3718 Greenbank Road

Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report

Prepared for:

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March 2022

PN: 2020-100

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1 Screening

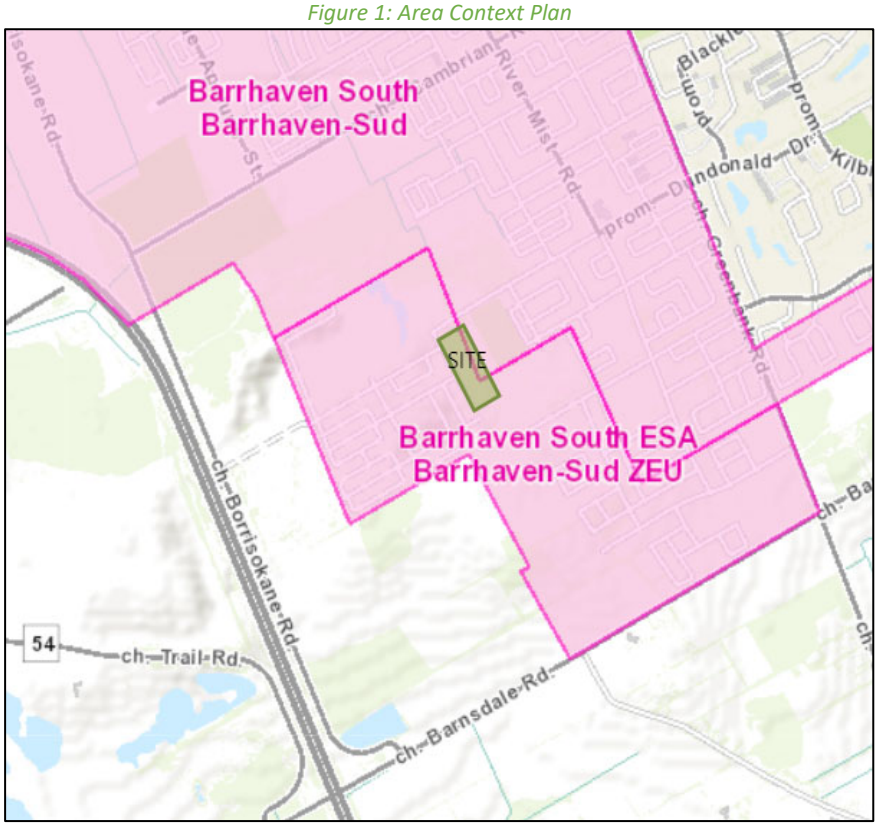
This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been completed and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required including the Design Review component and the Network Impact component. The application is for a draft site plan approval.

2 Existing and Planned Conditions

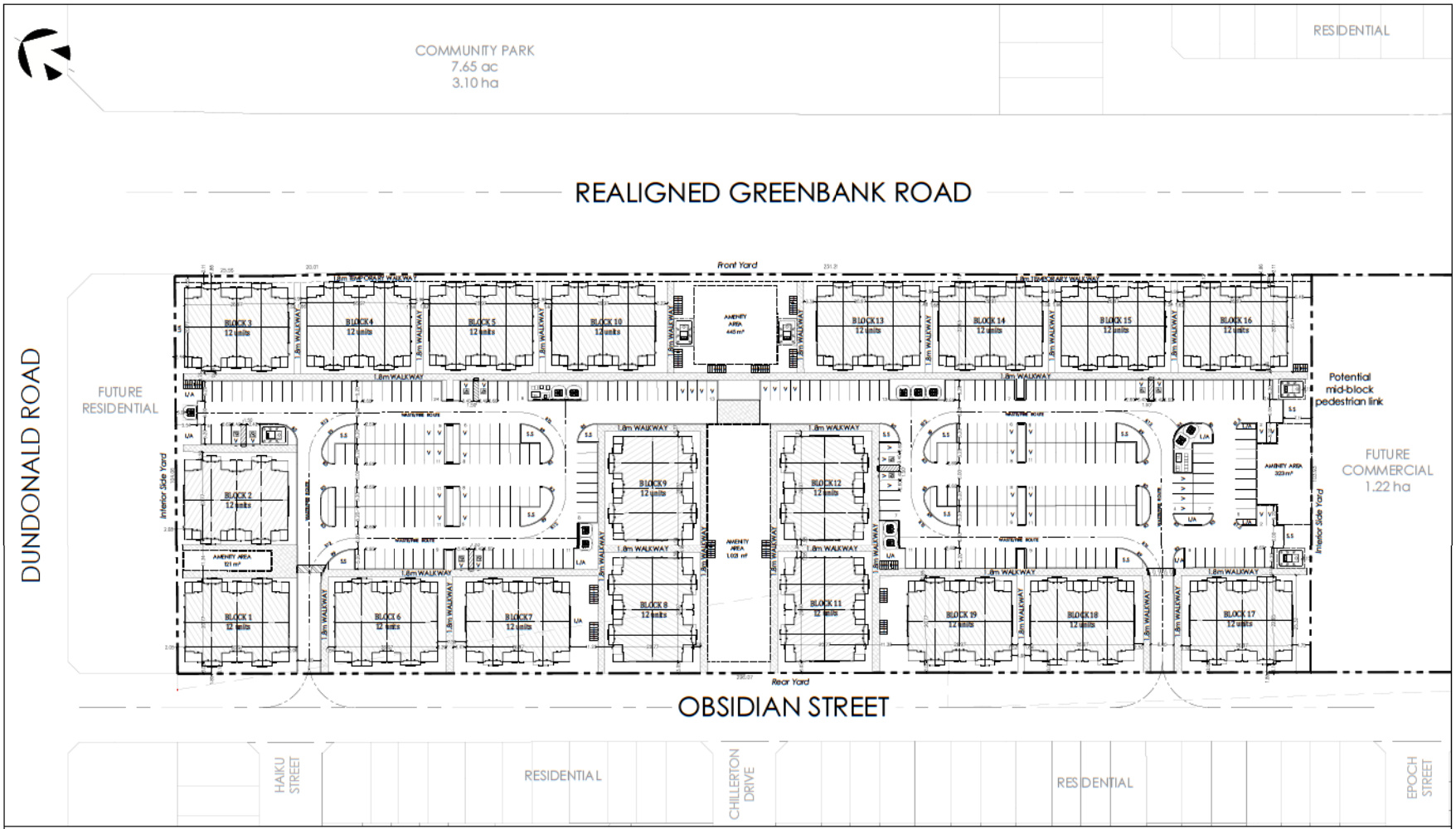
2.1 Proposed Development

The proposed residential development, located at 3718 Greenbank Road, is currently zoned as a Mineral Aggregate Reserve Zone (MR1). The proposed residential development will consist of a mixture of 228 stacked townhouse units. Access to the development lands will be provided to the east of the proposed development via Obsidian Street. The development will have active mode connections to the adjacent developments to allow access to shared community services (i.e. parks, schools, etc.). The anticipated full build-out and occupancy horizon is 2024. Figure 1 illustrates the Study Area Context. Figure 2 illustrates the proposed concept plan.

Figure 1: Area Context Plan



Source: http://maps.ottawa.ca/geoOttawa/ Accessed: December 21, 2020



SCALE 1:500

LEGEND

- STACKED TOWNS
- PAVERS
- CROSSWALK
- CURBS (0.2m)
- DEPRESSED CURB
- BALCONY
- PORCH
- PROJECTION (STAIRS)
- S.S SNOW STORAGE AREA
- L/A LANDSCAPED AREA
- BLOCK BOUNDARY
- BARRIER FREE PARKING
- BARRIER FREE PARKING SIGNAGE
- TACTILE WALKING SURFACE INDICATOR
- NO PARKING
- CONCRETE/ASPHALT PAD
- BIKE RACKS
- ENTRANCE
- V VISITOR PARKING

DATE (MM/DD/YY)	REVISION	BY
11/12/21	Draft for review	SP

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PROJECT TEAM

SITE PLAN DESIGN: KORSIAK Urban Planning
LANDSCAPE ARCHITECTS: NAK Design Strategies
PLANNING: J.L. Richards
TRANSPORTATION: GHD
ARCHITECTS: Q4A
MECHANICAL/ELECTRICAL: LRJ
CIVIL ENGINEER: Stantec

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Half Moon Bay South
Condo Block

PART OF LOT 8
CONCESSION 3 (RIDEAU FRONT)
GEOGRAPHIC TOWNSHIP OF NEPEAN
CITY OF OTTAWA

TITLE: SITE PLAN

DATE: November 22, 2021 | DRAWN BY: SP | CHECKED BY: CB | DRAWING NO.

FILE NO.: 0000000

JOB NO.: Mattamy - Half Moon Bay

SITE STATISTICS AND DEVELOPMENT DATA

SITE AREA	30,880m²(3.09 ha)
PAVED AREA	11,812.52 m² (38%)
LANDSCAPED AREA	9,285.88m² (30%)
TOTAL BUILDING COVERAGE	10,779.59 m² (35%)
TOTAL GROSS FLOOR AREA	34,660.76 m²
DENSITY (U/PH)	74 UPH
ZONE CATEGORY	R4Z[####]

DWELLING BLOCK	DWELLING TYPE	GROSS FLOOR AREA (m2)	UNITS
BLOCK 1-19	12 UNIT BACK-TO-BACK STACKED DWELLING	1,298.04 (per Block)	228
	TOTAL	24,662.76	228

SECTION	ZONE PROVISION - PLANNED UNIT DEVELOPMENT	REQUIRED	PROPOSED
162A(Table(c)(2)	MIN. LOT AREA (m²)	1,400m2	30,880m²
162A(Table(c)(2)	MIN. LOT WIDTH (m)	18m	103.93m
162A(Table(c)(2)	MIN. FRONT YARD SETBACK (m)	3.0m	3.0m
162A(Table(c)(2)	MIN. INTERIOR SIDE YARD SETBACK: FOR BUILDING WITHIN FIRST 21m FROM FRONT LOT LINE	3.0m	2.44m
	OTHER CASES	6.0m	2.05m
162A(Table(c)(2)	MIN. REAR YARD SETBACK (m)	7.5m	3.0m
162A(Table(c)(2)	MAX. BUILDING HEIGHT (m)	14.5m	12.0m (3 storeys)
101(Table)	RESIDENT PARKING - 1.2 spaces/unit	273.6	27.4
102(Table)	VISITOR PARKING - 0.2 spaces/unit	45.6	46
111A(Table)	MIN. BICYCLE PARKING - 0.5 spaces/unit	114	114
131(Table)(i)	MIN. WIDTH OF PRIVATE WAY/PARKING AISLE (m)	6.0m	6.0m
131(Table)(ii)	MIN. SETBACK FOR ANY WALL OF A RESIDENTIAL USE BUILDING TO A PRIVATE WAY (m)	1.8m	2.05m
131(Table)(iv)	MIN. SEPARATION DISTANCE BETWEEN BUILDINGS WITHIN A PLANNED UNIT DEVELOPMENT (m)	1.2m	4.94m
132(Table)	AMENITY AREA: TOTAL MIN. AMENITY AREA (6m² per unit)	1,368m²	1,938m²*
	MIN. COMMUNAL AMENITY AREA (min. 50% area)	684m²	1,911.0m²

*Individual amenity areas are provided on the balconies

SECTION	ADDITIONAL PROVISIONS	REQUIRED	PROPOSED
65(Table)	PERMITTED PROJECTION INTO REQUIRED YARDS:		
65(Table)(5)	FIRE ESCAPES, OPEN STAIRWAYS, STOOP (m)	>0.6m to lot line	1.83m
65(Table)(6)	COVERED OR UNCOVERED BALCONY, PORCH, DECK	>1m to lot line	2.11m
106(1)(a)	MIN. PERPENDICULAR PARKING SPACE SIZE (m)	2.6m x 5.2m	2.6m x 5.2m
106(2)	MIN. BARRIER FREE PARKING: TYPE A PARKING SPACE SIZE (m)	3.4m wide	3.4m wide
	TYPE B PARKING SPACE SIZE (m)	2.4m wide	2.4m wide
	ACCESS AISLE (m)	1.5m	1.5m
111B(Table)	MIN. BICYCLE PARKING SPACE DIMENSION, HORIZONTAL (m)	Width: 0.6m Length: 1.8m	Width: 0.6m Length: 1.8m
111(9)	MIN. BICYCLE PARKING SPACE ACCESS AISLE WIDTH (m)	1.5m	1.8m
109(3)(b)	MAX. WALKWAY WIDTH PERMITTED IN YARD (m)	1.8m	1.8m
110(1)	MIN. % OF PARKING LOT LANDSCAPED	15%	17%
110(Table)(1)(i)	LANDSCAPED AREA SURROUNDING PARKING LOT ABUTTING A STREET (m)	3.0m	N/A
	NOT ABUTTING A STREET (m)	3.0m	5.54m
110(3)	REFUSE COLLECTION AREAS:		
110(3)(b)	MIN. WASTE COLLECTION SETBACK TO LOT LINE (m)	3.0m	3.04m
110(3)(c)	OPAQUE SCREEN MIN. HEIGHT (m)	2.0m**	2.0m**

**Section 110(3)(c) where an in-ground refuse container is provided, the screening requirement of Section (3)(c) above may be achieved with soft landscaping (Minimum 2.0m)

2.2 Existing Conditions

2.2.1 Area Road Network

Borrisokane Road: Borrisokane Road is a Ministry of Ontario road with a two-lane rural cross-section and a posted speed limit of 80 km/h along the frontage of the site. No sidewalks are provided. North of Cambrian Road, Borrisokane Road is an Arterial Road, and south of Cambrian Road it is a Collector Road. Borrisokane is part of the Veterans Memorial Highway (Highway 416) corridor to the south of Cambrian Road and has a measured 37.5 metre right of way to the north of Cambrian Road.

Cambrian Road: Cambrian Road is a City of Ottawa collector road with a two-lane rural cross-section and a posted speed limit of 70 km/h for approximately 700 metres east of Borrisokane Road and 50 km/h in the remaining Study Area. To the west of Seeley's Bay Street, Cambrian Road has no sidewalks and to the east of Seeley's Bay Street, Cambrian Road has sidewalks. The Ottawa Official Plan reserves a 37.5 metre right-of-way from Cedarview (now Borrisokane Road) to Jockvale Road.

Dundonald Drive: Dundonald Drive is a City of Ottawa collector road with a two-lane urban cross-section and an unposted speed limit of 50 km/h. Sidewalks are present on both sides of the road within the Study Area. The measured right-of-way is 24 metres.

Kilbirnie Drive: Kilbirnie Drive is a City of Ottawa collector road with a two-lane urban cross-section and an unposted speed limit of 50 km/h. Sidewalks are present on both sides of the road within the Study Area. The measured right-of-way is 22 metres.

2.2.2 Existing Intersections

There are no existing signalized intersections within a one-kilometre radius of the proposed development, as the Re-Aligned Greenbank Road corridor has not been constructed and the adjacent developments are in various stages of the planning and development process. Therefore, no intersections will be analyzed for the existing horizon and new and planned intersections will be included in the analysis of future horizons.

