STONEBRIDGE DEVELOPMENT – NORTH

Transportation Impact Assessment

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1.0 INTRODUCTION

WATT Consulting Group is retained by Merdyn Group to prepare a Traffic Impact Assessment (TIA) for the proposed Stonebridge development in Mill Bay. This TIA is for the north portion of the site only. The development is a mixture of residential, congregate care, and commercial development. The site is located in the Mill Bay area of the CVRD as illustrated in **Figure 1**.

Prior to additional phases on the north side, after Phase 1A and 1B or prior to the south side developing an updated TIA may be requested by MoTI to consider updated operational conditions, changes in density, changes in road network, and / or site access design.

1.1 The Site Today

The entire site is located west of Highway 1 between Shawnigan-Mill Bay Road and Deloume Road. There is a creek that runs through the site the separates it into a north and south portion. The site today is occupied by one single family home and the demolished Pioneer Square Mall, at the northeast corner of the project site.

1.2 Proposed Development

In total, the proposed development contains 787 residential units and 113,500 square feet of commercial space. However, this report is only for the north portion of the site which is a total of 667 residential doors and 100,000 sq. ft. of commercial. The south portion of the development is not included in this report.

The maximum zoning permits up to 928 residential doors; however, based topography 787 doors is currently the maximum that could be constructed. In addition, there is only available water for up to 540 doors; therefore, even the proposed 667 doors on the north portion of the development exceeds available water.

The TIA will be updated every 3 years (as needed) and subject to update with each phase of the project, therefore if the current limitations on the ability to reach maximum densities change and allow beyond 667 doors MOTI will have opportunities to understand and evaluate any potential impacts due to the higher density.

1.3 This Report

This report provides the following:

- An overview of the existing and evolving transportation context, including vehicular, pedestrian, cycling, and transit facilities, and area travel characteristics
- An overview of the proposed development and the transportation-related features of the proposed site plan
- A projection of the site's trip generation, distribution, and assignment potential
- An assessment of existing traffic patterns and volumes in the study area during the AM and PM peak traffic hours.
- A review of the vehicular traffic volume changes that may occur in the area in the future due to growth in the surrounding area
- An operational assessment of vehicular traffic operations in the study area under existing, background, and post-development conditions

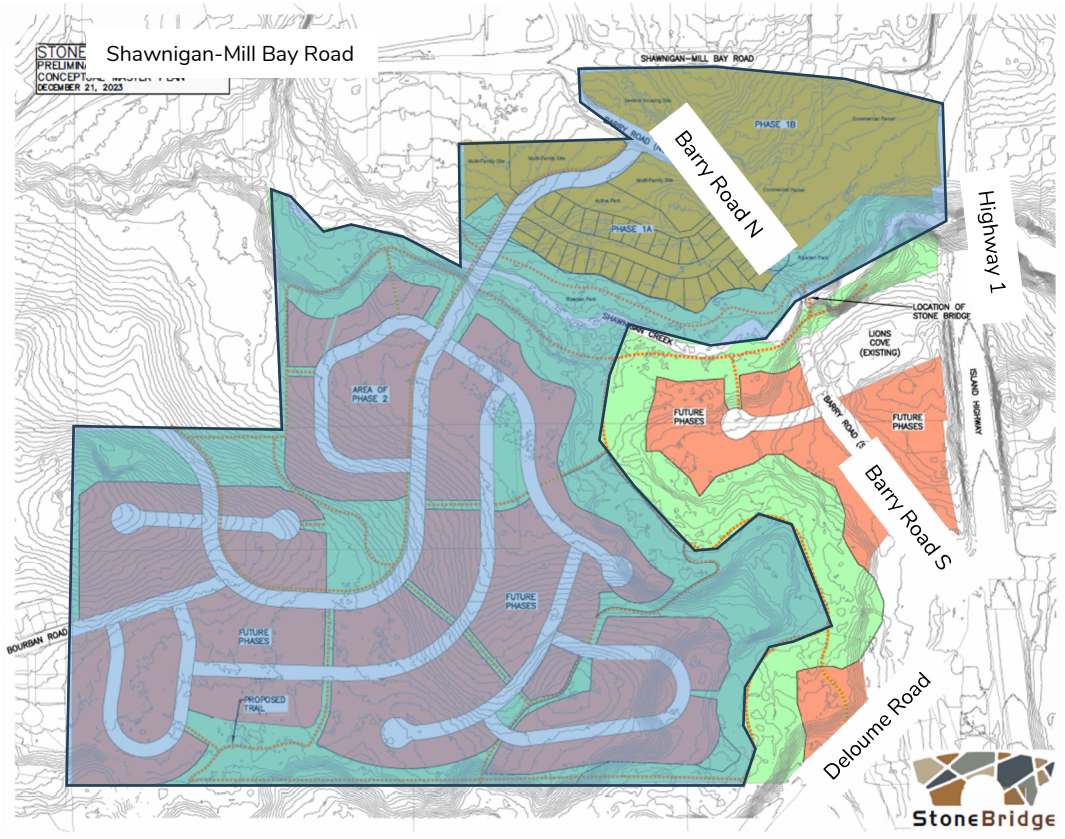


Figure 1 – Site Location (North Side in Blue)

2.0 TRANSPORTATION CONTEXT

2.1 Road Network

2.1.1 Existing Road Network

The existing road network, lane configuration, and intersection control within the study area are illustrated in

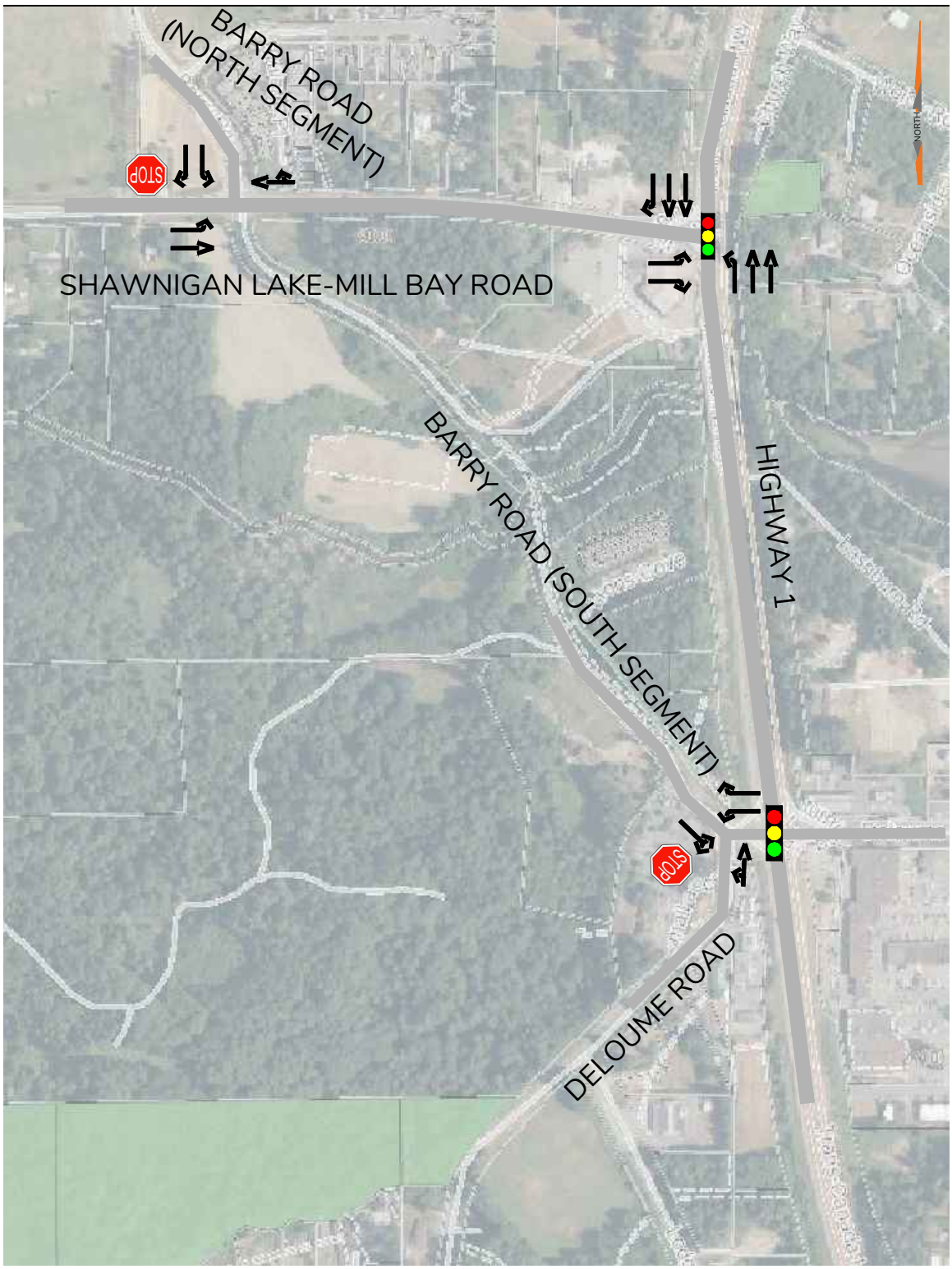
Figure 2. An outline of the characteristics of the existing roads and intersections within the study area are provided in **Table 1** and **Table 2**, respectively.

Table 1 – Existing Road Network

Road Name	Ownership	Classification	Extents	# of Lanes	On-Street Parking	Posted Speed Limit
Highway 1	MoTI	Rural Divided Arterial	Victoria to Departure Bay Ferry in Nanaimo	4 (2 in each direction)	Not permitted	80 km/h
Shawnigan -Mill Bay Road	MoTI	Rural Undivided Arterial	Highway 1 to Shawnigan Lake Road	2 (1 in each direction)	Permitted on north side from Hwy for approx. 80m	50 km/h
Barry Road North	MoTI	Local Road	Shawnigan -Mill Bay Road to Frances Kelsey Secondary School	2 (1 in each direction)	Not permitted	50 km/h

Table 2 – Study Area Intersection Overview

Intersection	Control Type	Features	Crosswalks
Highway 1 / Shawnigan-Mill Bay Road	Signalized	• Southbound channelized right turn (yield) • Separate eastbound left and right turns with right turn channelized with a yield • 65m northbound left turn lane with protected left turn phase • 'T' Intersection	South and west legs
Shawnigan-Mill Bay Road / Barry Road	Stop-control on Barry Road	• Southbound and eastbound left turn lanes • 'T' intersection	North and west legs (signed & marked)


BARRY ROAD (NORTH SEGMENT)
STOP
SHAWNIGAN LAKE-MILL BAY ROAD
NORTH
BARRY ROAD (SOUTH SEGMENT)
HIGHWAY 1
STOP
DELOUME ROAD

2.2 Transit Network

2.2.1 Existing Transit Network

An outline of the nearby transit routes within the study area is provided in **Table 3**.

