



2077 GARIBALDI WAY DEVELOPMENT

Traffic Impact Assessment

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Our File: 2467.B01

Date: August 2, 2018

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1.0 INTRODUCTION

Watt Consulting Group was retained by Caspian Construction to conduct a traffic impact assessment for the proposed development at 2077 Garibaldi Way in the Resort Municipality of Whistler, BC. This report reviews existing traffic conditions and post development traffic conditions for both the short and long term horizon. The report also reviews the proposed site access and other modes of transportation for the site.

1.1 STUDY AREA

The study area for this project includes the site access and the following intersections:

- Nordic Drive / Highway 99;
- Nordic Drive / Nordic Place;
- Garibaldi Way / Nordic Drive; and,
- Garibaldi Way / Eva Lake Road

All key intersections within the study area are stop controlled. **Figure 1** shows the study area and site location.

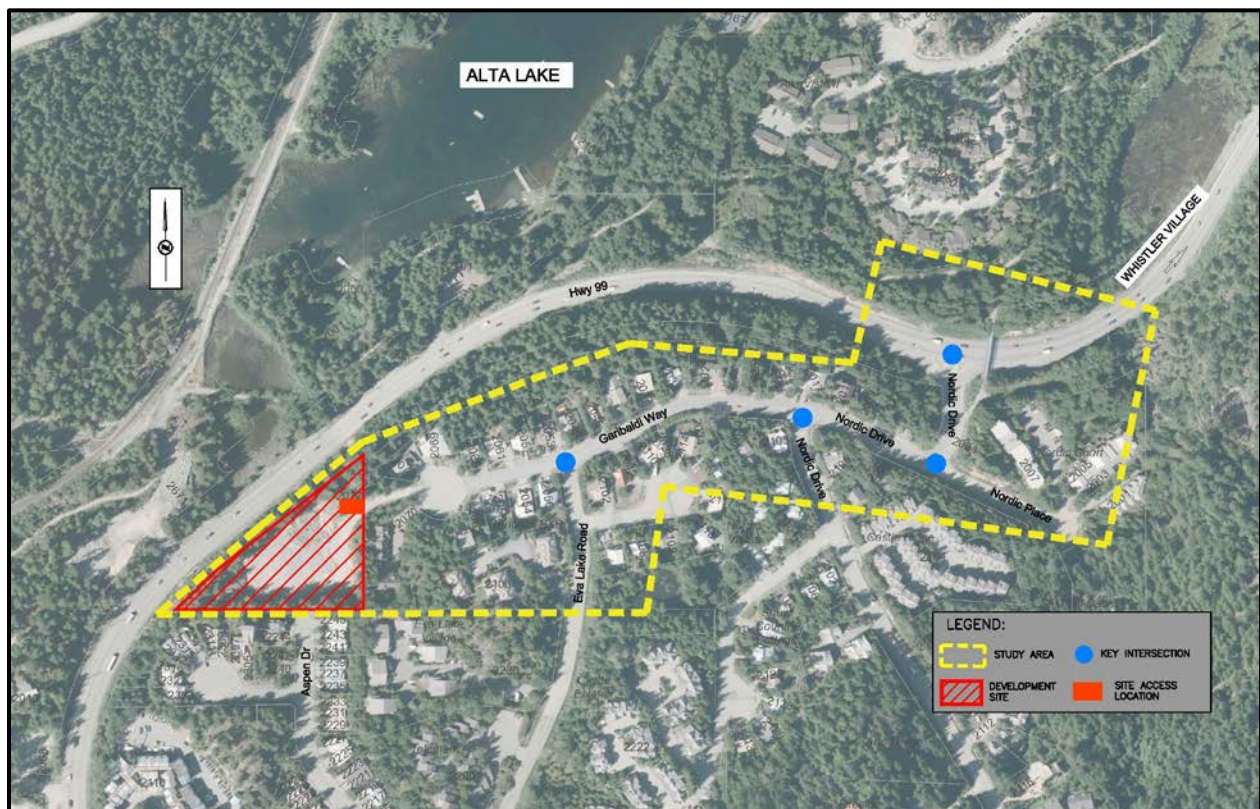


Figure 1: Study Area and Site Location

2.0 EXISTING CONDITIONS

2.1 LAND USE

The development site is currently a residential lot for detached dwelling (RS-E1), which is undeveloped. The land use around the proposed site is single/multi-family residential.

