Prepared for:

City of Toronto

Metro Hall
20th Floor,
55 John Street,
Toronto, ON, M5V 3C6

Attention: Grace Tesa

Lawrence Park Neighbourhood Investigation of Basement Flooding & Road Improvement Environmental Assessment

Final Report

submitted by:

Aquafor Beech Ltd.

January 31st, 2018

Contact:
Dave Maunder, P.Eng
Aquafor Beech Limited
Maunder.d@aquaforbeech.com
2600 Skymark Avenue
Building 6, Unit 202
Mississauga, ON L4W 5B2
T. 905.629.0099 ext.290
F. 905.629.0089

Aquafor Beech Reference: 65319

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1.0 INTRODUCTION

1.1 Background

The Lawrence Park Neighbourhood (LPN) study area is located in the central part of the City within Ward 25 – Don Valley West within the West Don River watershed (see **Figure 1.1.1**). The study area is roughly bounded by Blythwood Road, Ridgefield Road and Sunnydene Crescent to the south, Mildenhall Road to the north, Mount Pleasant Road to the west, and Bayview Avenue and Valleyanna Road in the east.

The area was originally developed in the 1920's to the 1950's and is located within two former municipalities within the City (Toronto and North York). Slightly over 30 percent of the original homes have been renovated or reconstructed.

Several of the unimproved roads in the area, including the associated drainage systems are in a state of disrepair or are substandard. On most of the unimproved roads the existing roadside drainage systems which convey stormwater are poor to non-existent. There are, in a number of areas, no continuous paths for stormwater to flow during rainfall events. Furthermore, on the east side of the study area there is a lack of sidewalks.

The study area is also one of many within the City of Toronto that has experienced incidences of basement flooding in recent years. The storm events that have caused flooding included May 12, 2000, August 19, 2005 and July 8, 2013.

As a result of the above issues, the City developed a work plan to identify the problems and opportunities, undertake field and desktop analysis to define existing conditions, identify and evaluate alternative solutions, select the preferred solution and develop an implementation plan for the proposed measures. Preliminary design of the preferred solution will also be undertaken upon completion of this study and will be presented under separate cover.

The study has been undertaken using the Master Plan approach (Approach #2), under the Municipal Class Environmental Assessment process. Further details are described in Chapter 3.

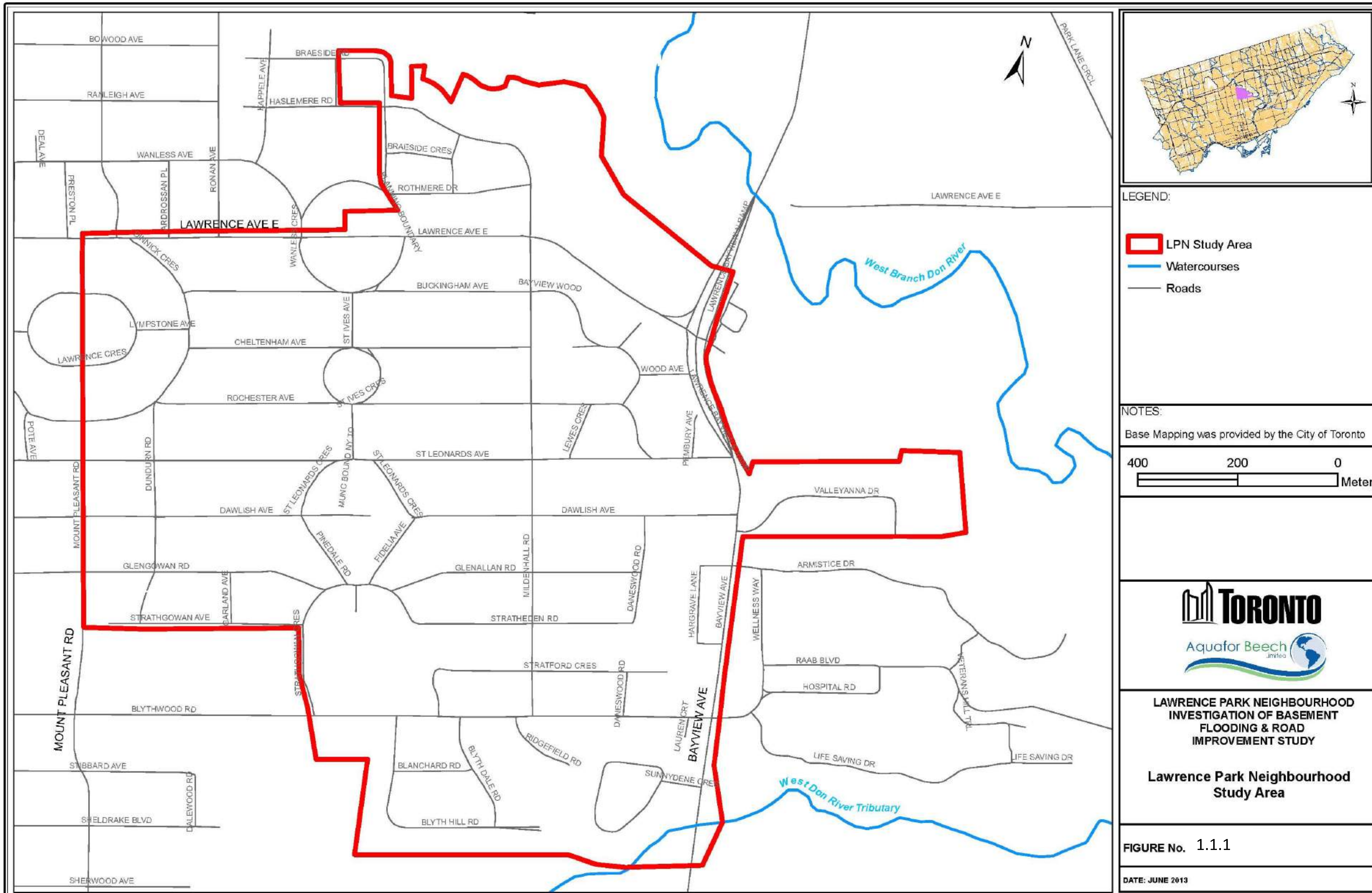


Figure 1.1.1 – Lawrence Park Study Area

1.2 Study Area Characteristics

The study area, together with the existing sanitary, combined and storm sewer infrastructure, is shown in **Figure 1.2.1**. The study area covers 160 hectares. The predominant land use is residential (single family homes) with some institutional uses along Lawrence Avenue East and Blythwood Road.

Other significant features include the Glendon Forest Environmentally Significant Area (ESA), which is located east of the study area, as well as the Sherwood ESA, which is located southwest of the study area. Don River West Branch also flows adjacent to the study area. Don River West Branch flows in a southeastern direction to Lake Ontario. These features are described in more detail in Sections 4.2.3 and 4.2.4.

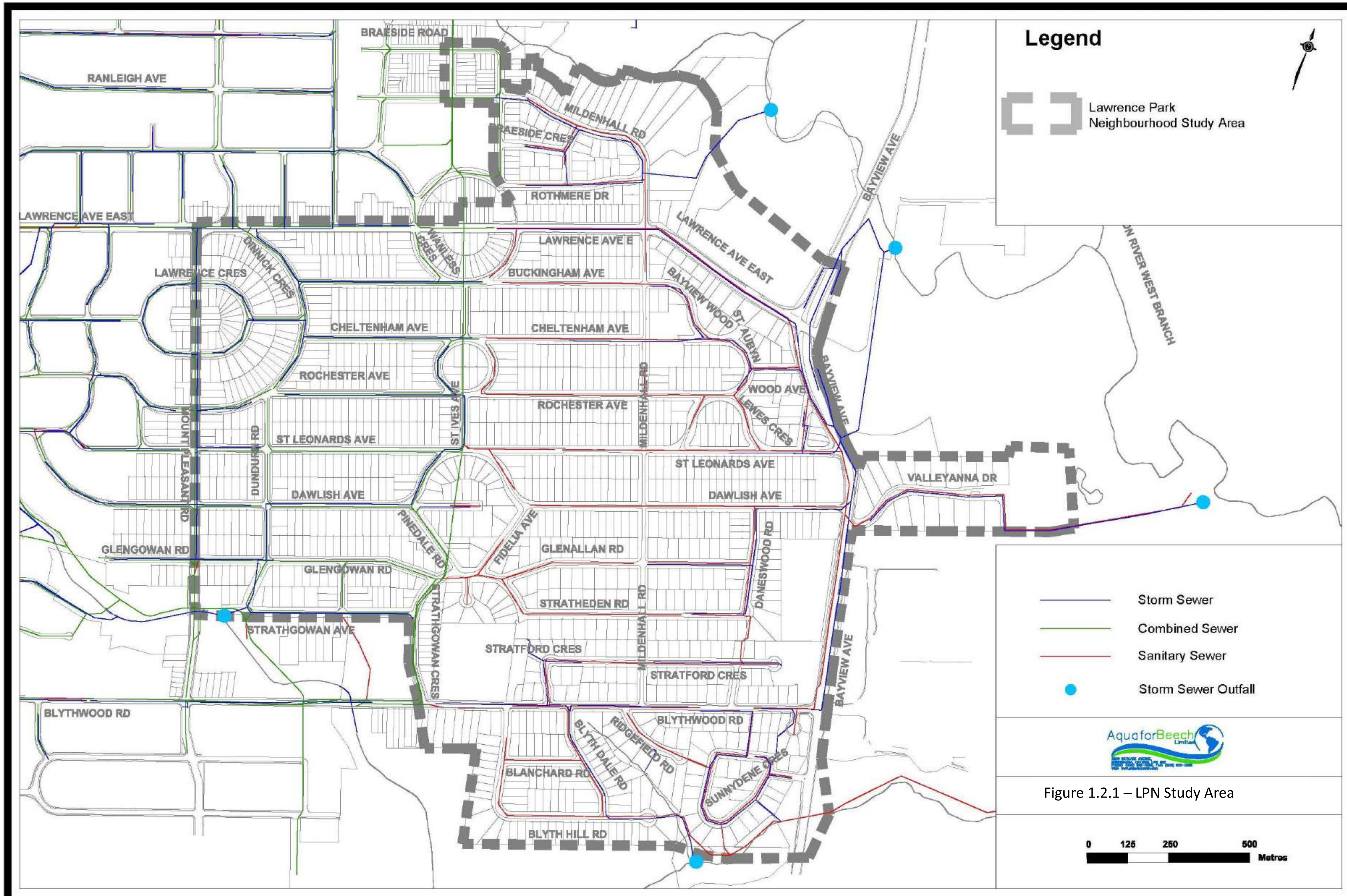


Figure 1.2.1 – Lawrence Park Study Area with Existing Sewer Infrastructure

1.3 Study Purpose and Primary Tasks

The study purpose has been defined as follows:

- To address issues relating to deteriorated road conditions, traffic, pedestrian safety, poor drainage; and
- To address surface and basement flooding within the Lawrence Park Neighbourhood Study Area through the Municipal Class Environmental Assessment Process.

The study, which began in 2012, has been undertaken using the Municipal Class Environmental Assessment Master Plan (Approach #2). The primary tasks which were undertaken as part of this study and the associated chapters which information is provided are summarized below:

Chapter 1 – Define the study purpose

Chapter 2 – Define the problems and opportunities associated with the study area

Chapter 3 – Provide an overview of the Environmental Assessment process together with the approach used for this study. Also provide a summary of the consultation process

Chapter 4 – Establish existing environmental and socio- economic conditions

Chapter 5 – Provide a description of the existing roads, drainage and transportation systems

Chapter 6 – Assess the adequacy or capacity of the existing roads, drainage and transportation systems under existing conditions

Chapter 7 – Develop and assess alternative remedial measures for the sewer systems

Chapter 8 – Develop and assess alternative remedial measures for the roads, drainage and pedestrian safety components of the study

Chapter 9 – Develop and assess alternative remedial measures for the transportation component of the study

Chapter 10 – Provide a description of the Preferred Solution for the sewer systems, roads, drainage, pedestrian safety and traffic components of the study. Costing, implementation and the approvals process is also provided.

2.0 PROBLEM AND OPPORTUNITY IDENTIFICATION

2.1 General

The design and construction of our road and drainage systems has changed significantly since development was initiated in the Lawrence Park area. Whereas past practices and associated standards were limited with respect to the types of materials to construct the road and the size of the pipe or culvert to convey stormwater from the lands to the receiving stream; present standards have been improved and the design of road and drainage systems are more integrated. Furthermore, until the mid 1980's drainage systems were designed on the basis that stormwater should be removed from the lands as quickly as possible without any regard to the impact on the streams and rivers receiving these flows. More recently, it has been understood that this practice leads to increased flooding and erosion, degraded water quality and reduction in baseflows which impacts the resident fisheries.

2.2 Identification of Problems and Opportunities

Deteriorated Road Infrastructure and Drainage Systems

The design and construction of the road and storm drainage systems has changed significantly since development was initiated in the Lawrence Park area over 50 years ago. Whereas past practices and associated standards were limited with respect to the types of materials to construct the road and the size of the pipe or culvert to convey stormwater from the lands to the receiving stream; present standards have been improved and the design of road and drainage systems are more integrated.

Many of the roads were built over 50 years ago and are approaching the end of their service life. The underlying road structures on several streets are deteriorated to the point that road resurfacing cannot address the road condition and, therefore, these must be reconstructed with functional road drainage systems.

Pavement widths vary across the study area from approximately 6 metres to 9 metres. Current standards set the minimum road width at 7.2 metres to accommodate emergency and service vehicle access.

In the eastern section of the study area (east of St. Ives Crescent which is the former City of North York), the original drainage system was comprised of ditches and road side culverts which conveyed flows to the West Don River. Over time, some storm sewers have been installed and other sections have been filled in, in part, by landowners or developers who have re-graded individual properties. As a result, the existing road drainage system no longer performs as originally designed. Excessive ponding on the roads occurs during rainfall or snowmelt events and the lack of a proper drainage system will contribute to surface flooding of properties.

Pedestrian Safety

The majority of the roads in the western section (i.e. former City of Toronto) of the study area have sidewalks on both sides. In contrast, the eastern section (i.e. former City of North York) of the study area generally does not contain sidewalks. However, an area along the western shoulder of Mildenhall Road between Blythwood Road and Lawrence Avenue East, which is delineated by a solid white pavement marking, is used by pedestrians.

The lack of sidewalks combined with the narrow roads in the area can lead to potential vehicle and pedestrian conflicts which may be compounded in winter by snow windrows that further reduce the useable road width. Furthermore, there is limited connectivity to existing sidewalks in the western portion of the study area and reduced accessibility and linkages to key destinations within the neighbourhood (i.e., elementary schools, parks, a daycare, and TTC bus stops).

Traffic Management

Traffic volumes in the study area were found to be within the City expected range for local and collector roads as identified in the City's road classification system.

Substandard sightlines were noted at the intersections of Blythwood Road and Strathgowan Crescent; Mount Pleasant Road and Lawrence Crescent; and Mount Pleasant Road and St. Leonards Avenue due to trees and structures.

Residents also identified concerns with speeding, particularly on Mildenhall Road (between Lawrence Avenue and Blythwood Road).

Basement Flooding

Basement flooding incidents were reported following the storm events that occurred on May 12, 2000, August 19, 2005, and July 8, 2013 and through questionnaires completed by residents and returned as part of this study.

General locations of reported basement flooding are shown on Figure ES-2 and discussed in Chapter 5. The intense rainfall during these extreme storm events resulted in stormwater volumes entering the sewers that exceeded the system design capacities

Engineering assessments using hydraulic modelling identified specific locations at risk of basement flooding during extreme events which overload the existing storm, sanitary, combined and partially-separated sewer systems. The frequency and specific causes of basement flooding vary between the different sewer systems which service the study area.

Environmental

The City of Toronto undertook a series of five (5) studies that were completed in 2003. The study, which is now referred to as the Wet Weather Flow Master Plan (WWFMP) addressed a number of issues related to drainage, protection of streams and rivers from stormwater discharge and the integrated design of road and storm systems. The WWFMP includes a Vision Statement that “recognizes rainwater as a potential resource to be utilized to improve the health of Toronto’s watercourses”. The WWFMP philosophy and principles also provided direction for treating stormwater at the source (i.e. on private and public properties) as well as looking at integrated road and storm drainage systems and end-of-pipe control and/or treatment measures.

The study area together with the West Don River, which receives stormwater from the study area, experiences several of the issues as identified in the Don River WWFMMP. Opportunities for water quality improvement were identified in the EA, however, the focus of the study was on reduced surface and basement flooding.

In summary then, the primary types of problems within the study relate to:

- Deteriorated road infrastructure and road drainage;
- Pedestrian safety;
- Traffic management;
- Basement flooding;
- Incidences of surface and basement flooding; and
- Environmental

The opportunities include:

- Development of an integrated road and storm drainage system to current standards which also addresses the primary problems identified and the concerns of the residents within the study area.
- Incorporation of stormwater measures in locations where road, drainage and pedestrian safety improvements are recommended and where feasible which will; (i) improve water quality and reduce flow volumes to the receiving streams including the West Don River, (ii) reduce surface and basement flooding, and (iii)

are consistent with the requirements of the City of Toronto Wet Weather Flow Master Plan.

3.0 THE ENVIRONMENTAL ASSESSMENT PROCESS

3.1 The Environmental Assessment

The Municipal Class Environmental Assessment (Class EA), Municipal Engineers Association (MEA) document (October 2000, as amended in 2007, 2011 and 2015), describes the process that municipalities must follow in order to meet Ontario's Environmental Assessment requirements for water, wastewater and road projects, including Master Plans. The process is illustrated in **Figure 3.1.1**, and may involve up to five phases of assessment. These phases include:

- **Phase 1**: Establish the Problem or Opportunity
- **Phase 2**: Identify and Assess Alternative Solutions to the Problem, and Select a Preferred Solution
- **Phase 3**: Identify and Assess Alternative Design Concepts for the Preferred Solution, and Select a Preferred Design Concept
- **Phase 4**: Prepare an Environmental Study Report
- **Phase 5**: Proceed with Implementation

Public and agency consultation is also an important and necessary component of the above process.

The level of assessment depends on the type of project or Master Plan that a municipality is undertaking. The MEA's Class EA document classifies projects as Schedules 'A', 'B' or 'C' depending on their level of environmental impact and public concern.

- **Schedule 'A'** projects are generally routine maintenance and upgrade projects; they do not have big environmental impacts or need public input. Schedule 'A' projects are all so routine that they are generally pre-approved without any further public consultation.
- **Schedule 'A+'** projects are also pre-approved as with Schedule 'A', however this schedule ensures that public notification is carried out advising the property owners of works to be undertaken in their local area. The public retains the opportunity to comment to municipal council but there is no appeal to the MOECC given that the projects are pre-approved.
- **Schedule 'B'** projects have more environmental impact and do have public implications. Examples would be stormwater ponds, river crossings, expansion of water or sewage plants beyond their rated capacity, new or expanded outfalls and intakes, and the like. Schedule 'B' projects require completion of Phases 1 and 2 of the Class EA process.

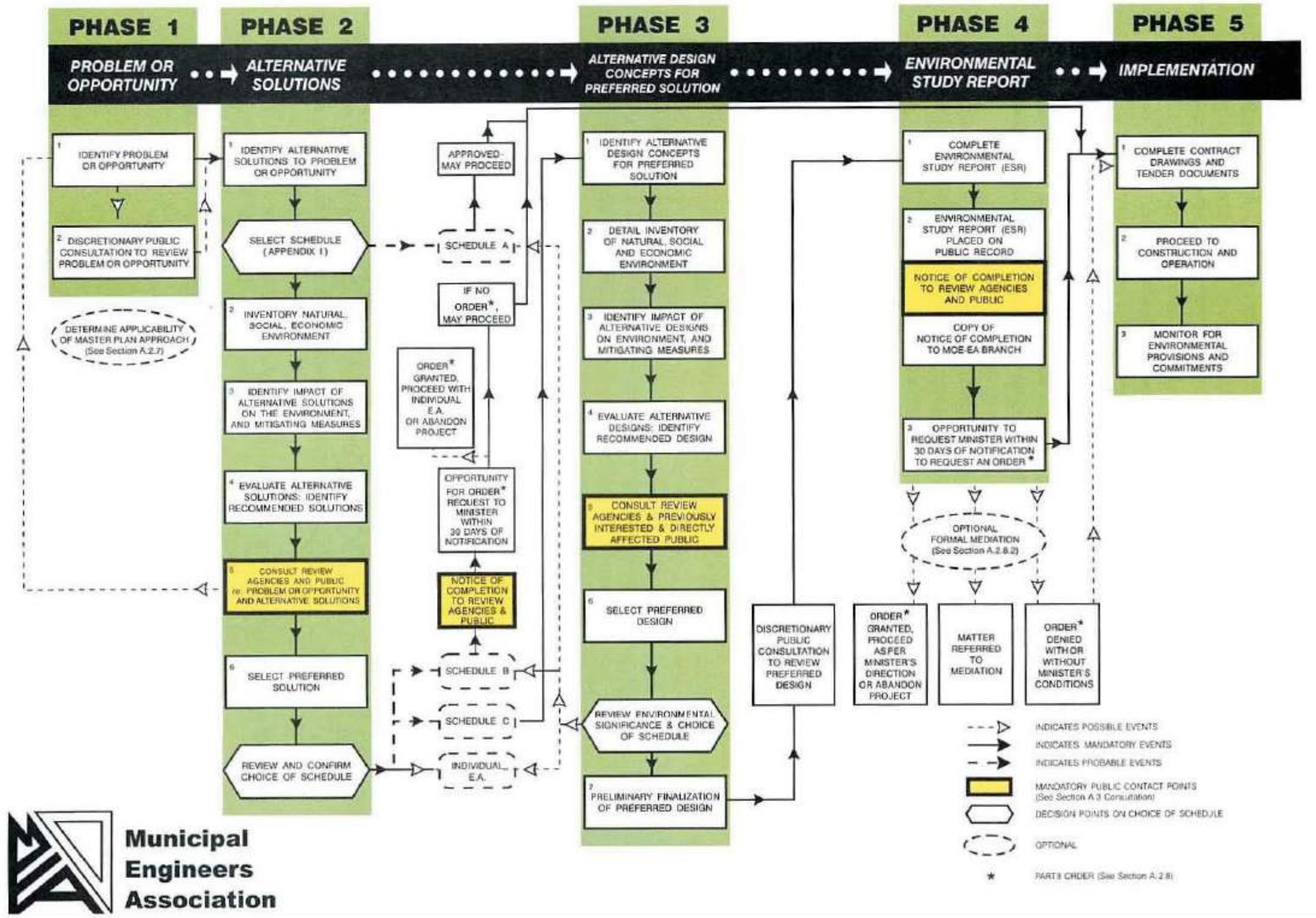
- **Schedule 'C'** projects have the most major public and environmental impacts. Examples would be storage tanks and tunnels with disinfection, anything involving chemical treatment, or expansion beyond a water or sewage plant's rated capacity. Schedule 'C' projects require completion of Phases 1 through 4 of the Class EA process, before proceeding to Phase 5 implementation.

- The MEA's Class EA document identifies different approaches to completing Master Plans. There are four approaches, each representing different levels of assessment. All Master Plans must address at least the first two phases of the Class Environmental Assessment process. **Approach 1**, the most common approach, is to follow Phases 1 and 2 as defined above, then use the Master Plan as a basis for future investigations of site specific Schedule 'B' and 'C' projects. Any Schedule 'B' and 'C' projects that need specific Phase 2 work and Phases 3 and 4 works usually have this Phase 2, 3 and 4 deferred until the actual project is implemented.
- **Approach 2** is to complete all of the work necessary for Schedule 'B' site specific projects at the time they are identified. Using this approach, a municipality would identify everything it needed in the first ten years and would complete all the site specific work required, including public consultation to meet Class EA requirements. The Master Plan in such cases has to be completed with enough detail so that the public in site specific locations can be reasonably informed, and so that the approving government Agencies (Conservation Authorities, Natural Resources, Federal Department of Fisheries and Oceans, Transportation Canada etc.) can be satisfied that their concerns will be addressed before construction commences.
- **Approach 3** is to complete the requirements of Schedule 'B' and Schedule 'C' at the Master Plan stage.
- **Approach 4** is to integrate approvals under the EA and Planning Acts. For example, the preparation of new or amended Official Plans could be undertaken simultaneously with Master Plans for water, wastewater and transportation, and approval for both sought through the same process.

The City has selected Approach 2 for undertaking this Master Plan. The Master Plan will therefore be completed such that the level of investigation, consultation and documentation is sufficient to fulfill the Municipal Class EA requirements for the Schedule 'B' projects identified in the Master Plan. Additional studies will be required for any project which falls under Schedule 'C'.

Figure 3.1.1 – Municipal Class EA Planning and Design Process

NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA



3.2 Public Consultation

A comprehensive public consultation program (see Appendix A) was incorporated into the EA study and included the following components:

- Stakeholder List – A mailing list was created and maintained throughout the study. It included local community groups, institutions and ratepayer associations within the study area, as well as members of the public who requested to be added to the list via telephone, email or comment sheets submitted during public consultations.
- Newspaper Notices – Notices were placed in the North York Mirror to announce the commencement of the EA (January 2013) and to publicize each public consultation event throughout the study process. The notices provided a description of the study, invited the public to attend the consultation event, and identified ways to obtain more information.
- Direct Mail – Direct mail was only used for issuing a letter after the third Public Information Centre (PIC) and for the invite letter for the fourth PIC. PIC notices were issued through Canada Post ahead of the meetings.
- Public Information Centres (PICs) – A total of seven (7) PICs were held at four (4) stages throughout the study. The PICs consisted of an open house where participants had the opportunity view display boards and speak with members of the project team and City staff, followed by a formal presentation and question and answer and/or discussion period. Feedback Forms were distributed at each PIC to encourage participants to submit written comments.
- Community Advisory Group (CAG) Meetings – A CAG was formed at the outset of the EA that enabled neighbourhood groups, resident associations, local residents, and local institutions to provide advice and comments to City staff and the project team during the study. The CAG included approximately 20 members and met four times between November 2013 and April 2016.
- General Meetings – Numerous meetings were held, and correspondence had, with individuals and various interest groups (Mildenhall Pedestrian Safety Group, Lawrence Park Ratepayers Association, Mildenhall Ratepayers Association, WalkTO, Toronto Centre for Active Transportation, Toronto French School);
- Project Website – A project website (www.toronto.ca/lawrencepark) was created to serve as a portal for all project information, updates, and consultation materials throughout the study. The website was promoted in the Notice of Study Commencement and each PIC notice. In advance of PIC #3 and #4, a copy of meeting materials which included key study findings and recommendations were posted on the website for review by community members prior to each consultation session.

Copies of all public consultation materials and meeting summaries can be found in Appendix A.

3.2.1 Public Notification

A Notice of Study Commencement was published in January 2013 in the North York Mirror. The notice was also delivered to approximately 2,000 households within the study area and to the local ratepayers association. The notice introduced the study, explained the Municipal Class EA process and identified means of providing input. A questionnaire was also distributed with the Notice of Commencement that residents were encouraged to complete and submit in order to provide the project team with background information on the study area and identify key concerns. Results of the questionnaire are summarized in Section 5.3.3.

Prior to each Public Information Centre, a notice was distributed to all residents in the study area. Notices were also published in the North York Mirror and sent to those individuals who had requested to be added to the study mailing list. Each PIC notice included a description of the study, invited the public to attend the event, and identified ways to obtain more information. The notices for PIC #3 and #4 also included more detailed information about the study process and encouraged residents to visit the project website to review study findings and recommendations in advance of each meeting.

3.2.2 Public Information Centre #1

Public Information Centre (PIC) #1 was held on April 22, 2013 from 6:30-8:30 pm at Sunny View Jr. and Sr. Public School. The purpose of the PIC was to:

- Present initial findings from a preliminary assessment conducted by the project team;
- Receive community input on the key problems and opportunities within the study area;
- Present results from the questionnaire distributed to residents in January 2013; and
- Discuss next steps for the EA process.

The format of the meeting consisted of an open house from 6:30-7:00 pm, followed by a presentation from 7:00-7:30 pm, and question and answer period from 7:45-8:20 pm. Approximately 100 people participated in the PIC.

During the open house, participants were able to review display boards that focused on various aspects of the EA. Members of the EA project team and City staff were available at the open house to answer questions informally and respond to feedback.

During the PIC, many participants took the opportunity to provide input by completing a Feedback Form or during the question and answer session. A total of 37 Feedback Forms were collected and an additional 31 comments were received by the Councillor or project team before the comment period deadline of May 6, 2013.

The two discussion questions were:

1. Considering the questionnaire results and issues the project team has identified to date, what are the key issues, problems or opportunities (within the parameters of the study) that we should be aware of? Have we missed anything?
2. The next step in the study process is the development of alternative solutions to address the problems and issues identified, as well as criteria to evaluate those alternatives. As the project team begins to think about developing evaluation criteria, what are the key factors they should keep in mind?

A summary of public comments can be found in the PIC #1 summary report in Appendix A.

3.2.3 Public Information Centre #2

The second PIC was held on November 19, 2013 from 6:30-9:00 pm at the Toronto French School. The purpose of the PIC was to:

- Review the study purpose and process;
- Present a summary of existing conditions and long list of alternatives;
- Present and receive community input on the proposed evaluation criteria; and
- Discuss next steps for the EA process.

The PIC format consisted of an open house from 6:30-7:00 pm, followed by a presentation and question and answer period from 7:00-7:50 pm, small group discussions from 7:50-8:25 pm and a reporting and plenary discussion from 8:25-8:45 pm. At the conclusion of the meeting, from 8:45-9:00 pm, time was set aside for meeting participants to complete a questionnaire that was distributed at the outset of the meeting. Approximately 100 people participated in the PIC.

During the open house, participants had an opportunity to review display boards that focused on existing conditions in the study area, a long list of alternative solutions, and conceptual illustrations of alternative road cross-sections. Members of the EA project team and City staff were available at the open house to answer questions informally and respond to feedback.

Participants were able to offer feedback through small table discussions on evaluation criteria and/or by completing a more detailed questionnaire that included questions on the evaluation criteria, existing conditions, a long list of alternatives, and conceptual roadway cross-sections. An online version of the questionnaire was also available on the project website after the PIC. A combined total of 180 questionnaires were received, which were handed in at the PIC, submitted after the meeting, or completed online.

The input received from participants during the roundtable sessions on evaluation criteria was focused around two discussion questions:

1. Thinking about the proposed criteria that will be used to evaluate alternative solutions, what would you say are the top 3 most important criteria? Which are the least important?
2. Thinking about the long list of alternative solutions, have we missed any criteria? Do you have any other feedback on the proposed criteria?

A summary of public comments can be found in the PIC #2 summary report in Appendix A.

3.2.4 Public Information Centre #3

The third round of PICs was held in May 2015 and consisted of four separate public meetings. Each PIC event focused on the recommended solutions for a set of streets within the study area. The PICs took place on May 13, 14, 19 and 21, 2015 from 6:30-9:00 pm at the Lawrence Park Community Church. The PICs were designed to:

- Review the study purpose, process and existing conditions;
- Present alternative solutions and the evaluation process;
- Present recommended alternative solutions;
- Receive community input and answer questions; and
- Discuss next steps for the EA process.

The format of the PICs consisted of an open house from 6:30-7:00 pm, followed by two presentations from 7:00-7:50 pm. The first presentation focused on preliminary recommendations for basement flooding and traffic safety and the second presentation covered preliminary recommendations for various groupings of study area streets. Questions of clarification were taken after each presentation. From 7:50-9:00 pm community members were given the opportunity to view display boards on the preliminary recommendations, speak to project team members and City staff, and complete Feedback Forms that were distributed at the outset of the meeting. A total of 126 people signed in and participated in the four PICs.

During the open house, the display boards were divided into three topic stations. The three topic stations focused on preliminary recommendations for basement flooding, traffic safety, and study area streets and included background information on each topic area. Members of the EA project team and City staff were available at each topic station to answer questions informally and respond to feedback.

At the PICs, participants were able to provide feedback by completing a Feedback Form that included questions on basement flooding, traffic safety, and the assessment of study area streets. A total of 65 Feedback Forms were received, which were either handed in at the PICs or submitted after the meetings.

Following PIC #3, a notice was released by members of the community to all residences that announced that 349 mature trees in the neighbourhood would be impacted by the proposed works in the Lawrence Park Neighbourhood. Ribbons were tied to trees and signs placed on lawns. In reaction to the community message, the City received 360 emails from concerned residents. City issued a letter and FAQ responding to the information.

A summary of public comments can be found in the PIC #3 summary report in Appendix A.

3.2.5 Public Information Centre #4

The fourth PIC and final took place on May 26, 2016 from 6:30-9:30 pm at the Lawrence Park Community Church. The purpose of the PIC was to:

- Review the study purpose and process;
- Provide an update on the work completed since PIC #3 (May 2015);
- Obtain community feedback on the revised plan and recommendations to address deteriorating road conditions, traffic problems, pedestrian safety, road drainage problems and basement flooding issues in the Lawrence Park Neighbourhood; and
- Discuss next steps for the EA process.

The PIC format consisted of an open house from 6:30-7:00 pm followed by a presentation from 7:00-7:50 pm. The presentation focused on recommendations for road reconstruction including an updated assessment of tree impacts, and a review of the recommendations for basement flooding and traffic safety. Following the presentation, remarks were made by City Councillor Jaye Robinson, Frank Morneau of the Lawrence Park Ratepayers Association, and Mayor John Tory. Questions of clarification were taken from 8:30-9:30 pm after the presentation and remarks. Approximately 149 people signed in and participated in the PIC.

During the open house, participants had an opportunity to view displays that featured the revised tree assessments and study recommendations, which included illustrations of existing and proposed road dimensions. Members of the EA project team and City staff were available at the open house to answer questions informally and respond to feedback.

At the end of the meeting, community members were given the opportunity to speak informally to project team members and City staff, and complete Feedback Forms that were distributed at the outset of the meeting.

The input received from participants was focused around three discussion questions:

1. Do you agree with the revised plan to protect street trees? Why or why not?
2. Do you agree with the revised recommendation for Mildenhall Road south of Lawrence (7.2 metre road with 2 sidewalks)? Why or why not?
3. Do you have any further feedback on any of the other study recommendations for basement flooding, study area streets or traffic safety?

A total of 27 Feedback Forms were received, which were either handed in at the PIC or submitted after the meeting. Sixty-five (65) additional comments were received from participants through letters, telephone calls, and emails leading up to and after the PIC.

A summary of public comments can be found in the PIC #4 summary report in Appendix A.

3.2.6 Community Advisory Group Meetings

A Community Advisory Group (CAG) was established by the City to enable Lawrence Park neighbourhood residents, associations and local institutions to provide advice and comments to City staff and the project team during the EA study. The mandate of the CAG was to liaise with the project team to discuss and provide feedback on matters within the scope of the EA. The CAG consisted of approximately 20 members from the Lawrence Park community and played a key role in reviewing presentation materials in advance of the PICs.

The CAG members consisted of local residents and representatives of neighbourhood businesses, community groups and institutions that reflected the character of many streets within the study area, as well as representation from the local Councillor. The Terms of Reference for the CAG is detailed in Appendix A. Letters were issued inviting members to join the CAG.

The CAG was established following PIC #1 and met four times during the EA, generally in advance of the broader public consultation meetings. The format of the meetings consisted of a presentation by City staff and/or the project team followed by a roundtable discussion. The meetings took place on:

- November 5, 2013;
- June 16, 2014;
- April 23, 2015; and
- April 5, 2016.

The CAG Terms of Reference and meeting minutes can be found in Appendix A.

3.2.7 Councillor Briefings

City staff met regularly with the local Councillor, Jaye Robinson, to provide briefings on study progress and upcoming public consultation meetings.

3.2.8 Website

The project website was used to share all background information related to the study, meeting materials, project updates and staff contact information (www.toronto.ca/lawrencepark). The website was updated regularly as the study progressed and served as a means for community members to access detailed information on study findings and recommendations in advance of PIC #3 and #4.

3.3 Petitions

Two separate petitions were received from area residents. Fifty-three persons signed a petition opposed to any City proposal involving the construction of a sidewalks and/or the removal of any healthy trees in connection with road construction, while the second petition signed by 44 residents of Dawlish Avenue opposed the construction of a sidewalk and/or removal of trees along Dawlish Avenue.

The Lawrence Park Ratepayer Association requested that City staff defer their staff report on the project until the association completed a poll of residents. On October 28, 2016, the Lawrence Park Ratepayer Association submitted a summary report of a door-to-door survey conducted of area residents. A copy is attached in Appendix A

3.4 Meetings

Several requests were received from area residents to meet with City staff to gain a better understanding of the study approach and recommendations.

A meeting was held with Dr. Nabil Bechai, President of the Mildenhall Ratepayers Association on December 2, 2015 to discuss the study objectives and information that had been presented to-date. Dr. Bechai arranged a meeting with City staff and members of the Mildenhall Ratepayers Association and Lawrence Park Ratepayer's Association along with residents of the neighbourhood on March 3, 2016. The purpose of the meeting was to provide an update on revisions being made by the City and obtain input from interested residents.

On March 21, 2016, City staff met with three area residents, Mr. Fulgraff, Mr. Brasseur and Mr. Wilhelm to address their questions about the analysis of stormwater drainage. A meeting was also held on October 18, 2016 with Mr. Wilhelm to provide response to a list of 80 questions submitted to the City on February 11, 2016. A copy of the responses to the questions is included in Appendix A.

In addition to the above meetings, City staff responded to telephone and email inquiries from residents and interested stakeholders throughout the study process.

3.5 Notification and Consultation with Affected Property Owner

The study recommendations include the replacement and upgrading of existing storm and sanitary sewers located on three private properties that will require easement agreements. A letter was issued by registered mail to each property owner to inform them of the requirements and request to meet.

At the request of both the York University and Toronto French School, City staff met with representatives to discuss the recommendations and address their questions and comments. Copies of correspondence and meeting minutes can be found in Appendix A.

3.6 Agency and Indigenous Consultation

The Notice of Study Commencement was distributed in January 2013 to all relevant government agencies to inform them of the study and requesting feedback. Notices were also sent ahead of each PIC. Responses letters were received from TRCA.

Letters were issued to the following indigenous contacts:

- Mississauga's of the New Credit First Nation
- Alderville First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island
- Kawartha Nishwabe First Nations
- Curved Lake First Nation

Copies of the notices of Public Information Centres were also sent inviting these groups to attend the Public Information Centres and to inform them of the study recommendations.

Following the Notice of Commencement, a response letter was received from the Toronto & Region Conservation Authority (TRCA), dated February 27, 2013. Copies of correspondence can be found in Appendix B.

On April 14, 2014, the City and consultant meet with representatives from TRCA to discuss the study and information to assist in the analysis. A copy of the minutes from this meeting are included in Appendix B.

3.7 Report to Council

City staff summarized the study recommendations and presented a report to the Public Works & Infrastructure Committee (PWIC) of Toronto City Council at its meeting on May 9, 2017. , prepared the request to proceed with the 30-day public review. The report outlined the study recommendations and a request to proceed with a 30-day public review. All persons on the mailing list were notified of the report’s availability and opportunity to arrange to speak or submit comments to PWIC. A number of persons submitted emails and/or appeared before the Committee to share their comments:

1. City Council direct the General Manager, Transportation Services, to install the proposed sidewalk for Pinedale Road, Strathgowan Crescent and Glenallen Road on the north side of the street to ensure connectivity and safe pedestrian access to Blythwood Junior Public School.

2. City Council direct the General Manager, Transportation Services to install the proposed sidewalk for Mildenhall Road on the east side of the street to connect to the existing sidewalk on Mildenhall north of Lawrence, provide safe pedestrian access to Cheltenham Park and the Toronto French School.

3. City Council endorse the Lawrence Park Neighbourhood Investigation of Basement Flooding (Area 20) and Road Improvement Class Environmental Assessment Study Master Plan as summarized by the projects listed in Attachment 23 to the report (May 1, 2017) from the Chief Engineer and Executive Director, Engineering and Construction

Services, the General Manager, Toronto Water and the General Manager, Transportation Services, as amended by Parts 1 and 2 above.

4. City Council authorize the Chief Engineer and Executive Director, Engineering and Construction Services to publish a Notice of Completion and file the Lawrence Park Neighbourhood Investigation of Basement Flooding (Area 20) and Road Improvement Class Environmental Assessment Study Master Plan report in the public record for a minimum 30 days, in accordance with the requirements of the Municipal Class Environmental Assessment process.

5. City Council direct the Chief Engineer and Executive Director, Engineering and Construction Services, to establish a Construction Liaison Committee, comprised of local residents and City staff and modelled on the Construction Liaison Committee as part of the Hogg's Hollow Stormwater Management and Roads Improvement Class Environmental Assessment Study, to work in collaboration with City staff to determine construction mitigation measures, tree protection measures, and facilitate communication with neighbourhood residents, including communications on the potential by-law infractions for that can result for homeowners where sidewalks are being added.

6. City Council direct the appropriate City staff to follow the model of the Hogg's Hollow Stormwater Management and Roads Improvement Class Environmental Assessment Study and retain as many trees as possible during the detailed design and construction phases by researching and reviewing international best practices with regard to tree protection and construction, consulting with the Construction Liaison Committee, and using measures, including but not limited to:
    a. localized road narrowing and/or shifting;
    b. pinching the road;
    c. on-site supervision by certified arborists;
    d. excavation techniques such as hand digging, and pneumatic and hydraulic excavation techniques;
    e. root pruning techniques;
    f. backfill techniques; and
    g. tree care during construction.

7. City Council request that the General Manager, Transportation Services to prioritize the installation of the proposed sidewalk on Mildenhall Road due to ongoing pedestrian safety concerns.

3.8 Notice of Completion

The filing of this Master Plan and the issuance of the Notice of Completion fulfill the requirements for Schedule 'B' projects under the Municipal Class EA process. Subject to comments received, the receipt of the necessary approvals, and funding, the City of Toronto intends to continue with the detailed design and construction of the recommended projects.

4.0 EXISTING CONDITIONS

4.1 Study Area

The study area is approximately 160 hectares, which drains south-eastward to the west branch of the Don River. Although the general slope of area is towards south-east and the Don River West Branch, there are low lying areas not providing positive drainage and resulting in accumulation of surface storm flow flooding.

Topography across the study area group generally dips from the northwest to the southeast and towards the Don River West Branch. Based on the digital elevation model for the LPN study area, the ground surface elevation ranges from approximately 176 m to 126 m above mean sea level, with the exception of areas near the West Don River which are situated at elevations of approximately 110 m AMSL.

From the field survey, low lying areas were identified as well as low points within the roadway where there may be potential for ponding. Direction of flow for the overland system was determined as best as possible. Any special drainage features were documented such as roadside ditches that are located within the LPN study area.

4.2 Natural Environment

4.2.1 General

This section will describe the natural environment within and adjacent to the LPN study area. The objective of the following sections is to describe the natural (as well as social and economic) environment from a study area perspective.

4.2.2 Geology, Physiography and Soils

The LPN study area is located adjacent to the Don Valley. The Don Valley is notable because of its deep wide valley in the lower reaches. At the Bloor Street Viaduct, the valley is about 400 m wide while the river is only about 15 m wide. This is due to its glacial origins. The Don River and its deep valley were formed about 12,000 years ago at the end of the Wisconsinan Glaciation. During that glaciation which lasted for 35,000 years, all of Ontario was covered in ice. As the climate warmed the glaciers began to melt. As the ice front retreated in southern Ontario, several rivers were formed that drained into Lake Iroquois, a glacier lake which was the precursor to Lake Ontario. The Don River is now small in comparison to the deep and wide valley that resulted from its glacial origin. The Don River is now classified as an underfit river.

The landscape at that time was loose glacial till so the large amounts of glacier melt water eroded deep valleys over thousands of years. As time progressed, isostatic uplift caused the earth's plate to rise and tilt. This caused Lake Iroquois to drain towards the south. A remnant of its shoreline can be seen on the north side of Davenport Road in Toronto. In the Don Valley, the old shoreline is evident just north of Eglinton Avenue. Today the source of the Don River is the Oak Ridges Moraine, another legacy of the Wisconsin glaciation.

The location of the old shoreline is important when considering soils in the Don watershed. Soils north of the old shoreline are mostly luvisolic *Halton Till* while south of the shoreline they are still sandy glaciolacustrine deposits.

The Don Valley contains one of the most interesting locations for studying the regional geological history. The Don Valley Brick Works was an old brick making factory with a quarry where they extracted shale. At the rear wall, local geologists discovered a record of the past three glaciations. There are nine distinct layers visible dating back 120,000 years.

4.2.3 Terrestrial Communities

In October 2014 and 2016, Aquafor Beech Limited completed ecological investigations in natural and semi-natural areas in and adjacent to where construction works were proposed. The study area consists of urban residential lands with some institutional (i.e. educational) land uses. Terrestrial and aquatic habitat is primarily contained within the west branch of the Don River Valley, and smaller tributary ravine to the Don River (Burke Brook) including Blythwood Ravine Park and Sunnydene Park. As shown below, two Environmentally Significant Areas are present within the City’s Natural Heritage System identified within the study area (**Figure 4.2.1**). The study area does not contain any Areas of Natural and Scientific Interest (ANSIs).

Environmentally Significant Areas

As shown below in **Figure 4.2.1**, Environmentally Significant Areas (ESAs) within the study area include Glendon Forest (ESA #34) and Sherwood Park (ESA #71). Burke Brook Forest (ESA #9) is adjacent to the study area, east of Sherwood Park and Bayview Avenue.

Glendon Forest is located within the Don River valley system and is primarily a mixture of cultural, forest, bluff, swamp, and marsh communities; 4 of which are considered significant. Many of the wetland communities in this ESA are supported by groundwater seepage. A total of 37 significant flora and 2 significant fauna species have been recorded in this 60.6 hectare ESA. The eastern portion of the Valleyanna Dr. Site and northern portion of Site #2 are within this ESA.

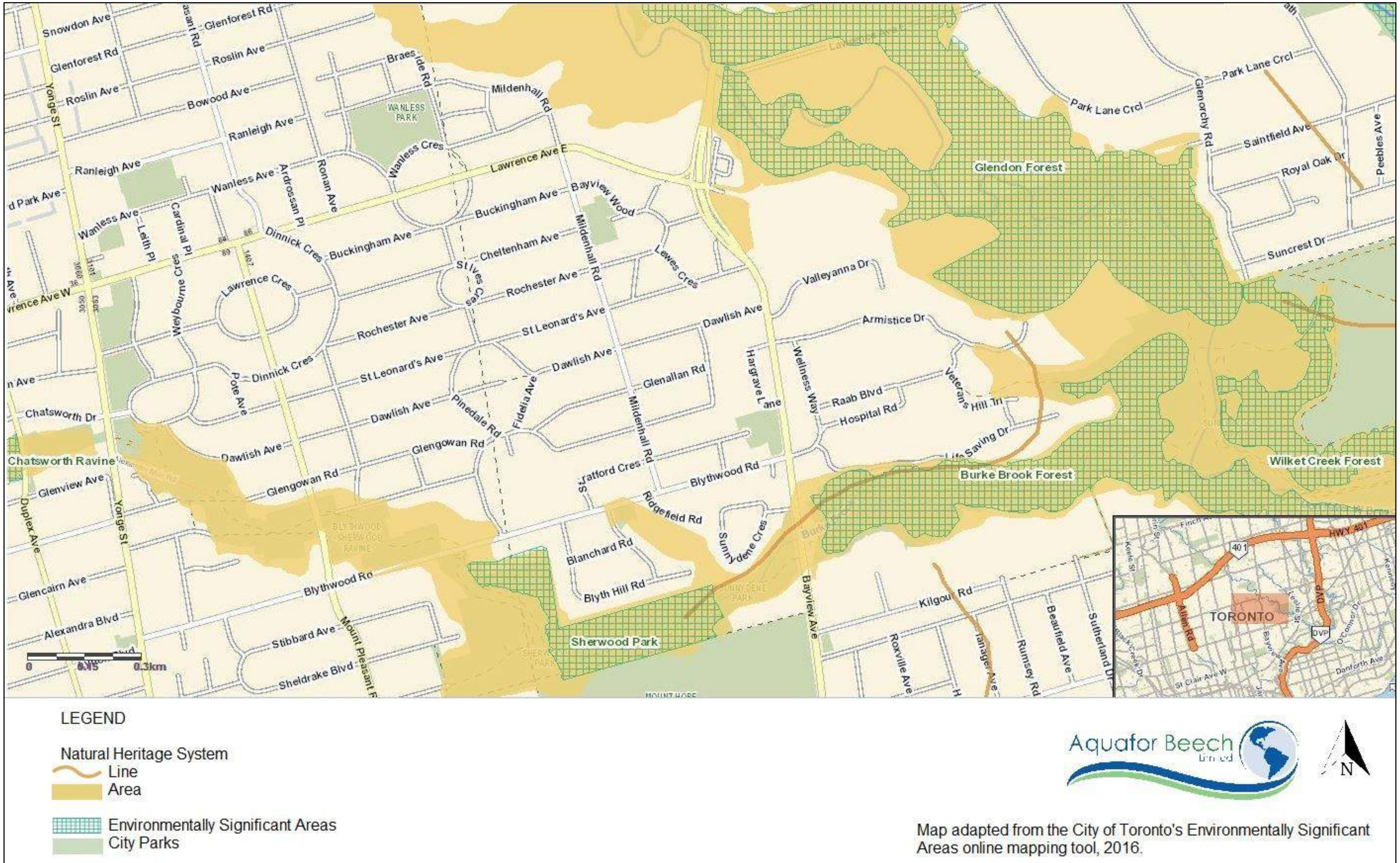


Figure 4.2.1 – City of Toronto Natural Heritage System and Environmentally Sensitive Areas

Sherwood Park is located south of Blyth Hill Road. Vegetation communities primarily consist of deciduous and mixed forest on steep slopes, table lands, and bottomlands along Burke Brook. Seepage areas are present on both slopes and bottomlands, and support habitat-sensitive wetland species. A total of 13 significant vegetation communities, 22 significant species of flora, and 2 significant species of fauna have previously been recorded in this area. The slopes directly south of Blyth Hill Road support multiple seepage areas within a mature forest supporting trees over 150 years in age. Site #3 is located near this ESA.

Other Natural Areas

Other natural areas investigated as part of this study include the forested ravine slopes and bottomlands behind the Toronto French School (Site #1) and Blythwood Ravine Park (Site #4).

Figure 4.2.2 – Sugar maple forest, Site #1

Natural areas at Site #1 contain ravine slopes dominated by mature sugar maple (**Figure 4.2.2**) and oak forests, and bottomlands containing mature hemlock forest and deciduous woodland communities. While contiguous with the West Don River valley, natural areas north of the Toronto French School are not included in the Glendon Forest ESA.

The northern portion of Blythwood Ravine Park is located within Site #4. Vegetation communities consist of mid-aged deciduous forest on slopes and cultural meadow and woodland communities in the bottomlands and along the channel.

4.2.4 Aquatic Communities

As mentioned above in Section 4.2.3, the west branch of the Don River is located adjacent to the LPN study area. Further information on this Don River West Branch and the aquatic communities they support is detailed below.

Don River West Branch

The Don River watershed is located in the City of Toronto; the headwaters are located within the Oak Ridges Moraine. Two major branches of the Don River (East and West Branch) converge before flowing into Lake Ontario. A number of smaller tributaries also exist.

The Don River has undergone dramatic changes over time. Previously, the watershed supported sensitive brook trout (*Salvelinus fontinalis*) and Atlantic salmon (*Salmo salar*). Today, trout and salmon remain in the Don River Valley but are not native or reproducing. Rather, they are maintained by stocking. The Don River represents one of the most degraded systems in the GTA. This is reflective of the urban location as well as the time at which the watershed was developed. Many historic and natural characteristics were not retained and environmentally informed planning decisions were not applied (TRCA 2009).

At the Lower West Branch of the Don River is located adjacent to the LPN study area. The western branch begins near Maple, Ontario, flowing south-east through the suburban industrial belt of Concord (Vaughan), and the G. Ross Lord Reservoir. It crosses Yonge Street as it flows through Hoggs Hollow, past York University's Glendon ("valley of the Don") campus, and then flows on to Leaside before the confluence with the East Branch.

Within the study area, the main branch Lower West Don River is warmwater fish habitat. Burke Brook is classified as coldwater fish habitat. (TRCA 2009)

TRCA’s Regional Watershed Monitoring Program (RWMP) monitors four (4) stations in the Lower West Don River (TRCA 2009). No data is available specific to Burke Brook. The Ontario Stream Assessment Protocol (OSAP) is used every three (3) years to assess the fish community and aquatic habitat. Monitoring data for the Lower Don available on TRCA’s website includes the years 2002 and 2005. Species captured included:

- White Sucker (*Catostomus commersonii*)
- Blacknose Dace (*Rhinichthys atratulus*)
- Longnose Dace (*R. cataractae*)
- Fathead Minnow (*Pimephales promelas*)
- Common Carp (*Cyprinus carpio*)
- Creek Chub (*Semotilus atromaculatus*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Pumpkinseed (*Lepomis gibbosus*)

Index of Biological Integrity (IBI) results for these two monitoring years showed that the quality of the fish community was “poor” at the majority of the monitoring stations with an overall rating of “B”. The study area is within Fisheries Management Zone 5, and riverine short term target species are Johnny Darter (*Etheostoma nigrum*), common shiner (*Luxilus cornutus*), white sucker and rainbow trout (migratory) (*Oncorhynchus mykiss*). Riverine long term target species are rainbow darter (*E. caeruleum*) and northern redbelly dace (*Chrosomus eos*). The overall watershed rating for target species scored a “D”. (TRCA 2009)

Benthic macroinvertebrates are monitored at RWMP stations on an annual basis using OSAP. The majority of the Lower West Don stations rated "potentially impaired", with an overall watershed rating of "F" (Fail) (TRCA 2009).

In summary, the Lower West Don River is highly degraded, containing warm to coolwater fish species and poor water quality.

4.2.5 Species at Risk

One Federally and Provincially Endangered species was located at multiple sites during site investigations completed in 2014 and 2016. Butternut (*Juglans cinerea*) was located at Site #1 (one tree), the Valleyanna Site (three trees), and Site #4 (one tree). The locations of these trees will be detailed in a forthcoming Environmental Impact Study (EIS) to be prepared by Aquafor Beech Limited.

Butternut is a short-lived (<75 years), mast-bearing tree in the walnut family (Juglandaceae). It is frequently found along moist streambanks and within riparian areas, although it will also occur on well-drained sites underlain by limestone (Poisson and Ursic, 2013). As butternut is intolerant of shade it does not comprise a large component of mature forests. In Canada this species is restricted to southern Ontario and Quebec where the soils are calcareous, and is absent on the granites of the Canadian Shield.

The primary threat to butternut is an introduced exotic fungal pathogen, *Sirococcus clavigignenti-juglandacearum* ("butternut canker"). Infection generally occurs through wounds, broken branches or leaf scars, causing twig dieback and eventual tree mortality. The most obvious sign of infection is a black, oozing canker on the stem or twigs. Hybridization with other walnut species, most notably English walnut (*J. regia*) and Japanese walnut (*J. aliantifolia*), is also a threat. Hybrid trees are not protected under the Endangered Species Act.

A recovery strategy for butternut (Poisson and Ursic, 2013) has been developed, however a habitat regulation is not yet in place. For the interim, the general habitat provisions of the Endangered Species Act apply. In Aquafor Beech Limited's past experience, the Ministry of Natural Resources and Forestry (MNRF) has interpreted butternut habitat as being an area 50 metres surrounding each stem. Any development activities or site alterations within butternut habitat demand that a certified Butternut Health Assessor determine whether the individual is retainable and therefore protected under the Endangered Species Act, based on provincial protocols. Accordingly, it is recommended that butternut in the study area be assessed at least 2 years' prior to the anticipated construction date. Delaying assessments closer to the date of construction may result in project delays should permits under the Endangered Species Act be required.

4.2.6 Tree Inventory

In July and August 2013, certified arborists from Aboud & Associates Inc. inventoried and assessed trees within the right-of-way (ROW) and those with crowns approaching the ROW. The final tree inventory report is included in Appendix D.

The purpose of the inventory and assessment was to determine the amount, location, and type of trees which could potentially be impacted by future construction; as well as to assign a preservation priority ranking and minimum tree protection zone (TPZ) for each tree in accordance with the trunk diametre method prescribed by the City of Toronto. Preservation priority rankings were assigned based upon each tree's current condition. The preservation priority rankings had four levels: High, ModHigh, Moderate and Low. The following defines each ranking:

- High – Mature (diameter at breast height (DBH) 50 cm or greater), healthy and in good overall condition.
- ModHigh – Immature to established (up to 49 cm DBH). Generally healthy and with good form; or, somewhat compromised in health and form but providing a significant benefit to the neighbourhood (i.e., large canopy, and some maintenance could improve health and/or form).
- Moderate – No size limit. The tree has clear indications of biological stress and/or structural deficiencies, which are unlikely to improve through maintenance.
- Low – No size limit. Biological health and/or structural condition are greatly compromised such that removal would be recommended regardless of potential construction impacts. Size is small to large.

Table 4.2.1, taken from the Aboud & Associates report (see Appendix D), presents the criteria and levels for each preservation priority ranking.

Table 4.2.1 – Breakdown of preservation priority rankings by criteria

Preservation Priority Ranking	DBH	Biological Health	Condition
High	50 cm and greater	"H" only	"H" only
ModHigh	< 50 cm	"H" – "H(M)"	"H" – "H(M)"
Moderate	Any	"H(M)" – "M"	"H(M)" – "M"
Low	Any	"M(L)" – "L"	"M(L)" – "L"

A TPZ was assigned to each tree using a desktop calculation. The calculated TPZ is based on the DBH of the tree, and was determined using the City of Toronto's required tree protection distances, which employs a calculation based upon the DBH of a tree to give a protection distance from the base of a tree. The TPZ is calculated by doubling the tree protection distance and adding the DBH.

A total of 2,648 trees were inventoried and assessed by Aboud & Associates Inc. In 2014, in part due to public interest, ice storm damage, as well as emerald ash borer and birch borer infestation; staff from the City of Toronto's Forestry department and an ISA-certified arborist from Aquafor Beech Limited further refined the work undertaken by Aboud and Associates Inc. The objectives of the work completed in 2014 were to refine the TPZ according to field conditions and, if necessary, inventory any trees that may have been missed or had been removed since the original inventory.