Table 3 – Existing Transit Network

Route # and Name	Extents	Headways	Nearest Stop(s)	Walking Distance to Nearest Stop
8 – Mill Bay / Duncan	Duncan to Mill Bay Ferry and Shawnigan Lake (clockwise)	Weekdays: Every 60 – 140 minutes (245 minutes midday) Weekends: 1 mid-morning and 2 mid-afternoon trips on Saturday, 1 late morning and 1 late afternoon trip on Sunday	Shawnigan-Mill Bay Road / Barry Road (WB) Deloume Road / Barry Road	110 m (1 minute) 50 m (<1 minute)
9 – Mill Bay / Duncan	Duncan to Shawnigan Lake and Mill Bay (counterclockwise)	Weekdays: Every 130 – 140 minutes (230 minutes midday) Weekends: 1 midday trip and 1 evening trip on Saturday, 1 early afternoon trip on Sunday	Shawnigan-Mill Bay Road / Barry Road (EB) Deloume Road / Barry Road	0m (0 minutes) 50m (<1 minute)
66 CVX Cowichan – Victoria Express	Duncan to Victoria	Weekdays: 3 AM peak trips and 1 mid-morning trip to Victoria, 1 mid-afternoon trip and 3 PM peak trips to Duncan Saturday: 3 trips in each direction	Deloume Road / Lodgepole Road	190 m (3 minutes), or 550 m (8 minutes)
99 SVX Shawnigan Lake – Victoria Express	Cobble Hill and Shawnigan Lake to Victoria	Weekdays: 2 AM peak trips to Victoria and 2 PM peak trips to Shawnigan Lake and Cobble Hill	Shawnigan-Mill Bay Road / Wilkinson Road Deloume Road / Lodgepole Road	500 m (7 minutes) 190 m (3 minutes), or 550 m (8 minutes)

The eastbound and westbound bus stops at Shawnigan Lake-Mill Bay Road / Barry Road have identification signs only and paved shoulders to access the signed and marked crosswalk across Shawnigan Lake-Mill Bay Road. The bus stops on Shawnigan-Mill Bay Road closest to the Highway only have identification signs for the stops. The westbound stop requires people to wait in the grass area. None of these stops are accessible.

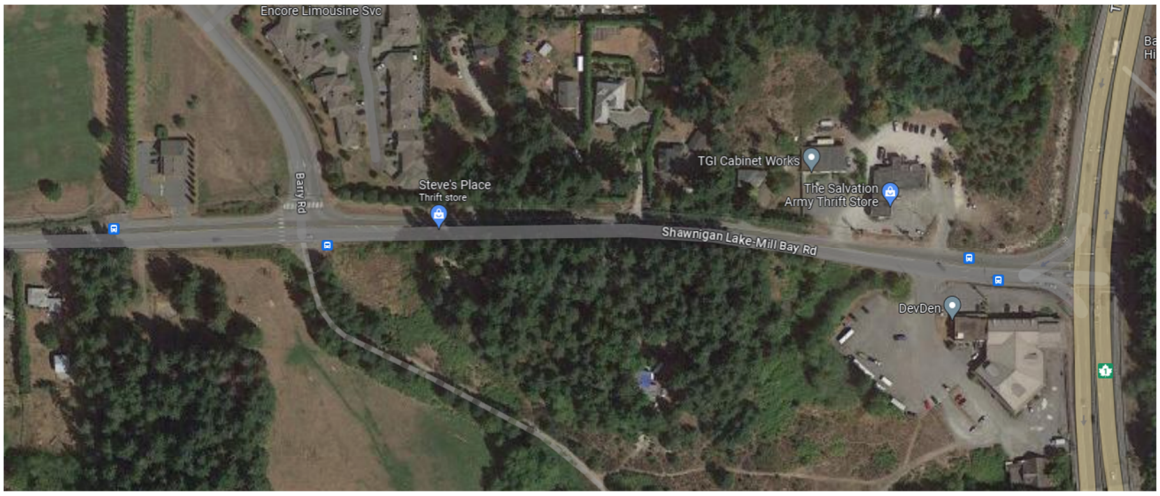


Figure 3 – Bus Stop Locations on Shawnigan Lake-Mill Bay Road

2.3 Cycling and Pedestrian Network

Highway 1 has wide >2m paved shoulders on both sides of the road; however, the paved shoulder along the southbound right turn lane narrows to a barrier curb which eliminates any walking space onto Shawnigan-Mill Bay Road. In addition to the wide paved shoulders, on the bridge across the Shawnigan Creek there are separate pedestrian/sidewalk facilities. There are no shoulders on Shawnigan-Mill Bay Road from Highway 1 until past the existing and future commercial sites (approximately 100m). Then paved shoulders are available on both sides of the road for pedestrians and cyclists to share.

Marked crosswalks are available on the south and west sides of the Highway 1 / Shawnigan-Mill Bay Road intersection. The Shawnigan-Mill Bay Road / Barry Road intersection has signed and marked crosswalks on the west and north sides.

3.0 PROPOSED DEVELOPMENT

In total, the north portion of the development is 667 residential units and 100,000 square feet of commercial space in Phases 1A, 1B, Phase 2, and Future Phases. The key land uses, and transportation-related elements of the proposed site plan are summarized in **Table 4**.

Table 4 – Development Proposal (North Side)

Site Element	Details
Residential Units	667 units
Commercial GFA	100,000 sq. ft.
Vehicular Access	3 accesses: • Up to 2 accesses from Shawnigan Lake-Mill Bay Road serving the Commercial development • 1 access on Barry Road North (new road segment) • Future potential extensions to Bourbon Road and / or directly to Shawnigan Mill Bay Road west of Phase 2 area.

3.1 Site Access

The primary site access for Commercial portion of the development is on Shawnigan Lake-Mill Bay Road with a single right in / right out access with the potential for a left turn into the site. The ability to provide a left turn into the commercial will depend on the final location of the site access and the final land use mix within the commercial site. This will be reviewed at Development Permit within information on left turn queue and access location provided to MoTI for review prior to issuance of the Development Permit to determine if a left turn in is feasible. The minimum standard for an urban left turn lane is a 54m taper plus a minimum of 15m of storage. Therefore at least 70m is required to avoid the taper starting at Highway 1. A second commercial access will be located off Barry Road North and will be a full movement access. Phase 1a residential will have an access off Barry Road North as well as from the internal collector road. The remaining parts of the north side development will also utilize the collector road to Barry Road North to access their lots.

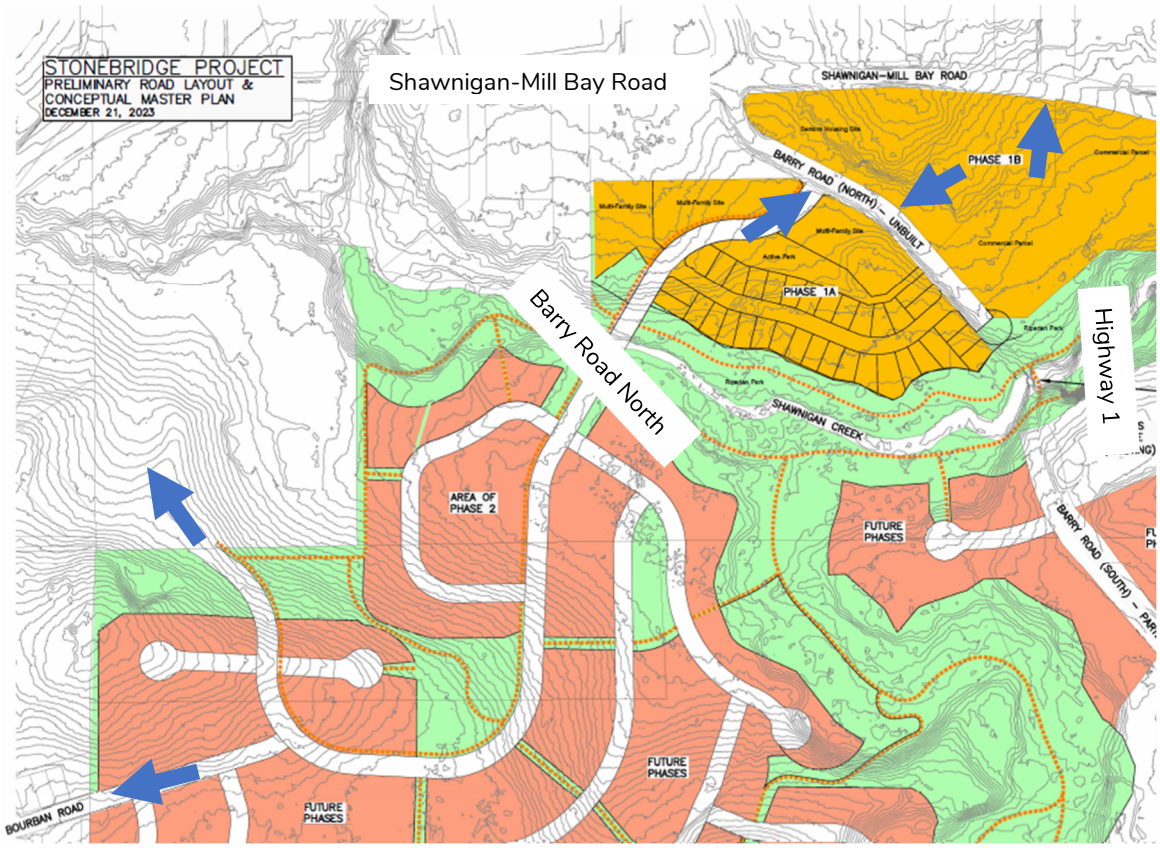


Figure 4 – Site Accesses for North Portion of Development

3.2 Sight Distance

The intersection of Barry Road and Shawnigan-Mill Bay Road is an existing intersection; however, a fourth leg is proposed to be added to the south side of the intersection. There is a vertical curve to the east of Barry Road which impacts the sight lines from Barry Road to the east. A field assessment was performed to measure the available sight distance on the proposed leg. **Table 5** outlines the required turning sight distance from a stop onto a 50km/h roadway and the measured sight distance on the future fourth leg of Barry Road at Shawnigan-Mill Bay Road.