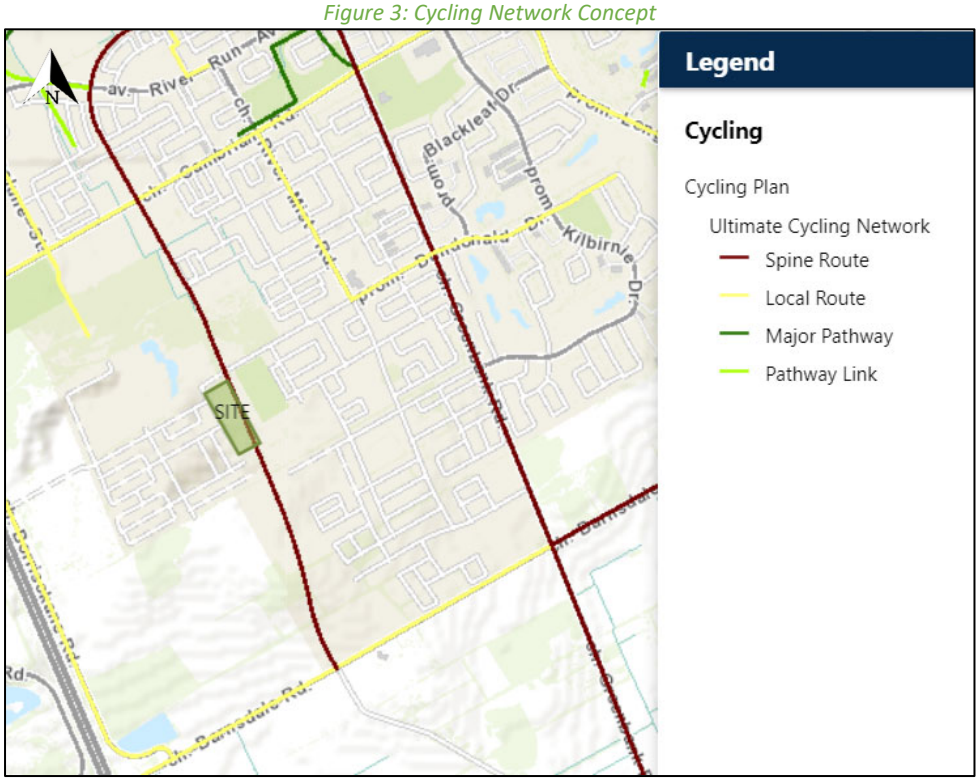
2.2.3 Existing Driveways

There are no existing driveways within 200 metres of the potential future accesses except for residential driveways along Dundonald Drive and Kilbirnie Drive, east of Re-Aligned Greenbank Road. These driveways are not expected to provide access to significant traffic generators and would therefore have no impact on this TIA.

2.2.4 Cycling and Pedestrian Facilities

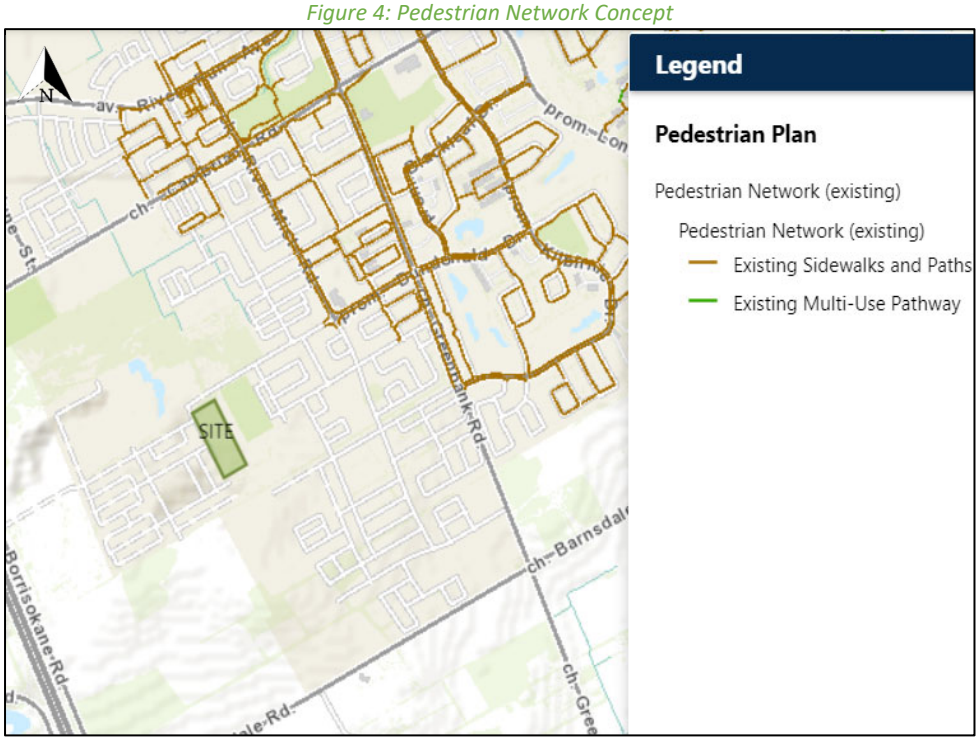
No cycling facilities and very limited pedestrian facilities currently exist along Borrisokane Road or Cambrian Road. As Re-Aligned Greenbank Road has not yet been constructed, no cycling or pedestrian facilities currently exist. Approved cycling infrastructure as part of The City of Ottawa's Ultimate Cycling Network includes plans for local cycling routes along Cambrian Road, Borrisokane Road and Apolune Way. A spine route is also planned for the Re-Aligned Greenbank Road. These approved cycling plans are shown in Figure 3. Figure 4 illustrates the pedestrian facilities in the study area.

Figure 3: Cycling Network Concept



Source: http://maps.ottawa.ca/geoOttawa/Accessed: December 21, 2020

Figure 4: Pedestrian Network Concept

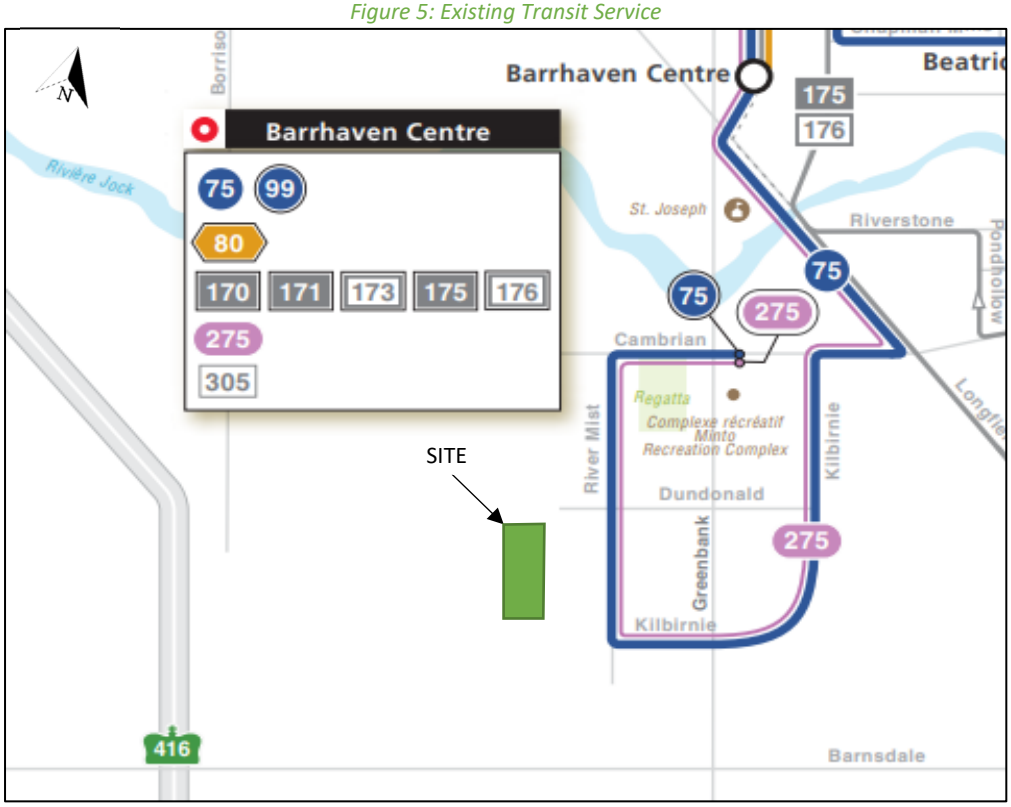


Source: http://maps.ottawa.ca/geoOttawa/Accessed: December 21, 2020

2.2.5 Existing Transit

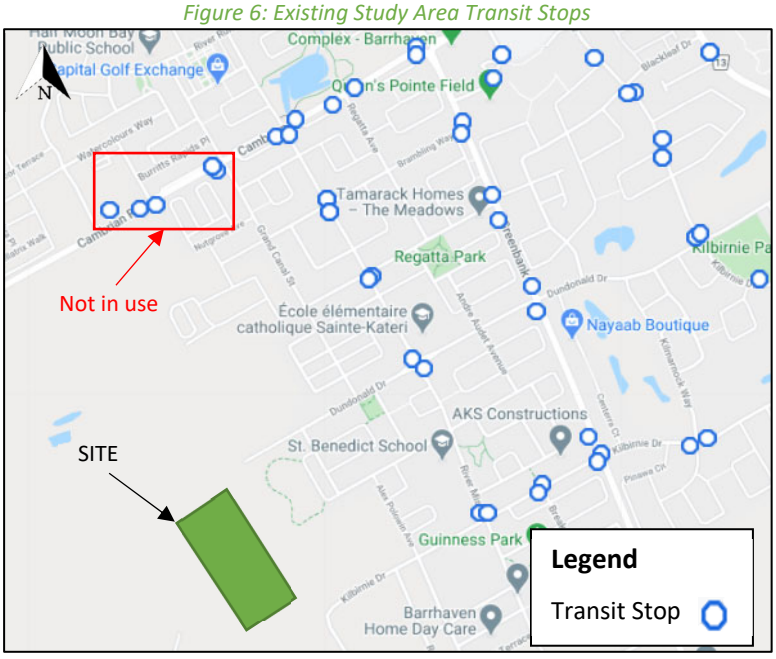
There is no existing transit service along the boundary roads. East of the subject development, Route 75 and Route 275 run along Kilbirnie Drive, River Mist Road and Cambrian Road. Figure 5 illustrates the existing transit service and Figure 6 illustrates the existing transit stops.

Figure 5: Existing Transit Service



Source: http://www.octranspo.com/ Accessed: December 21, 2020

Figure 6: Existing Study Area Transit Stops



Source: http://plan.octranspo.com/plan Accessed: December 21, 2020

2.2.6 Existing Area Traffic Management Measures

There are no existing area traffic management measures within the Study Area.

2.2.7 Existing Peak Hour Travel Demand

There are no existing intersections in the Study Area that will be examined as outlined in Section 2.2.2 above.

2.2.8 Collision Analysis

As illustrated in Figure 7, no significant collisions are noted in the vicinity of the study area. Therefore, no collision analysis has been performed.

Figure 7: Study Area Collision Records – Representation of 2014-2016

Source: https://maps.bikeottawa.ca/collisions/ Accessed: December 21, 2020

2.3 Planned Conditions

2.3.1 Changes to the Area Transportation Network

The planned development is subject to policies outlined in the City of Ottawa's Master Plan and the Barrhaven South Urban Expansion Area Community Design Plan (CDP). Additionally, Development Charges (DC) outlined in the 2019 City of Ottawa Intersection Control Measures By-Law will impact the planned development.

Expected changes to the subject development as outlined in the City of Ottawa's Master Plan are:

- The Re-Aligned Greenbank Road extension, south of Cambrian Road, is located on the east side of the proposed development. This will provide Arterial Road connectivity to the site. The timing of this extension is unknown as it is not included in the City of Ottawa's Transportation Master Plan 2031 Affordable Road Network and is only indicated as a 'Conceptual Arterial Extension' in the Network Concept Plan. The proposed cross-section of Re-Aligned Greenbank Road can be seen in Figure 8.

- A ‘Conceptual Future Transit Corridor’. This is shown along the Re-Aligned portion of Greenbank Road, south of Cambrian Road in the Rapid Transit and Priority 2031 Network Concept Plan. This is not shown on the 2031 Affordable Rapid Transit and Priority Network.
- A cycling spine route indicated along the Re-Aligned portion of Greenbank Road, south of Cambrian Road in the Primary Urban Cycling Network map.

Intersection Control Measures outlined in the 2019 Ottawa Development Charges By-Law are expected to be implemented at the following intersections:

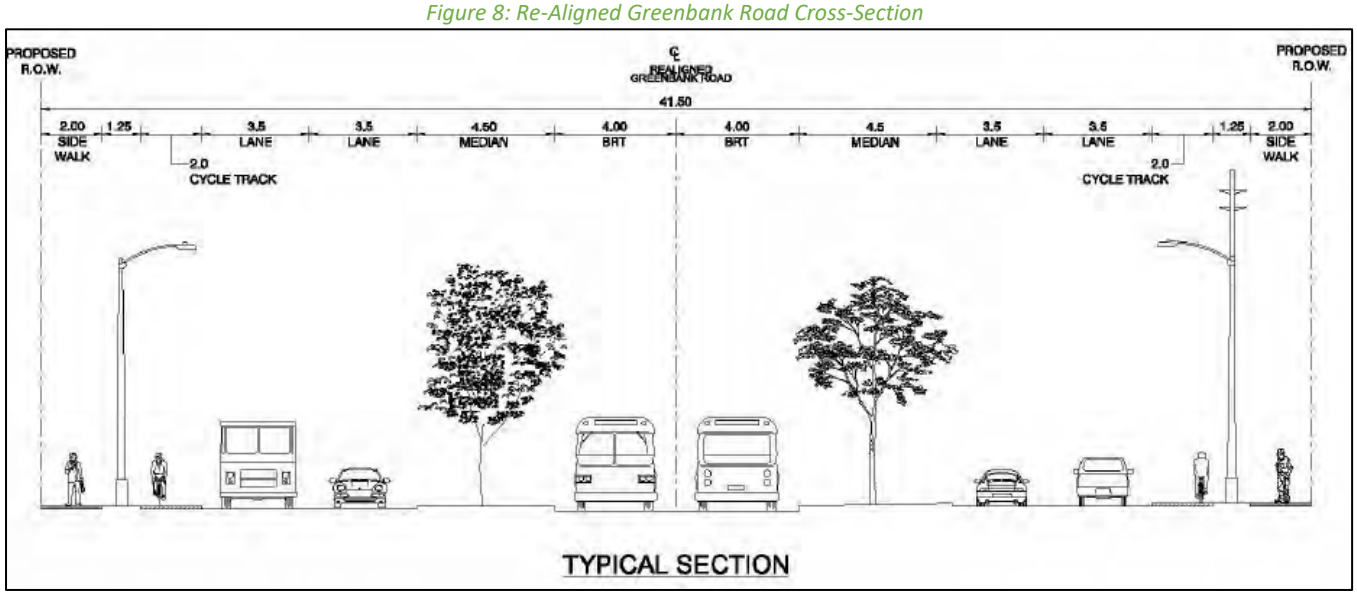
- Cambrian Road and Borrisokane Road
- Cambrian Road and Apolune Way
- Old Greenbank Road and Kilbirnie Drive
- Old Greenbank Road and Barnsdale Road

The intersection modification at Apolune Way and Cambrian Road is underway and is expected that these changes will be complete prior to the proposed development’s build-out year of 2024. City of Ottawa staff has indicated that signalization of this intersection is anticipated to be warranted in 2024 or 2025 and signal design will be completed as a City project. The planned intersection design can be seen in Appendix B as an excerpt from the RMA completed at the intersection of Apolune Way and Cambrian Road (Stantec, 2019). Correspondence with City of Ottawa staff confirming this approach to the design and signalization timeline of Cambrian Road at Apolune Way has also been included in Appendix B. Additionally, the *3717 Borrisokane Road Transportation Impact Assessment* (CGH, 2020) has recommended the inclusion of an eastbound right-turn lane at this intersection for the report’s 2029 future analysis horizon.

The subject development is within the Barrhaven South Urban Expansion Area CDP. As such, it is subject to the planning polices outlined in the CDP. Some of the expected changes outlined are:

- Road Network:
    - The subject development proposes a connection to the north-south collector road (Elevation Way) and to two east-west collector roads (Dundonald Drive and Kilbirnie Drive extensions) which connect to the three development accesses. These collector roads are subject to the City of Ottawa Road Corridor Planning and Design Guidelines. All collector roads have cycling and pedestrian facilities, and parking facilities and Elevation Way will also include transit.
    - The Re-Aligned Greenbank Road extension will provide arterial road connection to the site. The proposed cross-section of the Re-Aligned Greenbank Road can be seen in Figure 8

Figure 8: Re-Aligned Greenbank Road Cross-Section



Source: Barrhaven South Urban Expansion Study Area Community Design Plan Transportation Master Study. Accessed: December 21, 2020

- Pedestrian Network:
  - Future sidewalks are proposed along the east-west collector road extensions of Dundonald Drive and Kilbirnie Drive at their connections to the proposed development's local road network
- Cycling Network:
  - A local cycling route is proposed along the east-west collector road extensions of Dundonald Drive and Kilbirnie Drive at their connections to the proposed development's local road network
  - A cycle track is proposed along Re-Aligned Greenbank Road.
- Transit Network:
  - A BRT route is proposed along Re-Aligned Greenbank Road with a BRT station at the intersection of Dundonald Drive and Re-Aligned Greenbank Road as well as a BRT station and Park and Ride facility at the intersection of Re-Aligned Greenbank Road and Kilbirnie Drive.