2.2 ROAD NETWORK

Highway 99 (Sea to Sky Highway) is an undivided two lane rural arterial road under the jurisdiction of the Ministry of Transportation and Infrastructure (MoTI). Nordic Drive is a local road under the jurisdiction of the Resort Municipality of Whistler, which provides a connection to Highway 99. Nordic Place is a short local road with low volumes. Garibaldi Way is the site access road connected to Nordic Drive. Garibaldi Way dead ends (Cul-de-Sac) at the immediate east of the development site. Eva Lake Road is a local road running north-south, which is providing a connection between Garibaldi Way and Whistler Road. See **Figure 1** for the existing roadway network.

On Highway 99, Nordic Drive is located 2.5 km south of Village Gate Boulevard (main entrance of Whistler Village). The intersection of Nordic Drive / Highway 99 has three approaches and is stop controlled. There are dedicated left and right turn lanes on Highway 99. Nordic Drive has dedicated left and right turn lanes. The eastbound and northbound approaches have channelized islands for right turns.

The intersection of Garibaldi Way/Nordic Drive is all-way (three legs) stop-controlled. At the other two study intersections on the adjacent local roads, stop control type is not typical; there are stop signs installed on the legs with low volumes rather than standard convention.

The posted speed limit is 60 km/h on Highway 99 within the study area and 50 km/h everywhere else in the study area.

2.3 TRAFFIC COUNTS

Traffic counts were collected at four study intersections: (1) Nordic Drive / Highway 99, (2) Nordic Drive / Nordic Place, (3) Garibaldi Way / Nordic Drive, and (4) Eva Lake Road / Garibaldi Way. The traffic counts were undertaken during the PM peak hour (4:00 to 5:00 PM) on July 10 - 12, 2018.

2.4 SEASONAL FACTORS

Based on the MoTI's highway count data (Site: Whistler 15-069NS; Highway 99, 210m north of Nordic Drive), the highway traffic volumes were reported seasonally consistent. At the count site, seasonal factors were reported as 0.925 for August, 0.98 for September, and 1.009 for March. There are no seasonal factor data available between December and January for the winter ski season.

On the highway, summer volumes are considered representative of a high season of the year since summer volumes (July/August) are higher than annual average. Therefore, measured traffic counts (measured in July 2018) were directly used for the analysis with no seasonal adjustments.

2.5 TRAFFIC MODELLING – BACKGROUND INFORMATION

Analysis of the traffic conditions at the intersections within the study area were undertaken using Synchro software.

Synchro / SimTraffic is a two-part traffic modelling software that provides analysis of traffic conditions based on traffic control, geometry, volumes and traffic operations. Synchro software (Synchro 10) is used because of its ability to provide analysis using the Highway Capacity Manual (2010) methodology, while SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly “seeding” or positioning vehicles travelling throughout the network. These measures of effectiveness include level of service (LOS), delay and 95th percentile queue length.

The type of traffic control are analyzed to determine the level of service and delays. The level of services are broken down into six letter grades with LOS A being excellent operations and LOS F being unstable/failure operations. Level of service C is generally considered to be an acceptable LOS by most municipalities. Level of service D is generally considered to be on the threshold between acceptable and unacceptable operations. A description of level of service and Synchro is provided in **Appendix A**.

2.6 EXISTING TRAFFIC – RESULTS

The existing traffic volumes and lane geometrics were entered into Synchro to determine the existing traffic conditions during the PM peak hour. At the intersection of Nordic Drive/Highway 99, the northbound left movement is currently operating at a failing level of service (LOS F) and all other movements are operating at acceptable levels of service (LOS D or better) during the PM peak hour. All other stop-controlled intersections within the study area are currently operating at an excellent level of service (LOS A) for all movements. See **Figure 2** for 2018 existing volumes and levels of service.