Table 5: Intersection Sight Distances at Proposed Access Location for 50km/h

Turn Type	Direction	Required Turning Sight Distance (meters)	Measured Turning Sight Distance (meters)	Achieved
Left	Looking West (left)	105	> 250	Yes
	Looking East (right)	105	185	Yes
Right	Looking West (left)	95	> 250	Yes

This intersection is located in a school zone; therefore, between 8am and 5pm the speed limit is reduced to 30km/h from 50km/h. The requirements for this intersection have been met for both the 30km/h and 50km/h road as well as 60km/h (if vehicles travelling above the posted limit). Therefore, there is no issues with the addition of a fourth leg at the intersection with stop control remaining on Barry Road.

For the commercial phase of the development the site access on Shawnigan Mill Bay Road and along the Barry Road will be reviewed for sight distance to ensure turning sight distance (for 50km/h) is provided once the final location of the accesses is determined. The placement of an access, for the commercial portion of the development, directly onto Shawnigan Mill Bay Road will be positioned in consideration of turning sight distance requirements to avoid any vertical curve mitigations to achieve the turning sight distances. Placement of the access will also consider distance from Highway 1 to accommodate a left turn lane and minimize the potential for any (left turn) queues back to Highway 1. During the Development Permit for the commercial phase of the project, when the placement of the driveway is confirmed, it will be further assessed.

3.3 Internal Road Network

Figure 4 outlines the potential road network for within the north side of the site. The road network is expected to follow this general network with the key spine roadway from Barry Road (north) west through the site being a collector road that will either connect long term to Bourban Road and / or back to Shawnigan Mill Bay Road through 1070 Shawnigan Mill Bay Road (lands outside of the development). Although this road would be a 'collector' it is intended to be designed to 50km/h and still feel like a subdivision roadway. The internal network will be 50km/h with the local roads being

considered for 30km/h design speeds (subject to Chief Engineer acceptance). This area is expected to become a drainage improvement area within the CVRD which will allow for curb and gutter along the roadways (or an urban cross section). Cross sections for the internal roadways will be to MoTI Section 1400 – Subdivision road standards. If the drainage improvement area is not achieved then alternative considerations (strata roads, rural roads) for the cross sections will be identified.

4.0 TRAFFIC OPERATIONS ANALYSIS

4.1 Traffic Analysis Scenarios and Time Periods

Traffic operations analysis has been undertaken during the weekday AM and PM periods under the following scenarios:

- Existing Conditions
- 2028 and 2038 Background Conditions
- 2028 Post-Development Opening Day Conditions
- 2038 Post-Development 10 year Horizon Conditions
- 2038 Post-Development Conditions with Mitigation Measures

4.2 Methodology and Performance Evaluation Criteria

Intersection capacity analysis for the existing and proposed conditions was completed using the Vistro software package, which uses the Highway Capacity Manual (HCM) evaluation methodology.

Results are measured in volume-to-capacity ratio, delay (seconds), level of service (LOS), and 95th percentile queue length (metres). The volume-to-capacity ratio (v/c) is an indicator of the capacity utilization for the key movements in the intersection. A v/c of 1.0 indicates that certain governing traffic movements through the intersection are operating at maximum capacity.

The LOS for unsignalized (stop-controlled and roundabout) intersections is determined by the calculated delay for each critical movement. The LOS for a signalized intersection includes additional factors such as geometry, traffic and pedestrian volumes, and signal phasing / timing. LOS is broken down into six letter grades, with LOS A being excellent operation, and LOS F being unstable / failing operations.

Table **6** summarizes the delay per vehicle with the corresponding LOS for both signalized and unsignalized intersections.

Table 6 – Level of Service Criteria

Level of Service (LOS)	Unsignalized Intersections: Average Vehicle Delay (sec / veh)	Signalized Intersections: Average Vehicle Delay (sec / veh)
A	0-10	0-10
B	> 10-15	>10-20
C	>15-25	>20-35
D	>25-35	>35-55
E	>35-50	>55-80
F	>50	>80

4.3 Input and Calibration Parameters

Heavy Vehicle Percentage

The percentage of heavy vehicles for each movement was based on the information collected as part of the turning movement counts. Where not available, a default value of 2 percent heavy vehicles was assumed.

Peak Hour Factor

The Peak Hour Factor (PHF) was based on the information collected as part of the turning movement counts. PHFs were calculated for each intersection using the overall intersection volumes. A PHF of 0.85 was used for thru traffic along Shawnigan Lake-Mill Bay Road at the Commercial accesses, and a PHF of 0.80 was used for all other movements where calculated PHFs are unavailable.

Signal Timings

The signal timing for Shawnigan-Mill Bay Road was collected from the Ministry of Transportation and Infrastructure (MoTI). The existing signal timings were applied to all scenarios.

Intersection Configurations

The new south leg of the Shawnigan Lake-Mill Bay Road / Barry Road intersection was assumed to have one lane per direction with stop control maintained on Barry Road.

4.4 Existing Conditions

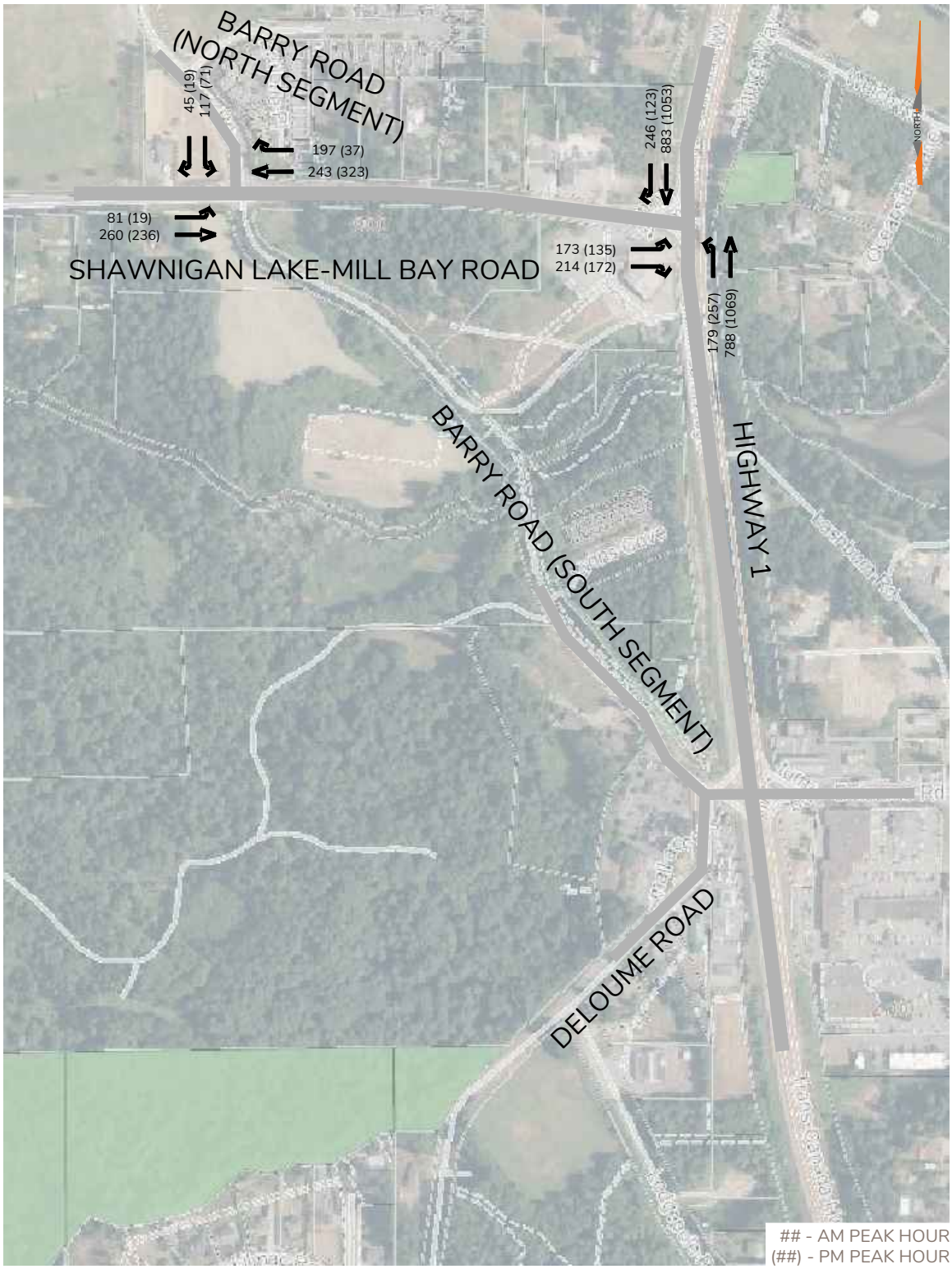
4.4.1 Existing Traffic Volumes

Turning movement counts were established for intersections in the study area for the weekday AM and PM periods. Traffic counts adopted as the basis for this study are summarized in **Table7**.

Table 7 – Existing Turning Movement Counts

Intersection	Count Date	Time Period	Source
Highway 1 / Shawnigan Lake-Mill Bay Road	Tuesday, September 19, 2023	8:00 – 9:00 AM 2:45 – 5:30 PM	WATT
Shawnigan Lake-Mill Bay Road / Barry Road	Tuesday, September 19, 2023	8:00 – 9:00 AM 2:45 – 5:30 PM	WATT

The PM peak hour chosen for the analysis is 3:30 to 4:30 PM, as this is the hour with the highest total traffic volume passing through the Highway 1 / Shawnigan Lake-Mill Bay Road intersection. This peak hour generally captures only a portion of the school traffic from Frances Kelsey. The existing traffic volumes for the weekday AM and PM peak hours are illustrated in **Figure 5**.


BARRY ROAD (NORTH SEGMENT)
45 (19)
117 (71)
197 (37)
243 (323)
246 (123)
883 (1053)
NORTH
81 (19)
260 (236)
SHAWNIGAN LAKE-MILL BAY ROAD
173 (135)
214 (172)
179 (257)
788 (1069)
BARRY ROAD (SOUTH SEGMENT)
HIGHWAY 1
DELOUME ROAD
- AM PEAK HOUR
(##) - PM PEAK HOUR

4.4.2 Existing Traffic Operations

Intersection analysis results for existing conditions are summarized in **Table 8**.