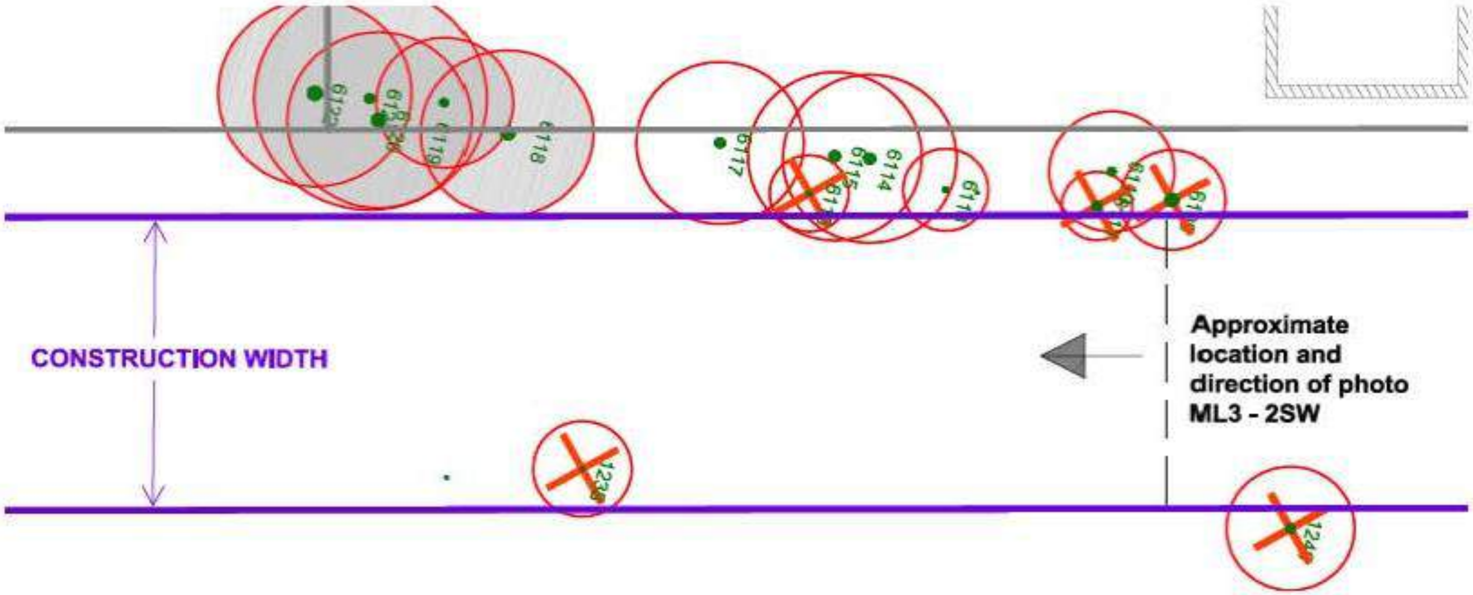
In reviewing the TPZ for trees in Lawrence Park, it was apparent that the desktop calculation method to assess potential impacts to trees was not practical for the Lawrence Park neighbourhood, as the TPZ for many trees extended into the existing roadway and resulted in a higher number of tree removals than was necessary. To correct the TPZ and consider the location of existing infrastructure, City and Consultant staff assessed critical construction sensitivity factors for each tree and, using a measuring tape, recorded the distance from the tree where the tree would likely be negatively impacted if construction were to occur within that zone. This radial distance was then doubled to get a revised TPZ, **herein referred to as the Tree Impact Zone (TIZ),** which is the area in which construction would likely negatively impact the tree. The following four factors were taken into consideration in the determination of the TIZ, with the minimum TPZ distances per City guidelines used as a starting point and augmented as warranted:

1. Species type (rationale: species vary in their tolerances to root disturbance);
2. Age (rationale: younger trees are generally more tolerant of root disturbance than older trees);
3. Health (rationale: trees in poor health are generally less tolerant of root disturbance); and
4. Proximity to existing infrastructure (e.g. roads limiting extent of root growth)
    - Some trees have proportionately small TIZs. This often occurs when trees are close to existing infrastructure such as roads, raised planters, etc. While the minimum TPZ (per City guidelines) would extend into the road, in reality the tree roots do not extend into the road and would not be impacted by proposed construction works within the existing footprint of the road.

The TIZ is used in subsequent components of the study to assess impacts on street trees due to potential construction impacts. In assessing potential impacts to trees, the TIZ was overlain on construction option drawings (**Figure 4.2.3**). Depending on the location of the tree and its TIZ, trees were placed into one of three categories:

1. Removed – The intrusion into the TIZ is such that the tree will likely not survive in the short – medium term due to injuries incurred by construction. As such, it is recommended that trees in this category be removed.
2. Preserved – Intrusion into the TIZ is minor and as such the tree may survive after construction following appropriate aftercare. As such, trees in this category will be preserved.
3. Not Impacted – Intrusion into the TIZ is not proposed and as such it is not anticipated that trees in this category will be significantly impacted.

As stated previously, the TIZ approach taken by the City's Forestry Department in collaboration with Aquafor Beech Limited in 2014 resulted in a more accurate assessment with respect to the removal of trees than the TPZ desktop calculation methodology employed in 2013.



	**Not Impacted:** The TIZ lies completely outside of the construction width and will not be impacted.
	**Preserved if Possible:** Construction inside the TIZ; the tree will be impacted by construction. Design, construction and post construction mitigation techniques will be used to preserve the tree.
	**Removed and Replaced:** Construction significantly inside the TIZ. Tree significantly impacted by construction to the extent that removal is expected.

Figure 4.2.3 – Tree Impact Zones

4.3 Socio – Economic Environment

4.3.1 Land Use

The dominant land use in the study area is residential representing approximately 70% of the service area. Approximately 20% of the area is associated with roadway area while the remainder is a combination of institutional and open space. The residential development is currently single family with no multilevel developments. A condominium/apartment development located north east of Bayview Avenue and Blythwood Road is currently under construction. **Table 4.3.1** presents a summary of land use information. **Table 4.3.1** also shows the population information based on 2011 census data based on the sanitary boundaries. In total there is a population of 4,094 persons associated with LPN study area.

The reported area flooding is associated with the residential area which is predominately single family homes. There is a moderate amount of open space in the area associated with institutional lands and park areas. The land use has been processed based on the defined storm service boundary.

Table 4.3.1 – Land Use Classification

Land Use Classification		LPN Study Area		
		Land Use Area (Ha)	Percentage of Total (%)	Population
Residential	Single Family	109	68%	4,094
	Multilevel Families	0	0%	-
Industrial /Commercial /Institutional	Commercial	0	0%	-
	Industrial	0	0%	-
	Institutional	14	9%	-
Open Space	Open Area	6	4%	-
	Roadway	31	19%	-
Total		160	100%	4,094
Note: Land use summary based on storm service area.				

The City of Toronto Official Plan (November 2002) indicates that the "Neighbourhoods" land use designation dominates the study area. The uses permitted in the Neighbourhoods designation include residential uses in lower scale buildings such as detached houses, semi-detached houses, duplexes, triplexes, townhouses, and interspersed walk-up apartments. Parks, local institutions, home occupations, cultural and recreational facilities, and small-scale retail, service, and office uses are also permitted in the Neighbourhoods designation.

In the eastern portion of Lawrence Park Neighbourhood Area along Bayview Avenue, and scattered in small pockets throughout the study area, there are *Mixed Use Areas,* which achieve a multitude of planning objectives by combing a broad array of residential uses, institutions, offices, retail and services, recreation and cultural activities, entertainment, and parks and open spaces.

Centred on Mount Pleasant Road, the neighbourhood grew slowly with medium-sized houses on narrow but deep lots. There are few commercial businesses within a ten-minute walk. The closest grocery stores are close to Yonge and Lawrence.

The neighbourhood is located in a setting that includes gently rolling hills, several parks, and a ravine. Lawrence Park's shops, schools and recreational facilities are located on its periphery.

4.4 Proposed land Use

Based on the Toronto Official Plan, no significant land use by the City is proposed within the study area.

4.5 Transportation

In its early years, the neighbourhood's transportation was served predominantly by the northern section of the Toronto Transportation Commission's Yonge streetcar. When the Yonge subway opened to Eglinton in 1954, the TTC replaced this service with trolley buses on Yonge Street and Mount Pleasant Road, both terminating at the Eglinton station. The trolleys left Yonge when the subway was extended further north in 1973, although a less frequent local bus service remained; the trolleys on Mount Pleasant lasted until 1991, when they were replaced with regular buses.

Most Lawrence Park residents are within walking distance of bus routes that run along Yonge Street, Mount Pleasant Road, Bayview Avenue and Lawrence Avenue. The Lawrence subway station, located at the intersection of Yonge and Lawrence, is part of the Yonge-University-Spadina line.

Both Bayview and Yonge Street connect to Highway 401 within a five- to ten-minute drive from Lawrence Park.

5.0 EXISTING DRAINAGE AND ROADS NETWORKS

5.1 General

The area within the main study boundary is about 160 ha, of which about 111 ha is served by a separated sewer system. Topography of the study area is such that the water flows from northwest to the southeast and east end to the west branch of the Don River at the designated outfalls as shown in **Figure 5.1.1**. The high point in study area is located at northwest side where as the low point is located at the southeast boundary of the study area.

Figure 5.1.2shows the Lawrence Park Neighbourhood (LPN) study area which is generally located in the central part of the City within Ward 25 – Don Valley West. Also shown are general locations where historical flooding was reported to the City. The study area is roughly bounded by Blythwood Road, Ridgefield Road and Sunnydene Crescent to the south, Don River West Branch to the north, Mount Pleasant Road to the west, and Bayview Avenue in the east.

The distribution of land use within the Lawrence Park Neighbourhood (LPN) study area is approximately 70% single and multiple residential, approximately 10% institutional and commercial, and 20% park area and roadway. A majority of the commercial developments are located adjacent to Bayview Avenue.

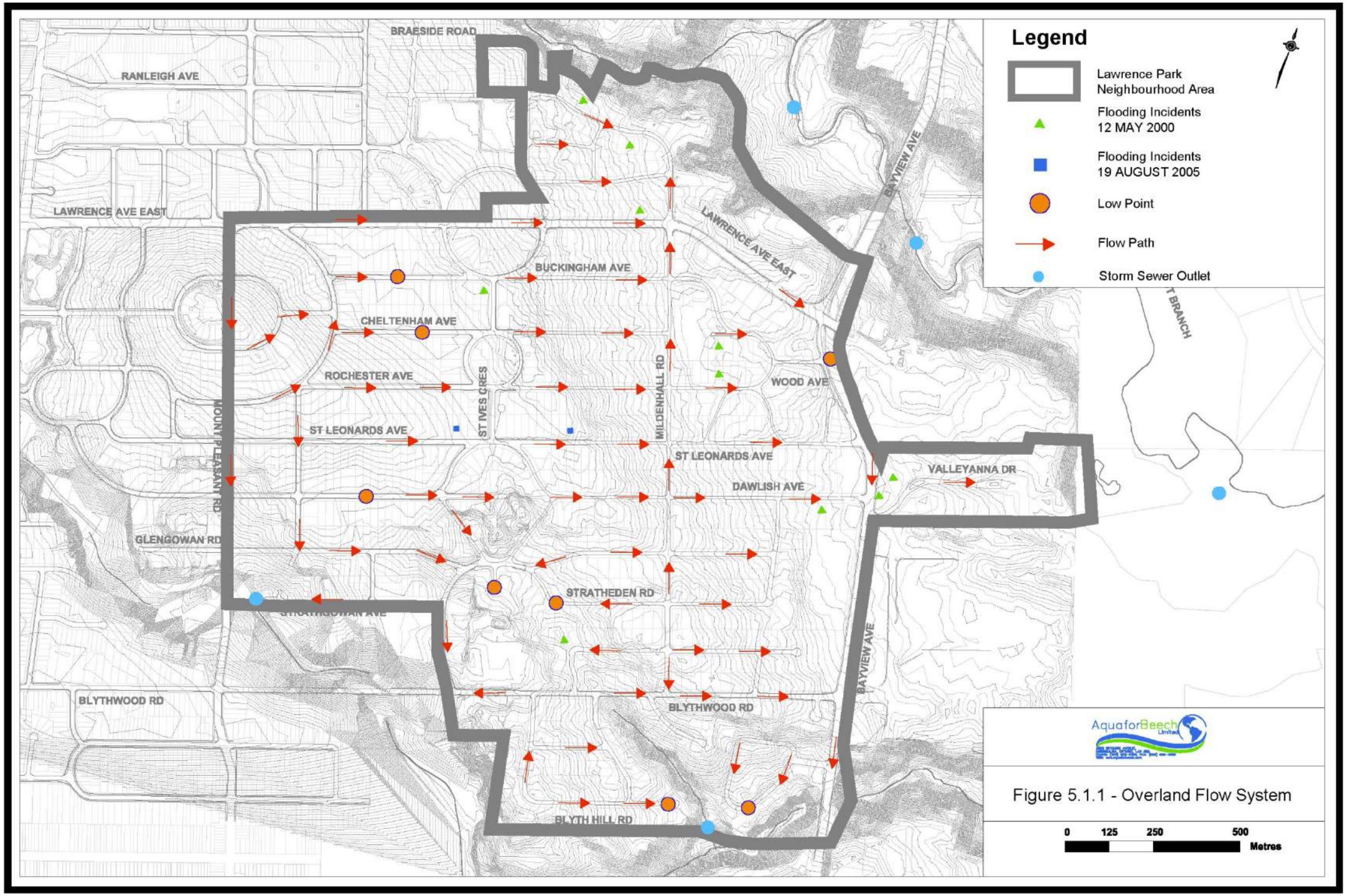


Figure 5.1.1: Overland Flow Routes

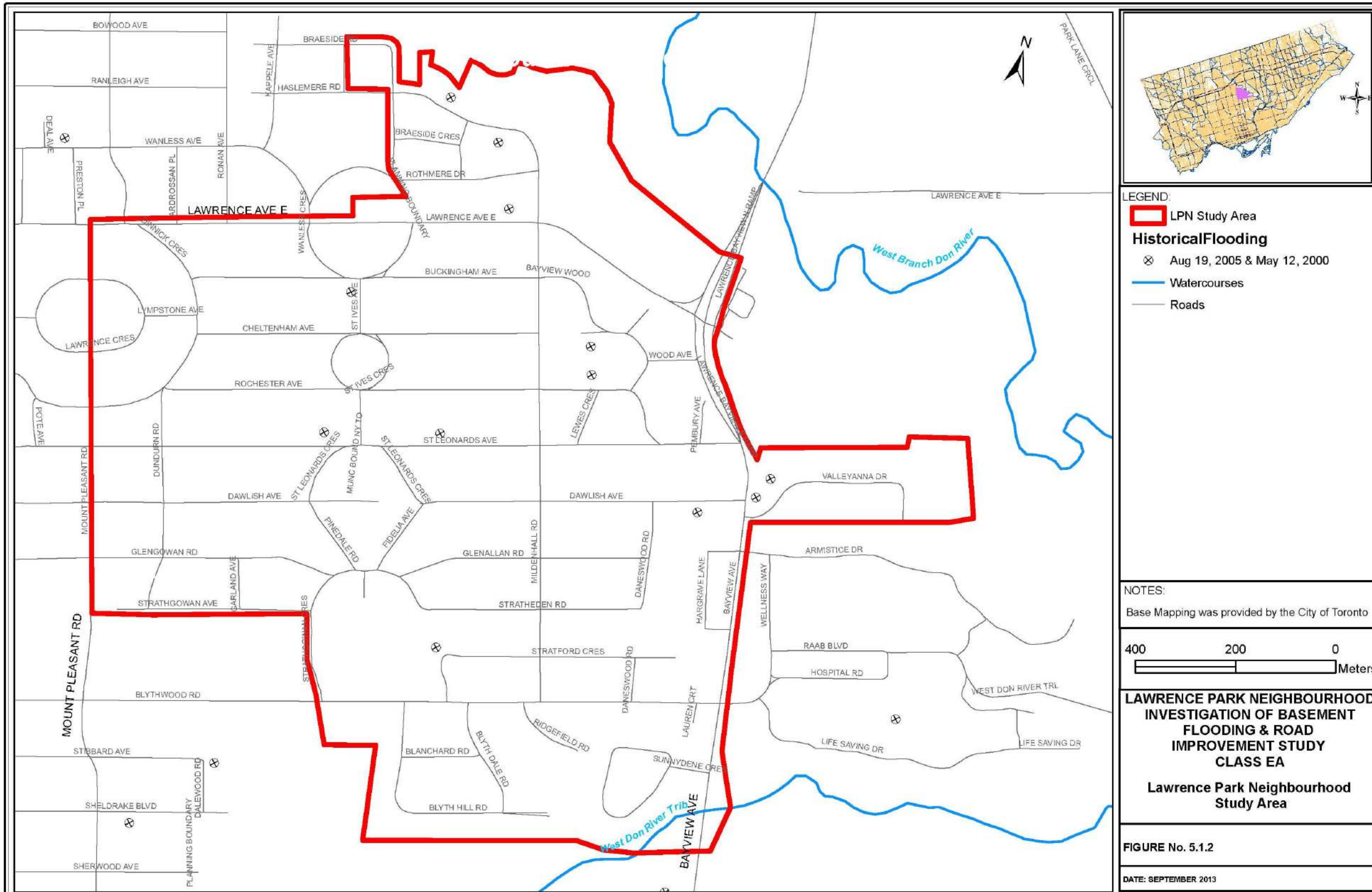


Figure 5.1.2 – Historical Flooding Map

5.2 Existing Storm Drainage, Combined and Sanitary Systems

5.2.1 Description of the Storm Drainage, Combined and Sanitary Systems

The study area is serviced by a mix of combined, sanitary and road storm sewers as well as roadside ditches. The Lawrence Park Neighbourhood Sewershed has five (5) stormwater outfalls discharging into a tributary of the west branch of the Don River.

A majority of the homes in area to the west of St. Ives Avenue (former City of Toronto) were initially serviced with combined sewers, which carry both wastewater and stormwater runoff. Throughout the 1960s until the mid 1980s, the City undertook sewer separation programs whereby stormwater runoff from public property was directed to a storm sewer. Subdivisions to the east of St. Ives Avenue (former City of North York) within the study area that were constructed from the 1960's onward are serviced by road ditches as well as a separate storm and sanitary system.

As of 2013, approximately 10% of the area is serviced by combined sewers, 20.5% with partially separated sewers (storm/combined) and 69.5% with separated sewers (storm/sanitary).

5.3 Surface and Basement Flooding

5.3.1 General

In general, there are two common types of flooding that they are caused by large amounts of water coming from heavy rainfall over a short period of time or snowmelt.

Surface Flooding

Surface flooding is water that flows over land and is usually generated by rainfall or snowmelt. Home's proximity to any water features; channel restrictions and the slope of the terrain contribute to overland flow. Water from overland flooding can enter through the home's doors, windows, reverse sloping driveways and/or holes in the walls of the foundation.

Basement Flooding

Water can leak into the basement through holes and cracks in foundation walls, floors and from the building rooftop. Particularly in older homes (15 years or older), cracks may have developed in the foundation or floor slab, which allows water to enter the basement. Basement flooding also occurs when water backs-up from the storm, sanitary or combined sewer.

5.3.2 City Flooding records

Figure 5.3.1 shows the locations of basement flooding reported to the City for two historical storm events in LPN study area. The events include May 12, 2000 and August 19, 2005. Out of approximately 1,300 properties in LPN study area, there were 10 reported basements flooded for the May 2000 event and a total of two reported flooded during the August 2005 event. There were no properties that reported flooding on both the May 2000 and August 2005 events. The centre of the August 19, 2005 event passed north of the LPN study area resulting in few reported flooding cases in the area in comparison to other parts of the City.

5.3.3 Questionnaire

A questionnaire was distributed to all residents within the Lawrence Park Neighbourhood in late January 2013. The submission deadline was February 28, 2013. Approximately 387 residents responded out of the 2,000 households (estimated) that received the survey. This response rate is approximately 17% and is considered high compared to other basement flooding studies in Toronto. The objective of the questionnaire was to gather input on flooding, road conditions, pedestrian safety, traffic issues, etc.

The questionnaire results were presented in the Public Information Centre (PIC) No. 1 graphically. **Figure 5.3.2** and **Figure 5.3.3** present the basement and surface flooding responses from the questionnaire results.

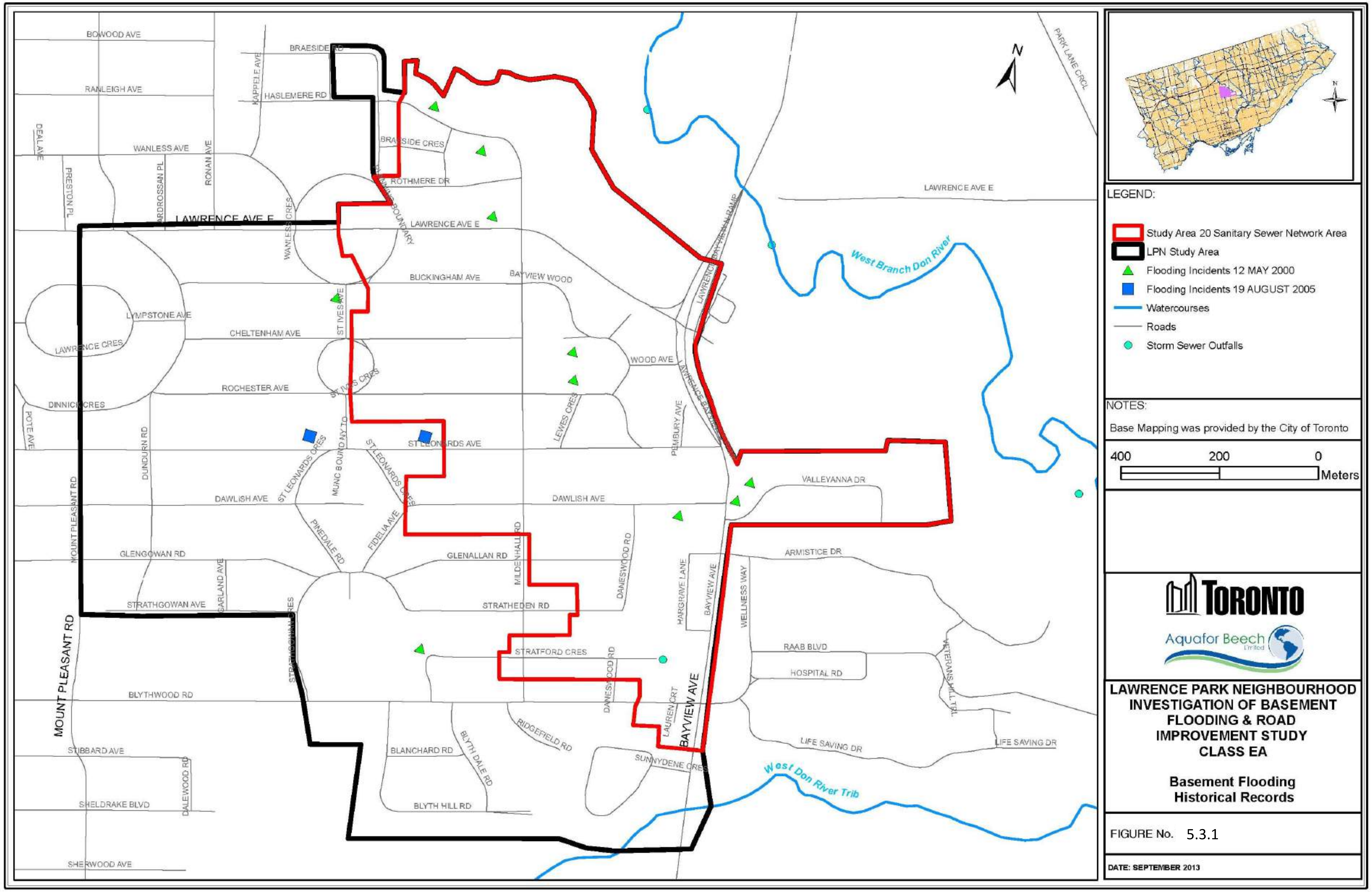
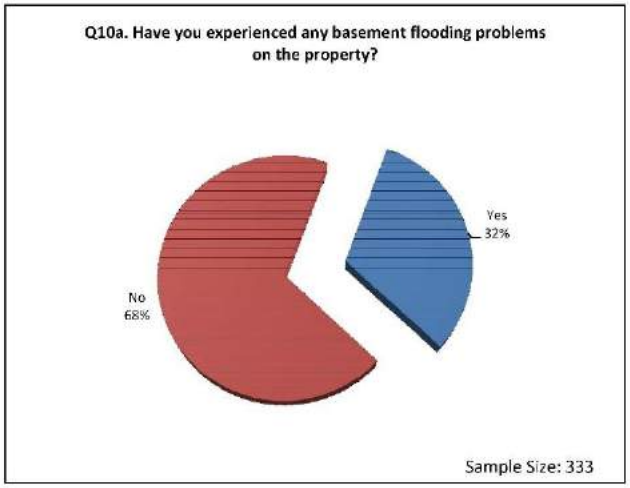
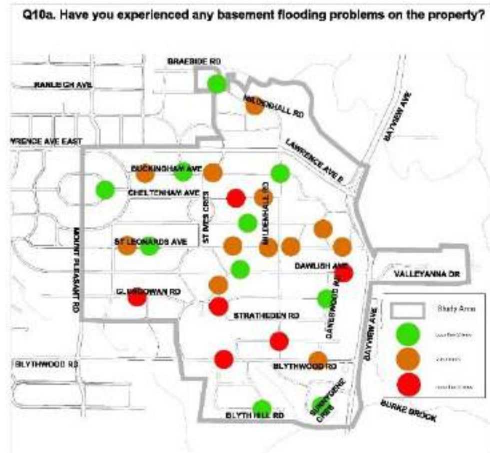


Figure 5.3.1 – Basement Flooding Historical Records

Basement and Surface Flooding Responses





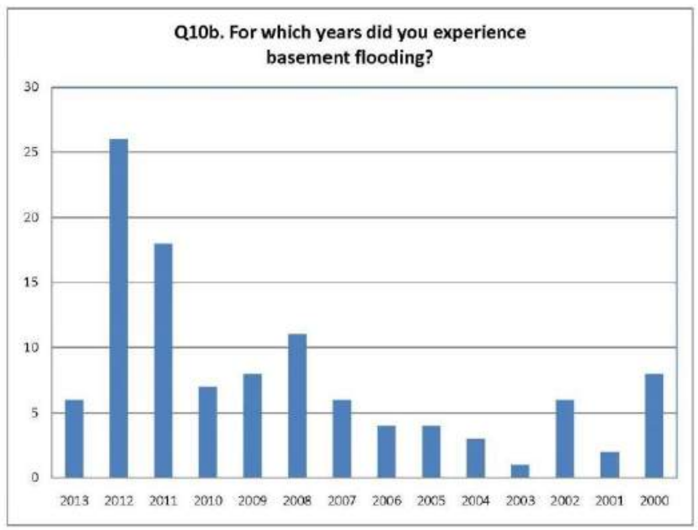


Figure 5.3.2 – Basement Flooding Survey Results (PIC #1)

Basement and Surface Flooding Responses

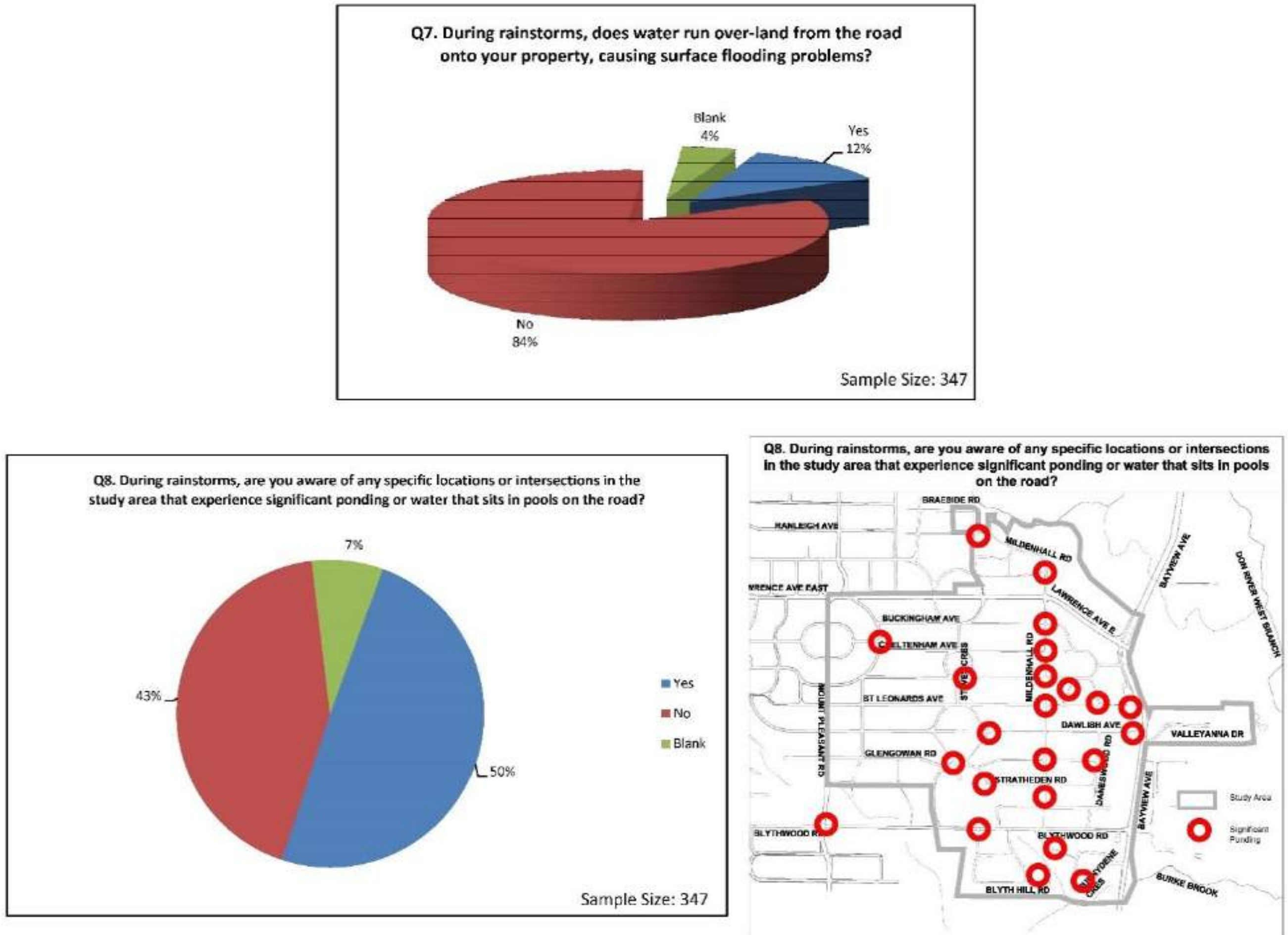


Figure 5.3.3 – Surface Flooding Survey Results (PIC#1)

5.3.4 Types of Flooding Problems

In general, surface and basement flooding are the two common types of flooding. Provided below is a simplified table (**Table 5.3.1**) defining the location of flooding, type of flooding, potential causes and potential remedial measures.

Table 5.3.1 – Summary of Flooding Types, Potential Primary Causes and Potential Remedial Measures

Type of Flooding	Potential Causes	Primary Remedial Measures
Basement Flooding	Insufficient Sewer Capacity, presence of reverse-sloped driveways	Sewer upgrades, on-line or off-line storage, modification of inlet capacity
Surface Flooding	Lack of major system (overland flow path), presence of reverse-sloped driveways	Construction of adequate major system outlet, modification of inlet capacity
Basement & Surface Flooding	Undersize laterals & trunk combined sewer, improper downspout and/or foundation drain connections	Combination of the above plus disconnection of downspouts

5.4 Road Structure

Two reports were prepared by Terraprobe Inc. in support of this study. Both reports are provided in Appendix F. The first report, entitled "Pavement Evaluation Report for Municipal Class EA Study for Lawrence Park Neighborhood" (Terraprobe 2013) had the following objectives:

- Evaluate the roadways through an initial visual inspection;
- Investigate pavement thickness, composition and structure;
- Explore underlying subsurface conditions through borehole drilling, in-situ testing and laboratory testing;
- Providing recommendations with respect to rehabilitation alternatives and feasibility of infiltrating storm water runoff; and
- Providing preliminary pavement design recommendations

This information, in turn, will be used to assist in defining the type of road and sewer reconstruction measures that may need to be undertaken.

This section will discuss the findings and recommendations with respect to the road structure while the subsequent section will address items relating to soils type, permeability and ground water levels which is detailed in the report entitled “Geotechnical Investigation Municipal Class EA Study for Lawrence Park Neighborhood – Storm Sewer Improvements Report” (Terraprobe 2014).

A total of fifty-two shallow boreholes ranging from about 0.8 m to 2.0 m below ground surface were drilled within the study area based on the Borehole Location Plan shown in **Figure 5.5.1**. The average pavement structures of the investigated road network are summarized in Tables 2A and 2B within the Terraprobe report. A brief summary of the findings is presented below.

The average pavement thickness varies from 80 mm to 750 mm. Fill material consisting of clayey silt/silty clay, sandy silt/silty sand, gravelly sand/sandy gravel and sand were encountered beneath pavement structures, extending to depths ranging from 0.7 m to 2.0 m below the gravel surface.

The above information, together with Average Annual Daily Traffic (AADT) was utilized to provide typical roadway maintenance and rehabilitation activities. The representative rehabilitation measure for each of the streets within the study area is illustrated in **Figure 5.4.1**.

Routine Preventative Maintenance

Undertake maintenance treatments such as routing and sealing existing cracks in the asphalt pavement, patching potholes, patching road surface defects around maintenance chambers etc.; Preventive measures are meant to preserve the pavement, mitigate future deterioration and maintain or improve driving comfort.

Partial Depth Asphalt Removal (Mill and Overlay)

Mill (i.e. remove the existing asphalt concrete to a specified thickness) and Overlay (i.e. repave with a specified layer of hot mix asphalt.) Existing deficient curb and sidewalk will be repaired.

Full Depth Asphalt Removal

For flexible pavement, remove the existing asphalt, regrade, level and compact the existing granular material and repave the roadway with hot mix asphalt. For composite pavement, remove the existing asphalt to expose the underling concrete slab, repair the concrete slab and joints and repave the roadway with hot mix asphalt. Existing deficient curb and sidewalk will be repaired.

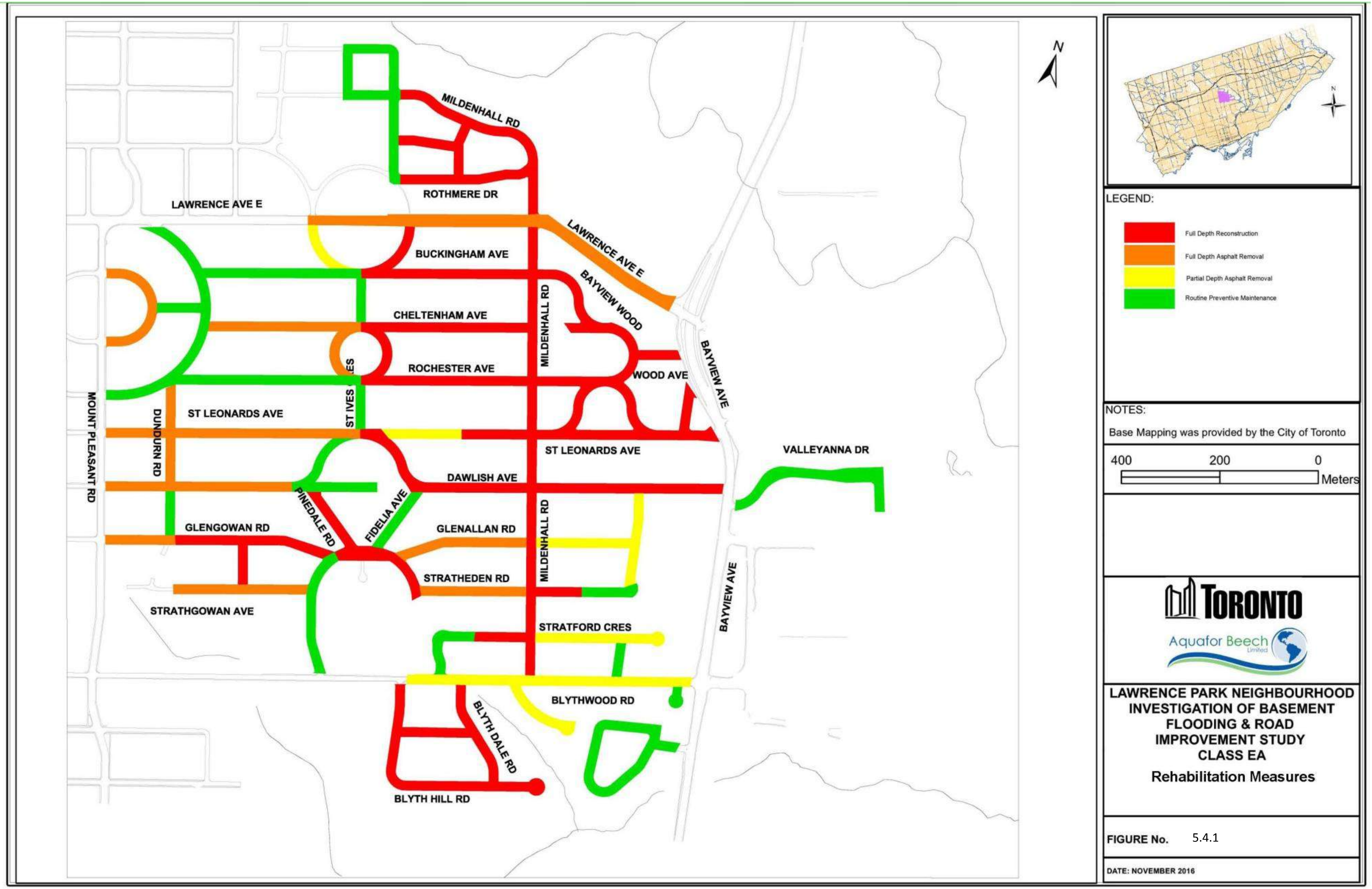


Figure 5.4.1 – Representative Rehabilitation Measures

Full Depth Reconstruction

Remove existing asphalt, concrete and underlying granular materials and excavate to the road design subgrade elevation. Reconstruct the roadway by placing and compacting the granular sub-base followed by the granular base and then repave roadway with hot mix asphalt. Existing deficient curb and sidewalk will be repaired.

5.5 Soils Investigation

The second report was undertaken in order to determine the prevailing subsurface groundwater conditions within the study area and to provide geotechnical engineering recommendations for storm sewer improvements. The geotechnical investigation for the storm sewer component consisted of advancing thirty-two (32) boreholes with depths varying from about 2.7 m to 6.6 m below the existing ground surface based on the Borehole Location Plan shown in **Figure 5.5.1**. Recovered soil samples were examined as to the visual and textural characteristics by the geotechnical engineers. The geotechnical laboratory testing consisted of moisture content determination on all soil samples; and a sieve and hydrometer analysis on selected sixteen (16) soil samples as well as Atterberg Limits testing on selected five (5) soil samples. The permeability of the soil samples was estimated based on the results of the grain size analysis. Twenty (20) soil samples were selected by Terraprobe for soil chemistry analysis for selected metals and inorganic parameters.

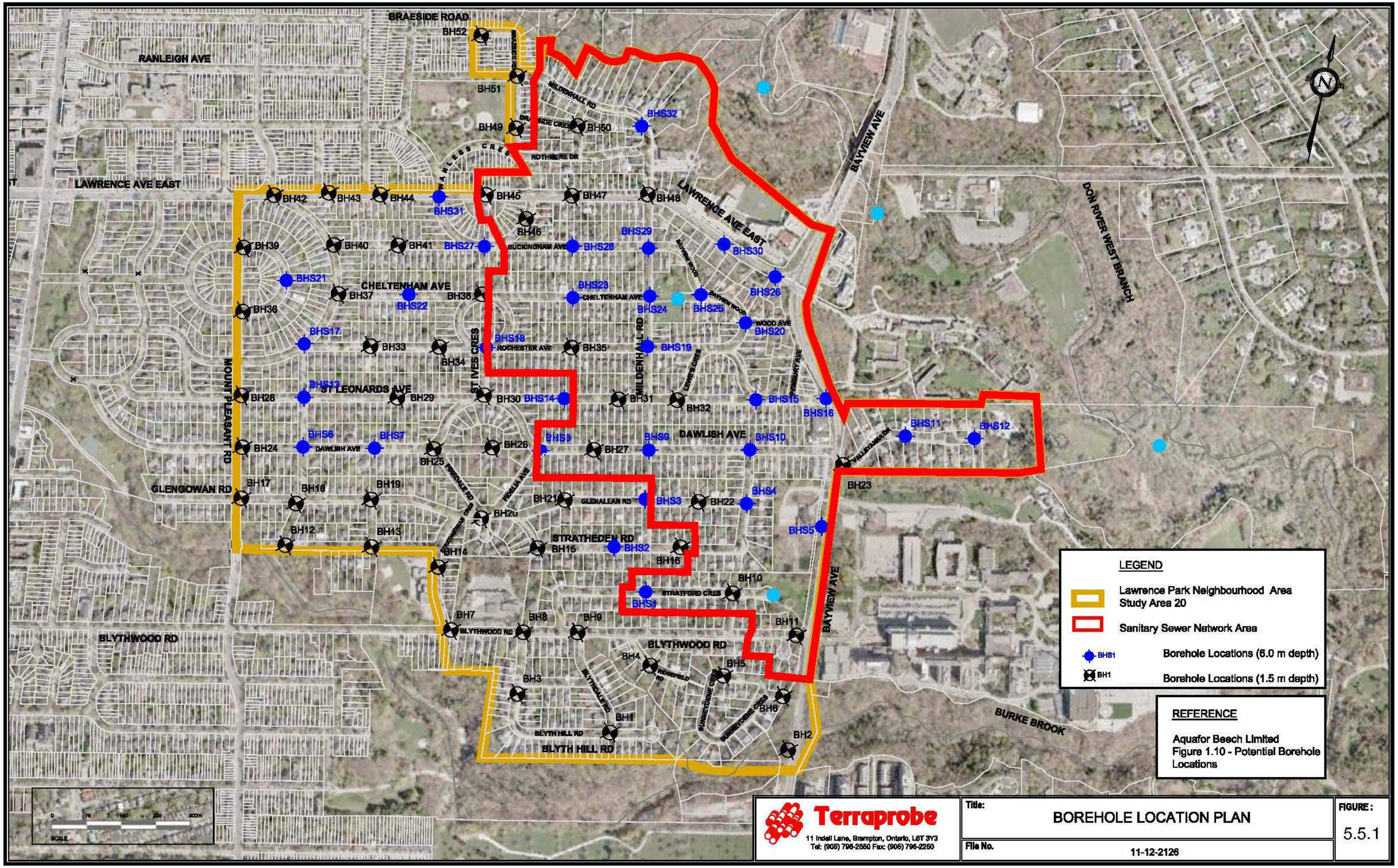


Figure 5.5.1 – Borehole Location Plan

A zone of earth fill and/or weathered/disturbed material was encountered in all boreholes (except borehole 1 and 14) beneath the topsoil/pavement structure and extended to depths varying from 0.8 m and 4.6 m below existing grade. The earth fill and/or weathered/disturbed material consisted of mixed composition comprising sandy silt to silty sand/clayey silt, with trace to some amounts of grave particles.

The geotechnical report and accompanying boreholes detail the soil content found at each location. The estimated permeability at sixteen of the locations is summarized in **Table 5.5.1**.

Table 5.5.1 – Estimated Soil Permeability at Sixteen Locations

Borehole No. Sample No.	Sampling Depth below Grade	Percentage				Estimated Permeability (on the order of)
		Gravel	Sand	Silt	Clay	
S 1 SS 6	4.7 m	1	81	15	3	10-3 cm/sec
S 3 SS 7	6.3 m	6	80	14		10-3 cm/sec
S 5 SS 6	4.8 m	1	6	38	55	10-7 cm/sec
S 8 SS 3	1.8 m	2	47	43	8	10-5 cm/sec
S 9 SS4	2.5 m	4	87	9		10-2 cm/sec
S 11 SS 6	6.3 m	6	34	43	17	10-6 cm/sec
S 13 SS 5	3.3 m	0	60	38	2	10-3 cm/sec
S 14 SS 4	2.4 m	2	48	42	8	10-5 cm/sec
S 18 SS 4	2.5 m	0	20	71	9	10-5 cm/sec
S 21 SS 4	2.5 m	0	63	29	8	10-5 cm/sec
S 22 SS 6	4.8 m	1	83	16		10-3 cm/sec
S 24 SS 7	6.3 m	0	5	34	61	10-8 cm/sec
S 26 SS 4	2.5 m	0	56	39	5	10-4 cm/sec
S 28 SS 4	2.5 m	0	5	35	60	10-7 cm/sec

S 30 SS 7	6.2 m	3	32	47	18	10-7 cm/sec
S 32 SS 6	4.7 m	4	41	39	16	10-7 cm/sec

In order to assess the permeability of the soils they were grouped into five types. The soils types together with the coefficient of permeability are shown in **Table 5.5.2**.

Table 5.5.2 – Soils Type and Coefficient of Permeability

Soil Type	Coefficient of Permeability
Gravel	$1 – 10^{-3}$ m/s
Sand	$10^{-2} – 10^{-6}$ m/s
Silty Sand	$10^{-3} – 10^{-7}$ m/s
Silt	$10^{-5} – 10^{-9}$ m/s
Glacial Till	$10^{-6} – 10^{-12}$ m/s

Table 5.5.2 summarizes typical permeability of soils for five representative soil groups. A comparison of **Table 5.5.1** and **Table 5.5.2** , together with an identification of the dominant soils group in shows that, in general, the soils are quite permeable and should therefore be conducive toward infiltrating of stormwater runoff.

Observations pertaining to the depth water level and caving were made in the open boreholes at the time of drilling and on two separate occasions thereafter. Monitoring wells were installed at sixteen selected locations. Typically ground water elevations are 5-6m below the surface. The depth decreases to 2-3m in some lower lying areas.

<u>Soil Chemistry Analysis</u>

Selected twenty (20) soil samples (BH-S1 SS2, BH-S3 SS5, BH-S4 SS3, BH-S7 SS4, BH-S9 SS3, BH-S11 SS6, BH-S12 SS6, BH-S15 SS2, BH-S17 SS6, BH-S18 SS7, BH-S19 SS2, BH-S21 SS5, BH-S22 SS5, BH-S24 SS4, BH-S26 SS2, BH-S28 SS3, BH-S29 SS4, BH-S30 SS5, BH-S31 SS3 and BH-S32 SS4) were submitted to AGAT Laboratories for chemical analysis (for metal and other inorganic parameters included in amended O. Regulation 153/04 Table 1 site condition standards). Results of the chemical analysis were compared with standards for assessing soil quality found in Table 1 Standards of the *Soil, Ground Water and Sediment Standards for Use Under Part XV. I of the Environmental Protection Act* of Ontario (April 15, 2011) for Residential/Parkland/Institutional (RPI) and Industrial/Commercial/Community (ICC) property.

The results of chemical analysis indicate that all soil samples submitted for analytical testing meet the Table 1 Standards found in the *Soil, Ground Water and Sediment Standards for Use Under Part XV. I of the Environmental Protection Act* of Ontario (April 15, 2011) for Residential/Parkland/Institutional (RPI) and Industrial/Commercial/Community (ICC) property with the exception of soil samples (BH-S1 SS2, BH-S3 SS5, BH-S4 SS3, BH-S7 SS4, BH-S9 SS3, BH-S15 SS2, BH-S17 SS6, BH-S18 SS7, BH-S19 SS2, BH-S24 SS4, BH-S26 SS2, BH-S28 SS3, BH-S29 SS4, BH-S30 SS5, BH-S31 SS4, BH-S32 SS4) which exceeds Electrical Conductivity (EC) and/or Sodium Absorption Ratio (SAR). The elevated EC and SAR are likely associated with the use of road salts below and around the roadway pavement structure, and are similar to those encountered on a number of other roadways within the City of Toronto.

5.6 Transportation

5.6.1 General

A report entitled 'Municipal Class EA Lawrence Park Neighborhood – Traffic and Road Report' (Morrison Hershfield, 2015) was prepared and is included as Appendix G.

The objectives of this study were to investigate the traffic and road improvements that are required within the neighbourhood. For this study the study area is generally bounded by Lawrence Avenue East to the north, Bayview Avenue to the east, Blythwood Avenue to the south and Mount Pleasant Road to the west. The primary tasks that were undertaken in this study are summarized below.

- Traffic surveys and counts were undertaken and mathematical modeling was carried out in order to define traffic patterns, traffic movements and infiltration of vehicles within the study area;
- Turning movements at intersections were studied and the Level of Service, delay and queues were examined at main intersections in order to understand traffic operations;
- Field measurements were undertaken together with an assessment of collision analysis for the last 5 years in order to understand the state of traffic safety;

A summary of the findings is presented below.

5.6.2 Travel Patterns

A variety of methods including turning movement counts, traffic volume counts and a questionnaire were used to define travel patterns. Provided below is a summary of the findings.

<u>Turning Movements</u>

An 8 hour turning movement counts assessment was undertaken during morning (6 to 10 am) and evening (3 to 7 pm) rush hours at the following 10 locations:

1. Lawrence Avenue E and Mildenhall Road;
2. Lawrence Avenue E and Mount Pleasant Road;
3. Mount Pleasant Road and St. Leonard's Avenue;
4. Mount Pleasant Road and Glengowan Road;
5. Mount Pleasant Road and Blythwood Road;
6. Bayview Avenue and Blythwood Road;
7. Bayview Avenue and Lawrence Avenue E (ERT – East Ramp Terminal);
8. Bayview Avenue and Lawrence Avenue E (WRT – West Ramp Terminal)
9. Lawrence Avenue E and Toronto French School access; and
10. Bayview Avenue and Armistice Drive.

The data was used, in part, to study the travel patterns as well as traffic operations within the study area.

Morrison and Hershfield together with Ontario Traffic Inc. also conducted an 8-hour Automated Traffic Recorder (ATR) volume counts from 6 to 10 am and from 3 to 7 pm for 18 locations located within the study area.

An Origin-Destination (O-D) license plate trace survey was also undertaken to help assess the flow of vehicles in and out of the study area. This information will assist in understanding the study area travel patterns and, in particular, to highlight the through (infiltration) trips across the study area. Infiltration trips are defined as trips that start outside the study area and also end outside the study area. The O-D survey was conducted at all entrances/exits of the study area.

A home questionnaire was also circulated at the second Public Open House. The information was used to assist in identifying the origins and destinations of certain types of trips, particularly the Internal-External trips.

The above information was then input to the EMME mathematical model in order to understand traffic movements within the study area and accordingly, to be able to improve and control them if needed.

Within the study area all of the roads are classified as local roads with the exception of Mildenhall Road and Blythwood Road which are classified as collector roads (Lawrence Park E, Bayview Avenue and Mount Pleasant Road were not considered in the analysis as they are influenced by traffic from outside of the study area). As per the 2008 Road Classification System of the City of Toronto, local roads convey less than 2,500 vehicles per day, while collectors convey between 2,500-8,000 vehicles per day.

A summary of the traffic patterns and traffic volume is provided in Figures 2-4 and 2-5 in Appendix G.

Generally speaking, the volume of traffic on the internal roads (local) within the study area is relatively small. The exceptions are Mildenhall Road and Blythwood Road which are collector roads.

In addition, relatively larger volumes can be found on Dawlish Avenue and St. Leonards Avenue during the afternoon peak hour on the westbound direction. This may be due to the absence of turning restrictions at these locations.

The traffic volume figures help to illustrate the infiltration routes for traffic from the arterial roadway system. Specifically, Mildenhall Road, though it is a collector roadway. The volume figures also illustrate unexpectedly high volumes at the Stratford Crescent and Daneswood Road intersection that is located just west of Bayview Avenue north of Blythwood Road and is therefore a point of traffic infiltration. This intersection has the one leg of Stratford Crescent on the east as a short cul-de-sac stub with little traffic, so it is a fairly uninterrupted direct route to Mildenhall Road. It was concluded that based on volumes that were seen on Mildenhall Road between Lawrence Avenue East and Blythwood Road that it is being used as a route for infiltration, though that is part of its function being categorized as a Collector Road. It can also be seen that Stratford Crescent and Daneswood Road is being used as an alternate route to Mildehall Road to access Blythwood Road. A turn restriction could be placed on Blythwood Road at Daneswood Road but this would result in added traffic using the Mildenhall and Blythwood intersection and be an inconvenience to local residents.

5.6.3 Existing Traffic Operations and Level of Service

An intersection capacity and level of service (LOS) analysis was undertaken for the area bounded by Mt. Pleasant Road, Blythwood Road Bayview Avenue and Lawrence avenue East. The objective of the analysis was to determine the level of service at each intersection and to assess the potential impact on local roads within the study area.

The intersections that were considered in the analysis were:

- Lawrence Avenue East and Mildenhall Road;
- Lawrence Avenue East and Mount Pleasant Road;
- Mount Pleasant Road and St. Leonard's Avenue;
- Mount Pleasant Road and Glengowan Road;

- Mount Pleasant Road and Blythwood Road;
- Bayview Avenue and Blythwood Road;
- Bayview Avenue and Lawrence Avenue East (ERT – East Ramp Terminal);
- Bayview Avenue and Lawrence Avenue East (WRT – West Ramp Terminal);
- Lawrence Avenue East and TFS Access; and,
- Bayview Avenue and Armistice Drive.

The analysis provides details at the above noted intersections with respect to Measures of Effectiveness (MOE's) including:

- The capacity of the intersection on an overall basis and for individual movements;
- The volume to capacity ratio for individual movements, each approach and the overall intersection; and
- The LOS for the movements at the intersection, particularly the movements experiencing the greatest delay (critical movements).

The LOS for both signalized and unsignalized intersections is related to the intersection delay and is a quantitative measure of the ability of the intersection (or movement) to be accommodated. Generally, an overall intersection value of LOS C or better is determined to be satisfactory. An, operation level of LOS D while still being satisfactory, indicates higher levels of delay and may warrant improvements.

A summary of the LOS results for each of the 10 intersections as noted above is provided in **Table 5.6.1**.

Table 5.6.1– Intersection Performance Summary

Intersection	Intersection LOS	
	AM	PM
Lawrence Ave E and Mildenhall Rd	B	B
Lawrence Ave E and Mount Pleasant Rd	**F**	**E**
Mount Pleasant Rd and St. Leonard's Ave	B	A
Mount Pleasant Rd and Glengowan Rd	A	A
Mount Pleasant Rd and Blythwood Rd	C	**E**
Bayview Ave and Blythwood Rd	**E**	**F**
Bayview Ave and Lawrence Ave E (ERT)	**F**	**E**
Bayview Ave and Lawrence Ave E (WRT)	**F**	**F**
Lawrence Ave E and TFS Access	B	B
Bayview Ave and Armistice Dr	D	D

Note: WRT- West Ramp Terminal; ERT – East Ramp Terminal.

In summary, the analysis shows that there is only one intersection that fails (with LOS – F) during both the morning and afternoon peak hours. That intersection is Bayview Avenue and Lawrence Avenue E (WRT). There are three intersections that fail either in the morning or afternoon peak hour. They are:

- Lawrence Avenue E and Mount Pleasant Road
- Bayview Avenue and Blythwood Road
- Bayview Avenue and Lawrence Avenue E (ERT)

Details of the findings for each of the intersections and associated discussion are presented within the Road and Traffic Report (Appendix G). The potential impact to the local roads is summarized below:

The northbound movement at the Lawrence Avenue E and Mount Pleasant Road intersection was assessed a LOS of F during the morning rush hour. The queues spill past the intersections of Mount Pleasant Road, St. Leonard's Avenue, Dawlish Avenue, Glengowan Road and almost reach the intersection of Mount Pleasant Road and Blythwood Road during the morning rush hour. This may result in infiltration of vehicles along Mildenhall Road.

The PM eastbound movement at the Bayview Avenue and Blythwood Road intersection is failing. The eastbound queue extends past the Mildenhall Road intersection during the afternoon peak hour and extends past the Mildenhall Road and the Mount Pleasant Road intersections during morning peak hour. This may result in infiltration of vehicles along Mildenhall Road. Table 3-3 and Figures 3-2 and 3-3 in Appendix G summarize the traffic conditions and volumes recorded at the key intersections.

5.6.4 Existing Road Conditions

5.6.4.1 Road Classification

According to the 2008 Road Classification System of the City of Toronto, the Road Classification criteria for each type of roads are summarized in **Table 5.6.2**. The roads within the Lawrence Park Neighbourhood are classified as follows:

<u>Major Arterials</u>

The primary function for major arterials is for traffic movement, with greater than 20,000 vehicles per day. Highway priority for winter maintenance is given to major arterials. Lawrence Avenue East, Bayview Avenue, and Mount Pleasant Road are the major arterials within this Study Area.

Collectors

The primary functions for collectors are to provide access to property and traffic movement, with 2,500 to 8,000 vehicles and less than 1,500 transit vehicles per day. The intersections with arterial roads would be signalized. Medium priority for winter maintenance is given to major arterials. Mildenhall Road and Blythwood Road within the Study Area are classified as Collectors. There is 2.1 km between the congested Eglinton Avenue and Lawrence Avenue East with the only collector road between being Blythwood Road, thus it draws significant traffic.

Similarly there is almost 1.2 km between Mount Pleasant Road and Bayview Avenue and those roads being fairly congested. Mildenhall Road draws some traffic through volumes are well within the range for a collector road. Thus the Collector Road function is a bit strained in the area likely resulting in more traffic on the Arterial roadways.

Local Roads

The primary function for local roads is to provide access to property, with less than 2,500 vehicles per day without any transit traffic. Low traffic speed is expected. Low priority for winter maintenance is given for these roads. All the other roads within the neighbourhood besides those mentioned above are classified as Local Roads.

Appendix G – the Traffic and Road Report which was conducted by Morrison Hershfield – summarizes the traffic volumes for a number of streets located within the study area.

Based on traffic counts that were undertaken, local roads have daily volumes ranging between 185 and 1,477 vehicles per day. For Mildenhall Road, the daily volume between Lawrence Avenue East and Blythwood Road was 3,059 vehicles per day.

Table 5.6.2 - Road Classification Criteria (2008 Road Classification System of City of Toronto)

Characteristics	Locals	Collectors	Major Arterials
Traffic movement versus property access	Property access primary function	Traffic movement and property access of equal importance	Traffic movement primary consideration; subject to property access control
Typical daily motor vehicle traffic volume (both direction)	Less than 2,500	2,500 - 8000	More than 20,000
Minimum number of peak period lanes (excluding bicycle lanes)	One (one-way streets) or two	One (one-way streets) or two	Four
Desirable connections	Locals, collectors	Locals, collectors, arterials	Collectors, arterials, expressways
Flow characteristics	Interrupted flow	Interrupted flow	Uninterrupted except at signals and crosswalks
Legal speed limit, km/h	40 – 50	40 - 50	50 – 60
Accommodation of pedestrians	Sidewalks on one or both sides	Sidewalks on both sides	Sidewalks on both sides
Accommodation of cyclists	Special facilities as required	Special facilities as required	Wide curb lane or special facilities desirable
Surface transit	Generally not provided	Permitted	Preferred
Surface transit daily passengers	Not applicable	Less than 1,500	More than 5,000
Heavy truck restrictions (e.g. seasonal or night time)	Restrictions preferred	Restrictions permitted	Generally no restrictions
Typical spacing between traffic control devices (m)	0 – 150	215 - 400	215 – 400
Typical right-of-way width, m	15 – 22	20 - 27	20 – 45

5.6.4.2 Sightlines and Stopping Distance

The ability of a driver to see ahead is important for the safe and efficient operation of a vehicle. At an intersection, the available sight distance must be considered for both vehicles approaching the intersection and vehicles departing from a stopped position at the intersection.

Morrison Hershfield conducted a sightline review of the intersections within the Lawrence Park neighborhood and identified potential locations of intersections with a lack of sight distance.

Through the site visits a total of six locations with poor sight distance were identified. The locations are:

- Lawrence Crescent / Mount Pleasant Road (south intersection)
- St. Leonard's Avenue / Mount Pleasant Road
- Dawlish Avenue / Mount Pleasant Road
- Strathgowan Avenue / Blythwood Road
- Rochester Avenue / Mildenhall Road
- Wanless Crescent / Lawrence Avenue East (east intersection)

As shown, the first six intersections with a lack of sight distance are located in the perimeter of the Study Area where the local roads connect with the collector roads or the major arterials. The individual intersections are discussed in detail in the following sections.

<u>Lawrence Crescent / Mount Pleasant Road (south intersection)</u>

The movements of concern are:

1. Westbound right turn vehicle from Lawrence Crescent to Mount Pleasant Road with the approaching north bound traffic from the left on Mount Pleasant Road
2. Westbound left turn vehicle from Lawrence Crescent to Mount Pleasant Road with the approaching southbound bound vehicle from the right on Mount Pleasant Road

In the first case, the sightline of a stopped westbound vehicle at Lawrence Crescent to the approaching northbound vehicle on the curb lane on Mount Pleasant is blocked by a line of roadside trees and thick evergreen trees. The estimated sight distance available to an approaching northbound vehicle is approximately 50m. The required sight distance for the vehicle to turn left without interruption to the mainline flow is 110m and for the vehicle to turn right is approximately 158m. The distance needed for the vehicle to cross is 105m (see **Figure 5.6.1**).