2.3.2 Other Study Area Developments

The Meadows Phase 4

North of the proposed development is Phase 4 of the Meadows Tamarack Development which was expected to be built out during 2019. As the traffic counts used are not expected to capture the traffic generation from this site, the development traffic of this site will be considered in both the existing analysis and future analysis horizons. Phase 4 will have 136 townhouse units and 50 single family units This development is anticipated to produce 142 two-way AM peak period auto trips and 171 two-way PM peak period auto trips. (IBI 2018)

The Meadows Phase 5

North of the proposed development is Phase 5 of the Tamarack Development of the Meadows and is expected to be built-out during 2022. Phase 5 will have 221 townhouse units and 125 single family units. This development is anticipated to produce 294 two-way AM peak period auto trips and 334 two-way PM peak period auto trips. (IBI 2018)

3809 Borrisokane Road

West of the proposed development is the 3809 Borrisokane Road development which is expected to be built-out during 2025. This development will include 590 residential units, split between townhouse units and detached

home units. Access to Borrisokane Road will be provided as part of an interim phase only. Approximately 300 units will use this connection prior to the full build-out in 2025 at which time the connection to Borrisokane Road will be closed. 3718 Greenbank Road will include a connection to 3809 Borrisokane Road. This development is expected to produce 401 two-way AM peak period auto trips and 457 two-way PM peak period auto trips. (CGH 2019).

Half Moon Bay West

North of the proposed development is the Mattamy Development of Half Moon Bay West which is expected to be built-out during 2024. This development will include 446 single family homes, 455 townhomes, and 72 apartment units. Construction has not yet commenced on this subdivision. This development is expected to produce 536 two-way AM peak period auto trips and 659 two-way PM peak period auto trips. (Stantec 2019).

Citi Gate's Highway 416 Employment Lands

North of the proposed development is the Citi Gate Corporate Campus. This development will include 32,516 square metres allocated towards a shopping centre, 165,600 square metres allocated towards business parks and 105,000 square metres allocated towards car dealerships. The full build-out year is 2029 with an interim development year of 2019. This development is expected to produce 4267 two-way AM peak period auto trips and 4848 two-way PM peak period auto trips. (Novatech 2012).

Mattamy's Half Moon Bay North Phase 9 (Apartment Block)

North of the proposed development is the Half Moon Bay North Phase 9 development which was expected to be built-out during 2019. As the traffic counts used are not expected to capture the traffic generation from this site, the development traffic of this site will be considered in the existing and future analysis horizons This development will consist of 60 stacked townhouses. This development is expected to produce 74 two-way AM peak period auto trips and 80 two-way PM peak period auto trips. (Stantec 2018).

3285 Borrisokane Road

North of the proposed development is 3285 Borrisokane Road which is expected to be built-out during 2020. As the traffic counts used are not expected to capture the traffic generation from this site, the development traffic of this site will be considered in the existing analysis and future analysis horizons. This development will include 125 single family homes and 75 townhouses. This development is expected to produce 129 two-way AM peak period auto trips and 146 two-way PM peak period auto trips. (Parsons 2018).

3713 Borrisokane Road

Northwest of the proposed development is an industrial development which is expected to be built-out during 2022. The development will include approximately 3,250 square metres of general office space and 9,385 square metres of industrial buildings. This development is expected to produce 136 two-way AM peak period auto trips and 188 two-way PM peak period auto trips. (CGH 2020).

3717 Borrisokane Road

Directly northwest of the proposed development is a residential development which is expected to be built-out during 2024. The development will include approximately 170 detached homes, and 433 townhouses. This development is expected to produce 384 two-way AM peak period auto trips and 445 two-way PM peak period auto trips. An eastbound right-turn lane has been recommended at the intersection of Cambrian Road and Apolune Way within the report's 2029 future total analysis horizon (CGH 2020).

Barrhaven South Expansion Lands (Quinn's Pointe 2)

To the southeast of the proposed development is the Minto Development of Quinn's Pointe 2. This development will include 536 single-family dwelling units, 493 townhomes, 100 apartment units, and two elementary schools, anticipated over 2 phases of construction for the horizon years of 2022 and 2025. A total of 749 two-way AM peak period auto trips and 813 two-way PM peak period auto trips are expected from this development (Stantec 2018).

Half Moon Bay South Phase 5

Southeast of the proposed development is the Mattamy Development of Half Moon Bay South which is expected to be built-out during 2020. As the traffic counts used are not expected to capture the traffic generation from this site, the development traffic of this site will be considered in the existing and future analysis horizons. The development will consist of 164 single detached home units and 97 townhouse units. This development is expected to produce 180 two-way AM peak period auto trips and 207 two-way PM peak period auto trips. (CGH 2019)

3831 Cambrian Road

The proposed development at 3831 Cambrian Road consists of a 4,024 square metre supermarket and an attached 929 square metre retail store. This development is anticipated to be built-out in 2023 and generate 134 new two-way AM peak hour, 88 new two-way PM peak hour auto trips. (CGH 2021)

3387 Borrisokane Road

North of Cambrian Road is the Glenview Development of 3387 Borrisokane Road which is expected to be built-out during 2022. The development is expected to have 179 single family units and 109 townhouses. The development is anticipated to produce 137 two-way AM peak period auto trips and 174 two-way PM peak period auto trips. The trip distribution for this development has been reviewed and no effect has been noted at the Study Area intersections. (Stantec 2016)

3 Study Area and Time Periods

3.1 Study Area

The subject site does not have any existing boundary roads to consider and Re-Aligned Greenbank Road is beyond the study horizons.

The Study will instead focus on the development access to Cambrian Road and the connections to Dundonald Drive and Kilbirnie Drive.

3.2 Time Periods

As the proposed development is composed entirely of residential units the AM and PM peak hours will be examined.

3.3 Horizon Years

The anticipated build-out year is 2024. As a result, the full build-out plus five years horizon year is 2029.

4 Exemption Review

Table 1 summarizes the exemptions for this TIA.

Table 1: Exemption Review

Module	Element	Explanation	Exempt/Required
Design Review Component			

Module	Element	Explanation	Exempt/Required
4.1 Development Design	4.1.2 Circulation and Access	Only required for site plans	Required
	4.2.3 New Street Networks	Only required for plans of subdivision	Exempt
4.2 Parking	4.2.1 Parking Supply	Only required for site plans	Required
	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	Exempt
Network Impact Component			
4.5 Transportation Demand Management	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Required
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Required
4.8 Network Concept		Only required when proposed development generates more than 200 person-trips during the peak hour in excess of equivalent volume permitted by established zoning	Required

5 Development-Generated Travel Demand

5.1 Trip Generation and Mode Shares

This TIA has been prepared using the vehicle and person trips for the residential components using the TRANS Trip Generation Study Report (2009). Table 2 summarizes the person trip rates for the proposed land use.

Table 2: Trip Generation Person Trip Rates

Dwelling Type	Land Use Code	Peak Hour	Vehicle Trip Rate	Person Trip Rates
Townhouses	224 (TRANS)	AM	0.54	0.98
		PM	0.71	1.16

Using the above Person Trip rates, the total person trip generation has been estimated. Table 3 below illustrates the total person trip generation by dwelling type.

Table 3: Total Person Trip Rates

Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Townhouses	228	83	140	223	140	124	264

Using the most recent National Capital Region Origin-Destination (OD Survey), the existing mode shares for South Nepean have been summarized in Table 4.

Table 4: Mode Share

Travel Mode	South Nepean Mode Share
Auto Driver	60%
Auto Passenger	15%
Transit	15%
Cyclist	1%
Pedestrian	9%

Total	100%

There are no major transit upgrades (i.e. BRT, transit priority measures, etc.) within the Study Area that are planned to be in place by the study horizons that will be examined in this study. Therefore, the existing mode shares will be carried forward.

Using the above mode shares and the person trip rates, the person trips by mode have been projected. Table 5 summarizes the trip generation by mode.

Table 5: Trip Generation by Mode

Travel Mode	Mode Share	In	Out	Total	In	Out	Total
Auto Driver	60%	50	84	134	84	74	158
Auto Passenger	15%	12	21	33	21	19	40
Transit	15%	12	21	33	21	19	40
Cyclist	1%	1	1	2	1	1	3
Pedestrian	9%	7	13	20	13	11	24
Total	**100%**	**83**	**140**	**223**	**140**	**124**	**264**

As shown above, 134 AM and 158 PM new peak hour two-way vehicle trips are projected as a result of the proposed development.

5.2 Trip Distribution

To understand the travel patterns of the subject development, the OD survey has been reviewed to determine the existing travel patterns that will be applied to the new vehicle trips. Table 6 below summarizes the distribution for South Nepean.

Table 6: OD Survey Existing South Nepean Distribution

To/From	% of Trips
North	80%
South	5%
East	10%
West	5%
Total	100%

5.3 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the Study Area road network. As the connection to the Kilbirnie Drive extension is anticipated to occur as part of the 2025 build-out horizon of the Quinn's Pointe 2 development, the connection to Kilbirnie Drive will only be considered in the 2029 future analysis horizon. Figure 9 illustrates the 2024 new site generated volumes and Figure 10 illustrates the 2029 new site generated volumes.

Figure 9: 2024 New Site Generation Auto Volumes

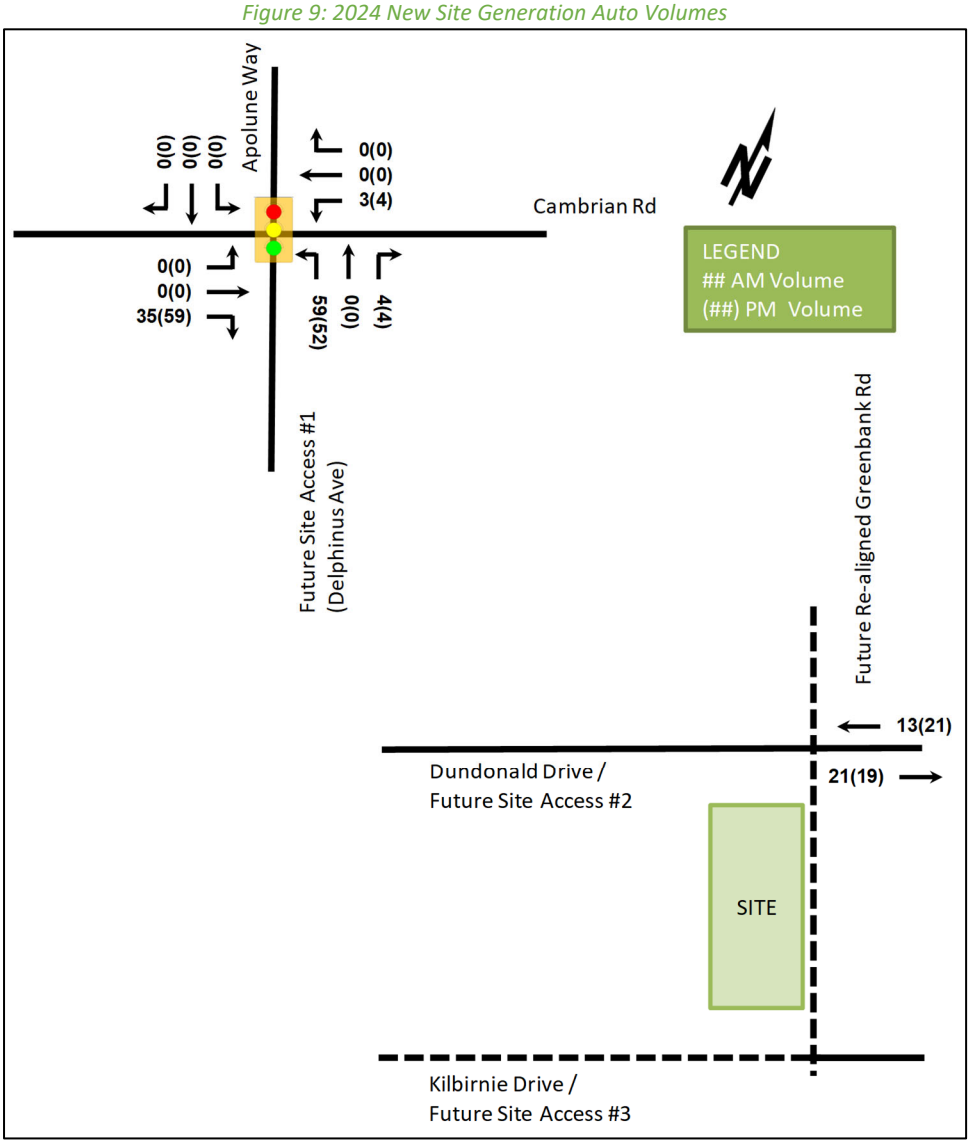
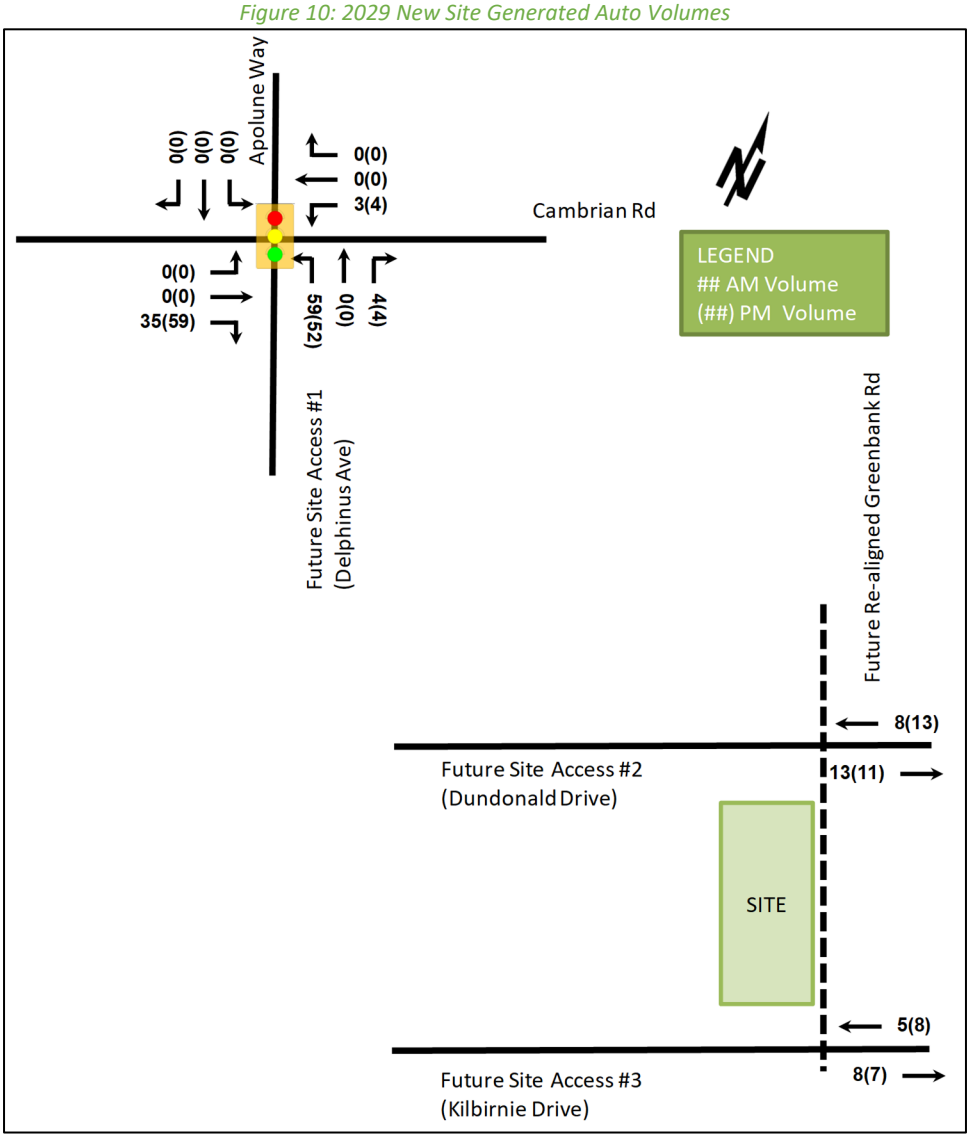


Figure 10: 2029 New Site Generated Auto Volumes



6 Background Network Travel Demand

6.1 Transportation Network Plans

The transportation network plans were discussed in Section 2.3.1 and are not anticipated to have an impact on the site, trip generation, or distribution.