Table 8 – Existing Intersection Operations

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Highway 1 / Shawnigan Lake-Mill Bay Rd				
NBL	0.73 (0.73)	C (C)	31.8 (28.4)	34.1 (46.5)
NBT	0.36 (0.44)	A (A)	4.3 (4.3)	10.4 (14.0)
SBT	0.62 (0.78)	B (B)	13.7 (17.7)	44.7 (65.9)
SBR	0.39 (0.21)	B (B)	12.1 (12.2)	22.8 (12.0)
EBL	0.69 (0.61)	C (C)	25.8 (26.8)	30.0 (24.7)
EBR	0.39 (0.36)	C (C)	22.4 (24.2)	14.2 (12.3)
Shawnigan Lake-Mill Bay Rd / Barry Rd				
SBL	0.40 (0.18)	D (C)	25.2 (16.5)	14.7 (5.1)
SBR	0.07 (0.03)	B (B)	10.6 (10.6)	1.6 (0.7)
EBL	0.07 (0.02)	A (A)	8.6 (8.2)	1.9 (0.4)
EBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)

Notes:
1. ## (##) = AM (PM)

The southbound left turning movement at Shawnigan-Mill Bay Road / Barry Road currently has an LOS D during the AM peak hour, which includes peak student drop-off time at the nearby Frances Kelsey Secondary School. As the drop-off peak is relatively short, this LOS can be considered acceptable. During the PM peak hour, which begins at 3:30 PM after the school pick-up peak, this movement operates with an LOS C. All other movements studied have an LOS C or better, which is considered acceptable.

The existing northbound left turn lane is 65m long which is below current MoTI standards for a minimum of 30m storage plus 80m of PL for a total length of 110m. However, the 95th percentile queue does not exceed the existing total length of the northbound left turn. On occasions when the left turn queue does exceed the length of the left turn there are queue extension loops that trigger an extended northbound left turn phase to help clear the queue from blocking the adjacent northbound through lane. The queue loops are allowing MoTI to manage queue spillback at this intersection for the northbound left turn until a solution to extend the turn lane is feasible. All other queues are less than the provided storage.

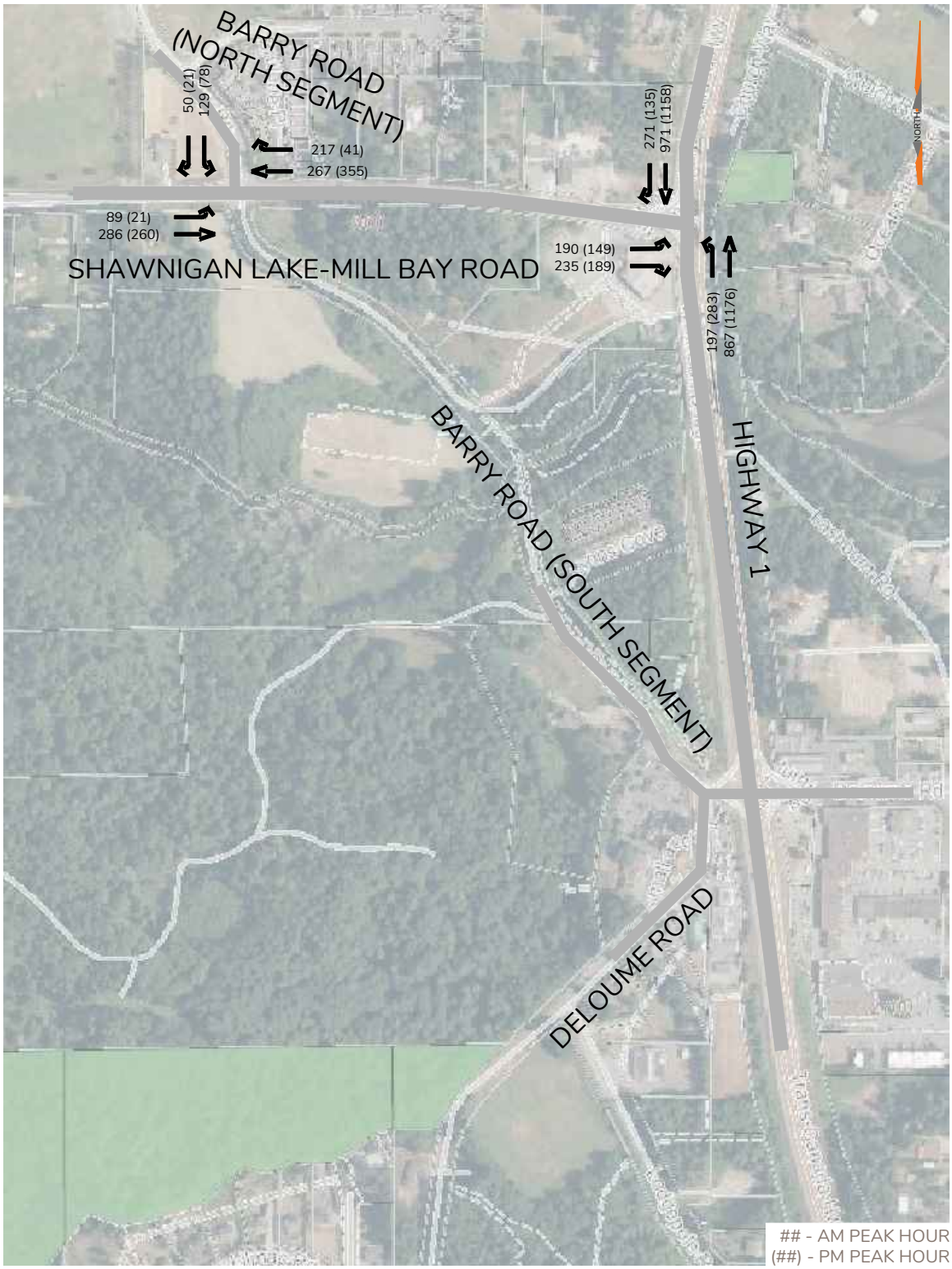
4.5 Background Conditions

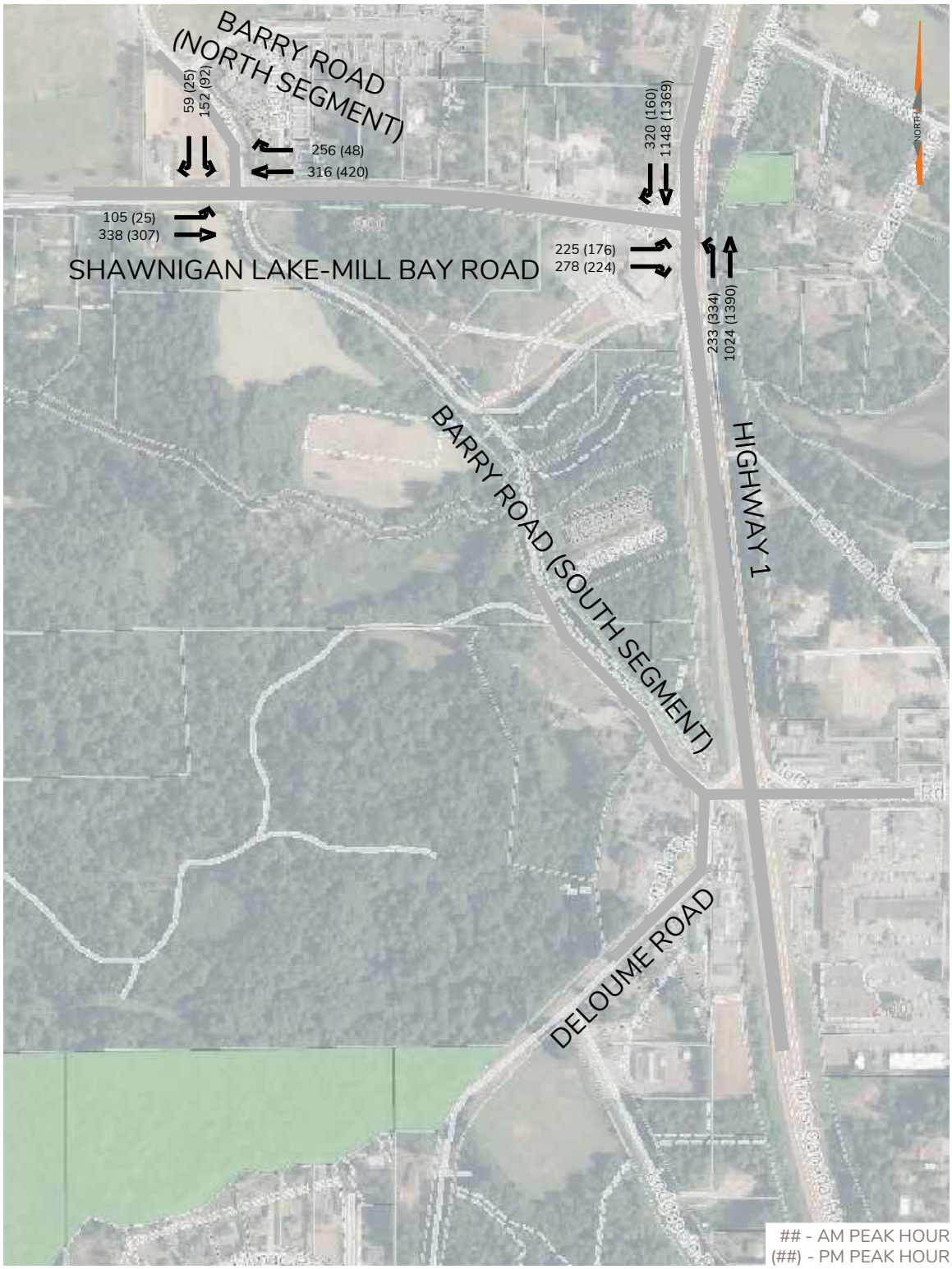
4.5.1 Corridor Growth

The existing traffic volumes were compared to historical data from the last 29 years. Based on a review of historical data to current conditions the linear growth rate has been less than 1% per year in this segment of Highway 1. Therefore, a conservative growth rate of 1% per year was utilized to obtain opening day background traffic and 10 year post opening day background traffic.

4.5.2 Background Traffic Volumes

Background traffic volumes are the existing traffic volumes adjusted to the 2028 and 2038 horizon years. Background traffic volumes for 2028 and 2038 are illustrated in **Figure 6** and **Figure 7**.


BARRY ROAD (NORTH SEGMENT)
50 (21)
129 (78)
217 (41)
267 (355)
271 (135)
971 (1158)
NORTH
89 (21)
286 (260)
SHAWNIGAN LAKE-MILL BAY ROAD
190 (149)
235 (189)
197 (283)
867 (1176)
BARRY ROAD (SOUTH SEGMENT)
HIGHWAY 1
DELOUME ROAD
- AM PEAK HOUR
(##) - PM PEAK HOUR


BARRY ROAD (NORTH SEGMENT)
59 (25)
152 (92)
256 (48)
316 (420)
320 (160)
1148 (1369)
105 (25)
338 (307)
SHAWNIGAN LAKE-MILL BAY ROAD
225 (176)
278 (224)
233 (334)
1024 (1390)
BARRY ROAD (SOUTH SEGMENT)
HIGHWAY 1
DELOUME ROAD
NORTH
- AM PEAK HOUR
(##) - PM PEAK HOUR

4.5.3 Background Traffic Operations

Intersection analysis results for background conditions for 2028 and 2038 are summarized in **Table 9** and **Table 10**, respectively.

