwell Road.

With the start of the Mount Hope Interchange project in August 2005, HRM Council approved an infrastructure agreement for the first phase of development within the plan area: Russell Lake West. In August 2006, HRM Council approved the second phase of development when it established a CCC charge area for the Portland Hills Subdivision.

Development of the remaining lands was based on the assumption that the Caldwell Road connector would be completed and is restricted by policy ML-8 which states:

ML-8 Upon satisfying the requirements to allow development under policy ML-2, development shall be permitted on parcels 1 to 13 (as shown on Map 9N) except that no road connection be established with Portland Estates Boulevard West until the Caldwell Road Connector has been constructed to Caldwell Road. No further development shall be permitted within the Morris-Russell Lake Secondary Plan Area until the Caldwell Road Connector has been constructed to Caldwell Road unless a traffic study has been undertaken by a qualified consultant which demonstrates that the level of service on Portland Street and Caldwell Road conforms to the performance criteria established under the Municipality's Guidelines for Preparation of Traffic Impact Studies and the road classification established under policy ML-5.

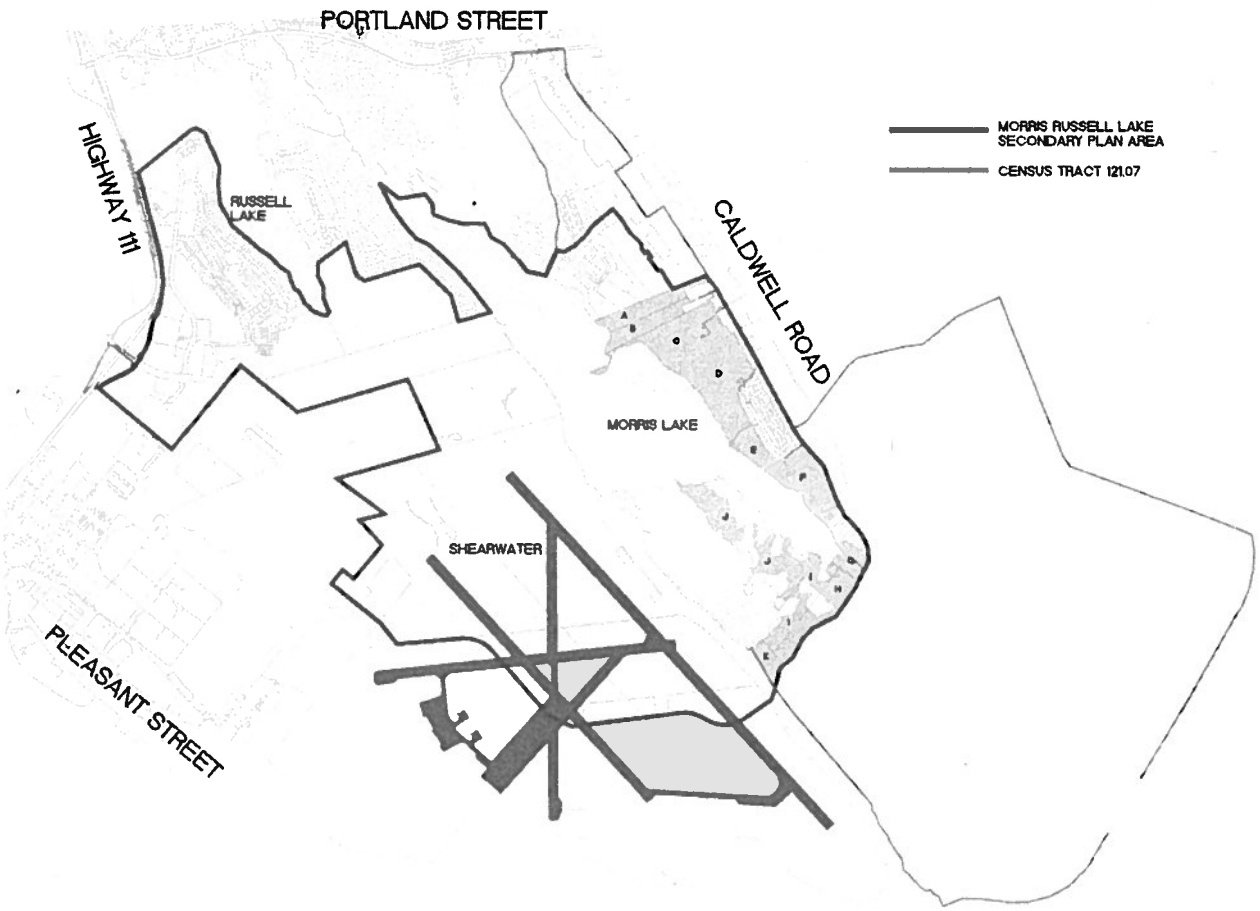


Figure 1 Morris Russell Lake Secondary Plan Area

In 2006, a portion of the Shearwater Airfield was deeded from DND to the Canada Lands Company, who was given the mandate to develop the land. This provided the roadway corridor and the funding source to complete the Shearwater Connector project. Since that time, the land has been reacquired by DND putting both the roadway corridor and project funding in jeopardy.

In 2010, the Cherrywood Drive Extension residential development, which was the first development with main access to Caldwell Road, was approved. A traffic study[1] was able to demonstrate that the proposed 47 unit development conformed to the HRM guidelines. This small residential development, however, was considered in isolation of the remaining lands along the east side of Morris Lake.

Rather than take this *"piece meal or first come first served"* approach on subsequent development applications, HRM Planning staff have decided to conduct a traffic impact study of all of the remaining lands within the Morris-Russell Lake secondary plan area to determine if any further development can take place.

3.0 Study Area

The study area is shown on Figure 2. Sub Areas A – J generally represent sub areas 18, MLE2, MLE1, 16,17,23,24, and 25 identified in Map 9N of the Morris-Russell Lake secondary planning strategy.

The study area is also located within Traffic Zone 278, and Census Tract 121.07.

3.1 Roadway Network

The major roadway network consists of Portland Street to the north, Caldwell Road to the east, Pleasant Street to the south, and Highway 111 to the west.

The road network to be analysed is the Portland Street corridor from Baker Drive to Caldwell Road. This corridor includes signalized intersections at Baker Drive, Eisener, Portland Estates Boulevard, Portland Hills Drive, and Caldwell Road.

[1] Traffic Impact Statement - Proposed Residential Development Cherrywood Drive Extension, Portland Hills Phase 5, Dartmouth, NS, Genivar, October 2010

