Transportation Impact Assessment – Step 3 & 4: Forecasting & Analysis

1345,1375 Hemlock Road & 375 Codd's Road

Prepared for Bayview Group
By Arcadis

February 2, 2024

TIA Plan Reports - Certification

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

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

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

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;

2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;

3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and

4. I am either a licensed[1] or registered[1] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering ☑ or transportation planning □.

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

Dated at Ottawa this 2nd day of February, 2024.
(City)

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Professional Title: Project Engineer

Ben Pascolo-Neveu

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

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Table of Contents

Table of Contents

Table of Contents

List of Tables

Table of Contents

List of Figures

List of Exhibits

List of Appendices

Table of Contents

Executive Summary

Arcadis was retained by Bayview Group to undertake a Transportation Impact Assessment (TIA) in support of a Site Plan Control application for a proposed mixed-use residential development consisting of three separate property parcels to be located at 1345, 1375 Hemlock Road and 375 Codd's Road within Wateridge Village, Ottawa.

The proposed development consists of two, 9-storey buildings fronting onto Hemlock Road and an additional 6-storey building fronting onto Codd's Road, with a total of 455 dwelling units and approximately 581 square metres of gross leasable area for ground floor commercial uses. This mid-rise development is anticipated to be constructed and fully occupied in a single phase by the end of 2026. A 2031 horizon year was therefore assumed for this study, representing 5 years beyond the expected full build-out of the subject lands.

Upon consultation with City Transporation Project Manager, a reduced scope TIA consisting of a joint Forecasting and Analysis (Step 3 & 4) submission was approved for this study due to the negligible traffic impacts anticipated on the adjacent road network beyond those already considered in previous studies. The proposed development is expected to generate up to 61 and 63 two-way vehicular trips during the weekday morning and afternoon peak hours. Of these total trips, however, only 21 vehicles per hour in excess of what was previously included in the Wateridge Phase 2A/2B TIA were calculated for the proposed development. The impact of those 21 additional vehicular trips can be considered negligible when distributed amongst the three key access intersections connecting Wateridge Village to the regional road network. Consistent with the Wateridge Phase 2A/2B TIA, refinements to the existing 'blended rate' mode share were applied to better represent the travel characteristics based on the site density and its location within the Community Core. The mode share targets proposed in this study are supported by a host of Transportation Demand Management (TDM) Measures to further reduce reliance on non-auto modes of travel.

Given that site-generated traffic contributions will have no significant impact on the three regional site access intersections which have already been evaluated as part of recent transportation studies conducted for Wateridge Village, it was not necessary to undertake any additional intersection capacity analysis for this study. Further, no intersection capacity or auxiliary lane analyses were required at the proposed site access driveways, as all four locations will provide connections to local roads which can be considered to have sufficiently low volumes and operating speeds to safely accommodate these additional driveway locations from a transportation perspective.

In terms of site design, the primary entrances for each building will be barrier-free to provide direct pedestrian access to the nearest boundary street. A network of pathways is proposed throughout the three parcels to facilitate pedestrian connections between building entrances and pedestrian facilities proposed on each boundary street which are planned to integrate seamlessly with the cycle tracks and sidewalks on both sides of the 'Hemlock Core Street', abutting the subject development to the south.

On the periphery of the study area, the Montreal Road & Wanaki Road/Bathgate Drive intersection was recently constructed as a fully 'protected intersection' to replace the Montreal & Burma/Bathgate configuration to increase comfort and safety for vulnerable road users. Potential longer-term improvements to transit and active transportation facilities have been defined through the recently-completed Montreal Road Environmental Assessment (EA) which will further support travel by non-auto modes through transit priorities measures (curbside bus lanes) and enhanced cycling facilities in the form of grade-separated cycle tracks along this significant arterial road.

A multi-modal analysis of each study area intersection was reviewed from previous TIAs conducted for Wateridge Village which identified deficiencies in the existing road network and potential remediation measures that the City could consider in order to meet the prescribed targets. These remediation measures would improve mobility and comfort for all transportation modes but are not required to safely accommodate the proposed development.

As no physical modifications are needed to accommodate site-generated demand, an RMA will not be required in support of this development. Further, a Post-Development Monitoring Plan is not required to support the proposed development, as regional site access intersections are expected to operate at an acceptable level of service (i.e. LOS 'D' or better) beyond the 2031 horizon year of this study. It is important to also note that a Post-Development Monitoring Plan was prepared as part of the Phase 2A/2B TIA to manage and mitigate any potential cut-through traffic impacts in adjacent neighbourhoods which included the subject development lands.

Based on the findings of this study, it is the overall opinion of Arcadis that the proposed development will integrate well with and can be safely accommodated by the adjacent transportation network.

1 Introduction

Arcadis was retained by Bayview Group to undertake a Transportation Impact Assessment (TIA) in support of a Site Plan Control application for a proposed mixed-use residential development consisting of three separate property parcels to be located at 1345, 1375 Hemlock Road and 375 Codd's Road within Wateridge Village, Ottawa.

In accordance with the City of Ottawa's Transportation Impact Assessment Guidelines, published in June 2017, the following report is divided into four major components:

- **Screening** – Prior to the commencement of a TIA, an initial assessment of the proposed development is undertaken to establish the need for a comprehensive review of the site based on three triggers: Trip Generation, Location and Safety.
- **Scoping** – This component of the TIA report describes both the existing and planned conditions in the vicinity of the development and defines study parameters such as the study area, analysis periods and analysis years of the development. It also provides an opportunity to identify any scope exemptions that would eliminate elements of scope described in the TIA Guidelines that are not relevant to the development proposal, based on consultation with City staff.
- **Forecasting** – The Forecasting component of the TIA is intended to review both the development-generated travel demand and the background network travel demand, and provides an opportunity to rationalize this demand to ensure projections are within the capacity constraints of the transportation network.
- **Analysis** – This component documents the results of any analyses undertaken to ensure that the transportation related features of the proposed development are in conformance with prescribed technical standards and that its impacts on the transportation network are both sustainable and effectively managed. It also identifies a development strategy to ensure that what is being proposed is aligned with the City of Ottawa's city-building objectives, targets and policies.

Throughout the development of a TIA report, each of the four study components above are typically submitted in draft form to the City of Ottawa and undergo a review by a designated Transportation Project Manager (TPM). For this TIA, however, it was confirmed with the City TPM that a joint Forecasting and Analysis submission would be sufficient, due to the reduced scope proposed for this study.

It is not expected that a Roadway Modification Application (RMA) will be required to support the proposed development, as the road network for Wateridge Village is currently being built out to accommodate multi-modal transportation demands within the community beyond the City's 2031 ultimate planning horizon. Further, the proposed development is expected to have relatively low vehicular trip generation, the details of which will be confirmed in this study. A Post-Development Monitoring Plan was also approved for the subject lands as part of Wateridge Phase 2A/2B TIA (Dillon, 2019, D07-16-15-0003 Phase 2A/2B).

2 TIA Screening

An initial screening was completed to confirm the need for a Transportation Impact Assessment by reviewing the following three triggers:

- **Trip Generation**: Based on the proposed number of apartment dwelling units, the minimum development size threshold has been exceeded and therefore the Trip Generation trigger is satisfied.
- **Location**: The proposed development is not located within a Design Priority Area (DPA) or within a Transit-Oriented Development (TOD) zone. Furthermore, it does not propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Network. The Location trigger is therefore not satisfied.
- **Safety**: Boundary street conditions were reviewed to determine if there is an elevated potential for safety concerns adjacent to the site. Based on this review, the Safety Trigger is not satisfied.

As the proposed development meets the Trip Generation, the need to undertake a Transportation Impact Assessment is confirmed.

A copy of the Screening Form is provided in **Appendix A**.

3 Project Scoping

3.1 Description of Proposed Development

3.1.1 Site Location

The proposed development is located within the Core area of the Wateridge Village community at 1345, 1375 Hemlock Road and 375 Codd's Road on three separate parcels of land approximately 1.2 hectares in total size. The three subject property parcels are generally bound by Hemlock Road to the south, Tawadina Road to the north, Michael Stoqua Street to the east and Codd's Road to the west.

The site location and its surrounding context is illustrated in **Exhibit 1**.

3.1.2 Land Use Details

The subject property parcels are currently undeveloped greenfield sites, and according to GeoOttawa, are all zoned GM31 H(30) – General Mixed-Use.

The proposed development consists of two, 9-storey buildings and a 6-storey building divided amongst the three property parcels. **Table 1** below provides a breakdown of the proposed land uses associated with each property parcel included in this development.

Table 1 - Land Use Statistics

	RESIDENTIAL (UNITS)	GROUNDFLOOR COMMERCIAL (M^2)
Building 1	216 units	~411.7 m^2
Building 2	131 units	~169.2 m^2
Building 3	108 units	N/A
Total	**455 units**	**~580.9 m^2**

The proposed development will provide a total of 397 vehicle parking spaces in three separate, two-storey underground parking garages, along with 244 bicycle parking spaces. Some visitor parking will be provided at-grade adjacent to the primary residential building entrance as well. Vehicular access to the sites will be provided via three, two-way private approaches: two on Bareille-Snow Street, one on Tawadina Road. An additional outbound-only private approach is proposed for the eastern development parcel on Michael Stoqua Street.

The configuration of the proposed development is illustrated in **Exhibit 2**.

3.1.3 Development Phasing & Date of Occupancy

For the purposes of this study, it is assumed that the proposed development will be constructed and fully occupied in a single phase by the end of 2026.

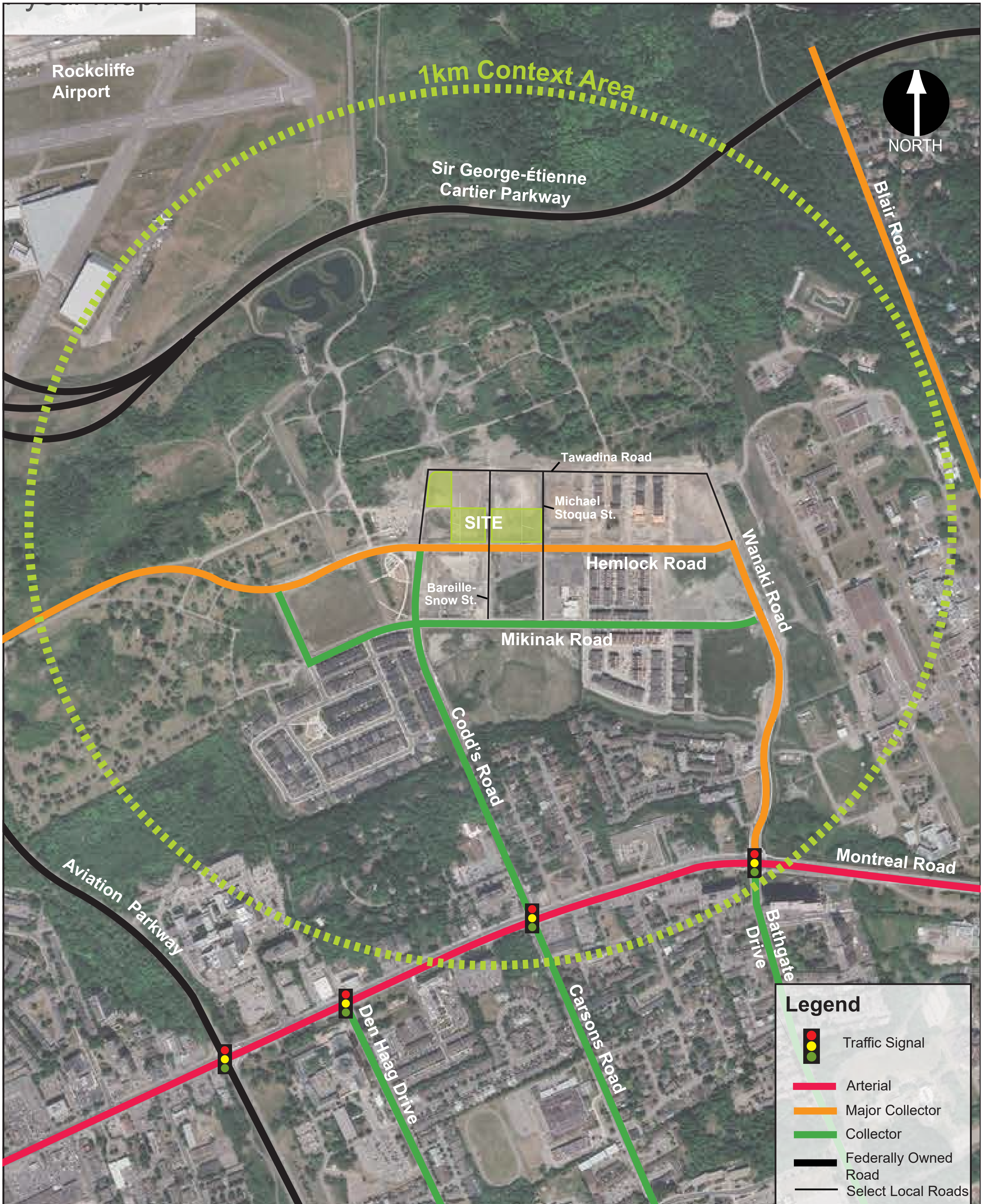

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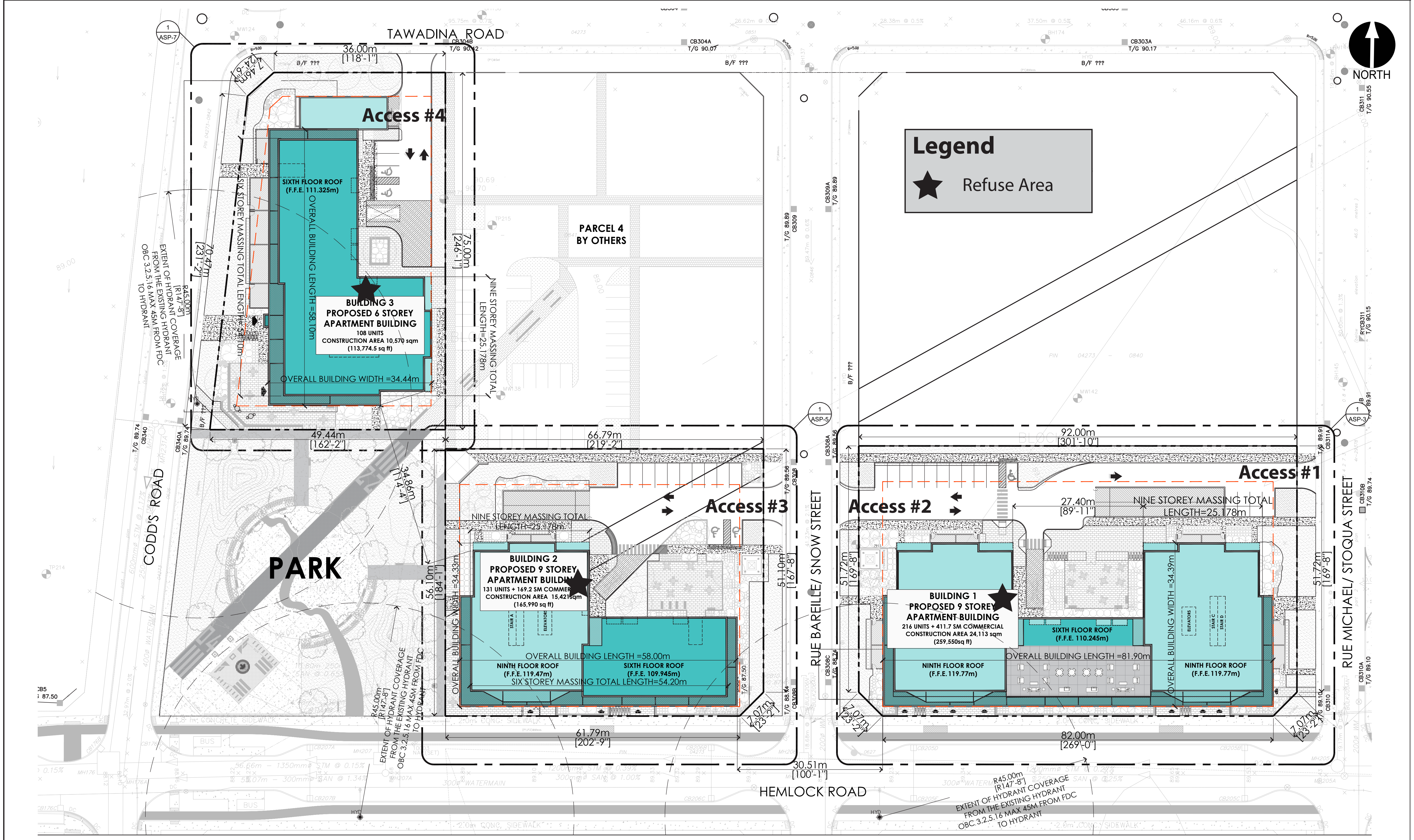
Exhibit 1: Site Location

PROJECT No. 138889

SCALE: 50m 0m 100m



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1345, 1375 Hemlock & 375 Codd's
Transportation Impact Assessment

Exhibit 2: Proposed Development

PROJECT No. 138889

SCALE: 0m 10m 20m

3.1.4 Existing Road Network

3.1.4.1 Roadways

The proposed development is bound by the following road(s):

- **Hemlock Road** is a major collector road under the jurisdiction of the City of Ottawa that extends east-west through Wateridge Village from Wanaki Road in the east, and presently terminates at Vedette Way in the west. Hemlock Road will ultimately continue further west to the Aviation Parkway and reconnect with its western segment, which is classified as an arterial road. In the vicinity of the proposed development, Hemlock Road is planned to function as a 'Core Street' with a two-lane urban cross-section, a posted speed limit of less than 50km/h and a 24-metre right-of-way.
- **Tawadina Road** is a local road under the jurisdiction of the City of Ottawa that extends east-west from Wanaki Road in the east to Codd's Road in the west. This road is planned to have a two-lane urban cross-section and a posted speed limit of less than 50 km/h within its 20-metre right-of-way.
- **Bareille-Snow Street** is a local road under the jurisdiction of the City of Ottawa, providing a north-south connection between Tawadina Road and Mikinak Road. This road is planned to have a two-lane urban cross-section and a posted speed limit of less than 50km/h within its 20-metre right-of-way.
- **Michael Stoqua Street** is a local road under the jurisdiction of the City of Ottawa, providing a north-south connection between Tawadina Road and Mikinak Road. This road is planned to have a two-lane urban cross-section and a posted speed limit of less than 50km/h within its 20-metre right-of-way.

Other existing or planned roads within the vicinity of the proposed development are as follows:

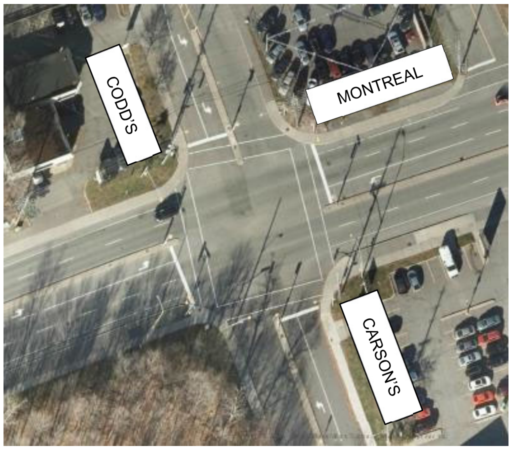
- **Codd's Road** is a collector road under the jurisdiction of the City of Ottawa that extends north-south from Montreal Road to Hemlock Road, becoming a local road further north. This road is expected to have a speed limit of less than 50km/h and a two-lane urban cross-section within its 26-metre right-of-way.
- **Wanaki Road** is a major collector road under the jurisdiction of the City of Ottawa that extends from Hemlock Road in the north and was recently connected to Montreal Road as part of the 'protected intersection' redesign of Montreal & Burma. Further north of Hemlock, Wanaki Road is planned to function as a local road. This road is expected to have a speed limit of 50km/h and a two-lane urban cross-section within its 26-metre right-of-way.
- **Montreal Road** is classified as an Arterial Mainstreet through the context area and extends east-west from North River Road to Highway 417. East of Highway 417, Montreal Road becomes St. Joseph Boulevard. The road generally consists of a four-lane, divided cross-section with a 37.5-metre right-of-way and a posted speed limit of 60 km/h.

3.1.4.2 Nearby Driveways

Currently, there are only single-family home driveways on Michael Stoqua Street within 200 metres of any of the proposed site access locations.

3.1.4.3 Intersections

The following intersections have the greatest potential to be impacted by the proposed development:



- **Montreal Road & Codd's Road/Carson's Road** is a four-legged, signalized intersection with two through lanes in each direction on Montreal Road, single through-lanes on the sidestreets and auxiliary left-turn lanes on each approach. The intersection is located approximately 600 metres south of the site.

- **Montreal Road & Wanaki Road/Bathgate Drive** was recently constructed as a 'protected intersection' to replace the Montreal & Burma/ Bathgate configuration. The intersection maintains two through lanes in each direction on Montreal Road, single through lanes on the sidestreets and auxiliary left-turn lanes on each approach. There are also cross-rides for cyclists on all legs of the intersection.

3.1.4.4 Traffic Management Measures

Within the vicinity of the subject site, Hemlock Road and Codd's Road have been recently constructed with curb bulb-outs to frame parking and create horizontal friction for motorists. Based on a review of the approved geometric roadway design drawings for Wateridge Village Phase 2B (IBI Group, 2019), additional traffic calming measures are planned on Tawadina Road which will locally narrow the road from 8.5 metres to 7.0 metres at regular intervals to calm traffic.

3.1.5 Existing Bicycle and Pedestrian Facilities

Pedestrian facilities are currently provided in the form of concrete sidewalks on both sides of Montreal Road through the context area, along with exclusive bike lanes. It should be noted as well that multi-use paths (MUP) presently exist on the west side of the Aviation Parkway and on the north side of the Sir George-Étienne Cartier Parkway.

The internal road network within Wateridge Village is presently in its early stages of development, therefore some roads lack formal pedestrian and cycling facilities. Concrete sidewalks and MUPs are present on Codd's Road and Mikinak Road throughout the context area.

As development progresses, it is expected that active transportation facilities will be integrated within road rights-of-way to maintain consistency with the Former Rockcliffe Community Design Plan (August 2015).

3.1.6 Existing Transit Facilities and Service

The following transit routes, operated by OC Transpo, exist within the vicinity of the site:

- **Route #12** provides regular, all-day service between Parliament and Blair Station, generally operating on 12- to 15-minute headways during weekday peak periods. On weekends, service is reduced to between 15- and 30-minute intervals.
- **Route #15** provides weekday, peak period transit service between Gatineau and Blair, generally operating on 15-minute headways.
- **Route #25** provides regular, all-day service between Millenium and Blair Station/ Collège La Cité, generally operating on 10- to 15-minute headways during weekday peak periods. On weekends, service is reduced to between 12- and 30-minute intervals.
- **Route #27** provides weekday, selected time period service to date between Wateridge Village and St. Laurent Station with 30-minute headways. Service is provided towards St. Laurent during the weekday morning peak period, and towards Wateridge Village during the weekday afternoon peak period.

Bus stops for Route #27 are currently provided on Codd's Road and Mikinak Road within a 300- to 400-metre walking distance of the proposed development, while all other routes noted above will be accessed from bus stops on Montreal Road which are approximately 800 metres from subject lands.

The four transit routes that serve the context area are illustrated in **Figure 1** below. Transit maps for the above noted routes are provided in **Appendix B**.

Figure 1 - Existing Transit Routes

Source: OC Transpo System Map, April 2023

3.1.7 Collision History

The proposed development is located within Wateridge Village, a new community, therefore there are no historical collision records available for any roads adjacent to the site for the past 5 years. Collision records for the intersections of Montreal & Codd's/Carson's, as well as Montreal & Burma/Bathgate were reviewed in prior studies, including the TIAs for Phases 1A, 1B, 2A/2B and the Community Transportation Study (CTS). Further, the intersection of Montreal & Burma/ Bathgate was recently reconstructed as a 'protected intersection', which is expected to address sightline issues identified on the northbound and southbound approaches. No safety concerns were noted at the Montreal & Codd's/Carson's intersection. The vast majority of incidents at this intersection were minor rear-end collisions that resulted in property damage only.

Relevant extracts of collision analysis from Section 2.6 of the Wateridge Phase 1B TIA are included in **Appendix C**.

3.2 Planned Conditions

3.2.1 Transportation Network

3.2.1.1 Future Road Network Projects

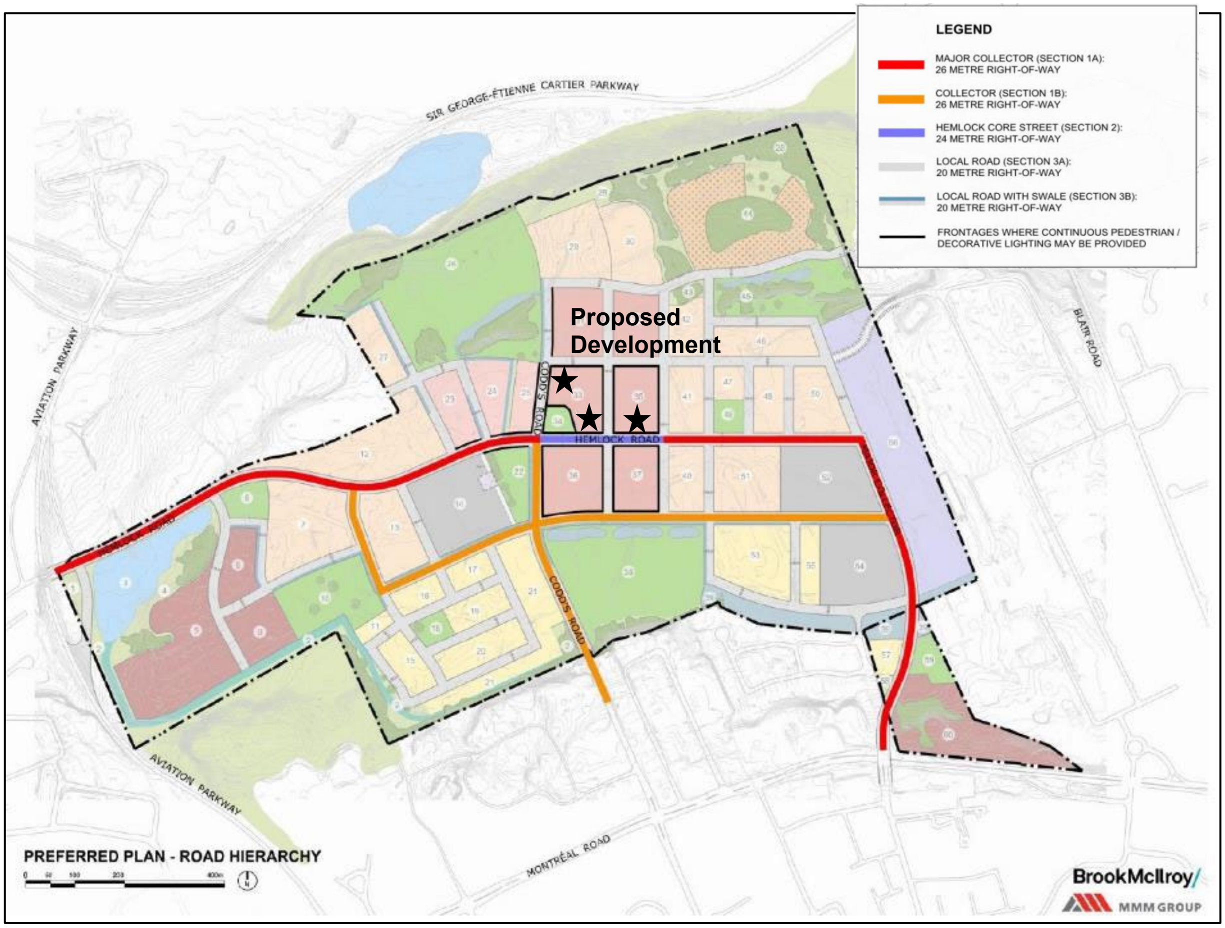
The 2013 Transportation Master Plan (TMP) outlines future road network modifications required in the 2031 'Affordable Network'. A review of the TMP Affordable Plan indicates that there were no planned changes to the arterial road network within the broader area surrounding the proposed development.

The road network from the CFB Rockcliffe CDP is shown in **Figure 2** below. Along the site's frontage, Hemlock Road is designated a 'Core Street', while Codd's Road, Michael Stoqua Street, Tawadina Road and Bareille-Snow Street are identified as local roads.

According to the Rockcliffe CDP, the key features of the Hemlock Core Street include a two-lane cross-section flanked on both sides by segregated cycling facilities, on-street parking and concrete sidewalks. By contrast, the collector road cross-section includes a two-lane cross-section flanked on one side by a multi-use path, on-street parking and a concrete sidewalk. The remaining local roads will have a two-lane cross-section with concrete sidewalks on at least one side.

As noted previously, Hemlock Road will ultimately continue further west to reconnect with its western segment at the Aviation Parkway. The Hemlock extension, which is anticipated to be fully implemented by 2023 or 2024, will help facilitate direct connectivity to the Aviation Parkway via an existing northbound on-ramp and southbound off-ramp.

Figure 2 – Road Classifications



Source: CFP Rockcliffe CDP (2015) – Fig. 5.8

<u>Wateridge Phases 1A & 1B – Pedestrian Safety Review</u>

The Wateridge Phases 1A & 1B Pedestrian Safety Review (Arcadis IBI, 2023) was recently conducted to evaluate the need for All-Way Stop Control (AWSC) and Pedestrian Crossovers (PXOs) to facilitate connectivity within these earlier phases of Wateridge, including the following key intersections along the subdivision's internal collector road network:

- Wanaki & Provender (3-legged intersection)
- Wanaki & Hemlock (3-legged intersection)
- Wanaki & Mikinak (3-legged intersection)
- Codd's & Mikinak (4-legged intersection)
- Codd's & Hemlock (4-legged intersection)

This Safety Review analysed traffic volume projections based on 'existing conditions' (i.e. traffic volume data collected in mid-2022) and total traffic projections for the full build-out of Wateridge

Village and provided suggested configurations of the above noted intersections. Through the projected vehicular travel demands, queuing analysis and sightline review, it was determined that AWSC would be warranted at all intersections in the longer-term with the exception of Wanaki & Mikinak which triggered the requirements for a PXO on its south leg to satisfy a future desire line between proposed complementary uses.

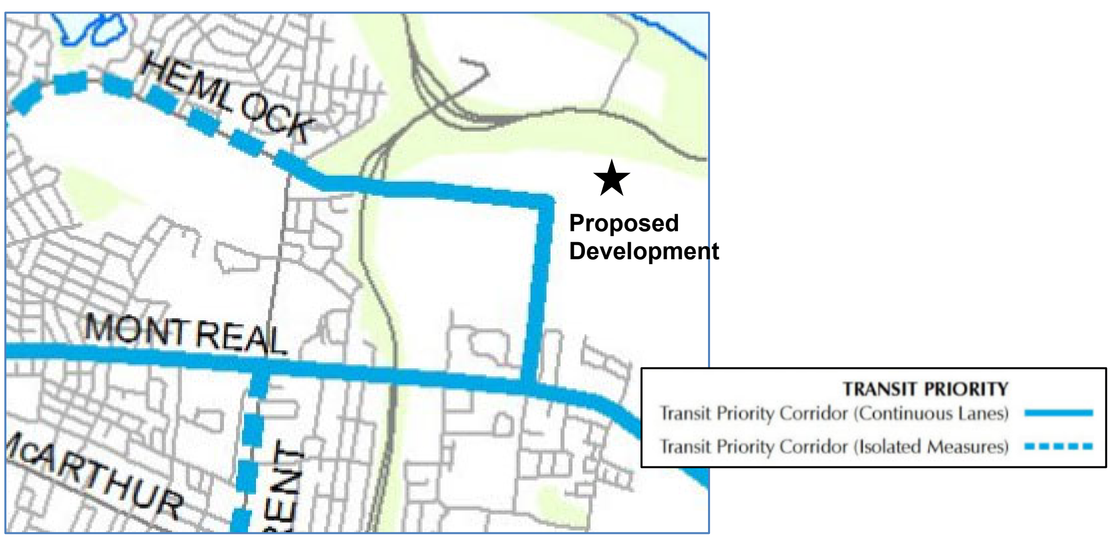
3.2.1.2 Future Transit Facilities and Services

The 2013 TMP outlines the future rapid transit and transit priority (RTTP) network. The following projects were noted in the 'Affordable RTTP Network' that may have a significant impact on future travel demand in the vicinity of the proposed development:

- **Montreal Road:** According to the TMP, this project would involve the development of new exclusive bus lanes east of St. Laurent Boulevard. Since the development of the TMP, the recently-completed Montreal-Blair Transit Priority Environmental Assessment (EA) recommended the implementation of a 'fully-protected' intersections on Montreal Road within the vicinity of Wateridge Village, upgrades to the existing on-road cycling facilities to grade-separated cycle tracks and the introduction of curbside transit lanes along this key arterial corridor.
- **Hemlock Road/Codd's Road:** The TMP identified Hemlock Road and Codd's Road between St. Laurent Boulevard and Montreal Road as Transit Priority Corridors with Continuous Bus Lanes. Since the TMP was published in 2013, the Former CFB Rockcliffe CDP (2015) envisioned the road network within Wateridge Village as supporting local transit only and without dedicated transit lanes. Despite the CDP's deviation from the TMP, City staff have recently indicated that the feasibility of isolated transit priority measures at major intersections along Hemlock Road and Codd's Road should still be considered as a feasible option to reduce transit delays as required.

Figure 3 below illustrates the transit infrastructure projects in the vicinity of the proposed development that are part of the TMP's 2031 Affordable Network.

Figure 3 - Future 'Affordable RTTP Network Projects'



Source: 2013 Transportation Master Plan – Map 5 '2031 Affordable Network'

3.2.1.3 Future Cycling and Pedestrian Facilities

The 2013 Ottawa Cycling Plan (OCP) designates Beechwood Avenue and Hemlock Road west of Codd's Road as a 'Cross-Town Bikeway', with the objective of providing continuous connectivity over long distances for cyclists crossing the city. Codd's Road is designated as a 'Local Route in the OCP, which provides connections to higher-order cycling networks, including 'Neighbourhood Bikeways', 'Cross-Town Bikeways' and Major Pathways.

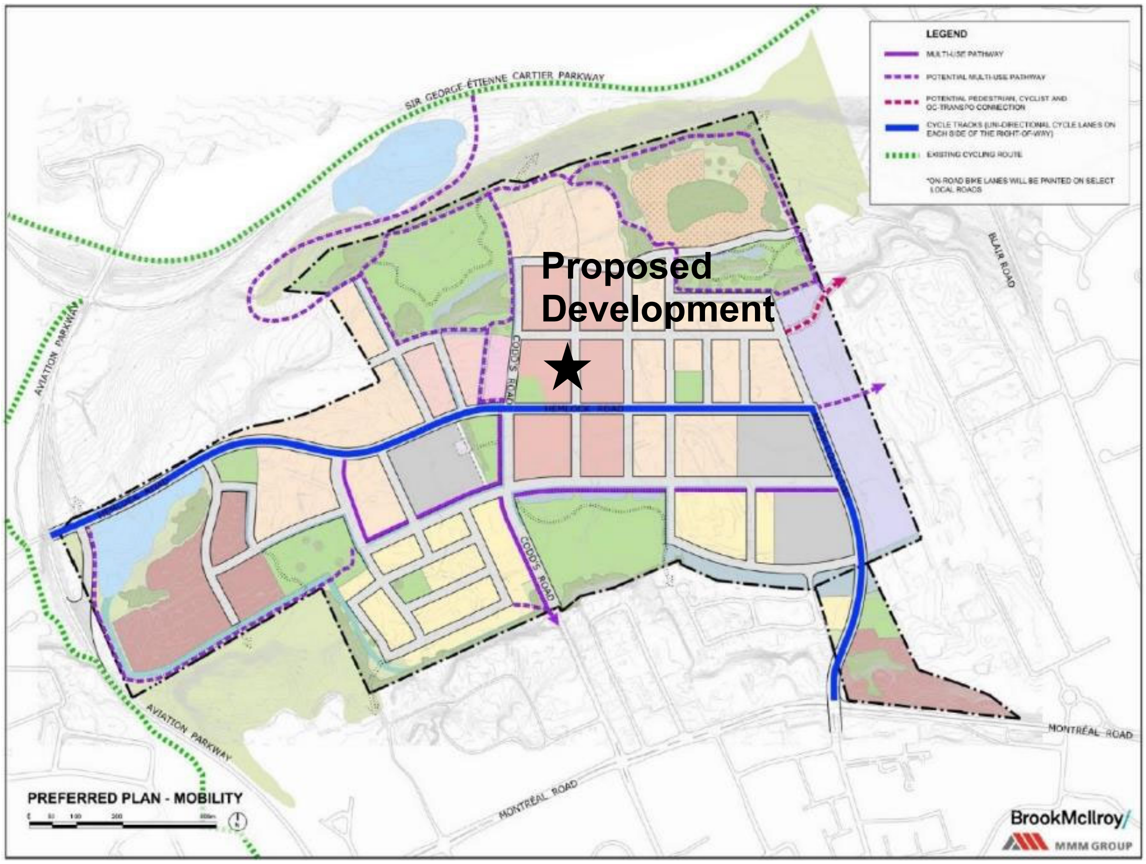
The conceptual alignment for a Major Pathway is also indicated along the northern boundary of the Wateridge Village community.

The future pedestrian and cycling network was further refined as part of the Former CFB Rockcliffe CDP (August, 2015). As shown on **Figure 4** below, an overall preferred Mobility Plan was developed for Wateridge Village during the CDP process.

Key features outlined in the CDP's preferred mobility plan relevant to this study include:

- Uni-directional cycle tracks on Hemlock Road and Wanaki Road; and
- A multi-use path (MUP) on the south side of Mikinak Road and the west side of Codd's Road.

Figure 4 – Wateridge Mobility Plan



Source: CFP Rockcliffe CDP – Figure 5.6

3.2.1.4 Future Adjacent Developments

The City of Ottawa Transportation Impact Assessment (TIA) Guidelines specify that all significant developments proposed within the surrounding area which are likely to occur within the study's horizon year must be identified and taken into consideration in the development of future background traffic projections.

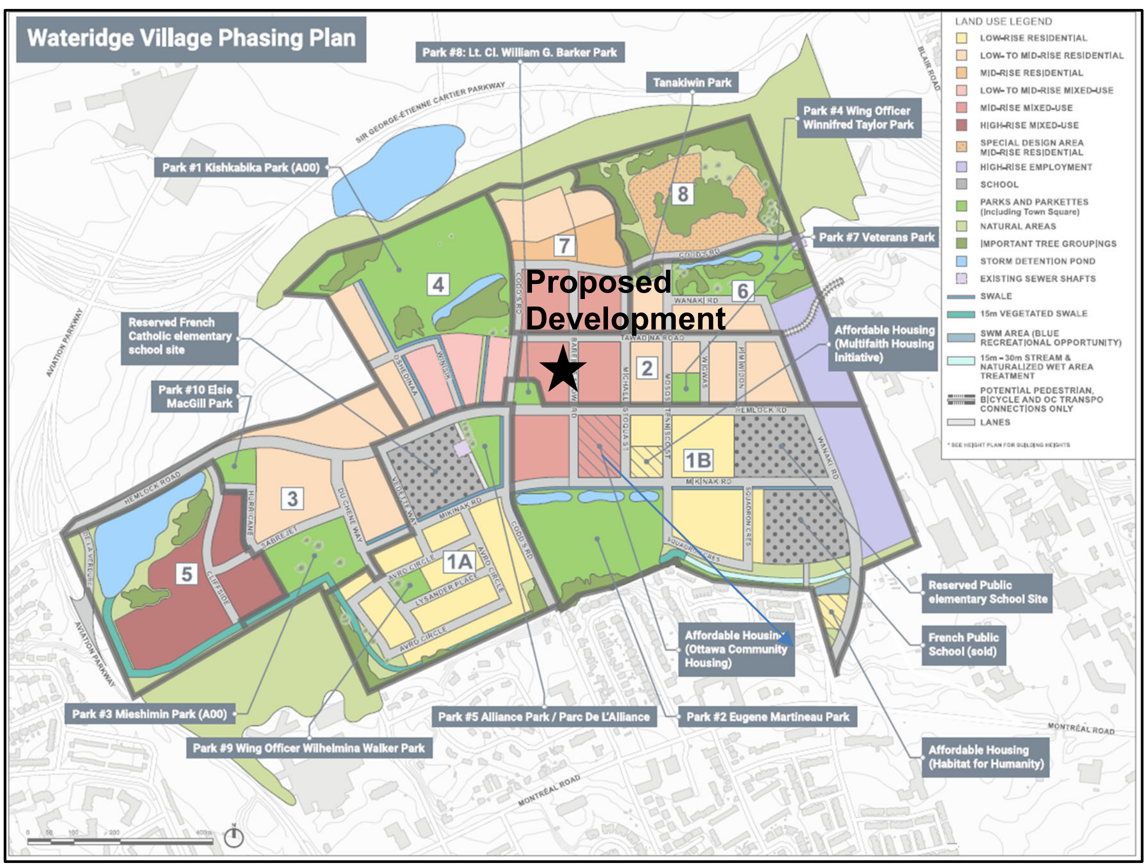
The following adjacent developments were considered within the vicinity of the subject lands:

- **Phase 1A** consists of 214 residential dwelling units and an elementary school block. This phase of Wateridge Village is nearing completion, with all residential land uses built out/ occupied and only the school block to be developed.
- **Phase 1B** consists of approximately 720 dwelling units and 32,450 m^2 of commercial space. Construction is currently underway for this portion of the proposed development.
- **Phases 2A/2B** includes approximately 271,601 m^2 of commercial space and 990 residential dwelling units. Google Earth aerial imagery captured in February 2022 indicates that Phase 2B east of Michael Stoqua Street has been mostly built out, while construction has not yet started on Phase 2A. A Monitoring Plan was prepared in April 2019 for this Draft Plan of Subdivision. The proposed development at 1345, 1375 Hemlock Road and 375 Codd's Road was included as part of Phase 2B which will be considered throughout this study.

