

FERGUS GOLF CLUB PROPOSED RESIDENTIAL RE-DEVELOPMENT

URBAN TRANSPORTATION CONSIDERATIONS Zoning By-Law Amendment, Official Plan Amendment, Plan of Subdivision and Plan of Condominium

Township of Centre Wellington, Wellington County

Prepared For: 883890 Ontario Limited c/o Fergus Development Inc.

February 2022



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1.0 INTRODUCTION

BA Group has been retained by 883890 Ontario Limited c/o Fergus Development Inc. to provide transportation consulting services related to a proposed residential re-development on a site municipally known as 8243 & 8282 Wellington Road 19, in the Township of Centre Wellington, in the County of Wellington. The existing golf course (the "Site") consists of two parcels; the northwest parcel ("NW Site"), situated on the north side of Wellington Road 19, and the southeast parcel ("SE Site"), situated on the south side of Wellington Road 19. The Site is surrounded by agricultural land to the north and west of the NW Site, and south of the SE Site. Third Line is adjacent to the east side of the Site and an existing residential dwelling exists on the west side of the SE Site. The Site location is illustrated in **Figure 1** and the Site context is in **Figure 2**.

This Transportation Considerations Report has been prepared as part of the **Zoning By-Law Amendment, Official Plan Amendment, Draft Plan of Subdivision and Draft Plan of Condominium** being submitted to the Township of Centre Wellington, County of Wellington and GRCA.

1.1 EXISTING SITE CONTEXT

In 2010, the Fairview and Lake Belwood Golf Clubs were merged to form the Fergus Golf Club. Fairview, which was built in 1977, referred to as the SE Site, is 39.85ha and includes a 9-hole golf course. Lake Belwood (the NW Site) was constructed in 2000, is 42.35ha and includes a total of 18 holes. The total Site area is 82.20ha, and the proposed residential redevelopment will be located on the SE Site, while the communal water and wastewater services are integrated into the existing Golf Course, which will remain, on the NW Site.

1.2 PROPOSED DEVELOPMENT

The proposed development includes the construction of 118 single detached residential dwellings. The development statistics for the proposed development are summarized in **Table 1**. The proposed development is illustrated in **Figure 3** and reduced scale architectural plans are provided in **Appendix A**.

The proposed Site circulation and access includes a network of internal private roads (12 metre right-of-ways) with two full accesses along Wellington Road 19 and two full accesses along 3 Line. All access points to Wellington Road 19 and 3 Line will be unsignalized with stop control on the minor streets only. The proposed internal private road cross-section is provided in **Appendix B**. A new access for the NW Site is also proposed to align with the proposed north access to the SE Site on Wellington Road 19.



TABLE 1 DEVELOPMENT PROPOSAL

	Land Use	Proposed Statistics
	Single Detached Residential Dwellings	118 units
	Site Access & Circulation	• 2 full accesses along Wellington Road 19 and 2 full accesses along 3 Line. • An internal network of private roads with 12 metre right-of-ways.

Notes:

1. Site statistics based on site plans prepared by GSP Group dated December 10, 2021.





FIGURE 1 SITE LOCATION

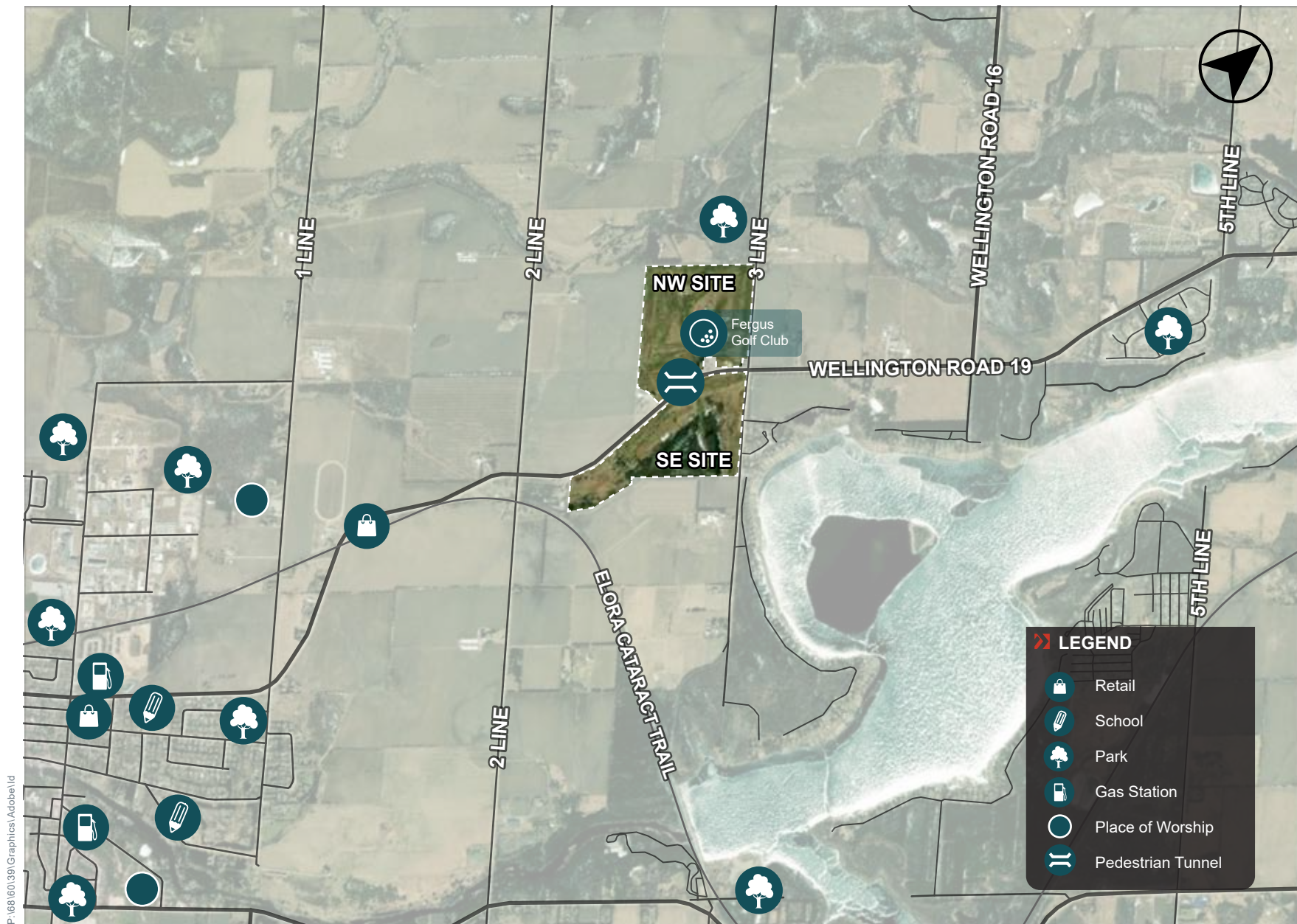


FIGURE 2 SITE CONTEXT

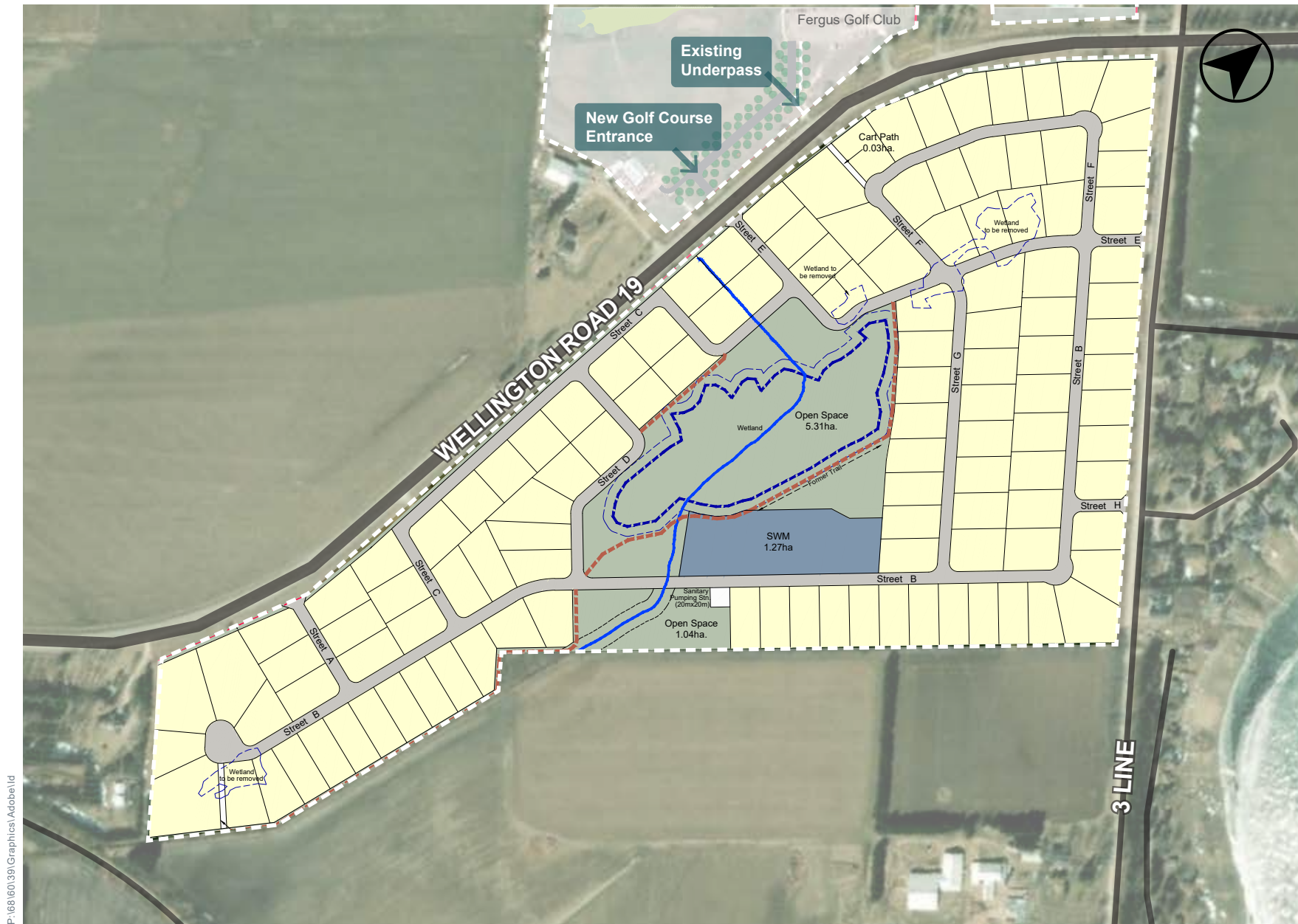


FIGURE 3 PROPOSED DEVELOPMENT

1.3 STUDY SCOPE

Development Concept Plan

- A summary of the proposed development concept plan.
- An overview of the Site and the area-wide transportation system.
- A review of the transportation elements of the proposed development plan that includes access and circulation.

Transportation Context

- A description of the existing transportation context with consideration for the area road network, transit system and active transportation facilities.
- A description of future transportation changes and/or improvements to the area context such as planned road upgrades and active transportation improvements.

Site Plan

- A review of the functionality and appropriateness of the proposed internal private road network.

Traffic Operations Review

- An assessment of the existing traffic patterns and traffic volumes in the study area during the key weekday morning and afternoon peak hours.
- A comprehensive review of traffic-related changes that may occur in the area with consideration for corridor growth and construction of other area development projects.
- A review of traffic operations at intersections in the area under existing and future conditions including an assessment of the operational impacts of the proposed development.
- An assessment of the need for traffic signals at the access points on Wellington Road 19.

Site Access Review

- A review of the proposed accesses at Wellington Road 19 and the proposed accesses at 3 Line.
- Confirmation of the proposed traffic control at the Site access points.
- Evaluation of the sight distance at the proposed access points.
- Evaluation of the need for left-turn lanes at the access points on Wellington Road 19.

The findings of this review are summarized in the following sections.



2.0 TRANSPORTATION CONTEXT

2.1 AREA ROAD NETWORK

The existing area network of arterial roads, collector roads and local roads are described below and illustrated in **Figure 4**. The existing and future lane configuration and traffic control are shown in **Figure 5** and **Figure 6**, respectively.

Wellington Road 19 is a northeast/southwest Wellington County arterial road that extends from Robinson Road/Tom Street in the southwest to East West Garafraxa Townline in the northeast, connecting the Town of Fergus to the border between Wellington County and Dufferin County. In the vicinity of the Site, Wellington Road 19 has a rural 2-lane cross section with paved shoulders and a defacto speed limit of 80 km/h.

3 Line is a northwest/southeast Wellington County local road that extends from Lake Belwood in the southeast to Wellington County Road 109 in the northwest. 3 Line is paved southeast of Wellington County Road 19 (adjacent to the proposed development) and the speed limit is not posted.

2.2 AREA TRANSIT NETWORK

The Township of Centre Wellington does not currently operate a local public transit system and there are no plans to establish transit service in the vicinity of the Site. The closest public transit systems to the Site are in Guelph (30 km away), Elmira (30 km away) and Orangeville (35 km away). Guelph and Elmira (through bus travel to Waterloo) have multiple GO Transit connections and a VIA Rail station in Kitchener.

2.3 AREA CYCLING NETWORK

Active Transportation Plan (2012)

In 2012, Wellington County, in association with the seven local area municipalities and Wellington-Dufferin-Guelph (WDG) completed an Active Transportation Plan. The plan is a long-term strategy to create a pedestrian and cycling supportive environment that will encourage both utilitarian and recreational travel by walking and cycling, while promoting the importance of active lifestyles for residents and tourists.

Existing cycling facilities near the Site are described below. The Active Transportation Plan includes recommendations for a variety of improvements throughout the County. On Wellington Road 19, there are future plans to extend the paved shoulders east of 3 Line.

Wellington Road 19

In the vicinity of the Site, Wellington Road 19 includes paved shoulders for cyclists.

Elora Cataract Trail

Just south of Wellington Route 19 there is an off-road “spine route” know as the Elora Cataract Trail, a 47 kilometer long trail between Elora and Forks of Credit Provincial Park. The trail is located along the southern edge of the SE Site, and crosses 2 Line, 150 metres southeast of Wellington Road 19.

The existing area cycling facilities are displayed in **Figure 7**.



2.4 AREA PEDESTRIAN CONTEXT

There is an existing pedestrian tunnel under Wellington Road 19 which provides connectivity between the Site and the Fergus Golf Club (East & West).



