LYNDEN GARDEN BLOCK PLAN

Urban Transportation Considerations
City of Brantford

Prepared For: Welton & Innes GP Inc. (Welton & Innes)

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1.0 INTRODUCTION

BA Group is retained by Welton & Innes GP Inc. (Welton & Innes) to provide transportation advisory services in relation to the Lynden Garden Block Plan Area (referred to herein as the "Site"). The Site is a 77.7-hectare plot of land, generally bounded by existing residential and the Lynden Hills Park to the west, County of Brant agricultural and natural heritage area to the east, Lynden Road to the south, and natural heritage area to the north. The CN rail corridor forms the south-east boundary of the Site.

Figure 1 and **Figure 2** illustrate the location and context of the Site in relation to the surrounding area.

This report forms part of the background to the Lynden Garden Block Plan, and, in particular, it supports the Block Servicing Strategy in accordance with the Block C10 Block Terms of Reference prepared by Welton & Innes.

1.1 EXISTING SITE CONTEXT

The Site is currently primarily agriculture and is part of the 2,720 hectares of land annexed to the City of Brantford from the County of Brant in 2017 to accommodate new growth. The existing areas located to the west of the Site are primarily residential with largely industrial and commercial land uses to the south-west of the Site.

1.2 EXISTING PLANNING CONTEXT

1.2.1 Official Plan

The City of Brantford Official Plan Envisioning Our City:2051 (OP) designates the northern portion of the Site as "Core Natural Areas Designation". The majority of the remaining land is designated as "Residential Area", with the exception of the land fronting Lynden Road is designated as "Neighbourhood Centre" and "Neighbourhood Corridor" on Schedule 4 of the OP.

The OP proposes various transportation-related projects within the Site boundaries/vicinity, including:

- A proposed road right-of-way of 40 metres along Lynden Road, extending from Brantwood Park Road in the west to Garden Avenue in the east (OP, Schedule 13);
- A new minor collector road proposed within the Site boundaries (OP Schedule 12), discussed in further detail in **Section 2.1.2** of this report; and,
- Proposed off-road and on-road bikeways and trails within the Site vicinity (OP Schedule 11), discussed in further detail in **Section 2.3**.

Welton & Innes is completing a Block Plan to permit the development of a mixed-use community on the subject lands consistent with the latest direction of City's OP. Future applications are planned to bring zoning for the lands into conformance with the OP.

1.2.2 Transportation Master Plan

The City of Brantford Transportation Master Plan (2020), prepared in support of the City's OP, proposes various transportation-related projects within the Site vicinity to support the proposed development.

Consistent with the OP:

- a minor collector road is proposed within the Site boundaries to provide connections through the lands to the existing transportation network; and
- several new off -road and on-road bikeways and trails are being considered within the Site vicinity, providing further connections to other areas of the City of Brantford and the County of Brant.

Overall, the Transportation Master Plan envisions the Site as being well-integrated within the existing and future road network and active transportation network.

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FIGURE 1 SITE LOCATION

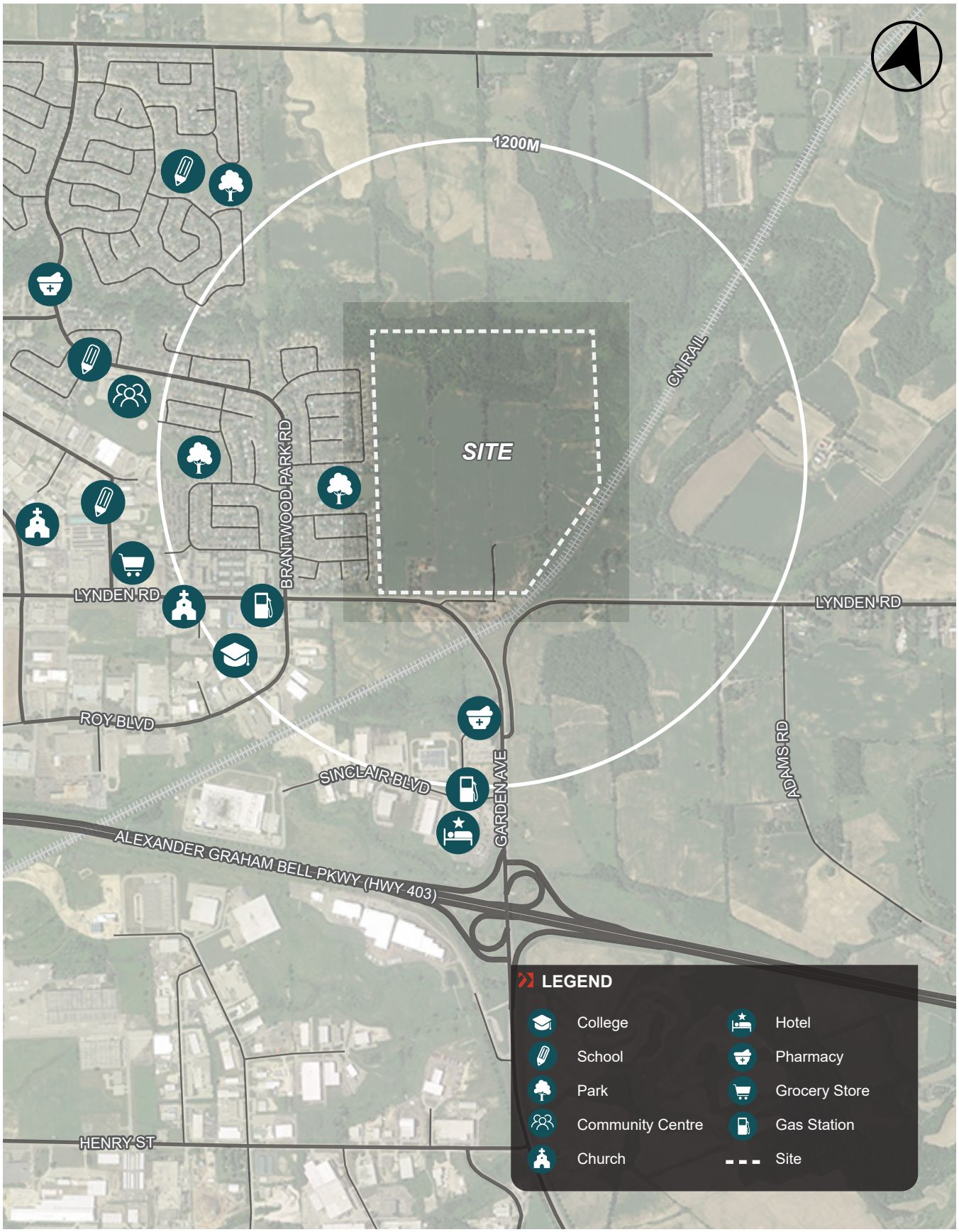

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FIGURE 2 EXISTING SITE CONTEXT

1.3 STUDY SCOPE

BA Group has undertaken a review of the key transportation related aspects of the proposed Block Plan to permit the proposed development. Key aspects of the concept development reviewed are as follows:

Transportation Context

- A description of the existing transportation context of the Site considering the area road network, transit system, and active transportation network.

Development Plan

- A review of the proposed development programme; and
- A review of the transportation elements of the proposed development plan including the proposed road network and a description of the proposed road cross-sections.

Travel Demand Forecasting

- Assessment of the existing traffic activity patterns and volumes in the study area during the key weekday morning and afternoon peak periods;
- A comprehensive review of traffic changes that may occur in the area in the future with background development and general corridor growth; and
- An assessment of the trip generation characteristics of the proposed development.

Traffic Operations Review

- A review of traffic operations at intersections in the area under existing and future conditions including an assessment of the operational impacts of the proposed development and recommended road improvements.

The methodology, analysis, and findings are summarized in the following sections.

2.0 TRANSPORTATION CONTEXT

2.1 AREA ROAD NETWORK

2.1.1 Existing Area Road Network

The Site is well-served by a variety of roadway connections provided across the City, the County of Brant, and to/from the Greater Toronto and Hamilton Area (GTHA). A detailed description of the area road network surrounding the Site is provided in **Table 1.** The existing road network classification is illustrated in **Figure 3**, while existing intersection configurations and traffic control are illustrated in **Figure 4**.

TABLE 1 EXISTING AREA STREET NETWORK

Road Type		Road Name	Parking & Regulations	Roadway Limits	Description
Provincial Highway	E-W	Highway 403	Parking is not permitted at any time along either side of the roadway.	Highway 403 extends from Woodstock in the west (where it continues west as Highway 401) to Mississauga (where it continues east as Highway 401).	Highway 403 is an east-west provincial highway. Near the Site vicinity, the roadway has a four-lane cross-section with two lanes in each direction. In the vicinity of the Site, the unposted default speed limit is assumed to be 100 km/h.
Major Arterial	N-S	Garden Avenue	Parking is not permitted at any time along either side of the roadway.	Garden Avenue extends from Lynden Road in the north to the City's southern limits in the south where it continues into the County of Brant. This roadway has a full-moves interchange with Highway 403, approximately 1 km south of the Site. Garden Avenue splits into two sections through a T-intersection, north of the Highway 403 interchange. The east-west section of Garden Avenue continues as Lynden Road near the intersection at Adams Road (local road), continuing west beyond the City limits. The north-south section of Garden Avenue continues south as County Road 18.	Garden Avenue is a north-south major arterial road. Near the Site vicinity, the roadway has a four-lane cross-section with two lanes in each direction. A southbound left turn storage lane is provided at the intersection with Garden Avenue (eastern section). In the vicinity of the Site, the posted speed limit is 60 km/h.

Road Type		Road Name	Parking & Regulations	Roadway Limits	Description
	E-W	Lynden Road	Parking is not permitted at any time along either side of the roadway.	Lynden Road extends from Park Road North in the west to Garden Avenue in the east, where it continues into the County of Brant. It is noted that Lynden Road continues as Garden Avenue southwards where the roadway splits into two sections, north of the Highway 403 interchange. The east-west section continues as Lynden Road east of the Adams Road (local road) intersection.	Lynden Road is an east-west major arterial road. Near the Site vicinity, the roadway has a four-lane cross-section with eastbound and westbound left turn storage lanes at the intersection with Brantwood Park Road / Roy Boulevard. In the vicinity of the Site, the posted speed limit is 50 km/h.
Major Collector	N-S	Brantwood Park Road	Near the Site vicinity, parking is permitted north of Fieldgate Drive in dedicated parking lanes.	Brantwood Park Road extends from Lynden Road in the south to Powerline Road in the north.	Brantwood Park Road is a north-south major collector road. Near the Site vicinity, the roadway generally has a two-lane cross-section, with the exception of dedicated left-turn lanes at or near the intersection with Lynden Road / Roy Boulevard. In the vicinity of the Site, the posted speed limit is 50 km/h.
Minor Collector	N-S / E-W	Roy Boulevard	Near the Site vicinity, parking is not permitted at any time along either side of the roadway.	Roy Boulevard extends from Lynden Road in the north to its western terminus approximately 190 metres west of Woodyatt Drive.	Roy Boulevard is an L-shaped minor collector road. Near the Site vicinity, the roadway has a two-lane cross-section with a right-turn lane at the Lynden Road intersection. In the vicinity of the Site, the unposted default speed limit is assumed to be 50 km/h.

2.1.2 Proposed Area Road Network

The City of Brantford's Official Plan (OP, August 2021) illustrates a proposed minor collector roadway within the Site boundaries. This roadway is proposed to extend northwards from Lynden Road in the form of loop to serve future Site residents. Moreover, Lynden Road, extending from Brantwood Park Road in the west to Garden Avenue in the east, is proposed to have a road allowance widening to a right-of-way width of 40 metres according to Schedule 13 of the Official Plan. The Site is well served by adjacent existing transit services. No transit services are identified by the OP and TMP within the Block Plan area. A more detailed discussion of these provisions and the Site's finer grain road network is discussed in **Section 3.2**.

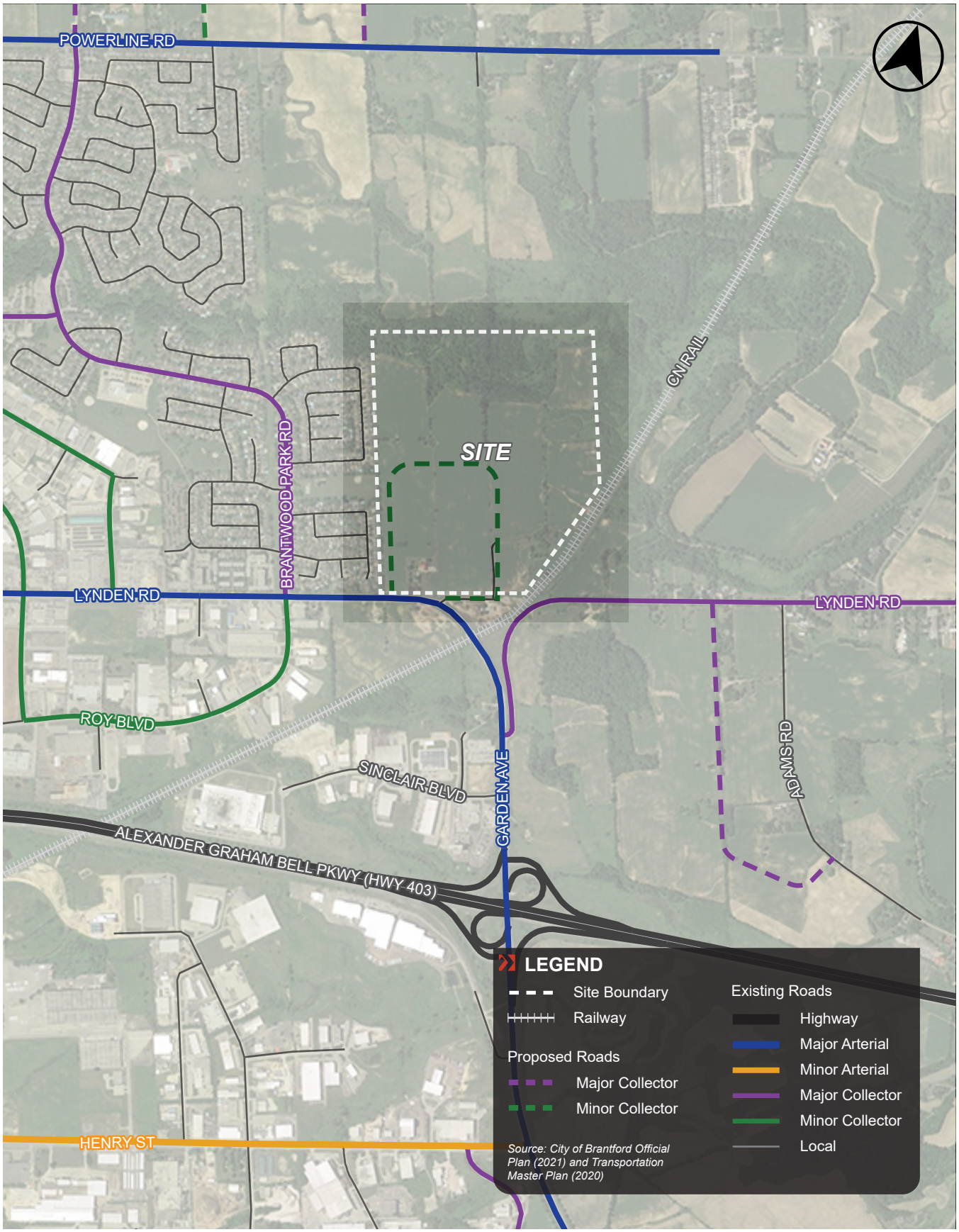

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FIGURE 3 EXISTING AND FUTURE AREA ROAD CLASSIFICATION

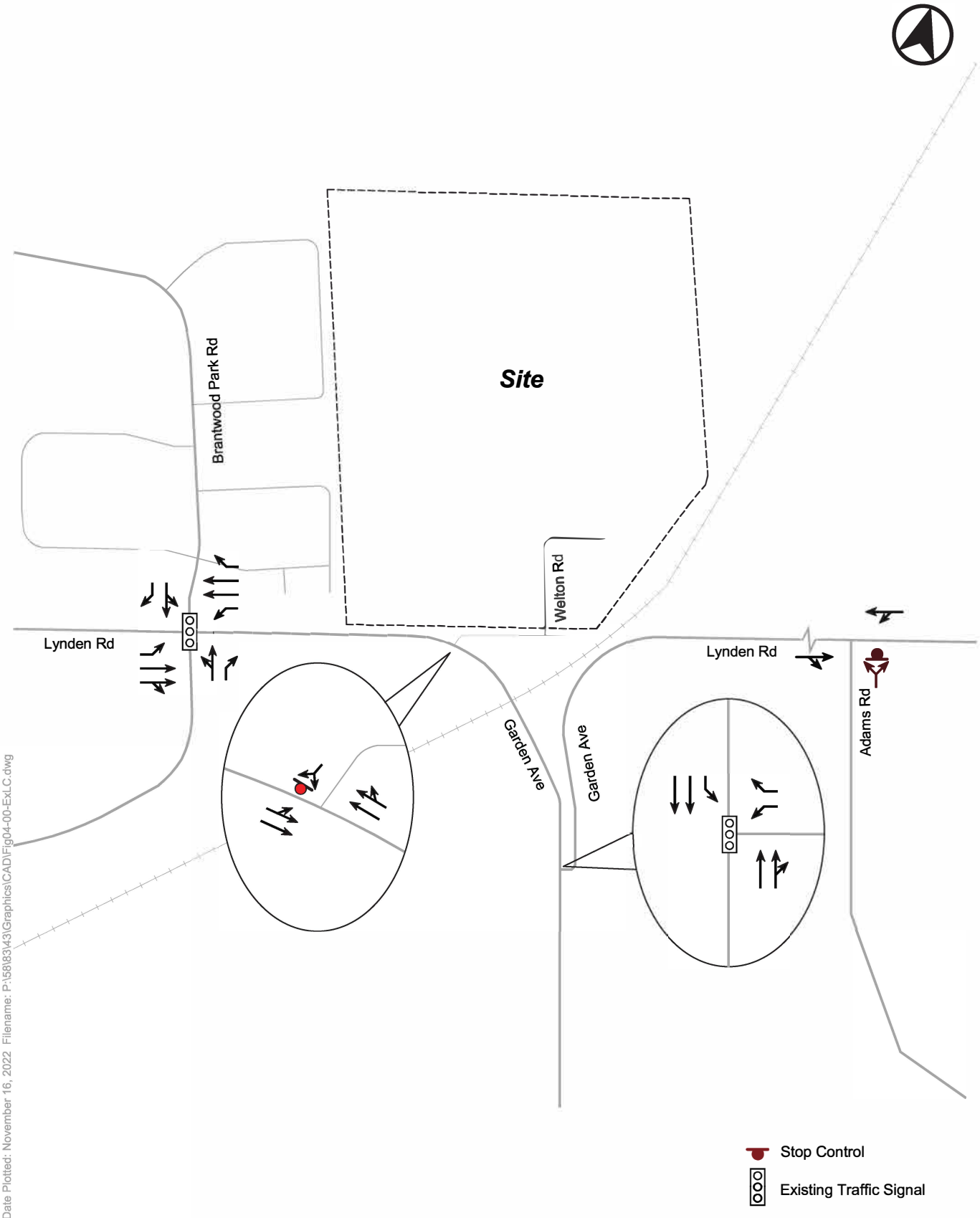

FIGURE 4 EXISTING LANE CONFIGURATION & TRAFFIC CONTROL

2.2 AREA TRANSIT NETWORK

2.2.1 Existing Area Transit Network

The Site is well-served by several existing bus transit routes operated by Brantford Transit. Four (4) bus routes are accessible within an 800-metre radius of the Site. The existing transit routes operating in the area are outlined in **Table 2** and illustrated in **Figure 5.**

TABLE 2 EXISTING AREA TRANSIT NETWORK

Route		Headway (Weekday Peaks)	Closest Stop(s)	Route Description
Brantford Transit	4A Mall Link	~30 minutes	Brantwood Park Road and Fieldgate Drive (~ 550 metres / ~ 7-minute walk)	The 4C Mall Link bus route operates from the Brantford bus transit terminal and makes a loop using the following roads: Market, Terrace Hill, North Park, Fairview, Lynden, Sympatica, Brantwood Park, Banbury, Dunsdon, Ashgrove, Varadi, King George, St Paul and William. Evening service is provided through the 13 King George Rd Brantwood Park bus route.
	4C Mall Link	~30 minutes	Brantwood Park Road & Lynden Road (~ 400 metres / ~ 5-minute walk)	The 4C Mall Link bus route operates from the Brantford bus transit terminal and makes a loop using the following roads: Brant, St. Paul, King George, Varadi, Ashgrove, Dunsdon, Banbury, Brantwood Park, Sympatica, Lynden, Fairview, North Park, Terrace Hill, and Market.
	2 West Street Brier Park	~30 minutes	Roy Boulevard & Lynden Road (~ 400 metres / ~ 5-minute walk)	The 2 West Street Brier Park bus route operates from the Brantford bus transit terminal, up Clarence and West Street and loops through the Brier Park area using the following roads: Lynden, Park Road North, Dunsdon, Bernard, Evelyn, Memorial, Applewood, Lynden, West and Clarence.
	9 Echo Place	~30 minutes	Duncan Graham Building (~250 metres / ~3-minute walk)	The 9 Echo Place bus route travels from the Brantford bus transit terminal, and loops through the Echo Place area using the following roads: Colborne, Glenwood, Colborne, Garden, Grey, Lyndhyrst, Grey, Wayne Gretzky Pkwy, Holiday, Wayne Gretzky, Roy, Lynden, Garden, Grey, Linden, Colborne and Dalhousie. Evening service is provided through the 14 Echo Place East Ward bus route.

2.2.2 Future Area Transit Network

The City's TMP identified implementation plans for a 'Transit Focus' approach with growth in new areas of the City. Lynden Garden is identified in the City's TMP as an area served by existing transit (Figure 4-63 of TMP).

Future studies by the City will identify improvements to existing transit service, routes, and operations changes across Brantford. No specific proposed expansions to the area transit network are identified within the Site boundaries in the City's OP and TMP.

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FIGURE 5 EXISTING TRANSIT CONTEXT

2.3 AREA PEDESTRIAN & CYCLING CONTEXT

The existing and future active transportation context is illustrated in **Figure 6.**

2.3.1 Existing Area Pedestrian Context

Surrounding Area

The existing Site consists of agricultural land, located adjacent to a residential community. In addition to industrial uses, there are also various amenities, services, and key destinations within walking distance of the Site, that are not yet connected by pedestrian infrastructure (sidewalks) surrounding the Site.

Within a 1200-metre radius (~15-minute walking distance) of the Site boundary, a range of services, amenities, retail, and other key destinations are available. The Lynden Hills Park and the Splash 'n Play Splashpad can be reached within an 800-metre (10 minute) walking distance. Additionally, along the Lynden Road corridor, the following destinations can be accessed: the New City Church, NewCastle College, and a retail plaza containing various food outlets, a grocery store, and a gym. Along Garden Avenue, another plaza can be accessed which contains the Brantford Medical Centre.

There is a sidewalk within 350 metres of the boundary of the Site (at Brantwood Park Road) which should be connected to the proposed minor collector road system. With the development of the Site, there is also an opportunity to establish sidewalks along the collector and local street system within the Site boundary and controlled crossings of Lynden Road at the proposed signal.

2.3.2 Future Area Pedestrian Context

Improvements to the pedestrian context within the Site boundaries and Site vicinity have been proposed as part of the Block Plan. These improvements include:

- a finer-grain pedestrian network within the Site, including connections to park lands and trails and existing sidewalks; and,
- controlled crossings of Lynden Road for pedestrians at the proposed Minor Collector signalized intersection with Lynden Road.

2.3.3 Existing Area Cycling Network

Under existing conditions, there are limited protected / designated cycling facilities and routes in the vicinity of the Site.

Within 800 metres of the Site, an on-road signed bike route is located:

- along Brantwood Park Drive, from Lynden Road in the south to Powerline Road in the north where it connects to other bikeways, including the multi-use trail along Wayne Gretzky Parkway and the bike lane along Dunsdon Street.
- along Lynden Road, from Wayne Gretzky Parkway in the west to Brantwood Park Drive in the east.

Planned improvements to the cycling network (as described below) will allow for the Site to be better connected within the City's cycling network.

2.3.4 Future Area Cycling Network

As mentioned in Section 1.2 (Planning Context) the Official Plan (OP) and Transportation Master Plan (TMP) identify the routes of several proposed on-road and off-road bikeways and trails in the vicinity of the Site. The majority of these proposed routes will be on-road routes (i.e., bike lanes and share facilities). The TMP also identifies the type of cycling infrastructure proposed along each route.

The TMP proposes the following improvements in the direct vicinity of the Site:

- Proposed bike lane / paved shoulder along the proposed minor collector roadway loop within the Site boundaries;
- Proposed buffered bike lane along Lynden Road / Garden Avenue along the Site's boundary;
- Proposed bike lane / paved shoulder along Lynden Road, from Garden Avenue in the west to the City's eastern limits; and,
- Proposed bike lane / paved shoulder along Roy Boulevard / Brantwood Park Drive.

The Block Plan proposes to incorporate cycling lanes along the new Minor Collector roadway and sidewalks throughout, that will provide both the cycling and pedestrian connectivity envisioned for the Site in the TMP and connecting existing and proposed parks and natural features.

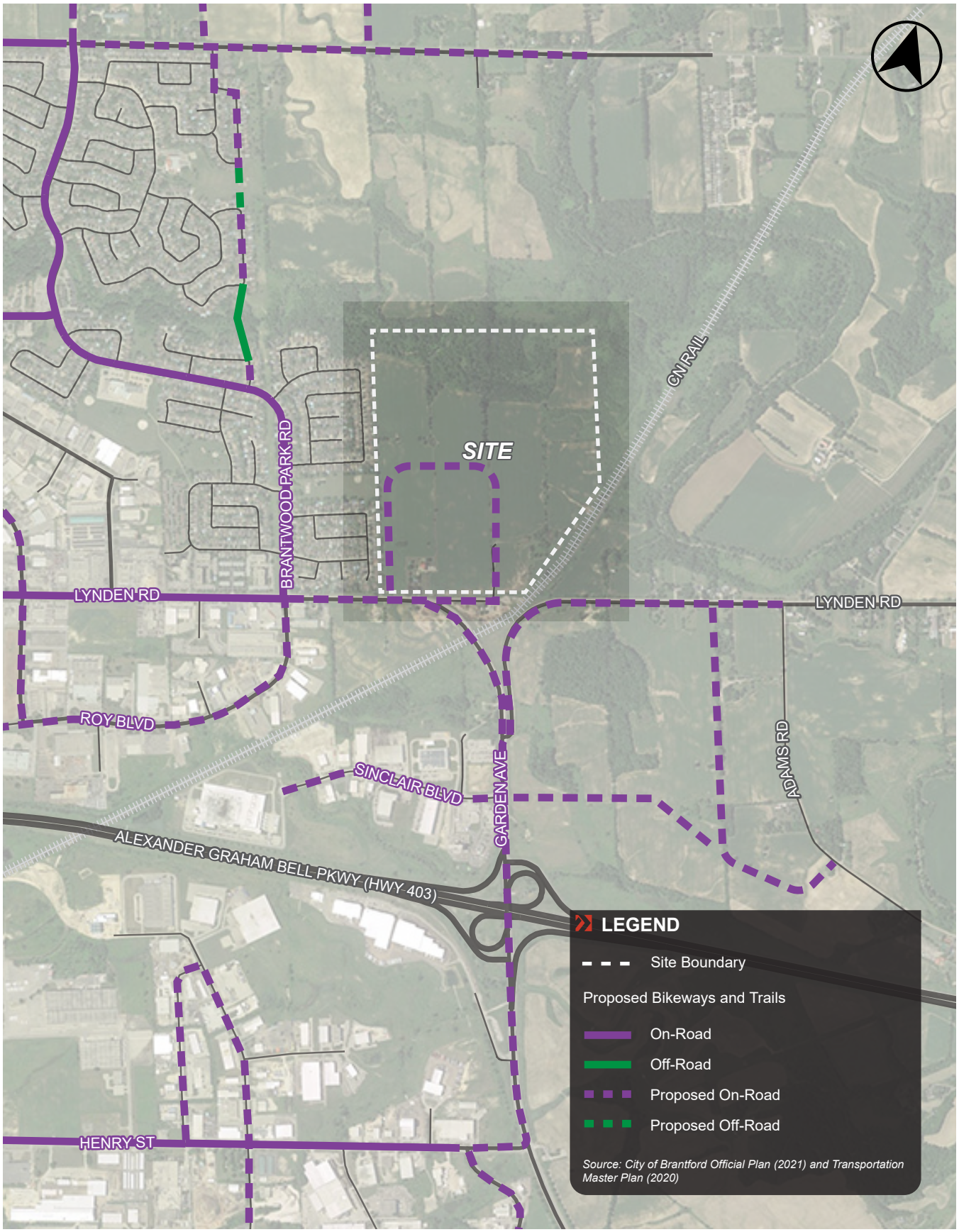

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FIGURE 6 EXISTING AND FUTURE ACTIVE TRANSPORTATION CONTEXT

3.0 THE BLOCK PLAN

A comprehensive plan has been developed for the Lynden Garden Block Plan area. The development plan provides an overall vision guiding the development of the property to create a new neighbourhood, Lynden Garden, located in the north-east of the City, just north of the Garden Avenue interchange on Highway 403.

The Lynden Garden Block Plan illustrating the land use schedule and development densities contemplated for Lynden Garden is included for reference in **Appendix A**.

3.1 DEVELOPMENT PROGRAM

A mixed-use subdivision is proposed for the Site, including 1,016 residential units in a range of low and medium density housing types. Dedicated space for parks is also included.

The proposed site statistics are outline in **Table 3**.

TABLE 3 PROPOSED RESIDENTIAL SITE STATISTICS

Land Use		Units / GFA
Resident		
Resident	Single-Detached	536 units
	Townhouse	480 units
	Total	**1,016 units**

3.2 KEY TRANSPORTATION ELEMENTS OF THE BLOCK PLAN

The following are key elements of the Block Plan from a mobility and transportation perspective:

- Delivery of a collector and local **Street Network** that provides the necessary street linkages to service the new development; and,
- Delivery of **Active Transportation Infrastructure** which will provide connections through the new community to the existing and planned active transportation networks described in **Section 2.3.3** and **Section 2.3.4**.

3.2.1 Street Network

The Block Plan introduces a number of new public roads that have been designed to respect the vision of the TMP, OP, and Linear Municipal Infrastructure Standards. The Site delivers a grid network of roads that include active transportation facilities, while respecting a number of physical, environmental, and policy constraints within the bounds of the Site study area limit where these connections can occur.

Key elements of the new area public street network within the Block Plan, include:

- A new Minor Collector Road that creates a loop through the Site, connecting both ends to Lynden Road/Garden Ave;
- A new signalized intersection at the west intersection of the proposed Minor Collector Road and existing Lynden Road (~400 metres east of Brentwood Park Road);
- On-road bike infrastructure along the proposed Minor Collector Road consistent with the City OP and TMP; and
- Trail/pedestrian connections to the existing neighbourhood west of the Site through a proposed addition to the Lynden Hills Park, and to the proposed park lands within the Site.

3.2.2 Proposed Cross-Sections

The City's TMP and Linear Infrastructure Standards were referenced in developing the cross-sections proposed for the Lynden Garden Block Plan. The City identifies standards up to 18.5 metres for local roads and standards up to 24.5 metres for collector roads. Two standards are proposed for the Site: a 22 metre Minor Collector Road and an 18.5 metre Local Road.

Each section is provided in **Appendix B** for reference.

The **Minor Collector Road** within the Block Plan is proposed to have a 22 metre right-of-way which includes the following key elements:

- Basic 2-lane urban cross-section (3.5 metre travel lanes);
- On-street bike lanes on both sides (1.6 metres to edge-of-pavement; effective width of 1.9 metres to edge of travel way);
- A pedestrian boulevard / sidewalk on both sides (1.8 metres).

The overall width of the proposed cross-section differs from the City's maximum standard (of up to 24.5 metres). However, the width of individual elements of the cross section have been kept consistent with the City's standards.

The **local roads** within the Block Plan are proposed to have an 18.5 metre right-of-way which includes the following key elements:

- Basic 2-lane urban cross-section, plus parking on one-side (7.8 metres pavement width);
- A pedestrian boulevard / sidewalk (1.5 metres) on both sides.

The local road section proposed is consistent with the City's maximum standard of 18.5 metres.

4.0 TRAFFIC VOLUME FORECASTING

4.1 STUDY AREA ROAD NETWORK

The area road network included in the scope of the traffic analysis includes the following intersections:

Signalized Intersections:

- Lynden Road / Brantwood Park Road / Roy Boulevard
- Garden Avenue (via Lynden Road West) / Garden Avenue (via Lynden Road East)

Unsignalized Intersections:

- Lynden Road / Garden Avenue

4.2 EXISTING TRAFFIC VOLUMES

Turning movement volumes at the study area intersections were determined based on traffic count information collected by Spectrum Traffic Inc. on behalf of BA Group. The traffic count information adopted for the basis of the vehicular traffic volume forecasting is summarized in **Table 4**. The count summaries are provided in **Appendix C**.

TABLE 4 TRAFFIC DATA INFORMATION

Intersection	Date	Conducted By
Lynden Road / Brantwood Park Road / Roy Boulevard	Tuesday, September 13, 2022	Spectrum Traffic Data Inc.
Lynden Road / Garden Avenue	Wednesday, June 2, 2022	
Garden Avenue / Garden Avenue[1]		

Notes:
1. A “T”-shaped, signalized intersection south of the Lynden Road / Garden Avenue intersection.

The counts were conducted during the weekday morning and afternoon peak periods, where the busiest hours of traffic are during the two-hour intervals of 7:30 a.m. to 9:30 a.m. and 4:00 p.m. to 6:00 p.m., respectively). Within these two-hour intervals, the hour with the greatest volume in each of the weekday morning and afternoon peak periods were adopted as the peak hour traffic volumes for the intersection.