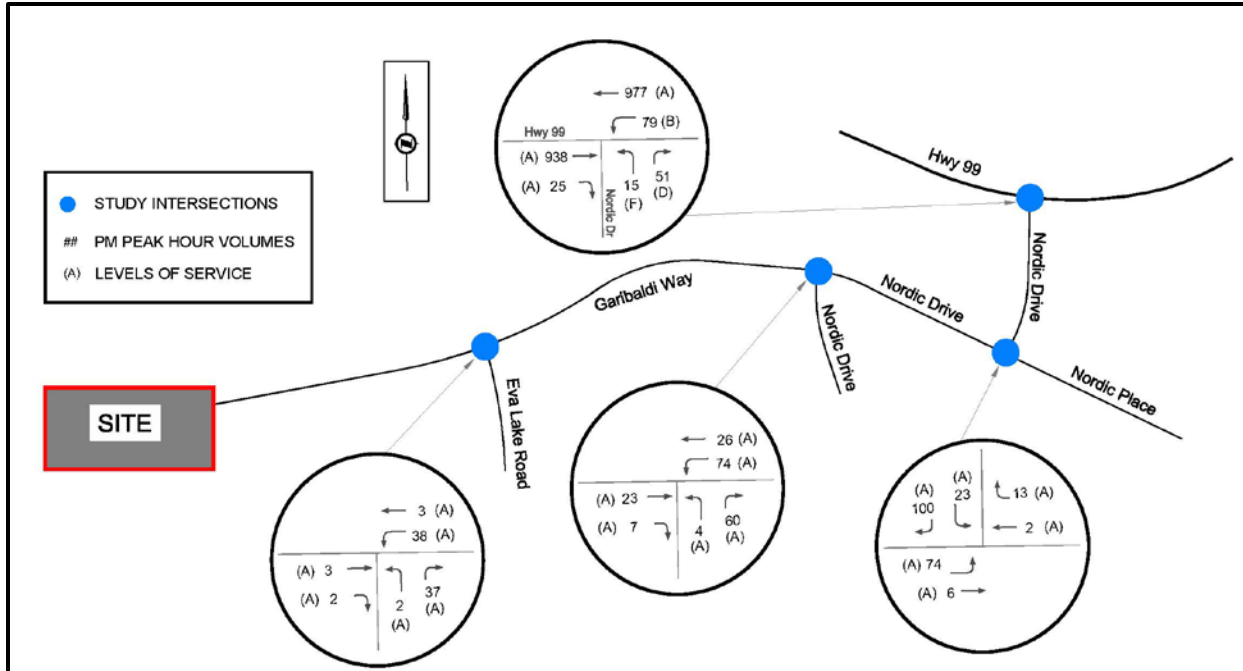


Figure 2: 2018 Existing Volumes and Levels of Service (PM Peak Hour)

3.0 POST DEVELOPMENT CONDITIONS

3.1 PROPOSED LAND USE

The proposed development is 48 units of multi-family housing.

3.2 SITE ACCESS

It is assumed the site be accessed from Garibaldi Way (access road) via the intersection of Nordic Drive/Highway 99. The west end of Garibaldi Way would be extended to the development site.

3.3 TRIP GENERATION

The PM peak hour is utilized to assess the worst case scenario traffic conditions. The development trips were generated using the ITE Trip Generation Manual 10th Edition. The development will generate 27 trips during the PM peak hour. The PM peak hour site trips are summarized in **Table 1**.

TABLE 1 – PM PEAK HOUR TRIP GENERATION

ITE Code	Land Use	Size	Trip Rate	Total Trips	Trips In	Trips Out
230	Multi-family Housing (Low-Rise)	48 units	0.56 trips / unit	27	17	10

3.4 TRIP ASSIGNMENT

The development trips were assigned to the study intersections and site access based on the distribution of existing trips at the intersection of Nordic Drive/Highway 99. It is assumed that all site trips be from/to the intersection of Nordic Drive/Highway 99.

The new trips entering and exiting the site were assigned the following percentages:

PM Peak Hour

- 24% of entering trips are from Highway 99 Eastbound
- 76% of entering trips are from Highway 99 Westbound
- 23% of exiting trips are to Highway 99 Eastbound
- 77% of exiting trips are to Highway 99 Westbound

Figure 3 shows site trips assigned to the existing roadway network.

