



City of
Peterborough

To: **Members of the Planning Committee**

From: **Ken Hetherington, Manager, Planning Division**
Kevin Jones, Manager, Transportation Division

Meeting Date: **August 24, 2015**

Subject: **Report PLPD15-041**
Class EA for the Otonabee River Trail
Extension and Shoreline Improvements around Little Lake

Purpose

A report to endorse the Class Environmental Assessment for the Otonabee River Trail Extension and Shoreline Improvements around Little Lake and to recommend the approval of the preliminary design and traffic calming measures for the area.

Recommendations

That Council approve the recommendations outlined in Report PLPD15-041 dated August 24, 2015, of the Manager, Planning Division and the Manager, Transportation Division, as follows:

- a) That Council endorse the Class Environmental Assessment for the Otonabee River Trail Extension and Shoreline Improvements around Little Lake and the preliminary design be approved in accordance with Exhibit "A" attached to Report PLPD15-041.
- b) That the proposed traffic calming measures for the area recommended in the Class Environmental Assessment Report, as shown in Exhibit "A" attached to Report PLPD15-041 be approved.
- c) That Council direct staff to finalize the Otonabee River Trail Extension and Shoreline Improvements Environmental Study Report and post for public review for the mandatory 30 day public review period in accordance with the provisions of the Municipal Class Environmental Assessment Process.

Budget and Financial Implications

Approval of the preliminary design and filing of the Environmental Study Report for the 30 day public review period has no direct financial implications.

With the approval of the recommendations, a Request for Proposals will be issued for the production of the detailed design, specifications and tender package for the Otonabee River Trail Extension and Shoreline Improvements around Little Lake. \$150,000 is available for this purpose in the Otonabee River Trail – Del Crary Park to Little Lake Cemetery account, Budget Reference No. 7-1.04.

The consultant's preliminary construction cost estimate total for the trail extension and lake shoreline improvements is \$1,975,675.00. A preliminary cost estimate for the traffic calming measures is \$300,000.00 which will be refined as detailed engineering drawings are prepared.

Future capital budget request submissions will be made to implement the phased construction of the recommended design and traffic calming measures.

Background

A contract for services to conduct a Municipal Class Environmental Assessment for the Otonabee Trail Extension around Little Lake, and a Land-Use / Urban Design Study for the Special Policy Area identified in Schedule "J" of the City's Official Plan was awarded to AECOM Canada Ltd., in the amount of \$97,949.00, plus HST of \$12,733.37, for a total cost of \$110,682.37(RFP P-34-12).

Although not originally related to the EA, a petition was submitted to Council with 37 signatures of Ware Street residents requesting the installation of speed bumps to discourage speeding on the street. The petition was submitted to Council around the end of May, 2014. Subsequently, Council directed Staff to report back regarding potential traffic calming measures for Ware Street.

Staff recommended that the investigation of potential traffic calming measures on Ware Street be included in the scope of the EA because road network modifications were being considered as part of the Otonabee River Trail extension, which could impact the traffic using Ware Street. Ware Street is the next road south of Crescent Street, which flanks the Little Lake shoreline, from Del Crary Park to the Little Lake Cemetery (see Exhibit "A"). A Traffic Study is a significant component of the Class Environmental Assessment final document and is discussed in greater detail later in this report.

The Class EA Process

The study followed the Class Environmental Assessment Process for Schedule B projects and included public consultation with interested members of the public and consultation with review agencies and other interest groups. In addition to shoreline restoration, the project implements a portion of the Little Lake Loop trail that was recommended as part of the Little Lake Master Plan (2010).

The Grand Vision

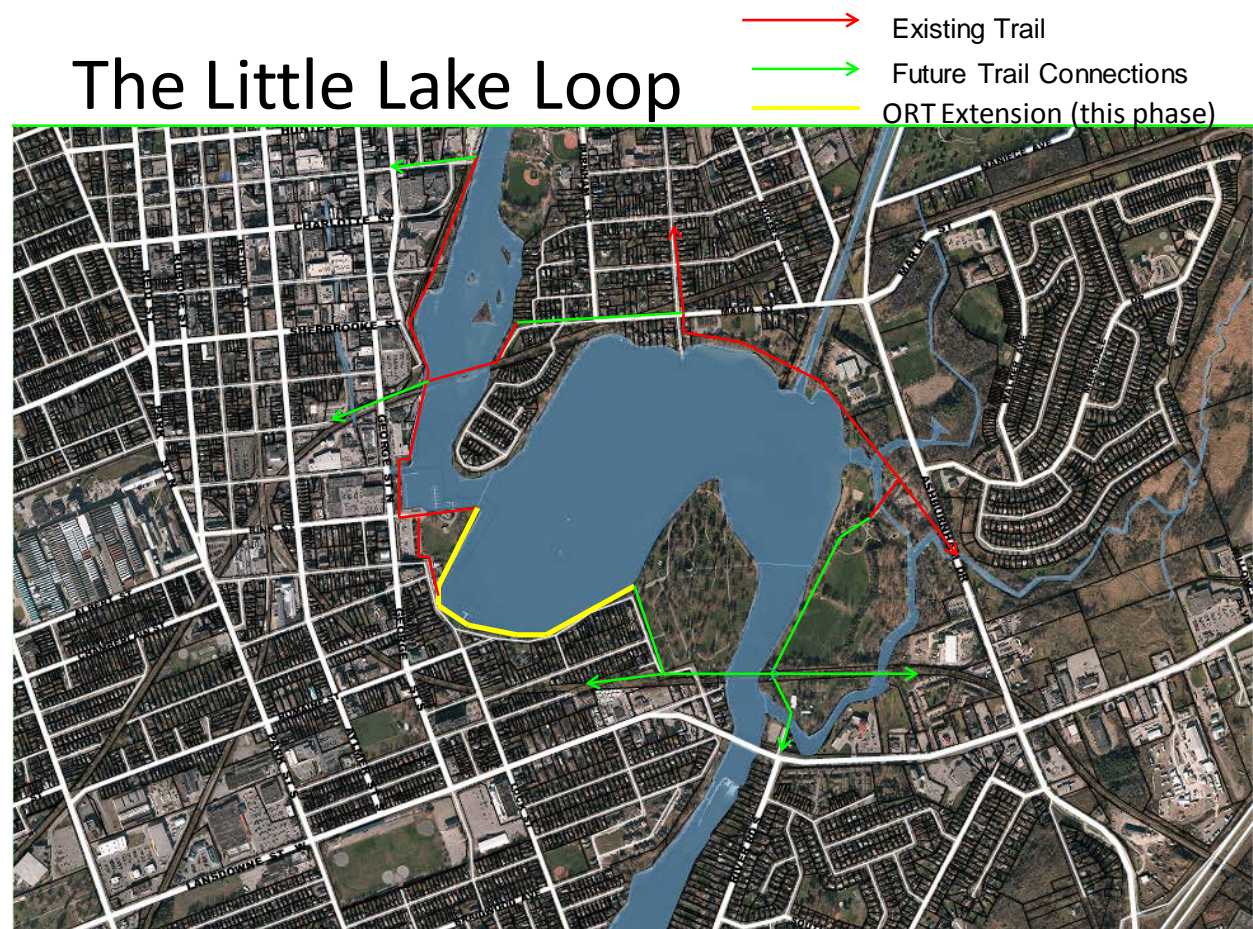


Figure 1

This phase of the Otonabee River Trail (ORT) Extension begins at the point in Del Crary Park and ends at Haggart Street. The grand vision is to construct future trail up to the former CPR spur line, cross the river using the piers of the former train bridge, then proceed north near the Little Lake shoreline through Beavermead Park to complete the loop. The construction of Trans-Canada Trail between the west end of Maria Street and Rogers Cove is scheduled for completion this fall.

Options Evaluated

A number of improvement options were identified and considered as part of the study, including 4 separate options for the trail development and 4 options for the shoreline restoration. The trail options included:

1. A Multi-Use Pathway from Haggart Street to Perry Street;
2. A Multi-Use Path (Perry Street to Romaine Street), plus a Two Way Cycle Track and Separated Pedestrian Path (Romaine Street to Haggart Street;
3. A Pedestrian Path plus on Road Cycling Route; and
4. A Hybrid “Refined Alternative” incorporating elements of the 3 original alternatives.

The shoreline treatment options ranged from naturalized shorelines with new vegetation treatments to gabion baskets, crib walls and mixed treatments with vegetation and field stone retaining treatments. The recommended plan incorporates various shoreline treatments that fit with the context of various portions of the study area.

Public Consultation

Four Public Information Centres (PIC's) took place relating to the Class Environmental Assessment for the Otonabee Trail Extension around Little Lake: October 30, 2013 and June 5, 2014, in the Public Library Auditorium, October 16, 2014, at the Peterborough Lion's Club Community Centre and on June 4, 2015, in the Public Library Auditorium.

The Public Information Centres were well attended, as the meetings effectively dealt with two studies: The Municipal Class Environmental Assessment for the Otonabee Trail Extension around Little Lake, and the Land-Use / Urban Design Study for the Special Policy Area identified in Schedule “J” of the City’s Official Plan. Information and recommendations related to the Land Use and Urban Design Study are outlined separately in Report PLPD15- 040. The two initiatives were combined in the scope of services because they are located within the same area. The EA had to take information and decisions into consideration relating to the Land Use – Urban Design Study and vice-versa. For example, if one of the conclusions of the Trail Extension EA is to limit the number of driveways on Crescent Street, then it needed to be considered as part of the Land-Use and Urban Design Study.

Comments from persons, committees and agencies interested in the study were received in writing, by email and verbally at the information meetings or at any time through the study period. The Executive Summary for the Final Class Environmental Assessment for the Otonabee River Trail around Little Lake – Trail Concepts and Traffic Study Report is

appended as Exhibit “B” to this report. It summarizes the background information, details related to existing conditions, the Otonabee River Trail Extension concepts and the recommended traffic calming measures for Ware Street.

Highlights of the Recommended Plan for the Otonabee River Trail Extension

Currently at its north end, the Otonabee River Trail begins at Simcoe Street and runs through Millennium Park, all the way south into Del Crary Park. In Del Crary Park, a wide expanse of brick paving surrounds the Little Lake Marina and ends at the point of land behind the Fred Anderson stage.

The Point in Del Crary Park



Figure 2

The point is the place where the Otonabee River Trail Extension begins. As visitors to the park will naturally gather here, the conceptual design, illustrated on Figure 2, conservatively proposes an extension to the brick paving, benches and additional planting. Not necessarily part of the EA, the design of the point should be reviewed in the transition from conceptual design to detailed design.

In contemplating the form of the trail extension, a guiding principle was established early on in the EA to separate pedestrian activity from the cycling path of travel. Taking into consideration the volume of pedestrians in Del Crary Park and individuals who want to leisurely walk and experience the waterfront, it became clear that cyclists and pedestrians should not use the same path of travel where possible. As a result, the recommended conceptual design places pedestrians on a water-side trail and places cyclists on an existing wide brick paved surface between the stage and the parking lot through Del Crary Park.

The Trail behind the Art Gallery

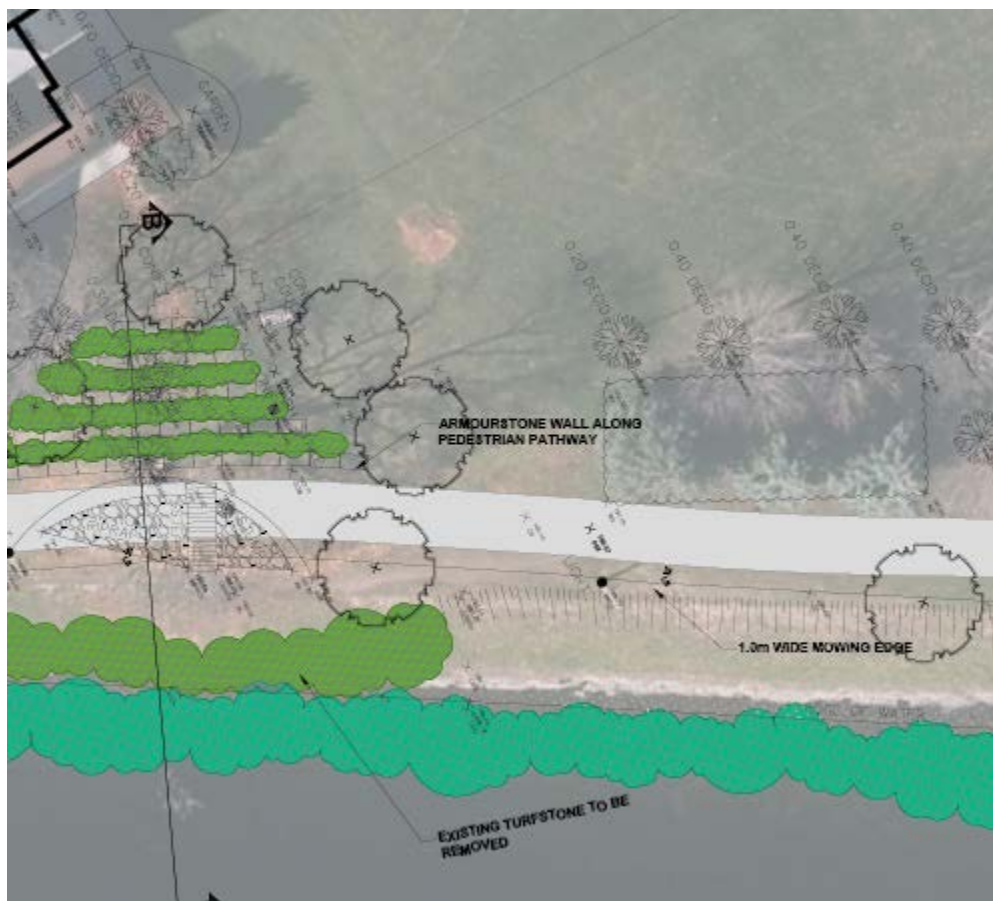


Figure 3

Currently, a dirt footpath drops below the top of the shoreline's bank behind the Art Gallery. The plan, shown on Figure 3, is to build the 3 metre wide trail along the top of the bank to maintain its elevation. Earth retention is required along the Art Gallery side of the trail to accomplish this.

Behind the Art Gallery toward Crescent Street

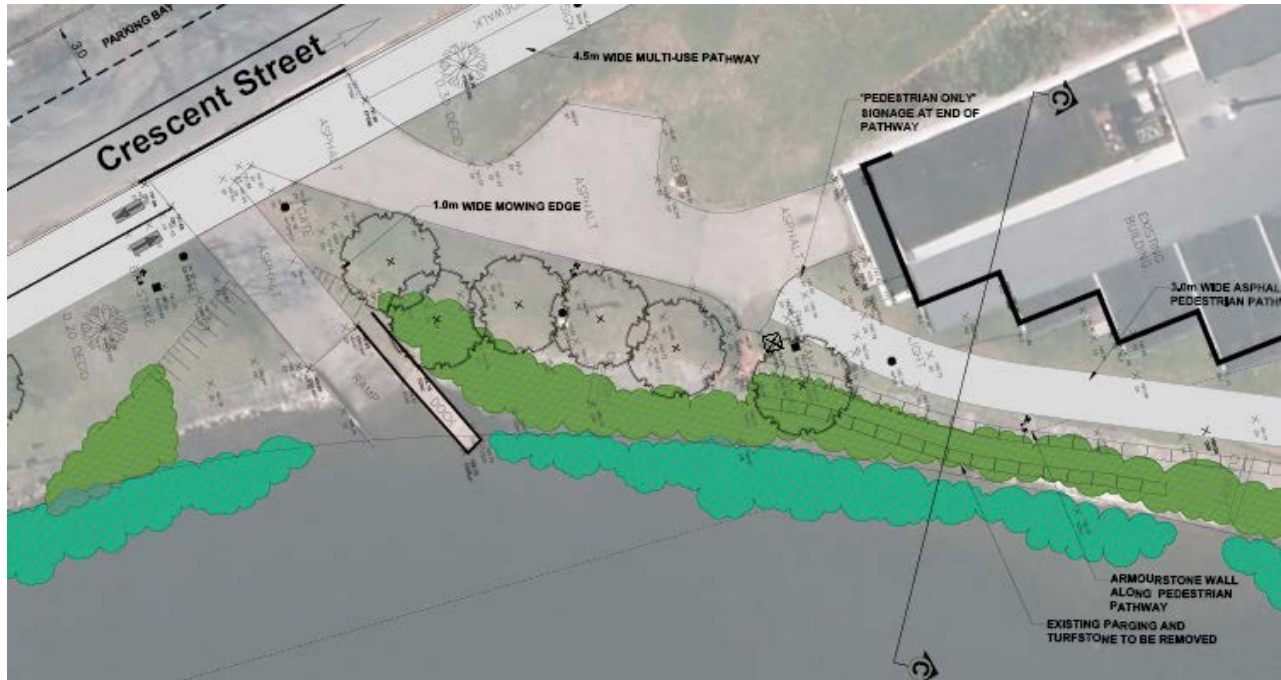


Figure 4

Figure 4 shows that as the trail approaches Crescent Street there is the possibility of simply connecting it to the Art Gallery's driveway. The driveway can take trail users up to the boulevard. This solution takes advantage of an expanse of existing asphalt – a not often used driveway primarily used for access to the Art Gallery's loading dock. At the detailed design stage, the possibility of providing flood protection to the Art Gallery will be investigated further. In the spring, water can flood into the Art Gallery's loading dock area, often very close to the floor level.

On the boulevard, the trail is shared by cyclists and pedestrians, but the trail is extra wide to accommodate both users, and a centre line will be painted on the path to separate each direction of travel. Similar approaches are being used on the new Multi-Use Trails currently under construction on Brealey Drive and Ashburnham Drive. East of the Art Gallery's driveway, it was determined through the EA to be judicious with the amount of new asphalt paving introduced around the lake. The portion of Crescent Street between Romaine Street and Perry Street feels more like an extension of Lock Street, as it carries Lock Street traffic through to the Downtown. As a result the trail is kept off the road until arrival at the T Wharf. In the stretch between the driveway and the T Wharf, the trail is 4.5 metres wide to enable it to accommodate cyclists and pedestrians.

The T Wharf: A destination and a transitioning point

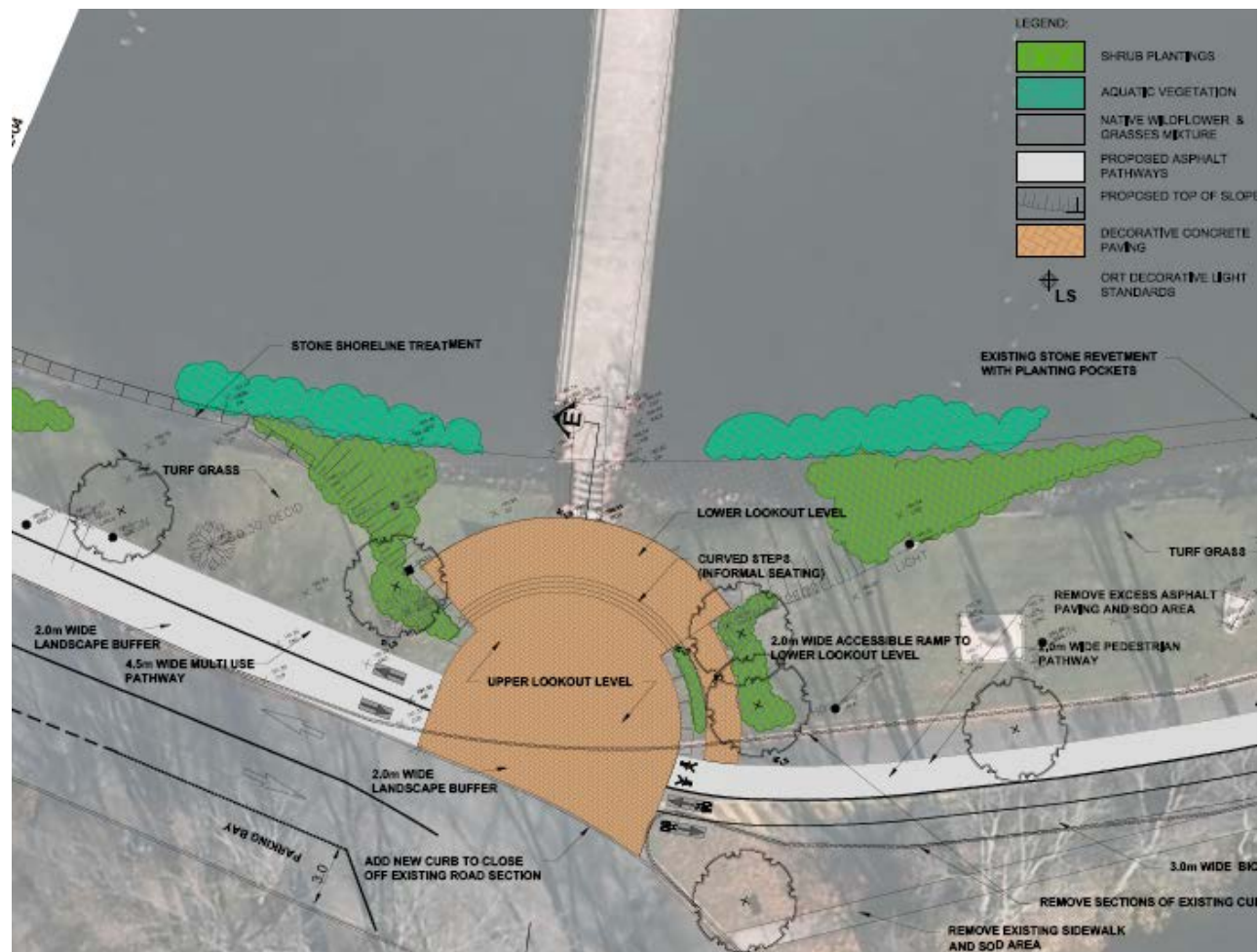


Figure 5

At the T Wharf, it is recommended to close the west bound merge lane of Crescent Street to vehicular traffic and to put the pedestrian lane and the cycling track on the existing pavement. This is illustrated on Figure 5. The Traffic Study component of the EA addresses the impact of the closure together with other traffic issues. Romaine Street connects Crescent Street to Lock Street a short distance south of this area. The Romaine Street connection to Crescent Street is recommended to be converted into a one-way access point to Crescent Street. Crescent Street east of Romaine Street is recommended to be converted into a one-way eastbound Street (to Little Lake Cemetery), making the one-way yield lane or “gore” beside the T Wharf redundant. The result is more, attractive public open space along the waterfront.

The concept design takes advantage of the opportunity to appropriately connect the trail to the T Wharf and create a sense of place for this recently renovated and attractive

feature of the lake. The concept design shows space for gathering with a semi-circular set of stairs and a 2.0 metre wide access ramp with complimentary landscaping.

Conversion of Crescent Street to a one-way Street

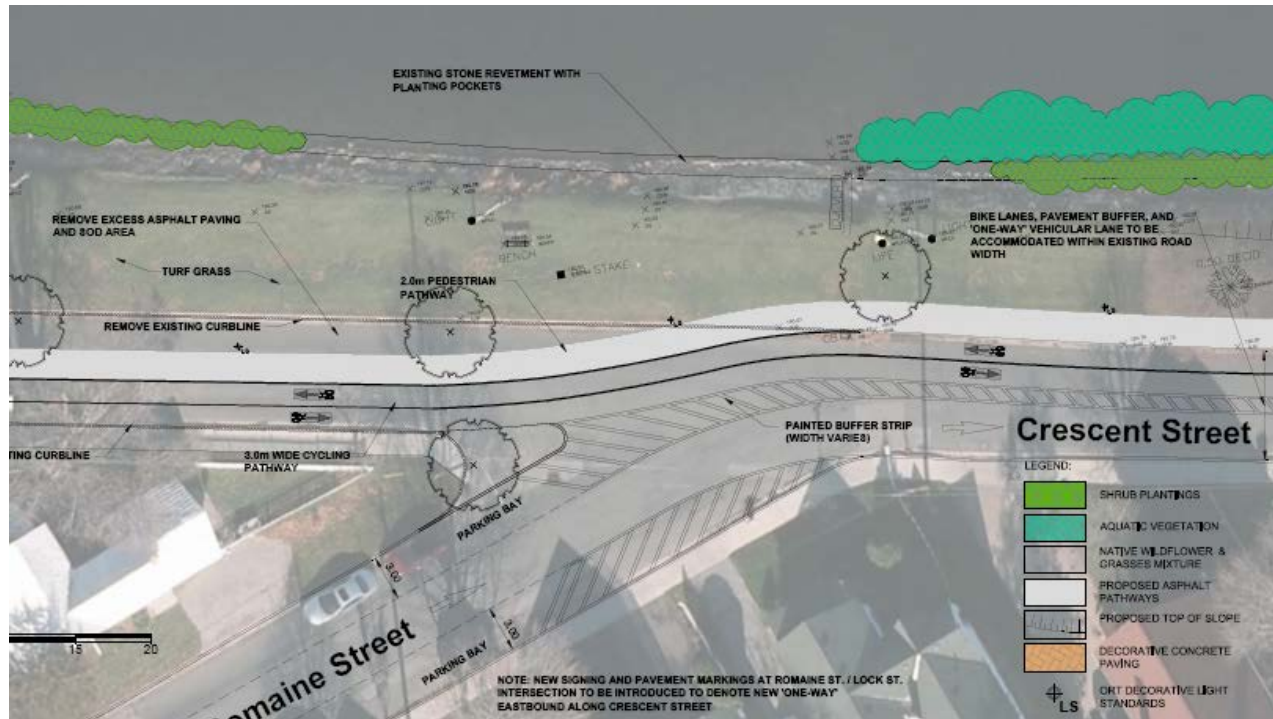


Figure 6

In keeping with the objective to use existing infrastructure where practical, past the gore, a 3.0 metre wide cycle track is placed along the shoreline side of the road and is separated from the one-way vehicular traffic lane by a 1.0 metre wide painted buffer strip, as shown on Figure 6. The traffic engineers scrutinized the arrangement and deduced that Crescent Street is currently wide enough to share the road in this fashion. With this arrangement, cyclists next to the vehicular traffic lane will be traveling in the same direction. Some modifications may be made at the detailed design phase to introduce landscaped buffers in key locations to enhance safety while still allowing sufficient space for Crescent Street residents to back out of their driveways.

The Conversion of Crescent Street to a one-way street combined with a two-way, on-road cycle track along Crescent Street would provide cyclists with their own lane in each direction separated from both cars and people walking or strolling along the waterfront. The cycle track would attract recreational and utilitarian cyclists to use the facility, as being separated from motorists by a buffer will provide comfort for all types of cyclists.

Recommended Trail Solution along Crescent Street

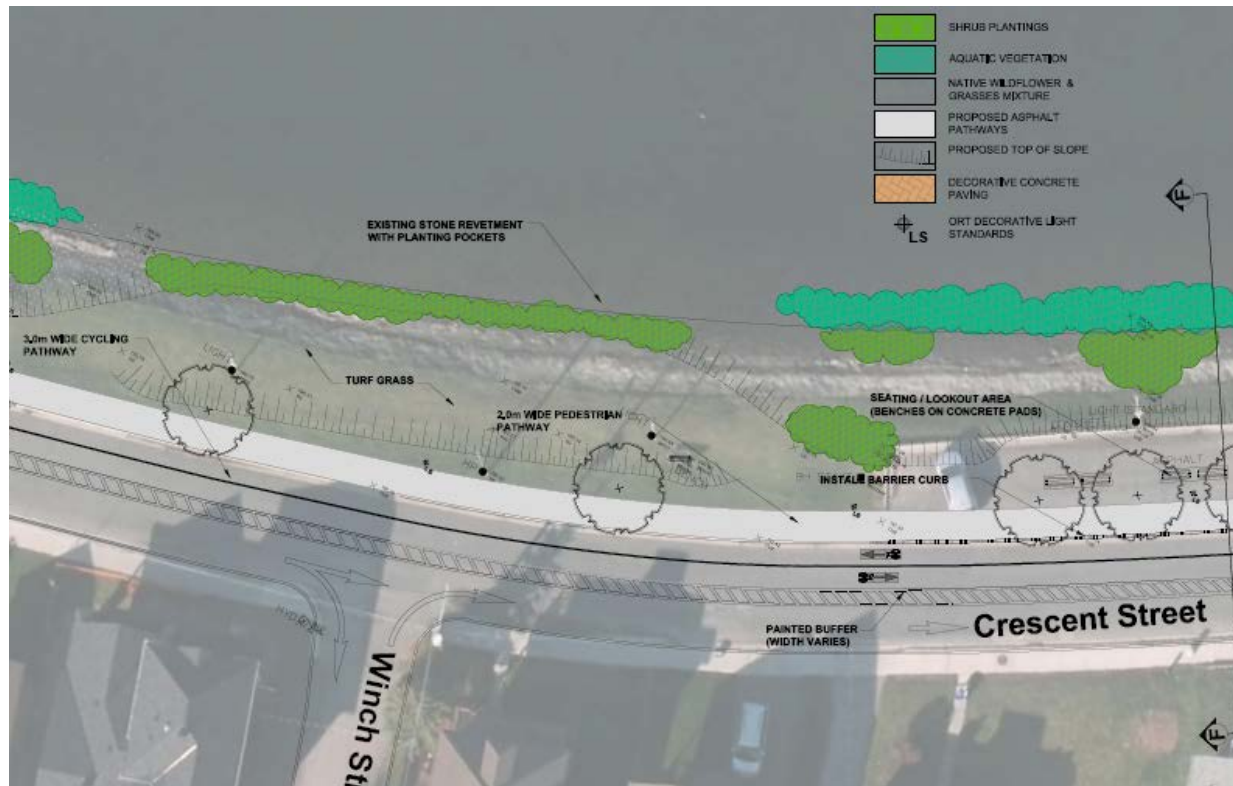


Figure 7

With the 3.0 metre wide two-way cycle track on the road, a 2.0 metre wide walkway is proposed abutting the Crescent Street curb line. Pedestrians and cyclists are separated by the barrier curb. The proposed location of the walkway, as illustrated on Figure 7, has a minimal impact on existing trees, sculpture and infrastructure. Also through the consultation process, people said they wanted to minimize the extent of paving along the shoreline. Placing the cycle track on the road and eliminating the current parking bays along Crescent Street helps to achieve that objective.

Locating the walkway portion of the Otonabee River Trail Extension along the Crescent Street curb line allows its construction away from the spring flood-line and on land with a more consistent, flatter elevation. It also takes advantage of the use of existing asphalt paving in the areas where existing parking lots are located along the lake. The remainder of the asphalt in these parking lots will be removed or converted in part, to serve as paved surfaces for access to the shoreline or places to sit adjacent to the trail. The Traffic Study Report noted that removal of the parking bays along the shoreline will also reduce the external traffic using Crescent Street. This should increase the safety for pedestrians and cyclists and encourage more people and families to ride or walk along the Little Lake shoreline, as originally envisioned in the Little Lake Master Plan.

The implementation of the trail would result in the removal of the five (5) parking bays along Crescent Street from Haggart Street to Romaine Street. While this may change how residents and visitors park, the surrounding road network should continue to have sufficient parking areas either on-road or within parking lots which are a short walk from the lakeside. Additionally, the Traffic Study noted that parking needs may be mitigated by the implementation of a new parking lot adjacent to the road closure on Haggart Street where it crosses the former CP Rail corridor.

The Trail Extension's terminus at Haggart Street

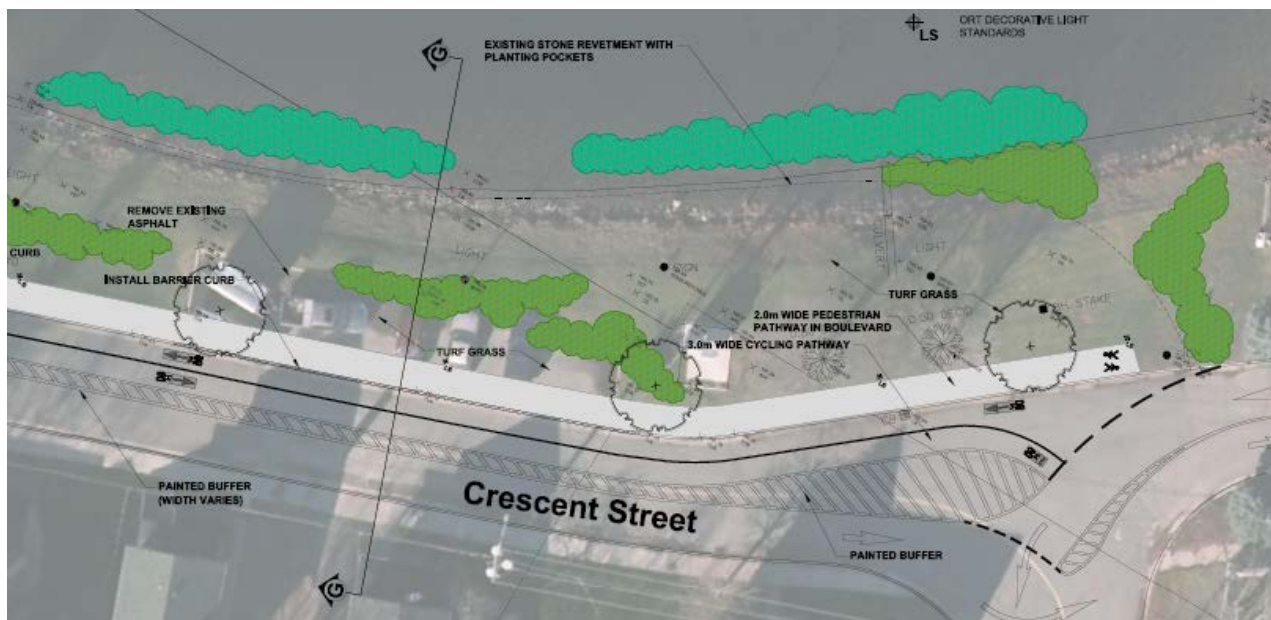


Figure 8

Figure 8 shows that the trail extension ends at Haggart Street. A stop sign will be installed at the end of the trail at its intersection with the driveway entrance to Little Lake Cemetery. Haggart Street does not have a sidewalk, so pedestrians and cyclists will have to share the road with vehicles until such time as the trail is extended to the former CP Rail spur line.

Ware Street Traffic Calming

Following the Otonabee River Trail Public Information Centre (PIC) #1, a public petition was presented to Council from residents of Ware Street regarding their concerns about high speed traffic on Ware Street. This issue was investigated as part of this traffic study with vehicle speed and volume counts undertaken during June and July of 2014. The data revealed that 10% to 30% of Ware Street traffic exceeds the current 50 km/hr posted speed limit. While speeding has been observed and recorded along Ware Street, the

overall traffic volumes are relatively low with about 340-520 vehicles recorded per average weekday.

The Traffic Study also found a pattern of traffic using Ware Street and Crescent Street as a cut-through route to avoid the George Street and Lock Street corridors. This traffic accesses Ware Street and Crescent Street via Haggart Street which intersects with Lansdowne Street East. Approximately 30% of the cut-through traffic was found to be using Ware Street as a through route. Much of this cut-through traffic was observed to be higher speed vehicles during the traditional peak hours of the day.

Closure of Haggart Street at the CP Rail Corridor

The study assessed the traffic diversion that would occur as a result of the conversion of Crescent Street to a one-way street combined with the closure of Haggart Street and estimated traffic on Ware Street would be reduced by approximately 60% to 90%, through the removal of longer distance trips attempting to by-pass the Lansdowne Street, George Street, and Lock Street corridors. This would not only reduce overall traffic on Ware Street, it would also remove the higher-speed vehicles which presented safety concerns to residents. The report concluded that the Haggart Street closure would sufficiently calm the traffic conditions on Ware Street and should alleviate the concerns of the local residents.

The closure of Haggart Street will require the design and construction of a cul-de-sac to facilitate snow clearing, garbage collection and road maintenance activities. In addition, the design for a trail connection between Crescent Street and the former CP Rail right-of-way should be included in any reconstruction plans for Haggart Street to continue the implementation of the Little Lake Trail Loop. The Traffic Study report also noted the potential to incorporate some parking in the vicinity of the closure to replace parking that will be removed on Crescent Street.

It is recommended that staff include the closure of Haggart Street and the construction of the necessary cul-de-sac treatments and/or future parking lot as part of future capital budget submissions and that a detailed design be prepared for the reconstruction.

Improving the Lock Street / Ware Street Intersection

Another traffic calming measure that should be implemented in the study area is a raised crosswalk with curb extensions (bulb-outs) on both sides of the intersection along Lock Street. A raised crosswalk is a marked pedestrian crossing point at an intersection or mid-block location constructed at a higher elevation than the adjacent roadway. The raised surface improves drivers' awareness of the potential for pedestrians and forces approaching vehicles to reduce speeds, providing an opportunity for drivers to ensure that no pedestrian is crossing.

Curb extensions are areas where the curb shifts toward the centreline of the road, narrowing the road, shortening crossing distances, and improving visibility of pedestrians approaching the crossing. The Traffic Study report recommended curb extensions be implemented on both sides of the raised crosswalk at the intersections of Lock Street and Ware Street. The curb extensions would force drivers on Lock Street to slow down as they approach the intersection. In addition, curb extensions would give drivers on Ware Street protection and better visibility of cross traffic if cars are parked on Lock Street. This is particularly beneficial when there are events at the Memorial Centre, Morrow Park or Del Crary Park, as vehicles tend to park on Lock Street. Curb extensions would also ensure vehicles do not park too closely to the intersection or raised crosswalk so that pedestrians are visible.

Ware Street Realignment at Lock Street



Figure 9

With the recent decision to purchase the CP Rail corridor through this portion of the City, there is a longer term opportunity to realign Ware Street to eliminate the offset intersection at Lock Street and create a four way intersection (see Figure 9). Creating a four way intersection should promote improved vehicle and pedestrian safety performance, particularly as the CP Rail corridor is transitioned to a new off road trail, at which time the level of pedestrian and cyclist crossing activity could be expected to increase significantly.

It is recommended that staff include the reconstruction of the Lock Street / Ware Street intersection in future capital budget submissions and that a detailed design be prepared for the reconstruction that includes the above noted traffic calming measures along with the realignment of the (future) trail crossing.

Summary of Traffic Study Recommendations

Figure 10 provides a summary of the recommended improvements for the Otonabee River Trail extension and to address the request for traffic calming measures on Ware Street. The key recommendations include:

- Closure of Crescent Street between Romaine Street and Lock Street (the “Gore”)
- Conversion of Crescent Street to One-Way eastbound
- Removal of parking bays on Crescent Street
- Construction of Two-Way Multi-Use Trail from Del Crary Park along Lock Street to the T Wharf
- Modification of lane markings to provide a 3.0 m wide two way cycling track on the old westbound lanes of Crescent Street, separated from the Eastbound traffic with a 1.0 m wide painted buffer area
- Construction of a 2.0 m wide walking path along north side of Crescent Street
- Closure of Haggart Street at the former CP Rail right-of-way
- Review opportunity to construct off site parking lot at termination of Haggart Street
- Realignment of Ware Street at Lock Street and construction of raised crosswalk and curb extensions as part of future trail construction

Summary of Traffic Study Recommendations

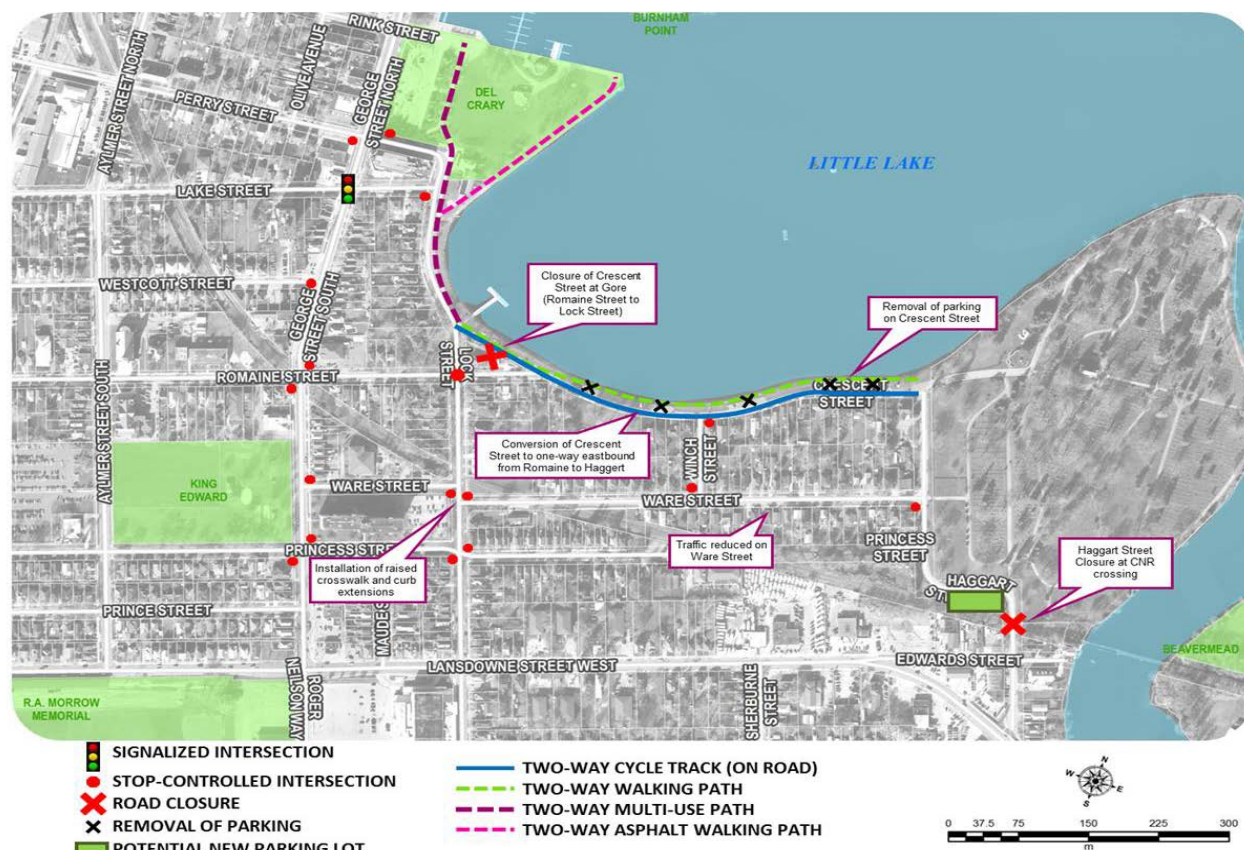


Figure 10

Little Lake Shoreline Improvements

Many decades ago, the slope of the Little Lake shoreline was hard-lined all the way from the point in Del Crary Park to well inside the Little Lake Cemetery. It was probably done to address the erosion of the shoreline due to a high amount of boating activity and the movement of lake ice especially due to winds in the late winter or early spring. It was done at a time when it was not known how much this sort of shoreline treatment can damage the ecological health of a lake. Without a riparian zone along the shoreline, life in the lake dwindles. The riparian zone provides shelter and source of food for organisms in the lake and along the shoreline. It is largely responsible for kick-starting the food chain.

Through the EA, the opportunity to improve the shoreline before the construction of the Otonabee River Trail extension was identified. Figures 11, 12 and 13 illustrate the proposed shoreline improvements at different locations along Crescent Street.

Recommended Shoreline Treatments

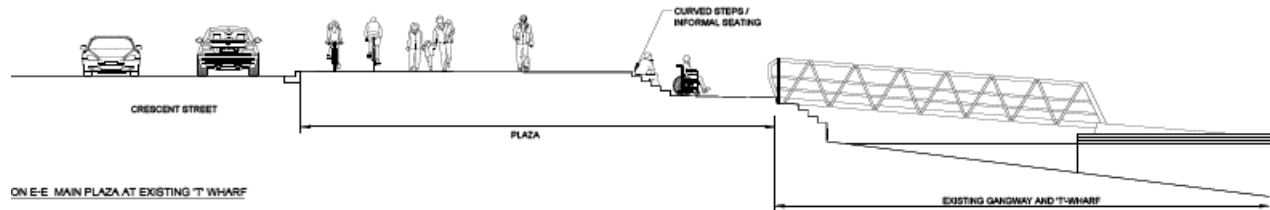


Figure 11

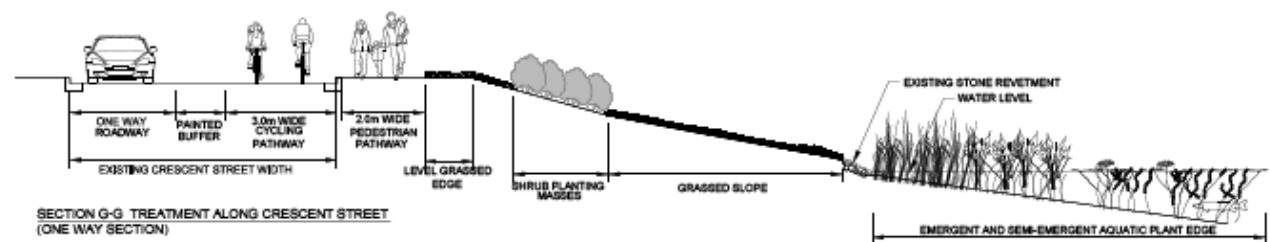


Figure 12

The shoreline restoration plan calls for the removal of concrete in the water and on the shoreline in strategic areas, assisting to restore the ecology of the lake. Through the consultation process, people said they wanted the design to allow for public access to the water in many areas. The plan strikes a compromise providing numerous locations for people to access the water's edge.

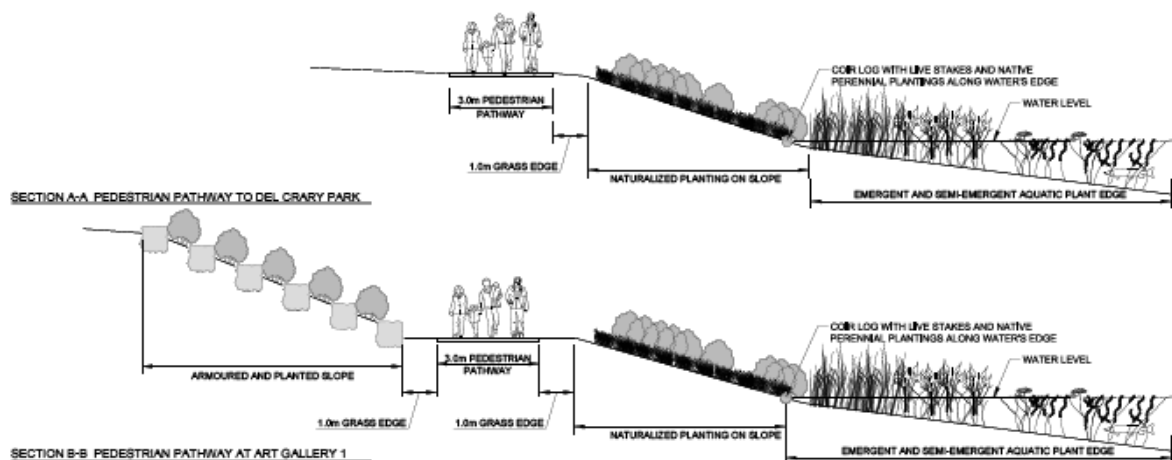


Figure 13

In Del Crary Park, large interlocking concrete precast units were installed long ago, now grass is growing in them. In this area, the majority of the interlocking pre-cast is proposed to remain as a large amount of people can gather and spend time along this section of shoreline. Further down the shoreline, concrete was actually poured in the water and on the slope of the shore, creating more of a sterile edge. Most of this is proposed to be removed and replaced with plantings, but includes open areas for public access to the water.

Summary

The Otonabee River Trail Extension from the marina area in Del Crary Park to the Little Lake Cemetery is a significant step towards realizing the long-standing vision of completing a trail loop around Little Lake.

Removing much of the hard-surface treatment of the Little Lake shoreline and replacing it with a low vegetative edge (riparian buffer) will assist in restoring the ecology of the lake.

The recommendation to close Haggart Street at the former CP Rail spur line represents the most significant traffic calming measure for Ware Street and the study area. The traffic operational analysis considered the potential increase in residential density that could result with a Zoning By-law Amendment to implement the recommendations of the Land Use-Urban Design Study. It concluded that the resultant road network would be sufficient to accommodate traffic through the study area.

The preliminary design recommendations for the Otonabee River Trail Extension and Shoreline Improvements around Little Lake include a complimentary set of recommendations for traffic calming measures in the area. The consultation process required under the EA was combined with the consultations associated with the Land Use-Urban Design Study producing a coordinated vision for the re-development of private properties, as well as improvements to public space in the area.

Submitted by,

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Prepared by,

Concurred with,

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Attachments:

Exhibit A – Class Environmental Assessment for the Otonabee River Trail Extension
around Little Lake - Trail Concepts and Traffic Study Report

City of Peterborough

Class Environmental Assessment for the Otonabee River Trail Extension around Little Lake **Trail Concepts and Traffic Study Report** FINAL



June 29, 2015

AECOM



City of Peterborough

Class Environmental Assessment for the Otonabee River Trail Extension around Little Lake Trail Concepts and Traffic Study Report FINAL

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Project Number:

60299357

Date:

June 2015

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.



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June 30, 2015

Brian Buchardt
City of Peterborough
Planning & Development Services Department
500 George Street North
Peterborough, ON, K9H 3R9

Dear Mr. Buchardt:

Project No: 60299357

**Regarding: Class Environmental Assessment for the Otonabee River Trail Extension
around Little Lake Trail Concepts and Traffic Study Report**

AECOM is pleased to provide this FINAL Little Lake Otonabee River Trail Concepts and Traffic Study Report to the City of Peterborough. The report captures comments received from the Public Open House on June 4, 2015.

AECOM was retained by the City of Peterborough to undertake a study in support of the Otonabee River Trail (ORT) Environmental Assessment by presenting potential trail concepts for the ORT extension around Little Lake as well as determining the related impacts to traffic and the plan for future intensification on the adjacent road network.

This report documents the traffic study findings, trail and cycling concepts, incorporating the comments from local residents. Recommendations are provided regarding the Otonabee River Trail and cycling facilities along Little Lake (Crescent Street from Haggart Street to Perry Street) and to address the received concerns of Ware Street residents.

If you have any further questions regarding this report, please contact the undersigned at (905) 668 4021 extension 2434.

Sincerely,

AECOM Canada Ltd.

A handwritten signature in black ink, appearing to read "Khawar Ashraf", written over a light gray rectangular background.