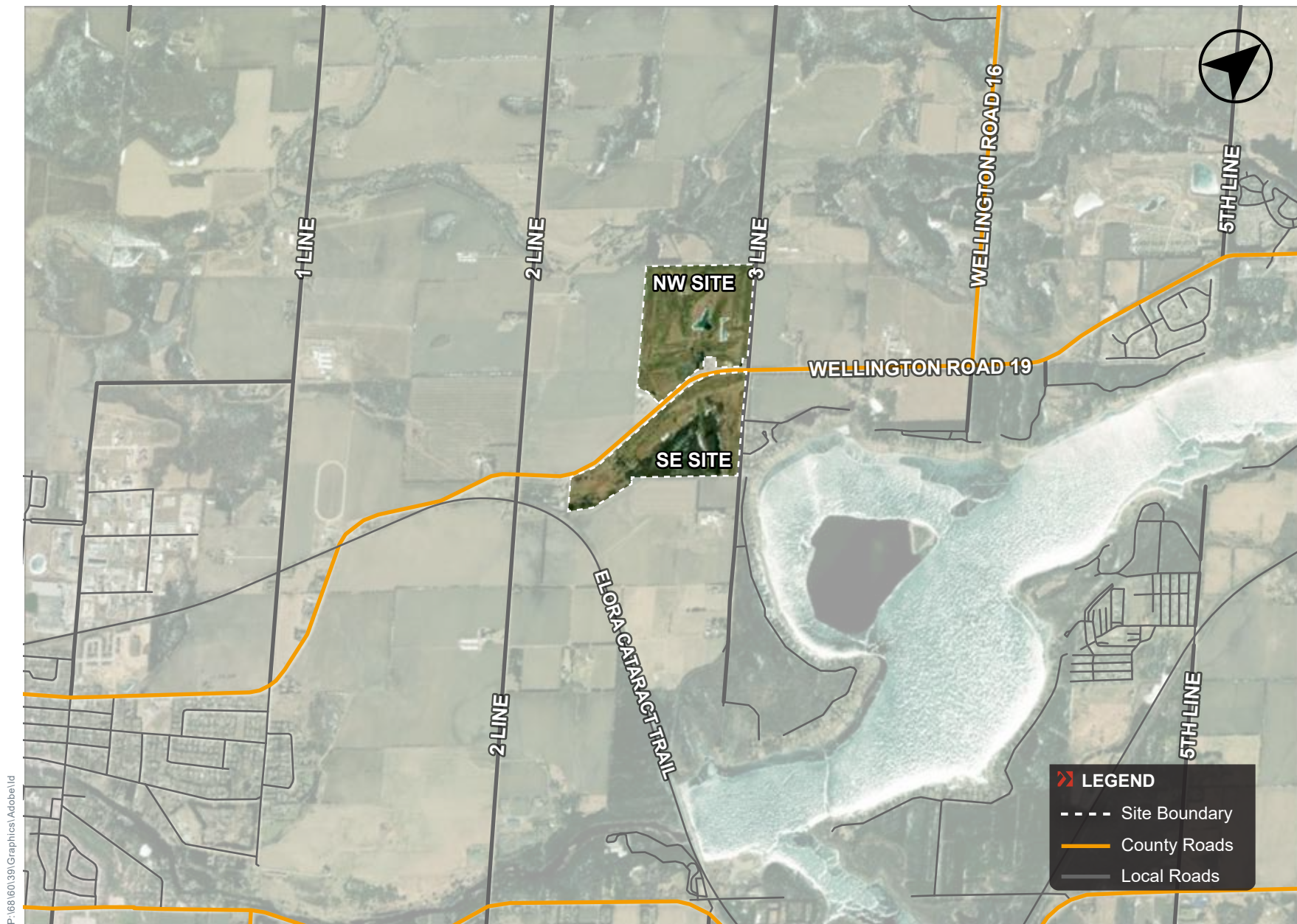


FIGURE 4 AREA ROAD NETWORK



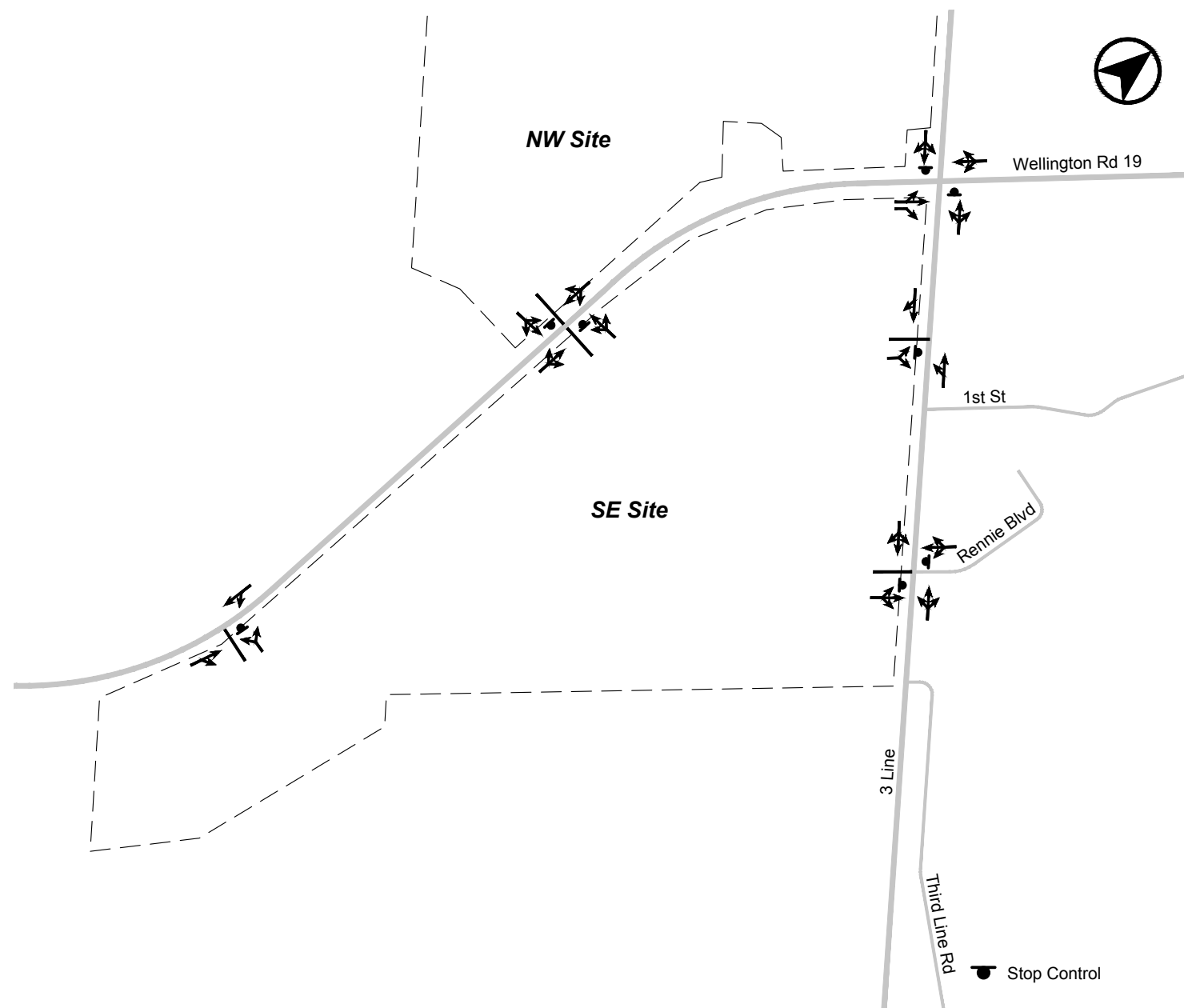


FIGURE 6 FUTURE LANE CONFIGURATION AND TRAFFIC CONTROL

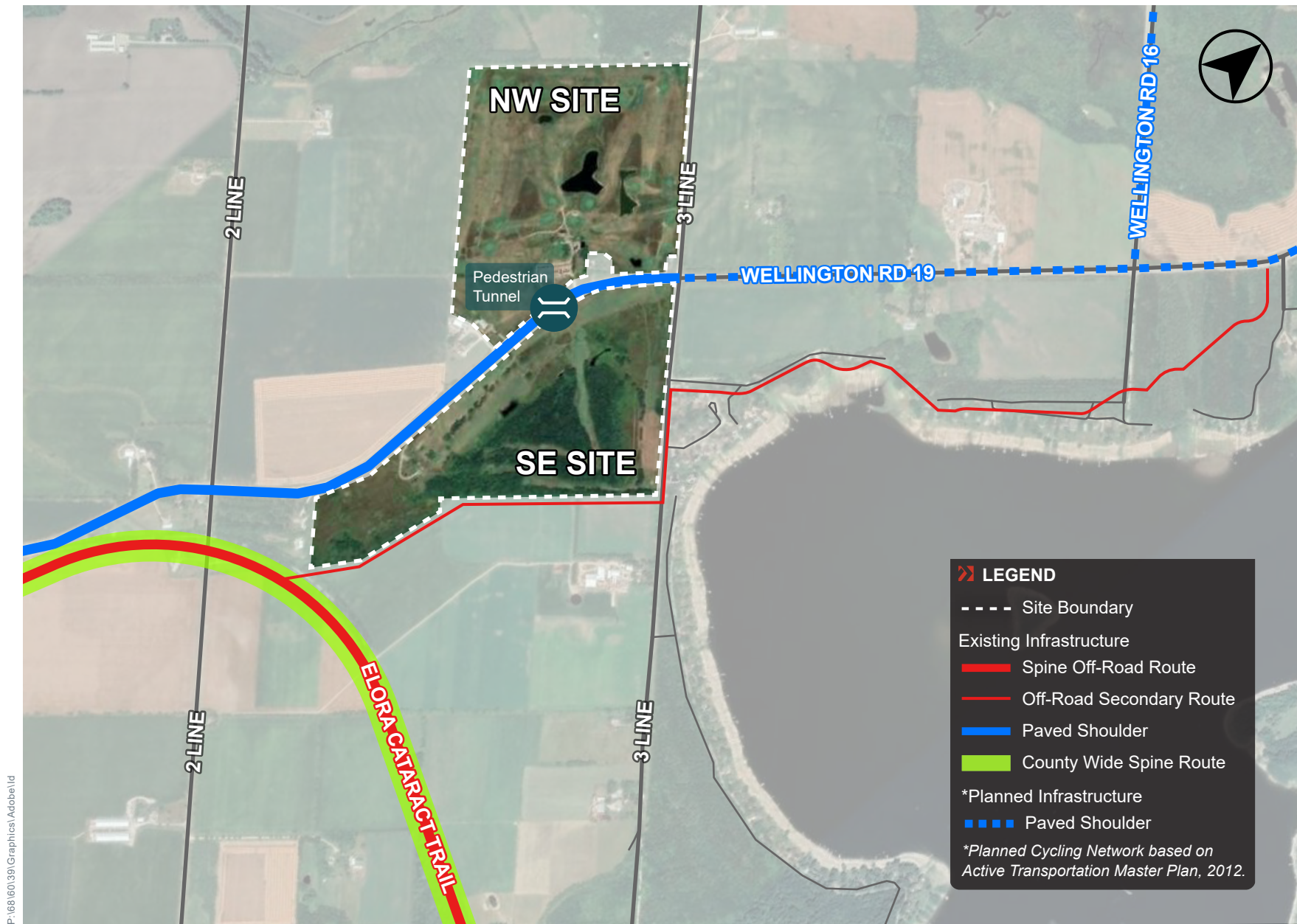


FIGURE 7 EXISTING & FUTURE AREA CYCLING AND PEDESTRIAN NETWORK

3.0 TRAFFIC VOLUME FORECASTING

3.1 EXISTING TRAFFIC VOLUMES

Baseline existing turning movement volumes were established for the intersection of **Wellington Road 19 / 3 Line** based on the most recently available traffic count data, collected by Spectrum Traffic Inc. on behalf of BA Group. Typical weekday morning and afternoon peak hours were not reflected in the traffic counts taken at the intersection, as the heaviest volumes were observed between 3:15 pm and 4:15 pm. Since the proposed residential development is anticipated to generate the heaviest traffic volumes during the commuting peak hours, traffic counts taken between 8:00 am and 9:00 am and between 4:30 pm and 5:30 pm, were adopted for the purpose of the analysis to represent the weekday morning and afternoon peak hours, respectively.

The most recent traffic count information is summarized in **Table 2**. Detailed traffic count data is provided in **Appendix C**.

TABLE 2 EXISTING TRAFFIC COUNT INFORMATION

Intersection	Date of Count	Source
Wellington Road 19 / 3 Line	Tuesday, March 2, 2021	Spectrum Traffic Inc.

Existing turning movement volumes were rounded to the nearest 5 vehicles.

Existing traffic volumes for the weekday morning and afternoon peak hours adopted for the analysis are illustrated in **Figure 8**.



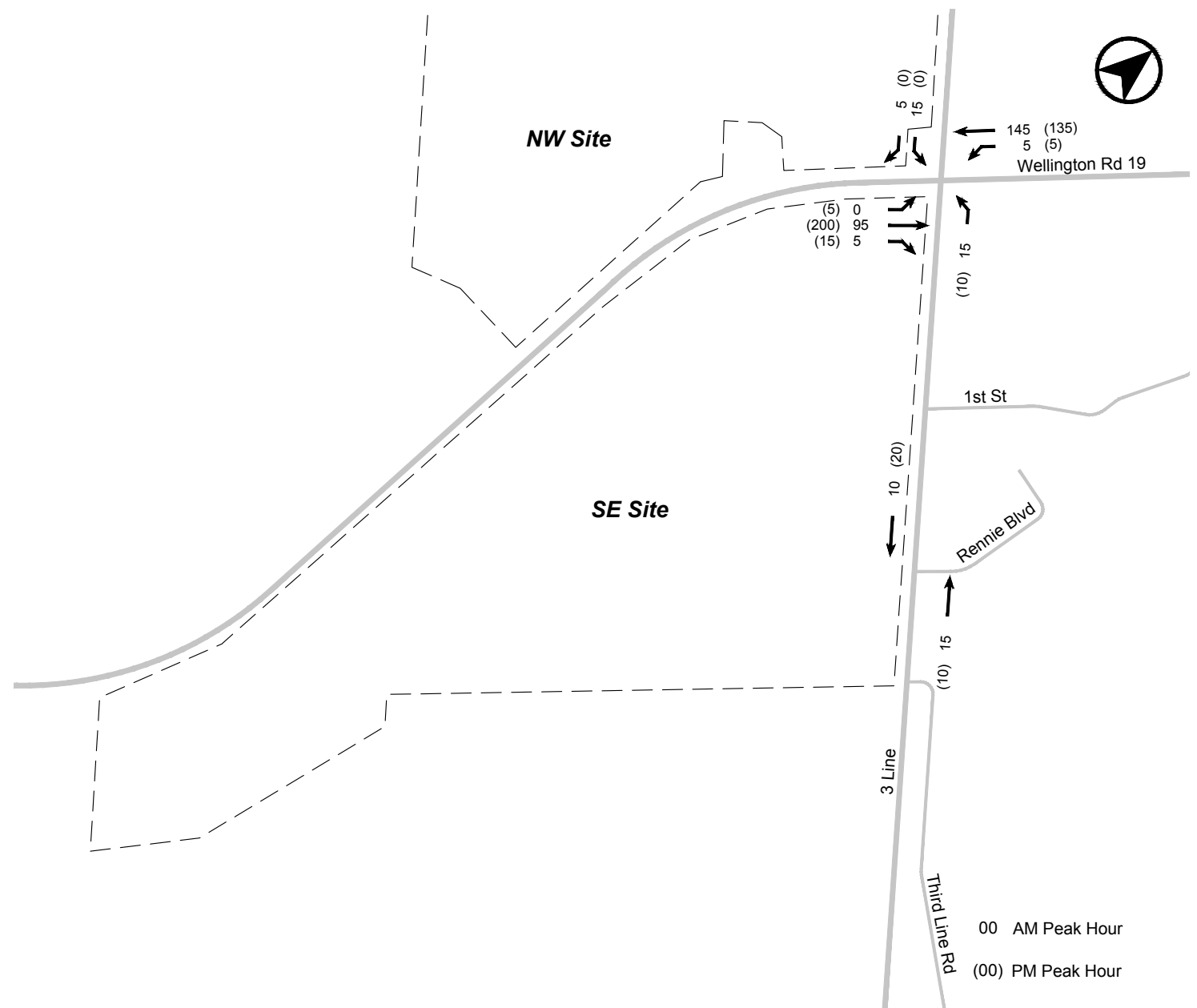


FIGURE 8 EXISTING TRAFFIC VOLUMES

3.2 BACKGROUND TRAFFIC ALLOWANCES

Forecasted background traffic volumes for the 2026 and 2031 horizon years account for changes to traffic conditions in the network over time, due to additional development in the area, and represent the summation of existing traffic volumes and growth along the Wellington Road 19 corridor. Traffic allowances for specific background developments were not included in the analysis, as there are no planned developments in the immediate vicinity of the Site.

3.2.1 General Corridor Growth

In order to conservatively capture development progress outside of the Site vicinity and study area for both horizon years of 2026 (Site build-out) and 2031 (five-years beyond build-out), the a growth rate of 2% per year was applied during the weekday morning and afternoon peak hours.

General corridor growth allowances for both the 2026 and 2031 horizon years are illustrated in **Figure 9** and **Figure 10**, respectively.

3.2.2 Future Background Traffic Volumes

Future background traffic volumes in the 2026 and 2031 horizon years, representing the summation of the existing traffic volumes plus general corridor growth allowances, are illustrated in **Figure 11** and **Figure 12**, respectively.