Across the study area road network, turning movement volumes were rounded to the nearest five (5) vehicles and reviewed in detail to ensure a general consistency in traffic volumes along road links between intersections. For example, eastbound traffic volumes exiting one intersection and entering the adjacent intersection should theoretically be equivalent. Where necessary and appropriate, minor volume adjustments were made to conservatively balance (i.e. balancing upwards) traffic volumes to provide a baseline existing traffic volume layer for the purposes of the traffic operations analysis.

The baseline existing traffic volumes established for the study area during the weekday morning and afternoon peak hours are illustrated in **Figure 7**.

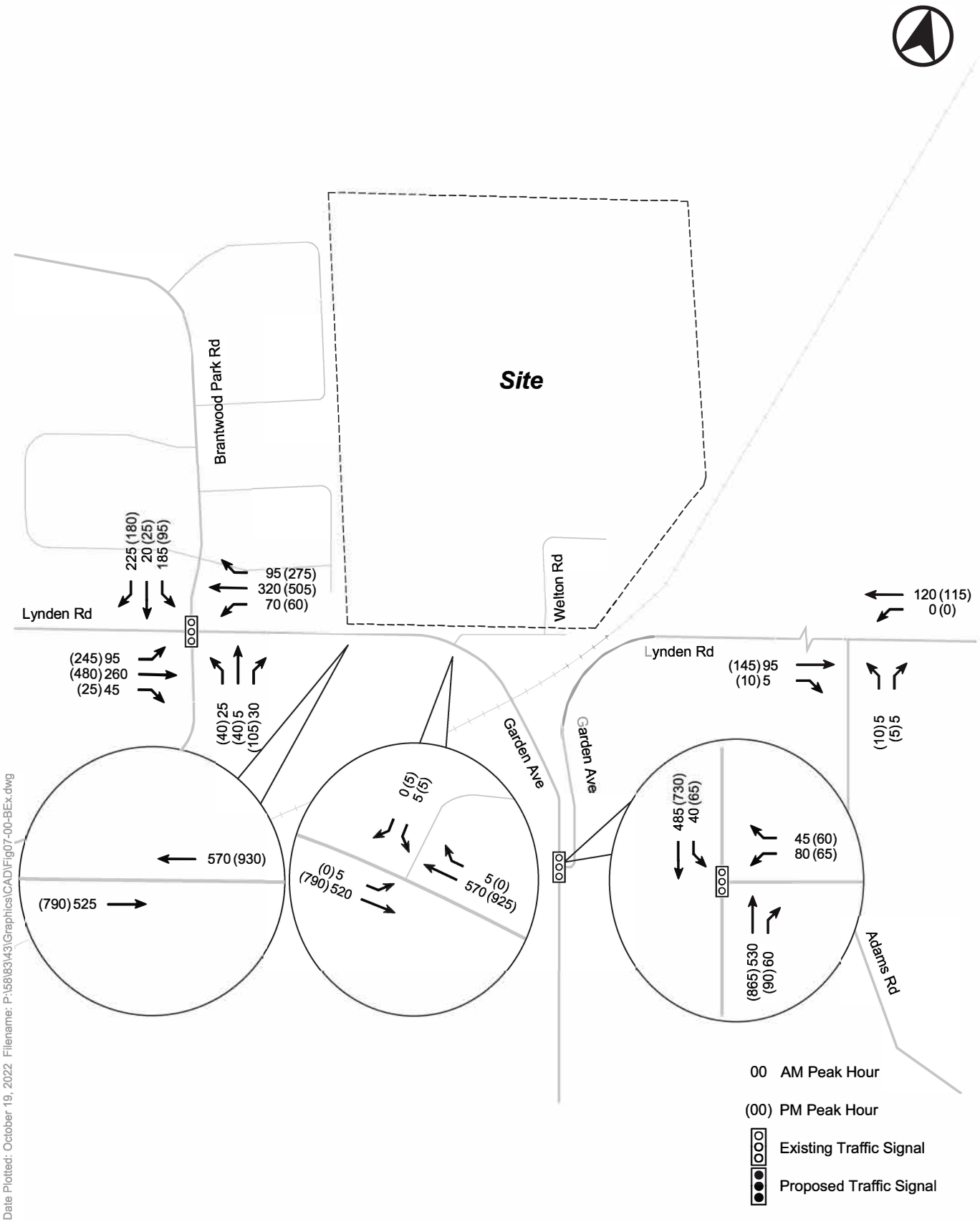


FIGURE 7 BASELINE EXISTING TRAFFIC VOLUMES

4.3 FUTURE BACKGROUND TRAFFIC VOLUMES

4.3.1 Background Development Traffic Allowances

Allowances were made under future traffic conditions to account for new traffic generated by other development proposals in proximity to the proposed Site that are either under construction, approved, being reviewed, or for which an application is expected to be submitted to the City in the near future.

Under the five-year horizon of the year 2027, the total development programme for the three (3) background developments includes approximately 550 dwelling units and 43,000 m^2 non-residential GFA. **Table 5** summarizes the list of background developments considered in this study.

TABLE 5 BACKGROUND DEVELOPMENTS LIST

Development	Description	Report Source	Traffic Volume Source
Lynden Park Mall Expansion	85 residential units 96 hotel suites 40,038 m^2 retail expansion GFA 2,693 m^2 medical office GFA	R. J. Burnside	TIS Report
200 Brantwood Park Road	56 residential units	IBI Group	Not available[1,2]
150 Lynden Road	120 senior living units 192 assisted living units	Not available	

Notes:
1. Given that no traffic impact studies were available for the 200 Brantwood Park Road and 150 Lynden Road applications, respective trip generation and distribution parameters were assumed to be consistent with those published in this study.
2. The site statistics were based on City staff reports accessible online at the time of the study.

4.3.2 General Corridor Growth Trends

An additional, annually compounded growth rate of 2% was adopted along the Lynden Road corridor to the future horizon year of 2027 to account for conservative traffic volume growth outside of the immediate study area.

4.3.3 Future Background Traffic Volumes

Future background traffic volumes are comprised of the established baseline existing traffic volumes (**Figure 7**) and future traffic growth from background developments (**Figure 8**), and are illustrated in **Figure 9**.

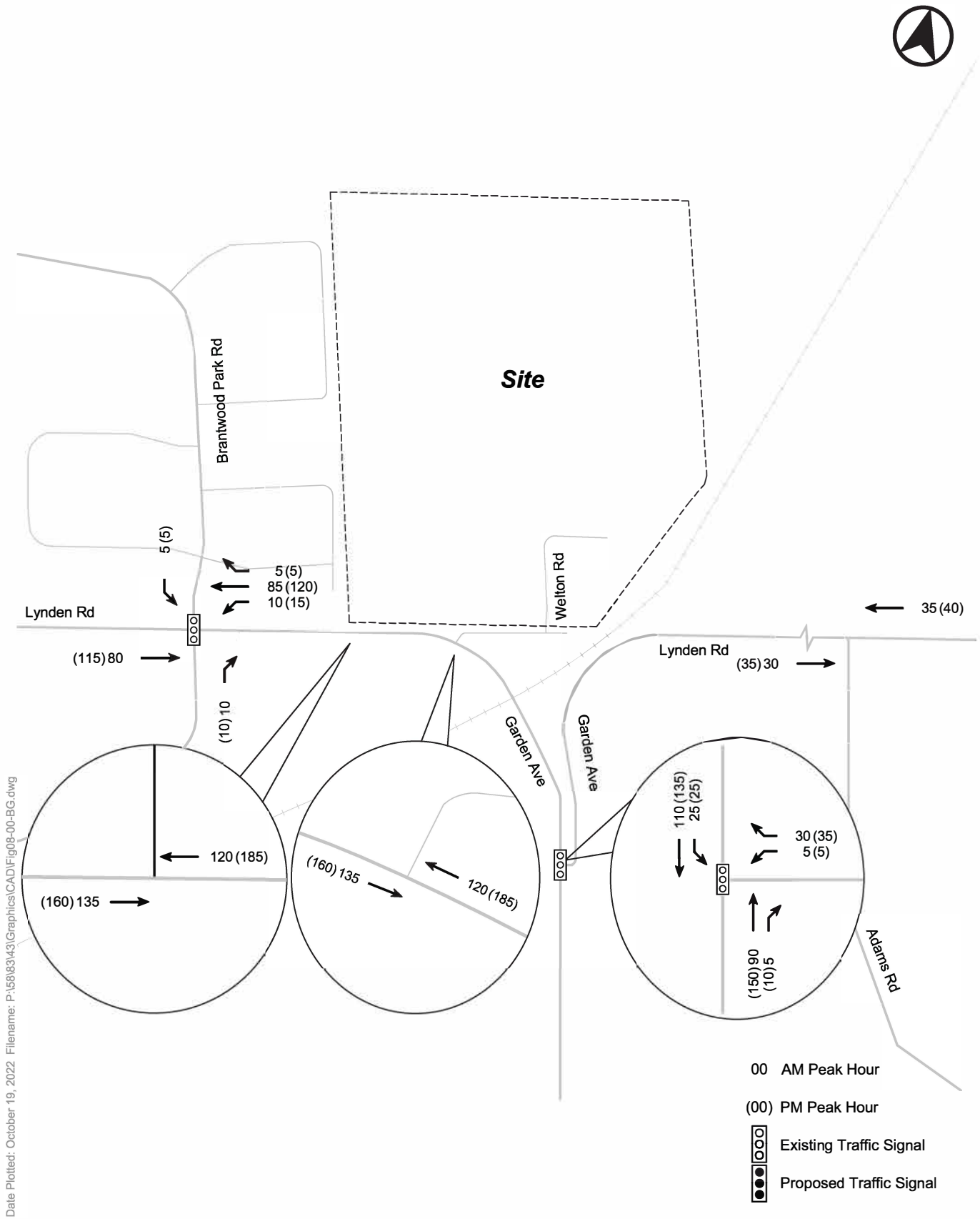


FIGURE 8 BACKGROUND GROWTH TRAFFIC VOLUMES

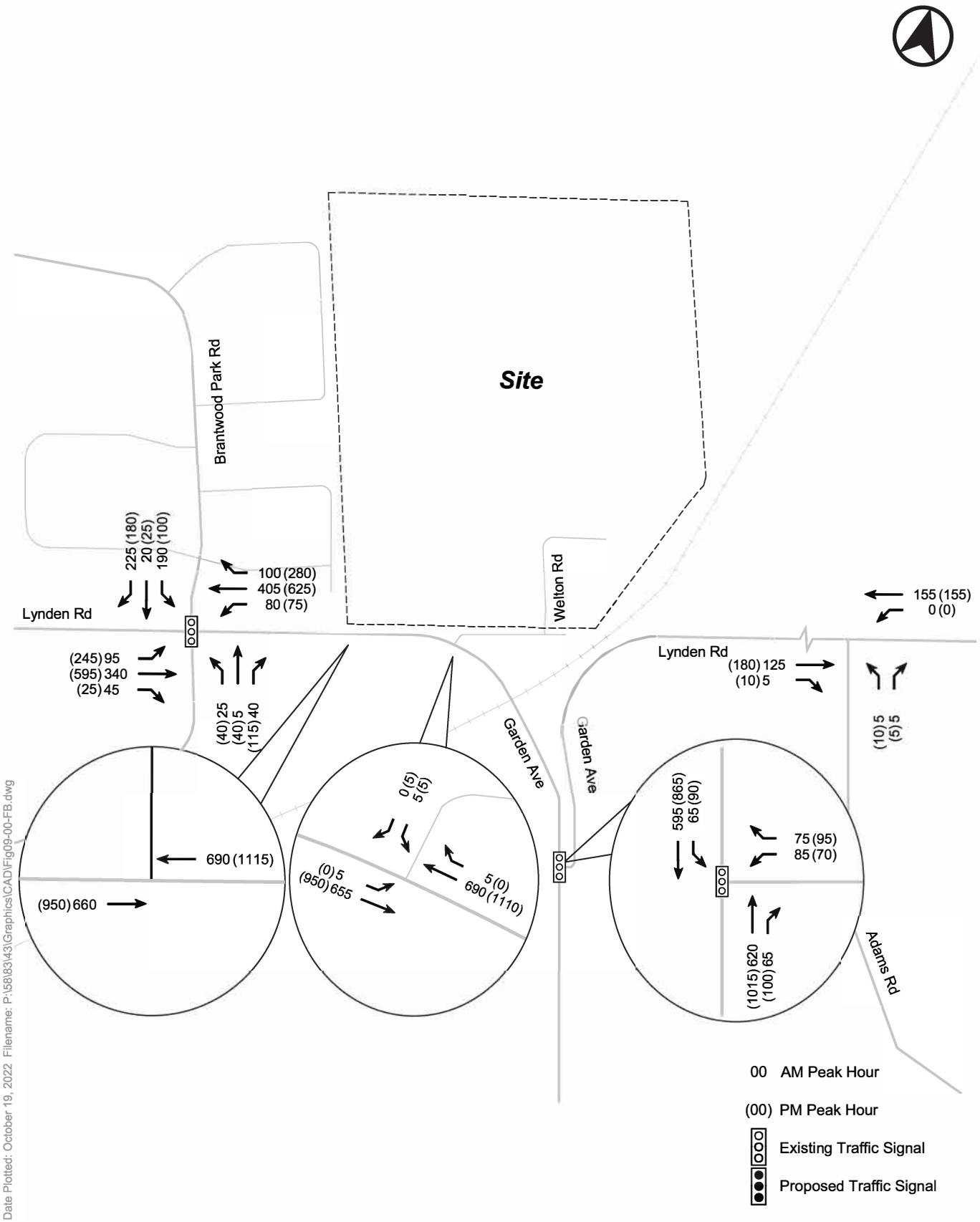


FIGURE 9 FUTURE BACKGROUND TRAFFIC VOLUMES

4.4 SITE TRAFFIC VOLUMES

The trip generation potential of the proposed residential development was estimated based on trip generation surveys published in the Institute of Transportation Engineers' Trip Generation Manual (11th Edition). The trip generation data from the manual and the resulting trip generation for the Site is provided in **Table 6**.

On this basis, the site will generate in the order of 590 and 765 two-way vehicle trips in the weekday morning and afternoon peak hours, respectively. The residential site trips illustrated on the study area road network during weekday peak hours are illustrated in **Figure 10**.

TABLE 6 RESIDENTIAL SITE TRAFFIC VOLUMES

Unit Type	Trip Parameter	AM Peak Hour			PM Peak Hour		
		In	Out	2-Way	In	Out	2-Way
Single-Detached • 536 units	*LUC 210 Trip Rate*	*0.17*	*0.47*	*0.64*	*0.57*	*0.33*	*0.90*
	Trip Generation	90	255	345	305	175	480
Townhouse • 480 units	*LUC 215 Trip Rate*	*0.15*	*0.35*	*0.50*	*0.34*	*0.25*	*0.59*
	Trip Generation	75	170	245	165	120	285
Total Site Trip Generation • **1,016 total units**		**165**	**425**	**590**	**470**	**295**	**765**

Notes:
1. All site trips are rounded to the nearest five (5).
2. All trip generation rates are in trips per unit.

Residential vehicle site trips were assigned onto the area road network based upon a review of travel information provided by the 2016 Transportation Tomorrow Survey (TTS) for home-based trips in the site environs. The TTS queries are provided in **Appendix D**.

The residential site traffic distribution is summarized in **Table 7**.

TABLE 7 RESIDENTIAL SITE TRAFFIC DISTRIBUTION

To / From Cardinal Direction	Corridor	Inbound	Outbound
North	Brantwood Park Road	7%	7%
South	Garden Avenue	23%	29%
East	Lynden Road	6%	4%
	Highway 403	16%	15%
West	Lynden Road	40%	38%
	Highway 403	8%	7%
Total		**100%**	**100%**

Notes:
1. 2006 TTS zones include 8906 and 8949.

4.5 FUTURE TOTAL TRAFFIC VOLUMES

Future total traffic volumes represent the summation of future background traffic volumes (**Figure 9**) and site traffic volumes (**Figure 10**), and are illustrated in **Figure 11**.

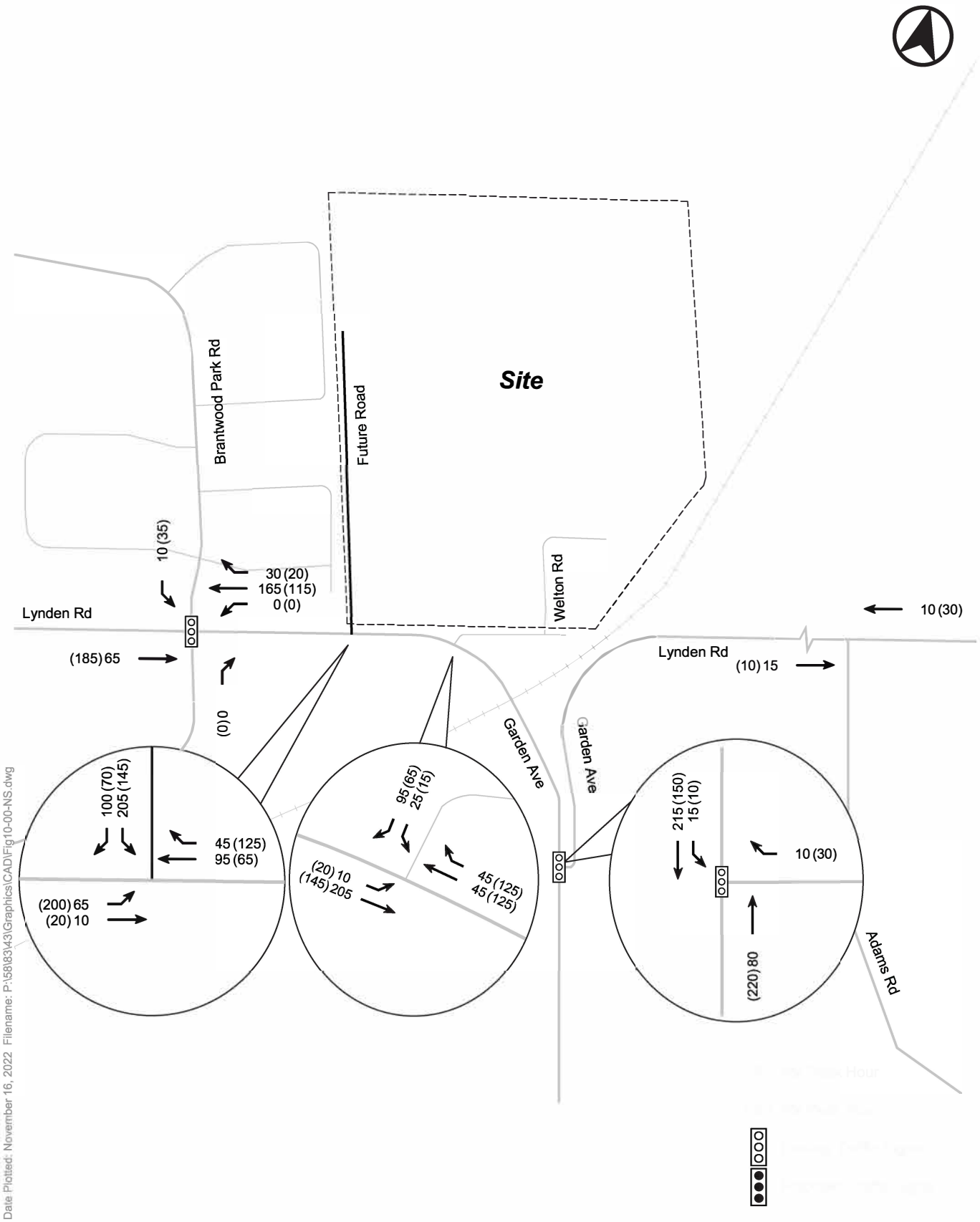


FIGURE 10 NEW SITE TRAFFIC VOLUMES

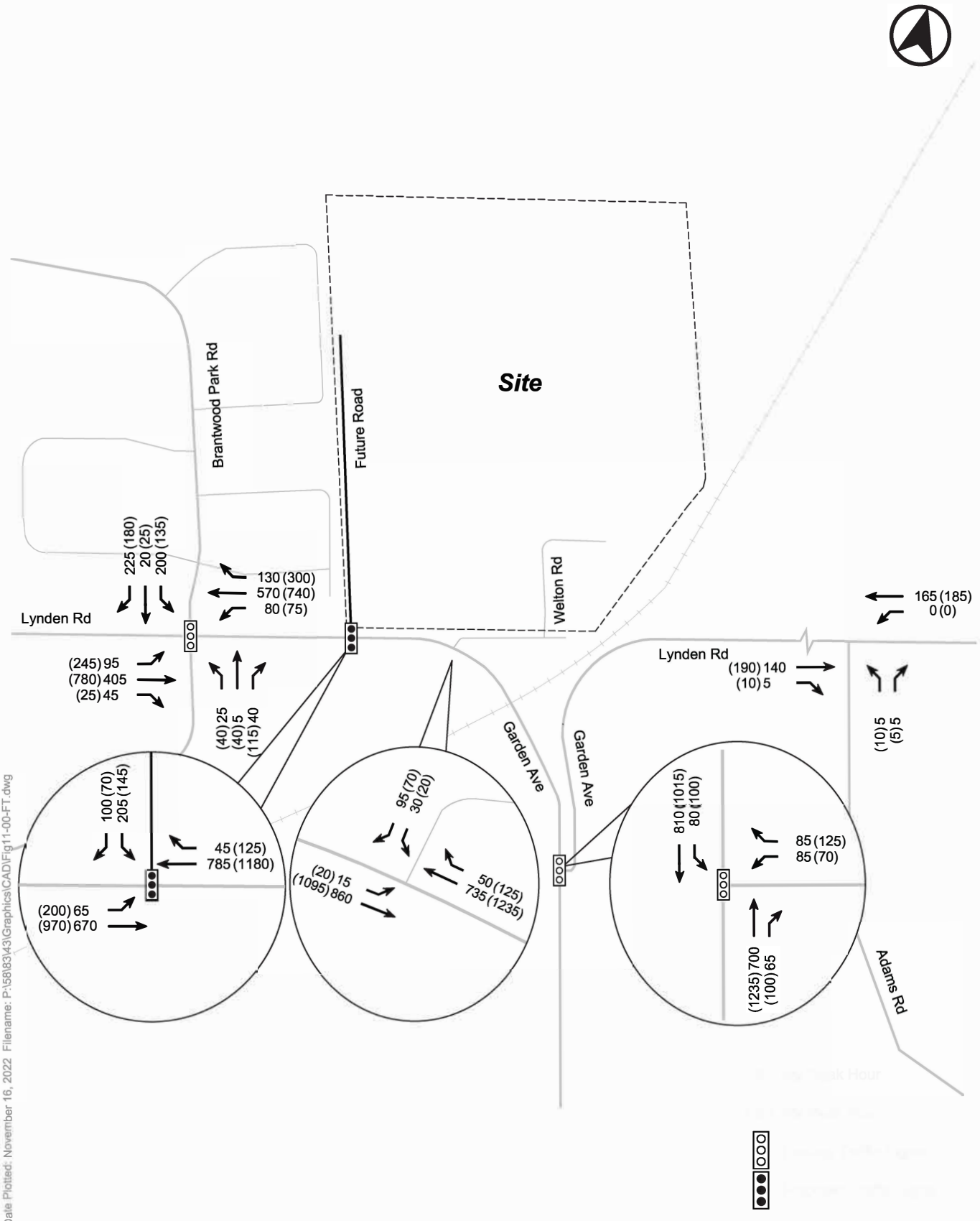


FIGURE 11 FUTURE TOTAL TRAFFIC VOLUMES

5.0 TRAFFIC OPERATIONS ANALYSIS

5.1 ANALYSIS METHODOLOGY

The intersection capacity analysis was completed using Synchro Version 11.0 and the Highway Capacity Manual (HCM) methodology. All Synchro worksheets are provided in **Appendix E**.

For signalized intersections, the volume-to-capacity ratio (v/c) is an indicator of the capacity utilization for the key movements in the intersection. A v/c of 1.00 indicates that certain governing traffic movements through the intersection are operating at or near maximum capacity. The primary overall level of service (LOS) indicator is delay, both on individual movements and expressed as an average for all vehicles processed. Many busy urban intersections operate at LOS D to E, which reflects average delays in the range of 35 to 80 seconds

For unsignalized intersections, level of service (LOS) characterizes operational conditions for key movements in terms of delay within the traffic stream. LOS A represents a good level of service with short delays. LOS F represents a poor level of service with long delays. The volume to capacity ratio (v/c) is an indicator of the capacity utilization for key movements at the intersection and resultant residual capacity potential.

The LOS criteria provided by the HCM methodology is summarized as follows:

1. Signalized Intersection LOS

    a. LOS A: Control Delay ≤ 10s
    b. LOS B: 10s < Control Delay ≤ 20s
    c. LOS C: 20s < Control Delay ≤ 35s
    d. LOS D: 35s < Control Delay ≤ 55s
    e. LOS E: 55s < Control Delay ≤ 80s
    f. LOS F: Control Delay > 80s

2. Unsignalized Intersection LOS

    a. LOS A: Control Delay ≤ 10s
    b. LOS B: 10s < Control Delay ≤ 15s
    c. LOS C: 15s < Control Delay ≤ 25s
    d. LOS D: 25s < Control Delay ≤ 35s
    e. LOS E: 35s < Control Delay ≤ 50s
    f. LOS F: Control Delay > 50s

5.2 MODELLING INPUT AND CALIBRATION PARAMETERS

Key parameters used in the analysis include:

Lane Configuration

Under existing traffic conditions, the Synchro model adopts the existing lane configuration as observed in the field at the time of the 2022 traffic counts. Under future traffic conditions, the Synchro model will assume the proposed site access configurations onto Lynden Road.

Signal Timing Plans

The existing signal timing plans at the study area signalized intersections were provided by the City of Brantford. These are attached in **Appendix F**.

Other Data Inputs

Heavy vehicle percentages, peak hour factors and pedestrian and bicycle crossing volumes were derived from existing traffic counts. Where field data is not available (for example, at future intersections), default values assumed in the Synchro models were adopted.

5.3 ANALYSIS SCENARIOS

The following scenarios were reviewed for the weekday morning and afternoon peak hours:

1. Baseline existing traffic conditions (as illustrated in **Figure 7**)
2. Future background traffic conditions (as illustrated in **Figure 9**)
3. Future total traffic conditions (as illustrated in **Figure 11**)

5.4 SIGNALIZED INTERSECTION ANALYSIS

5.4.1 Proposed Signalized Access

A signalized access is proposed onto Lynden Road near the southwest corner of the property. The signal would provide for mid-block crossing opportunities for pedestrians and vulnerable road users, mitigate traffic flows along Lynden Road, and reduce delays for vehicles entering or exiting the Site.

The need for a signal has been reviewed based on guidance provided by the Ontario Traffic Manual (OTM Book 12). The signal is warranted based on the satisfaction of Justification 2 and 4 of the OTM methodology.

The detailed signal warrant review is provided in **Appendix G**.

Operations results at the proposed signal under future total conditions (with the site development) is provided in **Table 8**. The intersection will operate under capacity at overall v/c of 0.38 and 0.62 during the weekday morning and afternoon peak hours, respectively.

TABLE 8 LYNDEN ROAD / MINOR COLLECTOR ROAD CAPACITY ANALYSIS (PROPOSED SIGNAL)

Movement	Future Total Traffic Operations	
	V/C	LOS
EBL	0.18 (0.60)	A (A)
EBT	0.29 (0.40)	A (A)
WBTR	0.25 (0.48)	A (B)
SBL	0.71 (0.60)	D (D)
SBR	0.07 (0.05)	C (D)
Overall	**0.38 (0.62)**	**B (B)**

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).

5.4.2 Lynden Road / Brantwood Park Road / Roy Boulevard

The intersection of Lynden Road / Brantwood Park Road / Roy Boulevard operates under signal control with cycle lengths of approximately 90 seconds in the weekday peak hours. **Table 9** summarizes the Synchro capacity results at the intersection.

Under existing traffic conditions, the intersection operates under capacity at overall v/c ratios of 0.39 and 0.47 during the weekday morning and afternoon peak hours, respectively.

Under all future traffic conditions, the intersection will continue to operate under capacity at overall v/c ratios of 0.52 and 0.61 or better during the weekday morning and afternoon peak hours, respectively.

Based on the foregoing, no mitigation measures or improvements are recommended at this intersection.

TABLE 9 LYNDEN ROAD / BRANTWOOD PARK ROAD / ROY BOULEVARD CAPACITY ANALYSIS

Movement	Existing Traffic Operations		Future Background Traffic Operations		Future Total Traffic Operations	
	V/C	LOS	V/C	LOS	V/C	LOS
EBL	0.21 (0.43)	A (A)	0.23 (0.49)	A (A)	0.30 (0.57)	B (A)
EBTR	0.21 (0.27)	B (A)	0.27 (0.33)	B (B)	0.32 (0.44)	B (B)
WBL	0.15 (0.11)	A (A)	0.19 (0.16)	A (B)	0.21 (0.20)	A (A)
WBT	0.22 (0.28)	B (B)	0.28 (0.35)	B (B)	0.40 (0.43)	B (B)
WBR	0.07 (0.20)	B (C)	0.08 (0.23)	B (C)	0.13 (0.27)	B (B)
NBLT	0.14 (0.35)	C (C)	0.14 (0.34)	C (C)	0.14 (0.32)	C (C)
NBR	0.03 (0.08)	C (C)	0.04 (0.08)	C (C)	0.04 (0.08)	C (C)
SBLT	0.80 (0.57)	D (D)	0.81 (0.58)	D (D)	0.82 (0.68)	D (D)
SBR	0.18 (0.12)	C (C)	0.18 (0.12)	C (C)	0.18 (0.12)	C (C)
Overall	**0.39 (0.47)**	**B (B)**	**0.43 (0.53)**	**B (B)**	**0.52 (0.61)**	**B (B)**

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).

5.4.3 Garden Avenue (Via Lynden Road West) / Garden Avenue (Via Lynden Road East)

The intersection of Garden Avenue / Garden Avenue operates under signal control with cycle lengths of approximately 90 seconds in the weekday peak hours. **Table 10** summarizes the Synchro capacity results at the intersection.

Under existing traffic conditions, the intersection operates under capacity at overall v/c ratios of 0.26 and 0.38 during the weekday morning and afternoon peak hours, respectively.

Under all future traffic conditions, the intersection will continue to operate under capacity at overall v/c ratios of 0.34 and 0.52 or better during the weekday morning and afternoon peak hours, respectively.

Based on the foregoing, no mitigation measures or improvements are recommended at this intersection.

TABLE 10 GARDEN AVENUE / GARDEN AVENUE CAPACITY ANALYSIS

Movement	Existing Traffic Operations		Future Background Traffic Operations		Future Total Traffic Operations	
	V/C	LOS	V/C	LOS	V/C	LOS
WBL	0.54 (0.46)	D (D)	0.57 (0.48)	D (D)	0.57 (0.39)	D (D)
WBR	0.03 (0.04)	D (D)	0.05 (0.07)	D (D)	0.06 (0.38)	D (D)
NBTR	0.23 (0.38)	A (A)	0.27 (0.44)	A (A)	0.30 (0.54)	A (A)
SBL	0.07 (0.18)	A (A)	0.13 (0.31)	A (A)	0.17 (0.48)	A (B)
SBT	0.19 (0.29)	A (A)	0.23 (0.34)	A (A)	0.32 (0.41)	A (A)
Overall	**0.26 (0.38)**	**A (A)**	**0.30 (0.44)**	**A (A)**	**0.34 (0.52)**	**A (A)**

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).

5.5 UNSIGNALIZED INTERSECTION ANALYSIS

Table 11 summarizes the analysis results for unsignalized intersections in the study area.

Under future traffic conditions, all movements operate acceptably in both peak hours at levels-of-service (LOS) D or better. No mitigation measures nor improvements are recommended.

TABLE 11 UNSIGNALIZED INTERSECTION CAPACITY RESULTS

Movement	Existing		Future Background		Future Total	
	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)
Lynden Road / Garden Avenue						
EBLT / EBL [2]	A (A)	0.4 (0.0)	A (A)	0.4 (0.0)	B (B)	12.5 (13.2)
SBLR	B (C)	12.0 (18.0)	B (C)	13.8 (23.6)	B (D)	12.1 (32.0)

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).
2. With the site development, an eastbound left turn storage lane is proposed at the Lynden Road / Garden Avenue intersection.

6.0 SUMMARY AND CONCLUSIONS

BA Group is retained by Welton & Innes GP Inc. to provide transportation consulting services in relation to a Block Plan application being submitted to the City of Brantford to permit the construction of the proposed development of the Lynden Garden Block Plan Area.

6.1 KEY FINDINGS

Existing Site Context

1. The Site is a 77.7-hectare plot of land, generally bounded by existing residential and the Lynden Hills Park to the west, County of Brant agricultural and natural heritage area to the east, Lynden Road to the south, and County of Brant agricultural and natural heritage area to the north. The CN rail corridor forms the south-east boundary of the Site.

2. The Site is currently primarily used for agriculture and is part of the 2,720 hectares of land annexed to the City of Brantford from the County of Brant in 2017 to accommodate new growth.

Existing Planning Context

3. Within Schedule 4 of the City of Brantford Official Plan (OP, 2021), the land is primarily designated as a core natural area and residential area, while the land fronting Lyndon Road is designated as “Neighbourhood Centre” and “Neighbourhood Corridor”.

4. The City OP and Transportation Master Plan (TMP, 2020) propose various transportation-related projects within the Site boundaries and within the Site vicinity, including:
    a. A road widening of Lynden Road to an overall right-of-way width of 40 metres;
    b. Introduction of a minor collector road within the Site boundaries with on-street cycling infrastructure; and
    c. On-road and off-road bikeways and trails within the Site limits and vicinity.

Transportation Context

5. The Site is well-served by a variety of existing roadway connections provided across the City, the County of Brant, and to/from the Greater Toronto and Hamilton Area (GTHA), including via adjacent arterial roads and Highway 403.