Khawar Ashraf
Senior Project Manager, Transportation
khawar.ashraf@aecom.com

KA:ka
Encl.
cc: Mike Hubicki, Jamshaid Muzaffar, Owen McGaughey, AECOM

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
-	-	2014/12/11	Draft report issued for comment
1	OM/JR	2015/06/30	Final report revised based on City comments and refined option

AECOM Signatures

Report Prepared
By:



Jamshaid Muzaffar, P.Eng.
Transportation Engineer

Stamp

Report Prepared
By:



Owen McGaughey, P.Eng.
Transportation Engineer

Stamp

Report Reviewed
By:



Khawar Ashraf
Senior Project Manager,
Transportation

Executive Summary

This study was undertaken to support the Otonabee River Trail (ORT) Environmental Assessment by presenting potential trail concepts for the ORT extension around Little Lake as well as determining the related impacts to the traffic on the adjacent road network. The study area is bound by Ware Street to the south, Perry Street to the north, George Street to the West and Haggart Street to the east. The intersections of Crescent Street, Romaine Street and Lock Street form a gore¹, where traffic on Crescent Street is limited to one-way westbound traffic (from Romaine Street to Lock Street). North of the Gore (at Crescent Street and Lock Street), Crescent Street and Lock Street merge thereby increasing overall traffic and shifting from localized traffic patterns to include local and through traffic. The road network is predominately residential, with George Street and Lock Street serving as the major connections to the downtown core.

Existing Conditions

The existing traffic conditions for the study area were determined through analysis of recent traffic count data (turning movement counts) at intersections within the study area, as well as data and observations collected during a site visit conducted by AECOM.

There is a lack of active transportation infrastructure within the Little Lake study area. The existing cycling network in Peterborough (as of 2011) includes off-road facilities near the study area, but not through. The demand for a trail facility closer to Little Lake is evident through observations made during AECOM's site visit, which revealed that due to use over time, desire lines have formed in the grass adjacent to the lake, indicating a clear preference of pedestrians to walk along the lakeside.

With regards to driver tendencies and travel patterns, the traffic data indicated that the PM period is the peak period of travel. The traffic within the study area is also impacted by local events which take place within or around the study area. These events draw in additional drivers and impact on-road parking within the study area. These events include:

- Peterborough MusicFest – Free outdoor concert series held at Del Crary Park (north end of study area)
- Peterborough Petes Hockey – Peterborough's OHL hockey team, which plays home games at the Peterborough Memorial Centre located just south of the study area.
- Peterborough Dragonboat Festival – An annual team paddling boat race event held at Little Lake every summer.

The traffic within the study area is also impacted by vehicles that use the study area residential road network as a by-pass to avoid the George Street and Lansdowne Street corridors. This *cut-through* traffic typically accesses Edwards Street/Haggart Street from Lansdowne Street, and travels on Crescent Street and Ware Street towards George Street and Lock Street, thereby avoiding the traffic signals and higher volumes on George Street and Lock Street, and infiltrating the local road network with higher speed through traffic. These higher speeds on Crescent Street and Ware Street impact the comfort of walking, cycling, and driving on the local roads.

Under existing conditions, there are several options for parking within the Little Lake Study Area, including on-street parking, paid parking lots and free parking lots. There are five small parking bays situated along Crescent Street, servicing visitors to the lake. A paid parking lot can be found at Del Crary Park, accommodating 88 vehicles.

¹ Triangular piece of land enclosed by merging/connecting roadways.

The existing road network traffic operations were assessed utilizing Synchro 9 software package, which is based on the Highway Capacity Manual (HCM) 2000 methodology. The base year traffic analysis was conducted for weekday AM and PM Peak hour scenarios, which revealed that the AM peak period of traffic occurs closer to the mid-day timeframe of 10:00AM to 12:00PM (partially due to people who choose to have lunch at the lakeside). The PM peak period of traffic occurs from 3:00PM to 7:00PM, which is consistent with evening commuter travel periods. Under existing conditions, the traffic operations analysis concluded that all intersections are performing well in the AM and PM peak hours. The signalized intersection at George Street and Lake Street is operating at an overall **LOS A**, and all unsignalized intersections are below capacity, with all approaches at volume-to-capacity Ratio (V/C ratio)² of **0.55** or less.

Otonabee River Trail (ORT) Concepts

To support the ORT EA, this study provides three (3) potential concepts for the ORT extension, which impact Crescent Street within the study area. The concepts presented in this study are:

1. Alternative 1: Multi-Use Pathway from Haggart Street to Perry Street
 - A single 4.0 m wide path shared by both pedestrians and cyclists, from Haggart Street to Perry Street.
 - The Gore to be closed to vehicular use.
 - Crescent Street (Haggart Street to Lock Street) to be converted to a Bicycle Priority Street.
2. Alternative 2: Multi-Use Path, Two-Way Cycle Track and Separated Pedestrian Path
 - A single 4.0 m wide path shared by both pedestrians and cyclists, from Perry Street to Romaine Street.
 - A single 2.0 m to 3.0 m wide pedestrian only pathway from Haggart Street to Romaine Street.
 - The Gore to be closed to vehicular use.
 - Crescent Street (Haggart Street to Romaine Street) to be converted to one-way westbound route.
 - Romaine Street (Crescent Street to Lock Street) to be converted to one-way westbound route.
 - Two-way on-road cycle track on Crescent Street / Romaine Street from Haggart Street to Lock Street
3. Alternative 3: Pedestrian Path, On-Road Cycling, and Multi-Use Path
 - A single 4.0 m wide multi-use path shared by both pedestrians and cyclists, from the existing ORT to south of Lock Street.
 - A single 3.0 m stone dust walking path from south of Lake Street along the Del Crary Park shoreline.
 - A single 4.5 m wide multi-use path from south of Lake Street to Lock Street.
 - A single 3.0 m walking path from Lock Street to Haggart Street.
 - Two-way on-road cycle track on Crescent Street from Lock Street to Romaine Street.
 - The Gore to be closed to vehicular use.
 - Crescent Street (Haggart Street to Lock Street) to be converted to a **Bicycle Priority Street**.

² V/C ratios indicate the level of congestion on a road, where a v/c ratio of 1.00 means that the traffic on a road segment is equal to the vehicle capacity of the road segments. A 0.9 v/c ratio is typically used to identify capacity deficiencies that may need to be addressed through network improvements (v/c of 0.9 or higher is generally indication of stop and go traffic conditions)

Based on client and public feedback on these three trail concepts, a “Refined” option was developed, including a multi-use path, two-way cycle track, and separated pedestrian path:

- A single 4.5 m wide multi-use path shared by both pedestrians and cyclists, from the existing ORT to Lake Street.
- A single 3.0 m asphalt walking path from Lake Street north along the Del Crary Park shoreline.
- A single 4.5 m wide multi-use path from Lake Street to Lock Street.
- A single 2.0 m walking path from Lock Street to Haggart Street.
- Two-way on-road cycle track on Crescent Street from Lock Street to Haggart Street.
- Crescent Street through the “gore” to be closed to vehicular use.
- Crescent Street (Haggart Street to Romaine Street) to be converted to one-way eastbound route.
- Romaine Street (Crescent Street to Lock Street) to be converted to one-way eastbound route (optional to provide parking on both sides of the street).
- The existing five parking bays along Crescent Street to be removed, with the dropped curb replaced by a standard barrier curb.
- The pavement surface within the on-road cycle track to be generally smooth and free of hazards for cyclists.
- The catch basins on Crescent Street to be modified or replaced to be more cyclist-friendly.

The Refined option is illustrated in **Figure ES-1**.

It is concluded that the refined option would best achieve the active transportation and infrastructure goals for the City of Peterborough. A two-way on-road cycle track along Crescent Street would provide cyclists with their own lane in each direction separated from both cars and people walking or strolling along the waterfront. The cycle track would attract recreational and utilitarian cyclists to use the facility, as being separated from motorists by a buffer will provide comfort ability for all types of cyclists. The two-way cycle track would continue through the gore between Romaine Street and Lock Street. North of Lock Street, cyclists would have the option to continue cycling on-road with other vehicles or on a multi-use path shared with pedestrians. The concept would include intersection treatments where the cycle track intersects Crescent Street / Romaine Street and Crescent Street / Lock Street to facilitate such cycling movements. This option provides both cyclists and pedestrians with safe options to travel along the lakeshore, and is most feasible due to minimal infrastructure impacts, as all on-road improvements can be made within existing curb limits.

Traffic Calming on Ware Street

During the Otonabee River Trail Public Information Centre (PIC) #1, a public petition was presented to the City of Peterborough from residents of Ware Street within the Little Lake study area regarding concerns of high speed traffic on Ware Street (also identified in existing conditions). This issue was investigated as part of this traffic study using speed statistics provided by the city. The data revealed that 10% to 30% of Ware Street traffic exceeded 50 km/hr (posted speed limit), while 36% to 62% of traffic along Ware Street exceeds 40 km/h speeds. While not in excess of the posted speed limit, local road traffic above 40 km/h is generally considered higher speed as well, presenting potential safety implications for roads near children activity. It is important to note that while speeding has been observed and recorded along Ware Street, the overall traffic volumes in the AM and PM peaks are relatively low. Thus, speeding and safety concerns raised by residents can be mitigated by simply reducing the traffic over Ware Street (traffic calming).

A potential traffic calming measure assessed in this study relates to the Haggart Street cut-through traffic identified in existing conditions. Since the by-pass traffic accessing Ware Street and Crescent Street via Haggart Street was observed to be higher speed vehicles, a closure of Haggart Street south of the study area may potentially calm the existing traffic conditions on Ware Street. Closing Haggart Street would remove the possibility of longer distance trips using Ware Street and Crescent Street to by-pass the Lansdowne Street, George Street, and Lock Street corridors. The cut-through traffic would instead remain on the major arterial routes such as George Street and Lansdowne Street which are better suited for higher speed traffic. Additionally, the Haggart Street closure will reduce traffic on Crescent Street, improving the environment for walking and cycling adjacent to the street. Through desktop analysis, it was found that the Haggart Street closure would significantly reduce traffic on Ware Street, Haggart Street, and Crescent Street (62% to 90% reduction) in the AM and PM peak hours.

Another traffic calming measure that should be implemented is a raised crosswalk with curb extensions (bulbouts) on both sides of the intersection along Lock Street. A raised crosswalk is a marked pedestrian crossing point at an intersection or mid-block location constructed at a higher elevation than the adjacent roadway. The raised surface improves drivers' awareness of the potential for pedestrians and has a traffic calming effect, as one of its effects is to reduce speed. Raised crosswalks force approaching vehicles to reduce speeds, providing an opportunity for drivers to ensure that no pedestrian is crossing. In addition, drivers must reduce speed in order to clear the crosswalk safely.

Curb extensions are areas where the curb shifts toward the centreline of the road, narrowing the road and improving visibility of pedestrians approaching the crossing. Curb extensions should be implemented on both sides of the raised crosswalk (as shown in **Figure 22**). At the intersections of Lock Street and Ware Street, there is only a two-way stop for vehicles travelling on Ware Street; thus, the curb extensions would force drivers on Lock Street to slow down as they approach the intersection. In addition, curb extensions would give drivers on Ware Street protection and better visibility of cross traffic if cars are parked on Lock Street because they would have room to move forward into the intersection to see cross traffic without advancing into their lane. This is particularly important when there are events at the nearby arena, as vehicles tend to park on Lock Street. Curb extensions would also ensure vehicles do not park too closely to the intersection or raised crosswalk.

The recommended traffic calming measures are illustrated in **Figure ES-1**.

Traffic Operational Analysis

In order to assess the traffic impacts of implementing the ORT trail concepts presented in this study, the traffic operations for the trail concepts were modelled and analyzed for the trail opening year scenario (assumed as 2015) and a future scenario 20 year post-trail opening (2035). The road network would only be impacted by two of the trail concept recommendations (closure of Haggart Street and conversion of Crescent Street into a one-way westbound route), and therefore both of these alternatives were tested for the opening day and future horizon year scenarios. The road network scenarios assessed for this study are listed below, and were analyzed for both AM and PM Peak hours.

- Scenario 1: 2015 Haggart Street Closure
- Scenario 2: 2015 Haggart Street Closure and Crescent Street One-Way
- Scenario 3: 2035 Haggart Street Closure (with Intensification)
- Scenario 4: 2035 Haggart Street Closure and Crescent Street One-Way (with Intensification)

The future year scenarios implemented a 1% annual increase in traffic, as well as considered additional traffic generated by intensification planned within the study area. The proposed intensification is anticipated to be primarily residential, with a mix of three-storey townhouses and low-rise condominiums as well as limited ground floor retail (coffee shops, convenience stores, banks, etc.). The development will occur over two major blocks, listed below.

- BLOCK 1: Crescent Street / Lake Street / George Street / Romaine Street (Residential/Limited retail)
- BLOCK 2: Crescent Street / Haggart Street / Ware Street / Lock Street (Residential)

A conservative approach for future intensification was adopted for this traffic study, estimating the new developments will consist of 400 total dwelling units by 2035. Utilizing trip generation rates from the ITE trip generation guide (9th edition), the proposed new developments are expected to generate a total of 128 trips in the AM Peak hour and a total of 210 trips in the PM Peak hour. This site generated traffic was distributed to the network using travel patterns extracted from the 2011 Transportation Tomorrow Survey.

The result of the traffic operational analysis concluded that the traffic impacts associated with the implementation of the three trail alternatives at opening day (2015) are minimal and can be accommodated by the existing road network within the study area. In both opening year scenarios, the signalized intersection at George Street and Lake Street is expected to operate at an overall LOS A, and all unsignalized intersections are below capacity, with all approaches at V/C Ratio of 0.55 or less. Additionally, under future conditions with the proposed intensification nearly complete (2035, Block 1 fully developed and Block 2 partially developed), the road network will still be able to accommodate the increased traffic from annual growth and trips generated by the new developments. In all future year scenarios tested, the signalized intersection at George Street and Lake Street is forecasted to operate at an overall LOS A, and all unsignalized intersections are below capacity with all approaches at V/C Ratio of 0.71 or less. While the traffic simulation revealed potential congestion and queuing issues at the George Street / Perry Street, George Street / Westcott Street and George Street / Romaine Street intersections, users would naturally adjust their trip making patterns to utilize nearby parallel routes to reduce delays.

With the Refined option as the recommended trail concept, the road network would be impacted by the Haggart Street closure at the disused rail line south of the study area and the closure of Crescent Street along the Gore (Romaine Street to Lock Street). The traffic analysis accounted for these network impacts for both ORT opening year conditions (2015) and future conditions (2035, including intensification), and concluded that the road network would be sufficient to accommodate traffic through the study area. Though the analysis considered conversion of Crescent Street to one-way westbound and the recommended trail concept includes Crescent as one-way eastbound, the total bidirectional traffic on Ware Street is anticipated to be similar, with all local westbound traffic on Ware Street and local eastbound traffic divided between Crescent and Ware Streets.

The road network recommendations are summarized in **Figure ES-1**.

Figure ES-1: Summary of Recommendations

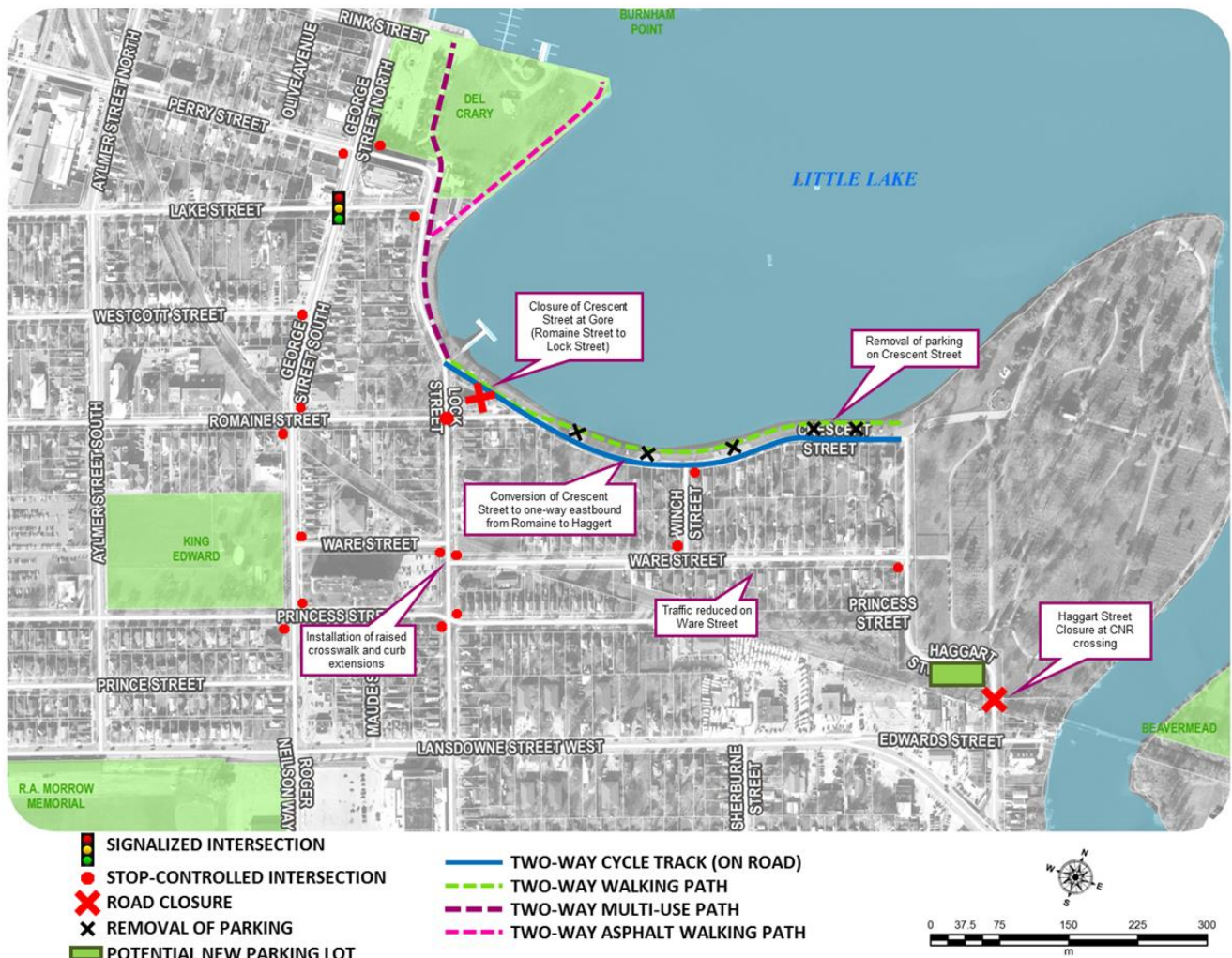


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Appendices

- Appendix A. Existing Intersection Turning Movement Counts
- Appendix B. Weekly Vehicle Counts and Speed Statistics
- Appendix C. Synchro/SimTraffic Reports
- Appendix D. Otonabee River Trail Alignment

1. Introduction and Background

This study was undertaken to support the Otonabee River Trail (ORT) Environmental Assessment by presenting potential trail concepts for the ORT extension around Little Lake as well as determining the related impacts to the traffic on the adjacent road network, for both trail opening day conditions (2015) and future conditions (2035).

1.1 Background

1.1.1 Otonabee River Trail (ORT) Environmental Assessment

In April 2013, the City of Peterborough retained AECOM to complete a Schedule B Municipal Class Environmental Assessment (EA) study for the extension of the Otonabee River Trail (ORT) around Little Lake. The recommendation for the trail extension was presented in the Little Lake Master Plan (2010). The trail extension would provide a dedicated active transportation facility that takes advantage of the lakeside location while also providing inter-connectivity to the existing ORT as well as potential future cycling facilities. The purpose of the EA study is to identify a recommended design for the ORT around Little Lake from Haggart Street to the George Street Wharf in Del Cray Park. Please refer to the "Otonabee River Trail Extension around Little Lake MCEA Schedule B Report" for more details.

During the EA process, it became evident that a better understanding of the neighbourhood's existing and future traffic patterns would be beneficial to support the EA study. Thus, the City retained AECOM to complete the Little Lake ORT Concepts and Traffic Study (Traffic Study).

1.1.2 City of Peterborough Comprehensive Transportation Plan

The City of Peterborough Comprehensive Transportation Plan (CTP) was completed in August 2012, and was initiated as an update to the 2002 Comprehensive Transportation Plan. The key departure from the previous plan is the greater emphasis on active transportation in the City of Peterborough and a substantially smaller road capital program. According to the CTP report, the vision for active transportation in Peterborough is to "prioritize active models of transportation through policies, infrastructure and programs that foster a cycling and pedestrian network with high degrees of connectivity, safety and local context sensitivity"³.

The CTP recommends a significant expansion of the cycling network in the City of Peterborough, adding 83 km of on-road facilities (cycling lanes) and 48 km of off-road facilities (trails and multi-use paths, including the ORT). The recommended future cycling network was developed to balance the needs of both recreational and utilitarian cyclists, accommodating users of varied skill, fitness and comfort level. Within the vicinity of Little Lake, the CTP calls for bicycle infrastructure to be constructed along George Street, Romaine Street, Lock Street (south of Romaine Street), and Haggart Street.

The City has also expressed interest in a new long term trail facility which would be implemented along the decommissioned rail line at the south portion of the study area (crossing the George Street and Romaine Street intersection, Lock Street north of Ware Street, Ware Street east of Lock Street, and Haggart Street north of Edwards Street). This trail would add connectivity and continuity to the ORT trail, and attract longer distance cycling trips. This potential trail, in addition to the ORT trail, would increase cycling mode share adjacent to Little Lake.

³ "City of Peterborough Comprehensive Transportation Plan" Report, prepared by Morrison-Hershfield. August 2012.

1.1.3 George Street Improvement Project Class Environmental Assessment (EA)

In the summer and fall of 2014, the City of Peterborough initiated a Class Environmental Assessment (EA) to improve walking and cycling infrastructure along George Street from Sherbrooke Street to Perry Street. The corridor was identified as a prime candidate for improvement by the Active and Safe Community Routes group (including representatives from the City, GreenUP, Peterborough County-City Health Unit, Access, Centre, Council of Persons with Disabilities, and interested citizens) in 2006. In 2012, the Peterborough CTP recommended on-road bike facilities along the corridor as a short term priority.

The Class EA assessed opportunities to improve the pedestrian and cycling environment in the study area. The results of the EA study concluded that the Complete Streets option is the best option to address the problem statement. The Complete Streets option includes reconfiguration of George Street to provide two vehicle travel lanes, separate left-turn lanes at intersections and entrances, pedestrian islands, on-road bike lanes, removal of some on-street parking, and a new traffic signal at George Street and Dalhousie Street. The final EA report is currently awaiting council adoption, at which point the final ESR will be posted for public review.

For the purpose of this study, it is assumed that the improvements outlined in the recommended Complete Streets alternative will be in place when the trail is implemented. The key impact the improvements will have on the Little Lake study area is the on-road cycle lanes to be implemented on George Street from Perry Street to Sherbrooke Street, at the north end of the study area.

1.2 Study Area

This traffic study focuses on the Crescent Street corridor and the surrounding road network which would be impacted by the Otonabee River Trail around Little Lake. The study area is bound by Ware Street to the south, Perry Street to the north, George Street to the West and Haggart Street to the east. The road network is predominately residential, with George Street and Lock Street serving as the major connections to the downtown core. All roads in the study area have two-lane cross section, and the speed limit of the study area roadways is 50 km/h.

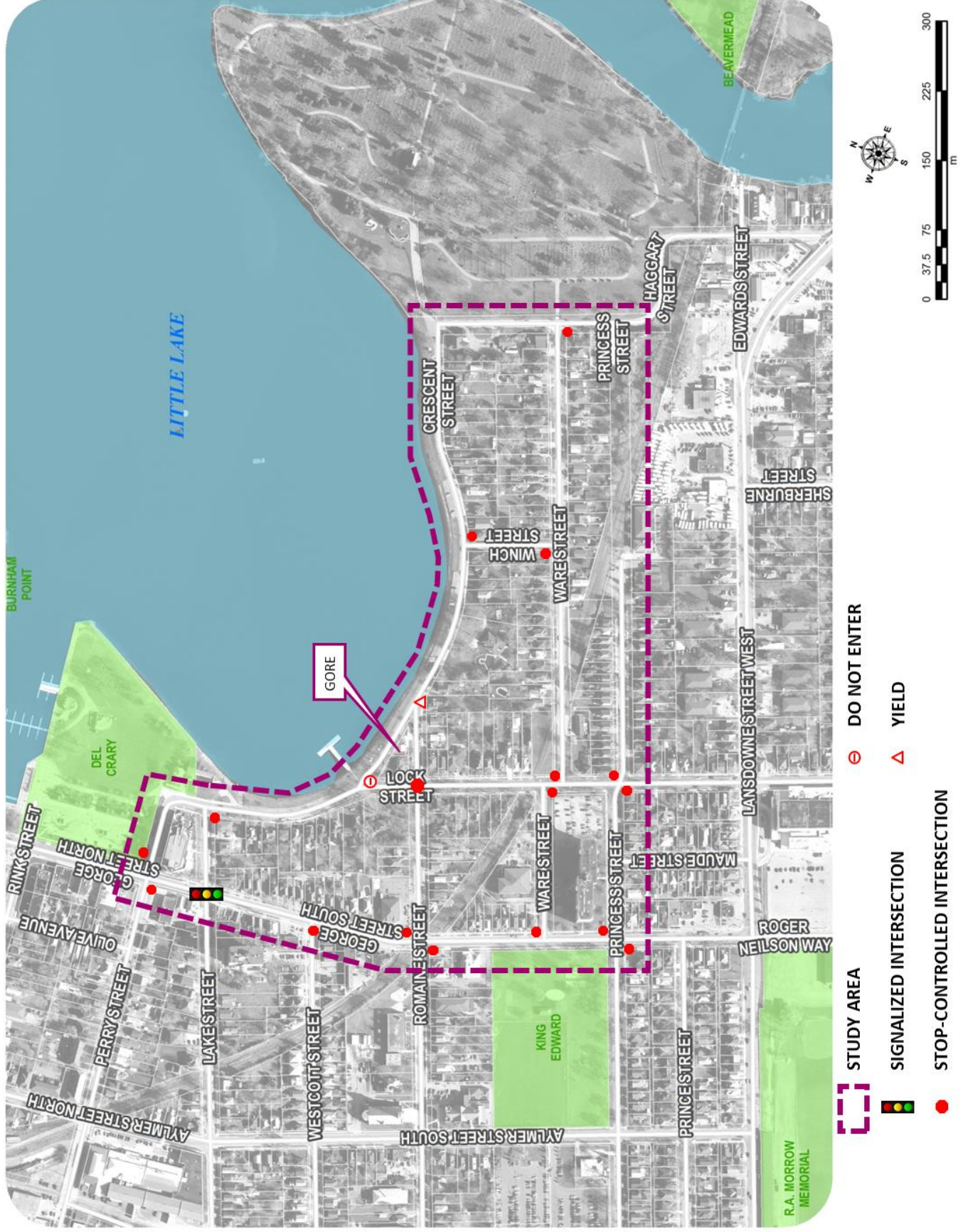
Crescent Street from Haggart Street to Romaine Street runs along Little Lake and is fronted by residential units. With the lakeside being a popular destination for residents and local events, there are five (5) small parking areas on the north side of Crescent Street. The intersections of Crescent Street, Romaine Street and Lock Street form a gore⁴, where traffic on Crescent Street is limited to one-way westbound traffic (from Romaine Street to Lock Street). North of the Gore (at Crescent Street and Lock Street), Crescent Street and Lock Street merge thereby increasing overall traffic and shifting from localized traffic patterns to include local and through traffic. At the north terminus of Crescent Street (Perry Street) is the Art Gallery of Peterborough, Del Crary Park, and mid-rise a residential apartment building. The neighbourhoods enclosed by Crescent Street, Haggart Street, Ware Street, George Street, and Lake Street are predominately residential, with most commercial and retail located along George Street. Travel patterns in the area are impacted by local activities around Little Lake and Del Crary Park, as well as sporting events held at the Peterborough Memorial Centre area located just south of the study area at Lansdowne Street and Lock Street.

AECOM conducted a site visit of the study area during which AECOM staff collected road measurements, pictures along Crescent Street, and observed traffic patterns and driver tendencies within the study area limits.

The study area is presented in **Figure 1**.

⁴Triangular piece of land enclosed by merging/connecting roadways.

Figure 1: Little Lake Traffic Study Area



1.3 Public Information Centres

AECOM attended three public information centres (PICs). The purpose of these meetings was to inform the public about the proposed plans surrounding Little Lake. In return, citizens of Peterborough could provide feedback and comments on the plans. The major comments and concerns that were provided are:

- **Cut through traffic on Ware Street:** Drivers would typically access Edwards Street / Haggart Street from Lansdowne Street, and travel on Crescent Street and Ware Street towards George Street and Lock Street, thereby avoiding the traffic signals and higher volumes on George Street and Lock Street.
- **Speeding on Ware Street:** The local residents that live on Ware Street raised concerns that drivers are driving with excessive speed on Ware Street and are not aware they are on a residential street.
- **Lack of cycling or walking trails along Little Lake:** Residents of Peterborough raised concerns that there was no walking or cycling path along Little Lake continuing south from Del Crary Park.

2. Existing Conditions

This section presents an overview of the existing conditions in the study area, such as existing travel patterns, traffic volumes, lane configurations, parking facilities, active transportation network, and overall traffic operations.

2.1 Data Collection

The collection of traffic data for this study was completed by the City of Peterborough. The following types of traffic data were provided to AECOM for the purpose of this traffic study:

- Intersection Turning Movement Counts (TMC)
 - *8-hour traffic counts conducted on a standard weekday (Tuesday, Wednesday or Thursday), recording all movements at the intersection at 15-minute intervals.*
- Weekly Vehicle Counts
 - *24-hour traffic counts conducted over a span of 18 calendar days (June 20 to July 7, 2014), recording vehicle class, speed, and vehicle count data.*

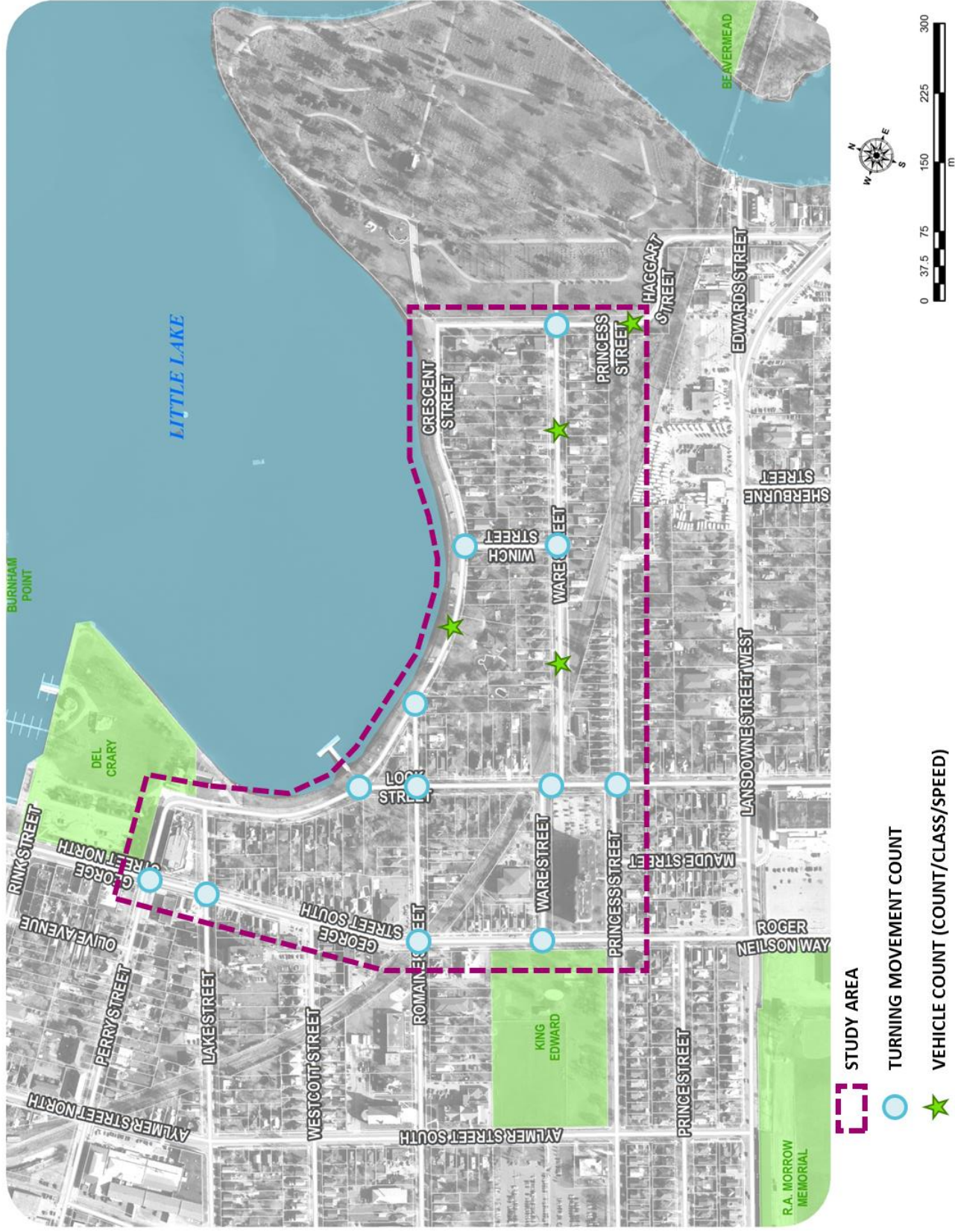
Table 1 and **Figure 2** summarize the traffic data collected in this traffic study.

Table 1: Summary of Data Collected

Count Location	Date Collected
Turning Movement Counts	
George Street at Perry Street	July 31, 2014
George Street at Lake Street	
George Street at Romaine Street	
George Street at Ware Street	
Crescent Street at Lock Street	
Crescent Street at Romaine Street	
Crescent Street at Winch Street	
Lock Street at Romaine Street	September 3, 2014
Lock Street at Ware Street	
Lock Street at Princess Street	July 31, 2014
Ware Street at Winch Street	
Ware Street at Haggart Street	
Weekly Vehicle Counts (Counts, Class, Speed)	
Crescent Street between Winch Street and Romaine Street	June 20, 2014 – July 7, 2014
Haggart Street between Edwards Street and Princess Street	
Ware Street between Lock Street and Winch Street	
Ware Street between Winch Street and Haggart Street	

The complete turning movement counts (TMC) and weekly vehicle counts are provided in **Appendices A** and **B**.

Figure 2: Traffic Count Locations



2.2 Existing Active Transportation / Trail Network

The City of Peterborough's existing active transportation network consists of numerous off-street trails, multi-use paths, on-street cycling facilities, and sidewalks. According to the TAC Urban Transportation Indicators Fourth Survey, in 2006, the City of Peterborough ranked 2nd amongst comparable 'Category D' cities in work trip walking mode share (7.9%) and work trip cycling mode share (2.3%). This reveals a clear desire for Peterborough residents to use active modes and potentially shift to active modes with the implementation of supportive infrastructure. The existing cycling infrastructure in the City is heavily weighted in favour of off-road facilities over on-road facilities, with the existing cycling network being comprised of 38 km of off-road facilities and 15 km of on-road facilities.

There is a lack of active transportation infrastructure within the Little Lake study area. The existing cycling network in Peterborough (as of 2011) includes off-road facilities adjacent to the study area, which terminate at Del Crary Park at the north end of the study area. There are sidewalks along all roads within the study area, including along Crescent Street opposite to the lakeside. The demand for a trail facility closer to the lake is evident through observations made during AECOM's site visit. Due to use over time, desire lines have formed in the grass adjacent to the lake, indicating a clear preference of pedestrians to walk along the lakeside (illustrated in **Figure 3**).

Figure 3: Desire Lines along Crescent Street Lakeside



The demand for active transportation facilities will increase within the study area as the CTP and George Street EA recommendations are implemented, which will introduce connecting cycling facilities to the city and the downtown area.

2.3 Travel Patterns in Study Area

This section details the existing traffic patterns in the Little Lake study area, as determined through site observations and traffic data analysis.

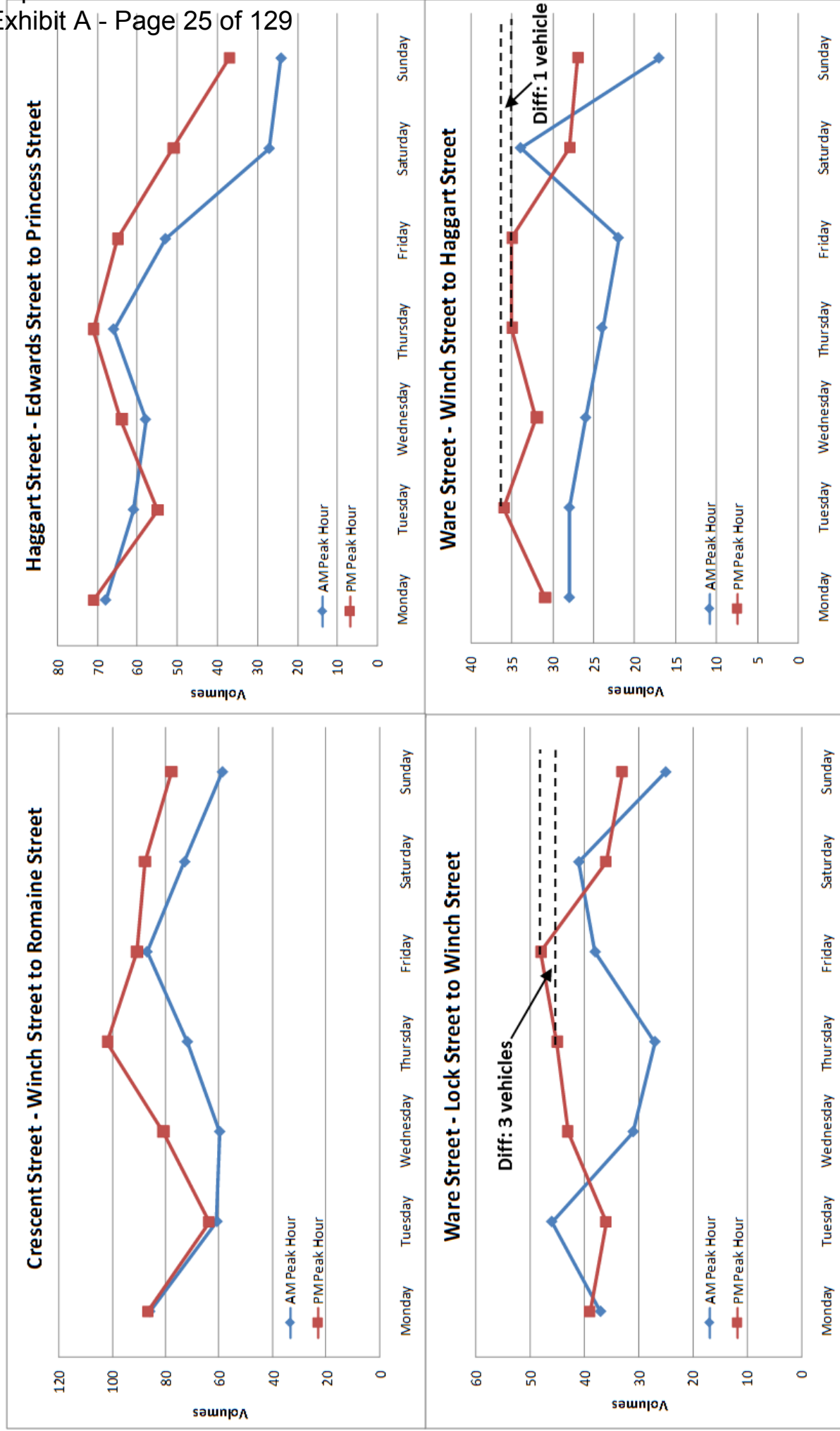
2.3.1 Traffic Patterns / Observations

Study Area Traffic Profile

As detailed earlier in this report, the Little Lake study area is primarily residential. Typically, such areas would exhibit the highest traffic levels during the AM peak period and PM peak period due to commuters travelling to / from work. In order to capture representative traffic patterns, the traffic analysis for this study was conducted using a typical weekday at both AM and PM peak hours. To ensure the traffic study would adopt a conservative approach (worst-case scenario), the weekly vehicle counts were analyzed to determine which days of the week generated the highest traffic volumes.

The weekly traffic profiles for the count locations are compared in **Figure 4**. It should be noted that only the first full week of data collected was considered in the traffic profile comparison between June 23, 2014 and June 29, 2014, as the second week included Canada Day on July 1, 2014. With Canada Day being a statutory holiday, the traffic pattern during the second week would not be representative of typical travel patterns due to the influence of holiday activities.

Figure 4: Weekly Peak Traffic Profile for Study Area



From the weekly traffic profiles presented above, it is evident that the PM peak hour volumes are generally higher than the AM peak hour. When comparing the traffic flows over the seven-day week, the highest PM traffic volumes along Crescent Street and Haggart Street are observed on Thursday. On Ware Street, slightly higher PM peak traffic was observed on Friday (Lock Street to Winch Street) and Tuesday (Winch Street to Haggart Street), but the difference in vehicles between the weekday peaks is minimal (3 vehicles or less). The AM peak hour volumes show a greater variance in which day of the week generates the highest volume, but as the overall volumes remains greater in the PM peak hour, the weekday variance for PM is more relevant for traffic analysis. Thus, from the seven-day traffic observations, it can be concluded that overall Thursday traffic volumes are the highest. Recognizing this, detailed traffic analysis should be conducted using Thursday traffic volumes to remain conservative.

2.3.2 Traffic Impacts by Local Events

The traffic patterns in the study area are also influenced by local events which occur on a regular basis. The events which have the greatest impact on travel patterns are summarized below.

Peterborough 'MusicFest'

The Peterborough MusicFest (formerly known as The Festival of Lights) is a free outdoor concert held every Wednesday and Saturday night at 8:00PM. MusicFest is an annual summer event, which ran from June 28 to August 27 in 2014. The concert is held in Del Crary Park (at the north end of the Study Area, off Crescent Street/Perry Street), and attracts spectators from all over the City of Peterborough. The venue has limited parking options, and event organizers encourage residents to park in downtown Peterborough and nearby neighbourhoods on the event website.



Source: <http://www.thepeterboroughexaminer.com/>

The concert series impacts the study area through increased through traffic and spectators potentially parking in the study area neighbourhoods. According to observed travel patterns (weekday vehicle counts), traffic in the study area does increase around the concert times but remains lower than observed PM Peak hour traffic. This indicates that while the MusicFest does influence traffic volumes within the Little Lake study area, the PM Peak hour remains the critical traffic period.

Peterborough Petes Hockey

The Peterborough Petes ice-hockey team is a member of the Ontario Hockey League (OHL) which hosts their home-games at the Peterborough Memorial Centre (PMC), located just south of the Little Lake study area at Lansdowne Street and Lock Street. During the regular season (September to March), the Petes play at PMC on Thursdays, Saturdays, and Sundays. The arena has a seating capacity of approximately 4,300 and provides 500 parking spaces. Parking costs for events is \$3.00.



Source: <http://www.gopetesgo.com/>

While the arena is located outside of the study area, the traffic generated by the hockey games would impact George Street due to spectators travelling from the downtown core. The traffic impacts on the local roads

in the study area are likely minimal, however local traffic can be affected by spectators who choose to park in the surrounding neighbourhoods in order to avoid the parking costs and delay leaving the venue caused by event spectators exiting the arena simultaneously.

Peterborough Dragonboat Festival

The Peterborough Dragonboat Festival is an annual team paddling boat race event held at Little Lake in the summer. The festival attracts several community teams (approximately 80 teams in 2014) and has raised more than \$2.4 million in support of cancer care and treatment in the Peterborough region. During the festival, the local road network is temporarily impacted by the influx of participants and spectators.



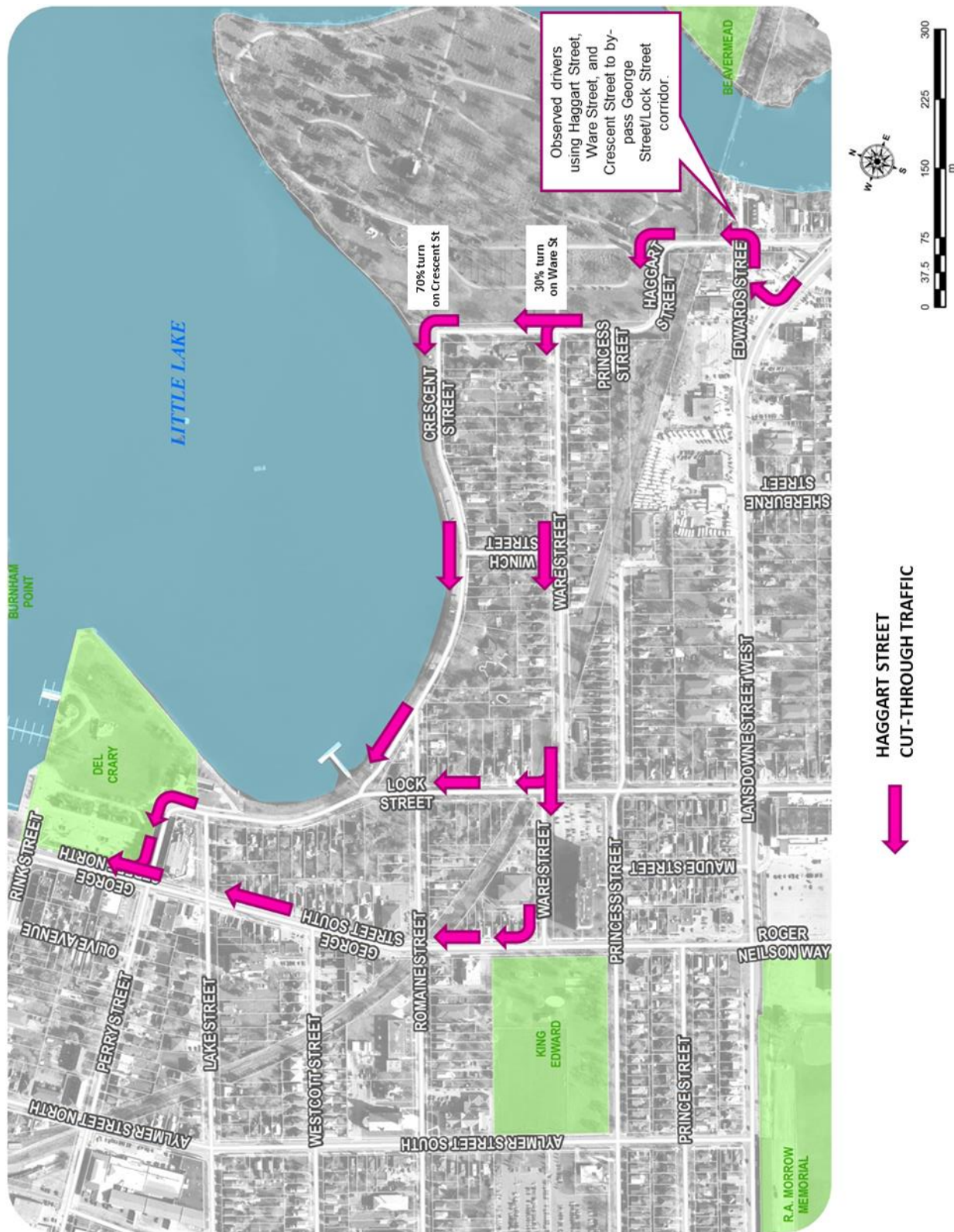
Source: <http://www.peterboroughdragonboatfestival.com/>

2.3.3 Haggart Street Cut-through Traffic

From site observations and traffic count data, it was revealed that traffic in the study area was being impacted by vehicles that would use the study area road network as a by-pass to avoid the George Street and Lansdowne Street corridors. This *cut-through* traffic typically accesses Edwards Street/Haggart Street from Lansdowne Street, and travels on Crescent Street and Ware Street towards George Street and Lock Street, thereby avoiding the traffic signals and higher volumes on George Street and Lock Street. This pattern is illustrated in **Figure 5**.

Since drivers who are conducting this movement are utilizing Crescent Street and Ware Street as a by-pass route, the traffic generally travels at a higher speed than localized traffic. While the overall magnitude of the cut-through traffic is relatively low, the higher speeds on Crescent Street and Ware Street impact the comfort of walking, cycling, and driving on the local network.

Figure 5: Haggart Street Cut-Through Traffic



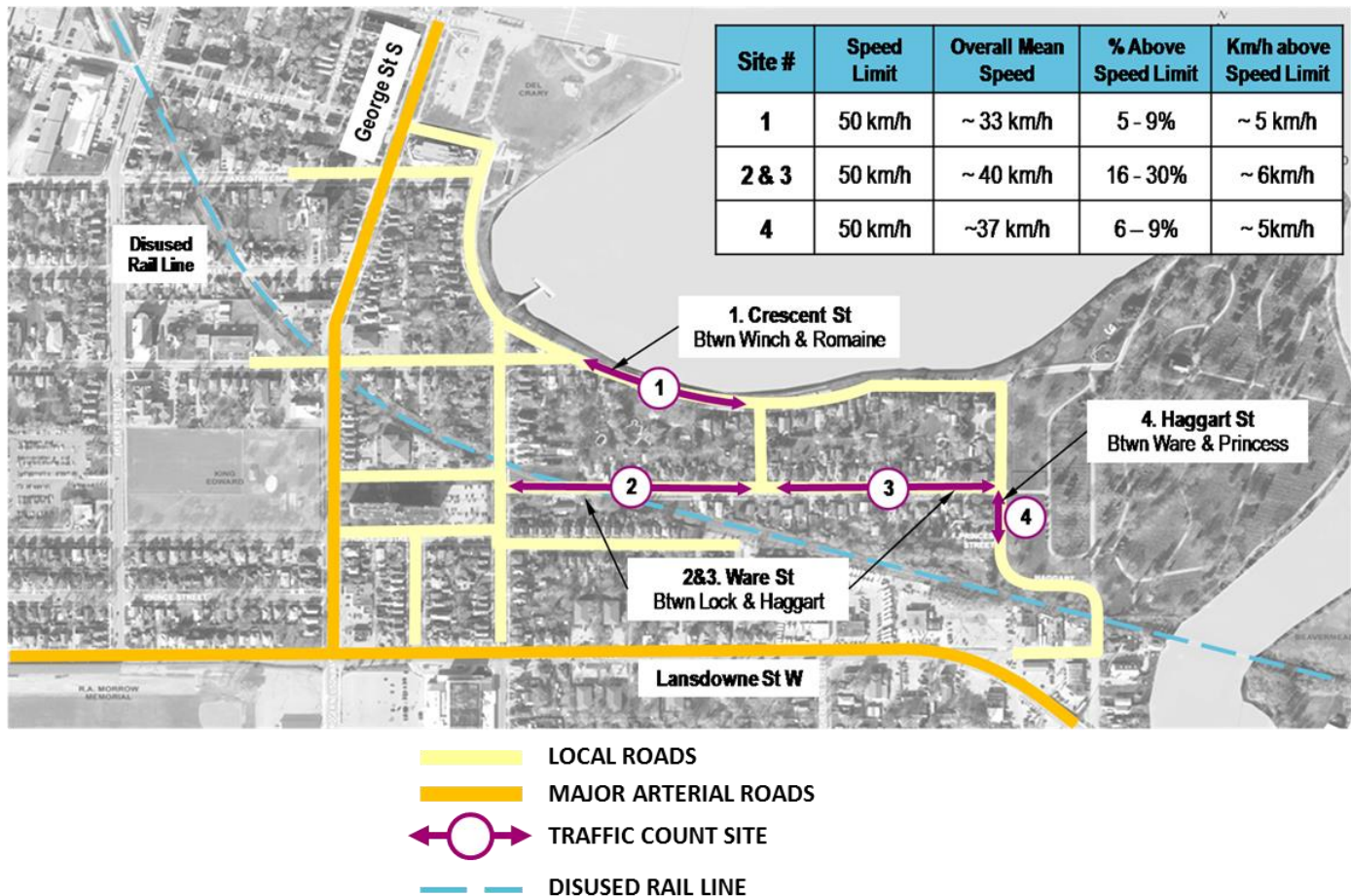
2.3.4 Speed Statistics

The weekly vehicle counts collected for the purpose of this study also recorded traffic speed statistics for segments of Crescent Street, Ware Street and Haggart Street. The observed data shows that while the majority of traffic along these routes was travelling at or below the speed limit of 50 km/hr (for local roads), some speeding is occurring along the above noted roads.