Figure 5.6.1 – Sightline at Lawrence Crescent to SB Vehicle on Mount Pleasant Ave.

In the second case, the sightline of a stopped westbound vehicle on Lawrence Crescent to the approaching southbound vehicle on the curb lane on Mount Pleasant is blocked thick vegetation bush at around 25m from the intersection.

The estimated sight distance available to a southbound vehicle is approximately 50m. The required sight distance for the vehicle to turn left without interruption to the flow is 158m. The distance needed for the vehicle to cross is 105m.

Lawrence Crescent / Mount Pleasant Road (north intersection)

Figure 5.6.2 – Sightline at St. Leonard's Ave. to NB Vehicle on Mount Pleasant Ave.

Similar to the south intersection, the sightline of a stopped westbound vehicle on Lawrence Crescent to the approaching northbound vehicle on the curb lane on Mount Pleasant is blocked by a line of roadside trees and slightly elevated front lawn at the south-east corner. The crest curve on Mount Pleasant further aggravates the problem. The estimated sight distance available to an approaching northbound vehicle is approximately 40m. The required sight distance for the vehicle to turn left without interruption to the mainline flow is 110m and for the vehicle to turn right is approximately 158m. The distance needed for the vehicles to cross is 105m (See **Figure 5.6.2**).

St. Leonard's Avenue / Mount Pleasant Road

Figure 5.6.3 – Sightline at Dawlish Ave. to SB Vehicle on Mount Pleasant Ave.

The sightline of a stopped westbound vehicle on St. Leonard's Avenue to an approaching northbound vehicle is blocked by the heavy vegetation on the southeast corner of the intersection. Since this is a signalized intersection, only the westbound right turn movement onto Mount Pleasant Road is of concern. The available sight distance is estimated to be approximately 50m, but the required sight distance for this movement is 158m (see **Figure 5.6.3**).

Dawlish Avenue / Mount Pleasant Road

The sightline of a stopped westbound vehicle on Dawlish Avenue to an approaching southbound vehicle is blocked by the elevated front lawn and retaining wall on the property at the northeast corner of the intersection. The available sight distance to an approaching southbound vehicle is approximately 60m, but the required sight distance for the left turn movement and crossing movement to an approaching vehicle from the right is 125m (see **Figure 5.6.4**).

Figure 5.6.4 – Sightline at Strathgowan Ave. to WB Vehicle on Blythwood Road

Strathgowan Avenue / Blythwood Road

The sightline of a stopped southbound vehicle on Strathgowan Avenue to an approaching westbound vehicle on Blythwood Road is blocked by the elevated lawn and the dense vegetation of the Sunny View Public School on the northeast corner of the T-intersection. The available sight distance is estimated to be approximately 35m, and the required sight distance left turn and right turn vehicle to the approaching westbound vehicle is 98 m and125m respectively (see **Figure 5.6.5**).

Figure 5.6.5 – Sightline at Lawrence Cres. to NB Vehicle on Mount Pleasant Ave.

Rochester Avenue / Mildenhall Road

The sightline of a stopped westbound vehicle on Rochester Avenue to an approaching southbound vehicle on Mildenhall Road is obstructed by the dense vegetation at the northeast corner of the intersection. The available sight distance is approximately 30 m, but the required sight distance for the westbound turn onto Mildenhall Road is 125 m (see **Figure 5.6.6**).

Figure 5.6.6 – Sightline at Rochester Ave. to SB Vehicle on Mildenhall Road

Wanless Crescent / Lawrence Avenue East (east intersection)

The sightline of a stopped northbound vehicle on Wanless Crescent (east intersection) to an approaching westbound vehicle on Lawrence Avenue East is obstructed by the elevated front lawn at the northwest corner of the intersection. The available sight distance is approximately 70m, but the required sight distance for the northbound right turn and left turn onto Lawrence Avenue East are 150m and 200m respectively. Similarly, the sightline to an eastbound approaching vehicle on Lawrence Avenue East is obstructed by an elevated lawn / interlocking retaining wall. The available distance is approximately 50m and the required distance is 200m (see **Figure 5.6.7** and **Figure 5.6.8**).

Figure 5.6.7 – Sightline at Wanless Cres. to EB Vehicle on Lawrence Ave.

Figure 5.6.8 – Sightline at Wanless Cres. to WB Vehicle on Lawrence Ave.

Sight line obstruction letters about the trees/bushes were mailed out shortly after November 6 and 7, 2014, and a follow-up investigation was conducted on November 26, 2014. The sight line concerns were addressed, and no further action was recommended.

Specific to the stone wall at Blythwood Road and Strathgown Avenue, a letter was sent out March 17, 2015 to the owner of the retaining wall to initiate discussions on how this issue will be addressed.

5.6.4.3 Pedestrian and Cyclist Safety

Figure 5.6.9 illustrates the locations of existing sidewalks (pedestrian facilities) within the study area. Also shown on the figure are key destinations within, and adjacent to the study area. As can been seen of the figure pedestrian facilities exist only in the west part of the neighborhood (former City of Toronto) and there are few facilities in the eastern portion (former City of North York) of the study area.

Currently, there is no cycling facility within the neighbourhood. New cycling facilities in Toronto are identified in the Toronto Bike Plan and the Lawrence Park Neighbourhood is not identified in the bike network, therefore, new cycling facilities such as bike lanes are not expected.

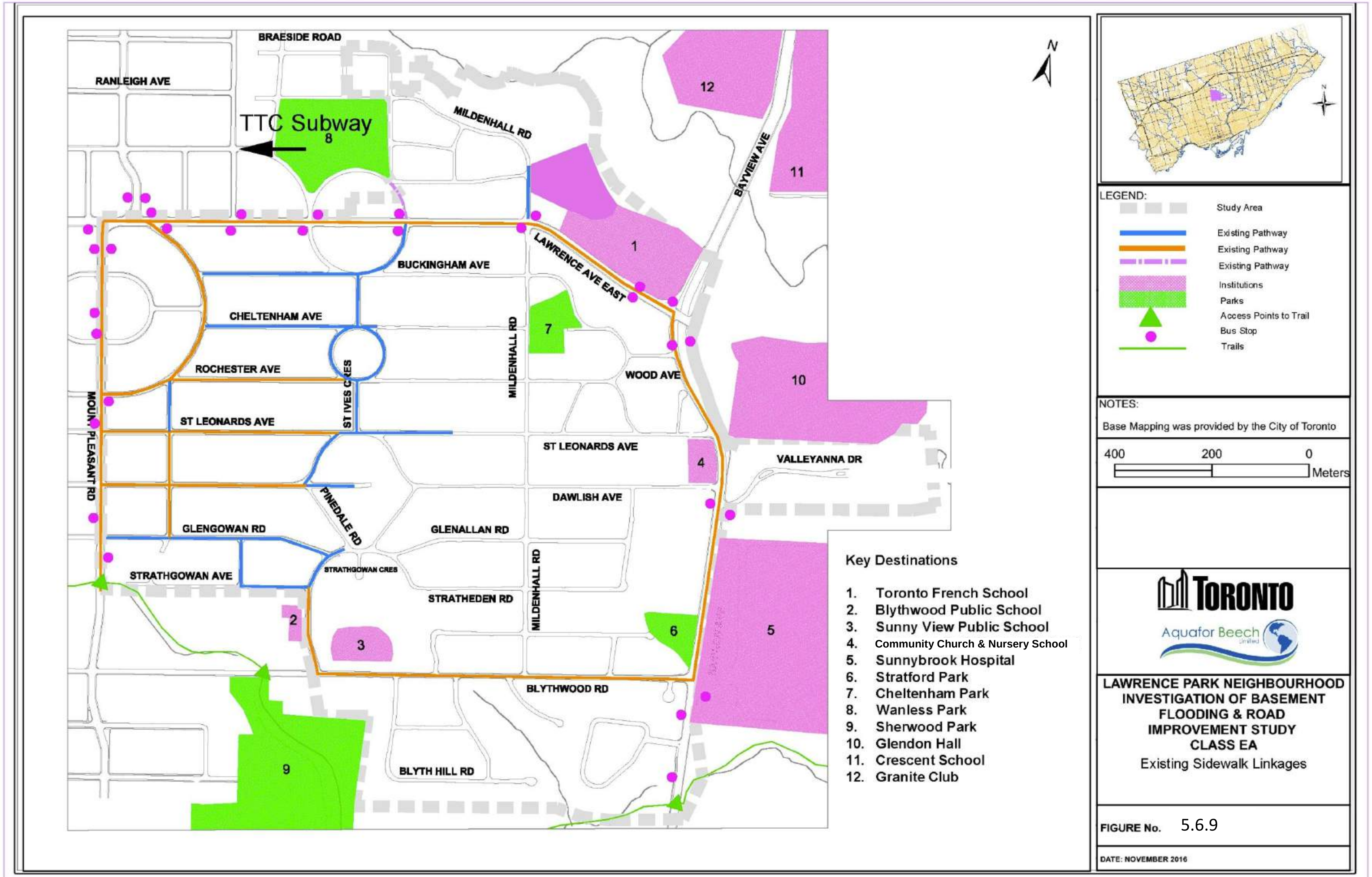


Figure 5.6.9 – Existing Pedestrian Linkages

5.6.4.4 Road Widths

The available road widths and the impacts of the final road widths play a major role in determining the solutions to be adopted in this EA Study. This section provides an overview of the City standards related minimum road width requirements, and specific considerations when determining a feasible road width under roadside constraints.

5.6.4.5 City Standards

The recognized transportation infrastructure policy for a local residential roadway within the City of Toronto consists of a 20 m right-of-way, an 8.5m paved road surface, concrete curbs and a 1.7m to 2.0m sidewalk on one side or both sides of the road.

5.6.4.5.1 Minimum Requirements

In the event where the City standards cannot be adopted due to constraints to road expansion (mature trees, private properties, etc.), There are a number of factors that could to be considered in determining the minimum allowable road width for this study, namely:

- Requirements for emergency vehicle access
- Requirements for service vehicle access
- Consideration for cyclist and pedestrian / vehicle conflict
- Consideration for two-way traffic flow
- Requirement for winter road maintenance (reduction in road width as a result of snow banks)
- Impact to utilities and underground infrastructure
- On-street parking
- Types of cross section (urban versus rural)
- Impact to roadside features

Figure 5.6.10 shows Rochester Road blocked as a result of street parking on both sides, narrow road, and large construction vehicle.

Figure 5.6.11 is an illustration of several of the factors which are taken into consideration when defining the preferred road width.

Figure 5.6.10 – Rochester Road Blocked as a Result of Street Parking on both Sides, Narrow Road, and Large Construction Vehicle

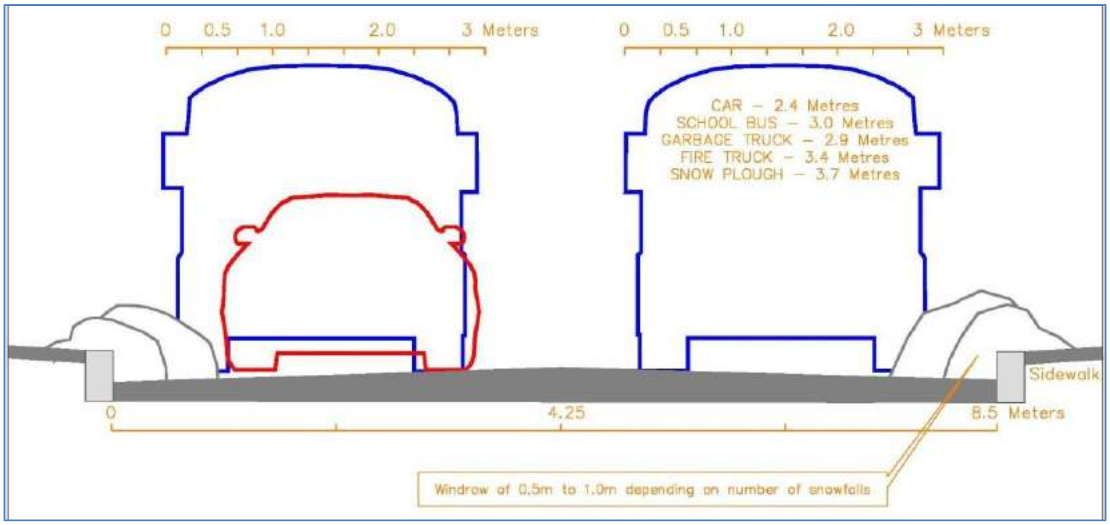


Figure 5.6.11 – Factors which are Taken into Consideration when Defining the Preferred Road Width

Emergency Vehicles

Many streets in the neighbourhood are narrower than ideal; there is street parking allowed; this in conjunction with appropriately slower posted speeds and travel times in residential neighbourhoods would make emergency service vehicle response times a bit longer but not atypical for a residential neighbourhood. Snow storage and snow banks in the winter time could make response times longer in the winter given the tight roadway corridors.

The Ontario Fire Code states that fire access routes shall be maintained so as to be immediately ready for use at all times by fire department vehicles and the routes shall not be obstructed by vehicles, gates, fences, building materials, vegetation, signs, or any other form of obstruction. The City’s obligation to public safety must recognize this and provide for a minimum clear road width of 7.2 m at any time.

Vehicle Widths

Although 4.25 m lane widths would be ideal for major local streets, a minimum of 3.6 m would be sufficient for each lane of traffic. Therefore, a minimum of 7.2 m would be needed to facilitate two lane of traffic with no parking.

Pedestrian and Cycling on the Road

A pedestrian or cyclist on the road will occupy a space of approximately 1.7 m.

On Street Parking

According to the City's policy, a minimum of 2.0 m of additional width should be allowed if on-street parking is permitted.

Other Considerations

Winter maintenance can significantly reduce the width of the travelled portion of the roadway. Windrows created after a number of winter storms can extend to more than 1.0 m from the edge of the pavement.

6.0 ASSESSMENT OF EXISTING CONDITIONS – SEWER SYSTEMS

6.1 General

The previous sections have provided a description of the existing sewer networks together with a summary of historical flooding problems and associated information.

The following sections outline the model calibration and validation together with the assessment of existing sewer infrastructure conditions for the Lawrence Park Neighbourhood study area. The existing sewer infrastructure systems and its conditions will be discussed and evaluated separately in the subsequent sections.

Flow monitoring was carried out from June to November, 2013. Three (3) flow monitors were installed in the sanitary sewer system. Three (3) flow monitors were also installed in the combined sewer system. No flow monitors were installed in the storm sewer system. Details of the flow monitoring program can be found in Appendix C, Technical Memorandum No. 4.

6.2 Sanitary Sewer System

6.2.1 Dry and Wet-Weather Analysis

The dry weather flow results for LPN Study Area indicate that the per capita generation rate for the residential area, while high are similar to standard values used by municipalities. The high Average DWF (L/Cap/day) values most likely reflect the age and condition of the sewer system in the area. In addition, factors that influence the uncertainty with these rates are as follows:

- Unaccounted population
- Uncertainty and inconsistency of industrial, commercial or institutional flows/equivalent population
- Illegal or unknown connections to the sanitary sewer system
- Localized high groundwater table

With respect to wet-weather flow, results of the monitoring data analysis identified peak I/I rates to be higher than 0.26 L/s/ha at all sanitary monitoring stations in the area. This indicates that the sanitary system I/I exceeds design allowances, at least for the observed events. Compared to typical I/I values the LPN Study Area sanitary system showed a response to wet weather expected for a system of this age. Additional detail is provided in Appendix C.

6.2.2 Description of the Sanitary Sewer Model

Figure 6.2.1 shows the sanitary sewer system. The figure also shows the range of pipe sizes identified in the LPN study area. The 75 ha sanitary service area consists of 610 properties according to the population database. The area is primarily single-family detached residential landuse which was initially developed in the 1920's to 1940's. The sanitary sewer system drains to the West Don Sanitary Trunk Sewer. The trunk sewer flows easterly and combines with the Wilket Creek Sanitary Trunk Sewer that ultimately discharges to the Ashbridges Bay Wastewater Treatment Plant.

A detailed model of the sanitary sewer system was developed to assess the performance of the system, as well as to identify and simulate alternatives. Sanitary sewer network information and population data were compiled from City of Toronto databases. All manholes and sanitary sewer pipes, and contributing sub-catchments were represented in the model. In total, 251 pipes and 254 connecting manhole nodes received and conveyed flow from 164 sub-catchments. Flow and water level in each pipe in the sanitary sewer system is calculated by the model and is based on the dry-weather flow and I/I generated by rainfall.

Monitoring data collected from June 2013 to the end of the monitoring period was used to simulate the observed events as well as determine an average sanitary per capita flow rate and ground water infiltration (GWI), both of which constitute the dry-weather flow for simulating historic and design storm events.

Dry weather per capita flow generation rates and patterns are documented in Appendix C. The population data made available by the City was used with the per capita dry-weather generation rates and the estimated GWI to determine the dry-weather flow. Industrial, commercial, and institutional (ICI) dry-weather flows were calculated from the monitoring flow data and used in the model.

In addition to sanitary sewer flow, the model results indicate the water level, or hydraulic grade line (HGL) in each sewer pipe. This information was used to determine which sewers surcharged above the pipe or above the road surface. It was assumed that the typical basement was 1.8 meters below the road surface (as defined by the top of each manhole). Therefore, any sewer with an HGL within 1.8 m of the road surface was assumed to cause basement flooding in the nearby properties.

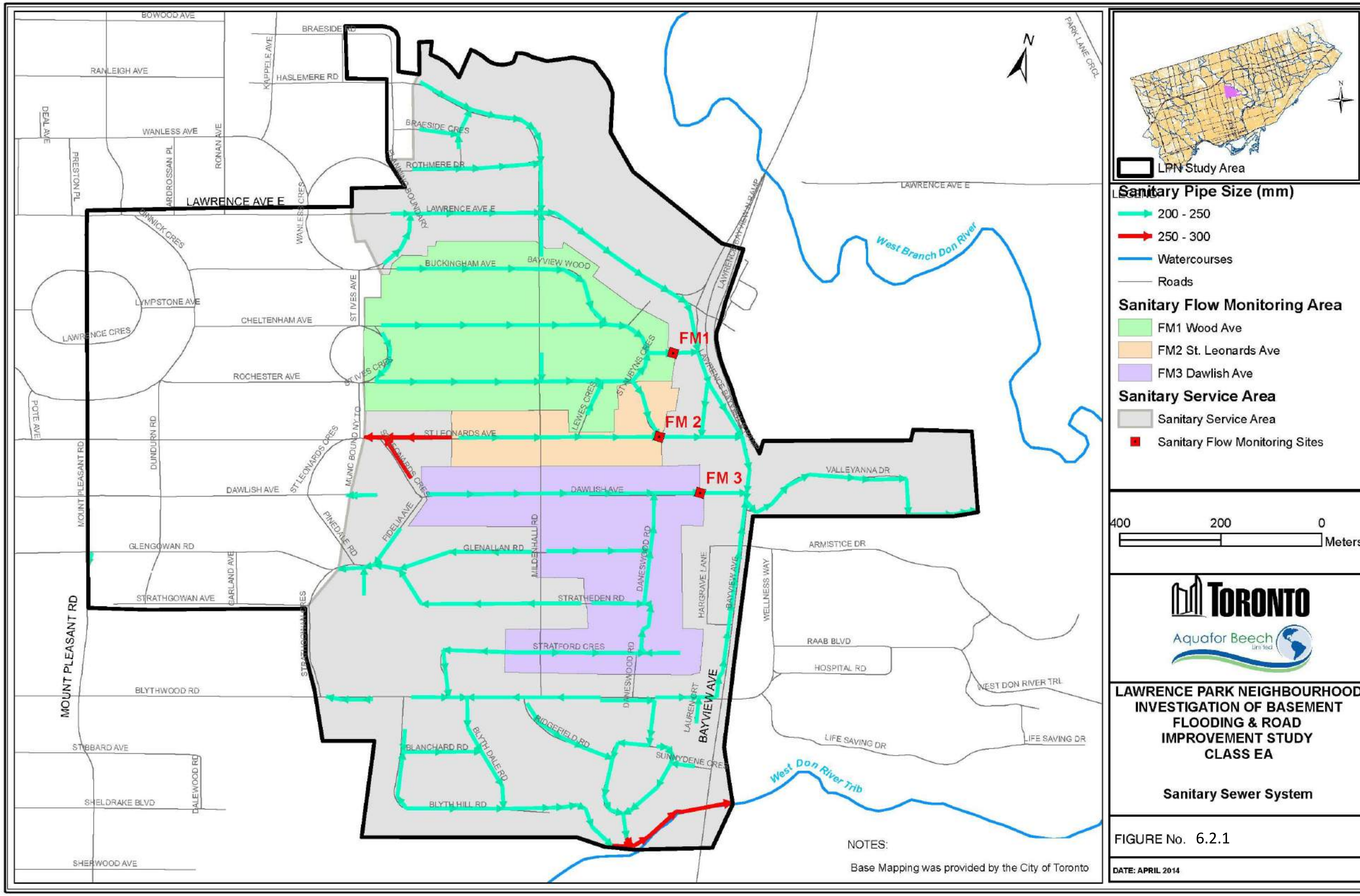


Figure 6.2.1 – Sanitary Sewer System

6.2.3 Model Calibration and Validation

Model calibration is achieved by changing model parameters to produce results matching the measurements within a reasonable accuracy in terms of peak flows, runoff volumes and water levels. Model validation involves testing the calibrated model performance using a different set of measurements than the calibration period to ensure the repeatability of the model results.

The model relied on the observed monitoring data for input. The measured dry-weather, per capita flow rates and daily patterns were applied to the residential areas. Calculated ICI dry weather flow rates were used for ICI land use. Observed rainfall was used to simulate the response of the sanitary system; the observed flow at the monitoring locations was used to verify the flow predicted by the model for a range of rainfall events.

The rainfall events used for calibration and validation are those measured in the period June to November 2013.

After reviewing the results of the monitoring program, there were five storm events (June 10th, 2013, June 28th, 2013, July 07th, 2013, July 08th, 2013 and July 27th, 2013) that were considered suitable for calibration and verification of the model. The storms were selected based on their relatively high intensity, accuracy of recording and reliability. A total of 78.3 mm rainfall was recorded at the City's RG39-P (Mt. Pleasant) rain gauge station on July 08th, 2013 with 120.1 mm/hr peak rainfall intensity. The rainfall on July 08th event recorded during the monitoring period was equivalent to a 25-year storm event for the LPN study area. This event was considered for calibration as it was the largest storm event recorded according to volume, as well as the most intense over the course of the entire flow monitoring period, and the other which had rainfall depths of 12 mm and 34 mm respectively, were considered for verification.

The July 08th, 2013 rainfall event was the primary event used for model calibration. In comparing model results with measurements, sanitary flow and level were matched to observed data by changing model parameters to reflect rapid, medium or slow I/I response. The calibrated model was then used to simulate other observed events and assess the accuracy and repeatability of the model (validation).

Based on four validation events, the July 08th, 2013 calibration is appropriate for events with total rainfall volume in the range of approximately 12 to 78 mm. However, the applicability of the July 08th, 2013 calibration parameters for events outside of this range is questionable, and therefore should be used with caution. For the purposes of this study dealing with extreme storm events, a second validation with the historic May 12, 2000 storm was therefore performed as described in the following section.

6.2.4 Simulation of Historical Events

The rainfall on July 8th event recorded during the monitoring period was equivalent to a 25-year storm event. The calibration/validation of the model to this storm was reasonable. Two large, historic storms were simulated using the existing conditions model. A secondary verification was undertaken to assess the impact of larger storms such as the May 12, 2000 and August 19, 2005 events with the intention of replicating the flooding that occurred in LPN study area for confirmation purposes.

Basement flooding from the sanitary system is considered possible if the following condition exists:

- The surcharge level in the sanitary sewer is higher than 1.8 m below the surface elevation, which coincides with the assumed basement elevation for homes and the sanitary service lateral.

The surcharge level, or maximum HGL has been represented at model nodes is categorized and colour-coded as follows:

- Green: The HGL is greater than 1.8 m from the surface, the theoretical basement elevation, or for shallow sewers that are within 1.8 from the surface, the water level remains in the pipe.
- Yellow: The HGL is less than 1.8 m below surface but below the ground elevation.
- Red: The HGL is at or above the ground surface and flooding from the sewer to the street occurs.

Furthermore, the slope of the HGL at each pipe segment can indicate whether the cause of surcharge is from the sewer being under-capacity (i.e. bottleneck) or the result of backwater from another downstream sewer. Therefore, the "surcharge state" of each pipe in the sewer system is defined in included and colour-coded in three categories as follows:

- Green: The Pipe is not surcharged
- Yellow: The Pipe is surcharged, and the slope of the HGL is shallower than the pipe slope, meaning the surcharge is due to backup as a result of an over-loaded downstream pipe.
- Red: The Pipe is surcharged, and the slope of the HGL is steeper than the pipe slope, meaning the surcharge is caused by the pipe, which is over-loaded and is acting as a bottleneck (flow exceeds its capacity).

Figure 6.2.2 presents the May 12, 2000 event was run initially using the local Mount Pleasant/Broadway City rain gauge data. The May 12, 2000 simulation results show surcharging in the area of Rochester Avenue and Mildenhall Road, Valleyanna Drive and Bayview Avenue where the water surface elevation is within 1.8 m of the ground surface where historical basement flooding has been reported. The model showed flooding for the May 12, 2000 event which is consistent with records for this event in the area. As such the sanitary system model parameters and simulation results for the May 12, 2000 historical event are consistent with the reported flooding in the area.

The model was also validated with the August 19, 2005 event using rainfall data from the City gauge no. 102. **Figure 6.2.3** presents the August 19, 2005 historical event model simulation results. The August 19, 2005 model simulation results show system surcharging is more widespread than the May 12, 2000 event. During this event there were two incidences of flooding which were reported to the City. **Figure 6.2.3** also shows hydraulic issues in the system for this event and a high risk of basement flooding, which is consistent with locations where basement flooding has been reported. The records are provided by the City or collected from a questionnaire at the initial stage of this study.

Both the May 12, 2000 and August 19, 2005 events validate the sanitary system model. For the purpose of evaluating the sanitary system for the May 12, 2000 event the sanitary system model is considered valid and suitable. As such, the model calibration parameters were considered valid to represent the wet weather response in the system to replicate the flooding that occurred in LPN study area for this event.

The calibrated model parameters were found to be valid for severe storm events much larger than the monitored events. Details of the model calibration and simulation of historical storms are provided in Appendix C.

6.2.5 Assessment Event

The model was used to simulate the May 12, 2000 event as measured at the Oriole Yard Gauge. The event is considered the design or assessment event for the sanitary sewer system for the basement flooding level of protection criteria. For these simulations the per capita average dry weather flow is based on existing dry weather flow conditions.

Figure 6.2.4 shows the simulation results showing surcharging in the sanitary system and water surface elevations less than 1.8 m below the ground. The model water surface elevation is elevated because there is insufficient conveyance capacity in the system during peak wet weather flow periods as a result of I/I. The model shows the HGL is within 1.8 m of the ground

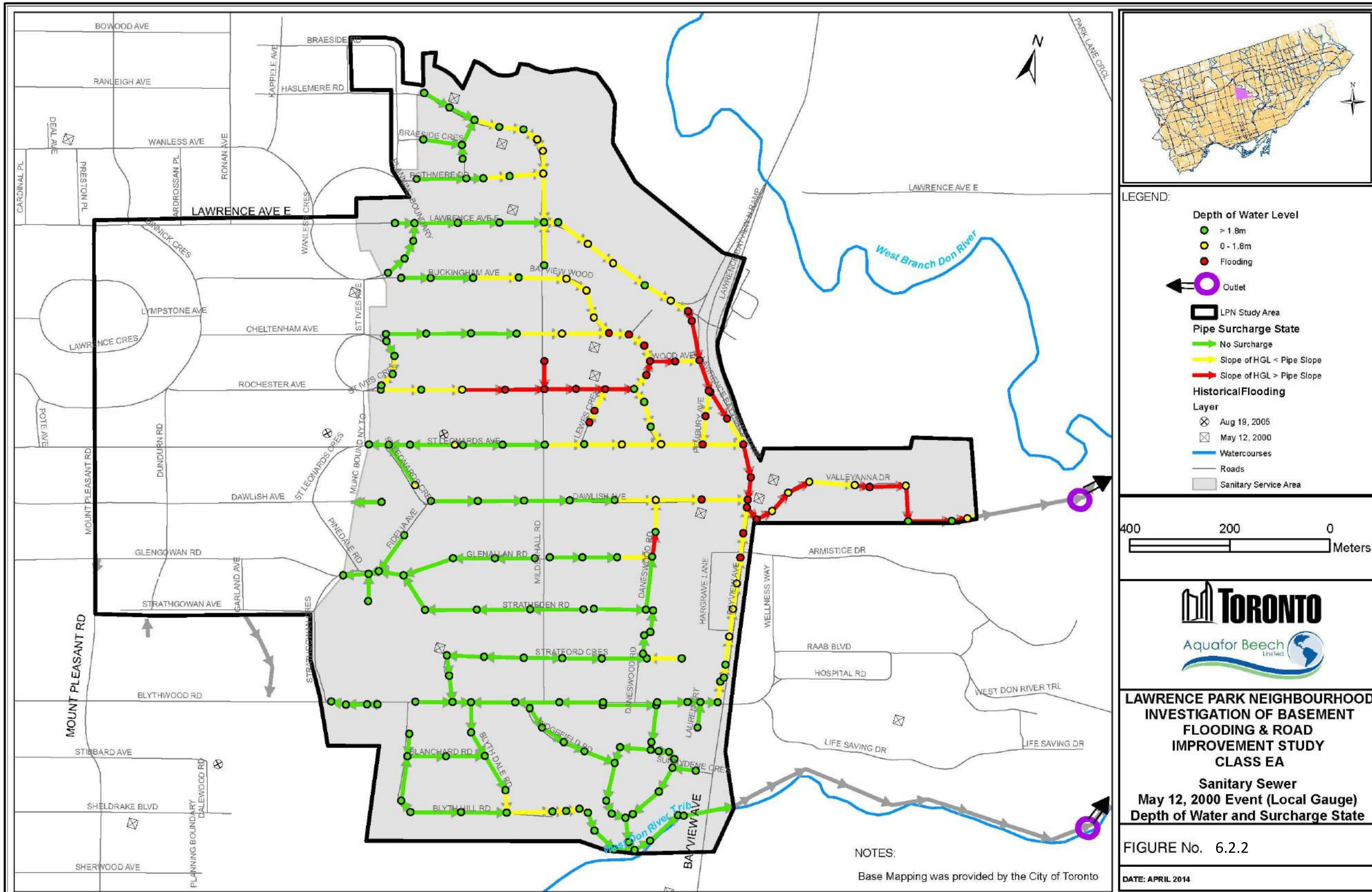


Figure 6.2.2 – Sanitary Sewer – Depth of Water and Surcharge State, May 12, 2000 Event (Local Gauge)

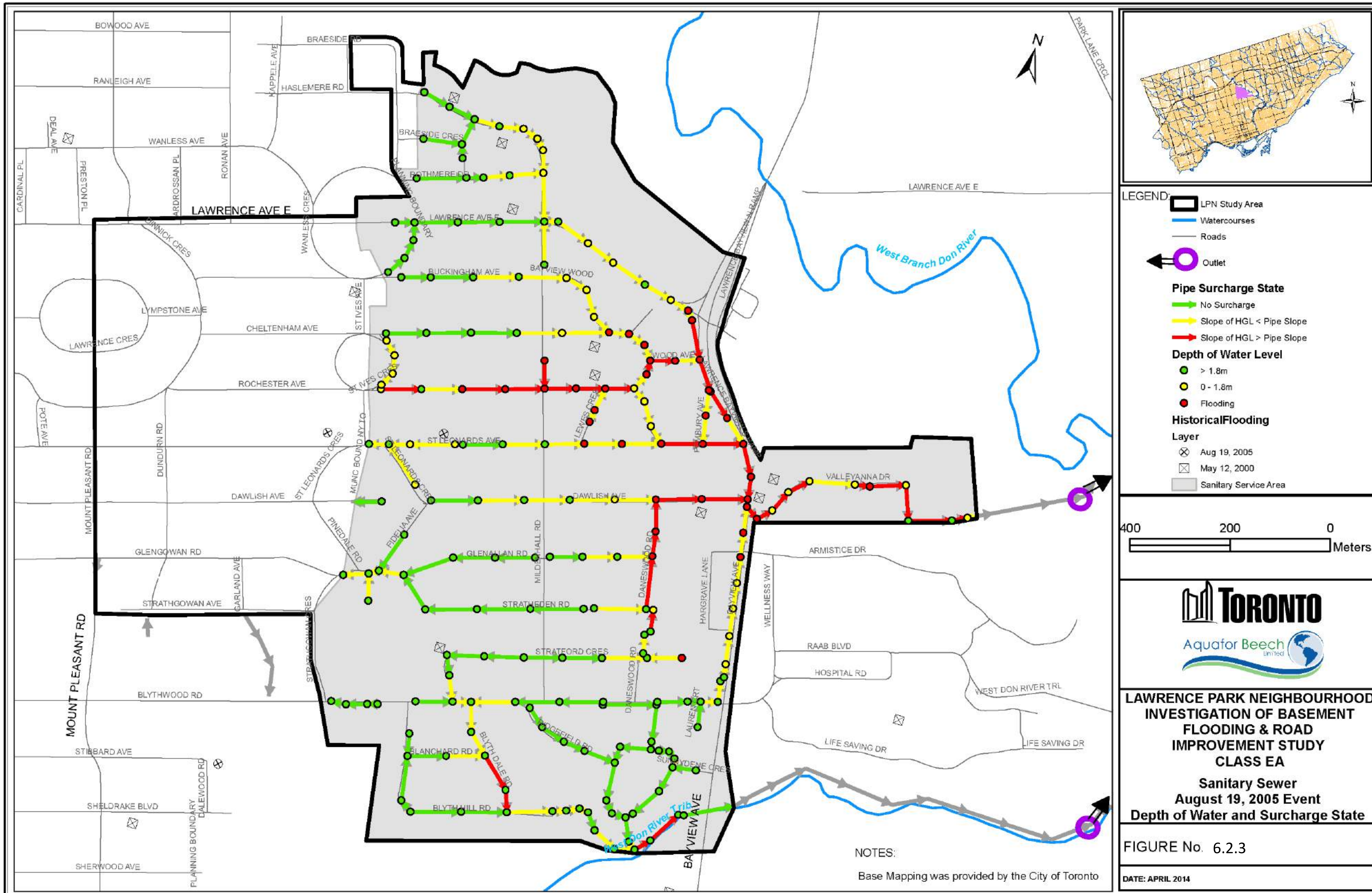


Figure 6.2.3 – Sanitary Sewer – Depth of Water and Surcharge State, August 19, 2005 Event

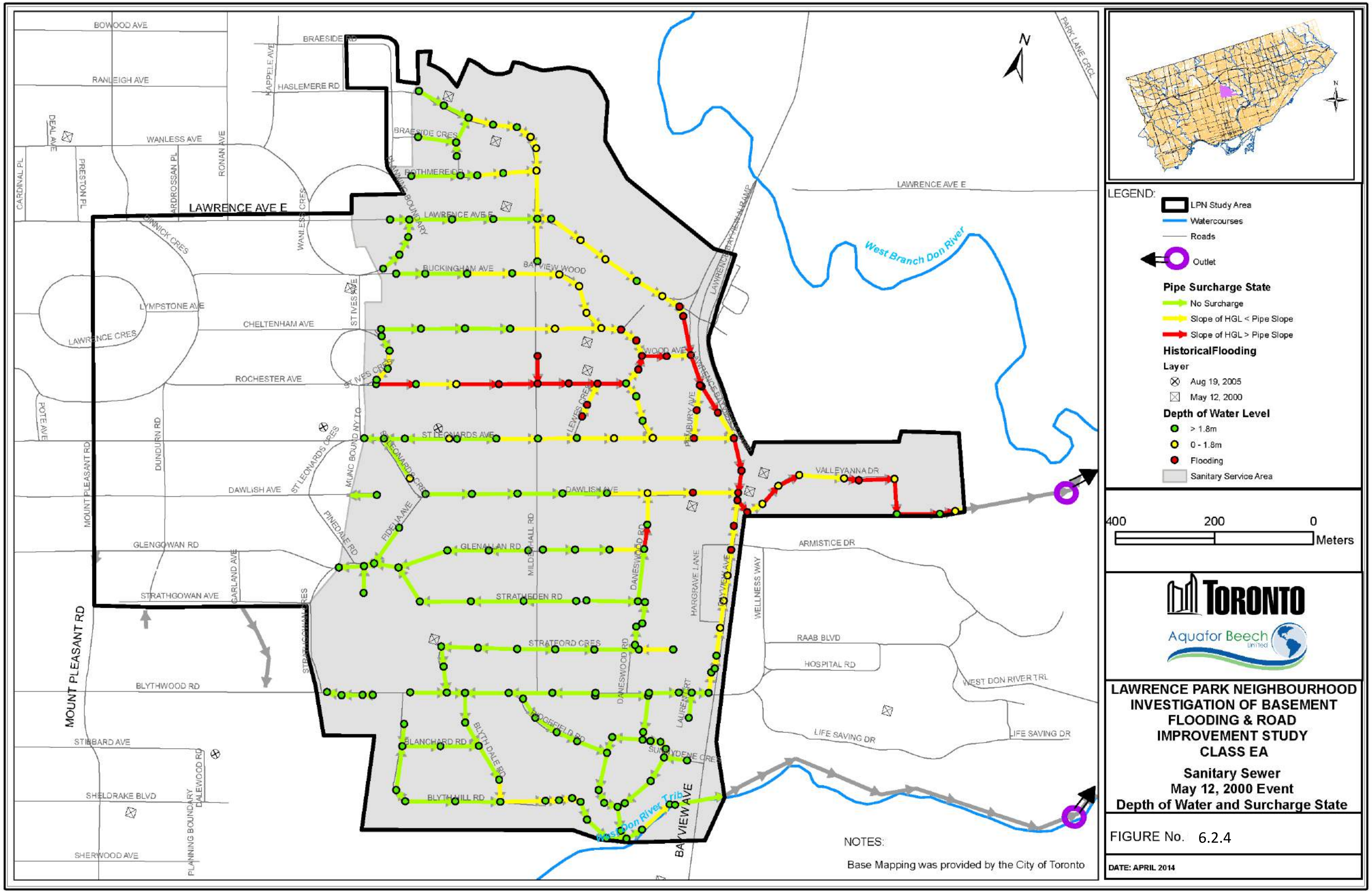


Figure 6.2.4 – Sanitary Sewer – Depth of Water and Surcharge State, May 12, 2000 Event

surface in the area including in the vicinity of Valleyanna Drive and Bayview Avenue where the water surface reaches ground level.

The assessment event model results display more widespread surcharging risks than expected based on the historical basement flooding reports from the City. The sanitary system can be described as not providing adequate capacity to convey additional I/I flows associated with the assessment event of May 12, 2000 as measured at Oriole Yard Gauge.

6.2.6 Summary of Sanitary Sewer System Hydraulic Performance

Based on the simulation runs and summary in Appendix C, the presence of shallow sewers and bottlenecks in a few certain areas (i.e. Bayview Avenue and Valleyanna Drive) can reduce the effective level of service to less than the 2-year return frequency.

The sanitary system model did show surcharge in the system primarily in the Valleyanna/Bayview area a result of the May, 12, 2000 and August 19, 2005 storms which corresponds to the basement flooding reports and questionnaire results in most areas. Sanitary sewer back-up was identified as a factor in basement flooding in the area for the May 12, 2000 and August 19, 2005 events.

Through the data collection and model development process there is believed to be a linkage between the storm system performance and sanitary system. The linkage is thought to be between surface flow and sanitary system inflow rates. In low lying area (Strathgowan/Fidelia) surface ponding during large events occurs as there is no natural overland flow path. As such the ponding water becomes a source of sanitary system inflow which can contribute sufficient flow volume resulting surcharging of the sanitary system.

The summary findings of the sanitary sewer system are provided below.

- Calibration of the sanitary sewer system was also reasonable. Three monitors were installed at strategic locations within the existing sanitary sewer system.
- The sanitary sewer system, during wet weather events, experiences significant infiltration/inflow. The three primary sources of I/I include downspouts connected to the sanitary sewer, private property sources and stormwater entering manhole covers.
- Sewers located along Valleyanna Drive and segments along Bayview Avenue were not designed for large rainfall events such as May 12, 2000 and August 19, 2005. Water ponding on road surface is likely contributed excess water to sanitary sewer system in area of Rochester Avenue, St. Leonards Avenue, Dawlish Avenue and Valleyanna Drive.

- It should be noted that that the existing sanitary sewer system was not designed for large rainfall events as per the current level of service.

6.3 Dual Storm Drainage System

The dual storm drainage system consists of the sewer system (minor system) and the overland flow system (major system). The dual storm drainage model considers the interaction between the two systems and accurately simulates the flow and water depth in every element of the minor and the major systems.

6.3.1 Preliminary Physical Assessment

The storm study area is approximately 160 hectares (larger than the 111 ha sanitary service area) consisting of five sewersheds that drains via five (5) outlets toward a tributary of the west branch of the Don River.

A majority of the homes in area to the west of St. Ives Avenue (former City of Toronto) were initially serviced with combined sewers, which carry both wastewater and stormwater runoff. Throughout the 1960s until the mid-1980s, the City undertook sewer separation programs whereby stormwater runoff from public property was directed to a storm sewer. Subdivisions to the east of St. Ives Avenue (former City of North York) within the study area that were constructed from the 1960’s onward are serviced by road ditches as well as a separate storm and sanitary system.

The storm sewer system within the study area comprises approximately 240 storm pipes totalling approximately 14 kilometres of sewer length. This area includes 250 manholes and 367 catchbasins. The sizes of storm sewer pipes are either circular or rectangular and ranges between 200 mm to 2100 mm in diameter. A majority of the streets in the study area are serviced by a storm sewer system. These storm sewers discharge to the Don River West Branch via storm sewer outfalls.

An eastern portion of the LPN study area has ditch drainage along the road right-of-way instead of standard curb and gutter which is typically found in urban residential neighbourhoods. There is approximately 5 kilometres of ditches which collect storm flow, discharge to several common ditch inlets, and ultimately into the City’s storm system.

The DEM with break lines was used to delineate the overland drainage system features such as surface drainage flow path and direction, surface ponding areas, and drainage area boundaries. Field checks were completed to verify the DEM with respect to surface ponding locations, overland flow routes and the storm catchment boundary.

Not all streets provide drainage as a result some low lying areas exist where there is no defined overland flow route or outlet. Overland storm flows accumulate in these areas and surface flooding may occur under heavy storm events. Low lying areas identified as part of the field survey include the Buckingham Avenue, Blyth Hill Road, Strathgowan Crescent, Sunnydene Crescent and Stratheden Road locations which correspond to reported basement flooding and/or responses basement flooding from PIC 1 questionnaire in the area. **Figure 6.3.1** presents the overland flow path and surface ponding areas for the LPN study area.

There are no stormwater management facilities in the study area as indicated in the sewer infrastructure data.

A field survey was conducted in the fall/winter of 2012 to visually inspect each property from the street in the LPN study area to determine where the roof downspouts discharge (underground or surface) as well as document homes with reverse slope driveway together with catchbasin types. Complete details of the field survey are provided in Appendix C.

The results of the survey indicate that approximately 55% of the households in the LPN study area are still connected or partially connected to the sewer system. Some houses in the study area (11%) have reverse slope driveways which slope from the street downward the house. Surface flows can accumulate at the bottom of the driveway and storm sewer surcharge into the drain at the base of the driveway can cause surface and basement flooding. The majority of the reverse slope driveways are located in the southern part of LPN study area (south of Blythwood Road.

The storm drainage systems, both the minor and major systems, generally flow south and southeast towards the Don River West Branch.

Details of the sub-catchment and sewer characteristics, roof downspout connection details, and other storm area details are provided in Appendix C.

6.3.2 Description of Dual Storm Drainage Model

The storm sewer network was assembled using the sewer network database provided by the City. The system was modeled manhole to manhole and the number of catchbasins between manholes was input as the number of inlets called gullies in the model to account for the distribution of major and minor system flows. The minor system consisted of the storm sewer network. The overland flow system typically consisted of streets with flows constrained by the curb along both sides of the street. LPN study area does have approximately 5.0 km of ditch drainage as part of the overland flow network. The accompanying graphic below illustrates a typical rural roadway cross section (**Figure 6.3.2**).

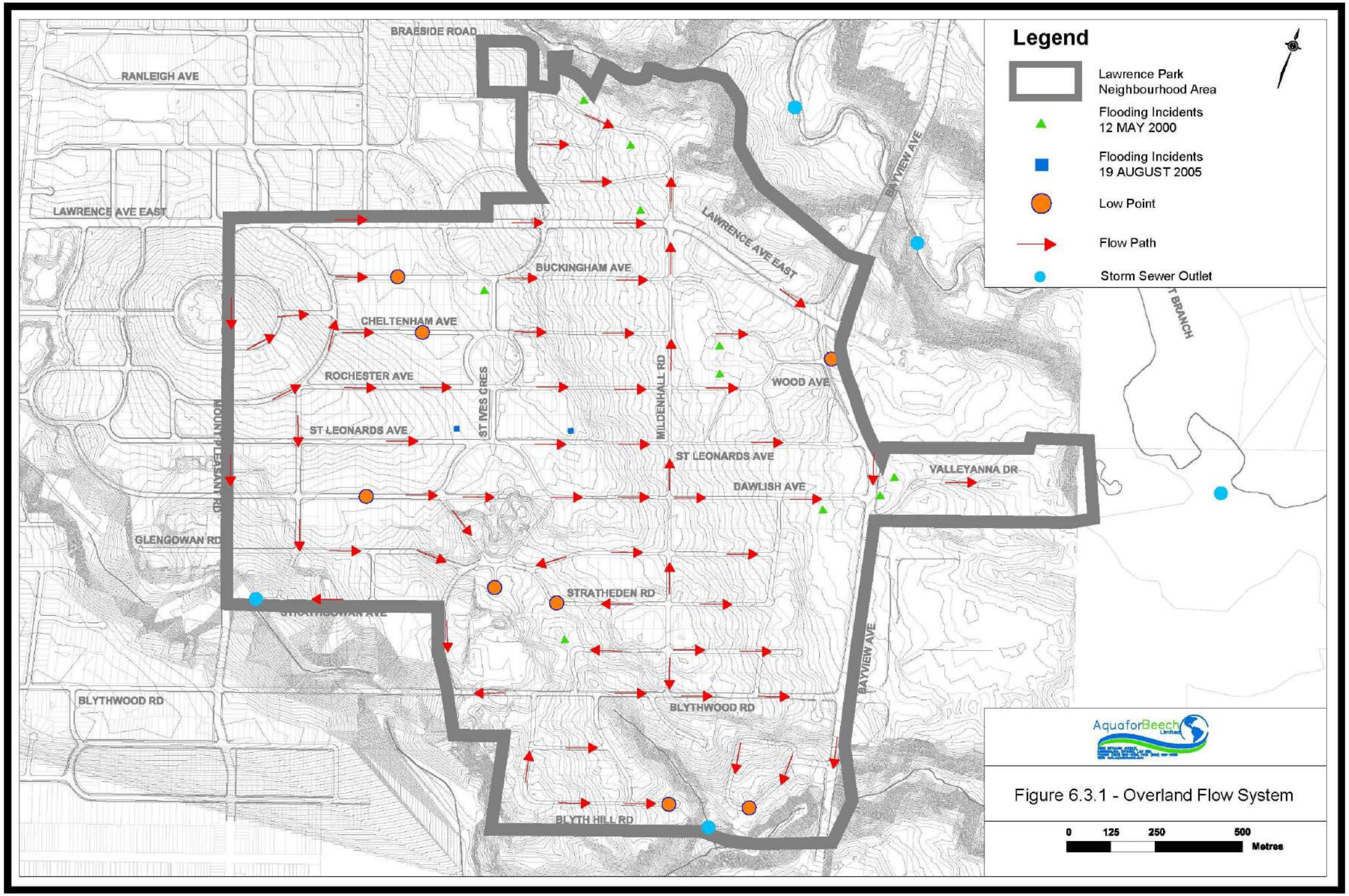


Figure 6.3.1 – Overland Flow System

Figure 6.3.2 – Existing Typical Rural Roadway Cross Section

The streets were modelled as wide shallow open channels to reflect the appropriate geometry, cross section and channel roughness. The overland channel invert levels were set at the manhole cover elevations so that flows into the overland channels can occur when there is flooding out of the manholes from the minor drainage system or when the flow is restricted into the minor system at the catchbasin based on the catchbasin inlet capture capacity. The inlet capture capacity of the catchbasin defines the limit of inflow/outflow between the pipe and overland networks.

The typical roadway channels defined to represent local and collector roads consisted of user defined cross sections. Two typical cross sections were used in the study area including a road right-of-way (ROW) width of 20.1 metres with a height of 0.30 metres for local roads, and a ROW width of 26.1 metres and a height of 0.30 metres for collector roads. Adjustments were made to the network as necessary, such as additional nodes, overland segments, invert adjustments, etc., to replicate the overland flow paths predominately associated with roadways. The accompanying graphic below illustrates a typical urban roadway cross section (**Figure 6.3.3**).

A portion of the LPN study area has ditch drainage along the road right-of-way instead of standard curb and gutter which is typically found in urban residential neighbourhoods. For this

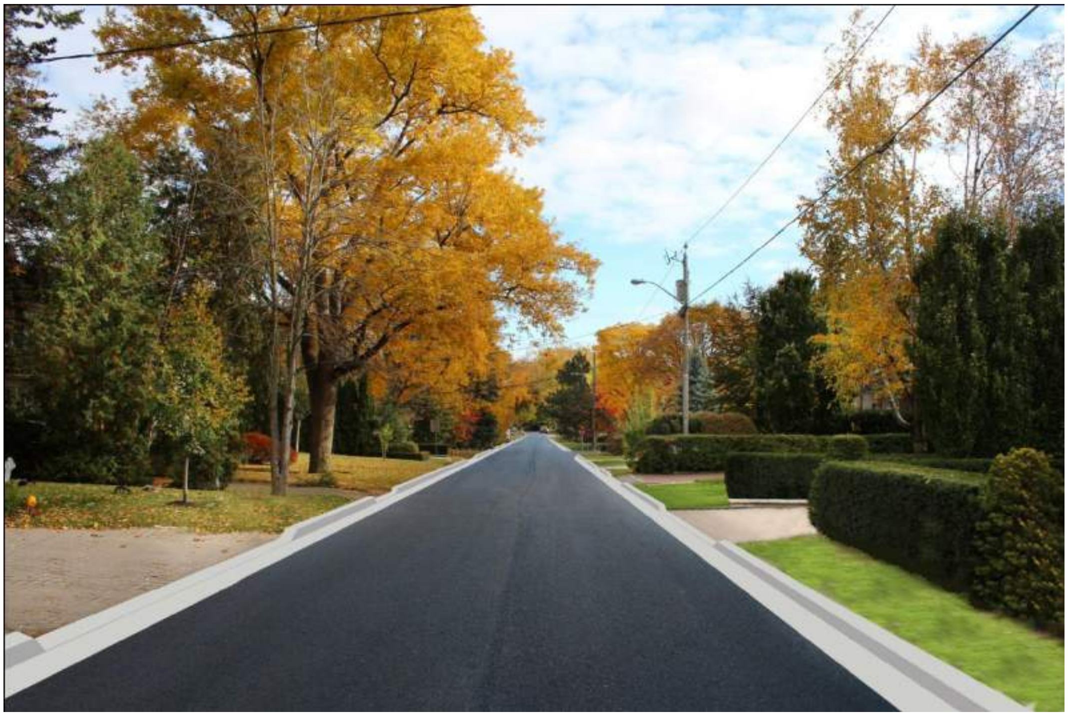


Figure 6.3.3 – Typical Urban Roadway Cross Section

portion of the LPN study area, the roadway cross sections were used including survey data undertaken in the winter of 2013 to define existing road conditions. While the surface flow depth greater than 300 mm above surface, it could indicate potential surface flooding of private properties, and hence potential basement flooding from surface runoff in these areas.

The major system is connected to the minor system through inlets, or catchbasins. The number of catchbasins was adjusted in the database and the type of catchbasin cover was considered using the information obtained from the field survey. Catchbasin capacity was considered in the model as a head discharge relationship and limited to 55 L/s which was provided based on the road drainage study entitled "Road and Bridge Deck Drainage Systems, J. Marsalek, 1982". The inlet characteristics and number of catchbasins associated with a subcatchment and overland flow segment are defined at model nodes defined as "gully" nodes.

With the completion of the major system network, tests were undertaken to ensure network continuity between the overland network (major) and pipe network (minor) behaved as expected. The end result was a dual drainage model of the storm drainage network.

The balance of the catchment area was connected to an overland flow segment and consists of pervious and impervious areas associated with grassed areas, driveways, roadways, and disconnected downspouts. The overland flow would only enter the minor system through a model node defined as a "gully".

The hydrologic model used in InfoWorks is the EPA SWMM RUNOFF routine. The primary hydrological parameters include the subcatchment area, percent imperviousness, width, and ground slope. The initial values for these parameters were determined by using land use and topography information contained in the City's GIS database.

For the larger storm event, it is assumed that the downspout capacity of a roof drainage system would be exceeded (roof downspout capacity - 3 L/s each as suggested by the City's Draft InfoWorks CS Modelling Guidelines, 2014) such that a portion of roof runoff would overflow to the surrounding pervious surface and contribute to the overland flow. The SWMM runoff model was used in conjunction with the Horton infiltration method for the previous areas within InfoWorks CS. Flow routing was performed using the SWMM routing model.

The study area consists of five separate catchment areas and corresponding number of sewer outlets. The model includes 354 sub-catchment areas, 442 nodes, 437 sewer links and 804 overland flow links.

Details of the model set up and the used parameters are provided in Appendix C

6.3.3 Model Calibration and Validation

Model calibration is achieved by changing model parameters to produce results matching the measurements within a reasonable accuracy in terms of peak flows, runoff volumes and water levels. Model validation involves testing the calibrated model performance using a different set of measurements than the calibration period to ensure the repeatability of the model results.

Flow monitoring was carried out from June to November, 2013. Three (3) flow monitors were installed in the sanitary sewer system. Three (3) flow monitors were also installed in the combined sewer system. No flow monitors were installed in the storm sewer system.

Five (5) storm events were selected for calibration and validation of the model based on their relatively high intensity, accuracy of recording and reliability. The five selected events include June 10, June 28, July 07, July 08 and July 27, 2013. The rainfall depths of the five storm events ranged between 12 mm and 78 mm. The storm on July 08th was considered for calibration.

This storm has the highest volume (78.3 mm) and highest intensity (120.1 mm/hr). The June 10th, June 28th, July 07th and the July 27th events were used for model verification. In comparing model results with measurements, both flow and water depths in the sewer were considered.

Details of the results of calibration and validation at each monitoring locations are provided in Appendix C.

Based on the modeling results, it can be summarized that:

- Generally very little adjustment to parameters was found necessary from the initial model parameters;
- The model suggests localized surcharging in the minor system during the 2 and 5-year events and in both the minor and major system during a 100 year design event; and
- The primary areas where deficiencies occur are within the former City of North York. Within this area a poor to non-existent major system exists. An insufficient storm drainage system may contribute to flooding as water may enter the sanitary sewer system through manhole covers. In addition, there are numerous reverse grade driveways where stormwater may enter private property due to the lack of difference in change in elevation between the road & top of driveway. This issue will be addressed as part of the road component of the study.

The calibration and validation results provide a reasonable level of confidence in the model simulation to represent the actual performance of the sewer system.

To further validate the storm dual drainage model simulations were undertaken with the calibrated model using larger historic events in order to compare reported basement flooding with the modelling results.

6.3.4 Simulation of Historical Events

The results of overland flow depth and storm pipe flow depth were compared to actual flooding records for the May 12, 2000 and August 19, 2005 event to further verify that the model is representative of stormwater conditions in the area.

The May 12, 2000 simulation was completed using rainfall data from the Oriole Yard City gauge while the August 19, 2005 simulation was completed using rainfall data from the City gauge no. 102 north of LPN study area. The rainfall data for the August 19th, 2005 is not available from the local Mount Pleasant/Broadway City gauge. Hence, the rainfall data was adopted from the City gauge no. 102 north of LPN study area. The May 12, 2000 event was reviewed initially as this event resulted in more widespread flooding in LPN study area while the August 19, 2005 event did not.

Results of the analysis in terms of water level in the sewer system and in the overland flow system were compared to the historic basement flooding reports for each storm. The potential of basement flooding occurring was considered if this condition was reached:

- Surface water level is above an elevation (gutter elevation) of greater than 300 mm.

Figure 6.3.4 illustrates the surface water levels in the overland flow system for the May 12, 2000 event for LPN study area. **Figure 6.3.5** shows the surface water level in the overland flow system for the August 19, 2005 event. Four different surface flow depth categories that are outlined in these figures for these two storms include:

1. From surface to 150 mm above surface. This indicates that the flow is contained within the street pavement.
2. From 150 mm to 300 mm above surface. This indicates the water is above the pavement but contained within the street right-of-way.
3. More than 300 mm above surface. This indicates potential surface flooding of private properties, and hence potential basement flooding from surface runoff.
4. A portion of the LPN study area has ditch drainage along the road right-of-way instead of standard curb and gutter which is typically found in urban residential neighbourhoods. For this portion of the LPN study area, the existing road conditions are deteriorated and in poor condition. While the surface flow depth is greater than 300 mm above surface, it could indicate potential surface flooding of private properties, and hence potential basement flooding from surface runoff.

Figure 6.3.6 and **Figure 6.3.7** present the surcharge state in the storm sewer system for the May 12, 2000 event and August 19, 2005 event respectively for LPN study area in terms of the maximum water level, or Hydraulic Grade Line (HGL) in the storm sewer system. The HGL as defined at model nodes is categorized and colour-coded as follows:

- Green: The HGL is greater than 1.8 m from the surface, the theoretical basement elevation, or for shallow sewers that are within 1.8 from the surface, the water level remains in the pipe (shallow sewers not surcharged are shown using the hatch symbol).
- Yellow: The HGL is less than 1.8 m below surface but below the ground elevation.
- Red: The HGL is at or above the ground surface and flooding from the sewer to the street occurs.
- Shallow sewers (those with the obvert less than 1.8m below ground elevation) are indicated with a hatch symbol.

Additionally, the slope of the HGL at each pipe segment can indicate whether the cause of surcharge is from the sewer being under-capacity (i.e. bottleneck) or the result of backwater from another downstream sewer. Therefore, the “surcharge state” of each pipe in the sewer system is defined in included and colour-coded in three categories as follows:

- Green: The Pipe is not surcharged (i.e. “surcharge state < 1”, meaning water level is below the crown of pipe).