- **Phases 3/5** consists of 745 low to mid-rise dwelling units, 1,081 high-rise dwelling units, mixed-use commercial/retail for 580 employees and approximately 2.5 hectares of public park space. Phases 3 & 5 are expected to be built out in 2023 and 2025, respectively.
- **715 Mikinak Road** consists of 271 dwelling units and approximately 265 m^2 of ground floor commercial space. Construction has not yet begun on this development.
- **455 Wanaki Road** consists of fewer than 13 dwelling units in a 3-storey apartment building serving Habitat for Humanity. The anticipated traffic impacts of this development are expected to be negligible.
- **875 Montreal Road** includes 4 dwelling units and approximately 420 m^2 of ground floor commercial space within two low-rise mixed-use buildings. A TIA report was approved for this site in April 2021 with an assumed occupancy date of 2022. As indicated in the TIA conducted for this study, its site-generated traffic impacts are expected to be negligible.
- **971 Montreal Road** consists of 78 dwelling units within a 9-storey apartment building that will replace an existing restaurant on the site. A TIA Screening Form was submitted, indicating that the Trip Generation Trigger is not met for this development. The anticipated occupancy date is 2025.

The approximate locations of the developments of significance are shown in **Figure 5** below. Consistent with the Phase 2A/2B TIA (now Phases 2 & 4), Phase 2C (now Phase 7) and Phase 2D (now Phases 6 & 8) were assumed to be outside of the scope of this study.

Figure 5 – Adjacent Developments



Source: Wateridge Phases 3 & 5 TIA – Fig. 3

3.2.2 Network Concept Screenline

Not Applicable: A network screenline analysis is not required for this development, as it does not trigger the threshold prescribed by the TIA Guidelines of 200 person-trips during the peak hour beyond what is otherwise permitted by zoning. Detailed trip generation will be provided in the Forecasting section of this report.

3.3 Study Area

Based on preliminary trip generation results developed as part of the TIA Screening, site context and direct access to a variety of transportation modes, the proposed development is expected to be a relatively low traffic generator, with approximately 205 person-trips projected during both the weekday morning and weekday afternoon peak hours.

Person-trip volumes were derived using the 2020 TRANS Trip Generation Manual and ITE Trip Generation (11th Edition) and will be further detailed in the Forecasting component of this study. Travel demand will subsequently be stratified by mode share, divided amongst the four proposed access driveways and further dispersed by the three primary access intersections with the regional road network , including Montreal & Codd's/Carson's and Montreal & Wanaki/Bathgate, as well as the Hemlock/Aviation Parkway interchange. Given the location of the proposed development within the Core Area of Wateridge Village, it is expected that the vehicular mode share will constitute a lower proportion of overall auto trips in comparison with other surrounding developments.

As discussed previously, All-Way Stop Control (AWSC) and Pedestrian Crossover (PXO) warrants for key internal intersections within Wateridge Village were reviewed as part of the Wateridge Phases 1A & 1B – Pedestrian Safety Review (Arcadis IBI, 2023) at key subdivision intersections along Hemlock Road, Wanaki Road and Codd's Road. Given that this analysis was recently completed based on the City's latest traffic control and pedestrian warrants, it was therefore not necessary to revisit the analysis conducted to account any nominal site-generated traffic impacts beyond those considered in the comprehensive assembly of total traffic generation developed as part of this Safety Review.

It is important to note as well that site-generated trips were largely accounted for as part of the overarching Wateridge Phase 2A/2B TIA (D07-16-15-0003 Phase 2A/2B) and the additional site-generated traffic contributions associated with the subject development resulted in the order of just 25 two-way vehicular trips during each weekday peak hour. Further, the Phase 2A/2B TIA included a Network Impact Component with intersection capacity analyses which modelled overall traffic impacts at the regional access intersections for Wateridge Village and the proposed vehicular connections serving the subject lands will all occur via local roads that can be assumed to operate at a high Level of Service. **As such, additional intersection capacity analyses are not required as part of this study.**

As the road network within Wateridge Village is being constructed to accommodate full build-out of the community and has been established in a such a way that it is fully-inclusive of all modes of travel, it is reasonable to assume that the proposed development, being among the earlier phases of the ultimate development plan for the area, shall be easily accommodated on the adjacent road network. Further, the TIA for Phase 1B, Block 19 (Novatech, 2020) provides recent Multi-Modal Level of Service (MMLOS) analyses for the signalized study area intersections on Montreal Road at Codd's Road and Wanaki Road. Although the Phase 2A/2B TIA did not provide any MMLOS analyses, the approach delays were referenced and compared against the Phase 1B results. **An additional analyses of off-site multi-modal network conditions are therefore not necessary for the proposed development**.

Given the above, this TIA will focus on site-specific impacts, integration with its boundary streets, including a functional review of the site access geometry and intersection control, on-site drive aisle requirements to accommodate proposed design vehicles and a review of the site's parking and loading requirements. Based on the reduced scope of analysis required for this study, it was confirmed with the City TMP that a joint Forecasting and Analysis (Step 3 & 4) submission would be deemed acceptable.

3.4 Time Periods

The proposed development primarily consists of residential land uses, with Buildings 1 and 2 each featuring a neighbourhood-scale ground floor commercial component. As such, traffic generated during the weekday morning and afternoon peak hours is expected to result in the most significant impact to traffic operations on the adjacent road network in terms of combined development-generated and background traffic. These two time periods will therefore be considered for any analysis required as part of this study.

3.5 Existing Lane Configurations and Traffic Volumes

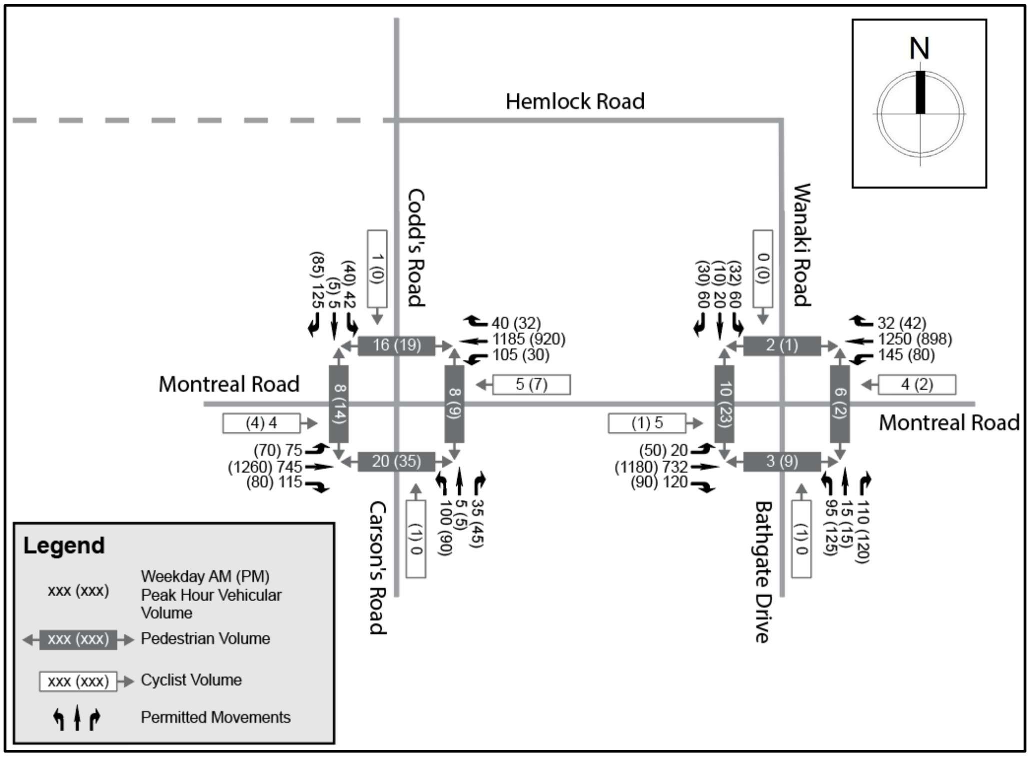
3.5.1.1 Existing Traffic Volumes

The existing weekday peak hour traffic volumes presented in this study were based on City of Ottawa turning movement counts conducted in November 2018, consistent with other recently-completed transportation studies within the vicinity of the subject lands. It is acknowledged that development within Wateridge Village has been ongoing since that time, however given the road closures associated with the reconstruction of Montreal Road west of St. Laurent Boulevard and the ongoing COVID-19 pandemic, it was not possible to collect updated turning movement count data representative of typical baseline conditions.

Given that the adjacent road network has been analysed extensively through previous transportation studies conducted for Wateridge Village, it is assumed that the TIA for Wateridge Phase 2A/2B TIA (Dillon, 2019) provides an adequate representation of Existing Traffic when superimposed with 50% of the Phase 2A/2B site-generated traffic. This additional traffic is assumed to represent the impacts associated with development that has occurred in the area since the Phase 2A/2B study was conducted. The existing traffic volumes are shown below in **Figure 6** and are provided for reference purposes only. As discussed previously, any intersection capacity analysis referenced in this study will instead focus on Future conditions.

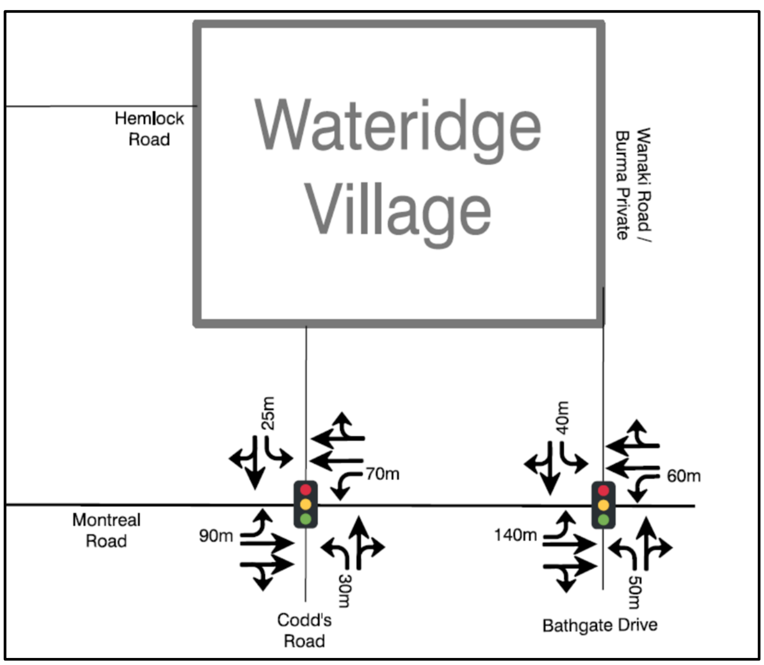
The existing lane configurations and intersection control are shown in **Figure 7** below.

Figure 6 – Existing Traffic Volumes



Note: Pedestrian and Cyclist volumes were counted on Tuesday, June 28, 2022.

Figure 7 – Existing Lane Configurations and Intersection Control



Source: Wateridge TIA Phase 2A/2B (Dillon, 2019) – Figure 18

3.6 Analysis Years

Based on the anticipated build-out year of the proposed development, the following two analysis years will be considered in this TIA:

- Year 2026 – Full Build-out of the Proposed Development
- Year 2031 – 5 Years Beyond Full Build-out/Occupancy

3.7 Exemptions Review

The TIA Guidelines provide exemption considerations for elements of the Design Review and Network Impact components. **Table 2** summarizes the TIA modules that are not applicable to this study.

Table 2 - Exemptions Review

TIA MODULE	ELEMENT	EXEMPTION CONISDERATIONS	REQUIRED
DESIGN REVIEW COMPONENT			
4.1 Development Design	4.1.2 Circulation and Access	• Only required for site plans	✓
	4.1.3 New Street Networks	• Only required for plans of subdivision	✗
4.2 Parking	4.2.1 Parking Supply	• Only required for site plans	✓
	4.2.2 Spillover Parking	• Only required for site plans where parking supply is 15% below unconstrained demand	✗
NETWORK IMPACT COMPONENT			
4.5 Transportation Demand Management	All Elements	• Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	✓
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	• Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	✓
4.8 Network Concept	n/a	• Only required when proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning	✗

4 Forecasting

4.1 Demand Rationalization

The purpose of this section is to rationalize future travel demands within the study area to account for potential capacity limitations in the transportation network and its ability to effectively accommodate the additional demand generated by a new development.

4.1.1 Description of Capacity Issues

A review of intersection capacity analyses for the Wateridge Phase 2A/2B and the Wateridge Phase 3/5 Draft TIA (J.L. Richards, 2021) indicate that there are no capacity issues expected within the timeframe of this study at any of the key access locations for Wateridge Village, including Montreal & Codd's/Carson's, Montreal & Wanaki/Bathgate, as well as the Hemlock/Aviation Parkway interchange.

4.1.2 Adjustment to Development-Generated Demands

Based on the lack of documented capacity issues from previous TIAs conducted for Wateridge Village, no adjustments to development-generated demands were applied in this study beyond the use of a refined 'blended' mode share, consistent with the Wateridge Phase 2A/2B TIA.

4.1.3 Adjustment to Background Network Demands

As prescribed in the TIA Guidelines and consistent with other TIAs conducted within Wateridge Village, the effects of peak-hour spreading have been considered in future analysis years of this study. It is anticipated that as traffic volumes continue to gradually increase, traffic will have a natural tendency to be more evenly distributed across the peak hour (PHF = 1.0) and eventually increase demands in the shoulders of the peak as well. The impacts of peak spreading are typically accounted for in the analysis of future conditions in recognition of this.

As no specific capacity issues have been identified through previous studies, no further adjustments to background network demands are necessary.

4.2 Development Generated Traffic

4.2.1 Trip Generation Methodology

Peak hour site-generated traffic volumes for the residential land use were developed using the 2020 TRANS Trip Generation Summary Report. The TRANS trip generation rates are based on blended rates derived from 49 trip generation studies undertaken between 2008 and 2012, the Institute of Transportation Engineers (ITE) Trip Generation Manual (11th Edition) and the 2011 TRANS Origin-Destination (O-D) Travel Survey. Separate peak period person-trip generation rates were developed for single-detached housing, low-rise multifamily housing (i.e. two storeys or less) and high-rise multifamily housing (i.e. three storeys or more). Site-generated peak period person-trips were estimated using these rates and subsequently subdivided based on representative mode share percentages applicable to the study area. Mode-specific adjustment factors were then applied to these peak period person-trips to determine the number of peak hour vehicle, passenger, transit, cycling and pedestrian trips.

The commercial components of the proposed development will be exclusively street-oriented, ground-floor uses with active entrances and will provide neighbourhood-scale amenities. As such, these businesses will primarily generate walking trips and only a negligible number of auto trips, therefore it was not necessary to undertake a separate commercial trip generation exercise as part of this study.

As the Wateridge Phase 2A/2B and the Rockcliffe CDP accounted for development in this area of 143 units/ha and the proposed development will result in 392 units/ha, only the difference in the trip generation between those densities will be reviewed at the regional site access intersections for Wateridge Village.

4.2.2 Residential Trip Generation Results

4.2.2.1 Peak Period Trip Generation

Peak period person-trips associated with the proposed development were determined using the trip generation rates from the 2020 TRANS Trip Generation Summary Report for the residential land use. The weekday peak periods are defined as (7:00 to 9:30) and (15:30 to 18:00). The peak period person-trip generation results for the proposed development have been summarized in **Table 3** below.

Table 3 – Peak Period Person-Trip Generation

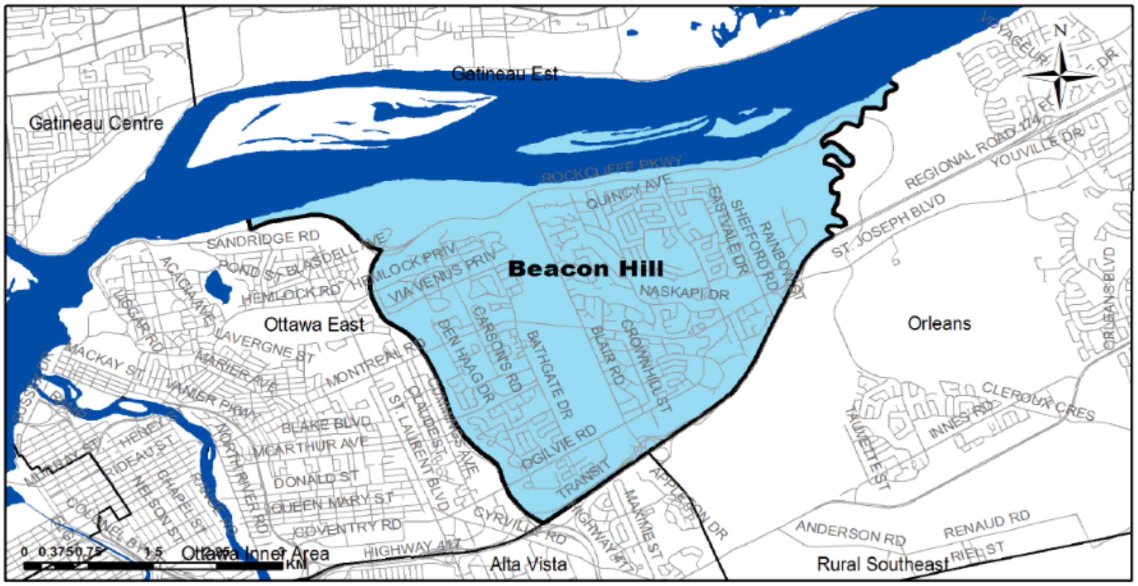
LAND USE	SIZE		PERIOD	PEAK PERIOD PERSON-TRIPS		
				IN	OUT	TOTAL
Multi-Unit (High-Rise)[1]	Building 1	216 units	AM	54	119	173
			PM	113	82	195
	Building 2	131 units	AM	32	72	104
			PM	68	50	118
	Building 3	108 units	AM	27	60	87
			PM	56	41	97
TOTAL		**455 units**	**AM**	**113**	**251**	**364**
			PM	**238**	**172**	**410**

Notes: [1] – 2020 TRANS defines 'Multi-Unit High-Rise' as 3 storeys or taller.

4.2.2.2 Mode Share Proportions

The 2011 TRANS Origin-Destination (O-D) Survey provides approximations of the existing modal share within the Ottawa East Traffic Assessment Zone (TAZ). The extents of the Beacon Hill TAZ are illustrated in **Figure 8** below. Relevant extracts from the 2011 O-D Survey are provided in **Appendix D**.

Figure 8 - Ottawa Beacon Hill TAZ



Source: 2011 TRANS O-D Survey

Existing weekday morning and afternoon peak hour mode share distributions for the proposed development were reviewed to obtain a better understanding of the travel characteristics within the Beacon Hill TAZ. Consistent with the Wateridge Phase 2A/2B TIA, refinements to the existing 'blended rate' mode share were applied to better represent the travel characteristics based on the site density and its location within the Community Core. The blended O-D Survey mode share distribution was used to determine the appropriate ratio of cycling and walking trips, which was not specifically defined in the Phase 2 TIA.

The existing blended mode share derived from the O-D Survey, along with the mode share targets extracted from the Phase 2 TIA and the mode share targets proposed for the subject development, are shown in **Table 4** below.

Table 4 – Existing & Proposed Mode Share Targets

TRAVEL MODE	O-D SURVEY - EXISTING MODE SHARE							WATERIDGE PHASE 2 TIA	MODE SHARE TARGETS
	AM FROM	AM TO	AM WITHIN	PM FROM	PM TO	PM WITHIN	BLENDED RATE [1]		
Auto Driver	59%	56%	32%	63%	58%	51%	56%	35%	35%
Auto Passenger	9%	12%	13%	12%	14%	25%	13%	13%	13%
Transit	26%	22%	5%	19%	24%	5%	19%	35%	35%
Cycling	2%	1%	2%	1%	2%	1%	1%	17%	3%
Walking	0%	2%	28%	2%	0%	17%	5%		14%
Other	5%	8%	21%	2%	3%	1%	6%	0%	0%

Notes:

[1] Weighted average of AM 'From', AM 'Within', PM 'To' & PM 'Within' from the 2011 TRANS O-D Survey, Beacon Hill TAZ

4.2.2.3 Trip Generation by Mode

The mode share targets from **Table 4** were applied to the number of development generated peak period person-trips to determine the number of trips per travel mode. The peak period to peak hour adjustment factors from Table 4 of the 2020 TRANS Trip Generation Summary Report were subsequently applied in order to convert to peak hour trips, shown in **Table 5** below.

Table 5 – Residential Peak Hour Person-Trips by Mode

MODE	AM Peak Hour			PM Peak Hour		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Auto Driver	19	42	61	37	26	63
Auto Passenger	7	15	22	14	10	24
Transit	21	49	70	39	28	67
Cycling	2	4	6	3	2	5
Walking	9	21	30	17	13	30
Total	58	131	**189**	110	79	**189**

As the Rockcliffe CDP previously accounted for development of 143 units/ha for the subject lands, the trips associated with those units are not included in the volumes from this proposed development at the regional study area intersections. The reduced trips were generated using the 2009 TRANS Trip Generation Residential Trip Rates Study Report to remain consistent with the methodology applied in the Wateridge Phase 2A/2B TIA. The resulting trips that were previously accounted for are outlined below in **Table 6**.

Table 6 – Residential Peak Hour Person-Trips Accounted for in CDP

MODE	AM Peak Hour			PM Peak Hour		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Auto Driver	9	31	40	27	16	43
Auto Passenger	3	11	15	10	6	16
Transit	9	31	40	27	16	43
Cycling	1	3	3	2	1	4
Walking	4	12	16	15	7	21
Total	26	88	**114**	80	47	**127**

These trips were then subtracted from the 2020 TRANS generated peak hour trips proportionally from each building to provide a realistic trip distribution from each access driveway. The resulting

Auto Driver peak hour trips for each building within the residential land use are summarized in **Table 7** below.

Table 7 – Additional Residential Peak Hour Auto Driver-Trips beyond CDP Density Targets

BUILDING	SIZE	PERIOD	PEAK HOUR VEHICLE TRIPS		
			IN	OUT	TOTAL
Building 1	216 units	AM	5	6	11
		PM	5	6	11
Building 2	131 units	AM	3	4	7
		PM	3	4	7
Building 3	108 units	AM	2	1	3
		PM	2	1	3
Total	**455 units**	**AM**	**10**	**11**	**21**
		PM	**10**	**11**	**21**

The results of the residential trip generation demonstrate that approximately 66% of the residential trips from the proposed development were previously accounted for in the Wateridge Phase 2A/2B and Phase 3/5 TIAs. As such, the majority of the downstream traffic impacts for the 1345, 1375 Hemlock Road and 375 Codd's Road development have been analyzed and considered in previous studies, therefore the new impacts from the proposed development are negligible.

4.2.2.4 Trip Reduction Factors

Deduction of Existing Development Trips

The subject property is currently undeveloped and therefore does not generate any trips.

Pass-by Traffic

Not Applicable: As discussed previously, it has been assumed that the proposed ground-floor commercial uses will generate a negligible number of vehicular trips and therefore it was not necessary to consider the application of a pass-by rate as part of the trip generate exercise undertaken for this study.

Synergy/Internalization

Synergy or internalization is typically applied to developments with two or more land uses to prevent double-counting of trips with multiple intermediate destinations within the same site. With respect to this site, the interaction between the residential and commercial land uses as the primary trip purpose is not expected to be significant in terms of vehicle trips. As such, no internalization has been considered in the analysis.

Based on the trip generation exercise presented above, the proposed development is expected to generate up to 61 and 63 new two-way vehicular trips during the weekday morning and afternoon peak hours at the proposed site access driveways. This trip generation is only 21 vehicles in excess of what had already been considered in the Wateridge Phase 2A/2B and therefore the net increase can be considered negligible.

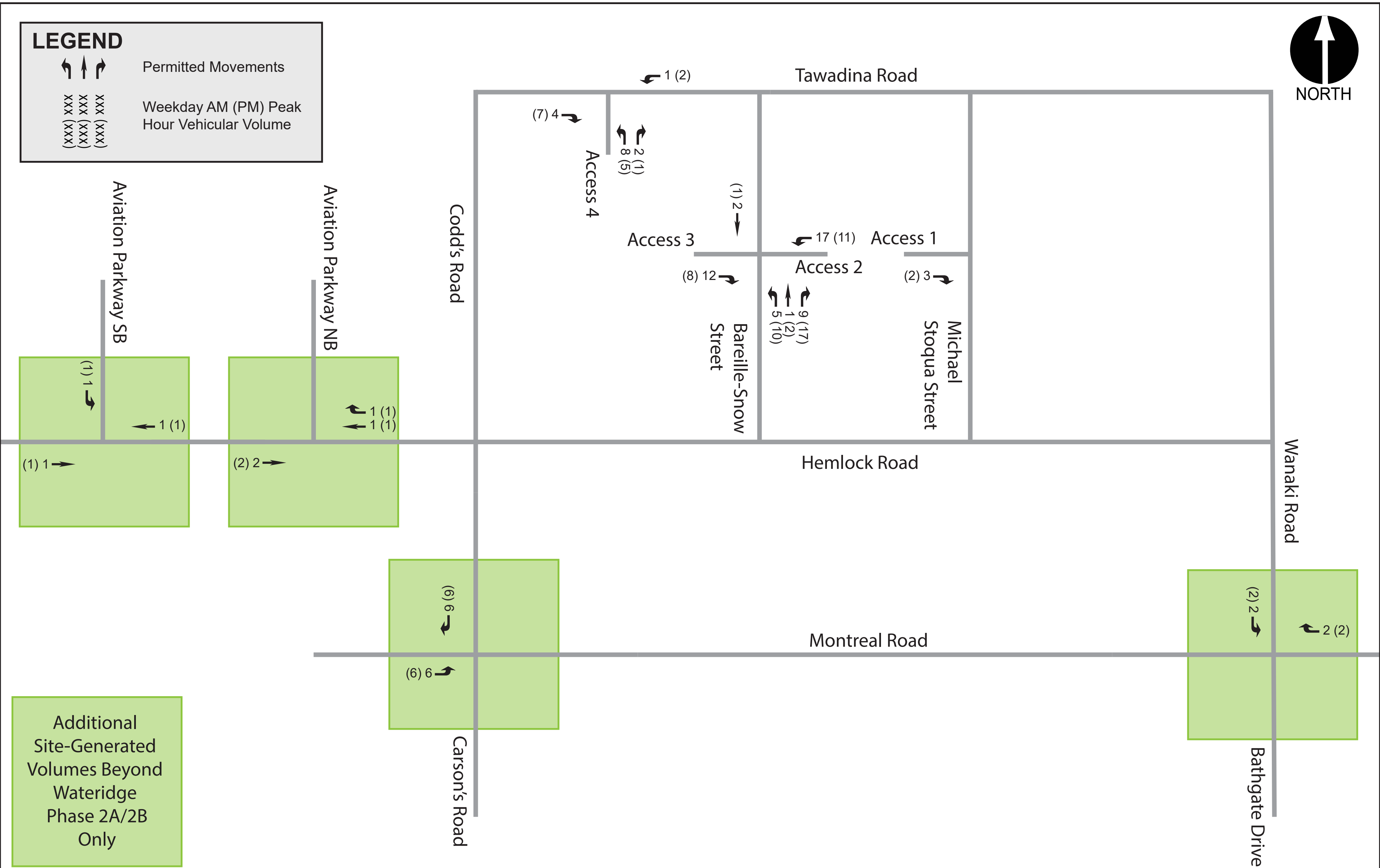
4.2.3 Trip Distribution and Assignment

Route selection and weighting for the proposed development distribution was derived based on a review of travel patterns from Ottawa Beacon Hill Traffic Assessment Zone (TAZ), the configuration of the road network within the vicinity of the site and the concentration of employment nodes within adjacent TAZs. Consideration was given to Google Maps travel times during peak hour conditions, as well as intersection-level turning movement counts at each study area intersection.

The global distribution of site-generated traffic defined below is also consistent with other TIAs conducted within Wateridge Village:

- 10% to/from the East
    - 100% via Montreal Road
- 45% to/from the South
    - 50% via Aviation Parkway
    - 30% via St. Laurent Boulevard
    - 15% via Blair Road
    - 5% via Carson's Road
- 45% to/from the West
    - 50% via Montreal Road
    - 25% via George-Étienne Cartier Parkway
    - 25% via Hemlock Road

Utilizing the estimated number of new auto trips and applying the above distribution, future site-generated traffic volumes are illustrated for each of the study area intersections in **Exhibit 3** below.



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1345, 1375 Hemlock & 375 Codd's Transportation Impact Assessment

Exhibit 3 - Site Generated Traffic

PROJECT No. 138889

SCALE: N.T.S.

4.3 Background Network Traffic

4.3.1 Changes to the Background Transportation Network

To properly assess future traffic conditions, planned modifications to the transportation network that may impact travel patterns or demand within the study area must be considered. Based on the future changes to the transportation network described in the Scoping section of this report, planned improvements to active transportation infrastructure support the targeted mode shares, while the extension of Hemlock Road will provide an additional route to/from the subject sites, thereby reducing travel demand at the existing access points on Montreal Road. Improvements to transit and active transportation facilities have been determined through the completed Montreal Road Environmental Assessment (EA) which will further support travel by non-auto modes on this arterial road within the study area in the longer-term.

4.3.2 General Background Growth Rates

The background growth rate is intended to represent any regional growth from outside the study area that will travel along the adjacent road network. Consistent with other TIAs conducted within the study area, a 0% growth rate is proposed within the internal road network of Wateridge Village, as well as on Montreal Road. It is acknowledged, however, that the Wateridge development will generate significant traffic volumes and therefore the impacts of this development have been accounted for separately in this analysis.

4.3.3 Other Area Development

Future adjacent developments in the vicinity of the proposed development have been identified previously in the Scoping section of this report. **Table 8** below summarizes the land use details and expected build-out year of these future adjacent developments.

Table 8 - Future Adjacent Developments

DEVELOPMENT	LAND USE	EXPECTED BUILD-OUT YEAR
Wateridge Phase 1A	• 214 residential dwelling units • Elementary School Block	2021[1]
Wateridge Phase 1B	• 720 residential dwelling units • 32,450 m^2 of commercial space	2022[2]
Wateridge Phase 2A/2B	• 990 residential dwelling units • 271,601 m^2 of commercial space	2022
Wateridge Phases 3 & 5	• 1826 residential dwelling units • Commercial space for 580 employees • 2.5 ha public park space	2023 2025[3]
715 Mikinak	• 271 residential dwelling units • 265 m^2 of commercial space	2026[4]

Notes:
[1] All residential units fully built out/occupied. Only the school block remains to be constructed.
[2] Construction is underway. Build-out/occupancy assumed to occur by 2026 study analysis year.
[3] Phases 3 & 5 are expected to be built out in 2023 and 2025 respectively.
[4] Construction has not yet begun. Build-out assumed by 2026 study analysis year.

4.4 Traffic Volume Summary

4.4.1 Future Background Traffic Volumes

Future background traffic volumes were derived by superimposing future adjacent development volumes directly onto existing traffic. As discussed previously, all background growth through the study area was assumed to originate from these adjacent developments and thus no growth rate was considered in the calculation of future background traffic volumes.

Since the adjacent developments are expected by the build-out/occupancy of the proposed development in 2026, future background volumes can be represented by a single scenario.

Exhibit 4 below presents the future background traffic volumes anticipated for both the 2026 and 2031 analysis years.

4.4.2 Future Total Traffic Volumes

Future total traffic volumes have been established by combining the site-generated traffic volumes with the future background traffic volumes. Similar to the future background volumes, future total volumes can be represented by a single scenario for the purposes of this study.

Exhibit 5 below presents the future total traffic volumes anticipated for both the 2026 and 2031 analysis years.

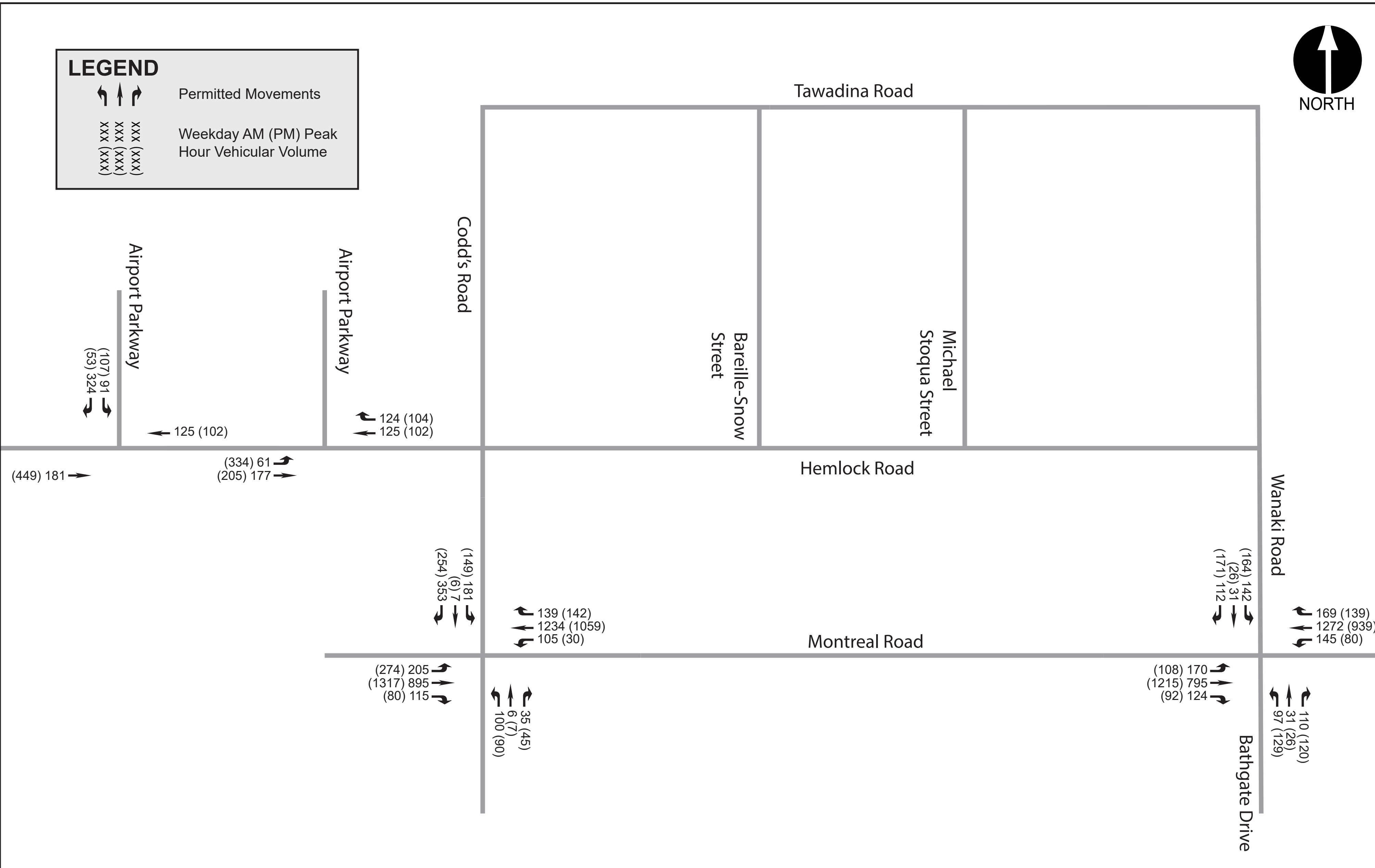

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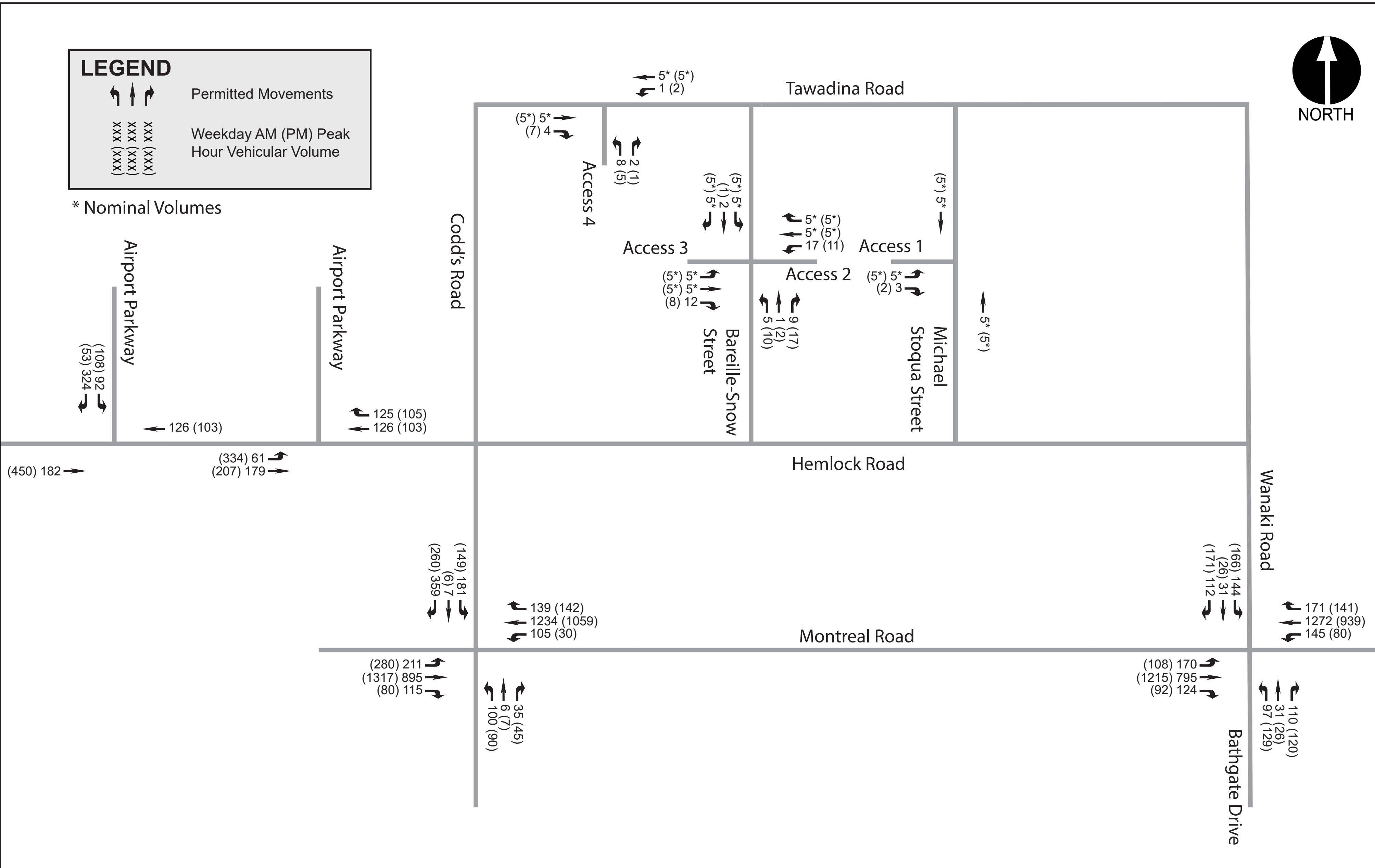
Exhibit 4 - Future (2026 & 2031) Background Traffic

PROJECT No. 138889

SCALE: N.T.S.