For Crescent Street, 5% to 9% of total observed traffic was speeding, exceeding the speed limited by approximately 5 km/h. Similar statistics were recorded on Haggart Street, with 6% to 9% of traffic observed traffic approximately 5 km/h above the speed limit. The most frequent observations of speeding were recorded on Ware Street, where 16% to 30% of travellers were exceeding the speed limit by about 6 km/h.

The existing speed statistics are summarized in **Figure 6**.

Figure 6: Speed Statistics Summary



Through traffic count data and on-site observations, it was noted that the vehicles that travel in excess of the speed limit are using the local road network as a through-traffic route, while local residents tend to travel at or below the speed limit.

2.4 Parking in Study Area

Under existing conditions, there are several options for parking within the Little Lake Study Area, including on-street parking, paid parking lots and free parking lots.

2.4.1 Parking Lots

There are five small parking bays along Crescent Street which accommodate five to ten vehicles each, serving residents visiting the lakeside. At the north end of the study area, there is a paid parking lot at Del Crary Park that can accommodate 88 vehicles. The rate for parking at the Del Crary parking lot is \$1.00 / hour with a daily maximum of \$7.00. A monthly parking pass for the lot can be purchased from the City of Peterborough Parking Department for \$33.50.

2.4.2 On-Street Parking

On-street parking is permitted on most streets within the study area without restriction. According to the City of Peterborough Parking By-law (By-law #09-136), parking and stopping restrictions within the study area are as follows:

No Stopping

- Crescent Street (east side) from Lake Street to 29 meters south of Lake Street

No Parking

- Crescent Street (south side) from Haggart Street to Lock Street
- Crescent Street (north side) from Lake Street to Haggart Street
- George Street North (east side) from Lake Street to Rink Street
- George Street North (west side) from 12 metres south of Perry Street to 30 metres north of Perry Street
- George Street South (west side) from Lansdowne Street to Princess Street
- Princess Street (north side) from Park Street to 18 metres east of George Street
- Princess Street (both sides) from Lock Street to CNR Railway Track
- Romaine Street (south side) from George Street to Monaghan Road
- Ware Street (both sides) from Lock Street to Haggart Street (parking prohibited on north side 1st to 15th day of each month and on south side from 16th to last day of each month).

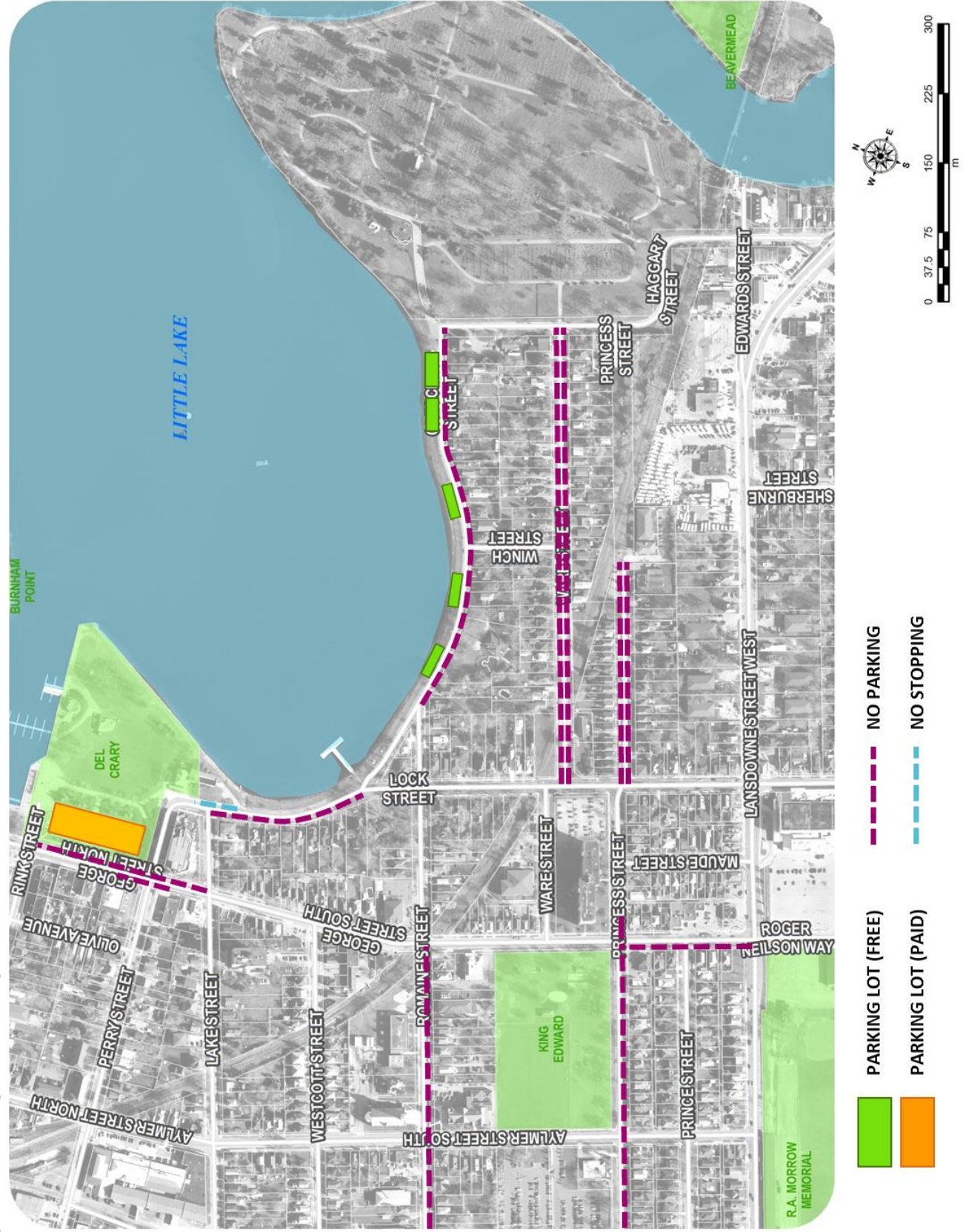
Figure 7 summarizes parking within the Little Lake study area.

2.4.3 Parking Utilization

Under existing conditions, parking is primarily used by local residents and visitors to Little Lake. In addition, residents who work near the study area tend to drive to the lake and park during lunch hours to eat lunch at the lakeside. This pattern contributes to the AM peak traffic period being closer to the mid-day (10:00AM to 12:00PM) instead of the typical AM peak period of 6:00AM to 9:00AM

Parking in the study area is also utilized by spectators of local events such as the Peterborough MusicFest at Del Crary Park and Peterborough Petes hockey game at the PMC (discussed in Section 2.3.2). Spectators park their vehicles within the study area and walk to the event venues due to limited parking availability at the venues, parking costs at venues, or to avoid increased traffic near the venues.

Figure 7: Parking within Study Area



2.5 Intersection Operations, Existing Conditions

The study area consists of one signalized intersection and 13 unsignalized intersections, as presented in **Table 2**.

Table 2: Study Area Intersections

No.	Intersections	Traffic Control Type
1	George Street at Perry Street	Stop
2	George Street at Lake Street	Signal
3	George Street at Westcott Street	Stop
4	George Street at Romaine Street	
5	George Street at Ware Street	
6	George Street at Princess Street	
7	Crescent Street at Lake Street	
8	Crescent Street at Lock Street	
9	Crescent Street at Romaine Street	Yield
10	Crescent Street at Winch Street	Stop
11	Lock Street at Romaine Street	
12	Lock Street at Ware Street	
13	Lock Street at Princess Street	
14	Ware Street at Winch Street	
15	Ware Street at Haggart Street	

The traffic operation analysis was conducted at all study area intersections using the Synchro 9 software package, which is based on the Highway Capacity Manual (HCM) 2000 methodology. These analyses provide a detailed assessment of traffic operations in the study area including level of service (LOS), delay and volume-to-capacity (V/C) ratios for each of the intersection approaches and movements. The LOS is assigned on the basis of average delay per vehicle and includes deceleration delay, queue move-up time, stopped delay, and final acceleration delay. For signalized intersections, LOS ranges from A for 10 seconds or less average delay, to LOS F for delays greater than 80 seconds. For un-signalized intersections, the LOS ranges from 10 seconds or less for LOS A, to LOS F for delays greater than 50 seconds. Acceptable operations are generally considered to be LOS D or better; however, during peak hours, a LOS E may be considered acceptable.

The existing traffic analysis was conducted for weekday AM and PM Peak hour scenarios. According to traffic count data, the AM peak period of traffic occurs closer to the mid-day timeframe of 10:00AM to 12:00PM. This is partially due to the number of people who choose to drive to the lakeside and park for lunch (as discussed earlier). The PM peak period of traffic occurs from 3:00PM to 7:00PM, which is consistent with evening commuter travel periods.

The existing traffic volumes were analyzed using existing lane configurations as shown in **Figure 8**. The base year AM and PM peak hour turning movement traffic volumes are summarized in **Figure 9**.

Figure 8: Existing Lane Configurations

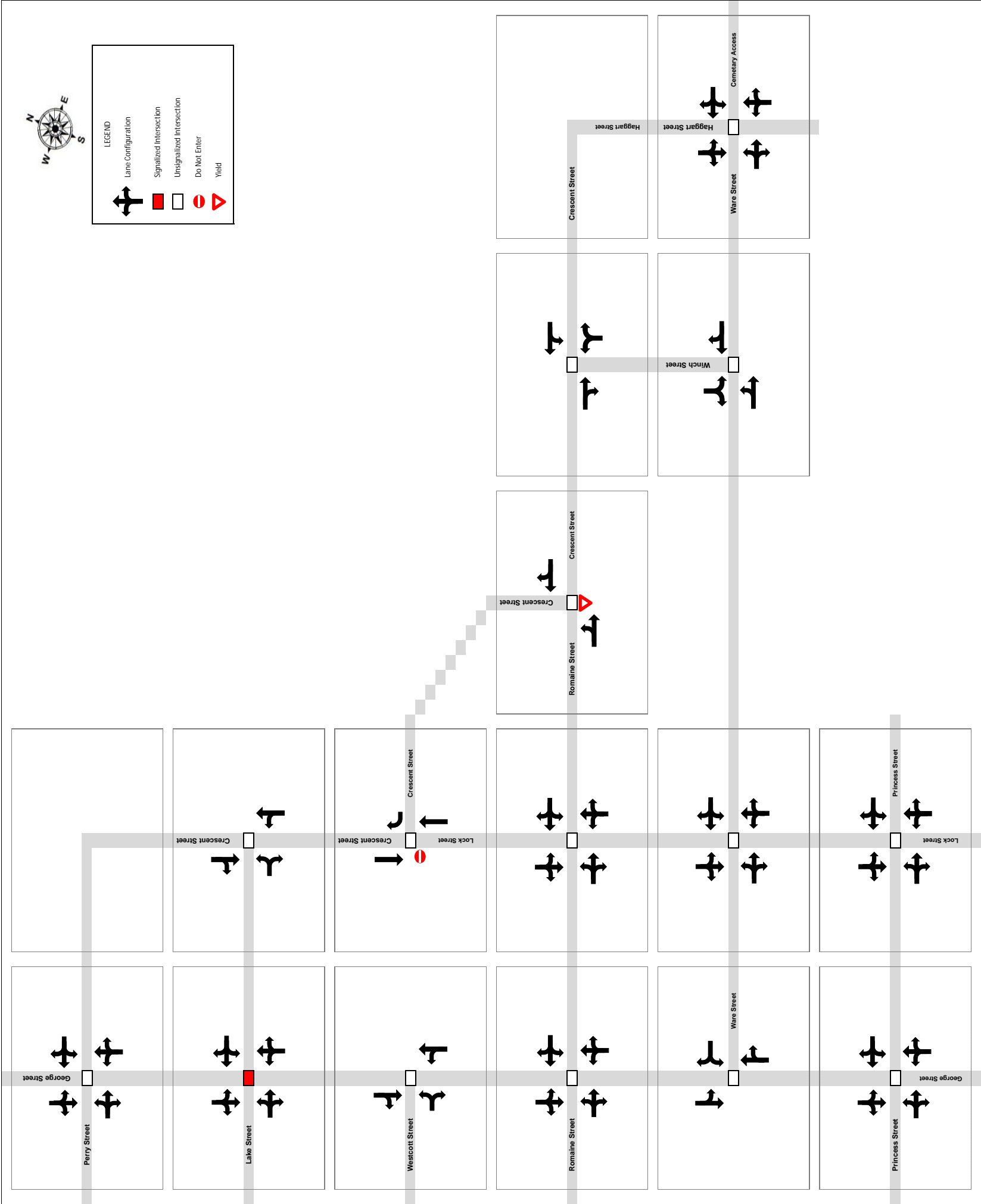
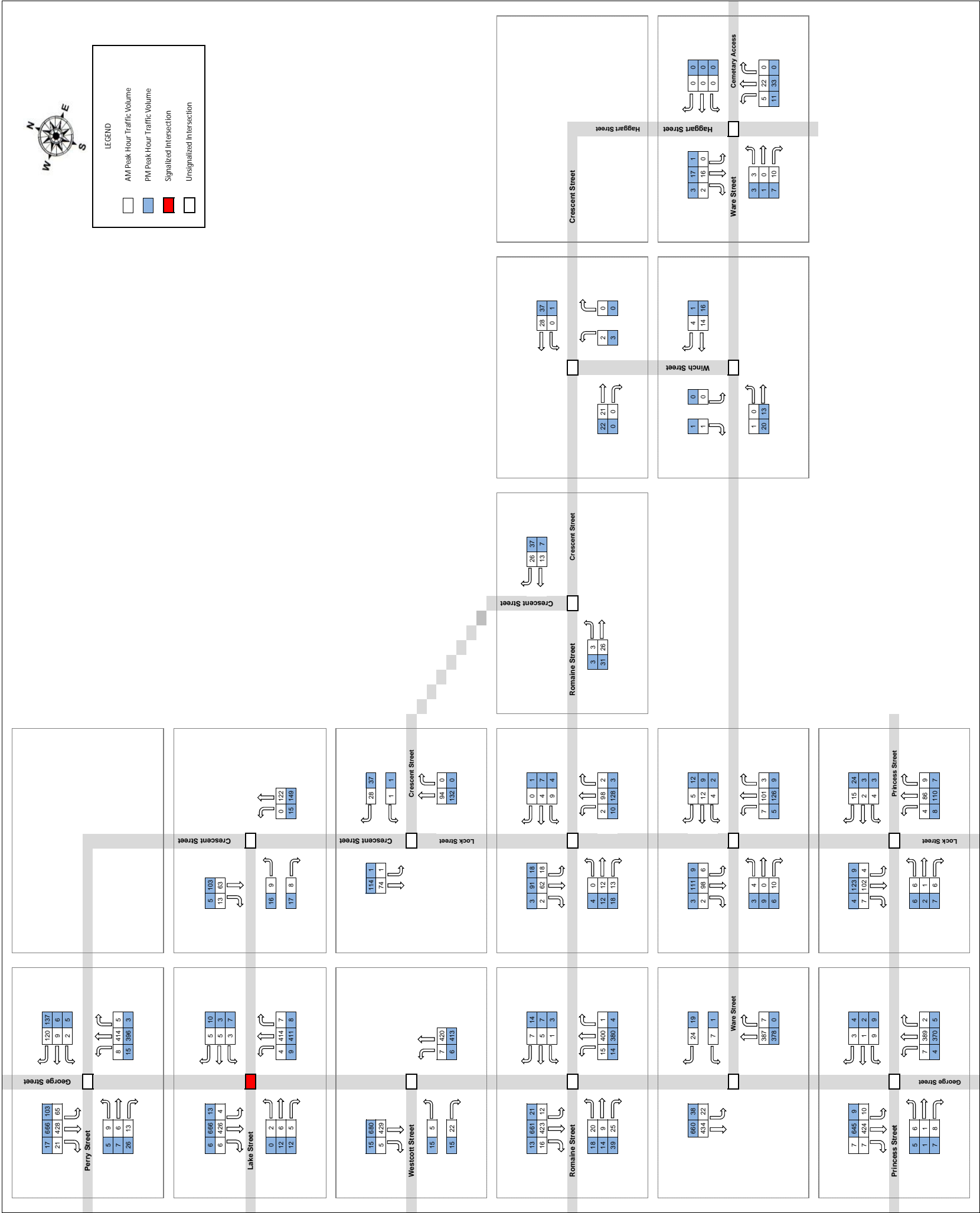


Figure 9: Existing AM/PM Peak Hour Traffic Volumes



The peak hour traffic analysis reflects operating conditions for the highest (peak) 15-minute period within the hour. The key parameters used in the analysis include:

- Peak Hour Factor (PHF) calculated using traffic counts for intersections where counts are available. For intersections where counts are not available, assume a PHF of 0.92.
- Analysis period = 15 minutes.
- Clearance intervals of 4 second amber and 2 second all-red.
- In the absence of traffic timing plans, a cycle length of 90 seconds with optimized splits was used for existing conditions.
- Heavy vehicle percentages derived from traffic counts.
- Crossing pedestrians at all intersections and pedestrian calls at signalized intersection extracted from traffic counts.
- Default Synchro 9 values assumed for all other inputs.

Under existing conditions, the traffic operations analysis concluded that all intersections are performing well in the AM and PM peak hours. The signalized intersection at George Street and Lake Street is operating at an overall **LOS A**, and all unsignalized intersections are below capacity, with all approaches at volume-to-capacity Ratio (V/C ratio)⁵ of **0.55** or less. The existing AM and PM traffic operations are summarized in **Figure 10** and **Table 3**.

Detailed Synchro HCM reports and SimTraffic Queue Reports for existing AM and PM intersection operations are provided in **Appendix C**.

⁵ V/C ratios indicate the level of congestion on a road, where a v/c ratio of 1.00 means that the traffic on a road segment is equal to the vehicle capacity of the road segments. A 0.9 v/c ratio is typically used to identify capacity deficiencies that may need to be addressed through network improvements (v/c of 0.9 or higher is generally indication of stop and go traffic conditions)

Figure 10: Existing Traffic Operations (AM and PM Peak hour)

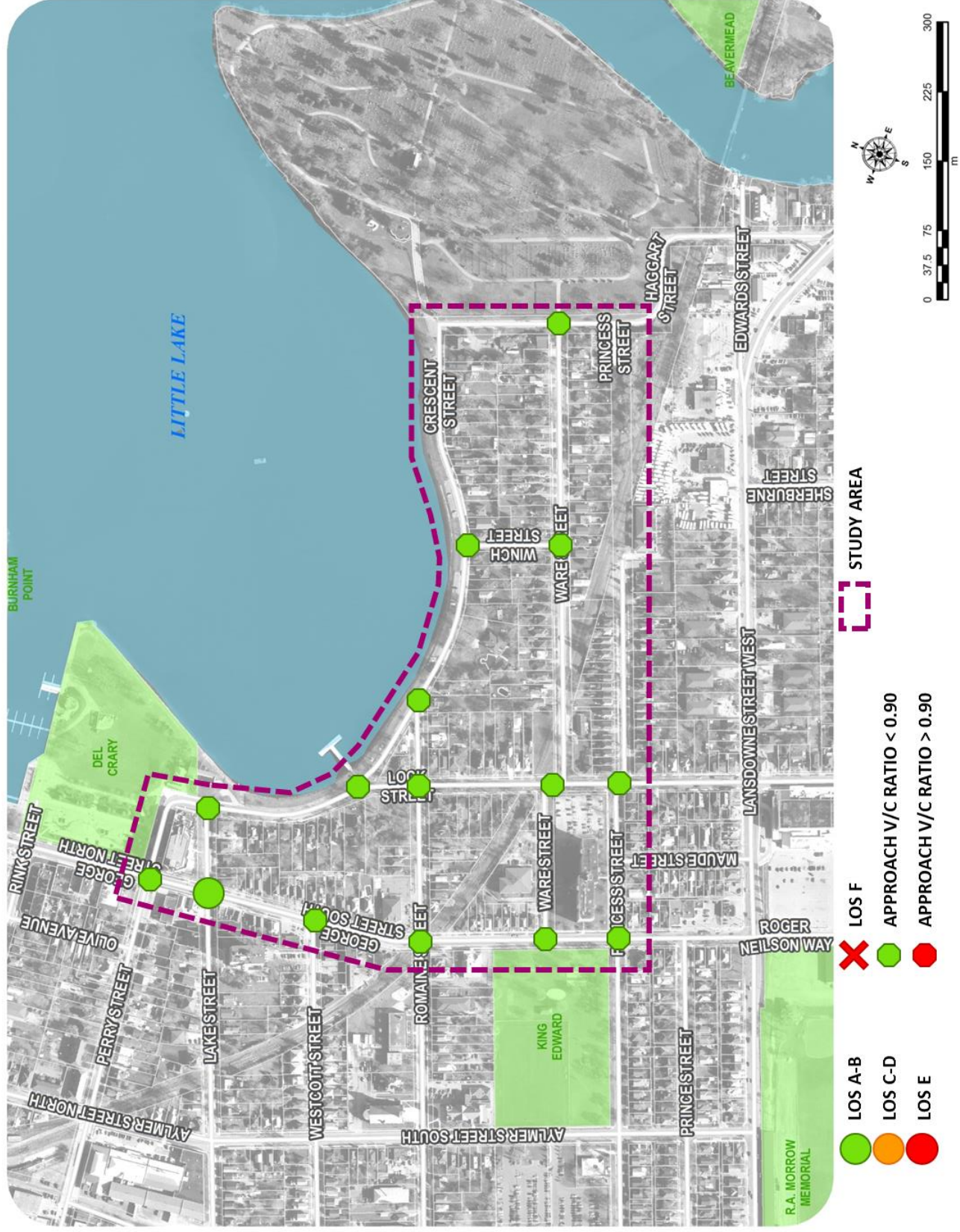


Table 3: Existing Conditions Traffic Operations (AM and PM Peak Hour)

Intersection	Approach / Movement	Storage (m)	Weekday											
			AM						PM					
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Signalized Intersection														
George Street / Lake Street	EB LTR	245.0	41.1	D	0.13	11.5	3.6	14.9	39.6	D	0.11	19.7	6.3	22.3
	WB LTR	70.0	41	D	0.12	13.6	4.1	19.6	39.8	D	0.14	13.0	4.6	18.5
	NB LTR	100.0	2.8	A	0.33	37.2	13.8	53.5	3.2	A	0.33	37.1	13.3	53.1
	SB LTR	50.0	2.8	A	0.33	35.2	13.4	47.2	4.8	A	0.55	48.2	20.0	51.2
	Overall Intersection		4	A	0.31	-	-	-	5.5	A	0.52	-	-	-
Unsignalized Intersections														
George Street / Perry Street	EB LTR	65.0	28.3	D	0.16	12.8	5.3	12.9	41.7	E	0.30	16.1	7.5	21.0
	WB LTR	110.0	15.4	C	0.29	20.5	12.6	23.2	26.0	D	0.53	39.3	19.1	51.1
	NB LTR	50.0	0.2	A	0.01	12.5	2.1	21.9	0.6	A	0.02	21.9	5.3	34.7
	SB LTR	120.0	1.9	A	0.07	31.0	11.8	42.2	2.8	A	0.11	44.7	17.5	68.3
Crescent Street / Lake Street	EB LR	70.0	9.4	A	0.03	12.6	4.3	14.8	10.0	A	0.05	15.2	6.8	16.8
	NB TL	155.0	0.0	-	0.00	-	-	-	0.8	A	0.01	3.6	0.4	6.9
	SB TR	110.0	0.0	-	0.05	-	-	-	0.0	-	0.07	-	-	-
George Street / Westscott Street	EB LR	210.0	14.7	B	0.09	13.6	6.5	16.1	22.0	C	0.13	13.3	5.8	14.7
	NB TL	100.0	0.2	A	0.01	6.1	1.0	13.1	0.4	A	0.01	13.1	2.3	25.8
	SB TR	100.0	0.0	-	0.29	1.2	0.1	1.8	0.0	-	0.45	0.9	0.0	1.2
Lock Street / Crescent Street	WB R	85.0	9.0	A	0.04	4.9	0.8	10.1	9.3	A	0.05	6.9	1.4	11.6
	NB T	45.0	0.0	-	0.06	-	-	-	0.0	-	0.09	-	-	-
	SE T	160.0	0.0	-	0.05	-	-	-	0.0	-	0.08	-	-	-
George Street / Romaine Street	EB LTR	190.0	19.0	C	0.19	17.4	8.7	18.8	31.9	D	0.37	22.1	12.1	27.2
	WB LTR	145.0	15.8	C	0.04	9.3	2.7	9.1	21.6	C	0.10	14.4	6.0	17.6
	NB LTR	105.0	0.5	A	0.01	10.2	2.3	15.9	0.5	A	0.02	17.8	3.9	29.6
	SB LTR	100.0	0.3	A	0.01	12.9	2.7	25.7	0.5	A	0.02	13.9	3.2	24.2
Lock Street / Romaine Street	EB LTR	145.0	7.1	A	0.03	12.5	5.3	9.3	7.4	A	0.05	13.5	7.5	12.7
	WB LTR	60.0	7.7	A	0.02	11.4	3.6	12.9	7.6	A	0.01	7.8	1.8	9.3
	NB LTR	125.0	7.7	A	0.14	13.2	9.4	16.2	8.1	A	0.18	16.6	10.7	19.8

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Intersection	Approach / Movement	Storage (m)	Weekday											
			AM						PM					
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Romaine Street / Crescent Street	SB LTR	45.0	7.7	A	0.11	14.9	9.3	18.4	7.9	A	0.15	15.2	10.4	17.2
	WB TL	60.0	2.5	A	0.01	-	-	-	1.2	A	0.00	-	-	-
	NE LR	155.0	8.5	A	0.03	1.7	0.1	3.8	8.4	A	0.03	0.5	0.0	0.7
Winch Street / Crescent Street	EB TR	155.0	0.0	-	0.01	-	-	-	0.0	-	0.02	-	-	-
	WB TL	225.0	0.0	-	0.00	-	-	-	0.2	A	0.00	-	-	-
	NB LR	85.0	8.8	A	0.00	4.2	0.6	8.9	8.9	A	0.00	4.1	0.5	9.0
George Street / Ware Street	WB LR	145.0	13.7	B	0.07	14.3	6.1	15.1	11.8	B	0.04	11.0	4.1	9.1
	NB TR	60.0	0.0	-	0.26	-	-	-	0.0	-	0.25	-	-	-
	SB TL	110.0	0.7	A	0.02	12.0	3.0	19.6	0.9	A	0.04	21.7	6.3	34.0
Lock Street / Ware Street	EB LTR	145.0	9.3	A	0.04	12.8	6.1	10.5	9.8	A	0.05	13.5	6.6	13.0
	WB LTR	240.0	10.3	B	0.03	12.0	4.2	12.6	10.2	B	0.04	13.1	4.9	14.8
	NB LTR	50.0	0.5	A	0.01	1.9	0.2	4.7	0.3	A	0.00	1.2	0.1	3.2
Ware Street / Winch Street	SB LTR	105.0	0.5	A	0.00	2.4	0.2	6.6	0.4	A	0.00	2.8	0.3	5.0
	EB TL	240.0	0.0	-	0.00	-	-	-	0.4	A	0.00	-	-	-
	WB TR	225.0	0.0	-	0.01	-	-	-	0.0	-	0.02	-	-	-
Haggart Street / Ware Street	SB LR	85.0	8.4	A	0.00	2.6	0.2	5.4	8.5	A	0.00	-	-	-
	EB LR	225.0	8.6	A	0.01	9.4	2.7	9.2	8.6	A	0.02	12.0	4.7	9.3
	NB TL	250.0	2.0	A	0.01	1.3	0.1	1.8	2.6	A	0.01	1.8	0.1	1.8
George Street / Princess Street	SB TR	110.0	0.0	-	0.01	-	-	-	0.0	-	0.01	-	-	-
	EB LTR	190.0	15.9	C	0.05	11.5	3.8	15.1	20.2	C	0.06	10.6	3.3	11.8
	WB LTR	145.0	19.1	C	0.05	10.8	3.2	12.9	23.0	C	0.08	11.4	3.7	13.9
Lock Street / Princess Street	NB LTR	125.0	0.2	A	0.01	5.6	0.8	10.0	0.2	A	0.00	7.6	1.0	15.0
	SB LTR	60.0	0.3	A	0.01	14.1	2.7	26.1	0.2	A	0.01	6.2	0.9	12.9
	EB LTR	145.0	9.9	A	0.02	10.4	3.4	9.3	10.3	B	0.02	11.0	3.8	9.3
Lock Street / Princess Street	WB LTR	185.0	9.7	A	0.03	13.9	5.1	17.4	9.6	A	0.04	14.6	6.4	16.2
	NB LTR	105.0	0.3	A	0.00	2.5	0.2	6.6	0.6	A	0.01	3.4	0.3	7.5
	SB LTR	35.0	0.3	A	0.00	1.7	0.1	3.4	0.5	A	0.01	3.5	0.4	6.6

3. Otonabee River Trail Concepts

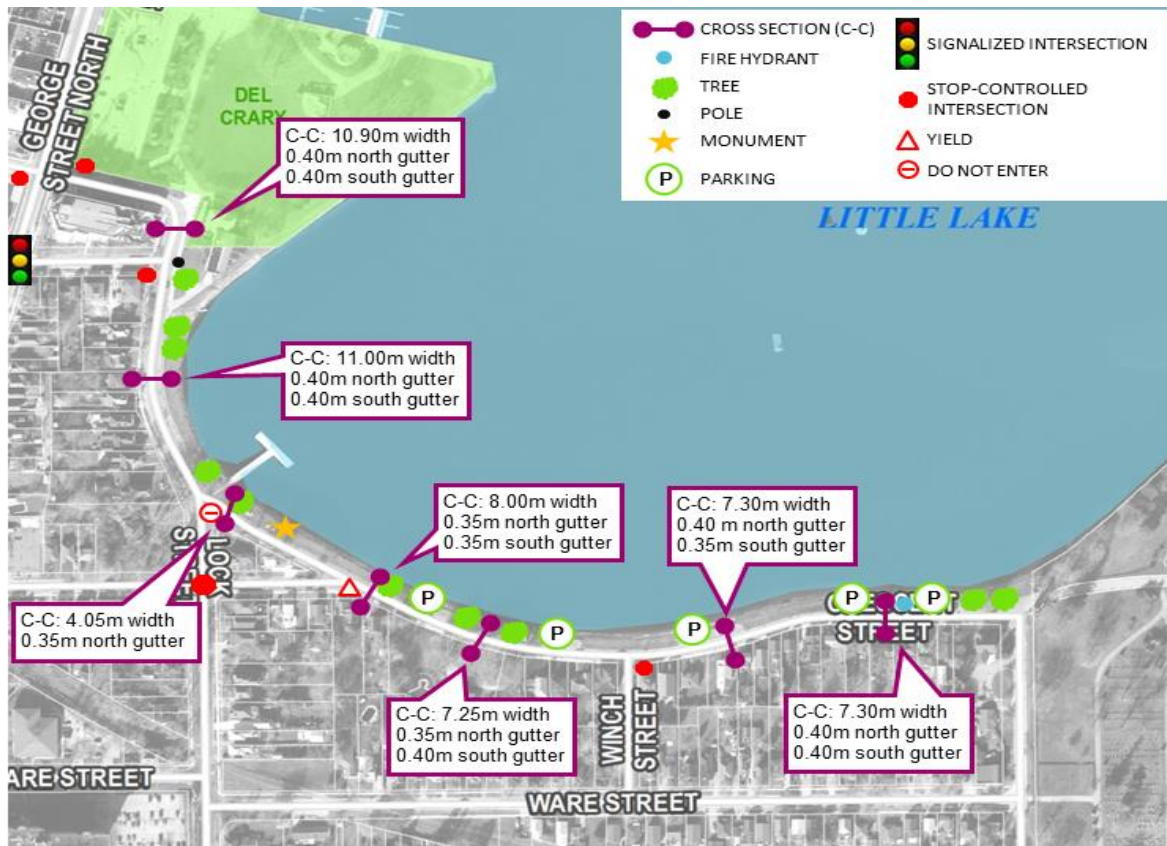
As discussed earlier, the Little Lake Master Plan (2010) recommended an extension of the Otonabee River Trail around Little Lake, which will provide active transportation infrastructure for both pedestrians and cyclists around Little Lake in the City of Peterborough. This trail is intended to attract both recreational and utilitarian users by providing a dedicated active transportation facility that takes advantage of the lakeside location while also providing inter-connectivity to the existing ORT as well as potential future cycling facilities. The purpose of the Otonabee River Trail EA is to provide the recommended design for the trail extension.

To support the EA, this section will provide potential concept options for the ORT trail extension. The concepts presented here will have related impacts to Crescent Street within the Study Area, which will be evaluated from a traffic operations perspective later in this report (Section 5).

3.1 Existing Conditions along Trail Study Area

During the site visit, AECOM collected measurements along Crescent Street from Haggart Street to Perry Street, as well as noted potential impedances along the planned ORT trail corridor (trees, fire hydrants, parking lots, hydro poles, etc.). The results of the site visit are summarized in **Figure 11**.

Figure 11: Little Lake Site Visit Measurements / Observations



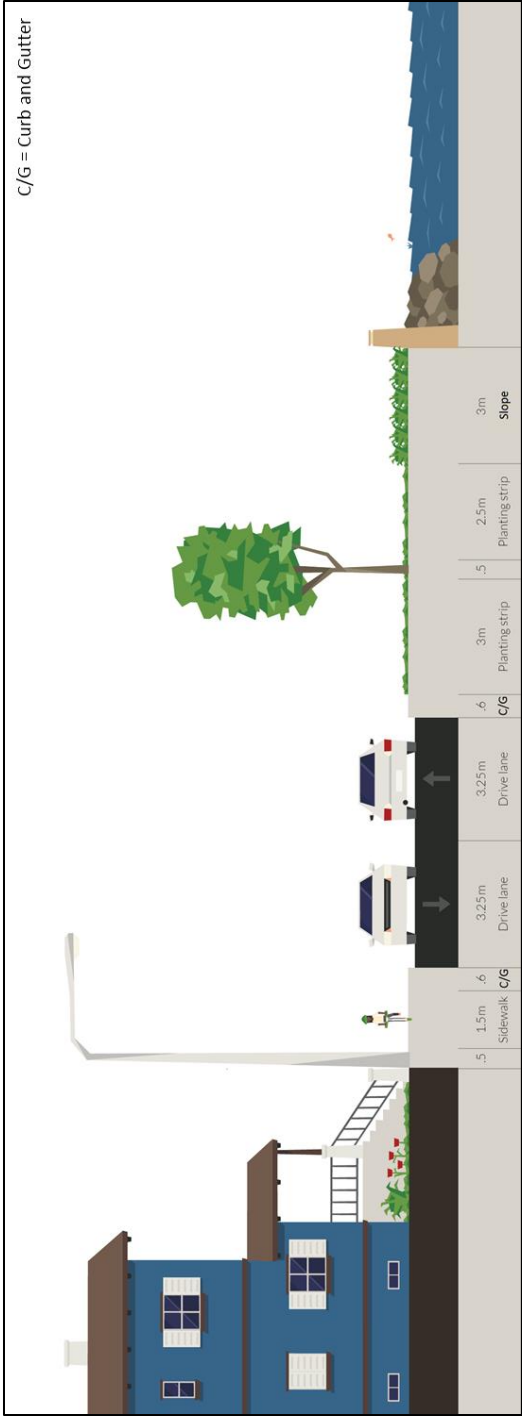
Note: C-C = Curb to Curb

The existing trail study area and lakeside road conditions are also summarized as cross-sectional diagrams in **Figure 12**.

Figure 12:

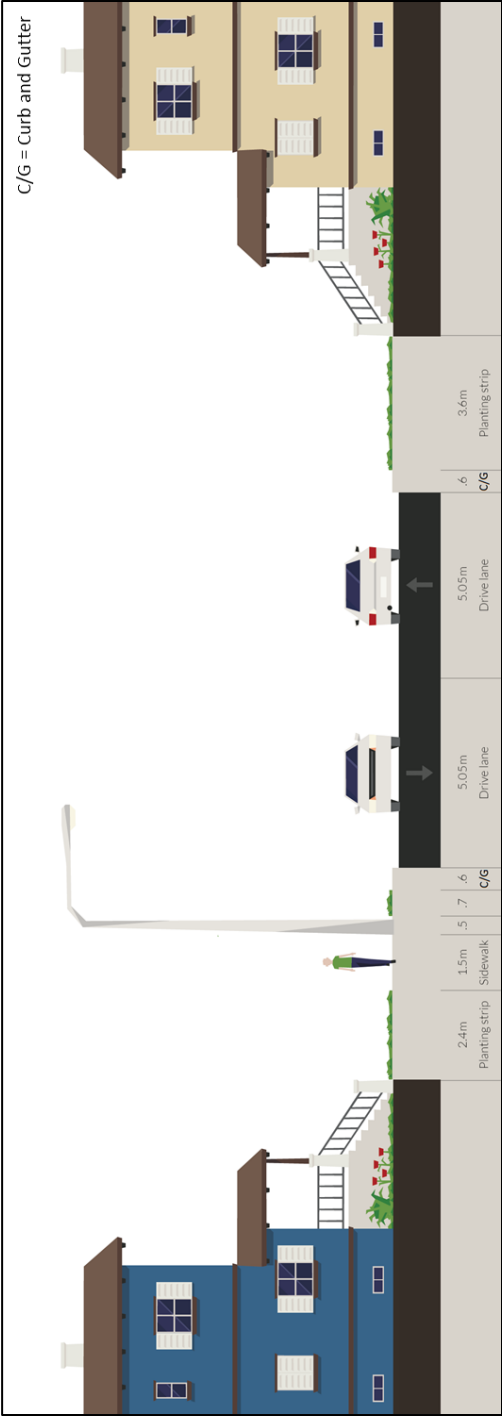
Existing Conditions Cross-Sections

Crescent Street – Haggart Street to Romaine Street



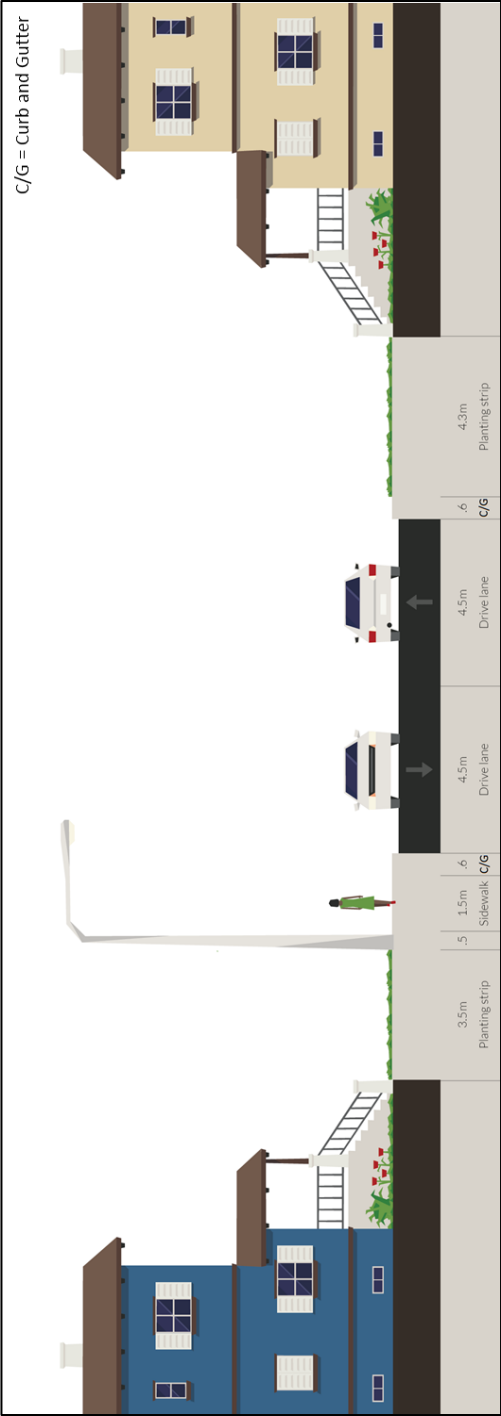
Note: South side sidewalk, no cycling facilities.

Lock Street - Romaine Street to Crescent Street

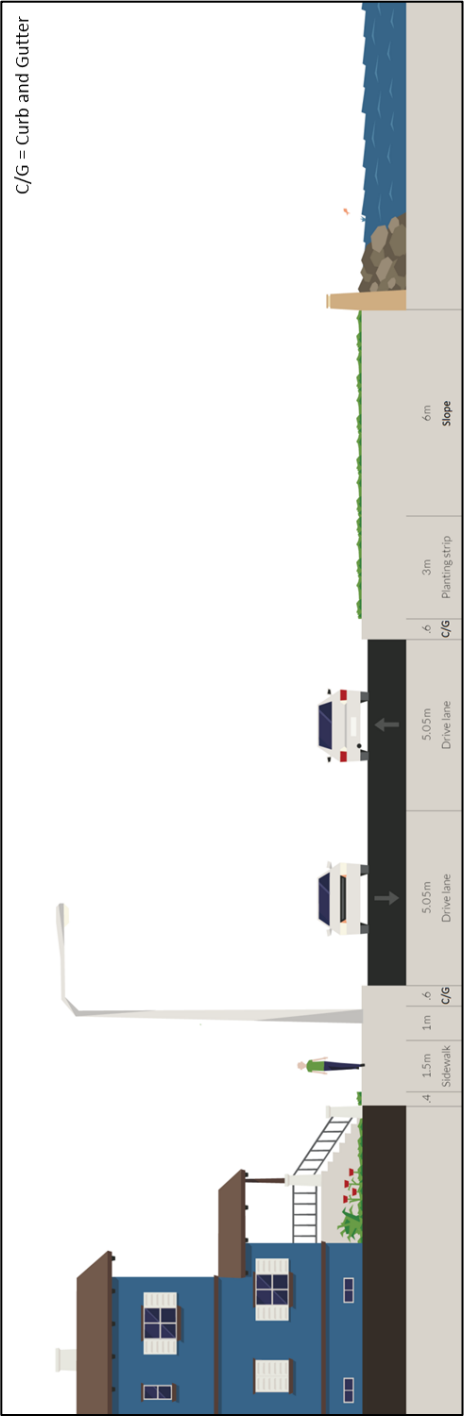


Note: West side sidewalk, no cycling facilities.

Romaine Street – Crescent Street to Lock Street



Crescent Street – Lock Street to Del Cray Park / George Street



3.1.1 Cycling along Little Lake

According to Ontario Traffic Manual (OTM) Book 18⁶ section 2.4 (Route Selection Criteria), the Little Lake trail study area is an ideal location for a cycling facility. The bulleted list below summarizes key points supporting cycling within the study area.

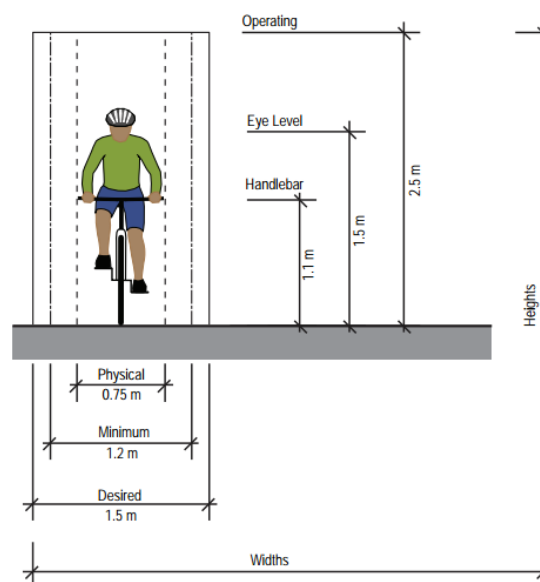
- **Access and Potential Use:** Cyclists are more inclined to use cycling facilities that are located close to key points of origin and destination. The Little Lake study area is directly adjacent to residential neighbourhoods, the Little Lake pier, and Del Cray Park.
- **Connectivity and Directness:** Routes that are selected to form or expand a bicycle network should improve connections to other cycle facilities, modes of transportation, and places of interest. The ORT trail extension would not only provide a connection to the existing trail, but also expand upon the growing active transportation network recommended as part of the CTP.
- **Physical Barrier:** The Little Lake trail study area is generally flat, with few physical barriers and impedances that can easily be avoided / removed when developing the trail design.
- **Attractiveness:** Scenery is an important consideration for any cycling network, especially for routes geared towards touring and recreational cyclists. The proximity of the trail to Little Lake provides attractive scenery, thereby improving the overall cycling experience.
- **Safety and Comfort:** The safety and risk exposure of cyclists must be considered when determining an appropriate cycling route, which includes accounting for factors such as user conflict, traffic volumes and speeds, truck and bus volumes, sightlines, and maintenance conditions. While Crescent Street does attract a fair amount of peak hour traffic, it remains primarily a residential access road with the posted speed limit of 50 km/h. To accommodate safe and comfortable on-road cycling, especially in mixed traffic, the traffic along Crescent Street would require traffic calming (reduced volumes, speed reductions).
- **Accommodation of Existing and Future Demand:** According to the Peterborough CTP, transportation in the City of Peterborough in future years will have a greater focus on active transportation. This is a clear indication of residents' desire to utilize active modes for both utilitarian and recreational uses. The ORT extension would help to facilitate this mode shift to walking and cycling in the short term, and accommodate future demands as the cycling network in Peterborough grows and improves connectivity.
- **Consistent with Local Tourism Strategies and Goals:** Local Peterborough tourism events such as the MusicFest summer concert series and the Peterborough Dragonboat Festival (discussed in Section 2.3) occur around Little Lake. Improving walking and cycling access to the Little Lake area will help draw spectators and participants to such events.

⁶ Ontario Traffic Manual Book 18 – Cycling Facilities, December 2013

3.1.2 Crescent Street Cycling Limitations

From the measurements taken during the site visit and guidelines from American Association of State Highway and Transportation Officials⁷ (AASHTO), it was concluded that Crescent Street (Haggart Street to Lock Street) at its current width is unable to accommodate a two-way on-road separated cycle track. A typical cyclist requires at least 1.5 m clearance to cycle one-way comfortably. Recognizing this, a dedicated two-way cycle track requires 3.0 m to 4.0 m. With the curb-to-curb cross section of Crescent Street limited to approximately 7.3 m, it would be impossible to implement a separated two-way cycle track while accommodating two-way traffic.

It was observed that the catch basins and gutters along Crescent Street are unfavorable to cyclists. It is recommended that, in the event of a bicycle lane or cycle track being implemented on Crescent Street, the catch basins and gutters be modified or replaced to be more cyclist-friendly. The gutters, particularly on the north side of the street, could be narrowed and replaced with asphalt, which would shift the asphalt-concrete seam closer to the curb and away from the wheelpath of cyclists. The catch basins should be modified or replaced so that the grates on the gutters are placed perpendicular to the road and, a cyclist's wheels are not able to get caught in the grates. Metal could be welded horizontally within the grate openings to minimize the length of the opening within the grate. If Crescent Street is reconstructed at some point long-term, the catch basins should be relocated outside of the cycle track, such as with a side-inlet design.



Based on information from the AASHTO Guide for the Planning, Design and Operation of Bicycle Facilities, 2012

3.2 Trail Options

The following section details potential options of the Otonabee River Trail extension around Little Lake, with focus on the cycling options.

3.2.1 Alternative 1: Multi-Use Pathway from Haggart Street to Perry Street

Alternative 1 for the ORT trail extension around Little Lake is a multi-use path along Little Lake from Haggart Street to Perry Street. According to OTM Book 18, a multi-use path is a type of active transportation path that is separated from motor vehicles by a physical boundary (strip of grass, paved 'splash strip', etc.). This option provides a continuous, consistent shared-use facility along the length of the Little Lake shoreline. Additionally, this concept would encourage on-road cycling on Crescent Street from Haggart Street to Romaine Street. The path would be implemented as:

- A single 4.0 m wide path shared by both pedestrians and cyclists, from Haggart Street to Perry Street.
- The Gore to be closed to vehicular use.
- Crescent Street (Haggart Street to Lock Street) to be converted to a **Bicycle Priority Street**⁸.

⁷ AASHTO Guide for the Planning, Design and Operation of Bicycle Facilities, 2012.

⁸ A Bicycle Priority Street, also known as "bicycle boulevard", is a street that has been optimized for bicycle travel through treatments like traffic calming and traffic reduction. It is preferred that traffic volumes on bicycle priority streets are less than 1500 vehicles / day, and that traffic speeds are no greater than 30 km/hr. Please refer to <<http://nacto.org/cities-for-cycling/design-guide/bicycle-boulevards/>> for more information.

- This initiative would require the traffic on Crescent Street to be reduced and calmed such that the speed and volumes along Crescent Street are sufficiently low to prioritize on-street cycling.
- The speed limit on Crescent Street should be reduced to 30 km/hr, and additional speed management measures may be required if vehicle speeds substantially exceed the reduced speed limit.