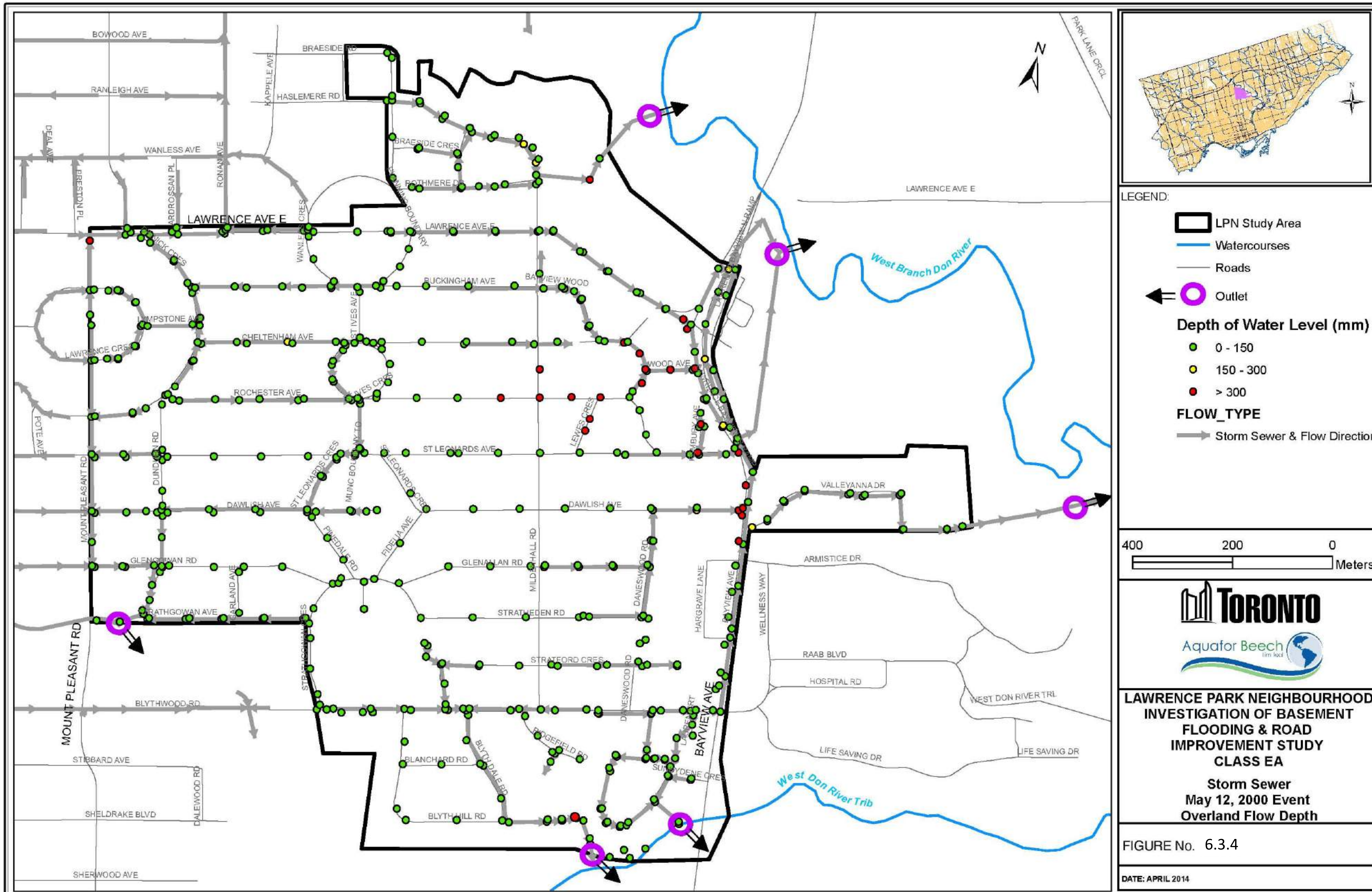


Figure 6.3.4 – Storm Sewer – Overland Flow Depth Map, May 12, 2000 Event

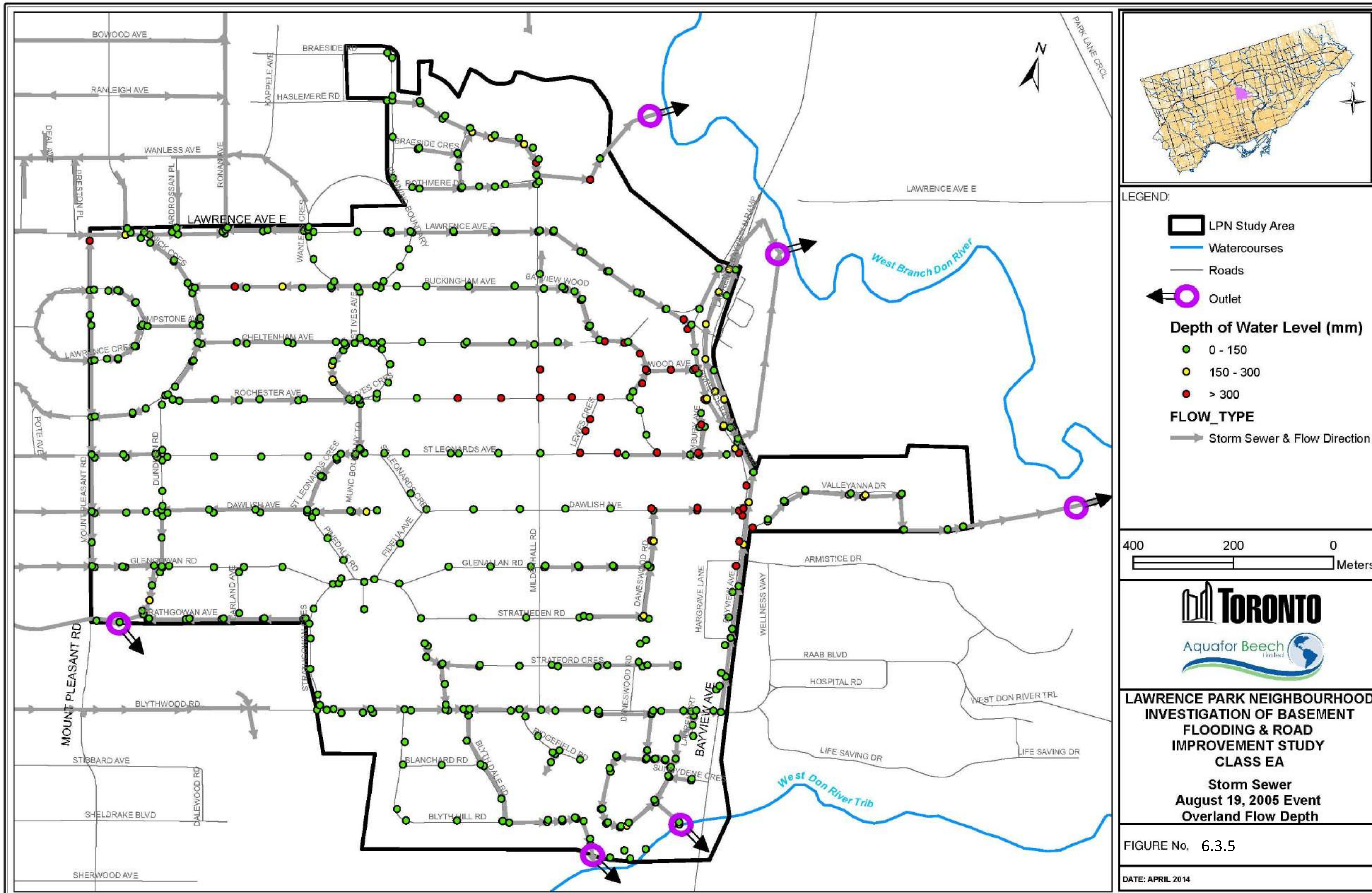


Figure 6.3.5 – Storm Sewer – Overland Flow Depth Map, August 19, 2005 Event

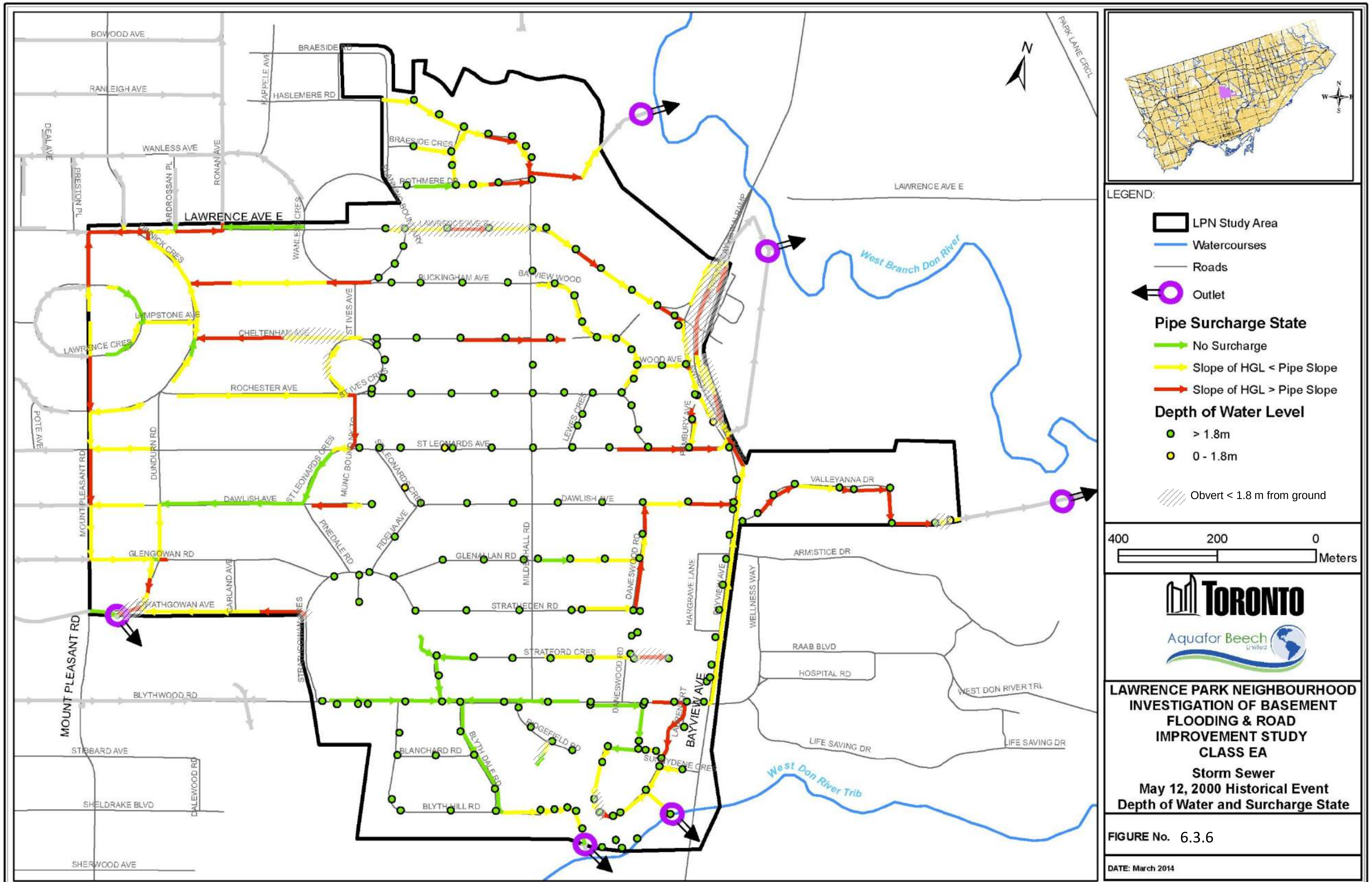


Figure 6.3.6 – Storm Sewer – Depth of Water and Surcharge State Map, May 12, 2000 Event

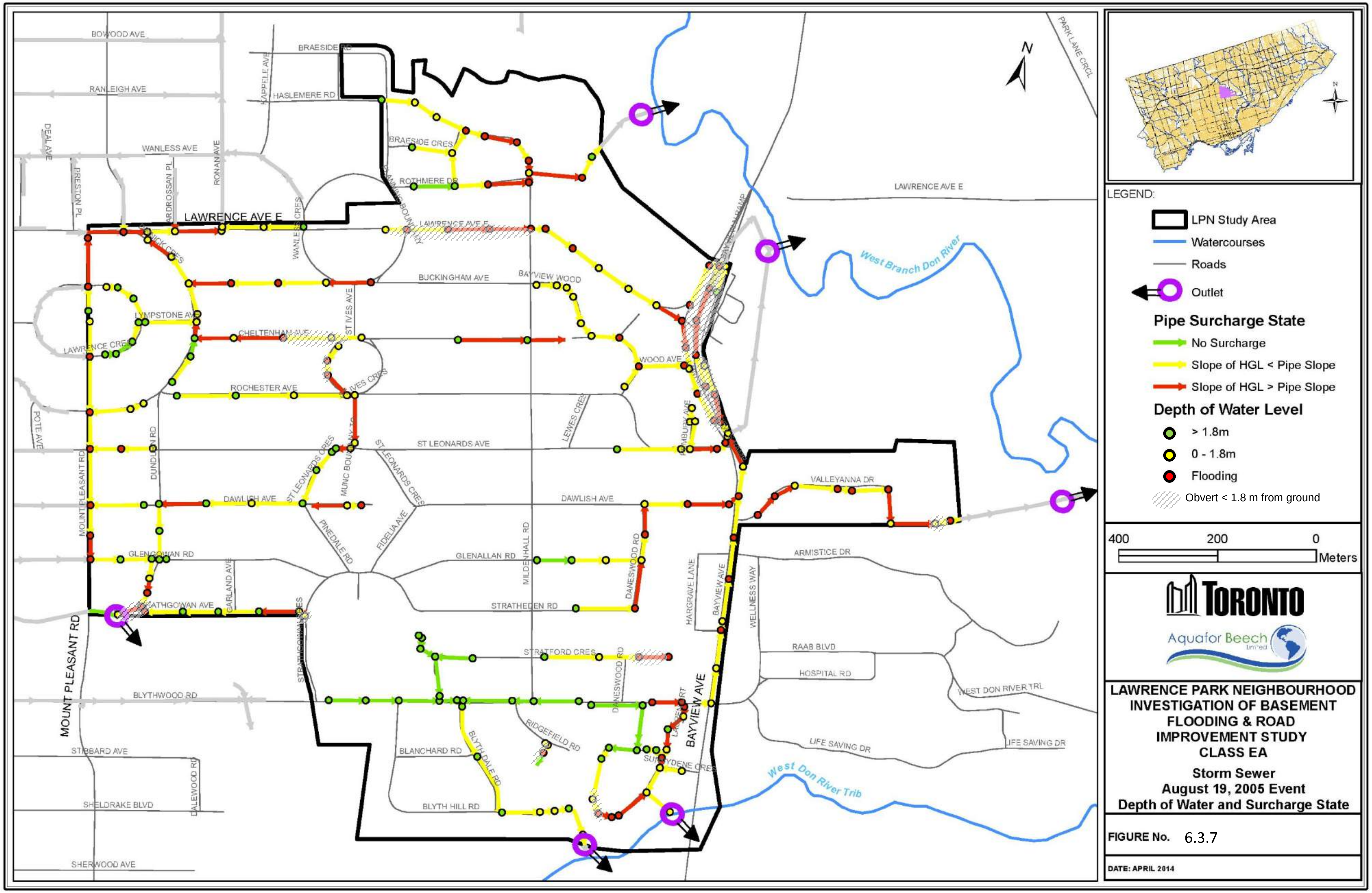


Figure 6.3.7 – Storm Sewer – Depth of Water and Surcharge State Map, August 19, 2005 Event

- Yellow: The Pipe is surcharged, and the slope of the HGL is shallower than the pipe slope, meaning the surcharge is due to backup as a result of an over-loaded downstream pipe.
- Red: The Pipe is surcharged, and the slope of the HGL is steeper than the pipe slope, meaning the surcharge is caused by the pipe, which is over-loaded and is acting as a bottleneck (flow exceeds its capacity).

By reviewing **Figure 6.3.4** through **Figure 6.3.7** in conjunction with the flooding records and historical reports the modelling results provide insight to the possible causes of flooding as it relates to the storm drainage system.

The results of the calibrated model for the May 12, 2000 and August 19, 2005 events show several locations (Dawlish Avenue at Bayview Avenue, Rochester Avenue at Mildenhall Road, and Wood Avenue at St. Aubyn's Crescent) where the overland depth is greater than 300 mm.

The elevated storm flows and overland flow shown for the May 12, 2000 event may contribute to inflow to the sanitary system at low points in the overland flow system and therefore contribute to basement flooding. Overall the storm system model results are consistent with reported flooding in LPN study area.

Reviewing **Figure 6.3.4** through **Figure 6.3.7** reveals the following about the May 12, 2000 and August 19, 2005 events:

- For the May 12, 2000 event there is widespread surcharging in the system that overlaps with historical flooding. Surface flow is generally greater than 300 mm for several locations;
- The August 19, 2005 event results in widespread surcharging in the system; this is consistent with locations where surface or basement flooding has been reported; and,
- Based on the historical events simulation the storm system model is considered representative of the storm systems in LPN study area verifying the model for subsequent analysis.

6.3.5 Assessment Event

The City assessment event for the storm system is the 100-year design storm. The results of the model simulation are presented in **Figure 6.3.8** and **Figure 6.3.9**, respectively showing overland flow depth and minor system surcharge.

Figure 6.3.8 shows the overland flow depth is exceeded throughout some of ditch drainage system east of Mildenhall Road. **Figure 6.3.9** also presents the storm pipe network is surcharged throughout most of the system with the water surface elevation within 1.8 m of the

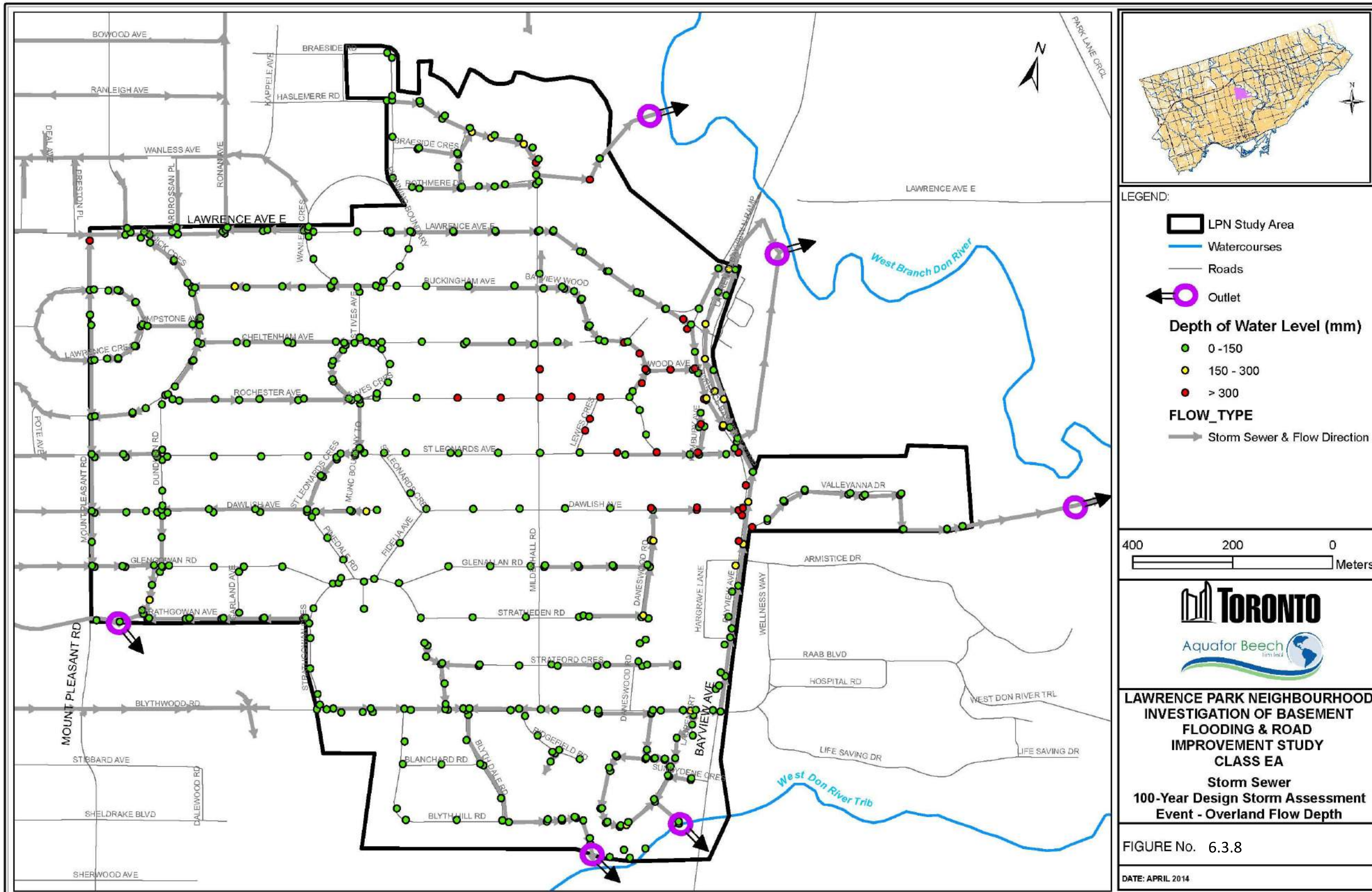


Figure 6.3.8 – Storm Sewer – Overland Flow Depth, 100-Year Design Storm Assessment Event

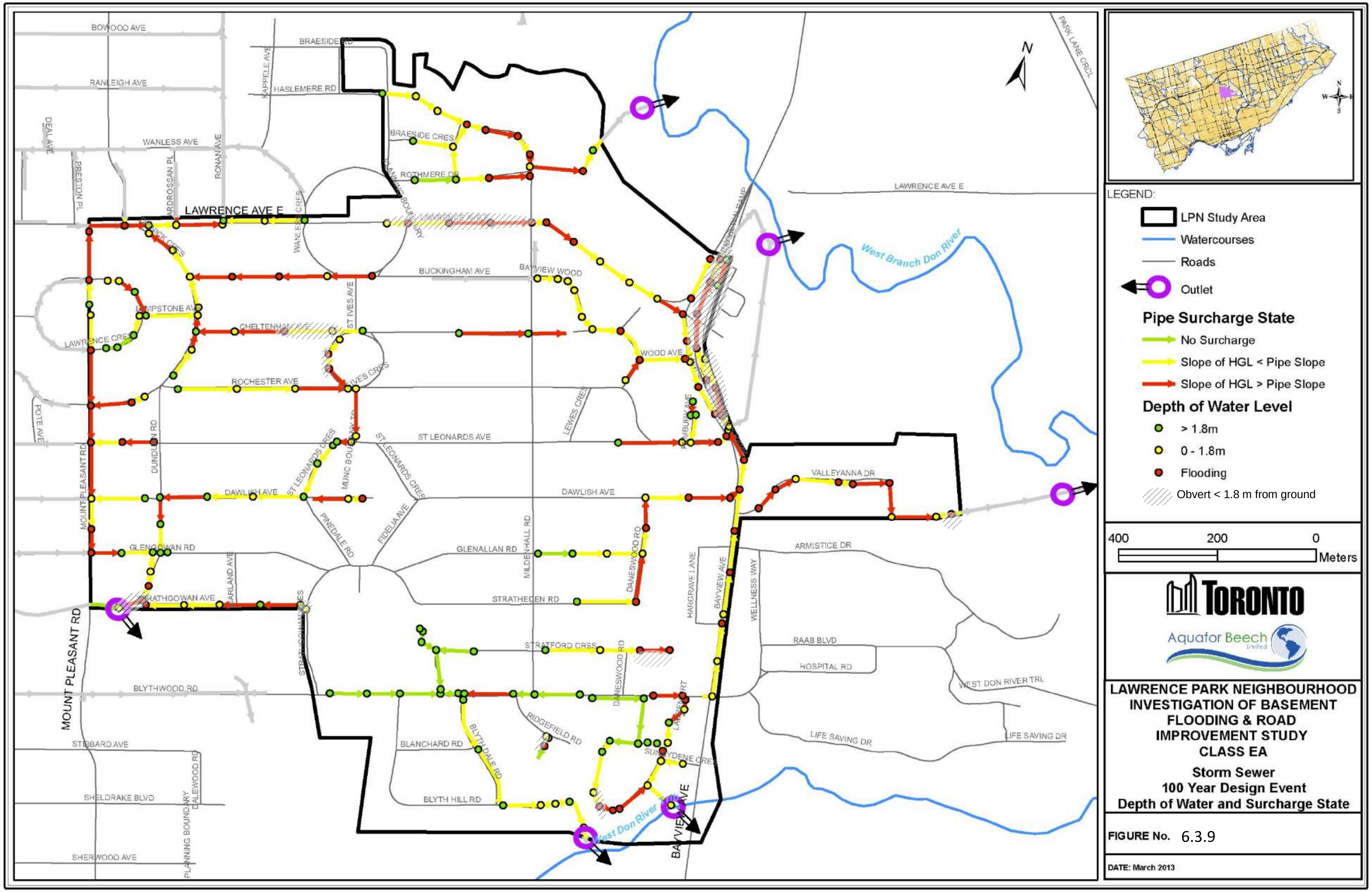


Figure 6.3.9 – Storm Sewer – Depth of Water and Surcharge State,100 Year Design Storm Assessment Event

ground surface.

The 100-year assessment event model results are used to develop and evaluate alternative remedial measures and size the preferred solutions for LPN study area.

6.3.6 Summary of Storm Drainage System Hydraulic Performance

Under large events, the system weaknesses are revealed. During 100-year design storm conditions, it can be seen that the storm sewer system is surcharged in many areas; with the surcharge level higher than the basement elevation and reaching the surface in many areas. Overland flow is exceeding the capacity of the major drainage system in areas associated with basement flooding (Dawlish Avenue at Bayview Avenue, Rochester Avenue at Mildenhall Road, and Wood Avenue at St. Aubyns Crescent).

The simulation of the August 19, 2005 historic storm event shows a similar level of system problems and potential flooding as the 100-year design storm event simulation.

The primary areas where deficiencies occur are within the former City of North York. Within this area a poor to non-existent major system exists. An insufficient storm drainage system can contribute to flooding as water can enter the sanitary sewer system through manhole covers. In addition, there are numerous reverse grade driveways where stormwater can enter private property due to the lack of difference in change in elevation between the road & top of driveway. This issue will be addressed as part of the road component of the study.

6.4 Combined Sewer System

6.4.1 Description of the Combined Sewer Model

The combined service area is approximately 45 hectares (smaller than the 111 ha sanitary service area) consisting of 352 properties. The area is primarily single-family detached residential land use which was initially developed in the 1920’s to 1940’s. A combined trunk sewer is running from north to south along St. Ives Ave and Strathgowan Crescent through the LPN study area. The combined service boundary for LPN study area is south of Lawrence Avenue East, north of Blythwood Road between Mount Pleasant Road and St. Ives Avenue in the former City of North York. The combined sewer system generally flows south towards Blythwood Road. Presently there is no underground storage tank in LPN study area.

Details of the sewer characteristics and other combined area details are provided in Appendix C.

A detailed model of the combined sewer system was developed to assess the performance of the system, as well as to identify and simulate alternatives. Combined sewer network information and population data were compiled from City of Toronto databases.

The combined sewer system within the LPN study area compromises approximately 140 combined pipes totalling approximately 9 kilometres of sewer length. The area consists of 131 manholes and 99 catchbasins.

Flow and water level in each pipe in the combined sewer system is calculated by the model and is based on the dry-weather flow and I/I generated by rainfall.

Monitoring data collected from June 2013 to the end of the monitoring period was used to simulate the observed events as well as determine an average sanitary per capita flow rate and ground water infiltration (GWI), both of which constitute the dry-weather flow for simulating historic and design storm events.

Dry weather per capita flow generation rates and patterns are documented in Appendix C. The population data made available by the City was used with the per capita dry-weather generation rates and the estimated GWI to determine the dry-weather flow. Industrial, commercial, and institutional (ICI) dry-weather flows were calculated from the monitoring flow data and used in the model.

In addition to combined sewer flow, the model results indicate the water level, or hydraulic grade line (HGL) in each sewer pipe. This information was used to determine which sewers surcharged above the pipe or above the road surface. It was assumed that the typical basement was 1.8 meters below the road surface (as defined by the top of each manhole). Therefore, any sewer with an HGL within 1.8 m of the road surface was assumed to cause basement flooding in the nearby properties.

6.4.2 Model Calibration and Validation

Model calibration is achieved by changing model parameters to produce results matching the measurements within a reasonable accuracy in terms of peak flows, runoff volumes and water levels. Model validation involves testing the calibrated model performance using a different set of measurements than the calibration period to ensure the repeatability of the model results.

The model relied on the observed monitoring data for input. The measured dry-weather, per capita flow rates and daily patterns were applied to the residential areas. Calculated ICI dry weather flow rates were used for ICI land use. Observed rainfall was used to simulate the response of the combined system; the observed flow at the monitoring locations was used to verify the flow predicted by the model for a range of rainfall events.

The rainfall events used for calibration and validation are those measured in the period June to November 2013.

After reviewing the results of the monitoring program, there were only five storm events (June 10th, 2013, June 28th, 2013, July 07th, 2013, July 08th, 2013 and July 27th, 2013) that were considered suitable for calibration and verification of the model. The storms were selected based on their relatively high intensity, accuracy of recording and reliability. A total of 78.3 mm rainfall was recorded at the City's RG39-P (Mt. Pleasant) rain gauge station on July 08th, 2013 with 120.1 mm/hr peak rainfall intensity. The rainfall on July 08^{th} event recorded during the monitoring period was equivalent to a 25-year storm event for the LPN study area. This event was considered for calibration as it was the largest storm event recorded according to volume, as well as the most intense over the course of the entire flow monitoring period, and the other which had rainfall depths of 12 mm and 34 mm respectively, were considered for verification.

In general, for the calibration, subcatchment parameters were adjusted so that the peak flow and total volume for the simulated values were within 15% of the monitored data. There is generally good agreement for the July 08th, 2013 event on volume, peak flow and depth with the exception on peak flow for site 5. It might be caused by a malfunction of measuring equipment at that time. The calibrated model was then used to simulate other observed events and assess the accuracy and repeatability of the model (validation).

Based on four validation events, the July 08th, 2013 calibration is appropriate for events with total rainfall volume in the range of approximately 12 to 78 mm. However, the applicability of the July 08th, 2013 calibration parameters for events outside of this range is questionable, and therefore should be used with caution. For the purposes of this study dealing with extreme storm events, a second calibration with the historic August 19, 2005 storm was therefore performed as described in the following section.

6.4.3 Simulation of Historical Event

The rainfall on July 8^{th} event recorded during the monitoring period was equivalent to a 25-year storm event. The calibration/validation of the model to this storm was reasonable. Two large, historic storms were simulated using the existing conditions model. A secondary verification was undertaken to assess the impact of larger storm such as the August 19, 2005 event with the intention of replicating the flooding that occurred in LPN study area for confirmation purposes.

The model was validated with the August 19, 2005 event using rainfall data from the City gauge no. 102. During this event there were two incidences of flooding which was reported to the City. **Figure 6.4.1** shows the August 19, 2005 historical event model simulation results and it also illustrates hydraulic issues in the system for this event and a high risk of basement flooding, which is consistent with locations where basement flooding has been reported. The records are provided by the City or collected from a questionnaire at the initial stage of this study.

For the purpose of evaluating the combined system for the August 19, 2005 event the combined system model is considered valid and suitable. As such, the model calibration parameters were considered valid to represent the wet weather response in the system to replicate the flooding that occurred in LPN study area for this event.

The calibrated model parameters were found to be valid for severe storm events much larger than the monitored events. Details of the model calibration and simulation of historical storms are provided in Appendix C.

6.4.4 Assessment Event

The City assessment event for the combined system is the 100-year design storm. The event is considered the design or assessment event for the combined sewer system for the basement flooding level of protection criteria. For the assessment event the per capita average dry weather flow is based on existing dry weather flow conditions.

Figure 6.4.2 shows the simulation results showing surcharging in the combined system and water surface elevations less than 1.8 m below the ground. The model shows the HGL is within 1.8 m of the ground surface in the area including in the vicinity of St. Leonard’s Avenue and St. Ives Avenue, Glengowan Road and Garland Avenue. These areas are served only by combined sewers and storm sewer is not installed presently.

The 100-year assessment event model results are used to develop and evaluate alternative remedial measures and size the preferred solutions for LPN study area.

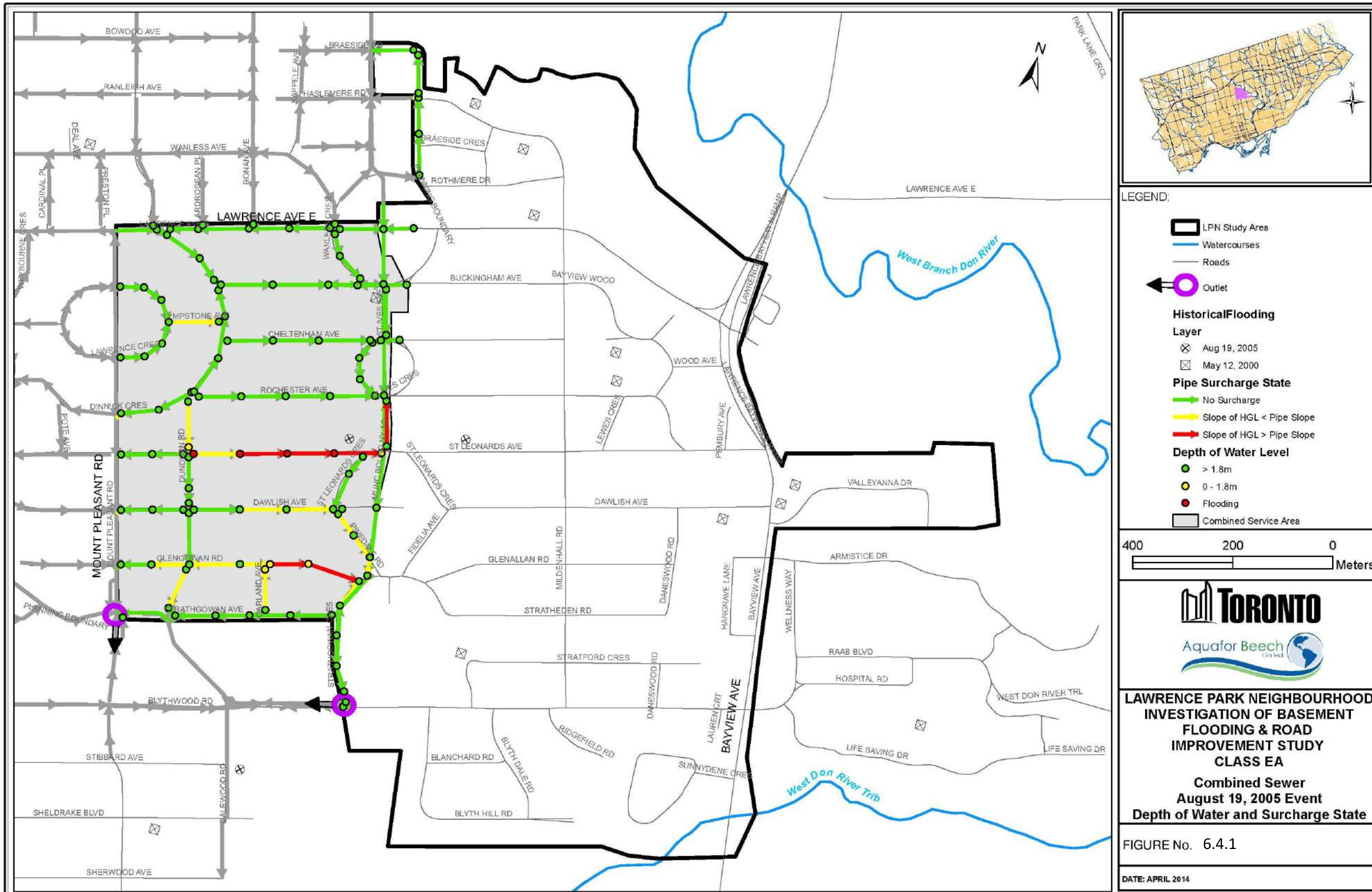


Figure 6.4.1 – Combined Sewer – Depth of Water and Surcharge State, August 19. 2005 Event

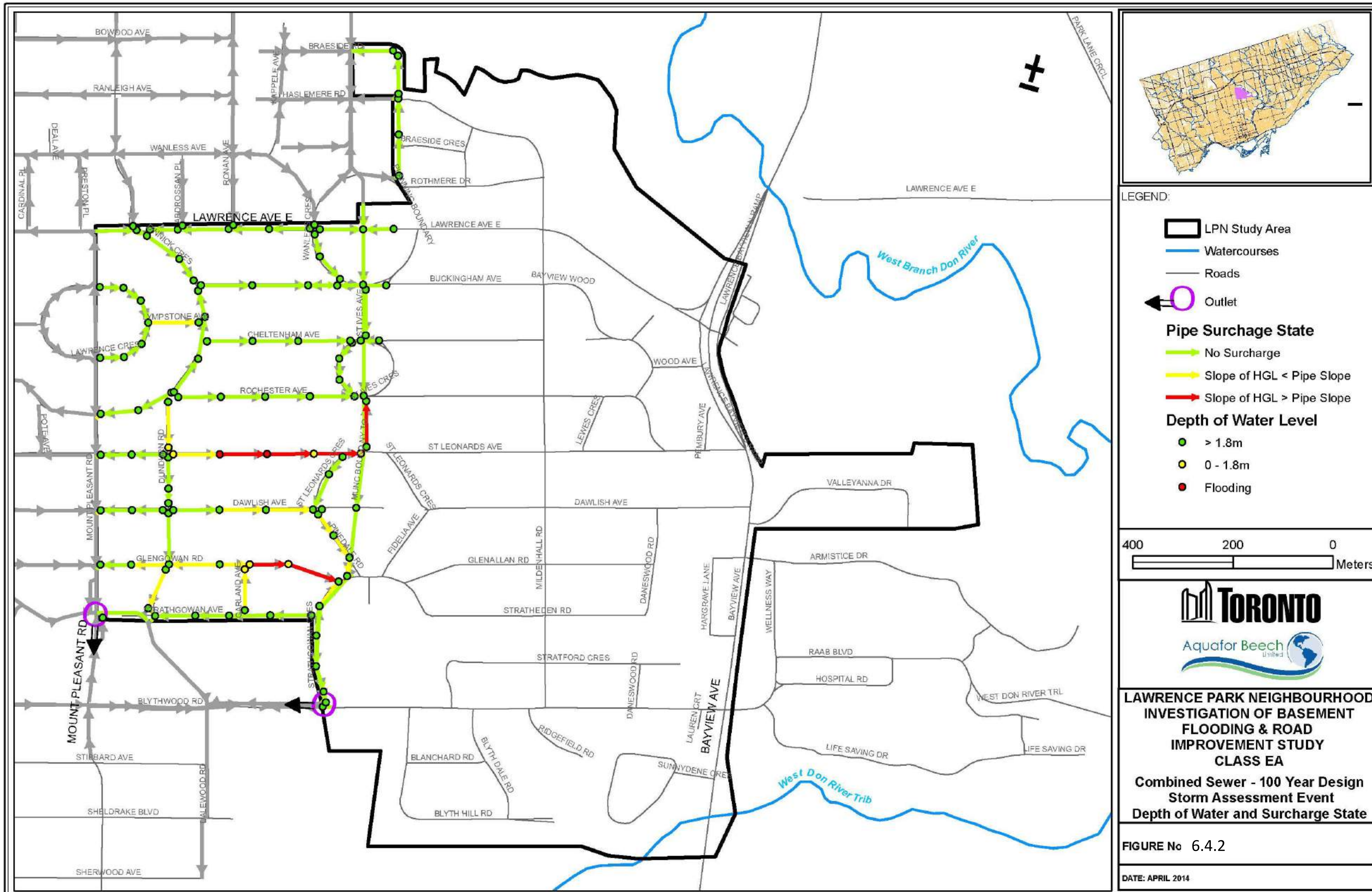


Figure 6.4.2 – Combined Sewer – Depth of Water and Surcharge State, 100 Year Design Storm Assessment Event

6.4.5 Summary of Combined Sewer System Hydraulic Performance

The combined sewer system model did show surcharge in the system primarily in the St. Leonard's/St. Ives and Glengowan/Garland areas a result of the August 19, 2005 and 100-year design storms which corresponds to the basement flooding reports and questionnaire results. The back-up of flows in a few areas which are serviced by the original combined sewer was identified as a factor in basement flooding in the area for the 100-year design storm and August 19, 2005 events.

The summary findings of the combined sewer system are provided below.

- Calibration of the combined sewer system model was reasonable, in part aided by the fact that a large event (approximately 1:25 year) occurred during the monitoring process. Two of the monitors were installed in local sewers, with the third being installed in a combined trunk sewer.
- Flooding is generally limited to a few areas which are serviced by the original combined sewer.

7.0 DEVELOPMENT AND ASSESSMENT OF ALTERNATIVE REMEDIAL MEASURES – BASEMENT FLOODING

7.1 General

The following section considers remedial measures associated with storm, combined and sanitary systems in the LPN study area to alleviate basement flooding. The performance of remedial measures associated with the sanitary system is based on the May 12, 2000 assessment event. The performance of remedial measures associated with the combined & storm systems are based on the 100-year design storm. This section outlines the evaluation criteria and presents alternatives control measures. The outcome of this section is the identification of preferred solutions to address basement flooding in the LPN study area.

As noted from the Public Information Centres, and as established from the questionnaire, flooding may be attributed to both public and private property problems. It should be emphasized that the development and evaluation of alternatives will only address basement flooding that is attributed to public property issues.

7.2 Level of Service Criteria

In April 2006, City Council approved a Basement Flooding Work Plan (now referred to as the Basement Flooding Protection Program or BFPP) to undertake comprehensive engineering studies and identify infrastructure improvements in chronic basement flooding areas that experienced significant flooding during extreme storms in May 2000 and August 2005. In 2013, the BFPP was expanded City-wide.

As part of the work plan, an enhanced level of service criteria was adopted by Council that are to be applied for the sanitary, combined and storm sewer systems in basement flooding study areas.

The criteria, as defined in this study are provided below:

- Sanitary Sewer System:

  The maximum hydraulic grade line (HGL) of the sanitary system shall be maintained at an elevation at least 1.8m below the ground elevation under a storm event equivalent to the May 12, 2000 storm as gauged at the City's Oriole Yard, located at Sheppard Avenue and Leslie Street;

- Combined Sewer System

The maximum HGL of the combined sewer system shall be maintained at an elevation at least 1.8m below the ground elevation under a storm event equivalent to the City 100-year design storm. During the 100-year design event, if the depth of the major system flow is less than 300 mm within the right-of-way, then the target level of service is considered satisfied.

- Storm Drainage System:

  A 100 year level of protection is being targeted for the storm system. During this event, the major system flows are to be maintained within the road allowance and no deeper than outlined in the Wet Weather Flow Management Guidelines, November 2006 (Wet Weather Flow Management Guidelines, City of Toronto, November 2006) and the maximum HGL of the storm sewer system shall be maintained at no surcharge level, where feasible, for the local street sewers, during the City 100-year design storm.

- Partially separated area (combined/storm) – in areas where a majority of the storm sewers are shallow and constructed after the combined sewer was installed – only surface flooding criteria (the depth of the major system flow is less than 300 mm within the right-of-way) is applied as the foundation drain is connected to the combined sewer; and

- Separated area (sanitary/storm) – in areas where sanitary and storm sewers were installed – surface flooding criteria (the depth of the major system flow is less than 300 mm within the right-of-way).

These criteria were used as a basis for defining level of service and subsequent remedial works which, in turn, lead to the selection of the preferred alternatives.

7.3 Development and Analysis of Alternatives

In developing alternatives an initial screening was done to eliminate or identify any constraints in potential remedial measures. Remedial measures to address basement flooding fall into one of six categories:

- “Do Nothing”
- Source control measures.
- Local measures.
- Remedial measures applicable to the sanitary sewer systems.
- Remedial measures applicable to the combined sewer systems.
- Remedial measures applicable to the storm drainage systems.

Table 7.3.1 lists the remedial measures and describes the advantages, disadvantages and applicability. This table was used as screening method from which a short list of remedial measures was considered in the development of alternatives and the measures were subject to quantitative assessment of their effectiveness.

From **Table 7.3.1** the following remedial measures were considered for the LPN study area.

"Do Nothing": The first category, "do nothing", entails no changes to the system. This alternative would result in no changes in the drainage systems. Under this condition the target level of service set by the City for the storm system would not be met. Under the "do nothing" alternative the storm drainage system level of service is approximately equal to a 2 year design event for the minor system. The level of service for the storm major system cannot be uniformly defined. Where the sanitary or combined system is overloaded the "Do Nothing" alternative would not meet the City criteria. As a consequence the "Do Nothing" alternative was not considered in the evaluation process as it does not meet the City's target levels, and would not result in any reduction of basement flooding under storms similar to the design events and those recently experienced (2000 and 2005).

Figure 7.3.1 – "Do Nothing" Alternative

Source Control Measures: The only source control measure which is carried further in the alternatives is roof downspout disconnection. In the past, the City encouraged residents on a voluntary basis to disconnect downspouts and re-direct runoff towards grass areas and/or to rain barrels. To move this program to a higher disconnection level, the City adopted a mandatory disconnection program. A theoretical 75% roof downspout disconnection of all house connected roofs is considered for all alternatives as a base remedial measure to reduce basement flooding. Although other source control measures were not further considered, they are encouraged by the City as voluntary initiatives that promote storm runoff control at source.

A variety of non-structural source control measures to improve water quality and / or reduce stormwater runoff may be implemented. Bioretention is one of the measures would address as part of addressing water quality objectives.

Local Remedial Measures: These measures if properly implemented provide the highest level of protection for individual properties. They are highly recommended specially for isolated cases of basement flooding. These measures, although not included in the quantitative assessment or the costing of alternatives, are recommended for implementation in all alternatives especially for isolated houses where reported basement flooding is not related to City's sanitary, combined or storm system issues. Implementation of these measures will further reduce flooding risk to a property if installed and maintained properly.

Sanitary System Remedial Measures: All measures identified in **Table 7.3.1** are applicable to LPN study area.

Combined System Remedial Measures: All measures identified in **Table 7.3.1** are applicable to LPN study area.

Storm System Remedial Measures: All measures identified in **Table 7.3.1** are applicable to LPN study area.

Table 7.3.1– Evaluation of Remedial Measures

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Source Control	Roof Leader Disconnection	Divert roof runoff from sanitary sewers thereby reducing the peak flows and volume of runoff.	May temporarily limit property use (i.e. ponding in yards). Potential increase in overland flow. May require grade change.	Applicable in areas where overland flow does not cause a problem. To be assessed on an individual property basis.	Very Feasible	41 % of the roofs are connected to the sanitary sewer. (in separated sewer area)
	Soak Away Pits	Effective in reducing storm water volume entering the sewer by redirecting roof drainage.	Implementation costs for retrofit would be considerably high due to disruption, damage and restoration of property.	Difficult to implement in already developed areas on public property. Not enforceable on private property.	Implemented where possible	Area highly developed and not socially favourable. Effective for low intensity, low volume events. Not effective for large, intense rainfall events.
	Porous Pavement	Reduces storm water runoff through infiltration.	Requires the initiative/co-operation of private property owners. Low efficiency/cost ratio (will require financial incentive).	Applicable to any impervious surface.	Implemented where possible	Not favourable since measure is better suited for proposed industrial /commercial / institutional land use and area is well developed. Soils not favourable for this area. Effective for low intensity low volume events. Not effective for large intense rainfall events.

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Local Remedial Measures	Backflow Prevention with or without Sump Pump	Effective solution for individual properties to prevent basement flooding due to sewer surcharge.	Required installation in basement to reduce costs and sporadic maintenance by home owner (will require financial assistance).	May be applied anywhere.	Feasible	Provides the highest protection for individual properties. Preferable for isolated cases of basement flooding.
	Sump Pump for Foundation Drains	Disconnection of drains from sewer prevents hydrostatic pressure due to sewer surcharge. Reduces I/I in cases of drain connections to sanitary sewer.	Requires installation in basement to reduce costs and sporadic maintenance by home owner. Requires electrical backup supply to work under power failure.	Large scale application feasible.	Feasible given discharge to surface proves to be safe	Provides the highest protection for individual properties. Preferable for isolated cases of basement flooding.
	Lot Regrading	Effective in reducing local flooding and high I/I to foundation drains.	Potential increase in overland flow and potential flooding to adjacent properties.	Applicable in areas where overland flow does not cause a problem. To be assessed on an individual property basis.	Limited	Reduces local overland flooding problems.
	Rain Barrel	Reduces storm runoff by promoting re-use of roof runoff, thus reduces municipal water consumption.	Requires co-operation of home owner (may require financial assistance).	Where space for barrel exists. May be used even where basement flooding has not occurred.	Feasible	Encouraged by the City.

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Sanitary Systems	Sealing Sanitary Sewer Manhole Covers	Low cost measure effectively reducing I/I in sanitary sewers.	Reduces self-ventilation of sewer system. Must be avoided at high points of system.	Primarily at low points of system or where frequent road flooding occurs.	Feasible	Effective in low-lying areas. Eliminates overland flow from entering the sanitary system.
	Pipe & Manhole Rehabilitation	Maintenance measure reducing I/I into sanitary sewer thus reducing need for construction.	None.	Should be focused where high I/I is evident.	Feasible	Identifiable I/I sources. Part of O&M.
	System Storage (in-line/off-line sewers)	Allows some flexibility regarding location of construction. Construction generally less extensive than sewer replacement. Less O&M requirements than underground storage tank. Does not require open space for implementation.	Requires favourable hydraulic conditions of existing sewer for optimal operation and minimal maintenance.	Anywhere where other utilities do not impose constraints and hydraulic conditions allow implementation.	Feasible	Temporary sanitary in-line/offline storage required
	Pipe Upgrade (pipe replacement/ twinning)	Provides reduction/ elimination of sewer surcharge capacity for future growth.	Very disruptive construction due to length of upgrades.	Anywhere where other utilities do not impose constraints.	Feasible	Sanitary pipe upgrade required to improve flow capacity and velocity

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Sanitary Systems (cont'd)	Underground Storage Tank	More compact and thus potentially less disruptive during construction than other alternatives for storage or flow capacity increases.	Requires open space for construction at a hydraulically effective location. Interferes with recreational land use during construction. Adds noticeably to O&M costs of system.	Applicable where and if open space (parkland, school yard, etc) is available.	Feasible	Not required for sanitary system
	Internal Diversion	Balances flow in existing systems with minimal construction.	Reduces/eliminates spare capacity in other parts of system to accommodate more intensive storms	Where system loadings vary substantially between areas and if receiving system can accommodate influx.	Feasible	Eliminate the future need/use of existing easement
	Operations and Maintenance (i.e. sewer flushing)	Prevent potential bottlenecks from grease/sediment build-up.	None.	Everywhere, particularly where basement flooding has occurred.	Feasible	Continuation of maintenance cycles and inspections. More frequent O&M in areas of flooding occurrences.

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Combined Systems	Inlet Control Devices	Effective in controlling the storm water entering the combined system.	Water ponding will occur on open areas.	Applied in situations where sewer surcharge causes basement flooding and overland flow is not a problem as the major drainage system has adequate outlet capacity and there are no sags in the street.	Feasible	Located throughout area where road sag/low point does not exist or where additional overland flow could be relieved either by storage, diversion or conveyance.
	System Storage (in-line/off-line sewers)	Effective in regulating/moderating peak flows at locations where the capacity of a sewer is inadequate.	Costs can vary significantly depending on sewer depth and the presence of bedrock. Land/space requirements can limit the application of the in-line/off-line storage.	Applied in situations where head and space in the street are available. Most effective if the downstream sewer system does not have adequate capacity to convey the peak flow.	Feasible	In-line and off-line storage controls excess storm water until there is sufficient downstream capacity. Storage possible in shallow sewer if not connected to homes and is for overland flow.
	Relief Sewers/Pipe Upgrades	Effective in preventing surcharge of existing combined sewer system.	High capital cost due to construction constraints.	Applied in situations where combined sewer is undersized.	Feasible	Pipe upgrades required in some areas.

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Combined Systems (cont'd)	Overland Flow Diversion and Outlets	Effectively reduce inflow of runoff into the storm sewer by re-directing runoff into grass areas or overland routes with adequate capacity.	Difficult to implement in urbanized areas due availability of open/grassed areas.	Applied in situations where overland flow routes or natural channels are available.	Not Feasible	No feasible overland routes in area.
	Internal Diversion	Balances flow in existing systems with minimal construction.	Reduces/eliminates spare capacity in other parts of system to accommodate more intensive storms.	Where system loadings vary substantially between areas and if receiving system can accommodate influx.	Not Feasible	Internal diversion located along Dundurn Road. Flows drain to the same trunk sewer within 100 metres.
	Operations and Maintenance (i.e. sewer flushing)	Prevent potential bottlenecks from sediment build-up.	None.	Everywhere, particularly where basement flooding has occurred.	Feasible	Continuation of maintenance cycles and inspections. More frequent O&M in areas of flooding occurrences.

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Storm Systems	Increase Inlet Capacity by Adding Catchbasins	Effective in rapidly conveying runoff from ground into storm sewer system.	Moderate capital costs and potential construction constraints.	Applied where the sewer system has extra capacity and overland flow causes flooding. Reduce overland flow depth.	Feasible	Applied in low-lying areas where street ponding occurs.
	Inlet Control Devices	Effective in controlling the storm water entering the storm system.	Water ponding will occur on open areas.	Applied in situations where sewer surcharge causes basement flooding and overland flow is not a problem as the major drainage system has adequate outlet capacity and there are no sags in the street.	Feasible	Located throughout area where road sag/low point does not exist or where additional overland flow could be relieved either by storage, diversion or conveyance.
	System Storage (in-line/off-line sewers)	Effective in regulating/moderating peak flows at locations where the capacity of a sewer is inadequate.	Costs can vary significantly depending on sewer depth and the presence of bedrock. Land/space requirements can limit the application of the in-line/off-line storage.	Applied in situations where head and space in the street are available. Most effective if the downstream sewer system does not have adequate capacity to convey the peak flow.	Feasible	In-line and off-line storage controls excess storm water until there is sufficient downstream capacity. Storage possible in shallow sewer if not connected to homes and is for overland flow.
	Storm Relief Sewers/Pipe Upgrades	Effective in preventing surcharge of existing storm sewer system.	High capital cost due to construction constraints.	Applied in situations where storm sewer is undersized.	Feasible	Pipe upgrades required in some areas.

Control Type	Control Measure	Advantage	Disadvantage	Applicability	Feasibility	Comment
Storm Systems (cont'd)	Provide SWM facilities	Effective in controlling storm water peak flows by temporarily storing runoff and releasing at a controlled rate.	The footprints of SWM facilities occupy a significant amount of space.	Applied where open space is available.	Not Feasible	Limited space availability. Area is well developed with limited open space.
	Overland Flow Diversion and Outlets	Effectively reduce inflow of runoff into the storm sewer by re-directing runoff into grass areas or overland routes with adequate capacity.	Difficult to implement in urbanized areas due availability of open/grassed areas.	Applied in situations where overland flow routes or natural channels are available.	Feasible	No feasible overland routes in area.
	Operations and Maintenance (i.e. sewer flushing)	Prevent potential bottlenecks from sediment build-up.	None.	Everywhere, particularly where basement flooding has occurred.	Feasible	Continuation of maintenance cycles and inspections. More frequent O&M in areas of flooding occurrences.

Table 7.3.1 evaluates each remedial measure in terms of feasibility and if the remedial was required based on the type of system in order to be considered for each of the alternatives for the separated area and combined area respectively. The remedial measures considered for each alternative is part of the development of the recommended basement flooding solutions and is summarized below:

Separated System

- Roof leader disconnection – Sanitary Alternative 1, 2, 3;
- Sealing sanitary sewer maintenance hole covers – Sanitary Alternative 1, 2, 3;
- System storage (in-line/off-line) – Sanitary Alternative 2, 3; and
- Pipe upgrades – Sanitary Alternative 1, 2, 3.

Combined System

- Inlet control devices (ICD's) – Combined Alternative 2;
- System storage (inline/offline) – Combined Alternative 2; and
- Relief sewers/ pipe upgrades – Combined Alternative 1.

7.4 Sizing of Alternatives

Sizing of remedial measures is accomplished using the computer model. Additional sewer elements or remedial measures are added to the system model, and sizes and lengths are estimated then adjusted until the model shows acceptable results based on the level of service criteria associated with the storm, combined and sanitary systems (refer to Section 7.2). For the sanitary and combined systems, a value of 450 lpcd is used in the assessment for sizing of facilities. Storage elements are also sized using the computer modelling results. Locations for storage include public lands, open spaces and within the street right-of-way. The availability of space was assessed by reviewing the available plan and profile drawings. When sizing the required facility, elimination of surcharging above the basement elevation was the criteria through, which remedial measures were sized.

7.4.1 Alternatives Development Background

7.4.1.1 Sanitary System

A rainfall and flow monitoring program was carried out from June 2013 to November 2013. Flow monitoring locations were selected at 3 combined sewer sites and 3 sanitary sewer sites. The July 8, 2013 event had approximately 4,000 – 5,000m^3 of excess infiltration/inflow beyond the capacity of the existing sanitary sewer system for the area which drains to Valleyanna Drive.

As part of the field program undertaken from this study Aquafor staff identified approximately 90 homes within the former City of North York in the LPN study area where downspout discharged into the ground.

A downspout connectivity testing program in the area was then conducted by the City in the fall/winter of 2013. The objective of the survey was to perform dye testing at selected houses in the separated sewer area to determine where roof downspouts discharge (sanitary sewer or otherwise). A total of 22 houses were tested, nine (9) of the houses showed that the downspouts discharge to the sanitary sewer and thirteen (13) showed that the downspouts are connected elsewhere. Based on the dye test results, approximately 41 percent of the house downspouts were assumed to discharge to the sanitary sewer.

In summary, the sanitary sewer system, during wet weather events, experiences significant infiltration/inflow. The three primary sources of I/I include downspouts connected to the sanitary sewer, private property sources and stormwater entering manhole covers.

7.4.1.2 Combined System

A rainfall and flow monitoring program was carried out from June 2013 to November 2013. Flow monitoring locations were located at 3 combined sewer sites and 3 sanitary sewer sites. Two of the monitors (station 4 and 5) were installed in local combined sewers, with the third (station 6) installed in a combined trunk sewer. Station 4 exhibited surcharged conditions during the July 8, 2013 event.

7.4.1.3 Storm System

Flow monitoring was not undertaken in the storm sewer system as the area east of St. Ives was initially serviced by a ditch system with shallow storm sewers being installed at a later date, and, information provided from the plumbing records at the time of this study suggested that foundation drains are generally not connected to the storm sewer. Thus, the surcharge of storm sewers would not cause backup through the foundation drains and thus result in basement flooding.

7.4.2 Alternatives Development – Sanitary Sewer

The following three sanitary sewer system alternatives were developed and evaluated.

7.4.2.1 Sanitary Alternative 1 – Conveyance

This alternative includes the following remedial measures:

- Mandatory downspout disconnection (a theoretical 75% disconnection rate was assumed as a base condition);
- Sealing sanitary manhole covers in low lying areas to minimize the inflow of storm water into the sanitary system;
- Capacity upgrades on St. Aubyns Crescent from Bayview Wood to Wood Avenue (525 mm), on Rochester Avenue to Wood Avenue (450 mm) and on Wood Avenue to Bayview Avenue (600 mm);
- Capacity upgrades on Bayview Avenue to Wood Avenue (450 mm), Bayview Avenue to Dawlish Avenue (675 mm) and on Bayview Avenue to Armistice Drive (450 mm); and
- Capacity upgrades on Valleyanna Drive to the east end of the road (675 mm) and through the existing easement up to the outlet which is connected to the West Don Sanitary Trunk Sewer.

Figure 7.4.1 presents the sanitary system remedial measures for Sanitary Alternative 1. This alternative maintains the sanitary system HGL more than 1.8m from the surface for the May 12, 2000 evaluation event as measured at the Oriole Yard gauging station. However, this alternative would increase the peak flows to trunk sewer from approximately 50 L/s to about 290 L/s.