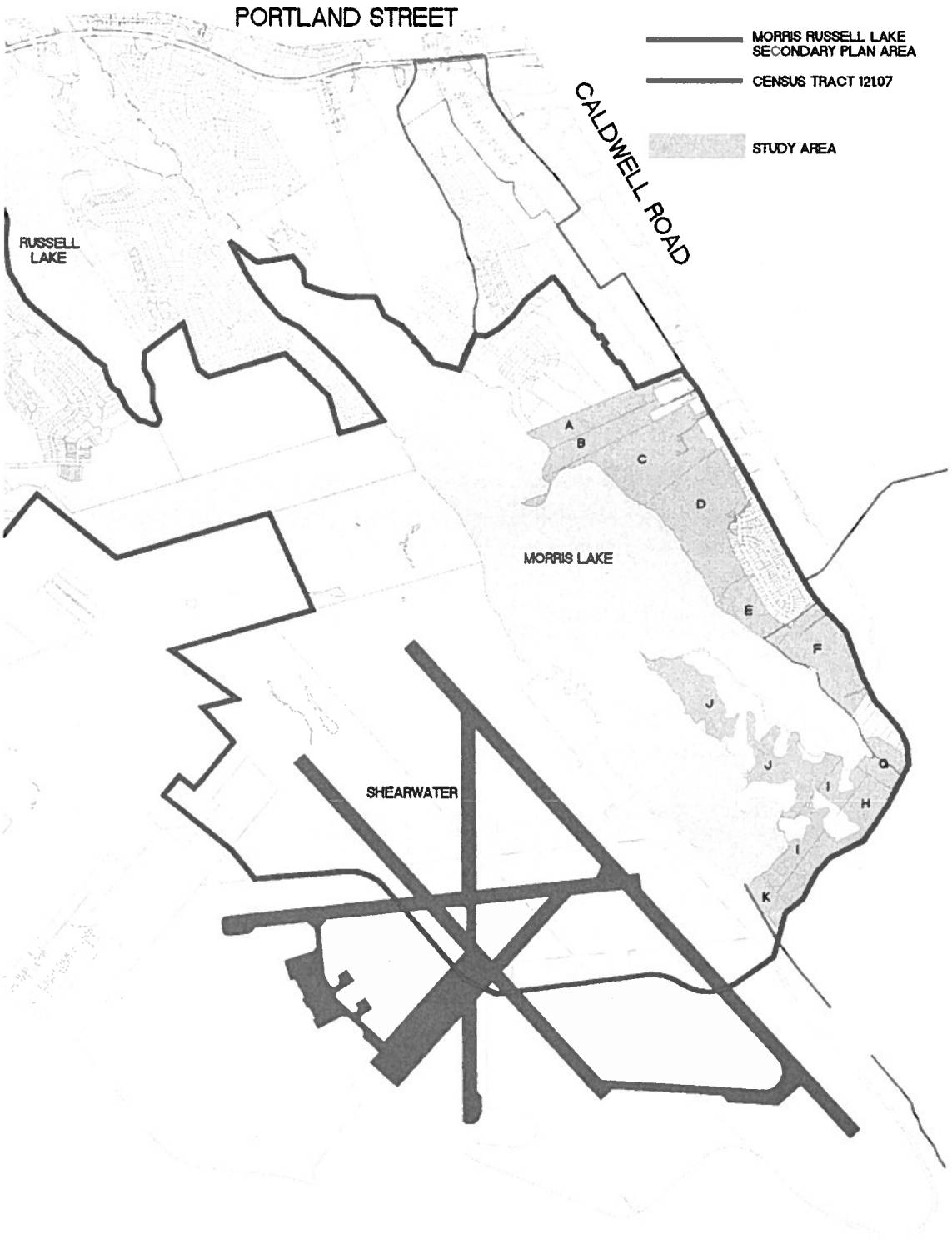


Figure 2 Study Area

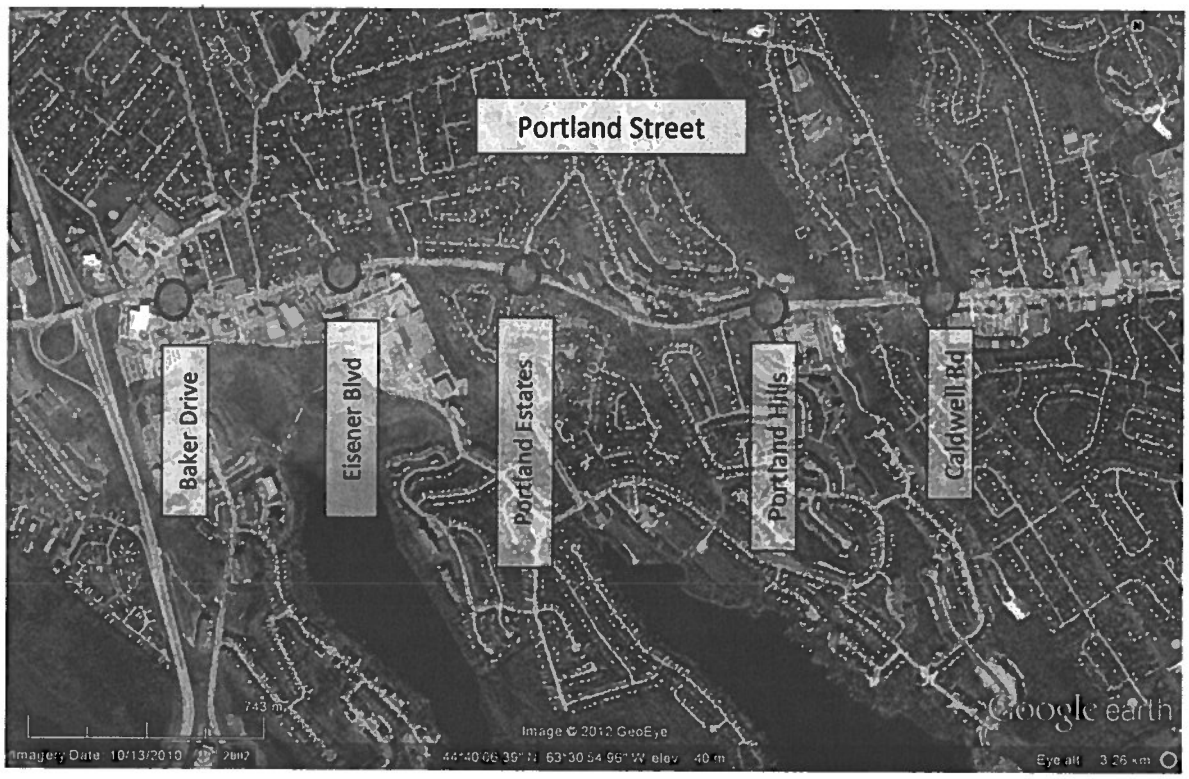


Figure 3 - Portland Street Corridor

3.2 Population and Housing Projections

The Morris-Russell Lake Area CCC Analysis study (CBCL 2005) identified land area, population and development densities for the study area. To be consistent with this study, this analysis uses the same population and development density assumptions. A summary is provided below. The CBCL study did not provide documentation on how land areas were calculated. For this study, population estimates were based on land parcels which excluded designated wetlands.

Table 1 – Population and Development Densities

Sub-Area	Designation	Area (Acres)	Density (Pers/Ac)	Population
A	Residential	12.16	20.0	243
B	Residential	11.13	20.0	223
C	Residential	29.91	20.0	598
D	Residential	33.69	20.0	674
E	Residential	9.50	20.0	190
F	Residential	20.35	20.0	407
G	Residential	6.34	20.0	127
H	Residential	14.01	13.4	188
I	Residential	12.34	13.4	165
J	Residential	29.67	13.4	398
K	Residential	4.72	13.4	63
Study Area Total		**183.81**	**17.82**	**3275**

Table 2 – Household Projections					
Sub-Area	Area (Acres)	Units per Acre	Housing Units	HD Units	LD Units
A	12.16	8.00	97	53	44
B	11.13	8.00	89	49	40
C	29.91	8.00	239	132	108
D	33.69	8.00	270	148	121
E	9.50	8.00	76	42	34
F	20.35	8.00	163	90	73
G	6.34	8.00	51	28	23
H	14.01	5.00	70	39	32
I	12.34	5.00	62	34	28
J	29.67	5.00	148	82	67
K	4.72	5.00	24	13	11
Study Area Total			**1288**	**709**	**580**

Notes

1. Split between high density and low density units assumed to be 55-45

4.0 Methodology

4.1 Design Hour Volume

Design hour volume (DHV) is the hourly traffic volume that an intersection or highway section is sized to accommodate. It represents the single peak hour traffic volume that is considered to represent acceptable operating conditions. For most traffic impact studies, the typical weekday morning and afternoon rush hour periods are examined.

DHV is comprised of three main components: existing traffic conditions, background traffic growth, and the travel demand generated by a proposed development.

Existing Traffic Conditions

The HRM Guidelines for the Preparation of Transportation Impact Studies (TIS)[2] recommends using the most recent traffic counts. It also suggests using traffic count data from other recent TIS studies conducted in the area. It qualifies this with the following statement:

> *Where the available traffic count data is not representative of current conditions or appears to be inconsistent, perhaps due to weather, construction activity or other factors, additional traffic counts may be required.*

Since there are no permanent traffic counters on Portland Street or Caldwell Road, HRM collects traffic count data through machine count and manual turning movement counts at various times throughout the year. Machine counts are usually collected during a one week period during the year, and turning movement counts are collected on one-day during the AM and PM peak hour. In some cases, traffic counts are collected only once every two years. Counts are seasonally adjusted for the month and day of the week, using factors obtained from Halifax Harbour Bridges. Even with the adjustment factors, there can be significant variations in count data from year to year due to weather, construction activity, and other factors.