The Alternative 1 trail layout is summarized in **Figure 13** below, and the roadway cross sections for Alternative 1 are presented in **Figure 14**.

Figure 13: Alternative 1: A 4.0m wide Multi-Use Pathway from Haggart Street to Perry Street

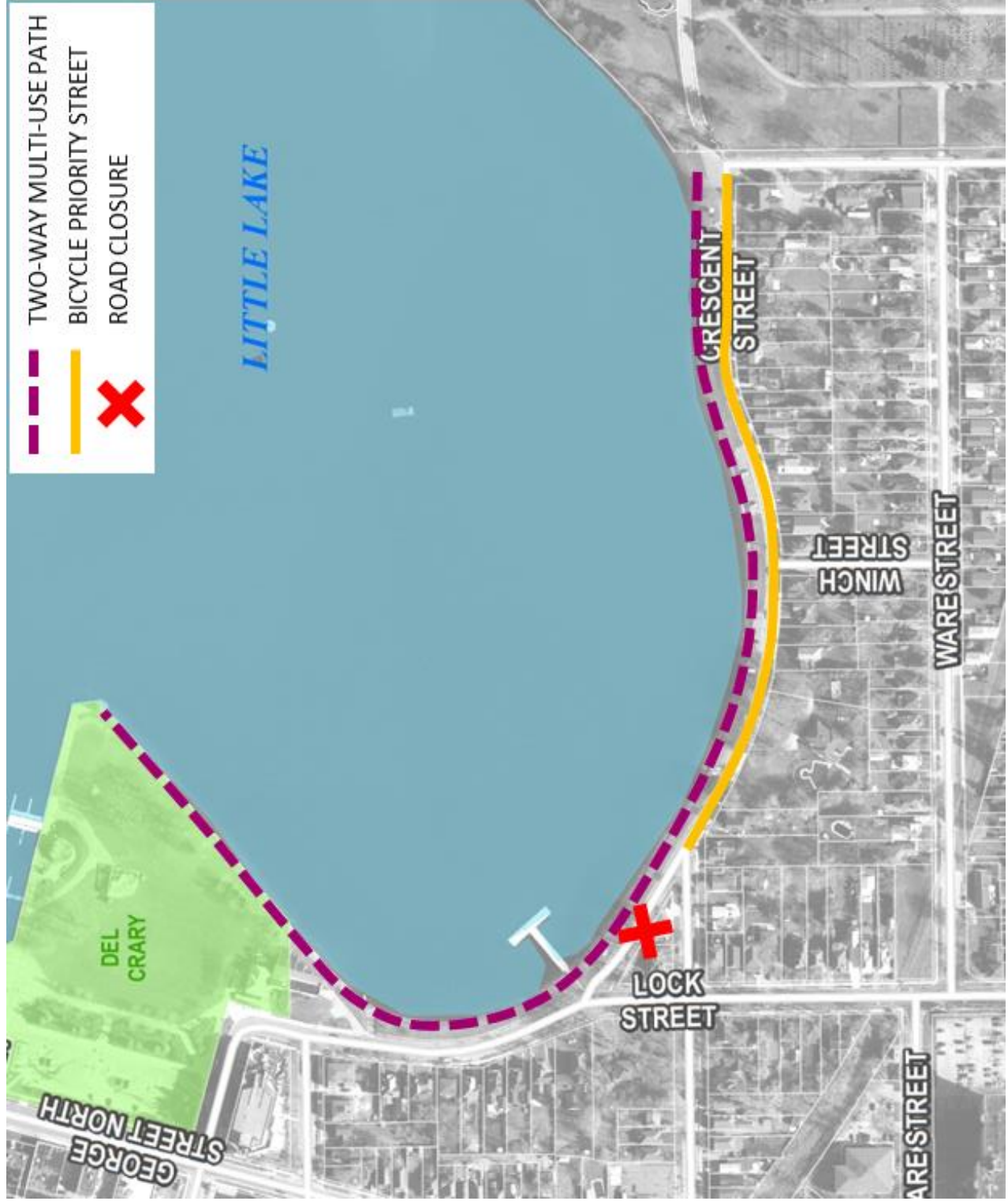
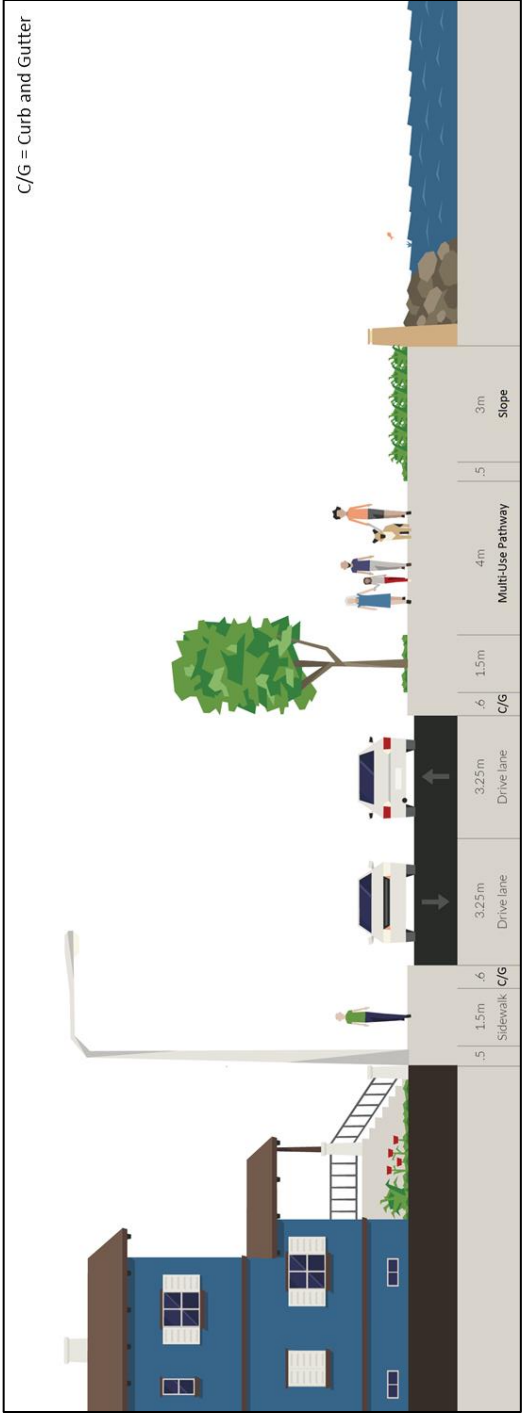


Figure 14:

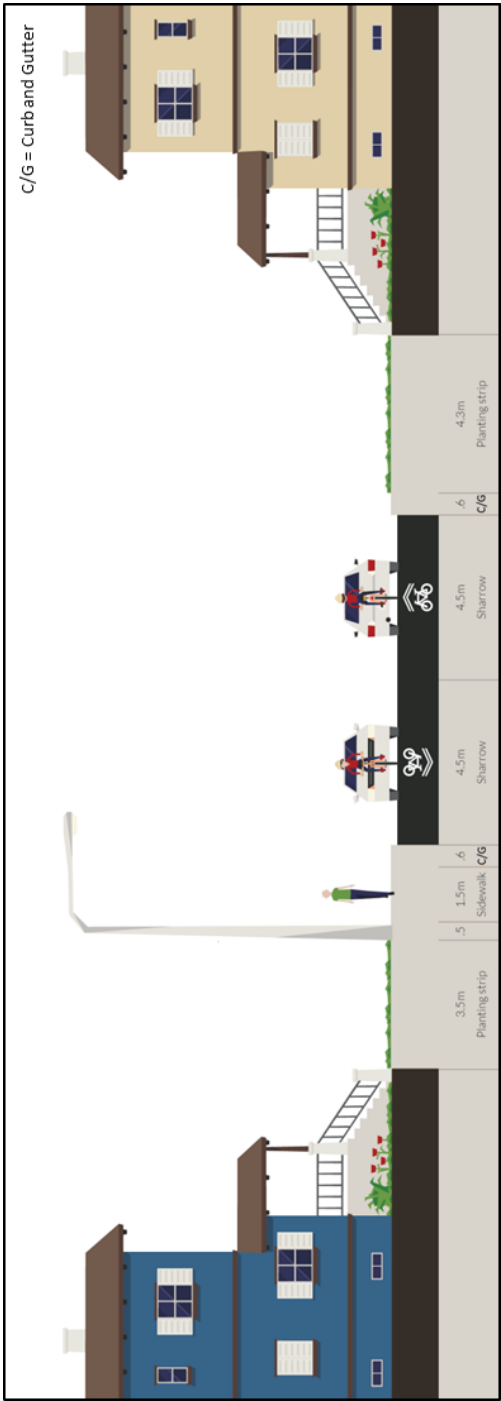
Alternative 1 Cross Sections

Crescent Street – Haggart Street to Romaine Street



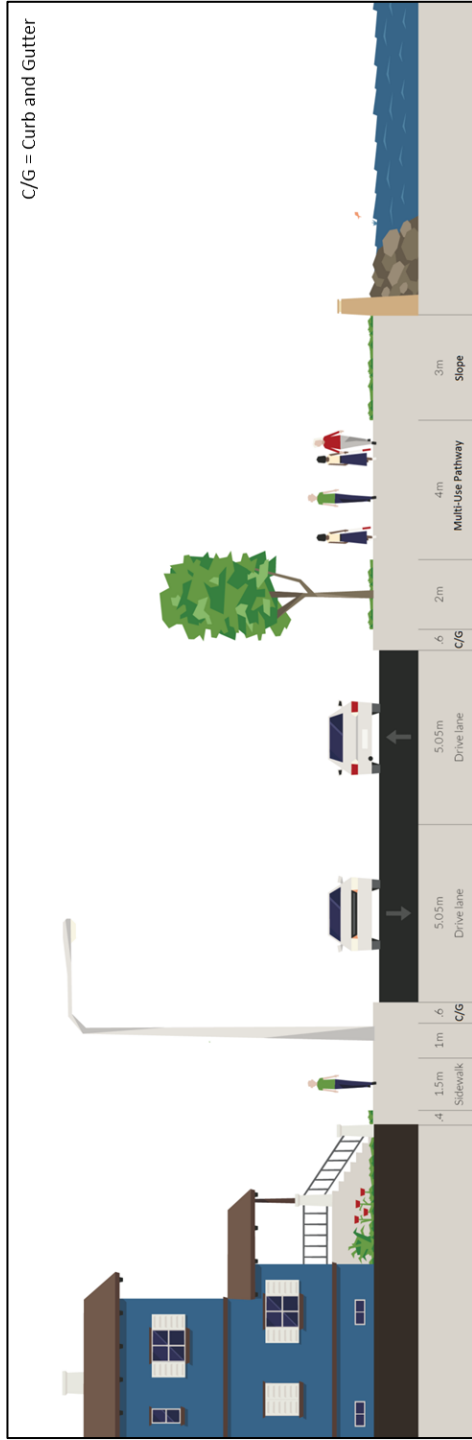
Note: Pathway may be shifted closer to or further from road depending on shoreline treatment.

Romaine Street – Crescent Street to Lock Street



Note: Implement sharrows to highlight on-street cycling priority.

Crescent Street – Lock Street to Del Cray Park / George Street



Note: Pathway may be shifted closer to or further from road depending on shoreline treatment.

The multi-use pathway would require the least amount of space and would not require any major road infrastructure changes on Crescent Street. However, this option does not separate pedestrians and cyclists. Pedestrian and cyclist separation is desirable due to the high volume of users that may use the trail after construction. Multi-use pathways are acceptable at low to moderate volumes of people walking and cycling, but at higher volumes, low-speed pedestrians and moderate-speed cyclists should be separated through the provision of a separate, parallel cycle track to reduce the potential for conflict between users.

Under this option, cyclists would have the option to ride on Crescent Street instead of the multi-use path, since Crescent Street would be converted to a Bicycle Priority Street. However, less confident cyclists will likely opt to remain on the separate multi-use path. On-street cyclists would be able to access the multi-use at Crescent Street at the Gore (Romaine Street).

3.2.2 Alternative 2: Multi-Use Path, Two-Way Cycle Track and Separated Pedestrian Path

Alternative 2 for the ORT trail is a multi-use pathway from Perry Street to Lock Street and separated cycling and pedestrian facilities from Lock Street to Haggart Street. This option would require the conversion of Crescent Street from Haggart Street to Lock Street to a one-way road and widening the street (shifting the north curb) in order to accommodate the separated cycle track. Alternative 2 would provide separation along a segment of the route in a way that requires less space and less reconstruction of existing infrastructure, as it utilizes the existing curb-to-curb roadway. The trail would be implemented as:

- A single 4.0 m wide path shared by both pedestrians and cyclists, from Perry Street to Romaine Street.
- A single 2.0 m to 3.0 m wide pedestrian only pathway from Haggart Street to Romaine Street.
- The Gore to be closed to vehicular use.
- Crescent Street (Haggart Street to Romaine Street) to be converted to one-way westbound route.
- Romaine Street (Crescent Street to Lock Street) to be converted to one-way westbound route.
- Two-way on-road cycle track on Crescent Street / Romaine Street from Haggart Street to Lock Street.

The Alternative 2 trail layout is summarized in **Figure 15**, and the roadway cross sections for Alternative 2 are presented in **Figure 16**.

The cycle track should have a minimum width of 3.0 m (1.5 m per direction), exclusive of the curb and gutter. Where space is available, a desired cycle track width of 4.0 m should be provided. The cycle track would be separated from traffic using painted buffers and linear barriers (armadillos), thereby creating separation while also permitting infrequent encroachment by vehicles backing in or out of the driveways along Crescent Street (such as moving trucks). The cycle track should also be accompanied by appropriate signage informing drivers of the cycle track and the direction of permitted vehicular travel. Cyclists using the cycle track can access the multi-use path at the Gore to continue cycling in a separated facility, or continue on-road at Lock Street.

As discussed above, Alternative 2 would require the conversion of Crescent Street to a one-way road to



accommodate the cycle track. The westbound direction was chosen to support AM Peak hour commuter traffic patterns, under the assumption that residents are more time-sensitive during the morning commute. All eastbound traffic previously using Crescent Street traffic will be diverted to parallel routes (Ware Street or Lansdowne Street). The traffic impacts of this trail option will be analyzed in detail in Section 5 of this report.

The partial separation of cyclists and pedestrians in this trail concept is supportive of the active transportation goals of the City of Peterborough. The trail will likely attract high active transportation usage, and the separation of modes will best accommodate residents and visitors to the lake.

Figure 15: Alternative 2 - Multi-use path, Two-Way Cycle Track and Separated Pedestrian path

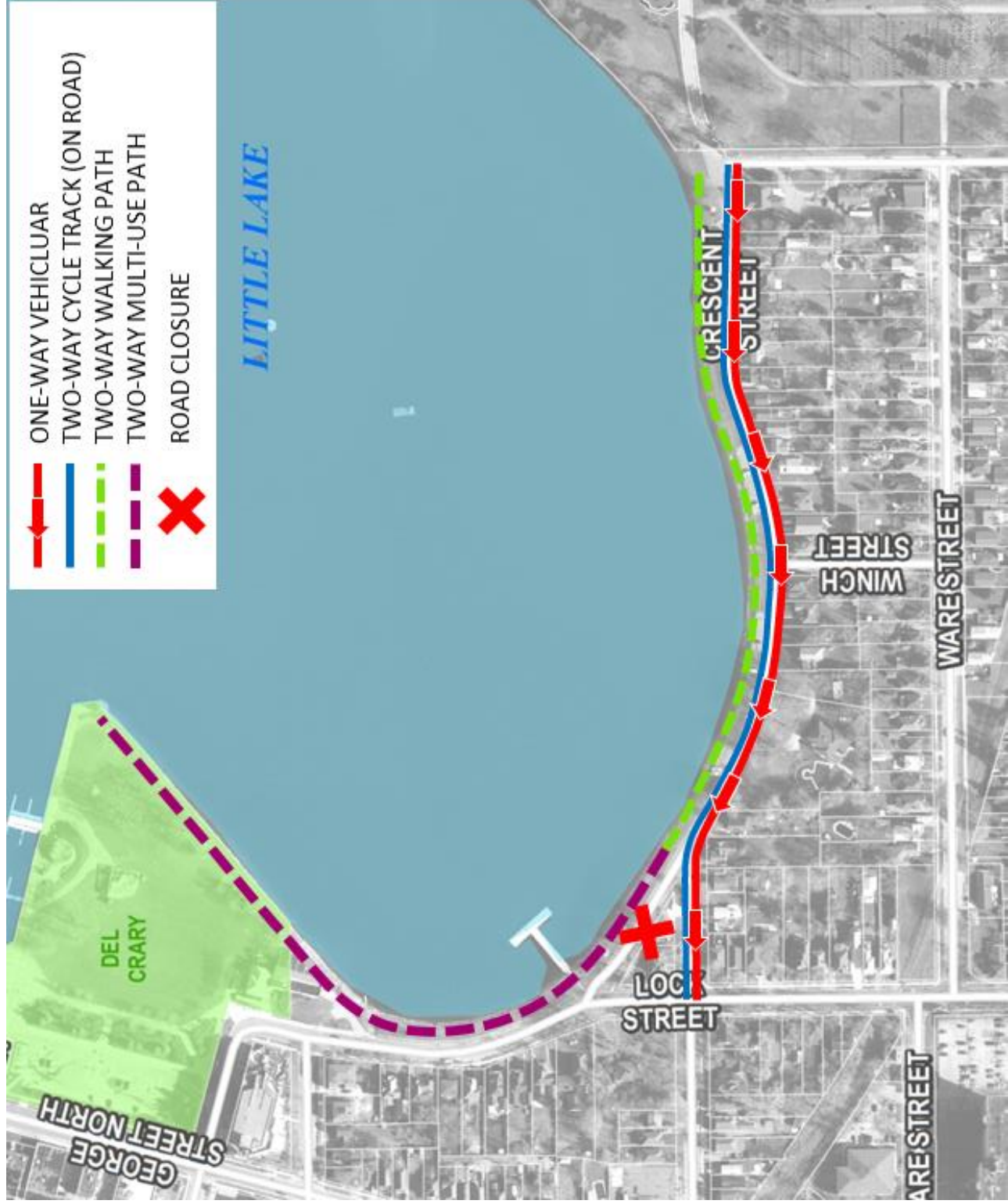
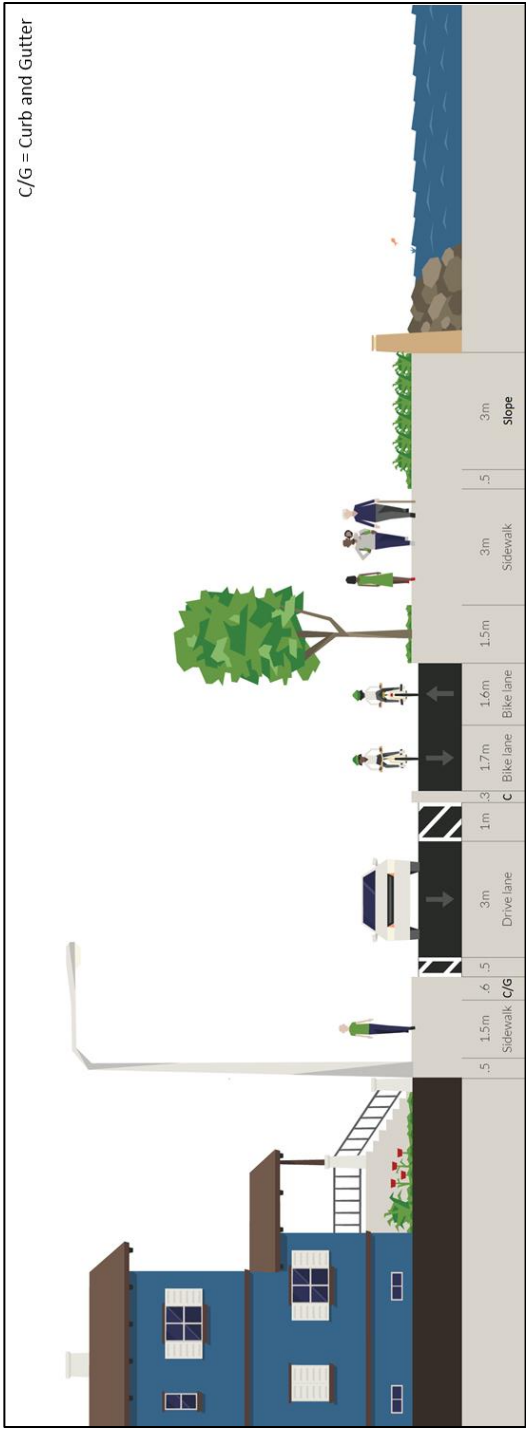


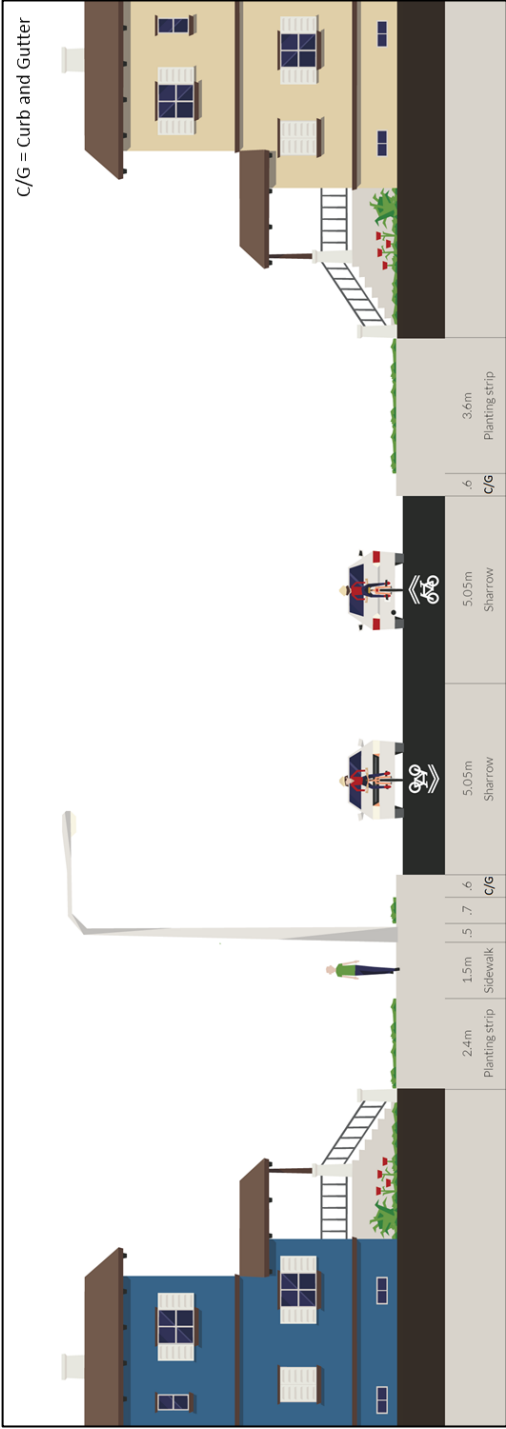
Figure 16:

Alternative 2 Cross Sections

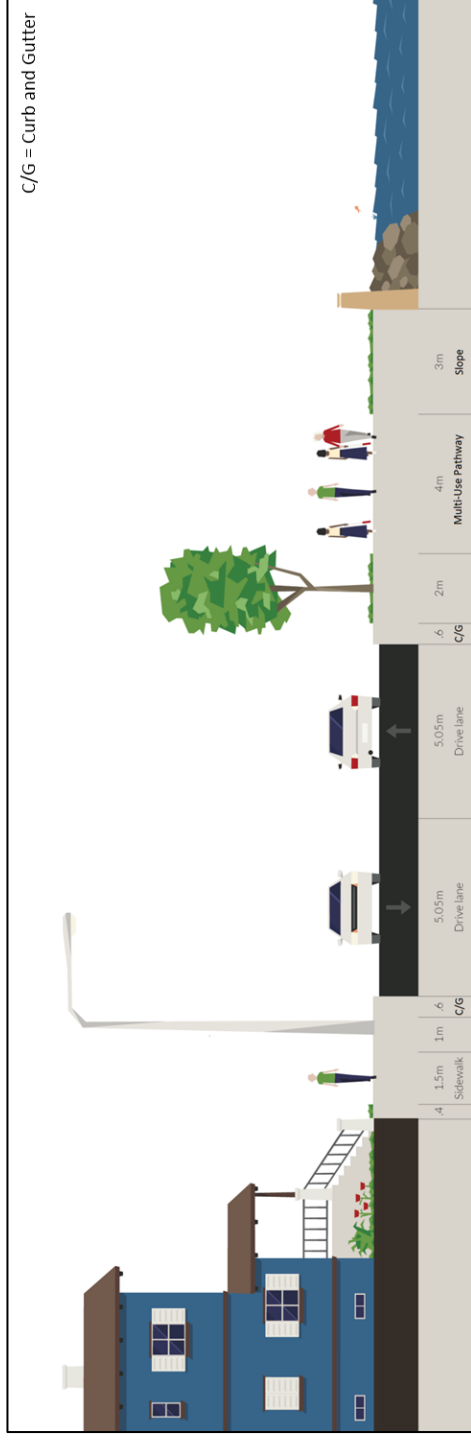
Crescent Street – Haggart Street to Romaine Street



Lock Street – Romaine Street to Crescent Street



Crescent Street - Lock Street to Del Crary Park / George Street



3.2.3 Alternative 3: Pedestrian Path, On-Road Cycling, and Multi-Use Path

Alternative 3 for the ORT trail is a multi-use pathway from Perry Street to Lock Street, separated bicycling and pedestrian facilities from Lock Street to Romaine Street, and a separated pedestrian path from Romaine Street to Haggart Street. This option would also encourage on-road cycling on Crescent Street (Haggart Street to Romaine Street) through conversion of Crescent Street to a Bicycle Priority Street. Alternative 3 provides separation of cyclists and pedestrians along a short segment of the route, options for cyclists to ride on-road or off-road, and requires minimal reconstruction of existing infrastructure as it utilizes the existing curb-to-curb roadway. The traffic impacts of Alternative 3 would be identical to Alternative 1. The trail would be implemented as:

- A single 4.0 m wide multi-use path shared by both pedestrians and cyclists, from the existing ORT to south of Lock Street.
- A single 3.0 m stone dust walking path from south of Lake Street along the Del Cray Park shoreline.
- A single 4.5 m wide multi-use path from south of Lake Street to Lock Street.
- A single 3.0 m walking path from Lock Street to Haggart Street.
- Two-way on-road cycle track on Crescent Street from Lock Street to Romaine Street.
- The Gore to be closed to vehicular use.
- Crescent Street (Haggart Street to Lock Street) to be converted to a **Bicycle Priority Street**.
 - This initiative would require the traffic on Crescent Street to be reduced and calmed such that the speed and volumes along Crescent Street are sufficiently low to prioritize on-street cycling.
 - The speed limit on Crescent Street should be reduced to 30 km/hr, and additional speed management measures may be required if vehicle speeds substantially exceed the reduced speed limit.

The Alternative 3 trail layout is summarized in **Figure 17**, and the roadway cross sections for Alternative 3 are presented in **Figure 18**.

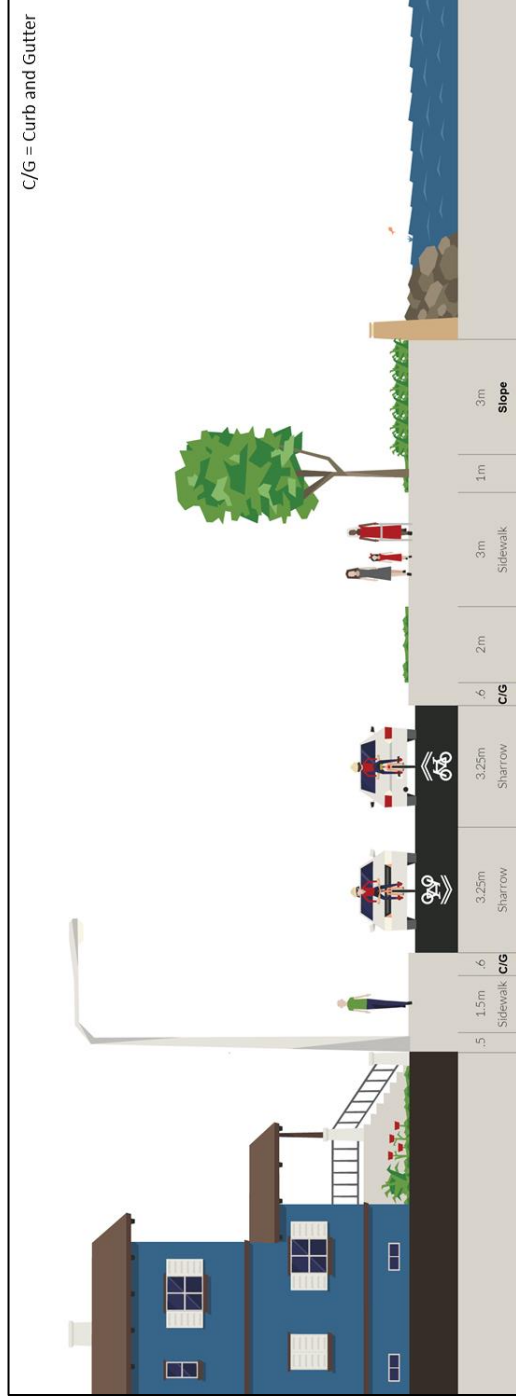
The partial separation of cyclists and pedestrians in this trail concept is also supportive of the active transportation goals of the City of Peterborough; encouraging cycling in the study area both on- and off-road while providing pedestrians separated walking facilities.

Figure 17: Alternative 3 - Pedestrian Path, On-Road Cycling, and Multi-Use Path

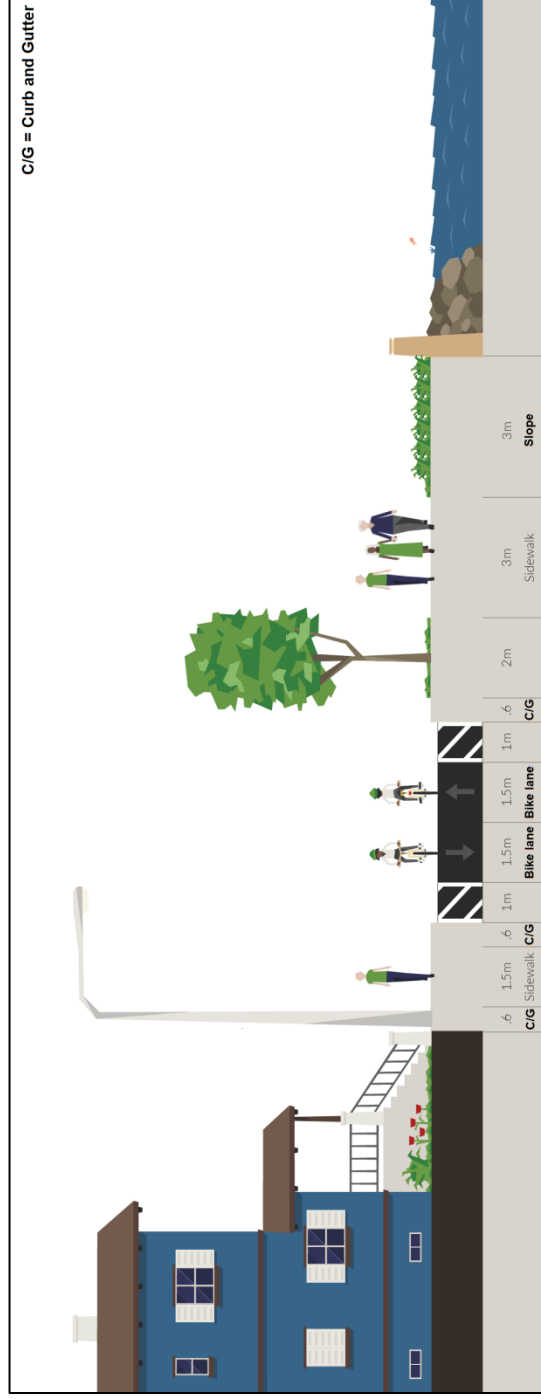


Figure 18: Alternative 3 Cross Sections

Crescent Street – Haggart Street to Romaine Street



Crescent Street – Romaine Street to Lock Street



3.2.4 Refined Option: Multi-Use Path, Two-Way Cycle Track and Separated Pedestrian Path

The refined option is a combination of Alternative 2 and 3 and the public's comments. For this option; the ORT trail is a multi-use pathway from Perry Street to Lock Street and a separate cycle track and pedestrian path from Lock Street to Haggart Street. To accommodate the cycle track east of Romaine Street, Crescent Street would be converted to a one-way eastbound street. The refined option provides separation of cyclists and pedestrians along a short segment of the route and requires minimal reconstruction of existing infrastructure as it utilizes most of the existing curb-to-curb roadway. The facility would be implemented as:

- A single 4.5 m wide multi-use path shared by both pedestrians and cyclists, from the existing ORT to Lake Street.
- A single 3.0 m asphalt walking path from Lake Street north along the Del Cray Park shoreline.
- A single 4.5 m wide multi-use path from Lake Street to Lock Street.
- A single 2.0 m walking path from Lock Street to Haggart Street.
- Two-way on-road cycle track on Crescent Street from Lock Street to Haggart Street.
- Crescent Street through the "gore" to be closed to vehicular use.
- Crescent Street (Haggart Street to Romaine Street) to be converted to one-way eastbound route.
- Romaine Street (Crescent Street to Lock Street) to be converted to one-way eastbound route (optional to provide parking on both sides of the street).
- The existing five parking bays along Crescent Street to be removed, with the dropped curb replaced by a standard barrier curb.
- The pavement surface within the on-road cycle track to be generally smooth and free of hazards for cyclists.
- The catch basins on Crescent Street to be modified or replaced to be more cyclist-friendly.

Figure 19 summarizes the Refined Option trail layout and **Figure 20** illustrates the major trail cross sections.

Figure 19: Refined Option: Multi-Use Path, Two-Way Cycle Track and Separated Pedestrian Path

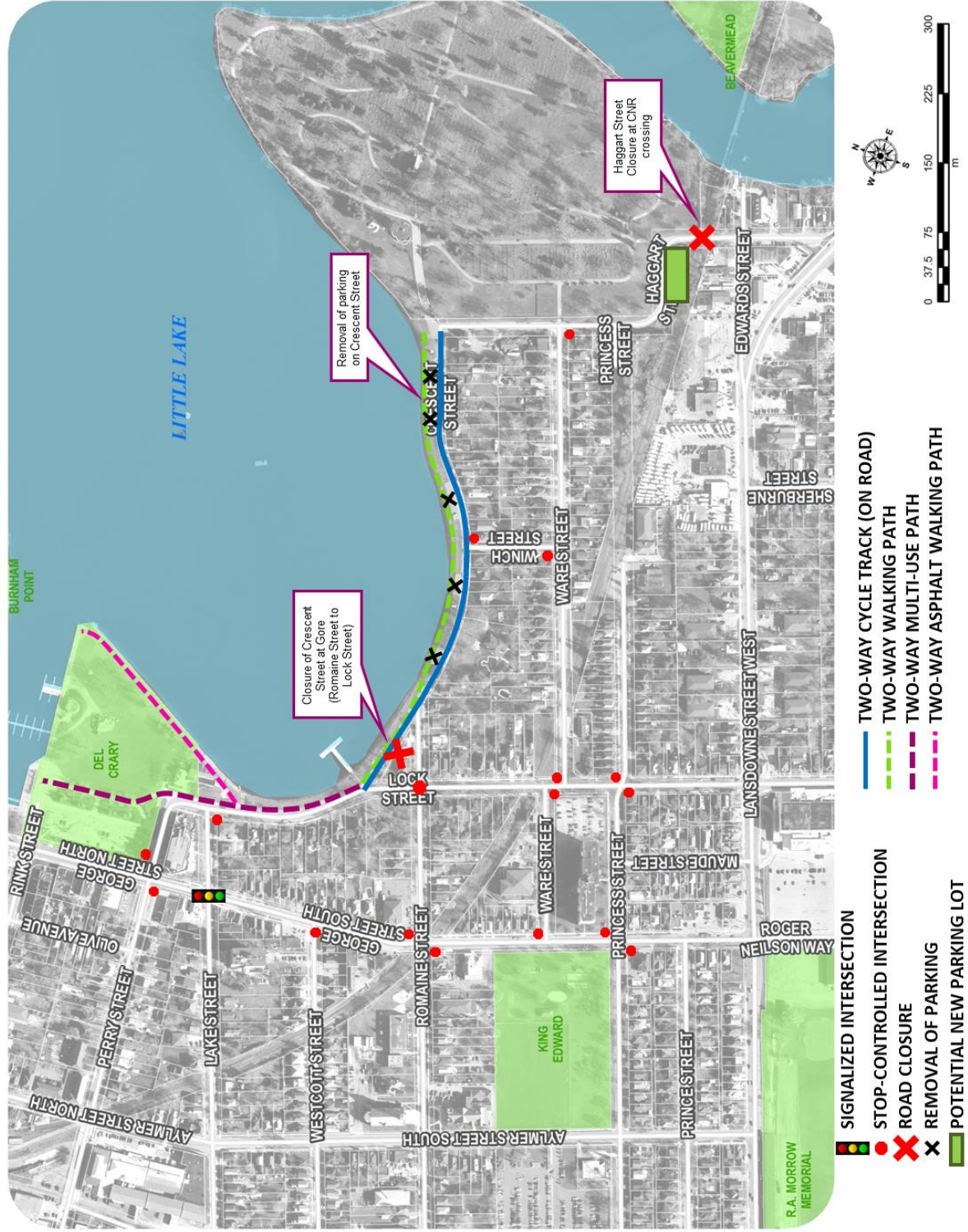
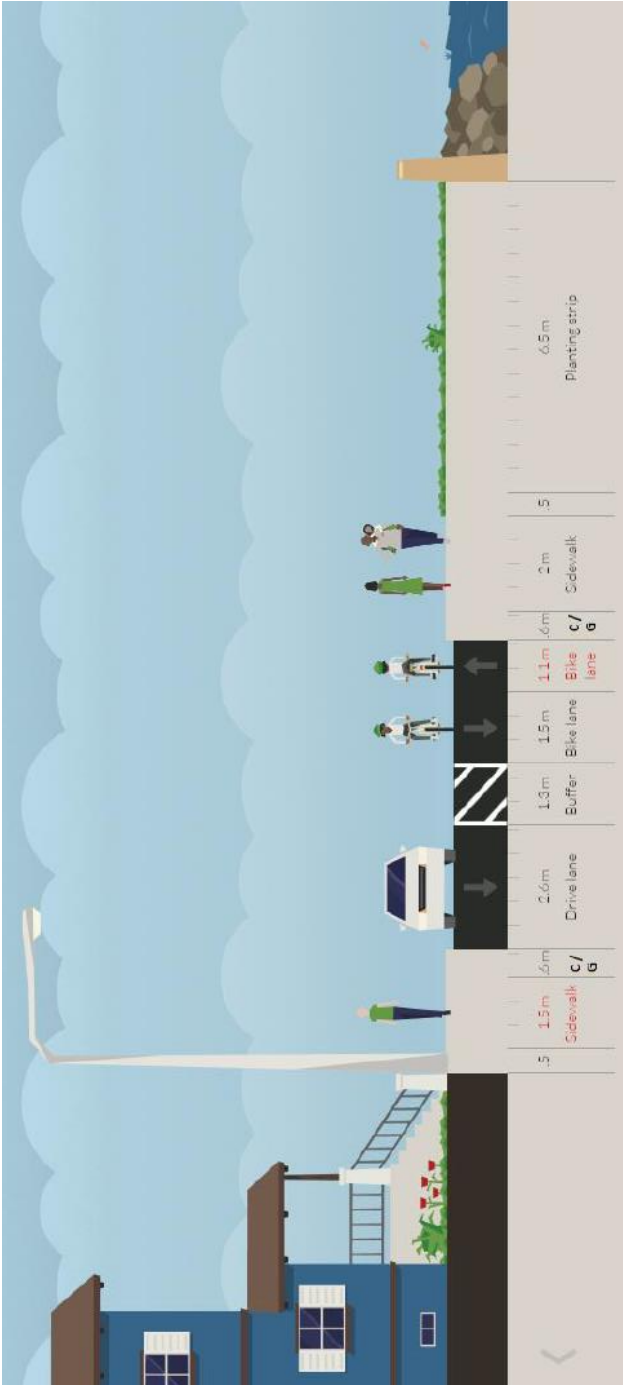


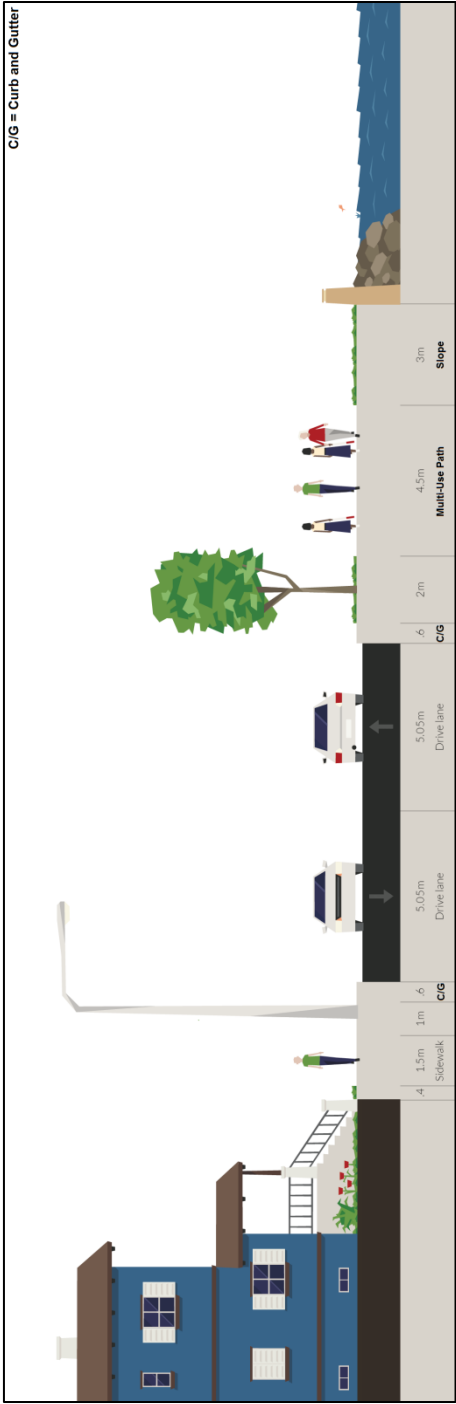
Figure 20: Refined Option Cross Sections

Crescent Street – Haggart Street to Romaine Street



Note: Gutter of 0.4 m included in the 0.6 m curb-and-gutter. The gutters would be added to the driving lane and cycle track to create a 3.0 m driving lane and 3.0 m cycle track.

Crescent Street - Lock Street to Del Crary Park / George Street



4. Traffic Calming on Ware Street

4.1 Introduction

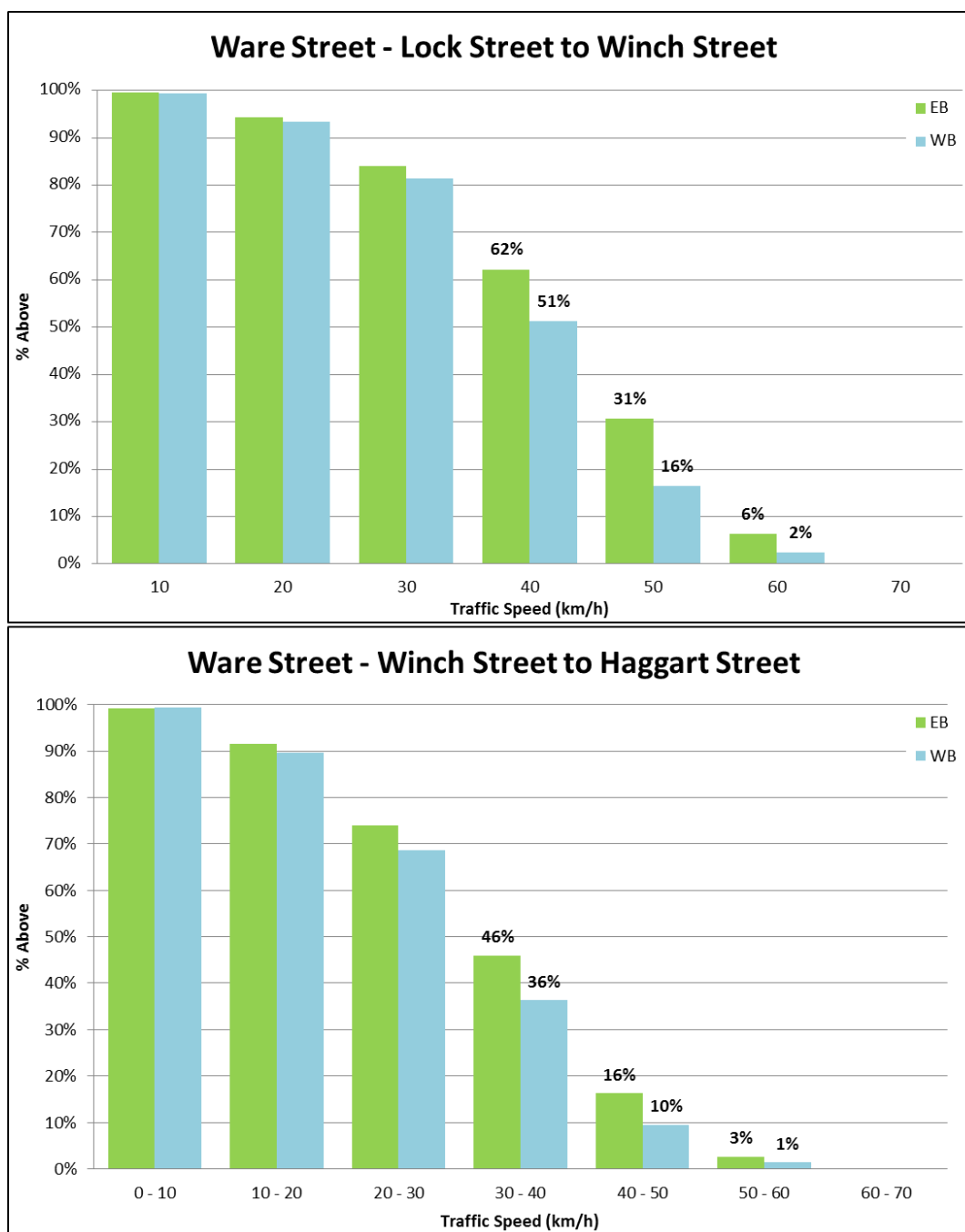
During the Otonabee River Trail Public Information Centre (PIC) #1, a public petition was presented to the City of Peterborough from residents of Ware Street within the Little Lake study area regarding concerns of high speed traffic on Ware Street. Local residents expressed distress over high speed traffic utilizing Ware Street as a through traffic route, with safety being a primary issue. This issue was investigated as part of this traffic study.

4.2 Existing Speed Profile

As detailed in Section 2.3.4, the weekday traffic count data revealed that speeding within the local roads in the study area occurs most frequently along Ware Street. **Figure 21** summarizes the speed statistics collected along Ware Street.

As shown above, 10% to 30% of Ware Street traffic exceeds the 50 km/hr speed limit. Additionally, 36% to 62% of traffic along Ware Street exceeds 40 km/h speeds. While this is not in excess of the posted speed limit, local road traffic above 40 km/h is generally considered higher speed as well. The typical speed limit in school zones is 40 km/h to reflect safety concerns for roads near children activity. This same safety rationale can be applied to local residential roads like Ware Street, where children may be near the road during the AM peak hour (on their way to school) and the PM peak hour (back home from school).

It is important to note that while speeding has been observed and recorded along Ware Street, the overall traffic volumes in the AM and PM peaks are relatively low. Thus, speeding and safety concerns raised by residents may be mitigated by simply reducing the traffic that utilizes Ware Street.

Figure 21: Ware Street Speed Statistics

4.3 Potential Traffic Calming Measures

4.3.1 Haggart Street Closure

As previously discussed, observed traffic data revealed a pattern of traffic using Ware Street and Crescent Street as a cut-through route to avoid the George Street and Lock Street corridors. This traffic accesses Ware Street and Crescent Street through Haggart Street, with approximately 30% of the cut-through traffic using Ware Street as a through route (as summarized in **Figure 5**). Since through traffic is a contributing factor to the observed speeding on Ware Street, the closure of Haggart Street south of the study area may potentially calm the existing traffic conditions on Ware Street.

Closing Haggart Street would remove the possibility of longer distance trips using Ware Street and Crescent Street to bypass the Lansdowne Street, George Street, and Lock Street corridors. The cut-through traffic would instead remain on the major arterial routes such as George Street and Lansdowne Street which are better suited for higher speed traffic. The residential neighbourhoods on Ware Street and Crescent Street currently separated from the industrial/commercial areas just south of the study area by the disused CNR rail line, thus making the rail line crossing at Haggart Street an ideal location for closure. It should be noted that Haggart Street would be closed to vehicular traffic only, and would remain open for walking and cycling as well as provide a connection to the potential future trail along the disused rail line. The closure and redistribution of traffic currently using Haggart Street is summarized in **Figure 22**.

The closure of Haggart Street would reduce traffic on Ware Street to only local residents. Since the traffic would be restricted to only local residents, the speeds observed in existing conditions would likely reduce as well. The traffic reduction due to the Haggart Street closure was determined through desktop analysis, and is summarized in **Figure 23**.

Additionally, the Haggart Street closure will reduce traffic on Crescent Street, improving the walking and cycling environment along the waterfront.

If Crescent Street were to be converted to one-way with a two-way cycle track combined with a Haggart Street closure, Crescent would not be an attractive street for most drivers to use as it would only serve local traffic. Drivers who would drive east on Crescent Street would need to drive slow due to the narrow lane. The lack of parking along Crescent would discourage visitors from using and parking along Crescent Street, instead diverting to Lock Street or Del Crary Park. The closure of Haggart Street would remove all through traffic, as the only exit from Crescent Street would be to Lock Street via Ware Street. Visitors to the area could instead park at Del Crary Park, walk, or cycle down the path along Crescent Street, to view the lake.