6. In addition to industrial uses, there are also various amenities, services, and key destinations within walking distance of the Site. Within a10 to 15-minute walking distance of the Site, the area destinations that can be accessed include the Lynden Hills Park, a retail plaza containing various food outlets, a grocery store, and a gym, and another plaza can be accessed which contains the Brantford Medical Centre and a CIBC bank.

7. Under existing conditions, there are limited protected / designated cycling facilities and routes in the Site area. It is noted that the City OP and TMP identifies several proposed on-road and off-road bikeways and trails in the vicinity of the Site, connecting the Site to the City’s wider cycling network.

8. As noted above, the City of Brantford OP and TMP illustrate a proposed minor collector roadway within the Site boundaries (with cycling facilities). This roadway is proposed to extend northwards from Lynden Road in the form of a loop to serve future Site residents. The OP also identifies a road widening along Lynden Road to an overall right-of-way of 40 metres.

9. The Site is well-served by several existing bus transit routes operated by Brantford Transit. Four (4) bus routes that are accessible within an 800-metre radius of the Site.

Proposed Block Plan

10. A comprehensive plan has been developed for the Lynden Garden Block Plan area. The development plan provides an overall vision guiding the development of the property to create a new neighbourhood, Lynden Garden, located in the north-east of the City, just north of the Garden Avenue interchange on Highway 403. A mixed-use subdivision is proposed for the Site, including 1,016 residential units in a range of low and medium density housing types. Dedicated space for parks is also included.

11. The Block Plan introduces a number of new public roads that have been designed to respect the vision of the OP and TMP. Key elements of the new area public road network within the Block Plan include:
    - A new Minor Collector Road (22-metre cross-section) that creates a loop through the Site, providing two connections to the existing area road network at Lynden Road/Garden Ave;
    - A new signalized intersection at the west intersection of the proposed Minor Collector road and the existing Lynden Road;
    - A road widening along Lynden Road to permit an overall future right-of-way of 40 metres;
    - A fine grain network of local roads (18.5-metre cross-section); and,
    - On-road bike infrastructure within the proposed Minor Collector Road consistent with the City OP and TMP.

Traffic Volume Forecasting and Analysis

12. The Site will generate in the order of 590 and 765 two-way vehicle trips in the weekday morning and afternoon peak hours, respectively.

13. A signalized access is warranted and proposed at the intersection of the proposed Minor Collector Road and Lynden Road near the southwest corner of the property. The signal would provide for mid-block crossing opportunities for pedestrians and vulnerable road users, and provide controlled access for vehicles entering or exiting the Site.

14. With the Site development, all study area intersections, including the proposed Minor Collector Road intersections, will operate under capacity and at acceptable levels-of-service in the weekday peak hours.

Summary

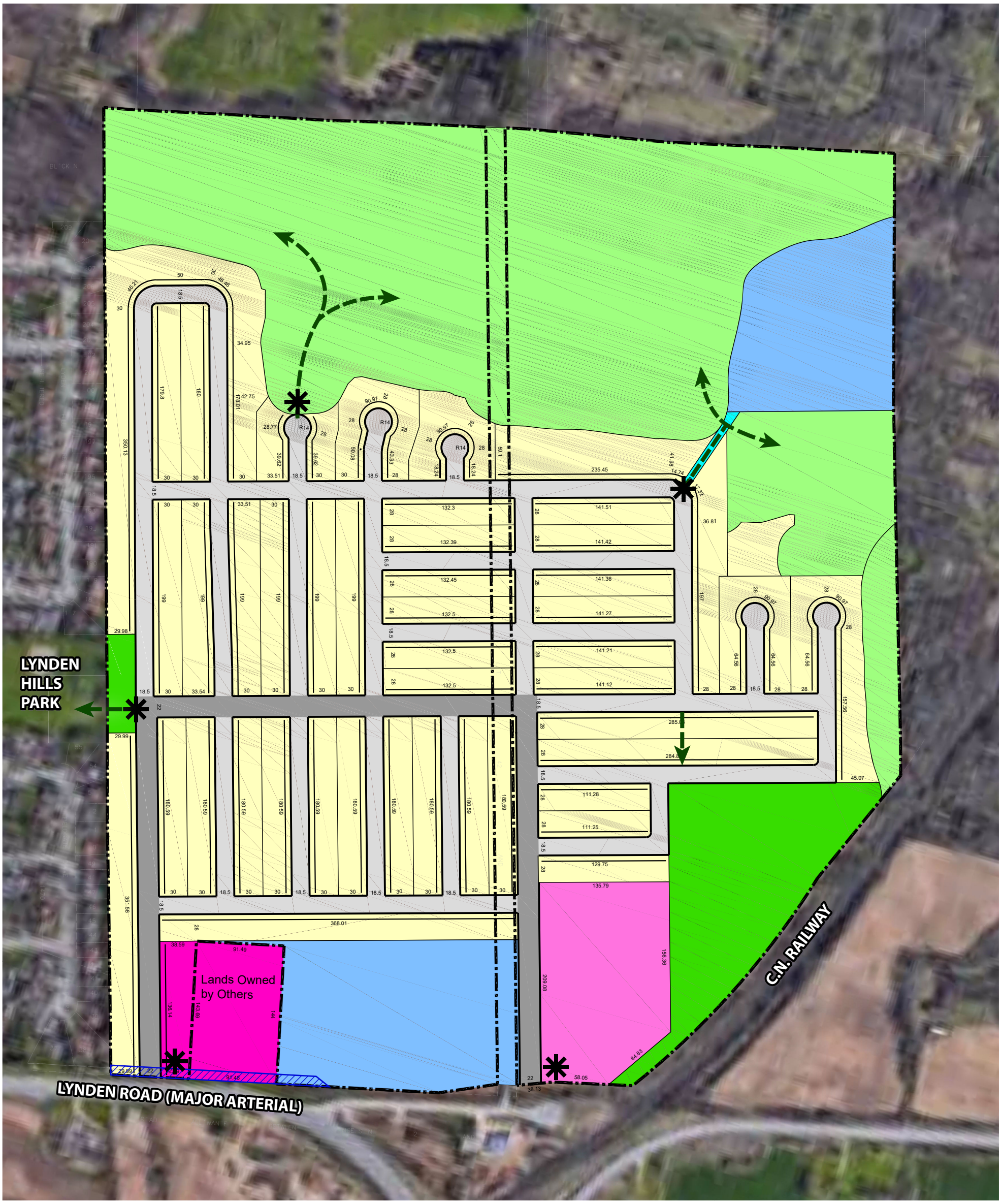
15. A signal is warranted and proposed at the intersection of the proposed Minor Collector Road and existing Lynden Road.

16. The street network, as proposed for the current Block Plan, is consistent with the City's plans for roads and active transportation in the OP and TMP.

17. The cross-section elements of the new collector and local roads proposed within the Lynden Garden Block Plan are consistent with the City Linear Standards for an 18.5m local road and with a minor collector road (of less than 24.5 metres). The proposed Minor Collector Road for Lynden Garden is proposed to accommodate 2 travel-lanes plus bike lanes in a 22 metre right-of-way.

18. Based on the foregoing, the study area transportation network is expected to effectively accommodate the proposed development. Lynden Garden Block Plan can appropriately be accommodated on the area road network without further road network improvements beyond what is proposed within the Site limits and already planned by the City in the Site vicinity.

Appendix A:
Lynden Garden Draft Concept Plan



LAND USE & TRANSPORTATION

		Area	% of Area
1)	Neighbourhood Residential	28.1ha	36.9%
2)	Neighbourhood Corridor	2.7ha	3.5%
3)	Neighbourhood Centre	0.5ha	0.6%
4)	Neighbourhood Park	3.9ha	5.1%
5)	Natural Heritage System	22.1ha	29.0%
6)	Storm Water Management (SWM)	6.7ha	8.8%
7)	SWM Access Block	0.1ha	0.1%
8)	Local Road (18.5m ROW)	9.7ha	12.6%
9)	Minor Collector Road (22m ROW)	2.6ha	3.4%
	TOTAL	76.4ha	

Landmark / Focal Point

Trail / Walkway

Potential 10m Road Widening

SCHEDULE 1
LYNDEN GARDEN BLOCK PLAN

CONCEPTUAL MASTER PLAN

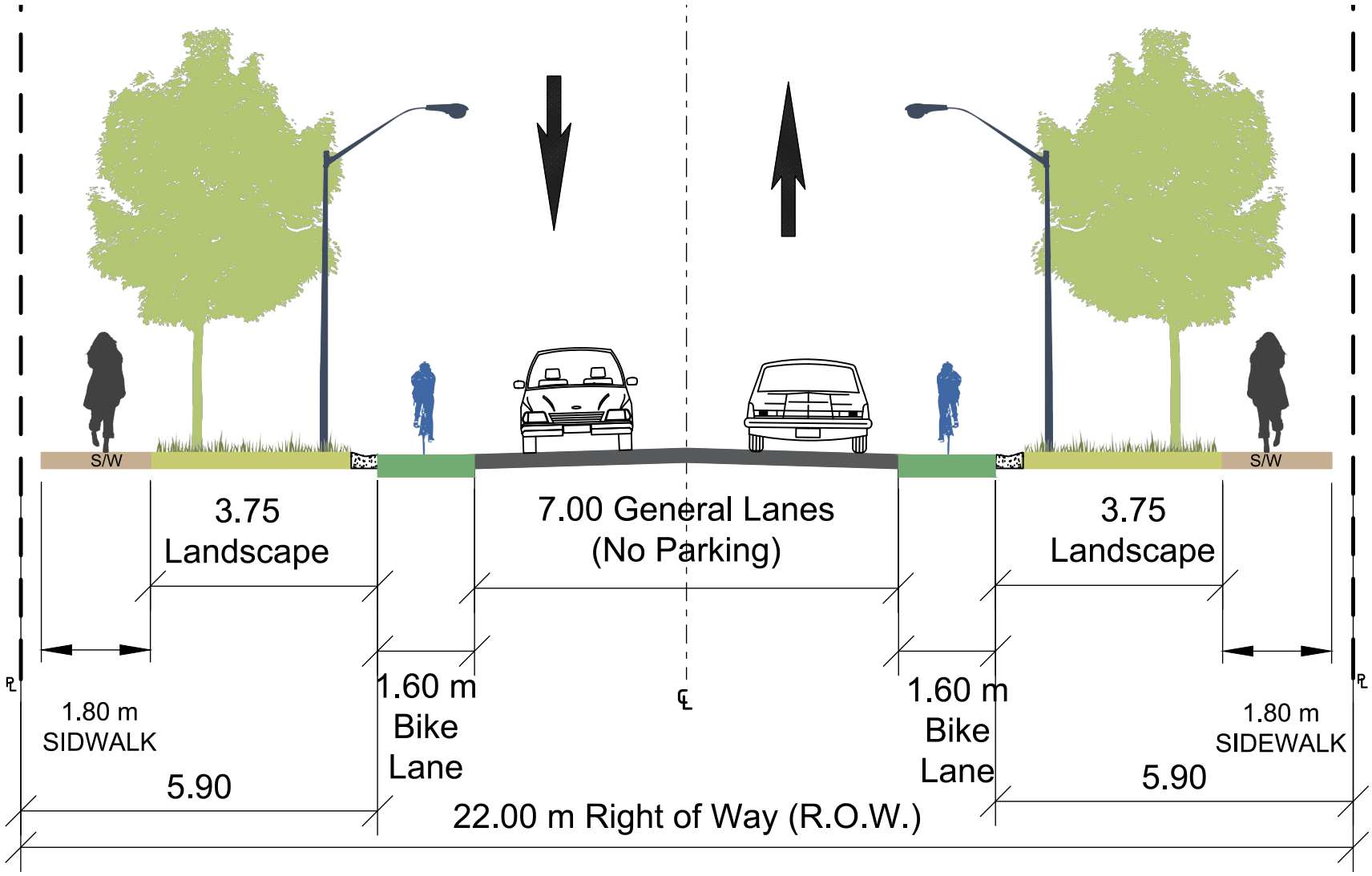
PREPARED FOR:
WELTON & INNES G.P. INC.

SCALE
1:4,000

PROJECT No.
1720

DATE
November 8, 2022

Appendix B:
Road Cross Sections



Scale

BA Group

LYNDEN GARDEN

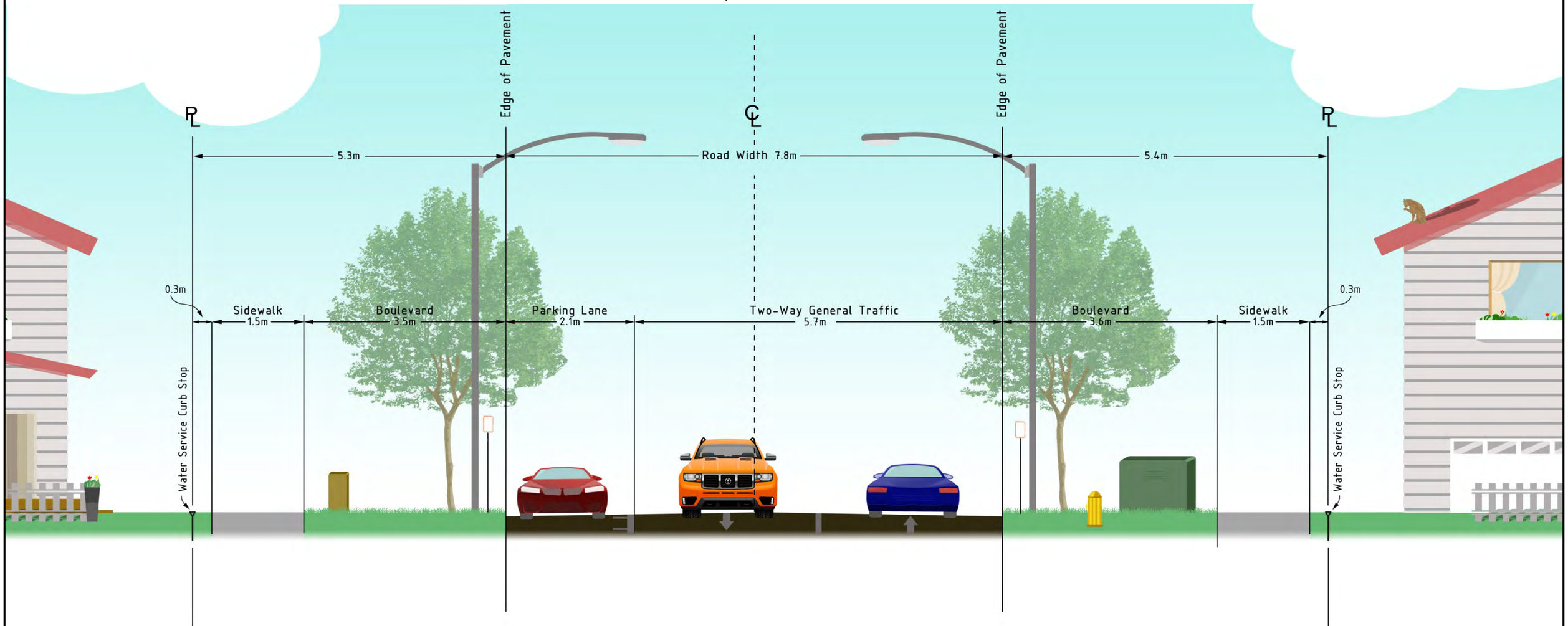
PROPOSED 22m COLLECTOR CROSS-SECTION

Project:	LYNDEN GARDEN
Project No.	5883-43
Date:	NOVEMBER 09, 2022
Revised:	–
Drawing No.	XS-01

FIGURE 2

LOCAL ROAD

(18.5m ROW, 7.8m Road Width)



CITY OF BRANTFORD Public Works Commission	Date:	Revised:	Scale:
	October 2017	February 2020	N.T.S.
LOCAL ROAD 18.5 M ROW, 7.8 M ROAD WIDTH Drawing Number: G-101	Drawn by:	Checked by:	Approved by:
	A.L.	L.V.	L.V.

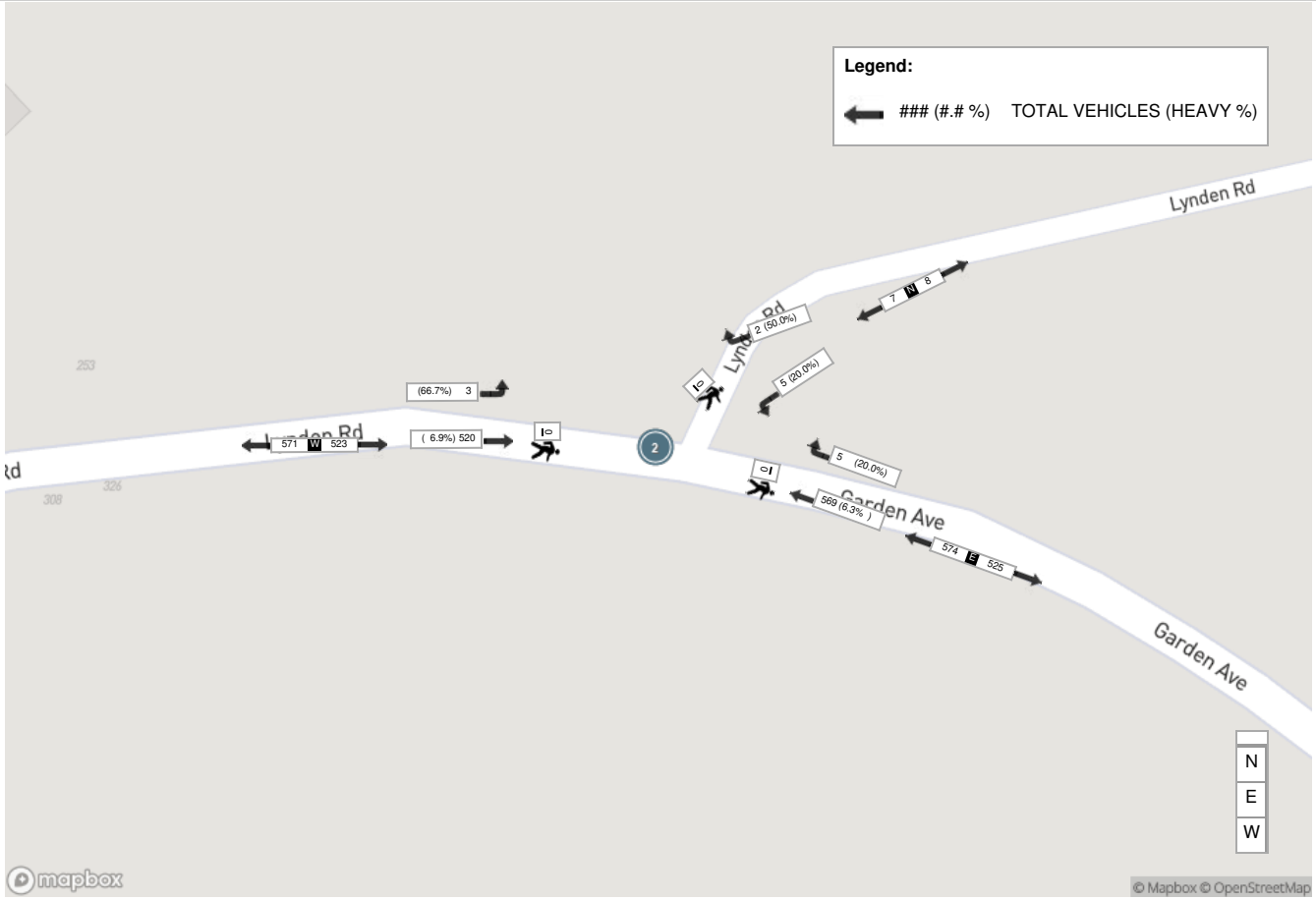
NOTES:

1. Curbs not shown. See Roads Manual and Detailed Cross-sections for curb, gutter and subdrain standards.
2. Pavement design details not shown. See Roads manual for pavement design standards.
3. Lane markings are shown for information only and do not represent marking requirements. See Roads Manual for pavement marking standards.
4. Road grade and crossfall shall be in accordance with the Roads and Transportation Manual.
5. Sidewalk Grade: minimum of 0.5% and maximum of 5%; Sidewalk Crossfall: minimum of 2% and maximum of 4%.
6. Water service curb stops shall be on the property line. Installation on hard surfaced area, such as driveways and walkways shall be avoided.
7. A minimum clearance of 0.3 m must be maintained between the gas line and the property line.

Appendix C:
Turning Movement Counts

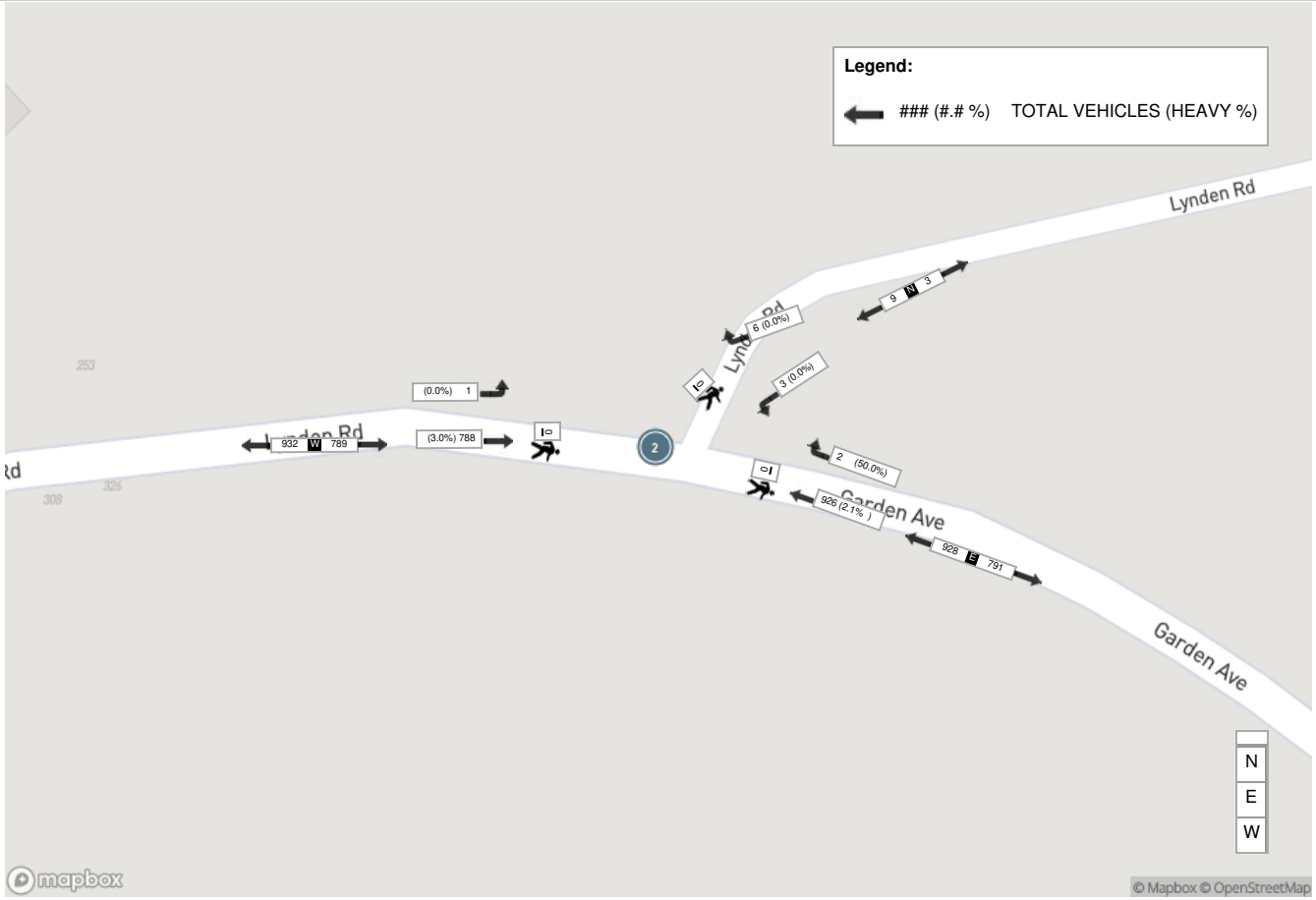
BA Group
300 45 ST. CLAIR AVE W
TORONTO ONTARIO, M4V 1K9
CANADA

Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast Clouds (10.16 °C)

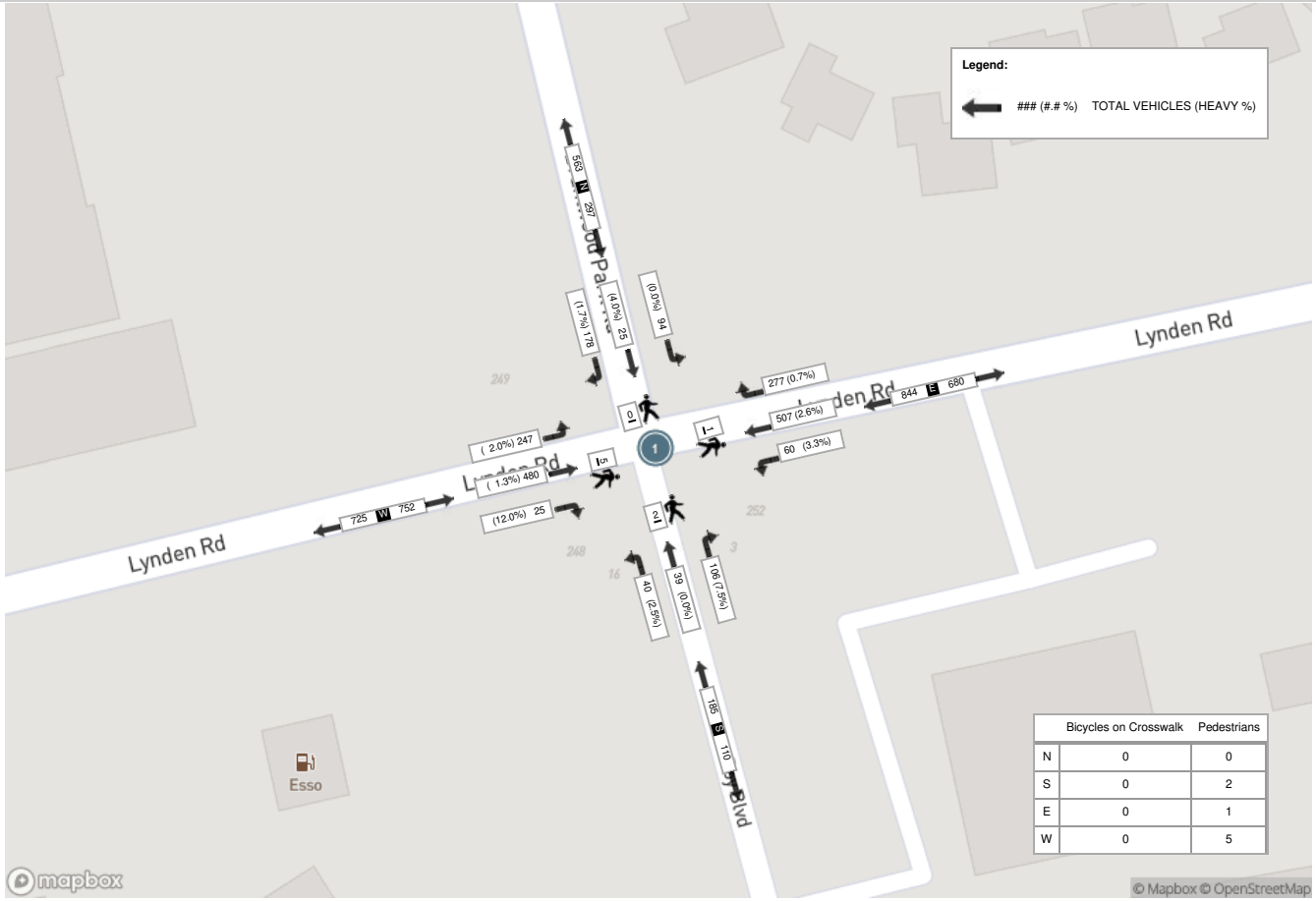


BA Group
300 45 ST. CLAIR AVE W
TORONTO ONTARIO, M4V 1K9
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Broken Clouds (16.29 °C)

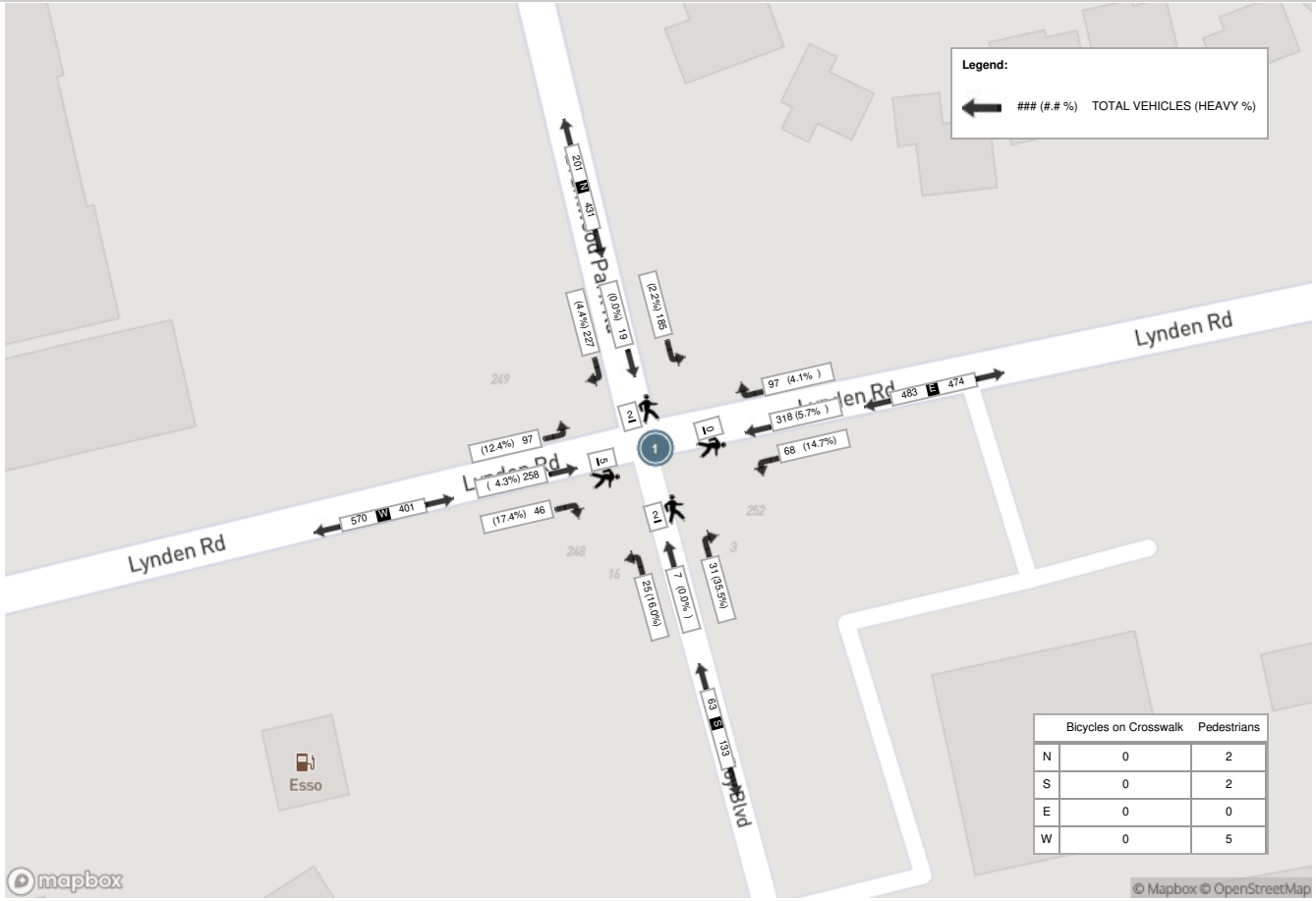


Peak Hour: 04:15 PM - 05:15 PM **Weather: Broken Clouds (10.96 °C)**



	Bicycles on Crosswalk	Pedestrians
N	0	0
S	0	2
E	0	1
W	0	5

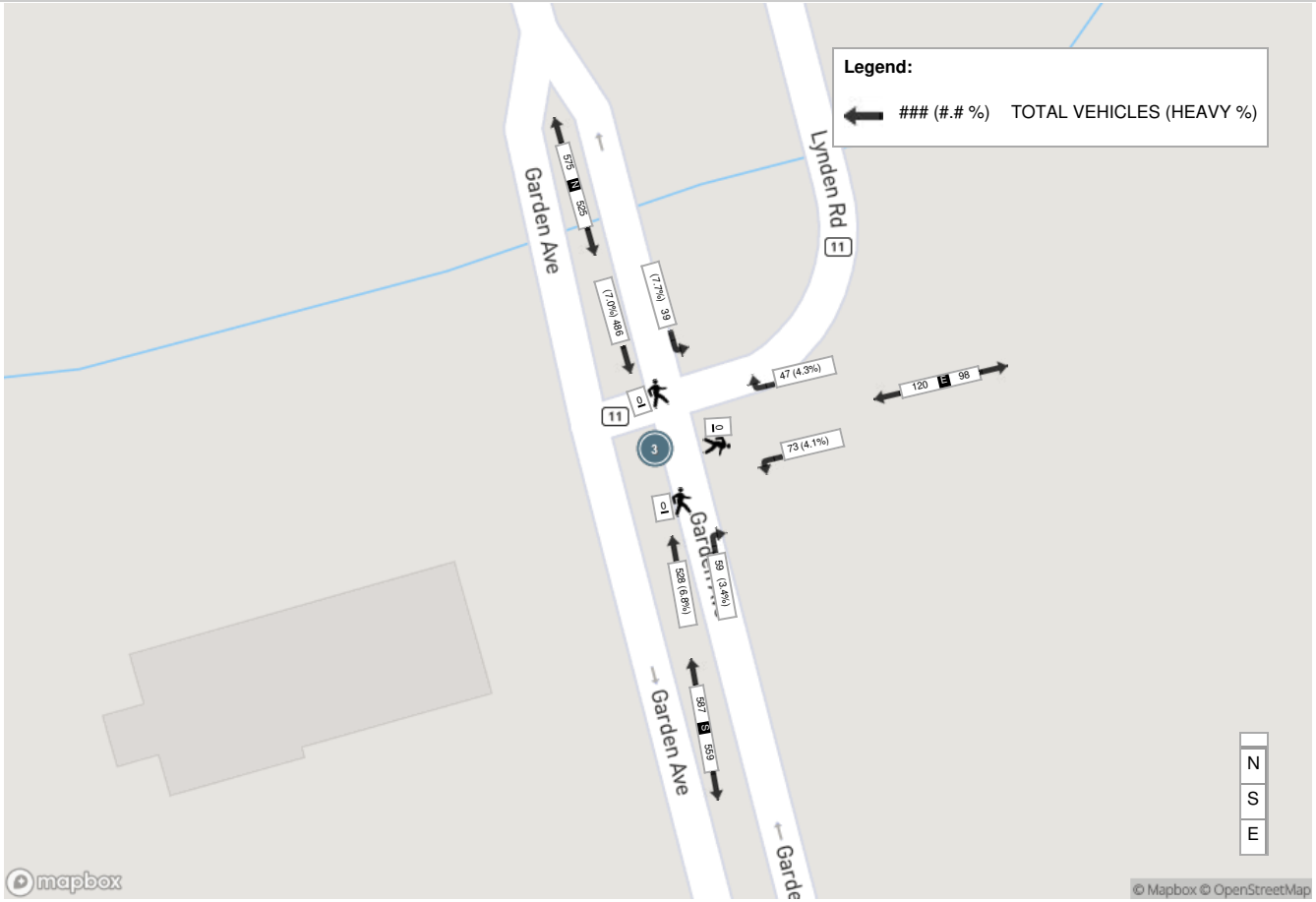
Selected Hour: 08:00 AM - 09:00 AM **Weather:**