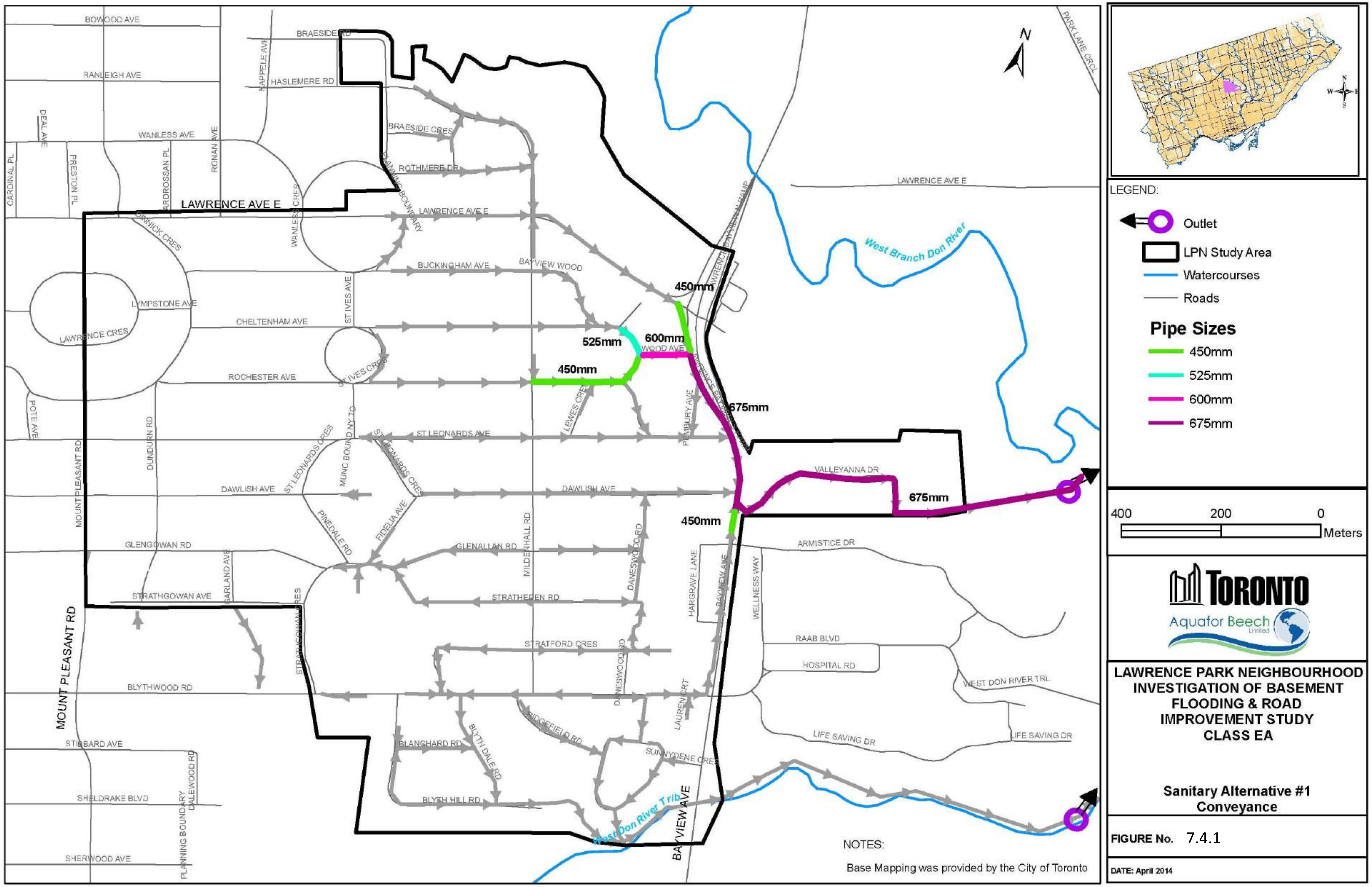


Figure 7.4.1 – Sanitary Alternative #1 - Conveyance

7.4.2.2 Sanitary Alternative 2 – Inline Storage

This alternative includes the following remedial measures:

- Mandatory downspout disconnection(a theoretical 75% disconnection rate was assumed as a base condition);
- Sealing sanitary manhole covers in low lying areas to minimize the inflow of storm water into the sanitary system;
- Capacity upgrades on Rochester Avenue to Wood Avenue (525 mm) and on Wood Avenue to Bayview Avenue (675 m);
- In-line storage in the form of a box culvert (1400 mm x 2000 mm – 840 m^3) on Bayview Avenue;
- In-line storage in the form of a box culvert (1700 mm x 1000 mm – 300 m^3) on Dawlish Avenue;
- In-line storage in the form of a box culvert (600 mm x 1000 mm – 30 m^3) on Bayview Avenue; and
- Replacement of 550 m of existing sanitary sewer along Valleyanna Drive easterly into an easement in order to receive flows from the three proposed underground storage facilities.

Figure 7.4.2 presents the sanitary sewer remedial measures for Sanitary Alternative 2. This alternative maintains the sanitary sewer system HGL more than 1.8m from the surface for the May 12, 2000 evaluation event as measured at the Oriole Yard gauging station. The alternative also limits flows to the West Don Sanitary Trunk Sewer to current levels. However, the alternative is limited with respect to technical feasibility and operations and maintenance as the control structures (e.g. orifices) to limit the flows from the three proposed storage facilities will be quite small. This alternative may also require work on private property.

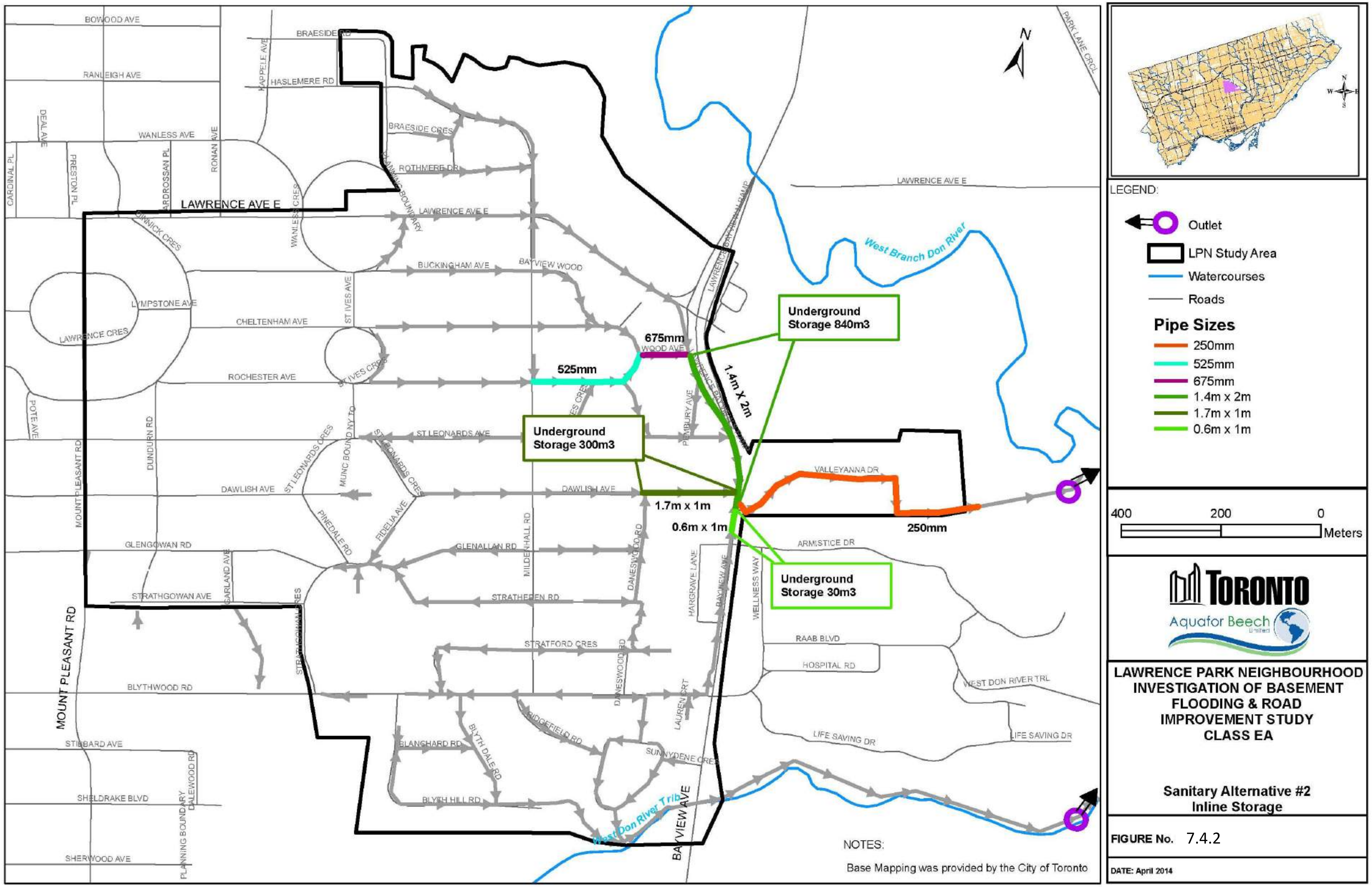


Figure 7.4.2 – Sanitary Alternative #2 – Inline Storage

7.4.2.3 Sanitary Alternative 3 – Conveyance and Inline Storage

This alternative includes the following remedial measures:

- Mandatory downspout disconnection (a theoretical 75% disconnection rate was assumed as a base condition);
- Sealing sanitary manhole covers in low lying areas to minimize the inflow of storm water into the sanitary system;
- Capacity upgrades on St. Aubyns Crescent to Wood Avenue (525 mm), on Rochester Avenue to Wood Avenue (450 mm) and on Wood Avenue to Bayview Avenue (600 m);
- Capacity upgrades on Bayview Avenue to Wood Avenue (450 mm), Bayview Avenue to Dawlish Avenue (675 mm) and on Bayview Avenue to Armistice Drive (450 mm);
- Capacity upgrades along the sections of sewer on Valleyanna Drive (675 mm);
- In-line storage in the form of a box culvert (2000 mm x 2000 mm – 1100 m^3) on Valleyanna Drive; and
- Lowering, and therefore replacement, of the existing 250 mm sanitary sewer east of Valleyanna Drive in order to receive flows from the proposed underground storage facility.

Figure 7.4.3 presents the sanitary system remedial measures for Sanitary Alternative 3. This alternative maintains the sanitary system HGL more than 1.8m from the surface for the May 12, 2000 evaluation event as measured at the Oriole Yard gauging station. This alternative also limits flows to the West Don Sanitary Trunk Sewer to existing levels. This alternative may also require work on private property.

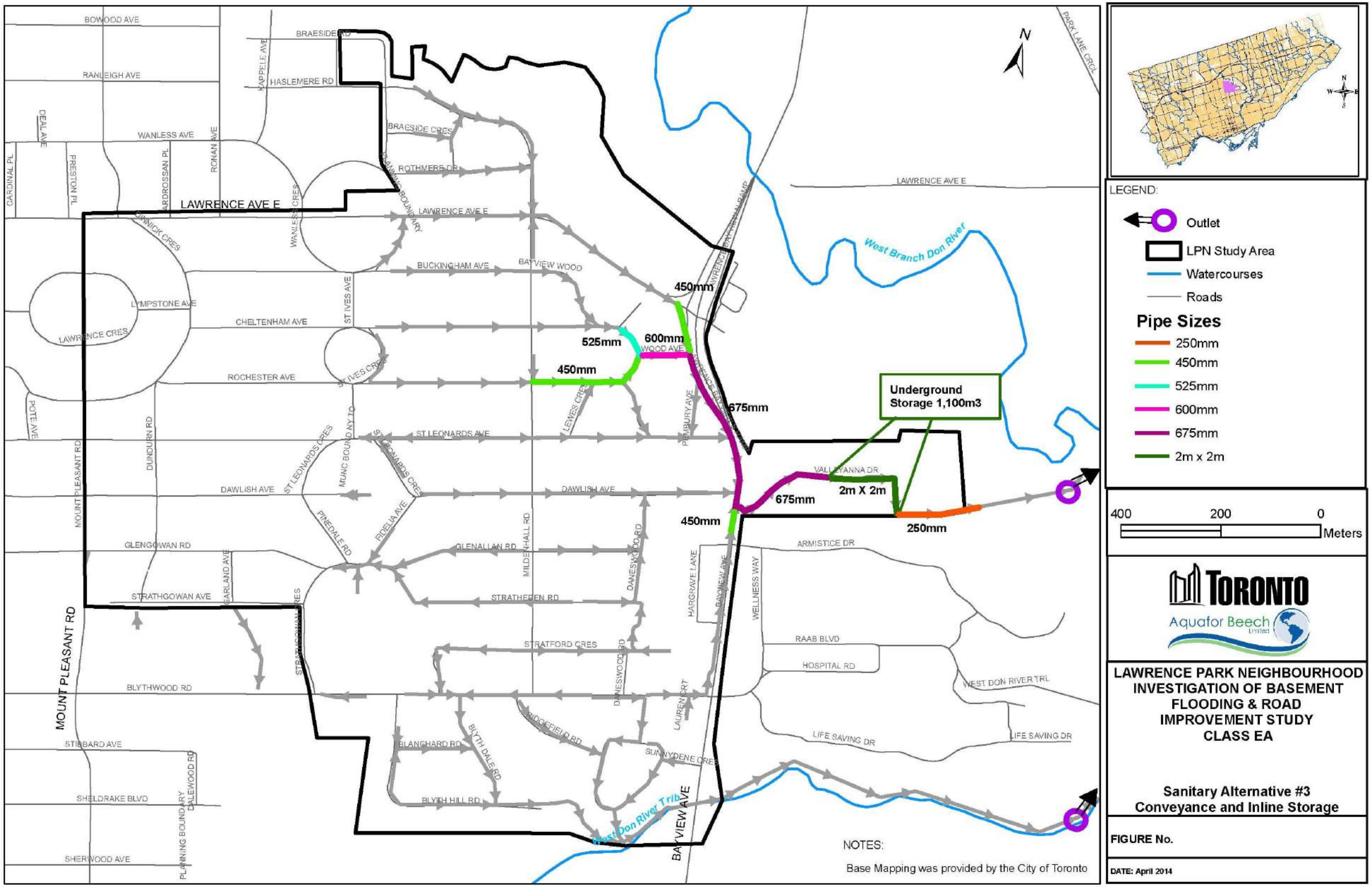


Figure 7.4.3 – Sanitary Alternative #3 – Conveyance and Inline Storage

7.4.3 Alternatives Development – Combined Sewer

The following two combined sewer alternatives were developed and evaluated.

7.4.3.1 Combined Alternative 1 – Conveyance

This alternative includes the following remedial measures:

- Mandatory downspout disconnection (a theoretical 75% disconnection rate was assumed as a base condition);
- Sewer separation that includes the installation of a new 300 mm storm pipe on Dundurn Road draining south to St. Leonard's Avenue and disconnection of catchbasins from combined sewers and reconnecting to new storm sewers;
- Sewer separation that includes the installation of new 300 to 375 mm storm pipe on St. Leonards Avenue draining east into the existing truck storm sewer on St. Leonard's Cresent and disconnection of catchbasins from combined sewers and reconnecting to new storm sewers; and
- Sewer separation including the installation of new 450 mm storm pipe on Glengowan Avenue draining west into the existing storm sewer south of Dundurn Road that carroes flow to the outfall in Blythwood Ravine Park and disconnection of catchbasins from combined sewers and reconnecting to new storm sewers. The direction of flow for this proposed storm sewer in the opposite direction of flow in the combined sewer.

Figure 7.4.4 presents the combined sewer system remedial measures for Combined Alternative 1. The conveyance improvements control the HGL in the combined sewer to the crown of the pipe for the City's 100-year design storm event.

This alternative (sewer separation) was one of the strategies developed in the Wet Weather Flow Master Plan.

This alternative would increase flow into the existing storm system but the existing storm system is still sufficient to control the HGL to the crown of storm pipe under the 2-year design event. Under the 100 year design event, the criterion of no surcharge to the existing storm sewer system along Mount Pleasant is not met.

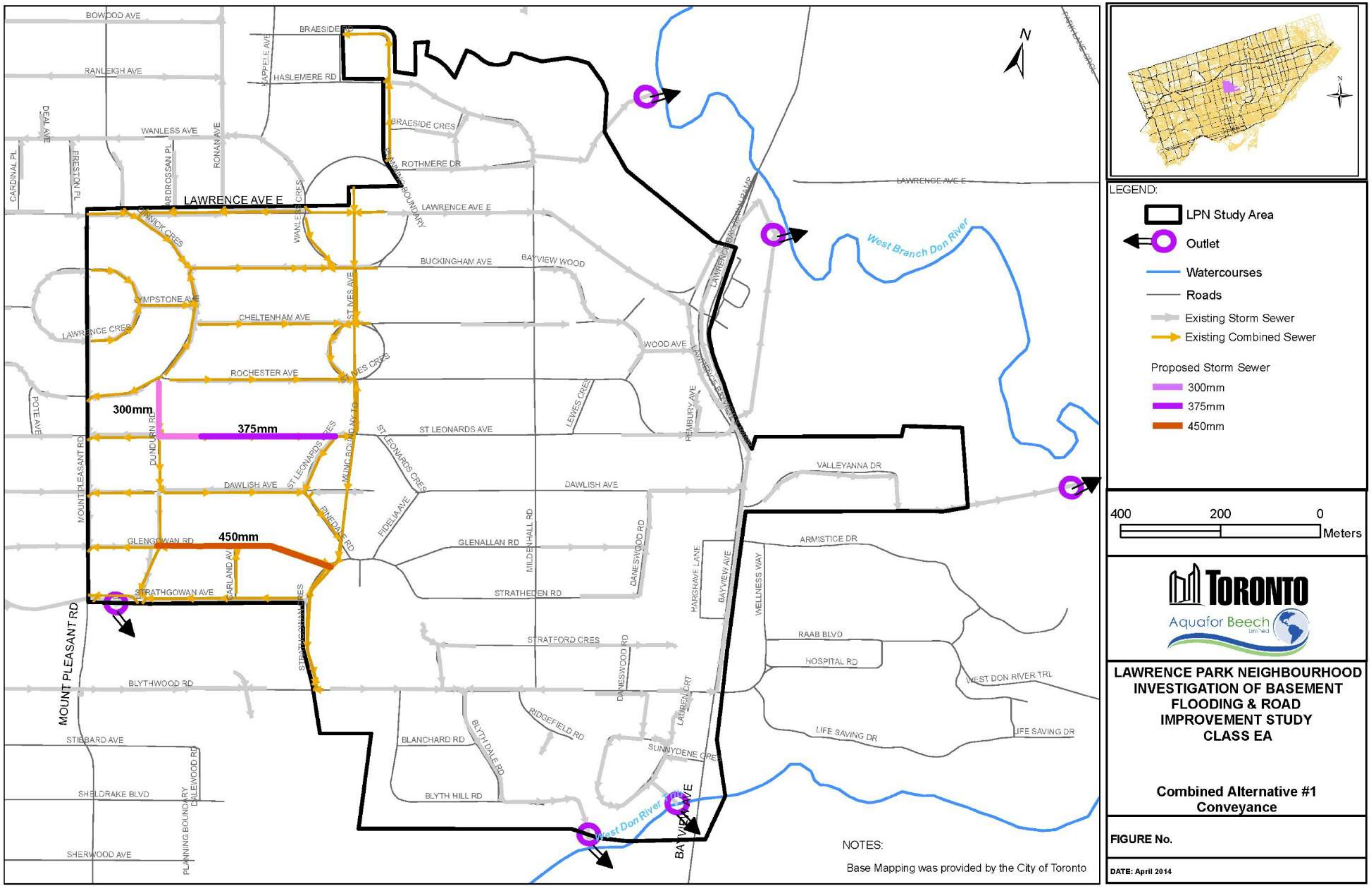


Figure 7.4.4 – Combined Alternative #1 - Conveyance

7.4.3.2 Combined Alternative 2 – Offline Storage

This alternative includes the following remedial measures:

- Mandatory downspout disconnection (a theoretical 75% disconnection rate was assumed as a base condition);
- Off-line underground storage in the form of a box culvert (2000 mm x 1500 mm – 600 m^3) on St. Leonards Avenue;
- Off-line underground storage in the form of a box culvert (1000 mm x 1000 mm – 90 m^3) on Glengowan Avenue;
- Off-line underground storage in the form of a box culvert (2000 mm x 1200 mm – 480 m^3) on Glengowan Avenue; and
- Inlet controls which limit flows to 20 L/s for catch basins located along St. Leonards Avenue and Glengowan Avenue.

Figure 7.4.5 presents the combined sewer system remedial measures for Combined Alternative 2. The stormwater storage improvements control the HGL in the combined sewer to the crown of the pipe for the City's 100-year design storm event.

This alternative is premised on managing excess storm flows on St. Leonards Avenue and Glengowan Avenue. Excess runoff for the western part of Glengowan and St. Leonards would be conveyed to the existing storm sewer system whereas excess runoff from the eastern part of Glengowan would be conveyed to the combined trunk sewer.

7.4.4 Alternatives Development – Storm Sewer

The previous sections summarized the development of alternatives for the sanitary and combined sewer systems as surcharging in these two systems will result in basement flooding.

Section 7.2 provided information with respect to the storm sewer criteria.

Storm sewers in the LPN study area are primarily intended to convey surface flows from private property and public right of ways.

Therefore, storm sewers, if they surcharge will not result in basement flooding but may contribute to surface flooding issues. The areas where surface flooding occurs are localized and will be addressed as part of an integrated road reconstruction and storm sewer replacement of the study as required.

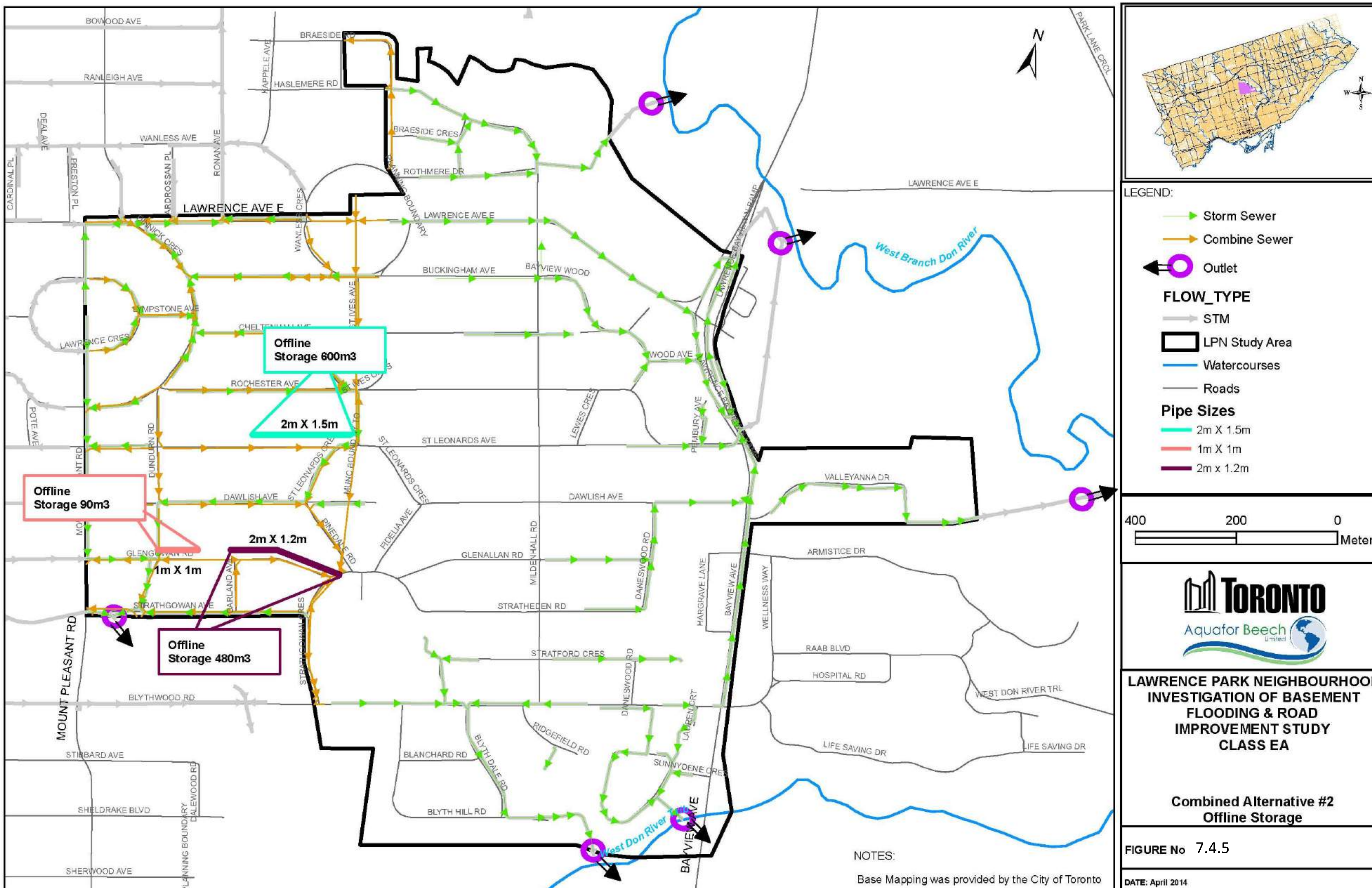


Figure 7.4.5 – Combined Alternative #2 – Offline Storage

7.5 Evaluation Criteria

In order to evaluate the alternative solutions identified in the previous sections, evaluation criteria have been developed in order to select the preferred solution. The evaluation criteria include socio-cultural, technical considerations, natural environment and economic considerations. These criteria, together with a description of the criteria and measures for assigning scores are presented in **Table 7.6.1**. It should be noted that the “do nothing” alternative (alternative 1) is not considered in the evaluation criteria.

7.6 Evaluation of Alternatives

For each of the comparative criteria, a rating ranging from 0 to 4 was applied specific to the particular solution being evaluated where 0 represents the worst condition and 4 the best, as identified in **Table 7.6.2** and **Table 7.6.3**. Based on this approach, an overall rating based on the total scoring was obtained for each alternative solution. Subsequently a ranking was assigned for each alternative solution with the highest overall total assigned 1 and the others sequentially 2, 3, etc. based on the scoring. Where the total ratings are the same, the same ranking was assigned.

In the evaluation methodology proposed, the best ranking corresponds to No. 1 and is the preferred solution. The worst ranking is the least desirable alternative. The evaluation of the alternative solutions is presented in **Table 7.6.2** and **Table 7.6.3** with additional information on the scoring of the alternatives for each criterion summarized below:

Table 7.6.1 - Evaluation Criteria - Basement and Surface Flooding

Category	Criteria	Description of Criteria	Measures for Assigning Scores
Socio-Cultural			
	Impact on Urban Greenspace/Recreational Uses (Street Trees, Parks, Open Spaces)	Potential of alternative to impact vegetation, street trees, public parks and open spaces and associated wildlife	Scores are assigned as follows: • 4 – less than 20% of moderate - high caliber trees are impacted • 3 – 20-40% of moderate - high caliber trees are impacted • 2 – 41-60% of moderate - high caliber trees are impacted • 1 – 61-80% of moderate - high caliber trees are impacted • 0 – greater than 80% of moderate - high caliber trees are impacted
	Community Impact -Disruption to Community During Construction	Potential to impact the community in terms of access to the site, visibility, road access, construction of mitigation measure in valley lands / parks, possible noise / odour / light, short-term construction impact, etc.	Scores are assigned as follows: • 4 – no impact on community • 3 – minor impact on community • 2 – moderate impact on community • 1 – significant impact on community
Technical – Technical Effectiveness			
	Effectiveness of Control Measure	Effectiveness of the alternative in the reduction of basement flooding and/or surface flooding in the study area based on the design criteria considered.	Scores are assigned as follows: • 4 –achieves stated requirements or better • 3 –achieves stated requirements • 2 –limited effectiveness in achieving stated requirements • 0 – no effectiveness in achieving stated requirements
	Feasibility of Control Measure	The extent to which the alternative is feasible in terms of availability of space, accessibility, ease of construction, construction requirements.	Scores are assigned as follows: • 4 – feasible in terms of stated considerations • 3 – partially feasible in terms of stated considerations • 2 – limited feasibility in terms of stated considerations. • 0 – not feasible in terms of stated considerations
	Downstream	The impacts of the alternative in increasing the	Scores are assigned as follows:

Category	Criteria	Description of Criteria	Measures for Assigning Scores
	Impacts on Downstream Trunk Sewers / Treatment Facilities / Receiving Water	peak flow rate and total flow in the downstream receiving water system	• 4 – reduces the peak flow and total flow downstream • 3 – maintains the peak flow and total flow downstream • 2 – moderate impact in increasing the peak flow and total flow downstream • 1 – significant impact in increasing the peak flow and total flow downstream
Natural Environment			
	Potential Impact on Terrestrial Systems (Vegetation, Trees in Valleys and Parks, Wildlife)	Potential to alternative to impact terrestrial habitats or systems, including terrestrial features / functions (ANSIs, ESAs), unique vegetation species or wildlife	Scores are assigned as follows: • 4 – no impact on usage or vegetation • 3 – limited impact on usage or vegetation • 2 – moderate impact on usage or vegetation • 1 – significant impact on usage or vegetation
	Potential Impact on Aquatic Systems, Aquatic Life and Aquatic Vegetation	Potential to impact aquatic habitats or systems, including possible impacts on aquatic life, features / functions	Scores are assigned as follows: • 4 – improves aquatic habitats or systems • 3 – no impact on aquatic habitats or systems • 2 – moderate impact on aquatic habitats or systems • 1 – significant impact on aquatic habitats or systems
Economic			
	Capital Costs	The relative estimated capital cost as compared to the other alternatives	Scores are assigned as follows: • 4 – no capital cost • 3 – lowest capital cost of alternatives 2 through 4 • 2 – within 10% of the lowest of alternatives 2 through 4 • 1 – within 20% of the lowest of alternatives 2 through 4 • 0 – greater than 20% of the lowest of alternatives 2 through 4

Category	Criteria	Description of Criteria	Measures for Assigning Scores
	Operating/ Maintenance Costs	The relative operation/maintenance cost as compared to the other alternatives	Scores are assigned as follows: • 4 – lowest overall cost • 3 – lowest of alternatives 2 through 4 • 2 – within 10% of alternatives 2 through 4 • 1 – within 20% of alternatives 2 through 4 • 0 – greater than 20% of alternatives 2 through 4

Table 7.6.2 - Evaluation of Alternatives - Sanitary Sewer System

Alternatives	Comparative Criteria Scoring									Total Score
	Socio-Cultural Criteria		Technical Considerations			Natural Environment Criteria		Cost Considerations		
	Impact on Urban Greenspace / Recreational Use (Trees, Parks, Open Spaces)	Disruption to Community During Construction	Effectiveness of Control Measure	Feasibility of Control Measure	Downstream Impacts on Downstream Trunk Sewers / Treatment Facilities / Receiving Water	Potential Impact on Terrestrial Systems (Vegetation, Trees, Wildlife)	Potential Impact on Aquatic Systems, Aquatic Life and Aquatic Vegetations	Capital Cost	O &M Cost	Total
Alternative 1	3	2	4	2	1	1	2	3	4	22
Alternative 2	4	1	4	0	3	2	3	2	1	20
Alternative 3	4	2	4	3	3	2	3	4	3	28

Table 7.6.3 - Evaluation of Alternatives - Combined Sewer System

Alternatives	Comparative Criteria Scoring									Total Score
	Socio-Cultural Criteria		Technical Considerations			Natural Environment Criteria		Cost Considerations		
	Impact on Urban Greenspace / Recreational Use (Trees, Parks, Open Spaces)	Disruption to Community During Construction	Effectiveness of Control Measure	Feasibility of Control Measure	Downstream Impacts on Downstream Trunk Sewers / Treatment Facilities / Receiving Water	Potential Impact on Terrestrial Systems (Vegetation, Trees, Wildlife)	Potential Impact on Aquatic Systems, Aquatic Life and Aquatic Vegetations	Capital Cost	O &M Cost	Total
Alternative 1	4	2	4	4	2	4	3	4	4	31
Alternative 2	4	2	3	2	3	3	3	3	2	25

7.6.1 Socio-Cultural Environment

7.6.1.1 Impact on Urban Greenspace/Recreational Uses

A score of 4 was given to sanitary alternatives 2 and 3 as all project work should be within the existing road. A small percentage of existing trees (less than 20 percent) should therefore be impacted.

A score of 4 was also given to both combined sewer alternatives for the same reasons as noted above.

7.6.1.2 Community Impact

Community impact considers the level of disruption in the community. All the alternatives will affect the community during periods of construction although this impact is temporary.

For the sanitary sewers Alternative 2 was given the lowest score of 1 as this alternative involves construction of two underground storage facilities under Bayview Avenue, which is an arterial road. Alternatives 1 and 3 were assigned a score of 2 as there will be a moderate level of impact on the community.

For the combined sewer alternatives both Alternative 1 and 2 were assigned a score of 2 as a moderate level of disruption to the community is anticipated.

7.6.2 Technical Considerations

7.6.2.1 Effectiveness of Control Measures

Implementing sanitary and combined system remedial measures will meet or exceed the level of service set out by the City for the sanitary and combined sewer systems reducing the risk of basement flooding.

For the sanitary sewer system all alternatives reduce the risk of basement flooding the same and were assigned a score of 4.

For the combined sewer alternatives Alternative 1 meets or exceeds the level of service as set by the City and thus was assigned a score of 4. The effectiveness of Alternative 2 is contingent on the inlet control devices remaining in place (the devices may be inadvertently removed) and was therefore assigned a score of 3.

7.6.2.2 Feasibility of Control Measures

The feasibility of the control measures involves various considerations including easements, regulatory approvals, ease of construction and construction requirements.

For the sanitary sewer alternatives Alternative 1 was assigned a score of 2 and Alternative 3 was assigned a score of 3. Both of these alternatives involve replacement of sewers with larger diameter sewers following a similar alignment. Alternative 2 was assigned a score of 1 as two underground storage facilities are required under Bayview Avenue. Furthermore, the control rates from these facilities will be low thereby requiring control devices which may malfunction resulting in upstream flooding.

None of the sanitary alternatives received a score of 4 as easement requirements downstream (east) of Valleyanna have been confirmed yet.

For the combined system Alternative 1 is considered to have the least construction issues as it involves installing new storm sewers within the road right-of-way and was therefore given a score of 4. Alternative 2 is considered more challenging because of the size of storage facilities and thus the likelihood of utility conflict is greater. A score of 0 was therefore assigned.

7.6.2.3 Downstream Impacts

For the sanitary sewer Alternatives 2 and 3 were assigned a score of 3 as they maintain the peak flow to the downstream trunk sewer. Alternative 1 significantly increases the peak flow and was therefore assigned a score of 1.

For the combined sewer system Alternative 1 results in a moderate increase in peak flows at the storm sewer outlet. A score of 2 was assigned. Alternative 2, which was assigned a score of 3, maintains peak flows.

7.6.3 Natural Environment

7.6.3.1 Terrestrial System

Alternative 1 was given the lowest score for the sanitary sewer alternatives as this alternative involves replacement of the entire length of pipe from Valleyanna to the existing trunk sewer located in the West Don River valley (Environmentally Significant Areas - ESAs). Alternatives 2 and 3 were assigned a score of 2 as the length of sewer to be replaced within the valley is the same.

A score of 4 was given to both combined sewer alternatives as all project work is anticipated to occur within the existing road width.

7.6.3.2 Aquatic System

For the sanitary sewer system Alternatives 2 and 3 were assigned a score of 3 as there are no impacts to aquatic habitats or systems. Alternative 1 will require work adjacent to the West Don River and was therefore assigned a score of 2.

Alternatives 1 and 2 for the combined system were assigned a score of 3 as no impacts are anticipated.

7.6.4 Economic Considerations

7.6.4.1 Capital Cost

Sanitary Alternative 2 has the highest construction cost followed by Alternative 1, with Alternative 3 having the lowest construction cost.

For the combined alternatives, Alternative 2 with storage was the most expensive and was assigned a score of 2 while Alternative 1 was scored 4.

7.6.4.2 Operating and Maintenance (O&M) Cost

Alternative 1, for the sanitary system scored the highest (4) as this system does not include any storage facilities which generally require additional operation and maintenance. Alternative 3 was assigned a score of 3 due to the inline storage elements that generally require some level of inspection. Alternative 2 was assigned a score of 1 as there are three storage units, each with a low release rate which has highest O & M cost among the three alternatives.

In a similar manner, Alternative 1 for the combined system is a gravity operated system requiring the least operation and maintenance (score 4). Alternative 2 was assigned a score of 2 due to the presence of three offline storage facilities as well as inlet control devices which has highest O & M cost among the two alternatives.

7.7 Conclusion

As presented in **Table 7.6.2**, Sanitary Alternative 3 scored the highest overall among the three alternatives. Based on the evaluation Alternative 3 for the sanitary system is identified as the Preferred Solution. The model results for the remedial measures for Sanitary Alternative 3 is presented in Appendix C – Preferred Alternative Model Results for Sanitary and Combined Areas.

Table 7.6.3 presents the evaluation of the combined alternatives for LPN study area. Combined Alternative 1 scored the highest overall among the two alternatives. Based on the evaluation undertaken in **Table 7.6.3**, Alternative 1 for the combined system is identified as the Preferred Solution. The model results for the remedial measures for Combined Alternative 1 is presented in Appendix C, Appendix C – Preferred Alternative Model Results for Sanitary and Combined Areas.

Sanitary Alternative 3 and Combined Alternative 1 are identified as the Preferred Solution to reduce the risk of basement flooding and improve the level of service in the LPN study area.

8.0 DEVELOPMENT AND ASSESSMENT OF ALTERNATIVE REMEDIAL MEASURES –ROADS, DRAINAGE AND PEDSTRIAN SAFETY

8.1 General

As was noted in Chapter 2 of this report, this study addressed issues relating to:

- Deteriorated road infrastructure
- Pedestrian safety
- Traffic management
- Poor road drainage
- Incidences of basement flooding

Many of the roads were built over 50 years ago and are approaching the end of their service life. The underlying road structures on several streets are deteriorated to the point that road resurfacing cannot address the road condition and, therefore, these must be reconstructed with functional road drainage systems. Pavement widths vary across the study area from approximately 6 metres to 9 metres. Current standards set the minimum road width at 7.2 metres to accommodate emergency and service vehicle access. There is a general lack of sidewalks and pedestrian linkages in the eastern section (former North York) as well as sub-standard sightlines at various intersections in the study area.

Based on the findings to date we have established that there are various streets where common issues relating to poor road conditions, narrow road widths, poor drainage and no sidewalks were identified. These areas were identified and grouped into 18 different locations (for the purpose of the EA process). **Figure 8.2.1** illustrates the location of each of the 18 locations. Each of the 18 locations were evaluated in order to come up with an integrated solution that would address these issues on both a project specific and overall system wide manner.

8.2 Development and Assessment of Alternatives

At the second Public Open House a preferred width of 8.5 m with one or two sidewalks was presented. These two alternatives were presented as they are consistent with City of Toronto standards (see section 5.6.4.5.1). As a result of public input, the study team reconsidered the above and developed additional alternatives.

A total of eight alternatives were considered for each of the projects that addressed issues related to local roads. Five alternatives were considered for the collector road (Mildenhall Road – from Lawrence Avenue East to Blythwood Road).

For the local roads the alternatives considered the following variables:

- Road width of 7.2 m or 8.5 m (7.2 m was considered the minimum road width to meet criteria as noted in section 5.6);
- Urban or rural cross section; and
- With no sidewalk or one sidewalk

Figure 8.2.2 illustrates each of the eight alternatives that were considered. It should be noted that the “Do Nothing” alternative – Alternative 1 – is not shown as part of the eight alternatives considered as “Do Nothing” was not considered an option given the sub-standard conditions of the existing road, drainage system and lack of sidewalks.

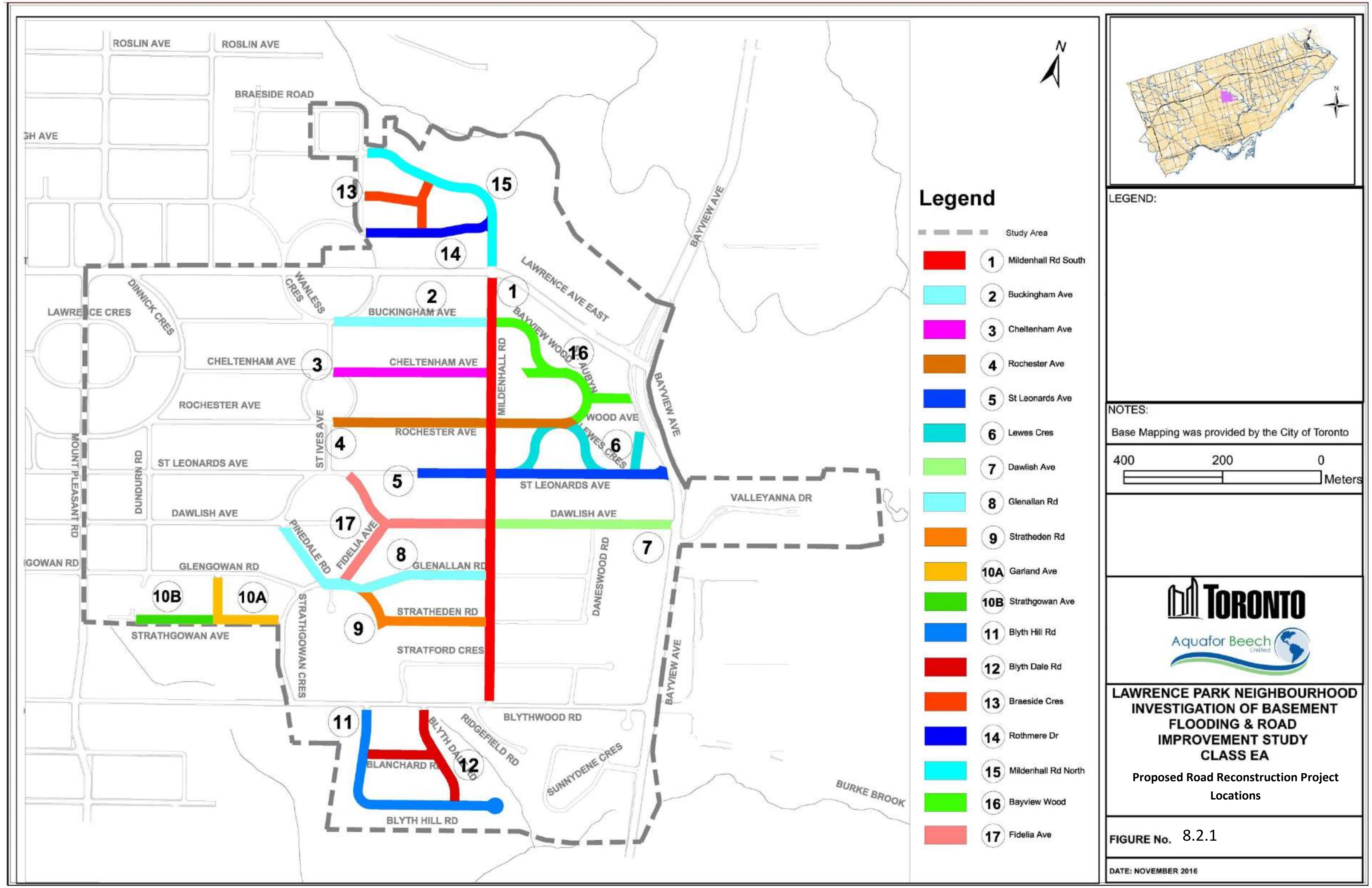


Figure 8.2.1 – Locations of Proposed Road Reconstruction Projects

Alternative 2:

- 8.5 metre road width
- Rural cross section
- 1 sidewalk

Alternative 3:

- 8.5 metre road width
- Urban cross section
- 1 sidewalk

Alternative 4:

- 7.2 metre road width
- Rural cross section
- 1 sidewalk

Alternative 5:

- 7.2 metre road width
- Urban cross section
- 1 sidewalk

Alternative 6:

- 8.5 metre road width
- Rural cross section
- No sidewalk

Alternative 7:

- 8.5 metre road width
- Urban cross section
- No sidewalk

Alternative 8:

- 7.2 metre road width
- Rural cross section
- No sidewalk

Alternative 9:

- 7.2 metre road width
- Urban cross section
- No sidewalk

Figure 8.2.2 – Alternative Roadway Cross Sections

For Mildenhall Road south of Lawrence Avenue East to Blythwood Road a total of five alternatives were considered. These alternatives included:

- Urban cross section only;
- 8.5 m or 9.5 m roadway widths;
- One or two sidewalks; and
- 7.2 m road width with two sidewalks

Figure 8.3.1 illustrates each of the five alternatives that were considered. It should be noted that the “Do Nothing” alternative – Alternative 1 – is not shown as part of the eight alternatives considered as “Do Nothing” was not considered an option given the sub-standard conditions of the existing road, drainage system and lack of sidewalks.

8.3 Evaluation Criteria

In order to evaluate the alternative solutions identified in the previous sections, evaluation criteria have been developed in order to select the preferred solution. The evaluation criteria include socio-cultural, technical considerations, natural environment and economic considerations. These criteria, together with a description of the criteria and measures for assigning scores are presented in **Table 8.3.1**

Three items are noted in **Table 8.3.1**. They are summarized below.

- The Weighting Factor for each criterion is 1, except for Pedestrian Safety, Impact on Urban Greenspace and Surface/Basement Flooding which is assigned a factor of at least 2 because these specific criteria were identified as "Most Important" from the community. See the Summary Report for the 2nd public event (Nov. 5, 2013).
- Other Criteria which fall under the categories of Socio-Cultural, Technical Effectiveness, Natural Environment and Economic were also considered but were not included in the evaluation as they are not relevant or scored equally for each alternative.
- In situations where the top two alternatives scored within one point of each other a qualitative assessment was made in order to select the preferred solution.

One of the criteria is defined as Pedestrian Connectivity. Pedestrian Connectivity takes into consideration streets that create a priority linkage. The Essential Links Capital Program (City of Toronto, 2002) considers the road class, the presence of pedestrian generators such as nearby schools, parks, bus stops, right-of-way and road width, impact on trees and vegetation as well as other factors such as above-ground utility relocations in making recommendations for constructing sidewalks. Further information on how priority linkages were defined is provided in section 9.4

Alternative 2:

- 9.5 metre road width
- Urban cross section
- 2 sidewalk

Alternative 3:

- 9.5 metre road width
- Urban cross section
- 1 sidewalk

Alternative 4:

- 8.5 metre road width
- Urban cross section
- 2 sidewalk

Alternative 5:

- 8.5 metre road width
- Urban cross section
- 1 sidewalk

Alternative 6:

- 7.2 metre road width
- Urban cross section
- 2 sidewalks

Figure 8.3.1 – Alternative Roadway Cross Sections

Table 8.3.1 – Evaluation Criteria – Road, Traffic and Surface Flooding

Category	Criteria	Description of Criteria	Measures for Assigning Scores	*Weighting Factor
Socio-Cultural				
	Pedestrian Safety for Local Roads	Ability of alternative to provide safe conditions for pedestrians on local roads	Scores are assigned as follows: • 4 – one sidewalk with boulevard separation between sidewalk/road • 3 – sidewalk on one side without boulevard • 0 – no sidewalk	2
	Pedestrian Safety for Collector Roads (Mildenhall)	Ability of alternative to provide safe conditions for pedestrians on collector roads	Scores are assigned as follows: • 4 – sidewalks on both sides without boulevard • 3 – sidewalk on one side without boulevard • 0 – no sidewalk	2
	Impact on Urban Greenspace/Recreational Uses (Street Trees, Parks, Open Spaces)	Potential of alternative to impact vegetation, street trees, public parks and open spaces and associated wildlife	Scores are assigned as follows: • 4 – do nothing, results in no tree removals • 3 – lowest estimated tree removals of alternatives 2 - 9 • 2 – alternatives within 10% of the alternative with the lowest estimated tree removals • 1 – alternatives within 20% of the alternative with the lowest estimated tree removals • 0 – alternatives with greater than 20% more estimated tree removals as compared to alternative with the lowest estimated tree removals	4
Technical – Technical Effectiveness				
	Surface Flooding	Ability of alternative to reduce surface flooding associated with public property issues	Scores are assigned as follows: • 4 - significant reduction in surface flooding risks • 0 - no change in surface flooding risk	2
	Stormwater Quality	Potential impact of the alternative on stormwater quality	Scores are assigned as follows: • 4 - improvement in stormwater quality discharges at outfalls • 0 – no change	1
	Pavement Structural Conditions	Ability of alternative to improve existing roadway structure	Scores are assigned as follows: • 4 – structure of roadway meets the provincial and city pavement condition standards • 0 – structure of roadway does not meet the provincial and city pavement condition standards	1

Category	Criteria	Description of Criteria	Measures for Assigning Scores	*Weighting Factor
	Pedestrian Connectivity	Ability of alternative to provide link to existing destinations	Scores are assigned as follows, and are only applicable to the following street sections identified as Priority Connections: • 4 – creates a priority pedestrian linkage or maintains an existing sidewalk • 0 – does not create a high priority pedestrian linkage	1
	Accessibility for Maintenance & Emergency Vehicle for Local Roads	Ability of the alternative to provide safe conditions for emergency and operation vehicles	Scores are assigned as follows: • 4 – 8.5m pavement width • 2 – 7.2m pavement width • 0 < 7.0 m pavement width	1
	Accessibility for Maintenance & Emergency Vehicle for Collector Roads (Mildenhall)	Ability of the alternative to provide safe conditions for emergency and operation vehicles	Scores are assigned as follows: • 4 – 9.5m pavement width • 3 – 8.5m pavement width • 2 – 7.2m pavement width • 0 < 7.0 m pavement width	1
Economic				
	Capital Costs	The relative estimated capital cost as compared to the other alternatives	Scores are assigned as follows: • 4 – no capital cost • 3 – lowest capital cost of alternatives 2 through 9 • 2 – within 10% of the lowest of alternatives 2 through 9 • 1 – within 20% of the lowest of alternatives 2 through 9 0 – greater than 20% of the lowest of alternatives 2 through 9	1

8.4 Evaluation of Alternatives

For each of the comparative criteria, a rating ranging from 0 to 4 was applied specific to the particular alternative being evaluated where 0 represents the worst condition and 4 the best, as identified in **Table 8.3.1**. Based on this approach, an overall rating based on the total scoring was obtained for each alternative solution. Subsequently a ranking was assigned for each alternative solution with the highest overall total assigned 1 and the others sequentially 2, 3, etc. based on the scoring. Where the total ratings are the same, the same ranking was assigned.

In the evaluation methodology proposed, the best ranking (highest score) corresponds to No. 1 and is the preferred solution. The worst ranking (least score) is the least desirable alternative

The evaluation of the alternative solutions for all 18 locations is summarized in **Table 8.4.1**. Appendix C provides the scoring for each of the 18 locations.

The Recommended Alternative Solutions for each of the projects is illustrated on **Figure 8.4.1**.

Table 8.4.1 –Summary of Scoring For the 18 Road Reconstruction Locations

Project ID/ Width No. of Sidewalk Cross Section	Alt #1	Alt #2	Alt #3	Alt #4	Alt #5
	-	9.5 m 2 Urban	9.5 m 1 Urban	8.5 m 2 Urban	8.5 m 1 Urban
1	22	41	40	41	44

Project ID/ Width No. of Sidewalk Cross Section	Alt #1	Alt #2	Alt #3	Alt #4	Alt #5	Alt #6	Alt #7	Alt #8	Alt #9
	-	8.5 m 1 Rural	8.5 m 1 Urban	7.2 m 1 Rural	7.2 m 1 Urban	8.5 m 0 Rural	8.5 m 0 Urban	7.2 m 0 Rural	7.2 m 0 Urban
2	22	21	19	20	18	13	17	13	25
3	20	21	19	20	18	13	17	13	25
4	22	29	27	28	30	21	25	21	33
5	22	32	30	32	34	21	29	21	33
6	20	29	31	28	34	21	29	25	33
7	22	32	30	32	34	21	25	21	33
8	20	25	23	24	26	13	21	13	25
9	20	21	23	20	26	13	21	17	25
10A	20	29	31	33	35	-			
10B	20	20	22	20	22	13	21	17	25
11	22	21	19	20	22	13	21	13	25
12	22	21	19	20	18	13	17	13	25
13	20	20	18	20	18	13	13	13	25
14	22	21	19	20	22	13	17	13	25
15	22	33	35	32	38	21	29	25	33
16	20	29	31	28	30	21	29	25	33
17	22	21	19	20	22	13	21	13	25

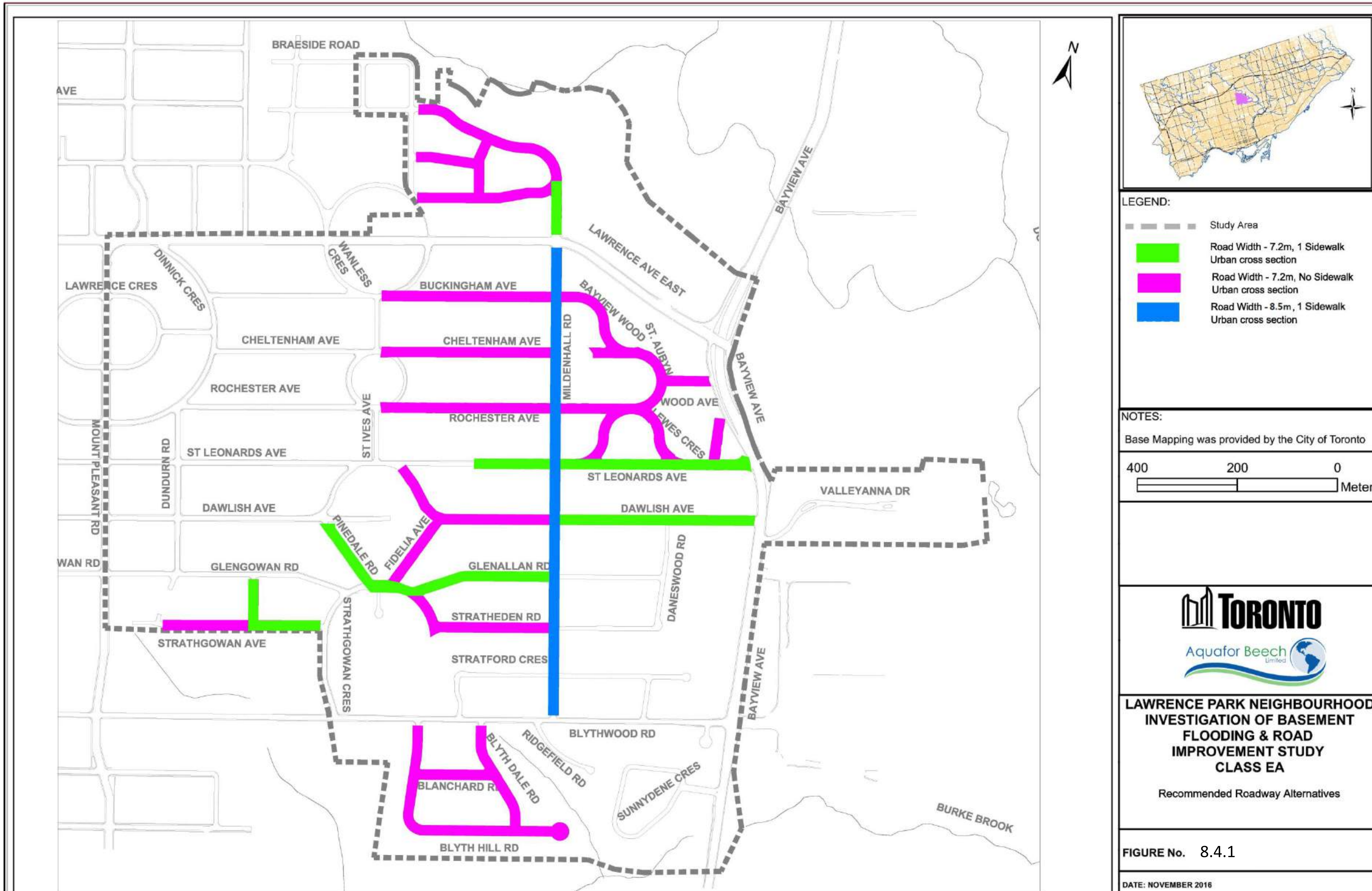


Figure 8.4.1 – Recommended Roadway Alternatives

A summary of the Preferred Solution together with several of the key reasons for selecting the alternative is provided below:

Preferred Solution – Alternative #9 – 7.2 m Road – Urban Cross Section – No Sidewalk

This alternative was selected for projects:

#2 – Buckingham Avenue – From Wanless Crescent to Mildenhall Road

- Results in least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#3 – Cheltenham Avenue – From East of St. Ives

- Results in least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#4 – Rochester Avenue – From St. Ives to Lewes Crescent

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#6 – Lewes Crescent and Pembury Avenue

- Results in the least impact to street trees
- A sidewalk is not included as it does not provide a priority linkage
- Addresses surface flooding by providing a storm drainage system to prevent ponding
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#9 – Stratheden Road – West of Mildenhall Road

- Results in the least impact to street trees
- A sidewalk is not included as it does not provide a priority linkage

- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#10B – Strathgowan Avenue – From Garland Ave to Dundurn Rd

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#11 – Blyth Hill Road

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#12 – Blyth Dale Road and Blanchard Road

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#13 – Braeside Crescent and Proctor Crescent

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#14 – Rothmere Drive

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#15 – Mildenhall Road North – From Lawrence Ave East to Braeside Rd

- Results in the least impact to street trees

- Retains existing sidewalk with least impact on existing street trees
- Addresses surface flooding by providing a storm drainage system to prevent ponding
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#16 – Bayview Wood, St. Aubyns Crescent & Wood Avenue

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#17 – Fidelia Ave, Dawlish Ave & St. Leonards Cres – West of Mildenhall Rd

- Results in the least impact to street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

Preferred Solution - Alternative #5 – 7.2 m Road – Urban Cross Section – One Sidewalk

#5 – St. Leonard’s Avenue – East of St. Ives Avenue

- Results in the moderate impact to street trees
- Includes a sidewalk helping to establish a pedestrian linkage to key destinations in the neighbourhood
- Addresses surface flooding by providing a storm drainage system to prevent ponding
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#7 – Dawlish Avenue – East of Mildenhall Road

- Results in the moderate impact to street trees
- Includes a sidewalk helping to establish a pedestrian linkage to key destinations in the neighbourhood
- Addresses surface flooding by providing a storm drainage system to prevent ponding
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#8 – Glenallan Road and Pinedale Road – West of Mildenhall Road

- Results in the moderate impact to street trees
- Includes a sidewalk helping to establish a pedestrian linkage to key destinations in the neighbourhood
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

#10A – Garland Ave & Strathgowan Ave – From Garland Ave to Strathgowan Cres

- Results in the least impact to street trees
- Retains existing sidewalk with least impact on existing street trees
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

It should also be noted that the existing sidewalk located on Mildenhall Road north of Lawrence Avenue will be retained.

Preferred Solution – Alternative #5 – 8.5 m Road – Urban Cross Section – One Sidewalk

#1 – Mildenhall Road – From Lawrence Avenue East to Blythwood Road
This segment of road is classified as a collector road. The Preliminary Preferred Alternative was selected for the following reasons:

- Results in the least impact to street trees
- A sidewalk is included as this will provide a priority pedestrian linkage to key destinations in the neighbourhood
- Surface flooding is addressed by providing a storm drainage system to prevent ponding
- Meets the requirements for an improvement of roadway structure, improvement in stormwater quality and ability to provide safe conditions for emergency and operational vehicles

8.5 Conclusions

Input from the third Public Open House was summarized and incorporated into a document entitled Summary Notes Open House #3 which is included in Appendix A. A series of meetings were then held between City staff and the consulting team. Based on public input and subsequent discussions between the City and the consulting team it was agreed to select a different Preferred Alternative for Mildenhall Road – From Lawrence Avenue East to Blythwood Road. The original alternative, which included an 8.5 m roadway and one sidewalk, was replaced due to concerns from the public about safety and traffic speed together with the request for a narrower road.

The new Preferred Alternative for Mildenhall Road is Alternative #6 which includes a 7.2 m roadway with two sidewalks. This narrower option addresses resident's concerns regarding traffic speed. Two sidewalks have been selected to improve pedestrian safety as Mildenhall Road is the busiest road within the study area. Construction of this alternative (as compared to the original preferred alternative) is 20 cm wider and this may result in an additional 3 trees being removed due to construction. Parking restrictions will remain largely unchanged and parking around the Cheltenham Park will be examined at the detailed design stage.