Figure 22: Haggart Street Closure and Traffic Redistribution

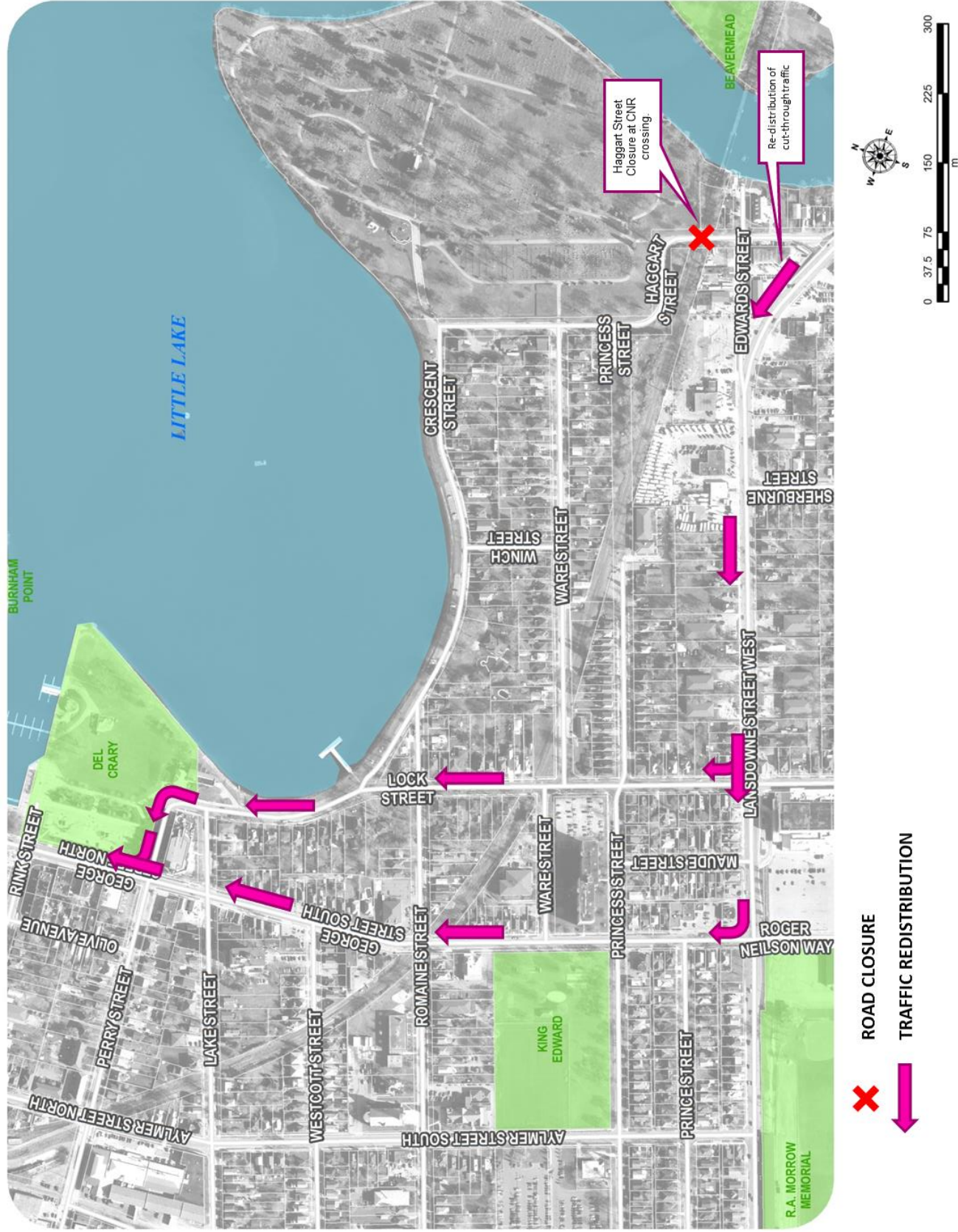
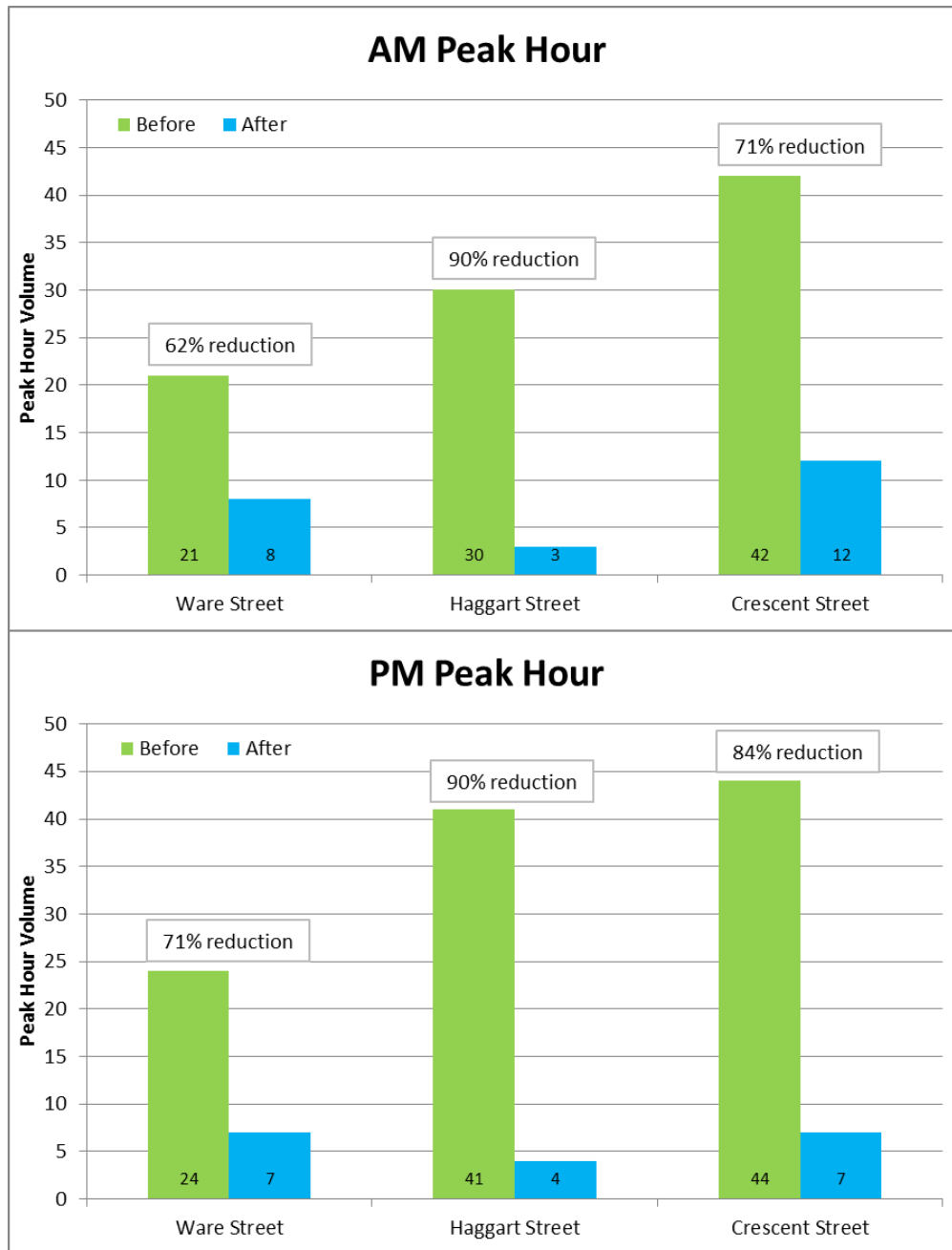


Figure 23: Traffic Reduction on Ware Street due to Haggart Street Closure

As shown above, the Haggart Street closure would reduce traffic on Ware Street, Haggart Street and Crescent Street significantly (62% to 90% reduction) in the AM and PM peak hours. For Ware Street, the frequency of peak hour trips would reduce from approximately one vehicle every minute to one vehicle every four minutes. While this reduction in traffic is considerable, it should be emphasized that the overall traffic on these roads is relatively low. Thus, implementing the closure should sufficiently calm the traffic and safety concerns raised by residents at PIC #1.

4.3.2 Raised Crossings and Curb Extensions on Ware Street

A raised crosswalk with curb extensions should be installed at the Ware Street and Lock Street intersection.

Raised Pedestrian Crossing⁹

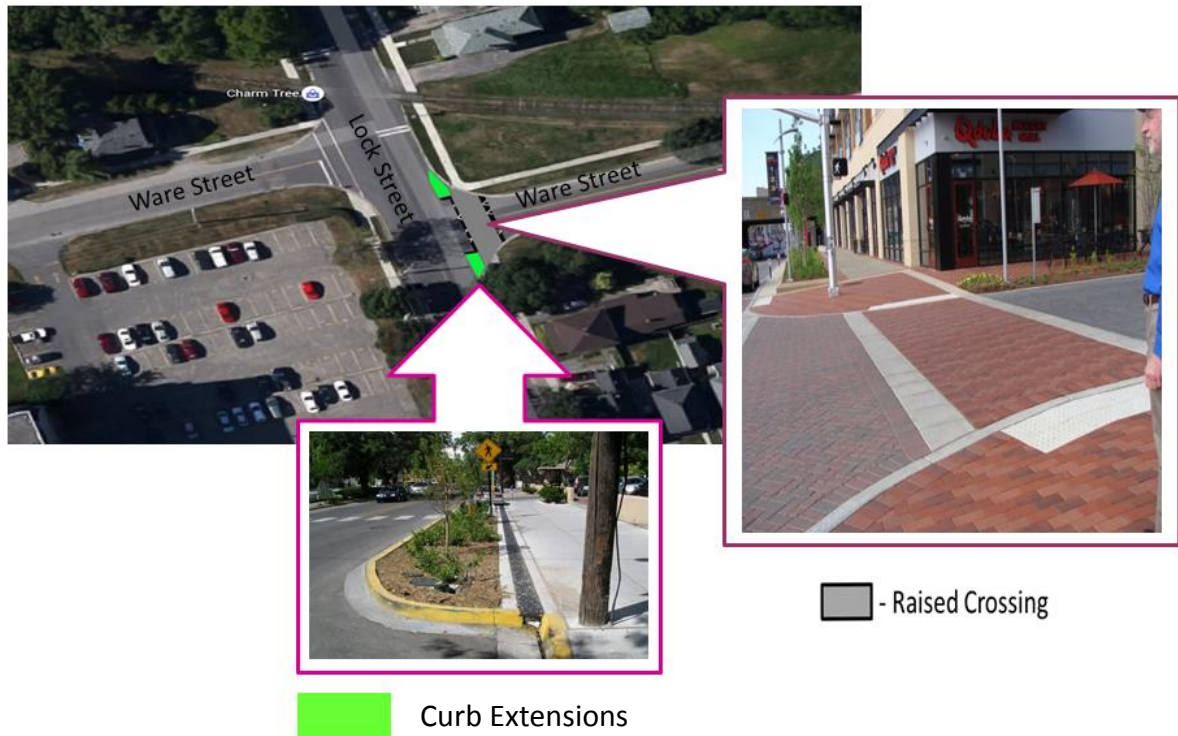
A raised crosswalk is a marked pedestrian crossing point at an intersection or mid-block location constructed at a higher elevation than the adjacent roadway. The raised surface improves drivers' awareness of the potential for pedestrians and has a traffic calming effect, as one of its effects is to reduce speed. Raised crosswalks force approaching vehicles to reduce speeds, providing an opportunity for drivers to ensure that no pedestrian is crossing. In addition, drivers must reduce speed in order to clear the crosswalk safely. Implementation of raised crosswalks requires road signage (advanced warning before hand) and pavement markings.

Curb Extensions

Curb extensions are areas where the curb shifts toward the centreline of the road, narrowing the road and improving visibility of pedestrians approaching the crossing. Curb extensions should be implemented on both sides of the raised crosswalk (as shown in **Figure 22**). At the intersections of Lock Street and Ware Street, there is only a two-way stop for vehicles travelling on Ware Street; thus, the curb extensions would force drivers on Lock Street to slow down as they approach the intersection. In addition, curb extensions would give drivers on Ware Street protection and better visibility of cross traffic if cars are parked on Lock Street because they would have room to move forward into the intersection to see cross traffic without advancing into their lane. This is particularly important when there are events at the nearby arena, as vehicles tend to park on Lock Street. Curb extensions would also ensure vehicles do not park too closely to the intersection or raised crosswalk. **Figure 24** shows the approximate location of the raised crosswalk.

It is recommended that traffic volumes and speeds be monitored after the Haggart Street closure and implementation of a raised crosswalk on Ware Street to confirm whether traffic has been calmed with these measures.

⁹ OTM, *Traffic Calming Measures – Raised Crosswalk* < <http://www.directtraffic.ca/wp-content/uploads/2014/02/Book-151.pdf> >

Figure 24: Example of Raised Crossings on Ware Street

4.3.3 Additional Traffic Calming Options

After a period of monitoring the impacts of the Haggart Street closure, if speeding issues continue to be observed on Ware Street, additional traffic calming measures may be considered. The following traffic calming measures can help mitigate speeding on Ware Street. It should be noted that the measures discussed here are intended as high-level recommendations and not detailed designs.

Speed Humps¹⁰

Speed humps are rounded raised areas of pavement (3 to 4 inches high) which approximately span the width of a road. Speed humps are often placed in a series (typically spaced 100 to 200 m apart). This measure is usually implemented on residential roads at midblock placement (not at intersections). Implementation of speed humps require road signage (advance warning before first hump in a series) and typically have pavement markings as well (zigzag, shark's tooth, chevron, zebra markings, etc.). Speed humps force approaching vehicles to reduce speeds in order to clear the hump safely. Subsequent humps in the series are spaced appropriately to prevent vehicles from accelerating beyond the acceptable speed before encountering another hump. Speeds between humps have been observed to be reduced by 20% to 25% on average.

For Ware Street, speed humps could be implemented to ensure traffic speeds are limited. **Figure 25** below shows the approximate placement of speed humps along Ware Street. The layout shown in **Figure 25** is intended as a guideline, and detailed analysis/design would be required if the speed humps are to be implemented.

¹⁰ ITE, *Traffic Calming Measures – Speed Hump* <<http://www.ite.org/traffic/hump.asp>>

Speed Tables / Raised Intersections¹¹

A speed table is a long raised speed hump (3 to 4 inches) with a flat section in the middle (~3 metres) and ramps at each end (~2 metres each). It is often constructed with brick or other textured materials along the flat section, and is typically long enough to accommodate the entire wheelbase of an automobile. Speed tables are generally implemented at crosswalks, raising the level of the road to curb height to accommodating pedestrian crossing. As with speed humps, speed tables require road signage (advance warning before speed table) and typically include pavement markings. Speed tables reduce traffic speeds, but generally to a lesser degree than Speed Humps. However speed tables provide improved safety due to increased pedestrian visibility and likelihood that a driver yields to a pedestrian.

For Ware Street, a speed table / raised intersection can be implemented at the Ware Street / Winch Street intersection thereby providing speed reduction as well as a pedestrian crossing facility. It should be noted that drainage can be complicated in raised intersection retrofitting. **Figure 26** below shows the approximate placement of speed humps along Ware Street. The layout shown in **Figure 26** is intended as a guideline, and detailed analysis/design would be required if a speed table is to be implemented.

Chicanes¹²

Chicanes are a series of narrowing or curb extensions that alternate forming S-shaped curves. With chicanes implemented, traffic along the route is forced to adjust speed in order to negotiate the curves. Chicanes are most effective with equivalent volumes of both approaches.

For Ware Street, chicanes could be implemented from Lock Street to Haggart Street to reduce traffic speeds. **Figure 27** below shows the approximate placement of chicanes along Ware Street. The layout shown in **Figure 27** is intended as a guideline, and detailed analysis/design would be required if the speed humps are to be implemented.

¹¹ ITE, *Traffic Calming Measures – Speed Table* <<http://www.ite.org/traffic/table.asp>>

¹² ITE, *Traffic Calming Measures – Chicane* <<http://www.ite.org/traffic/chicane.asp>>

Figure 25: Example of Speed Humps on Ware Street

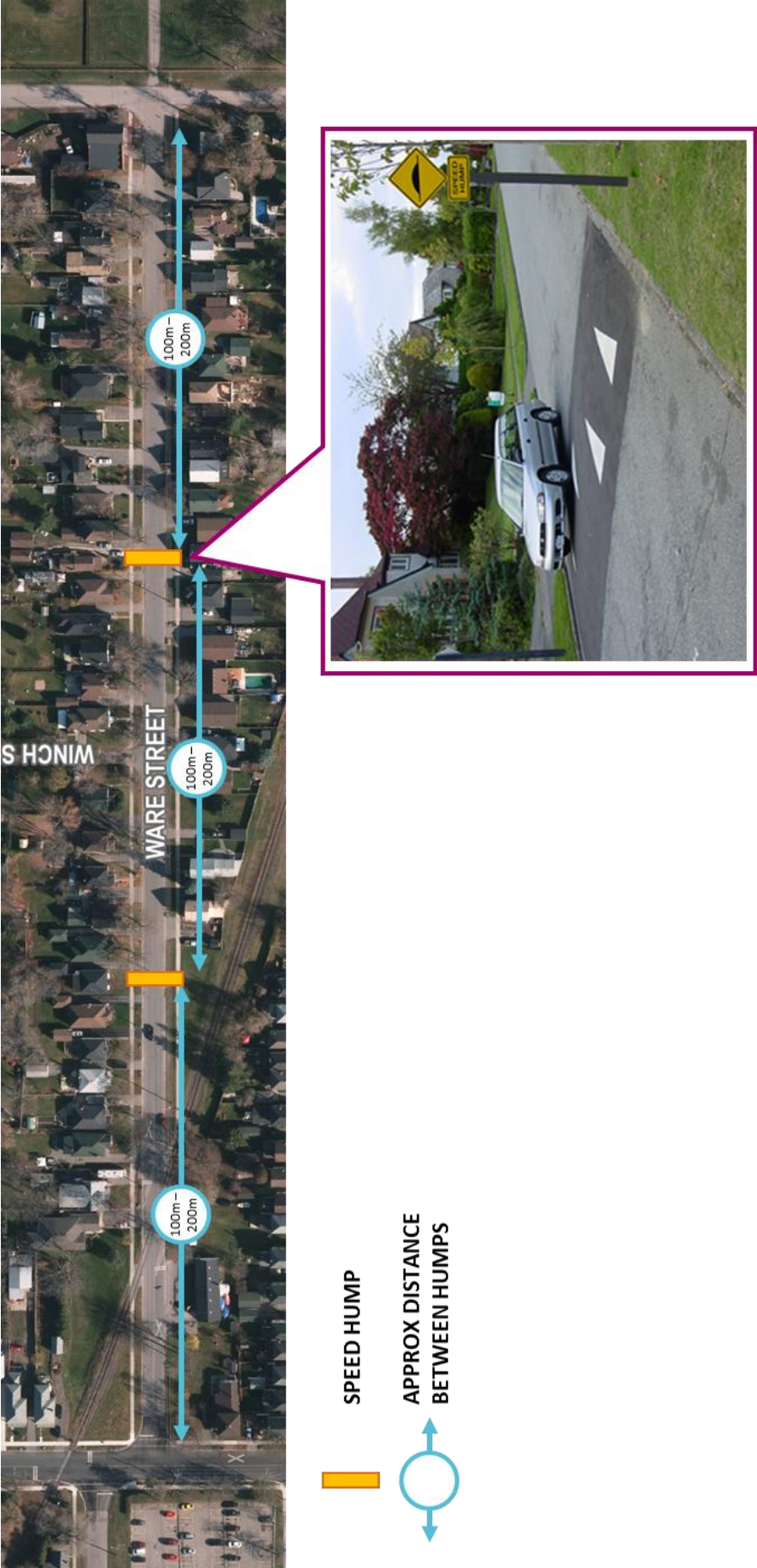


Figure 26: Example of Speed Table at Ware Street / Winch Street



SPEED TABLE



Figure 27: Example of Chicanes at Ware Street / Winch Street



5. Traffic Operations Analysis

This section details the traffic analysis used to support of the trail options for the Otonabee River Trail detailed in Section 3.

The traffic study considers the impacts of the Haggart Street closure as well as the conversion of Crescent Street to a westbound only one-way route to support the ORT concepts. The study focuses on the opening year for the trail (assumed as 2015) and a 20-year horizon (2035), at which point the intensification expected within the study area is expected to be in place.

For the purpose of this traffic study, it is assumed that existing volumes will be retained for the 2015 opening year (i.e. no growth in traffic). Also, the one-way Crescent Street scenarios considered in the study assumed that Crescent would be one-way westbound. The recommended trail concept includes conversion of Crescent Street to one-way eastbound. **It is expected that the traffic analysis results would be similar for the one-way eastbound scenario. The total bidirectional volume on Ware Street is expected to be similar, with a larger volume of westbound traffic instead of eastbound traffic. There may be a trivial increase in delay at the Ware Street and Lock Street intersection due to the higher westbound volume, though the Ware Street volume is still expected to be low (and lower than today due to the Haggart closure). There would be a corresponding slight decrease in delay at the Lock Street and Romaine Street intersection.**

5.1 2015 ORT Opening Year

5.1.1 Scenario 1: 2015 Haggart Street Closure

The Haggart Street closure (discussed in Section 4.3.1) will reduce the existing traffic on Ware Street, Haggart Street and Crescent Street. This initiative will address residents' concern about Ware Street through traffic while also promoting the conversion of Crescent Street into a Bicycle Priority Street. However, the vehicles that previously cut-through Ware Street and Crescent Street would re-distribute to the George Street and Lock Street corridors and thus increase traffic on those routes. As discussed in Section 3, the implementation of the ORT will result in the closure of the Crescent Street Gore for vehicular use from Romaine Street to Lock Street, with westbound traffic re-routed to Romaine Street. Additionally, the existing parking bays along Crescent Street will be removed with the implementation of the river trail. To account for the loss in parking, the City may consider implementing a parking lot adjacent to the Haggart Street closure site at the disused rail line. This location would be ideal due to the reduction in Haggart Street traffic.

All other road network attributes, such as signal timing assumptions, peak hour factors, commercial vehicle mode share, and on-road pedestrian movements are expected to remain consistent with existing conditions. **Figure 28** illustrates the road network predictions for Scenario 1.

The redistribution of traffic due to the Haggart Street closure was conducted using a desktop analysis. The traffic was distributed to the George Street and Lock Street corridors, assuming traffic that cut-through Haggart Street would use Lansdowne Street to access George Street and Lock Street.

Figure 29 and **Figure 30** summarize the lane configurations and traffic volumes for Scenario 1.

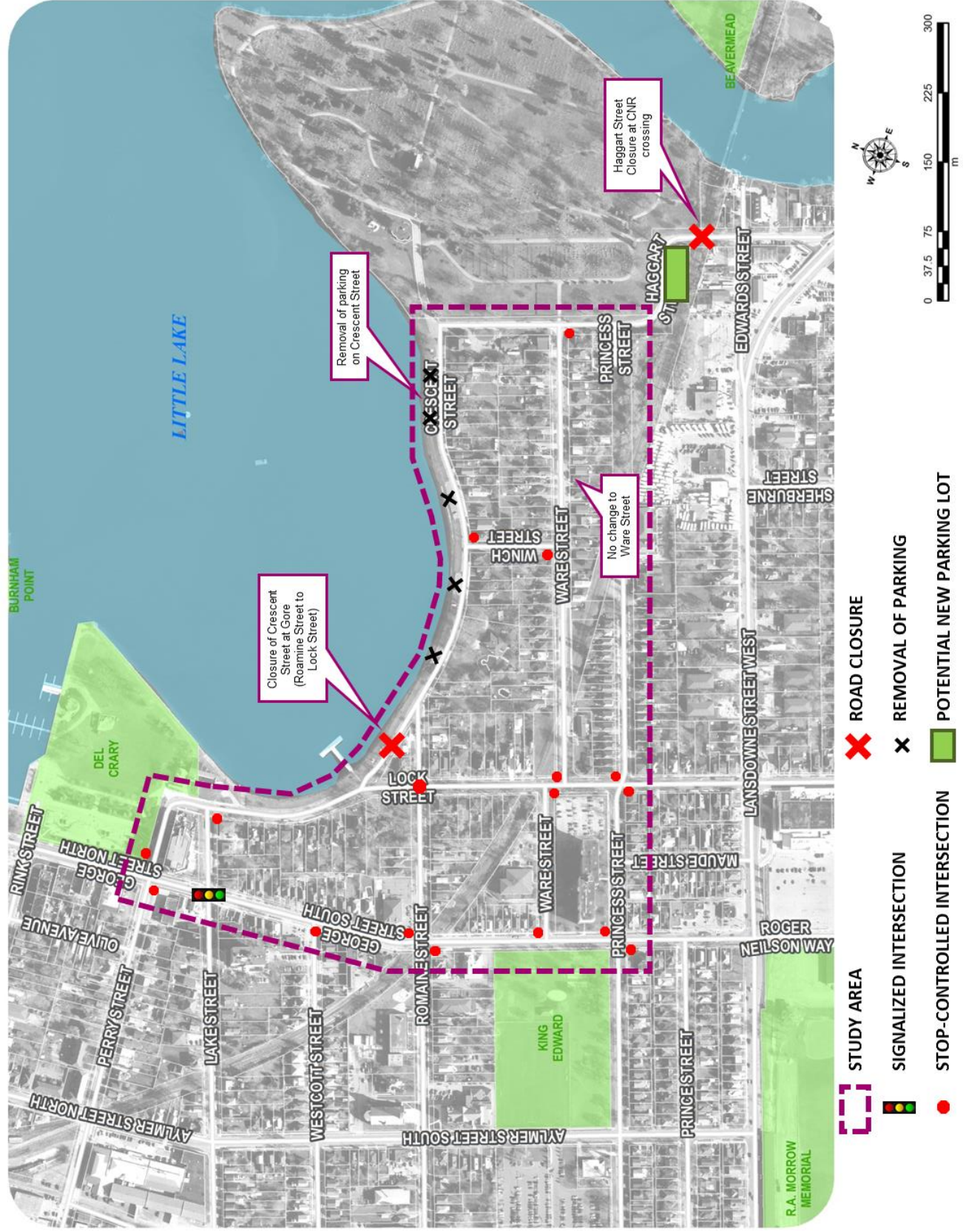
5.1.1.1 Intersection Operations

The results of the capacity and queuing analysis for the study area intersections for Scenario 1 (as detailed above) are summarized in **Table 4** for the AM and PM peak hours. Complete Synchro HCM Reports and SimTraffic queuing reports are provided in **Appendix C**.

The operational analysis results shown in **Table 4** indicate that all intersections in the study area will operate without issue under Scenario 1 for both the AM and PM Peak hours. The signalized intersection at George Street and Lake Street is operating at an overall **LOS A**, and all unsignalized intersections are below capacity, with all approaches at V/C ratio of **0.55** or less.

From the queue analysis, the PM Peak hour simulation revealed that the 95th queue for the southbound approach for the George Street / Lake Street intersection would slightly exceed the distance to the upstream intersection (George Street / Perry Street). Since the traffic is predominately through-traffic and the potential intersection blockage is minor, it is concluded that no network changes would be required to mitigate the blockage.

Figure 28: Scenario 1 – Horizon Year 2015 Haggart with Street Closure



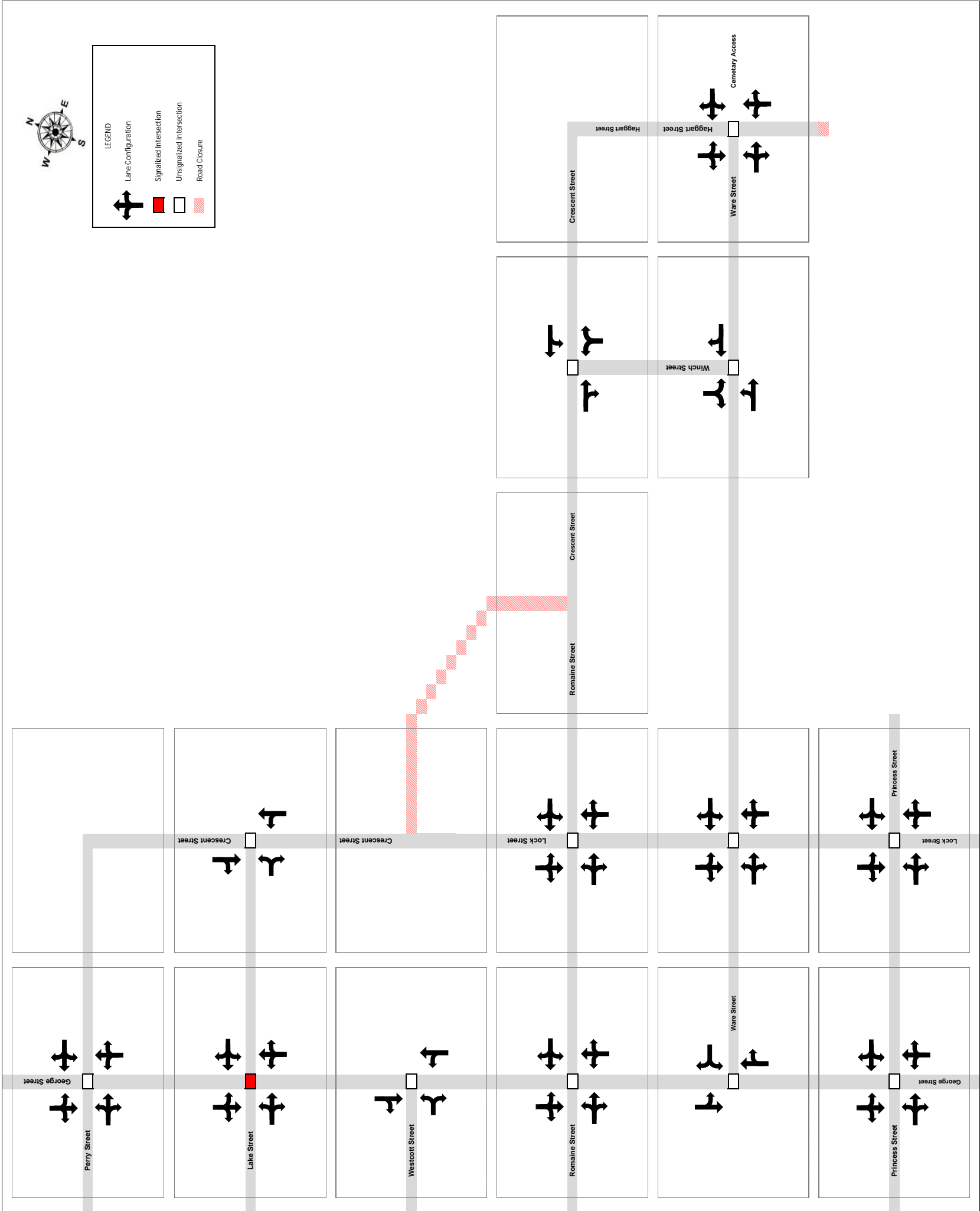


Figure 30: Scenario 1 - Horizon Year 2015 Haggart Street Closure Traffic Volumes

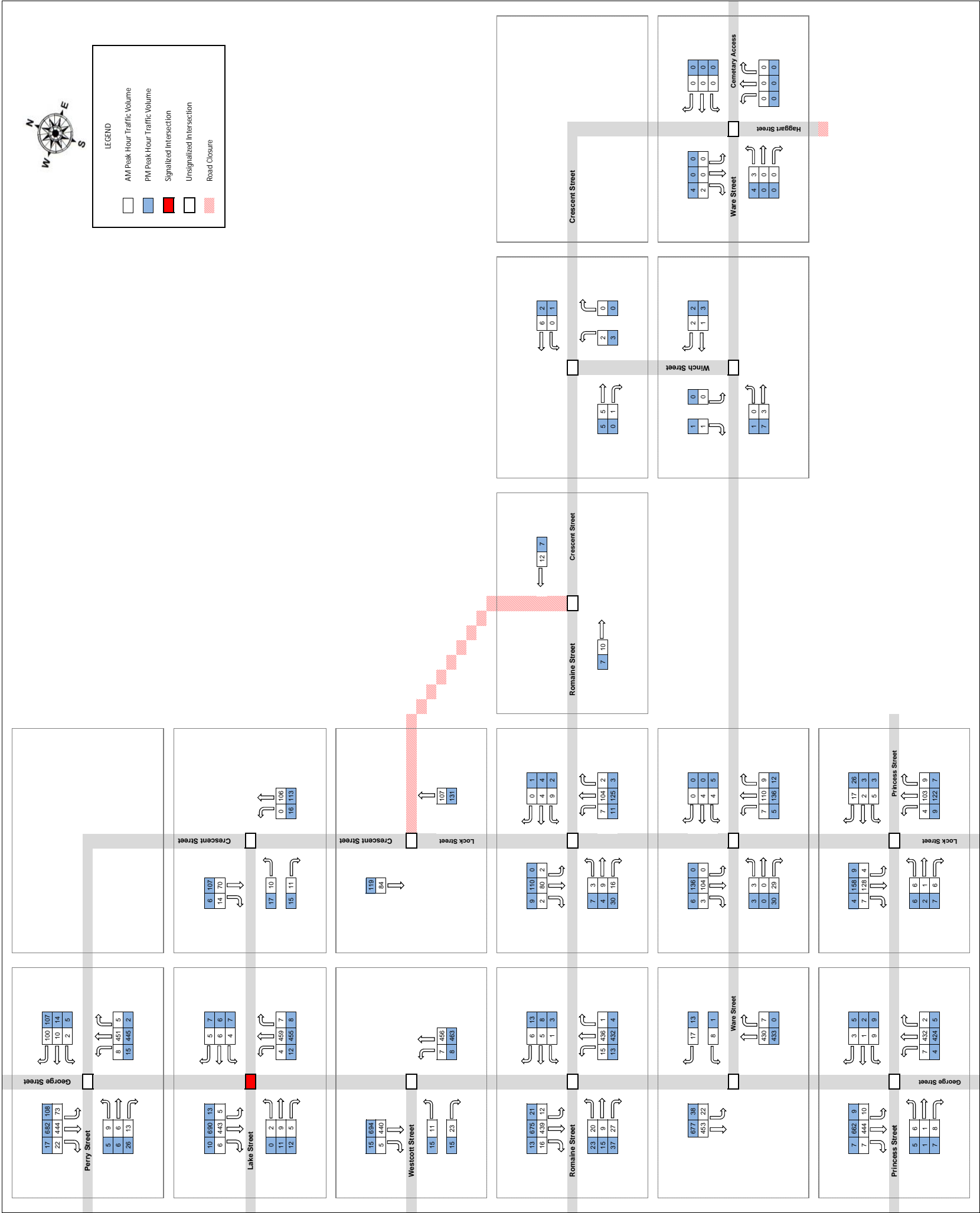


Table 4: Scenario 1 – Horizon Year 2015 Haggart Street Closure Traffic Operations (AM and PM Peak Hour)

Intersection	Approach / Movement	Storage (m)	Weekday											
			AM						PM					
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Signalized Intersection														
George Street / Lake Street	EB LTR	245.0	41.1	D	0.13	12.2	4.2	15.8	39.6	D	0.11	14.7	4.9	19.5
	WB LTR	70.0	41.2	D	0.13	12.9	3.9	16.7	39.8	D	0.14	12.9	4.6	14.8
	NB LTR	100.0	2.9	A	0.34	39.8	15.3	50.8	3.4	A	0.37	40.4	14.3	61.2
	SB LTR	50.0	2.8	A	0.33	40.8	15.7	45.9	4.8	A	0.55	53.0	21.3	51.2
Overall Intersection			4	A	0.33	-	-	-	5.5	A	0.52	-	-	-
Unsignalized Intersections														
George Street / Perry Street	EB LTR	65.0	28.1	D	0.16	14.3	6.3	15.5	41.6	E	0.30	16.8	8.1	19.3
	WB LTR	110.0	15.7	C	0.26	20.7	11.4	28.1	29.0	D	0.49	25.5	14.0	34.5
	NB LTR	50.0	0.2	A	0.01	9.5	1.2	23.5	0.6	A	0.02	24.5	6.2	40.5
	SB LTR	120.0	2.0	A	0.07	28.2	10.0	39.8	2.9	A	0.12	58.5	23.1	83.0
Crescent Street / Lake Street	EB LR	70.0	9.3	A	0.03	12.6	4.9	13.3	9.8	A	0.05	13.5	5.4	16.5
	NB TL	155.0	0.0	-	0.00	-	-	-	1.0	A	0.01	2.0	0.1	4.4
	SB TR	110.0	0.0	-	0.05	0.8	0.0	1.0	0.0	-	0.07	-	-	-
George Street / Westscott Street	EB LR	210.0	14.6	B	0.09	15.7	6.4	18.7	23.1	C	0.14	13.1	5.4	14.6
	NB TL	100.0	0.2	A	0.01	6.5	0.9	13.4	0.3	A	0.01	12.3	2.2	23.0
	SB TR	100.0	0.0	-	0.28	-	-	-	0.0	-	0.45	-	-	-
George Street / Romaine Street	EB LTR	190.0	19.7	C	0.19	18.1	9.3	20.6	34.8	D	0.40	23.7	12.3	31.6
	WB LTR	145.0	16.6	C	0.04	9.3	2.7	9.1	23.1	C	0.11	13.4	5.3	15.3
	NB LTR	105.0	0.4	A	0.01	11.6	2.4	20.7	0.5	A	0.02	19.3	5.0	29.0
	SB LTR	100.0	0.3	A	0.01	10.8	2.1	20.4	0.5	A	0.02	15.9	3.7	25.2
Lock Street / Romaine Street	EB LTR	145.0	7.2	A	0.03	12.0	4.7	9.2	7.4	A	0.05	13.6	6.5	14.1
	WB LTR	60.0	7.8	A	0.02	12.1	3.9	15.6	7.6	A	0.01	7.1	1.5	9.2
	NB LTR	125.0	7.8	A	0.14	13.9	9.7	15.2	8.1	A	0.17	17.2	11.1	19.9
	SB LTR	45.0	7.7	A	0.11	14.9	9.1	19.9	7.9	A	0.15	15.7	10.5	19.9

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Intersection	Approach / Movement	Storage (m)	Weekday											
			AM						PM					
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Winch Street / Crescent Street	EB	TR	155.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
	WB	TL	225.0	-	0.00	-	-	-	0.0	A	0.00	-	-	-
	NB	LR	85.0	A	0.00	4.7	0.7	9.0	8.6	A	0.00	5.5	0.9	7.6
George Street / Ware Street	WB	LTR	145.0	D	0.14	16.1	5.8	24.1	12.6	B	0.03	10.1	3.2	10.0
	NB	LTR	60.0	-	0.28	-	-	-	0.0	-	0.28	1.1	0.0	1.4
	SB	LTR	110.0	A	0.05	11.3	3.4	14.6	1.0	A	0.04	19.2	5.0	30.3
Lock Street / Ware Street	EB	LTR	145.0	A	0.04	12.7	5.9	10.3	9.4	A	0.04	12.6	5.7	10.2
	WB	LTR	240.0	B	0.01	7.8	1.8	9.2	11.4	B	0.01	5.4	0.9	9.2
	NB	LTR	50.0	A	0.01	1.6	0.2	2.7	0.3	A	0.00	1.5	0.2	2.1
	SB	LTR	105.0	-	0.00	1.8	0.1	1.4	0.0	-	0.00	2.4	0.2	3.8
Ware Street / Winch Street	EB	LTR	240.0	-	0.00	-	-	-	0.9	A	0.00	-	-	-
	WB	LTR	225.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
	SB	LTR	85.0	A	0.00	2.1	0.2	4.5	8.4	A	0.00	2.0	0.1	4.5
Haggart Street / Ware Street	EB	LR	225.0	A	0.00	4.9	0.8	7.7	8.5	A	0.00	5.1	0.8	9.1
	NB	TL	250.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
	SB	TR	110.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
George Street / Princess Street	EB	LTR	190.0	C	0.05	9.8	2.9	10.2	21.0	C	0.06	10.3	3.2	11.2
	WB	LTR	145.0	C	0.06	10.2	3.1	10.3	24.5	C	0.09	10.8	3.5	11.2
	NB	LTR	125.0	A	0.01	5.7	0.7	13.2	0.1	A	0.00	8.1	1.1	16.6
	SB	LTR	60.0	A	0.01	11.5	2.0	17.7	0.2	A	0.01	6.8	1.1	14.6
Lock Street / Princess Street	EB	LTR	145.0	B	0.02	10.4	3.3	10.3	10.6	B	0.02	10.3	3.3	9.3
	WB	LTR	185.0	A	0.03	14.4	5.8	17.8	9.7	A	0.04	15.8	6.8	18.4
	NB	LTR	105.0	A	0.00	1.5	0.1	3.2	0.6	A	0.01	2.6	0.3	5.6
	SB	LTR	35.0	A	0.00	1.1	0.0	1.4	0.4	A	0.01	3.6	0.4	6.6

5.1.2 Scenario 2: 2015 Haggart Street Closure and Crescent Street One-Way

The second opening-year daytime network scenario assumes the implementation of the Haggart Street closure, as well as an on-road two-way cycle track on Crescent Street (detailed in Section 3, Alternative 2). This concept requires Crescent Street to be converted to a westbound-only one-way road from Haggart Street to Lock Street. Similar to Scenario 1, the Gore will be closed for vehicular use from Romaine Street to Lock Street, with traffic re-routed to Romaine Street. Additionally, the existing parking bays along Crescent Street will be removed with the implementation of the trail. To account for the loss in parking, the City may consider implementing a parking lot adjacent to the Haggart Street closure site at the disused rail line.

All other road network attributes, such as signal timing assumptions, peak hour factors, commercial vehicle mode share, and on-road pedestrian movements are expected to remain consistent with existing conditions. **Figure 31** illustrates the road network predictions for Scenario 2.

The redistribution of traffic due to the Crescent Street westbound one-way and Haggart Street closure was conducted using a desktop analysis. With the Haggart Street closure in place, the Crescent Street eastbound through traffic is assumed to shift to Lansdowne Street, while local Crescent Street eastbound traffic is assumed to shift to Ware Street.

Figure 32 and **Figure 33** below summarize the lane configurations and traffic volumes for Scenario 2.

5.1.2.1 Intersection Operations

The results of the capacity and queuing analysis for the study area intersections for Scenario 2 (as detailed above) are summarized in **Table 5** for the AM and PM peak hours. Complete Synchro HCM Reports and SimTraffic queuing reports are provided in **Appendix C**. Heavy vehicle percentages, pedestrian movements, and key parameters are expected to remain consistent with existing conditions. Heavy vehicle percentages, pedestrian movements, and key parameters are assumed to remain consistent with existing conditions.

The operational analysis results shown in **Table 5** indicate that all intersections in the study area will operate without issue under Scenario 2 for both the AM and PM Peak hours. The signalized intersection at George Street and Lake Street is operating at an overall **LOS A**, and all unsignalized intersections are below capacity, with all approaches at V/C Ratio of **0.55** or less.

From the queue analysis, the PM Peak hour simulation revealed that the 95th queue for the southbound approach for the George Street / Lake Street intersection would slightly exceed the distance to the upstream intersection (George Street / Perry Street). Since the traffic is predominately through-traffic and the potential intersection blockage is minor, it is concluded that no network changes would be required to mitigate the blockage.