	Bicycles on Crosswalk	Pedestrians
N	0	2
S	0	2
E	0	0
W	0	5

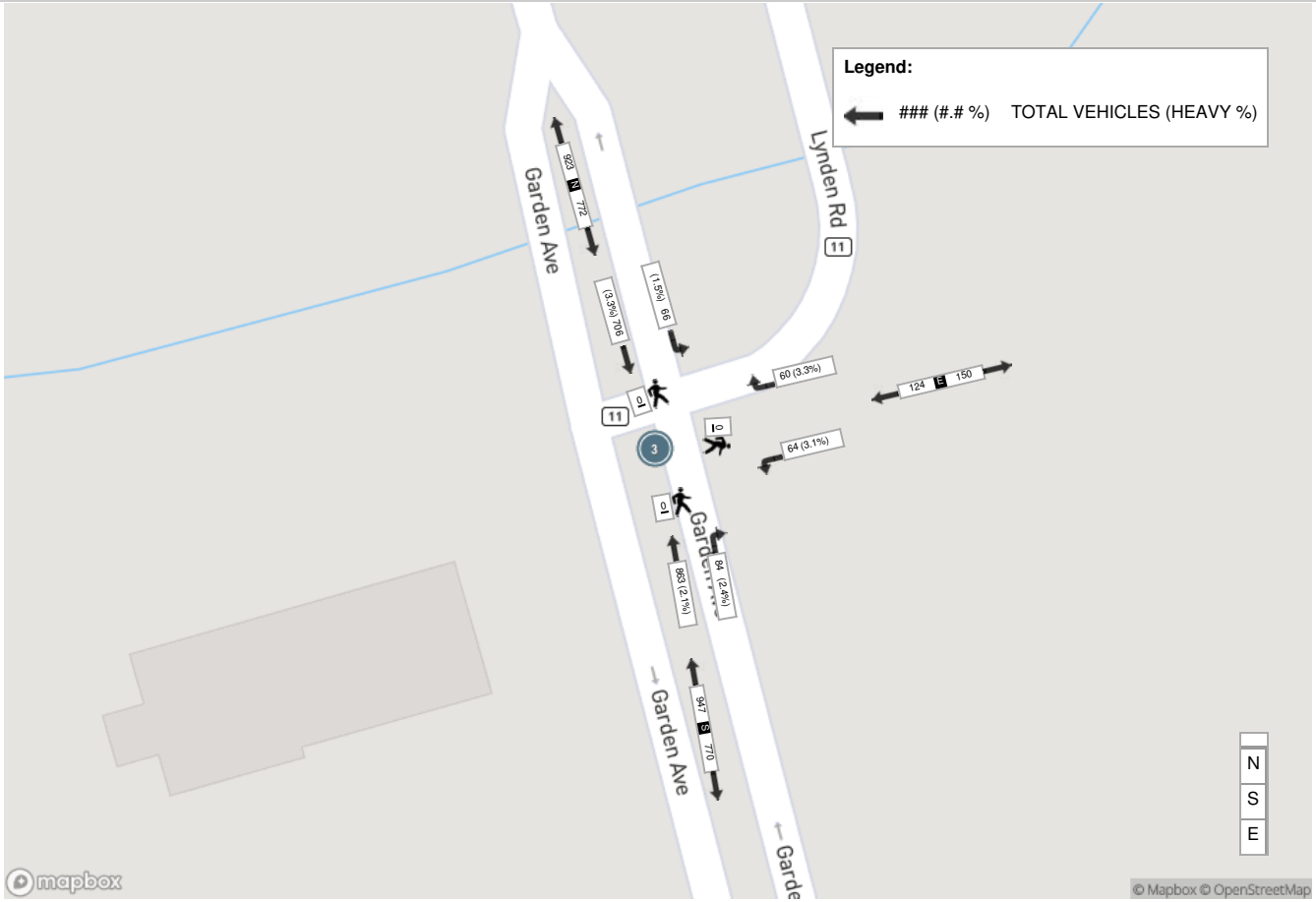
BA Group
300 45 ST. CLAIR AVE W
TORONTO ONTARIO, M4V 1K9
CANADA

Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast Clouds (10.16 °C)



BA Group
300 45 ST. CLAIR AVE W
TORONTO ONTARIO, M4V 1K9
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Broken Clouds (16.29 °C)



Appendix D:
TTS Trip Distribution

Wed Jun 08 2022 13:29:51 GMT-0400 (Eastern Daylight Time) - Run Time: 2623ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of destination - pd_dest
Column: 2006 GTA zone of origin - gta06_orig

Filters:
(Start time of trip - start_time In 600-859
and
Trip purpose of origin - purp_orig In H,
and
2006 GTA zone of origin - gta06_orig In 8906,8949
and
Primary travel mode of trip - mode_prime In D, M, P, T, U)

Trip 2016
Table:

	8906	8949	**Total**
Mississau	0	20	**20**
Burlington	114	26	**140**
Flamboro	101	0	**101**
Ancaster	0	10	**10**
Glanbrook	0	26	**26**
Hamilton	144	93	**237**
Lincoln	27	0	**27**
Waterloo	9	12	**21**
Kitchener	36	8	**44**
Cambridg	19	22	**41**
North Dur	31	0	**31**
Puslinch	60	0	**60**
Oxford	60	0	**60**
Brant	231	191	**422**
Haldiman	7	41	**48**
Brantford	1104	749	**1853**
External	20	0	**20**

Wed Jun 08 2022 13:42:11 GMT-0400 (Eastern Daylight Time) - Run Time: 2688ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest
Column: 2006 GTA zone of origin - gta06_orig

Filters:
(Start time of trip - start_time In 600-859
and
Trip purpose of origin - purp_orig In H,
and
2006 GTA zone of origin - gta06_orig In 8906,8949
and
Primary travel mode of trip - mode_prime In D, M, P, T, U
and
Planning district of destination - pd_dest In 147,)

Trip 2016
Table:

	8906	8949	**Total**
8901	22	14	**36**
8902	23	0	**23**
8903	178	39	**217**
8904	0	54	**54**
8905	14	4	**18**
8906	101	43	**144**
8907	102	57	**159**
8908	19	10	**29**
8909	11	0	**11**
8910	95	74	**169**
8911	23	10	**33**
8912	31	0	**31**
8913	0	13	**13**
8914	7	0	**7**
8915	26	0	**26**
8916	0	91	**91**
8917	68	11	**79**
8918	33	0	**33**
8919	38	0	**38**
8920	19	5	**24**
8921	67	0	**67**
8924	18	155	**173**
8927	0	7	**7**
8929	173	0	**173**
8930	0	20	**20**
8933	0	16	**16**
8934	0	5	**5**
8935	35	0	**35**
8937	0	11	**11**
8949	0	112	**112**

Wed Jun 08 2022 13:45:46 GMT-0400 (Eastern Daylight Time) - Run Time: 2758ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of origin - pd_orig
Column: 2006 GTA zone of destination - gta06_dest

Filters:
(Start time of trip - start_time In 1500-1759
and
Trip purpc
and
2006 GTA 8949
and
Primary tr M P T U)

Trip 2016
Table:

	8906	8949	**Total**
Brampton	0	10	**10**
Mississau	24	0	**24**
Milton	30	0	**30**
Burlington	84	61	**145**
Flamboro	90	0	**90**
Ancaster	26	20	**46**
Hamilton	144	36	**180**
Lincoln	27	0	**27**
Waterloo	9	12	**21**
Kitchener	36	8	**44**
Cambridg	69	22	**91**
North Dun	31	0	**31**
City of Gu	0	8	**8**
Puslinch	60	0	**60**
Oxford	60	29	**89**
Brant	163	218	**381**
Haldiman	38	0	**38**
Brantford	706	822	**1528**
External	0	9	**9**

Wed Jun 08 2022 13:43:44 GMT-0400 (Eastern Daylight Time) - Run Time: 2626ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig
Column: 2006 GTA zone of destination - gta06_dest

Filters:
(Start time of trip - start_time In 1500-1759
and
Trip purpc
and
2006 GTA 8949
and
Primary tr M P T U
and
Planning ( )

Trip 2016
Table:

	8906	8949	**Total**
8901	15	7	**22**
8902	15	36	**51**
8903	125	0	**125**
8904	0	13	**13**
8905	14	4	**18**
8906	66	43	**109**
8907	188	140	**328**
8908	7	10	**17**
8909	11	0	**11**
8910	0	74	**74**
8911	12	10	**22**
8912	31	7	**38**
8913	0	7	**7**
8914	7	0	**7**
8916	0	134	**134**
8917	25	0	**25**
8918	12	0	**12**
8919	38	0	**38**
8920	19	24	**43**
8921	14	0	**14**
8922	15	16	**31**
8923	62	0	**62**
8924	0	17	**17**
8925	0	10	**10**
8926	0	22	**22**
8927	0	24	**24**
8930	27	54	**81**
8933	0	16	**16**
8934	0	20	**20**
8935	0	5	**5**
8937	0	11	**11**
8948	0	6	**6**
8949	0	112	**112**

AM
OUTBOUND
2022-11-16

RESIDENTIAL VEHICLE TRIP DISTRIBUTION

Traffic Volume Allocation

Zone	Trips	%	NORTH Brantwood Park Rd	SOUTH Garden Avenue	EAST Lynden Rd	EAST Highway 403	WEST Lynden Rd	WEST Highway 403	TOTAL
Mississauga	20	1%			10%	90%			100.00%
Burlington	140	4%			10%	90%			100.00%
Flamborough	101	3%			50%	50%			100.00%
Ancaster	10	0%			30%	70%			100.00%
Glanbrook	26	1%			20%	80%			100.00%
Hamilton	237	8%			20%	80%			100.00%
Lincoln	27	1%		20%		80%			100.00%
Waterloo	21	1%	50%				50%		100.00%
Kitchener	44	1%	50%				50%		100.00%
Cambridge	41	1%	50%				50%		100.00%
North Dumfries	31	1%	50%				50%		100.00%
Puslinch	60	2%			50%	50%			100.00%
Oxford	60	2%					20%	80%	100.00%
Brant	422	13%		100%					100.00%
Haldimand-Norfolk	48	2%		100%					100.00%
8901	36	1%	10%				90%		100.00%
8902	23	1%	10%				90%		100.00%
8903	217	7%					100%		100.00%
8904	54	2%					100%		100.00%
8905	18	1%	50%				50%		100.00%
8906	144	5%	100%						100.00%
8907	159	5%					100%		100.00%
8908	29	1%		100%					100.00%
8909	11	0%		100%					100.00%
8910	169	5%		100%					100.00%
8911	33	1%		40%			50%	10%	100.00%
8912	31	1%		10%			80%	10%	100.00%
8913	13	0%		30%			60%	10%	100.00%
8914	7	0%					80%	20%	100.00%
8915	26	1%					70%	30%	100.00%
8916	91	3%					70%	30%	100.00%
8917	79	3%					60%	40%	100.00%
8918	33	1%		10%			60%	30%	100.00%
8919	38	1%		20%			50%	30%	100.00%
8920	24	1%		20%			60%	20%	100.00%
8921	67	2%		20%			60%	20%	100.00%
8924	173	6%		30%			60%	10%	100.00%
8927	7	0%		60%			20%	20%	100.00%
8929	173	6%		30%			50%	20%	100.00%
8930	20	1%		30%			50%	20%	100.00%
8933	16	1%		50%			50%		100.00%
8934	5	0%		50%			50%		100.00%
8935	35	1%		50%			50%		100.00%
8937	11	0%		50%			50%		100.00%
8949	112	4%					100%		100.00%
	3142	100%							

Route Split Totals

Zone	NORTH Brantwood Park Rd	SOUTH Garden Avenue	EAST Lynden Rd	EAST Highway 403	WEST Lynden Rd	WEST Highway 403	TOTAL
Mississauga	0.00%	0.00%	0.06%	0.57%	0.00%	0.00%	0.6%
Burlington	0.00%	0.00%	0.45%	4.01%	0.00%	0.00%	4.5%
Flamborough	0.00%	0.00%	1.61%	1.61%	0.00%	0.00%	3.2%
Ancaster	0.00%	0.00%	0.10%	0.22%	0.00%	0.00%	0.3%
Glanbrook	0.00%	0.00%	0.17%	0.66%	0.00%	0.00%	0.8%
Hamilton	0.00%	0.00%	1.51%	6.03%	0.00%	0.00%	7.5%
Lincoln	0.00%	0.17%	0.00%	0.69%	0.00%	0.00%	0.9%
Waterloo	0.33%	0.00%	0.00%	0.00%	0.33%	0.00%	0.7%
Kitchener	0.70%	0.00%	0.00%	0.00%	0.70%	0.00%	1.4%
Cambridge	0.65%	0.00%	0.00%	0.00%	0.65%	0.00%	1.3%
North Dumfries	0.49%	0.00%	0.00%	0.00%	0.49%	0.00%	1.0%
Puslinch	0.00%	0.00%	0.95%	0.95%	0.00%	0.00%	1.9%
Oxford	0.00%	0.00%	0.00%	0.00%	0.38%	1.53%	1.9%
Brant	0.00%	13.43%	0.00%	0.00%	0.00%	0.00%	13.4%
Haldimand-Norfolk	0.00%	1.53%	0.00%	0.00%	0.00%	0.00%	1.5%
8901	0.11%	0.00%	0.00%	0.00%	1.03%	0.00%	1.1%
8902	0.07%	0.00%	0.00%	0.00%	0.66%	0.00%	0.7%
8903	0.00%	0.00%	0.00%	0.00%	6.91%	0.00%	6.9%
8904	0.00%	0.00%	0.00%	0.00%	1.72%	0.00%	1.7%
8905	0.29%	0.00%	0.00%	0.00%	0.29%	0.00%	0.6%
8906	4.58%	0.00%	0.00%	0.00%	0.00%	0.00%	4.6%
8907	0.00%	0.00%	0.00%	0.00%	5.06%	0.00%	5.1%
8908	0.00%	0.92%	0.00%	0.00%	0.00%	0.00%	0.9%
8909	0.00%	0.35%	0.00%	0.00%	0.00%	0.00%	0.4%
8910	0.00%	5.38%	0.00%	0.00%	0.00%	0.00%	5.4%
8911	0.00%	0.42%	0.00%	0.00%	0.53%	0.11%	1.1%
8912	0.00%	0.10%	0.00%	0.00%	0.79%	0.10%	1.0%
8913	0.00%	0.12%	0.00%	0.00%	0.25%	0.04%	0.4%
8914	0.00%	0.00%	0.00%	0.00%	0.18%	0.04%	0.2%
8915	0.00%	0.00%	0.00%	0.00%	0.58%	0.25%	0.8%
8916	0.00%	0.00%	0.00%	0.00%	2.03%	0.87%	2.9%
8917	0.00%	0.00%	0.00%	0.00%	1.51%	1.01%	2.5%
8918	0.00%	0.11%	0.00%	0.00%	0.63%	0.32%	1.1%
8919	0.00%	0.24%	0.00%	0.00%	0.60%	0.36%	1.2%
8920	0.00%	0.15%	0.00%	0.00%	0.46%	0.15%	0.8%
8921	0.00%	0.43%	0.00%	0.00%	1.28%	0.43%	2.1%
8924	0.00%	1.65%	0.00%	0.00%	3.30%	0.55%	5.5%
8927	0.00%	0.13%	0.00%	0.00%	0.04%	0.04%	0.2%
8929	0.00%	1.65%	0.00%	0.00%	2.75%	1.10%	5.5%
8930	0.00%	0.19%	0.00%	0.00%	0.32%	0.13%	0.6%
8933	0.00%	0.25%	0.00%	0.00%	0.25%	0.00%	0.5%
8934	0.00%	0.08%	0.00%	0.00%	0.08%	0.00%	0.2%
8935	0.00%	0.56%	0.00%	0.00%	0.56%	0.00%	1.1%
8937	0.00%	0.18%	0.00%	0.00%	0.18%	0.00%	0.4%
8949	0.00%	0.00%	0.00%	0.00%	3.56%	0.00%	3.6%
	7.2%	**28.0%**	**4.8%**	**14.8%**	**38.1%**	**7.0%**	**100.0%**
	7.00%	**29.00%**	**4.00%**	**15.00%**	**38.00%**	**7.00%**	**100%**

CARDINAL DIRECTION	
NORTH	7.00%
SOUTH	29.00%
EAST	19.00%
WEST	45.00%

PM
INBOUND
2022-11-16

RESIDENTIAL VEHICLE TRIP DISTRIBUTION

Traffic Volume Allocation

Zone	Trips	%	NORTH Brantwood Park Rd	SOUTH Garden Avenue	EAST Lynden Rd	EAST Highway 403	WEST Lynden Rd	WEST Highway 403	TOTAL
Brampton	10	0%			10%	90%			100.00%
Mississauga	24	1%			10%	90%			100.00%
Milton	30	1%			50%	50%			100.00%
Burlington	145	5%			10%	90%			100.00%
Flamborough	90	3%			50%	50%			100.00%
Ancaster	46	2%			30%	70%			100.00%
Hamilton	180	6%			20%	80%			100.00%
Lincoln	27	1%		20%		80%			100.00%
Waterloo	21	1%	50%				50%		100.00%
Kitchener	44	2%	50%				50%		100.00%
Cambridge	91	3%	50%				50%		100.00%
North Dumfries	31	1%	50%				50%		100.00%
City of Guelph	8	0%	10%		50%		40%		100.00%
Puslinch	60	2%			50%	50%			100.00%
Oxford	89	3%					20%	80%	100.00%
Brant	381	13%		100%					100.00%
Haldimand-Norfolk	38	1%		100%					100.00%
8901	22	1%	10%				90%		100.00%
8902	51	2%	10%				90%		100.00%
8903	125	4%					100%		100.00%
8904	13	0%					100%		100.00%
8905	18	1%	50%				50%		100.00%
8906	109	4%	100%						100.00%
8907	328	12%					100%		100.00%
8908	17	1%		100%					100.00%
8909	11	0%		100%					100.00%
8910	74	3%		100%					100.00%
8911	22	1%		40%			50%	10%	100.00%
8912	38	1%		10%			80%	10%	100.00%
8913	7	0%		30%			60%	10%	100.00%
8914	7	0%					80%	20%	100.00%
8916	134	5%					70%	30%	100.00%
8917	25	1%					60%	40%	100.00%
8918	12	0%		10%			60%	30%	100.00%
8919	38	1%		20%			50%	30%	100.00%
8920	43	2%		20%			60%	20%	100.00%
8921	14	0%		20%			60%	20%	100.00%
8922	31	1%		20%			50%	30%	100.00%
8923	62	2%		20%			50%	30%	100.00%
8924	17	1%		30%			60%	10%	100.00%
8925	10	0%		20%			50%	30%	100.00%
8926	22	1%		20%			50%	30%	100.00%
8927	24	1%		60%			20%	20%	100.00%
8930	81	3%		30%			50%	20%	100.00%
8933	16	1%		50%			50%		100.00%
8934	20	1%		50%			50%		100.00%
8935	5	0%		50%			50%		100.00%
8937	11	0%		50%			50%		100.00%
8948	6	0%		50%			50%		100.00%
8949	112	4%					100%		100.00%
	2840	100%							

Route Split Totals

Zone	NORTH Brantwood Park Rd	SOUTH Garden Avenue	EAST Lynden Rd	EAST Highway 403	WEST Lynden Rd	WEST Highway 403	TOTAL
Brampton	0.00%	0.00%	0.04%	0.32%	0.00%	0.00%	0.4%
Mississauga	0.00%	0.00%	0.08%	0.76%	0.00%	0.00%	0.8%
Milton	0.00%	0.00%	0.53%	0.53%	0.00%	0.00%	1.1%
Burlington	0.00%	0.00%	0.51%	4.60%	0.00%	0.00%	5.1%
Flamborough	0.00%	0.00%	1.58%	1.58%	0.00%	0.00%	3.2%
Ancaster	0.00%	0.00%	0.49%	1.13%	0.00%	0.00%	1.6%
Hamilton	0.00%	0.00%	1.27%	5.07%	0.00%	0.00%	6.3%
Lincoln	0.00%	0.19%	0.00%	0.76%	0.00%	0.00%	1.0%
Waterloo	0.37%	0.00%	0.00%	0.00%	0.37%	0.00%	0.7%
Kitchener	0.77%	0.00%	0.00%	0.00%	0.77%	0.00%	1.5%
Cambridge	1.60%	0.00%	0.00%	0.00%	1.60%	0.00%	3.2%
North Dumfries	0.55%	0.00%	0.00%	0.00%	0.55%	0.00%	1.1%
City of Guelph	0.03%	0.00%	0.14%	0.00%	0.11%	0.00%	0.3%
Puslinch	0.00%	0.00%	1.06%	1.06%	0.00%	0.00%	2.1%
Oxford	0.00%	0.00%	0.00%	0.00%	0.63%	2.51%	3.1%
Brant	0.00%	13.42%	0.00%	0.00%	0.00%	0.00%	13.4%
Haldimand-Norfolk	0.00%	1.34%	0.00%	0.00%	0.00%	0.00%	1.3%
8901	0.08%	0.00%	0.00%	0.00%	0.70%	0.00%	0.8%
8902	0.18%	0.00%	0.00%	0.00%	1.62%	0.00%	1.8%
8903	0.00%	0.00%	0.00%	0.00%	4.40%	0.00%	4.4%
8904	0.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.5%
8905	0.32%	0.00%	0.00%	0.00%	0.32%	0.00%	0.6%
8906	3.84%	0.00%	0.00%	0.00%	0.00%	0.00%	3.8%
8907	0.00%	0.00%	0.00%	0.00%	11.55%	0.00%	11.5%
8908	0.00%	0.60%	0.00%	0.00%	0.00%	0.00%	0.6%
8909	0.00%	0.39%	0.00%	0.00%	0.00%	0.00%	0.4%
8910	0.00%	2.61%	0.00%	0.00%	0.00%	0.00%	2.6%
8911	0.00%	0.31%	0.00%	0.00%	0.39%	0.08%	0.8%
8912	0.00%	0.13%	0.00%	0.00%	1.07%	0.13%	1.3%
8913	0.00%	0.07%	0.00%	0.00%	0.15%	0.02%	0.2%
8914	0.00%	0.00%	0.00%	0.00%	0.20%	0.05%	0.2%
8916	0.00%	0.00%	0.00%	0.00%	3.30%	1.42%	4.7%
8917	0.00%	0.00%	0.00%	0.00%	0.53%	0.35%	0.9%
8918	0.00%	0.04%	0.00%	0.00%	0.25%	0.13%	0.4%
8919	0.00%	0.27%	0.00%	0.00%	0.67%	0.40%	1.3%
8920	0.00%	0.30%	0.00%	0.00%	0.91%	0.30%	1.5%
8921	0.00%	0.10%	0.00%	0.00%	0.30%	0.10%	0.5%
8922	0.00%	0.22%	0.00%	0.00%	0.55%	0.33%	1.1%
8923	0.00%	0.44%	0.00%	0.00%	1.09%	0.65%	2.2%
8924	0.00%	0.18%	0.00%	0.00%	0.36%	0.06%	0.6%
8925	0.00%	0.07%	0.00%	0.00%	0.18%	0.11%	0.4%
8926	0.00%	0.15%	0.00%	0.00%	0.39%	0.23%	0.8%
8927	0.00%	0.51%	0.00%	0.00%	0.17%	0.17%	0.8%
8930	0.00%	0.86%	0.00%	0.00%	1.43%	0.57%	2.9%
8933	0.00%	0.28%	0.00%	0.00%	0.28%	0.00%	0.6%
8934	0.00%	0.35%	0.00%	0.00%	0.35%	0.00%	0.7%
8935	0.00%	0.09%	0.00%	0.00%	0.09%	0.00%	0.2%
8937	0.00%	0.19%	0.00%	0.00%	0.19%	0.00%	0.4%
8948	0.00%	0.11%	0.00%	0.00%	0.11%	0.00%	0.2%
8949	0.00%	0.00%	0.00%	0.00%	3.94%	0.00%	3.9%
	7.7%	**23.2%**	**5.7%**	**15.8%**	**40.0%**	**7.6%**	**100.0%**
	7.00%	**23.00%**	**6.00%**	**16.00%**	**40.00%**	**8.00%**	**100%**

CARDINAL DIRECTION	
NORTH	7.00%
SOUTH	23.00%
EAST	22.00%
WEST	48.00%

Appendix E:
Synchro Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	260	45	70	320	95	25	5	30	185	20	225
Future Volume (vph)	95	260	45	70	320	95	25	5	30	185	20	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00		0.96	1.00
Satd. Flow (prot)	1612	3333		1583	3438	1553		1606	1196		1786	1528
Flt Permitted	0.52	1.00		0.52	1.00	1.00		0.66	1.00		0.72	1.00
Satd. Flow (perm)	885	3333		869	3438	1553		1101	1196		1345	1528
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	116	317	55	85	390	116	30	6	37	226	24	274
RTOR Reduction (vph)	0	13	0	0	0	56	0	0	28	0	0	210
Lane Group Flow (vph)	116	359	0	85	390	60	0	36	9	0	250	64
Confl. Peds. (#/hr)							5					5
Heavy Vehicles (%)	12%	4%	17%	14%	5%	4%	16%	0%	35%	2%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	51.2	45.6		52.8	46.4	46.4		21.0	21.0		21.0	21.0
Effective Green, g (s)	51.2	45.6		52.8	46.4	46.4		21.0	21.0		21.0	21.0
Actuated g/C Ratio	0.57	0.51		0.59	0.52	0.52		0.23	0.23		0.23	0.23
Clearance Time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	548	1688		560	1772	800		256	279		313	356
v/s Ratio Prot	c0.01	0.11		0.01	c0.11							
v/s Ratio Perm	0.11			0.08		0.04		0.03	0.01		c0.19	0.04
v/c Ratio	0.21	0.21		0.15	0.22	0.07		0.14	0.03		0.80	0.18
Uniform Delay, d1	9.0	12.3		8.1	11.9	11.0		27.3	26.6		32.5	27.6
Progression Factor	1.00	1.00		0.98	0.98	0.90		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.3		0.1	0.3	0.2		0.3	0.0		13.3	0.2
Delay (s)	9.2	12.6		8.1	11.9	10.1		27.6	26.7		45.8	27.9
Level of Service	A	B		A	B	B		C	C		D	C
Approach Delay (s)		11.8			11.0			27.1			36.4	
Approach LOS		B			B			C			D	

Intersection Summary				
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.39			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	48.6%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	520	570	5	5	0
Future Volume (Veh/h)	5	520	570	5	5	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	547	600	5	5	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	605				886	302
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	605				886	302
tC, single (s)	5.4				*5.2	7.9
tC, 2 stage (s)						
tF (s)	2.9				*2.6	3.8
p0 queue free %	99				99	100
cM capacity (veh/h)	638				517	570

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	187	365	400	205	5
Volume Left	5	0	0	0	5
Volume Right	0	0	0	5	0
cSH	638	1700	1700	1700	517
Volume to Capacity	0.01	0.21	0.24	0.12	0.01
Queue Length 95th (m)	0.2	0.0	0.0	0.0	0.2
Control Delay (s)	0.4	0.0	0.0	0.0	12.0
Lane LOS	A				B
Approach Delay (s)	0.1		0.0		12.0
Approach LOS					B

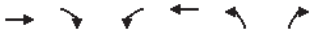
Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	27.9%	ICU Level of Service	A	
Analysis Period (min)	15			

* User Entered Value

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	80	45	530	60	40	485
Future Volume (vph)	80	45	530	60	40	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3335		1671	3374
Flt Permitted	0.95	1.00	1.00		0.42	1.00
Satd. Flow (perm)	1736	1553	3335		742	3374
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	82	46	546	62	41	500
RTOR Reduction (vph)	0	42	8	0	0	0
Lane Group Flow (vph)	82	4	600	0	41	500
Heavy Vehicles (%)	4%	4%	7%	3%	8%	7%
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	7.9	7.9	70.1		70.1	70.1
Effective Green, g (s)	7.9	7.9	70.1		70.1	70.1
Actuated g/C Ratio	0.09	0.09	0.78		0.78	0.78
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	152	136	2597		577	2627
v/s Ratio Prot	c0.05		c0.18			0.15
v/s Ratio Perm		0.00			0.06	
v/c Ratio	0.54	0.03	0.23		0.07	0.19
Uniform Delay, d1	39.3	37.5	2.7		2.3	2.6
Progression Factor	1.00	1.00	1.00		0.56	0.54
Incremental Delay, d2	3.7	0.1	0.2		0.2	0.2
Delay (s)	43.0	37.6	2.9		1.5	1.6
Level of Service	D	D	A		A	A
Approach Delay (s)	41.0		2.9			1.6
Approach LOS	D		A			A

Intersection Summary				
HCM 2000 Control Delay	6.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	95	5	0	120	5	5
Future Volume (Veh/h)	95	5	0	120	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	107	6	0	135	6	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			113		245	110
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			113		245	110
tC, single (s)			4.6		6.7	6.9
tC, 2 stage (s)						
tF (s)			2.7		3.8	3.9
p0 queue free %			100		99	99
cM capacity (veh/h)			1225		681	793

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	113	135	12
Volume Left	0	0	6
Volume Right	6	0	6
cSH	1700	1225	733
Volume to Capacity	0.07	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	10.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	10.0
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	16.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	480	25	60	505	275	40	40	105	95	25	180
Future Volume (vph)	245	480	25	60	505	275	40	40	105	95	25	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.96	1.00
Satd. Flow (prot)	1770	3528		1752	3539	1615		1832	1509		1813	1573
Flt Permitted	0.41	1.00		0.45	1.00	1.00		0.78	1.00		0.71	1.00
Satd. Flow (perm)	768	3528		829	3539	1615		1463	1509		1345	1573
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	263	516	27	65	543	296	43	43	113	102	27	194
RTOR Reduction (vph)	0	3	0	0	0	123	0	0	94	0	0	161
Lane Group Flow (vph)	263	540	0	65	543	173	0	86	19	0	129	33
Confl. Peds. (#/hr)							5					5
Heavy Vehicles (%)	2%	1%	12%	3%	2%	0%	2%	0%	7%	0%	4%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	60.3	51.8		55.1	49.2	49.2		15.3	15.3		15.3	15.3
Effective Green, g (s)	60.3	51.8		55.1	49.2	49.2		15.3	15.3		15.3	15.3
Actuated g/C Ratio	0.67	0.58		0.61	0.55	0.55		0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	609	2030		568	1934	882		248	256		228	267
v/s Ratio Prot	c0.04	0.15		0.01	0.15							
v/s Ratio Perm	c0.25			0.06		0.11		0.06	0.01		c0.10	0.02
v/c Ratio	0.43	0.27		0.11	0.28	0.20		0.35	0.08		0.57	0.12
Uniform Delay, d1	5.9	9.6		7.0	10.9	10.4		32.9	31.4		34.3	31.7
Progression Factor	1.00	1.00		1.35	1.22	2.07		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.3		0.1	0.3	0.5		0.8	0.1		3.2	0.2
Delay (s)	6.4	9.9		9.6	13.7	22.0		33.8	31.5		37.5	31.9
Level of Service	A	A		A	B	C		C	C		D	C
Approach Delay (s)		8.8			16.1			32.5			34.1	
Approach LOS		A			B			C			C	

Intersection Summary				
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	57.1%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	790	925	0	5	5
Future Volume (Veh/h)	0	790	925	0	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	859	1005	0	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1005				1434	502
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1005				1434	502
tC, single (s)	4.1				*6.1	*5.6
tC, 2 stage (s)						
tF (s)	2.2				*3.0	*2.9
p0 queue free %	100				97	99
cM capacity (veh/h)	697				181	691

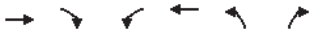
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	286	573	670	335	10
Volume Left	0	0	0	0	5
Volume Right	0	0	0	0	5
cSH	697	1700	1700	1700	287
Volume to Capacity	0.00	0.34	0.39	0.20	0.03
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.9
Control Delay (s)	0.0	0.0	0.0	0.0	18.0
Lane LOS					C
Approach Delay (s)	0.0		0.0		18.0
Approach LOS					C