6.2 Background Growth

Surrounding development Traffic Impact Assessments have used a 2% traffic growth within the Study Area of this report. As such, an annual background growth of 2% will be used in order to remain consistent with these studies and to capture any growth not already directly considered as discussed in Section 2.3.2. This growth rate has been applied to the eastbound and westbound volumes at Cambrian Road and Apolune Way which have been taken from the 2018 intersection counts performed at Borrisokane Road and Cambrian Road and included in *The Meadows Phase 5 Transportation Impact Assessment Report* (IBI, 2018). Traffic Data can be found in Appendix C.

6.3 Other Developments

The background developments explicitly considered in both the 2024 and 2029 background conditions include the Meadows Phase 4, Meadows Phase 5, Half Moon Bay West, Half Moon Bay Phase 5, Citi Gate's Highway 416 Employment Lands, Half Moon Bay North Phase 9, 3713 Borrisokane Road, 3717 Borrisokane Road, 3809 Borrisokane Road, 3285 Borrisokane Road, and 3831 Cambrian Road developments. The Quinn's Pointe Two development is only considered in the 2029 background conditions. All background developments are discussed in Section 2.3.2.

7 Demand Rationalization

7.1 2024 Future Background Intersection Operations

Figure 11 illustrates the 2024 future background volumes and Table 7 summarizes the background intersection operations for the study area. Signal warrants have been evaluated at the intersection of Cambrian Road and Apolune Way and are found to be warranted for the 2024 future background horizon. Signal warrants are provided in Appendix D.

The level of service for signalized intersections the level of service is based on the v/c ratio, as required by the City of Ottawa, for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2024 future background horizon are provided in Appendix E.

The signal timing at the intersection of Cambrian Road and Apolune Way was optimized and Amber Clearance, All Red Clearance, Walk, and Flash Don't Walk times were calculated using the methodology provided in OTM Book 12-Traffic Signals. Intersection geometry at Apolune Way and Cambrian Road is based on the RMA prepared by Stantec which has been provided in Appendix B.

In addition, the background volumes illustrate that the right-turn volume at Elevation Way and Cambrian Road will exceed 30% in both peak hours. This would warrant the inclusion of an eastbound right-turn lane once the intersection is signalized. As noted above, the signal will be analyzed without an eastbound right-turn lane to determine if the operations also support the right-turn volume percentage warrant.

Figure 11: 2024 Future Background Volumes

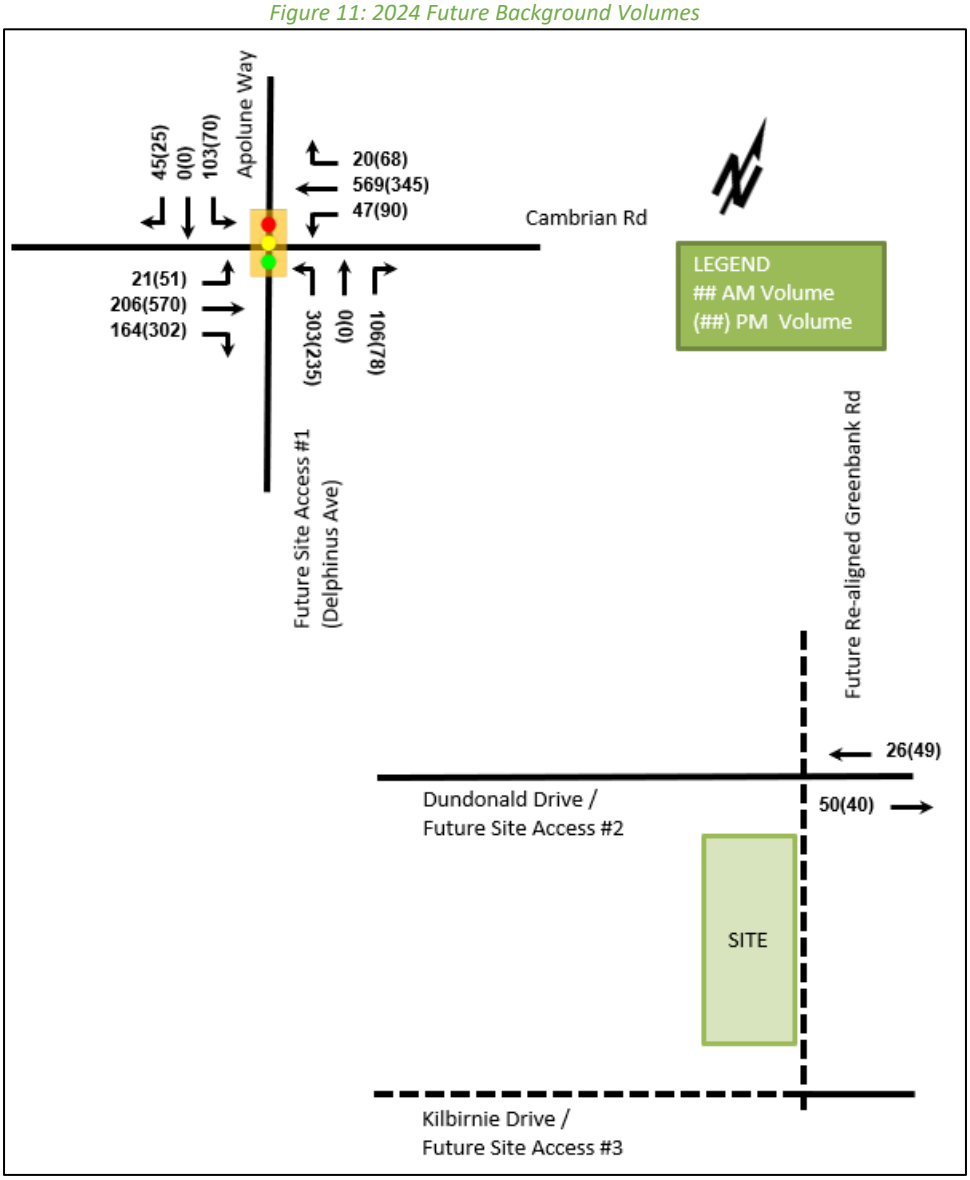


Table 7:2024 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Apolune Way & Cambrian Rd *(Signalized)*	EBL	A	0.19	23.8	8.1	A	0.12	10.3	9.6
	EBT/R	A	0.56	23.6	71.4	E	0.93	36.4	**#203.4**
	WBL	A	0.18	20.8	13.2	D	0.81	68.0	**#46.1**
	WBT/R	D	0.88	43.1	143.2	A	0.44	13.3	60.3
	NBL	A	0.51	23.6	81.1	A	0.59	39.8	**#85.4**
	NBT/R	A	0.10	0.2	0.0	A	0.11	0.3	0.0
	SBL	A	0.18	18.1	26.8	A	0.19	31.5	25.6
	SBT/R	A	0.05	0.1	0.0	A	0.03	0.1	0.0
	Overall	**B**	**0.67**	**28.2**	**-**	**C**	**0.80**	**3.2**	**-**

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00

The intersection operations for the 2024 future background horizon generally operate satisfactorily during the peak hours with all v/c ratios below 1.00 and no high delays noted. During the PM peak period, the shared eastbound through / right-turn movement queue is anticipated to block the eastbound left-turn lane, the westbound through / right-turn movement queue is anticipated to extend past the westbound left-turn lane, and the northbound left-turn queue is anticipated to block the northbound through / right-turn movement. As the eastbound movements do not operate over capacity, an eastbound right-turn lane is not shown to be warranted based on intersection operations. As such an eastbound right-turn lane has not been considered at this intersection and no other mitigation measures are recommended at this time.

7.2 2029 Future Background Intersection Operations

Figure 12 illustrates the 2029 background horizon volumes and Table 8 summarizes the background intersection operations for the study area. The level of service for signalized intersections the level of service is based on the v/c ratio, as required by the City of Ottawa, for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2029 future background horizon are provided in Appendix F.

The background volumes illustrate that the eastbound right-turn volume at Elevation Way and Cambrian Road will exceed 30% in both peak hours. This would warrant the inclusion of an eastbound right-turn lane. As noted above, the signal will be analyzed without an eastbound right-turn lane to determine if the operations also support the right-turn volume percentage warrant.

The westbound left-turn movement will operate as a protected and permissive turn during the PM peak period.

Figure 12: 2029 Future Background Volumes

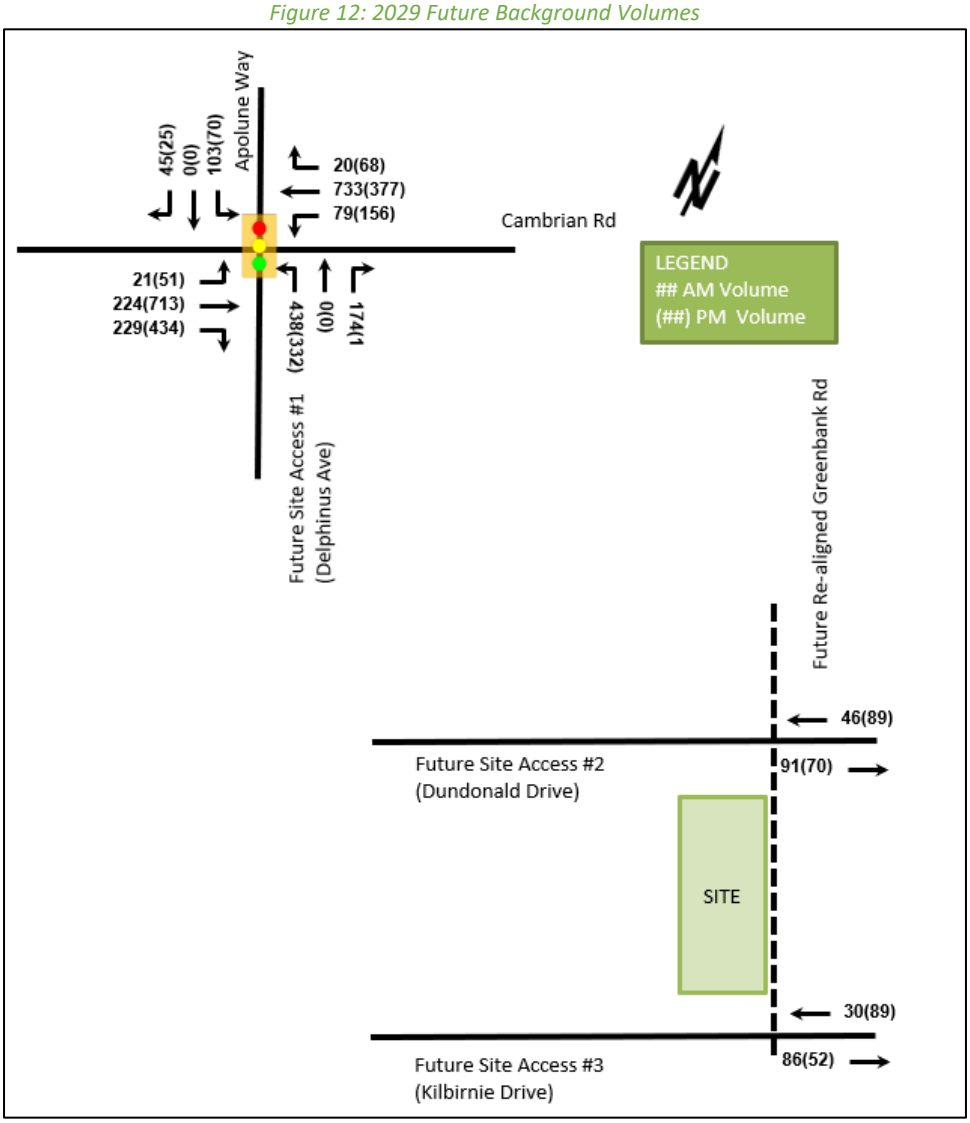


Table 8: 2029 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Apolune Way & Cambrian Rd *(Signalized)*	EBL	A	0.28	29.7	9.9	A	0.11	12.6	11.4
	EBT/R	A	0.59	22.8	94.7	**F**	**1.20**	**126.6**	**#404.8**
	WBL	A	0.29	22.1	22.1	E	0.95	87.0	#64.2
	WBT/R	E	0.94	50.6	**#234.1**	A	0.39	10.2	61.0
	NBL	D	0.84	46.1	**#154.4**	**F**	**1.14**	**136.7**	**#146.8**
	NBT/R	A	0.17	0.4	0.0	A	0.21	0.8	0.0
	SBL	A	0.22	23.6	28.5	A	0.27	40.4	26.8
	SBT/R	A	0.06	0.2	0.0	A	0.03	0.1	0.0
	Overall	**D**	**0.89**	**35.6**	**-**	**F**	**1.17**	**90.3**	**-**

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00

The intersection operations for the 2029 future background horizon generally operate satisfactorily during the peak hours with all v/c ratios below 1.00 with the exception of the eastbound through/right-turn, and the

northbound left-turn. High delays in the PM peak period are also noted at these movements. During the AM peak, the shared westbound through/right-turn movement queue is anticipated to extend past the westbound left-turn lane and the northbound left-turn queue is anticipated to block the northbound through / right-turn movement. During the PM peak, the shared eastbound through / right-turn queue is expected to extend past the eastbound left-turn lane, the westbound left-turn queue is anticipated to block the westbound through / right-turn movement, and the northbound left-turn queue is anticipated to block the northbound / right-turn movement. Given the noted capacity issues and extended queues of the eastbound through / right-turn lane, the intersection operations support the inclusion of an eastbound right-turn lane, as warranted based on the intersection volumes. No other capacity issues are noted.

An eastbound right-turn lane will help improve the discussed capacity issues and is summarized below in Table 9. With the implemented mitigation measure, the intersection operations for the 2029 future background horizon generally operate satisfactorily during the peak hours with all v/c ratios below 1.00 and no high delays noted. During the AM peak, the shared westbound through / right movement queue is anticipated to extend past the westbound left-turn lane and the northbound left-turn queue is anticipated to block the northbound through / right-turn movement. In the PM peak, the shared eastbound through / right-turn queue is expected to extend past the eastbound left-turn lane, the westbound left-turn queue will block the westbound through / right-turn movement, and the northbound left-turn queue is anticipated to block the northbound through / right-turn movement. No other capacity issues are noted.

The eastbound right-turn lane mitigation measure is consistent with the recommended eastbound right-turn lane for the 2029 future horizon within the *3717 Borrisokane Road Transportation Impact Study* (CGH Transportation, 2020).

Table 9: 2029 Future Background Intersection Operations - Mitigated

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Apolune Way & Cambrian Rd *(Signalized)*	EBL	A	0.28	29.7	9.9	A	0.14	19.0	14.2
	EBT	A	0.28	19.9	46.7	E	0.92	48.3	**#216.8**
	EBR	A	0.28	3.1	12.6	A	0.58	16.4	70.9
	WBL	A	0.18	18.8	19.7	C	0.77	40.7	**#45.7**
	WBT/R	E	0.94	50.6	**#234.1**	A	0.48	17.3	81.0
	NBL	D	0.84	47.2	**#155.4**	C	0.78	48.7	**#120.4**
	NBT/R	A	0.17	0.4	0.0	A	0.17	0.5	0.0
	SBL	A	0.22	23.9	28.6	A	0.18	29.5	23.4
	SBT/R	A	0.06	0.2	0.0	A	0.03	0.1	0.0
	Overall	**D**	**0.89**	**33.2**	**-**	**D**	**0.85**	**31.9**	**-**

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00

7.3 Modal Share Sensitivity

Capacity constraints have been noted at the Apolune Way and Cambrian Road intersection by the 2029 background conditions. An eastbound right-turn lane is warranted and should be included in the future intersection design and construction. Once in place the intersection will have residual capacity and can accommodate future development to the south of Cambrian Road. No additional capacity constraints are noted in the background horizons.

The proposed development is an auto focused development and will be assessed with typical modal share splits for the area. Minimal risk is noted for not achieving these modal shares and the adjacent road network has the residual capacity to accommodate this development.

8 Development Design

8.1 Design for Sustainable Modes

The proposed development is a residential subdivision and therefore auto and bicycle parking areas will be within each resident's home. Visitor parking for both auto and bicycles will be located within the site.