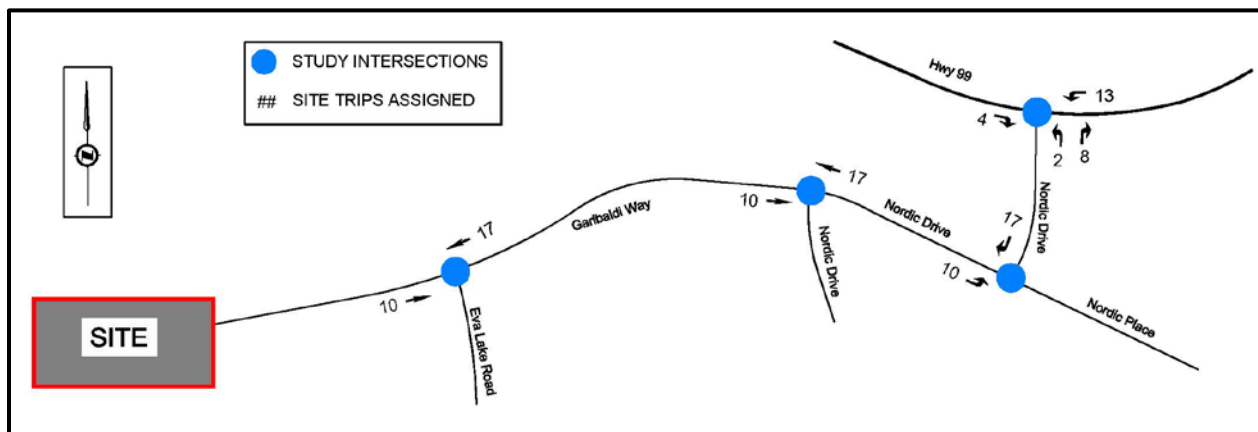


Figure 3: Site Trip Assignment (PM Peak Hour)

3.5 POST DEVELOPMENT TRAFFIC ANALYSIS RESULTS - FULL BUILD OUT

The weekday PM peak hour post development traffic volumes were entered into Synchro to determine the post development traffic conditions at the study intersections.

At the intersection of Nordic Drive/Highway 99, the northbound left movement is currently operating at a failing level of service (LOS F) due to high through volumes of Highway 99; however, the volume of left turn movements is low (15 vph). The addition of two vehicles from the development increases the delays from 5 minutes to 7 minutes. This is due to the unstable nature of a failing movement that makes each additional vehicle add exponential delay.

The northbound right movement will continue to operate at a LOS D with an additional delay of 1.1 seconds. On Highway 99, the westbound left movement will continue to operate at a LOS B with an additional delay of less than a half second. No queuing issues were found at all turn lanes at the intersection with the development.

At all other study intersections on Nordic Drive and Garibaldi Way, all movements will continue to operate at an excellent level of service (LOS A) with the development during the PM peak hour. There will be minimal additional delays (less than a second) for all movements at these local road study intersections. **Table 2** summarizes 2018 PM peak hour traffic conditions with / without the development. **Figure 4** shows 2018 post development volumes and levels of service.

TABLE 2 – 2018 PM PEAK HOUR CONDITIONS COMPARISON

Intersection	Movement	Existing			Post Development		
		Synchro/Sim	Simulation	Simulation	Synchro/Sim	Simulation	Simulation
		LOS	Delay* (s)	95% Queue (m)	LOS	Delay* (s)	95% Queue (m)
Nordic Dr/Hwy 99	EBT	A	0	2.0	A	0	1.4
	EBR	A	0	-	A	0	-
	WBL	B	12.2	21.4	B	12.4	22.9
	WBT	A	0	-	A	0	-
	NBL	F	316.5	15.1	F	421.7	15.3
	NBR	D	25.4	-	D	26.5	-
Nordic Dr/Nordic PI*	EBLT	A	1.1	-	A	1.6	-
	WBT	A	6.3	9.9	A	5.3	10.8
	SBLR	A	2.0	-	A	2.6	-
Nordic Dr/Garibaldi Way*	EBT	A	4.1	16.4	A	4.9	17.2
	WBT	A	5.5	14.9	A	5.6	14.6
	NBL	A	4.5	15.5	A	4.7	14.3
Eva Lake Rd/Garibaldi Way*	EBT	A	6.1	6.6	A	5.8	11.2
	WBL	A	1.8	-	A	2.0	-
	NBL	A	3.1	13.2	A	3.8	13.8

*Note: Delays based on SimTraffic results except for Nordic Dr/Hwy 99 (Synchro HCM 2010)