Table 9 – Background Intersection Operations - 2028

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Highway 1 / Shawnigan Lake-Mill Bay Rd				
NBL	0.74 (0.74)	C (C)	33.0 (29.1)	37.8 (50.6)
NBT	0.37 (0.46)	A (A)	4.4 (4.4)	12.5 (15.8)
SBT	0.64 (0.81)	B (B)	14.4 (19.0)	51.1 (72.8)
SBR	0.40 (0.22)	B (B)	12.6 (12.5)	25.8 (13.2)
EBL	0.71 (0.65)	C (C)	27.2 (28.1)	33.7 (27.3)
EBR	0.39 (0.37)	C (C)	23.4 (25.1)	15.7 (13.6)
Shawnigan Lake-Mill Bay Rd / Barry Rd				
SBL	0.44 (0.20)	D (C)	28.4 (17.3)	17.8 (5.8)
SBR	0.07 (0.03)	B (B)	10.8 (10.7)	1.7 (0.7)
EBL	0.08 (0.02)	A (A)	8.7 (8.2)	2.0 (0.4)
EBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)

Notes:
1. ## (##) = AM (PM)

In 2028 there is no change in the LOS at either intersection. While the northbound left turn 95th percentile queue length increases it remains less than 65m (existing length of the turn lane).

Table 10 – Background Intersection Operations - 2038

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Highway 1 / Shawnigan Lake-Mill Bay Rd				
NBL	0.76 (0.76)	D (C)	35.7 (30.3)	46.0 (58.8)
NBT	0.40 (0.50)	A (A)	4.8 (4.8)	17.3 (21.3)
SBT	0.68 (0.90)	B (C)	15.9 (23.8)	64.0 (92.0)
SBR	0.43 (0.24)	B (B)	13.7 (13.6)	32.6 (16.0)
EBL	0.74 (0.67)	C (C)	29.9 (29.7)	41.5 (32.0)
EBR	0.41 (0.39)	C (C)	25.5 (26.4)	19.3 (15.8)
Shawnigan Lake-Mill Bay Rd / Barry Rd				
SBL	0.56 (0.25)	E (C)	38.0 (19.4)	26.9 (7.4)
SBR	0.08 (0.04)	B (B)	11.1 (11.0)	2.0 (0.8)
EBL	0.09 (0.02)	A (A)	8.9 (8.3)	2.3 (0.5)
EBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)

Notes:
1. ## (##) = AM (PM)

The southbound left turn movement at Shawnigan Lake-Mill Bay Road / Barry Road will operate at an LOS E during the AM peak hour in 2038 during school drop-off. During the PM peak hour, this movement operates with an LOS C. All other turning movements at existing intersections will maintain their existing LOS C or better. The northbound 95th percentile left turn queue at Shawnigan-Mill Bay Road remains less than the 65m provided for the left turn.

4.5.4 Left Turn Extension Cycle

As previously mentioned, the northbound left turn has an existing queue extension loop that triggers an alternative signal timing plan that extends the left turn phase to clear the northbound left turn queues. The following outlines results of analysis of PM peak hour traffic conditions if this alternative cycle was triggered for the entire PM peak hour. See **Table 11**.

Table 11 – 2028 PM Peak Hour Background Intersection Operations with Left Turn Extension

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Highway 1 / Shawnigan Lake-Mill Bay Rd				
NBL	0.72	C	26.2	44.8
NBT	0.47	A	4.6	15.1
SBT	0.89	C	22.3	75.3
SBR	0.24	B	13.0	12.8
EBL	0.62	C	25.4	24.5
EBR	0.36	C	22.9	12.2

The implementation of this alternative cycle drops the LOS for the southbound movement to a LOS C, but only increases the delay by a few seconds. This indicates, even in the longer term the queue extension loops could continue to be utilized to manage the northbound left turn queues; however, MoTI has indicated that they would prefer not to manage the queues using the extension loops in the long term.

4.6 Post-Development Conditions

4.6.1 Site Trip Generation

Given the limited existing trips for the site (i.e. one single family home), existing site trips were not removed from the trip generation forecast.

Vehicular trip generation rates for the proposed mixed-use development are based on the *ITE Trip Generation Manual (11th Edition)*. The trip generation forecast for the north portion of the development is provided in **Table 13**. This development is forecasted to generate a total of 701 new trips during the weekday AM peak hour and 1,372 new trips during the weekday PM peak hour.

Table 12 –Trip Generation Rates

Land Use	AM Peak Hour			PM Peak Hour		
	In	Out	2-Way	In	Out	2-Way
Trip Generation Rates						
Congregate Care Facility (ITE LU 253)[1]	0.05	0.03	0.08	0.09	0.09	0.18
Shopping Plaza (40-150k) - Supermarket (ITE LU 821)[2]	2.19	1.34	3.53	4.33	4.70	9.03
Single-Family Detached Housing (ITE LU 210)[1]	0.18	0.52	0.70	0.59	0.35	0.94
Multifamily Housing (Low-Rise), Not Close to Rail Transit (ITE LU 220)[1]	0.10	0.30	0.40	0.32	0.19	0.51

Notes:
1. Trip rates are per dwelling unit
2. Trip rates are per 1,000 ft^2 GFA

Table 13 – Unadjusted Site Trip Generation

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	2-Way	In	Out	2-Way
Congregate Care Facility	120 units	6	4	10	11	11	22
Shopping Plaza (40-150k)	100,000 sq. ft.	219	134	353	433	470	903
Single-Family Detached Housing	397 lots	70	208	278	232	138	370
Multifamily Housing (Low-Rise)	270 units	12	48	60	48	29	77
Total		**307**	**394**	**701**	**724**	**648**	**1,372**

4.6.2 Trip Modifications

Internal trip volumes were estimated for the commercial site using the NCHRP 684 methodology for internal trip capture between the commercial site and the residential land use. As identified in **Table 14** there between 1.4% and 16% 'internal' trips between the commercial and north side residential use.

Table 14 – Internal and External Trips

Land Use	AM Peak Hour		PM Peak Hour	
	Internal	External	Internal	External
Congregate Care Facility	0	10	0	22
Shopping Plaza	5	348	109	794
Single-Family	3	275	90	280
Multifamily Housing (Low-Rise)	2	58	19	58
Total	**10**	**691**	**218**	**1,154**

Pass-by trips consist of vehicles which currently travel along Shawnigan-Mill Bay Road past the site regardless of the development's presence but who will now choose to enter the commercial component of the development only due to its convenient location on their way by. These trips are added as entering and exiting the development but are removed from the thru traffic volumes on Shawnigan Lake-Mill Bay Road at the access.

Similar to pass-by trips, diverted trips consist of vehicles which would have travelled on Highway 1 through the study area regardless of the development's presence, but instead chose to enter the development due to its convenient location. These trips are included as entering and exiting the development but are shifted from through traffic to turning traffic at Shawnigan Lake-Mill Bay Road. Pass-by and diverted trip volumes were estimated using data from the ITE *Trip Generation Manual*, 11th Edition. The combined diverted and pass-by trips represent 34% of the commercial trips. The mixture of land uses at this site lend themselves to higher pass-by/diverted trips including potentially a grocery store, liquor store, and pharmacy which tend to attract drivers on their way to/from work and driving by. Therefore the 34% rate is expected to be low. It should be noted that diverted trips are added to the northbound left turn on Highway 1 which would be similar if these were primary trips and therefore the added northbound left traffic is expected to be similar even if the trips are more primary than estimated. Residential land uses do not create pass-by or diverted trips as all trips are primary. See **Table 15** for primary and pass-by/diverted trips.

Table 15 – Primary and Pass-by/Diverted Trips

Land Use	AM Peak Hour		PM Peak Hour	
	Primary	Pass-by Diverted	Primary	Pass-by Diverted
Congregate Care Facility	10	**0**	22	0
Shopping Plaza	348	0	524	270
Single-Family	275	0	280	0
Multifamily Housing (Low-Rise)	58	0	58	0
Total	**691**	**0**	**884**	**270**

4.6.3 Trip Distribution and Assignment

The trip distribution pattern for site traffic to/from was established based on existing traffic patterns and key origins and destinations in the area. The distribution of inbound and outbound traffic adopted for the proposed development is outlined in **Table 16, 17, and 18**.

Table 16 – Site Traffic Distribution (Area A - Congregate Care)

Street	Direction	AM	PM
Highway 1	South	40 % In / 50 % Out	30 % In / 20 % Out
Highway 1	North	50 % In / 40 % Out	40 % In / 35 % Out
Shawnigan Lake-Mill Bay Road	West	10 % In / 10 % Out	30 % In / 45 % Out