As discussed in Section 2.3.1 above, the Barrhaven South Urban Expansion Study proposes a local cycling route along the extension of Dundonald Road, currently proposed as off-road cycling facilities in the form of a multi-use pathway. Re-Aligned Greenbank Road is proposed to include cycle tracks, with cycling track extensions along Kilbirnie Drive as part of the Park and Ride connection. The site plan provides internal pathway connections to Re-Aligned Greenbank Road for both pedestrian and cycling modes, and a sidewalk is provided along Obsidian Street to connect to Dundonald Road and Kilbirnie Drive.

8.2 Circulation and Access

Two accesses will be provided along Obsidian Street and connect to private lanes within the subject site. No fire routes are provided internal to the site and molok garbage collection stations are provided internally for vehicles to enter and exit the site.

9 Parking

9.1 Parking Supply

The parking requirements and provisions for the proposed development are summarized in Table 10.

Table 10: Parking Provisions

Land Use	Parking Rate	Parking Required	Parking Provided
Residential - Stacked	1.2 spaces/unit	274	320
Visitor - Stacked	0.2 spaces/unit	46	
Total Vehicle Parking		**320**	
Residential (bicycle)	0.5 spaces/dwelling unit	114	114
Total Bicycle Parking		114	

Based on the City of Ottawa Zoning By-laws, a total of 274 residential automobile parking spaces are required as a minimum, and 46 residential visitor vehicle parking spaces are required. As shown above, 320 vehicle automobile parking spaces are provided which meets the required number of automobile parking spaces.

Approximately 114 bicycle parking spaces are required. As shown in Table 10, the required bicycle parking space provisions for bicycle parking have been met.

10 Boundary Street Design

Table 11 summarizes the MMLOS analysis for the boundary streets of Obsidian Street. The boundary street analysis is based on the policy area of developing community The Re-Aligned Greenbank Road corridor will be a future boundary road to the proposed development however its construction is anticipated to occur outside of the future horizons of this TIA. Any MMLOS analysis will be completed as part of the detailed design of the corridor and is beyond the scope of this study. The MMLOS worksheets has been provided in Appendix G.

Table 11: Boundary Street MMLOS Analysis

Segment	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target
Obsidian Street	B	B	A	B	-	N/A	-	N/A

Obsidian Street will meet the MMLOS targets for the area.

11 Access Intersections Design

11.1 Location and Design of Access

Access to the subject site will be provided to the east via the local road of Obsidian Street. Obsidian Street will connect to the east-west collections of Dundonald Drive and Kilbirnie Drive, ultimately connecting to the Re-aligned Greenbank Road corridor in the future. Additionally, access north along the planned north-south collector road (Elevation Way) to Cambrian Road (at Apolune Way) will be provided through adjacent developments.

The intersection of Cambrian Road and Apolune Way is considered a study area intersection and is not considered an access intersection.

As the Greenbank corridor is not expected to be re-aligned within the future horizons considered in this study, the MMLOS and capacity analysis will be completed as part of the detailed design of the corridor and is beyond the scope of this study.

11.2 Access Intersection Control

No intersections are located on the boundary of the site and access is provided through collector roadways. Assessment of the network intersections is provided in Section 16.

11.3 Access Intersection Design

No access intersections are considered in this TIA.

12 Transportation Demand Management

12.1 Context for TDM

The mode shares used within the TIA represent this area of the City and have not been altered.

The subject site is not within a design priority or transit-oriented design area.

Total bedrooms within the development is subject to finalize layouts of the stacked townhomes and resident set up within those units. No age restrictions noted.

12.2 Need and Opportunity

The subject site has been assumed to rely predominately on auto travel and those assumptions have been carried through the analysis. A decrease in the low transit or non-auto mode shares will result in higher volumes along Cambrian Road. Little opportunity is available to shift these modes until major infrastructure projects, such as the Re-aligned Greenbank Road corridor, are complete to increase the transit and active mode network from South Barrhaven to the rest of the City.

12.3 TDM Program

As discussed above, any “suite of post-occupancy TDM measures” are limited in their applicability. It is anticipated that this development will rely predominantly on auto travel and those assumptions have been carried through the analysis. As a result, no TDM measures are recommended at this time beyond those required for zoning and standard site design.

13 Neighbourhood Traffic Management

The adjacent development TIAs have assessed the potential road capacity for the collectors roads on the west side of the Re-Aligned Greenbank Road corridor and residual capacity has been noted. As the subject site directly accesses Obsidian Way, the relative impact of the site traffic will be assessed to adherence with the TIA guidelines AADT thresholds. For a local road, the TIA guidelines note a daily traffic threshold of 100 vehicles and a peak hour threshold of 120 vehicles. As directed by the City, this is considered a two-way volume threshold.

The trips generation outlines a total two-way volume of 134 vehicles during the AM peak and 158 vehicles during the PM peak. These volumes exceed the guideline thresholds without consideration of adjacent development traffic.

In general, the TIA thresholds are too low for local roadways when considered as two-way volumes. The thresholds may be more applicable as one-way volumes, although they will still be too low for application when considering areas where multiple local roads connect to adjacent local roads to access the collector or arterial road network. No mitigation is recommended based on the low threshold limits.

14 Transit

14.1 Route Capacity

Overall, the forecasted new transit trips would result in approximately one bus (single bus, 55-person capacity) being required to accommodate the transit trips generated from the subject site.

It is anticipated that the ultimate transit route will be along Elevation Way from Cambrian Road to Kilbirnie Drive with future centre median BRT lanes within the Re-Aligned Greenbank Road corridor. The interim service will loop through the Ridge subdivision to the west on Dundonald Drive and Kilbirnie Drive.

14.2 Transit Priority

The Cambrian Road at Apolune Way intersection design will need to consider the transit movement requirements, assumed in this study to be the northbound right-turn and westbound left-turn movements. The PM peak is noted to have delays for the westbound left-turn movement that may need to be reduced for transit service needs.

15 Review of Network Concept

Cambrian Road may potentially approach or exceed a single lane capacity in the peak direction by the 2029 background and total future conditions. These volume projections are dependent on surrounding development growth being realized, Re-Aligned Greenbank Road being constructed beyond the study horizon, and on growth proceeding at the same rate. The likely impact of the interim condition is extended queues along Cambrian Road, between Borrisokane Road and Greenbank Road.

The network concept, as identified within the City of Ottawa's Transportation Master Plan Map 10, illustrates extensive improvements within Barrhaven South:

- New Re-Aligned Greenbank Road, from Chapman Mills Drive to Cambrian Road
- Re-Aligned Greenbank Road extension south of Cambrian Road
- Widening of Cambrian Road from the Re-Aligned Greenbank Road to the existing Greenbank Road
- Widening of Jockvale Road from Cambrian Road to Prince of Wales Drive
- Widening of Barnsdale Road between Highway 416 and Prince of Wales Drive
- New interchange at Barnsdale Road and Highway 416

These planned improvements are expected to address the high volumes experienced along Cambrian Road, therefore no changes to the network concept are required.

16 Network Intersection Design

16.1 Network Intersection Control

Signal warrants have been evaluated at the intersection of Cambrian Road and Apolune Way and have found signalization to be warranted for the 2024 future total, 2029 future background, and the 2029 future total horizons. Signal warrants are provided in Appendix C.

16.2 Network Intersection Design

16.2.1 2024 Future Total Intersection Operations

The 2024 future total future traffic volumes are illustrated in Figure 13 and the intersection operations are summarized in Table 12. The level of service for signalized intersections is based on HCM 2010 calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2024 future total horizon have been provided in Appendix H.

The intersection has been configured the same as the in the 2024 future background conditions.

Figure 13: 2024 Future Total Volumes

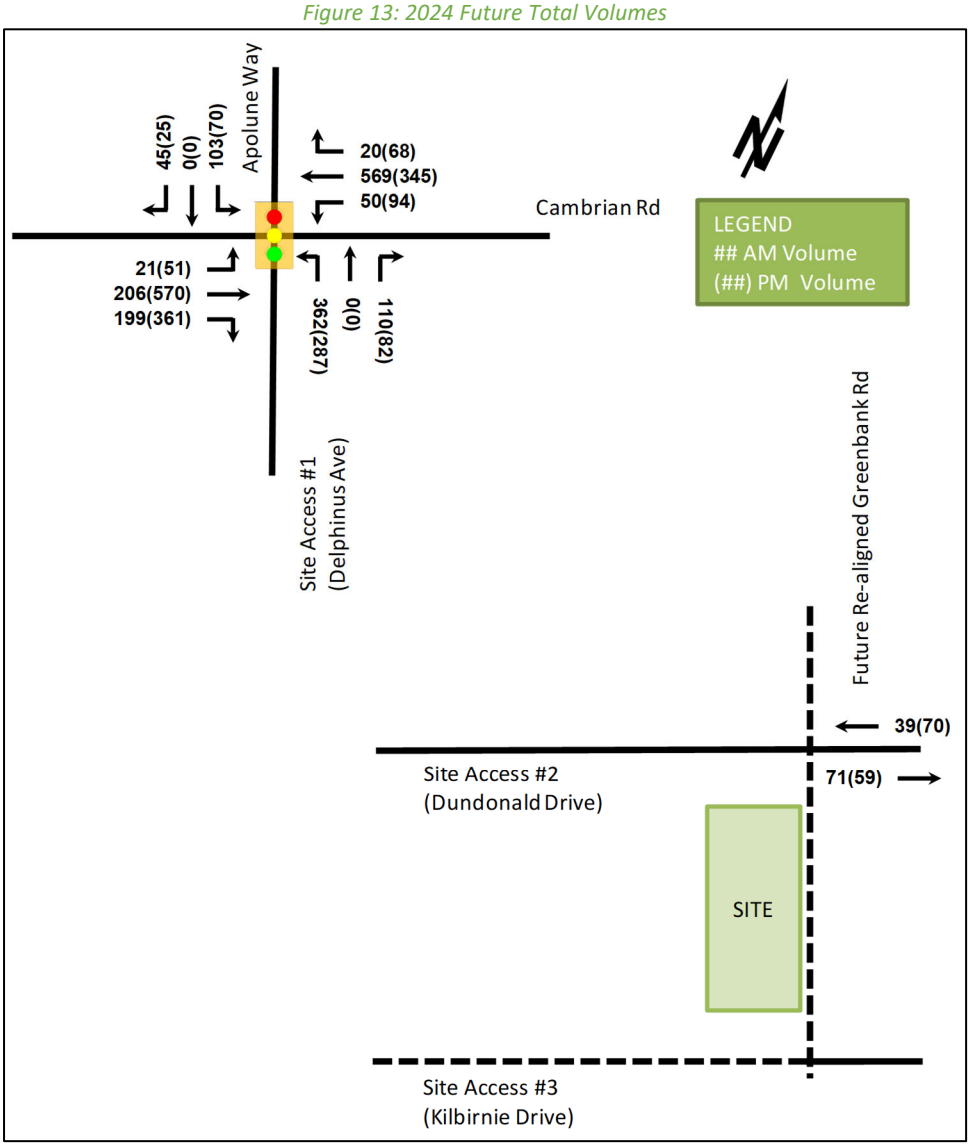


Table 12: 2024 Future Total Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Apolune Way & Cambrian Rd (Signalized)	EBL	A	0.19	23.8	8.3	A	0.11	9.7	9.6
	EBT/R	B	0.62	24.6	80.2	E	0.95	38.0	**#266.3**
	WBL	A	0.21	21.8	14.5	D	0.89	**84.9**	**#51.5**
	WBT/R	D	0.88	43.1	145.2	A	0.41	12.4	60.3
	NBL	B	0.61	26.6	104.4	C	0.78	53.5	**#114.8**
	NBT/R	A	0.10	0.2	0.0	A	0.12	0.3	0.0
	SBL	A	0.18	18.1	27.0	A	0.20	34.3	25.6
	SBT/R	A	0.05	0.1	0.0	A	0.03	0.1	0.0
	Overall	**C**	**0.73**	**28.8**	-	**D**	**0.89**	**34.2**	-

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00

The intersection operations for the 2024 future total horizon generally operate satisfactorily during the peak hours with all v/c ratios below 1.00 and a high delay noted during the PM peak for the westbound left-turn

movement. Similar to the 2024 background conditions, During the PM peak, the shared westbound through/right movement queue is anticipated to extend past the westbound left-turn lane, and the northbound left-turn queue is anticipated to block the northbound through/ right-turn movement. No other capacity issues are noted.

16.2.2 2029 Future Total Intersection Operations

The 2029 future total future traffic volumes are illustrated in Figure 14 and the intersection operations are summarized in Table 13. The level of service for signalized intersections is based on HCM 2010 calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2029 future total horizon have been provided in Appendix I.

As noted during the background conditions, the right-turn lane has been included in the 2029 future total conditions. The right-turn lane is anticipated to be included in the detailed design of the Cambrian Road and Apolune Way intersection, as it is warranted during the 2024 background conditions and operationally may impact the intersection by 2029.

Figure 14: 2029 Future Total Volumes

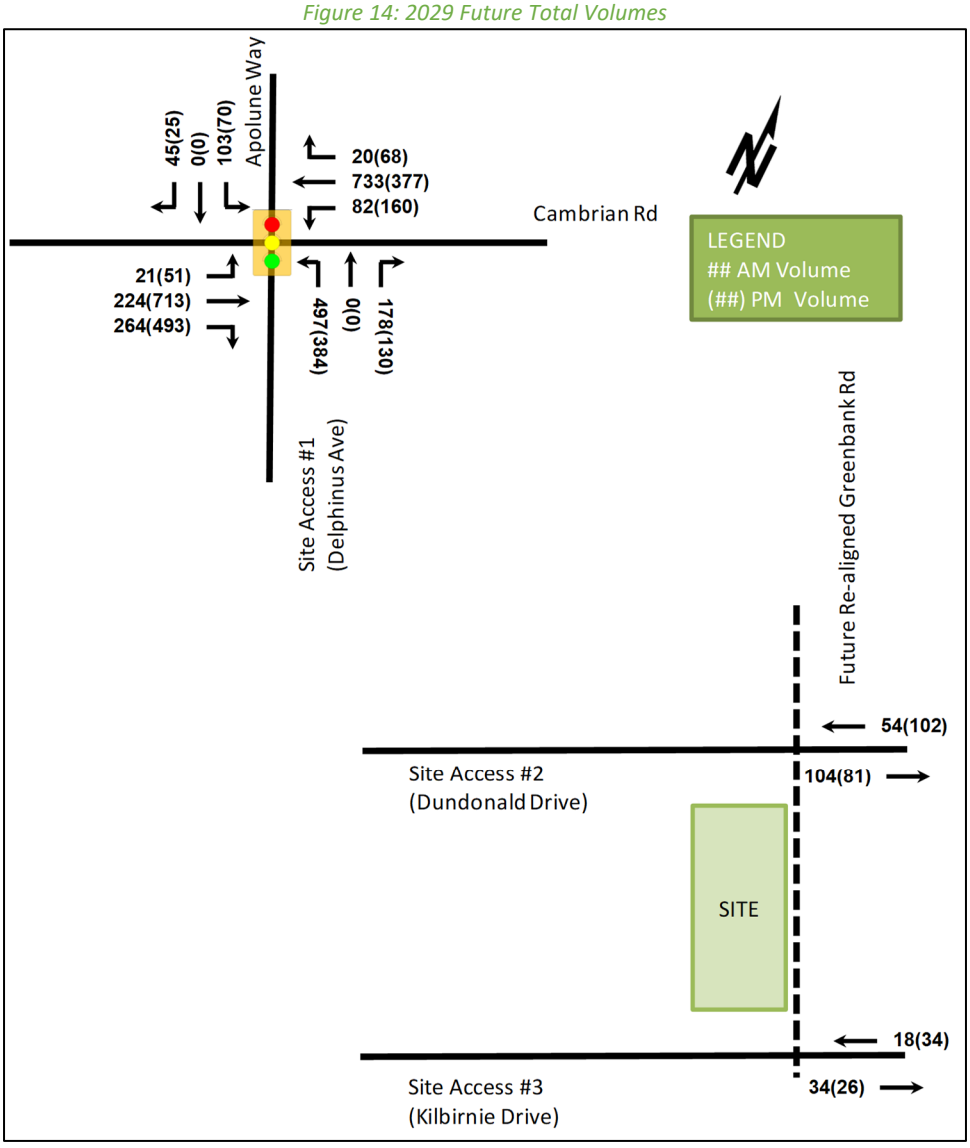


Table 13: 2029 Future Total Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Apolune Way & Cambrian Rd (Signalized)	EBL	A	0.28	29.7	9.9	A	0.16	19.4	16.4
	EBT	A	0.28	19.9	46.7	E	0.92	48.0	**#216.8**
	EBR	A	0.32	3.1	13.3	B	0.64	18.0	84.3
	WBL	A	0.18	19.0	20.5	D	0.85	53.0	**#42.7**
	WBT/R	E	0.94	50.6	**#234.1**	A	0.48	17.3	81.0
	NBL	E	0.96	64.1	**#186.8**	D	0.90	62.3	**#149.3**
	NBT/R	A	0.17	0.4	0.0	A	0.18	0.6	0.0
	SBL	A	0.23	23.9	28.7	A	0.18	29.7	23.4
	SBT/R	A	0.06	0.2	0.0	A	0.03	0.1	0.0
	Overall	**E**	**0.95**	**36.9**	**-**	**E**	**0.91**	**34.9**	**-**

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00

The 2029 future total conditions will operate similar to the 2029 background conditions and no other capacity issues are noted.