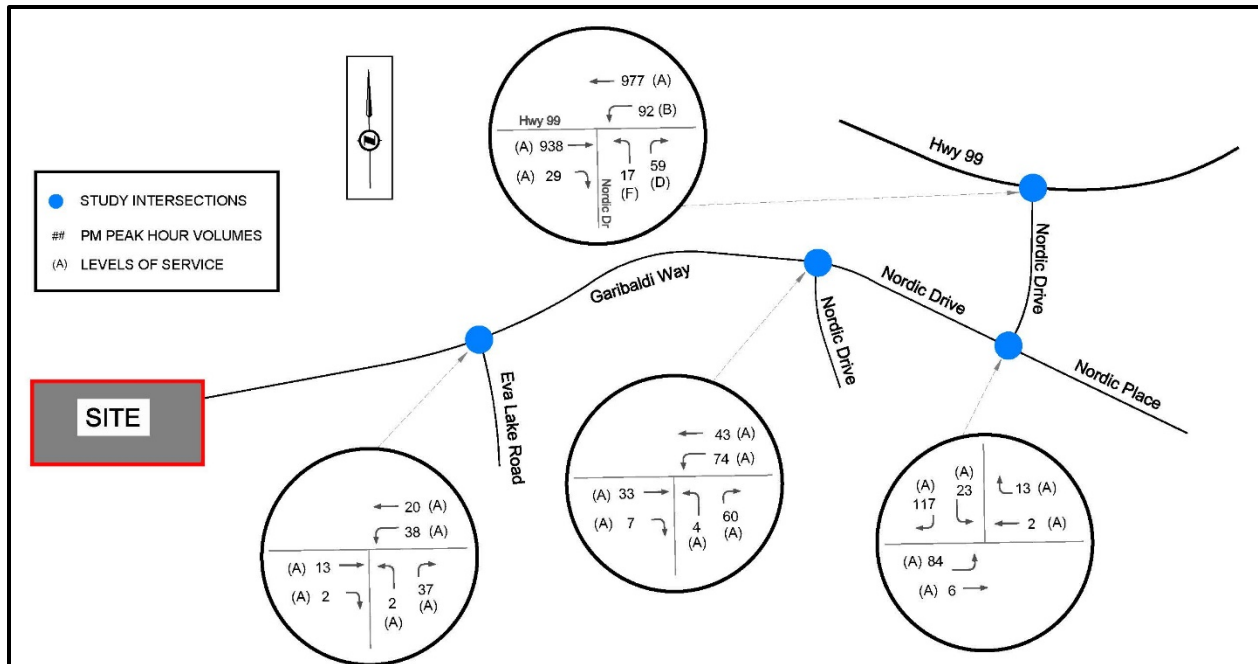


Figure 4: 2018 Post Development PM Peak Hour Volumes and Levels of Service

3.6 MITIGATIONS FOR SHORT TERM

At Nordic Drive/Highway 99, a change in traffic control could be considered to improve the failing level of service for the northbound left turn movement. A traffic signal warrant review was undertaken based on 2018 traffic volumes.

For a traffic signal warrant evaluation, there are a total of 9 warrant requirements by the MoTI's manual. A traffic signal could be installed if one or more of the signal warrants are met. At the intersection, a couple of the signal warrants are almost met; Interruption of Continuous Traffic, Four Hour Volume, and Peak Hour Volume; however, the volume of traffic on Nordic Drive is below the threshold for signalization, particularly when the right turning traffic (that is channelized) is removed.

Based on the results of signal warrant review, a further study, MoTI, could be conducted for the intersection to improve existing delays on Nordic Drive.

4.0 LONG TERM CONDITIONS – 10 YEAR HORIZON

The long term conditions were analyzed assuming the existing roadway network. Annual growth rate of PM peak hour volumes on Highway 99 was estimated at 0.9% between 2007 MoTI's short counts (measured in August) and 2018 PM counts (measured in July) at Nordic Drive. Therefore, the 2018 existing traffic volumes were projected with a 1% annual growth rate to obtain the 2028 background traffic volumes.

4.1 LONG TERM TRAFFIC ANALYSIS RESULTS

Table 3 summarizes 2028 (10-year horizon) PM peak hour traffic conditions with / without the development. **Figure 5** shows 2028 post development volumes and levels of service.

In the long term (2028), at the intersection of Nordic Drive/Highway 99, the northbound left movement will suffer excessive delays due to the projected background volumes if current stop control remains. With the development, all other movements will continue to operate at the same levels of service (all acceptable) as 2018 existing. Mitigation measures should be considered, by MoTI, to improve extreme delays for the northbound left movement at the intersection. These measures may include signalization or restriction of the side street left turn movement.