For this study, the most recent traffic counts were obtained from HRM Traffic and Right-of-Way Services. To ensure that the traffic count data was representative of current conditions, machine count data and turning movement counts for both Portland Street and Caldwell Road were reviewed for the period 2001-2011.

[2] Guidelines for the Preparation of Transportation Impact Studies, 8th Revision, HRM Traffic and Right-of-Way Services, September 2007

Background Traffic Growth

The HRM guidelines recommend the selection of a horizon year. This generally represents full build-out or the year in which development is completed. Background traffic growth refers to adjustments made to existing traffic conditions to account for other developments and other changes to the transportation system.

Travel Demand

For this study, travel demand was estimated through the application of four-step process consisting of trip generation, trip distribution, modal split, and traffic assignment. This process is described below:

4.2 Trip Generation

Two methods were used to estimate the number of trips generated by the study area. The first method is based on population, and uses the trip generation equations developed for the VISUM HRM Regional travel demand model. The second method is based on housing units and uses trip generation rates found in the ITE Trip Generation Manual. Both methods are described below:

Population Method

The trip generation equations developed for the HRM regional travel demand model are based on the assumption that every HRM resident 15 years of age and over makes on average, 5.07 trips per day[3]. To determine the number of vehicle trips made during the peak hour, modal split, peak hour, vehicle occupancy factors, and internal capture rates are applied.

For this study, the following factors were used:

Modal Split	10%
Peak Hour Factor	10%
Vehicle Occupancy	1.35[4]
Internal Capture Rate	25%

[3] This figure is derived from data obtained from the 2006 Census, the 2006 Transportation Tomorrow Survey (Greater Toronto Area), and the Halifax Space Time Activity Research (STAR) Project (St Marys University)
[4] This figure is taken from HRM Cordon Surveys

Housing Unit Method

The housing unit method uses trip generation rates that are based on the ITE Trip Generation Manual. To determine the number of vehicle trips made during the peak hour, modal split and internal capture rate factors are applied.

For this study, the following factors were used:

Modal Split	10%
Internal Capture Rate	25%

4.3 Trip Distribution

Previous studies have made assumptions with respect to trip distribution based on the consultant's familiarity with traffic patterns in the area. For this study, the VISUM HRM Regional travel demand model calibrated to the 2009 PM Peak hour was used.

4.4 Modal Split

Modal split refers to the percentage of trips using other modes of transportation. It includes transit, cycling, and walking trips. The 2006 Journey-to-Work data indicates that approximately 13.7 percent of study area residents used transit, cycled, or walked to work.[5] These trips include those residents using the Portland Hills Park and Ride terminal. Work trips account for only a portion of all trips made during the peak hour. Other trips include those trips made for shopping, appointments, school, etc. These trips typically have a lower transit usage. To account for these trips, a modal split of 10 percent was used for the study.

4.5 Internal Capture Rates

Internal capture refers to the number of trips that are made within the study area, and therefore have no impact on the regional street network. For this study, it also included trips made to the east side of Caldwell Road. The internal capture rate was assumed to be 25 percent for this study. A similar figure was obtained from the VISUM HRM travel demand model.

4.6 Traffic Assignment

Traffic assignment refers to the specific route taken during a trip and is based on trip distribution. Previous studies have made assumptions with respect to traffic assignment based on the consultant's familiarity with traffic patterns in the area. For this study, the same methodology was used.

[5] Census Tract Profile for 121.07, 2006 Census, Statistics Canada

4.7 Evaluation of Traffic Impacts

The HRM TIS guide requires the evaluation of all signalized and unsignalized intersections which will be noticeably affected by site-generated traffic volumes for all relevant time periods and scenarios. It requires the identification of all intersections and individual traffic movements where:

- The overall volume/capacity ratio of an intersection exceeds 0.85
- The volume/capacity ratio of an individual through or shared movement exceeds 0.85
- The volume/capacity ratio of an exclusive movement exceeds 1.0
- An exclusive turning movement generates queues which exceed the available turning lane.

For the Cherrywood Drive Extension TIS, the consultant was able to demonstrate that the overall v/c ratio for the Portland Street at Caldwell Road intersection did not exceed 0.85 with site generated volumes. The consultant was also able to demonstrate that the v/c ratio for all through, shared, and exclusive movements also conformed to the HRM guidelines.

For this study the following intersections were analysed using the Synchro Studio 7 software:

- Portland Street at Baker Drive
- Portland Street at Eisener Boulevard
- Portland Street at Portland Estates Boulevard
- Portland Street at Portland Hills Drive
- Portland Street at Caldwell Road

5.0 Results

5.1 Design Hour Volume

Design hour volumes were developed for both the AM and PM peak hour periods for the Portland Street corridor between Baker Drive and Caldwell Road.

Existing Traffic Conditions

Traffic volume data for the 10 year period from 2001-2011 were obtained from HRM Traffic and Right-of-Way Services. Machine counts were available for every year for the section of Portland Street between Baker Drive and Highway 111, and for the section of Caldwell Road, between Portland Street and Hampton Green. The counts were obtained at various times through the year. Turning movement counts for the Portland at Baker intersection were available for every year. Turning movement counts for the Portland at Caldwell Road intersection were available every second year.

Average Annual Weekday Traffic (AAWT) volume estimates for Portland Street and Caldwell Road are presented below:

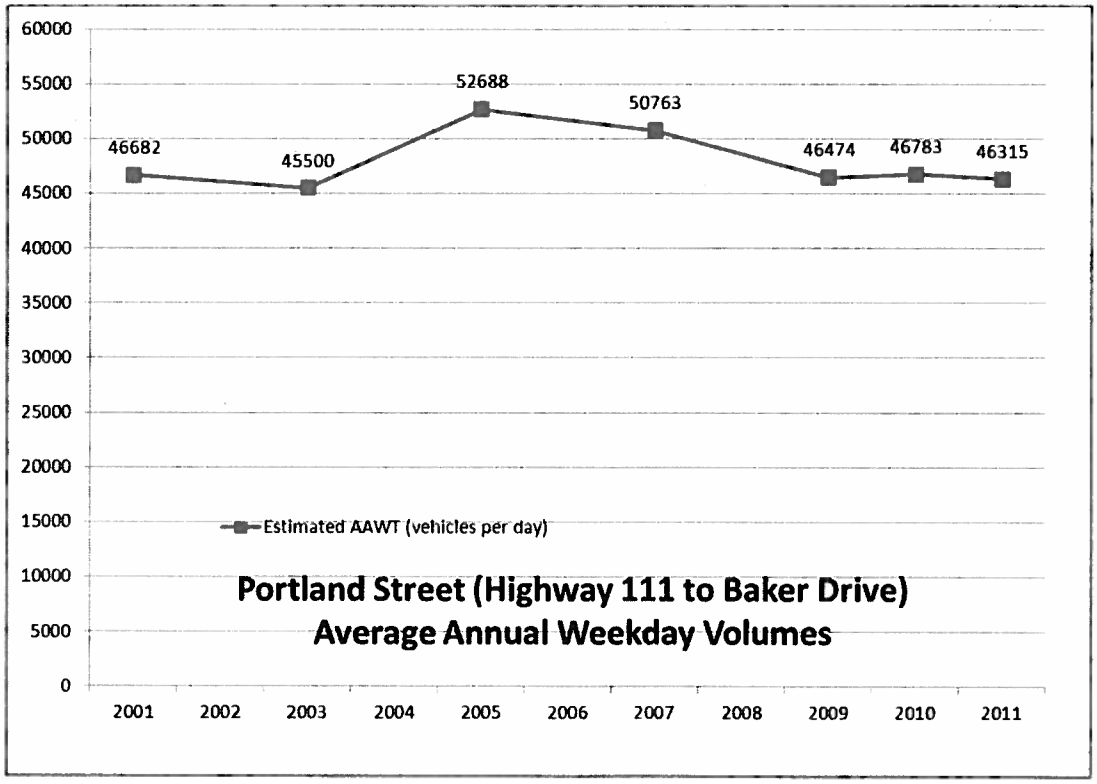


Figure 4 - Portland Street AAWT Volumes

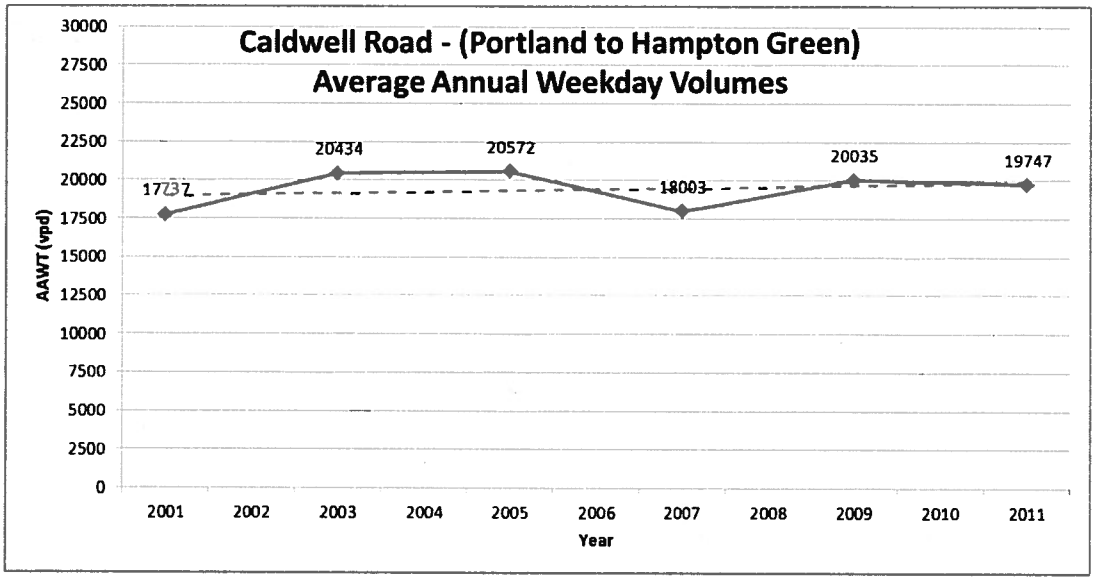


Figure 5 Caldwell Road AAWT Volumes

The data indicates that traffic volumes on Portland Street dropped between 2005 and 2007 with the opening of the Mount Hope Interchange, and have stabilized over the last 3 years. The traffic volumes on Caldwell Road have also stabilized over the last 3 years with the development restrictions in the area.

The stabilization of daily traffic volumes should also result in the stabilization of peak hour volumes. This was not the case for the left turn movement from Caldwell Road onto Portland Street in the AM peak hour. A plot of left turn volumes is shown on Figure 6. The data indicates that left turn volumes dropped dramatically in 2007 and 2009, and then increased dramatically in 2011. The 2007 count was taken in September, the 2009 count was taken in August, and the 2011 count was taken May. Based on a review of the 10 year period, there is no logical explanation for the 2007 count other than a counting error or some unforeseen event (ie traffic accident). The 2009 count was taken during the summer, which could explain why it was so low. This is important to note because the TIS for the Cherrywood Drive extension was based on these volumes. The 2011 count is consistent with the other counts.

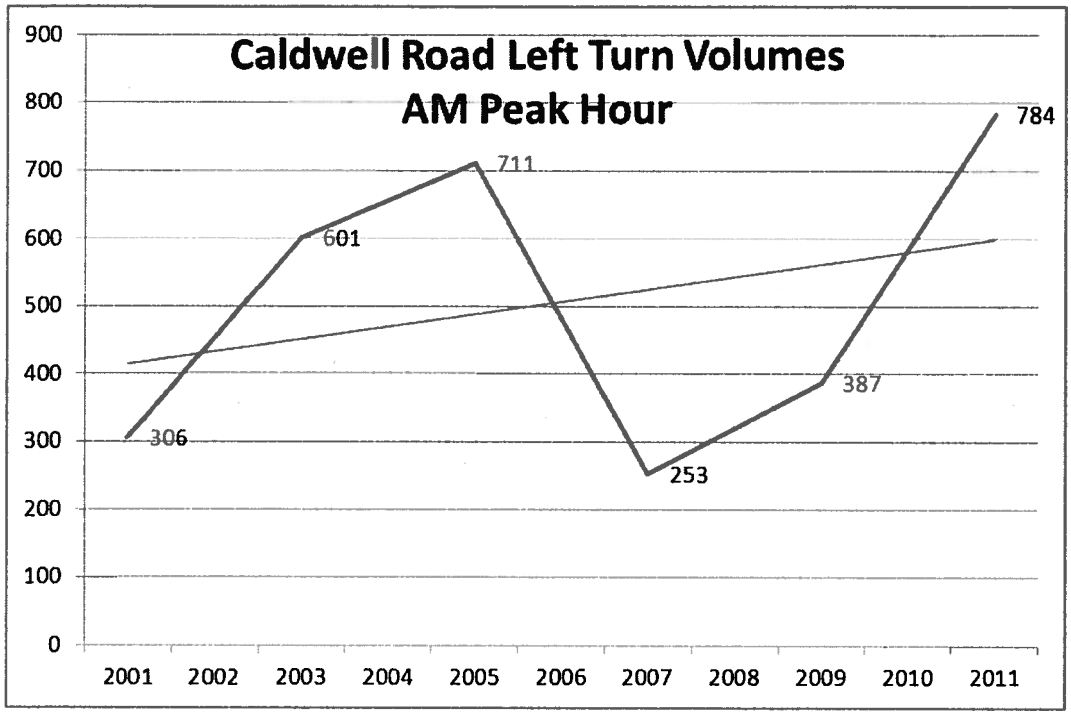


Figure 6 Caldwell Road Left Turn Volumes

Turning movement counts were obtained from HRM Traffic and Right-of-Way Services for the AM and PM peak hour. The volumes were balanced and adjusted to provide a 2011 AM and PM peak hour baseline. A summary is shown in the Appendix.

Background Growth

Before background growth can be calculated, the horizon or build out year must be selected. The build out year was based on the assumption that 200 residential units per year would be constructed. Based on this rate and a total of 1288 residential units, it would 7 years for build out. A 2018 baseline was selected.

Traffic volumes on Portland Street and Caldwell Road have been increasing at rates of 0.50 percent and 0.40 percent respectively. To account for site generated traffic, the background traffic growth rate on Portland Street and Caldwell Road was set at 0.25 percent and 0 percent per year respectively.

5.2 Trip Generation

Trip generation estimates using both the population and housing unit method are presented in Tables 1 and 2 below:

Table 1 Trip Generation - Population Method

Sub-Area	Population	POP15	Trips	Peak Hour Person Trips	Peak Hour Person Car Trips	Car Trips
A	243	190	961	97	87	65
B	223	174	880	89	80	59
C	598	467	2366	238	215	159
D	674	526	2665	268	242	179
E	190	148	751	76	68	50
F	407	317	1609	162	146	108
G	127	99	502	51	45	34
H	188	146	743	75	67	50
I	165	129	654	66	59	44
J	398	310	1572	158	143	106
K	63	49	250	25	23	17
TOTALS	**3275**	**2555**	**12952**	**1305**	**1174**	**870**
External Trips						**653**

Notes:

1. POP15 is the percentage of the population 15 years of age and over.
2. Trips is the average number of trips per day generated by a person 15 years of age and over. This number is taken from the VISUM traffic model
3. Peak Hour Factor of 0.10 was assumed
4. Modal Split of 10 percent was used.
5. Occupancy rate of 1.35 was used based on cordon surveys conducted by HRM during the PM peak hour.

Table 2 Trip Generation – Housing Unit Method

Sub-Area	Dwelling Units	HD Units	LD Units	Modal Split	Internal Capture	External Car Trips
A	97	53	44	90.0%	75.0%	51
B	89	49	40	90.0%	75.0%	47
C	239	132	108	90.0%	75.0%	127
D	270	148	121	90.0%	75.0%	143
E	76	42	34	90.0%	75.0%	40
F	163	90	73	90.0%	75.0%	86
G	51	28	23	90.0%	75.0%	27
H	70	39	32	90.0%	75.0%	37
I	62	34	28	90.0%	75.0%	33
J	148	82	67	90.0%	75.0%	79
K	24	13	11	90.0%	75.0%	12
TOTALS	1288	709	580			**682**

Notes:
1. Trips is the average number of trips per day generated by a person 15 years of age and over. This number is taken from the VISUM traffic model
2. PHF - peak hour factor (assumed)
3. Modal Split is based on the modal split for Traffic Zone 278 which is part of Census Tract 121.08.