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1345, 1375 Hemlock & 375 Codd's Transportation Impact Assessment

Exhibit 5 - Future (2026 & 2031) Total Traffic

PROJECT No. 138889

SCALE: N.T.S.

5 Analysis

5.1 Development Design

5.1.1 Design for Sustainable Modes

For consistency with the City of Ottawa's Urban Design Guidelines and transportation policies, new developments shall provide safe and efficient access for all users, while creating an environment that encourages walking, cycling and transit use.

Two of the property parcels within the proposed development abut the segment Hemlock Road identified in the Rockcliffe CDP as the Hemlock Core Street which is planned to accommodate grade-separated cycle tracks and concrete sidewalks in both directions to promote the use of active transportation modes.

The primary entrances for each building will be barrier-free to provide direct pedestrian access to the nearest boundary street. A network of pathways is proposed throughout the three parcels to facilitate connections between building entrances and pedestrian facilities proposed on each boundary street. The above noted design and infrastructure improvements contribute to a development that will reduce private auto usage by integrating well with the existing and proposed sustainable transportation infrastructure.

The study area is presently served by four transit routes, as indicated previously in **Figure 1**. All three development parcels will be within a 400m walking distance to existing on Codd's Road and Mikinak Road, as well as future bus stops on Hemlock Road adjacent to the site. The actual walking distance to the nearest bus stop for each primary building entrance are provided in **Table 9** below.

Table 9 – Distances between Primary Entrances and Nearest Bus Stops

	BUILDING 1	BUILDING 2	BUILDING 3
Primary Commercial Entrance (Existing Bus Stops)	370m	395m	355m
Primary Commercial Entrance (Proposed Bus Stops)	240m	135m	135m

The proposed bike parking areas are generally located either at-grade within close proximity to primary active commercial/residential building entrances, or within the upper level of the parking garage for ease of access. Wherever feasible, outdoor bike racks for Buildings 1 and 2 which directly abut Hemlock Road are located adjacent to the proposed cycle track facility to facilitate connectivity and encourage cycling as a convenient mode of transportation.

The TDM-Supportive Development Design and Infrastructure Checklist was completed and is provided in **Appendix E**. This checklist identifies specific measures that are being considered in association with the proposed development to offset the vehicular impact on the adjacent road network, including providing bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible and ensuring safe, direct and attractive walking routes from building entrances to nearby transit stops.

5.1.2 Circulation and Access

The proposed development will provide two, two-way private approaches on Bareille-Snow Street, a two-way private approach on Tawadina Road and one outbound-only connection on Michael

Stoqua Street. The two-way internal drive aisles for the subject development parcels will provide between 6.0 and 6.7 metres of clear width within the surface parking lots, while the underground parking garages will provide 6 metres of clear width which conforms to the minimum requirements specified in the Zoning By-law.

Refuse areas are provided for each of the three proposed development, as indicated previously on **Exhibit 2**. It is expected that refuse bins will be rolled to the public ROW for collection and therefore waste collection vehicles will not be required to enter any of the three sites. A swept path analysis exercise was to confirm that delivery trucks and TAC standard LSU vehicles are able to access each site, maneuver to the designed loading area and egress back onto the public ROW. Through this swept path analysis exercise, it was confirmed that the curb radii at each of the proposed access driveways could be reduced to 5m, per the City's Traffic-Calming Guidelines.

Swept path analyses for the proposed development is included in **Appendix F**.

5.1.3 New Street Networks

Not Applicable: The New Street Networks element is exempt from this TIA, as defined in the study scope. This element is not required for development applications involving site plans.

5.2 Parking

5.2.1 Parking Supply

Vehicular parking will be provided at-grade and underground with a total of 397 spaces proposed on-site, consisting of 343 tenant, 43 visitor spaces and 11 commercial spaces. Zoning By-law 2008-250 indicates that a minimum of 279 vehicle parking spaces are required on-site. As such, the proposed development is in compliance with the by-law in terms of vehicular parking supply.

A total of 33 bike parking spaces are provided outside across all 3 sites, while the remaining 211 stalls are provided in the upper levels of the park garage for the three buildings within the proposed development.

A total of 244 bicycle parking spaces are proposed on-site, comprising of 239 residential spaces and 5 outdoor commercial spaces. The proposed development therefore provides bicycle parking in excess of the 229 spaces required in the by-law.

A breakdown of vehicular and bike parking provided in comparison with the by-law requirements is provided in **Table 10** below.

Table 10 – Vehicular Parking Supply in Comparison with Required Spaces

BUILDING	PARKING TYPE	VEHICULAR PARKING STALLS		BIKE PARKING STALLS	
		ZONING BYLAW REQUIREMENTS	PARKING PROVIDED	ZONING BYLAW REQUIREMENTS	PARKING PROVIDED
Building 1 (216 units, ~411.7 m^2 commercial)	Resident	108	166	108	116
	Visitor	21	21		
	Commercial	11	11	2	2
	Sub-Total	**140**	**198**	**110**	**118**
Building 2 (131 units, ~169.2 m^2 commercial)	Resident	66	120	65.5	67
	Visitor	12	12		
	Commercial	N/A	N/A	<1	3
	Sub-Total	**78**	**132**	**66**	**70**
Building 3 (108 dwelling units)	Resident	53	57	53	56
	Visitor	10	10		
	Commercial	N/A	N/A	N/A	N/A
	Sub-Total	**63**	**67**	**53**	**56**
Overall Total		**298**	**397**	**229**	**244**

Accessible parking spaces are provided for all three buildings within the proposed development in accordance with the City of Ottawa Accessibility Design Standards (2015), as summarized in **Table 11** below.

Table 11 – Summary of Accessible Parking Requirements per Building

BUILDING	ACCESSIBLE PARKING REQUIRED	ACCESSIBLE PARKING PROVIDED
Building 1	Type A – 2 spaces Type B – 3 spaces	Type A – 2 spaces Type B – 3 spaces
Building 2	Type A – 2 spaces Type B – 2 spaces	Type A – 2 spaces Type B – 2 spaces
Building 3	Type A – 1 spaces Type B – 2 spaces	Type A – 1 spaces Type B – 2 spaces
Total	**Type A – 5 spaces** **Type B – 7 spaces**	**Type A – 5 spaces** **Type B – 7 spaces**

5.3 Boundary Streets

There are five existing boundary streets adjacent to the proposed development: Tawadina Road, Michael Stoqua Street, Bareille-Snow Street, Hemlock Road, and Codd's Road.

5.3.1 Mobility

Segment-based Multi-Modal Level of Service (MMLOS) was previously conducted as part of the TIA for Wateridge Phase 1B, Block 19 immediately to the west of the proposed development and are summarized in **Table 12** below.

Table 12 – Segment-Based Multi-Modal Level of Service (MMLOS)

LOCATION	LEVEL OF SERVICE BY MODE			
	PEDESTRIAN (PLOS)	BICYCLE (BLOS)	TRANSIT (TLOS)	TRUCK (TkLOS)
SEGMENT(S)				
Bareille-Snow Street	B (Target: C)	B (Target: D)	- [1] (Target: N/A)	- (Target: N/A)
Hemlock Road	B (Target: C)	A (Target: D)	E (Target: D[1])	- (Target: N/A)

Source: Wateridge Phase 1B, Block 19 (Novatech, 2020)

Notes:

1. Local roads are not expected to support transit service.

Although not included in the analysis for the Wateridge Phase 1B, Block 19 TIA, Codd's Road, Michael Stoqua Street and Tawadina Road are local roads that will consist of a similar cross-section to Bareille-Snow Street and therefore the segment-based MMLOS results for these two roads are expected to be the same.

As indicated in Table 9 above, the PLOS and BLOS targets are being achieved on all boundary streets. The segment of Hemlock Road abutting the subject development operates slightly beyond its target of 'D' with a TLOS of 'E'. Opportunities to implement any isolated transit measures should be considered in order to reduce the potential for transit delays along this segment of Hemlock Road.

No TkLOS analysis was conducted for any of the boundary streets, as none are classified as arterial roads and truck routes according to the Transportation Master Plan.

Detailed extracts of the Segment-based Multi-Modal Level of Service (MMLOS) analyses from the Wateridge Phase 1B, Block 19 TIA are provided in **Appendix G**.

5.3.2 Road Safety

As discussed previously in the study scope, the proposed development is located within Wateridge Village, a new community, therefore there are no historical collision records available for any roads adjacent to the site for the past 5 years.

Collision records for the intersections of Montreal & Codd's/Carson's, as well as Montreal & Burma/Bathgate were reviewed in prior studies, including the TIAs for Phases 1A, 1B, 2A/2B and the Wateridge Village Community Transportation Study (CTS) and the key conclusions of this analysis are summarized in Section 3.1.7 above.

Relevant extracts of collision analysis from Section 2.6 of the Wateridge Phase 1B TIA are included in **Appendix C**.

5.4 Access Intersections

5.4.1 Location and Design of Access

The proposed development will provide two, two-way private approaches on Bareille-Snow Street, a two-way private approach on Tawadina Road and one outbound-only approach on Michael Stoqua Street. The proposed site access driveways are in conformance with the City of Ottawa Private Approach By-law 2003-447, with particular confirmation of the following items:

- <u>Width</u>: A private approach shall have a minimum width of 2.4m and a maximum width of 9.0m. The City of Ottawa Zoning By-law, however, indicates that for driveways providing access to a parking lot or parking garage, a two-way private approach shall have a minimum width of 6.0m and a one-way private approach shall have a minimum width of 3m.
    - ➢ Access #1 (one-way) will be 5.2m wide ✓
    - ➢ Site Access #2 and #3 (two-way) will be 6.7m wide ✓
    - ➢ Access #4 (two-way) will be 6m wide. ✓
- <u>Quantity and Spacing of Private Approaches</u>: For sites with frontage between 35 and 45 metres, a maximum of two (2) two-way private approaches or two (2) one-way private approaches are permitted. For sites with frontage between 46 and 150 metres, a maximum of one (1) two-way private approach and two (2) one-way private approaches or two (2) two-way private approaches is permitted. Any two private approaches must be separated by at least 9.0m and can be reduced to 2.0m in the case of two, one-way driveways. On lots that abut more than one roadway, these provisions apply to each frontage separately.
    - ➢ Building 1 – A two-way private is proposed on Bareille-Snow Street and one-way private approach is proposed on Michael Stoqua Street, both of which are accommodated on 52-metre frontages. ✓
    - ➢ Building 2 – A single, two-way private approach is proposed within the approximate 51-metre frontage on Bareille-Snow Street. ✓
    - ➢ Building 3 – A single, two-way private approach is proposed within the approximate 36-metre frontage on Tawadina Road. ✓
- <u>Distance from Property Line</u>: Private approaches must be at least 3.0m from the abutting property line, however this requirement can be reduced to 0.3m provided that the access is a safe distance from the access serving the adjacent property, sight lines are adequate and that it does not create a traffic hazard.
    - ➢ All four proposed site access driveways are offset at least 3 metres from the nearest property line. ✓
- <u>Slopes of Private Approaches:</u> The grade of a private approach serving a parking area of more than 50 spaces must not exceed 2% within the private property for a distance of 9 metres from the highway/curb line.
    - ➢ A review of the grading plan indicates that the slopes of the proposed site access driveways serving the subject lands are expected to remain within the acceptable 2%, with the exception of Access #1 (2.1%) and Access #3 (2.7%) as a result of grading constraints. Given that these slopes are reasonably close to the Private Approach By-law threshold, satisfy the intent of the by-law to contain drainage within subject lands and do not pose accessibility or safety challenges for individuals, this slight exceedance is deemed acceptable in both instances.

The Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads (June 2017) does not suggest a minimum clear throat length for a site access driveway proposed on a local road. The clear throat length is provided to ensure that any queues that form due to on-site circulation blockages do not spillback onto collector or higher-order roads. Given the low traffic volumes typically expected on local roads, occasional queue spillback is not likely to result in traffic operational issues.

5.4.2 Access Intersection Control

It is anticipated that the site access driveways will be unsignalized.

5.4.3 Access Intersection Design (MMLOS)

Not Applicable – The site access driveways will be unsignalized, therefore intersection-based MMLOS analysis is not required for these locations.

5.5 Transportation Demand Management (TDM)

The City of Ottawa is committed to implementing Transportation Demand Management (TDM) measures on a City-wide basis in an effort to reduce automobile dependence, particularly during the weekday peak travel periods. TDM initiatives are aimed at encouraging individuals to use non-auto modes of travel during the peak periods.

5.5.1 Context for TDM

As discussed previously, the proposed development is located adjacent to Hemlock Road within the Core Area of Wateridge Village, which will include enhanced facilities to further support the use of active and sustainable modes of transportation such as active frontages, as well as cycle tracks and concrete sidewalks on both sides of the road. The three local roads adjacent to the development will include a concrete sidewalk on at least one side allowing for easy connection to the facilities on Hemlock Road. The planned unit breakdown is as follows: 0.4% Studio, 72.2% One-Bedroom and 27.4% Two-Bedroom.

5.5.2 Need and Opportunity

With the development of Wateridge Village, there is an opportunity to increase the overall proportion of sustainable transportation trips within the surrounding community.

Mode share targets applied in this TIA were consistent with Wateridge Village Phase 2 and although the sustainable mode share targets aim to achieve a higher active transportation target in comparison with a typical blended rate, given the development's context and the suite of TDM measures outlined below, it is expected that these targets will be achievable.

5.5.3 TDM Program

The proposed development conforms to the City's TDM principles by providing convenient and direct connections to adjacent pedestrian and cycling facilities.

The City of Ottawa's TDM Measures Checklist was completed for the proposed development and is provided in **Appendix E**. This checklist indicates measures that are being contemplated as part of this development, including the following:

- Designate an internal program coordinator, or contract with an external coordinator;
- Display relevant transit schedules and route maps at entrances;
- Unbundle parking costs from purchase price and monthly rent; and

- Provide a multimodal travel option information package to new residents.

5.6 Neighbourhood Traffic Management

5.6.1 Adjacent Neighbourhoods

As the development is dependent on collector roads for access, a review of Neighbourhood Traffic Management thresholds is required as part of the TIA process.

The TIA Guidelines specify a thresholds for collector and major collector roads, as shown in **Table 13** below.

Table 13 - Neighbourhood Threshold Review

BOUNDARY STREET	CLASSIFICATION	THRESHOLD	FUTURE (2031) TOTAL TRAFFIC PEAK DIRECTION VOLUMES
Codd's Road	Collector Road	300 Vehicles/Hour (2,500 Vehicles/Day)	547 Vehicles/Hour (AM Peak) 430 Vehicles/Hour (PM Peak)
Hemlock Road	Major Collector Road	600 Vehicles/Hour (5,000 Vehicles/Day)	253 Vehicles/Hour (AM Peak) 450 Vehicles/Hour (PM Peak)
Wanaki Road	Major Collector Road	600 Vehicles/Hour (5,000 Vehicles/Day)	372 Vehicles/Hour (AM Peak) 363 Vehicles/Hour (PM Peak)

As shown in **Table 13** above, Codd's Road is projected to operate above the threshold for a collector road, however this is not uncommon on the approach to an intersection with a significant arterial such as Montreal Road and the site-generated traffic volumes and the site-generated traffic impacts are not anticipated to change the role or function of this road. Furthermore, Codd's Road has been designed with traffic calming measures, has segregated bicycle facilities, a buffered sidewalk and limited residential driveways. These results are consistent with the Wateridge Phase 3/5 TIA which recommended reclassifying Codd's Road within the study area as a major collector road to better reflect its role and function as a primary multi-modal connection between Wateridge Village and Montreal Road.

It is acknowledged that some site-generated traffic may cut-through the neighbourhood south of Montreal Road, however, as indicated on **Exhibit 3**, the proposed development is an overall low traffic generator and Wateridge Village is well connected to the regional road network. Both of these factors will contribute to a reduced likelihood for neighbourhood traffic impacts. Further, a Post-Development Monitoring Plan (see

Appendix H) was developed as part of the TIA for Wateridge Phase 2A/2B to help manage and mitigate any potential cut-through traffic impacts in adjacent neighbourhoods, should this become and issue as development within Wateridge Village progresses. As previously mentioned, the net vehicular impact of this development is nominal when compared to the previous traffic projections and analysis prepared as part of the Wateridge Phase 2A/2B application.

5.7 Transit

5.7.1 Route Capacity

The estimated future site-generated transit demand was provided in the Forecasting component of this study and the results are summarized in **Table 14** below.

Table 14 – Development Generated Transit Demand

PERIOD	PEAK PERIOD DEMAND		
	IN	OUT	TOTAL
AM	21	49	70
PM	39	28	67

As indicated in **Table 14** above, site-generated two-way transit ridership volumes of up to 70 and 67 passengers are expected during the weekday morning and afternoon peak hours, respectively. With consideration that the study area is served by four transit routes during the weekday peak hours with average headways of approximately 20 minutes and that a typical OC Transpo bus has an approximate 100-passenger capacity, these site-generated transit trips are expected to be easily accommodated with the existing transit service. As such, no additional transit capacity will be required specifically for the proposed development. It is expected, however, that transit capacity and coverage will continue to improve incrementally within the community as Wateridge Village is built out.

5.7.2 Transit Priority Measures

The expected increase in transit ridership associated with the proposed development is not expected to trigger the need for any isolated transit priority measures to offset any transit delays.

As discussed previously, the Montreal Road EA investigated options for improving transit service efficiency along this corridor in the longer-term which will further reduce reliance on private automobiles. This EA study resulted in a recommended plan which includes curbside bus lanes, along with improved multi-modal connectivity for surrounding communities to access Blair and Montreal Stations.

5.8 Intersection Design

The following sections summarizes results of the multi-modal intersection capacity analysis conducted within the study area, as referenced from other previous studies.

5.8.1 Intersection Control

The following section evaluates the need to conduct traffic signal warrant analyses and roundabout analyses at any applicable study area intersections.

5.8.1.1 Traffic Signal Warrants

Not Applicable – All intersections within the study area are presently signalized with the exception of the southbound off-ramp at Hemlock Road & the Aviation Parkway, which is configured as a stop-controlled intersection. The capacity analysis presented in subsequent sections of this report indicates that this intersection is expected to operate at an acceptable level of service (i.e. LOS 'D' or better) beyond the horizon year of this study. As such, no traffic signal warrant analysis is necessary for this study.

5.8.1.2 Roundabout Analysis

Not Applicable - As per the City's Roundabout Implementation Policy, intersections that satisfy any of the following criteria should be screened utilizing the Roundabout Initial Feasibility Screening Tool:

- At any new City intersection;
- Where traffic signals are warranted; or
- At intersections where capacity or safety problems are being experienced.

None of the study area intersections meet any of the above criteria, therefore no roundabout analysis is required for this study.

Further, the Montreal Road EA functional design did not identify roundabouts as a preferred form of traffic control through the study area.

5.8.2 Intersection Capacity Analyses

Because the proposed development will be a low traffic generator and the key site access intersections for Wateridge Village have been extensively studied in numerous TIAs, it was agreed by City technical staff that a comparison of site-generated traffic volumes with the corresponding future total traffic volumes from the recent Phase 2A/2B and Phase 3/5 studies would sufficiently address the capacity analysis portion of the TIA for these three intersections. Extracts from Wateridge Phase 2A/2B and Phase 3/5 are provided in **Appendix I** and a summary is provided in **Table 15** below.

Table 15 – Wateridge Phase 2A/2B– 2022 & 2027 Total Traffic [1] and Phase 3/5 - 2025 & 2030 Total Traffic[2]

INTERSECTION	TRAFFIC CONTROL	AM PEAK HOUR		PM PEAK HOUR	
		OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)	OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)
Montreal & Codd's/ Carson's[2]	Signalized	B (0.68)	**NBL (1.06)**	A (0.56)	NBL (0.88)
Montreal & Wanaki/ Bathgate[1]	Signalized	A (0.55)	EBL (0.89)	A (0.53)	NBL (0.84)
Hemlock & Aviation Parkway NB On-Ramp[2]	Unsignalized	A (2.4s)	EBTL (2.4s)	A (6.5s)	EBTL (6.5s)
Hemlock & Aviation Parkway SB Off-Ramp[2]	Unsignalized	A (14.2s)	SBL (14.2s)	A (14.1s)	SBL (14.1s)

[1]*Source: Wateridge TIA Phase 2A/2B (Dillon, 2019)*
[2]*Source: Wateridge TIA Phase 3/5 Draft (J.L.Richards, 2021)*

Based on the above results extracted from the Wateridge Phases 2A/2B and 3/5 TIAs and presented in **Table 15** above, there is shown to be significant additional capacity available overall at the three key access intersections associated with Wateridge Village under 2026 and 2031 analysis years of this study. Based on the logical distribution of site-generated traffic applied in the Forecasting component of this TIA, the proposed development is expected to contribute negligible volumes to the three regional access intersections of less than 10 vehicles per hour during the weekday morning and afternoon peak hours.

5.8.3 Intersection Design (MMLOS)

5.8.3.1 Intersection-Based MMLOS Results

As discussed in the study scope, Intersection-based Multi-Modal Level of Service (MMLOS) analysis was recently conducted as part of the Wateridge Phase 1B, Block 19 TIA. This analysis was based on the methodology prescribed in the 2015 City of Ottawa Multi-Modal Level of Service (MMLOS) Guidelines. A 2017 addendum to the original MMLOS Guidelines was subsequently released along with a standardized spread to calculate level of service for each mode. The parameters from the Wateridge Phase 1B TIA were extracted and refined as necessary to account for updates to the MMLOS calculation methodology, as well as the recently-completed conversion of Montreal & Wanaki/Bathgate to a fully 'protected intersection' configuration.

Detailed MMLOS analysis conducted using the City of Ottawa's standardized spreadsheet, as well as extracts from the Wateridge Phase 1B, Block 19 TIA, are provided **Appendix G**.

The refined intersection-based MMLOS results are summarized in **Table 16** below.

Table 16 – Intersection-Based MMLOS

INTERSECTION	LEVEL OF SERVICE BY MODE			
	PEDESTRIAN (PLOS)	BICYCLE (BLOS)	TRANSIT (TLOS)	TRUCK (TkLOS)
Montreal & Codd's/ Carson's	**F** (Target: C)	**F** (Target: B)	**F** (Target: C)	**E** (Target: D)
Montreal & Wanaki/ Bathgate	**E** (Target: C)	**C** [1] (Target: B)	**B** (Target: C)	**E** (Target: D)

Source: Adapted from Wateridge Phase 2A/2B TIA (Dillon, 2019)

Note: [1]BLOS revised in recognition of two-stage left-turn facilitated by recent 'protected intersection' upgrade.

5.8.3.2 Summary of Potential Improvements

Based on the MMLOS results outlined in **Table 16** above, the following measures have been identified that could improve conditions for each travel mode:

Pedestrians

- The analysis indicates that both study area intersections are not currently meeting the City's PLOS target of 'C', based on the result of the PETSI score. According to the Wateridge Phase 1B, Block 19 TIA, improving the PLOS would require reducing crossing distances and restricting turning movements on Montreal Road. It should be noted that although Montreal & Wanaki/Bathgate intersection does not achieve the target PLOS, its recent upgrade to a 'protected intersection' is expected to help significantly improve overall pedestrian comfort and safety.

Cyclists

- Based on the analysis, neither study area intersection is presently achieving the BLOS target of 'B'. The upgrade of Montreal & Wanaki/Bathgate to a 'protected intersection' configuration substantially improved the BLOS from 'F' to 'B' by facilitating two-stage left-turns for cyclists on all approaches, however due to the assumed operating speed on Montreal Road (70km/h), the overall BLOS would still operate slightly above the target of BLOS 'B'. A substantial reduction in operating speeds along Montreal Road to 50km/h, as well as the introduction of a 'protected intersection' configuration at the Montreal & Codd's intersection would be required to achieve the BLOS target at both locations.

Transit

- The results of the analysis indicate that the Montreal & Wanaki intersection is presently operating within the TLOS target of 'C', while the Montreal & Codd's/Carson's intersection is exceeding this target with a TLOS of 'F'. The Montreal Road EA functional design includes curbside transit lanes which would be expected to significantly reduce transit delays and improve the TLOS along this corridor in the longer-term.

Truck

- The results of the analysis indicate that both intersections are operating slightly above the TkLOS target of 'D'. Failure to meet the TkLOS target can be attributed to the single receiving lane on the sidestreets, as well as the relatively tight turning radii. It should be noted, however, that truck turning movements at these intersections are expected to be infrequent, as none of the sidestreets are designated as truck routes in the Official Plan or are classified as arterial roads.

The recommended measures listed above are intended only as suggestions to the City on how the MMLOS within the study area could be improved and do not identify measures to be implemented as a direct consequence of this development. The MMLOS analysis identifies existing deficiencies in the study area which are not expected to be exacerbated by the proposed development.

5.9 Geometric Review

5.9.1 Sight Distance and Corner Clearances

The proposed site access driveways are located along straight segments of Michael Stoqua Street, Bareille-Snow Street and Tawadina Road with clear sightlines in both directions. The Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads indicates that a minimum corner clearance of 15m should be maintained between a private approach on a local road and any intersecting road. The proposed site access driveways will be located at least 30 metres from the nearest intersecting road and therefore the offset distance prescribed in TAC is achievable at all four locations.

5.9.2 Auxiliary Lane Analysis

The four proposed site access driveways all provide vehicular connections to local roads which can be assumed to have low vehicle volumes and operating speeds, therefore a review of auxiliary left- or right-turn lanes is not required at any of these locations.

A review of the left- and right-turn auxiliary turning lane requirements for the signalized study area intersections is provided below:

5.9.2.1 Signalized Auxiliary Left-Turn Requirements

The results of the 95th percentile queue length analysis conducted as part of the Phase 2A/2B and 3/5 TIAs which are expected to be most impacted by the proposed development are presented in **Table 17** below.

Table 17 - Auxiliary Left-Turn Storage Analysis at Signalized Intersections

INTERSECTION	APPROACH	95TH %ILE QUEUE LENGTH		EXISTING PARALLEL LANE LENGTH (M)	STORAGE DEFICIENCY (M)
		AM PEAK HR	PM PEAK HR		
Montreal & Codd's/ Carson's [1]	EB	m10.5	m6.0	90	-
Montreal & Wanaki/Bathgate [2]	SB	46	52	40	-

Sources: [1] Wateridge Phase 3/5 Draft TIA (J.L. Richards, 2021)
[2] Wateridge Phase 2A/2B TIA (Dillon, 2019)

As indicated in **Table 17**, the results of the queuing analysis conducted as part of the Phase 3/5 TIA indicate that the eastbound left-turn movement is expected to have a 95th percentile queue length of in the order of 11 metres which could easily be accommodated in the 90 metres of available parallel lane storage.

It should be noted that although projected southbound left-turn queue lengths at the Montreal & Wanaki intersection indicate that minor capacity issues of 1 to 2 car lengths may potentially occur within the timeframe of this study, the proposed development will contribute nominal volumes to this movement in the order of just 2 to 3 vehicles or an approximate 2% increase during each weekday peak hour. Further, Montreal & Wanaki was recently reconstructed as a 'protected intersection' to improve driver sightlines, which may also result in improved traffic operations and mitigate the occurrence of future potential queuing issues at this location. As such, no additional modifications to the southbound left-turn auxiliary lane are required.

5.9.2.2 Signalized Auxiliary Right-Turn Lane Requirements

Section 9.14 of TAC suggests that auxiliary right-turn lanes shall be considered when more than 10% of vehicles on an approach are turning right and when the peak hour demand exceeds 60 vehicles. The purpose of this guideline is to mitigate operational impacts to through-traffic, particularly on high-speed arterial roadways, and may not be applicable in all circumstances.

There are presently no auxiliary right-turn lanes provided at any of the regional access study area intersections. Despite this, queue lengths on all right-turns on Montreal Road and Hemlock Road are expected to remain manageable, as indicated by queuing analysis conducted for the Phase 2A/2B and 3/5 TIAs, remaining well within the spacing between adjacent signalized intersections and therefore are expected to result in minimal upstream and downstream traffic impacts. Due to the low overall traffic volumes expected to originate from the east, the westbound right-turn movements at both intersections on Montreal Road will experience negligible volume increases of at most 2 additional vehicles per hour. As such, no auxiliary right-turn lanes are required to accommodate site-generated traffic.

5.10 Summary of Recommended Modifications

All study area intersections were shown to operate at an acceptable level of service (i.e. LOS 'D' or better) during the weekday peak hours and beyond the 2031 horizon year, based on extracts from previous TIAs for Wateridge Village reviewed as part of this study.

Based on the queuing analyses referenced in the preceding section, the Montreal & Wanaki intersection may experience minor spillback on the southbound left-turn auxiliary lane during weekday peak periods. Site-generated traffic volumes are expected to contribute a negligible number of additional vehicle trips to this movement (i.e. 3 vehicles per hour less), therefore it is not anticipated that any potential queuing issues will be exacerbated by the proposed development. Further, the recent conversion of Montreal & Wanaki to a 'protected intersection' configuration is expected to mitigate these potential spillback issues.

The MMLOS results indicated existing identified deficiencies documented in other TIAs conducted within Wateridge Village. These deficiencies primarily pertain to user comfort and highlight potential issues that could be considered for improvement by the City but are not required to safely accommodate the proposed development.

6 Conclusion

The proposed mixed-use residential development at 1345, 1375 Hemlock Road and 375 Codd's Road is expected to generate up to 61 and 63 two-way vehicular trips during the weekday morning and afternoon peak hours which represents only 21 vehicles in excess of what had already been considered in the Wateridge Phase 2A/2B. This magnitude of additional trips can be considered negligible, especially when stratified by mode share from the Ottawa East Traffic Assessment Zone (TAZ) in the O-D Survey and divided amongst the three key access intersections connecting Wateridge Village to the regional road network. Consistent with the Phase 2A/2B TIA, refinements to the existing 'blended rate' mode share were applied to better represent the travel characteristics based on the site density and its location within the Community Core.

No intersection capacity or auxiliary lane analyses were required at the proposed site access driveways, as all four locations will provide connections to local roads which can be considered to have sufficiently low volumes and operating speeds to safely accommodate these additional vehicular connections from a transportation perspective.

A multi-modal analysis of each study area intersection referenced from previous TIAs conducted for Wateridge Village identified deficiencies in the existing road network and potential remediation measures have been suggested in which the City could consider in order to meet the prescribed targets. These remediation measures would improve mobility and comfort for all transportation modes but are not required to safely accommodate the proposed development.

As no physical modifications are required to accommodate site-generated demand, an RMA will not be required. Further, a Post-Development Monitoring Plan is not required to support the proposed development, as regional site access intersections are expected to operate at an acceptable level of service (i.e. LOS 'D' or better) beyond the 2031 horizon year of this study. It is important to also note that a Post-Development Monitoring Plan was prepared as part of the TIA for Wateridge Phase 2A/2B to help mitigate any potential cut-through traffic impacts in adjacent neighbourhoods which included the subject development lands.

Based on the findings of this study, it is the overall opinion of Arcadis that the proposed development will integrate well with and can be safely accommodated by the adjacent transportation network.

Appendix A – TIA Screening Form

City of Ottawa 2017 TIA Guidelines Screening Form

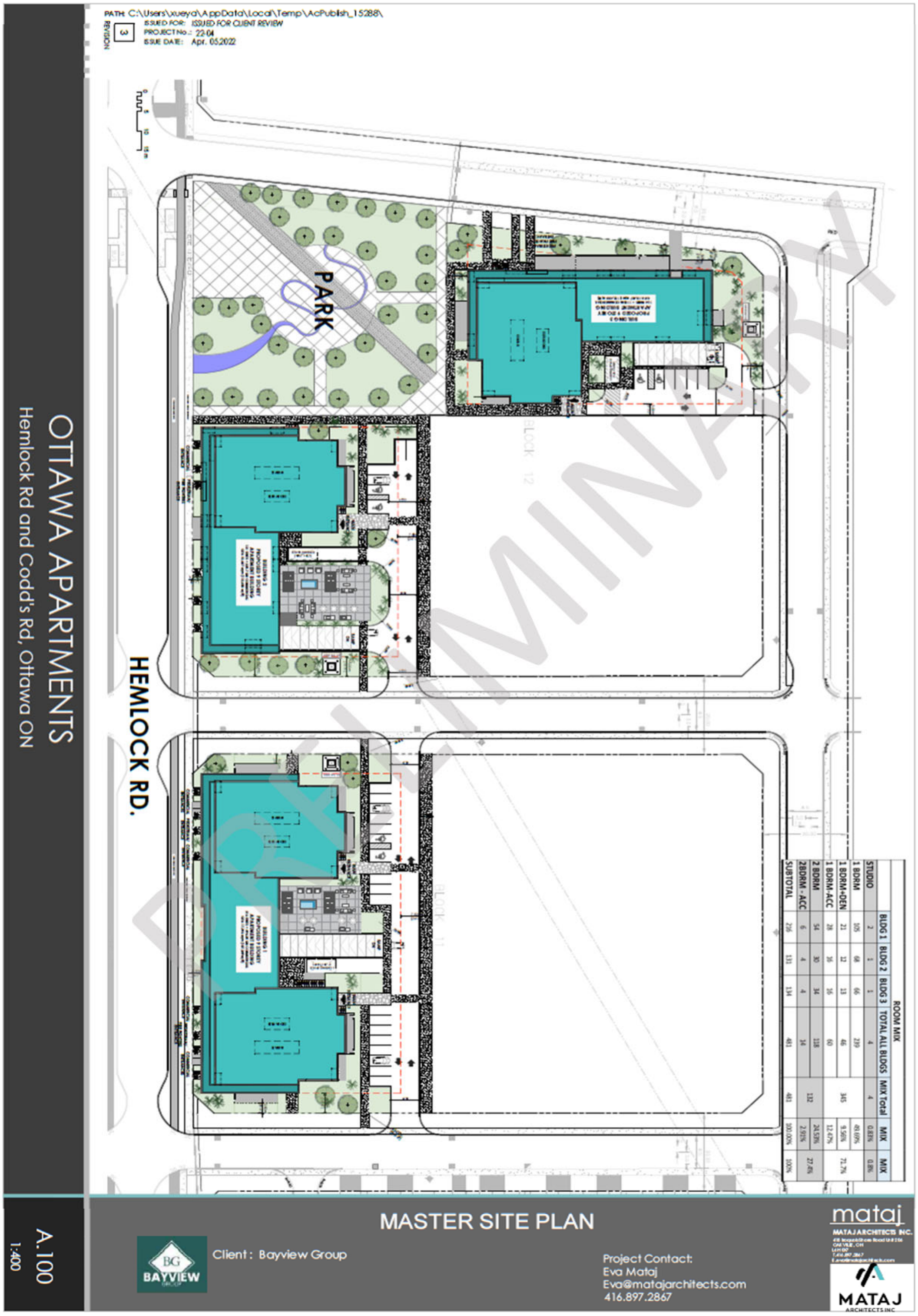
1. Description of Proposed Development

Municipal Address	Parcels 2, 3 & 5, Wateridge Phase 2, 1345-1375 Hemlock Road & 375 Codd's Road, Ottawa, ON
Description of Location	The three sites are located within Phase 2 of the Wateridge development. They are bordered by Tawadina Road to the north, Hemlock Road to the south, Codd's Road to the west and Michael Stoqua Street to the east.

Land Use Classification	Mixed-Use (Residential & Commercial)
Development Size (units)	Total - 455 units Building 1 - 216 Units; Building 2 - 131 Units; Building 3 - 108 Units
Development Size (m^2)	Building 1 - 411.7m^2 Building 2 - 169.2m^2 Building 3 - N/A
Number of Accesses and Locations	One (1) new Outbound-only access on Michael Stoqua Street. Two (2) new all-movement access driveways on Bareille-Snow Street. One (1) new all-movement access driveway on Tawadina Road.
Phase of Development	Single Phase

Buildout Year	2026

If available, please attach a sketch of the development or site plan to this form.



2. Trip Gen Trigger

Considering the Development's Land Use Type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size	
Single-family homes	40 units	
Townhomes or apartments	90 units	✓
Office	3,500 m^2	
Industrial	5,000 m^2	
Fast-food restaurant or coffee shop	100 m^2	
Destination Retail	1,000 m^2	
Gas Station or convenience market	75 m^2	

**If the development has a land use type other than what is presented in the table above, estimates of person trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

Based on the above, the Trip Generation Trigger is satisfied.

3. Location Triggers

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

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6) See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA.*

Based on the above, the Location Trigger is not satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street 80km/hr or greater?		✓
Are there any horizontal/vertical curvatures on a boundary street that limit sight lines at a proposed driveway?		✓

Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/suburban conditions?)		✓
Is the proposed driveway within auxiliary lanes of an intersection?		✓
Does the proposed driveway make use of an existing median break that serves an existing site?		✓
Is there a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		✓
Does the development include a drive-thru facility?		✓

Based on the above, the Safety Trigger is not satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?	✓	
Does the development satisfy the Location Trigger?		✓
Does the development satisfy the Safety Trigger?		✓

Based on the results of the TIA Screening Form, the Trip Generation Trigger is satisfied. As such, a TIA is required for the proposed development.