Figure 31: Scenario 2 - Horizon Year 2015 Haggart Street Closure and Crescent Street Westbound One-Way

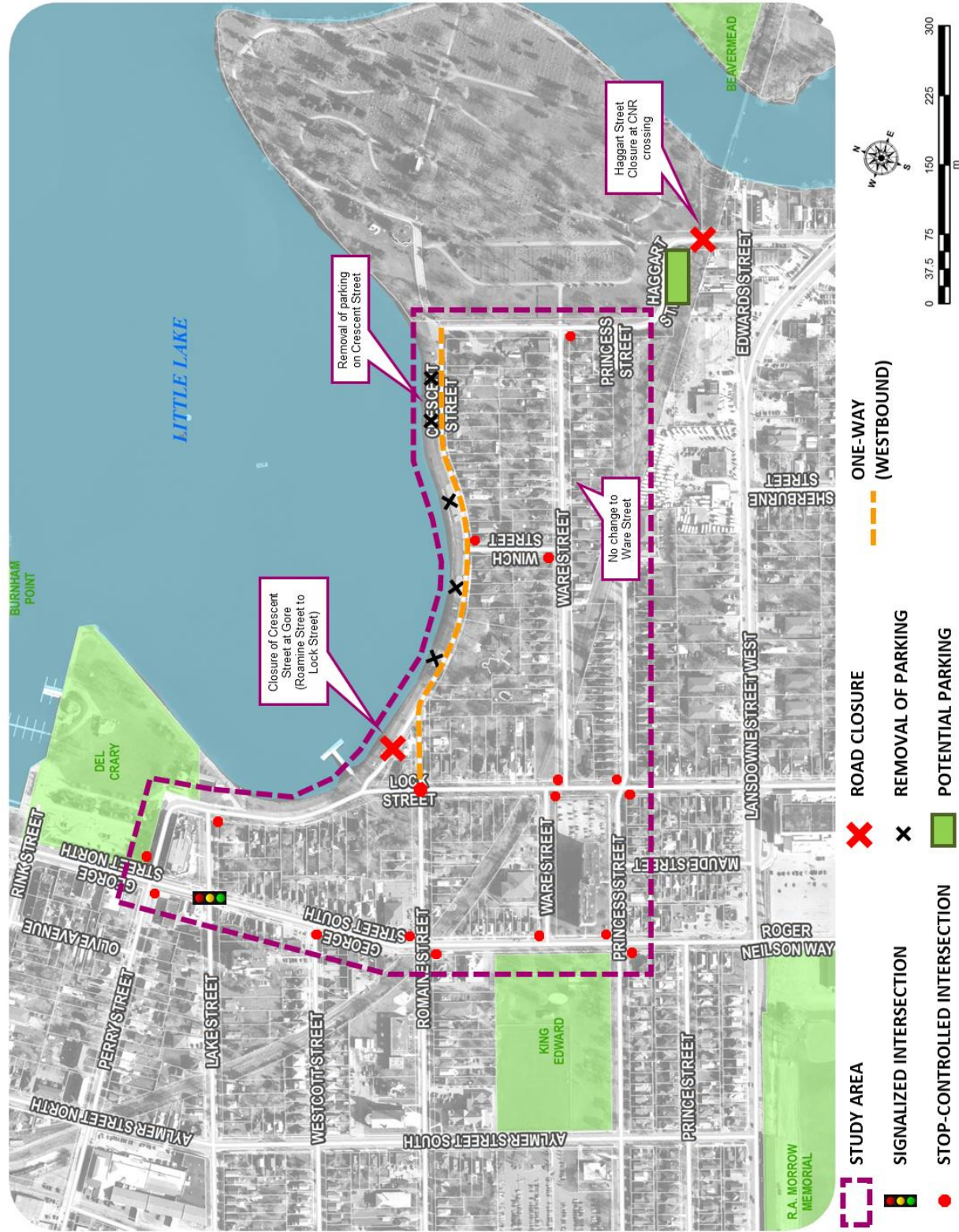


Figure 32: Scenario 2 - Horizon Year 2015 Crescent Street WB One-Way Lane Configurations

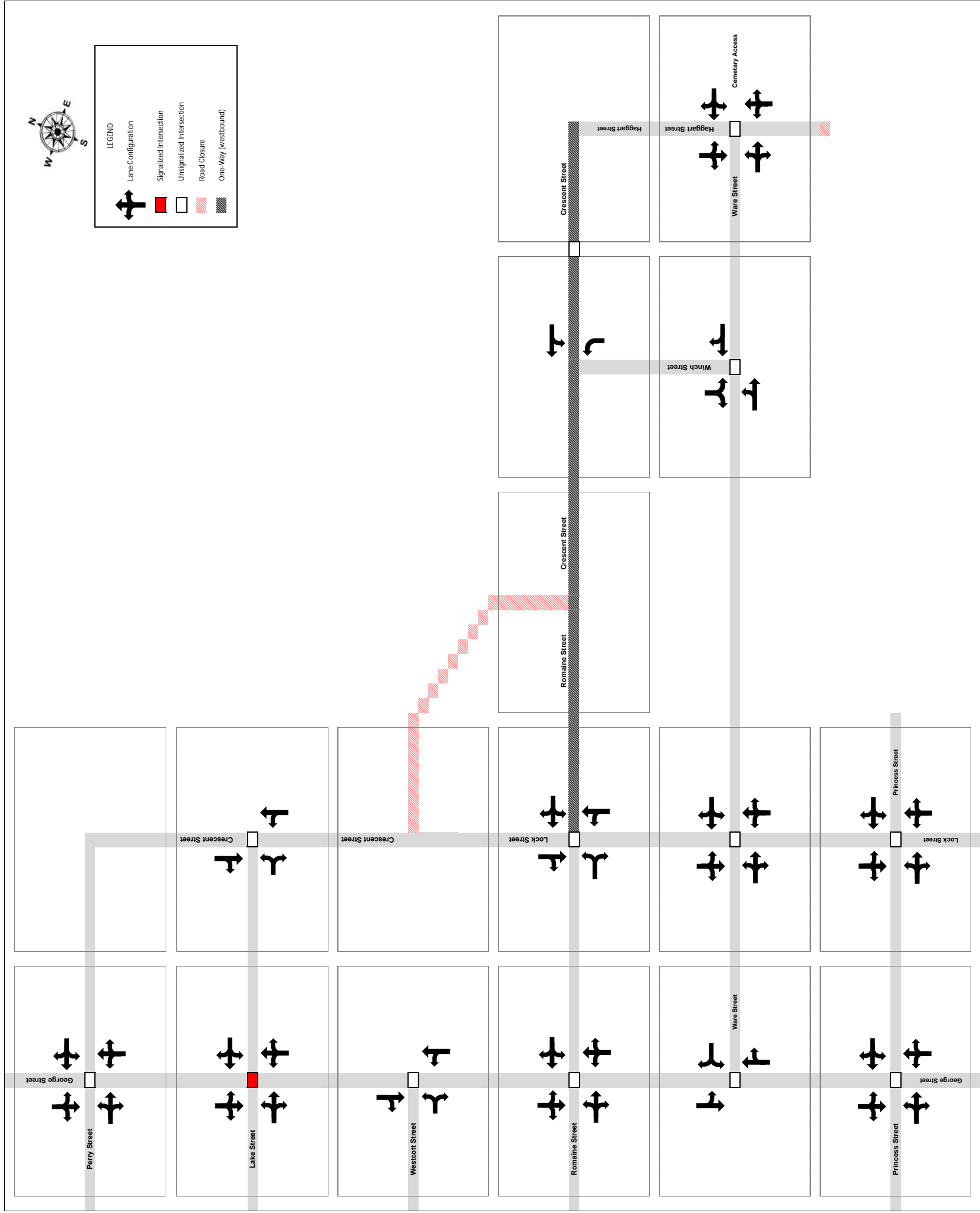


Figure 33: Scenario 2 - 2015 Crescent Street WB One-Way Traffic Volumes

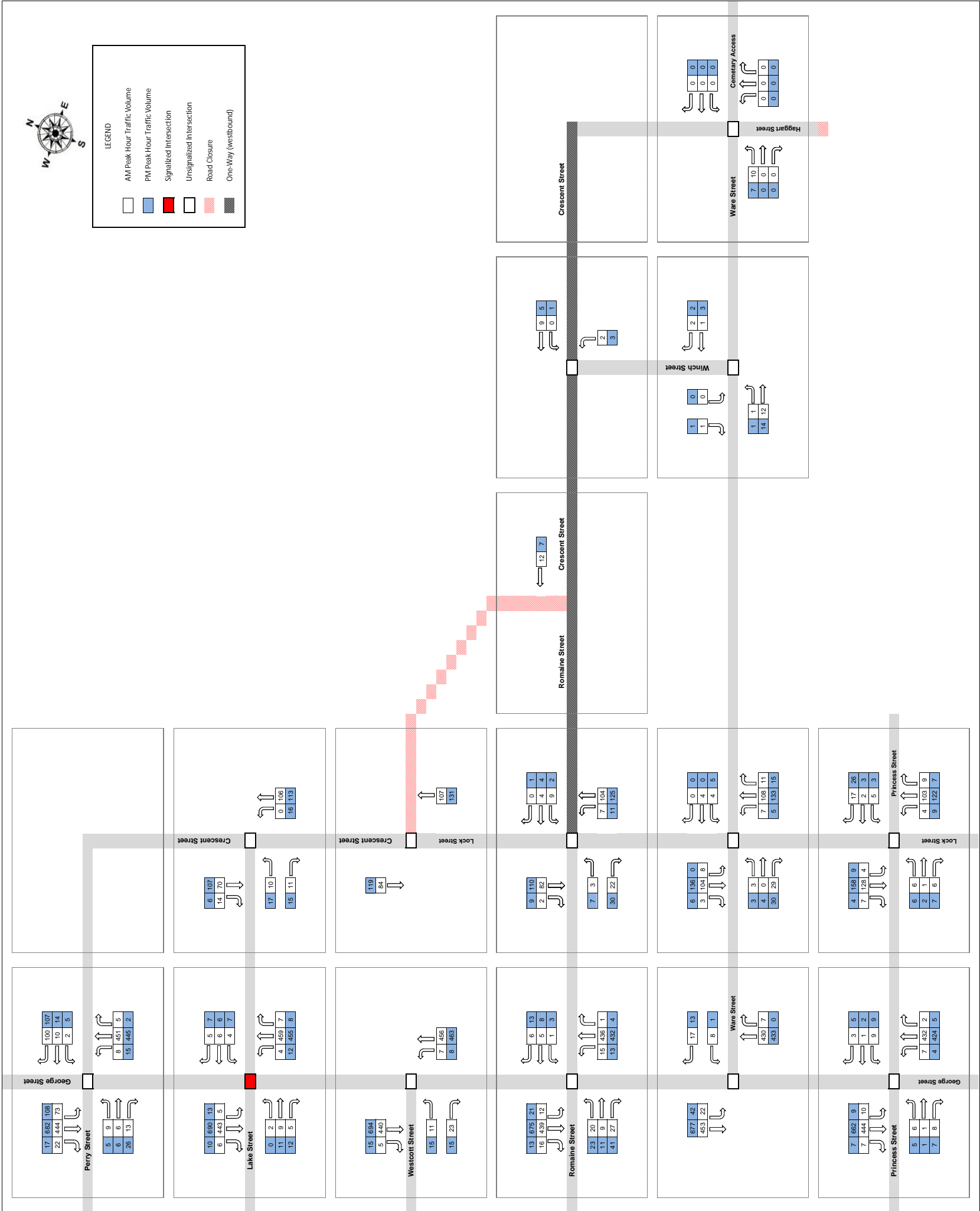


Table 5: Scenario 2 – Horizon Year 2015 Crescent Street WB One-Way Traffic Operations (AM and PM Peak Hour)

Intersection	Approach / Movement	Storage (m)	Weekday												
			AM						PM						
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	
Signalized Intersection															
George Street / Lake Street	EB	LTR	245.0	41.1	D	0.13	11.7	4.1	13.8	39.6	D	0.11	14.6	5.4	17.2
	WB	LTR	70.0	41.2	D	0.13	12.0	3.8	15.5	39.8	D	0.14	10.8	3.6	12.6
	NB	LTR	100.0	2.9	A	0.34	36.2	13.5	49.1	3.4	A	0.37	44.0	16.0	58.5
	SB	LTR	50.0	2.8	A	0.33	33.3	12.5	42.2	4.8	A	0.55	51.7	21.1	51.5
	Overall Intersection			4	A	0.33	-	-	-	5.5	A	0.52	-	-	-
Unsignalized Intersections															
George Street / Perry Street	EB	LTR	65.0	28.1	D	0.16	13.3	6.0	12.4	41.6	E	0.30	15.6	7.5	18.0
	WB	LTR	110.0	15.7	C	0.26	20.7	12.0	28.0	29.0	D	0.49	28.2	15.2	42.4
	NB	LTR	50.0	0.2	A	0.01	9.9	1.3	23.6	0.6	A	0.02	25.9	6.8	43.6
	SB	LTR	120.0	2.0	A	0.07	27.8	10.6	39.8	2.9	A	0.12	51.1	20.1	78.8
Crescent Street / Lake Street	EB	LR	70.0	9.3	A	0.03	12.5	4.6	13.7	9.8	A	0.05	13.2	6.0	10.9
	NB	TL	155.0	0.0	-	0.00	-	-	-	1.0	A	0.01	1.2	0.1	1.5
	SB	TR	110.0	0.0	-	0.05	-	-	-	0.0	-	0.07	-	-	-
George Street / Westcott Street	EB	LR	210.0	14.6	B	0.09	13.4	6.3	15.8	23.1	C	0.14	12.8	5.9	14.1
	NB	TL	100.0	0.2	A	0.01	8.9	1.4	19.3	0.3	A	0.01	19.2	2.6	36.0
	SB	TR	100.0	0.0	-	0.28	-	-	-	0.0	-	0.45	-	-	-
George Street / Romaine Street	EB	LTR	190.0	19.7	C	0.19	17.6	9.8	20.1	32.6	D	0.38	21.1	11.6	25.4
	WB	LTR	145.0	16.6	C	0.04	9.7	2.9	10.1	23.1	C	0.11	13.4	5.0	16.8
	NB	LTR	105.0	0.4	A	0.01	19.6	3.6	36.2	0.5	A	0.02	17.7	3.4	37.2
	SB	LTR	100.0	0.3	A	0.01	12.1	2.7	20.7	0.5	A	0.02	14.6	3.5	24.8
Lock Street / Romaine Street	EB	L	145.0	7.3	A	0.01	4.3	0.6	8.8	7.5	A	0.01	7.9	1.8	11.3
		R	-	6.2	-	0.03	13.8	5.6	10.5	6.4	-	0.04	14.2	6.1	11.3
	WB	LTR	60.0	7.9	A	0.02	11.6	3.5	14.7	7.7	A	0.01	7.2	1.6	9.3
	NB	TL	125.0	7.8	A	0.14	9.3	5.7	12.5	8.0	A	0.17	13.1	7.0	18.0
SB	TR	45.0	7.7	A	0.11	14.2	9.1	18.0	7.9	A	0.15	16.1	9.8	19.2	

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Intersection	Approach / Movement	Storage (m)	Weekday											
			AM						PM					
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Winch Street / Crescent Street	WB	TL	225.0	-	0.00	-	-	-	1.2	A	0.00	-	-	-
	NB	L	85.0	A	0.00	3.5	0.4	9.0	8.6	A	0.00	4.1	0.5	6.1
George Street / Ware Street	WB	LTR	145.0	D	0.14	15.2	5.9	20.2	12.6	B	0.03	10.1	3.3	9.4
	NB	LTR	60.0	-	0.28	-	-	-	0.0	-	0.28	-	-	-
	SB	LTR	110.0	A	0.05	11.2	3.5	13.4	1.1	A	0.04	22.6	6.2	39.1
Lock Street / Ware Street	EB	LTR	145.0	A	0.04	12.9	6.1	11.3	9.6	A	0.05	12.9	6.1	10.4
	WB	LTR	240.0	B	0.01	8.9	2.3	9.2	11.5	B	0.01	6.7	1.4	9.1
	NB	LTR	50.0	A	0.01	1.7	0.2	2.8	0.3	A	0.00	2.9	0.3	6.0
	SB	LTR	105.0	A	0.01	5.3	0.8	11.2	0.0	-	0.00	1.5	0.1	2.6
Ware Street / Winch Street	EB	LTR	240.0	A	0.00	-	-	-	0.5	A	0.00	-	-	-
	WB	LTR	225.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
	SB	LTR	85.0	A	0.00	3.4	0.4	7.3	8.4	A	0.00	1.7	0.1	1.5
Haggart Street / Ware Street	EB	LR	225.0	A	0.01	8.0	2.1	8.4	8.5	A	0.01	7.3	1.7	8.4
	NB	TL	250.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
George Street / Princess Street	EB	LTR	190.0	C	0.05	11.3	3.8	12.4	21.0	C	0.06	9.8	2.9	11.0
	WB	LTR	145.0	C	0.06	10.3	3.2	10.2	24.5	C	0.09	11.6	3.7	12.7
	NB	LTR	125.0	A	0.01	7.0	1.0	13.6	0.1	A	0.00	11.1	1.5	21.1
	SB	LTR	60.0	A	0.01	8.0	1.3	15.6	0.2	A	0.01	9.5	1.3	18.8
Lock Street / Princess Street	EB	LTR	145.0	B	0.02	10.8	3.6	9.3	10.6	B	0.02	10.8	3.6	10.3
	WB	LTR	185.0	A	0.03	15.2	5.8	19.1	9.7	A	0.04	15.4	7.0	18.3
	NB	LTR	105.0	A	0.00	2.8	0.2	6.7	0.6	A	0.01	2.8	0.3	5.4
	SB	LTR	35.0	A	0.00	-	-	-	0.4	A	0.01	4.3	0.5	5.3

5.1.3 Summary

The operational analysis for ORT opening year under both trail concept scenarios revealed that while traffic will be re-distributed throughout the study area road network, the intersection capacities are sufficient to accommodate increased traffic due to the volume redistribution. Under both Scenario 1 and 2, the road network continues to perform well with no network operational issues projected.

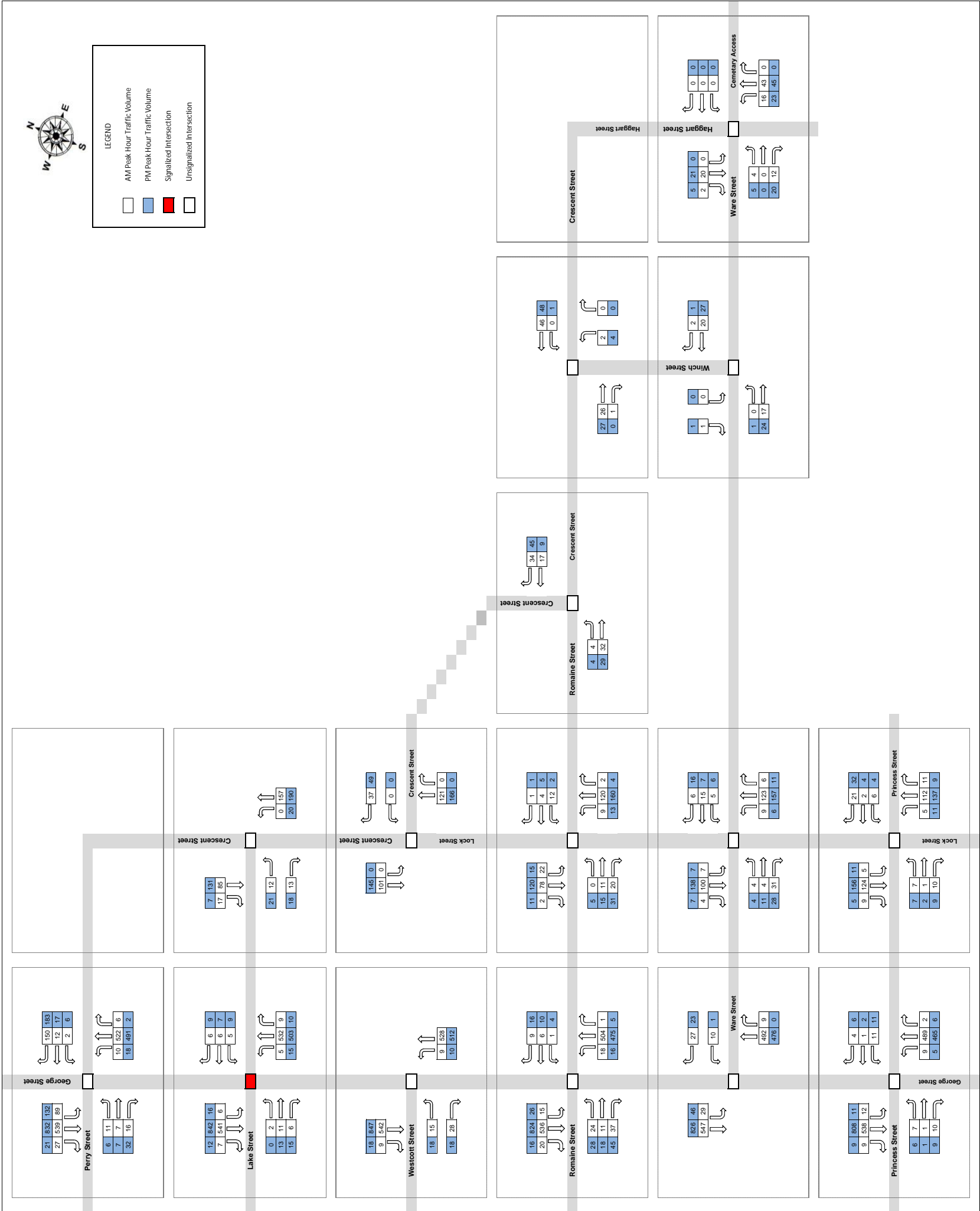
5.2 Future Traffic Conditions - Intensification

In addition to evaluating the traffic operations for the ORT opening year (2015), this section analyzes the future traffic conditions for both trail/road network scenarios. The future horizon year for this traffic study is assumed as 20 years after the opening of the trail (2035). The traffic operational analysis will take into account annual growth in traffic as well as additional traffic generated by planned intensification within the study area. Details on the intensification were provided by the City of Peterborough and the development planning consultant Gladki Planning Associates (GPA).

5.2.1 Future Background Traffic Growth

Traffic within the study area is assumed to grow by 1% annually, in accordance with traffic growth recommendations provided by Kevin Jones, Manager of Transportation at the City of Peterborough. **Figure 34** summarizes the AM and PM peak hour background traffic for the 2035 future horizon year.

Figure 34: 2035 Future “Do Nothing” Background Traffic Volumes



5.2.2 Proposed Intensification

The proposed intensification within the Little Lake study area will be primarily residential, with a mix of three-storey townhouses and low-rise condominiums. The development will occur over two major blocks:

- BLOCK 1: Crescent Street / Lake Street / George Street / Romaine Street
- BLOCK 2: Crescent Street / Haggart Street / Ware Street / Lock Street

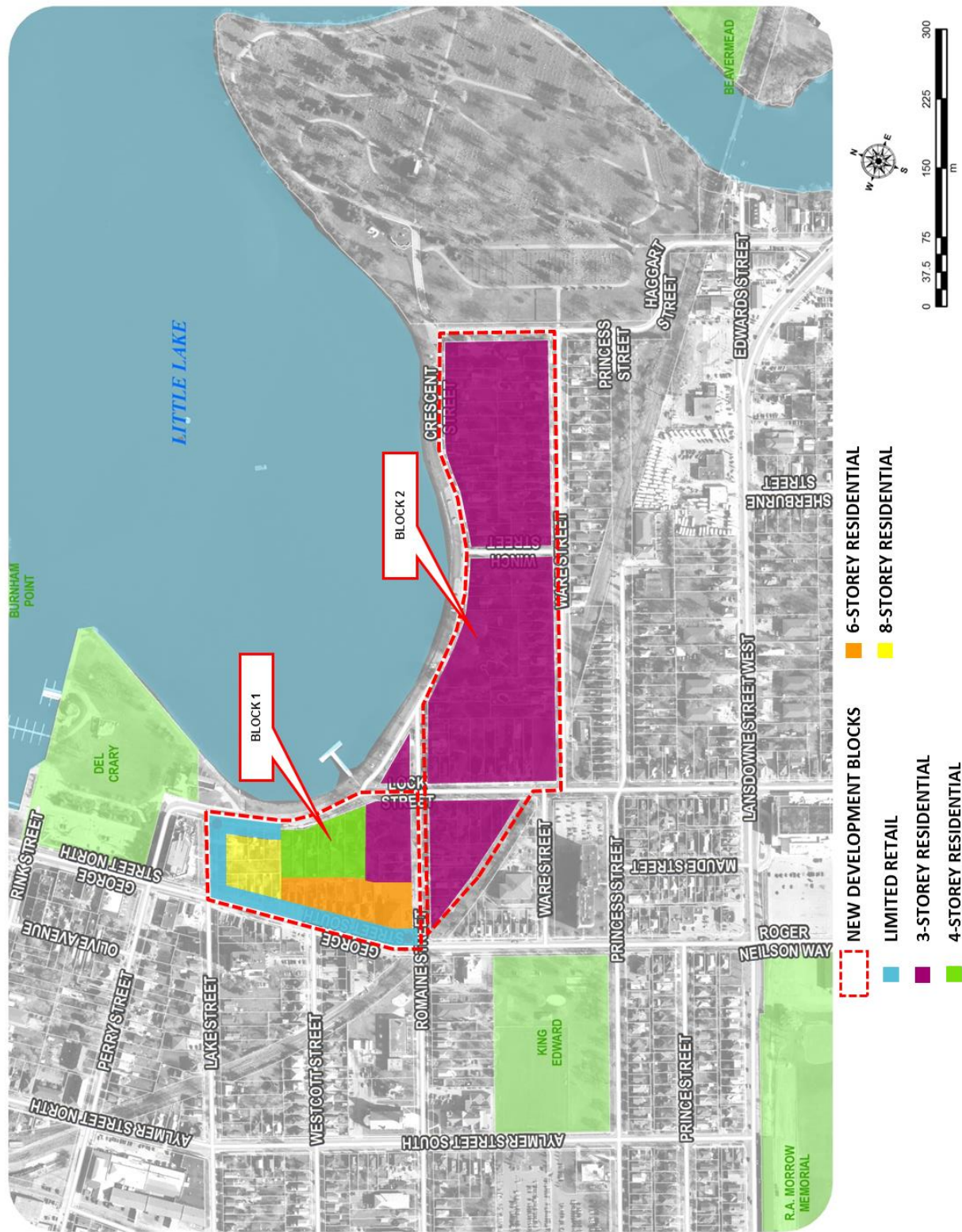
The Block 1 developments will include low-rise condominiums, townhouses, and limited ground floor retail (coffee shops, convenience stores, banks, etc.). Block 2 will consist of only three-storey townhouses. While the Gore is part of the intensification study area (Block 2), Gladki Planning Associates indicated that the Gore would not be re-developed as part of the intensification.

It should be noted that the intensification being proposed is currently at a planning phase. Thus for the purpose of this traffic study, some reasonable projections were made regarding future site traffic based on discussions with the City and GPA. The future intensification at Block 1 and Block 2 are considered long-term improvements, with the full build-out schedule extending beyond the 2035 ultimate horizon year for this study. Through guidance from the City of Peterborough and GPA, it was assumed that by 2035 Block 1 would achieve full development while Block 2 would be partially developed. The property parcels in the Block 2 boundaries are being acquired for development as they become available, and as groups of adjacent parcels are acquired, areas within Block 2 would start to see development from the existing single-detached homes to three-storey townhouses.

Recognizing that the detailed design and layout of the proposed intensification has yet to be finalized, a conservative approach was for future intensification was adopted for this traffic study, estimating the new developments will consist of 400 total dwelling units by 2035.

Figure 35 below shows the predicted location of the proposed developments.

Figure 35: Future Development Intensification Overview



5.2.2.1 Trip Generation for Site Traffic

The site traffic from the proposed intensification was estimated using trip rates from the ITE trip generation guide (9th edition) for both residential and commercial land use types. The trip generation is summarized in **Table 6** below.

Table 6: Trip Generation for Proposed Intensification

Land Use	Source	Unit (s)	New Development Generated Trips					
			AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
BLOCK 1								
Commercial	ITE (820)	3879 sq. m.	25	15	40	74	81	155
	Pass-by Reduction		50.29%	50.29%		50.29%	50.29%	
	Net Commercial		12	8	20	37	41	78
Condominium (8 floors)	ITE (230)	55	4	20	24	19	9	28
Condominium (6 floors)	ITE (230)	53	4	20	24	19	9	28
Condominium (4 floors)	ITE (230)	36	3	13	16	12	6	19
Townhouses (3 floors)	ITE (230)	24	2	9	11	8	4	13
BLOCK 2								
Townhouses (3 floors)	ITE (230)	45	8	25	34	28	17	45
TOTAL TRIPS			33	94	128	124	86	210

The proposed new developments are expected to generate a net 33 trips inbound and a net 94 trips outbound, resulting in a total of 128 trips in the AM Peak hour. In the PM Peak hour, the sites are expected to generate a net 124 inbound trips and a net 86 outbound trips, resulting in a total of 210 trips.

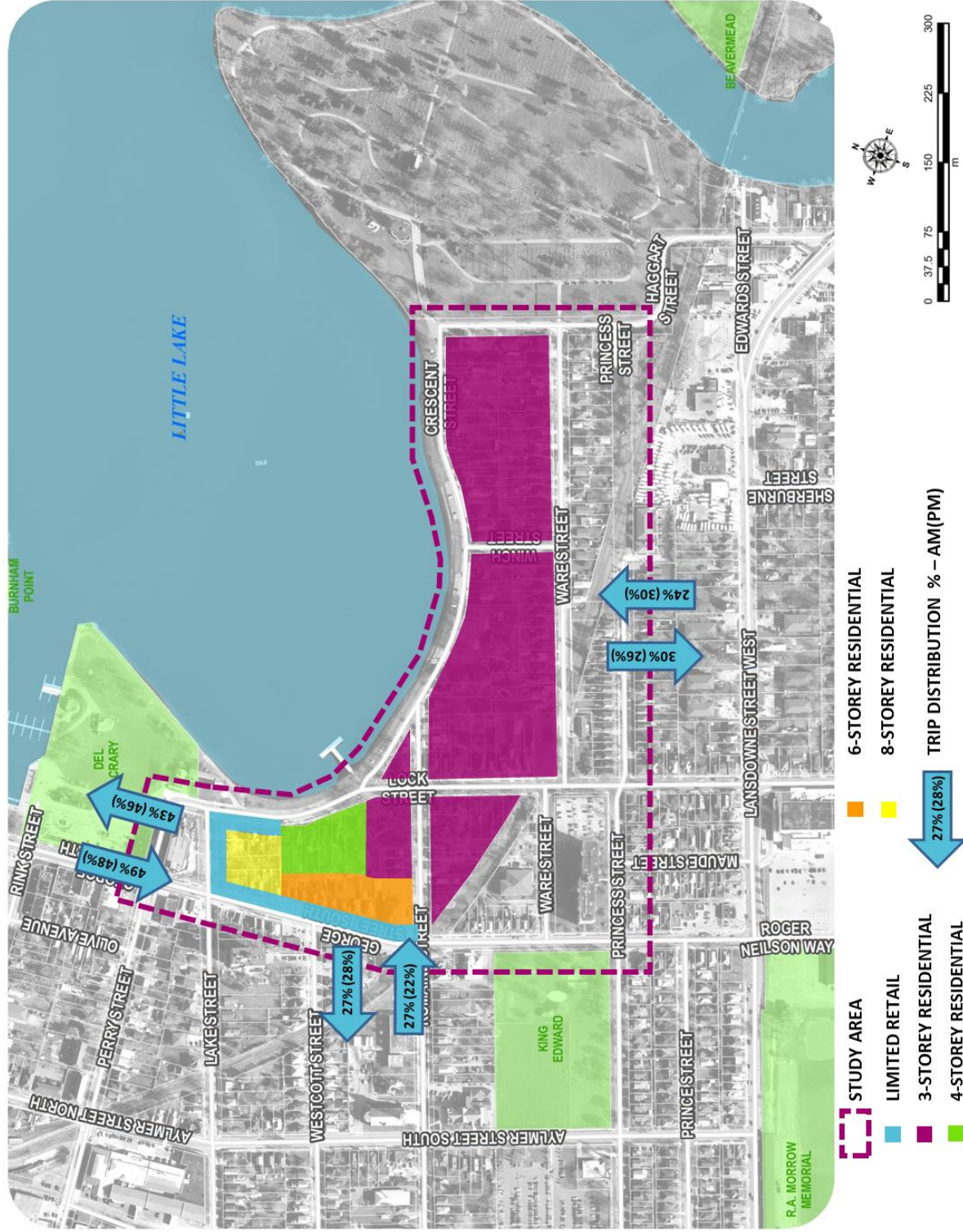
5.2.2.2 Trip Distribution

The future trip distribution for the development-generated traffic is assumed to remain consistent with present-day trip-making patterns for the Little Lake Study area. Trip distribution patterns were extracted from the 2011 Transportation Tomorrow Survey (TTS)¹³. The distribution of proposed site traffic is summarized in **Figure 36** below.

Since this traffic study is not considering site access operations, it is assumed that the traffic generated at Block 1 and Block 2 evenly loads onto the adjacent road network.

¹³ The Transportation Tomorrow Survey is a comprehensive travel survey conducted every 5 years for southern Ontario.

Figure 36: Proposed Intensification Trip Distribution



5.2.2.3 Horizon Year 2035 - "Do Nothing" Traffic Operations

Figure 37 below summarizes the proposed intensification site traffic as it is assigned through the road network, and **Figure 38** shows the total 2035 horizon year traffic under the "Do Nothing" road configuration. The lane configuration for the future "Do Nothing" scenario is consistent with the existing scenario, summarized in **Figure 8**.

The results of the capacity and queuing analysis for the study area intersections for 2035 "Do Nothing" are summarized in **Table 7** for the AM and PM peak hours. Complete Synchro HCM Reports and SimTraffic queuing reports are provided in Appendix C. Heavy vehicle percentages, pedestrian movements, and key parameters are assumed to remain consistent with existing conditions.

The operational analysis results shown in **Table 7** indicate that, with the exception of two intersections, the study area signalized intersection are projected to operate at an overall LOS A and unsignalized intersections will operate below capacity with all approaches at a V/C ratio of 0.71 or less. The excepted intersections are:

- George Street at Perry Street:
 - Eastbound (LTR) and westbound (LTR) approaches are at V/C ratio of 1.16 or less and an overall LOS F.
 - Eastbound (LTR) and southbound (LTR) 95th and max queue in excess of distance from nearest upstream intersection.
- George Street at Romaine Street:
 - Eastbound (LTR) and westbound (LTR) approaches are at V/C ratio of 1.15 or less and an overall LOS F.

The PM Peak hour 2035 "Do Nothing" traffic simulation forecasted high queues for the westbound approach at the George Street / Perry Street intersection, which would curve around the Perry Street / Crescent Street bend and block the Crescent Street / Lake Street intersection. While this issue was revealed in this operational analysis, it is important to consider that the traffic model assigns trips to the network statically, and thus does not account for shifts in driver behaviour due to traffic conditions. As shown in **Figure 38**, the total traffic making right turns at George Street / Perry Street is far greater than those at George Street / Lake Street and George Street / Romaine Street. Thus in reality, drivers attempting the right turn, left turn or through movement at George Street / Perry Street would not elect to wait in traffic when other viable options to access George Street exist. Drivers would naturally shift to Lake Street where the right turns can be regulated by George Street / Lake Street signalized intersection, or at Romaine Street further south.

Similarly, the eastbound and westbound traffic approaching the George Street / Romaine Street intersection (forecasted as LOS F) would likely be re-distributed to the available capacity at adjacent facilities, such as the signalized intersection at George Street / Lake Street.

With these rationalizations considered, it can be concluded that the 2035 "Do Nothing" road network will be able to accommodate the future traffic within the study area from both natural traffic growth and the proposed intensification.

Figure 37: Horizon Year 2035 - Proposed Intensification Site Traffic (AM & PM Peak Hour)

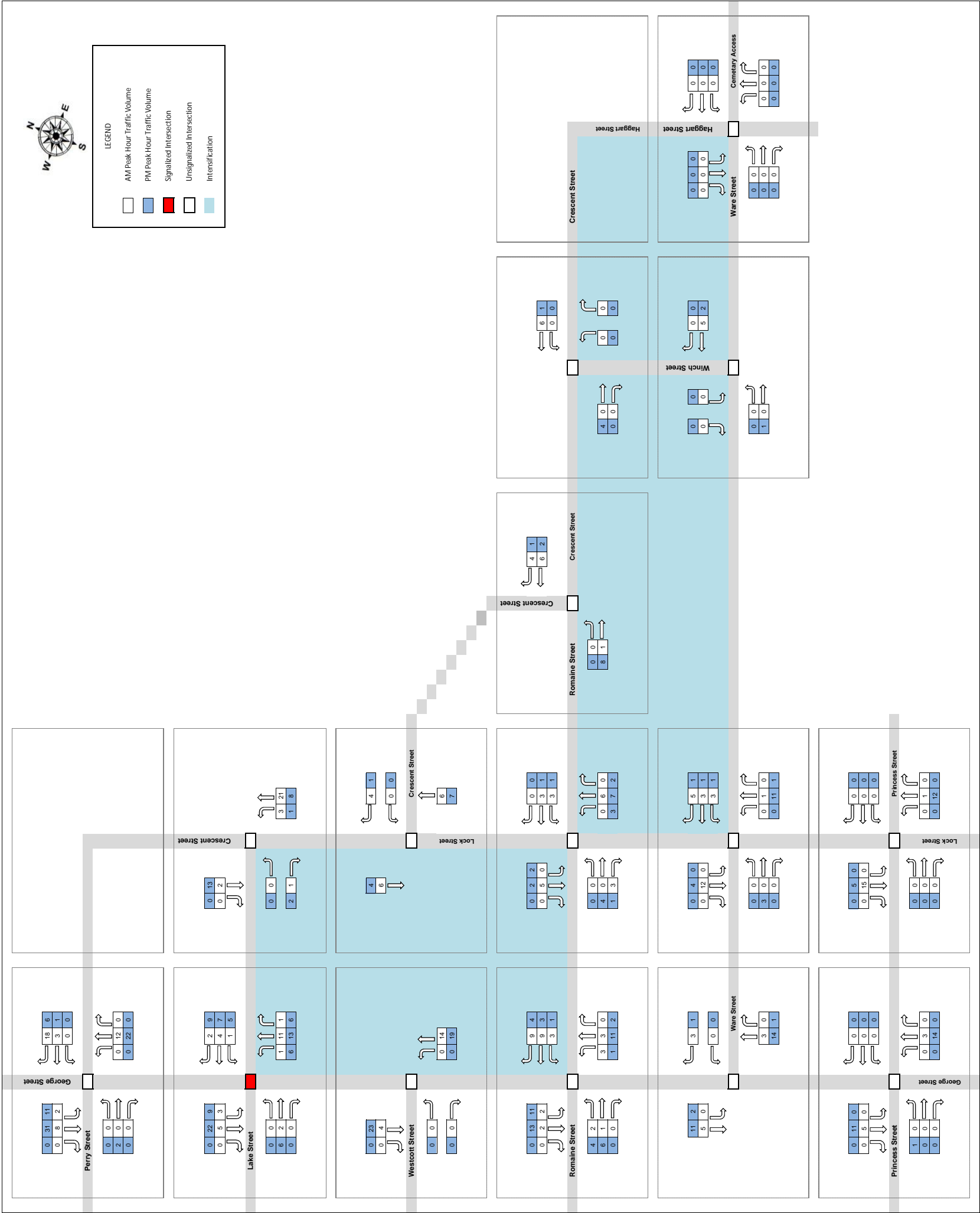


Figure 38: Horizon Year 2035 - “Do Nothing” Total Traffic (including Intensification)

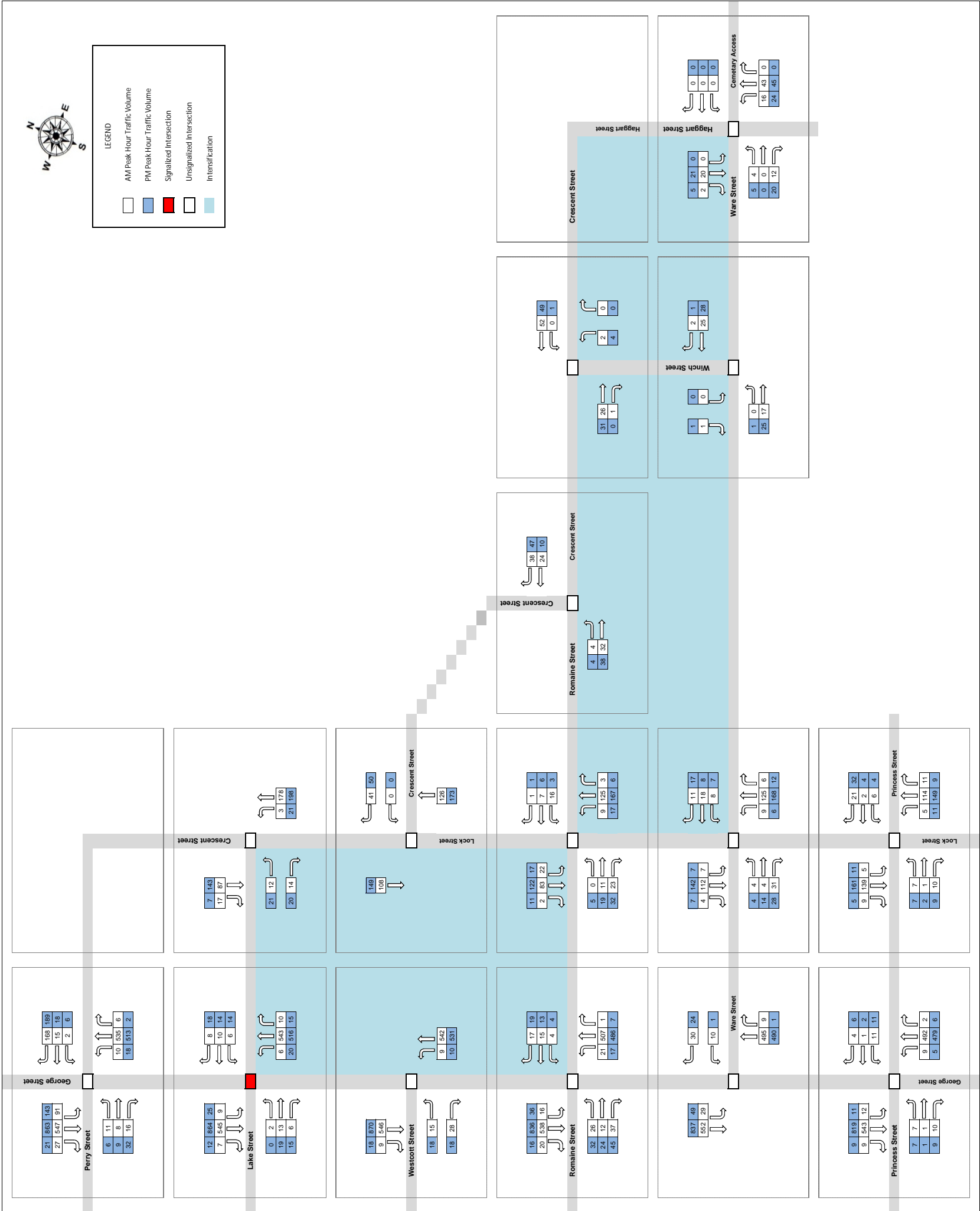


Table 7: Horizon Year 2035 - “Do Nothing” Traffic Operations (AM and PM Peak Hour)

Intersection	Approach / Movement	Storage (m)	Weekday													
			AM						PM							
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue		
Signalized Intersection																
George Street / Lake Street	EB	LTR	245.0	D	0.13	12.7	4.5	15.8	39.8	D	0.18	18.1	7.9	22.5		
	WB	LTR	70.0	D	0.17	17.8	6.9	21.0	40.8	D	0.29	17.2	7.0	19.7		
	NB	LTR	100.0	A	0.42	56.1	22.7	64.4	4.0	A	0.44	62.1	27.0	83.5		
	SB	LTR	50.0	A	0.41	50.1	21.3	51.6	7.4	A	0.71	64.4	35.4	52.5		
	Overall Intersection		5.1	A	0.4	-	-	-	7.9	A	0.67	-	-	-	-	
Unsignalized Intersections																
George Street / Perry Street	EB	LTR	65.0	F	0.41	16.7	7.9	19.6	309.3	F	1.12	29.8	14.0	41.1		
	WB	LTR	110.0	C	0.52	38.1	19.6	52.9	161.6	F	1.16	113.2	61.9	97.0		
	NB	LTR	50.0	A	0.01	12.5	2.4	21.6	0.8	A	0.03	40.4	12.3	49.6		
	SB	LTR	120.0	A	0.10	57.1	22.3	84.5	4.6	A	0.17	130.9	65.2	119.7		
Crescent Street / Lake Street	EB	LR	70.0	A	0.04	13.1	5.3	15.2	10.6	B	0.07	31.7	12.5	41.0		
	NB	TL	155.0	A	0.00	1.7	0.1	3.0	0.9	A	0.02	74.7	18.6	94.6		
	SB	TR	110.0	-	0.07	-	-	-	0.0	-	0.10	0.9	0.0	1.3		
George Street / Westscott Street	EB	LR	210.0	C	0.15	15.9	7.2	22.0	44.0	E	0.30	15.9	6.9	18.7		
	NB	TL	100.0	A	0.01	15.9	2.6	31.8	0.6	A	0.02	24.1	5.1	34.0		
	SB	TR	100.0	-	0.35	1.2	0.1	1.5	0.0	-	0.57	1.3	0.1	1.3		
Lock Street / Crescent Street	WB	R	85.0	A	0.05	6.1	1.2	9.0	9.6	A	0.07	17.9	3.6	22.6		
	NB	L	45.0	-	0.08	-	-	-	0.0	-	0.11	13.6	1.5	9.5		
	SE	R	160.0	-	0.07	-	-	-	0.0	-	0.10	-	-	-		
	EB	LTR	190.0	D	0.36	22.2	12.0	28.4	223.1	F	1.15	39.7	19.1	54.4		
George Street / Romaine Street	WB	LTR	145.0	C	0.16	14.7	6.4	19.4	53.7	F	0.34	26.0	12.7	38.6		
	NB	LTR	105.0	A	0.02	21.0	5.8	31.6	0.8	A	0.03	31.6	5.8	66.3		
	SB	LTR	100.0	A	0.02	17.8	4.3	30.8	1.0	A	0.04	31.9	11.3	42.6		
Lock Street / Romaine Street	EB	LTR	145.0	A	0.04	12.9	6.0	10.4	7.8	A	0.07	14.0	9.0	15.9		
	WB	LTR	60.0	A	0.04	13.6	5.1	15.0	7.8	A	0.01	9.3	2.6	9.3		
	NB	LTR	125.0	A	0.18	15.1	10.3	17.1	8.6	A	0.24	20.1	12.5	25.7		
	SB	LTR	45.0	A	0.14	15.9	10.3	19.2	8.3	A	0.19	16.6	11.0	20.8		

Intersection	Approach / Movement	Storage (m)	Weekday												
			AM						PM						
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	
Romaine Street / Crescent Street	WB	TL	60.0	2.9	A	0.02	-	-	-	1.3	A	0.01	-	-	-
	NE	LR	155.0	8.5	A	0.04	0.5	0.0	0.7	8.5	A	0.04	-	-	-
Winch Street / Crescent Street	EB	TR	155.0	0.0	-	0.02	-	-	-	0.0	-	0.02	-	-	-
	WB	TL	225.0	0.0	-	0.00	-	-	-	0.2	A	0.00	-	-	-
	NB	LR	85.0	8.9	A	0.00	3.4	0.4	8.9	9.1	A	0.01	5.8	1.1	9.0
	WB	LR	145.0	16.3	C	0.12	15.2	7.2	19.1	14.6	B	0.07	11.6	4.3	11.5
George Street / Ware Street	NB	TR	60.0	0.0	-	0.32	-	-	-	0.0	-	0.31	2.5	0.2	4.8
	SB	TL	110.0	0.8	A	0.03	19.9	5.3	33.7	1.5	A	0.06	30.9	9.9	46.7
	EB	LTR	145.0	9.6	A	0.05	13.3	6.5	13.4	10.5	B	0.07	14.3	7.5	14.4
Lock Street / Ware Street	WB	LTR	240.0	10.9	B	0.06	13.4	6.5	11.3	10.9	B	0.05	14.3	6.5	15.3
	NB	LTR	50.0	0.5	A	0.01	4.1	0.5	8.5	0.3	A	0.00	1.4	0.1	3.4
	SB	LTR	105.0	0.5	A	0.01	3.9	0.5	8.0	0.4	A	0.01	4.4	0.6	7.8
Ware Street / Winch Street	EB	TL	240.0	0.0	-	0.00	-	-	-	0.3	A	0.00	-	-	-
	WB	TR	225.0	0.0	-	0.02	-	-	-	0.0	-	0.02	-	-	-
	SB	LR	85.0	8.4	A	0.00	2.6	0.5	4.3	8.5	A	0.00	2.7	0.2	7.3
Haggart Street / Ware Street	EB	LR	225.0	8.6	A	0.02	10.6	3.5	9.2	8.7	A	0.03	12.5	5.3	10.6
	NB	TL	250.0	2.0	A	0.01	1.7	0.1	3.0	2.6	A	0.02	2.3	0.2	5.5
	SB	TR	110.0	0.0	-	0.01	-	-	-	0.0	-	0.02	-	-	-
George Street / Princess Street	EB	LTR	190.0	19.6	C	0.07	10.1	3.2	10.1	29.2	D	0.11	11.9	4.1	13.0
	WB	LTR	145.0	25.1	D	0.09	11.6	4.1	11.3	34.9	D	0.15	13.4	4.8	15.7
	NB	LTR	125.0	0.3	A	0.01	11.3	2.1	22.2	0.2	A	0.01	16.6	2.1	28.0
	SB	LTR	60.0	0.3	A	0.01	11.1	1.9	21.3	0.3	A	0.01	12.6	1.8	30.0
Lock Street / Princess Street	EB	LTR	145.0	10.4	B	0.02	11.2	3.9	10.5	10.9	B	0.03	11.2	3.9	9.3
	WB	LTR	185.0	10.0	A	0.04	16.1	6.8	19.0	10.0	B	0.06	15.2	6.9	17.5
	NB	LTR	105.0	0.3	A	0.00	2.9	0.3	7.8	0.6	A	0.01	3.2	0.4	8.1
	SB	LTR	35.0	0.3	A	0.00	3.1	0.3	5.1	0.5	A	0.01	3.5	0.4	6.7

5.2.3 Scenario 3: 2035 Haggart Street Closure with Intensification

Scenario 3 analyzes the Haggart Street closure under 2035 future conditions, with the proposed intensification in place. The background 1% annual traffic growth was applied to the Scenario 1 total volumes such that the traffic redistribution due to the Haggart Street closure is consistent with Scenario 1 distribution assumptions. Please refer to Section 5.1.1 for more details of the road network and traffic redistribution. **Figure 39** summarizes the Scenario 4 road network assumptions. **Figure 40** and **Figure 41** show the lane configurations and future background traffic (without intensification) for Scenario 3.

Redistribution of site traffic with the Haggart Street closure in place, inbound/outbound traffic for Intensification Block 2 utilizing Haggart Street to access Lansdowne Street was redistributed to the Lock Street corridor. Eastbound through-traffic on Crescent Street and Ware Street generated by the new developments was re-assigned as westbound traffic which would then turn left onto Lock Street and exit the study area. Similarly, westbound through traffic from Haggart Street was re-distributed to Lock Street northbound. **Figure 42** and **Figure 43** summarize the new development site traffic and total traffic for Scenario 3, respectively.

5.2.3.1 Intersection Operations

The results of the capacity and queuing analysis for the study area intersections for Scenario 3 are summarized in **Table 8** for the AM and PM peak hours. Complete Synchro HCM Reports and SimTraffic queuing reports are provided in **Appendix C**. Heavy vehicle percentages, pedestrian movements, and key parameters are assumed to remain consistent with existing conditions.

The operational analysis results shown in **Table 8** indicate that, with the exception of three intersections, the study area signalized intersection is projected to operate at an overall LOS A and unsignalized intersections are projected to operate below capacity with all approaches at a V/C ratio of **0.71** or less. The excepted intersections are:

- George Street at Perry Street:
 - Eastbound (LTR) and westbound (LTR) approaches are at V/C ratio of 1.24 or less and an overall LOS F.
 - Westbound (LTR) and southbound (LTR) 95th and max queue in excess of distance from nearest upstream intersection.
- George Street at Westcott Street:
 - Eastbound (LR) approach at overall LOS F.
- George Street at Romaine Street:
 - Eastbound (LTR) and Westbound (LTR) approaches are at V/C ratio of 1.34 or less and an overall LOS F.

As with the PM Peak hour 2035 “Do Nothing” traffic simulation, the Scenario 3 simulation forecasted high queues for the westbound approach at the George Street / Perry Street intersection, blocking Crescent Street / Lake Street. The same rationale as stated for the 2035 “Do Nothing” scenario can be applied here, such that in reality, drivers would re-route to parallel roads with available capacity to avoid congestion at the George Street / Perry Street intersection. Similar shifts would occur at the congested eastbound/westbound approaches at George Street / Westcott Street and George Street / Romaine Street.

With these rationalizations considered, it can be concluded that the 2035 Haggart Street Closure scenario road network will be able to accommodate the future traffic within the study area from both natural traffic growth and the proposed intensification.