Both trip generation methods produced similar results. Since the housing unit method produced a higher value, it was used in the study.

5.3 Trip Distribution

The HRM VISUM travel demand model calibrated to the 2009 PM peak hour base year was used for trip distribution. The model results were applied to both the AM and PM peak hour volumes.

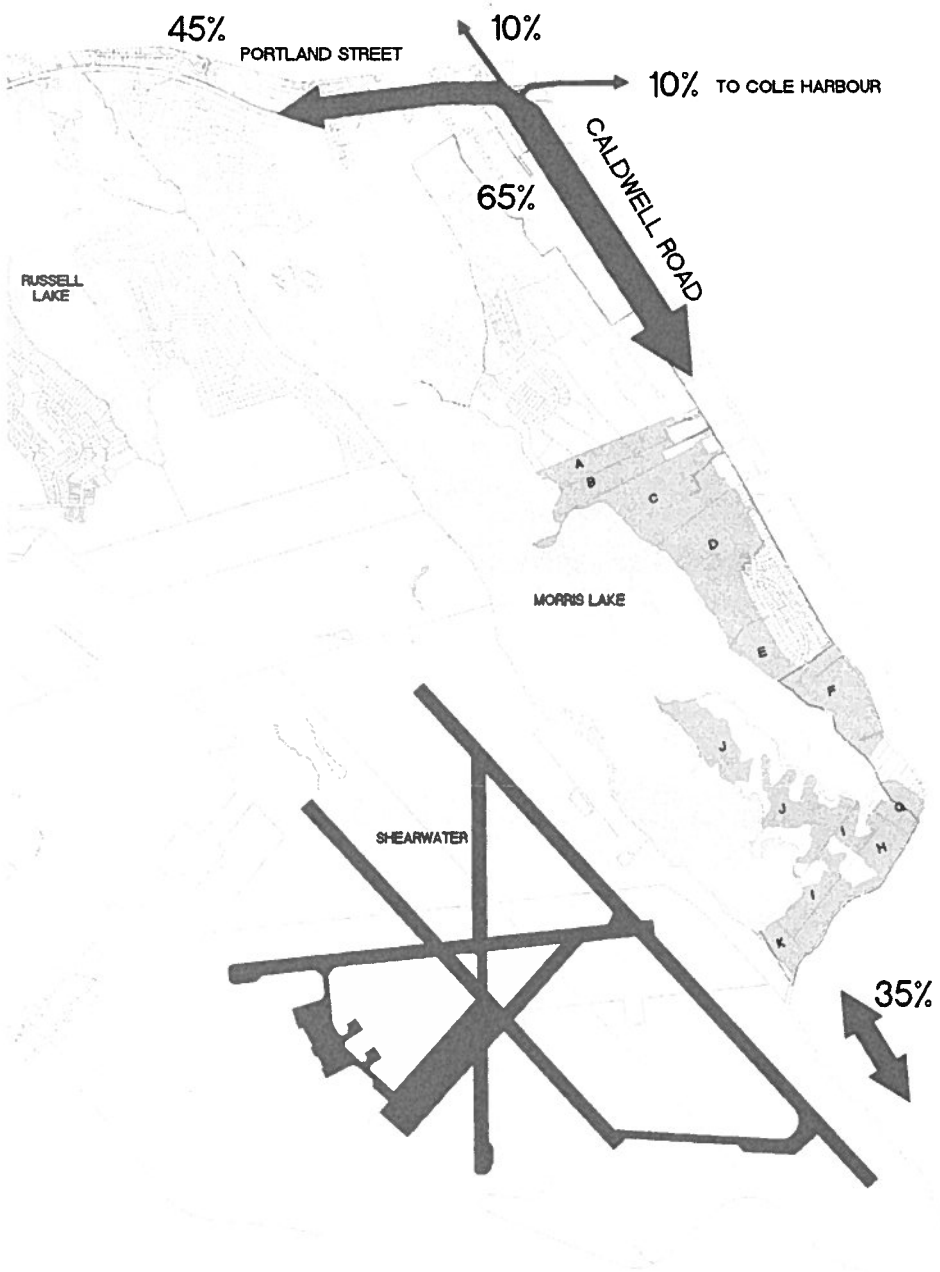


Figure 7 External Trip Distribution

5.4 Modal Split

A modal split of 10 percent was used and applied at the trip generation stage.

5.5 Traffic Assignment

Traffic assignment was done manually using the trip distribution results and the manual turning movement counts. A factor of 65 percent was used to determine volumes in the peak hour direction. The results are presented in the Appendix.

5.6 Evaluation of Impacts

The Synchro Studio 7 software was used to analyse the signalized intersections along Portland Street. Traffic signal timing plans were obtained from HRM Traffic and Right-of-Way Services and were optimized using the Synchro software.

Table 3 - Summary Level of Service Analysis - Portland Street at Baker Drive

LOS Criteria	Control Delay (sec/veh), LOS, and v/c Ratio by Intersection Movement												Intersection
	EBL	EBT	EBR	WB-L	WB-T	WB-R	NB-L	NB-LTR		SBL	SBT	SBR	LOS- v/c
2011 AM Peak – Existing Conditions													
Volume	130	580	290	10	1460	10	460	50		10	40	90	
v/c	0.88	0.36	0.2	0.03	1.06	0.01	1.12	1.13		0.00	0.12	0.27	
Delay	98	20.2	18.4	21.7	79	21.5	147.5	151.6		0	42.6	44.1	E
LOS	F	C	B	C	E	C	F	F		0	D	D	1.10
Approach delay		29.8			78.3			149.6			80		
Approach LOS		C			E			F			E		
2018 AM Peak – With Site Buildout													
Volume	132	654	295	11	1617	10	468	51		11	41	92	
v/c	0.89	0.40	0.20	0.04	1.14	0.01	1.21	1.22		0.00	0.14	0.29	
Delay	100.70	19.50	17.40	20.70	105.60	20.40	181.30	185.40		0.00	43.50	45.10	F
LOS	F	B	B	C	F	C	F	F		0.00	D	D	1.18
Approach delay		28.8			104.5			183.4			95.3		
Approach LOS		C			F			F			F		
2011 PM Peak –Existing Conditions													
Volume	410	1480	410	210	750	50	370	160		20	100	110	
v/c	1.63	0.73	0.28	2.28	0.44	0.04	1.70	1.67		0.00	0.59	0.62	
Delay	356.10	17.50	10.90	636.50	18.90	14.80	393.10	381.50		0.00	58.20	59.30	F
LOS	F	B	B	F	B	B	F	F		0.00	E	E	1.93
Approach delay		76.7			147.1			387.2			50.5		
Approach LOS		E			F			F			D		
2018 PM Peak –With Site Buildout													
Volume	417	1580	417	229	821	51	377	163		48	108	112	
v/c	1.65	0.80	0.29	3.61	0.50	0.04	1.58	1.54		0.00	0.63	0.63	
Delay	367.30	20.90	11.80	1240.00	20.80	15.80	340.20	320.10		0.00	60.60	59.80	F
LOS	F	C	B	F	C	B	F	F		0.00	E	E	2.71
Approach delay		79.1			274.4			330.2			51.7		
Approach LOS		E			F			F			D		

The analysis indicates that the overall intersection volume/capacity ratio exceeds 0.85 for all four time periods. During the AM peak, the Portland westbound through movement v/c exceeds the 0.85, and the Baker Drive northbound approach v/c exceeds 1.00. During the PM peak, the Portland Street eastbound left approach v/c exceeds 1.00, and the Baker Drive northbound approach v/c exceeds 1.00.