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	35.6%	ICU Level of Service	A	
Analysis Period (min)	15			

* User Entered Value

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	65	60	865	90	65	730
Future Volume (vph)	65	60	865	90	65	730
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3489		1770	3505
Flt Permitted	0.95	1.00	1.00		0.27	1.00
Satd. Flow (perm)	1752	1568	3489		501	3505
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	70	65	930	97	70	785
RTOR Reduction (vph)	0	59	6	0	0	0
Lane Group Flow (vph)	70	6	1021	0	70	785
Heavy Vehicles (%)	3%	3%	2%	2%	2%	3%
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	7.8	7.8	70.2		70.2	70.2
Effective Green, g (s)	7.8	7.8	70.2		70.2	70.2
Actuated g/C Ratio	0.09	0.09	0.78		0.78	0.78
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	151	135	2721		390	2733
v/s Ratio Prot	c0.04		c0.29			0.22
v/s Ratio Perm		0.00			0.14	
v/c Ratio	0.46	0.04	0.38		0.18	0.29
Uniform Delay, d1	39.1	37.7	3.1		2.5	2.8
Progression Factor	1.00	1.00	1.00		0.78	0.77
Incremental Delay, d2	2.2	0.1	0.4		1.0	0.3
Delay (s)	41.4	37.8	3.5		3.0	2.4
Level of Service	D	D	A		A	A
Approach Delay (s)	39.6		3.5			2.5
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	145	10	0	115	10	5
Future Volume (Veh/h)	145	10	0	115	10	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	151	10	0	120	10	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			161		276	156
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			161		276	156
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	99
cM capacity (veh/h)			1430		718	895

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	161	120	15
Volume Left	0	0	10
Volume Right	10	0	5
cSH	1700	1430	769
Volume to Capacity	0.09	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.0	0.0	9.8
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	18.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	340	45	80	405	100	25	5	40	190	20	225
Future Volume (vph)	95	340	45	80	405	100	25	5	40	190	20	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00		0.96	1.00
Satd. Flow (prot)	1612	3361		1583	3438	1553		1606	1196		1785	1528
Flt Permitted	0.47	1.00		0.46	1.00	1.00		0.65	1.00		0.72	1.00
Satd. Flow (perm)	796	3361		763	3438	1553		1095	1196		1344	1528
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	116	415	55	98	494	122	30	6	49	232	24	274
RTOR Reduction (vph)	0	10	0	0	0	59	0	0	37	0	0	209
Lane Group Flow (vph)	116	461	0	98	494	63	0	36	12	0	256	65
Confl. Peds. (#/hr)							5					5
Heavy Vehicles (%)	12%	4%	17%	14%	5%	4%	16%	0%	35%	2%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	50.5	45.0		52.9	46.2	46.2		21.3	21.3		21.3	21.3
Effective Green, g (s)	50.5	45.0		52.9	46.2	46.2		21.3	21.3		21.3	21.3
Actuated g/C Ratio	0.56	0.50		0.59	0.51	0.51		0.24	0.24		0.24	0.24
Clearance Time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	496	1680		509	1764	797		259	283		318	361
v/s Ratio Prot	0.01	0.14		c0.01	c0.14							
v/s Ratio Perm	0.12			0.10		0.04		0.03	0.01		c0.19	0.04
v/c Ratio	0.23	0.27		0.19	0.28	0.08		0.14	0.04		0.81	0.18
Uniform Delay, d1	9.3	13.0		8.2	12.4	11.1		27.1	26.5		32.4	27.4
Progression Factor	1.00	1.00		0.99	1.01	1.08		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.4		0.2	0.4	0.2		0.2	0.1		13.7	0.2
Delay (s)	9.6	13.4		8.3	13.0	12.1		27.4	26.5		46.1	27.6
Level of Service	A	B		A	B	B		C	C		D	C
Approach Delay (s)		12.7			12.2			26.9			36.6	
Approach LOS		B			B			C			D	

Intersection Summary				
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.43			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	51.0%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	655	690	5	5	0
Future Volume (Veh/h)	5	655	690	5	5	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	689	726	5	5	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	731				1083	366
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	731				1083	366
tC, single (s)	5.4				*5.2	7.9
tC, 2 stage (s)						
tF (s)	2.9				*2.6	3.8
p0 queue free %	99				99	100
cM capacity (veh/h)	552				414	512

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	235	459	484	247	5
Volume Left	5	0	0	0	5
Volume Right	0	0	0	5	0
cSH	552	1700	1700	1700	414
Volume to Capacity	0.01	0.27	0.28	0.15	0.01
Queue Length 95th (m)	0.2	0.0	0.0	0.0	0.3
Control Delay (s)	0.4	0.0	0.0	0.0	13.8
Lane LOS	A				B
Approach Delay (s)	0.1		0.0		13.8
Approach LOS					B

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	31.6%	ICU Level of Service	A	
Analysis Period (min)	15			

* User Entered Value

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	85	75	620	65	65	595
Future Volume (vph)	85	75	620	65	65	595
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3338		1671	3374
Flt Permitted	0.95	1.00	1.00		0.38	1.00
Satd. Flow (perm)	1736	1553	3338		674	3374
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	88	77	639	67	67	613
RTOR Reduction (vph)	0	70	8	0	0	0
Lane Group Flow (vph)	88	7	698	0	67	613
Heavy Vehicles (%)	4%	4%	7%	3%	8%	7%
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.0	8.0	70.0		70.0	70.0
Effective Green, g (s)	8.0	8.0	70.0		70.0	70.0
Actuated g/C Ratio	0.09	0.09	0.78		0.78	0.78
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	154	138	2596		524	2624
v/s Ratio Prot	c0.05		c0.21			0.18
v/s Ratio Perm		0.00			0.10	
v/c Ratio	0.57	0.05	0.27		0.13	0.23
Uniform Delay, d1	39.4	37.5	2.8		2.5	2.7
Progression Factor	1.00	1.00	1.00		0.58	0.57
Incremental Delay, d2	5.0	0.1	0.3		0.5	0.2
Delay (s)	44.4	37.7	3.1		1.9	1.8
Level of Service	D	D	A		A	A
Approach Delay (s)	41.3		3.1			1.8
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	125	5	0	155	5	5
Future Volume (Veh/h)	125	5	0	155	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	140	6	0	174	6	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			146		317	143
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			146		317	143
tC, single (s)			4.6		6.7	6.9
tC, 2 stage (s)						
tF (s)			2.7		3.8	3.9
p0 queue free %			100		99	99
cM capacity (veh/h)			1189		617	758

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	146	174	12
Volume Left	0	0	6
Volume Right	6	0	6
cSH	1700	1189	680
Volume to Capacity	0.09	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	10.4
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.4
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	18.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	595	25	75	625	280	40	40	115	100	25	180
Future Volume (vph)	245	595	25	75	625	280	40	40	115	100	25	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.96	1.00
Satd. Flow (prot)	1770	3537		1752	3539	1615		1832	1509		1812	1573
Flt Permitted	0.34	1.00		0.39	1.00	1.00		0.78	1.00		0.71	1.00
Satd. Flow (perm)	642	3537		723	3539	1615		1461	1509		1341	1573
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	263	640	27	81	672	301	43	43	124	108	27	194
RTOR Reduction (vph)	0	2	0	0	0	102	0	0	103	0	0	160
Lane Group Flow (vph)	263	665	0	81	672	199	0	86	21	0	135	34
Confl. Peds. (#/hr)							5					5
Heavy Vehicles (%)	2%	1%	12%	3%	2%	0%	2%	0%	7%	0%	4%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	60.0	51.4		54.8	48.8	48.8		15.6	15.6		15.6	15.6
Effective Green, g (s)	60.0	51.4		54.8	48.8	48.8		15.6	15.6		15.6	15.6
Actuated g/C Ratio	0.67	0.57		0.61	0.54	0.54		0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	535	2020		508	1918	875		253	261		232	272
v/s Ratio Prot	c0.05	0.19		0.01	0.19							
v/s Ratio Perm	c0.28			0.09		0.12		0.06	0.01		c0.10	0.02
v/c Ratio	0.49	0.33		0.16	0.35	0.23		0.34	0.08		0.58	0.12
Uniform Delay, d1	6.3	10.2		7.2	11.6	10.8		32.7	31.2		34.2	31.4
Progression Factor	1.00	1.00		1.45	1.30	1.94		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.7	0.4		0.1	0.5	0.6		0.8	0.1		3.7	0.2
Delay (s)	7.0	10.6		10.6	15.6	21.4		33.5	31.3		37.9	31.6
Level of Service	A	B		B	B	C		C	C		D	C
Approach Delay (s)		9.6			16.9			32.2			34.2	
Approach LOS		A			B			C			C	

Intersection Summary				
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.53			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	60.7%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	950	1110	0	5	5
Future Volume (Veh/h)	0	950	1110	0	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1033	1207	0	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1207				1724	604
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1207				1724	604
tC, single (s)	4.1				*6.1	*5.6
tC, 2 stage (s)						
tF (s)	2.2				*3.0	*2.9
p0 queue free %	100				96	99
cM capacity (veh/h)	585				122	613

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	344	689	805	402	10
Volume Left	0	0	0	0	5
Volume Right	0	0	0	0	5
cSH	585	1700	1700	1700	203
Volume to Capacity	0.00	0.41	0.47	0.24	0.05
Queue Length 95th (m)	0.0	0.0	0.0	0.0	1.2
Control Delay (s)	0.0	0.0	0.0	0.0	23.6
Lane LOS					C
Approach Delay (s)	0.0		0.0		23.6
Approach LOS					C

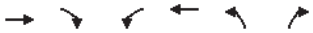
Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	40.7%	ICU Level of Service	A	
Analysis Period (min)	15			

* User Entered Value

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	70	95	1015	100	90	865
Future Volume (vph)	70	95	1015	100	90	865
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3491		1770	3505
Flt Permitted	0.95	1.00	1.00		0.22	1.00
Satd. Flow (perm)	1752	1568	3491		408	3505
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	102	1091	108	97	930
RTOR Reduction (vph)	0	93	6	0	0	0
Lane Group Flow (vph)	75	9	1193	0	97	930
Heavy Vehicles (%)	3%	3%	2%	2%	2%	3%
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.0	8.0	70.0		70.0	70.0
Effective Green, g (s)	8.0	8.0	70.0		70.0	70.0
Actuated g/C Ratio	0.09	0.09	0.78		0.78	0.78
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	155	139	2715		317	2726
v/s Ratio Prot	c0.04		c0.34			0.27
v/s Ratio Perm		0.01			0.24	
v/c Ratio	0.48	0.07	0.44		0.31	0.34
Uniform Delay, d1	39.0	37.6	3.4		2.9	3.0
Progression Factor	1.00	1.00	1.00		0.81	0.76
Incremental Delay, d2	2.4	0.2	0.5		2.4	0.3
Delay (s)	41.4	37.8	3.9		4.8	2.6
Level of Service	D	D	A		A	A
Approach Delay (s)	39.3		3.9			2.8
Approach LOS	D		A			A

Intersection Summary				
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	180	10	0	155	10	5
Future Volume (Veh/h)	180	10	0	155	10	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	188	10	0	161	10	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			198		354	193
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			198		354	193
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	99
cM capacity (veh/h)			1387		648	854

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	198	161	15
Volume Left	0	0	10
Volume Right	10	0	5
cSH	1700	1387	705
Volume to Capacity	0.12	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.0	0.0	10.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.2
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	405	45	80	570	130	25	5	40	200	20	225
Future Volume (vph)	95	405	45	80	570	130	25	5	40	200	20	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00		0.96	1.00
Satd. Flow (prot)	1612	3377		1583	3438	1553		1606	1196		1785	1528
Flt Permitted	0.35	1.00		0.41	1.00	1.00		0.65	1.00		0.72	1.00
Satd. Flow (perm)	598	3377		679	3438	1553		1083	1196		1342	1528
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	116	494	55	98	695	159	30	6	49	244	24	274
RTOR Reduction (vph)	0	8	0	0	0	55	0	0	37	0	0	207
Lane Group Flow (vph)	116	541	0	98	695	104	0	36	12	0	268	67
Confl. Peds. (#/hr)							5					5
Heavy Vehicles (%)	12%	4%	17%	14%	5%	4%	16%	0%	35%	2%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	49.8	44.4		52.4	45.7	45.7		21.9	21.9		21.9	21.9
Effective Green, g (s)	49.8	44.4		52.4	45.7	45.7		21.9	21.9		21.9	21.9
Actuated g/C Ratio	0.55	0.49		0.58	0.51	0.51		0.24	0.24		0.24	0.24
Clearance Time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	391	1665		462	1745	788		263	291		326	371
v/s Ratio Prot	c0.02	0.16		0.02	c0.20							
v/s Ratio Perm	0.15			0.11		0.07		0.03	0.01		c0.20	0.04
v/c Ratio	0.30	0.32		0.21	0.40	0.13		0.14	0.04		0.82	0.18
Uniform Delay, d1	9.8	13.8		8.5	13.7	11.7		26.7	26.0		32.2	26.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	0.5		0.2	0.7	0.3		0.2	0.1		15.3	0.2
Delay (s)	10.2	14.3		8.7	14.3	12.0		26.9	26.1		47.5	27.2
Level of Service	B	B		A	B	B		C	C		D	C
Approach Delay (s)		13.6			13.4			26.4			37.2	
Approach LOS		B			B			C			D	

Intersection Summary				
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.52			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	55.9%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	15	860	735	50	30	95
Future Volume (Veh/h)	15	860	735	50	30	95
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	905	774	53	32	100
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		179				
pX, platoon unblocked					0.93	
vC, conflicting volume	827				1285	414
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	827				1160	414
tC, single (s)	5.4				*5.2	*5.2
tC, 2 stage (s)						
tF (s)	2.9				*2.6	*2.6
p0 queue free %	97				91	89
cM capacity (veh/h)	494				345	881

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	16	452	452	516	311	132
Volume Left	16	0	0	0	0	32
Volume Right	0	0	0	0	53	100
cSH	494	1700	1700	1700	1700	640
Volume to Capacity	0.03	0.27	0.27	0.30	0.18	0.21
Queue Length 95th (m)	0.8	0.0	0.0	0.0	0.0	6.2
Control Delay (s)	12.5	0.0	0.0	0.0	0.0	12.1
Lane LOS	B					B
Approach Delay (s)	0.2			0.0		12.1
Approach LOS						B

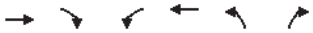
Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	38.0%	ICU Level of Service	A	
Analysis Period (min)	15			

* User Entered Value

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	85	85	700	65	80	810
Future Volume (vph)	85	85	700	65	80	810
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	1553	3341		1671	3374
Flt Permitted	0.95	1.00	1.00		0.35	1.00
Satd. Flow (perm)	1736	1553	3341		621	3374
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	88	88	722	67	82	835
RTOR Reduction (vph)	0	80	7	0	0	0
Lane Group Flow (vph)	88	8	782	0	82	835
Heavy Vehicles (%)	4%	4%	7%	3%	8%	7%
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	8.0	8.0	70.0		70.0	70.0
Effective Green, g (s)	8.0	8.0	70.0		70.0	70.0
Actuated g/C Ratio	0.09	0.09	0.78		0.78	0.78
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	154	138	2598		483	2624
v/s Ratio Prot	c0.05		0.23			c0.25
v/s Ratio Perm		0.01			0.13	
v/c Ratio	0.57	0.06	0.30		0.17	0.32
Uniform Delay, d1	39.4	37.5	2.9		2.6	3.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.0	0.2	0.3		0.8	0.3
Delay (s)	44.4	37.7	3.2		3.3	3.3
Level of Service	D	D	A		A	A
Approach Delay (s)	41.1		3.2			3.3
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	140	5	0	165	5	5
Future Volume (Veh/h)	140	5	0	165	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	157	6	0	185	6	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			163		345	160
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			163		345	160
tC, single (s)			4.6		6.7	6.9
tC, 2 stage (s)						
tF (s)			2.7		3.8	3.9
p0 queue free %			100		99	99
cM capacity (veh/h)			1171		593	740

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	163	185	12
Volume Left	0	0	6
Volume Right	6	0	6
cSH	1700	1171	659
Volume to Capacity	0.10	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	10.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.6
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	18.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
5: Lynden Rd & Site Access Rd

Future Total AM
11-16-2022

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	65	670	785	45	205	100
Future Volume (vph)	65	670	785	45	205	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	3610	5145		1805	1615
Flt Permitted	0.30	1.00	1.00		0.95	1.00
Satd. Flow (perm)	576	3610	5145		1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	728	853	49	223	109
RTOR Reduction (vph)	0	0	5	0	0	90
Lane Group Flow (vph)	71	728	897	0	223	19
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	68.5	68.5	68.5		17.5	17.5
Effective Green, g (s)	68.5	68.5	68.5		17.5	17.5
Actuated g/C Ratio	0.68	0.68	0.68		0.18	0.18
Clearance Time (s)	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	394	2472	3524		315	282
v/s Ratio Prot		c0.20	0.17		c0.12	
v/s Ratio Perm	0.12					0.01
v/c Ratio	0.18	0.29	0.25		0.71	0.07
Uniform Delay, d1	5.7	6.2	6.0		38.8	34.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	0.3	0.2		7.1	0.1
Delay (s)	6.7	6.5	6.2		45.9	34.5
Level of Service	A	A	A		D	C
Approach Delay (s)		6.5	6.2		42.2	
Approach LOS		A	A		D	

Intersection Summary				
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.38			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0	
Intersection Capacity Utilization	50.9%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
1: Roy Blvd/Brantwood Park Rd & Lynden Rd

Future Total PM
11-16-2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	245	780	25	75	740	300	40	40	115	135	25	180
Future Volume (vph)	245	780	25	75	740	300	40	40	115	135	25	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.96	1.00
Satd. Flow (prot)	1770	3546		1752	3539	1615		1832	1509		1812	1573
Flt Permitted	0.28	1.00		0.29	1.00	1.00		0.74	1.00		0.70	1.00
Satd. Flow (perm)	524	3546		541	3539	1615		1387	1509		1322	1573
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	263	839	27	81	796	323	43	43	124	145	27	194
RTOR Reduction (vph)	0	2	0	0	0	97	0	0	100	0	0	157
Lane Group Flow (vph)	263	864	0	81	796	226	0	86	24	0	172	37
Confl. Peds. (#/hr)							5					5
Heavy Vehicles (%)	2%	1%	12%	3%	2%	0%	2%	0%	7%	0%	4%	1%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	58.6	49.7		53.0	46.9	46.9		17.2	17.2		17.2	17.2
Effective Green, g (s)	58.6	49.7		53.0	46.9	46.9		17.2	17.2		17.2	17.2
Actuated g/C Ratio	0.65	0.55		0.59	0.52	0.52		0.19	0.19		0.19	0.19
Clearance Time (s)	5.0	6.0		5.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	464	1958		400	1844	841		265	288		252	300
v/s Ratio Prot	c0.06	0.24		0.01	0.22							
v/s Ratio Perm	c0.31			0.11		0.14		0.06	0.02		c0.13	0.02
v/c Ratio	0.57	0.44		0.20	0.43	0.27		0.32	0.08		0.68	0.12
Uniform Delay, d1	7.3	11.9		8.1	13.3	12.0		31.4	29.9		33.9	30.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	0.7		0.3	0.7	0.8		0.7	0.1		7.4	0.2
Delay (s)	8.9	12.7		8.4	14.1	12.8		32.1	30.0		41.3	30.3
Level of Service	A	B		A	B	B		C	C		D	C
Approach Delay (s)		11.8			13.3			30.9			35.5	
Approach LOS		B			B			C			D	

Intersection Summary				
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	65.5%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	1095	1235	125	20	70
Future Volume (Veh/h)	20	1095	1235	125	20	70
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	1190	1342	136	22	76
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		180				
pX, platoon unblocked					0.88	
vC, conflicting volume	1478				2049	739
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1478				1922	739
tC, single (s)	4.1				*6.1	*5.6
tC, 2 stage (s)						
tF (s)	2.2				*3.0	*2.9
p0 queue free %	95				72	85
cM capacity (veh/h)	462				78	522

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	22	595	595	895	583	98
Volume Left	22	0	0	0	0	22
Volume Right	0	0	0	0	136	76
cSH	462	1700	1700	1700	1700	229
Volume to Capacity	0.05	0.35	0.35	0.53	0.34	0.43
Queue Length 95th (m)	1.2	0.0	0.0	0.0	0.0	16.0
Control Delay (s)	13.2	0.0	0.0	0.0	0.0	32.0
Lane LOS	B					D
Approach Delay (s)	0.2			0.0		32.0
Approach LOS						D

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	50.2%	ICU Level of Service		A
Analysis Period (min)	15			

* User Entered Value

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	70	125	1235	100	100	1015
Future Volume (vph)	70	125	1235	100	100	1015
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	3499		1770	3505
Flt Permitted	0.95	1.00	1.00		0.16	1.00
Satd. Flow (perm)	1752	1568	3499		295	3505
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	134	1328	108	108	1091
RTOR Reduction (vph)	0	69	5	0	0	0
Lane Group Flow (vph)	75	65	1431	0	108	1091
Heavy Vehicles (%)	3%	3%	2%	2%	2%	3%
Turn Type	Prot	Perm	NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.8	9.8	68.2		68.2	68.2
Effective Green, g (s)	9.8	9.8	68.2		68.2	68.2
Actuated g/C Ratio	0.11	0.11	0.76		0.76	0.76
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	190	170	2651		223	2656
v/s Ratio Prot	c0.04		c0.41			0.31
v/s Ratio Perm		0.04			0.37	
v/c Ratio	0.39	0.38	0.54		0.48	0.41
Uniform Delay, d1	37.3	37.3	4.5		4.2	3.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	1.4	0.8		7.3	0.5
Delay (s)	38.7	38.7	5.3		11.5	4.3
Level of Service	D	D	A		B	A
Approach Delay (s)	38.7		5.3			5.0
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	190	10	0	185	10	5
Future Volume (Veh/h)	190	10	0	185	10	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	198	10	0	193	10	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			208		396	203
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			208		396	203
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	99
cM capacity (veh/h)			1375		613	843

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	208	193	15
Volume Left	0	0	10
Volume Right	10	0	5
cSH	1700	1375	674
Volume to Capacity	0.12	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.0	0.0	10.5
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.5
Approach LOS			B

Intersection Summary				
Average Delay		0.4		
Intersection Capacity Utilization		20.6%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	200	970	1180	125	145	70
Future Volume (vph)	200	970	1180	125	145	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.95	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	3610	5112		1805	1615
Flt Permitted	0.13	1.00	1.00		0.95	1.00
Satd. Flow (perm)	255	3610	5112		1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	1054	1283	136	158	76
RTOR Reduction (vph)	0	0	9	0	0	65
Lane Group Flow (vph)	217	1054	1410	0	158	11
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	72.0	72.0	56.6		14.0	14.0
Effective Green, g (s)	72.0	72.0	56.6		14.0	14.0
Actuated g/C Ratio	0.72	0.72	0.57		0.14	0.14
Clearance Time (s)	4.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	360	2599	2893		252	226
v/s Ratio Prot	c0.07	0.29	0.28		c0.09	
v/s Ratio Perm	c0.37					0.01
v/c Ratio	0.60	0.41	0.49		0.63	0.05
Uniform Delay, d1	7.5	5.5	13.0		40.5	37.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	0.5	0.6		4.8	0.1
Delay (s)	10.3	6.0	13.6		45.3	37.3
Level of Service	B	A	B		D	D
Approach Delay (s)		6.7	13.6		42.7	
Approach LOS		A	B		D	

Intersection Summary				
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.63			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	59.7%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Appendix F:
Existing Signal Timings

CITY OF BRANTFORD ENGINEERING DEPARTMENT
TRAFFIC SIGNAL TIMING SHEET

INTERSECTION OF GARDEN AVENUE @ GARDEN AVENUE (T-INTERSECTION)

PHASE	1	2 NB	3	4 EB	5	6 SB	7	8 WB
MIN GREEN		10		7		10		7
WALK		7		7		7		7
PED CLEAR		14		14		14		14
VEH EXTENSION				3.0				3.0
MAX 1		30		18		30		18
MAX 2		35		20		35		20
AMBER		4.0		4.0		4.0		4.0
RED CLEARANCE		2.0		2.0		2.0		2.0

Garden Avenue @ Garden Avenue (T-Intersection)

AM PLAN

Cycle Length	90	CoS	701	Offset	85

Phase 1		Phase 2	73	Phase 3		Phase 4	17
Phase 5		Phase 6	73	Phase 7		Phase 8	17

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

OFF PEAK PLAN

Cycle Length	90	CoS	702	Offset	26

Phase 1		Phase 2	58	Phase 3		Phase 4	22
Phase 5		Phase 6	58	Phase 7		Phase 8	22

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

PM PEAK PLAN (STEP 3)

Cycle Length	90	CoS	703	Offset	16

Phase 1		64	66	Phase 3		Phase 4	24
Phase 5		Phase 6	66	Phase 7		Phase 8	24

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

NIGHT PLAN - FREE OPERATION

Cycle Length		CoS		Offset	

Phase 1		Phase 2		Phase 3		Phase 4	
Phase 5		Phase 6		Phase 7		Phase 8	

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

Time of Days Steps and Patterns

Step	Program	Plan Begins	Plan
Step 1	1	06:00	1
Step 2	1	09:00	2
Step 3	1	14:30	3
Step 4	1	18:00	2
Step 5	1	22:30	5
Step 6	2	09:00	3
Step 7	2	18:00	2
Step 8	2	22:00	5
Step 9	3	09:00	3
Step 10	3	18:00	5

Notes:
Program 1 - Monday to Friday
Program 2 - Saturday
Program 3 - Sunday

City of Brantford Engineering Department
Traffic Signal Timing Sheet

Intersection of Lynden Road @ Brantwood Park Road @ Roy Boulavard

Phase	1 WB LT	2 EB	3	4 SB	5 EB LT	6 WB	7	8 NB
Min Green	7	10		10	7	10		10
Walk		7		7		7		7
Ped Clear		22		26		22		26
Veh Extension	3.0			3.0	3.0			3.0
Max 1	11	40		18	11	40		18
Max 2	12	45		20	12	45		20
Amber	3.0	4.0		4.0	3.0	4.0		4.0
Red Clearance	2.0	2.0		2.0	2.0	2.0		2.0
Red Revert	2.0	2.0		2.0	2.0	2.0		2.0

Lynden Road @ Brantwood Park Road @ Roy Boulavard

AM PLAN

Cycle Length	90	CoS	701	Offset	47

Phase 1	15	Phase 2	43	Phase 3		Phase 4	32
Phase 5	11	Phase 6	47	Phase 7		Phase 8	32

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

OFF PEAK PLAN

Cycle Length	100	CoS	702	Offset	50

Phase 1	18	Phase 2	40	Phase 3		Phase 4	31
Phase 5	13	Phase 6	46	Phase 7		Phase 8	31

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

PM PEAK PLAN (STEP 3)

Cycle Length	110	CoS	703	Offset	64

Phase 1	19	Phase 2	40	Phase 3		Phase 4	31
Phase 5	11	Phase 6	48	Phase 7		Phase 8	31

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

NIGHT PLAN (FREE OPERATION)

Cycle Length		CoS		Offset	

Phase 1		Phase 2		Phase 3		Phase 4	
Phase 5		Phase 6		Phase 7		Phase 8	

Phase	1	2	3	4	5	6	7	8
Coordinated								
Vehicle Recall								
Vehicle Max Recall								
Pedestrian Recall								

Time of Days Steps and Patterns

Step	Program	Plan Begins	Plan
Step 1	1	06:00	1
Step 2	1	09:00	2
Step 3	1	14:30	3
Step 4	1	18:00	2
Step 5	1	22:30	5
Step 6	2	09:00	3
Step 7	2	18:00	2
Step 8	2	22:00	5
Step 9	3	09:00	3
Step 10	3	18:00	5

Notes:
Program 1 - Monday to Friday
Program 2 - Saturday
Program 3 - Sunday

Appendix G:
Signal Warrant Review

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? Lynden Road / New Local Road

What is the direction of the Main Road street? East-West

When was the data collected?

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 2 or more

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 3

d.- What is the operating environment? Urban Population >= 10,000 AND Speed < 70 km/hr

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00	65	670	0	0	0	0	0	785	45	205	0	100	21
9:00	50	609	0	0	0	0	0	701	35	158	0	77	11
11:00	50	611	0	0	0	0	0	704	35	158	0	77	16
12:00	55	697	0	0	0	0	0	800	38	174	0	85	25
14:00	130	680	0	0	0	0	0	825	81	94	0	45	29
15:00	177	890	0	0	0	0	0	1081	110	128	0	62	26
16:00	200	970	0	0	0	0	0	1180	125	145	0	70	21
17:00	213	811	0	0	0	0	0	997	133	154	0	74	16
Total	**940**	**5,938**	**0**	**0**	**0**	**0**	**0**	**7,073**	**602**	**1,216**	**0**	**590**	**165**

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

* Include only collisions that are susceptable to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	4	79	4	79					
Factored 8 hour pedestrian volume	87		87		0		0		
% Assigned to crossing rate	100%		100%						
Net 8 Hour Pedestrian Volume at Crossing									174
Net 8 Hour Vehicular Volume on Street Being Crossed									14,553

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	4	79	4	79	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	4	79	4	79			0	0	
Factored volume of total pedestrians	87		87		0		0		
Factored volume of delayed pedestrians	87		87		0		0		
% Assigned to Crossing Rate	100%		100%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									174
Net 8 Hour Volume of Delayed Pedestrians									174

Analysis Sheet

Input Sheet | Results Sheet | Proposed Collision

GO TO Justification:

Intersection: Lynden Road / New Local Road Count Date:

Justification 1: Minimum Vehicle Volumes

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW ☐	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☑	8:00	9:00	11:00	12:00	14:00	15:00	16:00	17:00		
1A	480	720	600	900	1,870	1,630	1,635	1,849	1,855	2,448	2,690	2,382		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
1B	180	255	180	255	305	235	235	259	139	190	215	228		
	COMPLIANCE %				100	92	92	100	55	75	84	89	687	86
Restricted Flow Signal Justification 1:					Both 1A and 1B 100% Fullfilled each of 8 hours					Yes ☐		No ☑		
					Lesser of 1A or 1B at least 80% fulfilled each of 8 hours					Yes ☑		No ☐		

Justification 2: Delay to Cross Traffic

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW ☐	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☑	8:00	9:00	11:00	12:00	14:00	15:00	16:00	17:00		
2A	480	720	600	900	1,565	1,395	1,400	1,590	1,716	2,258	2,475	2,154		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
2B	50	75	50	75	226	169	174	199	188	243	266	277		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
Restricted Flow Signal Justification 2:					Both 2A and 2B 100% Fullfilled each of 8 hours					Yes ☑		No ☐		
					Lesser of 2A or 2B at least 80% fulfilled each of 8 hours					Yes ☑		No ☐		

Justification 3: Combination

Combination Justification 1 and 2

	Justification Satisfied 80% or More			Two Justifications Satisfied 80% or More	
Justification 1	Minimun Vehicular Volume	YES ☑	NO ☐	YES ☑	NO ☐
Justification 2	Delay Cross Traffic	YES ☑	NO ☐	JUSTIFIED	

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main)	Heaviest Minor Approach	Required Value	Average % Compliance	Overall % Compliance
		X	Y (actual)	Y (warrant threshold)		
Justification 4	14:00	1,716	139	115	100 %	100 %
	15:00	2,258	190	115	100 %	
	16:00	2,475	215	115	100 %	
	17:00	2,154	228	115	100 %	

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

Intersection: Lynden Road / New Local Road Count Date:

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	100	%	☐	☑
	B	Crossing Volume	86	%		
2. Delay to Cross Traffic	A	Main Road	100	%	☑	☐
	B	Crossing Road	100	%		
3. Combination	A	Justificaton 1	86	%	☑	☐
	B	Justification 2	100	%		
4. 4-Hr Volume			100	%	☑	☐
5. Collision Experience			0	%	☐	☑
6. Pedestrians	A	Volume	Justification not met		☐	☑
	B	Delay	Justification not met			

Appendix C1B:
Lynden Garden Block Plan (BP-01-2023) Traffic Study Addendum

October 16, 2023

TO:
Herthana Siva
Manager, Development
(905) 850 6154 x234
Sorbara Group of Companies
3700 Steeles Avenue West, Suite 800
Vaughan, Ontario L4L 8M9

RE: Lynden Garden Block Plan (BP-01-2023)
Traffic Study Addendum – Response to Comments

1.0 INTRODUCTION

BA Group is retained by Welton & Innes GP Inc. (Welton & Innes) to provide transportation advisory services in relation to the Lynden Garden Block Plan Area (referred to herein as the "Site"). The Site is a 77.7-hectare plot of land, generally bounded by existing residential and the Lynden Hills Park to the west, County of Brant agricultural and natural heritage area to the east, Lynden Road to the south, and natural heritage area to the north. The CN rail corridor forms the south-east boundary of the Site.

A transportation study dated December of 2022 and titled *Lynden Garden Block Plan – Urban Transportation Considerations* formed part of the application submission for the Lynden Garden Block Plan and supported the Block Servicing Strategy in accordance with the Block C10 Terms of Reference prepared by Welton & Innes. Since that time, comments were received from the City of Brantford in a letter dated June 22, 2023.

This letter provides responses to the received comments and discusses changes within the updated block plan.

2.0 RESPONSES TO COMMENTS

2.1 CITY OF BRANTFORD – DEVELOPMENT ENGINEERING COMMENTS

Comment 17: The Welton Road allowance bisects the subject property with a 20.117 metre right of way. The proposed development relies on the sale and closure of this road allowance to construct the lot fabric identified in the Block Plan, which cannot be guaranteed.

Response: Noted. The collector road has been revised to follow the road allowance.

Comment 18: The proposed Collector Road route will require a 24.5 metre right-of-way, whereas only 22 metres is demonstrated.