Figure 8.5.1illustrates the Preferred Alternative for Mildenhall Road south of Lawrence Avenue East together with the other 17 locations.

After the fourth and final PIC, the above Preferred Solution was reviewed by City staff. It was determined that a 7.2 m road width one (1) sidewalk would be selected in order to reduce (by seven (7)) the number of tree removals.

Staff presented a report to the Public Works & Infrastructure Committee (PWIC) of Toronto City Council, at its meeting on May 9, 2017. The report outlined the study recommendations and a request to proceed with a 30-day public review. All persons on the mailing list were notified of the report's availability and opportunity to arrange to speak or submit comments to PWIC. A number of persons submitted emails and/or appeared before the Committee to share their comments.

Figure 8.5.2 illustrates the final Preferred Solution for Mildenhall Road south of Lawrence Avenue East together with the other 17 locations.

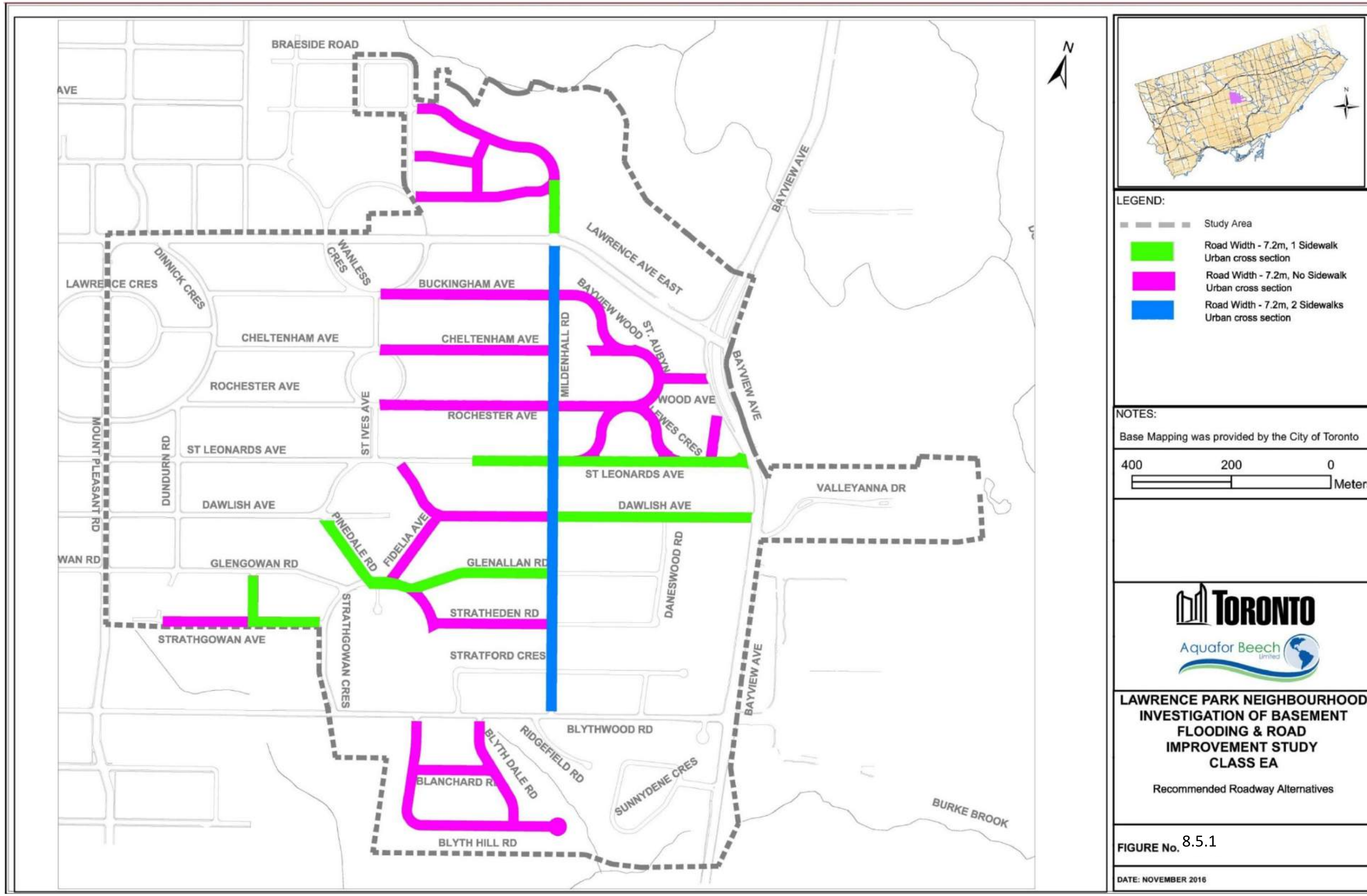


Figure 8.5.1 – Recommended Roadway Alternatives

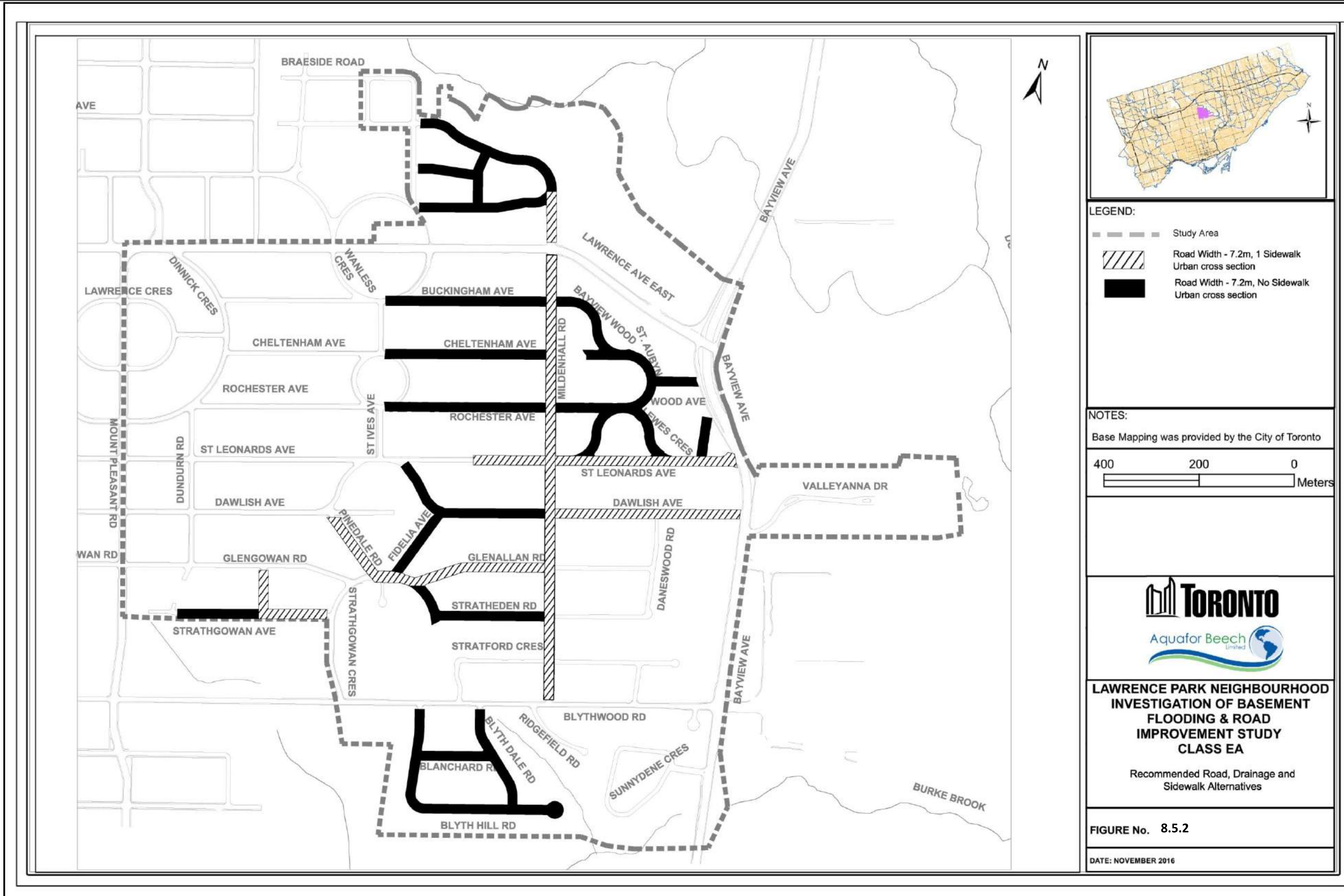


Figure 8.5.2: Recommended Road, Drainage and Sidewalk Alternatives (Preferred Solution)

9.0 DEVELOPMENT AND ASSESSMENT OF ALTERNATIVE REMEDIAL MEASURES –TRAFFIC

9.1 General

Section 5.6 of this report defined existing conditions for the transportation component of this study including an overview on travel patterns including infiltration of vehicles, existing traffic operations and level of service, existing sightline concerns, existing road conditions, pedestrian and cyclist safety and road width requirements. This section will discuss recommendations as they relate to sightline issues, traffic infiltration and the development of a pedestrian linkage network throughout the study area.

9.2 Sightlines

Section 5.6.4.2 summarized the location of sight line problems within the study area. The following six sites were identified as having sight line issues:

- Lawrence Crescent / Mount Pleasant Road (south intersection)
- St. Leonard's Avenue / Mount Pleasant Road
- Dawlish Avenue / Mount Pleasant Road
- Strathgowan Avenue / Blythwood Road
- Rochester Avenue / Mildenhall Road
- Wanless Crescent / Lawrence Avenue East (east intersection)

Staff from the City of Toronto and the consulting team visited each of the sites to confirm the extent of the sight line issue as well as to provide initial recommendations for addressing any issues. Recommendations for each of the six sites are provided below.

Lawrence Crescent / Mount Pleasant Road (south intersection)

Based on the field trip it was noted that there are some lower branches on the trees located on the north-east corner of the intersection that partially obstruct the view of approaching vehicles on Mount Pleasant Drive. City staff will approach the homeowner requesting that the property owner remove the bushes that are obstructing sight lines.

St. Leonard's Avenue / Mount Pleasant Road

Based on the field trip it was noted that there are several bushes located on the southeast corner of the intersection that partially obstruct the view of approaching vehicles on Mount

Pleasant Drive. City staff will approach the homeowner requesting that the property owner remove the bushes that are obstructing sight lines.

Dawlish Avenue / Mount Pleasant Road

This intersection is controlled by traffic control signals. Vehicles on Mount Pleasant Drive approaching Dawlish Avenue do not have an obstructed view. There have been no reported collisions involving westbound left turning vehicles at this location during the preceding three years. From an operational perspective, no works are therefore recommended.

Strathgowan Avenue / Blythwood Road

Based on the field visit, it has been verified that the stone wall located on the north-east corner of the intersection is creating a sight obstruction for southbound vehicles of approaching vehicles westbound on Blythwood. It is recommended that the wall be removed or relocated during the Lawrence Park roadway reconstruction.

Rochester Avenue / Mildenhall Road

Based on the field visit it was established that north and southbound vehicles on Mildenhall Road can be seen by westbound vehicles on Rochester Avenue from a position slightly forward of the stop sign. From an operational perspective, no works are therefore recommended.

Wanless Crescent / Lawrence Avenue East (east intersection)

Based on the field trip it was identified that there is no sight obstruction for motorists exiting Wanless Crescent at this location. Approaching vehicles on Lawrence Avenue East can be seen from a position slightly forward of the stop sign. From an operational perspective, no works are therefore recommended.

9.3 Traffic Infiltration

Generally speaking, the volume of traffic on the internal roads (local) within the study area is relatively small. The exceptions are Mildenhall road and Blythwood Road which are collector roads.

In addition, relatively larger volumes can be found on Dawlish Avenue and St. Leonards Avenue during the afternoon peak hour on the westbound direction. This may be due to the absence of turning restrictions at these locations.

It was concluded that Stratford Crescent and Daneswood Road is being used as an alternate route to Mildehall Road to access Blythwood Road. A turn restriction was initially recommended on Blythwood Road at Daneswood Road to reduce infiltration. However, further to input from the City, this recommendation was overturned.

9.4 Pedestrian Linkage Network

Section 5.6.4.3 described the existing locations of existing sidewalks (pedestrian facilities) within the study area. The key destinations within, and adjacent to the study area were also identified.

It is the City’s policy to promote safety and walkability through the installation of sidewalks on both sides of arterial and collector roads and on at least one side of local streets. The Essential Links Capital Program (City of Toronto, 2002) considers the road class, the presence of pedestrian generators such as nearby schools, parks, bus stops, right-of-way and road width, impact on trees and vegetation as well as other factors such as above-ground utility relocations in making recommendations for constructing sidewalks.

As is shown in **Figure 9.4.1**, pedestrian facilities exist only in the west part of the neighborhood (former City of Toronto) and there are few facilities in the eastern portion (former City of North York) of the study area.

Prior to identifying and recommending locations of potential new sidewalks, the key destinations within the neighbourhood and in the surrounding area must be identified. These locations may include institutions, parks, the Sunnybrook Hospital, bus stops, and walking trails. Once the key destinations are mapped, the missing links can then be identified and a strategy to provide better connectivity for pedestrians to these key destinations can be recommended.

Figure 9.4.1 shows a map of the key destinations within and in the vicinity of the Study Area. There are three schools within the area: Toronto French School, Blythwood Junior Public School, and the Sunny View Public School. There is also a community church and nursery school at Bayview Avenue and Dawlish Avenue with entrances from both St. Leonard’s Avenue and Dawlish Avenue. There are three parks within the Study Area: Cheltenham Park at Cheltenham Avenue and Mildenhall Road; Stratford Park at Blythwood Road and Bayview Avenue; and the Blythwood Ravine Park near Mount Pleasant and Blythwood Road along the tributary to the Don River. A walking trail crosses through the neighbourhood with access through Strathgowan Avenue and Blythwood Road 100 m west of Strathgowan Crescent from the neighbourhood. Lastly, the Sunnybrook Hospital and York University Glendon Campus is located east of the neighbourhood.

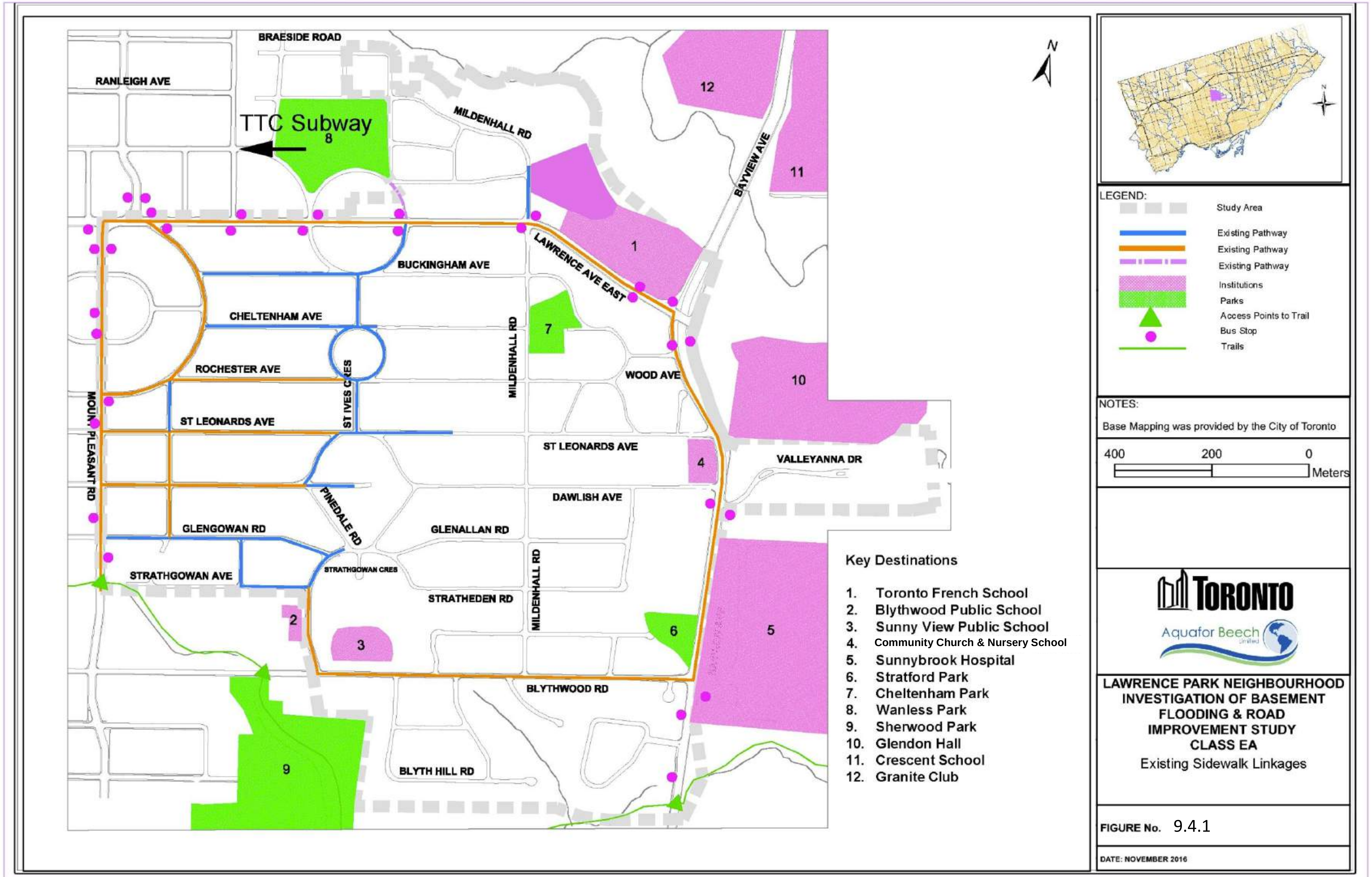


Figure 9.4.1 – Existing Pedestrian Linkages

Lawrence Avenue East, Bayview Avenue, and Mount Pleasant Road are all bus routes with stops along the road. The Bayview Avenue route (Route 11) has stops at Lawrence Avenue East and at the Sunnybrook Hospital. The route runs between Yonge Subway line at Davisville Station and connects to the York Region Transit at Bayview Avenue and Steeles Avenue.

As noted, there is a general lack of continuation of the pedestrian facilities to the east side of the neighbourhood east of St. Ives Crescent and a connectivity of the facilities in the north-south direction. In order to determine the potential locations for new sidewalk, several factors should be considered including:

- Vicinity to key pedestrian destinations;
- Potential accessibility for or persons with disabilities and older adults;
- Connectivity to existing facilities;
- Available road width and potential impact on natural and linear infrastructure;
- Recommendations as outlined in the road classification system; and
- Preservation of vegetation and other roadside features

In general, sidewalks should be provided wherever possible to facilitate and encourage pedestrian movement within the neighbourhood. As part of this EA study, the study team examined potential locations of the sidewalks that best improve pedestrian connectivity with the neighbourhood and to the key destinations, while considering the potential impacts of sidewalks on street trees.

Figure 9.4.2 illustrates the recommended pedestrian linkage for the Lawrence Park Neighbourhood. Also provided is a summary of existing conditions as well as an overview as to why additional pedestrian linkages are required for the streets noted below.

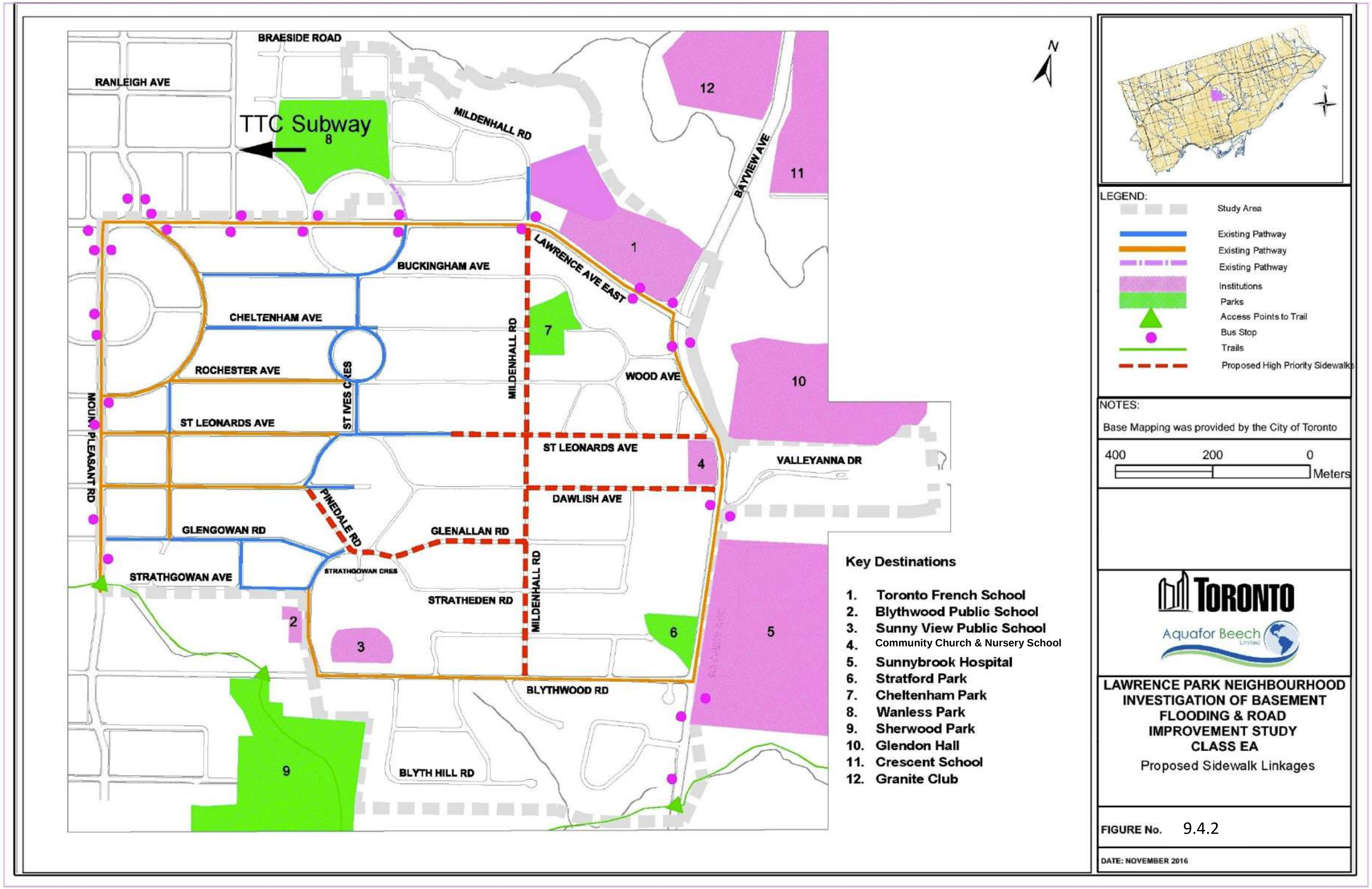


Figure 9.4.2 – Proposed Sidewalk Linkages

Mildenhall Road

Figure 9.4.3 – Mildenhall Road

According to the City of Toronto Road Classification System, Mildenhall Road has been identified as a collector road. While sidewalks are recommended on both sides of a collector road, such as those on Blythwood Road, Mildenhall Road currently has no sidewalk. Much like how it facilitates vehicular traffic, Mildenhall Road is the most direct north-south pedestrian route in the neighbourhood connecting to all east-west roads within the neighbourhood. It provides a key north-south connection to the Toronto French School to the north on Lawrence Avenue East and connection to Blythwood Road to the south that leads to the Sunny View Public School and Blythwood Public School. Mildenhall Road also provides a route to the Cheltenham Park. As such, Mildenhall Road is a logical location for a new pedestrian facility, on at least one side or on both sides of the road as recommended by the Road Classification System. **Figure 9.4.3** shows pedestrians jogging on Mildenhall Road.

The Preferred Solution, as presented in Section 8.4, is to construct a 7.2m urban cross section roadway with one sidewalk as this alternative best meets the requirements as defined in Chapter 8.

St. Leonard's Avenue

According to the City of Toronto Road Classification System, St. Leonard's Avenue has been identified as a local road and a sidewalk, subject to local conditions, is recommended on at least one side of the road. Currently, there are sidewalks on both sides on the road west of St. Ives Crescent, and the sidewalk continues on the north side for 200m east of St. Ives Crescent. The sidewalk discontinues where the road tightening and the on-road ditches begin. Although the wide roadside shoulders provide a path for pedestrians, the path is undefined and uneven at multiple locations. A new sidewalk will provide:

- a continuation of the existing sidewalk and better connectivity between the west and east side of the neighbourhood;
- a route for commuters of the bus route on Bayview Avenue;
- a protected path for pedestrians and children to Lawrence Park Nursery School located on Bayview Avenue and St. Leonard's Avenue;
- a route to walk to Sunnybrook hospital; and
- a potential connection to Mildenhall Road if a new sidewalk is built there.

The Preferred Solution, as provided in Section 8.4, is to construct a 7.2m urban cross section roadway with one sidewalk as this alternative best meets the requirements as designed in Chapter 8

Dawlish Avenue

Similar to St. Leonard's Avenue, Dawlish Avenue has been identified as a local road and sidewalk is recommended on at least one side of the road according to the City of Toronto Road Classification System. There are sidewalks on both sides on the road west of St. Leonard's Crescent, but the sidewalk discontinues as the road splits at St. Leonard's Crescent. Similar to St. Leonard's Avenue, a new sidewalk will provide:

- a continuation of the existing sidewalk and better connectivity between the west and east side of the neighbourhood, although the connection is indirect as Dawlish Avenue is split at St. Leonard's Crescent;
- a route connecting commuters to the bus route on Bayview Avenue;
- a protected path for pedestrians and children to Lawrence Park Nursery School located on Bayview Avenue and St. Leonard's Avenue;
- a route to walk to Sunnybrook hospital; and
- a potential connection to Mildenhall Road if a new sidewalk is built there.

The Preferred Solution, as provided in Section 8.4, is to construct a 7.2m urban cross section roadway with one sidewalk as this alternative best meets the requirements as designed in Chapter 8.

Strathgowan Crescent and Glenallen Road

This short portion of road in the south-east corner of the neighbourhood can serve as a key route for pedestrians walking to the Sunny View Public School or Blythwood Public School. Currently, Strathgowan Crescent between Pinedale Road and Blythwood Road has sidewalk on both sides. It is recommended that the sidewalk be extended to Mildenhall Road. As a minimum, the sidewalk should be extended beyond Glenallan Road since there are four points of traffic merging to Strathgowan Crescent at this location. The point where Stratheden Road turns into Strathgowan Crescent also has substandard sightline, as evident by a temporary reduction of speed posted by the City, therefore, it will be prudent to keep the pedestrians off the road at this location by adding at least one sidewalk.

The Preferred Solution, as provided in Section 8.4, is to construct a 7.2m urban cross section roadway with one sidewalk as this alternative best meets the requirements as designed in Chapter 8.

Pinedale Road

As shown in **Figure 9.4.4**, this short portion of road between Dawlish Avenue and Strathgowan Road is an obvious missing link for a continuous sidewalk in the north-south direction. It provides a direct route to the two public schools and a new sidewalk will connect to the existing sidewalks on St. Leonards Avenue and St. Ives Avenue to the north and Strathgowan Crescent to the south.

Figure 9.4.4 - Narrow ROW on Pinedale Road

The Preferred Solution, as provided in Section 8.4, is to construct a 7.2m urban cross section roadway with one sidewalk as this alternative best meets the requirements as designed in Chapter 8.

Cheltenham Avenue, Buckingham Avenue, and Rochester Avenue

In general, the existing facilities should be extended to east of St. Ives Crescent to provide continuity. However, these roads do not connect to the major arterials directly, therefore, addition of new sidewalks may benefit only small portion of the neighbourhood. The benefits will have to be compared against the potential impacts of the road expansion to the adjacent properties.

Currently, there is no cycling facility within the neighbourhood. New cycling facilities in Toronto are identified in the Cycling Network Plan and the Lawrence Park Neighbourhood is not identified in the bike network. Thus, there are recommendations with respect to cycling facilities.

10.0 DESCRIPTION OF THE PREFERRED SOLUTION

10.1 General

The previous chapters reviewed the alternatives that were considered and provided a summary as to the process for selecting the Preferred Solution. This chapter will present further information with respect to:

- Costing information
- Mitigation of potential impact considerations
- Implementation considerations
- Considerations at the detail design stage
- Environmental Assessment considerations

The following sections outline the above considerations for:

- Sewer system projects;
- Roads, drainage and pedestrian safety projects; and
- Traffic projects

10.2 Sewer System Projects

Sewer works for this project will be required for two primary reasons. The first reason is to provide additional storm, combined or sanitary sewer system capacity such that basement or surface flooding is reduced and the criteria as defined by the City is met. This section will summarize the proposed works together with the appropriate implementation considerations.

The second reason for constructing sewer works is to improve local drainage issues that exist due to a deteriorated and sub-standard conveyance system. These storm sewer works will be carried out in coordination with the road and pedestrian safety works and are described further in section 10.3.

10.2.1 Level of Service

In April 2006, City Council approved a Basement Flooding Work Plan (now referred to as the Basement Flooding Protection Program or BFPP) to undertake comprehensive engineering studies and identify infrastructure improvements in chronic basement flooding areas that experienced significant flooding during extreme storms in May 2000 and August 2005. In 2013, the BFPP was expanded City-wide.

As part of the work plan, an enhanced level of service criteria was adopted by Council that are to be applied for the sanitary, combined and storm sewer systems in basement flooding study areas.

The criteria, as defined in this study are provided below

- Sanitary Sewer System:

The maximum hydraulic grade line (HGL) of the sanitary system shall be maintained at an elevation at least 1.8m below the ground elevation under a storm event equivalent to the May 12, 2000 storm as gauged at the City's Oriole Yard, located at Sheppard Avenue and Leslie Street;

- Combined Sewer System

The maximum HGL of the combined sewer system shall be maintained at an elevation at least 1.8m below the ground elevation under a storm event equivalent to the City 100-year design storm. During the 100-year design event, if the depth of the major system flow is less than 300 mm within the right-of-way, then the target level of service is considered satisfied.

- Storm Drainage System:

A 100 year level of protection is being targeted for the storm system. During this event, the major system flows are to be maintained within the road allowance and no deeper than outlined in the Wet Weather Flow Management Guidelines, November 2006 (Wet Weather Flow Management Guidelines, City of Toronto, November 2006) and the maximum HGL of the storm sewer system shall be maintained at no surcharge level, where feasible, for the local street sewers, during the City 100-year design storm.

- Partially separated area (combined/storm) – in areas where a majority of the storm sewers are shallow and constructed after the combined sewer was installed – only surface flooding criteria (the depth of the major system flow is less than 300 mm within the right-of-way) is applied as the foundation drain is connected to the combined sewer; and

- Separated area (sanitary/storm) – in areas where sanitary and storm sewers were installed – surface flooding criteria (the depth of the major system flow is less than 300 mm within the right-of-way).

These criteria were used as a basis for defining Level of Service and subsequent remedial works which, in turn, lead to the selection of the Preferred Solution.

10.2.2 Preferred Solution

As was noted previously, the study area is located within two former municipalities within the City (Toronto and North York). The former City of Toronto was initially serviced by a combined sewer system, while the former City of North York was serviced by a separated sewer system. Preferred remedial works for each area were developed and presented in Section 7.4.

Preferred Solution – Separated Sewer Area

Flooding in fully separated areas is the result of flows from extreme rainfall events exceeding the capacity of the existing sanitary sewer system. In order to reduce basement and surface flooding within the separated sewer area the following key works are recommended as per Sanitary Alternative #3 as shown in **Figure 7.4.3**.

- Mandatory downspout disconnection
- Sealing of sanitary maintenance holes in low lying areas to reduce inflows
- Capacity upgrades on St. Aubyns Crescent to Wood Avenue (525 mm), on Rochester Avenue to Wood Avenue (450 mm) and on Wood Avenue to Bayview Avenue (600 m);
- Capacity upgrades on Bayview Avenue to Wood Avenue (450 mm), Bayview Avenue to Dawlish Avenue (675 mm) and on Bayview Avenue to Armistice Drive (450 mm);
- Capacity upgrades along the sections of sewer on Valleyanna Drive (675 mm);
- In-line storage in the form of a box culvert (2000 mm x 2000 mm – 1100 m^3) on Valleyanna Drive; and
- Lowering, and therefore replacement, of the existing 250 mm sanitary sewer east of Valleyanna Drive in order to receive flows from the proposed underground storage facility.

The separated area discharges into the West Don Trunk Sanitary Sewer. Under existing conditions, the model indicates a peak flow of 0.29 m^3/s. For the preferred solution, the peak flow is to be maintained at a value equal to or less than existing conditions. With the storage component for sanitary flows in the preferred solutions, the model results show a peak flow rate of 0.04 m^3/s

Preferred Solution – Combined Sewers Area

Flooding in the combined sewer area is a result of flows during extreme rainfall events exceeding the capacity of the original combined sewers. In order to reduce basement and surface flooding within the combined sewer area the following key works are recommended as per Combined Alternative #1 as shown in **Figure 7.4.4**:

- Mandatory downspout disconnection;

- Capacity upgrades including the installation of a new 300 mm storm pipe on Dundurn Road and disconnection of catch basins from combined sewers and reconnecting to new storm sewers;
- Capacity upgrades including the installation of new 300 to 375 mm storm pipe on St. Leonard's Avenue and disconnection of catch basins from combined sewers and reconnecting to new storm sewers; and
- Capacity upgrades including the installation of new 450 mm storm pipe on Glengowan Avenue and disconnection of catch basins from combined sewers and reconnecting to new storm sewers.

10.2.3 Effectiveness of the Preferred Solution

Implementing sanitary and combined system remedial measures will meet or exceed the level of service set out by the City for the sanitary and combined sewer systems reducing the risk of basement flooding.

<u>Separated Sewer Area</u>

Figure 7.4.3 presents the preferred remedial measures for the separated sewer area. The Preferred Solution maintains the sanitary system HGL more than 1.8m from the surface for the May 12, 2000 evaluation event as measured at the Oriole Yard gauging station. This alternative also limits flows to the West Don Sanitary Trunk Sewer to existing levels. This alternative, in order to provide an outlet, also requires work on private property. The result of the remedial measures for the Preferred Solution is presented in Appendix C.

<u>Combined Sewer Area</u>

Figure 7.4.4 presents the preferred remedial measures in the area serviced by the combined system. The conveyance improvements control the HGL to more than 1.8m from the surface for the City's 100-year design storm event. The result of the preferred remedial measures for the Preferred Solution is presented in Appendix C.

This alternative (sewer separation) was one of the strategies developed in the Wet Weather Flow Master Plan.

10.2.4 Impact on Downstream Systems

For the Preferred Solution for the separated sewer area, the provision of larger diameter sewers and storage along Valleyanna Drive provides the required capacity in the system to reduce the risk of basement flooding while maintaining the existing peak flow rate into the main sanitary trunk sewer as per the model for the separated sewer area.

For the Preferred Solution for the combined sewer area, the model results indicate increased flow into the existing storm system would result. This alternative would increase flow into the existing storm system. General Measures to Reduce Flooding

General measures which could be implemented to reduce the likelihood of flooding as well as to improve the overall benefit to the environment have been previously mentioned and are summarized below.

General Lot Level Controls

The implementation of source control at the lot level should be encouraged for the entire study area. In addition to the advantage of reducing flow to the sewer systems, these measures will aid in significantly reducing the risk of local basement flooding problems. Source controls can be used to isolate homes with the use of sanitary lateral backflow preventers and sump pumps for foundation drains. It also has the benefit of reducing flows directed at local sanitary and storm sewers

Downspout Disconnection

In the past, the City encouraged residents on a voluntary basis to disconnect downspouts and re-direct runoff towards grassed areas and/or rain barrels. The benefits of encouraging a higher level of disconnection include:

- A reduction in flows from roof areas entering the sewer system and treatment plants,
- Reducing the risk of sewer back-ups that lead to the conditions of basement flooding,
- Encouraging water-efficient landscaping to allow for more infiltration, particularly for areas where yard and garden areas are available (typically for the predominantly residential Lawrence Park neighbourhood)
- Encouraging water conservation through more reliance on the use rainwater for landscape maintenance, particularly for large residential areas.

To move this program to a higher disconnection level, the City is currently in the final phase of a mandatory disconnection program aimed at obtaining at least 75% roof downspout disconnection, City wide.   The 3rd and final phase of the mandatory disconnection program ends December 3rd, 2016.

Street Level Controls

Sealing of sanitary manhole covers in low lying areas, where storm water surface ponding could occur will result in eliminating a significant source of storm water inflow to the sanitary sewer system during wet weather conditions

I/I investigations should continue to isolate and confirm sources of I/I in the area. This program is to support the final design and implementation of remedial measures. Any reduction in I/I volumes will reduce the size of alternatives with respect to pipe diameter or length of pipe replacement.

10.2.5 Mitigation Measures

The potential environmental and social impacts associated with the Preferred Solution are related to the construction, implementation and long-term usage of the remedial measures. The impacts, their potential sources and methods of mitigation are identified in the following sections.

10.2.5.1 Environmental Impacts

A majority of the proposed remedial measures will occur within the municipal right-of-way and therefore will have minimal on vegetation located within the existing study area.

In the fully separated area, the existing 250 mm diameter sanitary sewer along Valleyanna Drive is proposed to be lowered through 28 Valleyanna Drive up to the edge of the valley lands in order to accommodate the proposed storage tank upstream. The pipe replacing the 250 mm sanitary sewer will be of the same size with the extent of the replacement to stop short of the valley lands. **Figure 10.2.1** illustrates the location within 28 Valleyanna Drive where the existing sanitary sewer will need to be replaced.

<u>Construction Impacts to Natural Heritage</u>

The vegetation assessment completed by Aquafor Beech Limited has identified a linear cultural woodland community within the Right-of-Way and deciduous forest on the valley slopes. The sanitary sewer is located on a private residential laneway adjacent to cultural woodland within the tablelands, and does not extend onto the valley slope. Impacts to natural heritage features resulting from the replacement of the sanitary sewer consist of localized impacts to residential landscaping. Potential impacts to vegetation communities resulting from vegetation removals to accommodate the proposed sewer upgrade (approximately a 6 m wide corridor along the length of the pipe) and construction access road will be mitigated through a revegetation/restoration plan developed in consultation with the City of Toronto and the Toronto and Region Conservation Authority. At a minimum, trees will be replaced at a 3:1 ratio and efforts will be made to improve wildlife habitat through the provision of habitat plantings, etc. Trees to be protected during construction will be subject to the provisions of the City of Toronto's Tree Protection Policy and Specifications for Construction Near Trees guidelines (City of Toronto, July 2016), or subsequent update. As part of the detailed design phase, the study team will explore options to minimize the disturbance to trees within the tablelands, including but not limited to the avoidance of sensitive biological timing windows, etc. An erosion and sediment control plan will also be developed.

10.2.5.2 Sediment and Dust Control

Potential sources for sedimentation related to construction activities include sediments disturbed and deposited by construction vehicles and blowing sand and dust. The following mitigating measures are proposed:

- Place sediment traps to receive storm runoff during construction
- Provide tire washing facilities for construction vehicles that exit the sites
- Install silt fencing along the perimeters of the work sites where appropriate to prevent migration of sediment-laden storm runoff
- Cover exposed excavated material to prevent erosion by rain and wind
- Water or other dust suppressants to be employed during construction to control release of dust particles to the air
- Cover catch basins with filter fabric during construction to prevent the migration of sediments into the conveyance system and ultimately to the watercourses.

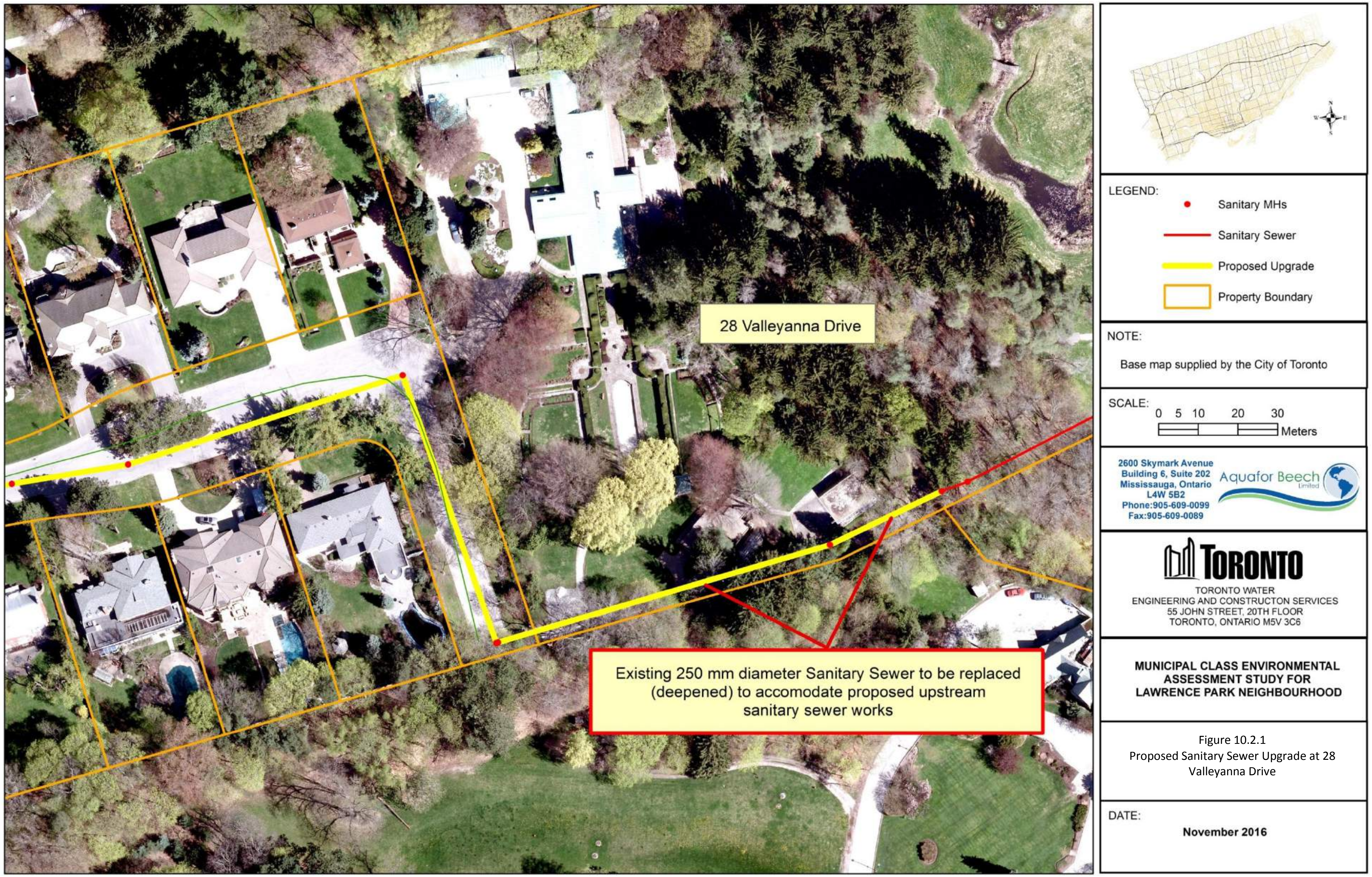


Figure 10.2.1 – Proposed Sanitary Sewer Upgrade at 28 Valleyanna Drive

Erosion and sediment control plan, and the selection of appropriate measures will be addressed during the detailed design and construction as per the City requirements. Any construction projects impacting TRCA regulated lands require an erosion and sediment control plan be prepared referencing the Greater Golden Horseshoe Conservation Authorities Erosion and Sediment Control Guideline for Urban Construction (downloadable from www.sustainabletechnologies.ca).

10.2.5.3 Trees

The potential removal of existing trees is always of concern. The proposed mitigation measures include the following:

- Protective fencing around trees designated to remain;
- Mature trees will be avoided so as to eliminate the need for their removal;
- Small trees, if removed, will be replaced or replanted. The replaced trees will be in accordance with City's requirements;
- Root pruning, if required, will be done in accordance with City Standards; and,
- Proper consultation with the Urban Forestry.

10.2.5.4 Restoration

All sites/areas disturbed by construction activities will be restored. The proposed mitigating measures include the following:

- Disturbed sidewalks, roads and parking areas will be restored to their existing conditions after construction;
- Removed small trees will be replanted or replaced;
- Disturbed park areas will be restored to their existing conditions; and,
- Disturbance to private properties are to be restored to original conditions or better

10.2.5.5 Noise and Vibration

Truck traffic and construction equipment operation and general construction activities are potential noise and vibration sources. Mitigation measures include:

The City's anti-noise by-law will be enforced for all construction activities;

- Hours of operation during construction activities will be restricted to the hours between 7:00 am and 7:00 pm;
- Pre-construction survey will be undertaken for houses which may be affected by

- soil vibration during construction activities; and,
- Where rock excavation is required, blasting will not be permitted.

10.2.5.6 Fuel Spills

Fuel spills are likely to occur during the onsite refueling of construction equipment with the potential to contaminate surface and groundwater. Mitigation measures include:

- Refueling in designated areas at a minimum distance of 15 m from a watercourse
- Spill containment for on-site storage tanks
- Spill clean-up contingency plan

10.2.5.7 Traffic

Potential concern includes local traffic disruption during construction due to closed roads or blockage of driveways. The following mitigating measures are proposed:

- Consultation will be held with the City's Transportation Department to determine which lane(s) of traffic will be maintained or detour utilized to ensure a constant flow of traffic during construction; and
- Homeowners will be notified if temporary blockage to their driveway during construction has to be considered, which will be kept to a minimum. Where possible, alternative short term parking will be provided.

10.2.5.8 Private Property

Temporary disruptions to private property include access/egress to driveways and potential interruption of water and sanitary services to residences. Due to the maturity of the existing neighbourhood, these impacts can only be managed through a well-managed construction program that will require consultation with the City and the various agencies and liaising between property owners and construction crews.

Where easements will be required for the proposed works, the following is currently known:

- 28 Valleyanna Drive: Confirmation of the existing easement status and potential negotiations will be required regarding the type and timing of the proposed works.

10.2.6 Cost Estimates

10.2.6.1 Unit Cost Estimates

To estimate the capital cost of the recommended remedial measures on a preliminary basis, unit costs were first established. The unit costs are based on the following sources:

- Recent contracts tendered by the City, in the last three years.
- Recent contracts tendered in other Ontario municipalities.
- Unit prices as prepared for the City of Toronto Basement Flooding Program (1-4) being undertaken by the City.

10.2.6.2 Estimate of Probable Costs

Preliminary capital costs were estimated for each of the two projects and are provided below. Details of the cost estimates are provided in Appendix I. The costs include an allowance (10%) for engineering design and construction supervision together with a 20% contingency.

The estimated costs for the remedial works for the Separated Sewer Area (see **Figure 7.4.3**) and the Combined Sewer Area (see **Figure 7.4.4**) are provided in **Table 10.2.1**

It should be noted that the proposed storm drainage works along Glengown Road is presented in Section 10.3 and is intended to replace the Glengown Road portion of the preferred solution (Combine Alternative 1).

Table 10.2.1 – Estimated Capital Costs for Remedial Works for the Combined and Separated Sewer Areas.

Streets	Reference Figure Number	Estimated Capital Cost	Municipal Class EA Schedule
Combined Sewer Area			
Dundurn Road, and St. Leonard's Avenue	Figure 7.4.4	$4,000,000	Schedule 'A+'
Glengowan Road			
Separated Sewer Area			
Bayview Avenue, Rochester Avenue, St. Aubyn's Crescent, Valleyanna Drive, Wood Avenue.	Figure 7.4.3	$15,000,000	Schedule 'B'

10.2.7 Sequence of Implementation

In staging the implementation of the remedial measures, the following could be considered:

- Sealing of sanitary manhole covers is a very cost-effective remedial measure and could be implemented sooner than other measures which require design and tendering stages;
- Implementation of roof downspout disconnection should have high a priority since this will significantly reduce potential basement flooding in most areas under the level of protection criteria. The area downspout survey indicates approximately 50% of downspouts are already disconnected, which is reflected in the analysis. The level of disconnection does not meet the 75% disconnection rate goal of the City. Achieving a higher percentage of disconnection will be beneficial;
- For the separated sewer area, initial field assessments were carried out to determine where downspouts, which discharged into the ground, discharged to. For the few downspouts that were checked, it was found that a reasonable percentage discharged directly to the sanitary sewer system. It should be noted that it would take only 20-25 downspouts to overload the existing sanitary sewer system during large rainfall events. Approximately 100 homes were identified where the downspouts may discharge to the sanitary sewer system. The City should, therefore, conduct future testing for the homes that were identified as potentially having roof downspouts discharge to the sanitary sewer system;
- Additional I/I investigation to identify the primary I/I sources. The outcome of this investigation may lead to refining the size and extent of the preferred remedial measures. As well, any reduction in I/I will reduce the risk of basement flooding.

The proposed sanitary sewer works for the separated sewer area should be coordinated with road reconstruction and storm sewer works which are proposed for areas east of St. Ives Avenue (see section 10.3.7). This is required as there are common works proposed for several streets. In addition, the proposed sanitary sewer works will need to proceed from the downstream limit and work upstream. Timing of the works will also need to be coordinated with City wide priorities.

Similarly, the storm sewer works proposed for the combined sewer area should be coordinated with road reconstruction works west of St. Ives Avenue. It should be noted that the Preferred Solution for Glengowan Avenue as shown in Figure 7.4.4 shows the proposed storm sewer draining from an easterly to westerly direction. The Preferred Solution in the Road Drainage and Pedestrian Safety Projects in Section 10.3.3 propose that the storm sewer follows the existing road grade from west to east and should be considered in place of the preferred solution developed for Basement Flooding Protection.

Implementation sequencing is discussed for the proposed basement flooding projects, together with the proposed road, drainage and pedestrian safety projects in Section 10.3.8.

10.2.8 Future Agency Approvals

Ministry of Environment and Climate Change (MOECC)

Each element of the recommended infrastructure will require an MOECC Environmental Compliance Approval (formerly a Certificate of Approval) for Sewage Works since these projects fall under Section 53 of the Ontario Water Resources Act (amended 2011).

Considerations for each project may include:

- A pre-application consultation with MOECC Toronto Water – Water Infrastructure Management (WIM)
- Application fees for Environmental Compliance Approval;
- Filing of applications at least 6-8 weeks in advance of construction activities;
- Development of a monitoring program for tracking short and long term system performance; and,
- Early and ongoing dialogue with the MOECC during planning stages.

Toronto and Region Conservation Authority (TRCA)

TRCA approvals will be required for projects at Sites 1 (Mildenhall), 2 (Bayview), 4 (Strathgowan), and at Valleyanna Drive.

Department of Fisheries and Oceans

As stated earlier, projects with the potential to impact fish habitat, including those with in-water works, will require that the proponent complete a self-assessment to determine if the project needs to be submitted to the Department of Fisheries and Oceans (DFO) for review. It is recommended that the self-assessment occur during the detailed design phase.

City of Toronto Divisions

The following departments must be circulated and consulted in the design and construction phases:

- Transportation Services
- Toronto Water – Water Infrastructure Management (WIM)
- Engineering and Construction Services (ECS)
- Ravine and Natural Features Protection (RNFP)
- Parks, Forestry and Recreation (PF&R)
- Urban Forestry (UF)

Projects must comply with City of Toronto Tree Bylaws, Policies, and Permitting requirements, including an arborist inventory, Ecological Land Classification (ELC) assessment of the potential areas of impact and adjacent vegetation communities, and mitigation and compensation (e.g. tree replacements, restoration, and/or enhancements).

10.2.9 Summary of Environmental Assessment Undertakings

The Basement Flooding Protection projects summarized in **Table 10.2.2** have been grouped into three (3) projects, two for the combined area west of St, Ives Crescent (see **Figure 7.4.4**) and one (1) project for the separated area east of St. Ives Crescent (see **Figure 7.4.3**).

The implementation of the above projects is to be considered along with the Preferred Solutions for Road, Drainage and Pedestrian Safety projects discussed in Section 10.3.8.

It should be noted that the proposed storm sewer on Glengowan Avenue (Project BF-02) is addressed under the Road, Drainage and Pedestrian Safety Projects and as such, the cost estimate for the combined sewer area has been adjusted in **Table 10.2.2**.

Table 10.2.2 – Summary of Preferred Solution – Basement Flooding Protection Projects

Project No.	Streets	Recommended Works	Estimated Capital Cost	Class EA Schedule
BF-01[1]	• Dundurn Road (Rochester Avenue to St. Leonard's Avenue) • St. Leonard's Avenue (Dundurn Road to St. Ives Avenue)	Addition of storm sewer	$2,400,000	Schedule 'A+'
BF-02[1]	• Glengowan Road (Dundurn Road to Strathgowan Crescent) •	Addressed under Road, Drainage and Pedestrian Safety Projects		
BF-03[2]	• Valleyanna Drive;	Replacement and addition of sanitary sewer and installation of a 1,100 m^3 underground tank.	$15,000,000	Schedule 'B'
	• 28 Valleyanna Drive; and • 2075 Bayview Avenue	Replacement of Sanitary Sewer		
	• Bayview Avenue (Lawrence Avenue to Armistice Drive); • Rochester Avenue (Mildenhall Road to St. Aubyns Crescent); • St. Aubyn's Crescent (Rochester Avenue to Bayview Wood); and • Wood Avenue.	Replacement of sanitary sewer (to be integrated with RDS-02*)		

(1) Combined Sewer Area –Figure 7.4.2

(2) Separated Sewer Area – Figure 7.4.3

10.3 Roads, Drainage and Pedestrian Safety Projects

Chapter 8 discussed the development and assessment of alternative remedial measures related to roads, drainage and pedestrian safety. In summary, various streets were identified where common issues related to poor conditions, narrow road widths, poor drainage and no sidewalks were identified.

The following sections will provide further information with respect to:

- Costing information
- Mitigation of potential impact considerations
- Implementation considerations
- Considerations at the detail design stage
- Environmental Assessment considerations

10.3.1 Preferred Solution

The Preferred Solution for each of the 18 locations is summarized in**Figure 10.3.1**. An overview as to the key elements for each of the recommended alternatives that form the preferred solution is also provided in this figure.

In general, the Preferred Solution as recommended in this study will include road reconstruction together with installation of storm sewers within the roadway. The roads will be constructed to a 7.2 m pavement width with a curb and, on selected roads, one 1.5 m sidewalk. It should be noted the Preferred Solution for Mildenhall Road between Lawrence Avenue East and Blythwood Road was not presented as part of the EA process and was a result of the implementation of recommendations made by the Public Works and Infrastructure Committee (PWIC) to balance pedestrian safety and tree impacts.

Reconstruction will either include full depth reconstruction or full depth asphalt removal (refer to **Figure 10.3.2** for details).

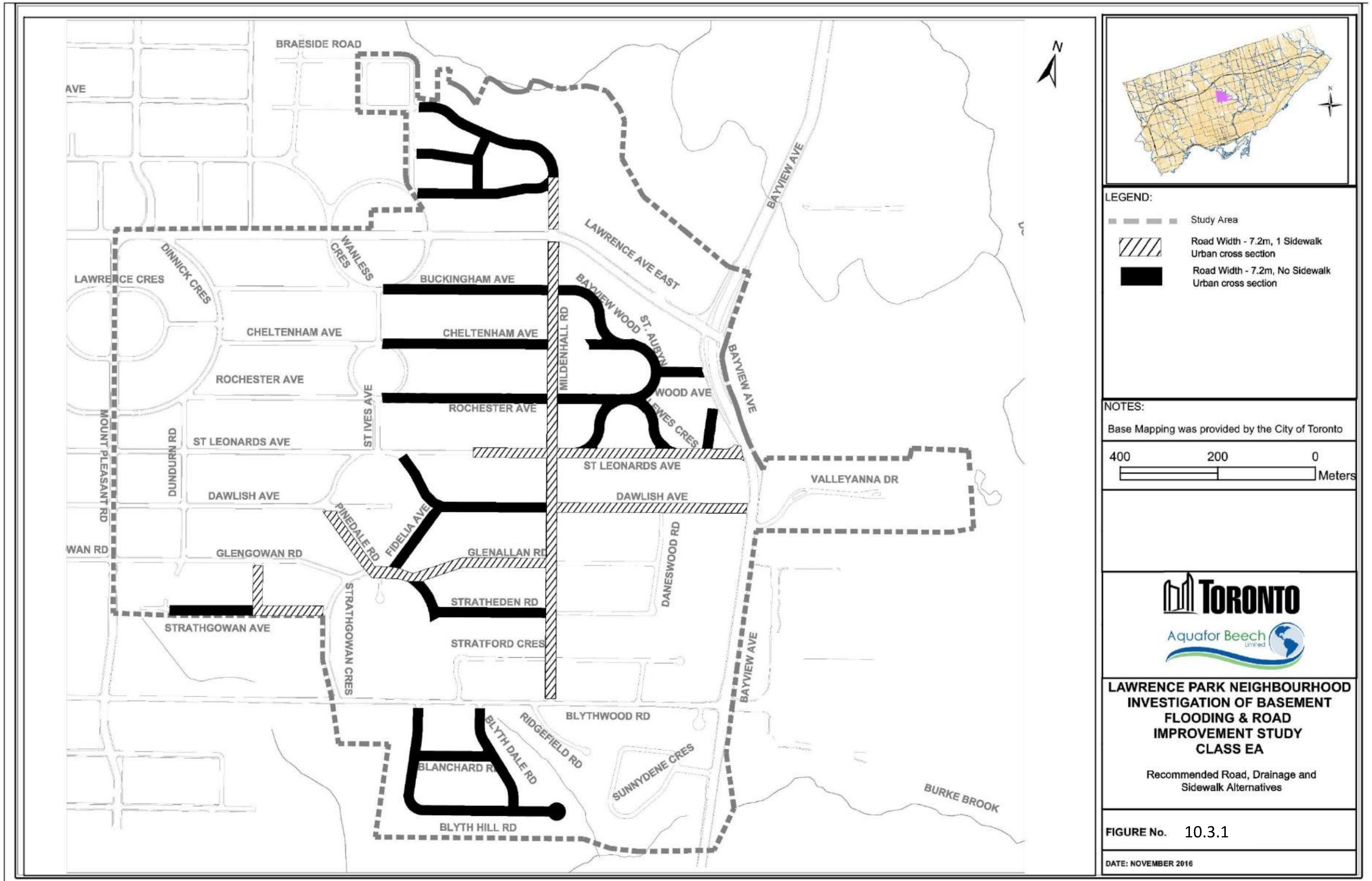


Figure 10.3.1: PWIC Recommended Roadway Alternatives

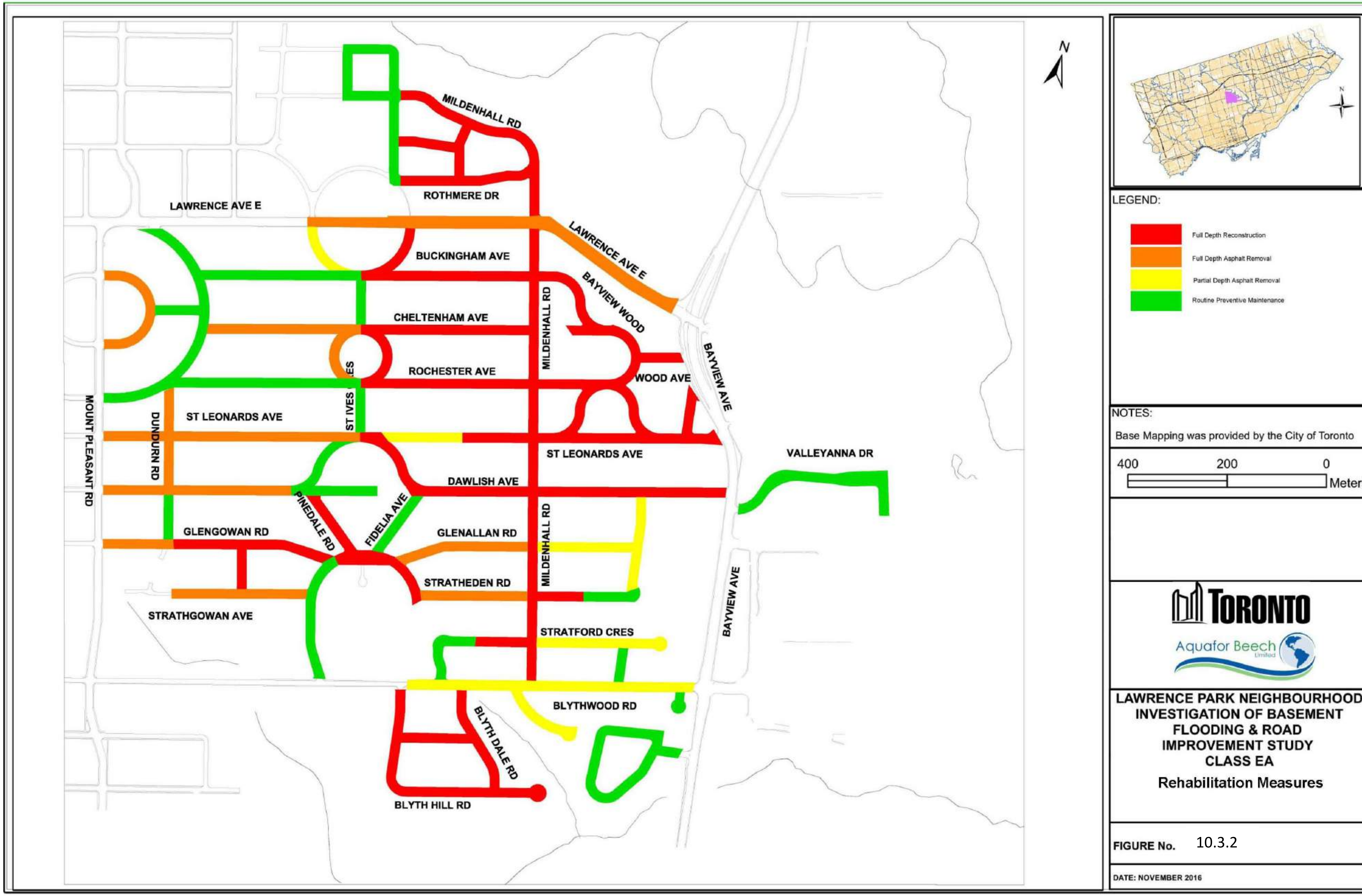


Figure 10.3.2 – Rehabilitation Measures

Full depth reconstruction will include 1) removing existing asphalt, concrete and underlying granular materials and excavating to the road design subgrade elevation; 2) reconstructing the roadway by placing and compacting the granular sub-base followed by the granular base and then repaving roadway with hot mix asphalt.