Table 4- Summary of Level of Service Analysis - Portland Street at Eisener Boulevard

LOS Criteria	Control Delay (sec/veh), LOS, and v/c Ratio by Intersection Movement												Intersection
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	LOS- v/c
2011 AM Peak – Existing Conditions													
Volume	0	560	70	330	1380	0	90	0	60	30	70	10	
v/c	0.00	0.59	0	0.64	0.69	0.00	0.49	0.00	0.04	0.18	0.44	0.00	
Delay	0	20.4	0	10.9	10	0	31.1	0	27.8	29.1	31	0	B
LOS	0	C	0	B	B	0	C	0	C	C	C	0	0.63
Approach delay		20.4			10.2			29.8	0		30.5		
Approach LOS		C			B			C			C		
2018 AM Peak – With Site Buildout													
Volume	0	634	71	369	1536	0	92	0	1	31	71	10	
v/c	0.00	0.65	0.00	0.76	0.77	0.00	0.41	0.00	0.00	0.20	0.47	0.00	
Delay	0.00	23.10	0.00	19.80	13.00	0.00	31.70	0.00	0	32.80	35.10	0.00	B
LOS	0.00	C	0.00	B	B	0.00	C	0.00	12	C	D	0.00	0.68
Approach delay		23.1			14.3			30.6			34.4		
Approach LOS		C			B			C			C		
2011 PM Peak –Existing Conditions													
Volume	0	1530	70	120	680	0	240	0	3	90	50	90	
v/c	0.00	0.94	0.00	0.77	0.34	0.00	0.83	0.00	0.00	0.55	0.59	0.00	
Delay	0.00	35.70	0.00	49.40	10.90	0.00	64.10	0.00	0	54.60	56.20	0.00	D
LOS	0.00	D	0.00	D	B	0.00	E	0.00	0	D	E	0.00	0.87
Approach delay		35.7			16.7			67.8			55.6		
Approach LOS		D			B			E			E		
2018 PM Peak –With Site Buildout													
Volume	0	1665	71	135	765	0	244	0	177	92	51	92	
v/c	0.00	0.97	0.00	1.01	0.37	0.00	0.89	0.00	0.00	0.57	0.61	0.00	
Delay	0.00	39.60	0.00	116.70	10.90	0.00	75.90	0.00	NBR	57.70	60.20	0.00	D
LOS	0.00	D	0.00	F	B	0.00	E	0.00	0	E	E	0.00	0.97
Approach delay		39.6			26.8			109.9			59.2		
Approach LOS		D			C			F			E		

The analysis indicates that the overall intersection volume/capacity ratio exceeds 0.85 for the 2011 and 2018 PM peak periods. During the PM peak, the Portland eastbound through movement v/c exceeds the 0.85, and the Eisener northbound approach v/c exceeds 0.85.

Table 5 Summary of Level of Service Analysis - Portland Street at Portland Estates Blvd

LOS Criteria	Control Delay (sec/veh), LOS, and v/c Ratio by Intersection Movement												Intersection
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	LOS- v/c
2011 AM Peak – Existing Conditions													
Volume	60	560	30	40	1570	20	40	120	20	20	50	100	
v/c	0.40	0.33	0	0.09	0.89	0.00	0.15	0.32	0.00	0.07	0.26	0.00	
Delay	21.4	13.3	0	9.5	27.6	0	32.2	33.8	0	31.4	33.2	0	C
LOS	C	B	0	A	C	0	C	C	0	C	C	0	0.69
Approach delay		14.1			27.2			33.4	0		33		
Approach LOS		B			C			C			C		
2018 AM Peak – With Site Buildout													
Volume	61	652	31	45	1763	20	41	122	23	22	51	102	
v/c	0.48	0.35	0.00	0.11	0.93	0.00	0.18	0.36	0.00	0.09	0.29	0.00	
Delay	26.60	12.60	0.00	8.60	29.50	0.00	37.30	39.20	0.00	36.30	38.30	0.00	C
LOS	C	B	0.00	A	C	0.00	D	D	0.00	D	D	0.00	0.75
Approach delay		13.7			29			38.7			38.1		
Approach LOS		B			C			D			D		
2011 PM Peak –Existing Conditions													
Volume	60	1880	30	30	710	30	40	120	20	30	30	50	
v/c	0.16	0.96	0.00	0.29	0.38	0.00	0.15	0.36	0.00	0.13	0.12	0.00	
Delay	8.10	33.00	0.00	27.80	12.70	0.00	37.90	40.20	0.00	37.80	37.60	0.00	C
LOS	A	C	0.00	C	B	0.00	D	D	0.00	D	D	0.00	0.77
Approach delay		32.3			13.3			39.7			37.6		
Approach LOS		C			B			D			D		
2018 PM Peak –With Site Buildout													
Volume	61	2045	31	34	808	31	41	122	27	37	31	51	
v/c	0.17	1.01	0.00	0.33	0.42	0.00	0.16	0.40	0.00	0.18	0.13	0.00	
Delay	8.00	45.00	0.00	32.30	12.40	0.00	41.20	43.90	0.00	41.50	40.80	0.00	D
LOS	A	D	0.00	C	B	0.00	D	D	0.00	D	D	0.00	0.8
Approach delay		44			13.2			43.3			41		
Approach LOS		D			B			D			D		

The analysis indicates that the overall intersection volume/capacity ratio does not exceed 0.85 for all four time periods. During the AM peak, the Portland westbound through movement exceeds 0.85. During the PM peak, the Portland eastbound through movement v/c exceeds the 0.85.

Table 6 - Summary of Level of Service Analysis - Portland Street at Portland Hills

LOS Criteria	Control Delay (sec/veh), LOS, and v/c Ratio by Intersection Movement												Intersection
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	LOS- v/c
2011 AM Peak – Existing Conditions													
Volume	20	540	40	160	1590	30	20	30	110	20	20	20	
v/c	0.15	0.33		0.29	0.81	0.00	0.13	0.23	0.00	0.00	0.27	0.00	
Delay	9.9	10		4.3	13.3	0	29.3	29.9	0	0	30.3	0	B
LOS	A	A		A	B	0	C	C	0	0	C	0	0.71
Approach delay		10			12.5			29.9	0		30.3		
Approach LOS		A			B			C			C		
2018 AM Peak – With Site Buildout													
Volume	20	635	41	181	1788	31	20	31	122	22	20	20	
v/c	0.17	0.36		0.35	0.85	0.00	0.11	0.25	0.00	0.00	0.36	0.00	
Delay	12.00	9.70		4.40	14.80	0.00	34.00	35.00	0.00	0.00	36.30	0.00	B
LOS	B	A		A	B	0.00	C	D	0.00	0.00	D	0.00	0.77
Approach delay		9.7			13.9			34.9			36.3		
Approach LOS		A			B			C			D		
2011 PM Peak –Existing Conditions													
Volume	40	1850	40	100	730	20	20	30	110	20	20	20	
v/c	0.09	0.88		0.53	0.33	0.00	0.15	0.37	0.00	0.00	0.46	0.00	
Delay	4.90	18.60		23.20	6.10	0.00	42.40	44.20	0.00	0.00	46.40	0.00	B
LOS	A	B		C	A	0.00	D	D	0.00	0.00	D	0.00	0.84
Approach delay		18.3			8.2			44			46.4		
Approach LOS		B			A			D			D		
2018 PM Peak –With Site Buildout													
Volume	41	2028	41	114	832	20	20	31	135	135	25	20	
v/c	0.10	0.93		0.69	0.38	0.00	0.15	0.55	0.00	0.00	0.00	0.72	
Delay	4.30	23.10		41.70	7.00	0.00	46.20	51.60	0.00	0.00	0.00	75.00	C
LOS	A	C		D	A	0.00	D	D	0.00	0.00	0.00	E	0.93
Approach delay		22.7			11.1			51			75		
Approach LOS		C			B			D			E		

The analysis indicates that the overall intersection volume/capacity ratio exceeds 0.85 for the 2018 PM peak period. During the PM peak, the Portland eastbound through movement v/c exceeds the 0.85.