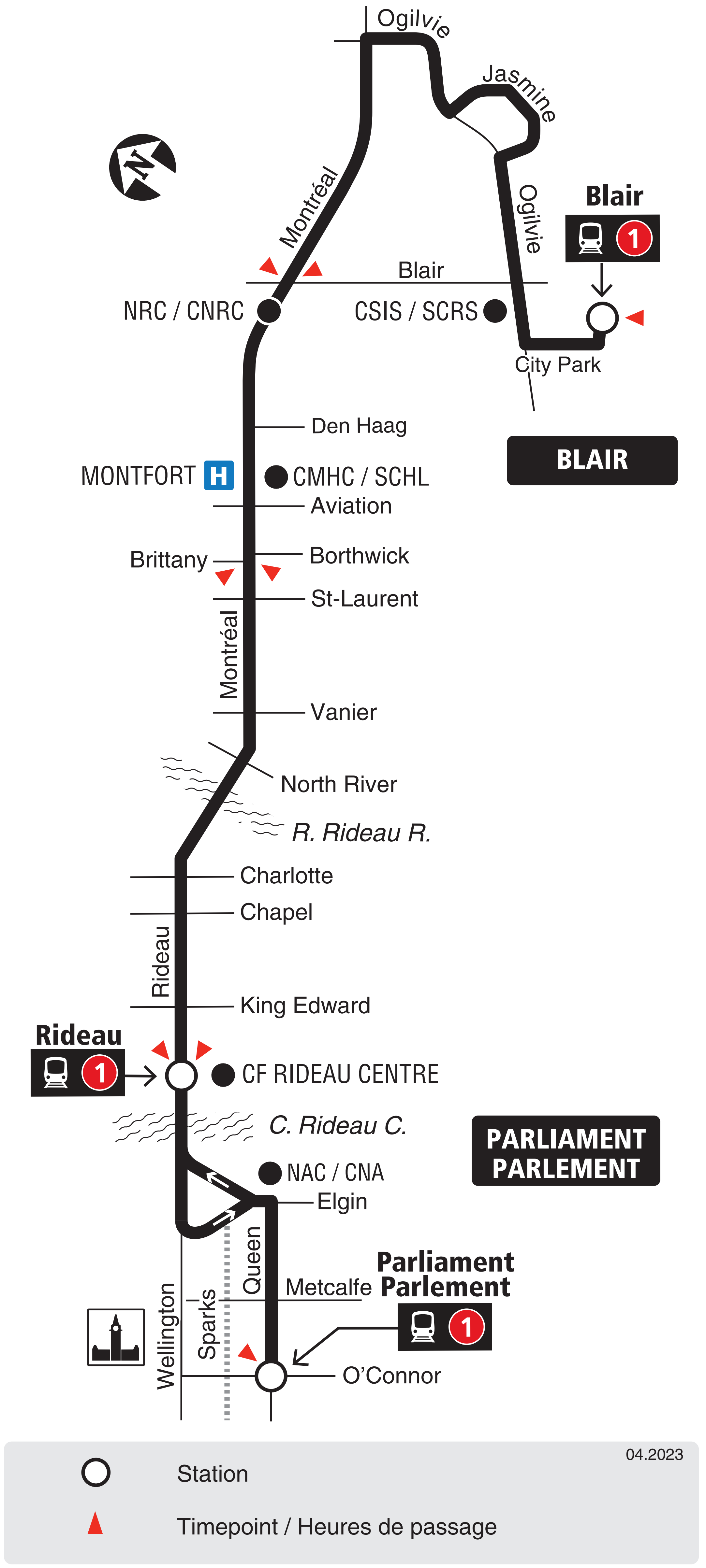
Appendix B – OC Transpo Routes

12 Fréquent

PARLIAMENT / PARLEMENT
BLAIR

7 days a week / 7 jours par semaine

All day service
Service toute la journée



04.2023

Schedule / Horaire 613-560-1000
Text / Texto* 560560
plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres
*Standard message rates may apply / Les tarifs réguliers de messagerie texte peuvent s'appliquer

Customer Service
Service à la clientèle **613-560-5000**

Lost and Found / Objets perdus...... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective April 23, 2023
En vigueur 23 avril 2023

OC Transpo
INFO 613-560-5000
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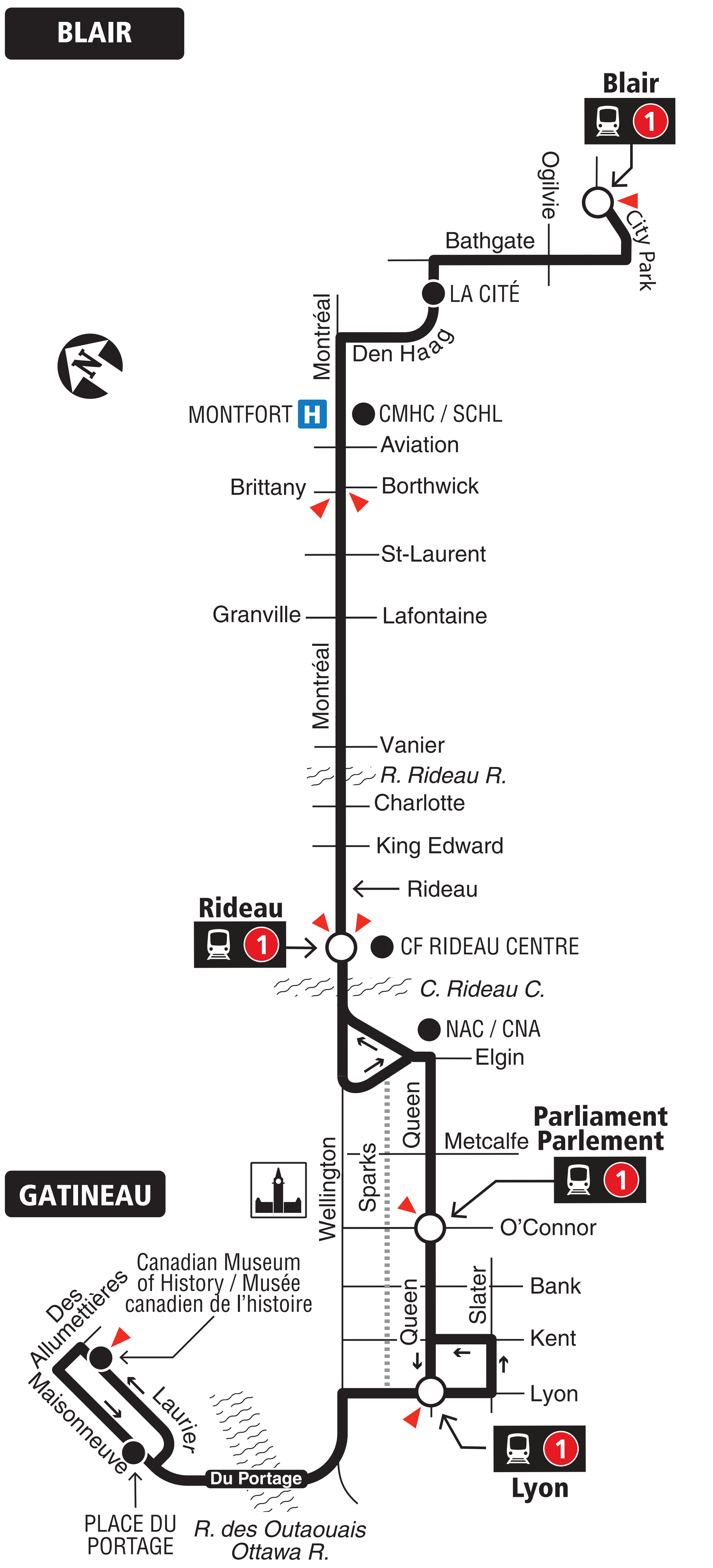
15

Local

GATINEAU
BLAIR

Monday to Friday / Lundi au vendredi
Peak Periods
Périodes de pointe



04.2023

Station

Timepoint / Heures de passage

04.2023

Schedule / Horaire 613-560-1000
Text / Texto* 560560
plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres
*Standard message rates may apply / Les tarifs réguliers de messagerie texte peuvent s'appliquer

Customer Service
Service à la clientèle **613-560-5000**

Lost and Found / Objets perdus...... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective April 23, 2023
En vigueur 23 avril 2023

OC Transpo **INFO 613-560-5000**
octranspo.com

25

MILLENNIUM

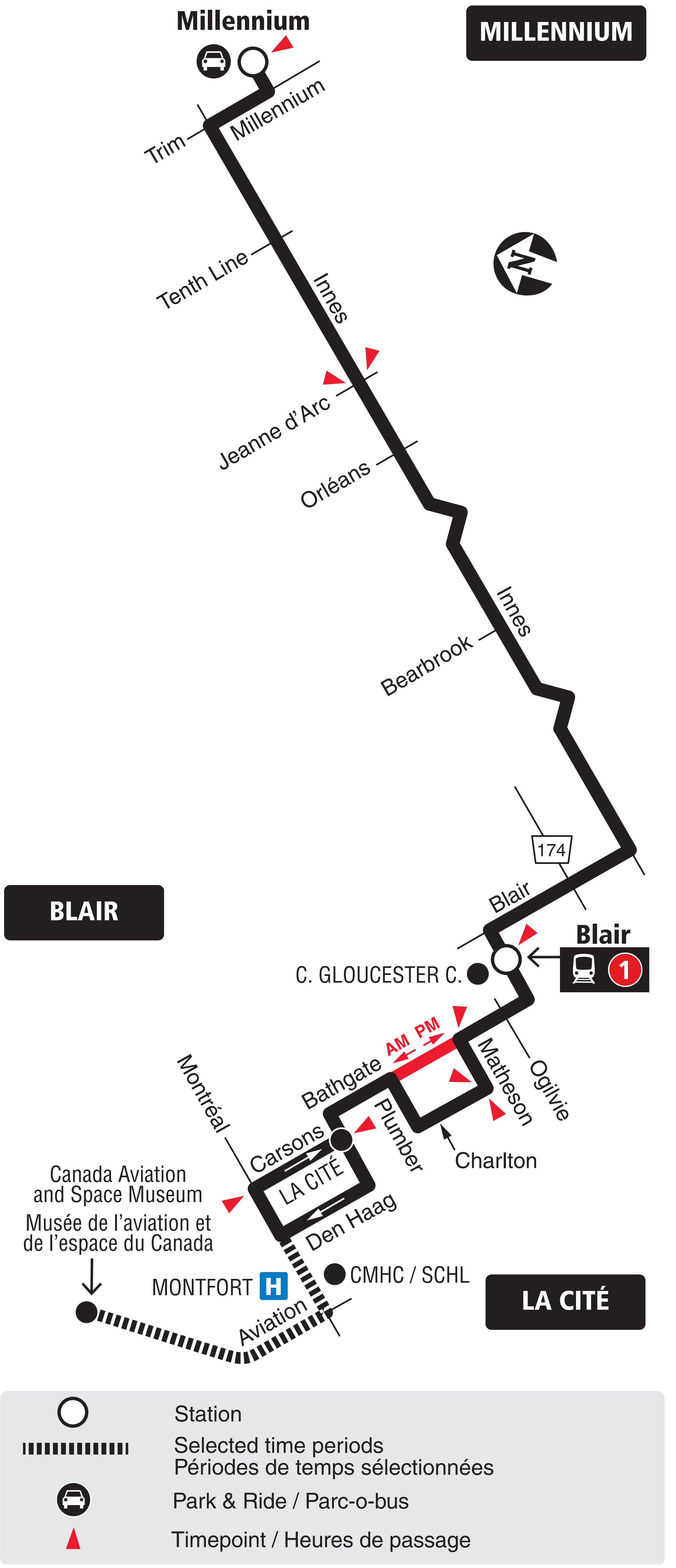
LA CITÉ
BLAIR

Fréquent

7 days a week / 7 jours par semaine

All day service

Service toute la journée



2020.07

Schedule / Horaire.......613-560-1000

Text / Texto 560560

plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

Customer Service
Service à la clientèle **613-741-4390**

Lost and Found / Objets perdus...... **613-563-4011**

Security / Sécurité.................... **613-741-2478**

Effective August 8, 2020

En vigueur 8 août 2020

OC Transpo **INFO 613-741-4390**
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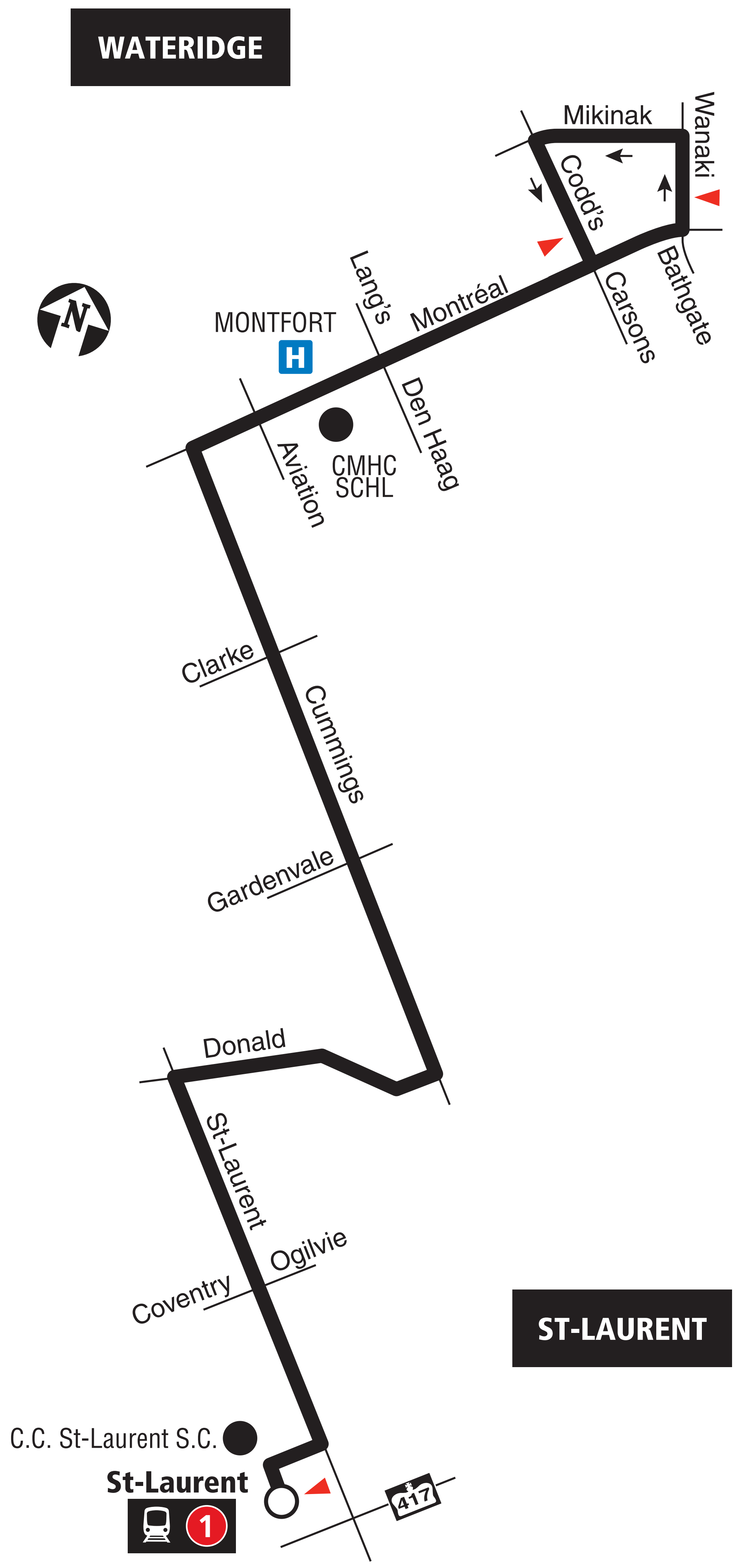
27 WATERIDGE / ST-LAURENT

Local

Monday to Friday / Lundi au vendredi
Selected time periods
Périodes sélectionnées



2022.06

Station

Timepoint / Heures de passage

2022.06

Schedule / Horaire.......613-560-1000
Text / Texto 560560
plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

Customer Service
Service à la clientèle **613-560-5000**

Lost and Found / Objets perdus...... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective June 26, 2022
En vigueur 26 juin 2022

OC Transpo **INFO 613-560-5000**
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Appendix C – Collision Analysis

Table 1: Existing Traffic Operations

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Montreal/Carsons/Codd's	B(B)	0.62(0.67)	WBT(EBT)	11.6(13.0)	A(B)	0.60(0.61)
Montreal/Bathgate/Burma	A(A)	0.55(0.49)	WBT(NBL)	5.0(7.5)	A(A)	0.53(0.46)
Montreal/Aviation Parkway	F(F)	1.16(1.19)	NBL(WBL)	42.3(52.8)	D(E)	0.86(0.96)
Montreal/Blair	B(B)	0.62(0.65)	WBT(NBL)	13.7(14.4)	A(A)	0.60(0.52)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 1, study area intersections 'as a whole' are currently operating at an acceptable LoS 'D' or better during the morning and afternoon peak hours, with the exception of the Montreal/Aviation intersection, which is operating close to or at capacity (LoS 'D' or LoS 'E') during peak hours.

The 'critical' movements at study area intersections are currently operating at an acceptable LoS 'C' or better, with the exception of the Montreal/Aviation intersection's 'critical' movements that are operating above capacity (LoS 'F') during both peak hours. These results are generally consistent with the results outlined in the original CTS, with the exception of the Montreal/Aviation intersection. Based on the 2011 volumes used as the basis of the analysis within the CTS, the Montreal/Aviation intersection was operating with 'critical' movements of LoS 'D' to LoS 'F' and overall intersection performance of LoS 'C'.

Mitigative measures to improve the performance of the 'critical' movements at the Montreal/Aviation intersection to an acceptable LoS 'D' would require the construction of additional auxiliary turn lanes along the Aviation Parkway, namely an additional northbound left-turn lane (double left-turn) and a southbound right-turn lane. Any widening to this intersection due to poor existing intersection performance would require further consultation and discussion with City of Ottawa and NCC Staff.

Following the City's new Multi-Modal Level of Service guidelines, the performance of passenger vehicles at intersections is becoming less of a priority over accommodating multi-modes. Providing space and facilities for pedestrians and cyclists at intersections and providing transit priority where applicable is becoming a larger focus for the City at major intersections. Widening the Montreal/Aviation intersection to accommodate the existing vehicle volume would likely decrease the existing level of service experienced at this intersection for non-auto modes. In addition, the City is focused on reducing the use of single-occupancy vehicles, and increasing the use of transit and active modes. As such, maintaining the existing cross-section of this intersection is recommended from a multi-modal transportation perspective.

2.6 EXISTING ROAD SAFETY CONDITIONS

Collision history for study area roads (2012 to 2014, inclusive) was obtained from the City of Ottawa and most collisions (69%) involved only property damage, indicating low impact speeds, 30% involved personal injuries and there was 1 fatal injury at the Montreal/Burma intersection. The accident involved a vehicle turning westbound left from Montreal Road onto Bathgate Drive and a motorcycle travelling eastbound through the intersection. It is understood that there are poor sightlines for drivers performing the westbound left-turn and the northbound left-turn movements at this intersection because of roadway geometry, which has been confirmed through field observation. As such, fully protected left-turn phases could be implemented for these movements to improve existing operations of the left-turn movements.

Within the study area, the primary causes of collisions cited by police include; rear end (41%), turning movement (31%), and angle (15%) type collisions. A standard unit of measure for assessing collisions at an intersection is based on the number collisions per million entering vehicles (MEV). At intersections within the study area, reported collisions have historically take place at a rate of:

- 1.58/MEV at the Montreal/Aviation intersection;
- 0.31/MEV at the Montreal/Codd's intersection;
- 1.02/MEV at the Montreal/Burma intersection; and
- 0.76/MEV at the Montreal/Blair intersection.

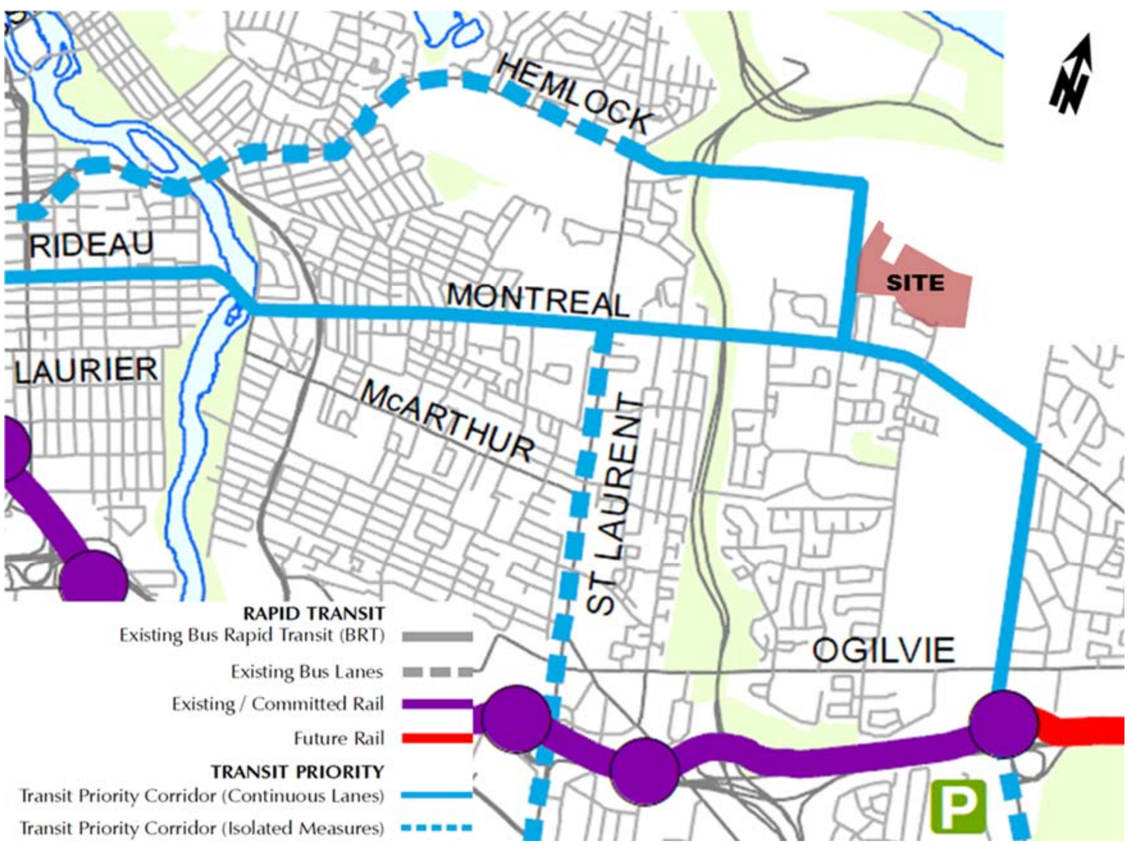
At the Montreal/Burma intersection, where there are poor sightlines for northbound and westbound left-turning vehicles, there were 18 collisions in the 3-year period. Of these 18 collisions, 9 (50%) were turning or angle type collisions involving a left-turning vehicle. The source collision data as provided by the City of Ottawa and related analysis is provided as Appendix C.

3. DEMAND FORECASTING

3.1 PLANNED STUDY AREA TRANSPORTATION NETWORK CHANGES

According to the Transportation Master Plan (TMP) there are a number of planned transit priority projects in close proximity to the subject development. These are shown in Figure 6, and include continuous transit lanes on Montreal Road, as well as on Hemlock Road and Codd's Road through the Wateridge development. It is noteworthy that providing continuous lanes through the development area would require a widening of some internal roads to four lanes. As this is inconsistent with the envisioned road network being proposed within the recent City-approved Development Concept Plan, the Development Concept Plan's road/transit plan supersedes the TMP in this location. The planned LRT corridor is located south of the study area along Highway 417/OR174, with stations at Blair Road, Cyrville Road, St. Laurent Boulevard and Vanier Parkway.

Figure 6: Transit Priority and Rapid Transit – TMP Affordable Network



Source: City of Ottawa Transportation Master Plan

Appendix D – Trip Generation Data

3.2 Recommended Residential Trip Generation Rates

A blended trip rate was developed from the three data sources through application of a rank-sum weighting process, considering the strengths and weaknesses of each dataset for the dwelling type in question. The recommended blended **residential person-trip rates** are presented in **Table 3**. All rates represent person-trips per dwelling unit and are to be applied to the **AM or PM peak period.**

Table 3: Recommended Residential Person-trip Rates

ITE Land Use Code	Dwelling Unit Type	Period	Person-Trip Rate
210	Single-detached	AM	2.05
		PM	2.48
220	Multi-Unit (Low-Rise)	AM	1.35
		PM	1.58
221 & 222	Multi-Unit (High-Rise)	AM	0.80
		PM	0.90

3.3 Adjustment Factors – Peak Period to Peak Hour

The various trip generation data sources require some adjustment to standardize the data for developing robust blended trip rates. The peak period conversion factor in **Table 4** may be used where applicable to develop trip generation rate estimates in the desired format.

Table 4: Adjustment Factors for Residential Trip Generation Rates

Factor	Application	Apply To	Period	Value
Peak Period Conversion Factor	**Peak period to peak hour conversion.** Because the 2020 TRANS Trip Generation Study reports trip generation rates by peak period, factors must be applied if the practitioner requires peak hour rates. In practice, the conversion to peak hour trip rates should occur **after** the application of modal shares.	Person-trip rates per peak period	AM	0.50
			PM	0.44
		Vehicle trip rates per peak period	AM	0.48
			PM	0.44
		Transit trip rates per peak period	AM	0.55
			PM	0.47
		Cycling trip rates per peak period	AM	0.58
			PM	0.48
		Walking trip rates per peak period	AM	0.58
			PM	0.52

Table 8: Residential Mode Share for High-Rise Multifamily Housing

District	Period	Mode				
		Auto Driver	Auto Pass.	Transit	Cycling	Walking
Ottawa Centre	AM	18%	2%	26%	1%	52%
	PM	17%	9%	21%	1%	52%
Ottawa Inner Area	AM	26%	6%	28%	5%	34%
	PM	25%	8%	21%	6%	39%
Île de Hull	AM	27%	3%	37%	12%	21%
	PM	26%	8%	27%	11%	28%
Ottawa East	AM	39%	7%	38%	2%	13%
	PM	40%	14%	28%	3%	15%
Beacon Hill	AM	48%	9%	30%	3%	10%
	PM	52%	16%	28%	0%	4%
Alta Vista	AM	38%	12%	42%	2%	7%
	PM	45%	16%	28%	2%	9%
Hunt Club	AM	39%	6%	44%	1%	9%
	PM	44%	11%	35%	2%	9%
Merivale	AM	41%	6%	42%	2%	8%
	PM	41%	11%	33%	2%	13%
Ottawa West	AM	28%	11%	41%	3%	16%
	PM	33%	11%	26%	7%	23%
Bayshore/Cedarview	AM	40%	12%	38%	2%	8%
	PM	40%	15%	33%	1%	11%
Hull Périphérie	AM	48%	11%	30%	1%	10%
	PM	47%	15%	23%	3%	13%
Orleans	AM	54%	7%	29%	0%	10%
	PM	61%	13%	21%	0%	6%
South Gloucester / Leitrim	AM	50%	15%	25%	1%	9%
	PM	53%	17%	21%	1%	9%
South Nepean	AM	58%	6%	30%	2%	4%
	PM	54%	15%	25%	0%	7%
Kanata - Stittsville	AM	43%	26%	28%	0%	4%
	PM	55%	19%	21%	0%	5%
Plateau	AM	53%	9%	35%	3%	1%
	PM	65%	7%	25%	2%	1%
Aylmer	AM	45%	17%	25%	0%	13%
	PM	31%	21%	23%	4%	20%
Pointe Gatineau	AM	44%	15%	24%	3%	14%
	PM	52%	15%	20%	2%	11%
Gatineau Est	AM	53%	10%	25%	0%	12%
	PM	61%	10%	25%	0%	4%
Masson-Angers	AM	63%	15%	19%	0%	3%
	PM	64%	18%	16%	0%	1%
Other Rural Districts	AM	63%	15%	19%	0%	3%
	PM	64%	18%	16%	0%	1%

5 RESIDENTIAL DIRECTIONAL SPLITS

After calculating the total person trips generated by the development and applying the appropriate modal shares, directional factors can be applied to estimate the number of inbound and outbound trips by vehicle. The vehicle trip directional splits were developed for both the AM and PM peak periods[2]. The vehicle trip directional splits, as shown in **Table 9**, have been developed for the NCR based on a review of the local trip generator surveys as well as the latest published data in the ITE *Trip Generation Manual* (10th Edition).

Table 9: Recommended Vehicle Trip Directional Splits (Peak Period)

ITE Land Use Code	Dwelling Unit Type	Period	Inbound	Outbound
210	Single-detached	AM	30%	70%
		PM	62%	38%
220	Multi-Unit (Low-Rise)	AM	30%	70%
		PM	56%	44%
221 & 222	Multi-Unit (High-Rise)	AM	31%	69%
		PM	58%	42%

6 NON-RESIDENTIAL MODE SHARE

Mode shares were developed for three types of non-residential development: schools (elementary and high school); employment generators; and commercial (retail) generators. These mode shares were developed through data provided by the Ville de Gatineau from local school surveys as well as the TRANS Origin-Destination Survey. The non-residential mode shares presented below are limited and do not capture all development types. For data on the travel characteristics associated with colleges and universities, transportation terminals, and sports and entertainment venues in the National Capital Region, practitioners should refer to the various reports for the TRANS *Special Generators Survey* (2013), which are posted on the TRANS website. For other development types, practitioners may need to carry out their own local generator data collection where necessary.

[2] A directional split for active transportation was calculated based on the local generator surveys for low-rise and mid-rise land uses. The splits are mostly in-line with the vehicle directional splits, which could be used as a rough assumption for areas with lower vehicle mode share.

Strip Retail Plaza (<40k)
(822)

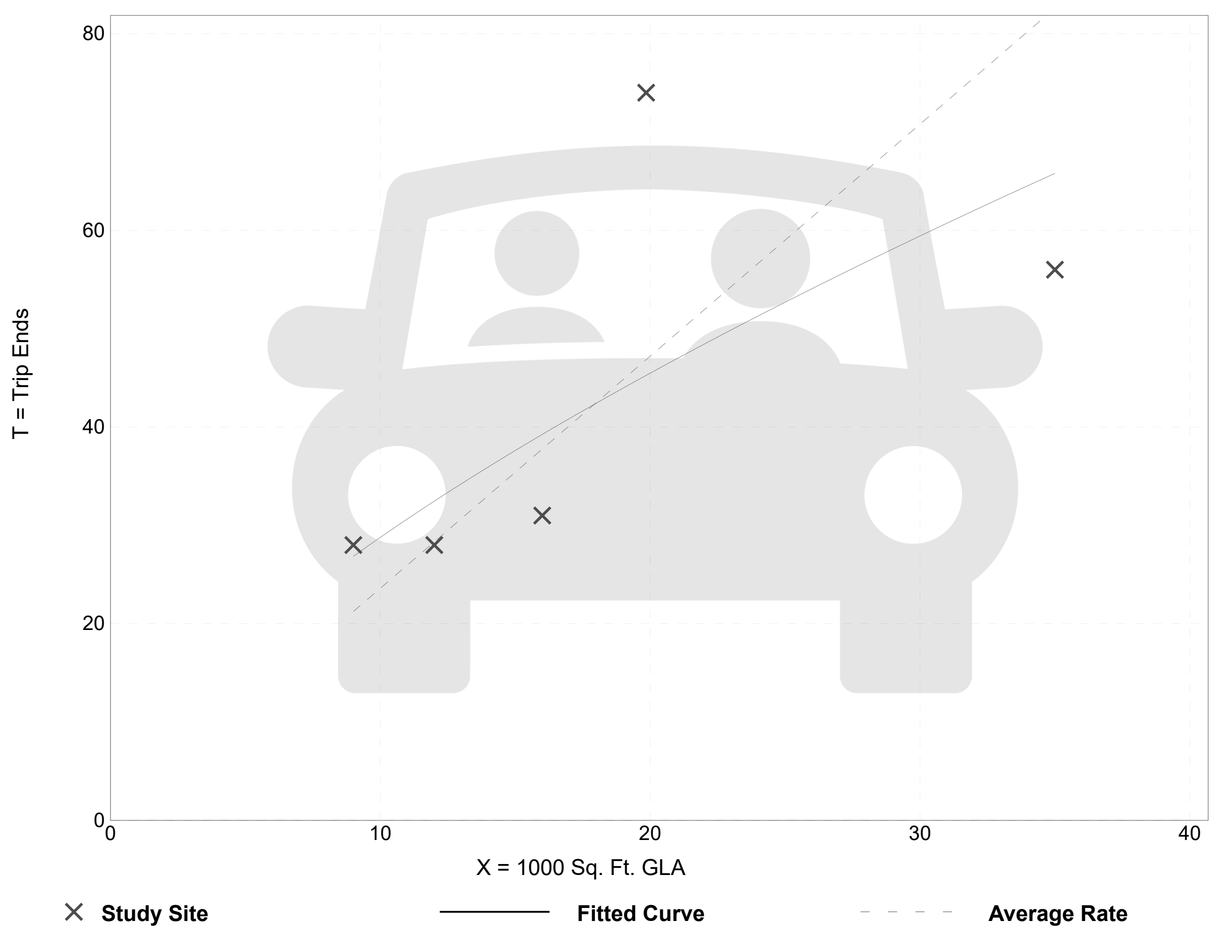
Vehicle Trip Ends vs:	**1000 Sq. Ft. GLA**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	5
Avg. 1000 Sq. Ft. GLA:	18
Directional Distribution:	60% entering, 40% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
2.36	1.60 - 3.73	0.94

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Ln(T) = 0.66 Ln(X) + 1.84

R^2= 0.57

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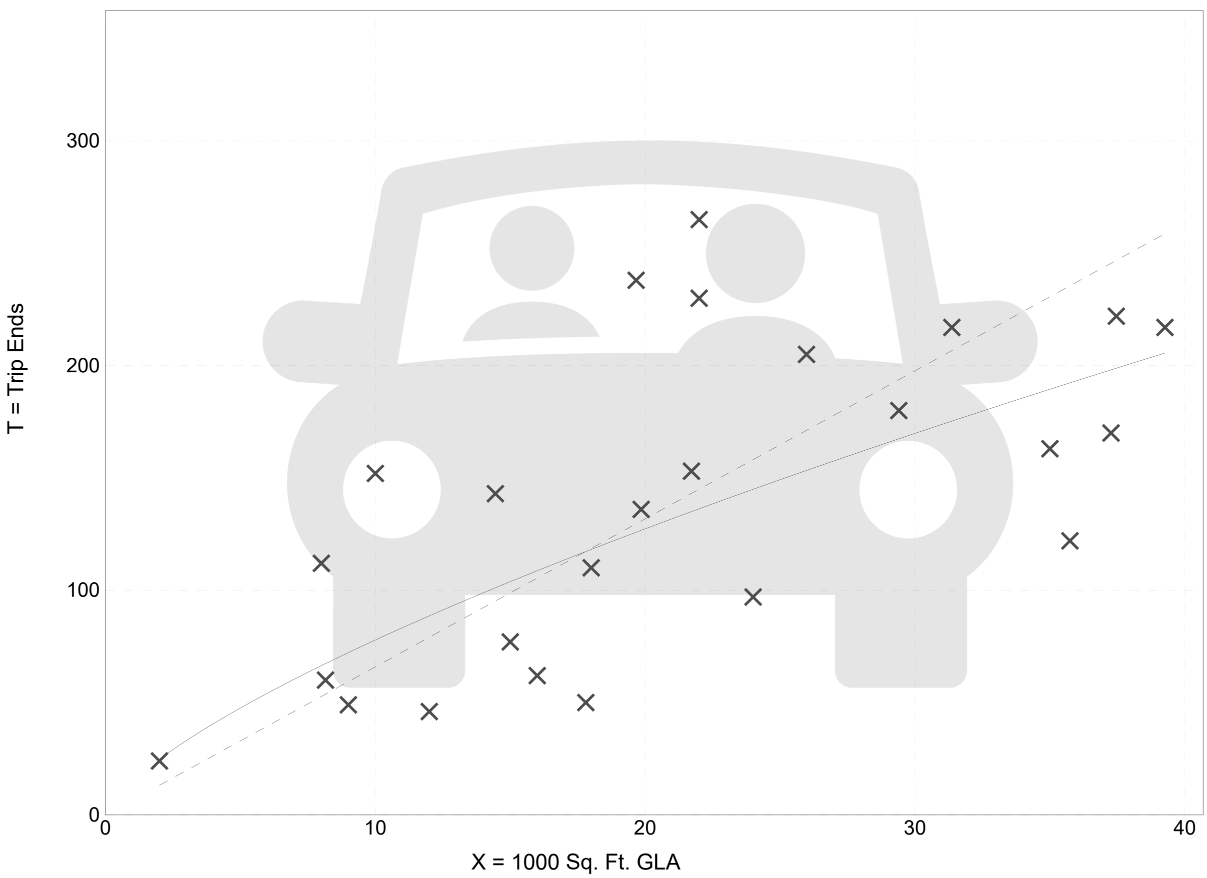
Strip Retail Plaza (<40k)
(822)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GLA**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	25
Avg. 1000 Sq. Ft. GLA:	21
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
6.59	2.81 - 15.20	2.94

Data Plot and Equation



Study Site **Fitted Curve** **Average Rate**

Fitted Curve Equation: $Ln(T) = 0.71 Ln(X) + 2.72$ **$R^2 = 0.56$**

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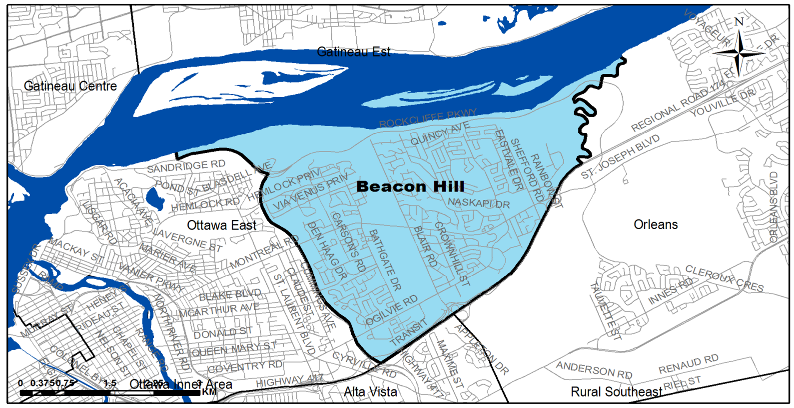
Beacon Hill

Demographic Characteristics

Population	31,270	Actively Travelled	24,100
Employed Population	13,740	Number of Vehicles	18,210
Households	14,030	Area (km^2)	21.5



Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	6,480	5,850	12,330
Part Time Employed	520	890	1,410
Student	3,190	3,200	6,390
Retiree	3,140	4,640	7,780
Unemployed	260	330	590
Homemaker	10	710	730
Other	260	350	610
Total:	13,870	15,960	29,840

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	2,890	3,340	6,220
Licensed Drivers	10,470	11,270	21,740
Telecommuters	50	70	120
Trips made by residents	35,950	41,850	77,800

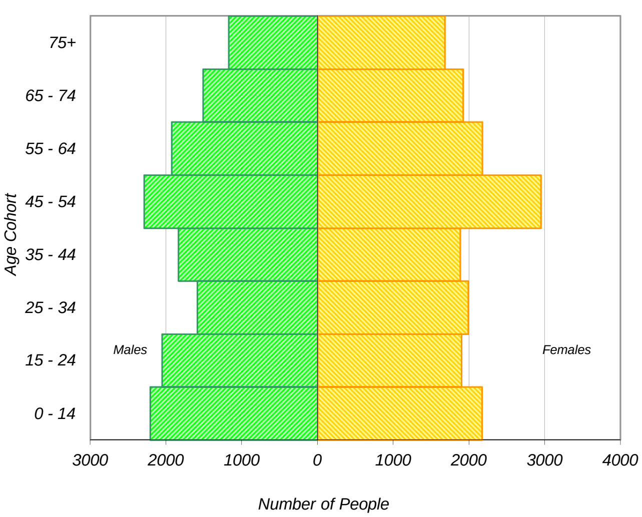
Household Size		
1 person	3,850	27%
2 persons	5,290	38%
3 persons	2,140	15%
4 persons	1,750	12%
5+ persons	1,000	7%
Total:	14,030	100%

Households by Vehicle Availability		
0 vehicles	1,600	11%
1 vehicle	7,550	54%
2 vehicles	4,230	30%
3 vehicles	470	3%
4+ vehicles	180	1%
Total:	14,030	100%

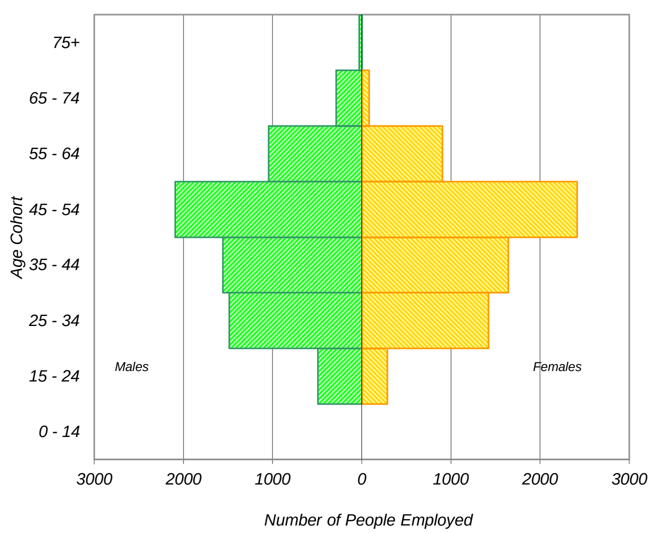
Selected Indicators	
Daily Trips per Person (age 5+)	2.61
Vehicles per Person	0.58
Number of Persons per Household	2.23
Daily Trips per Household	5.55
Vehicles per Household	1.30
Workers per Household	0.98
Population Density (Pop/km2)	1450

Households by Dwelling Type		
Single-detached	5,110	36%
Semi-detached	1,610	11%
Townhouse	3,800	27%
Apartment/Condo	3,510	25%
Total:	14,030	100%