Response: Noted. The collector road has been revised to 24.5m in the updated block plan provided in **Attachment A**. This is consistent with Standard G-103 in the City's *Design and Construction Manual - Linear Municipal Infrastructure Standards.*

Comment 19: Lynden Road is identified in the Official Plan for an ultimate right-of-way of 40.0 metres. At a minimum the right-of-way needs to be expanded by approximately 10 metres to align with the 9 Coral Court property line.

Response: Noted. The required changes to the right-of-way are reflected in the updated block plan provided in **Attachment A**.

Comment 20: The proposed new westerly Collector Road intersection with Lynden Road warrants a traffic signal based on the number of units proposed. As per City policy, this intersection also needs to be reviewed for the merits of a potential roundabout installation.

Response: Noted. An intersection control study is provided in **Section 3.0**, including the traffic operations analysis under both the signal and roundabout conditions in **Section 3.1**.

Comment 21: A sidewalk or multi-use trail will be required along Lynden Road along the frontage of the subject Block Plan area.

Response: The design of the sidewalk or multi-use trail will be detailed during the future draft plan of subdivision process.

Comment 22: Due to the close intersection spacing (150ish metres) between the proposed Collector Road and the existing remnant stub of Lynden Road, two full movement intersections could be problematic, especially if both intersections required signalization. The existing intersection also currently lacks a left-turn lane. Consideration of two roundabouts will need to be carried out in future analysis.

Response:
An intersection control study was carried out in this update to the December 2022 TIS and detailed in **Section 3.1** that evaluates roundabouts vs. signals and comments on the appropriateness of either control in this context. If a future signal is constructed at the Lynden Road / Site Access Road intersection, traffic operations

at the Lynden Road / Garden Avenue (connecting to the existing Welton Road) intersection can be accommodated by restricting turning movements to westbound right-in / southbound left-right-out. There is also adequate property allowance for a 50 metre (circulating diameter) roundabout to be considered by the City within it's right-of-way at later date.

Comment 23: Transportation generally accepts the findings of the Transportation Impact Study, however as per the comment above, roundabout screening needs to be completed for the Arterial Road at Collector Road and Collector Road at Collector Road intersections.

Response: Noted. The intersection control studies for both intersections with Lynden Road – Garden Avenue are provided in **Section 3.0**.

Comment 24: Based on the number of type of units contemplated, on-street parking is typically required at a minimum of 0.5 spaces per unit which would equate to over 500 on-street parking spaces being required. The current proposed cross-sections suggest no on-street parking on the Collector Road and single sided parking on the Local Roads. Design changes to the cross-section will be required to increase on-street parking opportunities.

Response: The collector road has been revised to 24.5m in the updated block plan provided in **Attachment A**. We recommend that a on-street parking demonstration plan be provided at draft plan of subdivision. The 24.5 m right-of-way is consistent with Standard G-103 in the City's *Design and Construction Manual - Linear Municipal Infrastructure Standards.*

Comment 25: The proposed cross-section for the Collector Road requires revisions to meet the City's standard 24.5 metre cross-section and must be designed to accommodate a future transit route.

Response: Noted. The collector road has been revised to 24.5m in the updated block plan provided in **Attachment A**. The 24.5 m right-of-way is consistent with Standard G-103 in the City's *Design and Construction Manual - Linear Municipal Infrastructure Standards*

2.2 CITY OF BRANTFORD – TRANSPORTATION COMMENTS

Comment: A TIS will be required. This will analyze the impact of the development on Lynden Road, and possibly others and determine the need for improvements and traffic control from a safety and capacity perspective. In order to carry out the study, an estimated unit count will be required. Since the two proposed Collector Roads are less than 150 metres apart where they meet Lynden Road, this poses issues for future traffic control options and the implementation of turn lanes.

Response: A TIS was first submitted in December of 2022 titled *Lynden Garden Block Plan – Urban Transportation Considerations*. The study analyzed the traffic impacts of 1,016 residential units and concluded that the study area road network could accommodate the proposed development.

An intersection control study was carried out in this update to the December 2022 TIS and detailed in **Section 3.1** that evaluates roundabouts vs. signals and comments on the appropriateness of either control in this

context. If a future signal is constructed at the Lynden Road / Site Access Road intersection (not currently warranted), traffic operations at the Lynden Road / Garden Avenue (connecting to the existing Welton Road) intersection can be accommodated by restricting turning movements to westbound right-in / southbound left-right-out. There is also adequate property allowance for a 50 metre (circulating diameter) roundabout to be considered by the City within it's right-of-way at later date.

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Comment: A TDS will be required. Typically Collector Roads are 24.5, opposed to 22, but this submission may predate this requirement. The TDS will need to assess the proposed road network. Currently the Collector Road throughout the Development will involve 90 degrees turns, typically placed at all-way stop control intersections. This configuration may deter the Collector Road from operating as intended and the proposal could be difficult to maneuver for buses. The older section of Lynden Road, a remnant from a previous realignment would need to be updated to a Collector Road standard. The TDS also needs to review traffic calming measures and on-street parking.

Response: The collector road has been revised to 24.5m in the updated block plan provided in **Attachment A**. We recommend that bus manoeuvres be demonstrated on the future draft plan along the main circulating routes. TAC-recommended traffic calming measures will also be considered such as narrowing pavement width, curb bump-outs, raised crosswalks and speed bumps, along with the implementation of warning signage according to TAC guidelines.

Comment: Based on the commentary from the meeting, the TIS study area will be bound by the intersections of Lynden Road at Brantwood Park Road/ Roy Boulevard and extending southerly to the Highway 403 ramp interchanges along Garden Ave, and encompassing all intersections in between. The horizon year will be 5 years post full build-out for City intersections and 10 years for the 403 interchanges, as per the MTO guidelines.

Response: Our understanding is that the site is not within the MTO Permit Control area (link: https://www.hcms.mto.gov.on.ca/PermitsControlledArea) and not considered a reviewing agency for this site. The permit control area in proximity to the Highway 403 ramps at Garden Avenue is illustrated in **Exhibit 1**.

However, to provide further context and information, site traffic volumes heading to/from the ramp terminals are calculated to represent a growth rate of up to 1% to 2% on the Garden Avenue corridor – which is consistent with typical background corridor growth considered for development applications within the MTO's permit control area.

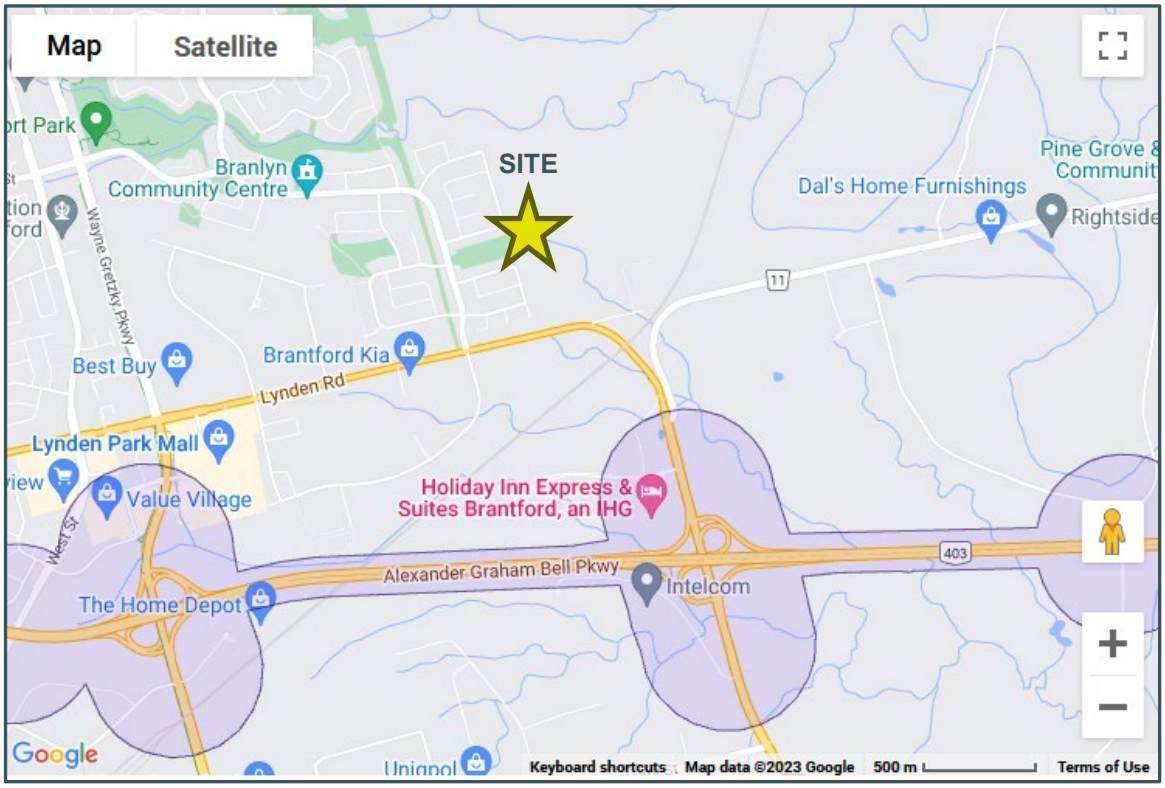


EXHIBIT 1: MTO PERMIT CONTROL AREA

Comment: Additionally, discussions will need to take place regarding the City's Welton Road allowance that currently bisects this site and whether this road allowance is to be retained for a future connection, or whether it may be available to be purchased.

Response: Noted.

2.3 MINISTRY OF TRANSPORTATION ONTARIO COMMENTS

Comment: The owner(s) shall submit to the Ministry of Transportation a copy of a Traffic Impact Study indicating the anticipated traffic volumes and their impact on Garden Avenue through the following locations:

- Highway 403 and Garden Avenue North ramp terminal,
- Highway 403 and Garden Avenue South ramp terminal,
- Garden Avenue and Sinclair Boulevard, and
- Garden Avenue and Lynden Road.

Response: Our understanding is that the site is not within the MTO Permit Control area (link: https://www.hcms.mto.gov.on.ca/PermitsControlledArea) and not considered a reviewing agency for this site.

However, to provide further context and information, site traffic volumes heading to/from the ramp terminals are calculated to represent a growth rate of up to 1% to 2% on the Garden Avenue corridor – which is consistent with typical background corridor growth considered for development applications within the MTO's permit control area.

Additionally, the analysis for Garden Avenue / Lynden Road (the three-legged intersection) is provided in the December 2022 TIS. There are no operational issues identified at the intersection with the site's full buildout.

3.0 INTERSECTION CONTROL STUDY

The initial assessment for the feasibility of a roundabout, as outlined in the City of Brantford's *Design and Construction Manual – Linear Municipal Infrastructure Standards* (dated February of 2023), was undertaken for both access intersections onto Lynden Road – Garden Avenue.

The results of the intersection control study, in consideration of both the option of a traffic signal and a roundabout, at the two adjacent intersections along Lynden Road is provided in **Table 1**. With respect to evaluating signalization, the Lynden Road / Lynden Road intersection is proposed to either operate as right-turns only (unsignalized) or a signal with partial moves (right-turns and southbound left) in tandem with the new Collector Road / Lynden Road signalized intersection. The existing and proposed eastbound left traffic volumes at Lynden Road / Lynden Road can be readily accommodated at the proposed Lynden Road / Future Collector Road signal without introducing a new left turn lane.

Based on the initial screening assessment, signal or roundabout control could suitably address traffic capacity in future, signalization scoring higher in the assessment matrix. The scoring table is based on the following scoring:

- A "1 out of 5" represents the option that would result in the least desirable outcome of any particular category (ex: right-of-way, intersection geometry, safety, etc.); other forms of intersection control present better outcomes.
- A "5 out of 5" represents an option that would result in minimal downside of any particular category; no other forms of intersection control would present better outcomes.
- Scores in between (i.e., 2, 3 or 4 out of 5) the two ultimate ends are chosen relative to one another, given that no ideal option exists (i.e., either form of intersection control would be undesirable in some way or another).
- For example, a roundabout was scored "5 out of 5" on safety given that it is expected to be the option that results in the safest intersection control with respect to vehicular speed, even though collisions would be expected at a roundabout and both forms of intersection control require careful consideration of integration with pedestrian and active transportation facilities. The signal was scored "3 out of 5" based on the collision history at the signal at Brantwood Park Road / Lynden Road / Roy Boulevard, and the fact that a roundabout option could mitigate some of the existing collisions along the corridor.

TABLE 1 INITIAL ASSESSMENT MATRIX – LYNDEN ROAD ARTERIAL / NEW COLLECTOR ROADS

Criteria	Roundabout Assessment	Signal Assessment	Roundabout Score	Signal Score
Right-of-Way (ROW)	Additional ROW is required on all sides of the future intersections with Lynden Road for the implementation of a roundabout including re-grading at the approach to the Garden Avenue rail crossing.	Signal control would not require as much property for implementation. Signal control would also not require additional lands for the east access road (Lynden Road / Garden Avenue intersection) unless an additional left-in is considered (not required to support site traffic)	2 out of 5	4 out of 5
Intersection Spacing	Roundabouts have a small advantage compared to two signals to mitigate queueing between intersections.	Signalization of Lynden Road – Garden Avenue could be coordinated with the proposed collector road signal and to restrict eastbound lefts, minimize impacts to queuing along Lynden Avenue.	5 out of 5	4 out of 5
Safety	A roundabout option would reduce potential comparable collisions observed at Brantwood Park Road / Lynden Road (12 of 12 collision over 6 years). by eliminating the potential for left-turning and angled collisions. Future pedestrians and cyclists also experience a lower number of conflict points at roundabouts than at other intersections. However, the TAC manual cautions that "cyclists may experience more safety issues at roundabouts than other road users," depending on what bicycle facilities are provided at the intersection.	As the TAC manual states, the signal may be safer for pedestrians with vision and mobility challenges, since roundabouts rely more on road users' judgment on when to yield than a conventional traffic signal control. Signalization is also consistent with the intersection control type upstream and downstream along Lynden Road.	4 out of 5	3 out of 5
Delays or Queues	Based on the future total traffic conditions analysis presented in **Section 3.1**, both the signal with RIRO and the dual roundabout option would accommodate travel demand at the intersections.		5 out of 5	5 out of 5
Traffic Flows	The north leg (i.e., Site Access Road) will generate only 20% of the total traffic at the intersection. However, roundabouts will reduce delays for north leg traffic volumes.	Priority for east-west travel flow (80% of the intersection traffic) would be maintained by the signal. However, a signal introduces intergreen (amber and all-red) delays for all movements.	3 out of 5	4 out of 5

Criteria	Roundabout Assessment	Signal Assessment	Roundabout Score	Signal Score
Nearby Structures or Traffic Control	Implementation of a roundabout at the Lynden Road / Lynden Road intersection is impacted by the north approach to the Garden Avenue rail crossing and would require significant fill and regrading.	The traffic signal at the site access road and either right-turns only or partial-moves signal at Lynden Road / Lynden Road could be implemented based on existing and OP property allowances.	1 out of 5	5 out of 5
Nearby Driveways	There are no nearby driveways that would impede a roundabout or signal design.		5 out of 5	5 out of 5
Land Use Context	There are two traffic signals upstream and downstream of the site along the Lynden Road corridor. To construct two roundabouts in between these coordinated signals may be a source of confusion for drivers, or may signal a land use transition (i.e. a gateway) that does not presently exist.	. Signalized intersection control is consistent with the upstream and downstream intersection control in the surrounding area.	1 out of 5	5 out of 5
Traffic Calming	Roundabouts are an effective measure for vehicular traffic calming. At a roundabout, the horizontal deflection of vehicles reduces travel speeds and encourages drivers to slow down upon approach to the intersection.	A signal may encourage higher travel speeds along Lynden Road. The OTM Book 12 suggests that a traffic signal is not an appropriate form of traffic calming. However, a traffic signal would allow for the metering of vehicular travel along Lynden Road (currently operating under free-flow conditions).	5 out of 5	2 out of 5
Vulnerable Road Users	The section of Lynden Road currently exhibits pedestrian crossing volumes of up to five (5) persons in the peak hours. There is currently no major pedestrian desire line to the south of Lynden Road across the site. Both forms of intersection control require careful consideration of integration with pedestrian and active transportation facilities.		5 out of 5	5 out of 5
Transit Service	Roundabouts would allow for buses to make a southbound left at Lynden Road / Lynden Road.	A right-in / right-out configuration would restrict southbound left transit routing opportunities. Buses could reroute to the proposed signal or be facilitated through a partial-moves (right-in/right-out/left-out) signal without introducing a centre left turn lane along Lynden Road.	5 out of 5	3 out of 5
Total Score			**41**	**45**

Signalization scores higher, for the following reasons:

- Signalized intersection control is consistent with the upstream and downstream intersection control along Lynden Road. The proposed signalized collector road intersection with Lynden Road does not represent a major gateway between upstream and downstream land use or intersections, that a roundabout might typically signal.
- Implementation of two roundabouts would require additional land-takings beyond the OP widenings considered for Lynden Road - including on the south side of the Lynden Road corridor. Please see **Attachment F** for a conceptual plan illustrating these impacts.
- Implementation of a roundabout at the Lynden Road / Lynden Road intersection is impacted by the north approach to the Garden Avenue rail crossing and would require significant fill and regrading. Existing and estimated eastbound left turning traffic at Lynden Road / Lynden Road intersection is not significant. The intersection could be implemented as a right-turns only unsignalized intersection (centre median) or partial moves signal (right-turns and southbound left only) to support transit routing with less impact to the existing rail crossing. Transit routing could also be supported by circulating through the Draft Plan if Lynden Road / Lynden Road is restricted to right-turns only.

The property impacts of a roundabout vs. signalization, at a preliminary level, have been demonstrated in the conceptual design plan provided in **Attachment F**. While the intersection control study above scores in favour of signalization in this context, the preliminary design exercise also indicates there is space for a 50 metre (circulating diameter) roundabout to be considered by the City without further property allowance on the Welton & Innes lands, should they choose to pursue a roundabout controlled corridor in future. At this time, roundabouts would be out of character with the rest of the corridor, would require property taking on the south side of Lynden Road, and would require significant reconstruction of the Garden Avenue rail crossing approach to support a low amount of existing and estimated left turning traffic that can otherwise be accommodated by the future signal at Lynden Road / Proposed Collector.

3.1 TRAFFIC OPERATIONS ANALYSIS

The following sections detail the traffic operations analysis results for both the signalized access option and the roundabout option.

The traffic operations methodology and input parameters are largely consistent with those presented in the December 2022 TIS. However, an additional background development known as the Bella Gardens Subdivision (east of Garden Avenue, just south of Lynden Road to the east of the site lands) was included in all future scenarios.

3.1.1 Analysis Results

For the signalized access option, given concerns regarding the spacing between the two collector roads, the unsignalized Lynden Road / Garden Avenue intersection (the east site access) is proposed to be restricted to a right-in / right-out only access, or configured to be a partial moves signal. The analysis results of the Lynden Road intersections as analyzed under these conditions are based on calibration and modelling parameters consistent with the previous December 2022 study (through Synchro Version 11.0).

The analysis results are summarized in **Table 2** (capacity results) and **Table 2** (queuing results). During the peak hours, a signal at Lynden Road / Site Access Road would operate at v/c of 0.03 to 0.78 and levels-of-service (LOS) D or better.

A right-in / right-out configuration at Lynden Road / Lynden Road would operate at v/c of 0.03 to 0.43 and LOS C or better. A partial moves signal at Lynden Road / Lynden Road would operate at v/c of 0.04 to 0.53 and levels-of-service (LOS) D or better.

Under either of the two options, queue lengths at both accesses are manageable and can be contained within reasonable storage lengths. The southbound left turn at the west signal is expected to generate queues up to 76m in the weekday peak hours, while the eastbound left turn is expected to generate queues up to 58m.

Synchro worksheets are provided in **Attachment B**. Traffic volume figures pertaining to the signal and RIRO access option are provided in **Attachment D**.

TABLE 2 CAPACITY ANALYSIS RESULTS

Traffic Control / Lane Configuration	Movement	Future Total Traffic Operations		
		V/C	LOS	Delay (sec.)
Lynden Road / Site Access Road (West Collector Road)				
Signalized / Full-Moves	EBL	0.24 (0.78)	A (C)	8.5 (34.6)
	EBT	0.37 (0.42)	A (A)	8.2 (6.9)
	WBT	0.38 (0.74)	A (C)	8.3 (21.4)
	WBR	0.03 (0.15)	A (B)	6.1 (12.7)
	SBL	0.75 (0.68)	D (D)	45.9 (46.1)
	SBR	0.07 (0.05)	C (D)	32.2 (35.7)
	Overall	**0.47 (0.78)**	**B (B)**	**14.0 (19.1)**
Lynden Road / Garden Avenue (East Collector Road)				
Unsignalized / Right-In / Right-Out	EBT	0.33 (0.37)	A (A)	Free-Flow
	WBT	0.24 (0.43)	A (A)	
	WBR	0.03 (0.09)	A (A)	
	SBR	0.23 (0.22)	B (C)	14.7 (17.7)
Signalized / Partial-Moves	EBT	0.43 (0.46)	A (A)	2.9 (2.7)
	WBT	0.31 (0.53)	A (A)	3.9 (4.9)
	WBR	0.04 (0.15)	A (A)	2.9 (3.1)
	SBL	0.06 (0.07)	D (D)	41.6 (43.1)
	SBR	0.10 (0.21)	D (D)	41.9 (44.0)
	Overall	**0.39 (0.50)**	**A (A)**	**5.5 (5.0)**

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).
2. Analysis results are provided by Synchro Version 11.0 modelling software.

TABLE 3 QUEUING RESULTS

Traffic Control / Lane Configuration	Movement	Future Total Traffic Operations	
		50th Percentile Queues	95th Percentile Queues
Lynden Road / Site Access Road (West Collector Road)			
Signalized / Full-Moves	EBL	6.5 (29.6)	17.5 (57.6)
	WBR	0.0 (9.2)	4.6 (25.7)
	SBL	53.5 (38.1)	76.0 (58.0)
	SBR	0.0 (0.0)	13.1 (12.1)
Lynden Road / Garden Avenue (East Collector Road)			
Unsignalized / Right-In / Right-Out	SBR	Not Provided.[2]	7.0 (6.8)
Signalized / Partial Moves	WBR	0.0 (1.6)	3.5 (9.1)
	SBL	1.0 (1.0)	4.2 (4.2)
	SBR	0.0 (4.3)	15.6 (17.1)

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).
2. Analysis results are provided by Synchro Version 11.0 modelling software. Synchro does not provide 50th percentile queues for unsignalized intersections.

3.1.2 Dual Roundabout Option

The Lynden Road access points were also analyzed as roundabouts using modelling software SIDRA version 9.1. Two travel lanes were assumed within the circulating roadway and on all approach and exit legs at the accesses. No auxiliary turn lanes were assumed at the roundabouts.

The analysis results are summarized in **Table 3**. All approaches under the dual-lane roundabout configuration will operate with acceptable levels-of-service (LOS) and v/c ratios ranging from 0.09 to 0.51 in both peak hours.

SIDRA worksheets and traffic volume figures pertaining to this access configuration are provided in **Attachment C** and **Attachment D**, respectively.

TABLE 4 DUAL ROUNDABOUT – CAPACITY ANALYSIS RESULTS

Traffic Control / Lane Configuration	Movement	Future Total Traffic Operations		
		V/C	LOS	Delay (sec.)
Lynden Road / Site Access Road (West Collector Road)				
Roundabout / Full-Moves	WBT	0.30 (0.53)	A (A)	2.9 (3.4)
	WBTR	0.30 (0.53)	A (A)	2.9 (3.3)
	SBL	0.11 (0.09)	B (B)	11.1 (11.9)
	SBR	0.12 (0.11)	A (A)	5.3 (6.6)
	EBLT	0.34 (0.44)	A (A)	3.8 (4.5)
	EBT	0.34 (0.44)	A (A)	3.1 (3.0)
	Overall	**0.34 (0.53)**	**A (A)**	**3.7 (3.8)**
Lynden Road / Garden Avenue (East Collector Road)				
Roundabout / Full-Moves	WBT	0.29 (0.55)	A (A)	2.9 (3.4)
	WBTR	0.29 (0.55)	A (A)	2.9 (3.3)
	SBL	0.11 (0.10)	B (B)	11.0 (12.1)
	SBR	0.11 (0.12)	A (A)	5.2 (6.8)
	EBLT	0.37 (0.43)	A (A)	4.0 (4.5)
	EBT	0.37 (0.43)	A (A)	3.2 (3.0)
	Overall	**0.37 (0.55)**	**A (A)**	**3.8 (3.9)**

Notes:
1. XX (XX) – Weekday Morning Peak Hour (Weekday Afternoon Peak Hour).
2. Analysis results are provided by SIDRA Version 9.1 modelling software.

4.0 COLLISION REVIEW

BA Group reviewed historical collision data from the years of 2018 to 2023 at several locations along Lynden Road, including the intersections of Brantwood Park Road / Lynden Road / Roy Boulevard and Lynden Road / Garden Avenue. A summary of the total observed collisions is provided from **Table 4** to **Table 8**. The collision data is provided in **Attachment E**.

4.1 BRANTWOOD PARK ROAD / LYNDEN ROAD / ROY BOULEVARD

At the signalized intersection of Brantwood Park Road / Lynden Road / Roy Boulevard, most vehicles (30 out of 49 vehicles) involved in collisions were travelling eastbound or westbound along Lynden Road (as summarized in **Table 5**). None of the observed collisions were fatal, two (2) collisions in the past six-year period resulted in personal injuries. Most collisions (14 out of 25 = 56%) resulted in property damage.

Of the 25 total collisions (involving 49 vehicles) at the existing signal, 10 were recorded as turning movements (8 of which involved left-turning drivers), 8 were rear-ends, 4 were angled and 2 were sideswipes. Two (2) of the total collisions also involved speeding vehicles. Assuming similar collision characteristics if the Lynden Road / Site Access were to be signalized, a roundabout option would mitigate 12 of 25 total collisions over 6 years

TABLE 5 BRANTWOOD PARK ROAD / LYNDEN ROAD / ROY BOULEVARD – YEARLY COLLISION DATA SUMMARY

Year	Class of Collision				Total	Average Annual Daily Traffic (AADT)[1]	Total Collisions / AADT
	Fatal	Personal Injury	Property Damage	Other			
2018	--	--	1	5	6	2,075	0.00289157
2019	--	1	4	--	5		0.00240964
2020	--	--	4	--	4		0.00192771
2021	--	--	4	--	4		0.00192771
2022	--	1	1	1	3		0.00144578
2023	--	--	--	3	3		0.00144578
Total	**0**	**2**	**14**	**9**	**25**	**--**	

Notes:
1. AADT is estimated as (AM Peak Hour Volumes + PM Peak Hour Volumes) ÷ 5. The Peak Hour Volumes are adopted from the 2023 baseline existing traffic volumes presented in the December 2022 TIS.

TABLE 6 BRANTWOOD PARK ROAD / LYNDEN ROAD / ROY BOULEVARD – COLLISION BY INITIAL DIRECTION OF DRIVER

Manoeuvre	Initial Direction of Driver				Total	Total Mitigated by Roundabout
	Northbound	Southbound	Eastbound	Westbound		
Going Ahead	2	2	6	6	16	**13**[1] • 8 turning left • 5 angle
Stopped	--	8	3	1	12	**1** • 1 angle
Turning Left	2	--	3	3	8	**8** • 8 turning left
Slowing	--	2	2	1	5	**0**
Turning Right	--	2	1	2	5	**2** • 2 angle
Other	--	1	1	--	2	**0**
Reversing	--	--	--	1	1	**0**
Total	**4**	**15**	**16**	**14**	**49 vehicles**	**24 vehicles**

Notes:
1. Of the total vehicles completing a "going ahead" manoeuvre, 8 are involved in collisions with left-turning vehicles, 5 are involved in angle collisions, 2 are involved in rear-end collisions, and 1 is involved in a sideswipe collision. Of these total "going ahead" vehicles, 13 of these vehicles would not be involved in collisions if the intersection were designed as a roundabout, as collisions with left-turning vehicles and angle collisions will essentially be eliminated.

TABLE 7 BRANTWOOD PARK ROAD / LYNDEN ROAD / ROY BOULEVARD – COLLISION BY INITIAL IMPACT TYPE

Initial Impact Type	Initial Direction of Driver				Total	Total Mitigated by Roundabout
	Fatal	Personal Injury	Property Damage	Other		
Turning	--	1	6	3	10	**8**[1] • 8 turning left
Rear End	--	--	5	3	8	**0**
Angle	--	1	1	2	4	4 • 4 angle
Sideswipe	--	--	1	1	2	**0**
Slow Moving Vehicle	--	--	1	--	1	**0**
Total	**0**	**2**	**14**	**9**	**25 collisions**	**12 collisions**

Notes:
1. Of the total collisions classified as turning collisions, 8 collisions involve vehicles making a left turn, while the other 2 collisions involve vehicles making a right turn. The 8 collisions involving vehicles making a left turn would be eliminated by a roundabout.

4.2 LYNDEN ROAD EAST OF BRANTWOOD PARK ROAD TO GARDEN AVENUE

For the section of Lynden Road east of the intersection up to and including the intersection with Garden Avenue, three (3) total collisions were observed in the past six (6) years, none of which were fatal.

TABLE 8 LYNDEN ROAD / GARDEN AVENUE – YEARLY COLLISION DATA SUMMARY

Year	Class of Collision					Average Annual Daily Traffic (AADT)[1]	Total Collisions / AADT
	Fatal	Personal Injury	Property Damage	Other	Total		
2018	--	--	1	--	1	1,725	0.0005797
2019	--	--	--	--	0		0
2020	--	--	--	--	0		0
2021	--	--	--	--	0		0
2022	--	--	--	--	0		0
2023	--	--	--	--	0		0
Total	**0**	**0**	**1**	**0**	**1**	**--**	

Notes:
1. AADT is estimated as (AM Peak Hour Volumes + PM Peak Hour Volumes) ÷ 5. The Peak Hour Volumes are adopted from the 2023 baseline existing traffic volumes presented in the December 2022 TIS.

TABLE 9 LYNDEN ROAD BETWEEN BRANTWOOD PARK ROAD AND GARDEN AVENUE – YEARLY COLLISION DATA SUMMARY

Year	Class of Collision					Average Annual Daily Traffic (AADT)[1]	Total Collisions / AADT
	Fatal	Personal Injury	Property Damage	Other	Total		
2018	--	--	--	1	1	1,720	0.0005814
2019	--	--	--	--	0		0
2020	--	--	--	--	0		0
2021	--	--	--	--	0		0
2022	--	--	--	1	1		0.0005814
2023	--	--	--	--	0		0
Total	**0**	**0**	**0**	**2**	**2**	**--**	

Notes:
1. AADT is estimated as (AM Peak Hour Volumes + PM Peak Hour Volumes) ÷ 5. The Peak Hour Volumes are adopted from the 2023 baseline existing traffic volumes presented in the December 2022 TIS.