Table 7- Summary of Level of Service Analysis - Portland Street at Caldwell Road

LOS Criteria	Control Delay (sec/veh), LOS, and v/c Ratio by Intersection Movement												Intersection
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	N8R	SBL	SBT	SBR	LOS- v/c
2011 AM Peak – Existing Conditions													
Volume	10	430	230	160	1080	60	680	130	150	60	50	20	
v/c	0.17	0.52	0.16	0.51	0.93	0.00	1.03	0.57	0.00	0.18	0.52	0.00	
Delay	35.3	37.9	22.2	27	45.8	0	76.1	39	0	39.2	56.4	0	D
LOS	D	D	C	C	D	0	E	D	0	D	E	0	0.94
Approach delay		32.5			43.5			65.3	0		48.5		
Approach LOS		C			D			E			D		
2018 AM Peak – With Site Buildout													
Volume	10	431	337	184	1099	61	879	174	194	61	74	20	
v/c	0.18	0.60	0.23	0.69	1.06	0.00	1.27	0.63	0.00	0.20	0.52	0.00	
Delay	41.00	45.00	23.00	38.90	86.00	0.00	166.90	37.70	0.00	42.90	55.60	0.00	F
LOS	D	D	C	D	F	0.00	F	D	0.00	D	E	0.00	1.1
Approach delay		35.4			79.5			128.8			50.6		
Approach LOS		D			E			F			D		
2011 PM Peak –Existing Conditions													
Volume	20	1240	720	160	530	60	300	70	230	140	50	20	
v/c	0.07	0.92	0.86	0.98	0.36	0.00	0.67	0.76	0.00	0.54	0.49	0.00	
Delay	20.20	40.60	55.50	91.50	17.20	0.00	40.60	55.30	0.00	46.30	53.80	0.00	D
LOS	C	D	E	F	B	0.00	D	E	0.00	D	D	0.00	0.83
Approach delay		45.8			33.1			48			48.8		
Approach LOS		D			C			D			D		
2018 PM Peak –With Site Buildout													
Volume	20	1248	919	204	539	61	407	94	254	142	94	20	
v/c	0.08	1.01	1.15	1.09	0.38	0.00	0.91	0.82	0.00	0.56	0.63	0.00	
Delay	24.70	65.30	135.70	126.30	20.30	0.00	64.10	S9.70	0.00	51.20	59.70	0.00	E
LOS	C	E	F	F	C	0.00	E	E	0.00	D	E	0.00	0.97
Approach delay		94.5			47.2			62.1			55		
Approach LOS		F			D			E			D		

The analysis indicates that the overall intersection volume/capacity ratio exceeds 0.85 for the 2011 AM peak, the 2018 AM peak, and the 2018 PM peak periods. During the AM peak, the Portland Street westbound through movement v/c exceeds 0.85, and the Caldwell northbound left movement exceeds 0.91.

6.0 Observations

- The Baker Drive and Caldwell Road intersections appear to be the choke points along the Portland Street corridor.

- The Baker Drive intersection exceeds the HRM guidelines for both the 2011 AM and PM peak periods. The bus pre-emption phases will increase the v/c ratios. This will only get worse with the addition of site generated and background growth traffic volumes.

- The Caldwell Road intersection exceeds the HRM guidelines for the 2011 AM peak period. This will only get worse with the addition of site generated and background growth traffic volumes.

- The Caldwell Road intersection generally operates within the HRM guidelines for the 2011 PM peak period. The addition of site generated and background traffic volume will create capacity problems on the Portland Street.

- The Eisener Boulevard, Portland Estates Boulevard and the Portland Hills Drive intersections are operating quite well because of the relatively low side street volumes. As traffic volumes on Portland Street increase over time, v/c ratios on Portland Street will only marginally exceed the warrant for transportation system changes.

- During the 2018 AM peak hour period, site generated traffic represents only 5.28 and 12.57 percent of the total traffic volume at the Baker Drive and Caldwell Road intersections.

- During the 2018 PM peak hour period, site generated traffic represents only 4.45 and 11.07 percent of the total traffic volume at the Baker Drive and Caldwell Road intersections.

7.0 Identification of Transportation System Changes

The HRM TIS guide requires that all reasonable attempts should be made to identify transportation and other changes that mitigate the transportation impacts of a development. Site generated traffic should not exceed the HRM v/c criteria outlined in the guide.

The HRM guide requires that the overall intersection v/c ratio, and that of individual through and shared-through movements should not exceed 0.85. The v/c ratio for protected and/or exclusive turning movements should not exceed 1.00.

There are three potential solutions to the Portland Street corridor. They are described as follows:

Allow the Volume-to-Capacity Ratio to Exceed 0.85

Allowing the v/c ratio to exceed 0.85 would eliminate the need for transportation improvements at the Eisener, Portland Estates, and Portland Hills intersections.

By limiting the v/c ratio to 0.85, HRM has defined acceptable operating conditions. A lower limit would result in unnecessary road widening projects with very little to be gained in terms of driver benefits. A higher limit would result in lower construction costs but would result in a reduction of driver benefits.

Upgrading these three intersections and/or widening Portland Street in this area is likely cost prohibitive given the restricted right-of-way. Increasing the v/c ratio will take advantage of the full capacity of these intersections.

Reduce Travel Demand

Reducing site generated, background growth, and/or existing traffic demand along this corridor will lower the v/c ratio.

Site generated traffic volumes could be reduced by restricting development or increasing transit usage. Since the v/c ratios on most of the Portland Street approaches already exceed 0.85, lowering site generated traffic volumes or increasing transit usage will not have any impact on v/c ratios.

A background traffic growth rate of 0.25 percent was used in this study. It is not reasonable to assume that the background growth rate will be any lower than this.

The Shearwater Connector project was designed to divert existing traffic away from Portland Street. Another way to reduce existing traffic volumes is to restrict turning movements at certain intersections. There does not appear to be any opportunities to eliminate turning movements without severely restricting access to the adjacent lands.

Increase Roadway Capacity

Intersection capacity can be increased by restricting turning movements, changing traffic signal timings, and adding travel lanes. There does not appear to be any opportunities to restrict turning movements or change traffic signal timings. Adding travel lanes appears to be the only option for the Baker Drive and Caldwell Road intersections. One option for Baker Drive and two options for Caldwell Road were investigated. They are described below:

7.1 Double Left Turn – Portland Street at Caldwell Road

The addition of a second left turn lane from Caldwell Road onto Portland Street was modelled using the Synchro software. The analysis indicates that the intersection improvements can accommodate site generated travel demand in the 2018 AM peak. It cannot accommodate travel demand in the 2018 PM peak. The v/c ratio for the Portland Street eastbound through and right turn approaches were 1.01 and 1.13 respectively

7.2 Roundabout – Portland Street at Caldwell Road

The Synchro Studio 7 software does not have the capability to model roundabouts. Instead, the SIDRA Intersection 5.1 was used to model a roundabout at Caldwell Road. Initial results indicate that a roundabout similar to the on shown on Figure 8 can accommodate site generated travel demand in the 2018 AM Peak. It cannot accommodate travel demand in the 2018 PM peak.

7.3 Roundabout – Portland Street at Baker Drive

The SIDRA Intersection 5.1 was used to model a roundabout at Baker Drive. Initial results indicate that conversion of the intersection to a roundabout cannot accommodate site generated travel demand.