16.2.3 Network Intersection MMLOS

Table 14 summarizes the MMLOS analysis for the network intersection and based on the service levels for Developing Communities. Where applicable, AM and PM peak results have been displayed separately (AM(PM)). The MMLOS worksheets have been provided in Appendix G.

Table 14: Study Area Intersection MMLOS Analysis

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
Apolune Way & Cambrian Rd (EB right-turn lane)	**D**	C	**E**	B	C(**F**)	D	-	No Target	**E**	D

The pedestrian LOS will be met for all legs with the exception of the eastbound direction due to the addition of the right-turn lane. This is due to the crossing distance although the addition of protected phasing at the intersection or right-turn on red restrictions would bring the PLOS to the required targets. This should be confirmed during the detailed design exercise for the final intersection layout and anticipated signal timing.

The bicycle LOS is limited due to mixed traffic conditions on the north approach, and the high vehicle operating speeds and the left-turn configuration along Cambrian Road. Bike boxes or a protected intersection would need to be implemented during the detailed design of the intersection to improve these future conditions.

Transit LOS is limited due to signal delays and does not meet the target except during the PM peak. As the transit movements have been assumed in the westbound left-turn and northbound right-turn movements, improved timing or recall for the westbound left-turn would need to be implemented to reduce possible transit delays.

The auto LOS will not meet the targets, predominantly due to the east-west volumes demands along Cambrian Road. The northbound left-turn does influence the overall delay, and would require additional capacity on Cambrian Road to allow signal timing to be allocated for this movement.

It is recommended that the City re-evaluate the MMLOS analysis during the detailed design of the intersection and confirm the trade-off required to meet, or not meet, the MMLOS targets.

17 Summary of Improvements Indicates and Modifications Options

The following summarizes the analysis and results presented in this TIA report:

Proposed Site and Screening

- The proposed site includes 228 stacked townhouse units and 320 parking spaces
- Access to the development will be provided to the east via Obsidian Street
- The development is proposed to be completed as a single phase by 2024
- A TIA is required including the Design Review component and the Network Impact Component as determined by the TIA Screening
- The application for the proposed site is for a draft site plan approval

Existing Conditions

- Cambrian Road, Kilbirnie Drive, and Dundonald Drive are both collector roads
- Cambrian Road does not have sidewalks to the west of Seeley's Bay Street and both Kilbirnie Drive and Dundonald Drive have sidewalks on both sides
- On the study area roadways, cycling conditions are classified as mixed traffic conditions
- The existing transit routes #75 and 275 stop on Cambrian Road, however no existing transit service runs along the boundary roads
- There are no existing intersections in the study area

Development Generated Travel Demand

- The proposed development is forecasted to generate 223 people two-way trips during the AM peak and 264 people two-way trips during the PM peak
- Based on the area mode shares, a total of 134 two-way vehicle trips will be generated during the AM peak and 158 two-way vehicle trips during the PM peak
- The distribution of the site trips is estimated to be 80% to the north, 5% to the south, 10% to the east, and 5% to the west

Background Conditions

- The background developments explicitly considered in both the background conditions include the Meadows Phase 4, Meadows Phase 5, Half Moon Bay West, Half Moon Bay Phase 5, Citi Gate's Highway 416 Employment Lands, Half Moon Bay North Phase 9, 3713 Borrisokane Road, 3717 Borrisokane Road, 3809 Borrisokane Road, 3285 Borrisokane Road, and 3831 Cambrian Road developments, and Quinn's Pointe Two development is only considered in the 2029 background conditions
- A 2% background growth has been applied to the area to capture growth outside the explicit development areas considered above
- Signalization of Cambrian Road and Apolune Way is warranted in the 2024 future background horizon
- A westbound right-turn lane is warranted in 2024 and operations will be impacted by 2029 without the inclusion of the turn lane in the intersection design and construction

Development Design

- The internal private drive aisles meet the minimum width requirements
- Sidewalks are proposed within the site plan and connect to Obsidian Way and the future Re-Aligned Greenbank Road corridor

Parking

- The proposed site includes the required parking to meet the Zoning Bylaw minimums for both car and bicycle spaces

Boundary Street Design

- Obsidian Street meets the boundary road MMLOS targets
- The Re-Aligned Greenbank Road corridor will be completed beyond the study horizons and should be completed as part of the ongoing design project by the City

Access Intersection Design

- No access intersections were considered in this TIA

TDM

- The lack of supporting infrastructure limits the potential for TDM measures to reduce the auto reliance anticipated for the proposed development
- Beyond the study horizons, the transit network along Re-Aligned Greenbank Road and the associated cycling and pedestrian networks will begin to produce the connectivity required to see a mode shift from the proposed development
- No TDM measures are recommended at this time beyond those required for zoning and standard subdivision design

Neighbourhood Traffic Management

- Based on the trip generation, the proposed site would exceed the TIA guidelines thresholds for local roads
- The volume thresholds outlined in the TIA guidelines are considered to be exceedingly low, given they are for two-way volumes, therefore, no mitigation is recommended for Obsidian Street

Transit

- No transit service is provided on the boundary road network
- A transit route along Elevation Way from Cambrian Road to Kilbirnie Drive will service this development beginning in the 2024 horizon
- To meet minimum area transit use, approximately one bus trips, or equivalent capacity, would be required to support the proposed development during the AM and PM peak hours

Review of Network Concept

- Cambrian Road will potentially exceed a single lane capacity by 2029 and begin to impact access intersections between Borrisokane Road and Re-Aligned Greenbank Road

Network Intersection Design

- Intersection geometry at Apolune Way and Cambrian Road is based on the RMA prepared by Stantec
- Signalization of Cambrian Road and Apolune Way is warranted in the 2024 future background horizons
- No operational issues are noted in the 2024 future total horizon for the intersection of Cambrian Road and Apolune Way without an eastbound right-turn lane
- No operational issues are noted in 2029 future total horizon with the inclusion of an eastbound right-turn lane

- The Cambrian Road at Apolune Way intersection will not meet a combination of pedestrian, bicycle, or transit MMLOS targets due to road widths, mixed traffic conditions, high vehicle operating speeds, and intersection delays
- The functional design will need to be re-evaluated by the City prior to the detailed design and construction to confirm the trade-off required to meet, or not meet, the MMLOS targets

18 Conclusion

It is recommended that, from a transportation perspective, the proposed development application proceed.

Prepared By:

Robin Marinac, EIT
Senior Transportation Engineer

Reviewed By:

Andrew Harte, P.Eng.
Senior Transportation Engineer

Appendix A

TIA Screening Form and PM Certification Form

13 Markham Avenue
Ottawa ON K2G 3Z1

City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 04-Dec-20
Project Number: 2020-100
Project Reference: Mattamy HMBSPh8

1.1 Description of Proposed Development	
Municipal Address	3718 Greenbank Road
Description of Location	South of Dundonald Dr, west of realigned Greenbank Rd, north of Kilbirnie Dr, east of a residential development
Land Use Classification	Mineral Aggregate Reserve Zone (MR1)
Development Size	204 stacked townhouse units, and 14 townhouse units
Accesses	Access provided through adjacent properties
Phase of Development	Single Phase
Buildout Year	2024
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger		
Land Use Type	Townhomes or apartments	
Development Size	218	Units
Trip Generation Trigger	Yes	

1.3 Location Triggers	
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?	No
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?	No
Location Trigger	No

1.4. Safety Triggers	
Are posted speed limits on a boundary street 80 km/hr or greater?	No
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?	No
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions)?	No
Is the proposed driveway within auxiliary lanes of an intersection?	No
Does the proposed driveway make use of an existing median break that serves an existing site?	No
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?	No
Does the development include a drive-thru facility?	No
Safety Trigger	No

TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed[1] or registered[2] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering √ or transportation planning □.

[1,2] License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.

City Of Ottawa
Infrastructure Services and Community Sustainability
Planning and Growth Management
110 Laurier Avenue West, 4th fl.
Ottawa, ON K1P 1J1
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Urbanisme et Gestion de la croissance
110, avenue Laurier Ouest
Ottawa (Ontario) K1P 1J1
Tél. : 613-580-2424
Télécopieur: 613-560-6006

Dated at ___Ottawa_____ this __20__ day of _____September_____, 2018.
(City)

Name: _____Andrew Harte_____
(Please Print)

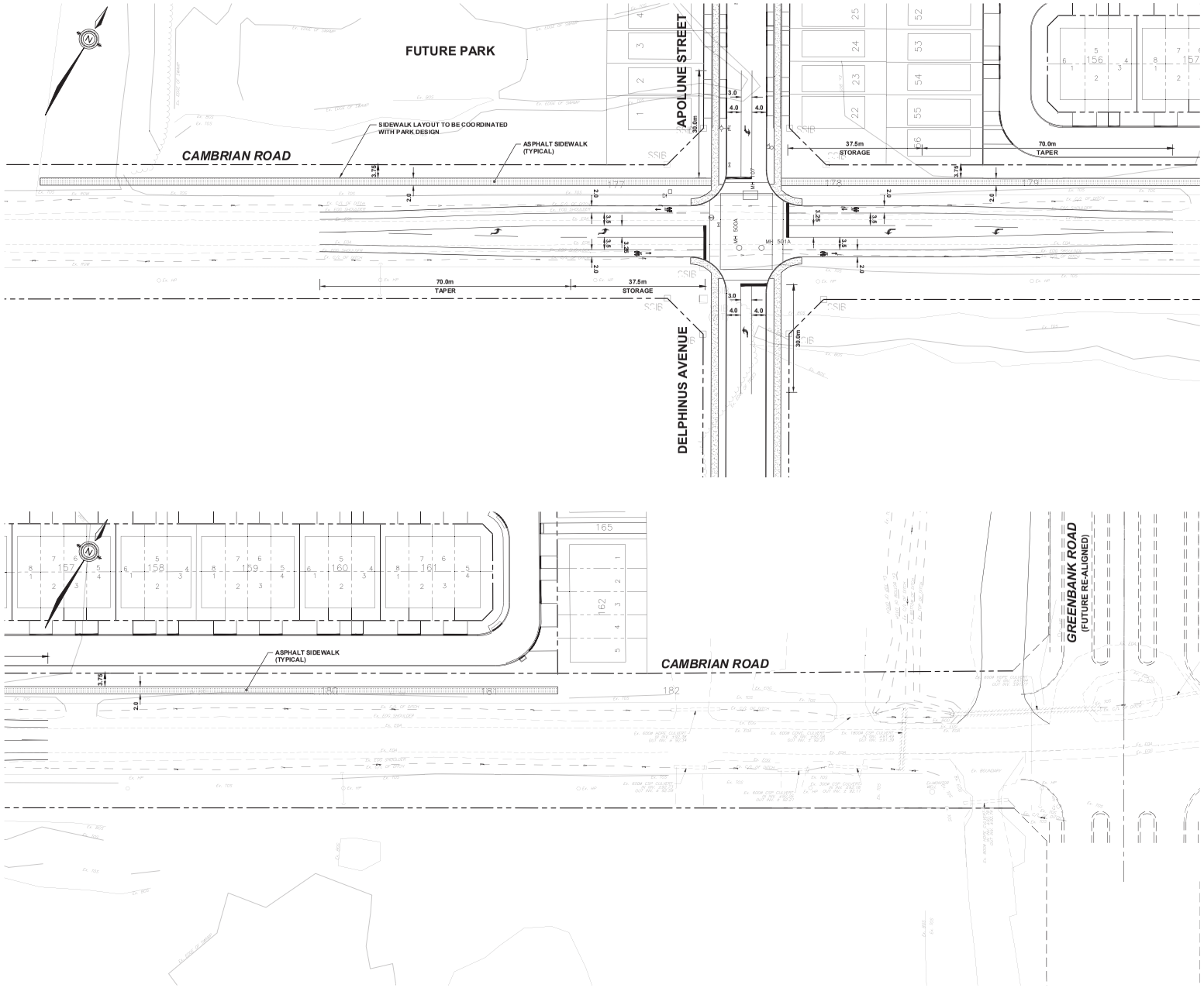
Professional Title: _____Professional Engineer_____

_____
Signature of Individual certifier that s/he meets the above four criteria

Office Contact Information (Please Print)
Address: 13 Markham Avenue
City / Postal Code: Ottawa / K2G 3Z1
Telephone / Extension: (613) 697-3797
E-Mail Address: Andrew.Harte@CGHTransportation.com

Appendix B

Apolune Way and Cambrian Road RMA



Stantec

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

Consultants

Legend

Notes

3.	REVISED PER COMMENTS	J.B.		19.04.03
2.	REVISED PER COMMENTS	J.B.		18.12.18
1.	ISSUED FOR CLIENT REVIEW	J.B.		18.12.10
Issued		By	Appd.	YY.MM.DD

File Name: 012450-sjd	G.R.L.	J.B.	J.B.	18.11.28
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

MATTAMY HALF MOON BAY WEST

TAMARACK MEADOWS PHASE 5 AND 6

Ottawa, Ontario

Title

ROADWAY MODIFICATIONS
CAMBRIAN RD. AT APOLUNE ST./DELPHINUS AVE.
FUNCTIONAL DESIGN PLAN

Project No.	Scale
1-636-01240	1:500 (0, 5, 15, 30m)

Drawing No.	Sheet	Revision
01	1 of 1	1

Appendix C

Traffic Data

Survey Date: Tuesday February 15 2018
Weather: Cloudy

TURNING MOVEMENT COUNT SUMMARY - ALL MODES

AM Peak Hour: 7:30 AM to 8:30 AM
MD Peak Hour: 11:30 AM to 12:30 PM
PM Peak Hour: 4:45 PM to 5:45 PM

AADT FACTOR: 1.0

Turning Movement Count - Full Study Summary Report (Vehicles)

Time Period		Borrisokane Road Northbound					Borrisokane Road Southbound					N/S STREET TOTAL	0 Eastbound					Cambrian Road Westbound					E/W STREET TOTAL	Grand TOTAL
		LT	ST	RT	U-Turns	NB TOTAL	LT	ST	RT	U-Turns	SB TOTAL		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
7:00	8:00	0	28	10	0	**38**	72	15	0	0	**87**	**125**	0	0	0	0	**0**	8	0	350	0	**358**	**358**	**483**
8:00	9:00	0	48	13	0	**61**	123	22	0	0	**145**	**206**	0	0	0	0	**0**	5	0	346	0	**351**	**351**	**557**
9:00	10:00	0	24	1	0	**25**	60	22	0	0	**82**	**107**	0	0	0	0	**0**	1	0	209	0	**210**	**210**	**317**
AVG AM Pk HR		0	33	8	0	**41**	85	20	0	0	**105**	**146**	0	0	0	0	**0**	5	0	302	0	**306**	**306**	**452**
11:30	12:30	0	54	9	0	**63**	105	26	0	0	**131**	**194**	0	0	0	0	**0**	4	0	139	0	**143**	**143**	**337**
12:30	13:30	0	48	6	0	**54**	87	23	0	0	**110**	**164**	0	0	0	0	**0**	2	0	117	0	**119**	**119**	**283**
AVG MD Pk HR		0	51	8	0	**59**	96	25	0	0	**121**	**179**	0	0	0	0	**0**	3	0	128	0	**131**	**131**	**310**
15:00	16:00	0	40	1	0	**41**	58	51	0	0	**109**	**150**	0	0	0	0	**0**	13	0	159	0	**172**	**172**	**322**
16:00	17:00	0	25	0	0	**25**	344	43	0	0	**387**	**412**	0	0	0	0	**0**	11	0	162	0	**173**	**173**	**585**
17:00	18:00	0	22	0	0	**22**	352	36	0	0	**388**	**410**	0	0	0	0	**0**	14	0	198	0	**212**	**212**	**622**
AVG PM Pk HR		0	29	0	0	**29**	251	43	0	0	**295**	**324**	0	0	0	0	**0**	13	0	173	0	**186**	**186**	**510**
TOTAL		0	373	56	0	**429**	1,382	282	0	0	**1,664**	**2,093**	0	0	0	0	**0**	66	0	2,110	0	**2,175**	**2,175**	**4,268**
EQ 12Hr		0	519	77	0	596	1921	392	0	0	2313	2909	0	0	0	0	0	91	0	2932	0	3024	3024	5933
Note: These volumes are calculated by multiplying the totals by the appropriate expansion factor.											1.39													
AVG 12Hr		0	519	77	0	596	1921	392	0	0	2313	2909	0	0	0	0	0	91	0	2932	0	3024	3024	5933
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.											1.0													
AVG 24Hr		0	680	101	0	781	2516	514	0	0	3030	3811	0	0	0	0	0	120	0	3841	0	3961	3961	7772
Note: These volumes are calculated by multiplying the Average Daily 12hr. totals by the 12 to 24 expansion factor.													1.31											