Population



Employed Population

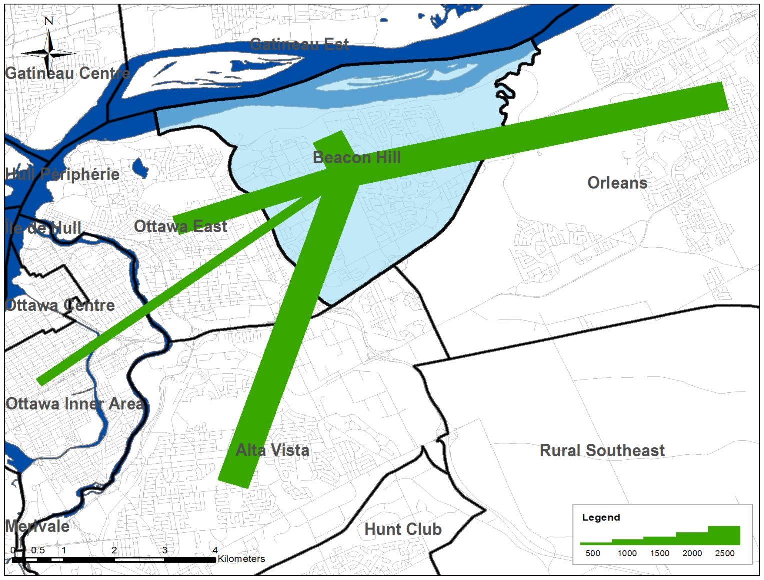


* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

Travel Patterns

Top Five Origins of Trips to Beacon Hill

AM Peak Period



Summary of Trips to and from Beacon Hill

AM Peak Period (6:30 - 8:59) Districts	Destinations of Trips From District	% Total	Origins of Trips To District	% Total
Ottawa Centre	1,880	12%	190	1%
Ottawa Inner Area	1,380	9%	1,450	7%
Ottawa East	1,750	11%	2,110	10%
Beacon Hill	5,170	33%	5,170	25%
Alta Vista	1,850	12%	2,690	13%
Hunt Club	170	1%	380	2%
Merivale	540	3%	580	3%
Ottawa West	610	4%	150	1%
Bayshore / Cedarview	240	2%	550	3%
Orléans	760	5%	4,180	20%
Rural East	60	0%	350	2%
Rural Southeast	10	0%	480	2%
South Gloucester / Leitrim	30	0%	240	1%
South Nepean	50	0%	370	2%
Rural Southwest	0	0%	90	0%
Kanata / Stittsvile	170	1%	280	1%
Rural West	40	0%	70	0%
Île de Hull	440	3%	50	0%
Hull Périphérie	240	2%	310	1%
Plateau	10	0%	130	1%
Aylmer	0	0%	250	1%
Rural Northwest	30	0%	90	0%
Pointe Gatineau	70	0%	560	3%
Gatineau Est	40	0%	250	1%
Rural Northeast	90	1%	80	0%
Buckingham / Masson-Angers	0	0%	50	0%
Ontario Sub-Total:	14,710	94%	19,330	92%
Québec Sub-Total:	920	6%	1,770	8%
Total:	15,630	100%	21,100	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	10,440	19%	12,360	22%	2,750	9%
School	2,230	4%	6,640	12%	3,100	11%
Shopping	5,550	10%	5,310	10%	4,960	17%
Leisure	5,440	10%	4,840	9%	2,720	9%
Medical	1,410	3%	1,250	2%	360	1%
Pick-up / drive passenger	3,780	7%	3,930	7%	2,440	8%
Return Home	24,470	44%	19,210	35%	11,910	41%
Other	1,810	3%	1,680	3%	870	3%
Total:	55,130	100%	55,220	100%	29,110	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	6,900	66%	8,100	51%	1,230	24%
School	1,380	13%	5,220	33%	2,520	49%
Shopping	190	2%	130	1%	150	3%
Leisure	310	3%	180	1%	310	6%
Medical	230	2%	320	2%	10	0%
Pick-up / drive passenger	660	6%	1,230	8%	580	11%
Return Home	490	5%	350	2%	230	4%
Other	280	3%	400	3%	140	3%
Total:	10,440	100%	15,930	100%	5,170	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	450	3%	420	4%	110	2%
School	80	1%	180	2%	40	1%
Shopping	1,380	9%	1,380	12%	840	13%
Leisure	1,230	8%	1,080	9%	490	8%
Medical	70	0%	120	1%	140	2%
Pick-up / drive passenger	1,470	10%	760	7%	860	13%
Return Home	9,610	66%	7,240	63%	3,800	58%
Other	360	2%	320	3%	220	3%
Total:	14,650	100%	11,500	100%	6,500	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	139,460		21%
AM Peak Period	31,540	23%	16%
PM Peak Period	32,650	23%	20%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	33,590	61%	33,580	61%	13,320	46%
Auto Passenger	7,800	14%	8,280	15%	5,370	18%
Transit	10,220	19%	10,180	18%	1,370	5%
Bicycle	560	1%	590	1%	340	1%
Walk	820	1%	640	1%	6,730	23%
Other	2,140	4%	1,970	4%	1,960	7%
Total:	55,130	100%	55,240	100%	29,090	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	6,100	59%	8,970	56%	1,640	32%
Auto Passenger	970	9%	1,860	12%	670	13%
Transit	2,680	26%	3,500	22%	270	5%
Bicycle	170	2%	150	1%	80	2%
Walk	20	0%	240	2%	1,450	28%
Other	480	5%	1,200	8%	1,060	21%
Total:	10,420	100%	15,920	100%	5,170	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	9,280	63%	6,640	58%	3,320	51%
Auto Passenger	1,810	12%	1,590	14%	1,640	25%
Transit	2,760	19%	2,750	24%	340	5%
Bicycle	110	1%	210	2%	50	1%
Walk	330	2%	20	0%	1,080	17%
Other	350	2%	300	3%	70	1%
Total:	14,640	100%	11,510	100%	6,500	100%

Avg Vehicle Occupancy	From District	To District	Within District
24 Hours	1.23	1.25	1.40
AM Peak Period	1.16	1.21	1.41
PM Peak Period	1.20	1.24	1.49

Transit Modal Split	From District	To District	Within District
24 Hours	20%	20%	7%
AM Peak Period	27%	24%	10%
PM Peak Period	20%	25%	6%

Appendix E – TDM Checklists

TDM-Supportive Development Design and Infrastructure Checklist:
Residential Developments (multi-family or condominium)

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☐
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☐
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☐
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☐
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☒
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☒
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☒
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☒
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☒
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☒
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☒
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☒
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☒
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	☐
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☒
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	☐
	2.3	**Bicycle repair station**	
BETTER	2.3.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☒
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐

	TDM-supportive design & infrastructure measures: *Residential developments*		**Check if completed & add descriptions, explanations or plan/drawing references**
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☒
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide up to three carshare parking spaces in an R3, R4 or R5 Zone for specified residential uses *(see Zoning By-law Section 94)*	☐
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☒
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☒
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Provide separate areas for short-term and long-term parking (using signage or physical barriers) to permit access controls and simplify enforcement (i.e. to discourage residents from parking in visitor spaces, and vice versa)	☒

TDM Measures Checklist:
Residential Developments (multi-family, condominium or subdivision)

Legend

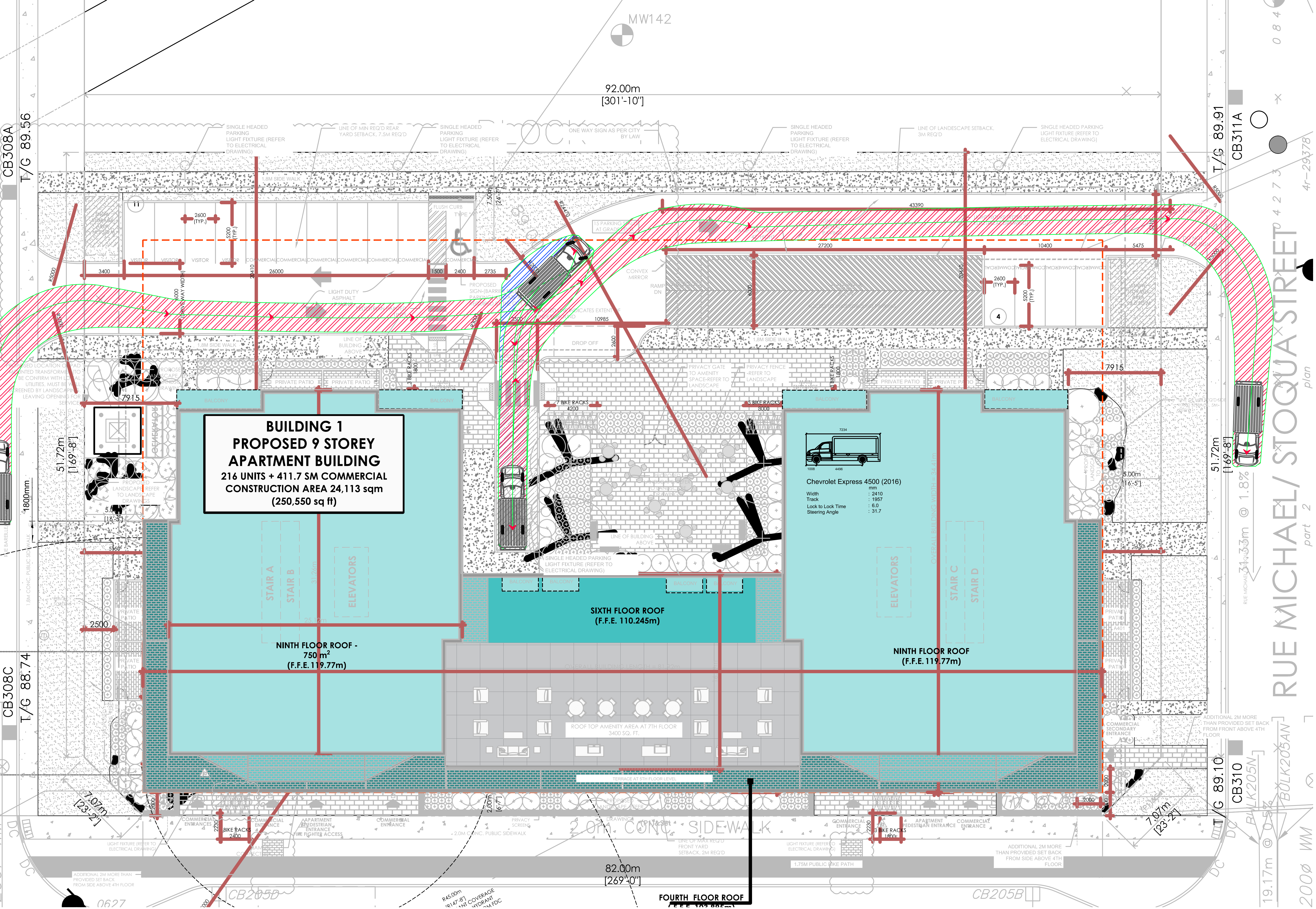
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance
★	The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Residential developments*	Check if proposed & add descriptions
	1.	**TDM PROGRAM MANAGEMENT**	
	1.1	**Program coordinator**	
BASIC ★	1.1.1	Designate an internal coordinator, or contract with an external coordinator	☑
	1.2	**Travel surveys**	
BETTER	1.2.1	Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
	2.	**WALKING AND CYCLING**	
	2.1	**Information on walking/cycling routes & destinations**	
BASIC	2.1.1	Display local area maps with walking/cycling access routes and key destinations at major entrances *(multi-family, condominium)*	☐
	2.2	**Bicycle skills training**	
BETTER	2.2.1	Offer on-site cycling courses for residents, or subsidize off-site courses	☐

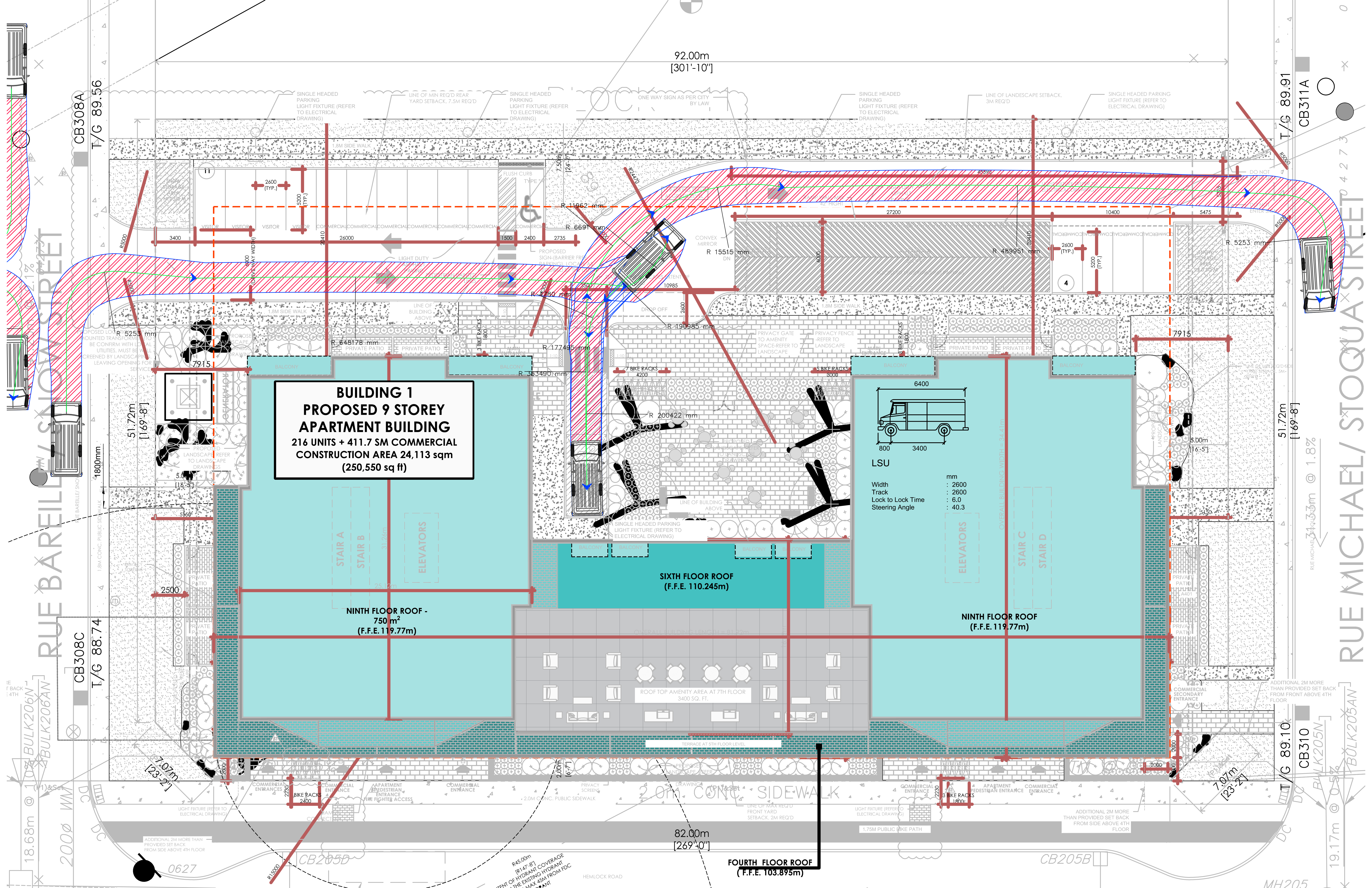
		TDM measures: *Residential developments*	Check if proposed & add descriptions
	3.	**TRANSIT**	
	3.1	**Transit information**	
BASIC	3.1.1	Display relevant transit schedules and route maps at entrances *(multi-family, condominium)*	☑
BETTER	3.1.2	Provide real-time arrival information display at entrances *(multi-family, condominium)*	☐
	3.2	**Transit fare incentives**	
BASIC ★	3.2.1	Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in, to encourage residents to use transit	☐
BETTER	3.2.2	Offer at least one year of free monthly transit passes on residence purchase/move-in	☐
	3.3	**Enhanced public transit service**	
BETTER ★	3.3.1	Contract with OC Transpo to provide early transit services until regular services are warranted by occupancy levels *(subdivision)*	☐
	3.4	**Private transit service**	
BETTER	3.4.1	Provide shuttle service for seniors homes or lifestyle communities (e.g. scheduled mall or supermarket runs)	☐
	4.	**CARSHARING & BIKESHARING**	
	4.1	**Bikeshare stations & memberships**	
BETTER	4.1.1	Contract with provider to install on-site bikeshare station *(multi-family)*	☐
BETTER	4.1.2	Provide residents with bikeshare memberships, either free or subsidized *(multi-family)*	☐
	4.2	**Carshare vehicles & memberships**	
BETTER	4.2.1	Contract with provider to install on-site carshare vehicles and promote their use by residents	☐
BETTER	4.2.2	Provide residents with carshare memberships, either free or subsidized	☐
	5.	**PARKING**	
	5.1	**Priced parking**	
BASIC ★	5.1.1	Unbundle parking cost from purchase price *(condominium)*	☑
BASIC ★	5.1.2	Unbundle parking cost from monthly rent *(multi-family)*	☑

		TDM measures: *Residential developments*	Check if proposed & add descriptions
	6.	**TDM MARKETING & COMMUNICATIONS**	
	6.1	**Multimodal travel information**	
BASIC ★	6.1.1	Provide a multimodal travel option information package to new residents	☑
	6.2	**Personalized trip planning**	
BETTER ★	6.2.1	Offer personalized trip planning to new residents	☐

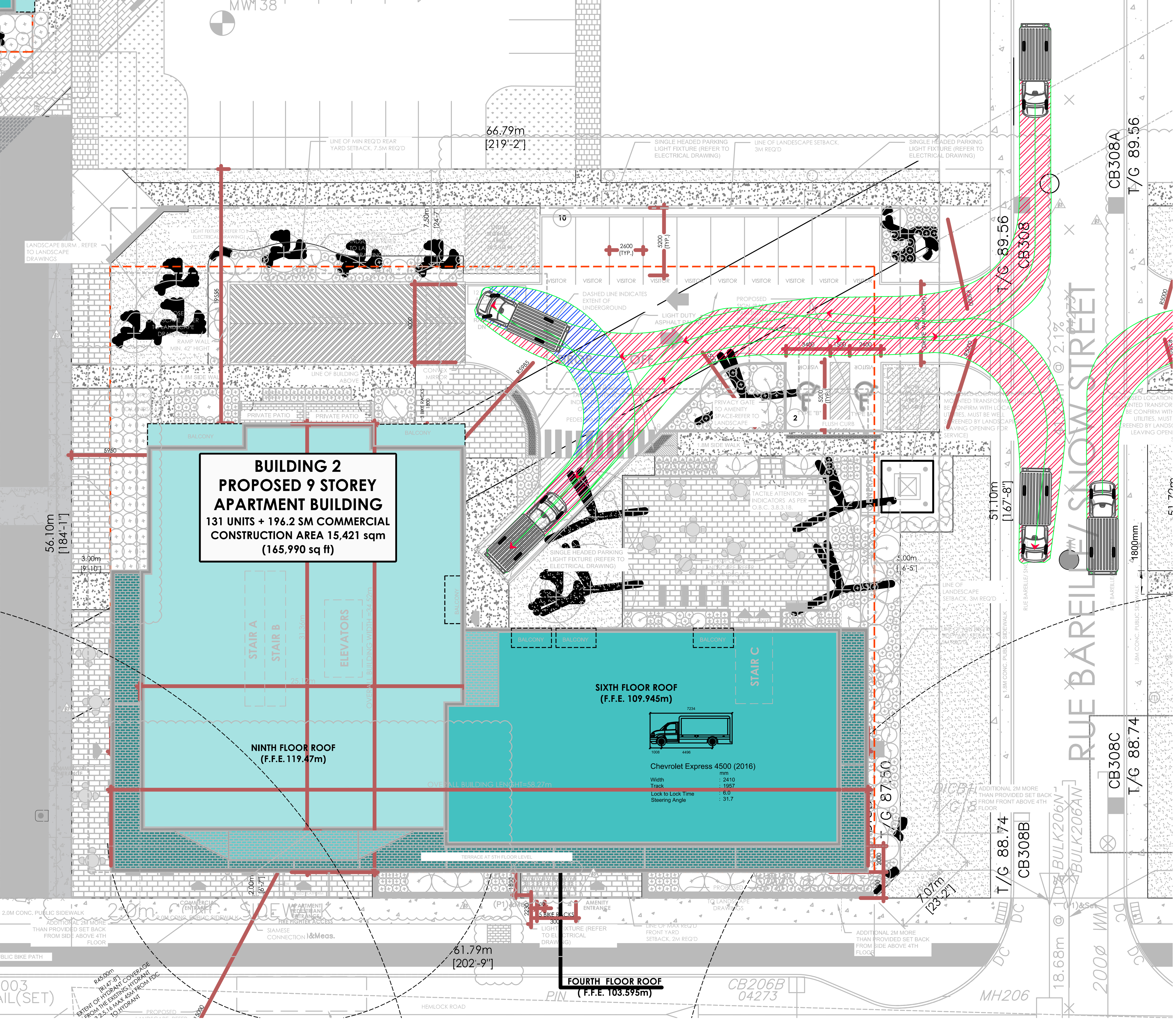
Appendix F – Swept Path Analyses

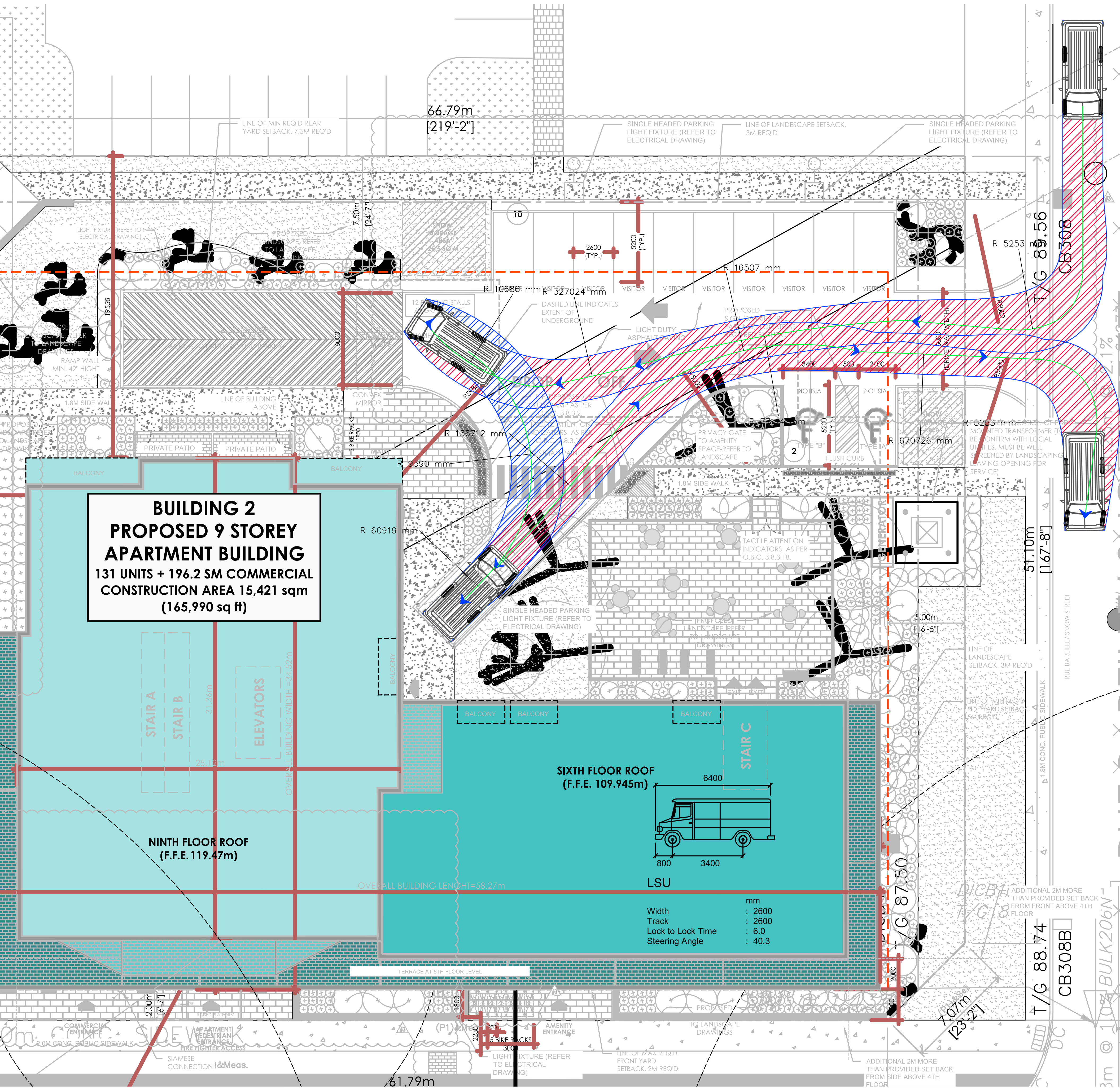


BUILDING 1
PROPOSED 9 STOREY APARTMENT BUILDING
216 UNITS + 411.7 SM COMMERCIAL
CONSTRUCTION AREA 24,113 sqm
(250,550 sq ft)
92.00m
[301'-10"]
82.00m
[269'-0"]
51.72m
[169'-8"]
MW142
CB308A
T/G 89.56
CB308C
T/G 88.74
CB311A
T/G 89.91
CB310
T/G 89.10
RUE MICHAEL/ STOQUA STREET
2.0m CONC. SIDEWALK
SIXTH FLOOR ROOF
(F.F.E. 110.245m)
NINTH FLOOR ROOF -
750 m^2
(F.F.E. 119.77m)
NINTH FLOOR ROOF
(F.F.E. 119.77m)
FOURTH FLOOR ROOF
ROOF TOP AMENITY AREA AT 7TH FLOOR
3400 SQ. FT.
TERRACE AT 5TH FLOOR LEVEL
STAIR A
STAIR B
STAIR C
STAIR D
ELEVATORS
Chevrolet Express 4500 (2016)
Width : 2410
Track : 1957
Lock to Lock Time : 6.0
Steering Angle : 31.7
7915
5.00m
[16'-5"]
7.07m
[23'-2"]
1800mm
2500
DROP OFF
1.8M SIDE WALK
PRIVATE PATIO
BALCONY
COMMERCIAL ENTRANCE
APARTMENT PEDESTRIAN ENTRANCE
COMMERCIAL SECONDARY ENTRANCE
1.75M PUBLIC BIKE PATH

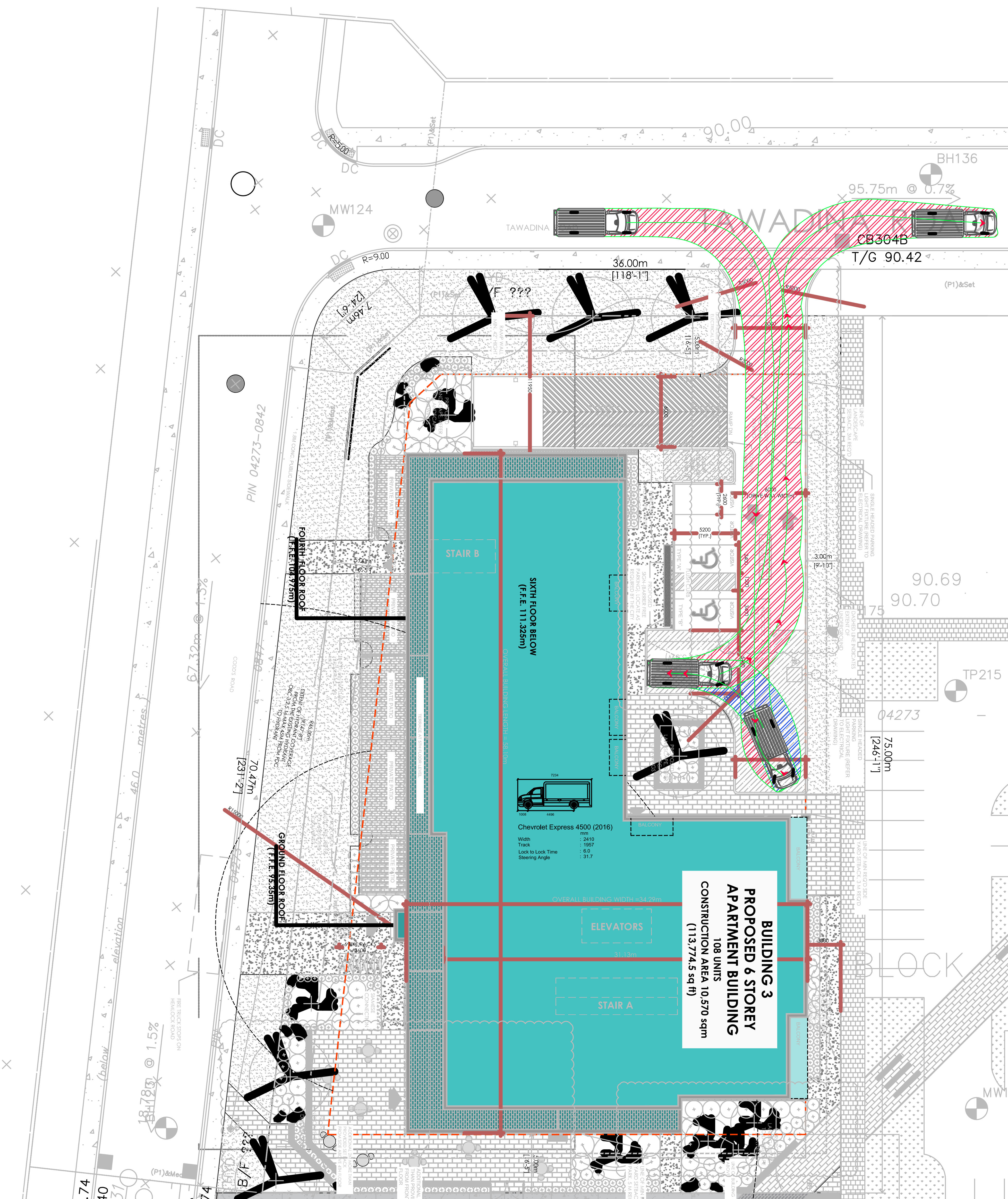


92.00m
[301'-10"]
BUILDING 1
PROPOSED 9 STOREY
APARTMENT BUILDING
216 UNITS + 411.7 SM COMMERCIAL
CONSTRUCTION AREA 24,113 sqm
(250,550 sq ft)
SIXTH FLOOR ROOF
(F.F.E. 110.245m)
NINTH FLOOR ROOF - 750 m²
(F.F.E. 119.77m)
NINTH FLOOR ROOF
(F.F.E. 119.77m)
FOURTH FLOOR ROOF
(F.F.E. 103.895m)
LSU
6400
800
3400
mm
Width : 2600
Track : 2600
Lock to Lock Time : 6.0
Steering Angle : 40.3
STAIR A
STAIR B
STAIR C
STAIR D
ELEVATORS
ROOF TOP AMENITY AREA AT 7TH FLOOR
3400 SQ. FT.
82.00m
[269'-0"]
51.72m
[169'-8"]
RUE BAREILLE / SNOW STREET
RUE MICHAEL / STOQUA STREET
CB308A
T/G 89.56
CB308C
T/G 88.74
CB311A
T/G 89.91
CB310
T/G 89.10
2.0m. CONC. SIDEWALK
7915
2500
7.07m
[23'-2"]
R 5253 mm
R 11962 mm
R 6691 mm
R 15515 mm
R 489951 mm
R 190985 mm
R 177495 mm
R 363490 mm
R 200422 mm
R 648178 mm

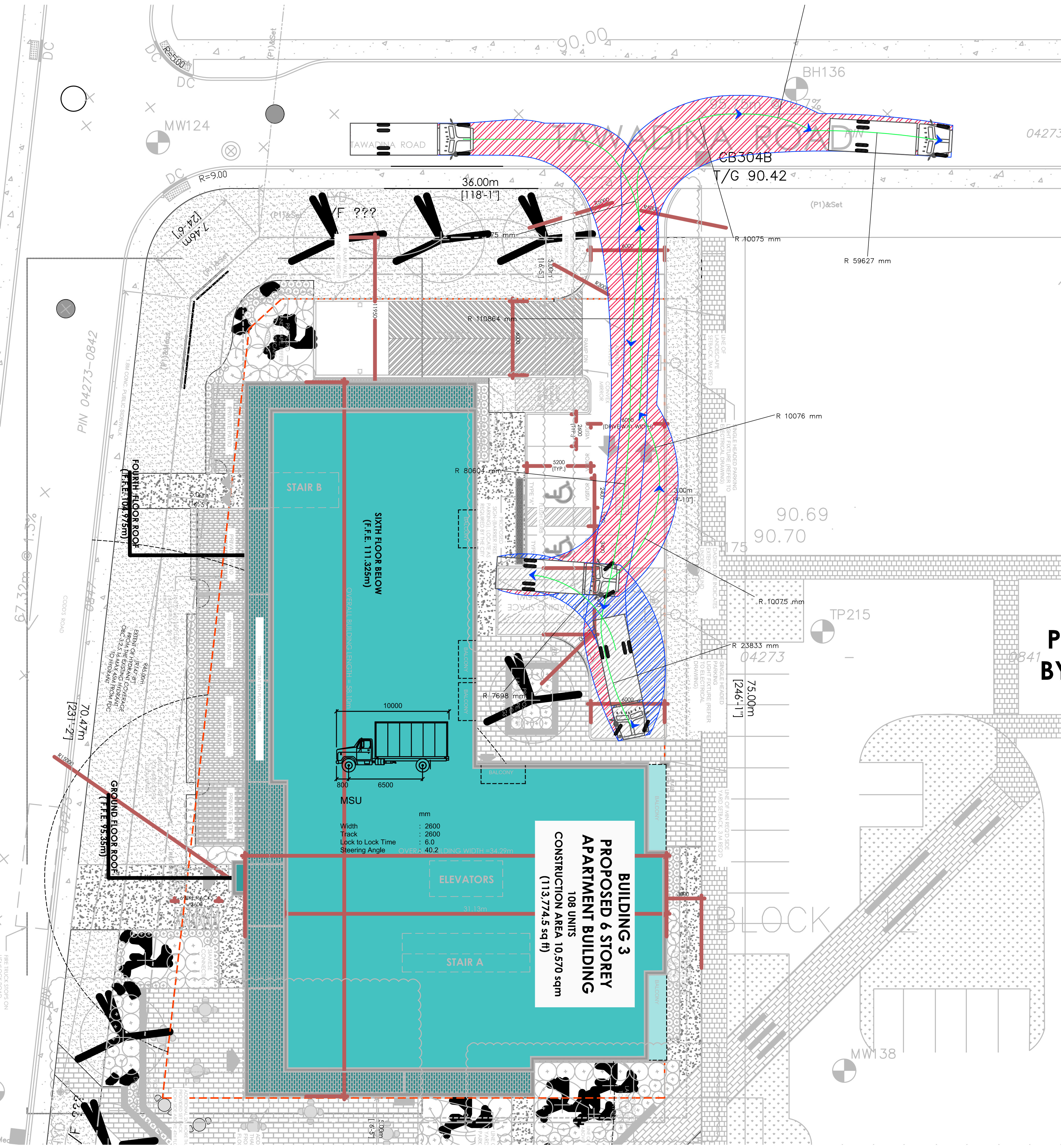

BUILDING 2
PROPOSED 9 STOREY
APARTMENT BUILDING
131 UNITS + 196.2 SM COMMERCIAL
CONSTRUCTION AREA 15,421 sqm
(165,990 sq ft)
NINTH FLOOR ROOF
(F.F.E. 119.47m)
SIXTH FLOOR ROOF
(F.F.E. 109.945m)
FOURTH FLOOR ROOF
(F.F.E. 103.595m)
Chevrolet Express 4500 (2016)
RUE BAREILLE / SNOW STREET
66.79m
[219'-2"]
61.79m
[202'-9"]
56.10m
[184'-1"]
51.10m
[167'-8"]
7.07m
[23'-2"]
CB308A
T/G 89.56
CB308
CB308C
T/G 88.74
CB308B
CB206B
04273
MH206
STAIR A
STAIR B
STAIR C
ELEVATORS



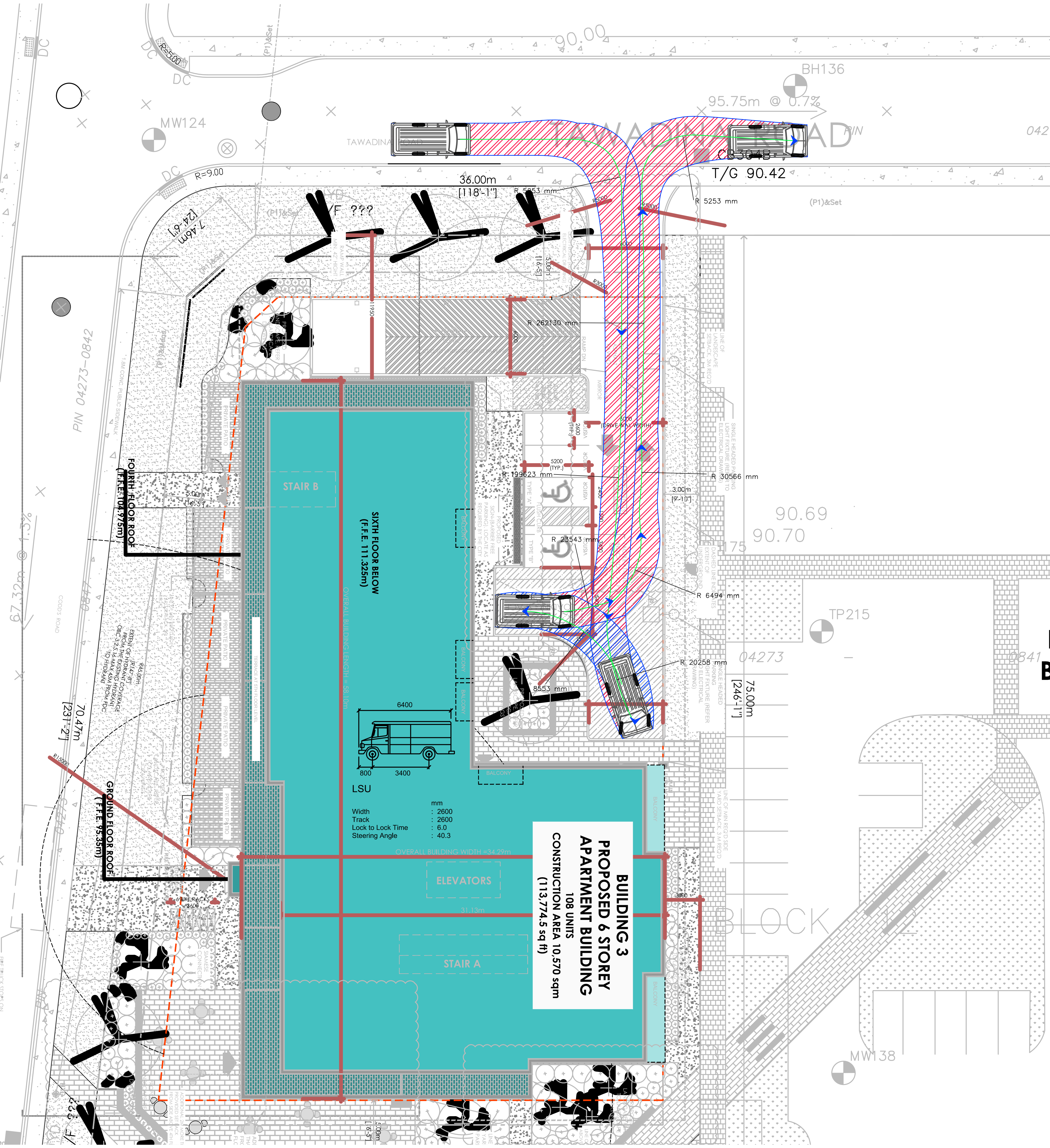
66.79m
[219'-2"]
LINE OF MIN REQ'D REAR YARD SETBACK, 7.5M REQ'D
SINGLE HEADED PARKING LIGHT FIXTURE (REFER TO ELECTRICAL DRAWING)
LINE OF LANDESCAPE SETBACK, 3M REQ'D
R 10686 mm
R 327024 mm
R 16507 mm
R 5253 mm
R 136712 mm
R 9390 mm
R 60919 mm
R 670726 mm
DASHED LINE INDICATES EXTENT OF UNDERGROUND
LIGHT DUTY ASPHALT
CONVEX MIRROR
PRIVATE PATIO
PRIVATE PATIO
BALCONY
BUILDING 2
PROPOSED 9 STOREY
APARTMENT BUILDING
131 UNITS + 196.2 SM COMMERCIAL
CONSTRUCTION AREA 15,421 sqm
(165,990 sq ft)
STAIR A
STAIR B
ELEVATORS
STAIR C
NINTH FLOOR ROOF
(F.F.E. 119.47m)
SIXTH FLOOR ROOF
(F.F.E. 109.945m)
6400
800
3400
LSU
mm
Width : 2600
Track : 2600
Lock to Lock Time : 6.0
Steering Angle : 40.3
OVERALL BUILDING LENGHT=58.27m
TERRACE AT 5TH FLOOR LEVEL
PRIVACY GATE TO AMENITY SPACE-REFER TO LANDSCAPE
TACTILE ATTENTION INDICATORS AS PER O.B.C. 3.8.3.18.
SINGLE HEADED PARKING LIGHT FIXTURE (REFER TO ELECTRICAL DRAWING)
VISITOR
FLUSH CURB
T/G 89.56
CB308
51.10m
[167'-8"]
5.00m
[16'-5"]
LINE OF LANDESCAPE SETBACK, 3M REQ'D
T/G 87.50
T/G 88.74
CB308B
7.07m
[23'-2"]
ADDITIONAL 2M MORE THAN PROVIDED SET BACK FROM FRONT ABOVE 4TH FLOOR
ADDITIONAL 2M MORE THAN PROVIDED SET BACK FROM SIDE ABOVE 4TH FLOOR
LINE OF MAX REQ'D FRONT YARD SETBACK, 2M REQ'D
COMMERCIAL ENTRANCE
APARTMENT PEDESTRIAN ENTRANCE
FIRE FIGHTER ACCESS
SIAMESE CONNECTION
AMENITY ENTRANCE
5 BIKE RACKS
61.79m
2.00m
[6'-7"]
7.50m
[24'-7"]
2600 (TYP.)
5200 (TYP.)
RUE BAREILLE/ SNOW STREET
1.8M CONC. PUBLIC SIDEWALK