Figure 8 Potential Portland Street at Caldwell Road Roundabout

8.0 Summary and Conclusions

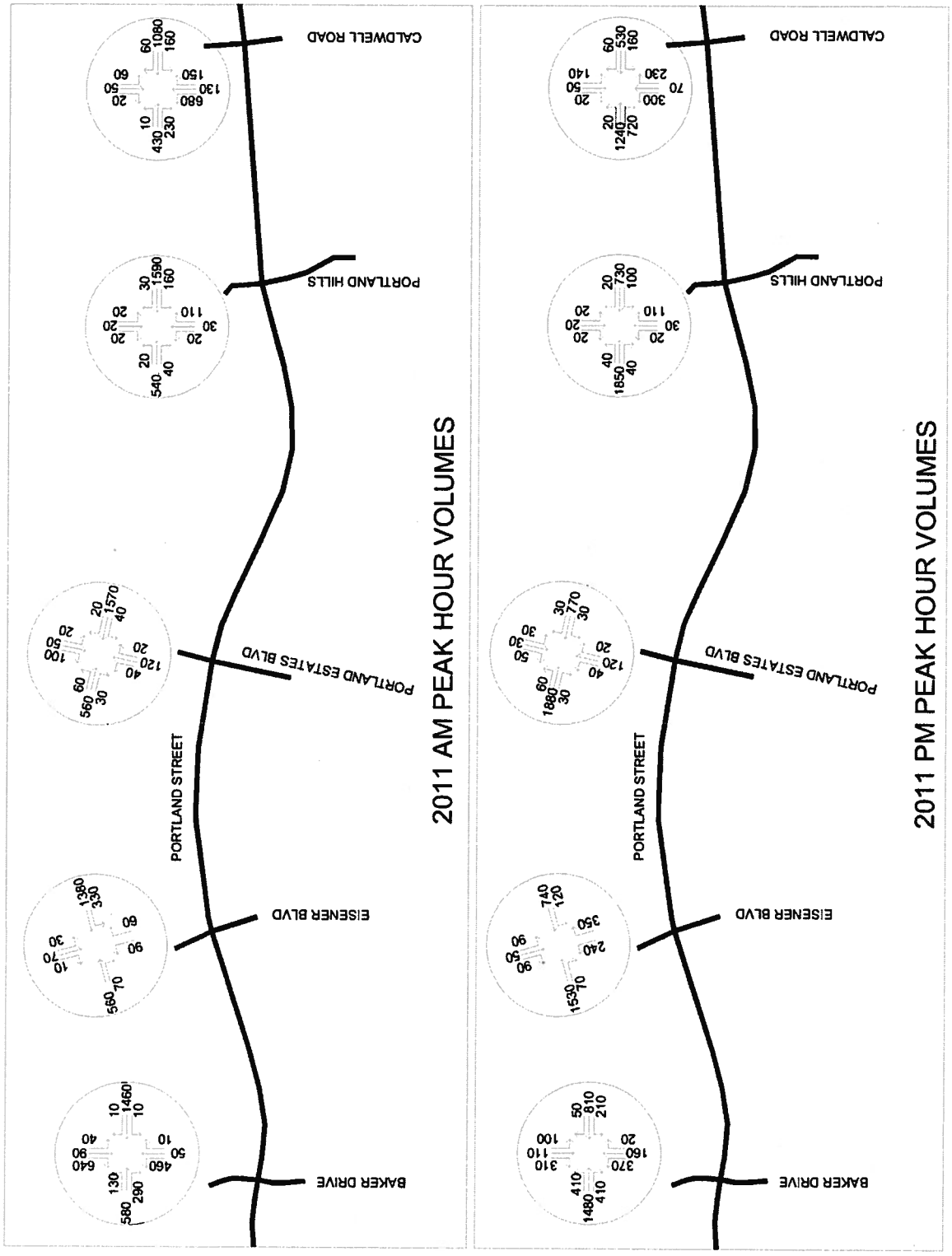
A traffic study has confirmed that no further development should be permitted within the Morris-Russell Lake Secondary Plan area until the Shearwater Connector is constructed to Caldwell Road.

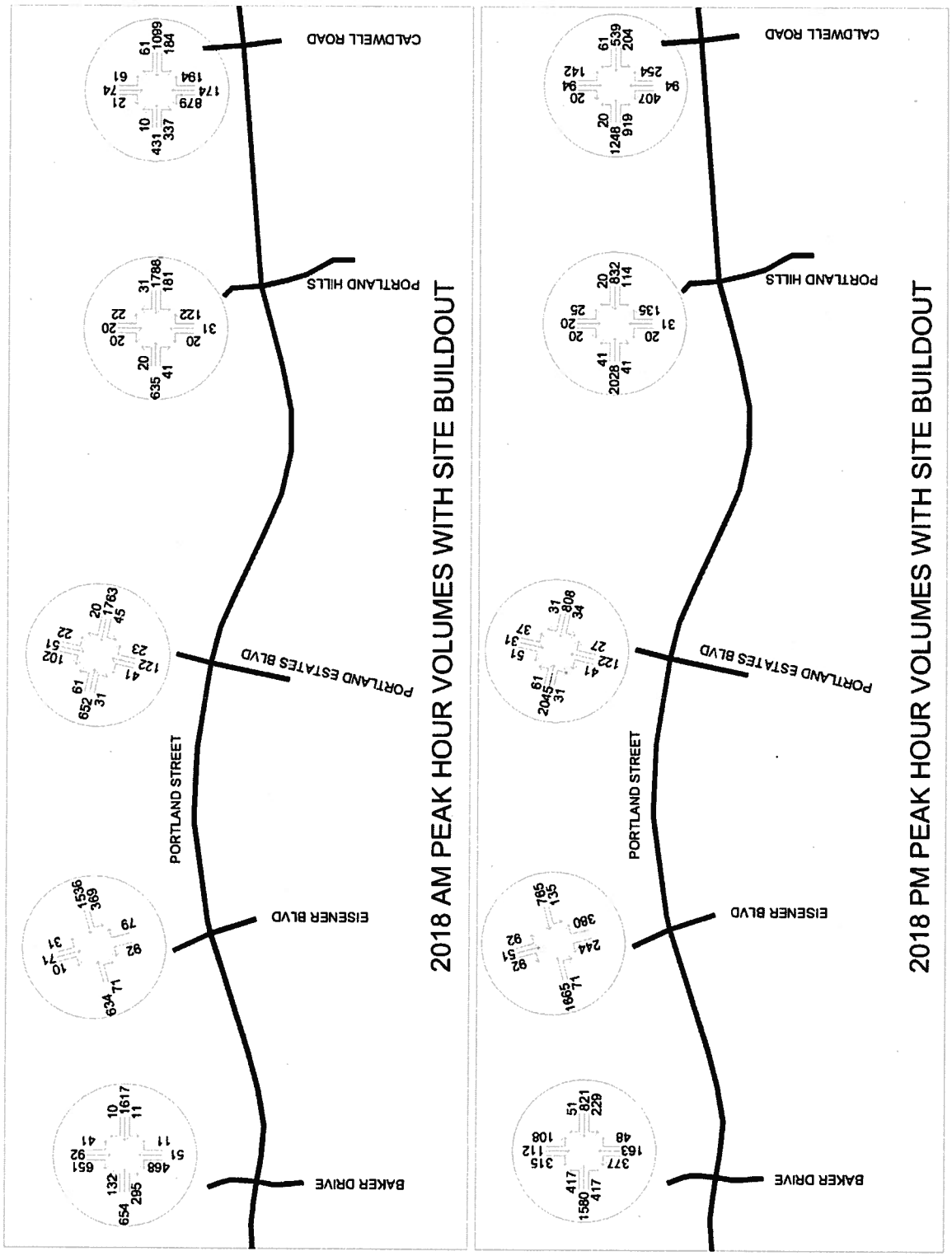
The intersections at Eisener Boulevard, Portland Estates Boulevard, and Portland Hills Drive currently operate within the HRM performance criteria for signalized intersections. The addition of background traffic growth and site generated development will eventually cause these three intersections to only marginally exceed the performance criteria. It is recommended that no improvements be made to these three intersections.

Current volume-to-capacity ratios at the Caldwell Road intersection exceed HRM performance standards. Conversion of the intersection to a roundabout can accommodate site generated travel demand for the 2018 AM peak hour period, but not for the 2018 PM peak hour period. The addition of left turn lane on Caldwell Road can accommodate site generated travel demand for the 2018 AM peak hour period, but cannot accommodate travel demand for the 2018 PM peak hour period. A second left hand turning lane and other geometric improvements to the intersection would however result in improved performance for existing road users and should be considered for addition to the Five-year Project Plan.

Current volume-to-capacity ratios at the Baker Drive intersection exceed HRM performance standards. Conversion of the intersection to a roundabout will not be able to accommodate site generated travel demand.

APPENDIX


2011 AM PEAK HOUR VOLUMES
2011 PM PEAK HOUR VOLUMES
CALDWELL ROAD
PORTLAND HILLS
PORTLAND ESTATES BLVD
PORTLAND STREET
EISENER BLVD
BAKER DRIVE


2018 AM PEAK HOUR VOLUMES WITH SITE BUILDOUT
2018 PM PEAK HOUR VOLUMES WITH SITE BUILDOUT
CALDWELL ROAD
PORTLAND HILLS
PORTLAND ESTATES BLVD
PORTLAND STREET
EISENER BLVD
BAKER DRIVE