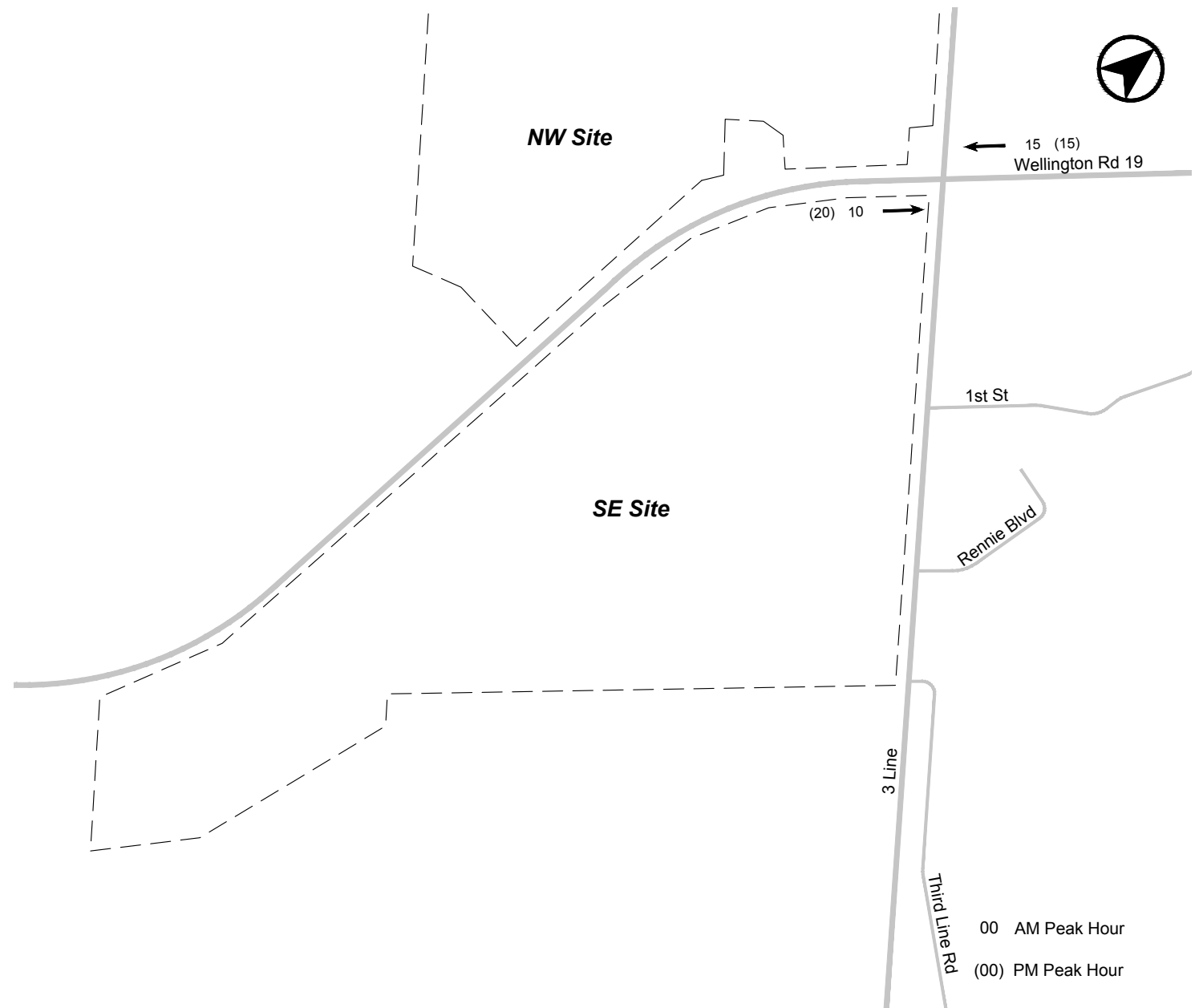


FIGURE 9 2026 CORRIDOR GROWTH TRAFFIC VOLUMES

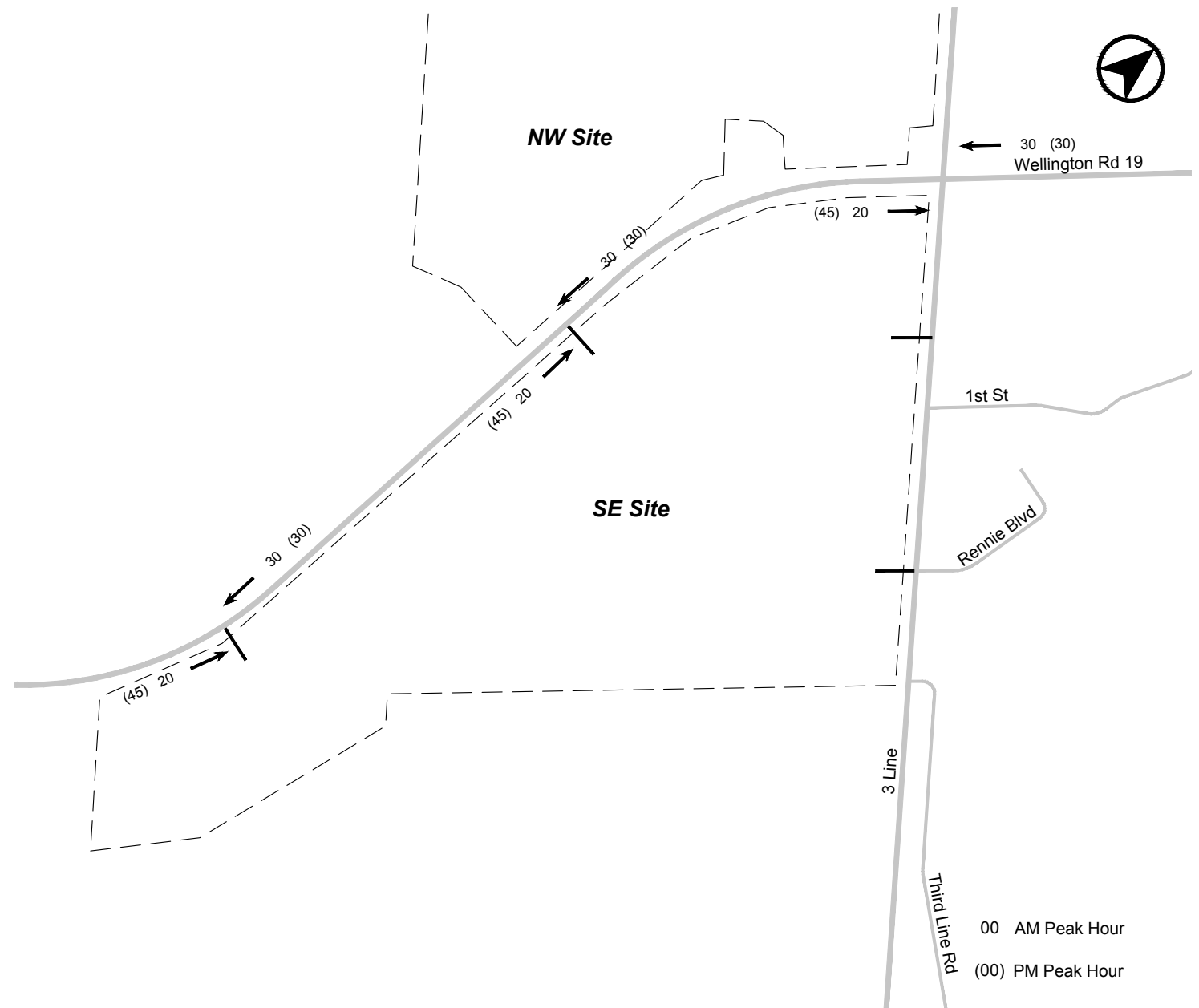


FIGURE 10 2031 CORRIDOR GROWTH TRAFFIC VOLUMES

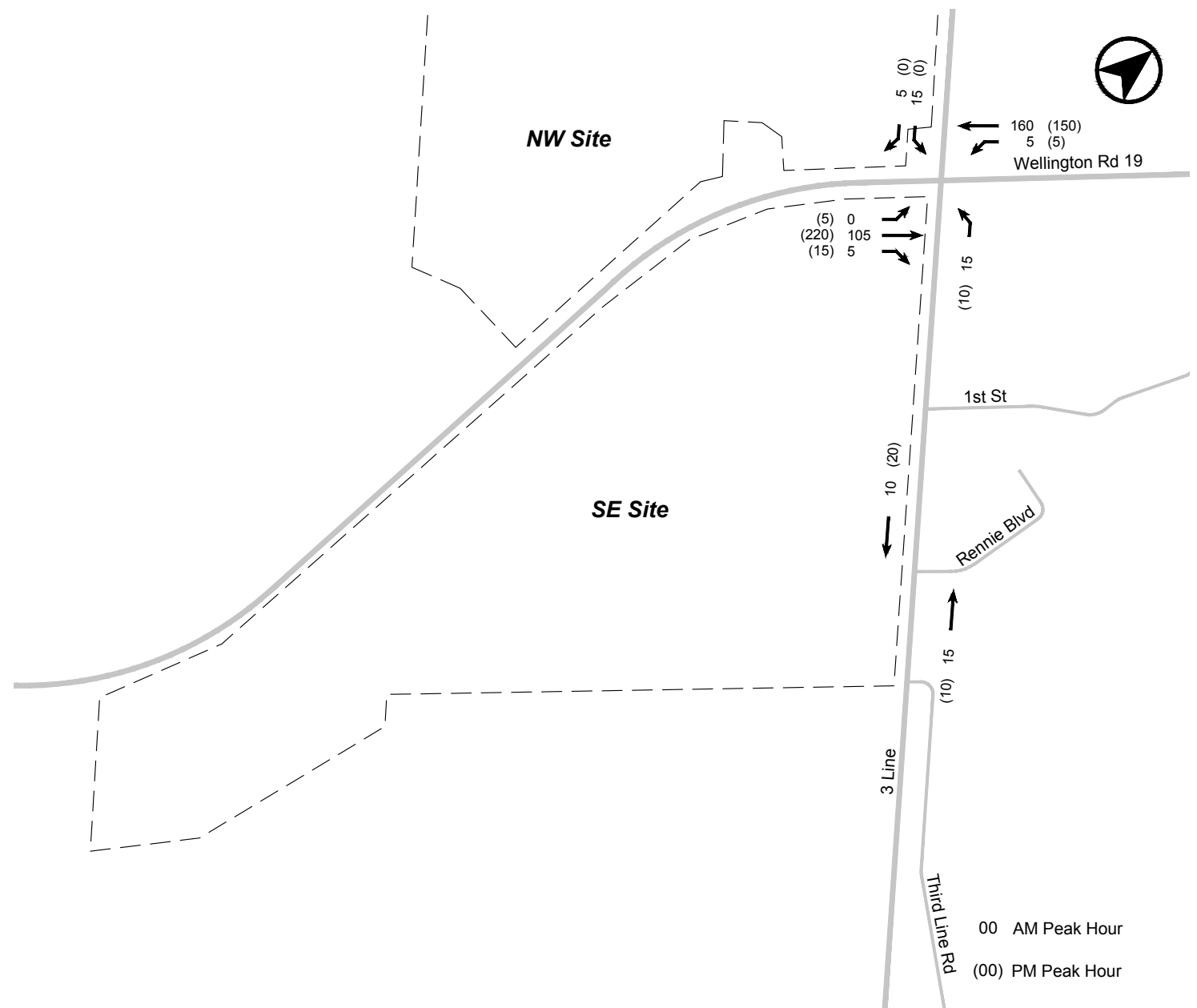


FIGURE 11 2026 FUTURE BACKGROUND TRAFFIC VOLUMES

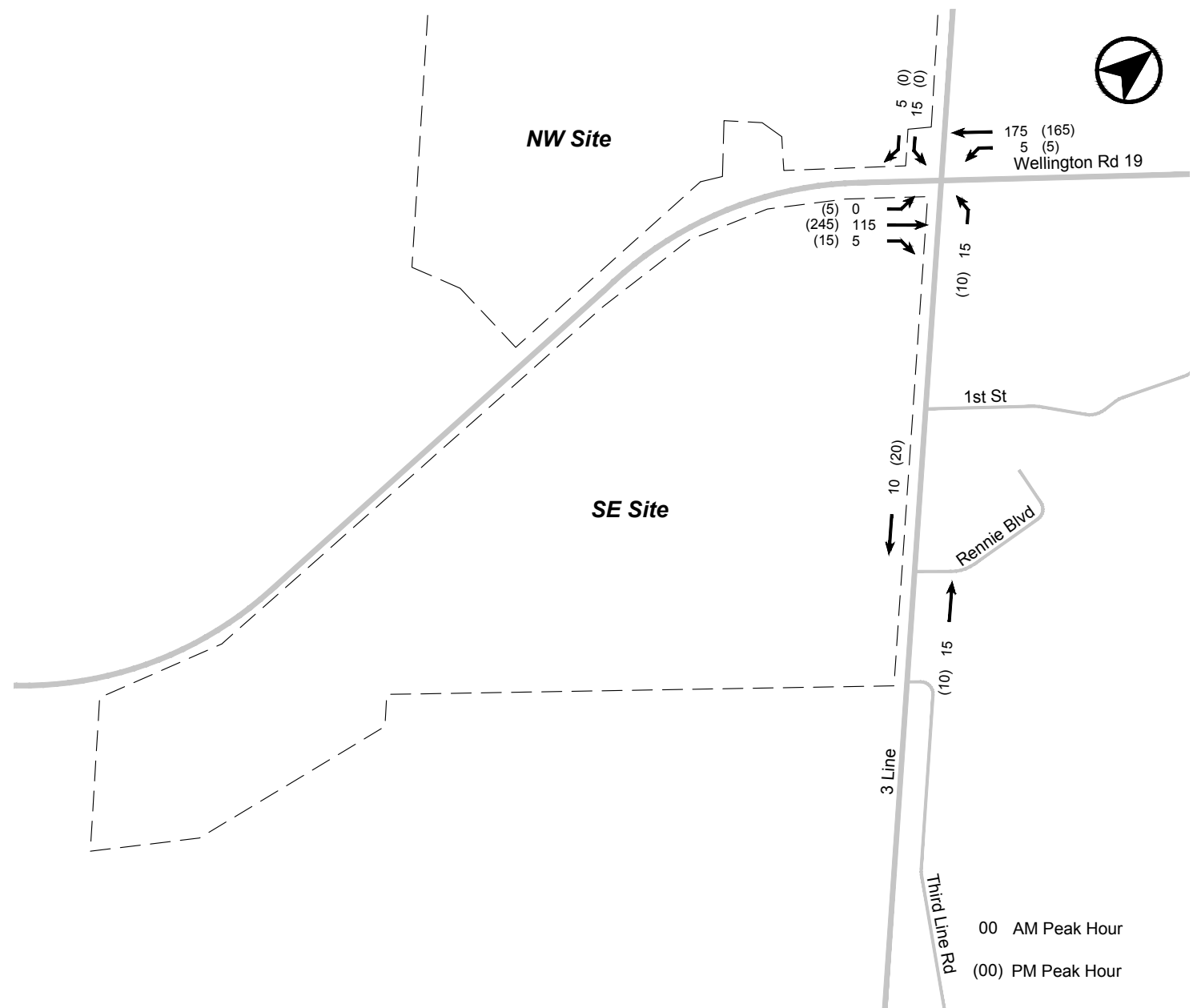


FIGURE 12 2031 FUTURE BACKGROUND TRAFFIC VOLUMES

3.3 SITE TRAFFIC VOLUMES

Residential Trip Generation

The residential trip generation potential of the proposed SE Site is based upon trip behaviour observed within the ITE Trip Generation Manual (10th Edition), Land Use Code (LUC) 210 (Single-Family Detached Housing). The trip rates and resultant trips are summarized in **Table 3**.

The Site anticipates in the order of 90 and 120 two-way residential vehicle trips during the weekday morning and afternoon peak hours, respectively.

TABLE 3 RESIDENTIAL TRIP GENERATION

	AM Peak Hour			PM Peak Hour		
	In	Out	2-Way	In	Out	2-Way
Directional Distribution	25%	75%	100%	63%	37%	100%
Residential Trip Rate (118 single-family detached housing)	0.19	0.56	0.74	0.62	0.37	0.99
Residential Site Trips	25	65	90	75	45	120

Notes:

1. Site trips are rounded to the nearest 5 vehicles.

Golf Course Trip Generation

The trip generation potential of the golf course on the NW Site is based upon trip behaviour observed within the ITE Trip Generation Manual (11th Edition), Land Use Code (LUC) 430 (Golf Course). The trip rates and resultant trips are summarized in **Table 3**.

The Site anticipates in the order of 35 and 55 two-way residential vehicle trips during the weekday morning and afternoon peak hours, respectively.

TABLE 4 GOLF COURSE TRIP GENERATION

	AM Peak Hour			PM Peak Hour		
	In	Out	2-Way	In	Out	2-Way
Directional Distribution	79%	21%	100%	53%	47%	100%
Trip Rate (vehicles/hole)	1.39	0.37	1.76	1.54	1.37	2.91
Golf Course Site Trips (18 holes)	25	10	35	30	25	55

Notes:

1. Site trips are rounded to the nearest 5 vehicles.

Since no information regarding existing traffic associated with the golf course on the NW Site was available, a conservative approach was adopted, wherein the trips summarized in the table above were added to the network to account for the new golf course entrance, and no traffic was removed.



Trip Distribution

The new trips for the Site in the weekday morning and afternoon peak hours were assigned to the study area road network based on the observed travel patterns at the intersection of **Wellington Road 19 / 3 Line**.

The Site traffic distribution is summarized in **Table 5**. Site traffic volumes on the area road network are illustrated in **Figure 13**.

TABLE 5 SITE TRAFFIC DISTRIBUTION

To / From Site	Corridor	Inbound		Outbound	
		AM	PM	AM	PM
North	3 Line	5%	0%	0%	0%
South	3 Line	5%	5%	5%	5%
East	Wellington Road 19	50%	40%	40%	55%
West	Wellington Road 19	40%	55%	55%	40%
Total		100%		100%	

3.4 FUTURE TOTAL TRAFFIC VOLUMES

Future total traffic volumes in the 2026 and 2031 horizon years reflect the sum of future background traffic volumes in the respective horizons with total SE and NW Site traffic volumes, and are summarized in **Figure 14** and **Figure 15**, respectively.



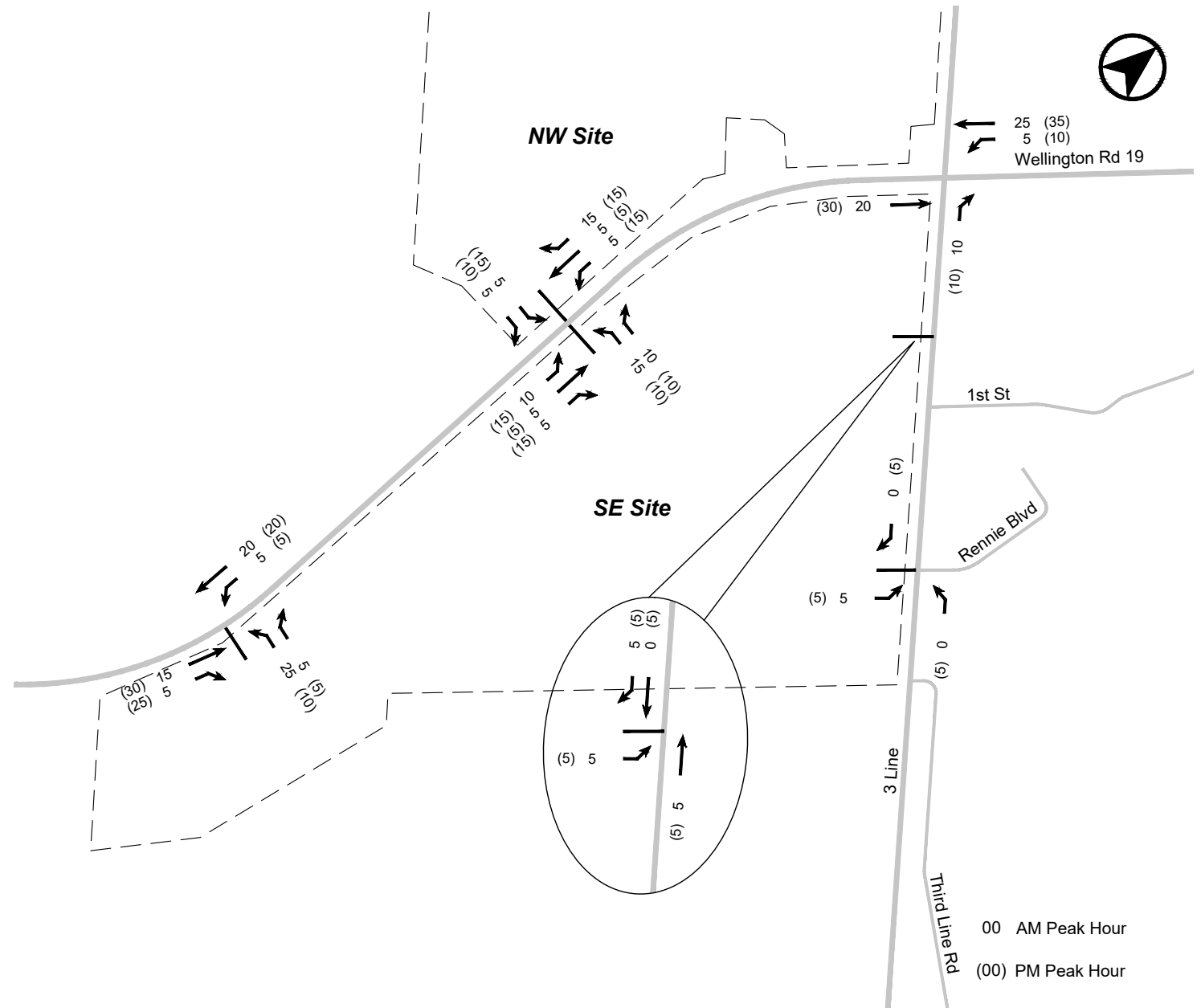


FIGURE 13 SITE TRAFFIC VOLUMES

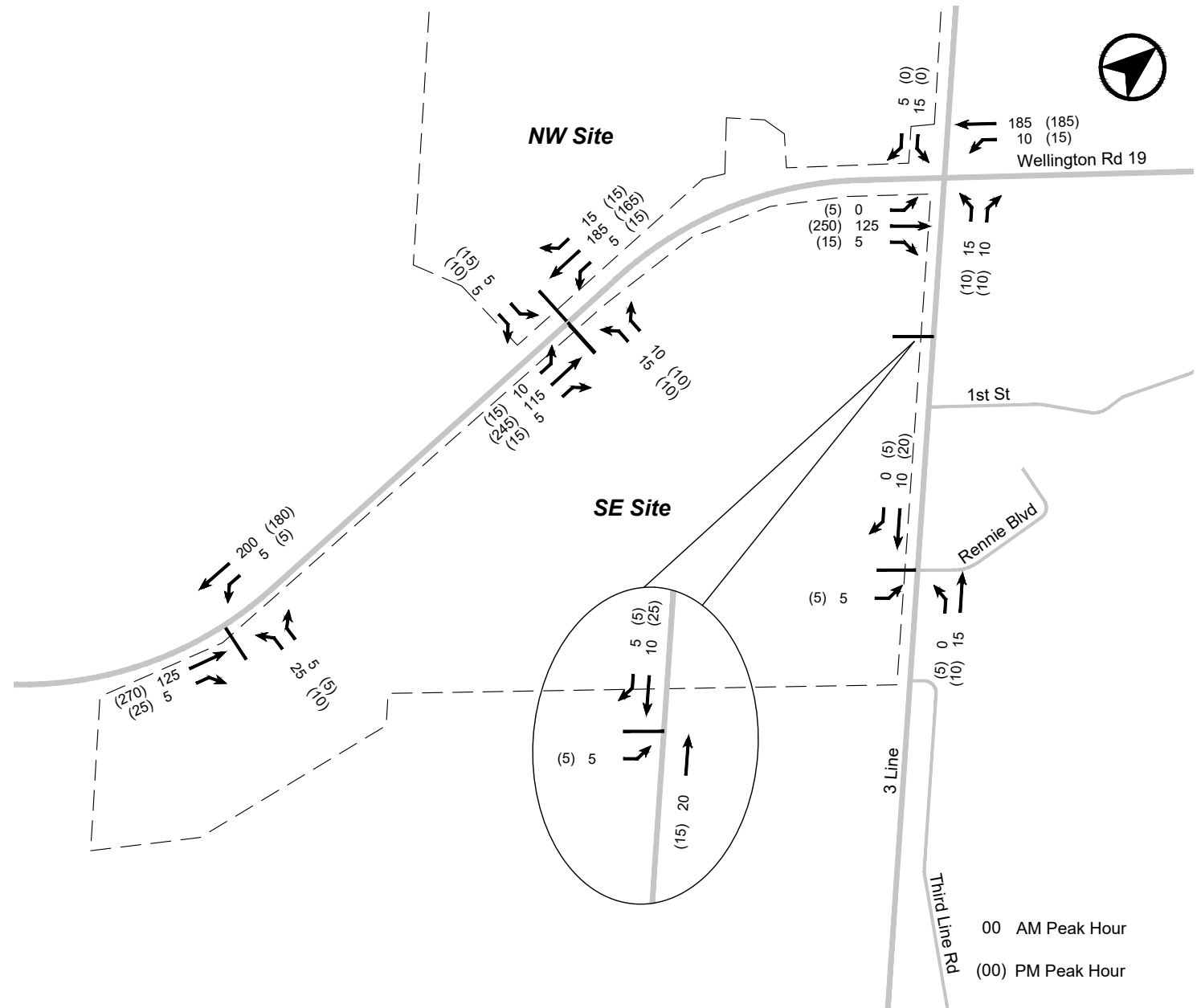


FIGURE 14 2026 FUTURE TOTAL TRAFFIC VOLUMES

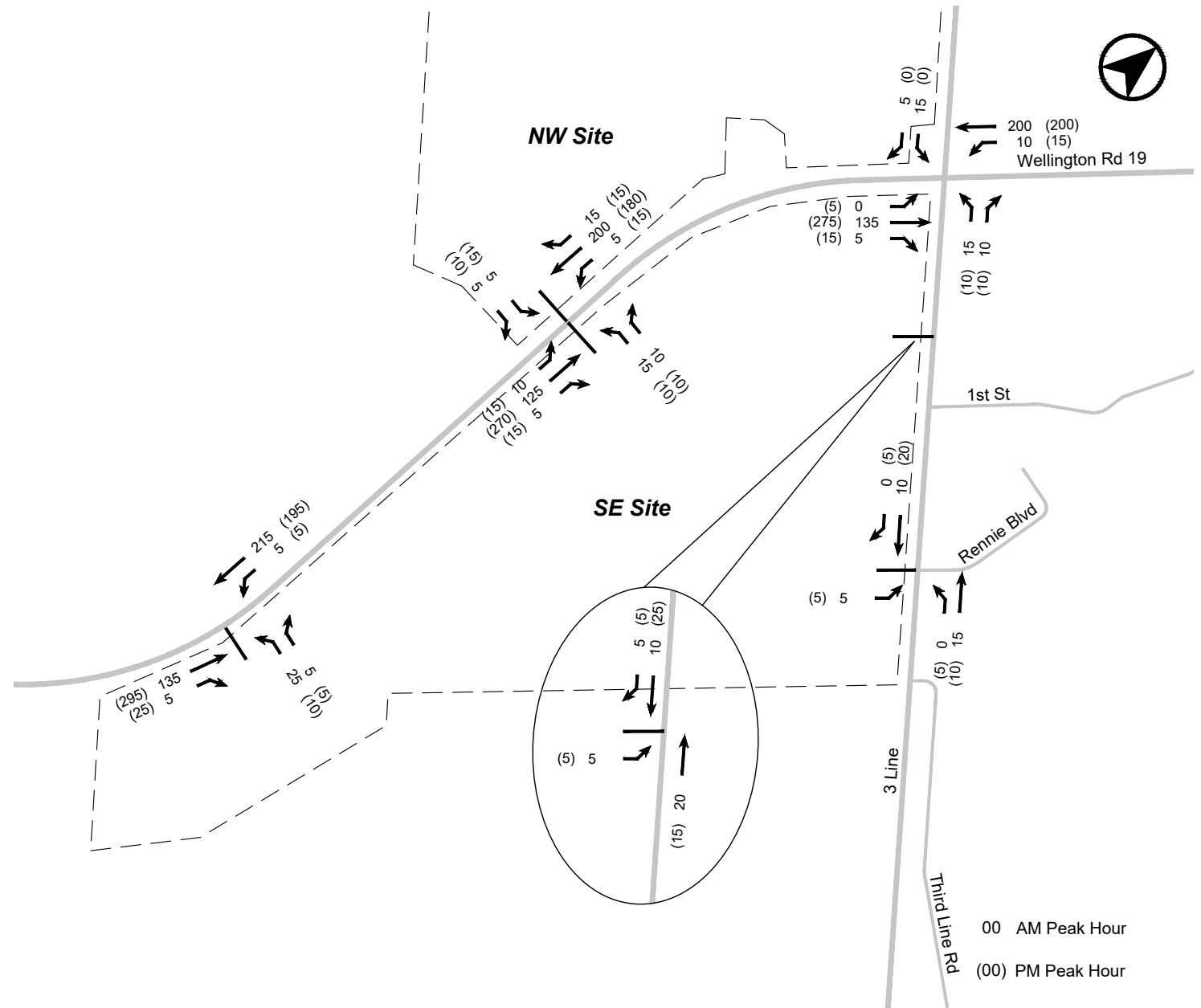


FIGURE 15 2031 FUTURE TOTAL TRAFFIC VOLUMES

4.0 TRAFFIC OPERATIONS ANALYSIS

4.1 TRAFFIC OPERATIONS SCENARIOS

A traffic operations analysis was completed for the following scenarios:

- Existing traffic conditions;
- Future background traffic conditions (2026 horizon year);
- Future total traffic conditions (2026 horizon year with full build-out);
- Future background traffic conditions (2031 horizon year at 5 years post build-out); and
- Future total traffic conditions (2031 horizon year at 5 years post build-out).

4.2 ANALYSIS METHODOLOGY

The intersection capacity analysis was completed using Synchro Version 11 and the Highway Capacity Manual (HCM 2000) methodology. For unsignalized intersections, including all intersections in the study area, level of service (LOS) characterizes operational conditions for key movements in terms of delay within the traffic stream¹. LOS A represents a good level of service with short delays. LOS E and F represent longer delays.

4.3 INPUT AND CALIBRATION PARAMETERS

Key parameters adopted in the analysis include:

Lane Configurations

Lane configurations are based on existing configurations at the intersection of **Wellington Road 19 / 3 Line**. For all Site accesses, there is assumed to be one lane in each direction of travel to and from the intersection.

Heavy Vehicle Percentages

Heavy vehicle percentages were derived from existing turning movement counts. Where the intersection is not existing, as is the case with the Site accesses, the Synchro default of 2% is assumed for all movements.

Pedestrian and Cycling Volumes

Volumes of pedestrians and cyclists were derived from existing turning movement counts.

Synchro defaults have been adopted for all other parameters.