ATTACHMENT A: UPDATED BLOCK PLAN

PROPOSED LAND USE	Area	% of Area
1) Neighbourhood Residential	28.8ha	37.7%
2) Neighbourhood Corridor	3.6ha	4.7%
3) Neighbourhood Centre	0.4ha	0.6%
4) Neighbourhood Park	2.7ha	5.0%
5) NHS	22.1ha	29.0%
6) SWM	5.7ha	7.5%
7) SWM Access Block	0.1ha	0.1%
8) Pumping Station	0.2ha	0.3%
9) Lynden Road Widening (10m)	0.1ha	0.1%
10) ROW	12.7ha	16.6%
TOTAL	76.4ha	

PROPOSED RESIDENTIAL UNIT TYPES

20' (6.1m) Town Houses	35%
32' (9.75m) Single Detached	30%
36' (10.97m) Single Detached	35%

DETAILED CONCEPT PLAN

PART OF LOT 42, 43
CONCESSION 2
GEOGRAPHIC TOWNSHIP OF BRANTFORD,
COUNTY OF BRANT

PREPARED FOR:
SORBARA group of companies

SCALE 1:4,000

PROJECT No. L19-1708

DATE August 21, 2023

ATTACHMENT B: SYNCHRO WORKSHEETS

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1055	760	50	0	105
Future Volume (Veh/h)	0	1055	760	50	0	105
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	1111	800	53	0	111
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		179				
pX, platoon unblocked					0.89	
vC, conflicting volume	853				1356	400
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	853				1162	400
tC, single (s)	5.4				*5.2	7.9
tC, 2 stage (s)						
tF (s)	2.9				*2.6	3.8
p0 queue free %	100				100	77
cM capacity (veh/h)	480				342	483

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	SB 1
Volume Total	556	556	400	400	53	111
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	53	111
cSH	1700	1700	1700	1700	1700	483
Volume to Capacity	0.33	0.33	0.24	0.24	0.03	0.23
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	7.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	14.7
Lane LOS						B
Approach Delay (s)	0.0		0.0			14.7
Approach LOS						B

Intersection Summary				
Average Delay		0.8		
Intersection Capacity Utilization		34.2%	ICU Level of Service	A
Analysis Period (min)		15		

* User Entered Value

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	80	800	820	45	255	105
Future Volume (vph)	80	800	820	45	255	105
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	34.0	34.0	34.0	34.0	29.0	29.0
Total Split (s)	71.0	71.0	71.0	71.0	29.0	29.0
Total Split (%)	71.0%	71.0%	71.0%	71.0%	29.0%	29.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	65.6	65.6	65.6	65.6	20.4	20.4
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.20	0.20
v/c Ratio	0.24	0.37	0.38	0.05	0.75	0.27
Control Delay	10.4	8.9	9.0	2.6	50.2	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	8.9	9.0	2.6	50.2	7.5
LOS	B	A	A	A	D	A
Approach Delay		9.1	8.7		37.7	
Approach LOS		A	A		D	

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 13.8		Intersection LOS: B	
Intersection Capacity Utilization 60.1%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 5: Lynden Rd & Site Access Rd

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	87	870	891	49	277	114
v/c Ratio	0.24	0.37	0.38	0.05	0.75	0.27
Control Delay	10.4	8.9	9.0	2.6	50.2	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	8.9	9.0	2.6	50.2	7.5
Queue Length 50th (m)	6.5	38.2	39.5	0.0	53.5	0.0
Queue Length 95th (m)	17.5	59.9	61.7	4.6	76.0	13.1
Internal Link Dist (m)		367.4	69.8		120.3	
Turn Bay Length (m)	30.0			30.0	50.0	
Base Capacity (vph)	373	2412	2412	1095	418	462
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.36	0.37	0.04	0.66	0.25

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	80	800	820	45	255	105
Future Volume (vph)	80	800	820	45	255	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	3610	3610	1615	1805	1615
Flt Permitted	0.29	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	559	3610	3610	1615	1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	870	891	49	277	114
RTOR Reduction (vph)	0	0	0	17	0	91
Lane Group Flow (vph)	87	870	891	32	277	23
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	65.6	65.6	65.6	65.6	20.4	20.4
Effective Green, g (s)	65.6	65.6	65.6	65.6	20.4	20.4
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.20	0.20
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	366	2368	2368	1059	368	329
v/s Ratio Prot		0.24	c0.25		c0.15	
v/s Ratio Perm	0.16			0.02		0.01
v/c Ratio	0.24	0.37	0.38	0.03	0.75	0.07
Uniform Delay, d1	7.0	7.8	7.9	6.0	37.4	32.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	0.4	0.5	0.1	8.4	0.1
Delay (s)	8.5	8.2	8.3	6.1	45.9	32.2
Level of Service	A	A	A	A	D	C
Approach Delay (s)		8.3	8.2		41.9	
Approach LOS		A	A		D	

Intersection Summary				
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0	
Intersection Capacity Utilization	60.1%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBT	WBT	WBR	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	1055	760	50	5	105
Future Volume (vph)	1055	760	50	5	105
Turn Type	NA	NA	Perm	Prot	Perm
Protected Phases	2	6		4	
Permitted Phases			6		4
Detector Phase	2	6	6	4	4
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	34.0	34.0	34.0	24.0	24.0
Total Split (s)	75.0	75.0	75.0	25.0	25.0
Total Split (%)	75.0%	75.0%	75.0%	25.0%	25.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	76.6	76.6	76.6	9.4	9.4
Actuated g/C Ratio	0.77	0.77	0.77	0.09	0.09
v/c Ratio	0.43	0.31	0.05	0.06	0.55
Control Delay	3.2	4.3	1.4	39.8	18.5
Queue Delay	0.1	0.0	0.0	0.0	0.0
Total Delay	3.2	4.3	1.4	39.8	18.5
LOS	A	A	A	D	B
Approach Delay	3.2	4.1		19.5	
Approach LOS	A	A		B	

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.55			
Intersection Signal Delay: 4.5		Intersection LOS: A	
Intersection Capacity Utilization 46.7%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Lynden Rd & Garden Ave

Lane Group	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	1111	800	53	5	111
v/c Ratio	0.43	0.31	0.05	0.06	0.55
Control Delay	3.2	4.3	1.4	39.8	18.5
Queue Delay	0.1	0.0	0.0	0.0	0.0
Total Delay	3.2	4.3	1.4	39.8	18.5
Queue Length 50th (m)	13.4	18.3	0.0	1.0	0.0
Queue Length 95th (m)	41.8	39.6	3.5	4.2	15.6
Internal Link Dist (m)	61.2	120.3		10.8	
Turn Bay Length (m)			30.0	15.0	
Base Capacity (vph)	2610	2610	1044	162	284
Starvation Cap Reductn	275	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.48	0.31	0.05	0.03	0.39

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	1055	760	50	5	105
Future Volume (vph)	0	1055	760	50	5	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor		0.95	0.95	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		3406	3406	1346	902	1077
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		3406	3406	1346	902	1077
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1111	800	53	5	111
RTOR Reduction (vph)	0	0	0	12	0	101
Lane Group Flow (vph)	0	1111	800	41	5	10
Heavy Vehicles (%)	66%	6%	6%	20%	100%	50%
Turn Type		NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)		76.6	76.6	76.6	9.4	9.4
Effective Green, g (s)		76.6	76.6	76.6	9.4	9.4
Actuated g/C Ratio		0.77	0.77	0.77	0.09	0.09
Clearance Time (s)		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		2608	2608	1031	84	101
v/s Ratio Prot		c0.33	0.23		0.01	
v/s Ratio Perm				0.03		c0.01
v/c Ratio		0.43	0.31	0.04	0.06	0.10
Uniform Delay, d1		4.1	3.6	2.8	41.3	41.4
Progression Factor		0.60	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5	0.3	0.1	0.3	0.5
Delay (s)		2.9	3.9	2.9	41.6	41.9
Level of Service		A	A	A	D	D
Approach Delay (s)		2.9	3.8		41.9	
Approach LOS		A	A		D	

Intersection Summary				
HCM 2000 Control Delay	5.5	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.39			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0	
Intersection Capacity Utilization	46.7%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	1150	1355	140	0	75
Future Volume (Veh/h)	0	1150	1355	140	0	75
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1250	1473	152	0	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		180				
pX, platoon unblocked					0.87	
vC, conflicting volume	1625				2098	736
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1625				1965	736
tC, single (s)	4.1				*6.1	6.9
tC, 2 stage (s)						
tF (s)	2.2				*3.0	3.3
p0 queue free %	100				100	78
cM capacity (veh/h)	406				76	366

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	SB 1
Volume Total	625	625	736	736	152	82
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	152	82
cSH	1700	1700	1700	1700	1700	366
Volume to Capacity	0.37	0.37	0.43	0.43	0.09	0.22
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	6.8
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	17.7
Lane LOS						C
Approach Delay (s)	0.0		0.0			17.7
Approach LOS						C

Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	48.8%	ICU Level of Service	A	
Analysis Period (min)	15			

* User Entered Value

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	245	970	1290	140	180	75
Future Volume (vph)	245	970	1290	140	180	75
Turn Type	pm+pt	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Detector Phase	5	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.0	34.0	34.0	34.0	24.0	24.0
Total Split (s)	24.0	71.0	47.0	47.0	29.0	29.0
Total Split (%)	24.0%	71.0%	47.0%	47.0%	29.0%	29.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Recall Mode	None	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	73.0	70.0	52.1	52.1	16.0	16.0
Actuated g/C Ratio	0.73	0.70	0.52	0.52	0.16	0.16
v/c Ratio	0.76	0.42	0.74	0.17	0.68	0.25
Control Delay	32.9	7.5	24.1	10.4	50.9	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.9	7.5	24.1	10.4	50.9	9.7
LOS	C	A	C	B	D	A
Approach Delay		12.6	22.8		38.7	
Approach LOS		B	C		D	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 19.9 — Intersection LOS: B
Intersection Capacity Utilization 74.2% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Lynden Rd & Site Access Rd

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	266	1054	1402	152	196	82
v/c Ratio	0.76	0.42	0.74	0.17	0.68	0.25
Control Delay	32.9	7.5	24.1	10.4	50.9	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.9	7.5	24.1	10.4	50.9	9.7
Queue Length 50th (m)	29.6	42.1	112.5	9.2	38.1	0.0
Queue Length 95th (m)	57.6	65.6	#196.1	25.7	58.0	12.1
Internal Link Dist (m)		367.1	70.3		89.5	
Turn Bay Length (m)	30.0			30.0	50.0	
Base Capacity (vph)	451	2525	1882	870	397	419
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.42	0.74	0.17	0.49	0.20

Intersection Summary

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	245	970	1290	140	180	75
Future Volume (vph)	245	970	1290	140	180	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	3610	3610	1615	1805	1615
Flt Permitted	0.09	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	168	3610	3610	1615	1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	1054	1402	152	196	82
RTOR Reduction (vph)	0	0	0	28	0	69
Lane Group Flow (vph)	266	1054	1402	124	196	13
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	70.0	70.0	52.2	52.2	16.0	16.0
Effective Green, g (s)	70.0	70.0	52.2	52.2	16.0	16.0
Actuated g/C Ratio	0.70	0.70	0.52	0.52	0.16	0.16
Clearance Time (s)	4.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	343	2527	1884	843	288	258
v/s Ratio Prot	c0.11	0.29	0.39		c0.11	
v/s Ratio Perm	c0.43			0.08		0.01
v/c Ratio	0.78	0.42	0.74	0.15	0.68	0.05
Uniform Delay, d1	24.1	6.4	18.7	12.4	39.6	35.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.5	0.5	2.7	0.4	6.5	0.1
Delay (s)	34.6	6.9	21.4	12.7	46.1	35.7
Level of Service	C	A	C	B	D	D
Approach Delay (s)		12.4	20.5		43.0	
Approach LOS		B	C		D	

Intersection Summary				
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.78			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	74.2%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBT	WBT	WBR	SBL	SBR
Lane Configurations					
Traffic Volume (vph)	1150	1355	140	5	75
Future Volume (vph)	1150	1355	140	5	75
Turn Type	NA	NA	Perm	Prot	Perm
Protected Phases	2	6		4	
Permitted Phases			6		4
Detector Phase	2	6	6	4	4
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	34.0	34.0	34.0	24.0	24.0
Total Split (s)	75.0	75.0	75.0	25.0	25.0
Total Split (%)	75.0%	75.0%	75.0%	25.0%	25.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	80.9	80.9	80.9	9.3	9.3
Actuated g/C Ratio	0.81	0.81	0.81	0.09	0.09
v/c Ratio	0.44	0.51	0.17	0.06	0.40
Control Delay	3.0	5.4	1.9	39.8	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	5.4	1.9	39.8	21.7
LOS	A	A	A	D	C
Approach Delay	3.0	5.1		22.8	
Approach LOS	A	A		C	

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 4.7 — Intersection LOS: A
Intersection Capacity Utilization 55.0% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: Lynden Rd & Garden Ave

Lane Group	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	1250	1473	152	5	82
v/c Ratio	0.44	0.51	0.17	0.06	0.40
Control Delay	3.0	5.4	1.9	39.8	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	5.4	1.9	39.8	21.7
Queue Length 50th (m)	26.4	44.3	1.6	1.0	4.3
Queue Length 95th (m)	33.3	92.3	9.1	4.2	17.1
Internal Link Dist (m)	61.2	120.3		10.8	
Turn Bay Length (m)			30.0	15.0	
Base Capacity (vph)	2834	2862	891	162	339
Starvation Cap Reductn	158	0	0	0	0
Spillback Cap Reductn	0	193	0	0	3
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.47	0.55	0.17	0.03	0.24

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	1150	1355	140	5	75
Future Volume (vph)	0	1150	1355	140	5	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor		0.95	0.95	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		3505	3539	1077	902	1615
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		3505	3539	1077	902	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1250	1473	152	5	82
RTOR Reduction (vph)	0	0	0	23	0	55
Lane Group Flow (vph)	0	1250	1473	129	5	27
Heavy Vehicles (%)	0%	3%	2%	50%	100%	0%
Turn Type		NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)		78.1	78.1	78.1	7.9	7.9
Effective Green, g (s)		78.1	78.1	78.1	7.9	7.9
Actuated g/C Ratio		0.78	0.78	0.78	0.08	0.08
Clearance Time (s)		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		2737	2763	841	71	127
v/s Ratio Prot		0.36	c0.42		0.01	
v/s Ratio Perm				0.12		c0.02
v/c Ratio		0.46	0.53	0.15	0.07	0.21
Uniform Delay, d1		3.7	4.1	2.7	42.6	43.1
Progression Factor		0.60	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5	0.7	0.4	0.4	0.8
Delay (s)		2.7	4.9	3.1	43.1	44.0
Level of Service		A	A	A	D	D
Approach Delay (s)		2.7	4.7		43.9	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	5.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	55.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

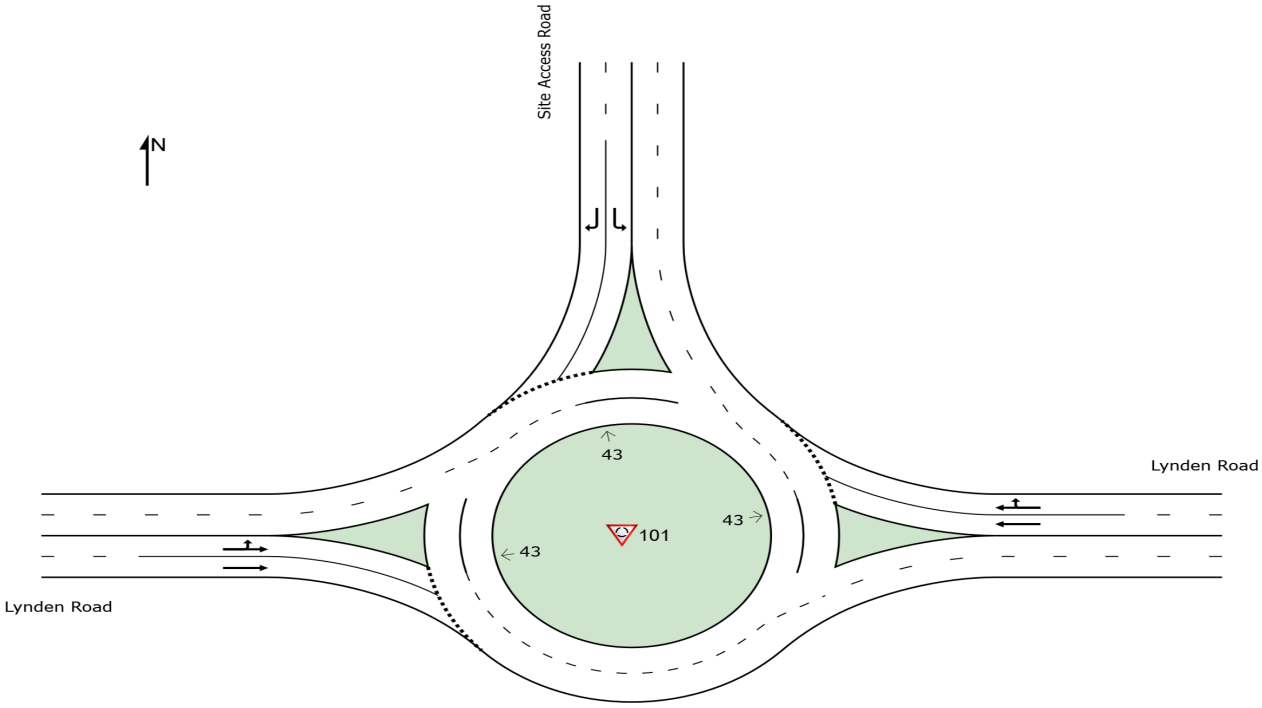
ATTACHMENT C: SIDRA WORKSHEETS

SITE LAYOUT

Site: 101 [Future Total AM - Site Access Road (Site Folder: General)]

Lynden Road / Site Access Road
Site Category: NA
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 101 [Future Total AM - Site Access Road (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Lynden Road / Site Access Road
Site Category: NA
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Lynden Road															
Lane 1	431	6.0	431	6.0	1430	0.301	100	2.9	LOS A	1.7	12.2	Full	500	0.0	0.0
Lane 2[d]	499	5.4	499	5.4	1656	0.301	100	2.9	LOS A	1.7	12.3	Full	500	0.0	0.0
Approach	929	5.7	929	5.7		0.301		2.9	LOS A	1.7	12.3				
North: Site Access Road															
Lane 1[d]	125	0.0	125	0.0	1183	0.106	100	11.1	LOS B	0.4	2.9	Full	500	0.0	0.0
Lane 2	109	0.0	109	0.0	922	0.118	100	5.3	LOS A	0.4	3.1	Full	500	0.0	0.0
Approach	234	0.0	234	0.0		0.118		8.4	LOS A	0.4	3.1				
West: Lynden Road															
Lane 1	446	5.5	446	5.5	1309	0.341	100	3.8	LOS A	2.0	14.9	Full	500	0.0	0.0
Lane 2[d]	510	6.0	510	6.0	1497	0.341	100	3.1	LOS A	2.1	15.3	Full	500	0.0	0.0
Approach	957	5.8	957	5.8		0.341		3.5	LOS A	2.1	15.3				
All Vehicles	2120	5.1	2120	5.1		0.341		3.7	LOS A	2.1	15.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Lynden Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	431	-	431	6.0	1430	0.301	100	NA	NA
Lane 2	450	49	499	5.4	1656	0.301	100	NA	NA
Approach	880	49	929	5.7		0.301			

North: Site Access Road

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	125	-	125	0.0	1183	0.106	100	NA	NA
Lane 2	-	109	109	0.0	922	0.118	100	NA	NA
Approach	125	109	234	0.0		0.118			

West: Lynden Road									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	38	408	446	5.5	1309	0.341	100	NA	NA
Lane 2	-	510	510	6.0	1497	0.341	100	NA	NA
Approach	38	918	957	5.8		0.341			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2120	5.1	0.341

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

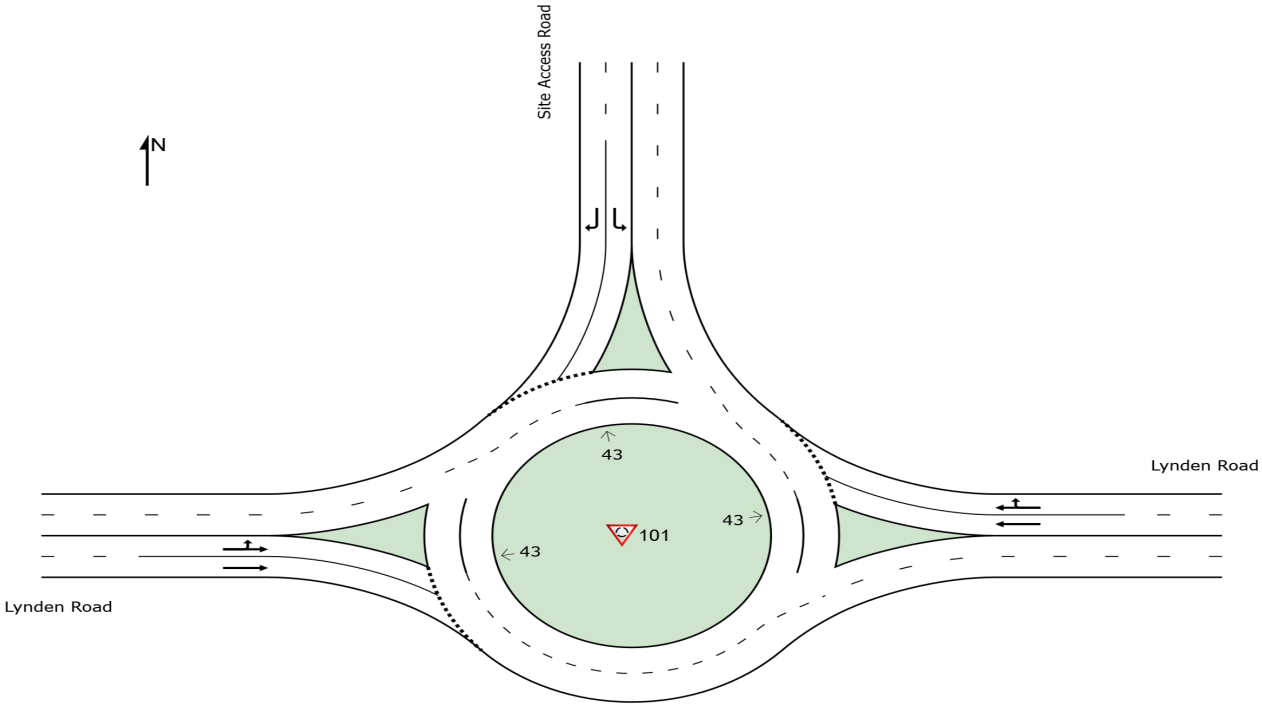
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Site Access Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

SITE LAYOUT

Site: 101 [Future Total AM - Lynden & Garden (Site Folder: General)]

Lynden Road / Garden Avenue
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



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LANE SUMMARY

Site: 101 [Future Total AM - Lynden & Garden (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Lynden Road / Garden Avenue
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Lynden Road															
Lane 1	409	6.0	409	6.0	1409	0.290	100	2.9	LOS A	1.6	11.6	Full	500	0.0	0.0
Lane 2[d]	472	5.3	472	5.3	1627	0.290	100	2.9	LOS A	1.6	11.7	Full	500	0.0	0.0
Approach	880	5.6	880	5.6		0.290		2.9	LOS A	1.6	11.7				
North: Site Access Road															
Lane 1[d]	130	0.0	130	0.0	1188	0.110	100	11.0	LOS B	0.4	3.0	Full	500	0.0	0.0
Lane 2	103	0.0	103	0.0	928	0.111	100	5.2	LOS A	0.4	2.9	Full	500	0.0	0.0
Approach	234	0.0	234	0.0		0.111		8.5	LOS A	0.4	3.0				
West: Lynden Road															
Lane 1	486	5.4	486	5.4	1302	0.374	100	4.0	LOS A	2.3	16.8	Full	500	0.0	0.0
Lane 2[d]	557	6.0	557	6.0	1490	0.374	100	3.2	LOS A	2.4	17.3	Full	500	0.0	0.0
Approach	1043	5.7	1043	5.7		0.374		3.6	LOS A	2.4	17.3				
All Vehicles	2158	5.1	2158	5.1		0.374		3.8	LOS A	2.4	17.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Lynden Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	409	-	409	6.0	1409	0.290	100	NA	NA
Lane 2	418	54	472	5.3	1627	0.290	100	NA	NA
Approach	826	54	880	5.6		0.290			

North: Site Access Road

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	130	-	130	0.0	1188	0.110	100	NA	NA
Lane 2	-	103	103	0.0	928	0.111	100	NA	NA
Approach	130	103	234	0.0		0.111			

West: Lynden Road									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	49	438	486	5.4	1302	0.374	100	NA	NA
Lane 2	-	557	557	6.0	1490	0.374	100	NA	NA
Approach	49	995	1043	5.7		0.374			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2158	5.1	0.374

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

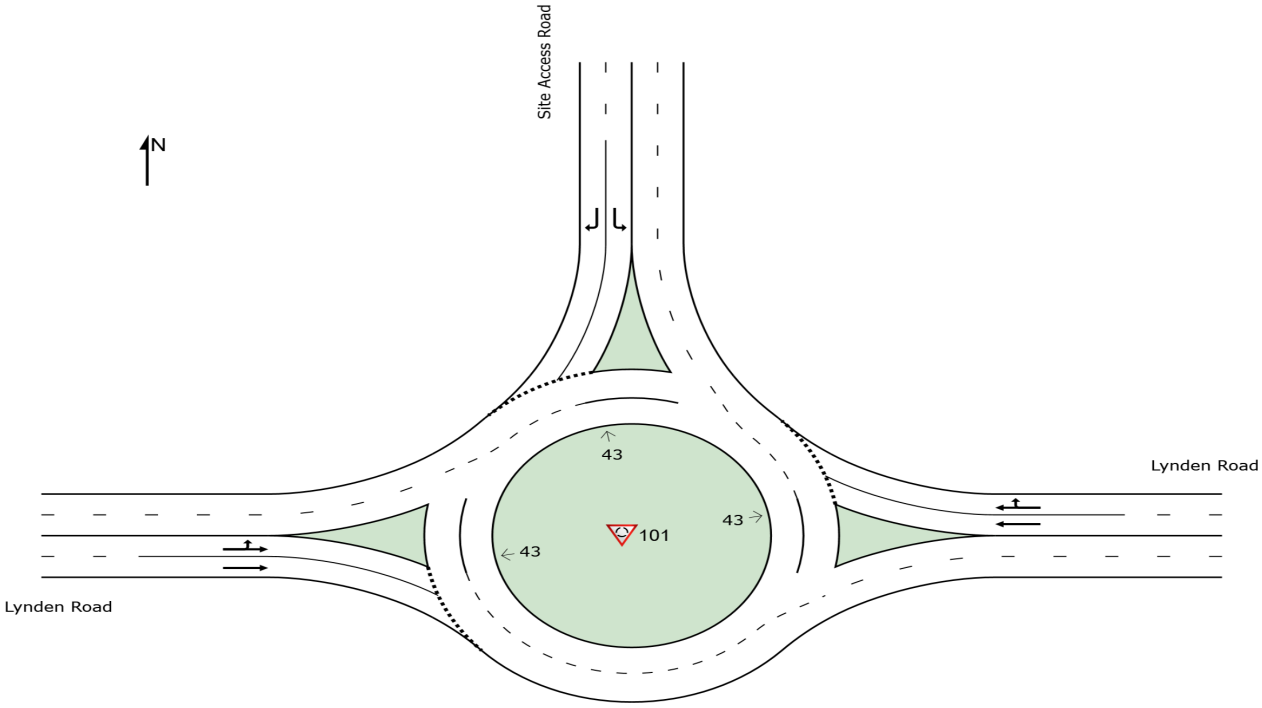
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Site Access Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

SITE LAYOUT

Site: 101 [Future Total PM - Site Access Road (Site Folder: General)]

Lynden Road / Site Access Road
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 101 [Future Total PM - Site Access Road (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Lynden Road / Site Access Road
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Lynden Road															
Lane 1	710	2.0	710	2.0	1352	0.525	100	3.4	LOS A	3.8	26.7	Full	500	0.0	0.0
Lane 2[d]	822	1.7	822	1.7	1565	0.525	100	3.3	LOS A	3.8	27.1	Full	500	0.0	0.0
Approach	1533	1.8	1533	1.8		0.525		3.3	LOS A	3.8	27.1				
North: Site Access Road															
Lane 1[d]	87	0.0	87	0.0	959	0.091	100	11.9	LOS B	0.4	2.9	Full	500	0.0	0.0
Lane 2	76	0.0	76	0.0	680	0.112	100	6.6	LOS A	0.5	3.3	Full	500	0.0	0.0
Approach	163	0.0	163	0.0		0.112		9.5	LOS A	0.5	3.3				
West: Lynden Road															
Lane 1	602	1.6	602	1.6	1381	0.436	100	4.5	LOS A	3.1	22.0	Full	500	0.0	0.0
Lane 2[d]	692	2.0	692	2.0	1589	0.436	100	3.0	LOS A	3.2	22.6	Full	500	0.0	0.0
Approach	1293	1.8	1293	1.8		0.436		3.7	LOS A	3.2	22.6				
All Vehicles	2989	1.7	2989	1.7		0.525		3.8	LOS A	3.8	27.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Lynden Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	710	-	710	2.0	1352	0.525	100	NA	NA
Lane 2	687	136	822	1.7	1565	0.525	100	NA	NA
Approach	1397	136	1533	1.8		0.525			

North: Site Access Road

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	87	-	87	0.0	959	0.091	100	NA	NA
Lane 2	-	76	76	0.0	680	0.112	100	NA	NA
Approach	87	76	163	0.0		0.112			

West: Lynden Road									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	120	482	602	1.6	1381	0.436	100	NA	NA
Lane 2	-	692	692	2.0	1589	0.436	100	NA	NA
Approach	120	1174	1293	1.8		0.436			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2989	1.7	0.525

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Flow Rate sec	Capacity veh/h	Deg. Satn veh/h	Min. Delay v/c	Merge Delay sec	sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

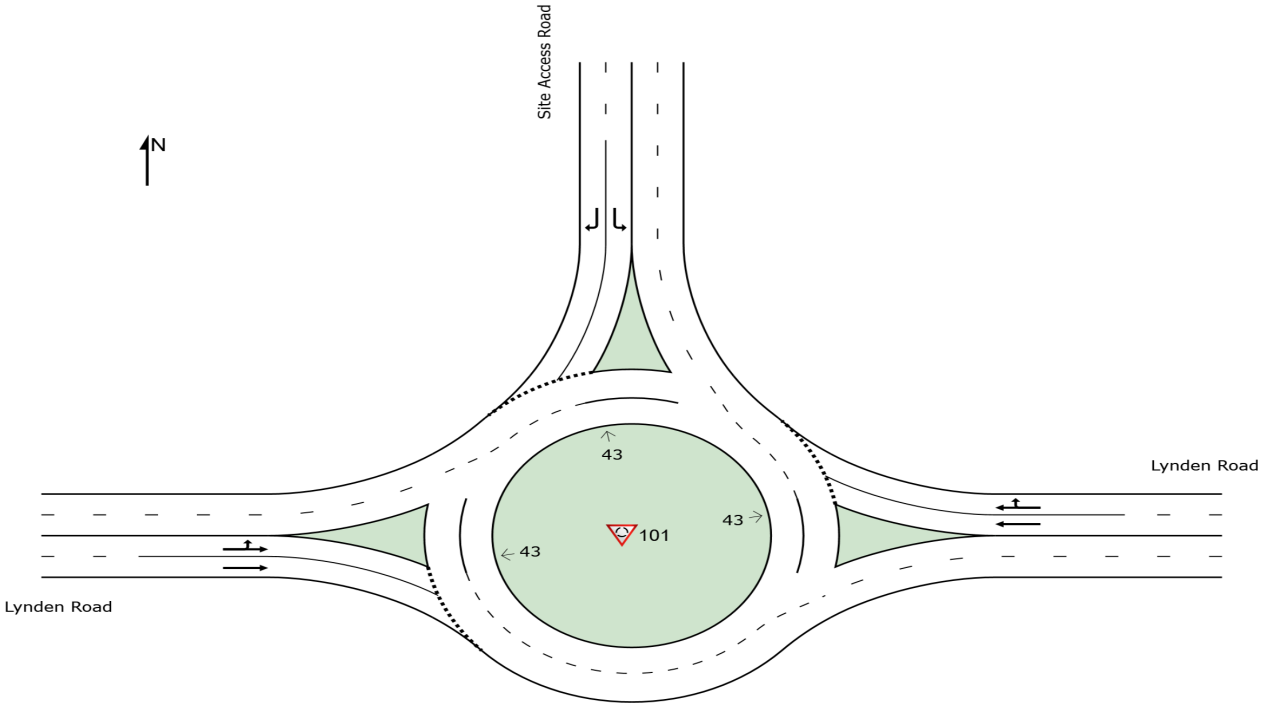
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Site Access Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

SITE LAYOUT

Site: 101 [Future Total PM - Lynden & Garden (Site Folder: General)]

Lynden Road / Garden Avenue
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BA CONSULTING GROUP LTD | Licence: PLUS / 1PC | Created: September 19, 2023 3:09:28 PM
Project: P:\58\83\43\Analysis\07. SIDRA\Response to Comments_Future Total_July 2023.sip9

LANE SUMMARY

Site: 101 [Future Total PM - Lynden & Garden (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Lynden Road / Garden Avenue
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Lynden Road															
Lane 1	738	2.0	738	2.0	1352	0.546	100	3.4	LOS A	4.0	28.7	Full	500	0.0	0.0
Lane 2[d]	855	1.7	855	1.7	1567	0.546	100	3.3	LOS A	4.1	29.0	Full	500	0.0	0.0
Approach	1592	1.8	1592	1.8		0.546		3.3	LOS A	4.1	29.0				
North: Site Access Road															
Lane 1[d]	92	0.0	92	0.0	938	0.098	100	12.1	LOS B	0.5	3.2	Full	500	0.0	0.0
Lane 2	76	0.0	76	0.0	657	0.116	100	6.8	LOS A	0.5	3.4	Full	500	0.0	0.0
Approach	168	0.0	168	0.0		0.116		9.7	LOS A	0.5	3.4				
West: Lynden Road															
Lane 1	587	1.6	587	1.6	1372	0.427	100	4.5	LOS A	3.0	21.4	Full	500	0.0	0.0
Lane 2[d]	674	2.0	674	2.0	1577	0.427	100	3.0	LOS A	3.1	22.0	Full	500	0.0	0.0
Approach	1261	1.8	1261	1.8		0.427		3.7	LOS A	3.1	22.0				
All Vehicles	3022	1.7	3022	1.7		0.546		3.9	LOS A	4.1	29.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

East: Lynden Road

Mov. From E To Exit:	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	738	-	738	2.0	1352	0.546	100	NA	NA
Lane 2	719	136	855	1.7	1567	0.546	100	NA	NA
Approach	1457	136	1592	1.8		0.546			

North: Site Access Road

Mov. From N To Exit:	L2 E	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	92	-	92	0.0	938	0.098	100	NA	NA
Lane 2	-	76	76	0.0	657	0.116	100	NA	NA
Approach	92	76	168	0.0		0.116			

West: Lynden Road									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	120	467	587	1.6	1372	0.427	100	NA	NA
Lane 2	-	674	674	2.0	1577	0.427	100	NA	NA
Approach	120	1141	1261	1.8		0.427			
	Total	%HV	Deg.Satn (v/c)						
All Vehicles	3022	1.7		0.546					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length m	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Flow Rate sec	Capacity veh/h	Deg. Satn veh/h	Min. Delay v/c	Merge Delay sec	sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Site Access Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Lynden Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