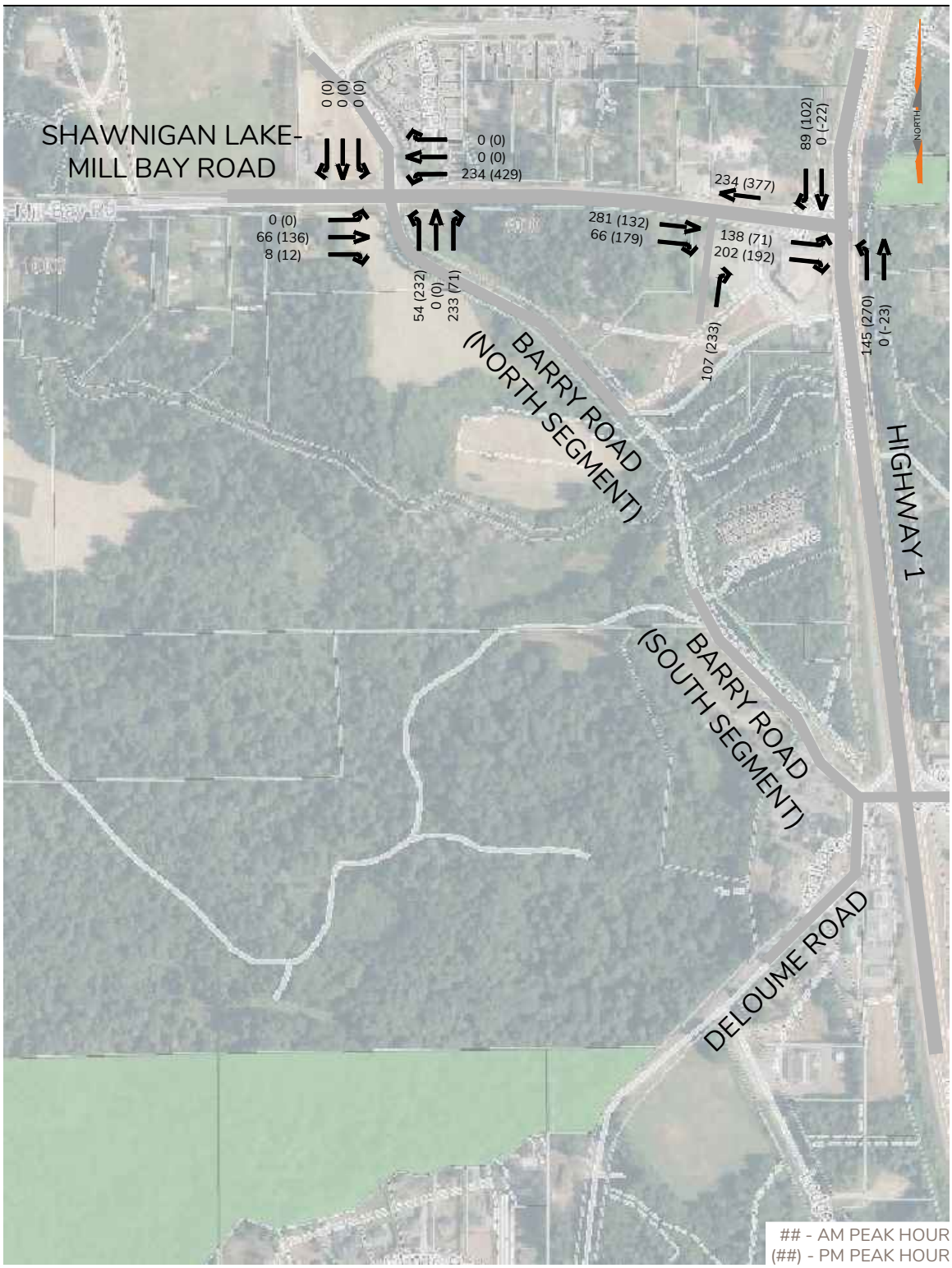
Table 17 – Site Traffic Distribution (Area B - Shopping Plaza with Supermarket)

Street	Direction	AM	PM
Highway 1	South	50 % In / 55 % Out	40 % In / 50 % Out
Highway 1	North	20 % In / 25 % Out	10 % In / 10 % Out
Shawnigan Lake-Mill Bay Road	West	30 % In / 20 % Out	50 % In / 40 % Out

Table 18 – Site Traffic Distribution (Areas C and D - Residential)

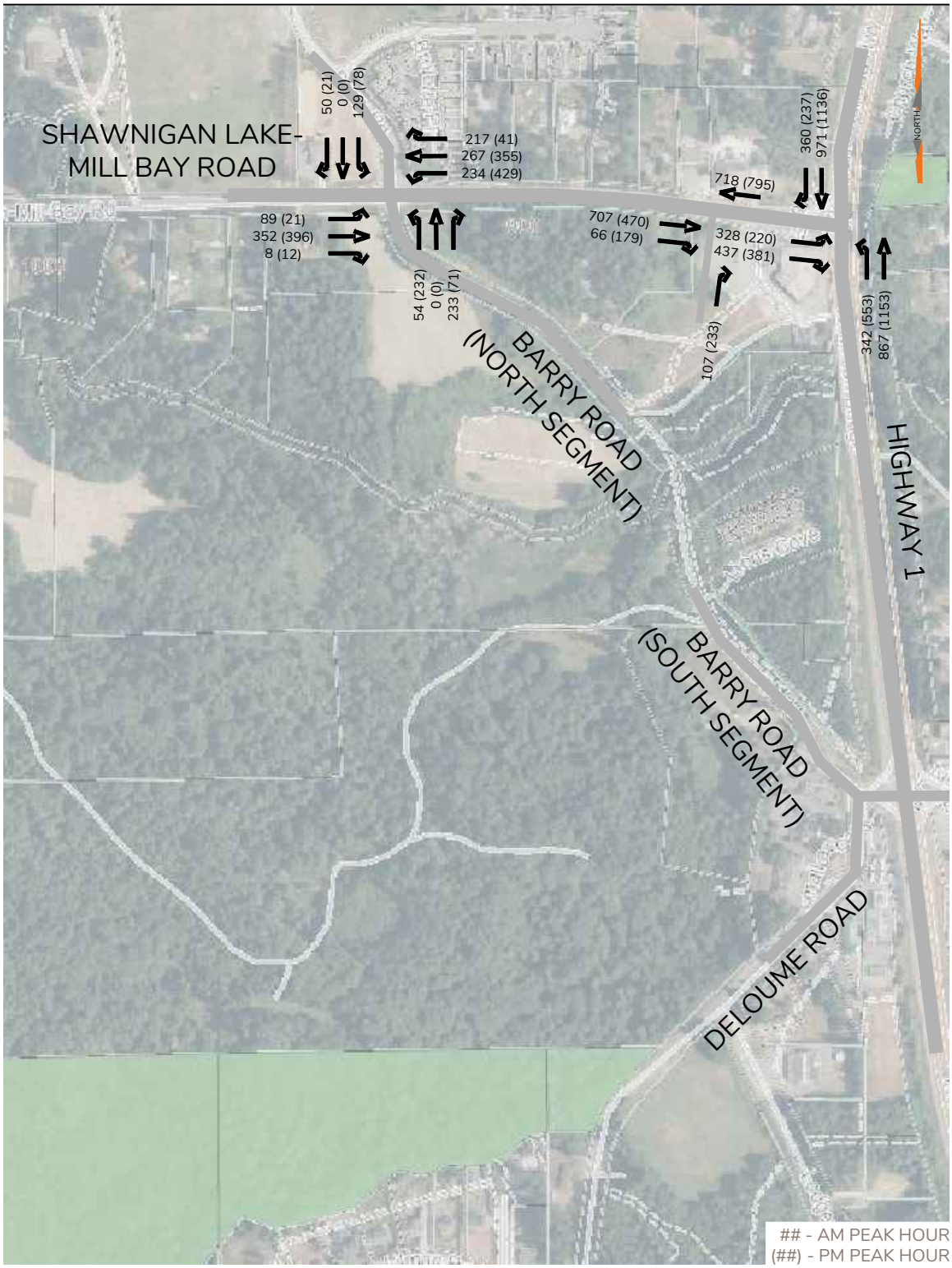
Street	Direction	AM	PM
Highway 1	South	40 % In / 50 % Out	70 % In / 30 % Out
Highway 1	North	50 % In / 40 % Out	25 % In / 15 % Out
Shawnigan Lake-Mill Bay Road	West	10 % In / 10 % Out	5 % In / 55 % Out

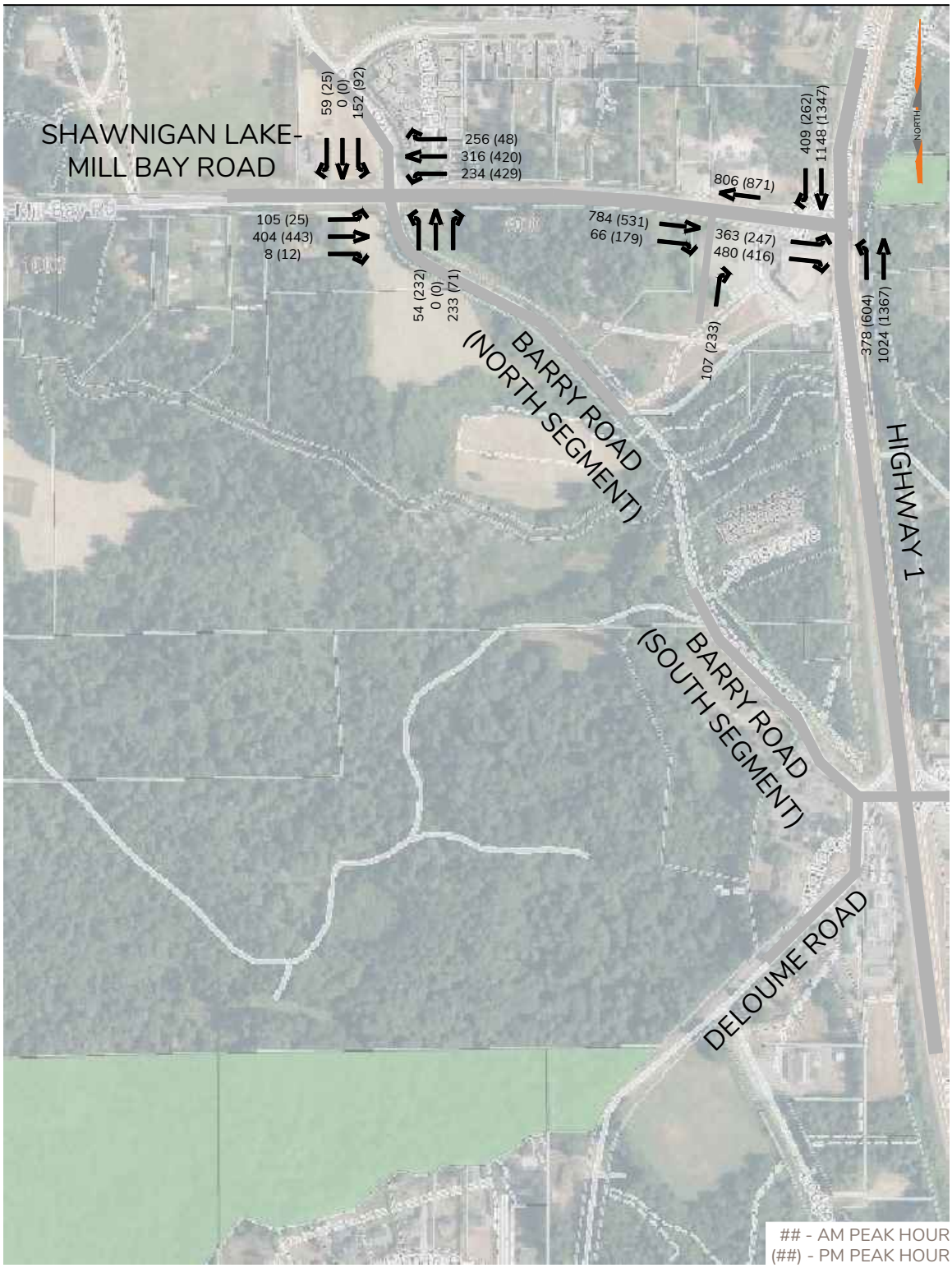
The site traffic volumes assigned to the area road network are illustrated in **Figure 8**.