BUILDING 3
PROPOSED 6 STOREY
APARTMENT BUILDING
108 UNITS
CONSTRUCTION AREA 10,570 sqm
(113,774.5 sq ft)
SIXTH FLOOR BELOW
(F.F.E. 111.325m)
FOURTH FLOOR ROOF
(F.F.E. 104.975m)
GROUND FLOOR ROOF
(F.F.E. 95.35m)
STAIR B
STAIR A
ELEVATORS
Chevrolet Express 4500 (2016)
TAWADINA
36.00m
[118'-1"]
7.46m
[24'-6"]
70.47m
[231'-2"]
75.00m
[246'-1"]
67.32m @ 1.3%
95.75m @ 0.7%
18.78m @ 1.5%
90.00
90.69
90.70
MW124
BH136
CB304B
T/G 90.42
TP215
PIN 04273-0842
04273
R=9.00
R=5.00
DC
(P1)&Set
3.00m
[9'-10"]
BLOCK



TAWADINA ROAD
90.00
BH136
MW124
CB304B
T/G 90.42
R=9.00
R=5.00
36.00m
[118'-1"]
7.46m
[24'-6"]
R 10075 mm
R 59627 mm
R 110864 mm
R 10076 mm
R 80604 mm
R 10075 mm
R 23833 mm
R 7698 mm
90.69
90.70
TP215
04273
75.00m
[246'-1"]
PIN 04273-0842
67.32m @ 1.3%
70.47m
[231'-2"]
FOURTH FLOOR ROOF
(F.F.E. 104.375m)
GROUND FLOOR ROOF
(F.F.E. 95.35m)
STAIR B
SIXTH FLOOR BELOW
(F.F.E. 111.325m)
10000
800
6500
MSU
mm
Width : 2600
Track : 2600
Lock to Lock Time : 6.0
Steering Angle : 40.2
ELEVATORS
STAIR A
BUILDING 3
PROPOSED 6 STOREY
APARTMENT BUILDING
108 UNITS
CONSTRUCTION AREA 10,570 sqm
(113,774.5 sq ft)
BLOCK
MW138



90.00
BH136
95.75m @ 0.7%
MW124
TAWADINA ROAD
CB304B
T/G 90.42
R=5.00
R=9.00
36.00m
[118'-1"]
7.46m
[24'-6"]
R 5253 mm
R 262130 mm
R 199623 mm
R 30566 mm
R 23543 mm
R 6494 mm
R 20258 mm
8553 mm
3.00m
[9'-10"]
5.00m
[16'-5"]
90.69
90.70
TP215
04273
75.00m
[246'-1"]
PIN 04273-0842
67.32m @ 1.3%
70.47m
[231'-2"]
FOURTH FLOOR ROOF
(F.F.E. 104.975m)
GROUND FLOOR ROOF
(F.F.E. 95.35m)
SIXTH FLOOR BELOW
(F.F.E. 111.325m)
STAIR B
ELEVATORS
STAIR A
6400
800
3400
LSU
mm
Width : 2600
Track : 2600
Lock to Lock Time : 6.0
Steering Angle : 40.3
BUILDING 3
PROPOSED 6 STOREY
APARTMENT BUILDING
108 UNITS
CONSTRUCTION AREA 10,570 sqm
(113,774.5 sq ft)
BLOCK
MW138

Appendix G – MMLOS Analyses

Multi-Modal Level of Service - Intersections Form

Consultant	IBI Group	Project	1000/1050 Tawadina Road
Scenario	Future (2026 & 2031) Total Traffic	Date	01-Jun-21
Comments	refined from Wateridge Phase 1B, Block 19 TIA		

To add intersections
Select columns LMNO, right-click and *Copy;*
Then select column P, right-click and *Insert Copied Cells*

INTERSECTIONS		Montreal & Codds/ Carsons				Montreal & Wanaki/ Bathgate				Intersection C			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	7	6	8	8	4	4	5	5				
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m				
	Conflicting Left Turns	Protected/ Permissive	Protected/ Permissive	Permissive	Permissive	Protected/ Permissive	Protected/ Permissive	Permissive	Permissive				
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control				
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed				
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No				
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel				
	Corner Radius	10-15m	10-15m	10-15m	5-10m	10-15m	5-10m	10-15m	10-15m				
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings				
	PETSI Score	4	20	-12	-11	56	57	40	40				
	Ped. Exposure to Traffic LoS	F	F	F	F	D	D	E	E	-	-	-	-
	Cycle Length	120	120	120	120	120	120	120	120				
	Effective Walk Time	45	58	10	10	24	24	9	9				
	Average Pedestrian Delay	23	16	50	50	38	38	51	51				
	Pedestrian Delay LoS	C	B	E	E	D	D	E	E	-	-	-	-
	Level of Service	F	F	F	F	D	D	E	E	-	-	-	-
		F				E				-			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP				
	IF Dedicated Right Turn Lane, THEN Right Turn Configuration, ELSE <blank>					Not Applicable	Not Applicable	Not Applicable	Not Applicable				
	Dedicated Right Turning Speed					Not Applicable	Not Applicable	Not Applicable	Not Applicable				
	Cyclist Through Movement			Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-	-	-	-
	Separated or Mixed Traffic	Mixed Traffic	Mixed Traffic	Separated	Separated	Separated	Separated	Separated	Separated	-	-	-	-
	Left Turn Approach	One lane crossed	One lane crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed				
	Operating Speed	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	≥ 60 km/h				
	Left Turning Cyclist	D	D	F	F	B	B	B	C	-	-	-	-
	Level of Service	D	D	F	F	B	B	B	C	-	-	-	-
		F				C				-			
Transit	Average Signal Delay	≤ 30 sec	> 40 sec	≤ 20 sec	≤ 10 sec			≤ 10 sec	≤ 10 sec				
	Level of Service	D	F	C	B	-	-	B	B	-	-	-	-
		F				B				-			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	> 15 m	10 - 15 m				
	Number of Receiving Lanes on Departure from Intersection	≥ 2	≥ 2	1	1	≥ 2	≥ 2	1	1				
	Level of Service	B	B	E	E	B	B	C	E	-	-	-	-
		E				E				-			
Auto	Volume to Capacity Ratio	0.0 - 0.60				0.0 - 0.60							
	Level of Service	A				A				-			

Extracts from TIAs for Multi-Modal Level of Services (MMLOS) Analyses

Wateridge Phase 2A/2B TIA – Synchro files for Intersection-based MMLOS

Wateridge Phase 1B TIA - for segment-based MMLOS

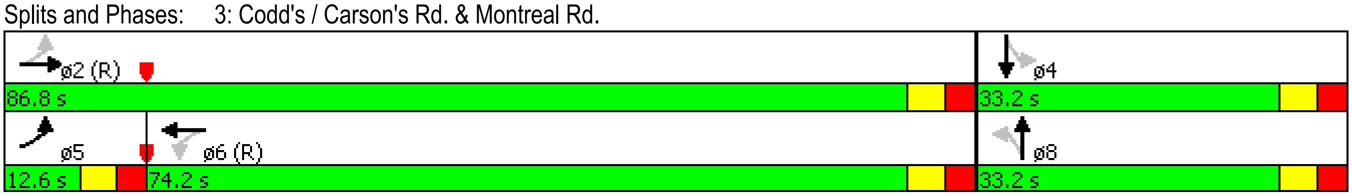
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	895	115	105	1235	55	100	5	35	100	5	210
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Confl. Bikes (#/hr)												
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	6%	2%	9%	3%	3%	10%	5%	0%	3%	1%	0%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	105	1010	0	105	1290	0	100	40	0	100	215	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	10.9	33.2		33.2	33.2		33.2	33.2		33.2	33.2	
Total Split (s)	12.6	86.8		74.2	74.2		33.2	33.2		33.2	33.2	
Total Split (%)	10.5%	72.3%		61.8%	61.8%		27.7%	27.7%		27.7%	27.7%	
Maximum Green (s)	6.7	80.6		68.0	68.0		27.0	27.0		27.0	27.0	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.9		2.9	2.9		2.9	2.9		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.9	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		C-Max	C-Max		Max	Max		Max	Max	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Pedestrian Calls (#/hr)		10		10	10		10	10		10	10	
Act Effct Green (s)	80.9	80.6		68.1	68.1		27.0	27.0		27.0	27.0	
Actuated g/C Ratio	0.67	0.67		0.57	0.57		0.22	0.22		0.22	0.22	
v/c Ratio	0.49	0.47		0.38	0.70		0.56	0.11		0.35	0.49	
Control Delay	16.1	3.3		15.3	15.8		54.8	14.6		43.3	17.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	16.1	3.3		15.3	15.8		54.8	14.6		43.3	17.4	
LOS	B	A		B	B		D	B		D	B	
Approach Delay		4.5			15.7			43.3			25.6	
Approach LOS		A			B			D			C	
Queue Length 50th (m)	2.5	12.4		9.5	62.2		19.3	0.8		18.4	11.7	
Queue Length 95th (m)	m3.8	m17.1		16.2	70.9		36.8	9.1		33.4	32.9	
Internal Link Dist (m)		284.4			325.2			440.9			559.8	
Turn Bay Length (m)	90.0			70.0			30.0			25.0		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	217	2170		276	1845		179	358		286	442	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.48	0.47		0.38	0.70		0.56	0.11		0.35	0.49	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 13.8	Intersection LOS: B
Intersection Capacity Utilization 95.3%	ICU Level of Service F
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Codd's / Carson's Rd. & Montreal Rd.



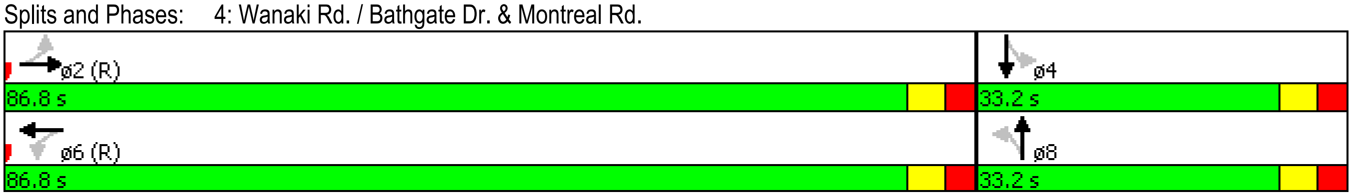
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Volume (vph)	170	785	125	145	1265	140	100	30	110	105	30	110
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Confl. Bikes (#/hr)												
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	3%	3%	3%	1%	4%	6%	6%	1%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	170	910	0	145	1405	0	100	140	0	105	140	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	33.2	33.2		33.2	33.2		33.2	33.2		33.2	33.2	
Total Split (s)	86.8	86.8		86.8	86.8		33.2	33.2		33.2	33.2	
Total Split (%)	72.3%	72.3%		72.3%	72.3%		27.7%	27.7%		27.7%	27.7%	
Maximum Green (s)	80.6	80.6		80.6	80.6		27.0	27.0		27.0	27.0	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.9	2.9		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Pedestrian Calls (#/hr)	10	10		10	10		10	10		10	10	
Act Effct Green (s)	90.1	90.1		90.1	90.1		17.5	17.5		17.5	17.5	
Actuated g/C Ratio	0.75	0.75		0.75	0.75		0.15	0.15		0.15	0.15	
v/c Ratio	0.80	0.37		0.38	0.58		0.71	0.46		0.72	0.48	
Control Delay	36.8	3.4		9.9	8.5		73.3	17.2		74.1	24.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	36.8	3.4		9.9	8.5		73.3	17.2		74.1	24.1	
LOS	D	A		A	A		E	B		E	C	
Approach Delay		8.7			8.6			40.6			45.5	
Approach LOS		A			A			D			D	
Queue Length 50th (m)	7.2	18.1		9.2	57.9		21.1	5.8		22.2	10.6	
Queue Length 95th (m)	#73.9	24.5		26.7	102.7		35.1	20.8		36.4	25.9	
Internal Link Dist (m)		325.2			555.4			431.2			525.0	
Turn Bay Length (m)	140.0			60.0			50.0			40.0		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	213	2434		384	2428		218	411		225	399	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.80	0.37		0.38	0.58		0.46	0.34		0.47	0.35	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 14.0 Intersection LOS: B
Intersection Capacity Utilization 93.9% ICU Level of Service F
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Wanaki Rd. / Bathgate Dr. & Montreal Rd.



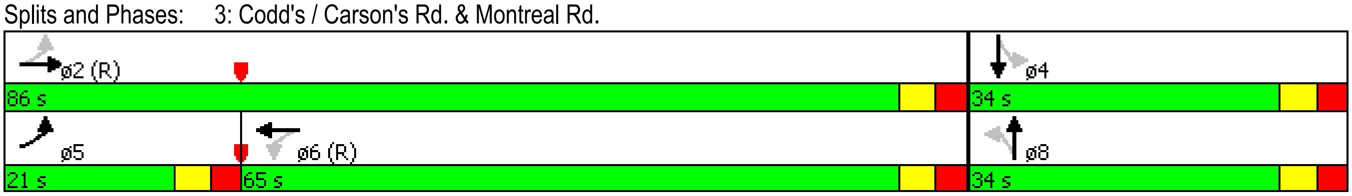
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1315	80	30	1055	70	90	5	45	70	5	130
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Confl. Bikes (#/hr)												
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	2%	6%	3%	2%	1%	0%	0%	0%	1%	0%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	155	1395	0	30	1125	0	90	50	0	70	135	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	10.9	33.2		33.2	33.2		33.2	33.2		33.2	33.2	
Total Split (s)	21.0	86.0		65.0	65.0		34.0	34.0		34.0	34.0	
Total Split (%)	17.5%	71.7%		54.2%	54.2%		28.3%	28.3%		28.3%	28.3%	
Maximum Green (s)	15.1	79.8		58.8	58.8		27.8	27.8		27.8	27.8	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.6	2.9		2.9	2.9		2.9	2.9		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.9	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		C-Max	C-Max		Max	Max		Max	Max	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Pedestrian Calls (#/hr)		10		10	10		10	10		10	10	
Act Effct Green (s)	80.1	79.8		64.2	64.2		27.8	27.8		27.8	27.8	
Actuated g/C Ratio	0.67	0.66		0.54	0.54		0.23	0.23		0.23	0.23	
v/c Ratio	0.53	0.64		0.19	0.64		0.34	0.13		0.24	0.31	
Control Delay	23.2	19.2		15.4	16.7		43.0	13.1		40.2	9.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	23.2	19.2		15.4	16.7		43.0	13.1		40.2	9.0	
LOS	C	B		B	B		D	B		D	A	
Approach Delay		19.6			16.7			32.3			19.7	
Approach LOS		B			B			C			B	
Queue Length 50th (m)	20.7	91.8		2.6	64.6		16.4	0.8		12.4	0.9	
Queue Length 95th (m)	m24.2	m103.2		m6.6	73.7		30.8	10.1		24.5	15.3	
Internal Link Dist (m)		284.4			325.2			440.9			559.8	
Turn Bay Length (m)	90.0			70.0			30.0			25.0		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	351	2178		160	1756		261	383		291	437	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.44	0.64		0.19	0.64		0.34	0.13		0.24	0.31	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 19.1 Intersection LOS: B
Intersection Capacity Utilization 100.9% ICU Level of Service G
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Codd's / Carson's Rd. & Montreal Rd.



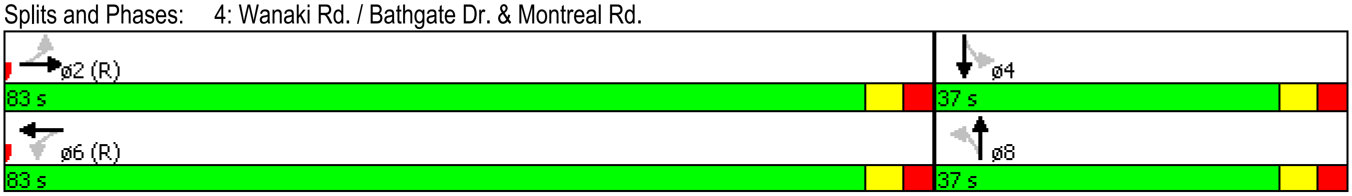
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1210	90	80	930	110	130	20	120	140	25	170
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Confl. Bikes (#/hr)												
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	2%	2%	1%	1%	0%	0%	9%	3%	1%	4%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	105	1300	0	80	1040	0	130	140	0	140	195	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	33.2	33.2		33.2	33.2		33.2	33.2		33.2	33.2	
Total Split (s)	83.0	83.0		83.0	83.0		37.0	37.0		37.0	37.0	
Total Split (%)	69.2%	69.2%		69.2%	69.2%		30.8%	30.8%		30.8%	30.8%	
Maximum Green (s)	76.8	76.8		76.8	76.8		30.8	30.8		30.8	30.8	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.9	2.9		2.9	2.9	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.2	6.2		6.2	6.2		6.2	6.2		6.2	6.2	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Pedestrian Calls (#/hr)	10	10		10	10		10	10		10	10	
Act Effct Green (s)	86.1	86.1		86.1	86.1		21.5	21.5		21.5	21.5	
Actuated g/C Ratio	0.72	0.72		0.72	0.72		0.18	0.18		0.18	0.18	
v/c Ratio	0.34	0.55		0.36	0.44		0.89	0.42		0.74	0.49	
Control Delay	8.5	6.9		14.1	8.4		96.2	20.9		68.7	14.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.5	6.9		14.1	8.4		96.2	20.9		68.7	14.5	
LOS	A	A		B	A		F	C		E	B	
Approach Delay		7.0			8.8			57.1			37.2	
Approach LOS		A			A			E			D	
Queue Length 50th (m)	4.4	28.5		5.9	42.7		27.8	10.3		29.0	7.4	
Queue Length 95th (m)	m7.0	32.1		19.7	70.3		45.7	25.0		45.6	24.7	
Internal Link Dist (m)		325.2			555.4			431.2			525.0	
Turn Bay Length (m)	140.0			60.0			50.0			40.0		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)	306	2354		222	2362		210	438		269	498	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.34	0.55		0.36	0.44		0.62	0.32		0.52	0.39	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 15.2	Intersection LOS: B
Intersection Capacity Utilization 87.3%	ICU Level of Service E
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Wanaki Rd. / Bathgate Dr. & Montreal Rd.



1.0 SEGMENT MMLOS

This section provides a review of the boundary streets using complete streets principles. The Multi-Modal Level of Service (MMLOS) guidelines produced by IBI Group in 2015 were used to evaluate the LOS of the boundary roadways for each mode of transportation. The subject site is bounded by the following streets:

a) Codd's Road to the west
b) Hemlock Road to the north
c) Barielle-Snow Street to the east
d) Mikinak Road to the south

Schedule 'B' of the City of Ottawa's Official Plan indicates that all boundary streets are located within the General Urban Area. The boundary streets are approved as part of the Phase 1B subdivision. The boundary street analysis is based on the approved cross-sections.

Targets for the Pedestrian Level of Service (PLOS), Bicycle Level of Service (BLOS), Transit Level of Service (TLOS), Truck Level of Service (TkLOS) and Vehicular Level of Service (Auto LOS) for the study area roadways are based on the targets for roadways within the General Urban Area, as identified in Exhibit 22 of the MMLOS guidelines.

1.1 Pedestrian Level of Service (PLOS)

Exhibit 4 of the MMLOS guidelines has been used to evaluate the segment PLOS of the planned boundary streets. Exhibit 22 of the MMLOS guidelines suggest a target PLOS C for all road classes. The results of the segment PLOS analysis are summarized in **Table 1**.

Table 1: PLOS Segment Analysis

Sidewalk Width	Boulevard Width	Avg. Daily Curb Lane Traffic Volume	Presence of On-Street Parking	Operating Speed [2]	Segment PLOS
Codd's Road (west side) [1]					
3.6m	>2m	> 3000 vpd	No	50 km/h	B
Codd's Road (east side)					
2.0m	>2m	> 3000 vpd	Yes	50 km/h	B
Hemlock Road (north and south side)					
2.0m	>2m	> 3000 vpd	Yes	50 km/h	B
Barielle-Snow Street (west side)					
1.8m	0.5-2m	< 3000 vpd	N/A	50 km/h	B
Mikinak Road (north side)					
2.0m	0	< 3000 vpd	Yes	50 km/h	B
Mikinak Road (south side) [1]					
3.6m	>2m	< 3000 vpd	No	50 km/h	A

1. Multi-use pathway evaluated
2. Operating speed of taken as the assumed posted speed limit (40 km/hr) plus 10 km/h

1.2 Bicycle Level of Service (BLOS)

Exhibit 11 of the MMLOS guidelines has been used to evaluate the segment BLOS of the planned boundary streets. Exhibit 22 of the MMLOS guidelines a target BLOS B for local cycling routes and a target BLOS D for all roads with no cycling designation in the General Urban Area. The results of the segment BLOS analysis are summarized in **Table 2**.

Table 2: BLOS Segment Analysis

Road Class	Bike Route	Type of Bikeway	Travel Lanes (Per Direction)	Operating Speed	Segment BLOS
Codd's Road (west side)					
Collector	Local	MUP	1	50 km/h	A
Codd's Road (east side)					
Collector	Local	Mixed Traffic	1	50 km/h	D
Hemlock Road (north and south side)					
Collector	No Designation	Uni-directional Cycle Track	1	50 km/h	A
Barielle-Snow Street (west side)					
Local (Residential)	No Designation	Mixed Traffic	1	50 km/h	B
Mikinak Road (north side)					
Collector	No Designation	Mixed	1	50 km/h	D
Mikinak Road (south side)					
Collector	No Designation	MUP	1	50 km/h	A

1.3 Transit Level of Service (TLOS)

Exhibit 15 of the MMLOS guidelines has been used to evaluate the segment TLOS of the planned boundary streets. No TLOS target is suggested in Exhibit 22 the MMLOS guidelines for the boundary streets. Codd's Road, Hemlock Road and Mikinak Road will serve transit and have been evaluated for TLOS despite having no target. Barielle-Snow Street has not been evaluated for TLOS. The results of the segment TLOS analysis are summarized in **Table 3**.

Table 3: TLOS Segment Analysis

Facility Type	Level/Exposure to Congestion Delay, Friction and Incidents			Segment TLOS
	Congestion	Friction	Incident Potential	
Codd's Road				
Mixed Traffic – Moderate Parking/Driveway Friction	Yes	Medium	Medium	E
Hemlock Road				
Mixed Traffic –Moderate Parking/Driveway Friction	Yes	Medium	Medium	E
Mikinak Road				
Mixed Traffic – Moderate Parking/Driveway Friction	Yes	Medium	Medium	E

1.4 Truck Level of Service (TkLOS)

No TkLOS target is suggested in Exhibit 22 of the MMLOS guidelines for the boundary streets. The boundary streets (collectors and local) have not been evaluated for TkLOS.

1.5 Vehicular Level of Service (Auto LOS)

Exhibit 22 of the MMLOS guidelines suggest a target Auto LOS D for all roads within the General Urban Area. The typical lane capacity along the study area roadways are based on the City's guidelines for the TRANS Long-Range Transportation Model. The lane capacity along the boundary streets has been estimated based on roadway classification and general characteristics (i.e. suburban with limited access, urban with on-street parking, etc.). Traffic volumes have been based on the total projected peak hour traffic volumes (Figure 14) presented in the 2014 CTS. The results of the Auto LOS analysis are summarized in the following table.

Table 4: Auto LOS Segment Analysis

Direction	Directional Capacity	Traffic Volumes		V/C Ratio and LOS			
		AM Peak	PM Peak	AM Peak		PM Peak	
				V/C	LOS	V/C	LOS
Codd's Road							
NB	400	198	245	0.50	A	0.61	B
SB	400	249	256	0.62	B	0.64	B
Hemlock Road							
EB	400	153	155	0.38	A	0.39	A
WB	400	154	177	0.39	A	0.44	A
Mikinak Road							
EB	400	49	66	0.12	A	0.17	A
WB	400	60	55	0.15	A	0.14	A

Total traffic volumes on Barielle-Snow Street were not projected in the 2014 CTS, however as it is a local class road, volumes are anticipated to be lower than the collector roads that it connects

Appendix H – Post-Development Monitoring Plan for Phase 2A/2B

CANADA LANDS COMPANY

Wateridge Village Phase 2A & 2B

Monitoring Program

April 2019 – 18-8319

Table of Contents

Figures

Tables

1.0 Introduction

A transportation monitoring program has been developed for Wateridge Village Phase 2A and 2B to better understand travel behaviors for each phase of development. The monitoring program addresses three items as follows:

- Monitoring of cut through traffic from Wateridge Village
- Monitoring of transit shares for Wateridge Village
- Monitoring of constrained network intersections

The objectives, and approach for conducting the monitoring program to satisfy the conditions for Subdivision Registration are described herein.

1.1 Conditions of Subdivision Approval

Subdivision Agreement – Schedule E, (Part C) Conditions of Plan Approval

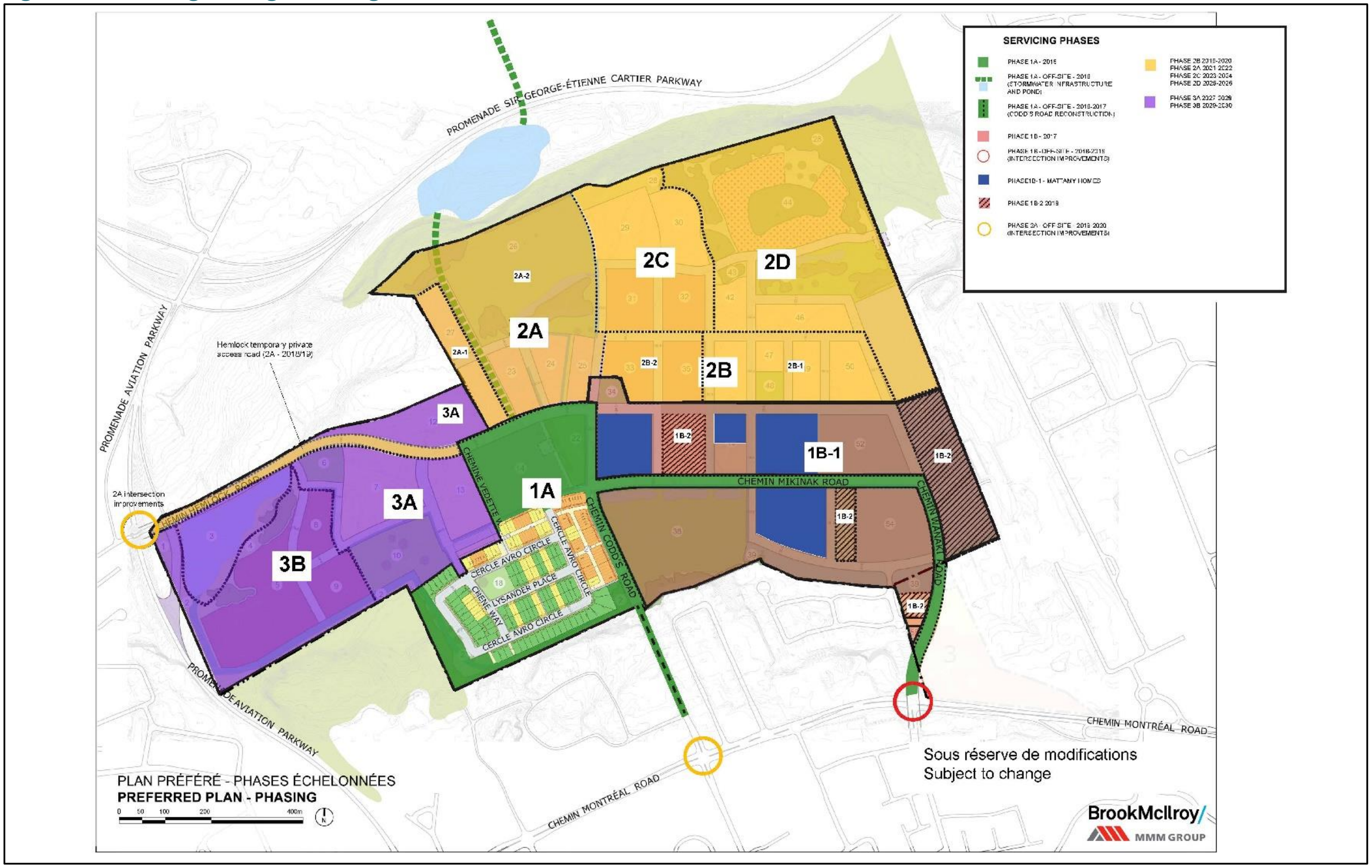
Condition #	Details
13a - Highways/ Roads	The owner acknowledges and agrees to retain a Professional Engineer with expertise in the field of transportation planning and/or traffic operations to prepare a Transportation Impact Study and any subsequent Transportation studies as required prior to the registration of the Plan, to the satisfaction of the General Manager, Planning and Growth Management. The study shall comply with the City of Ottawa's Transportation Impact Assessment Guidelines. The Owner further agrees to revise the draft plan in accordance with the recommendations of the study to the satisfaction of the General Manager, Planning and Growth Management.
17 - Traffic	The owner acknowledges and agrees to conduct, at their expense a **traffic study** (including monitoring traffic over a two month period) signed by a consultant on the TIA pre-approved consultant list to assess the traffic movements to and from the subject site in the surrounding area (bound by Sir George-Etienne Cartier Parkway, St Laurent Boulevard, Montreal Road and Blair Road). As well the study should evaluate the effect of the traffic from the subject site on the neighbouring local street network, in particular to the community to the south, at the owners sole expense and to the satisfaction of the General Manager, Planning and Growth Management.

DILLON CONSULTING

Condition #	Details
	The study shall commence one (1) year after 80% occupancy of each phase of the proposed plan of subdivision. The owner shall be responsible for implementation of the study recommendations at its sole expense, and to the satisfaction f the General Manager, Planning and Growth Management.
19 - Public Transit	The Owner acknowledges and agrees that prior to registration, a **monitoring program** will be developed to evaluate the success of targeted modal shares to the satisfaction of the General Manager, Planning and Growth Management.

A TIA has been developed for the Wateridge Village Phase 2A and 2B addressing conditions 13a under a separate cover. The monitoring program described herein, is presented alongside the TIA to satisfy the remaining identified conditions.

Figure 1: Wateridge Village Phasing Plan



Site plan provided October 25, 2018.

2.0 Monitoring Program

The monitoring program includes three components:

1. Monitoring of neighbourhood cut through traffic;
2. Monitoring of transit shares;
3. Monitoring of constrained network intersections.

Each component of the monitoring program addressed the following:

• Objective	Purpose of the study
• Context	Background information
• Approach	How the study will be undertaken
• Frequency and duration,	Time of day, length of study, number of samples
• Metrics	What quantifiable metrics will be used
• Deliverable	

The monitoring program has been designed such that each component can be executed independently. The plan can be adapted in the future by adding and/or modifying a component to address additional unforeseen concerns.

2.1 Monitoring of neighbourhood cut through traffic

2.1.1 Objective

To determine how many vehicle are travelling through adjacent residential neighbourhood with the increase in vehicles due to Phase 2A and 2B of Wateridge Village.

2.1.2 Context

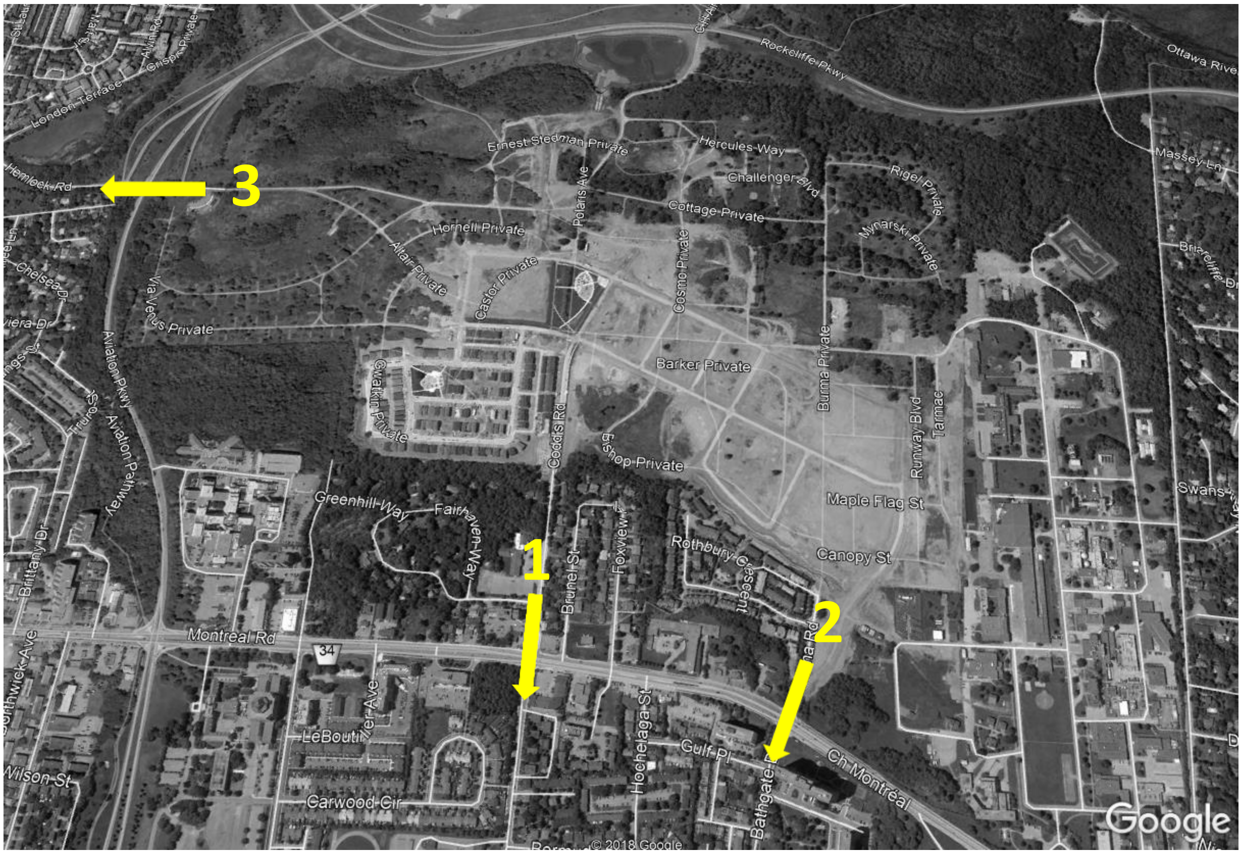
Phase 2a and 2B of Wateridge village includes 3 vehicle accesses (**Figure 2**):

1. Montreal Road intersection at Codd's Road / Carson's Road,
2. Montreal Road intersection at Burma Road (Wanaki Road) / Bathgate Drive, and
3. Hemlock Road at Aviation Parkway (NB on-ramp)

Codd's Road and Burma Road (Wanaki Road) north of Montreal Road are aligned with Bathgate Drive and Carson's Road south of Montreal Road, respectively. There is potential for vehicles to/from Wateridge Village to use Bathgate Drive and Carson's Road south of Montreal Road which could increase vehicle volumes in the adjacent residential development and College La Cité.

The introduction of a new Wateridge Village access at Hemlock Road will also likely result in an increase in vehicles on Hemlock Road between the Aviation Parkway and St Laurent Boulevard. While it is anticipated that many of the Wateridge Village vehicles that use the Hemlock Road access would be to/from the Aviation Parkway, monitoring is required to ensure that vehicles volumes on Hemlock Road west of the parkway are manageable.

Figure 2: Wateridge Site Access



2.1.3 Approach

Several traffic counts will be conducted at the <u>three</u> access intersections. The data will identify:

- The share of site generated vehicles that travel eastbound and westbound on Montreal Road versus the vehicles that travel through the neighbourhood to the south;
- Potential growth in vehicle volumes through the neighbourhood to the south (comparison with existing November 2018 vehicle volumes);
- The share of total generated vehicles at the Hemlock Road access that are to/from the Aviation Parkway versus Hemlock Road west of the Aviation Parkway.

The traffic counts will be scheduled to occur one year following 80% occupancy of Phase 2A and 2B of Wateridge Village, once area travel patterns have been better established. (Estimated to be in 2023)

Phase	Estimated Completion Year
Phase 2A and 2B	2022 / 2023

2.1.4 Frequency and duration

Initial traffic counts were completed in November 2018 at the existing access intersections. These counts will serve as a baseline for comparing how vehicle volumes have changed pre and post Phase 2A and 2B development.

The monitoring program is to include 2 counts at each access intersection (6 counts total). Traffic counts are to be completed during the months of May and September.

Each traffic count will include 8 hours per day (7-10 AM, 11:30AM - 1:30PM, and 3 - 6PM,on a Wednesday or Thursday) in order to align with typical City of Ottawa traffic reports.

2.1.5 Metrics

The traffic data collected through the monitoring program will help determine <u>the proportion of vehicles from the development that use Montreal Road verses Codd's Road / Carson's Road or Burma Road (Wanaki) / Bathgate Drive</u>.

The November 2018 data identified the following daily and peak period distributions for vehicle trips from Wateridge Village travelling through the community to the South versus those travelling westbound and eastbound along Montreal Road. The percentages have been included in **Table 1** below. For instance, the existing daily percentages, at Codd's/ Carson's Road are as follows: approximately 3% of *daily* vehicles from Wateridge Village travel through the community to the south versus the 63% that are westbound for Montreal Road and 34% for eastbound Montreal Road.

The Phase 2A & 2B TIA assumed a 0% site generated distribution from the Wateridge community to the South as all southbound traffic was assumed to be via Aviation Parkway and St. Laurent Boulevard. The traffic distribution aligns with the Former Rockcliffe Redevelopment Community Transportation Study (CTS) and the Phase 1A Transportation brief prepared by Parsons.

The analysis will address both inbound and outbound trips. Daily, AM and PM peak period distributions will be identified from the traffic data and will be included in the assessment. The table also identifies proposed triggers that are to be used for identifying whether to implement traffic calming measures. Measures to divert traffic potentially include installing speed humps or a speed display board.

Table 1: Share of Vehicle Trips Travelling South versus eastbound or westbound on Montreal Road

	Codd's / Carson's			Burma (Wanaki) / Bathgate		
Condition	Daily (in & out)	Peak Period (peak dir)		Daily (in & out)	Peak Period (peak dir)	
		AM	PM		AM	PM
Existing Distribution	3% / 3%	5.3%	6.7%	19% / 15%	30%	30%
Proposed Future Distribution from TIA	N/A	3.6%	2.1%	N/A	10.9%	7.8%
Threshold for Considering Traffic Calming Measures	**10%**	**10%**	**10%**	**30%**	**30%**	**30%**

While the proportion of vehicles is an interesting metric for monitoring, the hourly volume of vehicles will also be identified and assessed to determine the average growth in potential cut-through traffic through the community to the south. Continued growth in vehicle volumes may require traffic calming measures, or other approaches to maintain acceptable speeds and volumes on area roadways. The collected data will be compared to the November 2018 data as well as the data obtained from other future monitoring to identify potential trends.

Table 2 presents the existing and proposed roadway volume as well as the proposed thresholds for considering traffic calming measures. The trigger for traffic calming was identified based on the volume requirements to change the designation of a roadway. The noted roads south of Montreal Road are Collector roadways with a proposed capacity for peak hour volumes up to 600 vehicles / hour.

Table 2: Volume of Vehicle Trips to/through Quarries and Carson Grove Neighbourhoods

	Codd's / Carson's		**Burma (Wanaki) / Bathgate**	
Condition	Peak Period (peak dir)		Peak Period (peak dir)	
	AM	PM	AM	PM
Existing Volume	225	140	285	260
Proposed Future Volume from TIA	225	140	300	270
Proposed Threshold for Considering Traffic Calming Measures	**600**	**600**	**600**	**600**

The collected data at the Hemlock Road access will identify the volume of Wateridge Village Site traffic that uses the Aviation Parkway versus Hemlock Road west of the parkway. Daily, AM peak period, and PM peak period distributions will be identified. The focus of the analysis will be on outbound trips from the Wateridge Village (inbound trips would require an additional count at the Aviation Parkway off-ramp).

The TIA that was completed for Phase 2A and 2B indicated that 29% outbound site generated trips via Hemlock would be destined westbound toward St Laurent Boulevard and Beechwood Avenue, representing 60 vehicles in the AM peak hour. This, in addition to existing traffic, represents a total outbound volume of 295 vehicles travelling westbound via Hemlock in the AM peak hour, equivalent to 59% of total traffic at this access. As identified above, if more than 600 vehicles per hour are observed using Hemlock Road in the peak direction, traffic calming measures should be investigated.

2.1.6 Deliverable

A memo will be prepared documenting the results of the monitoring program.