¹ HCM Level of Service criteria for unsignalized intersections:

- LOS A: Control Delay $\leq 10s$
- LOS B: $10s < \text{Control Delay} \leq 15s$
- LOS C: $15s < \text{Control Delay} \leq 25s$
- LOS D: $25s < \text{Control Delay} \leq 35s$
- LOS E: $35s < \text{Control Delay} \leq 50s$
- LOS F: Control Delay $> 50s$



4.4 CAPACITY ANALYSIS RESULTS

Intersections within the study area, including existing and planned for the future, operate acceptably under future conditions. No mitigation measures or improvements are recommended for any of the Site intersections, as volumes remain relatively low under future total conditions in 2026 and 2031. All movements at unsignalized intersections in the study area, including the Site accesses, are expected to operate acceptably at LOS B or better.

Table 6 summarizes the capacity analysis results for intersections in the study area. Synchro reports are provided in **Appendix D**.

TABLE 6 UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS RESULTS

Key Movements	Existing		2026 Horizon Year				2031 Horizon Year			
			Future Background		Future Total		Future Background		Future Total	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Wellington Road 19 / 3 Line										
EBLT	0.0 (0.2)	A (A)	0.0 (0.2)	A (A)	0.0 (0.2)	A (A)	0.0 (0.2)	A (A)	0.0 (0.2)	A (A)
WBLTR	0.3 (0.3)	A (A)	0.2 (0.3)	A (A)	0.5 (0.7)	A (A)	0.2 (0.2)	A (A)	0.4 (0.7)	A (A)
NBLTR	10.5 (11.4)	B (B)	10.7 (11.8)	B (B)	10.5 (11.5)	B (B)	11.0 (12.3)	B (B)	10.7 (11.8)	B (B)
SBLTR	10.2 (0.0)	B (A)	10.4 (0.0)	B (A)	11.0 (0.0)	B (A)	10.6 (0.0)	B (A)	11.2 (0.0)	B (A)
Wellington Road 19 / South Site Access										
WBLT	Intersection does not exist.				0.2 (0.2)	A (A)	Intersection does not exist.	0.2 (0.2)		A (A)
NBLR					10.7 (11.5)	B (B)		10.9 (11.8)		B (B)
Wellington Road 19 / North Site Access										
	Intersection does not exist.				0.7 (0.5)	A (A)	Intersection does not exist.	0.6 (0.5)		A (A)
WBLT					0.2 (0.7)	A (A)		0.2 (0.7)		A (A)
NBLR					10.5 (11.7)	B (B)		10.7 (12.1)		B (B)
					10.4 (11.9)	B (B)		10.6 (12.3)		B (B)
East Site Access / 3 Line										
EBLR	Intersection does not exist.				8.7 (8.8)	A (A)	Intersection does not exist.	8.7 (8.8)		A (A)
NBLT					0.0 (2.3)	A (A)		0.0 (2.3)		A (A)
West Site Access / 3 Line										
EBLR	Intersection does not exist.				8.7 (8.8)	A (A)	Intersection does not exist.	8.7 (8.8)		A (A)

Notes:

1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).
2. All delay values are in seconds (s).



5.0 TRAFFIC SIGNAL WARRANTS

In order to ensure that the road network in the vicinity of the Site maintains acceptable operations in the future, traffic signals were considered at the two proposed Site accesses on Wellington Road 19, inclusive of the proposed new access for the NW Site that aligns with the north access for the SE Site, and at the intersection of **Wellington Road 19 / 3 Line**, under 2031 future conditions,. For the Site accesses on Wellington Road 19, the traffic signal warrant analysis was based on the Ontario Traffic Manual (OTM) Book 12 methodology (Justification 7), while for the four-legged existing (two-way stop control) intersection that currently exists, Justifications 1, 2 and 3 were used.

The results of the traffic signal warrant analysis are summarized in **Table 7** and **Table 8**, with the relevant excerpts and detailed analysis provided in **Appendix E**.

TABLE 7 TRAFFIC SIGNAL WARRANTS – WELLINGTON ROAD 19 / 3 LINE

Justification	Description	Required	Hour Ending								Percentage Compliance	
		1 Lane [Free Flow]	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00	Average	Sectional
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches	480	324	354	302	330	379	439	516	443	77%	19%
		100%	67%	74%	63%	69%	79%	80%	100%	80%		
	B. Vehicle volume, minor streets	120	25	25	18	19	24	30	21	21	19%	
		100%	21%	21%	15%	16%	20%	25%	18%	17%		
2. Delay to Cross Traffic	A. Vehicle volume, major street	480	329	329	284	311	355	409	495	423	75%	30%
		100%	69%	69%	59%	65%	74%	80%	100%	80%		
	B. Combined vehicle/pedestrian volume crossing artery from minor street	50	10	18	10	14	22	22	13	12	30%	
		100%	20%	36%	20%	28%	44%	44%	26%	24%		
Overall Compliance is 30% ²												

Notes:

1. Relevant OTM excerpts are provided in **Appendix E**.
2. Justification 3 cannot be applied here, since neither of the other justifications reaches 80% compliance.



TABLE 8 TRAFFIC SIGNAL WARRANTS – WELLINGTON ROAD 19 SITE ACCESSES

Justification	Description	Minimum Requirement 1 Lane Highways [Free Flow]		Compliance		
				Sectional		Entire % (≥150) ²
		Base	“T”	Actual Traffic Volumes	% of Required	
Wellington Road 19 / South Site Access						
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	480	231	48%	6%
	B ⁽¹⁾ . Vehicle volume, along minor streets (average hour)	120	180	11	6%	
2. Delay to Cross Traffic	A. Vehicle volume, major street (average hour)	480	480	220	46%	23%
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50 ⁵	50	11	23%	
Wellington Road 19 / North Site Access						
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	480	235	49%	17%
	B ⁽¹⁾ . Vehicle volume, along minor streets (average hour)	120	--	20	17%	
2. Delay to Cross Traffic	A. Vehicle volume, major street (average hour)	480	480	215	45%	18%
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50 ⁵	50	9	18%	

Notes:

- For “T” intersections, the base required values should be increased by 50% for case 1B.
- For future intersections, the warrant should be met with 150% (as opposed to 100% for an existing intersection with an 8-hour count estimate).
- Average hourly volumes were derived based on the formula presented in the OTM Book 12.
AHV = (weekday morning peak hour volumes + weekday afternoon peak hour volumes) ÷ 4
- Relevant OTM excerpts are provided in **Appendix E**.
- There is an error within the OTM excerpts (confirmed in discussions with MTO staff): the 50% increase due to “T” intersections only applies to Justification 1B.

Based on the above, under future total conditions in 2031, traffic signals are not warranted at the intersection of Wellington Road 19 & 3 Line or at either of the proposed Site accesses along Wellington Road 19.



6.0 SIGHT DISTANCE EVALUATION

6.1 WELLINGTON ROAD 19

Due to COVID, a comprehensive sight distance review was completed for the two proposed access points to the SE Site utilizing aerial photos. Sight distances were evaluated in accordance with Transportation Association of Canada (TAC) guidelines for both stopping sight distance and turning sight distance, using a conservative design speed of 100 km/h (20 km/h over the speed limit).

As shown in **Table 9**, all minimum required sight distances are met along Wellington Road 19 at the proposed SE Site access points. It is however important to note that the available sight distance is dependent on the right-of-way being kept clear of vertical obstructions up to the ditch line. Tree trimming may be required to maintain adequate sight distance, particularly at the north Site access.



TABLE 9 SIGHT DISTANCE (WELLINGTON ROAD 19 AT SITE ACCESS POINTS)

Movement	TAC Minimum Requirement (metres)	Available Sight Distance (metres)
Stopping Sight Distance (Design Speed of 100 km/h)		
South Site Access		
Left turn from Wellington Road 19 to South Site Access Road ¹	185	197
North Site Access		
Left turn from Wellington Road 19 to North Site Access Road ¹	185	430
New Golf Course Driveway (NW Site)		
Left turn from Wellington Road 19 to NW Site	185	270
Turning Sight Distance (Design Speed of 100 km/h)		
South Site Access		
Left-turn from South Site Access Road to Wellington Road 19 (stop condition) ²	210	720
Right-turn from South Site Access Road to Wellington Road 19 (stop condition) ³	185	217
North Site Access		
Left-turn from North Site Access Road to Wellington Road 19 (stop condition) ²	210	210
Right-turn from North Site Access Road to Wellington Road 19 (stop condition) ³	185	430
New Golf Course Driveway (NW Site)		
Left-turn from Golf Course Driveway to Wellington Road 19 (stop condition) ²	210	300
Right-turn from Golf Course Driveway to Wellington Road 19 (stop condition) ³	185	580

Notes:

1. Transportation Association of Canada (TAC) Manual, Table 2.5.2.
2. Transportation Association of Canada (TAC) Manual, Case B1; Table 9.9.4
3. Transportation Association of Canada (TAC) Manual, Case B2; Table 9.9.6

6.2 3 LINE

Due to COVID, a review of the aerial photos for the proposed access points to the SE Site on the 3rd Line was completed to confirm the sight distance. Sight distance at the 2 proposed access points is deemed to be more than adequate since 3 Line adjacent to the NW & SE Site vicinity has limited to no horizontal or vertical curvature.



7.0 EVALUATION FOR LEFT-TURN LANES ON WELLINGTON ROAD 19

As part of this report, a detailed evaluation for left-turn lanes on Wellington Road 19 at both proposed access points (north and south) for the SE Site was completed using the Ministry of Transportation Ontario (MTO) Geometric Design Standards for Ontario Highways.

Since the defacto posted speed limit on Wellington Road 19 is 80 km/h, to be conservative, the evaluation was completed for a design speed of 90 km/h as well as 100 km/h. The highest left-turning volume at the south access for the SE Site was estimated to be 5 vehicles and occurs during both the morning and afternoon peak period. The highest left-turning volume at the north access for the SE Site was estimated to be 15 vehicles and occurs during the afternoon peak period.

As shown in the detailed evaluation in **Appendix F**, left-turn lanes are not required on Wellington Road 19 at either access to the SE Site.



8.0 SUMMARY AND CONCLUSIONS

BA Group has been retained by 883890 Ontario Limited c/o Fergus Development Inc. to provide transportation consulting services related to a proposed residential re-development on a site municipally known as 8243 & 8282 Wellington Road 19, in the Township of Centre Wellington, in the County of Wellington. The existing golf course (the "Site") consists of two parcels; the northwest parcel ("NW Site"), situated on the north side of Wellington Road 19, and the southeast parcel ("SE Site"), situated on the south side of Wellington Road 19.

The proposed development includes the construction of 118 single-detached residential dwellings.

The proposed Site circulation and access includes a network of internal private roads (12 metre right-of-ways) with two full accesses along Wellington Road 19 and two full accesses along 3 Line. All access points to Wellington Road 19 and 3 Line will be unsignalized with stop control on the minor streets only. A new access for the NW Site is also proposed to align with the proposed north access to the SE Site on Wellington Road 19.

Key findings of the Transportation Considerations Report are summarized as follows:

Transportation Context

- The Site is adjacent to Wellington Road 19 and 3 Line. Wellington Road 19 is a Wellington County arterial road and 3 Line is a Wellington County local road.
- The Township of Centre Wellington does not currently operate a local public transit system and there are no plans at this time to establish transit service in the vicinity of the Site.
- In the vicinity of the Site, Wellington Road 19 includes paved shoulders for cyclists and there are future plans to extend the paved shoulders east of 3 Line.
- Just south of Wellington Route 19 there is an off-road "spine route" known as the Elora Cataract Trail, a 47 kilometer long trail between Elora and Forks of Credit Provincial Park. The trail is located along the southern edge of the SE Site, and crosses 2 Line, 150 metres southeast of Wellington Road 19.
- There is a pedestrian tunnel under Wellington Road 19 which provides connectivity between the SE Site and the NW Site



Traffic Operations Analysis

- The proposed development is forecast to generate 90 and 120 two-way residential vehicle trips in the weekday morning and afternoon peak hours, respectively.
- Since no information regarding existing traffic associated with the golf course on the NW Site was available, a conservative approach was adopted, wherein the estimated vehicle trips were added to the network to account for the new golf course entrance, and no traffic was removed.
- The Site anticipates in the order of 35 and 55 two-way golf club vehicle trips during the weekday morning and afternoon peak hours, respectively.
- All intersections in the study area, including the Site access points, are expected to operate under capacity under future total conditions.
- Based on a detailed analysis using the Ontario Traffic Manual Book 12, under future total conditions in 2031, traffic signals are not warranted at the intersection of Wellington Road 19 & 3 Line or at either of the proposed Site accesses along Wellington Road 19.

Sight Distance Assessment

- All minimum required Site distances are met along Wellington Road 19 at the proposed Site access points. It is however important to note that the available sight distance is dependent on the right-of-way being kept clear of vertical obstructions up to the ditch line. Tree trimming may be required to maintain adequate sight distance, particularly at the north Site access along Wellington Road 19.

Evaluation for Left-Turn Lanes

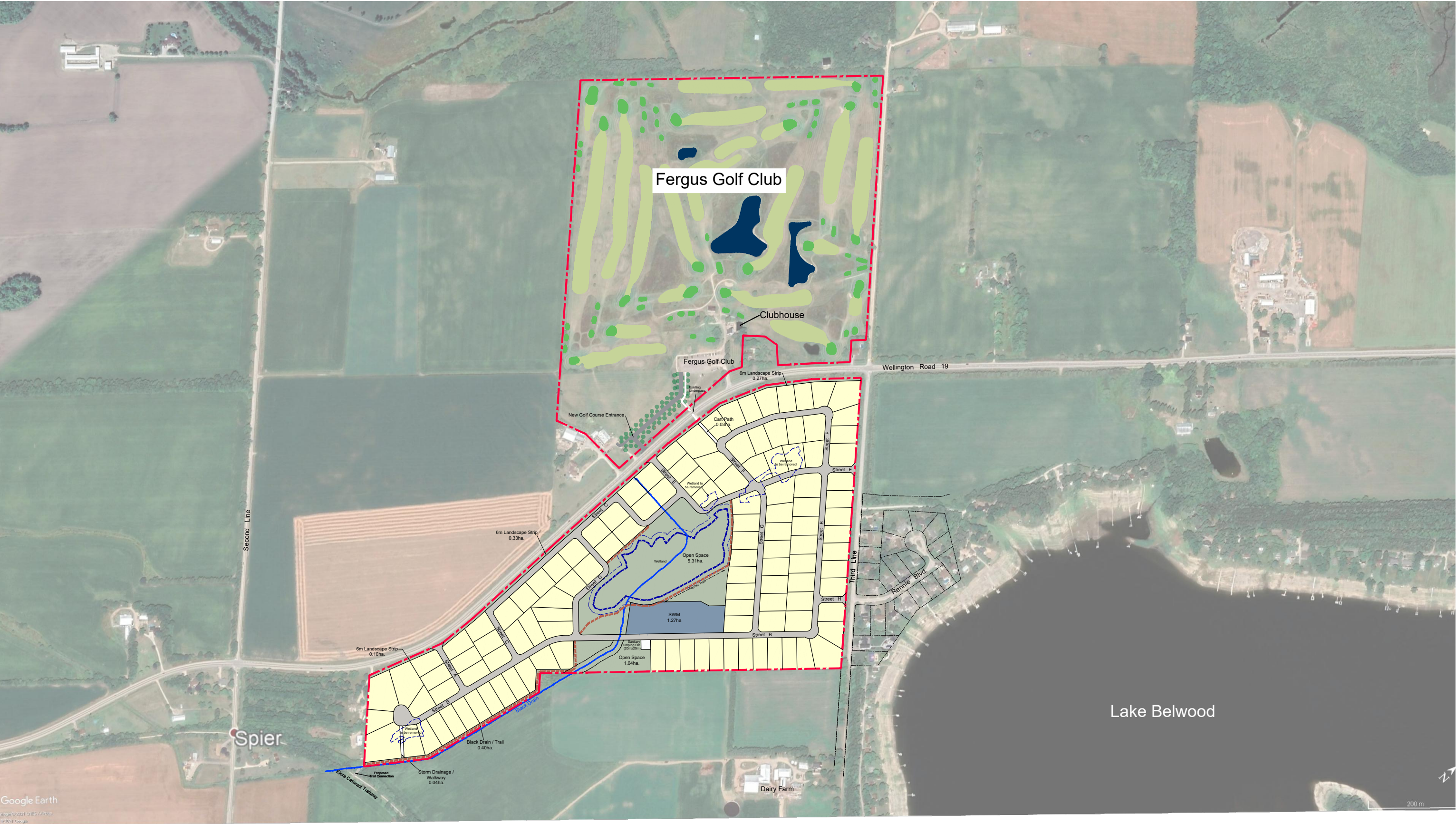
- The evaluation for a left-turn lane on Wellington Road 19 at both of the proposed accesses was completed for a design speed of 90 km/h as well as 100 km/h. The highest left-turning volume at the south access was estimated to be 5 vehicles and occurs during both the morning and afternoon peak period. The highest left-turning volume at the north access was estimated to be 15 vehicles and occurs during the afternoon peak period. The evaluation confirmed that left-turn lanes are not required on Wellington Road 19 at either access to the SE Site.

Based on the foregoing, the proposed development can be accommodated on the future transportation network.



Appendix A

Development Concept Plan



FERGUS GOLF COURSE DEVELOPMENT

- 1/2 Acre Residential Lots
- GRCA Wetland / OP Core Greenlands
- 10m Wetland Buffer
- Potential Trails

Site Area: 39.85ha. (98.5ac.)
No. of Lots: 118
Area of wetlands to be removed: 7,076sq.m.



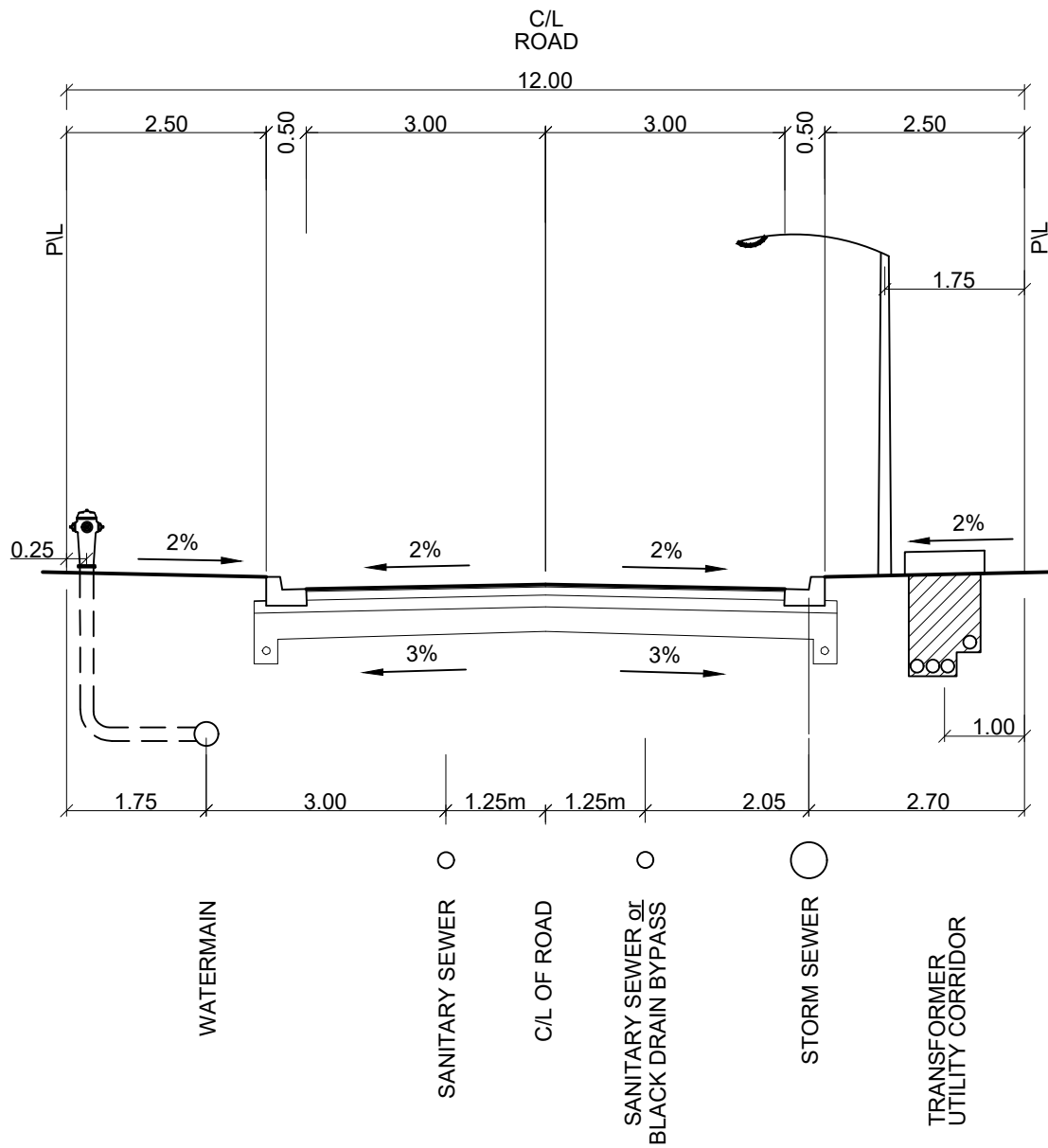
NOTE: This concept should be considered as a preliminary demonstration model that illustrates an 'order of magnitude' development scenario for the site. The number of lots are approximate and subject to more detailed design as well as municipal planning approvals.