SHAWNIGAN LAKE-
MILL BAY ROAD
0 (0)
0 (0)
0 (0)
0 (0)
0 (0)
234 (429)
0 (0)
66 (136)
8 (12)
54 (232)
0 (0)
233 (71)
281 (132)
66 (179)
234 (377)
89 (102)
0 (-22)
138 (71)
202 (192)
107 (233)
145 (270)
0 (-23)
BARRY ROAD
(NORTH SEGMENT)
BARRY ROAD
(SOUTH SEGMENT)
HIGHWAY 1
DELOUME ROAD
NORTH
- AM PEAK HOUR
(##) - PM PEAK HOUR

4.6.4 Post-Development Traffic Volumes

Post-development traffic volumes are the sum of background traffic volumes and site traffic volumes. Post-development traffic volumes for 2028 and 2028 are illustrated in **Figure 9 and 10**.


SHAWNIGAN LAKE-
MILL BAY ROAD
50 (21)
0 (0)
129 (78)
217 (41)
267 (355)
234 (429)
89 (21)
352 (396)
8 (12)
54 (232)
0 (0)
233 (71)
707 (470)
66 (179)
718 (795)
360 (237)
971 (1136)
328 (220)
437 (381)
107 (233)
342 (553)
867 (1153)
BARRY ROAD
(NORTH SEGMENT)
HIGHWAY 1
BARRY ROAD
(SOUTH SEGMENT)
DELOUME ROAD
NORTH
- AM PEAK HOUR
(##) - PM PEAK HOUR


SHAWNIGAN LAKE-
MILL BAY ROAD
59 (25)
0 (0)
152 (92)
256 (48)
316 (420)
234 (429)
105 (25)
404 (443)
8 (12)
784 (531)
66 (179)
806 (871)
409 (262)
1148 (1347)
363 (247)
480 (416)
54 (232)
0 (0)
233 (71)
107 (233)
378 (604)
1024 (1367)
BARRY ROAD
(NORTH SEGMENT)
HIGHWAY 1
BARRY ROAD
(SOUTH SEGMENT)
DELOUME ROAD
NORTH
- AM PEAK HOUR
(##) - PM PEAK HOUR

4.6.5 Post-Development Traffic Operations

Intersection analysis results for post-development conditions for 2028 are summarized in **Table 19**.

Table 19 – Post-Development Intersection Operations - 2028

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Highway 1 / Shawnigan Lake-Mill Bay Rd				
NBL	0.88 (0.92)	D (D)	50.6 (46.2)	94.3 (137.6)
NBT	0.38 (0.44)	A (A)	6.7 (4.9)	31.5 (30.7)
SBT	0.74 (0.97)	C (D)	24.6 (38.7)	87.2 (126.6)
SBR	0.63 (0.47)	C (C)	24.0 (23.6)	67.8 (46.4)
EBL	0.85 (0.81)	D (D)	38.1 (40.4)	82.1 (61.2)
EBR	0.51 (0.64)	C (D)	29.3 (36.3)	42.3 (42.9)
Shawnigan Lake-Mill Bay Rd / Barry Rd				
NBL	0.71 (2.7)	F (F)	249.8 (3365.8)	181.1 (658.8)
NBT	0.00 (0.00)	F (F)	243.2 (3355.0)	181.1 (658.8)
NBR	0.33 (0.11)	F (F)	207.8 (3318.4)	181.1 (658.8)
SBL	2.56 (1.19)	F (F)	3009.9 (633.4)	319.3 (103.1)
SBT	0.00 (0.00)	E (E)	40.7 (46.4)	1.7 (0.7)
SBR	0.07 (0.03)	B (B)	10.8 (10.6)	1.7 (0.7)
EBL	0.08 (0.02)	A (A)	8.7 (8.1)	2.0 (0.4)
EBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
EBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBL	0.19 (0.28)	A (A)	8.3 (8.5)	3.8 (5.2)
WBT	0.00 (0.00)	A (A)	0.0 (0.0)	3.8 (5.2)
WBR	0.00 (0.00)	A (A)	0.0 (0.0)	3.8 (5.2)

Shawnigan Lake-Mill Bay Rd / Commercial Access				
NBR	0.23 (0.32)	C (B)	15.3 (13.7)	7.0 (10.8)
EBT	0.01 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
EBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBT	0.01 (0.01)	A (A)	0.0 (0.0)	0.0 (0.0)

Notes:
1. ## (##) = AM (PM)

The southbound thru movement at Highway 1 / Shawnigan Lake-Mill Bay Road will drop to an LOS D during the 2028 PM peak hour with the existing signal timing plans. The northbound left turn movement and eastbound movements will operate at LOS D during the 2028 AM and PM peak hours. The northbound left 95th percentile queue length is 138m during the PM peak hour, which exceeds the left turn left turn storage by almost 75m. By full build-out of the development, management of the northbound left queues by the queue extension loops will become difficult due even the average queue length reaching the end of the turn existing single turn lane. If a second northbound left turn lane could be provided the northbound left 95th percentile queue reduces to 50m which can be managed by the queue loops. Addition of a second northbound left turn lane may also require reconfiguration of the bridge to accommodate the required PL plus storage (130m). Introduction of a dual northbound left would require a second receiving lane on Shawnigan-Mill Bay Road. The alternative is to extend the storage of the existing left turn lane by narrowing the wide (3m) shoulder in the northbound direction to allow for extension of the left turn lane.

At Shawnigan Lake-Mill Bay Road / Barry Road, the northbound movement and southbound left turn movement will operate at LOS E / F, during the AM and PM peak hours with stop control and no separate turn lanes for the westbound and northbound movements at the intersection. A change in traffic control is required before full build-out of the development.

The northbound right turn movement at Shawnigan Lake-Mill Bay Road / Commercial Access will operate at a LOS C with the through movements at a LOS A. If a left turn into the site is provided it is expect that the queues will be less than 15m; however, it will need to be confirmed at Development Permit stage.

Table 20 – Post-Development Intersection Operations - 2038

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Highway 1 / Shawnigan Lake-Mill Bay Rd				
NBL	0.91 (0.90)	E (D)	61.5 (43.0)	113.0 (140.3)
NBT	0.41 (0.48)	A (A)	7.4 (5.7)	40.3 (39.9)
SBT	0.80 (1.18)	C (F)	27.7 (356.2)	104.8 (568.2)
SBR	0.67 (0.55)	C (C)	26.6 (28.0)	78.9 (56.0)
EBL	0.87 (0.81)	D (D)	45.0 (41.8)	96.3 (66.0)
EBR	0.53 (0.63)	C (D)	31.3 (36.2)	45.5 (45.3)
Shawnigan Lake-Mill Bay Rd / Barry Rd				
NBL	0.84 (2.73)	F (F)	471.8 (3429.8)	265.2 (662.9)
NBT	0.00 (0.00)	F (F)	463.2 (3418.6)	265.2 (662.9)
NBR	0.34 (0.11)	F (F)	421.1 (3381.7)	265.2 (662.9)
SBL	3.35 (1.20)	F (F)	4442.0 (649.3)	390.8 (104.3)
SBT	0.00 (0.00)	E (E)	46.1 (46.8)	2.0 (0.8)
SBR	0.08 (0.03)	B (B)	11.1 (10.6)	2.0 (0.8)
EBL	0.09 (0.02)	A (A)	8.9 (8.2)	2.3 (0.4)
EBT	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
EBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBL	0.20 (0.28)	A (A)	8.4 (8.5)	3.8 (5.2)
WBT	0.00 (0.00)	A (A)	0.0 (0.0)	3.8 (5.2)
WBR	0.00 (0.00)	A (A)	0.0 (0.0)	3.8 (5.2)

Shawnigan Lake-Mill Bay Rd / Commercial Access				
NBR	0.25 (0.32)	C (B)	16.0 (13.7)	7.5 (10.8)
EBT	0.01 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
EBR	0.00 (0.00)	A (A)	0.0 (0.0)	0.0 (0.0)
WBT	0.01 (0.01)	A (A)	0.0 (0.0)	0.0 (0.0)

Notes:
1. ## (##) = AM (PM)

With the existing signal timing at Shawnigan-Mill Bay Road / Highway 1 the southbound through movement will drop to an LOS F and have a significant queue length in the PM peak hour. In the AM peak hour the northbound left turn will operate at a LOS E. The northbound 95th percentile queue length will increase to up to 141m in the PM peak hour.

4.7 Mitigated Post-Development Conditions

Based on the results of the analysis mitigation is required at several of the intersections.

At Shawnigan-Mill Bay Road / Barry Road North a westbound left turn lane is warranted based on the volume of left turners once the commercial site is built. A separate northbound left turn should be provided to match the opposing southbound left turn lane and the intersection may need to be signalized with Phase 1b (the commercial development). Further assessment of the timing of the signal will be needed during the commercial development permit application as the location of the accesses and the type of commercial land use is not fully known and different commercial uses have a wide range of trip generation. The need for a signal at Barry Road North / Shawnigan Mill Bay Road will also depend on the location and permitted turns of the commercial access on Shawnigan Mill Bay Road which is not known at this stage. The signal at Barry Road North is not warranted with just Phase 1a (residential). The alternative to a signal is a roundabout. There is approximately 38.8m diameter of space at the Shawnigan Mill Bay Road / Barry Road North intersection. Assuming a minimum shoulder/pedestrian/cycling space around a roundabout of 2m there would only be 34.8m remaining for the inscribed diameter of a roundabout. At 34.8m diameter it may be possible to design a roundabout that would accommodate transit and school buses within the circulatory roadway; however, MoTI typical standard for a single lane

roundabout is 40-60m (Table 740.A) to accommodate WB-20 which would need to be accommodated for deliveries to the commercial centre as well as to/from Shawnigan Mill Bay Road. A roundabout at this location may lack width to accommodate heavy truck traffic, provide minimal landscaping separation around the outside of the roundabout and provide limited active transportation facilities around the roundabout.