2.2 Monitoring of Transit Shares for Wateridge Village

2.2.1 Objective

To determine the share of Wateridge Village site trips that are accommodated by transit.

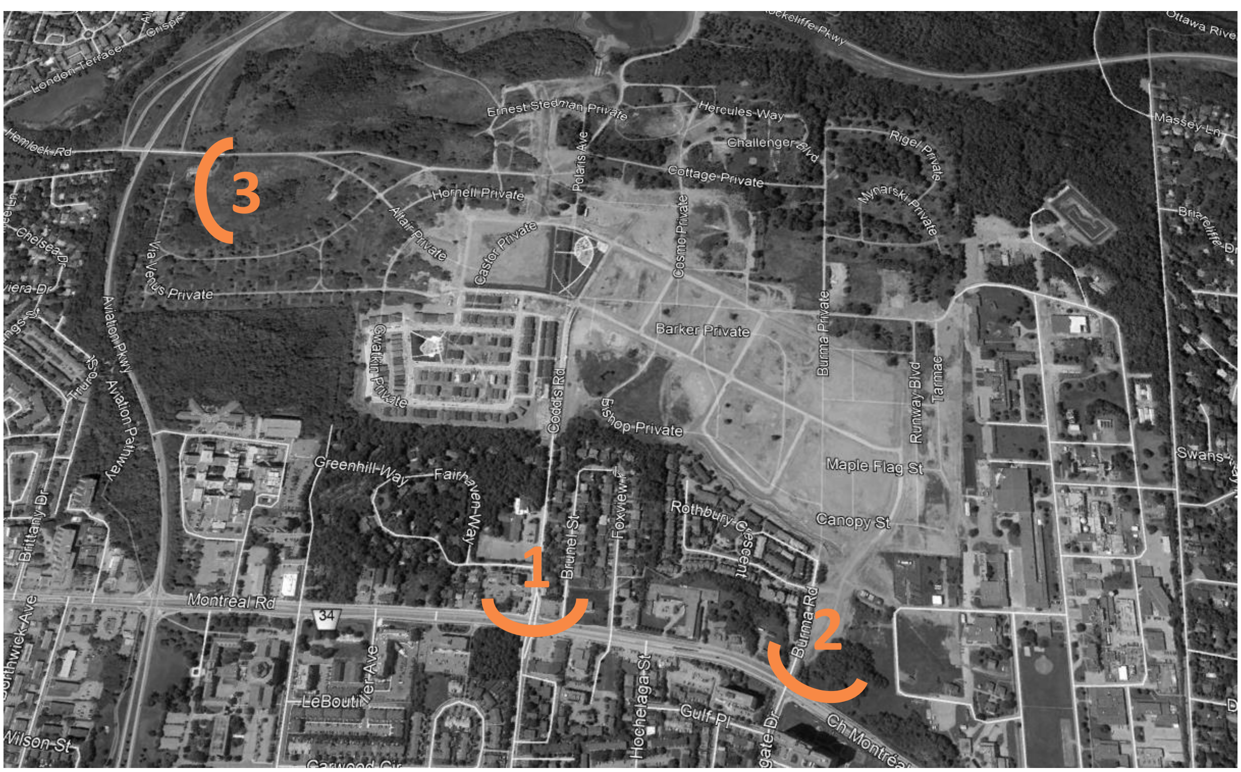
2.2.2 Context

The CTP, CDP, and TIAs for Wateridge Village is based on achieving a 35% transit mode share, particularly during the peak periods when the roadway network is at capacity. The development is provided with transit service, however the development it in its early stages, with no onsite employment and is yet to include the planned community core. Most site generated trips are therefore external to the area. While the community will be more transit focused as it develops, the current limited service frequency and hours of operation may hinder the attractiveness of transit.

2.2.3 Approach

A vehicle classification and occupancy study will be undertaken following completion of Phase 2A and 2B of Wateridge Village. Any available OC Transpo data will be utilized in addition to this occupancy study to help establish transit mode shares. The focus will be on passenger boardings during the AM peak period. Identifying PM mode share may be challenging due to a lack of Automated Passenger Count (APC) alighting data. Field staff will be situated at the three site accesses (**Figure 3**) tabulating the number of inbound and outbound vehicles with an estimate for the number of passengers per vehicle.

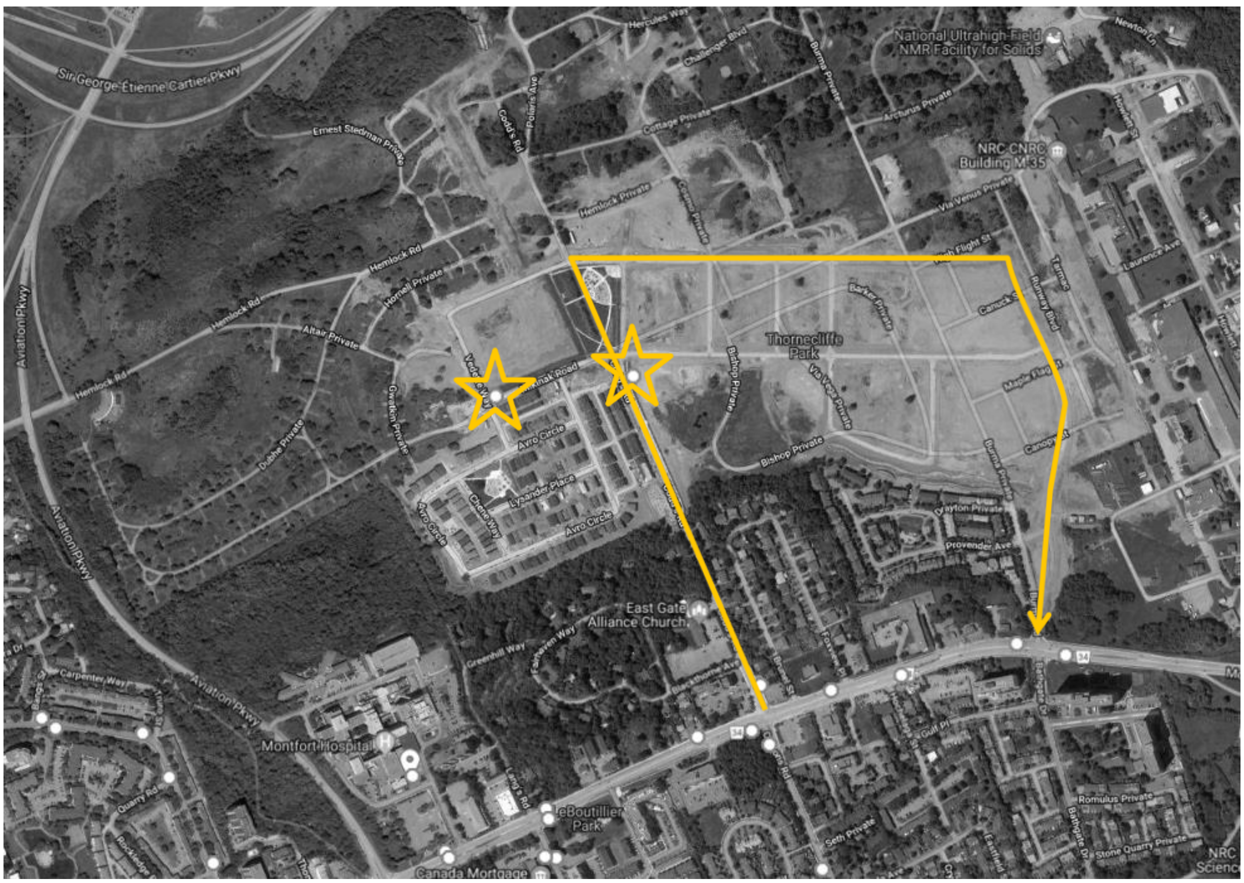
Figure 3: C&O Data Collection Locations



All modes will be included in the study including buses, bicycles, and pedestrians.

Once Phase 2A and 2B have been developed, the transit routes that serve the site will be modified with additional stops along the route. The existing Wateridge Transit Stops, and a proposed transit routing for Phase 2A and 2B is presented in **Figure 4**. It is noted that the identified transit routing may change, particularly with the potential for connections to Hemlock Road. Obtaining APC data from OC Transpo for all stops within the study area allows for a clear understanding of passenger boardings within the Village regardless of transit routing. Stop level boarding data from OC Transpo will be used to confirm the number of transit passenger boardings during the AM peak period (since a visual inspection of on-board passengers can be difficult for buses). Over 10% of OC Transpo buses are equipped with APC devices and the buses are rotated among all bus routes. There is therefore a reasonably significant sample of data for each service booking that can be used to determine peak transit boardings for stops in Wateridge Village.

Figure 4: OC Transpo Transit Stops (Existing Stops and Planned Phase 2A and 2B route)



It is recognized that while pedestrian and cyclists will be included in the C&O counts at the 3 vehicle site accesses, there is potential that active transportation trips use other pathways that are not being collected, potentially underestimating total active transportation usage. The collected data however will provide a meaningful breakdown of auto drivers, auto passengers, and transit passengers.

2.2.4 Frequency and duration

The study will be undertaken over a single day (on a Wednesday or Thursday) for a 3 hour AM peak period to align with typical OC Transpo reporting periods.

2.2.5 Metrics

The following metrics will be used to identify AM peak period transit mode shares for Wateridge Village:

- Number of outbound vehicle and person trips
- Total peak period on-site transit boardings.

The data will be compiled into a single database representing all modes of travel and mode shares will be determined. The identified mode shares will be compared with the 35% peak transit mode share target, to determine if TDM tools should be used to further encourage transit use. There will be a limited ability to implement exclusive transit priority roadway infrastructure to encourage transit use due to the constrained ROW; however several potential options have been identified. For additional detail please refer to the TDM checklist included in Appendix C of the Phase 2A and 2B TIA.The following are a few measures hat can be adopted to increase the transit mode share:

- Install transit amenities such as shelters in advance of when warrants may be met;
- Minimize use of bus bays;
- Provide transit information;
- Consider transit fare incentives;
- Investigate if there are opportunities to increase the profile of transit through the community with signage, branding, and potential transit priority measures at site accesses (Codd's/Montreal Road, Wanaki/Montreal, Hemlock/Aviation Parkway) and internal to the development.

These measures will shift the priority to transit users and encourage a higher mode share.

2.2.6 Deliverable

A memo will be prepared documenting the results of the monitoring program. The data collected as part of the study along with relevant OC Transpo data will provided to CLC.

2.3 Monitoring of constrained network intersections

2.3.1 Objective

To assess operations (V/Cs, delays, and queues) through identified constrained network intersections with the increase in vehicles from Phase 2A and 2B of Wateridge Village.

2.3.2 Context

The TIA that was undertaken for Phase 2A and 2B of Wateridge Village suggests that the following two intersections are already operating close to capacity in the peak hours.

1. Montreal Road and St. Laurent Boulevard, and
2. Montreal Road and Aviation Parkway

Table 3: Existing LOS and Critical Movements

Intersection	Date	AM Peak Hour	PM Peak Hour
Montreal Road and St. Laurent Boulevard	January 2016	LOS E (SBL)	LOS E (EBT,WBL,NBT,SBL)
Montreal Road and Aviation Parkway.	January 2018	LOS E (EBT, SBL)	LOS E (EBT, WBT, NBL, NBT)

The addition of Phase 2A and 2B site generated traffic puts additional pressure on these already constrained network intersections. It is understood that in the future additional network connections will be provided between Wateridge Village and the Aviation Parkway which will modify travel patterns in the area. As well, an Environmental Assessment is currently underway for Montreal Road from St. Laurent Boulevard Blair Road assessing the ability to accommodate transit priority measures which may result in changes to the roadway configuration. The TIA therefore suggested that these already constrained intersections be monitored to ensure they do not result in unmanageable vehicle congestion.

2.3.3 Approach

Traffic counts will be conducted at the two network intersections. The data will be used to identify if vehicle volumes are being maintained or have grown since occupancy of Wateridge Village Phase 2A and 2B.

The traffic counts will be scheduled to occur one year following 80% occupancy of Phase 2A and 2B of Wateridge Village, once area travel patterns have been better established. (Estimated to be in 2023)

2.3.4 Frequency and duration

The monitoring program is to include 2 counts at each access intersection (4 counts total). Traffic counts are to be completed during the months of May and September.

Each traffic count will be undertaken over a single day (7-10 AM, 11:30AM - 1:30PM, and 3 - 6PM, on a Wednesday or Thursday) in order to align with typical City of Ottawa traffic reports.

2.3.5 Metrics

The traffic data collected through the monitoring program will help determine the theoretical volume to capacity ratios and intersection delays associated with the increase in vehicles due to Phase 2A and 2B of Wateridge Village. The analysis will also assess if vehicle queues are continuously growing, and/or if they extend back to impact adjacent intersections.

- Analysis of weekday AM and PM peak hours
- V/C Ratio
- Movement Delay

Daily, AM and PM peak period vehicle volume distributions will also be identified to determine how long the intersections are at capacity. It is recognized that operations may be constrained for a short duration. Continued network intersection failure may require measures to satisfy the vehicle demand in advance of the future Aviation Parkway connection to Hemlock Road, and other potential modifications being identified through the Montreal Road Transit Priority EA.

Specific metrics to trigger change are as follows.

- Queues reaching adjacent intersections;
- Average V/C ratio over the peak period > 1.0 for all critical approaches;
- Movement Delay for all critical movements > 110 seconds (typical signal cycle length).

Remediation steps include: advancing the provision of access from Aviation Parkway to Hemlock Road, and prioritizing critical transit movements at the affected intersection. It is noted that the intersections along Montreal Road are being reconfigured through the Montreal-Blair Road Transit Priority Corridor Study.

2.3.6 Deliverable

A memo will be prepared documenting the results of the monitoring program with recommendations. This memo will be shared with the Traffic Engineering group.

Appendix I – Intersection Capacity Analyses Extracts

4.0 Analysis

4.1 Development Design

4.1.1 Design for Sustainable Modes

The community will be designed for sustainable modes of transportation. Facilities will include sidewalks and bike lanes / MUP as presented in **Table 11**. On-street parking for vehicles will be limited to Collector roadways and on Hemlock Road in the core area. Local roads will not include on-street parking which will help encourage use of sustainable modes.

Table 11: Design for Sustainable Modes

Roadway	Cycling	Pedestrian	Parking
Hemlock Road, Wanaki Road	Segregated cycling facilities	Sidewalks on both sides	On-street parking on one side
Codd's Road, Mikinak Road	Multi-Use Pathway	Sidewalk on one side	On-street parking on one side
Hemlock Core Street	Segregated cycling facilities	Sidewalks on both sides	On-street parking on both sides (curbless)
Local Streets	Mixed traffic	Sidewalks on one or both sides	None

Transit service is currently provided along Codd's Road. As service expands in the area, additional stops will be situated along Codd's Road, as well as Wanaki Road and Mikinak Road. The route will be relocated to Hemlock Road once the road is constructed east of Codd's Road along with transit stops to ensure residents are within 400m of a stop. There will be direct and convenient sidewalks and paved surfaces between the residential developments and the transit stops.

4.1.2 Circulation and Access

Not applicable; exempted during screening and scoping.

4.1.3 New Street Networks

The roadway network for Wateridge Village Phase 2A and 2B includes the construction of Hemlock Road as a future Major Collector through the Village. The road will connect to Wanaki Road in the east of the site providing a connection to Montreal Road. Hemlock Road will also be open for vehicle, cycling and pedestrian access on the west side of the site connecting to Aviation Parkway.

Planned cross-sections for the study area roadways were obtained from the CDP and are included in **Appendix A**. Hemlock Road will have a 26m cross-section except for the Hemlock Core Street where a 24m cross-section is identified. Codd's Road and Wanaki Road area planned with 26m ROW.

It is noted that while the 2031 affordable rapid transit and transit priority network includes Codd's Road and Hemlock Road as transit priority corridors with continuous lanes, the planned cross section for these roads include a single travel lane per direction used by both vehicles and transit. On street parking and lay-by parking is provided on these roadways, however the planned 2.4 - 2.5m lane would not suffice as a potential future transit lane. The parking lanes are planned to be protected with bump outs at intersecting roadways to reduce pedestrian crossing distances.

Hemlock Road will intersect Codd's Road in the centre of the Village. An all-way stop control would operate with LOS A during the AM and PM peak hours as presented in **Table 12.**

Table 12: Future AM (PM) Peak Hour Vehicle Operations (New Street Network)

Codd's Rd. & Hemlock Rd. - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBTRL	85 (85)	7.5 (7.6)	A (A)	0.10 (0.10)	-	-
WBTRL	95 (65)	7.8 (7.6)	A (A)	0.11 (0.08)	-	-
NBTRL	50 (65)	7.4 (7.4)	A (A)	0.06 (0.07)	-	-
SBLR	60 (35)	7.4 (7.2)	A (A)	0.07 (0.04)	-	-
OVERALL	**290 (250)**			**0.09 (0.08)**		
WORST MOVEMENT		**WBTRL (EBTRL)**		**0.11 (0.10)**		

4.2 Parking

Not applicable; exempted during screening & scoping.

4.3 Boundary Street Design

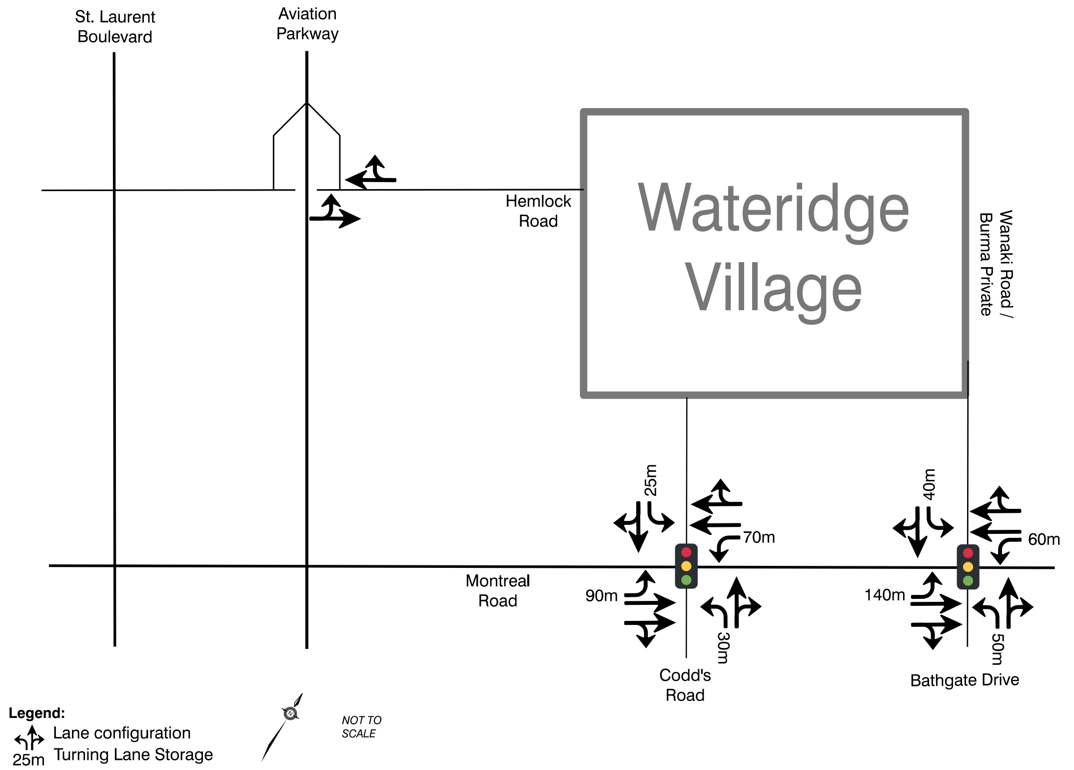
4.3.1 Design Concept

The Multi-Modal Level of Service (MMLOS) was evaluated for the following boundary and access road segments to assist with developing a design concept that maximizes the achievement of the MMLOS objectives:

- Montreal Road,
- Hemlock Road,
- Codd's Road, and
- Wanaki Road.

Since the development will be within 300 metres of a school in the future, Hemlock Road, Codd's Road and Wanaki Road are subject to MMLOS targets for of the school policy area. Montreal Road is subject to different targets throughout its length; classified as an Arterial roadway within the General Urban Policy Area. **Table 13** presents the minimum desirable LOS targets for each mode considering the policy area and road classification for each of the roads under review.

Figure 18: Access Intersection Configuration



4.4.2 Intersection Control

The intersections of Montreal Road at Codd's Road and at Wanaki Road are signal controlled. These intersections are provided with eastbound left turn storage lanes. The intersection at Codd's Road includes a dedicated protected signal phase for access into the development, and vehicles are permitted as well during the eastbound through movement. At Wanaki Road, eastbound left turns do not have a protected signal phase and must yield to EB traffic. There are no westbound right turn lanes, as vehicles use a shared through / right turn lane for access to the site.

As part of Phase 2 of the Wateridge Village development, Hemlock Road will enable access between Aviation Parkway and the development. Eastbound and westbound vehicles will be uncontrolled at the northbound ramp to Aviation Parkway. Vehicles on the southbound ramp from Aviation to Hemlock Road will continue to stop and yield to east/west traffic on Hemlock Road.

4.4.3 Intersection Design

The sections that follow present the analysis of intersection operations during the AM and PM peak hours under existing and future conditions.

4.4.3.1 Existing Access Intersection Operations

Table 15 summarizes the Synchro results for the existing access intersections during the weekday AM and PM peak hours. **Appendix B** contains the intersection performance worksheets.

Table 15: Existing AM (PM) Peak Hour Vehicle Operations (Access Intersections)

Codd's / Carson's Rd. & Montreal Rd. - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBL	55 (45)	13.5 (9.8)	A (A)	0.31 (0.18)	4.3 (3.7)	m5.0 (m4.3)
EBTR	860 (1340)	14 (18.7)	A (C)	0.55 (0.74)	39.5 (71.5)	m47.8 (m78.1)
WBL	105 (30)	10 (8.4)	A (A)	0.35 (0.19)	7.3 (1.9)	m10.7 (m4.2)
WBTR	1220 (945)	14.7 (12.7)	C (A)	0.72 (0.54)	49.3 (51.1)	m68.4 (60)
NBL	100 (90)	45 (43.1)	A (A)	0.42 (0.35)	20.6 (18.3)	37 (33.4)
NBTR	40 (50)	14.2 (13.1)	A (A)	0.12 (0.15)	1 (1)	9.8 (10.7)
SBL	35 (35)	38.2 (38.6)	A (A)	0.14 (0.14)	6.8 (6.8)	15.5 (15.6)
SBTR	100 (70)	9.7 (11.2)	A (A)	0.27 (0.20)	1 (1)	14.2 (12.4)
OVERALL	**2515 (2605)**			**0.59 (0.60)**		
WORST MOVEMENT		**WBTR (EBTR)**		**0.72 (0.74)**		
Wanaki Rd. / Bathgate Dr. & Montreal Rd. - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBL	20 (50)	50.4 (9.2)	A (A)	0.37 (0.20)	3.2 (3.3)	m6.2 (m4.1)
EBTR	845 (1265)	35.2 (10.3)	B (B)	0.61 (0.64)	72.8 (43.5)	82.6 (44)
WBL	145 (80)	87.9 (24.9)	E (A)	0.94 (0.54)	32.3 (9.1)	m59.3 (28.2)
WBTR	1260 (910)	38.6 (10)	E (A)	0.90 (0.45)	143 (49.3)	#178.1 (61.1)
NBL	95 (125)	23.4 (47)	A (A)	0.21 (0.48)	14.3 (26.4)	25.9 (45.2)
NBTR	125 (135)	7.2 (22.3)	A (A)	0.21 (0.39)	3.9 (12.6)	15.1 (30.2)
SBL	35 (15)	21.4 (38.1)	A (A)	0.08 (0.08)	5 (2.9)	11.4 (8.8)
SBTR	80 (40)	17.3 (17.2)	A (A)	0.14 (0.13)	9.1 (1.9)	18.8 (10.8)
OVERALL	**2605 (2620)**			**0.71 (0.53)**		
WORST MOVEMENT		**WBL (EBTR)**		**0.94 (0.64)**		
Hemlock Rd. & Aviation Pkwy NB On Ramp - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBTL	60 (200)	**Uncontrolled Movements** No Delay				
WBTR	0 (0)					
OVERALL	**60 (200)**					
WORST MOVEMENT						

Notes:

#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.

4.4.3.2 Future Access Intersection Operations

Table 16 summarizes the Synchro results for the access intersections during the weekday AM and PM peak hours for the 2022/2027 horizon. **Appendix B** contains the intersection performance worksheets. The analysis includes the following modifications between existing and future conditions:

- PHF from 0.9 to 1.0 for all intersections
- Access provided on Hemlock Road between Wateridge Village and Aviation Parkway.

Table 16: Future AM (PM) Peak Hour Vehicle Operations (Access Intersections)

Codd's / Carson's Rd. & Montreal Rd. - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBL	130 (180)	24.3 (26.7)	B (B)	0.6 (0.6)	5.4 (26.4)	m8.1 (m29.9)
EBTR	1010 (1395)	3.4 (19.3)	A (B)	0.47 (0.64)	13.1 (92.7)	m17.5 (m102.6)
WBL	105 (30)	15.4 (16)	A (A)	0.38 (0.19)	9.4 (2.7)	m16.1 (m6.6)
WBTR	1300 (1135)	15.6 (17.4)	C (B)	0.71 (0.66)	62.6 (65.3)	72.2 (77.4)
NBL	100 (90)	62 (44.2)	B (A)	0.64 (0.38)	19.7 (16.5)	#41.6 (31.2)
NBTR	40 (50)	14.6 (13.1)	A (A)	0.11 (0.13)	0.8 (0.8)	9.1 (10.1)
SBL	110 (75)	44.2 (40.6)	A (A)	0.38 (0.26)	20.4 (13.4)	36.4 (26)
SBTR	245 (160)	21.4 (8.7)	A (A)	0.55 (0.35)	17.4 (0.9)	41.7 (16.5)
OVERALL	**3040 (3115)**			**0.58 (0.6)**		
WORST MOVEMENT		**WBTR (WBTR)**		**0.71 (0.66)**		
Wanaki Rd. / Bathgate Dr. & Montreal Rd. - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBL	170 (105)	52.5 (9.1)	D (A)	0.89 (0.36)	7.8 (4.5)	#77.1 (m7.1)
EBTR	920 (1305)	3.8 (7.1)	A (A)	0.39 (0.56)	19.4 (29)	25.5 (32.6)
WBL	145 (80)	11.2 (14.7)	A (A)	0.4 (0.37)	10.5 (6.1)	m43.1 (20)
WBTR	1440 (1070)	9.7 (8.8)	B (A)	0.61 (0.46)	68.9 (45.6)	107.4 (73.1)
NBL	100 (130)	61.3 (85.8)	B (D)	0.61 (0.84)	20.3 (27.4)	34.9 (45.4)
NBTR	140 (140)	15.9 (20.7)	A (A)	0.43 (0.41)	5.6 (10.4)	20.8 (25.2)
SBL	135 (160)	79.3 (76.1)	D (D)	0.8 (0.82)	28.4 (33.5)	46.2 (52.1)
SBTR	140 (195)	22.8 (15)	A (A)	0.45 (0.49)	10.6 (8.1)	26.4 (25.5)
OVERALL	**3190 (3185)**			**0.55 (0.53)**		
WORST MOVEMENT		**EBL (NBL)**		**0.89 (0.84)**		
Hemlock Rd. & Aviation Pkwy NB On Ramp - AM (PM) Peak Hour						
Movement	Volume	Delay (s)	LOS	V/C	Q50th (m)	Q95th (m)
EBTL	130 (285)	3.7 (5.7)	A (A)	0.04 (0.13)	-	0.9 (3.1)
WBTR	105 (70)	0 (0)	A (A)	0.06 (0.04)	-	0 (0.0)
OVERALL	**235 (355)**			**0.05 (0.11)**		
WORST MOVEMENT		**WBTR (EBTL)**		**0.06 (0.13)**		

Notes:

#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.
m	Volume for 95th percentile queue is metered by upstream signal.

The analysis confirms that vehicles will continue to operate with satisfactory conditions at access intersections achieving LOS D or better in the peak hours. The analysis also confirms that the existing eastbound left turn storage on Montreal Road at Codd's Road and at Wanaki Road are adequate to accommodate the identified vehicle queues.

4.5 Transportation Demand Management

To ensure that the target transit and non-motorized mode shares are achieved in the future, TDM measures can be adopted to encourage sustainable transportation choices. Many of the tools available can be implemented through the planning and design of the community, while others can be adopted through the site plan development and after the site is occupied.

Appendix C contains the complete TDM checklists which help to identify relevant TDM measures to be adopted in the future.

From the TDM checklists, some recommendations are as follows:

- display relevant transit schedules and route maps at residential building entrances;
- display local area maps with walking/cycling access routes and key destinations at major entrances;
- contract with provider to install on-site bikeshare station;
- contract with provider to install on-site carshare vehicles and promote their use by residents;
- unbundle parking costs - condominium purchase price / monthly rent;
- provide a multimodal travel option information package to new residents.

TDM-supportive design & infrastructure measures:

- Locate buildings close to the street, and do not locate parking areas between the street and building entrances
- Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations
- Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort
- Provide shower and lockers for retail employees.

4.6 Neighbourhood Traffic Management

The site generated traffic is to travel between the site and the arterial road network using Codd's Road, Hemlock Road and Wanaki Road which are all identified Collector roadways.

The total forecast traffic volumes presented in **Figure 16** suggest that Hemlock Road and Wanaki Road (between Montreal Road and Hemlock Road) accommodate up to 335 vph which is appropriate for the Major Collector designation with peak hour volumes up to 600vph. Codd's Road is not anticipated to accommodate more than 300 vehicles in the peak hour confirming the Collector roadway designation.

movements at unsignalized intersections are also assigned a LOS based on their respective V/C ratio.

Existing and Background Conditions

The following **Table 11** and **Table 12** summarize existing and projected background conditions at study area intersections, in the absence of the proposed development. The objective of this analysis is to determine if network improvements are, or will be required to support background traffic, or if projected future demand should be adjusted (e.g. once an auto network becomes saturated, a modal shift can be expected). Detailed Synchro output data for existing and future background conditions are provided in **Appendix D**.

Table 11: Study Area Intersection Operations – Existing

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
St. Laurent/Hemlock - Pretimed Signal									
EBL	1 L	0.08	22.3	A	8	0.10	22.5	A	10
EBT	1 T	0.14	22.7	A	17	0.47	27.9	A	47
EBR	1 R	0.55	4.1	A	15	0.46	3.7	A	14
WBL	1 L	0.32	26.0	A	25	0.23	25.0	A	17
WB	1 T/R	0.38	25.6	A	38	0.15	21.7	A	17
NBL	1 L	0.70	16.5	B	48	0.90	32.6	D	#104.0
NB	1 T/R	0.19	6.5	A	19	0.32	7.2	A	30
SB	1 L/T/R	0.41	18.5	A	48	0.34	17.6	A	40
Overall		**0.57**	**14.1**	**A**	-	**0.66**	**19.3**	**B**	-
Hemlock/Aviation S off-ramp - Unsignalized									
EBT	1 T	0.09	0.0	A	0	0.26	0.0	A	0
WBT	1 T	0.04	0.0	A	0	0.03	0.0	A	0
SB	1 L/R	0.41	11.2	A	16	0.14	10.6	A	4
Overall		**0.37**	**7.2**	**A**	-	**0.34**	**1.9**	**A**	-
Hemlock/Aviation N on-ramp - Unsignalized									
EB	1 T/L	0.05	3.7	A	1	0.24	6.9	A	8
WB	1 T/R	0.07	0.0	A	0	0.05	0.0	A	0
Overall		**0.18**	**2.0**	**A**	-	**0.34**	**5.9**	**A**	-
Codd's/Mikinak - Unsignalized									
EB	1 L/T/R	0.07	7.4	A	0	0.05	7.4	A	0
WB	1 L/T/R	0.07	8.1	A	0	0.07	8.1	A	0
NB	1 L/T/R	0.16	8.0	A	0	0.21	8.3	A	0
SB	1 L/T/R	0.14	8.1	A	0	0.12	8.0	A	0
Overall		**0.30**	**7.9**	**A**	-	**0.29**	**8.1**	**A**	-
Aviation/Montreal - Actuated-Coordinated Signal									
EBL	1 L	0.25	19.3	A	12	0.30	21.1	A	14
EBT	2 T	0.79	43.0	C	128	0.96	54.2	E	#200.5
EBR	1 R	0.48	13.6	A	43	0.50	18.9	A	61
WBL	1 L	0.96	70.5	E	#132.7	1.70	362.0	F	#139.3
WBT	2 T	0.78	26.2	C	#177.7	0.76	45.3	C	160
WBR	1 R	0.23	2.1	A	4	0.39	21.5	A	57
NBL	1 L	0.87	57.8	D	#76.2	0.95	65.5	E	#115.0
NBT	1 T	0.68	54.8	B	81	0.76	53.1	C	#140.7

NBR	1 R	0.54	11.0	A	29	0.45	12.8	A	35
SBL	1 L	0.75	44.2	C	66	0.46	28.3	A	36
SBT	1 T	0.84	67.2	D	#100.3	0.84	64.3	D	#128.4
SBR	1 R	0.16	0.8	A	0	0.15	0.7	A	0
Overall		**0.84**	**37.3**	**D**	-	**1.03**	**63.3**	**F**	-
Carsons/Codd's/Montreal - Actuated-Coordinated Signal									
EBL	1 L	0.36	4.4	A	m7.9	0.29	3.8	A	m5.5
EB	1 T & 1 T/R	0.41	4.2	A	82	0.49	3.6	A	m31.3
WBL	1 L	0.39	19.6	A	38	0.13	14.1	A	11
WB	1 T & 1 T/R	0.58	17.1	A	134	0.48	14.2	A	104
NBL	1 L	0.81	80.7	D	51	0.59	58.4	A	39
NB	1 T/R	0.22	13.5	A	14	0.20	14.7	A	13
SBL	1 L	0.20	40.6	A	19	0.33	45.9	A	27
SB	1 T/R	0.45	10.3	A	20	0.39	10.6	A	17
Overall		**0.57**	**15.1**	**A**	-	**0.48**	**11.4**	**A**	-
Aviation/Sir George E off-ramp/Sir George E on-ramp - Unsignalized									
EB	1 L/T/R	0.50	14.9	A	23	0.26	10.2	A	9
NB	1 T/R	0.25	0.0	A	0	0.49	0.0	A	0
SBL	1 L	0.00	8.2	A	0	0.01	9.5	A	0
SBT	1 T	0.18	0.0	A	0	0.07	0.0	A	0
Overall		**0.67**	**4.9**	**B**	-	**0.72**	**2.2**	**C**	-
Aviation/Sir George W on-ramp/Sir George W off-ramp - Unsignalized									
WB	1 L/T/R	1.38	232.4	F	153	0.23	21.2	A	7
NBL	1 L	0.23	7.9	A	7	0.25	8.1	A	8
NBT	1 T	0.02	0.0	A	0	0.03	0.0	A	0
SB	1 T/R	0.01	0.0	A	0	0.04	0.0	A	0
Overall		**0.67**	**109.9**	**B**	-	**0.72**	**7.9**	**C**	-

Notes: *# - denotes 95th percentile volume exceeding capacity*
Ideal saturation flow rate assumed to be 1,800 veh/h/lane
PHF assumed to be 0.90

As shown in **Table 11**, study area intersections are currently operating well with an acceptable overall Auto-LOS 'D' or better during weekday morning and afternoon peak hours, with the exception of the Aviation/Montreal intersection, which is currently operating over capacity with an overall Auto-LOS of 'F' during the weekday afternoon peak hour. With regard to 'critical' movements at study area intersections, they are operating with an Auto-LOS of 'D' or better during both peak hours, with the exception of the westbound approach at the Aviation/Sir George W on-ramp/Sir George W off-ramp intersection, which is operating with an Auto-LOS 'F' during the AM peak hour. During the PM peak hour, the eastbound through and northbound left-turn movements at the Aviation/Montreal intersection are currently operating near capacity with an overall Auto-LOS 'E' and the westbound left-turn movement is operating over capacity with an Auto-LOS 'F'.

In terms of 95th percentile queues, there are several critical movements at the Aviation/Montreal intersection that are projected to spillback and block adjacent lanes and intersections (e.g. the AM westbound through movement and the PM east and westbound through movements at the Aviation/Montreal intersection etc.), which is denoted by a '#' in the previous **Table 11**.

Based on our local area knowledge/field observations, the above network performance assessment is generally consistent with pre-pandemic conditions, with the exception of the unsignalized Aviation/Sir George West on/off-ramp intersection. The long delays and the failing westbound movement reported is attributed to the small number of westbound through and left-turning vehicles unable able to find an acceptable gap in the north/southbound traffic streams (i.e. 1 to 2 veh/h during peak hours may experience longer than normal delays). In reality, the westbound through and/or left-turn movement at this location can be completed in two stages with minimal delays (e.g. using the median/left-turn lane as refuge), which is an acceptable maneuver that is not recognized by the intersection capacity analysis software tool Synchro. In our experience, the unsignalized Aviation/Sir George West on/off-ramp intersection operates acceptably during peak hours.

Potential measures to improve individual movements that are operating near or over capacity during peak hours include:

Aviation/Montreal

- Dual westbound left-turn lanes, which will require dual southbound receiving lanes; and
- Optimize signal timing splits.

Aviation/Sir George West on/off-ramp

- Implement all-way STOP control or a roundabout (if necessary, as our local area knowledge/field observations suggest this intersection operates acceptably).

The suggested improvement measures mentioned above are only provided for information/decision making purposes and have not been assumed for the subsequent analysis. If any of these possible measures are desirable by the City, further investigation of their feasibility may be required to support their justification. It should also be noted that the above suggested measures to improve network operations are provided to mitigate impacts related to background traffic only (i.e. the above suggested measures to improve network operations are not required to support the projected traffic generated by the subject development).

The following **Table 12** summarizes intersection operations for future scenarios with the addition of background traffic volumes only for the 2025 horizon year and beyond. This future background scenario assumes no intersection or network improvements.