Scale 1:7,500 | December 10, 2021 | Project No.: 21021 | Drawn By: SL



Appendix B

Internal Roads Cross-Section



FERGUS GOLF COURSE DEVELOPMENT
PROPOSED 12m LANE ROW CROSS SECTION

NTS



RJB 1.00

Appendix C

Turning Movement Counts



Turning Movement Count (1 . WELLINGTON COUNTY RD 19 & THIRD LINE)

Start Time	N Approach THIRD LINE						E Approach WELLINGTON COUNTY RD 19						S Approach THIRD LINE						W Approach WELLINGTON COUNTY RD 19						Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total		
00:00:00	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	1	3	
00:15:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	
00:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
00:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	5
01:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2	4
01:15:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4
01:30:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	5
01:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	5
02:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
02:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	3
02:30:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	2	3	5
02:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
03:00:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	5
03:15:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	2	3	7
03:30:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	1	3	7
03:45:00	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2	9
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04:15:00	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	11
04:30:00	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	3	0	0	0	3	6	14
04:45:00	0	0	0	0	0	0	0	7	0	0	0	7	0	0	0	0	0	0	0	5	0	0	0	5	12	24
05:00:00	0	0	0	0	0	0	0	6	0	0	0	6	1	0	0	0	0	1	0	0	0	0	0	0	7	28
05:15:00	0	0	0	0	0	0	0	15	0	0	0	15	0	0	0	0	0	0	0	4	0	0	0	4	19	44
05:30:00	1	0	0	0	0	1	0	15	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	16	54
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06:00:00	0	0	0	0	0	0	0	18	0	0	0	18	0	0	0	0	0	0	0	15	0	0	0	15	33	85
06:15:00	0	0	0	0	0	0	0	23	0	0	0	23	1	0	2	0	0	3	0	9	0	0	0	9	35	101
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07:30:00	0	0	0	0	0	0	0	43	0	0	0	43	0	0	4	0	0	4	0	20	0	0	0	20	67	193
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08:15:00	0	0	0	0	0	0	0	47	3	0	0	50	0	0	7	0	0	7	0	24	0	0	0	24	81	268
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09:30:00	0	0	0	0	0	0	0	18	0	0	2	18	1	0	0	0	0	1	1	12	0	0	0	13	32	204
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10:00:00	2	0	0	0	0	2	1	30	0	0	0	31	0	0	1	0	0	1	3	17	0	0	0	20	54	187
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10:30:00	0	0	0	0	0	0	0	32	0	0	0	32	1	0	2	0	0	3	1	17	0	0	0	18	53	208
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19:00:00	0	0	0	0	0	0	0	11	0	0	0	11	1	0	0	0	0	1	3	16	0	0	0	19	31	162
19:15:00	0	0	0	0	0	0	0	11	0	0	0	11	0	0	2	0	0	2	0	19	0	0	0	19	32	146
19:30:00	0	0	0	0	0	0	0	11	0	0	0	11	1	0	0	0	0	1	0	9	0	0	0	9	21	120
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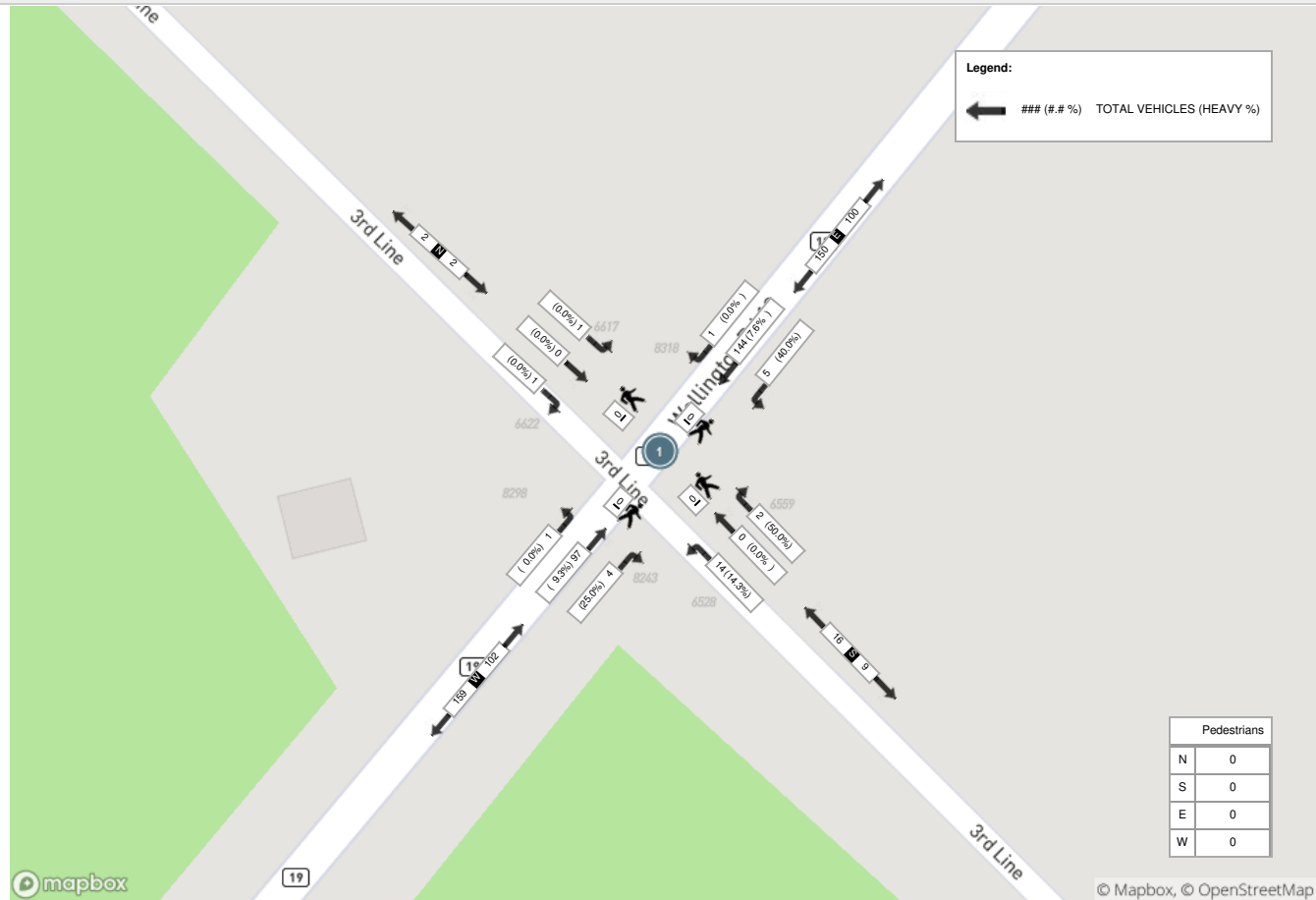
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23:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Grand Total	21	1	4	0	3	26	5	1670	29	0	6	1704	35	1	122	0	4	158	124	1633	20	3	2	1780	3668	-
Approach%	80.8%	3.8%	15.4%	0%	-	0.3%	98%	1.7%	0%	-	22.2%	0.6%	77.2%	0%	-	7%	91.7%	1.1%	0.2%	-	-	-	-	-	-	
Totals %	0.6%	0%	0.1%	0%	0.7%	0.1%	45.5%	0.8%	0%	46.5%	1%	0%	3.3%	0%	4.3%	3.4%	44.5%	0.5%	0.1%	48.5%	-	-	-	-	-	
Heavy	0	1	0	0	-	0	92	3	0	-	5	1	6	0	-	8	73	0	0	-	-	-	-	-	-	
Heavy %	0%	100%	0%	0%	-	0%	5.5%	10.3%	0%	-	14.3%	100%	4.9%	0%	-	6.5%	4.5%	0%	0%	-	-	-	-	-	-	
Bicycles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bicycle %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	



Selected Hour: 08:00 AM - 09:00 AM Weather:

Start Time	N Approach THIRD LINE						E Approach WELLINGTON COUNTY RD 19						S Approach THIRD LINE						W Approach WELLINGTON COUNTY RD 19						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
08:00:00	0	0	0	0	0	0	0	38	0	0	0	38	1	0	3	0	0	4	1	15	0	0	0	16	58
08:15:00	0	0	0	0	0	0	0	47	3	0	0	50	0	0	7	0	0	7	0	24	0	0	0	24	81
08:30:00	1	0	1	0	0	2	1	36	1	0	0	38	0	0	2	0	0	2	0	18	0	0	0	18	60
08:45:00	0	0	0	0	0	0	0	23	1	0	0	24	1	0	2	0	0	3	3	40	1	0	0	44	71
Grand Total	1	0	1	0	0	2	1	144	5	0	0	150	2	0	14	0	0	16	4	97	1	0	0	102	270
Approach%	50%	0%	50%	0%		-	0.7%	96%	3.3%	0%		-	12.5%	0%	87.5%	0%		-	3.9%	95.1%	1%	0%		-	-
Totals %	0.4%	0%	0.4%	0%		0.7%	0.4%	53.3%	1.9%	0%		55.6%	0.7%	0%	5.2%	0%		5.9%	1.5%	35.9%	0.4%	0%		37.8%	-
PHF	0.25	0	0.25	0		0.25	0.25	0.77	0.42	0		0.75	0.5	0	0.5	0		0.57	0.33	0.61	0.25	0		0.58	-
Heavy	0	0	0	0		0	0	11	2	0		13	1	0	2	0		3	1	9	0	0		10	-
Heavy %	0%	0%	0%	0%		0%	0%	7.6%	40%	0%		8.7%	50%	0%	14.3%	0%		18.8%	25%	9.3%	0%	0%		9.8%	-
Lights	1	0	1	0		2	1	133	3	0		137	1	0	12	0		13	3	88	1	0		92	-
Lights %	100%	0%	100%	0%		100%	100%	92.4%	60%	0%		91.3%	50%	0%	85.7%	0%		81.3%	75%	90.7%	100%	0%		90.2%	-
Single-Unit Trucks	0	0	0	0		0	0	6	0	0		6	1	0	0	0		1	1	5	0	0		6	-
Single-Unit Trucks %	0%	0%	0%	0%		0%	0%	4.2%	0%	0%		4%	50%	0%	0%	0%		6.3%	25%	5.2%	0%	0%		5.9%	-
Buses	0	0	0	0		0	0	5	2	0		7	0	0	2	0		2	0	3	0	0		3	-
Buses %	0%	0%	0%	0%		0%	0%	3.5%	40%	0%		4.7%	0%	0%	14.3%	0%		12.5%	0%	3.1%	0%	0%		2.9%	-
Articulated Trucks	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	1	0	0		1	-
Articulated Trucks %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	1%	0%	0%		1%	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-

Selected Hour: 08:00 AM - 09:00 AM Weather:

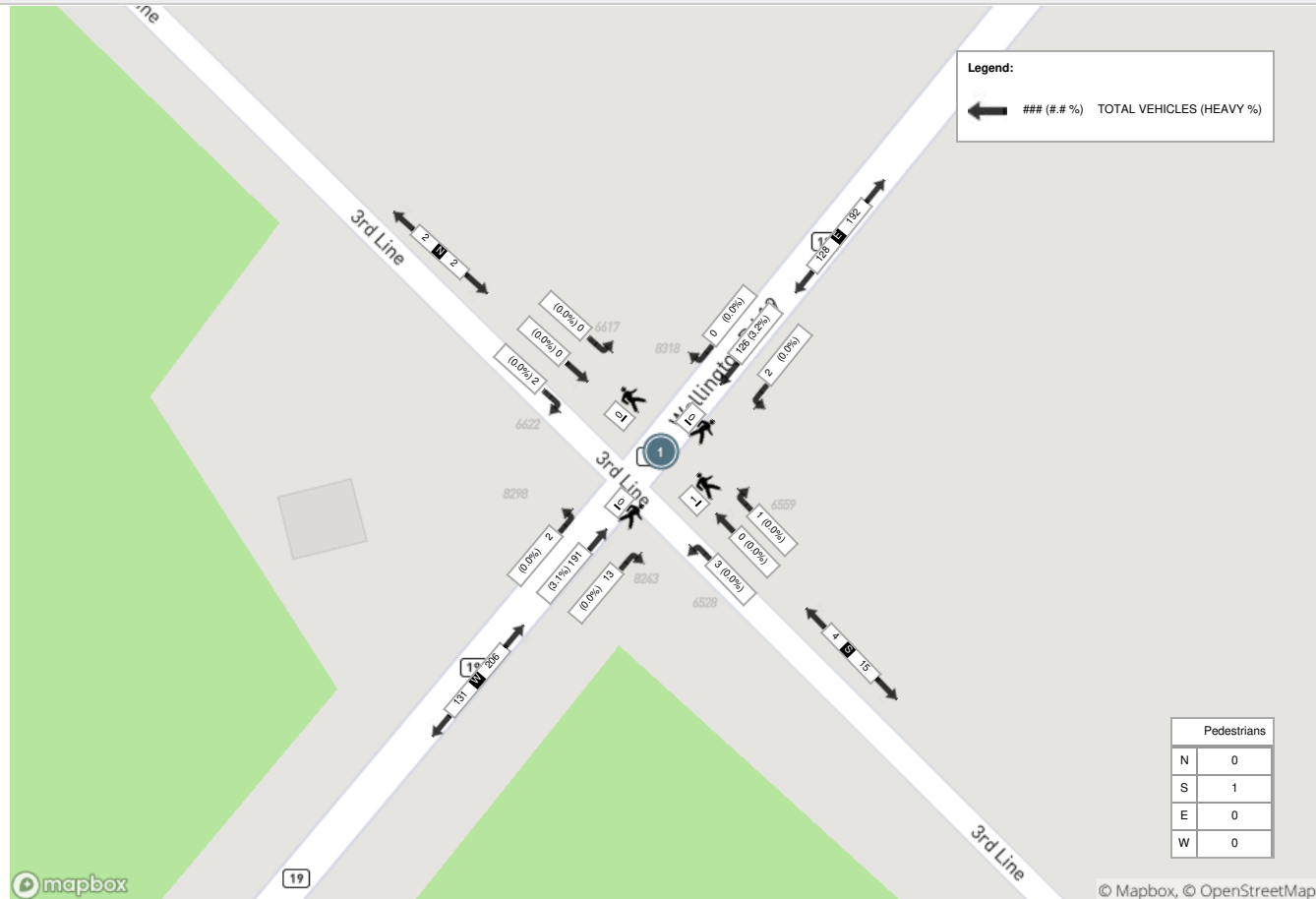




Selected Hour: 04:30 PM - 05:30 PM Weather:

Start Time	N Approach THIRD LINE						E Approach WELLINGTON COUNTY RD 19						S Approach THIRD LINE						W Approach WELLINGTON COUNTY RD 19						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
16:30:00	0	0	0	0	0	0	0	43	0	0	0	43	0	0	0	0	1	0	3	44	0	0	0	47	90
16:45:00	0	0	0	0	0	0	0	27	1	0	0	28	0	0	2	0	0	2	3	54	2	0	0	59	89
17:00:00	2	0	0	0	0	2	0	30	1	0	0	31	1	0	1	0	0	2	2	40	0	0	0	42	77
17:15:00	0	0	0	0	0	0	0	26	0	0	0	26	0	0	0	0	0	0	5	53	0	0	0	58	84
Grand Total	2	0	0	0	0	2	0	126	2	0	0	128	1	0	3	0	1	4	13	191	2	0	0	206	340
Approach%	100%	0%	0%	0%		-	0%	98.4%	1.6%	0%		-	25%	0%	75%	0%		-	6.3%	92.7%	1%	0%		-	-
Totals %	0.6%	0%	0%	0%		0.6%	0%	37.1%	0.6%	0%		37.6%	0.3%	0%	0.9%	0%		1.2%	3.8%	56.2%	0.6%	0%		60.6%	-
PHF	0.25	0	0	0		0.25	0	0.73	0.5	0		0.74	0.25	0	0.38	0		0.5	0.65	0.88	0.25	0		0.87	-
Heavy	0	0	0	0		0	0	4	0	0		4	0	0	0	0		0	0	6	0	0		6	-
Heavy %	0%	0%	0%	0%		0%	0%	3.2%	0%	0%		3.1%	0%	0%	0%	0%		0%	0%	3.1%	0%	0%		2.9%	-
Lights	2	0	0	0		2	0	122	2	0		124	1	0	3	0		4	13	185	2	0		200	-
Lights %	100%	0%	0%	0%		100%	0%	96.8%	100%	0%		96.9%	100%	0%	100%	0%		100%	100%	96.9%	100%	0%		97.1%	-
Single-Unit Trucks	0	0	0	0		0	0	1	0	0		1	0	0	0	0		0	0	1	0	0		1	-
Single-Unit Trucks %	0%	0%	0%	0%		0%	0%	0.8%	0%	0%		0.8%	0%	0%	0%	0%		0%	0%	0.5%	0%	0%		0.5%	-
Buses	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	-
Buses %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Articulated Trucks	0	0	0	0		0	0	3	0	0		3	0	0	0	0		0	0	5	0	0		5	-
Articulated Trucks %	0%	0%	0%	0%		0%	0%	2.4%	0%	0%		2.3%	0%	0%	0%	0%		0%	0%	2.6%	0%	0%		2.4%	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	1	-	-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	100%	-	-	-	-	-	0%	-	-	-

Selected Hour: 04:30 PM - 05:30 PM Weather:

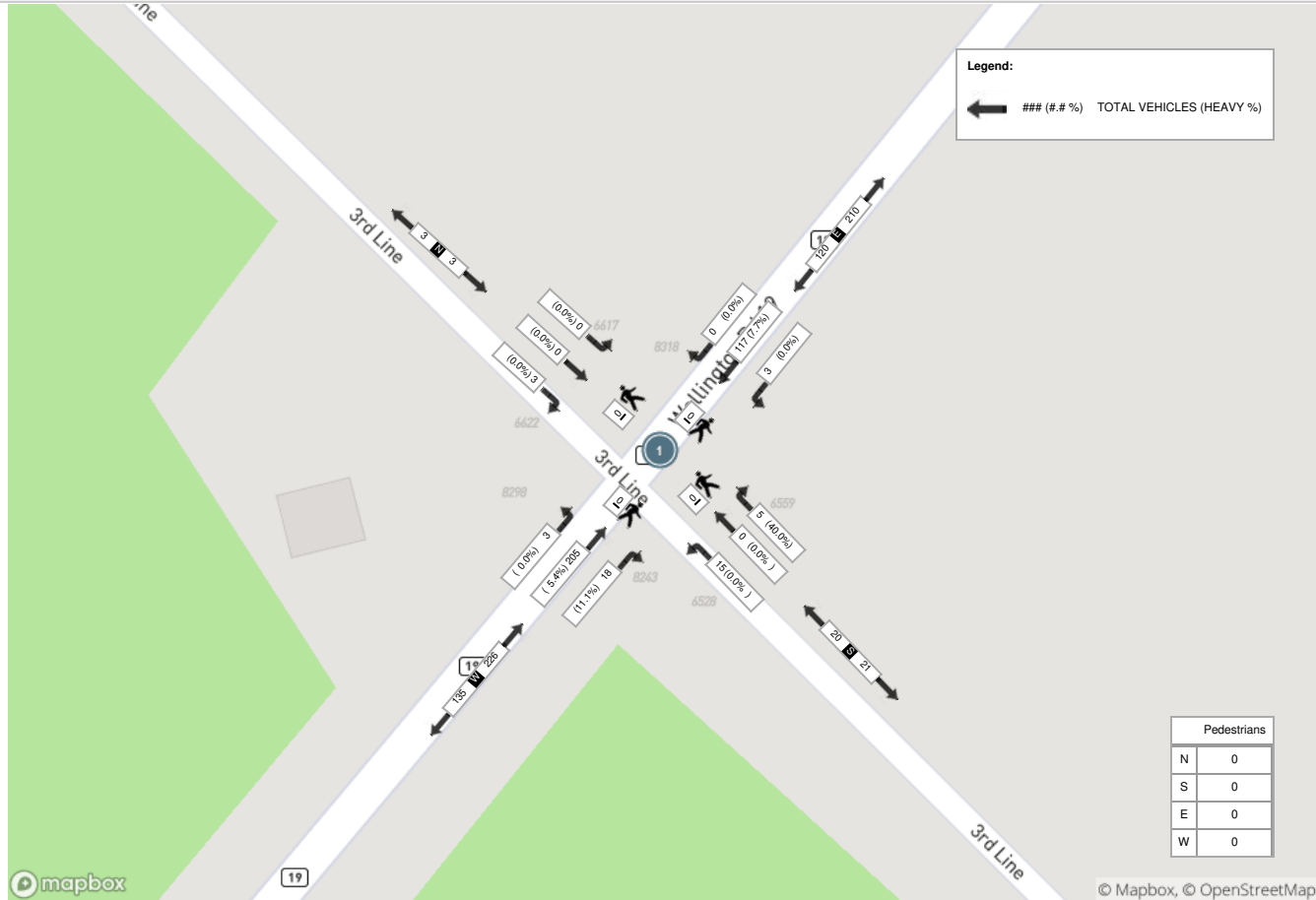




Peak Hour: 03:15 PM - 04:15 PM Weather:

Start Time	N Approach THIRD LINE						E Approach WELLINGTON COUNTY RD 19						S Approach THIRD LINE						W Approach WELLINGTON COUNTY RD 19						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
15:15:00	0	0	0	0	0	0	0	31	1	0	0	32	1	0	4	0	0	5	6	44	1	0	0	51	88
15:30:00	0	0	0	0	0	0	0	24	1	0	0	25	3	0	5	0	0	8	4	48	1	0	0	53	86
15:45:00	2	0	0	0	0	2	0	22	1	0	0	23	0	0	4	0	0	4	5	55	1	0	0	61	90
16:00:00	1	0	0	0	0	1	0	40	0	0	0	40	1	0	2	0	0	3	3	58	0	0	0	61	105
Grand Total	3	0	0	0	0	3	0	117	3	0	0	120	5	0	15	0	0	20	18	205	3	0	0	226	369
Approach%	100%	0%	0%	0%		-	0%	97.5%	2.5%	0%		-	25%	0%	75%	0%		-	8%	90.7%	1.3%	0%		-	-
Totals %	0.8%	0%	0%	0%		0.8%	0%	31.7%	0.8%	0%		32.5%	1.4%	0%	4.1%	0%		5.4%	4.9%	55.6%	0.8%	0%		61.2%	-
PHF	0.38	0	0	0		0.38	0	0.73	0.75	0		0.75	0.42	0	0.75	0		0.63	0.75	0.88	0.75	0		0.93	-
Heavy	0	0	0	0		0	0	9	0	0		9	2	0	0	0		2	2	11	0	0		13	-
Heavy %	0%	0%	0%	0%		0%	0%	7.7%	0%	0%		7.5%	40%	0%	0%	0%		10%	11.1%	5.4%	0%	0%		5.8%	-
Lights	3	0	0	0		3	0	108	3	0		111	3	0	15	0		18	16	194	3	0		213	-
Lights %	100%	0%	0%	0%		100%	0%	92.3%	100%	0%		92.5%	60%	0%	100%	0%		90%	88.9%	94.6%	100%	0%		94.2%	-
Single-Unit Trucks	0	0	0	0		0	0	4	0	0		4	0	0	0	0		0	0	2	0	0		2	-
Single-Unit Trucks %	0%	0%	0%	0%		0%	0%	3.4%	0%	0%		3.3%	0%	0%	0%	0%		0%	0%	1%	0%	0%		0.9%	-
Buses	0	0	0	0		0	0	1	0	0		1	2	0	0	0		2	2	7	0	0		9	-
Buses %	0%	0%	0%	0%		0%	0%	0.9%	0%	0%		0.8%	40%	0%	0%	0%		10%	11.1%	3.4%	0%	0%		4%	-
Articulated Trucks	0	0	0	0		0	0	4	0	0		4	0	0	0	0		0	0	2	0	0		2	-
Articulated Trucks %	0%	0%	0%	0%		0%	0%	3.4%	0%	0%		3.3%	0%	0%	0%	0%		0%	0%	1%	0%	0%		0.9%	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	0		-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	0%		-	-	-	-	-	0%	-	-

Peak Hour: 03:15 PM - 04:15 PM Weather:



Appendix D

Synchro Worksheets

HCM Unsignalized Intersection Capacity Analysis
4: 3 Line & Wellington Road 19

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	200	15	5	135	0	10	0	0	0	0	0
Future Volume (Veh/h)	5	200	15	5	135	0	10	0	0	0	0	0
Sign Control		Free			Free		Stop				Stop	
Grade		0%			0%		0%				0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	217	16	5	147	0	11	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	147			233			384	384	217	384	400	147
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	147			233			384	384	217	384	400	147
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			98	100	100	100	100	100
CM capacity (veh/h)	1435			1335			571	546	823	571	534	900
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	222	16	152	11	0							
Volume Left	5	0	5	11	0							
Volume Right	0	16	0	0	0							
cSH	1435	1700	1335	571	1700							
Volume to Capacity	0.00	0.01	0.00	0.02	0.00							
Queue Length 95th (m)	0.1	0.0	0.1	0.5	0.0							
Control Delay (s)	0.2	0.0	0.3	11.4	0.0							
Lane LOS	A	A	A	B	A							
Approach Delay (s)	0.2		0.3	11.4	0.0							
Approach LOS			B		A							
Intersection Summary												
Average Delay					0.5							
Intersection Capacity Utilization					22.5%						A	
Analysis Period (min)					15							

HCM Unsignalized Intersection Capacity Analysis
4: 3 Line & Wellington Road 19

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	95	5	5	145	0	15	0	0	15	0	5
Future Volume (Veh/h)	0	95	5	5	145	0	15	0	0	15	0	5
Sign Control		Free			Free		Stop				Stop	
Grade		0%			0%		0%				0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	103	5	5	158	0	16	0	0	16	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	158			108			276	271	103	271	276	158
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	158			108			276	271	103	271	276	158
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			98	100	100	98	100	99
CM capacity (veh/h)	1422			1483			671	633	952	680	629	887
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	103	5	163	16	21							
Volume Left	0	0	5	16	16							
Volume Right	0	5	0	0	5							
cSH	1422	1700	1483	671	720							
Volume to Capacity	0.00	0.00	0.00	0.02	0.03							
Queue Length 95th (m)	0.0	0.0	0.1	0.6	0.7							
Control Delay (s)	0.0	0.0	0.3	10.5	10.2							
Lane LOS			A	B	B							
Approach Delay (s)	0.0		0.3	10.5	10.2							
Approach LOS			B		B							
Intersection Summary												
Average Delay					1.4							
Intersection Capacity Utilization					24.6%						A	
Analysis Period (min)					15							

HCM Unsignalized Intersection Capacity Analysis
4: 3 Line & Wellington Road 19

2026 Future Background (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	220	15	5	150	0	10	0	0	0	0	0
Future Volume (Veh/h)	5	220	15	5	150	0	10	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	239	16	5	163	0	11	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	163			255			422	422	239	422	438	163
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	163			255			422	422	239	422	438	163
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			98	100	100	100	100	100
CM capacity (veh/h)	1416			1310			539	519	800	539	509	882
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	244	16	168	11	0							
Volume Left	5	0	5	11	0							
Volume Right	0	16	0	0	0							
cSH	1416	1700	1310	539	1700							
Volume to Capacity	0.00	0.01	0.00	0.02	0.00							
Queue Length 95th (m)	0.1	0.0	0.1	0.5	0.0							
Control Delay (s)	0.2	0.0	0.3	11.8	0.0							
Lane LOS	A	A	A	B	A							
Approach Delay (s)	0.2		0.3	11.8	0.0							
Approach LOS			B		A							
Intersection Summary												
Average Delay				0.5								
Intersection Capacity Utilization				23.6%							A	
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis
4: 3 Line & Wellington Road 19

2026 Future Background (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	105	5	5	160	0	15	0	0	15	0	5
Future Volume (Veh/h)	0	105	5	5	160	0	15	0	0	15	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	114	5	5	174	0	16	0	0	16	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	174			119			303	298	114	298	303	174
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	174			119			303	298	114	298	303	174
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			98	100	100	98	100	99
CM capacity (veh/h)	1403			1469			644	612	939	663	608	869
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	114	5	179	16	21							
Volume Left	0	0	5	16	16							
Volume Right	0	5	0	0	5							
cSH	1403	1700	1469	644	694							
Volume to Capacity	0.00	0.00	0.00	0.02	0.03							
Queue Length 95th (m)	0.0	0.0	0.1	0.6	0.7							
Control Delay (s)	0.0	0.0	0.2	10.7	10.4							
Lane LOS	A	A	B	B	B							
Approach Delay (s)	0.0		0.2	10.7	10.4							
Approach LOS			B		B							
Intersection Summary												
Average Delay				1.3							A	
Intersection Capacity Utilization				25.4%								
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

3. North Site Access/Golf Course Access & Wellington Road 19

2026 Future Total (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Volume (veh/h)	10	115	5	5	185	15	15	0	10	5	0	5
Future Volume (Veh/h)	10	115	5	5	185	15	15	0	10	5	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	125	5	5	201	16	16	0	11	5	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked	217			130			374	376	128	380	371	209
VC, conflicting volume												
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	217			130			374	376	128	380	371	209
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			97	100	99	99	100	99
CM capacity (veh/h)	1353			1455			575	548	923	566	552	831
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	141	222	27	10								
Volume Left	11	5	16	5								
Volume Right	5	16	11	5								
cSH	1353	1455	679	674								
Volume to Capacity	0.01	0.00	0.04	0.01								
Queue Length 95th (m)	0.2	0.1	1.0	0.4								
Control Delay (s)	0.7	0.2	10.5	10.4								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.7	0.2	10.5	10.4								
Approach LOS	B	B	B	B								
Intersection Summary												
Average Delay				1.3							A	
Intersection Capacity Utilization				21.9%								
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

2. South Site Access & Wellington Road 19

2026 Future Total (AM)

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	125	5	5	200	25	5
Future Volume (Veh/h)	125	5	5	200	25	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	136	5	5	217	27	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None			None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked				141	366	138
VC, conflicting volume						
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol				141	366	138
IC, single (s)				4.1	6.4	6.2
IC, 2 stage (s)						
p0 queue free %				100	96	99
CM capacity (veh/h)				1442	632	910
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	141	222	32			
Volume Left	0	5	27			
Volume Right	5	0	5			
cSH	1700	1442	664			
Volume to Capacity	0.08	0.00	0.05			
Queue Length 95th (m)	0.0	0.1	1.2			
Control Delay (s)	0.0	0.2	10.7			
Lane LOS	A	A	B			
Approach Delay (s)	0.0	0.2	10.7			
Approach LOS	B	B	B			
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			24.5%			A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 5: 3 Line & West Site Access

2026 Future Total (AM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR	
Lane Configurations	W			W	W		
Traffic Volume (veh/h)	5	0	0	20	10	5	
Future Volume (Veh/h)	5	0	0	20	10	5	
Sign Control	Stop	Free	Free	Free	Free	Free	
Grade	0%			0%	0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	5	0	0	22	11	5	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type				None	None		
Median storage (veh)							
Upstream signal (m)							
pX platoon unblocked							
VC, conflicting volume	36	14	16				
VC1, stage 1 conf vol							
VC2, stage 2 conf vol							
VCu, unblocked vol	36	14	16				
IC, single (s)	6.4	6.2	4.1				
IC, 2 stage (s)							
IF (s)	3.5	3.3	2.2				
p0 queue free %	99	100	100				
CM capacity (veh/h)	977	1067	1602				
Direction, Lane #	EB 1	NB 1	SB 1				
Volume Total	5	22	16				
Volume Left	5	0	0				
Volume Right	0	0	5				
cSH	977	1602	1700				
Volume to Capacity	0.01	0.00	0.01				
Queue Length 95th (m)	0.1	0.0	0.0				
Control Delay (s)	8.7	0.0	0.0				
Lane LOS	A						
Approach Delay (s)	8.7	0.0	0.0				
Approach LOS	A						
Intersection Summary							
Average Delay			1.0				
Intersection Capacity Utilization			13.3%				A
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis 4: 3 Line & Wellington Road 19

2026 Future Total (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		W	W	W	W	W		W	W	W	W	W
Traffic Volume (veh/h)	0	125	5	10	185	0	15	0	10	15	0	5
Future Volume (Veh/h)	0	125	5	10	185	0	15	0	10	15	0	5
Sign Control		Free	Free	Free	Free	Free		Stop		Stop		Stop
Grade		0%			0%			0%		0%		0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	136	5	11	201	0	16	0	11	16	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type					None							
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	201			141			364	359	136	370	364	201
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	201			141			364	359	136	370	364	201
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			97	100	99	97	100	99
CM capacity (veh/h)	1371			1442			585	563	913	576	560	840
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	136	5	212	27	21							
Volume Left	0	0	11	16	16							
Volume Right	0	5	0	11	5							
cSH	1371	1700	1442	685	623							
Volume to Capacity	0.00	0.00	0.01	0.04	0.03							
Queue Length 95th (m)	0.0	0.0	0.2	1.0	0.8							
Control Delay (s)	0.0	0.0	0.5	10.5	11.0							
Lane LOS			A	B	B							
Approach Delay (s)	0.0		0.5	10.5	11.0							
Approach LOS			B	B	B							
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			27.9%									A
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
2. South Site Access & Wellington Road 19

2026 Future Total (PM)

Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	EB	EB	WB	WB	NB	NB	
Traffic Volume (veh/h)	270	25	5	180	10	5	
Future Volume (Veh/h)	270	25	5	180	10	5	
Sign Control	Free	Free	Free	Free	Stop	Stop	
Grade	0%	0%	0%	0%	0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	283	27	5	196	11	5	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None						
Median storage (veh)							
Upstream signal (m)							
pX platoon unblocked							
VC, conflicting volume		320			512	306	
VC1, stage 1 conf vol							
VC2, stage 2 conf vol							
VCu, unblocked vol		320			512	306	
IC, single (s)		4.1			6.4	6.2	
IC, 2 stage (s)							
IF (s)		2.2			3.5	3.3	
p0 queue free %		100			98	99	
CM capacity (veh/h)		1240			519	733	
Direction, Lane #	EB 1	WB 1	NB 1				
Volume Total	320	201	16				
Volume Left	0	5	11				
Volume Right	27	0	5				
cSH	1700	1240	572				
Volume to Capacity	0.19	0.00	0.03				
Queue Length 95th (m)	0.0	0.1	0.7				
Control Delay (s)	0.0	0.2	11.5				
Lane LOS	A	B					
Approach Delay (s)	0.0	0.2	11.5				
Approach LOS		B					
Intersection Summary							
Average Delay		0.4					
Intersection Capacity Utilization		25.7%					
Analysis Period (min)		15					

HCM Unsignalized Intersection Capacity Analysis
6. 3 Line & East Site Access

2026 Future Total (AM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR	
Lane Configurations	EB	EB	NB	NB	SB	SB	
Traffic Volume (veh/h)	5	0	0	15	10	0	
Future Volume (Veh/h)	5	0	0	15	10	0	
Sign Control	Stop	Free	Free	Free	Free	Free	
Grade	0%	0%	0%	0%	0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	5	0	0	16	11	0	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type							
Median storage (veh)							
Upstream signal (m)							
pX platoon unblocked							
VC, conflicting volume		27	11	11			
VC1, stage 1 conf vol							
VC2, stage 2 conf vol							
VCu, unblocked vol		27	11	11			
IC, single (s)		6.4	6.2	4.1			
IC, 2 stage (s)							
IF (s)		3.5	3.3	2.2			
p0 queue free %		99	100	100			
CM capacity (veh/h)		988	1070	1608			
Direction, Lane #	EB 1	NB 1	SB 1				
Volume Total	5	16	11				
Volume Left	5	0	0				
Volume Right	0	0	0				
cSH	988	1608	1700				
Volume to Capacity	0.01	0.00	0.01				
Queue Length 95th (m)	0.1	0.0	0.0				
Control Delay (s)	8.7	0.0	0.0				
Lane LOS	A						
Approach Delay (s)	8.7	0.0	0.0				
Approach LOS		A					
Intersection Summary							
Average Delay			1.4				
Intersection Capacity Utilization			13.3%				
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

4: 3 Line & Wellington Road 19

2026 Future Total (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4	4	4	4			4			4	4
Traffic Volume (veh/h)	5	250	15	15	185	0	10	0	10	0	0	0
Future Volume (Veh/h)	5	250	15	15	185	0	10	0	10	0	0	0
Sign Control		Free		Free			Stop		Stop		Stop	
Grade		0%		0%			0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	272	16	16	201	0	11	0	11	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	201			288			515	515	272	526	531	201
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	201			288			515	515	272	526	531	201
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			98	100	99	100	100	100
CM capacity (veh/h)	1371			1274			464	456	767	450	447	840
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	277	16	217	22	0							
Volume Left	5	0	16	11	0							
Volume Right	0	16	0	11	0							
cSH	1371	1700	1274	579	1700							
Volume to Capacity	0.00	0.01	0.01	0.04	0.00							
Queue Length 95th (m)	0.1	0.0	0.3	0.9	0.0							
Control Delay (s)	0.2	0.0	0.7	11.5	0.0							
Lane LOS	A	A	B	A	A							
Approach Delay (s)	0.2	0.7	11.5	0.0								
Approach LOS			B	A								
Intersection Summary												
Average Delay			0.8									
Intersection Capacity Utilization			32.1%									
Analysis Period (min)			15									

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Synchro 11 Report

HCM Unsignalized Intersection Capacity Analysis

3: North Site Access/Golf Course Access & Wellington Road 19

2026 Future Total (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4	4	4	4			4			4	4
Traffic Volume (veh/h)	15	245	15	15	165	15	10	0	10	15	0	10
Future Volume (Veh/h)	15	245	15	15	165	15	10	0	10	15	0	10
Sign Control		Free		Free			Stop		Stop		Stop	
Grade		0%		0%			0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	266	16	16	179	16	11	0	11	16	0	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	195			282			536	533	274	536	533	187
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	195			282			536	533	274	536	533	187
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			98	100	99	96	100	99
CM capacity (veh/h)	1378			1280			441	442	765	441	442	855
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	298	211	22	27								
Volume Left	16	16	11	16								
Volume Right	16	16	11	11								
cSH	1378	1280	560	549								
Volume to Capacity	0.01	0.01	0.04	0.05								
Queue Length 95th (m)	0.3	0.3	1.0	1.2								
Control Delay (s)	0.5	0.7	11.7	11.9								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.5	0.7	11.7	11.9								
Approach LOS			B	B								
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			27.7%									
Analysis Period (min)			15									

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Synchro 11 Report

HCM Unsignalized Intersection Capacity Analysis
6: 3 Line & East Site Access

2026 Future Total (PM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			4	1	
Traffic Volume (veh/h)	5	0	5	10	20	5
Future Volume (Veh/h)	5	0	5	10	20	5
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	11	22	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
VC, conflicting volume	46	24	27			
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	46	24	27			
IC, single (s)	6.4	6.2	4.1			
IC, 2 stage (s)						
IF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
CM capacity (veh/h)	962	1052	1587			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	5	16	27			
Volume Left	5	5	0			
Volume Right	0	0	5			
cSH	962	1587	1700			
Volume to Capacity	0.01	0.00	0.02			
Queue Length 95th (m)	0.1	0.1	0.0			
Control Delay (s)	8.8	2.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.8	2.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			1.7			A
Intersection Capacity Utilization			15.0%			
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
5: 3 Line & West Site Access

2026 Future Total (PM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			4	1	
Traffic Volume (veh/h)	5	0	0	15	25	5
Future Volume (Veh/h)	5	0	0	15	25	5
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	0	16	27	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
VC, conflicting volume	46	30	32			
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	46	30	32			
IC, single (s)	6.4	6.2	4.1			
IC, 2 stage (s)						
IF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
CM capacity (veh/h)	965	1045	1580			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	5	16	32			
Volume Left	5	0	0			
Volume Right	0	0	5			
cSH	965	1580	1700			
Volume to Capacity	0.01	0.00	0.02			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.8	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	8.8	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.8			A
Intersection Capacity Utilization			13.3%			
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
4: 3 Line & Wellington Road 19

2031 Future Background (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	245	15	5	165	0	10	0	0	0	0	0
Future Volume (Veh/h)	5	245	15	5	165	0	10	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	266	16	5	179	0	11	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	179			282			465	465	266	465	481	179
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	179			282			465	465	266	465	481	179
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			98	100	100	100	100	100
CM capacity (veh/h)	1397			1280			505	491	773	505	481	864
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	271	16	184	11	0							
Volume Left	5	0	5	11	0							
Volume Right	0	16	0	0	0							
cSH	1397	1700	1280	505	1700							
Volume to Capacity	0.00	0.01	0.00	0.02	0.00							
Queue Length 95th (m)	0.1	0.0	0.1	0.5	0.0							
Control Delay (s)	0.2	0.0	0.2	12.3	0.0							
Lane LOS	A	A	A	B	A							
Approach Delay (s)	0.2		0.2	12.3	0.0							
Approach LOS			B		A							
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			25.1%									
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
4: 3 Line & Wellington Road 19

2031 Future Background (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	115	5	5	175	0	15	0	0	15	0	5
Future Volume (Veh/h)	0	115	5	5	175	0	15	0	0	15	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	125	5	5	190	0	16	0	0	16	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	190			130			330	325	125	325	330	190
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	190			130			330	325	125	325	330	190
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			97	100	100	97	100	99
CM capacity (veh/h)	1384			1455			618	591	926	626	587	852
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	125	5	195	16	21							
Volume Left	0	0	5	16	16							
Volume Right	0	5	0	0	5							
cSH	1384	1700	1455	618	669							
Volume to Capacity	0.00	0.00	0.00	0.03	0.03							
Queue Length 95th (m)	0.0	0.0	0.1	0.6	0.8							
Control Delay (s)	0.0	0.0	0.2	11.0	10.6							
Lane LOS	A	A	B	B	B							
Approach Delay (s)	0.0		0.2	11.0	10.6							
Approach LOS			B		B							
Intersection Summary												
Average Delay			1.2									
Intersection Capacity Utilization			26.2%									
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3. North Site Access/Golf Course Access & Wellington Road 19