Figure 39: Scenario 3 – Horizon Year 2035 Haggart Street Closure with Intensification

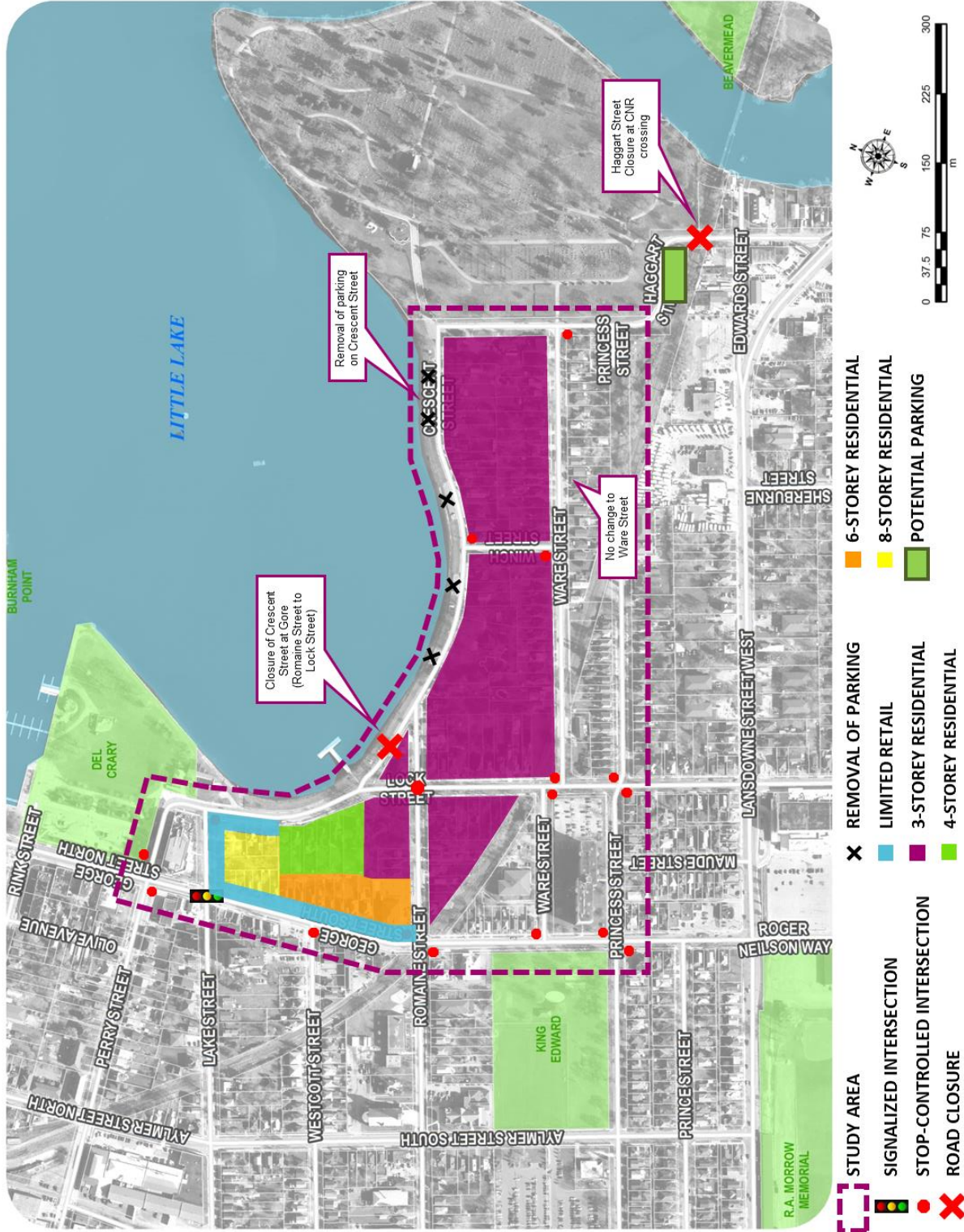


Figure 40: Scenario 3: 2035 Haggart Street Closure Lane Arrangements

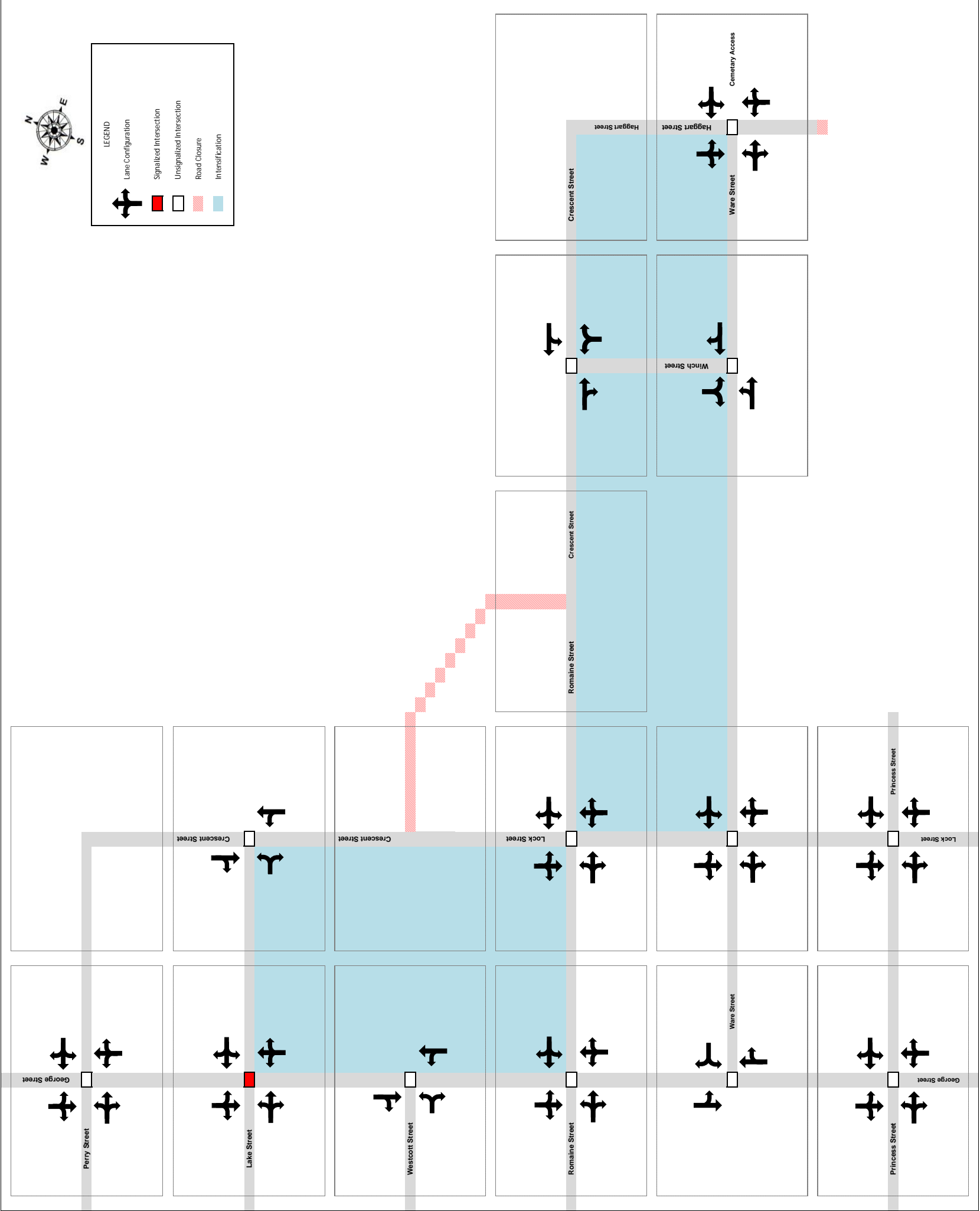


Figure 41: Scenario 3: 2035 Haggart Street Closure Background Traffic

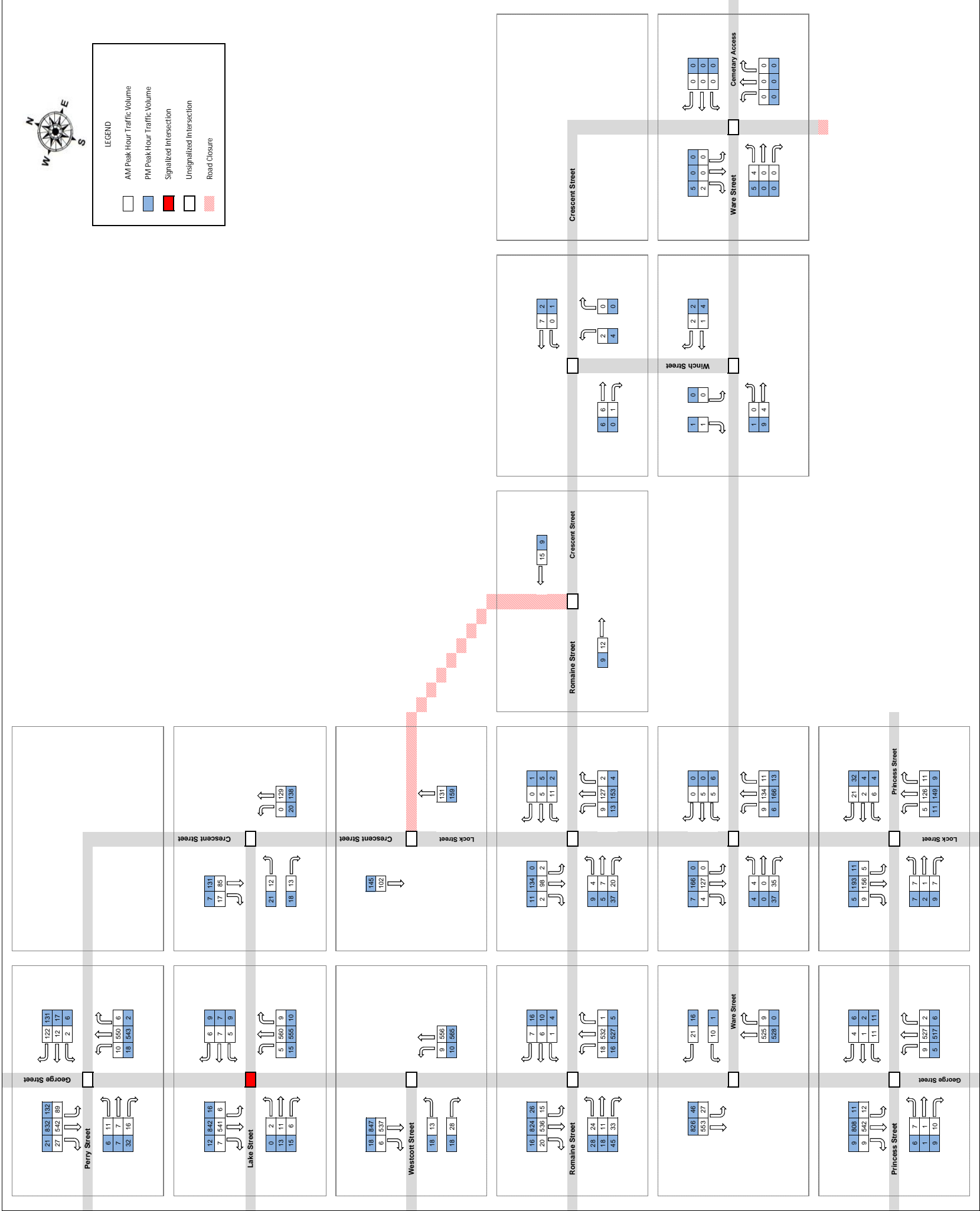


Figure 42: Scenario 3: 2035 Haggart Street Closure New Development Traffic

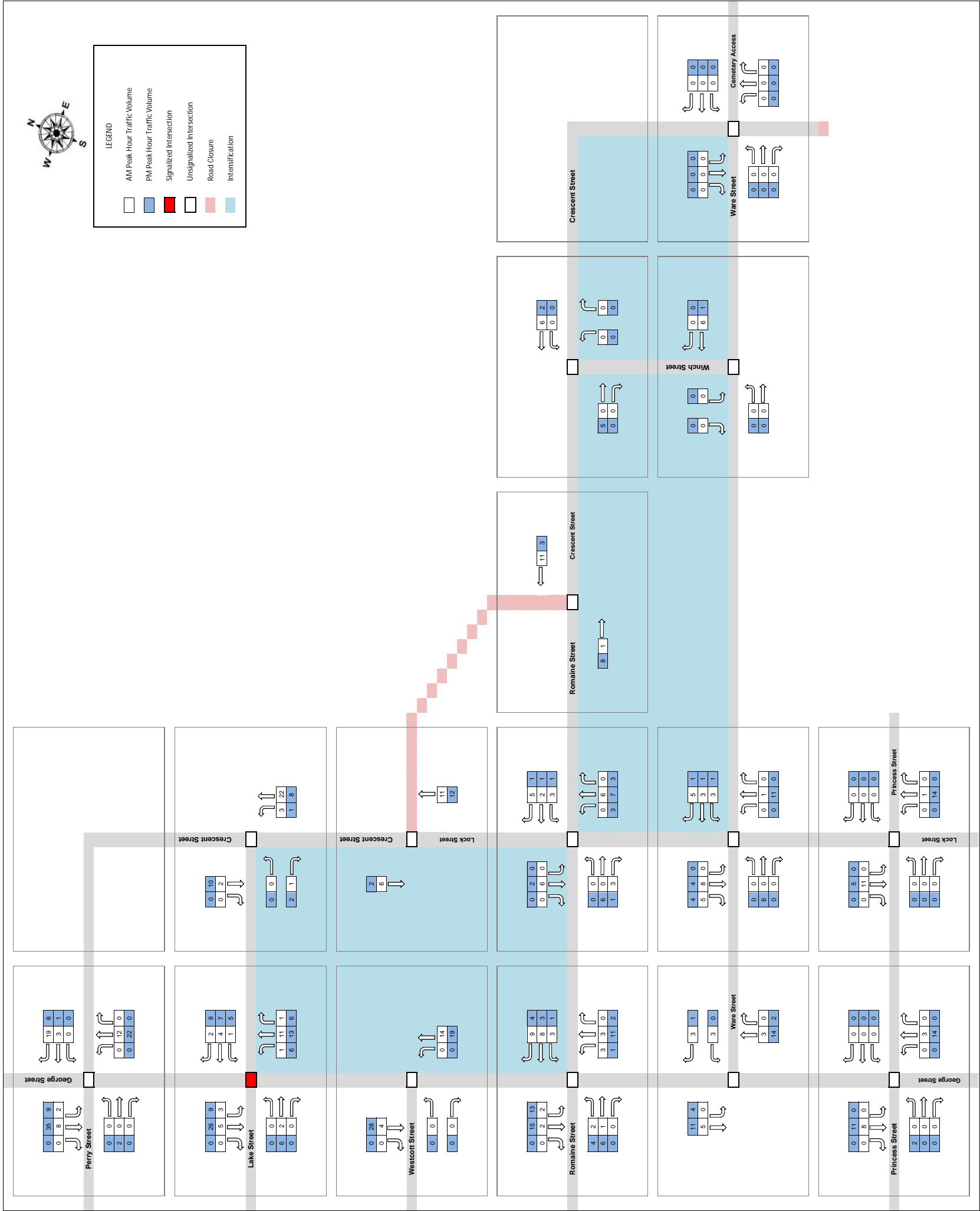


Figure 43: Scenario 3: 2035 Haggart Street Closure Total Traffic

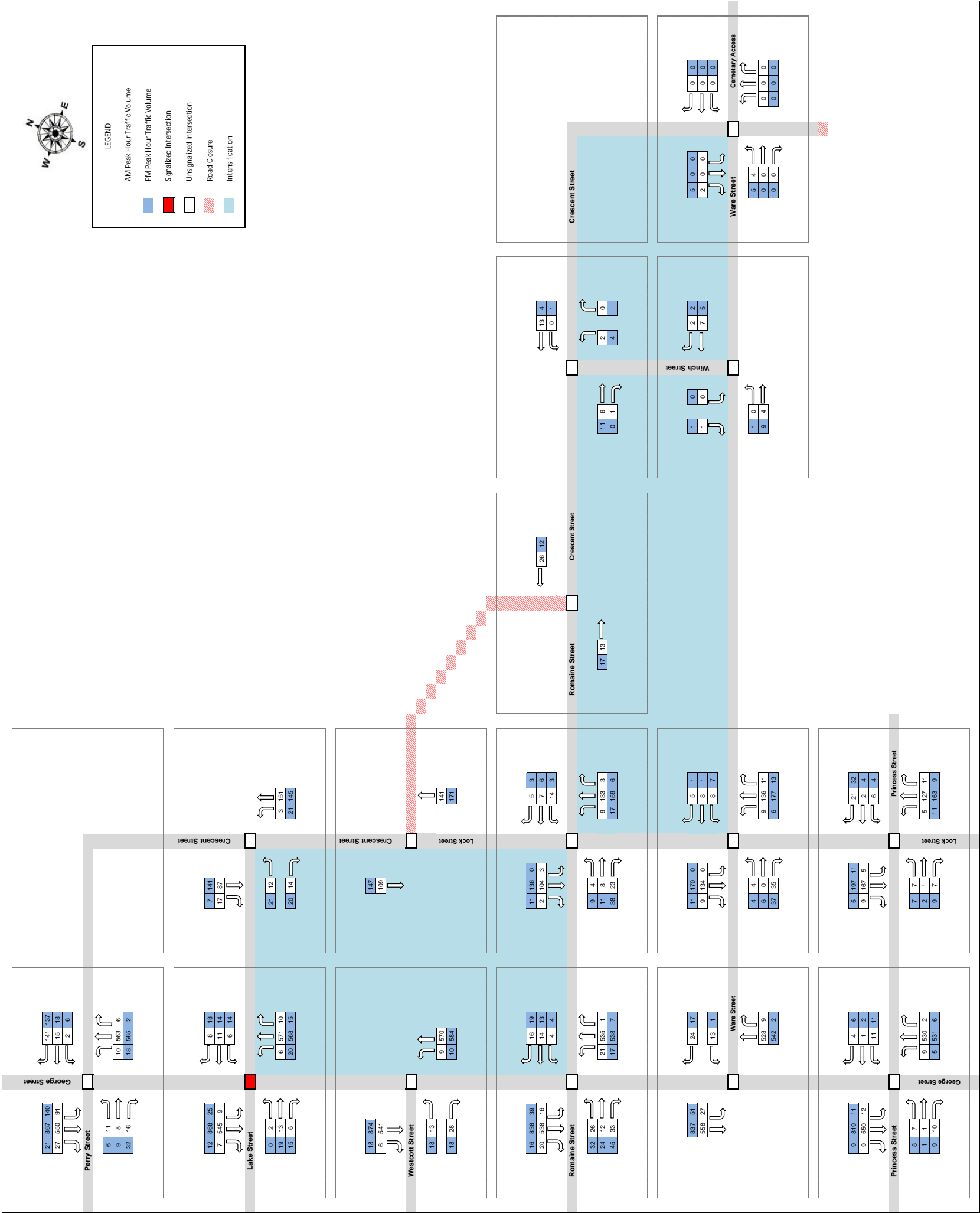


Table 8: Scenario 3 – Horizon Year 2035 Haggart Street Closure Traffic Operations (AM and PM Peak Hour)

Intersection	Approach / Movement	Storage (m)	Weekday												
			AM						PM						
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	
Signalized Intersection															
George Street / Lake Street	EB	LTR	245.0	39.6	D	0.13	12.5	4.4	16.8	39.8	D	0.18	40.2	11.2	33.0
	WB	LTR	70.0	40.1	D	0.18	17.8	6.7	26.4	40.8	D	0.29	18.9	8.2	24.5
	NB	LTR	100.0	3.9	A	0.44	49.9	20.8	61.1	4.4	A	0.48	95.9	44.7	98.4
	SB	LTR	50.0	3.7	A	0.41	49.8	22.3	51.0	7.5	A	0.71	67.7	41.0	53.0
	Overall Intersection			5.2	A	0.42	-	-	-	-	8	A	0.67	-	-
Unsignalized Intersections															
George Street / Perry Street	EB	LTR	65.0	68.3	F	0.40	15.7	7.1	17.8	364.0	F	1.23	46.3	18.6	48.0
	WB	LTR	110.0	25.2	D	0.49	31.2	17.4	38.7	215.0	F	1.24	118.0	67.1	94.0
	NB	LTR	50.0	0.3	A	0.01	19.0	3.5	36.0	0.8	A	0.03	42.6	12.4	49.4
	SB	LTR	120.0	2.6	A	0.10	51.7	20.1	77.5	5.1	A	0.17	150.6	87.6	123.0
Crescent Street / Lake Street	EB	LR	70.0	9.6	A	0.04	13.1	5.2	14.5	10.3	B	0.06	60.0	20.8	55.6
	NB	TL	155.0	0.2	A	0.00	1.2	0.1	1.5	1.1	A	0.02	99.6	30.8	77.2
	SB	TR	110.0	0.0	-	0.07	-	-	-	0.0	-	0.10	9.6	0.9	7.7
George Street / Westscott Street	EB	LR	210.0	18.4	C	0.14	15.6	7.3	20.6	50.3	F	0.33	25.4	9.1	29.3
	NB	TL	100.0	0.3	A	0.01	9.9	1.5	19.8	0.6	A	0.02	61.3	16.1	84.5
	SB	TR	100.0	0.0	-	0.35	0.9	0.0	1.1	0.0	-	0.57	1.2	0.1	2.2
George Street / Romaine Street	EB	LTR	190.0	33.1	D	0.37	17.5	10.3	19.7	308.4	F	1.34	55.0	23.4	65.4
	WB	LTR	145.0	24.3	C	0.16	15.0	6.9	18.0	67.1	F	0.40	16.1	7.1	17.8
	NB	LTR	105.0	0.6	A	0.02	20.4	5.2	32.8	0.8	A	0.03	58.2	13.4	73.8
	SB	LTR	100.0	0.4	A	0.02	15.8	3.5	25.2	1.1	A	0.04	31.2	10.6	40.3
Lock Street / Romaine Street	EB	LTR	145.0	7.4	A	0.05	12.9	5.6	11.8	7.7	A	0.07	21.7	9.6	20.3
	WB	LTR	60.0	7.8	A	0.04	12.2	4.6	11.3	7.7	A	0.02	10.4	3.1	12.4
	NB	LTR	125.0	8.1	A	0.19	15.3	10.6	17.6	8.6	A	0.23	54.9	17.0	39.3
	SB	LTR	45.0	8.0	A	0.14	17.0	10.5	21.9	8.3	A	0.19	18.3	9.9	22.8

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Intersection	Approach / Movement	Storage (m)	Weekday											
			AM						PM					
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Winch Street / Crescent Street	EB	TR	155.0	-	0.00	-	-	-	0.0	-	0.01	-	-	-
	WB	TL	225.0	-	0.00	-	-	-	1.5	A	0.00	-	-	-
	NB	LR	85.0	A	0.00	4.0	0.5	8.9	8.7	A	0.01	5.3	0.9	7.6
George Street / Ware Street	WB	LR	145.0	C	0.13	19.3	7.8	25.8	15.0	C	0.05	11.5	4.5	10.1
	NB	TR	60.0	-	0.34	0.9	0.0	1.1	0.0	-	0.35	20.3	2.1	10.2
	SB	TL	110.0	A	0.03	21.1	5.5	33.5	1.5	A	0.06	31.2	10.1	43.2
Lock Street / Ware Street	EB	LTR	145.0	A	0.05	13.3	6.2	13.4	10.1	B	0.07	13.2	6.7	11.2
	WB	LTR	240.0	B	0.04	12.3	4.5	13.5	12.3	B	0.02	8.0	1.9	10.2
	NB	LTR	50.0	A	0.01	3.5	0.5	6.8	0.3	A	0.00	12.3	1.9	12.4
	SB	LTR	105.0	-	0.00	2.3	0.2	5.0	0.0	-	0.00	2.5	0.2	3.2
Ware Street / Winch Street	EB	TL	240.0	-	0.00	-	-	-	0.7	A	0.00	-	-	-
	WB	TR	225.0	-	0.01	-	-	-	0.0	-	0.01	-	-	-
	SB	LR	85.0	A	0.00	2.9	0.3	6.0	8.4	A	0.00	1.1	0.0	1.4
Haggart Street / Ware Street	EB	LR	225.0	A	0.00	5.7	1.0	7.7	8.5	A	0.01	6.1	1.1	7.7
	NB	TL	250.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
	SB	TR	110.0	-	0.00	-	-	-	0.0	-	0.00	-	-	-
George Street / Princess Street	EB	LTR	190.0	C	0.08	11.6	4.1	11.4	32.4	D	0.13	11.4	4.0	11.2
	WB	LTR	145.0	D	0.10	10.7	3.5	9.3	38.1	E	0.16	11.9	4.0	13.9
	NB	LTR	125.0	A	0.01	11.6	2.0	22.4	0.2	A	0.01	33.3	4.3	31.4
	SB	LTR	60.0	A	0.01	11.8	2.5	21.1	0.3	A	0.01	16.2	2.8	30.9
Lock Street / Princess Street	EB	LTR	145.0	B	0.03	10.7	3.4	11.3	11.3	B	0.03	11.6	4.1	10.4
	WB	LTR	185.0	B	0.04	15.1	5.9	19.7	10.2	B	0.06	21.9	8.3	27.5
	NB	LTR	105.0	A	0.00	1.7	0.1	2.2	0.5	A	0.01	28.2	3.6	23.7
	SB	LTR	35.0	A	0.00	2.4	0.2	3.8	0.5	A	0.01	5.7	0.7	13.4

5.2.4 Scenario 4: 2035 Crescent Street as WB One-Way with Intensification

Scenario 4 analyzes the conversion of Crescent Street to a westbound-only one-way route under 2035 future conditions, with the proposed intensification in place. The background 1% annual traffic growth was applied to the Scenario 2 total volumes; thus, the traffic redistribution due to the Haggart Street closure and Crescent Street EB one-way is consistent with the Scenario 2 distribution assumptions. Please refer to Section 5.1.2 for more details of the road network and traffic redistribution. **Figure 44** summarizes the Scenario 4 road network assumptions.

Figure 45 and

Figure 46 show the lane configurations and future background traffic (without intensification) for Scenario 4.

5.2.4.1 Redistribution of Site Traffic

With Crescent Street converted to a westbound-only one-way, it is assumed that the Intensification Block 2 development along Crescent Street will not have any access to Crescent Street. The site traffic generated and assigned to Crescent Street eastbound was diverted to Ware Street and Lansdowne Street, via Lock Street.

Figure 47 and

Figure 48 summarize the new development site traffic and total traffic for Scenario 4, respectively.

5.2.4.2 Intersection Operations

The results of the capacity and queuing analysis for the study area intersections for Scenario 4 are summarized in **Table 9** for the AM and PM peak hours. Complete Synchro HCM Reports and SimTraffic queuing reports are provided in **Appendix C**. Heavy vehicle percentages, pedestrian movements, and key parameters are assumed to remain consistent with existing conditions.

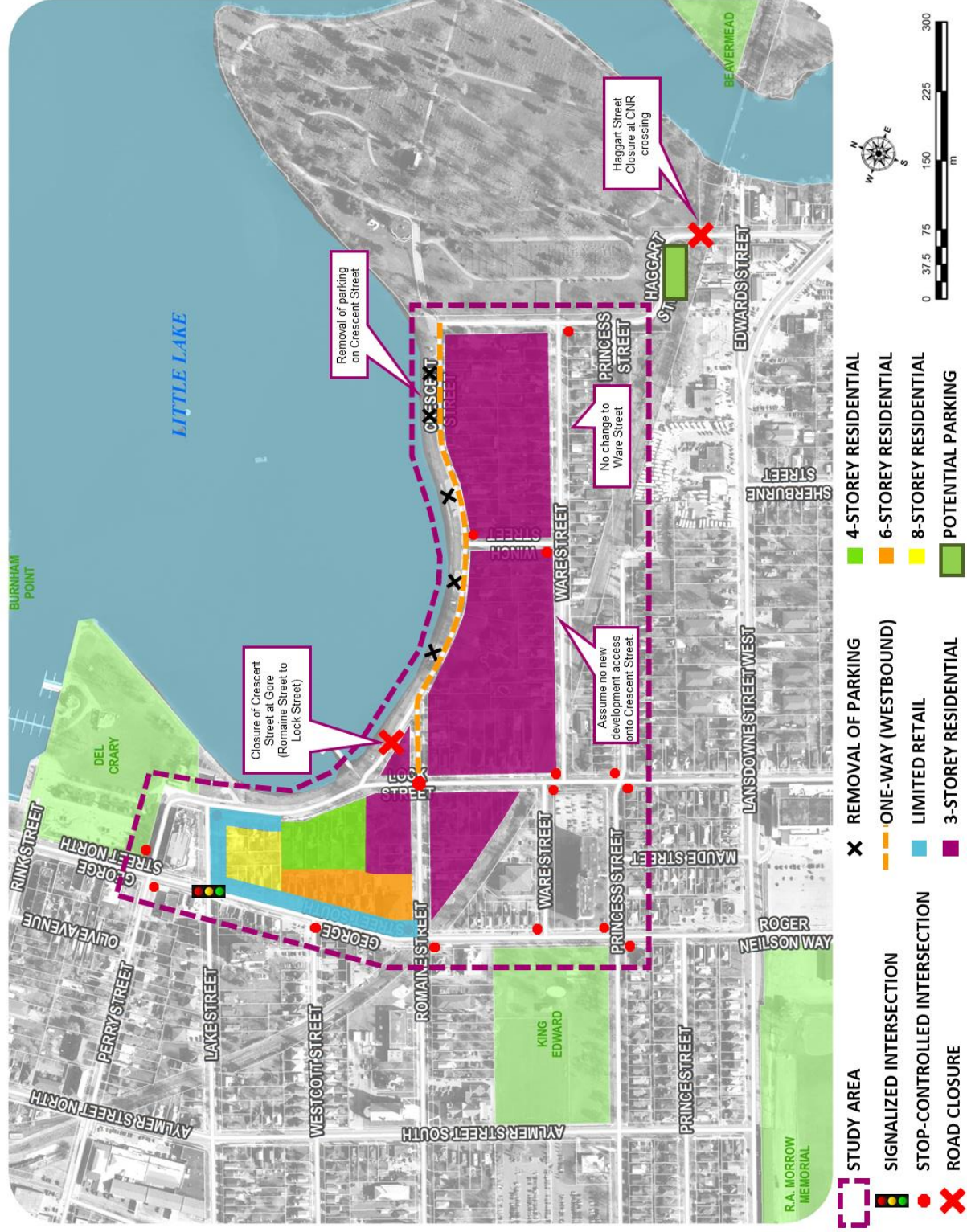
The operational analysis results shown in **Table 9** indicate that, with the exception of three intersections, the study area signalized intersection is projected to operate at an overall LOS A and unsignalized intersections are projected to operate below capacity with all approaches at a V/C ratio of **0.71** or less. The excepted intersections are:

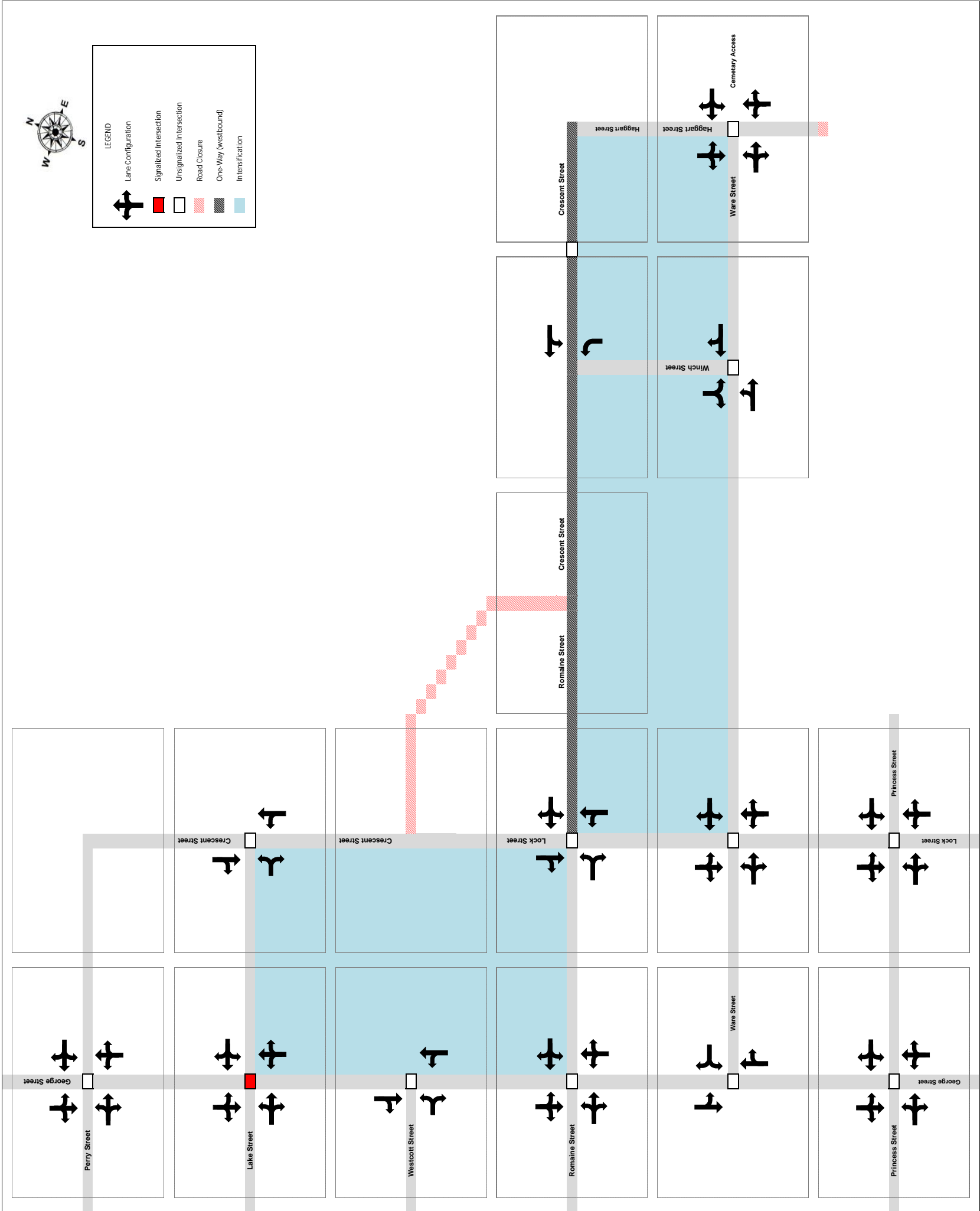
- George Street at Perry Street:
 - Eastbound (LTR) and Westbound (LTR) approaches are at V/C ratio of 1.24 or less and an overall LOS F.
 - Westbound (LTR) and Southbound (LTR) 95th and max queue in excess of distance from nearest upstream intersection.
- George Street at Westcott Street:
 - Eastbound (LR) approach at overall LOS F.
- George Street at Romaine Street:
 - Eastbound (LTR) and Westbound (LTR) approaches are at V/C ratio of 1.34 or less and an overall LOS F.

As with the PM Peak hour 2035 “Do Nothing” traffic simulation, the Scenario 4 simulation forecasted high queues for the westbound approach at the George Street / Perry Street intersection, blocking Crescent Street / Lake Street. The same rationale as stated for the 2035 “Do Nothing” scenario can be applied here, such that in reality, drivers would re-route to parallel roads with available capacity to avoid congestion at the George Street / Perry Street intersection. Similar shifts would occur at the congested eastbound/westbound approaches at George Street / Westcott Street and George Street / Romaine Street.

With these rationalizations considered, it can be concluded that the 2035 Haggart Street Closure scenario road network will be able to accommodate the future traffic within the study area from both natural traffic growth and the proposed intensification.

Figure 44: Scenario 4: 2035 Crescent Street as WB One-Way





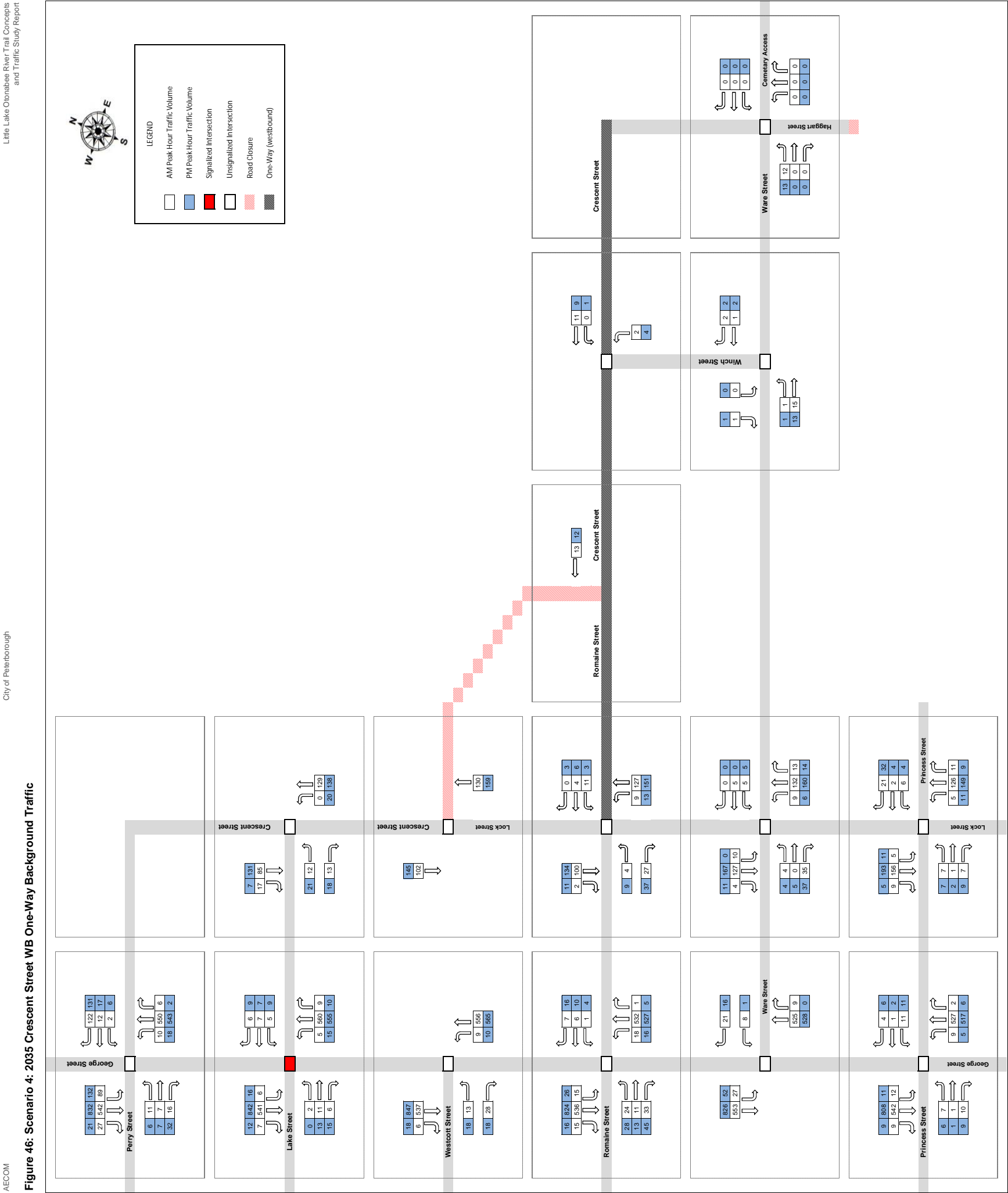
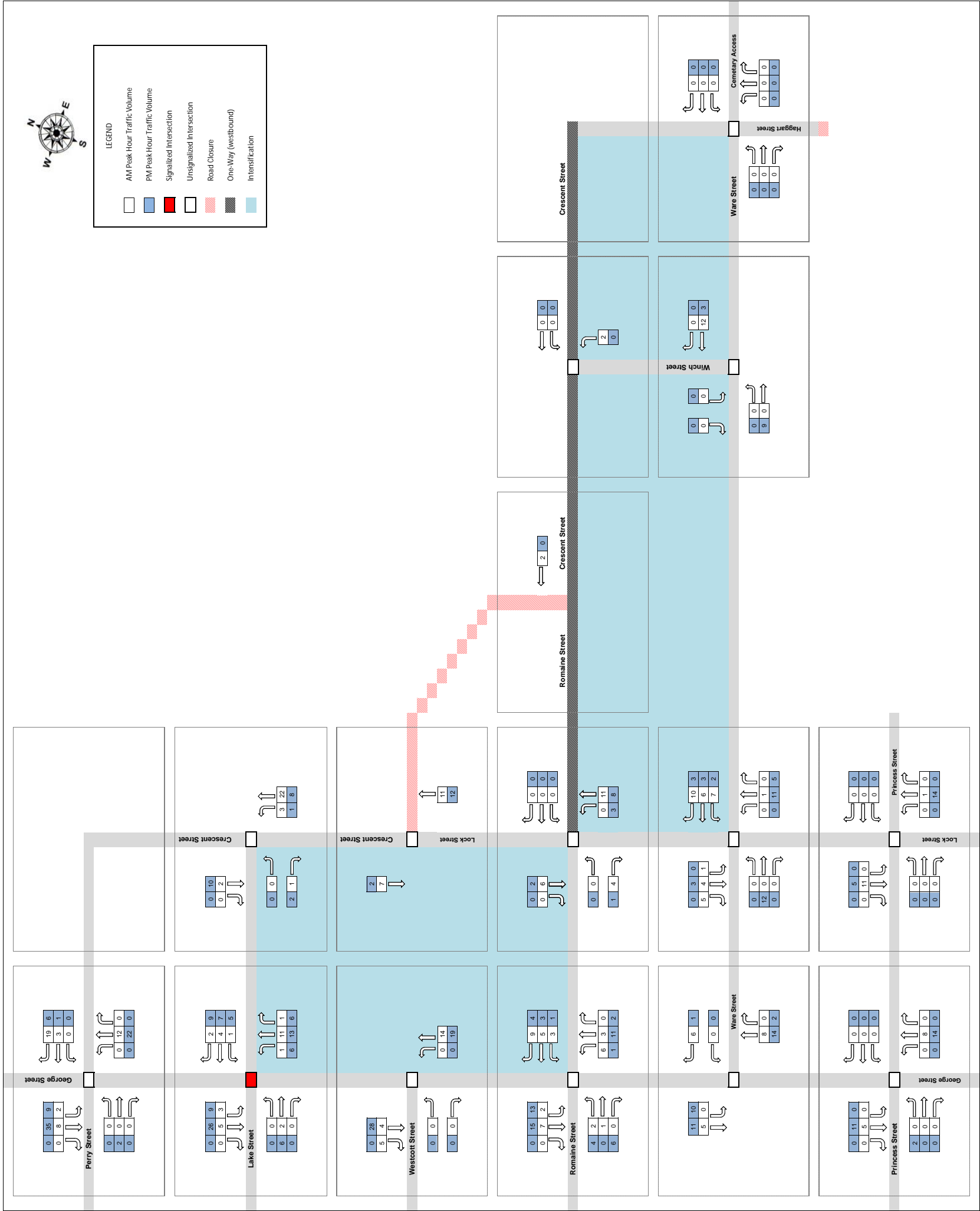


Figure 47: Scenario 4: 2035 Haggart Street Closure and Crescent Street WB One-Way New Development Traffic



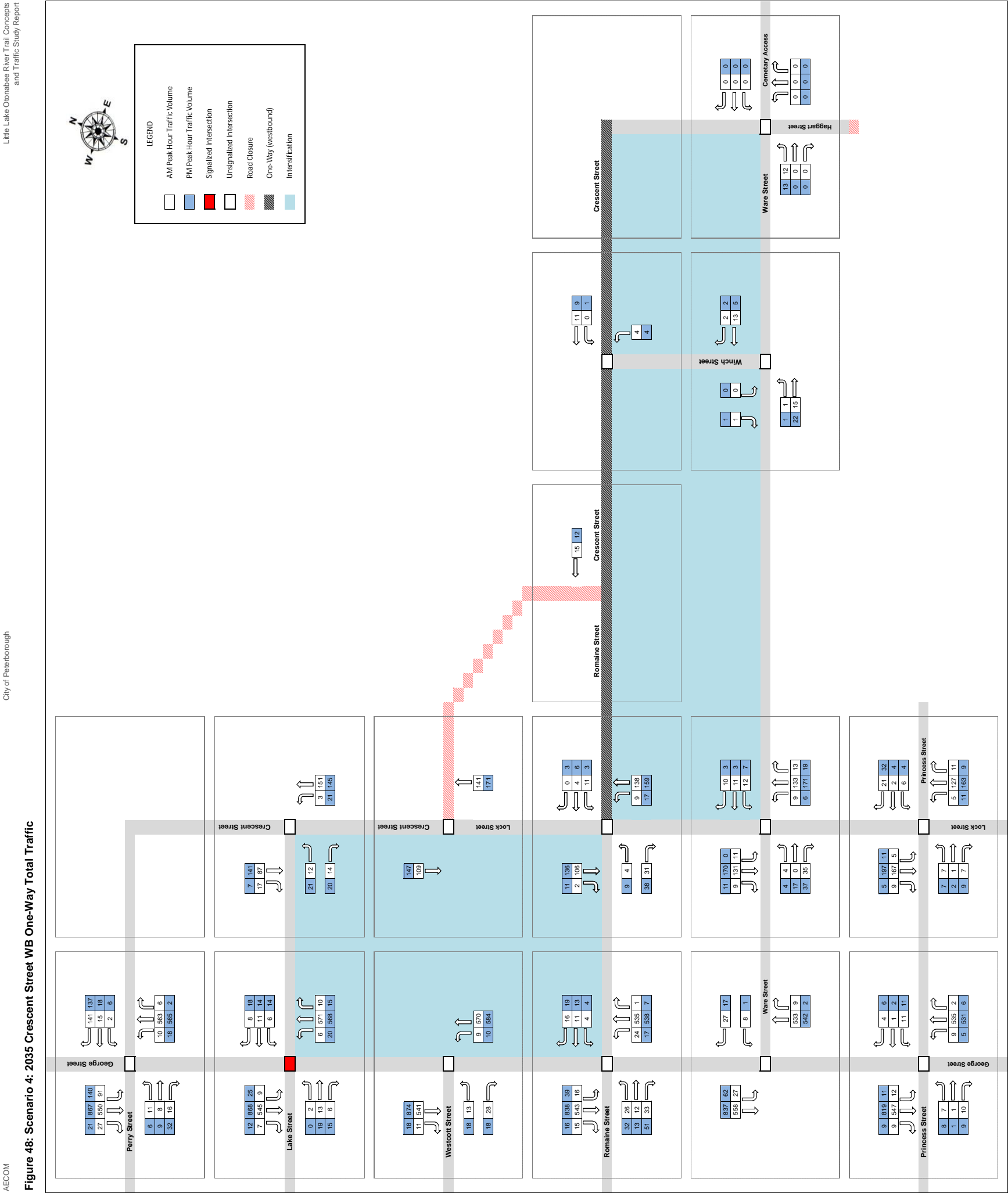


Table 9: Scenario 4: 2035 Crescent Street WB One-Way Traffic Operations (AM and PM Peak Hour)

Intersection	Approach / Movement	Storage (m)	Weekday												
			AM						PM						
			Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	
Signalized Intersection															
George Street / Lake Street	EB	LTR	245.0	39.6	D	0.13	14.7	5.3	19.3	39.8	D	0.18	18.9	7.3	26.4
	WB	LTR	70.0	40.1	D	0.18	15.9	6.5	20.7	40.8	D	0.29	20.4	9.0	26.3
	NB	LTR	100.0	3.9	A	0.44	53.1	22.4	64.6	4.4	A	0.48	74.1	32.8	93.6
	SB	LTR	50.0	3.7	A	0.41	48.0	20.7	51.3	7.5	A	0.71	67.9	35.3	53.2
	Overall Intersection			5.2	A	0.42	-	-	-	8	A	0.67	-	-	-
Unsignalized Intersections															
George Street / Perry Street	EB	LTR	65.0	68.3	F	0.40	17.2	7.9	23.0	364.0	F	1.23	32.2	13.6	35.6
	WB	LTR	110.0	25.2	D	0.49	28.0	15.6	37.0	215.0	F	1.24	110.5	56.4	88.5
	NB	LTR	50.0	0.3	A	0.01	18.8	3.9	29.1	0.8	A	0.03	43.9	13.5	48.4
	SB	LTR	120.0	2.6	A	0.10	46.7	17.9	68.2	5.1	A	0.17	141.2	74.8	121.7
Crescent Street / Lake Street	EB	LR	70.0	9.6	A	0.04	13.2	5.4	13.6	10.3	B	0.06	34.8	11.8	33.2
	NB	TL	155.0	0.2	A	0.00	-	-	-	1.1	A	0.02	78.1	19.4	55.1
	SB	TR	110.0	0.0	-	0.07	-	-	-	0.0	-	0.10	5.6	0.3	6.6
George Street / Westscott Street	EB	LR	210.0	18.4	C	0.14	14.1	6.8	16.6	50.3	F	0.33	16.3	6.8	21.9
	NB	TL	100.0	0.3	A	0.01	11.4	1.8	25.6	0.6	A	0.02	33.9	8.2	56.8
	SB	TR	100.0	0.0	-	0.35	-	-	-	0.0	-	0.57	1.5	0.1	2.2
George Street / Romaine Street	EB	LTR	190.0	32.8	D	0.37	20.1	11.0	28.0	242.0	F	1.18	41.7	17.9	52.5
	WB	LTR	145.0	23.2	C	0.14	14.2	6.3	16.7	62.1	F	0.38	16.1	7.3	20.5
	NB	LTR	105.0	0.6	A	0.02	21.5	5.0	39.0	0.8	A	0.03	37.5	8.7	65.2
	SB	LTR	100.0	0.4	A	0.02	16.5	4.1	24.6	1.1	A	0.04	27.2	7.9	37.0
Lock Street / Romaine Street	EB	L	145.0	7.5	A	0.01	6.3	1.1	11.4	7.7	A	0.02	8.9	2.4	9.0
		R	-	6.4	-	0.04	14.1	6.1	10.6	6.7	-	0.05	14.9	7.1	12.1
	WB	LTR	60.0	8.0	A	0.02	12.1	3.9	15.4	7.8	A	0.02	9.8	2.9	9.3
	NB	TL	125.0	8.1	A	0.19	10.4	6.1	12.7	8.5	A	0.22	14.4	7.8	18.2
SB	TR	45.0	7.9	A	0.14	17.6	10.4	22.2	8.2	A	0.19	17.4	11.1	21.6	

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Intersection	Approach / Movement		Storage (m)	Weekday											
				AM						PM					
				Delay	LOS	v/c	95th Queue	Average Queue	Max Queue	Delay	LOS	v/c	95th Queue	Average Queue	Max Queue
Winch Street / Crescent Street	WB	TL	225.0	0.0	-	0.00	-	-	0.7	A	0.00	-	-	-	
	NB	L	85.0	8.6	A	0.00	5.5	0.9	8.6	A	0.01	4.7	0.7	9.2	
George Street / Ware Street	WB	LR	145.0	16.5	C	0.11	14.4	6.4	15.5	C	0.05	11.6	4.4	11.1	
	NB	TR	60.0	0.0	-	0.34	-	-	0.0	-	0.35	1.2	0.1	1.5	
	SB	TL	110.0	0.8	A	0.03	19.2	5.6	28.5	A	0.07	41.6	13.9	65.2	
Lock Street / Ware Street	EB	LTR	145.0	9.6	A	0.05	13.2	7.0	12.7	B	0.09	13.5	7.7	13.8	
	WB	LTR	240.0	11.2	B	0.06	13.5	6.1	12.6	B	0.02	8.6	2.2	9.2	
	NB	LTR	50.0	0.5	A	0.01	2.4	0.3	5.3	A	0.00	4.7	0.5	9.8	
	SB	LTR	105.0	0.6	A	0.01	7.2	1.3	13.0	-	0.00	1.1	0.1	1.9	
Ware Street / Winch Street	EB	TL	240.0	0.5	A	0.00	-	-	0.3	A	0.00	-	-	-	
	WB	TR	225.0	0.0	-	0.01	-	-	0.0	-	0.01	-	-	-	
	SB	LR	85.0	8.4	A	0.00	2.7	0.6	5.7	A	0.00	1.6	0.1	2.8	
Haggart Street / Ware Street	EB	LR	225.0	8.5	A	0.01	9.5	3.0	8.4	A	0.01	9.4	3.0	8.4	
	NB	TL	250.0	0.0	-	0.00	-	-	0.0	-	0.00	-	-	-	
George Street / Princess Street	EB	LTR	190.0	20.6	C	0.08	11.5	3.8	14.6	D	0.13	11.8	3.9	13.5	
	WB	LTR	145.0	27.0	D	0.10	11.1	3.8	10.3	E	0.16	12.3	4.5	13.3	
	NB	LTR	125.0	0.3	A	0.01	12.3	2.1	27.3	A	0.01	12.4	1.9	23.4	
	SB	LTR	60.0	0.4	A	0.01	12.4	2.2	25.4	A	0.01	19.6	3.0	35.8	
Lock Street / Princess Street	EB	LTR	145.0	10.8	B	0.03	10.0	3.1	9.2	B	0.03	11.4	4.1	9.3	
	WB	LTR	185.0	10.2	B	0.04	15.6	6.3	18.4	B	0.06	15.9	7.2	17.9	
	NB	LTR	105.0	0.3	A	0.00	2.8	0.3	6.8	A	0.01	5.6	0.9	12.0	
	SB	LTR	35.0	0.2	A	0.00	2.8	0.3	5.5	A	0.01	7.2	1.2	12.0	

6. Conclusions and Recommendations

This section summarizes the conclusions of this traffic study and lists the recommendations for the road network and trail alternatives based on the analysis presented in this report.

Road Network Recommendations

Based on the observed traffic from the turning movement counts and weekly traffic counts collected as well as site observations, it was concluded that the higher speed through-traffic currently on Ware Street and Crescent Street (~54 km/hr) is utilizing the local roads via Edwards Street and Haggart Street as a by-pass to the Lansdowne Street and George Street corridors. While the overall traffic volumes on Crescent Street and Ware Street are relatively low, this by-pass movement still impacts the road network due to the higher speeds and increased volumes. Additionally, the high speed traffic on Ware Street during peak periods has also been brought forward by the local community as a safety concern. It is therefore recommended that **Haggart Street be closed** at the disused rail line, thereby eliminating the possibility of cut-through traffic. Through desktop analysis, it was determined that the closure of Haggart Street would reduce the traffic on Crescent Street and Ware Street significantly.

The Haggart Street closure would also support all three trail concepts presented in this report by reducing the traffic on Crescent Street from Haggart Street to Lock Street. This reduction in traffic, accompanied by appropriate road markings and signage, would support the conversion of Crescent Street into a one-way street with two way cycle track, where cycling would be encouraged.