Table 12: Study Area Intersection Operations – Background (2025, 2030)

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
St. Laurent/Hemlock - Pretimed Signal									
EBL	1 L	0.08	22.3	A	8	0.10	22.5	A	10
EBT	1 T	0.14	22.7	A	17	0.47	27.9	A	47
EBR	1 R	0.55	4.1	A	15	0.46	3.7	A	14
WBL	1 L	0.32	26.0	A	25	0.23	25.0	A	17
WB	1 T/R	0.38	25.6	A	38	0.15	21.7	A	17
NBL	1 L	0.70	16.5	B	48	0.90	32.6	D	#104.0
NB	1 T/R	0.19	6.5	A	19	0.32	7.2	A	30
SB	1 L/T/R	0.41	18.5	A	48	0.34	17.6	A	40
Overall		**0.57**	**14.1**	**A**	-	**0.66**	**19.3**	**B**	-
Hemlock/Aviation S off-ramp - Unsignalized									
EBT	1 T	0.09	0.0	A	0	0.26	0.0	A	0
WBT	1 T	0.04	0.0	A	0	0.03	0.0	A	0
SB	1 L/R	0.41	11.2	A	16	0.14	10.6	A	4
Overall		**0.37**	**7.2**	**A**	-	**0.34**	**1.9**	**A**	-
Hemlock/Aviation N on-ramp - Unsignalized									
EB	1 T/L	0.05	3.7	A	1	0.24	6.9	A	8
WB	1 T/R	0.07	0.0	A	0	0.05	0.0	A	0
Overall		**0.18**	**2.0**	**A**	-	**0.34**	**5.9**	**A**	-
Codd's/Mikinak - Unsignalized									
EB	1 L/T/R	0.07	7.4	A	0	0.05	7.4	A	0
WB	1 L/T/R	0.07	8.1	A	0	0.07	8.1	A	0
NB	1 L/T/R	0.16	8.0	A	0	0.21	8.3	A	0
SB	1 L/T/R	0.14	8.1	A	0	0.12	8.0	A	0
Overall		**0.30**	**7.9**	**A**	-	**0.29**	**8.1**	**A**	-
Aviation/Montreal - Actuated-Coordinated Signal									
EBL	1 L	0.25	19.3	A	12	0.30	21.1	A	14
EBT	2 T	0.79	43.0	C	128	0.96	54.2	E	#200.5
EBR	1 R	0.48	13.6	A	43	0.50	18.9	A	61
WBL	1 L	0.96	70.5	E	#132.7	1.70	362.0	F	#139.3
WBT	2 T	0.78	26.2	C	#177.7	0.76	45.3	C	160
WBR	1 R	0.23	2.1	A	4	0.39	21.5	A	57
NBL	1 L	0.87	57.8	D	#76.2	0.95	65.5	E	#115.0
NBT	1 T	0.68	54.8	B	81	0.76	53.1	C	#140.7
NBR	1 R	0.54	11.0	A	29	0.45	12.8	A	35
SBL	1 L	0.75	44.2	C	66	0.46	28.3	A	36
SBT	1 T	0.84	67.2	D	#100.3	0.84	64.3	D	#128.4
SBR	1 R	0.16	0.8	A	0	0.15	0.7	A	0
Overall		**0.84**	**37.3**	**D**	-	**1.03**	**63.3**	**F**	-
Carsons/Codd's/Montreal - Actuated-Coordinated Signal									
EBL	1 L	0.36	4.4	A	m7.9	0.29	3.8	A	m5.5
EB	1 T & 1 T/R	0.41	4.2	A	82	0.49	3.6	A	m31.3
WBL	1 L	0.39	19.6	A	38	0.13	14.1	A	11
WB	1 T & 1 T/R	0.58	17.1	A	134	0.48	14.2	A	104
NBL	1 L	0.81	80.7	D	51	0.59	58.4	A	39

NB	1 T/R	0.22	13.5	A	14	0.20	14.7	A	13
SBL	1 L	0.20	40.6	A	19	0.33	45.9	A	27
SB	1 T/R	0.45	10.3	A	20	0.39	10.6	A	17
Overall		**0.57**	**15.1**	**A**	-	**0.48**	**11.4**	**A**	-
Aviation/Sir George E off-ramp/Sir George E on-ramp - Unsignalized									
EB	1 L/T/R	0.50	14.9	A	23	0.26	10.2	A	9
NB	1 T/R	0.25	0.0	A	0	0.49	0.0	A	0
SBL	1 L	0.00	8.2	A	0	0.01	9.5	A	0
SBT	1 T	0.18	0.0	A	0	0.07	0.0	A	0
Overall		**0.67**	**4.9**	**B**	-	**0.72**	**2.2**	**C**	-
Aviation/Sir George W on-ramp/Sir George W off-ramp - Unsignalized									
WB	1 L/T/R	1.38	232.4	F	153	0.23	21.2	A	7
NBL	1 L	0.23	7.9	A	7	0.25	8.1	A	8
NBT	1 T	0.02	0.0	A	0	0.03	0.0	A	0
SB	1 T/R	0.01	0.0	A	0	0.04	0.0	A	0
Overall		**0.67**	**109.9**	**B**	-	**0.72**	**7.9**	**C**	-
Notes:	*# - denotes 95th percentile volume exceeding capacity* *Ideal saturation flow rate assumed to be 1,800 veh/h/lane* *PHF assumed to be 0.90*								

As shown in **Table 12**, assuming no signal timing or network modifications for the 2025 horizon year and with a 0% background growth rate, study area intersections are projected to continue operating similar to existing conditions (in the absence of traffic generated by the subject development).

Similar to existing conditions, movements that are operating near or over capacity during peak hours can be improved with the measures mentioned previously.

With regard to the implementation of the new northbound off-ramp (from the Aviation Parkway to Hemlock), this scenario was also assessed using the intersection capacity analysis software Synchro. Project background volumes for this scenario were derived by summing together volumes depicted in **Figure 17** and **Figure 19** (i.e. *Background Traffic Volumes (2025, 2030)* and *'New' Projected Non-Site-Generated Traffic – with new Aviation off-ramp*). Given the new northbound off-ramp is projected to attract a relatively small amount of non-site-generated traffic, study area intersections are projected to continue operating similar to existing and background conditions (in the absence of traffic generated by the subject development). However, in terms of critical movements, it should be noted that with the additional non-site-generated traffic, generated by the new northbound off-ramp, the northbound through movement at the Aviation/Montreal intersection is projected to operate with an Auto-LOS 'D' during both weekday morning and afternoon peak hours, as opposed to an Auto-LOS 'C' or better.

Detailed Synchro output data for projected future background conditions (with and without a new northbound off-ramp) are provided in **Appendix D**.

Adjustments to Background Network Demand

Given the majority of study area intersections are projected to operate with spare capacity for future background conditions, it is not considered necessary to adjust projected background demands at this time.

Table 13: Study Area Intersection Operations – Total Projected (2025, 2030)

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
St. Laurent/Hemlock - Pretimed Signal									
EBL	1 L	0.09	22.6	A	8	0.11	22.7	A	10
EBT	1 T	0.23	23.8	A	24	0.57	30.1	A	56
EBR	1 R	0.55	4.1	A	15	0.46	3.7	A	14
WBL	1 L	0.38	27.4	A	29	0.33	27.8	A	21
WB	1 T/R	0.49	27.9	A	48	0.25	23.7	A	26
NBL	1 L	0.70	16.5	B	48	0.90	32.6	D	#104.0
NB	1 T/R	0.21	6.3	A	20	0.33	7.2	A	31
SB	1 L/T/R	0.41	18.5	A	48	0.34	17.6	A	40
Overall		**0.57**	**15.1**	**A**	-	**0.67**	**20.0**	**B**	-
Hemlock/Aviation S off-ramp - Unsignalized									
EBT	1 T	0.12	0.0	A	0	0.29	0.0	A	0
WBT	1 T	0.08	0.0	A	0	0.06	0.0	A	0
SBL	1 L/R	0.54	14.2	A	27	0.30	14.1	A	10
Overall		**0.43**	**8.2**	**A**	-	**0.41**	**3.1**	**A**	-
Hemlock/Aviation N on-ramp - Unsignalized									
EB	1 T/L	0.05	2.4	A	1	0.28	6.5	A	9
WB	1 T/R	0.16	0.0	A	0	0.13	0.0	A	0
Overall		**0.34**	**1.2**	**A**	-	**0.49**	**4.7**	**A**	-
Hurricane/Hemlock - Unsignalized									
EB	1 T/R	0.11	0.0	A	0	0.13	0.0	A	0
WB	1 T/L	0.00	0.0	A	0	0.00	0.0	A	0
NBL	1 L/R	0.12	11.2	A	3	0.12	11.1	A	3
Overall		**0.21**	**2.0**	**A**	-	**0.22**	**2.0**	**A**	-
Madjibizo/Hemlock - Unsignalized									
EB	1 L/T/R	0.14	7.9	A	0	0.17	8.0	A	0
WB	1 L/T/R	0.14	7.9	A	0	0.08	7.6	A	0
NB	1 L/T/R	0.02	7.8	A	0	0.02	7.8	A	0
SB	1 L/T/R	0.05	7.1	A	0	0.05	7.0	A	0
Overall		**0.27**	**7.8**	**A**	-	**0.29**	**7.7**	**A**	-
Codd's/Mikinak - Unsignalized									
EB	1 L/T/R	0.29	9.3	A	0	0.28	9.2	A	0
WB	1 L/T/R	0.08	8.9	A	0	0.08	8.9	A	0
NB	1 L/T/R	0.37	10.7	A	0	0.44	11.4	A	0
SB	1 L/T/R	0.17	9.0	A	0	0.14	8.9	A	0
Overall		**0.49**	**9.8**	**A**	-	**0.50**	**10.2**	**A**	-
Aviation/Montreal - Actuated-Coordinated Signal									
EBL	1 L	0.27	19.9	A	12	0.32	21.9	A	14
EBT	2 T	0.83	44.9	D	135	0.99	60.9	E	#211.7
EBR	1 R	0.48	13.6	A	43	0.50	18.9	A	61
WBL	1 L	1.13	122.3	F	m#166.6	2.00	489.4	F	#167.9
WBT	2 T	0.81	26.4	D	#193.1	0.80	44.6	C	164
WBR	1 R	0.23	2.2	A	m5.3	0.39	19.5	A	55
NBL	1 L	0.87	57.8	D	#76.2	0.95	65.5	E	#115.0
NBT	1 T	0.68	54.8	B	81	0.76	53.1	C	#140.7

NBR	1 R	0.62	15.5	B	41	0.50	13.3	A	40
SBL	1 L	0.75	44.2	C	66	0.46	28.3	A	36
SBT	1 T	0.84	67.2	D	#100.3	0.84	64.3	D	#128.4
SBR	1 R	0.16	0.8	A	0	0.15	0.7	A	0
Overall		**0.90**	**42.8**	**E**	**-**	**1.11**	**75.6**	**F**	**-**
Carsons/Codd's/Montreal - Actuated-Coordinated Signal									
EBL	1 L	0.66	14.3	B	m19.8	0.53	16.3	A	m15.2
EB	1 T & 1 T/R	0.43	5.6	A	104	0.50	3.8	A	m31.4
WBL	1 L	0.43	22.9	A	39	0.14	15.9	A	11
WB	1 T & 1 T/R	0.66	21.3	B	149	0.54	16.9	A	119
NBL	1 L	1.06	142.9	F	#64.7	0.88	103.0	D	#47.9
NB	1 T/R	0.19	12.3	A	14	0.19	14.4	A	13
SBL	1 L	0.48	46.3	A	43	0.67	59.7	B	53
SB	1 T/R	0.62	20.9	B	46	0.52	9.9	A	22
Overall		**0.68**	**22.0**	**B**	**-**	**0.56**	**16.0**	**A**	**-**
Aviation/Sir George E off-ramp/Sir George E on-ramp - Unsignalized									
EB	1 L/T/R	0.58	16.9	A	30	0.33	10.9	A	12
NB	1 T/R	0.29	0.0	A	0	0.53	0.0	A	0
SBL	1 L	0.00	8.4	A	0	0.01	9.8	A	0
SBT	1 T	0.19	0.0	A	0	0.08	0.0	A	0
Overall		**0.74**	**5.6**	**C**	**-**	**0.79**	**2.5**	**C**	**-**
Aviation/Sir George W on-ramp/Sir George W off-ramp - Unsignalized									
WB	1 L/T/R	1.81	424.1	F	207	0.35	28.6	A	12
NBL	1 L	0.27	8.1	A	9	0.29	8.3	A	10
NBT	1 T	0.02	0.0	A	0	0.03	0.0	A	0
SB	1 T/R	0.01	0.0	A	0	0.04	0.0	A	0
Overall		**0.74**	**186.9**	**C**	**-**	**0.79**	**9.2**	**C**	**-**
Notes:	*# - denotes 95th percentile volume exceeding capacity* *Ideal saturation flow rate assumed to be 1,800 veh/h/lane* *PHF assumed to be 0.90*								

As shown in **Table 13**, study area intersections are projected to continue operating with an acceptable overall Auto-LOS 'C' or better during weekday morning and afternoon peak hours, with the exception of the Aviation/Montreal intersection, which is expected to operate near or over capacity with an overall Auto-LOS of 'E' during the weekday morning peak hour and an Auto-LOS of 'F' during the afternoon peak hour.

With regard to 'critical' movements at study area intersections, they are projected to operate with an Auto-LOS of 'D' or better during both peak hours, with the exception of the westbound left-turn movement at the Aviation/Montreal intersection, the northbound left-turn movement at the Codd's/Montreal intersection and the westbound approach at the Aviation/Sir George W on-ramp/Sir George W off-ramp, which are all projected to operate over capacity with an Auto-LOS 'F' during the AM peak hour. During the PM peak hour, several movements at the Aviation/Montreal intersection are projected to continue operating near or over capacity (i.e. Auto-LOS 'E' or 'F').

With regard to 95th percentile queues, several approaches are projected to continue exceeding available storage capacity (e.g. the westbound through movement during the AM and the eastbound and westbound through movements during the PM at the Aviation/Montreal intersection, etc.), which is denoted by a '#' in the previous **Table 13**.

Similar to existing and background conditions, there are some individual movements that are projected to operate near or over capacity during peak hours, which can be improved with the implementation of potential measures previously mentioned. With the addition of projected site-generated traffic, the following additional potential measures would be required to improve network operations:

Codd's/Montreal

- Implement a protected/permissive northbound left-turn signal phase;
- Increase signal cycle length and optimize timing splits.

Detailed Synchro output data for future total projected conditions (including the Synchro output with potential measures required to improve network operations) is provided in **Appendix E.**

As previously mentioned, the proposed Phases 3 and 5 of the Wateridge subdivision may include a new northbound off-ramp from Aviation Parkway to Hemlock Road. This new off-ramp would form the fourth leg of the already existing Hemlock/Aviation northbound on-ramp intersection and is projected to attracted 100 veh/h to 150 veh/h. The following **Figure 21** depicts 'total' projected volumes, assuming the new northbound off-ramp will be in place for the horizon year of 2025 and beyond, which was derived by superimposing site-generated traffic volumes onto projected background traffic volumes (e.g. summing together volumes depicted in **Figure 17**, **Figure 18** and **Figure 19**, resulting in **Figure 21**).

Appendix D

Existing and Background Conditions Output Data (2025, 2030)

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	133	63	0	31	324
Future Volume (Veh/h)	0	133	63	0	31	324
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	148	70	0	34	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked						
vC, conflicting volume	70				218	70
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	70				218	70
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				96	64
cM capacity (veh/h)	1531				770	993

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	70	394
Volume Left	0	0	34
Volume Right	0	0	360
cSH	1700	1700	969
Volume to Capacity	0.09	0.04	0.41
Queue Length 95th (m)	0.0	0.0	16.0
Control Delay (s)	0.0	0.0	11.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.2
Approach LOS			B

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	70	63	47	0	0
Future Volume (Veh/h)	61	70	63	47	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	78	70	52	0	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	122				310	96
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122				310	96
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				100	100
cM capacity (veh/h)	1465				651	960

Direction, Lane #	EB 1	WB 1
Volume Total	146	122
Volume Left	68	0
Volume Right	0	52
cSH	1465	1700
Volume to Capacity	0.05	0.07
Queue Length 95th (m)	1.2	0.0
Control Delay (s)	3.7	0.0
Lane LOS	A	
Approach Delay (s)	3.7	0.0
Approach LOS		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	101	691	113	1020	116	10	40	9
Future Volume (vph)	101	691	113	1020	116	10	40	9
Lane Group Flow (vph)	112	950	126	1173	129	70	44	177
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	13.0	80.0	67.0	67.0	40.0	40.0	40.0	40.0
Total Split (%)	10.8%	66.7%	55.8%	55.8%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	87.3	86.0	73.2	73.2	21.5	21.5	21.5	21.5
Actuated g/C Ratio	0.73	0.72	0.61	0.61	0.18	0.18	0.18	0.18
v/c Ratio	0.36	0.41	0.39	0.58	0.81	0.22	0.20	0.45
Control Delay	4.4	4.2	19.6	17.1	80.7	13.5	40.6	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.4	4.2	19.6	17.1	80.7	13.5	40.6	10.3
LOS	A	A	B	B	F	B	D	B
Approach Delay		4.2		17.3		57.0		16.4
Approach LOS		A		B		E		B
Queue Length 50th (m)	1.2	4.1	14.6	83.6	31.3	2.3	9.5	2.1
Queue Length 95th (m)	m7.9	82.0	38.4	134.1	50.8	14.1	19.0	20.2
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	320	2310	319	2032	247	466	348	522
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.41	0.39	0.58	0.52	0.15	0.13	0.34

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 5 (4%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 15.1 Intersection LOS: B
Intersection Capacity Utilization 85.3% ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	395	42	0	40	53
Future Volume (Veh/h)	0	395	42	0	40	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	439	47	0	44	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked					0.97	
vC, conflicting volume	47				486	47
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	47				457	47
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				92	94
cM capacity (veh/h)	1560				546	1022

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	439	47	103
Volume Left	0	0	44
Volume Right	0	0	59
cSH	1700	1700	745
Volume to Capacity	0.26	0.03	0.14
Queue Length 95th (m)	0.0	0.0	3.8
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	1.9		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	334	85	42	30	0	0
Future Volume (Veh/h)	334	85	42	30	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	371	94	47	33	0	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	80				900	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	80				900	64
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	76				100	100
cM capacity (veh/h)	1518				234	1001

Direction, Lane #	EB 1	WB 1
Volume Total	465	80
Volume Left	371	0
Volume Right	0	33
cSH	1518	1700
Volume to Capacity	0.24	0.05
Queue Length 95th (m)	7.7	0.0
Control Delay (s)	6.9	0.0
Lane LOS	A	
Approach Delay (s)	6.9	0.0
Approach LOS		

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	98	1002	31	865	91	8	60	5
Future Volume (vph)	98	1002	31	865	91	8	60	5
Lane Group Flow (vph)	109	1199	34	999	101	57	67	134
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	15.0	82.0	67.0	67.0	38.0	38.0	38.0	38.0
Total Split (%)	12.5%	68.3%	55.8%	55.8%	31.7%	31.7%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	89.4	88.1	75.6	75.6	19.4	19.4	19.4	19.4
Actuated g/C Ratio	0.74	0.73	0.63	0.63	0.16	0.16	0.16	0.16
v/c Ratio	0.29	0.49	0.13	0.48	0.59	0.20	0.33	0.39
Control Delay	3.8	3.6	14.1	14.2	58.4	14.7	45.9	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.8	3.6	14.1	14.2	58.4	14.7	45.9	10.6
LOS	A	A	B	B	E	B	D	B
Approach Delay		3.6		14.2		42.6		22.4
Approach LOS		A		B		D		C
Queue Length 50th (m)	2.8	20.7	2.9	57.3	24.3	2.0	15.4	1.3
Queue Length 95th (m)	m5.5	m31.3	10.8	104.1	39.1	12.8	26.7	17.3
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	406	2423	258	2098	280	433	330	478
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.49	0.13	0.48	0.36	0.13	0.20	0.28

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 72.5% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		Y	
Traffic Volume (veh/h)	0	133	63	0	31	324
Future Volume (Veh/h)	0	133	63	0	31	324
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	148	70	0	34	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked						
vC, conflicting volume	70				218	70
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	70				218	70
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				96	64
cM capacity (veh/h)	1531				770	993

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	70	394
Volume Left	0	0	34
Volume Right	0	0	360
cSH	1700	1700	969
Volume to Capacity	0.09	0.04	0.41
Queue Length 95th (m)	0.0	0.0	16.0
Control Delay (s)	0.0	0.0	11.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.2
Approach LOS			B

Intersection Summary				
Average Delay		7.2		
Intersection Capacity Utilization		37.0%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	70	63	47	0	0
Future Volume (Veh/h)	61	70	63	47	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	78	70	52	0	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	122				310	96
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122				310	96
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				100	100
cM capacity (veh/h)	1465				651	960

Direction, Lane #	EB 1	WB 1
Volume Total	146	122
Volume Left	68	0
Volume Right	0	52
cSH	1465	1700
Volume to Capacity	0.05	0.07
Queue Length 95th (m)	1.2	0.0
Control Delay (s)	3.7	0.0
Lane LOS	A	
Approach Delay (s)	3.7	0.0
Approach LOS		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	101	691	113	1020	116	10	40	9
Future Volume (vph)	101	691	113	1020	116	10	40	9
Lane Group Flow (vph)	112	950	126	1173	129	70	44	177
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	13.0	80.0	67.0	67.0	40.0	40.0	40.0	40.0
Total Split (%)	10.8%	66.7%	55.8%	55.8%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	87.3	86.0	73.2	73.2	21.5	21.5	21.5	21.5
Actuated g/C Ratio	0.73	0.72	0.61	0.61	0.18	0.18	0.18	0.18
v/c Ratio	0.36	0.41	0.39	0.58	0.81	0.22	0.20	0.45
Control Delay	5.0	5.0	19.6	17.1	80.7	13.5	40.6	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	5.0	19.6	17.1	80.7	13.5	40.6	10.3
LOS	A	A	B	B	F	B	D	B
Approach Delay		5.0		17.3		57.0		16.4
Approach LOS		A		B		E		B
Queue Length 50th (m)	1.1	3.8	14.6	83.6	31.3	2.3	9.5	2.1
Queue Length 95th (m)	m9.9	86.8	38.4	134.1	50.8	14.1	19.0	20.2
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	320	2310	319	2032	247	466	348	522
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.41	0.39	0.58	0.52	0.15	0.13	0.34

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 5 (4%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 15.4 Intersection LOS: B
Intersection Capacity Utilization 85.3% ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	395	42	0	40	53
Future Volume (Veh/h)	0	395	42	0	40	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	439	47	0	44	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked					0.97	
vC, conflicting volume	47				486	47
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	47				457	47
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				92	94
cM capacity (veh/h)	1560				546	1022

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	439	47	103
Volume Left	0	0	44
Volume Right	0	0	59
cSH	1700	1700	745
Volume to Capacity	0.26	0.03	0.14
Queue Length 95th (m)	0.0	0.0	3.8
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	1.9		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	334	85	42	30	0	0
Future Volume (Veh/h)	334	85	42	30	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	371	94	47	33	0	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	80				900	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	80				900	64
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	76				100	100
cM capacity (veh/h)	1518				234	1001

Direction, Lane #	EB 1	WB 1
Volume Total	465	80
Volume Left	371	0
Volume Right	0	33
cSH	1518	1700
Volume to Capacity	0.24	0.05
Queue Length 95th (m)	7.7	0.0
Control Delay (s)	6.9	0.0
Lane LOS	A	
Approach Delay (s)	6.9	0.0
Approach LOS		

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	98	1002	31	865	91	8	60	5
Future Volume (vph)	98	1002	31	865	91	8	60	5
Lane Group Flow (vph)	109	1199	34	999	101	57	67	134
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	15.0	82.0	67.0	67.0	38.0	38.0	38.0	38.0
Total Split (%)	12.5%	68.3%	55.8%	55.8%	31.7%	31.7%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	89.4	88.1	75.6	75.6	19.4	19.4	19.4	19.4
Actuated g/C Ratio	0.74	0.73	0.63	0.63	0.16	0.16	0.16	0.16
v/c Ratio	0.29	0.49	0.13	0.48	0.59	0.20	0.33	0.39
Control Delay	4.2	3.7	14.1	14.2	58.4	14.7	45.9	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.2	3.7	14.1	14.2	58.4	14.7	45.9	10.6
LOS	A	A	B	B	E	B	D	B
Approach Delay		3.8		14.2		42.6		22.4
Approach LOS		A		B		D		C
Queue Length 50th (m)	3.4	23.4	2.9	57.3	24.3	2.0	15.4	1.3
Queue Length 95th (m)	m5.9	m33.8	10.8	104.1	39.1	12.8	26.7	17.3
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	406	2423	258	2098	280	433	330	478
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.49	0.13	0.48	0.36	0.13	0.20	0.28

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 72.5% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	133	63	0	31	324
Future Volume (Veh/h)	0	133	63	0	31	324
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	148	70	0	34	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked						
vC, conflicting volume	70				218	70
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	70				218	70
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				96	64
cM capacity (veh/h)	1531				770	993

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	70	394
Volume Left	0	0	34
Volume Right	0	0	360
cSH	1700	1700	969
Volume to Capacity	0.09	0.04	0.41
Queue Length 95th (m)	0.0	0.0	16.0
Control Delay (s)	0.0	0.0	11.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.2
Approach LOS			B

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	70	63	47	0	0
Future Volume (Veh/h)	61	70	63	47	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	78	70	52	0	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	122				310	96
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122				310	96
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				100	100
cM capacity (veh/h)	1465				651	960

Direction, Lane #	EB 1	WB 1
Volume Total	146	122
Volume Left	68	0
Volume Right	0	52
cSH	1465	1700
Volume to Capacity	0.05	0.07
Queue Length 95th (m)	1.2	0.0
Control Delay (s)	3.7	0.0
Lane LOS	A	
Approach Delay (s)	3.7	0.0
Approach LOS		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	101	691	113	1020	116	10	40	9
Future Volume (vph)	101	691	113	1020	116	10	40	9
Lane Group Flow (vph)	112	950	126	1173	129	70	44	177
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	13.0	80.0	67.0	67.0	40.0	40.0	40.0	40.0
Total Split (%)	10.8%	66.7%	55.8%	55.8%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	87.3	86.0	73.2	73.2	21.5	21.5	21.5	21.5
Actuated g/C Ratio	0.73	0.72	0.61	0.61	0.18	0.18	0.18	0.18
v/c Ratio	0.36	0.41	0.39	0.58	0.81	0.22	0.20	0.45
Control Delay	4.4	4.2	19.6	17.1	80.7	13.5	40.6	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.4	4.2	19.6	17.1	80.7	13.5	40.6	10.3
LOS	A	A	B	B	F	B	D	B
Approach Delay		4.2		17.3		57.0		16.4
Approach LOS		A		B		E		B
Queue Length 50th (m)	1.2	4.1	14.6	83.6	31.3	2.3	9.5	2.1
Queue Length 95th (m)	m7.9	82.0	38.4	134.1	50.8	14.1	19.0	20.2
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	320	2310	319	2032	247	466	348	522
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.41	0.39	0.58	0.52	0.15	0.13	0.34

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 5 (4%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 15.1 Intersection LOS: B
Intersection Capacity Utilization 85.3% ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	395	42	0	40	53
Future Volume (Veh/h)	0	395	42	0	40	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	439	47	0	44	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked					0.97	
vC, conflicting volume	47				486	47
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	47				457	47
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				92	94
cM capacity (veh/h)	1560				546	1022

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	439	47	103
Volume Left	0	0	44
Volume Right	0	0	59
cSH	1700	1700	745
Volume to Capacity	0.26	0.03	0.14
Queue Length 95th (m)	0.0	0.0	3.8
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	1.9		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	334	85	42	30	0	0
Future Volume (Veh/h)	334	85	42	30	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	371	94	47	33	0	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	80				900	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	80				900	64
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	76				100	100
cM capacity (veh/h)	1518				234	1001

Direction, Lane #	EB 1	WB 1
Volume Total	465	80
Volume Left	371	0
Volume Right	0	33
cSH	1518	1700
Volume to Capacity	0.24	0.05
Queue Length 95th (m)	7.7	0.0
Control Delay (s)	6.9	0.0
Lane LOS	A	
Approach Delay (s)	6.9	0.0
Approach LOS		

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	98	1002	31	865	91	8	60	5
Future Volume (vph)	98	1002	31	865	91	8	60	5
Lane Group Flow (vph)	109	1199	34	999	101	57	67	134
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	15.0	82.0	67.0	67.0	38.0	38.0	38.0	38.0
Total Split (%)	12.5%	68.3%	55.8%	55.8%	31.7%	31.7%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	89.4	88.1	75.6	75.6	19.4	19.4	19.4	19.4
Actuated g/C Ratio	0.74	0.73	0.63	0.63	0.16	0.16	0.16	0.16
v/c Ratio	0.29	0.49	0.13	0.48	0.59	0.20	0.33	0.39
Control Delay	3.8	3.6	14.1	14.2	58.4	14.7	45.9	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.8	3.6	14.1	14.2	58.4	14.7	45.9	10.6
LOS	A	A	B	B	E	B	D	B
Approach Delay		3.6		14.2		42.6		22.4
Approach LOS		A		B		D		C
Queue Length 50th (m)	2.8	20.7	2.9	57.3	24.3	2.0	15.4	1.3
Queue Length 95th (m)	m5.5	m31.3	10.8	104.1	39.1	12.8	26.7	17.3
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	406	2423	258	2098	280	433	330	478
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.49	0.13	0.48	0.36	0.13	0.20	0.28

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 11.4	Intersection LOS: B
Intersection Capacity Utilization 72.5%	ICU Level of Service C
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	133	63	0	31	324
Future Volume (Veh/h)	0	133	63	0	31	324
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	148	70	0	34	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked						
vC, conflicting volume	70				218	70
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	70				218	70
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				96	64
cM capacity (veh/h)	1531				770	993

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	70	394
Volume Left	0	0	34
Volume Right	0	0	360
cSH	1700	1700	969
Volume to Capacity	0.09	0.04	0.41
Queue Length 95th (m)	0.0	0.0	16.0
Control Delay (s)	0.0	0.0	11.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.2
Approach LOS			B

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	70	63	47	0	0
Future Volume (Veh/h)	61	70	63	47	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	78	70	52	0	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	122				310	96
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122				310	96
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				100	100
cM capacity (veh/h)	1465				651	960

Direction, Lane #	EB 1	WB 1
Volume Total	146	122
Volume Left	68	0
Volume Right	0	52
cSH	1465	1700
Volume to Capacity	0.05	0.07
Queue Length 95th (m)	1.2	0.0
Control Delay (s)	3.7	0.0
Lane LOS	A	
Approach Delay (s)	3.7	0.0
Approach LOS		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	101	691	113	1020	116	10	40	9
Future Volume (vph)	101	691	113	1020	116	10	40	9
Lane Group Flow (vph)	112	950	126	1173	129	70	44	177
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	13.0	80.0	67.0	67.0	40.0	40.0	40.0	40.0
Total Split (%)	10.8%	66.7%	55.8%	55.8%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	87.3	86.0	73.2	73.2	21.5	21.5	21.5	21.5
Actuated g/C Ratio	0.73	0.72	0.61	0.61	0.18	0.18	0.18	0.18
v/c Ratio	0.36	0.41	0.39	0.58	0.81	0.22	0.20	0.45
Control Delay	5.0	5.0	19.6	17.1	80.7	13.5	40.6	10.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	5.0	19.6	17.1	80.7	13.5	40.6	10.3
LOS	A	A	B	B	F	B	D	B
Approach Delay		5.0		17.3		57.0		16.4
Approach LOS		A		B		E		B
Queue Length 50th (m)	1.1	3.8	14.6	83.6	31.3	2.3	9.5	2.1
Queue Length 95th (m)	m9.9	86.8	38.4	134.1	50.8	14.1	19.0	20.2
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	320	2310	319	2032	247	466	348	522
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.41	0.39	0.58	0.52	0.15	0.13	0.34

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 5 (4%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 15.4	Intersection LOS: B
Intersection Capacity Utilization 85.3%	ICU Level of Service E
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	395	42	0	40	53
Future Volume (Veh/h)	0	395	42	0	40	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	439	47	0	44	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked					0.97	
vC, conflicting volume	47				486	47
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	47				457	47
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				92	94
cM capacity (veh/h)	1560				546	1022

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	439	47	103
Volume Left	0	0	44
Volume Right	0	0	59
cSH	1700	1700	745
Volume to Capacity	0.26	0.03	0.14
Queue Length 95th (m)	0.0	0.0	3.8
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	1.9		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	334	85	42	30	0	0
Future Volume (Veh/h)	334	85	42	30	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	371	94	47	33	0	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	80				900	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	80				900	64
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	76				100	100
cM capacity (veh/h)	1518				234	1001

Direction, Lane #	EB 1	WB 1
Volume Total	465	80
Volume Left	371	0
Volume Right	0	33
cSH	1518	1700
Volume to Capacity	0.24	0.05
Queue Length 95th (m)	7.7	0.0
Control Delay (s)	6.9	0.0
Lane LOS	A	
Approach Delay (s)	6.9	0.0
Approach LOS		

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	98	1002	31	865	91	8	60	5
Future Volume (vph)	98	1002	31	865	91	8	60	5
Lane Group Flow (vph)	109	1199	34	999	101	57	67	134
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	15.0	82.0	67.0	67.0	38.0	38.0	38.0	38.0
Total Split (%)	12.5%	68.3%	55.8%	55.8%	31.7%	31.7%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	89.4	88.1	75.6	75.6	19.4	19.4	19.4	19.4
Actuated g/C Ratio	0.74	0.73	0.63	0.63	0.16	0.16	0.16	0.16
v/c Ratio	0.29	0.49	0.13	0.48	0.59	0.20	0.33	0.39
Control Delay	3.5	2.8	14.1	14.2	58.4	14.7	45.9	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.5	2.8	14.1	14.2	58.4	14.7	45.9	10.6
LOS	A	A	B	B	E	B	D	B
Approach Delay		2.9		14.2		42.6		22.4
Approach LOS		A		B		D		C
Queue Length 50th (m)	2.1	15.1	2.9	57.3	24.3	2.0	15.4	1.3
Queue Length 95th (m)	m5.0	m28.1	10.8	104.1	39.1	12.8	26.7	17.3
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	406	2423	258	2098	280	433	330	478
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.49	0.13	0.48	0.36	0.13	0.20	0.28

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.59	
Intersection Signal Delay: 11.0	Intersection LOS: B
Intersection Capacity Utilization 72.5%	ICU Level of Service C
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Appendix E

Total Projected Conditions
Output Data (2025, 2030)

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	179	120	0	89	324
Future Volume (Veh/h)	0	179	120	0	89	324
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	199	133	0	99	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked						
vC, conflicting volume	133				332	133
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	133				332	133
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				85	61
cM capacity (veh/h)	1452				663	916

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	199	133	459
Volume Left	0	0	99
Volume Right	0	0	360
cSH	1700	1700	846
Volume to Capacity	0.12	0.08	0.54
Queue Length 95th (m)	0.0	0.0	26.6
Control Delay (s)	0.0	0.0	14.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	14.2
Approach LOS			B

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	174	120	119	0	0
Future Volume (Veh/h)	61	174	120	119	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	193	133	132	0	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	265				528	199
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	265				528	199
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				100	100
cM capacity (veh/h)	1299				484	842

Direction, Lane #	EB 1	WB 1
Volume Total	261	265
Volume Left	68	0
Volume Right	0	132
cSH	1299	1700
Volume to Capacity	0.05	0.16
Queue Length 95th (m)	1.3	0.0
Control Delay (s)	2.4	0.0
Lane LOS	A	
Approach Delay (s)	2.4	0.0
Approach LOS		

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	171	691	113	1020	116	10	112	9
Future Volume (vph)	171	691	113	1020	116	10	112	9
Lane Group Flow (vph)	190	950	126	1237	129	70	124	272
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	13.0	80.0	67.0	67.0	40.0	40.0	40.0	40.0
Total Split (%)	10.8%	66.7%	55.8%	55.8%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	84.0	82.7	68.1	68.1	24.8	24.8	24.8	24.8
Actuated g/C Ratio	0.70	0.69	0.57	0.57	0.21	0.21	0.21	0.21
v/c Ratio	0.66	0.43	0.43	0.66	1.06	0.19	0.48	0.62
Control Delay	14.3	5.6	22.9	21.3	142.9	12.3	46.3	20.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.3	5.6	22.9	21.3	142.9	12.3	46.3	20.9
LOS	B	A	C	C	F	B	D	C
Approach Delay		7.0		21.5		96.9		28.8
Approach LOS		A		C		F		C
Queue Length 50th (m)	7.6	47.4	18.0	111.8	~32.8	2.2	26.9	20.6
Queue Length 95th (m)	m19.8	104.0	39.4	149.3	#64.7	13.5	43.1	46.4
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	289	2223	296	1874	164	466	348	527
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.43	0.43	0.66	0.79	0.15	0.36	0.52

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 5 (4%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 22.0 Intersection LOS: C
Intersection Capacity Utilization 93.4% ICU Level of Service F
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	444	99	0	102	53
Future Volume (Veh/h)	0	444	99	0	102	53
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	493	110	0	113	59
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked					0.93	
vC, conflicting volume	110				603	110
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	110				539	110
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				76	94
cM capacity (veh/h)	1480				470	943

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	493	110	172
Volume Left	0	0	113
Volume Right	0	0	59
cSH	1700	1700	568
Volume to Capacity	0.29	0.06	0.30
Queue Length 95th (m)	0.0	0.0	10.2
Control Delay (s)	0.0	0.0	14.1
Lane LOS			B
Approach Delay (s)	0.0	0.0	14.1
Approach LOS			B

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	334	196	99	101	0	0
Future Volume (Veh/h)	334	196	99	101	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	371	218	110	112	0	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	222				1126	166
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	222				1126	166
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	72				100	100
cM capacity (veh/h)	1347				164	878

Direction, Lane #	EB 1	WB 1
Volume Total	589	222
Volume Left	371	0
Volume Right	0	112
cSH	1347	1700
Volume to Capacity	0.28	0.13
Queue Length 95th (m)	9.0	0.0
Control Delay (s)	6.5	0.0
Lane LOS	A	
Approach Delay (s)	6.5	0.0
Approach LOS		

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	172	1002	31	865	91	8	131	5
Future Volume (vph)	172	1002	31	865	91	8	131	5
Lane Group Flow (vph)	191	1199	34	1067	101	57	146	229
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	35.5	35.5	35.5	35.5
Total Split (s)	15.0	82.0	67.0	67.0	38.0	38.0	38.0	38.0
Total Split (%)	12.5%	68.3%	55.8%	55.8%	31.7%	31.7%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.3	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	6.5	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes				
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	87.9	86.6	72.1	72.1	20.9	20.9	20.9	20.9
Actuated g/C Ratio	0.73	0.72	0.60	0.60	0.17	0.17	0.17	0.17
v/c Ratio	0.53	0.50	0.14	0.54	0.88	0.19	0.67	0.52
Control Delay	16.3	3.8	15.9	16.9	103.0	14.4	59.7	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	3.8	15.9	16.9	103.0	14.4	59.7	9.9
LOS	B	A	B	B	F	B	E	A
Approach Delay		5.5		16.8		71.0		29.3
Approach LOS		A		B		E		C
Queue Length 50th (m)	7.2	22.5	3.3	72.9	25.0	1.9	34.7	1.3
Queue Length 95th (m)	m15.2	m31.4	11.4	119.4	#47.9	12.8	53.2	22.1
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	378	2381	246	1982	174	433	330	546
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.50	0.14	0.54	0.58	0.13	0.44	0.42

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 16 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.88	
Intersection Signal Delay: 16.0	Intersection LOS: B
Intersection Capacity Utilization 88.9%	ICU Level of Service E
Analysis Period (min) 15	

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Carsons/Codd's & Montreal

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	179	120	0	89	324
Future Volume (Veh/h)	0	179	120	0	89	324
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	199	133	0	99	360
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		357				
pX, platoon unblocked						
vC, conflicting volume	133				332	133
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	133				332	133
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				85	61
cM capacity (veh/h)	1452				663	916

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	199	133	459
Volume Left	0	0	99
Volume Right	0	0	360
cSH	1700	1700	846
Volume to Capacity	0.12	0.08	0.54
Queue Length 95th (m)	0.0	0.0	26.6
Control Delay (s)	0.0	0.0	14.2
Lane LOS			B
Approach Delay (s)	0.0	0.0	14.2
Approach LOS			B

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	174	120	119	0	0
Future Volume (Veh/h)	61	174	120	119	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	68	193	133	132	0	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	265				528	199
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	265				528	199
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				100	100
cM capacity (veh/h)	1299				484	842

Direction, Lane #	EB 1	WB 1
Volume Total	261	265
Volume Left	68	0
Volume Right	0	132
cSH	1299	1700
Volume to Capacity	0.05	0.16
Queue Length 95th (m)	1.3	0.0
Control Delay (s)	2.4	0.0
Lane LOS	A	
Approach Delay (s)	2.4	0.0
Approach LOS		

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	171	691	113	1020	116	10	112	9
Future Volume (vph)	171	691	113	1020	116	10	112	9
Lane Group Flow (vph)	190	950	126	1237	129	70	124	272
Turn Type	pm+pt	NA	Perm	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2		6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.7	29.0	29.0	29.0	14.0	35.5	35.5	35.5
Total Split (s)	13.0	60.0	47.0	47.0	14.0	49.5	35.5	35.5
Total Split (%)	11.9%	54.8%	42.9%	42.9%	12.8%	45.2%	32.4%	32.4%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.5	3.3	3.3	3.3
All-Red Time (s)	1.0	2.3	2.3	2.3	0.5	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.7	6.0	6.0	6.0	4.0	6.5	6.5	6.5
Lead/Lag	Lead		Lag	Lag	Lead		Lag	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes		Yes	Yes
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	64.8	63.5	46.9	46.9	36.0	33.5	19.5	19.5
Actuated g/C Ratio	0.59	0.58	0.43	0.43	0.33	0.31	0.18	0.18
v/c Ratio	0.76	0.51	0.56	0.87	0.50	0.14	0.56	0.61
Control Delay	44.6	15.6	38.1	37.9	31.9	8.0	48.8	13.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.6	15.6	38.1	37.9	31.9	8.0	48.8	13.1
LOS	D	B	D	D	C	A	D	B
Approach Delay		20.5		37.9		23.5		24.2
Approach LOS		C		D		C		C
Queue Length 50th (m)	23.7	55.3	20.9	130.4	22.0	1.8	26.7	7.4
Queue Length 95th (m)	#77.9	95.5	#52.0	#195.5	31.3	10.6	40.8	29.7
Internal Link Dist (m)		644.0		227.7		171.5		619.4
Turn Bay Length (m)	75.0		70.0		45.0		25.0	
Base Capacity (vph)	249	1877	224	1416	256	632	331	554
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.51	0.56	0.87	0.50	0.11	0.37	0.49

Intersection Summary	
Cycle Length: 109.5	
Actuated Cycle Length: 109.5	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 100	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 28.8	Intersection LOS: C
Intersection Capacity Utilization 91.3%	ICU Level of Service F
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 8: Carsons/Codd's & Montreal