At all other study intersections on Nordic Drive and Garibaldi Way, all movements will continue to operate at an excellent level of service (LOS A) in the long term with the development. **Table 2** summarizes 2028 PM peak hour traffic conditions with / without the development. **Figure 5** shows 2028 post development volumes and levels of service.

TABLE 3 – 2028 PM PEAK HOUR CONDITIONS COMPARISON

Intersection	Movement	2028 Background			2028 Post Development		
		Synchro/Sim	Simulation		Synchro/Sim	Simulation	
		LOS	Delay* (s)	95% Queue (m)	LOS	Delay* (s)	95% Queue (m)
Nordic Dr/Hwy 99	EBT	A	0	1.3	A	0	2.2
	EBR	A	0	-	A	0	-
	WBL	B	13.3	23.6	B	13.7	29.6
	WBT	A	0	8.3	A	0	17.7
	NBL	F	656	22.7	F	854.3	21.1
	NBR	D	31.2	-	D	33	-
Nordic Dr/Nordic Pl	EBLT	A	1.7	-	A	2.1	-
	WBT	A	6.7	10.8	A	4.5	10.3
	SBLR	A	2.3	3.0	A	2.0	2.3
Nordic Dr/Garibaldi Way	EBT	A	3.9	17.6	A	4.6	18.4
	WBT	A	5.6	14.4	A	5.9	17.1
	NBL	A	4.5	14.8	A	4.1	14.8
Eva Lake Rd/Garibaldi Way	EBT	A	4.6	5.4	A	5.5	10.0
	WBL	A	1.8	-	A	2.2	-
	NBL	A	3.5	14.3	A	4.6	14.0

*Note: Delays based on SimTraffic results except for Nordic Dr/Hwy 99 (Synchro HCM 2010)

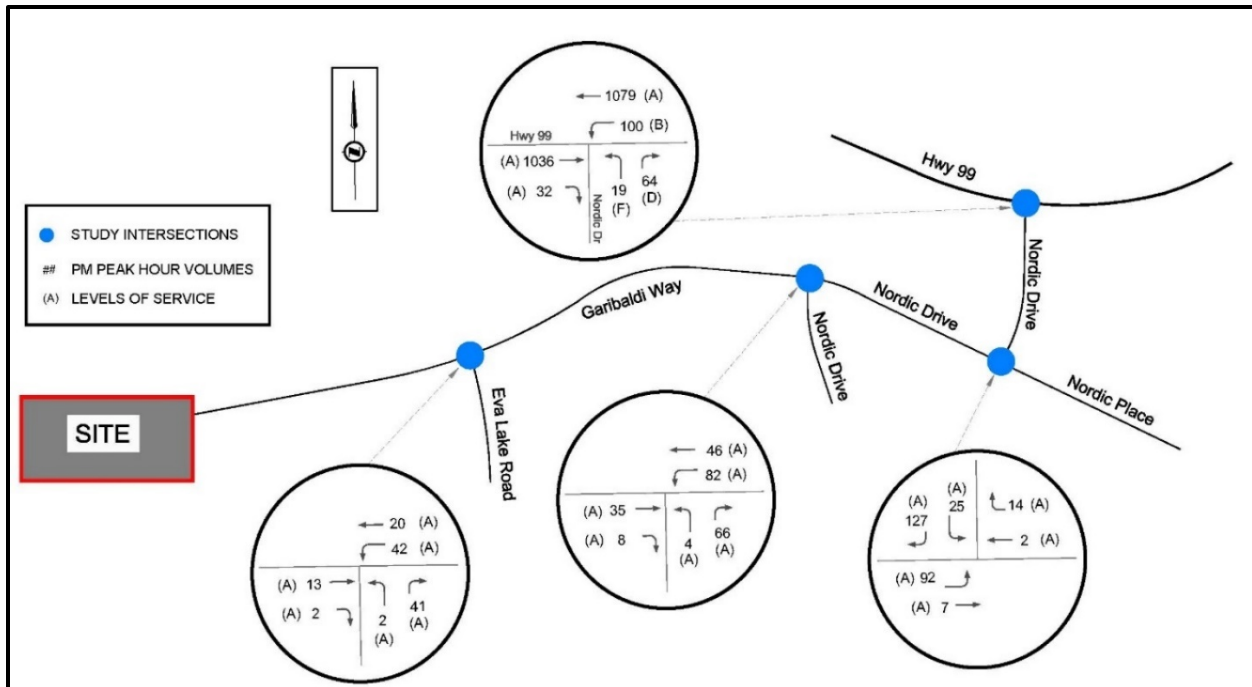


Figure 5: 2028 Post Development PM Peak Hour Volumes and Levels of Service

5.0 OTHER MODES

5.1 PEDESTRIAN FACILITIES AND BICYCLING FACILITIES

There are currently no sidewalks on Garibaldi Way, Nordic Drive, or Eva Lake Road. Pedestrians are currently using gravel or paved shoulders along the adjacent roads. There are no bike lanes on Garibaldi Way and the adjacent roads.