Full depth asphalt removal will include 1) removing the existing asphalt, regrade, level and compact the existing granular material and repaving the roadway with hot mix asphalt for flexible pavement; 2) removing existing asphalt to expose the underlying concrete slab, repairing the concrete slab and joints and repaving the roadway with hot mix asphalt for composite pavement.

Storm sewer works for this project will be required for a number of reasons. The first reason is to provide additional storm sewer capacity. In some locations, particularly in former North York, storm conveyance is served by overland flow ditches that are not able to adequately convey storm flows to an outlet. In other locations, storm conveyance is served by sewers that are either undersized or have connected downspouts. In addition, there are numerous reverse-sloped driveways where stormwater can enter private property. Finally, many homes in this area flood as a result of excessive flows from the roadway entering private property (based on reported flooding and historical records). Construction of a proper drainage system will alleviate this, as well as the other conditions as noted above.

10.3.2 Storm Sewer Sizing Criteria

The City identified the level of service criterion for the storm system to mitigate surface flooding. The level of service criteria is shown in Section 10.2.1.

A policy document – Lawrence Park Neighbourhood Environmental Assessment – Alternative Roadway Cross Sections and Drainage Policy (see Appendix H) – addressed road cross-section and drainage policy pertaining to the characteristics of the Lawrence Park Neighbourhood and ensure consistency with the Wet Weather Flow Master Plan. This policy document investigated the history with respect to roadway cross sections in the neighbourhood, highlighted potential conflicts between City policy at the time and the neighbourhood characteristics and defined how these policies could be interpreted based on City and public input.

Water Quality and Quantity Mitigation

The recommended drainage policy included references to the WWFMP and the (Draft) Stormwater Management Options for Reconstruction Projects, 2005. The principles from both documents included using rainwater as a resource and managing stormwater using a natural systems approach. Water quality and quantity targets were to be met through either retaining or enhancing roadside ditches and the use of infiltration / exfiltration or the equivalent where retention of any existing ditches was not feasible. **Figure 10.3.3** illustrates a design that was implemented in the late 1990's in the former City of Etobicoke.

Figure 10.3.3 – Perforated Pipe System

The objectives of the perforated pipe system is to infiltrate stormwater back into the ground thereby replenishing groundwater, reducing flows to the receiving watercourses and removing pollutants to the sewer. For the system shown in **Figure 10.3.3**, stormwater is directed from the catch basins into the lower perforated pipe for infiltration. Once the infiltration capacity is exceeded, flows are then discharged into the upper pipe and conveyed to the outfall.

A geotechnical investigation by Terraprobe Inc. was completed in 2014 as part of the Municipal Class EA for Lawrence Park Neighbourhood. The study states findings that approximately 50% of the soils are sandy. The initial objective for the Lawrence Park area is to infiltrate 15 mm of stormwater runoff from the road right-of-way which is consistent with the objectives in the WWFMP. Detailed design will require review of the geotechnical findings on a project-by-project basis to determine sizing of the perforated pipe systems.

<u>Surface and Basement Flood Mitigation</u>

The 2006 Council-adopted work plan defines the level of service criteria for the storm sewer system and is detailed in Section 10.2.1. Assessment of the storm sewer system for the 18 projects as defined in **Figure 10.3.11** will also use the criteria as defined in the City of Toronto InfoWorks CS Basement Flooding Studies Modelling Guideline (2014) – referred herein as the BF Guidelines.

A 100 year level of protection is being targeted for the storm system. During this event, the major system flows are to be maintained within the road allowance as outlined in the BF Guidelines, and the maximum HGL of the storm sewer system shall be maintained at no surcharge level, where feasible, for the local street sewers, during the City 100-year design storm.

In summary, the design criteria will include:

- 2-year (6-hour Chicago) storm conveyance by the minor system (i.e. no surcharging); and
- 100-year (6-hour Chicago) storm flows within the road right-of-way to a maximum storm flow depth of 0.3m above curb and 0.15m above curb where reverse sloped driveways are present and the HGL maintained below 1.8m;

The criteria as noted above were used as a basis for the design of the preferred storm sewer works. The following design guidance was also used in order to develop conceptual designs:

- Mandatory 75% downspout disconnection rate as per City policy;
- Utilizing the major system where possible to reduce the size of the minor system;
- Splitting the flows for the major and minor system such that at a minimum, the 2-year event is captured in the minor system (dependant on the existence of a major system);
- Maintaining storm pipe obvert depths at and below 2.1 m where feasible;
- Maintaining storm pipe slopes between 0.2% and 2% where feasible;
- Standard catch basin inlet capacity of 55 L/s based on the inlet rating curve in the BF Guidelines;
- Requirement of additional catch basin inlets where necessary; and
- Maximum spacing between maintenance holes at 90 m.

10.3.3 Storm Sewer Sizing for Road Reconstruction Project Locations

As previously mentioned, storm sewer works for this project will be required to provide additional storm capacity. This section will summarize the proposed works together with the appropriate implementation considerations. These works will be carried out in coordination with the road and pedestrian safety works described further in section 10.3. There are four storm subcatchment areas that drain to four outfalls – three along the West Don River and one to an open channel that eventually outlets to the West Don River as depicted in **Figure 10.3.4**. Sewer sizing details for each street is summarized in Appendix C.

Figure 10.3.5 through **Figure 10.3.10** show the sewer sizing for the preferred works for each of the drainage outfalls of the Lawrence Park Neighbourhood that drain to each of the four storm sewer outfalls.

Site 1 – Downstream of 101 Mildenhall Road (Toronto French School)

Site 1 drains an area in the northern part of the Lawrence Park Neighbourhood. The existing conditions for the area's storm drainage include the following:

- The existing area conveys flows from several streets located west of Mildenhall Road. Flows are conveyed through an easement located at the north limit of the Toronto French School;
- The existing sewer located within the easement is undersized and requires a capacity upgrade. Furthermore, a field investigation showed that the sewer may be in a state of disrepair and may be causing erosion within the ravine; this sewer is also undersized and requires a capacity upgrade;
- The existing easement agreement allows the City to enter the lands along the sewer alignment for the purposes of constructing and maintaining the storm sewer;
- There are four properties with reverse sloped driveways along Mildenhall Road.

The preferred works involve the following improvements

- Upgrading all of the existing storm sewers in the area to larger pipes as per **Figure 10.3.5**.

The model results for the 100-year event are shown in Appendix C. The model indicates that the proposed works maintain the HGL at or below the pipe crown within the road right-of-way and through the easement at 101 Mildenhall Road. The peak discharge rate was modelled at 2.7 m^3/s. The model also indicates increase flows to the West Don River as a result of the increased pipe sizes conveying the 100-year event. Overland flow depths are within guidelines.

It should be noted that it has been assumed that a 100-year pipe would be installed within the Toronto French School lands (see **Figure 10.3.6**). This has been assumed due to the concern of overland flow within the lands. Some of the upstream pipes are of similar size to the existing storm sewers but have been deepened to ensure that the maximum HGL is below 1.8 m. At the detail design stage, the appropriate split between the minor (pipe) and major (overland flow) systems can be determined and sizing of pipes upstream can be refined where necessary based on a detailed assessment of the storm conveyance through the TFS lands.

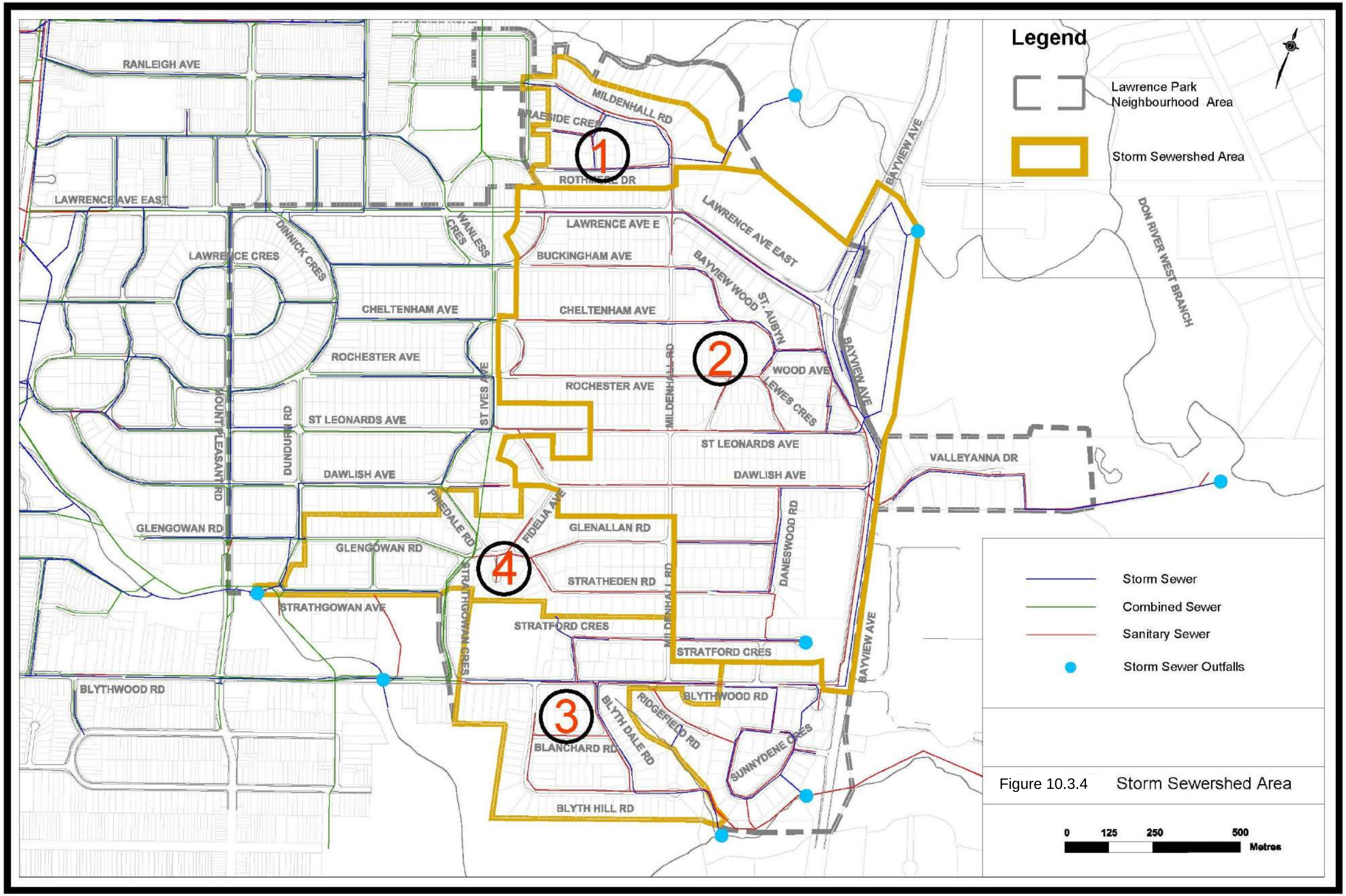


Figure 10.3.4 – Storm Sewershed Area

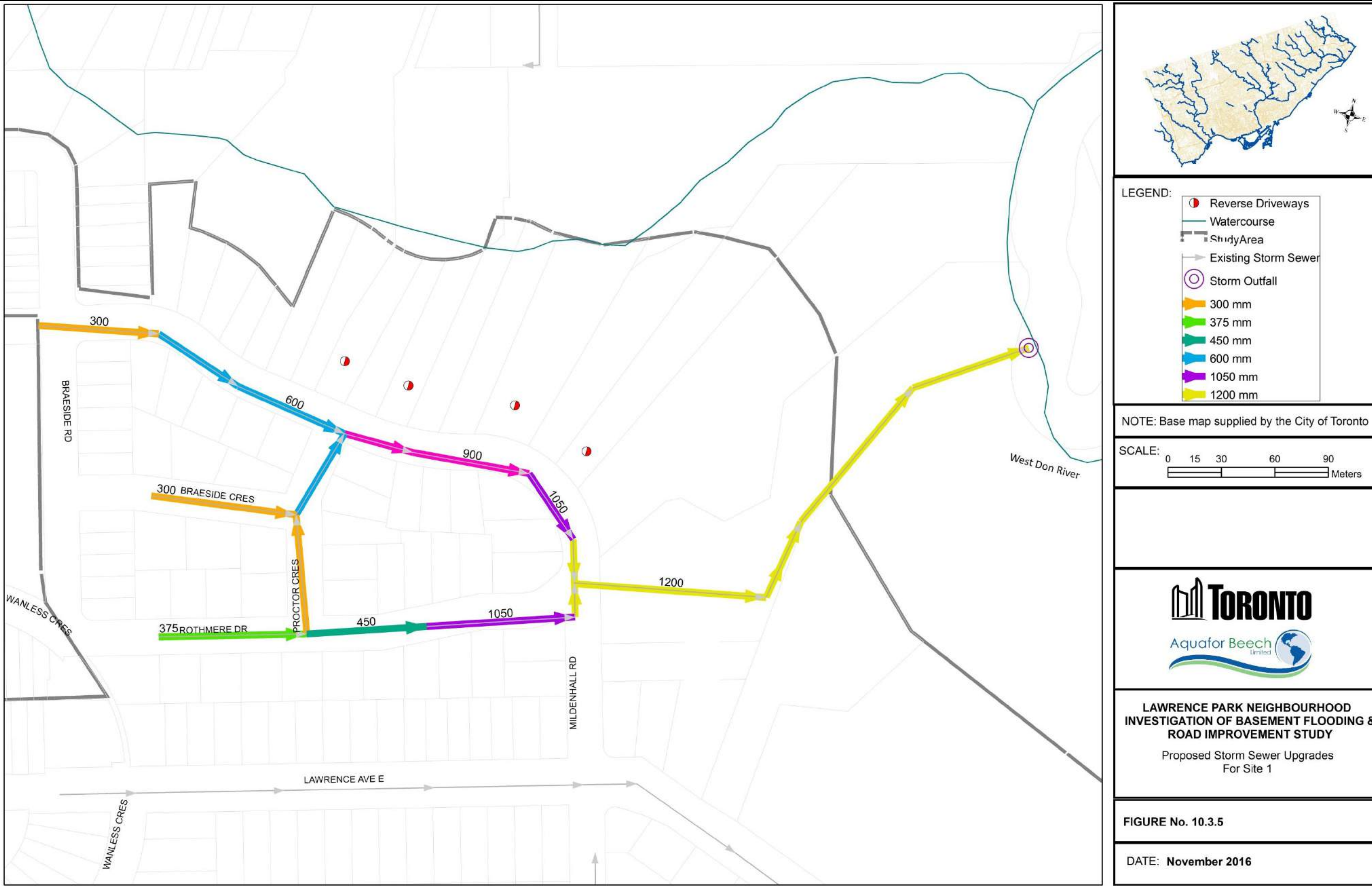


Figure 10.3.5 – Proposed Storm Sewer Upgrades for Site 1

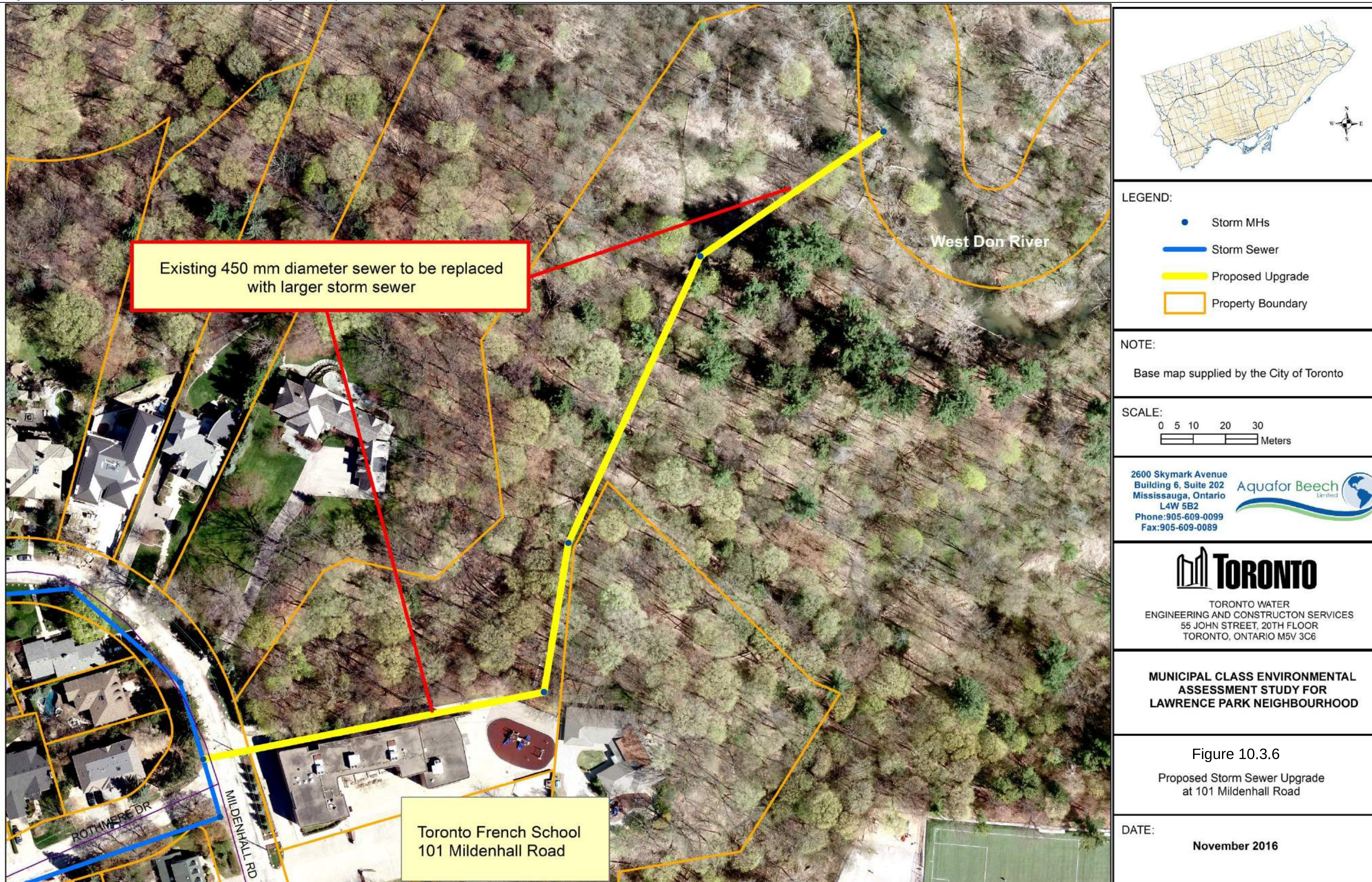


Figure 10.3.6 – Proposed Storm Sewer Upgrade at 101 Mildenhall Road

Site 2 – Downstream of 2275 Bayview Avenue (York University – Glendon College)

The drainage area for Site 2 is the largest of the drainage areas in the Lawrence Park Neighbourhood covering approximately 40 ha. The existing conditions include the following:

- The existing area conveys flows from several streets east of Bayview Avenue area east of Bayview Avenue. Flows are conveyed across Bayview Avenue at St. Leonard's Avenue through the York University's Glendon College campus at 2275 Bayview Avenue into a ravine with an outfall at the West Don River;
- The existing sewer conveying flows through the Glendon campus is undersized and requires a capacity upgrade. Furthermore, the upstream sewer in the ravine lands will need to be deepened to allow for upgrading of the storm sewer through the campus property;
- There is currently no existing easement through the Glendon campus that allows for upgrading of the storm sewer (at the time of this report);
- There are 67 properties with reverse sloped driveways throughout the drainage area. The majority of the reverse driveways are located along Dawlish Avenue, Rochester Avenue and St. Leonard's Avenue.

The preferred works includes the following as illustrated on **Figure 10.3.7**:

- Installation of 2,500 m of storm sewers for areas west of Bayview Avenue;
- Upgrading of existing storm sewers west of Bayview Avenue including across the intersection of St. Leonard's Avenue at Bayview Avenue;
- Upgrading the existing storm sewer on Bayview Avenue from Dawlish Avenue to the intersection of at St. Leonard's Avenue;
- Upgrading the existing storm sewers from Bayview Avenue, through the Glendon Campus to larger diameter pipes with capacity to convey the 100-year event while maintaining the criteria set out in the BF Guidelines;
- An easement to allow for construction and maintenance of the sewer within the Glendon Campus will be required;
- Deepening of the upstream sewer in the ravine area to allow for appropriate sizing of the sewer through the Glendon campus.

It should be noted that it has been assumed that a 100-year pipe would be installed within the York University Glendon Campus lands (see **Figure 10.3.8**). This has been assumed due to the concern of overland flow within the property. At the detailed design stage, the split between the minor (pipe) and major (overland flow) systems can be determined.

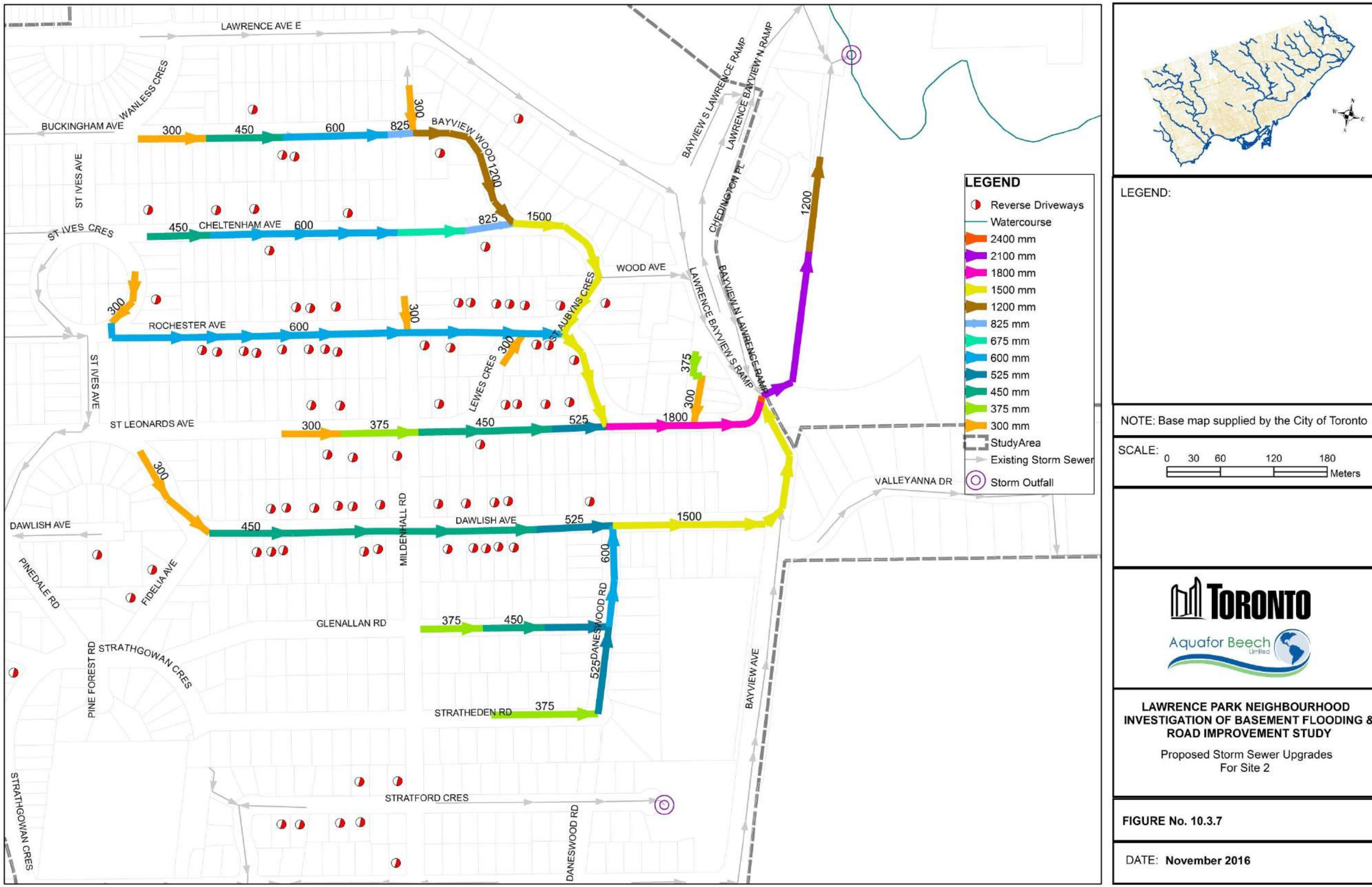


Figure 10.3.7 – Proposed Storm Sewer Upgrades for Site 2

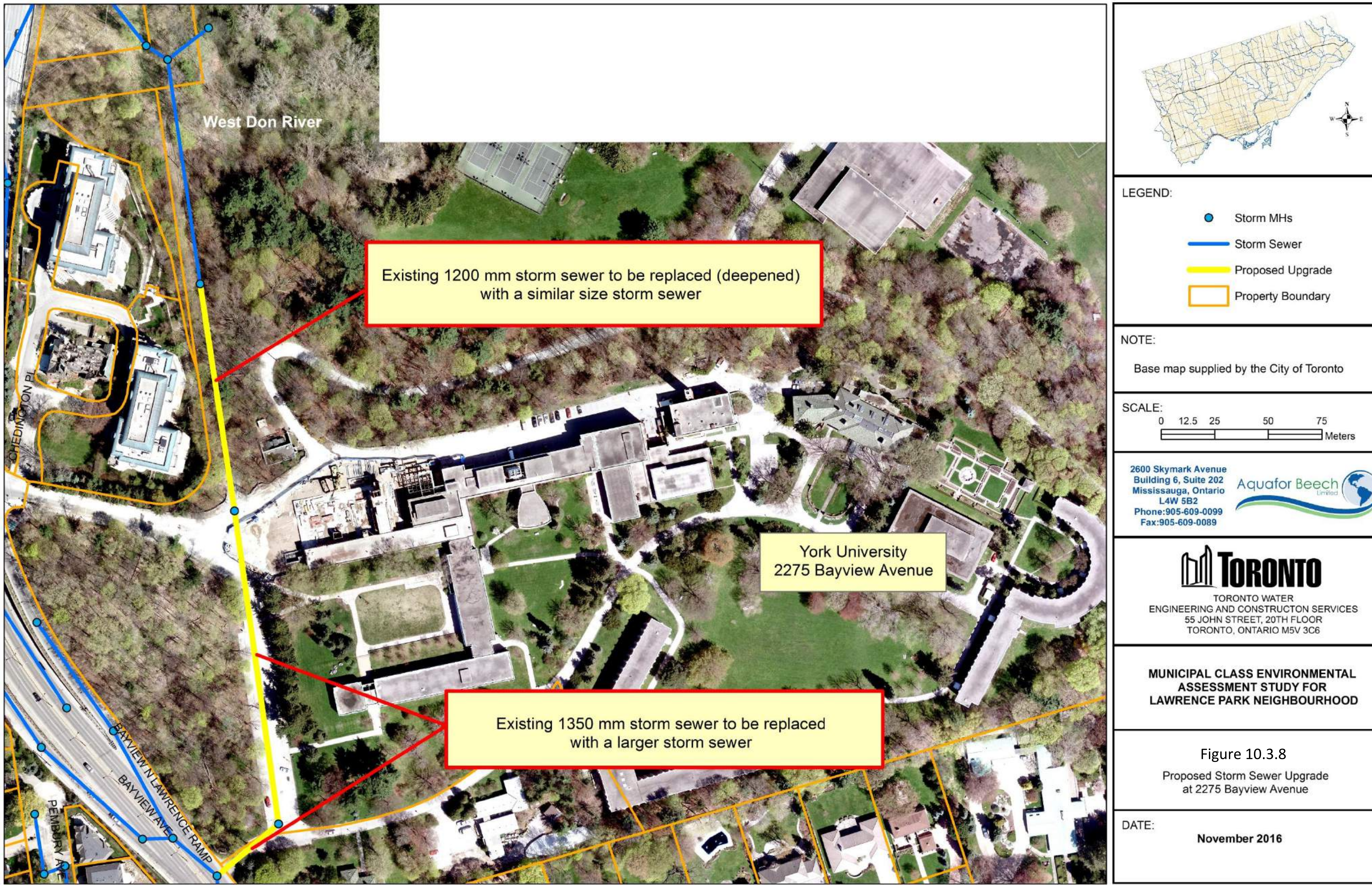


Figure 10.3.8 – Proposed Storm Sewer Upgrade at 2275 Bayview Avenue

The model results are shown in Appendix C for the 100-year event. The majority of the pipes flow full at peak flow. The peak flow level is maintained at or slightly above the pipe crown, but the HGL requirement is met throughout the site according to the model output. The model results show a peak flow of 4.6 m^3/s through this section of pipe for the 100-year event. Through the Glendon campus, the model results show that the proposed 100-year pipe has sufficient capacity to maintain HGL below 1.8 m with overland flow depth below 300 mm. At Bayview Avenue and St. Leonards Avenue, the pipe is in a state of surcharge with the peak flow level maintained at the crown of the pipe. Overland flow depth is maintained at the 300 mm threshold in this area for the 100-year event.

<u>Site 3 – Downstream of 70 Blyth Hill Road</u>

Site 3 drains an area in the southern part of the Lawrence Park Neighbourhood south of Stratford Crescent. The existing conditions include the following:

- The existing streets drain down Blyth Hill Road and are conveyed through the property of 70 Blyth Hill Road into a ravine that is an environmentally sensitive area;
- The existing sewer conveying flows on Blyth Hill Road through 70 Blyth Hill Road is undersized for the 100-year design storm with the HGL between 0 and 1.8 m depth.
- There are 37 properties with reverse sloped driveways in the drainage area.

The preferred works include the following as per **Figure 10.3.9**:

- Installation of 300 m of new storm sewers where none currently exist;
- Upgrading a 70 m section of sewer on Blyth Hill Road between Blythdale Road and the east cul-de-sac to box culvert to provide 800 m^3 of storage for the 100-year event. The storage facility will control flows via a 360 mm diameter orifice to a rate which can be accommodated by the existing sewer system from 70 Blyth Hill Road to the outlet. Sizing of the box culvert was based on review of the existing infrastructure through as-built drawings and site visit to the cul-de-sac at the east limit of Blyth Hill Road. Refinements to the Preferred Solution may be required for constructability during the preliminary or detailed design;

The model results are shown in Appendix C. The model results indicate that pipes are in a state of surcharge at peak flow, however the HGL is controlled to below 1.8 m from ground level. The 1,200 mm diameter pipe downstream of the box culvert as well as 750 mm diameter pipe is surcharged; however the HGL is controlled to below 1.8 m from ground level as measured from the maintenance holes in the cul-de-sac and the north side of 70 Blyth Hill Road respectively. The model indicates that the peak level in the box culvert is at the pipe crown 1.8 m below ground level. The downstream flow rate is restricted to 2.6 m^3/s. The model also indicates that overland flow depths meet the storm drainage criteria. At the Blyth Hill Road cul-de-sac, the model output indicates that the overland flow depth during the 100-year event is 148 mm which is still within the BF Guidelines.

The proposed box culvert was sized to capture the 100-year event due to a lack of a major system outlet.

Site 4 – West limit of Strathgown Crescent

Site 4 drains an area in approximately the middle of the Lawrence Park Neighbourhood towards the southwest. The existing conditions include the following:

- Many of the existing streets drain towards a low point near the centre of the drainage area at Strathden Road and Strathgown Crescent; these flows should be conveyed out of the low point and west to the open channel at the west limit of Strathgowan Avenue;
- There are 13 reverse sloped driveways scattered throughout the drainage area.

The preferred works are shown on **Figure 10.3.10** and includes:

- Installation of 1,750 m of new storm sewers where none currently exist;
- Replacement of the existing storm sewer on Strathgowan Avenue;
- Construction of a new outfall at the open drain in Blythwood Ravine Park to accommodate the preferred solution; and
- The recommended storm sewer works along Glengown Road replace the storm sewer works proposed in Combined Alternative 1 in the Basement Flooding Solutions.

The model results indicate the conveyance of the 100-year event utilizing the major and minor systems with the HGL requirement maintained throughout the area. It should be noted that the area along Strathgowan Crescent between Glenallen Road and Glengowan Road is a low point and that the 100-year design storm needs to be conveyed downstream via the minor system. Pipes showing a state of surcharge have flows contained at the pipe crown. The HGL rises above the 1.8 m depth requirement approaching the new outfall at the west limit of Strathgowan Crescent within Blythwood Ravine Park. The pipe corridor at this point is at the south side of the road along and into the park land area away from the residences on the north side of the road. The model result shows a downstream peak flow rate of 1.7 m^3/s draining to the Site 4 outfall and into the open drain; this flow is in addition to the flows entering the open drain from the storm sewer from Dundurn Road. The flows ultimately drain into the downstream concrete channel that conveys flows south-east. -

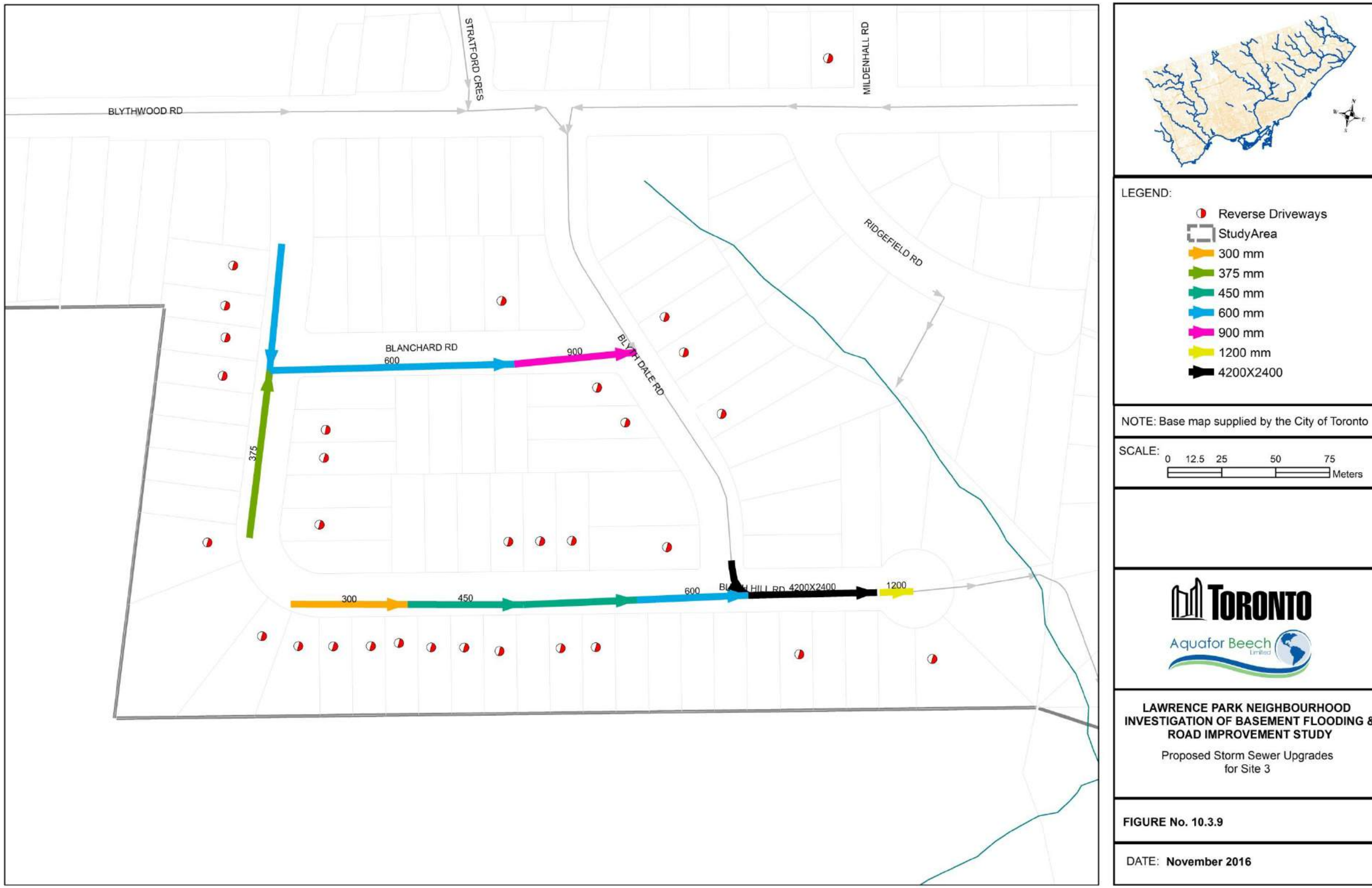


Figure 10.3.9 – Proposed Storm Sewer Upgrade for Site 3

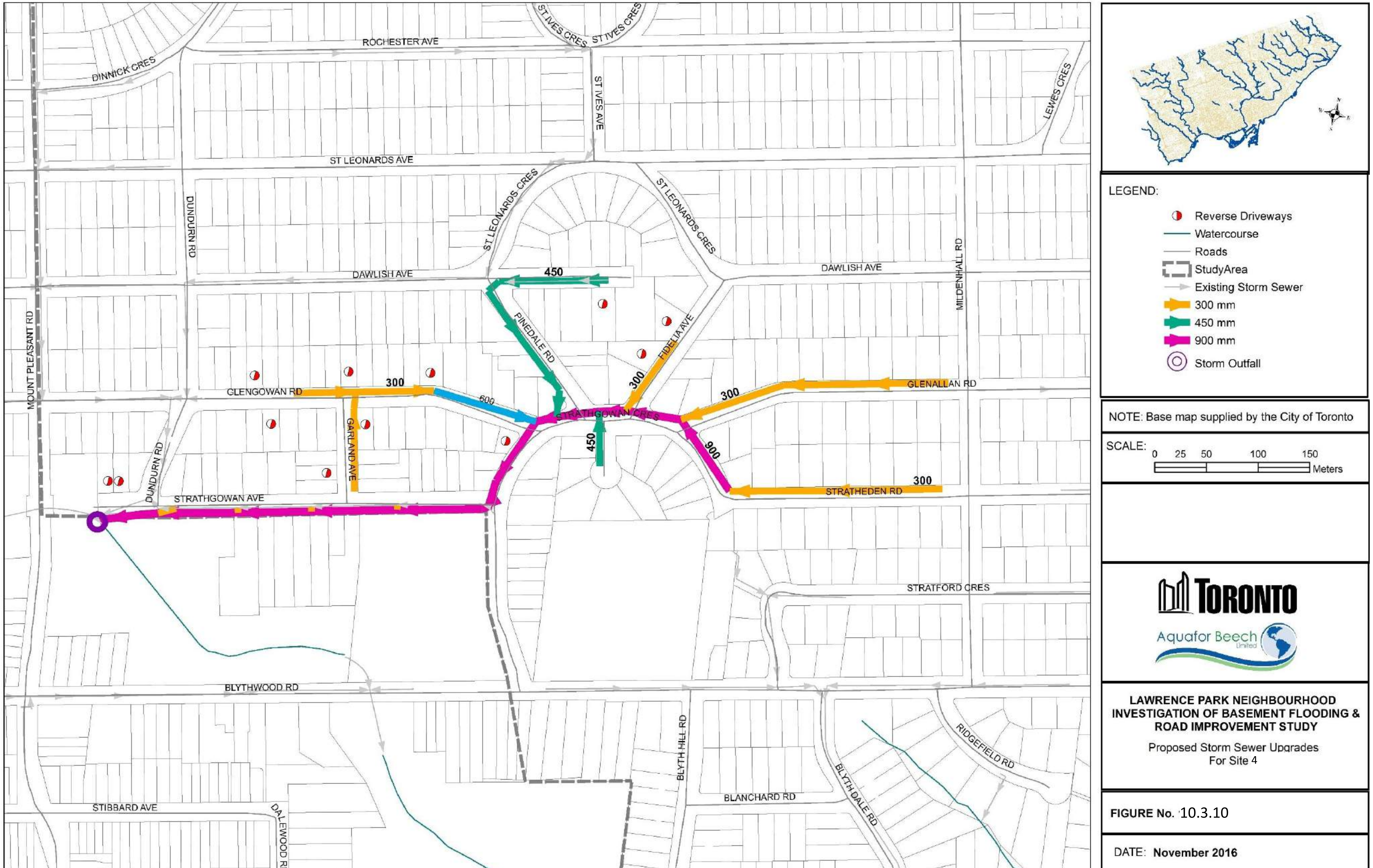


Figure 10.3.10 – Proposed Storm Sewer Upgrade for Site 4

10.3.4 Effectiveness of the Proposed Storm Sewer Works

The preferred measures were modelled under the 2 hour and the 6 Hour 100 Year Chicago Design Storm as per the BF Modelling Guidelines. The results are summarized below:

- For the 2-hour event, the model indicates that the preferred works conveys flows into the minor system without significant accumulation on the road right-of-way;
- No surcharge conditions are maintained where possible. In areas where the model indicates surcharge condition, the HGL requirement of 1.8 m or below from ground elevation was maintained throughout;
- Overland flow depth is maintained within the road right-of-way as per the BF Guidelines (less than 300 mm above gutter level and less than 150 mm along properties with reverse sloped driveways) except where noted. It is important to note that for detailed design, elevations from gutter to the highest point of each reverse sloped driveway within the right-of-way should be measured to confirm compliance with the guideline;
- Sites 1 and 2 have increased discharge rates to the West Don River. Discharge towards Site 3 is restricted to the pipe full capacity of the 750 mm diameter sewer at 70 Blyth Hill Road. For Site 4, discharge to the open channel at the west limit of Strathgowan Avenue is in addition to the existing stormwater flows;
- A 75% downspout disconnection rate was assumed in the model.

10.3.5 Mitigation Works

The following subsections outline mitigation measures related to the proposed road reconstruction works.

10.3.5.1 Road Reconstruction Works

Figure 10.3.11 illustrates the location of the 18 locations where road reconstruction and installation of storm sewers will be required. As has been noted previously, these works are required to improve local drainage issues that exist due to a deteriorated and sub-standard conveyance system as well as improve existing road conditions and pedestrian safety.

Citizens who have attended the Public Open Houses and community Advisory groups have expressed considerable concern regarding the potential loss of street trees as a result of the proposed road reconstruction projects. As has been noted in previous sections the City undertook considerable measures at the Environmental Assessment stage to initially define the location, type, age as well as general health of each street tree in a study undertaken by Aboud and Associates. Subsequent work was then undertaken by City and Aquafor Beech Ltd. to further refine and update this work as well as to better define whether each tree would be impacted. Details of the findings are presented in the Summary Tree Inventory Report (see Appendix D) as well as in the Public Consultation appendix (Appendix A). Examples of some of the information that was presented at the final PIC (PIC #4) are shown on the accompanying two figures. **Figure 10.3.12** illustrates a number of elements including the construction width for the proposed roadway together with a description of each of the trees located within this portion of road. Shown at the bottom of the page is a summary of which trees are to be removed, preserved if possible or are not impacted.

Figure 10.3.13 represents a Photoshopped image which corresponds to a section of the roadway shown in **Figure 10.3.12**. The top image represents existing conditions while the bottom image illustrates the proposed roadway, catch basins together with the proposed pavement width and roadway (or construction) width. In this image any tree which is slated to be removed has also been taken off the photo in an effort to illustrate the visual difference between existing and proposed conditions as a result of any tree removal. The Photoshopped image also shows a comparison between the existing and proposed pavement width. As can be seen from the selected illustrations (see **Figure 10.3.14** to **Figure 10.3.17**) the pavement with may increase or decrease for proposed conditions depending upon the street that is being considered.

In summary, there are approximately 2,700 street trees within the study area. For the streets where road reconstruction is proposed there are 1,201 street trees. Of these it is anticipated that 848 trees will not be impacted. Furthermore, it is anticipated that 247 trees would be preserved and 106 would be removed and replaced. As will be noted later, it is important to note that construction is not anticipated to begin until 2020 and will take at least 10 years to complete. The numbers as shown above will therefore have to be updated at the design stage of construction.

As noted above, the city has taken into consideration the concern by citizens relating to potential loss of street trees. Provided below is a summary of steps that will be undertaken in an attempt to minimize the impact to the existing tree canopy and the associated benefits afforded by the vegetation.

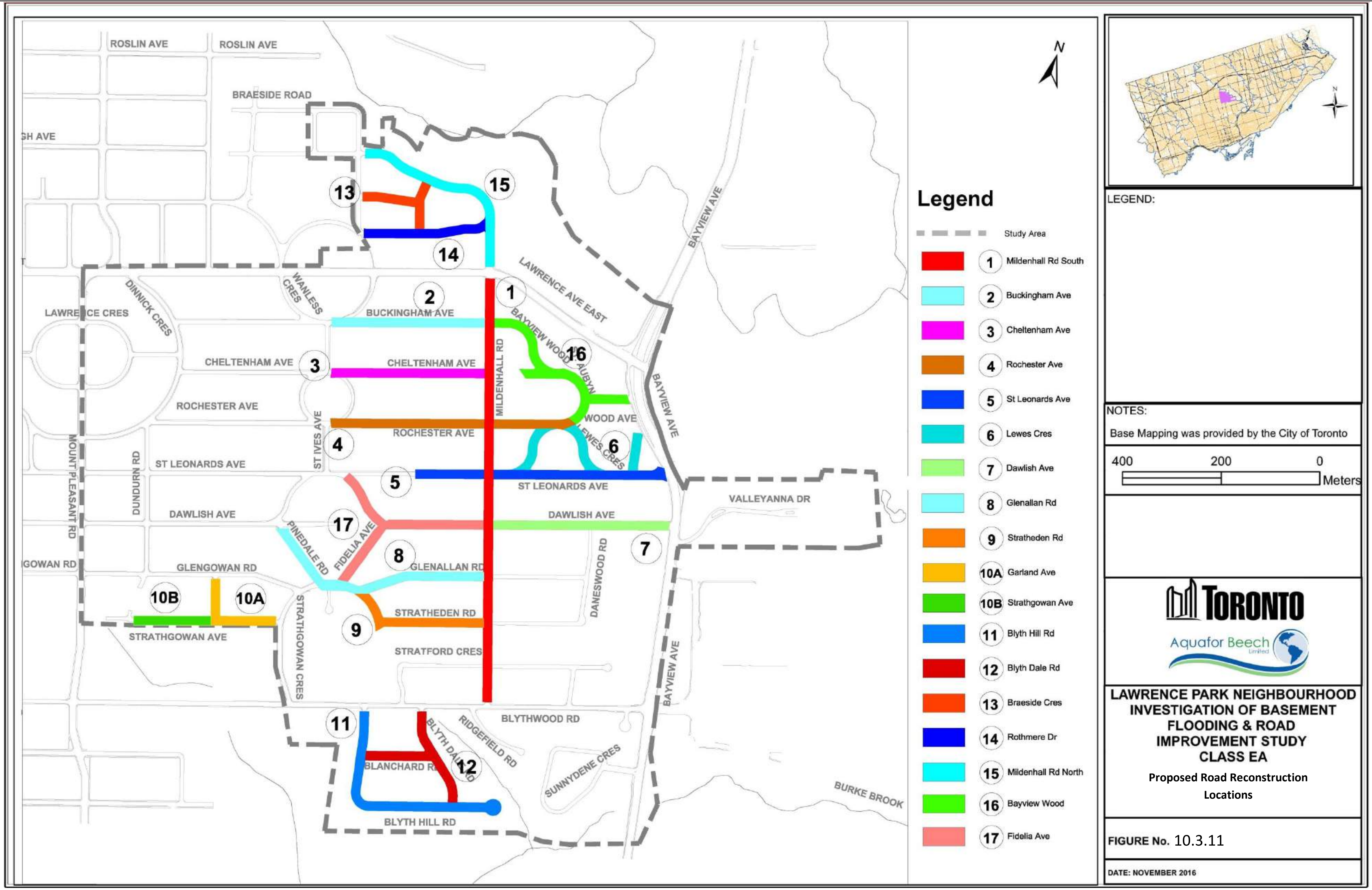
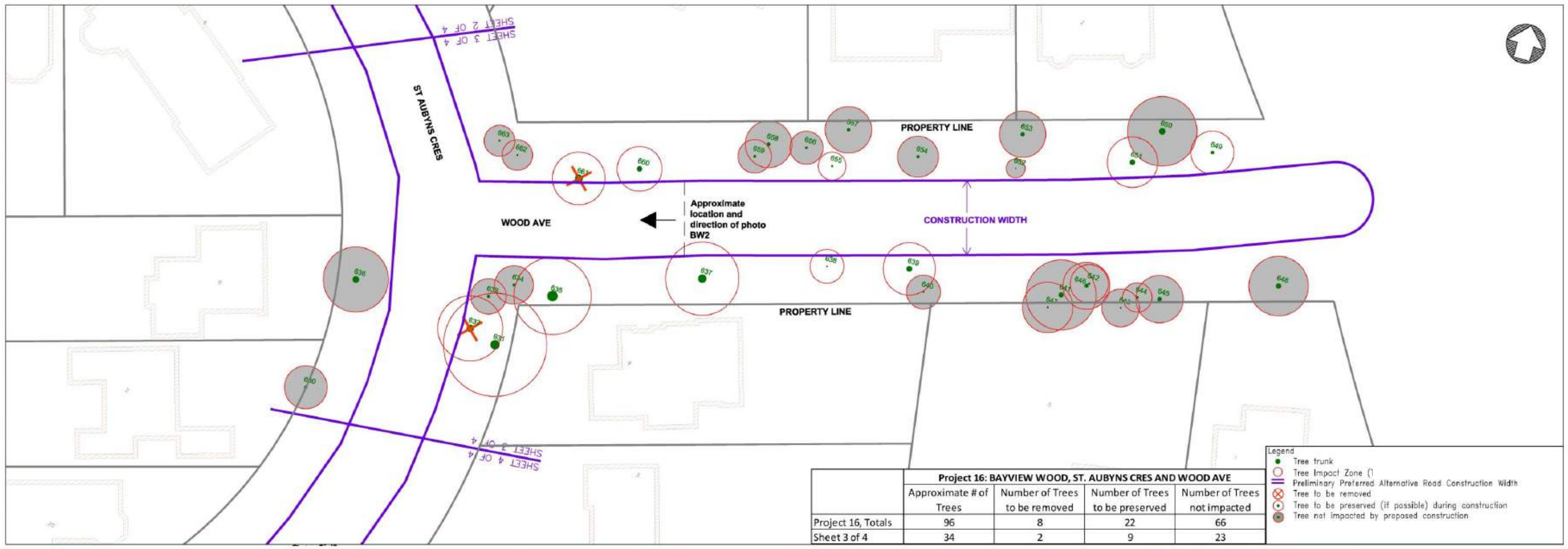


Figure 10.3.11 – Proposed Road Reconstruction Locations



	Project 16: BAYVIEW WOOD, ST. AUBYNS CRES AND WOOD AVE			
	Approximate # of Trees	Number of Trees to be removed	Number of Trees to be preserved	Number of Trees not impacted
Project 16, Totals	96	8	22	66
Sheet 3 of 4	34	2	9	23

Trees to be removed

Tree No	Tree Species		Condition	Diameter (cm)
632	QUERCUS RUBRA	Red Oak	ModHigh	74
661	QUERCUS RUBRA	Red Oak	ModHigh	78

Trees to be preserved (if possible)

Tree No	Tree Species		Condition	Diameter (cm)
649	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	Moderate	33
651	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	High	54
655	SORBUS AUCUPARIA	Mountain Ash	ModHigh	16
660	TILIA CORDATA	Littleleaf Linden	High	53
631	QUERCUS RUBRA	Red Oak	ModHigh	95
635	QUERCUS RUBRA	Red Oak	High	109
637	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	85
638	THUJA OCCIDENTALIS	Eastern White Cedar	ModHigh	12
639	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	55

Trees not Impacted

Tree No	Tree Species		Condition	Diameter (cm)
630	ACER PLATANOIDES	Norway Maple	ModHigh	31
636	ACER PLATANOIDES	Norway Maple	ModHigh	65
633	ACER PLATANOIDES	Norway Maple	ModHigh	29
634	ACER PLATANOIDES	Norway Maple	ModHigh	24
640	PICEA ABIES	Norway Spruce	ModHigh	12
641	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	Moderate	51
642	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	21
643	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	14
644	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	22
645	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	Moderate	42
647	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	16
648	ACER PLATANOIDES	Norway Maple	High	53
650	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	ModHigh	65
652	AMELANCHIER LAEVIS	Smooth Serviceberry	ModHigh	9
653	ACER RUBRUM	Red Maple	Low	39
654	ACER PLATANOIDES	Norway Maple	Moderate	30
656	ACER PLATANOIDES	Norway Maple	ModHigh	23
657	BETULA PAPYRIFERA	Paper Birch	Moderate	31
658	BETULA PAPYRIFERA	Paper Birch	ModHigh	34
659	BETULA PAPYRIFERA	Paper Birch	ModHigh	27
662	PICEA OMORIKA	Serbian Spruce	ModHigh	15
663	PICEA OMORIKA	Serbian Spruce	ModHigh	18
646	ACER SACCHARUM SSP SACCHARUM	Sugar Maple	Moderate	38

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TORONTO Engineering & Construction Services

JOHN P. KELLY, P.ENG. Director, Design & Construction Linear Underground Infrastructure

MICHAEL D'ANDREA, P.ENG. EXECUTIVE DIRECTOR Engineering & Construction Services

Manager, Design & Construction Linear Underground Infrastructure Basement Flooding Protection Program

16 BAYVIEW WOOD, ST. AUBYNS CRES AND WOOD AVE

City of Toronto

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Figure 10.3.12 – Tree Report for Wood Avenue

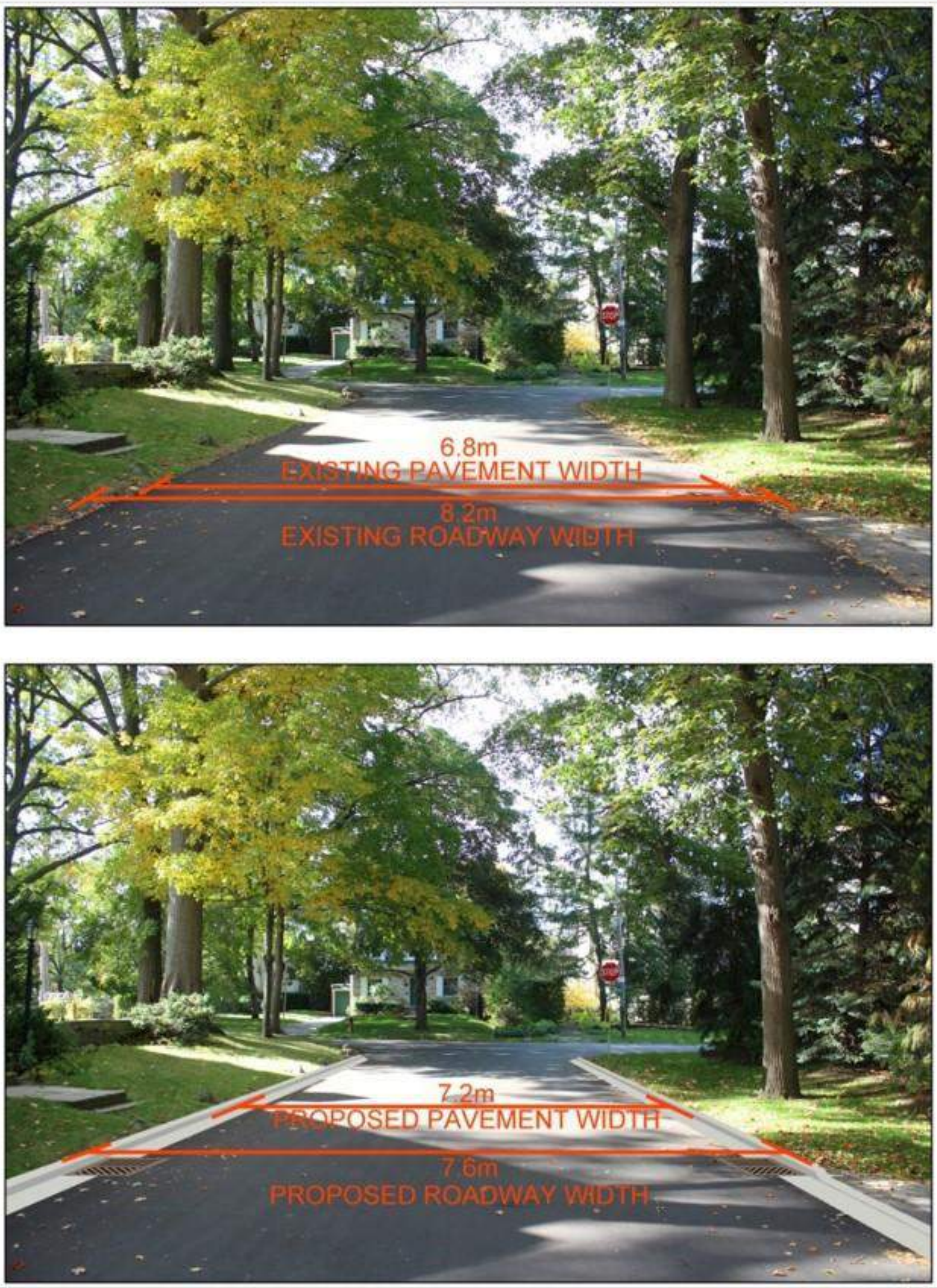
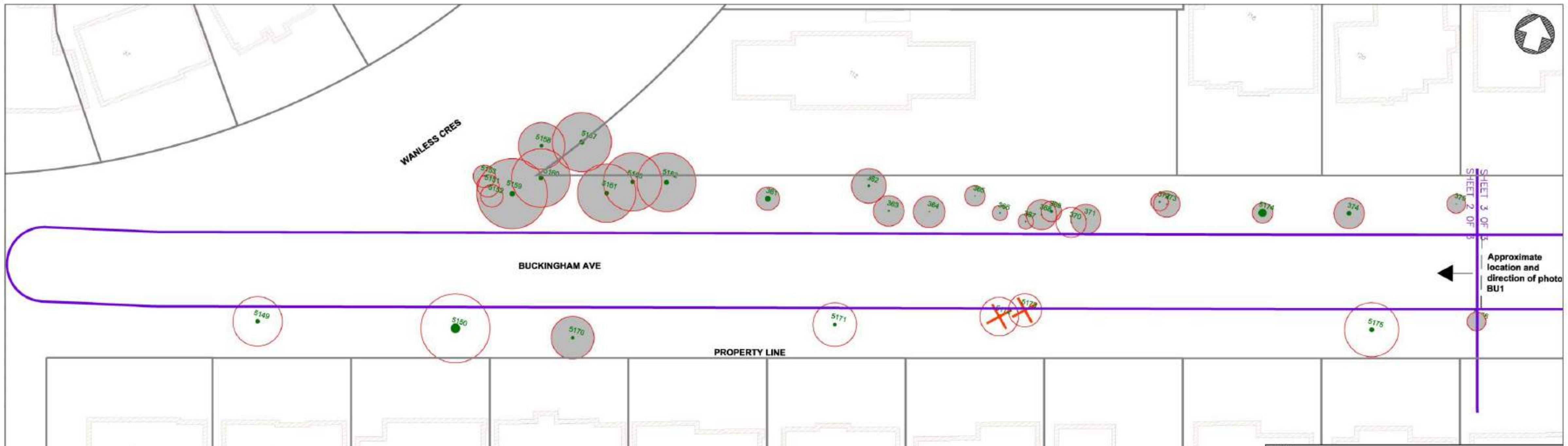