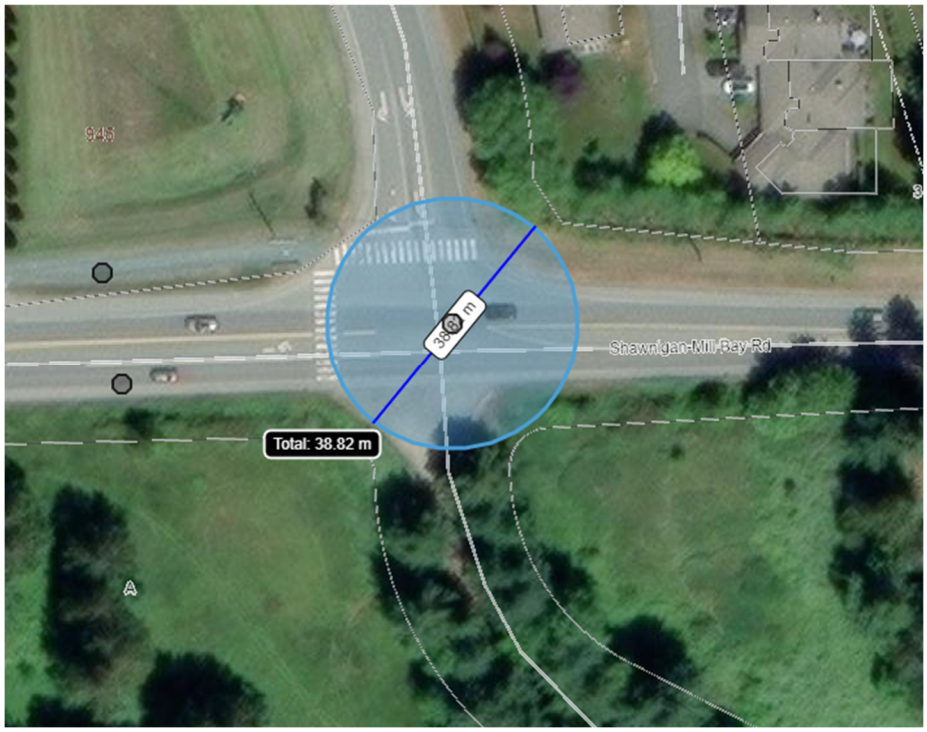


Figure 11 – Available Right-of-Way at Barry Road / Shawnigan Mill Bay Road

The major improvement for the development is the extension of the northbound left turn at Highway 1 / Shawnigan-Mill Bay Road to a storage length of 140m plus the 80m PL for a total left turn lane of 220m. In order to implement this left turn lane extension, the existing bridge may require reconfiguration or alternatively the existing 3m shoulder on the east side of the highway narrowed. The narrowing of the shoulder to extend the northbound left turn is being studied by structural and civil engineers to determine if it is feasible. Once the assessments are done drawings will be submitted to MoTI for consideration. If the 1% per year growth occurs at the Highway 1 / Shawnigan-Mill Bay Road intersection until 2038 the signal timing at the intersection will need to be adjusted to improve the southbound through to better than an LOS F. With minor adjustments the southbound movement can improve to an LOS D; however, the eastbound left and northbound left turn movements will drop to LOS E. As these are

secondary to moving traffic on Highway 1 these are acceptable operations. However, the northbound left turn queue will increase to 180m (additional 40m) which would require the left turn lane to increase to 260m (180m plus 80m PL).

The alternatives to extending the single northbound left turn lane at Shawnigan-Mill Bay Road are to provide a dual northbound left turn (add a second left turn lane) and associated receiving lane on Shawnigan-Mill Bay Road and / or manage the queues with the queue loops. The dual northbound left turn option may still require reconfiguration of the existing bridge and could lead to queuing as traffic has to merge back to a single lane. Long term management by the queue loops is not recommended as there would queue spillback exceeding the storage on a regular basis and this impacts the southbound through movement operations.

4.7.1 Traffic Operations with Mitigation Measures

Intersection analysis results for post-development conditions with the recommended mitigation measures for 2028 and 2038 are summarized in **Tables 21** and **22.**

Table 21 – Post-Development Operations with Mitigation Measures - 2028

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Shawnigan Lake-Mill Bay Rd / Barry Rd (Signalized)				
NBL	0.43 (0.53)	B (C)	15.9 (21.7)	40.1 (52.7)
NBT	0.43 (0.53)	B (C)	15.9 (21.7)	40.1 (52.7)
NBR	0.43 (0.53)	B (C)	15.9 (21.7)	40.1 (52.7)
SBL	0.43 (0.24)	B (B)	16.1 (14.8)	17.4 (8.7)
SBT	0.30 (0.20)	C (C)	25.9 (25.9)	8.6 (3.6)
SBR	0.30 (0.20)	C (C)	25.9 (25.9)	8.6 (3.6)
EBL	0.24 (0.04)	B (B)	19.7 (11.5)	14.3 (2.0)
EBT	0.38 (0.38)	B (A)	10.7 (7.7)	36.4 (28.9)
EBR	0.38 (0.38)	B (A)	10.7 (7.7)	36.4 (28.9)
WBL	0.50 (0.71)	C (C)	21.1 (21.4)	40.7 (55.7)
WBT	0.55 (0.41)	B (A)	13.2 (7.9)	56.2 (27.8)
WBR	0.55 (0.41)	B (A)	13.2 (7.9)	56.2 (27.8)

Table 22 – Post-Development Operations with Mitigation - 2038

Movement	v/c	LOS	Delay (s)	95% Queue (m)
Shawnigan Lake-Mill Bay Rd / Barry Rd (Signalized)				
NBL	0.43 (0.53)	B (C)	15.7 (21.7)	39.8 (52.7)
NBT	0.43 (0.53)	B (C)	15.7 (21.7)	39.8 (52.7)
NBR	0.43 (0.53)	B (C)	15.7 (21.7)	39.8 (52.7)
SBL	0.48 (0.24)	B (B)	16.5 (14.7)	19.5 (8.7)
SBT	0.31 (0.20)	C (C)	25.8 (25.8)	9.5 (4.0)
SBR	0.31 (0.20)	C (C)	25.8 (25.8)	9.5 (4.0)
EBL	0.30 (0.05)	C (B)	22.5 (11.6)	17.1 (2.2)
EBT	0.42 (0.38)	B (A)	11.4 (7.8)	40.9 (29.3)
EBR	0.42 (0.38)	B (A)	11.4 (7.8)	40.9 (29.3)
WBL	0.53 (0.71)	C (C)	22.9 (21.7)	43.1 (56.4)
WBT	0.61 (0.41)	B (A)	14.7 (8.0)	64.3 (28.2)
WBR	0.61 (0.41)	B (A)	14.7 (8.0)	64.3 (28.2)
Highway 1 / Shawnigan Lake-Mill Bay Rd (Adjusted Signal Timing)				
NBL	0.94	E	59.2	179.4
NBT	0.46	A	5.4	45.7
SBT	1.00	D	53.9	178.9
SBR	0.46	C	26.7	59.4
EBL	0.85	E	56.7	82.0
EBR	0.67	D	43.6	55.5

5.0 TRIGGERS

The above analysis is based on full build out of the north portion of the development in the next five years and the mitigations that will be required once all phases are built. A review of the first two phases of the development: Phase 1A and Phase 1B was undertaken to determine if they trigger the signal at Barry Road / Shawnigan-Mill Bay Road. Phase 1A includes 120 congregate care units, 270 multi-family units and 55 single family units. Phase 1B is the commercial development.

Analysis of Phase 1A found that the intersection of Barry Road / Shawnigan-Mill Bay Road will operate at a LOS B/C (with 2028 background volumes plus Phase 1A traffic) as stop controlled and therefore does not trigger the signal or left turn at the intersection. With the addition of the commercial development access onto Barry Road North a signal may be triggered by the commercial depending on site access location and configurations and final commercial land use. The need for a signal as part of the commercial phase will be further assessed and submitted to MoTI during the Development Permit application for the commercial site.

The queue length is the main trigger for extending the northbound left turn lane. It is recommended that the left turn be extended using the existing width on the bridge deck (narrow the shoulder) prior to the opening of the commercial site.

6.0 CONCLUSIONS

The existing intersection of Highway 1 / Shawnigan-Mill Bay Road and Barry Road North / Shawnigan-Mill Bay Road operate with acceptable LOS during the peak hours with the exception of the southbound left turn during the school arrival period in the AM peak hour. However, this poor operation occurs for a relatively short period of time. The northbound left turn on Highway 1 does occasionally extend beyond the available left turn storage of 65m. This existing left turn lane does not provide PL or the parallel length for vehicles to slow in the left turn lane as per current MoTI standard. This left turn lane should have at least 55m of storage and 80m of PL for a total of 135m under existing conditions. Reconfiguration of the laning on the bridge is accommodate the left turn storage with the commercial development. The developer is having the ability to shift the pavement marking on the bridge deck assessed by civil and structural engineers.

The commercial access location on Shawnigan Mill Bay Road has not been confirmed and therefore a determination of the ability to provide left turns into the site can't be made at this stage. During the development permit application, when the location as

well as the final land use mix on the commercial site is known, an assessment of the queues on Shawnigan Mill Bay Road and signal warrant at Barry Road North undertaken. There is insufficient right-of-way to accommodate a roundabout, instead of a signal, that can manage WB-20 vehicles as well as school and transit vehicles. At Barry Road North / Shawnigan-Mill Bay Road a westbound left turn lane and northbound left turn lane are required with the extension of Barry Road south of Shawnigan-Mill Bay Road.

Phase 1A (congregate care, 270 multi-family and 55 single family) can be built without triggering the signal and westbound left turn at Barry Road North or the northbound left turn lane extension on the Highway. The northbound left turn lane, on Highway 1, will continue to be managed by the queue loop until the commercial phase is added. The northbound left lane should be mitigated as part of the commercial development through narrowing the shoulder.

Along the Shawnigan-Mill Bay Road frontage of the development and along the new section of Barry Road it is recommended that a curb and sidewalk be provided over a shoulder, as long as the drainage improvement area is in place. This would match the curb on the north side of the road and made the eastbound bus stops accessible.

There are no sight distance issues with the development of the fourth leg of Barry Road / Shawnigan Mill Bay Road. During subsequent phases (especially the commercial phase) and when more detailed civil design of the internal site network is undertaken sight distance reviews are required to be undertaken to ensure sufficient sight distances are provided.

7.0 RECOMMENDATIONS

The developer is recommended to make the following transportation improvements:

1. Extend the northbound left turn lane at Highway 1 / Shawnigan-Mill Bay Road to 220m prior to completion of Phase 1a phase of the north portion of the site.
2. Undertake updated assessment, at Development Permit for Phase 1b, to confirm trigger for signalize the Shawnigan-Mill Bay Road / Barry Road intersection as well as the ability to provide a left turn lane into the site as part of the commercial phase.
3. Install curb/gutter and sidewalk along the Shawnigan-Mill Bay Road frontage of the development and along the new section of Barry Road.
4. Undertake, as requested by MoTI, updated TIAs before starting the next phase of the north portion or any portion of the south (Barry Road South) portion of the development.

5. Ensure sight distances are reviewed for all internal road intersections and the commercial access(es) when detailed civil design is completed.
6. Internal roads are to be urban cross sections as long as a drainage improvement area is created. The internal collector road will be designed to 50km/h and allow for a future connection to Bourbon Road or through an adjacent site back to Shawnigan Mill Bay Road.