Bike lanes or wider travel lanes are not required on the adjacent local roads due to low traffic volumes. No sidewalks are required on Garibaldi Way or the adjacent roads due to the low volumes and ability to share the roadway. There will be no safety issues expected with pedestrian circulations to and from the site and the site pedestrians still utilize existing facilities including the Valley Trail Bridge (overpass) to cross the highway.

Connection to the Valley Trail to Creek Side is possible via Aspen Drive and Whistler Road. The pedestrian friendly nature of these local roads does not require any sidewalk upgrades to further pedestrian mobility or safety.

5.2 TRANSIT

The Transit Bus service (Transit Route #20/21) operates along Garibaldi Way. Currently this route provides service to the Whistler and Creekside Village (shopping malls) several times for each peak hour. The nearest bus stop is on Garibaldi Way west of Nordic Drive (250m east of the site).

6.0 CONCLUSIONS

The proposed site will generate 27 vehicle trips during the PM peak hour. The development will have little impact on traffic operations on the surrounding roadway network. At all four study intersections, all movements will continue to operate at the same levels of service as without the development

At the intersection of Nordic Drive/Highway 99, the northbound left movement is currently operating at a failing level of service (LOS F) due to high through traffic of Highway 99. It is expected that up to two trips per hour will be added for this movement by the development. At the intersection, 2018 PM volumes and delays are close to the signal warrant levels; however, the side street does not meet the minimum threshold for a signal. The Ministry should review this intersection especially since there have been 16 vehicle crashes were reported in recent 5 years. Measures for this intersection could include signalization or turn movement restrictions. Any changes to the movements or traffic control at Nordic Drive may impact the entire neighbourhood as a signal may draw additional traffic.

No additional pedestrian / bicycling facility are required based on the existing traffic and expected pedestrian / bike volumes.

7.0 RECOMMENDATIONS

No mitigation is required due to the development.

The Ministry of Transportation and Infrastructure and the Resort Municipality of Whistler should undertake a review of the two key access points to this neighbourhood from Highway 99 to identify access management / traffic control requirements to provide improved left turn access to Highway 99 and mitigate impacts to the neighbourhood.

APPENDIX A: SYNCHRO BACKGROUND

SYNCHRO MODELLING SOFTWARE DESCRIPTION

The traffic analysis was completed using Synchro and SimTraffic traffic modeling software. Results were measured in delay, level of service (LOS) and 95th percentile queue length. Synchro is based on the Highway Capacity Manual (HCM) methodology. SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly “seeding” or positioning vehicles travelling throughout the network. The simulation is run five times (five different random seedings of vehicle types, behaviours and arrivals) to obtain statistical significance of the results.

Levels of Service

Traffic operations are typically described in terms of levels of service, which rates the amount of delay per vehicle for each movement and the entire intersection. Levels of service range from LOS A (representing best operations) to LOS E/F (LOS E being poor operations and LOS F being unpredictable/disruptive operations). LOS E/F are generally unacceptable levels of service under normal everyday conditions.

The hierarchy of criteria for grading an intersection or movement not only includes delay times, but also takes into account traffic control type (stop signs or traffic signal). For example, if a vehicle is delayed for 19 seconds at an unsignalized intersection, it is considered to have an average operation, and would therefore be graded as an LOS C. However, at a signalized intersection, a 19 second delay would be considered a good operation and therefore it would be given an LOS B. The table below indicates the range of delay for LOS for signalized and unsignalized intersections.

Table A1: LOS Criteria, by Intersection Traffic Control

Level of Service	Unsignalized Intersection Average Vehicle Delay (sec/veh)	Signalized Intersection Average Vehicle Delay (sec/veh)
A	Less than 10	Less than 10
B	10 to 15	11 to 20
C	15 to 25	20 to 35
D	25 to 35	35 to 55
E	35 to 50	55 to 80
F	More than 50	More than 80