FIGURE BW2
ILLUSTRATION OF EXISTING AND PROPOSED ROAD DIMENSIONS - **WOOD AVENUE**

Figure 10.3.13 – Illustration of Existing and Proposed Road Dimensions on Wood Avenue



	Project 2: BUCKINGHAM AVE			
	Approximate # of Trees	Number of Trees to be removed	Number of Trees to be preserved	Number of Trees not impacted
Project 2, Totals	59	7	9	43
Sheet 1 of 3	34	2	5	27

Legend
- Tree trunk
- Tree Impact Zone
- Preliminary Preferred Alternative Road Construction Width
- Tree to be removed
- Tree to be preserved (if possible) during construction
- Tree not impacted by proposed construction

Trees to be removed

Tree No	Tree Species		Condition	Diameter (cm)
5172	ACER PLATANOIDES	Norway Maple	ModHigh	43
5173	ACER PLATANOIDES	Norway Maple	ModHigh	25

Trees to be preserved (if possible)

Tree No	Tree Species		Condition	Diameter (cm)
370	MORUS ALBA	White Mulberry	Low	8
5149	PICEA PUNGENS GLAUCA	Colorado Spruce	ModHigh	44
5150	ACER PLATANOIDES	Norway Maple	ModHigh	100
5171	GLEDITSIA TRIACANTHOS VAR INERMIS	Smooth Honeylocust	ModHigh	31
5175	TILIA CORDATA	Littleleaf Linden	ModHigh	46

Trees not Impacted

Tree No	Tree Species		Condition	Diameter (cm)
5151	PICEA OMORIKA	Serbian Spruce	ModHigh	5
5152	PICEA OMORIKA	Serbian Spruce	ModHigh	6
5153	PICEA OMORIKA	Serbian Spruce	ModHigh	7
5157	FRAXINUS PENNSYLVANICA	Green Ash	Moderate	50
5158	FRAXINUS PENNSYLVANICA	Green Ash	Low	33
5159	FRAXINUS PENNSYLVANICA	Green Ash	Low	54
5160	FRAXINUS PENNSYLVANICA	Green Ash	ModHigh	44
5161	FRAXINUS PENNSYLVANICA	Green Ash	ModHigh	42
5162	BETULA PAPYRIFERA	#N/A	Moderate	49
5163	FRAXINUS PENNSYLVANICA	Green Ash	Moderate	42
5170	TILIA CORDATA	Littleleaf Linden	ModHigh	31
5174	QUERCUS ALBA	White Oak	ModHigh	84
5176	FAGUS SYLVATICA ATROPUNICEA	Copper Beech	ModHigh	5
361	GLEDITSIA TRIACANTHOS VAR INERMIS	Smooth Honeylocust	High	57
362	ABIES CONCOLOR	White Fir	ModHigh	22
363	CELTIS OCCIDENTALIS	Hackberry	ModHigh	16
364	MORUS ALBA	White Mulberry	Low	8
365	MORUS ALBA	White Mulberry	Low	6
366	MORUS ALBA	White Mulberry	Low	8
367	MORUS ALBA	White Mulberry	Low	9
368	ACER PLATANOIDES	Norway Maple	Low	12
369	FRAXINUS PENNSYLVANICA	Green Ash	Moderate	26
371	ACER PLATANOIDES	Norway Maple	Low	10
372	ACER NEGUNDO	Manitoba Maple	Moderate	14
373	ACER PLATANOIDES	Norway Maple	Low	10
374	GLEDITSIA TRIACANTHOS VAR INERMIS	Smooth Honeylocust	ModHigh	44
375	PYRUS CALLERYANA GLENS FORM	Chanticlear Pear	Moderate	6

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Aquafor Beech Limited

No. | DATE | REVISIONS | INITIAL | SIGNED

TORONTO Engineering & Construction Services

MICHAEL D'ANDREA, P.ENG.
EXECUTIVE DIRECTOR
Engineering & Construction Services

JOHN P. KELLY, P.ENG.
Director, Design & Construction
Linear Underground Infrastructure

Manager, Design & Construction
Linear Underground Infrastructure
Basement Flooding Protection Program

② BUCKINGHAM AVE
City of Toronto

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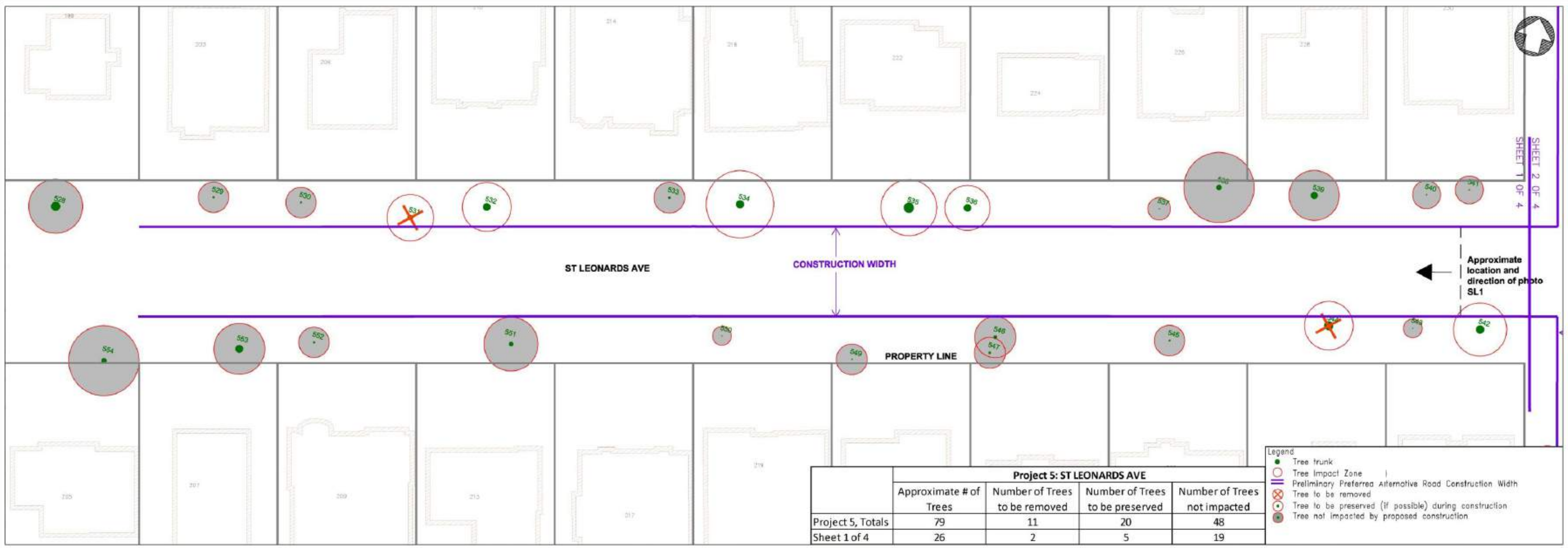
Figure 10.3.14 – Tree Report for Buckingham Avenue

FIGURE BU1
ILLUSTRATION OF EXISTING AND PROPOSED ROAD DIMENSIONS - **BUCKINGHAM AVE**

Figure 10.3.15 – Illustration of Existing and Proposed Road Width on Buckingham Avenue



	Project 5: ST LEONARDS AVE			
	Approximate # of Trees	Number of Trees to be removed	Number of Trees to be preserved	Number of Trees not impacted
Project 5, Totals	79	11	20	48
Sheet 1 of 4	26	2	5	19

Trees to be removed

Tree No	Tree Species		Condition	Diameter (cm)
544	ACER SACCHARINUM	Silver Maple	ModHigh	94
531	SALIX SP	Willow sp.	Moderate	52

Trees to be preserved (if possible)

Tree No	Tree Species		Condition	Diameter (cm)
542	ACER PLATANOIDES	Norway Maple	ModHigh	86
532	ACER PLATANOIDES	Norway Maple	Moderate	77
534	ACER PLATANOIDES	Norway Maple	High	82
535	ACER SACCHARINUM	Silver Maple	ModHigh	105
536	ACER SACCHARINUM	Silver Maple	High	76

Trees not impacted

Tree No	Tree Species		Conditions	Diameter (cm)
545	SYRINGA RETICULATA IVORY SILK	Japanese Tree Lilac	ModHigh	17
546	ACER PALMATUM	Japanese Maple	ModHigh	32
547	PICEA PUNGENS GLAUCA	Colorado Spruce	ModHigh	22
549	GLEDITSIA TRIACANTHOS VAR INERMIS	Smooth Honeylocust	ModHigh	9
550	GINKGO BILOBA	Ginkgo	ModHigh	6
551	PICEA PUNGENS GLAUCA	Colorado Spruce	ModHigh	43
552	GINKGO BILOBA	Ginkgo	ModHigh	14
553	ACER PLATANOIDES	Norway Maple	ModHigh	80
554	ABIES CONCOLOR	White Fir	High	52
543	ACER SACCHARINUM	Silver Maple	ModHigh	6
537	AMELANCHIER LAEVIS	Smooth Serviceberry	ModHigh	8
538	GLEDITSIA TRIACANTHOS VAR INERMIS	Smooth Honeylocust	High	52
539	TILIA CORDATA	Littleleaf Linden	High	71
540	LIRIODENDRON TULIPIFERA	Tulip Tree	ModHigh	8
541	LIRIODENDRON TULIPIFERA	Tulip Tree	ModHigh	8
533	SYRINGA RETICULATA IVORY SILK	Japanese Tree Lilac	ModHigh	19
528	ACER SACCHARINUM	Silver Maple	Moderate	94
529	SYRINGA RETICULATA IVORY SILK	Japanese Tree Lilac	ModHigh	14
530	ACER SACCHARINUM	Silver Maple	ModHigh	14

TORONTO Engineering & Construction Services

Consultants: Aquafor Beech Limited

No. | DATE | REVISIONS | INITIAL | SIGNED

JOHN P. KELLY, P.ENG. Director, Design & Construction Linear Underground Infrastructure

MICHAEL D'ANDREA, P.ENG. EXECUTIVE DIRECTOR Engineering & Construction Services

Manager, Design & Construction Linear Underground Infrastructure Basement Flooding Protection Program

(5) ST LEONARDS AVE
City of Toronto
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Figure 10.3.16 – Tree Report for St. Leonard's Avenue

FIGURE SL1
ILLUSTRATION OF EXISTING AND PROPOSED ROAD DIMENSIONS - **ST LEONARDS AVE**

Figure 10.3.17 – Illustration of Existing and Proposed Road Width for St. Leonard's Avenue

10.3.5.2 Localized Road Narrowing and Shifting of the Road

Efforts will be made at the detail design stage to narrowing the roadway at locations where additional efforts are required to protect existing street trees. This may occur in areas where one or more significant trees exist and where additional efforts should therefore be undertaken. In these situations localized narrowing of the road to a minimum of 6.6 m would be carried out. Due to the narrowing of the road parking would not be allowed within the narrowed section of the roadway. **Figure 10.3.18** illustrates the concept of localized road narrowing. As it is shown on the figure, a section of the road has been narrowed from 7.2 m to 6.6 m. The top right photo illustrates the loss of trees using the conventional road width (7.2 m) while the lower right photo illustrates the preservation of trees using a narrower road width (6.6 m). As noted above, the extent and location where roadway narrowing will be undertaken at the design stage in consultation with local residents.

Efforts will also be made to localized shifting of the road at select locations within the study area. Shifting of the road (the width would still remain at 7.2 m) would be utilized in locations where a significant number of trees are located along one side of the road while the other side has less vegetation. **Figure 10.3.19** illustrates the concept of shifting the road to protect existing trees. It shows an existing road together with Photoshopped images to illustrate the objective of shifting a road to protect existing vegetation. The top right photo shows the impact on existing trees if a conventional alignment is used. The bottom right photo illustrates the benefit of shifting the alignment and therefore protecting existing trees on the right side of the road. The extent and location where roadway narrowing will be undertaken at the design stage in consultation with local residents.

10.3.5.3 Tree Protection Techniques

Potential construction impacts to trees can be mitigated through adherence to Best Management Practices (BMPs) before, during, and after construction. The City of Toronto has recently updated their *Tree Protection Policy and Specifications for Construction Near Trees* guidelines (City of Toronto, July 2016). Unless site-specific considerations preclude it, tree protection measures are to be in accordance with this City guideline or subsequent update(s). The subsections below outline key recommended BMPs for the three phases of construction. Cooperation between construction staff, the City's forestry staff, and the project arborist (who is part of the construction contractor team) will be required during all three construction phases. It is further recommended that all construction phases, including aftercare, be supervised by the project arborist.

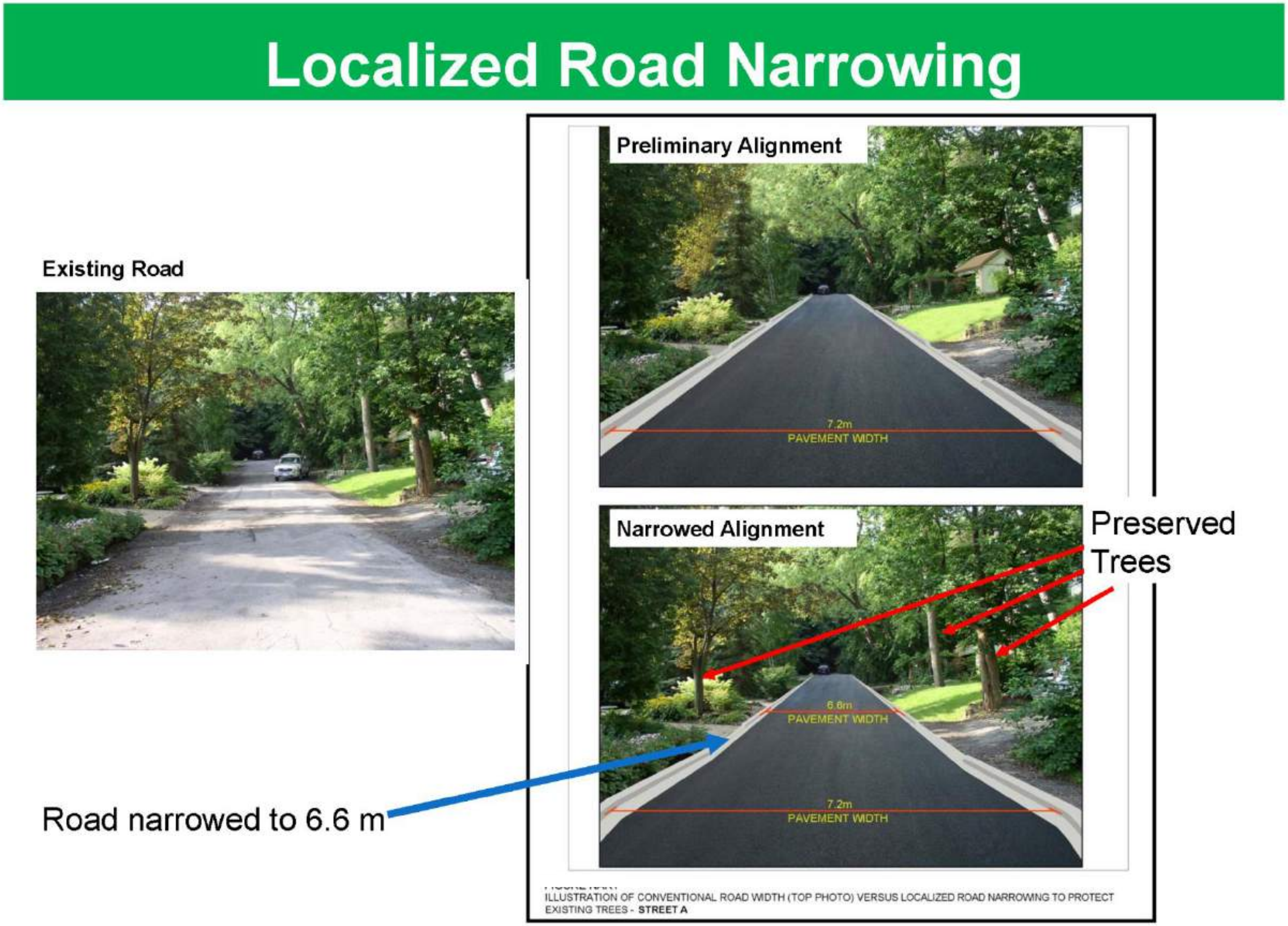

Figure 10.3.18 – Localized Road Narrowing

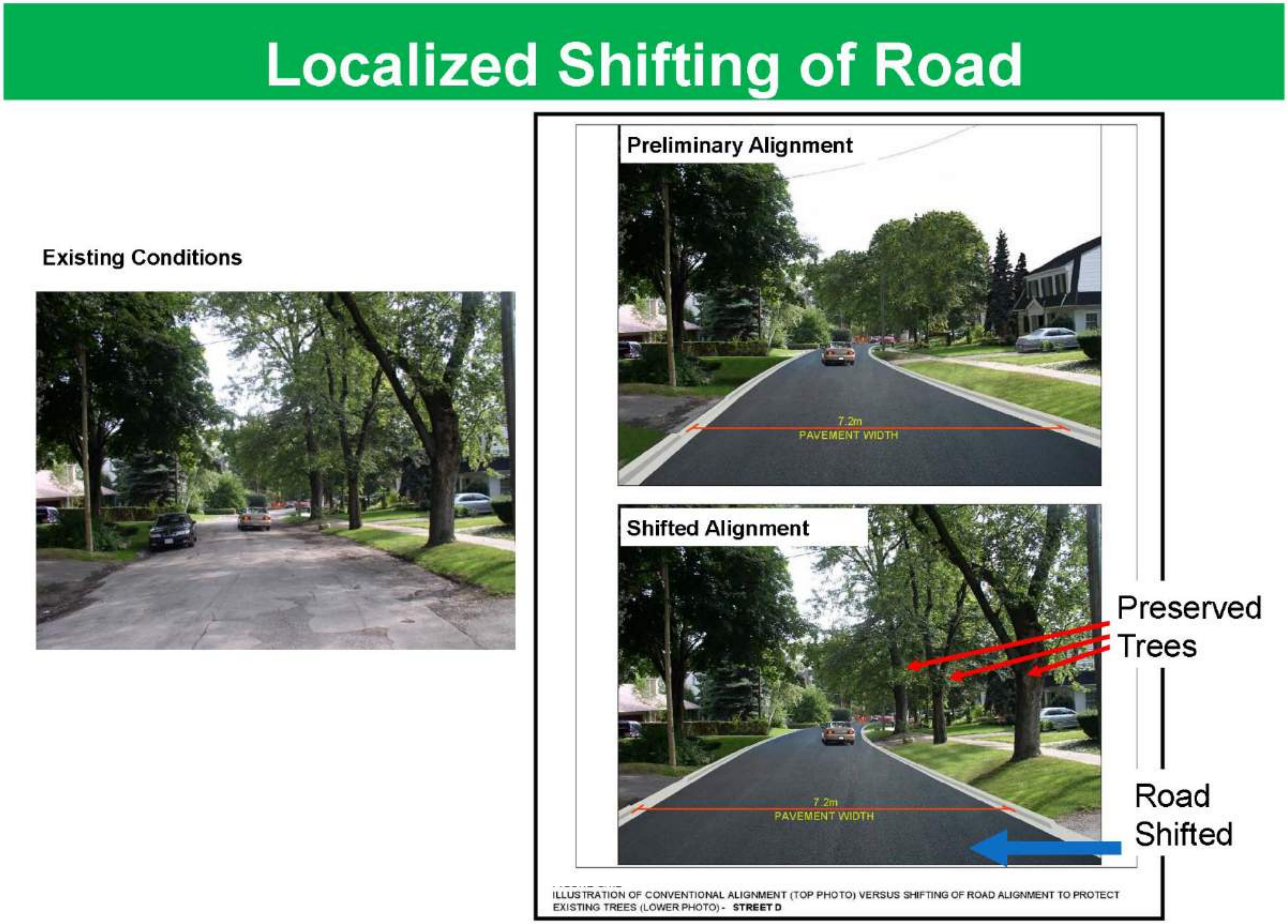

Figure 10.3.19 – Localized Road Shifting

Detailed Design/Pre-Construction Phase

Tree protection measures are to be incorporated into detailed construction design drawings and specifications, shall be fully implemented prior to construction, and will be subject to inspection and approval by the City and the project arborist.

In consultation with property owners in the Lawrence Park Neighbourhood, the City will undertake a Proactive Tree Planting Program to plant 100 new street trees within the municipal right-of-way prior to construction. The program will involve identifying potential locations and species type. This program will assist in allowing the new trees to become well established ahead of the proposed construction. During construction trees that are removed (99) will also be replaced with a new tree. Tree removals within the ravine areas will be subject to a 3:1 replacement ratio, while street trees removals will be subject to a 1:1 replacement ratio.

Prior to construction, in order to protect extant trees, tree protection fencing consisting of plywood hoarding or orange plastic webbing will be erected per City standards along the perimeter of the Tree Protection Zone (TPZ)*. Exceptions include cases where the TPZ extends into existing infrastructure such as roads or driveways, in which case tree protection fencing will be placed as far away from the tree as is feasible (e.g. at the edge of existing infrastructure). To protect the root zone, trunk, and lower branches; no activities are permitted inside the tree protection fencing. If, due to site specific constraints, protection within the TPZ cannot be accommodated, trees will be assessed on an individual basis by the City and the project arborist for horizontal root protection (**Figure 10.3.20**, to be used to prevent root compaction in a non-excavation situation), which can include but not necessarily be limited to: a) application of wood chip mulch; b) placement of plywood over wood chip mulch; c) application of gravel over geotextile fabric; and/or d) placement of road mats over wood chip mulch. In rare cases where trees may not have tree hoarding along the entire perimeter of the TPZ, trunk protection measures may be employed to avoid mechanical damage to trunks (see **Figure 10.3.21**). The installation of the tree protection fencing will be supervised by the project arborist (who is a member of the construction contract team).

Furthermore, if low-hanging branches impede the movement of construction equipment/vehicles, it is recommended that branches be pruned according to accepted arboricultural methods prior to the construction phase. This practice is commonly referred to a ‘crown cleaning’ or ‘crown raising’, and reduces the potential for hazards associated with branch failures. It should be noted that branch removal for purposes other than the maintenance/health of a tree is considered an injury under the Ravine and Natural Feature Protection by-law. As such, the need to remove branches of trees on lands subject to the by-law to accommodate construction vehicles should be identified on a tree protection plan (TPP) and in an arborist report. This work can be completed at the detailed design phase.

* As detailed in Section 2.4.6, the Tree Impact Zone (TIZ) is an individualized zone of tree protection that, unlike the tree protection zone (TPZ), does not solely rely on the diameter-at-breast height of the tree to determine the minimum distance tree protection fencing ought to be from a tree. Rather, the TIZ for each tree was determined by the City of Toronto Forestry Department staff and an Aquafor Beech Arborist and took into account tree tolerance to disturbance based on species, age, and health; as well as the location of existing infrastructure (e.g. roads, sidewalks, etc.). At the direction of the City of Toronto, the term TPZ is to be used in the implementation section of this report (Section 10.3.5.3) so that the language is consistent with other projects.

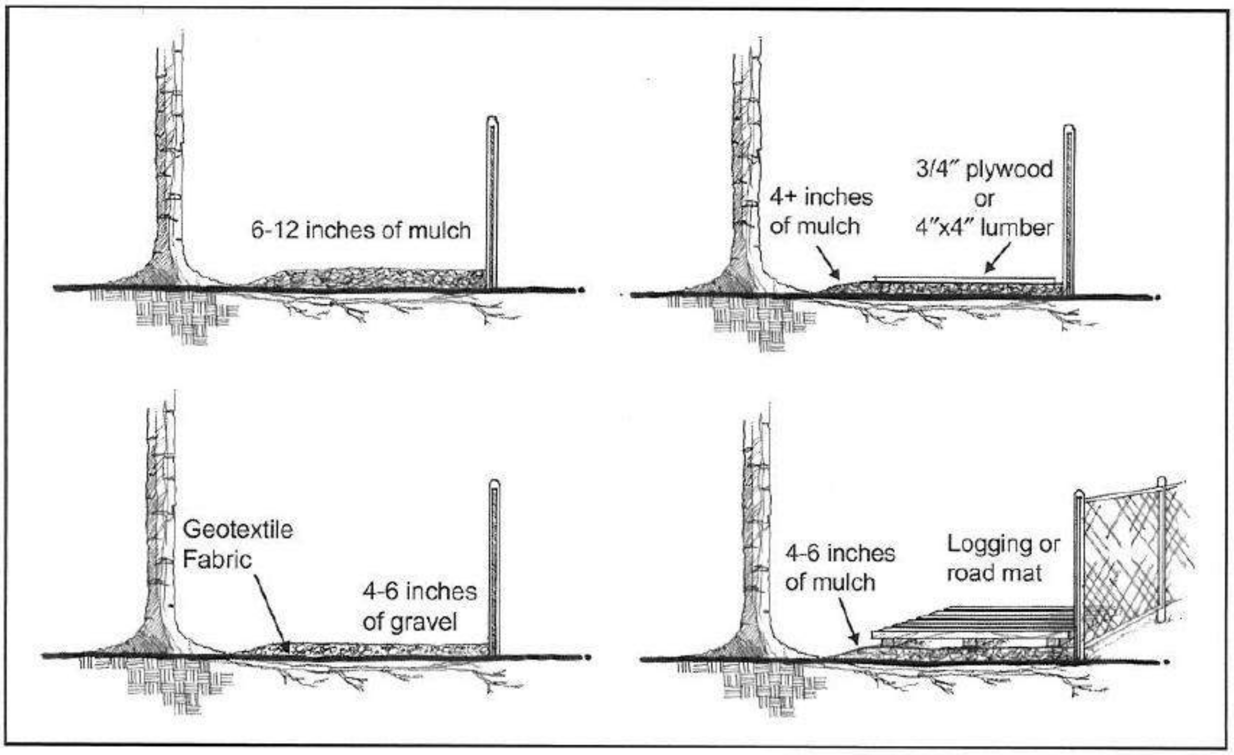

Figure 10.3.20 – Horizontal root protection options (from Fite and Smiley, 2008)

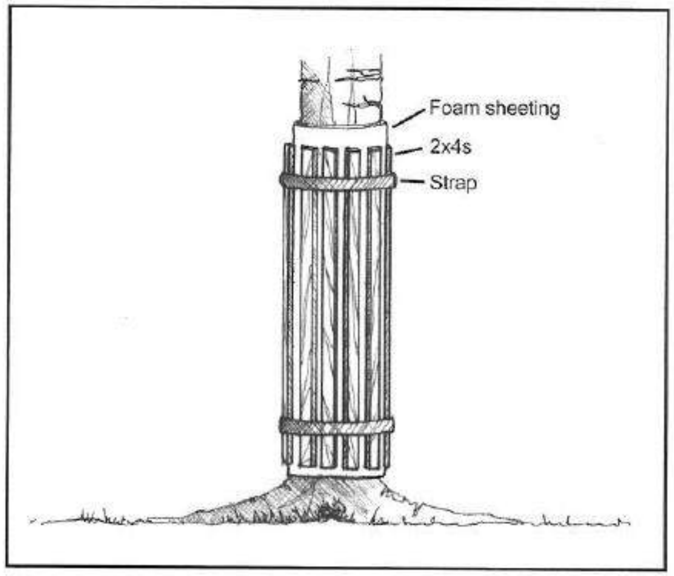

Figure 10.3.21 – Trunk protection structure (from Fite and Smiley, 2008)

One of the primary concerns during construction is minimizing damage to tree roots that extend outside of the TPZ. Excavation techniques that minimize impacts to roots include hand, pneumatic (air), and hydraulic excavation techniques (**Figure 10.3.22**) (provided that adequate pressure is used). Excavation around tree roots allows for City staff, the project arborist, and construction supervisor to assess if it is possible to work around tree roots and to refine the location of tree protection fencing as needed. In some cases, minor changes to the construction design may be made following root exploration exercises.

In cases where targeted root pruning is required; clean, flat cuts should be made with appropriate equipment such as loppers, hand saw, circular saw, or chain saw (Fite and Smiley, 2008; Matheny and Clark, 1998). Where possible, it is recommended that roots be pruned to the nearest lateral root (Matheny and Clark, 1998), and that cuts to roots close to the trunk of the tree, especially structural roots, be avoided is possible. Inert backfill material deposited into excavated areas should be porous enough to allow for adequate water infiltration and new root growth. As such, the use of heavy clays and compaction of backfill is not recommended. The bulk density of the backfilled soil should closely match that of undisturbed native soil to the extent feasible and should not meet or exceed the root-limiting bulk densities listed in **Table 10.3.1** below.

Table 10.3.1– Root-limiting bulk density values according to soil texture (from Coder, 2007).

soil texture	root-limiting bulk density (g/cc)
sand	1.8 g/cc
fine sand	1.75
sandy loam	1.7
fine sandy loam	1.65
loam	1.55
silt loam	1.45
clay loam	1.5
clay	1.4

Figure 10.3.22 – Pneumatic (left, photo: djc.com) and hydraulic (right, photo: Ruskins.co.uk) excavation techniques minimize damage to tree roots.

<u>During Construction Phase</u>

Tree care during construction shall consist of a regular irrigation regime, pest inspections, and tree injury/stress inspections. Regardless of irrigation frequency irrigation should penetrate the soil to the depth of the tree roots; generally, the upper 15-45 cm of soil within the TPZ and surrounding areas if possible (Fite and Smiley, 2008). If drought conditions are anticipated, 5-10 cm of organic mulch may be applied within the TPZ to conserve soil moisture, subsequent to an initial watering. The use of mulch may require additional irrigation to penetrate the mulch and soil to an adequate depth.

When stressed, some trees are more susceptible to infestation by insect and fungal pests. Should the project arborist notice signs of infestation, immediate action should be taken to eliminate the pest(s) and prevent its spread. Similarly, tree injuries (e.g. bark wound) and other potentially significant stresses should be remediated immediately and recorded for follow-up maintenance and monitoring purposes.

The preferred construction methodology to be used where proposed works are within and adjacent to parks and natural areas is jack-and-bore, as it is the least impactful to trees. It is recommended that this methodology be employed where technically feasible.

Post-Construction Phase

The post-construction phase entails a regular adaptive monitoring program which will identify changes in tree health and structure, evaluate the efficacy of pest and tree injury treatment measures employed during construction, and evaluate the efficacy tree aftercare measures. It is recommended that the monitoring be included as part of the construction project and undertaken by the project arborist to ensure project continuity. A re-assessment and associated arborist report is to be completed prior to the commencement of the post-construction monitoring, and be used as a comparison point between pre-construction conditions as well as future conditions. The monitoring shall apply to extant trees as well as newly-planted trees. Should changes to tree health and/or structure be detected, remedial treatments should be recommended and implemented as soon as possible. Tree aftercare includes a long-term maintenance program that consists of, but is not necessarily limited to, regular irrigation, aeration of compacted soils, pest management, and mulching (**Figure 10.3.23**). Fertilization should be utilized on an as-needed basis and is not recommended for at least one year post construction.

Tree protection fencing/hoarding and, if applicable, horizontal root protection measures are to be removed once the construction phase is completed.

Figure 10.3.23 – Tree monitoring and aftercare

10.3.5.4 Storm Sewer Works

Storm sewer works will mostly be confined within the road right-of-way will be coordinated with planned road reconstruction within the 18 locations.

As previously mentioned, the preferred construction methodology to be used where proposed works are within and adjacent to parks and natural areas is jack-and-bore, as it is the least impactful to trees and other vegetation. It is recommended that this methodology be employed where technically feasible.

Site 1 – 101 Mildenhall Road

The existing Site 1 outlet pipe runs east from Mildenhall Road via an existing easement along the north side of the Toronto French School and into the ravine conveying flows to the outfall at the West Don River.

According to City records, this easement allows for the upgrade and maintenance of the sewer works.

The proposed upgrade also involves the replacement and upgrade of sewer works in the ravine that is currently in a state of disrepair and causing extensive erosion (see **Figure 10.3.24**). Replacement of the outfall will also be required to accommodate the larger diameter pipe. In-water works will require the procurement of a permit from the TRCA.

Construction Impacts to Natural Heritage

The vegetation assessment completed by Aquafor Beech Limited. has identified a mature sugar maple forest on the valley slopes and mature hemlock forest and cultural communities within the valley and floodplain of the Don River. Potential impacts to vegetation communities resulting from vegetation removals to accommodate the proposed sewer upgrade and construction access road will be mitigated through a re-vegetation/restoration plan developed in consultation with the City of Toronto and the Toronto and Region Conservation Authority. At a minimum, trees will be replaced at a 3:1 ratio and efforts will be made to improve wildlife habitat through the provision of habitat structures, plantings, etc. Trees to be protected during construction will be subject to the provisions of the City of Toronto's *Tree Protection Policy and Specifications for Construction Near Trees* guidelines (City of Toronto, July 2016), or subsequent update. As part of the detailed design phase, the study team will explore options to minimize the disturbance to the valley, including but not limited to the use of jack and bore/tunneling options, avoidance of sensitive biological timing windows, etc. An erosion and sediment control plan will also be developed.

During field investigations within the valley at Site 1, it was discovered that the existing sewer pipe had been undermined and there was significant erosion in a tributary to the Don River (**Figure 10.3.24**). In addition to sewer upgrades, the study team will be exploring options to mitigate existing erosion in the tributary near the sewer manhole in the valley which will eliminate ongoing tree losses due to erosion, as well as improve water quality and fish habitat in the Don River.

Figure 10.3.24 – Undermined Sewer Pipe Causing Erosion at Site 1

<u>Site 2 – 2275 Bayview Avenue</u>

The existing outlet pipe conveying flows from Area 2 is proposed to be upgraded across the intersection of Bayview Avenue and St. Leonard's Avenue through the York University Glendon Campus and into the ravine to the north. There is currently no existing easement through the Glendon Campus. Confirmation of an easement will require potential negotiations.Bayview Avenue is an arterial road that must remain open during construction. Upgrade of this storm sewer will require jack and bore under Bayview Avenue to mitigate traffic impacts.

Construction Impacts to Natural Heritage

The preliminary vegetation assessment completed by Aquafor Beech Limited. has identified maple forest on valley slopes and cultural woodland communities within tableland areas. Potential impacts to vegetation communities resulting from vegetation removals (approximately a 6m wide corridor along an existing pathway, see **Figure 10.3.25**) to accommodate the proposed sewer upgrade and construction access road will be mitigated through a revegetation/restoration plan developed in consultation with the City of Toronto and the Toronto and Region Conservation Authority. At a minimum, trees will be replaced at a 3:1 ratio and efforts will be made to improve wildlife habitat and remove exotic invasive species where possible. Trees to be protected during construction will be subject to the provisions of the City of Toronto's *Tree Protection Policy and Specifications for Construction Near Trees* guidelines (City of Toronto, July 2016), or subsequent update. Given that there are existing cleared areas along the sewer line and at potential site access/staging areas, it is anticipated that vegetation removals at Site 2 will be minimal.

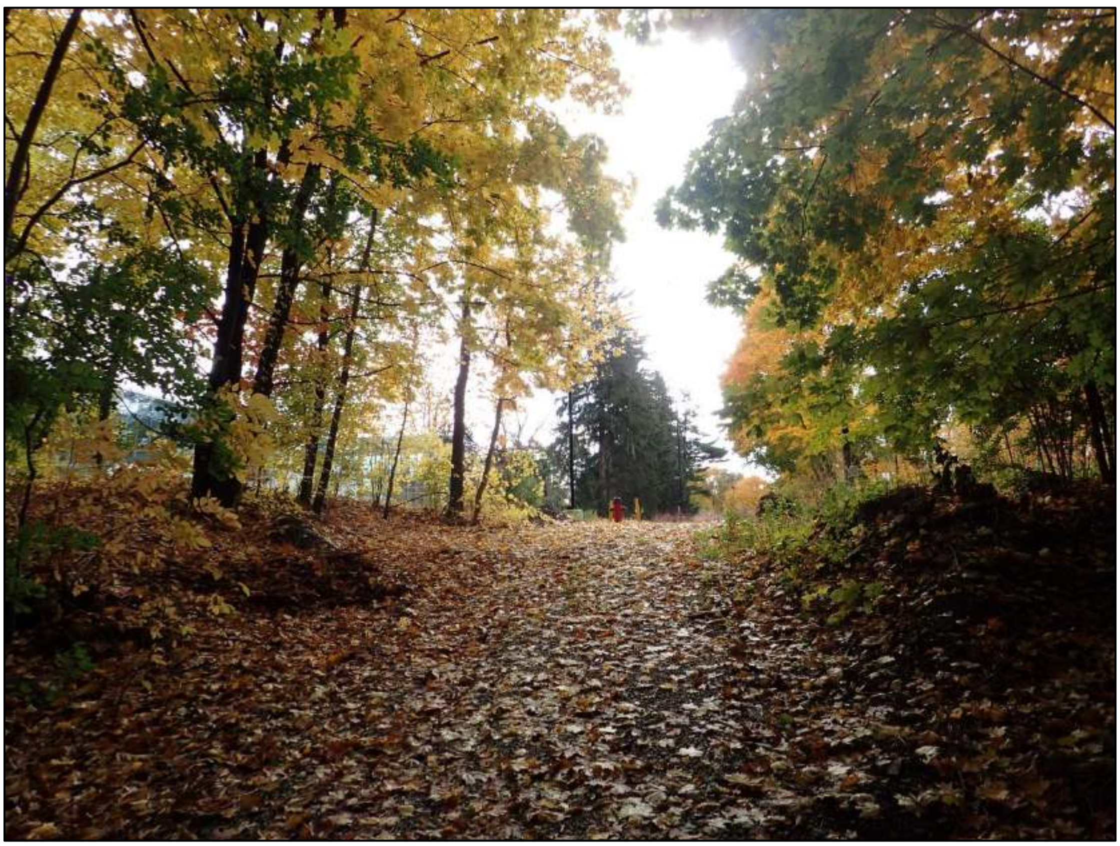

Figure 10.3.25 – Existing Pathway at Site 2, photo taken facing south towards York University Glendon Campus Driveway

Site 4 – Strathgowan Crescent to Strathgowan Avenue West Limit

New storm sewers are proposed to be laid conveying stormwater from the upstream low point to the open channel at the west limit of Strathgowan Avenue. The proposed works will require construction of the outlet pipe through parkland along the south side of Strathgowan Avenue near the west limit.

A 200 m section of deep storm sewer is part of the proposed works. The deep section of sewer will require jack and boring to a maximum depth of 16 m. At a minimum, two access pits will be required: one Strathgowan Crescent at Strathgowan Avenue and the other on Strathgowan Avenue upstream of the west limit.

Construction Impacts to Natural Heritage

The preliminary vegetation assessment completed by Aquafor Beech Limited. has identified parkland (Blythwood Ravine Park) and cultural woodland communities within the valley, and red oak and exotic maple forests on valley slopes. Potential impacts to cultural woodland consist of vegetation removals and/or impacts within the footprint of open pits dug to accommodate tunnelling. It is important to note that this construction method results in less impact to natural heritage features than an open cut corridor method. At the detailed design stage, efforts will be made to locate the tunnel pit outside of woodland areas if possible; there is an existing park space near the storm sewer outfall which consists of mown grass and planted trees (see **Figure 10.3.26**) which is the recommended location for the jack and bore pit (should that construction method be used). Furthermore, it is likely that in-water works will be required. Mitigation for vegetation losses will consists of a re-vegetation/restoration plan developed in consultation with the City of Toronto and the Toronto and Region Conservation Authority. At a minimum, trees will be replaced at a 3:1 ratio and efforts will be made to improve wildlife habitat and remove exotic invasive species where possible. Trees to be protected during construction will be subject to the provisions of the City of Toronto's *Tree Protection Policy and Specifications for Construction Near Trees* guidelines (City of Toronto, July 2016), or subsequent update. In-water works will be subject to a DFO self-assessment in addition to a permit from the TRCA. Standard mitigation measures relating to in-water works such as isolating the work area, rescuing fish within the isolated area, maintaining flow during construction, and proper erosion and sediment control are recommended.

Once the scope of work at Site 4 is at the detailed design phase, it is recommended that the City's Engineering department consult with Parks staff.

Figure 10.3.26 – Blythwood Ravine Park; sewer in foreground, cultural woodland in background, Strathgowan Ave. on left.

10.3.5.5 Sediment and Dust Control

Potential sources for sedimentation related to construction activities include sediments disturbed and deposited by construction vehicles and blowing sand and dust. The following mitigating measures are proposed:

- Place sediment traps to receive storm runoff during construction
- Provide tire washing facilities for construction vehicles that exit the sites
- Install silt fencing along the perimeters of the work sites where appropriate to prevent migration of sediment-laden storm runoff
- Cover exposed excavated material to prevent erosion by rain and wind
- Water or other dust suppressants to be employed during construction to control release of dust particles to the air
- Cover catch basins with filter fabric during construction to prevent the migration of sediments into the conveyance system and ultimately to the watercourses.

Erosion and sediment control plan, and the selection of appropriate measures will be addressed during the detailed design and construction as per the City requirements. Construction projects impacting watercourses and TRCA regulated lands require an erosion and sediment control plan be prepared referencing the Greater Golden Horseshoe Conservation Authorities Erosion and

Sediment Control Guideline for Urban Construction (downloadable from www.sustainabletechnologies.ca).

10.3.5.6 Restoration

All sites/areas disturbed by construction activities will be restored. The proposed

mitigating measures include the following:

- Disturbed sidewalks, roads and parking areas will be restored to their existing conditions after construction;
- Ongoing tree maintenance;
- Invasive species management;

- Removed small trees will be replanted or replaced;
- Disturbed park and natural areas will be restored to their existing conditions; and,
- Disturbance to private properties are to be restored to original conditions or better

10.3.5.7 Noise and Vibration

Truck traffic and construction equipment operation and general construction activities area potential noise and vibration sources. Mitigation measures include:

The City's anti-noise by-law will be enforced for all construction activities;

- Hours of operation during construction activities will be restricted to the hours
- between 7:00 a.m. and 7:00 p.m.;
- Pre-construction survey will be undertaken for houses which may be affected by
- soil vibration during construction activities; and,
- Where rock excavation is required, blasting will not be permitted.

10.3.5.8 Fuel Spills

Fuel spills are likely to occur during the onsite refueling of construction equipment with the potential to contaminate surface and groundwater. Mitigation measures include:

- Refueling in designated areas at a minimum distance of 15 m from a watercourse
- Spill containment for on-site storage tanks
- Spill clean-up contingency plan

10.3.5.9 Traffic

Potential concern includes local traffic disruption during construction due to closed

roads or blockage of driveways. The following mitigating measures are proposed:

- Consultation will be held with the City's Transportation Department to determine which lane(s) of traffic will be maintained or detour utilized to ensure a constant flow of traffic during construction; and
- Homeowners will be notified if temporary blockage to their driveway during construction has to be considered, which will be kept to a minimum. Where possible, alternative short-term parking will be provided.

10.3.5.10 Private Property

Temporary disruptions to private property include access/egress to driveways and potential interruption of water and sanitary services to residences. Due to the maturity of the existing neighbourhood, these impacts can only be managed through a well-managed construction program that will require consultation with the City and the various agencies and liaising between property owners and construction crews. Easements for the proposed storm sewer works are discussed in 10.3.3.

10.3.6 Cost Estimates

10.3.6.1 Unit Cost Estimates

To estimate the capital cost of the recommended remedial measures on a preliminary basis, unit costs were first established. The unit costs are based on the following sources:

- Recent contracts tendered by the City, in the last three years.
- Recent contracts tendered in other Ontario municipalities.
- Unit prices as prepared for the City of Toronto Basement Flooding Program (1-4) being undertaken by the City.

10.3.6.2 Estimate of Probable Costs

Preliminary capital costs were estimated for each of the eighteen (18) locations, plus the storm sewer works related to the outfalls and reconstruction of Glengowan Road and are provided below. Cost estimates for storm sewer outfall works are also provided as a separate line item. The estimated costs take into consideration the additional cost to install storm sewers along

Strathgowan Crescent and Strathogowan Avenue as well as under Bayview Avenue due to the requirement of jack and bore construction. Details of the cost estimates are provided in Appendix I. The costs include an allowance (10%) for engineering design and construction supervision together with a 20% contingency.

The estimated costs for the proposed construction works are provided in **Table 10.3.2**

Table 10.3.2 – Estimated Capital Costs for Road Reconstruction Works and Storm Sewer Outfall Works

Road Reconstruction or Sewer Outfall Number	Estimated Capital Cost
1 - Mildenhall Road South	$ 3,100,000
2 - Buckingham Avenue	$1,400,000
3 - Cheltenham Avenue	$1,500,000
4 - Rochester Avenue	$2,400,000
5 - St Leonards Avenue	$3,900,000
6 - Lewes Crescent	$1,800,000
7 - Dawlish Avenue	$2,900,000
8 - Glenallan Road	$2,600,000
9 - Stratheden Road	$1,800,000
10A - Garland Avenue	$4,000,000
10B - Strathgowan Avenue	$1,200,000
11 - Blyth Hill Road	$4,400,000
12 - Blyth Dale Road	$2,200,000
13 - Braeside Crescent	$1,100,000
14 - Rothmere Drive	$1,400,000
15 - Mildenhall Road North	$2,300,000

Road Reconstruction or Sewer Outfall Number	Estimated Capital Cost
16 - Bayview Wood	$3,200,000
17 - Fidelia Avenue	$1,600,000
Storm Sewer Outfall #1	$900,000
Storm Sewer Outfall #2	$1,900,000
Storm Sewer Outfall #4	$1,000,000
Glengowan Road	$1,600,000
Total Estimated Cost	$48,500,000

10.3.7 Summary of EA Undertakings

For the Roads, Drainage and Pedestrian Safety Projects, the eighteen locations have been grouped into four (4) projects according to the storm sewer system drainage areas and are listed in Table 10.3.4 and illustrated in Figure 10.3.27. The projects include:

- roads to be reconstructed with a 7.2 m pavement width;
- curb and gutter drainage system with new or replacement storm sewers and, where technically and operationally feasible and supported by underground conditions, the installation of a perforated pipe system; and
- a 1.5 m sidewalk on one side of five streets to be reconstructed.

It should also be noted that the preferred solution for Basement Flooding for Glengowan Road is now addressed under the Road Drainage and Pedestrian Safety Projects along with the corresponding cost estimate.

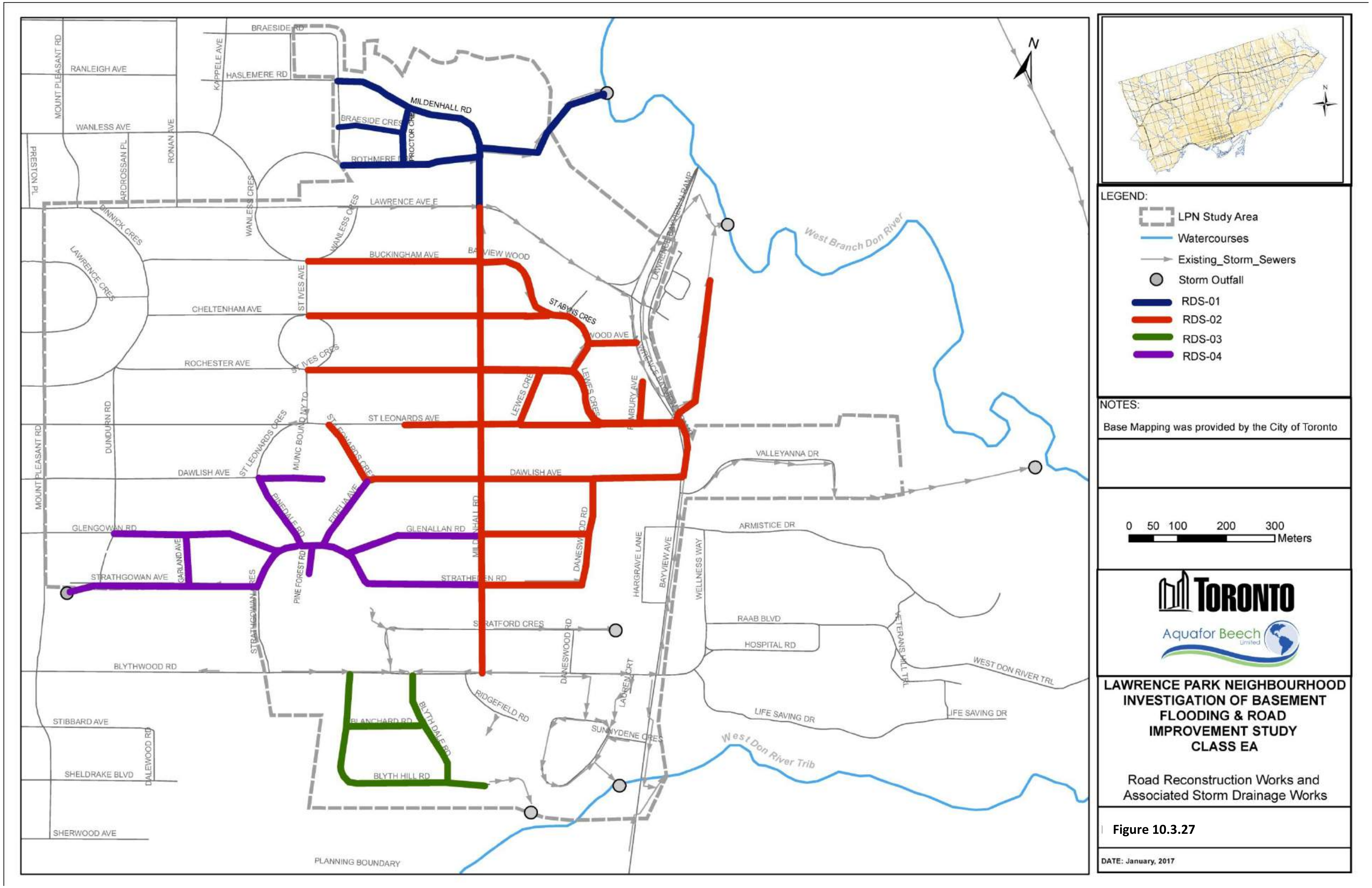

Figure 10.3.27: Preferred Solution: Road Reconstruction Works and Associated Storm Drainage Works

Table 10.3.3: Summary of Preferred Solution – Road Reconstruction Works and Associated Storm Drainage Improvements (Includes Basement Flooding Works)

Project No.	Streets	Recommended Works	Estimated Capital Cost	Class EA Schedule
RDS-01	• Braeside Crescent • Mildenhall Road (north of Rothmere Drive); • Proctor Crescent; • Rothmere Drive	Road reconstruction and replacement of storm sewer	$5,500.000	Schedule 'B'
	• 101 Mildenhall Road (Mildenhall Road through to and including the outfall at the West Don River Tributary)	Replacement of storm sewer and reconstruction of outfall		
RDS-02	• Bayview Wood; • Buckingham Avenue (St. Ives Avenue to Mildenhall Road); Cheltenham Avenue (St. Ives Avenue to and including Cheltenham Park); • Lewes Crescent; • Plembury Avenue; • Rochester Avenue (St. Ives Avenue to Mildenhall Road); • St. Aubyns Crescent; • St. Leonard's Crescent; • St. Leonard's Avenue (east of St. Ives Avenue).	Road reconstruction and addition or replacement of storm sewer	$24,000,000	Schedule 'A+'
	• Dawlish Avenue (St. Leonard's Crescent to Bayview Avenue –); • Glenallan Road (east of Mildenhall Road); • Mildenhall Road (Rothmere Drive to Blythwood Road).	Road reconstruction with sidewalk and addition or replacement of storm sewer		

<table>
<tr><th>Project No.</th><th>Streets</th><th>Recommended Works</th><th>Estimated Capital Cost</th><th>Class EA Schedule</th></tr>
<tr><td rowspan="2"></td><td>• Wood Avenue.</td><td>Road Reconstruction</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>• Bayview Avenue (Dawlish Avenue to St. Leonard's Avenue);
• Daneswood Road;
• St. Ives Crescent (Cheltenham Avenue to Rochester Avenue);
• Stratheden Road (east of Mildenhall Road);
• 2275 Bayview Avenue (York University).</td><td>Addition or replacement of storm sewer</td></tr>
<tr><td>RDS-03</td><td>• Blanchard Road;
• Blyth Dale Road; and
• Blyth Hill Road.</td><td>Road reconstruction and/or addition/replacement of storm sewer</td><td>$6,600,000</td><td>Schedule 'A+'</td></tr>
<tr><td rowspan="3">RDS-04</td><td>• Fidelia Avenue;
• Garland Avenue;
• Stratheden Road (west of Mildenhall Road);
• Strathgowan Avenue.</td><td>Road reconstruction and addition or replacement of storm sewers</td><td rowspan="3">$10,000,000</td><td rowspan="3">Schedule 'B'</td></tr>
<tr><td>• Glenallan Road (west of Mildenhall Road);
• Pinedale Road;
• Strathgowan Crescent (from Strathgowan Avenue to Stratheden Road).</td><td>Road reconstruction with sidewalk and addition or replacement of storm sewer</td></tr>
<tr><td>• Dawlish Avenue (from St. Leonard's Crescent east to the end of the cul-de-sac);
• Glengowan Road (Dundurn Road to Strathgowan Crescent);
• Pine Forest Road.</td><td>Addition or replacement of storm sewers</td></tr>
</table>

Project No.	Streets	Recommended Works	Estimated Capital Cost	Class EA Schedule
	• City of Toronto Blythwood/Sherwood Ravine	Addition of storm sewer and outfall		

10.3.8 Sequence of Implementation

Detailed design of the Preferred Solution will be dependent on the overall priority as compared to other City of Toronto projects as well as priorities within the ongoing City of Toronto Basement Flooding program and additional community consultation.

The following should be given consideration with respect to the sequence of implementation in order to limit disruption to local residents:

- The proposed road reconstruction and storm sewer works will need to be coordinated, in part, with the proposed sewer works for Basement Flooding Protection projects. For the separated sewer area (see **Figure 7.4.3**) sanitary sewer replacement is proposed for several roads (Wood Avenue, Rochester Avenue and Rochester Avenue) where road reconstruction and storm sewer installation is also proposed. Coordination of all works for these streets will minimize the inconvenience to local residents.
-
- With respect to prioritization of the other road and storm sewer works for the 18 locations, the works will have to proceed from the downstream limit (of where the storm sewers are to be installed) and progress upstream. The final prioritization will also be based on other considerations such as recurring operation and maintenance needs together with priorities as defined by the City of Toronto Benefitting Homeowners Policy (reference).

.The City prepared a staff report that was approved by City Council in May, 2017. This document provided a preliminary construction sequencing plan on the projects described above as noted in **Table 10.2.2** and **Table 10.3.3**. The sequencing plan groups the projects according to the sewer system drainage areas. The size and sequencing of each construction contract is based on providing basement flooding protection infrastructure as a first priority, limiting disruption to the neighborhood and ensuring that newly built infrastructure is not damaged by subsequent construction of the proposed works. The overall sequencing of work and actual construction schedule will be dependent on funding, prioritization and coordination of works with other City Divisions and utility companies, and securing the necessary property easements, permits and approvals.

10.4 Future Agency Approvals

Ministry of the Environment and Climate Change (MOECC)

Each element of the recommended storm sewer works, including the infiltration of stormwater, will require an MOECC Environmental Compliance Approval. The considerations for MOECC approval have been described previously in **Section10.2.8**.

Toronto and Region Conservation Authority (TRCA)

The TRCA maintains a checklist for permit application submissions related to infrastructure projects. Pre-consultation and/or site visits are encouraged for all applications prior to submission, particularly for those sites with complex review requirements.

For this study approvals from TRCA will be required for the proposed storm sewer outfall at sites 1, 2 and 4. Key considerations will include impacts on the environment as a result of the proposed works. This study included an Environmental Impact Study which provided a general Ecological Land Classification for the proposed alignments (See **Appendix E**). Further studies will better define the impact once the alignment has been confirmed. TRCA will also require a geomorphic assessment to define the impact on the aquatic and stream environment as a result of creating a new outfall at Sites 1 and 4.

City of Toronto Divisions

The following departments must be circulated and consulted in the design and construction phases:

- Transportation Services
- Toronto Water – Water Infrastructure Management (WIM)
- Engineering and Construction Services (ECS)
- Ravine and Natural Features Protection (RNFP)
- Parks, Forestry and Recreation (PF&R)
- Urban Forestry (UF)

Projects must comply with City of Toronto Tree Bylaws, Policies, and Permitting requirements, including an arborist inventory, Ecological Land Classification (ELC) assessment of the potential areas of impact and adjacent vegetation communities, and mitigation and compensation (e.g. tree replacements, restoration, and/or enhancements), particularly for Sites 1 and 2.

10.5 Traffic and Pedestrian Safety

Chapter 9 described the assessment of alternative remedial measures for traffic within the Lawrence Park neighborhood (for the area bounded by Lawrence Park Avenue E., Bayview Avenue, Blythwood Avenue and Mt. Pleasant Road. The proposed recommendations are relatively minor and will generally be dealt with as part of ongoing operations and maintenance or future rehabilitation projects.

In summary the proposed works include:

- Improving sightlines at three intersections: This includes removal of excess vegetation at St. Leonard’s Avenue/Mount Pleasant Road and Lawrence Crescent/Mount Pleasant Road (south intersection) and relocation of a stone wall along the north east corner of the Strathgowan Avenue/Blythwood Road intersection. The existing stone wall could be relocated as part of a future intersection or road reconstruction project.
- Improving pedestrian safety: Recommendations to improve pedestrian safety by installing sidewalks along five roads (Mildenhall Road south of Lawrence Avenue E., Dawlish Avenue between Mildenhall Road and Bayview Avenue, St. Leonards Avenue, Glenallen Road and Pinedale Road (see Figure 9.4.2 for specific locations). The sidewalks would be installed as part of the road reconstruction process.

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