ATTACHMENT D: TRAFFIC VOLUME FIGURES

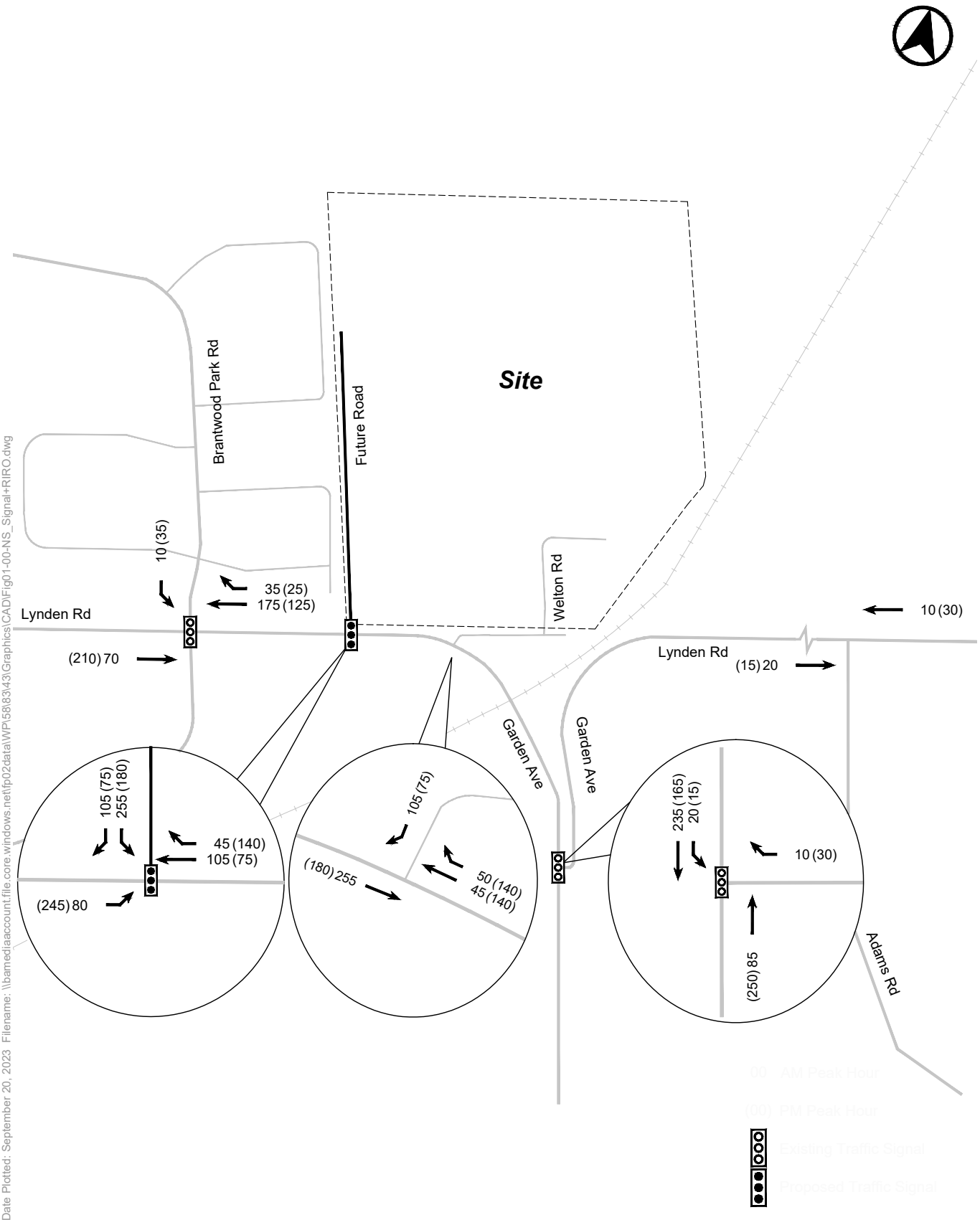


FIGURE 1 NEW SITE TRAFFIC VOLUMES

Signal & RIRO Access Configuration

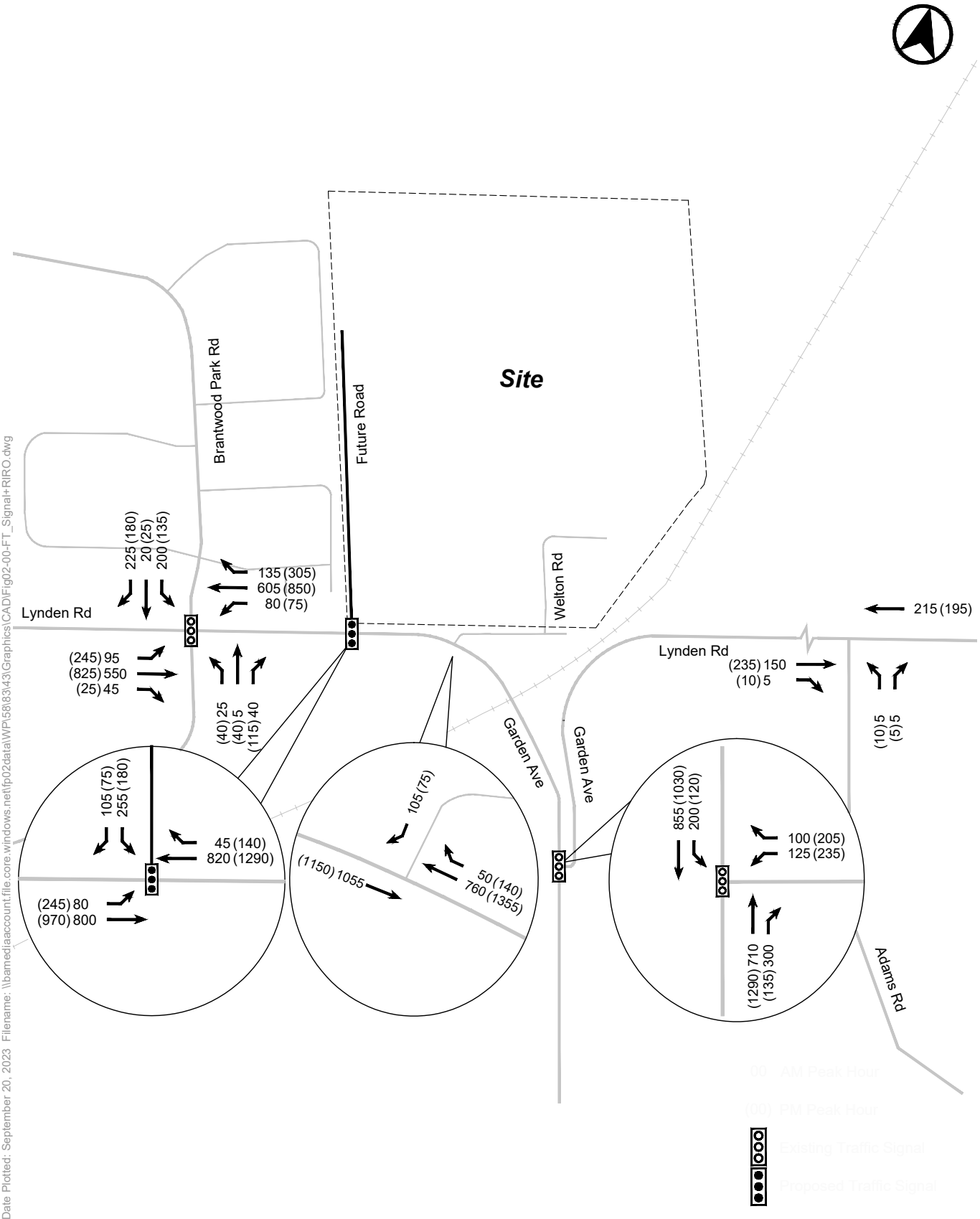


FIGURE 2 FUTURE TOTAL TRAFFIC VOLUMES

Signal & RIRO Access Configuration

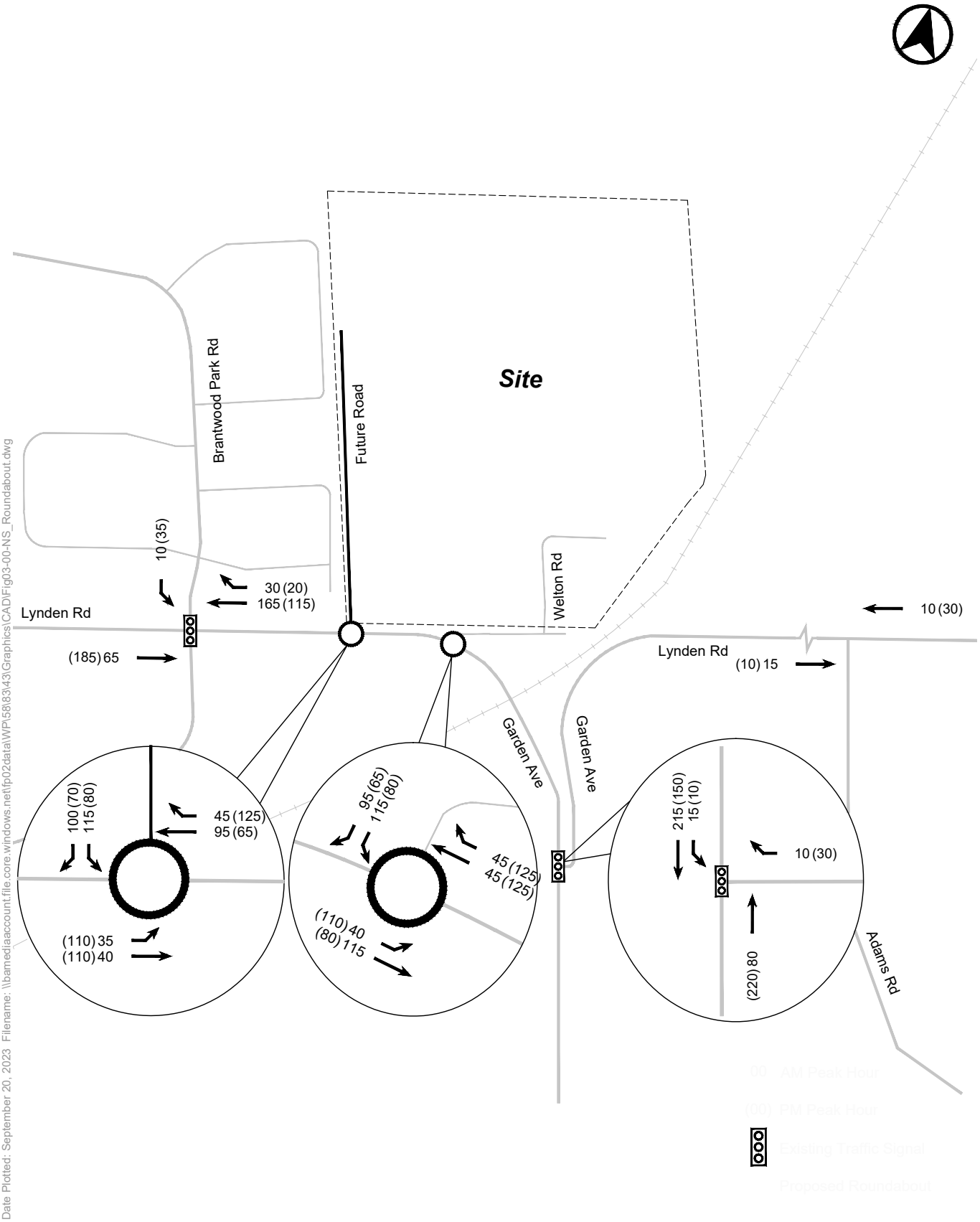


FIGURE 3 NEW SITE TRAFFIC VOLUMES

Dual Roundabout Access Configuration

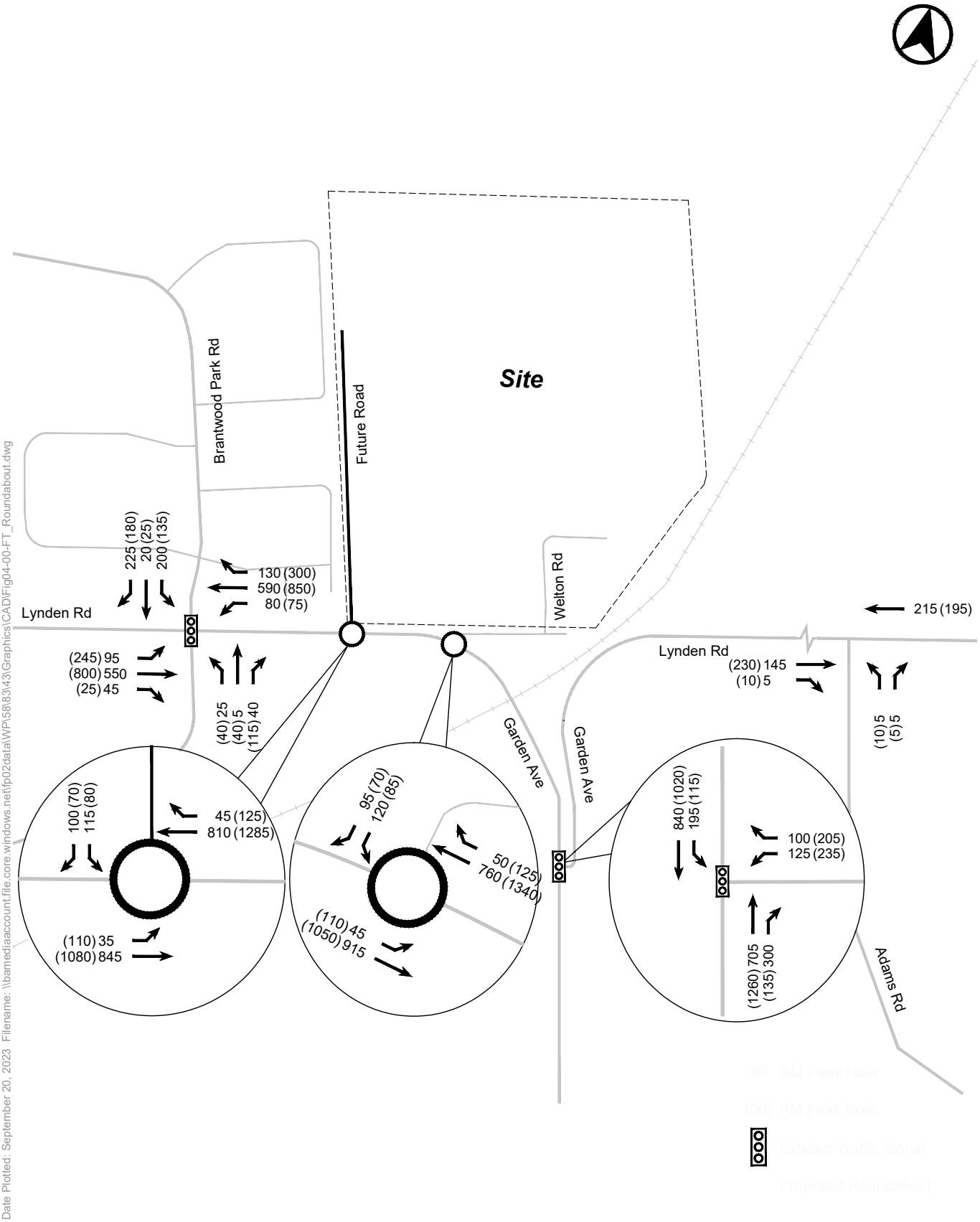


FIGURE 4 FUTURE TOTAL TRAFFIC VOLUMES

Dual Roundabout Access Configuration

ATTACHMENT E: COLLISION DATA

Collision Details Report

From: January 1, 2018 **To:** July 25, 2023

Location ..... BRANTWOOD PARK RD @ LYNDEN RD **Municipality.....** BRANTFORD

Traffic Control.... Traffic signal **Total Collisions....** 25

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
23-020289s	2023-May-13, Sat,11:12	Clear	Angle	Non-reportable	South	Dry	Turning right	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
23-014312s	2023-Apr-06, Thu,10:05	Clear	Turning movement	Non-reportable	South	Dry	Going ahead	Passenger van	Other motor vehicle	Driving properly	
Comments:					North	Dry	Turning left	Pick-up truck	Other motor vehicle	Improper turn	
23-004235s	2023-Jan-22, Sun,13:00	Snow	Rear end	Non-reportable	South	Packed snow	Stopped	Pick-up truck	Other motor vehicle	Driving properly	
Comments:					South	Packed snow	Slowing or stopping	Automobile, station wagon	Skidding/sliding	Driving properly	
22-052085	2022-Dec-22, Thu,17:52	Clear	Rear end	P.D. only	East	Dry	Turning right	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way	
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Lost control	
22-048061	2022-Nov-19, Sat,19:17	Clear	Angle	Non-reportable	South	Ice	Turning right	Automobile, station wagon	Other motor vehicle	Improper turn	
Comments:					East				Other motor vehicle		
22-047443	2022-Nov-18, Fri,17:12	Clear	Turning movement	Non-fatal injury	West	Dry	Going ahead	Pick-up truck	Other motor vehicle	Exceeding speed limit	
Comments:					East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Driving properly	
21-43802	2021-Nov-08, Mon,15:30	Clear	Turning movement	P.D. only	North	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
21-23576	2021-Jun-25, Fri,15:20	Rain	Turning movement	P.D. only	West	Wet	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	
Comments:					West	Wet	Turning left	Pick-up truck	Other motor vehicle	Improper turn	
21-05904	2021-Feb-17, Wed,18:00	Clear	Turning movement	P.D. only	South	Packed snow	Stopped	Pick-up truck	Other motor vehicle	Driving properly	
Comments:					West	Slush	Turning right				

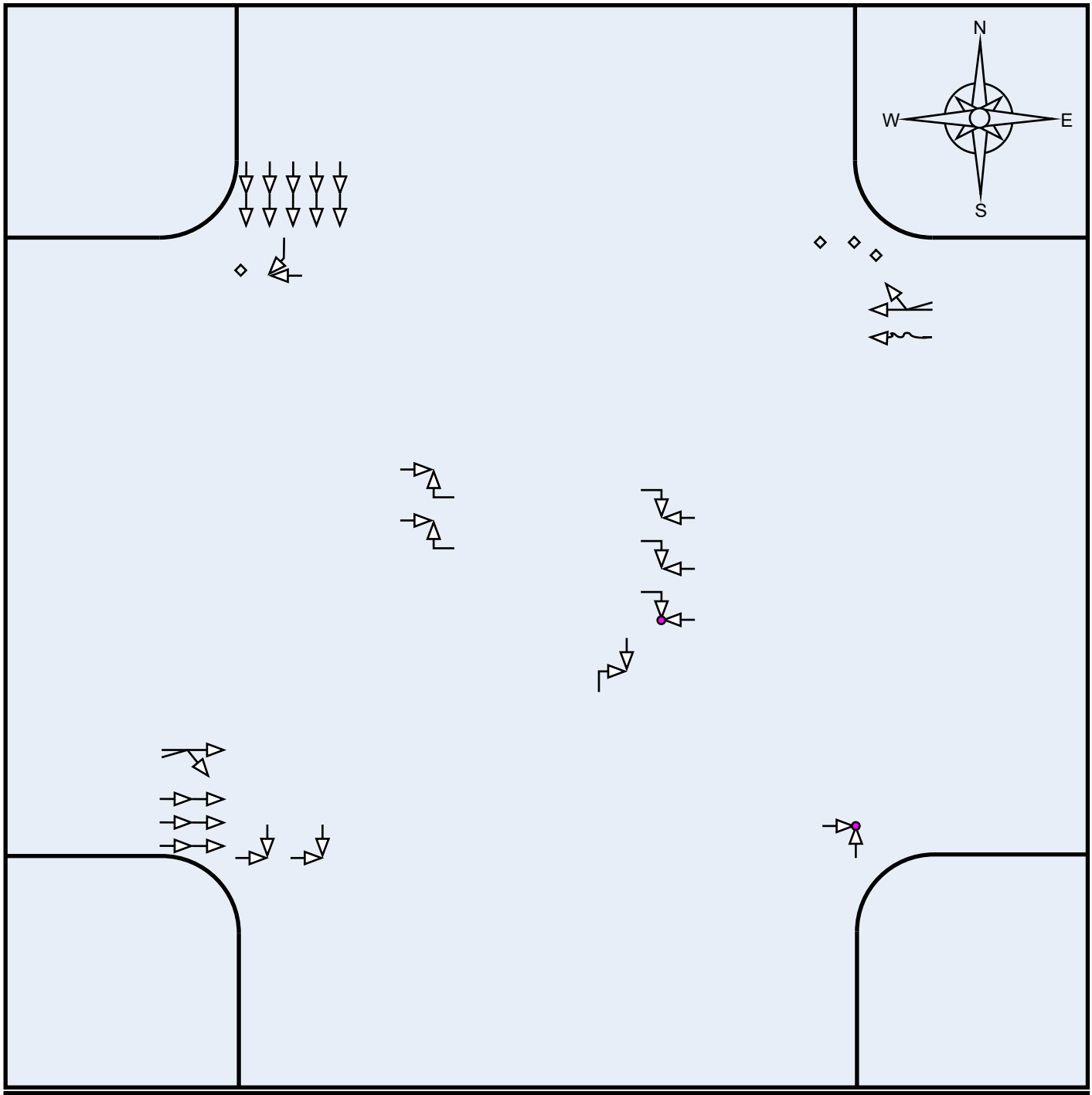
21-02906	2021-Jan-25, Mon,11:06	Clear	Turning movement	P.D. only	West	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Improper turn
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly
20-38046	2020-Sep-24, Thu,19:05		Rear end	P.D. only	East	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Driving properly
Comments:					East	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly
20-33595	2020-Aug-29, Sat,21:48	Clear	Rear end	P.D. only	South	Dry	Going ahead	Pick-up truck	Other motor vehicle	
Comments:					South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly
20-23191	2020-Jun-18, Thu,00:00	Clear	Rear end	P.D. only	South	Dry	Stopped	Delivery van	Other motor vehicle	Driving properly
Comments:					South	Dry	Stopped	Automobile, station wagon		Driving properly
20-18986	2020-May-22, Fri,14:52	Clear	Turning movement	P.D. only	East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Failed to yield right-of-way
Comments:					West	Dry	Going ahead	Truck - open		Driving properly
19-48781	2019-Dec-21, Sat,09:27	Clear	Angle	Non-fatal injury	North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Disobeyed traffic control
Comments:	D1 HTA 130(1) 9108952Z				East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly
19-44906	2019-Nov-21, Thu,17:30	Rain	Turning movement	P.D. only	West	Wet	Turning left	Automobile, station wagon	Other motor vehicle	Improper turn
Comments:					East	Wet	Going ahead		Other motor vehicle	
19-35683	2019-Sep-15, Sun,09:15	Clear	Angle	P.D. only	East	Dry	Going ahead	Pick-up truck	Other motor vehicle	Following too close
Comments:					South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly
19-19131	2019-May-18, Sat,15:00	Clear	Rear end	P.D. only	South	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly
Comments:	There were two vehicles in this accident. Second page missing				South	Dry		Unknown		
19-11828	2019-Apr-02, Tue,16:40	Clear	Sideswipe	P.D. only	East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly
Comments:	There were 3 cars involved in this accident. Third page is missing				East	Dry	Stopped	Automobile, station wagon	Other motor vehicle	Driving properly
18-022033	2018-Jun-08, Fri,18:00	Clear	Turning movement		East	Dry	Turning left	Automobile, station wagon	Other motor vehicle	Driving properly
Comments:					West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly
18-021877	2018-Jun-07, Thu,17:30	Clear	Turning movement		North	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly
Comments:					West	Dry	Turning right	Automobile, station wagon	Other motor vehicle	Driving properly

18-011003	2018-Mar-25, Sun,08:43	Clear	SMV other	P.D. only	West	Dry	Reversing	Automobile, station wagon	Building or wall	Driving properly
Comments:										
18-04826	2018-Feb-05, Mon,10:48	Clear	Sideswipe		West	Ice	Slowing or stopping	Automobile, station wagon	Skidding/sliding	Speed too fast for condition
Comments:					West	Loose snow	Stopped	Automobile, station wagon	Other motor vehicle	Other
18-01883	2018-Jan-31, Wed,15:30	Clear	Rear end		South	Dry	Slowing or stopping	Automobile, station wagon	Other motor vehicle	Following too close
Comments:					South	Dry	Stopped	Pick-up truck	Other motor vehicle	Driving properly
19-002050	2018-Jan-16, Tue,21:30	Snow	Rear end		East	Ice	Slowing or stopping	Pick-up truck	Skidding/sliding	Driving properly
Comments:					East	Slush	Stopped	Pick-up truck	Other motor vehicle	Driving properly

Collision Diagram

BRANTWOOD PARK RD @ LYNDEN RD (N345)

From: Jan 01, 2018 To: May 31, 2023



LEGEND

Turning Movement	6	Unknown	4	Angle	3	Angle Turning Left	0	Angle Turning Right	1
Approaching	0	Rear End	8	Sideswipe	2	SMV Other	1	SMV Unattended	0
Turning Movement	0	Fatal Collision	0	Injury Collision	0				

TOTAL 25

Collision Details Report

From: January 1, 2018 **To:** July 25, 2023

Location ..... GARDEN AVE @ LYNDEN RD W **Municipality.....** BRANTFORD

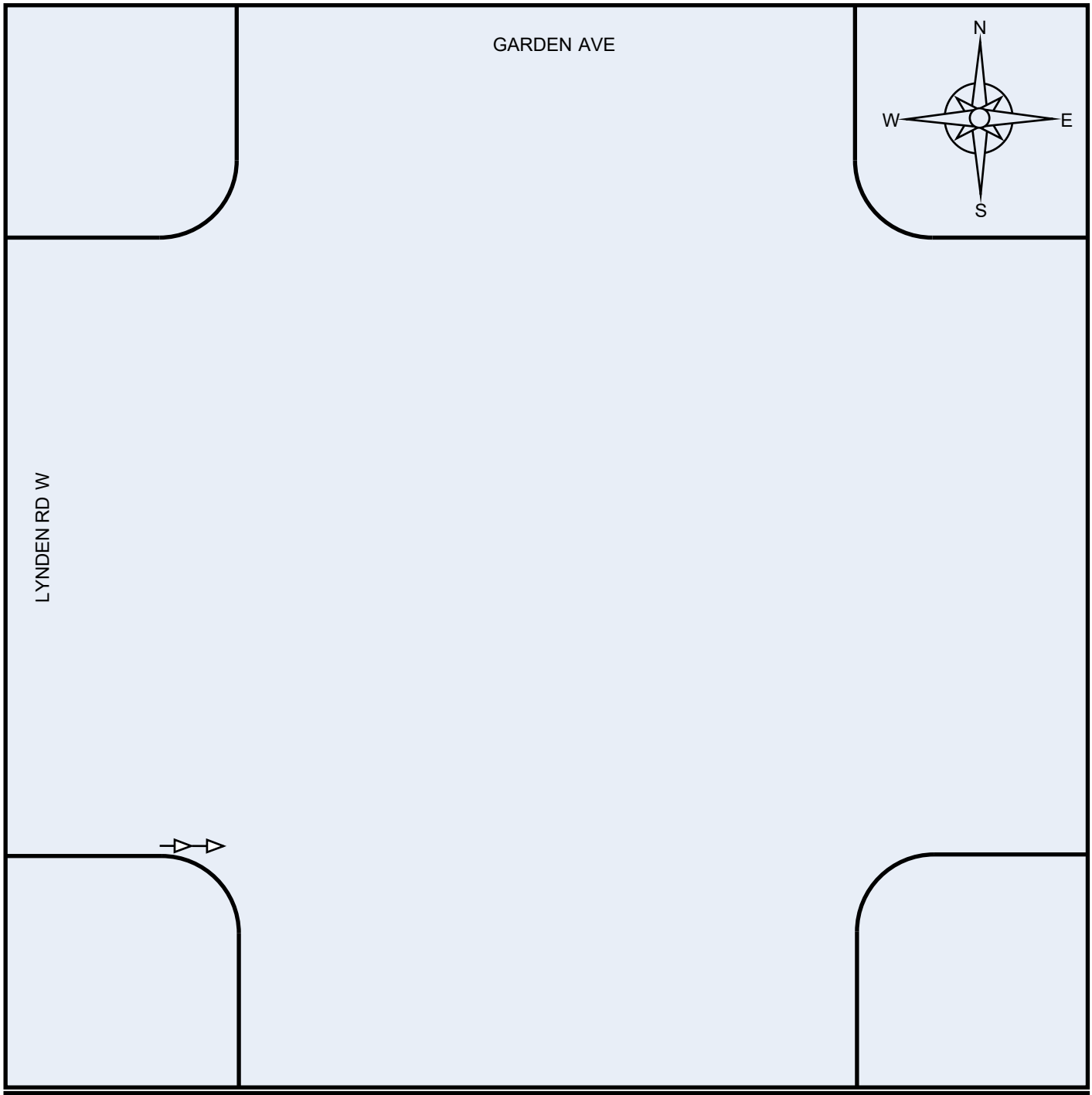
Traffic Control.... **Total Collisions....** 1

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
18-09210	2018-Mar-11, Sun,11:04	Clear	Rear end	P.D. only	East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					East	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Driving properly	

Collision Diagram

GARDEN AVE @ LYNDEN RD W (N318)

From: Jan 01, 2018 To: Dec 31, 2018



LEGEND												TOTAL
Turning Movement	0	Unknown	0	Angle	0	Angle Turning Left	0	Angle Turning Right	0			
Approaching	0	Rear End	1	Sideswipe	0	SMV Other	0	SMV Unattended	0			
Turning Movement	0	Fatal Collision	0	Injury Collision	0							1

Collision Details Report

From: January 1, 2018 **To:** July 25, 2023

Location ..... LYNDEN RD btwn BRANTWOOD PARK RD & GARDEN AVE **Municipality.....** BRANTFORD

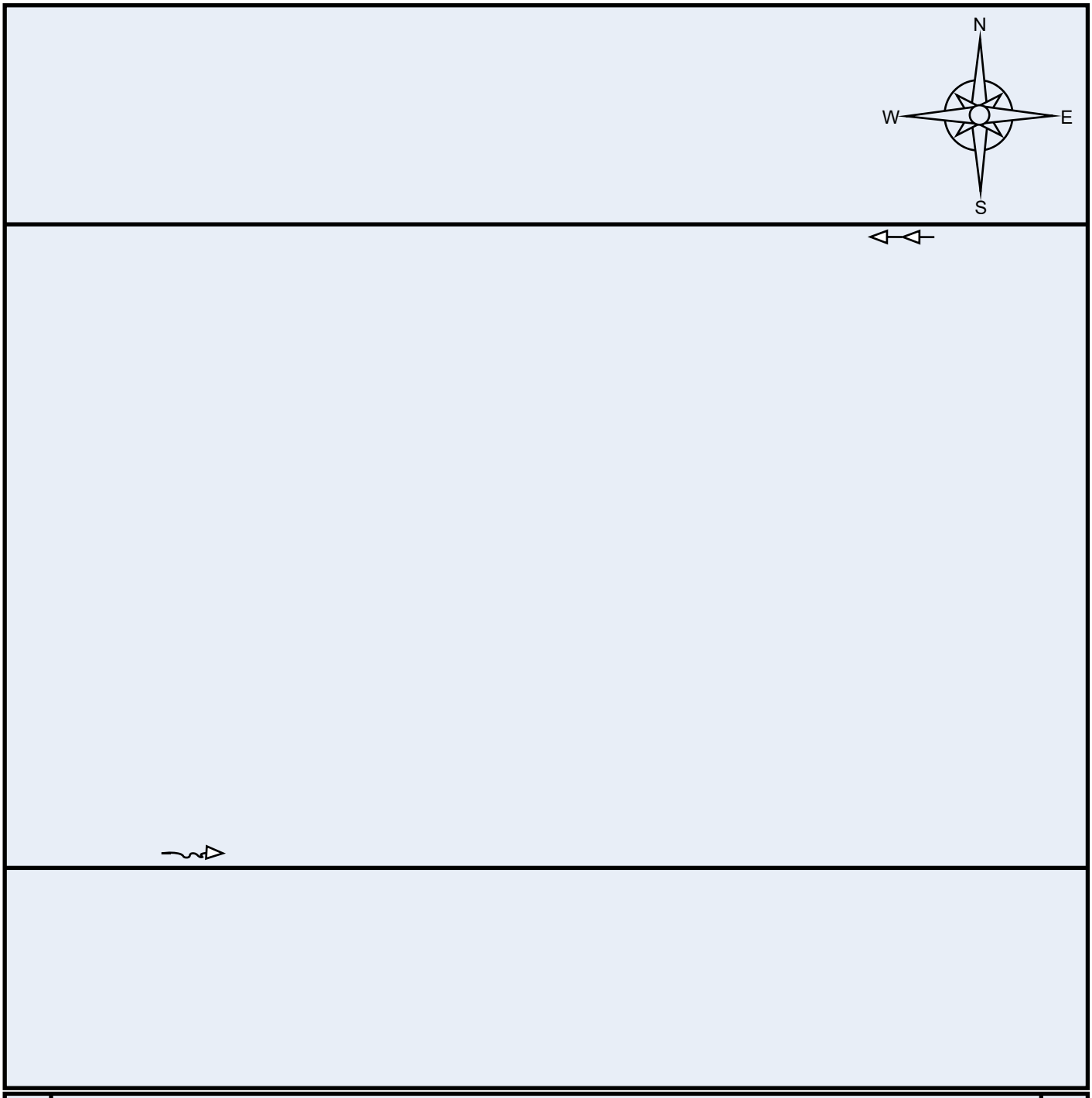
Traffic Control.... **Total Collisions....** 2

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	No. Ped
23-000555s	2022-Dec-27, Tue,01:00	Snow	SMV other	Non-reportable	East	Dry	Going ahead	Automobile, station wagon	Animal - wild	Driving properly	
Comments:	48: Wild animal										
18-039192	2018-Oct-04, Thu,16:35	Clear	Rear end		West	Dry	Going ahead	Automobile, station wagon	Other motor vehicle	Following too close	
Comments:					West	Dry	Stopped	Passenger van	Other motor vehicle	Driving properly	

Collision Diagram

LYNDEN RD btwn BRANTWOOD PARK RD & GARDEN AVE (4842)

From: Oct 01, 2018 To: Dec 31, 2022



LEGEND												TOTAL
Turning Movement	0	Unknown	0	Angle	0	Angle Turning Left	0	Angle Turning Right	0			
Approaching	0	Rear End	1	Sideswipe	0	SMV Other	1	SMV Unattended	0			
Turning Movement	0	Fatal Collision	0	Injury Collision	0							2

ATTACHMENT F: CONCEPTUAL DESIGN IMPACTS

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MOVEMENT
URBAN
ENVIRONMENTS
BAGROUP.COM

LYNDEN GARDENS

CONCEPTUAL DESIGN IMPACTS
OPTION COMPARISON

Date: 2023-10-13

Project No.: 5883-43

Scale: 1:400 0 2 4 6 8 10 20m

FD-00

Date Plotted: October 13, 2023 Filename: J:\5883-43\AXF\UNCTIONAL DESIGN\20231013\A-Lynden Garden-FD-R1-5883-43.dwg