Turning Movement Count - Full Study Summary Report (Pedestrians)

Time Period		Borrisokane Road NB Approach (East or West Crossing)	Borrisokane Road SB Approach (East or West Crossing)	N/S STREET TOTAL	0 EB Approach (North or South Crossing)	Cambrian Road WB Approach (North or South Crossing)	E/W STREET TOTAL	Grand TOTAL
7:00	8:00	0	0	**0**	0	0	**0**	**0**
8:00	9:00	0	0	**0**	0	0	**0**	**0**
9:00	10:00	0	0	**0**	0	1	**1**	**1**
11:30	12:30	0	0	**0**	0	0	**0**	**0**
12:30	13:30	0	0	**0**	0	0	**0**	**0**
15:00	16:00	0	0	**0**	0	0	**0**	**0**
16:00	17:00	0	228	**228**	0	0	**0**	**228**
17:00	18:00	0	0	**0**	0	0	**0**	**0**
TOTAL:		0	228	**228**	0	1	**1**	**229**

Appendix D

Signal Warrants

Cambrian Road @ Apolune Way / Delphinus Avenue
2024 FB

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	855	178%	178%	Yes
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	241	201%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	613	128%	128%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	178	356%		

Notes
1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, AHV = PM/2 or (AM + PM) / 4
4. T-intersection factor corrected, applies only to 1B

Appendix E

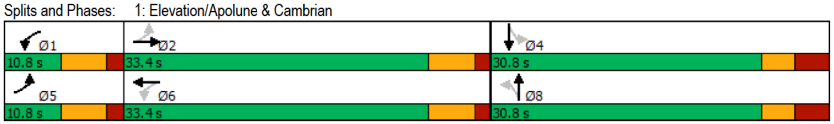
2024 Future Background Synchro Sheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	206	164	47	569	20	303	0	106	103	0	45
Future Volume (vph)	21	206	164	47	569	20	303	0	106	103	0	45
Satd. Flow (prot)	1602	1630	0	1602	1736	0	1565	1567	0	1565	1567	0
Flt Permitted	0.179			0.392			0.728			0.689		
Satd. Flow (perm)	302	1630	0	661	1736	0	1199	1567	0	1135	1567	0
Satd. Flow (RTOR)		61			3			620			291	
Lane Group Flow (vph)	21	370	0	47	589	0	303	106	0	103	45	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	10.7	23.7		10.7	23.7		30.7	30.7		30.7	30.7	
Total Split (s)	10.8	33.4		10.8	33.4		30.8	30.8		30.8	30.8	
Total Split (%)	14.4%	44.5%		14.4%	44.5%		41.1%	41.1%		41.1%	41.1%	
Yellow Time (s)	4.2	4.2		4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		3.2	3.2		3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7		6.2	6.2		6.2	6.2	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Act Effct Green (s)	26.5	23.7		27.7	25.9		24.9	24.9		24.9	24.9	
Actuated g/C Ratio	0.40	0.36		0.42	0.39		0.37	0.37		0.37	0.37	
v/c Ratio	0.10	0.60		0.14	0.87		0.68	0.11		0.24	0.06	
Control Delay	10.5	20.1		10.7	36.3		29.8	0.2		19.0	0.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.5	20.1		10.7	36.3		29.8	0.2		19.0	0.2	
LOS	B	C		B	D		C	A		B	A	
Approach Delay		19.5			34.4			22.1			13.3	
Approach LOS		B			C			C			B	
Queue Length 50th (m)	1.4	33.9		3.1	57.2		29.5	0.0		8.2	0.0	
Queue Length 95th (m)	4.5	59.5		7.9	#138.1		#76.3	0.0		22.4	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5			37.5			30.0			30.0		
Base Capacity (vph)	220	720		347	736		447	973		424	767	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.10	0.51		0.14	0.80		0.68	0.11		0.24	0.06	

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 66.7
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87

Intersection Signal Delay: 25.6 — Intersection LOS: C
Intersection Capacity Utilization 75.5% — ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Elevation/Apolune & Cambrian

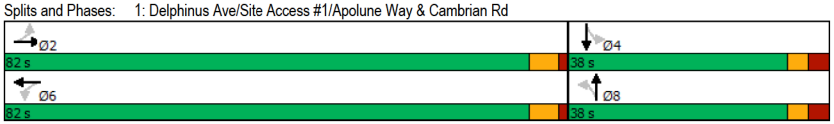


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	570	302	90	345	68	235	0	78	70	0	25
Future Volume (vph)	51	570	302	90	345	68	235	0	78	70	0	25
Satd. Flow (prot)	1602	1654	0	1602	1701	0	1565	1567	0	1565	1567	0
Flt Permitted	0.450			0.119			0.741			0.706		
Satd. Flow (perm)	759	1654	0	201	1701	0	1220	1567	0	1163	1567	0
Satd. Flow (RTOR)		44			16			341			544	
Lane Group Flow (vph)	51	872	0	90	413	0	235	78	0	70	25	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7		23.7	23.7		30.7	30.7		30.7	30.7	
Total Split (s)	82.0	82.0		82.0	82.0		38.0	38.0		38.0	38.0	
Total Split (%)	68.3%	68.3%		68.3%	68.3%		31.7%	31.7%		31.7%	31.7%	
Yellow Time (s)	4.2	4.2		4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		3.2	3.2		3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Act Effct Green (s)	55.4	55.4		55.4	55.4		32.5	32.5		32.5	32.5	
Actuated g/C Ratio	0.55	0.55		0.55	0.55		0.32	0.32		0.32	0.32	
v/c Ratio	0.12	0.93		0.81	0.44		0.59	0.11		0.19	0.03	
Control Delay	10.3	36.4		68.0	13.3		39.8	0.3		31.5	0.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.3	36.4		68.0	13.3		39.8	0.3		31.5	0.1	
LOS	B	D		E	B		D	A		C	A	
Approach Delay		34.9			23.1			30.0			23.2	
Approach LOS		C			C			C			C	
Queue Length 50th (m)	4.4	138.3		13.0	41.5		37.9	0.0		9.7	0.0	
Queue Length 95th (m)	9.6	203.4		#46.1	60.3		#85.4	0.0		25.6	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5			37.5			30.0			30.0		
Base Capacity (vph)	592	1299		156	1330		396	739		378	876	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.09	0.67		0.58	0.31		0.59	0.11		0.19	0.03	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 100.1
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93

Intersection Signal Delay: 30.2 — Intersection LOS: C
Intersection Capacity Utilization 94.5% — ICU Level of Service F
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd



Appendix F

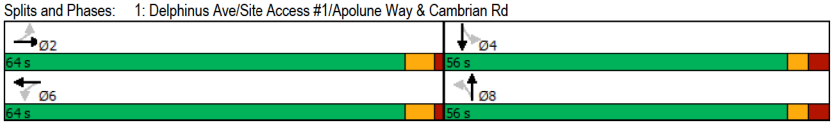
2029 Future Background Synchro Sheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	231	229	79	736	20	438	0	174	103	0	45
Future Volume (vph)	21	231	229	79	736	20	438	0	174	103	0	45
Satd. Flow (prot)	1602	1614	0	1602	1738	0	1565	1567	0	1565	1567	0
Flt Permitted	0.098			0.351			0.728			0.638		
Satd. Flow (perm)	165	1614	0	592	1738	0	1199	1567	0	1051	1567	0
Satd. Flow (RTOR)		58			2			593			148	
Lane Group Flow (vph)	21	460	0	79	756	0	438	174	0	103	45	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7		23.7	23.7		30.7	30.7		30.7	30.7	
Total Split (s)	64.0	64.0		64.0	64.0		56.0	56.0		56.0	56.0	
Total Split (%)	53.3%	53.3%		53.3%	53.3%		46.7%	46.7%		46.7%	46.7%	
Yellow Time (s)	4.2	4.2		4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		3.2	3.2		3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Act Effct Green (s)	52.7	52.7		52.7	52.7		50.0	50.0		50.0	50.0	
Actuated g/C Ratio	0.46	0.46		0.46	0.46		0.44	0.44		0.44	0.44	
v/c Ratio	0.28	0.60		0.29	0.95		0.84	0.17		0.22	0.06	
Control Delay	30.0	23.2		22.2	50.9		46.4	0.4		23.7	0.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	30.0	23.2		22.2	50.9		46.4	0.4		23.7	0.2	
LOS	C	C		C	D		D	A		C	A	
Approach Delay		23.5			48.2			33.3			16.5	
Approach LOS		C			D			C			B	
Queue Length 50th (m)	2.8	65.1		10.7	156.9		93.6	0.0		15.5	0.0	
Queue Length 95th (m)	10.0	96.9		22.2	#236.1		#154.4	0.0		28.5	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5			37.5			30.0			30.0		
Base Capacity (vph)	84	852		302	888		522	1018		458	766	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.25	0.54		0.26	0.85		0.84	0.17		0.22	0.06	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 114.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.95

Intersection Signal Delay: 35.8 Intersection LOS: D
Intersection Capacity Utilization 104.3% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	718	434	156	384	68	332	0	126	70	0	25
Future Volume (vph)	51	718	434	156	384	68	332	0	126	70	0	25
Satd. Flow (prot)	1602	1646	0	1602	1705	0	1565	1567	0	1565	1567	0
Flt Permitted	0.502			0.055			0.741			0.661		
Satd. Flow (perm)	847	1646	0	93	1705	0	1220	1567	0	1089	1567	0
Satd. Flow (RTOR)		42			16			291			517	
Lane Group Flow (vph)	51	1152	0	156	452	0	332	126	0	70	25	0
Turn Type	Perm	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7		9.5	23.7		30.7	30.7		30.7	30.7	
Total Split (s)	74.0	74.0		11.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	61.7%	61.7%		9.2%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	4.2	4.2		3.0	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.0	1.5		3.2	3.2		3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7		4.0	5.7		6.2	6.2		6.2	6.2	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Act Effct Green (s)	68.3	68.3		81.0	79.3		28.8	28.8		28.8	28.8	
Actuated g/C Ratio	0.57	0.57		0.68	0.66		0.24	0.24		0.24	0.24	
v/c Ratio	0.11	1.21		1.04	0.40		1.14	0.21		0.27	0.03	
Control Delay	12.6	128.8		112.7	10.3		136.7	0.8		40.4	0.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	12.6	128.8		112.7	10.3		136.7	0.8		40.4	0.1	
LOS	B	F		F	B		F	A		D	A	
Approach Delay		123.9			36.5			99.3			29.8	
Approach LOS		F			D			F			C	
Queue Length 50th (m)	5.2	~327.6		~25.0	43.3		~91.0	0.0		13.5	0.0	
Queue Length 95th (m)	11.5	#407.3		#67.9	62.5		#146.8	0.0		26.8	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5			37.5			30.0			30.0		
Base Capacity (vph)	482	954		150	1132		292	597		261	769	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.11	1.21		1.04	0.40		1.14	0.21		0.27	0.03	

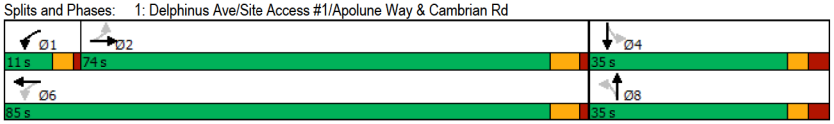
Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.21

Intersection Signal Delay: 92.9 Intersection LOS: F
Intersection Capacity Utilization 123.1% ICU Level of Service H
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd

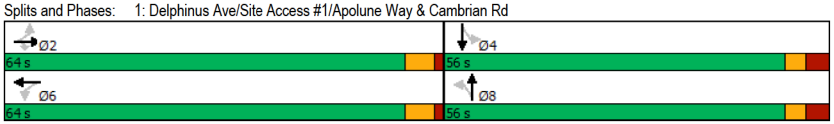


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	231	229	79	736	20	438	0	174	103	0	45
Future Volume (vph)	21	231	229	79	736	20	438	0	174	103	0	45
Satd. Flow (prot)	1602	1745	1483	1602	1738	0	1565	1567	0	1565	1567	0
Flt Permitted	0.098			0.575			0.728			0.643		
Satd. Flow (perm)	165	1745	1483	970	1738	0	1199	1567	0	1059	1567	0
Satd. Flow (RTOR)			229		2			593			148	
Lane Group Flow (vph)	21	231	229	79	756	0	438	174	0	103	45	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Detector Phase	2	2	2	6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7	23.7	23.7	23.7		31.1	31.1		31.1	31.1	
Total Split (s)	64.0	64.0	64.0	64.0	64.0		56.0	56.0		56.0	56.0	
Total Split (%)	53.3%	53.3%	53.3%	53.3%	53.3%		46.7%	46.7%		46.7%	46.7%	
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		3.6	3.6		3.6	3.6	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7	5.7	5.7	5.7		6.6	6.6		6.6	6.6	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		Max	Max		Max	Max	
Act Effct Green (s)	52.7	52.7	52.7	52.7	52.7		49.6	49.6		49.6	49.6	
Actuated g/C Ratio	0.46	0.46	0.46	0.46	0.46		0.43	0.43		0.43	0.43	
v/c Ratio	0.28	0.29	0.28	0.18	0.95		0.85	0.17		0.23	0.06	
Control Delay	30.0	20.0	3.1	18.9	50.9		47.4	0.4		23.9	0.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	30.0	20.0	3.1	18.9	50.9		47.4	0.4		23.9	0.2	
LOS	C	C	A	B	D		D	A		C	A	
Approach Delay		12.4			47.9			34.0			16.7	
Approach LOS		B			D			C			B	
Queue Length 50th (m)	2.8	31.3	0.0	10.1	156.9		94.2	0.0		15.6	0.0	
Queue Length 95th (m)	10.0	48.0	12.6	19.7	#236.1		#155.4	0.0		28.6	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5		30.0	37.5			30.0			30.0		
Base Capacity (vph)	84	890	869	495	888		518	1014		457	762	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.25	0.26	0.26	0.16	0.85		0.85	0.17		0.23	0.06	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 114.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.95

Intersection Signal Delay: 33.4 — Intersection LOS: C
Intersection Capacity Utilization 104.9% — ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd

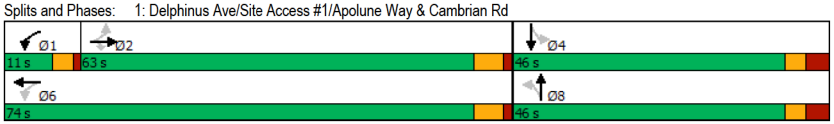


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	718	434	156	384	68	332	0	126	70	0	25
Future Volume (vph)	51	718	434	156	384	68	332	0	126	70	0	25
Satd. Flow (prot)	1602	1745	1483	1602	1705	0	1565	1567	0	1565	1567	0
Flt Permitted	0.495			0.104			0.741			0.676		
Satd. Flow (perm)	835	1745	1483	175	1705	0	1220	1567	0	1113	1567	0
Satd. Flow (RTOR)			172		12			253			457	
Lane Group Flow (vph)	51	718	434	156	452	0	332	126	0	70	25	0
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6			8			4		
Detector Phase	2	2	2	1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7	23.7	9.5	23.7		31.1	31.1		31.1	31.1	
Total Split (s)	63.0	63.0	63.0	11.0	74.0		46.0	46.0		46.0	46.0	
Total Split (%)	52.5%	52.5%	52.5%	9.2%	61.7%		38.3%	38.3%		38.3%	38.3%	
Yellow Time (s)	4.2	4.2	4.2	3.0	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5	1.5	1.0	1.5		3.6	3.6		3.6	3.6	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7	5.7	4.0	5.7		6.6	6.6		6.6	6.6	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None		Max	Max		Max	Max	
Act Effct Green (s)	50.4	50.4	50.4	63.2	61.5		39.6	39.6		39.6	39.6	
Actuated g/C Ratio	0.44	0.44	0.44	0.56	0.54		0.35	0.35		0.35	0.35	
v/c Ratio	0.14	0.93	0.58	0.84	0.49		0.78	0.18		0.18	0.03	
Control Delay	19.0	48.6	16.4	51.8	17.4		49.2	0.5		29.7	0.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	19.0	48.6	16.4	51.8	17.4		49.2	0.5		29.7	0.1	
LOS	B	D	B	D	B		D	A		C	A	
Approach Delay		35.8			26.2			35.8			21.9	
Approach LOS		D			C			D			C	
Queue Length 50th (m)	6.5	146.1	41.2	16.1	57.6		69.9	0.0		11.4	0.0	
Queue Length 95th (m)	14.2	#218.7	71.2	#41.4	83.0		#120.4	0.0		23.4	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5		30.0	37.5			30.0			30.0		
Base Capacity (vph)	423	885	837	186	1036		425	711		388	844	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.12	0.81	0.52	0.84	0.44		0.78	0.18		0.18	0.03	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 113.5
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93

Intersection Signal Delay: 32.8 Intersection LOS: C
Intersection Capacity Utilization 95.8% ICU Level of Service F
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd



Appendix G

MMLOS Worksheets

Multi-Modal Level of Service - Intersections Form

Consultant	**CGH Transportation**	**Project**	**2020-100**
Scenario	**Future Conditions**	**Date**	**29-Jun-21**
Comments	**Transit movements assumed NBR and WBL**		

INTERSECTIONS		**Cambrian & Apolune - EB right turn lane**							
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	3	3	3	4				
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m				
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive				
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control				
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed				
	Ped Signal Leading Interval?	No	No	No	No				
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel				
	Corner Radius	5-10m	5-10m	5-10m	5-10m				
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings				
	PETSI Score	**71**	**71**	**71**	**54**				
	Ped. Exposure to Traffic LoS	**C**	**C**	**C**	**D**	-	-	-	-
	Cycle Length								
	Effective Walk Time								
	Average Pedestrian Delay								
	Pedestrian Delay LoS	-	-	-	-	-	-	-	-
	Level of Service	**C**	**C**	**C**	**D**	**-**	**-**	**-**	**-**
		D				**-**			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach		Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP				
	Right Turn Lane Configuration		Not Applicable	Not Applicable	Not Applicable				
	Right Turning Speed		Not Applicable	Not Applicable	Not Applicable				
	Cyclist relative to RT motorists	-	**Not Applicable**	**Not Applicable**	**Not Applicable**	-	-	-	-
	Separated or Mixed Traffic	-	**Separated**	**Separated**	**Separated**	-	-	-	-
	Left Turn Approach	No lane crossed	No lane crossed	1 lane crossed	1 lane crossed				
	Operating Speed	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	≥ 60 km/h	≥ 60 km/h				
	Left Turning Cyclist	**B**	**B**	**E**	**E**	-	-	-	-
	Level of Service	**-**	**B**	**E**	**E**	**-**	**-**	**-**	**-**
		E				**-**			
Transit	Average Signal Delay		≤ 10 sec	≤ 20 sec			≤ 10 sec	> 40 sec	
	Level of Service	**-**	**B**	**C**	**-**	**-**	**B**	**F**	**-**
		C				**F**			
Truck	Effective Corner Radius								
	Number of Receiving Lanes on Departure from Intersection								
	Level of Service	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		-				**-**			
Auto	Volume to Capacity Ratio		0.91 - 1.00				0.91 - 1.00		
	Level of Service	**E**				**E**			

Multi-Modal Level of Service - Segments Form

Consultant	**CGH Transportation**	**Project**	**2020-100**
Scenario	**Future Conditions**	**Date**	**29-Jun-21**
Comments			

SEGMENTS			Obsidian	Section	Section
			1	2	3
Pedestrian	Sidewalk Width Boulevard Width	**B**	1.8 m < 0.5 m		
	Avg Daily Curb Lane Traffic Volume		≤ 3000		
	Operating Speed On-Street Parking		> 30 to 50 km/h yes		
	Exposure to Traffic PLoS		**B**	-	-
	Effective Sidewalk Width		1.5 m		
	Pedestrian Volume		250 ped/hr		
	Crowding PLoS		**B**	-	-
	Level of Service		**B**	-	-
Bicycle	Type of Cycling Facility	**A**	Mixed Traffic		
	Number of Travel Lanes		≤ 2 (no centreline)		
	Operating Speed		≤ 40 km/h		
	# of Lanes & Operating Speed LoS		**A**	-	-
	Bike Lane (+ Parking Lane) Width				
	Bike Lane Width LoS		-	-	-
	Bike Lane Blockages				
	Blockage LoS		-	-	-
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge		
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes		
	Sidestreet Operating Speed		≤ 40 km/h		
	Unsignalized Crossing - Lowest LoS		**A**	-	-
	Level of Service		**A**	-	-
Transit	Facility Type	-			
	Friction or Ratio Transit:Posted Speed				
	Level of Service		-	-	-
Truck	Truck Lane Width	-			
	Travel Lanes per Direction				
	Level of Service		-	-	-
Auto	**Level of Service**	**Not Applicable**			

Appendix H

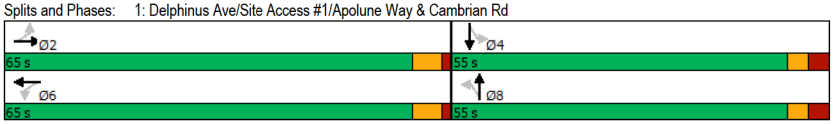
2024 Future Total Synchro Sheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	206	199	50	569	20	362	0	110	103	0	45
Future Volume (vph)	21	206	199	50	569	20	362	0	110	103	0	45
Satd. Flow (prot)	1602	1616	0	1602	1736	0	1565	1567	0	1565	1567	0
Flt Permitted	0.167			0.360			0.728			0.686		
Satd. Flow (perm)	282	1616	0	607	1736	0	1199	1567	0	1130	1567	0
Satd. Flow (RTOR)		57			2			640			243	
Lane Group Flow (vph)	21	405	0	50	589	0	362	110	0	103	45	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7		23.7	23.7		30.7	30.7		30.7	30.7	
Total Split (s)	65.0	65.0		65.0	65.0		55.0	55.0		55.0	55.0	
Total Split (%)	54.2%	54.2%		54.2%	54.2%		45.8%	45.8%		45.8%	45.8%	
Yellow Time (s)	4.2	4.2		4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		3.2	3.2		3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Act Effct Green (s)	38.6	38.6		38.6	38.6		49.3	49.3		49.3	49.3	
Actuated g/C Ratio	0.39	0.39		0.39	0.39		0.49	0.49		0.49	0.49	
v/c Ratio	0.19	0.62		0.21	0.88		0.61	0.10		0.18	0.05	
Control Delay	23.8	24.6		21.8	43.1		26.6	0.2		18.1	0.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	23.8	24.6		21.8	43.1		26.6	0.2		18.1	0.1	
LOS	C	C		C	D		C	A		B	A	
Approach Delay		24.6			41.4			20.5			12.7	
Approach LOS		C			D			C			B	
Queue Length 50th (m)	2.6	52.7		6.3	102.6		47.9	0.0		10.5	0.0	
Queue Length 95th (m)	8.3	80.2		14.5	145.2		104.4	0.0		27.0	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5			37.5			30.0			30.0		
Base Capacity (vph)	169	992		364	1041		591	1097		557	896	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.12	0.41		0.14	0.57		0.61	0.10		0.18	0.05	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 99.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.88

Intersection Signal Delay: 28.8 — Intersection LOS: C
Intersection Capacity Utilization 81.6% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd

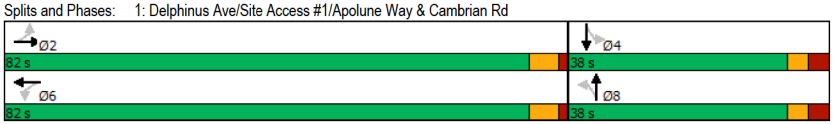


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	570	361	94	345	68	287	0	82	70	0	25
Future Volume (vph)	51	570	361	94	345	68	287	0	82	70	0	25
Satd. Flow (prot)	1602	1644	0	1602	1701	0	1565	1567	0	1565	1567	0
Flt Permitted	0.458			0.108			0.741			0.704		
Satd. Flow (perm)	772	1644	0	182	1701	0	1220	1567	0	1160	1567	0
Satd. Flow (RTOR)		52			16			341			544	
Lane Group Flow (vph)	51	931	0	94	413	0	287	82	0	70	25	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7		23.7	23.7		30.7	30.7		30.7	30.7	
Total Split (s)	82.0	82.0		82.0	82.0		38.0	38.0		38.0	38.0	
Total Split (%)	68.3%	68.3%		68.3%	68.3%		31.7%	31.7%		31.7%	31.7%	
Yellow Time (s)	4.2	4.2		4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		3.2	3.2		3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7		5.7	5.7		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Act Effct Green (s)	62.6	62.6		62.6	62.6		32.3	32.3		32.3	32.3	
Actuated g/C Ratio	0.59	0.59		0.59	0.59		0.30	0.30		0.30	0.30	
v/c Ratio	0.11	0.95		0.89	0.41		0.78	0.12		0.20	0.03	
Control Delay	9.7	38.0		84.9	12.4		53.5	0.3		34.3	0.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.7	38.0		84.9	12.4		53.5	0.3		34.3	0.1	
LOS	A	D		F	B		D	A		C	A	
Approach Delay		36.5			25.8			41.7			25.3	
Approach LOS		D			C			D			C	
Queue Length 50th (m)	4.4	159.8		15.5	41.5		57.7	0.0		11.4	0.0	
Queue Length 95th (m)	9.6	#266.3		#51.5	60.3		#114.8	0.0		25.6	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5			37.5			30.0			30.0		
Base Capacity (vph)	559	1205		131	1236		368	710		350	853	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.09	0.77		0.72	0.33		0.78	0.12		0.20	0.03	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 107
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.95

Intersection Signal Delay: 34.2 Intersection LOS: C
Intersection Capacity Utilization 101.4% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd



Appendix I

2029 Future Total Synchro Sheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	224	264	82	733	20	497	0	178	103	0	45
Future Volume (vph)	21	224	264	82	733	20	497	0	178	103	0	45
Satd. Flow (prot)	1602	1745	1483	1602	1738	0	1565	1567	0	1565	1567	0
Flt Permitted	0.099			0.582			0.728			0.638		
Satd. Flow (perm)	167	1745	1483	981	1738	0	1199	1567	0	1051	1567	0
Satd. Flow (RTOR)			264		2			605			150	
Lane Group Flow (vph)	21	224	264	82	753	0	497	178	0	103	45	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Detector Phase	2	2	2	6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7	23.7	23.7	23.7		31.1	31.1		31.1	31.1	
Total Split (s)	64.0	64.0	64.0	64.0	64.0		56.0	56.0		56.0	56.0	
Total Split (%)	53.3%	53.3%	53.3%	53.3%	53.3%		46.7%	46.7%		46.7%	46.7%	
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		3.6	3.6		3.6	3.6	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7	5.7	5.7	5.7		6.6	6.6		6.6	6.6	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		Max	Max		Max	Max	
Act Effct Green (s)	52.5	52.5	52.5	52.5	52.5		49.6	49.6		49.6	49.6	
Actuated g/C Ratio	0.46	0.46	0.46	0.46	0.46		0.43	0.43		0.43	0.43	
v/c Ratio	0.28	0.28	0.32	0.18	0.94		0.96	0.17		0.23	0.06	
Control Delay	29.7	19.9	3.1	19.0	50.6		64.1	0.4		23.9	0.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.7	19.9	3.1	19.0	50.6		64.1	0.4		23.9	0.2	
LOS	C	B	A	B	D		E	A		C	A	
Approach Delay		11.6			47.5			47.3			16.7	
Approach LOS		B			D			D			B	
Queue Length 50th (m)	2.8	30.2	0.0	10.6	155.9		~117.2	0.0		15.6	0.0	
Queue Length 95th (m)	9.9	46.7	13.3	20.5	#234.1		#186.8	0.0		28.7	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5		30.0	37.5			30.0			30.0		
Base Capacity (vph)	85	892	887	501	890		519	1022		455	764	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.25	0.25	0.30	0.16	0.85		0.96	0.17		0.23	0.06	

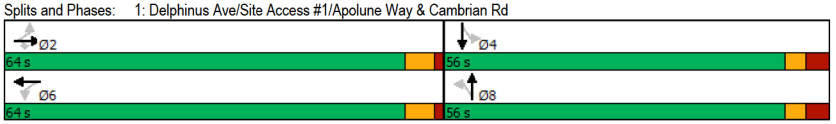
Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 114.5
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.96

Intersection Signal Delay: 36.9 Intersection LOS: D
Intersection Capacity Utilization 108.2% ICU Level of Service G
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	713	493	160	377	68	384	0	130	70	0	25
Future Volume (vph)	61	713	493	160	377	68	384	0	130	70	0	25
Satd. Flow (prot)	1602	1745	1483	1602	1705	0	1565	1567	0	1565	1567	0
Flt Permitted	0.502			0.107			0.741			0.674		
Satd. Flow (perm)	847	1745	1483	180	1705	0	1220	1567	0	1110	1567	0
Satd. Flow (RTOR)			196		13			255			465	
Lane Group Flow (vph)	61	713	493	160	445	0	384	130	0	70	25	0
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6			8			4		
Detector Phase	2	2	2	1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	23.7	23.7	23.7	9.5	23.7		31.1	31.1		31.1	31.1	
Total Split (s)	63.0	63.0	63.0	11.0	74.0		46.0	46.0		46.0	46.0	
Total Split (%)	52.5%	52.5%	52.5%	9.2%	61.7%		38.3%	38.3%		38.3%	38.3%	
Yellow Time (s)	4.2	4.2	4.2	3.0	4.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.5	1.5	1.5	1.0	1.5		3.6	3.6		3.6	3.6	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.7	5.7	5.7	4.0	5.7		6.6	6.6		6.6	6.6	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Recall Mode	None	None	None	None	None		Max	Max		Max	Max	
Act Effct Green (s)	50.2	50.2	50.2	63.0	61.3		39.6	39.6		39.6	39.6	
Actuated g/C Ratio	0.44	0.44	0.44	0.56	0.54		0.35	0.35		0.35	0.35	
v/c Ratio	0.16	0.92	0.64	0.85	0.48		0.90	0.18		0.18	0.03	
Control Delay	19.4	48.0	18.0	53.0	17.3		62.3	0.6		29.7	0.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	19.4	48.0	18.0	53.0	17.3		62.3	0.6		29.7	0.1	
LOS	B	D	B	D	B		E	A		C	A	
Approach Delay		35.0			26.7			46.7			21.9	
Approach LOS		C			C			D			C	
Queue Length 50th (m)	7.9	144.4	49.6	16.5	56.2		86.1	0.0		11.5	0.0	
Queue Length 95th (m)	16.4	#216.8	84.3	#42.7	81.0		#149.3	0.0		23.4	0.0	
Internal Link Dist (m)		519.1			354.3			415.4			383.2	
Turn Bay Length (m)	37.5		30.0	37.5			30.0			30.0		
Base Capacity (vph)	430	887	850	188	1039		426	713		388	850	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.14	0.80	0.58	0.85	0.43		0.90	0.18		0.18	0.03	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 113.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92

Intersection Signal Delay: 34.9 Intersection LOS: C
Intersection Capacity Utilization 98.8% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Delphinus Ave/Site Access #1/Apolune Way & Cambrian Rd