2031 Future Total (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Volume (veh/h)	10	125	5	5	200	15	15	0	10	5	0	5
Future Volume (Veh/h)	10	125	5	5	200	15	15	0	10	5	0	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	136	5	5	217	16	16	0	11	5	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None										
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	233			141			400	404	138	406	398	225
VC1, stage 1 conf vol												
VC2, stage 2 conf vol	233			141			400	404	138	406	398	225
VCu, unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, single (s)												
IC, 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			97	100	99	99	100	99
CM capacity (veh/h)	1335			1442			552	530	910	543	533	814
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	152	238	27	10								
Volume Left	11	5	16	5								
Volume Right	5	16	11	5								
cSH	1335	1442	657	652								
Volume to Capacity	0.01	0.00	0.04	0.02								
Queue Length 95th (m)	0.2	0.1	1.0	0.4								
Control Delay (s)	0.6	0.2	10.7	10.6								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.6	0.2	10.7	10.6								
Approach LOS		B		B								
Intersection Summary												
Average Delay				1.3								
Intersection Capacity Utilization				22.8%								
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

2. South Site Access & Wellington Road 19

2031 Future Total (AM)

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Volume (veh/h)	135	5	5	215	25	5
Future Volume (Veh/h)	135	5	5	215	25	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	147	5	5	234	27	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None				None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
VC, conflicting volume			152		394	150
VC1, stage 1 conf vol						
VC2, stage 2 conf vol			152		394	150
VCu, unblocked vol			4.1		6.4	6.2
IC, single (s)						
IC, 2 stage (s)			2.2		3.5	3.3
p0 queue free %			100		96	99
CM capacity (veh/h)			1429		609	897
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	152	239	32			
Volume Left	0	5	27			
Volume Right	5	0	5			
cSH	1700	1429	641			
Volume to Capacity	0.09	0.00	0.05			
Queue Length 95th (m)	0.0	0.1	1.3			
Control Delay (s)	0.0	0.2	10.9			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	10.9			
Approach LOS		B				
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			25.3%			
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 5: 3 Line & West Site Access

2031 Future Total (AM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			W	W	
Traffic Volume (veh/h)	5	0	0	20	10	5
Future Volume (Veh/h)	5	0	0	20	10	5
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	0	22	11	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
VC, conflicting volume	36	14	16			
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	36	14	16			
IC, single (s)	6.4	6.2	4.1			
IC, 2 stage (s)						
IF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
CM capacity (veh/h)	977	1067	1602			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	5	22	16			
Volume Left	5	0	0			
Volume Right	0	0	5			
cSH	977	1602	1700			
Volume to Capacity	0.01	0.00	0.01			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.7	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	8.7	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			13.3%			A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 4: 3 Line & Wellington Road 19

2031 Future Total (AM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		W	W	W	W	W		W	W	W	W	W
Traffic Volume (veh/h)	0	135	5	10	200	0	15	0	10	15	0	5
Future Volume (Veh/h)	0	135	5	10	200	0	15	0	10	15	0	5
Sign Control		Free	Free	Free	Free	Free		Stop	Stop	Stop	Stop	Stop
Grade		0%			0%			0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	147	5	11	217	0	16	0	11	16	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	217			152			391	386	147	397	391	217
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	217			152			391	386	147	397	391	217
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			97	100	99	97	100	99
CM capacity (veh/h)	1353			1429			561	544	900	553	540	823
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	147	5	228	27	21							
Volume Left	0	0	11	16	16							
Volume Right	0	5	0	11	5							
cSH	1353	1700	1429	663	600							
Volume to Capacity	0.00	0.00	0.01	0.04	0.04							
Queue Length 95th (m)	0.0	0.0	0.2	1.0	0.9							
Control Delay (s)	0.0	0.0	0.4	10.7	11.2							
Lane LOS			A	B	B							
Approach Delay (s)	0.0		0.4	10.7	11.2							
Approach LOS			B	B	B							
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			28.7%								A	
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

HCM Unsignalized Intersection Capacity Analysis

4: 3 Line & Wellington Road 19

2031 Future Total (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4	4	4	4			4			4	4
Traffic Volume (veh/h)	5	275	15	15	200	0	10	0	10	0	0	0
Future Volume (Veh/h)	5	275	15	15	200	0	10	0	10	0	0	0
Sign Control		Free		Free			Stop		Stop		Stop	
Grade		0%		0%			0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	299	16	16	217	0	11	0	11	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	217			315			558	558	299	569	574	217
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	217			315			558	558	299	569	574	217
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			97	100	99	100	100	100
CM capacity (veh/h)	1353			1245			435	431	741	421	422	823
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total	304	16	233	22	0							
Volume Left	5	0	16	11	0							
Volume Right	0	16	0	11	0							
cSH	1353	1700	1245	548	1700							
Volume to Capacity	0.00	0.01	0.01	0.04	0.00							
Queue Length 95th (m)	0.1	0.0	0.3	1.0	0.0							
Control Delay (s)	0.2	0.0	0.7	11.8	0.0							
Lane LOS	A	A	B	A	A							
Approach Delay (s)	0.2	0.7	11.8	0.0								
Approach LOS			B	A								
Intersection Summary												
Average Delay				0.8								
Intersection Capacity Utilization				32.9%								
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

3: North Site Access/Golf Course Access & Wellington Road 19

2031 Future Total (PM)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4	4	4	4			4			4	4
Traffic Volume (veh/h)	15	270	15	15	180	15	10	0	10	15	0	10
Future Volume (Veh/h)	15	270	15	15	180	15	10	0	10	15	0	10
Sign Control		Free		Free			Stop		Stop		Stop	
Grade		0%		0%			0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	293	16	16	196	16	11	0	11	16	0	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (m)												
pX platoon unblocked												
VC, conflicting volume	212			309			580	577	301	580	577	204
VC1, stage 1 conf vol												
VC2, stage 2 conf vol												
VCu, unblocked vol	212			309			580	577	301	580	577	204
IC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC, 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			97	100	99	96	100	99
CM capacity (veh/h)	1358			1252			412	417	739	412	417	837
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	325	228	22	27								
Volume Left	16	16	11	16								
Volume Right	16	16	11	11								
cSH	1358	1252	529	519								
Volume to Capacity	0.01	0.01	0.04	0.05								
Queue Length 95th (m)	0.3	0.3	1.0	1.3								
Control Delay (s)	0.5	0.7	12.1	12.3								
Lane LOS	A	A	B	B								
Approach Delay (s)	0.5	0.7	12.1	12.3								
Approach LOS			B	B								
Intersection Summary												
Average Delay				1.5								
Intersection Capacity Utilization				29.2%								
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis
6: 3 Line & East Site Access

2031 Future Total (PM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			4	1	
Traffic Volume (veh/h)	5	0	5	10	20	5
Future Volume (Veh/h)	5	0	5	10	20	5
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	11	22	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
VC, conflicting volume	46	24	27			
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	46	24	27			
IC, single (s)	6.4	6.2	4.1			
IC, 2 stage (s)						
IF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
CM capacity (veh/h)	962	1052	1587			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	5	16	27			
Volume Left	5	5	0			
Volume Right	0	0	5			
cSH	962	1587	1700			
Volume to Capacity	0.01	0.00	0.02			
Queue Length 95th (m)	0.1	0.1	0.0			
Control Delay (s)	8.8	2.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.8	2.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			1.7			A
Intersection Capacity Utilization			15.0%			
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
5: 3 Line & West Site Access

2031 Future Total (PM)

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			4	1	
Traffic Volume (veh/h)	5	0	0	15	25	5
Future Volume (Veh/h)	5	0	0	15	25	5
Sign Control	Stop	Free	Free	Free	Free	Free
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	0	16	27	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX platoon unblocked						
VC, conflicting volume	46	30	32			
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol	46	30	32			
IC, single (s)	6.4	6.2	4.1			
IC, 2 stage (s)						
IF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
CM capacity (veh/h)	965	1045	1580			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	5	16	32			
Volume Left	5	0	0			
Volume Right	0	0	5			
cSH	965	1580	1700			
Volume to Capacity	0.01	0.00	0.02			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	8.8	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	8.8	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.8			A
Intersection Capacity Utilization			13.3%			
Analysis Period (min)			15			

Appendix E

Signal Warrant Excerpts and Analysis

4.4 Justification 1 – Minimum Vehicle Volume

Purpose

The Minimum Vehicle Volume Justification is intended for applications where the principal reason for installing a traffic signal is the cumulative delay produced by a large volume of intersecting traffic at an unsignalized intersection.

Justification 1A reflects the lowest total traffic on all approaches, and Justification 1B reflects the lowest volume on the minor road for which the average delay is similar for both signalized and unsignalized conditions. Therefore, this justification is intended to address the minimum volume conditions for which signalization can be used to minimize total average vehicle delay at the intersection.

As volumes increase beyond threshold criteria, delay to traffic on the minor road will increase, and the overall delay for the intersection will be greater than would be the case if minor delays were distributed between both main and minor roadways.

Standard

The need for a traffic signal must be considered if both Justification 1A and Justification 1B are 100% fulfilled.

If Justifications 1A and 1B do not reach or exceed 100%, but are at least 80% fulfilled, the lesser fulfilled of the Justifications 1A or 1B can be used in the assessment of Justification 3, the Combination Justification.

In applying Justification 1 (Minimum Vehicle Volume) for “T” intersections, the justification values for the minor street are increased by 50%. This approach reflects the reduction in traffic volumes due to the lack of one of the approaches.

Table 12 may be used for Justification 1: Minimum Vehicle Volume. Restricted Flow is applicable to Urban Conditions, while Free Flow is applicable to Rural conditions (see Section 4.2 for definitions).

Guidelines

Justification 1 evaluates total intersection volume and total minor road volume. The hours selected should represent the eight highest hours of the 24-hour traffic volume, and they do not have to be consecutive hours. Each one of the highest eight hours of the entering volumes is compared to the justification value. The justification should be met for each of the eight hours. “Sectional Percent” is calculated in Table 12 for reference purposes, and may indicate how close an intersection is to achieving full justification. “Total Across” is calculated by adding all 8-hour compliance percentages. The Compliance % figures used in Table 12 must not exceed 100%.

Table 12 – Justification 1 – Minimum Vehicle Volume

100% SATISFIED – YES ☐ NO ☐
 80% SATISFIED – YES ☐ NO ☐

		MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				PERCENTAGE WARRANT								
APPROACH LANES		1		2 or MORE		HOUR ENDING								
FLOW CONDITION		FREE FLOW ☐	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☐									TOTAL ACROSS
A. ALL APPROACH LANES		480 (385)	720 (575)	600 (480)	900 (720)									
		100% FULFILLED												
		80% FULFILLED												
		ACTUAL % IF BELOW 80% VALUE												
														TOTAL DOWN / 8 =
B. MINOR STREET BOTH APPROACHES		120* (95)*	170* (135)*	120* (95)*	170* (135)*									TOTAL ACROSS
		100% FULFILLED												
		80% FULFILLED												
		ACTUAL % IF BELOW 80% VALUE												
														TOTAL DOWN / 8 =

* For "T" intersections, these values should be increased by 50%.

4.5 Justification 2 – Delay to Cross Traffic

Purpose

The Delay to Cross Traffic Justification is intended for applications where the traffic volume on the main road is so heavy that traffic on the minor road suffers excessive delay or hazard in entering or crossing the main road.

Standard

The need for a traffic signal must be considered if both Justification 2A and Justification 2B are 100% fulfilled. If Justifications 2A or 2B do not meet or exceed 100%, but both are at least 80% fulfilled, the lesser fulfilled of the justifications 2A or 2B can be used in the assessment of Justification 3, the Combination Justification.

Table 13 may be used for Justification 2: Delay to Cross Traffic. Restricted Flow is applicable to Urban Conditions, while Free Flow is applicable to Rural Conditions (see Section 4.2 for definitions).

Table 13 – Justification 2 – Delay to Cross Traffic100% SATISFIED – YES ☐ NO ☐80% SATISFIED – YES ☐ NO ☐

APPROACH LANES	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				PERCENTAGE WARRANT								TOTAL ACROSS
	1		2 or MORE		HOUR ENDING								
FLOW CONDITION	FREE FLOW ☐	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☐									
A. MAJOR STREET BOTH APPROACHES	480 (385)	720 (575)	600 (480)	900 (720)									
	100% FULFILLED												
	80% FULFILLED												
	ACTUAL % IF BELOW 80% VALUE												
TOTAL DOWN / 8 =													
B. TRAFFIC CROSSING MAJOR STREET	50 (40)	75 (60)	50 (40)	75 (60)									
	100% FULFILLED												
	80% FULFILLED												
	ACTUAL % IF BELOW 80% VALUE												
TOTAL DOWN / 8 =													

Guidelines

Justification 2 evaluates major road volume and minor road movements that cross the intersection. The hours selected should represent the eight highest hours of the 24-hour traffic volume, and they do not have to be consecutive hours. The entering volumes of each of the highest eight hours are compared to the justification value. The justification is met if the justification value is 100% and fulfilled by each of the eight hours.

“Sectional Percent” is calculated in Table 13 for reference purposes, and may indicate how close an intersection is to achieving full justification. “Total Across” is calculated by adding all 8-hour compliance percentages. The Compliance % figures used in Table 13 must not exceed 100%.

As right turns are not considered as traffic crossing a road, they should be deleted from the combined pedestrian and vehicle volume in the Delay to Cross Traffic Justification. In one-way street systems, left turns from a one-way street into another one-way

street should be treated in a similar manner to right turns, and be deleted from the justification.

When applying Justification 2B, the crossing volume consists of the sum of:

1. The number of pedestrians crossing the main road
2. Total left turns from both the side road approaches
3. The highest through volume from one of the side road approaches
4. Fifty percent of the heavier left-turn traffic movement from the main road when both of the following criteria are met:
 - a) The left-turn volume is greater than 120 vehicles per hour
 - b) The total of the heavier left-turn volume plus its opposing volume is greater than 720 vehicles per hour

- e) Pedestrian Grade Separations In cases of very heavy pedestrian and traffic volumes, it may be economically viable to construct pedestrian bridges or tunnels.
4. The priority placed on implementing a new pedestrian crossing device should reflect the proximity and convenience of existing crossings; a higher priority should be placed on crossings where no reasonable alternatives exist within walking distance.

4.10 Justification 7 – Projected Volumes

In some cases, it is desired to determine the future need for traffic signals at an existing or planned intersection. There are two basic scenarios. The first is that the intersection may exist and all that is changing is the addition of one or more developments which will add traffic to the intersection. The second is a development which will require, or be associated with, the construction of one or more new legs at an existing intersection or a completely new intersection or roadway.

The prediction of future traffic demands is based on knowledge of growth in roadway usage, growth of local traffic generators and predicted traffic volumes, obtained from a traffic

impact study, transportation planning study, environmental assessment or other similar evaluation. The preferred approach is that eight-hour volume projections are estimated as part of the engineering study and evaluated against Justifications 1, 2 or 3. It is incumbent upon the road authority to ensure that the calculation methodology is sound and is based on good data, so that there is a high level of confidence in the predicted traffic volumes.

For future development, especially where the intersection or road may not exist, eight-hour volumes may be difficult to obtain or predict with the necessary accuracy. If eight-hour volumes are unavailable or not considered to be of sufficient accuracy, Peak Hour Volumes (PHV) may be estimated as part of the transportation studies and reduced to Average Hourly Volumes (AHV) for comparison with traffic signal justifications for projected volumes.

Table 21 – Justification 7 – Projected Volumes

Justification	Description	Minimum Requirement 1 Lane Highways		Minimum Requirement 2 or more lanes		Compliance		
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Sectional		Entire %
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900			
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170			
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	480	720	600	900			
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170			

*Note: For "T" intersections, these values should be increased by 50%.

The Average Hourly Volume for a typical day can be estimated from the Peak Hour Volumes using the following relationships:

$$AHV = \frac{PHV}{2} \text{ or } AHV = \frac{amPHV + pmPHV}{4}$$

Alternately, the Average Hourly Volume for the eight highest hours of an average day can be estimated from Annual Average Daily Traffic (AADT) volume using the following relationship:

$$AHV = \frac{AADT}{16}$$

Where:

AHV = Average hourly volume

AADT = Annual average daily traffic

Analysis Using Eight-hour Volumes

If eight-hour projections are available, Justifications 1, 2 or 3 should be used. For the situation of an existing intersection with new development, Justifications 1 or 2 need to be met to 100%, or Justification 3 needs to be met to 80%.

For developments where new intersections or roadways are to be built, there is more uncertainty in the volume projections as the estimate requires projections of background traffic as well as development traffic. For this reason, where new intersection or roadway construction is required, Justifications 1 or 2 must be met to 120%.

Analysis Using Average Hour Volume

In the case that the volume estimates are based on the expansion of peak hour volumes or average daily traffic, the effect on Justifications 1 or 2 of the requirement to meet the warrant for each of eight hours would be lessened by averaging. As well, increased uncertainty is introduced by estimating from as little as one hour of traffic volume. For this reason, the thresholds are raised and, for traffic signals to be considered, Justification 7 as per Table 21 is used but with a 20% increase over the required volumes for an existing intersection and a 50% increase for a future intersection or roadway. For example, under restricted flow and two lanes, the AHV for Part 1A of Justification 7 must be met to $900 \times 1.20 = 1080$ vph.

Note that future volumes may include side street traffic attracted to the new traffic signal since the signal may provide a significant reduction in delay.

Table 22 – Future Development: Volume Expansion Required to Meet Justifications

Roadway Condition	Full Eight-hour Count Estimate Available		AHV Only Available
	Justification 1 or 2	Justification 3	Justification 7
Both Intersecting Roads Exist; Development is Future	100%	80%	120%
One Road, Both Roads and/or Intersection are Future; Development is Future	120%	N/A	150%

Project No.	6860-39
Intersection	Wellington Road 19 / 3 Line

ITE 210 - Single-Family Detached Housing Temporal Variation

Time Ending	% of daily total	% of daily peak hour
8:00	6.7	100%
9:00	6.2	93%
12:00	5.2	78%
13:00	5.5	61%
14:00	6	67%
16:00	7.2	80%
17:00	9	100%
18:00	8.8	98%

Temporal Variation

[illegible]

Existing Volumes

Time Ending	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	
8:00	5	0	0	0	0	1	0	61	2	0	136	0	
9:00	12	0	1	1	0	1	1	88	3	3	133	1	AM Peak
12:00	5	0	2	0	0	3	2	102	5	4	87	0	
13:00	9	0	2	0	0	2	5	103	10	0	99	2	
14:00	17	0	0	0	0	0	0	101	12	3	139	0	
16:00	17	0	3	0	0	2	3	174	13	3	96	0	
17:00	8	0	2	0	0	1	3	197	13	3	129	0	PM Peak
18:00	7	0	2	0	0	2	0	164	10	1	100	1	

2031 Corridor Growth Volumes

Time Ending	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	
8:00	0	0	0	0	0	0	0	22	0	0	32	0	
9:00	0	0	0	0	0	0	0	20	0	0	30	0	AM Peak
12:00	0	0	0	0	0	0	0	17	0	0	25	0	
13:00	0	0	0	0	0	0	0	28	0	0	18	0	
14:00	0	0	0	0	0	0	0	30	0	0	20	0	
16:00	0	0	0	0	0	0	0	36	0	0	24	0	
17:00	0	0	0	0	0	0	0	45	0	0	30	0	PM Peak
18:00	0	0	0	0	0	0	0	44	0	0	29	0	

Site Traffic

Time Ending	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
8:00	0	0	11	0	0	0	0	22	0	5	27	0
9:00	0	0	10	0	0	0	0	20	0	5	25	0
12:00	0	0	8	0	0	0	0	17	0	4	21	0
13:00	0	0	6	0	0	0	0	18	0	6	21	0
14:00	0	0	7	0	0	0	0	20	0	7	23	0
16:00	0	0	8	0	0	0	0	24	0	8	28	0
17:00	0	0	10	0	0	0	0	30	0	10	35	0
18:00	0	0	10	0	0	0	0	29	0	10	34	0

2031 Future Total

Time Ending	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR				
8:00	5	0	11	0	0	1	0	104	2	5	195	0	324	25	329	1
9:00	12	0	11	1	0	1	1	128	3	8	188	1	354	25	329	1
12:00	5	0	10	0	0	3	2	136	5	8	133	0	302	18	284	1
13:00	9	0	8	0	0	2	5	149	10	6	139	2	330	19	311	1
14:00	17	0	7	0	0	0	0	151	12	10	182	0	379	24	355	2
16:00	17	0	11	0	0	2	3	234	13	11	148	0	439	30	409	2
17:00	8	0	12	0	0	1	3	272	13	13	194	0	516	21	495	1
18:00	7	0	12	0	0	2	0	237	10	11	164	1	443	21	423	1

8-Hour Volume

Future Total (2031)		
Time Ending	Major	Minor
8:00	307	17
9:00	329	25
12:00	284	18
13:00	311	19
14:00	355	24
16:00	409	30
17:00	495	21
18:00	423	21
Total	2912	175

TRAFFIC SIGNAL WARRANTS - OTM Book 12, Justifications 1 & 2

		FUTURE									
Justification	Requirement									Averag	Percent
	1 lane Free Flow	8:00	9:00	12:00	Hour Ending		16:00	17:00	18:00		
1. Min Vehicle Volumes											
A. Vehicle volumes all approaches	480	324	354	302	330	379	439	516	443		
	Score	67%	74%	63%	69%	79%	91%	108%	92%		
		67	74	63	69	79	80	100	80	77	
B. Vehicle volumes, minor streets	120	25	25	18	19	24	30	21	21	19%	
	Score	21%	21%	15%	16%	20%	25%	18%	17%		
		21	21	15	16	20	25	18	17	19	
2. Delay to Cross Traffic											
A. Vehicle volumes, major street	480	329	329	284	311	355	409	495	423		
	Score	69%	69%	59%	65%	74%	85%	103%	88%		
		69	69	59	65	74	80	100	80	75	
B. Combined vehicle+ped minor street	50	10	18	10	14	22	22	13	12	30%	
	score	20%	36%	20%	28%	44%	44%	26%	24%		
		20	36	20	28	44	44	26	24	30	

OVERALL WARRANT FOR TRAFFIC SIGNAL IS 30%

OTM BOOK 12 - JUSTIFICATION 7 - Wellington Road 19 / South Site Access

STEP 1

	All Approaches	Minor Streets	Major Street	Combined Vehicle and Pedestrian Crossing Artery from Minor Streets	
amPHV	390	30	360	30	(25+5) Lefts + peds
pmPHV	535	15	520	15	(10+5) Lefts + peds
AHV	231	11	220	11	AHV = (amPHV+pmPHV)/4
		1B	2A	2B	

STEP 2

JUSTIFICATION 7

Justification	Description			Minimum Requirement 1 Lane Highways		Compliance		
		Free Flow	Restr. Flow	Restr. Flow	Free Flow	Sectional		ENTIRE
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	Does not apply.			480	231	48%	6%
	B. Vehicle volume, along minor streets (average hour)				180	11	6%	
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)				480	220	46%	23%
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)				50	11	23%	

*Note: For "T" intersections, 1B values should be increased by 50%. (The intersection is a "T" configuration thus values are increased in the above table.)