If Crescent Street were to be converted to one-way with a two-way cycle track combined with a Haggart Street closure, Crescent would not be an attractive street for most drivers to use as it would only serve local traffic. Drivers who would drive east on Crescent Street would need to drive slow due to the narrow lane. The lack of parking along Crescent would discourage visitors from using and parking along Crescent Street, instead diverting to Lock Street or Del Cray Park. The closure of Haggart Street would remove all through traffic, as the only exit from Crescent Street would be to Lock Street via Ware Street. Visitors to the area could instead park at Del Cray Park, walk, or cycle down the path along Crescent Street, to view the lake.

Traffic Calming on Ware Street

The closure of Haggart Street would reduce traffic on Ware Street by 60% to 90%. This would not only reduce overall traffic on Ware Street, it would also remove the higher-speed vehicles which presented safety concerns to residents of Ware Street. It is concluded that the Haggart Street closure would sufficiently calm the traffic conditions on Ware Street and alleviate the concerns of the local residents.

Trail Alternatives

Based on the three trail concepts presented in Section 3 of this report, it is concluded that a “Refined” option based on Alternatives 2 and 3 would best achieve the active transportation and infrastructure goals for the City of Peterborough. The Refined option includes the following components:

- A single 4.5 m wide multi-use path shared by both pedestrians and cyclists, from the existing ORT to Lake Street.
- A single 3.0 m asphalt walking path from Lake Street north along the Del Cray Park shoreline.
- A single 4.5 m wide multi-use path from Lake Street to Lock Street.
- A single 2.0 m walking path from Lock Street to Haggart Street.

- Two-way on-road cycle track on Crescent Street from Lock Street to Haggart Street.
- Crescent Street through the “gore” to be closed to vehicular use.
- Crescent Street (Haggart Street to Romaine Street) to be converted to one-way eastbound route.
- Romaine Street (Crescent Street to Lock Street) to be converted to one-way eastbound route (optional to provide parking on both sides of the street).
- The existing five parking bays along Crescent Street to be removed, with the dropped curb replaced by a standard barrier curb.
- The pavement surface within the on-road cycle track to be generally smooth and free of hazards for cyclists.
- The catch basins on Crescent Street to be modified or replaced to be more cyclist-friendly.

A two-way on-road cycle track along Crescent Street would provide cyclists with their own lane in each direction separated from both cars and people walking or strolling along the waterfront. The cycle track would attract recreational and utilitarian cyclists to use the facility, as being separated from motorists by a buffer will provide comfort ability for all types of cyclists. Although cyclists are separated from motorist, traffic speeds should be monitored to ensure that users are adhering to the speed limit. If vehicles are found to be travelling at substantially higher speeds, additional traffic calming measures may be considered (such as those discussed in Section 4.3.2).

The two-way cycle track would continue through the gore between Romaine Street and Lock Street. North of Lock Street, cyclists would have the option to continue cycling on-road with other vehicles or on a multi-use path shared with pedestrians. The concept would include intersection treatments where the cycle track intersects Crescent Street / Romaine Street and Crescent Street / Lock Street to facilitate such cycling movements. This option provides both cyclists and pedestrians with safe options to travel along the lakeshore, and is most feasible due to minimal infrastructure impacts, as all on-road improvements can be made within existing curb limits.

Parking

The implementation of the trail would result in the removal of the five (5) parking bays along Crescent Street from Haggart Street to Romaine Street. While this may affect how residents and visitors to the lake park, the surrounding road network should continue to have sufficient parking areas either on-road or within parking lots which are a short walk from the lakeside. Additionally, the parking needs may be mitigated by the implementation of a new parking lot adjacent to the road closure on Haggart Street. This area would no longer have traffic and is a viable option for future parking.

Traffic Study

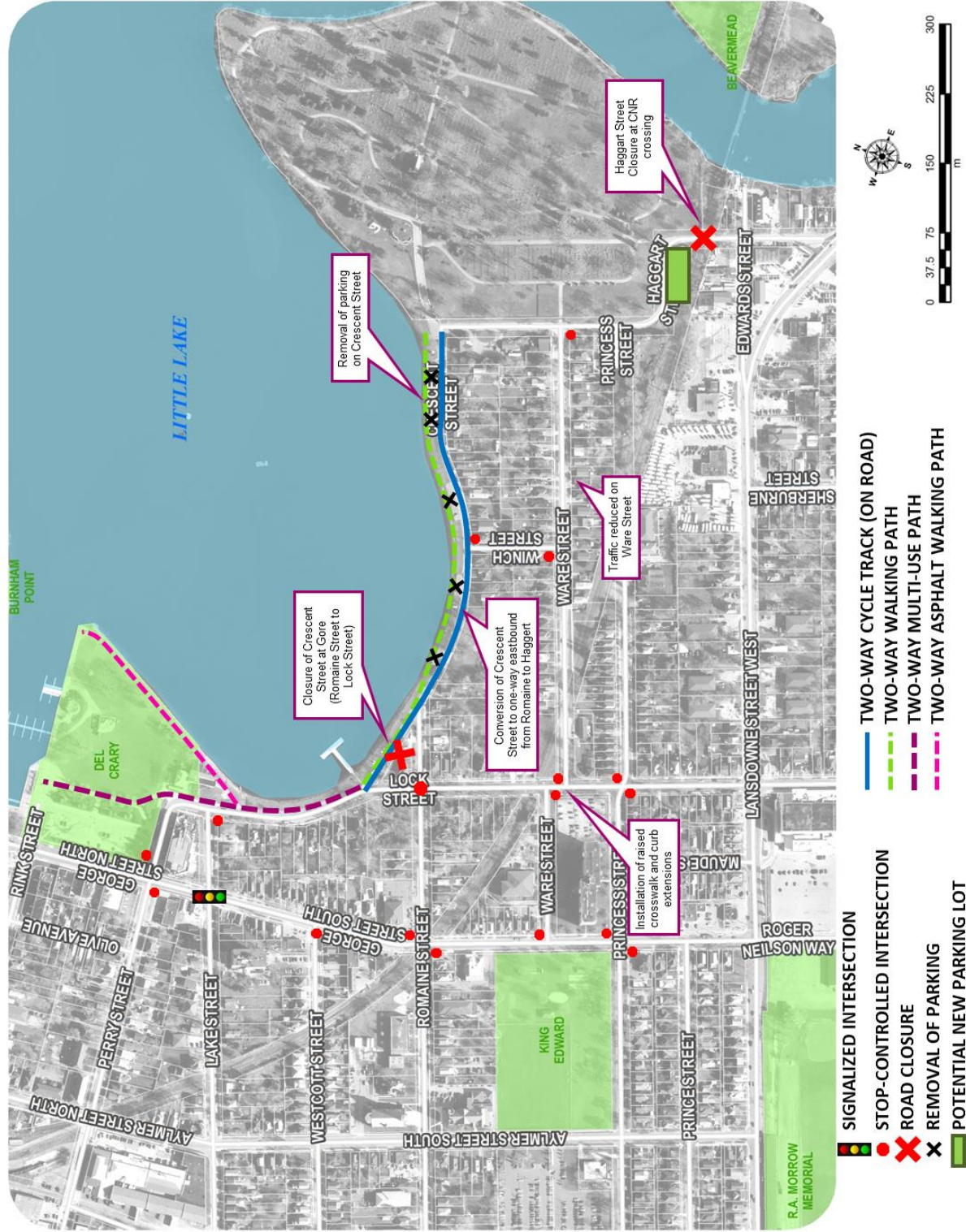
According to the traffic analysis presented in this report, it can be concluded that the traffic impacts associated with the implementation of the three trail alternatives at opening day (2015) are minimal and can be accommodated by the existing road network within the study area. Additionally, under future conditions with the proposed intensification nearly complete (2035, Block 1 fully developed and Block 2 partially developed), the road network will still be able to accommodate the increased traffic from annual growth and trips generated by the new developments. While the traffic simulation revealed potential congestion and queuing issues at the George Street / Perry Street, George Street / Westcott Street and George Street / Romaine Street intersections, users would naturally adjust their trip making patterns to utilize nearby parallel routes to reduce delays.

With the Refined option as the recommended trail concept, the road network would be impacted by the Haggart Street closure at the disused rail line south of the study area and the closure of Crescent Street along the Gore (Romaine Street to Lock Street). The traffic analysis accounted for these network impacts for both ORT opening year conditions (2015) and future conditions (2035, including intensification), and concluded that the road network would be sufficient to accommodate traffic through the study area. Though the analysis considered conversion of Crescent Street to one-way westbound and the recommended trail concept includes Crescent as one-way eastbound, the total bidirectional traffic on Ware Street is anticipated to be similar, with all local westbound traffic on Ware Street and local eastbound traffic divided between Crescent and Ware Streets.

Summary of Recommendations

Figure 49 below summarizes the road network, trail, traffic calming, and parking recommendations presented in this report.

Figure 49: Summary of Recommendations





Appendix D

Otonabee River Trail Alignment

SEE DRAWING L-02

MATCH LINE



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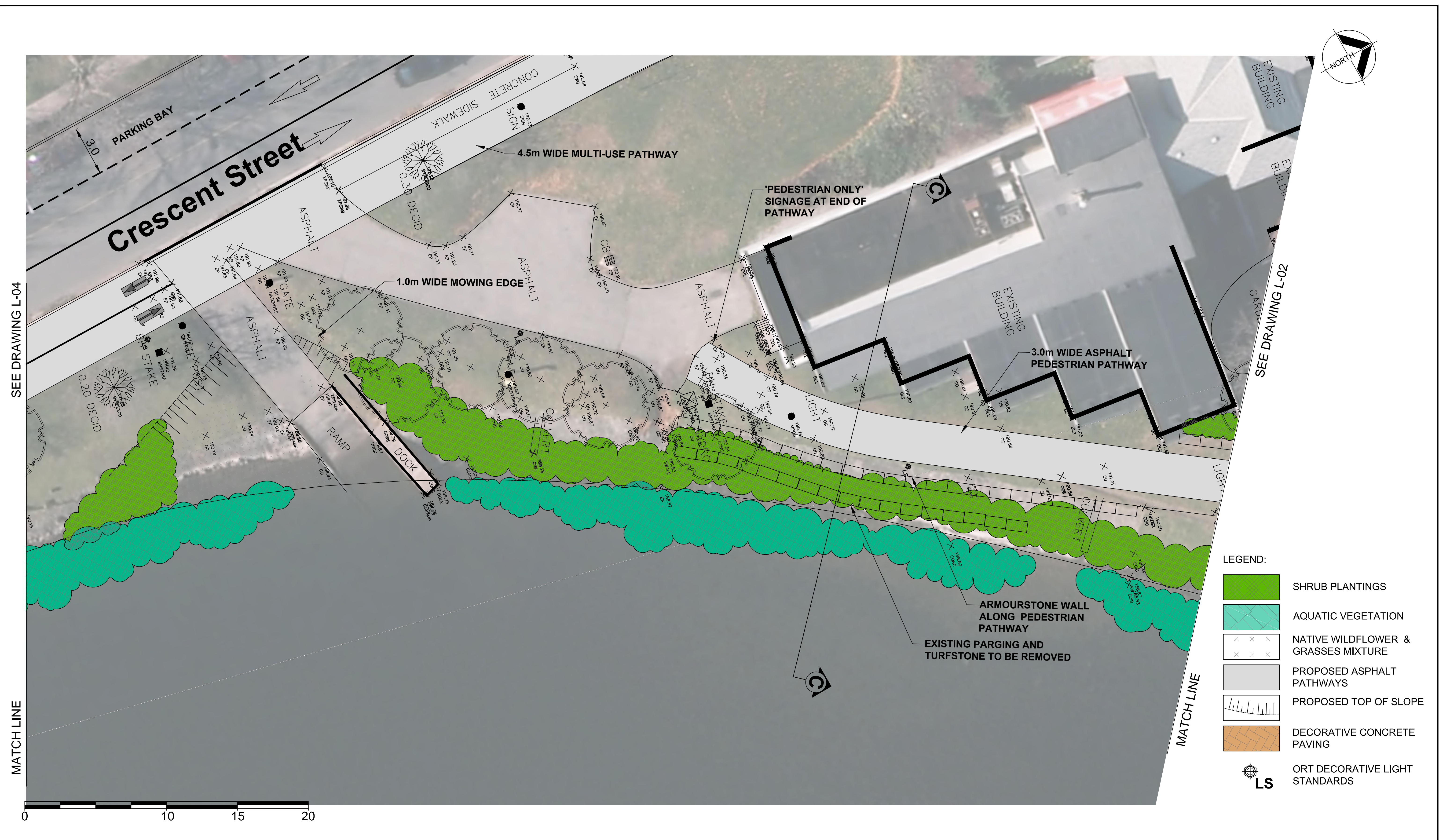
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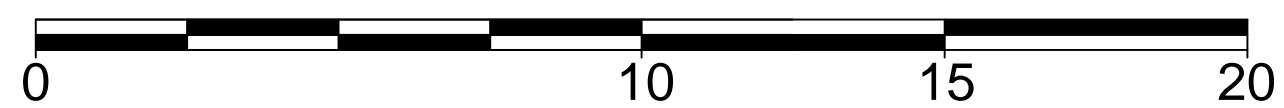
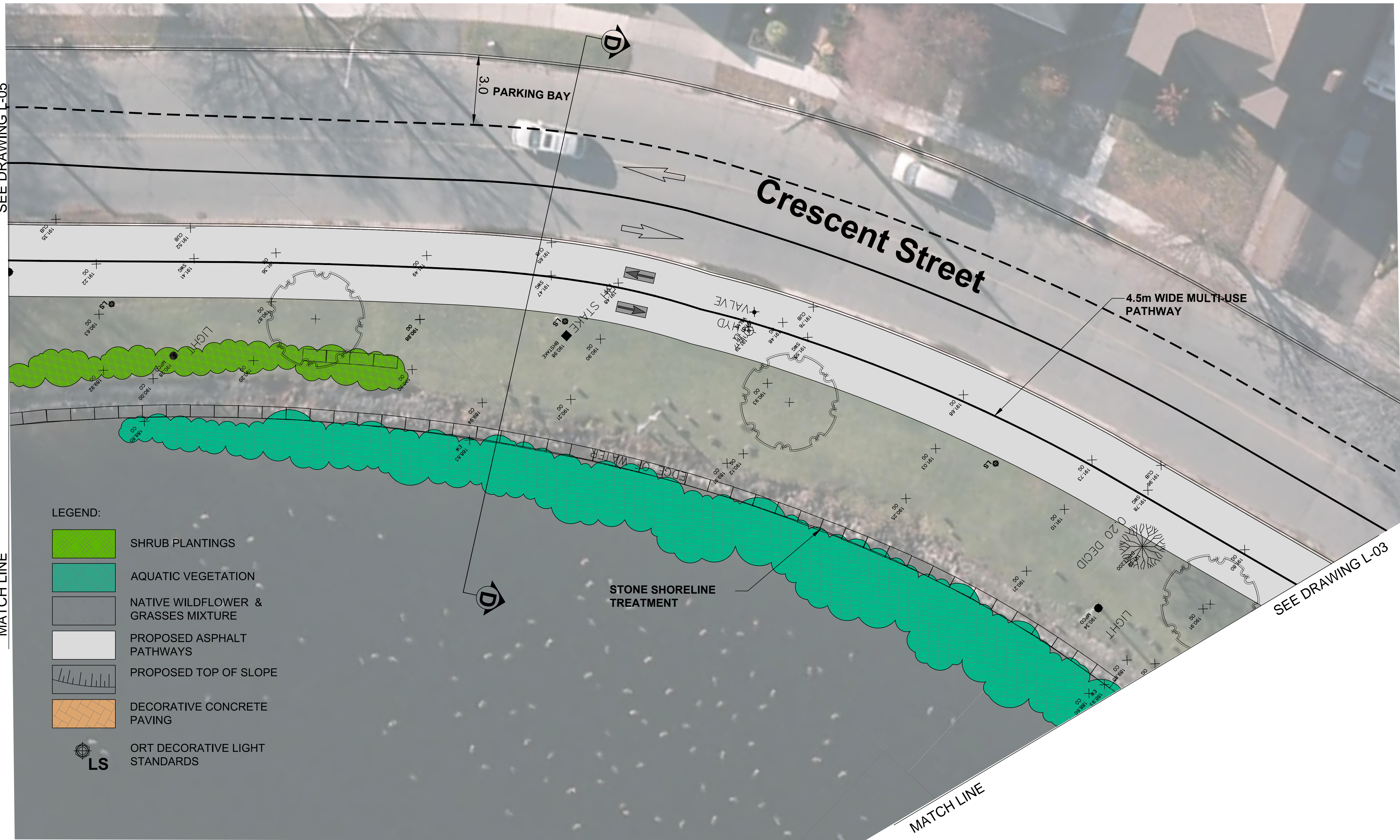
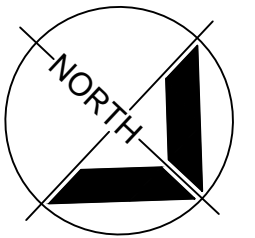
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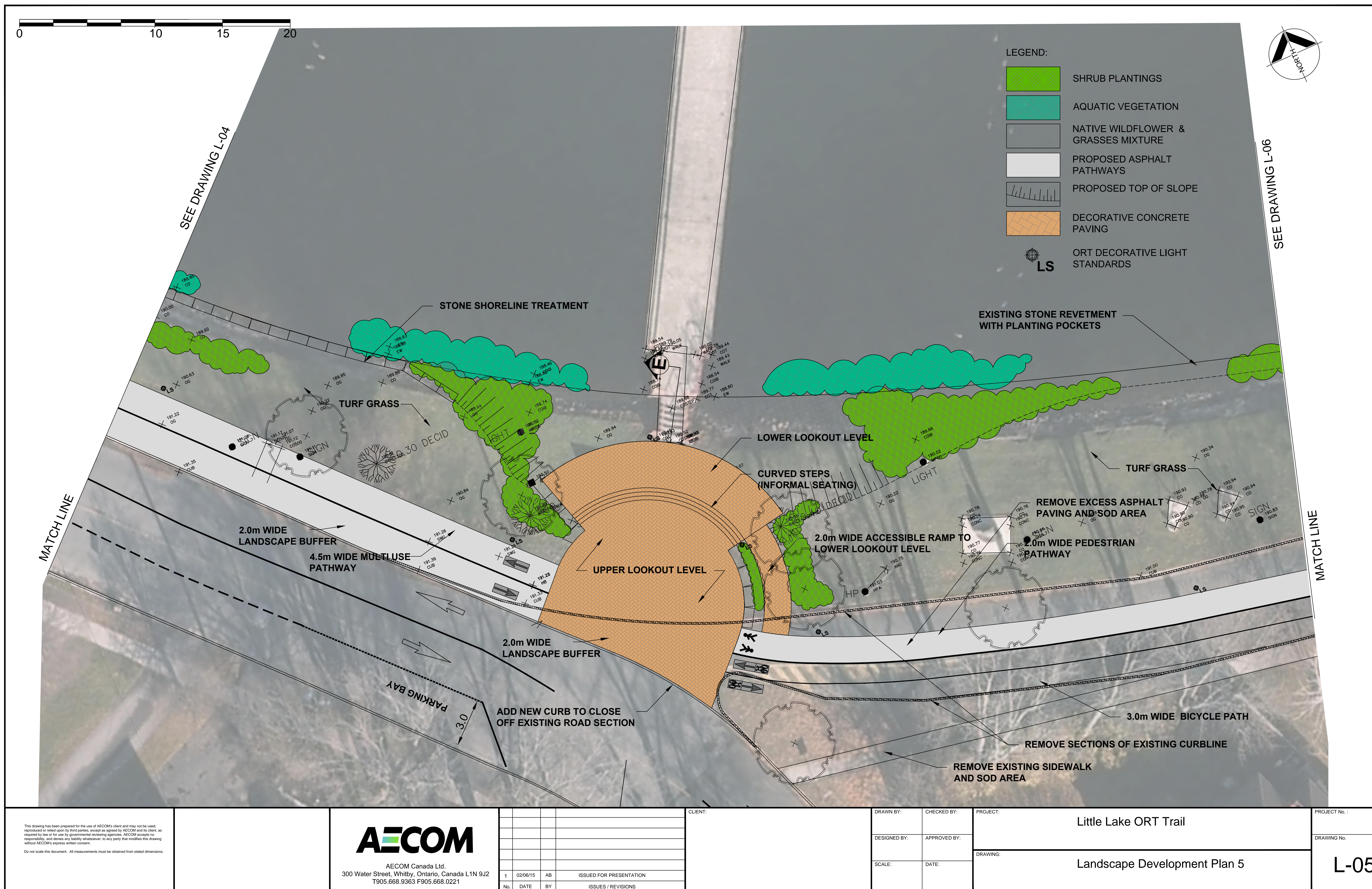
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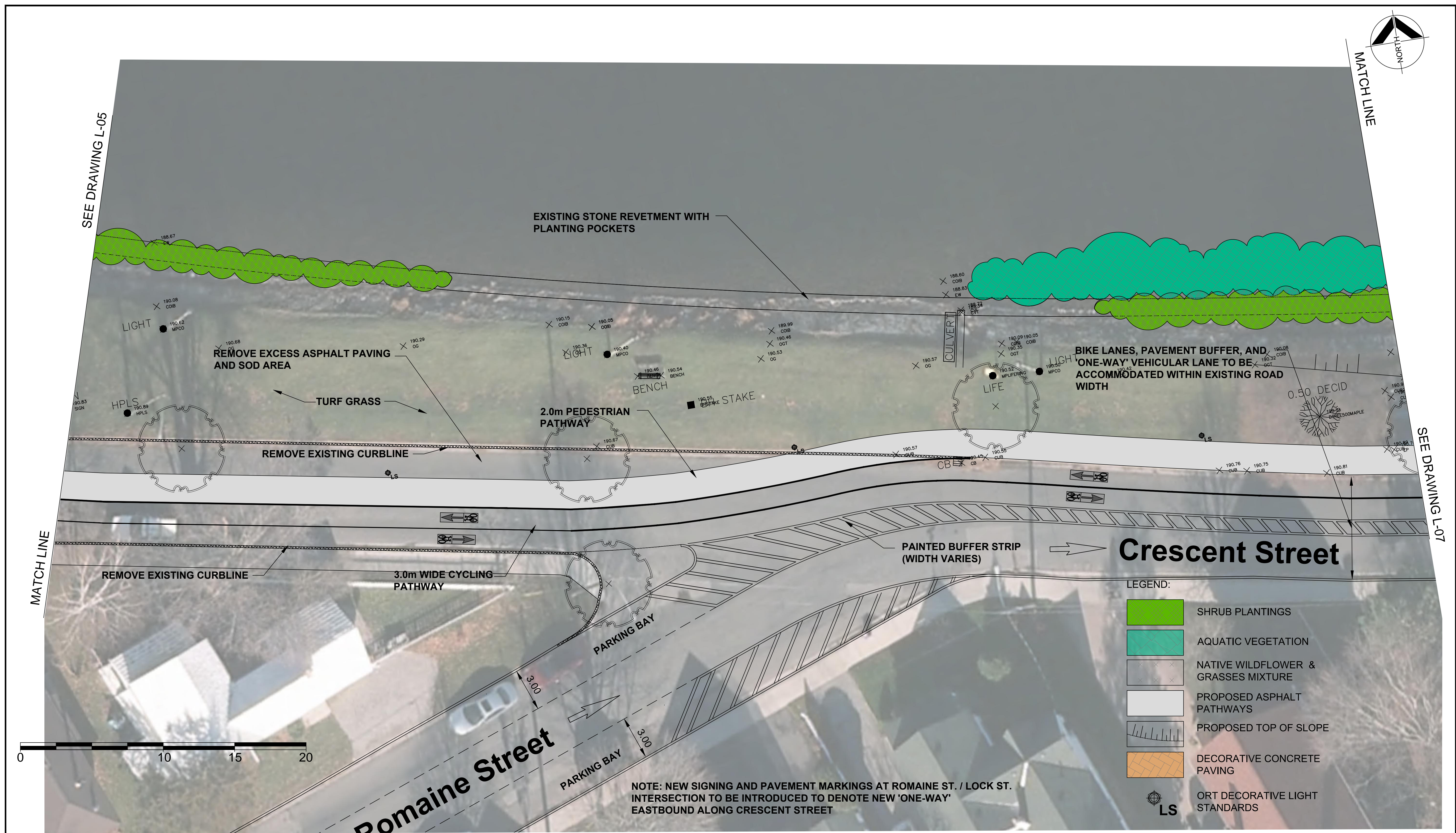
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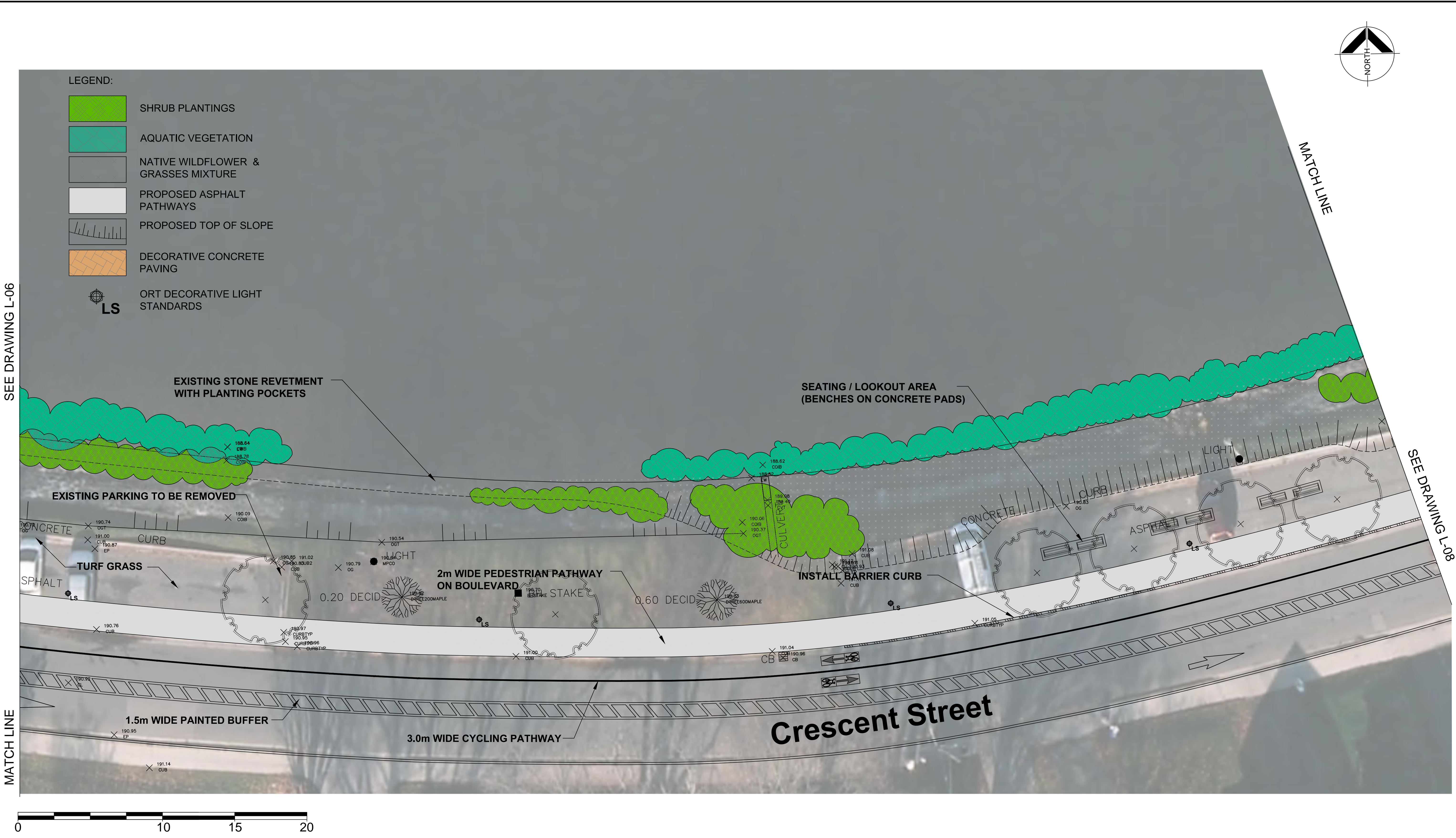
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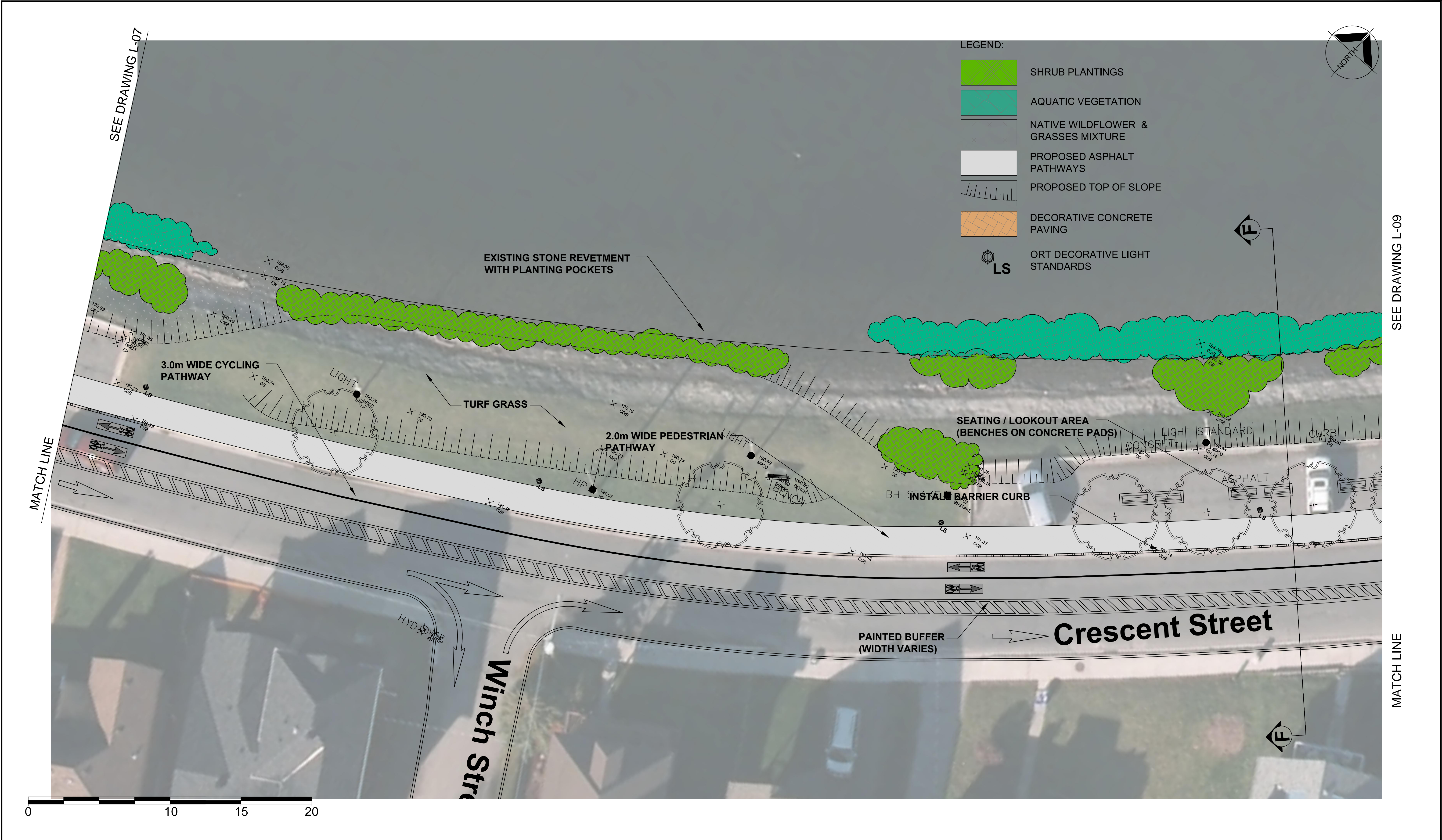
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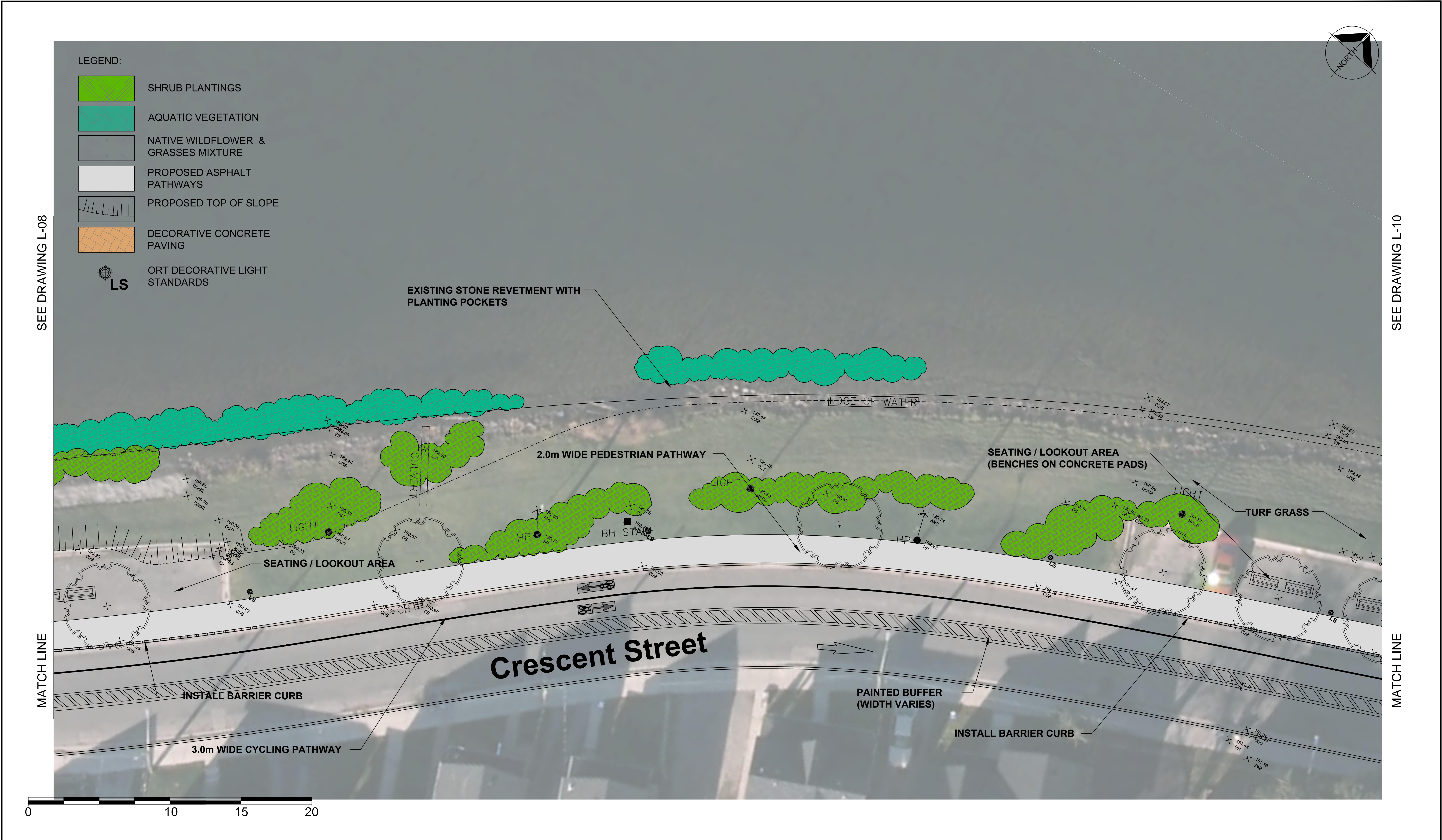
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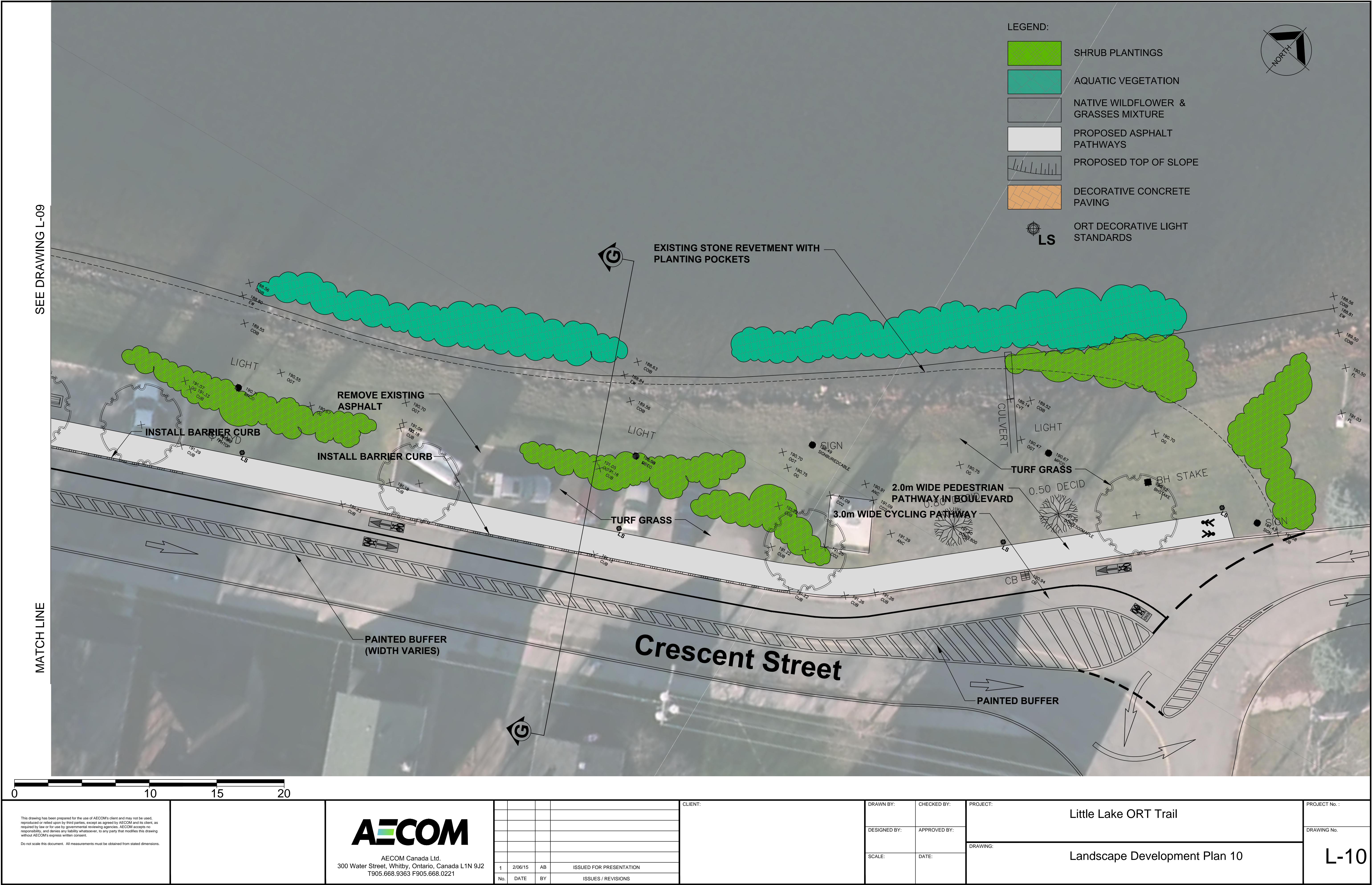
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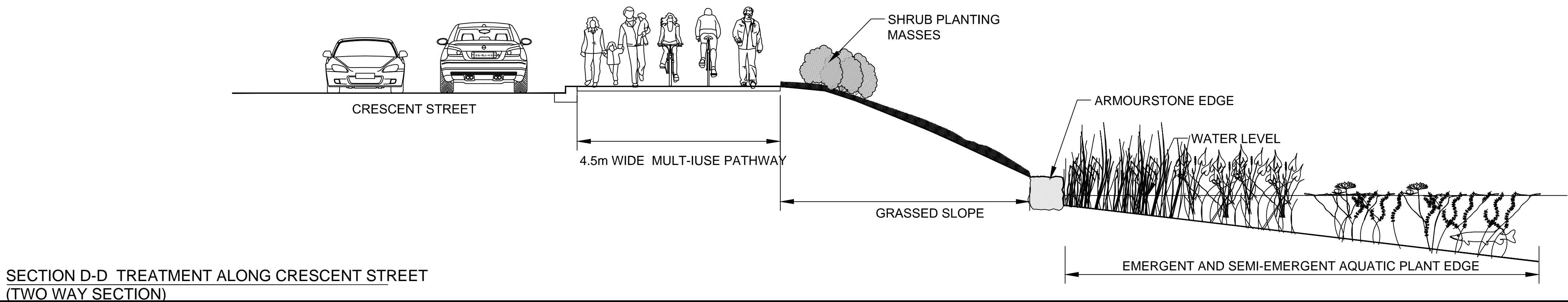
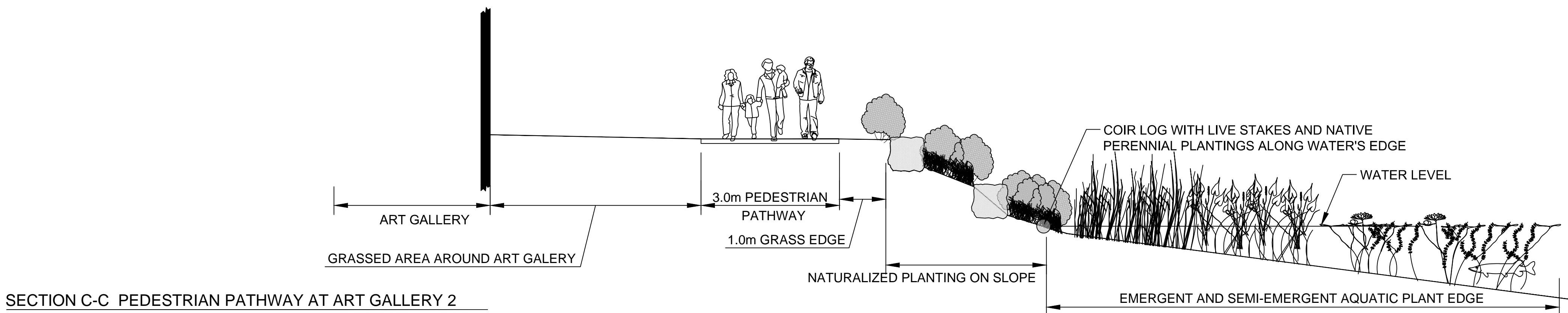
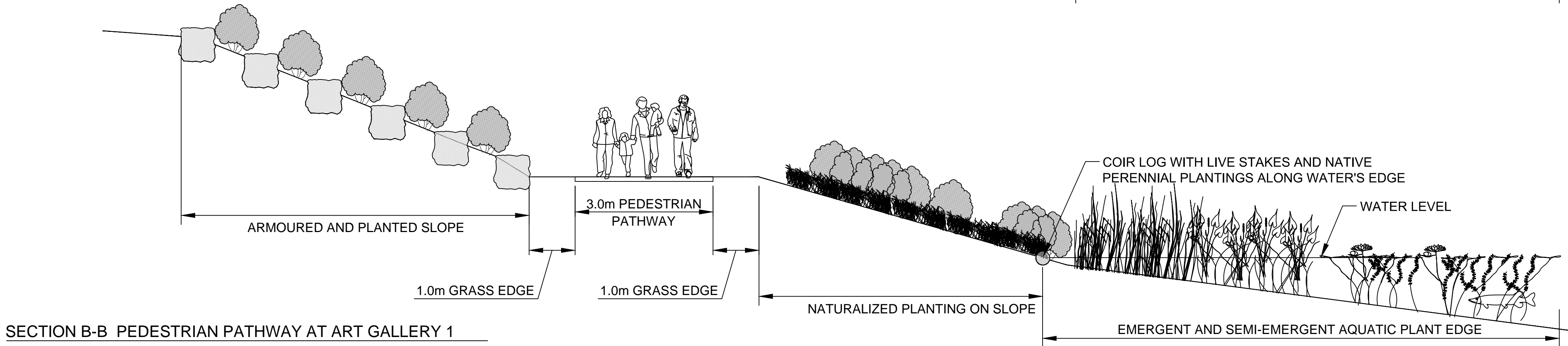
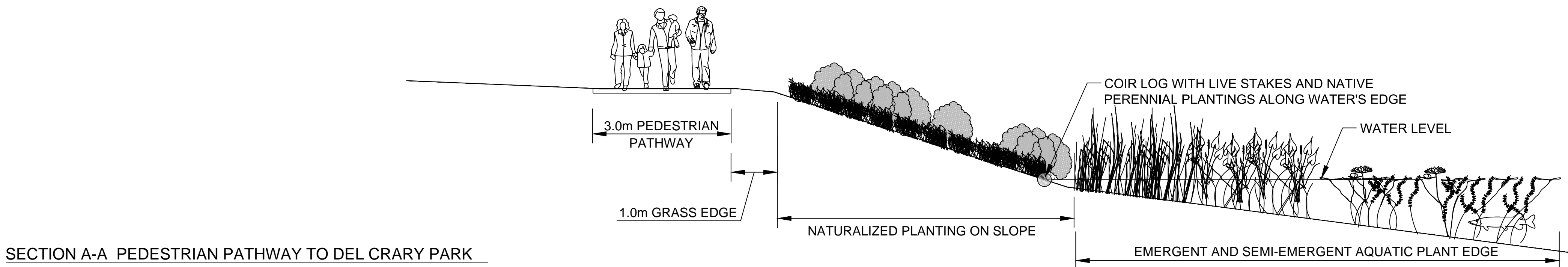


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1	2/06/15	AB	ISSUED FOR PRESENTATION										
No.	DATE	BY	ISSUES / REVISIONS										





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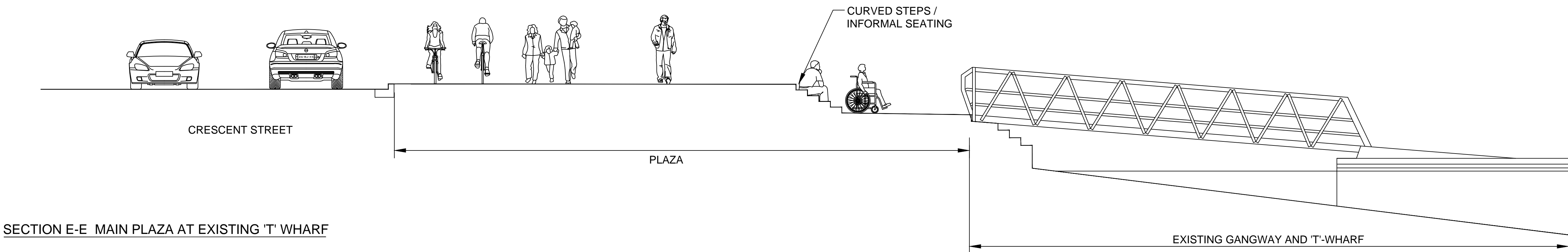
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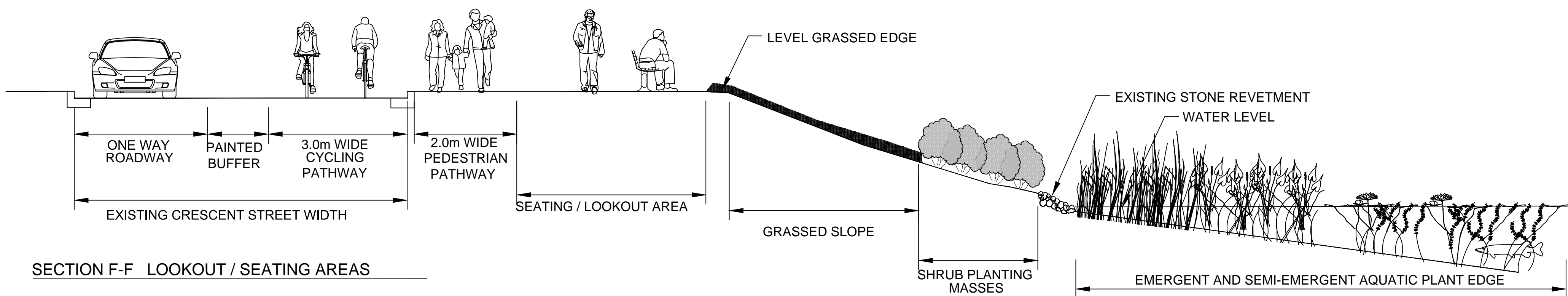
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SCALE:	DATE:

PROJECT:	Little Lake ORT Trail
DRAWING:	Landscape Development Sections 1

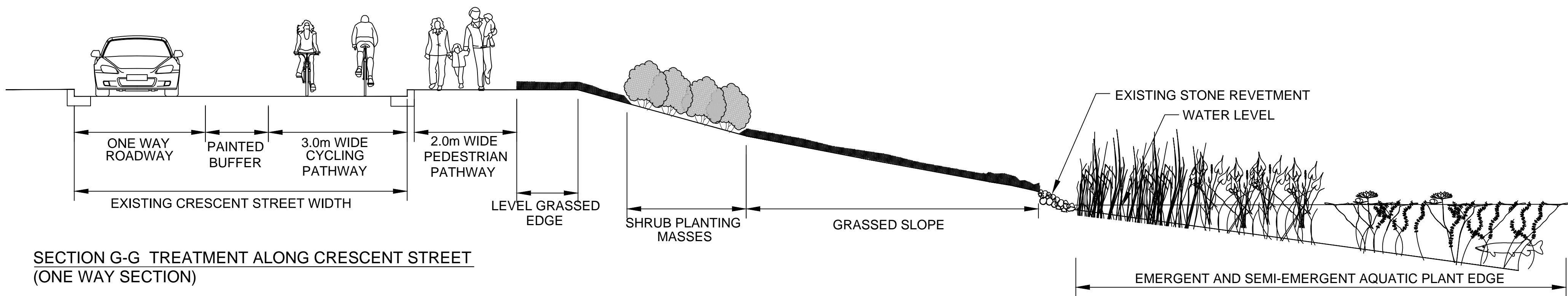
PROJECT No. :
DRAWING No.
S-01



SECTION E-E MAIN PLAZA AT EXISTING 'T' WHARF



SECTION F-F LOOKOUT / SEATING AREAS



SECTION G-G TREATMENT ALONG CRESCENT STREET
(ONE WAY SECTION)

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SCALE:	DATE:

PROJECT:	Little Lake ORT Trail
DRAWING:	Landscape Development Sections 2

PROJECT No. :
DRAWING No.
S-02