Analysis Using Average Hour Volume

For traffic signals to be considered, Justification 7 as per Table 21 is used but with a 20% increase over the required volumes for an existing intersection and a 50% increase for a future intersection or roadway.

Result: 23%
Required: 150%
NOT
WARRANTED

OTM BOOK 12 - JUSTIFICATION 7 - Wellington Road 19 / North Site Access

STEP 1

	All Approaches	Minor Streets	Major Street	Combined Vehicle and Pedestrian Crossing Artery from Minor Streets	
amPHV	385	35	350	20	(15+5) Lefts + peds
pmPHV	555	45	510	15	(10+5) Lefts + peds
AHV	235	20	215	9	AHV = (amPHV+pmPHV)/4
		1B	2A	2B	

STEP 2

JUSTIFICATION 7

Justification	Description			Minimum Requirement 1 Lane Highways		Compliance		
		Free Flow	Restr. Flow	Restr. Flow	Free Flow	Sectional		ENTIRE
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	Does not apply.			480	Numerical	%	17%
	B. Vehicle volume, along minor streets (average hour)				120	20	17%	
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)				480	215	45%	18%
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)				50	9	18%	

*Note: For “T” intersections, 1B values should be increased by 50%. (The intersection is a "T" configuration thus values are increased in the above table.)

Analysis Using Average Hour Volume

For traffic signals to be considered, Justification 7 as per Table 21 is used but with a 20% increase over the required volumes for an existing intersection and a 50% increase for a future intersection or roadway.

Result:	18%
Required:	150%
	NOT WARRANTED

Appendix F

Left-Turn Lane Analysis

Left-Turn Lane Warrant Analysis

Speed Limit (unposted) = 80 km/h

Design Speed = 100 km/h

AM Peak Period

South Access:

Existing Thru Traffic Volume: $V_T = 210$

Opposing Traffic Volume: $V_O = 130$

Left Turn Traffic Volume: $V_L = 5$

$$\text{Advancing Traffic Volume } V_A = V_T + V_L$$

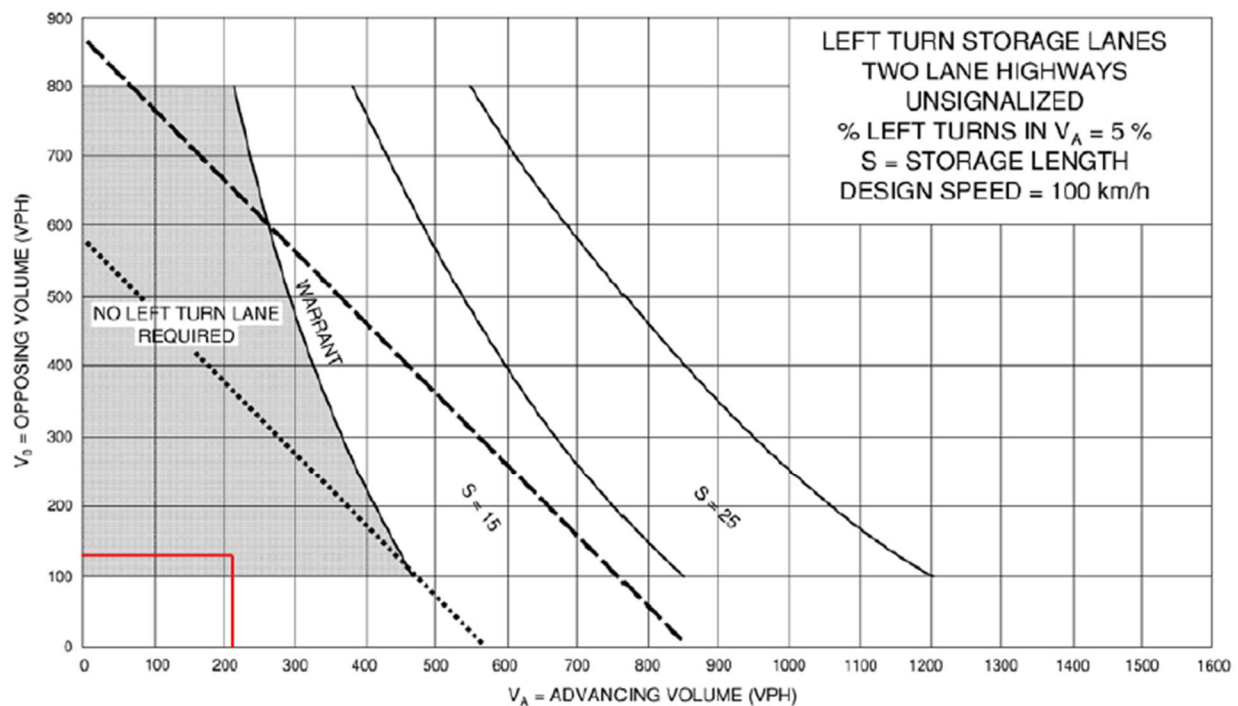
$$\text{Advancing Traffic Volume } V_A = 210 + 5$$

$$\text{Advancing Traffic Volume } V_A = 215$$

$$\text{Percentage of Left Turning Traffic} = \frac{V_L}{V_A} \times 100$$

$$\text{Percentage of Left Turning Traffic} = \frac{5}{215} \times 100$$

$$\text{Percentage of Left Turning Traffic} = 2.3\%$$



North Access:

Northbound Left

Existing Thru Traffic Volume: $V_T = 125$

Opposing Traffic Volume: $V_O = 205$

Left Turn Traffic Volume: $V_L = 10$

Advancing Traffic Volume $V_A = V_T + V_L$

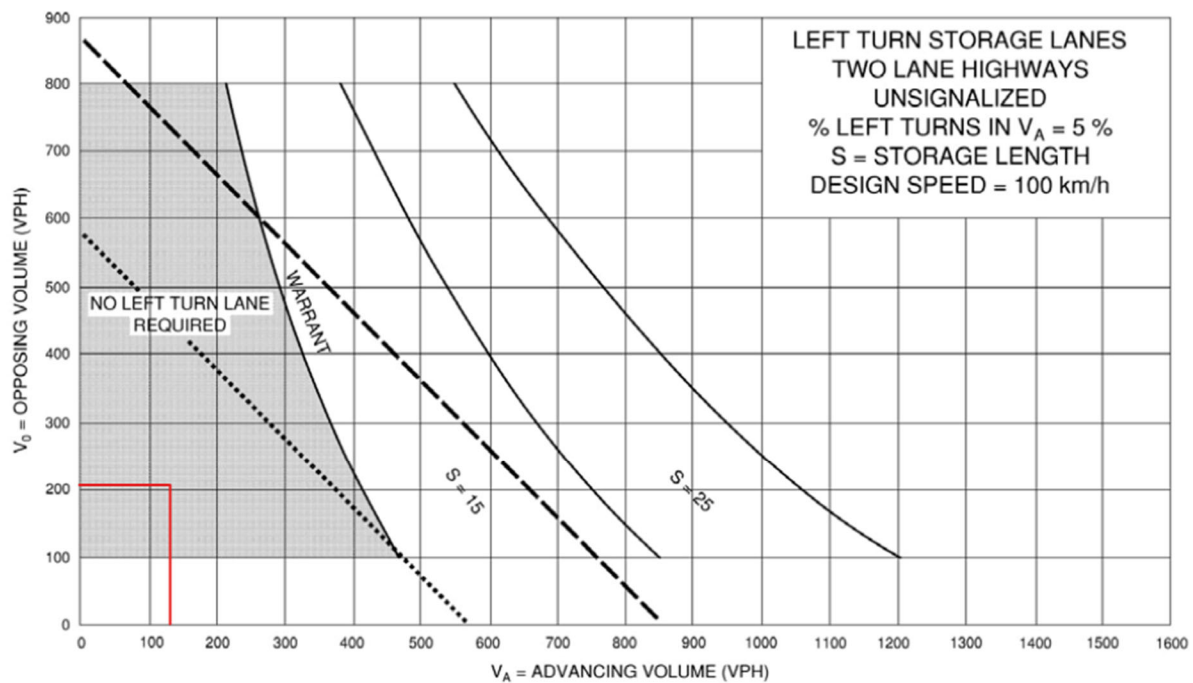
Advancing Traffic Volume $V_A = 125 + 10$

Advancing Traffic Volume $V_A = 135$

Percentage of Left Turning Traffic = $\frac{V_L}{V_A} \times 100$

Percentage of Left Turning Traffic = $\frac{10}{135} \times 100$

Percentage of Left Turning Traffic = 7.4%



Southbound Left

Existing Thru Traffic Volume: $V_T = 200$

Opposing Traffic Volume: $V_O = 140$

Left Turn Traffic Volume: $V_L = 5$

$$\text{Advancing Traffic Volume } V_A = V_T + V_L$$

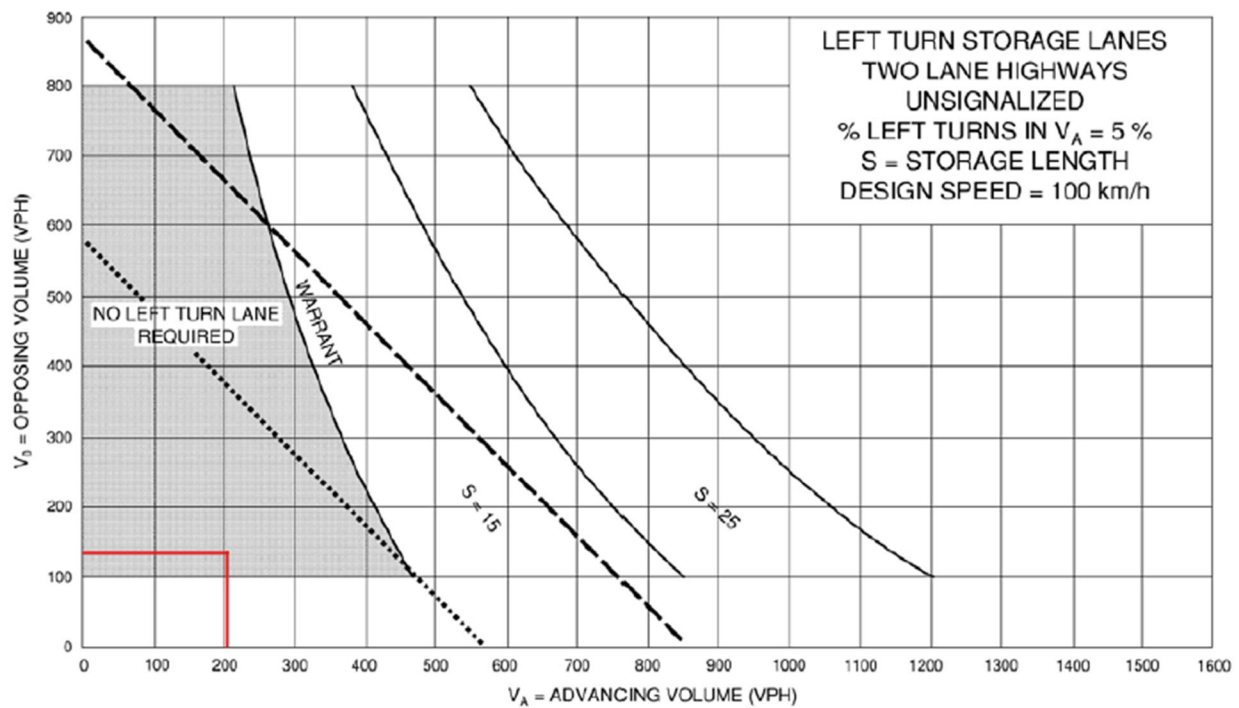
$$\text{Advancing Traffic Volume } V_A = 200 + 5$$

$$\text{Advancing Traffic Volume } V_A = 205$$

$$\text{Percentage of Left Turning Traffic} = \frac{V_L}{V_A} \times 100$$

$$\text{Percentage of Left Turning Traffic} = \frac{5}{205} \times 100$$

$$\text{Percentage of Left Turning Traffic} = 2.4\%$$



PM Peak Period

South Access:

Existing Thru Traffic Volume: $V_T = 185$

Opposing Traffic Volume: $V_O = 310$

Left Turn Traffic Volume: $V_L = 5$

Advancing Traffic Volume $V_A = V_T + V_L$

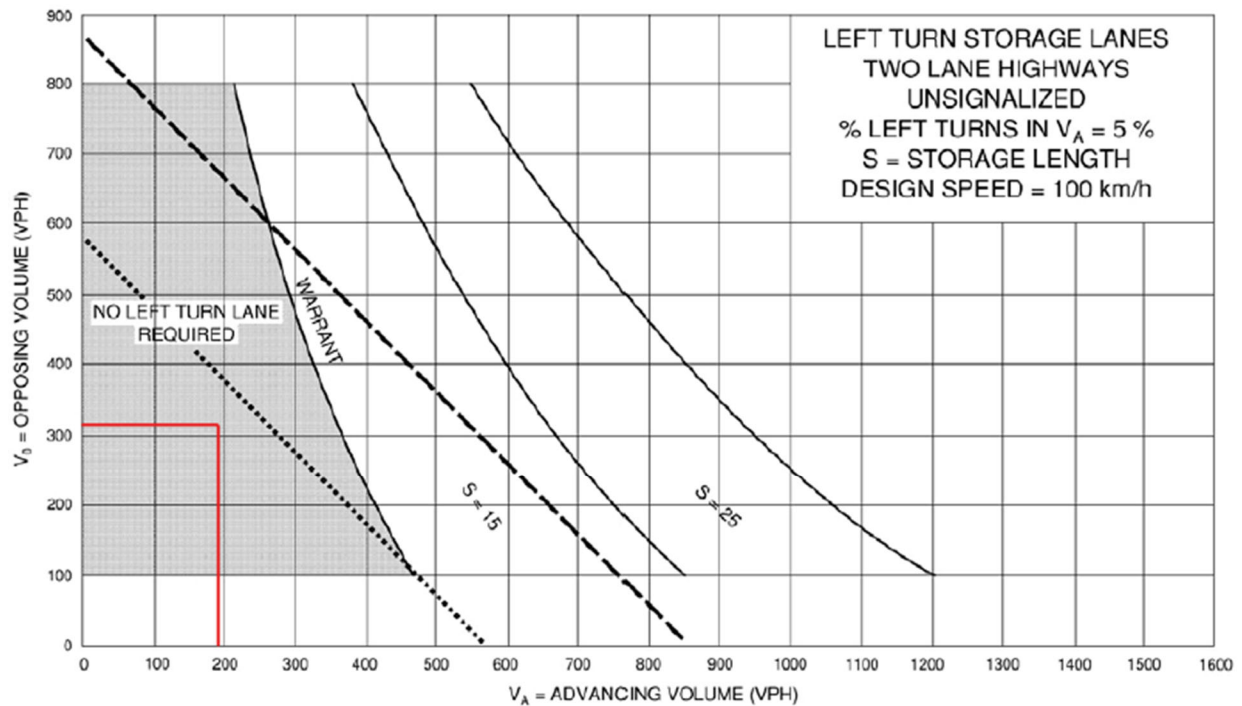
Advancing Traffic Volume $V_A = 185 + 5$

Advancing Traffic Volume $V_A = 190$

$$\text{Percentage of Left Turning Traffic} = \frac{V_L}{V_A} \times 100$$

$$\text{Percentage of Left Turning Traffic} = \frac{5}{190} \times 100$$

$$\text{Percentage of Left Turning Traffic} = 2.6\%$$



North Access

Northbound Left

Existing Thru Traffic Volume: $V_T = 270$

Opposing Traffic Volume: $V_O = 195$

Left Turn Traffic Volume: $V_L = 15$

$$\text{Advancing Traffic Volume } V_A = V_T + V_L$$

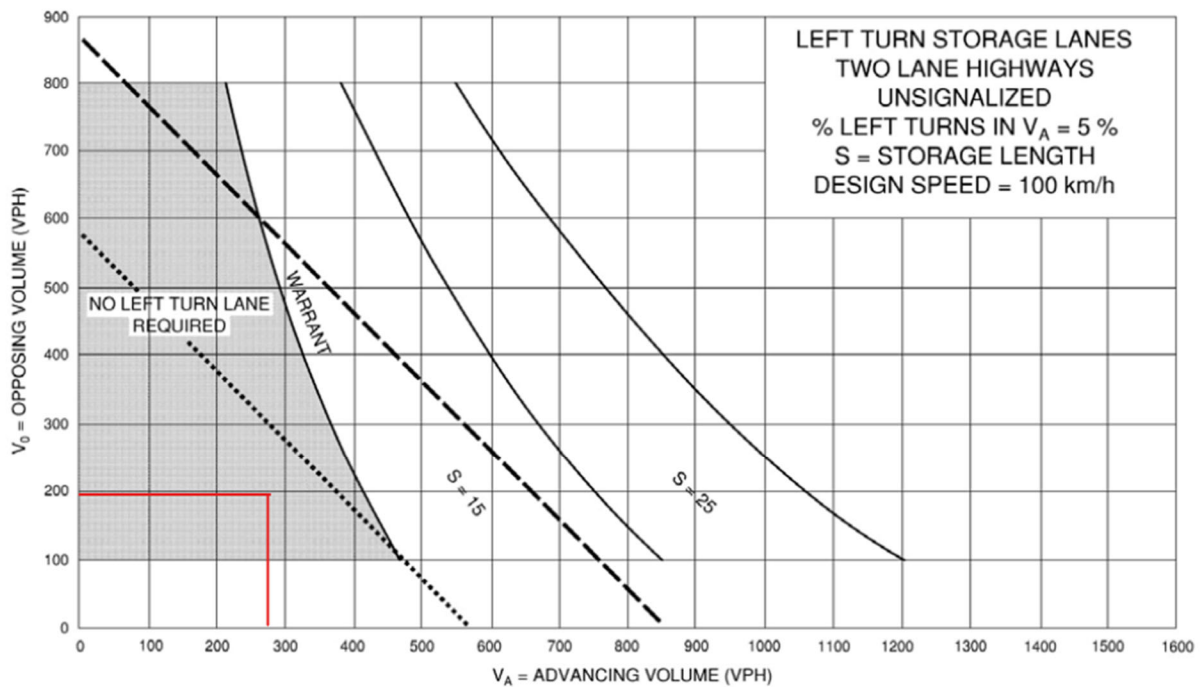
$$\text{Advancing Traffic Volume } V_A = 270 + 15$$

$$\text{Advancing Traffic Volume } V_A = 285$$

$$\text{Percentage of Left Turning Traffic} = \frac{V_L}{V_A} \times 100$$

$$\text{Percentage of Left Turning Traffic} = \frac{15}{285} \times 100$$

$$\text{Percentage of Left Turning Traffic} = 5.3\%$$



Southbound Left

Existing Thru Traffic Volume: $V_T = 180$

Opposing Traffic Volume: $V_O = 300$

Left Turn Traffic Volume: $V_L = 15$

Advancing Traffic Volume $V_A = V_T + V_L$

Advancing Traffic Volume $V_A = 180 + 15$

Advancing Traffic Volume $V_A = 195$

Percentage of Left Turning Traffic = $\frac{V_L}{V_A} \times 100$

Percentage of Left Turning Traffic = $\frac{15}{195} \times 100$

Percentage of Left Turning Traffic = 7.7%

